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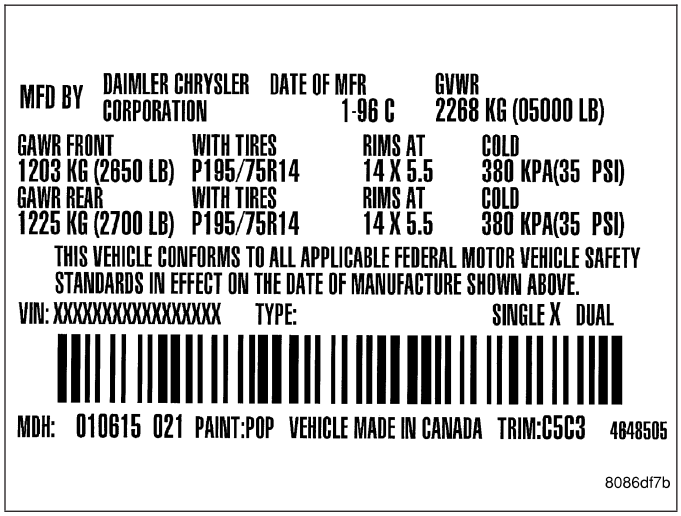
VEHICLE CERTIFICATION LABEL

DESCRIPTION

A vehicle certification label is attached to every DaimlerChrysler Corporation vehicle. The label certifies that the vehicle conforms to all applicable Federal Motor Vehicle Standards. The label also lists:

- Month and year of vehicle manufacture.
- Gross Vehicle Weight Rating (GVWR). The gross front and rear axle weight ratings (GAWR's) are based on a minimum rim size and maximum cold tire inflation pressure.
- Vehicle Identification Number (VIN).
- Type of vehicle.
- Type of rear wheels.
- Bar code.
- Month, Day and Hour (MDH) of final assembly.
- Paint and Trim codes.
- Country of origin.

The label is located on the driver-side door shut-face.

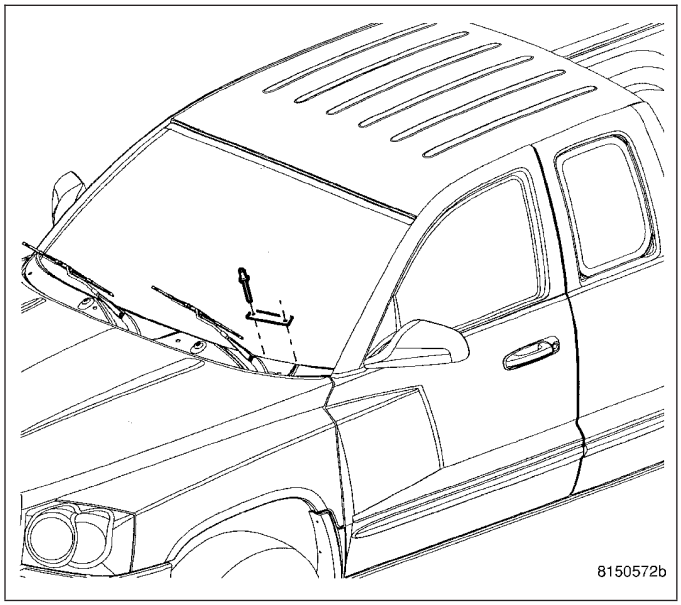


VEHICLE IDENTIFICATION NUMBER

DESCRIPTION

The Vehicle Identification Number (VIN) plate is attached to the top left side of the instrument panel. The VIN contains 17 characters that provide data concerning the vehicle. Refer to the decoding chart to determine the identification of a vehicle.

To protect the consumer from theft and possible fraud the manufacturer is required to include a Check Digit at the ninth position of the Vehicle Identification Number. The check digit is used by the manufacturer and government agencies to verify the authenticity of the vehicle and official documentation. The formula to use the check digit is not released to the general public.



VIN DECODING INFORMATION

POSITION	INTERPRETATION	CODE = DESCRIPTION
1	Country of Origin	1 = Manufactured by DaimlerChrysler Corporation
2	Make	D = Dodge
3	Vehicle Type	7 = Truck less Side Airbags 3 = Truck with Side Airbags
4	Gross Vehicle Weight Rating	H = 6001-7000 lbs.
5	Vehicle Line	E = Dakota 4x2 W = Dakota 4x4
6	Series	2 = Dakota ST 4 = Dakota SLT/Sport 5 = Dakota LARAMIE/SPORT
7	Body Style	2 = Club Cab Dakota 8 = Quad Cab Dakota
8	Engine	K = 3.7L 6 cyl. MPI Gasoline N = 4.7L 8 cyl. MPI Gasoline J = 4.7L 8 cyl. MPI High Output Gasoline
9	Check Digit	0 through 9 or X
10	Model Year	5 = 2005
11	Assembly Plant	S = Warren Truck Assembly
12 Thru 17	Vehicle Build Sequence	

VEHICLE EMISSION CONTROL INFORMATION (VECI) LABEL

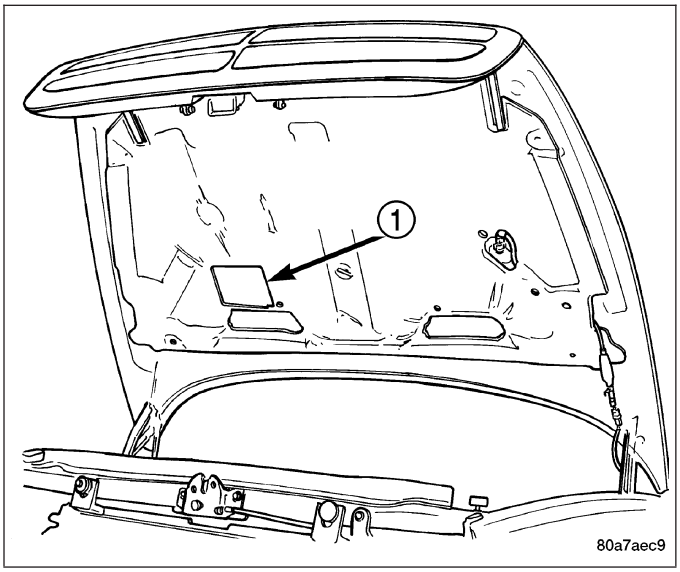
DESCRIPTION

All vehicles are equipped with a combined VECI label. This label is located in the engine compartment.

The VECI label contains the following:

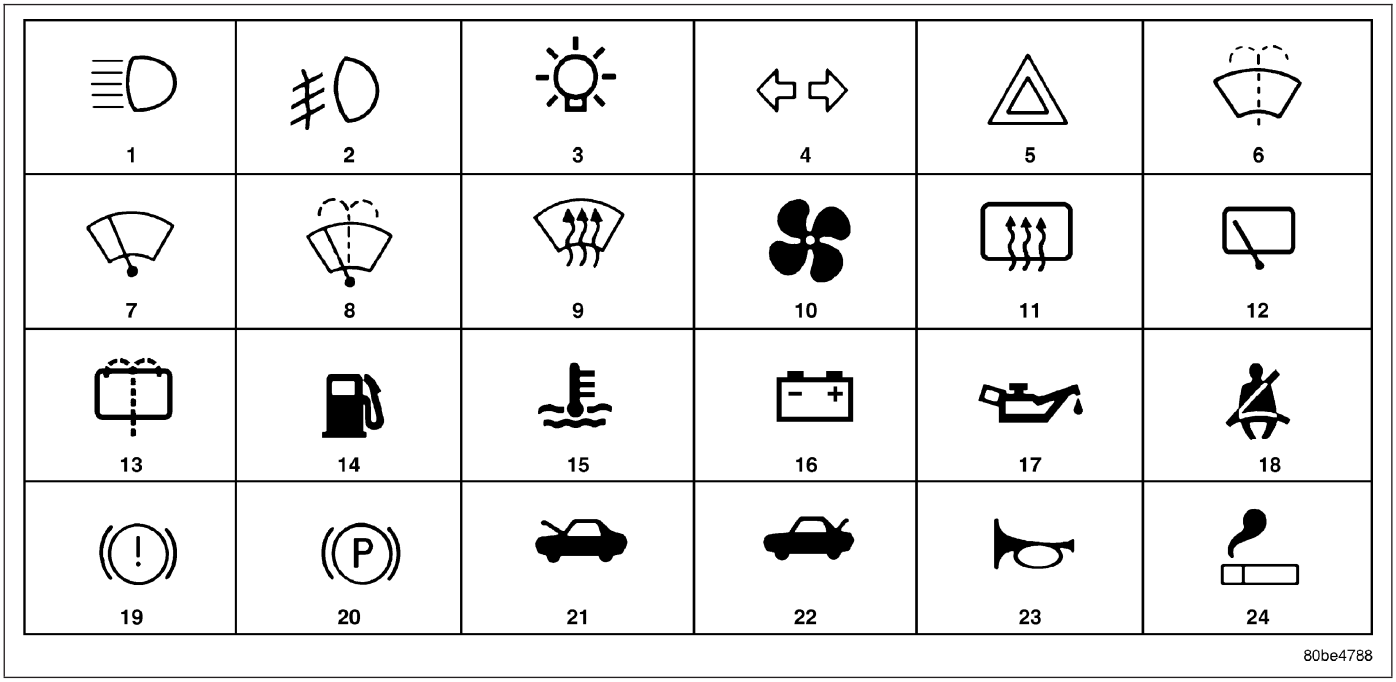
- Engine family and displacement
- Evaporative family
- Emission control system schematic
- Certification application
- Engine timing specifications (if adjustable)
- Idle speeds (if adjustable)
- Spark plug and gap

The label also contains an engine vacuum schematic. There are unique labels for vehicles built for sale in the state of California and the country of Canada. Canadian labels are written in both the English and French languages. These labels are permanently attached and cannot be removed without defacing information and destroying label.



INTERNATIONAL SYMBOLS

DESCRIPTION



The graphic symbols illustrated in the following International Control and Display Symbols Chart are used to identify various instrument controls. The symbols correspond to the controls and displays that are located on the instrument panel.

FASTENER IDENTIFICATION

DESCRIPTION

The SAE bolt strength grades range from grade 2 to grade 8. The higher the grade number, the greater the bolt strength. Identification is determined by the line marks on the top of each bolt head. The actual bolt strength grade corresponds to the number of line marks plus 2. The most commonly used metric bolt strength classes are 9.8 and 10.9. The metric strength class identification number is imprinted on the head of the bolt. The higher the class number, the greater the bolt strength. Some metric nuts are imprinted with a single-digit strength class on the nut face. Refer to the Fastener Identification and Fastener Strength Charts.

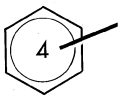
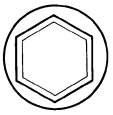
Bolt Markings and Torques - Metric

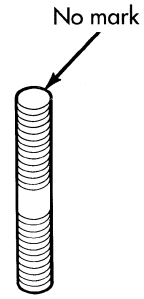
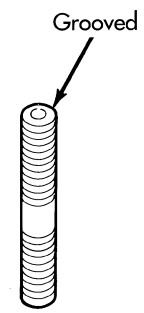
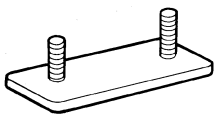
Bolt Markings	8.8/8.9		10.9		12.9	
Bolt Dia.	N·m	Ft. Lbs.	N·m	Ft. Lbs.	N·m	Ft. Lbs.
6	12	105*	14	120*	16	12
8	25	250*	32	23	38	28
10	54	40	60	45	74	55
12	95	70	108	80	135	100
14	155	115	175	130	216	160
16	243	180	324	210	324	240
* Inch Lbs.						

Bolt Markings and Torques - U. S. Customary

Bolt Markings	Grade 5		Grade 8	
Bolt Dia.	N·m	Ft. Lbs	N·m	Ft. Lbs
1/4 - 20	10	95*	14	125*
1/4 - 28	10	95*	17	150*
5/16 - 18	22	200*	30	270*
5/16 - 24	26	240*	33	300*
3/8 - 16	40	30	55	40
3/8 - 24	47	35	60	45
7/16 - 14	68	50	88	65
7/16 - 20	74	55	95	70
1/2 - 13	101	75	135	100
1/2 -20	115	85	150	110
9/16 - 12	135	105	182	135
9/16 - 18	155	115	202	150
5/8 - 11	202	150	263	195
5/8 - 18	215	160	284	210
3/4 - 10	230	170	297	220
3/4 - 16	236	175	304	225
7/8 - 14	405	300	540	400
* Inch Lbs.				

HOW TO DETERMINE BOLT STRENGTH

	Mark	Class
Hexagon head bolt	 Bolt head No. 4 — 4T; 5 — 5T; 6 — 6T; 7 — 7T; 8 — 8T; 9 — 9T; 10 — 10T; 11 — 11T	
	No mark	4T
Hexagon flange bolt w/washer hexagon bolt	 No mark	4T
Hexagon head bolt	Two protruding lines	5T
Hexagon flange bolt w/washer hexagon bolt	Two protruding lines	6T
Hexagon head bolt	Three protruding lines	7T
Hexagon head bolt	Four protruding lines	8T

	Mark	Class
Stud bolt		4T
		6T
Welded bolt		4T

95IN-4

FASTENER USAGE

DESCRIPTION

FASTENER USAGE

WARNING: Use of an incorrect fastener may result in component damage or personal injury.

Fasteners and torque specifications references in this Service Manual are identified in metric and SAE format.

During any maintenance or repair procedures, it is important to salvage all fasteners (nuts, bolts, etc.) for reassembly. If the fastener is not salvageable, a fastener of equivalent specification must be used.

THREADED HOLE REPAIR

Most stripped threaded holes can be repaired using a Helicoil®. Follow the vehicle or Helicoil® recommendations for application and repair procedures.

METRIC SYSTEM

DESCRIPTION

in-lbs to N•m

in- lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m
2	.2260	42	4.7453	82	9.2646	122	13.7839	162	18.3032
4	.4519	44	4.9713	84	9.4906	124	14.0099	164	18.5292
6	.6779	46	5.1972	86	9.7165	126	14.2359	166	18.7552
8	.9039	48	5.4232	88	9.9425	128	14.4618	168	18.9811
10	1.1298	50	5.6492	90	10.1685	130	14.6878	170	19.2071
12	1.3558	52	5.8751	92	10.3944	132	14.9138	172	19.4331
14	1.5818	54	6.1011	94	10.6204	134	15.1397	174	19.6590
16	1.8077	56	6.3270	96	10.8464	136	15.3657	176	19.8850
18	2.0337	58	6.5530	98	11.0723	138	15.5917	178	20.1110
20	2.2597	60	6.7790	100	11.2983	140	15.8176	180	20.3369
22	2.4856	62	7.0049	102	11.5243	142	16.0436	182	20.5629
24	2.7116	64	7.2309	104	11.7502	144	16.2696	184	20.7889
26	2.9376	66	7.4569	106	11.9762	146	16.4955	186	21.0148
28	3.1635	68	7.6828	108	12.2022	148	16.7215	188	21.2408
30	3.3895	70	7.9088	110	12.4281	150	16.9475	190	21.4668
32	3.6155	72	8.1348	112	12.6541	152	17.1734	192	21.6927
34	3.8414	74	8.3607	114	12.8801	154	17.3994	194	21.9187
36	4.0674	76	8.5867	116	13.1060	156	17.6253	196	22.1447
38	4.2934	78	8.8127	118	13.3320	158	17.8513	198	22.3706
40	4.5193	80	9.0386	120	13.5580	160	18.0773	200	22.5966

N•m to in-lbs

N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb
.2	1.7702	4.2	37.1747	8.2	72.5792	12.2	107.9837	16.2	143.3882
.4	3.5404	4.4	38.9449	8.4	74.3494	12.4	109.7539	16.4	145.1584
.6	5.3107	4.6	40.7152	8.6	76.1197	12.6	111.5242	16.6	146.9287
.8	7.0809	4.8	42.4854	8.8	77.8899	12.8	113.2944	16.8	148.6989
1	8.8511	5	44.2556	9	79.6601	13	115.0646	17	150.4691
1.2	10.6213	5.2	46.0258	9.2	81.4303	13.2	116.8348	17.2	152.2393
1.4	12.3916	5.4	47.7961	9.4	83.2006	13.4	118.6051	17.4	154.0096
1.6	14.1618	5.6	49.5663	9.6	84.9708	13.6	120.3753	17.6	155.7798
1.8	15.9320	5.8	51.3365	9.8	86.7410	13.8	122.1455	17.8	157.5500
2	17.7022	6	53.1067	10	88.5112	14	123.9157	18	159.3202
2.2	19.4725	6.2	54.8770	10.2	90.2815	14.2	125.6860	18.5	163.7458
2.4	21.2427	6.4	56.6472	10.4	92.0517	14.4	127.4562	19	168.1714
2.6	23.0129	6.6	58.4174	10.6	93.8219	14.6	129.2264	19.5	172.5970
2.8	24.7831	6.8	60.1876	10.8	95.5921	14.8	130.9966	20	177.0225
3	26.5534	7	61.9579	11	97.3624	15	132.7669	20.5	181.4480
3.2	28.3236	7.2	63.7281	11.2	99.1326	15.2	134.5371	21	185.8736
3.4	30.0938	7.4	65.4983	11.4	100.9028	15.4	136.3073	22	194.7247
3.6	31.8640	7.6	67.2685	11.6	102.6730	15.6	138.0775	23	203.5759
3.8	33.6342	7.8	69,0388	11.8	104.4433	15.8	139.8478	24	212.4270
4	35.4045	8	70.8090	12	106.2135	16	141.6180	25	221.2781

ft-lbs to N•m

ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m
1	1.3558	21	28.4722	41	55.5885	61	82.7049	81	109.8212
2	2.7116	22	29.8280	42	56.9444	62	84.0607	82	111.1770
3	4.0675	23	31.1838	43	58.3002	63	85.4165	83	112.5328
4	5.4233	24	32.5396	44	59.6560	64	86.7723	84	113.8888
5	6.7791	25	33.8954	45	61.0118	65	88.1281	85	115.2446
6	8.1349	26	35.2513	46	62.3676	66	89.4840	86	116.6004
7	9.4907	27	36.6071	47	63.7234	67	90.8398	87	117.9562
8	10.8465	28	37.9629	48	65.0793	68	92.1956	88	119.3120
9	12.2024	29	39.3187	49	66.4351	69	93.5514	89	120.6678
10	13.5582	30	40.6745	50	67.7909	70	94.9073	90	122.0236
11	14.9140	31	42.0304	51	69.1467	71	96.2631	91	123.3794
12	16.2698	32	43.3862	52	70.5025	72	97.6189	92	124.7352
13	17.6256	33	44.7420	53	71.8583	73	98.9747	93	126.0910
14	18.9815	34	46.0978	54	73.2142	74	100.3316	94	127.4468
15	20.3373	35	47.4536	55	74.5700	75	101.6862	95	128.8026
16	21.6931	36	48.8094	56	75.9258	76	103.0422	96	130.1586
17	23.0489	37	50.1653	57	77.2816	77	104.3980	97	131.5144
18	24.4047	38	51.5211	58	78.6374	78	105.7538	98	132.8702
19	25.7605	39	52.8769	59	79.9933	79	107.1196	99	134.2260
20	27.1164	40	54.2327	60	81.3491	80	108.4654	100	135.5820

N•m to ft-lbs

N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1	.7376	21	15.9888	41	30.2400	61	44.9913	81	59.7425
2	1.4751	22	16.2264	42	30.9776	62	45.7289	82	60.4801
3	2.2127	23	16.9639	43	31.7152	63	46.4664	83	61.2177
4	2.9502	24	17.7015	44	32.4527	64	47.2040	84	61.9552
5	3.6878	25	18.4391	45	33.1903	65	47.9415	85	62.6928
6	4.4254	26	19.1766	46	33.9279	66	48.6791	86	63.4303
7	5.1629	27	19.9142	47	34.6654	67	49.4167	87	64.1679
8	5.9005	28	20.6517	48	35.4030	68	50.1542	88	64.9545
9	6.6381	29	21.3893	49	36.1405	69	50.8918	89	65.6430
10	7.3756	30	22.1269	50	36.8781	70	51.6293	90	66.3806
11	8.1132	31	22.8644	51	37.6157	71	52.3669	91	67.1181
12	8.8507	32	23.6020	52	38.3532	72	53.1045	92	67.8557
13	9.5883	33	24.3395	53	39.0908	73	53.8420	93	68.5933
14	10.3259	34	25.0771	54	39.8284	74	54.5720	94	69.3308
15	11.0634	35	25.8147	55	40.5659	75	55.3172	95	70.0684
16	11.8010	36	26.5522	56	41.3035	76	56.0547	96	70.8060
17	12.5386	37	27.2898	57	42.0410	77	56.7923	97	71.5435
18	13.2761	38	28.0274	58	42.7786	78	57.5298	98	72.2811
19	14.0137	39	28.7649	59	43.5162	79	58.2674	99	73.0187
20	14.7512	40	29.5025	60	44.2537	80	59.0050	100	73.7562

in. to mm

in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
.01	.254	.21	5.334	.41	10.414	.61	15.494	.81	20.574
.02	.508	.22	5.588	.42	10.668	.62	15.748	.82	20.828
.03	.762	.23	5.842	.43	10.922	.63	16.002	.83	21.082
.04	1.016	.24	6.096	.44	11.176	.64	16.256	.84	21.336
.05	1.270	.25	6.350	.45	11.430	.65	16.510	.85	21.590
.06	1.524	.26	6.604	.46	11.684	.66	16.764	.86	21.844
.07	1.778	.27	6.858	.47	11.938	.67	17.018	.87	22.098
.08	2.032	.28	7.112	.48	12.192	.68	17.272	.88	22.352
.09	2.286	.29	7.366	.49	12.446	.69	17.526	.89	22.606
.10	2.540	.30	7.620	.50	12.700	.70	17.780	.90	22.860
.11	2.794	.31	7.874	.51	12.954	.71	18.034	.91	23.114
.12	3.048	.32	8.128	.52	13.208	.72	18.288	.92	23.368
.13	3.302	.33	8.382	.53	13.462	.73	18.542	.93	23.622
.14	3.556	.34	8.636	.54	13.716	.74	18.796	.94	23.876
.15	3.810	.35	8.890	.55	13.970	.75	19.050	.95	24.130
.16	4.064	.36	9.144	.56	14.224	.76	19.304	.96	24.384
.17	3.318	.37	9.398	.57	14.478	.77	19.558	.97	24.638
.18	4.572	.38	9.652	.58	14.732	.78	19.812	.98	24.892
.19	4.826	.39	9.906	.59	14.986	.79	20.066	.99	25.146
.20	5.080	.40	10.160	.60	15.240	.80	20.320	1.00	25.400

mm to in.

mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
.01	.00039	.21	.00827	.41	.01614	.61	.02402	.81	.03189
.02	.00079	.22	.00866	.42	.01654	.62	.02441	.82	.03228
.03	.00118	.23	.00906	.43	.01693	.63	.02480	.83	.03268
.04	.00157	.24	.00945	.44	.01732	.64	.02520	.84	.03307
.05	.00197	.25	.00984	.45	.01772	.65	.02559	.85	.03346
.06	.00236	.26	.01024	.46	.01811	.66	.02598	.86	.03386
.07	.00276	.27	.01063	.47	.01850	.67	.02638	.87	.03425
.08	.00315	.28	.01102	.48	.01890	.68	.02677	.88	.03465
.09	.00354	.29	.01142	.49	.01929	.69	.02717	.89	.03504
.10	.00394	.30	.01181	.50	.01969	.70	.02756	.90	.03543
.11	.00433	.31	.01220	.51	.02008	.71	.02795	.91	.03583
.12	.00472	.32	.01260	.52	.02047	.72	.02835	.92	.03622
.13	.00512	.33	.01299	.53	.02087	.73	.02874	.93	.03661
.14	.00551	.34	.01339	.54	.02126	.74	.02913	.94	.03701
.15	.00591	.35	.01378	.55	.02165	.75	.02953	.95	.03740
.16	.00630	.36	.01417	.56	.02205	.76	.02992	.96	.03780
.17	.00669	.37	.01457	.57	.02244	.77	.03032	.97	.03819
.18	.00709	.38	.01496	.58	.02283	.78	.03071	.98	.03858
.19	.00748	.39	.01535	.59	.02323	.79	.03110	.99	.03898
.20	.00787	.40	.01575	.60	.02362	.80	.03150	1.00	.03937

J901N-10

The metric system is based on quantities of one, ten, one hundred, one thousand and one million.

The following chart will assist in converting metric units to equivalent English and SAE units, or vise versa.

CONVERSION FORMULAS AND EQUIVALENT VALUES

MULTIPLY	BY	TO GET	MULTIPLY	BY	TO GET
in-lbs	x 0.11298	= Newton Meters (N·m)	N·m	x 8.851	= in-lbs
ft-lbs	x 1.3558	= Newton Meters (N·m)	N·m	x 0.7376	= ft-lbs
Inches Hg (60° F)	x 3.377	= Kilopascals (kPa)	kPa	x 0.2961	= Inches Hg
psi	x 6.895	= Kilopascals (kPa)	kPa	x 0.145	= psi
Inches	x 25.4	= Millimeters (mm)	mm	x 0.03937	= Inches
Feet	x 0.3048	= Meters (M)	M	x 3.281	= Feet
Yards	x 0.9144	= Meters	M	x 1.0936	= Yards
mph	x 1.6093	= Kilometers/Hr. (Km/h)	Km/h	x 0.6214	= mph
Feet/Sec	x 0.3048	= Meters/Sec (M/S)	M/S	x 3.281	= Feet/Sec
mph	x 0.4470	= Meters/Sec (M/S)	M/S	x 2.237	= mph
Kilometers/Hr. (Km/h)	x 0.27778	= Meters/Sec (M/S)	M/S	x 3.600	Kilometers/Hr. (Km/h)

COMMON METRIC EQUIVALENTS

1 inch = 25 Millimeters	1 Cubic Inch = 16 Cubic Centimeters
1 Foot = 0.3 Meter	1 Cubic Foot = 0.03 Cubic Meter
1 Yard = 0.9 Meter	1 Cubic Yard = 0.8 Cubic Meter
1 Mile = 1.6 Kilometers	

Refer to the Metric Conversion Chart to convert torque values listed in metric Newton- meters (N·m). Also, use the chart to convert between millimeters (mm) and inches (in.).

TORQUE REFERENCES

DESCRIPTION

Individual Torque Charts appear within many or the Groups. Refer to the Standard Torque Specifications Chart for torque references not listed in the individual torque charts.

SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			N•m	kgf-cm	ft-lbf	N•m	kgf-cm	ft-lbf
4T	6	1	5	55	48 in.-lbf	6	60	52 in.-lbf
	8	1.25	12.5	130	9	14	145	10
	10	1.25	26	260	19	29	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	74	760	55	84	850	61
	16	1.5	115	1,150	83	—	—	—
5T	6	1	6.5	65	56 in.-lbf	7.5	75	65 in.-lbf
	8	1.25	15.5	160	12	17.5	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1,050	76
	16	1.5	140	1,400	101	—	—	—
6T	6	1	8	80	69 in.-lbf	9	90	78 in.-lbf
	8	1.25	19	195	14	21	210	15
	10	1.25	39	400	29	44	440	32
	12	1.25	71	730	53	80	810	59
	14	1.5	110	1,100	80	125	1,250	90
	16	1.5	170	1,750	127	—	—	—
7T	6	1	10.5	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	105	1,050	76
	14	1.5	145	1,500	108	165	1,700	123
	16	1.5	230	2,300	166	—	—	—
8T	8	1.25	29	300	22	33	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	110	1,100	80	120	1,250	90
9T	8	1.25	34	340	25	37	380	27
	10	1.25	70	710	51	78	790	57
	12	1.25	125	1,300	94	140	1,450	105
10T	8	1.25	38	390	28	42	430	31
	10	1.25	78	800	58	88	890	64
	12	1.25	140	1,450	105	155	1,600	116
11T	8	1.25	42	430	31	47	480	35
	10	1.25	87	890	64	97	990	72
	12	1.25	155	1,600	116	175	1,800	130

LUBRICATION & MAINTENANCE

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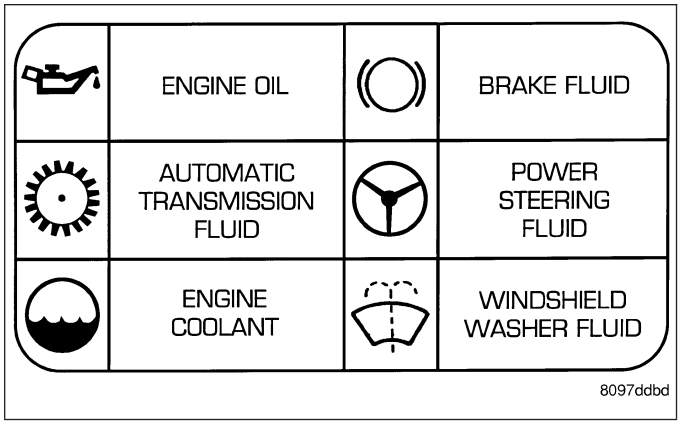
INTERNATIONAL SYMBOLS

DESCRIPTION

DaimlerChrysler Corporation uses international symbols to identify engine compartment lubricant and fluid inspection and fill locations.



PARTS & LUBRICANT RECOMMENDATION

DESCRIPTION

LUBRICANT RECOMMENDATIONS

Chassis

Component	Fluid, Lubricant, or Genuine Part
Steering Gear & Linkage, Ball Joints, Prop Shafts & Yokes, Wheel Bearings	Mopar® Multi-Purpose Lubricant NLGI Grade 2 EP, GC-LB

Body

Component	Fluid, Lubricant, and Genuine Part
Hinges:	
Door & Hood	Mopar® Engine Oil
Swing Gate	Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB
Latches: Door, Hood/Safety Catch, Swing Gate	Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB
Seat Regulator & Track	Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB
Lock Cylinders	Mopar® Lock Cylinder Lube

FLUID TYPES

When service is required, DaimlerChrysler Corporation recommends that only Mopar® brand parts, lubricants and chemicals be used. Mopar® provides the best engineered products for servicing DaimlerChrysler Corporation vehicles.

Only lubricants bearing designations defined by the following organization should be used to service a Chrysler Corporation vehicle.

- Society of Automotive Engineers (SAE)
- American Petroleum Institute (API)
- National Lubricating Grease Institute (NLGI)

API QUALITY CLASSIFICATION

This symbol on the front of an oil container means that the oil has been certified by the American Petroleum Institute (API) to meet all the lubrication requirements specified by DaimlerChrysler Corporation.

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GEAR LUBRICANTS

SAE ratings also apply to multigrade gear lubricants. In addition, API classification defines the lubricants usage. Such as API GL-5 and SAE 75W-90.

FLUID TYPES

DESCRIPTION

FUEL REQUIREMENTS

Your engine is designed to meet all emissions regulations and provide excellent fuel economy and performance when using high quality unleaded “regular” gasoline having an octane rating of 87. The routine use of premium gasoline is not recommended. Under normal conditions the use of premium fuel will not provide a benefit over high quality regular gasolines and in some circumstances may result in poorer performance.

Light spark knock at low engine speeds is not harmful to your engine. However, continued heavy spark knock at high speeds can cause damage and immediate service is required. Engine damage resulting from operation with a heavy spark knock may not be covered by the new vehicle warranty.

Poor quality gasoline can cause problems such as hard starting, stalling and hesitations. If you experience these symptoms, try another brand of gasoline before considering service for the vehicle.

Over 40 auto manufacturers world-wide have issued and endorsed consistent gasoline specifications (the Worldwide Fuel Charter, WWFC) to define fuel properties necessary to deliver enhanced emissions, performance and durability for your vehicle. We recommend the use of gasolines that meet the WWFC specifications if they are available.

REFORMULATED GASOLINE

Many areas of the country require the use of cleaner burning gasoline referred to as “reformulated” gasoline. Reformulated gasoline contain oxygenates, and are specifically blended to reduce vehicle emissions and improve air quality.

We strongly support the use of reformulated gasoline. Properly blended reformulated gasoline will provide excellent performance and durability for the engine and fuel system components.

GASOLINE/OXYGENATE BLENDS

Some fuel suppliers blend unleaded gasoline with oxygenates such as 10% ethanol, MTBE, and ETBE. Oxygenates are required in some areas of the country during the winter months to reduce carbon monoxide emissions. Fuels blended with these oxygenates may be used in your vehicle.

CAUTION: DO NOT use gasoline containing METHANOL. Gasoline containing methanol may damage critical fuel system components.

MMT IN GASOLINE

MMT is a manganese-containing metallic additive that is blended into some gasoline to increase octane. Gasoline blended with MMT provide no performance advantage beyond gasoline of the same octane number without MMT. Gasoline blended with MMT reduce spark plug life and reduce emission system performance in some vehicles. We recommend that gasolines free of MMT be used in your vehicle. The MMT content of gasoline may not be indicated on the gasoline pump; therefore, you should ask your gasoline retailer whether or not his/her gasoline contains MMT.

It is even more important to look for gasoline without MMT in Canada because MMT can be used at levels higher than allowed in the United States. MMT is prohibited in Federal and California reformulated gasoline.

SULFUR IN GASOLINE

If you live in the northeast United States, your vehicle may have been designed to meet California low emission standards with Cleaner-Burning California reformulated gasoline with low sulfur. If such fuels are not available in states adopting California emission standards, your vehicles will operate satisfactorily on fuels meeting federal specifications, but emission control system performance may be adversely affected. Gasoline sold outside of California is permitted to have higher sulfur levels which may affect the performance of the vehicle’s catalytic converter. This may cause the Malfunction Indicator Lamp (MIL), Check Engine or Service Engine Soon light to illuminate. We recommend that you try a different brand of unleaded gasoline having lower sulfur to determine if the problem is fuel related prior to returning your vehicle to an authorized dealer for service.

CAUTION: If the Malfunction Indicator Lamp (MIL), Check Engine or Service Engine Soon light is flashing, immediate service is required; see on-board diagnostics system section.

MATERIALS ADDED TO FUEL

All gasoline sold in the United States and Canada are required to contain effective detergent additives. Use of additional detergents or other additives is not needed under normal conditions.

FUEL SYSTEM CAUTIONS

CAUTION: Follow these guidelines to maintain your vehicle's performance:

- The use of leaded gas is prohibited by Federal law. Using leaded gasoline can impair engine performance, damage the emission control system, and could result in loss of warranty coverage.
- An out-of-tune engine, or certain fuel or ignition malfunctions, can cause the catalytic converter to overheat. If you notice a pungent burning odor or some light smoke, your engine may be out of tune or malfunctioning and may require immediate service. Contact your dealer for service assistance.
- When pulling a heavy load or driving a fully loaded vehicle when the humidity is low and the temperature is high, use a premium unleaded fuel to help prevent spark knock. If spark knock persists, lighten the load, or engine piston damage may result.
- The use of fuel additives which are now being sold as octane enhancers is not recommended. Most of these products contain high concentrations of methanol. Fuel system damage or vehicle performance problems resulting from the use of such fuels or additives is not the responsibility of DaimlerChrysler Corporation and may not be covered under the new vehicle warranty.

NOTE: Intentional tampering with emissions control systems can result in civil penalties being assessed against you.

ENGINE COOLANT

WARNING: ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. IF SWALLOWED, DRINK TWO GLASSES OF WATER AND INDUCE VOMITING. IF INHALED, MOVE TO FRESH AIR AREA. SEEK MEDICAL ATTENTION IMMEDIATELY. DO NOT STORE IN OPEN OR UNMARKED CONTAINERS. WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL. KEEP OUT OF REACH OF CHILDREN. DISPOSE OF GLYCOL BASE COOLANT PROPERLY, CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.

WARNING: DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT OPERATING TEMPERATURE OR HOT UNDER PRESSURE, PERSONAL INJURY CAN RESULT. AVOID RADIATOR COOLING FAN WHEN ENGINE COMPARTMENT RELATED SERVICE IS PERFORMED, PERSONAL INJURY CAN RESULT.

CAUTION: Use of Propylene Glycol based coolants is not recommended, as they provide less freeze protection and less corrosion protection.

The cooling system is designed around the coolant. The coolant must accept heat from engine metal, in the cylinder head area near the exhaust valves and engine block. Then coolant carries the heat to the radiator where the tube/fin radiator can transfer the heat to the air.

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769), or the equivalent ethylene glycol base coolant with organic corrosion inhibitors (called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% Ethylene Glycol and 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

CAUTION: Do not use coolant additives that are claimed to improve engine cooling.

CAUTION: Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769) may not be mixed with any other type of antifreeze. Mixing of coolants other than specified non-HOAT or other HOAT coolant, may result in engine damage that may not be covered under the new vehicle warranty, and decreased corrosion protection.

COOLANT PERFORMANCE

The required ethylene-glycol (antifreeze) and distilled water mixture depends upon climate and vehicle operating conditions. The coolant performance of various mixtures follows:

Pure Distilled Water - Distilled water can absorb more heat than a mixture of water and ethylene-glycol. This is for purpose of heat transfer only. Water also freezes at a higher temperature and allows corrosion.

100 percent Ethylene-Glycol - The corrosion inhibiting additives in ethylene-glycol need the presence of distilled water to dissolve. Without water, additives form deposits in system. These act as insulation causing temperature to rise to as high as 149°C (300°F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at -22°C (-8°F).

50/50 Ethylene-Glycol and Distilled Water - Is the recommended mixture, it provides protection against freezing to -37°C (-34°F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. If percentage is lower, engine parts may be eroded by cavitation. Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7°C (-90°F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because specific heat of antifreeze is lower than that of water.

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

ENGINE OIL

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.

When service is required, DaimlerChrysler Corporation recommends that only Mopar® brand parts, lubricants and chemicals be used. Mopar® provides the best engineered products for servicing DaimlerChrysler Corporation vehicles.

Only lubricants bearing designations defined by the following organization should be used.

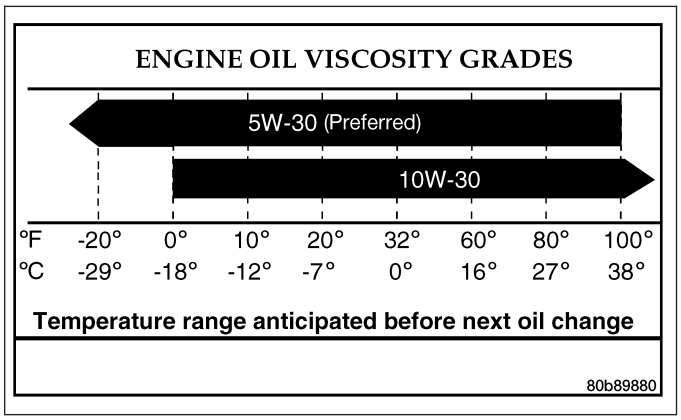
- Society of Automotive Engineers (SAE)
- American Petroleum Institute (API)
- National Lubricating Grease Institute (NLGI)
- Association des Constructeurs Européens d' Automobiles (European Automobile Manufacturers Association) (ACEA)

API SERVICE GRADE CERTIFIED

Use an engine oil that is API Certified. MOPAR® provides engine oils, that meet or exceed this requirement.

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. Use only engine oils with multiple viscosities such as 5W-30 or 10W-30. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. Select an engine oil that is best suited to your particular temperature range and variation.



ACEA Categories

For countries that use the ACEA European Oil Categories for Service Fill Oils, use engine oils that meet the requirements of ACEA A1/B1, A2/B2, or A3/B3.

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the front label of engine oil plastic bottles and the top of engine oil cans.

This symbol means that the oil has been certified by the American Petroleum Institute (API). Diamler-Chrysler only recommend API Certified engine oils. Use Mopar® engine oil or equivalent.

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TRANSFER CASE - NV233

Recommended lubricant for the NV233 transfer case is Mopar® ATF +4, Automatic Transmission Fluid.

TRANSFER CASE - NV244

Recommended lubricant for the NV244 transfer case is Mopar® ATF +4, Automatic Transmission Fluid.

AXLE

NOTE: DaimlerChrysler recommends Mopar® lubricants or lubricants of equal quality.

FRONT AXLE

- C205F - Mopar® Gear Lubricant 75W-90

REAR AXLE

- 8 1/4 - Mopar® Synthetic Gear Lubricant 75W-140
- 9 1/4 - Mopar® Synthetic Gear Lubricant 75W-140

POWER STEERING FLUID

Mopar® ATF +4, Automatic Transmission Fluid is required in the power steering system. Substitute fluids can induce power steering system failure.

Mopar® ATF +4, Automatic Transmission Fluid when new is red in color. The ATF is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. **This is normal.** ATF+4 also has a unique odor that may change with age. Consequently, odor and color cannot be used to indicate the fluid condition or the need for a fluid change.

AUTOMATIC TRANSMISSION FLUID

NOTE: Refer to Service Procedures in this group for fluid level checking procedures.

Mopar® ATF +4, Automatic Transmission Fluid is the recommended fluid for DaimlerChrysler automatic transmissions.

Dexron II fluid IS NOT recommended. Clutch chatter can result from the use of improper fluid.

Mopar® ATF +4, Automatic Transmission Fluid when new is red in color. The ATF is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. **This is normal.** ATF+4 also has a unique odor that may change with age. Consequently, odor and color cannot be used to indicate the fluid condition or the need for a fluid change.

FLUID ADDITIVES

DaimlerChrysler strongly recommends against the addition of any fluids to the transmission, other than those automatic transmission fluids listed above. Exceptions to this policy are the use of special dyes to aid in detecting fluid leaks.

Various “special” additives and supplements exist that claim to improve shift feel and/or quality. These additives and others also claim to improve converter clutch operation and inhibit overheating, oxidation, varnish, and sludge. These claims have not been supported to the satisfaction of DaimlerChrysler and these additives **must not be used.** The use of transmission “sealers” should also be avoided, since they may adversely affect the integrity of transmission seals.

MANUAL TRANSMISSION

NOTE: DaimlerChrysler recommends Mopar® lubricants or lubricants of equal quality.

- G238 - Mopar® ATF+4

OPERATION - AUTOMATIC TRANSMISSION FLUID

The automatic transmission fluid is selected based upon several qualities. The fluid must provide a high level of protection for the internal components by providing a lubricating film between adjacent metal components. The fluid must also be thermally stable so that it can maintain a consistent viscosity through a large temperature range. If the viscosity stays constant through the temperature range of operation, transmission operation and shift feel will remain consistent. Transmission fluid must also be a good conductor of heat. The fluid must absorb heat from the internal transmission components and transfer that heat to the transmission case.

FLUID CAPACITIES

SPECIFICATIONS

FLUID CAPACITIES

DESCRIPTION	SPECIFICATION
FUEL TANK	25 U.S. Gallons (95 Liters)****
ENGINE OIL	
3.7L - with Filter	4.7L (5.0 qts.)
4.7L - with Filter	5.6L (6.0 qts.)
COOLING SYSTEM	
3.7L	15.4L (16.2 qts.)***
4.7L	15.4L (16.2 qts.)***
AUTOMATIC TRANSMISSION	
Service Fill - 42RLE	3.8L (4.0 qts.)
O-haul Fill - 42RLE	8.3L (17.6 pts.)
Service Fill - 545RFE	2WD - 5.2 L (11 pts.)
	4WD - 6.2 L (13 pts.)
O-haul Fill - 545RFE	13.33L (28.0 pts.)
Dry fill capacity Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these figures may vary. (Refer to 21 - TRANSMISSION/AUTOMATIC/FLUID - STANDARD PROCEDURE)	
MANUAL TRANSMISSION	
G238	2.2L (4.65 pts.)
TRANSFER CASE	
NV233	1.18L (2.5 pts.)
NV244	1.35L (2.85 pts.)
FRONT AXLE	
C205F	1.66L (56 oz.)
REAR AXLE	
8 1/4 in.	2.07L (70 oz.)
9 1/4 in.	2.13L (72 oz.)
*** Includes 0.9L (1.0 qts.) for coolant reservoir.	
****Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.	
Power Steering	
Power steering fluid capacities are dependent on engine/chassis options as well as steering gear/cooler options. Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these capacities may vary.	

FLUID FILL/CHECK LOCATIONS

DESCRIPTION

The fluid check/fill points and lubrication locations are located in each applicable Sections.

MAINTENANCE SCHEDULES

DESCRIPTION

MAINTENANCE SCHEDULES

There are two maintenance schedules that show the **required** service for your vehicle.

First is Schedule **"B"**. It is for vehicles that are operated under the conditions that are listed below and at the beginning of the schedule.

- Day or night temperatures are below 32° F (0° C).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 10 miles (16 km).
- More than 50% of your driving is at sustained high speeds during hot weather, above 90° F (32° C).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert operation.
- **If equipped for and operating with E-85 (ethanol) fuel.**

NOTE: If ANY of these apply to you then change your engine oil every 3,000 miles (5 000 km) or 3 months, whichever comes first and follow schedule "B" of the ″Maintenance Schedules″ section of this manual.

NOTE: If ANY of these apply to you then change your coolant every 102,000 miles (163 000 km) or 60 months, whichever comes first and follow schedule "B" of the ″Maintenance Schedules″ section of this manual.

NOTE: Most vehicles are operated under the conditions listed for Schedule ″B″.

Second is Schedule **"A"**. It is for vehicles that are not operated under any of the conditions listed under Schedule ″B″.

Use the schedule that best describes your driving conditions. Where time and mileage are listed, follow the interval that occurs first.

NOTE: Under no circumstances should oil change intervals exceed 6000 miles (10 000 km) or 6 months whichever comes first.

CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.

At Each Stop for Fuel

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent and add if required.

Once a Month

- Check tire pressure and look for unusual wear or damage.
- Inspect the battery and clean and tighten the terminals as required.
- Check the fluid levels of coolant reservoir, brake master cylinder, and transmission and add as needed.
- Check all lights and all other electrical items for correct operation.

At Each Oil Change

- Change the engine oil filter.
- Inspect the exhaust system.
- Inspect the brake hoses.
- Inspect the CV joints (if equipped) and front suspension components.
- Check the automatic transmission fluid level.
- Check the coolant level, hoses, and clamps.

Schedule “B”

Follow schedule “B” if you usually operate your vehicle under one or more of the following conditions.

- Day or night temperatures are below 32° F (0° C).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 10 miles (16 km).
- More than 50% of your driving is at sustained high speeds during hot weather, above 90° F (32° C).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert operation.
- **If equipped for and operating with E-85 (ethanol) fuel.**

NOTE: If ANY of these apply to you then change your engine oil every 3,000 miles (5 000 km) or 3 months, whichever comes first and follow schedule “B” of the ″Maintenance Schedules″ section of this manual.

NOTE: If ANY of these apply to you then change your coolant every 102,000 miles (163 000 km) or 60 months, whichever comes first and follow schedule “B” of the ″Maintenance Schedules″ section of this manual.

Miles **(Kilometers)**	**3,000** **(5 000)**	**6,000** **(10 000)**	**9,000** **(14 000)**	**12,000** **(19 000)**	**15,000** **(24 000)**
Change engine oil and engine oil filter, or at 3 months whichever comes first.	X	X	X	X	X
Rotate tires.		X		X	
Change rear axle fluid.					X
Change front axle fluid (4X4).					X
Inspect engine air cleaner filter, replace if necessary.					X

Miles	**18,000**	**21,000**	**24,000**	**27,000**	**30,000**
(Kilometers)	**(29 000)**	**(34 000)**	**(38 000)**	**(43 000)**	**(48 000)**
Change engine oil and engine oil filter, or at 3 months whichever comes first.	X	X	X	X	X
Rotate tires.	X		X		X
Change rear axle fluid.					X
Change front axle fluid (4X4).					X
Check transfer case fluid level (4X4).					X
Inspect brake linings.	X				
Inspect engine air cleaner filter, replace if necessary.					X
Replace spark plugs.					X
Inspect PCV valve, replace as necessary.					X

Miles	**33,000**	**36,000**	**39, 000**	**42,000**	**45,000**
(Kilometers)	**(53 000)**	**(58 000)**	**(62 000)**	**(67 000)**	**(72 000)**
Change engine oil and engine oil filter, or at 3 months whichever comes first.	X	X	X	X	X
Rotate tires.		X		X	
Change rear axle fluid.					X
Change front axle fluid (4X4).					X
Inspect brake linings.		X			
Inspect engine air cleaner filter, replace if necessary.					X

Miles	**48,000**	**51,000**	**54,000**	**57,000**	**60,000**
(Kilometers)	**(77 000)**	**(82 000)**	**(86 000)**	**(91 000)**	**(96 000)**
Change engine oil and engine oil filter, or at 3 months whichever comes first.	X	X	X	X	X
Rotate tires.	X		X		X
Change rear axle fluid.					X
Change front axle fluid (4X4).					X
Inspect brake linings.			X		
Inspect engine air cleaner filter, replace if necessary.					X
Replace spark plugs.					X
Inspect PCV valve, replace as necessary.					X
Inspect auto tension drive belt and replace if required.					X
Drain and refill automatic transmission fluid, change filter (3.7L).					X
Drain and refill automatic transmission fluid and change main sump filter (4.7L).					X
Inspect transfer case fluid (4X4).					X
Flush and replace engine coolant at 60 months, or 102, 000 miles (163 000 km) whichever comes first.					

Miles	**63,000**	**66,000**	**69,000**	**72,000**	**75,000**
(Kilometers)	**(101 000)**	**(106 000)**	**(110 000)**	**(115 000)**	**(120 000)**
Change engine oil and engine oil filter, or at 3 months whichever comes first.	X	X	X	X	
Rotate tires.		X		X	
Change rear axle fluid.					X
Change front axle fluid (4X4).					X
Inspect brake linings.				X	
Inspect engine air cleaner filter, replace if necessary.					X
Inspect auto tension drive belt and replace if required.					X

Miles	**78,000**	**81,000**	**84,000**	**87,000**	**90,000**
(Kilometers)	**(125 000)**	**(130 000)**	**(134 000)**	**(139 000)**	**(144 000)**
Change engine oil and engine oil filter, or at 3 months whichever comes first.	X	X	X	X	X
Rotate tires.	X		X		X
Change rear axle fluid.					X
Change front axle fluid (4X4).					X
Check transfer case fluid level (4X4).					X
Inspect brake linings.					X
Inspect engine air cleaner filter, replace if necessary.					X
Replace spark plugs.					X
Inspect PCV valve, replace as necessary.					X
Inspect auto tension drive belt and replace if required.					X

Miles	**93,000**	**96,000**	**99,000**	**100,000**	**102,000**
(Kilometers)	**(149 000)**	**(154 000)**	**(158 000)**	**(160 000)**	**(163 000)**
Change engine oil and engine oil filter, or at 3 months whichever comes first.	X	X	X		X
Rotate tires.		X			X
Flush and replace engine coolant, if not done at 60 months.					X
Change rear axle fluid.		X			
Change front axle fluid (4X4).		X			

Miles (Kilometers)	**105,000 (168 000)**	**108,000 (173 000)**	**111,000 (178 000)**	**114,000 (182 000)**	**117,000 (187 000)**	**120,000 (192 000)**
Change engine oil and engine oil filter, or at 3 months whichever comes first.	X	X	X	X	X	X
Rotate tires.		X		X		X
Change rear axle fluid.	X					X
Change front axle fluid (4X4).	X					X
Inspect brake linings.		X				
Inspect engine air cleaner filter, replace if necessary.	X					X
Replace spark plugs.						X
Inspect PCV valve, replace as necessary.						X
Inspect auto tension drive belt and replace if required.‡	X					X
Drain and refill transfer case fluid (4X4).						X
Drain and refill automatic transmission fluid, change filter (3.7L).						X
Drain and refill automatic transmission fluid and change main sump filter and spin-on cooler return filter if equipped. (4.7L).						X

* This applies only if your vehicle is used for police, taxi, fleet, or frequent trailer towing.

Inspection and service should also be performed anytime a malfunction is observed or suspected. Retain all receipts.

Schedule “A”

Miles	**6,000**	**12,000**	**18,000**	**24,000**	**30,000**
(Kilometers)	**(10 000)**	**(19 000)**	**(29 000)**	**(38 000)**	**(48 000)**
[Months]	**[6]**	**[12]**	**[18]**	**[24]**	**[30]**
Change engine oil and engine oil filter.	X	X	X	X	X
Rotate tires.	X	X	X	X	X
Check transfer case fluid level (4X4).					X
Inspect brake linings.			X		
Inspect engine air cleaner filter, replace as necessary.					X
Replace spark plugs.					X

Miles	**36,000**	**42,000**	**48,000**	**54000**	**60,000**	**66,000**
(Kilometers)	**(58 000)**	**(67 000)**	**(77 000)**	**(84 000)**	**(96 000)**	**(106 000)**
[Months]	**[36]**	**[42]**	**[48]**	**[54]**	**[60]**	**[66]**
Change engine oil and engine oil filter.	X	X	X	X	X	X
Rotate tires.	X	X	X	X	X	X
Check transfer case fluid level (4X4).					X	
Flush and replace engine coolant at 60 months, regardless of mileage.					X	
Inspect brake linings.	X			X		
Replace engine air cleaner filter.					X	
Replace spark plugs.					X	
Inspect PCV valve, replace as necessary.					X	
Inspect auto tension drive belt and replace if required.					X	

Miles	**72,000**	**78,000**	**84,000**	**90,000**	**96,000**	**100,000**
(Kilometers)	**(115 000)**	**(125 000)**	**(134 000)**	**(144 000)**	**(154 000)**	**(160 000)**
[Months]	**[72]**	**[78]**	**[84]**	**[90]**	**[96]**	
Change engine oil and engine oil filter.	X	X	X	X	X	
Rotate tires.	X	X	X	X	X	X
Check transfer case fluid level (4X4).				X		
Inspect brake linings.	X			X		
Replace engine air cleaner filter.				X		
Replace spark plugs.				X		
Inspect PCV valve, replace as necessary.				X		
Inspect auto tension drive belt and replace if required.‡				X		

Miles (Kilometers) [Months]	102,000 (163 000) [102]	108,000 (173 000) [108]	114,000 (182 000) [114]	120,000 (192 000) [120]
Change engine oil and engine oil filter.	X	X	X	X
Rotate tires.	X	X	X	X
Drain and refill tranfer case fluid (4X4).				X
Flush and replace engine coolant, if not done at 60 months.	X			
Flush and replace engine coolant, if not done at 102,000 miles (163 000 km)				X
Inspect brake linings.		X		
Inspect engine air cleaner filter, replace as necessary.				X
Replace spark plugs.				X
Inspect PCV valve, replace as necessary.				X

‡ This maintenance is not required if previously performed.

Inspection and service should also be performed anytime a malfunction is observed or suspected. Retain all receipts.

WARNING:
You can be badly injured working on or around a motor vehicle. Do only that service work for which you have the knowledge and the right equipment. If you have any doubt about your ability to perform a service job, take your vehicle to a competent mechanic.

JUMP STARTING

STANDARD PROCEDURE

JUMP STARTING

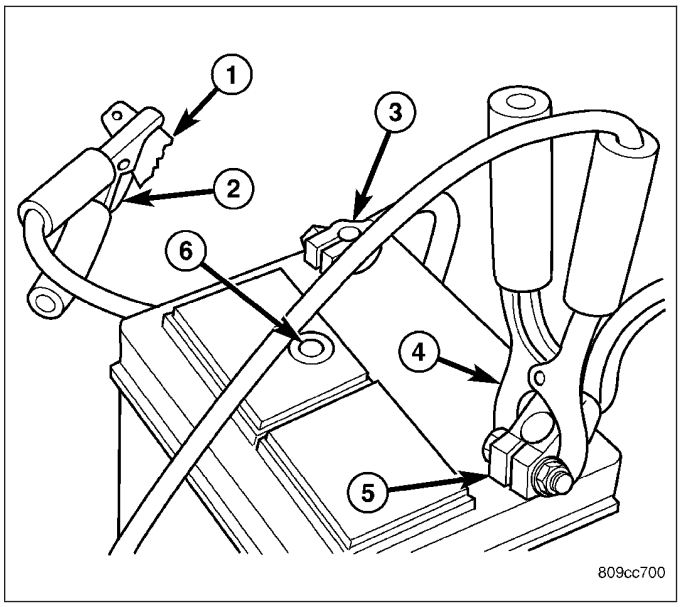
WARNING: REVIEW ALL SAFETY PRECAUTIONS AND WARNINGS IN THE BATTERY SYSTEM SECTION OF THE SERVICE MANUAL. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE)

- **DO NOT JUMP START A FROZEN BATTERY, PERSONAL INJURY CAN RESULT.**
- **IF EQUIPPED, DO NOT JUMP START WHEN MAINTENANCE FREE BATTERY INDICATOR DOT IS YELLOW OR BRIGHT COLOR.**
- **DO NOT JUMP START A VEHICLE WHEN THE BATTERY FLUID IS BELOW THE TOP OF LEAD PLATES.**
- **DO NOT ALLOW JUMPER CABLE CLAMPS TO TOUCH EACH OTHER WHEN CONNECTED TO A BOOSTER SOURCE.**
- **DO NOT USE OPEN FLAME NEAR BATTERY.**
- **REMOVE METALLIC JEWELRY WORN ON HANDS OR WRISTS TO AVOID INJURY BY ACCIDENTAL ARCING OF BATTERY CURRENT.**
- **WHEN USING A HIGH OUTPUT BOOSTING DEVICE, DO NOT ALLOW BATTERY VOLTAGE TO EXCEED 16 VOLTS. REFER TO INSTRUCTIONS PROVIDED WITH DEVICE BEING USED.**
  FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

CAUTION: When using another vehicle as a booster, do not allow vehicles to touch. Electrical systems can be damaged on either vehicle.

TO JUMP START A DISABLED VEHICLE:

1. Raise hood on disabled vehicle and visually inspect engine compartment for:
   - Battery cable clamp condition, clean if necessary.
   - Frozen battery.
   - Yellow or bright color test indicator, if equipped.
   - Low battery fluid level.
   - Generator drive belt condition and tension.
   - Fuel fumes or leakage, correct if necessary.



CAUTION: If the cause of starting problem on disabled vehicle is severe, damage to booster vehicle charging system can result.

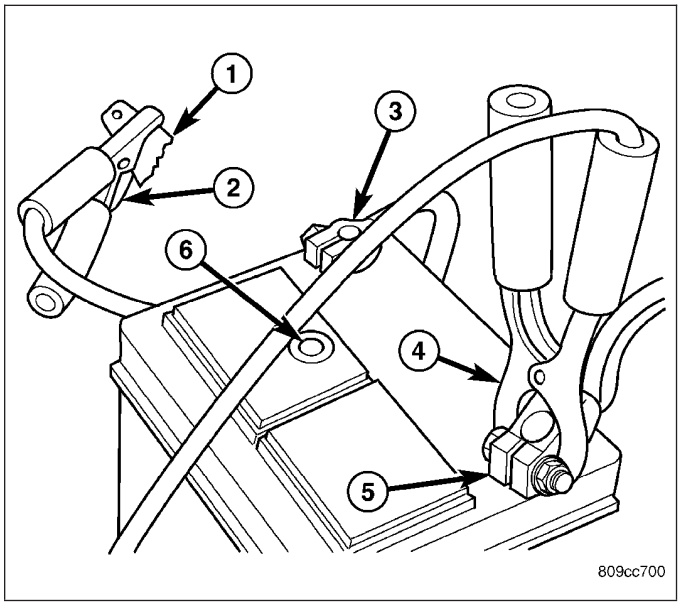
2. When using another vehicle as a booster source, park the booster vehicle within cable reach. Turn off all accessories, set the parking brake, place the automatic transmission in PARK or the manual transmission in NEUTRAL and turn the ignition OFF.
3. On disabled vehicle, place gear selector in park or neutral and set park brake. Turn off all accessories.
4. Connect jumper cables to booster battery. RED clamp (4) to positive terminal (+). BLACK clamp (2) to negative (3) terminal (-). DO NOT allow clamps at opposite end of cables to touch, electrical arc will result. Review all warnings in this procedure.
5. On disabled vehicle, connect RED jumper cable (4) clamp to positive (+) terminal. Connect BLACK jumper cable clamp to engine ground (1) as close to the ground cable attaching point as possible.
6. Start the engine in the vehicle which has the booster battery, let the engine idle a few minutes, then start the engine in the vehicle with the discharged battery.

CAUTION: Do not crank starter motor on disabled vehicle for more than 15 seconds, starter will overheat and could fail.

7. Allow battery in disabled vehicle to charge to at least 12.4 volts (75% charge) before attempting to start engine. If engine does not start within 15 seconds, stop cranking engine and allow starter to cool (15 min.), before cranking again.

DISCONNECT CABLE CLAMPS AS FOLLOWS:

- Disconnect BLACK cable clamp (2) from engine ground (1) on disabled vehicle.
- When using a booster vehicle, disconnect BLACK cable clamp (2) from battery negative terminal (3). Disconnect RED cable clamp (4) from battery positive terminal (5).
- Disconnect RED cable clamp (4) from battery positive terminal (4) on disabled vehicle.



TOWING

STANDARD PROCEDURE

TOWING RECOMMENDATIONS

A vehicle equipped with SAE approved wheel lift-type towing equipment can be used to tow all vehicles. When towing a 4WD vehicle using a wheel-lift towing device, use tow dollies under the opposite end of the vehicle. A vehicle with flatbed device can also be used to transport a disabled vehicle.

Four-Wheel Drive Vehicles

The manufacturer recommends towing with all wheels **OFF** the ground. Acceptable methods are to tow the vehicle on a flatbed or with one end of the vehicle raised and the opposite end on a towing dolly.

Two-Wheel Drive Vehicles

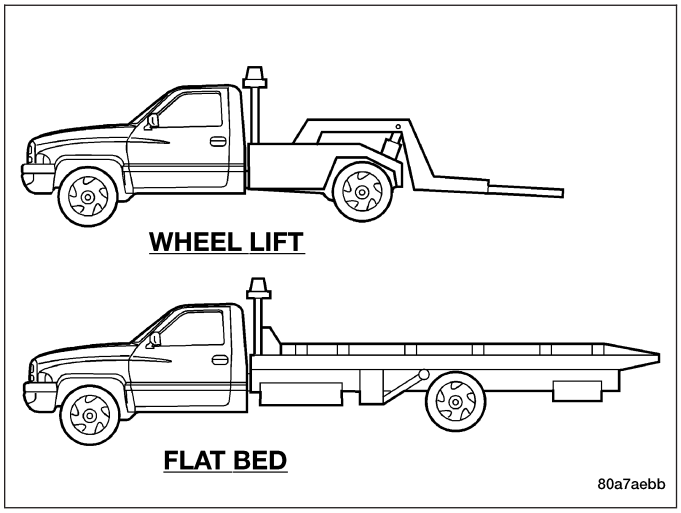
Provided that the transmission is operable, tow with the transmission in Neutral and the ignition key in the OFF position along with the front wheels raised and the rear wheels on the ground. The speed must not exceed 30 mph (50 km/h) and the distance must not exceed 15 miles (25 km).

If the vehicle is to be towed more than 15 miles (25 km), it must be towed on a flatbed, or with the rear wheels raised and the front wheels on the ground, or with the front end raised and the rear wheels on a towing dolly.

NOTE: Towing the vehicle at more than 30 mph (50 km/h) or for more than 15 miles (25 km) can cause severe transmission damage.

SAFETY PRECAUTIONS

CAUTION: The following safety precautions must be observed when towing a vehicle:



- Secure loose and protruding parts.
- Always use a safety chain system that is independent of the lifting and towing equipment.
- Do not allow towing equipment to contact the disabled vehicle's fuel tank.
- Do not allow anyone under the disabled vehicle while it is lifted by the towing device.
- Do not allow passengers to ride in a vehicle being towed.
- Always observe state and local laws regarding towing regulations.
- Do not tow a vehicle in a manner that could jeopardize the safety of the operator, pedestrians or other motorists.
- Do not attach tow chains, T-hooks, or J-hooks to a bumper, steering linkage, drive shafts or a non-reinforced frame hole.
- Do not tow a heavily loaded vehicle. Use a flatbed device to transport a loaded vehicle.

GROUND CLEARANCE

CAUTION: If vehicle is towed with wheels removed, install lug nuts to retain brake drums or rotors.

A towed vehicle should be raised until lifted wheels are a minimum 100 mm (4 in) from the ground. Be sure there is adequate ground clearance at the opposite end of the vehicle, especially when towing over rough terrain or steep rises in the road.

RAMP ANGLE

If a vehicle with flatbed towing equipment is used, the approach ramp angle should not exceed 15 degrees.

TOWING WHEN KEYS ARE NOT AVAILABLE

When the vehicle is locked and keys are not available, use a flat bed hauler. A wheel-lift device can be used on 4WD vehicles provided **all the wheels are lifted off the ground using tow dollies.**

FOUR WHEEL DRIVE TOWING

Chrysler Corporation recommends that a vehicle be transported on a flat-bed device. A Wheel-lift device can be used provided **all the wheels are lifted off the ground using tow dollies.**

WARNING: WHEN TOWING A DISABLED VEHICLE AND THE DRIVE WHEELS ARE SECURED IN A WHEEL LIFT OR TOW DOLLIES, ENSURE THE TRANSMISSION IS IN THE PARK POSITION.

CAUTION: Many vehicles are equipped with air dams, spoilers, and/or ground effect panels. To avoid component damage, a wheel-lift towing vehicle or a flat-bed hauling vehicle is recommended.

FOUR WHEEL DRIVE TOWING – REAR END LIFTED

WARNING: ENSURE VEHICLE IS ON A LEVEL SURFACE OR THE WHEELS ARE BLOCKED TO PREVENT VEHICLE FROM ROLLING.

1. Attach wheel lift device to front wheels.
2. Place the transmission in neutral.
3. Raise the front of the vehicle off the ground and install tow dollies under front wheels.
4. Attach wheel lift device to rear wheels and raise vehicle to towing position.
5. Attach safety chains to frame rails. Route chains so not to interfere with tail pipe when vehicle is lifted.
6. Turn the ignition switch to the OFF position to unlock the steering wheel.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

7. Secure steering wheel in straight ahead position with a clamp device designed for towing.
8. Place the transmission in park.

FOUR WHEEL DRIVE TOWING – FRONT END LIFTED

WARNING: ENSURE VEHICLE IS ON A LEVEL SURFACE OR THE WHEELS ARE BLOCKED TO PREVENT VEHICLE FROM ROLLING.

1. Attach wheel lift device to rear wheels.
2. Place the transmission in neutral.
3. Raise the rear of the vehicle off the ground and install tow dollies under rear wheels.
4. Attach wheel lift device to front wheels and raise vehicle to towing position.
5. Attach the safety chains.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

6. Turn the ignition switch to the OFF position to unlock the steering wheel.
7. Secure steering wheel in straight ahead position with a clamp device designed for towing.
8. Place the transmission in park.

RECREATIONAL TOWING (BEHIND MOTORHOME, ETC.) OF 4X4 VEHICLES

WARNING: You or others could be injured if you leave the vehicle unattended with the transfer case in the Neutral (N) position without first fully engaging the parking brake. The transfer case Neutral (N) position disengages both the front and rear driveshafts from the powertrain and will allow the vehicle to move despite the transmission position. The parking brake should always be applied when the driver is not in the vehicle.

CAUTION: Internal damage to the transfer case will occur if a front or rear wheel lift is used when recreational towing.

NOTE: Because of the design of the transfer cases only vehicles equipped with a NV 244 Generation II transfer case should be used for recreational towing.

NOTE: The NV 244 Generation II transfer case must be shifted into Neutral (N) for recreational towing. The Neutral (N) selection button is located on the lower left hand corner of the 4WD Control Switch. Shifts into and out of transfer case Neutral (N) can take place with the selector switch in any mode position.

NOTE: If the vehicle is to be towed for multiple days or one day for an eight hour or above duration, disconnect and isolate the battery to prevent discharge do to the illumination of the odometer and PRNDL light. After the battery negative cable is reinstalled the radio clock and stations will need to be reset.

Shifting into Neutral (N)

Use the following procedure to prepare your vehicle for recreational towing.

CAUTION: It is necessary to follow these steps to be certain that the transfer case is fully in Neutral (N) before recreational towing to prevent damage to internal parts.

1. Bring vehicle to a complete stop.
2. Shut engine OFF.
3. Place ignition key in the ON position.
4. Depress brake pedal.
5. Shift automatic transmission to Neutral (N) or depress clutch on manual transmission.
6. Using the point of a ballpoint pen or similar object, depress the recessed transfer case Neutral (N) button for 4 seconds.
7. After shift is completed and the Neutral (N) light comes on release Neutral (N) button.
8. Start engine.
9. Shift automatic transmission into Reverse (R).
10. Release brake pedal for five seconds and ensure that there is no vehicle movement.
11. Repeat steps 9 and 10 with the transmission in Drive (D).
12. Shut engine OFF and place ignition key to the unlocked OFF position.
13. Shift automatic transmission into Park (P).
14. Attach vehicle to tow vehicle with tow bar.

NOTE: Items 1 through 5 are requirements that must be met prior to depressing the Neutral (N) selection button, and must continue to be met until the 4 seconds elaspes and the shift has been completed. If any of these requirements (with the exception of 3 - Key ON) are not met prior to depressing the Neutral (N) button or are no longer met during the 4 second timer, then the Neutral (N) indicator light will flash continuously until all requirements are met or until the Neutral (N) button is released.

NOTE: The ignition key must be ON for a shift to take place and for the position indicator lights to be operable. If the key in not ON, the shift will not take place and no position indicator lights will be on or flashing.

NOTE: Flashing neutral (N) position indicator light indicates that shift requirements have not been met.

CAUTION: Damage to the transmission may occur if the transmission is shifted into Park (P) with the transfer case in Neutral (N) and the engine RUNNING. With the transfer case in Neutral (N) ensure that the engine is OFF prior to shifting the transmission into Park (P).

Shifting OUT of Neutral (N)

Use the following procedure to prepare your vehicle for normal usage.

1. Bring vehicle to a complete stop.
2. Shut engine OFF.
3. Place ignition key in the ON position.
4. Depress brake pedal.
5. Shift automatic transmission to Neutral (N) or depress clutch on manual transmission.
6. Using the point of a ballpoint pen or similar object, depress the recessed transfer case Neutral (N) button for 1 second.
7. After the Neutral (N) indicator light turns off release the Neutral (N) button.
8. After the Neutral (N) button has been released the transfer case will shift to the position identified by the selector switch.
9. Shift automatic transmission into Drive (D), release the clutch on manual transmission.

NOTE: Items 1 through 5 are requirements that must be met prior to depressing the Neutral (N) selection button, and must continue to be met until 1 second elapses and the shift has been completed. If any of these requirements (with the exception of 3 - key ON) are not met prior to depressing the Neutral (N) button or are no longer met during the 1 second time, then all of the mode position indicator lights will flash continuously until all requirements are met or until the Neutral (N) button is released.

NOTE: The ignition key must be ON for a shift to take place and for the position indicator lights to be operable. If the key is not ON, the shift will not take place and no position indicator lights will be on or flashing.

NOTE: Flashing neutral (N) position indicator light indicates that shift requirements have not been met.

CAUTION:

- **Do not use a bumper mounted clamp-on tow bar on your vehicle. The bumper face bar will be damaged.**
- **Do not disconnect the rear driveshaft because fluid will leak from the transfer case and damage internal parts.**

SUSPENSION

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WHEEL ALIGNMENT

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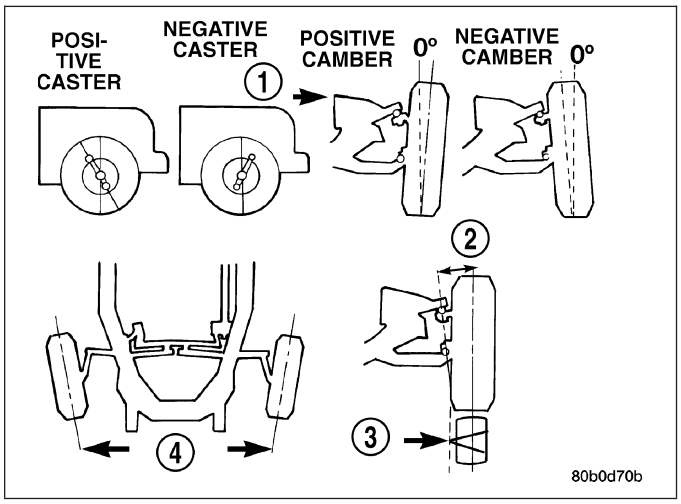
WHEEL ALIGNMENT

DESCRIPTION

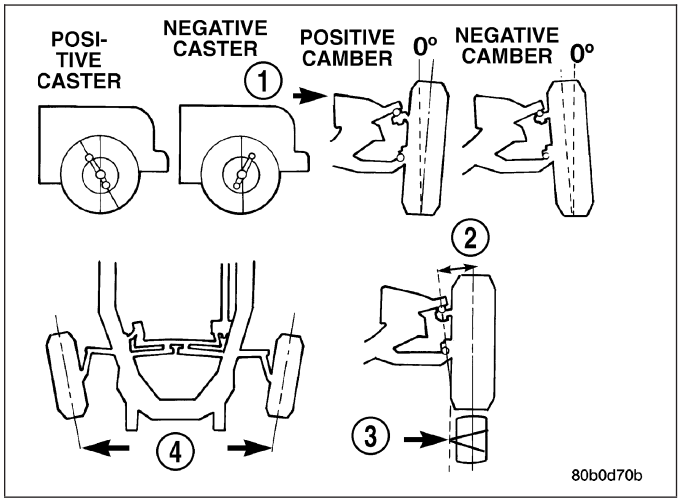
NOTE: Suspension components with rubber/urethane bushings should be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort could be affected and premature bushing wear may occur.

Wheel alignment involves the correct positioning of the wheels in relation to the vehicle. The positioning is accomplished through suspension and steering linkage adjustments. An alignment is considered essential for efficient steering, good directional stability and to minimize tire wear. The most important measurements of an alignment are caster, camber and toe.



CAUTION: Never attempt to modify suspension or steering components by heating or bending.

OPERATION



- **CASTER (1)** is the forward or rearward tilt of the steering knuckle from vertical. Tilting the top of the knuckle forward provides less positive caster. Tilting the top of the knuckle rearward provides more positive caster. Positive caster promotes directional stability. This angle enables the front wheels to return to a straight ahead position after turns.
- **CAMBER (2)** is the inward or outward tilt of the wheel relative to the center of the vehicle. Tilting the top of the wheel inward provides negative camber. Tilting the top of the wheel outward provides positive camber. Incorrect camber will cause wear on the inside or outside edge of the tire.
- **TOE (4)** is the difference between the leading inside edges and trailing inside edges of the front tires. Wheel toe position out of specification cause's unstable steering, uneven tire wear and steering wheel off- center. The wheel toe position is the **final** front wheel alignment adjustment.
- **THRUST ANGLE (3)** is the angle of the rear axle relative to the centerline of the vehicle. Incorrect thrust angle can cause off-center steering and excessive tire wear. Off-center steering, lead or pull and Minimal adjustment (clearance between spring seat hole and leaf spring pin) can be made by loosening the U-Bolts and moving one side forward and the other rearward. All damaged component(s) must be replaced to correct the thrust angle.

DIAGNOSIS AND TESTING

PRE-ALIGNMENT INSPECTION

Before starting wheel alignment, the following inspection and necessary corrections must be completed. Refer to Suspension and Steering System Diagnosis Chart below for additional information.

1. Inspect tires for size, air pressure and tread wear.
2. Inspect front wheel bearings for wear.
3. Inspect front wheels for excessive radial or lateral runout and balance.
4. Inspect ball studs, linkage pivot points and steering gear for looseness, roughness or binding.
5. Check intermediate shaft for excessive loosness or binding.
6. Inspect suspension components for wear and noise.
7. Check suspension ride height, per the recommended proceedure for variation side to side, in front and rear.
8. Road test the vehicle.

SUSPENSION AND STEERING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
FRONT END NOISE	1. Loose or worn wheel bearing.	1. Replace wheel bearing.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Loose body components.	3. Tighten or replace body components as necessary
	4. Loose or worn steering or suspension components.	4. Tighten or replace components as necessary.
EXCESSIVE PLAY IN STEERING	1. Loose or worn wheel bearing.	1. Replace wheel bearing.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Loose or worn steering gear.	3. Replace steering gear.
FRONT WHEELS SHIMMY	1. Loose or worn wheel bearing.	1. Replace wheel bearing.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Tires worn or out of balance.	3. Replace or balance tires.
	4. Alignment.	4. Align vehicle to specifications.
VEHICLE INSTABILITY	1. Loose or worn wheel bearing.	1. Replace wheel bearing.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Tire pressure.	3. Adjust tire pressure.
	4. Alignment.	4. Align vehicle to specifications.
EXCESSIVE STEERING EFFORT	1. Loose or worn steering gear.	1. Replace steering gear.
	2. Column coupler binding.	2. Replace coupler.
	3. Steering Pump	3. Replace Pump
	4. Tire pressure.	4. Adjust tire pressure.
	5. Alignment.	5. Align vehicle to specifications.
VEHICLE PULLS TO ONE SIDE	1. Tire pressure.	1. Adjust tire pressure.
	2. Tire.	2. Criss-Cross Front Tires.
	3. Alignment.	3. Align vehicle to specifications.
	4. Loose or worn steering or suspension components.	4. Tighten or replace components as necessary.
	5. Radial tire lead.	5. Rotate or replace tire as necessary.
	6. Brake pull.	6. Repair brake as necessary.
	7. Ride height.	7. Measure and adjust ride height.

STANDARD PROCEDURE

HEIGHT MEASUREMENT

The vehicle suspension height MUST be measured and adjusted before performing wheel alignment procedure. Also when front suspension components have been replaced. This measure must be performed with the vehicle supporting it's own weight and taken on both sides of the vehicle.

FRONT RIDE HEIGHT MEASUREMENT

1. Inspect tires and set to correct pressure.
2. Jounce the front of the vehicle.
3. With vehicle on level ground or hoist, make the following measurements:
   a. Front wheel spindle (center) to ground vertical distance.
   b. Measure the center of front face of bolt on the rear leg of lower control arm and the center of front face of front leg of control arm to ground vertical distance and take the average height.
   c. Difference between spindle and control arm bolt to ground average distance should be 71mm+/- 6mm. **Note that the control arm bolt is lower than the spindle**.
4. After making any ride height adjustment, roll vehicle preferably jouncing it also, to relieve camber Effects and then re-measure Lower control arm bolt to ground height.
5. Repeat the previous steps until the ride height is within specifications.

REAR RIDE HEIGHT MEASUREMENT

1. Inspect tires and set to correct pressure.
2. Jounce the front of the vehicle.
3. With vehicle on level ground or hoist, make the following measurements:
   a. Distance from the landing pad of the jounce bumper on the axle side to the jounce bumper cup lip of the frame side.
   b. The difference between the jounce bumper landing pad and the jounce bumper cup lip the reading should be 148 mm +/-10 mm for 9.25″ axle, 154 mm +/-10 mm for 8.25″ axle.

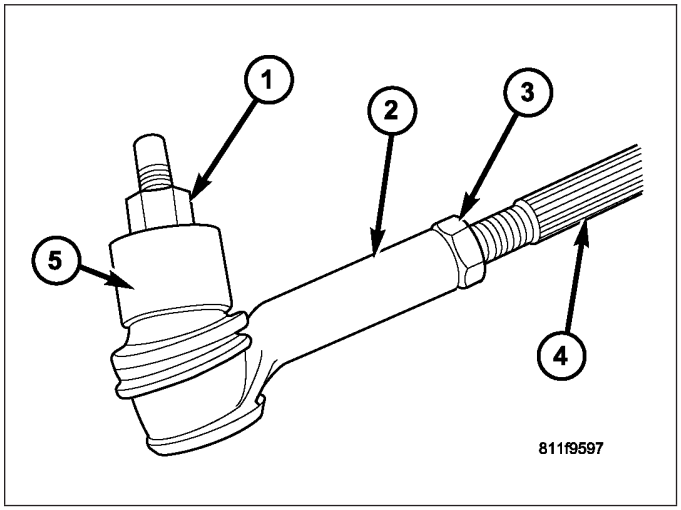
TOE ADJUSTMENT

SUSPENSION HEIGHT MESUREMENT MUST BE PERFORMED BEFORE AN ALIGNMENT.

The wheel toe position adjustment is the final adjustment.

1. Start the engine and turn wheels both ways before straightening the wheels. Secure the steering wheel with the front wheels in the straight-ahead position.
2. Loosen the tie rod jam nuts (3).

NOTE: Each front wheel should be adjusted for one-half of the total toe position specification. This will ensure the steering wheel will be centered when the wheels are positioned straight-ahead.



3. Adjust the wheel toe position by turning the inner tie rod (4) as necessary.
4. Tighten the tie rod jam nut (3) to 75 N·m (55 ft. lbs.).
5. Verify the specifications.
6. Turn off engine.

CAMBER, CASTER AND TOE ADJUSTMENT

Camber and caster angle adjustments involve changing the position of the lower control arm with the slots in the frame brackets to move the lower control arm inwards or outwards for proper adjustment. **This can be achieved by using a socket on the head of the cam bolt and turning clockwise or counterclockwise to achieve the proper specification.**

NOTE: Both front and rear lower control arm cam bolts are adjustable.

NOTE: Camber and caster adjustments must be made at the lower control arm The upper control arm is not adjustable.

NOTE: When the lower control arm cam bolts are loosened the lower control arm will normally go outwards automatically with the weight of the vehicle.

CASTER

Moving the rear position of the lower control arm at the frame in or out, will change the caster angle significantly and camber angle only slightly. To maintain the camber angle while adjusting caster, move the rear of the lower control arm in or out. Then move the front of the lower control arm slightly in the opposite direction.

CAMBER

Move both the front and rear of the lower control arm together in or out. This will change the camber angle significantly and caster angle slightly.

After adjustment is made tighten the lower control arm bolt & nuts to 203 N·m (150 ft. lbs.).

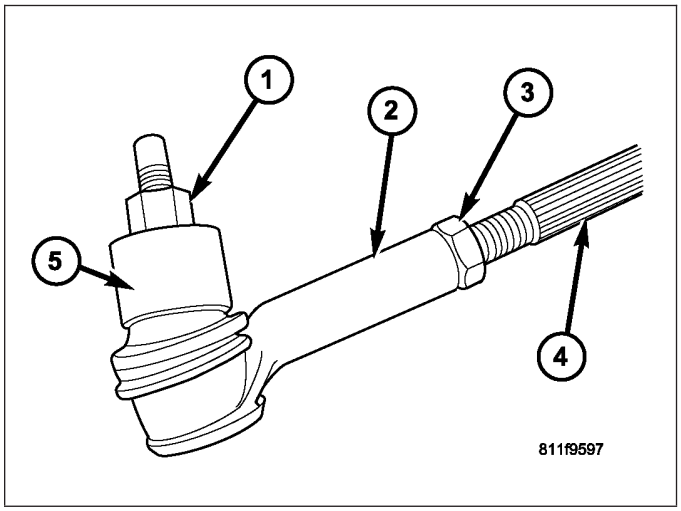
TOE ADJUSTMENT

The wheel toe position adjustment is the final adjustment.

1. Start the engine and turn wheels both ways before straightening the wheels. Secure the steering wheel with the front wheels in the straight-ahead position.
2. Loosen the tie rod jam nuts (3).

NOTE: Each front wheel should be adjusted for one-half of the total toe position specification. This will ensure the steering wheel will be centered when the wheels are positioned straight-ahead.

3. Adjust the wheel toe position by turning the inner tie rod (4) as necessary.
4. Tighten the tie rod jam nut (3) to 75 N·m (55 ft. lbs.).
5. Verify the specifications.
6. Turn off engine.



SPECIFICATIONS

ALIGNMENT

NOTE: All alignment specifications are in degrees.

SPECIFICATIONS

DESCRIPTION	SPECIFICATION			
VEHICLE	WHEEL BASE	CASTER	CAMBER	TOTAL TOE-IN
ALL	131 in	3.5 ± .05°	.25° ± .50°	.20° ± .05°
MAX RT/LT DIFFERENCE	—	-.20° ± .50°	0° ± .50°	0.05° ± 0.05°
DESCRIPTION	**REAR SPECIFICATION**			
CAMBER (-.10° ± 0.35°)		TOTAL TOE-IN (0.30° ± 0.35°)		
THRUST ANGLE 0° ± 0.4°				

FRONT

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FRONT

DESCRIPTION

SUSPENSION

The front suspension is designed to allow each wheel to adapt to different road surfaces independently. The wheels are mounted to hub/bearings units bolted to the steering knuckle. The double-row hub bearings are sealed and lubricated for life. The steering knuckles turn (pivot) on ball joints.

The front suspension is comprised of :

- Shock absorbers
- Control arms
- Steering knuckles
- Stabilizer bar
- Stabilizer link
- Tie Rod Ends
- Hub/Bearing
- Rack & Pinion
- Ball Joints

NOTE: Components attached with a nut must be torqued to specification.

NOTE: Suspension components with rubber/urethane bushings should be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort could be affected and premature bushing wear may occur.

CONTROL ARMS

The lower control arms bolt to the lower frame brackets and pivots through bushings. The frame brackets have slotted holes which allow the arms to be adjusted for caster and camber.

The control arms have lube for life ball studs. The control arm travel (jounce) is limited through the use of rubber/urethane bumpers. Rebound travel is limited by the shock absorber.

SPECIFICATIONS

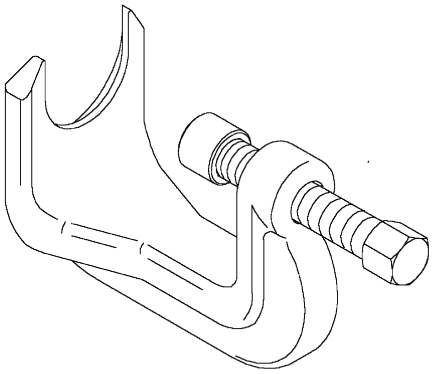
TORQUE CHART

TORQUE SPECIFICATIONS

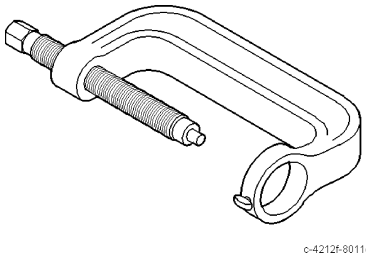
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Shock Absorber Upper Nut	102	75	—
Shock Absorber Lower Bolt	81	60	—
Lower Suspension Arm Frame Nuts	244	180	—
Lower Suspension Arm Ball Joint Nut	75	55	—
Upper Suspension Arm Frame Nuts	102	75	—
Upper Suspension Arm Ball Joint Nut	75	55	—
Stabilizer Bar Frame Bolt	61	45	—
Stabilizer Link to Lower Control Arm	169	125	—
Stabilizer Link Stabilizer Bar Nut	37	27	—
Hub/Bearing Bolts	163	120	—
Tie Rod End to Knuckle Nut	75	55	—
Tie Rod End Jam Nut	75	55	—

SPECIAL TOOLS

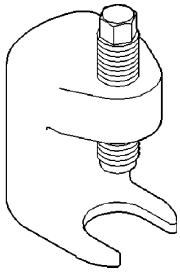
FRONT SUSPENSION

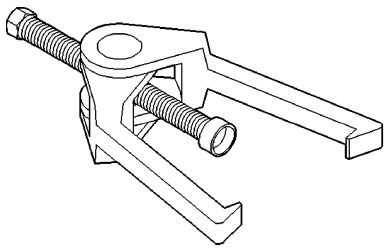


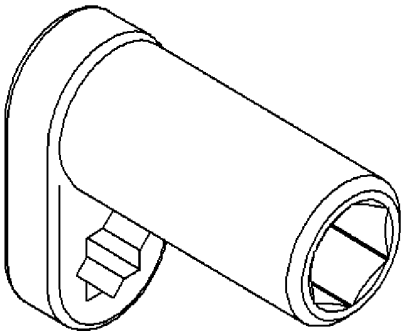
PULLER - 8677



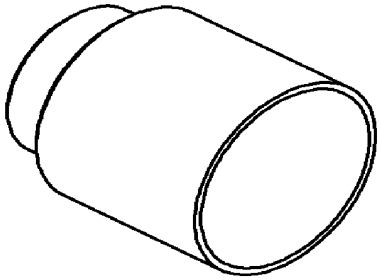
BALL JOINT PRESS - C-4212F



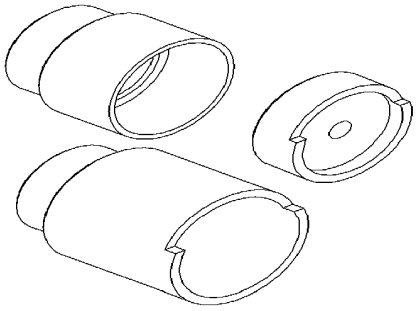




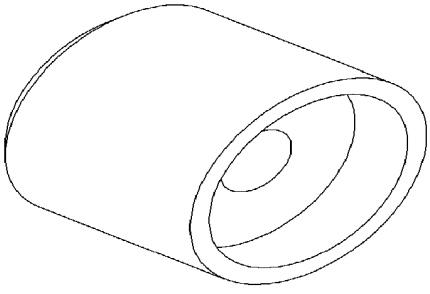
Wrench, Shock Nut 9362



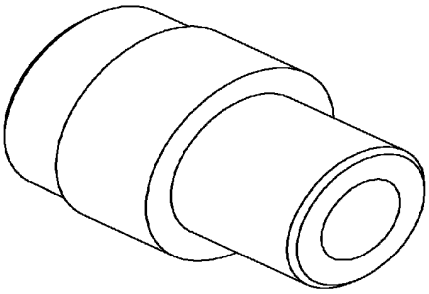
BALL JOINT - 9604



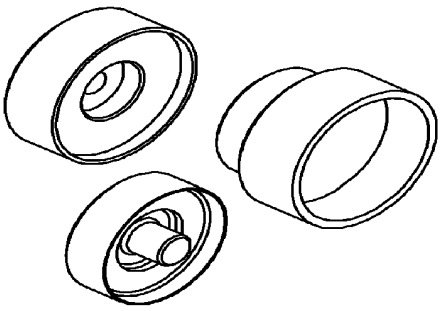
BALL JOINT - 9654



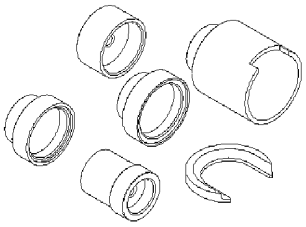
BALL JOINT - 8441-4



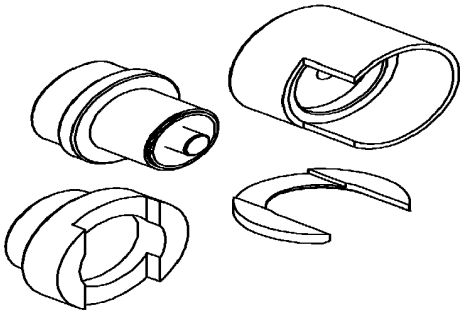
BALL JOINT - 8445-3



BUSHING - 9603



BUSHING - 9334



BUSHINGS - 9601

BUSHINGS

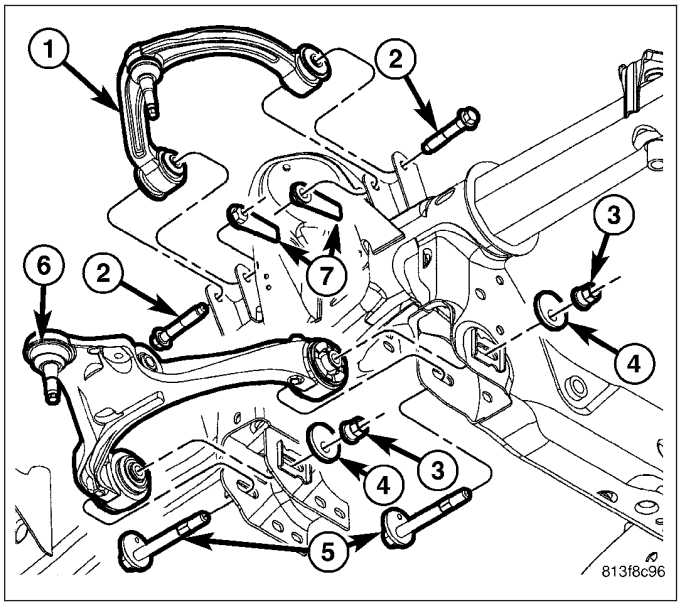
DESCRIPTION

Suspension components with rubber/urethane bushings should be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort could be affected and premature bushing wear may occur.

REMOVAL

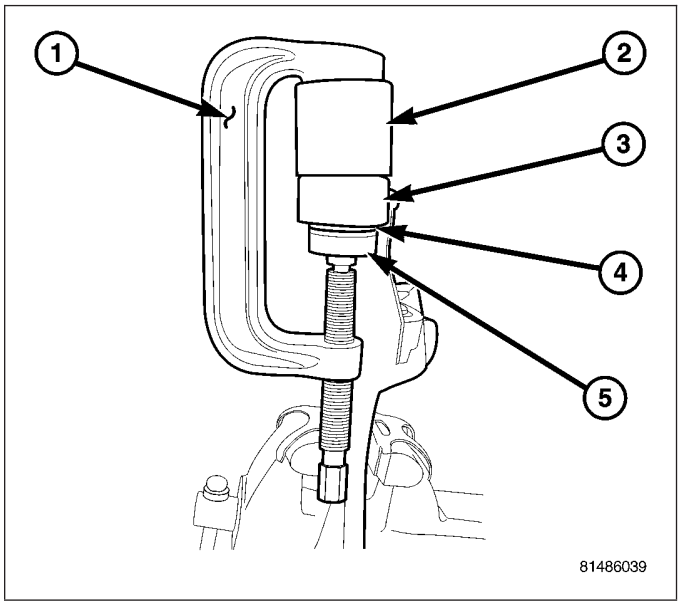
LOWER CONTROL ARM BUSHING

1. Remove the lower control arm (6) (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - REMOVAL).
2. Secure the control arm in a vise.



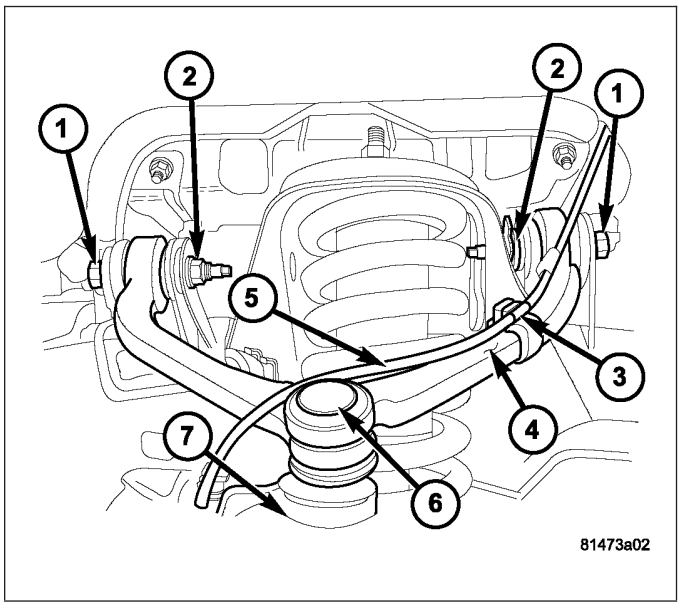
NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.

3. Install special tools C-4212-F (press) (1), 9334–5 (Receiver) (2), 9603–3 (Driver) (5) to press the bushing out of the lower control arm.



UPPER CONTROL ARM BUSHING

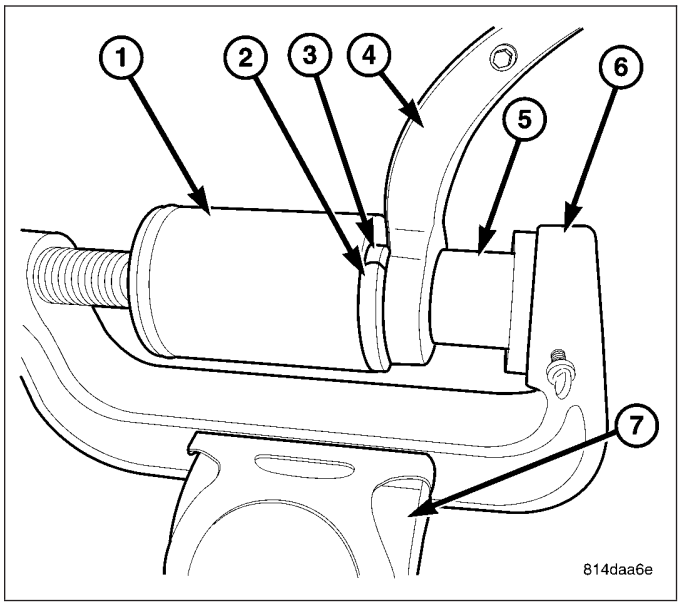
1. Remove the upper control arm (4) (Refer to 2 - SUSPENSION/FRONT/UPPER CONTROL ARM - REMOVAL).



2. Secure the control arm in a vise (7).

NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.

3. Install special tools C-4212-F (press) (6), 6761(Receiver) (1), 9601-2 (Reaction Plate) (2), 9601-1 (Driver) (5) to press the bushing (3) out of the upper control arm (4).

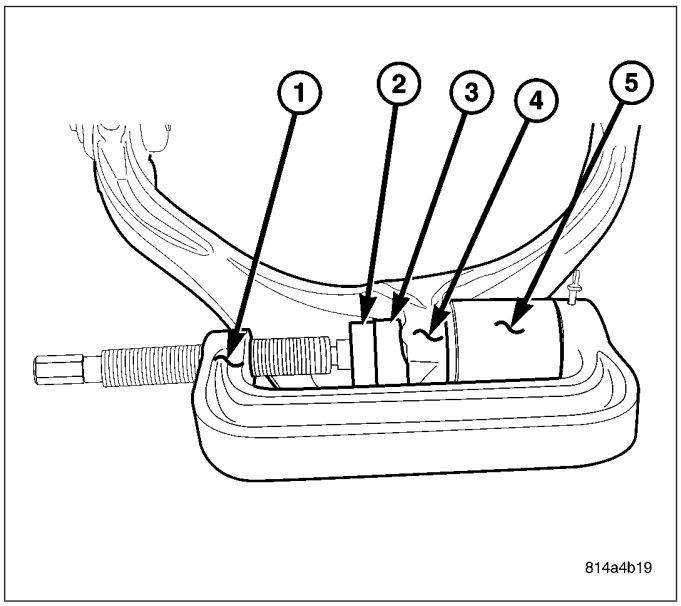


LOWER CONTROL ARM SHOCK BUSHING

1. Remove the shock (Refer to 2 - SUSPENSION/ FRONT/SHOCK - REMOVAL).

NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.

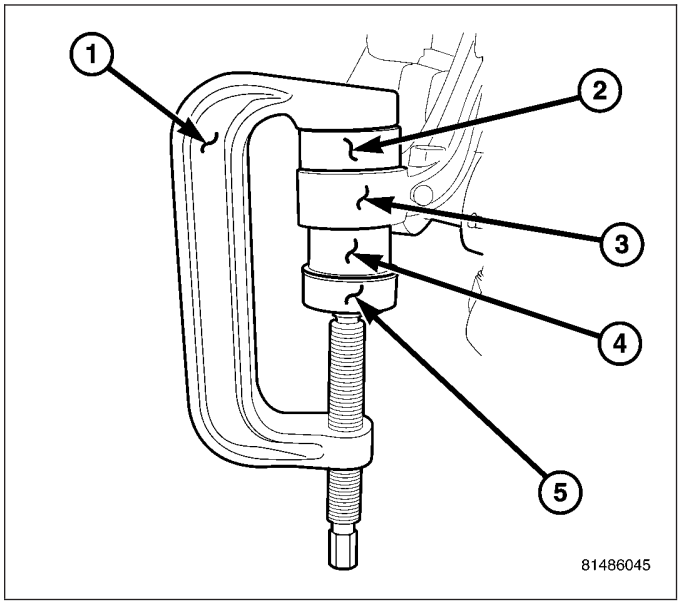
2. Install special tools to press the bushing (3) out of the lower control arm (4) using special tools C-4212-F (Press) (1), 9653–1 (driver) (4) and 9602 (Receiver) (5).



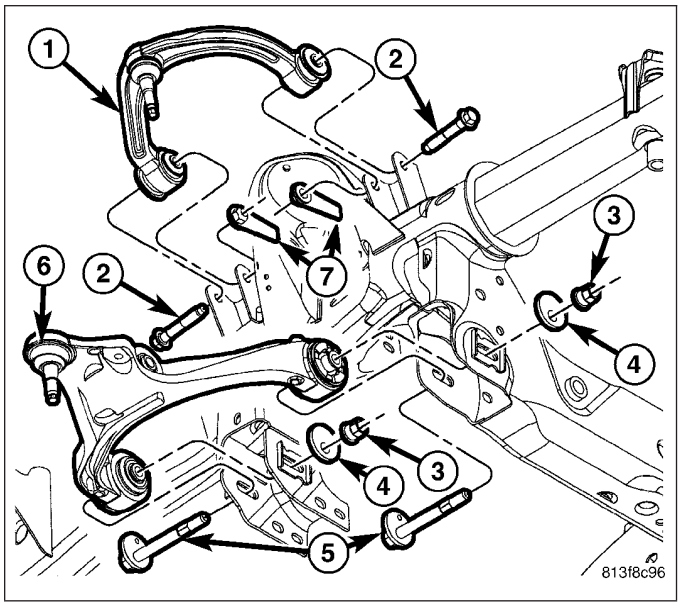
INSTALLATION

LOWER CONTROL ARM BUSHING

1. Install the new bushing (4) into the lower control arm (3) using tools C-4212-F (Press) (1), 9603–2 (Depth Gauge) (2), 9603–1 (Driver) (5).

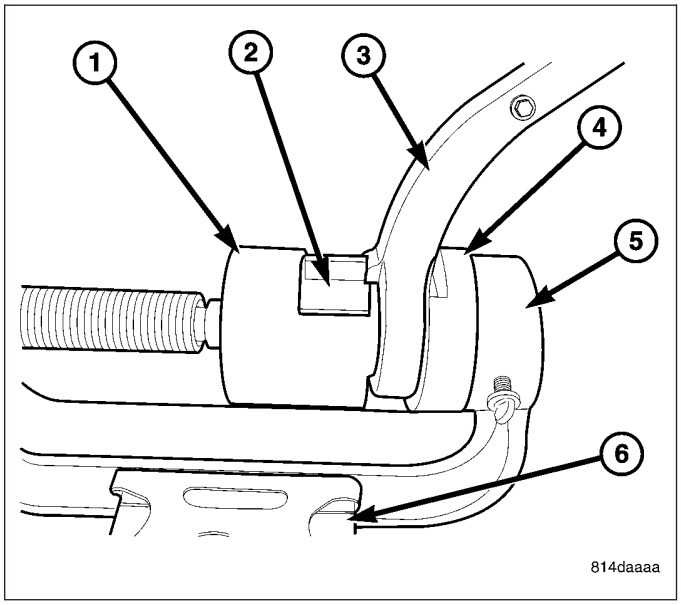


2. Remove the control arm from the vise.
3. Install the lower control arm (6) (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - INSTALLATION).
4. Reset the vehicle ride height (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).
5. Perform a wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

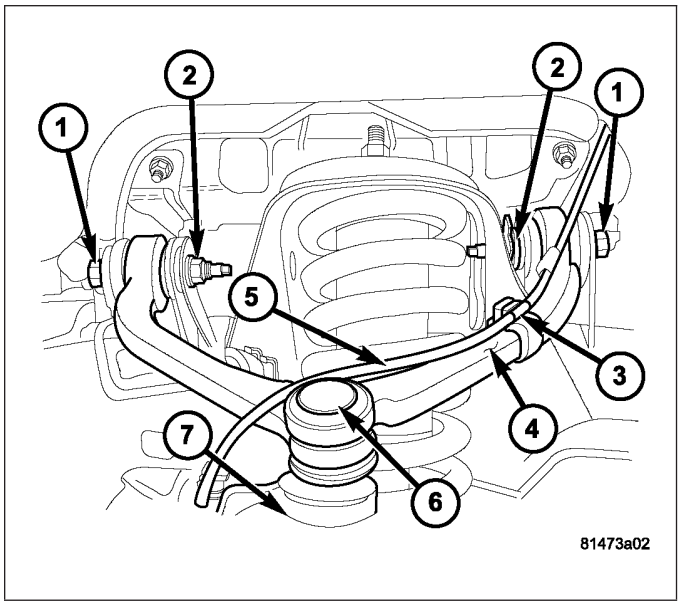


UPPER CONTROL ARM BUSHING

1. Install the new bushing (2) into the lower control (3) arm using tools C-4212-F (Press) (5), 9601-3 (Depth Gauge) (4), 9601-4 (Driver) (1).
2. Remove the control arm from the vise (6).



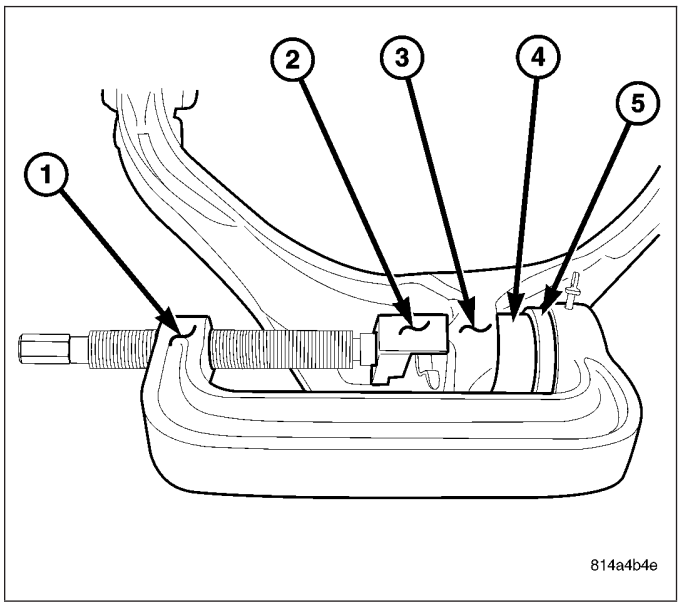
3. Install the upper control arm (4) (Refer to 2 - SUSPENSION/FRONT/UPPER CONTROL ARM - INSTALLATION).
4. Reset the vehicle ride height (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).
5. Perform a wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).



LOWER CONTROL ARM SHOCK BUSHING

NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.

1. Install the new shock bushing (3) into the lower control arm (3) using tools C-4212-F (Press) (1), 9653–3 (driver) (5), 9602–2 (Depth gauge) (2) the depth gauge will automatically set the depth of the bushing (4) in the control arm (3).
2. Install the shock (Refer to 2 - SUSPENSION/FRONT/SHOCK - INSTALLATION).



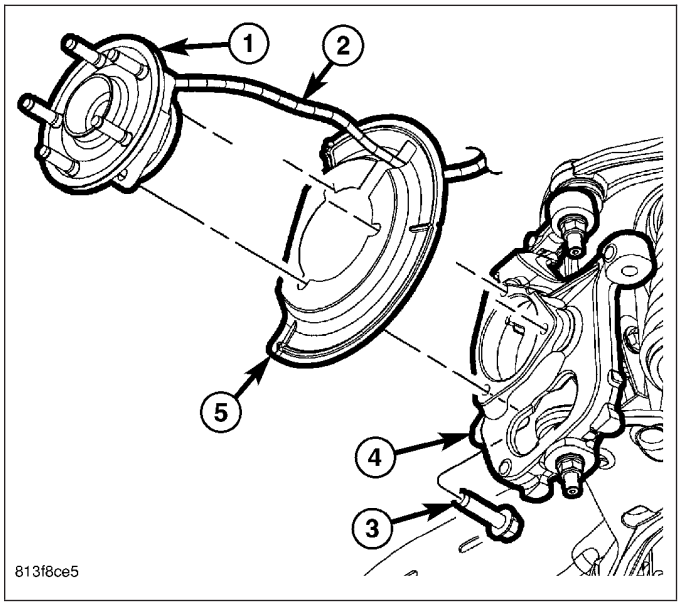
HUB / BEARING

REMOVAL

1. Raise and support the vehicle.
2. Remove the wheel and tire assembly.
3. Remove the brake caliper and rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
4. Remove the ABS wheel speed sensor if equipped, (Refer to 5 - BRAKES/ELECTRICAL/FRONT WHEEL SPEED SENSOR - REMOVAL).
5. Remove the halfshaft nut **4X4 only**.

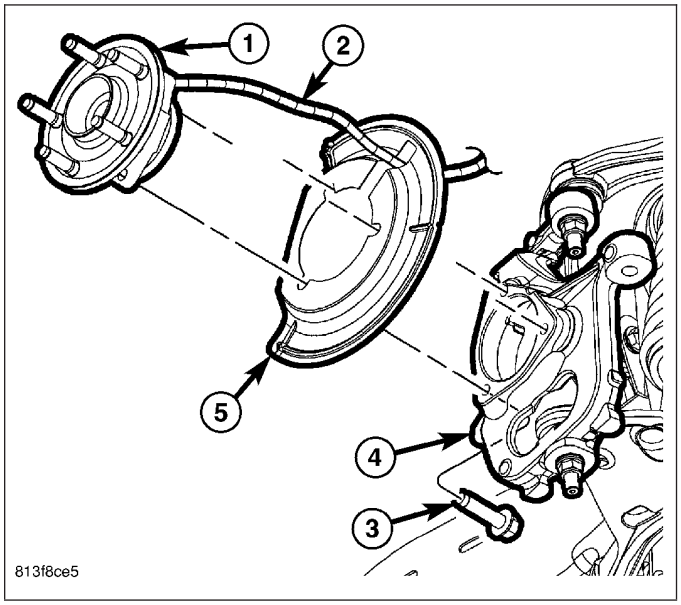
NOTE: Do not strike the knuckle with a hammer to remove the tie rod end or the ball joint. Damage to the steering knuckle will occur.

6. Pull down on the steering knuckle to separate the halfshaft from the hub/bearing. **4X4 only**
7. Remove the three hub/bearing mounting bolts (3) from the steering knuckle (4).
8. Slide the hub/bearing (1) out of the steering knuckle (4).
9. Remove the brake dust shield (5).



INSTALLATION

1. Install the brake dust shield (5).
2. Install the hub/bearing (1) into the steering knuckle (4) and tighten the bolts (3) to 163 N·m (120 ft. lbs.).
3. Install the brake rotor and caliper (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
4. Install the ABS wheel speed sensor (4) if equipped (Refer to 5 - BRAKES/ELECTRICAL/FRONT WHEEL SPEED SENSOR - INSTALLATION).



5. Install the halfshaft nut and tighten to 251 N·m (185 ft. lbs.) **4X4 only**.
6. Install the wheel and tire assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
7. Remove the support and lower vehicle.

KNUCKLE

DESCRIPTION

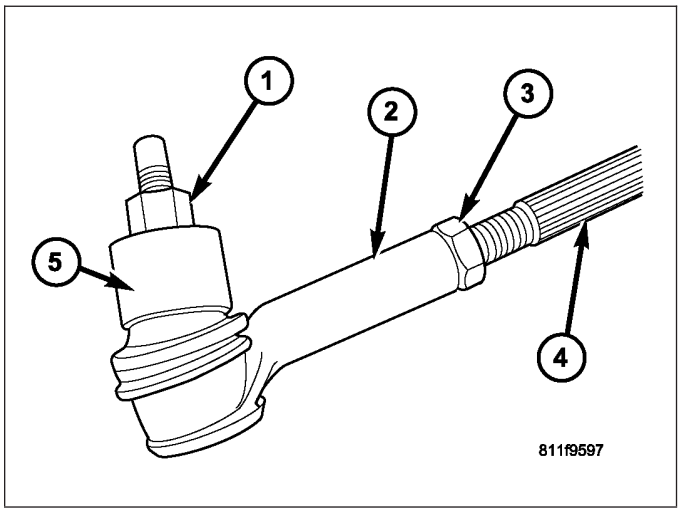
The knuckle is a single casting with legs machined for the upper and lower ball joints. The knuckle also has machined mounting locations for the front brake calipers and hub bearing.

OPERATION

The steering knuckle pivot between the upper and lower ball joint. Steering linkage attached to the knuckle allows the vehicle to be steered.

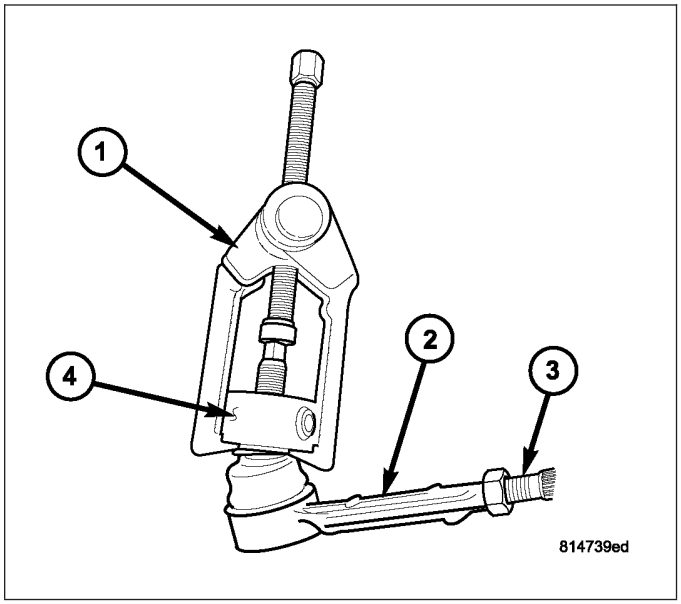
REMOVAL

1. Raise and support the vehicle.
2. Remove the wheel and tire assembly.
3. Remove the brake caliper, rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL), shield and ABS wheel speed sensor if equipped (Refer to 5 - BRAKES/ELECTRICAL/FRONT WHEEL SPEED SENSOR - REMOVAL).
4. Remove the front halfshaft nut **4X4 only**.
5. Remove the tie rod end nut (1).

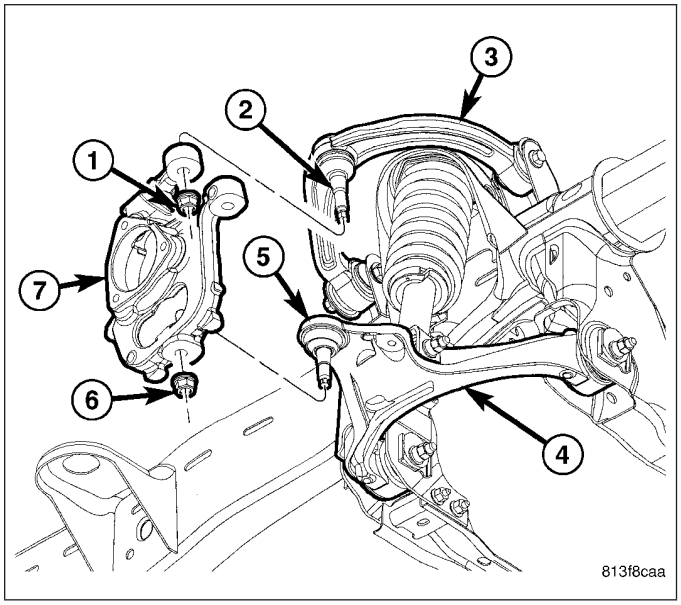


6. Separate the tie rod (2) from the knuckle with Remover C-3894–A (1).

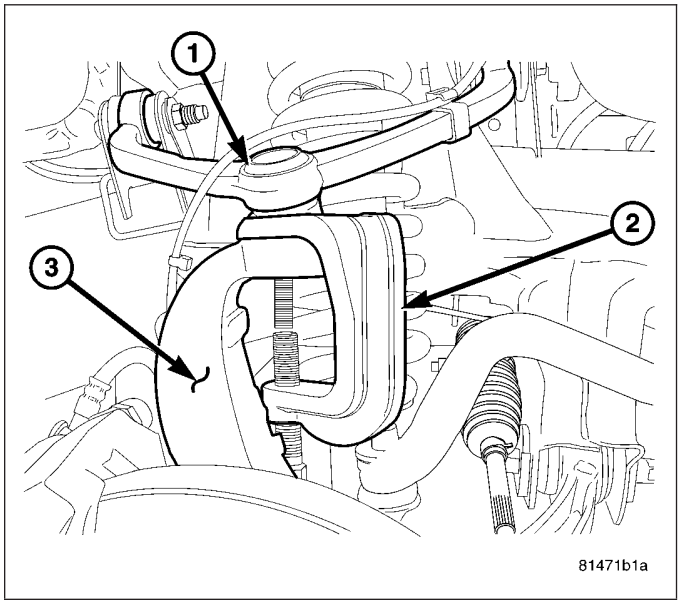
CAUTION: When installing Remover 8677 to separate the ball joint, be careful not to damage the ball joint seal.



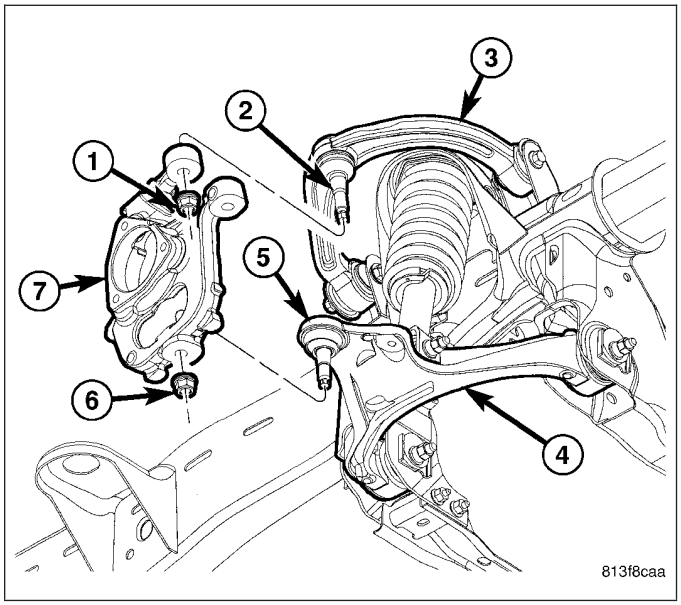
7. Remove the upper ball joint nut (1).



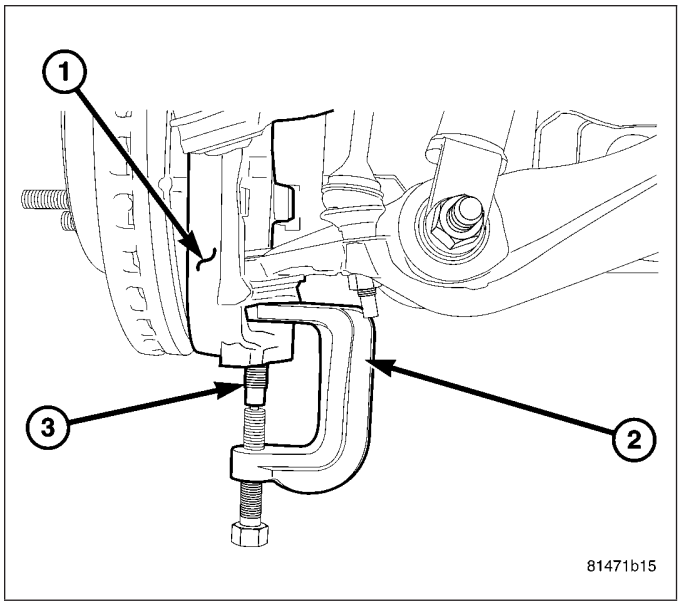
8. Separate the ball joint (1) from the knuckle (3) with Remover 8677 (2).
9. Install an hydraulic jack to support the lower control arm.



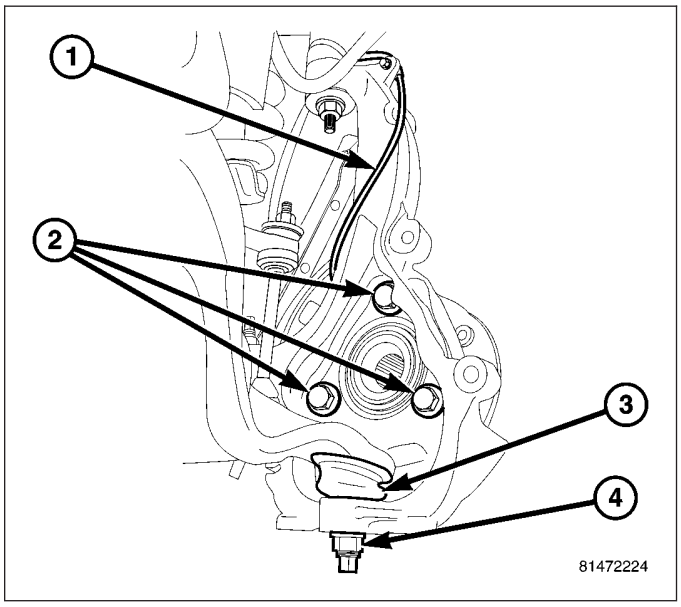
10. Remove the lower ball joint nut (6).



11. Separate the ball joint (3) from the knuckle (1) with Remover 8677 (2) and remove the knuckle (1).



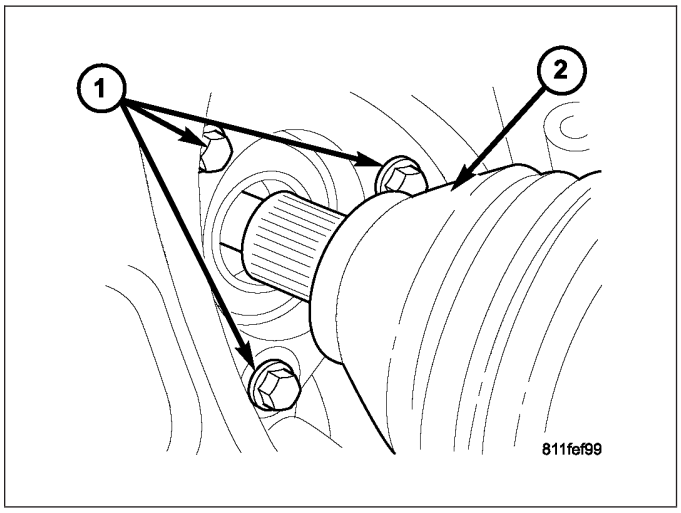
12. Remove the hub/bearing bolts (2) from the knuckle (1).
13. Remove the hub/bearing from the steering knuckle (1) (Refer to 2 - SUSPENSION/FRONT/ HUB / BEARING - REMOVAL).
14. Remove the steering knuckle (1).



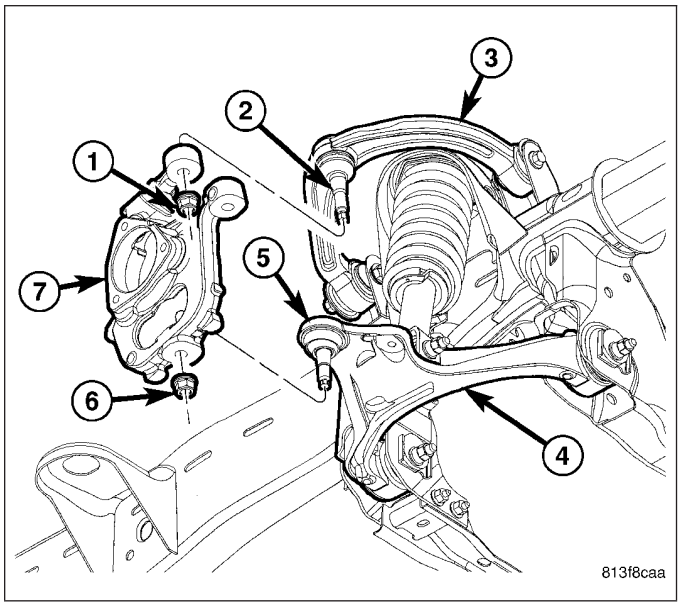
INSTALLATION

CAUTION: The ball joint stud tapers must be CLEAN and DRY before installing the knuckle. Clean the stud tapers with mineral spirits to remove dirt and grease.

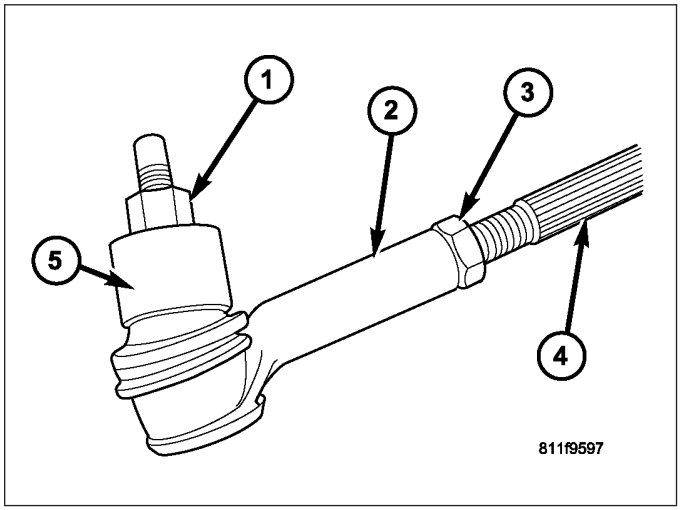
1. Install the hub/bearing to the steering knuckle and tighten the bolts (1) to 163 N·m (120 ft. lbs.).



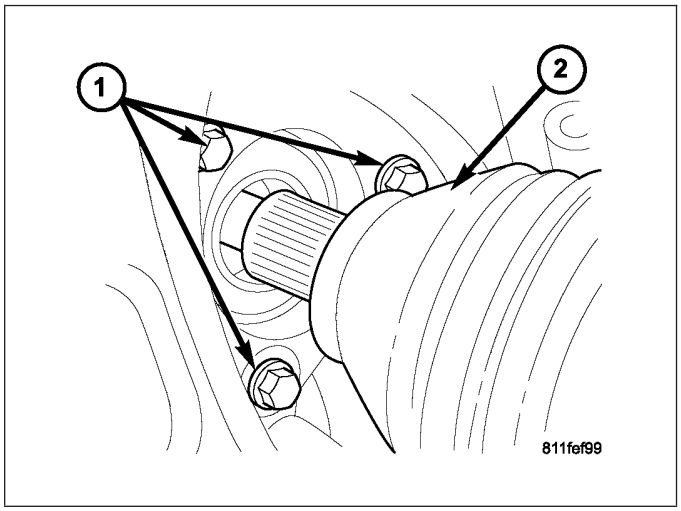
2. Install the knuckle (7) onto the upper (2) and lower ball joints (5).
3. Install the upper (1) and lower ball joint nuts (6). Tighten the nut to 75 N·m (55 ft. lbs.).
4. Remove the hydraulic jack from the lower control arm (4).



5. Install the tie rod end (2) and tighten the nut (1) to 75 N·m (55 ft. lbs.).



6. Install the front halfshaft (2) into the hub/bearing **4X4 only**.
7. Install the the halfshaft nut and tighten to 251 N·m (185 ft. lbs.) **4X4 only**.
8. Install the ABS wheel speed sensor if equipped (Refer to 5 - BRAKES/ELECTRICAL/FRONT WHEEL SPEED SENSOR - INSTALLATION) and brake shield, rotor and caliper (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
9. Install the wheel and tire assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
10. Remove the support and lower the vehicle.



11. Perform a wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

LOWER BALL JOINT

DIAGNOSIS AND TESTING

LOWER BALL JOINT

NOTE: If the ball joint is equipped with a lubrication fitting, grease the joint then road test the vehicle before performing test.

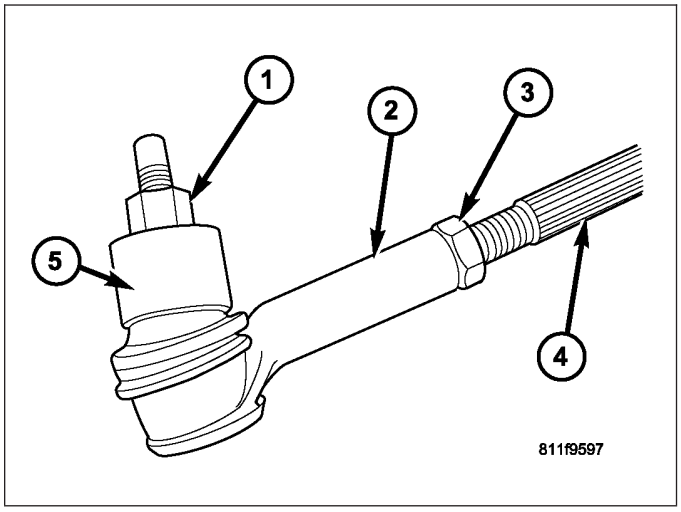
1. Raise the front of the vehicle. Place safety floor stands under both lower control arms as far outboard as possible. Lower the vehicle to allow the stands to support some or all of the vehicle weight.
2. Mount a dial indicator solidly to the topside of the lower control arm and then zero the dial indicator.
3. Position the indicator plunger against the bottom surface of the steering knuckle.

NOTE: The dial indicator plunger must be perpendicular to the machined surface of the steering knuckle.

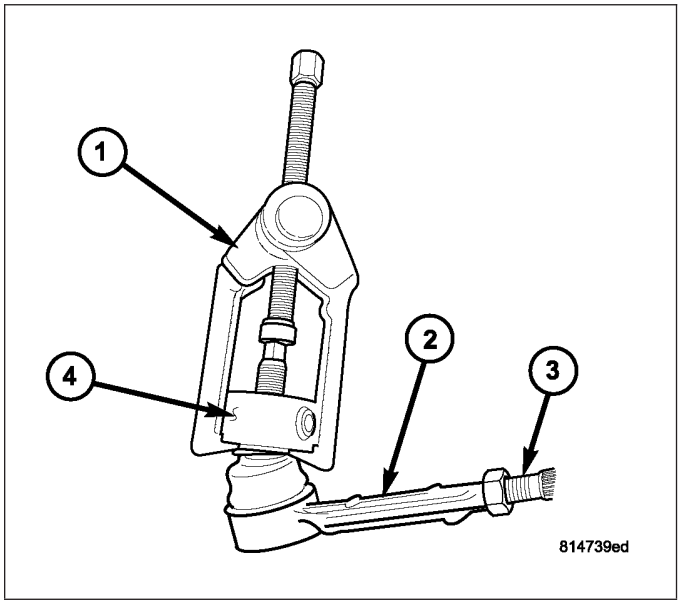
4. Position a pry bar under the tire assembly. Pry upwards on the tire assembly.
5. If the travel exceeds 0.5 mm (0.020 in.), replace the lower ball joint (Refer to 2 - SUSPENSION/FRONT/LOWER BALL JOINT - REMOVAL).

REMOVAL

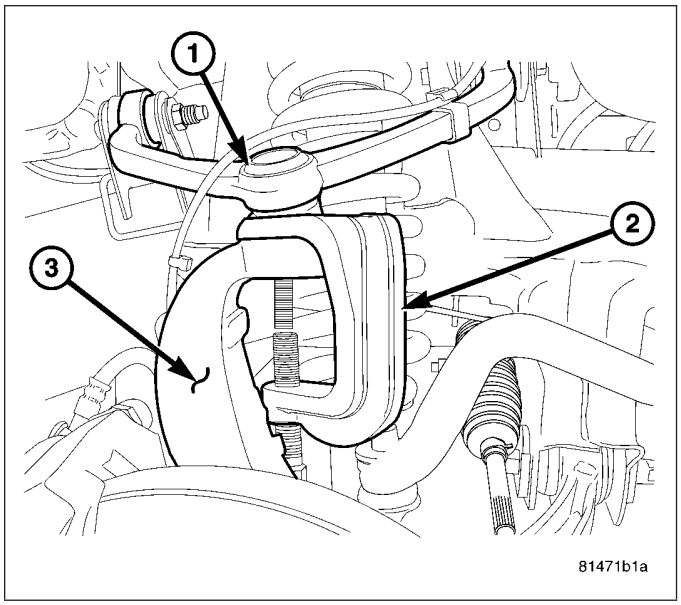
1. Remove the tire and wheel assembly.
2. Remove the brake caliper and rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
3. Remove the outer tie rod retaining nut (1) from the knuckle (5).



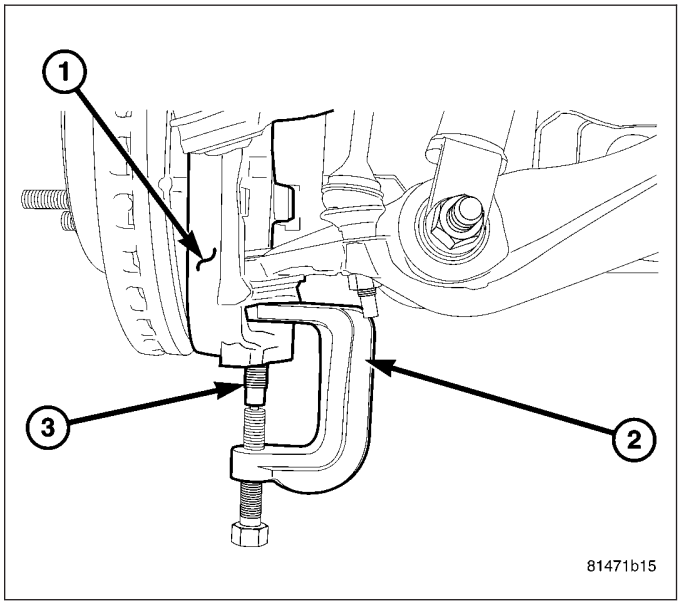
4. Separate the tie rod (1) from the steering knuckle using special tool C-3894–A (1) (Refer to 19 - STEERING/LINKAGE/TIE ROD END - REMOVAL).



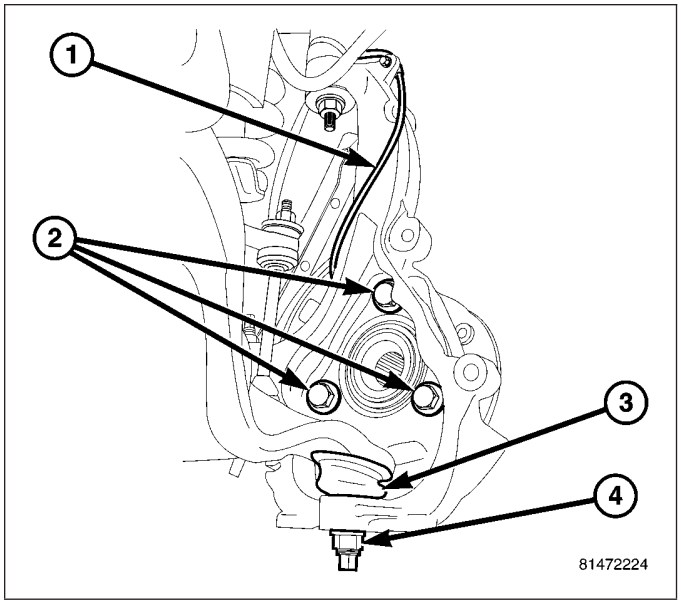
5. Remove the upper ball joint nut, then separate the upper ball joint (1) from the knuckle (3) using special tool 8677 (2).



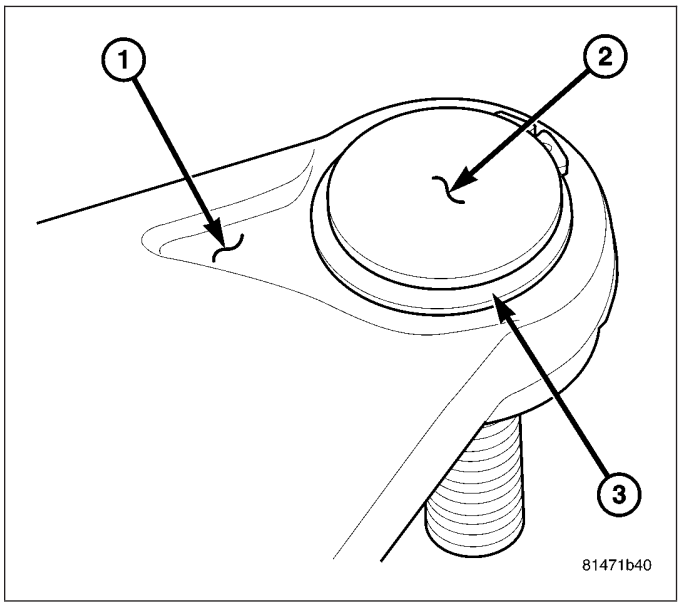
6. Remove the lower ball joint nut, then separate the lower ball joint (3) from the steering knuckle (1) using special tool 8677 (2).



7. Remove the steering knuckle (1) (Refer to 2 - SUSPENSION/FRONT/KNUCKLE - REMOVAL).

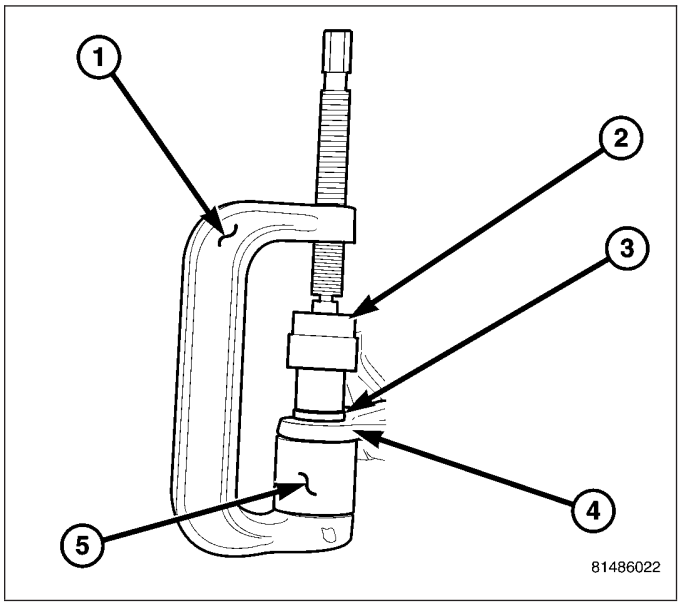


8. Move the halfshaft to the side and support the halfshaft out of the way **4X4 only**.
9. Remove the snap ring (3) from the ball joint flange (2).



NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.

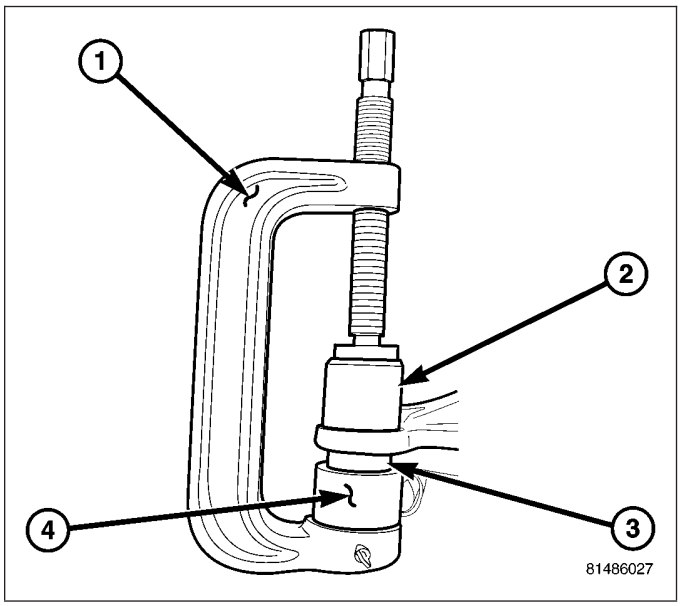
10. Press the ball joint (3) from the lower control arm (4) using special tools C-4212-F (PRESS) (1), 8445–3 (Driver) (2) and 9604 (Receiver) (5).



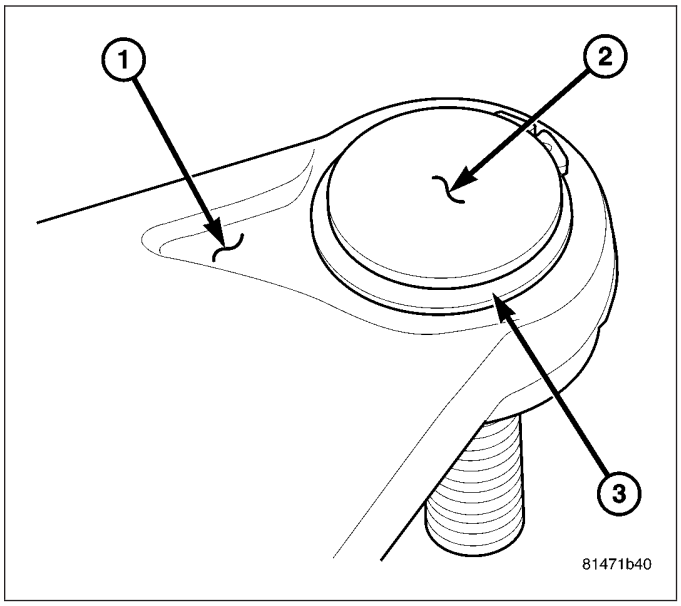
INSTALLATION

NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.

1. Install the ball joint (3) into the control arm and press in using special tools C-4212-F (press) (1), 8441–4 (Receiver) (2) and 9654–1 (Driver) (4).

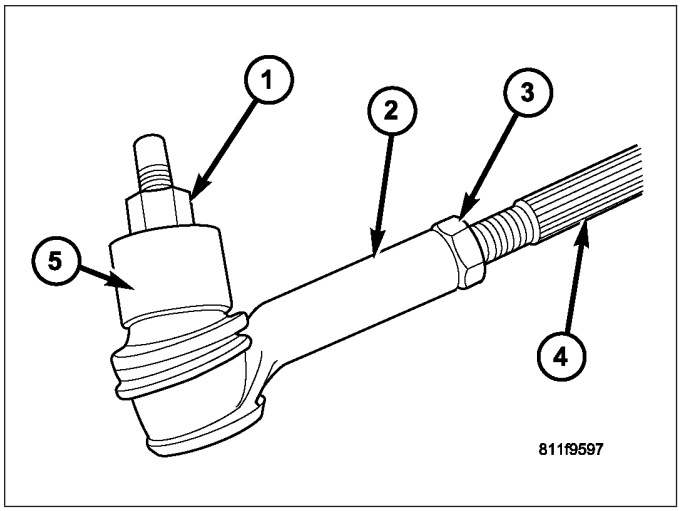


2. Install the snap ring (3) around the ball joint flange (2).



3. Remove the support for the halfshaft and install into position **4X4 only**.
4. Install the steering knuckle (Refer to 2 - SUSPENSION/FRONT/KNUCKLE - INSTALLATION).

5. Install the tie rod end (2) into the steering knuckle (5), then install the retaining nut (1) and tighten to 75 N·m (55 ft. lbs.) (Refer to 19 - STEERING/LINKAGE/TIE ROD END - INSTALLATION).
6. Install and tighten the halfshaft nut to 251 N·m (185 ft. lbs.). (If Equipped).
7. Install the brake caliper and rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
8. Install the tire and wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
9. Check the vehicle ride height (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

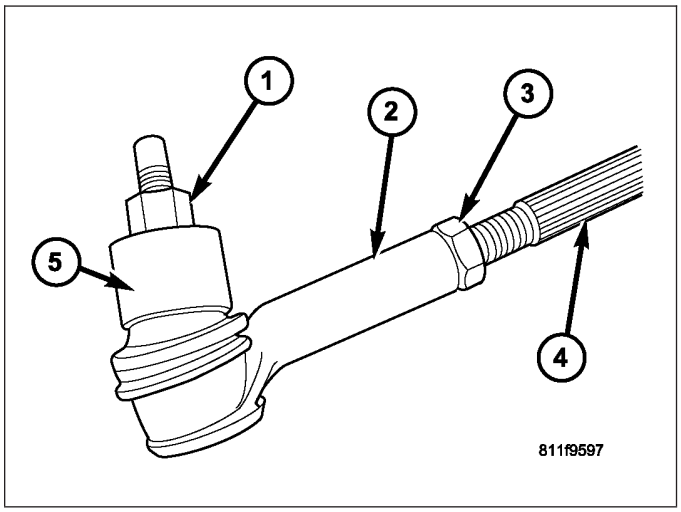


10. Perform a wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

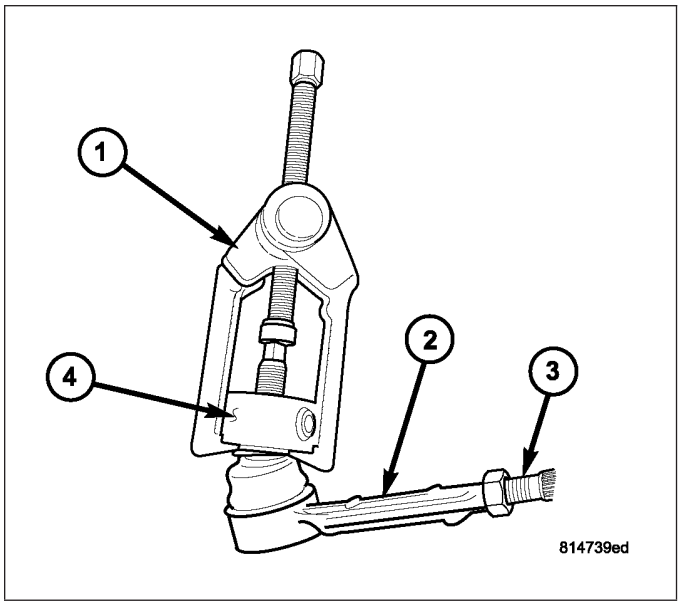
LOWER CONTROL ARM

REMOVAL

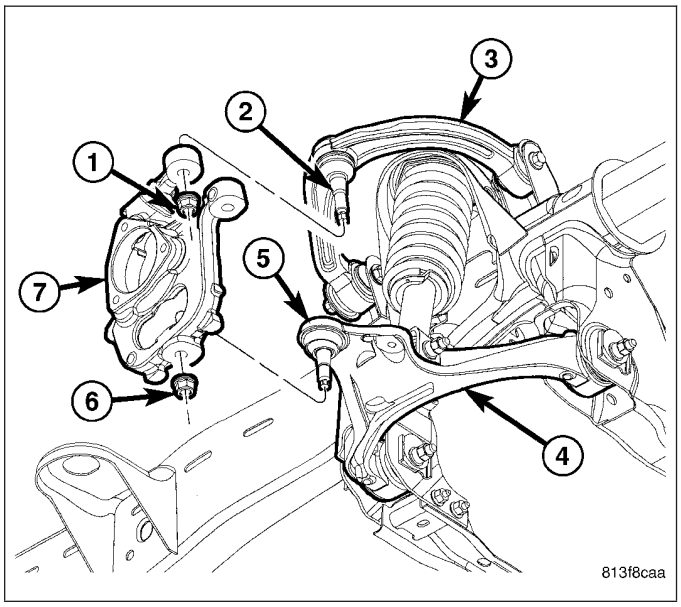
1. Raise and support the vehicle.
2. Remove the wheel and tire assembly.
3. Remove the disc brake caliper assembly (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
4. Remove the disc brake rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
5. Disconnect the wheel speed sensor at the wheel well.
6. Remove tie rod end jam nut (1).

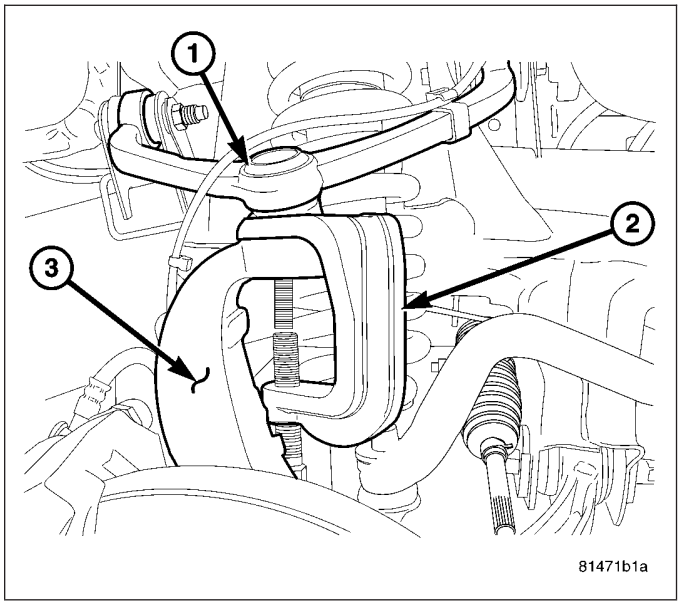


7. Disconnect the tie rod (2) from the knuckle using special tool C-3894–A (1) (Refer to 19 - STEERING/LINKAGE/TIE ROD END - REMOVAL).

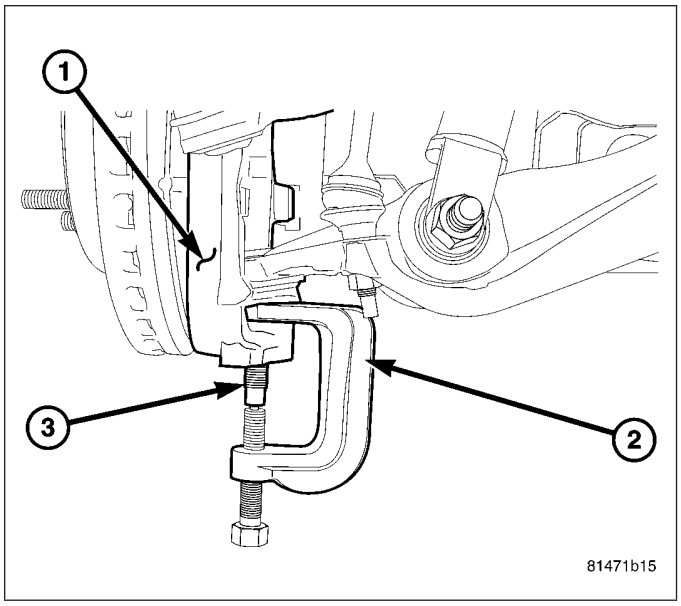


8. Remove the front halfshaft nut **4X4**.
9. Remove the upper ball joint nut. Separate the upper ball joint (1) from the steering knuckle (3) with Remover 8677 (2).



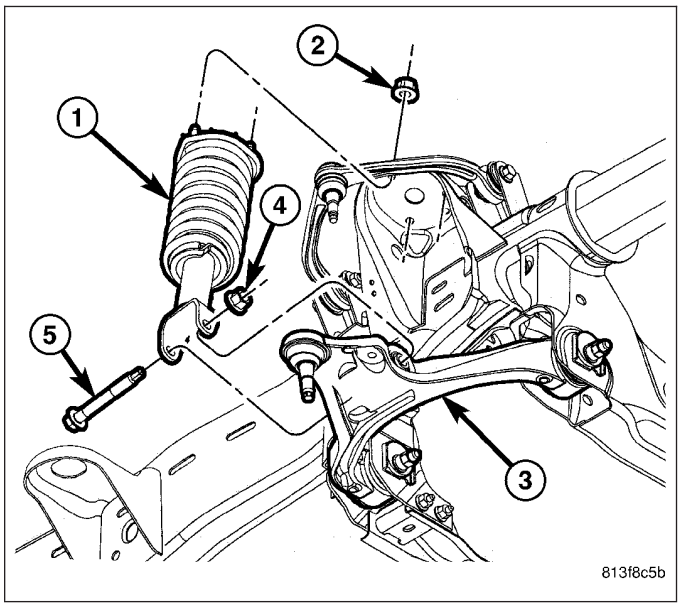


10. Remove the lower ball joint nut (3). Separate the lower ball joint (3) from the steering knuckle (1) with Remover 8677 (2).

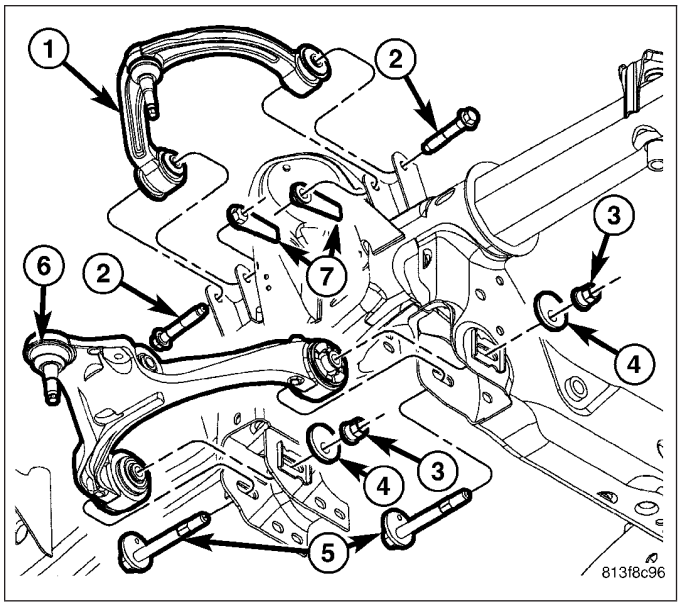


11. Remove the steering knuckle (7) (Refer to 2 - SUSPENSION/FRONT/KNUCKLE - REMOVAL).

12. Remove the stabilizer bar link (Refer to 2 - SUSPENSION/FRONT/STABILIZER LINK - REMOVAL).
13. Remove the shock absorber lower bolt (4) and nut (5).



14. Remove the lower control arm bolts (3) ,nuts (5) and washers(4).
15. Remove the lower control arm (6) from the vehicle.

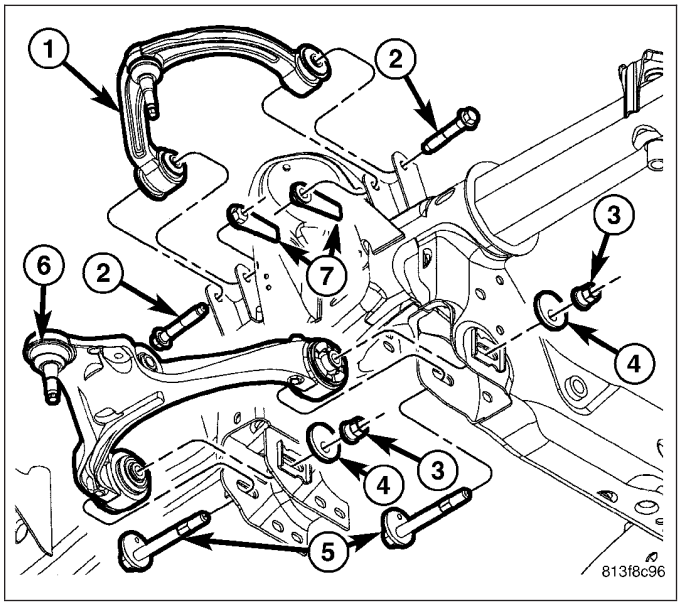


INSTALLATION

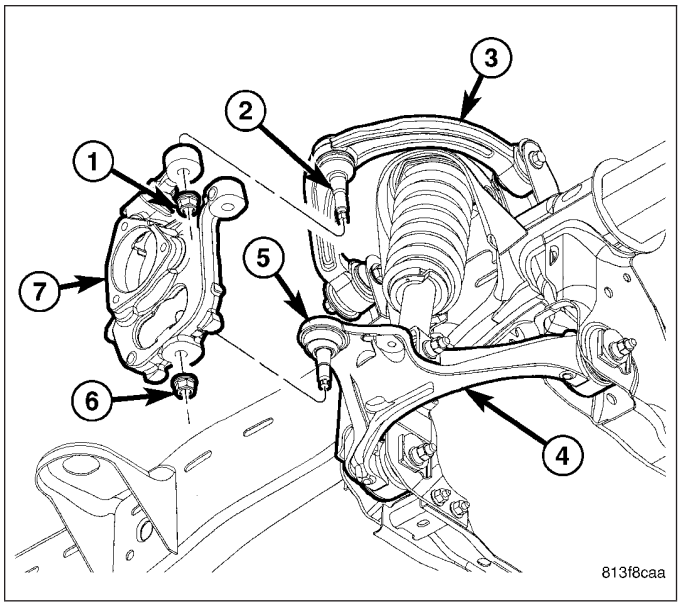
NOTE: All suspension components should be tighten with the weight of the vehicle on them (curb height).

1. Position the lower control arm (6) at the frame rail brackets. Install the pivot bolts (3) washers (4) and nuts (5). Tighten the nuts finger-tight.

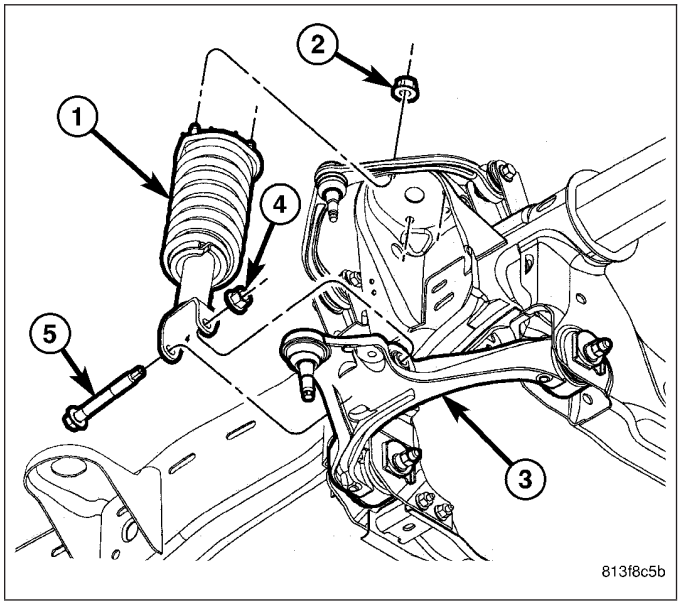
CAUTION: The ball joint stud taper must be CLEAN and DRY before installing the knuckle. Clean the stud taper with mineral spirits to remove dirt and grease.



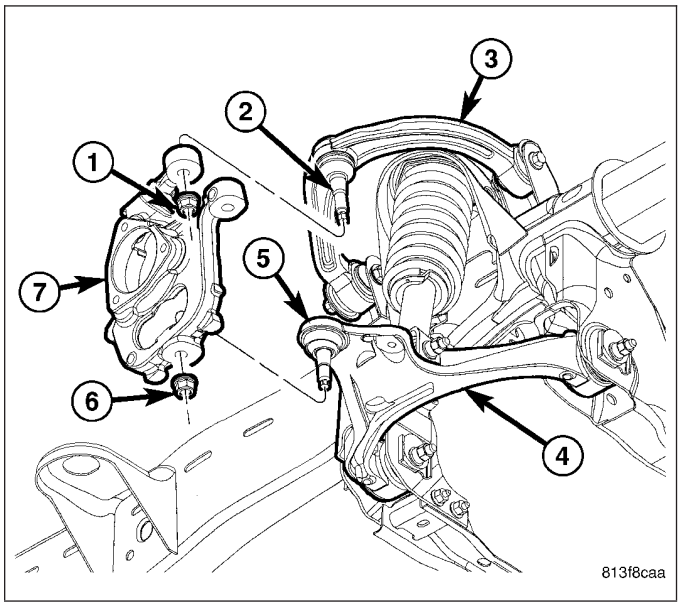
2. Install the steering knuckle (7) (Refer to 2 - SUSPENSION/FRONT/KNUCKLE - INSTALLATION).
3. Insert the lower ball joint (6) into the steering knuckle (7). Install and tighten the retaining nut (6) to 81 N·m (60 ft. lbs.).



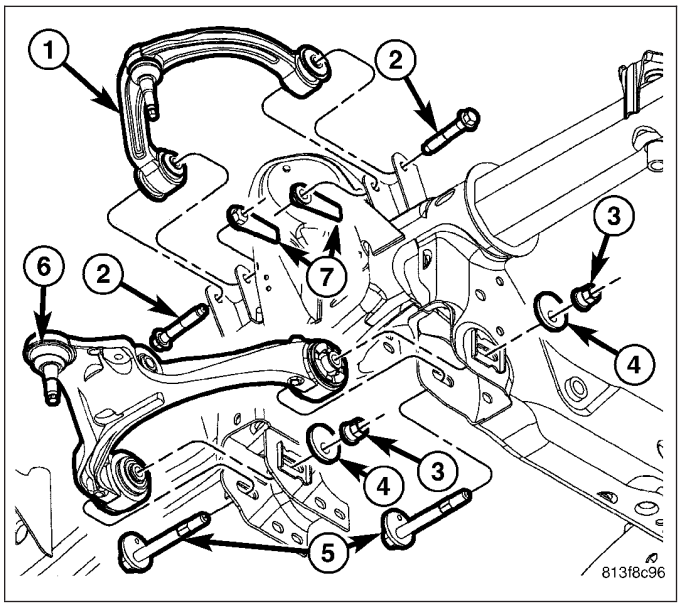
4. Install shock absorber lower bolt (4) and nut (5). Tighten to 81 N·m (60 ft. lbs.).



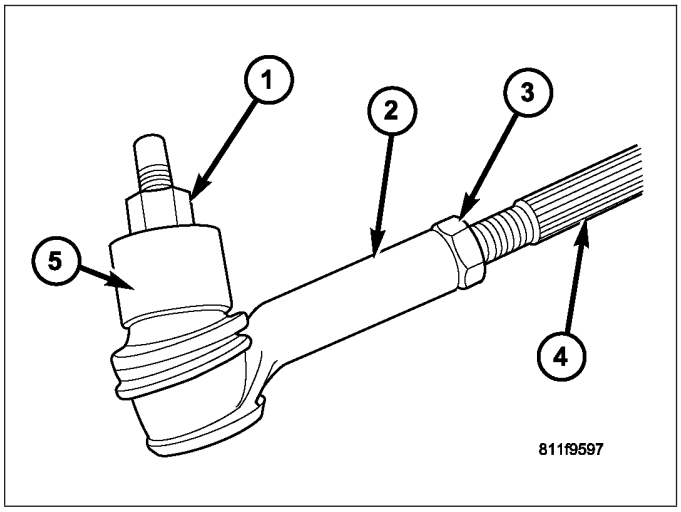
5. Install the front halfshaft nut **4X4**.
6. Insert the upper ball joint (2) into the steering knuckle (7). Install and tighten the retaining nut (1) to 75 N·m (55 ft. lbs.).



7. Install the stabilizer bar link (Refer to 2 - SUSPENSION/FRONT/STABILIZER LINK - INSTALLATION) and tighten to 169 N·m (125 ft. lbs.).
8. Tighten the lower control arm pivot nut (5) and bolts (3) (to 244 N·m (180 ft. lbs.).



9. Insert the outer tie rod end (2) into the steering knuckle (5). Install and tighten the retaining nut (1) to 75 N·m (55 ft. lbs.).



10. Install the disc brake rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
11. Install the disc brake caliper and adaptor assembly (2) and tighten to 135 N·m (100 ft. lbs.) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
12. Install the wheel and tire assembly, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
13. Remove the support and lower the vehicle.
14. Perform a wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

SHOCK

DIAGNOSIS AND TESTING

SHOCK

A knocking or rattling noise from a shock absorber may be caused by movement between mounting bushings and metal brackets or attaching components. These noises can usually be stopped by tightening the attaching nuts. If the noise persists, inspect for damaged and worn bushings, and attaching components. Repair as necessary if any of these conditions exist.

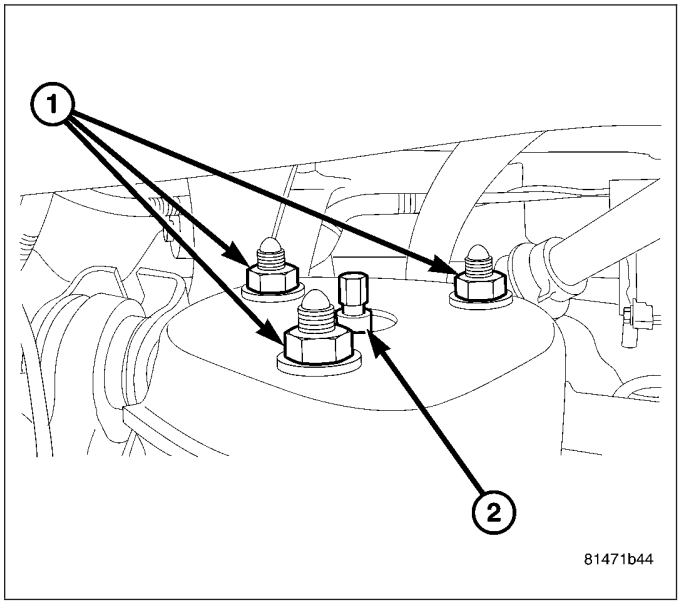
A squeaking noise from the shock absorber may be caused by the hydraulic valving and may be intermittent. This condition is not repairable and the shock absorber must be replaced.

The shock absorbers are not refillable or adjustable. If a malfunction occurs, the shock absorber must be replaced. To test a shock absorber, hold it in an upright position and force the piston in and out of the cylinder four or five times. The action throughout each stroke should be smooth and even.

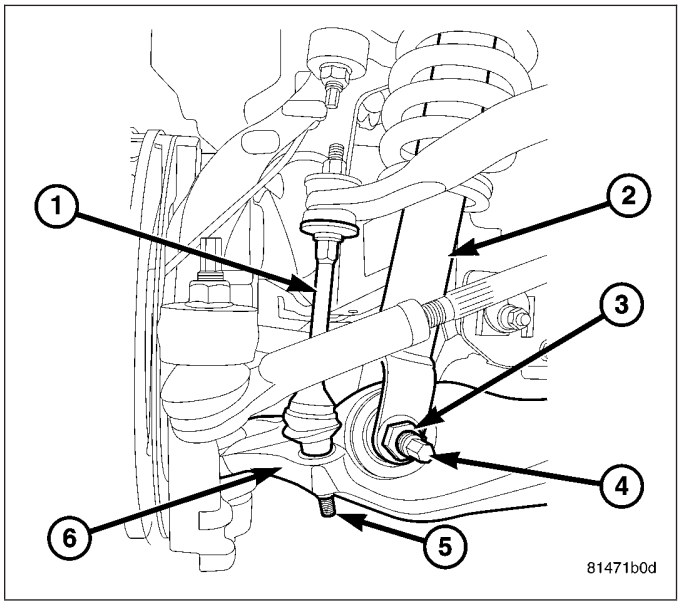
The shock absorber bushings do not require any type of lubrication. Do not attempt to stop bushing noise by lubricating them. Grease and mineral oil-base lubricants will deteriorate the bushing.

REMOVAL

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Support the lower control arm outboard end.
4. Remove the upper shock nuts (1).



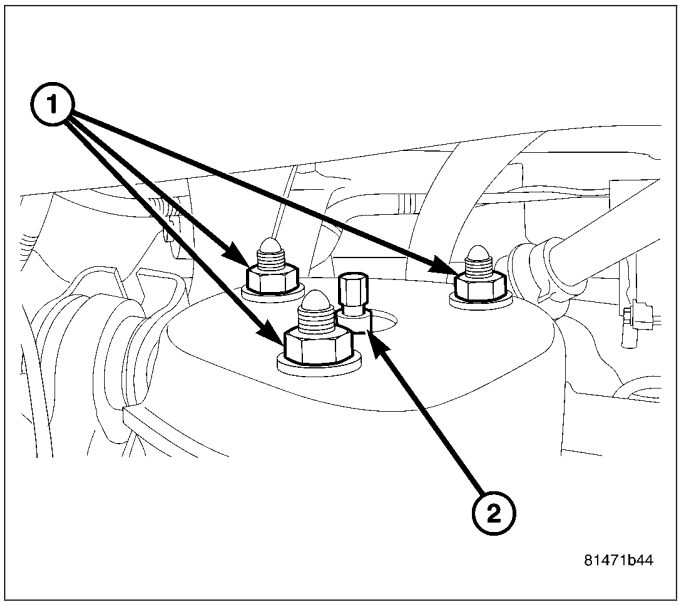
5. Remove the stabilizer link lower nut (5) and then separate the stabilizer link (1) from the lower control arm (6) to gain access to the lower shock nut (3) (Refer to 2 - SUSPENSION/FRONT/STABILIZER LINK - REMOVAL).
6. Remove the lower shock bolt (4) and nut (3).
7. Remove the shock (2).



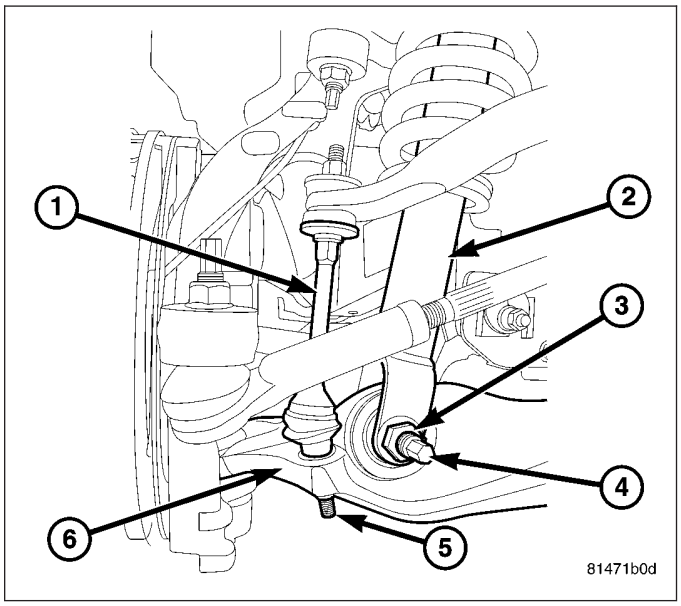
INSTALLATION

NOTE: All suspension components should be tighten with the weight of the vehicle on them (curb height).

1. Install the upper part of the shock (2) into the frame bracket.
2. Install the upper nuts (1). Tighten to 102 N·m (75 ft. lbs.).



3. Install the lower part of the shock (2) into the lower control arm shock bushing.
4. Position shock module clevis (2) to lower control (6). Install bolt (4) so head of bolt is facing rear of vehicle and hand start nut (3). Tighten the bolt (4) & nut (5) to 81 N·m (60 ft. lbs.).
5. Install the stabilizer link lower nut (5) to the lower control arm (6) (Refer to 2 - SUSPENSION/ FRONT/STABILIZER LINK - INSTALLATION).

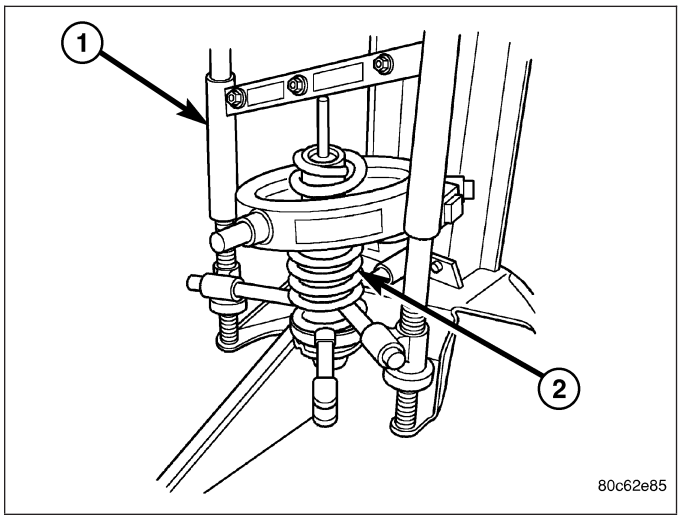


6. Remove the support from the lower control arm outboard end.
7. Install the tire and wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
8. Remove the support and lower the vehicle.

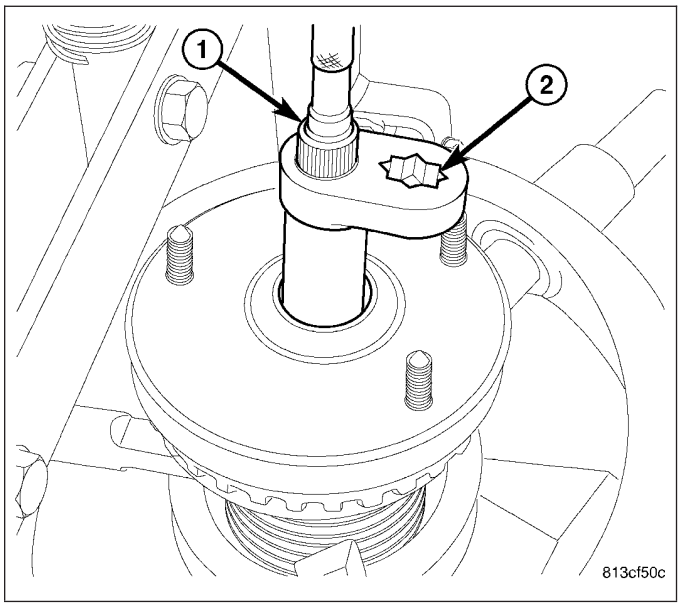
SPRING

REMOVAL

1. Remove the shock (Refer to 2 - SUSPENSION/ FRONT/SHOCK - REMOVAL).
2. Install the shock assembly in the Branick 7200® spring removal/installation tool or equivalent (1).
3. Compress the spring (2).

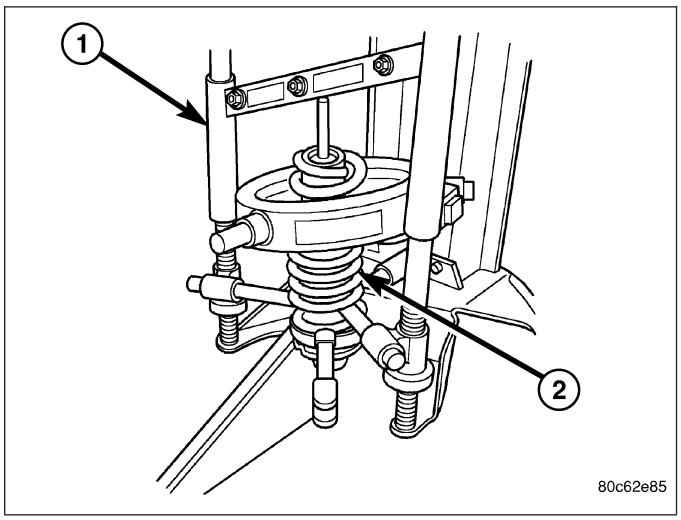


4. Position Wrench (2), Special Tool 9362, on shock shaft retaining nut. Next, insert 8 mm socket though Wrench onto hex located on end of shock shaft. While holding shock shaft from turning, remove nut from shock shaft using Wrench.
5. Remove the upper shock nut.
6. Remove the shock.
7. Remove the shock upper mounting plate.
8. Remove and inspect the upper and lower spring isolators.

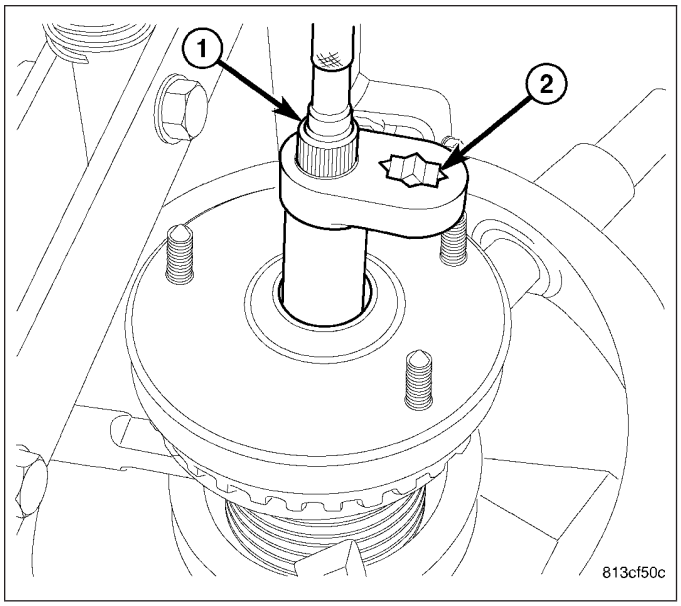


INSTALLATION

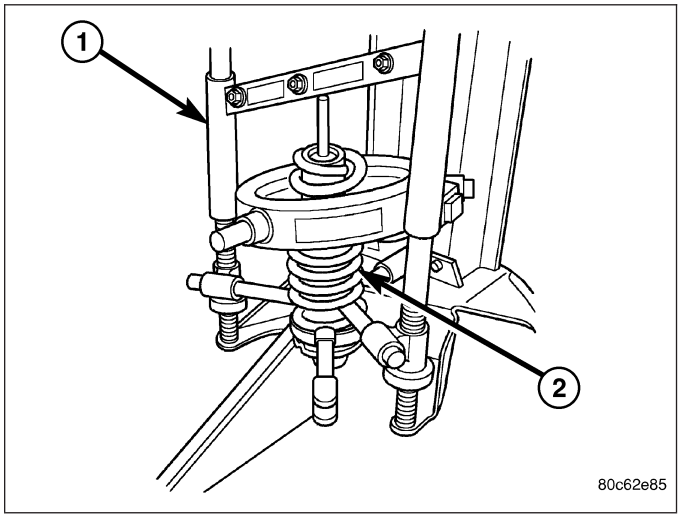
1. Install the lower isolator.
2. Install the upper isolator.
3. Position the shock into the coil spring.
4. Install the upper shock mounting plate.



5. Install Wrench (on end of a torque wrench), Special Tool 9362, on shock shaft retaining nut. Next, insert 8 mm socket though Wrench onto hex located on end of shock shaft. While holding shock shaft from turning, tighten nut using Wrench to 90 N·m (66 ft. lbs.) torque.
6. Install the shock upper mounting nut.



7. Decompress the spring (2).
8. Remove the shock assembly from the spring compressor tool (1).
9. Install the shock assembly (Refer to 2 - SUSPENSION/FRONT/SHOCK - INSTALLATION).



STABILIZER BAR

DESCRIPTION

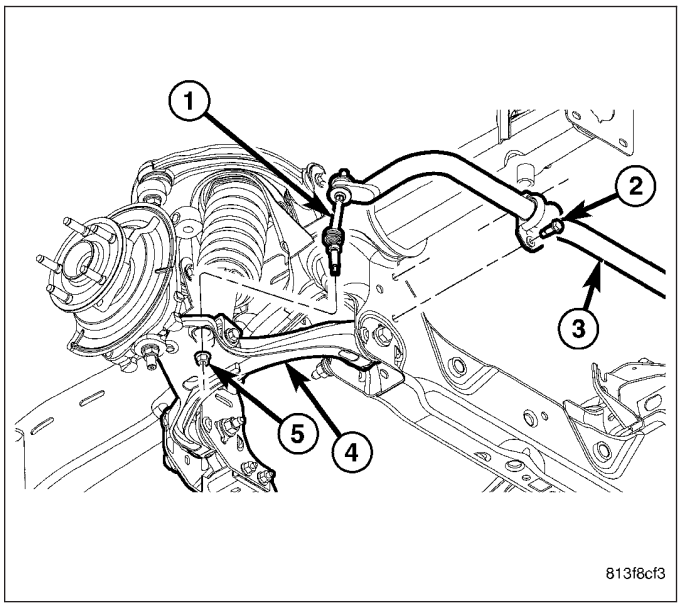
The bar extends across the front underside of the chassis and connects to the frame crossmember. The ends of the bar mount to the lower suspension arm. All mounting points of the stabilizer bar are isolated by bushings.

OPERATION

The stabilizer bar is used to minimize vehicle front sway during turns. The bar helps to maintain a flat attitude to the road surface.

REMOVAL

1. Remove the stabilizer link (1) upper nut and remove the retainers and grommets (Refer to 2 - SUSPENSION/FRONT/STABILIZER LINK - REMOVAL).
2. Remove the stabilizer bar retainer bolts (2) also remove the retainers from the frame sway bar and remove the bar (3).
3. If necessary, remove the bushings from the stabilizer bar.

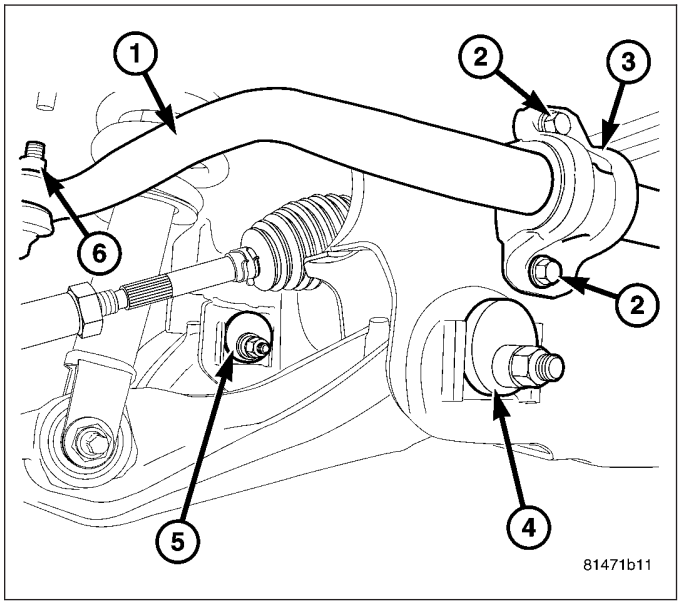


INSTALLATION

1. If removed, install the bushings on the stabilizer bar.
2. Position the stabilizer bar (1) on the frame crossmember brackets and install the bracket (3) and bolts (2) finger-tight.

NOTE: Check the alignment of the bar to ensure there is no interference with the either frame rail or chassis component. Spacing should be equal on both sides.

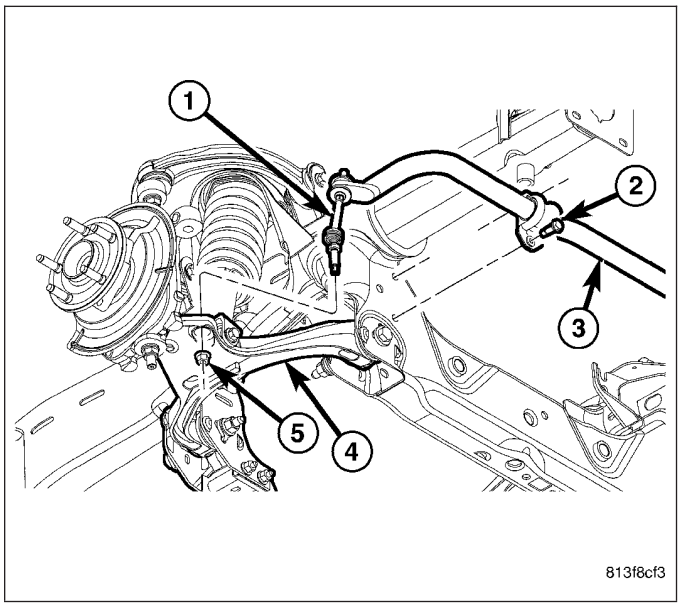
3. Install the stabilizer bar (1) to the stabilizer link and install the grommets and retainers.
4. Install the nuts (6) to the stabilizer link and tighten to 169 N·m (125 ft. lbs.) (Refer to 2 - SUSPENSION/FRONT/STABILIZER LINK - INSTALLATION).
5. Tighten the bracket bolts (2) to the frame to 61N·m (45 ft. lbs.).



STABILIZER LINK

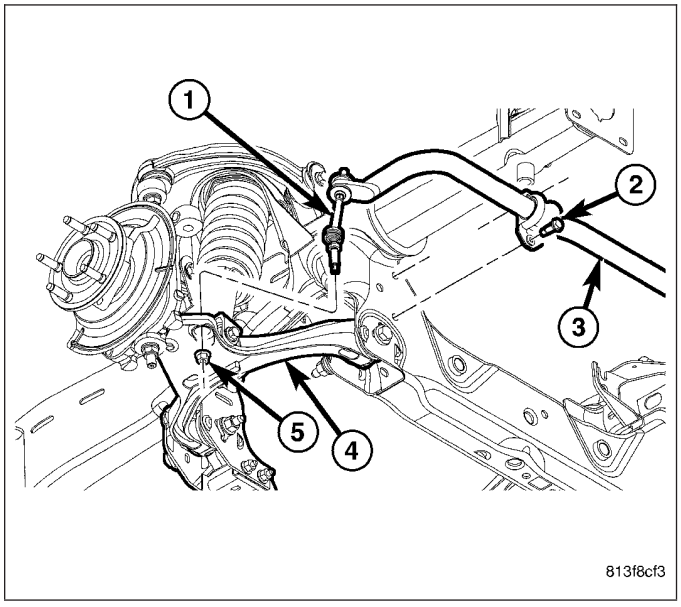
REMOVAL

1. Raise and support the vehicle.
2. Remove the lower nut (5).
3. Remove the upper nut, retainers and grommets from the stabilizer bar (3).
4. Remove the stabilizer link (1) from the vehicle.



INSTALLATION

1. Install the stabilizer link (1) to the vehicle.
2. Install the retainers, grommets and upper nut to the stabilizer bar (3) and Tighten to 37 N·m (27 ft. lbs.).
3. Install the lower nut (5) and Tighten to 169 N·m (125 ft. lbs.).
4. Remove the support and lower the vehicle.

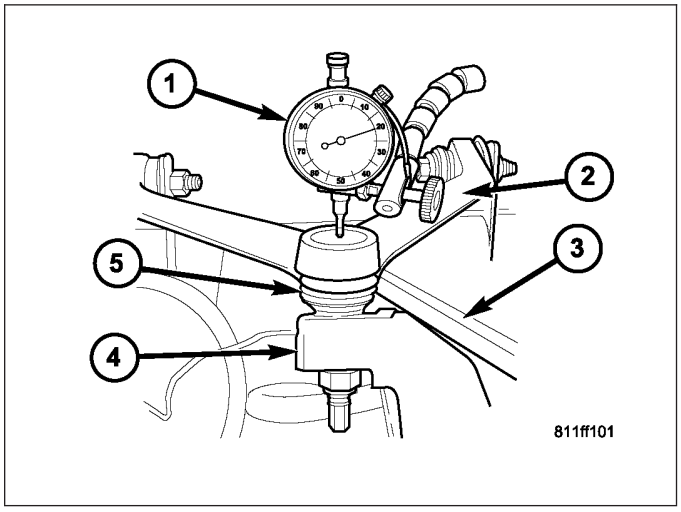


UPPER BALL JOINT

DIAGNOSIS AND TESTING

UPPER BALL JOINT

1. Raise the front of the vehicle. Place safety floor stands under both lower control arms as far outboard as possible. Lower the vehicle to allow the stands to support some or all of the vehicle weight.
2. Remove the front tires.
3. Mount a dial indicator (1) solidly to the frame and then zero the dial indicator.
4. Position dial indicator plunger on the topside of the upper ball joint (5).



NOTE: The dial indicator plunger must be perpendicular to the machined surface of the ball joint.

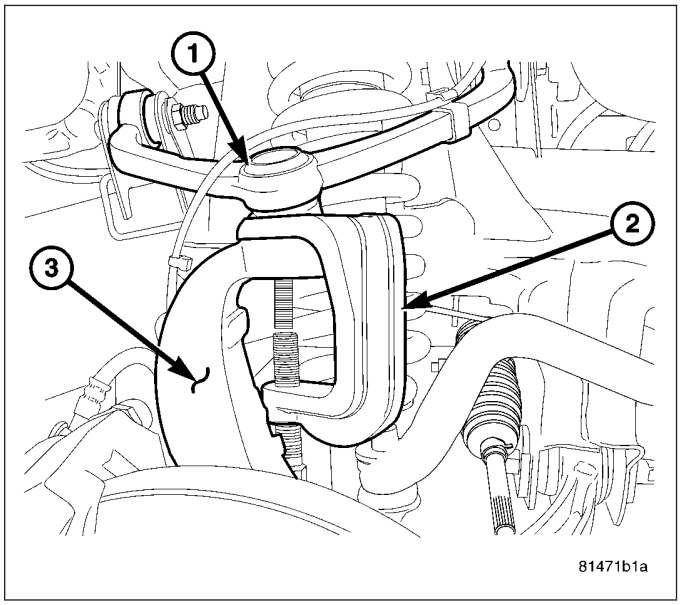
NOTE: Use care not to pry or tear the ball joint boot, when checking the free play.

5. Position a pry bar (3) between the steering knuckle (4) and the upper control arm (2). Pry upwards on the upper control arm.
6. If the travel exceeds 0.5 mm (0.020 in.), replace the upper control arm since the upper ball joint is integral to the arm (Refer to 2 - SUSPENSION/FRONT/UPPER CONTROL ARM - REMOVAL).
7. If the upper ball joint is within specs reinstall the front tires (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

UPPER CONTROL ARM

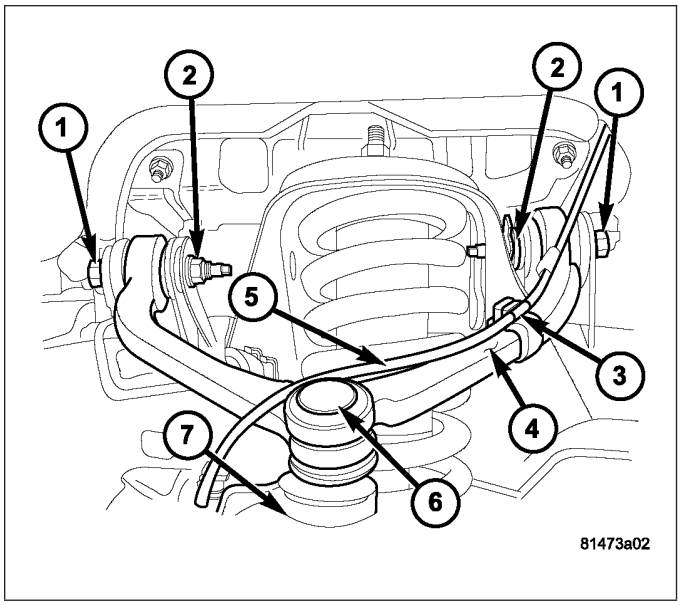
REMOVAL

1. Raise and support vehicle.
2. Remove wheel and tire assembly.
3. Remove the nut from upper ball joint.
4. Separate upper ball joint (1) from the steering knuckle (3) with Remover 8677 (2).



CAUTION: When installing Remover 8677 (2) to separate the ball joint, be careful not to damage the ball joint seal.

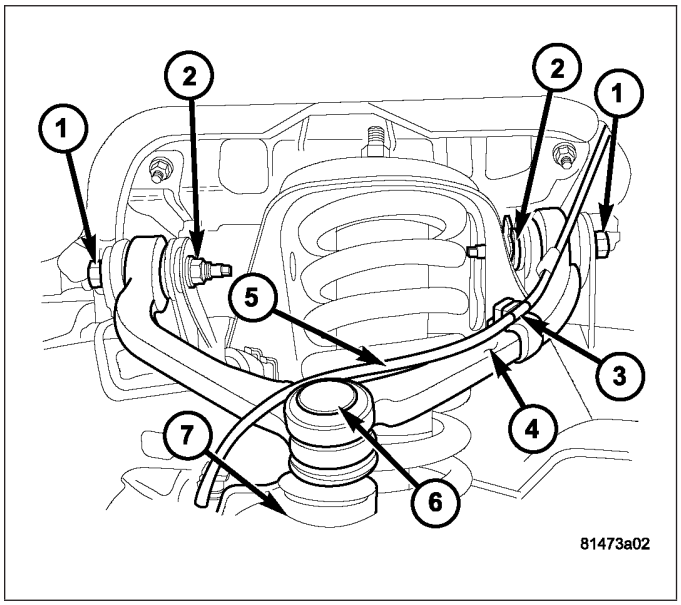
5. Remove the wheel speed sensor wire (5) from the retaining brackets (3) to the upper control arm (4).
6. Remove the control arm pivot bolts(1) and nuts (2) and remove control arm (4).



INSTALLATION

NOTE: All suspension components should be tighten with the weight of the vehicle on them (curb height).

1. Position the control arm (4) into the frame brackets. Install bolts (1) and nuts (2). Tighten to 102 N·m (75 ft. lbs.).
2. Reposition the wheel speed wire (5) into the retaining brackets (3).
3. Insert ball joint (6) in steering knuckle (7) and tighten ball joint nut to 75 N·m (55 ft. lbs.).



4. Install the wheel and tire assembly, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
5. Remove the support and lower vehicle.
6. Perform a wheel alignment, (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

REAR

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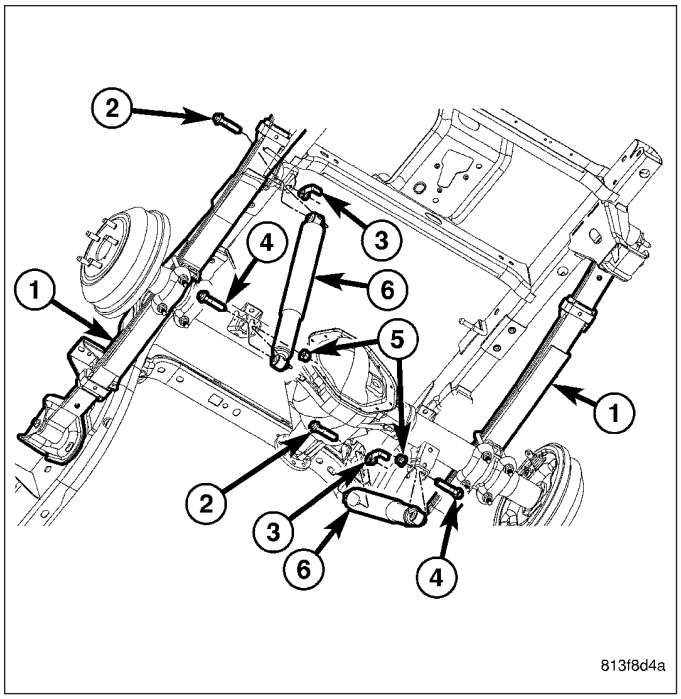
REAR

DESCRIPTION

The rear suspension is comprised of:

- Shock Absorbers (6)
- Jounce Bumpers
- Stabilizer Bar
- Stabilizer links
- Leaf Springs (1)
- Drive Axle

CAUTION: A vehicle should always be loaded so the vehicle weight center-line is located immediately forward of the rear axle. Correct vehicle loading provides proper front tire-to-road contact. This results in maximum vehicle handling stability and safety. Incorrect vehicle weight distribution can cause excessive tire tread wear, spring fatigue or failure, and erratic steering.



CAUTION: Suspension components with rubber/urethane bushings (except stabilizer bar) should be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort could be affected and premature bushing wear may occur.

DIAGNOSIS AND TESTING - REAR SUSPENSION

CONDITION	POSSIBLE CAUSES	CORRECTION
VEHICLE INSTABILITY	1. Loose or worn wheel bearings. 2. Loose, worn or bent suspension components. 3. Tire pressure.	1. Replace wheel bearings. 2. Inspect, tighten or replace components as necessary. 3. Adjust tire pressure.
VEHICLE PULLS TO ONE SIDE	1. Weak or broken spring. 2. Alignment. 3.Tires. 4. Brakes.	1. Replace spring. 2. Align vehicle to specifications. 3. Replace tires. 4. Repair as necassary.
KNOCKING, RATTLING OR SQUEAKING	1. Worn shock bushings. 2. Loose shock mounting. 3. Shock valve. 4. Weak or broken spring. 5. Loose, worn or bent suspension components.	1. Replace shock. 2. Tighten to specifications. 3. Replace shock. 4. Replace spring. 5. Inspect, tighten or replace components as necessary.
IMPROPER TRACKING	1. Loose, worn or bent suspension components. 2. Bent axle.	1. Inspect, tighten or replace components as necessary. 2.Replace axle.

SPECIFICATIONS

TORQUE CHART

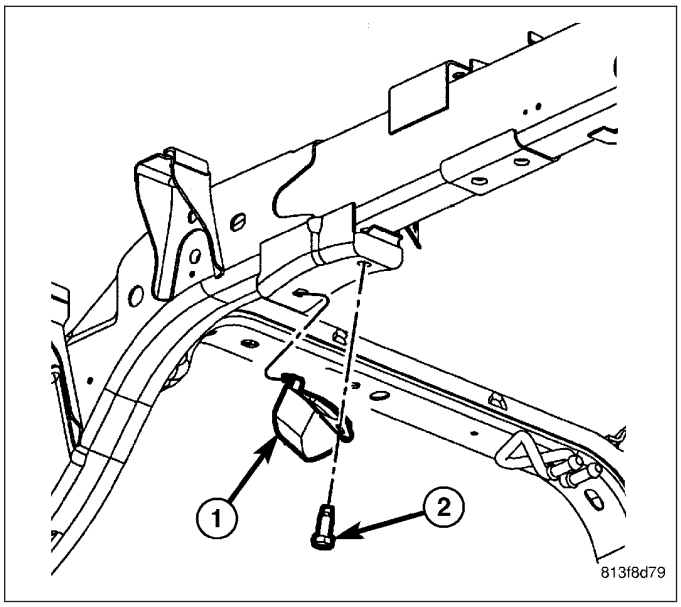
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Shock Absorber Lower Nut	102	75	—
Shock Absorber Upper Bolt	102	75	—
Stabilizer Retainer to the Axle	61	45	—
Stabilizer Link to Stabilizer Bar	102	75	—
Stabilizer Link to Frame	102	75	—
Jounce Bumper Bolts	41	30	—

JOUNCE BUMPER

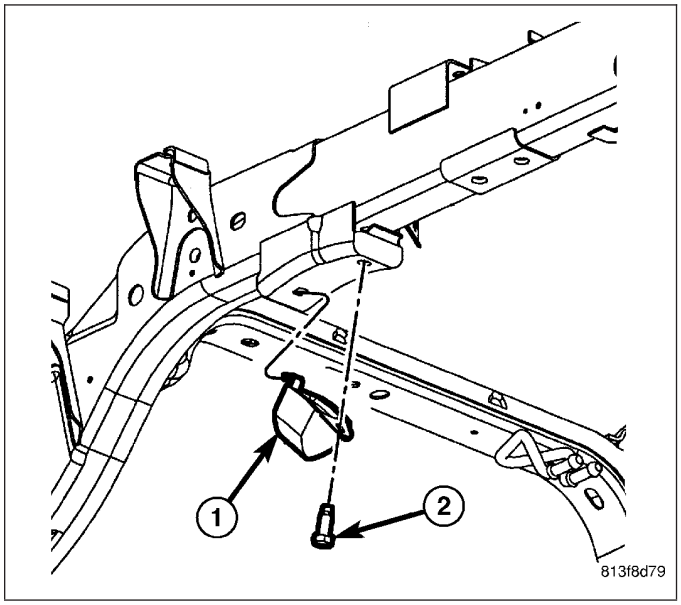
REMOVAL

1. Raise and support the vehicle.
2. Remove the bolts (2) securing the jounce bumper (1).
3. Remove the jounce bumper (1).



INSTALLATION

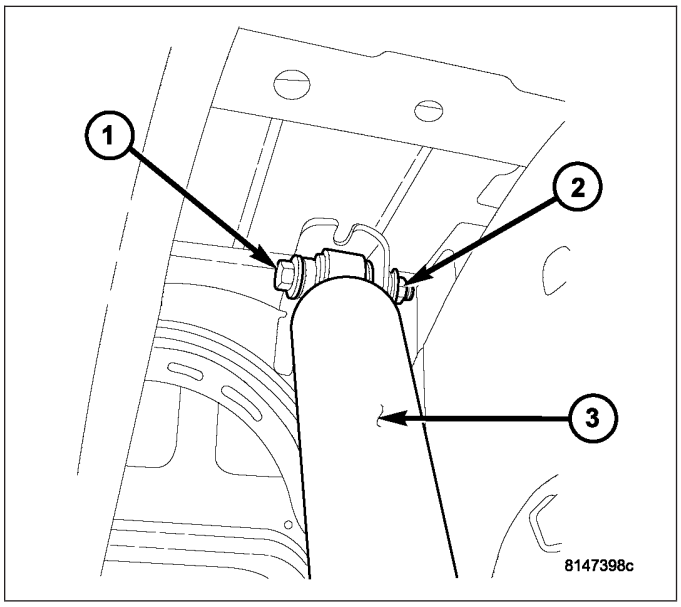
1. Install the jounce bumper (1) and bolts (2). Tighten to 41 N·m (30 ft.lbs.).
2. Remove the support and lower the vehicle.



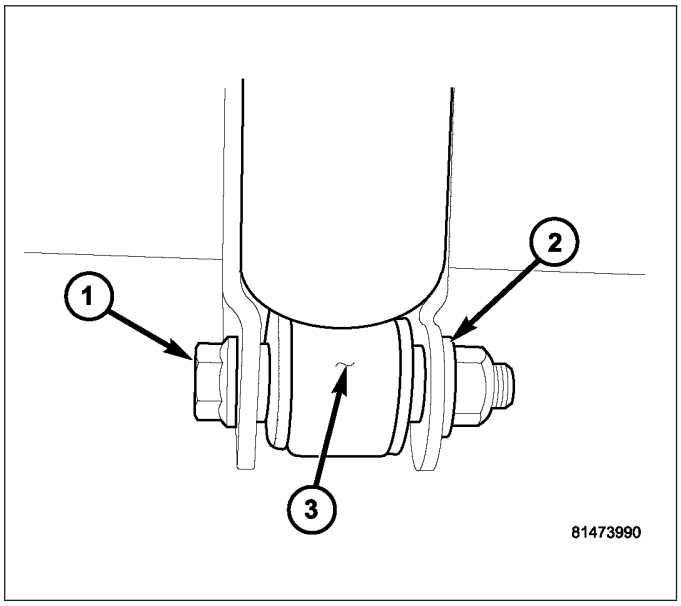
SHOCK

REMOVAL

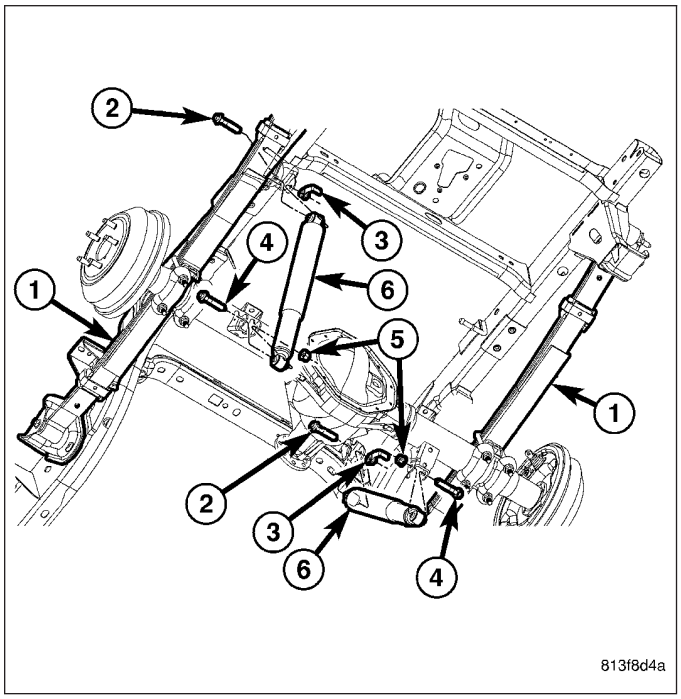
1. Raise vehicle and support the axle.
2. Remove the upper shock bolt (1) and nut (2).



3. Remove the lower shock bolt (1) and nut (2).

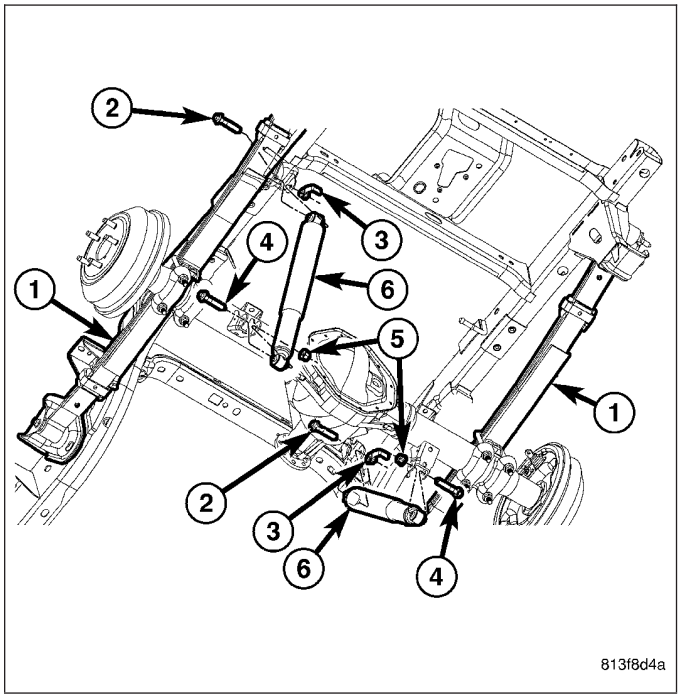


4. Remove the rear shock absorber (6) from the vehicle.

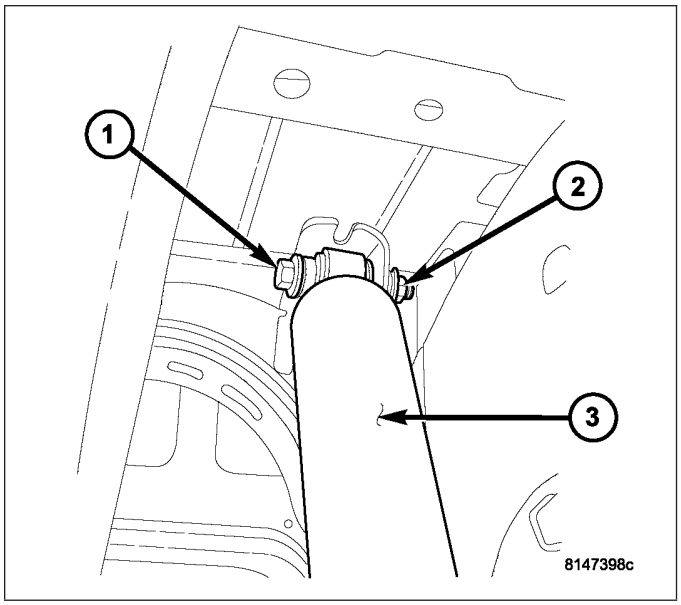


INSTALLATION

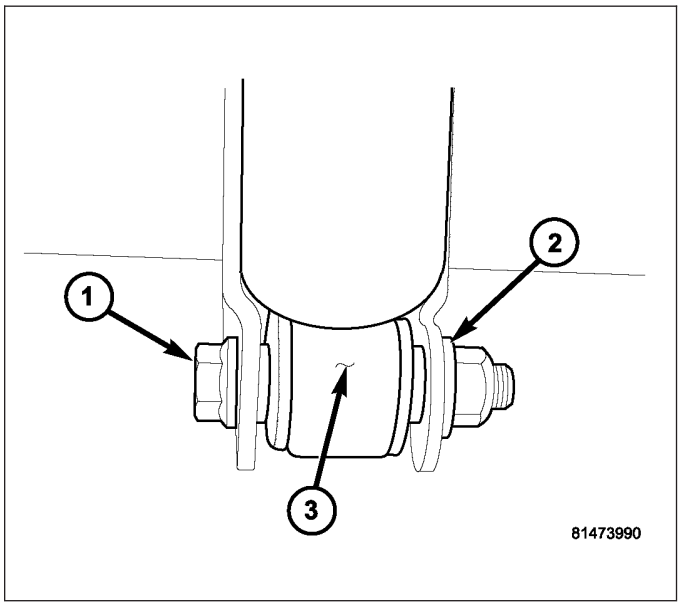
1. Position the shock absorber (6) to the vehicle.



2. Install the bolt (1) through the frame bracket and the shock (3). Install the nut (2) to the top bolt (1). Tighten to 102 N.m (75 ft. lbs.)



3. Install the bolt (1) through the axle bracket and the shock (3). Install the nut (2) to the bolt (1). Tighten to 102 N.m (75 ft. lbs.)
4. Remove the support and lower the vehicle.

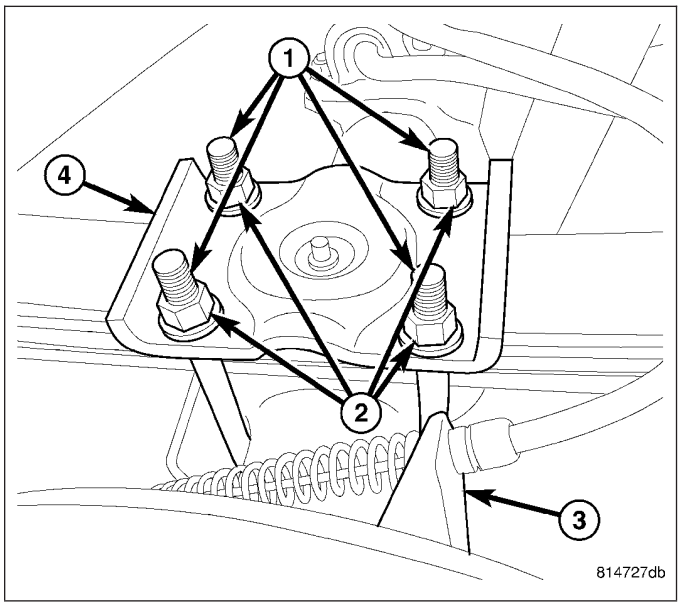


SPRING

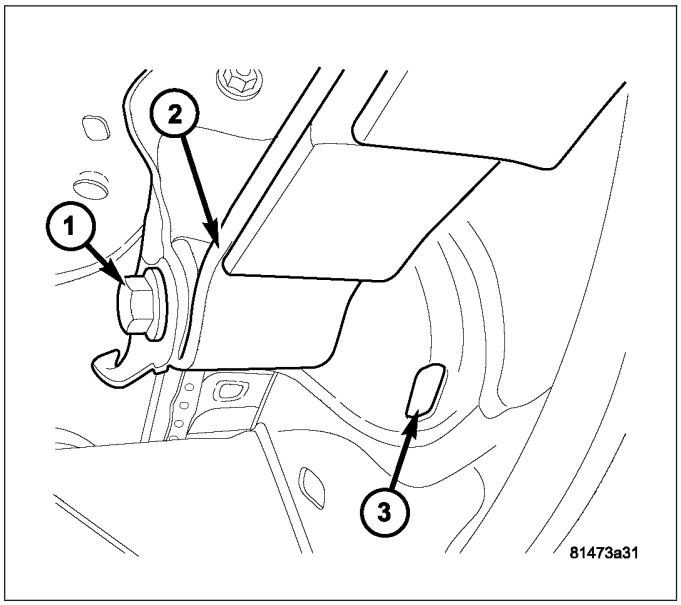
REMOVAL

CAUTION: The rear of the vehicle must be lifted only with a jack or hoist. The lift must be placed under the frame rail crossmember located aft of the rear axle. Use care to avoid bending the side rail flange.

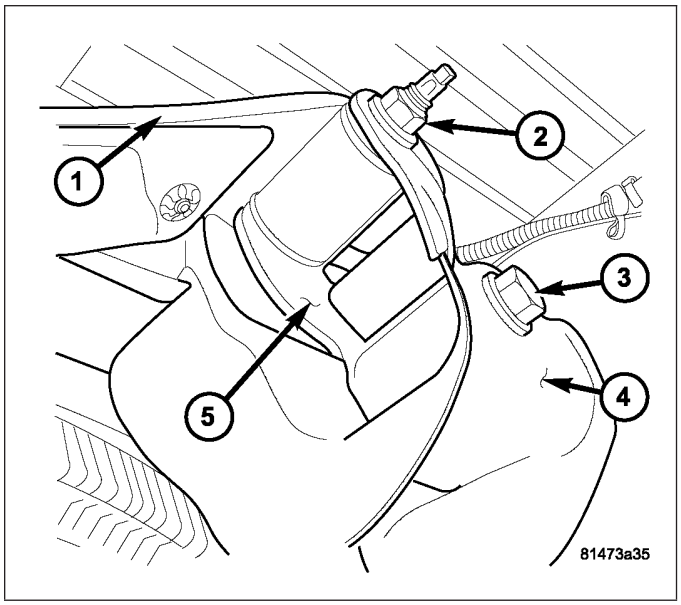
1. Raise the vehicle at the frame.
2. Use a hydraulic jack to relieve the axle weight.
3. Remove the wheel and tire assemblies.
4. Remove the nuts (2), the U-bolts (1) and spring plate (4) from the axle.



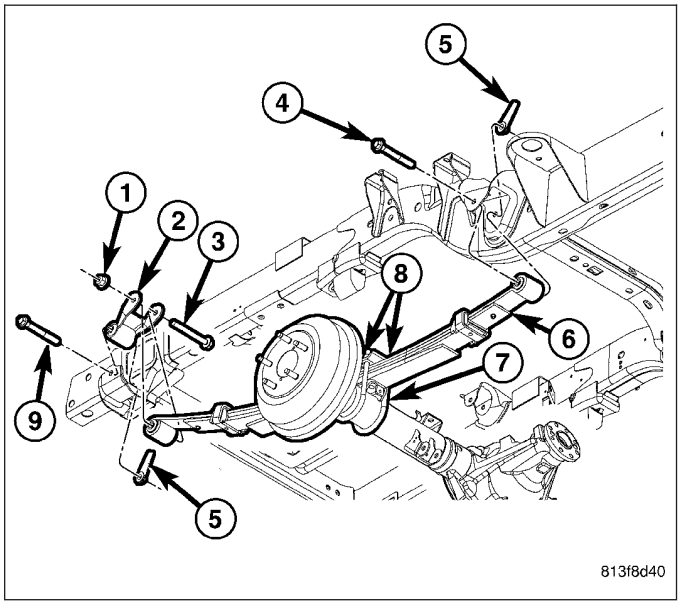
5. Loosen and remove the bolt (1) and then remove the flag nut through the access hole (3) in the bracket from the spring front eye (2).



6. Remove the nut and bolt (3) that attaches the spring shackle (5) to the rear frame bracket (4).



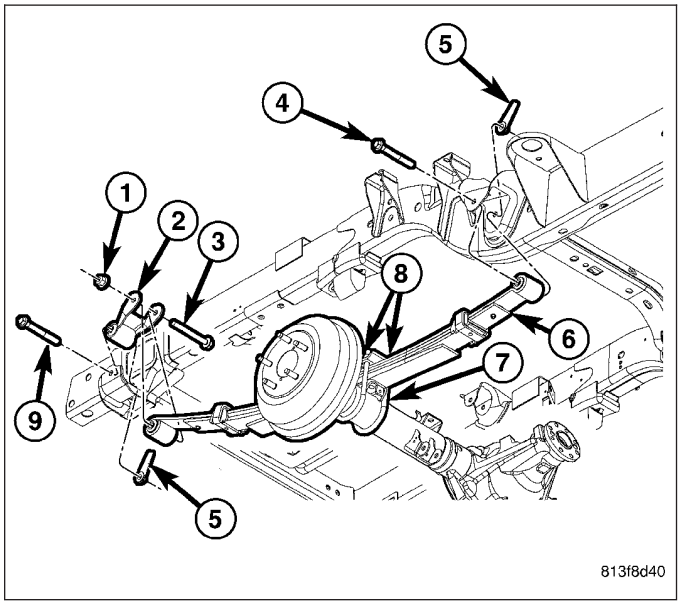
7. Remove the spring (6) from the vehicle.
8. Remove the shackle (2) from the spring (6).



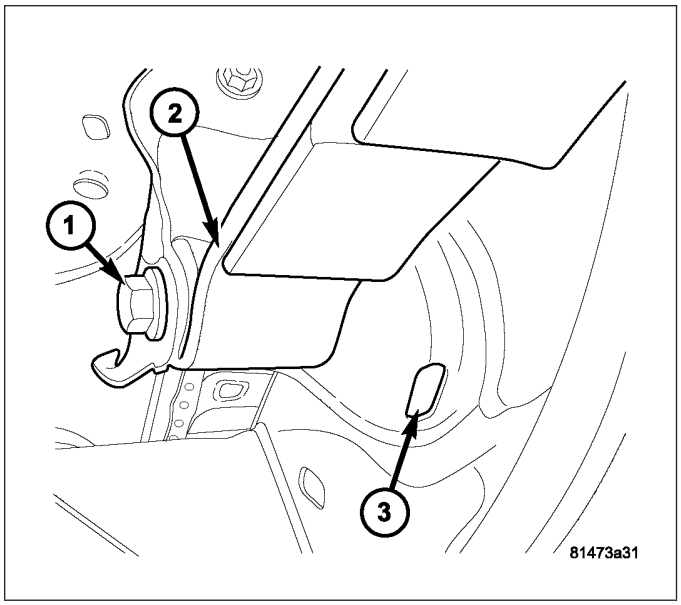
INSTALLATION

CAUTION: The rear of the vehicle must be lifted only with a jack or hoist. The lift must be placed under the frame rail crossmember located aft of the rear axle. Use care to avoid bending the side rail flange.

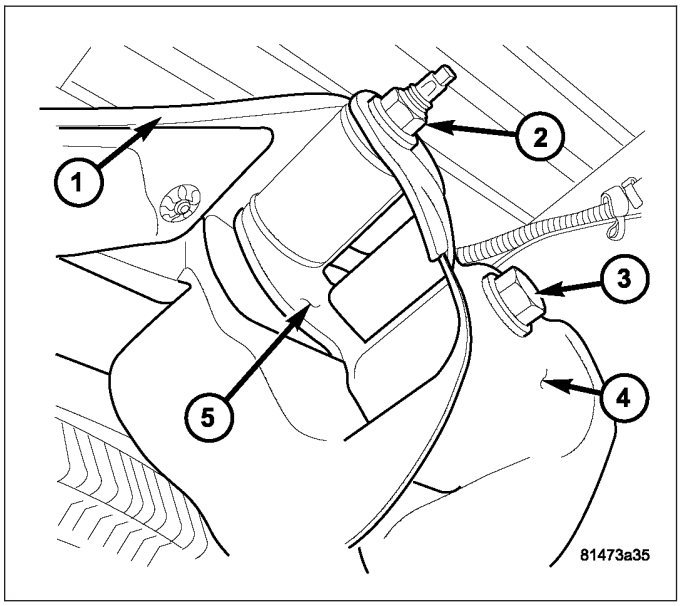
1. Install the spring shackle (2) on the spring (6) finger tight.
2. Position the spring (6) on the rear axle pad. Make sure the spring center bolt is inserted in the pad locating hole.



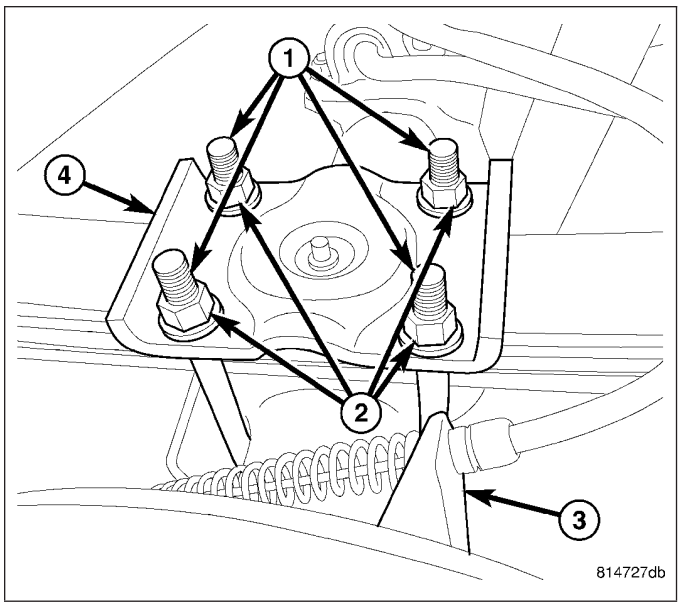
3. Align front spring eye (2) with the bolt hole in the front frame bracket. Install the spring eye bolt (1) and flag nut through the access hole in the frame (3) and tighten the bolt (1) finger-tight.



4. Align spring shackle eye with the bolt hole in the rear frame bracket (4). Install the bolt (3) and nut and tighten the spring shackle eye nut finger-tight.

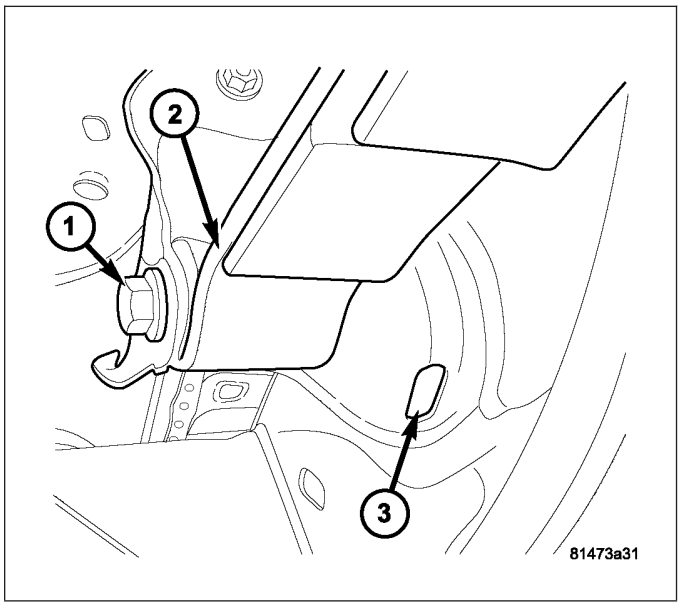


5. Install the U-bolts (1), spring plate (4) and nuts (2).
6. Tighten the U-bolt nuts (2) to 149 N·m (110 ft. lbs.).

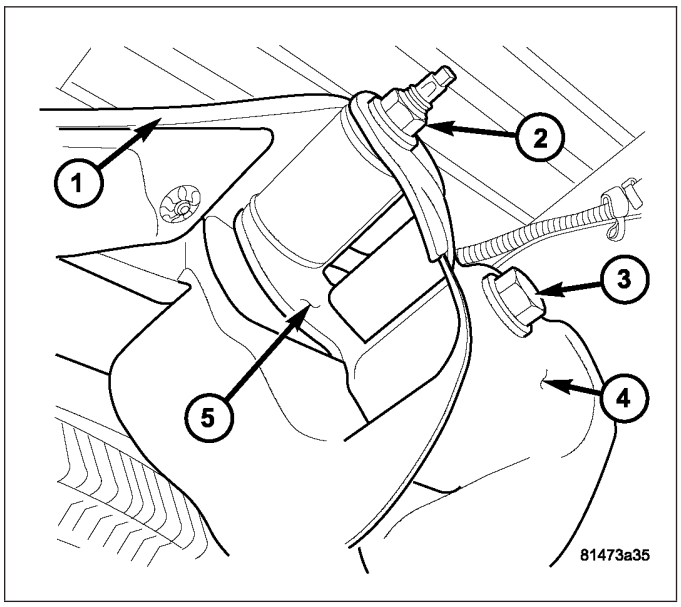


7. Install the wheel and tire assemblies. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

8. Remove the support stands from under the frame rails. Lower the vehicle until the springs are supporting the weight of the vehicle.
9. Tighten the spring eye pivot bolt (1) and flagnut to 163 N·m (120 ft. lbs.).



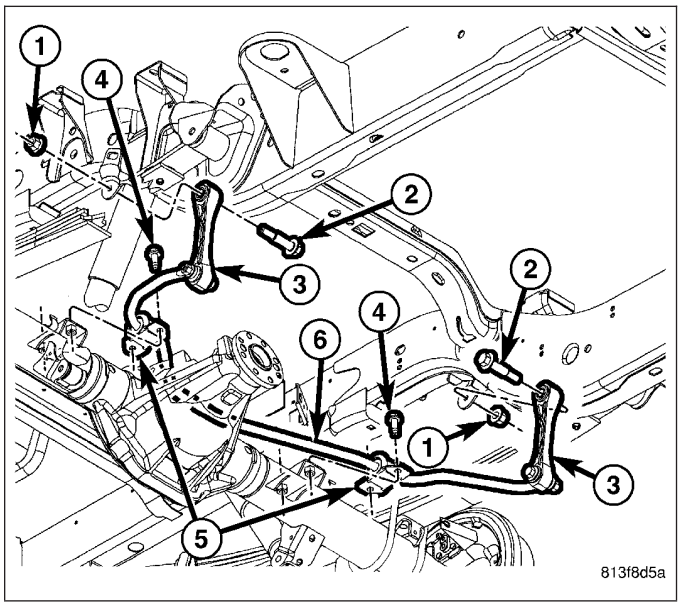
10. Tighten the upper shackle bolt and nut (2) and the lower shackle bolt (3) and nut to 163 N·m (120 ft. lbs.).



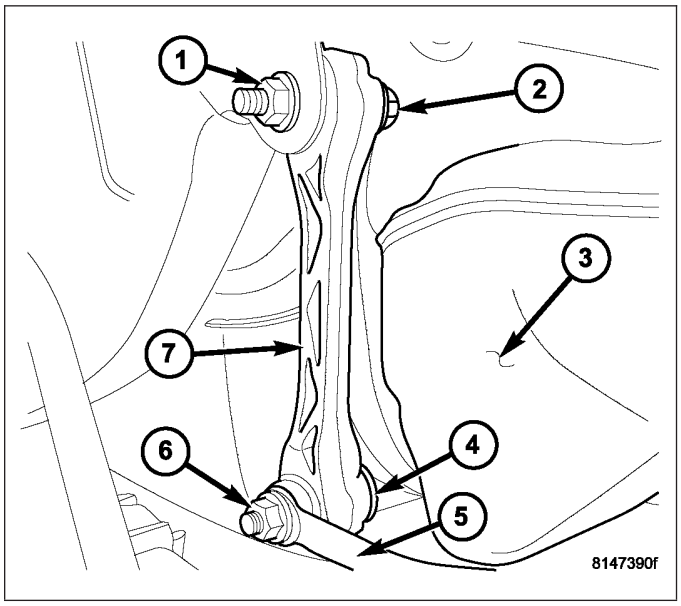
STABILIZER LINK

REMOVAL

1. Raise and support the vehicle.
2. Remove the rear tire.
3. Support the rear axle with a jack.
4. Remove the lower link nut (4) at the stabilizer bar (6).

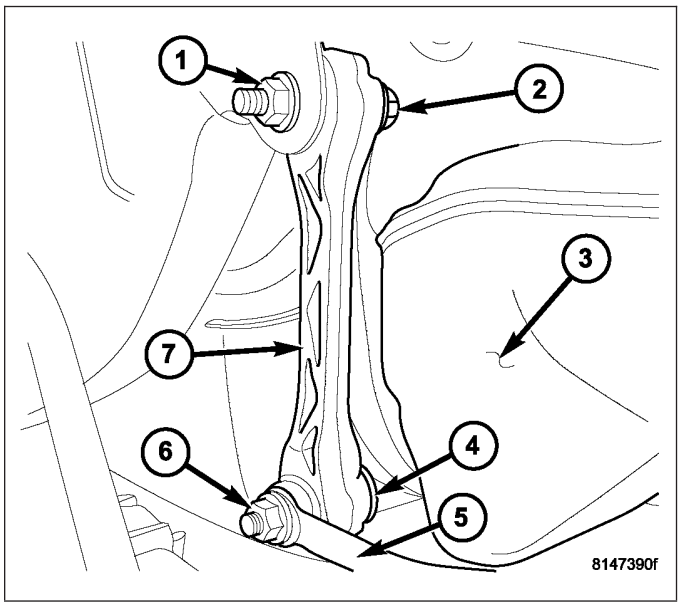


5. Remove the upper link nut (1) and bolt (2) at the frame. **On the left side stabilizer link (7), upper bolt pull the bolt (2) back after the nut (1) is removed and then pull the link (7) downward with the bolt (2) still in the link (7) to allow clearance from the fuel tank (3).**
6. Remove stabilizer link (7).

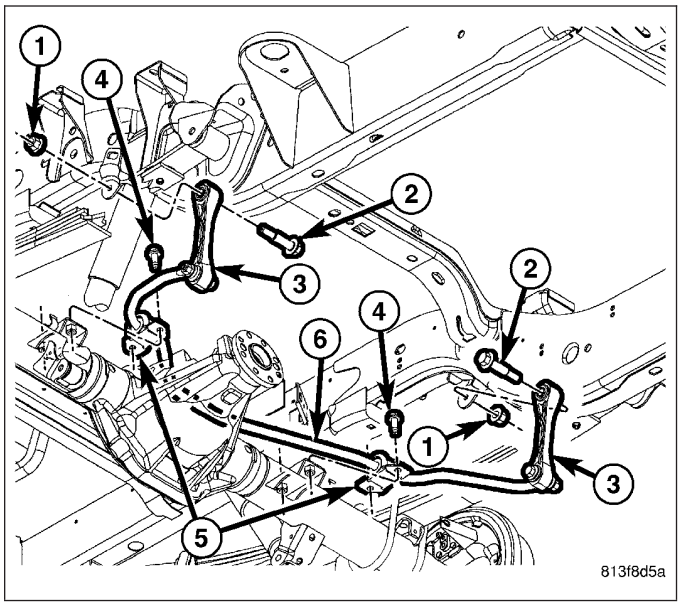


INSTALLATION

1. Install the upper bolt (2) into the stabilizer link then raise the link (7) into position with the frame and install the nut (1) for the stabilizer link (7) to the frame and tighten to 102 N·m (75 ft. lbs.).



2. Install the stabilizer link (3) to the stabilizer bar (6).
3. Install the nut (4) and tighten to 102 N·m (75 ft. lbs.).
4. Remove the jack and lower the vehicle.



STABILIZER BAR

DESCRIPTION

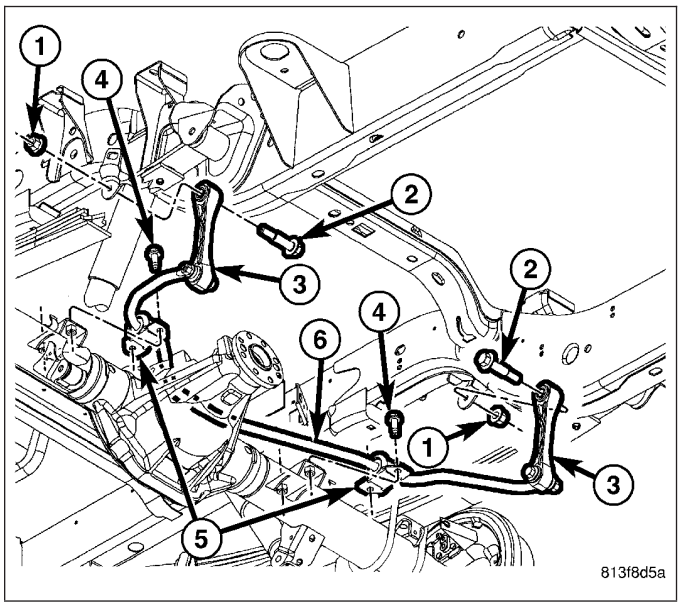
The stabilizer bar extends across the underside of the vehicle and is bolted to the of the axle. The links are bolted at the end of the bar and also bolted to the frame.

OPERATION

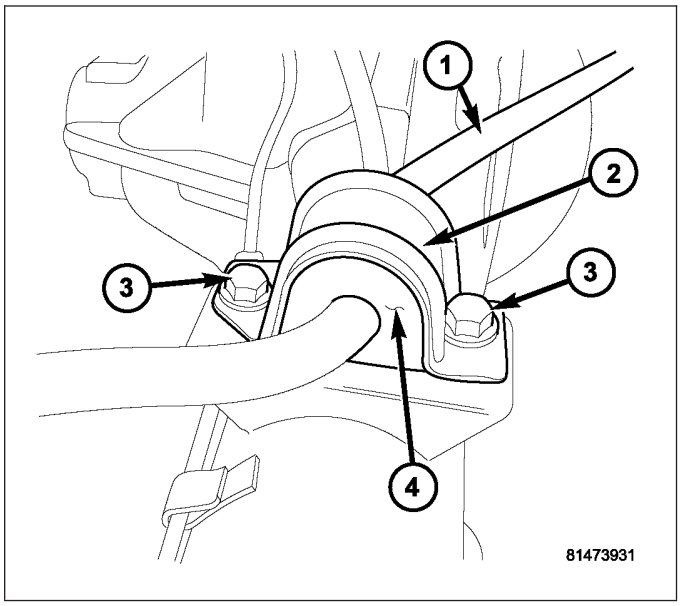
The stabilizer bar is used to minimize vehicle body sway. The spring steel bar helps to control the vehicle body in relationship to the suspension.

REMOVAL

1. Raise and support vehicle.
2. Remove nuts and bolts from the links (3) at the stabilizer bar (6).

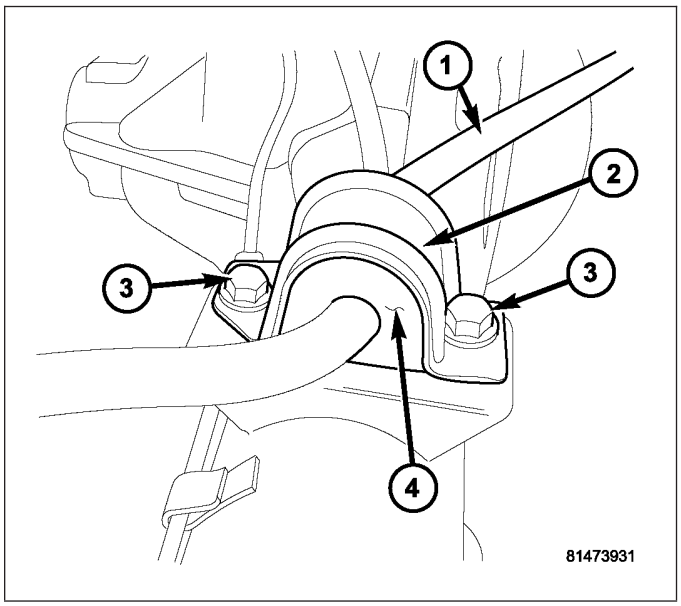


3. Remove stabilizer bar retainer bolts (3) and retainers (2).
4. Remove stabilizer bar (1) and replace worn, cracked or distorted bushings (4).

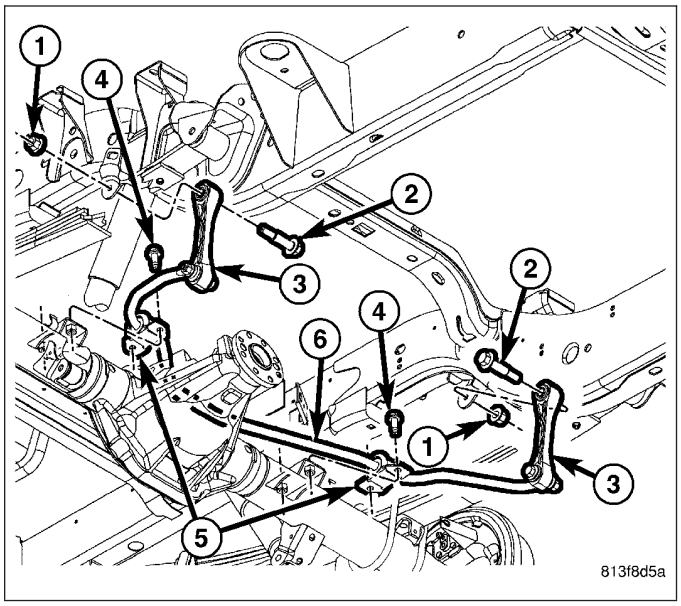


INSTALLATION

1. Install the stabilizer bushings (4).
2. Install the stabilizer bar (1) and center it with equal spacing on both sides. Install stabilizer bar retainers (2) and tighten bolts (3) to 54 N·m (40 ft. lbs.).



3. Install link (3) into the stabilizer bar (6). Install mounting nuts and bolts. Tighten stabilizer link nuts to 54 N·m (40 ft. lbs.).
4. Remove support and lower vehicle.



DIFFERENTIAL & DRIVELINE

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PROPELLER SHAFT

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PROPELLER SHAFT

DIAGNOSIS AND TESTING

PROPELLER SHAFT

PROPELLER SHAFT VIBRATION

Out-of-round tires or wheels that are out of balance, will cause a low frequency vibration.

Driveline vibration can also caused by loose or damaged engine mounts.

Propeller shaft vibration increases with vehicle speed. A vibration that occurs at a specific speed range, is not usually caused by an out of balance propeller shaft. Defective universal joints or an incorrect propeller shaft angle are usually the cause of such a vibration.

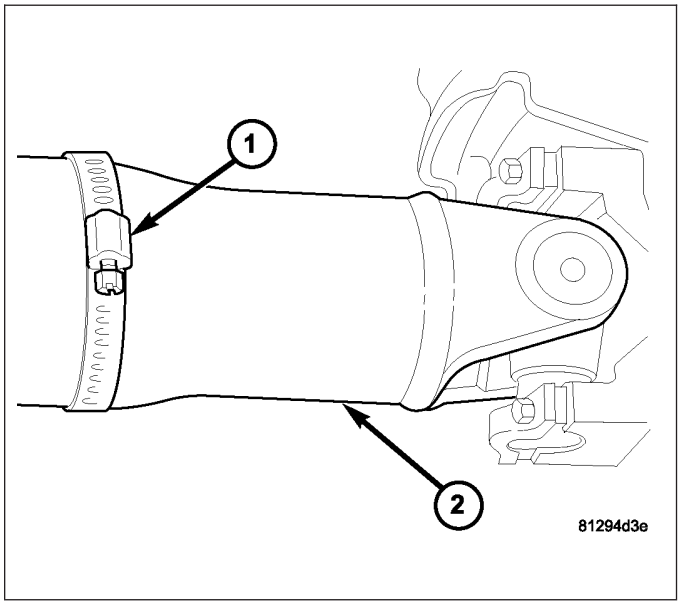
DRIVELINE VIBRATION

Drive Condition	Possible Cause	Correction
Propeller Shaft Noise	1) Undercoating or other foreign material on shaft.	1) Clean exterior of shaft and wash with solvent.
	2) Loose U-joint clamp screws.	2) Install new clamps and screws and tighten to proper torque.
	3) Loose or bent U-joint yoke or excessive runout.	3) Install new yoke.
	4) Incorrect driveline angularity.	4) Measure and correct driveline angles.
	5) Rear spring center bolt not in seat.	5) Loosen spring u-bolts and seat center bolt.
	6) Worn U-joint bearings.	6) Install new U-joint.
	7) Propeller shaft damaged or out of balance.	7) Installl new propeller shaft.
	8) Broken rear spring.	8) Install new rear spring.
	9) Excessive runout or unbalanced condition.	9) Re-index propeller shaft, test, and evaluate.
	10) Excessive drive pinion gear shaft runout.	10) Re-index propeller shaft and evaluate.
	11) Excessive axle yoke deflection.	11) Inspect and replace yoke if necessary.
	12) Excessive transfer case runout.	12) Inspect and repair as necessary.
Universal Joint Noise	1) Loose U-joint clamp screws.	1) Install new clamps and screws and tighten to proper torque.
	2) Lack of lubrication.	2) Replace as U-joints as necessary.

PROPELLER SHAFT BALANCE

If propeller shaft is suspected of being out of balance, use the following procedure.

NOTE: Indexing propeller shaft 180° relative to the yoke may eliminate some vibrations.

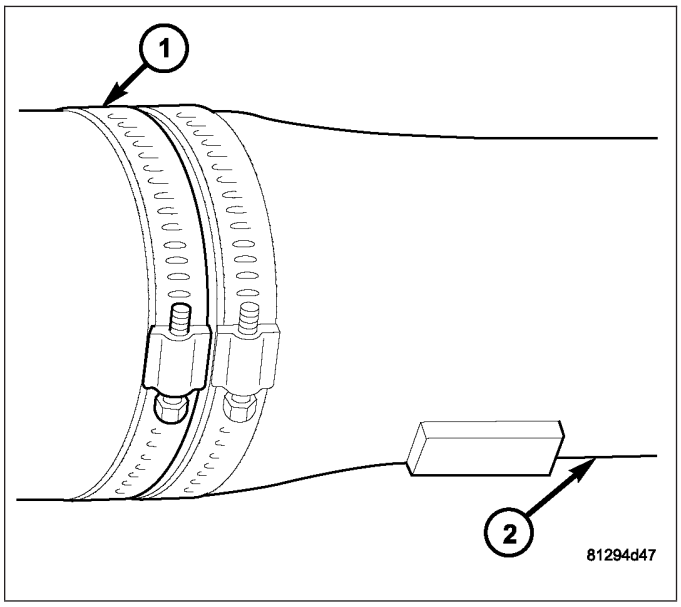


1. Raise and support vehicle.
2. Clean all foreign material from the propeller shaft and universal joints.
3. Inspect propeller shaft for missing balance weights, broken welds and bent areas. **If propeller shaft is bent, it must be replaced.**
4. Inspect universal joints for wear and properly installed.
5. Check propeller shaft bolt torques.
6. Remove wheels and install lug nuts to retain brake rotors.
7. Mark and number the shaft six inches from the pinion yoke end at four positions 90° apart.
8. Run and accelerate vehicle until vibration occurs. Note the intensity and speed the vibration occurred. Stop the engine.

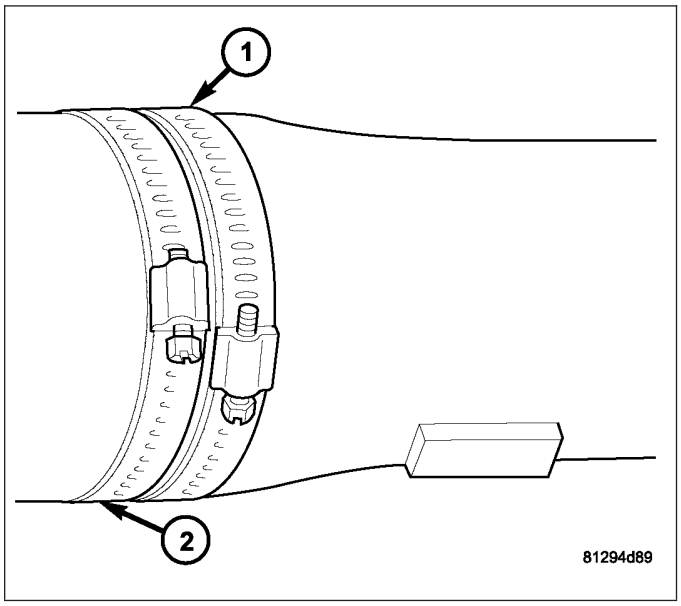
9. Install a screw clamp at position (1).
10. Start engine and check vibration. If there is little or no change move the clamp to the next positions. Repeat the vibration test.

NOTE: If there is no difference in vibration at this positions, the vibration may not be the propeller shaft.

11. If vibration decreased, install a second clamp (1) and repeat the test.



12. If additional clamp causes an additional vibration, separate the clamps 1/2 inch (1) above and below the mark. Repeat the vibration test.
13. Increase distance between the clamp screws (1) (2) and repeat test, until the least amount of vibration is noticed. Bend the slack end of the clamps so screws will not loosen.
14. If vibration remains unacceptable, repeat the procedure to the front end of the propeller shaft.
15. Install wheels and lower vehicle.



PROPELLER SHAFT RUNOUT

1. Clean propeller shaft surface, where dial indicator will contact the shaft.
2. Install dial indicator perpendicular to the shaft surface.
3. Measure runout at the center and ends of the shaft away from weld areas, so weld process does not affect measurements.
4. Refer to Runout Specifications chart.
5. If runout is out of specification, index the shaft 180° and take shaft runout measurements again.
6. If runout is now within specifications, mark shaft and yokes for proper orientation.
7. If runout is not within specifications, verify runout of the transmission/transfer case and axle are within specifications. Correct as necessary and measure propeller shaft runout again.
8. Replace propeller shaft if the runout still exceeds the limits.

RUNOUT SPECIFICATIONS

Front of Shaft	0.020 in. (0.50 mm)
Center of Shaft	0.025 in. (0.63 mm)
Rear of Shaft	0.020 in. (0.50 mm)
NOTE: Measure front/rear runout approximately 3 inches (76 mm) from the weld seam at each end of the shaft tube for tube lengths over 30 inches. For tube lengths under 30 inches, the maximum allowed runout is 0.020 in. (0.50 mm) for the full length of the tube.	

STANDARD PROCEDURE

PROPELLER SHAFT ANGLE

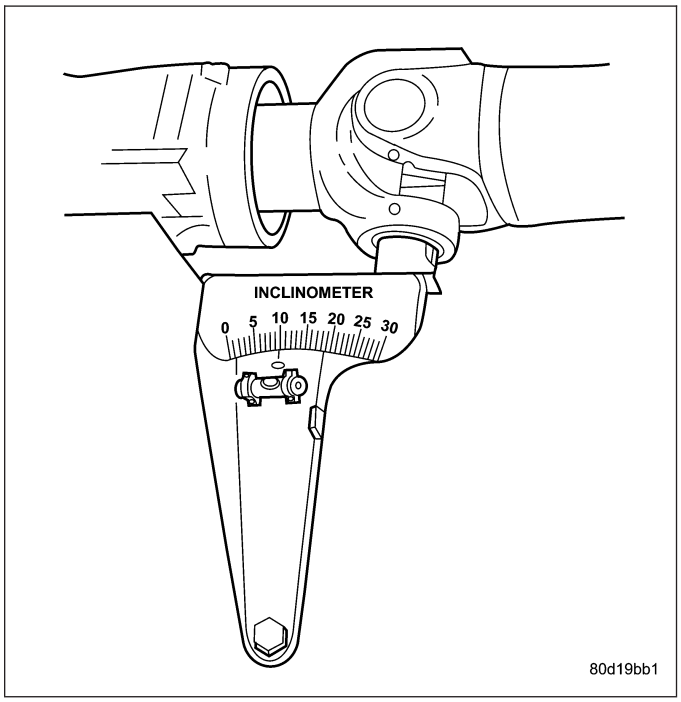
NOTE: This procedure applies to the front and rear propeller shaft.

1. Raise and support vehicle at the axles as level as possible, allowing wheels and propeller shaft to turn.
2. Remove universal joint snap rings if equipped, so inclinometer base will sits flat.
3. Rotate shaft until transmission/transfer case output yoke bearing cap is facing downward.

NOTE: Always make measurements from front to rear and from the same side of the vehicle.

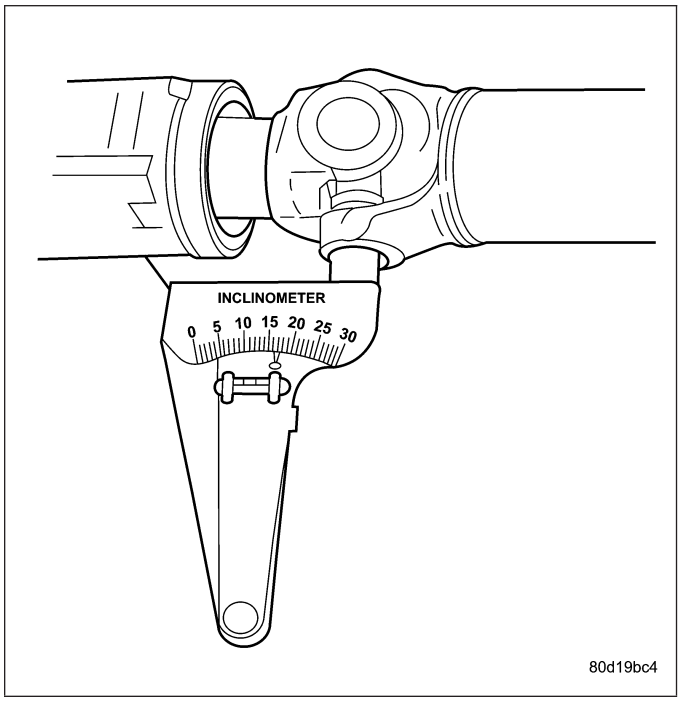
4. Place Inclinometer 7663 on yoke bearing cap or pinion flange ring, parallel to the shaft. Center bubble in sight glass and record measurement (A).

This measurement will give you the transmission or Output Yoke Angle (A).



5. Rotate propeller shaft 90 degrees and place Inclinometer 7663 on yoke bearing cap parallel to the shaft. Center bubble in sight glass and record measurement (C). This measurement can also be taken at the rear end of the shaft.

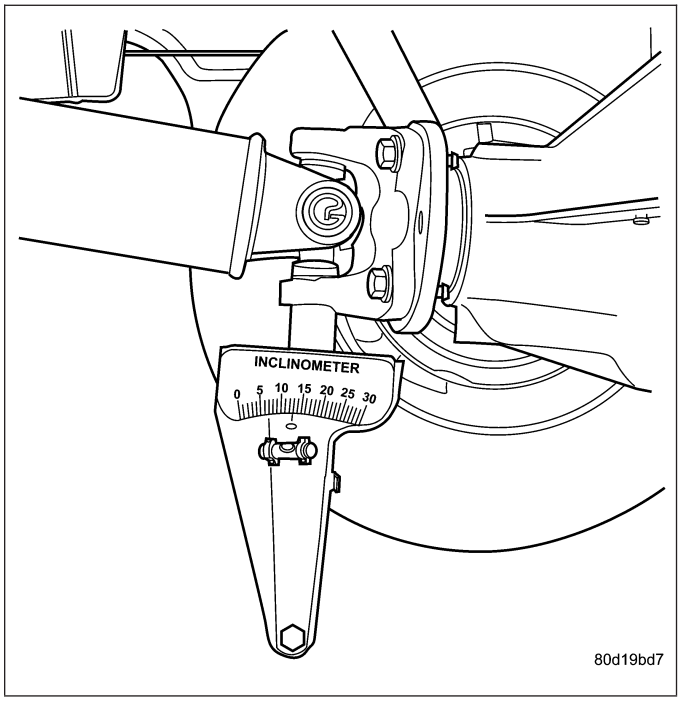
This measurement will give you the propeller shaft angle (C).



6. Subtract smaller figure from larger (C minus A) to obtain transmission output operating angle.
7. Rotate propeller shaft 90 degrees and place Inclinometer 7663 on pinion yoke bearing cap parallel to the shaft. Center bubble in sight glass and record measurement (B).

This measurement will give you the pinion shaft or input yoke angle (B).

8. Subtract smaller figure from larger (C minus B) to obtain axle Input Operating Angle.



PROPELLER SHAFT ANGLE RULES

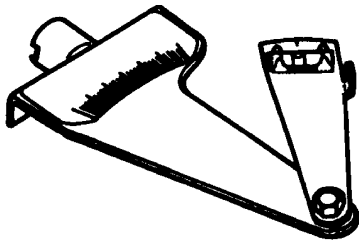
- Good cancellation of U-joint operating angles is within 1 degree.
- Operating angles less than 3 degrees.
- At least 1/2 of one degree continuous operating (propeller shaft) angle.

SPECIFICATIONS

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Center Bearing Bolts	68	50	-
Front Companion Flange Bolts	115	85	-
Rear Companion Flange Bolts	115	85	-

SPECIAL TOOLS

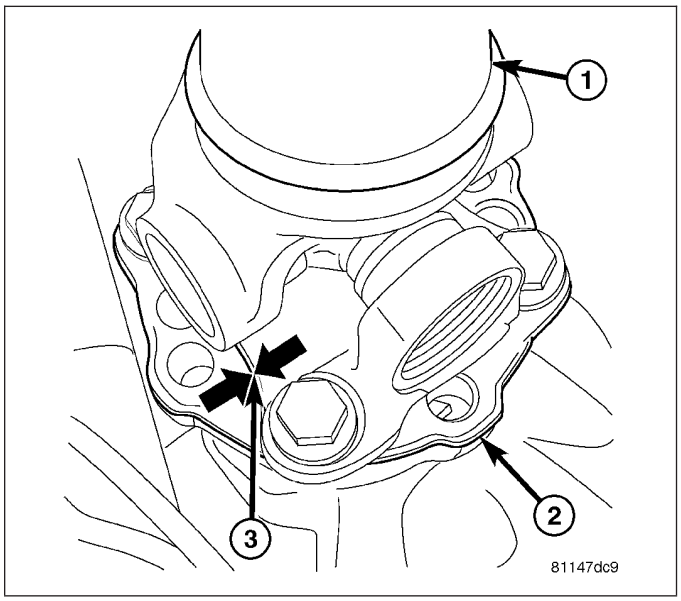


INCLINOMETER 7663

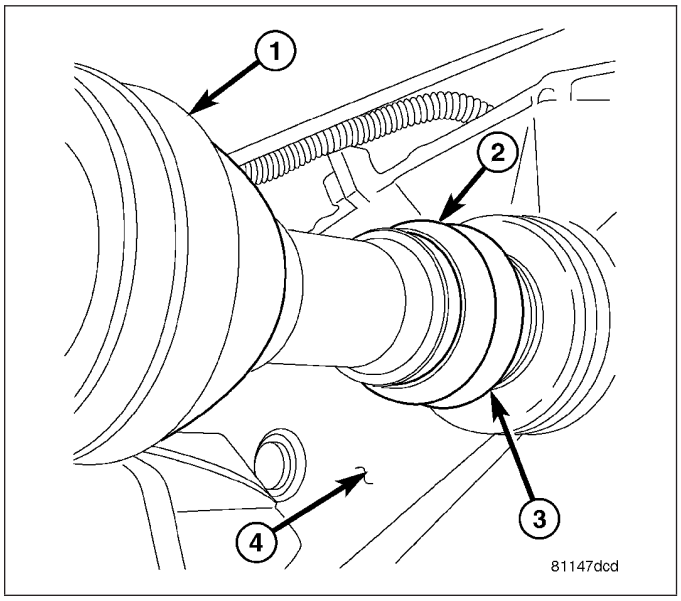
SHAFT-PROPELLER FRONT

REMOVAL

1. With vehicle in neutral, position vehicle on hoist.
2. Remove skid plate if equipped.
3. Mark a reference line (3) across propeller shaft flange and pinion flange (2).

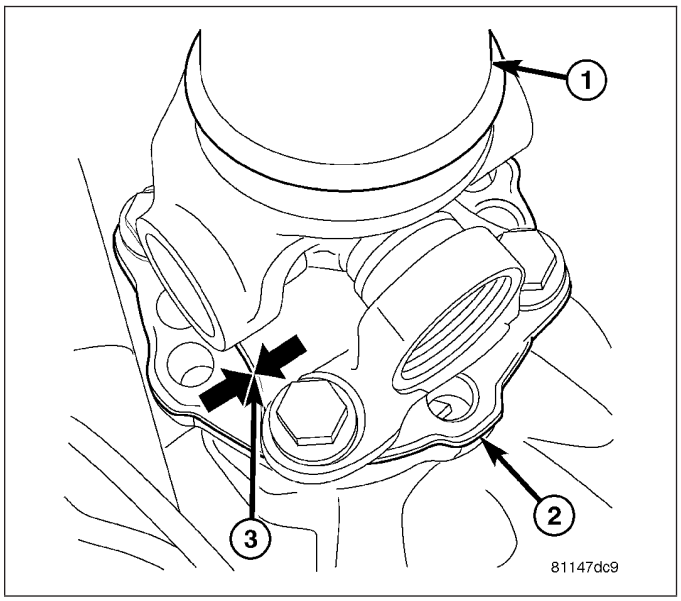


4. Remove exhaust crossover bolts from exhaust manifolds and lower crossover.
5. Remove boot clamp (3) from CV joint (1).
6. Remove pinion flange bolts.
7. Slide propeller shaft off the transfer case and remove shaft.



INSTALLATION

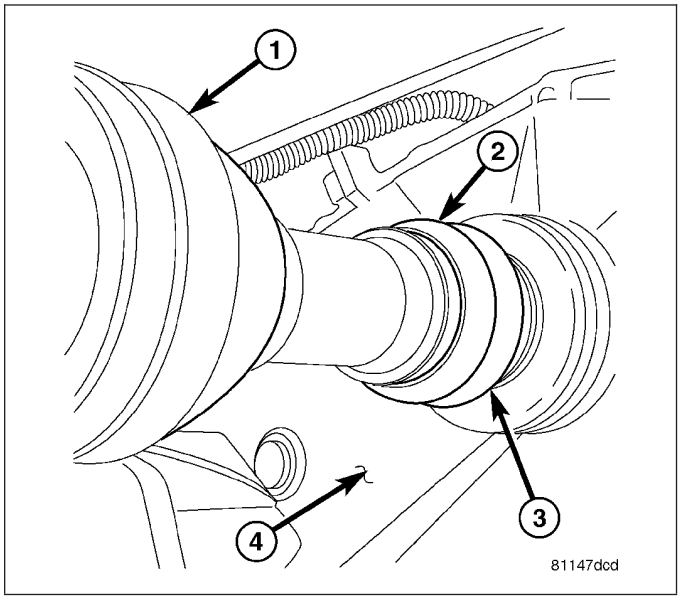
1. Slide propeller shaft onto transfer case.
2. Install propeller shaft with reference marks (3) aligned on pinion flange.



3. Install **new** pinion flange bolts and tighten to 115 N·m (85 ft. lbs.).

NOTE: Flange bolts incorporate a Loctite® patch, new bolts should be used. If bolts are not available, clean bolts and apply Loctite® 242 to the threads.

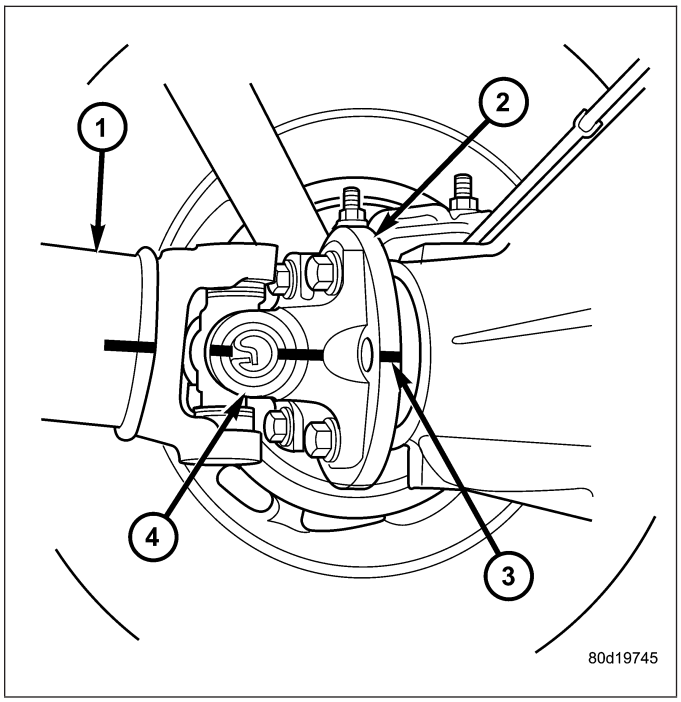
4. Install CV boot clamp (3).
5. Install skid plate, if equipped.



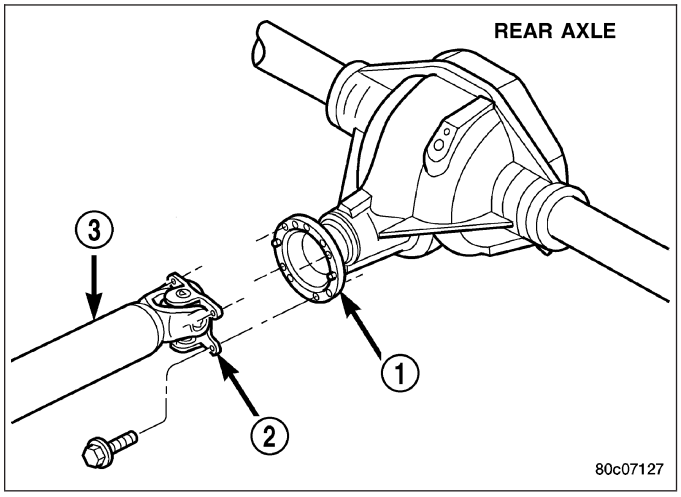
SHAFT-PROPELLER REAR

REMOVAL

1. With vehicle in neutral, position vehicle on hoist.
2. Mark a reference line (3) across the pinion flange (2) and propeller shaft flange (4).



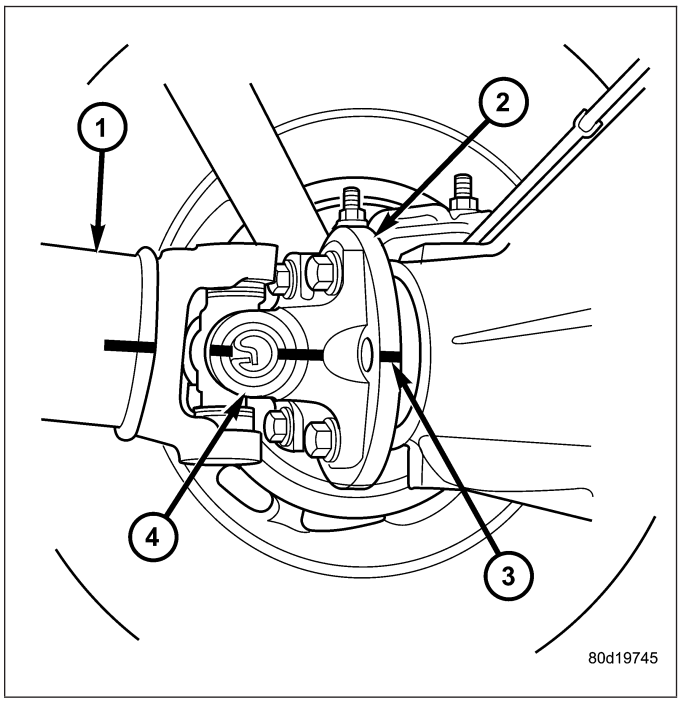
3. Remove flange bolts.
4. Slide slip yoke off of the transmission/transfer case output shaft and remove propeller shaft (3).



INSTALLATION

1. Slide slip yoke onto transmission/transfer case output shaft.
2. Align flange reference marks (3).
3. Install **new** flange bolts and tighten to 115 N·m (85 ft. lbs.).

NOTE: Flange bolts incorporate a Loctite® patch, new bolts should be used. If bolts are not available, clean bolts and apply Loctite® 242 to the threads.



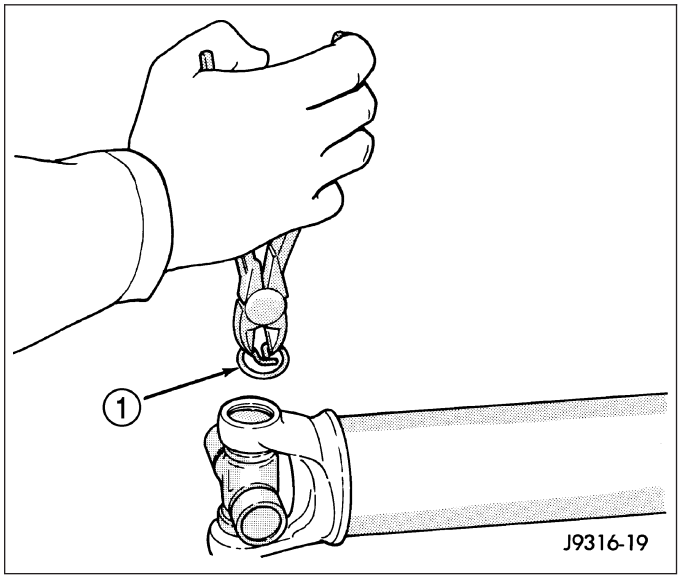
UNIVERSAL JOINTS-SINGLE CARDAN

DISASSEMBLY

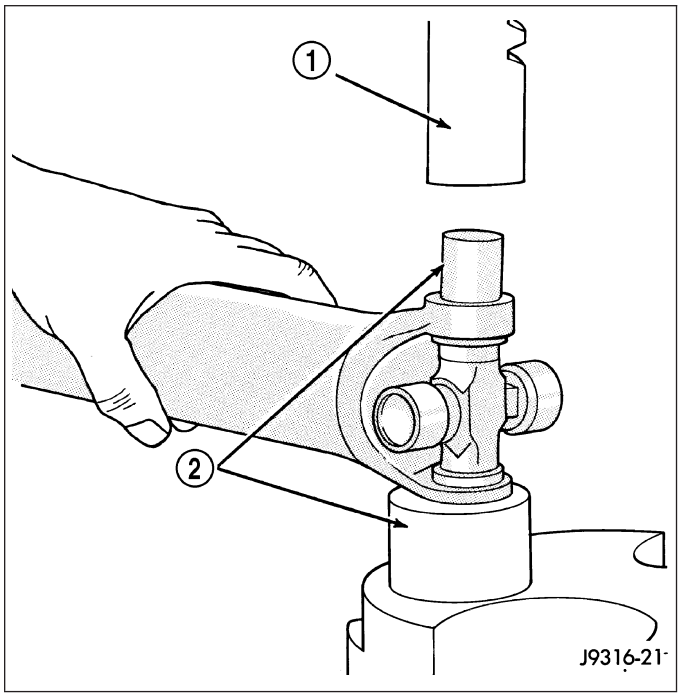
DISASSEMBLY - WITH SNAP RINGS

NOTE: This procedure describes a propeller shaft equipped with a cardan joint in the tube yoke. For propeller shafts equipped with a companion/slip yoke, repeat the steps to remove the remaining cardan joint.

1. Tap outside of bearing cap with a drift to loosen snap ring.
2. Remove snap rings (1) from both sides of yoke.



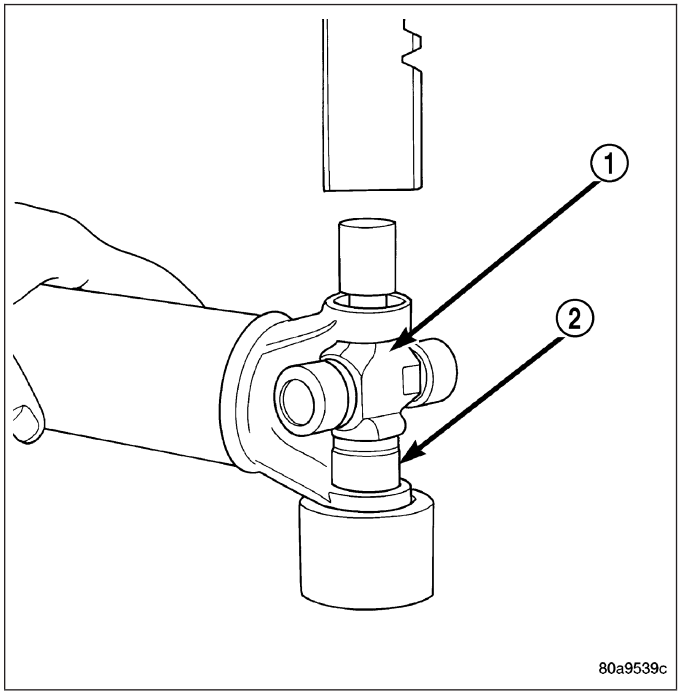
3. Position yoke with the grease fitting if equipped, pointing up.
4. Position a socket with a inside diameter large enough to receive the bearing cap, beneath the yoke on a press.
5. Place another socket with an outside diameter smaller than bearing cap on the upper bearing cap and press (1) the lower cap through the yoke.



NOTE: If the bearing cap will not pull out of the yoke by hand after pressing, tap the yoke ear near the bearing cap to dislodge the cap.

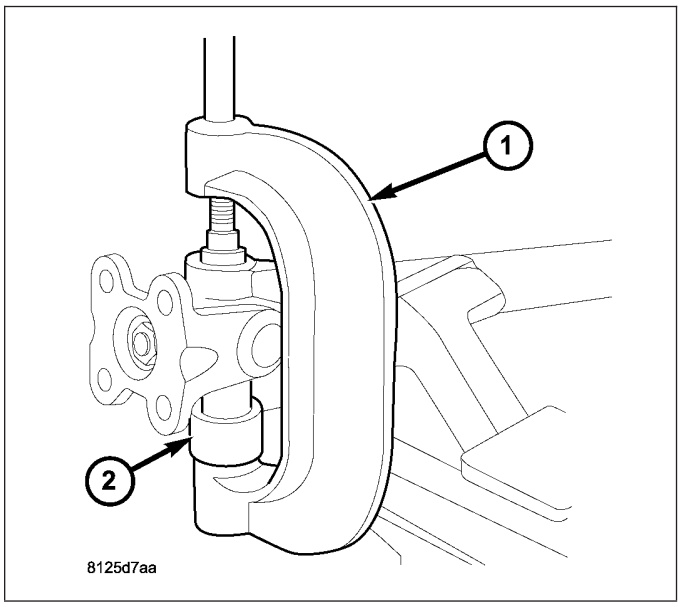
6. Pull bearing cap of the yoke.
7. Turn yoke over in the press and straighten the cross (1). Press the cross until the remaining bearing cap (2) can be removed.

CAUTION: If cross or bearing cap are not straight during removal, the bearing cap will score the walls of the yoke bore and damage can occur.

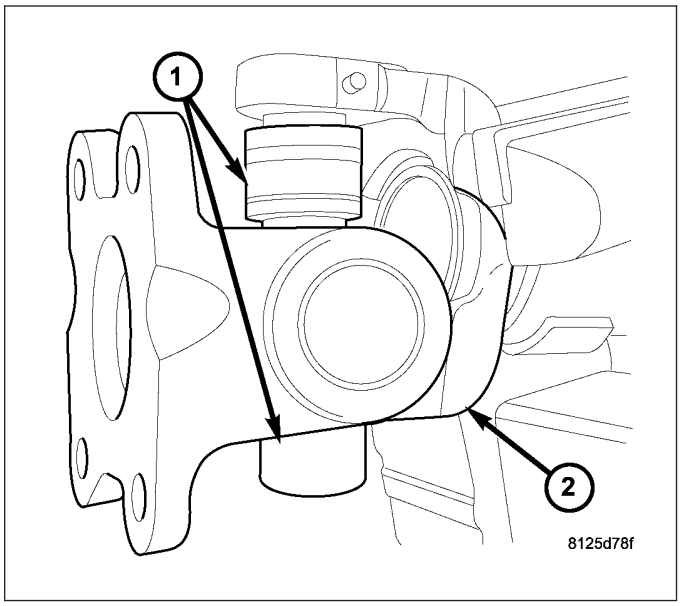


DISASSEMBLY - WITH INJECTED RINGS

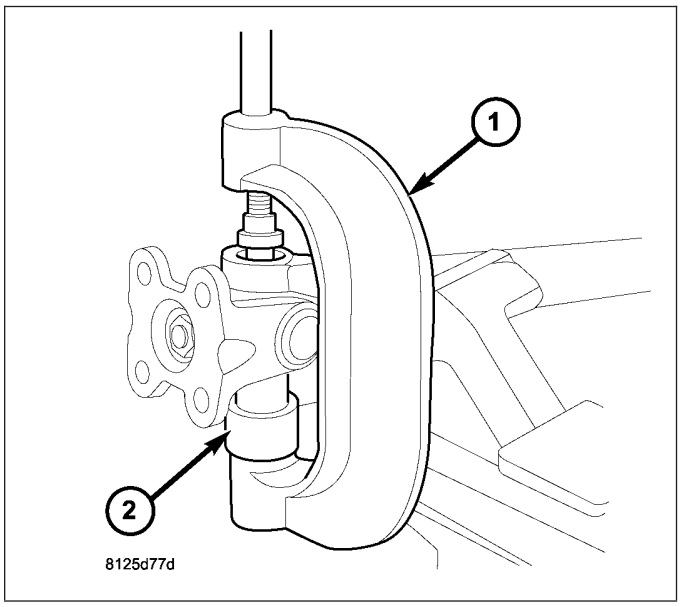
1. Place shaft yoke in vise.
2. Position U-joint press (1) with receiver (2) on propeller shaft yoke.



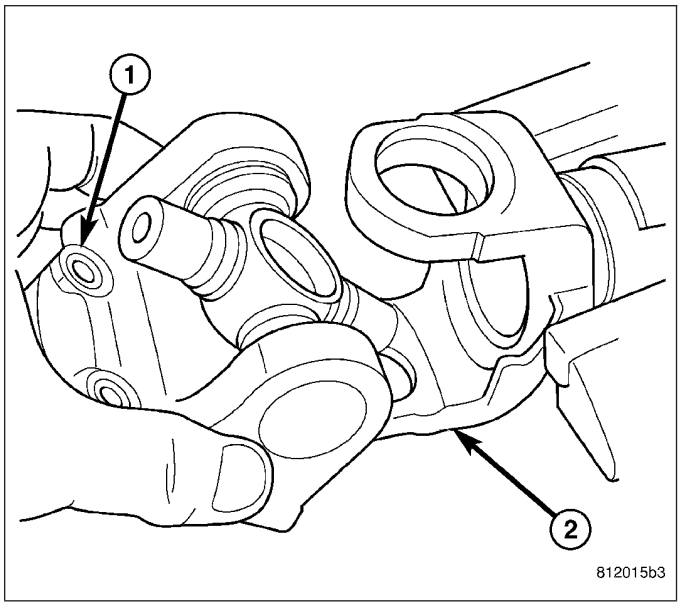
3. Pressed U-joint bearing caps (1) out of shaft yoke (2).



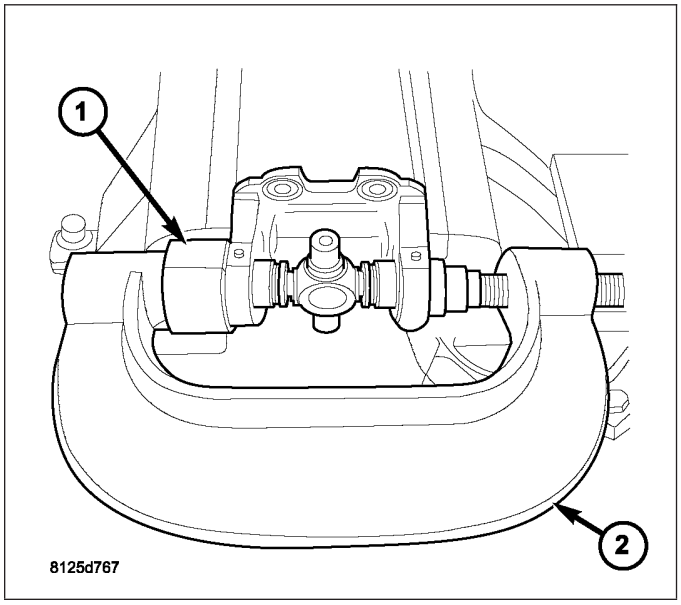
4. Remove lower bearing cap from shaft yoke.
5. Turn shaft over and position press (1) with receiver (2) on shaft yoke.



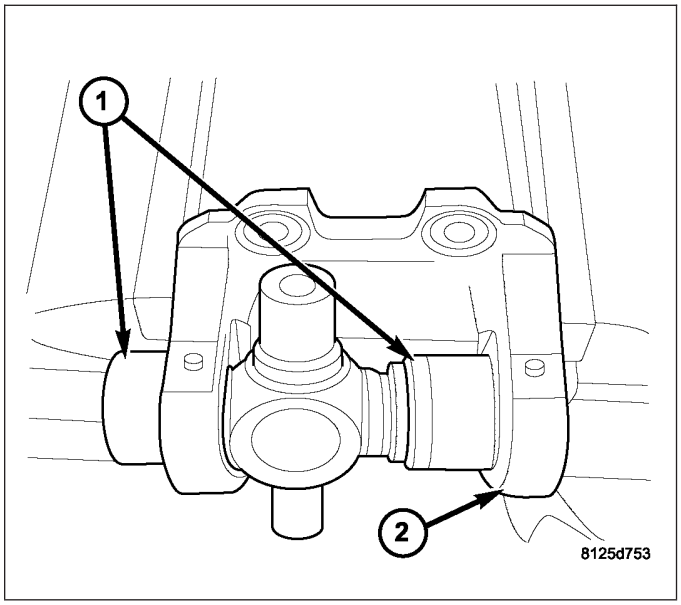
6. Press remaining U-joint bearing cap out of shaft yoke.
7. Remove flange (1) with U-joint out of shaft yoke (2).



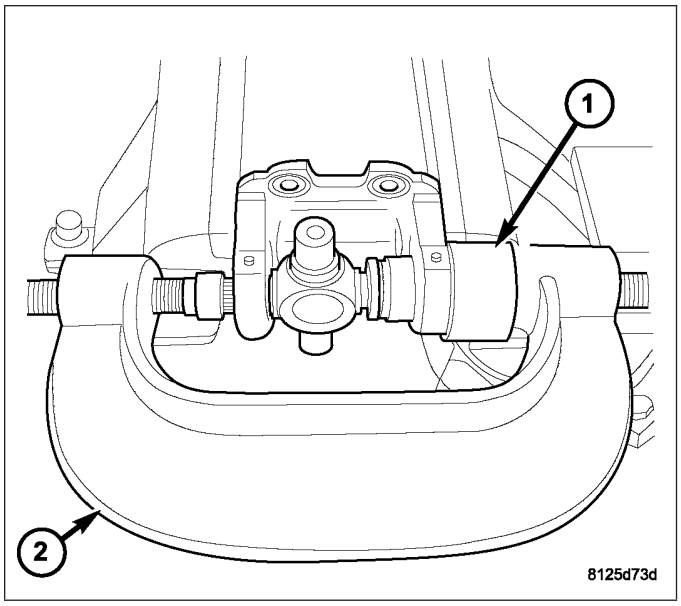
8. Position U-joint press (2) with receiver (1) on flange.



9. Press U-joint bearing caps (1) out of flange (2).



10. Remove bearing cap on the outside of the flange.
11. Position U-joint press (2) with receiver (1) on flange.
12. Press remaining U-joint bearing cap out of flange.
13. Remove U-joint from flange.

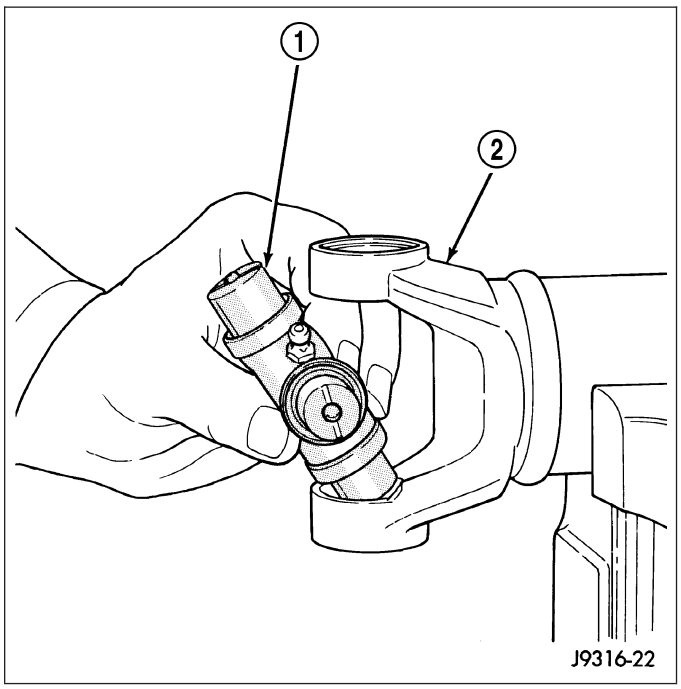


ASSEMBLY

ASSEMBLY - WITH SNAP RINGS

NOTE: This procedure describes a propeller shaft equipped a cardan joint in the tube yoke. For propeller shafts equipped with a companion/slip yoke, repeat the steps to remove the remaining cardan joint.

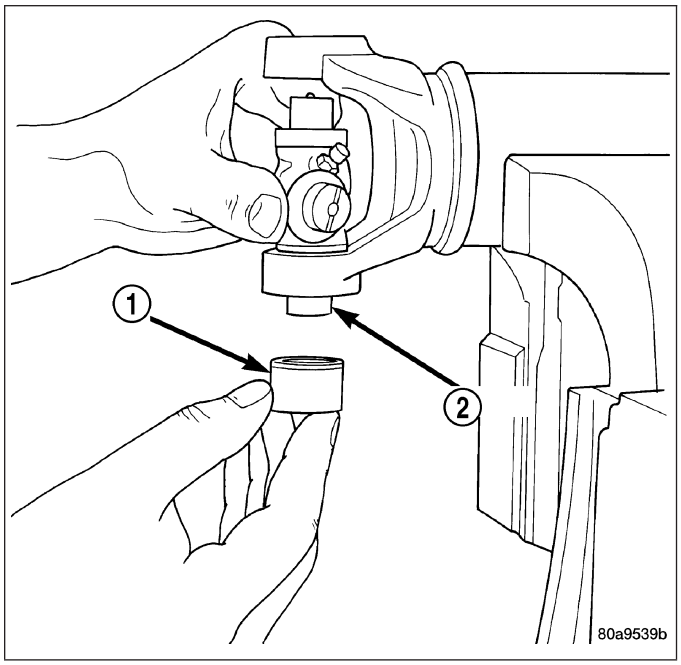
1. Apply (EP) N.L.G.I. Grade 1 or 2 grease to inside of yoke bores.
2. Position cross (1) in yoke with lube fitting pointing up, if equipped.



3. Place a bearing cap (1) over the cross end (2) and align cap with yoke bore.
4. Press bearing cap into the yoke bore enough to clear snap ring groove.
5. Repeat Step 3 and Step 4 to install the opposite bearing cap.

NOTE: If joint is stiff or binding, strike the yoke with a soft hammer to seat the needle bearings.

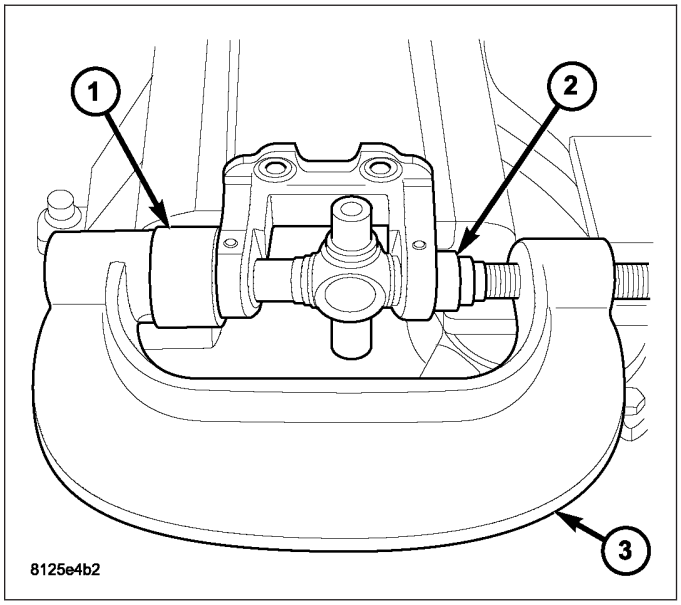
6. Add grease to lube fitting, if equipped.



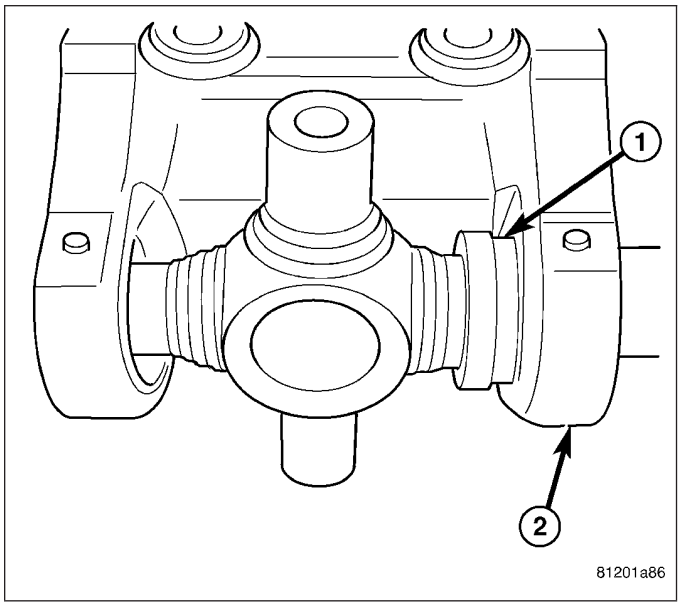
ASSEMBLY - WITH INJECTED RINGS

NOTE: Replacement joint has internal snap rings.

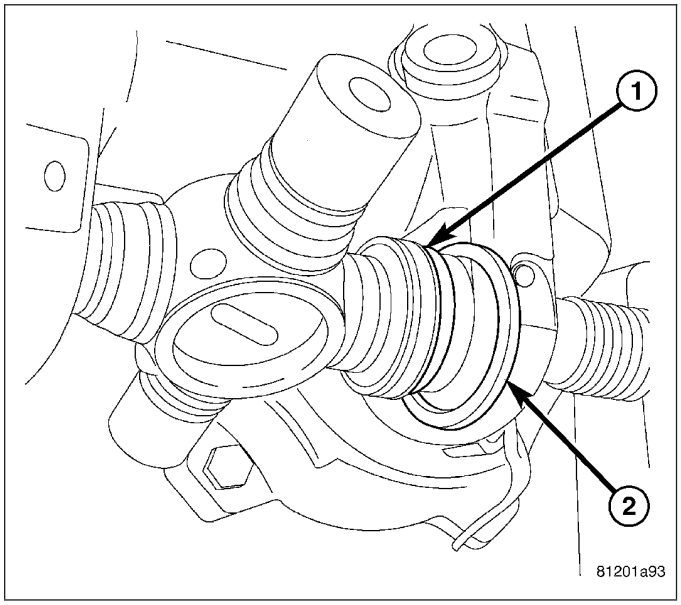
1. Place joint in flange with one bearing cap.
2. Position press (3) with receiver (1) on flange and bearing cap (2).



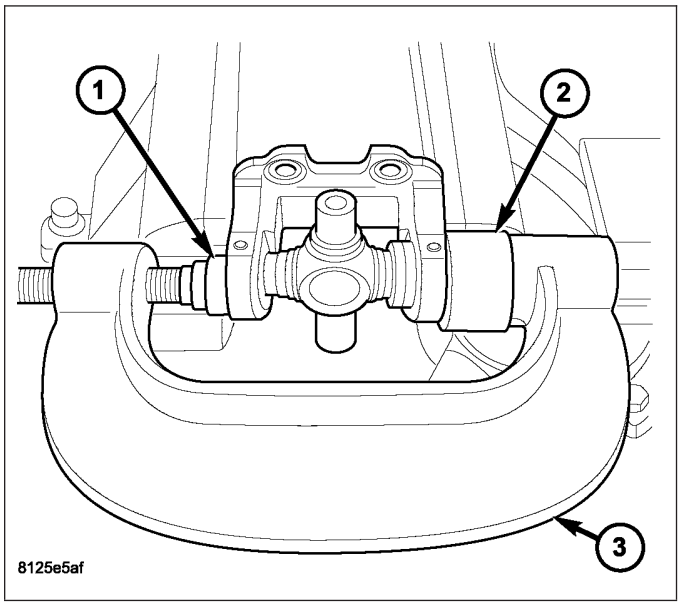
3. Press bearing cap until snap ring groove (1) is through the flange (2).



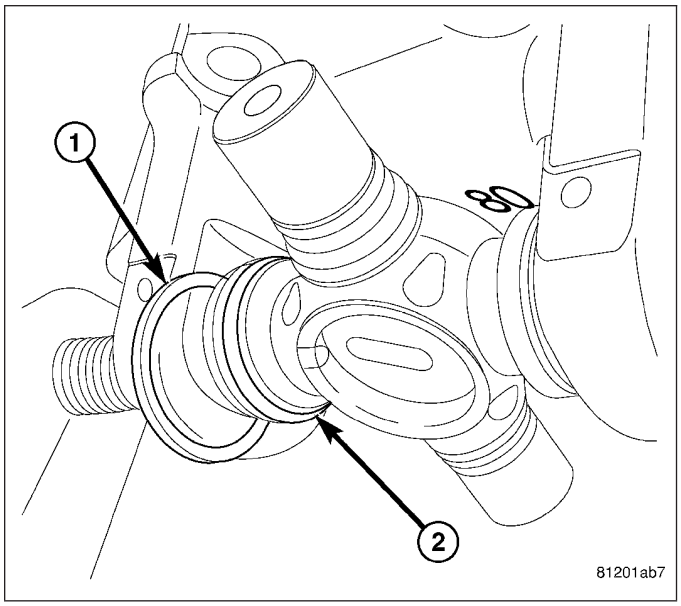
4. Install snap ring (2) on bearing (1).



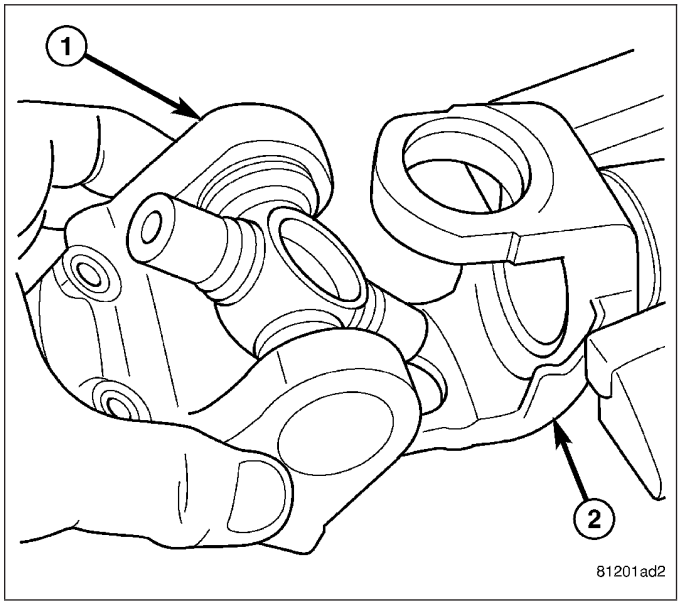
5. Position press (3) with receiver (2) on remaining bearing cap (1) and flange.



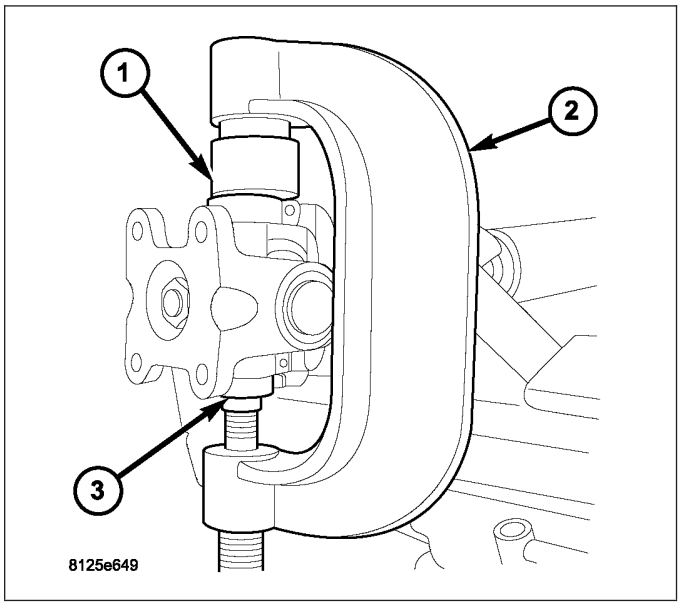
6. Press bearing cap until snap ring groove is through the flange.
7. Install snap ring (1) on bearing cap (2).



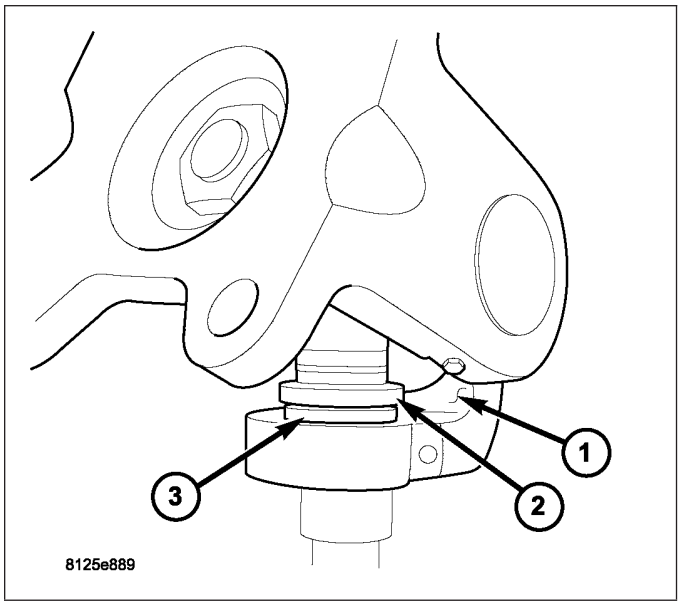
8. Install flange (1) with U-joint in yoke (2).



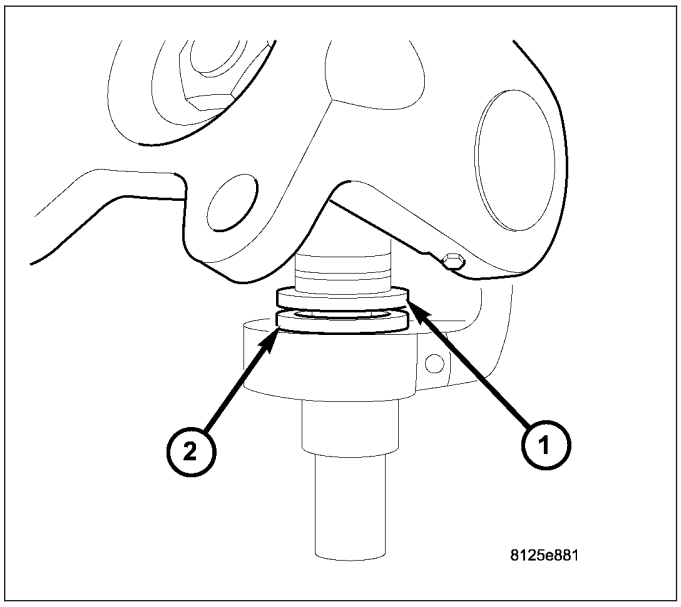
9. Position press (2) with receiver (1) and lower bearing cap (3) on yoke.



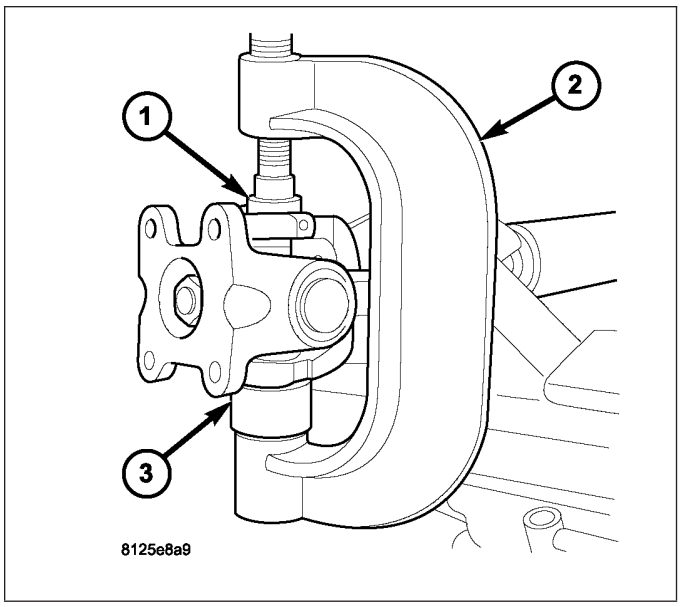
10. Press bearing cap until snap ring groove is through the yoke.



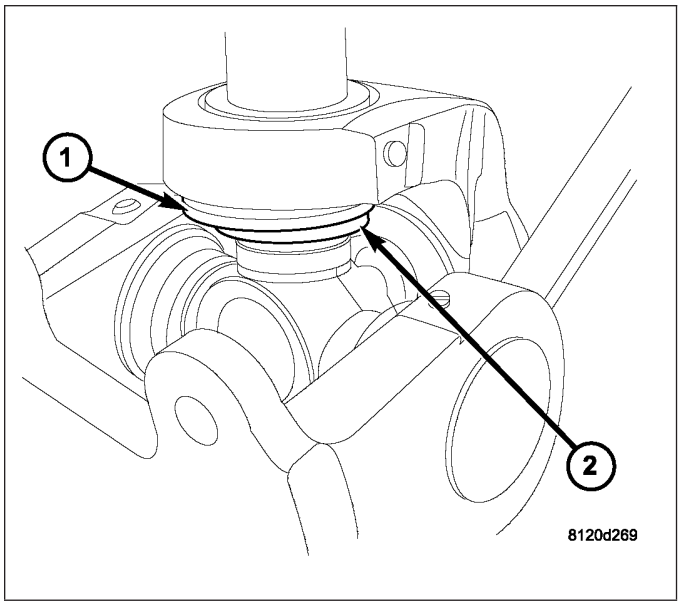
11. Install snap ring (2) on bearing cap (1).



12. Position press (2) with receiver (3) on remaining bearing cap (1) and yoke.



13. Press remaining bearing cap until snap ring groove is through the yoke.
14. Install snap ring (2) on bearing cap (1).



HALF SHAFT

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HALF SHAFT

CAUTION

CAUTION:: Never grasp half shaft assembly by the boots. This may cause the boot to pucker or crease and reduce the service life of the boot.
Avoid over angulating or stroking the C/V joints when handling the half shaft.
Half shafts exposed to battery acid, transmission fluid, brake fluid, differential fluid or gasoline may cause the boots to deteriorate. Failure to follow these instruction will result in damage.

DIAGNOSIS AND TESTING

HALF SHAFT

Check inboard and outboard C/V joint for leaking grease. This is a sign of boot or boot clamp damage.

NOISE/VIBRATION IN TURNS

A clicking noise or vibration in turns could be caused by a damaged outer C/V or inner tripod joint seal boot or seal boot clamps. This will result in the loss/contamination of the joint grease, resulting in inadequate lubrication of the joint. Noise could also be caused by another component of the vehicle coming in contact with the half shafts.

CLUNKING NOISE DURING ACCELERATION

This noise may be a damaged or worn C/V joint. A torn boot or loose/missing clamp on the inner/outer joint which has allowed the grease to be lost will damage the C/V joint.

SHUDDER/VIBRATION DURING ACCELERATION

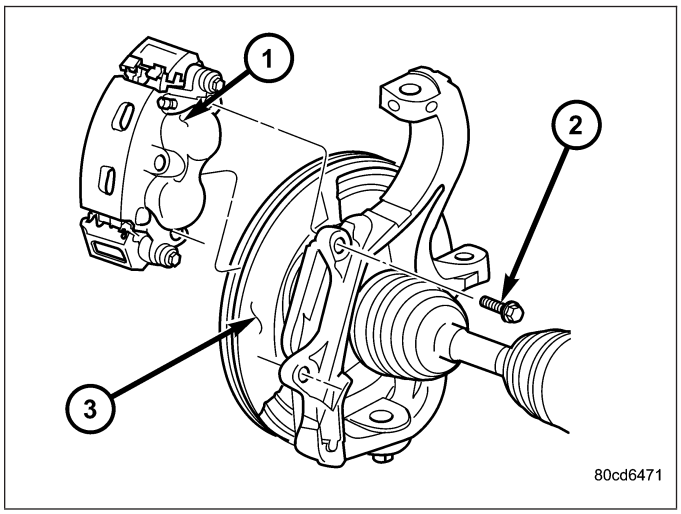
This could be a worn/damaged inner tripod joint or a sticking tripod joint. Improper wheel alignment may also cause a shudder or vibration.

VIBRATION AT HIGHWAY SPEEDS

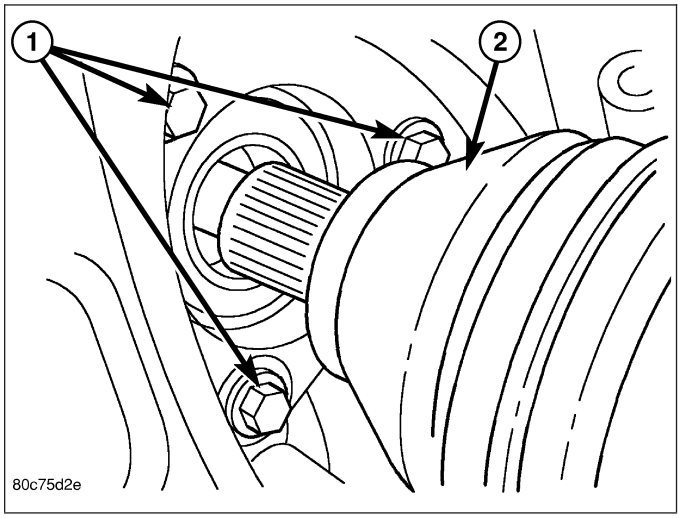
This problem could be a result of out of balance front tires or tire/wheel runout. Foreign material (mud, etc.) packed on the backside of the wheel(s) will also cause a vibration.

REMOVAL

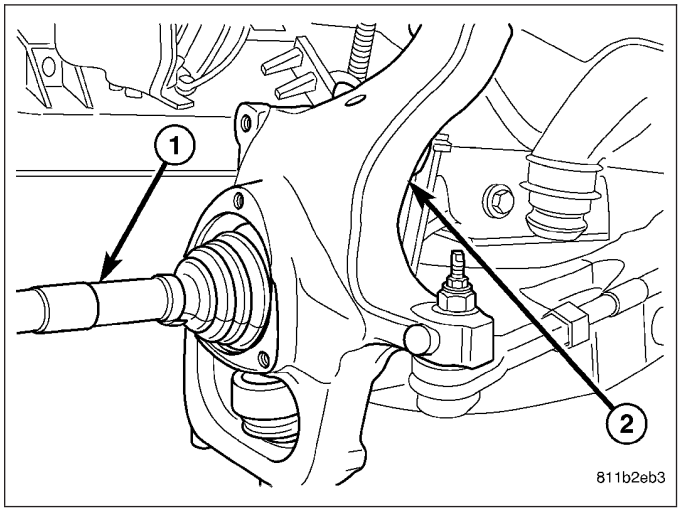
1. With vehicle in neutral, position vehicle on hoist.
2. Remove skid plate, if equipped.
3. Remove hub nut from the half shaft.
4. Remove brake caliper (1) and rotor (3).



5. Remove wheel speed sensor if equipped.
6. Remove hub bearing bolts (1) from the knuckle.

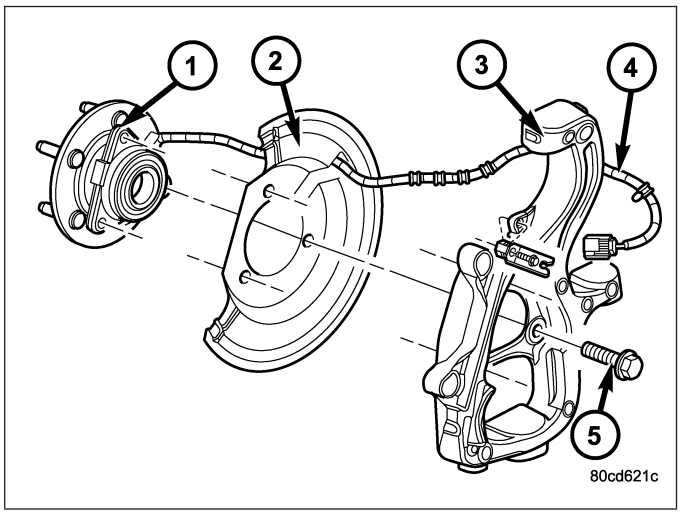


7. Remove hub bearing and brake shield from knuckle.
8. Support half shaft at the C/V joint housings.
9. Position two pry bars behind the inner C/V housing and disengage the C/V joint from the axle.
10. Remove half shaft (1) from vehicle.

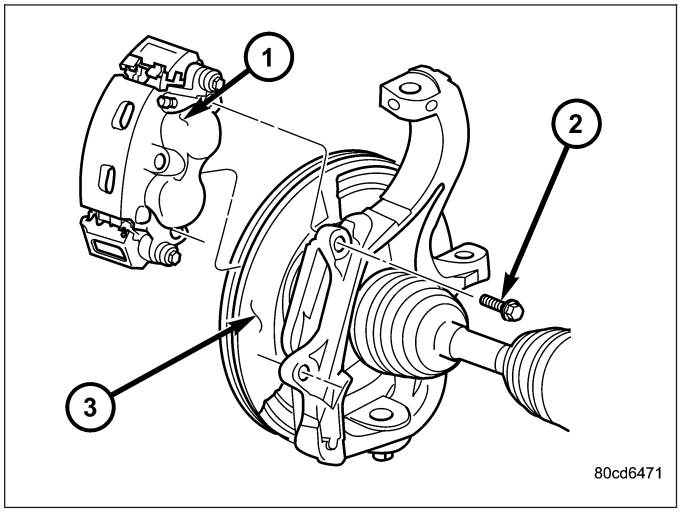


INSTALLATION

1. Apply a light coating of wheel bearing grease on the axle splines.
2. Insert half shaft into steering knuckle and onto the axle. Verify shaft snap-ring engages with the groove on the inside of the joint housing.
3. Clean hub bearing bore and hub bearing mating surface. Lightly coat mating surfaces with grease.
4. Install hub bearing (1) onto the axle half shaft and into steering knuckle (3). Tighten hub bearing bolts to 163 N·m (120 ft. lbs.).



5. Install wheel speed sensor, if equipped.
6. Install brake rotor (3) and caliper adapter with caliper (1).
7. Install half shaft nut. Apply brakes and tighten shaft nut to 251 N·m (185 ft. lbs.).
8. Install skid plate, if equipped.

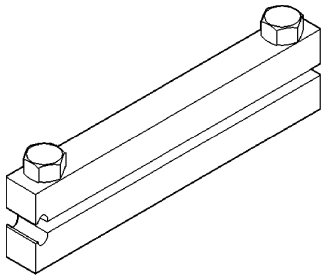


SPECIFICATIONS

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Hub Bearing Bolts	163	120	-
Half Shaft Nut	251	185	-

SPECIAL TOOLS



CLAMP INSTALLER C-4975A

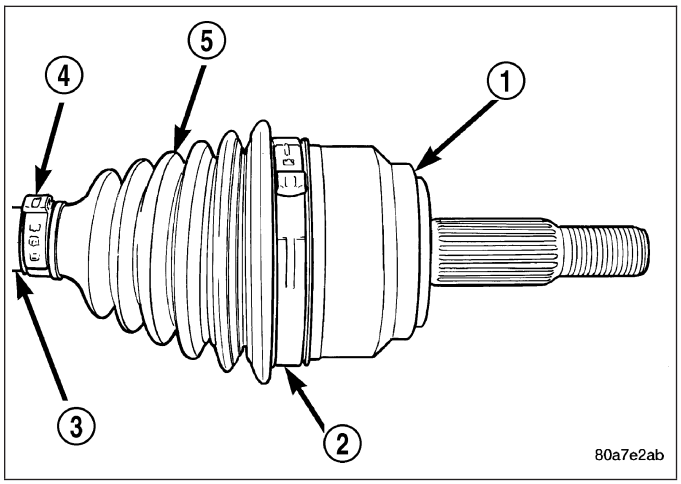
C/V JOINT/BOOT-OUTER

REMOVAL

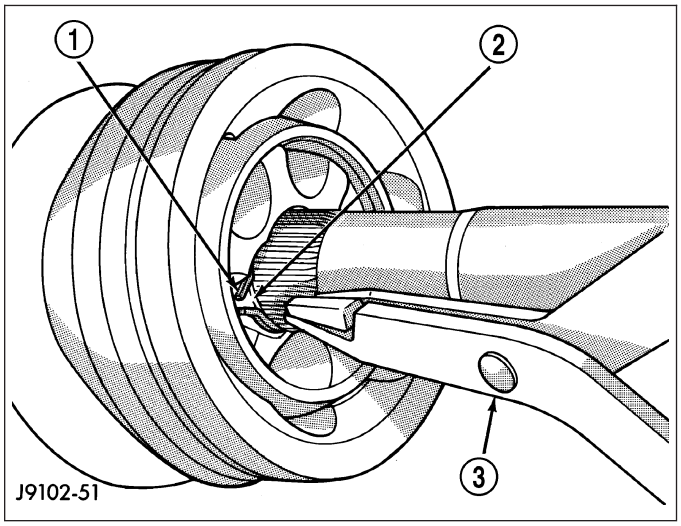
1. Place shaft in vise with soft jaws and support C/V joint.

CAUTION: Do not damage C/V housing or half shaft.

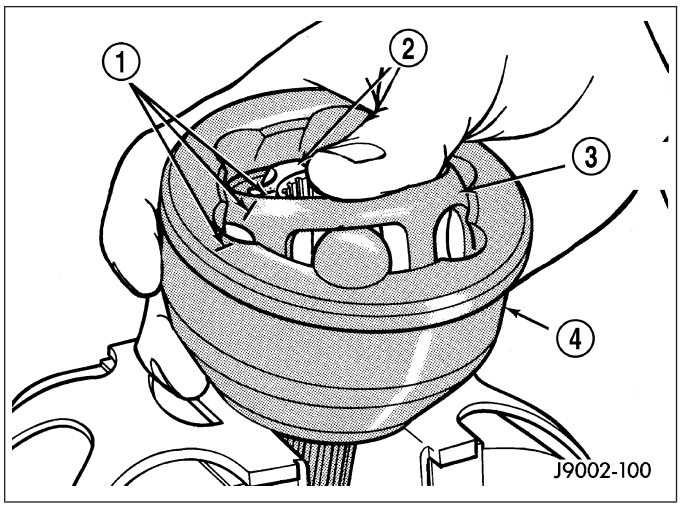
2. Remove clamps (2) (4) with a cut-off wheel or grinder.



3. Slide the boot down the shaft.
4. Remove lubricant to expose the C/V joint snap ring.
5. Spread snap ring (1) and slide the joint off the shaft.



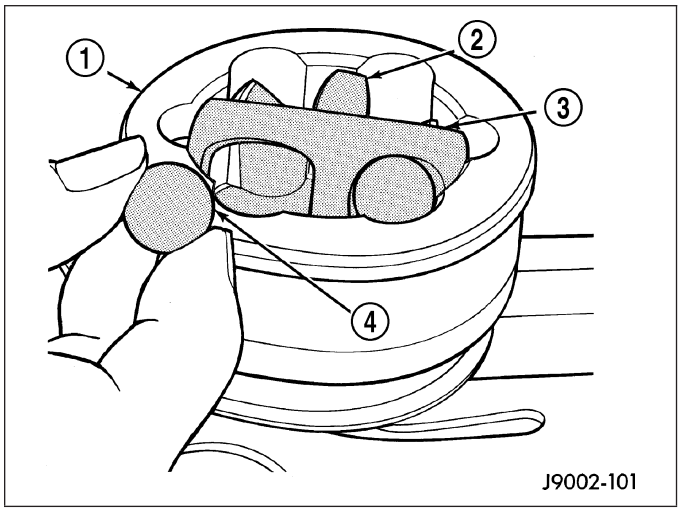
6. Slide boot off the shaft and discard old boot.
7. Mark alignment marks (1) on the inner race/hub (2), bearing cage (3) and housing with dabs of paint.



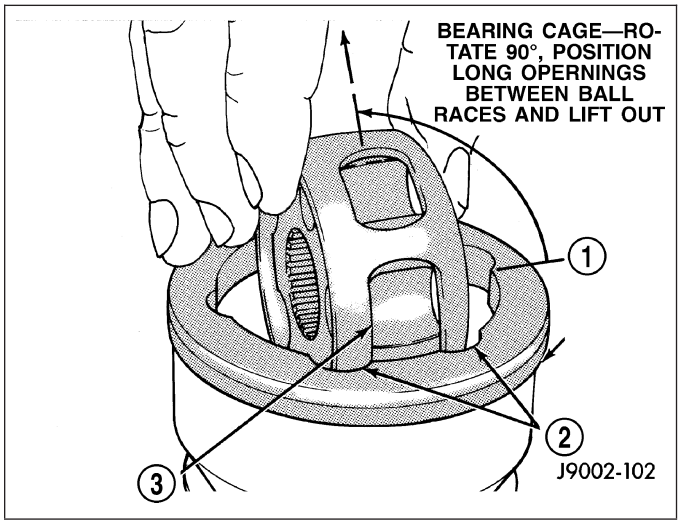
8. Clamp C/V joint in a vertical position in a soft jawed vise.
9. Press down one side of the bearing cage (3) to gain access to the ball at the opposite side.

NOTE: If joint is tight, use a hammer and brass drift to loosen the bearing hub. Do not contact the bearing cage with the drift.

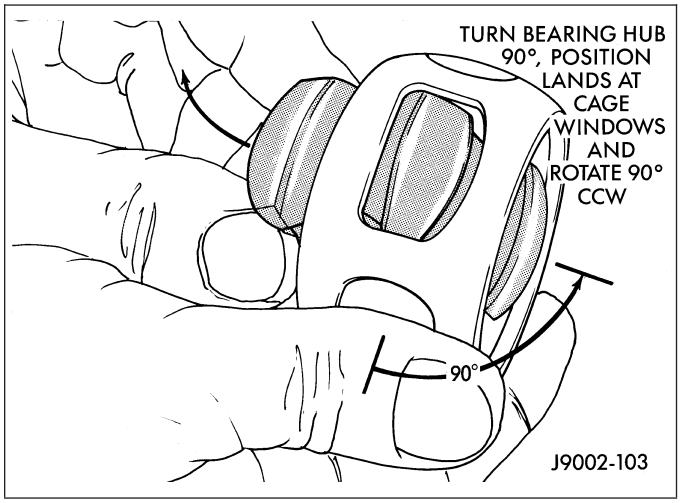
10. Remove ball (4) from the bearing cage (3).



11. Repeat step above until all six balls are removed from the bearing cage.
12. Lift cage and inner race (2) upward and out from the housing (1).

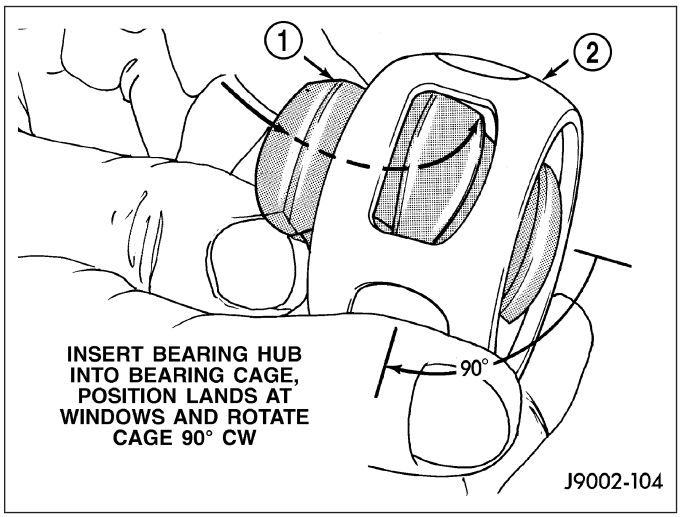


13. Turn inner race 90° in the cage and rotate the inner race/hub out of the cage.

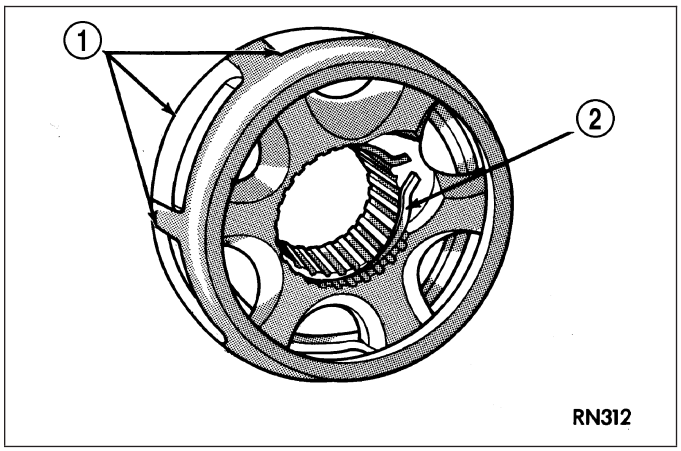


INSTALLATION

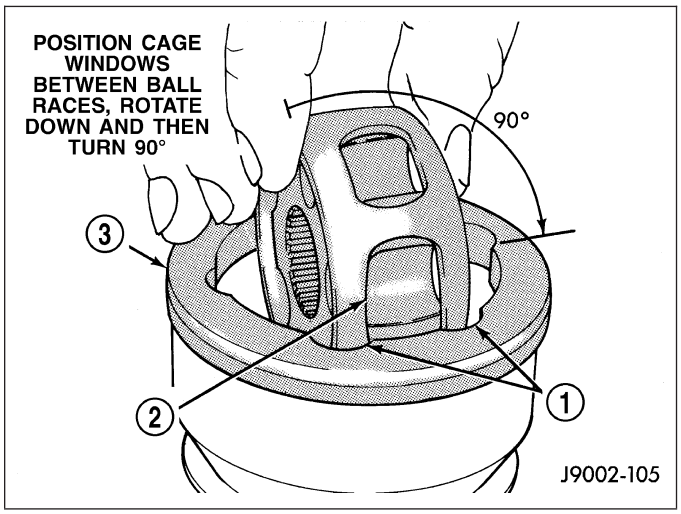
1. Apply a light coat of grease to the C/V joint components before assembling them.
2. Align inner race, cage and housing according to the alignment reference marks.
3. Insert inner race (1) into the cage (2) and rotate race into the cage.



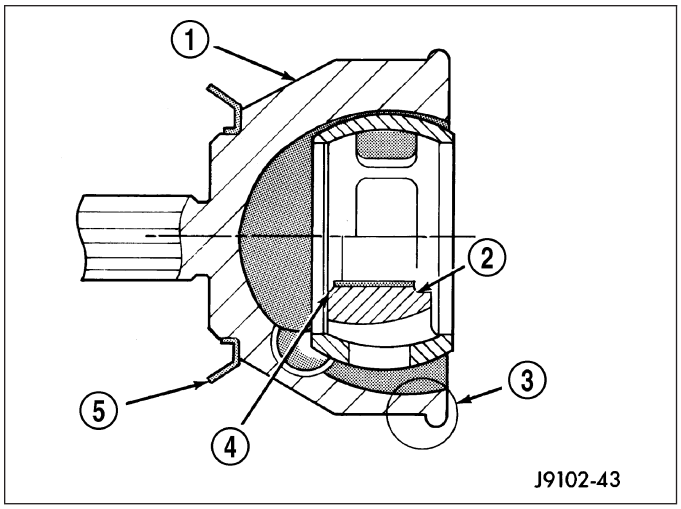
4. Rotate inner race/hub in the cage (1).



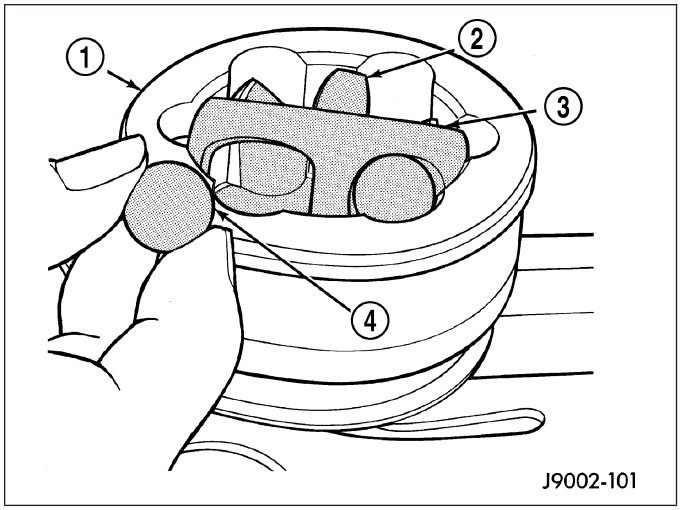
5. Insert cage into the housing (3).



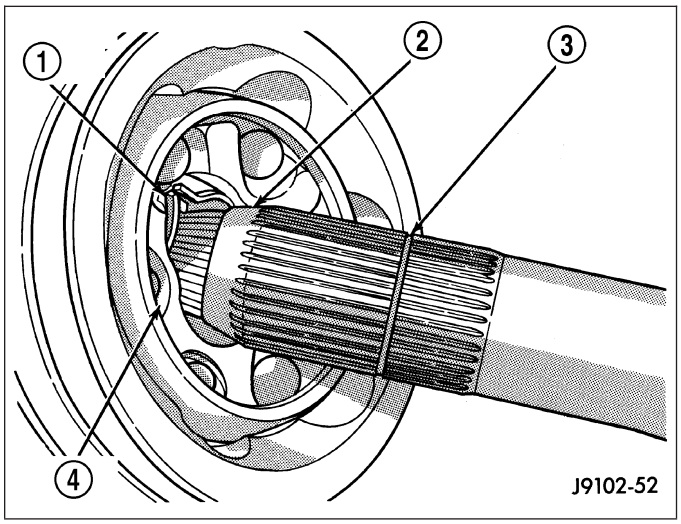
6. Rotate cage 90° into the housing (1).



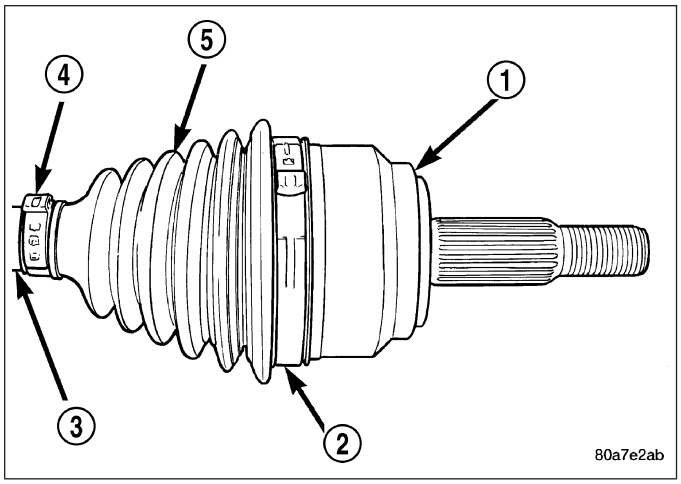
7. Apply lubricant included with replacement boot/joint to the ball races. Spread lubricant equally between all the races.
8. Tilt inner race/hub (2) and cage (3) and install the balls (4).



9. Place new clamps onto new boot and slide boot onto the shaft to it's original position.
10. Apply the rest of lubricant to the C/V joint and boot.
11. Push the joint onto the shaft until the snap ring (1) seats in the groove (3). Pull on the joint to verify the span ring has engaged.



12. Position boot on the joint in it's original position. Ensure boot is not twisted and remove any excess air.
13. Secure both boot clamps (2) (4) with Clamp Installer C-4975A. Place tool on clamp bridge and tighten tool until the jaws of the tool are closed.

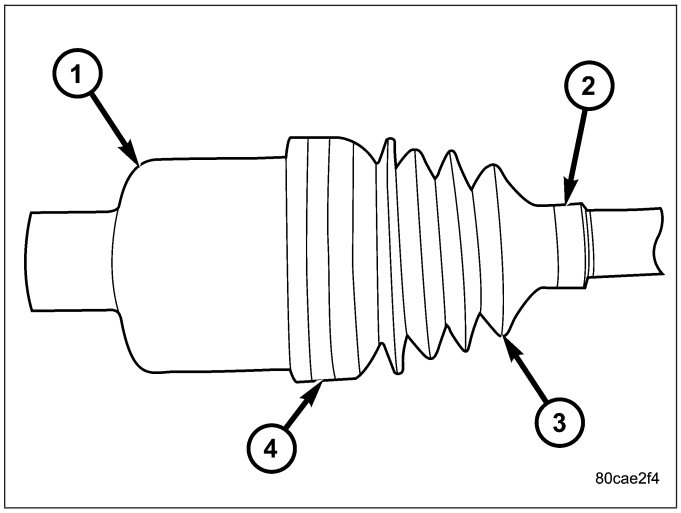


C/V JOINT/BOOT-INNER

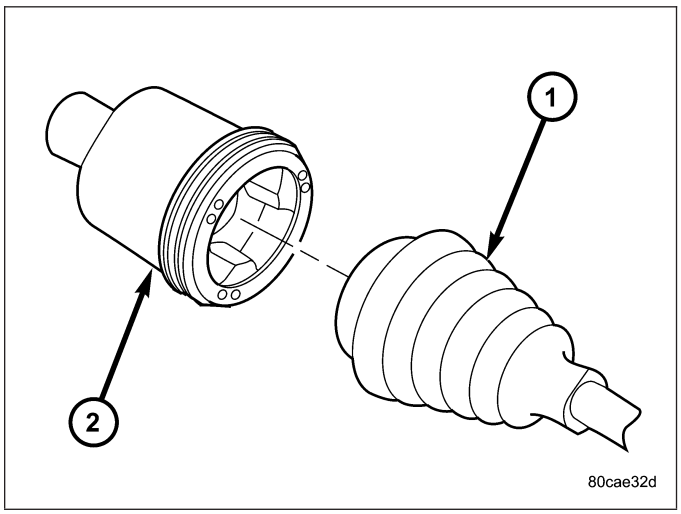
REMOVAL

1. Place shaft in vise with soft jaws and support C/V joint.
2. Remove clamps (2) (4) with a cut-off wheel or grinder.

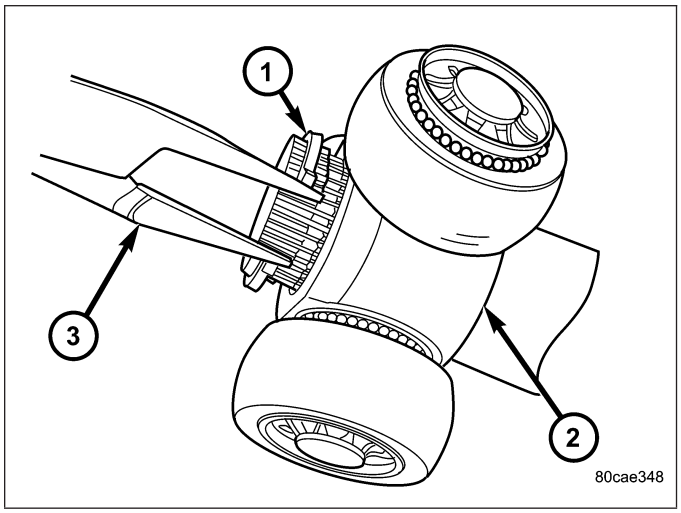
NOTE: Do not damage C/V housing or half shaft with cut-off wheel or grinder.



3. Remove housing (1) from the half shaft and slide boot (2) down shaft.

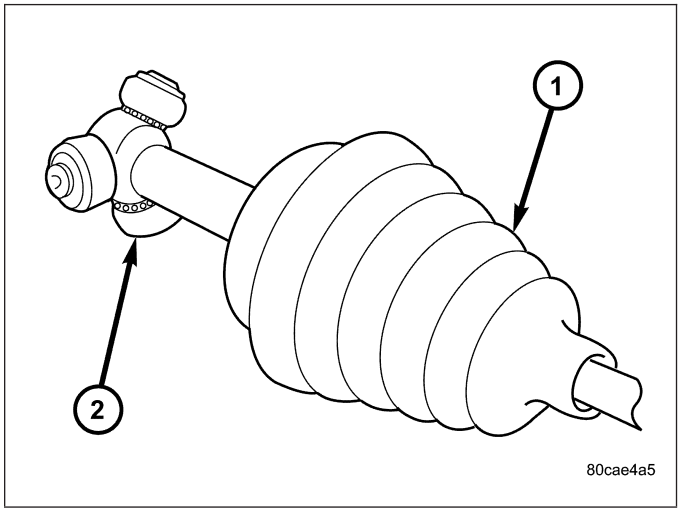


4. Remove housing bushing from the housing.
5. Remove tripod (2) snap ring (1).
6. Remove tripod and boot from the half shaft.
7. Clean and inspect C/V components for excessive wear and damage. Replace the tripod as a unit only if necessary.

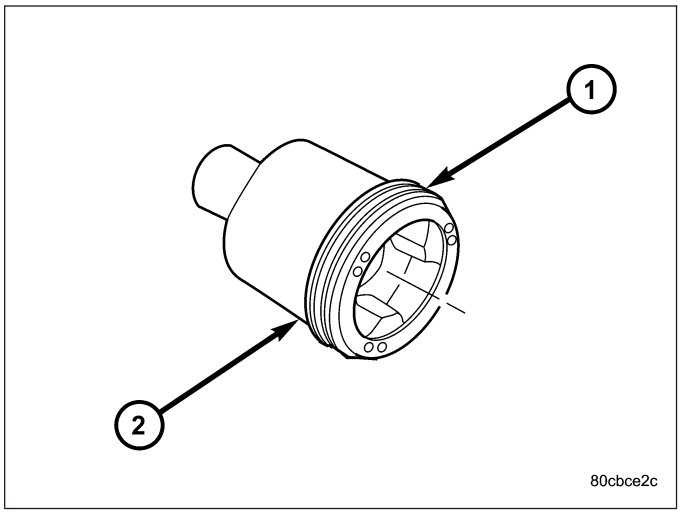


INSTALLATION

1. Slide **new** boot down the half shaft.
2. Install tripod (1) and tripod snap ring on the half shaft.



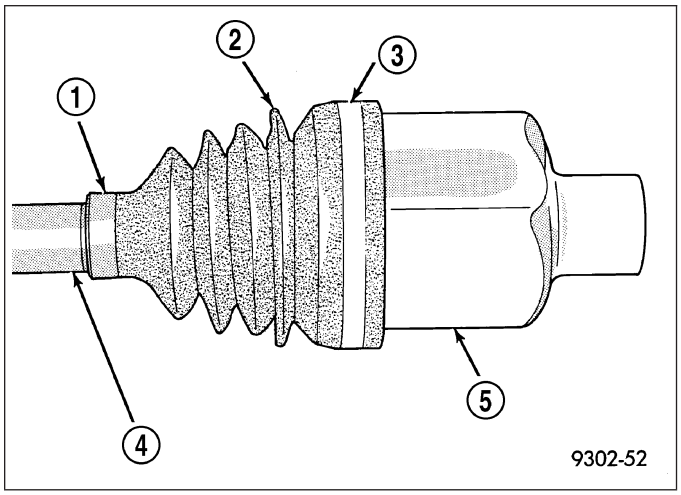
3. Pack grease supplied with the joint/boot into the housing and boot.
4. Coat tripod with supplied grease.
5. Install **new** bushing (2) onto the housing (1).



6. Insert tripod and shaft in the housing.
7. Position boot (2) on the joint in it's original position.

NOTE: Verify boot is not twisted and remove any excess air.

8. Secure both boot clamps with Clamp Installer C-4975A. Place tool on clamp bridge and tighten tool until the jaws of the tool are closed.



FRONT AXLE - C205F

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FRONT AXLE - C205F

DIAGNOSIS AND TESTING

FRONT AXLE - C205F

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, incorrect pinion depth, tooth contact, worn/damaged gears, or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak-noise range. If the noise stops or changes greatly check for:

- Insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side and pinions gears, usually do not cause noise during straight-ahead driving, when the gears are unloaded. The side gears are loaded during turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

Bearing noise can be either a whining or a growling sound.

Pinion bearings have a constant high pitch noise, because it rotates at a faster rate. This noise changes with vehicle speed. If noise is heard under a load, the rear pinion bearing is the source. If noise is heard during a coast, the front pinion bearing is the source.

Differential bearings usually produce a low pitch noise. The differential bearing noise is constant and varies only with vehicle speed.

Axle shaft bearing noise generally changes when the bearings are loaded. Turn vehicle sharply to the left and the right during a road test. This will load and unload the bearings and change the noise level. If axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 m.p.h.

LOW SPEED KNOCK

Low speed knock is generally caused by:

- Worn U-joints or C/V joints.
- Worn side-gear thrust washers.
- Worn pinion shaft bore.

VIBRATION

Vibration at the rear of the vehicle is usually caused by:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out of balance wheels.
- Loose wheel lug nuts.
- Worn U-joints or C/V joints.
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion yoke run out.
- Bent axle shaft(s).

Check for loose or damaged front-end components or engine/transmission mounts. These components can contribute to what appears to be an axle vibration. Also look at engine accessories, brackets and drive belts.

NOTE: All driveline components should be examined before starting any repair.

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear or the clutch engaged can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U-joints or C/V joints.
- Loose spring mounts.
- Loose pinion gear nut and yoke.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

To determined the source of a snap/clunk noise, raise vehicle on a hoist with the wheels free to rotate. Have a helper shift the transmission into gear and listen for the noise.

DIAGNOSTIC CHART

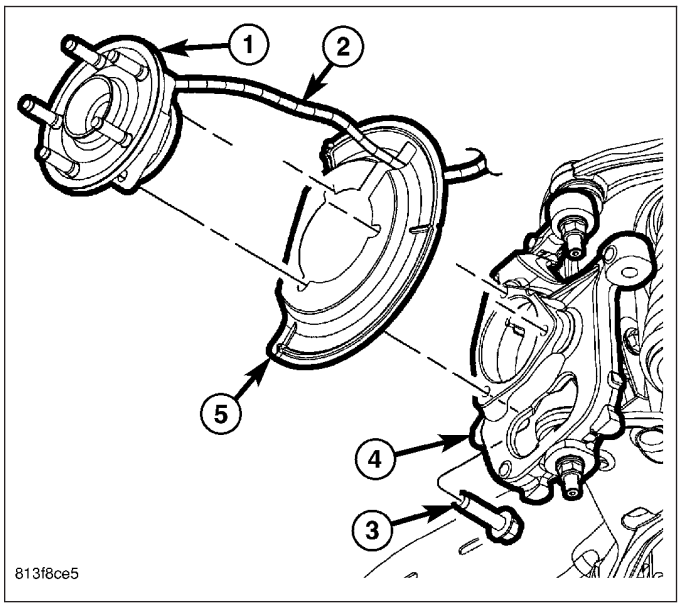
Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brinelled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
	3. End-play in pinion bearings.	3. Refer to pinion pre-load information and correct as necessary.
	4. Excessive gear backlash between the ring gear and pinion.	4. Check adjustment of the ring gear and pinion backlash. Correct as necessary.
	5. Improper adjustment of pinion gear bearings.	5. Adjust the pinion bearings pre-load.
	6. Loose pinion yoke nut.	6. Tighten the pinion yoke nut.
	7. Scuffed gear tooth contact surfaces.	7. Inspect and replace as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace the broken shaft after correcting tube mis-alignment.
	2 Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper adjustment of the differential bearings.	1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.

Condition	Possible Causes	Correction
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored yoke.	5. Replace yoke and seal.
	6. Axle cover not properly sealed.	6. Remove, clean, and re-seal cover.
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Re-adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Re-adjust ring gear backlash.
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.

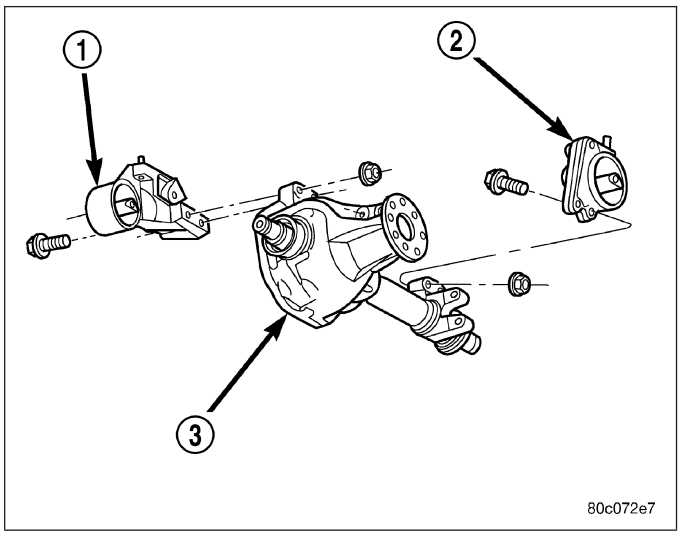
Condition	Possible Causes	Correction
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

REMOVAL

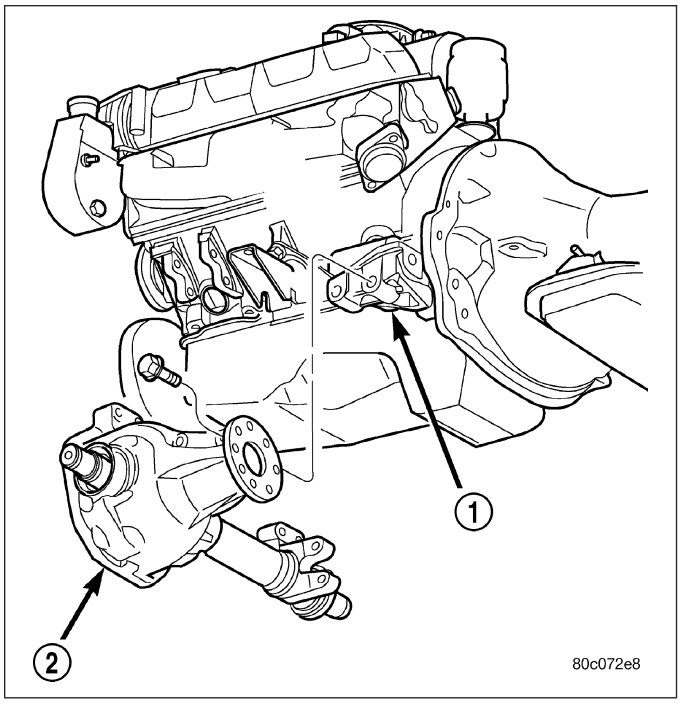
1. With vehicle in neutral, position on hoist.
2. Remove the skid plate, if equipped.
3. Remove skid plate support crossmember, if necessary.
4. Remove hub/bearing (1) wheel speed sensor (2) and dust shield (5) from knuckles (4).
5. Remove both half shafts.
6. Mark the propeller shaft, transfer case, and pinion companion flange for installation reference.
7. Remove the front propeller shaft.
8. Remove the axle vent tube.



9. Use an adjustable and movable jack to support the differential housing.
10. Remove bolts holding the axle to the engine mounts (1) (2).

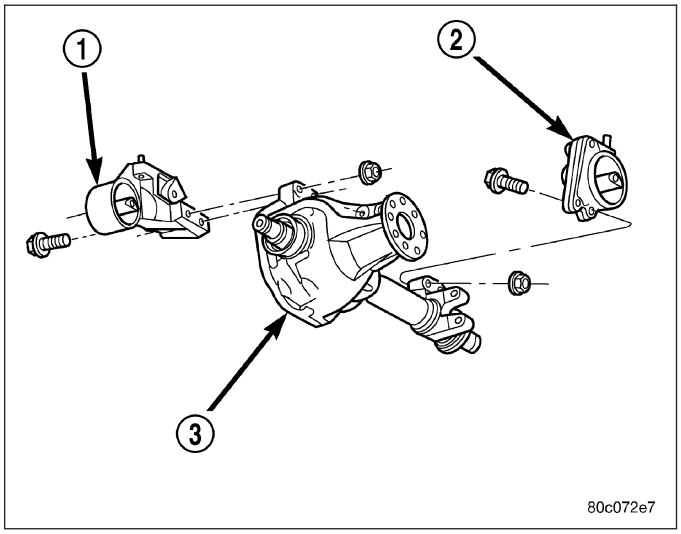


11. Remove bolts holding the axle (2) to the pinion nose bracket (1).
12. Lower the jack and housing.
13. Remove the axle from vehicle.

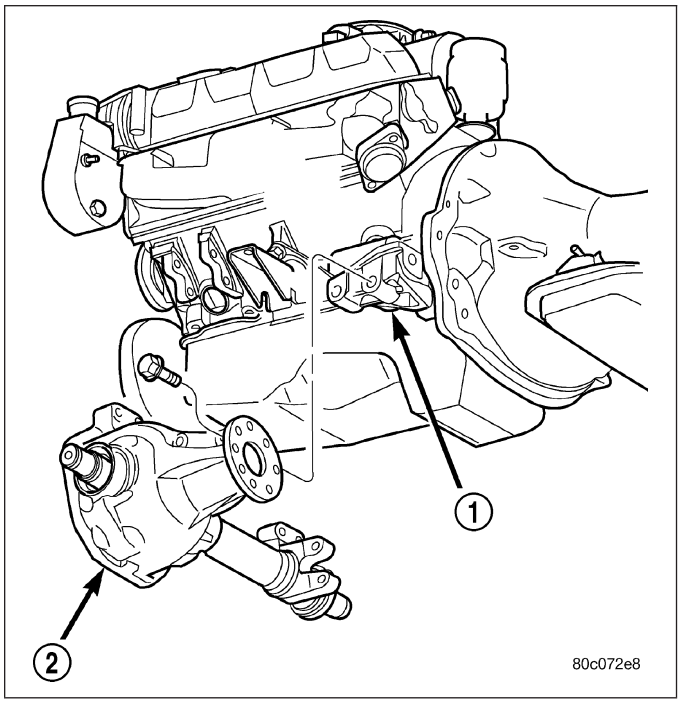


INSTALLATION

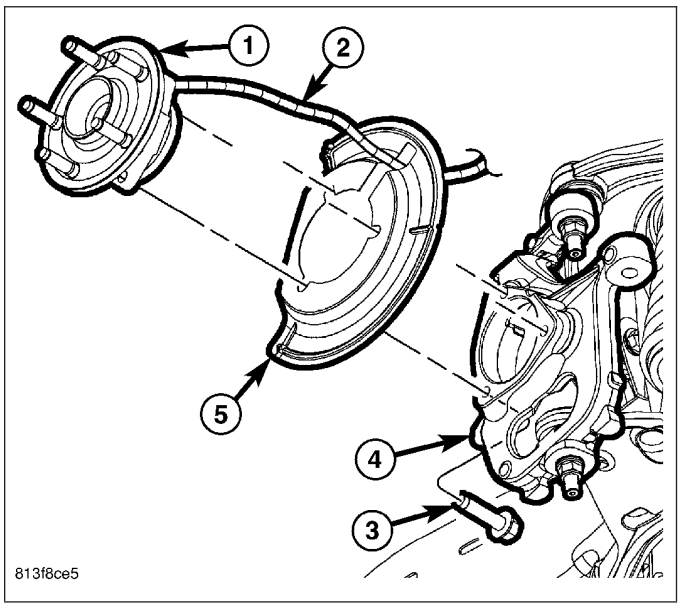
1. Raise the axle (3) into position. Loosely install the bolts and nuts to hold the axle to the engine mounts (1) (2).



2. Loosely install the bolts and nuts to hold the axle (2) pinion nose bracket (1).
3. Tighten all the bolts finger-tight, then tighten all bolts to 115 N·m (85 ft. lbs.).
4. Install the axle vent tube.
5. Align the reference marks on the propeller shaft, transfer case, and pinion companion flange.
6. Install propeller shaft.

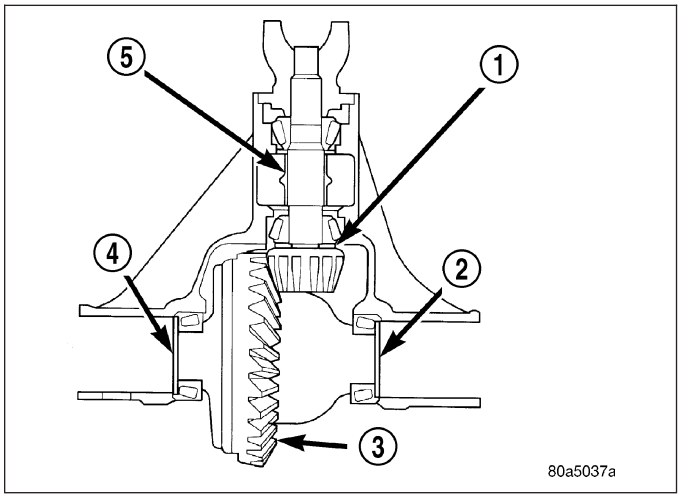


7. Install half shafts.
8. Install hub/bearing (1) wheel speed sensor (2) and dust shield (5) on knuckles (4).
9. Install skid plate support crossmember, if necessary.
10. Install skid plate, if necessary.
11. Check differential lubricant level and add lubricant, if necessary.



ADJUSTMENTS

Ring gear (3) and pinion are supplied as a matched sets. Identifying numbers for the ring gear and pinion are painted onto the pinion gear shaft and the side of the ring gear. A plus (+) number, minus (–) number or zero (0) along with the gear set sequence number (01 to 99) is on each gear. This first number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion marked with a (0). The next two numbers are the sequence number of the gear set. The standard depth provides the best teeth contact pattern. Compensation for pinion depth variance is achieved with select shims (1) located between the rear pinion bearing cone and pinion gear head.



If installing a new gear, note the depth variance number of the original and replacement pinion. Add or subtract this number from the original depth shim/oil slinger to compensate for the difference in the depth variances. The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim.

Pinion Gear Depth Variance Chart: Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

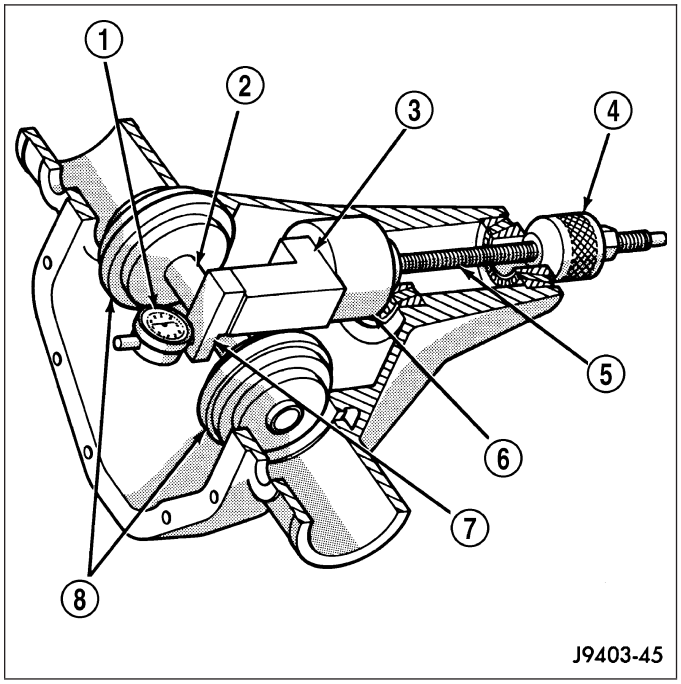
PINION GEAR DEPTH VARIANCE

Original Pinion Gear Depth Variance	New Pinion Gear Depth Variance								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

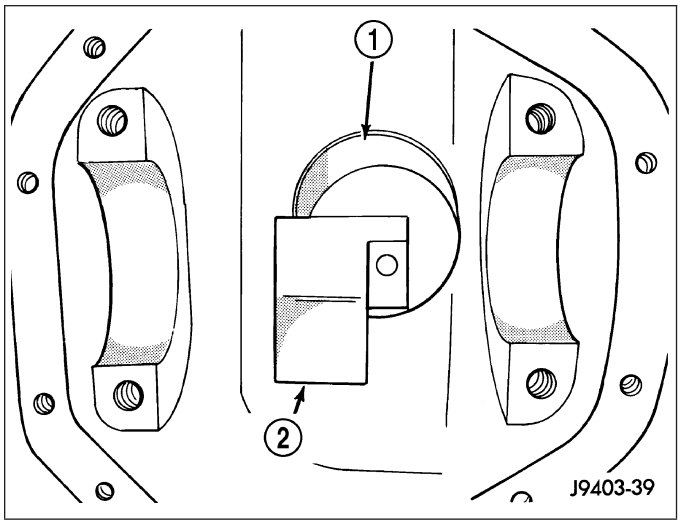
PINION DEPTH MEASUREMENT

Measurements are taken with pinion cups and pinion bearings installed in housing. Take measurements with a Pinion Gauge Set, Pinion Block 8177 (6), Arbor Discs 8541(8) and Dial Indicator C-3339 (1).

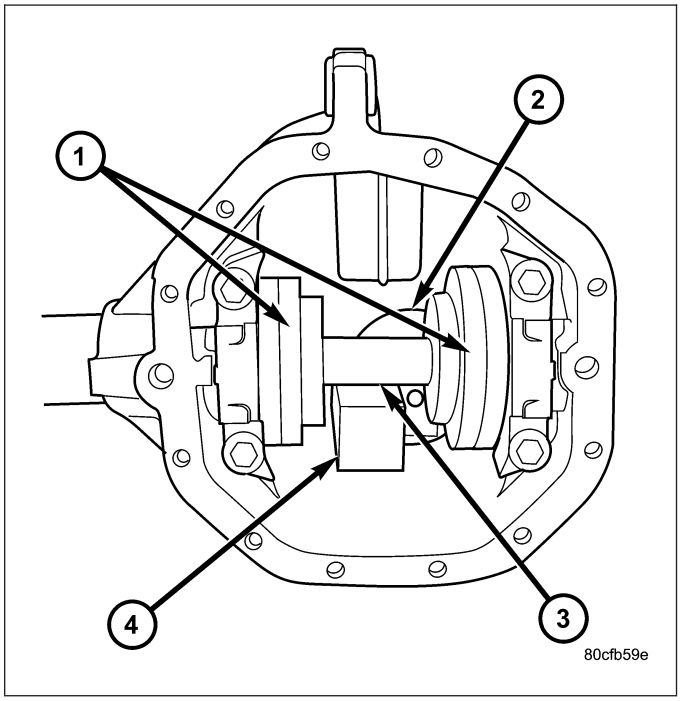
1. Assemble Pinion Height Block 6739 (3), Pinion Block 8177 (6) and rear pinion bearing onto Screw 6741 (5).



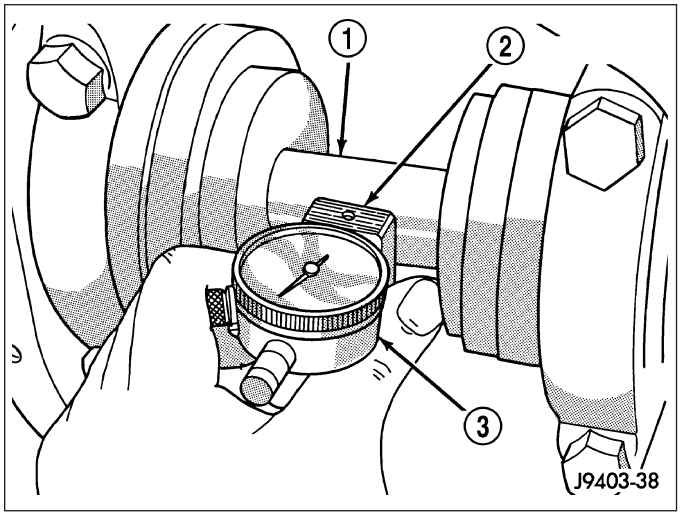
2. Insert assembled height gauge components (1) (2), rear bearing and screw into the housing through the pinion bearing cups.
3. Install front pinion bearing and Cone-Nut 6740 onto the screw. Tighten cone-nut until Torque To Rotate the screw is 2.0 N·m (18 in. lbs.).



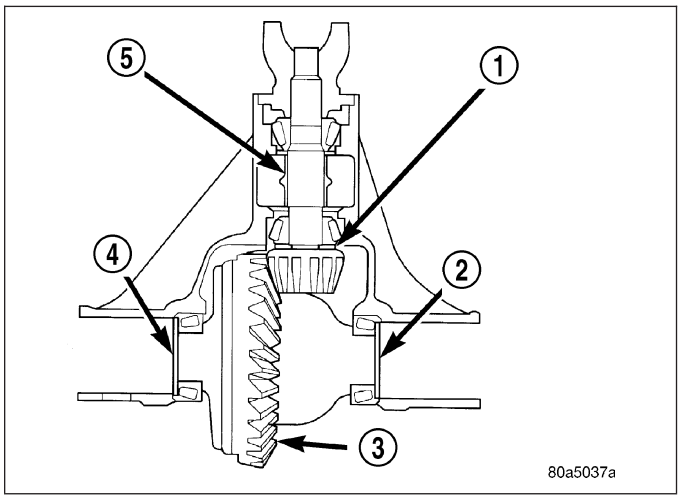
4. Place Arbor Discs 8541 (1) on Arbor D-115-3 (3) in position in the housing side bearing cradles. Install differential bearing caps on arbor discs (1) and tighten cap bolts to specification.
5. Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.
6. Place Scooter Block/Dial Indicator in position in the housing so dial probe and scooter block are flush against the surface of the pinion height block. Hold scooter block in place and zero the dial indicator. Tighten dial indicator face lock screw.



7. Slide the dial indicator (3) probe across the gap between the pinion height block and the arbor bar (1) with the scooter block (2) against the pinion height block. Slide the dial probe to the crest of the arbor bar and record the highest reading.
8. Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number marked on the shaft of the pinion gear using the opposite sign on the variance number. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.
9. Remove the pinion depth gauge components from the housing.

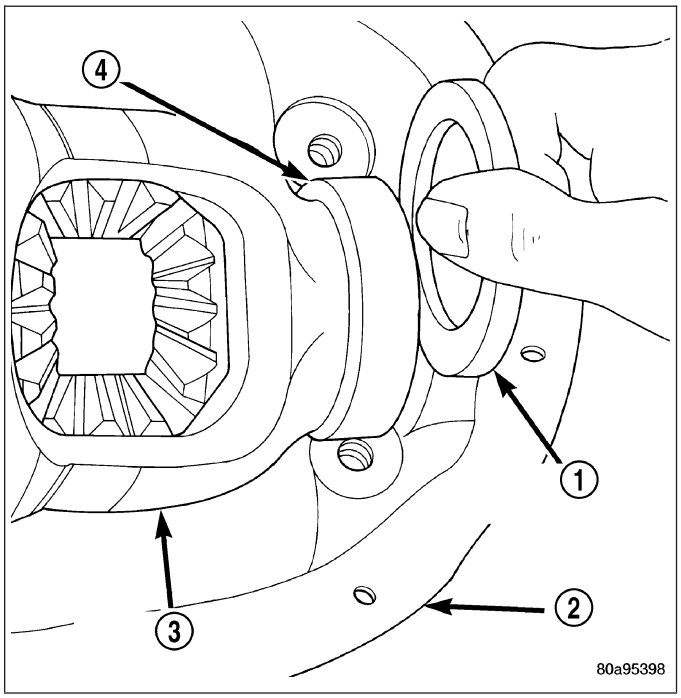


DIFFERENTIAL BEARING PRELOAD



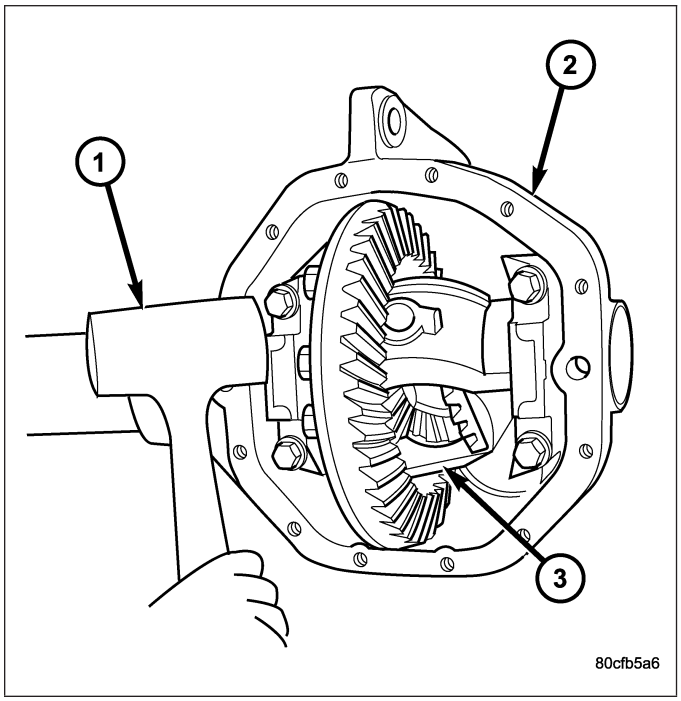
Differential side bearing preload and gear backlash is achieved by selective shims (2) (4) inserted between the bearing cup and the housing. The proper shim thickness can be determined using slip-fit Dummy Bearings 8398 in place of the differential side bearings and a Dial Indicator C-3339. Before measuring differential bearing preload and gear backlash, measure pinion gear depth and prepare pinion for installation. Pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After measuring shim thickness to take up differential side play, install pinion and measure gear backlash shim thickness. Overall shim thickness is the dial indicator reading and preload specification added together. The gear backlash measurement determines the shim thickness used on the ring gear (3) side of the differential case. Subtract gear backlash shim thickness from overall shim thickness to determine shim thickness for pinion gear side of the differential.

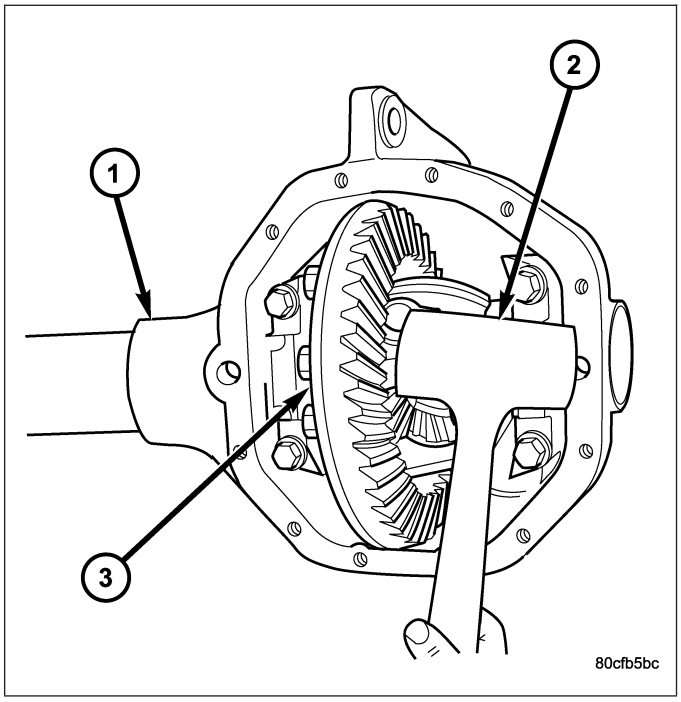
SHIM SELECTION



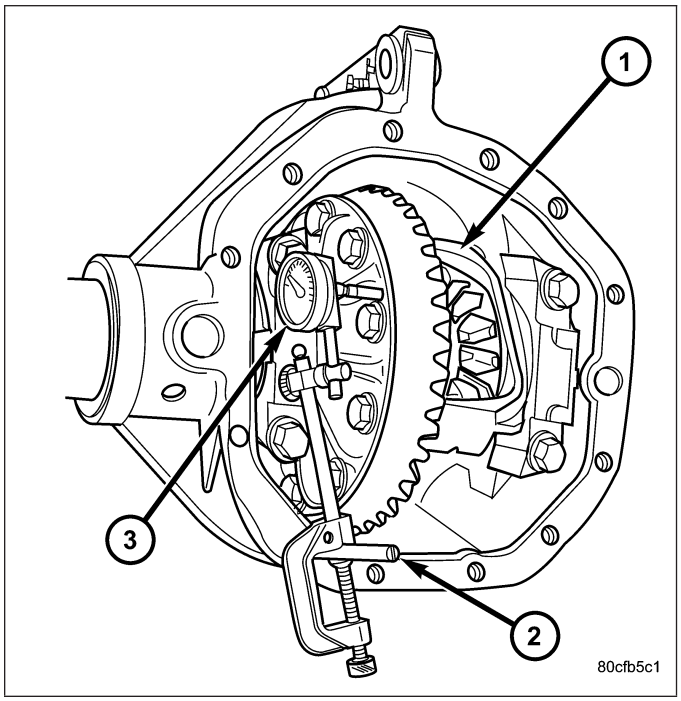
1. Remove side bearings from differential case.
2. Install ring gear if necessary, on differential case and tighten bolts to specification.
3. Install Dummy Bearings 8398 (4) on differential case.
4. Install differential case in the housing.
5. Insert Dummy Shims 8107 (1) starting point shims between both dummy bearings (4) and the housing.

6. Install the marked bearing caps in their correct positions. Install and snug the bolts.
7. Using a dead-blow hammer (1) (2) to seat the differential dummy bearings to each side of the differential housing (2) (1).

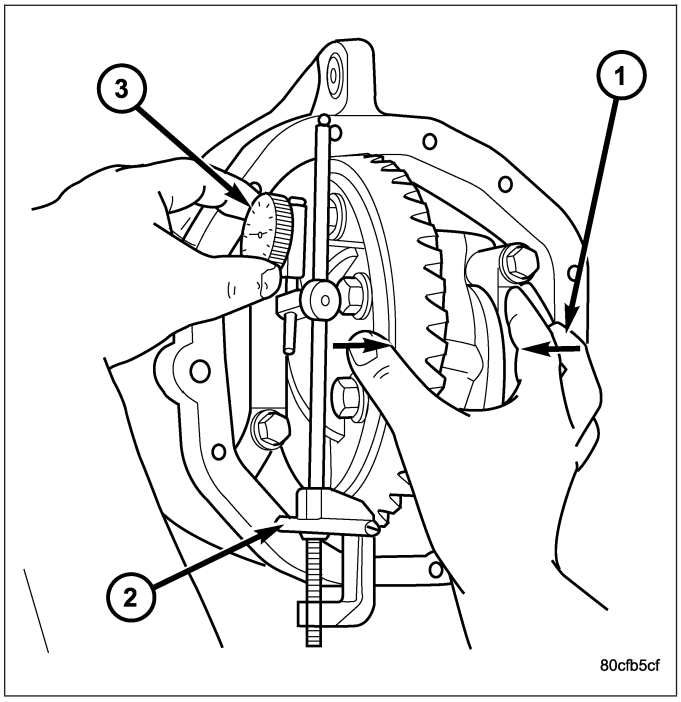


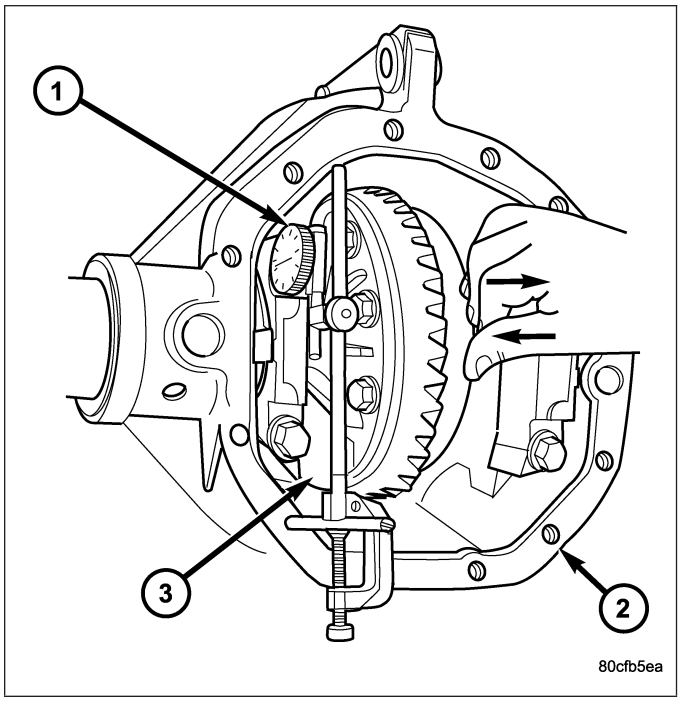


8. Install Pilot Stud C-3288-B (2) in cover bolt hole below ring gear.
9. Attach Dial Indicator C-3339 (3) to post and position dial indicator plunger on a flat surface on a ring gear bolt head.



10. Push and hold differential to the pinion gear side (1) of the housing and zero dial indicator (3).





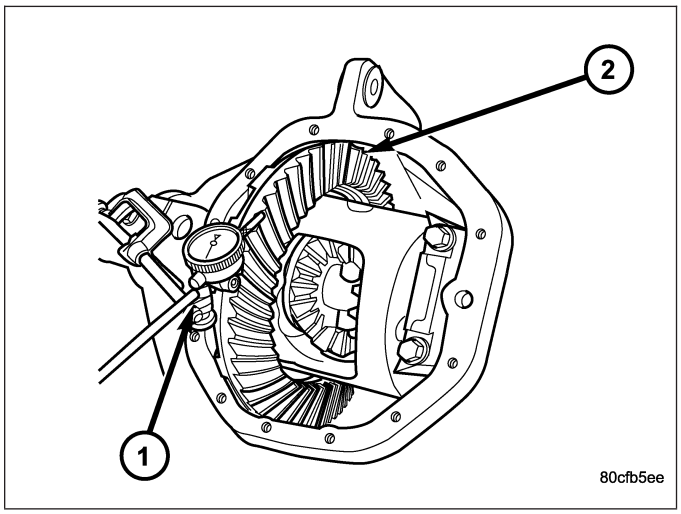
11. Push and hold differential case to the ring gear side (3) and record dial indicator (1) reading.
12. Add the dial indicator reading to the starting point shim thicknesses to determine the total shim thickness necessary to achieve zero differential end play.
13. Add 0.2 mm (0.008 in) to the zero end play total. This new total represents the shims needed to preload the new differential case bearings.
14. Rotate dial indicator out of the way on pilot stud.
15. Remove differential case, dummy bearings and dummy shims from the housing.
16. Install the pinion gear in the housing. Install the companion flange and establish the correct pinion rotating torque.
17. Install differential case and Dummy Bearings in the housing with a single dummy shim on the ring gear side of the axle and tighten retaining cap bolts.
18. Position the dial indicator plunger on a flat surface between the ring gear bolt heads.
19. Push and hold differential case toward pinion.
20. Zero dial indicator face to pointer.
21. Push and hold differential case to ring gear side of the housing.
22. Record dial indicator reading.
23. Subtract 0.05 mm (0.002 in.) from the dial indicator reading to compensate for backlash between ring and pinion gears. Add the resulting measurement to the thickness of the single dummy shim. This is the thickness of shim required to achieve proper backlash.
24. Subtract the backlash shim thickness from the total preload shim thickness. The remainder is the shim thickness required on the pinion side of the housing.
25. Rotate dial indicator out of the way on pilot stud.
26. Remove differential case, dummy bearings and dummy shim from the housing.
27. Install new side bearing cones and cups on differential case.
28. Install Spreader W-129-B and Adapter Plates 8142-A on the housing and spread open enough to receive differential case.

CAUTION: Never spread over 0.50 mm (0.020 in). If the housing is over-spread, it could be distorted or damaged.

29. Place the side bearing shims in the differential housing against the housing shoulder.
30. Install the differential case in the housing.
31. Rotate the differential case several times to seat the side bearings.

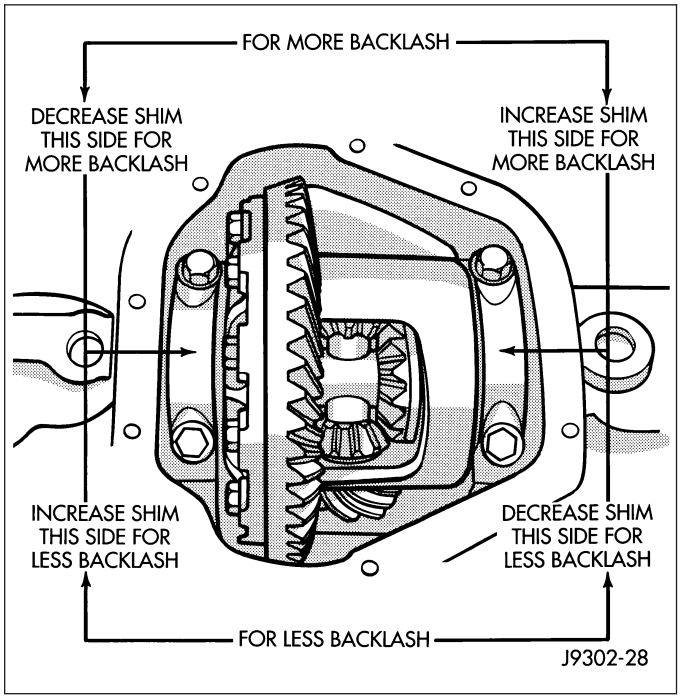
GEAR BACKLASH

1. Position the dial indicator (1) plunger against a ring gear tooth (2).
2. Push and hold ring gear upward while not allowing the pinion gear to rotate.
3. Zero dial indicator face to pointer.



4. Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm (0.005 in.) and 0.20 mm (0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the differential housing to the other.
5. Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.

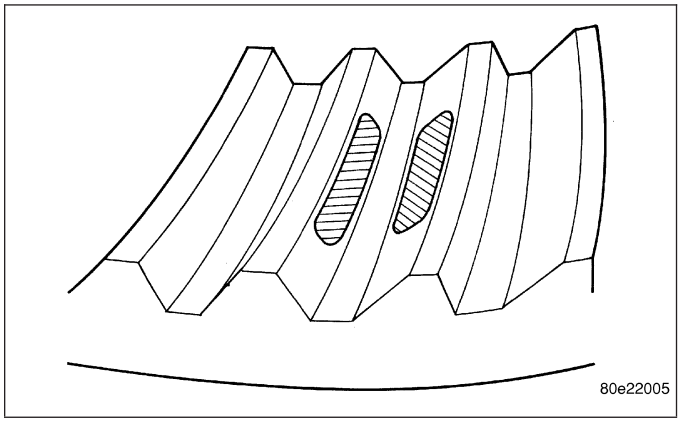
After the proper backlash is achieved, perform the Gear Contact Pattern procedure.



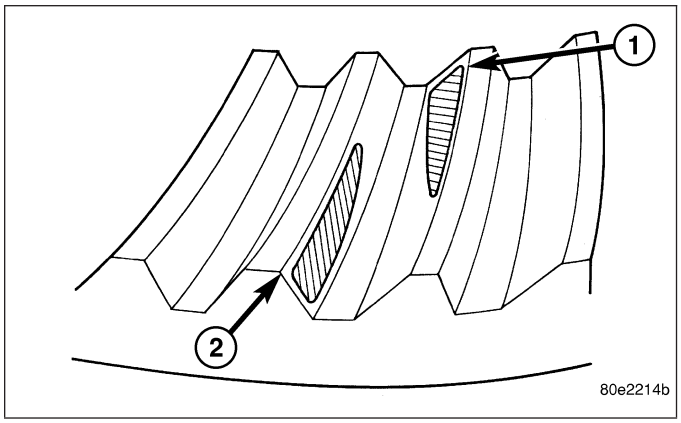
GEAR CONTACT PATTERN

1. Wipe clean each tooth of the ring gear.
2. Apply gear marking compound to all of the ring gear teeth.
3. Verify bearing cap bolts are torque specification.
4. Apply the brakes lightly to create at 14 N·m (10 ft. lbs.) pinion rotating torque.
5. Rotate the pinion/pinion yoke 4 full revolutions in each directions.
6. Read gear tooth contact pattern.

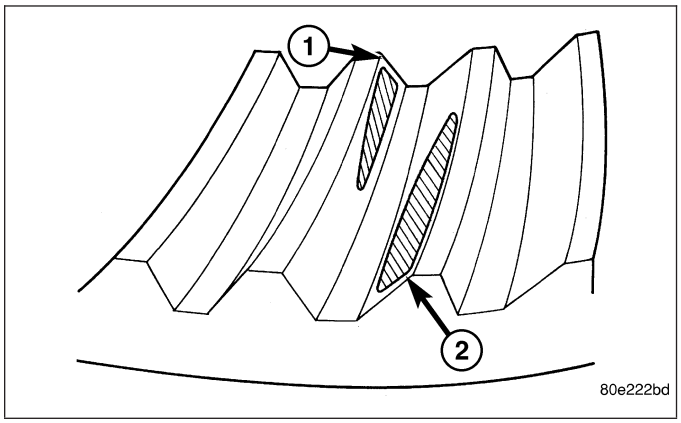
Gear contact pattern correct. Backlash and pinion depth is correct.



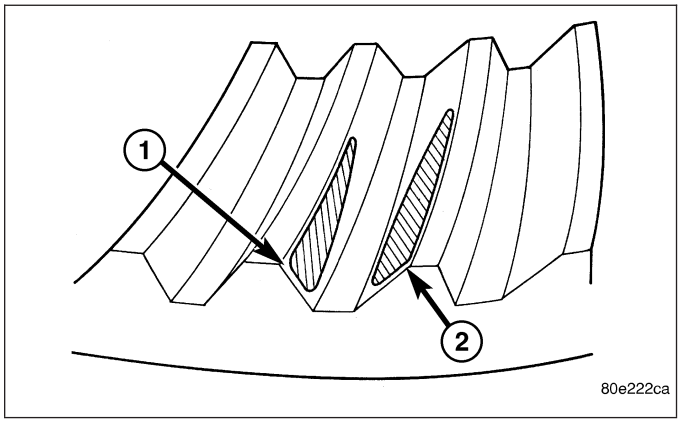
Ring gear too far away from pinion gear coast side toe (1) drive side heel (2). Decrease backlash by moving the ring closer to the pinion gear.



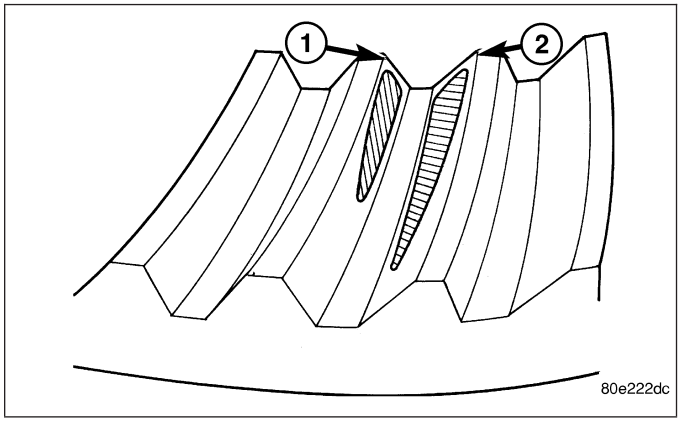
Ring gear too close to pinion gear drive side toe (1) coast side heel (2). Increase backlash, by moving the ring away from the pinion gear.



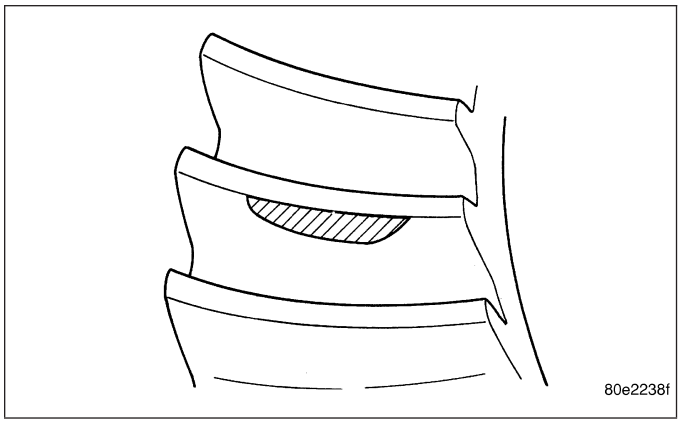
Ring gear too far away from pinion gear drive side heel (1) coast side heel (2). Decrease backlash, by moving the ring closer to the pinion gear.



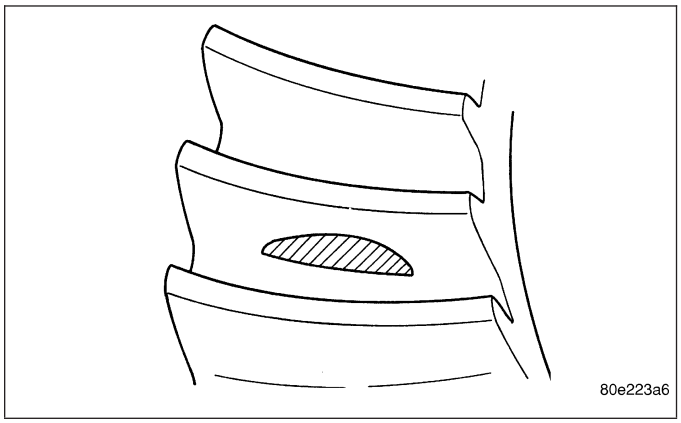
Ring gear too close to pinion gear drive side toe (1) coast side toe (2). Increase backlash, by moving the ring away from the pinion gear.



Pinion gear set too low. Increase pinion gear height, by increasing the pinion depth shim thickness.



Pinion gear set too high. Decrease pinion depth, by decreasing the pinion depth shim thickness.



SPECIFICATIONS

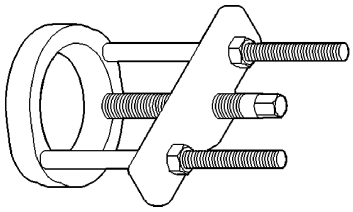
AXLE SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Axle Ratio	3.21, 3.55, 3.92
Differential Case Flange Runout	0.076 mm (0.003 in.)
Differential Side Gear Clearance	0-0.15 mm (0-0.006 in.)
Ring Gear Diameter	205 mm (7.562 in.)
Ring Gear Backlash	0.12-0.20 mm (0.005-0.008 in.)
Ring Gear Runout	0.12 mm (0.005 in.)
Pinion Bearing Preload - Original Bearings	1-2 N·m (10-20 in. lbs.)
Pinion Bearing Preload - New Bearings	1.7-2.5 N·m (15-22 in. lbs.)

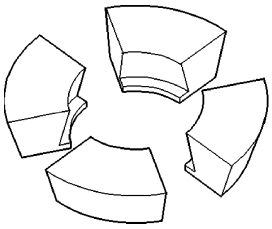
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Differential Fill Hole Plug	34	25	-
Differential Cover Bolts	41	30	-
Bearing Cap Bolts	61	45	-
Ring Gear Bolts	108	80	-
Pinion Nut	271-474	200-350	-

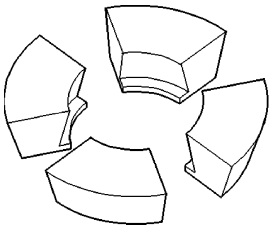
SPECIAL TOOLS



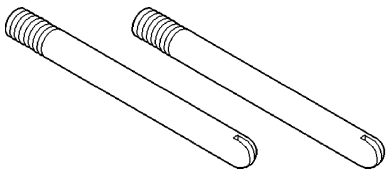
PULLER C-293-PA



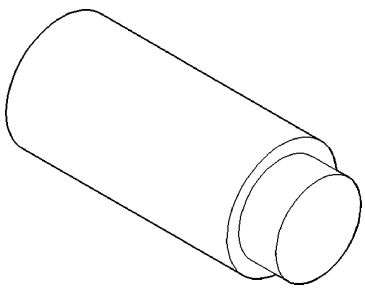
ADAPTER C-293-39



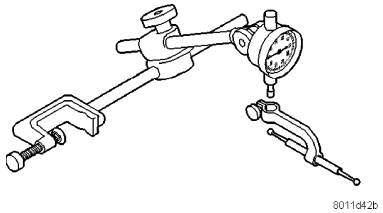
ADAPTER C-293-40



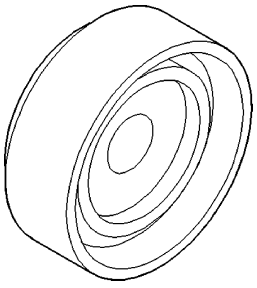
PILOT STUDS C-3288-B



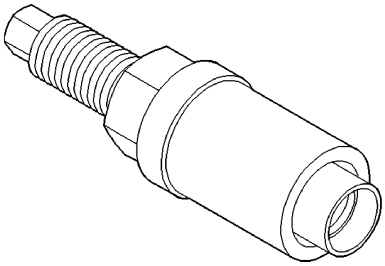
PLUG SP-3289



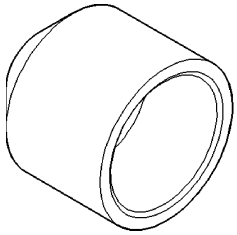
DIAL INDICATOR C-3339



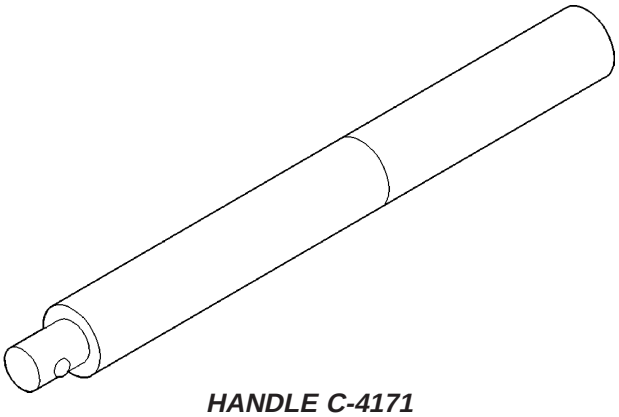
INSTALLER C-3716-A



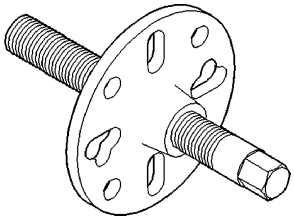
INSTALLER C-3718



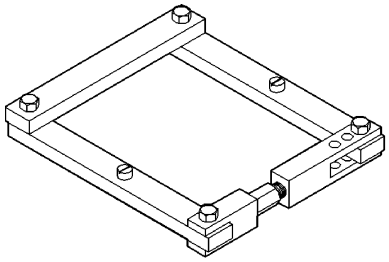
INSTALLER C-3972-A



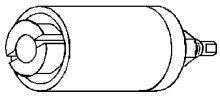
HANDLE C-4171



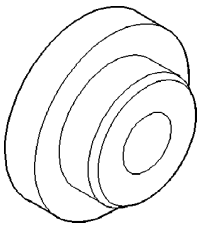
PULLER C-452



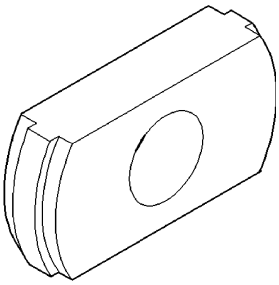
SPREADER W-129-B



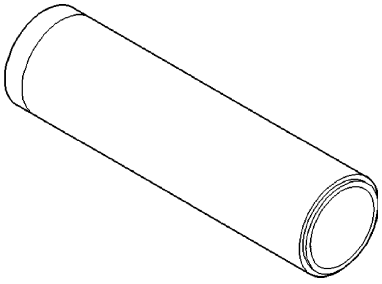
BEARING REMOVER C-4660-A



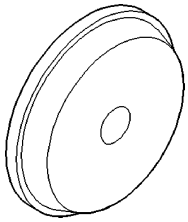
INSTALLER 5063



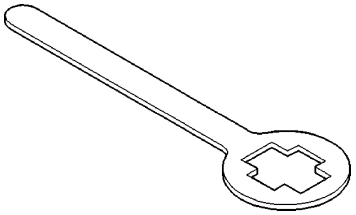
REMOVER D-103



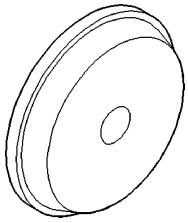
INSTALLER W-262



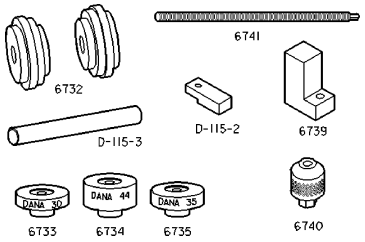
INSTALLER D-130



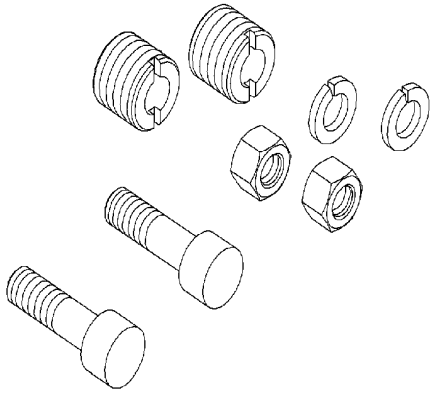
HOLDER 6719A



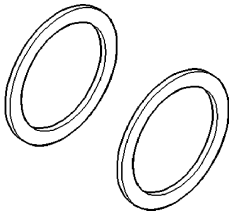
INSTALLER D-145



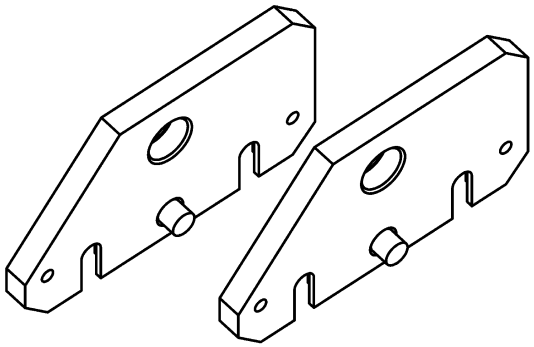
PINION DEPTH SET 6774



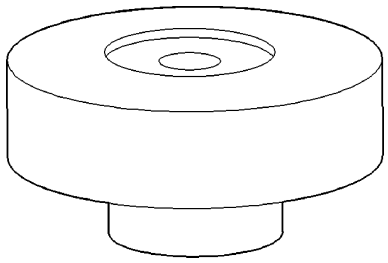
ADAPTER KIT 6987B



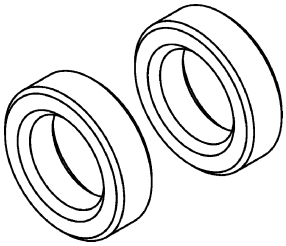
DUMMY SHIMS 8107



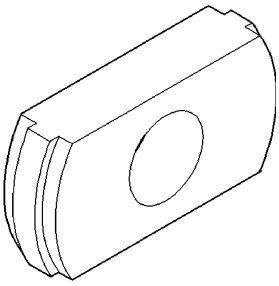
ADAPTER PLATES 8142A



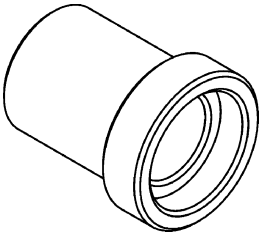
GAUGE BLOCK 8177



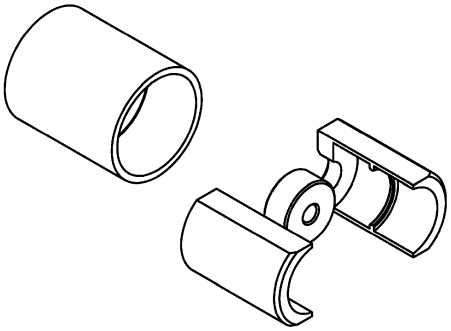
DUMMY BEARINGS 8398



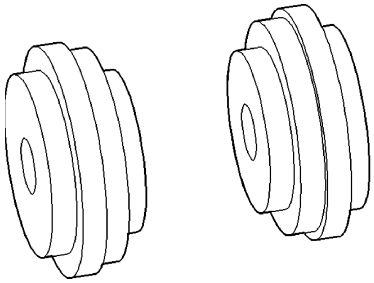
REMOVER 8401



INSTALLER 8402



REMOVER 8420A



ARBOR DISCS 8541

COVER-DIFFERENTIAL

REMOVAL

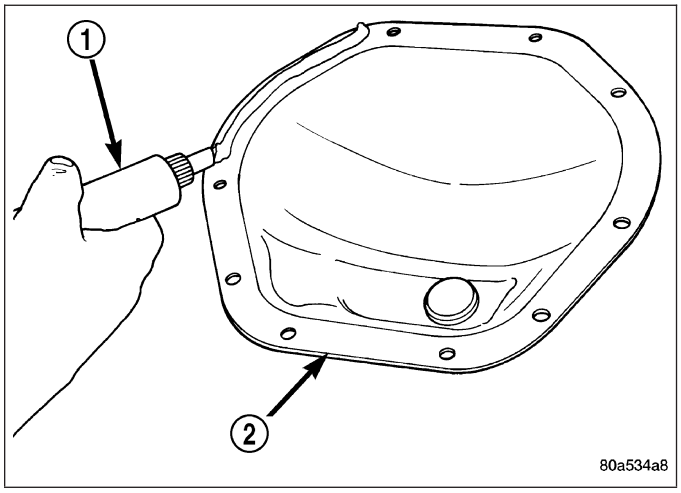
1. Remove fill plug.
2. Remove differential cover bolts.
3. Remove cover and drain fluid.

INSTALLATION

1. Apply a bead of orange Mopar Axle RTV Sealant (1) or equivalent to the housing cover (2).

CAUTION: If cover is not installed within 3 to 5 minutes, the cover must be cleaned and new RTV applied. Failure to follow these instructions will compromise adhesion quality.

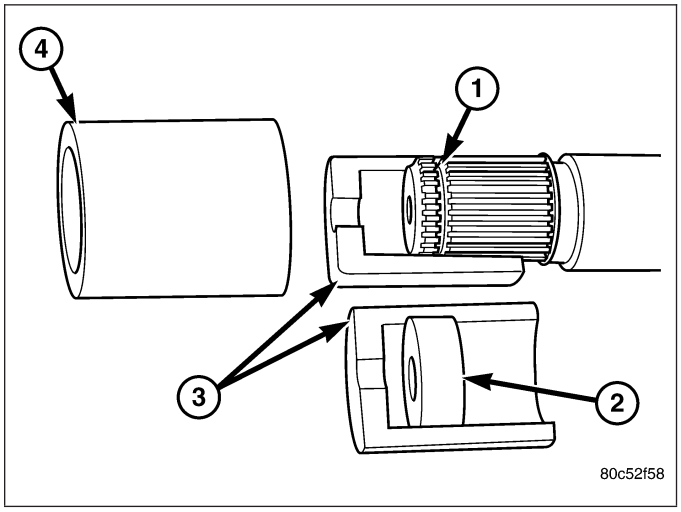
2. Install cover and tighten bolts in a criss-cross pattern to 22.5 N·m (16.5 ft. lbs.).
3. Fill differential with 1.66 L (3.5 pts.) of gear lubricant.
4. Install fill plug.



SHAFT-AXLE

REMOVAL

1. Remove half shaft from vehicle.
2. Clean axle seal area.
3. Remove snap ring from the axle shaft.
4. Remove axle (1) with Remove 8420A (2) (3) (4) and slide hammer.



INSTALLATION

1. Lubricate bearing bore and seal lip with gear lubricant.
2. Install axle shaft and engage shaft into side gear. Push firmly on axle shaft to engage snap-ring.
3. Check the differential fluid level and add fluid if necessary.
4. Install half shaft.
5. Install skid plate, if necessary.

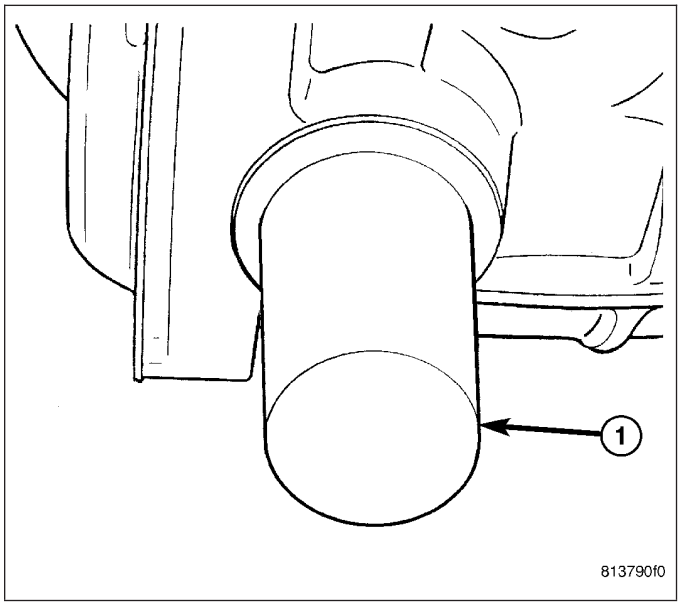
SEAL-AXLE SHAFT

REMOVAL

1. Remove half shaft and axle shaft.
2. Remove axle shaft seal with a seal pick.

INSTALLATION

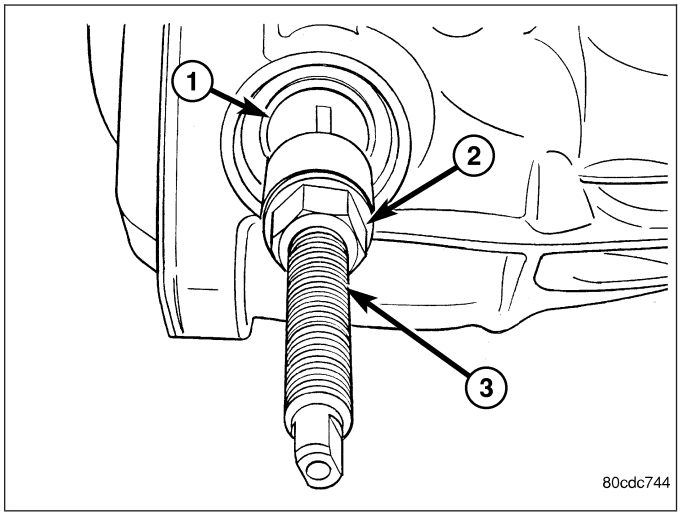
1. Wipe axle shaft tube bore clean.
2. Install **new** axle shaft seal with Installer 8402 (1).
3. Install axle shaft and half shaft.



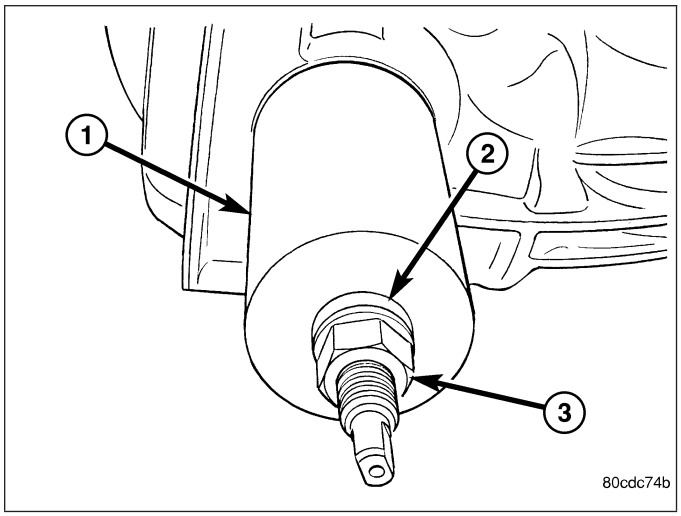
BEARING/BUSHING-AXLE

REMOVAL

1. Remove half shaft, axle shaft and seal.
2. Install axle shaft bearing Remover C-4660-A (3) in the bearing (1). Then tighten the nut (2) to spread the remover in the bearing.

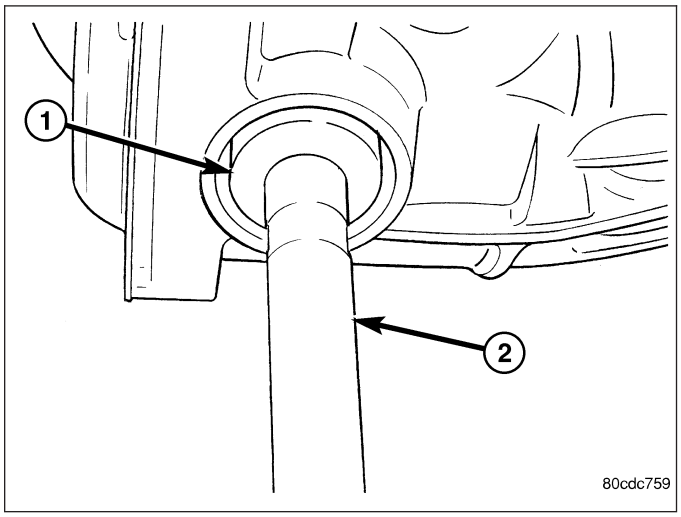


3. Install bearing remove cup (1) bearing (2) and nut (3). Tighten nut to draw bearing out.
4. Inspect axle shaft tube bore for roughness and burrs.

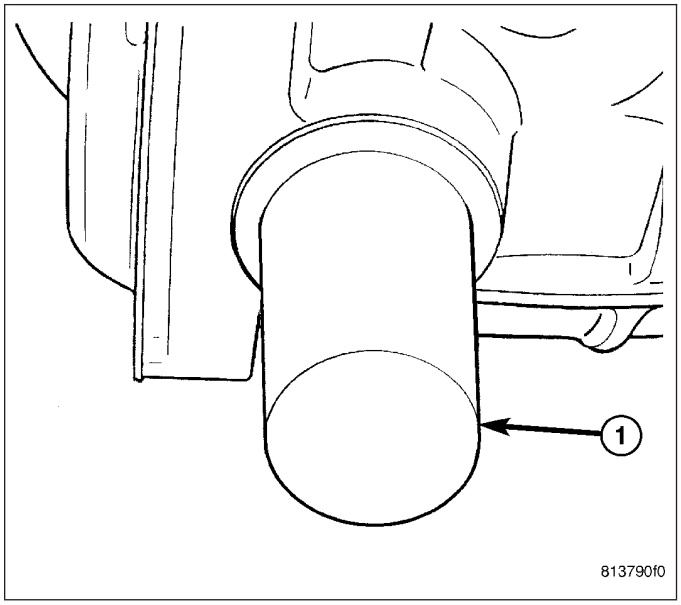


INSTALLATION

1. Wipe the axle shaft tube bore clean.
2. Install axle shaft bearing with Installer 5063 (1) and Handle C-4171 (2).



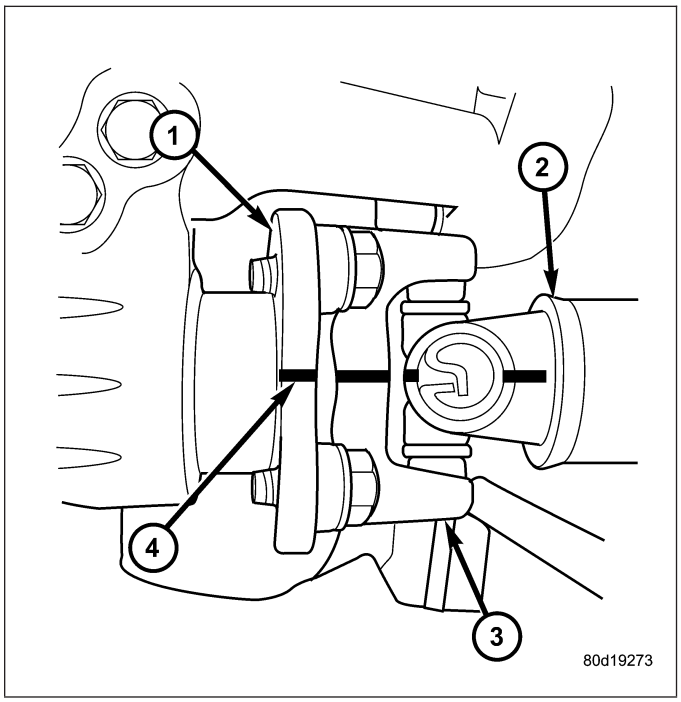
3. Install **new** axle shaft seal with Installer 8402 (1).
4. Install axle shaft and half shaft.



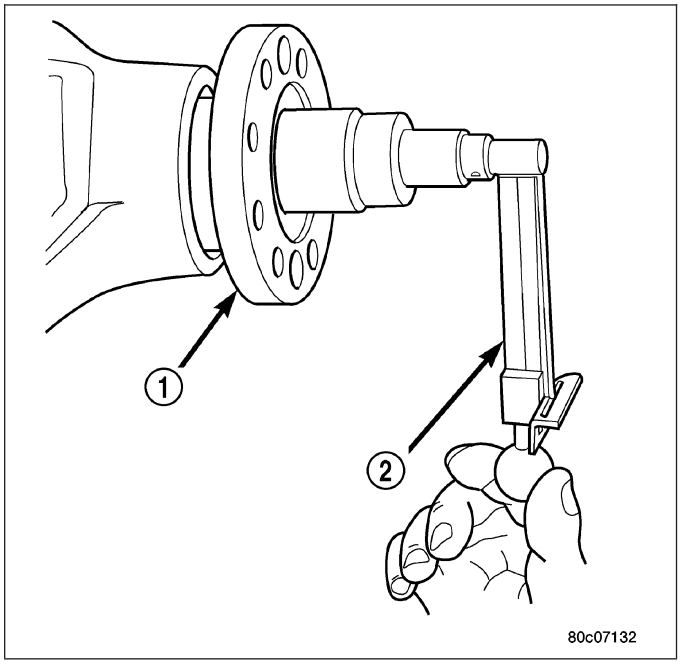
SEAL-PINION

REMOVAL

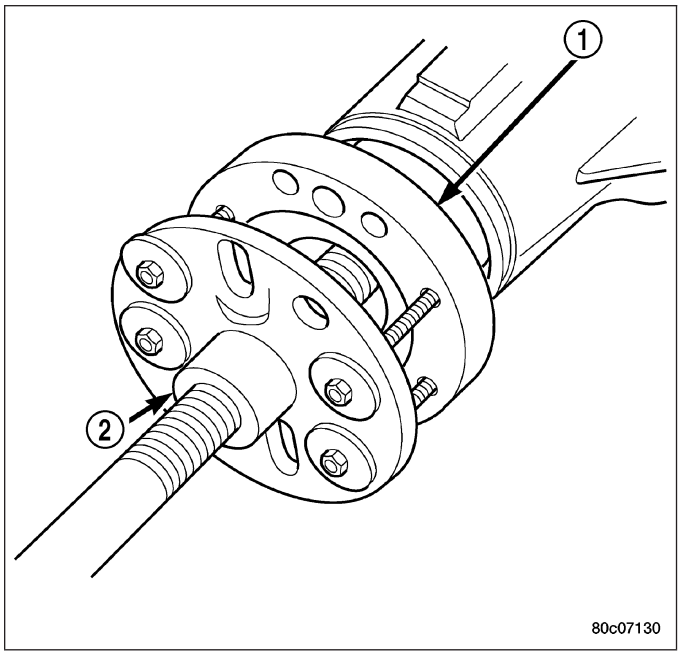
1. Remove both half shafts.
2. Mark propeller shaft (2) and pinion companion flange (2) for installation reference.
3. Remove front propeller shaft.



4. Rotate pinion flange (1) three to four times, to verify pinion rotates smoothly.
5. Record pinion rotating torque with an inch pound torque wrench (2) for installation reference.

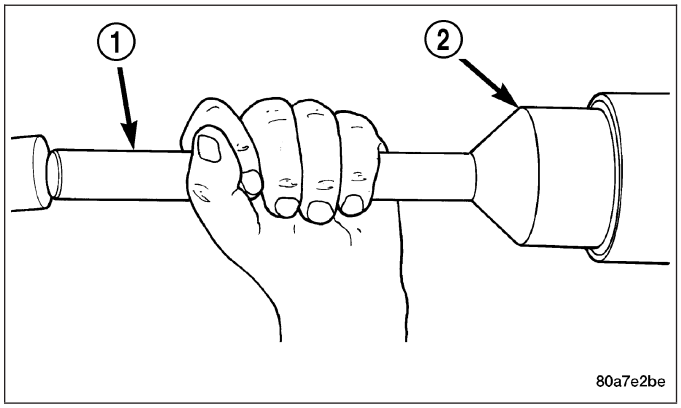


6. Hold companion flange with Holder 6719 and four bolts and washers.
7. Remove pinion nut.
8. Remove companion flange (1) with Remover C-452 (2).
9. Remove pinion seal with a seal pick.



INSTALLATION

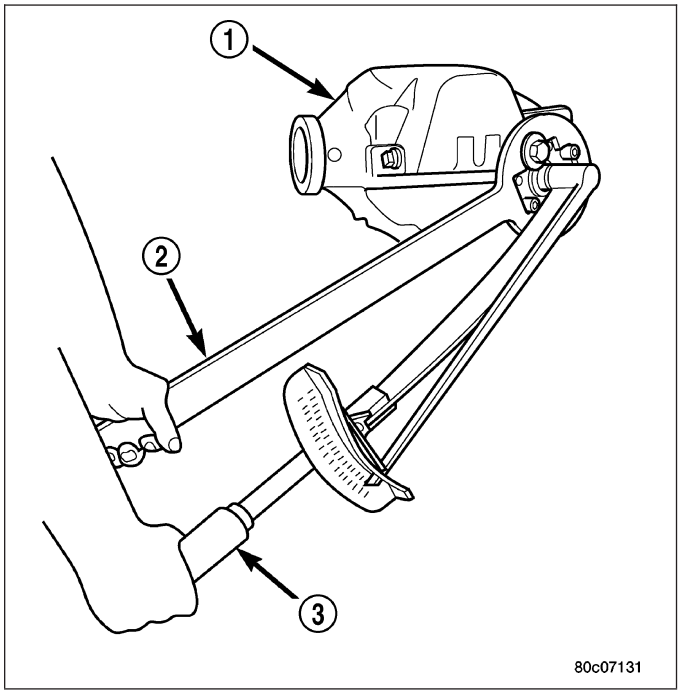
1. Apply a light coating of gear lubricant on the lip of pinion seal.
2. Install seal with Installer C-3972-A (2) and Handle C-4171 (1).



3. Install companion flange onto the pinion with Installer C-3718 and holder.
4. Hold companion flange with Holder 6719A (2).
5. Install **new** pinion nut and tighten nut until there is zero bearing end-play.

CAUTION: Do not exceed minimum tightening torque when installing companion flange at this point. Failure to follow these instructions will damage the collapsible spacer or bearings.

6. Tighten pinion nut to 271 N·m (200 ft. lbs.).

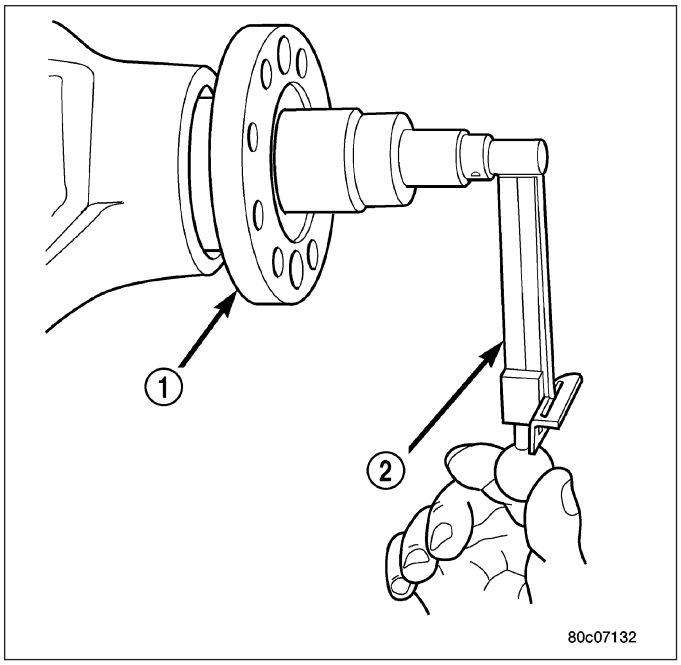


CAUTION: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed.

7. Record pinion (1) rotating torque, with a torque wrench (2). Rotating torque should be equal to the reading recorded during removal plus an additional 0.56 N·m (5 in. lbs.).
8. If rotating torque is low, tighten pinion nut in 6.8 N·m (5 ft. lbs.) increments until rotating torque is achieved.

NOTE: If maximum tightening torque is reached prior to reaching the required rotating torque, the collapsible spacer may have been damaged. Replace the collapsible spacer.

9. Install propeller shaft with reference marks aligned.
10. Install half shafts.
11. Add gear lubricant to differential housing if necessary.



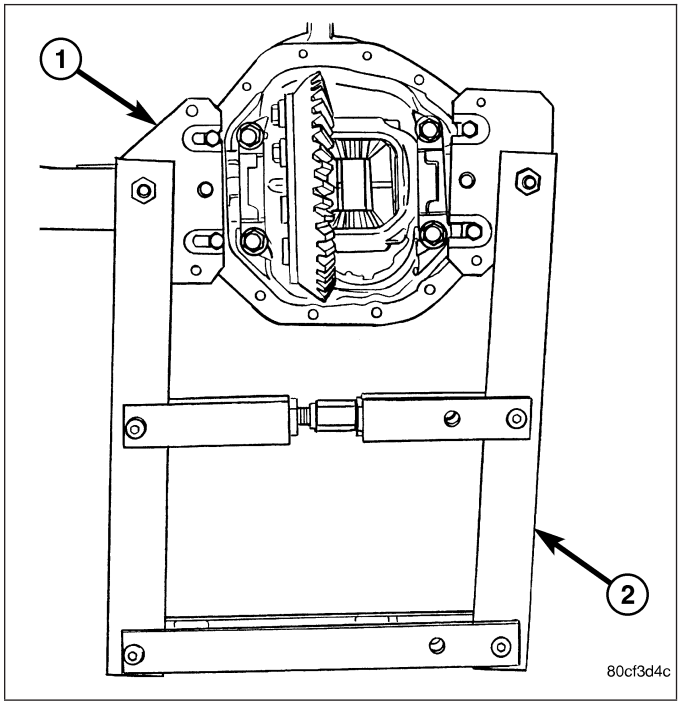
DIFFERENTIAL

REMOVAL

1. Remove differential housing cover and drain fluid.
2. Remove axle shafts.
3. Loosen bearing cap bolts.

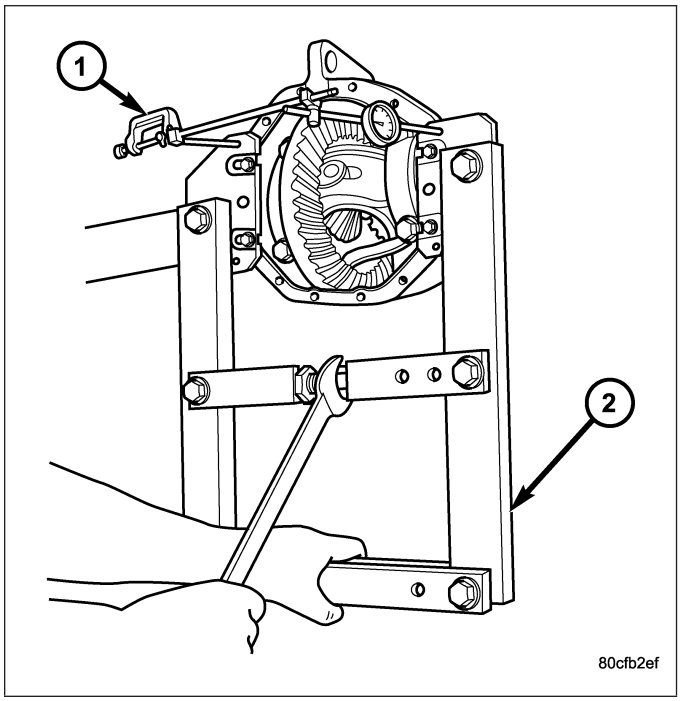
NOTE: Differential bearing cap reference numbers are stamped on caps and machined flat on the housing. If reference numbers cannot be found, make new marks for later reference.

4. Install Adapter Plates 8142-A (1) onto the housing.
5. Install Spreader W-129-B (2) onto the adapter plates and tighten the turnbuckle finger-tight.

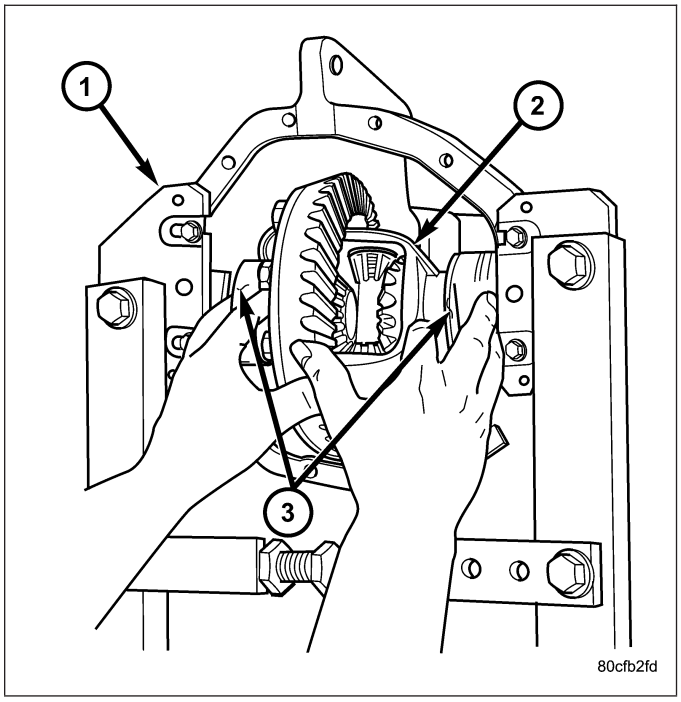


6. Install a Pilot Stud L-4438 at the left side of the differential housing. Attach Dial Indicator C-3339 (1) to pilot stud. Load the indicator plunger against the opposite side of the housing and zero the indicator.
7. Spread the housing to remove the differential case from the housing. Measure the distance with the dial indicator.

CAUTION: Never spread over 0.50 mm (0.020 in). Failure to follow these instructions will damage the housing.

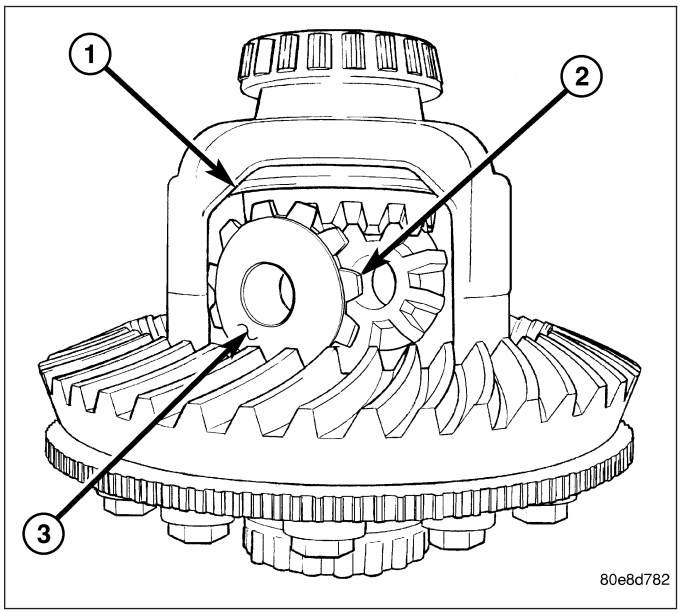


8. Remove dial indicator.
9. While holding the differential case in position, remove bearing cap bolts and caps.
10. Remove differential (2) from the housing (1). Ensure differential bearing cups and shims remain in position on the differential bearings.
11. Tag differential bearing cups and shims to indicate their location.
12. Remove spreader from housing.

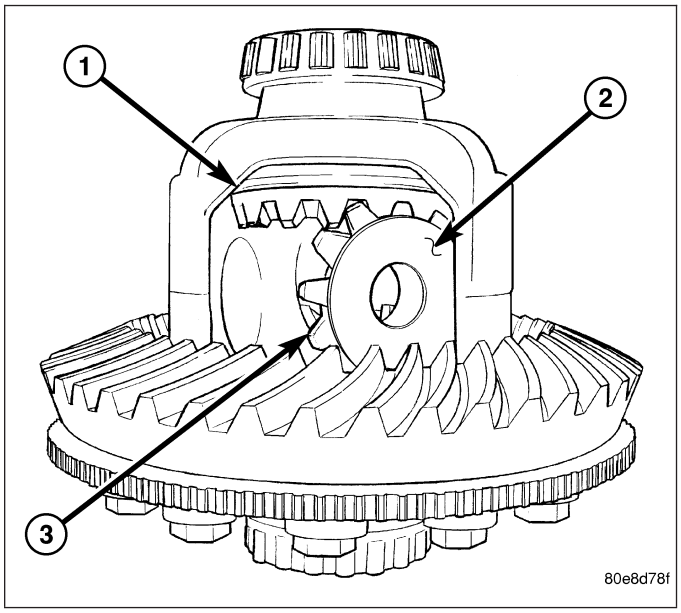


DISASSEMBLY

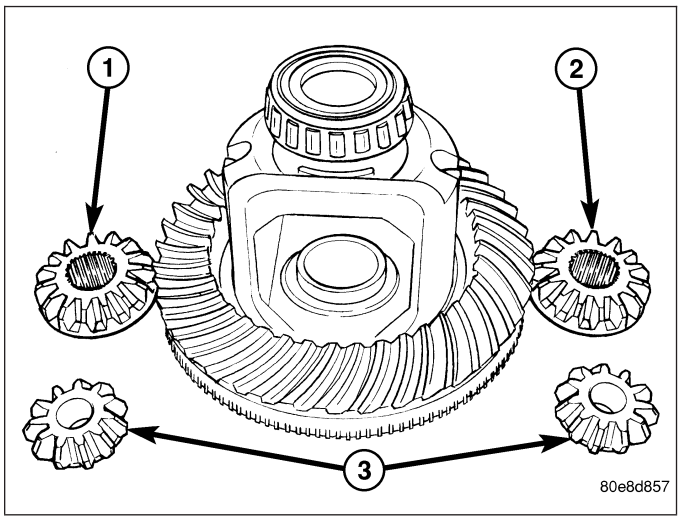
1. Rotate one pinion gear (2) with thrust washer (3) to the differential window (1) and remove gear and thrust washer.



2. Rotate remaining pinion gear (3) with thrust washer (2) to the differential window (1) and remove gear and washer.



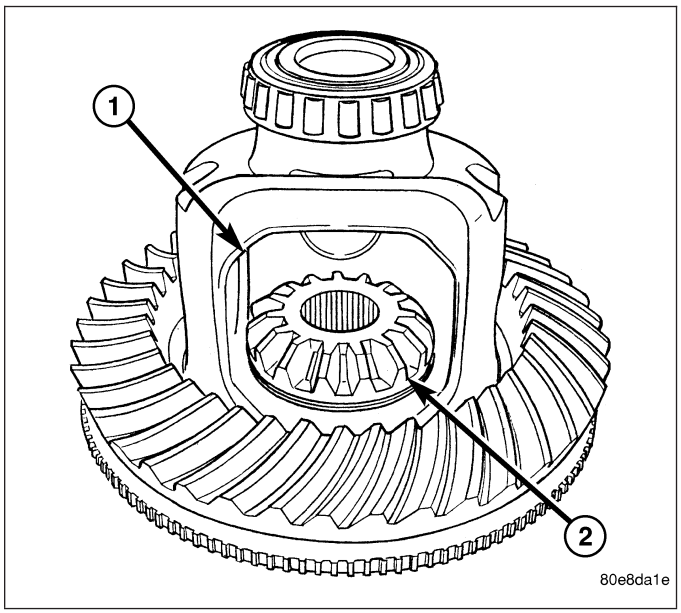
3. Remove differential side gears (1) (2) and thrust washers.



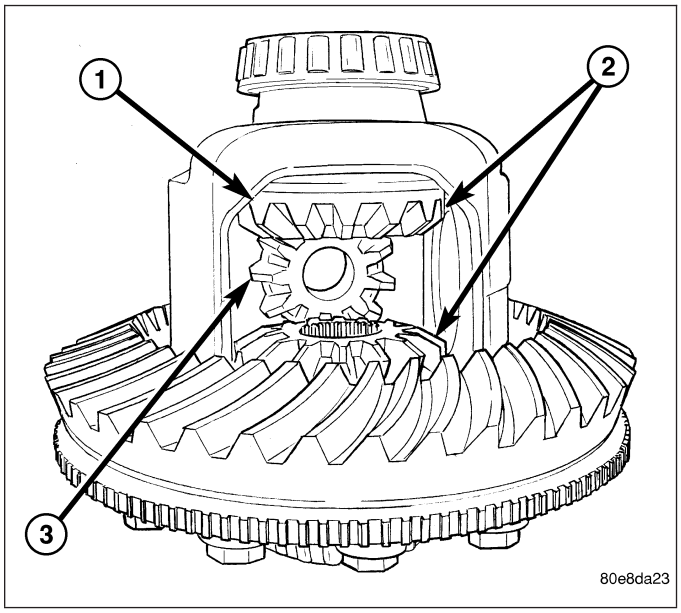
ASSEMBLY

NOTE: If same gears and thrust washers are being used, install them into their original locations.

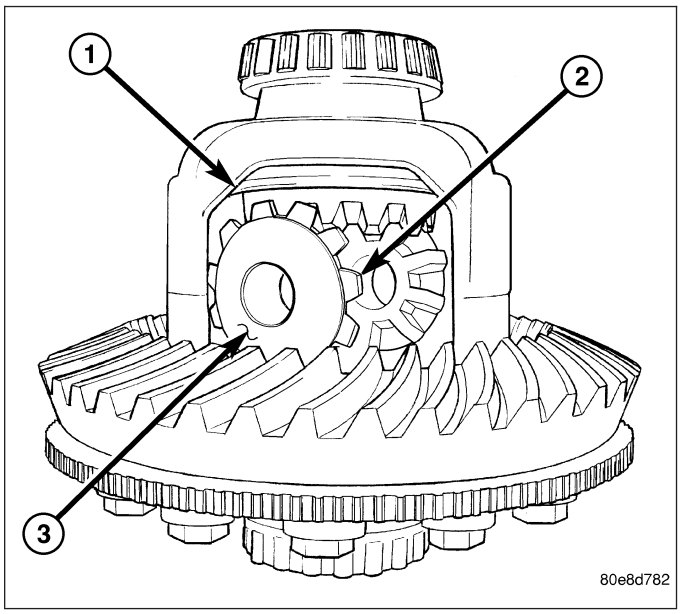
1. Lubricate all differential components with axle lubricant.
2. Install differential side gears (2) and thrust washers throught differential window (1).



3. Install first pinion gear (3) with thrust washer into differential window (1) and side gears (2). Rotate pinion gear into the case.

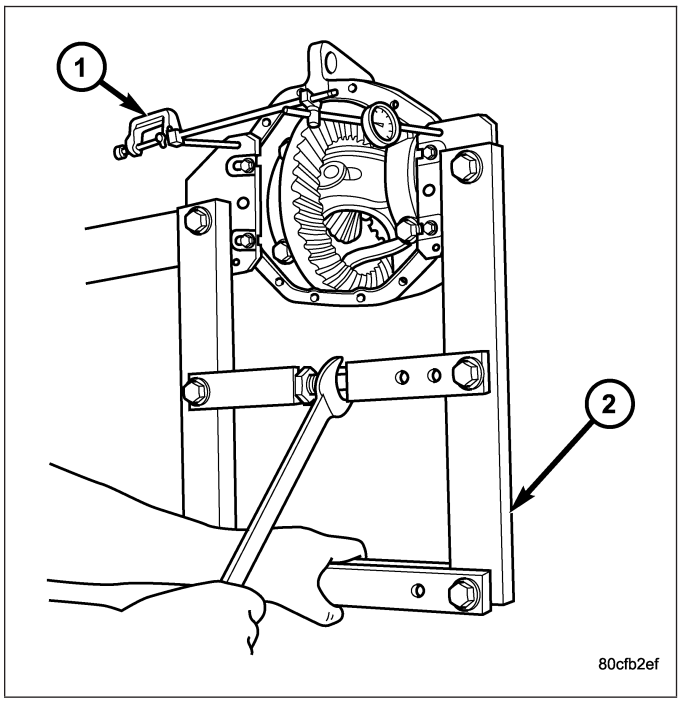


4. Install remaining pinion gear (2) and thrust washer (3). Rotate gears to align hole in the pinion gears with hole in the differential case.
5. Slide pinion shaft into the case and through the pinion gears to align the gears.



INSTALLATION

NOTE: If replacement differential bearings or differential case are replaced, Refer to adjustments for Differential Bearing Preload and Gear Backlash procedures.



1. Install Spreader W-129-B (1) with the Adapter Plates 8142-A and install the safety hold-down clamps. Tighten the tool turnbuckle finger-tight.
2. Install a Pilot Stud L-4438 at the left side of the differential housing. Attach Dial Indicator C-3339 (2) to pilot stud. Load indicator plunger against the opposite side of the housing and zero the indicator.
3. Spread housing and measure the distance with the dial indicator.

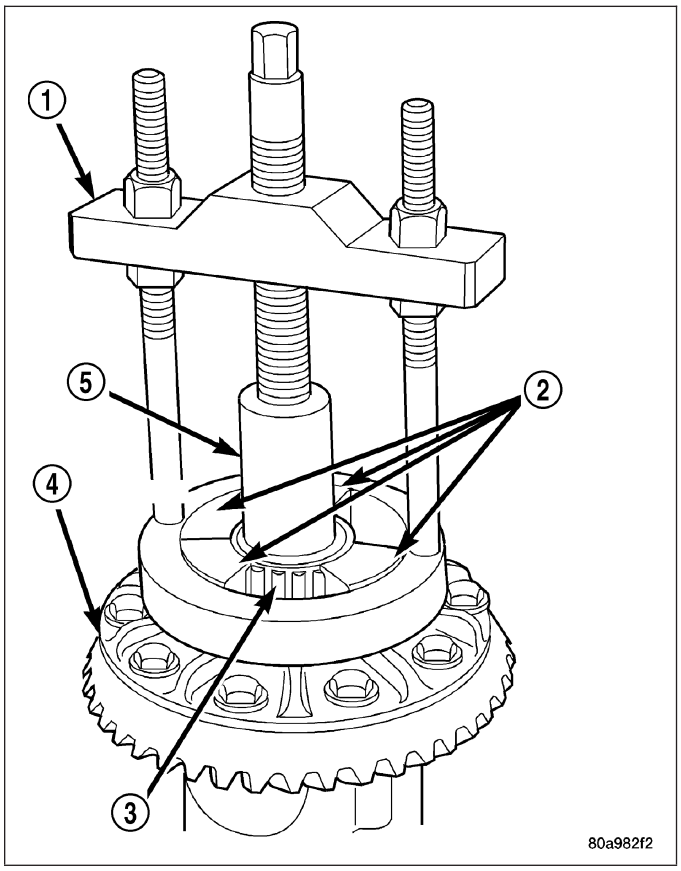
CAUTION: Never spread housing over 0.50 mm (0.020 in). Failure to follow these instructions will damage the housing.

4. Remove dial indicator (1).
5. Install differential case in the housing. Ensure differential bearing cups remain in position on the bearings and the differential preload shims are seated in the housing. Tap differential case to ensure bearings cups are seated in the housing.
6. Install bearing caps to their original locations and loosely install cap bolts.
7. Remove housing spreader (2).
8. Tighten the bearing cap bolts to 61 N·m (45 ft. lbs.).
9. Install differential.

BEARINGS-DIFFERENTIAL CASE

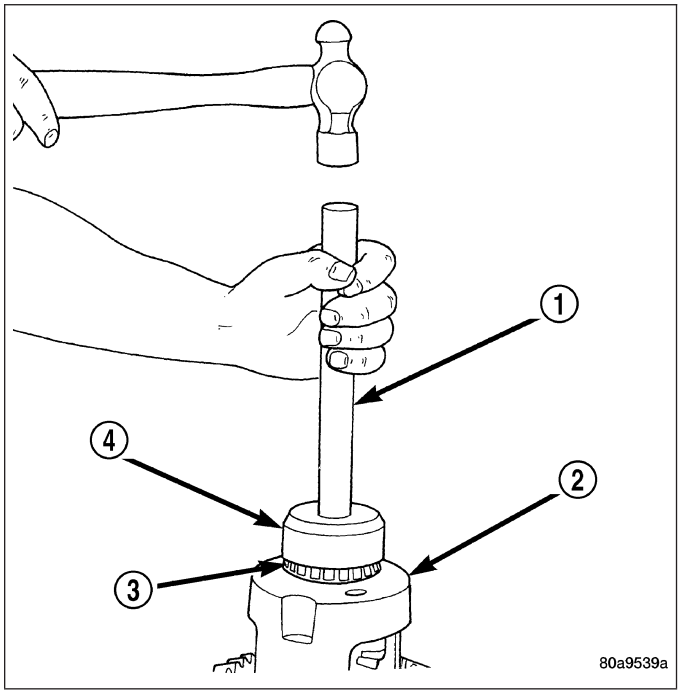
REMOVAL

1. Remove differential from housing.
2. Remove bearings (3) from differential case (4) with Puller C-293-PA (1) Adapters C-293-48 (2) and Plug C-293-3 (5).



INSTALLATION

1. Install differential case bearings (3) with Installer C-3716-A (4) and Handle C-4171 (1).
2. Install differential in axle housing.

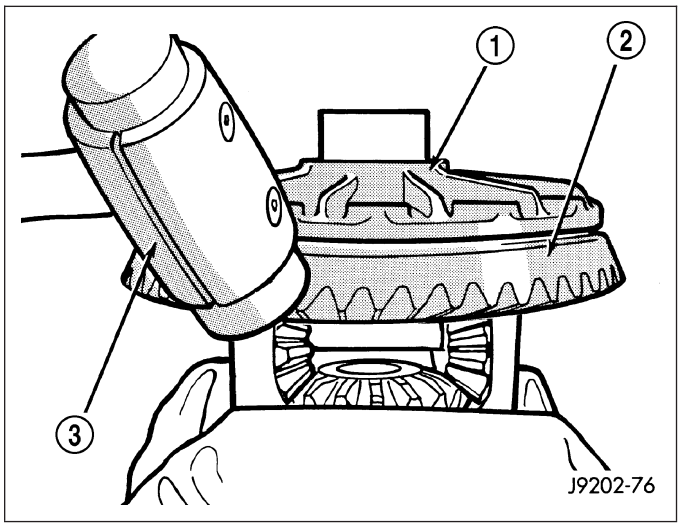


GEAR-PINION/RING

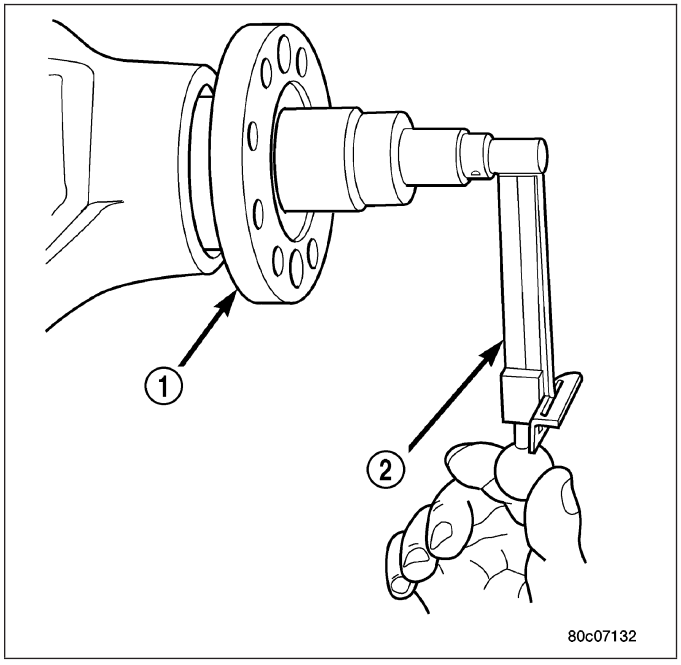
REMOVAL

NOTE: The ring gear and pinion are serviced in a matched set. Never replace one gear without replacing the other matching gear.

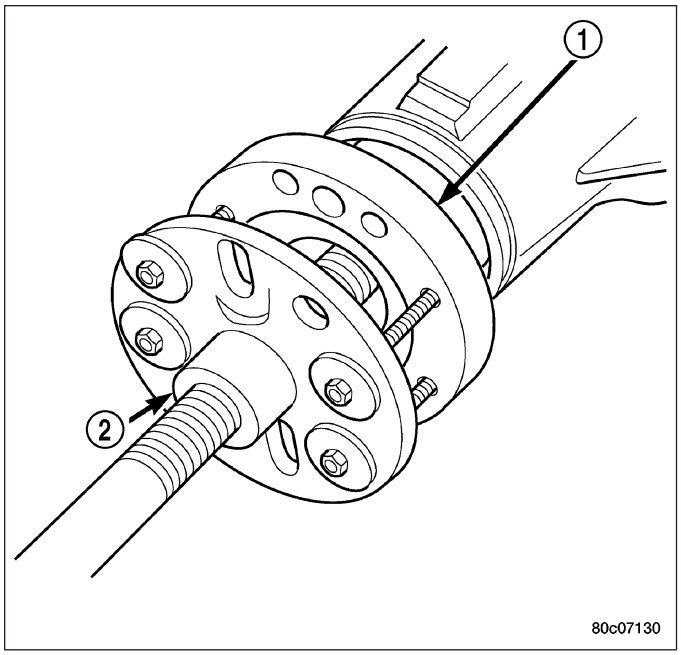
1. Remove differential from axle housing.
2. Place differential case in a vise with soft jaw.
3. Remove ring gear bolts.
4. Drive ring gear (2) from differential case (1) with a soft hammer.



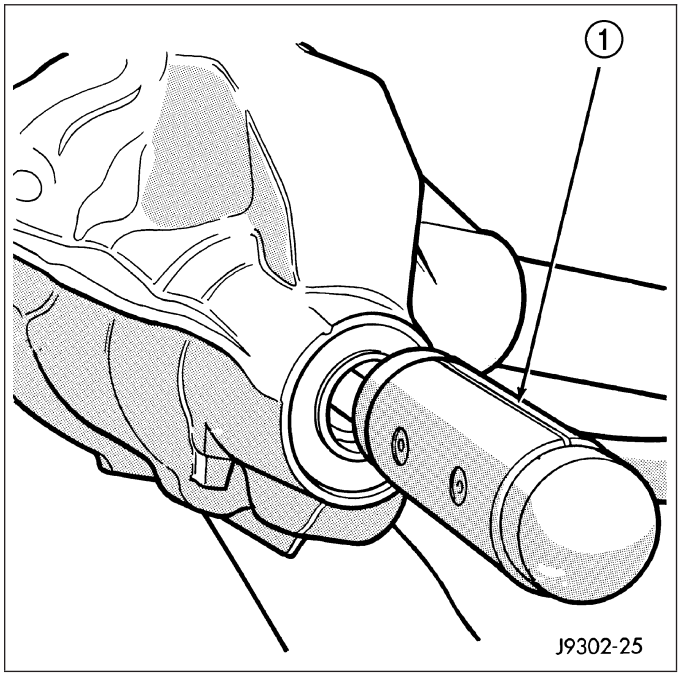
5. Remove propeller shaft.
6. Rotate companion flange and verify flange rotates smoothly.
7. Record pinion rotating torque with an inch pound torque wrench (2) for installation reference.



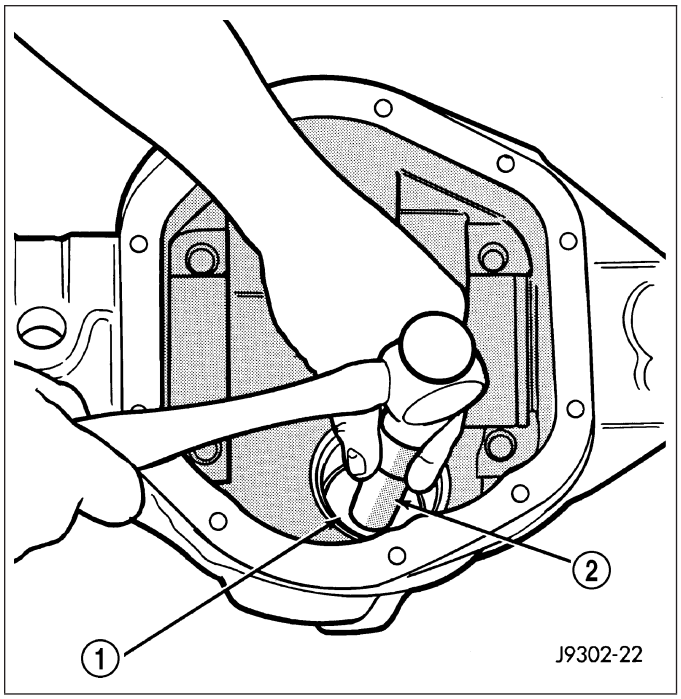
8. Install bolts into two of the threaded holes in the companion flange 180° apart.
9. Position Holder 6719 against the companion flange and install a bolt and washer into one of the remaining threaded holes. Tighten the bolts so that the Holder 6719 is held to the flange.
10. Remove pinion nut.
11. Remove companion flange (1) with Remover C-452 (2).



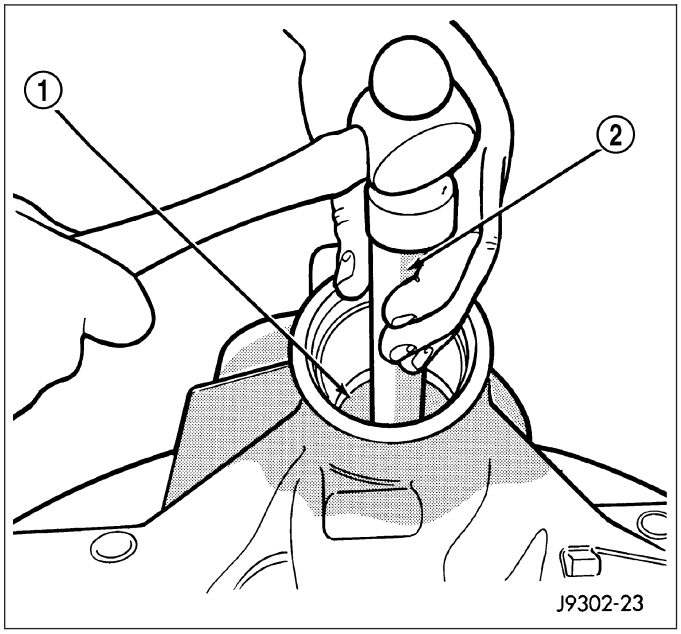
12. Remove pinion from differential housing with a hammer (1).



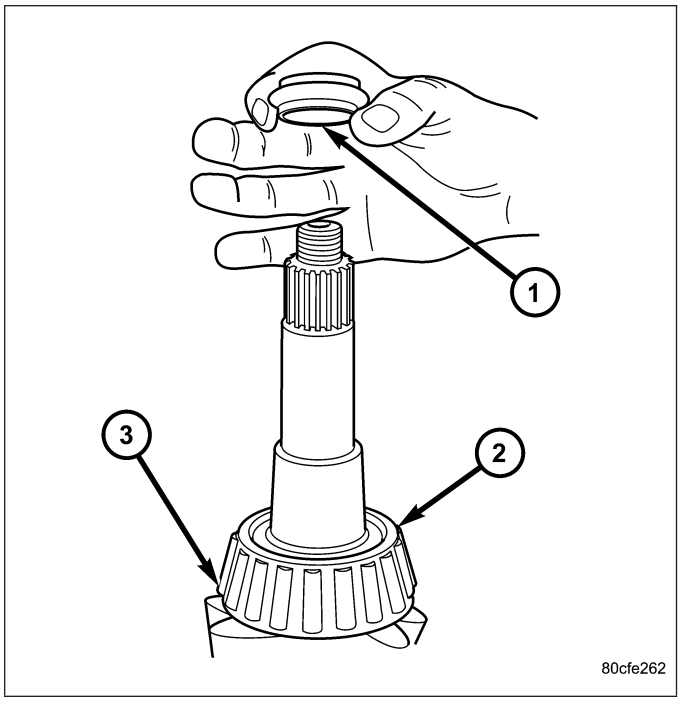
13. Remove pinion seal with a pry tool or a slide hammer mounted screw.
14. Remove oil slinger, if equipped, and front pinion bearing.
15. Remove front pinion bearing cup with Remover D-103 (1) and Handle C-4171 (2).



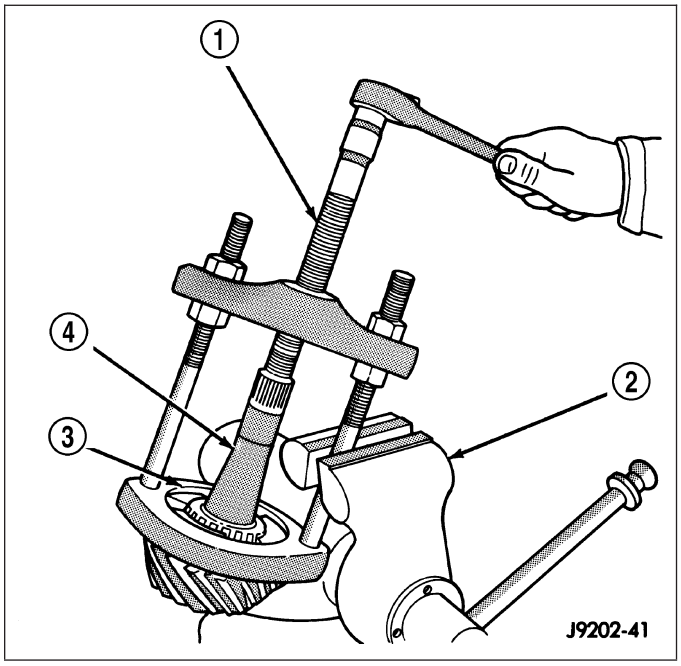
16. Remove rear pinion bearing cup with Remover 8401 (1) and Handle C-4171 (2).



17. Remove collapsible preload spacer (1).



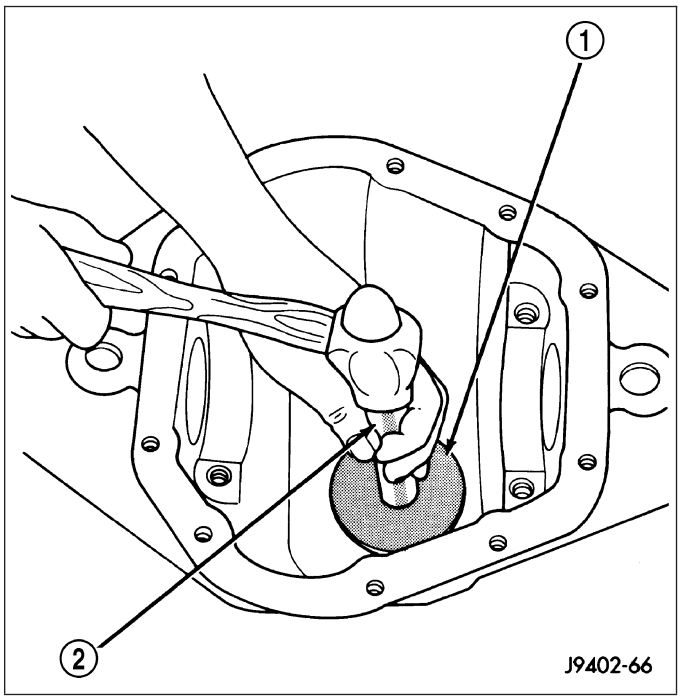
18. Remove rear pinion bearing from pinion shaft (4) with Puller C-293-PA (1) and Adapters C-293-42 (3).
19. Remove depth shims from pinion shaft and record shim thickness.



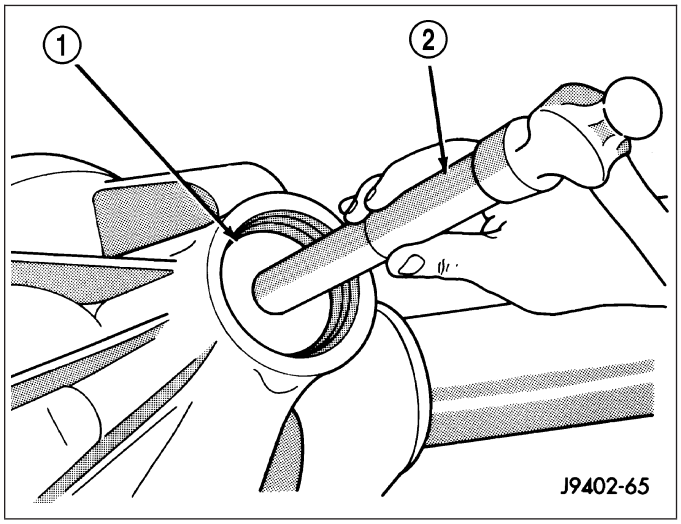
INSTALLATION

NOTE: The ring gear and pinion are serviced in a matched set. Never replace one gear without replacing the other. If ring and pinion gears or bearings are replaced, Refer to Adjustments for Pinion Gear Depth Setting.

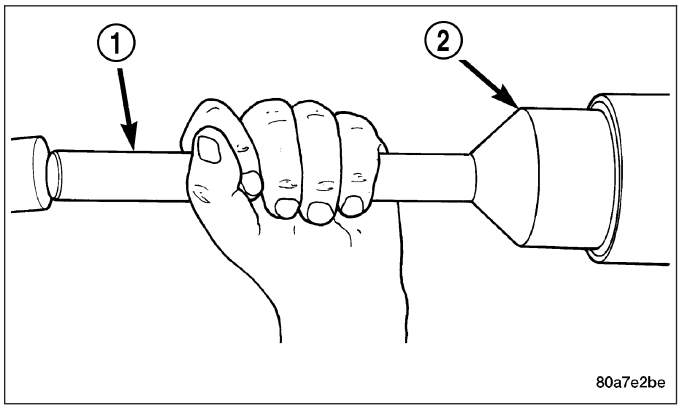
1. Apply Mopar Door Ease or equivalent lubricant to outside surface of the bearing cups.
2. Install rear pinion bearing cup with Installer D-145 (1) and Handle C-4171 (2).



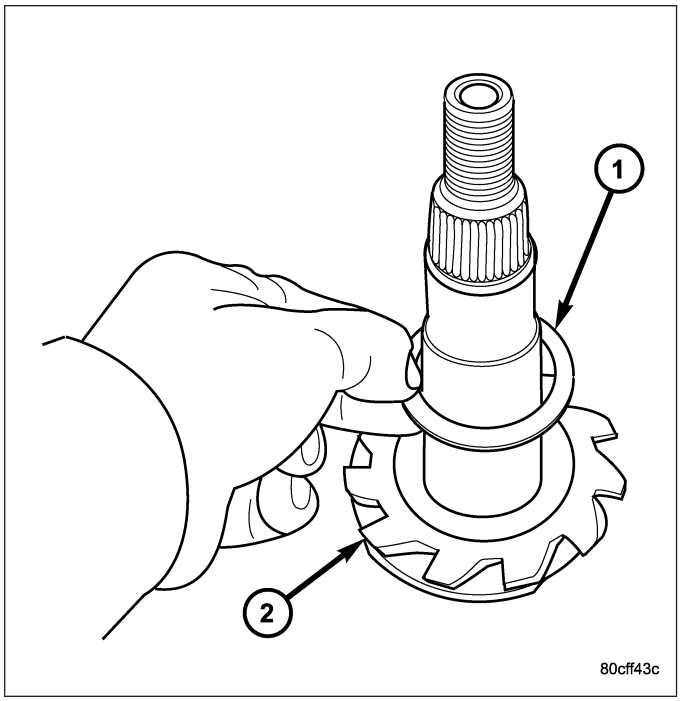
3. Install front pinion bearing cup with Installer D-129 (1) and Handle C-4171 (2).



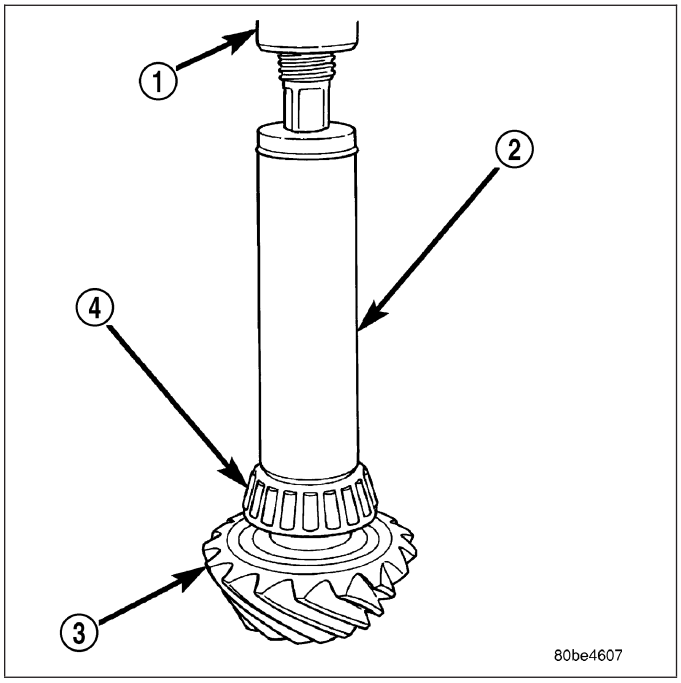
4. Install pinion front bearing and oil slinger if equipped.
5. Apply a light coating of gear lubricant on the lip of pinion seal.
6. Install pinion seal with an appropriate installer (2) and handle (1).



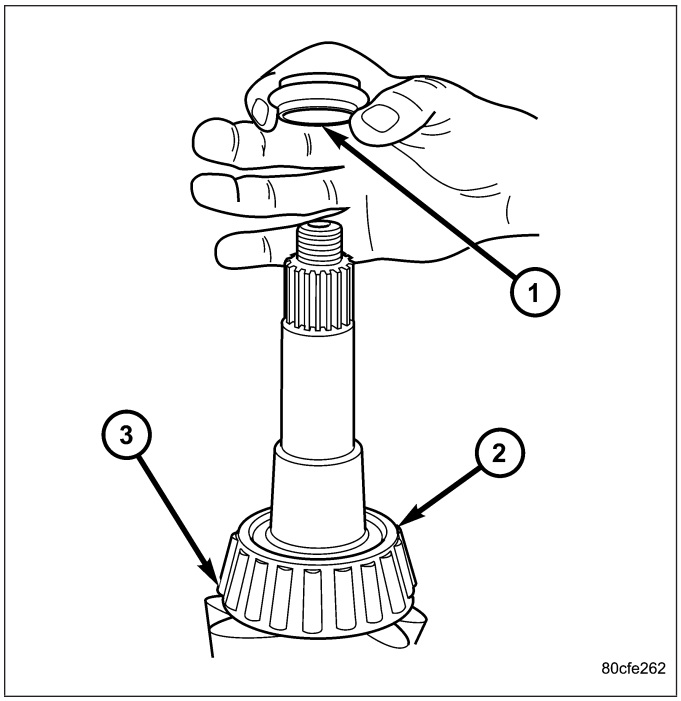
7. Place proper thickness depth shim (1) on pinion (2).



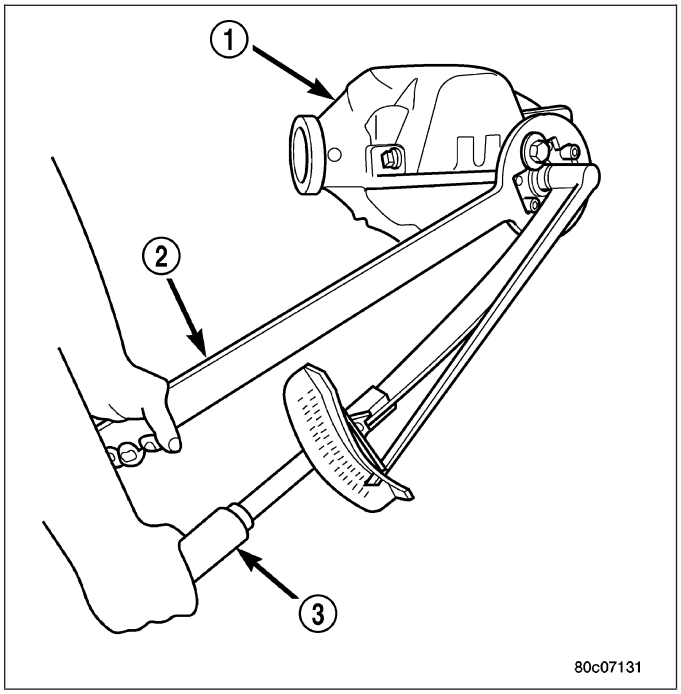
8. Install rear bearing (1) on pinion with Installer 6448 (2) and a press (1).



9. Install **new** collapsible preload spacer (1) onto the pinion.

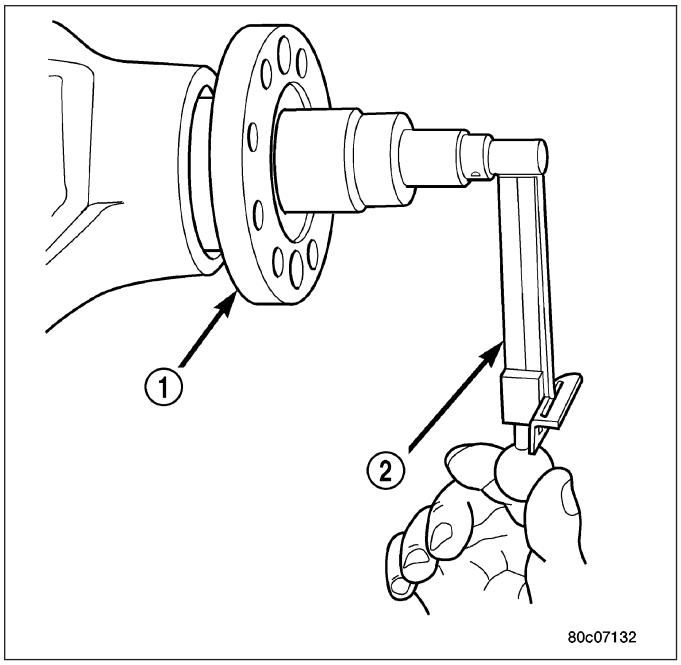


10. Install pinion gear into housing.
11. Install companion flange with Installer C-3718.
12. Install **new** pinion nut and tighten to 271 N·m (200 ft. lbs.).
13. With holder (2) and a torque wrench (3) set at 474 N·m (350 ft. lbs.), tighten pinion nut until end play is taken up.



14. Slowly tighten the pinion flange (1) nut in 6.8 N·m (5 ft. lbs.) increments until rotating torque is achieved. Measure rotating torque frequently to avoid overcrushing the collapsible spacer. The pinion rotating torque should be:
    - Original Bearings: 1 to 2.5 N·m (10 to 20 in. lbs.)
    - New Bearings: 1.7 to 2.5 N·m (15 to 22 in. lbs.)

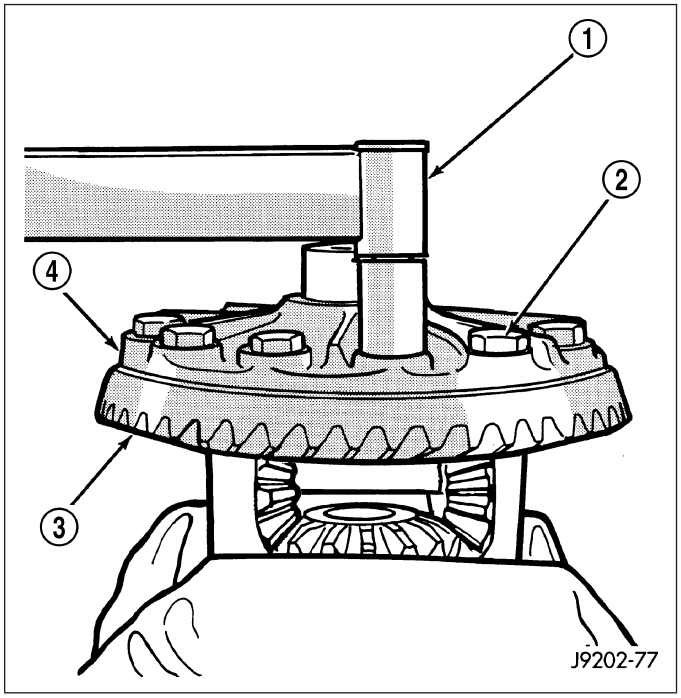
NOTE: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque.



15. Invert differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.
16. Invert differential case in the vise.
17. Install **new** ring gear bolts (2) and alternately tighten to 108 N·m (80 ft. lbs.).

CAUTION: Never reuse the ring gear bolts. Failure to follow these instructions will damage bolts.

18. Install differential in axle housing and verify gear mesh and contact pattern.
19. Install differential cover.



REAR AXLE - 8 1/4

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REAR AXLE - 8 1/4

DIAGNOSIS AND TESTING

REAR AXLE - 8 1/4

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, incorrect pinion depth, tooth contact, worn/damaged gears, or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak-noise range. If the noise stops or changes greatly check for:

- Insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side and pinions gears, usually do not cause noise during straight-ahead driving, when the gears are unloaded. The side gears are loaded during turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

Bearing noise can be either a whining or a growling sound.

Pinion bearings have a constant high pitch noise, because it rotates at a faster rate. This noise changes with vehicle speed. If noise is heard under a load, the rear pinion bearing is the source. If noise is heard during a coast, the front pinion bearing is the source.

Differential bearings usually produce a low pitch noise. The differential bearing noise is constant and varies only with vehicle speed.

Axle shaft bearing noise generally changes when the bearings are loaded. Turn vehicle sharply to the left and the right during a road test. This will load and unload the bearings and change the noise level. If axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 m.p.h.

LOW SPEED KNOCK

Low speed knock is generally caused by:

- Worn U-joints or C/V joints.
- Worn side-gear thrust washers
- Worn pinion shaft bore.

VIBRATION

Vibration at the rear of the vehicle is usually caused by:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out of balance wheels.
- Loose wheel lug nuts.
- Worn U-joints or C/V joints.
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion yoke run out.
- Bent axle shaft(s).

Check for loose or damaged front-end components or engine/transmission mounts. These components can contribute to what appears to be an axle vibration. Also look at engine accessories, brackets and drive belts.

NOTE: All driveline components should be examined before starting any repair.

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear or the clutch engaged can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U-joints or C/V joints.
- Loose spring mounts.
- Loose pinion gear nut and yoke.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

To determined the source of a snap/clunk noise, raise vehicle on a hoist with the wheels free to rotate. Have a helper shift the transmission into gear and listen for the noise.

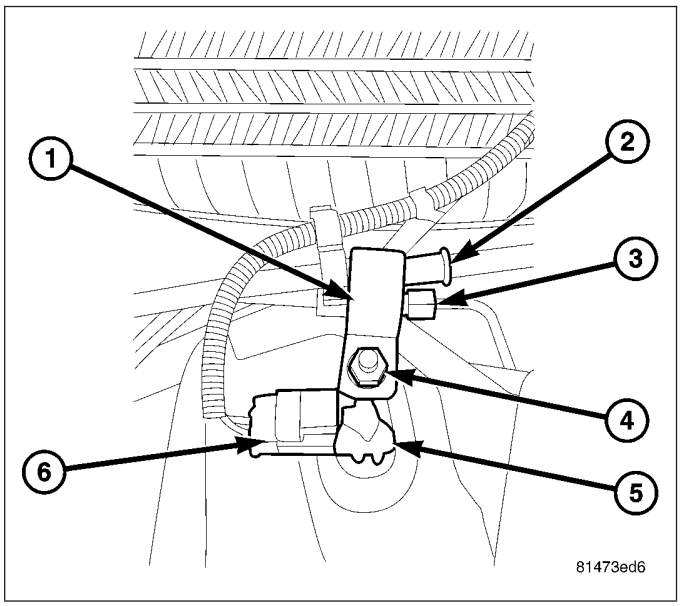
DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brinelled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace the broken shaft after correcting tube mis-alignment.
	2 Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper adjustment of the differential bearings.	1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored yoke.	5. Replace yoke and seal.
	6. Axle cover not properly sealed.	6. Remove, clean, and re-seal cover.

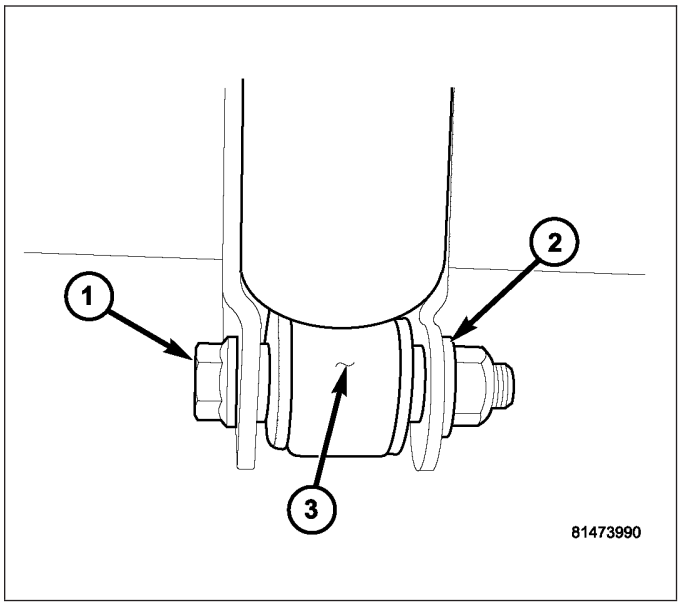
Condition	Possible Causes	Correction
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Re-adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Re-adjust ring gear backlash.
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern. Adjust backlash or pinion depth.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

REMOVAL

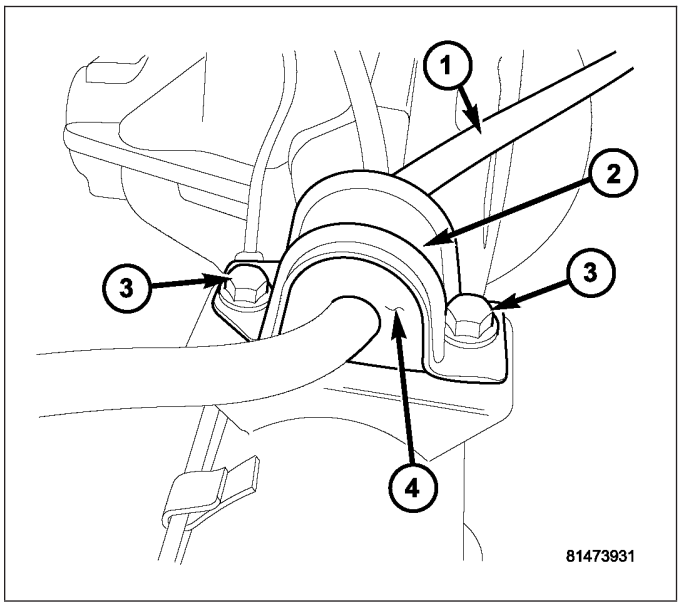
1. With vehicle in neutral, position on hoist.
2. Position a lift under axle and secure axle to lift.
3. Remove the wheels and rear brake componants.
4. Remove ABS sensor (5) from the differential housing.
5. Disconnect the brake hose at the axle junction block.
6. Disconnect the vent hose from the axle shaft tube.
7. Mark the propeller shaft and companion flange for installation alignment reference.
8. Remove propeller shaft.



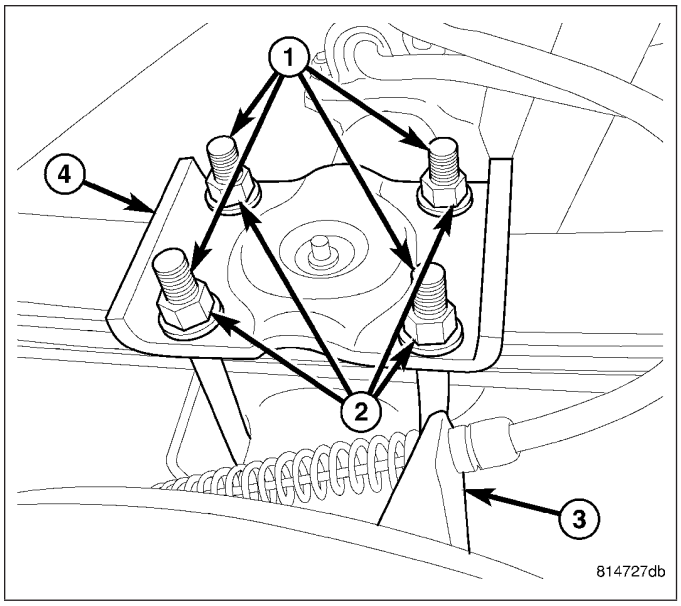
9. Remove shock absorbers (3) axle mounting (2) bolts (1).



10. Remove stabilizer bar (1) retainer clamp bolts (3) and retainer clamps (2) from the axle.

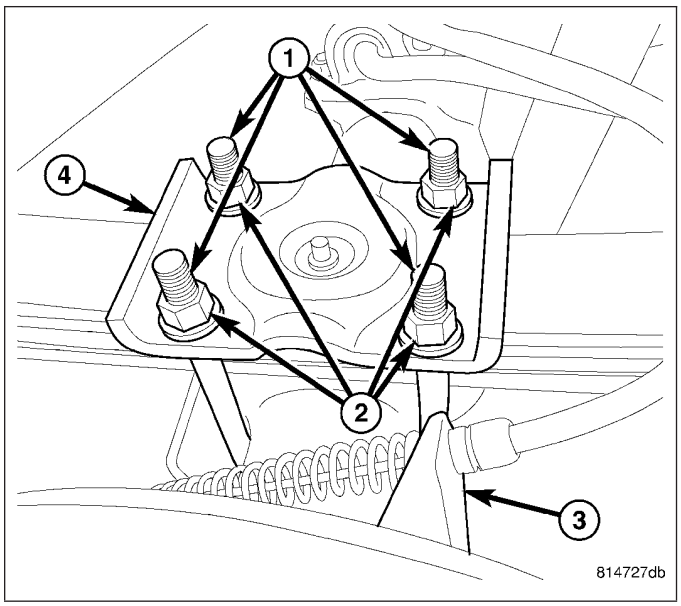


11. Remove spring clamps nuts (2) and spring plates (4).
12. Remove the axle from the vehicle.

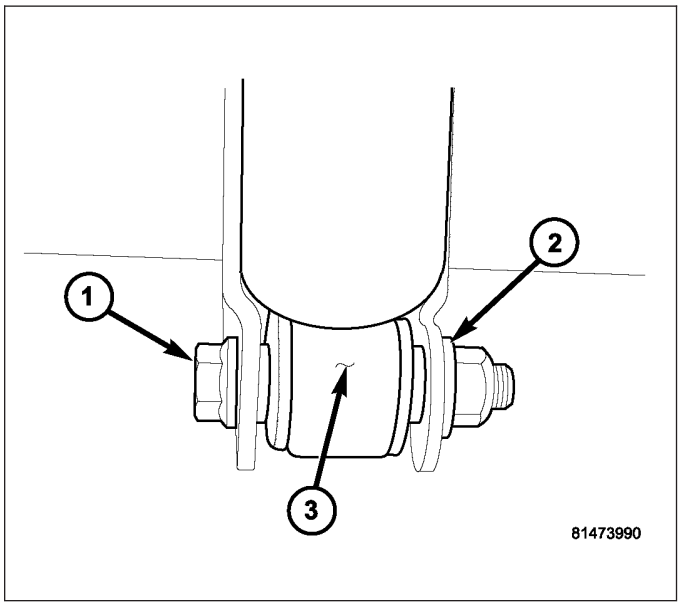


INSTALLATION

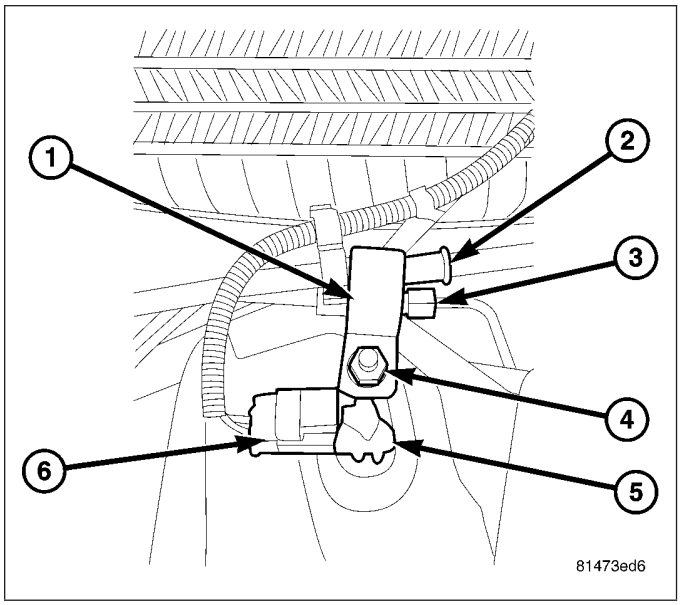
1. Raise axle with lifting device and align to the leaf spring centering bolts.
2. Install spring clamps (1) and spring plates (4). Tighten the U-bolt nuts (2) to 149 N·m (110 ft. lbs.).



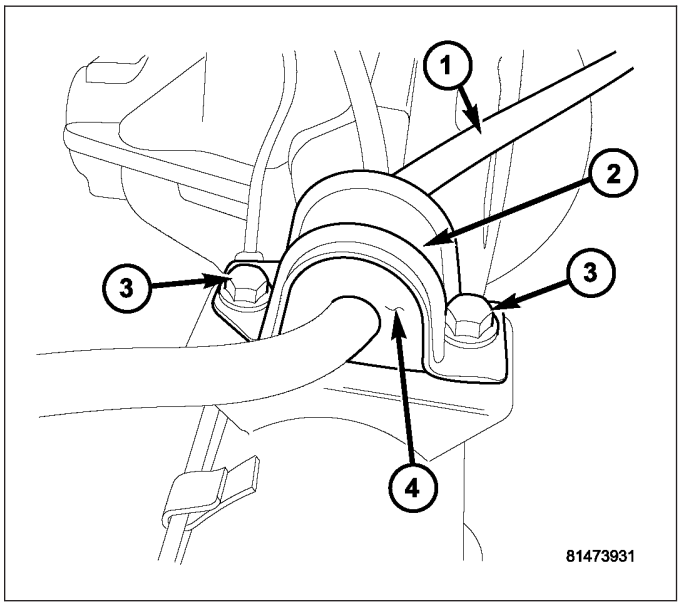
3. Install shock absorbers (3) and tighten nuts (2) to 102 N·m (75 ft. lbs.).



4. Install ABS sensor (5) into the differential housing.

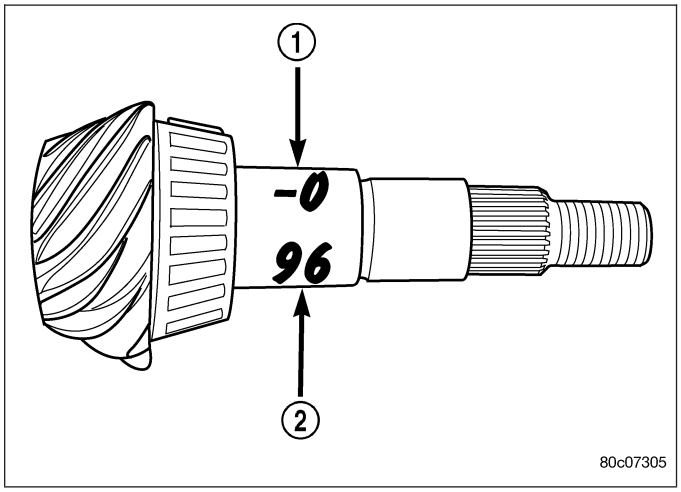


5. Install rear brake and park brake componants.
6. Connect brake hose to axle junction block.
7. Install stabilizer bar and center it with equal spacing on both sides. Tighten retainer clamp (2) bolts (3) to 61 N·m (45 ft. lbs.).
8. Install axle vent hose.
9. Install propeller shaft with reference marks aligned. Tighten bolts to 108 N·m (80 ft. lbs.).
10. Add gear lubricant, if necessary.



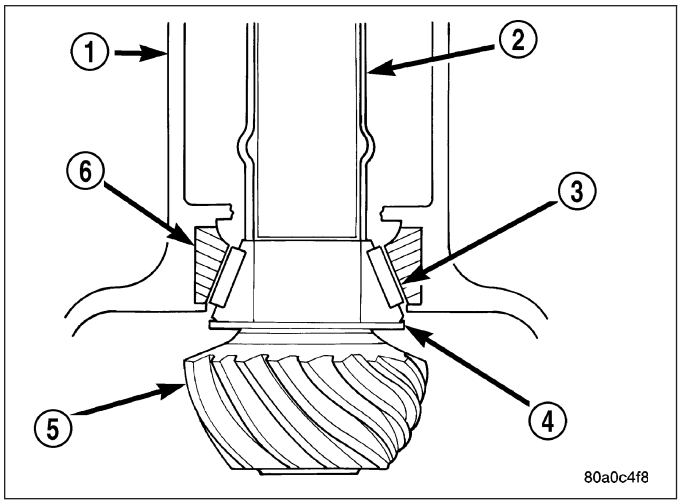
ADJUSTMENTS

Ring gear and pinion are supplied as matched sets. Identifying numbers for the ring gear and pinion are painted onto the pinion gear shaft and the side of the ring gear. A plus + number, minus – number or zero 0 along with the gear set sequence number 01 to 99 is on each gear. This first number (1) is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion marked with a zero 0. The next two numbers (2) are the sequence number of the gear set. The standard depth provides the best teeth contact pattern.



The pinion depth variance select shims (4) are placed behind the rear pinion bearing (3).

If installing a new gear, note the depth variance number of the original and replacement pinion. Add or subtract this number from the original depth shim/oil slinger to compensate for the difference in the depth variances. The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim.



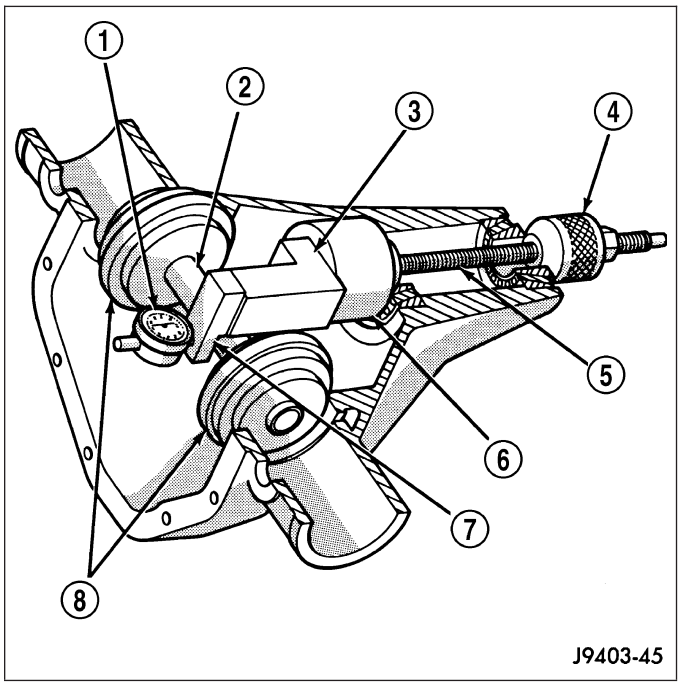
Pinion Gear Depth Variance Chart: Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

PINION GEAR DEPTH VARIANCE

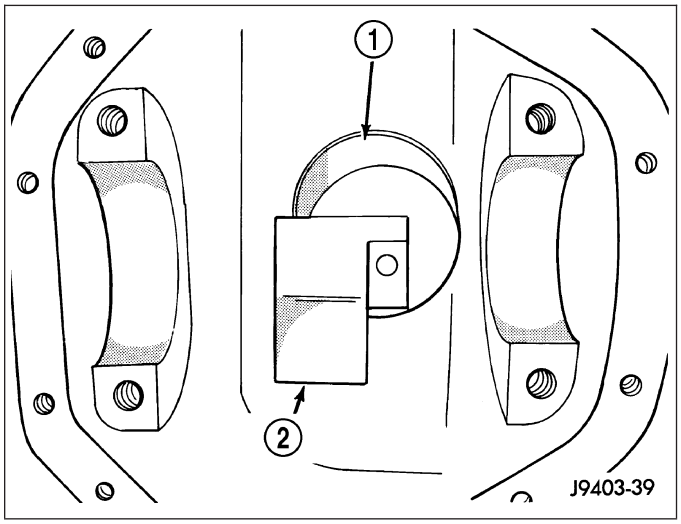
Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

PINION DEPTH MEASUREMENT

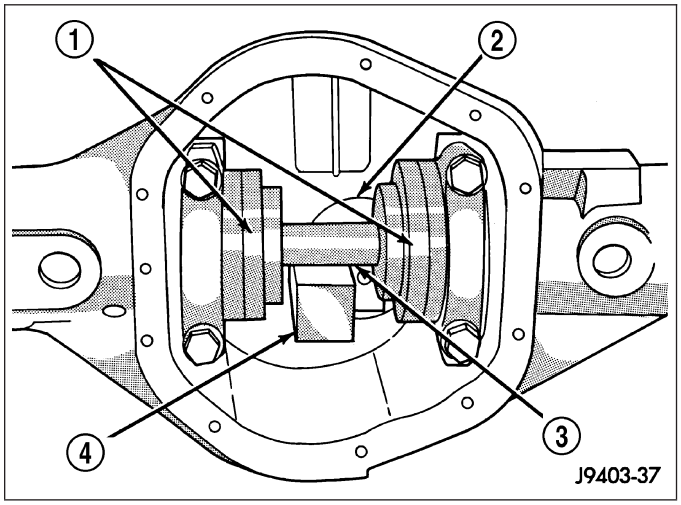
Measurements are taken with pinion bearing cups and pinion bearings installed in the housing. Take measurements with Pinion Gauge Set and Dial Indicator C-3339 (1).



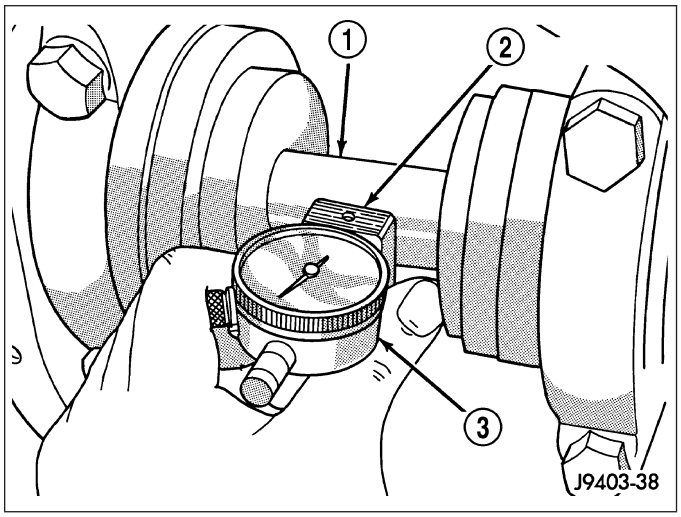
1. Assemble Pinion Height Block 6739 (2) Pinion Block 8540 (1) and rear pinion bearing onto Screw 6741.



2. Insert assembled height gauge components, rear bearing and screw into housing through pinion bearing cups.
3. Install front pinion bearing and Cone-Nut 6740 onto the screw. Tighten cone-nut until Torque To Rotate screw is 1.7 N·m (15 in. lbs.).
4. Place Arbor Disc 8541 (1) on Arbor D-115-3 (3) in position in the housing side bearing cradles. Install differential bearing caps on arbor discs and tighten cap bolts to specifications.



NOTE: Arbor Discs 8541 (1) has different step diameters to fit other axles. Choose proper step for axle being serviced.

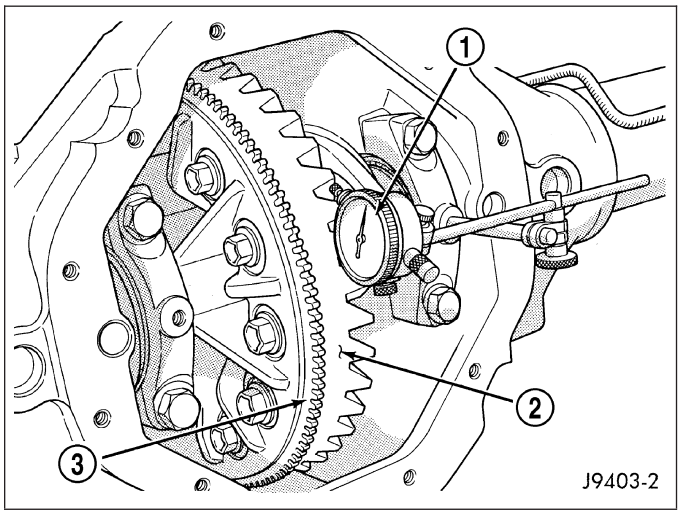


5. Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.
6. Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the rearward surface of the pinion height block. Hold scooter block in place and zero the dial indicator. Tighten dial indicator face lock screw.
7. Slowly slide dial indicator probe over the edge of the pinion height block.
8. Slide dial indicator (3) probe across the gap between the pinion height block and arbor bar (1) with the scooter block (2) against the pinion height block. When dial probe contacts the arbor bar, the dial pointer will turn clockwise. Continue moving dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator can not achieve a zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.
9. Select a shim equal to the dial indicator reading, plus the drive pinion gear depth variance number marked on the shaft of the pinion. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading. Then subtract 0.04064 mm (0.0016 in.) from the total measurement. This will be the correct shim selection for the pinion height.

DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

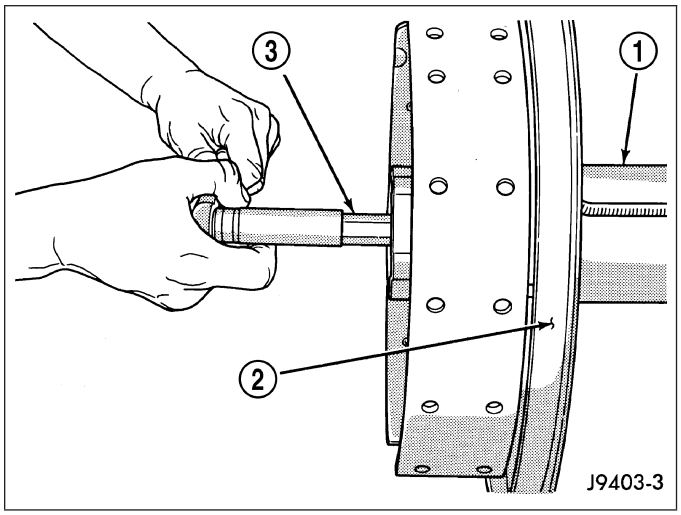
The following must be considered when adjusting bearing preload and gear backlash:

- The maximum ring gear backlash variation is 0.076 mm (0.003 in.).
- Mark the gears so the same teeth are meshed during all backlash measurements.
- Maintain the torque while adjusting the bearing preload and ring gear backlash.
- Excessive adjuster torque will introduce a high bearing load and cause premature bearing failure. Insufficient adjuster torque can result in excessive differential case free-play and ring gear noise.
- Insufficient adjuster torque will not support the ring gear correctly and can cause excessive differential case free-play and ring gear noise.



NOTE: The differential bearing cups will not always immediately follow the threaded adjusters as they are moved during adjustment. To ensure accurate bearing cup responses to the adjustments:

- **Maintain the gear teeth engaged (meshed) as marked.**
- **The bearings must be seated by rapidly rotating the pinion gear a half turn back and forth.**
- **Do this five to ten times each time the threaded adjusters are adjusted.**



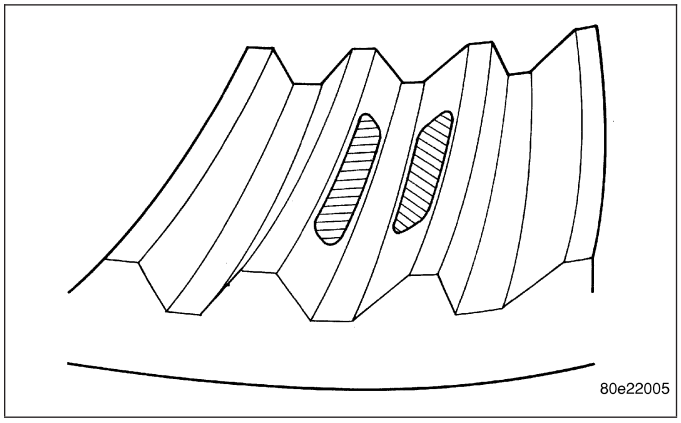
1. Through the axle tube with Wrench C-4164 adjust each threaded adjuster inward until the differential bearing free-play is eliminated. Allow some ring gear backlash, approximately 0.25 mm (0.01 in.) between the ring and pinion gear. Seat the bearing cups with the procedure described above.
2. Install dial indicator (1) and position the plunger against the drive side of a ring gear (2) tooth. Measure the backlash at 4 positions, 90 degrees apart around the ring gear. Locate and mark the area of minimum backlash.
3. Rotate the ring gear to the position of the least backlash. Mark the gear so that all future backlash measurements will be taken with the same gear teeth meshed.
4. Loosen the right-side, tighten the left-side threaded adjuster. Obtain backlash of 0.076-0.102 mm (0.003-0.004 in.) with each adjuster tightened to 14 N·m (10 ft. lbs.). Seat the bearing cups with the procedure described above.
5. Tighten the differential bearing cap bolts to 135 N·m (100 ft. lbs.).
6. Tighten the right-side threaded adjuster to 102 N·m (75 ft. lbs.). Seat the bearing cups with the procedure described above. Continue to tighten the right-side adjuster and seat bearing cups until the torque remains constant at 102 N·m (75 ft. lbs.)
7. Measure the ring gear backlash. The range of backlash is 0.15-0.203 mm (0.006-0.008 in.).
8. Continue increasing the torque at the right-side threaded adjuster until the specified backlash is obtained.

NOTE: The left-side threaded adjuster torque should have approximately 102 N·m (75 ft. lbs.). If the torque is considerably less, the complete adjustment procedure must be repeated.

9. Tighten the left-side threaded adjuster until 102 N·m (75 ft. lbs.) torque is indicated. Seat the bearing rollers with the procedure described above. Do this until the torque remains constant.
10. Install the threaded adjuster locks and tighten the lock screws to 10 N·m (90 in. lbs.).

After the proper backlash is achieved, perform the Gear Contact procedure.

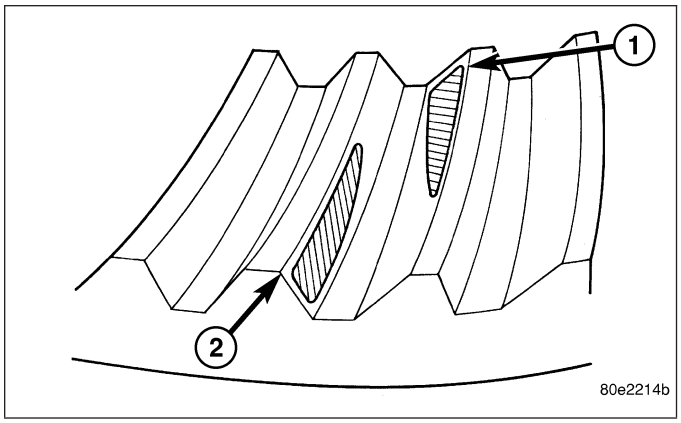
GEAR CONTACT PATTERN



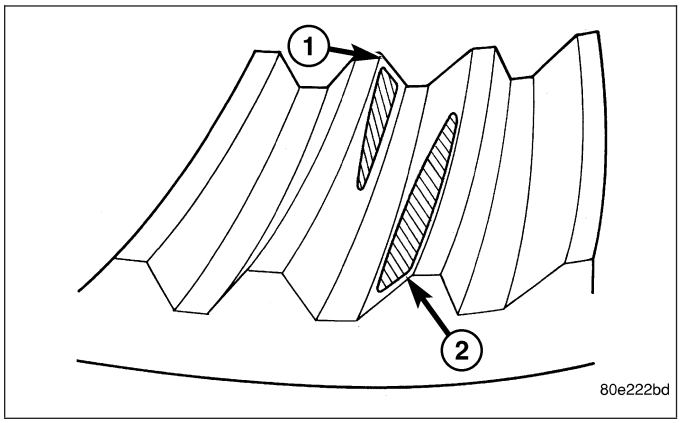
1. Wipe clean each tooth of the ring gear.
2. Apply gear marking compound to all of the ring gear teeth.
3. Verify bearing cap bolts are torque specification.
4. Apply parking brakes lightly to create at 14 N·m (10 ft. lbs.) pinion rotating torque.
5. Rotate the pinion/pinion yoke 4 full revolutions in each directions.
6. Read gear tooth contact pattern.

Gear contact pattern is correct. Backlash and pinion depth is correct.

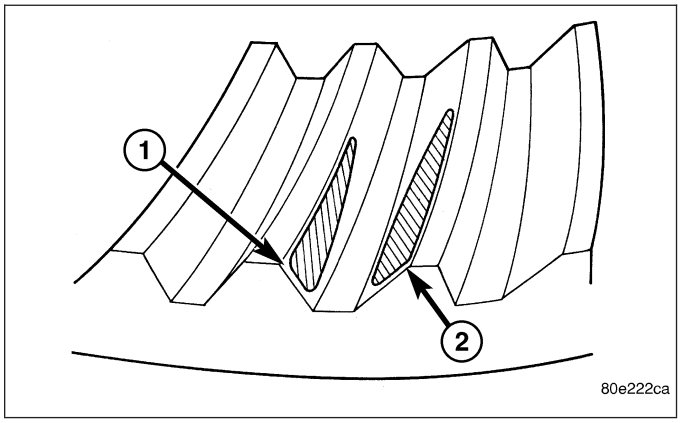
Ring gear is too far away from the pinion gear, coast side toe (1) drive side heel (2). Decrease backlash by moving ring closer to the pinion gear using the adjusters.



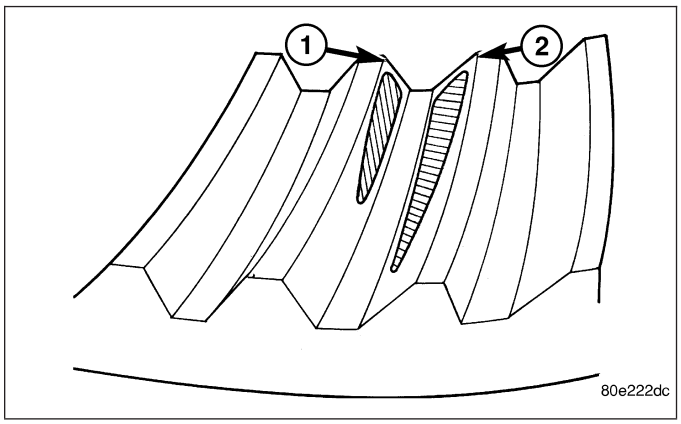
Ring gear is too close to the pinion gear, drive side toe (1) coast side heel (2). Increase backlash by moving ring away from the pinion gear using the adjusters.



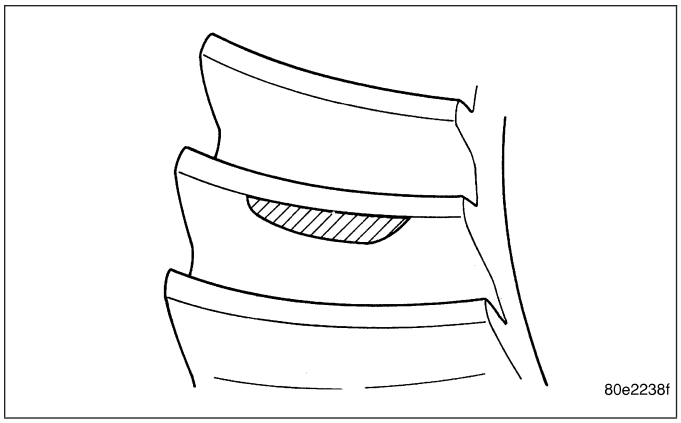
Ring gear is too far away from the pinion gear, drive side heel (1) coast side heel (2). Decrease backlash by moving ring gear closer to the pinion gear using the adjusters.



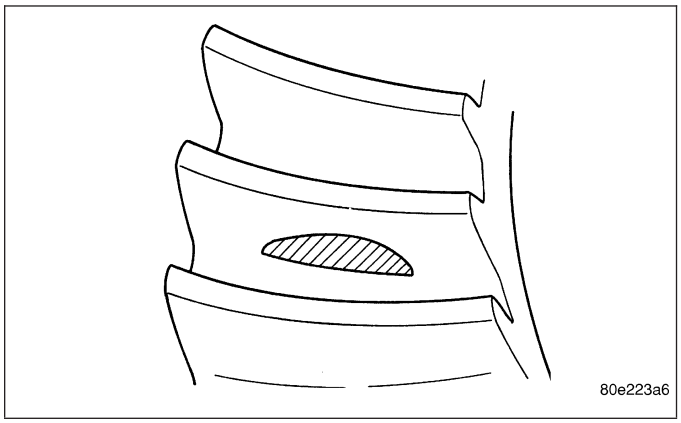
Ring gear is too close to the pinion gear, drive side toe (1) coast side toe (2). Increase backlash by moving ring gear away from the pinion gear using the adjusters.



Pinion gear is set too low. Increase pinion gear height, by increasing pinion depth shim thickness.



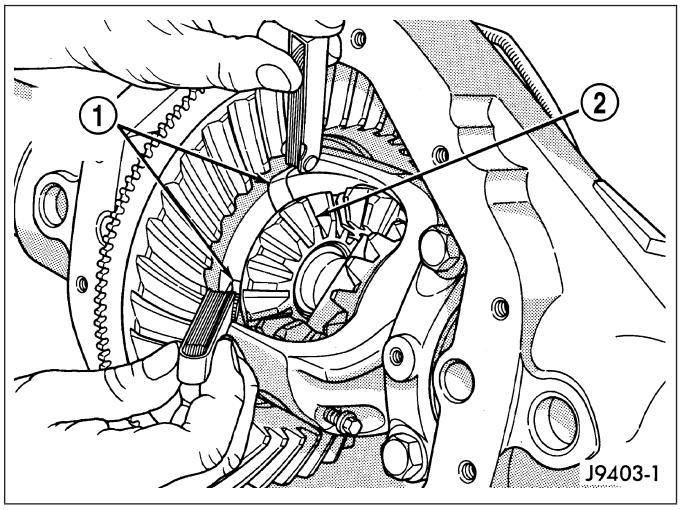
Pinion gear is set too high. Decrease pinion height by decreasing the pinion depth shim thickness.



SIDE GEAR CLEARANCE

When measuring side gear clearance, check each gear independently. If it necessary to replace a side gear, replace both gears as a matched set.

1. Install axle shafts and C-locks and pinion mate shaft.
2. Measure each side gear clearance. Insert a matched pair of feeler gauge (1) blades between the side gear (2) and differential housing on opposite sides of the hub.



SIDE GEAR CLEARANCE	0.007
THRUST WASHER THICKNESS	+ 0.033
TOTAL	0.040
	0.040
REPLACEMENT WASHER THICKNESS	− 0.037
NEW SIDE GEAR CLEARANCE	0.003

J9203-31

3. If side gear clearances is no more than 0.005 inch. Determine if the axle shaft is contacting the pinion mate shaft. **Do not remove the feeler gauges, inspect the axle shaft with the feeler gauge inserted behind the side gear.** If the end of the axle shaft is not contacting the pinion mate shaft, the side gear clearance is acceptable.
4. If clearance is more than 0.005 inch (axle shaft not contacting mate shaft), record the side gear clearance. Remove the thrust washer and measure its thickness with a micrometer. Add the washer thickness to the recorded side gear clearance. The sum of gear clearance and washer thickness will determine required thickness of replacement thrust washer.

In some cases, the end of the axle shaft will move and contact the mate shaft when the feeler gauge is inserted. The C-lock is preventing the side gear from sliding on the axle shaft.

5. If there is no side gear clearance, remove the C-lock from the axle shaft. Use a micrometer to measure the thrust washer thickness. Record the thickness and re-install the thrust washer. Assemble the differential case without the C-lock installed and re-measure the side gear clearance.
6. Compare both clearance measurements. If the difference is less than 0.012 inch (0.305 mm), add clearance recorded when the C-lock was installed to thrust washer thickness measured. The sum will determine the required thickness of the replacement thrust washer.
7. If clearance is 0.012 inch (0.305 mm) or greater, both side gears must be replaced (matched set) and the clearance measurements repeated.
8. If clearance (above) continues to be 0.012 inch (0.305 mm) or greater, the case must be replaced.

SPECIFICATIONS

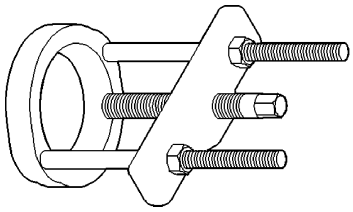
AXLE SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Axle Ratio	3.21, 3.55, 3.92
Differential Case Flange Runout	0.076 mm (0.003 in.)
Differential Case Clearance	0.12 mm (0.005 in.)
Ring Gear Diameter	209.5 mm (8.25 in.)
Ring Gear Backlash	0.12-0.20 mm (0.005-0.008 in.)
Ring Gear Runout	0.12 mm (0.005 in.)
Pinion Bearing Preload - Original Bearings	1-2 N·m (10-20 in. lbs.)
Pinion Bearing Preload - New Bearings	1.7-4 N·m (15-35 in. lbs.)

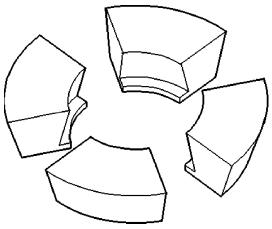
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Differential Cover Bolts	41	30	-
Bearing Cap Bolts	95	70	-
Ring Gear Bolts	102	75	-
Pinion Nut Minimum	285	210	-
Adjuster Lock Screw	10	-	90
Pinion Shaft Lock Screw	11	8	

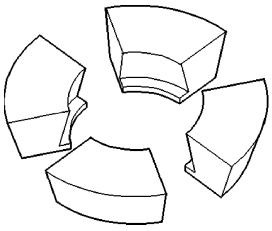
SPECIAL TOOLS



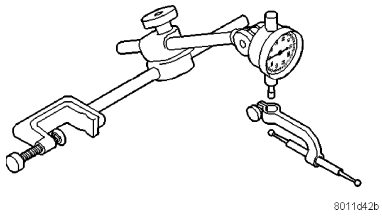
PULLER C-293-PA



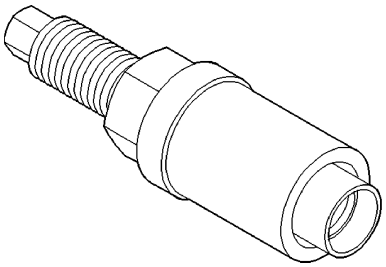
ADAPTERS C-293-47



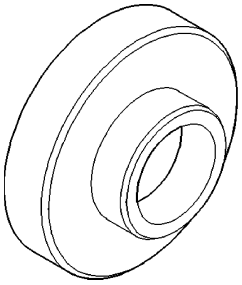
ADAPTERS C-293-48



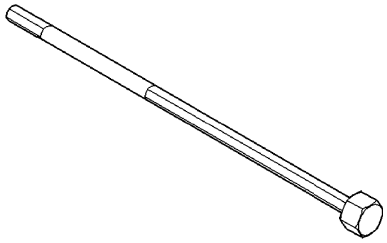
DIAL INDICATOR C-3339



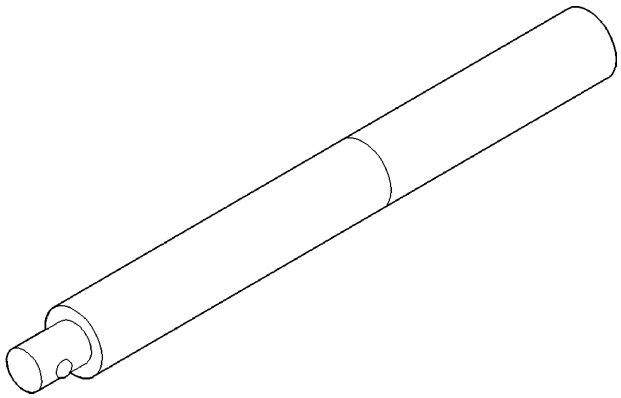
INSTALLER C-3718



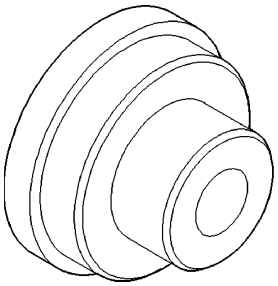
INSTALLER C-4076-B



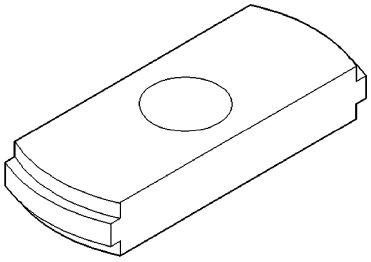
ADJUSTMENT WRENCH C-4164



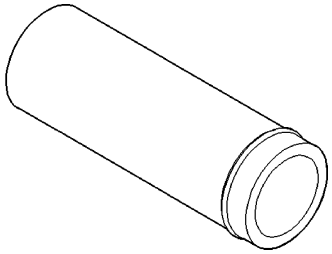
HANDLE C-4171



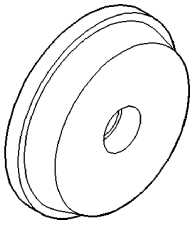
INSTALLER C-4198



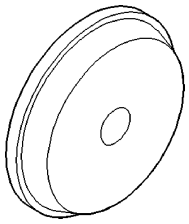
REMOVER C-4307



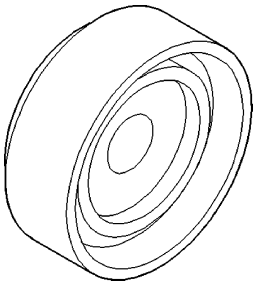
HANDLE C-4735



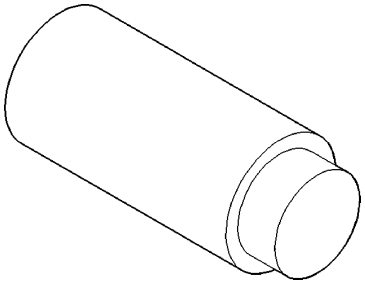
INSTALLER C-4308



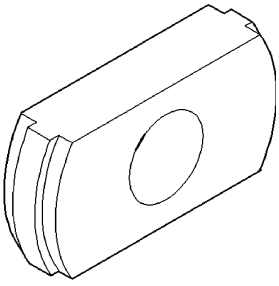
INSTALLER D-130



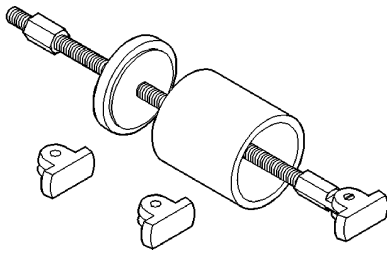
INSTALLER C-4340



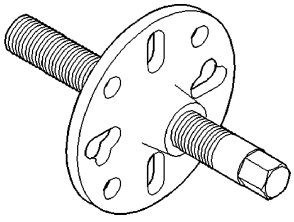
PLUG SP-3289



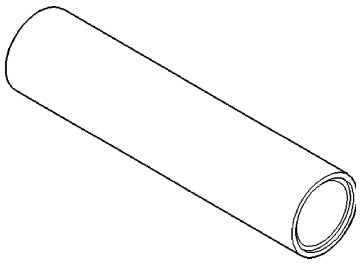
REMOVER C-4345



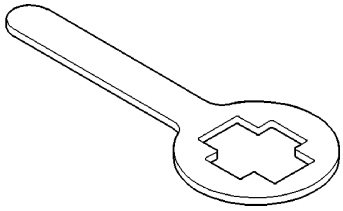
REMOVER/EXTRACTOR 6310



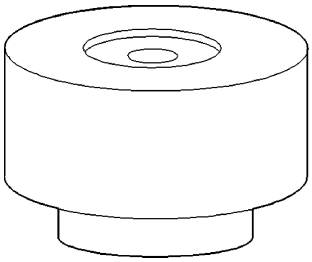
PULLER C-452



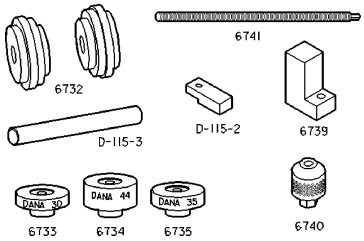
INSTALLER 6448



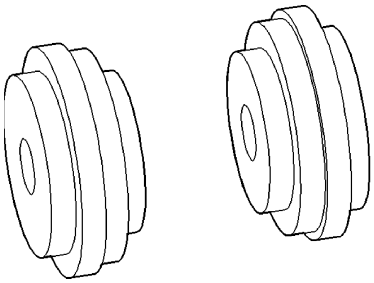
HOLDER 6719A



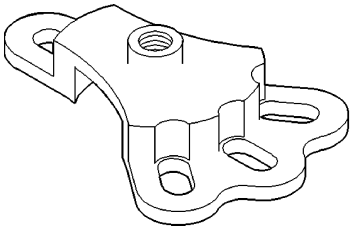
PINION BLOCK 8540



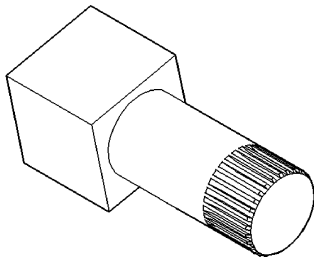
PINION DEPTH SET 6774



ARBOR DISCS 8541



TRAC-LOK TORQUE FIXTURE 6790

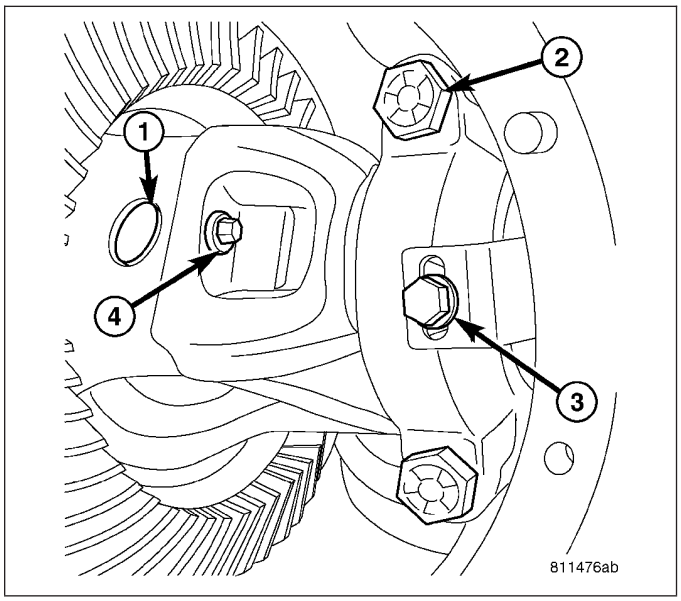


FIXTURE 8138

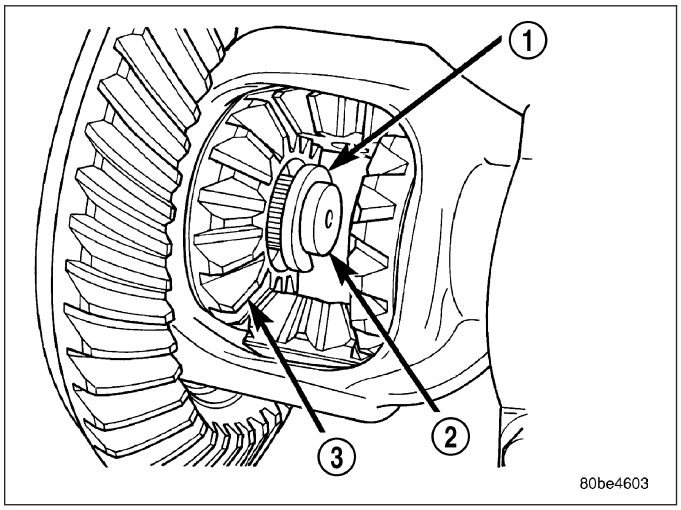
SHAFT-AXLE

REMOVAL

1. With vehicle in neutral, position on hoist.
2. Remove rear brake componants.
3. Remove differential housing cover and drain lubricant.
4. Rotate differential case so pinion mate shaft (1) lock screw (4) is accessible. Remove lock screw and pinion mate shaft from differential case.



5. Push axle shaft inward and remove C-lock (1) from the axle shaft (2).
6. Remove axle shaft.

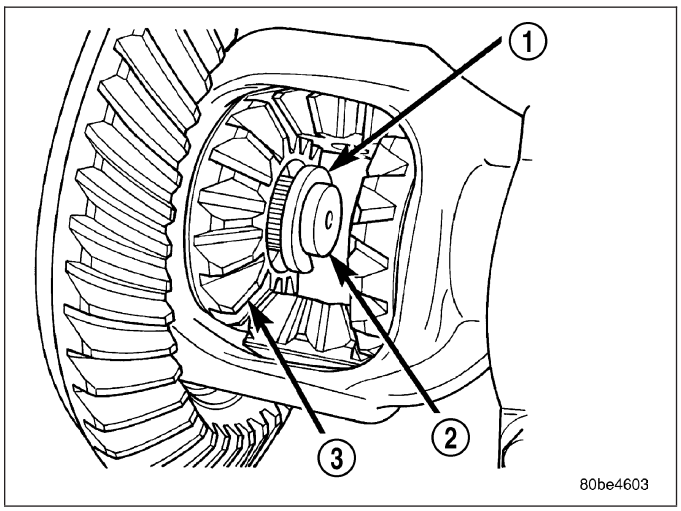


INSTALLATION

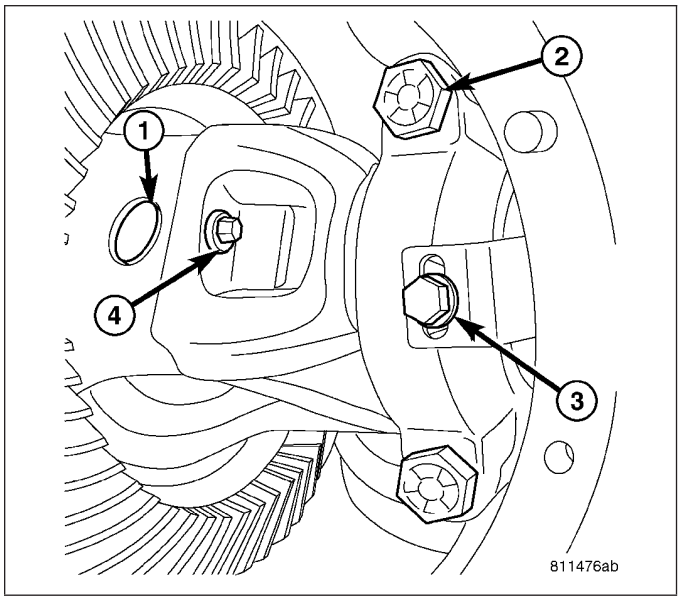
1. Lubricate bearing bore and seal lip with gear lubricant.
2. Install axle shaft through seal, bearing and engage into side gear (3) splines.

NOTE: Do not damaging axle shaft seal during axle installation.

3. Install C-lock (1) in axle shaft (2), then push axle shaft outward to seat C-lock in side gear.
4. Install pinion shaft into differential case and through thrust washers and differential pinions.



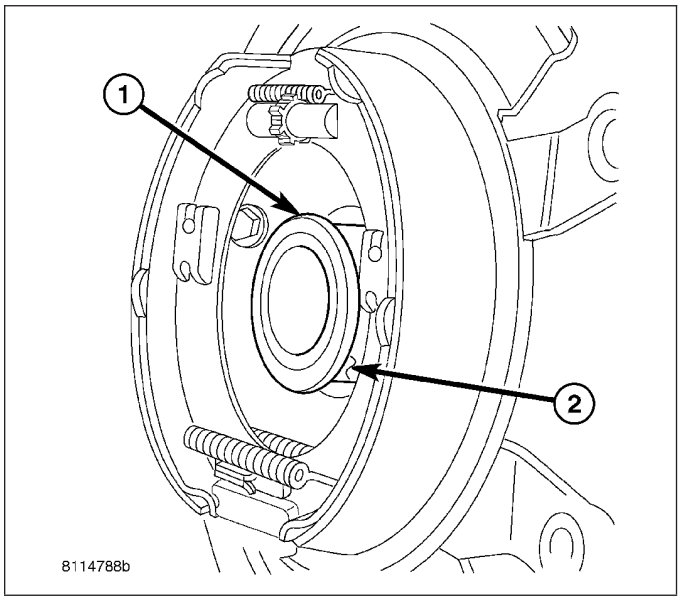
5. Align hole in shaft (1) with hole in the differential case and install lock screw (4) with Loctite® on the threads. Tighten lock screw to 11 N·m (8 ft. lbs.).
6. Install differential cover and fill with gear lubricant.
7. Install rear brake componants.



SEAL-AXLE SHAFT

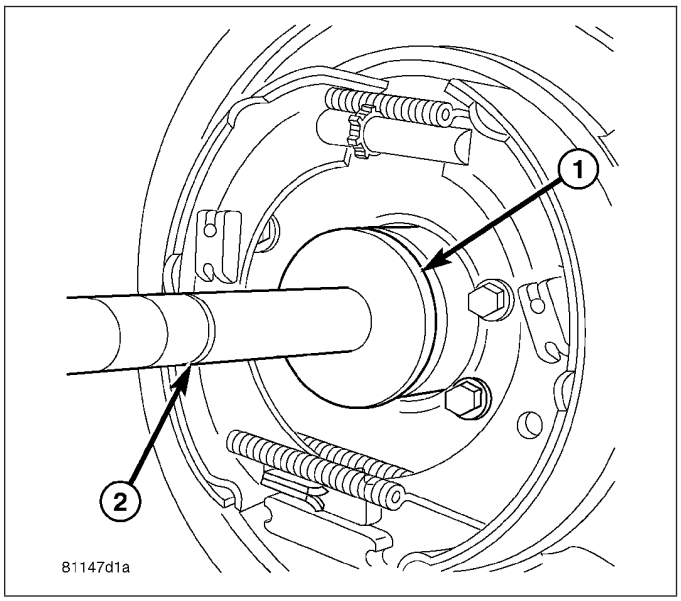
REMOVAL

1. Remove axle shaft.
2. Remove axle shaft seal (1) from axle tube (2) with a seal pick.



INSTALLATION

1. Remove any old sealer/burrs from axle tube.
2. Coat **new** seal lip with axle lubricant and install seal with Installer C-4189 (1) and Handle C-4171 (2).
3. Install axle shaft.

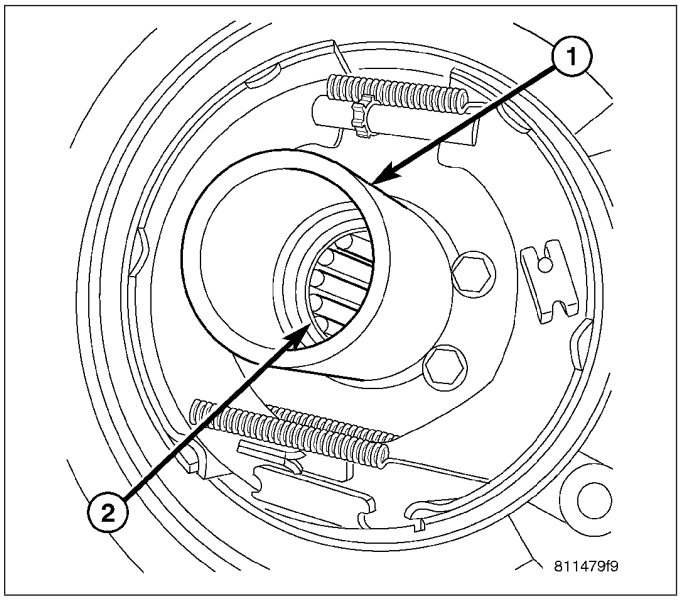


BEARING-AXLE

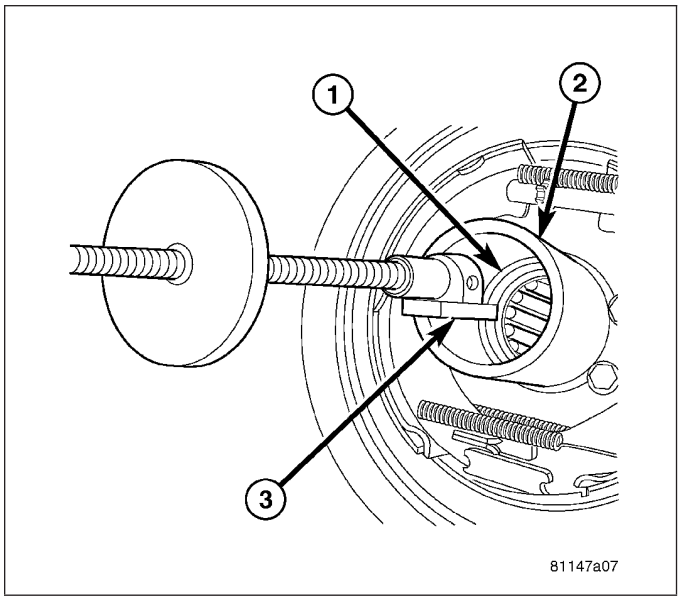
REMOVAL

NOTE: Remove bearing with Bearing Remover 6310 and Foot 6310-9.

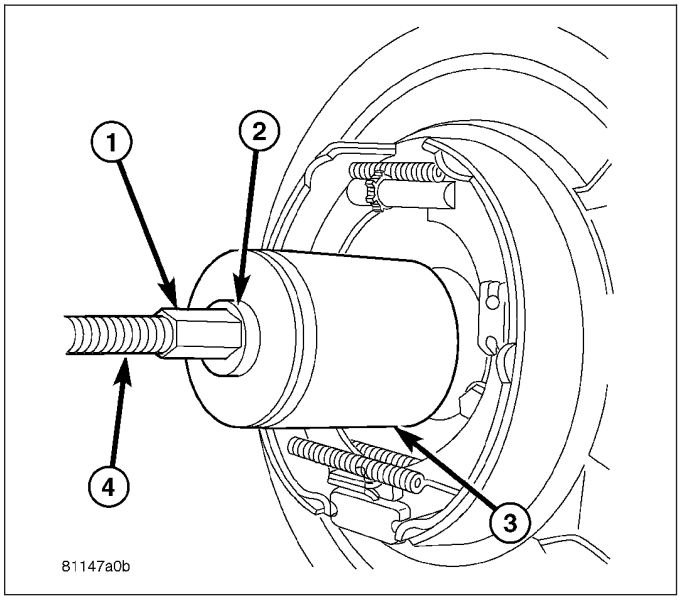
1. Remove axle shaft.
2. Remove axle seal with seal pick.
3. Position bearing receiver (1) on axle tube.



4. Insert bearing remover foot (3) through receiver (2) and bearing (1).

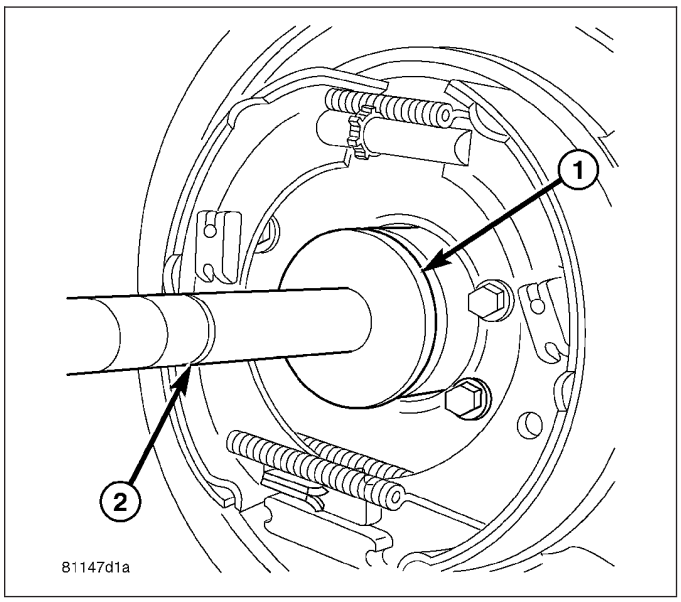


5. Tighten remove nut (1) to pull bearing (2) into the receiver (3).



INSTALLATION

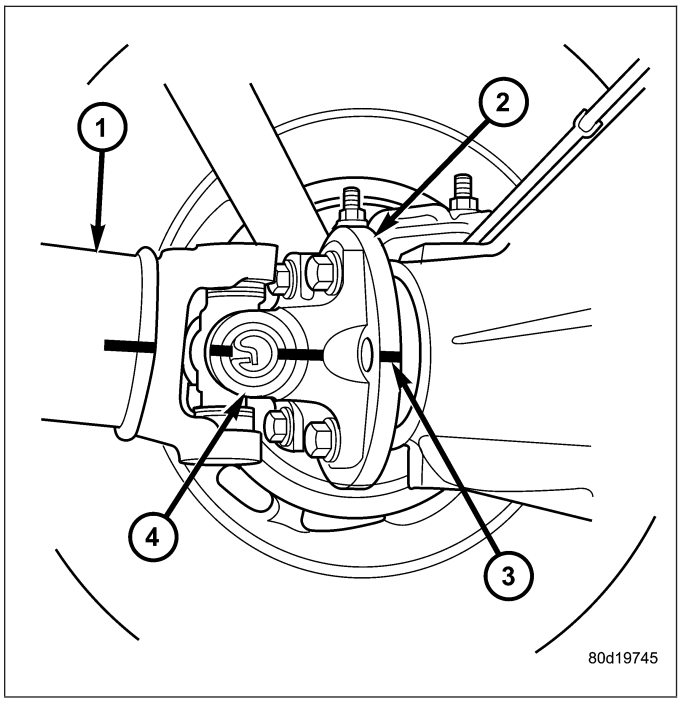
1. Remove any old sealer/burrs from axle tube.
2. Install axle shaft bearing with Installer C-4198 (1) and Handle C-4171 (2). Drive bearing with the bearing part number against the installer until tool contacts the axle tube.
3. Coat **new** axle seal lip with axle lubricant and install with Installer C-4198 (1) and Handle C-4171 (2).
4. Install axle shaft.



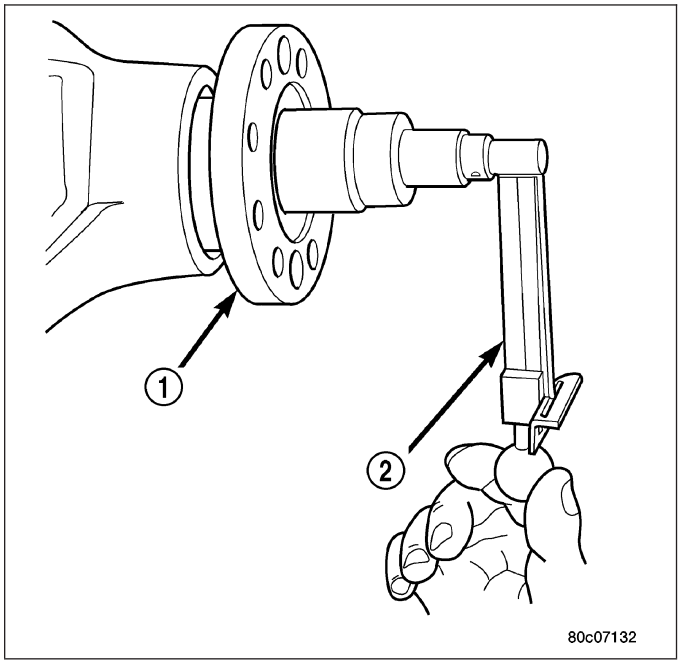
SEAL-PINION

REMOVAL

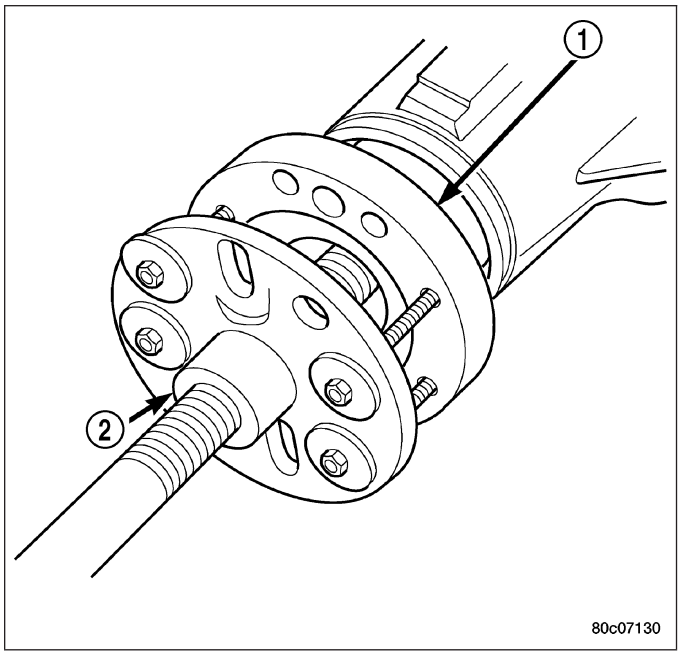
1. With vehicle in neutral, position on hoist.
2. Mark (3) companion flange (2) and pinion shaft (1) for installation reference.
3. Remove propeller shaft.



4. Remove rear brake componants to prevent any drag.
5. Rotate companion flange three or four times and verify flange rotates smoothly.
6. Measure rotating torque of the pinion (1) with a inch pound torque wrench (2) and record the reading for installation reference.

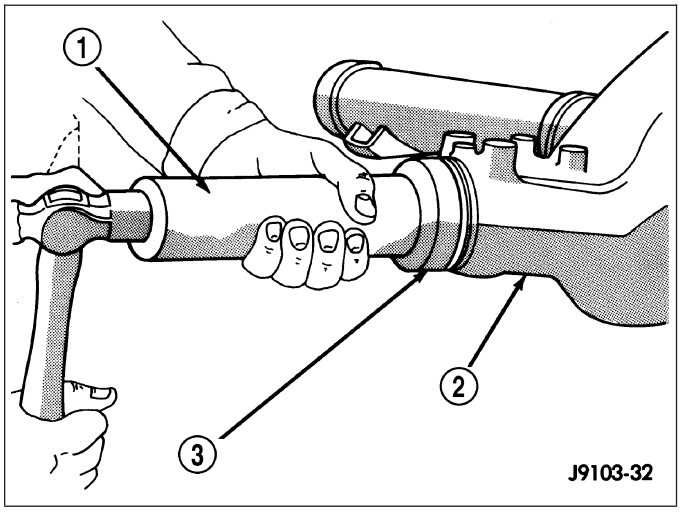


7. Install bolts into two of the threaded holes in the companion flange 180° apart.
8. Position Holder 6719 against the companion flange and install a bolt and washer into one of the remaining threaded holes. Tighten the bolts so the Holder 6719 is held to the flange.
9. Remove the pinion nut and washer.
10. Remove companion flange (1) with Remover C-452 (2).
11. Remove pinion seal with a pry tool or slide-hammer mounted screw.

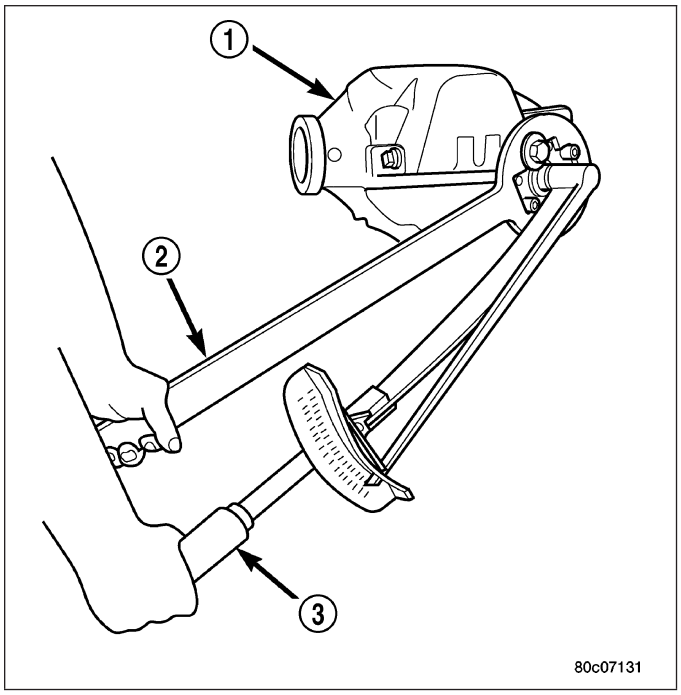


INSTALLATION

1. Apply a light coating of gear lubricant on the lip of pinion seal.
2. Install **new** pinion seal with Installer C-4076-B (3) and Handle C-4735 (1).

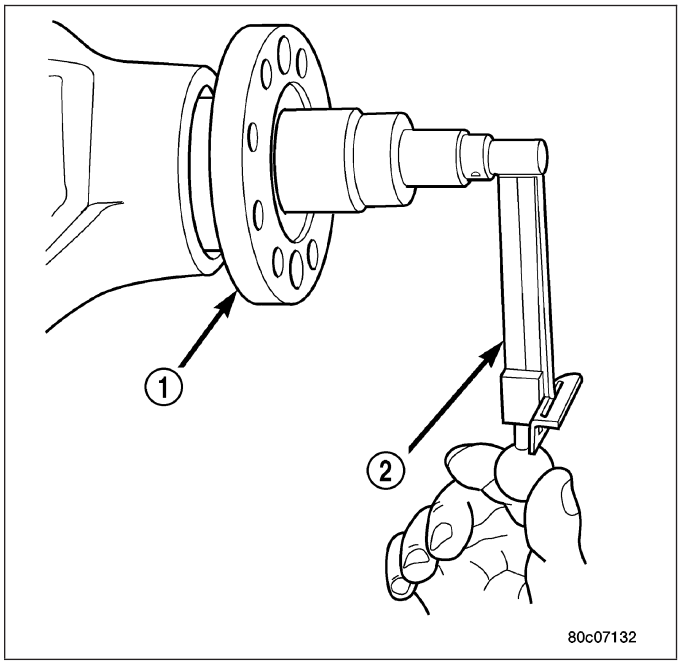


3. Install companion flange on the end of the shaft with the reference marks aligned.
4. Install bolts into two of the threaded holes in the companion flange 180° apart.
5. Position Holder 6719 (2) against the companion flange and install a bolt and washer into one of the remaining threaded holes. Tighten the bolts so Holder 6719 is held to the flange.
6. Install companion flange on pinion shaft with Installer C-3718 and Holder 6719.
7. Install pinion washer and a **new** pinion nut. The convex side of the washer must face outward.



CAUTION: Do not exceed the minimum tightening torque when installing the companion flange retaining nut at this point. Failure to follow these instructions can damage the collapsible spacer or bearings.

8. Hold companion flange with Holder 6719 (2) and tighten the pinion nut to 285 N·m (210 ft. lbs.). Rotate pinion several revolutions to ensure the bearing rollers are seated.
9. Rotate pinion flange (1) with an inch pound torque wrench (2). Rotating torque should be equal to the reading recorded during removal plus an additional 0.56 N·m (5 in. lbs.).



CAUTION: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. If rotating torque is exceeded, a new collapsible spacer must be installed. Failure to follow these instructions can damage the collapsible spacer or bearings.

10. If rotating torque is low use Holder 6719 to hold the companion flange and tighten pinion nut in 6.8 N·m (5 ft. lbs.) increments until proper rotating torque is achieved.

NOTE: The seal replacement is unacceptable if final pinion nut torque is less than 285 N·m (210 ft. lbs.).

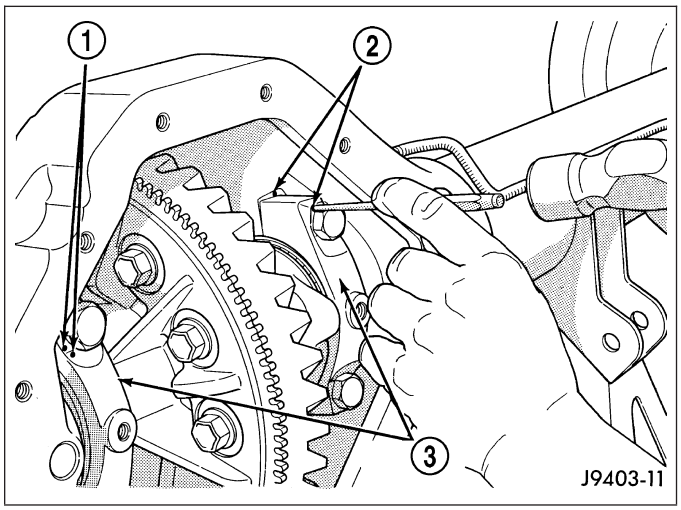
NOTE: The bearing rotating torque should be constant during a complete revolution of the pinion. If the rotating torque varies, this indicates a binding condition.

11. Install propeller shaft.
12. Install rear brake rotors componants.

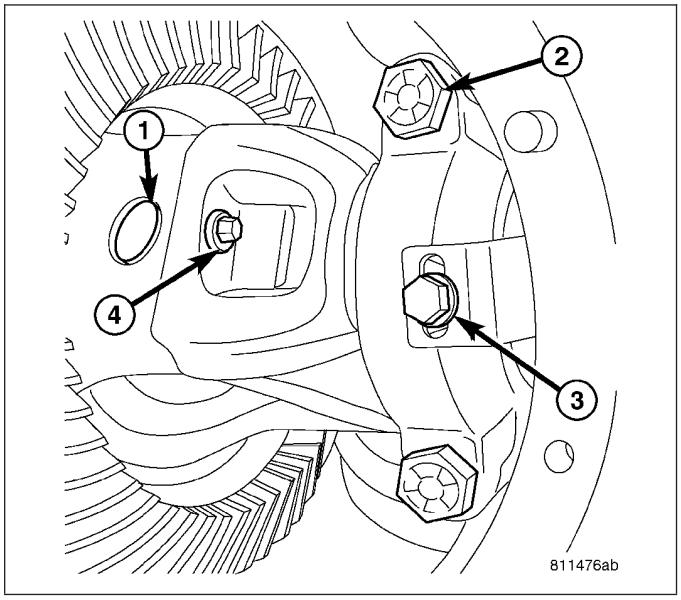
DIFFERENTIAL

REMOVAL

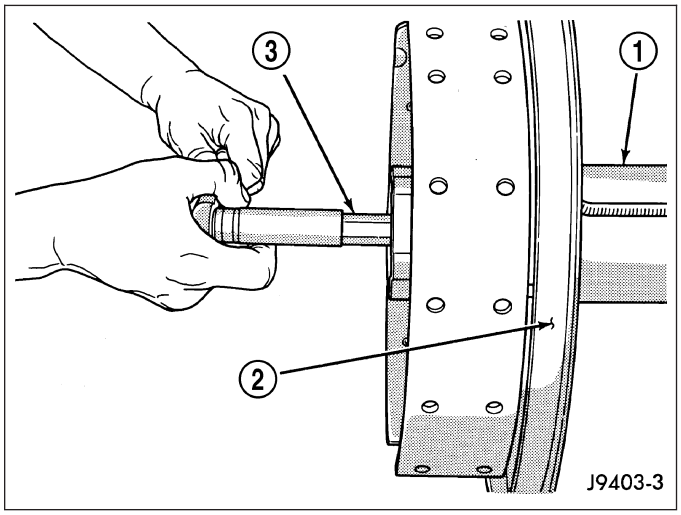
1. Remove differential cover and drain lubricant.
2. Remove axle shaft C-locks and axle shafts.
3. Remove ABS sensor from housing.
4. Mark (1) (2) bearing caps (3) for installation reference.



5. Remove bearing adjuster lock bolt (3) from bearing caps.
6. Loosen differential bearing cap bolts (2).

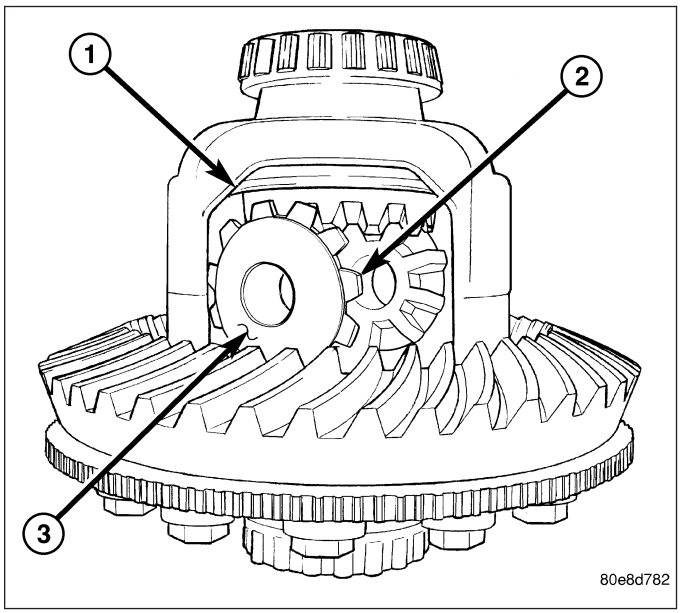


7. Loosen differential bearing adjusters through the axle tubes with Wrench C-4164 (3).
8. Hold differential case while removing bearing caps and adjusters.
9. Remove differential case and tag differential bearing cups and adjusters to indicate location.
10. Clean housing cavity with flushing oil, light engine oil or a lint free cloth.

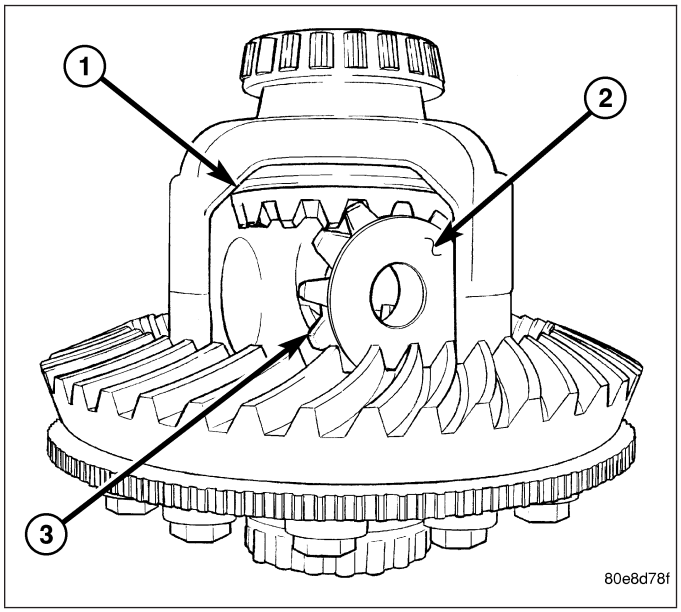


DISASSEMBLY

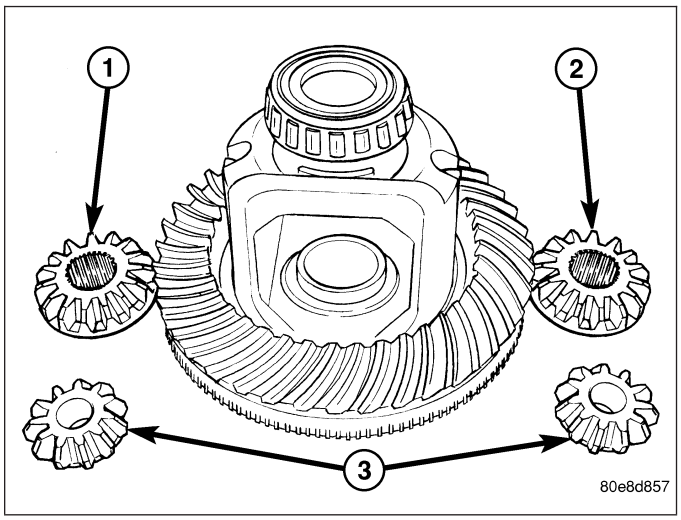
1. Rotate one pinion gear (2) with thrust washer (3) to the differential window (1) and remove gear and thrust washer.



2. Rotate remaining pinion gear (3) with thrust washer (2) to the differential window (1) and remove gear and washer.



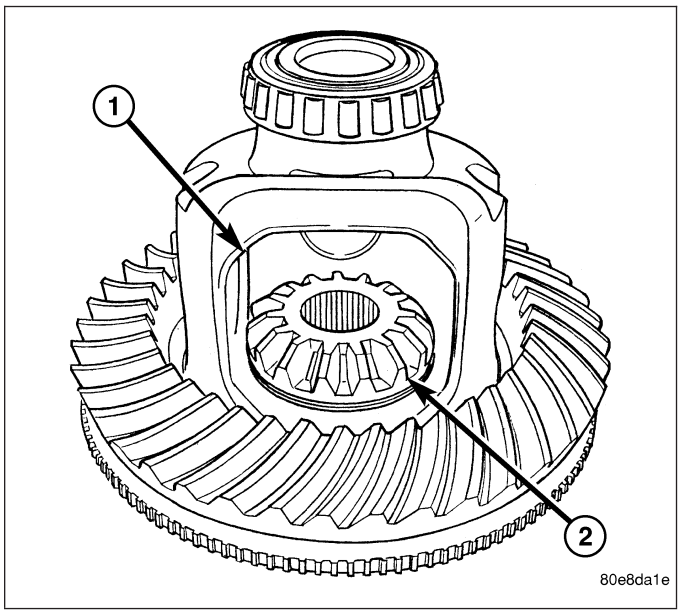
3. Remove differential side gears (1) (2) and thrust washers.



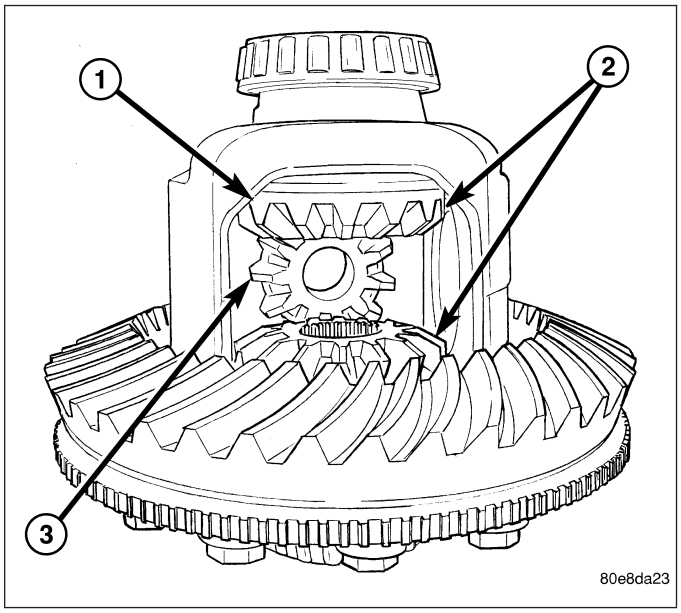
ASSEMBLY

NOTE: If same gears and thrust washers are being used, install them into their original locations.

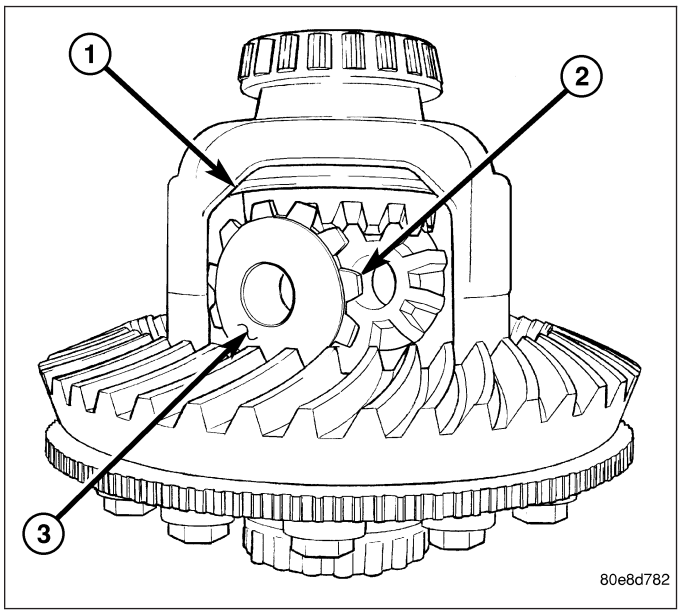
1. Lubricate all differential components with axle lubricant.
2. Install differential side gears (2) and thrust washers throught differential window (1).



3. Install first pinion gear (3) with thrust washer into differential window (1) and side gears (2). Rotate pinion gear into the case.



4. Install remaining pinion gear (2) and thrust washer (3). Rotate gears to align hole in the pinion gears with hole in the differential case.
5. Slide pinion shaft into the case and through the pinion gears to align the gears.

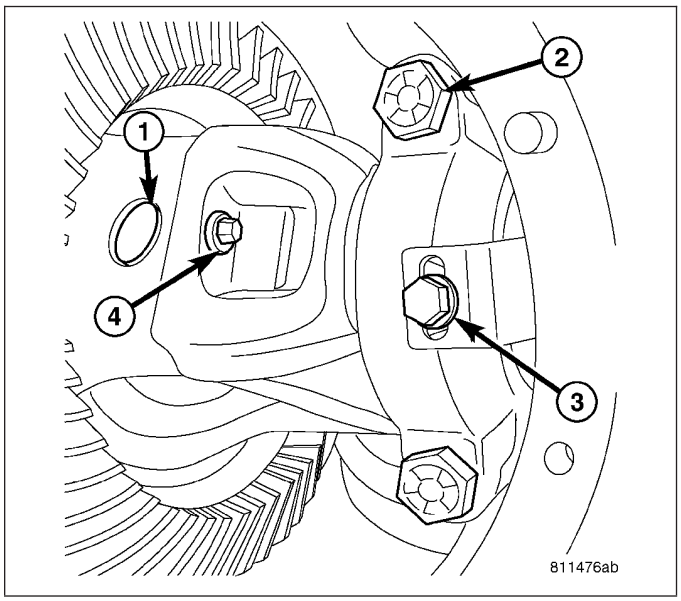


INSTALLATION

1. Apply a coat of hypoid gear lubricant to differential bearings, bearing cups and threaded adjusters.

NOTE: Grease can be used to keep the adjusters in position.

2. Install differential assembly into the housing.
3. Install differential bearing caps (2) in their original locations.
4. Install bearing cap bolts and tighten upper bolts to 14 N·m (10 ft. lbs.). Tighten lower bolts finger-tight until bolt head is seated.
5. Perform differential bearing preload and adjustment procedure.
6. Tighten bearing cap bolts in a criss-cross pattern to 95 N·m (70 ft. lbs.).
7. Install adjuster locks (3) on bearing caps and tighten to 10 N·m (90 in. lbs.).
8. Install axle shafts.
9. Install differential cover.

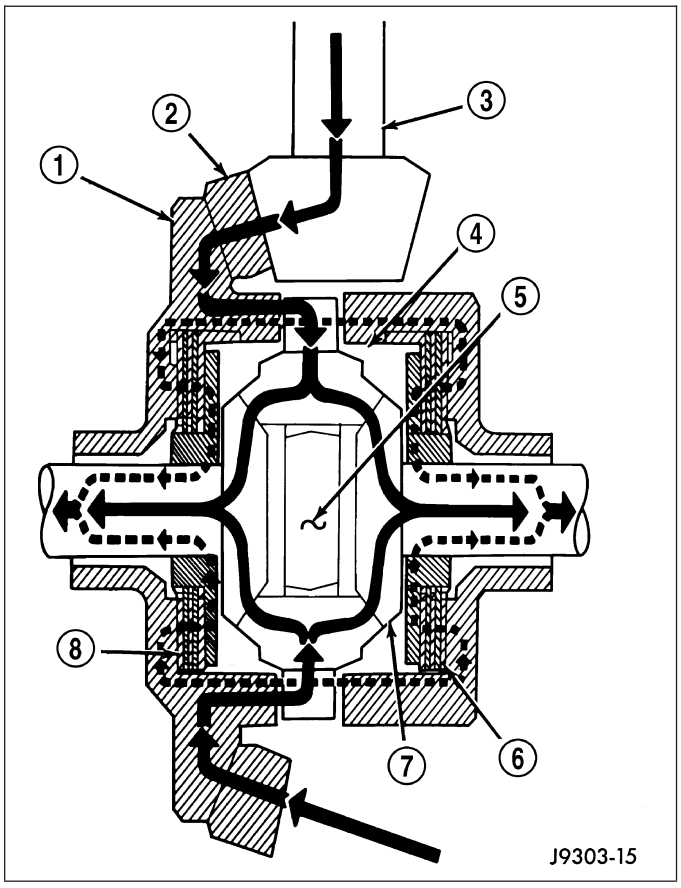


DIFFERENTIAL-TRAC-LOK

OPERATION

This differentials clutches are engaged by two concurrent forces. The first being the preload force exerted through Belleville spring washers within the clutch packs (6) (8). The second is the separating forces generated by the side gears (7) as torque is applied through the ring gear (2).

This design provides the differential action needed for turning corners and for driving straight ahead during periods of unequal traction. When one wheel looses traction, the clutch packs transfer additional torque to the wheel having the most traction. This differential resist wheel spin on bumpy roads and provide more pulling power when one wheel looses traction. Pulling power is provided continuously until both wheels loose traction. If both wheels slip due to unequal traction, Trac-lok® operation is normal. In extreme cases of differences of traction, the wheel with the least traction may spin.



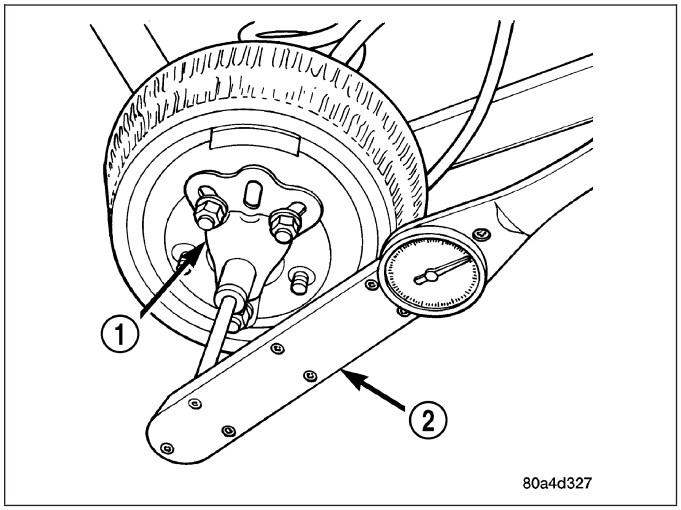
DIAGNOSIS AND TESTING

DIFFERENTIAL-TRAC-LOK

The most common problem is a chatter noise when turning corners. Before removing the unit for repair, drain, flush and refill the axle with the specified lubricant. Add a container of Mopar Limited Slip Additive after repair service or during a lubricant change.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure-eight turns. This maneuver will pump lubricant through the clutches. This will correct the condition in most instances. If the chatter persists, clutch damage could have occurred.

The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.

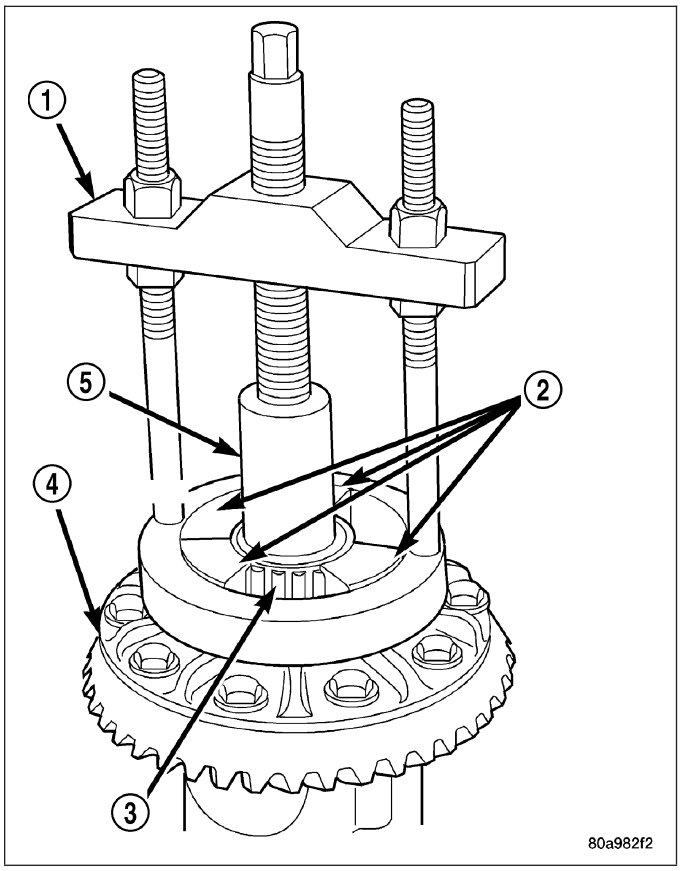


1. Place blocks in front and rear of both front wheels.
2. Raise one rear wheel until it is completely off the ground.
3. Engine off, transmission in neutral, and parking brake off.
4. Remove wheel and bolt Special Tool 6790 (1) or equivalent tool to studs.
5. Use torque wrench (2) on special tool to rotate wheel and read rotating torque.
6. If rotating torque is less than 41 N·m (30 ft. lbs.) or more than 271 N·m (200 ft. lbs.) on either wheel the unit must be replaced.

BEARINGS-DIFFERENTIAL CASE

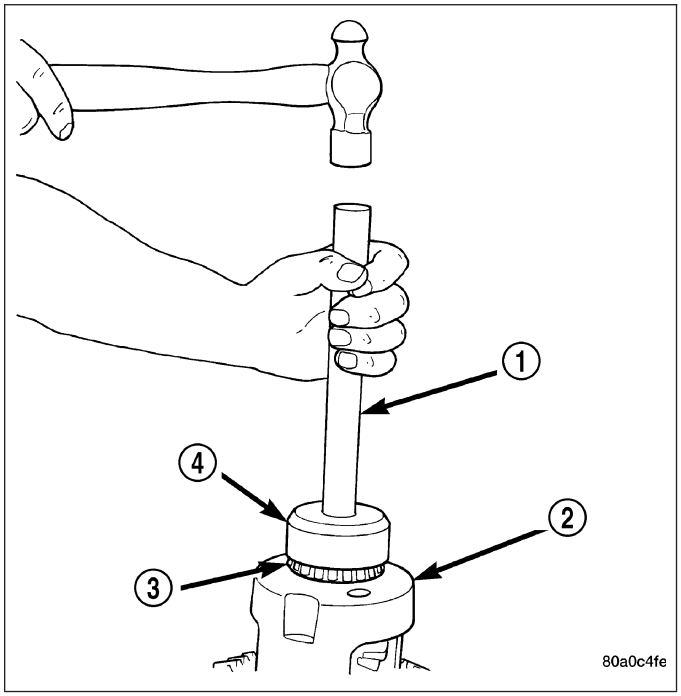
REMOVAL

1. Remove differential case (4).
2. Remove differential bearings (3) with Puller C-293-PA (1) and Adapters C-293-48 (2) and Plug SP-3289 (5).



INSTALLATION

1. Install differential side bearings (3) with Installer C-4340 (4) and Handle C-4171 (1).
2. Install differential case in axle.

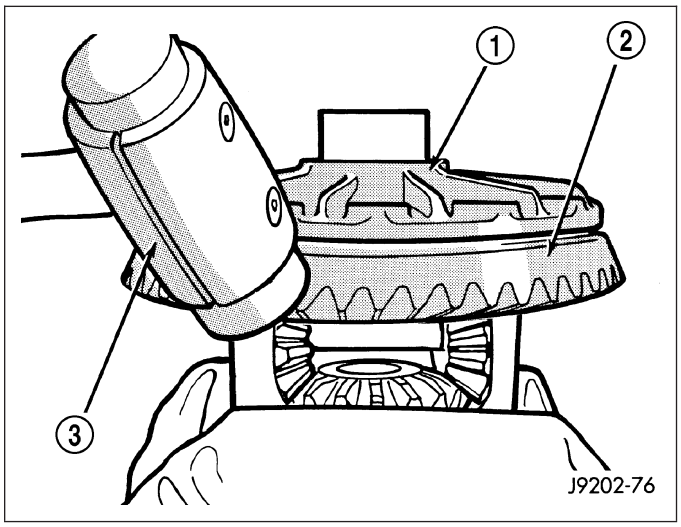


GEAR-PINION/RING/TONE RING

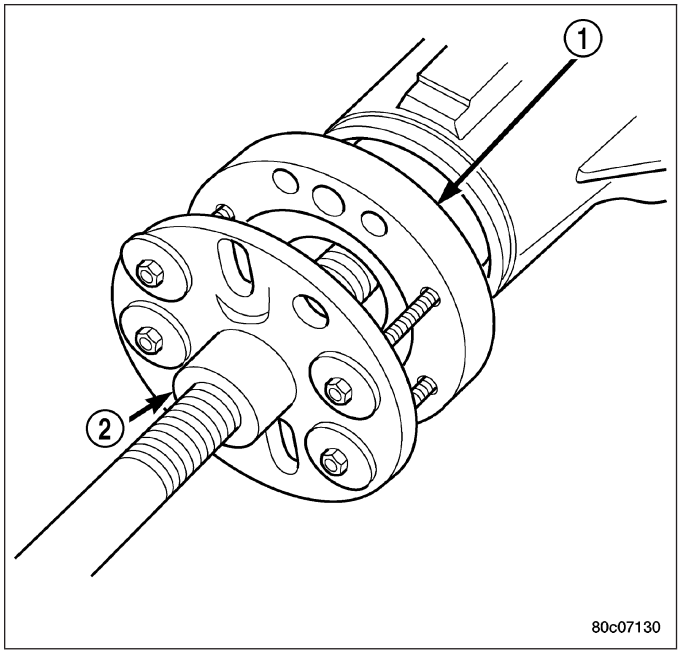
REMOVAL

NOTE: The ring gear and pinion are serviced in a matched set. Never replace one gear without replacing the other matching gear.

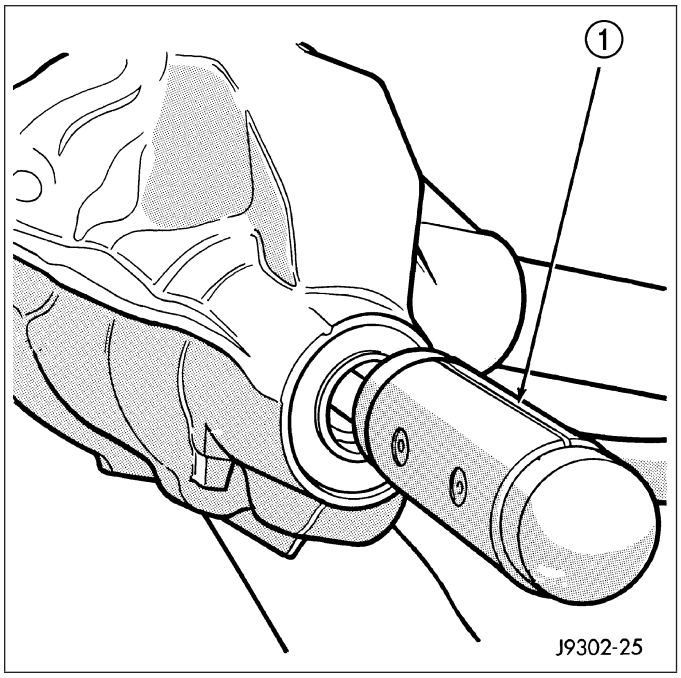
1. Remove differential from the axle housing.
2. Mark the companion flange and propeller shaft for installation alignment.
3. Disconnect propeller shaft from the companion flange and tie propeller shaft to underbody.
4. Place differential case (1) in a suitable vise with soft metal jaw protectors.
5. Remove ring gear (2) bolts from the differential case.
6. Drive ring gear off the differential case with a soft hammer (3).



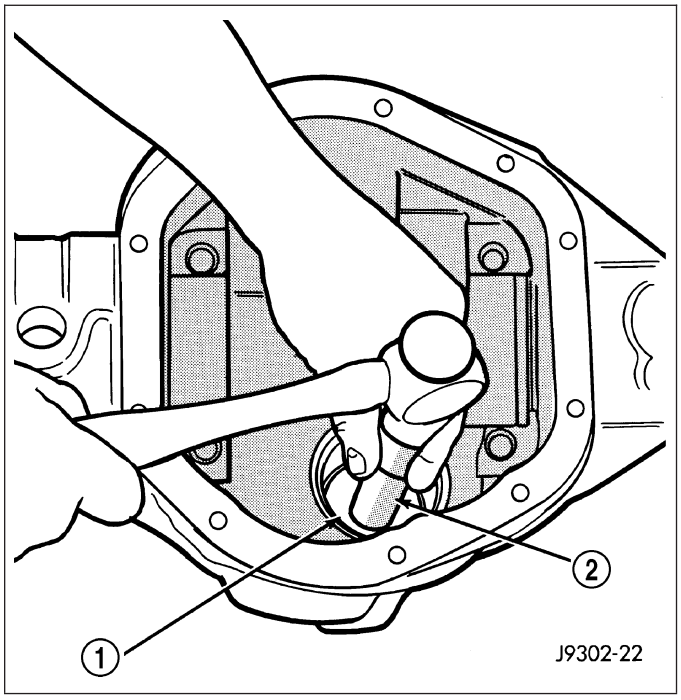
7. Install bolts into two of the threaded holes in the companion flange 180° apart.
8. Position Holder 6719 against the companion flange and install a bolt and washer into one of the remaining threaded holes. Tighten the bolts so the Holder 6719 is held to the flange.
9. Hold companion flange with Holder 6719 and remove companion flange nut and washer.
10. Remove the companion flange (1) with Remover C-452 (2).



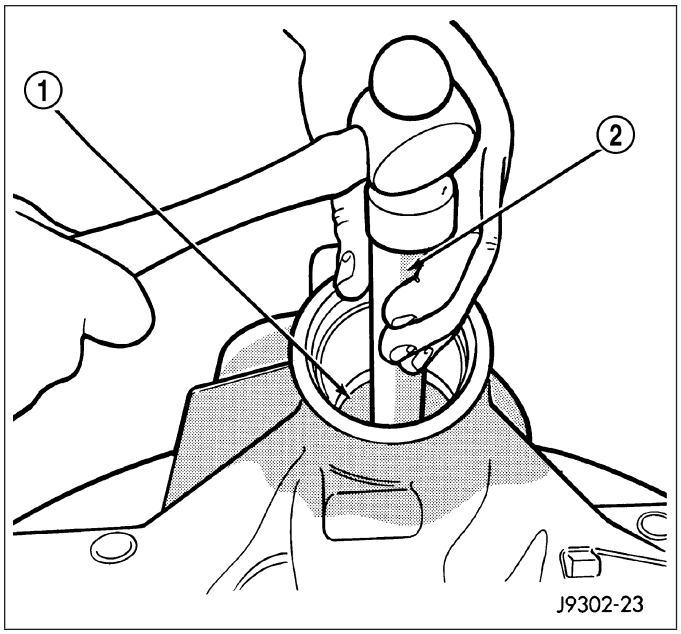
11. Remove pinion from housing with a soft hammer (1).
12. Remove pinion seal with a pry tool or slide-hammer mounted screw.
13. Remove oil slinger if equipped and front pinion bearing.



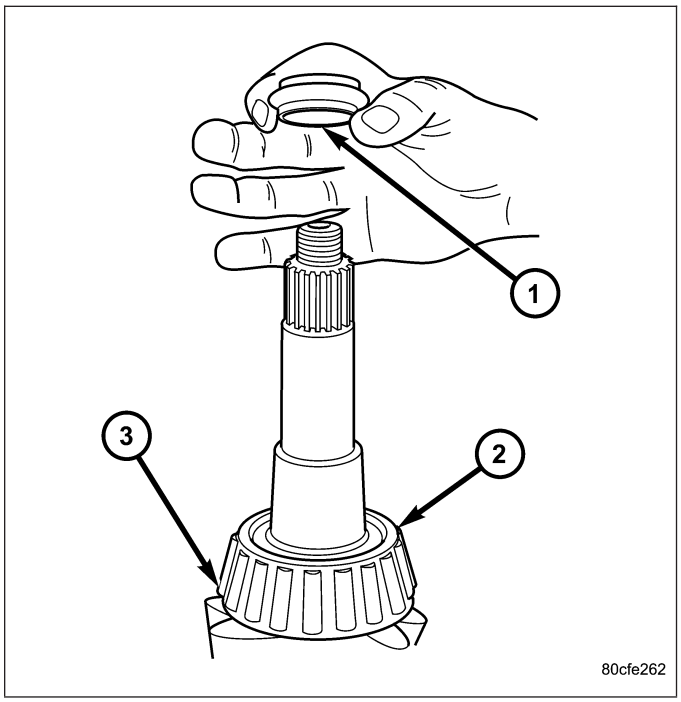
14. Remove front pinion bearing cup with Remover C-4345 (1) and Handle C-4171 (2).



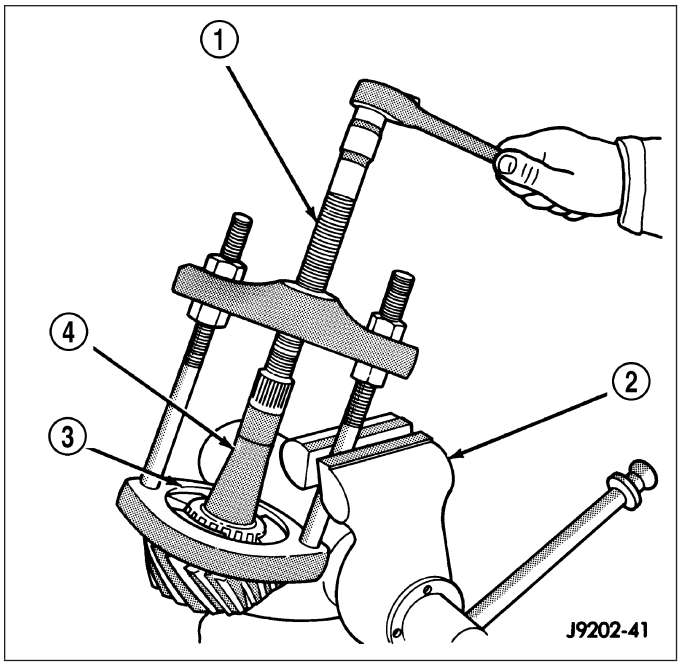
15. Remove rear bearing cup from housing with Remover C-4307 (1) and Handle C-4171 (2).



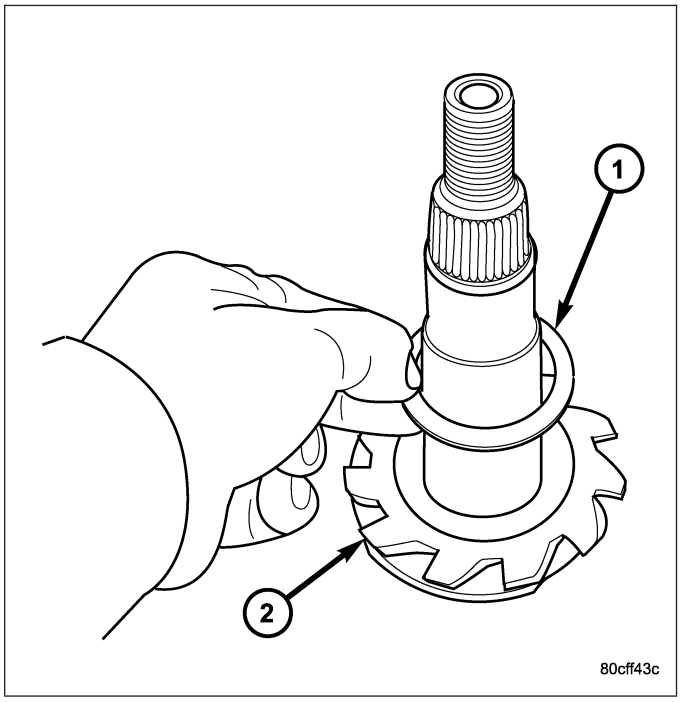
16. Remove collapsible preload spacer (1).



17. Remove rear bearing from pinion (4) with Puller/ Press C-293-PA (1) and Adapters C-293-47 (3).



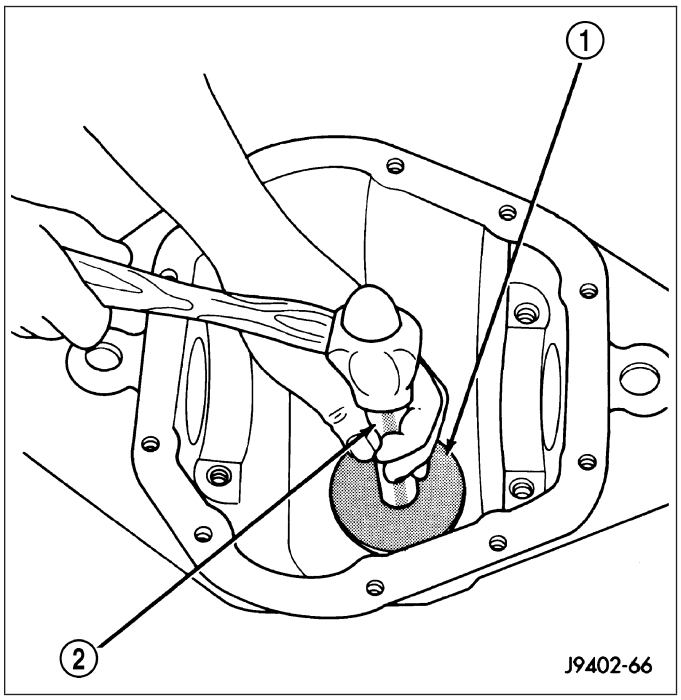
18. Remove pinion depth shim (1) from the pinion shaft (2) and record shim thickness.



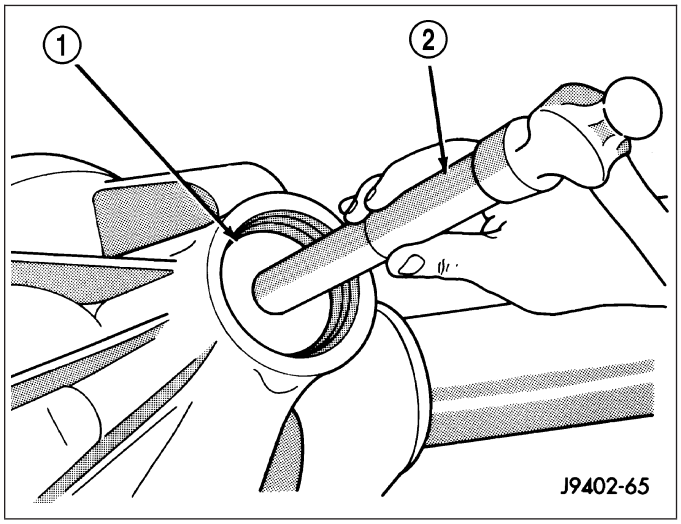
INSTALLATION

NOTE: The ring gear and pinion are serviced in a matched set. Never replace one gear without replacing the other matching gear. If ring and pinion gears or bearings are replaced, Refer to Adjustments for Pinion Gear Depth Setting.

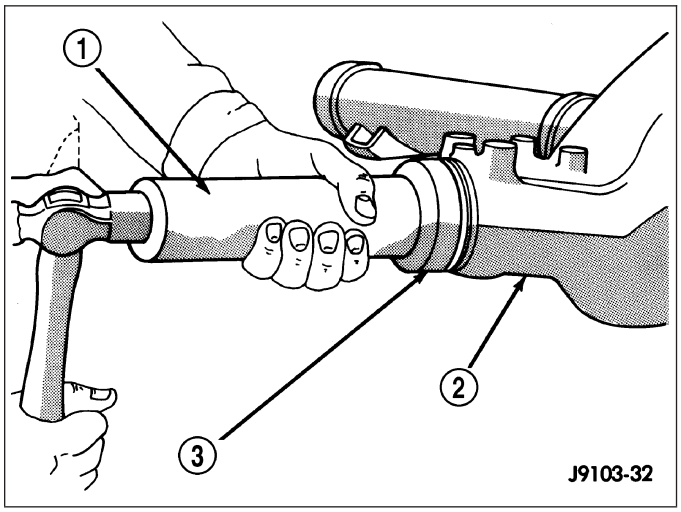
1. Apply Mopar Door Ease or equivalent stick lubricant to outside surface of pinion bearing cups.
2. Install rear pinion bearing cup with Installer C-4308 (1) and Handle C-4171(1).



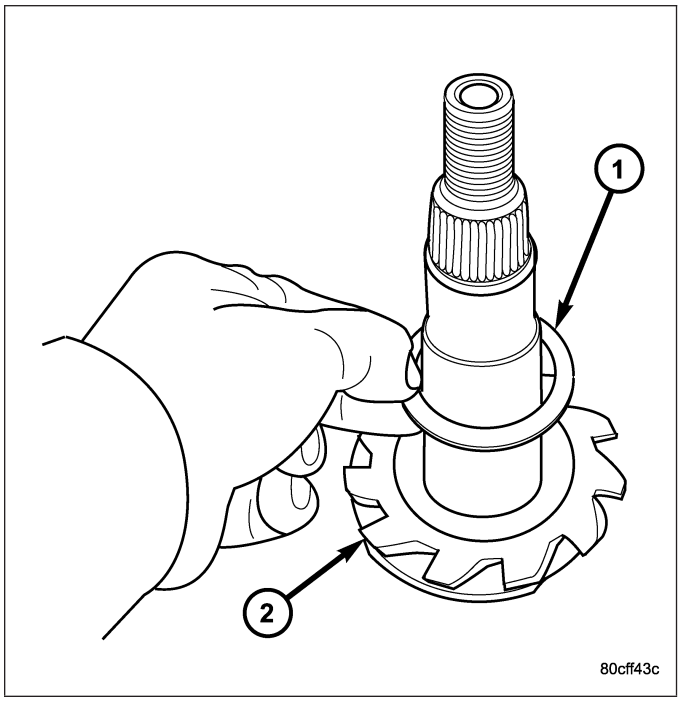
3. Install front pinion bearing cup with Installer D-130 (1) and Handle C-4171(2).



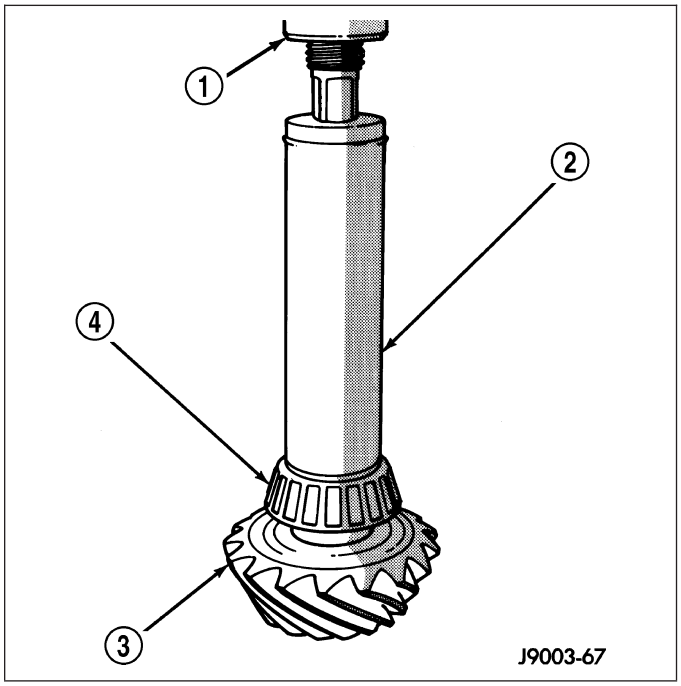
4. Lubricate and install front pinion bearing and oil slinger if equipped.
5. Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-4076-B (3) and Handle C-4735-1(1).



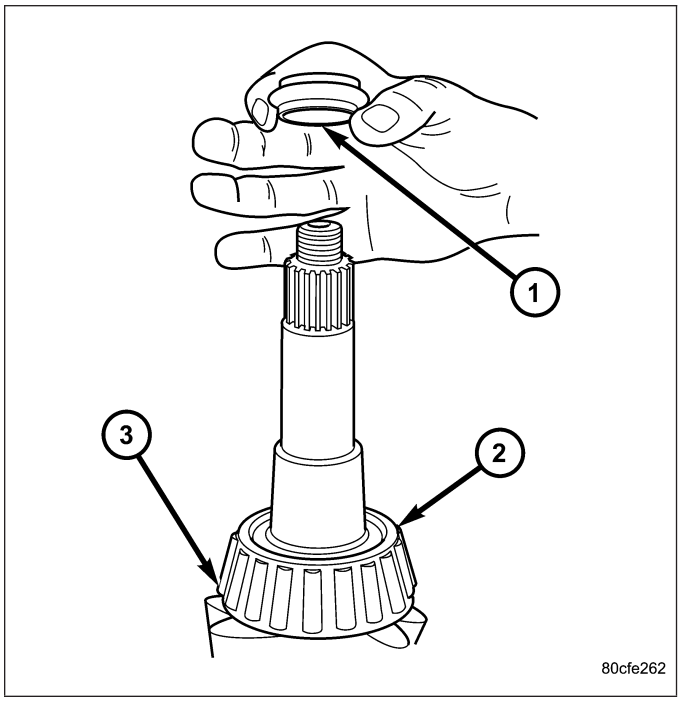
6. Install pinion depth shim (1) on the pinion shaft (2).



7. Install rear pinion bearing (4) and slinger if equipped, on the pinion (3) with Installer 6448 (2) and a press (1).



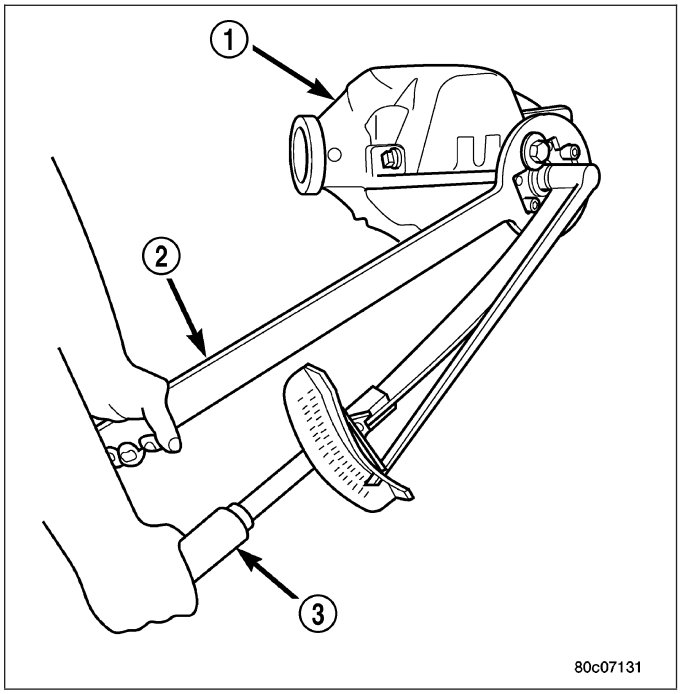
8. Install a **new** collapsible spacer (1) on the pinion gear shaft.
9. Lubricate rear pinion bearing (2) and install pinion into the housing.



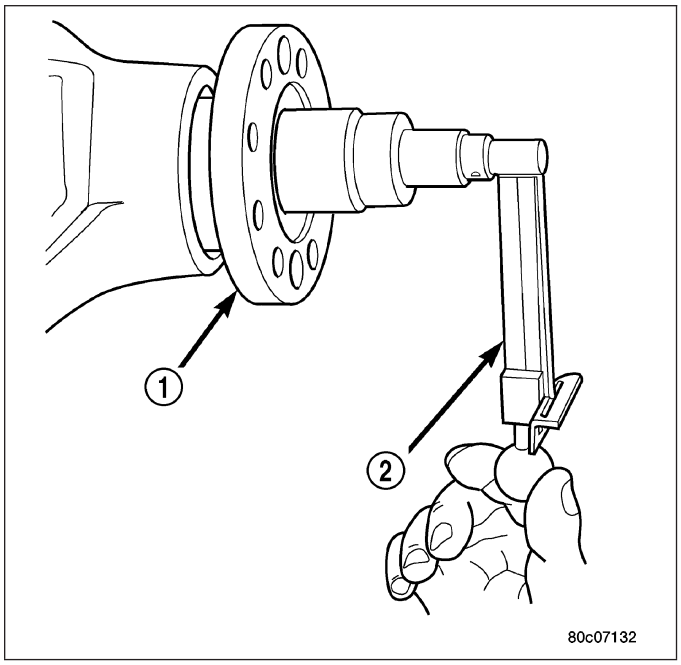
10. Install companion flange with Installer C-3718 and Holder 6719 (2).
11. Install bolts into two of the threaded holes in the companion flange 180° apart.
12. Position Holder 6719 (2) against the companion flange and install a bolt and washer into one of the remaining threaded holes. Tighten the bolts so the Holder 6719 is held to the flange.
13. Install the companion flange washer and a new nut on the pinion and tighten the pinion nut until there is zero bearing end-play.

CAUTION: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed.

14. With a torque wrench (3) tighten the pinion nut to 285 N·m (210 ft. lbs.).



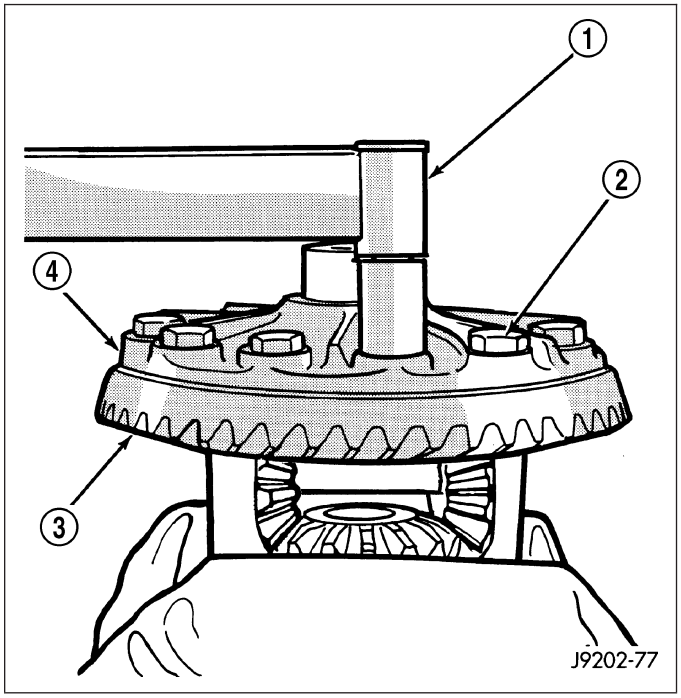
15. Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the desired rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer.
16. Check pinion rotating torque with an inch pound torque wrench. The pinion rotating torque should be:
    Original Bearings: 1 to 3 N·m (10 to 20 in. lbs.)
    New Bearings: 1.7 to 5 N·m (15 to 35 in. lbs.)



17. Position exciter ring on differential case. With a brass drift, slowly and evenly tap the exciter ring into position.
18. Position ring gear (3) on the differential case (4) and start two ring gear bolts (2). This will provide case-to-ring gear bolt hole alignment.
19. Invert the differential case in the vise.
20. Install **new** ring gear bolts and alternately tighten to 102 N·m (75 ft. lbs.).

CAUTION: Do not reuse ring gear bolts. Failure to follow these instruction will result in bolts fracturing causing damage.

21. Install differential in housing and verify gear mesh, backlash and contact pattern.
22. Install differential cover and fill with gear lubricant.
23. Install propeller shaft with reference marks aligned.



REAR AXLE - 9 1/4

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REAR AXLE - 9 1/4

DIAGNOSIS AND TESTING

REAR AXLE - 9 1/4

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, incorrect pinion depth, tooth contact, worn/damaged gears, or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak-noise range. If the noise stops or changes greatly check for:

- Insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side and pinions gears, usually do not cause noise during straight-ahead driving, when the gears are unloaded. The side gears are loaded during turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

Bearing noise can be either a whining or a growling sound.

Pinion bearings have a constant high pitch noise, because it rotates at a faster rate. This noise changes with vehicle speed. If noise is heard under a load, the rear pinion bearing is the source. If noise is heard during a coast, the front pinion bearing is the source.

Differential bearings usually produce a low pitch noise. The differential bearing noise is constant and varies only with vehicle speed.

Axle shaft bearing noise generally changes when the bearings are loaded. Turn vehicle sharply to the left and the right during a road test. This will load and unload the bearings and change the noise level. If axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 m.p.h.

LOW SPEED KNOCK

Low speed knock is generally caused by:

- Worn U-joints or C/V joints.
- Worn side-gear thrust washers
- Worn pinion shaft bore.

VIBRATION

Vibration at the rear of the vehicle is usually caused by:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out of balance wheels.
- Loose wheel lug nuts.
- Worn U-joints or C/V joints.
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion yoke run out.
- Bent axle shaft(s).

Check for loose or damaged front-end components or engine/transmission mounts. These components can contribute to what appears to be an axle vibration. Also look at engine accessories, brackets and drive belts.

NOTE: All driveline components should be examined before starting any repair.

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear or the clutch engaged can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U-joints or C/V joints.
- Loose spring mounts.
- Loose pinion gear nut and yoke.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

To determined the source of a snap/clunk noise, raise vehicle on a hoist with the wheels free to rotate. Have a helper shift the transmission into gear and listen for the noise.

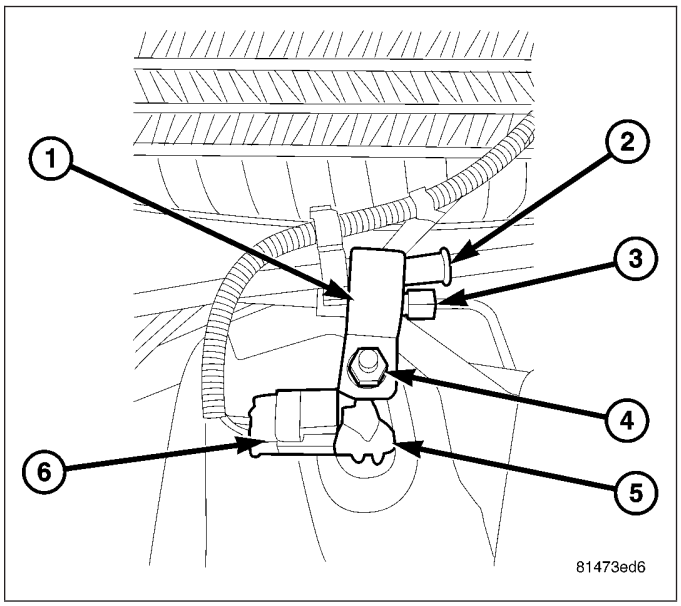
DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brinelled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace the broken shaft after correcting tube mis-alignment.
	2 Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper adjustment of the differential bearings.	1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored yoke.	5. Replace yoke and seal.
	6. Axle cover not properly sealed.	6. Remove, clean, and re-seal cover.

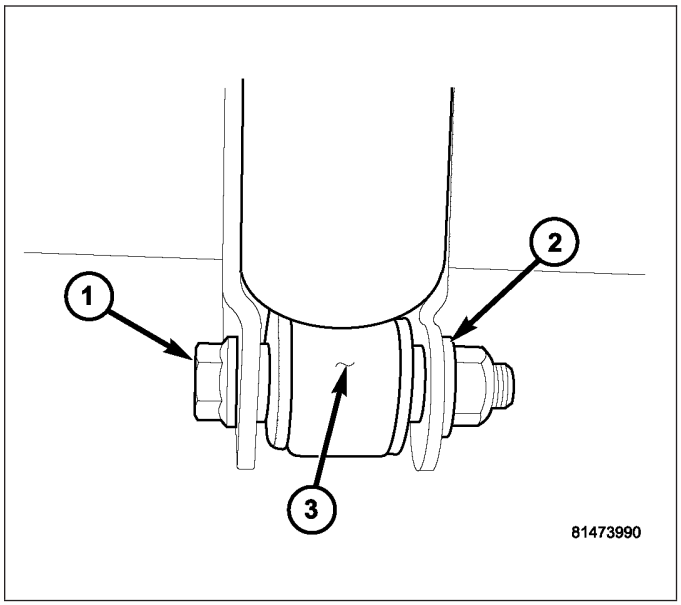
Condition	Possible Causes	Correction
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Re-adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Re-adjust ring gear backlash.
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern. Adjust backlash or pinion depth.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

REMOVAL

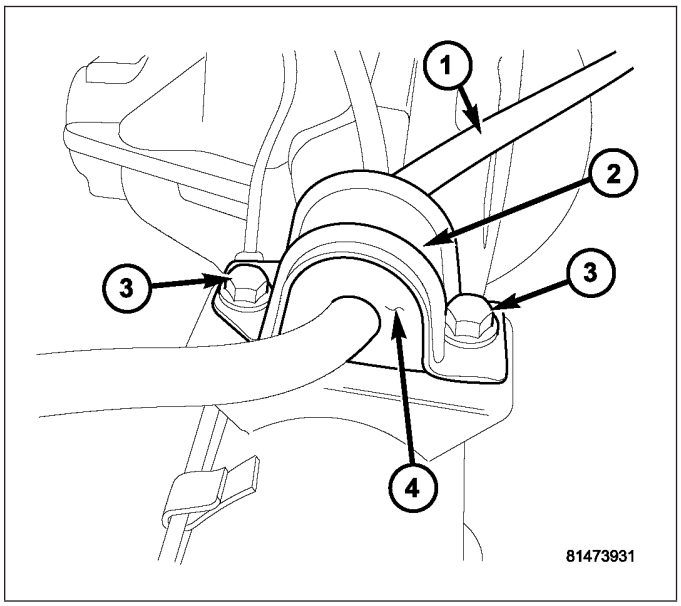
1. With vehicle in neutral, position on hoist.
2. Position a lift under axle and secure axle to lift.
3. Remove the wheels and rear brake componants.
4. Remove ABS sensor (5) from the differential housing.
5. Disconnect the brake hose at the axle junction block.
6. Disconnect the vent hose from the axle shaft tube.
7. Mark the propeller shaft and companion flange for installation alignment reference.
8. Remove propeller shaft.



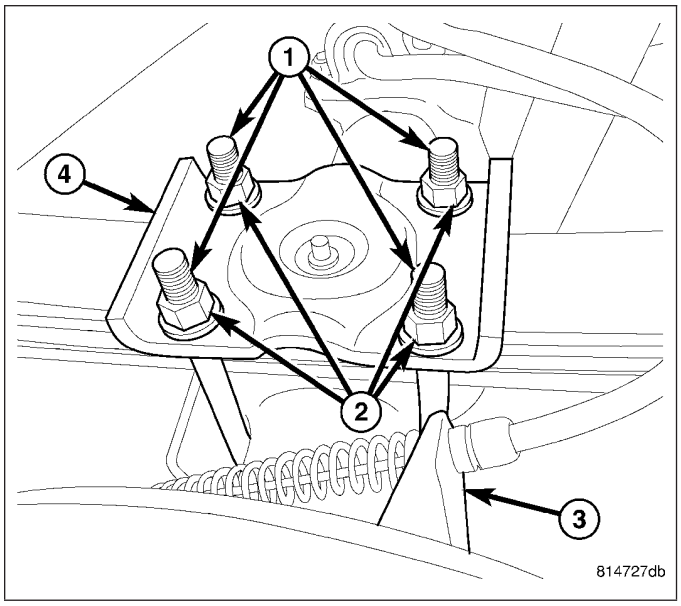
9. Remove shock absorbers (3) axle mounting (2) bolts (1).



10. Remove stabilizer bar (1) retainer clamp bolts (3) and retainer clamps (2) from the axle.

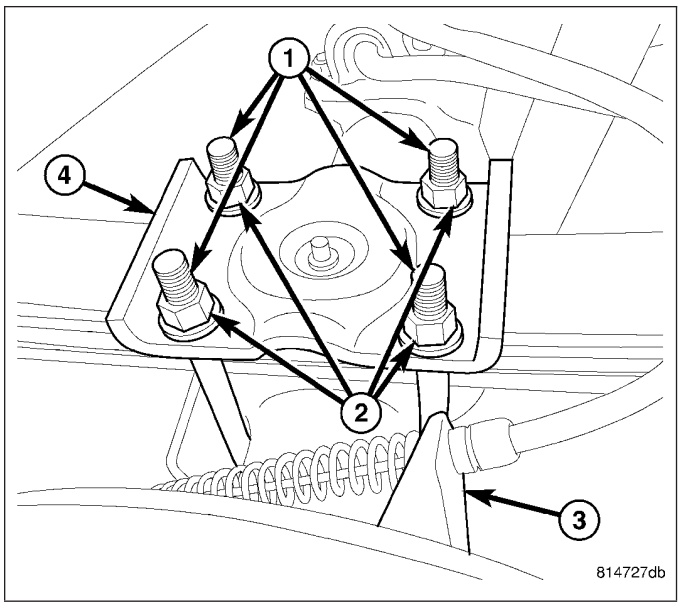


11. Remove spring clamps nuts (2) and spring plates (4).
12. Remove the axle from the vehicle.

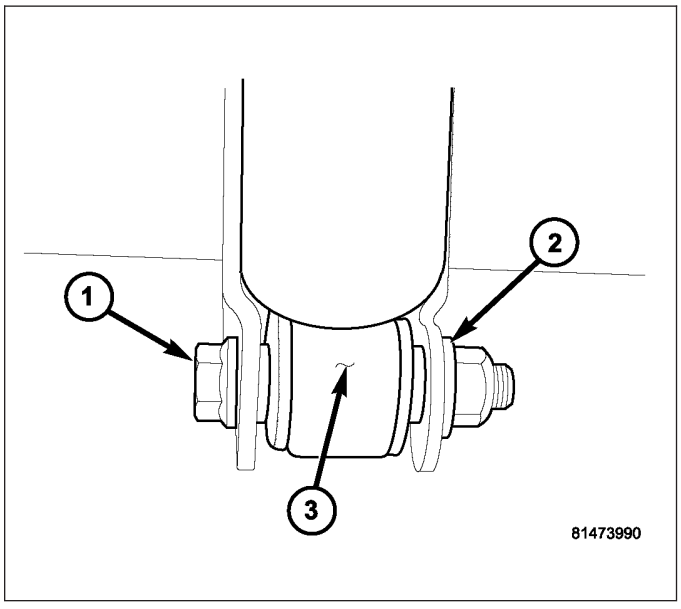


INSTALLATION

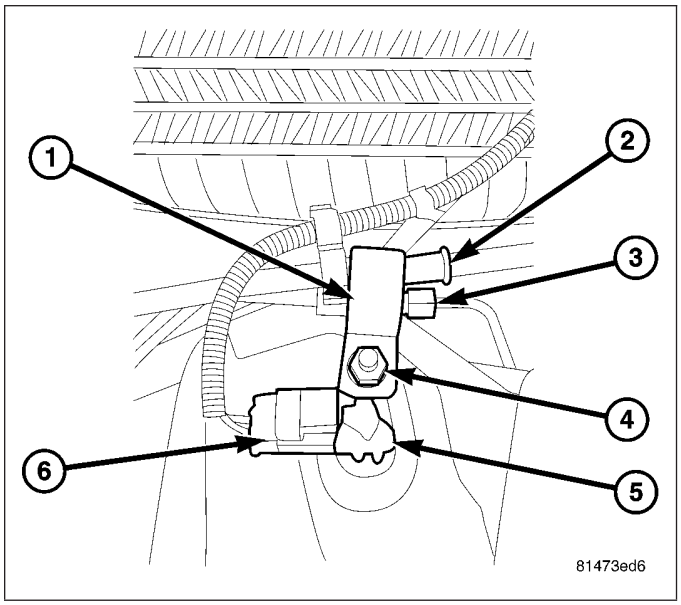
1. Raise axle with lifting device and align to the leaf spring centering bolts.
2. Install spring clamps (1) and spring plates (4). Tighten the U-bolt nuts (2) to 149 N·m (110 ft. lbs.).



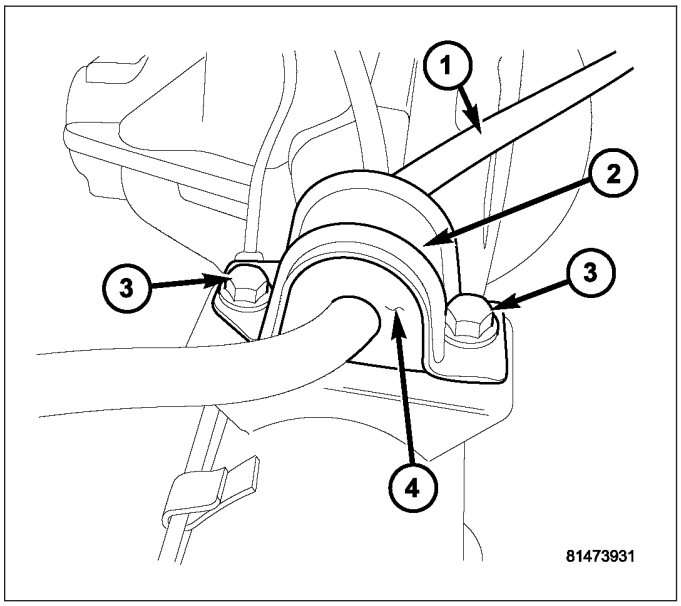
3. Install shock absorbers (3) and tighten nuts (2) to 102 N·m (75 ft. lbs.).



4. Install ABS sensor (5) into the differential housing.

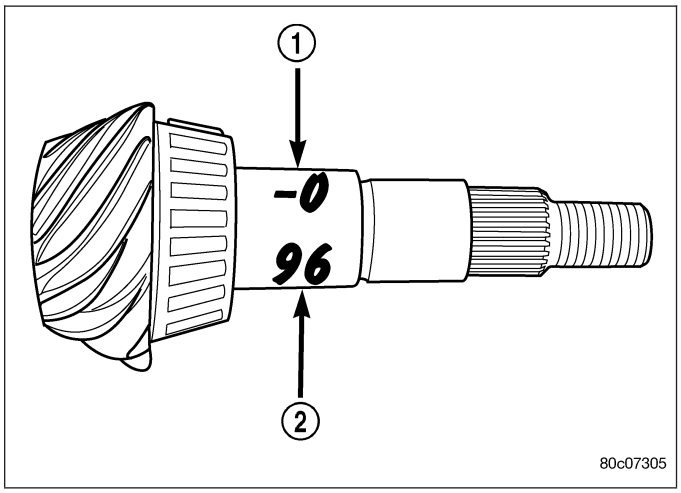


5. Install rear brake and park brake componants.
6. Connect brake hose to axle junction block.
7. Install stabilizer bar and center it with equal spacing on both sides. Tighten retainer clamp (2) bolts (3) to 61 N·m (45 ft. lbs.).
8. Install axle vent hose.
9. Install propeller shaft with reference marks aligned. Tighten bolts to 108 N·m (80 ft. lbs.).
10. Add gear lubricant, if necessary.



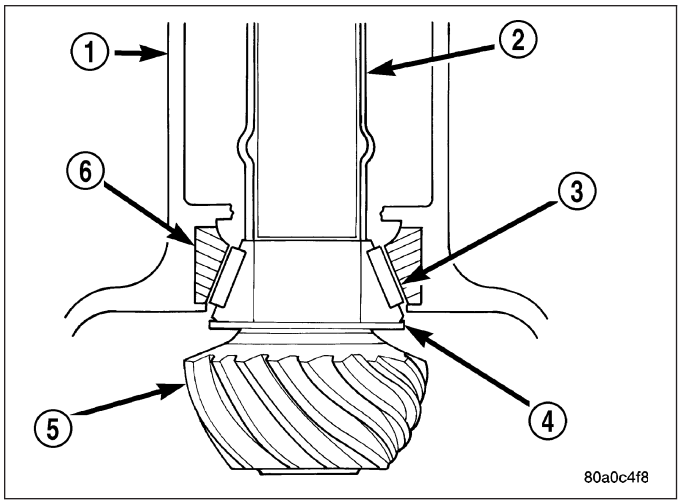
ADJUSTMENTS

Ring gear and pinion are supplied as matched sets. Identifying numbers for the ring gear and pinion are painted onto the pinion gear shaft and the side of the ring gear. A plus + number, minus – number or zero 0 along with the gear set sequence number 01 to 99 is on each gear. This first number (1) is the amount in thousandths of an inch the depth varies from the standard depth setting of a pinion marked with a zero 0. The next two numbers (2) are the sequence number of the gear set. The standard depth provides the best teeth contact pattern.



Compensation for pinion depth variance is achieved with select shims (4) located behind the rear pinion bearing (3).

If installing a new gear, note the depth variance number of the original and replacement pinion. Add or subtract this number from the original depth shim/oil slinger to compensate for the difference in the depth variances. The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim.



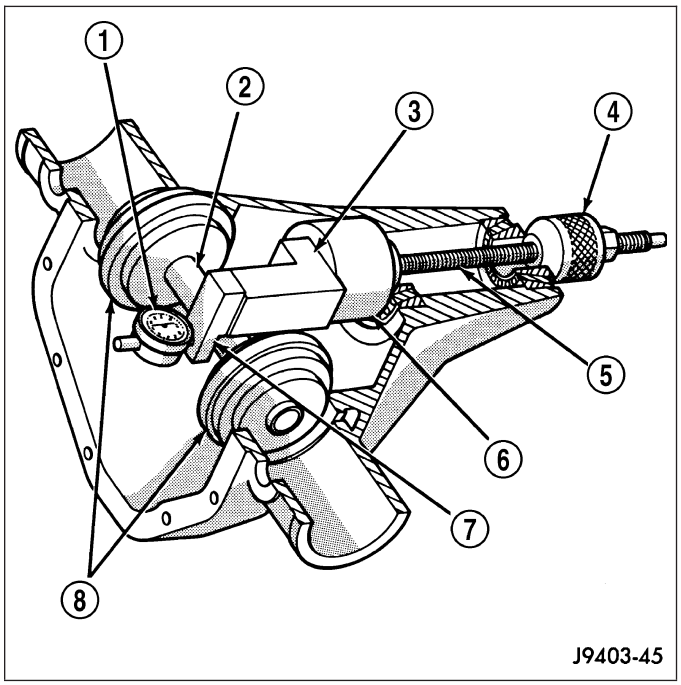
Pinion Gear Depth Variance Chart: Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

PINION GEAR DEPTH VARIANCE

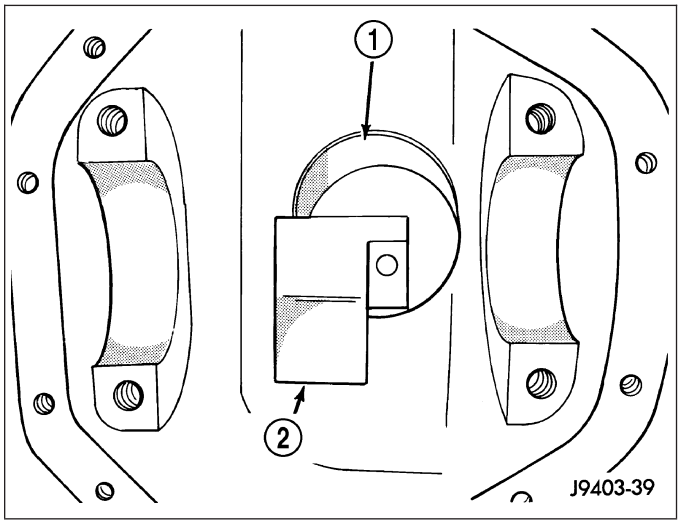
Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

PINION DEPTH MEASUREMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the housing. Take measurements with Pinion Gauge Set and Dial Indicator C-3339 (1).



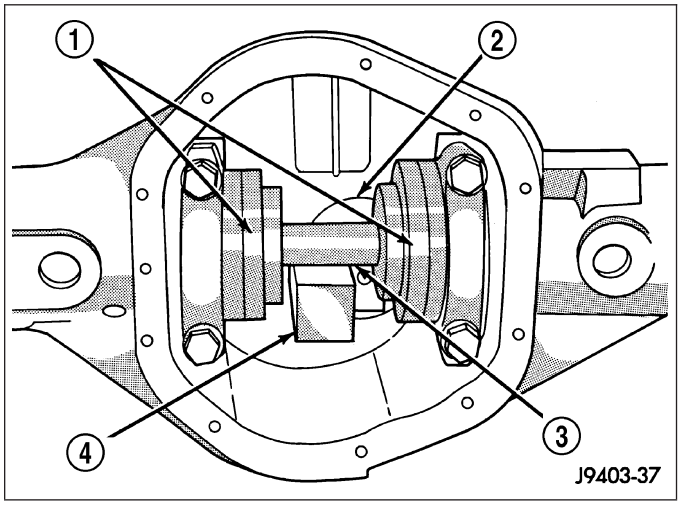
1. Assemble Pinion Height Block 6739 (1) Pinion Block 8542 (1) and rear pinion bearing onto Screw 6741.
2. Insert assembled height gauge components, rear bearing, and screw into the housing through pinion bearing cups.
3. Install front pinion bearing and Cone-Nut 6740 on screw. Tighten cone-nut on screw until Torque To Rotate screw is 1.7 N·m (15 in. Lbs.).



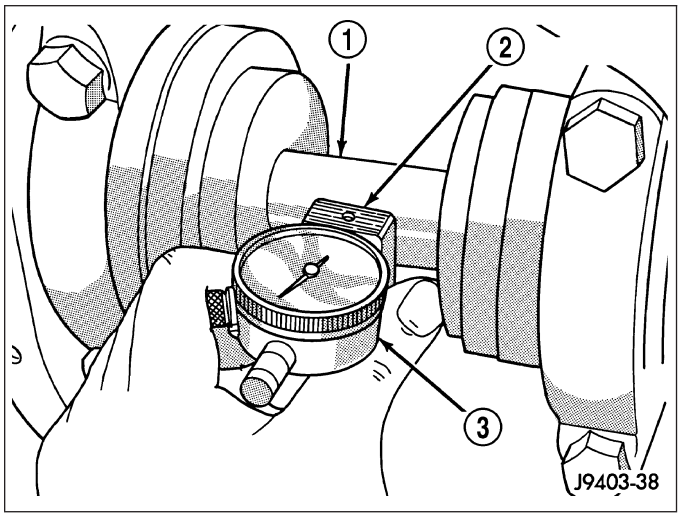
4. Place Arbor Disc 8541 (1) on Arbor D-115-3 (3) in position in the housing side bearing cradles. Install differential bearing caps on arbor discs and tighten cap bolts to 41 N·m (30 ft. lbs.).

NOTE: Arbor Discs 8541 has different step diameters to fit other axles. Choose proper step for axle being serviced.

5. Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.
6. Place Scooter Block/Dial Indicator in axle housing so dial probe and scooter block are flush against the pinion height block. Hold scooter block in place and zero the dial indicator. Tighten dial indicator face lock screw.



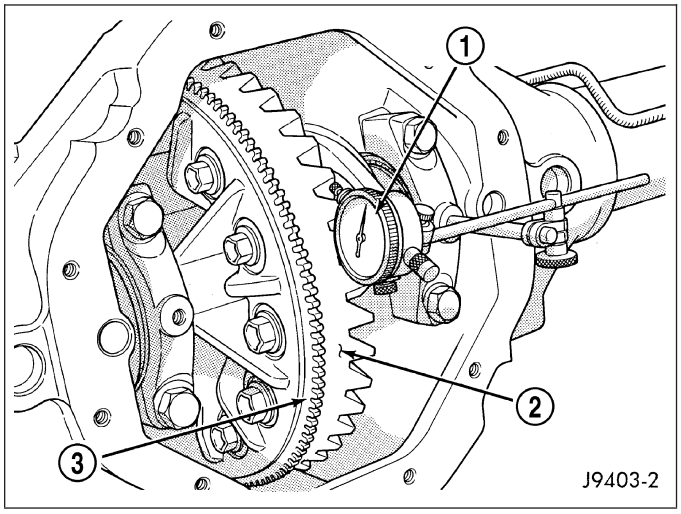
7. Slide the dial indicator (3) probe across the gap between the pinion height block and the arbor bar (1) with the scooter block (2) against the pinion height block. Move the dial probe to the crest of the arbor bar and record the highest reading.
8. Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number marked on the shaft of the pinion. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.



DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

The following must be considered when adjusting bearing preload and gear backlash:

- The maximum ring gear backlash variation is 0.076 mm (0.003 in.).
- Mark the gears so the same teeth are meshed during all backlash measurements.
- Maintain the torque while adjusting the bearing preload and ring gear backlash.
- Excessive adjuster torque will introduce a high bearing load and cause premature bearing failure. Insufficient adjuster torque can result in excessive differential case free-play and ring gear noise.
- Insufficient adjuster torque will not support the ring gear correctly and can cause excessive differential case free-play and ring gear noise.



NOTE: The differential bearing cups will not always immediately follow the threaded adjusters as they are moved during adjustment. To ensure accurate bearing cup responses to the adjustments:

- **Maintain the gear teeth engaged (meshed) as marked.**
- **The bearings must be seated by rapidly rotating the pinion gear a half turn back and forth.**
- **Do this five to ten times each time the threaded adjusters are adjusted.**

1. Through the axle tube use Wrench C-4164 to adjust each threaded adjuster inward until the differential bearing free-play is eliminated. Allow some ring gear backlash approximately 0.25 mm (0.01 in.) between the ring and pinion gear. Seat the bearing cups with the procedure described above.
2. Install dial indicator (1) and position the plunger against the drive side of a ring gear (2) tooth. Measure the backlash at 4 positions, 90 degrees apart around the ring gear. Locate and mark the area of minimum backlash.
3. Rotate the ring gear to the position of the least backlash. Mark the gear so that all future backlash measurements will be taken with the same gear teeth meshed.
4. Loosen the right-side, tighten the left-side threaded adjuster. Obtain backlash of 0.076-0.102 mm (0.003-0.004 in.) with each adjuster tightened to 14 N·m (10 ft. lbs.). Seat the bearing cups with the procedure described above.
5. Tighten differential bearing cap bolts to 136 N·m (100 ft. lbs.).
6. Tighten right-side threaded adjuster to 102 N·m (75 ft. lbs.). Seat the bearing cups with the procedure described above. Continue to tighten the right-side adjuster and seat bearing cups until the torque remains constant at 102 N·m (75 ft. lbs.)
7. Measure the ring gear backlash. The range of backlash is 0.15-0.203 mm (0.006-0.008 in.).

8. Continue increasing the torque at the right-side threaded adjuster until the specified backlash is obtained.

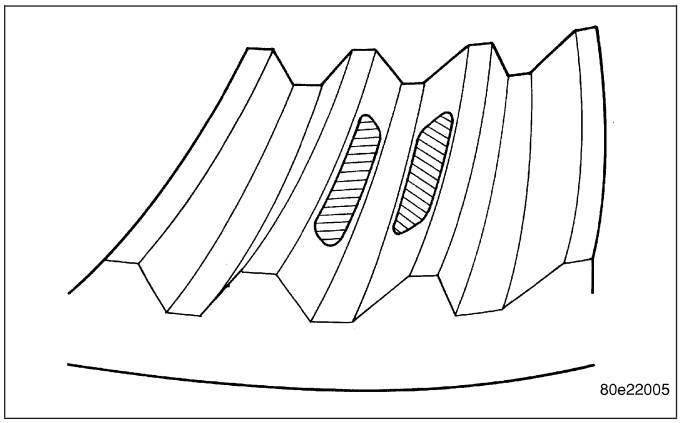
NOTE: The left-side threaded adjuster torque should have approximately 102 N·m (75 ft. lbs.). If the torque is considerably less, the complete adjustment procedure must be repeated.

9. Tighten the left-side threaded adjuster until 102 N·m (75 ft. lbs.) torque is indicated. Seat the bearing rollers with the procedure described above. Do this until the torque remains constant.
10. Install the threaded adjuster locks and tighten the lock screws to 10 N·m (90 in. lbs.).

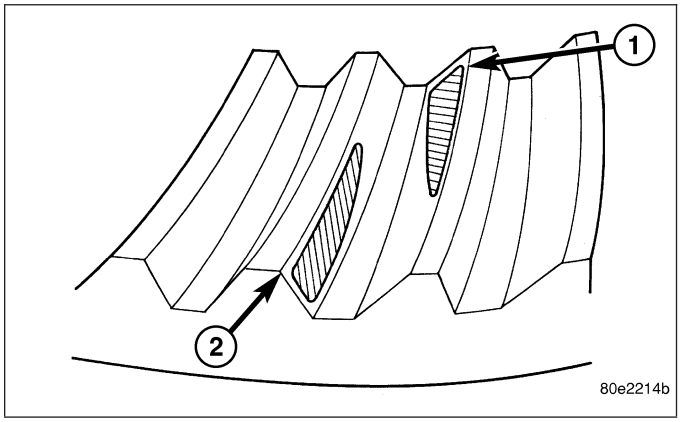
GEAR CONTACT PATTERN

1. Wipe clean each tooth of the ring gear.
2. Apply gear marking compound to all of the ring gear teeth.
3. Verify bearing cap bolts are torque specification.
4. Apply parking brakes lightly to create at 14 N·m (10 ft. lbs.) pinion rotating torque.
5. Rotate the pinion/pinion yoke 4 full revolutions in each directions.
6. Read gear tooth contact pattern.

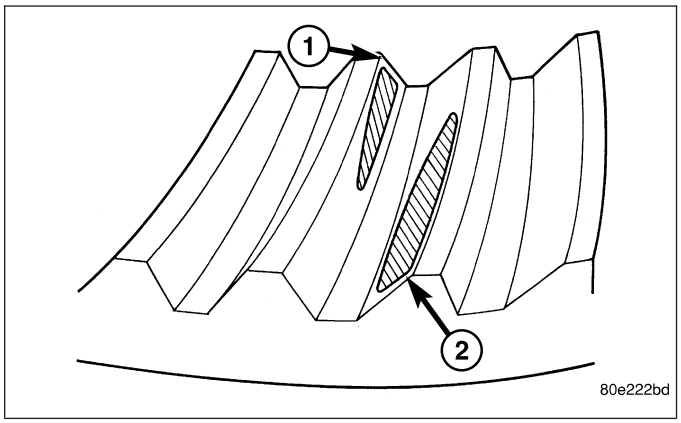
Gear contact pattern is correct. Backlash and pinion depth is correct.



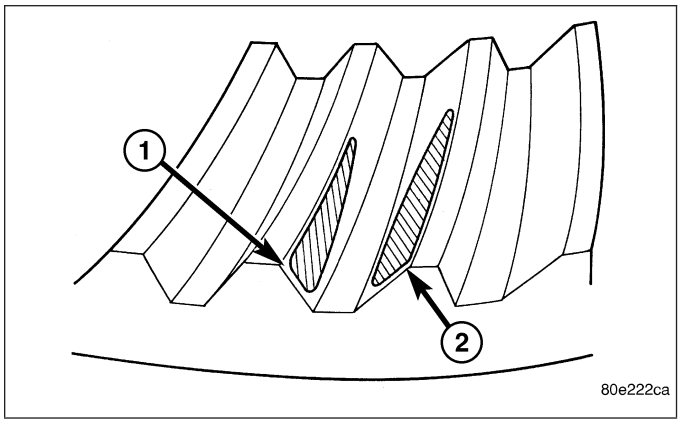
Ring gear is too far away from the pinion gear, coast side toe (1) drive side heel (2). Decrease backlash by moving ring closer to the pinion gear using the adjusters.



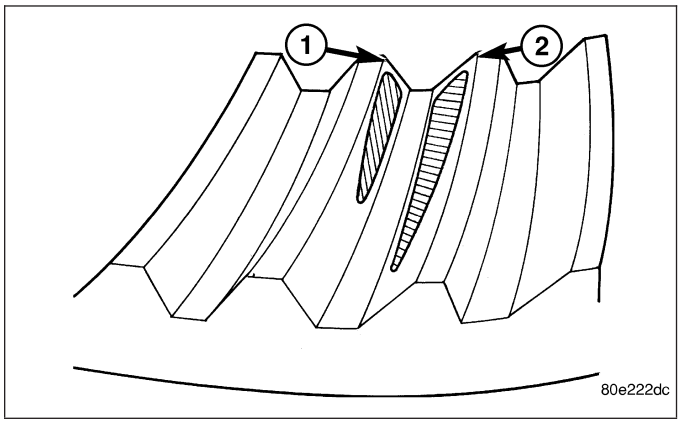
Ring gear is too close to the pinion gear, drive side toe (1) coast side heel (2). Increase backlash by moving ring away from the pinion gear using the adjusters.



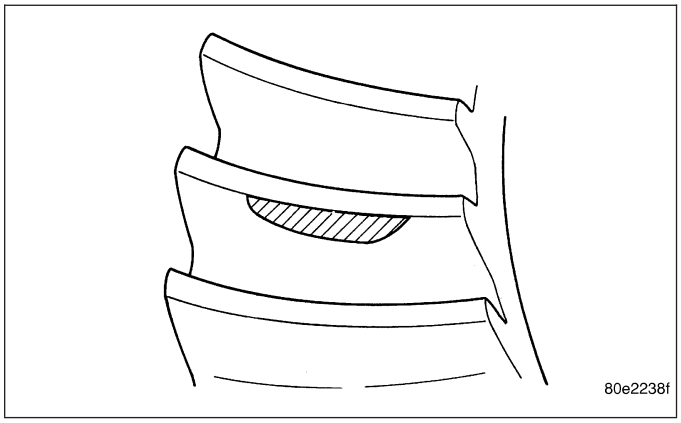
Ring gear is too far away from the pinion gear, drive side heel (1) coast side heel (2). Decrease backlash by moving ring gear closer to the pinion gear using the adjusters.



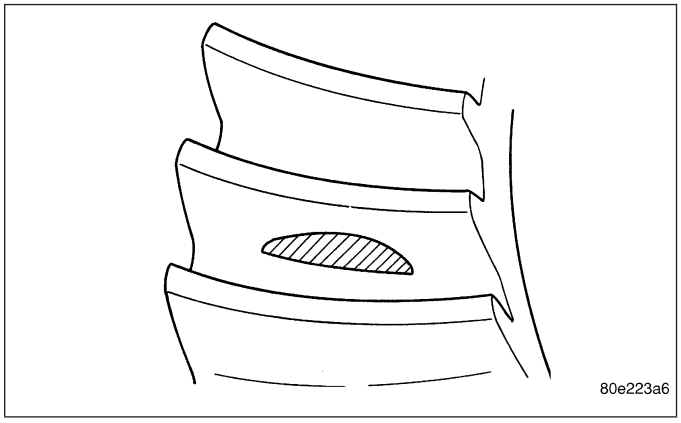
Ring gear is too close to the pinion gear, drive side toe (1) coast side toe (2). Increase backlash by moving ring gear away from the pinion gear using the adjusters.



Pinion gear is set too low. Increase pinion gear height, by increasing pinion depth shim thickness.



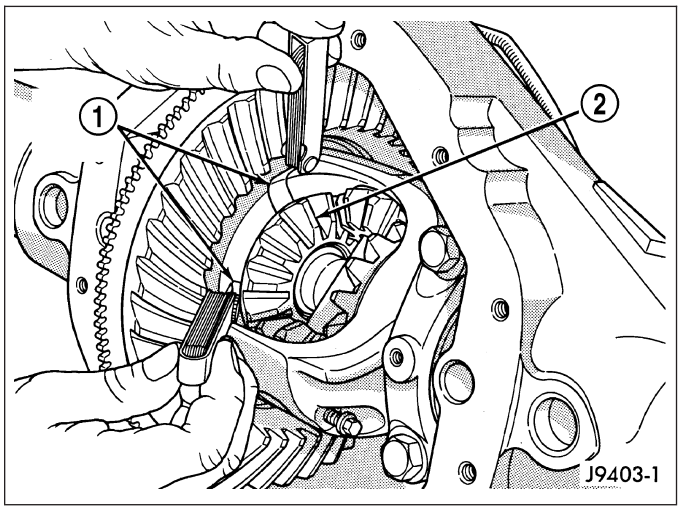
Pinion gear is set too high. Decrease pinion height by decreasing the pinion depth shim thickness.



SIDE GEAR CLEARANCE

When measuring side gear clearance, check each gear independently. If it necessary to replace a side gear, replace both gears as a matched set.

1. Install the axle shafts and C-locks and pinion mate shaft.
2. Measure each side gear clearance. Insert a matched pair of feeler gauge (1) blades between the side gear (2) and differential housing on opposite sides of the hub.



SIDE GEAR CLEARANCE	0.007
THRUST WASHER THICKNESS	+ 0.033
TOTAL	0.040
	0.040
REPLACEMENT WASHER THICKNESS	− 0.037
NEW SIDE GEAR CLEARANCE	0.003

J9203-31

3. If side gear clearances is no more than 0.005 inch. Determine if the axle shaft is contacting the pinion mate shaft. **Do not remove the feeler gauges, inspect the axle shaft with the feeler gauge inserted behind the side gear.** If the end of the axle shaft is not contacting the pinion mate shaft, the side gear clearance is acceptable.
4. If clearance is more than 0.005 inch (axle shaft not contacting mate shaft), record the side gear clearance. Remove the thrust washer and measure its thickness with a micrometer. Add the washer thickness to the recorded side gear clearance. The sum of gear clearance and washer thickness will determine required thickness of replacement thrust washer.

In some cases, the end of the axle shaft will move and contact the mate shaft when the feeler gauge is inserted. The C-lock is preventing the side gear from sliding on the axle shaft.

5. If there is no side gear clearance, remove the C-lock from the axle shaft. Use a micrometer to measure the thrust washer thickness. Record the thickness and re-install the thrust washer. Assemble the differential case without the C-lock installed and re-measure the side gear clearance.
6. Compare both clearance measurements. If the difference is less than 0.012 inch (0.305 mm), add clearance recorded when the C-lock was installed to thrust washer thickness measured. The sum will determine the required thickness of the replacement thrust washer.
7. If clearance is 0.012 inch (0.305 mm) or greater, both side gears must be replaced (matched set) and the clearance measurements repeated.
8. If clearance (above) continues to be 0.012 inch (0.305 mm) or greater, the case must be replaced.

SPECIFICATIONS

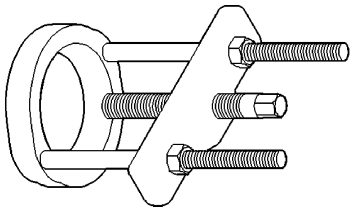
AXLE SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Axle Ratio	2.21, 3.55, 3.92
Differential Case Flange Runout	0.076 mm (0.003 in.)
Differential Case Clearance	0.12 mm (0.005 in.)
Ring Gear Diameter	235 mm (9.25 in.)
Ring Gear Backlash	0.12-0.20 mm (0.005-0.008 in.)
Ring Gear Runout	0.12 mm (0.005 in.)
Pinion Bearing Preload - Original Bearings	1-2 N·m (10-20 in. lbs.)
Pinion Bearing Preload - New Bearings	1.7-4 N·m (15-35 in. lbs.)

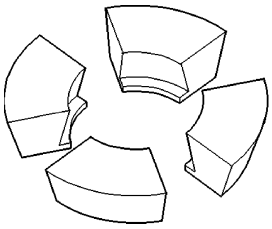
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Differential Cover Bolts	41	30	-
Bearing Cap Bolts	136	100	-
Ring Gear Bolts	157	115	-
Pinion Nut Minimum	285	210	-
Adjuster Lock Screw	10	7.5	90
Pinion Mate Shaft Lock Screw	11	8	97

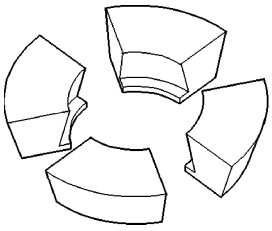
SPECIAL TOOLS



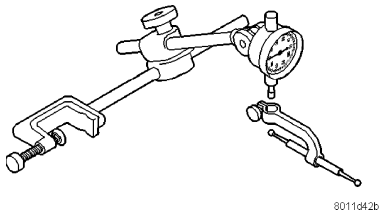
PULLER C-293-PA



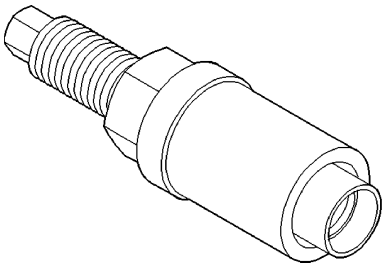
ADAPTERS C-293-47



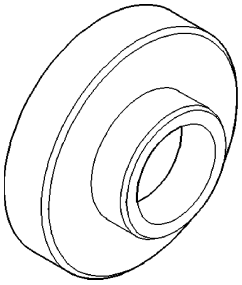
ADAPTERS C-293-37



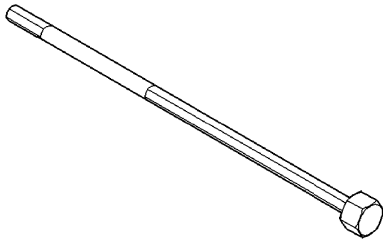
DIAL INDICATOR C-3339



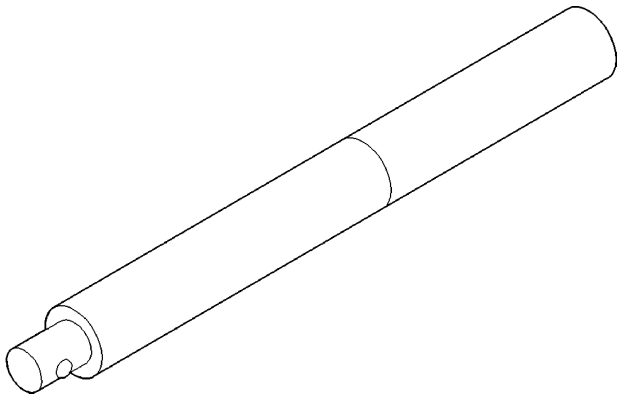
INSTALLER C-3718



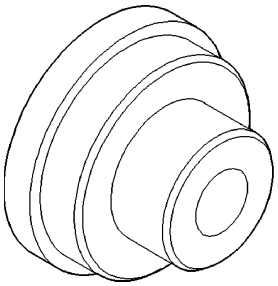
INSTALLER C-4076-B



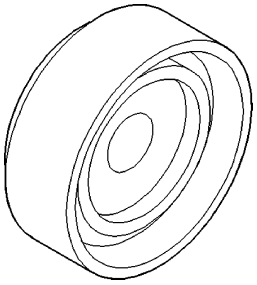
WRENCH C-4164



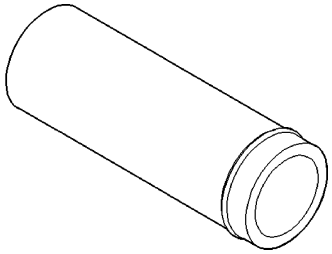
HANDLE C-4171



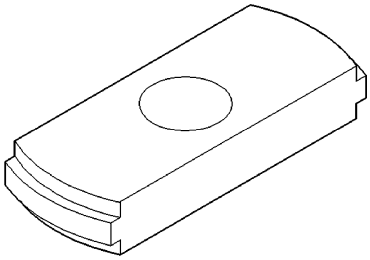
INSTALLER C-4198



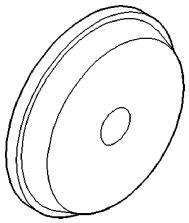
INSTALLER C-4213



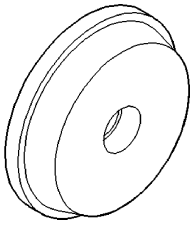
HANDLE C-4735-1



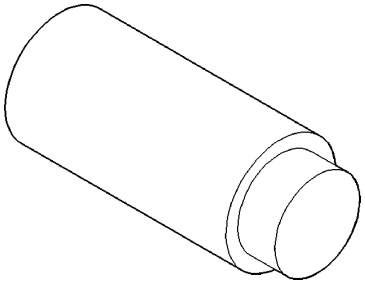
REMOVER C-4307



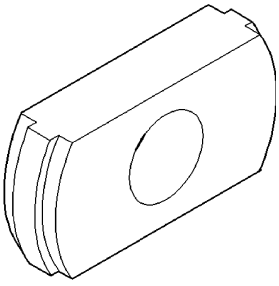
INSTALLER D-129



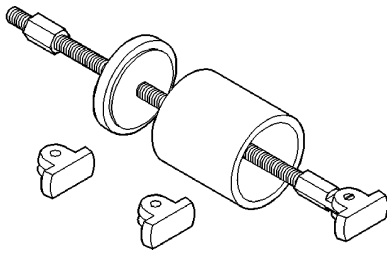
INSTALLER C-4308



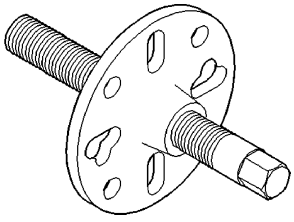
PLUG SP-3289



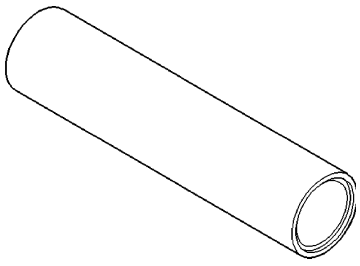
INSTALLER C-4345



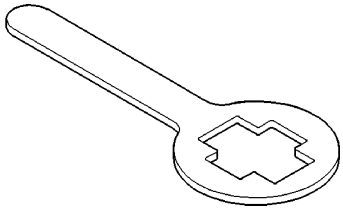
REMOVER/EXTRACTOR 6310



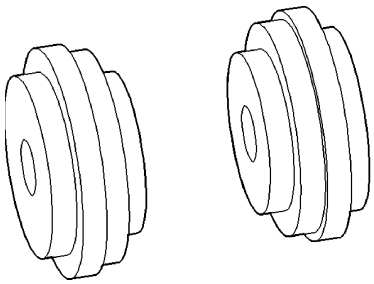
PULLER C-452



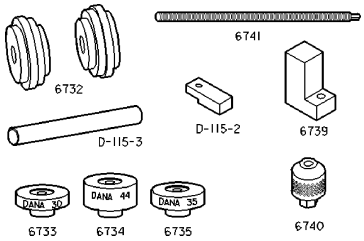
INSTALLER 6448



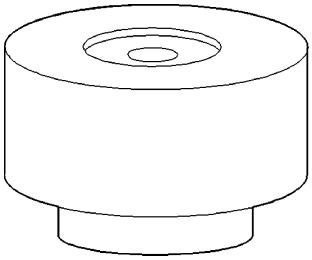
HOLDER 6719A



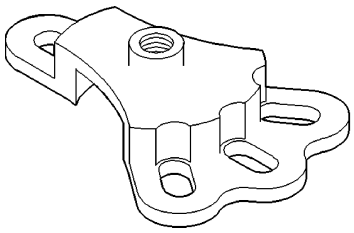
ARBOR DISCS 8541



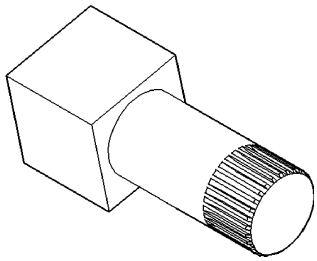
PINION DEPTH SET 6774



PINION BLOCK 8542



TRAC-LOK TORQUE FIXTURE 6790

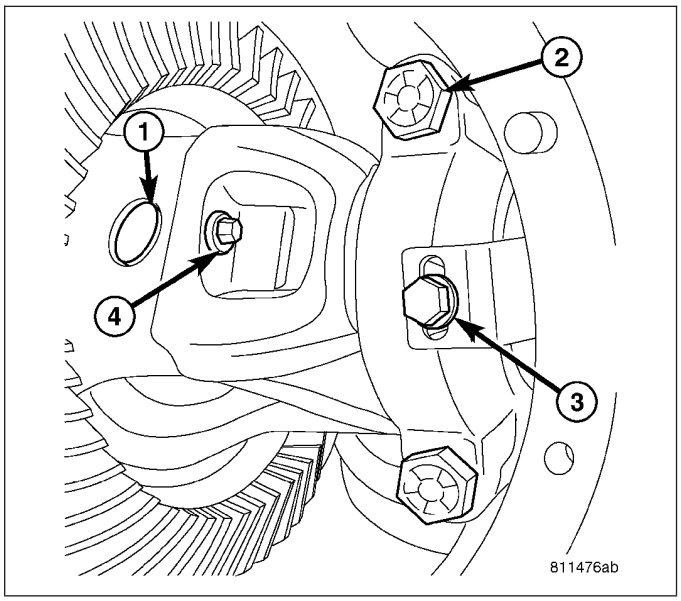


FIXTURE 8138

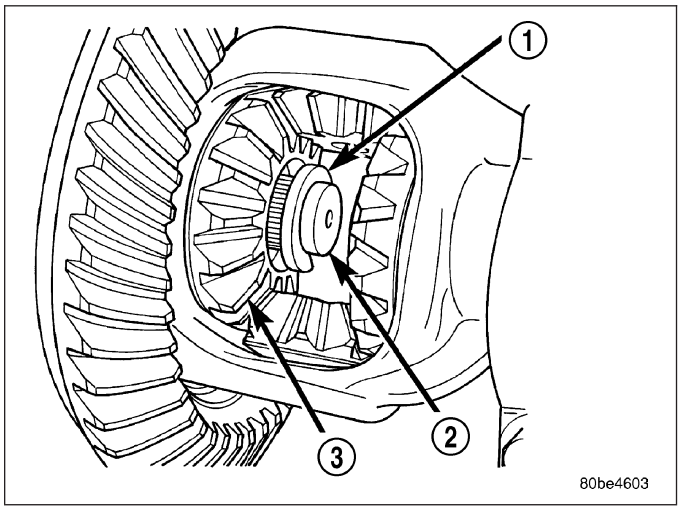
SHAFT-AXLE

REMOVAL

1. With vehicle in neutral, position on hoist.
2. Remove rear brake componants.
3. Remove differential housing cover and drain lubricant.
4. Rotate differential case so pinion mate shaft (1) lock screw (4) is accessible. Remove lock screw and pinion mate shaft from differential case.



5. Push axle shaft inward and remove C-lock (1) from the axle shaft (2).
6. Remove axle shaft.

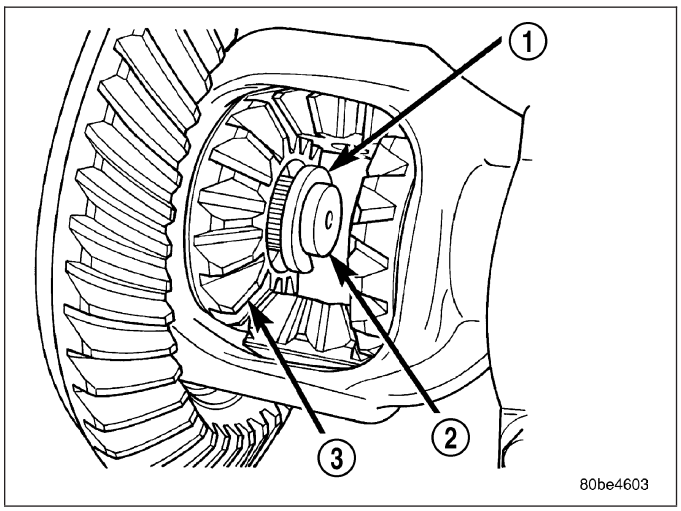


INSTALLATION

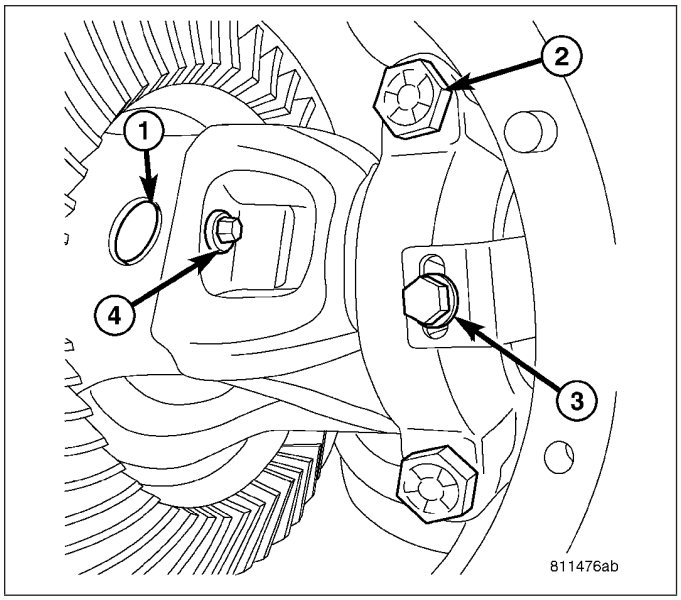
1. Lubricate bearing bore and seal lip with gear lubricant.
2. Install axle shaft through seal, bearing and engage into side gear (3) splines.

NOTE: Do not damaging axle shaft seal during axle installation.

3. Install C-lock (1) in axle shaft (2), then push axle shaft outward to seat C-lock in side gear.
4. Install pinion shaft into differential case and through thrust washers and differential pinions.



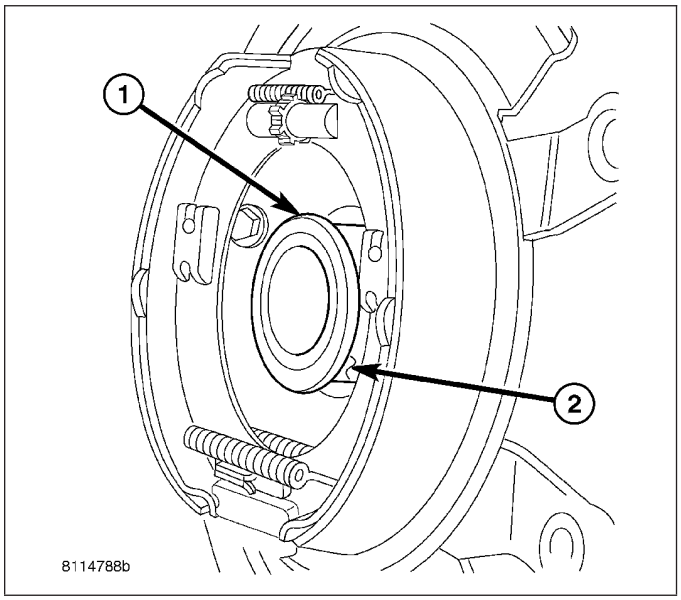
5. Align hole in shaft (1) with hole in the differential case and install lock screw (4) with Loctite® on the threads. Tighten lock screw to 11 N·m (8 ft. lbs.).
6. Install differential cover and fill with gear lubricant.
7. Install rear brake componants.



SEAL-AXLE SHAFT

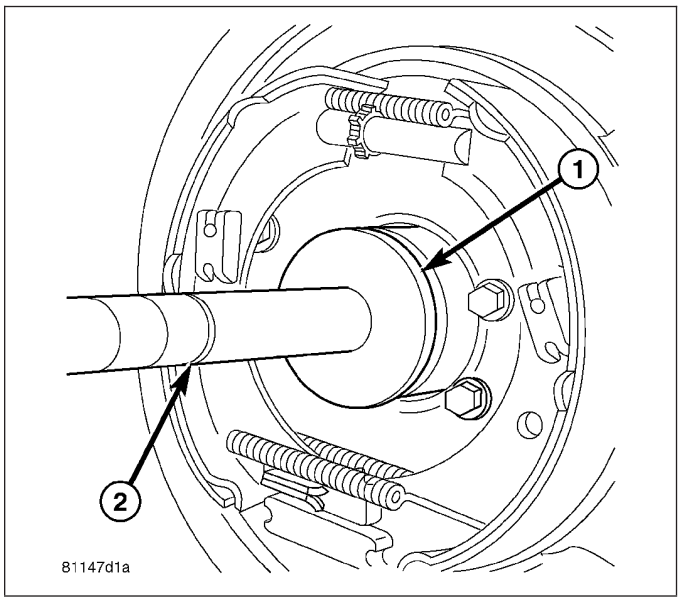
REMOVAL

1. Remove axle shaft.
2. Remove axle shaft seal (1) from axle tube (2) with a seal pick.



INSTALLATION

1. Remove any old sealer/burrs from axle tube.
2. Coat **new** seal lip with axle lubricant and install seal with Installer C-4189 (1) and Handle C-4171 (2).
3. Install axle shaft.

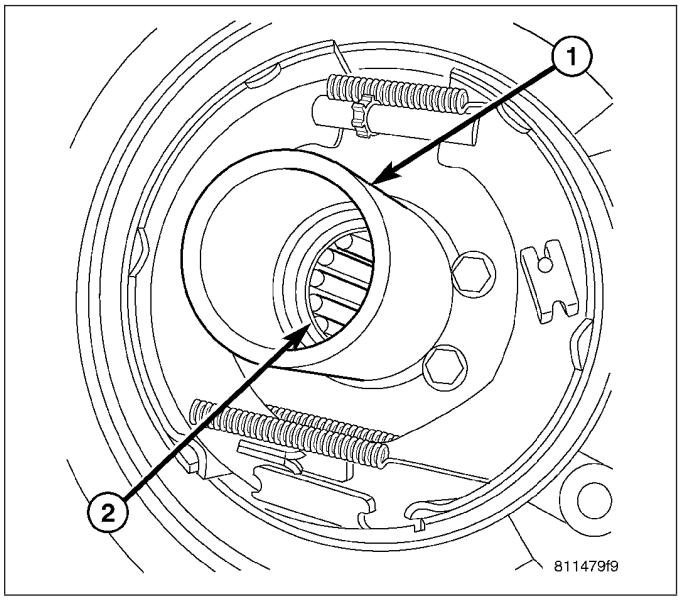


BEARING-AXLE

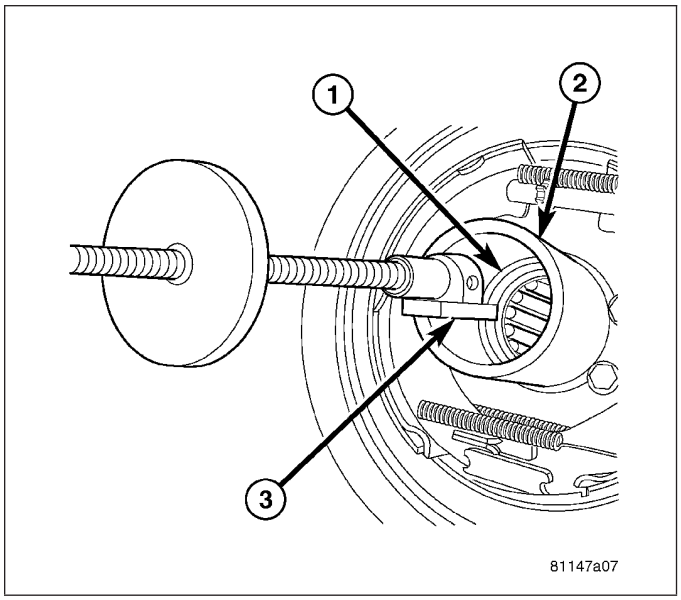
REMOVAL

NOTE: Remove bearing with Bearing Remover 6310 and Foot 6310-9.

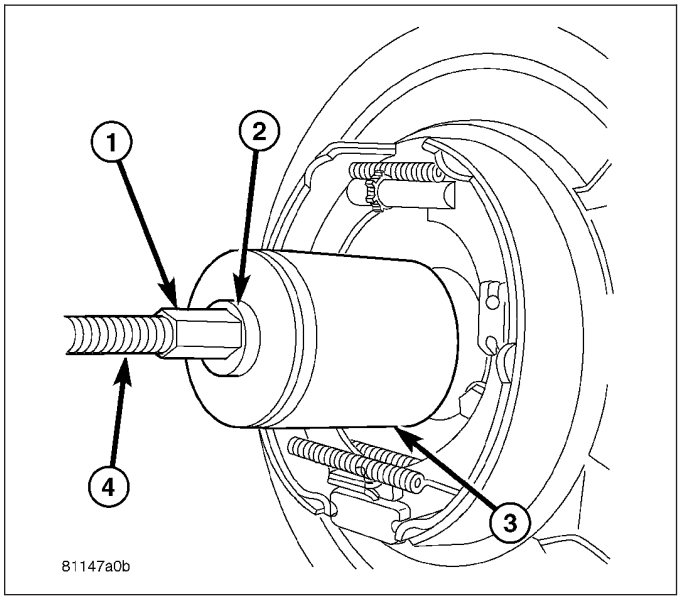
1. Remove axle shaft.
2. Remove axle seal with seal pick.
3. Position bearing receiver (1) on axle tube.



4. Insert bearing remover foot (3) through receiver (2) and bearing (1).

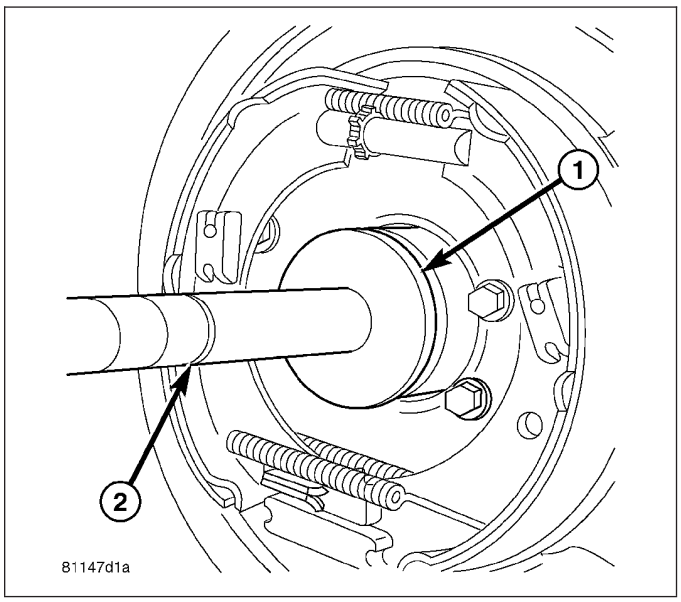


5. Tighten remove nut (1) to pull bearing (2) into the receiver (3).



INSTALLATION

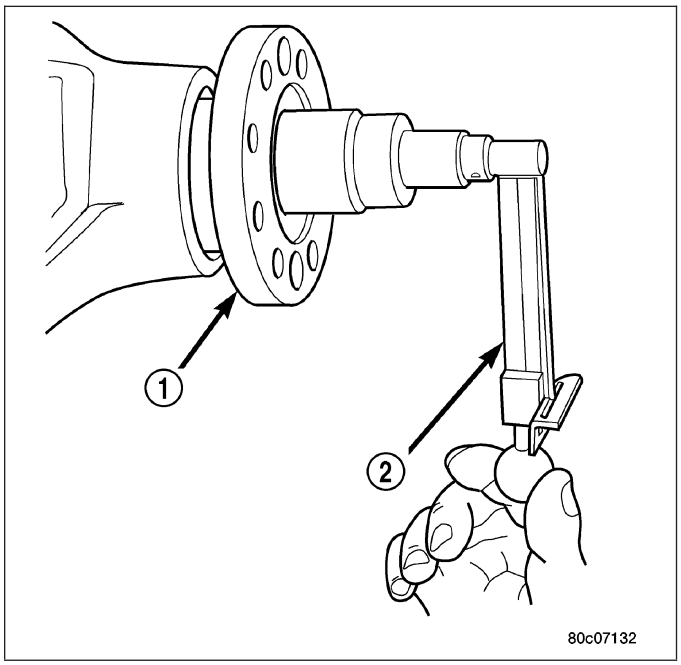
1. Remove any old sealer/burrs from axle tube.
2. Install axle shaft bearing with Installer C-4198 (1) and Handle C-4171 (2). Drive bearing with the bearing part number against the installer until tool contacts the axle tube.
3. Coat **new** axle seal lip with axle lubricant and install with Installer C-4198 (1) and Handle C-4171 (2).
4. Install axle shaft.



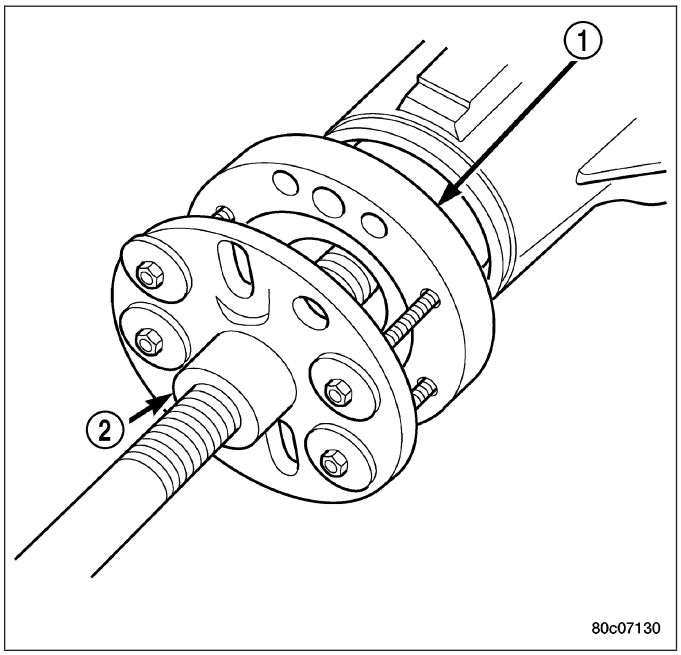
SEAL-PINION

REMOVAL

1. With vehicle in neutral, position on hoist.
2. Remove propeller shaft.
3. Remove rear brake components to prevent any drag.
4. Rotate companion flange (1) three or four times and record pinion rotating torque with an inch pound torque wrench (2).

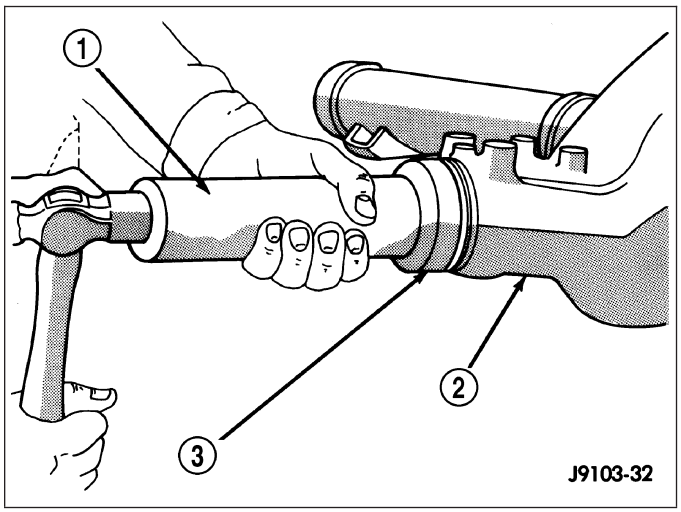


5. Install two bolts into the companion flange threaded holes, 180° apart. Position Holder 6719A against the companion flange and install and tighten two bolts and washers into the remaining holes.
6. Hold the companion flange with Holder 6719A and remove pinion nut and washer.
7. Remove companion flange (1) with Remover C-452 (2).
8. Remove pinion seal with pry tool or slide-hammer mounted screw.



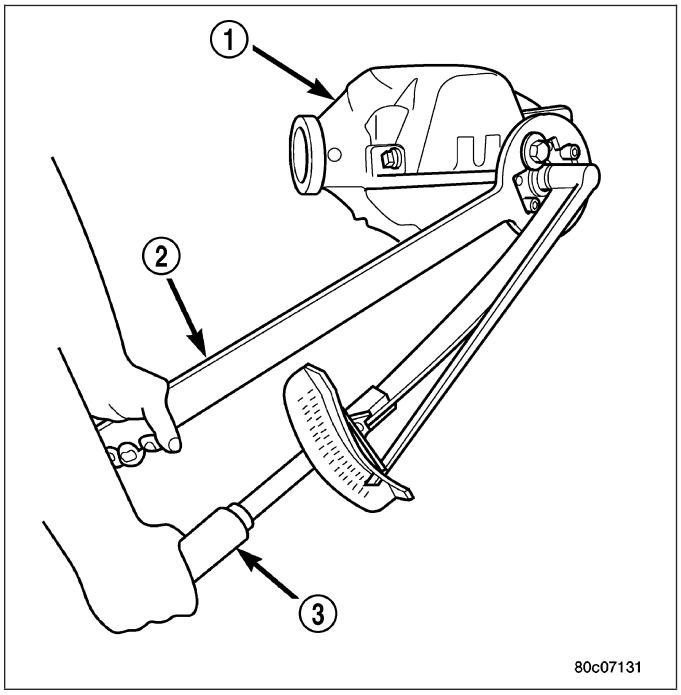
INSTALLATION

1. Apply a light coating of gear lubricant on the lip of pinion seal.
2. Install **new** pinion seal with Installer C-4076-B (3) and Handle C-4735 (1).



3. Install companion flange on the end of the shaft with the reference marks aligned.
4. Install two bolts into the threaded holes in the companion flange, 180° apart.
5. Position Holder 6719 against the companion flange and install a bolt and washer into one of the remaining threaded holes. Tighten the bolts so holder is held to the flange.
6. Install companion flange on pinion shaft with Installer C-3718 and Holder 6719.
7. Install pinion washer and a **new** pinion nut. The convex side of the washer must face outward.

CAUTION: Never exceed the minimum tightening torque 285 N·m (210 ft. lbs.) when installing the companion flange retaining nut at this point. Failure to follow these instruction will result in damage to collapsible spacer or bearings.



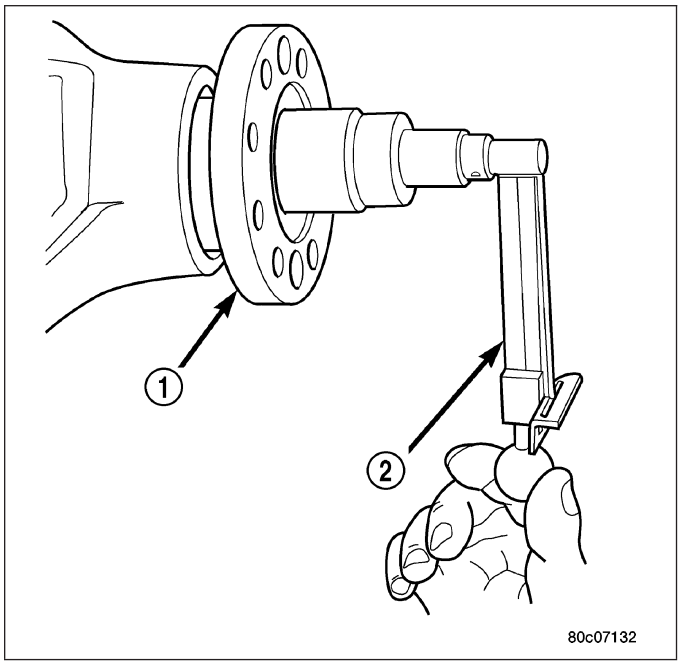
8. Hold companion flange with Holder 6719 (2) and tighten the pinion nut with a torque set to 285 N·m (210 ft. lbs.). Rotate pinion several revolutions to ensure the bearing rollers are seated.

9. Rotate pinion with an inch pound torque wrench (2). Rotating torque should be equal to the reading recorded during removal plus an additional 0.56 N·m (5 in. lbs.).

CAUTION: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. If rotating torque is exceeded, a new collapsible spacer must be installed. Failure to follow these instructions will result in damage to the collapsible spacer

10. If rotating torque is low, use Holder 6719 to hold the companion flange and tighten pinion nut in 6.8 N·m (5 ft. lbs.) increments until proper rotating torque is achieved.

NOTE: The bearing rotating torque should be constant during a complete revolution of the pinion. If the rotating torque varies, this indicates a binding condition.



NOTE: The seal replacement is unacceptable if the final pinion nut torque is less than 285 N·m (210 ft. lbs.).

11. Install propeller shaft.

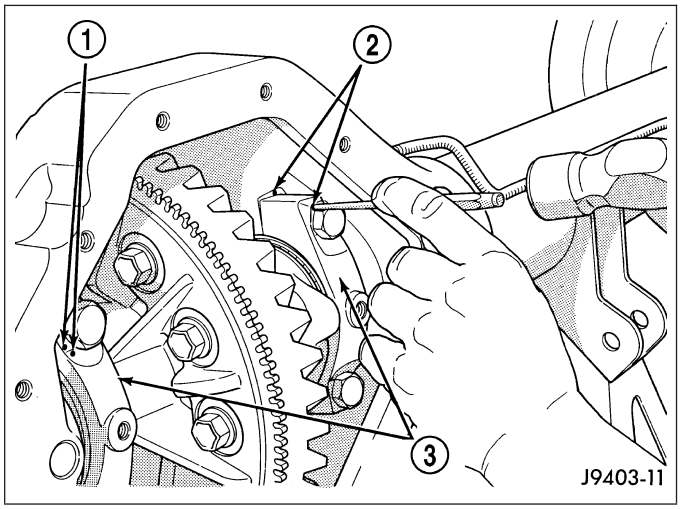
DIFFERENTIAL

REMOVAL

1. Remove filler plug from the differential cover.
2. Remove differential cover and drain the lubricant.
3. Remove axle shafts.
4. Remove RWAL/ABS sensor from housing.

NOTE: Side play resulting from bearing races being loose on case hubs requires replacement of the differential case.

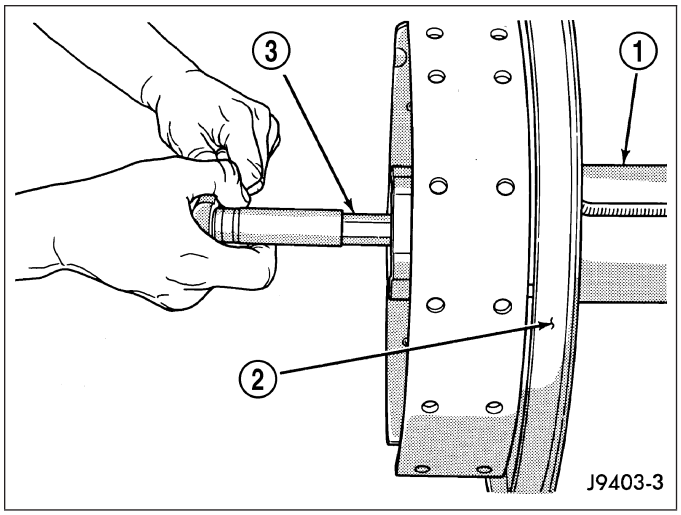
5. Mark differential housing and bearing caps (3) for installation reference.



6. Remove bearing threaded adjuster lock from each bearing cap.
7. Loosen differential bearing cap bolts.
8. Loosen differential bearing adjusters through the axle tubes (1) with Wrench C-4164 (3).
9. Hold differential case while removing bearing caps and adjusters.
10. Remove differential case.

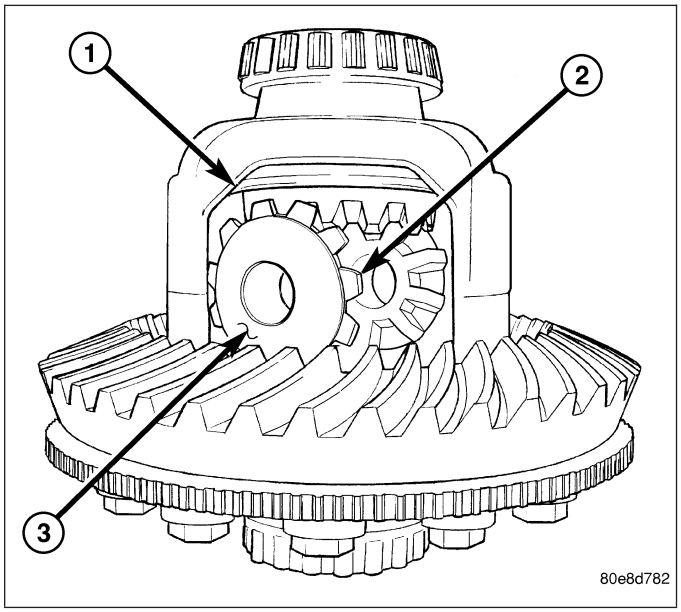
NOTE: Tag bearing cups and threaded adjusters to indicate their location.

11. Clean housing cavity with flushing oil, light engine oil or a lint free cloth.

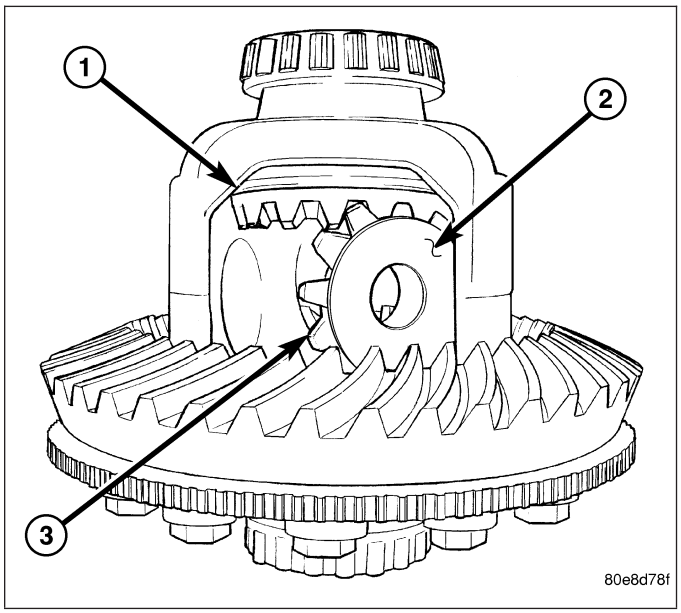


DISASSEMBLY

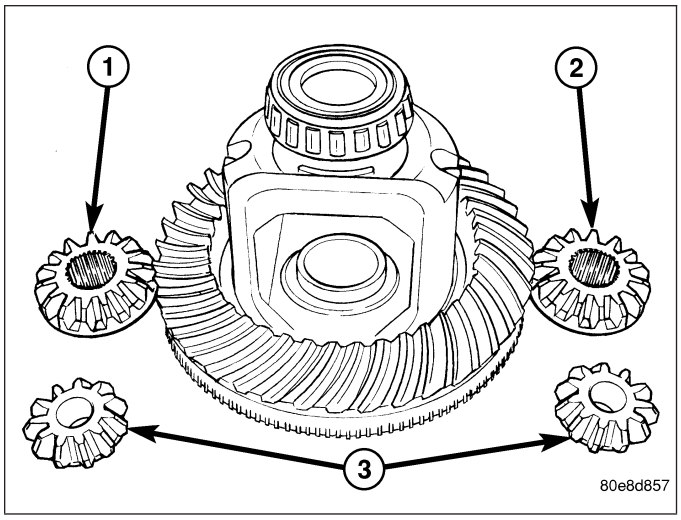
1. Rotate one pinion gear (2) with thrust washer (3) to the differential window (1) and remove gear and thrust washer.



2. Rotate remaining pinion gear (3) with thrust washer (2) to the differential window (1) and remove gear and washer.



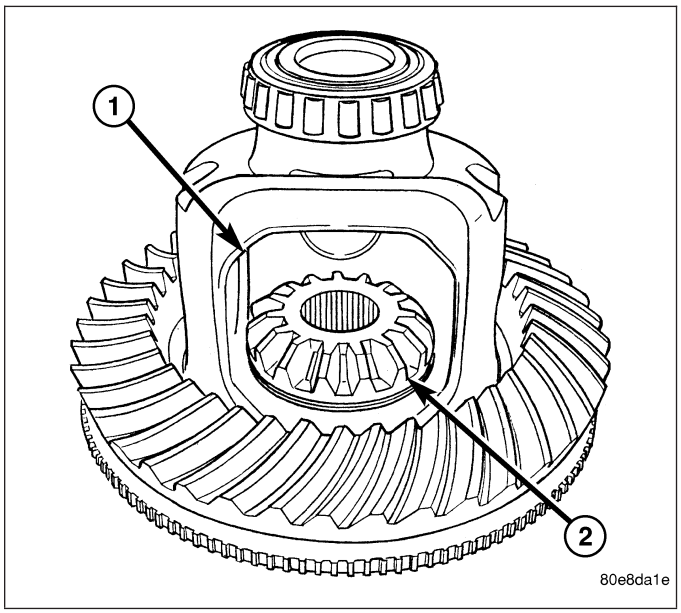
3. Remove differential side gears (1) (2) and thrust washers.



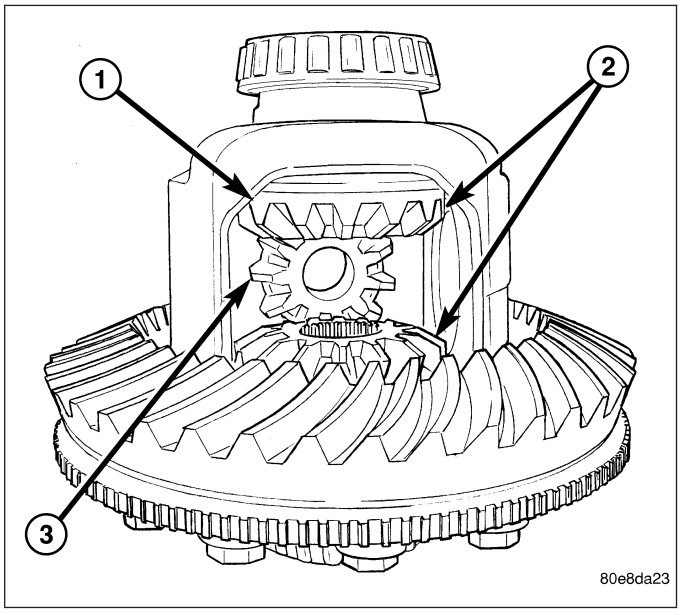
ASSEMBLY

NOTE: If same gears and thrust washers are being used, install them into their original locations.

1. Lubricate all differential components with axle lubricant.
2. Install differential side gears (2) and thrust washers.



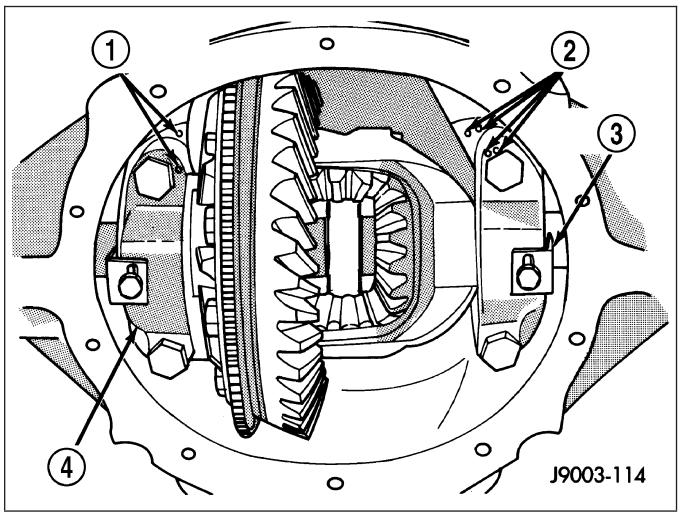
3. Install first pinion gear (3) with thrust washer into differential window (1) and side gears (2). Rotate pinion gear into the case.
4. Install remaining pinion gear and thrust washer. Rotate gears to align hole in the pinion gears with hole in the differential case.
5. Slide pinion shaft into the case and through the pinion gears to align the gears.



INSTALLATION

1. Apply a coating of hypoid gear lubricant to the differential bearings, bearing cups, and threaded adjusters. A dab of grease can be used to keep the adjusters in position.
2. Install differential assembly into the housing.
3. Install differential bearing caps (4) in their original locations.
4. Install bearing cap bolts and tighten the upper bolts to 14 N·m (10 ft. lbs.). Tighten the lower bolts finger-tight until the bolt head is seated.
5. Perform the differential bearing preload and adjustment procedure.

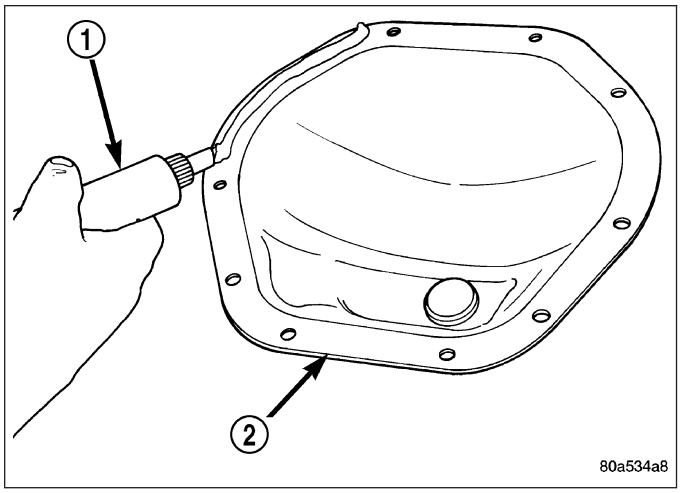
NOTE: Be sure that all bearing cap bolts are tightened to their final torque of 136 N·m (100 ft.lbs.) before proceeding.



6. Install axle shafts.

7. Apply a bead of orange Mopar Axle RTV Sealant (1) or equivalent to the housing cover (2).

CAUTION: If cover is not installed within 3 to 5 minutes, the cover must be cleaned and new RTV applied or adhesion quality will be compromised.



8. Install the cover and any identification tag and tighten cover bolts to 41 N·m (30 ft. lbs.).
9. Fill differential with lubricant to bottom of the fill plug hole. Refer to the Lubricant Specifications for the correct quantity and type.

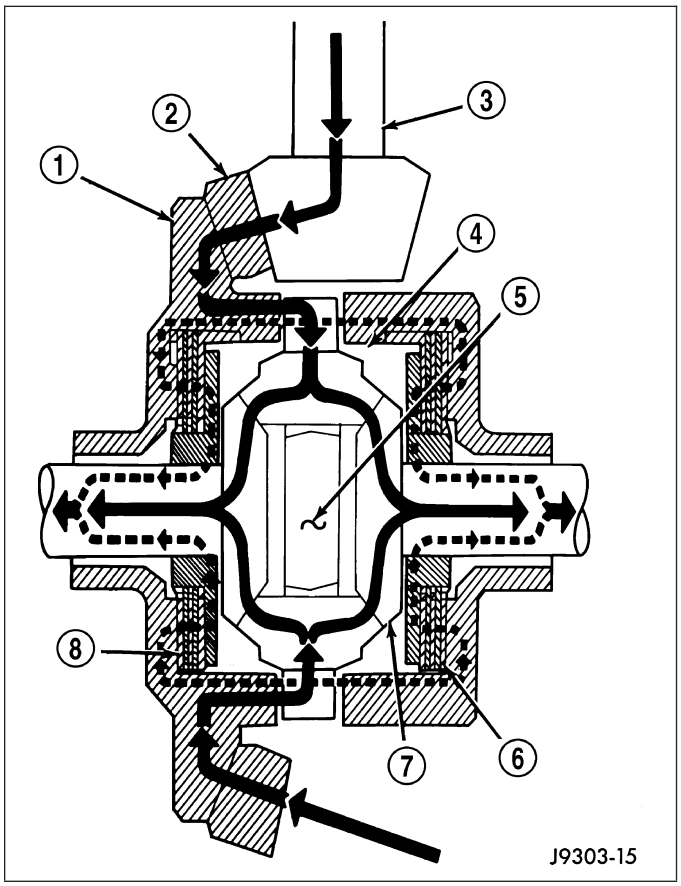
NOTE: Trac-lok™ differential equipped vehicles should be road tested by making 10 to 12 slow figure-eight turns. This maneuver will pump the lubricant through the clutch discs to eliminate a possible chatter noise complaint.

DIFFERENTIAL - TRAC-LOK

OPERATION

The differentials clutches (6) (8) are engaged by two concurrent forces. The first being the preload force exerted through Belleville spring washers within the clutch packs. The second is the separating forces generated by the side gears (7) as torque is applied through the ring gear.

This design provides the differential action needed for turning corners and for driving straight ahead during periods of unequal traction. When one wheel looses traction, the clutch packs transfer additional torque to the wheel having the most traction. This differential resist wheel spin on bumpy roads and provide more pulling power when one wheel looses traction. Pulling power is provided continuously until both wheels loose traction. If both wheels slip due to unequal traction, Trac-lok® operation is normal. In extreme cases of differences of traction, the wheel with the least traction may spin.



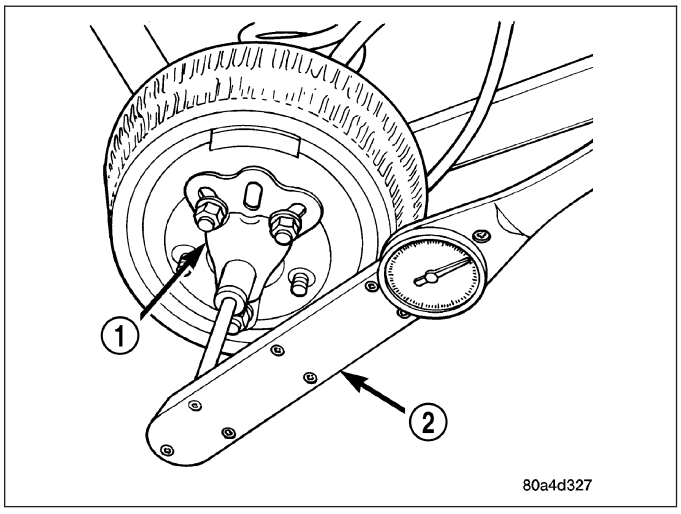
DIAGNOSIS AND TESTING

DIFFERENTIAL-TRAC-LOK

The most common problem is a chatter noise when turning corners. Before removing the unit for repair, drain, flush and refill the axle with the specified lubricant. Add a container of Mopar Limited Slip Additive after repair service or during a lubricant change.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure-eight turns. This maneuver will pump lubricant through the clutches. This will correct the condition in most instances. If the chatter persists, clutch damage could have occurred.

The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.



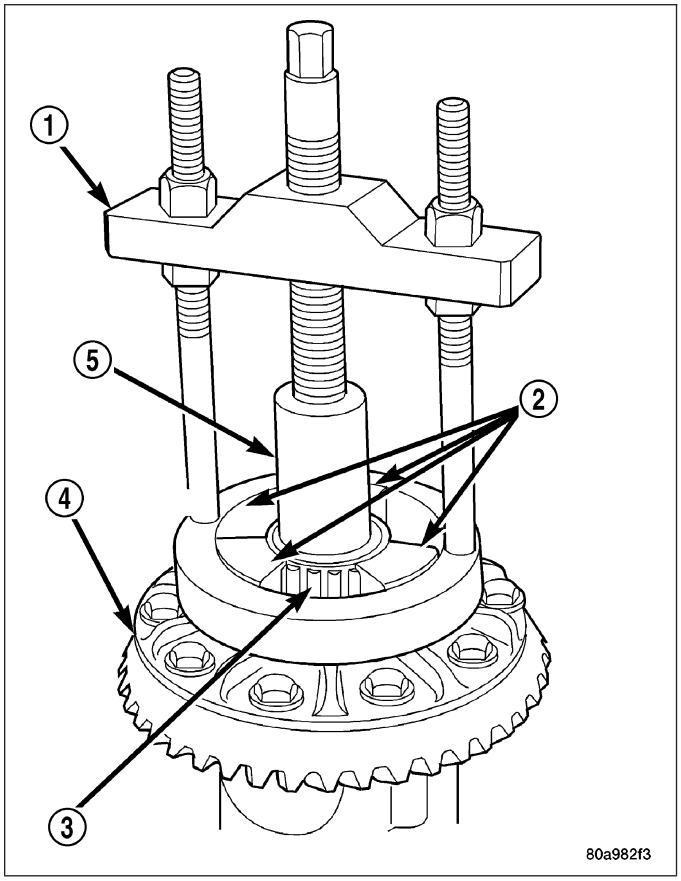
1. Place blocks in front and rear of both front wheels.
2. Raise one rear wheel until it is completely off the ground.
3. Engine off, transmission in neutral, and parking brake off.
4. Remove wheel and bolt Special Tool 6790 (1) or equivalent tool to studs.
5. Use torque wrench (2) on special tool to rotate wheel and read rotating torque.

6. If rotating torque is less than 41 N·m (30 ft. lbs.) or more than 271 N·m (200 ft. lbs.) on either wheel the unit must be replaced.

BEARINGS-DIFFERENTIAL CASE

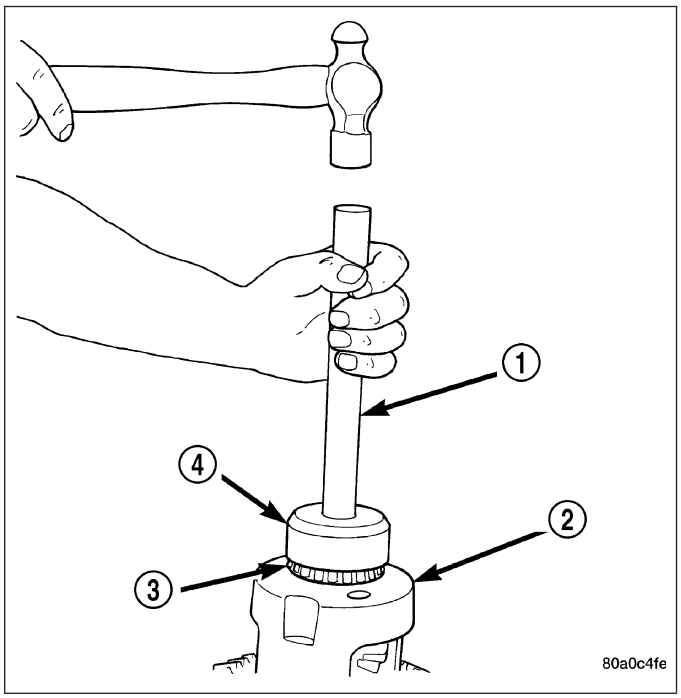
REMOVAL

1. Remove differential case from axle housing.
2. Remove differential bearings (3) from the case (4) with Puller/Press C-293-PA (1) and Adapters C-293-47 (2) and Plug C-293-3 (5).



INSTALLATION

1. Install differential (2) side bearings (3) with Installer C-4213 (4) and Handle C-4171 (1).
2. Install differential case into housing.

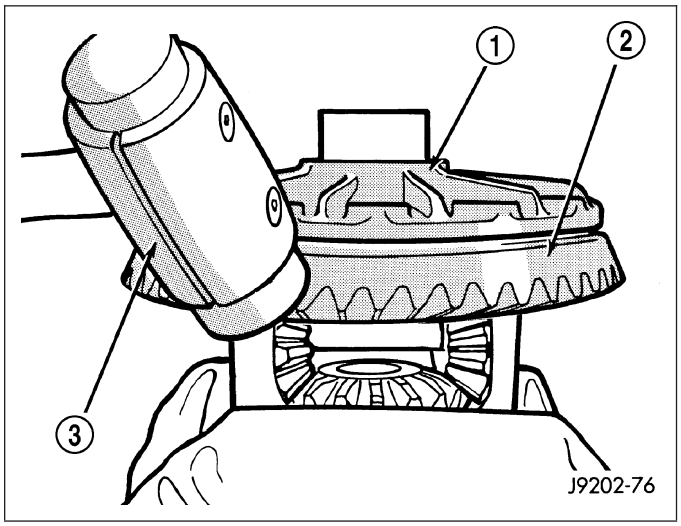


GEAR-PINION/RING/TONE RING

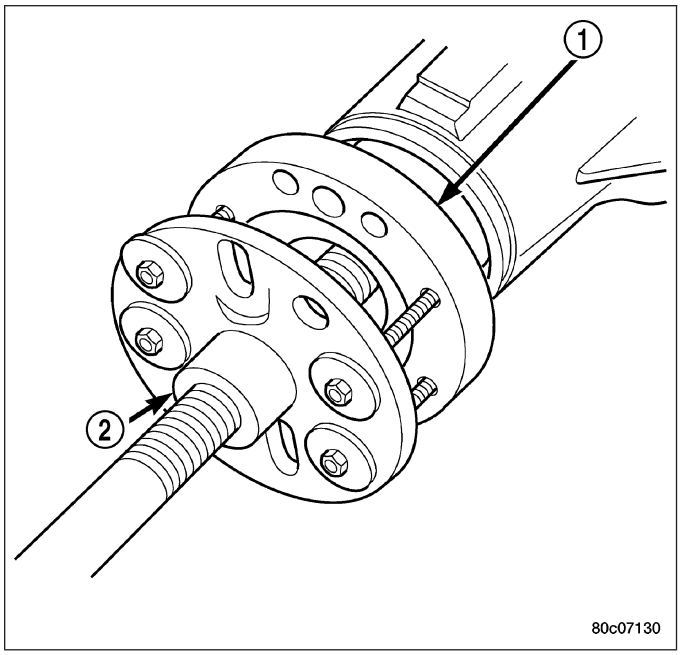
REMOVAL

NOTE: The ring gear and pinion are serviced in a matched set. Never replace one gear without replacing the other.

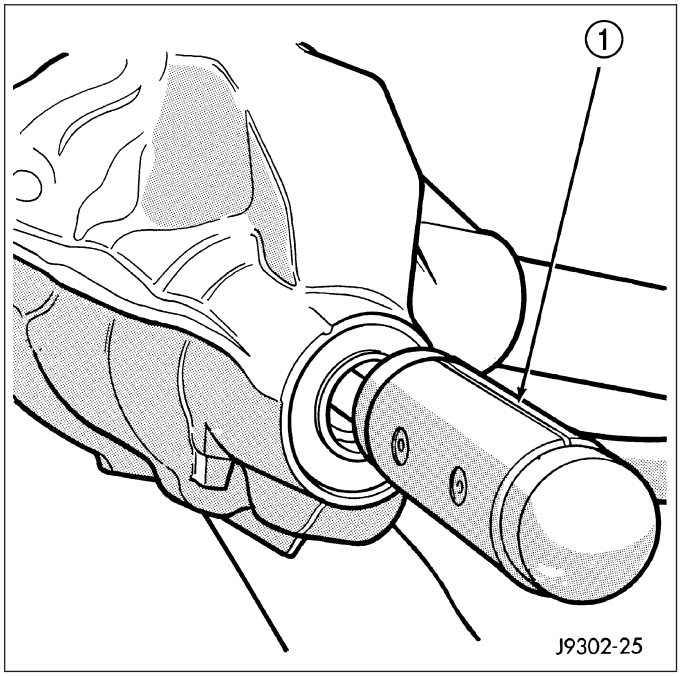
1. With vehicle in neutral, position on hoist.
2. Remove propeller shaft.
3. Remove axle shafts.
4. Remove differential from the differential housing.
5. Place differential case in a vise with soft metal jaw protectors.
6. Remove ring gear bolts from the differential case.
7. Drive ring gear (2) off the differential case (1) with a dead blow hammer (3).



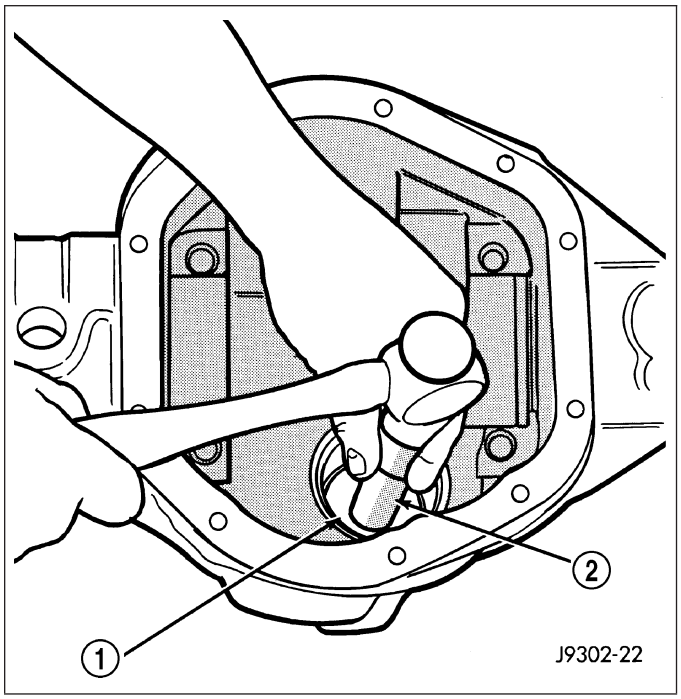
8. Install bolts into two of the threaded holes in the companion flange 180° apart.
9. Position Holder 6719 against the companion flange and install a bolt and washer into one of the remaining threaded holes. Tighten the bolts so the Holder 6719 is held to the flange.
10. Use Holder 6719 to hold companion flange and remove the companion flange nut and washer.
11. Remove the companion flange (1) from the pinion with Remover C-452 (2).



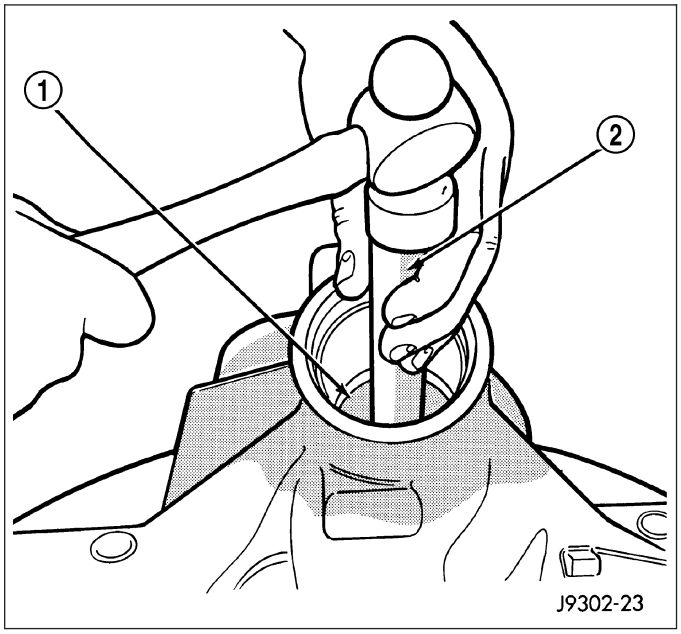
12. Remove pinion gear from housing with a dead blow hammer (1).



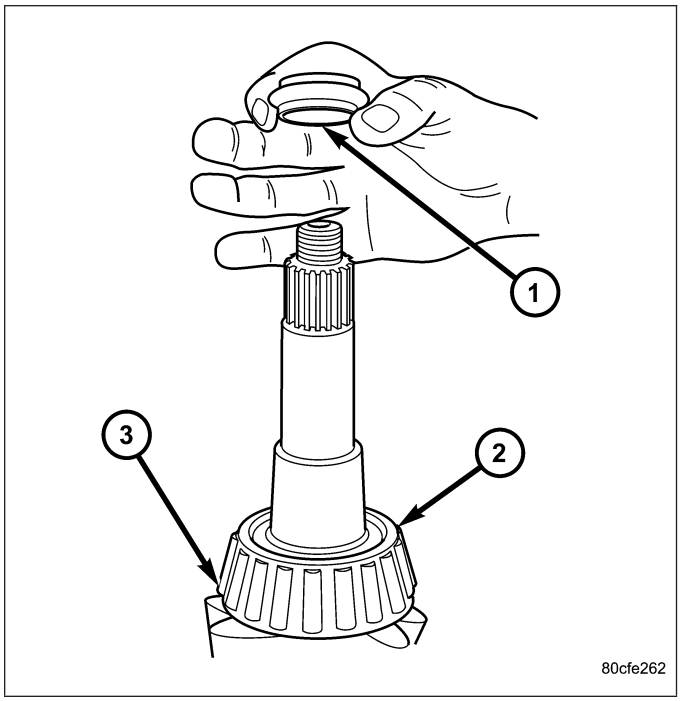
13. Remove pinion seal with a seal pick.
14. Remove oil slinger if equipped and front pinion bearing.
15. Remove front pinion bearing cup with Remover C-4345 (1) and Handle C-4171(2).



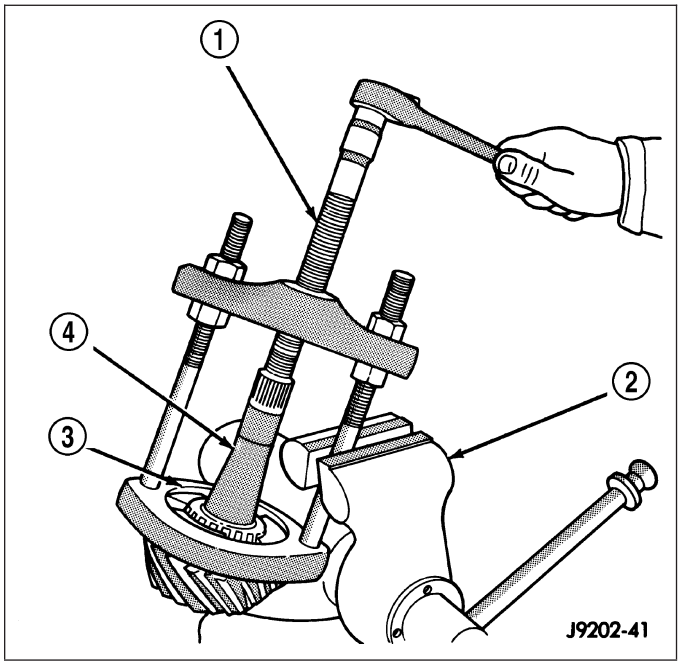
16. Remove rear bearing cup from housing with Remover C-4307 (1) and Handle C-4171(2).



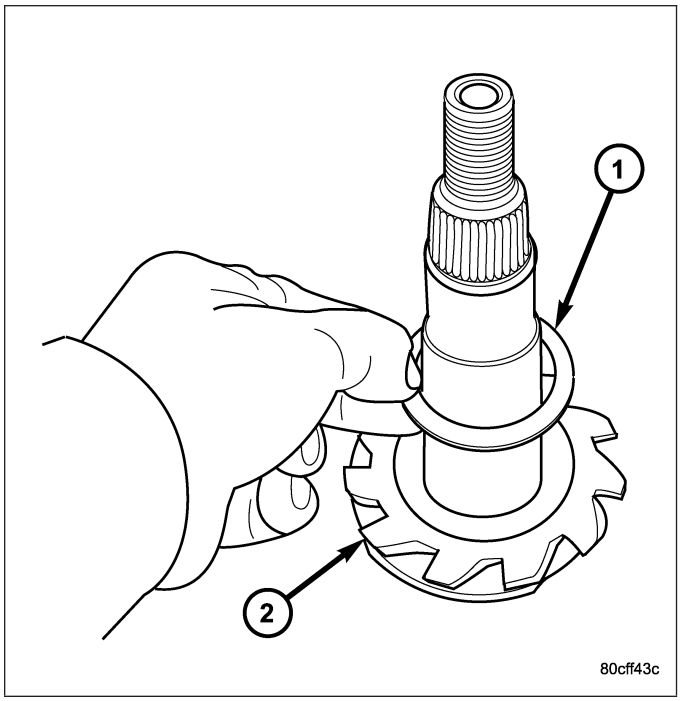
17. Remove collapsible preload spacer (1) from pinion shaft.



18. Remove rear pinion bearing from pinion shaft (4) with Puller/Press C-293-PA (1) and Adapters C-293-37 (3).



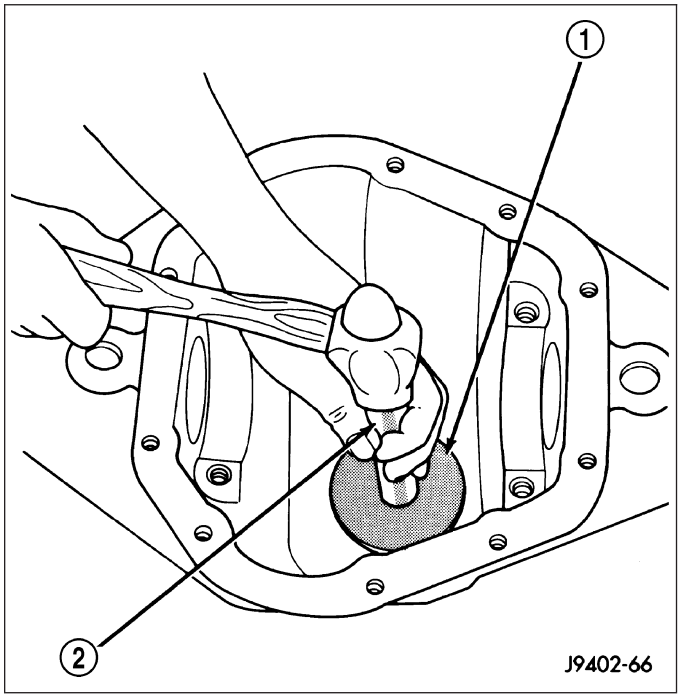
19. Remove pinion depth shims (1) from pinion shaft (2) and record shim thickness.



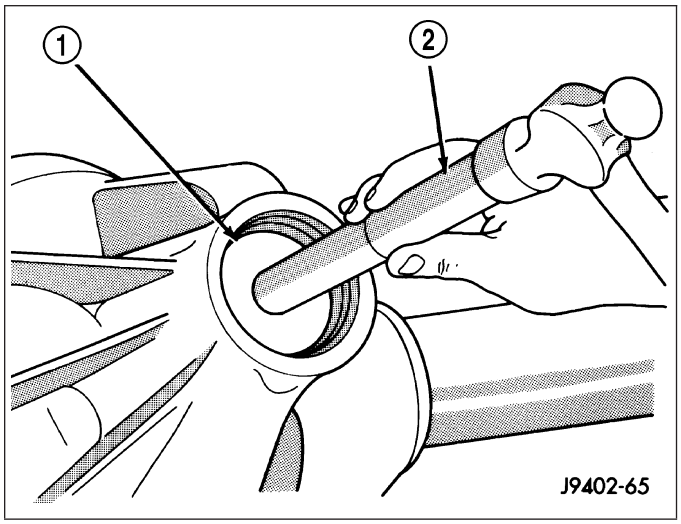
INSTALLATION

NOTE: The ring gear and pinion are serviced in a matched set. Do not one gear without replacing the matching gear. If ring and pinion gears or bearings are replaced, Refer to Adjustments for Pinion Gear Depth Setting.

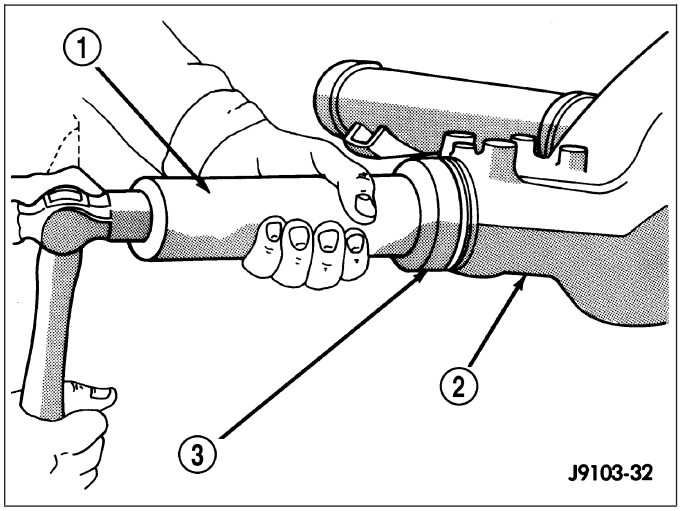
1. Apply Mopar Door Ease or stick lubricant to outside surface of pinion bearing cups.
2. Install rear pinion bearing cup with Installer C-4308 (1) and Handle C-4171 (2).



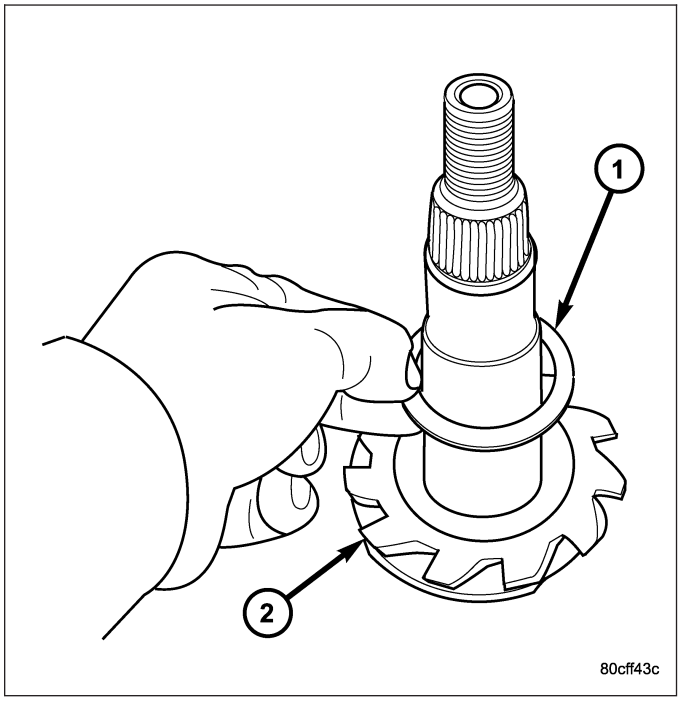
3. Install front pinion bearing cup with Installer D-129 (1) and Handle C-4171 (2).



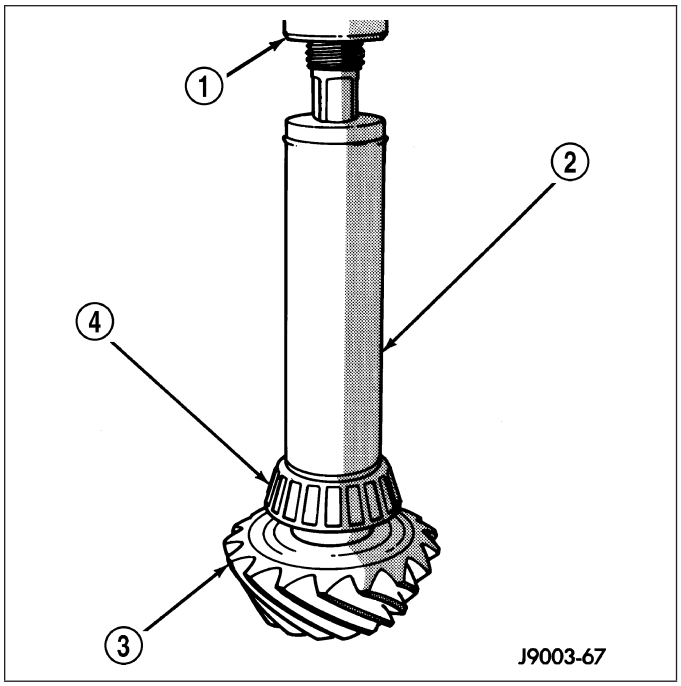
4. Install lubricate and install front pinion bearing into the housing.
5. Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-4076-B (3) and Handle (1) C-4735-1.



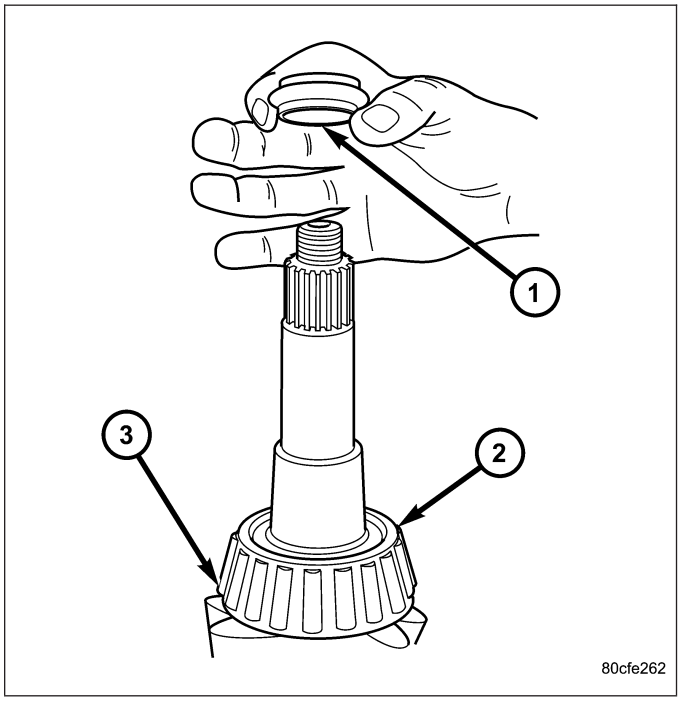
6. Install pinion depth shim (1) on the pinion shaft (2).



7. Install rear bearing (4) on the pinion (3) with Installer C-3095-A (2) and a press (1).

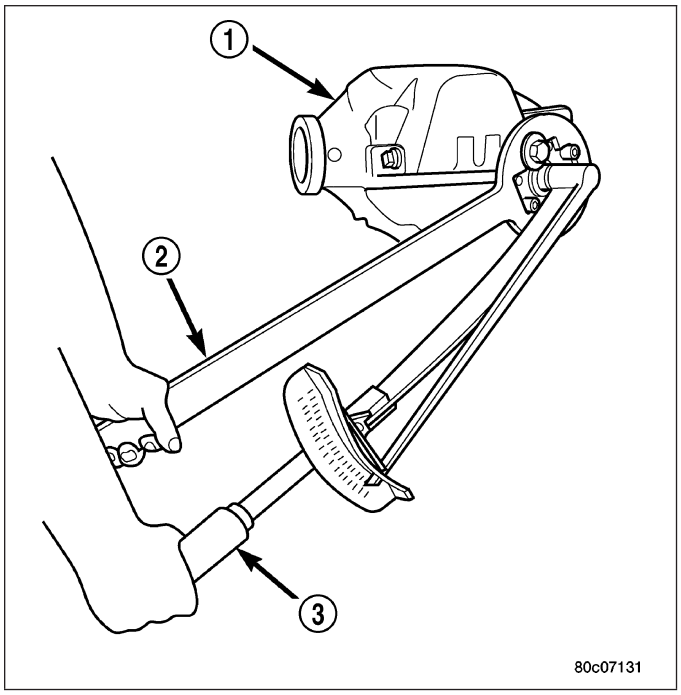


8. Install **new** collapsible spacer (1) on the pinion shaft.
9. Lubricate rear pinion bearing and install the pinion into the housing.

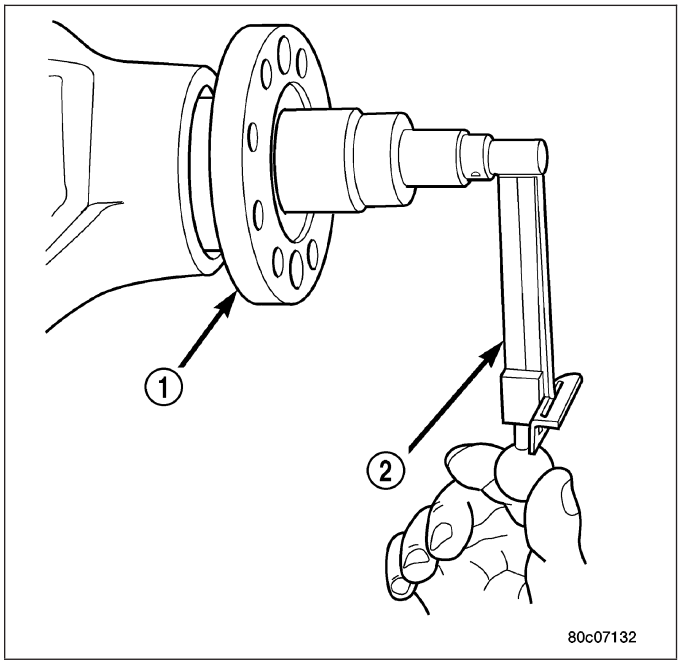


10. Install companion flange with Installer C-3718 and Holder 6719.
11. Install bolts into two of the threaded holes in the companion flange 180° apart.
12. Position Holder 6719 (2) against the companion flange and install a bolt and washer into one of the remaining threaded holes. Tighten the bolts so the Holder 6719 is held to the flange.
13. Install the companion flange washer and a new nut on the pinion and tighten the pinion nut until there is zero bearing end-play.
14. With a torque wrench (3) tighten the nut to 285 N·m (210 ft. lbs.).

NOTE: Never loosen pinion nut to decrease pinion rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed.



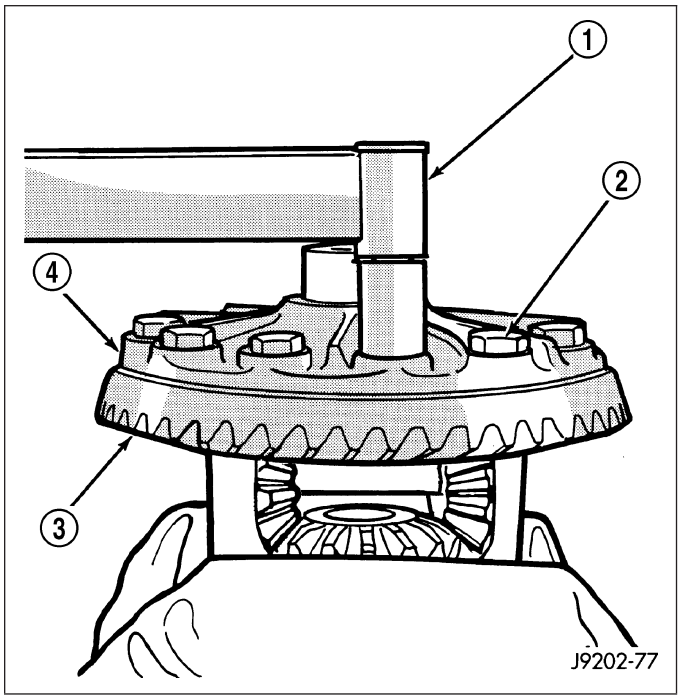
15. Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the desired rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer .
16. Check pinion rotating torque with an inch pound torque wrench (2). The pinion rotating torque should be: With Original Bearings: 1 to 3 N·m (10 to 20 in. lbs.). With New Bearings: 1.7 to 5 N·m (15 to 35 in. lbs.).



17. Position exciter ring on differential case. With a brass drift, slowly and evenly tap the exciter ring into position.
18. Position ring gear on the differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.
19. Invert the differential case (4) in the vise.
20. Install **new** ring gear bolts (2) and alternately tighten to 156 N·m (115 ft. lbs.).

CAUTION: Never reuse ring gear bolts. The bolts can fracture causing extensive damage.

21. Install differential in housing and verify gear mesh, backlash and contact pattern.
22. Install axle shafts.
23. Install differential cover and fill with gear lubricant.
24. Install propeller shaft with reference marks aligned.



BRAKES

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BRAKES - BASE

DIAGNOSIS AND TESTING

BASE BRAKE SYSTEM

Base brake components consist of the brake pads, calipers, brake drum & brake shoe assembly in the rear, rotors in the front, brake lines, master cylinder, booster, wheel cylinders and parking brake components.

Brake diagnosis involves determining if the problem is related to a mechanical, hydraulic, or vacuum operated component.

The first diagnosis step is the preliminary check.

PRELIMINARY BRAKE CHECK

1. Check condition of tires and wheels. Damaged wheels and worn, damaged, or underinflated tires can cause pull, shudder, vibration, and a condition similar to grab.
2. If complaint was based on noise when braking, check suspension components. Jounce front and rear of vehicle and listen for noise that might be caused by loose, worn or damaged suspension or steering components.
3. Inspect brake fluid level and condition. Note that the brake reservoir fluid level will decrease in proportion to normal lining wear. **Also note that brake fluid tends to darken over time. This is normal and should not be mistaken for contamination.**
   a. If fluid level is abnormally low, look for evidence of leaks at calipers, wheel cylinders, brake lines, and master cylinder.
   b. If fluid appears contaminated, drain out a sample to examine. System will have to be flushed if fluid is separated into layers, or contains a substance other than brake fluid. The system seals and cups will also have to be replaced after flushing. Use clean brake fluid to flush the system.
4. Check parking brake operation. Verify free movement and full release of cables and pedal. Also note if vehicle was being operated with parking brake partially applied.
5. Check brake pedal operation. Verify that pedal does not bind and has adequate free play. If pedal lacks free play, check pedal and power booster for being loose or for bind condition. Do not road test until condition is corrected.
6. Check booster vacuum check valve and hose.
7. If components checked appear OK, road test the vehicle.

ROAD TESTING

1. If complaint involved low brake pedal, pump pedal and note if it comes back up to normal height.

2. Check brake pedal response with transmission in Neutral and engine running. Pedal should remain firm under constant foot pressure.
3. During road test, make normal and firm brake stops in 10 mph range. Note faulty brake operation such as low pedal, hard pedal, fade, pedal pulsation, pull, grab, drag, noise, etc.
4. Attempt to stop the vehicle with the parking brake only and note grab, drag, noise, etc.

PEDAL FALLS AWAY

A brake pedal that falls away under steady foot pressure is generally the result of a system leak. The leak point could be at a brake line, fitting, hose, or caliper/wheel cylinder. If leakage is severe, fluid will be evident at or around the leaking component.

Internal leakage (seal by-pass) in the master cylinder caused by worn or damaged piston cups, may also be the problem cause.

An internal leak in the ABS system may also be the problem with no physical evidence.

LOW PEDAL

If a low pedal is experienced, pump the pedal several times. If the pedal comes back up worn linings, rotors, drums, or rear brakes out of adjustment are the most likely causes. The proper course of action is to inspect and replace all worn component and make the proper adjustments.

SPONGY PEDAL

A spongy pedal is most often caused by air in the system. However, thin brake drums or substandard brake lines and hoses can also cause a spongy pedal. The proper course of action is to bleed the system, and replace thin drums and substandard quality brake hoses if suspected.

HARD PEDAL OR HIGH PEDAL EFFORT

A hard pedal or high pedal effort may be due to lining that is water soaked, contaminated, glazed, or badly worn. The power booster or check valve could also be faulty.

PEDAL PULSATION

Pedal pulsation is caused by components that are loose, or beyond tolerance limits.

The primary cause of pulsation are disc brake rotors with excessive lateral runout or thickness variation, or out of round brake drums (If Equipped). Other causes are loose wheel bearings or calipers and worn, damaged tires.

NOTE: Some pedal pulsation may be felt during ABS activation.

BRAKE DRAG

Brake drag occurs when the lining is in constant contact with the rotor or drum. Drag can occur at one wheel, all wheels, fronts only, or rears only.

Drag is a product of incomplete brake shoe release. Drag can be minor or severe enough to overheat the linings, rotors and drums.

Minor drag will usually cause slight surface charring of the lining. It can also generate hard spots in rotors and drums from the overheat-cool down process. In most cases, the rotors, drums, wheels and tires are quite warm to the touch after the vehicle is stopped.

Severe drag can char the brake lining all the way through. It can also distort and score rotors and drums to the point of replacement. The wheels, tires and brake components will be extremely hot. In severe cases, the lining may generate smoke as it chars from overheating.

Common causes of brake drag are:

- Seized or improperly adjusted parking brake cables.
- Loose/worn wheel bearing.
- Seized caliper or wheel cylinder piston.
- Caliper binding on corroded bushings or rusted slide surfaces.

- Loose caliper mounting.
- Drum brake shoes binding on worn/damaged support plates.
- Mis-assembled components.
- Long booster output rod.

If brake drag occurs at all wheels, the problem may be related to a blocked master cylinder return port, or faulty power booster (binds-does not release).

BRAKE FADE

Brake fade is usually a product of overheating caused by brake drag. However, brake overheating and resulting fade can also be caused by riding the brake pedal, making repeated high deceleration stops in a short time span, or constant braking on steep mountain roads. Refer to the Brake Drag information in this section for causes.

BRAKE PULL

Front brake pull condition could result from:

- Contaminated lining in one caliper
- Seized caliper piston
- Binding caliper
- Loose caliper
- Rusty caliper slide surfaces
- Improper brake pads
- Damaged rotor

A worn, damaged wheel bearing or suspension component are further causes of pull. A damaged front tire (bruised, ply separation) can also cause pull.

A common and frequently misdiagnosed pull condition is where direction of pull changes after a few stops. The cause is a combination of brake drag followed by fade at one of the brake units.

As the dragging brake overheats, efficiency is so reduced that fade occurs. Since the opposite brake unit is still functioning normally, its braking effect is magnified. This causes pull to switch direction in favor of the normally functioning brake unit.

An additional point when diagnosing a change in pull condition concerns brake cool down. Remember that pull will return to the original direction, if the dragging brake unit is allowed to cool down (and is not seriously damaged).

REAR BRAKE GRAB OR PULL

Rear grab or pull is usually caused by improperly adjusted or seized parking brake cables, contaminated lining, bent or binding shoes and support plates, or improperly assembled components. This is particularly true when only one rear wheel is involved. However, when both rear wheels are affected, the master cylinder or proportioning valve could be at fault.

BRAKES DO NOT HOLD AFTER DRIVING THROUGH DEEP WATER PUDDLES

This condition is generally caused by water soaked lining. If the lining is only wet, it can be dried by driving with the brakes very lightly applied for a mile or two. However, if the lining is both soaked and dirt contaminated, cleaning and/or replacement will be necessary.

BRAKE LINING CONTAMINATION

Brake lining contamination is mostly a product of leaking calipers or worn seals, driving through deep water puddles, or lining that has become covered with grease and grit during repair. Contaminated lining should be replaced to avoid further brake problems.

WHEEL AND TIRE PROBLEMS

Some conditions attributed to brake components may actually be caused by a wheel or tire problem.

A damaged wheel can cause shudder, vibration and pull. A worn or damaged tire can also cause pull.

Severely worn tires with very little tread left can produce a grab-like condition as the tire loses and recovers traction. Flat-spotted tires can cause vibration and generate shudder during brake operation. A tire with internal damage such as a severe bruise, cut, or ply separation can cause pull and vibration.

BRAKE NOISES

Some brake noise is common with rear drum brakes and on some disc brakes during the first few stops after a vehicle has been parked overnight or stored. This is primarily due to the formation of trace corrosion (light rust) on metal surfaces. This light corrosion is typically cleared from the metal surfaces after a few brake applications causing the noise to subside.

BRAKE SQUEAK/SQUEAL

Brake squeak or squeal may be due to linings that are wet or contaminated with brake fluid, grease, or oil. Glazed linings and rotors with hard spots can also contribute to squeak. Dirt and foreign material embedded in the brake lining will also cause squeak/squeal.

A very loud squeak or squeal is frequently a sign of severely worn brake lining. If the lining has worn through to the brake pads in spots, metal-to-metal contact occurs. If the condition is allowed to continue, rotors can become so scored that replacement is necessary.

BRAKE CHATTER

Brake chatter is usually caused by loose or worn components, or glazed/burnt lining. Rotors with hard spots can also contribute to chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.

THUMP/CLUNK NOISE

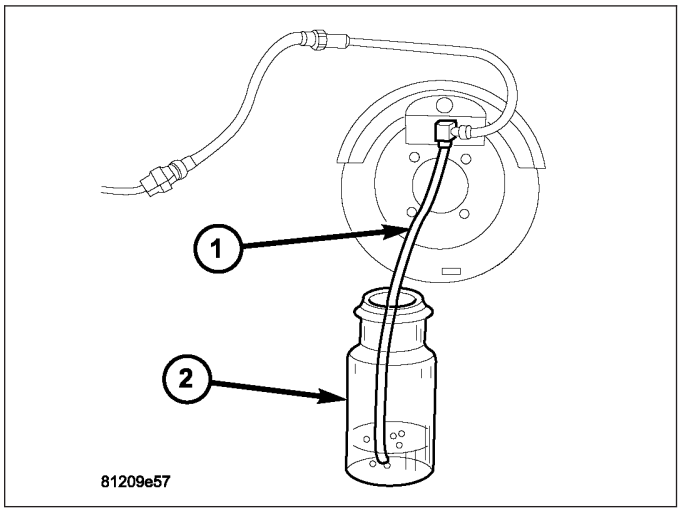
Thumping or clunk noises during braking are frequently **not** caused by brake components. In many cases, such noises are caused by loose or damaged steering, suspension, or engine components. However, calipers that bind on the slide surfaces can generate a thump or clunk noise.

STANDARD PROCEDURE

MANUAL BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

1. Remove reservoir filler caps and fill reservoir.
2. If calipers were overhauled, open all caliper bleed screws. Then close each bleed screw as fluid starts to drip from it. Top off master cylinder reservoir once more before proceeding.
3. Attach one end of bleed hose (1) to bleed screw and insert opposite end in glass container (2) partially filled with brake fluid. Be sure end of bleed hose is immersed in fluid.



NOTE: Bleed procedure should be in this order (1) Right rear (2) Left rear (3) Right front (4) Left front.

4. Open up bleeder, then have a helper press down the brake pedal. Once the pedal is down close the bleeder. Repeat bleeding until fluid stream is clear and free of bubbles. Then move to the next wheel.
5. Before moving the vehicle verify the pedal is firm and not mushy.
6. Top off the brake fluid and install the reservoir cap.

PRESSURE BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

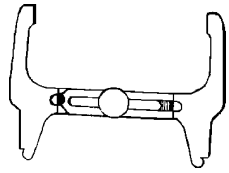
Follow the manufacturers instructions carefully when using pressure equipment. Do not exceed the tank manufacturers pressure recommendations. Generally, a tank pressure of 15-20 psi is sufficient for bleeding.

Fill the bleeder tank with recommended fluid and purge air from the tank lines before bleeding.

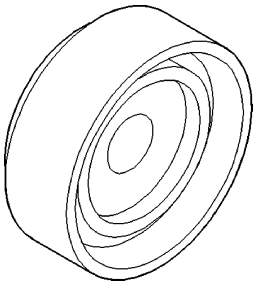
Do not pressure bleed without a proper master cylinder adapter. The wrong adapter can lead to leakage, or drawing air back into the system.

SPECIAL TOOLS

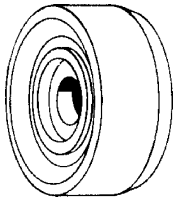
BASE BRAKES



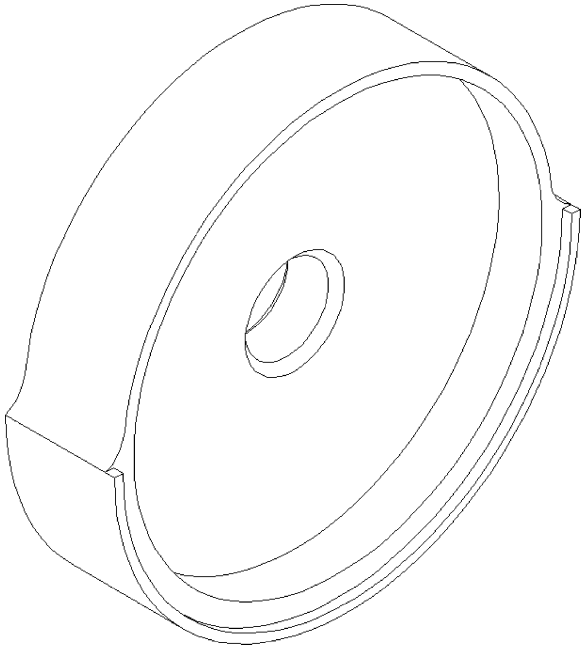
GAUGE, BRAKE SAFE-SET C-3919



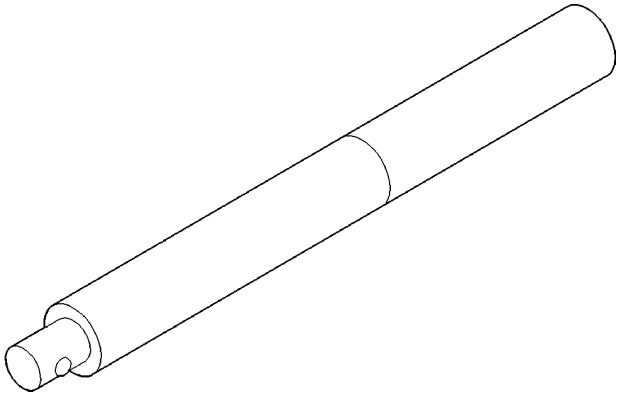
INSTALLER, BRAKE CALIPER DUST BOOT C-4340



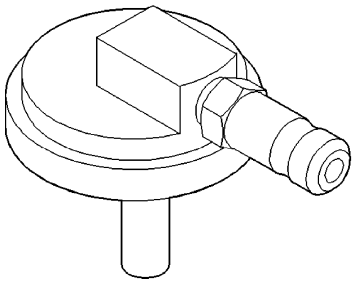
INSTALLER, BRAKE CALIPER DUST BOOT C-3716-A



Install Dust Boot 8248



HANDLE C-4171



CAP, MASTER CYLINDER PRESSURE BLEED 6921

HYDRAULIC/MECHANICAL

SPECIFICATIONS

TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Brake Booster Mounting Nuts	28	21	250
Master Cylinder Mounting Nuts	10	—	90
Caliper Mounting Pins Front	35	26	—
Caliper Adapter Mounting Bolts Front	176	130	—
Junction Block Bolts To Frame	14	10.5	125
Brake Pedal Assembly Bracket Nuts	8	—	75
Support Plate Mounting Bolts/Nuts	64	47	—
Brake Line Fittings Master Cylinder	19	14	170
Brake Line Fittings Junction Block	14	10.5	125
Brake Line Fittings to Brake Hose	14	10.5	125
Caliper Brake Line Banjo Bolt Front	28	21	250
Wheel Cylinder Brake Line Rear	16	11.6	140
Brake Hose Front Fitting	16	21	140
Mounting Bracket Bolt at Frame Front	14	10.5	125
Brake Hose Rear Fitting	16	21	140
Parking Brake Pedal Assembly	14	10.5	125
Hub/Bearing Bolts	176	130	—

BASE BRAKE

SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Front Disc Brake Caliper Type	Dual Piston Sliding
Front Disc Brake Caliper	2X54 mm (2.00 in.)
Front Disc Brake Rotor	336×28 mm (13.2×1.1 in.)
Front Disc Brake Rotor Max. Runout	0.025 mm (0.001 in.)
Front Disc Brake Rotor Max. Thickness Variation	0.010 mm (0.0004 in.)
Minimum Front Rotor Thickness	26.4 mm (1.039 in.)
Rear Brakes Drum Dual Shoes	Wheel Cylinders
Rear Brake Drum Size	295 X60 mm (11.5 in X 2.36 in.)
Rear Drum Brake Max. Runout	0.06 mm (0.0024 in.)
Rear Brake Drum Max Cut ID	297.5 mm (11.693 in.)
Wheel Cylinders	26.98 mm (1 1/16 in)
Brake Booster Type Gasoline Engines	Vacuum Dual Diaphragm

BRAKE LINES

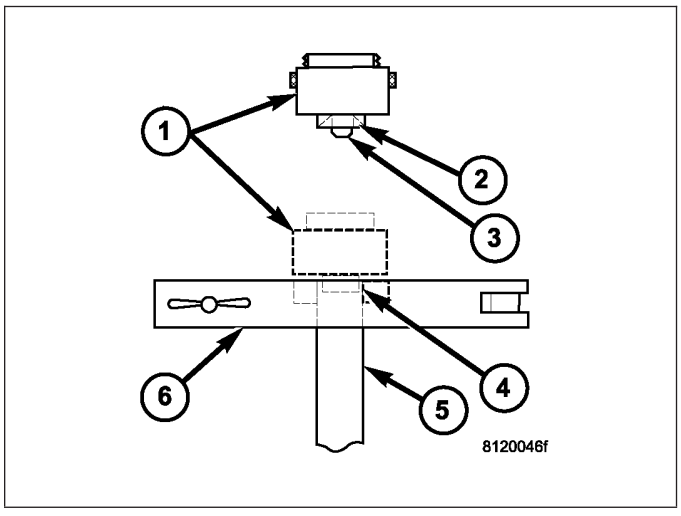
STANDARD PROCEDURE

ISO FLARING

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

To make a ISO flare use an ISO flaring tool kit.

1. Cut off damaged tube with Tubing Cutter.
2. Remove any burrs from the inside of the tube.
3. Install tube nut on the tube.
4. Position the tube in the flaring tool flush with the top of the tool bar (6). Then tighten the tool bar on the tube.
5. Install the correct size adaptor (1) on the flaring tool yoke screw.
6. Lubricate the adaptor (2).
7. Align the adaptor and yoke screw over the tube.
8. Turn the yoke screw in until the adaptor is squarely seated on the tool bar.



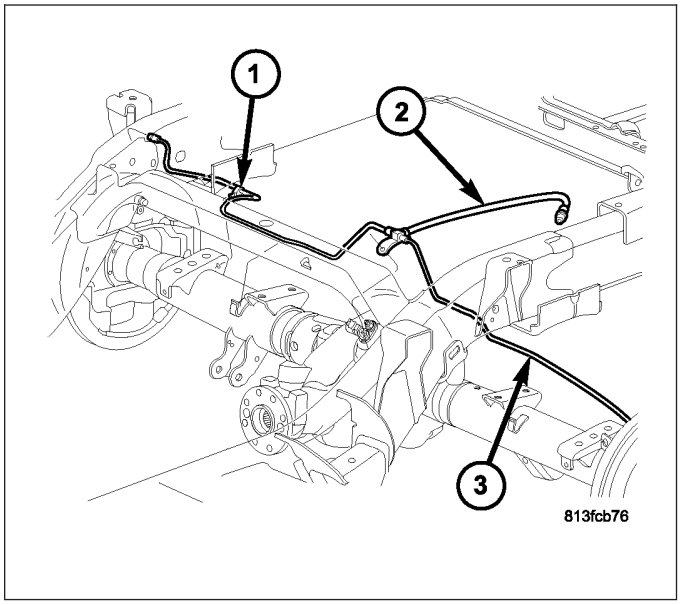
REMOVAL

REAR BRAKE LINES - BRAKE HOSE AT AXLE TO WHEEL CYLINDERS

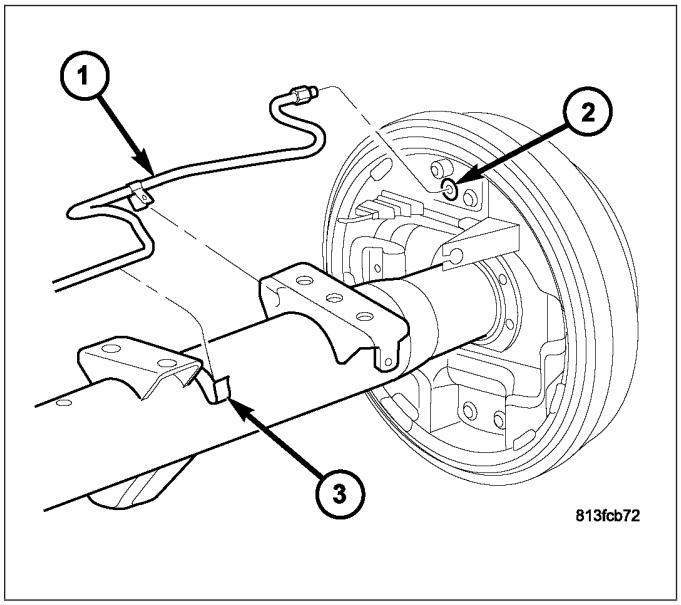
1. Raise and support the vehicle.

NOTE: If brake line (3) is being replaced

2. Remove the brake line (3) from the brake hose (2) at the axle.

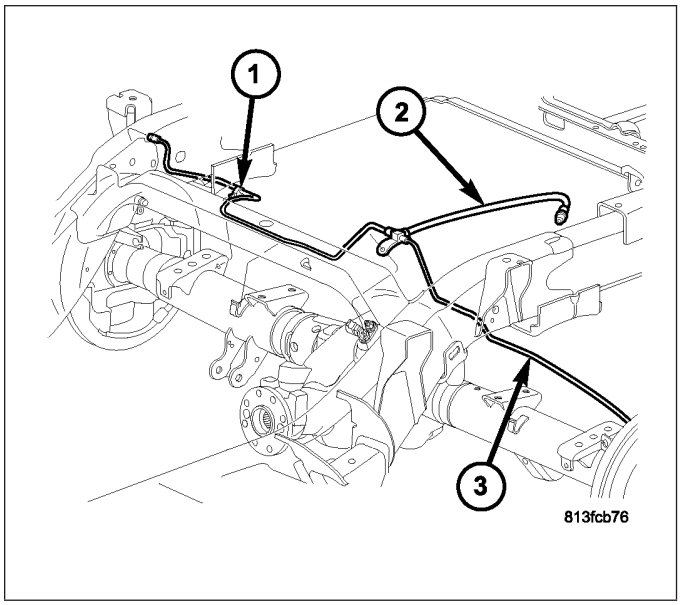


3. Remove the brake line from the clip on the spring bracket.
4. Remove the other end of the line (1) at the wheel cylinder (2).

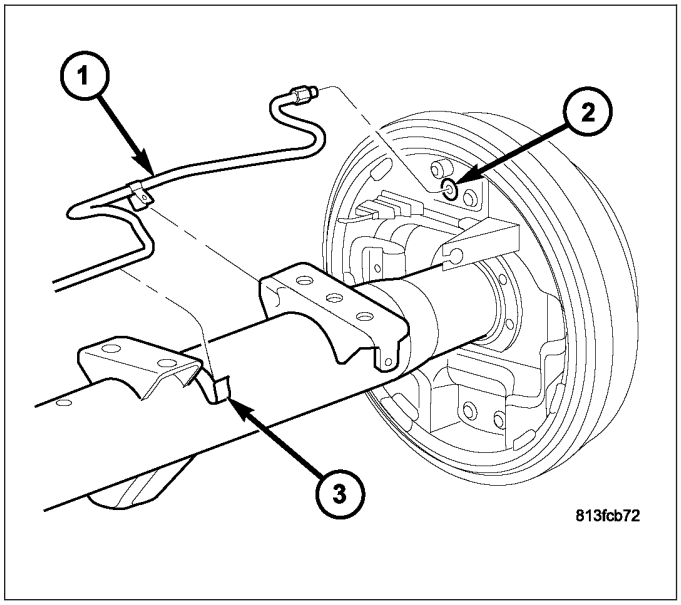


NOTE: If brake line (1) is being replaced

5. Remove the brake line (1) from the brake hose (2) at the axle.



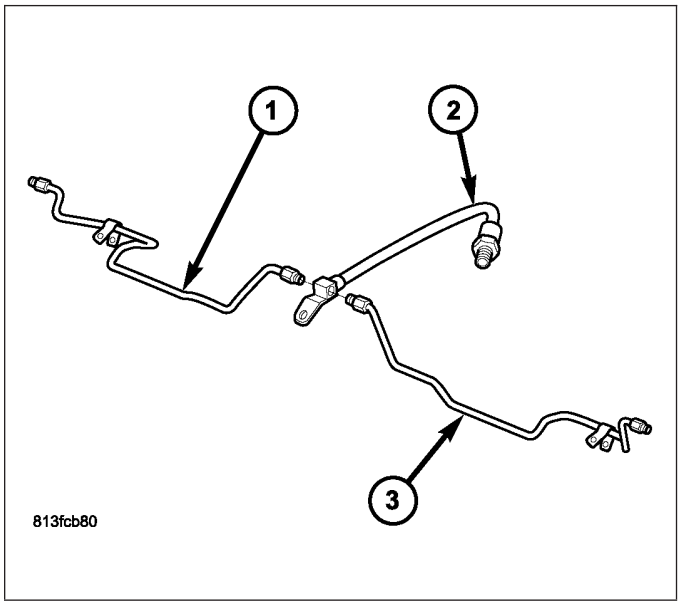
6. Remove the other end of the line (1) at the wheel cylinder (2).
7. Remove the line being replaced.



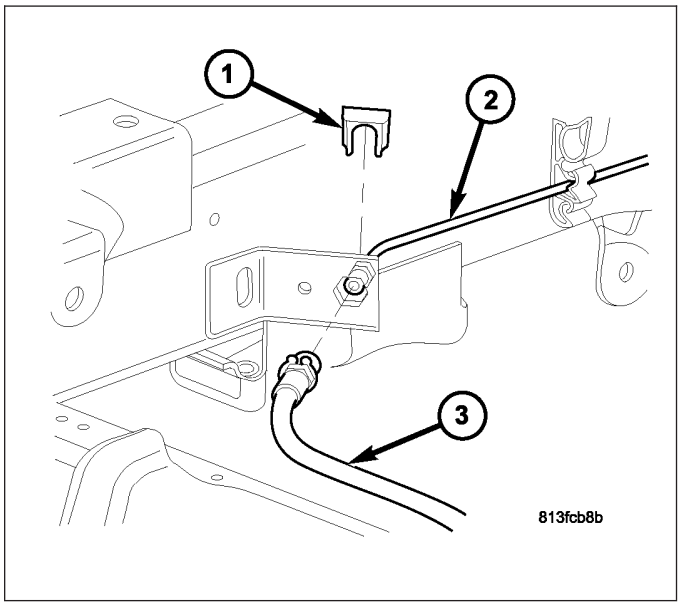
REAR BRAKE HOSE - AXLE TO FRAME

NOTE: The axle should be supported in the normal curb position for rear brake hose change.

1. Raise and support the vehicle.
2. Remove the brake lines (1&3) going into the brake hose (2).

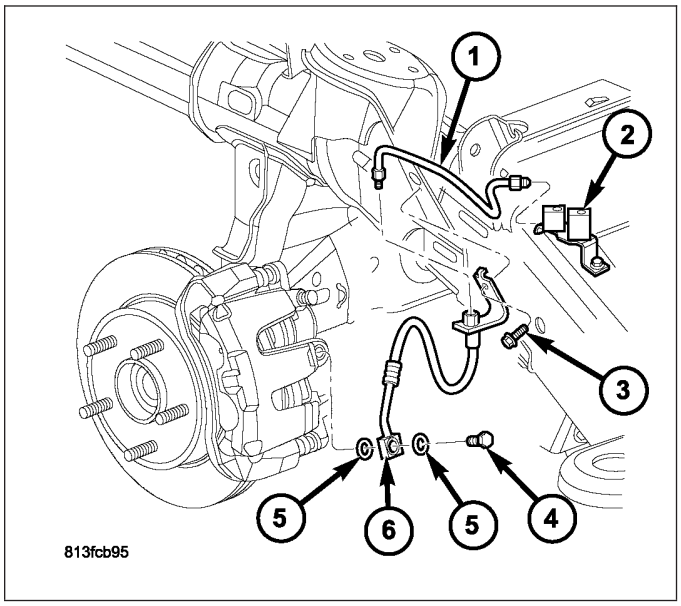


3. Remove the brake line (2) from the brake hose (3).
4. Remove the mounting clip (1) for the brake hose (3) at the frame.
5. Remove the hose (3).



FRONT CALIPER HOSE

1. Raise and support vehicle.
2. Remove the tire and wheel assembly.
3. Remove the brake line (1) from the brake hose (6) at the frame.
4. Remove the brake hose mounting bolt (3) from the frame.
5. Remove the brake line (1) from the junction block (2) **If necessary**.
6. Remove the brake hose banjo bolt (4) at the caliper **Discard the copper washers (5)**.
7. Remove the hose (6).



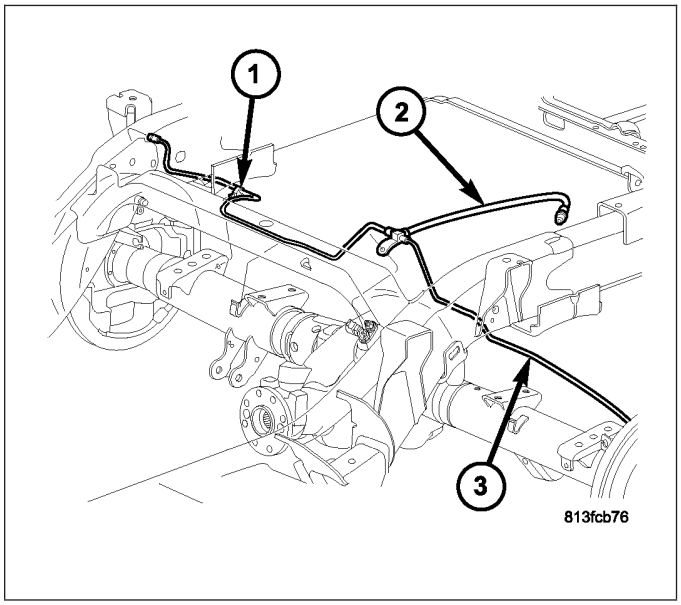
INSTALLATION

REAR BRAKE LINES - BRAKE HOSE AT AXLE TO WHEEL CYLINDERS

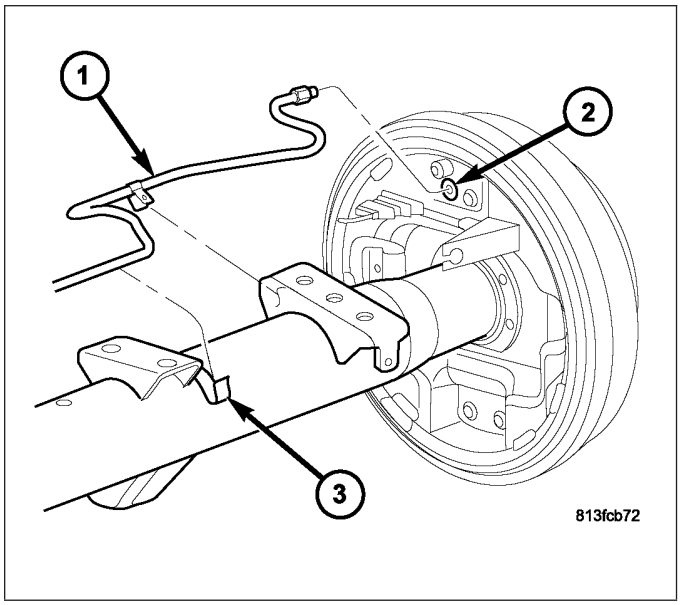
1. Install the line into the bend over tab at axle and then bend over the tab.
2. Install the brake line to the clip on the spring hanger.

NOTE: If brake line (3) was replaced

3. Install the brake line (3) at the brake hose (2) located at the axle.

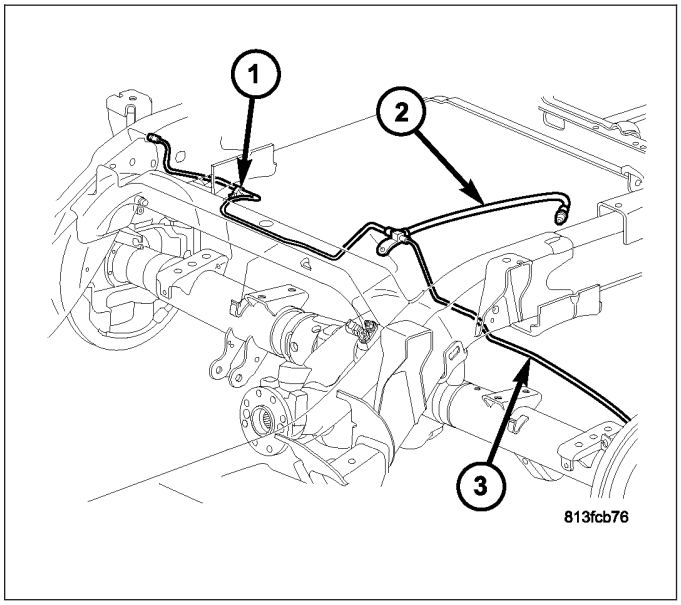


4. Install the brake line (1) at the wheel cylinder (2).

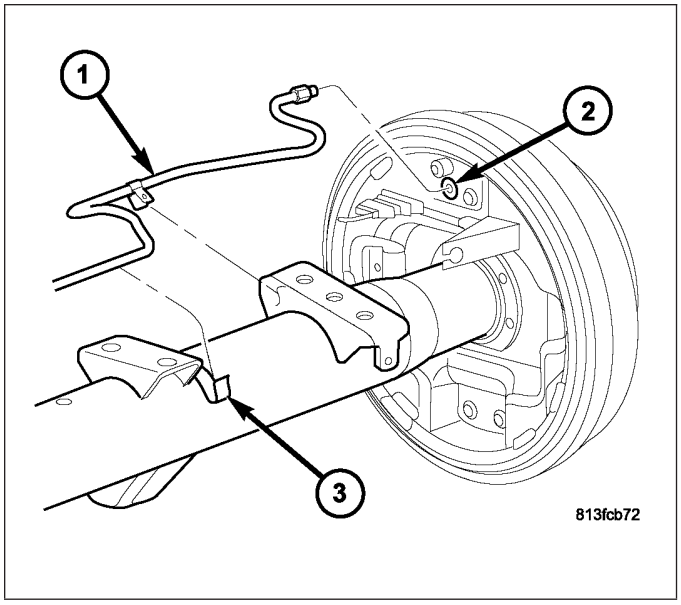


NOTE: If brake line (1) was replaced

5. Install the line into the bend over tab at axle and then bend over the tab.
6. Install the brake line to the clip on the spring hanger.
7. Install the brake line (1) at the brake hose (2) located at the axle.

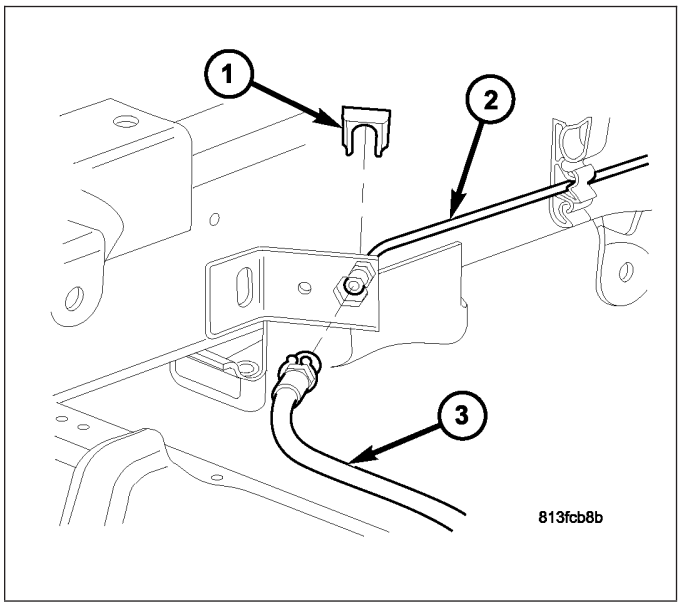


8. Install the brake line (1) at the wheel cylinder (2).
9. Lower the vehicle and remove the support.
10. Bleed the brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).

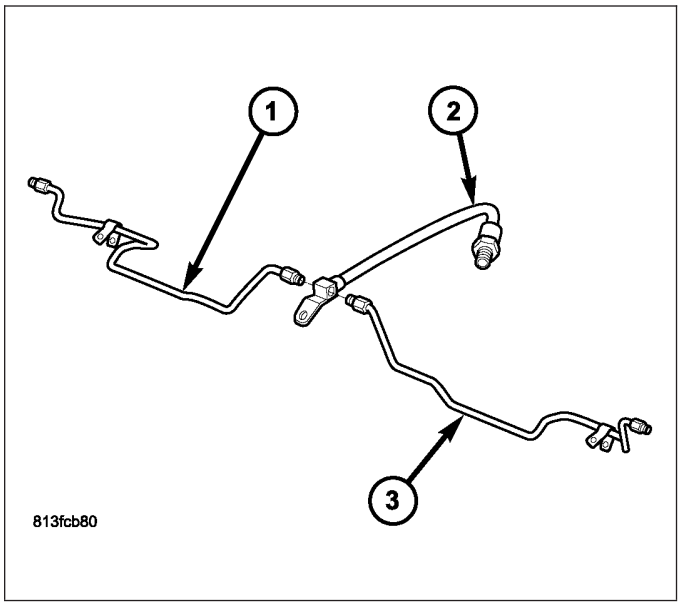


REAR BRAKE HOSE - AXLE TO FRAME

1. Install the brake hose (3) to the bracket and then install the clip (1).
2. Tighten the brake line (2) into the brake hose. Tighten to 16 N·m (21 ft.lbs.).

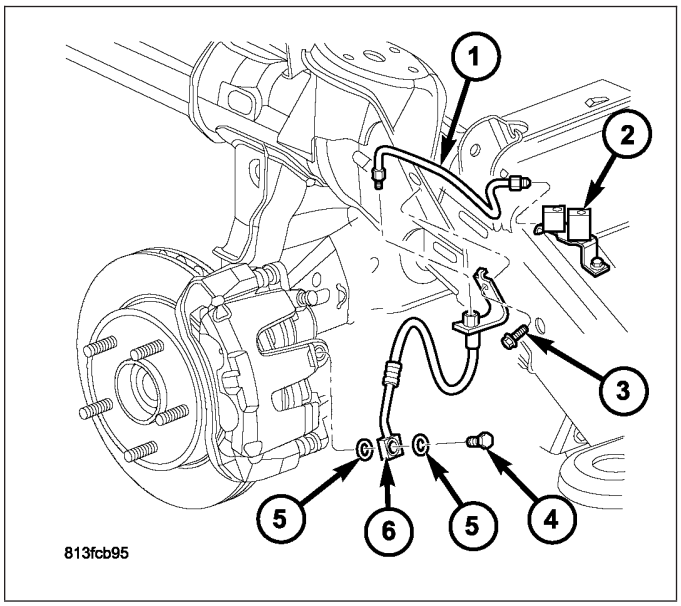


3. Install the brake line (2) to the axle stud.
4. Install the brake lines (1&3) into the brake hose (2).
5. Lower the vehicle and remove the support.
6. Bleed the brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).



FRONT CALIPER HOSE

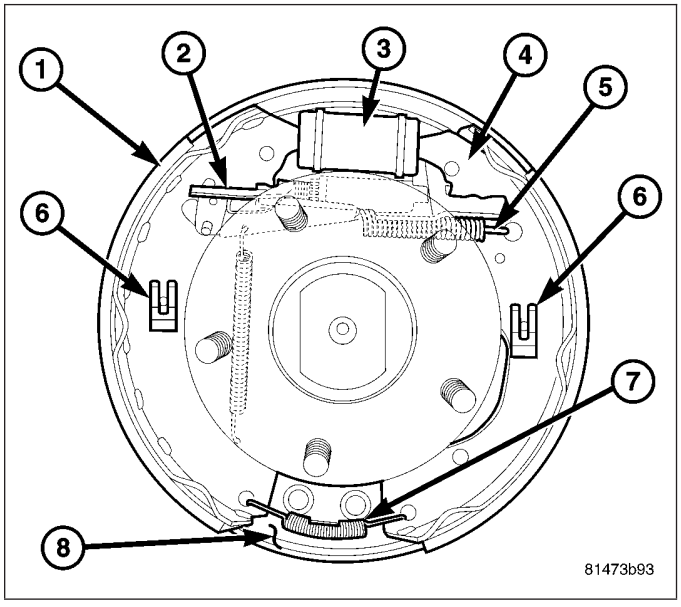
1. Install the brake hose (6) in position.
2. Install the mounting bracket bolt (3) at the frame, tighten to 14 N·m (125 in.lbs).
3. Install the brake line (1) into the junction block (2) and tighten to 14 N·m (125 in.lbs) **If removed.**
4. Install the brake line (1) into the brake hose (6) and tighten to 14 N·m (125 in.lbs).
5. Install the brake hose banjo bolt (4) **Use new copper washers (5)** at the caliper and tighten to 28 N·m (250 in.lbs).
6. Remove the support and lower the vehicle.
7. Bleed the brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).



BRAKE PADS/SHOES

DESCRIPTION

Drum brakes consist of dual shoes usually Leading (1) and Trailing (4), with wheel cylinders (3), an automatic self adjusting mechanism (2), springs (5 &7) and hold down clips (6) to hold the brake shoes against the dust shield (8).



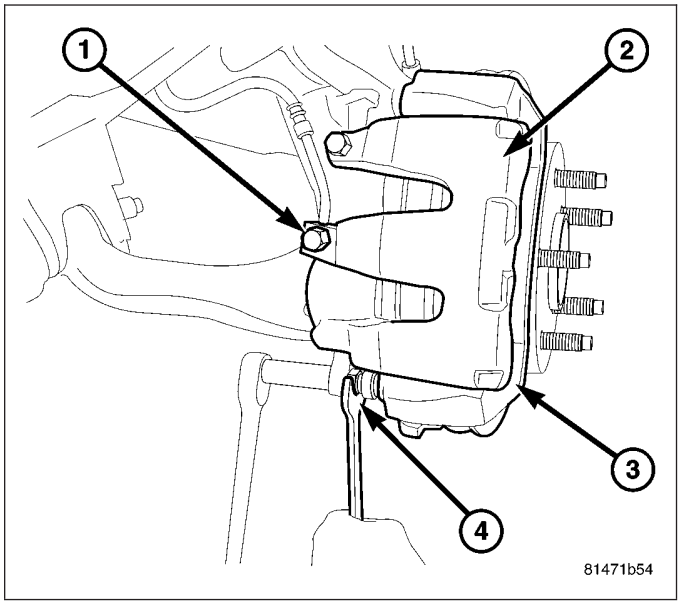
OPERATION

When the brake pedal is depressed hydraulic pressure pushes the rear wheel cylinder pistons outward. The wheel cylinder push rods then push the brake shoes outward against the brake drum. When the brake pedal is released return springs attached to the brake shoes pull the shoes back to there original position.

REMOVAL

FRONT DISC BRAKE PADS

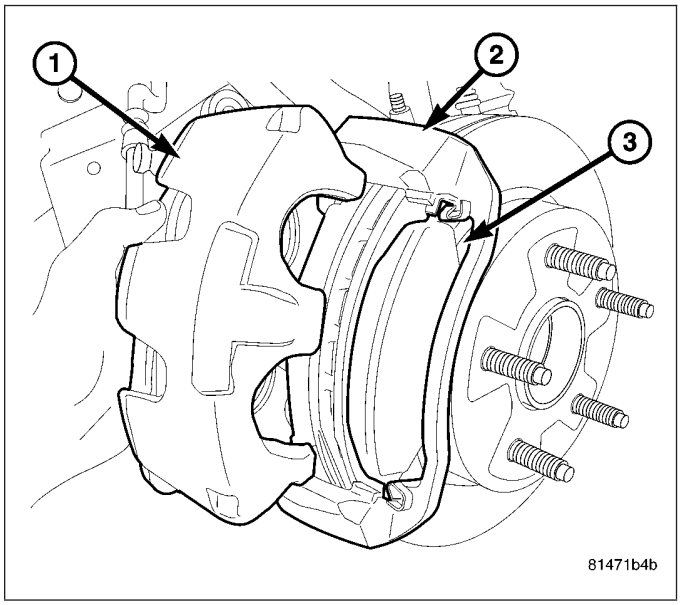
1. Raise and support vehicle.
2. Remove the wheel and tire assemblies.
3. Compress the caliper (2).
4. Remove the caliper slide pin bolts (4), (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).



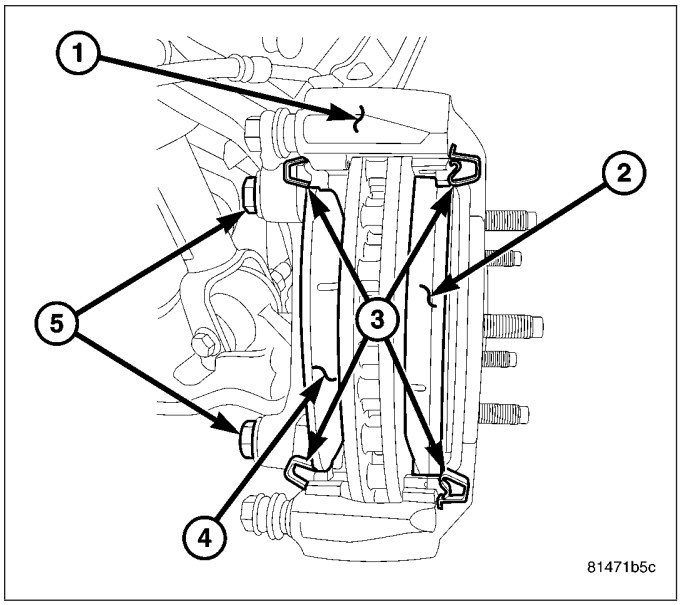
5. Remove the caliper (1) from the caliper adapter (2).

NOTE: Do not allow brake hose to support caliper assembly.

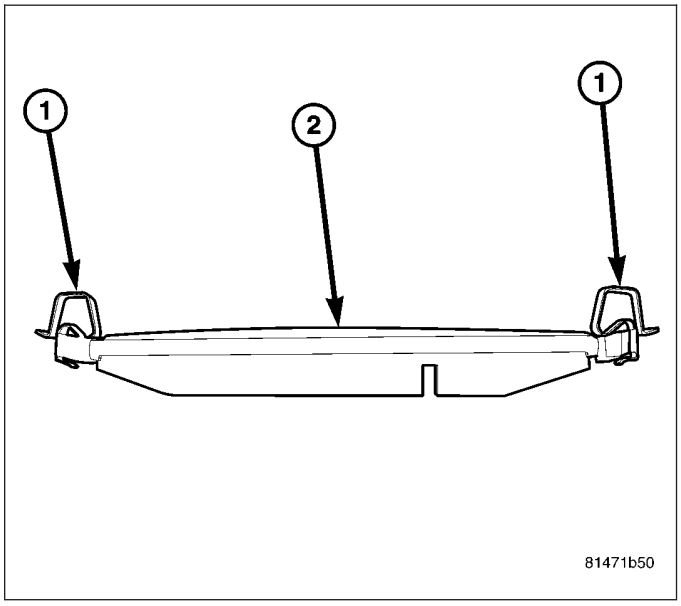
6. Support and hang the caliper.



7. Remove the inboard brake pad (4) from the caliper adapter (1).
8. Remove the outboard brake pad (2) from the caliper adapter (1).



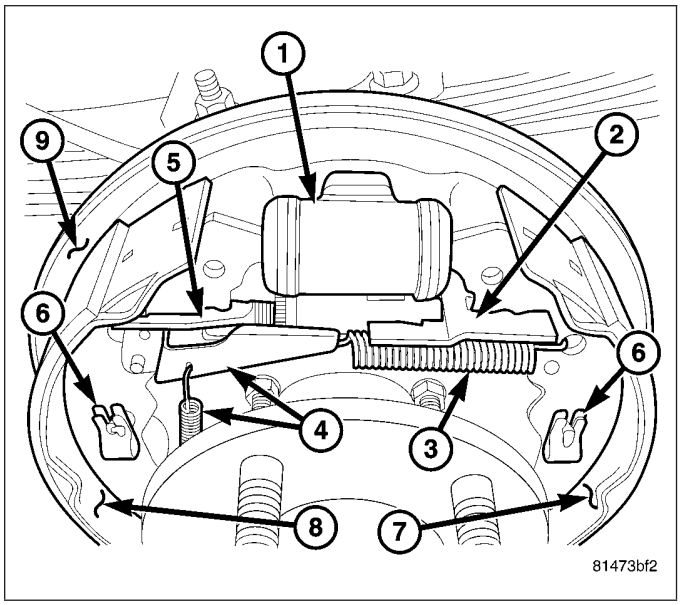
9. Remove the anti-rattle clips (1) from the pad (2).



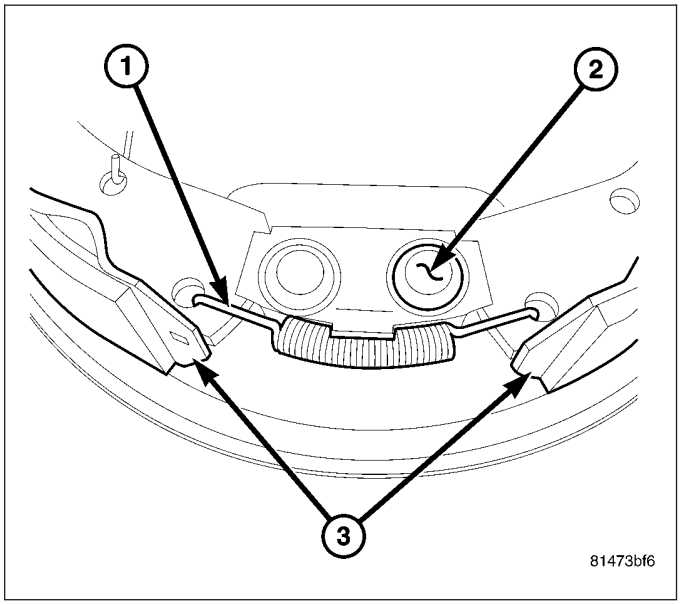
REAR BRAKE SHOES

1. Raise and support vehicle.
2. Remove wheel and tire assembly.
3. Remove clip nuts securing brake drum to wheel studs.
4. Remove drum. If drum is difficult to remove, remove rear plug from access hole in support plate. Back-off self adjusting by inserting a thin screwdriver into access hole and push lever away from adjuster star wheel. Then insert an adjuster tool into brake adjusting hole rotate adjuster star wheel to retract brake shoes.
5. Vacuum brake components to remove brake lining dust.

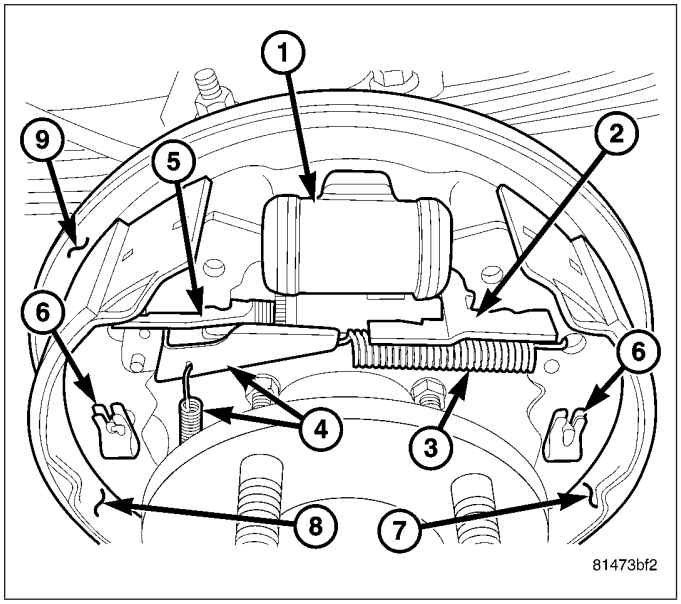
6. Remove shoe return spring (3) with brake spring plier tool.
7. Remove adjuster spring and lever (5). Disengage lever from spring by sliding lever forward to clear pivot and work lever out from under spring.



8. Disengage and remove shoe return spring (1) from brake shoes. (3)



9. Remove brake shoe hold down clips (6).
10. Remove rear brake shoe (7) from support plate (9).
11. Remove front brake shoe (8) from support plate (9).
12. Remove park brake lever (2) from the brake shoe.



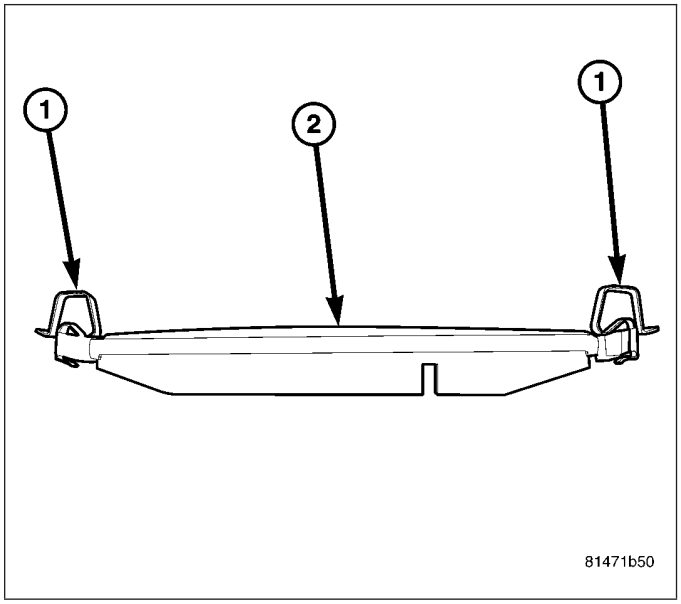
CLEANING

Clean the individual brake components, including the support plate and wheel cylinder exterior, with a water dampened cloth or with brake cleaner. Do not use any other cleaning agents. Remove light rust and scale from the brake shoe contact pads on the support plate with fine sandpaper.

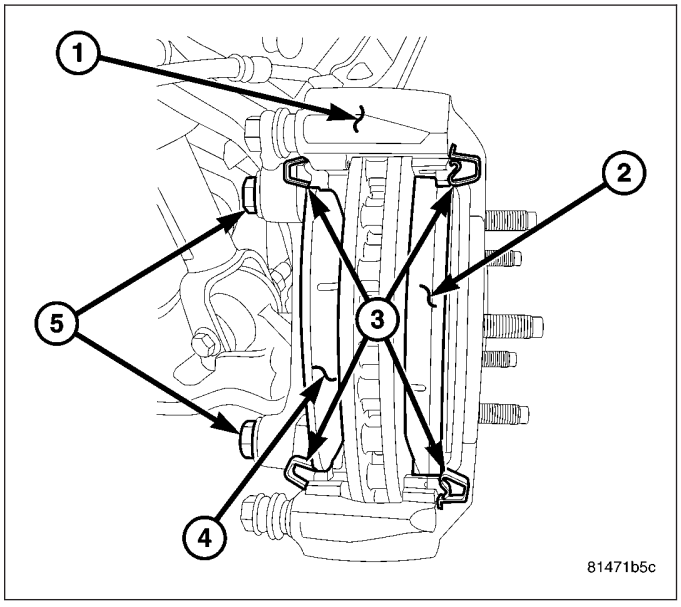
INSTALLATION

FRONT DISC BRAKE PADS

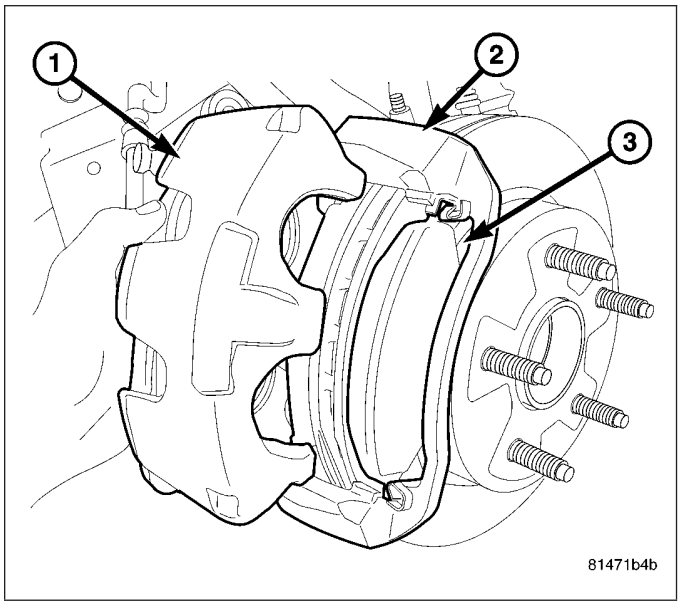
1. Bottom pistons in caliper bore with C-clamp. Place an old brake shoe between a C-clamp and caliper piston.
2. Clean caliper mounting adapter.
3. Install **new** anti-rattle clips (1) to the brake pads (2).



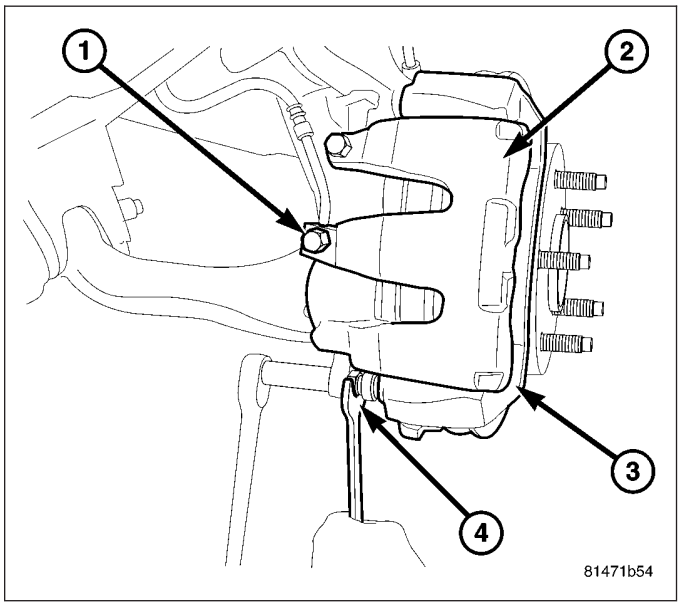
4. Install inboard brake pad (4) in adapter (1).
5. Install outboard brake pad (2) in adapter (1).



6. Install the caliper (1) over rotor, Then push the caliper onto the adapter (2).



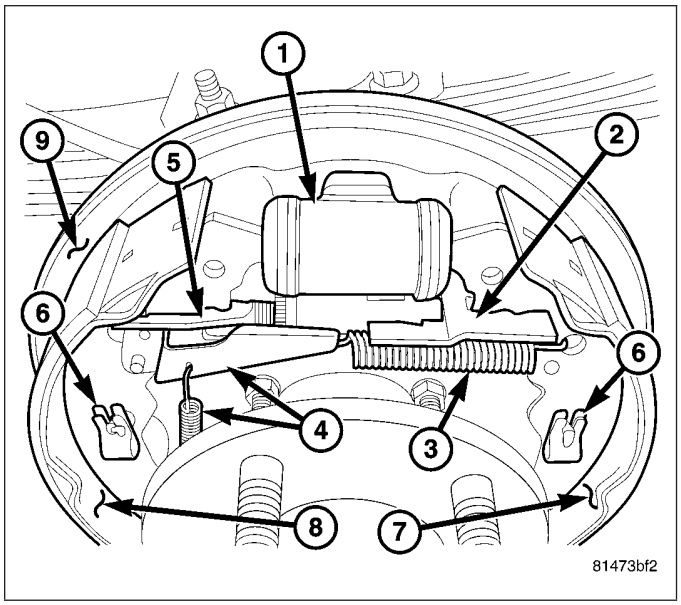
7. Install caliper slide pin bolts (4), (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
8. Install wheel and tire assemblies and lower vehicle, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
9. Apply brakes several times to seat caliper pistons and brake shoes and obtain firm pedal.
10. Top off master cylinder fluid level.



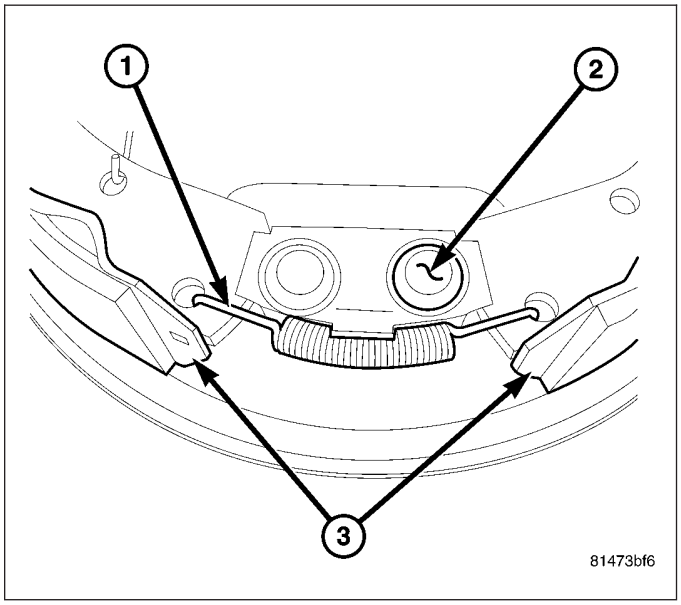
REAR BRAKE SHOES

1. Clean and inspect individual brake components.
2. Lubricate where the brake shoe contacts the support plate with high temperature grease or Lubriplate.
3. Lubricate adjuster screw socket, nut, button and screw thread surfaces with grease or Lubriplate.

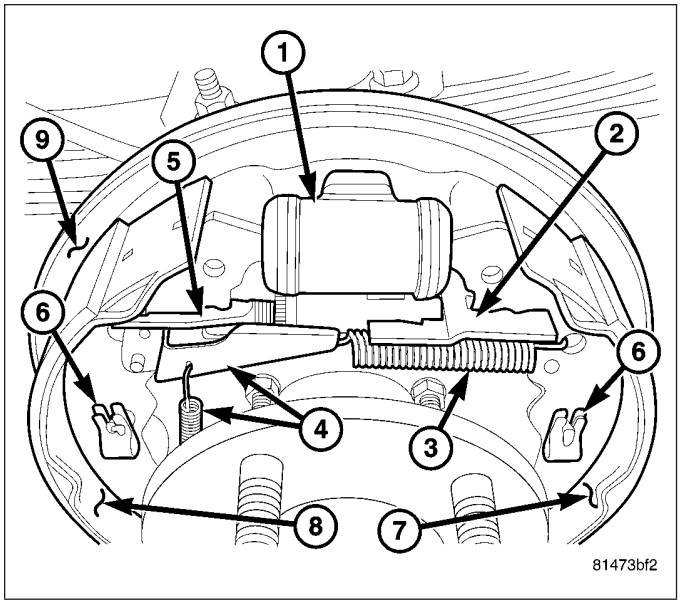
4. Install parking brake lever (2) to the rear shoe (7) and install the hold down clip (6).
5. Install the adjuster strut (5) onto the shoes and park brake lever (2).
6. Install the front shoe (8) on support plate (9). and install the hold down clip (6).
7. Install the adjuster spring and lever (4) in the slot in the adjuster strut (7).



8. Install the lower return spring (1) to the shoes (3).



9. Verify adjuster operation. Pull both shoes outward to move the adjuster lever (4) to rotate the star wheel. Be sure adjuster lever properly engages star wheel teeth.
10. Adjust brake shoes to drum with brake gauge.
11. Install wheel and tire assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).



ADJUSTMENTS - REAR DRUM BRAKE

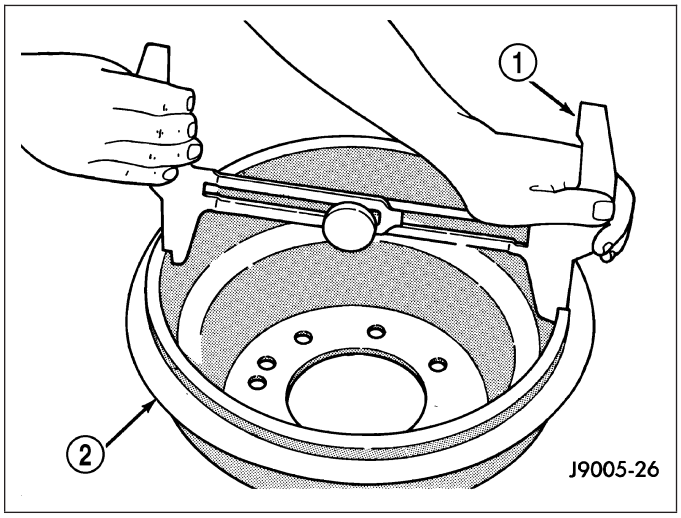
The rear drum brakes are equipped with a self-adjusting mechanism. Under normal circumstances, the only time adjustment is required is when the shoes are replaced, removed for access to other parts, or when one or both drums are replaced.

Adjustment can be made with a standard brake gauge or with adjusting tool. Adjustment is performed with the complete brake assembly installed on the backing plate.

ADJUSTMENT WITH BRAKE GAUGE

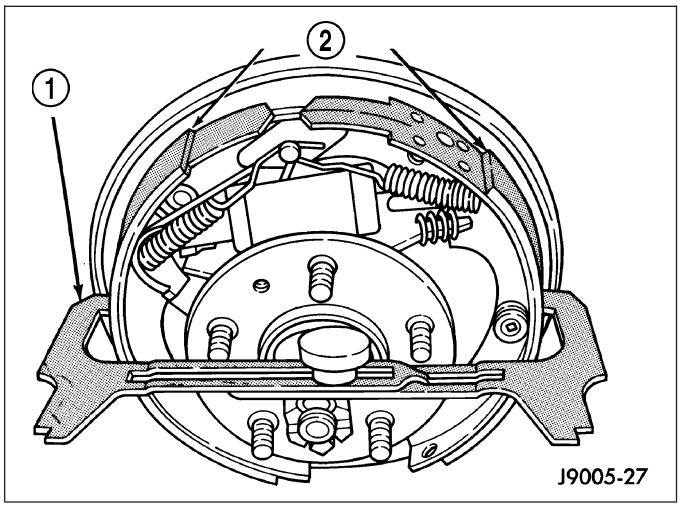
1. Be sure parking brakes are fully released.
2. Raise rear of vehicle and remove wheels and brake drums.
3. Verify that left and right automatic adjuster levers and cables are properly connected.
4. Insert brake gauge in drum. Expand gauge until gauge inner legs contact drum braking surface. Then lock gauge in position.
5. Reverse gauge and install it on brake shoes. Position gauge legs at shoe centers as shown. If gauge does not fit (too loose/too tight), adjust shoes.
6. Pull shoe adjuster lever away from adjuster screw star wheel.
7. Turn adjuster screw star wheel (by hand) to expand or retract brake shoes. Continue adjustment until gauge outside legs are light drag-fit on shoes.
8. Install brake drums and wheels and lower vehicle.
9. Drive vehicle and make 8-10 forward stops to operate automatic adjusters and equalize adjustment.

NOTE: Bring vehicle to complete standstill at each stop. Incomplete, rolling stops will not activate automatic adjusters.

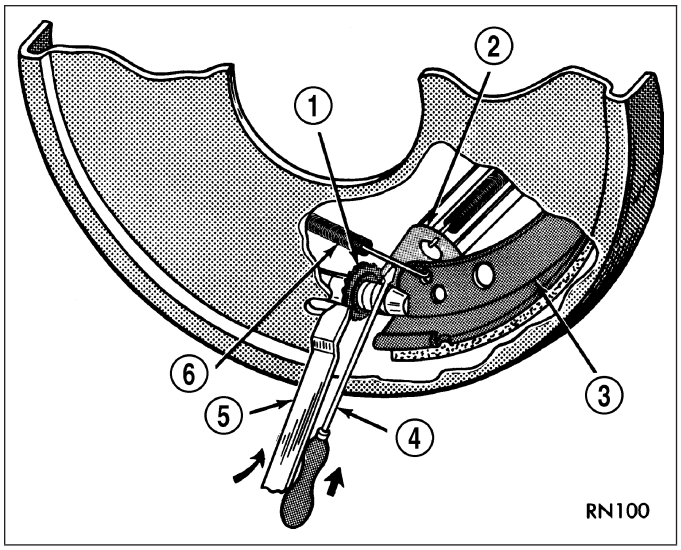


ADJUSTMENT WITH ADJUSTING TOOL

1. Be sure parking brake lever is fully released.
2. Raise vehicle so rear wheels can be rotated freely.
3. Remove plug from each access hole in brake support plates.
4. Loosen parking brake cable adjustment nut until there is slack in front cable.
5. Insert adjusting tool through support plate access hole and engage tool in teeth of adjusting screw star wheel.



6. Rotate adjuster screw star wheel (move tool handle upward) until slight drag can be felt when wheel is rotated.
7. Push and hold adjuster lever away from star wheel with thin screwdriver.
8. Back off adjuster screw star wheel until brake drag is eliminated.
9. Repeat adjustment at opposite wheel. Be sure adjustment is equal at both wheels.
10. Install support plate access hole plugs.
11. Adjust parking brake cable and lower vehicle.
12. Drive vehicle and make 8-10 forward stops to operate automatic adjusters and equalize adjustment.



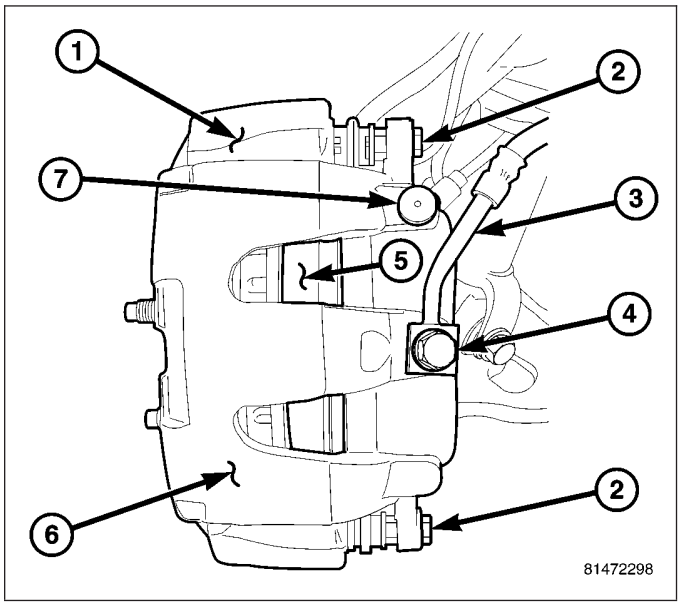
NOTE: Bring vehicle to complete standstill at each stop. Incomplete, rolling stops will not activate automatic adjusters.

DISC BRAKE CALIPERS

DESCRIPTION

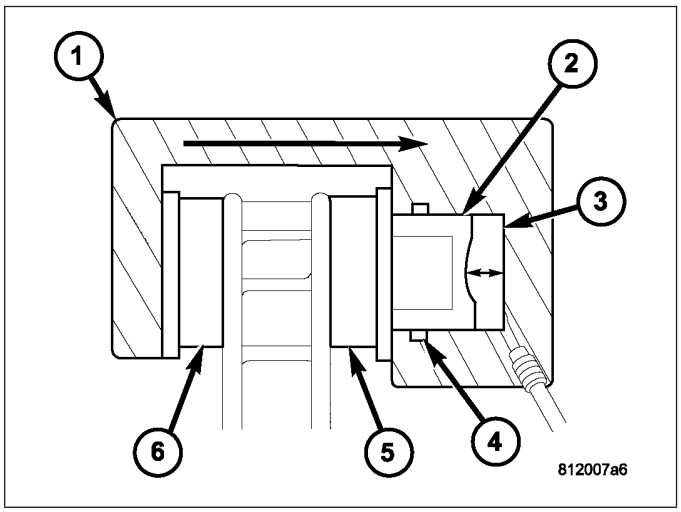
NOTE: Petroleum based grease should not be used on any of the rubber components of the caliper, Use only Non-Petroleum based grease.

The calipers are a dual piston type. The calipers are free to slide laterally, this allows continuous compensation for lining wear.



OPERATION

When the brakes are applied fluid pressure is exerted against the caliper piston (2). The fluid pressure is exerted equally and in all directions. This means pressure exerted against the caliper piston and within the caliper bore will be equal.



Fluid pressure applied to the piston is transmitted directly to the inboard brake pad (5). This forces the pad lining against the inner surface of the disc brake rotor. At the same time, fluid pressure within the piston bore forces the caliper to slide inward on the mounting bolts. This action brings the outboard brake pad lining (6) into contact with the outer surface of the disc brake rotor.

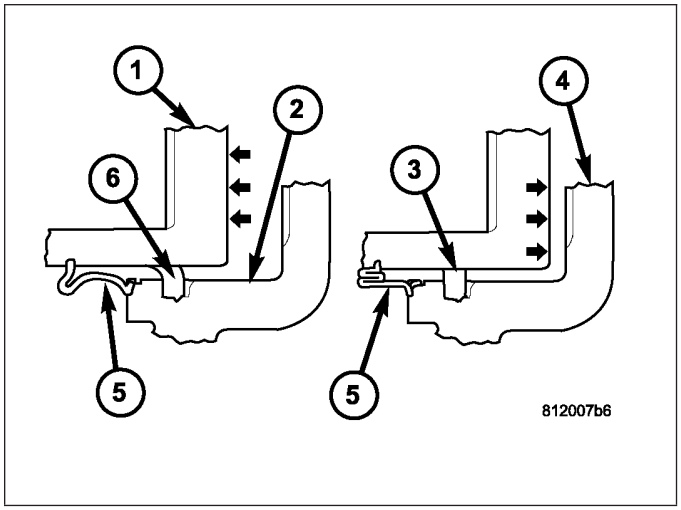
In summary, fluid pressure acting simultaneously on both piston and caliper, produces a strong clamping action. When sufficient force is applied, friction will attempt to stop the rotors from turning and bring the vehicle to a stop.

Application and release of the brake pedal generates only a very slight movement of the caliper and piston. Upon release of the pedal, the caliper and piston return to a rest position. The brake pads do not retract an appreciable distance from the rotor. In fact, clearance is usually at, or close to zero. The reasons for this are to keep road debris from getting between the rotor and lining and in wiping the rotor surface clear each revolution.

The caliper piston seal (4) controls the amount of piston (2) extension needed to compensate for normal lining wear.

During brake application, the seal is deflected outward by fluid pressure and piston movement(6). When the brakes (and fluid pressure) are released, the seal relaxes and retracts the piston (3).

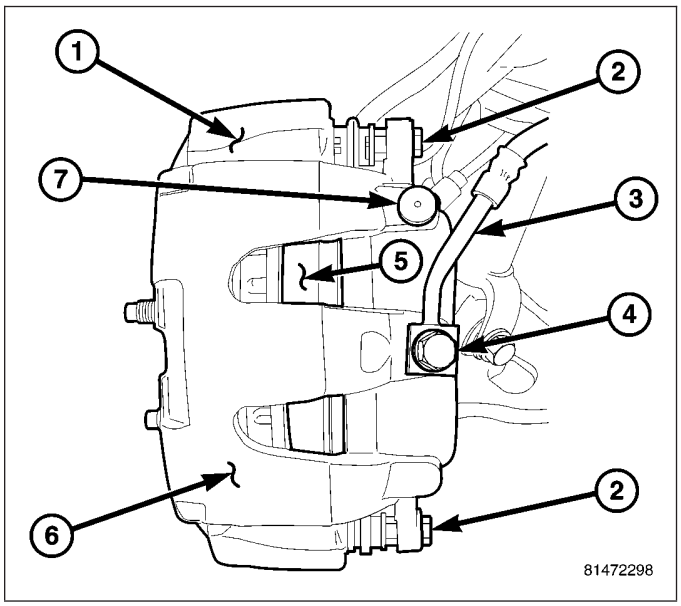
The amount of piston retraction is determined by the amount of seal deflection. Generally the amount is just enough to maintain contact between the piston and inboard brake pad.



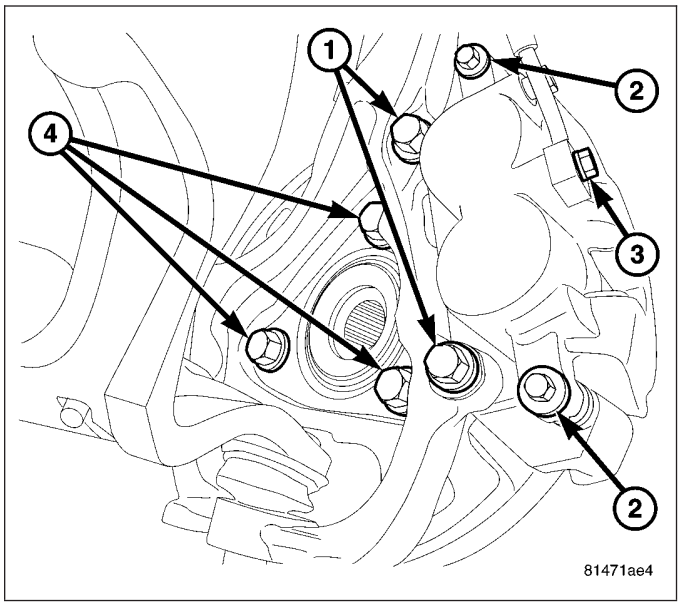
REMOVAL

CAUTION: Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose with result. Provide a suitable support to hang the caliper securely.

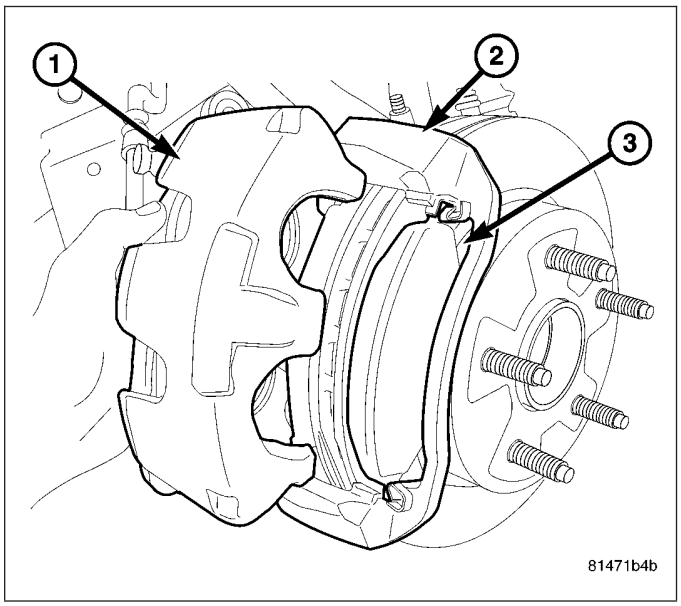
1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Compress the disc brake caliper (6).
4. Remove the banjo bolt (4) and discard the copper washers.



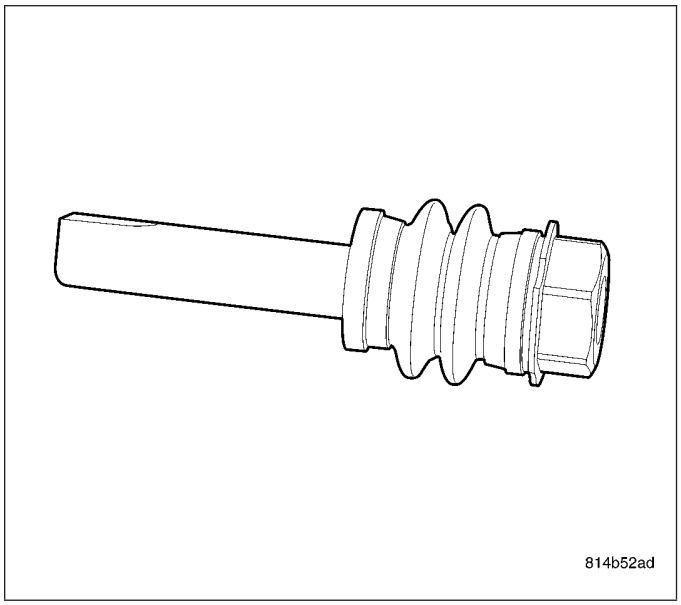
5. Remove the caliper slide pin bolts (2).



6. Remove the disc brake caliper (1) from the caliper adapter (2).

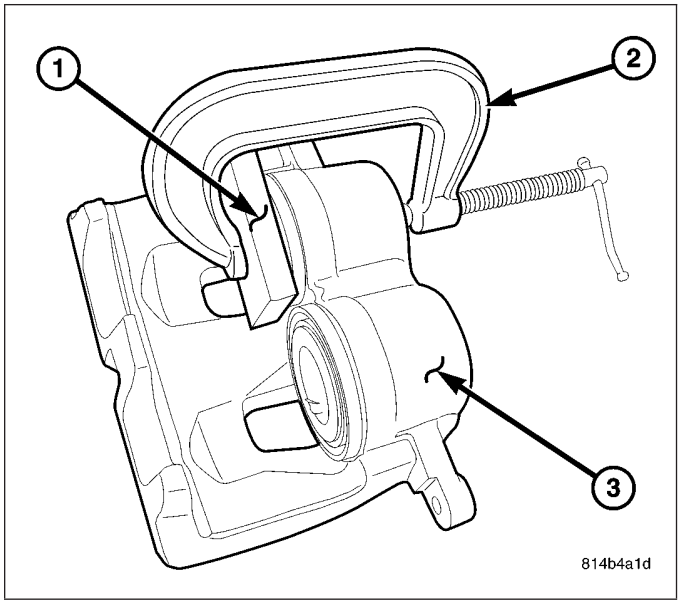


7. Remove the caliper slide pins from the adapter.



DISASSEMBLY

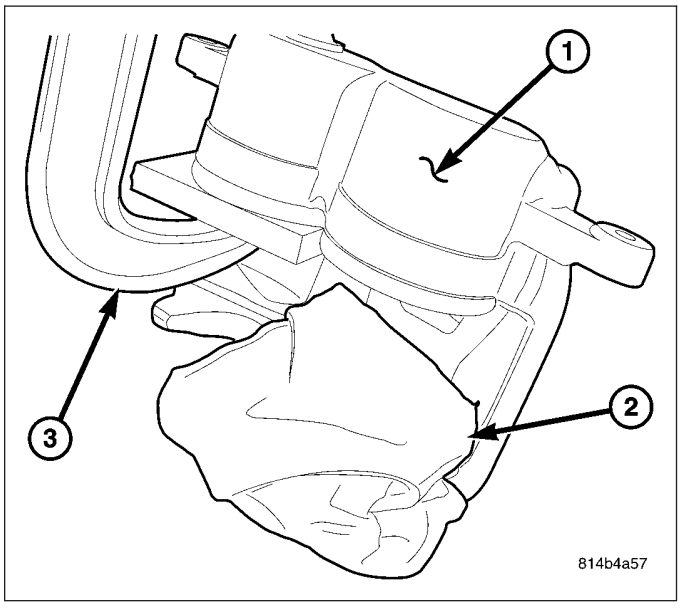
1. Drain the brake fluid from caliper.
2. C-clamp (2) a block of wood (1) over one piston.



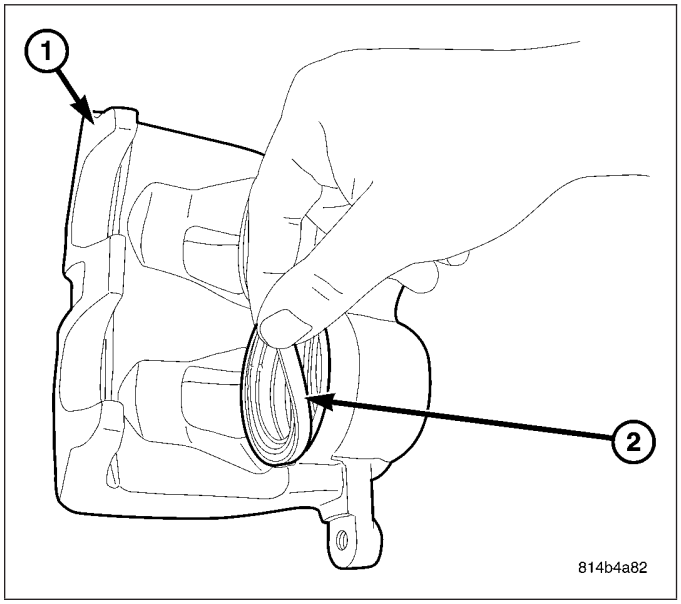
3. Take another piece of wood and pad it with one-inch thickness of shop towels (2). Place this piece in the outboard shoe side of the caliper in front of the other piston. This will cushion and protect caliper piston during removal.
4. To remove the caliper piston direct **short bursts of low pressure air** with a blow gun through the caliper brake hose port. Use only enough air pressure to ease the piston out.

CAUTION: Do not blow the piston out of the bore with sustained air pressure. This could result in a cracked piston.

WARNING: NEVER ATTEMPT TO CATCH THE PISTON AS IT LEAVES THE BORE. THIS COULD RESULT IN PERSONAL INJURY.

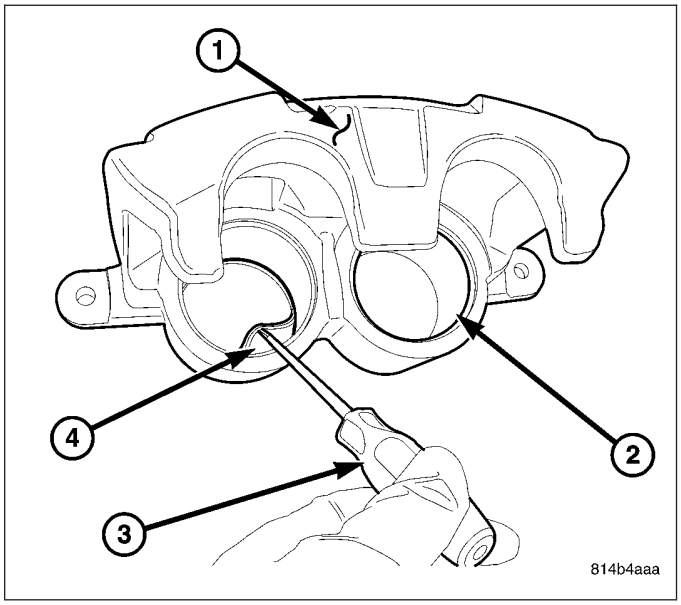


5. Remove the C-clamp and block of wood from the caliper and clamp it over the dust boot of the first piston removed. This will seal the empty piston bore.
6. Move the padded piece of wood in front of the other piston.
7. Remove the second piston using the same procedure with **short bursts of low pressure air**.
8. Remove piston dust boots (2) by hand.

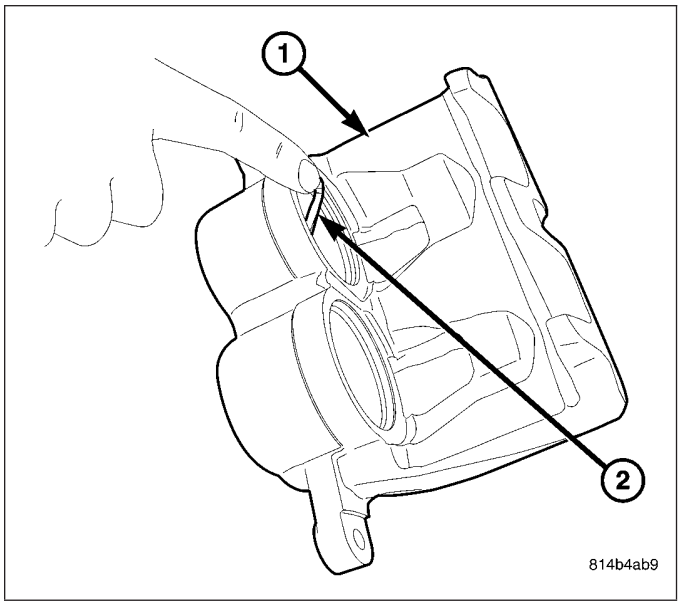


CAUTION: Do not scratch piston bore while removing the seals.

9. Remove the lip seal (4) with a pick tool (3) out of the groove.



10. Remove piston seals (2) from caliper (1) by hand.



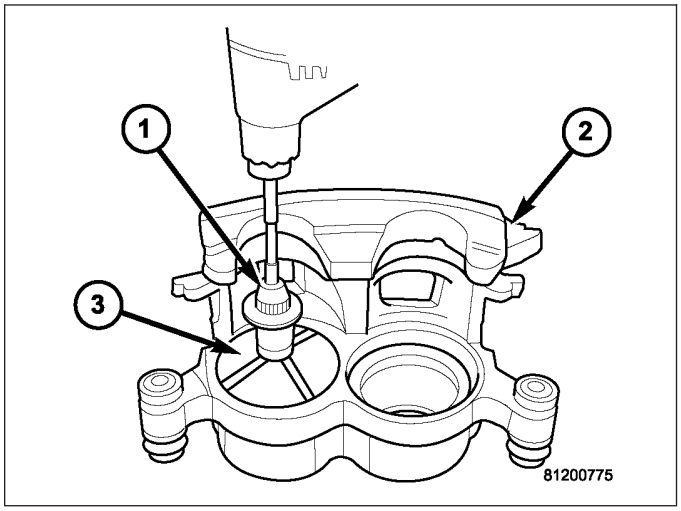
INSPECTION

The piston is made from a phenolic resin (plastic material) and should be smooth and clean.

The piston must be replaced if cracked or scored. Do not attempt to restore a scored piston surface by sanding or polishing.

CAUTION: If the caliper piston is replaced, install the same type of piston in the caliper. Never interchange phenolic resin and steel caliper pistons. The pistons, seals, seal grooves, caliper bore and piston tolerances are different.

The bore can be **lightly** polished with a brake hone (3) to remove very minor surface imperfections. The caliper should be replaced if the bore is severely corroded, rusted, scored, or if polishing would increase bore diameter more than 0.025 mm (0.001 inch).



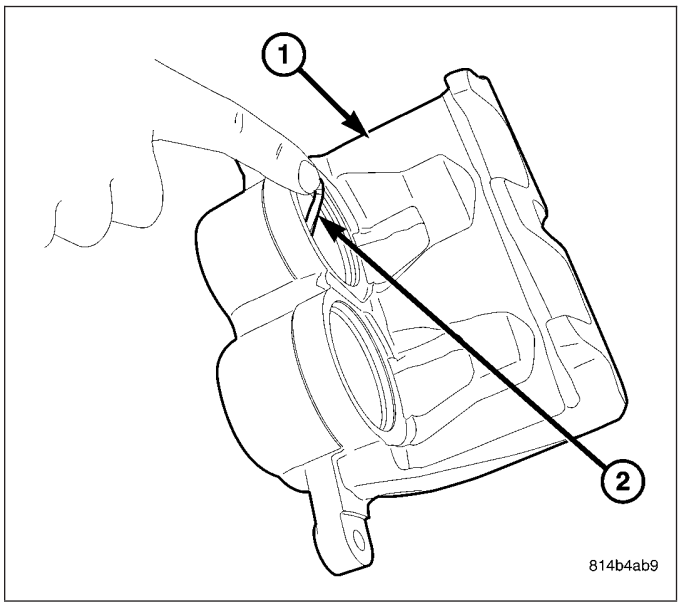
ASSEMBLY

CAUTION: Dirt, oil, and solvents can damage caliper seals. Insure assembly area is clean and dry.

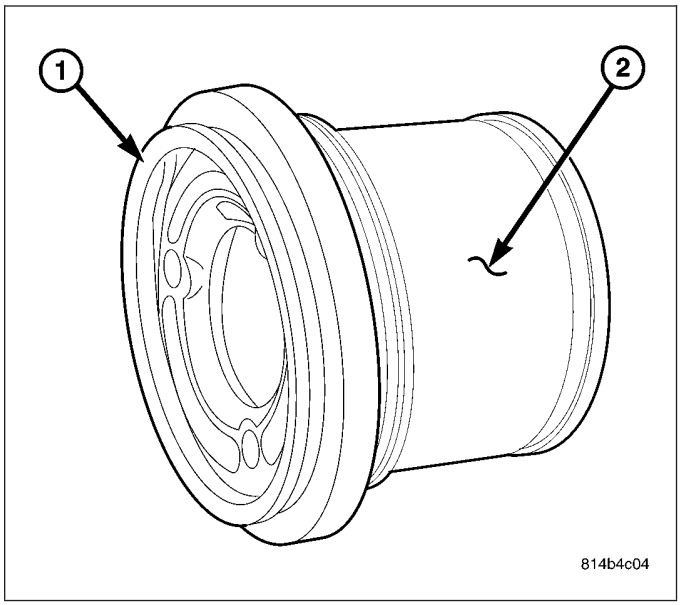
1. Lubricate caliper pistons, piston seals and piston bores with clean, fresh brake fluid.

NOTE: Verify seal is fully seated and not twisted.

2. Install new piston seals (2) into caliper bores (1).

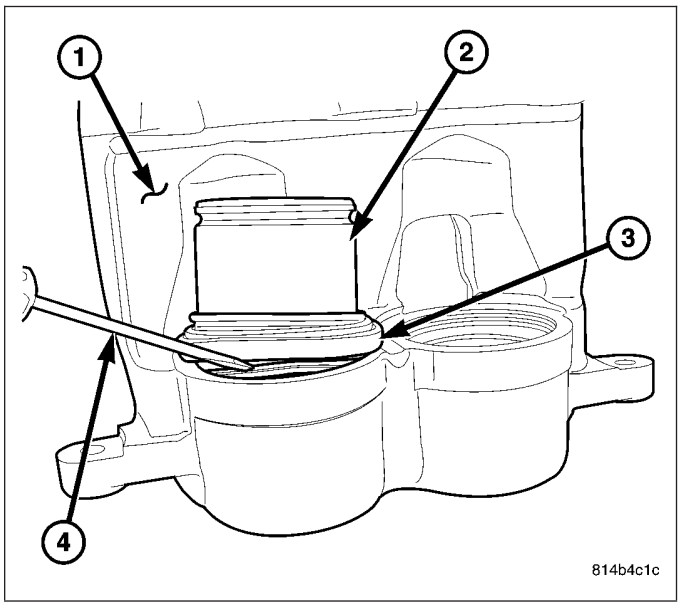


3. Leave boot (1) dry and slip onto end of piston (2).

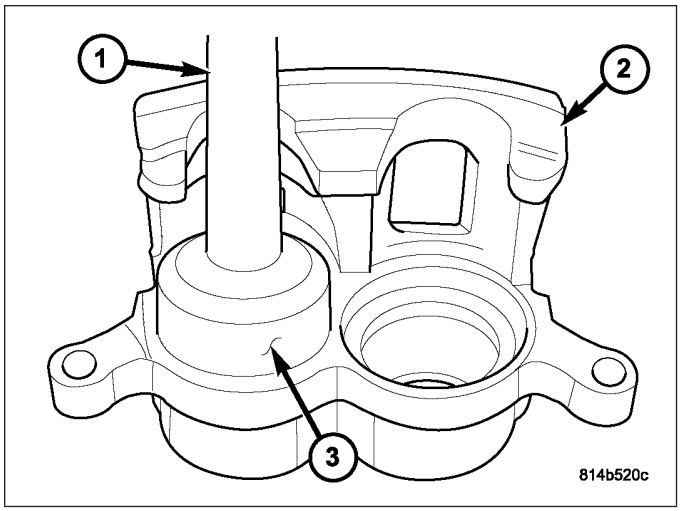


NOTE: The dust boot lip must be inserted before the piston

4. Slightly pull out lip portion of piston boot (3) so it protrudes past the bottom of the piston (2) and work lip into outermost groove on caliper housing (1).
5. Carefully press the lip (3) into the groove with a suitable tool (4) **Avoid using sharp-edged tools** This will ensure that the lip is nested into the groove all around before pushing the piston into the bore.



6. Press the piston fully into the bore using special tool C3716-A seal installer (3) with C-4171 Handle (1).
7. Once the piston is pressed into the bottom of the bore, Check to see that the dust boot bellows are not inflated with air. **If needed, push in between the dust boot and piston to expel any trapped air**.



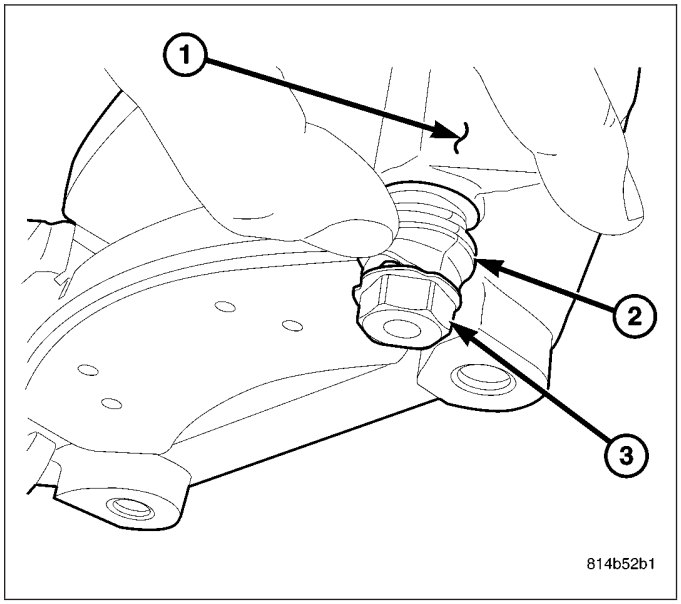
INSTALLATION

NOTE: Petroleum based grease should not be used on any of the rubber components of the caliper, Use only Non-Petroleum based grease.

NOTE: Clean slide pin bores thoroughly to remove any old grease.

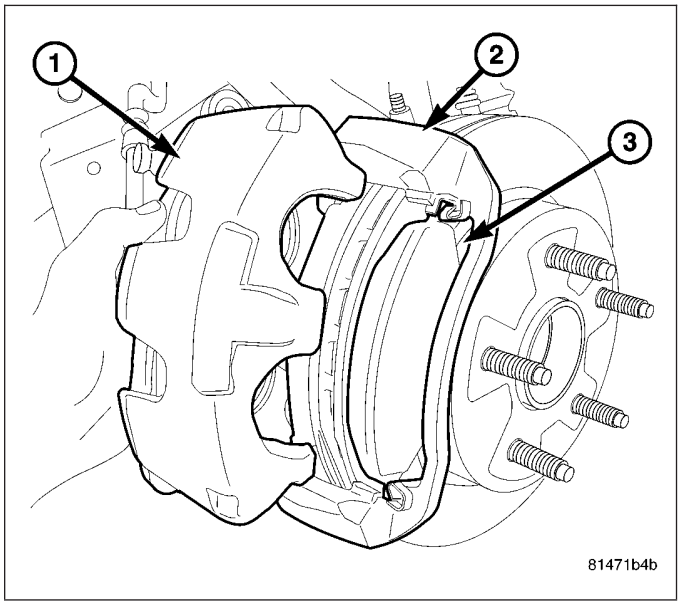
NOTE: Use grease packets included with kit or Dow Corning-807® grease.

1. Thoroughly coat the new slide pins (3) on all working surfaces.
2. Install the boot (2) onto the slide pin (3) and then insert into the adapter (1).
3. Push the pin (3) all the way into the adapter (1) and carefully expel the trapped air by gently pushing on the boot (2) near the slide pin head (3).

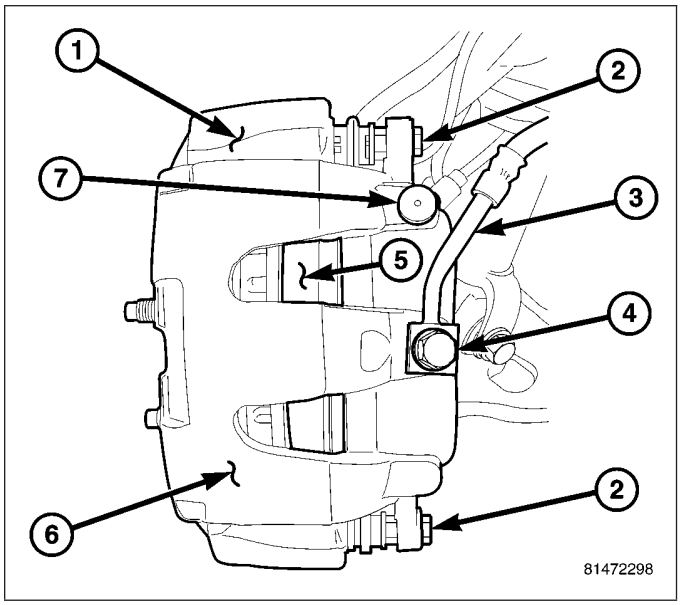


NOTE: Install a new copper washers on the banjo bolt when installing

4. Install the disc brake caliper (1) to the brake caliper adapter (2).



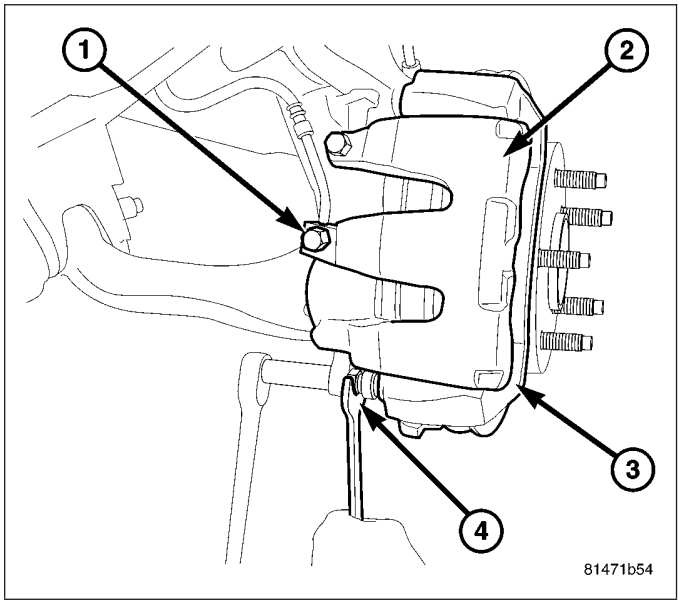
5. Install the banjo bolt (4) with new copper washers to the caliper (6). Tighten to 28 N·m (250 in. lbs.)
6. Install the caliper slide pin bolts (2). tighten to 32 N·m (24 ft. lbs.)
7. Bleed the base brake system, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL - STANDARD PROCEDURE).
8. Install the tire and wheel assembly, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
9. Lower the vehicle.



DISC BRAKE CALIPER ADAPTER

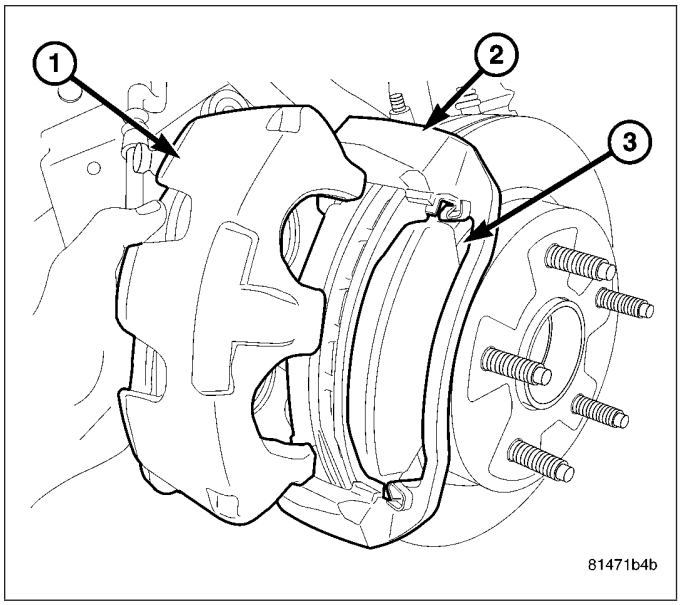
REMOVAL

1. Raise and support the vehicle.
2. Remove the front wheel and tire assembly.
3. Remove the caliper slide pin bolts (4) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).

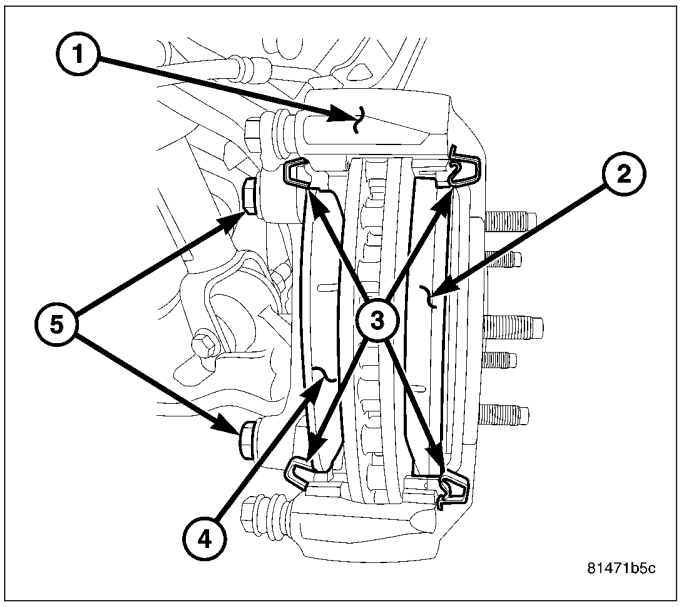


4. Remove the disc brake caliper (1) from the adapter (2).

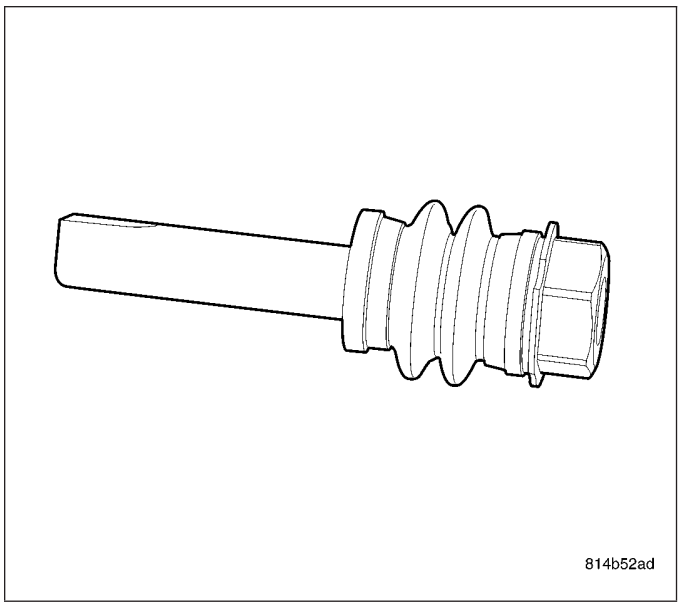
CAUTION: Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose will result. Provide a suitable support to hang the caliper securely.



5. Remove the inboard (4) and outboard (2) brake pads. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - REMOVAL).
6. Remove the caliper adapter mounting bolts (5).



7. Remove the caliper slide pins from the adapter.



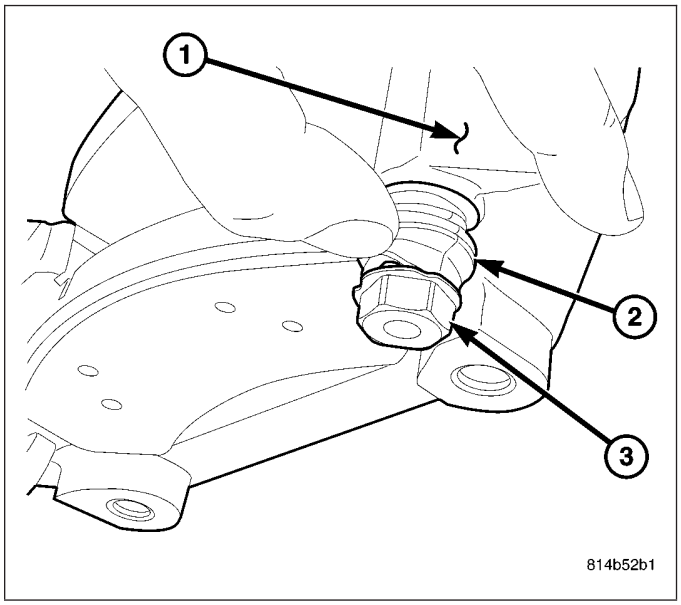
INSTALLATION

NOTE: Petroleum based grease should not be used on any of the rubber components of the caliper, Use only a Non-Petroleum based grease, such as Dow Corning-807® grease.

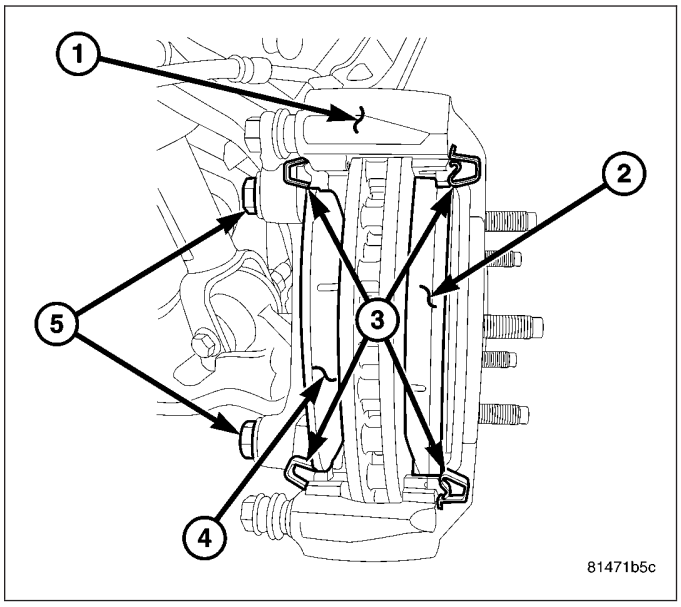
NOTE: Clean slide pin bores thoroughly to remove any old grease.

NOTE: Use grease packets included with kit or Dow Corning-807® grease.

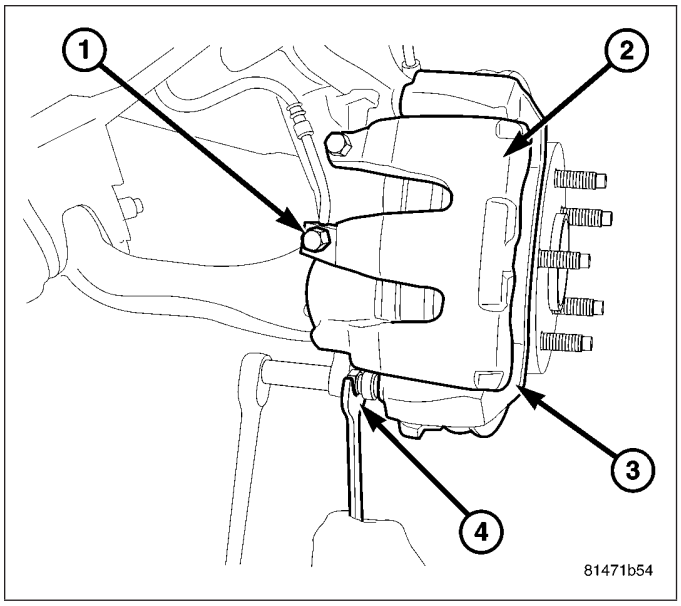
1. Thoroughly coat the new slide pins (3) on all working surfaces.
2. Install the boot (2) onto the slide pin (3) and then insert into the adapter (1).
3. Push the pin (3) all the way into the adapter (1) and carefully expel the trapped air by gently pushing on the boot (2) near the slide pin head (3).



4. Install the caliper adapter mounting bolts (5). Tighten the mounting bolts to 176 N·m (130 ft.lbs).
5. Install the inbound (4) and outboard (2) pads. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ BRAKE PADS/SHOES - INSTALLATION).



6. Install the caliper (2) and the caliper slide pin bolts (4) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
7. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).



FLUID

DIAGNOSIS AND TESTING

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

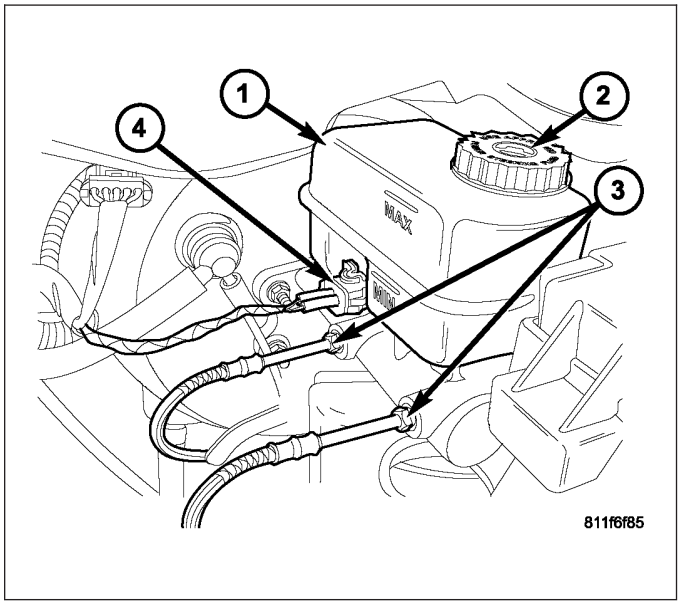
STANDARD PROCEDURE

BRAKE FLUID LEVEL

Always clean the master cylinder reservoir (1) and cap (2) before checking fluid level. If not cleaned, dirt could enter the fluid.

The fluid fill level is indicated on the side of the master cylinder reservoir (1).

The correct fluid level is to the MAX indicator on the side of the reservoir. If necessary, add fluid to the proper level.



SPECIFICATIONS

BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use only Mopar brake fluid or an equivalent from a tightly sealed container.

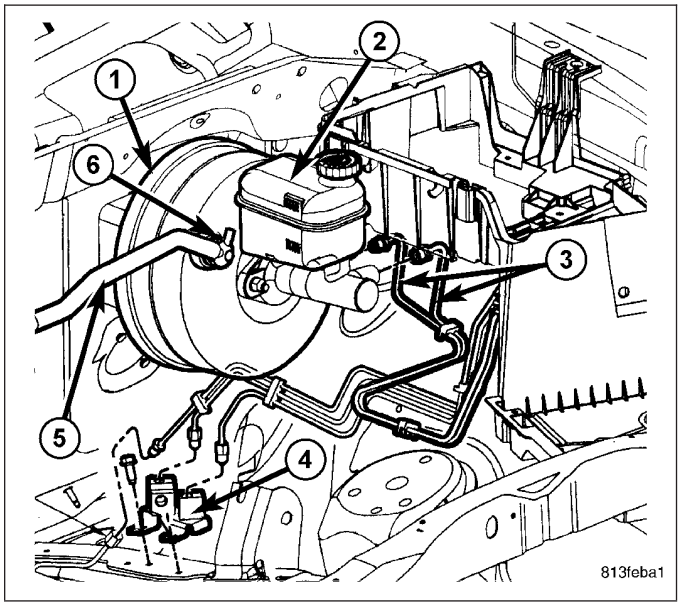
CAUTION: Never use reclaimed brake fluid or fluid from an container which has been left open. An open container of brake fluid will absorb moisture from the air and contaminate the fluid.

CAUTION: Never use any type of a petroleum-based fluid in the brake hydraulic system. Use of such type fluids will result in seal damage of the vehicle brake hydraulic system causing a failure of the vehicle brake system. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid, etc.

FLUID RESERVOIR

REMOVAL

1. Install the prop rod on the brake pedal to keep pressure on the brake system.
2. Remove the reservoir cap and siphon fluid into a drain container.
3. Disconnect the electrical connector from the fluid level switch in the reservoir (2).
4. Remove the reservoir mounting pin.
5. Remove the reservoir (2) from the master cylinder.
6. Remove old seals from the cylinder body.

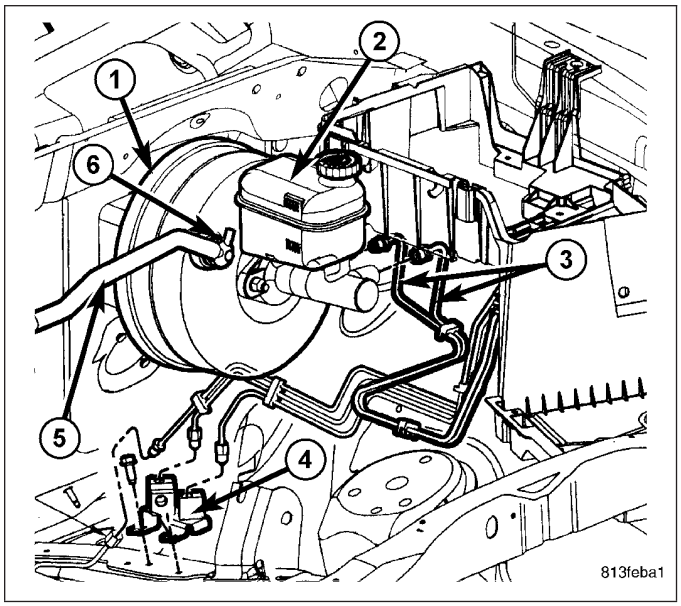


INSTALLATION

CAUTION: Do not use any type of tool to install the seals. Tools may cut, or tear the seals creating a leak problem after installation. Install the seals using finger pressure only.

1. Lubricate the new seals with clean brake fluid and Install new seals in cylinder body. Use finger pressure to install and seat seals.

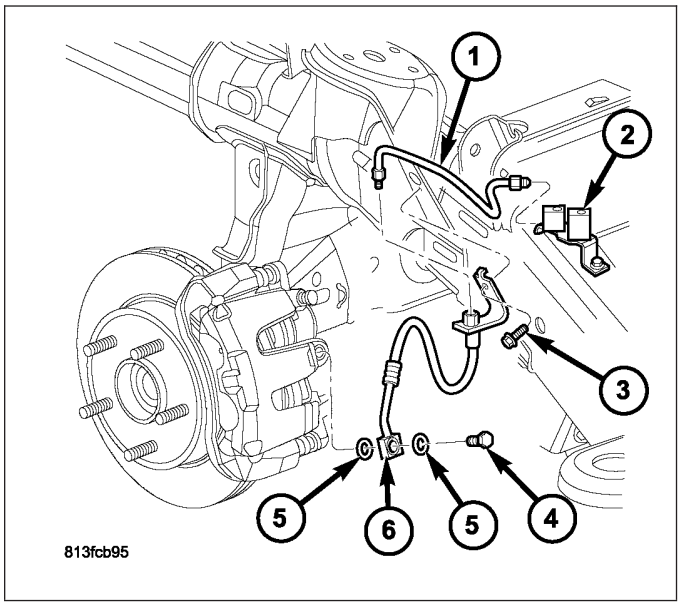
2. Start the reservoir (2) in the seals. Then rock the reservoir back and forth while pressing downward to seat it into the seals.
3. Install the mounting pin for the reservoir to the master cylinder.
4. Reconnect the electrical connector to the fluid reservoir level switch.
5. Remove the prop rod from the vehicle.
6. Fill and bleed base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE).



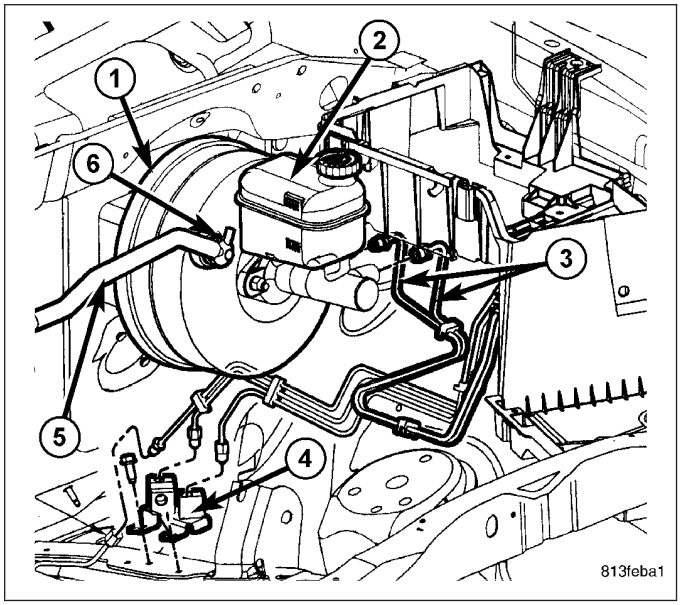
BRAKE JUNCTION BLOCK

REMOVAL

1. Remove the brake lines (1) going into the side of the junction block (2).

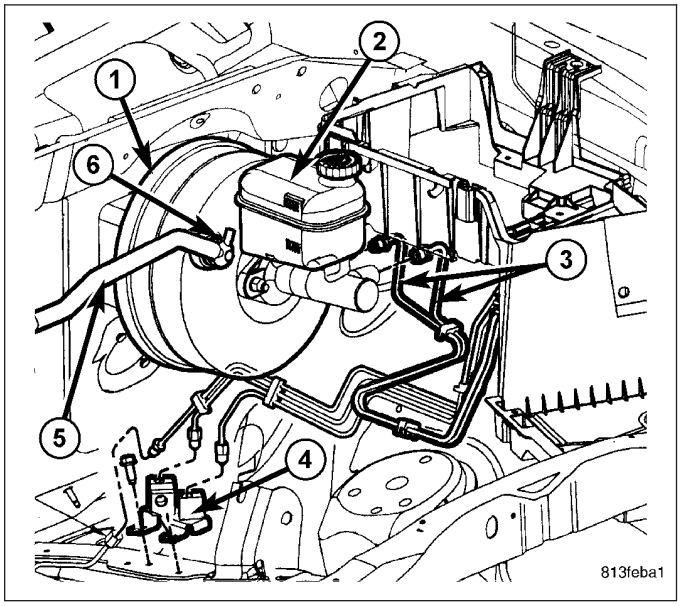


2. Remove the brake lines from the top of the junction block (4).
3. Remove the junction block (4) mounting bolt and remove the junction block.

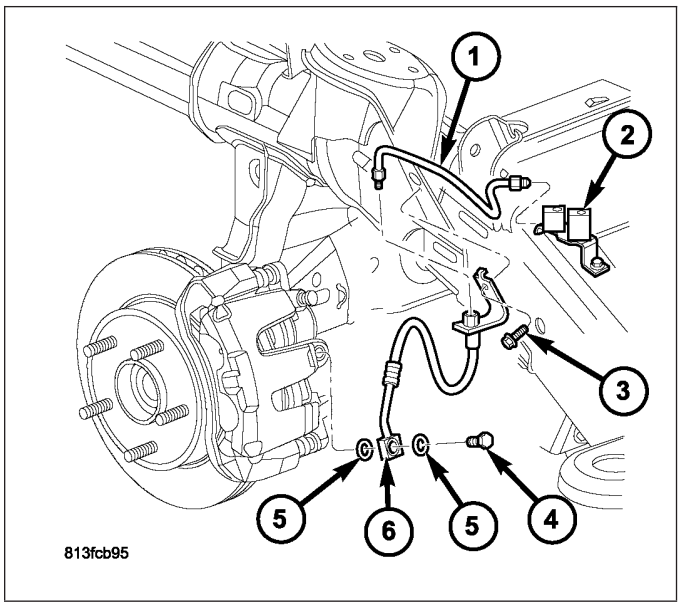


INSTALLATION

1. Position the junction block (4) and install the mounting bolt. Tighten the mounting bolt to 14 N·m (125 in. lbs.).
2. Install the brake lines into the top of the junction block (4) and tighten to 14 N·m (125 in. lbs.).



3. Install the brake lines (1) into the side of the junction block (2) and tighten to 14 N·m (125 in. lbs.).
4. Bleed the base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE).



MASTER CYLINDER

DESCRIPTION

A two-piece master cylinder is used on all models. The cylinder body containing the primary and secondary pistons is made of aluminum. The removable fluid reservoir is made of nylon reinforced with glass fiber. The reservoir stores reserve brake fluid for the hydraulic brake circuits and has a switch for indicating low fluid levels. The reservoir is the only serviceable component.

The fluid compartments of the nylon reservoir are interconnected to permit fluid level equalization. However, the equalization feature does not affect circuit separation in the event of a front or rear brake malfunction. The reservoir compartments will retain enough fluid to operate the functioning hydraulic circuit.

Care must be exercised when removing/installing the master cylinder connecting lines. The threads in the cylinder fluid ports can be damaged if care is not exercised. Start all brake line fittings by hand to avoid cross threading.

The cylinder reservoir can be replaced when necessary. However, the aluminum body section of the master cylinder is not a repairable component.

NOTE: If diagnosis indicates that an internal malfunction has occurred, the aluminum body section must be replaced as an assembly.

OPERATION

The master cylinder bore contains a primary and secondary piston. The primary piston supplies hydraulic pressure to the front brakes. The secondary piston supplies hydraulic pressure to the rear brakes.

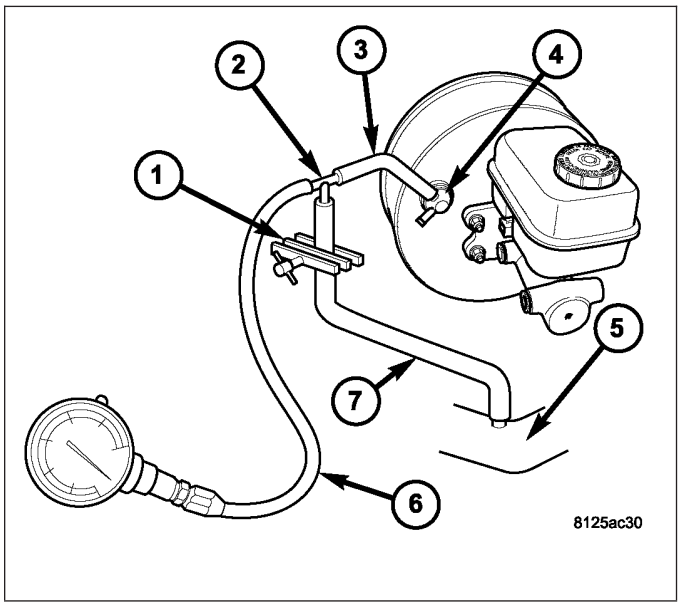
DIAGNOSIS AND TESTING

MASTER CYLINDER/POWER BOOSTER

1. Start engine and check booster vacuum hose connections. A hissing noise indicates vacuum leak. Correct any vacuum leak before proceeding.
2. Stop engine and shift transmission into Neutral.
3. Pump brake pedal until all vacuum reserve in booster is depleted.
4. Press and hold brake pedal under light foot pressure. The pedal should hold firm, if the pedal falls away master cylinder is faulty (internal leakage).
5. Start engine and note pedal action. It should fall away slightly under light foot pressure then hold firm. If no pedal action is discernible, power booster, vacuum supply, or vacuum check valve is faulty. Proceed to the POWER BOOSTER VACUUM TEST.
6. If the POWER BOOSTER VACUUM TEST passes, rebuild booster vacuum reserve as follows: Release brake pedal. Increase engine speed to 1500 rpm, close the throttle and immediately turn off ignition to stop engine.
7. Wait a minimum of 90 seconds and try brake action again. Booster should provide two or more vacuum assisted pedal applications. If vacuum assist is not provided, booster is faulty.

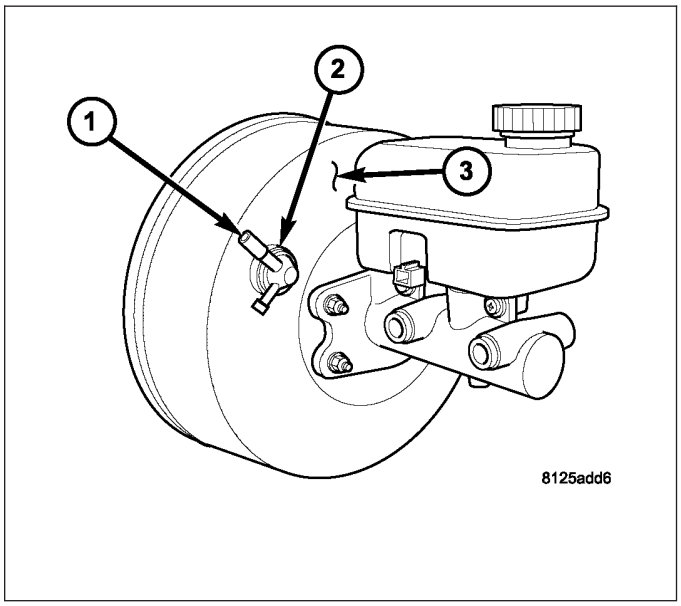
POWER BOOSTER VACUUM TEST

1. Connect vacuum gauge (6) to booster check valve (4) with short length of hose (3) and T-fitting (2).
2. Start and run engine at curb idle speed for one minute.
3. Observe the vacuum supply. If vacuum supply is not adequate, repair vacuum supply.
4. Clamp (1) hose (7) shut between intake vacuum source (5) and check valve (4).
5. Stop engine and observe vacuum gauge (6).
6. If vacuum drops more than one inch HG (33 millibars) within 15 seconds, booster diaphragm or check valve is faulty.



POWER BOOSTER CHECK VALVE TEST

1. Disconnect vacuum hose from check valve (1).
2. Remove check valve (1) and valve seal (2) from booster (3).
3. Use a hand operated vacuum pump for test.
4. Apply 15-20 inches vacuum at large end of check valve.
5. Plug off the small end to prevent vacuum leakage.
6. Vacuum should hold steady. If gauge on pump indicates vacuum loss, check valve is faulty and should be replaced.

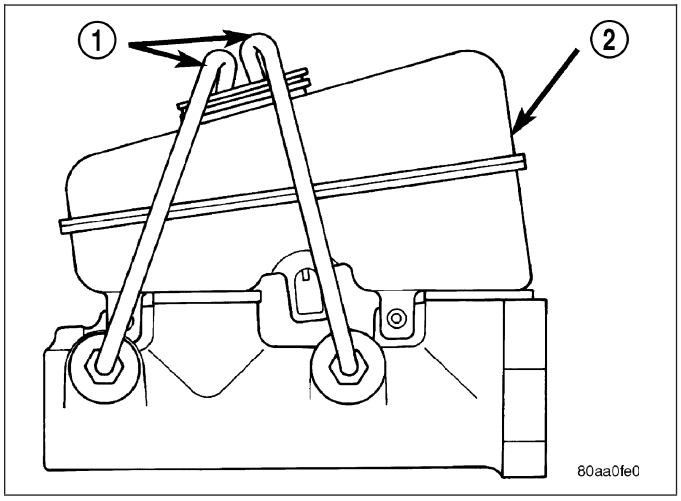


STANDARD PROCEDURE

MASTER CYLINDER BLEEDING

A new master cylinder should be bled before installation on the vehicle. Required bleeding tools include bleed tubes and a wood dowel to stroke the pistons. Bleed tubes can be fabricated from brake line.

1. Mount master cylinder in vise.
2. Attach bleed tubes to cylinder outlet ports (1). Then position each tube end into reservoir (2).
3. Fill reservoir with fresh brake fluid.
4. Press cylinder pistons inward with wood dowel. Then release pistons and allow them to return under spring pressure. Continue bleeding operations until air bubbles are no longer visible in fluid.



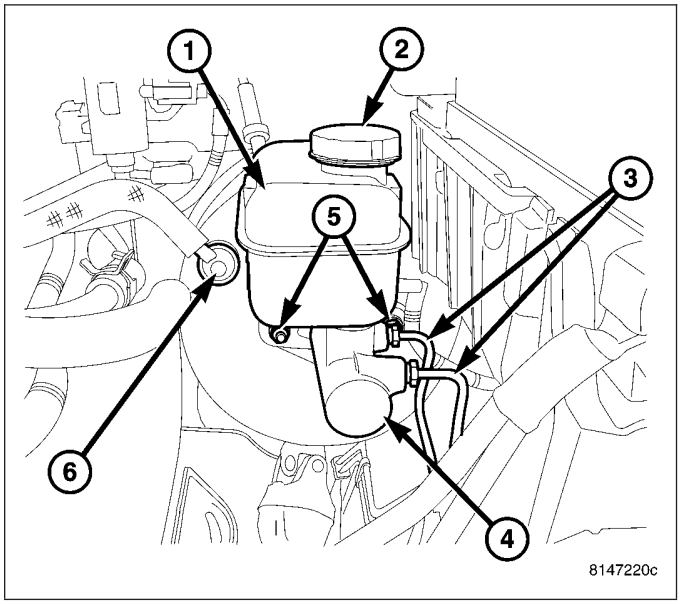
REMOVAL

1. Depress the brake pedal five times to deplete any vacuum that may remain in the booster unit.
2. Siphon and drain the fluid from the reservoir.
3. Disconnect the electrical connector for the low fluid level.

NOTE: Place a towel or rag under the master cylinder outlet port area to protect the vehicle from brake fluid damage.

4. Remove the brake lines (3) from the master cylinder (4).
5. Remove the four mounting nuts (5) from the master cylinder (4).
6. Remove the master cylinder (4).

NOTE: Gently ease the master cylinder & reservoir assembly away from the booster, During removal the master cylinder should be kept as perpendicular to the front of the booster as possible to avoid excess interference with the booster output rod and in order not to dislodge the output rod from its seat inside the booster.



INSTALLATION

NOTE: If master cylinder is replaced bleed cylinder before installation.

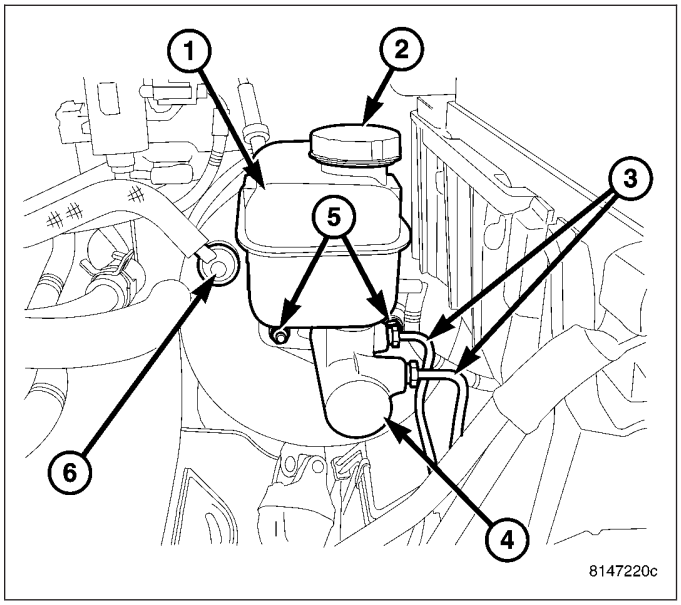
NOTE: Make sure the output rod of the brake booster is in position and retained by a output rod retaining ring, by looking into the boosters master cylinder mounting hole. This position will enable the output rod to enter inside of the master cylinder plunger sleeve during installation. Proper position is obtained when the output rod is centered perpendicular to the master cylinder mounting hole.

NOTE: Prior to installing the master cylinder assembly check that there is a vacuum seal present at the shoulder of the master cylinder flange and it's neck. A square seal must be present to ensure vacuum integrity with the booster.

1. Gently install the master cylinder (4) on the booster mounting studs (5).

NOTE: Take precautions to locate the master cylinder plunger over the booster output rod, before installing the master cylinder. If correctly fitted the master cylinder should slide easily onto the booster output rod before the mounting studs are engaged in the flange holes of the master cylinder.

2. Install new mounting nuts (5) and tighten to 10 N·m (90 in. lbs.)
3. Install the brake lines (3) and tighten to 19 N·m (170 in. lbs.).
4. Reconnect the electrical connector for the low fluid level switch.
5. Fill and bleed the base brake system. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

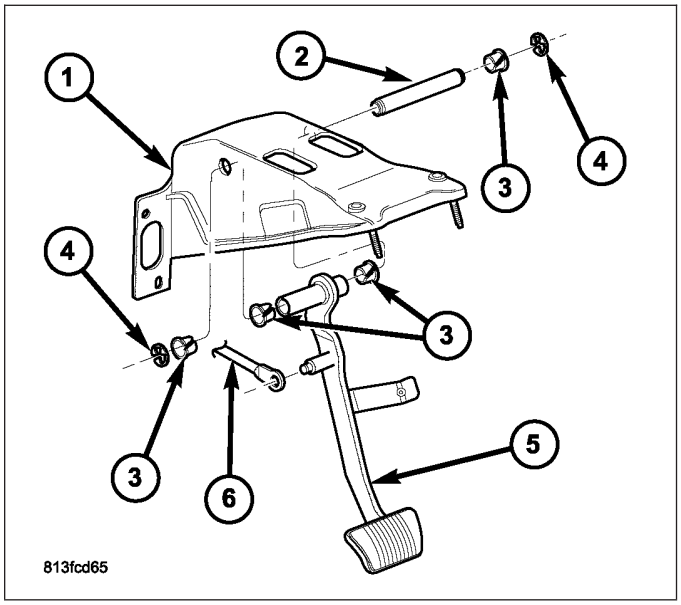


PEDAL

DESCRIPTION

NOTE: The brake pedal is serviced as a complete assembly including the bracket.

A suspended-type brake pedal (5) is used. The pedal is attached to the pedal support bracket (1) with a pivot shaft pin (2), bushings (3) and clips (4). If the bushings (3) become dry a spray lubricant can be used to eliminate noises. The booster push rod is attached to the pedal with a clip. The pedal (5), bushings (3), pivot pin (2) and support bracket (1) are not serviceable components.



OPERATION

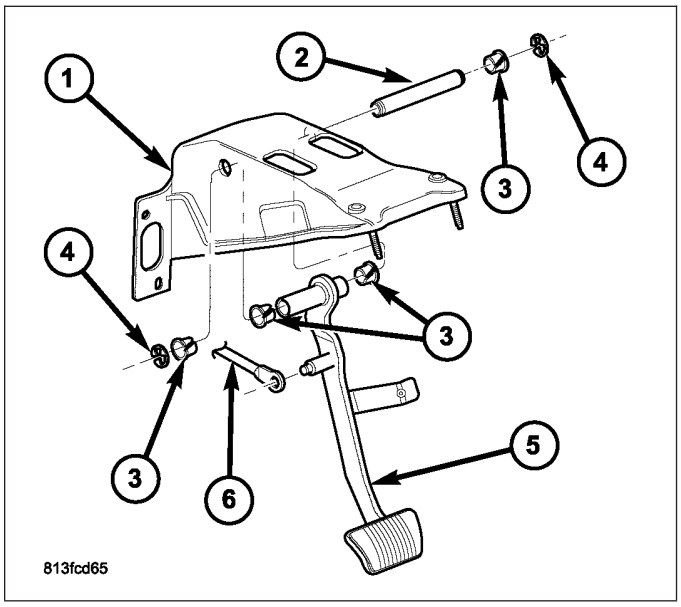
The brake pedal is attached to the booster push rod. When the pedal is depressed, the primary booster push rod is depressed which move the booster secondary rod. The booster secondary rod depress the master cylinder piston.

REMOVAL

WARNING: BEFORE SERVICING THE STEERING COLUMN THE AIRBAG SYSTEM MUST BE DISARMED. REFER TO ELECTRICAL RESTRAINT SYSTEM FOR SERVICE PROCEDURES. FAILURE TO DO SO MAY RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY.

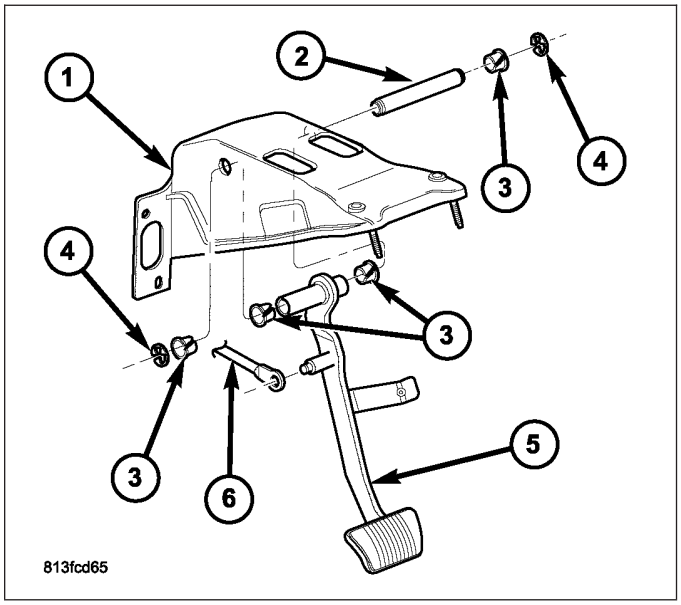
NOTE: The brake pedal is serviced as a complete assembly including accelerator pedal and the bracket.

1. Disconnect and isolate the battery negative cable to disable the airbag system. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).
3. Remove the steering column opening cover reinforcement.
4. Remove stop lamp switch. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - REMOVAL).
5. Remove clip securing booster push rod (6) to brake pedal (5).
6. Remove pedal pivot pin C-clip (4) and slide pin out of support bracket (1) and pedal (5).
7. Remove pedal and bushings (3).



INSTALLATION

1. Replace bushings (3) if worn or damaged.
2. Lubricate pedal bushings (3) and pivot pin (2) with Mopar multi mileage grease, Lubriplate, or a silicone grease.
3. Install bushings (3) in pedal and position pedal (5) in support (1).
4. Insert pivot pin (2) through support (1) and pedal bushings and install C-clip (4).
5. Install booster push rod (6) on brake pedal and install push rod retainer clip.



6. Install a new brake lamp switch (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - REMOVAL).
7. Install the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).
8. Install the steering column opening cover reinforcement.
9. Reconnect the negative battery cable.

POWER BRAKE BOOSTER

DESCRIPTION

All models use a tandem diaphragm, power brake booster.

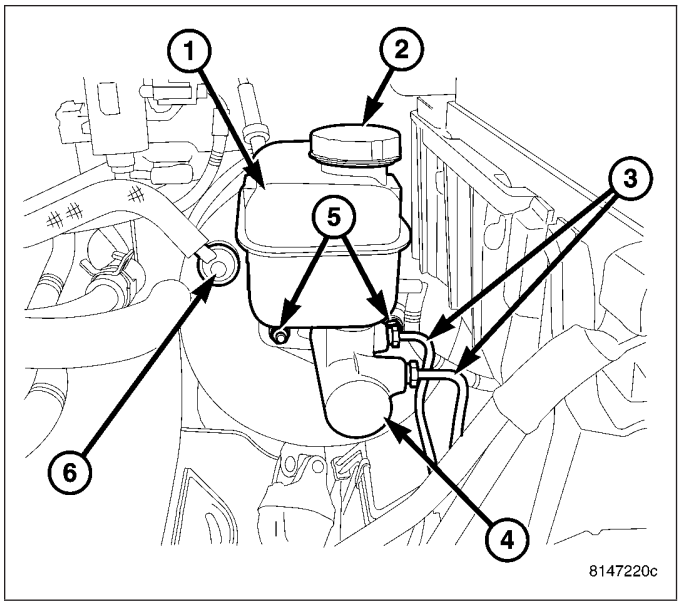
NOTE: The power brake booster is not a repairable component. The booster must be replaced as an assembly if diagnosis indicates a malfunction has occurred.

OPERATION

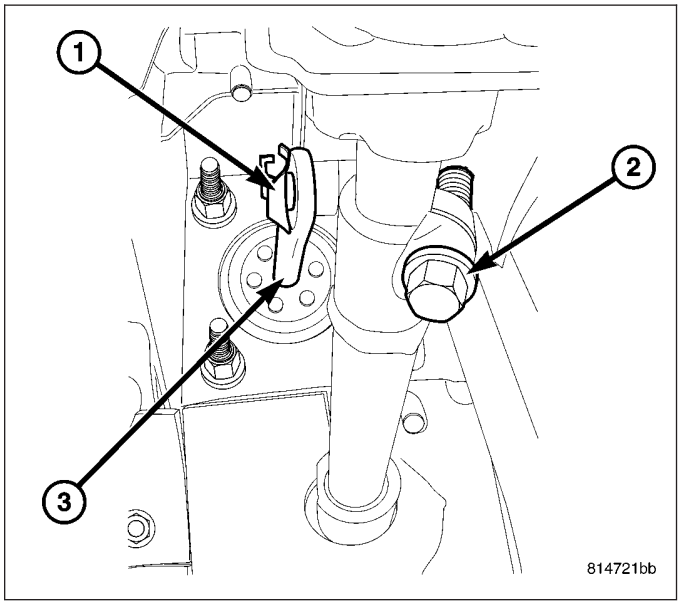
The booster unit consists of a single housing divided into two by a tandem diaphragm. The outer edge of the diaphragm is secured to the housing. A spacer block is located in between the cowl and the booster housing. The booster push rod, connects the booster to the brake pedal and master cylinder, is attached to the center of the diaphragm. A check valve is used in the booster outlet connected to the engine intake manifold. Power assist is generated by utilizing a combination of vacuum and atmospheric pressure to boost brake assist.

REMOVAL

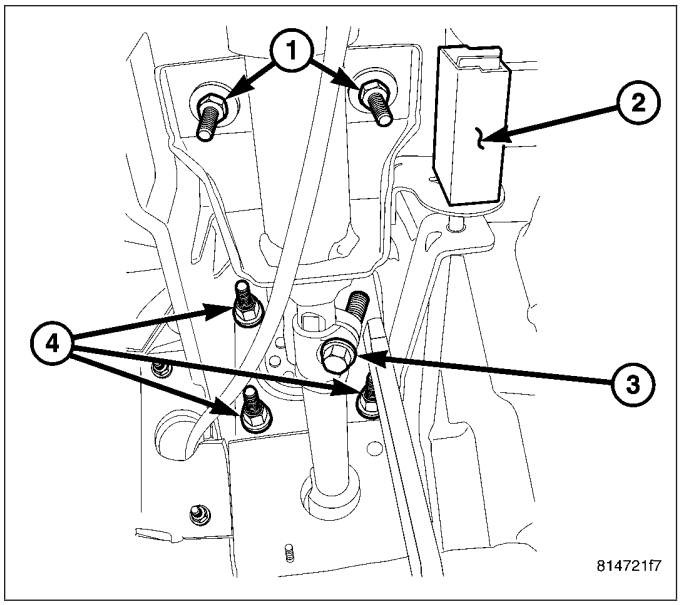
1. Remove master cylinder (4). (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - REMOVAL).
2. Disconnect vacuum line (6) at booster.



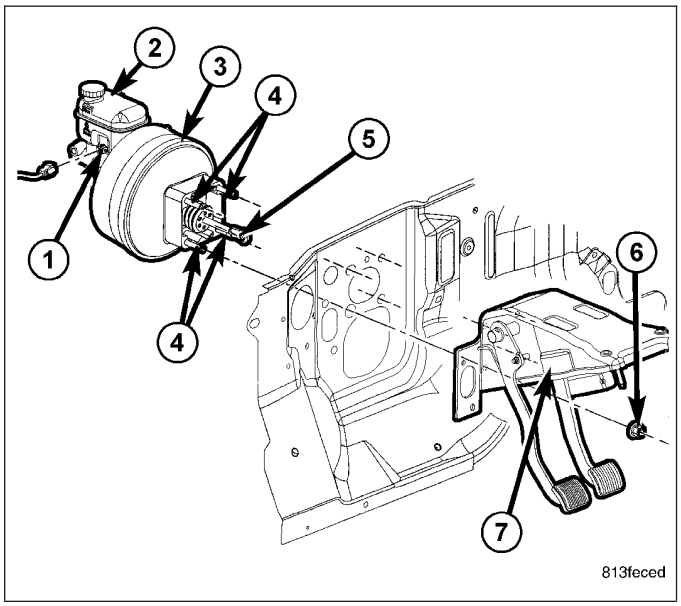
3. Remove clip (1) securing booster push rod (3) to brake pedal (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/PEDAL - REMOVAL).



4. Remove nuts (4) from booster mounting studs.

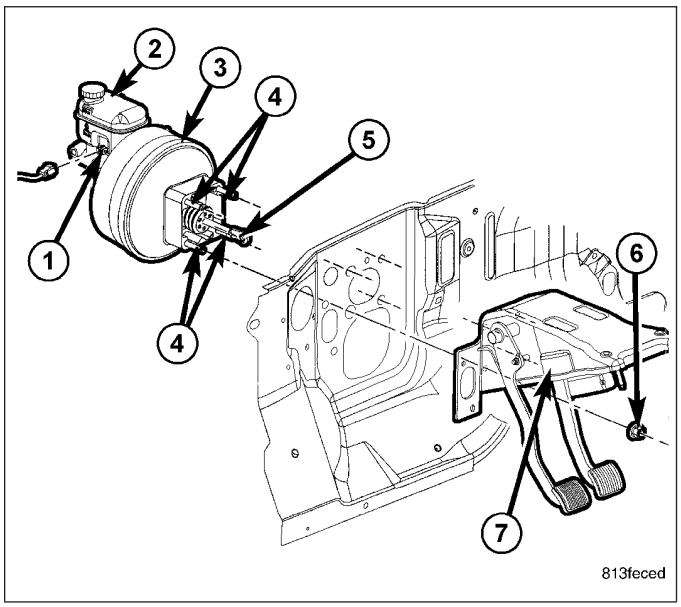


5. Remove booster (3), spacer and gaskets from front cowl panel.

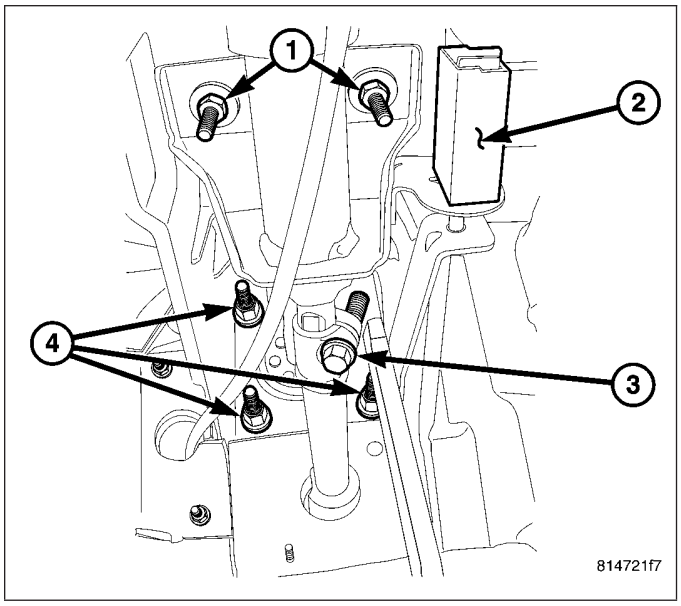


INSTALLATION

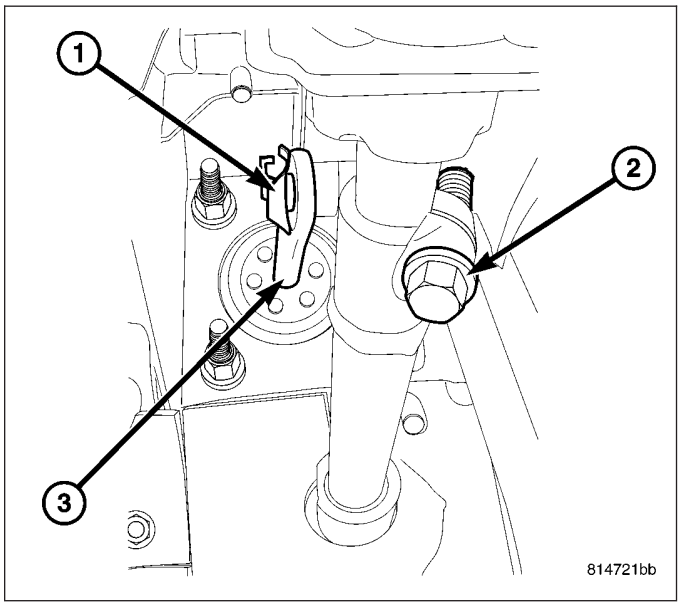
1. Position spacer and gaskets on booster studs.
2. Guide booster studs (4) into cowl panel holes and seat booster (3) on panel.



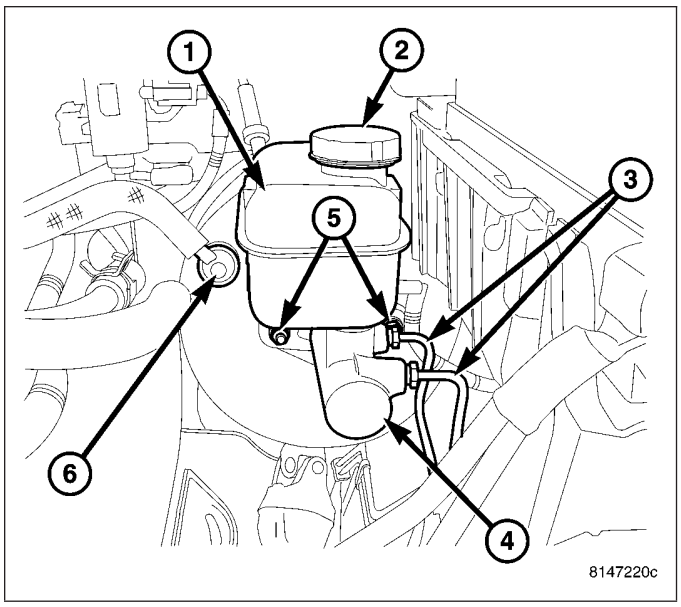
3. Install and tighten booster attaching nuts (4) to 28 N·m (250 in. lbs.).



4. Install booster push rod (3) on brake pedal and install clip (1). (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/PEDAL - INSTALLATION).



5. Connect vacuum hose to check valve (6).
6. Install master cylinder (4). (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - INSTALLATION).
7. Fill and bleed brake system. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



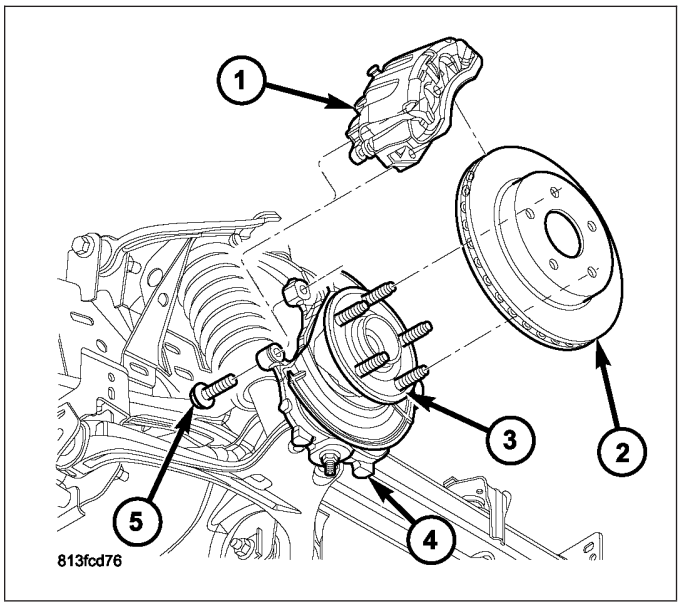
ROTORS

REMOVAL

1. Raise and support the vehicle.
2. Remove the wheel and tire assembly.
3. Remove the caliper (1) with the adaptor bolts (5) from the steering knuckle (4), (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL) and remove caliper adapter assembly (1).

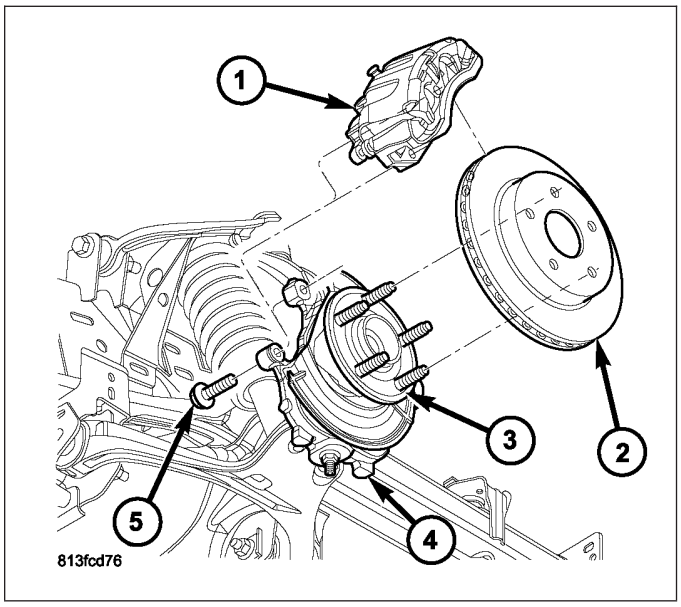
NOTE: Do not allow brake hose to support caliper adapter assembly (1).

4. Remove the rotor (2) from the hub/bearing (3).



INSTALLATION

1. Install the rotor (2) onto the hub/bearing (3).
2. Install the caliper adapter assembly (1), (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION) and tighten adapter bolts (5) to 176 N·m (130 ft.lbs.).
3. Install the wheel and tire assembly, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE) and lower the vehicle.
4. Apply the brakes several times to seat brake pads. Be sure to obtain firm pedal before moving vehicle.



DRUM

DIAGNOSIS AND TESTING - BRAKE DRUM

The maximum allowable diameter of the drum braking surface is indicated on the drum outer edge. Generally, a drum can be machined to a maximum of 1.52 mm (0.060 in.) oversize. Always replace the drum if machining would cause drum diameter to exceed the size limit indicated on the drum.

BRAKE DRUM RUNOUT

Measure drum diameter and runout with an accurate gauge. The most accurate method of measurement involves mounting the drum in a brake lathe and checking variation and runout with a dial indicator.

Variations in drum diameter should not exceed 0.03 mm (0.0012 in.). Drum runout should not exceed 0.06 mm (0.0024 in.) out of round. Machine the drum if runout or variation exceed these values. Replace the drum if machining causes the drum to exceed the maximum allowable diameter.

STANDARD PROCEDURE - BRAKE DRUM MACHINING

The brake drums can be machined on a drum lathe when necessary. Initial machining cuts should be limited to 0.12 - 0.20 mm (0.005 - 0.008 in.) at a time as heavier feed rates can produce taper and surface variation. Final finish cuts of 0.025 to 0.038 mm (0.001 to 0.0015 in.) are recommended and will generally provide the best surface finish.

Be sure the drum is securely mounted in the lathe before machining operations. A damper strap should always be used around the drum to reduce vibration and avoid chatter marks.

The maximum allowable diameter of the drum braking surface is stamped or cast into the drum outer edge.

CAUTION: Replace the drum if machining will cause the drum to exceed the maximum allowable diameter.

CLEANING

Clean the individual brake components, including the support plate and wheel cylinder exterior, with a water dampened cloth or with brake cleaner. Do not use any other cleaning agents. Remove light rust and scale from the brake shoe contact pads on the support plate with fine sandpaper.

INSPECTION

As a general rule, riveted brake shoes should be replaced when worn to within 0.78 mm (1/32 in.) of the rivet heads. Bonded lining should be replaced when worn to a thickness of 1.6 mm (1/16 in.).

Examine the lining contact pattern to determine if the shoes are bent or the drum is tapered. The lining should exhibit contact across its entire width. Shoes exhibiting contact only on one side should be replaced and the drum checked for runout or taper.

Inspect the adjuster screw assembly. Replace the assembly if the star wheel or threads are damaged, or the components are severely rusted or corroded.

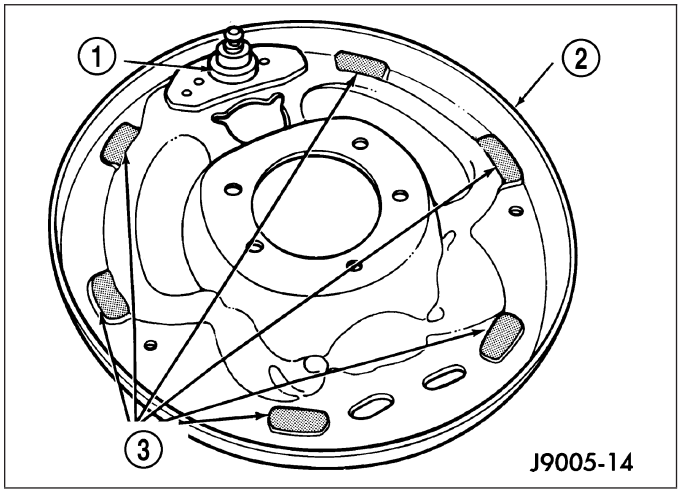
Discard the brake springs and retainer components if worn, distorted or collapsed. Also replace the springs if a brake drag condition had occurred. Overheating will distort and weaken the springs.

Inspect the brake shoe contact pads on the support plate, replace the support plate if any of the pads are worn or rusted through. Also replace the plate if it is bent or distorted .

ADJUSTMENTS - REAR DRUM BRAKE

The rear drum brakes are equipped with a self-adjusting mechanism. Under normal circumstances, the only time adjustment is required is when the shoes are replaced, removed for access to other parts, or when one or both drums are replaced.

Adjustment can be made with a standard brake gauge or with adjusting tool. Adjustment is performed with the complete brake assembly installed on the backing plate.



ADJUSTMENT WITH BRAKE GAUGE

1. Be sure parking brakes are fully released.
2. Raise rear of vehicle and remove wheels and brake drums.
3. Verify that left and right automatic adjuster levers and cables are properly connected.
4. Insert brake gauge in drum. Expand gauge until gauge inner legs contact drum braking surface. Then lock gauge in position.

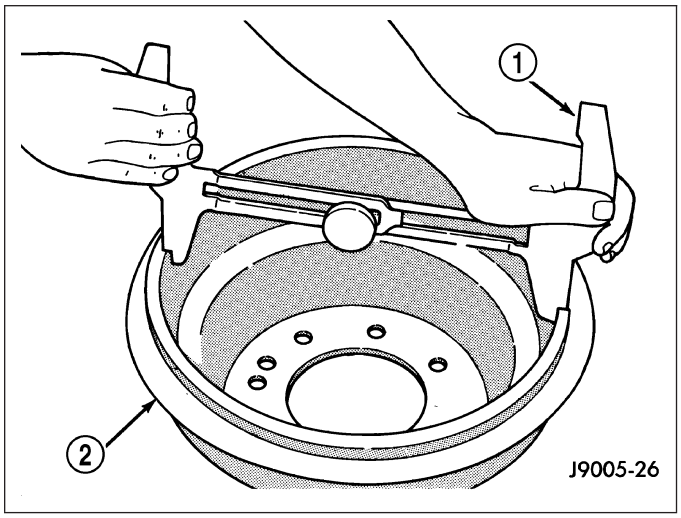
5. Reverse gauge and install it on brake shoes. Position gauge legs at shoe centers as shown. If gauge does not fit (too loose/too tight), adjust shoes.
6. Pull shoe adjuster lever away from adjuster screw star wheel.
7. Turn adjuster screw star wheel (by hand) to expand or retract brake shoes. Continue adjustment until gauge outside legs are light drag-fit on shoes.
8. Install brake drums and wheels and lower vehicle.
9. Drive vehicle and make 8-10 forward stops to operate automatic adjusters and equalize adjustment.

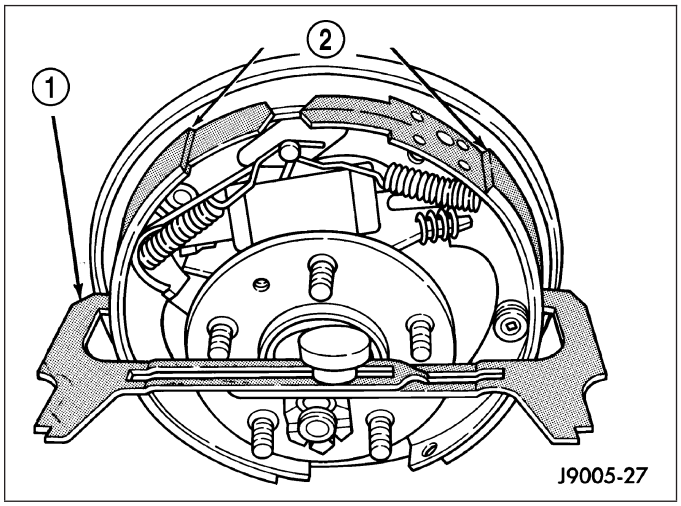
NOTE: Bring vehicle to complete standstill at each stop. Incomplete, rolling stops will not activate automatic adjusters.

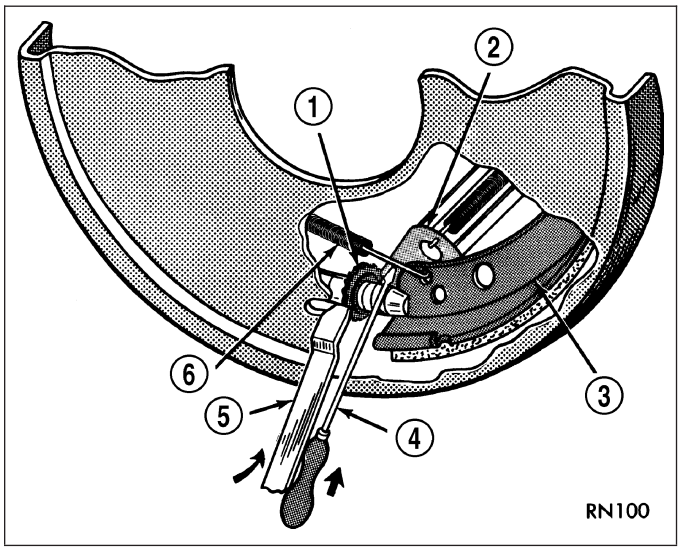
ADJUSTMENT WITH ADJUSTING TOOL

1. Be sure parking brake lever is fully released.
2. Raise vehicle so rear wheels can be rotated freely.
3. Remove plug from each access hole in brake support plates.
4. Loosen parking brake cable adjustment nut until there is slack in front cable.
5. Insert adjusting tool through support plate access hole and engage tool in teeth of adjusting screw star wheel.
6. Rotate adjuster screw star wheel (move tool handle upward) until slight drag can be felt when wheel is rotated.
7. Push and hold adjuster lever away from star wheel with thin screwdriver.
8. Back off adjuster screw star wheel until brake drag is eliminated.
9. Repeat adjustment at opposite wheel. Be sure adjustment is equal at both wheels.
10. Install support plate access hole plugs.
11. Adjust parking brake cable and lower vehicle.
12. Drive vehicle and make 8-10 forward stops to operate automatic adjusters and equalize adjustment.

NOTE: Bring vehicle to complete standstill at each stop. Incomplete, rolling stops will not activate automatic adjusters.



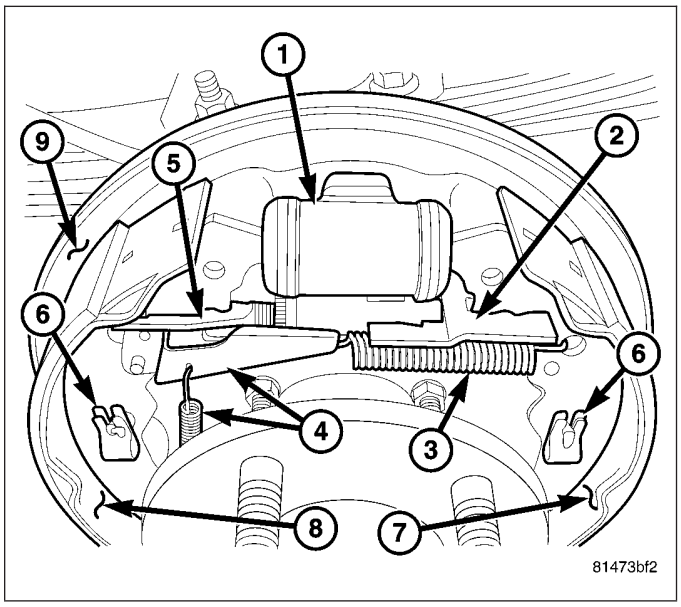




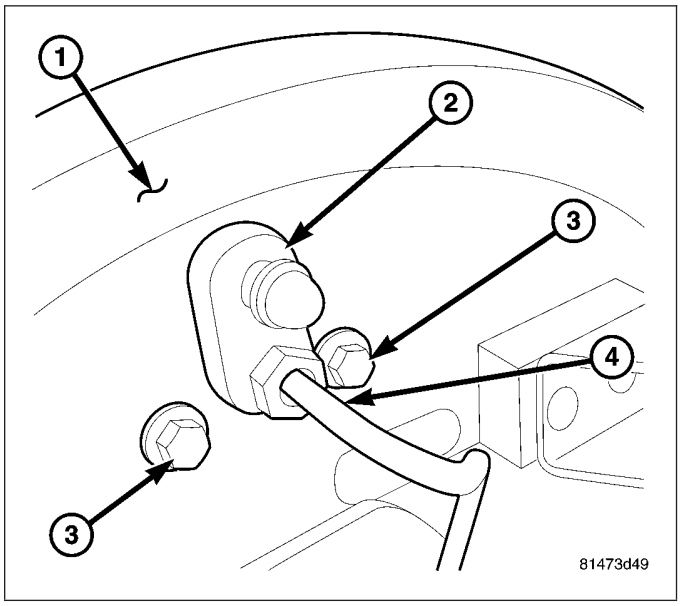
WHEEL CYLINDERS

REMOVAL

1. Remove wheel and tire assembly.
2. Remove brake drum.
3. Remove brake shoe return spring (3) and move shoes out of engagement with cylinder (1).

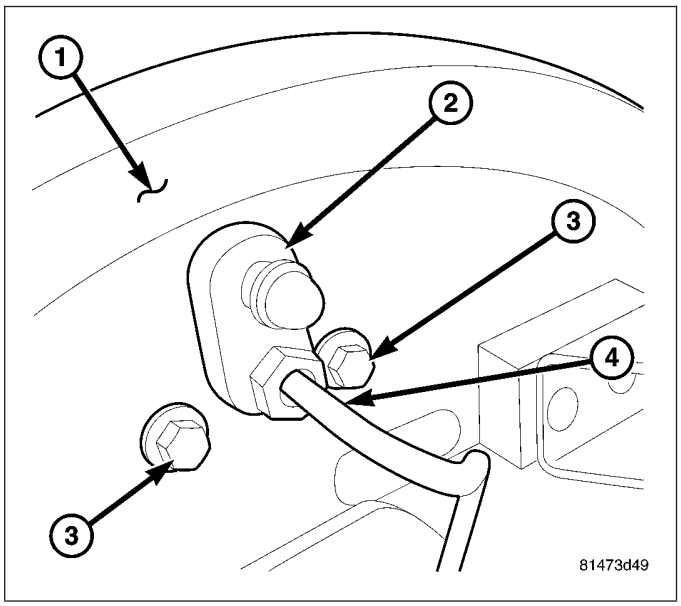


4. Disconnect wheel cylinder brake line (4).
5. Remove cylinder (2) attaching bolts (3) and remove cylinder from support plate (1).

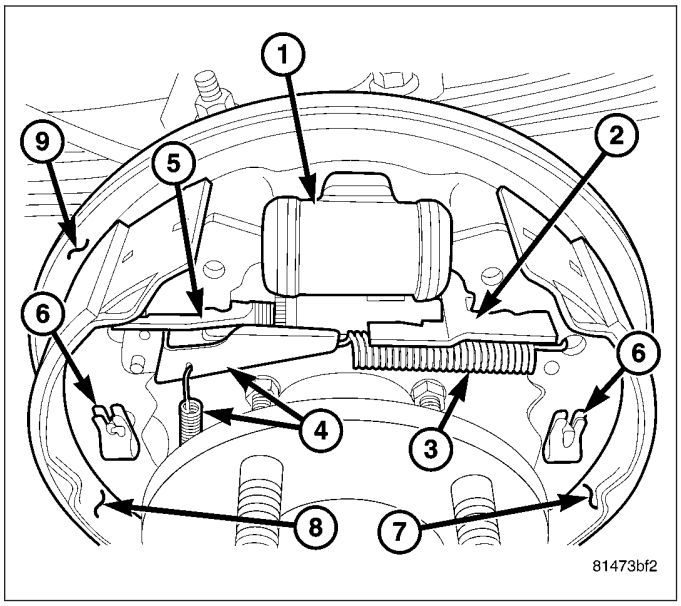


INSTALLATION

1. Install cylinder (2) and the mounting bolts (3) and tighten to 20 N·m (15 ft. lbs.).
2. Connect brake line (4) to cylinder (2).



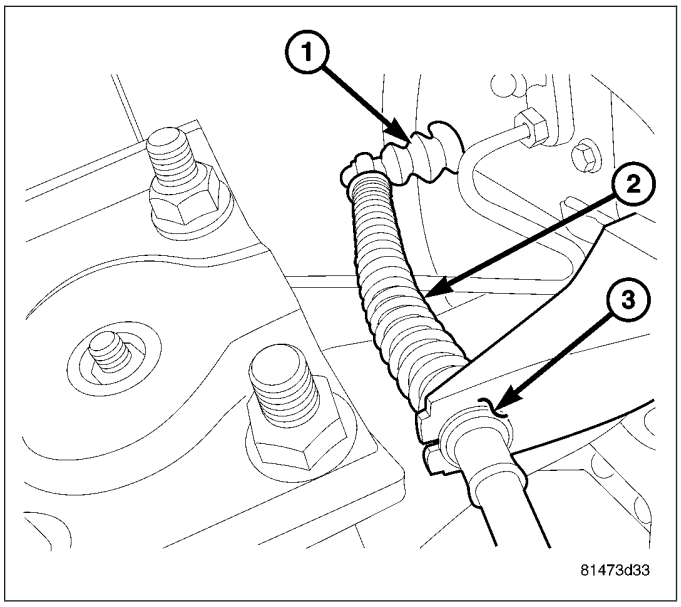
3. Install brake shoe return spring (3).
4. Install brake drum.
5. Install wheel and tire assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
6. Bleed base brake system. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



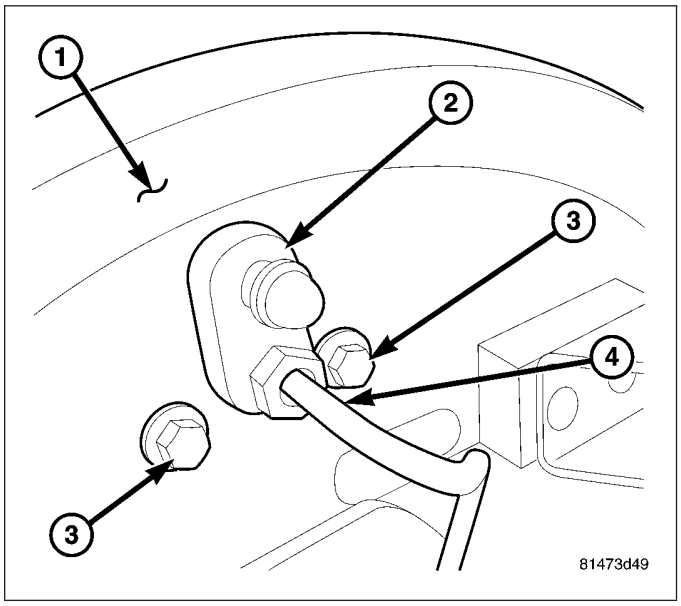
SUPPORT PLATE

REMOVAL

1. Remove wheel and tire assembly and brake drum.
2. Remove the parking brake cable (2) from the parking brake lever (1) in the rear of the support plate. (Refer to 5 - BRAKES/PARKING BRAKE/CABLES - REMOVAL).

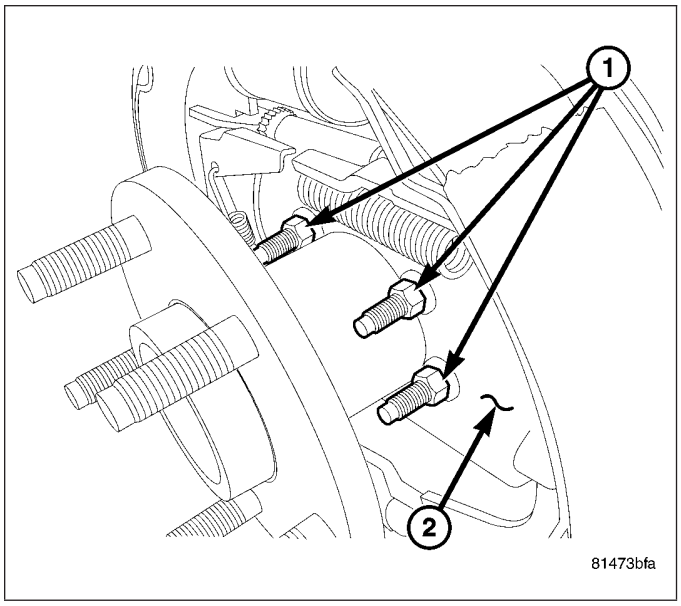


3. Disconnect the brake line (4) at the wheel cylinder (2).
4. Remove the wheel cylinder (2) from the support plate (1). (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/WHEEL CYLINDERS - REMOVAL).



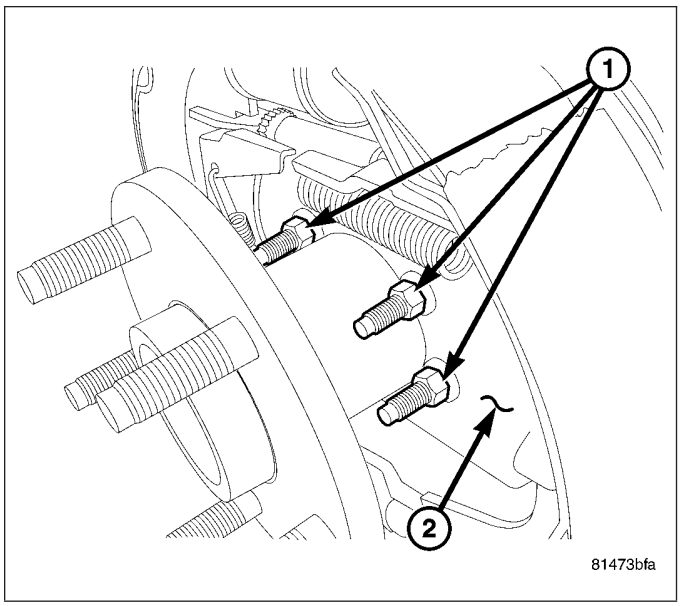
5. Remove the axle shaft, (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - 9 1/4/AXLE SHAFTS - REMOVAL).

6. Remove the nuts (1) attaching the support plate (2) to the axle and remove the support plate (2).

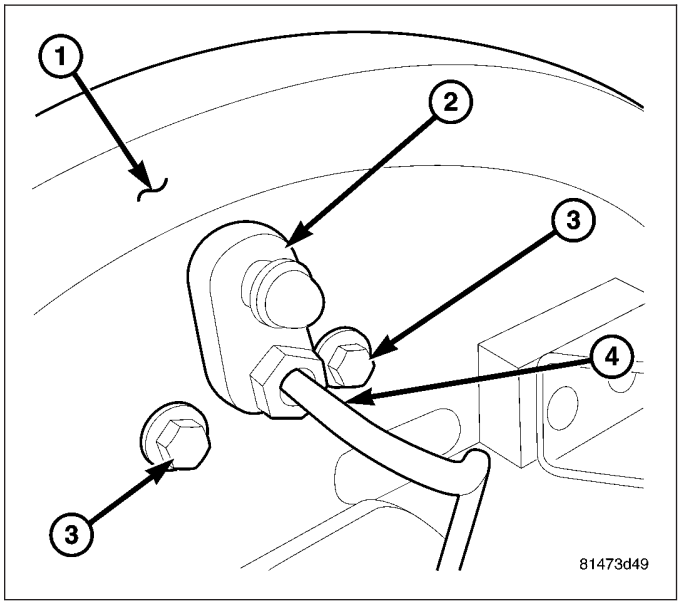


INSTALLATION

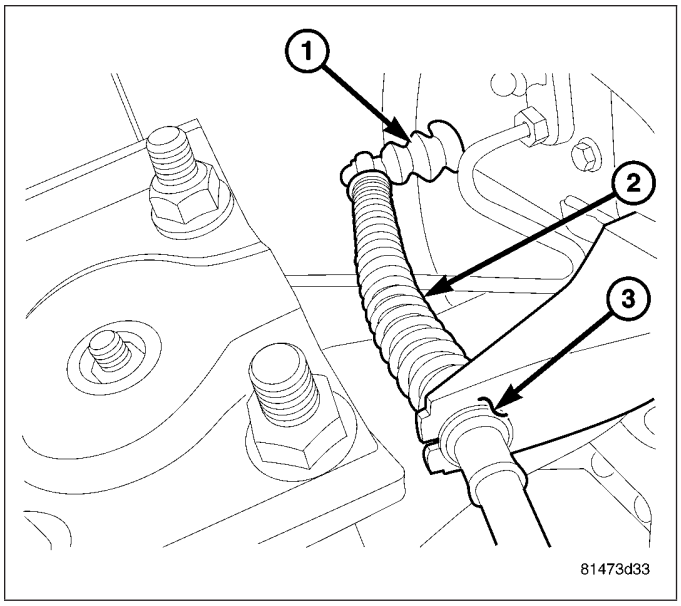
1. Install support plate (2) on axle flange. Tighten attaching nuts (1) to 68 N·m (55 ft. lbs.).



2. Install wheel cylinder (2). (Refer to 5 - BRAKES/ HYDRAULIC/MECHANICAL/WHEEL CYLINDERS - INSTALLATION).
3. Install brake line (4) in wheel cylinder (2).



4. Reassemble the brake shoe assembly and insert the lever (1) into the support plate.
5. Install the park brake cable (2) to the lever (1).



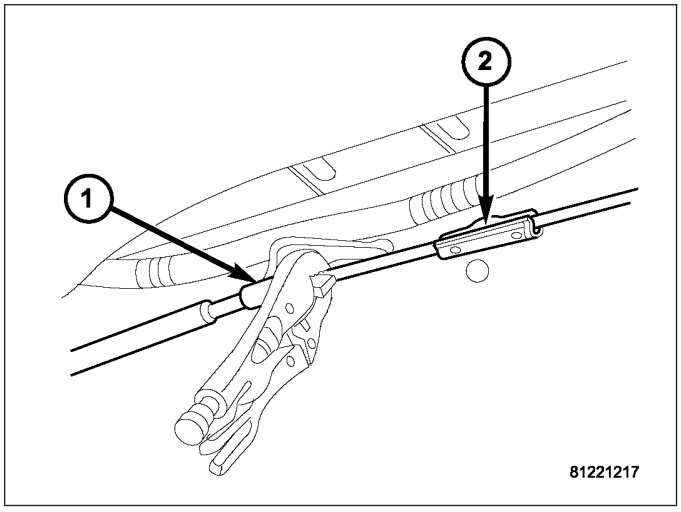
6. Install axle shaft, (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - 9 1/4/AXLE SHAFTS - INSTALLATION).
7. Adjust brake shoes to drum with brake gauge.
8. Install brake drum and wheel and tire assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE) (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
9. Bleed brake system. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

CABLES

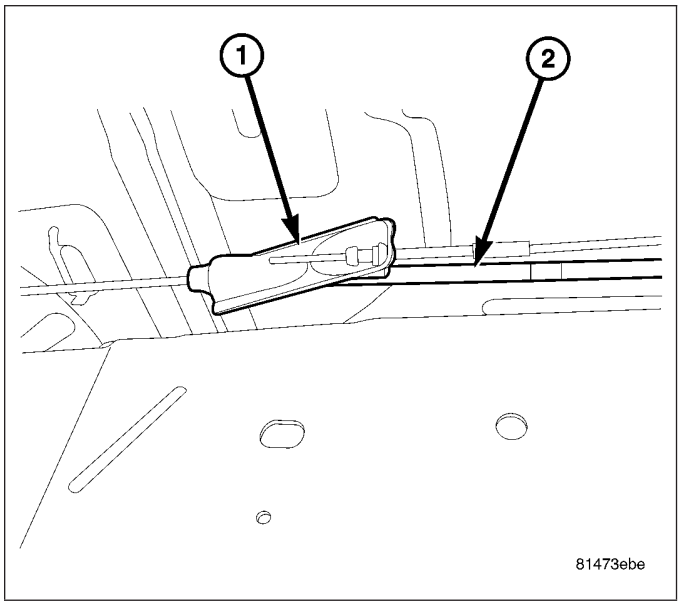
REMOVAL

FRONT PARKING BRAKE CABLE

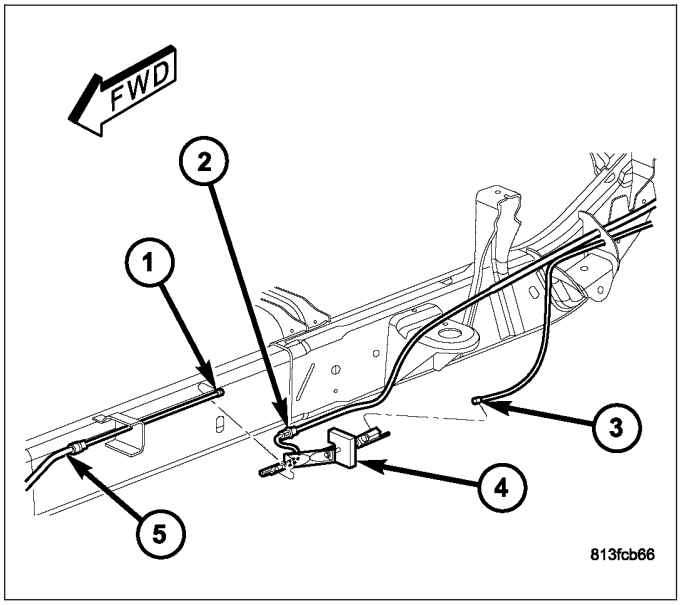
1. Raise and support vehicle.
2. Lockout the parking brake cable (2).



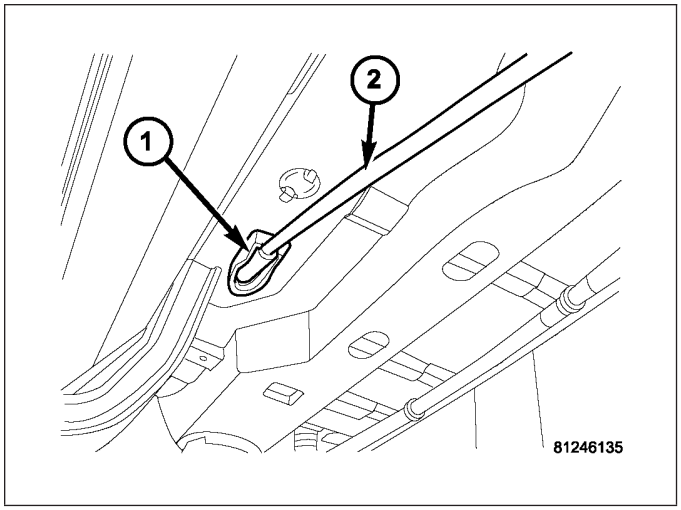
3. Loosen adjusting nut to create slack in front cable (1).
4. Remove the front cable from the cable adjuster (1).



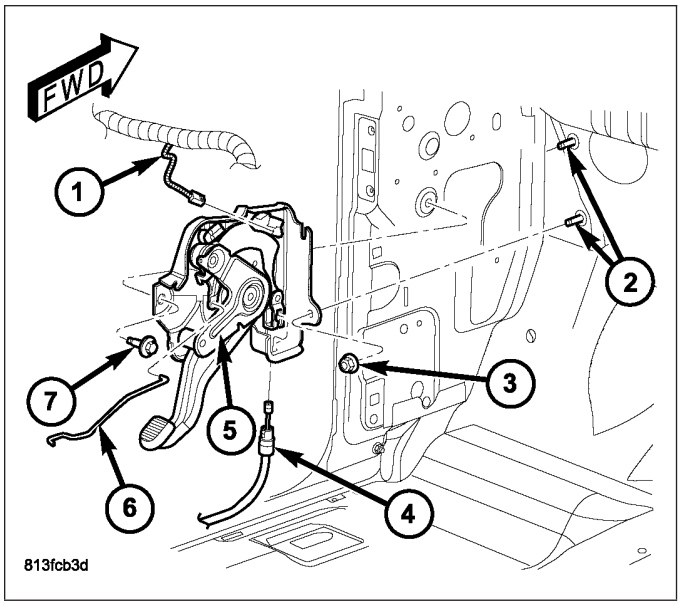
5. Compress cable end fitting at underbody bracket (5) and remove the cable (1) from the bracket.



6. Pull up on the cable (2) and remove the cable with the body grommet (1).
7. Lower vehicle.

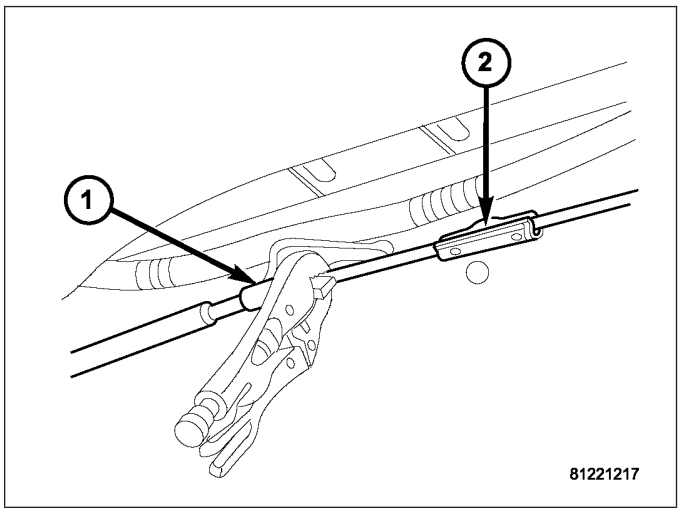


8. Push ball end of cable out (4) of pedal clevis with small screwdriver.
9. Compress cable end fitting (4) at the pedal bracket (5) and remove the cable (4).
10. Remove the left cowl trim and sill plate.
11. Pull up the carpet and remove the cable from the body clip.

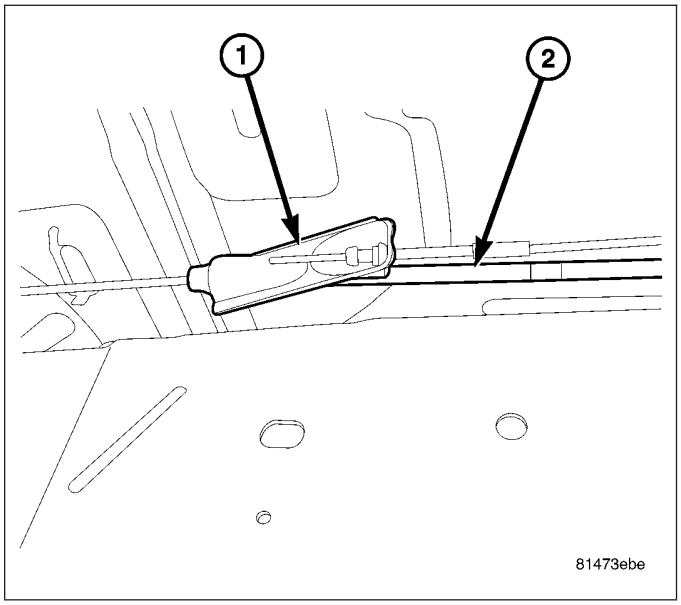


REAR PARK BRAKE CABLE

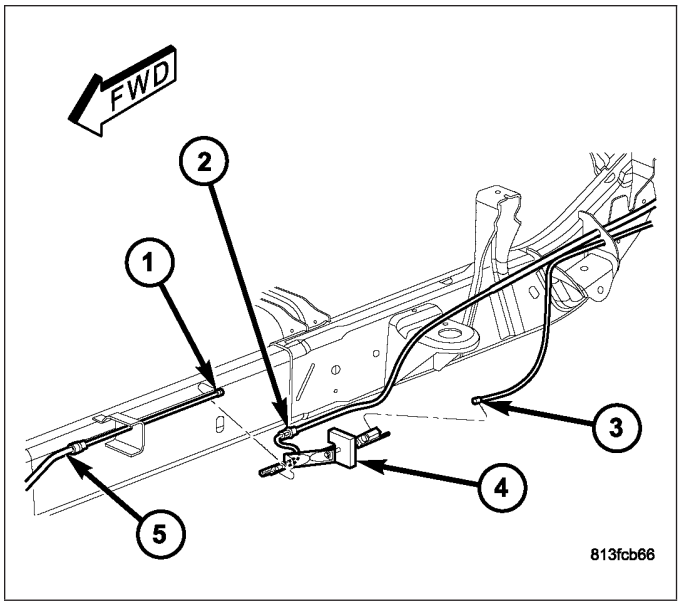
1. Raise and support the vehicle.
2. Lockout the parking brake cable (1).



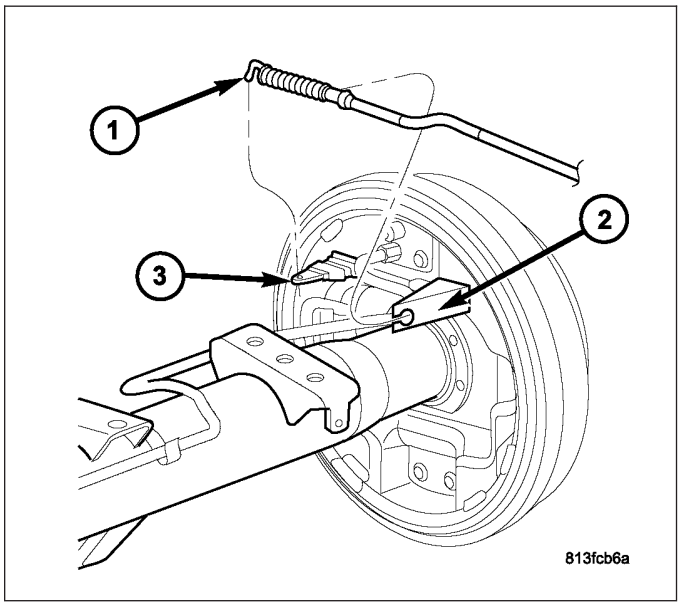
3. Loosen cable adjuster nut.
4. Remove the rear park brake cable from the intermediate park brake cable (2).



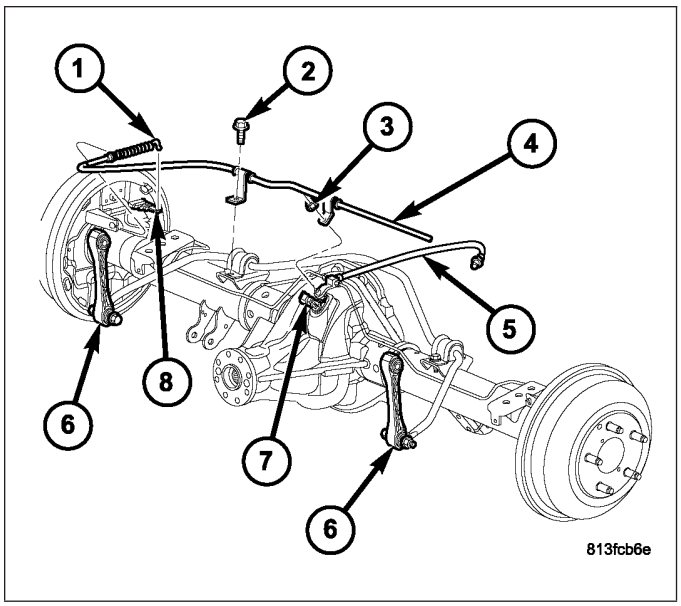
5. Compress tabs (2) on cable end fitting on the rear park brake cable to the frame mount bracket. Then pull the cable through the bracket.



6. Disengage the park brake cable (1) from the lever (3).
7. Compress cable tabs on each cable end fitting at the brake cable support plate (2).



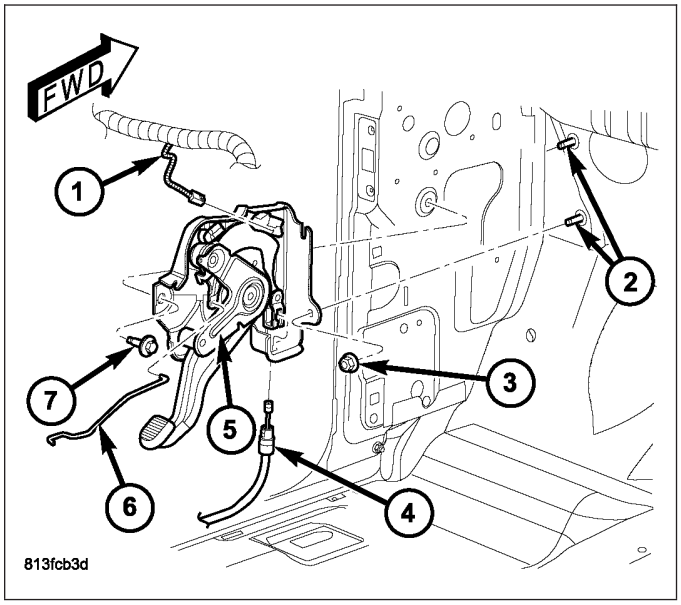
8. Remove the cables(4) from the brake cable supports (2&3).



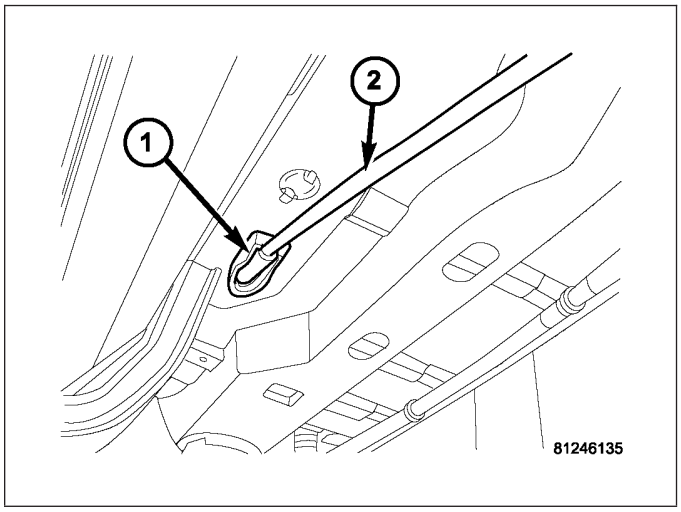
INSTALLATION

FRONT PARKING BRAKE CABLE

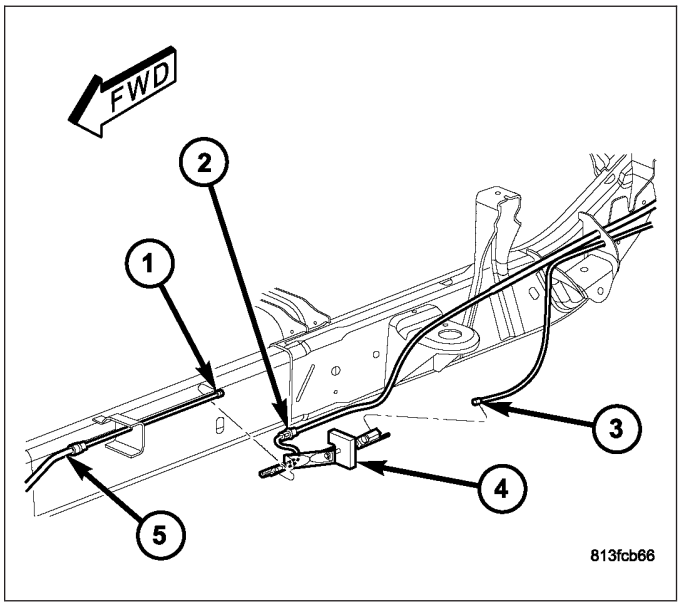
1. From inside the vehicle, insert the cable end fitting (4) into the hole in the pedal assembly (5).
2. Seat the cable retainer in the pedal assembly (4).
3. Engage the cable ball end in clevis on the pedal assembly.



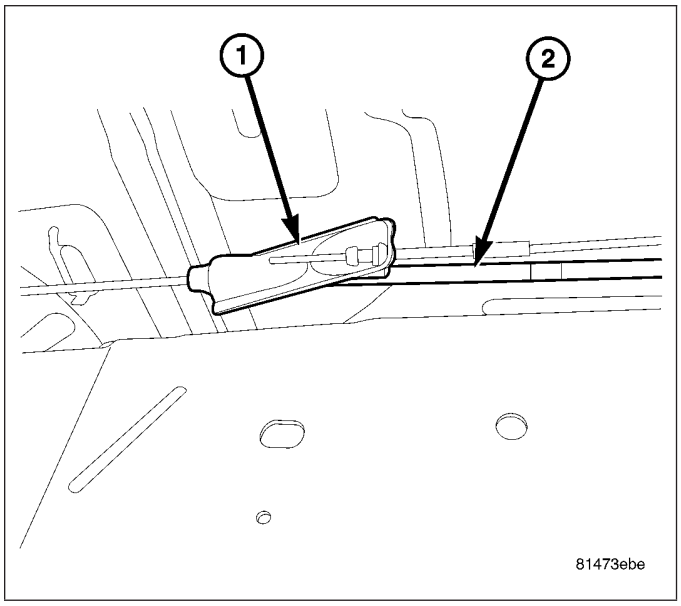
4. Route the cable (2) through the floorpan and install the body grommet (1).
5. Place the carpet down and install the left cowl trim and sill plate.



6. Raise and support the vehicle.
7. Route the cable (5) through the underbody bracket and seat the cable end fitting in the bracket.
8. Connect the cable (1) to the cable adjuster (4).



9. Perform the park brake adjustment procedure, (Refer to 5 - BRAKES/PARKING BRAKE/CABLE TENSIONER - ADJUSTMENTS).
10. Lower the vehicle.

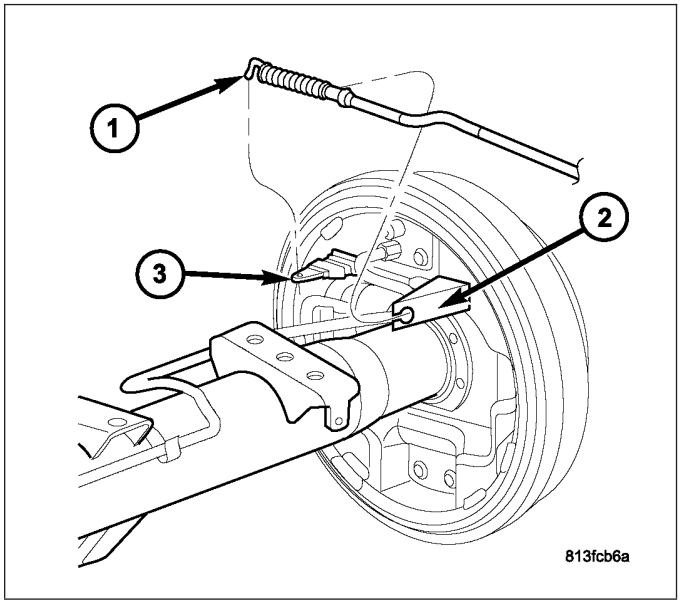


REAR PARK BRAKE CABLE

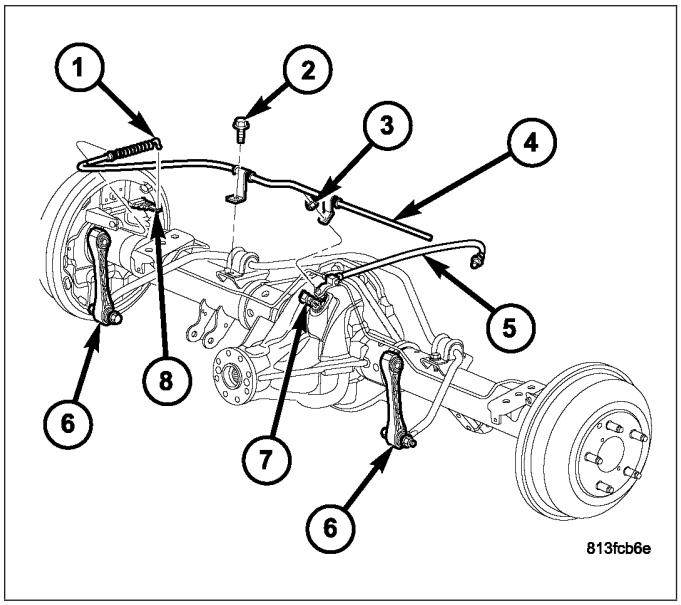
1. Push each cable end through the brake cable support plate hole (2) until the cable end fitting tabs lock into place.

NOTE: Pull on the cable to ensure it is locked into place.

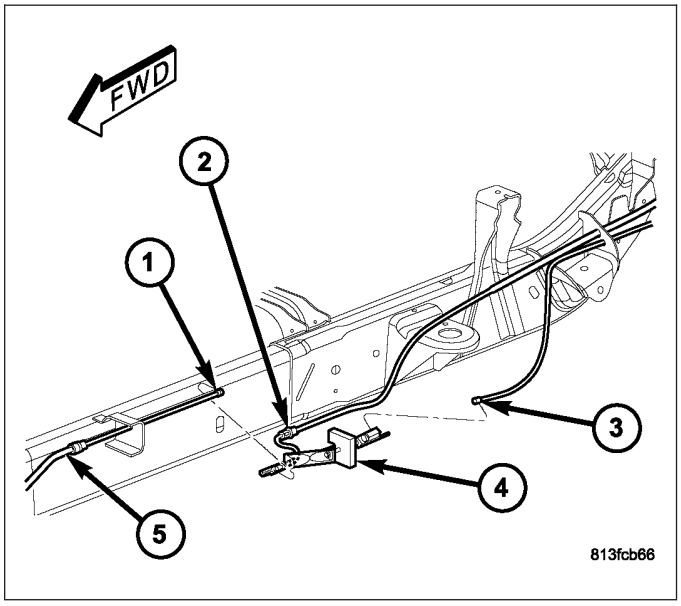
2. Install the rear cables (1) into the park brake lever behind the rear of the brake assembly (3).



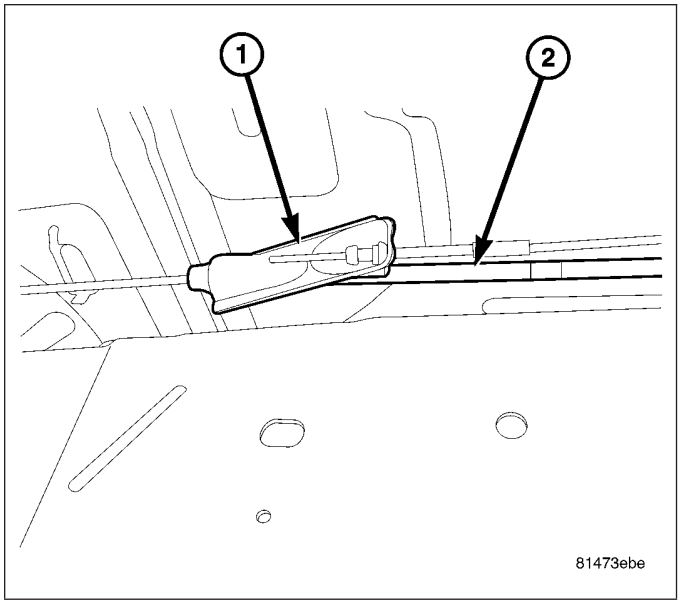
3. Install the hold down brackets for the park brake cable (2&3).



4. Install the cable (3) to the intermediate cable connector (4).
5. Release and remove the lock out device.



6. Perform the park brake adjustment procedure, (Refer to 5 - BRAKES/PARKING BRAKE/CABLE TENSIONER - ADJUSTMENTS).
7. Remove the supports and lower the vehicle.



ADJUSTMENTS - PARK BRAKE CABLE TENSIONER

NOTE: Tensioner adjustment is only necessary when the tensioner, or a cable has been replaced or disconnected for service. When adjustment is necessary, perform adjustment only as described in the following procedure. This is necessary to avoid faulty park brake operation.

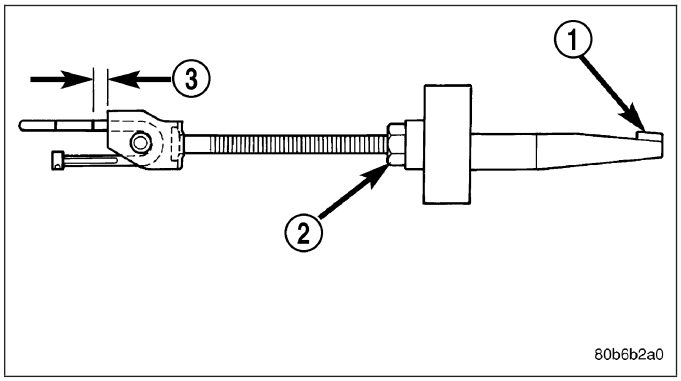
1. Raise vehicle.
2. Back off cable tensioner adjusting nut at equalizer to create slack in cables.
3. Remove rear wheel/tire assemblies. Then remove brake drums.
4. Verify brakes are in good condition and operating properly.
5. Verify park brake cables operate freely and are not binding, or seized.
6. Check rear brake shoe adjustment with standard brake gauge.
7. Install drums and verify that drums rotate freely without drag.
8. Reinstall wheel/tire assemblies after brake shoe adjustment is complete.
9. Lower vehicle enough for access to park brake foot pedal. Then fully apply park brakes.

NOTE: Leave park brakes applied until adjustment is complete.

10. Raise vehicle again.
11. Mark tensioner rod 6.35 mm (1/4 in.) from edge of tensioner bracket.
12. Tighten adjusting nut at equalizer until mark on tensioner rod moves into alignment with tensioner bracket.

CAUTION: Do not loosen, or tighten the tensioner adjusting nut for any reason after completing adjustment.

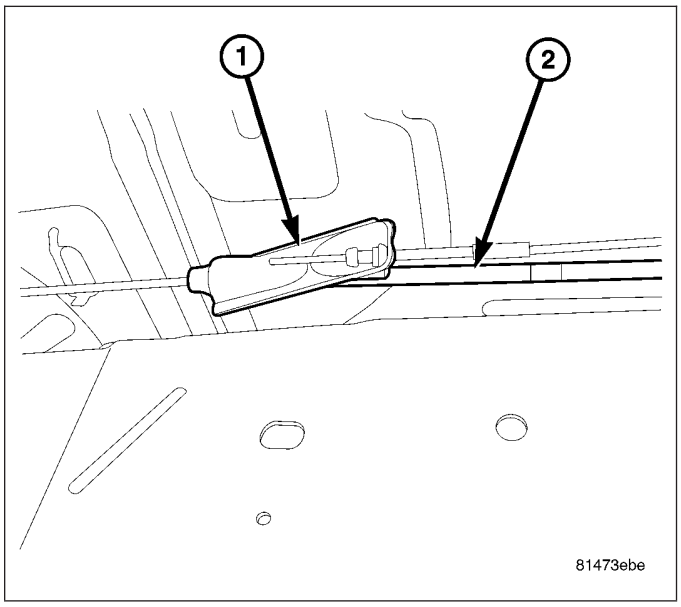
13. Lower vehicle until rear wheels are 15-20 cm (6-8 in.) off shop floor.
14. Release park brake foot pedal and verify that rear wheels rotate freely without drag. Then lower vehicle.



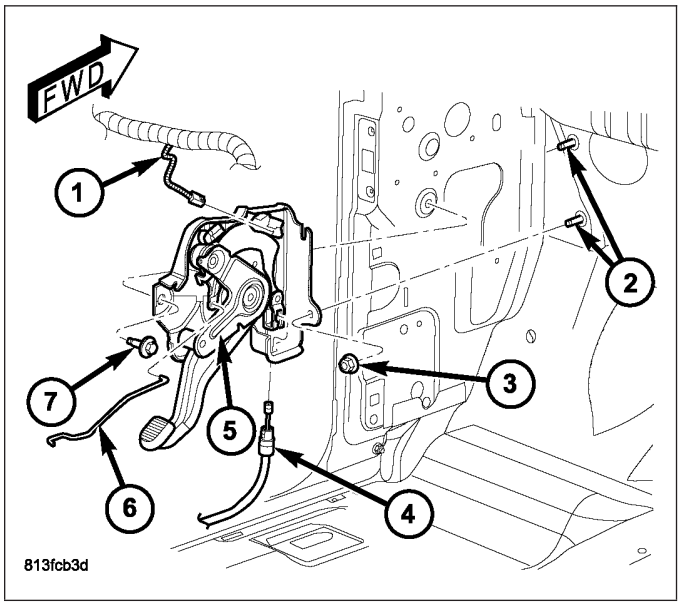
PEDAL

REMOVAL

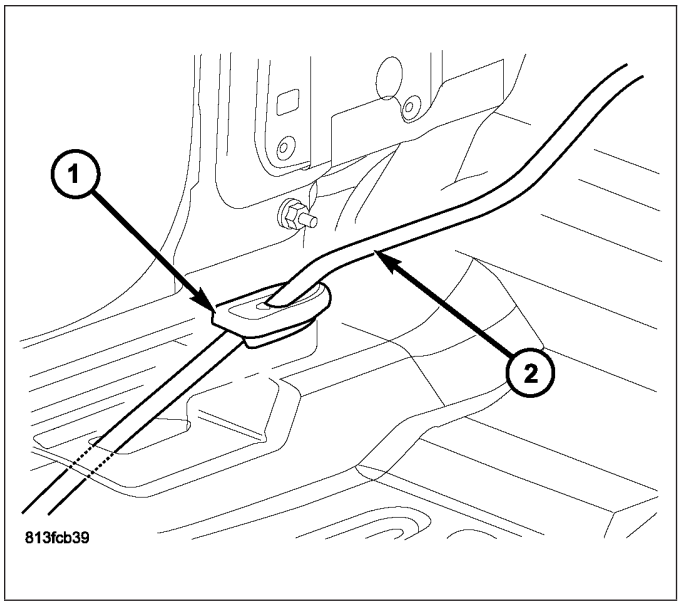
1. Release the parking brake.
2. Raise the vehicle.
3. Loosen the cable tensioner nut at the equalizer (1) to create slack in the front cable (2).
4. Lower the vehicle.



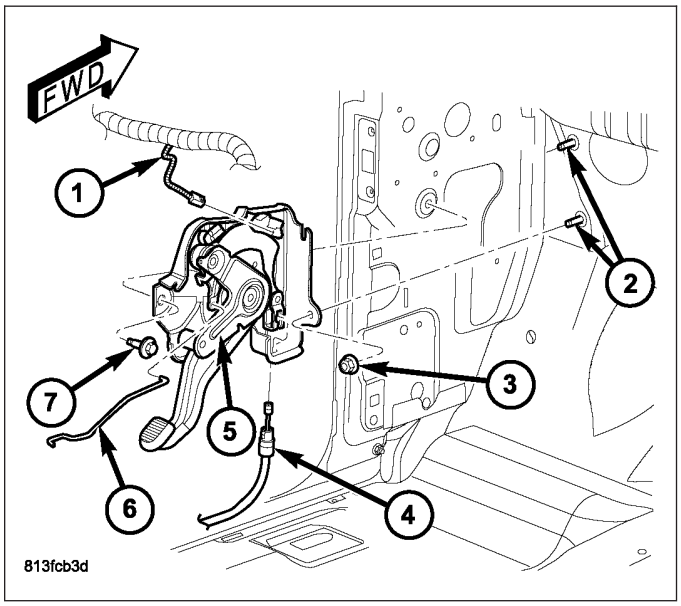
5. Disconnect the brake lamp wire from the switch (1) on the pedal assembly (5).



6. Roll the carpet back, loosen the front cable grommet (1) from the floor pan and the cable retainer.



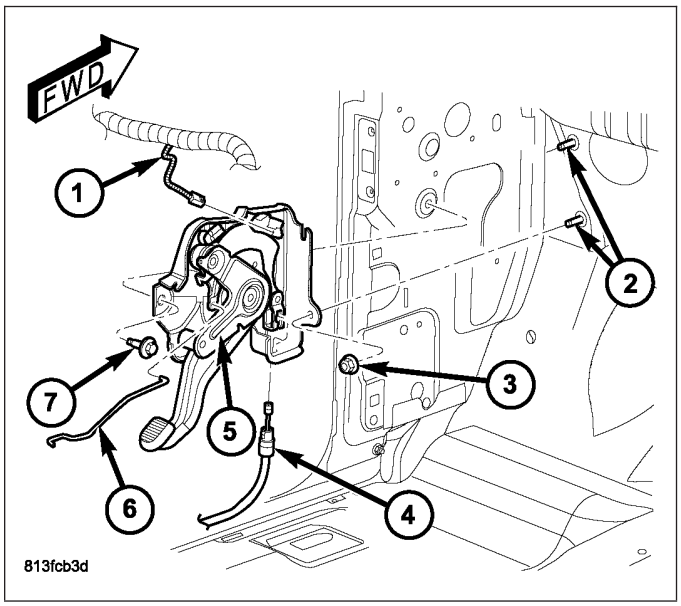
7. Disengage the release rod (6) from the arm on the pedal assembly (5)
8. Remove the bolt (7) & nuts (3) from the pedal assembly (5) and remove the assembly.



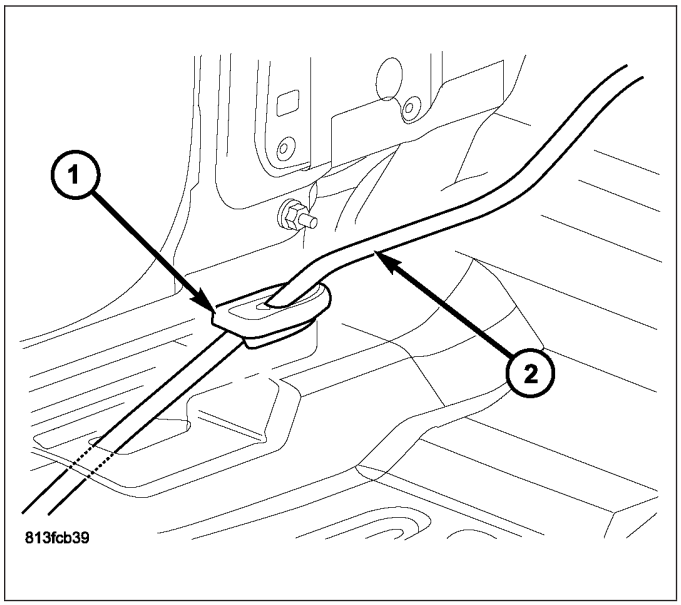
9. Disconnect the park brake cable (4) from the pedal assembly (5).

INSTALLATION

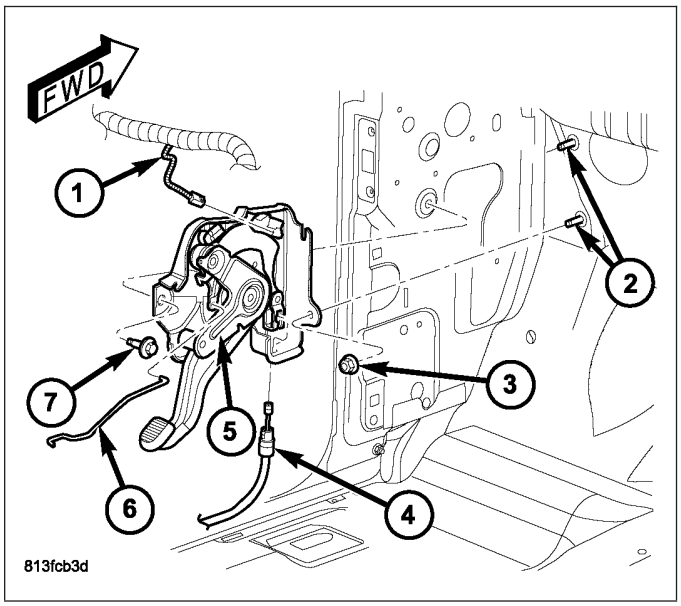
1. Connect the front cable (4) to the arm on the pedal assembly (5).
2. Position the replacement pedal assembly (5) on the dash and cowl.
3. Install the bolt (7)& nuts (3) and tighten to 14 N·m (125 in. lbs.).



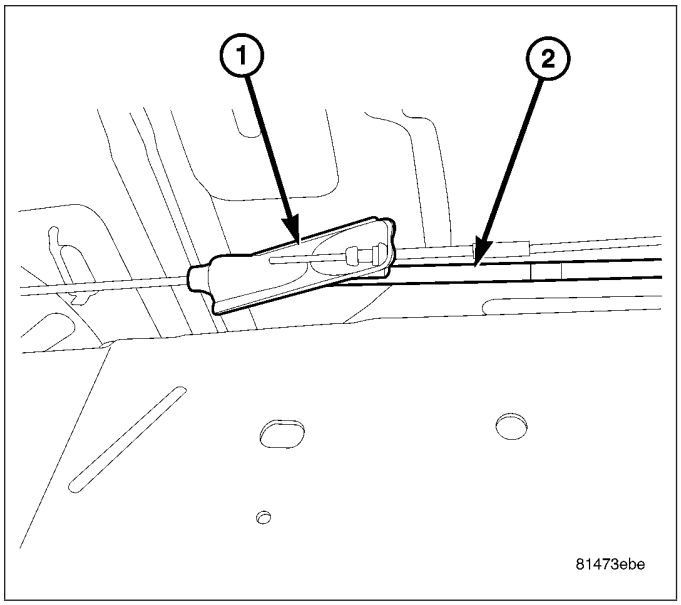
4. Tighten the front cable grommet (1) to the floor pan and the cable retainer, roll the carpet back.



5. Connect the wires (1) to the brake lamp switch.
6. Install the park brake release rod (6).



7. Raise the vehicle.
8. Adjust the parking brake cable tensioner (1) (Refer to 5 - BRAKES/PARKING BRAKE/CABLE TENSIONER - ADJUSTMENTS).



CABLE TENSIONER

ADJUSTMENTS - PARK BRAKE CABLE TENSIONER

NOTE: Tensioner adjustment is only necessary when the tensioner, or a cable has been replaced or disconnected for service. When adjustment is necessary, perform adjustment only as described in the following procedure. This is necessary to avoid faulty park brake operation.

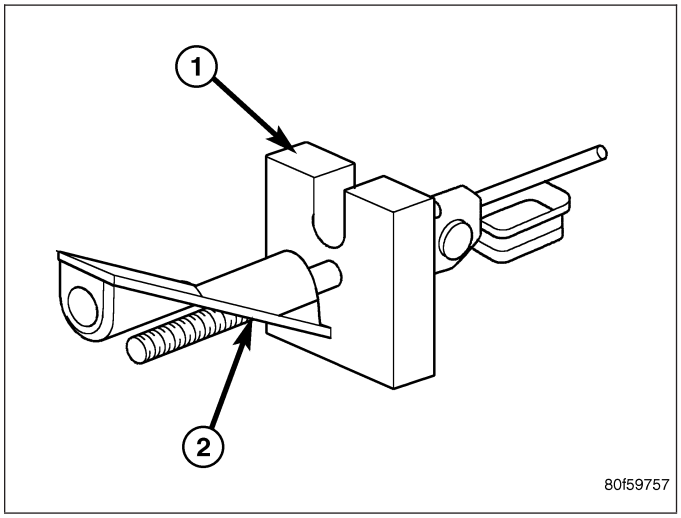
1. Raise vehicle.
2. Back off cable tensioner adjusting nut at equalizer to create slack in cables.
3. Remove rear wheel/tire assemblies. Then remove brake drums.
4. Verify brakes are in good condition and operating properly.
5. Verify park brake cables operate freely and are not binding, or seized.
6. Check rear brake shoe adjustment with standard brake gauge.
7. Install drums and verify that drums rotate freely without drag.
8. Reinstall wheel/tire assemblies after brake shoe adjustment is complete.
9. Lower vehicle enough for access to park brake foot pedal. Then fully apply park brakes.

NOTE: Leave park brakes applied until adjustment is complete.

10. Raise vehicle again.
11. Mark tensioner rod 6.35 mm (1/4 in.) from edge of tensioner bracket (1).
12. Tighten adjusting nut (2) at equalizer until mark on tensioner rod moves into alignment with tensioner bracket.

CAUTION: Do not loosen, or tighten the tensioner adjusting nut for any reason after completing adjustment.

13. Lower vehicle until rear wheels are 15-20 cm (6-8 in.) off shop floor.
14. Release park brake foot pedal and verify that rear wheels rotate freely without drag. Then lower vehicle.



BRAKES - ABS ELECTRICAL DIAGNOSTICS

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ABS ELECTRICAL DIAGNOSTICS (EBC125)

DIAGNOSIS AND TESTING

*ABS VERIFICATION TEST — VER 1 (EBC125)

Diagnostic Test

1. *ABS VERIFICATION TEST — VER 1

Turn the ignition off.
Connect all previously disconnected components and connectors.
Make sure all accessories are turned off and the battery is fully charged.
With the scan tool, clear DTCs in all modules.
Cycle the ignition off for 10 seconds, then on.
With the scan tool, select View DTCs in the ABS module.
If any DTCs have reset, perform the appropriate diagnostic procedure before continuing with this test.
If there are no DTCs present, road test the vehicle above 40 m.p.h. for at least two minutes.

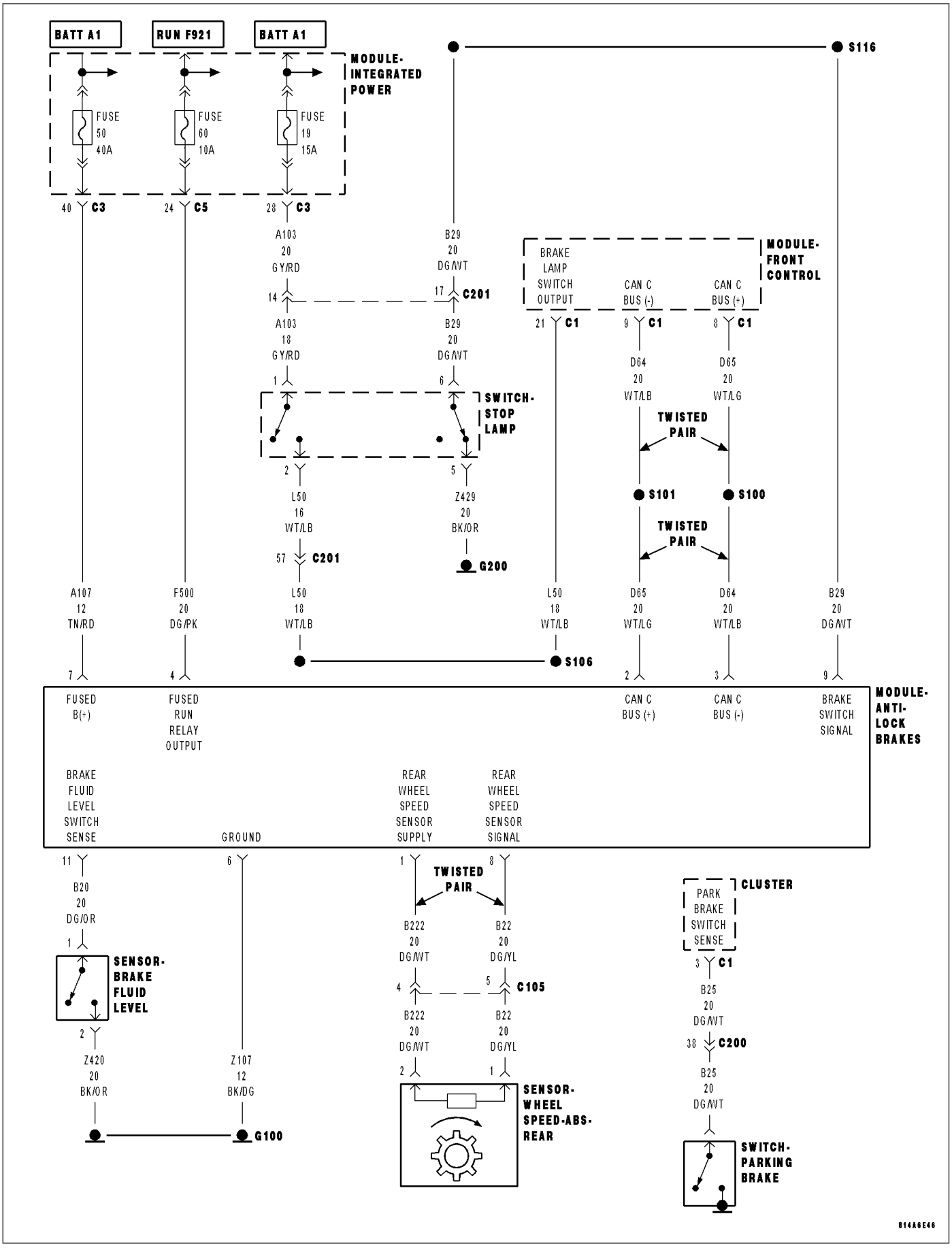
CAUTION: Make sure braking capability is available before road testing the vehicle. During the test drive, perform several anti-lock braking stops.
With the scan tool, select View DTCs in the Anti-Lock Brake Module.

Are there any DTCs present?

Yes >> Perform the appropriate diagnostic procedure(s).

No >> Test Complete

C1009–BRAKE FLUID LEVEL LOW (EBC125)



C1009–BRAKE FLUID LEVEL LOW (EBC125) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no system under voltage DTC present.
- **Set Condition:**
  This DTC will set if the brake fluid level switch indicates low brake fluid for 1 second.

Possible Causes
INTERMITTENT BRAKE FLUID LEVEL LOW DTC
BRAKE FLUID LEVEL LOW
(B20) BRAKE FLUID LEVEL SWITCH SENSE CIRCUIT SHORT TO GROUND
(Z420) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
BRAKE FLUID LEVEL SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC CONDITION IS PRESENT

Release the Parking Brake.
Turn the ignition off.
Turn the ignition on.
Monitor the Instrument Cluster.

Does the red Brake Warning Indicator stay on?

Yes >> Go To 2
No >> Go To 6

---

2. BRAKE FLUID LEVEL LOW

Turn the ignition off.
Inspect the Brake Fluid Level in accordance with the Service Information.

Is the Brake Fluid Level Low?

Yes >> Inspect the system and repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

C1009–BRAKE FLUID LEVEL LOW (EBC125) (CONTINUED)

3. (B20) BRAKE FLUID LEVEL SWITCH SENSE CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Brake Fluid Level Sensor harness connector.

Disconnect the Anti-lock Brake Module harness connector.

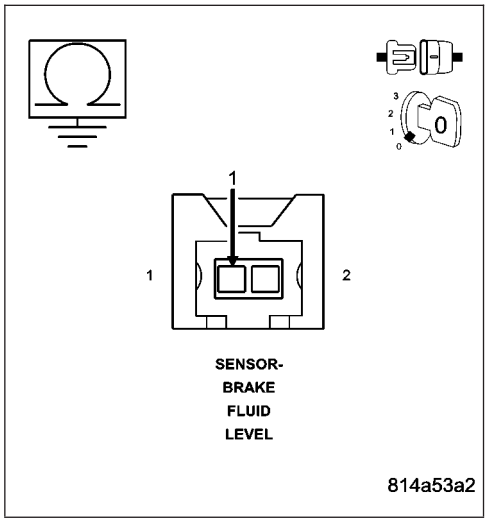
NOTE: Check connector - Clean/repair as necessary.

Measure the resistance between ground and the (B20) Brake Fluid Level Switch Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (B20) Brake Fluid Level Switch Sense circuit for a short to ground.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4



4. BRAKE FLUID LEVEL SENSOR

NOTE: Determine if the Brake Fluid Level Sensor is stuck in the down position. Repair as necessary.

Measure the resistance of the Brake Fluid Level Sensor at the sensor terminals.

NOTE: Resistance should be approximately 10,000 ohms with the reservoir full.

Is the resistance between 9,500 and 10,500 ohms?

Yes >> Go To 5

No >> Replace the Brake Fluid Level Switch in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

5. (Z420) GROUND CIRCUIT OPEN OR HIGH RESISTANCE

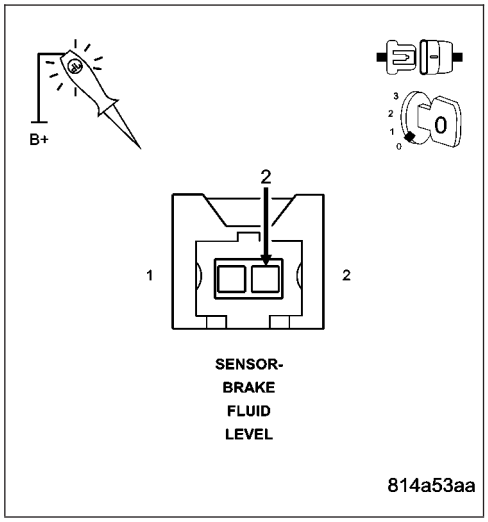
Using a 12–volt test light connected to 12 volts, check the (Z420) Ground circuit.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

Yes >> Replace the Anti-lock Brake Module in accordance with the Service Information. Refer to the symptom *Replacing the Anti-lock Brake Module for additional information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Repair the (B20) Brake Fluid Level Switch ground circuit for an open circuit or high resistance.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C1009–BRAKE FLUID LEVEL LOW (EBC125) (CONTINUED)

6. WIRING HARNESS INSPECTION

Turn the ignition off.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

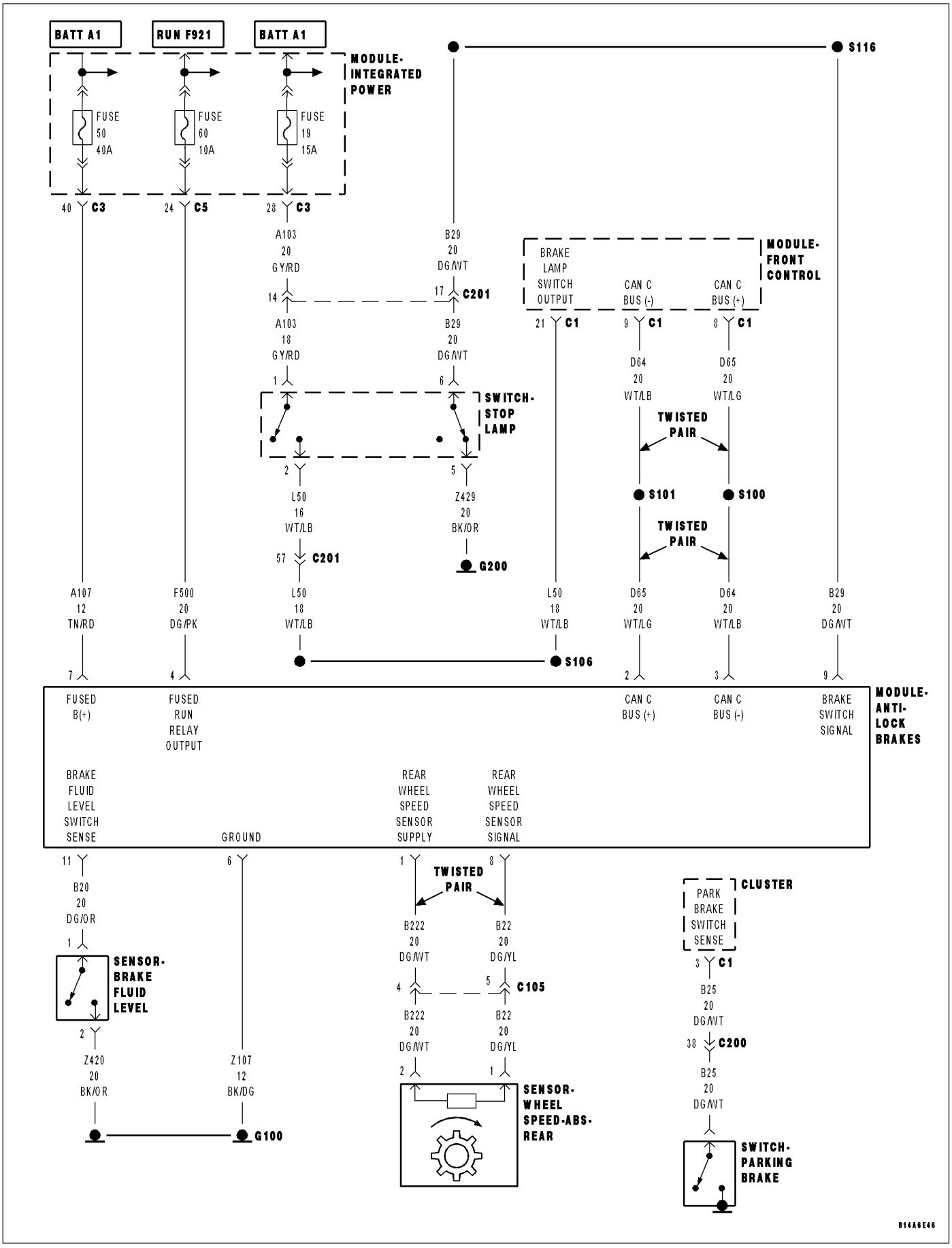
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C102B-REAR WHEEL SPEED SENSOR CIRCUIT (EBC125)



C102B-REAR WHEEL SPEED SENSOR CIRCUIT (EBC125) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no system under voltage or over voltage condition present.
- **Set Condition:**
  If the measured wheel speed sensor feedback voltage is less than .277 volts, the sensor is considered open. If the measured wheel speed sensor feedback voltage is greater than 1.277 volts, or if a sensor over current condition is detected, the sensor is considered shorted.
  If a shorted or open condition is present for more than 100 msec, the DTC will set.

Possible Causes
INTERMITTENT REAR WHEEL SPEED SENSOR DTC
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORT TO GROUND
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT
TONE WHEEL
EXCESSIVE REAR WHEEL SPEED SENSOR AIR GAP
WHEEL BEARING
REAR WHEEL SPEED SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2
No >> Go To 15

C102B-REAR WHEEL SPEED SENSOR CIRCUIT (EBC125) (CONTINUED)

2. WHEEL SPEED SENSOR INSPECTION

Turn the ignition off.

Inspect the Wheel Speed Sensor for proper mounting.

Inspect the Wheel Speed Sensor harness and connector.

Inspect the Wheel Speed Sensor for excessive debris on the sensor.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

---

3. TONE WHEEL DAMAGED/MISSING

Inspect the Tone Wheel in accordance with the Service Information.

NOTE: The Tone Wheel Teeth should be perfectly square, not bent or nicked.

Were any problems found?

Yes >> Replace the Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. EXCESSIVE WHEEL SPEED SENSOR AIR GAP

Measure the Wheel Speed Sensor Air Gap in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. WHEEL BEARING LOOSE/BINDING

Inspect the wheel bearings for excessive run out or improper clearance in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 6

C102B-REAR WHEEL SPEED SENSOR CIRCUIT (EBC125) (CONTINUED)

6. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Rear Wheel Speed Sensor harness connector.

Disconnect the Anti-lock Brake Module harness connector.

NOTE: Check connector - Clean/repair as necessary.

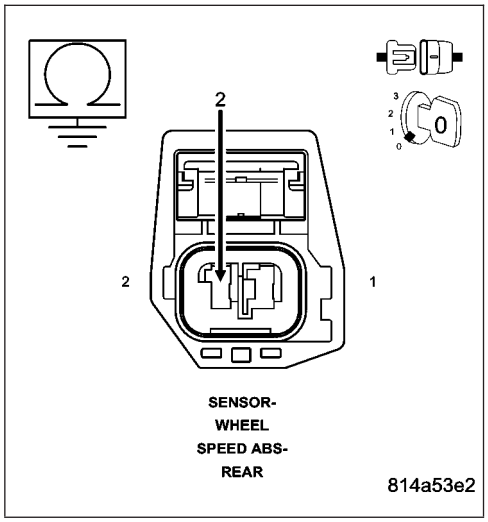
Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 7

No >> Repair the (B222) Rear Wheel Speed Sensor Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



7. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

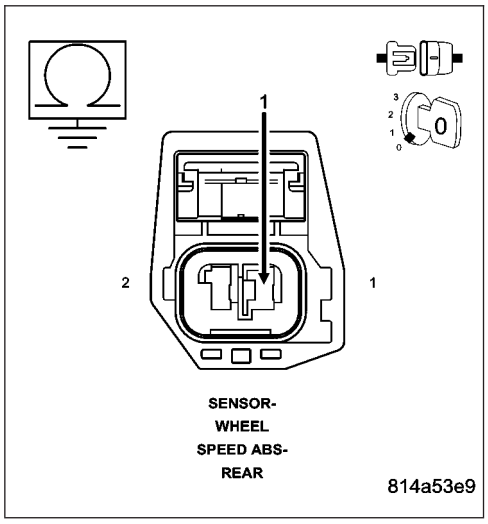
Measure the resistance between the (B22) Rear Wheel Speed Sensor Signal circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 8

No >> Repair the (B22) Rear Wheel Speed Sensor Signal circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C102B-REAR WHEEL SPEED SENSOR CIRCUIT (EBC125) (CONTINUED)

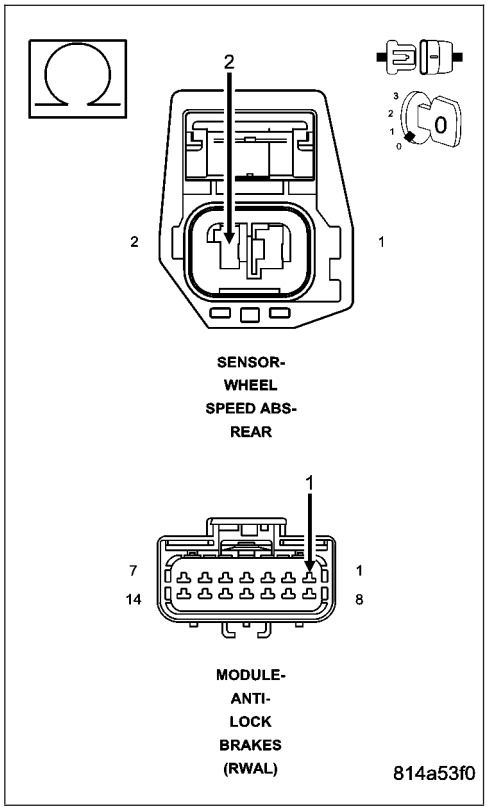
8. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN

Measure the resistance of the (B222) Rear Wheel Speed Sensor Supply circuit.

Is the resistance below 5 ohms?

Yes >> Go To 9

No >> Repair the open (B222) Rear Wheel Speed Sensor Supply circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C102B-REAR WHEEL SPEED SENSOR CIRCUIT (EBC125) (CONTINUED)

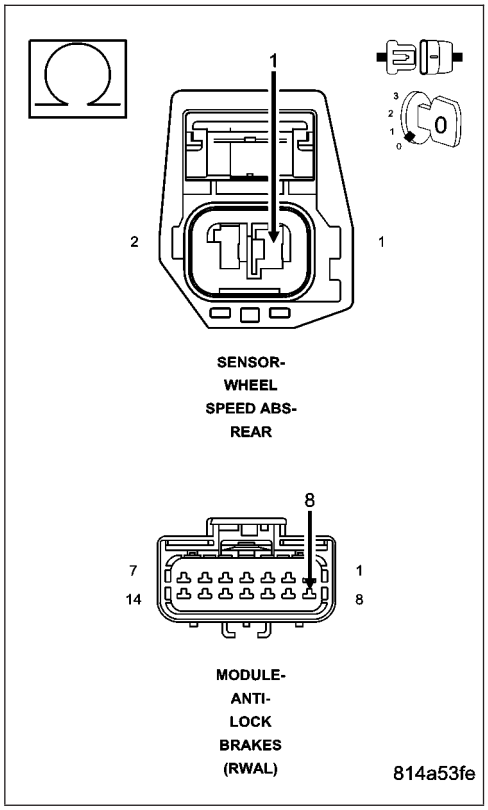
9. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the (B22) Rear Wheel Speed Sensor Signal circuit.

Is the resistance below 5 ohms?

Yes >> Go To 10

No >> Repair the open (B22) Rear Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



10. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE

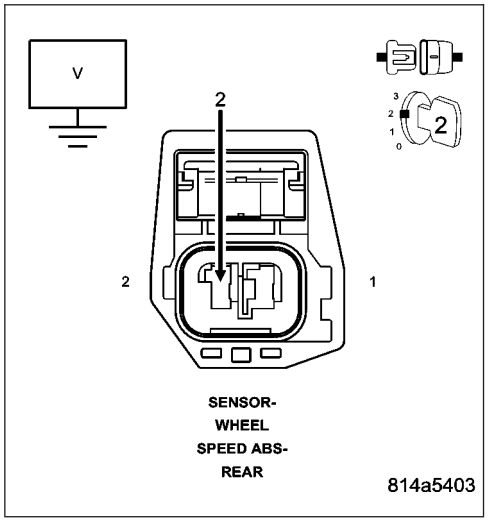
Turn the ignition on.

Measure the voltage of the (B222) Rear Wheel Speed Sensor Supply circuit.

Is there any voltage present?

Yes >> Repair (B222) Rear Wheel Speed Sensor Supply circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

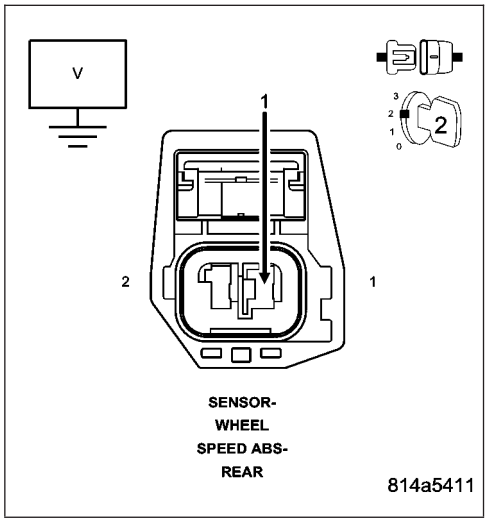
No >> Go To 11



C102B-REAR WHEEL SPEED SENSOR CIRCUIT (EBC125) (CONTINUED)

11. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (B22) Rear Wheel Speed Sensor Signal circuit.



Is there any voltage present?

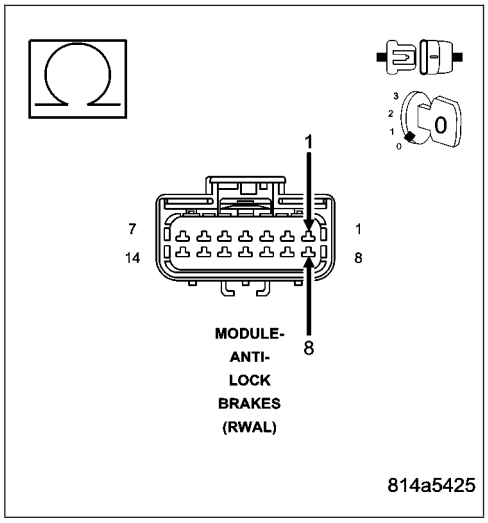
Yes >> Repair the (B22) Rear Wheel Speed Sensor Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 12

12. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and the (B22) Rear Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair (B222) Rear Wheel Speed Sensor Supply circuit for a short to the (B22) Rear Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 13

C102B-REAR WHEEL SPEED SENSOR CIRCUIT (EBC125) (CONTINUED)

13. REAR WHEEL SPEED SENSOR

Turn the ignition off.

Connect the Rear Wheel Speed Sensor harness connector.

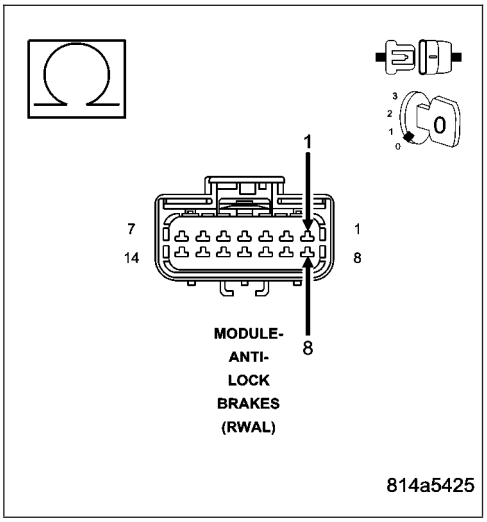
Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and (B22) Rear Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

NOTE: The resistance should be approximately 1600–2300 ohms at 76 degrees F.

Is the resistance within the noted range?

Yes >> Go to 14

No >> Replace the Rear Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



14. ANTI-LOCK BRAKE MODULE

Turn the ignition off.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

15. WIRING HARNESS INSPECTION

Turn the ignition off.

NOTE: Towing the vehicle with ignition ON may set this DTC.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

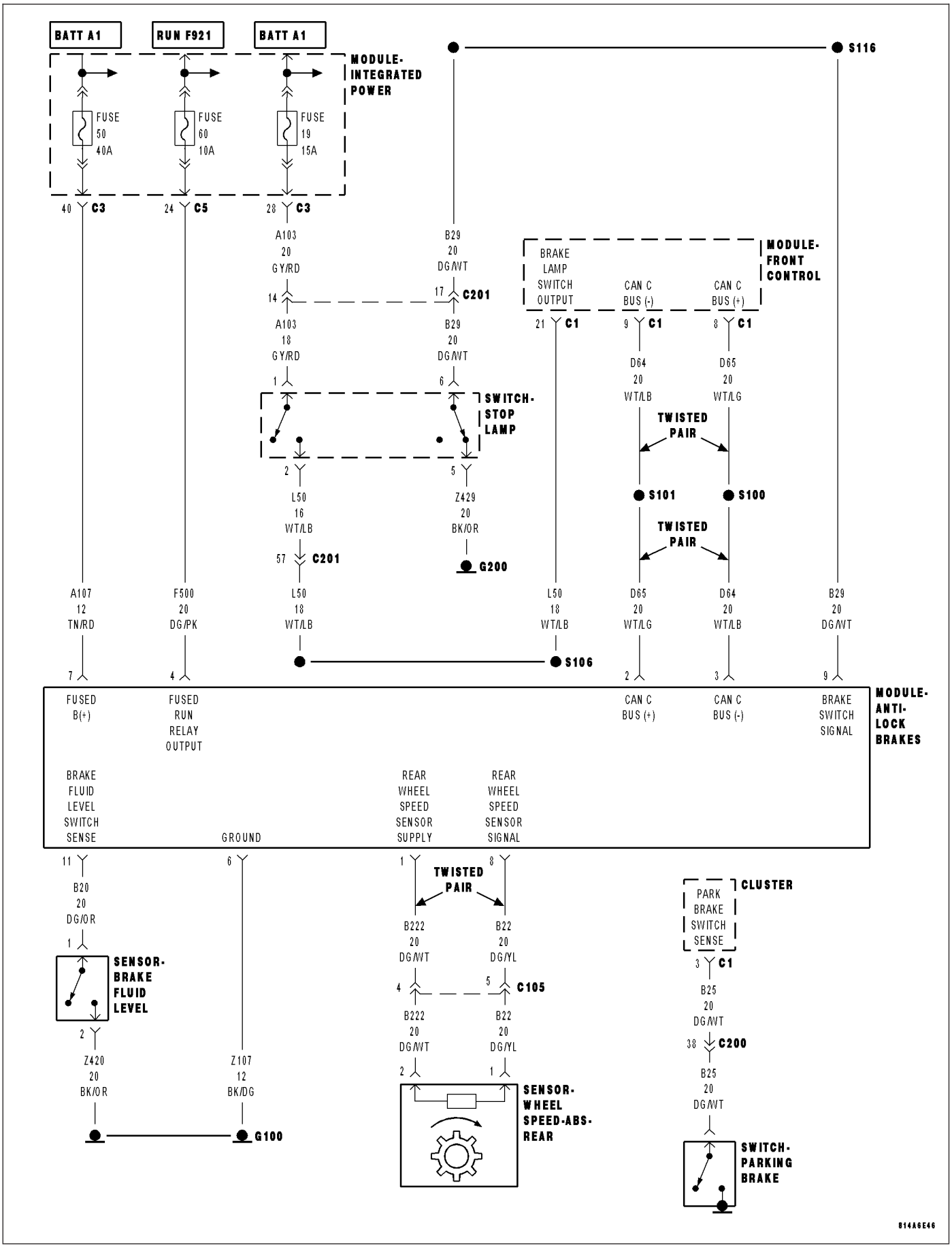
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (EBC125)



C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (EBC125) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no system under voltage or over voltage condition present.
- **Set Condition:**
  Each time excessive wheel speed sensor acceleration or deceleration is detected, a fault counter increments. If the fault counter exceeds a specified value, the DTC will set.

Possible Causes
INTERMITTENT REAR WHEEL SPEED SENSOR DTC
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORT TO GROUND
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT
TONE WHEEL
EXCESSIVE REAR WHEEL SPEED SENSOR AIR GAP
WHEEL BEARING
REAR WHEEL SPEED SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2
No >> Go To 15

C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (EBC125) (CONTINUED)

2. WHEEL SPEED SENSOR INSPECTION

Turn the ignition off.

Inspect the Wheel Speed Sensor for proper mounting.

Inspect the Wheel Speed Sensor harness and connector.

Inspect the Wheel Speed Sensor for excessive debris on the sensor.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

---

3. TONE WHEEL DAMAGED/MISSING

Inspect the Tone Wheel in accordance with the Service Information.

NOTE: The Tone Wheel Teeth should be perfectly square, not bent or nicked.

Were any problems found?

Yes >> Replace the Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. EXCESSIVE WHEEL SPEED SENSOR AIR GAP

Measure the Wheel Speed Sensor Air Gap in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. WHEEL BEARING LOOSE / BINDING

Inspect the wheel bearings for excessive run out or improper clearance in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 6

C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (EBC125) (CONTINUED)

6. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Rear Wheel Speed Sensor harness connector.

Disconnect the Anti-lock Brake Module harness connector.

NOTE: Check connector - Clean/repair as necessary.

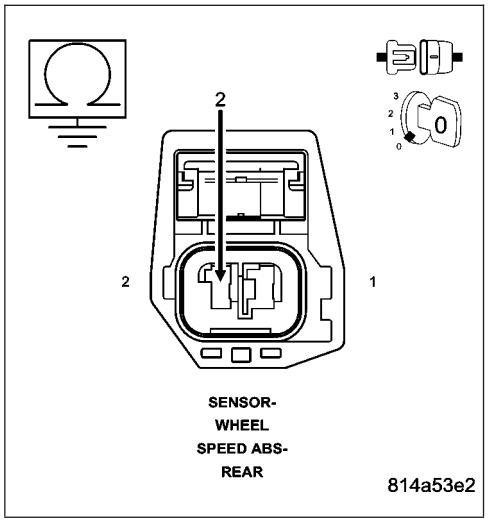
Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 7

No >> Repair the (B222) Rear Wheel Speed Sensor Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



7. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

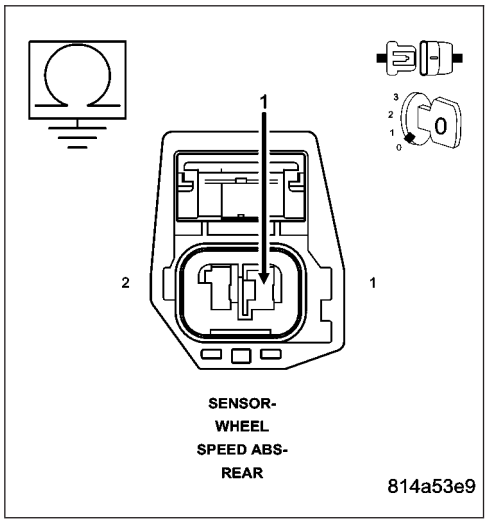
Measure the resistance between the (B22) Rear Wheel Speed Sensor Signal circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 8

No >> Repair the (B22) Rear Wheel Speed Sensor Signal circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (EBC125) (CONTINUED)

8. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN

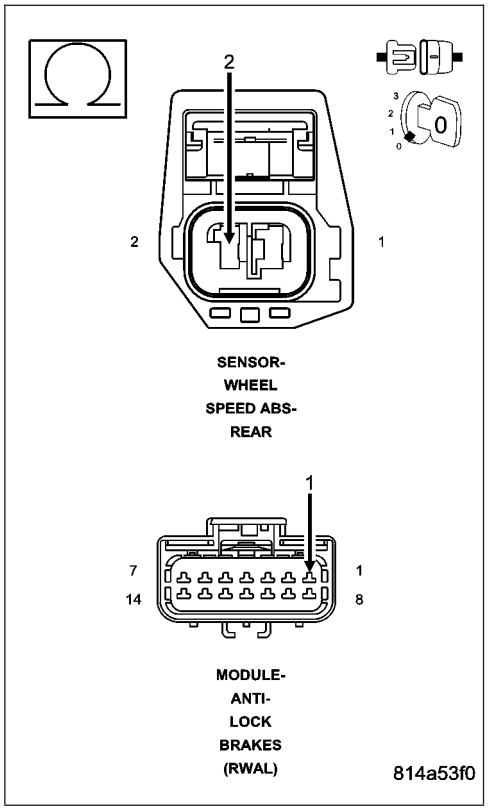
Measure the resistance of the (B222) Rear Wheel Speed Sensor Supply circuit.

Is the resistance below 5 ohms?

Yes >> Go To 9

No >> Repair the open (B222) Rear Wheel Speed Sensor Supply circuit.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (EBC125) (CONTINUED)

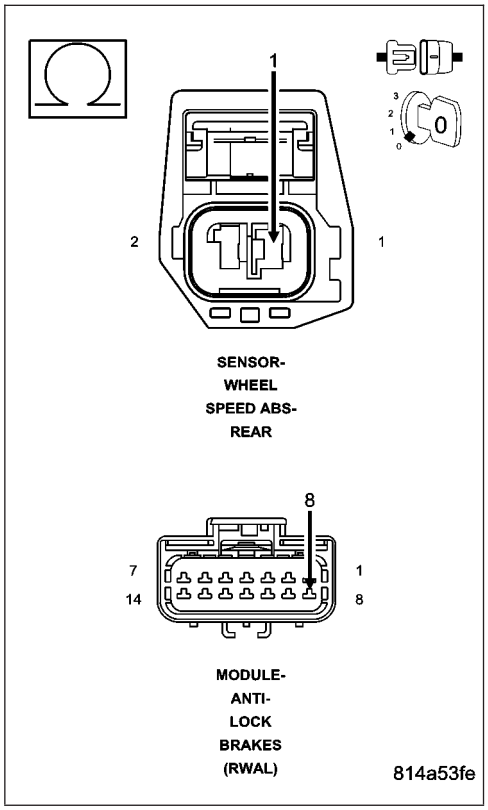
9. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the (B22) Rear Wheel Speed Sensor Signal circuit.

Is the resistance below 5 ohms?

Yes >> Go To 10

No >> Repair the open (B22) Rear Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



10. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE

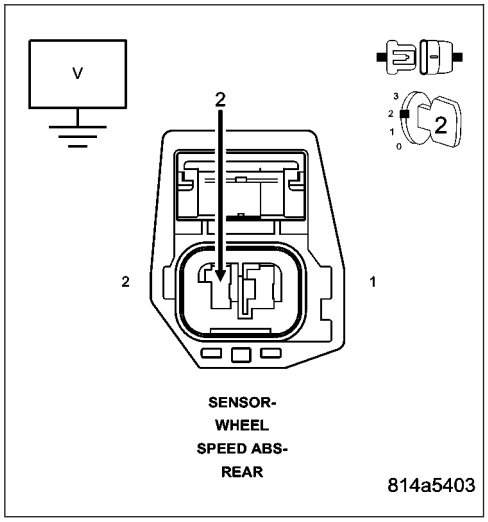
Turn the ignition on.

Measure the voltage of the (B222) Rear Wheel Speed Sensor Supply circuit.

Is there any voltage present?

Yes >> Repair (B222) Rear Wheel Speed Sensor Supply circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 11



C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (EBC125) (CONTINUED)

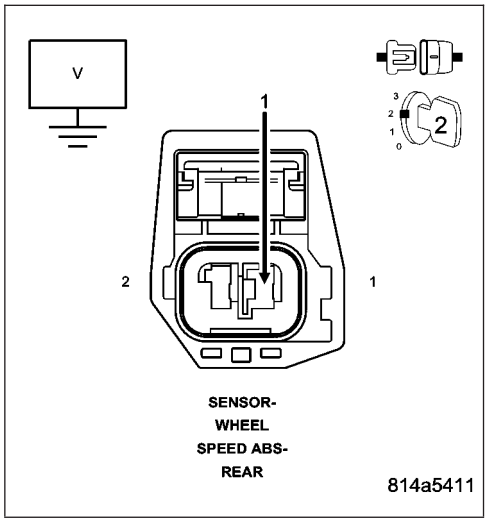
11. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (B22) Rear Wheel Speed Sensor Signal circuit.

Is there any voltage present?

Yes >> Repair the (B22) Rear Wheel Speed Sensor Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 12



12. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT

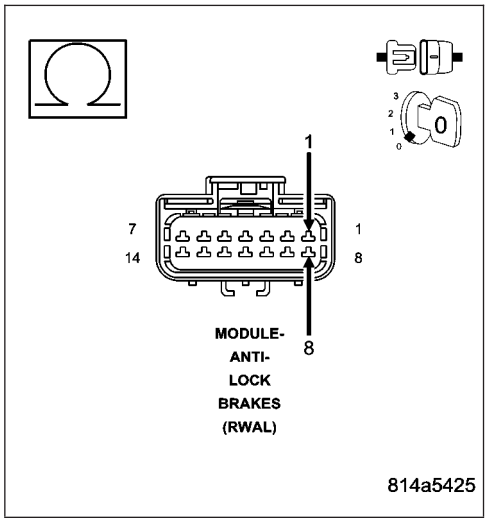
Turn the ignition off.

Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and the (B22) Rear Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair (B222) Rear Wheel Speed Sensor Supply circuit for a short to the (B22) Rear Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 13



C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (EBC125) (CONTINUED)

13. REAR WHEEL SPEED SENSOR

Turn the ignition off.

Connect the Rear Wheel Speed Sensor harness connector.

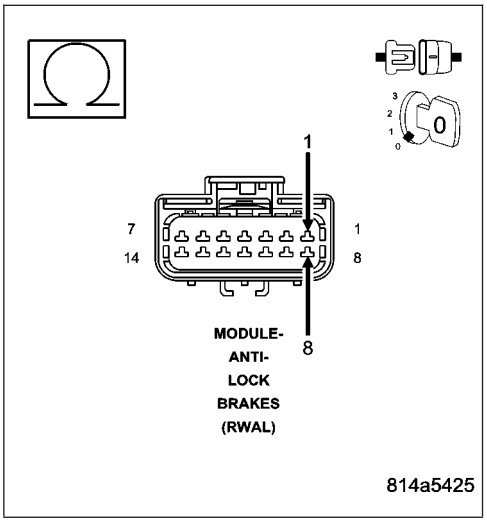
Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and (B22) Rear Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

NOTE: The resistance should be approximately 1600–2300 ohms at 76 degrees F.

Is the resistance within the noted range?

Yes >> Go to 14

No >> Replace the Rear Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



14. ANTI-LOCK BRAKE MODULE

Turn the ignition off.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

15. WIRING HARNESS INSPECTION

Turn the ignition off.

NOTE: Towing the vehicle with ignition ON may set this DTC.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C1078–TIRE REVOLUTIONS RANGE PERFORMANCE (EBC125)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The DTC will set if the stored tire size is out of range.

Possible Causes
INTERMITTENT TIRE REVOLUTIONS RANGE PERFORMANCE DTC
INCORRECT TIRE SIZE PROGRAMMED INTO ANTI-LOCK BRAKE MODULE
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC CONDITION IS PRESENT

Turn the ignition on.
Observe the ABS Warning Indicator.

Is the ABS Warning Indicator Flashing?

Yes >> Go To 2

No >> Go To 3

---

2. INCORRECT TIRES PROGRAMMED INTO ANTI-LOCK BRAKE MODULE

Inspect all four tires on the vehicle and note the size of each tire.

NOTE: A non-production size tire cannot be programmed into the CAB. The production Powertrain, with the production size tires, is the only emissions certified configuration that is available for reprogramming.
Turn the ignition on.
With the scan tool, read the tire size that is programmed into the CAB.

Does the displayed tire size match the actual tire size on the vehicle?

Yes >> Replace the Anti-lock Brake Module in accordance with the Service Information. Refer to the symptom *Replacing the Anti-lock Brake Module for additional information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Reprogram the tire size in accordance with the Service Information. Make sure that the ignition is on throughout the reprogramming procedure.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C1078–TIRE REVOLUTIONS RANGE PERFORMANCE (EBC125) (CONTINUED)

3. WIRING HARNESS INSPECTION

Turn the ignition off.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Hotline letters or Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C1079-TONE WHEEL TEETH COUNT RANGE PERFORMANCE (EBC125)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The DTC will set if the stored tone wheel tooth count is out of range.

Possible Causes
TONE RING/AXLE SIZE MISMATCH
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. TONE RING/AXLE SIZE MISMATCH

Turn the ignition on.

With the scan tool, determine the axle size that is programmed into the Anti-lock Brake Module.

Inspect and identify the vehicle axle size.

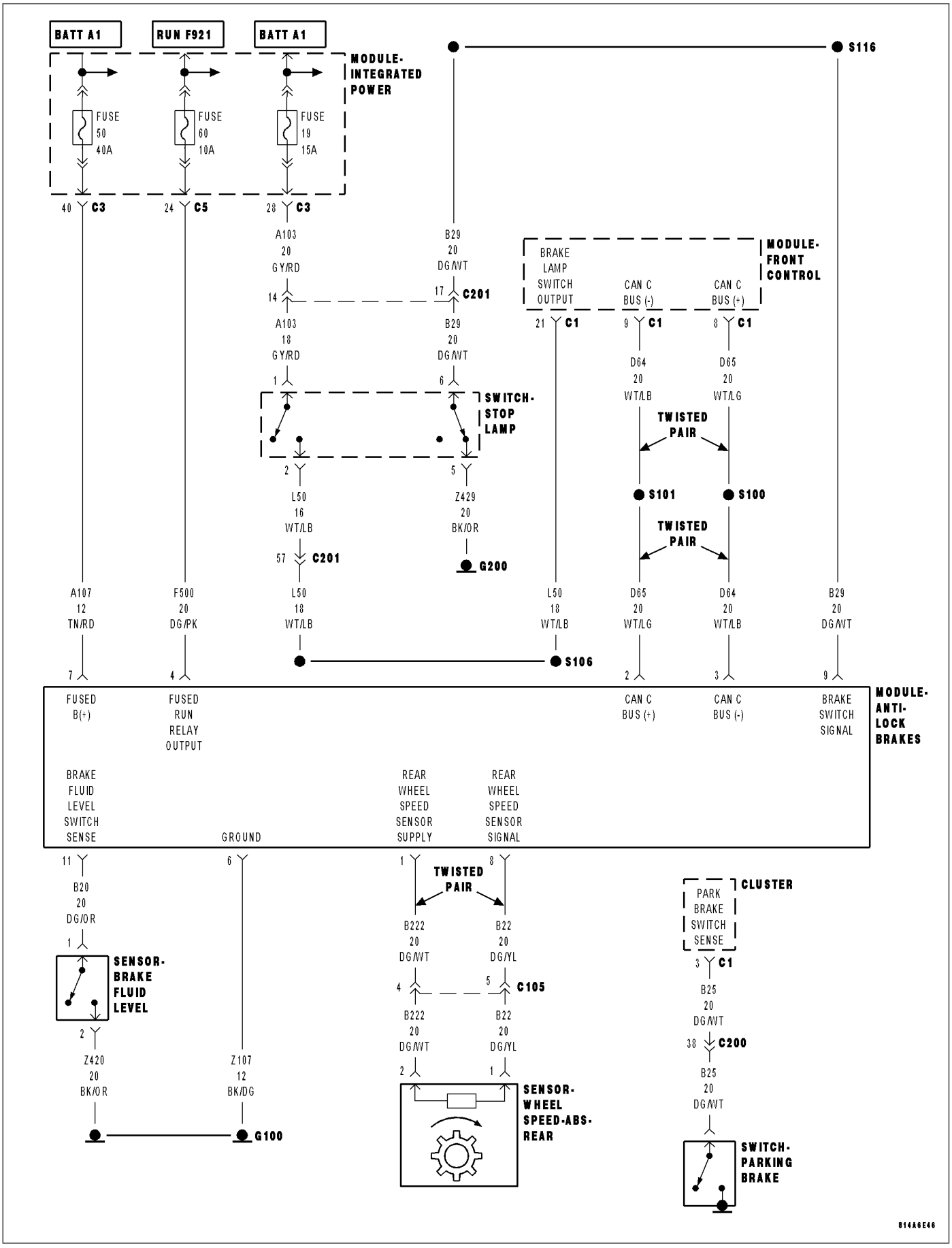
Compare the axle size programmed into the Anti-lock Brake Module, and the actual axle size installed into the vehicle.

Does the programmed axle size match the installed axle?

Yes >> Replace the Anti-lock Brake Module in accordance with the Service Information. Refer to the symptom *Replacing the Anti-lock Brake Module for additional information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Reprogram the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C107C–BRAKE PEDAL SWITCH 1/2 STUCK (EBC125)



C107C–BRAKE PEDAL SWITCH 1/2 STUCK (EBC125) (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With system voltage greater than 9.0 volts (+/- 10%) and vehicle speed present.
- **Set Condition:**
  Continuous brake applied signal starting no later than 2.2 seconds after ignition on and remaining until 10 seconds after sensed vehicle speed reaches 37.5 m.p.h.

Possible Causes
INTERMITTENT BRAKE SWITCH CIRCUIT DTC
(B29) BRAKE SWITCH SIGNAL CIRCUIT SHORT TO VOLTAGE
(B29) BRAKE SWITCH SIGNAL CIRCUIT OPEN
(Z429) GROUND CIRCUIT OPEN
BRAKE LAMP SWITCH
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. VERIFY THE CONDITION

NOTE: Driving with the brake applied may set this code.
Turn the ignition off.

Ensure all accessories are turned off and the battery is fully charged.

Turn the ignition on.

With the scan tool, monitor the status of the brake switch while pressing and releasing the brake pedal several times.

With the scan tool, erase DTCs.

CAUTION: Determine that braking capability is available before road testing the vehicle.
Road test the vehicle for at least 5 minutes over 40 MPH. Perform several anti-lock braking stops.

With the scan tool, read DTCs.

Does the original DTC reset and/or does intermittent brake switch operation occur?

Yes >> Go To 2

No >> The condition necessary to set this DTC is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors relative to this circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C107C–BRAKE PEDAL SWITCH 1/2 STUCK (EBC125) (CONTINUED)

2. BRAKE LAMP SWITCH

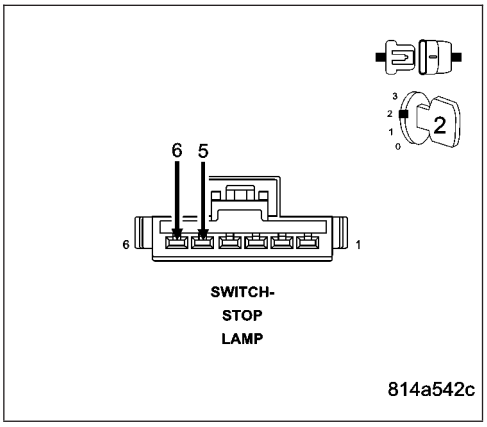
Turn ignition off.

Disconnect the Brake Lamp Switch harness connector.

Turn ignition on.

With the scan tool, monitor the brake switch status.

Connect and disconnect a jumper wire between the (Z429) Ground circuit and the (B29) Brake Switch Signal circuit.



Does the scan tool display correctly with the jumper wire connected and disconnected?

Yes >> Replace the Brake Lamp Switch in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

---

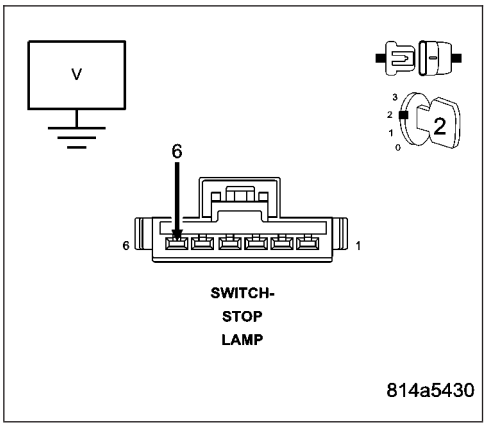
3. (B29) BRAKE SWITCH SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the Anti-lock Brake Module harness connector.

Turn the ignition on.

Measure the voltage of the (B29) Brake Switch Signal circuit.



Is there any voltage present?

Yes >> Repair the (B29) Brake Switch Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

C107C–BRAKE PEDAL SWITCH 1/2 STUCK (EBC125) (CONTINUED)

4. (B29) BRAKE SWITCH SIGNAL CIRCUIT OPEN

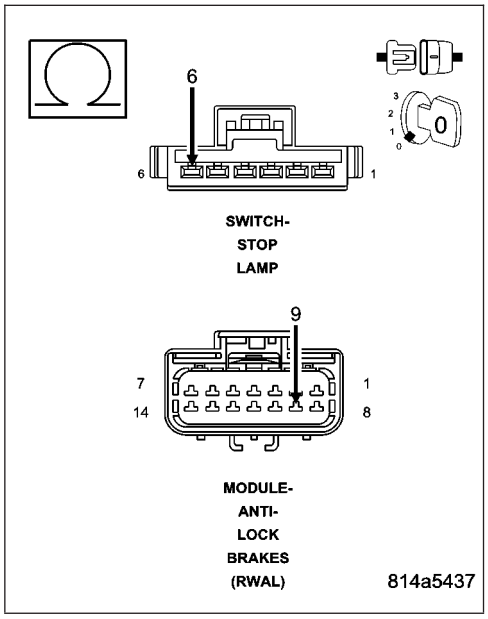
Turn the ignition off.

Measure the resistance of the (B29) Brake Switch Signal circuit between the Anti-lock Brake Module harness connector and the brake switch harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the open (B29) Brake Switch Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5



5. (Z429) GROUND CIRCUIT OPEN

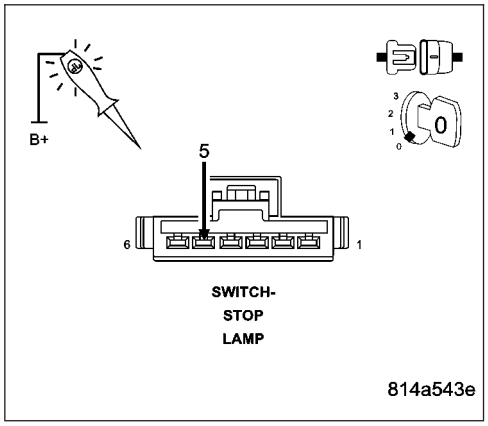
Using a 12–volt test light connected to 12 volts, check the (Z429) Ground circuit at the brake switch harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

Yes >> Replace the Anti-lock Brake Module in accordance with the Service Information. Refer to the symptom *Replacing the Anti-lock Brake Module for additional information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Repair the (Z429) Ground circuit for an open circuit or high resistance.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C1239-EMISSION ROLLS TEST ACTIVE (EBC125)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on.
- **Set Condition:**
  If the Anti-lock Brake Module receives two messages in a row from the FCM indicating that the extended diagnostic session is active. ABS is inhibited during the extended diagnostic session.

Possible Causes
CAN COMMUNICATION DTCS(S) PRESENT
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS PRESENT

NOTE: Ensure the battery is fully charged.
Turn the ignition on.
With the scan tool clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool select View DTCs in the Anti-lock Brake Module.

Is the status Active for this DTC?

Yes >> Go To 2

No >> Go To 3

---

2. ANTI-LOCK BRAKE MODULE

Turn the ignition on.
With the scan tool, select View DTCs in each module on the CAN B BUS and the CAN C BUS.

Are there CAN BUS communication DTCs present in any other module?

Yes >> Perform the appropriate diagnostic procedure before continuing with this test.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C1239-EMISSION ROLLS TEST ACTIVE (EBC125) (CONTINUED)

3. INTERMITTENT COMMUNICATION DTC

The condition necessary to set this DTC is not present at this time.

This DTC will set if the Anti-lock Brake Module receives 2 messages in a row from the FCM indicating that the Emissions Rolls test is active.

With the scan tool, select View DTCs in the PCM and FCM. If there are any communications DTCs present, perform the appropriate diagnostic procedure.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C123B-EXCESSIVE DUMP FAULT (EBC125)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  If more than 16 dump pulses in a row are detected without wheel speed recovery, this DTC will be set to active.

Possible Causes
INTERMITTENT EXCESSIVE DUMP TIME DTC
WHEEL SPEED WIRING HARNESS AND CONNECTORS
SUSPENSION
TONE WHEEL
WHEEL BEARING
BRAKE SYSTEM MECHANICAL CONDITION
ANTI-LOCK BRAKE HYDRAULIC CONTROL UNIT

Diagnostic Test

1. BRAKE SYSTEM MECHANICAL CONDITION

Inspect the front and rear brakes for a mechanical condition that would cause any wheel(s) to lock-up during braking.

Inspect the Parking Brake to make sure it releases properly.

Were any problems found?

Yes >> Repair the braking system as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. TONE WHEEL

Inspect each Tone Wheel for damage, missing teeth or looseness in accordance with the Service Information.

NOTE: The Tone Wheel Teeth should be perfectly square, not bent or nicked.

Were any problems found?

Yes >> Replace the Tone Wheel as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

C123B-EXCESSIVE DUMP FAULT (EBC125) (CONTINUED)

3. WHEEL BEARING

Inspect each wheel bearing for excessive run out or improper clearance in accordance with the Service Information.

Were any problems found?

Yes >> Repair or replace the wheel bearing(s) as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. WHEEL SPEED SENSOR WIRING HARNESS AND CONNECTORS

Start the engine.
With the scan tool, monitor the output of each Wheel Speed Sensor.
Raise and properly support the vehicle.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.
Allow the drive wheels to rotate.
Rotate the non-driven wheels by hand.
Wiggle test the Wheel Speed wiring harnesses and connectors.
Look for any excessive variations in sensed wheel speed.

Were any problems found?

Yes >> Repair the wiring harness or connectors as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. LOADED WHEEL BEARING/SUSPENSION CONCERN

CAUTION: Make sure that the vehicle has braking capability before performing a road test.

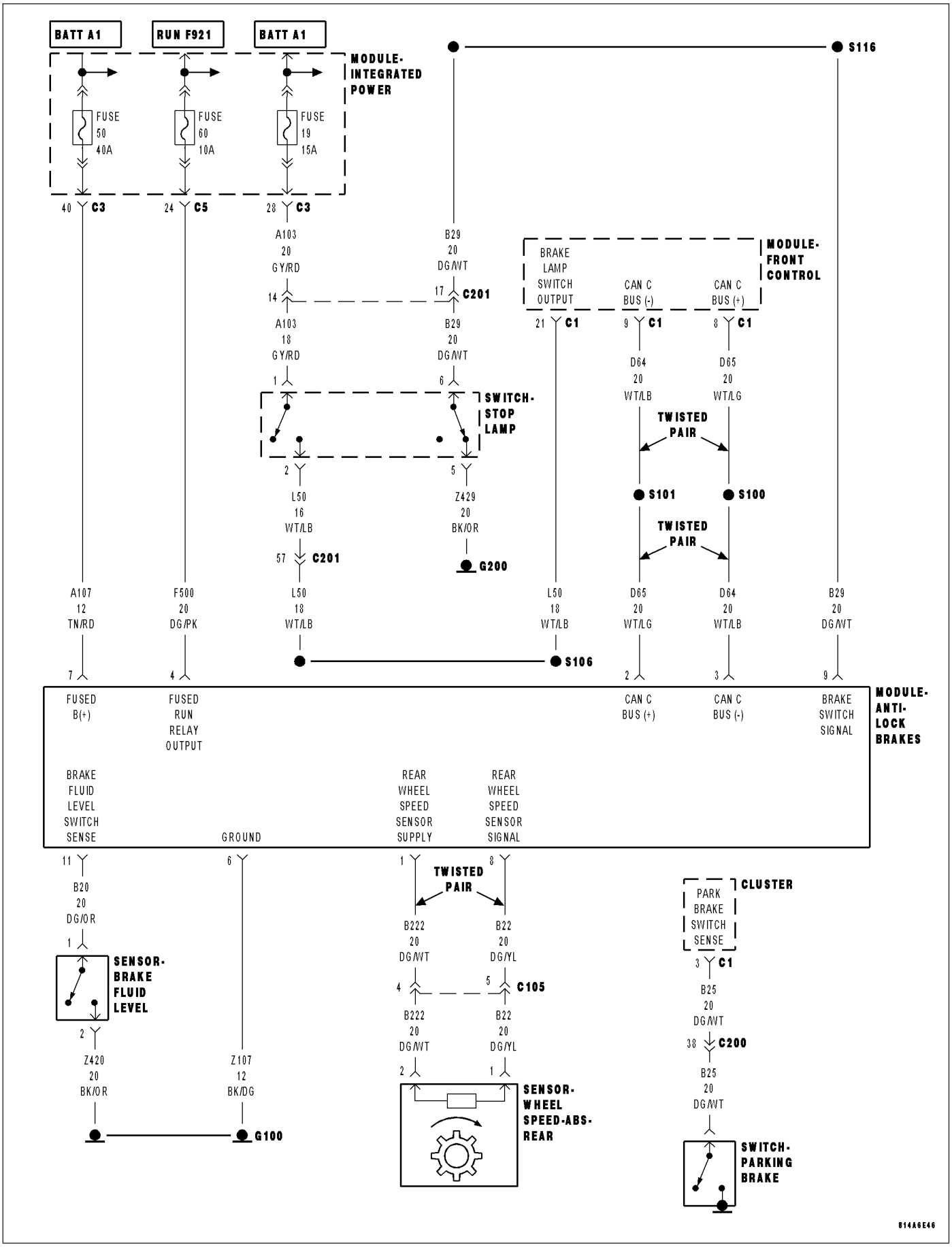
NOTE: Have an assistant drive the vehicle while monitoring the scan tool.
With the scan tool, monitor the output of each Wheel Speed Sensor.
Road test vehicle so wheel bearings and suspension are loaded.
Look for any excessive variations in sensed wheel speed.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Hydraulic Control Unit in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C2100-BATTERY VOLTAGE LOW (EBC125)



C2100-BATTERY VOLTAGE LOW (EBC125) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  If the sensed ignition voltage drops below 9.0 volts (+/- 10%) for 100 msec.

Possible Causes
INTERMITTENT BATTERY VOLTAGE LOW DTC
(F500) FUSED RUN RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
(Z107) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

NOTE: Diagnose and repair any powertrain Charging system DTCs before continuing with this procedure.

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

With the Scan tool, select View DTCs in the Anti-lock Brake Module. Record all DTC information.

Turn the ignition off.

Start the engine.

With the Scan tool read DTCs.

Is the status Active for this DTC?

Yes >> Go To 2

No >> Go To 4

---

2. (F500) FUSED RUN RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

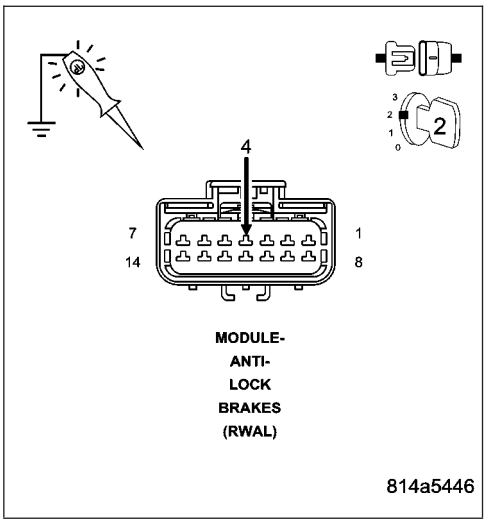
Disconnect the Anti-lock Brake Module harness connector.

Check connectors - Clean/repair as necessary.

Turn the ignition on.

Using a 12–volt test light connected to ground, check the (F500) Fused Run Relay Output circuit.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.



Is the test light illuminated and bright?

Yes >> Go To 3

No >> Repair the (F500) Fused Run Relay Output circuit for an open circuit or high resistance.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C2100-BATTERY VOLTAGE LOW (EBC125) (CONTINUED)

3. (Z107) GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Using a 12–volt test light connected to B+, check the (Z107) Ground circuit.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

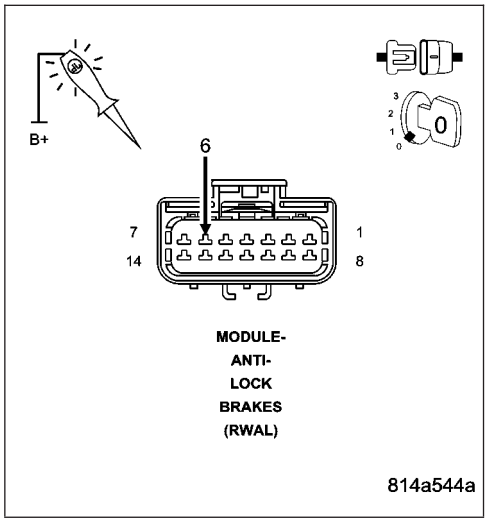
Is the test light illuminated and bright?

Yes >> Replace the Anti-lock Brake Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Repair the (Z107) Ground circuit for an open circuit or high resistance.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



4. INTERMITTENT DTC

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Check connectors - Clean/repair as necessary.

Inspect the vehicle for aftermarket accessories that may exceed the Charging System output.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C2101-BATTERY VOLTAGE HIGH (EBC125)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and no system undervoltage DTC active.
- **Set Condition:**
  If the sensed ignition voltage is greater than 16.5 volts (+/- 10%) for 100 msec.

Possible Causes
INTERMITTENT BATTERY VOLTAGE HIGH DTC
POWERTRAIN CHARGING SYSTEM DTCS PRESENT
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

NOTE: Diagnose and repair any powertrain Charging system DTCs before continuing with this procedure.

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

With the Scan tool, select View DTCs in the Anti-lock Brake Module. Record all DTC information.

Turn the ignition off.

Start the engine.

With the Scan tool read DTCs.

Is the status Active for this DTC?

Yes >> If there are no powertrain charging system DTCs present, replace the Anit-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. INTERMITTENT DTC

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Check connectors - Clean/repair as necessary.

Inspect the vehicle for aftermarket accessories that may exceed the Charging System output.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C2200-ANTI-LOCK BRAKE MODULE INTERNAL (EBC125)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The Anti-lock Brake Module has detected an error after a system self test.

Possible Causes
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. ANTI-LOCK BRAKE MODULE INTERNAL CONDITION

The Anti-lock Brake Module is reporting internal errors.

NOTE: Before continuing, check the Anti-lock Brake Module harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.
Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C2202-ORIGINAL VIN MISMATCH / MISSING (EBC125)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  This DTC will set if the current VIN does not match the broadcast VIN.

Possible Causes
ICOMMUNICATIONS DTC(S) PRESENT
POWERTRAIN CONTROL MODULE
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, erase DTCs.
Turn the ignition off.
Turn the ignition on.
Wait ten seconds.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2

No >> Go To 3

---

2. WRONG VIN PROGRAMMED IN PCM

Turn the ignition on.
With the scan tool, read the VIN in the PCM.
Compare VIN in the PCM to the vehicle VIN.

Is the correct VIN programmed in the PCM?

Yes >> Replace the Antilock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Powertrain Control Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C2202-ORIGINAL VIN MISMATCH / MISSING (EBC125) (CONTINUED)

3. COMMUNICATION DTCS PRESENT

Turn the ignition off.

With the scan tool, read DTCs in all other modules. If any communications DTCs are present, refer to the appropriate diagnostic procedure.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C2206-VEHICLE CONFIGURATION MISMATCH (EBC125)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  This DTC will set if the vehicle type is not identified or incorrectly identified.

Possible Causes
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. ANTI-LOCK BRAKE MODULE

NOTE: Diagnose and repair any Powertrain Control Module VIN or Communication DTCs before continuing with this test.

NOTE: If C2202–Original VIN Mismatch / Missing is set along with this DTC, perform the diagnostic procedure for C2202 before continuing with this test.

Turn the ignition on.

With the scan tool, clear DTCs.

Turn the ignition off.

Turn the ignition on.

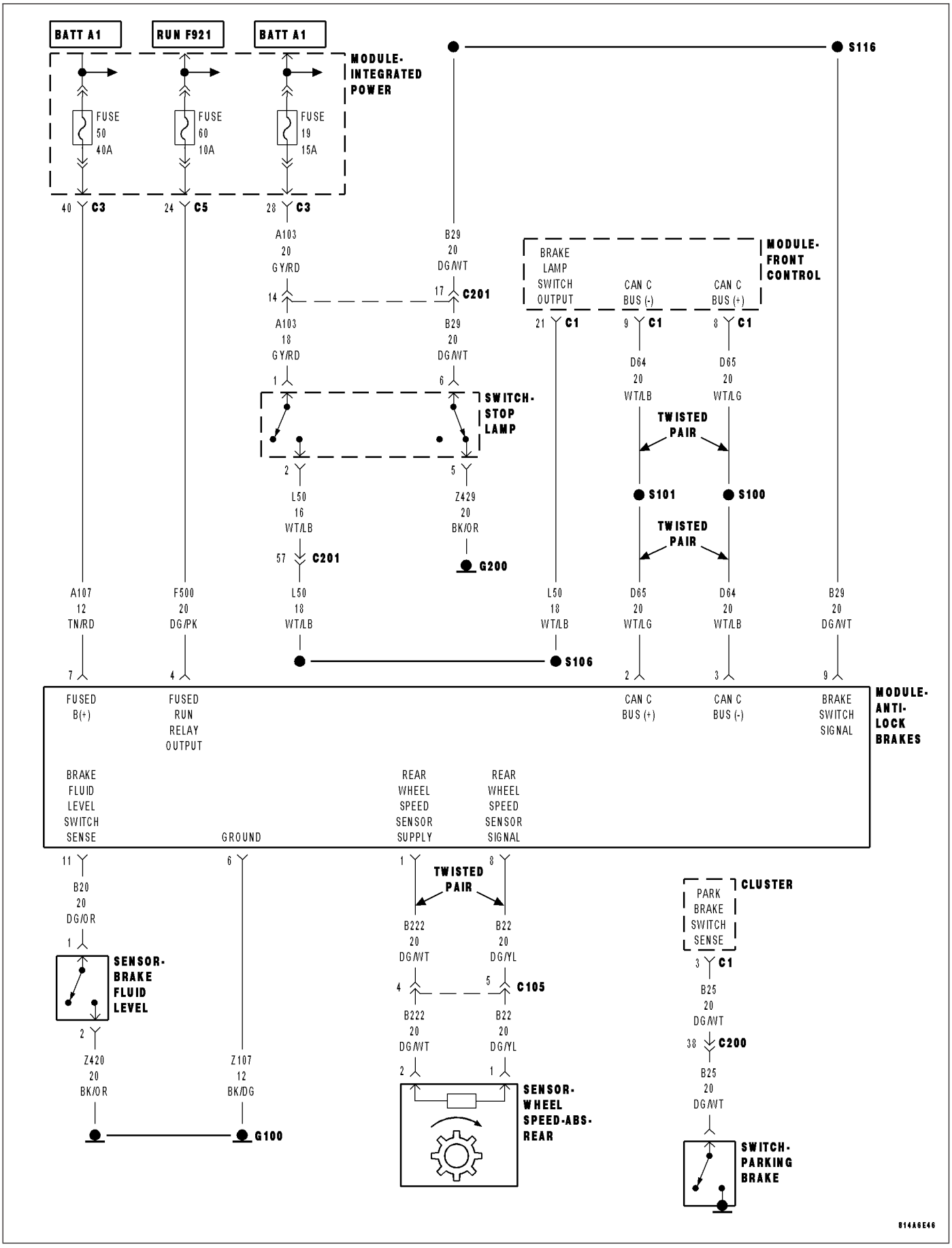
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Replace the Antilock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Use the scan tool to read DTCs in all other modules. If any communication DTCs are present, perform the appropriate diagnostic procedure. Refer to any Technical Service Bulletins that apply. If no problems are found, test is complete.

U0002–CAN C BUS OFF PERFORMANCE (EBC125)



U0002–CAN C BUS OFF PERFORMANCE (EBC125) (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  Whenever the CAN C Bus (+) or CAN C Bus (-) is open, shorted to voltage or shorted to ground.

Possible Causes
INTERMITTENT CAN C BUS OFF PERFORMANCE DTC
CAN C BUS DTCs SET IN FRONT CONTROL MODULE
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.
With the scan tool, clear DTCs in the Anti-lock Brake Module.
Cycle the ignition from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.
With the scan tool, select View DTCs in the Anti-lock Brake Module.

Does the DTC reset and/or remain active?

Yes >> Go to 2

No >> Go to 6

---

2. CAN C BUS DTCs SET IN FRONT CONTROL MODULE

With the scan tool, select View DTCs in the Front Control Module (FCM).

Are there any active CAN C Bus DTCs?

Yes >> Refer to 8 — ELECTRICAL/ELECTRONIC CONTROL MODULES — DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.
Perform the ABS Verification Test — VER 1 (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go to 3

U0002–CAN C BUS OFF PERFORMANCE (EBC125) (CONTINUED)

3. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Anti-lock Brake Module harness connector.

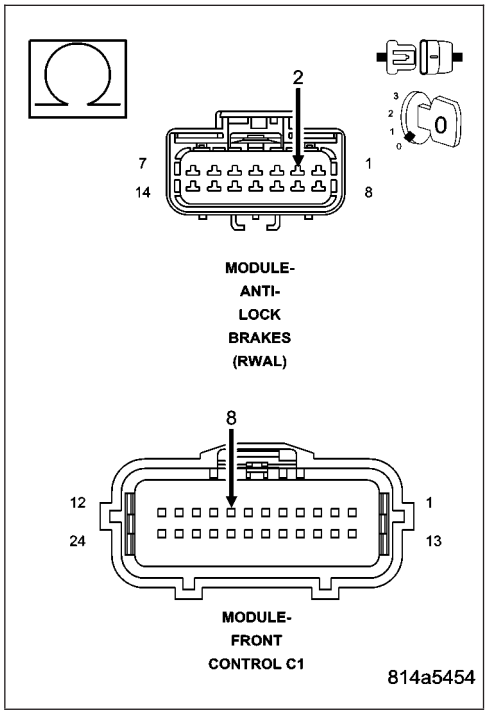
Disconnect the Front Control Module C1 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the Anti-lock Brake Module harness connector and the Front Control Module C1 harness connector.

Is the resistance above 2.0 ohms?

Yes >> Repair the (D65) CAN C Bus (+) circuit for an open.
Perform the ABS Verification Test — VER 1 (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go to 4



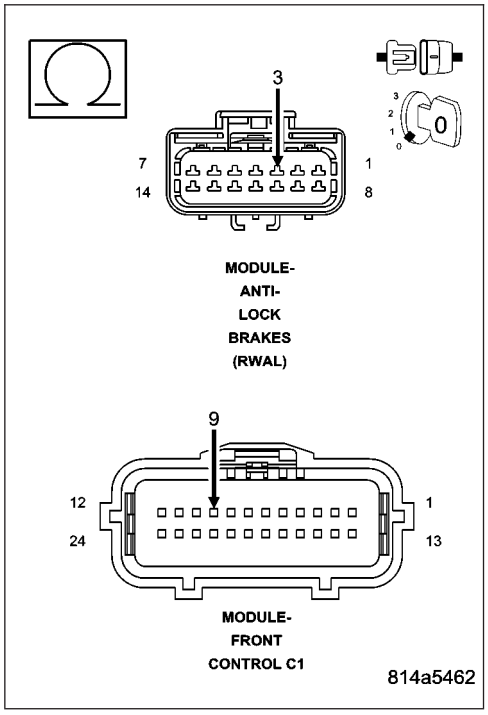
4. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the Anti-lock Brake Module harness connector and the Front Control Module C1 harness connector.

Is the resistance above 2.0 ohms?

Yes >> Repair the (D64) CAN C Bus (-) circuit for an open.
Perform the ABS Verification Test — VER 1 (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go to 5



U0002–CAN C BUS OFF PERFORMANCE (EBC125) (CONTINUED)

5. ANTI-LOCK BRAKE MODULE

Inspect the wiring between the Anti-lock Brake Module harness connector and the Front Control Module harness connector. If any problems are found, repair as necessary. If no problems are found, view repair.

Repair

Replace the Anti-lock Brake Module in accordance with the Service Information.

Perform the ABS Verification Test — VER 1 (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

---

6. INTERMITTENT CAN C BUS OFF PERFORMANCE DTC

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

Yes >> Repair as necessary.

Perform the ABS Verification Test — VER 1 (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test complete.

U0100–LOST COMMUNICATION WITH FRONT CONTROL MODULE (EBC125)

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. LOST COMMUNICATION WITH POWERTRAIN CONTROL MODULE (PCM)

The Anti-lock Brake Module is reporting that network communication has been lost with the Powertrain Control Module (PCM).

View repair.

Repair

Refer to 8 — ELECTRICAL/ELECTRONIC CONTROL MODULES — DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE (EBC125)

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. LOST COMMUNICATION WITH FRONT CONTROL MODULE (FCM)

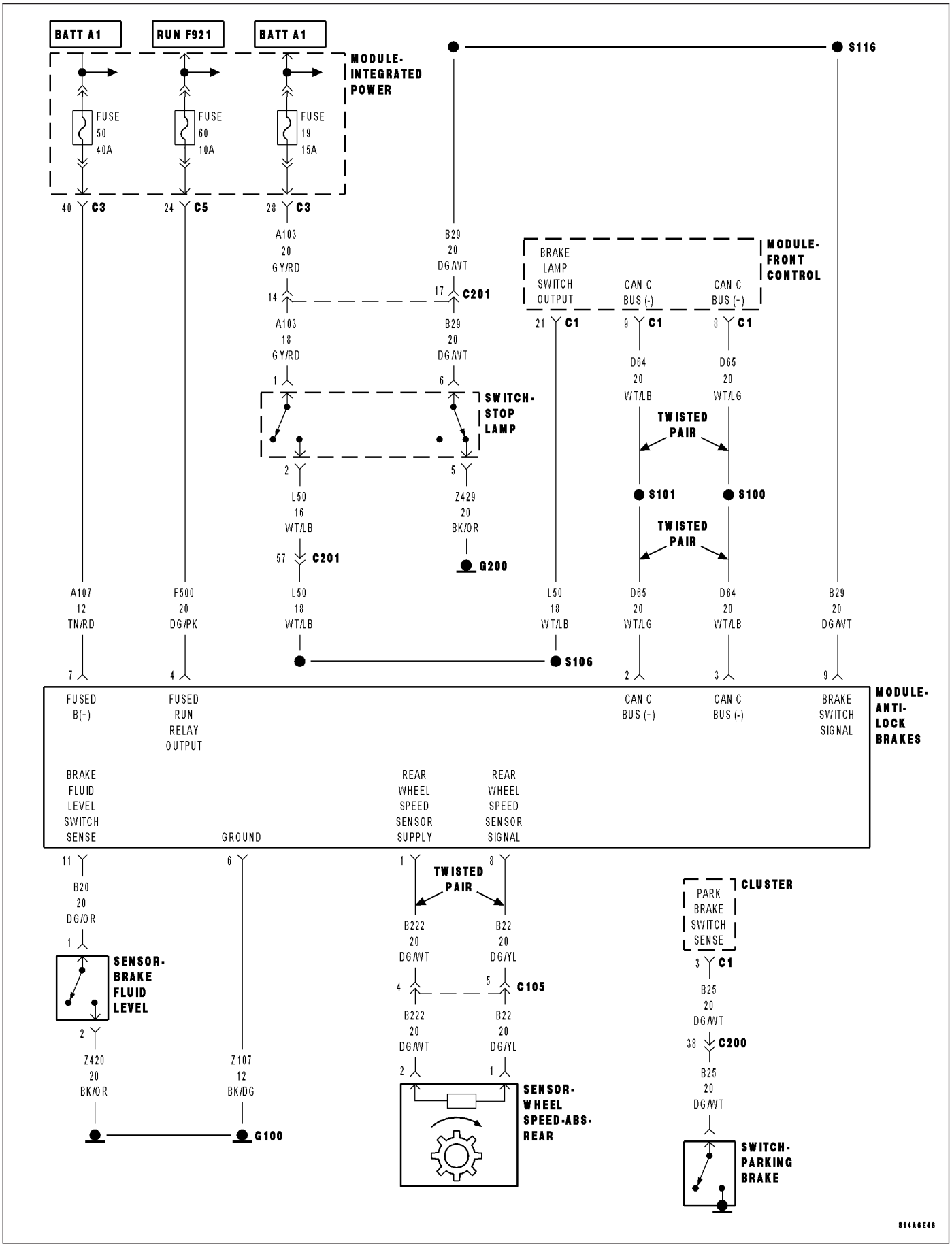
The Anti-lock Brake Module is reporting that network communication has been lost with the Front Control Module (FCM).

View repair.

Repair

Refer to 8 — ELECTRICAL/ELECTRONIC CONTROL MODULES — DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U1003–ESP CAN C BUS PERFORMANCE (EBC125)



U1003–ESP CAN C BUS PERFORMANCE (EBC125) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  One of the CAN messages that is assigned to the basic CAN channel was missed by the CAN driver. This means that the whole system was very slow in responding to the CAN interrupts.

Possible Causes
INTERMITTENT ESP CAN C BUS PERFORMANCE DTC
CAN C BUS DTCs SET IN FRONT CONTROL MODULE
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, clear DTCs in the Anti-lock Brake Module.

Cycle the ignition from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, select View DTCs in the Anti-lock Brake Module.

Does the DTC reset and/or remain active?

Yes >> Go to 2

No >> Go to 6

---

2. CAN C BUS DTCs SET IN FRONT CONTROL MODULE

With the scan tool, select View DTCs in the Front Control Module (FCM).

Are there any active CAN C Bus DTCs?

Yes >> Refer to 8 — ELECTRICAL/ELECTRONIC CONTROL MODULES — DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No >> Go to 3

U1003–ESP CAN C BUS PERFORMANCE (EBC125) (CONTINUED)

3. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Anti-lock Brake Module harness connector.

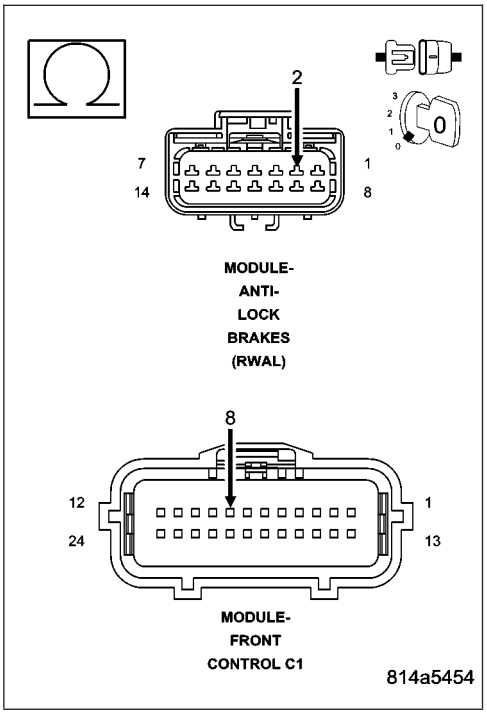
Disconnect the Front Control Module C1 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the Anti-lock Brake Module harness connector and the Front Control Module C1 harness connector.

Is the resistance above 2.0 ohms?

Yes >> Repair the (D65) CAN C Bus (+) circuit for an open.
Perform the ABS Verification Test — VER 1 (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go to 4



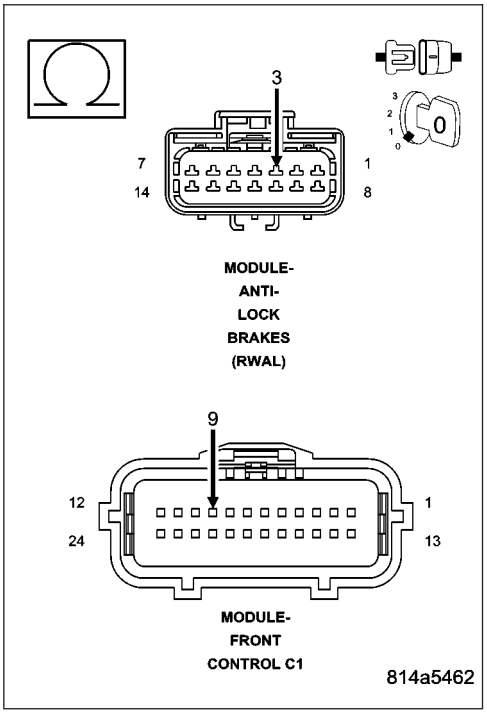
4. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the Anti-lock Brake Module harness connector and the Front Control Module C1 harness connector.

Is the resistance above 2.0 ohms?

Yes >> Repair the (D64) CAN C Bus (-) circuit for an open.
Perform the ABS Verification Test — VER 1 (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go to 5



U1003–ESP CAN C BUS PERFORMANCE (EBC125) (CONTINUED)

5. ANTI-LOCK BRAKE MODULE

Inspect the wiring between the Anti-lock Brake Module harness connector and the Front Control Module harness connector. If any problems are found, repair as necessary. If no problems are found, view repair.

Repair

Replace the Anti-lock Brake Module in accordance with the Service Information.

Perform the ABS Verification Test — VER 1 (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

---

6. INTERMITTENT ESP CAN C BUS PERFORMANCE DTC

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

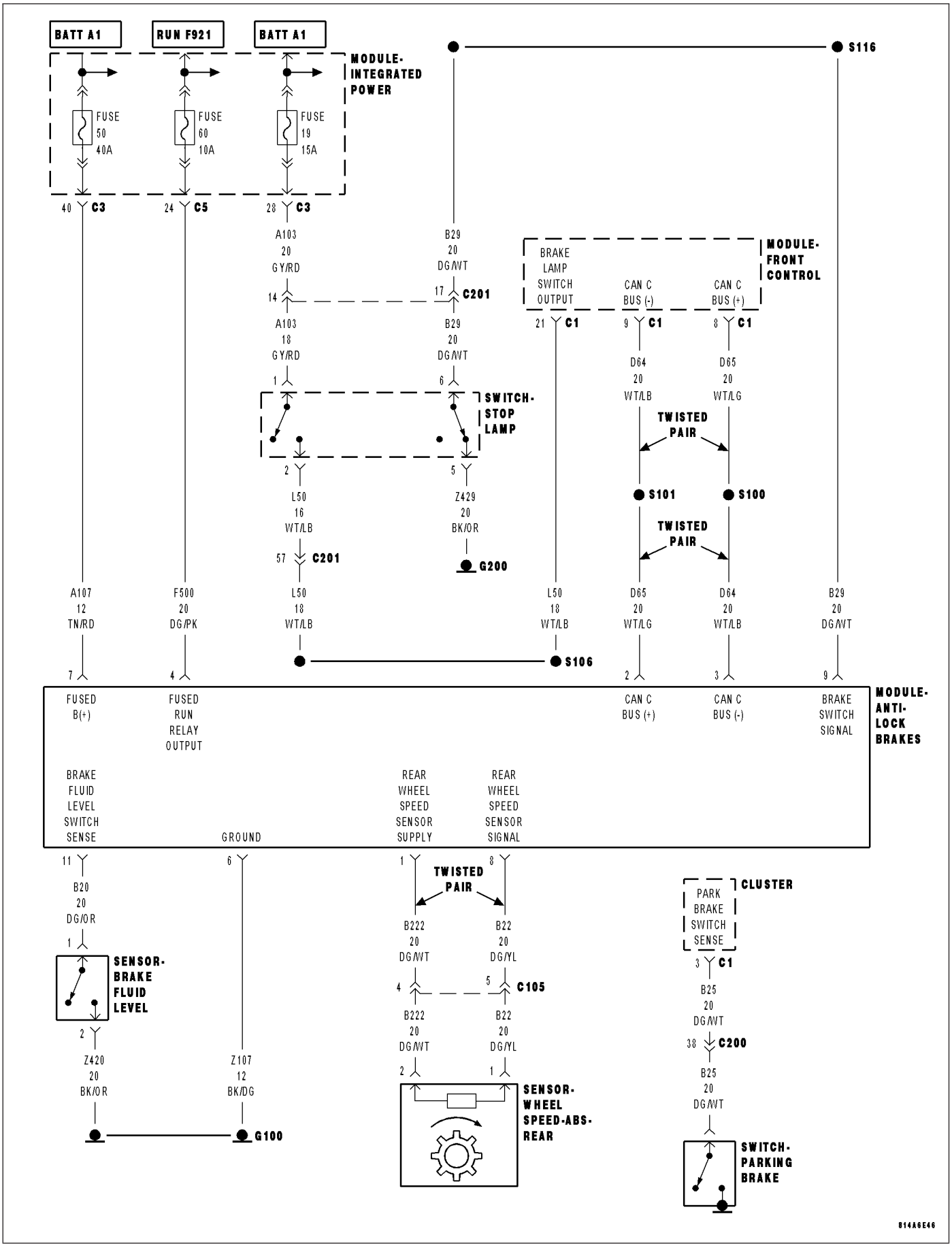
Were any problems found?

Yes >> Repair as necessary.

Perform the ABS Verification Test — VER 1 (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test complete.

U1004–CAN C BUS TRANSMIT PERFORMANCE (EBC125)



U1004–CAN C BUS TRANSMIT PERFORMANCE (EBC125) (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The CAN frame does not receive acknowledgment for a predefined amount of time.

Possible Causes
INTERMITTENT CAN C BUS TRANSMIT PERFORMANCE DTC
CAN C BUS DTCs SET IN FRONT CONTROL MODULE
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.
With the scan tool, select Clear Stored DTCs in the Anti-lock Brake Module.
Cycle the ignition from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.
With the Scan Tool, select View DTCs in the Anti-lock Brake Module.

Does the DTC reset and/or remain active?

Yes >> Go to 2

No >> Go to 6

---

2. CAN C BUS DTCs SET IN FRONT CONTROL MODULE

With the Scan Tool, select View DTCs in the Front Control Module (FCM).

Are there any active CAN C Bus DTCs?

Yes >> Refer to 8 — ELECTRICAL/ELECTRONIC CONTROL MODULES — DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No >> Go to 3

U1004–CAN C BUS TRANSMIT PERFORMANCE (EBC125) (CONTINUED)

3. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Anti-lock Brake Module harness connector.

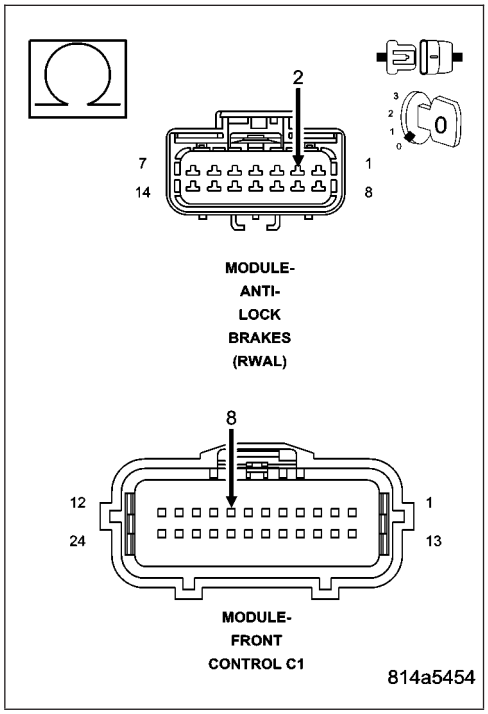
Disconnect the Front Control Module C1 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the Anti-lock Brake Module harness connector and the Front Control Module C1 harness connector.

Is the resistance above 2.0 ohms?

Yes >> Repair the (D65) CAN C Bus (+) circuit for an open.
Perform the ABS Verification Test — VER 1 (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go to 4



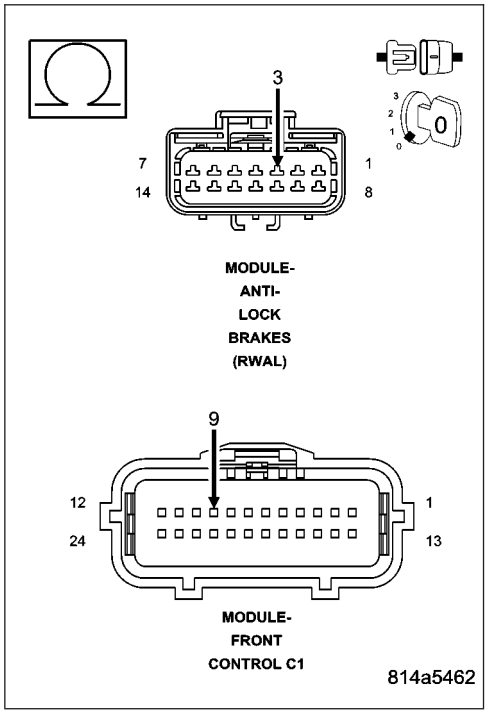
4. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the Anti-lock Brake Module harness connector and the Front Control Module C1 harness connector.

Is the resistance above 2.0 ohms?

Yes >> Repair the (D64) CAN C Bus (-) circuit for an open.
Perform the ABS Verification Test — VER 1 (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go to 5



U1004–CAN C BUS TRANSMIT PERFORMANCE (EBC125) (CONTINUED)

5. ANTI-LOCK BRAKE MODULE

Inspect the wiring between the Anti-lock Brake Module harness connector and the Front Control Module harness connector. If any problems are found, repair as necessary. If no problems are found, view repair.

Repair

Replace the Anti-lock Brake Module in accordance with the Service Information.

Perform the ABS Verification Test — VER 1 (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

---

6. INTERMITTENT CAN C BUS TRANSMIT PERFORMANCE DTC

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

Yes >> Repair as necessary.

Perform the ABS Verification Test — VER 1 (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test complete.

---

*ABS WARNING INDICATOR (EBC125)

Possible Causes
ANTI-LOCK BRAKE SYSTEM DTC PRESENT
INSTRUMENT CLUSTER

Diagnostic Test

1. INSTRUMENT CLUSTER ABS INDICATOR

Turn the ignition off.

Observe the ABS indicator lamp.

Turn the ignition on.

Select the appropriate condition for the ABS indicator lamp:

Illuminates for several seconds and turns off

Go To 2

Illuminates continuously

With the scan tool, read DTCs. Perform the appropriate diagnostic procedure.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

Does not illuminate

Replace the Instrument Cluster in accordance with the Service Information.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

---

2. ANTI-LOCK BRAKE SYSTEM DTC PRESENT

Turn the ignition on.

With the scan tool, select View DTCs in the Anti-lock Brake Module.

Are there any DTCs present?

Yes >> Refer to the appropriate diagnostic procedure.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Inspect the related wiring harness and connector terminals. Monitor the scan tool parameters while wiggle testing the related harness and connectors. Refer to any Technical Service Bulletins (TSB) that may apply. If no problems are found, test is complete.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

---

*REPLACING THE ANTILOCK BRAKE MODULE (EBC125)

Possible Causes
REPLACING THE ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. REPLACING THE ANTILOCK BRAKE MODULE

NOTE: Note: It may be necessary to call STAR to order a new ABS module.

NOTE: Note: Failure to properly program the ABS module will result in an illuminated or blinking ABS indicator.

Turn the ignition off.

Replace the Anti-lock Brake Module in accordance with the Service Information.

With the scan tool, perform the module configuration procedures as necessary in accordance with the Service Information.

Road test the vehicle above 40 m.p.h. for at least two minutes.

With the scan tool, select View DTCs in the Anti-Lock Brake Module.

Are there any DTCs present?

Yes >> Perform the appropriate diagnostic procedure(s).

No >> Test Complete
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

*VEHICLE SPEED SIGNAL OUTPUT (EBC125)

Possible Causes
INTERMITTENT VEHICLE SPEED SIGNAL
VEHICLE SPEED SIGNAL DTC SET IN POWERTRAIN CONTROL MODULE
ANTI-LOCK BRAKE MODULE DTCS PRESENT

Diagnostic Test

1. VEHICLE SPEED SIGNAL DTC SET IN PCM

Turn the ignition on.

With the scan tool, select view DTCs in the Powertrain Control Module.

Is the status Active for P0500?

Yes >> Refer to the Driveability section and perform the appropriate diagnostic procedure.

No >> Go To 2

---

2. ANTI-LOCK BRAKE MODULE DTCS PRESENT

With the scan tool, select view DTCs in the Anti-Lock Brake Module.

Are there any DTCs present in the Anti-lock Brake Module?

Yes >> Refer to the ABS section and perform the appropriate diagnostic procedure.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

---

3. INTERMITTENT VEHICLE SPEED SIGNAL

At this time, no DTCs are present.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Using the schematics as a guide, wiggle test the related circuit(s) while monitoring the scan tool data relative to the vehicle speed sensor circuit(s). Look for the data to change or for a DTC to set.

Refer to any technical service bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

ABS ELECTRICAL DIAGNOSTICS (340)

DIAGNOSIS AND TESTING

*ABS VERIFICATION TEST — VER 1 (340)

Diagnostic Test

1. *ABS VERIFICATION TEST — VER 1

Turn the ignition off.
Connect all previously disconnected components and connectors.
Make sure all accessories are turned off and the battery is fully charged.
With the scan tool, clear DTCs in all modules.
Cycle the ignition off for 10 seconds, then on.
With the scan tool, select View DTCs in the ABS module.
If any DTCs have reset, perform the appropriate diagnostic procedure before continuing with this test.
If there are no DTCs present, road test the vehicle above 40 m.p.h. for at least two minutes.

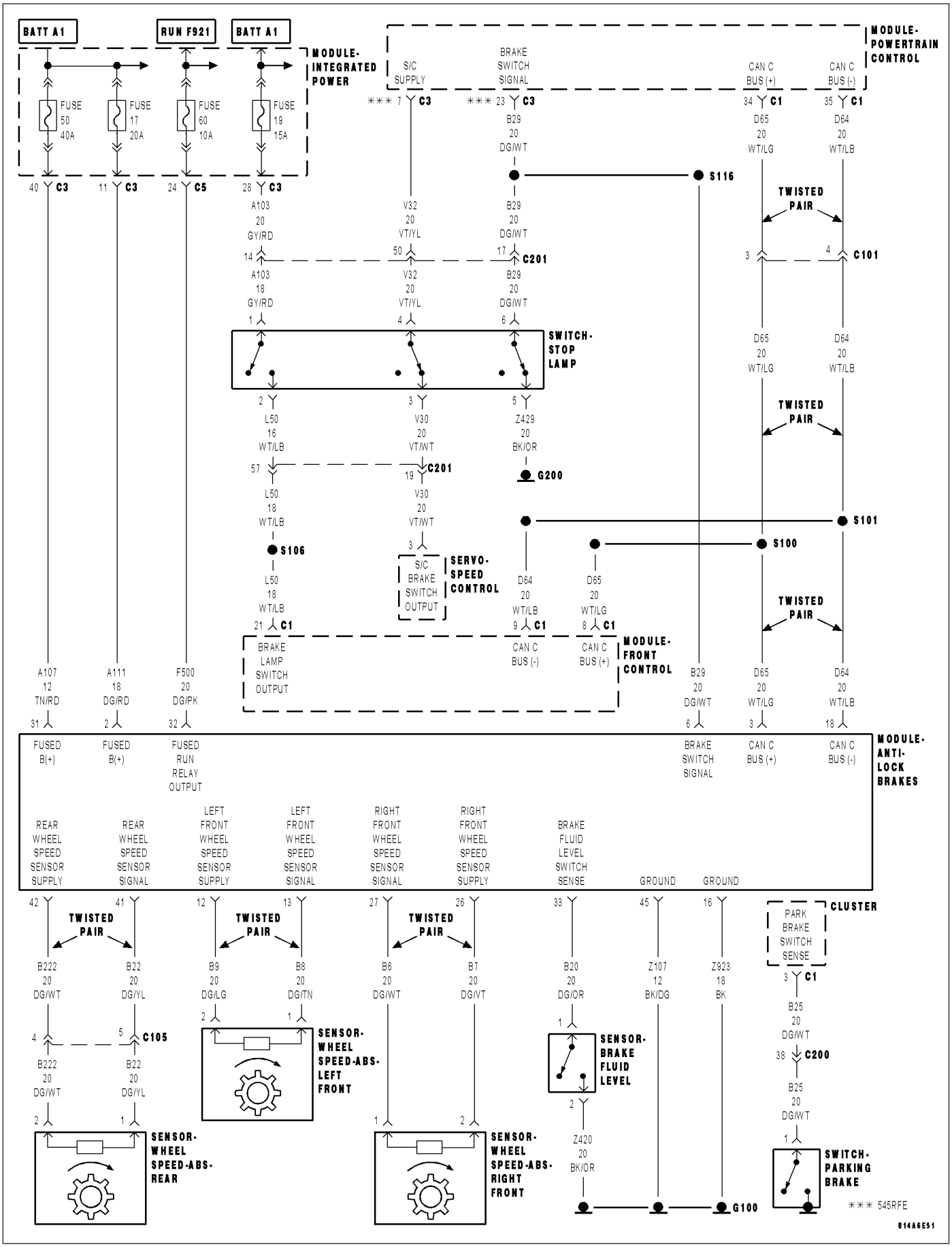
CAUTION: Make sure braking capability is available before road testing the vehicle. During the test drive, perform several anti-lock braking stops.
With the scan tool, select View DTCs in the Anti-Lock Brake Module.

Are there any DTCs present?

Yes >> Perform the appropriate diagnostic procedure(s).

No >> Test Complete

C1008–BRAKE FLUID LEVEL INPUT CIRCUIT HIGH (340)



C1008–BRAKE FLUID LEVEL INPUT CIRCUIT HIGH (340) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no system under voltage condition present.
- **Set Condition:**
  If the Brake Fluid Level Input is 80% of ignition voltage for more than 500 msec, the DTC will set.

Possible Causes
INTERMITTENT BRAKE FLUID LEVEL INPUT CIRCUIT HIGH DTC
(Z420) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
(B20) BRAKE FLUID LEVEL SWITCH SENSE CIRCUIT OPEN OR HIGH RESISTANCE
BRAKE FLUID LEVEL SWITCH
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2

No >> Go To 6

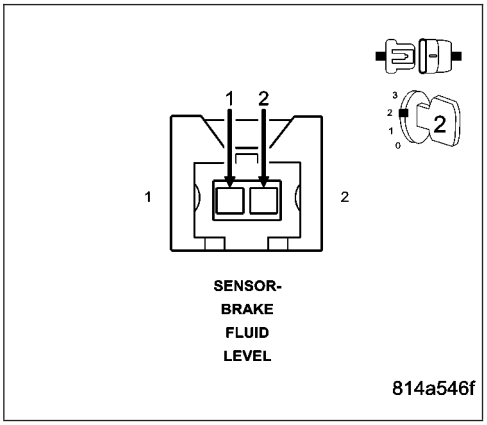
---

2. BRAKE FLUID LEVEL SWITCH

Turn the ignition off.
Disconnect the Brake Fluid Level Switch harness connector.

NOTE: Check connector - Clean/repair as necessary.
Turn the ignition on.
With the scan tool, monitor the Brake Fluid Level Switch state.
Connect a jumper wire between the (B20) Brake Fluid Level Switch Sense circuit and the (Z420) Ground circuit at the Brake Fluid Level Switch harness connector.

NOTE: The Brake Fluid Level Switch state on the scan tool should read Open with the harness disconnected and Closed with the jumper wire in place.



Does the Brake Fluid Level Switch state display on the scan tool as described?

Yes >> Replace the Brake Fluid Level Switch in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

C1008–BRAKE FLUID LEVEL INPUT CIRCUIT HIGH (340) (CONTINUED)

3. (Z420) GROUND CIRCUIT OPEN OR HIGH RESISTANCE

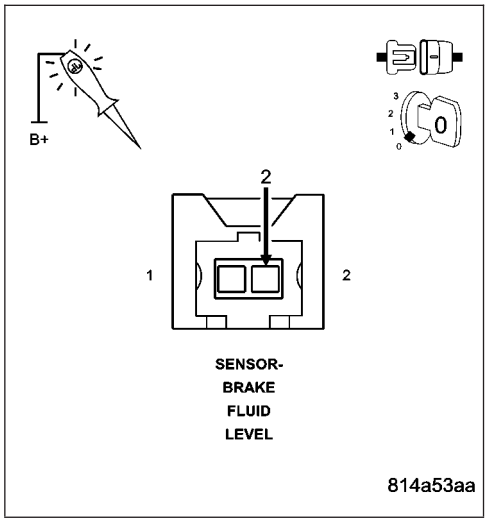
Using a 12–volt test light connected to 12 volts, check the (Z420) Ground circuit at the Brake Fluid Level Switch harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

Yes >> Go To 4

No >> Repair the (Z420) Ground circuit for an open circuit or high resistance.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



4. (B20) BRAKE FLUID LEVEL SWITCH SENSE CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Anti-lock Brake Module harness connector.

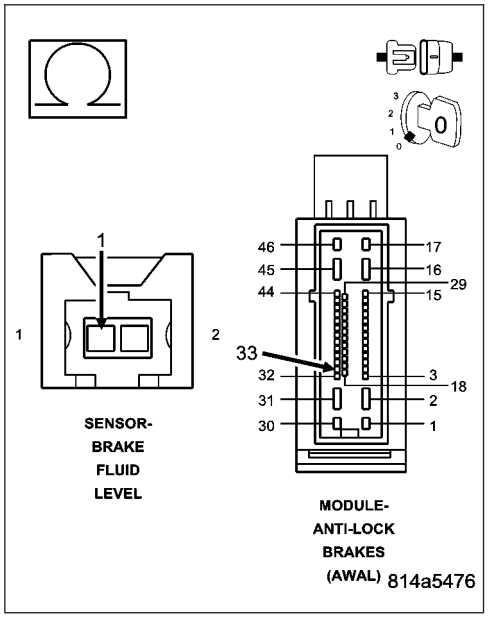
NOTE: Check connector - Clean/repair as necessary.

Measure the resistance of the (B20) Brake Fluid Level Switch Sense circuit.

Is the resistance above 5.0 ohms?

Yes >> Repair the (B20) Brake Fluid Level Switch Sense circuit for an open circuit or high resistance.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5



C1008–BRAKE FLUID LEVEL INPUT CIRCUIT HIGH (340) (CONTINUED)

5. ANTI-LOCK BRAKE MODULE

Turn the ignition off.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> If no other problems are found, replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

---

6. WIRING HARNESS INSPECTION

Turn the ignition off.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

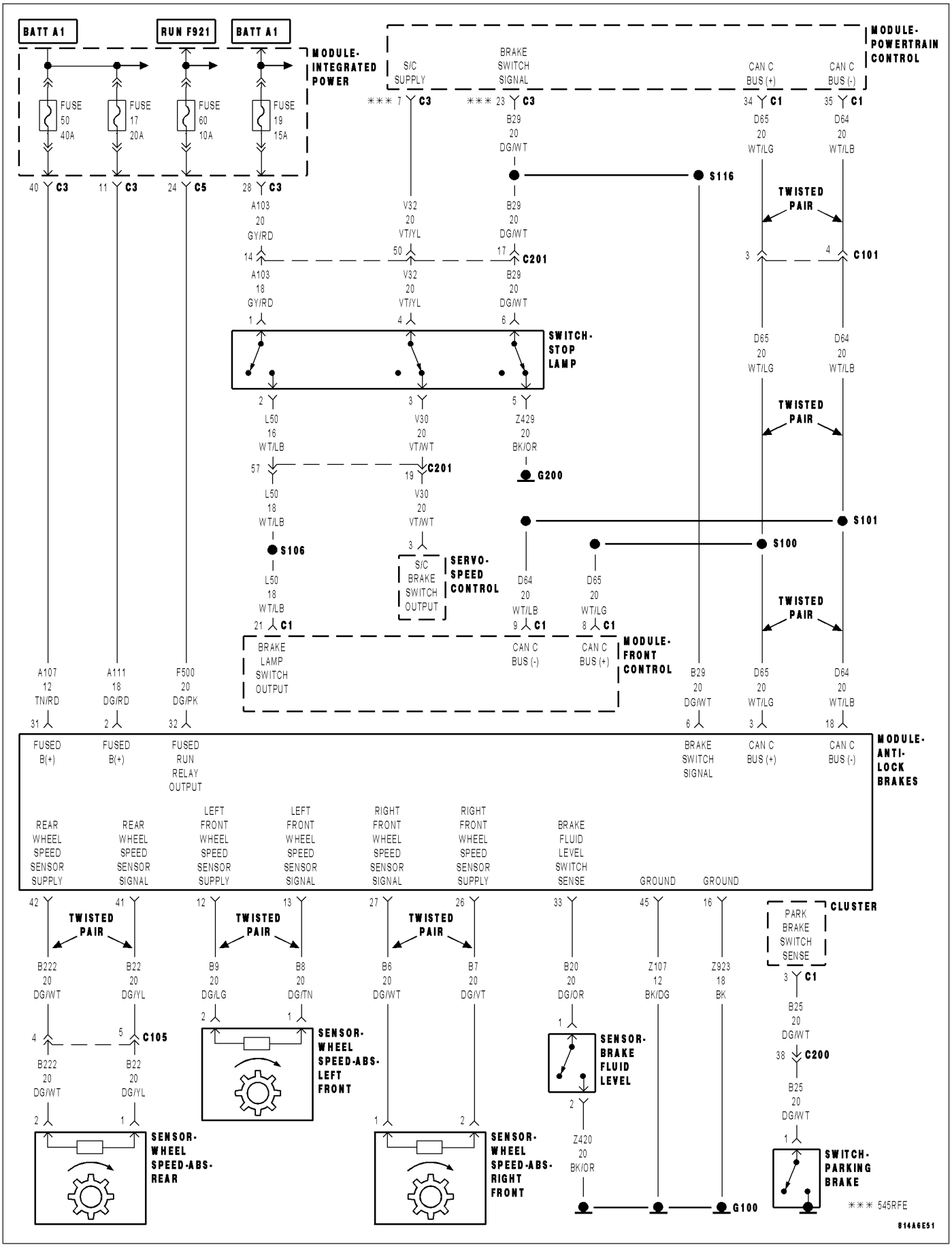
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C1009–BRAKE FLUID LEVEL LOW (340)



C1009–BRAKE FLUID LEVEL LOW (340) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no system under voltage DTC present.
- **Set Condition:**
  This DTC will set if the brake fluid level switch indicates low brake fluid for 1 second.

Possible Causes
INTERMITTENT BRAKE FLUID LEVEL LOW DTC
BRAKE FLUID LEVEL LOW
(B20) BRAKE FLUID LEVEL SWITCH SENSE CIRCUIT SHORT TO GROUND
(Z420) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
BRAKE FLUID LEVEL SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC CONDITION IS PRESENT

Release the Parking Brake.
Turn the ignition off.
Turn the ignition on.
Monitor the Instrument Cluster.

Does the red Brake Warning Indicator stay on?

Yes >> Go To 2
No >> Go To 6

---

2. BRAKE FLUID LEVEL LOW

Turn the ignition off.
Inspect the Brake Fluid Level in accordance with the Service Information.

Is the Brake Fluid Level Low?

Yes >> Inspect the system and repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

C1009–BRAKE FLUID LEVEL LOW (340) (CONTINUED)

3. (B20) BRAKE FLUID LEVEL SWITCH SENSE CIRCUIT SHORT TO GROUND

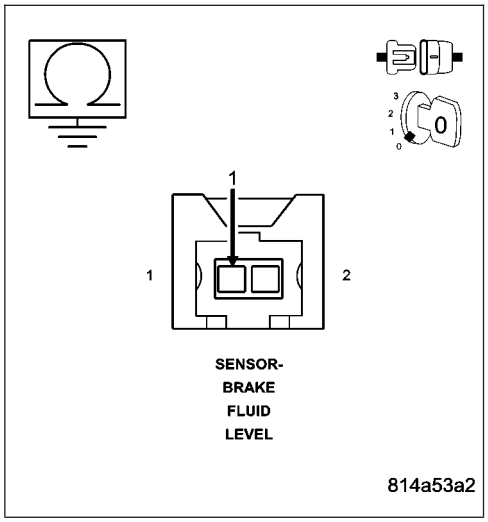
Turn the ignition off.

Disconnect the Brake Fluid Level Sensor harness connector.

Disconnect the Anti-lock Brake Module harness connector.

NOTE: Check connector - Clean/repair as necessary.

Measure the resistance between ground and the (B20) Brake Fluid Level Switch Sense circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (B20) Brake Fluid Level Switch Sense circuit for a short to ground.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

4. BRAKE FLUID LEVEL SENSOR

NOTE: Determine if the Brake Fluid Level Sensor is stuck in the down position. Repair as necessary.

Measure the resistance of the Brake Fluid Level Sensor at the sensor terminals.

NOTE: Resistance should be approximately 10,000 ohms with the reservoir full.

Is the resistance between 9,500 and 10,500 ohms?

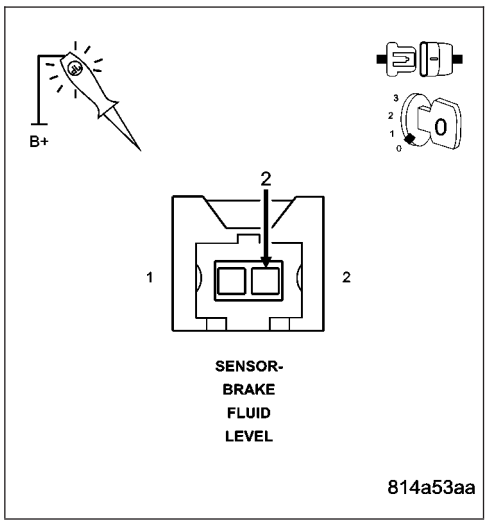
Yes >> Go To 5

No >> Replace the Brake Fluid Level Switch in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

5. (Z420) GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Using a 12–volt test light connected to 12 volts, check the (Z420) Ground circuit.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.



Is the test light illuminated and bright?

Yes >> Replace the Anti-lock Brake Module in accordance with the Service Information. Refer to the symptom *Replacing the Anti-lock Brake Module for additional information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Repair the (B20) Brake Fluid Level Switch ground circuit for an open circuit or high resistance.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C1009–BRAKE FLUID LEVEL LOW (340) (CONTINUED)

6. WIRING HARNESS INSPECTION

Turn the ignition off.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

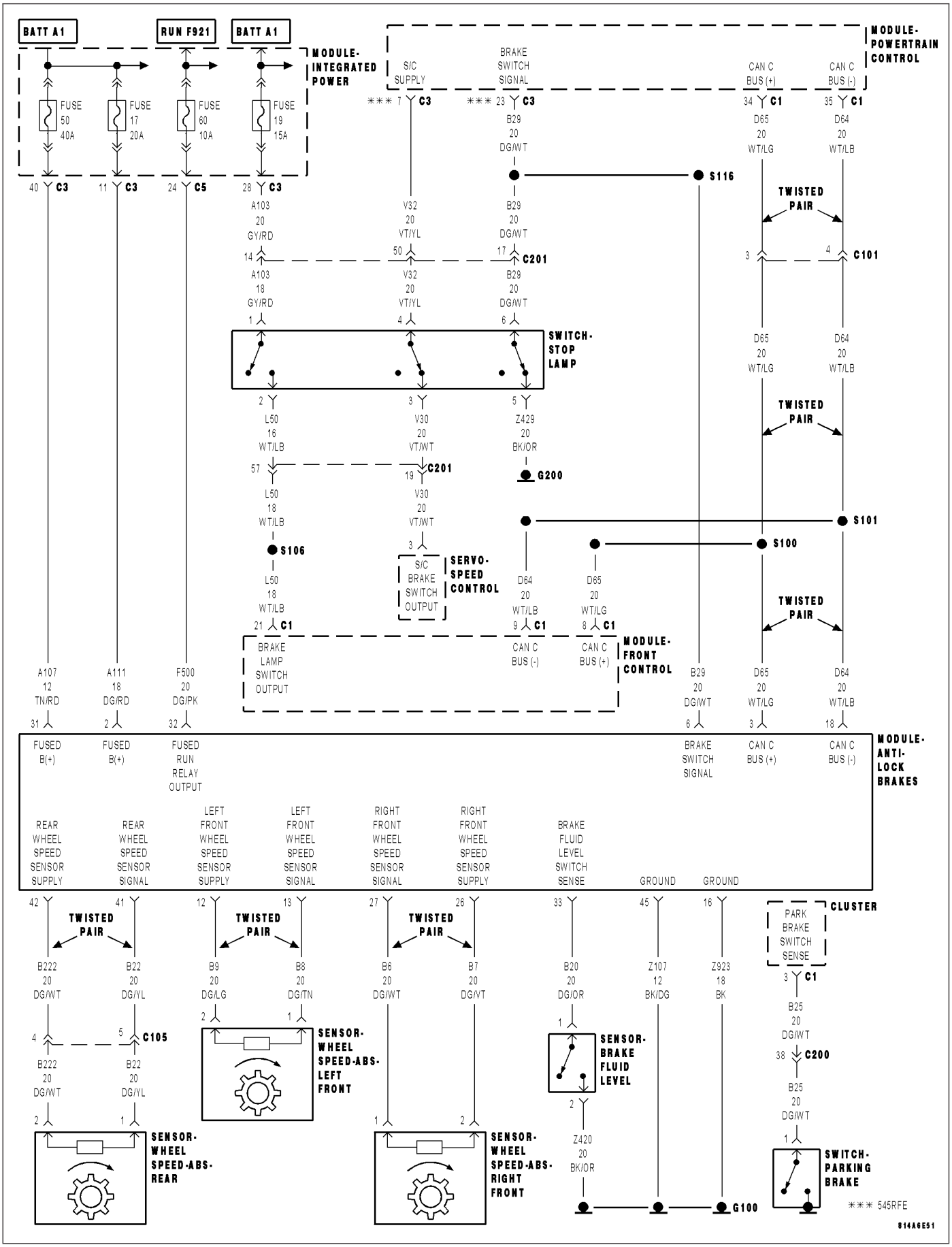
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C100A-LEFT FRONT WHEEL SPEED SENSOR CIRCUIT (340)



C100A-LEFT FRONT WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no system under voltage or over voltage condition present.
- **Set Condition:**
  If the measured wheel speed sensor feedback voltage is less than .304 volts, the sensor is considered open. If the measured wheel speed sensor feedback voltage is greater than 1.39 volts, or if a sensor over current condition is detected, the sensor is considered shorted.
  If a shorted or open condition is present for more than 100 msec, the DTC will set.

Possible Causes
INTERMITTENT LEFT FRONT WHEEL SPEED SENSOR DTC
(B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORT TO GROUND
(B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN
(B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN
(B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
(B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT
TONE WHEEL
EXCESSIVE LEFT FRONT WHEEL SPEED SENSOR AIR GAP
WHEEL BEARING
LEFT FRONT WHEEL SPEED SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2
No >> Go To 15

C100A-LEFT FRONT WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

2. WHEEL SPEED SENSOR INSPECTION

Turn the ignition off.

Inspect the Wheel Speed Sensor for proper mounting.

Inspect the Wheel Speed Sensor harness and connector.

Inspect the Wheel Speed Sensor for excessive debris on the sensor.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

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3. TONE WHEEL DAMAGED/MISSING

Inspect the Tone Wheel in accordance with the Service Information.

NOTE: The Tone Wheel Teeth should be perfectly square, not bent or nicked.

Were any problems found?

Yes >> Replace the Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. EXCESSIVE WHEEL SPEED SENSOR AIR GAP

Measure the Wheel Speed Sensor Air Gap in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. WHEEL BEARING LOOSE/BINDING

Inspect the wheel bearings for excessive run out or improper clearance in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 6

C100A-LEFT FRONT WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

6. (B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Left Front Wheel Speed Sensor harness connector.

Disconnect the Anti-lock Brake Module harness connector.

NOTE: Check connector - Clean/repair as necessary.

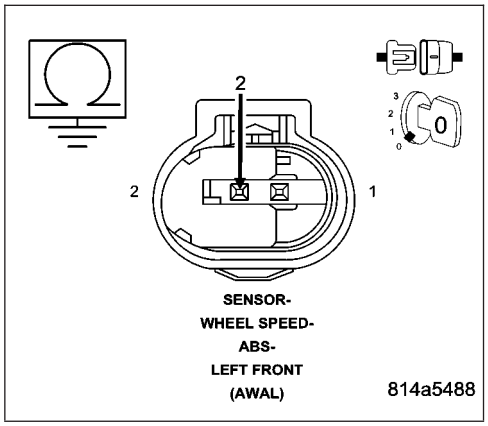
Measure the resistance between the (B9) Left Front Wheel Speed Sensor Supply circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 7

No >> Repair the (B9) Left Front Wheel Speed Sensor Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



7. (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

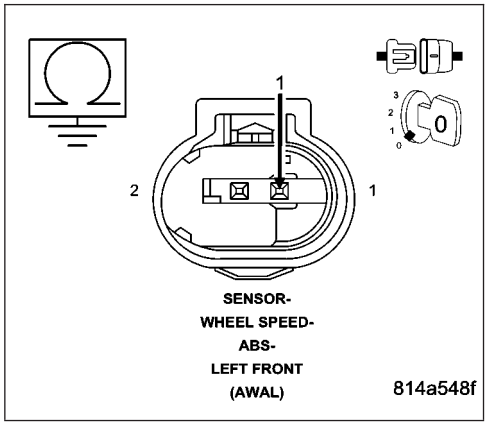
Measure the resistance between the (B8) Left Front Wheel Speed Sensor Signal circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 8

No >> Repair the (B8) Left Front Wheel Speed Sensor Signal circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C100A-LEFT FRONT WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

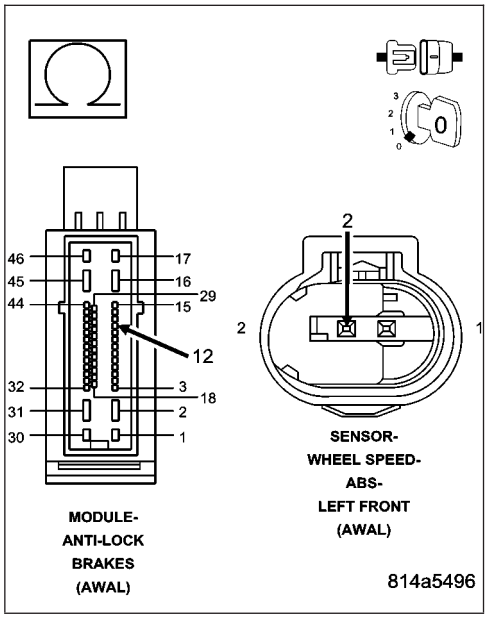
8. (B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN

Measure the resistance of the (B9) Left Front Wheel Speed Sensor Supply circuit.

Is the resistance below 5 ohms?

Yes >> Go To 9

No >> Repair the open (B9) Left Front Wheel Speed Sensor Supply circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



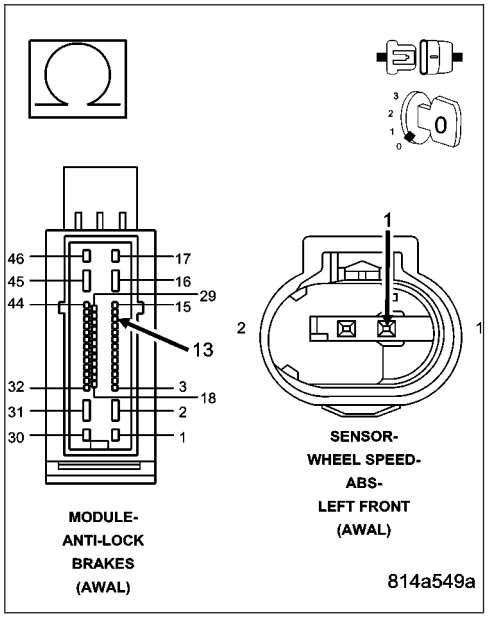
9. (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the (B8) Left Front Wheel Speed Sensor Signal circuit.

Is the resistance below 5 ohms?

Yes >> Go To 10

No >> Repair the open (B8) Left Front Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C100A-LEFT FRONT WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

10. (B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE

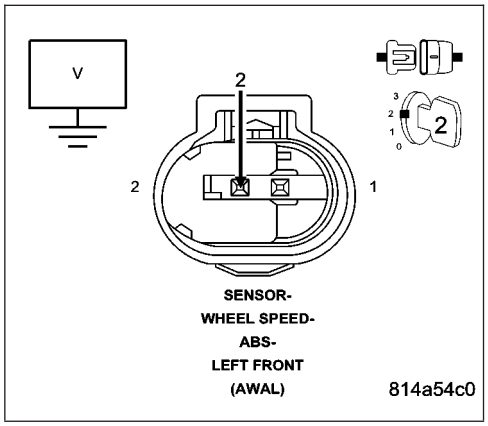
Turn the ignition on.

Measure the voltage of the (B9) Left Front Wheel Speed Sensor Supply circuit.

Is there any voltage present?

Yes >> Repair (B9) Left Front Wheel Speed Sensor Supply circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 11



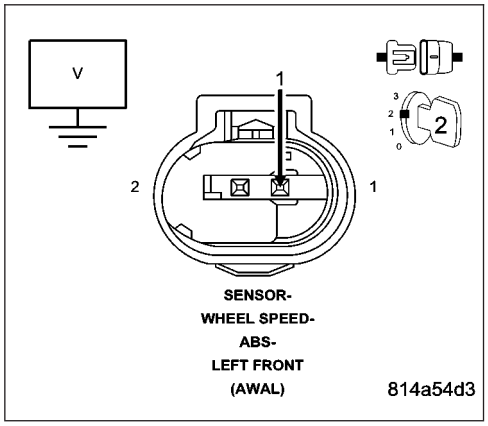
11. (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (B8) Left Front Wheel Speed Sensor Signal circuit.

Is there any voltage present?

Yes >> Repair the (B8) Left Front Wheel Speed Sensor Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 12



12. (B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT

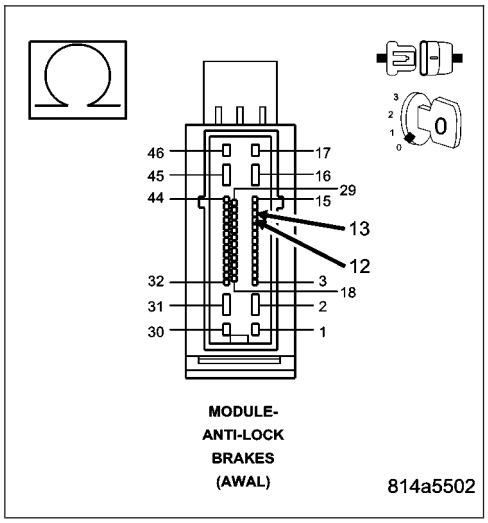
Turn the ignition off.

Measure the resistance between the (B9) Left Front Wheel Speed Sensor Supply circuit and the (B8) Left Front Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair (B9) Left Front Wheel Speed Sensor Supply circuit for a short to the (B8) Left Front Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 13



C100A-LEFT FRONT WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

13. LEFT FRONT WHEEL SPEED SENSOR

Turn the ignition off.

Connect the Left Front Wheel Speed Sensor harness connector.

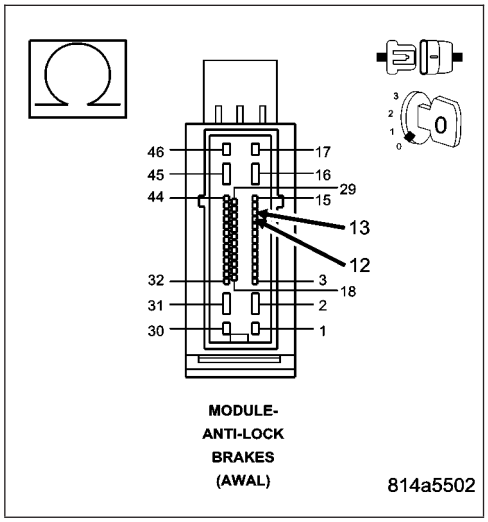
Measure the resistance between the (B9) Left Front Wheel Speed Sensor Supply circuit and (B8) Left Front Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

NOTE: The resistance should be approximately 1600–2300 ohms at 76 degrees F.

Is the resistance within the noted range?

Yes >> Go to 14

No >> Replace the Left Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



14. ANTI-LOCK BRAKE MODULE

Turn the ignition off.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

15. WIRING HARNESS INSPECTION

Turn the ignition off.

NOTE: Towing the vehicle with ignition ON may set this DTC.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

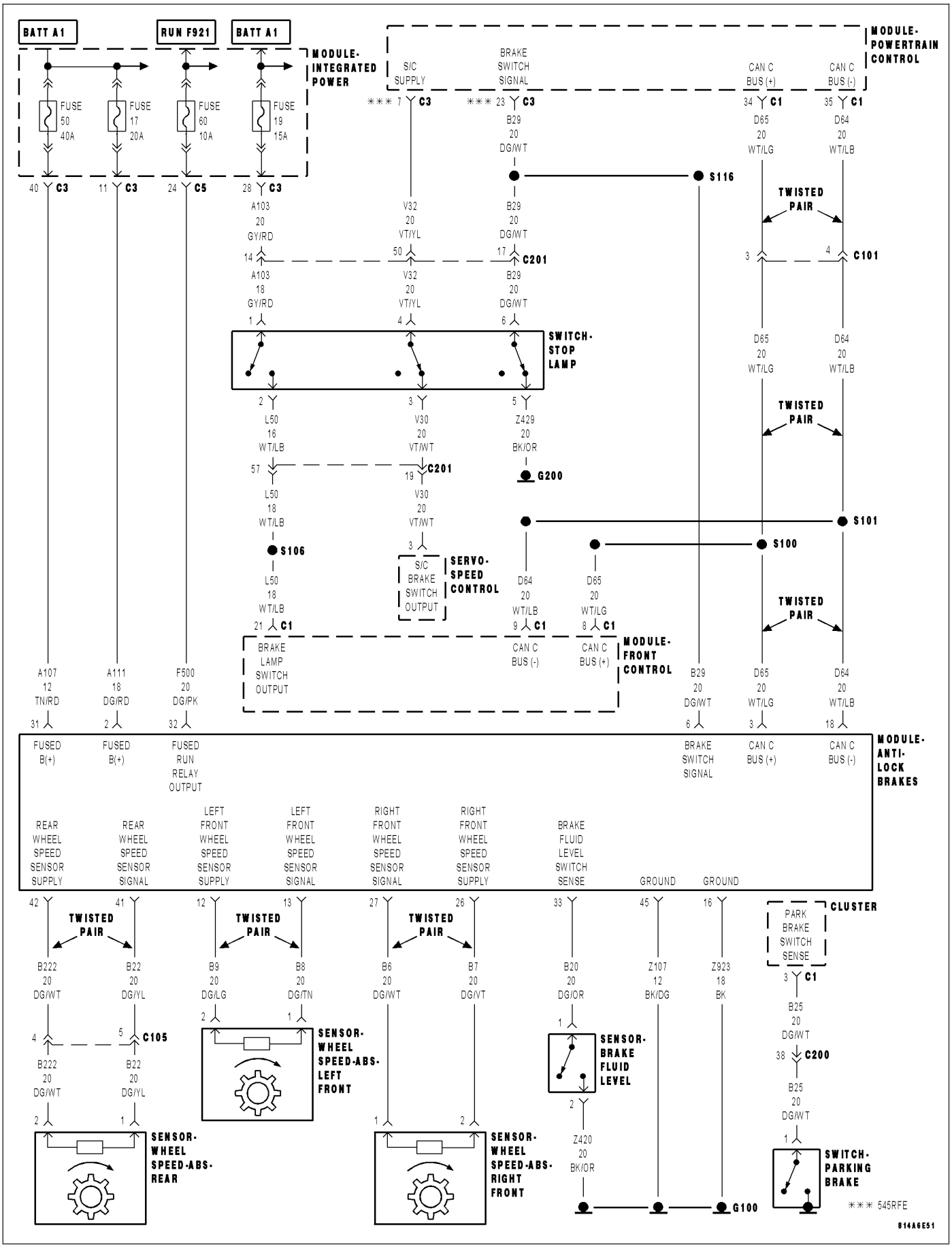
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340)



C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no system under voltage or over voltage condition present.
- **Set Condition:**
  Each time excessive wheel speed sensor acceleration or deceleration is detected, a fault counter increments. If the fault counter exceeds a specified value, the DTC will set.

Possible Causes
INTERMITTENT LEFT FRONT WHEEL SPEED SENSOR DTC
(B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORT TO GROUND
(B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN
(B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN
(B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
(B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT
TONE WHEEL
EXCESSIVE LEFT FRONT WHEEL SPEED SENSOR AIR GAP
WHEEL BEARING
LEFT FRONT WHEEL SPEED SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2
No >> Go To 15

C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

2. WHEEL SPEED SENSOR INSPECTION

Turn the ignition off.

Inspect the Wheel Speed Sensor for proper mounting.

Inspect the Wheel Speed Sensor harness and connector.

Inspect the Wheel Speed Sensor for excessive debris on the sensor.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

---

3. TONE WHEEL DAMAGED/MISSING

Inspect the Tone Wheel in accordance with the Service Information.

NOTE: The Tone Wheel Teeth should be perfectly square, not bent or nicked.

Were any problems found?

Yes >> Replace the Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. EXCESSIVE WHEEL SPEED SENSOR AIR GAP

Measure the Wheel Speed Sensor Air Gap in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. WHEEL BEARING LOOSE/BINDING

Inspect the wheel bearings for excessive run out or improper clearance in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 6

C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

6. (B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO GROUND

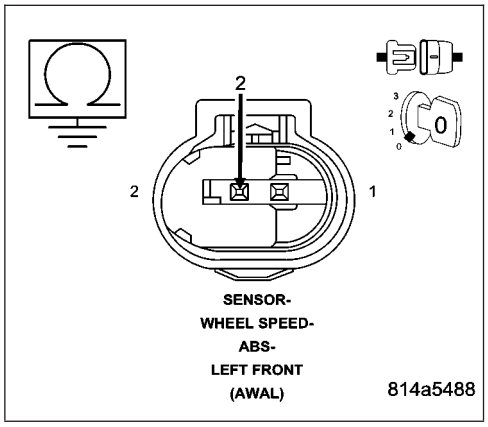
Turn the ignition off.

Disconnect the Left Front Wheel Speed Sensor harness connector.

Disconnect the Anti-lock Brake Module harness connector.

NOTE: Check connector - Clean/repair as necessary.

Measure the resistance between the (B9) Left Front Wheel Speed Sensor Supply circuit and ground.



Is the resistance above 5.0 ohms?

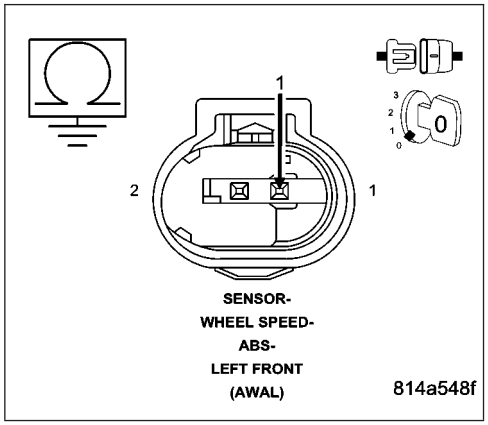
Yes >> Go To 7

No >> Repair the (B9) Left Front Wheel Speed Sensor Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

7. (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between the (B8) Left Front Wheel Speed Sensor Signal circuit and ground.



Is the resistance above 5.0 ohms?

Yes >> Go To 8

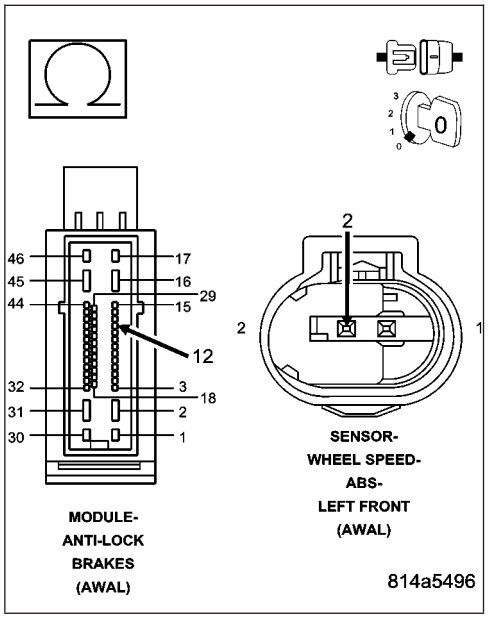
No >> Repair the (B8) Left Front Wheel Speed Sensor Signal circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

8. (B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN

Measure the resistance of the (B9) Left Front Wheel Speed Sensor Supply circuit.



Is the resistance below 5 ohms?

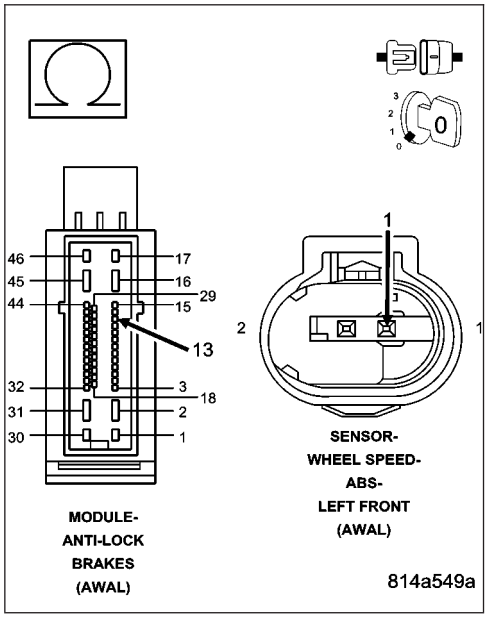
Yes >> Go To 9

No >> Repair the open (B9) Left Front Wheel Speed Sensor Supply circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

---

9. (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the (B8) Left Front Wheel Speed Sensor Signal circuit.



Is the resistance below 5 ohms?

Yes >> Go To 10

No >> Repair the open (B8) Left Front Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

10. (B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE

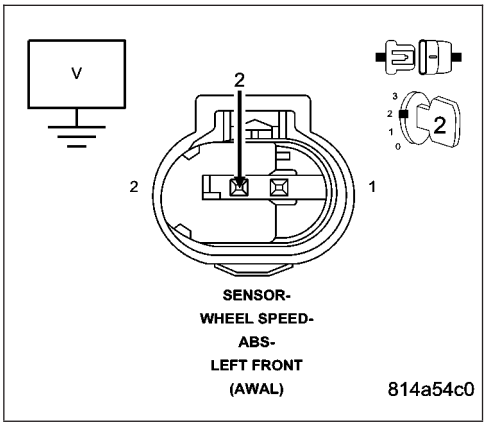
Turn the ignition on.

Measure the voltage of the (B9) Left Front Wheel Speed Sensor Supply circuit.

Is there any voltage present?

Yes >> Repair (B9) Left Front Wheel Speed Sensor Supply circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 11



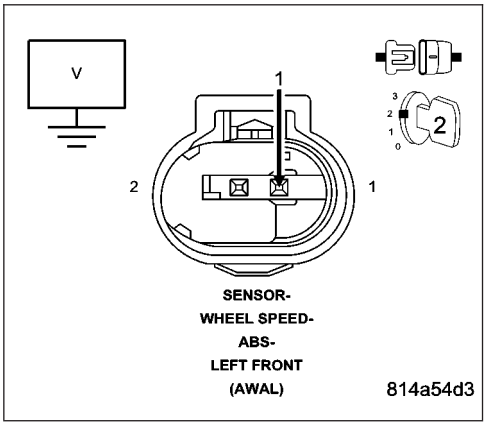
11. (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (B8) Left Front Wheel Speed Sensor Signal circuit.

Is there any voltage present?

Yes >> Repair the (B8) Left Front Wheel Speed Sensor Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 12



12. (B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT

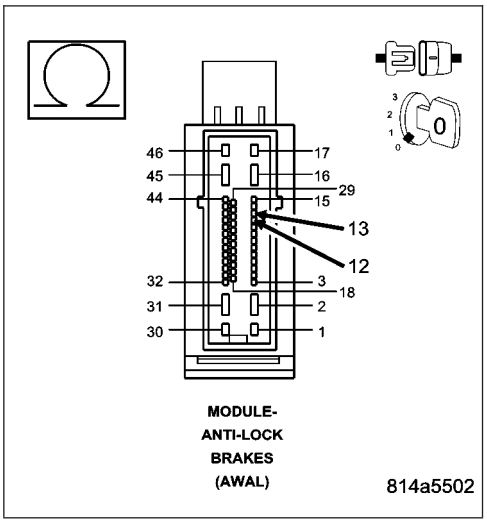
Turn the ignition off.

Measure the resistance between the (B9) Left Front Wheel Speed Sensor Supply circuit and the (B8) Left Front Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair (B9) Left Front Wheel Speed Sensor Supply circuit for a short to the (B8) Left Front Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 13



C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

13. LEFT FRONT WHEEL SPEED SENSOR

Turn the ignition off.

Connect the Left Front Wheel Speed Sensor harness connector.

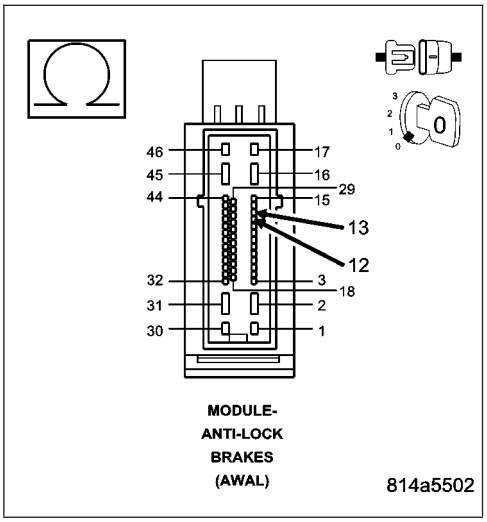
Measure the resistance between the (B9) Left Front Wheel Speed Sensor Supply circuit and (B8) Left Front Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

NOTE: The resistance should be approximately 1600–2300 ohms at 76 degrees F.

Is the resistance within the noted range?

Yes >> Go to 14

No >> Replace the Left Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



14. ANTI-LOCK BRAKE MODULE

Turn the ignition off.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

15. WIRING HARNESS INSPECTION

Turn the ignition off.

NOTE: Towing the vehicle with ignition ON may set this DTC.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

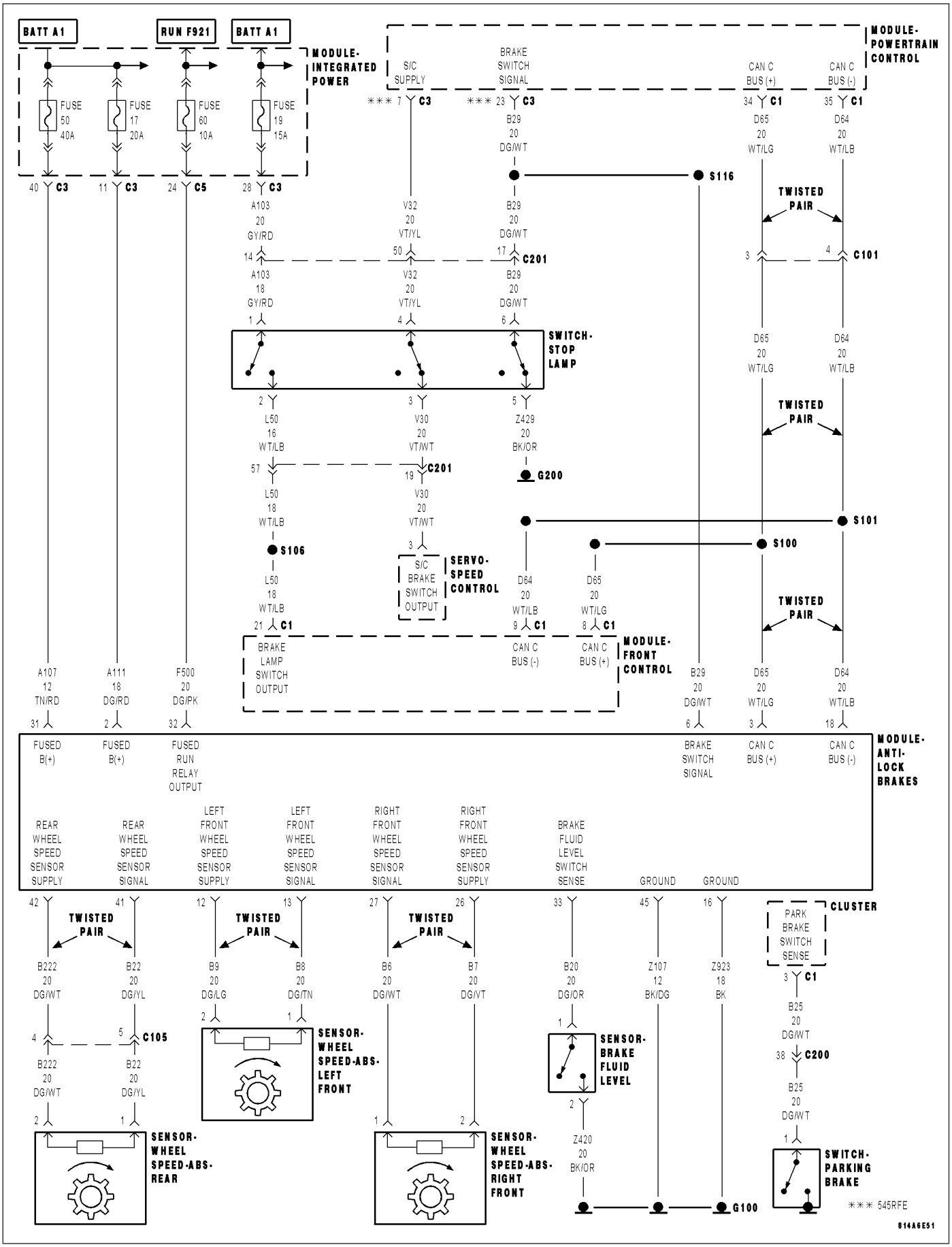
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340)



C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, no system under voltage or over voltage condition present, no open or shorted wheel speed sensor DTCs set, vehicle not under high acceleration, and vehicle speed greater than 0.
- **Set Condition:**
  This DTC will set if either one wheel is sensed above a predetermined range for 5000 msec while the other wheels are below 20% of maximum velocity of all wheels OR if more than one wheel is sensed at below 20% of maximum velocity of all wheels while at least one wheel is sensed above a predetermined range. The condition must exist for 2 minutes for this DTC to set.
  If the number of missing sensors changes at any update, the fault monitor is reset.

Possible Causes
INTERMITTENT LEFT FRONT WHEEL SPEED SENSOR DTC
(B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORT TO GROUND
(B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN
(B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN
(B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
(B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT
TONE WHEEL
EXCESSIVE LEFT FRONT WHEEL SPEED SENSOR AIR GAP
WHEEL BEARING
LEFT FRONT WHEEL SPEED SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2

No >> Go To 15

C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

2. WHEEL SPEED SENSOR INSPECTION

Turn the ignition off.

Inspect the Wheel Speed Sensor for proper mounting.

Inspect the Wheel Speed Sensor harness and connector.

Inspect the Wheel Speed Sensor for excessive debris on the sensor.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

---

3. TONE WHEEL DAMAGED/MISSING

Inspect the Tone Wheel in accordance with the Service Information.

NOTE: The Tone Wheel Teeth should be perfectly square, not bent or nicked.

Were any problems found?

Yes >> Replace the Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. EXCESSIVE WHEEL SPEED SENSOR AIR GAP

Measure the Wheel Speed Sensor Air Gap in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. WHEEL BEARING LOOSE/BINDING

Inspect the wheel bearings for excessive run out or improper clearance in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 6

C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

6. (B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Left Front Wheel Speed Sensor harness connector.

Disconnect the Anti-lock Brake Module harness connector.

NOTE: Check connector - Clean/repair as necessary.

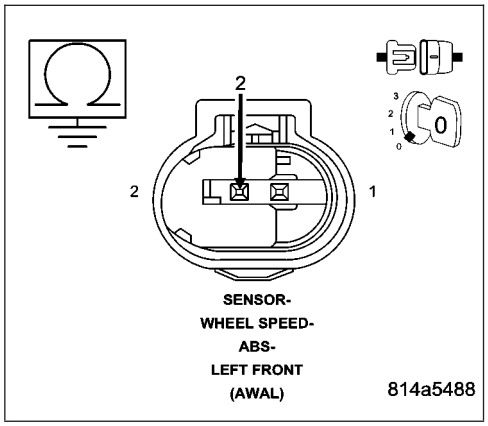
Measure the resistance between the (B9) Left Front Wheel Speed Sensor Supply circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 7

No >> Repair the (B9) Left Front Wheel Speed Sensor Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



7. (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

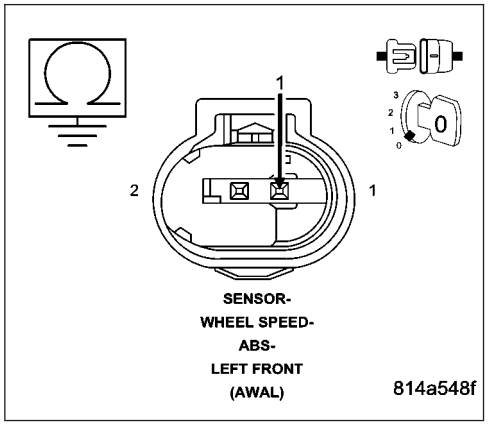
Measure the resistance between the (B8) Left Front Wheel Speed Sensor Signal circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 8

No >> Repair the (B8) Left Front Wheel Speed Sensor Signal circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

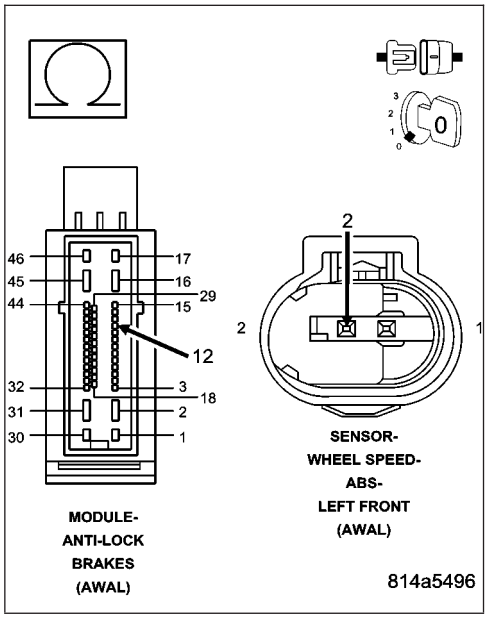
8. (B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN

Measure the resistance of the (B9) Left Front Wheel Speed Sensor Supply circuit.

Is the resistance below 5 ohms?

Yes >> Go To 9

No >> Repair the open (B9) Left Front Wheel Speed Sensor Supply circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



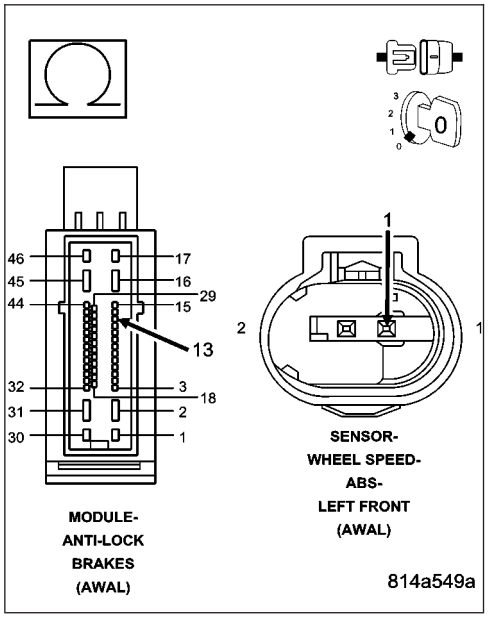
9. (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the (B8) Left Front Wheel Speed Sensor Signal circuit.

Is the resistance below 5 ohms?

Yes >> Go To 10

No >> Repair the open (B8) Left Front Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

10. (B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE

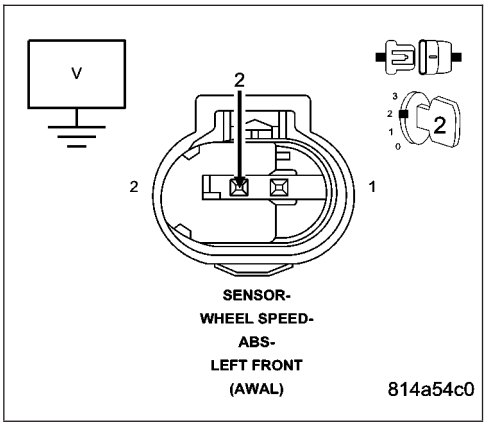
Turn the ignition on.

Measure the voltage of the (B9) Left Front Wheel Speed Sensor Supply circuit.

Is there any voltage present?

Yes >> Repair (B9) Left Front Wheel Speed Sensor Supply circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 11



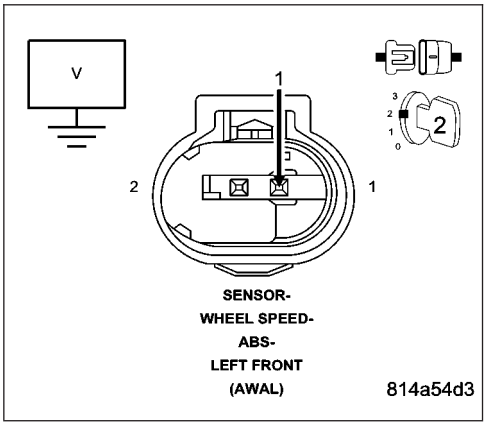
11. (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (B8) Left Front Wheel Speed Sensor Signal circuit.

Is there any voltage present?

Yes >> Repair the (B8) Left Front Wheel Speed Sensor Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 12



12. (B9) LEFT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B8) LEFT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT

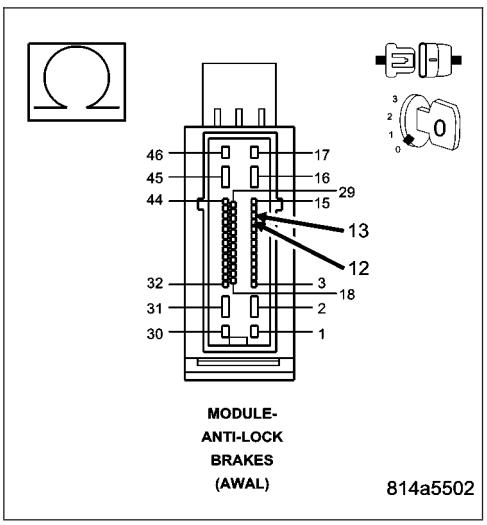
Turn the ignition off.

Measure the resistance between the (B9) Left Front Wheel Speed Sensor Supply circuit and the (B8) Left Front Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair (B9) Left Front Wheel Speed Sensor Supply circuit for a short to the (B8) Left Front Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 13



C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

13. LEFT FRONT WHEEL SPEED SENSOR

Turn the ignition off.

Connect the Left Front Wheel Speed Sensor harness connector.

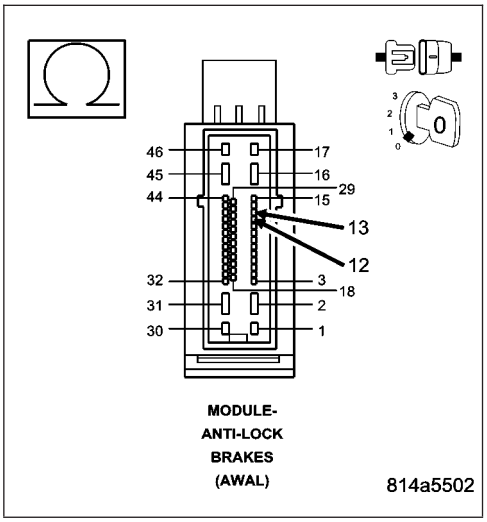
Measure the resistance between the (B9) Left Front Wheel Speed Sensor Supply circuit and (B8) Left Front Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

NOTE: The resistance should be approximately 1600–2300 ohms at 76 degrees F.

Is the resistance within the noted range?

Yes >> Go to 14

No >> Replace the Left Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



14. ANTI-LOCK BRAKE MODULE

Turn the ignition off.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

15. WIRING HARNESS INSPECTION

Turn the ignition off.

NOTE: Towing the vehicle with ignition ON may set this DTC.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

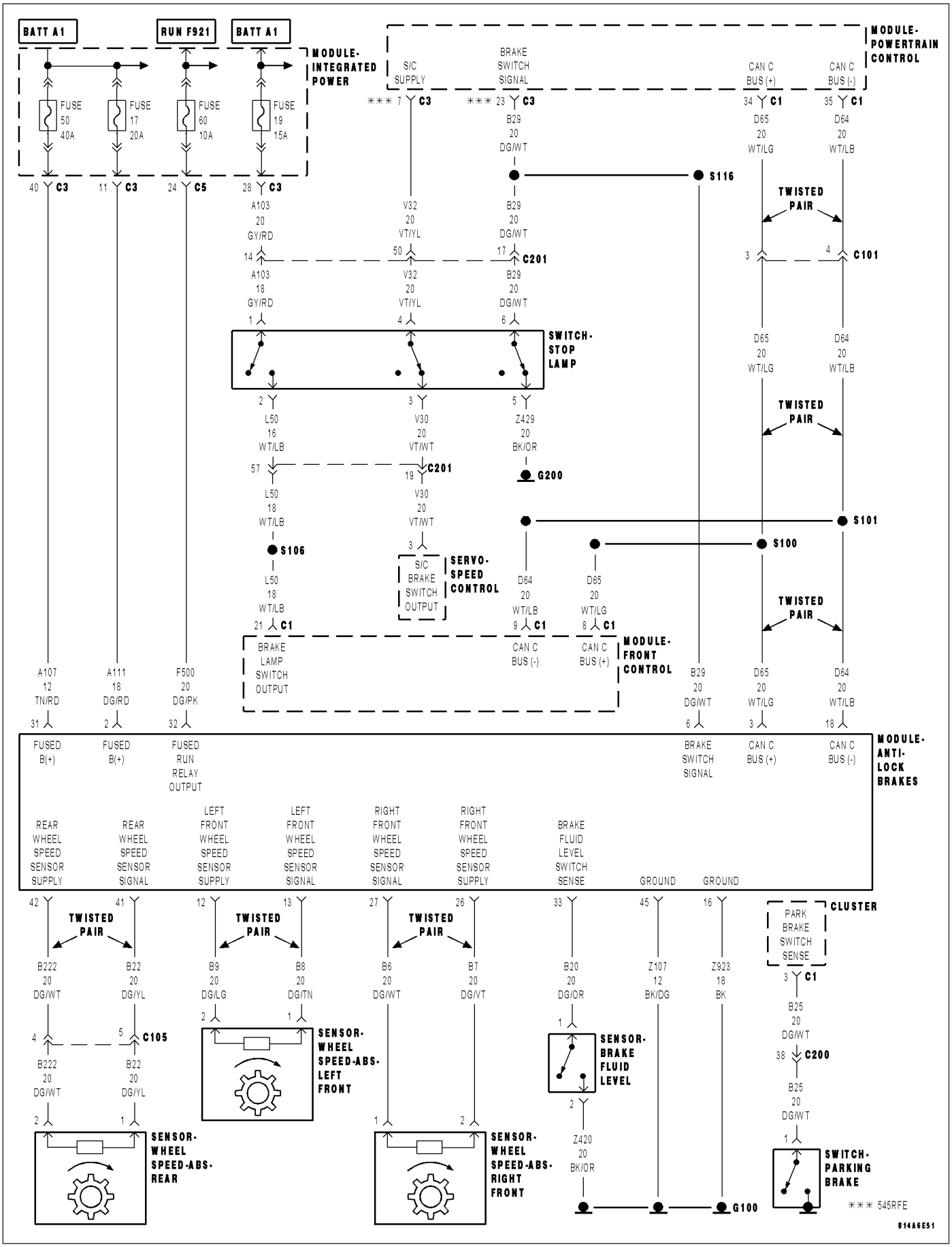
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C1015-RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT (340)



C1015-RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no system under voltage or over voltage condition present.
- **Set Condition:**
  If the measured wheel speed sensor feedback voltage is less than .304 volts, the sensor is considered open. If the measured wheel speed sensor feedback voltage is greater than 1.39 volts, or if a sensor over current condition is detected, the sensor is considered shorted.
  If a shorted or open condition is present for more than 100 msec, the DTC will set.

Possible Causes
INTERMITTENT RIGHT FRONT WHEEL SPEED SENSOR DTC
(B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORT TO GROUND
(B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN
(B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN
(B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
(B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT
TONE WHEEL
EXCESSIVE RIGHT FRONT WHEEL SPEED SENSOR AIR GAP
WHEEL BEARING
RIGHT FRONT WHEEL SPEED SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2
No >> Go To 15

C1015-RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

2. WHEEL SPEED SENSOR INSPECTION

Turn the ignition off.

Inspect the Wheel Speed Sensor for proper mounting.

Inspect the Wheel Speed Sensor harness and connector.

Inspect the Wheel Speed Sensor for excessive debris on the sensor.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

---

3. TONE WHEEL DAMAGED/MISSING

Inspect the Tone Wheel in accordance with the Service Information.

NOTE: The Tone Wheel Teeth should be perfectly square, not bent or nicked.

Were any problems found?

Yes >> Replace the Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. EXCESSIVE WHEEL SPEED SENSOR AIR GAP

Measure the Wheel Speed Sensor Air Gap in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. WHEEL BEARING LOOSE/BINDING

Inspect the wheel bearings for excessive run out or improper clearance in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 6

C1015-RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

6. (B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO GROUND

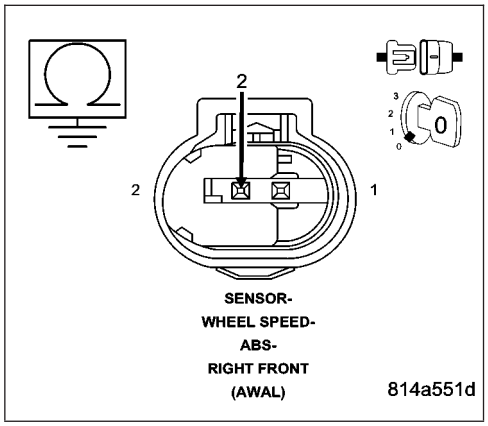
Turn the ignition off.

Disconnect the Right Front Wheel Speed Sensor harness connector.

Disconnect the Anti-lock Brake Module harness connector.

NOTE: Check connector - Clean/repair as necessary.

Measure the resistance between the (B7) Right Front Wheel Speed Sensor Supply circuit and ground.



Is the resistance above 5.0 ohms?

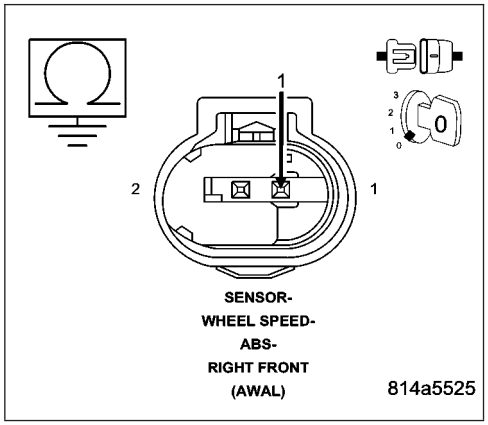
Yes >> Go To 7

No >> Repair the (B7) Right Front Wheel Speed Sensor Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

7. (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between the (B6) Right Front Wheel Speed Sensor Signal circuit and ground.



Is the resistance above 5.0 ohms?

Yes >> Go To 8

No >> Repair the (B6) Right Front Wheel Speed Sensor Signal circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C1015-RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

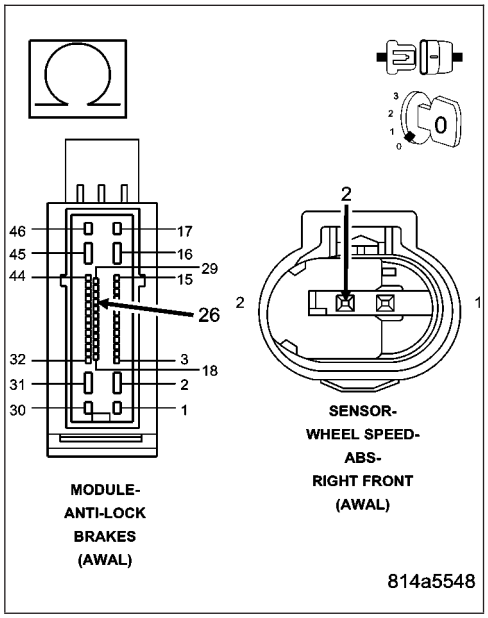
8. (B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN

Measure the resistance of the (B7) Right Front Wheel Speed Sensor Supply circuit.

Is the resistance below 5 ohms?

Yes >> Go To 9

No >> Repair the open (B7) Right Front Wheel Speed Sensor Supply circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



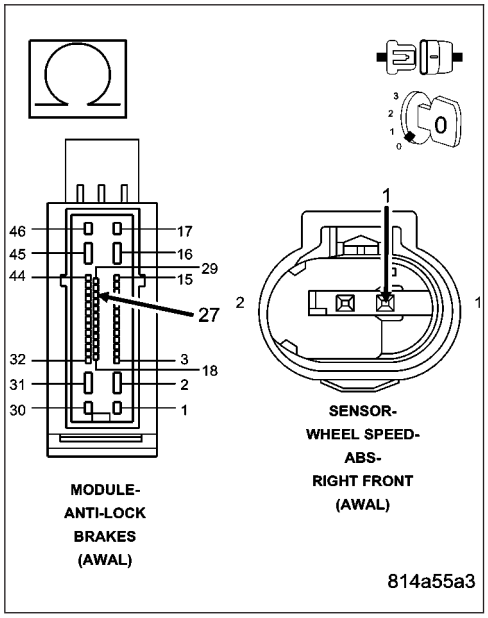
9. (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the (B6) Right Front Wheel Speed Sensor Signal circuit.

Is the resistance below 5 ohms?

Yes >> Go To 10

No >> Repair the open (B6) Right Front Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C1015-RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

10. (B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE

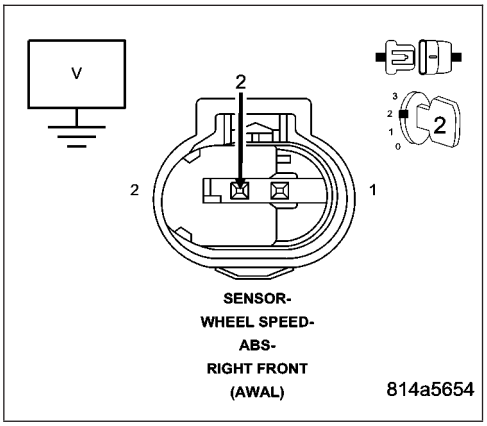
Turn the ignition on.

Measure the voltage of the (B7) Right Front Wheel Speed Sensor Supply circuit.

Is there any voltage present?

Yes >> Repair (B7) Right Front Wheel Speed Sensor Supply circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 11



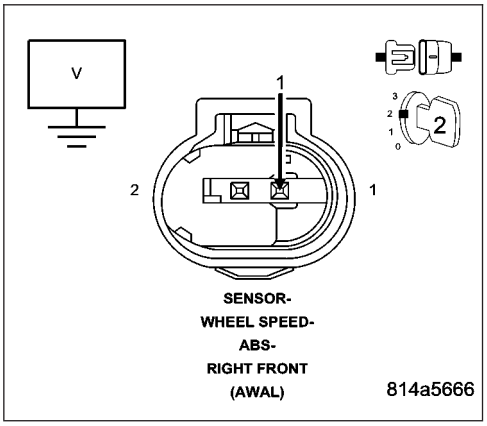
11. (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (B6) Right Front Wheel Speed Sensor Signal circuit.

Is there any voltage present?

Yes >> Repair the (B6) Right Front Wheel Speed Sensor Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 12



12. (B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT

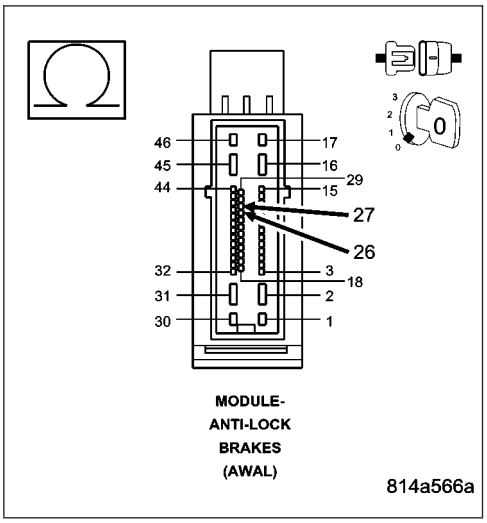
Turn the ignition off.

Measure the resistance between the (B7) Right Front Wheel Speed Sensor Supply circuit and the (B6) Right Front Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair (B7) Right Front Wheel Speed Sensor Supply circuit for a short to the (B6) Right Front Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 13



C1015-RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

13. RIGHT FRONT WHEEL SPEED SENSOR

Turn the ignition off.

Connect the Right Front Wheel Speed Sensor harness connector.

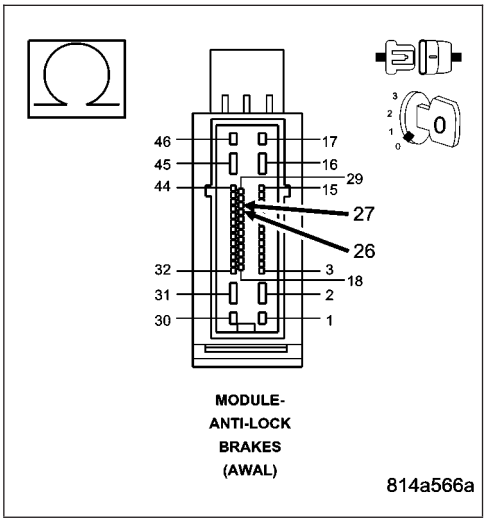
Measure the resistance between the (B7) Right Front Wheel Speed Sensor Supply circuit and (B6) Right Front Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

NOTE: The resistance should be approximately 1600–2300 ohms at 76 degrees F.

Is the resistance within the noted range?

Yes >> Go to 14

No >> Replace the Right Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



14. ANTI-LOCK BRAKE MODULE

Turn the ignition off.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

15. WIRING HARNESS INSPECTION

Turn the ignition off.

NOTE: Towing the vehicle with ignition ON may set this DTC.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

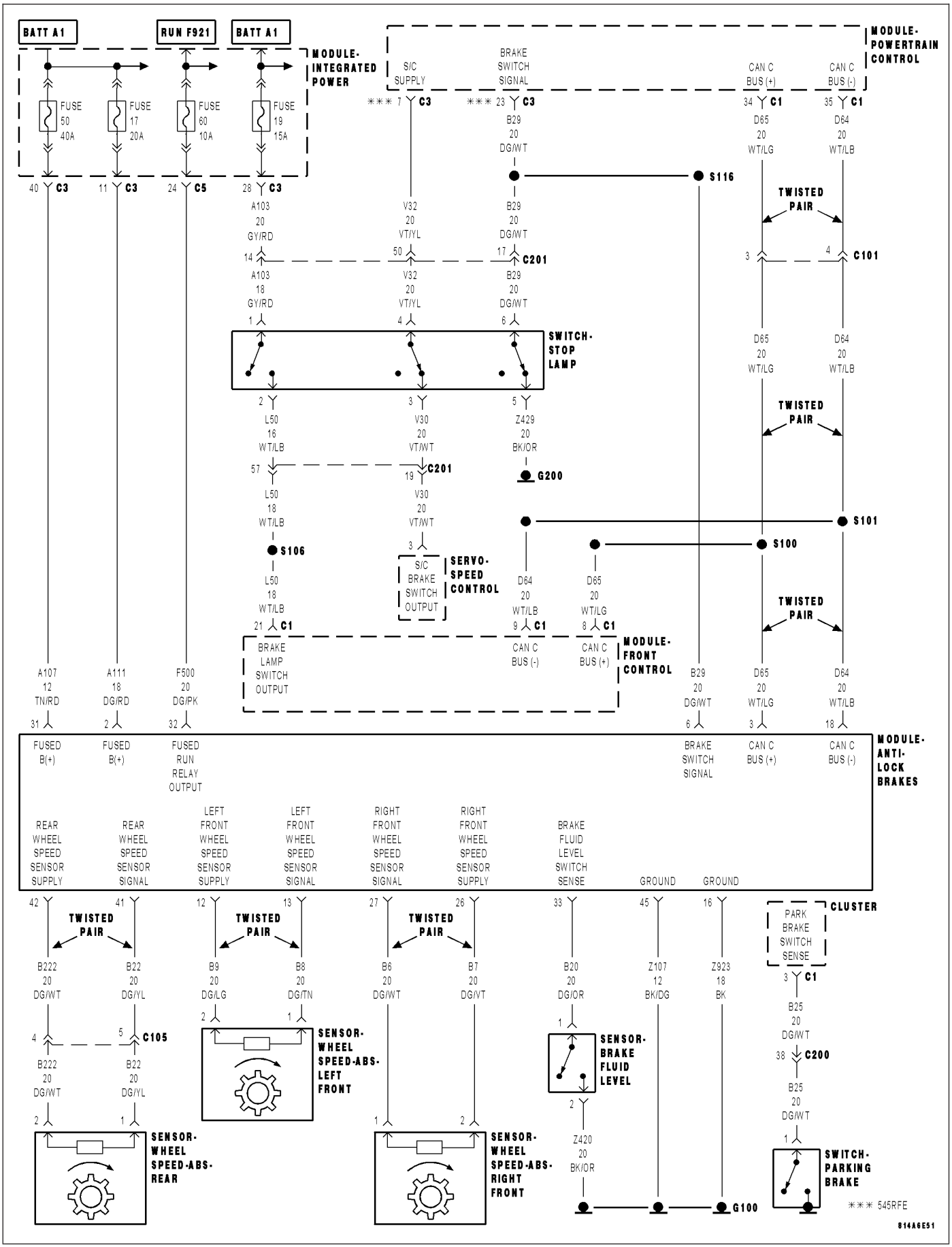
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340)



C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no system under voltage or over voltage condition present.
- **Set Condition:**
  Each time excessive wheel speed sensor acceleration or deceleration is detected, a fault counter increments. If the fault counter exceeds a specified value, the DTC will set.

Possible Causes
INTERMITTENT RIGHT FRONT WHEEL SPEED SENSOR DTC
(B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORT TO GROUND
(B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN
(B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN
(B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
(B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT
TONE WHEEL
EXCESSIVE RIGHT FRONT WHEEL SPEED SENSOR AIR GAP
WHEEL BEARING
RIGHT FRONT WHEEL SPEED SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2
No >> Go To 15

C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

2. WHEEL SPEED SENSOR INSPECTION

Turn the ignition off.

Inspect the Wheel Speed Sensor for proper mounting.

Inspect the Wheel Speed Sensor harness and connector.

Inspect the Wheel Speed Sensor for excessive debris on the sensor.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

---

3. TONE WHEEL DAMAGED/MISSING

Inspect the Tone Wheel in accordance with the Service Information.

NOTE: The Tone Wheel Teeth should be perfectly square, not bent or nicked.

Were any problems found?

Yes >> Replace the Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. EXCESSIVE WHEEL SPEED SENSOR AIR GAP

Measure the Wheel Speed Sensor Air Gap in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. WHEEL BEARING LOOSE/BINDING

Inspect the wheel bearings for excessive run out or improper clearance in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 6

C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

6. (B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Right Front Wheel Speed Sensor harness connector.

Disconnect the Anti-lock Brake Module harness connector.

NOTE: Check connector - Clean/repair as necessary.

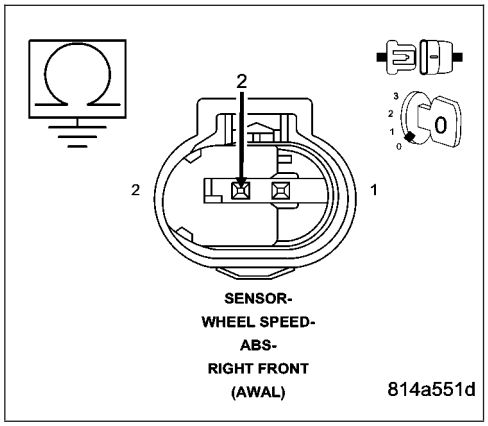
Measure the resistance between the (B7) Right Front Wheel Speed Sensor Supply circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 7

No >> Repair the (B7) Right Front Wheel Speed Sensor Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



7. (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

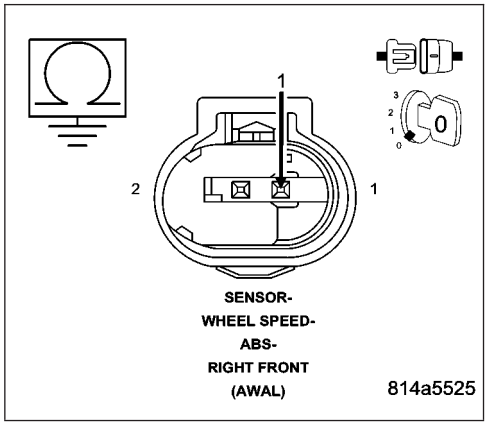
Measure the resistance between the (B6) Right Front Wheel Speed Sensor Signal circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 8

No >> Repair the (B6) Right Front Wheel Speed Sensor Signal circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

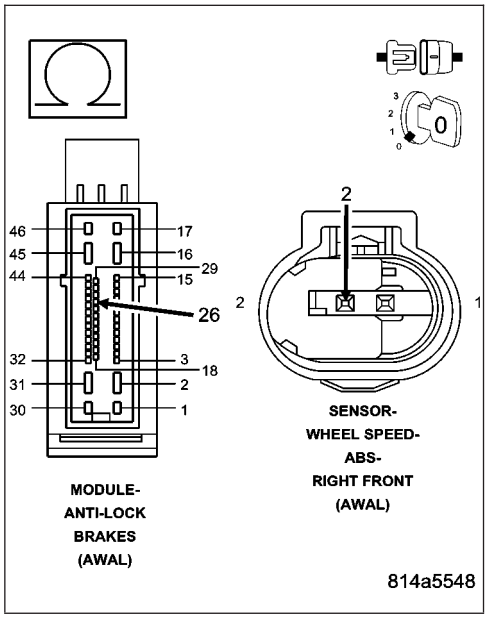
8. (B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN

Measure the resistance of the (B7) Right Front Wheel Speed Sensor Supply circuit.

Is the resistance below 5 ohms?

Yes >> Go To 9

No >> Repair the open (B7) Right Front Wheel Speed Sensor Supply circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



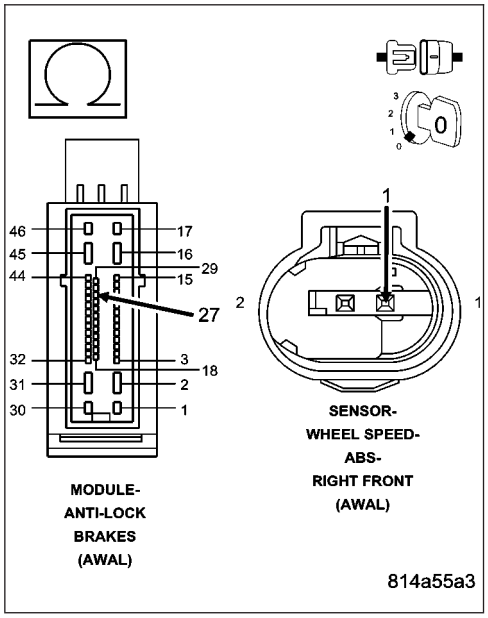
9. (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the (B6) Right Front Wheel Speed Sensor Signal circuit.

Is the resistance below 5 ohms?

Yes >> Go To 10

No >> Repair the open (B6) Right Front Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

10. (B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE

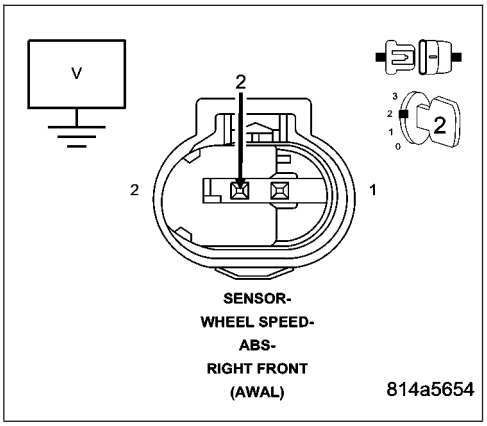
Turn the ignition on.

Measure the voltage of the (B7) Right Front Wheel Speed Sensor Supply circuit.

Is there any voltage present?

Yes >> Repair (B7) Right Front Wheel Speed Sensor Supply circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 11



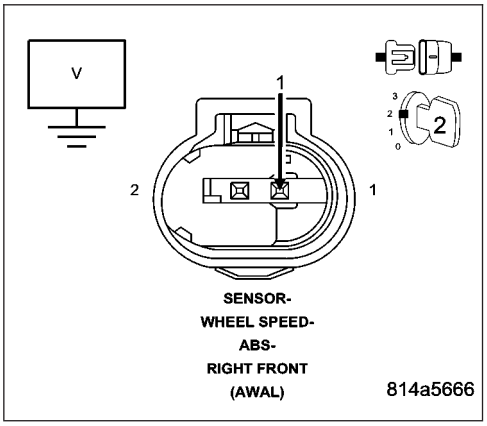
11. (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (B6) Right Front Wheel Speed Sensor Signal circuit.

Is there any voltage present?

Yes >> Repair the (B6) Right Front Wheel Speed Sensor Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 12



12. (B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT

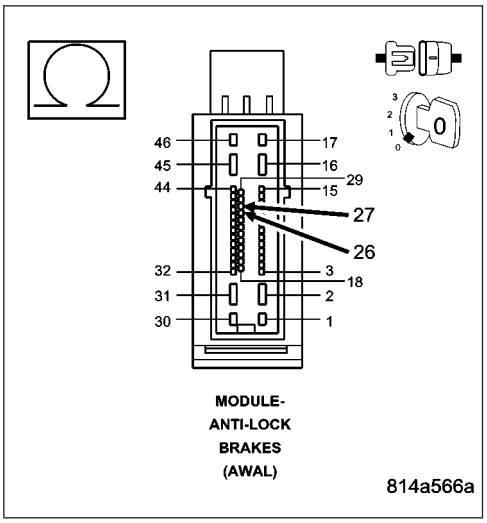
Turn the ignition off.

Measure the resistance between the (B7) Right Front Wheel Speed Sensor Supply circuit and the (B6) Right Front Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair (B7) Right Front Wheel Speed Sensor Supply circuit for a short to the (B6) Right Front Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 13



C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

13. RIGHT FRONT WHEEL SPEED SENSOR

Turn the ignition off.

Connect the Right Front Wheel Speed Sensor harness connector.

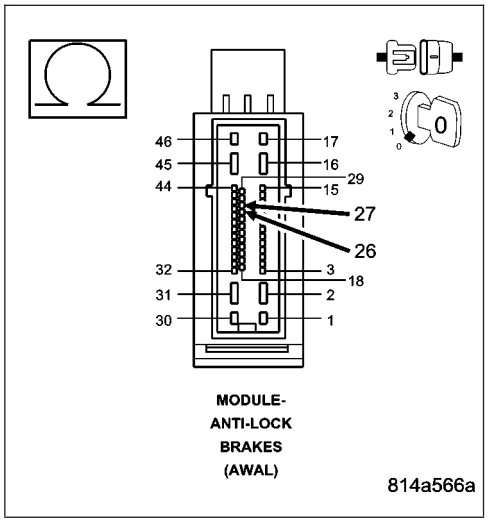
Measure the resistance between the (B7) Right Front Wheel Speed Sensor Supply circuit and (B6) Right Front Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

NOTE: The resistance should be approximately 1600–2300 ohms at 76 degrees F.

Is the resistance within the noted range?

Yes >> Go to 14

No >> Replace the Right Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



14. ANTI-LOCK BRAKE MODULE

Turn the ignition off.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

15. WIRING HARNESS INSPECTION

Turn the ignition off.

NOTE: Towing the vehicle with ignition ON may set this DTC.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

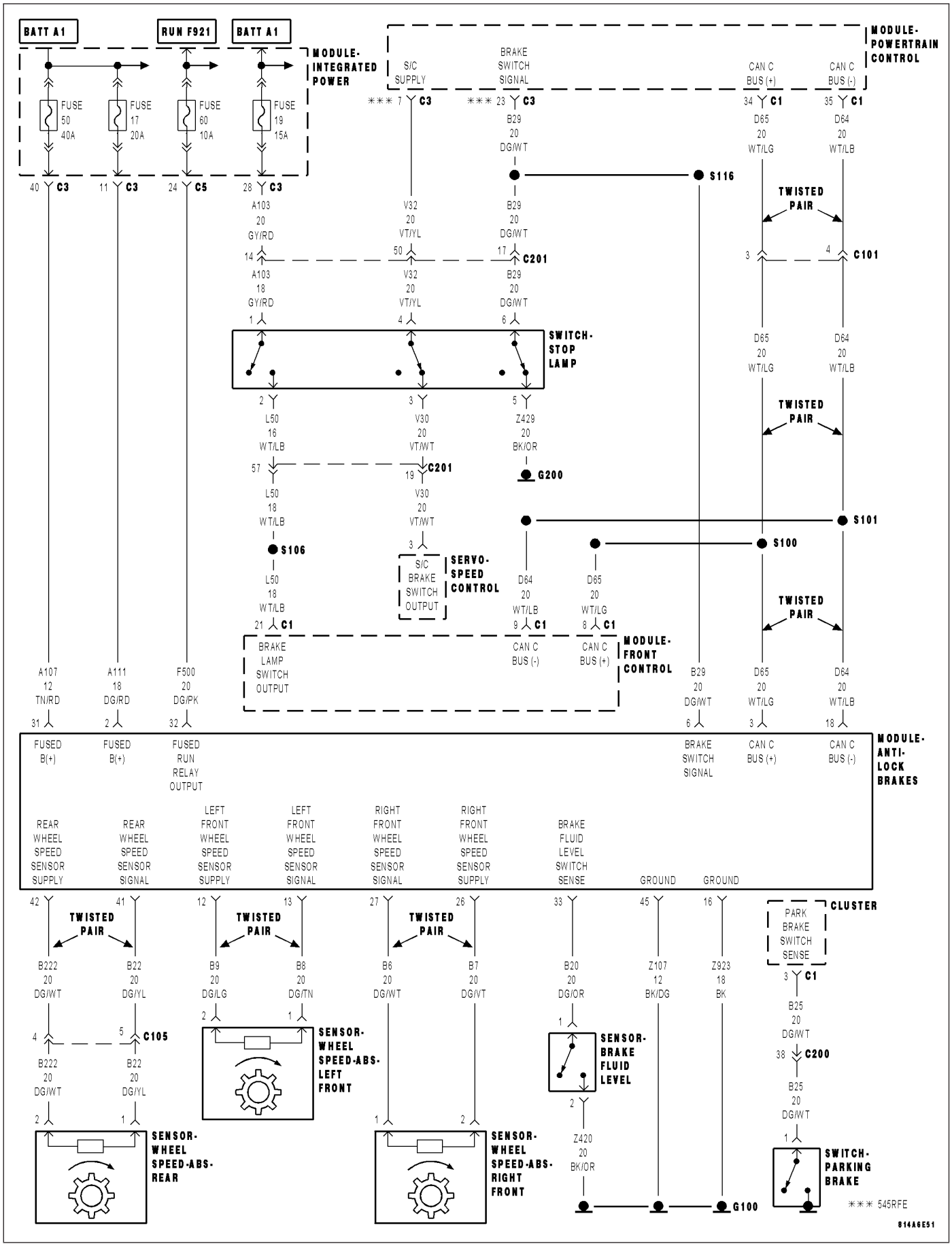
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340)



C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, no system under voltage or over voltage condition present, no open or shorted wheel speed sensor DTCs set, vehicle not under high acceleration, and vehicle speed greater than 0.
- **Set Condition:**
  This DTC will set if either one wheel is sensed above a predetermined range for 5000 msec while the other wheels are below 20% of maximum velocity of all wheels OR if more than one wheel is sensed at below 20% of maximum velocity of all wheels while at least one wheel is sensed above a predetermined range. The condition must exist for 2 minutes for this DTC to set.
  If the number of missing sensors changes at any update, the fault monitor is reset.

Possible Causes
INTERMITTENT RIGHT FRONT WHEEL SPEED SENSOR DTC
(B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORT TO GROUND
(B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN
(B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN
(B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
(B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT
TONE WHEEL
EXCESSIVE RIGHT FRONT WHEEL SPEED SENSOR AIR GAP
WHEEL BEARING
RIGHT FRONT WHEEL SPEED SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2

No >> Go To 15

C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

2. WHEEL SPEED SENSOR INSPECTION

Turn the ignition off.

Inspect the Wheel Speed Sensor for proper mounting.

Inspect the Wheel Speed Sensor harness and connector.

Inspect the Wheel Speed Sensor for excessive debris on the sensor.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

---

3. TONE WHEEL DAMAGED/MISSING

Inspect the Tone Wheel in accordance with the Service Information.

NOTE: The Tone Wheel Teeth should be perfectly square, not bent or nicked.

Were any problems found?

Yes >> Replace the Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. EXCESSIVE WHEEL SPEED SENSOR AIR GAP

Measure the Wheel Speed Sensor Air Gap in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. WHEEL BEARING LOOSE/BINDING

Inspect the wheel bearings for excessive run out or improper clearance in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 6

C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

6. (B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Right Front Wheel Speed Sensor harness connector.

Disconnect the Anti-lock Brake Module harness connector.

NOTE: Check connector - Clean/repair as necessary.

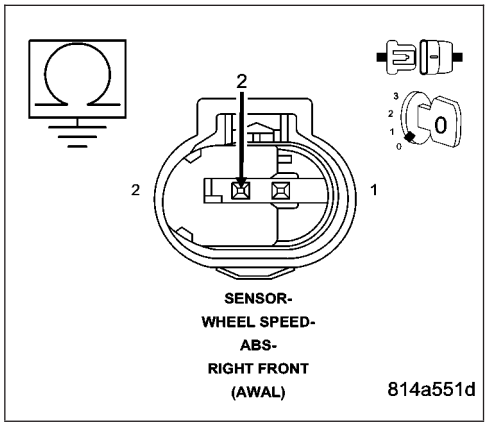
Measure the resistance between the (B7) Right Front Wheel Speed Sensor Supply circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 7

No >> Repair the (B7) Right Front Wheel Speed Sensor Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



7. (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

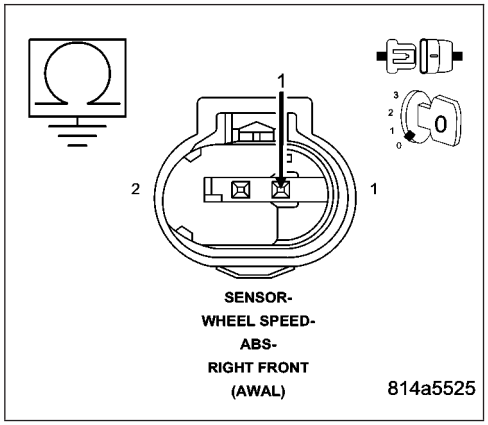
Measure the resistance between the (B6) Right Front Wheel Speed Sensor Signal circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 8

No >> Repair the (B6) Right Front Wheel Speed Sensor Signal circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

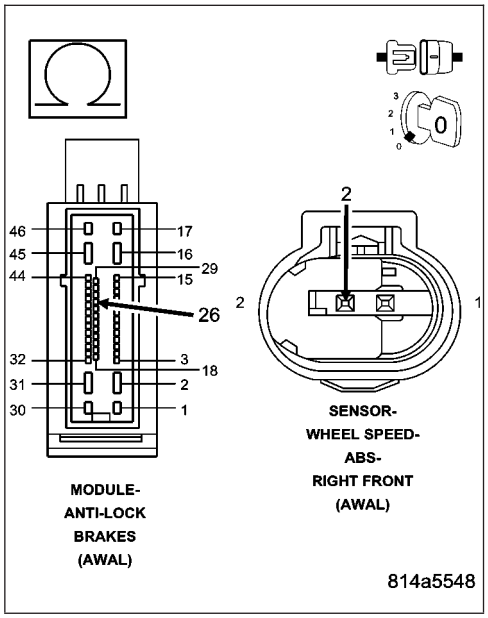
8. (B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN

Measure the resistance of the (B7) Right Front Wheel Speed Sensor Supply circuit.

Is the resistance below 5 ohms?

Yes >> Go To 9

No >> Repair the open (B7) Right Front Wheel Speed Sensor Supply circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



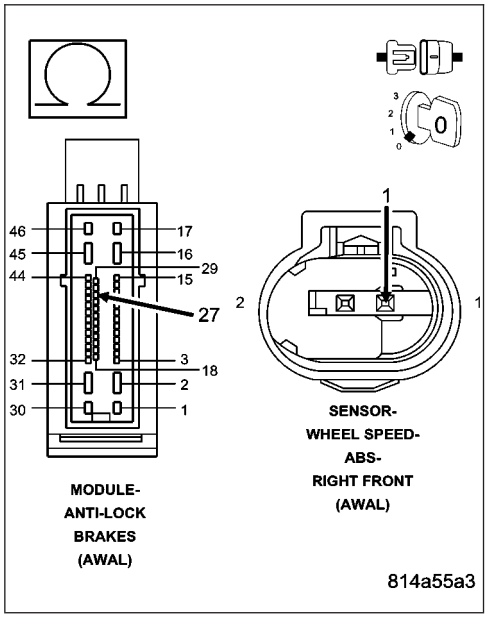
9. (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the (B6) Right Front Wheel Speed Sensor Signal circuit.

Is the resistance below 5 ohms?

Yes >> Go To 10

No >> Repair the open (B6) Right Front Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

10. (B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE

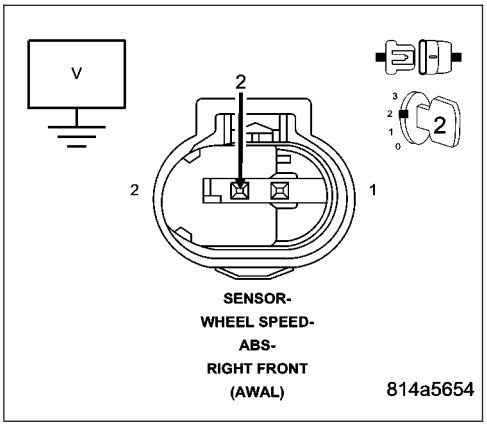
Turn the ignition on.

Measure the voltage of the (B7) Right Front Wheel Speed Sensor Supply circuit.

Is there any voltage present?

Yes >> Repair (B7) Right Front Wheel Speed Sensor Supply circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 11



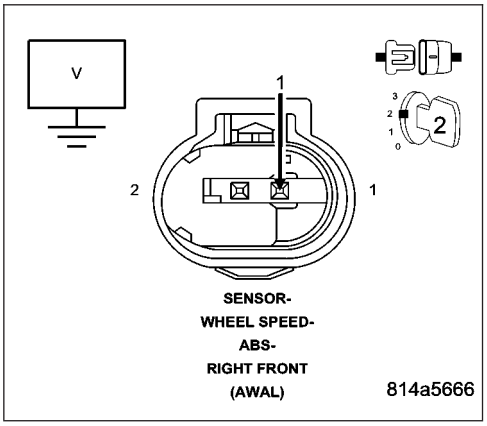
11. (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (B6) Right Front Wheel Speed Sensor Signal circuit.

Is there any voltage present?

Yes >> Repair the (B6) Right Front Wheel Speed Sensor Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 12



12. (B7) RIGHT FRONT WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B6) RIGHT FRONT WHEEL SPEED SENSOR SIGNAL CIRCUIT

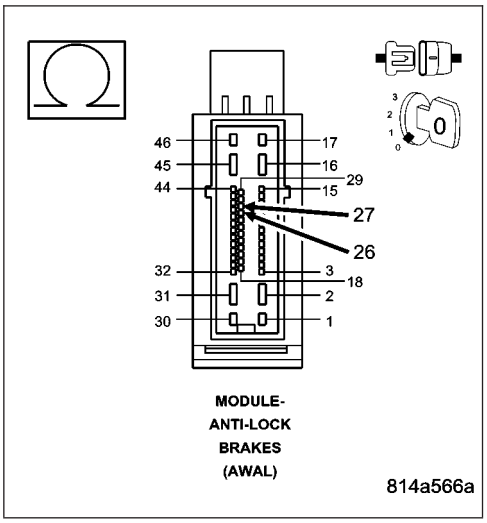
Turn the ignition off.

Measure the resistance between the (B7) Right Front Wheel Speed Sensor Supply circuit and the (B6) Right Front Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair (B7) Right Front Wheel Speed Sensor Supply circuit for a short to the (B6) Right Front Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 13



C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

13. RIGHT FRONT WHEEL SPEED SENSOR

Turn the ignition off.

Connect the Right Front Wheel Speed Sensor harness connector.

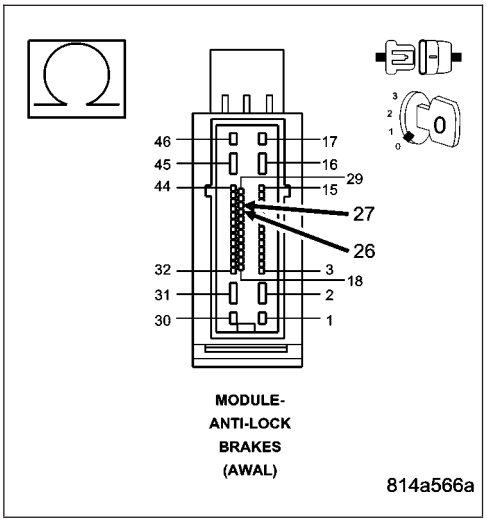
Measure the resistance between the (B7) Right Front Wheel Speed Sensor Supply circuit and (B6) Right Front Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

NOTE: The resistance should be approximately 1600–2300 ohms at 76 degrees F.

Is the resistance within the noted range?

Yes >> Go to 14

No >> Replace the Right Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



14. ANTI-LOCK BRAKE MODULE

Turn the ignition off.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

15. WIRING HARNESS INSPECTION

Turn the ignition off.

NOTE: Towing the vehicle with ignition ON may set this DTC.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

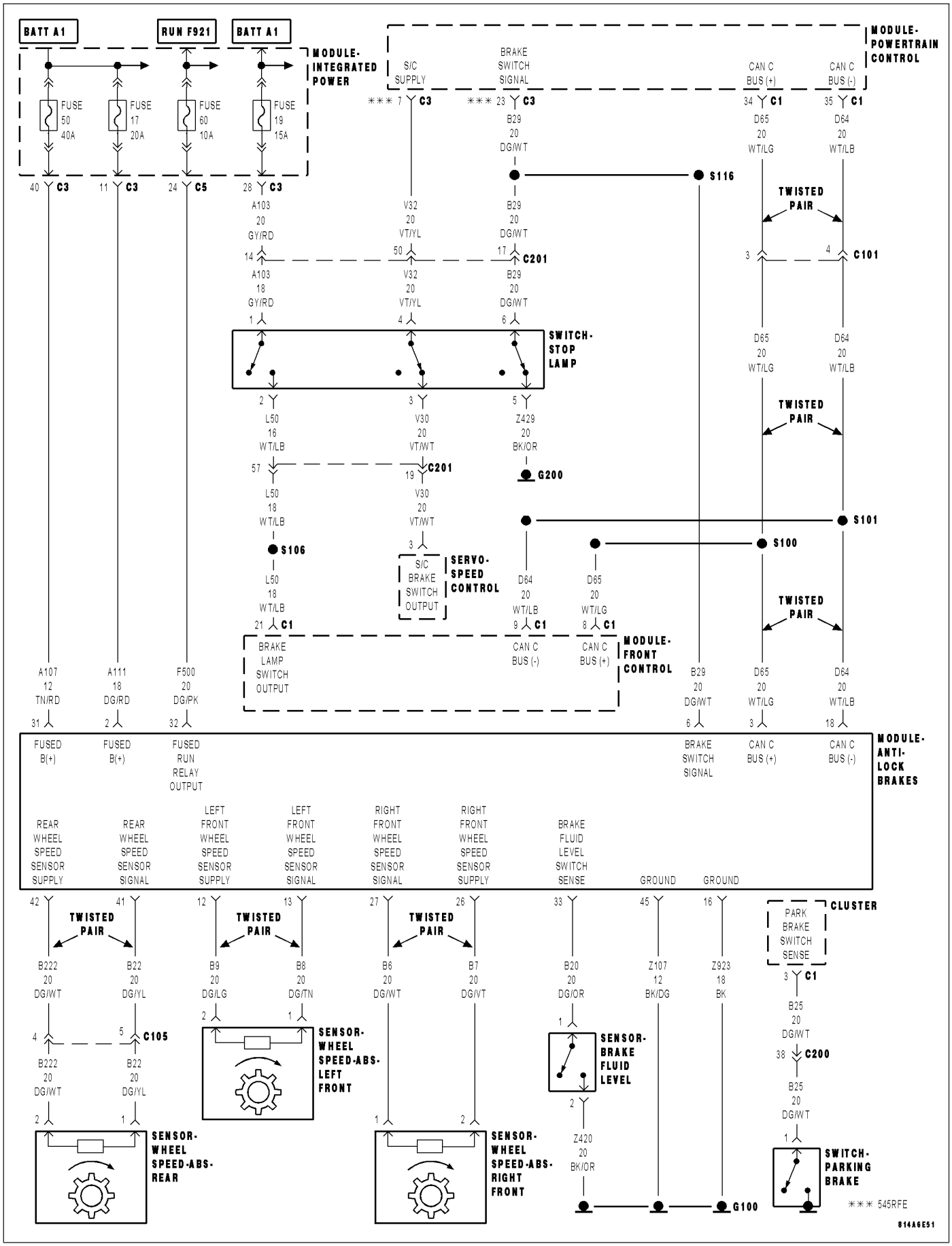
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C102B-REAR WHEEL SPEED SENSOR CIRCUIT (340)



C102B-REAR WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no system under voltage or over voltage condition present.
- **Set Condition:**
  If the measured wheel speed sensor feedback voltage is less than .304 volts, the sensor is considered open. If the measured wheel speed sensor feedback voltage is greater than 1.39 volts, or if a sensor over current condition is detected, the sensor is considered shorted.
  If a shorted or open condition is present for more than 100 msec, the DTC will set.

Possible Causes
INTERMITTENT REAR WHEEL SPEED SENSOR DTC
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORT TO GROUND
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT
TONE WHEEL
EXCESSIVE REAR WHEEL SPEED SENSOR AIR GAP
WHEEL BEARING
REAR WHEEL SPEED SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2
No >> Go To 15

C102B-REAR WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

2. WHEEL SPEED SENSOR INSPECTION

Turn the ignition off.

Inspect the Wheel Speed Sensor for proper mounting.

Inspect the Wheel Speed Sensor harness and connector.

Inspect the Wheel Speed Sensor for excessive debris on the sensor.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

---

3. TONE WHEEL DAMAGED/MISSING

Inspect the Tone Wheel in accordance with the Service Information.

NOTE: The Tone Wheel Teeth should be perfectly square, not bent or nicked.

Were any problems found?

Yes >> Replace the Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. EXCESSIVE WHEEL SPEED SENSOR AIR GAP

Measure the Wheel Speed Sensor Air Gap in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. WHEEL BEARING LOOSE/BINDING

Inspect the wheel bearings for excessive run out or improper clearance in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 6

C102B-REAR WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

6. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Rear Wheel Speed Sensor harness connector.

Disconnect the Anti-lock Brake Module harness connector.

NOTE: Check connector - Clean/repair as necessary.

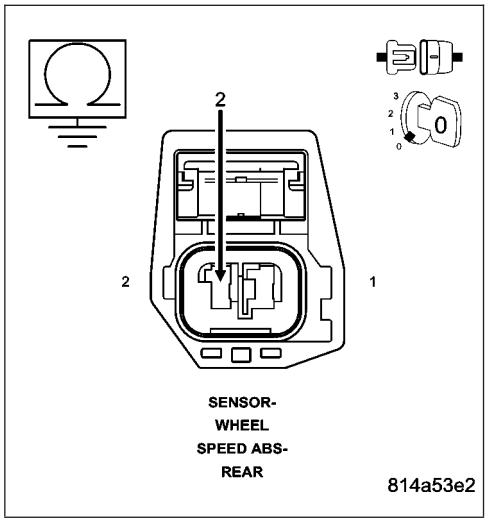
Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 7

No >> Repair the (B222) Rear Wheel Speed Sensor Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



7. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

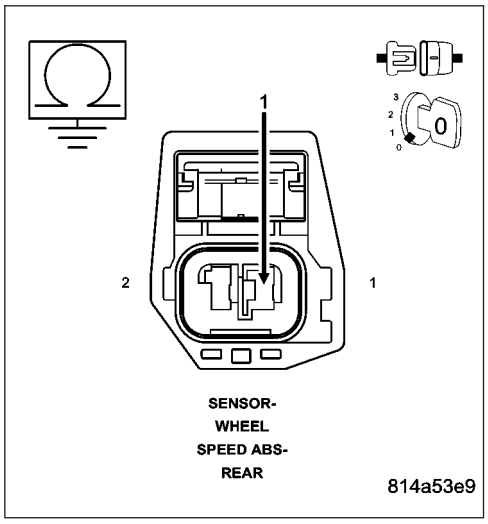
Measure the resistance between the (B22) Rear Wheel Speed Sensor Signal circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 8

No >> Repair the (B22) Rear Wheel Speed Sensor Signal circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C102B-REAR WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

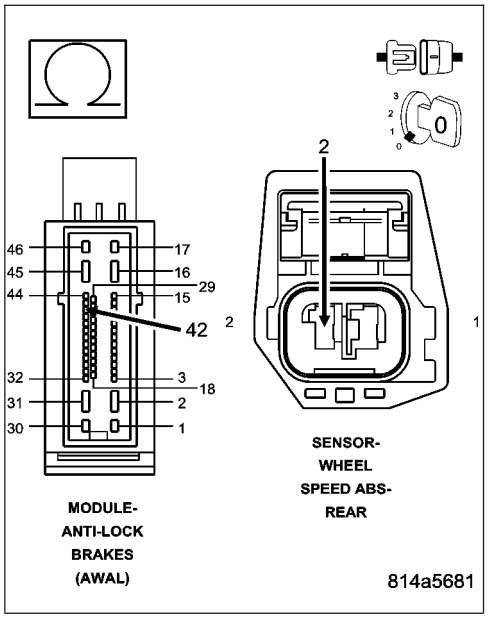
8. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN

Measure the resistance of the (B222) Rear Wheel Speed Sensor Supply circuit.

Is the resistance below 5 ohms?

Yes >> Go To 9

No >> Repair the open (B222) Rear Wheel Speed Sensor Supply circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



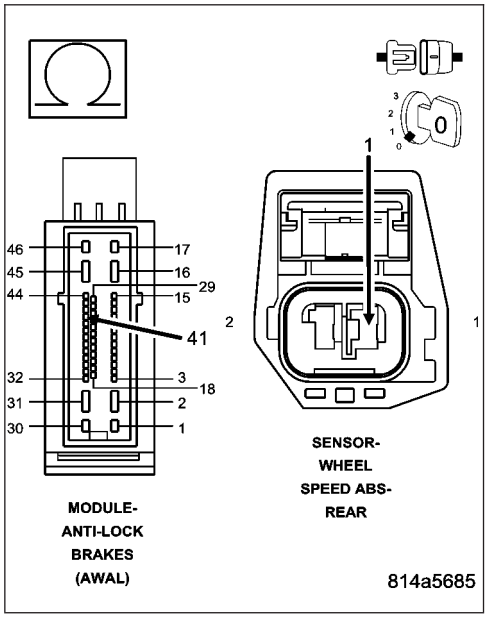
9. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the (B22) Rear Wheel Speed Sensor Signal circuit.

Is the resistance below 5 ohms?

Yes >> Go To 10

No >> Repair the open (B22) Rear Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

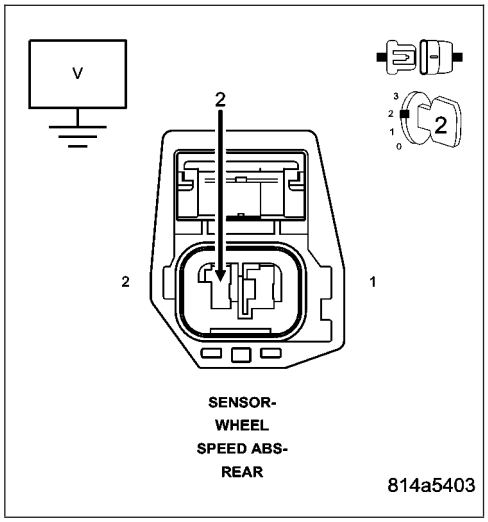


C102B-REAR WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

10. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (B222) Rear Wheel Speed Sensor Supply circuit.



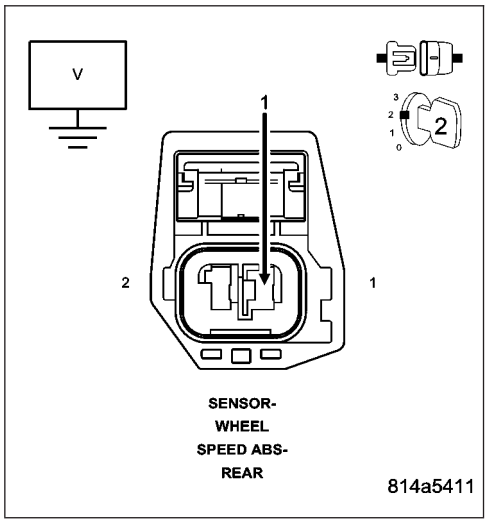
Is there any voltage present?

Yes >> Repair (B222) Rear Wheel Speed Sensor Supply circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 11

11. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (B22) Rear Wheel Speed Sensor Signal circuit.



Is there any voltage present?

Yes >> Repair the (B22) Rear Wheel Speed Sensor Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

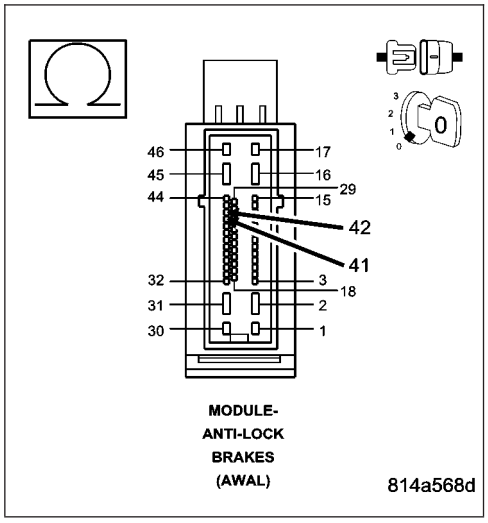
No >> Go To 12

C102B-REAR WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

12. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and the (B22) Rear Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair (B222) Rear Wheel Speed Sensor Supply circuit for a short to the (B22) Rear Wheel Speed Sensor Signal circuit.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 13

---

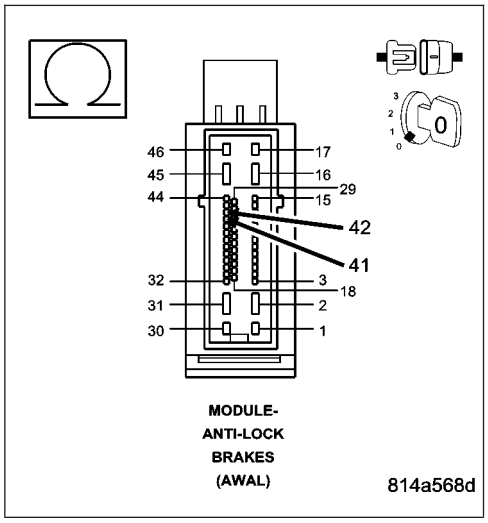
13. REAR WHEEL SPEED SENSOR

Turn the ignition off.

Connect the Rear Wheel Speed Sensor harness connector.

Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and (B22) Rear Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

NOTE: The resistance should be approximately 1600–2300 ohms at 76 degrees F.



Is the resistance within the noted range?

Yes >> Go to 14

No >> Replace the Rear Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C102B-REAR WHEEL SPEED SENSOR CIRCUIT (340) (CONTINUED)

14. ANTI-LOCK BRAKE MODULE

Turn the ignition off.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

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15. WIRING HARNESS INSPECTION

Turn the ignition off.

NOTE: Towing the vehicle with ignition ON may set this DTC.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

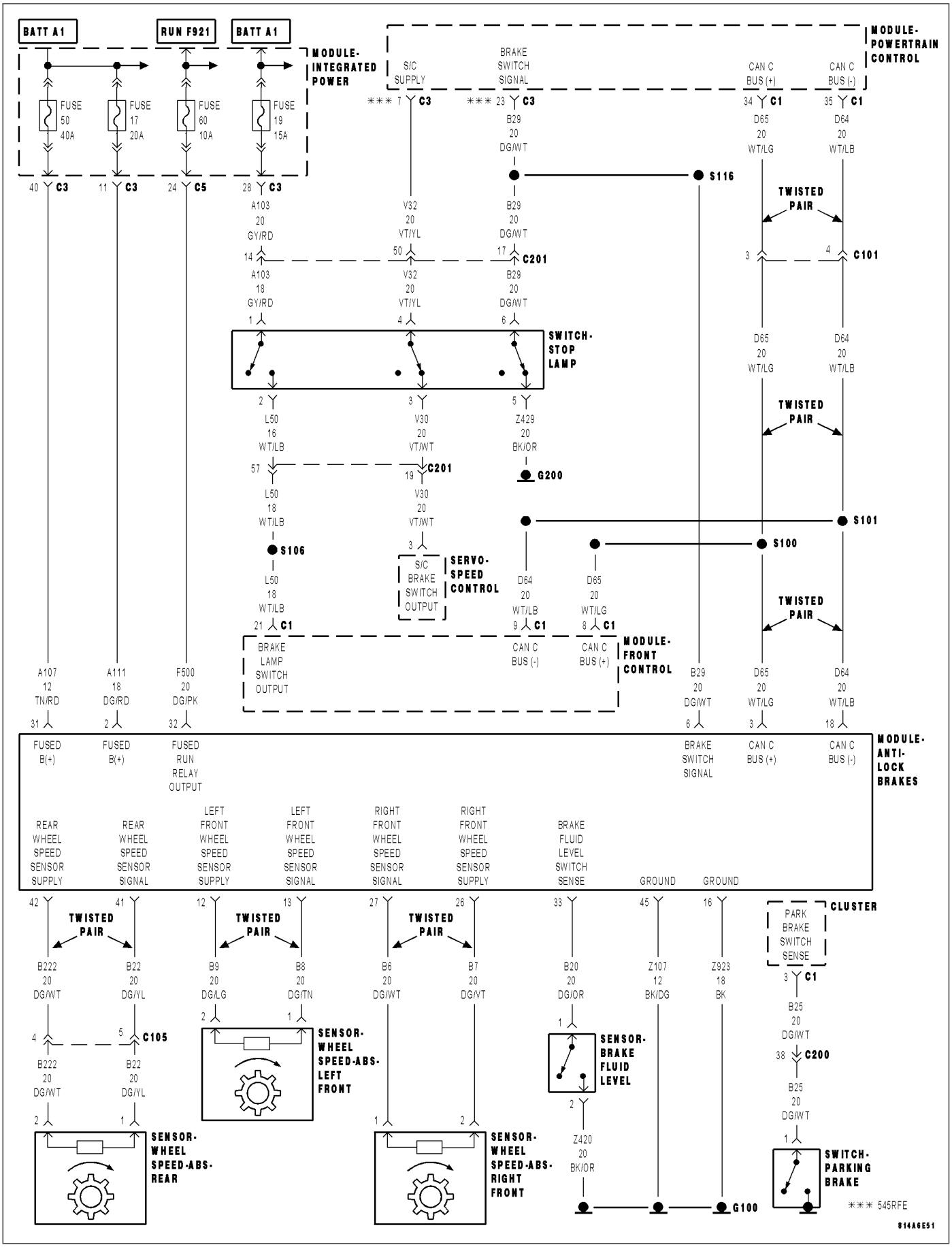
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340)



C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no system under voltage or over voltage condition present.
- **Set Condition:**
  Each time excessive wheel speed sensor acceleration or deceleration is detected, a fault counter increments. If the fault counter exceeds a specified value, the DTC will set.

Possible Causes
INTERMITTENT REAR WHEEL SPEED SENSOR DTC
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORT TO GROUND
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT
TONE WHEEL
EXCESSIVE REAR WHEEL SPEED SENSOR AIR GAP
WHEEL BEARING
REAR WHEEL SPEED SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2
No >> Go To 15

C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

2. WHEEL SPEED SENSOR INSPECTION

Turn the ignition off.

Inspect the Wheel Speed Sensor for proper mounting.

Inspect the Wheel Speed Sensor harness and connector.

Inspect the Wheel Speed Sensor for excessive debris on the sensor.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

---

3. TONE WHEEL DAMAGED/MISSING

Inspect the Tone Wheel in accordance with the Service Information.

NOTE: The Tone Wheel Teeth should be perfectly square, not bent or nicked.

Were any problems found?

Yes >> Replace the Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. EXCESSIVE WHEEL SPEED SENSOR AIR GAP

Measure the Wheel Speed Sensor Air Gap in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. WHEEL BEARING LOOSE/BINDING

Inspect the wheel bearings for excessive run out or improper clearance in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 6

C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

6. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Rear Wheel Speed Sensor harness connector.

Disconnect the Anti-lock Brake Module harness connector.

NOTE: Check connector - Clean/repair as necessary.

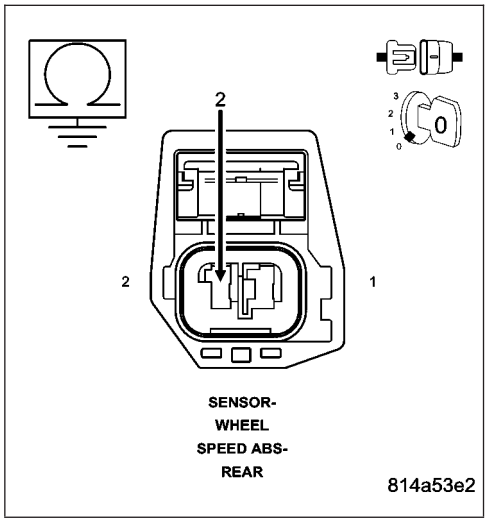
Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 7

No >> Repair the (B222) Rear Wheel Speed Sensor Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



7. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

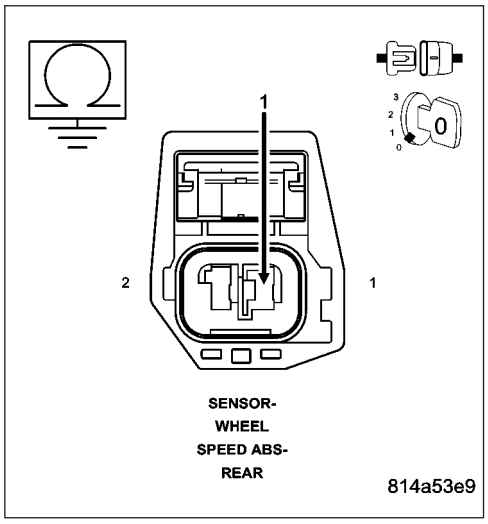
Measure the resistance between the (B22) Rear Wheel Speed Sensor Signal circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 8

No >> Repair the (B22) Rear Wheel Speed Sensor Signal circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

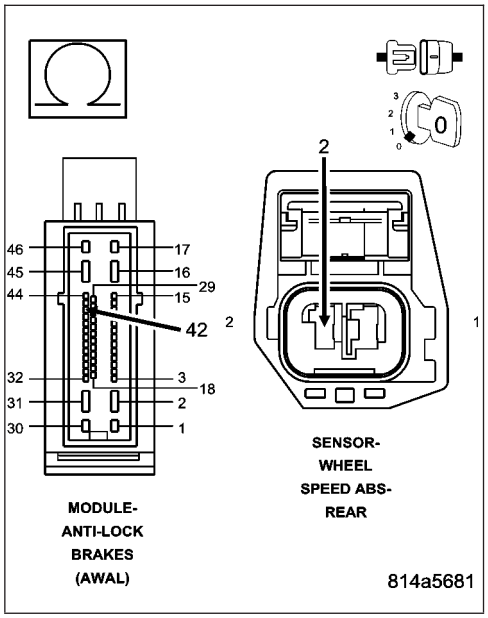
8. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN

Measure the resistance of the (B222) Rear Wheel Speed Sensor Supply circuit.

Is the resistance below 5 ohms?

Yes >> Go To 9

No >> Repair the open (B222) Rear Wheel Speed Sensor Supply circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



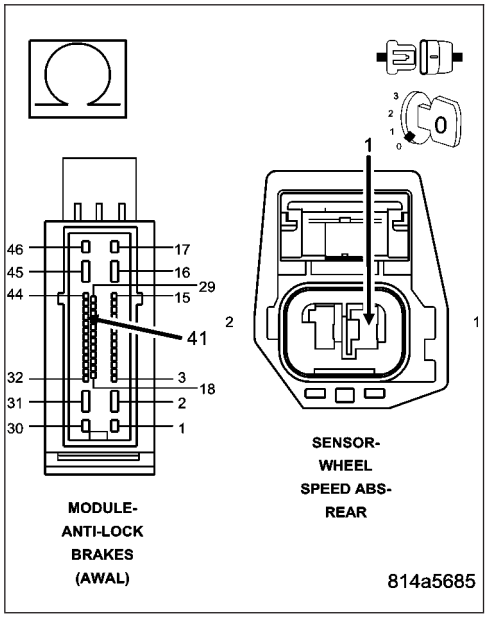
9. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the (B22) Rear Wheel Speed Sensor Signal circuit.

Is the resistance below 5 ohms?

Yes >> Go To 10

No >> Repair the open (B22) Rear Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

10. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE

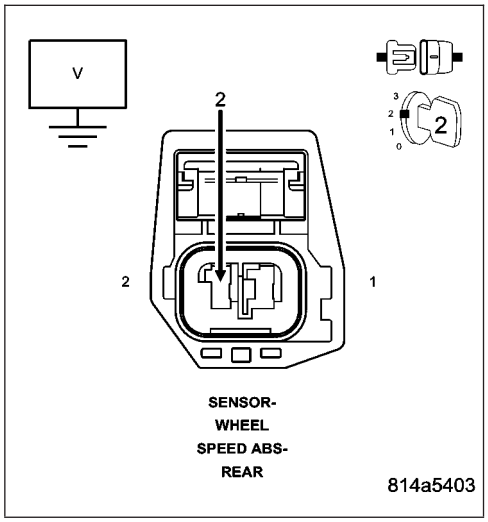
Turn the ignition on.

Measure the voltage of the (B222) Rear Wheel Speed Sensor Supply circuit.

Is there any voltage present?

Yes >> Repair (B222) Rear Wheel Speed Sensor Supply circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 11



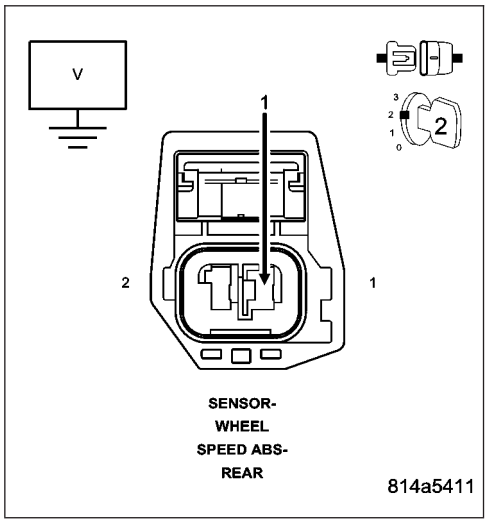
11. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (B22) Rear Wheel Speed Sensor Signal circuit.

Is there any voltage present?

Yes >> Repair the (B22) Rear Wheel Speed Sensor Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 12

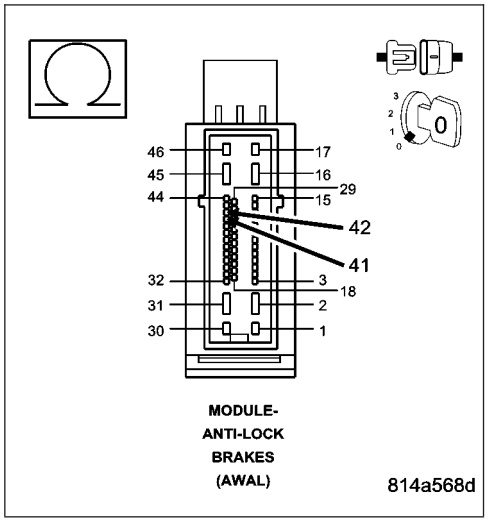


C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

12. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and the (B22) Rear Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair (B222) Rear Wheel Speed Sensor Supply circuit for a short to the (B22) Rear Wheel Speed Sensor Signal circuit.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 13

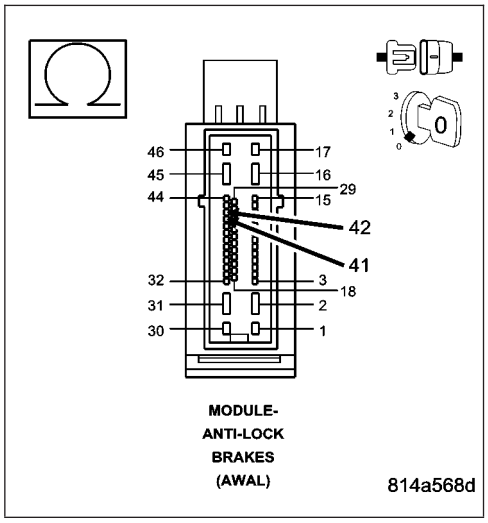
---

13. REAR WHEEL SPEED SENSOR

Turn the ignition off.

Connect the Rear Wheel Speed Sensor harness connector.

Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and (B22) Rear Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.



NOTE: The resistance should be approximately 1600–2300 ohms at 76 degrees F.

Is the resistance within the noted range?

Yes >> Go to 14

No >> Replace the Rear Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C1032-REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE (340) (CONTINUED)

14. ANTI-LOCK BRAKE MODULE

Turn the ignition off.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

---

15. WIRING HARNESS INSPECTION

Turn the ignition off.

NOTE: Towing the vehicle with ignition ON may set this DTC.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

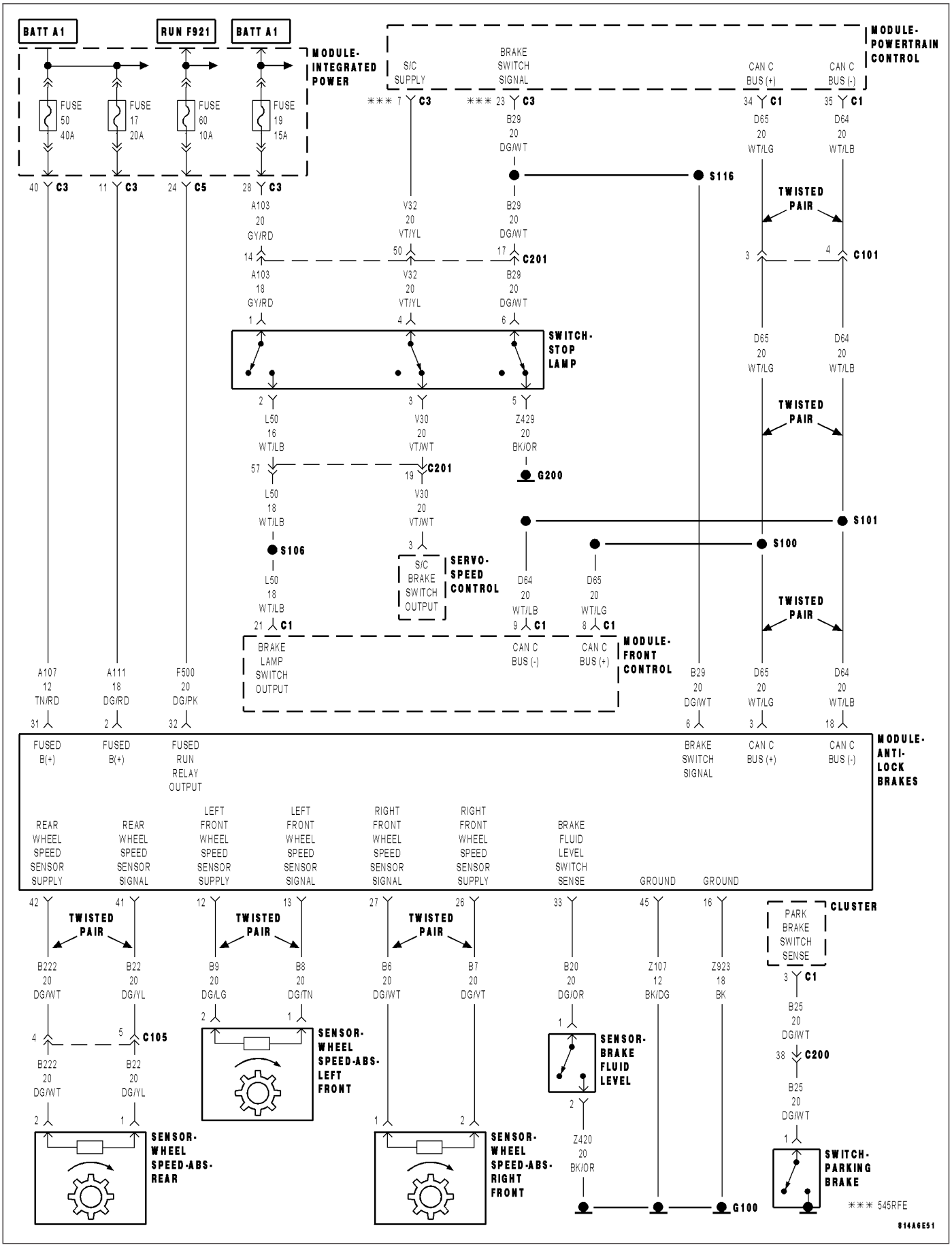
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C1035-REAR WHEEL SPEED COMPARATIVE PERFORMANCE (340)



C1035-REAR WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, no system under voltage or over voltage condition present, no open or shorted wheel speed sensor DTCs set, vehicle not under high acceleration, and vehicle speed greater than 0.
- **Set Condition:**
  This DTC will set if either one wheel is sensed above a predetermined range for 5000 msec while the other wheels are below 20% of maximum velocity of all wheels OR if more than one wheel is sensed at below 20% of maximum velocity of all wheels while at least one wheel is sensed above a predetermined range. The condition must exist for 2 minutes for this DTC to set.
  If the number of missing sensors changes at any update, the fault monitor is reset.

Possible Causes
INTERMITTENT REAR WHEEL SPEED SENSOR DTC
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORT TO GROUND
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
(B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT
TONE WHEEL
EXCESSIVE REAR WHEEL SPEED SENSOR AIR GAP
WHEEL BEARING
REAR WHEEL SPEED SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2

No >> Go To 15

C1035-REAR WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

2. WHEEL SPEED SENSOR INSPECTION

Turn the ignition off.

Inspect the Wheel Speed Sensor for proper mounting.

Inspect the Wheel Speed Sensor harness and connector.

Inspect the Wheel Speed Sensor for excessive debris on the sensor.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

---

3. TONE WHEEL DAMAGED/MISSING

Inspect the Tone Wheel in accordance with the Service Information.

NOTE: The Tone Wheel Teeth should be perfectly square, not bent or nicked.

Were any problems found?

Yes >> Replace the Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. EXCESSIVE WHEEL SPEED SENSOR AIR GAP

Measure the Wheel Speed Sensor Air Gap in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. WHEEL BEARING LOOSE/BINDING

Inspect the wheel bearings for excessive run out or improper clearance in accordance with the Service Information.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 6

C1035-REAR WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

6. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Rear Wheel Speed Sensor harness connector.

Disconnect the Anti-lock Brake Module harness connector.

NOTE: Check connector - Clean/repair as necessary.

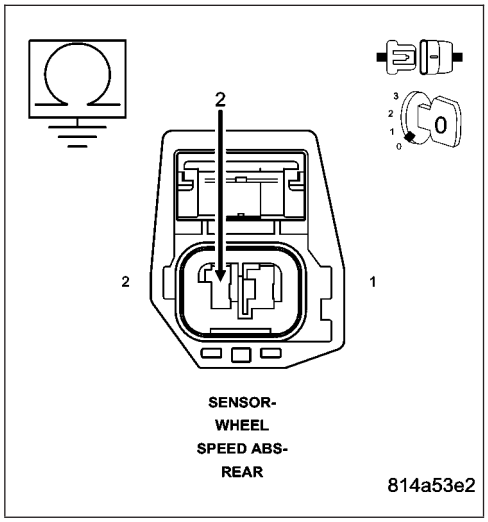
Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 7

No >> Repair the (B222) Rear Wheel Speed Sensor Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



7. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

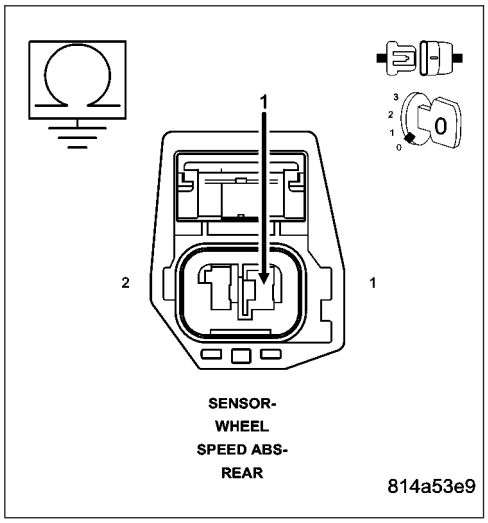
Measure the resistance between the (B22) Rear Wheel Speed Sensor Signal circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Go To 8

No >> Repair the (B22) Rear Wheel Speed Sensor Signal circuit for a short to ground.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C1035-REAR WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

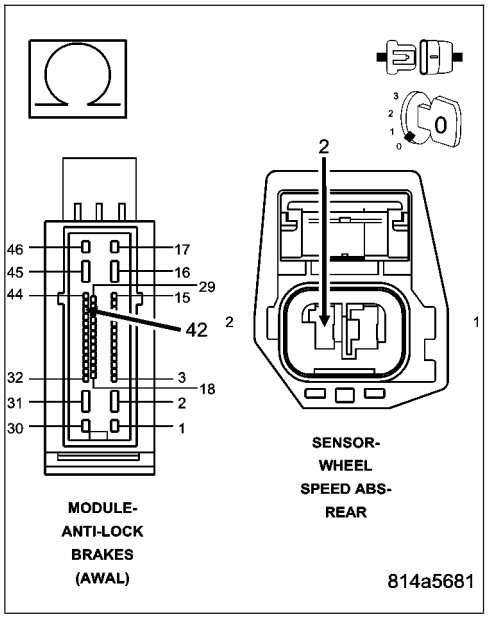
8. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT OPEN

Measure the resistance of the (B222) Rear Wheel Speed Sensor Supply circuit.

Is the resistance below 5 ohms?

Yes >> Go To 9

No >> Repair the open (B222) Rear Wheel Speed Sensor Supply circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



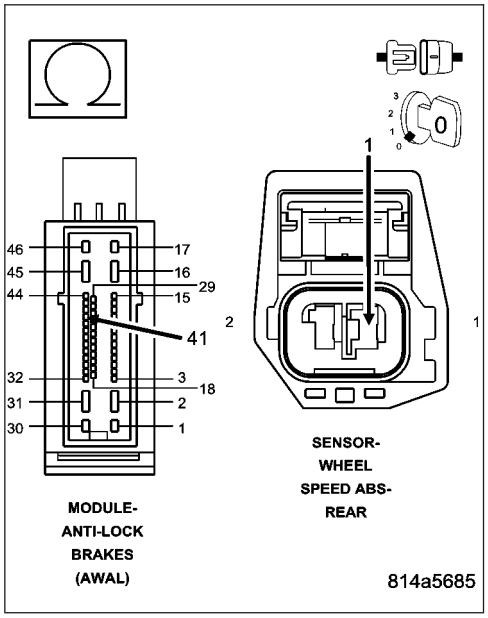
9. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the (B22) Rear Wheel Speed Sensor Signal circuit.

Is the resistance below 5 ohms?

Yes >> Go To 10

No >> Repair the open (B22) Rear Wheel Speed Sensor Signal circuit.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C1035-REAR WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

10. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE

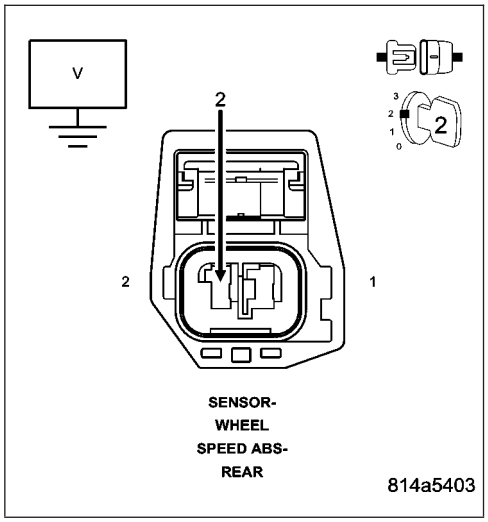
Turn the ignition on.

Measure the voltage of the (B222) Rear Wheel Speed Sensor Supply circuit.

Is there any voltage present?

Yes >> Repair (B222) Rear Wheel Speed Sensor Supply circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 11



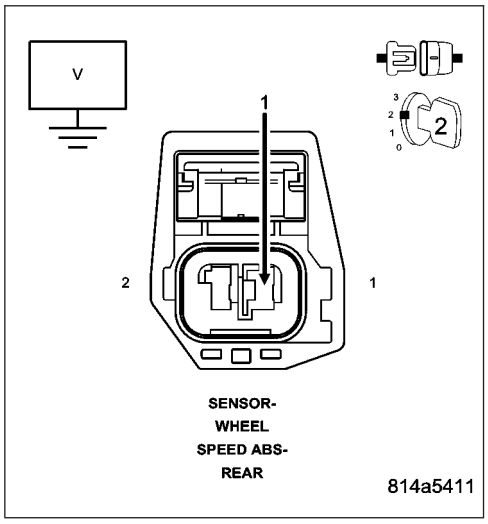
11. (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (B22) Rear Wheel Speed Sensor Signal circuit.

Is there any voltage present?

Yes >> Repair the (B22) Rear Wheel Speed Sensor Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 12

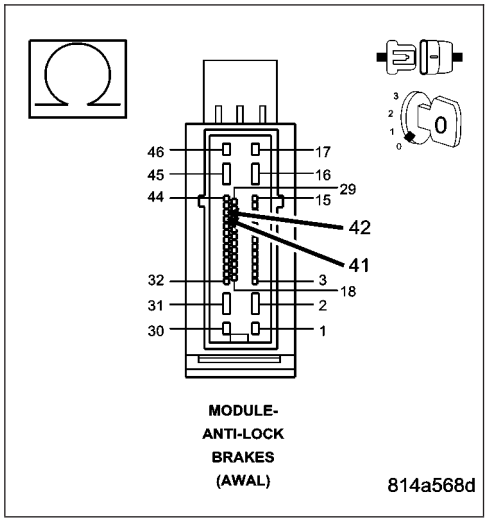


C1035-REAR WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

12. (B222) REAR WHEEL SPEED SENSOR SUPPLY CIRCUIT SHORTED TO THE (B22) REAR WHEEL SPEED SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and the (B22) Rear Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair (B222) Rear Wheel Speed Sensor Supply circuit for a short to the (B22) Rear Wheel Speed Sensor Signal circuit.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 13

---

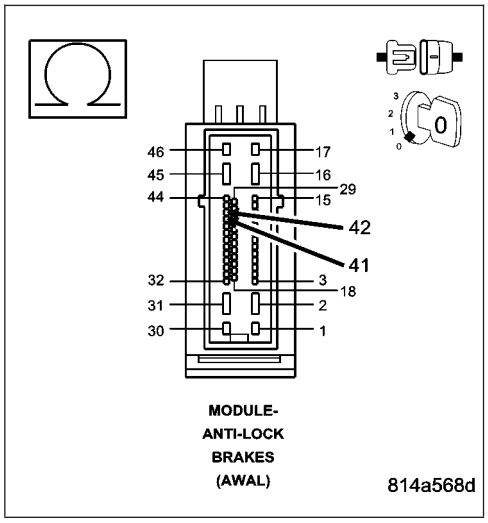
13. REAR WHEEL SPEED SENSOR

Turn the ignition off.

Connect the Rear Wheel Speed Sensor harness connector.

Measure the resistance between the (B222) Rear Wheel Speed Sensor Supply circuit and (B22) Rear Wheel Speed Sensor Signal circuit at the Anti-lock Brake Module harness connector.

NOTE: The resistance should be approximately 1600–2300 ohms at 76 degrees F.



Is the resistance within the noted range?

Yes >> Go to 14

No >> Replace the Rear Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C1035-REAR WHEEL SPEED COMPARATIVE PERFORMANCE (340) (CONTINUED)

14. ANTI-LOCK BRAKE MODULE

Turn the ignition off.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

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15. WIRING HARNESS INSPECTION

Turn the ignition off.

NOTE: Towing the vehicle with ignition ON may set this DTC.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

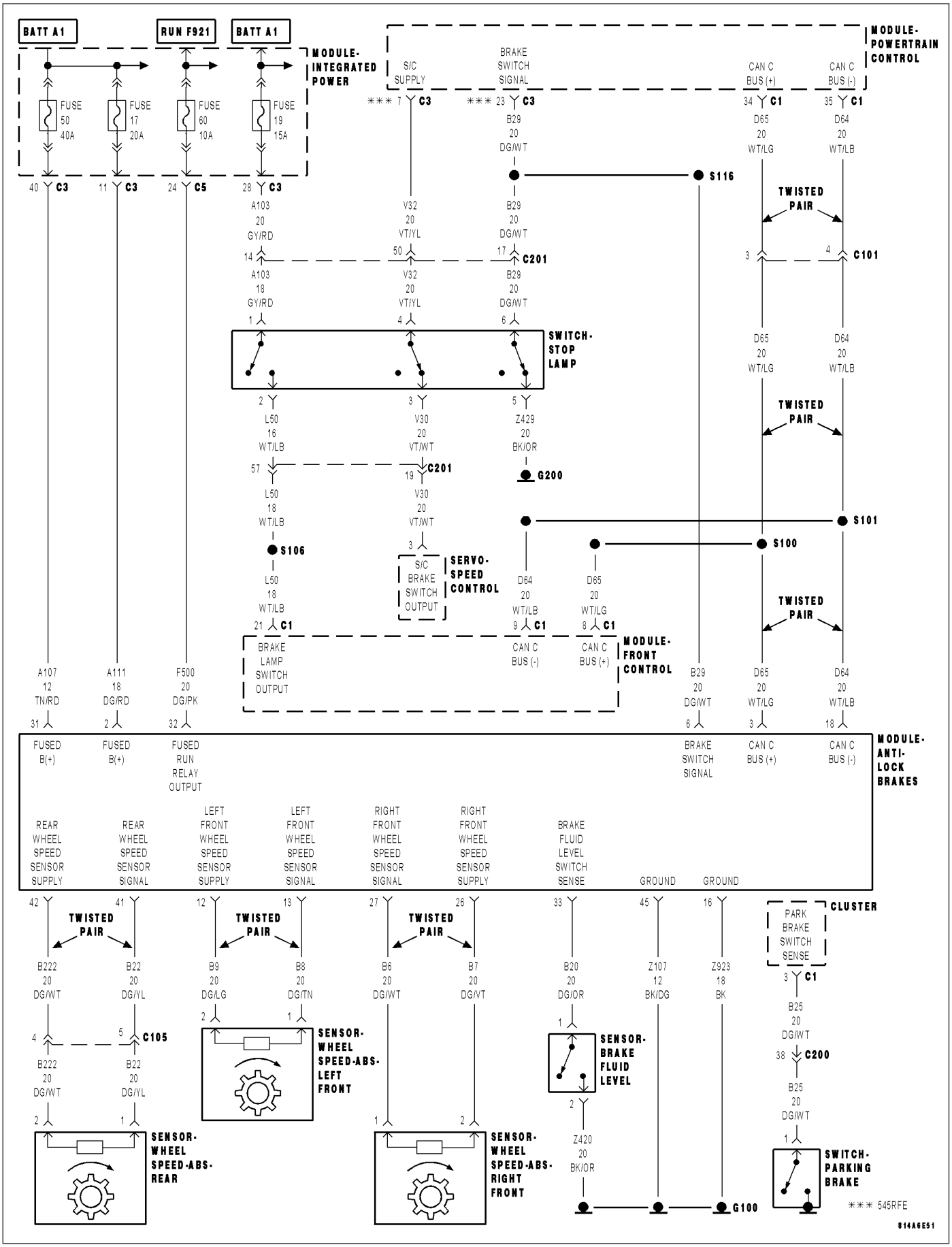
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C1073–ABS MOTOR CONTROL CIRCUIT (340)



C1073–ABS MOTOR CONTROL CIRCUIT (340) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no system under voltage condition present.
- **Set Condition:**
  OPEN CIRCUIT: If pump motor feedback remains greater than 0.75 volts for more than 50 msec (+/- 5 msec) after monitoring conditions are met, the DTC will set.
  LOCKED MOTOR: If the module detects that the motor is spinning at less than 500 r.p.m. after monitoring conditions are met, the DTC will set.
  LOW VOLTAGE: The voltage of the supply is monitored every 3 msec. If the voltage is low for 150 msec, the DTC will set.

Possible Causes
INTERMITTENT ABS MOTOR CONTROL CIRCUIT DTC
(A107) FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE
(Z107) OR (Z923) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, actuate the ABS pump motor.

Did the Pump Motor operate when actuated?

No >> Go To 2

Yes >> Go To 5

---

2. (A107) FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.
Disconnect the Anti-lock Brake Module harness connector.

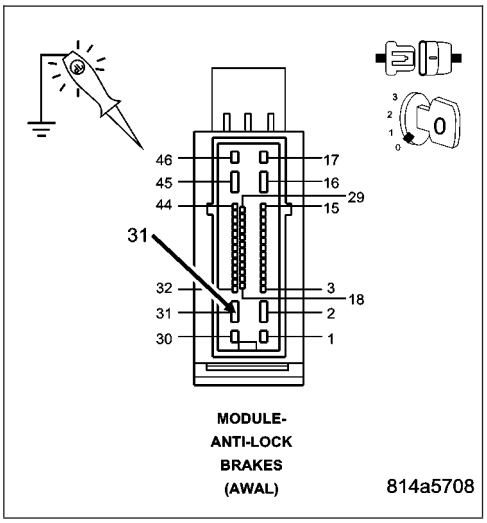
NOTE: Note: Check connector - Clean/repair as necessary.
Using a 12–volt test light connected to ground, check the (A107) Fused B+ Circuit.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

Yes >> Go To 3

No >> Repair the (A107) Fused B+ Circuit for an open circuit or high resistance.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



C1073–ABS MOTOR CONTROL CIRCUIT (340) (CONTINUED)

3. (Z107) or (Z923) GROUND CIRCUIT OPEN OR HIGH RESISTANCE

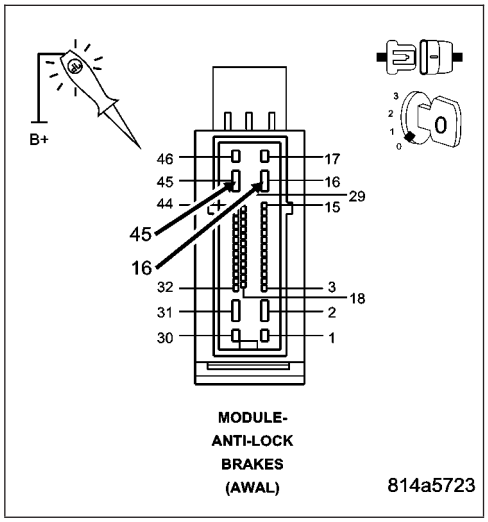
Using a 12–volt test light connected to 12–volts, check the (Z107) and (Z923) Ground circuits.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

Yes >> Go To 4

No >> Repair the (Z107) or (Z923) Ground Circuit(s) for an open circuit or high resistance.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



4. ANTI-LOCK BRAKE MODULE

Turn the ignition off.
Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.
Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> If no other problems are found, replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

5. WIRING HARNESS INSPECTION

Turn the ignition off.
Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.
Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C1078–TIRE REVOLUTIONS RANGE PERFORMANCE (340)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The DTC will set if the stored tire size is out of range.

Possible Causes
INTERMITTENT TIRE REVOLUTIONS RANGE PERFORMANCE DTC
INCORRECT TIRE SIZE PROGRAMMED INTO ANTI-LOCK BRAKE MODULE
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC CONDITION IS PRESENT

Turn the ignition on.
Observe the ABS Warning Indicator.

Is the ABS Warning Indicator Flashing?

Yes >> Go To 2

No >> Go To 3

---

2. INCORRECT TIRES PROGRAMMED INTO ANTI-LOCK BRAKE MODULE

Inspect all four tires on the vehicle and note the size of each tire.

NOTE: A non-production size tire cannot be programmed into the CAB. The production Powertrain, with the production size tires, is the only emissions certified configuration that is available for reprogramming.
Turn the ignition on.
With the scan tool, read the tire size that is programmed into the CAB.

Does the displayed tire size match the actual tire size on the vehicle?

Yes >> Replace the Anti-lock Brake Module in accordance with the Service Information. Refer to the symptom *Replacing the Anti-lock Brake Module for additional information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Reprogram the tire size in accordance with the Service Information. Make sure that the ignition is on throughout the reprogramming procedure.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C1078–TIRE REVOLUTIONS RANGE PERFORMANCE (340) (CONTINUED)

3. WIRING HARNESS INSPECTION

Turn the ignition off.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Refer to any Hotline letters or Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C1079-TONE WHEEL TEETH COUNT RANGE PERFORMANCE (340)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The DTC will set if the stored tone wheel tooth count is out of range.

Possible Causes
TONE RING/AXLE SIZE MISMATCH
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. TONE RING/AXLE SIZE MISMATCH

Turn the ignition on.

With the scan tool, determine the axle size that is programmed into the Anti-lock Brake Module.

Inspect and identify the vehicle axle size.

Compare the axle size programmed into the Anti-lock Brake Module, and the actual axle size installed into the vehicle.

Does the programmed axle size match the installed axle?

Yes >> Replace the Anti-lock Brake Module in accordance with the Service Information. Refer to the symptom *Replacing the Anti-lock Brake Module for additional information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Reprogram the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C1239-EMISSION ROLLS TEST ACTIVE (340)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and no BUS communication failure DTCs present.
- **Set Condition:**
  If the Anti-lock Brake Module receives two messages in a row indicating that the extended diagnostic session is active. ABS is inhibited during the extended diagnostic session.

Possible Causes
CAN COMMUNICATION DTCS(S) PRESENT
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS PRESENT

NOTE: Ensure the battery is fully charged.
Turn the ignition on.
With the scan tool clear DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool select View DTCs in the Anti-lock Brake Module.

Is the status Active for this DTC?

Yes >> Go To 2

No >> Go To 3

---

2. ANTI-LOCK BRAKE MODULE

Turn the ignition on.
With the scan tool, select View DTCs in each module on the CAN B BUS and the CAN C BUS.

Are there CAN BUS communication DTCs present in any other module?

Yes >> Perform the appropriate diagnostic procedure before continuing with this test.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C1239-EMISSION ROLLS TEST ACTIVE (340) (CONTINUED)

3. INTERMITTENT COMMUNICATION DTC

The condition necessary to set this DTC is not present at this time.

This DTC will set if the Anti-lock Brake Module receives 2 messages in a row from the FCM indicating that the Emissions Rolls test is active.

With the scan tool, select View DTCs in each of the modules on the CAN B BUS and the CAN C BUS. If there are any communications DTCs present, perform the appropriate diagnostic procedure.

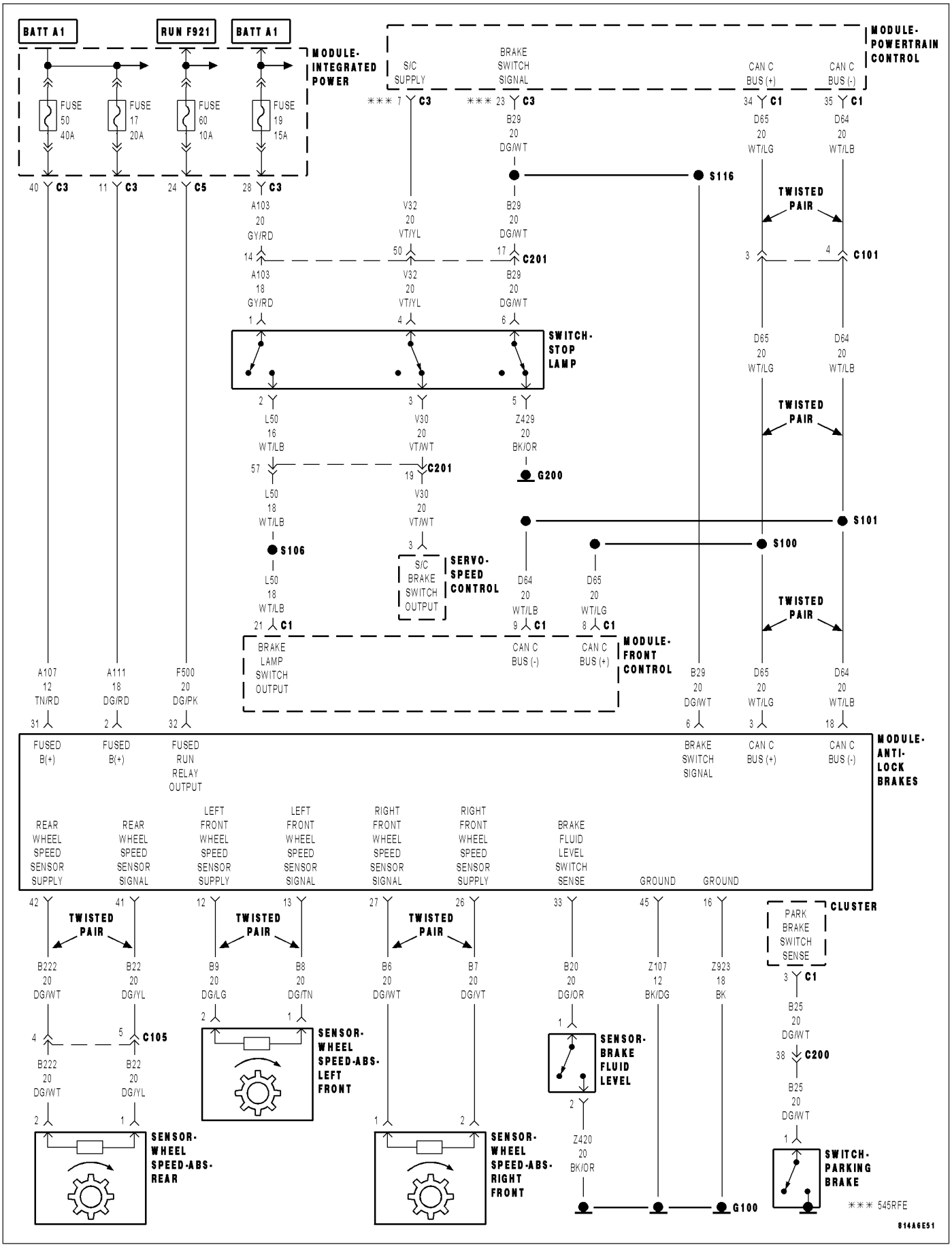
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C2100-BATTERY VOLTAGE LOW (340)



C2100-BATTERY VOLTAGE LOW (340) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  If the sensed ignition voltage drops below 10.0 volts for 100 msec.

Possible Causes
INTERMITTENT BATTERY VOLTAGE LOW DTC
(F500) FUSED RUN RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
(Z107) OR (Z923) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

NOTE: Diagnose and repair any powertrain Charging system DTCs before continuing with this procedure.

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

With the Scan tool, select View DTCs in the Anti-lock Brake Module. Record all DTC information.

Turn the ignition off.

Start the engine.

With the Scan tool read DTCs.

Is the status Active for this DTC?

Yes >> Go To 2

No >> Go To 4

---

2. (F500) FUSED RUN RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

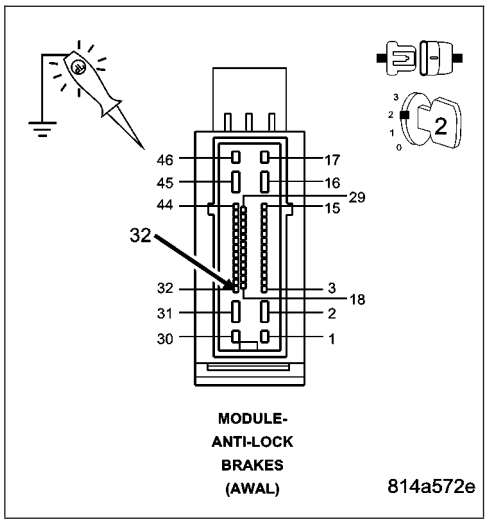
Disconnect the Anti-lock Brake Module harness connector.

Check connectors - Clean/repair as necessary.

Turn the ignition on.

Using a 12–volt test light connected to ground, check the (F500) Fused Run Relay Output circuit.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.



Is the test light illuminated and bright?

Yes >> Go To 3

No >> Repair the (F500) Fused Run Relay Output circuit for an open circuit or high resistance.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C2100-BATTERY VOLTAGE LOW (340) (CONTINUED)

3. (Z107) OR (Z923) GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Using a 12–volt test light connected to B+, check the (Z107) and the (Z923) Ground circuit.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

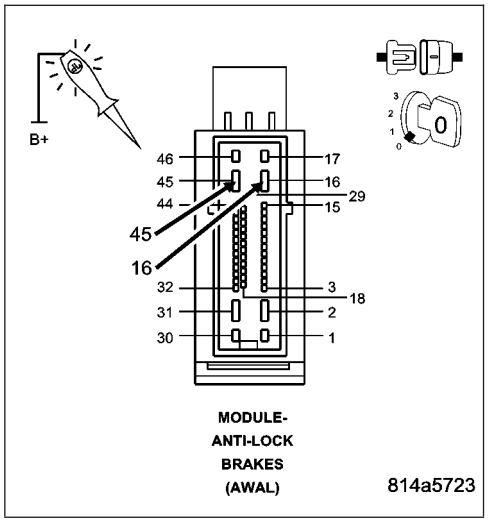
Is the test light illuminated and bright?

Yes >> Replace the Anti-lock Brake Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Repair the (Z107) and/or the (Z923) Ground circuit(s) for an open circuit or high resistance.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)



---

4. INTERMITTENT DTC

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Check connectors - Clean/repair as necessary.

Inspect the vehicle for aftermarket accessories that may exceed the Charging System output.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C2101-BATTERY VOLTAGE HIGH (340)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and no system undervoltage DTC active.
- **Set Condition:**
  If the sensed ignition voltage is greater than 16 volts for 100 msec.

Possible Causes
INTERMITTENT BATTERY VOLTAGE HIGH DTC
POWERTRAIN CHARGING SYSTEM DTCS PRESENT
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

NOTE: Diagnose and repair any powertrain Charging system DTCs before continuing with this procedure.

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

With the Scan tool, select View DTCs in the Anti-lock Brake Module. Record all DTC information.

Turn the ignition off.

Start the engine.

With the Scan tool read DTCs.

Is the status Active for this DTC?

Yes >> If there are no powertrain charging system DTCs present, replace the Anit-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. INTERMITTENT DTC

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Check connectors - Clean/repair as necessary.

Inspect the vehicle for aftermarket accessories that may exceed the Charging System output.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C2200-ANTI-LOCK BRAKE MODULE INTERNAL (340)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The Anti-lock Brake Module has detected an error after a system self test.

Possible Causes
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. ANTI-LOCK BRAKE MODULE INTERNAL CONDITION

The Anti-lock Brake Module is reporting internal errors.

NOTE: Before continuing, check the Anti-lock Brake Module harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.
Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C2202-ORIGINAL VIN MISMATCH / MISSING (340)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  This DTC will set if the current VIN does not match the broadcast VIN.

Possible Causes
ICOMMUNICATIONS DTC(S) PRESENT
POWERTRAIN CONTROL MODULE
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
With the scan tool, erase DTCs.
Turn the ignition off.
Turn the ignition on.
Wait ten seconds.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go To 2

No >> Go To 3

---

2. WRONG VIN PROGRAMMED IN PCM

Turn the ignition on.
With the scan tool, read the VIN in the PCM.
Compare VIN in the PCM to the vehicle VIN.

Is the correct VIN programmed in the PCM?

Yes >> Replace the Antilock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Replace the Powertrain Control Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

C2202-ORIGINAL VIN MISMATCH / MISSING (340) (CONTINUED)

3. COMMUNICATION DTCS PRESENT

Turn the ignition off.

With the scan tool, read DTCs in all other modules. If any communications DTCs are present, refer to the appropriate diagnostic procedure.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

C2206-VEHICLE CONFIGURATION MISMATCH (340)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  This DTC will set if the vehicle type is not identified or incorrectly identified.

Possible Causes
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. ANTI-LOCK BRAKE MODULE

NOTE: Diagnose and repair any Powertrain Control Module VIN or Communication DTCs before continuing with this test.

NOTE: If C2202–Original VIN Mismatch / Missing is set along with this DTC, perform the diagnostic procedure for C2202 before continuing with this test.

Turn the ignition on.

With the scan tool, clear DTCs.

Turn the ignition off.

Turn the ignition on.

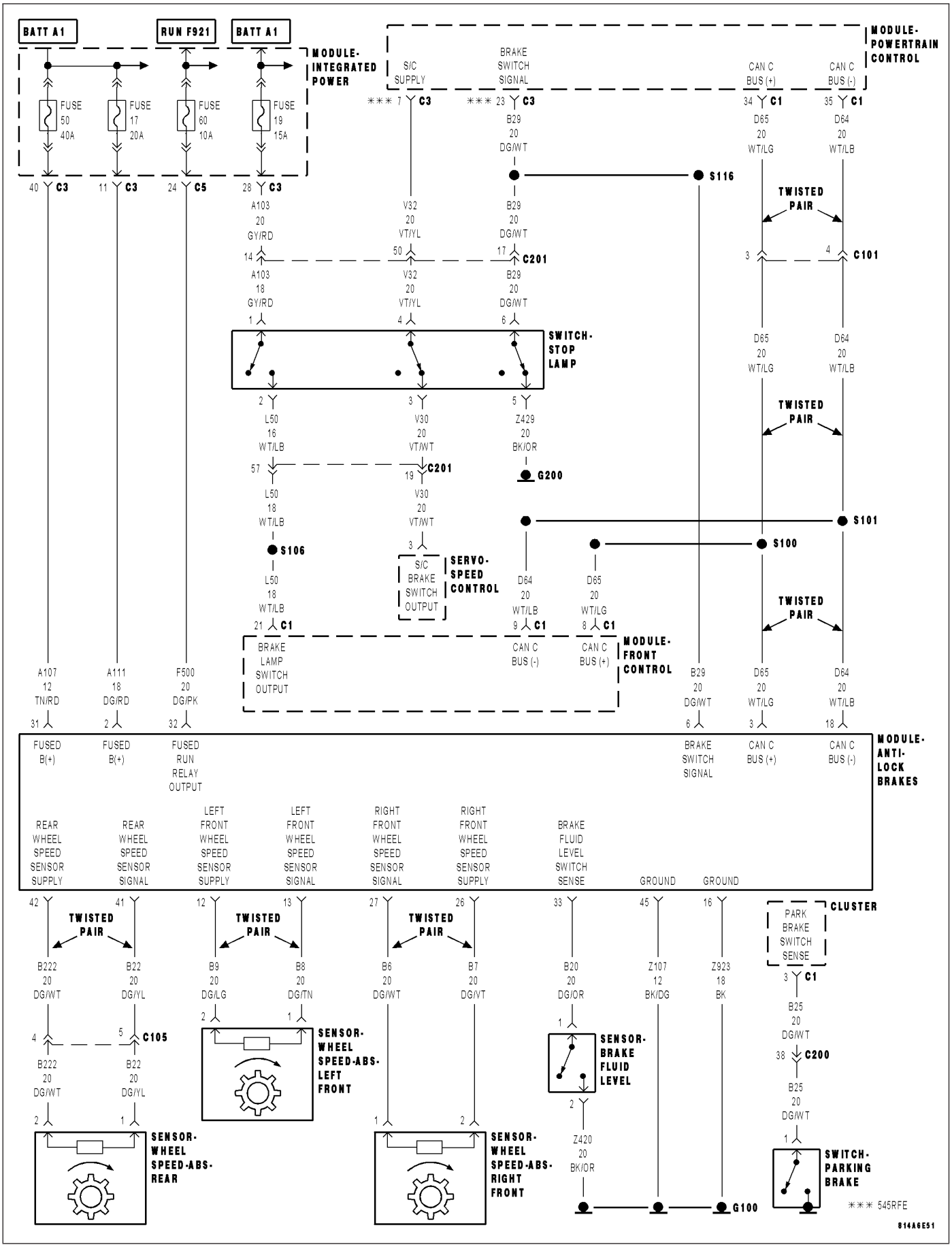
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Replace the Antilock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Use the scan tool to read DTCs in all other modules. If any communication DTCs are present, perform the appropriate diagnostic procedure. Refer to any Technical Service Bulletins that apply. If no problems are found, test is complete.

U0002–CAN C BUS OFF PERFORMANCE (340)



U0002–CAN C BUS OFF PERFORMANCE (340) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  Whenever the CAN C Bus (+) or CAN C Bus (-) is open, shorted to voltage or shorted to ground.

Possible Causes
INTERMITTENT CAN C BUS OFF PERFORMANCE DTC
CAN C BUS DTCs SET IN FRONT CONTROL MODULE
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.
With the scan tool, clear DTCs in the Anti-lock Brake Module.
Cycle the ignition from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.
With the scan tool, select View DTCs in the Anti-lock Brake Module.

Does the DTC reset and/or remain active?

Yes >> Go to 2

No >> Go to 6

---

2. CAN C BUS DTCs SET IN FRONT CONTROL MODULE

With the scan tool, select View DTCs in the Front Control Module (FCM).

Are there any active CAN C Bus DTCs?

Yes >> Refer to 8 — ELECTRICAL/ELECTRONIC CONTROL MODULES — DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No >> Go to 3

U0002–CAN C BUS OFF PERFORMANCE (340) (CONTINUED)

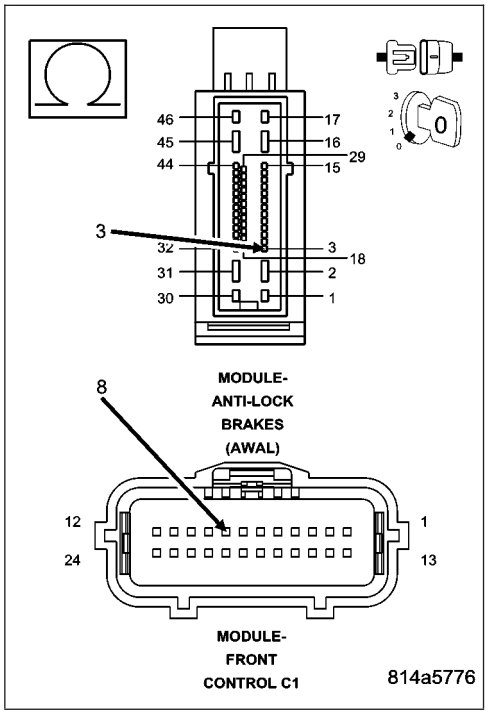
3. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Anti-lock Brake Module harness connector.

Disconnect the Front Control Module C1 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the Anti-lock Brake Module harness connector and the Front Control Module C1 harness connector.



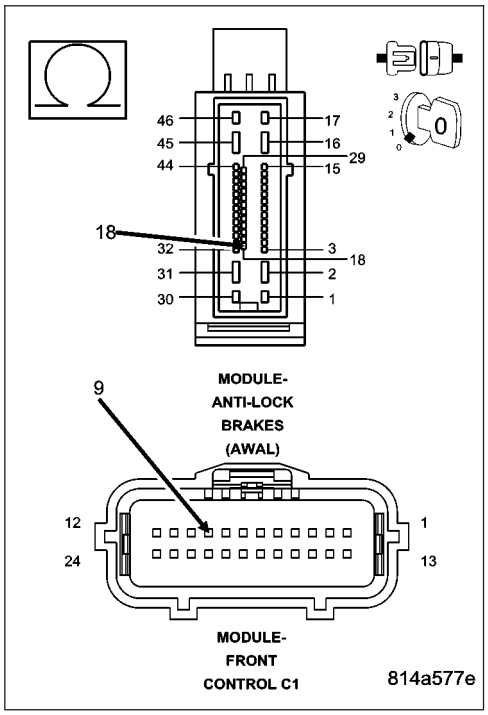
Is the resistance above 2.0 ohms?

Yes >> Repair the (D65) CAN C Bus (+) circuit for an open.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go to 4

4. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the Anti-lock Brake Module harness connector and the Front Control Module C1 harness connector.



Is the resistance above 2.0 ohms?

Yes >> Repair the (D64) CAN C Bus (-) circuit for an open.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go to 5

U0002–CAN C BUS OFF PERFORMANCE (340) (CONTINUED)

5. ANTI-LOCK BRAKE MODULE

Inspect the wiring between the Anti-lock Brake Module harness connector and the Front Control Module harness connector. If any problems are found, repair as necessary. If no problems are found, view repair.

Repair

Replace the Anti-lock Brake Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

---

6. INTERMITTENT CAN C BUS OFF PERFORMANCE DTC

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

Yes >> Repair as necessary.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test complete.

U0100–LOST COMMUNICATION WITH FRONT CONTROL MODULE (340)

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. LOST COMMUNICATION WITH POWERTRAIN CONTROL MODULE (PCM)

The Anti-lock Brake Module is reporting that network communication has been lost with the Powertrain Control Module (PCM).

View repair.

Repair

Refer to 8 — ELECTRICAL/ELECTRONIC CONTROL MODULES — DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE (340)

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. LOST COMMUNICATION WITH FRONT CONTROL MODULE (FCM)

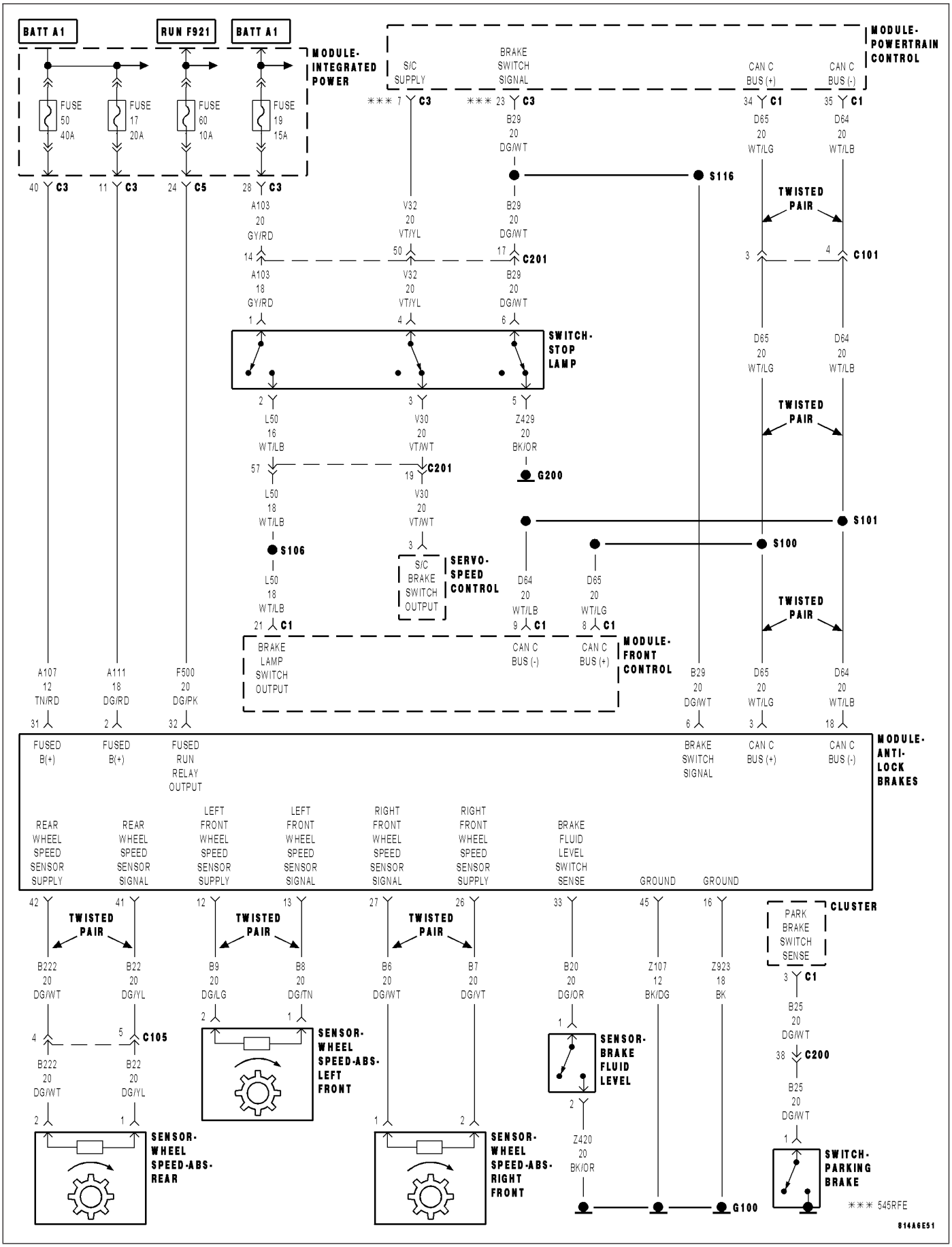
The Anti-lock Brake Module is reporting that network communication has been lost with the Front Control Module (FCM).

View repair.

Repair

Refer to 8 — ELECTRICAL/ELECTRONIC CONTROL MODULES — DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U1003–ESP CAN C BUS PERFORMANCE (340)



U1003–ESP CAN C BUS PERFORMANCE (340) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  One of the CAN messages that is assigned to the basic CAN channel was missed by the CAN driver. This means that the whole system was very slow in responding to the CAN interrupts.

Possible Causes
INTERMITTENT ESP CAN C BUS PERFORMANCE DTC
CAN C BUS DTCs SET IN FRONT CONTROL MODULE
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.
With the scan tool, clear DTCs in the Anti-lock Brake Module.
Cycle the ignition from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.
With the scan tool, select View DTCs in the Anti-lock Brake Module.

Does the DTC reset and/or remain active?

Yes >> Go to 2

No >> Go to 6

---

2. CAN C BUS DTCs SET IN FRONT CONTROL MODULE

With the scan tool, select View DTCs in the Front Control Module (FCM).

Are there any active CAN C Bus DTCs?

Yes >> Refer to 8 — ELECTRICAL/ELECTRONIC CONTROL MODULES — DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No >> Go to 3

U1003–ESP CAN C BUS PERFORMANCE (340) (CONTINUED)

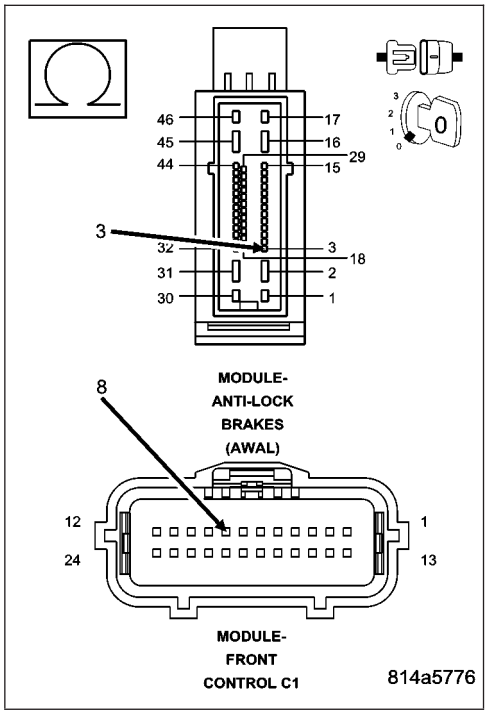
3. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Anti-lock Brake Module harness connector.

Disconnect the Front Control Module C1 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the Anti-lock Brake Module harness connector and the Front Control Module C1 harness connector.



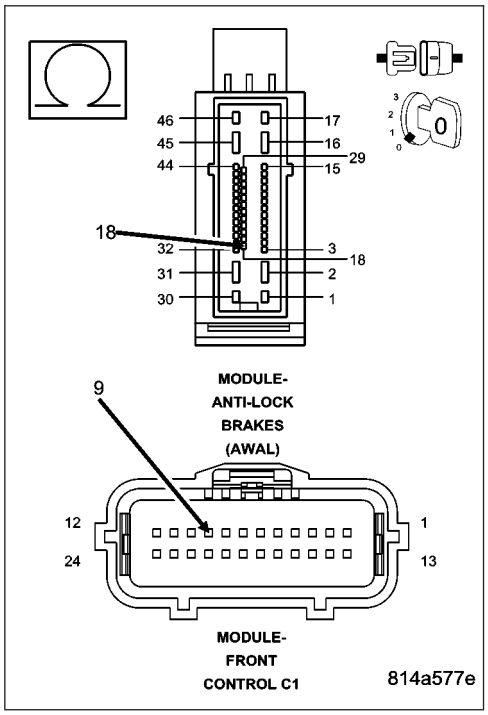
Is the resistance above 2.0 ohms?

Yes >> Repair the (D65) CAN C Bus (+) circuit for an open.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go to 4

4. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the Anti-lock Brake Module harness connector and the Front Control Module C1 harness connector.



Is the resistance above 2.0 ohms?

Yes >> Repair the (D64) CAN C Bus (-) circuit for an open.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go to 5

U1003–ESP CAN C BUS PERFORMANCE (340) (CONTINUED)

5. ANTI-LOCK BRAKE MODULE

Inspect the wiring between the Anti-lock Brake Module harness connector and the Front Control Module harness connector. If any problems are found, repair as necessary. If no problems are found, view repair.

Repair

Replace the Anti-lock Brake Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

---

6. INTERMITTENT ESP CAN C BUS PERFORMANCE DTC

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

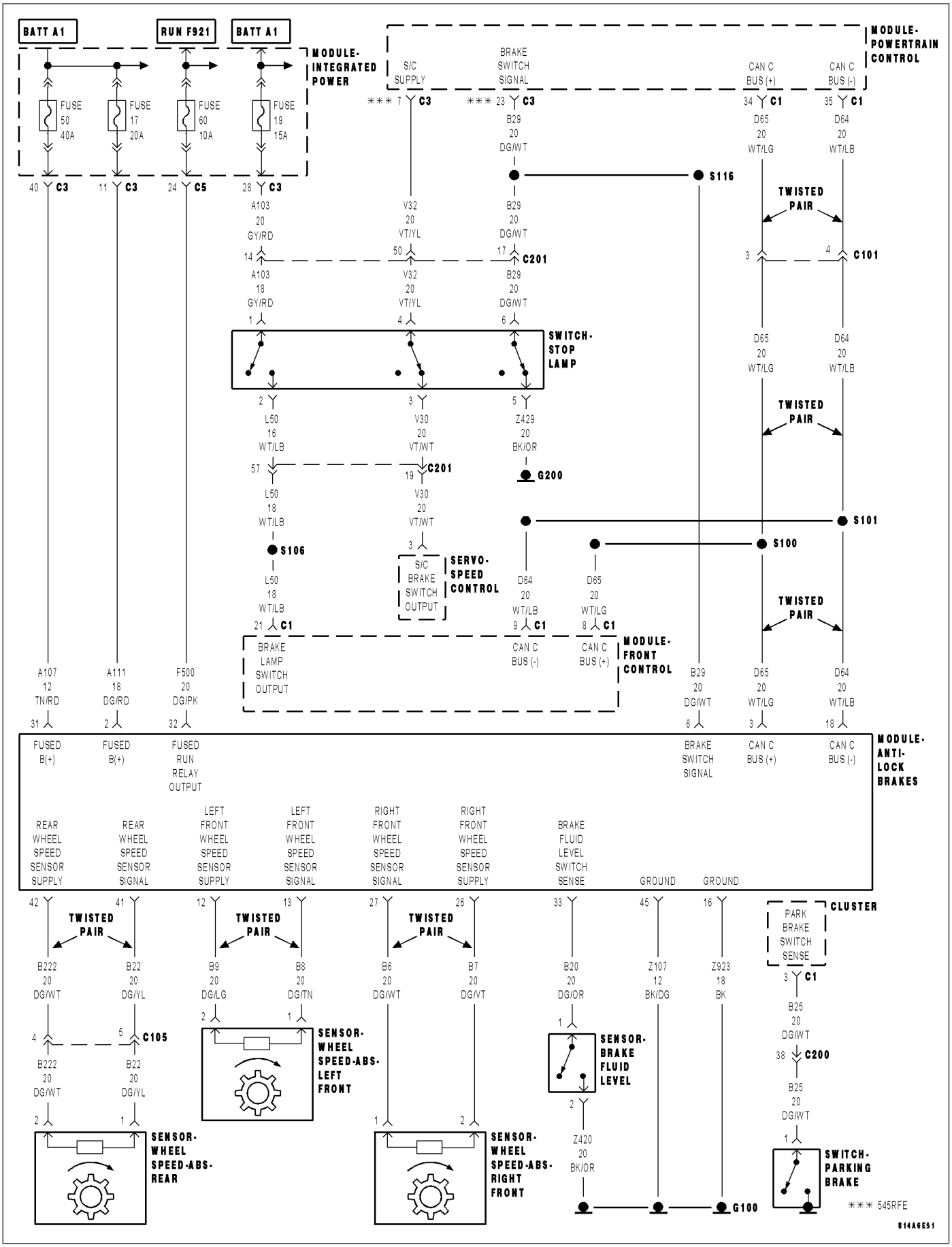
Were any problems found?

Yes >> Repair as necessary.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test complete.

U1004–CAN C BUS TRANSMIT PERFORMANCE (340)



U1004–CAN C BUS TRANSMIT PERFORMANCE (340) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The CAN frame does not receive acknowledgment for a predefined amount of time.

Possible Causes
INTERMITTENT CAN C BUS TRANSMIT PERFORMANCE DTC
CAN C BUS DTCs SET IN FRONT CONTROL MODULE
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, select Clear Stored DTCs in the Anti-lock Brake Module.

Cycle the ignition from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the Scan Tool, select View DTCs in the Anti-lock Brake Module.

Does the DTC reset and/or remain active?

Yes >> Go to 2

No >> Go to 6

---

2. CAN C BUS DTCs SET IN FRONT CONTROL MODULE

With the Scan Tool, select View DTCs in the Front Control Module (FCM).

Are there any active CAN C Bus DTCs?

Yes >> Refer to 8 — ELECTRICAL/ELECTRONIC CONTROL MODULES — DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No >> Go to 3

U1004–CAN C BUS TRANSMIT PERFORMANCE (340) (CONTINUED)

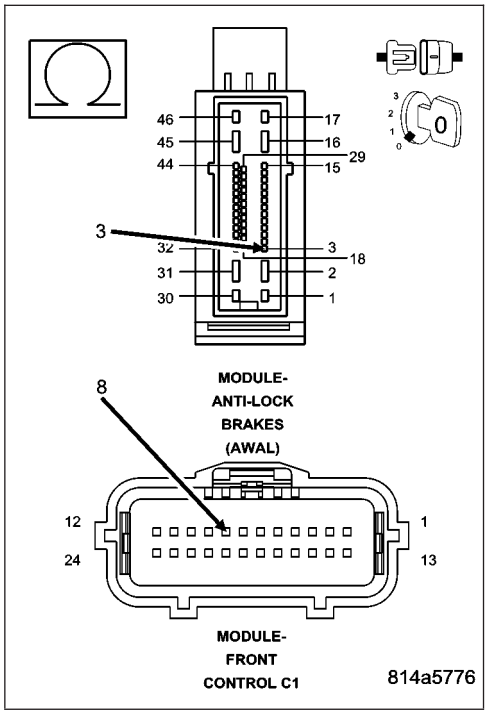
3. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Anti-lock Brake Module harness connector.

Disconnect the Front Control Module C1 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the Anti-lock Brake Module harness connector and the Front Control Module C1 harness connector.



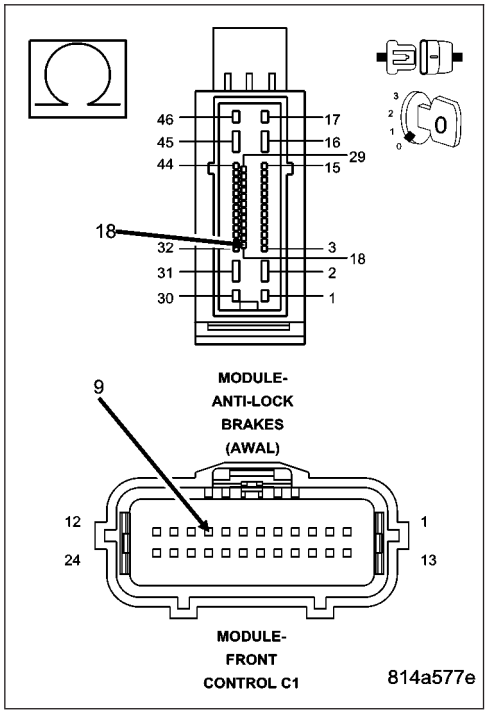
Is the resistance above 2.0 ohms?

Yes >> Repair the (D65) CAN C Bus (+) circuit for an open.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go to 4

4. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the Anti-lock Brake Module harness connector and the Front Control Module C1 harness connector.



Is the resistance above 2.0 ohms?

Yes >> Repair the (D64) CAN C Bus (-) circuit for an open.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go to 5

U1004–CAN C BUS TRANSMIT PERFORMANCE (340) (CONTINUED)

5. ANTI-LOCK BRAKE MODULE

Inspect the wiring between the Anti-lock Brake Module harness connector and the Front Control Module harness connector. If any problems are found, repair as necessary. If no problems are found, view repair.

Repair

Replace the Anti-lock Brake Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

---

6. INTERMITTENT CAN C BUS TRANSMIT PERFORMANCE DTC

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

Yes >> Repair as necessary.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test complete.

---

*ABS WARNING INDICATOR (340)

Possible Causes
ANTI-LOCK BRAKE SYSTEM DTC PRESENT
INSTRUMENT CLUSTER

Diagnostic Test

1. INSTRUMENT CLUSTER ABS INDICATOR

Turn the ignition off.

Observe the ABS indicator lamp.

Turn the ignition on.

Select the appropriate condition for the ABS indicator lamp:

Illuminates for several seconds and turns off

Go To 2

Illuminates continuously

With the scan tool, read DTCs. Perform the appropriate diagnostic procedure.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

Does not illuminate

Replace the Instrument Cluster in accordance with the Service Information.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

---

2. ANTI-LOCK BRAKE SYSTEM DTC PRESENT

Turn the ignition on.

With the scan tool, select View DTCs in the Anti-lock Brake Module.

Are there any DTCs present?

Yes >> Refer to the appropriate diagnostic procedure.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Inspect the related wiring harness and connector terminals. Monitor the scan tool parameters while wiggle testing the related harness and connectors. Refer to any Technical Service Bulletins (TSB) that may apply. If no problems are found, test is complete.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

---

*REPLACING THE ANTILOCK BRAKE MODULE (340)

Possible Causes
REPLACING THE ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. REPLACING THE ANTILOCK BRAKE MODULE

NOTE: Note: It may be necessary to call STAR to order a new ABS module.

NOTE: Note: Failure to properly program the ABS module will result in an illuminated or blinking ABS indicator.

Turn the ignition off.

Replace the Anti-lock Brake Module in accordance with the Service Information.

With the scan tool, perform the module configuration procedures as necessary in accordance with the Service Information.

Road test the vehicle above 40 m.p.h. for at least two minutes.

With the scan tool, select View DTCs in the Anti-Lock Brake Module.

Are there any DTCs present?

Yes >> Perform the appropriate diagnostic procedure(s).

No >> Test Complete
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

*VEHICLE SPEED SIGNAL OUTPUT (340)

Possible Causes
INTERMITTENT VEHICLE SPEED SIGNAL
VEHICLE SPEED SIGNAL DTC SET IN POWERTRAIN CONTROL MODULE
ANTI-LOCK BRAKE MODULE DTCS PRESENT

Diagnostic Test

1. VEHICLE SPEED SIGNAL DTC SET IN PCM

Turn the ignition on.

With the scan tool, select view DTCs in the Powertrain Control Module.

Is the status Active for P0500?

Yes >> Refer to the Driveability section and perform the appropriate diagnostic procedure.

No >> Go To 2

---

2. ANTI-LOCK BRAKE MODULE DTCS PRESENT

With the scan tool, select view DTCs in the Anti-Lock Brake Module.

Are there any DTCs present in the Anti-lock Brake Module?

Yes >> Refer to the ABS section and perform the appropriate diagnostic procedure.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Go To 3

---

3. INTERMITTENT VEHICLE SPEED SIGNAL

At this time, no DTCs are present.

Inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Using the schematics as a guide, wiggle test the related circuit(s) while monitoring the scan tool data relative to the vehicle speed sensor circuit(s). Look for the data to change or for a DTC to set.

Refer to any technical service bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES/ELECTRICAL - DIAGNOSIS AND TESTING)

No >> Test Complete.

BRAKES - ABS SERVICE INFORMATION

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BRAKES - ABS SERVICE INFORMATION

DESCRIPTION

Rear Wheel Antilock (RWAL) brake system. The RWAL brake system is designed to prevent rear wheel lock-up under heavy braking conditions on virtually all types of road surfaces. RWAL braking is desirable because a vehicle which is stopped without locking the wheels will retain directional stability. This allows the driver to retain greater control of the vehicle during braking.

The RWAL components include:

- RWAL Valve
- Antilock Brake Module (ABM)
- Rear Wheel Speed Sensor (WSS)

OPERATION

When the brakes are applied, hydraulic fluid is routed from the master cylinder's secondary circuit, to the RWAL valve. From there hydraulic fluid is routed to the rear brake wheel cylinders. The Controller Antilock Brake monitors rear wheel speed through the rear wheel speed sensor. If a wheel is about to lock-up, the ABM signals the RWAL valve. The RWAL valve modulates the hydraulic brake pressure to the rear wheels to prevent wheel lock-up.

NORMAL BRAKING

During light brake application, rear wheel deceleration is not sufficient to activate the antilock system components. During a normal stop hydraulic brake fluid flows unrestricted to the rear wheel cylinders to stop the vehicle. The antilock solenoid valves are inactive. The isolation valve is open and the dump valve is closed allowing normal fluid flow to the rear wheel cylinders.

REAR WHEEL ANTILOCK BRAKING

If the ABM senses impending rear wheel lock-up, it will energize the isolation solenoid. This prevents a further increase of driver induced brake pressure to the rear wheels. If this initial action is not enough to prevent rear wheel lock-up, the ABM will momentarily energize a dump solenoid. This opens the dump valve to vent a small amount of isolated rear brake pressure to an accumulator. The action of fluid moving to the accumulator reduces the isolated brake pressure at the wheel cylinders. The dump (pressure venting) cycle is limited to very short time periods (milliseconds). The ABM will pulse the dump valve until rear wheel deceleration reaches the desired slip rate programmed into the ABM. The system will switch to normal braking once wheel locking tendencies are no longer present.

DIAGNOSIS AND TESTING

ANTILOCK BRAKE SYSTEM

Diagnosis of base brake conditions which are mechanical in nature should be performed first. This includes brake noise, lack of power assist, parking brake, or vehicle vibration during normal braking.

The Anitilock brake system performs several self-tests every time the ignition switch is turned on and the vehicle is driven. The ABM monitors the system inputs and outputs circuits to verify the system is operating properly. If the ABM senses a malfunction in the system it will set a DTC into memory and trigger the warning lamp.

NOTE: The scan tool is used to diagnose the Anitlock Braking System. For test procedures refer to the Chassis Diagnostic Manual.

STANDARD PROCEDURE

ABS BRAKE BLEEDING

ABS system bleeding requires conventional bleeding methods plus use of the scan tool. The procedure involves performing a base brake bleeding, followed by use of the scan tool to cycle and bleed the HCU pump and solenoids. A second base brake bleeding procedure is then required to remove any air remaining in the system.

1. Perform base brake bleeding, (Refer to 5 - BRAKES - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - STANDARD PROCEDURE).
2. Connect scan tool to the Data Link Connector.
3. Select ANTILOCK BRAKES, followed by MISCELLANEOUS, then ABS BRAKES. Follow the instructions displayed. When scan tool displays TEST COMPLETE, disconnect scan tool and proceed.
4. Perform base brake bleeding a second time, (Refer to 5 - BRAKES - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - STANDARD PROCEDURE).
5. Top off master cylinder fluid level and verify proper brake operation before moving vehicle.

SPECIFICATIONS

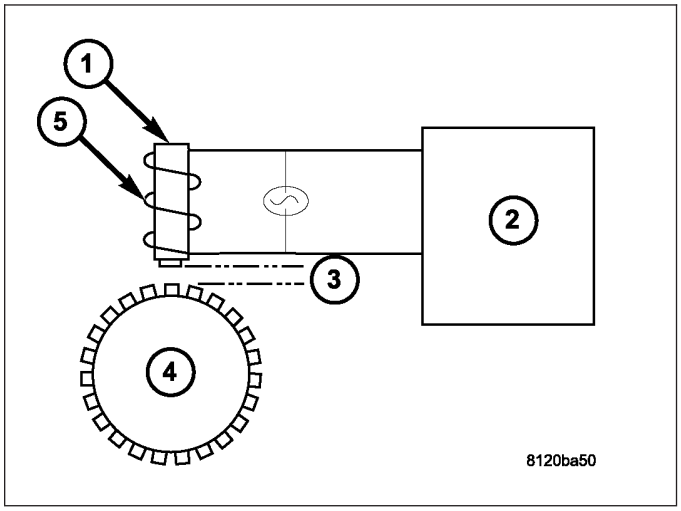
TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
HCU Assembly Mounting Bolts	15	11	—
ABM Mounting Screws	6	—	53
ABS Assembly Brake Line Fittings	19	—	170
Wheel Speed Sensors Front Sensor Bolt	21	—	190
Rear Wheel Speed Sensor Mounting Bolt	24	—	200
G-Sensor With (TCS)	5.6	—	50

SENSOR-WHEEL SPEED - FRONT

OPERATION



The Wheel Speed Sensor consists of a magnet (1) surrounded by windings from a single strand of wire (5). The sensor sends a small AC signal to the ABM. This signal is generated by magnetic induction. The magnetic induction is created when a toothed sensor ring (exciter ring or tone wheel) (4) passes the stationary magnetic WSS.

When the ring gear is rotated, the exciter ring (4) passes the tip of the WSS. As the exciter ring tooth approaches the tip of the WSS, the magnetic lines of force expand, causing the magnetic field to cut across the sensor's windings (5). This, in turn causes current to flow through the WSS circuit in one direction. When the exciter ring tooth moves away from the sensor tip, the magnetic lines of force collapse cutting the winding in the opposite direction. This causes the current to flow in the opposite direction. Every time a tooth of the exciter ring passes the tip of the WSS, an AC signal is generated current. Each AC signal (positive to negative signal or squarewave) is interpreted by the ABM. It then compares the frequency of the sinewave to a time value to calculate vehicle speed. The ABM continues to monitor the frequency to determine a deceleration rate that would indicate a possible wheel-locking tendency.

The signal strength of any magnetic induction sensor is directly affected by:

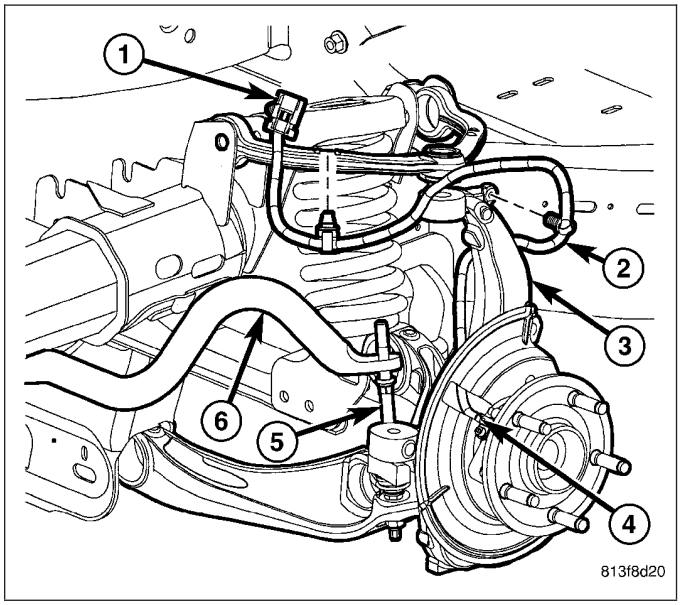
- Magnetic field strength; the stronger the magnetic field, the stronger the signal
- Number of windings in the sensor; more windings provide a stronger signal
- Exciter ring speed; the faster the exciter ring/tone wheel rotates, the stronger the signal will be
- Distance (3) "air gap" between the exciter ring teeth and WSS; the closer the WSS is to the exciter ring/tone wheel, the stronger the signal will be.

The WSS is not adjustable. A clearance specification has been established for manufacturing tolerances. If the clearance is not within these specifications, then either the WSS or other components may be damaged. The clearance between the WSS and the exciter ring is 0.005 – 0.050 in.

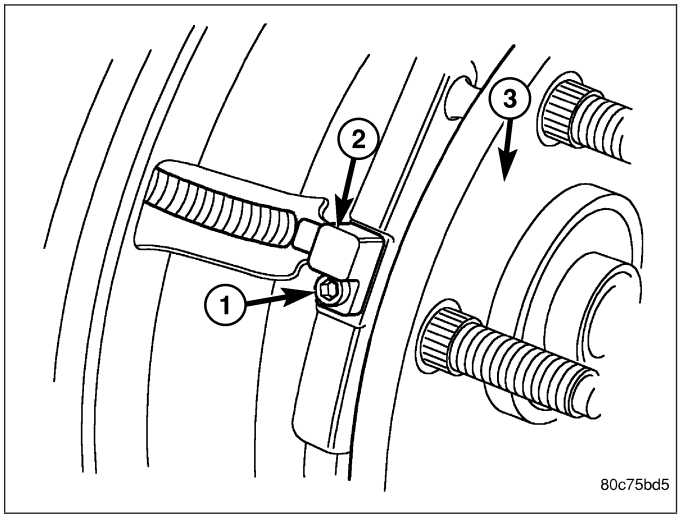
The assembly plant performs a "Rolls Test" on every vehicle that leaves the assembly plant. One of the test performed is a test of the WSS. To properly test the sensor, the assembly plant connects test equipment to the Data Link Connector (DLC). This connector is located to the right of the steering column and attached to the lower portion of the instrument panel. The rolls test terminal is spliced to the WSS circuit. The vehicle is then driven on a set of rollers and the WSS output is monitored for proper operation.

REMOVAL

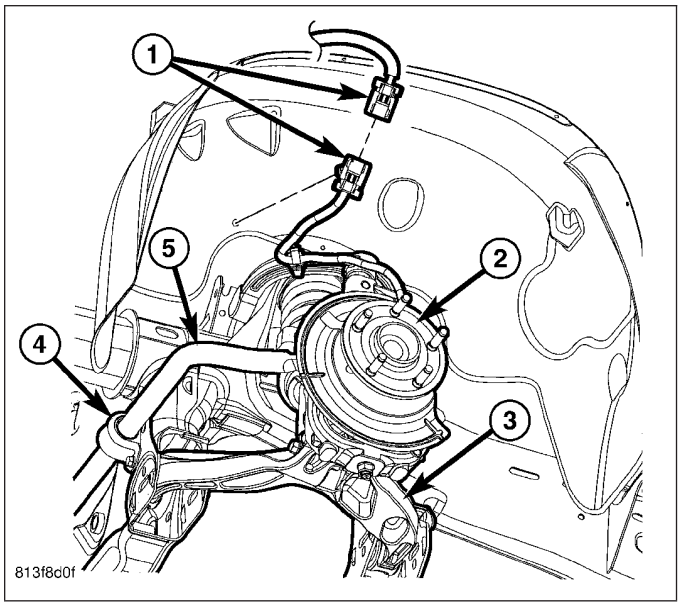
1. Raise and support the vehicle.
2. Remove the front rotor and caliper adapter. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).



3. Remove the wheel speed sensor mounting bolt (1) from the hub (3).
4. Remove the wheel speed sensor (2) from the hub (3).

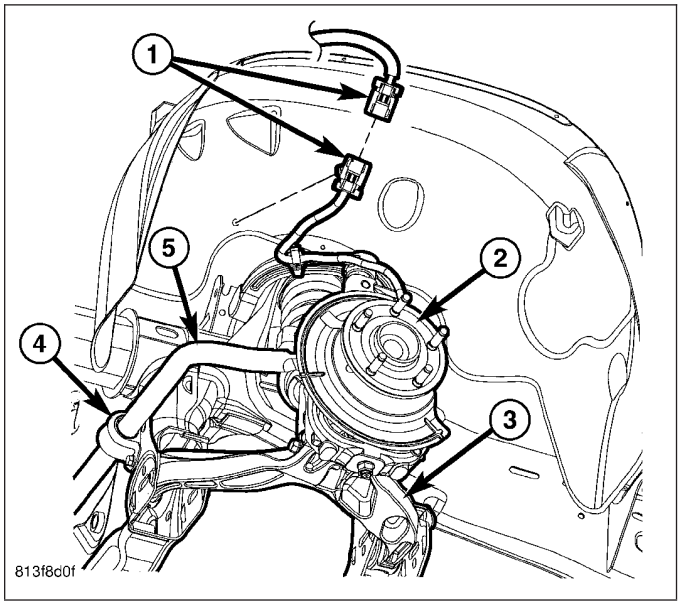


5. Remove the wiring from the clips and disconnect the electrical connector (1).

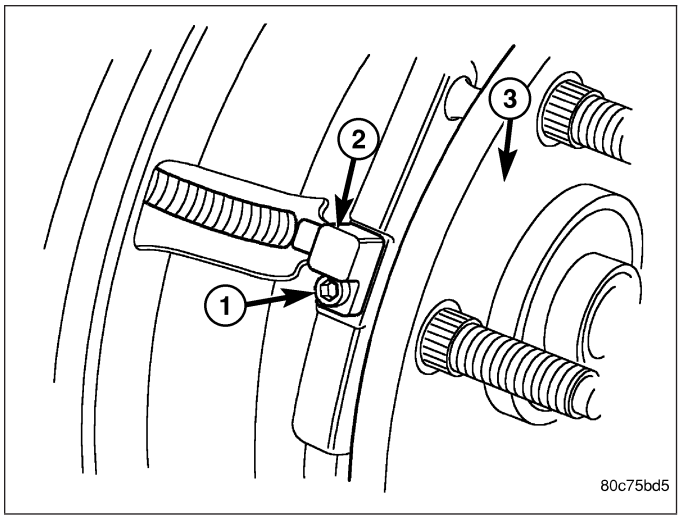


INSTALLATION

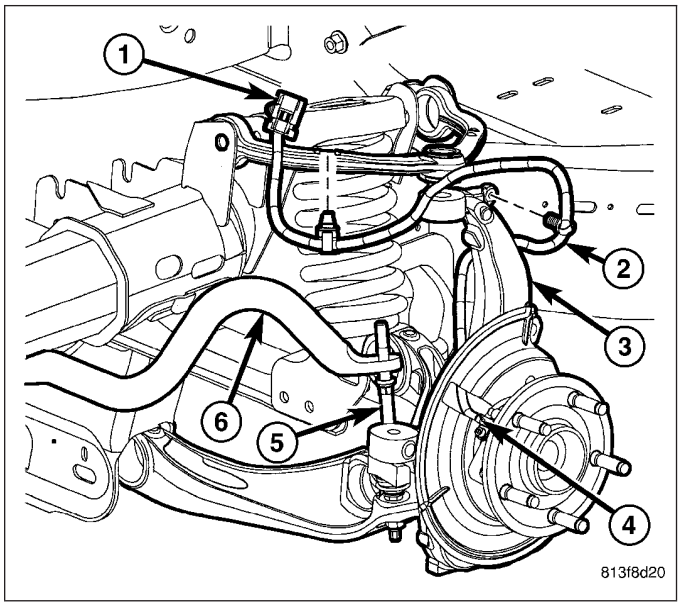
1. Install the wiring to the clips and Reconnect the electrical connector (1).



2. Install the wheel speed sensor (2) to the hub (3).
3. Install the wheel speed sensor mounting bolt (1) to the hub (3). Tighten the bolt to 21 N·m (190 in. lbs.).



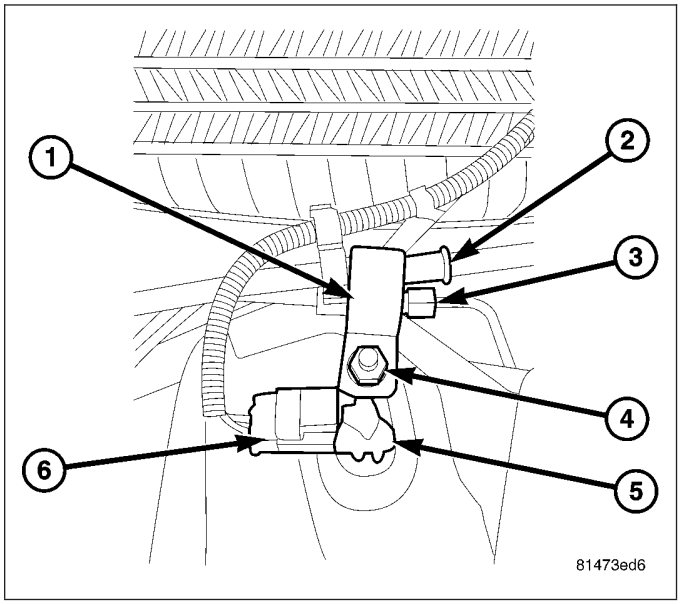
4. Install the front rotor and brake caliper assembly (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ ROTORS - INSTALLATION).

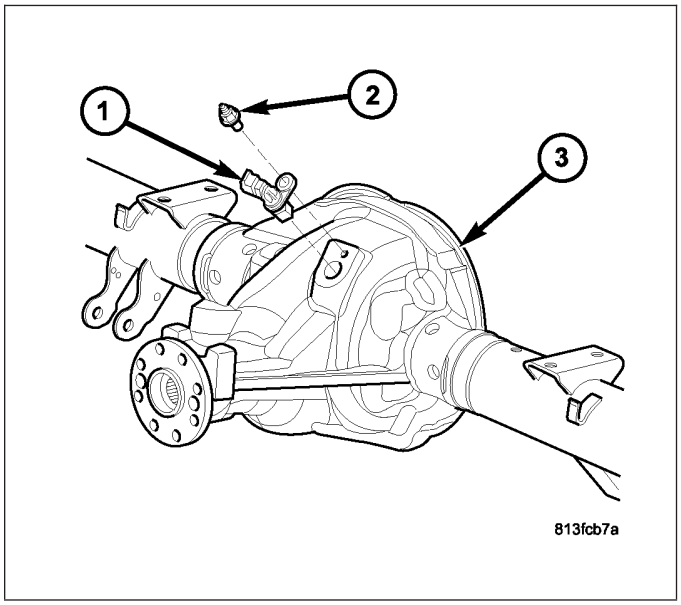


SENSOR-WHEEL SPEED-REAR

REMOVAL

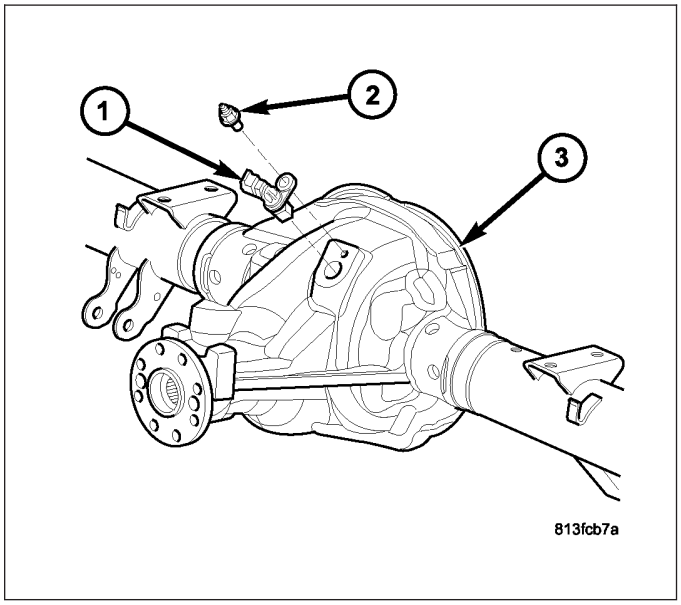
1. Raise vehicle on hoist.
2. Remove brake line mounting nut (4) and remove the brake line (3) from the sensor stud.
3. Remove the park brake cable (2) and bracket (1) from the sensor stud.
4. Disconnect the electrical connector (6).
5. Remove mounting stud (2) from the sensor (5).
6. Remove sensor (1) from differential housing (3).



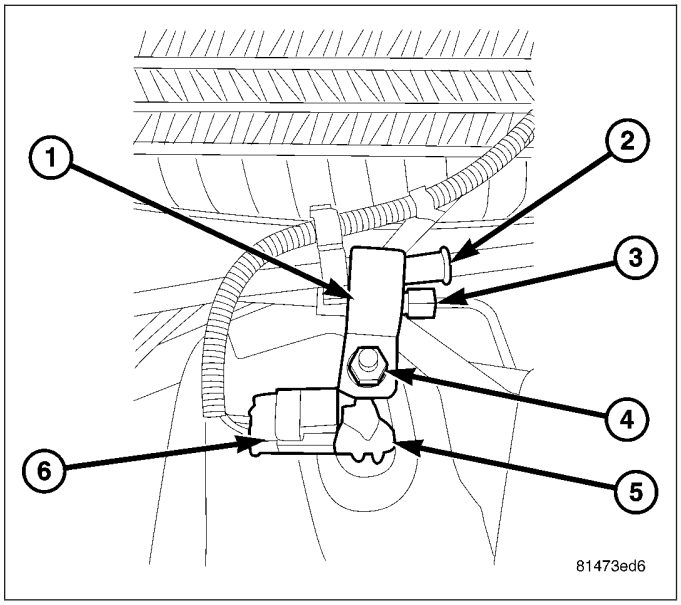


INSTALLATION

1. Connect harness to sensor (1). **Be sure seal is securely in place between sensor and wiring connector.**
2. Install O-ring on sensor (if removed).
3. Insert sensor (1) in differential housing (3).



4. Install the sensor mounting stud and tighten to 24 N·m (200 in. lbs.).
5. Reconnect the elctrical connector (6).
6. Install the brake line (3) on the sensor stud.
7. Install the park brake cable (2) and bracket (1) to the stud and install the nut (4).
8. Lower vehicle.



SENSOR-G

DESCRIPTION

The G-sensor is located inside the ABS controller. The sensor is not a separate serviceable part from the controller.

HCU (HYDRAULIC CONTROL UNIT)

DESCRIPTION

The HCU consists of a valve body, pump motor, low pressure accumulators, inlet valves, outlet valves and noise attenuators.

OPERATION

Accumulators in the valve body store extra fluid released to the system for ABS mode operation. The pump provides the fluid volume needed and is operated by a DC type motor. The motor is controlled by the ABM.

The valves modulate brake pressure during antilock braking and are controlled by the ABM.

The HCU provides three channel **ABS** or four channel **With Traction Control** pressure control to the front and rear brakes. One channel controls the rear wheel brakes in tandem **ABS**. The two remaining channels control the front wheel brakes individually.

During antilock braking, the solenoid valves are opened and closed as needed.

During normal braking, the HCU solenoid valves and pump are not activated. The master cylinder and power booster operate the same as a vehicle without an ABS brake system.

NOTE: The three modes mentioned below do occur but not necessarily in the order listed everytime.

During antilock braking, solenoid valve pressure modulation occurs in three stages, pressure increase, pressure hold, and pressure decrease. The valves are all contained in the valve body portion of the HCU.

PRESSURE DECREASE

The outlet valve is opened and the inlet valve is closed during the pressure decrease cycle.

A pressure decrease cycle is initiated when speed sensor signals indicate high wheel slip at one or more wheels. At this point, the ABM closes the inlet then opens the outlet valve, which also opens the return circuit to the accumulators. Fluid pressure is allowed to bleed off (decrease) as needed to prevent wheel lock.

Once the period of high wheel slip has ended, the ABM closes the outlet valve and begins a pressure increase or hold cycle as needed.

PRESSURE HOLD

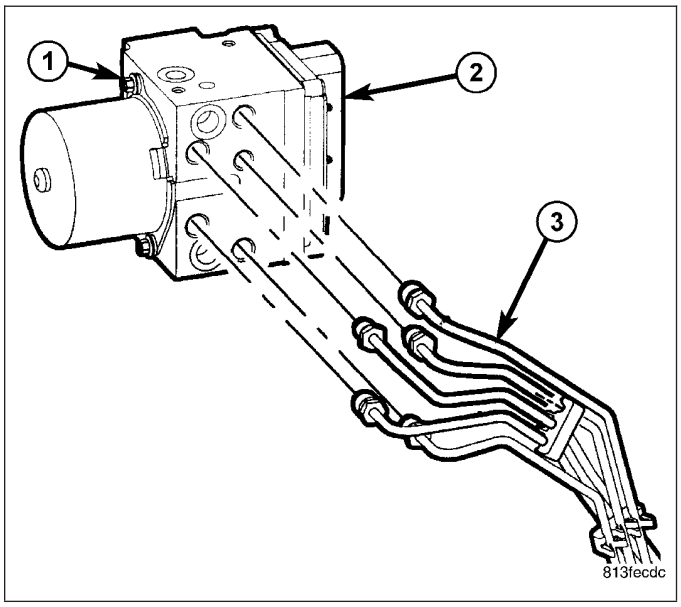
Both solenoid valves are closed in the pressure hold cycle but only the inlet valve is energized. Fluid apply pressure in the control channel is maintained at a constant rate. The ABM maintains the hold cycle until sensor inputs indicate a pressure change is necessary.

PRESSURE INCREASE

The inlet valve is open and the outlet valve is closed during the pressure increase cycle. The pressure increase cycle is used to reapply thew brakes. This cycle controls re-application of fluid apply pressure.

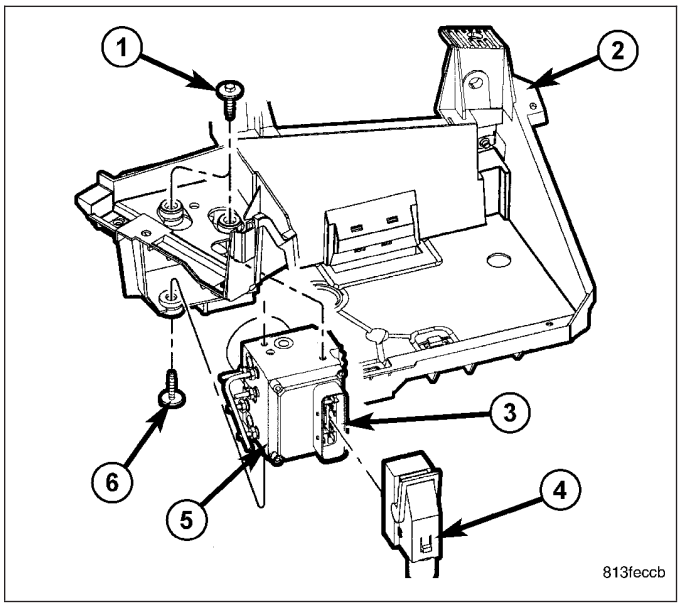
REMOVAL

1. Disconnect the battery cables from the battery.



2. Disconnect the brake lines (3) to the HCU (1).

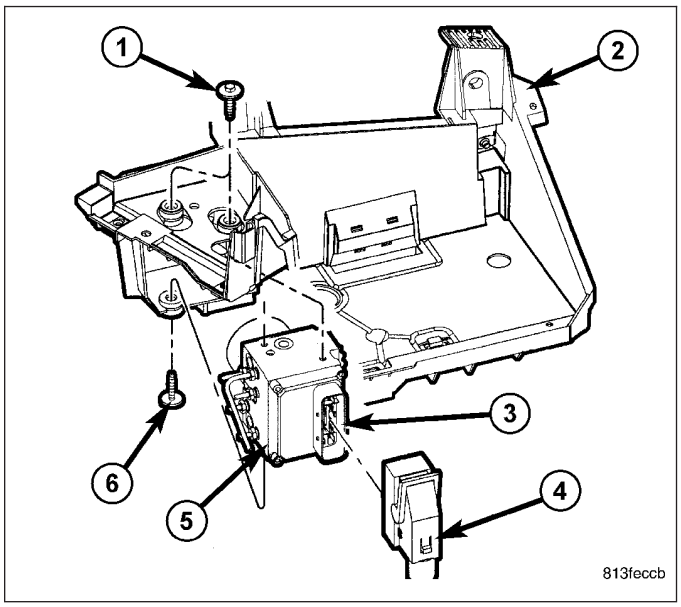
3. Disconnect the electrical harness connector (4).
4. Remove HCU assembly (5) mounting bolts (1&6).
5. Raise and support the vehicle.
6. Lift the HCU assembly (5) off the battery tray (2).
7. Remove the HCU assembly (2) from the vehicle.



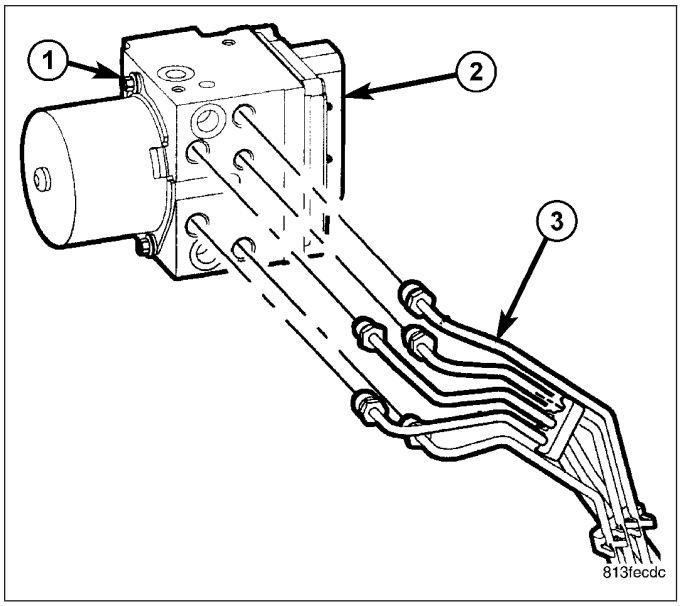
INSTALLATION

NOTE: If the ABM is being replaced with a new ABM it must be reprogrammed with the use of a scantool.

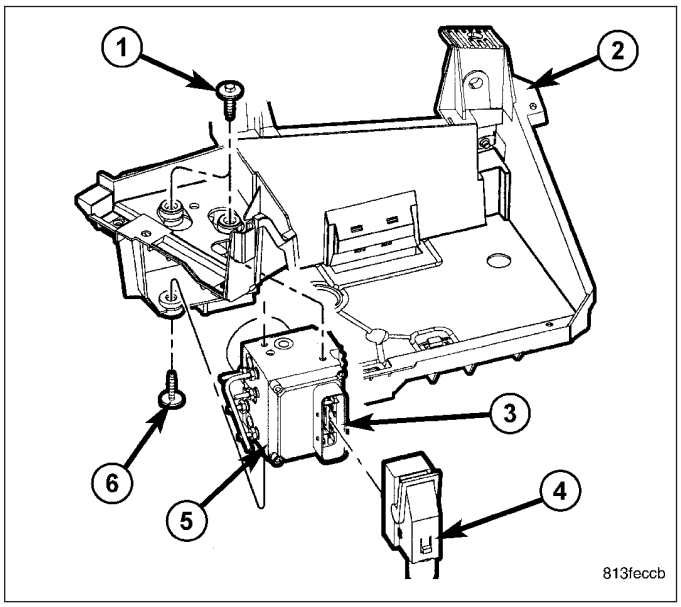
1. Reinstall the HCU assembly (5) to the vehicle.
2. Install HCU assembly (5) on the battery tray (2) and Tighten the nuts to 15 N·m (11 ft. lbs.).



3. Install the brake lines (3) to the HCU (1) and tighten to 19 N·m (170 in. lbs.).



4. Install the electrical harness connector (4) to the ABM (3).
5. Install the battery cables to the battery.
6. Bleed ABS brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).



CLUTCH

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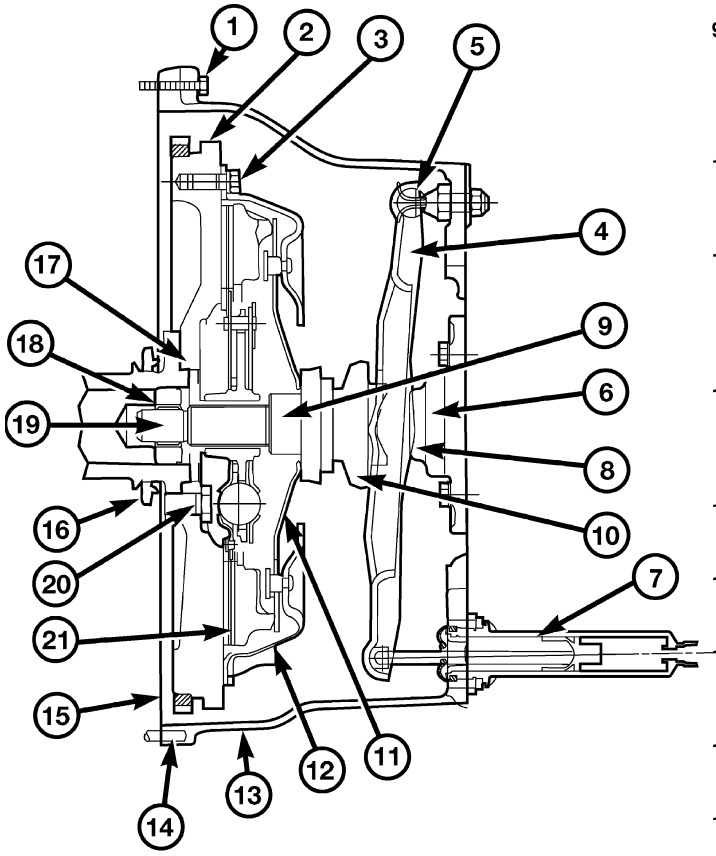
CLUTCH

WARNING

WARNING: Exercise care when servicing clutch components. Factory installed clutch discs do not contain asbestos fibers. Dust and dirt on clutch parts may contain asbestos fibers from aftermarket components. Breathing excessive concentrations of these fibers can cause serious bodily harm. Wear a respirator during service and never clean clutch components with compressed air or with a dry brush. Either clean the components with water dampened rags or use a vacuum cleaner specifically designed to remove asbestos fibers and dust. Do not create dust by sanding a clutch discs. Replace the disc if the friction material is damaged. Dispose of all dust and dirt containing asbestos fibers in sealed bags or containers. This will minimize exposure to yourself and to others. Follow all recommended safety practices prescribed by the occupational safety and health administration (OSHA) and the environmental safety agency (EPA), for the handling and disposal of products containing asbestos. Failure to follow these instructions may result in personal injury or death

DIAGNOSIS AND TESTING



1 Check clutch housing bolts. Tighten if loose. Be sure housing is fully seated on engine block.

2 Check flywheel. Scuff sand face to remove glaze. Clean surface with wax and grease remover. Replace flywheel if severely scored, worn or cracked. Secure flywheel with new bolts (if removed). Do not reuse old bolts. Use Mopar Lock N'Seal on bolts.

3 Tighten clutch cover bolts 2–3 threads at a time, alternately and evenly (in a star pattern) to specified torque. Failure to do so could warp the cover.

4 Check release fork. Replace fork if bent or worn. Make sure pivot and bearing contact surfaces are lubricated.

5 Check release fork pivot (in housing). Be sure pivot is secure and ball end is lubricated.

6 Transmission input shaft bearing will cause noise, chatter, or improper release if damaged. Check condition before installing transmission.

7 Check slave cylinder. Replace it if leaking. Be sure cylinder is properly secured in housing and cylinder piston is seated in release fork.

8 Check input shaft seal if clutch cover and disc were oil covered. Replace seal if worn, or cut.

9 Inspect release bearing slide surface of trans. front bearing retainer. Surface should be smooth, free of nicks, scores. Replace retainer if necessary. Lubricate slide surface before installing release bearing.

10 Do not replace release bearing unless actually faulty. Replace bearing only if seized, noisy, or damaged.

11 Check clutch cover diaphragm spring and release fingers. Replace cover if spring or fingers are bent, warped, broken, cracked. Do not tamper with factory spring setting as clutch problems will result.

12 Check condition of clutch cover. Replace clutch cover if plate surface is deeply scored, warped, worn, or cracked. Be sure cover is correct size and properly aligned on disc and flywheel.

13 Inspect clutch housing. Be sure bolts are tight. Replace housing if damaged.

14 Verify that housing alignment dowels are in position before installing housing.

15 Clean engine block surface before installing clutch housing. Dirt, grime can produce misalignment.

16 Check rear main seal if clutch disc and cover were oil covered. Replace seal if necessary.

17 Check crankshaft flange (if flywheel is removed). Be sure flange is clean and flywheel bolt threads are in good condition.

18 Check pilot bearing. Replace bearing if damaged. Lube with Mopar high temp. bearing grease before installation.

19 Check transmission input shaft. Disc must slide freely on shaft splines. Lightly grease splines before installation. Replace shaft if splines or pilot bearing hub are damaged.

20 Check flywheel bolt torque. If bolts are loose, replace them. Use Mopar Lock N'Seal to secure new bolts.

21 Check clutch disc facing. Replace disc if facing is charred, scored, flaking off, or worn. Also check runout of new disc. Runout should not exceed 0.5 mm (0.02 in.).

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During road test, drive the vehicle at normal speeds. Shift the transmission through all gear ranges and observe clutch action. If clutch chatters, grabs, slips or does not release properly and inspect clutch components. If problem is noise or hard shifting, check transmission and driveline component.

Inspection is recommended to determine a clutch problem.

CLUTCH CONTAMINATION

Oil leakage from either the rear main seal or transmission input shaft will produces a residue on the housing interior, clutch disc, plate and flywheel. Heat buildup caused by slippage between the plate, disc and flywheel, can bake the oil onto the components. The glaze-like residue ranges in color from amber to black.

Road splash contamination means dirt/water is entering the clutch housing.. Driving through deep water puddles can force water/road splash into the housing through loose bolts, housing cracks or through hydraulic line openings.

Oil, water or clutch fluid on the clutch disc and pressure plate surfaces will cause chatter, slip and grab.

NOTE: Clutch fluid leaks are usually from damaged slave cylinder push rod seals.

IMPROPER CLUTCH RELEASE OR ENGAGEMENT

Clutch release or engagement problems are caused by wear or damage to one or more clutch components. Release problems can result in hard shifting and noise. Items to look for are:

- Leak at clutch cylinder
- Leaks at connecting lines
- Loose slave cylinder bolts
- Worn/loose release fork
- Worn/loose pivot stud
- Damaged release bearing
- Worn clutch disc
- Worn/damaged pressure plate

Normal condensation in vehicles that are stored or for long periods of time can generate enough corrosion to make the disc stick to the flywheel or pressure plate. If this condition is experienced, correction only requires that the disc be loosened manually through the inspection plate opening.

Engagement problems usually result in slip, chatter, shudder and noisy operation. The primary causes are:

- Clutch disc contamination
- Worn clutch disc
- Flywheel damage
- Clutch misalignment
- Warped disc/pressure plate

CLUTCH MISALIGNMENT

Clutch components must be alignment with the crankshaft and transmission input shaft. Misalignment of any clutch component will cause grab, chatter and improper clutch release.

CLUTCH PRESSURE PLATE AND DISC RUNOUT

Check the clutch disc before installation. Axial (face) runout of a **new** disc should not exceed 0.50 mm (0.020 in.). Measure runout 6 mm (0.24 in.) from outer edge of disc facing.

A warped pressure plate or diaphragm spring will cause grab and incomplete release or engagement. Be careful when handling the plate and disc. Impact can distort the plate, diaphragm spring, release fingers and hub of the clutch disc.

CAUTION: Use alignment tool when positioning the disc on the flywheel. This will prevent accidental misalignment which could result in plate distortion and disc damage.

NOTE: Clutch plate distortion (and consequent misalignment) can result from improper bolt tightening.

DIAGNOSIS CHART

Diagnosis Chart

CONDITION	POSSIBLE CAUSES	CORRECTION
Disc facing worn out	1. Normal wear.	1. Replace cover and disc.
	2. Driver frequently rides (slips) the clutch. Results in rapid overheating and wear.	2. Replace cover and disc.
	3. Insufficient clutch cover diaphragm spring tension.	3. Replace cover and disc.
Clutch disc facing contaminated with oil, grease, or clutch fluid.	1. Leak at rear main engine seal or transmission input shaft seal.	1. Replace appropriate seal.
	2. Excessive amount of grease applied to the input shaft splines.	2. Remove grease and apply the correct amount of grease.
	3. Road splash, water entering housing.	3. Replace clutch disc. Clean clutch cover and reuse if in good condition.
	4. Slave cylinder leaking.	4. Replace hydraulic clutch linkage.
Clutch is running partially disengaged.	1. Release bearing sticking or binding and does not return to the normal running position.	1. Verify failure. Replace the release bearing and transmission front bearing retainer as necessary.
Flywheel below minimum thickness specification.	1. Improper flywheel machining. Flywheel has excessive taper or excessive material removal.	1. Replace flywheel.
Clutch disc, cover and/or diaphragm spring warped or distorted.	1. Rough handling. Impact bent cover, spring, or disc.	1. Replace disc or cover as necessary.
	2. Improper bolt tightening procedure.	2. Tighten clutch cover using proper procedure.
Facing on flywheel side of disc torn, gouged, or worn.	1. Flywheel surface scored or nicked.	2. Correct surface condition if possible. Replace flywheel and disc as necessary.
	2. Clutch disc sticking or binding on transmission input shaft.	2. Inspect components and correct/replace as necessary.
Clutch disc facing burnt. Flywheel and cover pressure plate surfaces heavily glazed.	1. Frequent operation under high loads or hard acceleration conditions.	1. Correct condition of flywheel and pressure plate surface. Replace clutch cover and disc. Alert driver to problem cause.
	2. Driver frequently rides (slips) clutch. Results in rapid wear and overheating of disc and cover.	2. Correct condition of flywheel and pressure plate surface. Replace clutch cover and disc. Alert driver to problem cause.

CONDITION	POSSIBLE CAUSES	CORRECTION
Clutch disc binds on input shaft splines.	1. Clutch disc hub splines damaged during installation.	1. Clean, smooth, and lubricate hub splines if possible. Replace disc if necessary.
	2. Input shaft splines rough, damaged, or corroded.	2. Clean, smooth, and lubricate shaft splines if possible. Replace input shaft if necessary.
Clutch disc rusted to flywheel and/or pressure plate.	1. Clutch not used for and extended period of time (e.g. long term vehicle storage).	1. Sand rusted surfaces with 180 grit sanding paper. Replace clutch cover and flywheel if necessary.
Pilot bearing seized, loose, or rollers are worn.	1. Bearing cocked during installation.	1. Install and lubricate a new bearing.
	2. Bearing defective.	2. Install and lubricate a new bearing.
	3. Bearing not lubricated.	3. Install and lubricate a new bearing.
	4. Clutch misalignment.	4. Inspect clutch and correct as necessary. Install and lubricate a new bearing.
Clutch will not disengage properly.	1. Low clutch fluid level.	1. Add Fluid / Replace hydraulic linkage assembly.
	2. Clutch cover loose.	2. Follow proper bolt tightening procedure.
	3. Clutch disc bent or distorted.	3. Replace clutch disc.
	4. Clutch cover diaphragm spring bent or warped.	4. Replace clutch cover.
	5. Clutch disc installed backwards.	5. Remove and install clutch disc correctly.
	6. Release fork bent or fork pivot loose or damaged.	6. Replace fork or pivot as necessary.
	7. Clutch master or slave cylinder failure.	7. Replace hydraulic linkage assembly.
Clutch pedal squeak.	1. Pivot pin loose.	1. Tighten pivot pin if possible. Replace clutch pedal if necessary.
	2. Master cylinder bushing not lubricated.	2. Lubricate master cylinder bushing.
	3. Pedal bushings worn out or cracked.	3. Replace and lubricate bushings.
Clutch master or slave cylinder plunger dragging andør binding	1. Master or slave cylinder components worn or corroded.	1. Replace clutch hydraulic linkage assembly.
Release bearing is noisy.	1. Release bearing defective or damaged.	1. Replace release bearing.

CONDITION	POSSIBLE CAUSES	CORRECTION
Contact surface of release bearing damaged.	1. Clutch cover incorrect or release fingers bent or distorted.	1. Replace clutch cover and release bearing.
	2. Release bearing defective or damaged.	2. Replace the release bearing.
	3. Release bearing misaligned.	3. Check and correct runout of clutch components. Check front bearing sleeve for damage/ alignment. Repair as necessary.
Partial engagement of clutch disc. One side of disc is worn and the other side is glazed and lightly worn.	1. Clutch pressure plate position incorrect.	1. Replace clutch disc and cover.
	2. Clutch cover, spring, or release fingers bent or distorted.	2. Replace clutch disc and cover.
	3. Clutch disc damaged or distorted.	2. Replace clutch disc.
	4. Clutch misalignment.	4. Check alignment and runout of flywheel, disc, pressure plate, andør clutch housing. Correct as necessary.

The clutch inspection chart outlines items to be checked before and during clutch installation.

The diagnosis charts Diagnosis Chart describe clutch problems, causes and correction.

SPECIFICATIONS

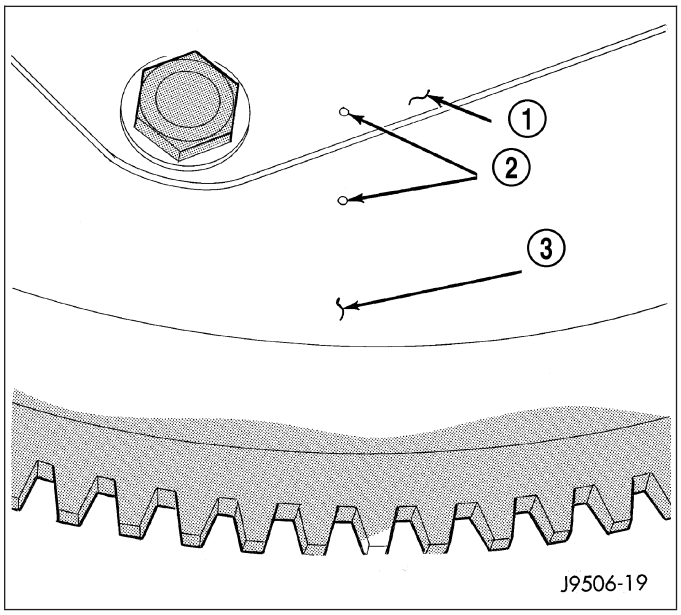
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Clutch Cover Bolts-5/16	23	17	-
Clutch Cover Bolts-3/8	41	30	-
Master Cylinder Reservoir Screws	5	-	40
Master Cylinder Nuts	54	40	-
Slave Cylinder Nuts	23	17	-
Dust Shield Bolt	12	-	105
Flywheel Bolts-3.9/5.9L	75	55	-
Flywheel Bolts-4.7L	95	70	-

CLUTCH DISC

REMOVAL

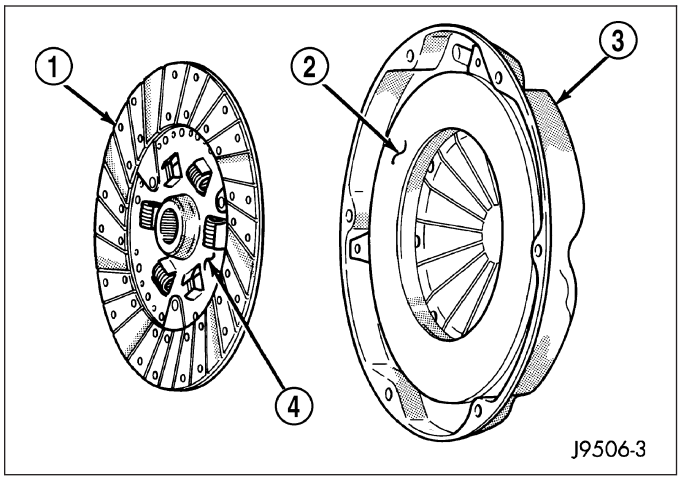
1. Raise vehicle.
2. Remove transmission and clutch housing as assembly.
3. If pressure plate is being removed for access to another component, mark position of pressure plate cover (1) on flywheel (3) with small punch marks (2).
4. Loosen pressure plate cover bolts evenly and in rotation to relieve spring tension. Loosen bolts a few threads at a time to avoid warping cover.
5. Remove cover bolts, pressure plate and clutch disc.



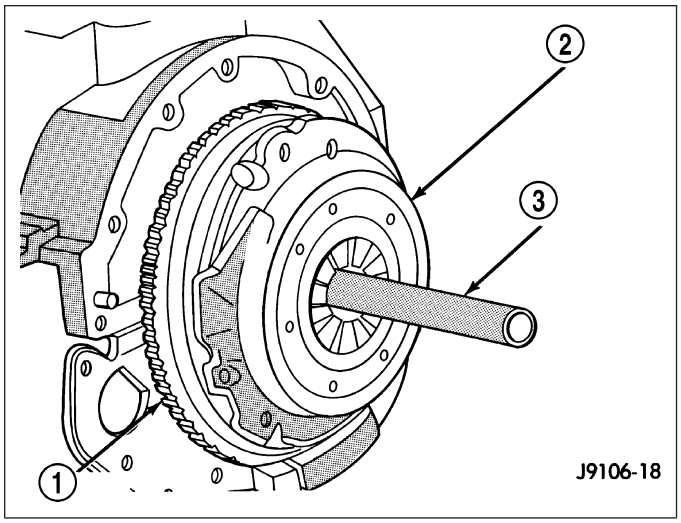
INSTALLATION

NOTE: Clean flywheel surface with solvent. Scuff sand surface with 120/180 grit emery cloth to remove minor scratches and glazing.

1. Check new clutch disc for runout and free operation on input shaft splines.
2. Lubricate crankshaft pilot bearing with a NLGI - 2 rated grease.
3. Verify that disc (1) hub (4) is positioned correctly. The raised portion of the hub faces away from the flywheel.



4. Position clutch disc with pressure plate (2) on the flywheel (1).
5. Insert alignment tool (3) or spare input shaft through clutch disc and into pilot bearing.
6. Install cover bolts finger tight.
7. Tighten cover bolts evenly (and in rotation) a few threads at a time. Cover bolts must be tightened evenly and to specified torque to avoid distorting cover.
8. Tighten cover bolts to:
   - 5/16 in. bolts to 23 N·m (17 ft. lbs.).
   - 3/8 in. bolts to 41 N·m (30 ft. lbs.).
9. Apply light coat of Mopar high temperature bearing grease to splines of transmission input shaft and to release bearing slide surface of front bearing retainer.



CAUTION: Do not over-lubricate shaft splines. This could result in grease contamination of disc.

10. Install transmission as assembly.

CLUTCH HOUSING

DIAGNOSIS AND TESTING

Clutch housing alignment is important to proper clutch operation. The housing maintains alignment between the crankshaft and transmission input shaft. Misalignment can cause clutch noise, hard shifting, incomplete release and chatter. It can also result in premature wear of the pilot bearing, cover release fingers and clutch disc. In severe cases, misalignment can also cause premature wear of the transmission input shaft and front bearing.

Housing misalignment is generally caused by incorrect seating on the engine or transmission, loose housing bolts, missing alignment dowels, or housing damage. Infrequently, misalignment may also be caused by housing mounting surfaces that are not completely parallel. Misalignment can be corrected with shims.

REMOVAL

1. Raise vehicle and support vehicle.
2. Remove transmission and clutch housing as assembly.
3. Remove release bearing, release fork and fork boot from input shaft and clutch housing.
4. Remove bolts attaching clutch housing to transmission.

INSTALLATION

1. Clean mounting surfaces of transmission and clutch housing. Use a wire brush if necessary followed by a wax and grease remover, or similar solvent. Also clean engine block surface as well.
2. Position clutch housing on transmission and install housing attaching bolts. Tighten A bolts to 38 N·m (28 ft. lbs.).
3. Install release fork pivot ball stud to housing, if necessary.
4. Lubricate release bearing bore, release fork contact surfaces, and release fork pivot stud with Mopar® high temperature bearing grease. Also lubricate transmission input shaft splines, pilot hub and bearing retainer slide surface with light coat of same grease.
5. Install release fork, bearing, and boot in housing. Be sure release fork boot is properly seated in housing.
6. Install transmission. Refer to 21 Transmission and Transfer Case for proper procedures. Tighten the upper transmission B bolts to 75 N·m (55 ft.lbs). Tighten all lower transmission C bolts to 50 N·m (37 ft.lbs.).

CLUTCH RELEASE BEARING

REMOVAL

1. Remove transmission. Refer to 21 Transmission and Transfer Case for procedures.
2. Disconnect release bearing from fork and remove bearing.

INSTALLATION

1. Inspect release bearing slide surface of transmission front bearing retainer. Replace retainer if slide surface is scored, worn or cracked.
2. Inspect release fork and fork pivot. Be sure pivot is secure and in good condition. Be sure fork is not distorted or worn. Replace release fork retainer spring if bent or damaged in any way.
3. Lightly lubricate pilot bearing, input shaft splines, bearing retainer slide surface, fork pivot and release fork pivot surface with Mopar® high temperature bearing grease.
4. Install release fork and bearing. Verify fork and bearing are properly secured.
5. Install transmission. Refer to 21 Transmission and Transfer Case for procedures.

FLYWHEEL

DIAGNOSIS AND TESTING

Check flywheel runout whenever misalignment is suspected. Flywheel runout should not exceed 0.08 mm (0.003 in.). Measure runout at the outer edge of the flywheel face with a dial indicator. Mount the indicator on a stud installed in place of one of the flywheel bolts.

Common causes of runout are:

- heat warpage
- improper machining
- incorrect bolt tightening
- improper seating on crankshaft flange shoulder
- foreign material on crankshaft flange

Flywheel machining is not recommended. The flywheel clutch surface is machined to a unique contour and machining will negate this feature. However, minor flywheel scoring can be cleaned up by hand with 180 grit emery, or with surface grinding equipment. Remove only enough material to reduce scoring (approximately 0.001 - 0.003 in.). Heavy stock removal is **not recommended.** Replace the flywheel if scoring is severe and deeper than 0.076 mm (0.003 in.). Excessive stock removal can result in flywheel cracking or warpage after installation; it can also weaken the flywheel and interfere with proper clutch release.

Clean the crankshaft flange before mounting the flywheel. Dirt and grease on the flange surface may cock the flywheel causing excessive runout. Use new bolts when remounting a flywheel and secure the bolts with Mopar® Lock And Seal. Tighten flywheel bolts to specified torque only. Overtightening can distort the flywheel hub causing runout.

PILOT BEARING

REMOVAL

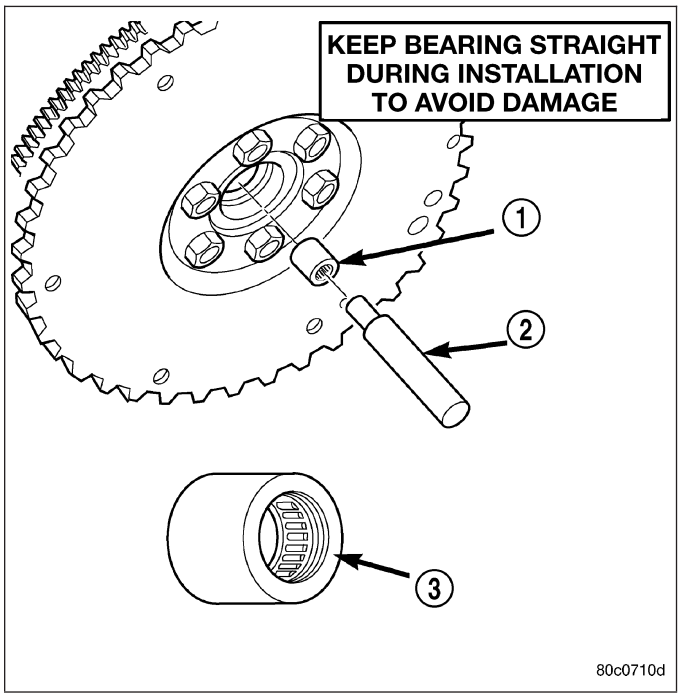
1. Remove transmission, transfer case, if equipped, and clutch housing. Refer to 21 Transmission and Transfer Case for procedures.
2. Remove clutch cover and disc.
3. Using a suitable blind hole puller, remove pilot bearing.

INSTALLATION

1. Clean bearing bore with solvent and wipe dry with shop towel.
2. Install new bearing (1) with clutch alignment tool (2). Keep bearing straight during installation. Do not allow bearing to become cocked. Tap bearing into place until flush with edge of bearing bore. Do not recess bearing.

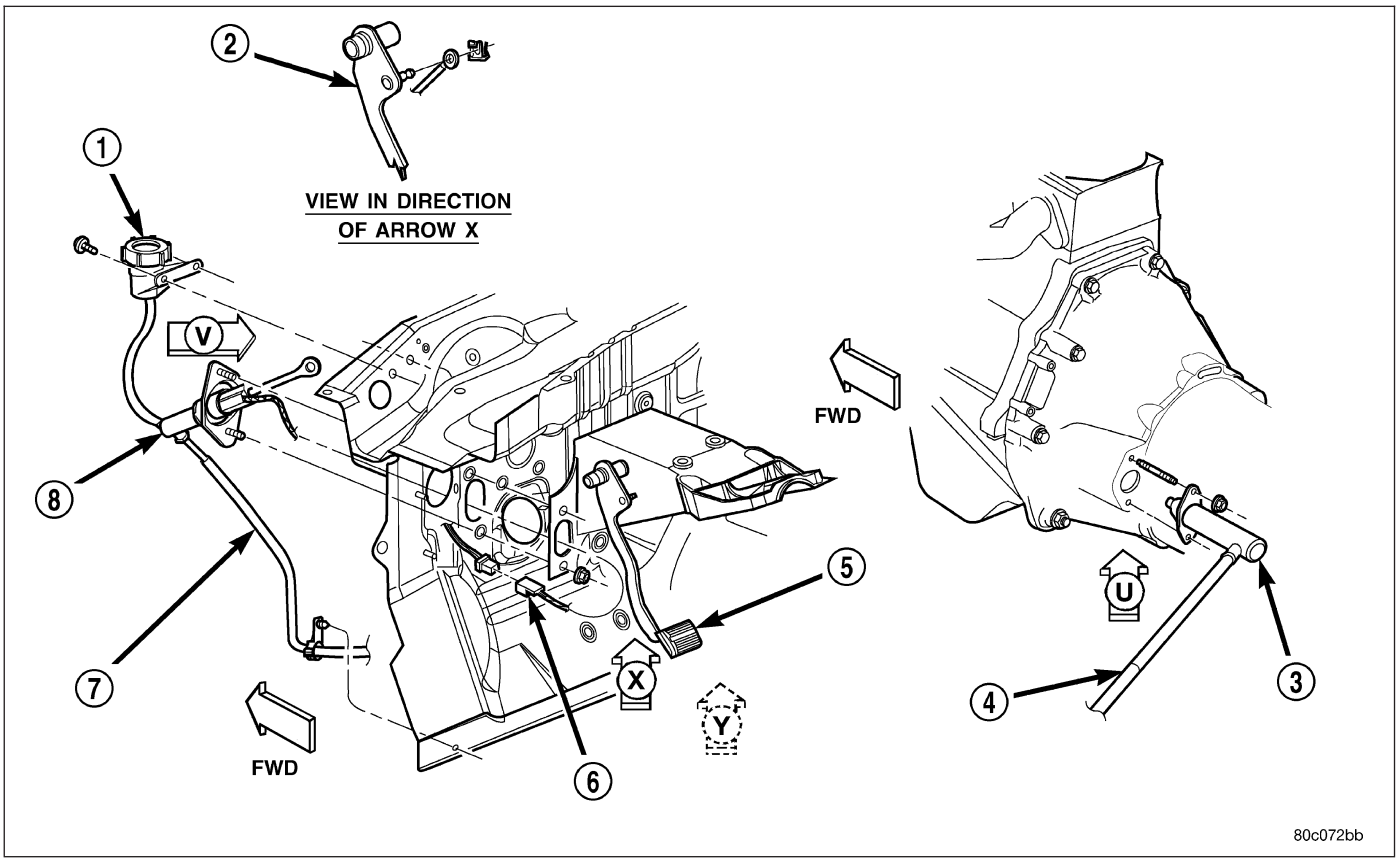
NOTE: Letter side of bearing (3) must face transmission.

3. Install clutch cover and disc.
4. Install clutch housing, transmission and transfer case, if equipped.



LINKAGE

REMOVAL



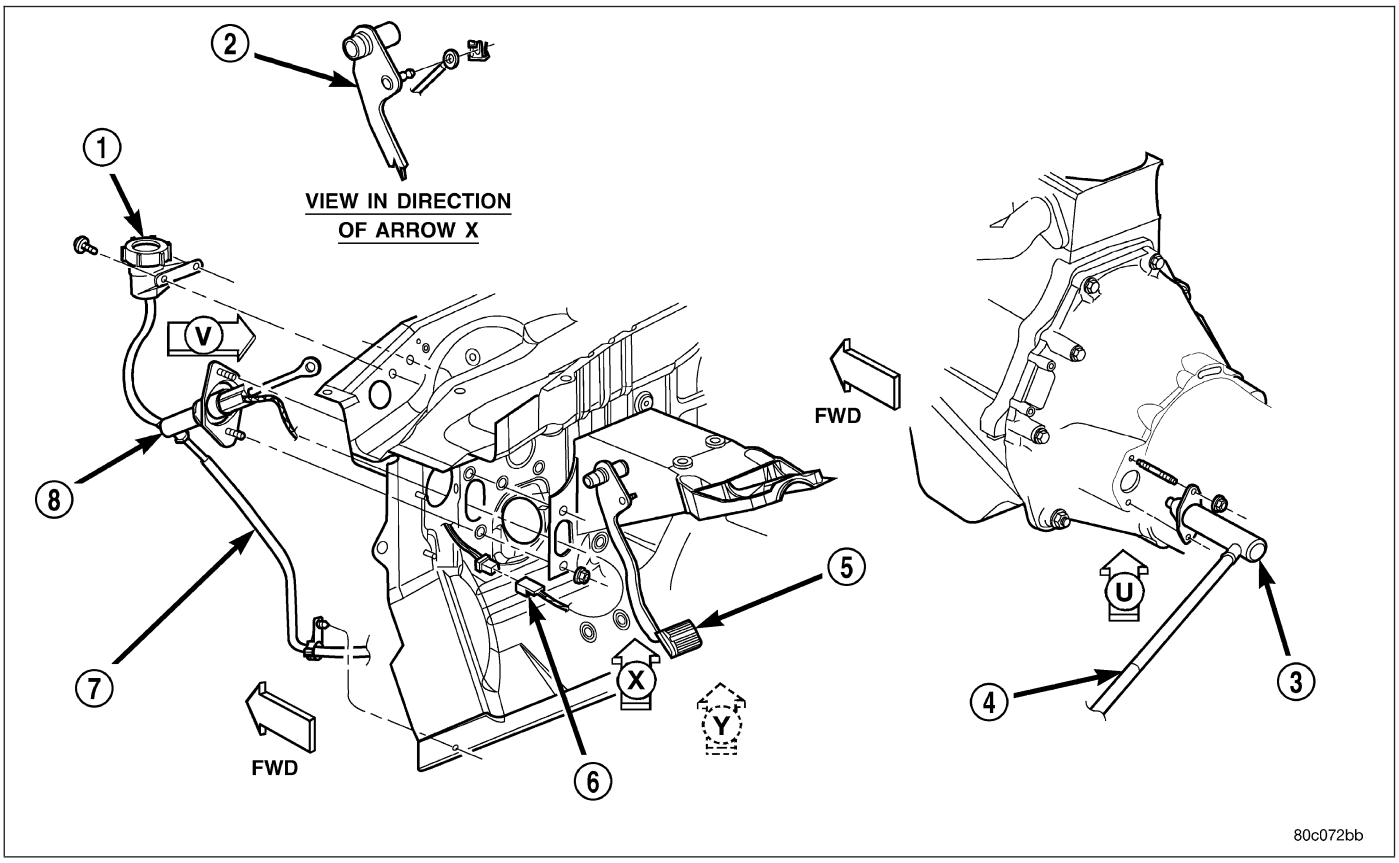
NOTE: The hydraulic linkage is serviced as a complete assembly only. The individual components must not be overhauled or serviced separately.

1. Raise and support vehicle.
2. Remove nuts attaching slave cylinder (3) to clutch housing.

CAUTION: Do not disconnect slave cylinder quick disconnect. If disconnected hydraulic linkage must be replaced.

3. Remove slave cylinder from housing.
4. Remove hydraulic fluid line (7) clip from the lower dash panel flange.
5. Lower vehicle.
6. Remove clip holding clutch master cylinder (8) push rod to clutch pedal (5).
7. Slide clutch master cylinder push rod off clutch pedal pin (2)
8. Disconnect clutch pedal position switch connector (6) from wiring harness.
9. Remove nuts holding clutch master cylinder to dash panel.
10. Verify that cap on clutch master cylinder reservoir (1) is tight to avoid undue spillage during removal.
11. Remove screws attaching clutch fluid reservoir (1) to dash panel.
12. Pull clutch master cylinder from dash panel.
13. Remove hydraulic linkage components from vehicle as an assembly.

INSTALLATION



NOTE: The hydraulic linkage is serviced as a complete assembly only. The individual components must not be serviced separately.

1. Tighten cap on clutch fluid reservoir (1) to avoid spillage during installation.
2. Position cylinders, connecting lines and reservoir in vehicle.
3. Insert clutch master cylinder (8) in dash panel.
4. Position reservoir (1) on dash panel and install reservoir screws. Tighten screws to 5 N·m (40 in. lbs.).
5. Install nuts that hold clutch master cylinder to dash panel. Tighten nuts to 54 N·m (40 ft. lbs.).
6. Apply light coating of grease to the inner diameter of the master cylinder push–rod and the outer diameter of the clutch pedal pin (2).
7. Install clutch master cylinder push rod on clutch pedal pin. Secure rod with retaining clip.
8. Connect clutch pedal position switch connector (6) to wiring harness.
9. Raise vehicle.
10. Insert slave cylinder push (3) rod through clutch housing opening and into release lever. Be sure end of rod is securely engaged in release lever. Check this before installing cylinder attaching nuts.

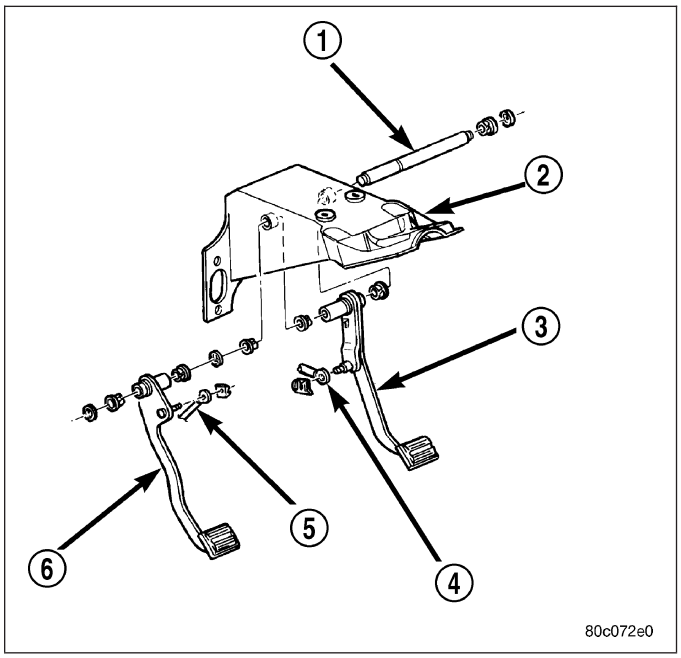
NOTE: If new clutch linkage is being installed, do not remove plastic shipping strap from the slave cylinder push rod. The strap will break on its own upon first clutch application.

11. Install and tighten slave cylinder attaching nuts to 23 N·m (200 in. lbs.).
12. Install hydraulic fluid line (7) clip into the hole in the lower dash panel flange.
13. Verify that fluid line from master cylinder to slave cylinder is properly routed.

CLUTCH PEDAL

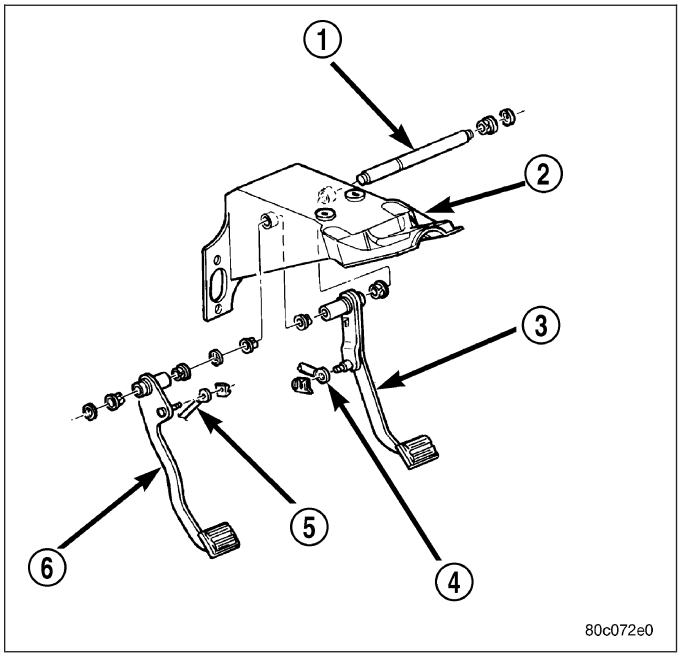
REMOVAL

1. Remove retaining clip securing push rod (5) on clutch pedal (6).
2. Slide push rod off clutch pedal pin.
3. Remove snap ring and washer attaching clutch pedal to the pivot shaft.
4. Slide pedal off pivot shaft (1) and remove pedal.
5. Remove and inspect bushings in pedal bore. Replace bushings if worn or cracked.



INSTALLATION

1. Lubricate pedal bushings and shaft (1) with a silicone grease or with Mopar® multi-mileage grease.
2. Install bushings in pedal bore and on pin.
3. Install pedal (6) on pivot shaft (1).
4. Secure pedal on shaft with washer and snap ring.
5. Apply light coating of grease to the inner diameter of the master cylinder push-rod (5) and the outer diameter of the clutch pedal pin.
6. Connect push rod to pedal and secure rod with retaining clip.

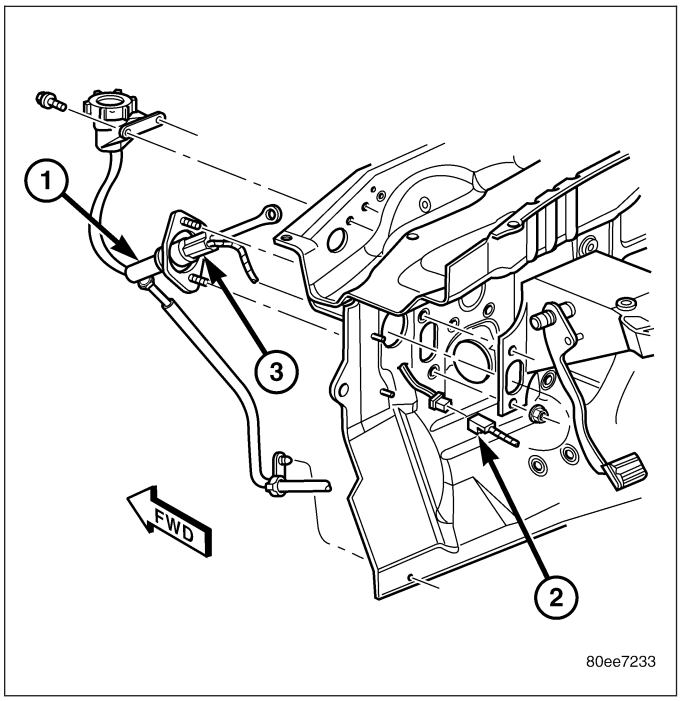


CLUTCH PEDAL POSITION SWITCH

DIAGNOSIS AND TESTING

NOTE: The clutch pedal position switch prevents the starter motor engagement unless the clutch pedal is depressed. Input from the switch is used to shut down/prevent operation of speed control system when the clutch pedal is depressed.

1. Disconnect switch 2-wire connector (2) under instrument panel.
2. Check switch (3) continuity with an ohmmeter while operating clutch pedal.
   - Pedal Depressed - Continuity
   - Pedal Released - No Continuity
3. If continuity is not present or always present, replace clutch master cylinder (1). Switch is not serviced separately.



COOLING

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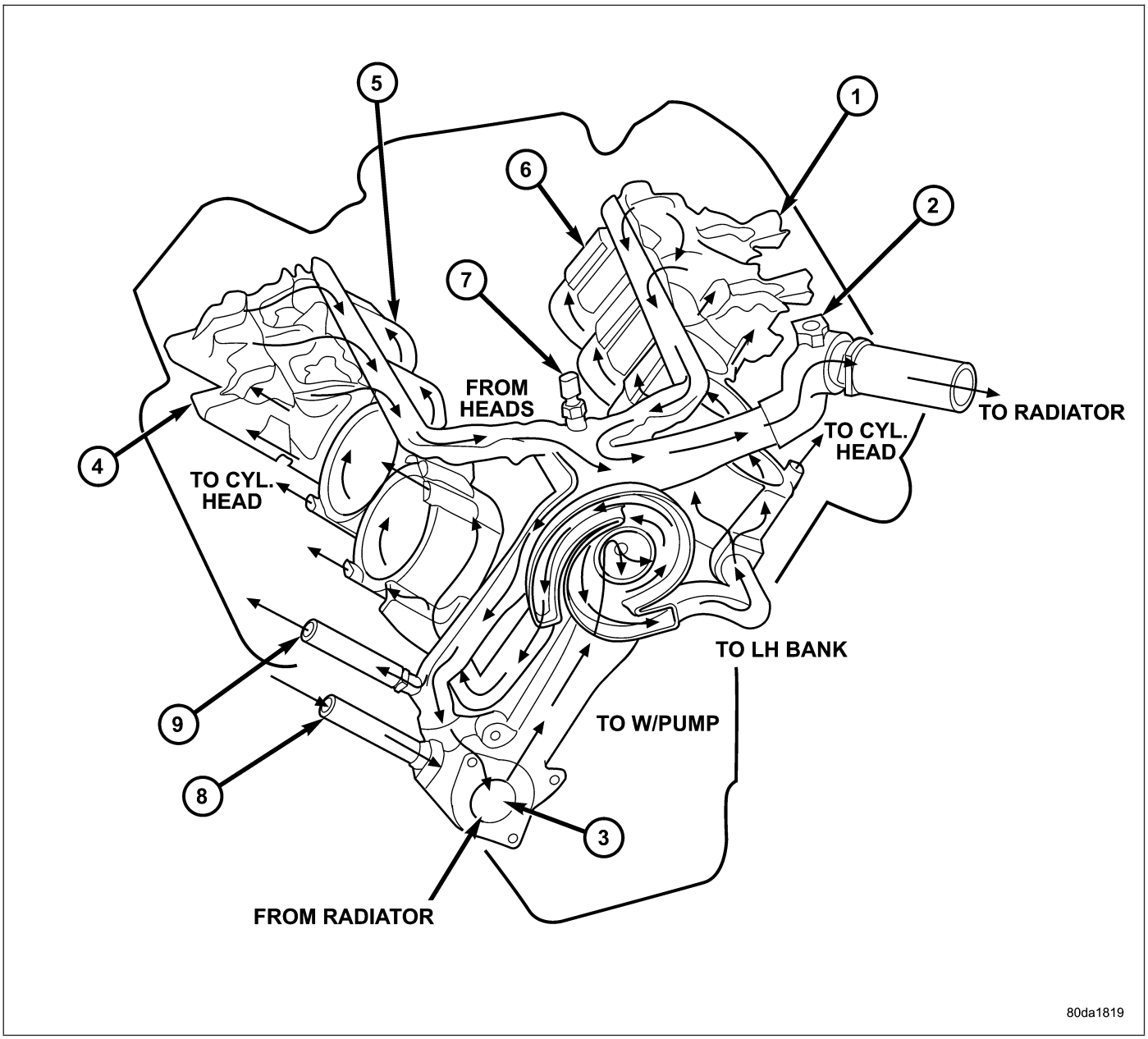
COOLING

DESCRIPTION



Engine Cooling System Flow - 3.7L/4.7L

1 - LH CYL. HEAD
2 - BLEED
3 - THERMOSTAT LOCATION
4 - RH CYL. HEAD
5 - RH BANK CYL. BLOCK
6 - LH BANK CYL. BLOCK
7 - COOLANT TEMP. SENSOR
8 - FROM HEATER CORE
9 - TO HEATER CORE

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible. It also maintains normal operating temperature and prevents overheating.

The cooling system provides a means of heating the passenger compartment and cooling the automatic transmission fluid (if equipped). The cooling system is pressurized and uses a centrifugal water pump to circulate coolant through the system. The coolant recovery/reserve system utilizes an ambient overflow bottle.

- Radiator
- Cooling fan (mechanical/Electrical)
- Thermal viscous fan drive
- Fan shroud
- Radiator pressure cap
- Thermostat
- Coolant reserve/overflow system
- Transmission oil cooler (if equipped with an automatic transmission)
- Coolant
- Water pump
- Hoses and hose clamps

OPERATION

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible. It also maintains normal operating temperature and prevents overheating.

The cooling system also provides a source of hot water (coolant) for heating the passenger compartment. The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system.

- When engine is cold the thermostat is closed. The cooling system has no flow through the radiator. The coolant flows through the engine, water pump, and heater.
- When engine is warm the thermostat is full open. The coolant flows through the radiator, heater, and water pump.

All engines utilize an ambient overflow bottle for coolant recovery/reserve.

An optional factory installed maximum duty cooling package is available on most models. This package will provide additional cooling capacity for vehicles used under extreme conditions such as trailer towing in high ambient temperatures.

DIAGNOSIS AND TESTING

ON-BOARD DIAGNOSTICS (OBD)

COOLING SYSTEM RELATED DIAGNOSTICS

The powertrain control module (PCM) has been programmed to monitor certain cooling system components:

- If the engine has remained cool for too long a period, such as with a stuck open thermostat, a Diagnostic Trouble Code (DTC) can be set.
- If an open or shorted condition has developed in the relay circuit controlling the electric radiator fan, a Diagnostic Trouble Code (DTC) can be set.

If the problem is sensed in a monitored circuit often enough to indicated an actual problem, a DTC is stored. The DTC will be stored in the PCM memory for eventual display to the service technician. (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

ACCESSING DIAGNOSTIC TROUBLE CODES

To read DTC's and to obtain cooling system data, (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

ERASING TROUBLE CODES

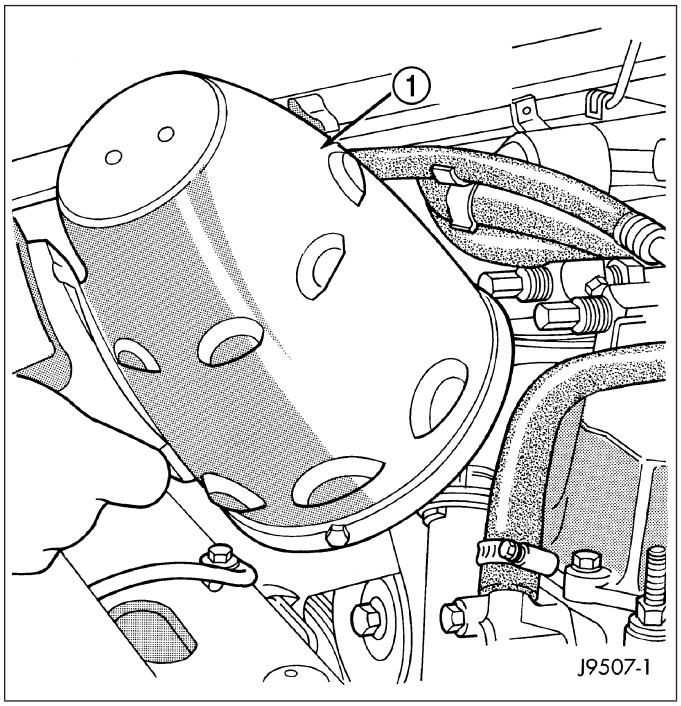
After the problem has been repaired, use the scan tool to erase a DTC. Refer to the appropriate Powertrain Diagnostic Procedures service information for operation of the scan tool.

COOLING SYSTEM - TESTING FOR LEAKS

ULTRAVIOLET LIGHT METHOD

A leak detection additive is available through the parts department that can be added to cooling system. The additive is highly visible under ultraviolet light (black light) (1). Pour one ounce of additive into cooling system. Place heater control unit in HEAT position. Start and operate engine until the radiator upper hose is warm to touch. Aim the commercially available black light tool at components to be checked. If leaks are present, black light will cause the additive to glow a bright green color.

The black light can be used in conjunction with a pressure tester to determine if any external leaks exist.



PRESSURE TESTER METHOD

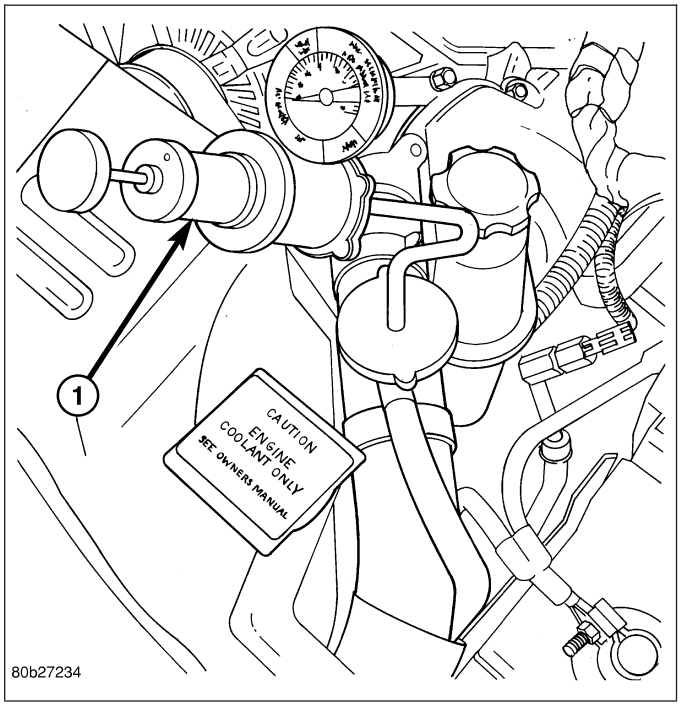
The engine should be at normal operating temperature. Recheck the system cold if the cause of coolant loss is not located during the warm engine examination.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING.

Carefully remove the radiator pressure cap from the filler neck and check coolant level. Push down on cap to disengage it from the stop tabs. Wipe the inside of filler neck and examine the lower inside sealing seat for nicks, cracks, paint, dirt and solder residue. Inspect the radiator-to- reserve/overflow tank hose for internal obstructions. Insert a wire through the hose to be sure it is not obstructed.

Inspect cams on the outside of filler neck. If the cams are damaged, seating of the pressure cap valve and tester seal will be affected.

Attach pressure tester (7700 or an equivalent) to radiator filler neck (1).



Operate tester pump to apply 103.4 kPa (15 psi) pressure to system. If hoses enlarge excessively or bulge while testing, replace as necessary. Observe the gauge pointer and determine the condition of the cooling system according to the following criteria:

Holds Steady: If the pointer remains steady for two minutes, serious coolant leaks are not present in system. However, there could be an internal leak that does not appear with normal system test pressure. If it is certain that coolant is being lost and leaks cannot be detected, inspect for interior leakage or perform Internal Leakage Test. Refer to INTERNAL LEAKAGE INSPECTION .

Drops Slowly: Indicates a small leak or seepage is occurring. Examine all connections for seepage or slight leakage with a flashlight. Inspect radiator, hoses, gasket edges and heater. Seal small leak holes with a Sealer Lubricant (or equivalent). Repair leak holes and inspect system again with pressure applied.

Drops Quickly: Indicates that serious leakage is occurring. Examine system for external leakage. If leaks are not visible, inspect for internal leakage. Large radiator leak holes should be repaired by a reputable radiator repair shop.

INTERNAL LEAKAGE INSPECTION

Remove engine oil pan drain plug and drain a small amount of engine oil. If coolant is present in the pan, it will drain first because it is heavier than oil. An alternative method is to operate engine for a short period to churn the oil. After this is done, remove engine dipstick and inspect for water globules. Also inspect the transmission dipstick for water globules and the transmission fluid cooler for leakage.

WARNING: WITH RADIATOR PRESSURE TESTER TOOL INSTALLED ON RADIATOR, DO NOT ALLOW PRESSURE TO EXCEED 145 KPA (21 PSI). PRESSURE WILL BUILD UP QUICKLY IF A COMBUSTION LEAK IS PRESENT. TO RELEASE PRESSURE, ROCK TESTER FROM SIDE TO SIDE. WHEN REMOVING TESTER, DO NOT TURN TESTER MORE THAN 1/2 TURN IF SYSTEM IS UNDER PRESSURE.

Operate the engine without the pressure cap on the radiator until the thermostat opens. Attach a Pressure Tester to filler neck. If pressure builds up quickly it indicates a combustion leak exists. This is usually the result of a cylinder head gasket leak or crack in engine. Repair as necessary.

If there is not an immediate pressure increase, pump the Pressure Tester. Do this until indicated pressure is within system range of 110 kPa (16 psi). Fluctuation of gauge pointer indicates compression or combustion leakage into cooling system.

Because the vehicle is equipped with a catalytic converter, **do not** remove spark plug cables or short out cylinders to isolate compression leak.

If the needle on the dial of pressure tester does not fluctuate, race engine a few times to check for an abnormal amount of coolant or steam. This would be emitting from exhaust pipe. Coolant or steam from exhaust pipe may indicate a faulty cylinder head gasket, cracked engine cylinder block or cylinder head.

A convenient check for exhaust gas leakage into cooling system is provided by a commercially available Block Leak Check tool. Follow manufacturers instructions when using this product.

COMBUSTION LEAKAGE TEST - WITHOUT PRESSURE TESTER

DO NOT WASTE reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

WARNING: DO NOT REMOVE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

Drain sufficient coolant to allow thermostat removal (Refer to 7 - COOLING - STANDARD PROCEDURE). Remove accessory drive belt or (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

Add coolant to radiator to bring level to within 6.3 mm (1/4 in) of the top of the thermostat housing.

CAUTION: Avoid overheating. Do not operate engine for an excessive period of time. Open draincock immediately after test to eliminate boil over.

Start engine and accelerate rapidly three times, to approximately 3000 rpm while observing coolant. If internal engine combustion gases are leaking into cooling system, bubbles will appear in coolant. If bubbles do not appear, internal combustion gas leakage is not present.

PRELIMINARY CHECKS

ENGINE COOLING SYSTEM OVERHEATING

Establish what driving conditions caused the complaint. Abnormal loads on the cooling system such as the following may be the cause:

- Prolonged idle
- Very high ambient temperature

- Slight tail wind at idle
- Slow traffic
- Traffic jams
- High speed or steep grades

Driving techniques that avoid overheating are:

- Idle with A/C off when temperature gauge is at end of normal range.
- Increasing engine speed for more air flow is recommended.

TRAILER TOWING:

Consult Trailer Towing section of owners manual. Do not exceed limits.

RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on vehicle that may effect cooling system. This may be:

- Engine adjustments (incorrect timing)
- Slipping engine accessory drive belt(s)
- Brakes (possibly dragging)
- Changed parts. Incorrect water pump or pump rotating in wrong direction due to belt not correctly routed
- Reconditioned radiator or cooling system refilling (possibly under filled or air trapped in system).

NOTE: If investigation reveals none of the previous items as a cause for an engine overheating complaint, refer to COOLING SYSTEM DIAGNOSIS CHART BELOW.

These charts are to be used as a quick-reference only. Refer to COOLING SYSTEM DIAGNOSIS CHART

COOLING SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open thermostat?	1. (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION). Replace thermostat if necessary.
	2. Is the temperature sending unit connected?	2. Check the temperature sensor connector. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING) . Repair connector if necessary.
	3. Is the temperature gauge operating OK?	3. Check gauge operation. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/ENGINE TEMPERATURE GAUGE - DESCRIPTION). Repair as necessary.
	4. Coolant level low in cold ambient temperatures accompanied with poor heater performance.	4. Check coolant level in the coolant reserve/overflow tank or degas bottle and the radiator. Inspect system for leaks. Repair leaks as necessary. Refer to the Coolant section of the manual text for WARNINGS and CAUTIONS associated with removing the radiator cap.
	5. Improper operation of internal heater doors or heater controls.	5. Inspect heater and repair as necessary. (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING) .

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS HIGH OR THE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM THE COOLING SYSTEM	1. Trailer is being towed, a steep hill is being climbed, vehicle is operated in slow moving traffic, or engine is being idled with very high ambient (outside) temperatures and the air conditioning is on. Higher altitudes could aggravate these conditions.	1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and attempt to drive the vehicle without any of the previous conditions. Observe the temperature gauge. The gauge should return to the normal range. If the gauge does not return to the normal range, determine the cause for overheating and repair. Refer to Possible Causes (2-18).
	2. Is the temperature gauge reading correctly?	2. Check gauge. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Repair as necessary.
	3. Is the temperature warning illuminating unnecessarily?	3. (Refer to 8 - ELECTRICAL/ INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).
	4. Coolant low in coolant reserve/ overflow tank and radiator?	4. Check for coolant leaks and repair as necessary. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following Step 6.	5. Tighten cap
	6. Poor seals at the radiator cap.	6. (a) Check condition of cap and cap seals. Refer to Radiator Cap. Replace cap if necessary. (b) Check condition of radiator filler neck or degas bottle. If neck is bent or damaged, replace radiator or degas bottle.
	7. Coolant level low in radiator but not in coolant reserve/overflow tank. This means the radiator is not drawing coolant from the coolant reserve/overflow tank as the engine cools	7. (a) Check condition of radiator cap and cap seals. Refer to Radiator Cap in this Group. Replace cap if necessary. (b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator. (c) Check condition of the hose from the radiator to the coolant tank. It should fit tight at both ends without any kinks or tears. Replace hose if necessary. (d) Check coolant reserve/overflow tank and tanks hoses for blockage. Repair as necessary.
	8. Incorrect coolant concentration	8. Check coolant. (Refer to LUBRICATION & MAINTENANCE/ FLUID TYPES - DESCRIPTION)

CONDITION	POSSIBLE CAUSES	CORRECTION
	9. Coolant not flowing through system	9. Check for coolant flow at radiator filler neck with some coolant removed, engine warm and thermostat open. Coolant should be observed flowing through radiator. If flow is not observed, determine area of obstruction and repair as necessary.
	10. Radiator or A/C condenser fins are dirty or clogged.	10. Remove insects and debris. (Refer to 7 - COOLING - STANDARD PROCEDURE).
	11. Radiator core is corroded or plugged.	11. Have radiator re-cored or replaced.
	13. Dragging brakes	13. Check and correct as necessary. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)
	12. Fuel or ignition system problems.	12. Refer to 14 - Fuel System or 8 - Electrical for diagnosis and testing procedures.
	14. Bug screen or cardboard is being , reducing airflow.	14. Remove bug screen or cardboard.
	15. Thermostat partially or completely shut.	15. Check thermostat operation and replace as necessary. (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL).
	16. Viscous fan drive not operating properly.	16. Check fan drive operation and replace as necessary (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - DIAGNOSIS AND TESTING).
	17. Cylinder head gasket leaking.	17. Check for cylinder head gasket leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	18. Heater core leaking.	18. Check heater core for leaks. (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING). Repair as necessary.

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READING IS INCONSISTANT (FLUCTUATES, CYCLES, OR IS ERRATIC	1. During cold weather operation, with the heater in the high position, the gauge reading may drop slightly.	1. During cold weather operation, with the heater in the high position, the gauge reading may drop slightly.
	2. Temperature gauge or engine mounted gauge sensor defective or shorted. Also, corroded or loose wiring in this circuit.	2. Check operation of gauge and repair if necessary. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).
	3. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running)	3. A normal condition. No correction is necessary. Gauge should return to normal range after vehicle is driven.
	4. Gauge reading high after re-starting a warmed up (hot) engine.	4. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation.
	5. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late).	5. Check and correct coolant leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	6. Cylinder head gasket leaking allowing exhaust gas to enter cooling system causing a thermostat to open late.	6. (a) Check for cylinder head gasket leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). (b) Check for coolant in the engine oil. Inspect for white steam emitting from the exhaust system. Repair as necessary.
	7. Water pump impeller loose on shaft.	7. Check water pump and replace as necessary. (Refer to 7 - COOLING/ENGINE/WATER PUMP - REMOVAL).
	8. Loose accessory drive belt. (water pump slipping)	8.. Check and correct as necessary (Refer to 7 - COOLING/ENGINE/ RADIATOR FAN - DIAGNOSIS AND TESTING).
	9. Air leak on the suction side of the water pump allows air to build up in cooling system causing thermostat to open late.	9. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT TO COOLANT TANK. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT RESERVE/ OVERFLOW TANK	1. Pressure relief valve in radiator cap is defective.	1. Check condition of radiator cap and cap seals. (Refer to 7 - COOLING/ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). Replace cap as necessary.

CONDITION	POSSIBLE CAUSES	CORRECTION
COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE READING HIGH OR HOT	1. Coolant leaks in radiator, cooling system hoses, water pump or engine.	1. Pressure test and repair as necessary. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH	1. Engine overheating. 2. Freeze point of coolant not correct. Mixture is too rich or too lean.	1. Check reason for overheating and repair as necessary. 2. Check coolant concentration. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).
HOSE OR HOSES COLLAPSE WHILE ENGINE IS RUNNING	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant reserve/overflow system.	1. (a) Radiator cap relief valve stuck. (Refer to 7 - COOLING/ ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). Replace if necessary (b) Hose between coolant reserve/overflow tank and radiator is kinked. Repair as necessary. (c) Vent at coolant reserve/overflow tank is plugged. Clean vent and repair as necessary. (d) Reserve/overflow tank is internally blocked or plugged. Check for blockage and repair as necessary.
NOISY VISCOUS FAN/DRIVE	1. Fan blades loose. 2. Fan blades striking a surrounding object. 3. Air obstructions at radiator or air conditioning condenser. 4. Thermal viscous fan drive has defective bearing. 5. A certain amount of fan noise may be evident on models equipped with a thermal viscous fan drive. Some of this noise is normal.	1. Replace fan blade assembly (Refer to 7 - COOLING/ENGINE/ RADIATOR FAN - REMOVAL). 2. Locate point of fan blade contact and repair as necessary. 3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser. 4. Replace fan drive. Bearing is not serviceable. (Refer to 7 - COOLING/ ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL) 5. Refer to (Refer to 7 - COOLING/ ENGINE/RADIATOR FAN - DESCRIPTION) for an explanation of normal fan noise.

CONDITION	POSSIBLE CAUSES	CORRECTION
INADEQUATE HEATER PERFORMANCE. THERMOSTAT FAILED IN OPEN POSITION	1. Has a Diagnostic trouble Code (DTC) been set?	1. (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION) for correct procedures and replace thermostat if necessary
	2. Coolant level low	2. (Refer to 7 - COOLING - STANDARD PROCEDURE)
	3. Obstructions in heater hose/ fittings	3. Remove heater hoses at both ends and check for obstructions
	4. Heater hose kinked	4. Locate kinked area and repair as necessary
	5. Water pump is not pumping water to/through the heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. If only one of the hoses is hot, the water pump may not be operating correctly or the heater core may be plugged. Accessory drive belt may be slipping causing poor water pump operation.	5. (Refer to 7 - COOLING/ENGINE/ WATER PUMP - REMOVAL) If a slipping belt is detected, (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - DIAGNOSIS AND TESTING). If heater core obstruction is detected, (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING).
STEAM IS COMING FROM THE FRONT OF VEHICLE NEAR THE GRILL AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP AND RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. During wet weather, moisture (snow, ice or rain condensation) on the radiator will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contacts the hot radiator, steam may be emitted. This usually occurs in cold weather with no fan or airflow to blow it away.	1. Occasional steam emitting from this area is normal. No repair is necessary.
COOLANT COLOR	1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant.	1. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION) Adjust coolant mixture as necessary.
COOLANT LEVEL CHANGES IN COOLANT RESERVE/OVERFLOW TANK. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the tank was between the FULL and ADD marks at normal operating temperature, the level should return to within that range after operation at elevated temperatures.	1. A normal condition. No repair is necessary.

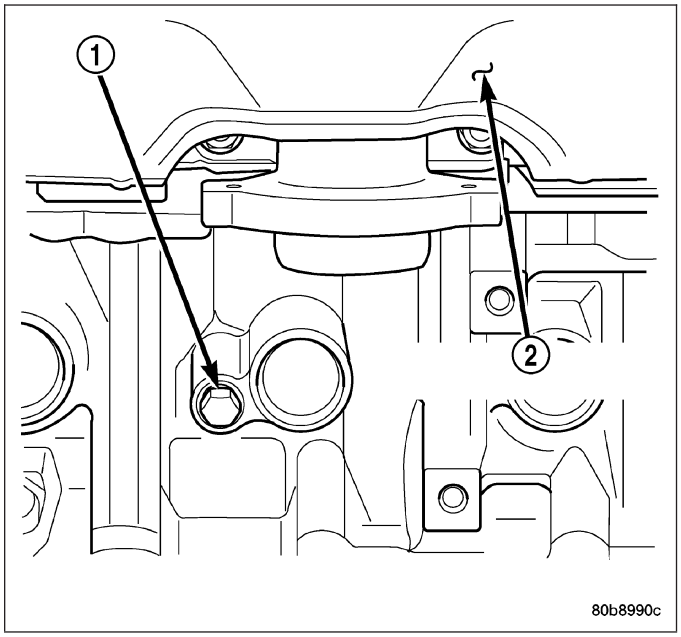
STANDARD PROCEDURE

DRAINING COOLING SYSTEM - ALL ENGINES

WARNING: DO NOT REMOVE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN RADIATOR DRAIN-COCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

1. Remove radiator pressure cap.
2. Loosen radiator petcock.
3. Remove cylinder block drain plugs (1).



REFILLING COOLING SYSTEM

WARNING: DO NOT REMOVE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

Clean cooling system prior to refilling. (Refer to 7 - COOLING - STANDARD PROCEDURE).

1. Install cylinder block drain plugs. Coat the threads with Mopar® Thread Sealant with Teflon.
2. Close radiator petcock.
3. Fill cooling system with a 50/50 mixture of water and antifreeze (Refer to LUBRICATION & MAINTENANCE/ FLUID TYPES - DESCRIPTION).
4. Fill coolant reserve/overflow tank to MAX mark on indicator stick.
5. Start and operate engine until thermostat opens (upper radiator hose warm to touch).
6. If necessary, add antifreeze mixture (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION), to the coolant reserve/overflow tank. This is done to maintain coolant level between the MAX and MIN marks. The level in the reserve/overflow tank may drop below the MIN mark after three or four warm-up and cool-down cycles.

ADDING ADDITIONAL COOLANT

The use of aluminum cylinder blocks, cylinder heads and water pumps requires special corrosion protection. In order to maintain the required protection for these components and cooling system performance, only use the appropriate fluid (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION) when servicing the vehicle. This coolant offers the best engine cooling without corrosion when mixed with 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution. This coolant offers the best engine cooling without corrosion when mixed with 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

CAUTION: Do not use coolant additives that are claimed to improve engine cooling.

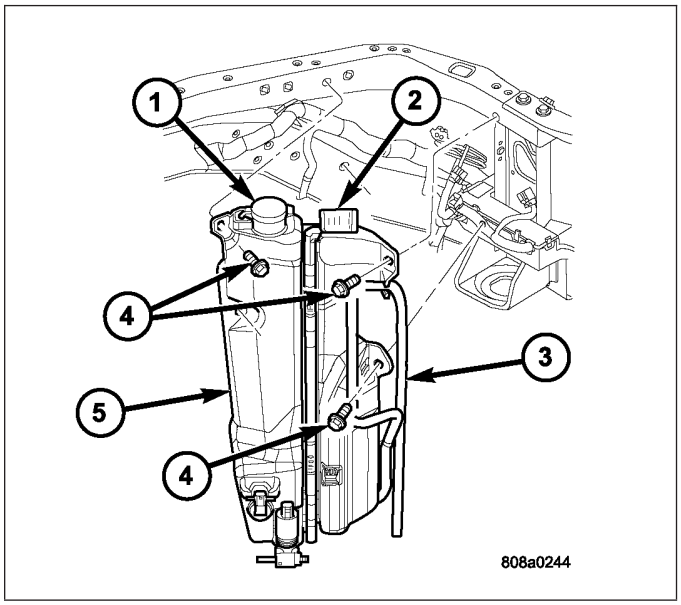
Do not remove the radiator cap to add coolant to the system. When adding coolant to maintain the correct level, do so only at the reserve/overflow bottle. Remove the radiator cap only for testing or when refilling the system after service. Removing the cap unnecessarily can cause loss of coolant and allow air to enter the system, which produces corrosion.

WARNING: DO NOT REMOVE OR LOOSEN THE RADIATOR CAP WITH THE COOLING SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM THE COOLANT OR HIGH PRESSURE STEAM CAN OCCUR.

COOLANT LEVEL CHECK

NOTE: Do not remove radiator cap for routine coolant level inspections. The coolant level can be checked at coolant recovery bottle (2).

The coolant reserve/overflow system (5) provides a quick method for determining coolant level without removing radiator pressure cap. With engine not running, open the coolant recovery bottle cap and remove coolant level indicator dipstick to observe coolant level in coolant recovery bottle. The coolant level should be between ADD and FULL marks. If the coolant level is at or below the ADD mark, fill the recovery bottle with a 50/50 mixture of antifreeze and water (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION) ONE QUART AT A TIME. Repeat this procedure until the coolant level is at the FULL mark.



COOLING SYSTEM CLEANING/REVERSE FLUSHING

CLEANING

Drain cooling system and refill with water. Run engine with radiator cap installed until upper radiator hose is hot. Stop engine and drain water from system. If water is dirty, fill system with water, run engine and drain system. Repeat until water drains clean.

REVERSE FLUSHING

Reverse flushing of cooling system is the forcing of water through the cooling system. This is done using air pressure in the opposite direction of normal coolant flow. It is usually only necessary with very dirty systems with evidence of partial plugging.

REVERSE FLUSHING RADIATOR

Disconnect radiator hoses from radiator inlet and outlet. Attach a section of radiator hose to radiator bottom outlet fitting and insert flushing gun. Connect a water supply hose and air supply hose to flushing gun.

CAUTION: Internal radiator pressure must not exceed 138 kPa (20 psi) as damage to radiator may result.

Allow radiator to fill with water. When radiator is filled, apply air in short blasts. Allow radiator to refill between blasts. Continue this reverse flushing until clean water flows out through rear of radiator cooling tube passages. Have radiator cleaned more extensively by a radiator repair shop.

REVERSE FLUSHING ENGINE

Drain cooling system. Remove thermostat housing and thermostat. Install thermostat housing. Disconnect radiator upper hose from radiator and attach flushing gun to hose. Disconnect radiator lower hose from water pump and attach a lead-away hose to water pump inlet fitting.

CAUTION: On vehicles equipped with a heater water control valve, be sure heater control valve is closed (heat off). This will prevent coolant flow with scale and other deposits from entering heater core.

Connect water supply hose and air supply hose to flushing gun. Allow engine to fill with water. When engine is filled, apply air in short blasts, allowing system to fill between air blasts. Continue until clean water flows through the lead away hose.

Remove lead away hose, flushing gun, water supply hose and air supply hose. Remove thermostat housing and install thermostat. Install thermostat housing with a replacement gasket. Refer to Thermostat Replacement. Connect radiator hoses. Refill cooling system with correct antifreeze/water mixture. Refer to Refilling the Cooling System.

CHEMICAL CLEANING

In some instances, use a radiator cleaner (Mopar Radiator Kleen or equivalent) before flushing. This will soften scale and other deposits and aid flushing operation.

CAUTION: Follow manufacturers instructions when using these products.

SPECIFICATIONS

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Automatic Belt Tensioner to Block - Bolts	41	30	-
Automatic Belt Tensioner Pulley - Bolt	61	45	-
Block Heater - Bolt	2	-	17
Generator/Compressor Mounting Bracket - Bolts -			
No. 1 and 2	54	40	-
No. 3	40	30	-
Fan Shroud Mounting - Bolts	6	-	50
Fan Blade to Fan Drive - Bolts	23	17	-
Idler Pulley - Bolt	54	40	-
Radiator to Support - Bolts	23	-	200
Thermostat Housing - Bolts - All Except 4.7L	23	-	200
Thermostat Housing - Bolts - 4.7L	13	-	112
Transmission Auxiliary Oil Cooler - Bolts	10	-	90
Upper Radiator Closure Panel - Bolts	10	-	90
Water Pump - Bolts	58	43	-

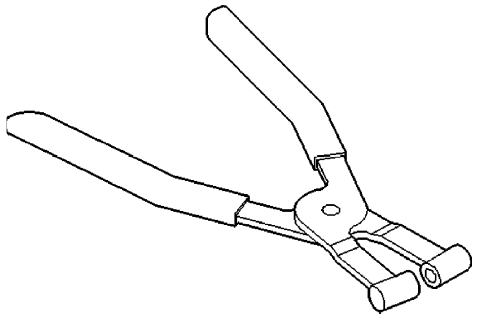
FILL VOLUMES

SPECIFICATIONS

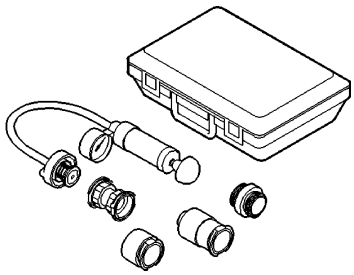
DESCRIPTION	SPECIFICATION	
	Metric	Standard
3.7L	15.4L	16.2 qts.- to the middle of the cold fill range
4.7L	15.4L	16.3 qts.
5.7L	15.4L	16.2 qts.

SPECIAL TOOLS

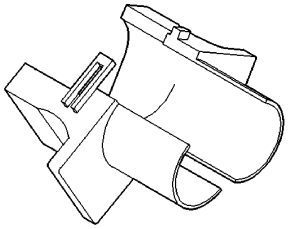
COOLING



Pliers Constant Pressure Hose Clamp - 6094



Cooling System Pressure Tester - 7700A



3/8” Quick Connect Release Tool - 6935

ACCESSORY DRIVE

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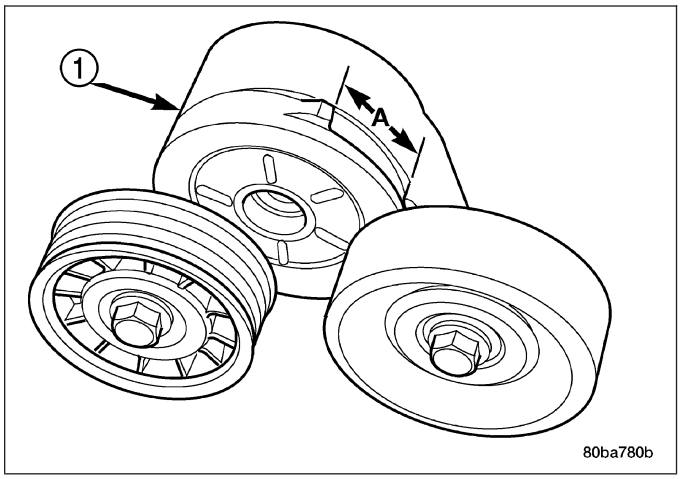
TENSIONERS-BELT

DESCRIPTION

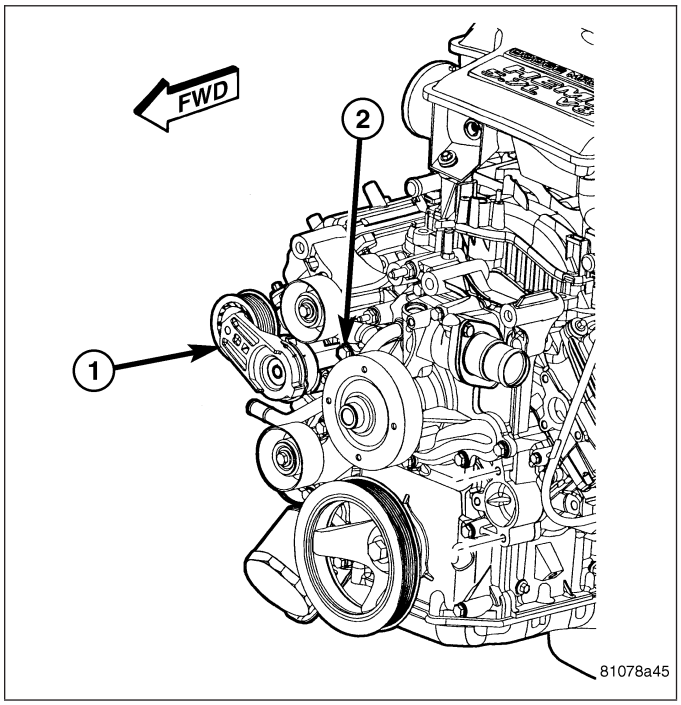
Correct drive belt tension is required to ensure optimum performance of the belt driven engine accessories. If specified tension is not maintained, belt slippage may cause; engine overheating, lack of power steering assist, loss of air conditioning capacity, reduced generator output rate, and greatly reduced belt life.

It is not necessary to adjust belt tension on the 3/7L and 4.7L engines. These engines are equipped with an automatic belt tensioner (1). The tensioner maintains correct belt tension at all times. Due to use of this belt tensioner, do not attempt to use a belt tension gauge on these engines.



OPERATION

The automatic belt tensioner maintains belt tension by using internal spring pressure, a pivoting arm and pulley to press against the drive belt.



REMOVAL

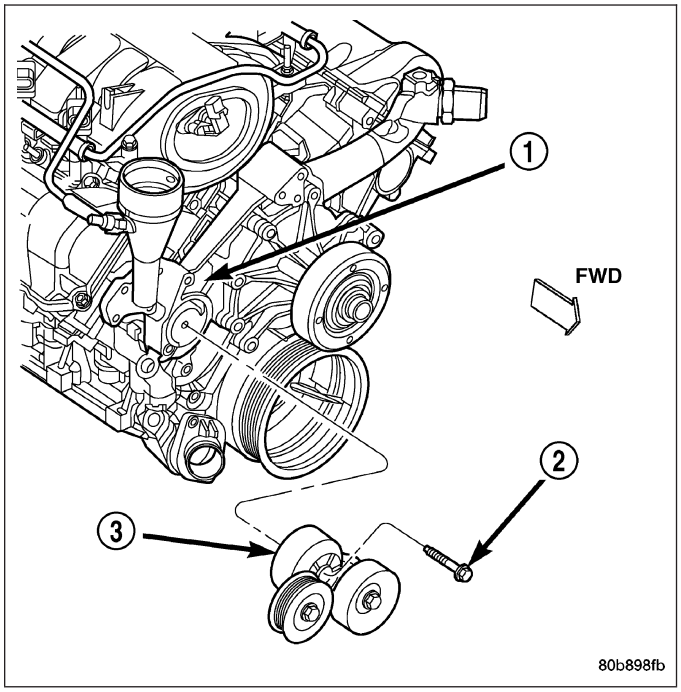
3.7L/4.7L ENGINE

On 4.7L engines, the tensioner (3) is equipped with an indexing tang on back of tensioner and an indexing stop on tensioner housing. If a new belt is being installed, tang must be within approximately 24 mm (.94 inches) of indexing stop. Belt is considered new if it has been used 15 minutes or less.

If the above specification cannot be met, check for:

- The wrong belt being installed (incorrect length/ width)
- Worn bearings on an engine accessory (A/C compressor, power steering pump, water pump, idler pulley or generator)
- A pulley on an engine accessory being loose
- Misalignment of an engine accessory
- Belt incorrectly routed.

NOTE: A used belt should be replaced if tensioner indexing arrow has moved to the minmum tension indicator. Tensioner travel stops at this point.



1. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
2. Remove tensioner assembly from mounting bracket (1).

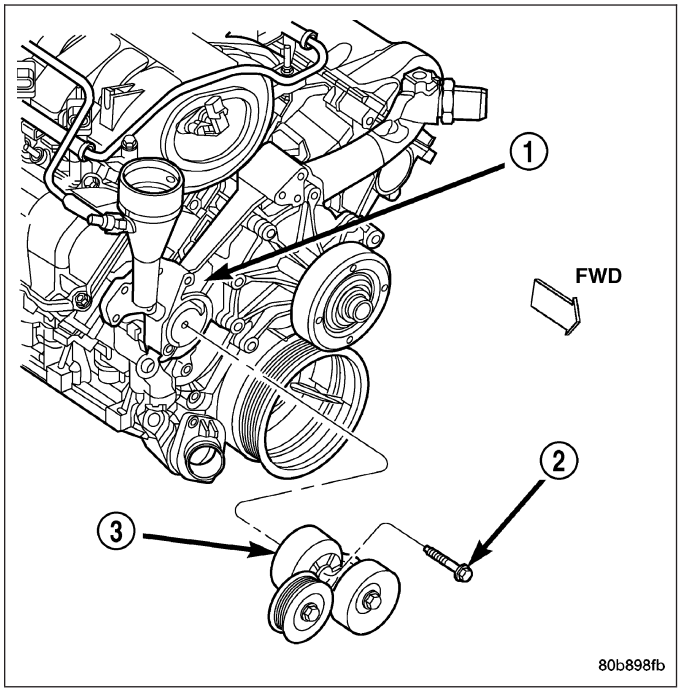
WARNING: BECAUSE OF HIGH SPRING PRESSURE, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY EXCEPT FOR PULLEY ON TENSIONER.

3. Remove pulley bolt. Remove pulley from tensioner.

INSTALLATION

3.7L/4.7L ENGINE

1. Install pulley and pulley bolt to tensioner. Tighten bolt to 61 N·m (45 ft. lbs.) torque.
2. An indexing slot is located on back of tensioner. Align this slot to the head of the bolt on the front cover. Install the mounting bolt. Tighten bolt to 41 N·m (30 ft. lbs.).
3. Install accessory drive belt (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
4. Check belt indexing marks.



BELTS-DRIVE

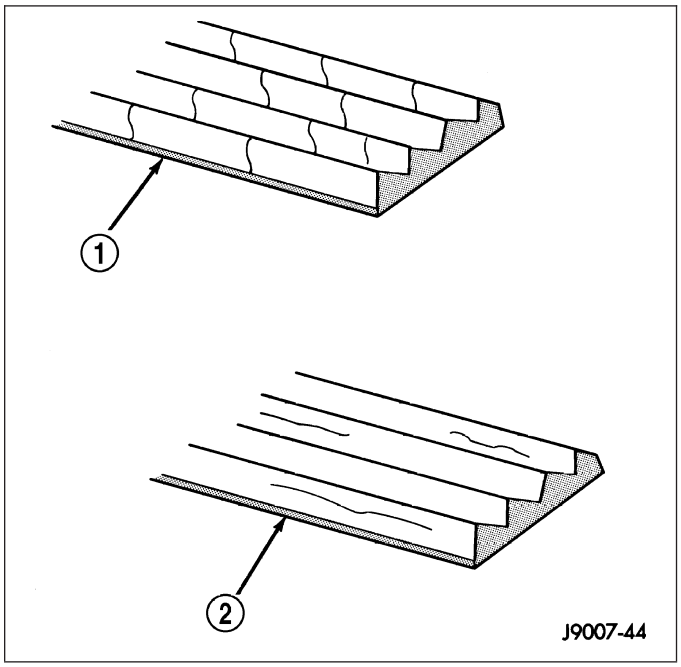
DIAGNOSIS AND TESTING

ACCESSORY DRIVE BELT

VISUAL DIAGNOSIS

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib , are considered normal. These are not a reason to replace the belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must be replaced. Also replace the belt if it has excessive wear, frayed cords or severe glazing.

Refer to ACCESSORY DRIVE BELT DIAGNOSIS CHART for further belt diagnosis.



NOISE DIAGNOSIS

Noises generated by the accessory drive belt are most noticeable at idle. Before replacing a belt to resolve a noise condition, inspect all of the accessory drive pulleys for alignment, glazing, or excessive end play.

ACCESSORY DRIVE BELT DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
RIB CHUNKING (One or more ribs has separated from belt body)	1. Foreign objects imbedded in pulley grooves.	1. Remove foreign objects from pulley grooves. Replace belt.
	2. Installation damage	2. Replace belt
RIB OR BELT WEAR	1. Pulley misaligned	1. Align pulley(s)
	2. Abrasive environment	2. Clean pulley(s). Replace belt if necessary
	3. Rusted pulley(s)	3. Clean rust from pulley(s)
	4. Sharp or jagged pulley groove tips	4. Replace pulley. Inspect belt.
	5. Belt rubber deteriorated	5. Replace belt
BELT SLIPS	1. Belt slipping because of insufficient tension	1. Inspect/Replace tensioner if necessary
	2. Belt or pulley exposed to substance that has reduced friction (belt dressing, oil, ethylene glycol)	2. Replace belt and clean pulleys
	3. Driven component bearing failure (seizure)	3. Replace faulty component or bearing
	4. Belt glazed or hardened from heat and excessive slippage	4. Replace belt.
LONGITUDAL BELT CRACKING	1. Belt has mistracked from pulley groove	1. Replace belt
	2. Pulley groove tip has worn away rubber to tensile member	2. Replace belt
″GROOVE JUMPING″ (Belt does not maintain correct position on pulley)	1. Incorrect belt tension	1. Inspect/Replace tensioner if necessary
	2. Pulley(s) not within design tolerance	2. Replace pulley(s)
	3. Foreign object(s) in grooves	3. Remove foreign objects from grooves
	4. Pulley misalignment	4. Align component
	5. Belt cordline is broken	5. Replace belt
BELT BROKEN (Note: Identify and correct problem before new belt is installed)	1. Incorrect belt tension	1. Replace Inspect/Replace tensioner if necessary
	2. Tensile member damaged during belt installation	2. Replace belt
	3. Severe misalignment	3. Align pulley(s)
	4. Bracket, pulley, or bearing failure	4. Replace defective component and belt

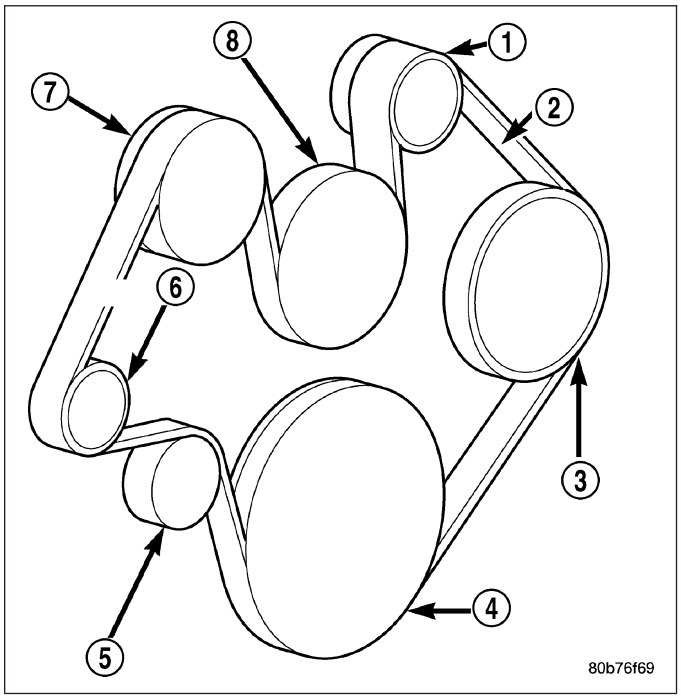
CONDITION	POSSIBLE CAUSES	CORRECTION
NOISE (Objectionable squeal, squeak, or rumble is heard or felt while drive belt is in operation)	1. Incorrect belt tension	1. Inspect/Replace tensioner if necessary
	2. Bearing noise	2. Locate and repair
	3. Belt misalignment	3. Align belt/pulley(s)
	4. Belt to pulley mismatch	4. Install correct belt
	5. Driven component induced vibration	5. Locate defective driven component and repair
TENSION SHEETING FABRIC FAILURE (Woven fabric on outside, circumference of belt has cracked or separated from body of belt)	1. Tension sheeting contacting stationary object	1. Correct rubbing condition
	2. Excessive heat causing woven fabric to age	2. Replace belt
	3. Tension sheeting splice has fractured	3. Replace belt
CORD EDGE FAILURE (Tensile member exposed at edges of belt or separated from belt body)	1. Incorrect belt tension	1. Inspect/Replace tensioner if necessary
	2. Belt contacting stationary object	2. Replace belt
	3. Pulley(s) out of tolerance	3. Replace pulley
	4. Insufficient adhesion between tensile member and rubber matrix	4. Replace belt

REMOVAL - 3.7L/4.7L

CAUTION: DO NOT LET TENSIONER ARM SNAP BACK TO THE FREEARM POSITION, SEVER DAMAGE MAY OCCUR TO THE TENSIONER.

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

1. Disconnect negative battery cable from battery.
2. Rotate belt tensioner (6) until it contacts it's stop. Remove belt (2), then slowly rotate the tensioner (6) into the freearm position.

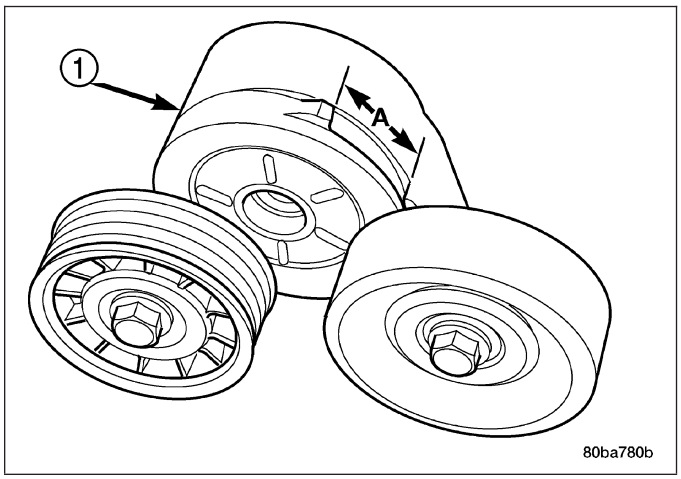


INSTALLATION - 3.7L/4.7L

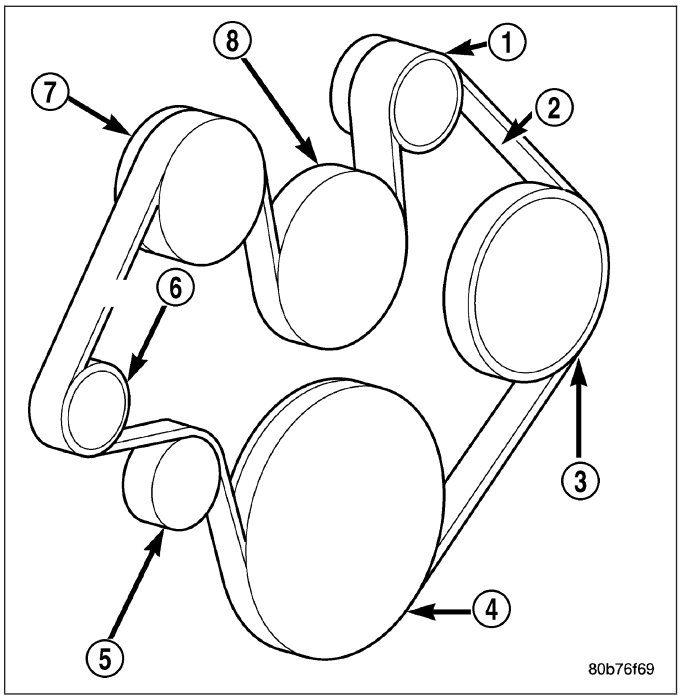
Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

1. Check condition of all pulleys.

CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction.



2. Install new belt. Route the belt around all pulleys except the idler pulley (5). Rotate the tensioner arm until it contacts it's stop position. Route the belt around the idler (5) and slowly let the tensioner rotate into the belt. Make sure the belt is seated onto all pulleys.
3. With the drive belt installed, inspect the belt wear indicator. On 4.7L Engines only, the gap between the tang and the housing stop (measurement A) must not exceed 24 mm (.94 inches). If the measurement exceeds this specification replace the serpentine accessory drive belt.



ENGINE

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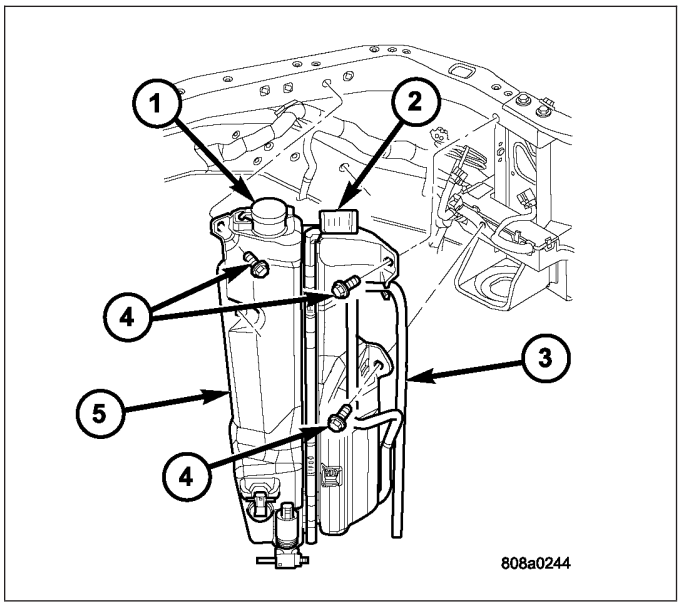
CONTAINER-COOLANT RECOVERY

DESCRIPTION

The coolant recovery containeris integral to the upper fan shroud assembly and is made of high temperature plastic.



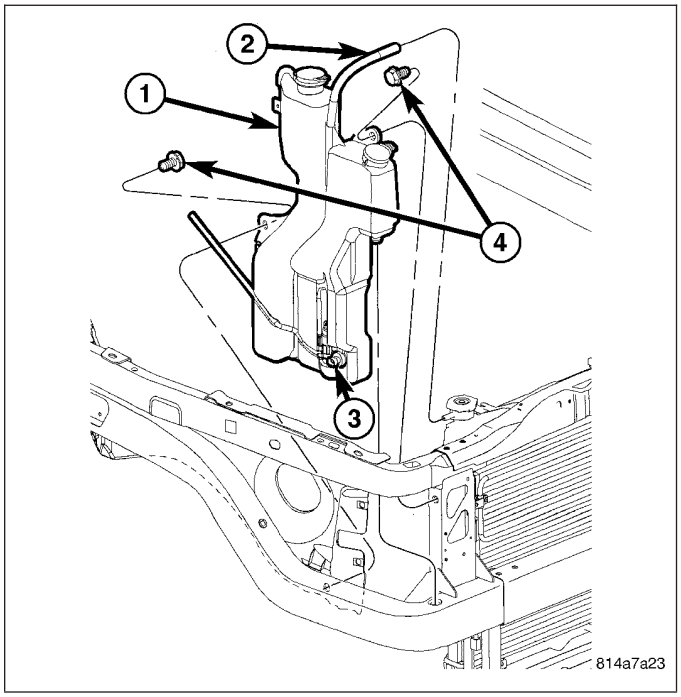
OPERATION

The coolant recovery container works in conjunction with the radiator pressure cap. It utilizes thermal expansion and contraction of coolant to keep coolant free of trapped air. It provides a volume for expansion and contraction of coolant. It also provides a convenient and safe method for checking coolant level and adjusting level at atmospheric pressure. This is done without removing the radiator pressure cap. The system also provides some reserve coolant to the radiator to cover minor leaks and evaporation or boiling losses.

As the engine cools, a vacuum is formed in the cooling system of both the radiator and engine. Coolant will then be drawn from the coolant tank and returned to a proper level in the radiator.

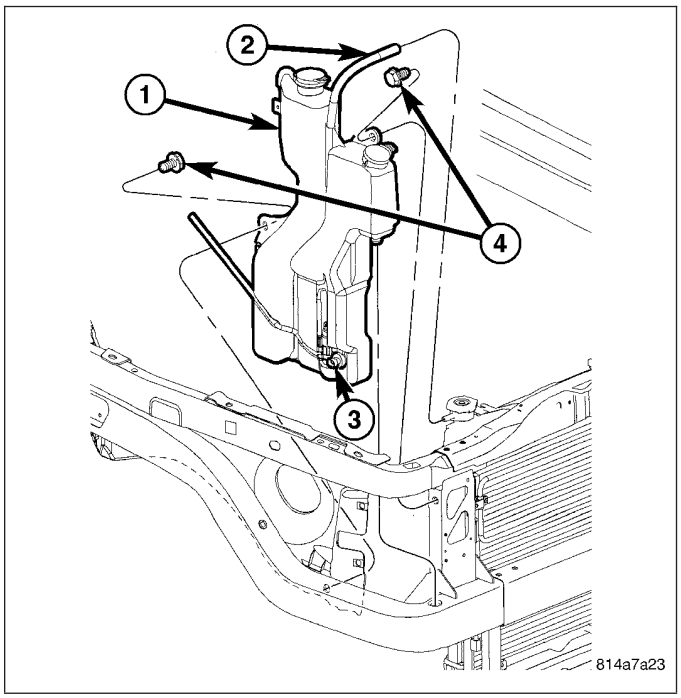
REMOVAL

1. Remove RH radiator seal.
2. Remove coolant recovery container hose (2).
3. Disconnect washer pump electrical connector (3).
4. Remove coolant recovery container mounting bolts (4) and clip.
5. Remove coolant recovery container (1) from vehicle



INSTALLATION

1. Position coolant recovery container(1) in vehicel.
2. Install coolant recovery container mounting bolts and clip. Tighten bolts to 8.5 N·m (75 in. lbs.).
3. Connect washer pump electrical connector (3).
4. Connect coolant recover container hose (2) to radiator.
5. Fill collant recover container with windshield washer fluid and with coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

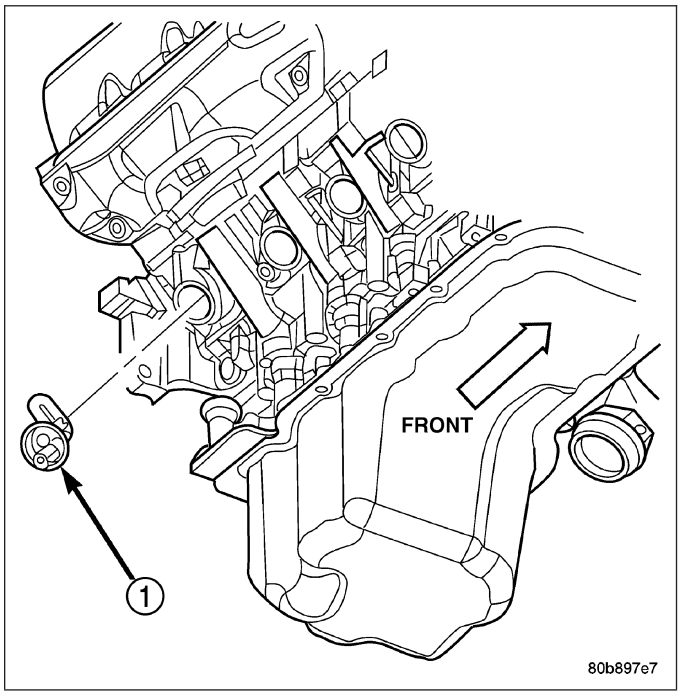


HEATER-ENGINE BLOCK

DESCRIPTION

WARNING: DO NOT OPERATE ENGINE UNLESS BLOCK HEATER CORD HAS BEEN DISCONNECTED FROM POWER SOURCE AND SECURED IN PLACE. THE POWER CORD MUST BE SECURED IN ITS RETAINING CLIPS AND ROUTED AWAY FROM EXHAUST MANIFOLDS AND MOVING PARTS.

An optional engine block heater is available on all models. The heater is equipped with a power cord. The heater is mounted in a core hole of the engine cylinder block (1) (in place of a freeze plug) with the heating element immersed in engine coolant. The cord is attached to an engine compartment component with tie-straps.



OPERATION

The heater warms the engine coolant providing easier engine starting and faster warm-up in low temperatures. Connecting the power cord to a grounded 110-120 volt AC electrical outlet with a grounded three wire extension cord provides the electricity needed to heat the element..

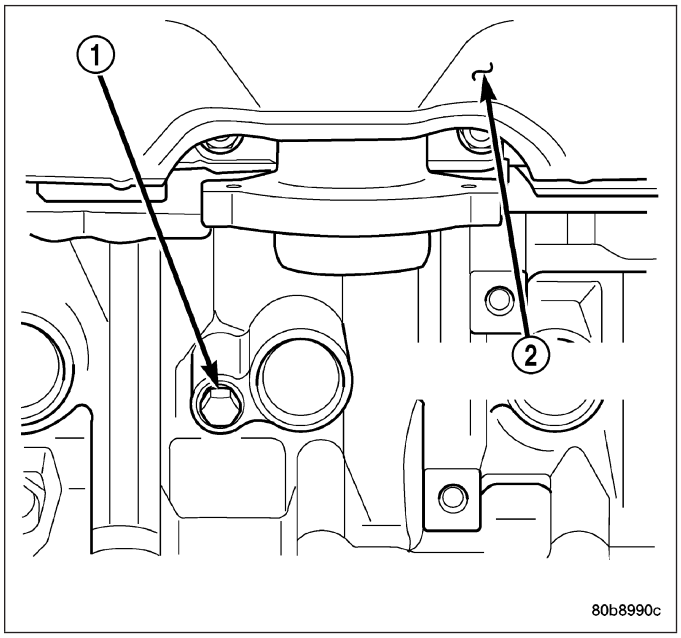
DIAGNOSIS AND TESTING - ENGINE BLOCK HEATER

If the unit does not operate, possible causes can be either the power cord or the heater element. Test the power cord for continuity with a 110-volt voltmeter or 110-volt test light. Test heater element continuity with an ohmmeter or a 12-volt test light.

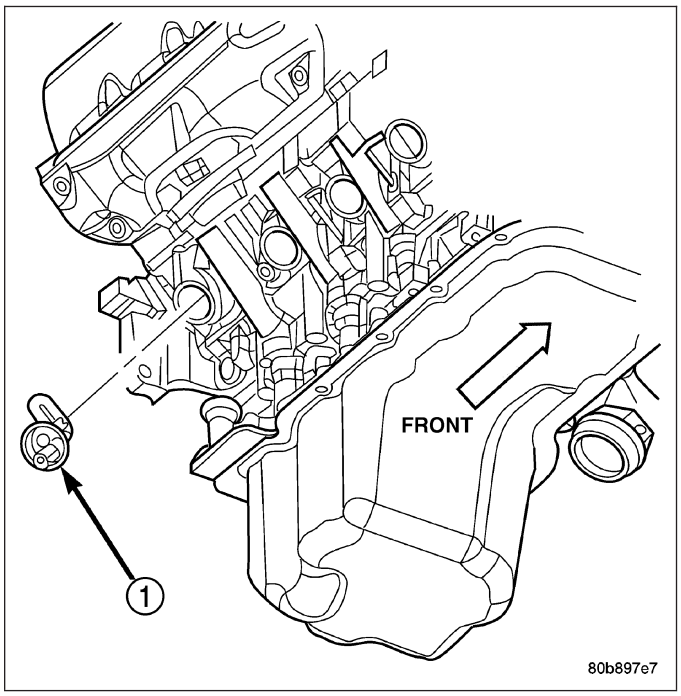
CAUTION: To prevent damage, the power cord must be secured in it's retainer clips and away from any components that may cause abrasion or damage, such as linkages, exhaust components, etc.

REMOVAL

1. Disconnect negative battery cable from battery.
2. Drain coolant from radiator (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Raise vehicle.
4. Remove engine cylinder block drain plug(s) (1) located on the sides of cylinder block above the oil pan rail.

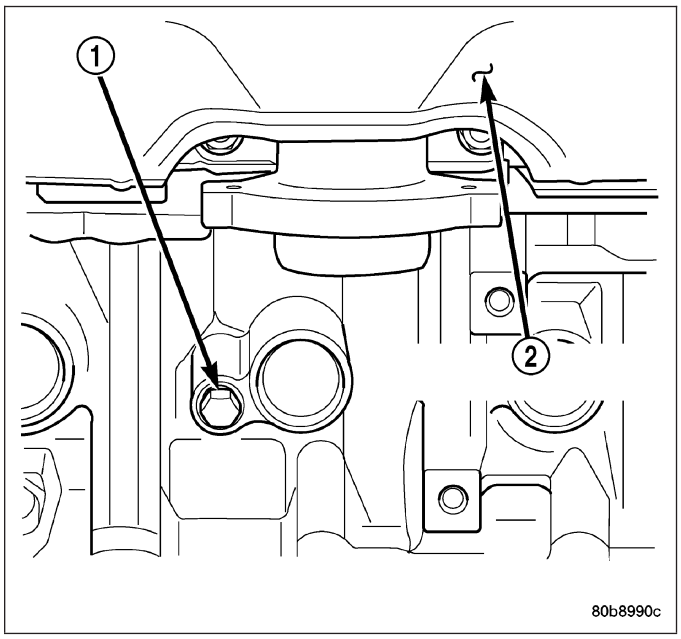


5. Remove power cord from block heater.
6. Loosen screw at center of block heater. Remove heater assembly (1).

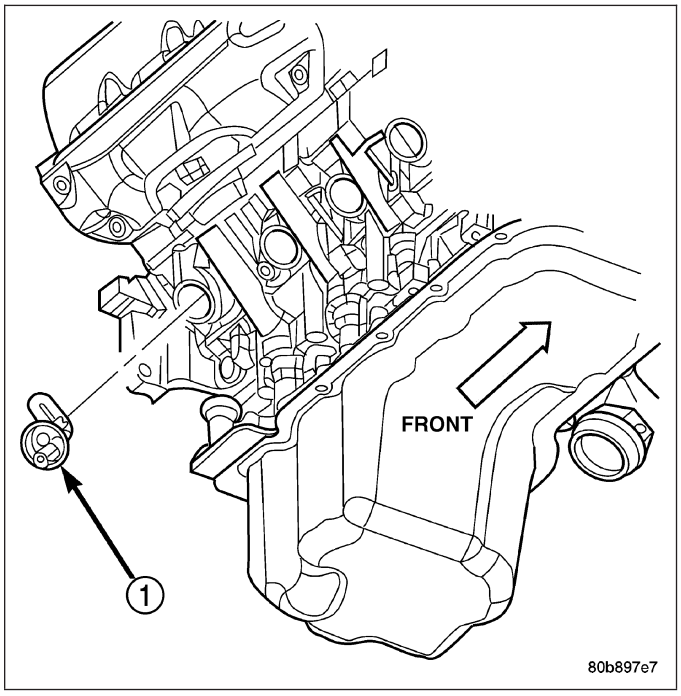


INSTALLATION

1. Install block drain plugs.



2. Thoroughly clean cylinder block core hole and block heater seat.
3. Insert block heater assembly with element loop pointing at twelve o'clock.
4. With block heater fully seated, tighten center screw to 2 N·m (17 in. lbs.) torque.
5. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
6. Start and warm the engine. Check for leaks.



SENSOR-ENGINE COOLANT TEMPERATURE

DESCRIPTION

The Engine Coolant Temperature (ECT) sensor is used to sense engine coolant temperature. The sensor protrudes into an engine water jacket.

The ECT sensor is a two-wire Negative Thermal Coefficient (NTC) sensor. Meaning, as engine coolant temperature increases, resistance (voltage) in the sensor decreases. As temperature decreases, resistance (voltage) in the sensor increases.

OPERATION

At key-on, the Powertrain Control Module (PCM) sends out a regulated 5 volt signal to the ECT sensor. The PCM then monitors the signal as it passes through the ECT sensor to the sensor ground (sensor return).

When the engine is cold, the PCM will operate in Open Loop cycle. It will demand slightly richer air-fuel mixtures and higher idle speeds. This is done until normal operating temperatures are reached.

The PCM uses inputs from the ECT sensor for the following calculations:

- for engine coolant temperature gauge operation through CCD or PCI (J1850) communications
- Injector pulse-width
- Spark-advance curves
- ASD relay shut-down times
- Idle Air Control (IAC) motor key-on steps
- Pulse-width prime-shot during cranking
- O2 sensor closed loop times
- Purge solenoid on/off times
- EGR solenoid on/off times (if equipped)
- Leak Detection Pump operation (if equipped)
- Radiator fan relay on/off times (if equipped)
- Target idle speed

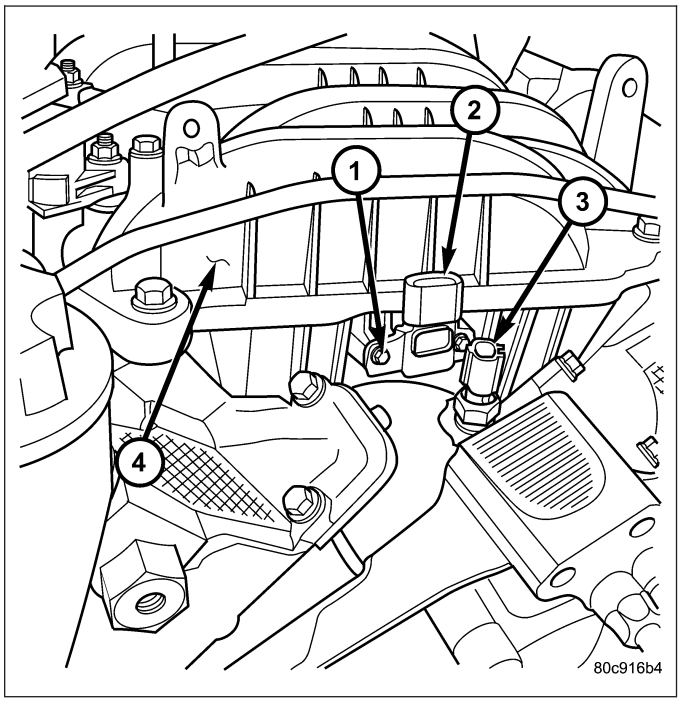
REMOVAL

3.7L ENGINE

The Engine Coolant Temperature (ECT) sensor (3) on the 3.7L engine is installed into a water jacket at front of intake manifold near rear of generator.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR.

1. Partially drain the cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE).
2. Disconnect the electrical connector from the sensor (3).
3. Remove the sensor from the intake manifold.

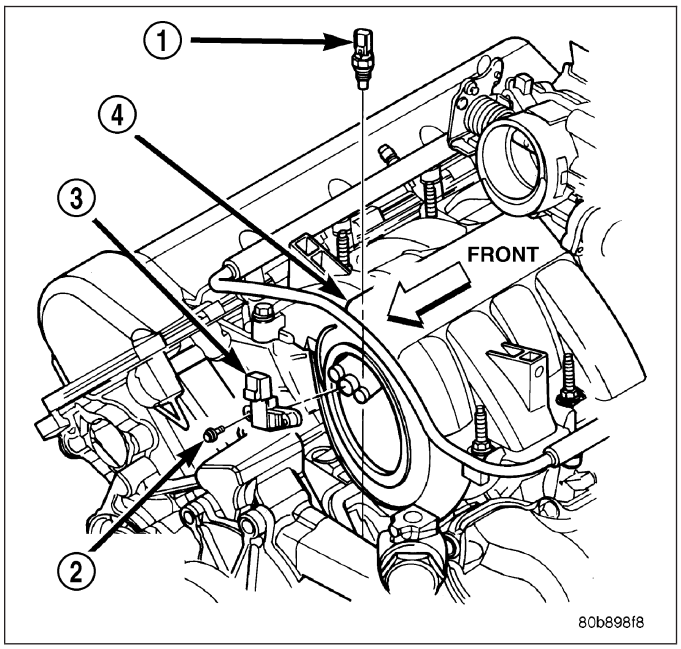


4.7L V-8

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE ENGINE COOLANT TEMPERATURE (ECT) SENSOR.

The Engine Coolant Temperature (ECT) sensor (1) on the 4.7L V-8 engine is located near the front of the intake manifold.

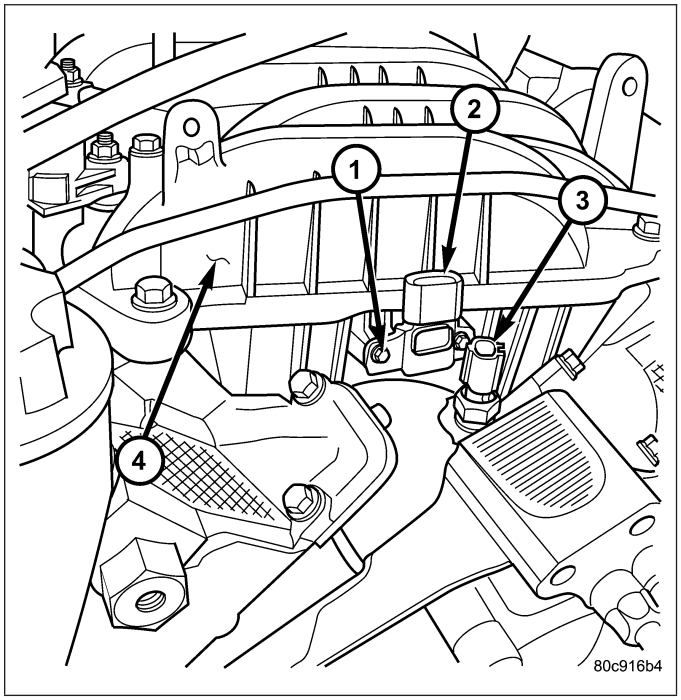
1. Partially drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
2. Disconnect the electrical connector from the ECT sensor (1).
3. Remove the sensor (1) from the intake manifold.



INSTALLATION

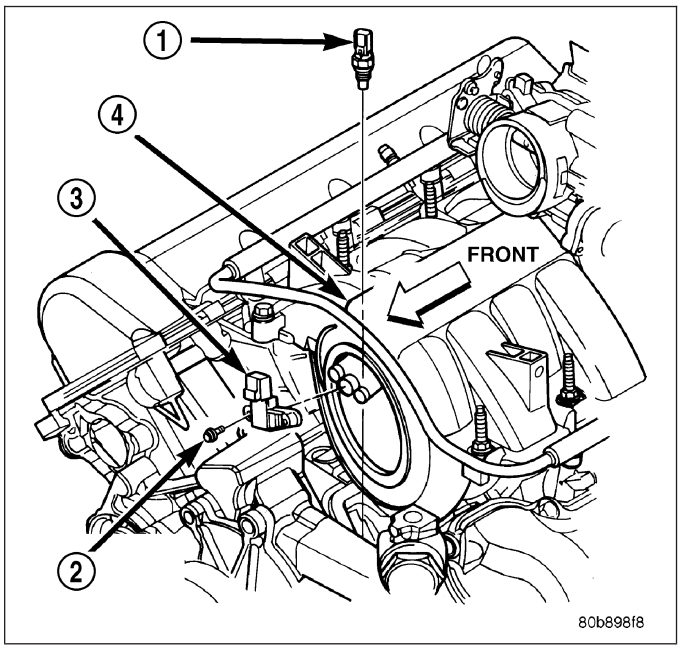
3.7L ENGINE

1. Apply thread sealant to sensor threads.
2. Install engine coolant sensor into intake manifold. (3). Tighten sensor to 11 N·m (97.3 in. lbs.) torque.
3. Connect the electrical connector.
4. Fill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).



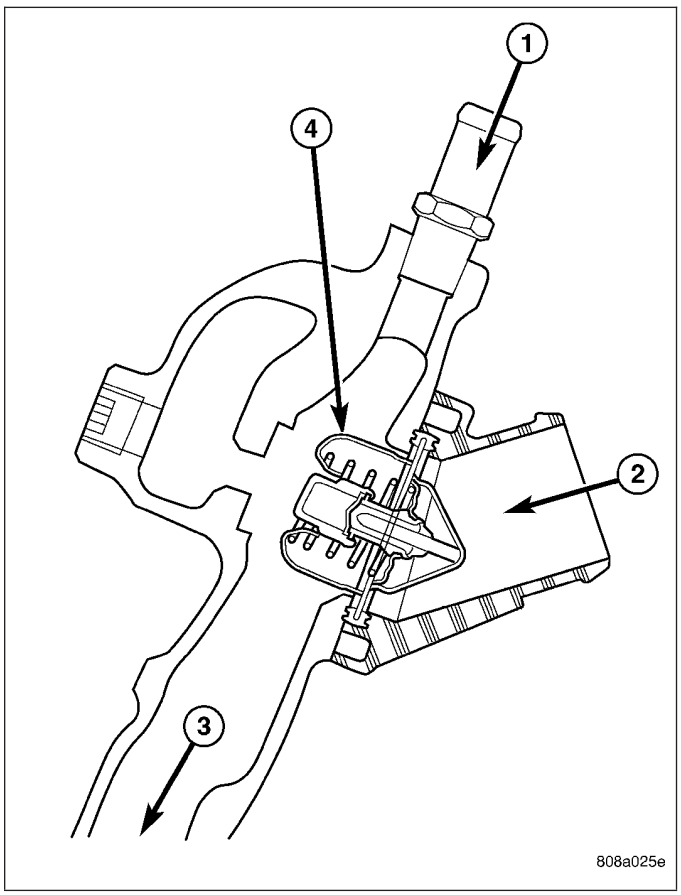
4.7L V-8

1. Apply thread sealant to sensor threads.
2. Install ECT sensor (1) to engine.
3. Tighten sensor to 11 N·m (97.3 in. lbs.) torque.
4. Connect electrical connector to sensor (1).
5. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).



THERMOSTAT-ENGINE COOLANT

DESCRIPTION



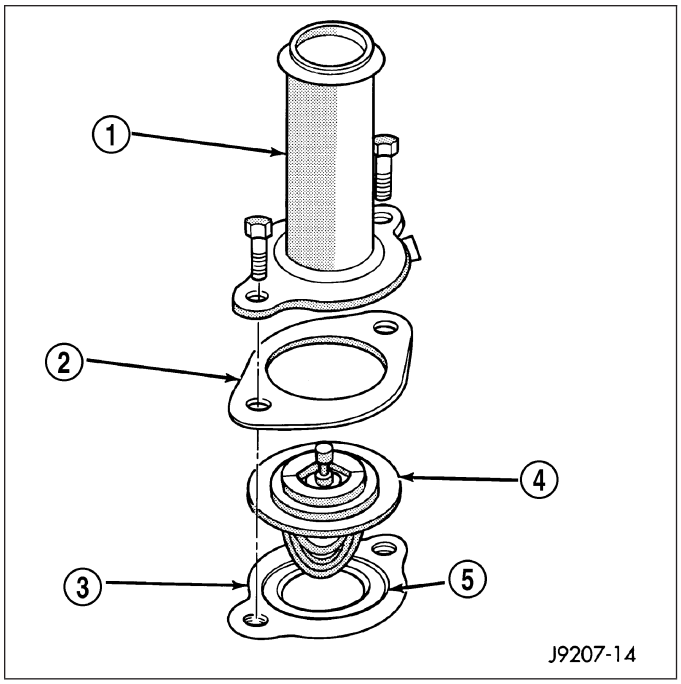
CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.

The thermostat on the 5.7L gas powered engine is located beneath the thermostat housing (1) at the front of the intake manifold.

The thermostat is a wax pellet driven, reverse poppet choke type.

Coolant leakage into the pellet container will cause the thermostat to fail in the open position. Thermostats very rarely stick. Do not attempt to free a thermostat with a prying device.

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation that can result in sludge formation.



OPERATION

The wax pellet is located in a sealed container at the spring end of the thermostat. When heated, the pellet expands, overcoming closing spring tension and water pump pressure to force the valve to open.

DIAGNOSIS AND TESTING - THERMOSTAT

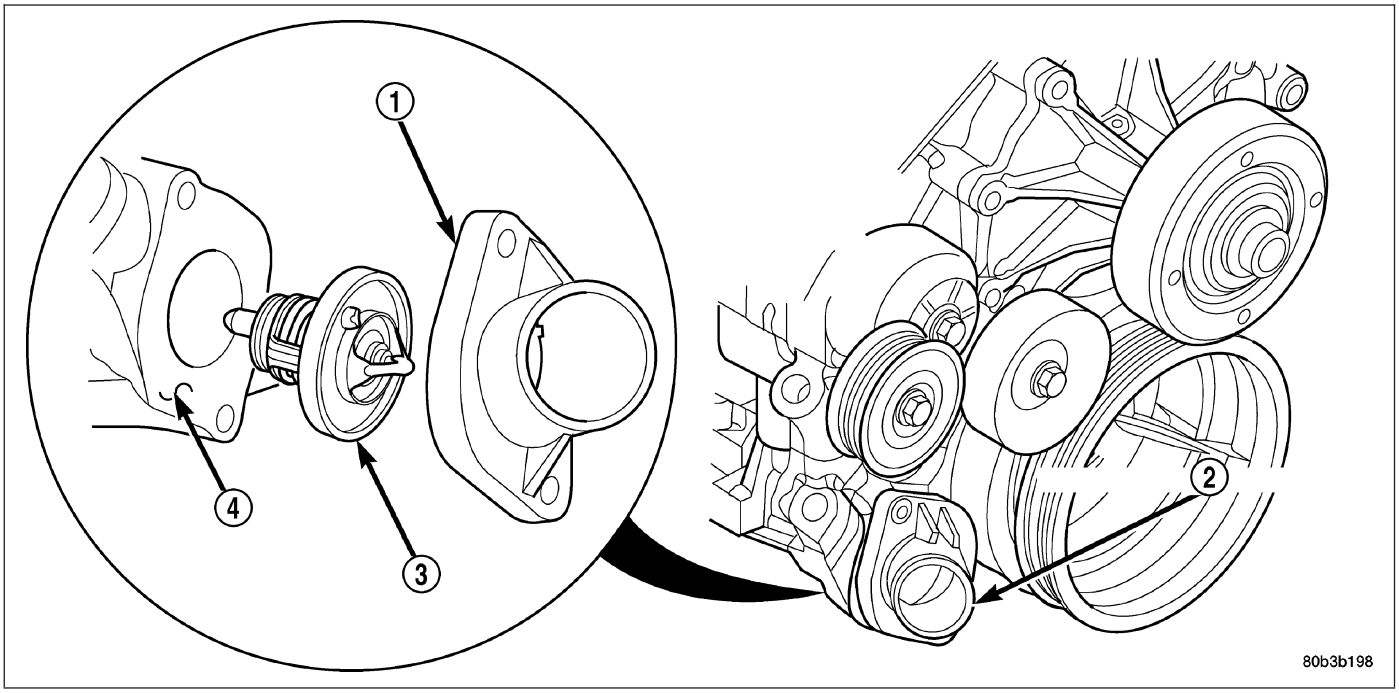
ON-BOARD DIAGNOSTICS

All **gasoline powered models** are equipped with On-Board Diagnostics for certain cooling system components. Refer to On-Board Diagnostics (OBD) in the Diagnosis section of this group for additional information. If the powertrain control module (PCM) detects low engine coolant temperature, it will record a Diagnostic Trouble Code (DTC) in the PCM memory. Do not change a thermostat for lack of heat as indicated by the instrument panel gauge or by poor heater performance unless a DTC is present. Refer to the Diagnosis section of this group for other probable causes. For other DTCs, (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION)

The DTC can also be accessed through the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures information for diagnostic information and operation of the DRB scan tool.

REMOVAL

3.7L/4.7L ENGINE

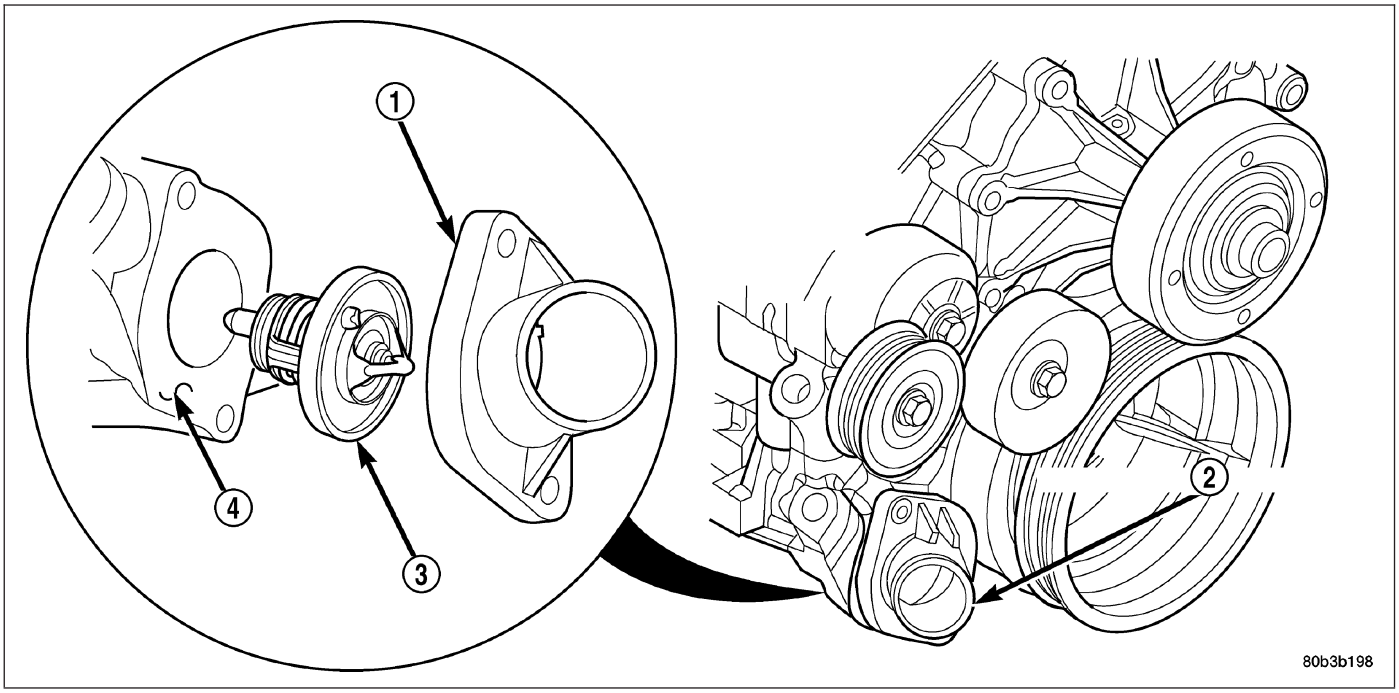


If thermostat is being replaced, be sure that replacement is specified thermostat for vehicle model and engine type.

1. Disconnect negative battery cable at battery.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE)
3. Raise vehicle on hoist.
4. Remove splash shield.
5. Remove lower radiator hose clamp and lower radiator hose at thermostat housing.
6. Remove thermostat housing mounting bolts , thermostat housing (1) and thermostat (3).

INSTALLATION

3.7L/4.7L ENGINE



1. Clean mating areas of timing chain cover and thermostat housing.
2. Install thermostat (spring side down) into recessed machined groove on timing chain cover.
3. Position thermostat housing on timing chain cover.
4. Install two housing-to-timing chain cover bolts. Tighten bolts to 13 N·m (112 in. lbs.) torque.

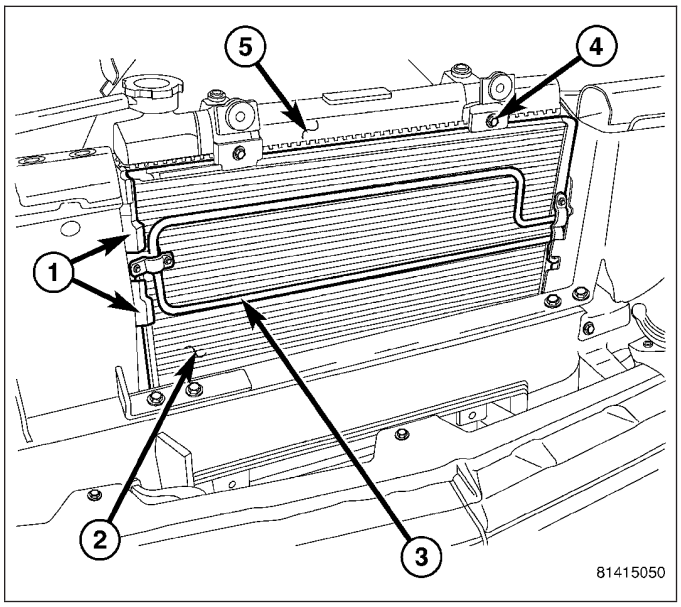
CAUTION: Housing must be tightened evenly and thermostat must be centered into recessed groove in timimg chain cover. If not, it may result in a cracked housing, damaged timing chain cover threads or coolant leaks.

5. Install lower radiator hose on thermostat housing.
6. Install splash shield.
7. Lower vehicle.
8. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
9. Connect negative battery cable to battery.
10. Start and warm the engine. Check for leaks.

RADIATOR

DESCRIPTION

The radiator (1) is a aluminum cross-flow design with horizontal tubes through the radiator core and vertical plastic side tanks.



OPERATION

The radiator supplies sufficient heat transfer using the cooling fins interlaced between the horizontal tubes in the radiator core to cool the engine.

DIAGNOSIS AND TESTING

RADIATOR COOLANT FLOW

Use the following procedure to determine if coolant is flowing through cooling system.

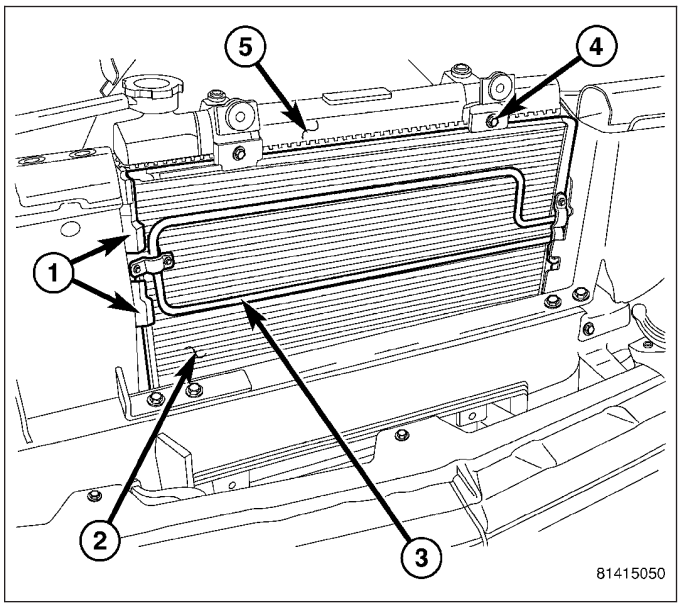
1. Idle engine until operating temperature is reached. If upper radiator hose is warm to the touch, thermostat is opening and coolant is flowing to radiator.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. USING A RAG TO COVER RADIATOR PRESSURE CAP, OPEN RADIATOR CAP SLOWLY TO FIRST STOP. ALLOW ANY BUILT-UP PRESSURE TO VENT TO THE RESERVE/OVERFLOW TANK. AFTER PRESSURE BUILD-UP HAS BEEN RELEASED, REMOVE CAP FROM FILLER NECK.

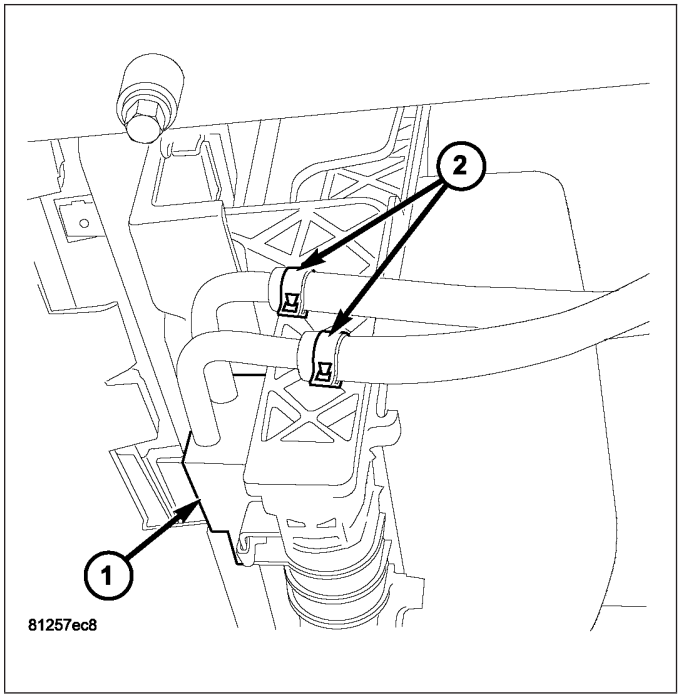
2. Drain a small amount of coolant from radiator until ends of radiator tubes are visible through filler neck. Idle engine at normal operating temperature. If coolant is flowing past exposed tubes, coolant is circulating.

REMOVAL

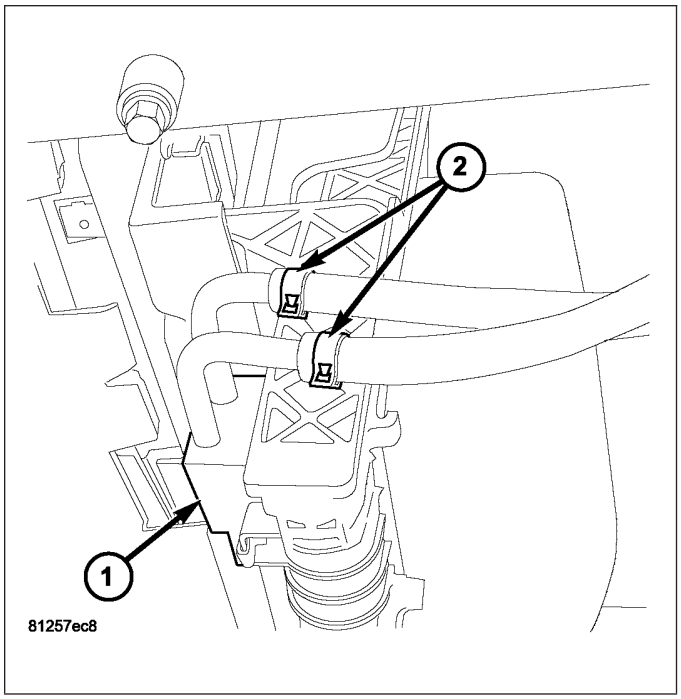
1. Disconnect battery negative cable.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE)
3. Remove pushpins (1) and the upper condenser/radiator seal.
4. Remove upper radiator hose.



5. DIsconnect power steering hoses from power steering fluid/transmission cooler.
6. Remove overflow tube.
7. Remove radiator fan shroud from the radiator and position over the radiator fan.
8. Raise vehicle.



9. Disconnect the power steering cooler lines (2).
10. Remove the lower radiator hose.
11. Lower vehicle.
12. Remove upper radiator mounting bolts.
13. Remove radiator.
14. Remove power steering fluid/transmission oil cooler form the radiator, if necessary.



CLEANING

Clean radiator fins With the engine cold, apply cold water and compressed air to the back (engine side) of the radiator to flush the radiator and/or A/C condenser of debris.

INSPECTION

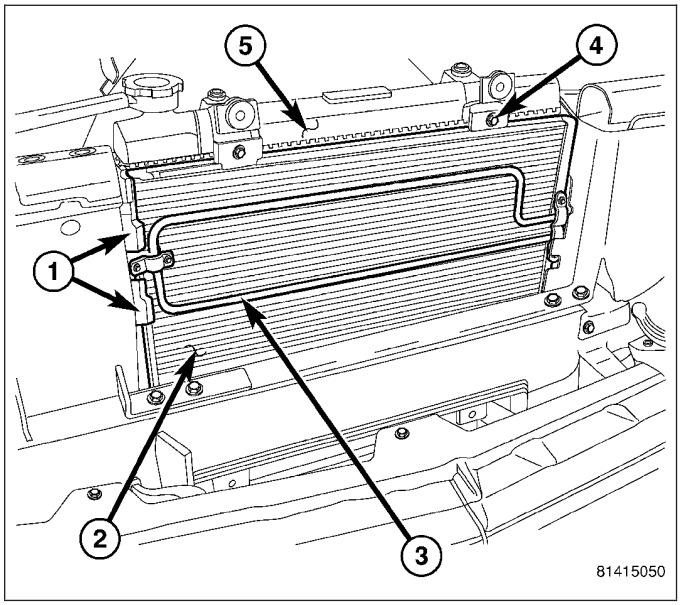
The radiator cooling fins should be checked for damage or deterioration. Inspect cooling fins to make sure they are not bent or crushed, these areas result in reduced heat exchange causing the cooling system to operate at higher temperatures. Inspect the plastic end tanks for cracks, damage or leaks.

Inspect the radiator neck for damage or distortion.

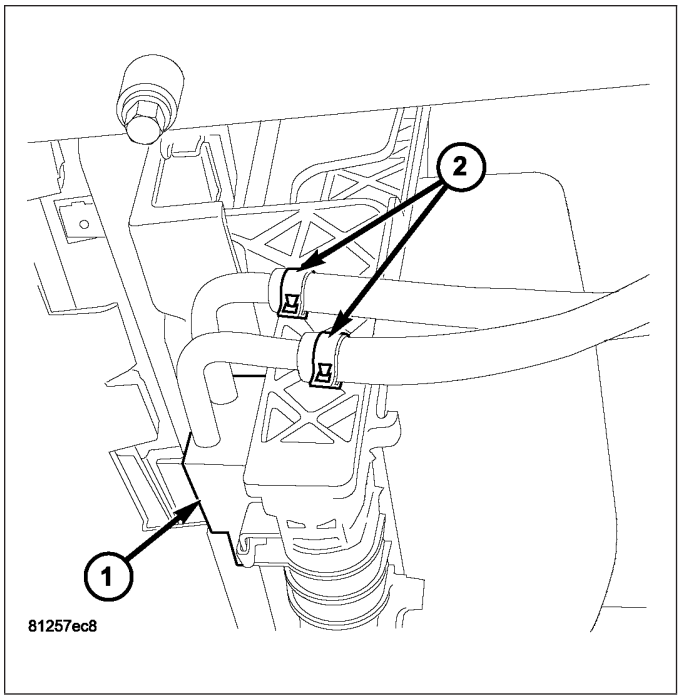
INSTALLATION

The radiator has two isolator pins on bottom of both tanks. These fit into alignment holes in radiator lower support.

1. Install power steering cooler, if removed.
2. Install transmission oil cooler if removed.
3. Install the upper radiator mount
4. Position isolator pins into alignment holes in radiator lower support.
5. Install upper radiator support. Tighten bolts to 23 N·m (200 in. lbs.)
6. Install LH and RH radiator side seals.
7. Install upper radiator hose.
8. Install overflow tube.
9. Install radiator shroud.



10. Install power steering cooler lines.
11. Install transmission cooler lines.
12. Install lower radiator hose.
13. Lower vehicle.
14. Fill radiator (Refer to 7 - COOLING - STANDARD PROCEDURE).
15. Connect battery negative cable.
16. Start and warm the engine. Check for leaks.



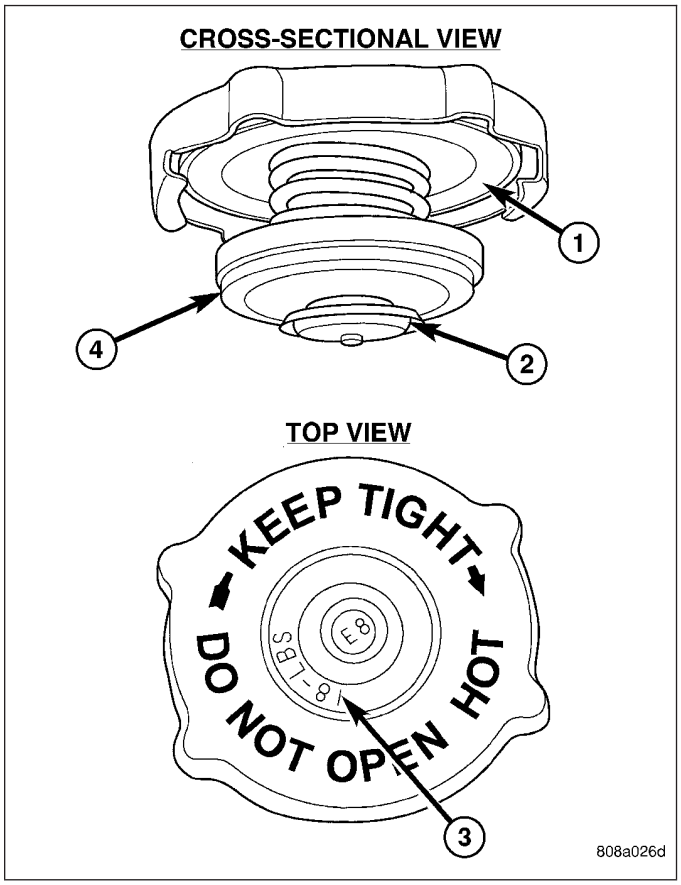
CAP-RADIATOR PRESSURE

DESCRIPTION

All cooling systems are equipped with a pressure cap on the radiator. This cap releases pressure at some point within a range of 131-to-158 kPa (19-to-23 psi). The pressure relief point (in pounds) is engraved on top of the cap (3).

The cooling system will operate at pressures slightly above atmospheric pressure. This results in a higher coolant boiling point allowing increased radiator cooling capacity. The cap contains a spring-loaded pressure relief valve (4). This valve opens when system pressure reaches the release range of 131-to-158 kPa (19-to-23 psi).

A rubber gasket (2) seals the radiator filler neck. This is done to maintain vacuum during coolant cool-down and to prevent leakage when system is under pressure.



OPERATION

A vent valve in the center of the cap will remain shut as long as the cooling system is pressurized. As the coolant cools, it contracts and creates a vacuum in cooling system. This causes the vacuum valve to open and coolant in reserve/overflow tank to be drawn through connecting hose into radiator. If the vacuum valve is stuck shut, or overflow hose is kinked, radiator hoses will collapse on cool-down.

DIAGNOSIS AND TESTING

RADIATOR CAP-TO-FILLER NECK SEAL

The pressure cap upper gasket (seal) pressure relief can be tested by removing overflow hose from radiator filler neck nipple. Attach hose of pressure tester tool 7700 (or equivalent) to nipple. It will be necessary to disconnect hose from its adapter for filler neck. Pump air into radiator. The pressure cap upper gasket should relieve at 131 kPa (21 psi) and hold pressure at a minimum of 130 kPa (18.8 psi).

WARNING: THE WARNING WORDS "DO NOT OPEN HOT" ON RADIATOR PRESSURE CAP, ARE A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, RADIATOR CAP SHOULD NOT BE REMOVED WHILE SYSTEM IS HOT AND/OR UNDER PRESSURE.

Do not remove radiator cap at any time **except** for the following purposes:

1. Check and adjust antifreeze freeze point.
2. Refill system with new antifreeze.
3. Conducting service procedures.
4. Checking for vacuum leaks.

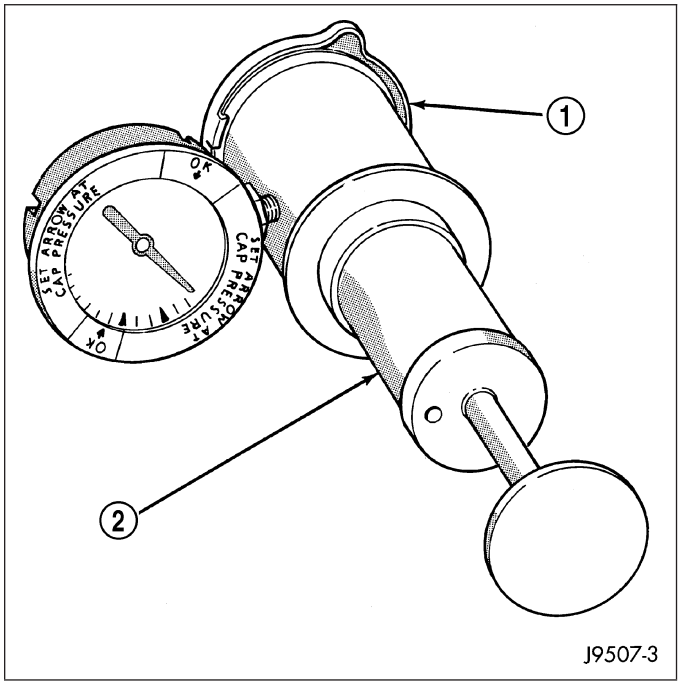
WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT AT LEAST 15 MINUTES BEFORE REMOVING RADIATOR CAP. WITH A RAG, SQUEEZE RADIATOR UPPER HOSE TO CHECK IF SYSTEM IS UNDER PRESSURE. PLACE A RAG OVER CAP AND WITHOUT PUSHING CAP DOWN, ROTATE IT COUNTER-CLOCKWISE TO FIRST STOP. ALLOW FLUID TO ESCAPE THROUGH THE COOLANT RESERVE/OVERFLOW HOSE INTO RESERVE/OVERFLOW TANK. SQUEEZE RADIATOR UPPER HOSE TO DETERMINE WHEN PRESSURE HAS BEEN RELEASED. WHEN COOLANT AND STEAM STOP BEING PUSHED INTO TANK AND SYSTEM PRESSURE DROPS, REMOVE RADIATOR CAP COMPLETELY.

RADIATOR CAP

Remove cap (1) from radiator. Be sure that sealing surfaces are clean. Moisten rubber gasket with water and install cap (1) on pressure tester 7700 (2) or an equivalent.

Operate tester pump to bring pressure to 138 kPa (20 psi) on gauge. If pressure cap (1) fails to hold pressure of at least 131 kPa (19 psi) replace cap. Refer to the following **CAUTION** .

The pressure cap may test properly while positioned on tool 7700 (or equivalent). It may not hold pressure or vacuum when installed on radiator. If so, inspect radiator filler neck and cap's top gasket for damage. Also inspect for dirt or distortion that may prevent cap from sealing properly.



CAUTION: Radiator pressure testing tools are very sensitive to small air leaks, which will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to tool. Turn tool upside down and recheck pressure cap to confirm that cap needs replacement.

CLEANING

Use only a mild soap and water to clean the radiator cap. Using any type solvent may cause damage to the seal in the radiator cap.

INSPECTION

Hold cap at eye level, right side up. The vent valve at bottom of cap should open. If rubber gasket has swollen and prevents vent valve from opening, replace cap.

Hold cap at eye level, upside down. If any light can be seen between vent valve and rubber gasket, replace cap. **Do not use a replacement cap that has a spring to hold vent shut.** A replacement cap must be the type designed for a coolant reserve/overflow system with a completely sealed diaphragm spring and a rubber gasket. This gasket is used to seal to radiator filler neck top surface. Use of proper cap will allow coolant return to radiator.

PUMP-WATER

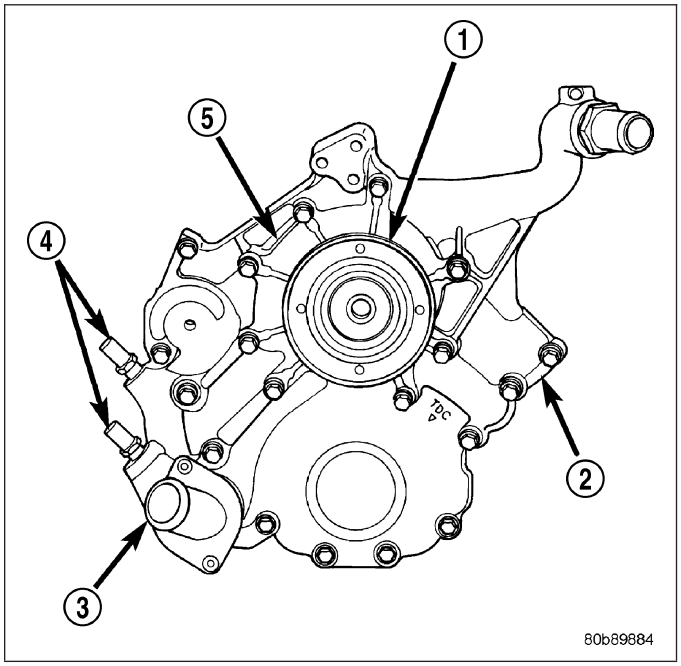
DESCRIPTION

WATER PUMP

A centrifugal water pump (1) circulates coolant through the water jackets, passages, intake manifold, radiator core, cooling system hoses and heater core. The pump is driven from the engine crankshaft by a single serpentine drive belt that drives the water pump pulley (1).

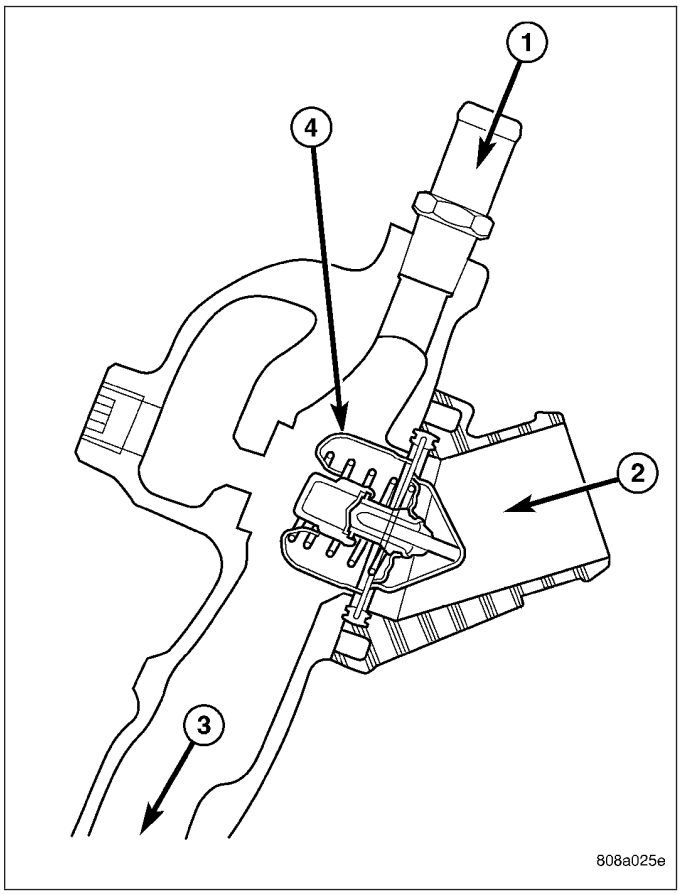
The water pump impeller is pressed onto the rear of a shaft that rotates in bearings pressed into the housing. The housing has two small holes to allow seepage to escape. The water pump seals are lubricated by the antifreeze in the coolant mixture. No additional lubrication is necessary.

Both heater hoses are connected to fittings on the timing chain front cover. The water pump is also mounted directly to the timing chain cover and is equipped with a non serviceable integral pulley.



WATER PUMP BYPASS - 4.7L

The 4.7L engine uses an internal water/coolant bypass system. The design uses galleries in the timing chain cover to circulate coolant during engine warm-up preventing the coolant from flowing through the radiator.



OPERATION

WATER PUMP

A centrifugal water pump circulates coolant through the water jackets, passages, intake manifold, radiator core, cooling system hoses and heater core, this coolant absorbs the heat generated when the engine is running. The pump is driven by the engine crankshaft via a drive belt.

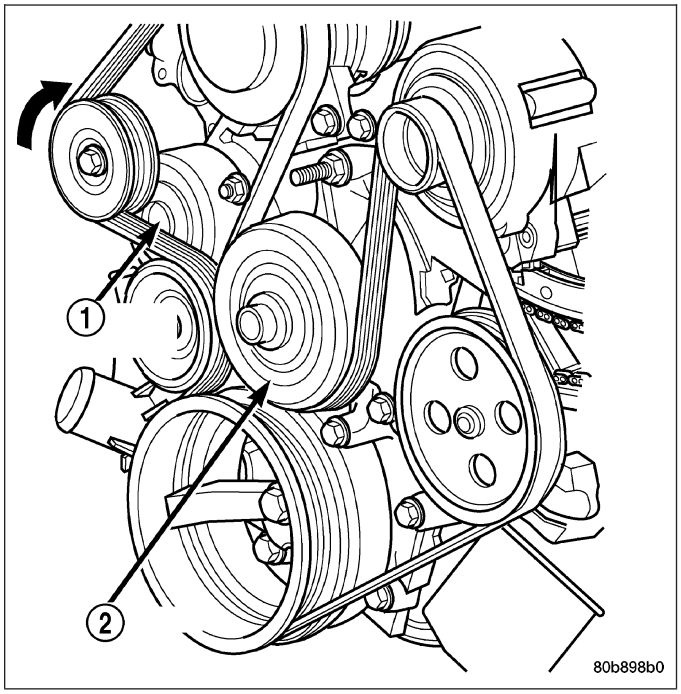
WATER PUMP BYPASS - 4.7L ENGINE

When the thermostat is in the closed position the bypass gallery is not obstructed allowing 100% flow. When the thermostat is in the open position the pill partially covers the bypass hole, reducing the amount of bypass flow. This design allows the coolant to reach operating temperature quickly when cold, while adding extra cooling during normal temperature operation.

REMOVAL

3.7L/4.7L ENGINE

The water pump on 3.7L/4.7L engines is bolted directly to the engine timing chain case cover.



1. Disconnect negative battery cable.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Remove fan/viscous fan drive assembly from water pump (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL). Do not attempt to remove fan/ viscous fan drive assembly from vehicle at this time.
4. If water pump is being replaced, do not unbolt fan blade assembly from thermal viscous fan drive.
5. Remove two fan shroud-to-radiator screws.
6. Remove fan shroud and fan blade/viscous fan drive assembly from vehicle.
7. After removing fan blade/viscous fan drive assembly, **do not** place thermal viscous fan drive in horizontal position. If stored horizontally, silicone fluid in viscous fan drive could drain into its bearing assembly and contaminate lubricant.
8. Remove accessory drive belt from the water pump pulley (2) (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
9. Remove upper radiator hose clamp and remove upper hose at water pump.
10. Remove seven water pump mounting bolts and one stud bolt.

CAUTION: Do not pry water pump at timing chain case/cover. The machined surfaces may be damaged resulting in leaks.

11. Remove water pump and gasket. Discard gasket.

CLEANING

Clean the gasket mating surface. Use caution not to damage the gasket sealing surface.

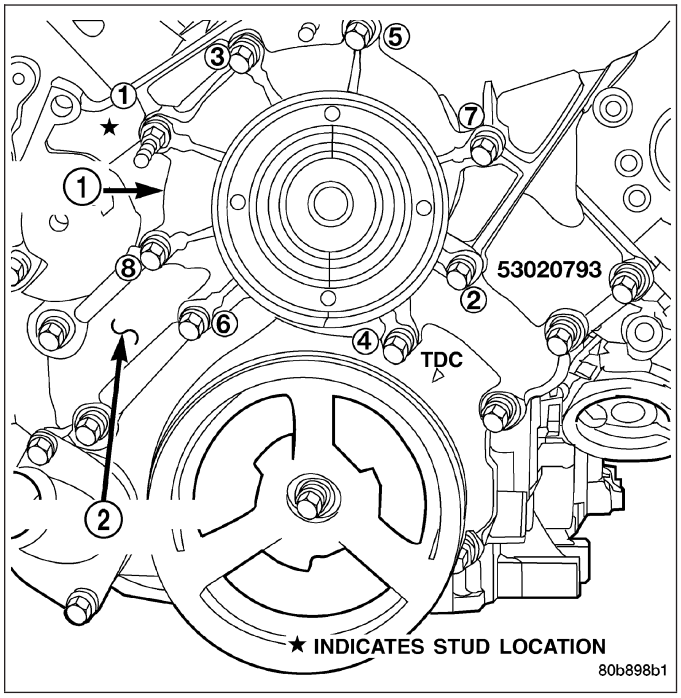
INSPECTION

Inspect the water pump assembly for cracks in the housing, water leaks from shaft seal, worn bearing or impeller rubbing either the pump body or timing chain case/cover.

INSTALLATION

3.7/4.7L ENGINE

1. Clean gasket mating surfaces.
2. Using a new gasket, position water pump (1) and install mounting bolts as shown. Tighten water pump mounting bolts to 58 N·m (43 ft. lbs.) torque.
3. Spin water pump to be sure that pump impeller does not rub against timing chain case/cover.

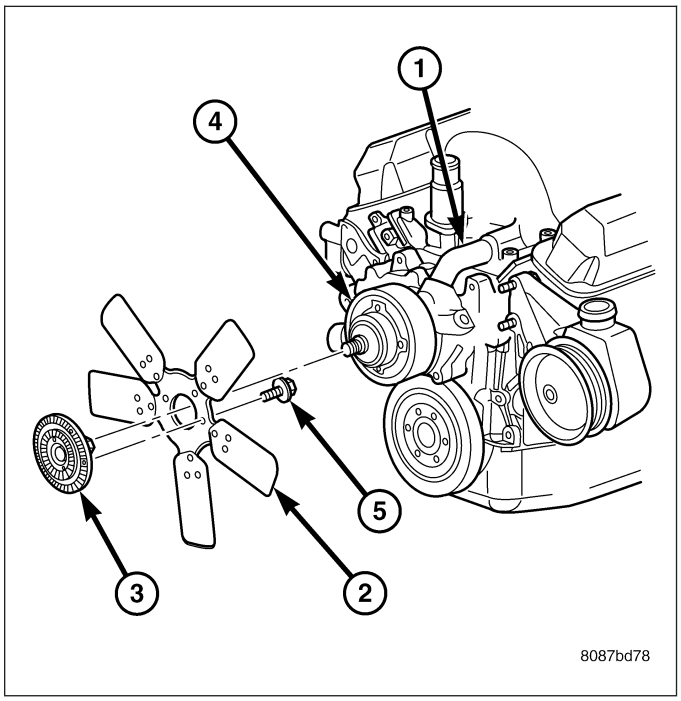


4. Connect radiator upper hose to water pump.
5. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
6. Position fan shroud and fan blade/viscous fan drive assembly.
7. Install two fan shroud-to-radiator screws.
8. Be sure of at least 25 mm (1.0 inches) between tips of fan blades and fan shroud.
9. Install fan blade/viscous fan drive assembly to water pump shaft (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
10. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
11. Connect negative battery cable.
12. Start and warm the engine. Check for leaks.

FAN-RADIATOR VISCOUS

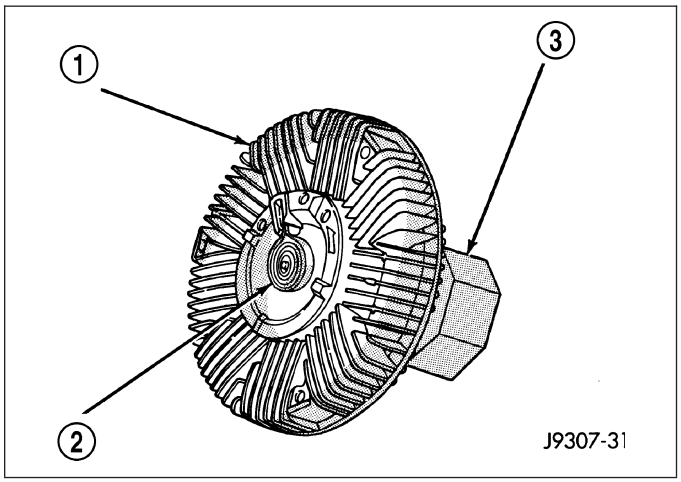
DESCRIPTION

The thermal viscous fan drive (3) is a silicone fluid filled coupling used to connect the fan blades to the water pump shaft (4). The coupling allows the fan to be driven in a normal manner. This is done at low engine speeds while limiting the top speed of the fan to a predetermined maximum level at higher engine speeds.



OPERATION

A thermostatic bimetallic spring coil (2) is located on the front face of the viscous fan drive unit (1). This spring coil reacts to the temperature of the radiator discharge air. It engages the viscous fan drive for higher fan speed if the air temperature from the radiator rises above a certain point. Until additional engine cooling is necessary, the fan will remain at a reduced rpm regardless of engine speed.



Only when sufficient heat is present, will the viscous fan drive engage. This is when the air flowing through the radiator core causes a reaction to the bimetallic coil. It then increases fan speed to provide the necessary additional engine cooling.

Once the engine has cooled, the radiator discharge temperature will drop. The bimetallic coil again reacts and the fan speed is reduced to the previous disengaged speed.

DIAGNOSIS AND TESTING - VISCOUS FAN DRIVE

NOISE

NOTE: It is normal for fan noise to be louder (roaring) when:

- The underhood temperature is above the engagement point for the viscous drive coupling. This may occur when ambient (outside air temperature) is very high.
- Engine loads and temperatures are high such as when towing a trailer.
- Cool silicone fluid within the fan drive unit is being redistributed back to its normal disengaged (warm) position. This can occur during the first 15 seconds to one minute after engine start-up on a cold engine.

LEAKS

Viscous fan drive operation is not affected by small oil stains near the drive bearing. If leakage appears excessive, replace the fan drive unit.

VISCOUS DRIVE

If the fan assembly free-wheels without drag (the fan blades will revolve more than five turns when spun by hand), replace the fan drive. This spin test must be performed when the engine is cool.

For the following test, the cooling system must be in good condition. It also will ensure against excessively high coolant temperature.

WARNING: BE SURE THAT THERE IS ADEQUATE FAN BLADE CLEARANCE BEFORE DRILLING.

1. Drill a 3.18-mm (1/8-in) diameter hole in the top center of the fan shroud.
2. Obtain a dial thermometer with an 8 inch stem (or equivalent). It should have a range of -18°-to-105°C (0°-to-220° F). Insert thermometer through the hole in the shroud. Be sure that there is adequate clearance from the fan blades.
3. Connect a tachometer and an engine ignition timing light. The timing light is to be used as a strobe light. This step cannot be used on the diesel engine.
4. Block the air flow through the radiator. Secure a sheet of plastic in front of the radiator. Use tape at the top to secure the plastic and be sure that the air flow is blocked.
5. Be sure that the air conditioner (if equipped) and blowe fan is turned off.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

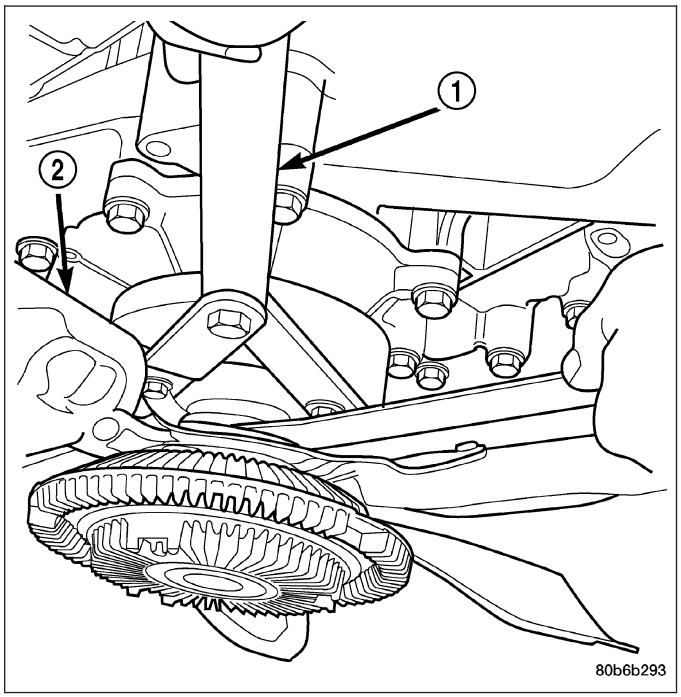
6. Start the engine and operate at 2400 rpm. Within ten minutes the air temperature (indicated on the dial thermometer) should be up to 88° C (190° F). Fan drive **engagement** should start to occur at/between:
   - 3.7L Automatic - 93° C - 99°C (200° F - 210° F)
   - 3.7L Manual/4.7L Automatic/5.9L - 85° - 91° C (185° - 195° F)
   - 4.7L Manual - 74° - 79° C (165° - 175° F)
   - 5.7L
   - 5.9L
   - Engagement is distinguishable by a definite **increase** in fan flow noise (roaring). The timing light also will indicate an increase in the speed of the fan.
7. When viscous drive engagement is verified, remove the plastic sheet. Fan drive **disengagement** should start to occur at or between:
   - 3.7L Automatic - 76°C - 81°C (168° F - 178° F)
   - 3.7L Manual/4.7L Auto/ 5.9L - 67°C - 73°C (153° F - 163° F)
   - 4.7L Manual - 56°C - 62°C (133° F - 143° F)
   - 5.7L A definite **decrease** of fan flow noise (roaring) should be noticed. If not, replace the defective viscous fan drive unit.

CAUTION: Some engines equipped with serpentine drive belts have reverse rotating fans and viscous fan drives. They are marked with the word REVERSE to designate their usage. Installation of the wrong fan or viscous fan drive can result in engine overheating.

CAUTION: If the viscous fan drive is replaced because of mechanical damage, the cooling fan blades should also be inspected. Inspect for fatigue cracks, loose blades, or loose rivets that could have resulted from excessive vibration. Replace fan blade assembly if any of these conditions are found. Also inspect water pump bearing and shaft assembly for any related damage due to a viscous fan drive malfunction.

REMOVAL

1. Partially drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
2. Remove the upper radiator hose.
3. Remove the air filter housing assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER ELEMENT - REMOVAL).
4. Using Tool 6958 and adapter pins 8346 (1), remove fan/viscous fan drive assembly from water pump. Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.
5. Position the fan/fan drive assembly in the radiator shroud.



6. Remove the two shroud mounting screws.
7. Remove the radiator shroud and fan drive assembly.
8. After removing fan blade/viscous fan drive assembly, **do not** place viscous fan drive in horizontal position. If stored horizontally, silicone fluid in the viscous fan drive could drain into its bearing assembly and contaminate lubricant.
9. Remove four bolts securing fan blade assembly to viscous fan drive.

CLEANING

Clean the fan blades using a mild soap and water. Do not use an abrasive to clean the blades.

INSPECTION

WARNING: DO NOT ATTEMPT TO BEND OR STRAIGHTEN FAN BLADES IF FAN IS NOT WITHIN SPECIFICATIONS.

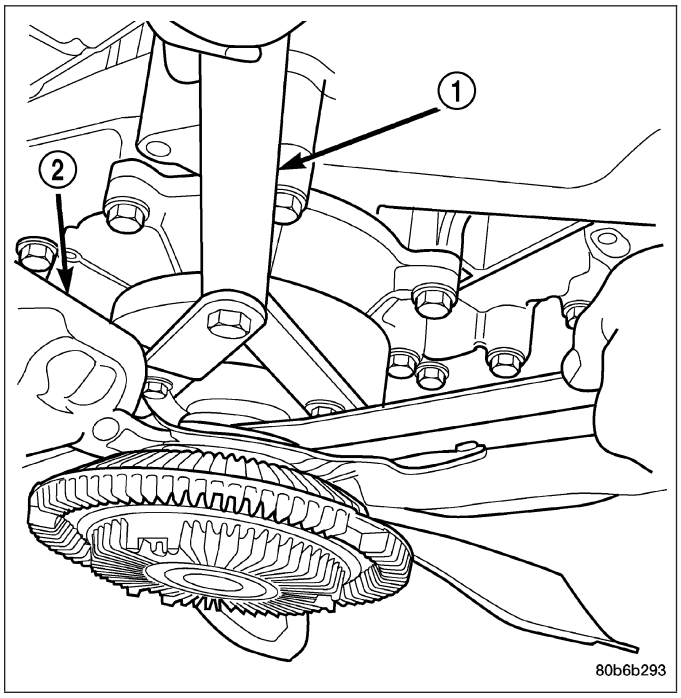
CAUTION: If fan blade assembly is replaced because of mechanical damage, water pump and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.

1. Remove fan blade assembly from viscous fan drive unit (four bolts).

2. Lay fan on a flat surface with leading edge facing down. With tip of blade touching flat surface, replace fan if clearance between opposite blade and surface is greater than 2.0 mm (.090 inch). Rocking motion of opposite blades should not exceed 2.0 mm (.090 inch). Test all blades in this manner.
3. Inspect fan assembly for cracks, bends, loose rivets or broken welds. Replace fan if any damage is found.

INSTALLATION

1. Install fan blade assembly to viscous fan drive. Tighten bolts to 23 N·m (17 ft. lbs.) torque.
2. Position fan blade/viscous fan drive assembly into the radiator shroud.
3. Install the radiator shroud and fan drive assemblu into the vehicle.
4. Install fan shroud retaining screws.Tighten screws to 6 N·M (50 lbs. in.)
5. Install fan blade/viscous fan drive assembly to water pump shaft.
6. Install the upper radiator hose.
7. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
8. Connect battery negative cable.



TUBE-WATER PUMP INLET

REMOVAL

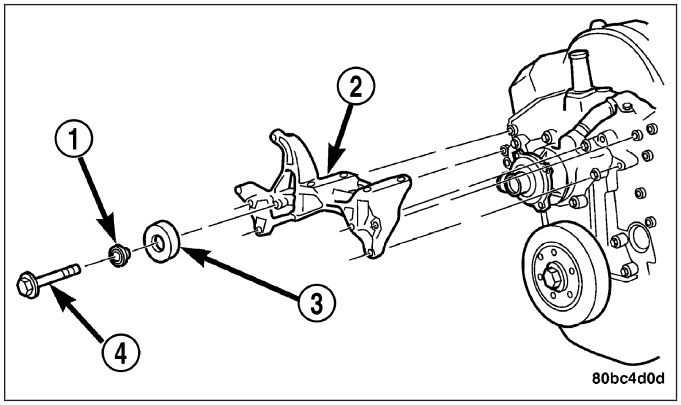
WITHOUT AIR CONDITIONING

1. Partially drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
2. Loosen both bypass hose clamps and position to center of hose. Remove hose from vehicle.

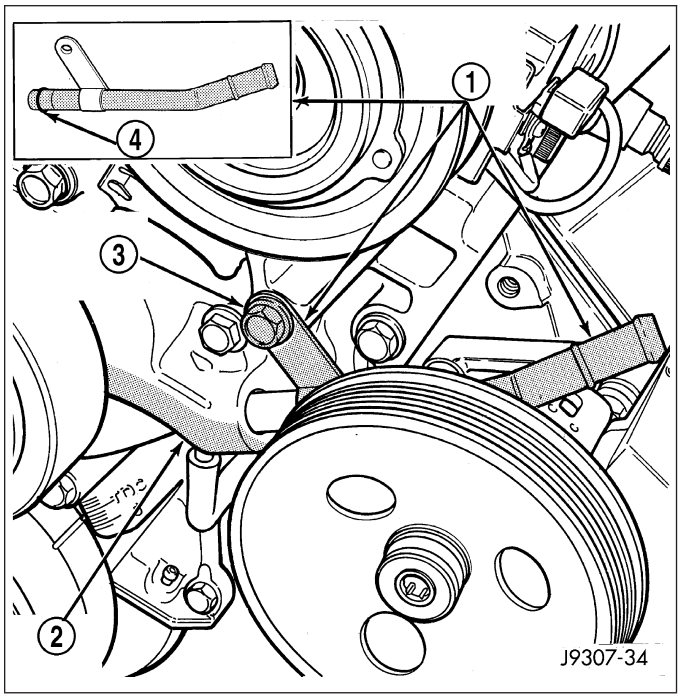
WITH AIR CONDITIONING

If equipped with A/C, the generator and A/C compressor along with their common mounting bracket (2) must be partially removed. Removing generator or A/C compressor from their mounting bracket is not necessary. Also, discharging A/C system is not necessary. **Do not** remove any refrigerant lines from A/C compressor.

WARNING: THE A/C SYSTEM IS UNDER PRESSURE EVEN WITH ENGINE OFF. REFER TO REFRIGERANT WARNINGS IN GROUP 24, HEATING AND AIR CONDITIONING.



1. Disconnect battery negative cable.



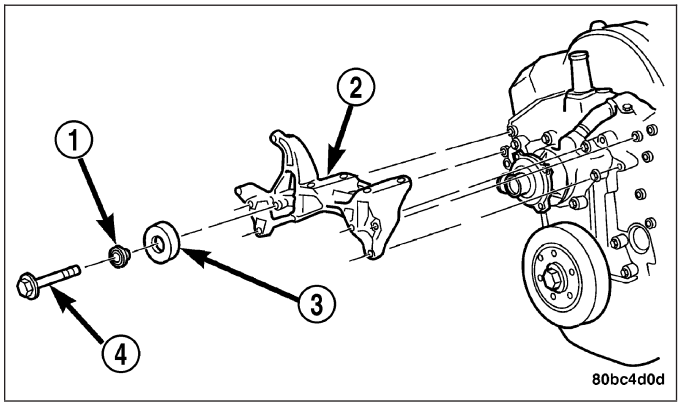
2. Partially drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Remove upper radiator hose clamp and hose at radiator.
4. Unplug wiring harness from A/C compressor.
5. Remove air cleaner assembly.
6. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
7. Remove bracket-to-intake manifold bolts.
8. The drive belt idler pulley must be removed to gain access to one of A/C compressor/generator bracket mounting bolts (3). Remove idler pulley bolt and remove idler pulley.
9. Remove oil dipstick tube mounting bol (3) at side of A/C-generator mounting bracket.
10. Disconnect throttle body cables.
11. Remove heater hose clamp and heater hose from heater hose coolant return tube.
12. Remove heater hose coolant return tube mounting bolt and remove tube from engine. Discard the old tube O-ring.
13. Remove six bracket bolts.
14. Lift and position generator and A/C compressor (along with their common mounting bracket) to gain access to bypass hose. A block of wood may be used to hold assembly in position.
15. Loosen and position both hose clamps to center of bypass hose. Remove hose from vehicle.

INSTALLATION

WITHOUT AIR CONDITIONING

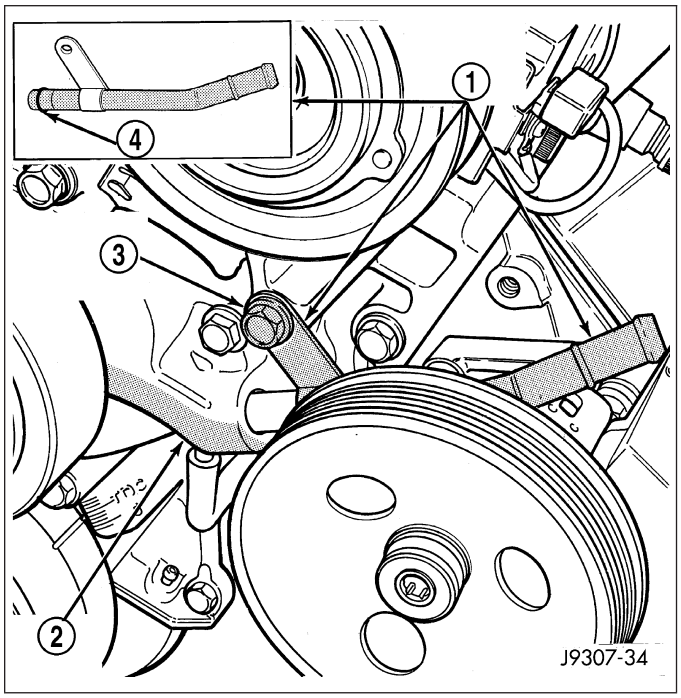
1. Position bypass hose clamps to center of hose.
2. Install bypass hose to engine.
3. Secure both hose clamps.
4. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Start and warm the engine. Check for leaks.

WITH AIR CONDITIONING



1. Position bypass hose clamps to center of hose.
2. Install bypass hose to engine.
3. Secure both hose clamps.
4. Install generator-A/C mounting bracket assembly to engine. Tighten bolts (number 1 and 2) to 54 N·m (40 ft. lbs.) torque. Tighten bolts (number 3) to 40 N·m (30 ft. lbs.) torque.

5. Install a new O-ring to the heater hose coolant return tube. Coat the new O-ring with antifreeze before installation.
6. Install coolant return tube and its mounting bolt to engine.
7. Connect throttle body control cables.
8. Install oil dipstick mounting bolt.
9. Install idler pulley. Tighten bolt to 54 N·m (40 ft. lbs.) torque.
10. Install drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
11. Install air cleaner assembly.
12. Install upper radiator hose to radiator.
13. Connect wiring harness to A/C compressor.
14. Connect battery negative cable.
15. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
16. Start and warm the engine. Check for leaks.



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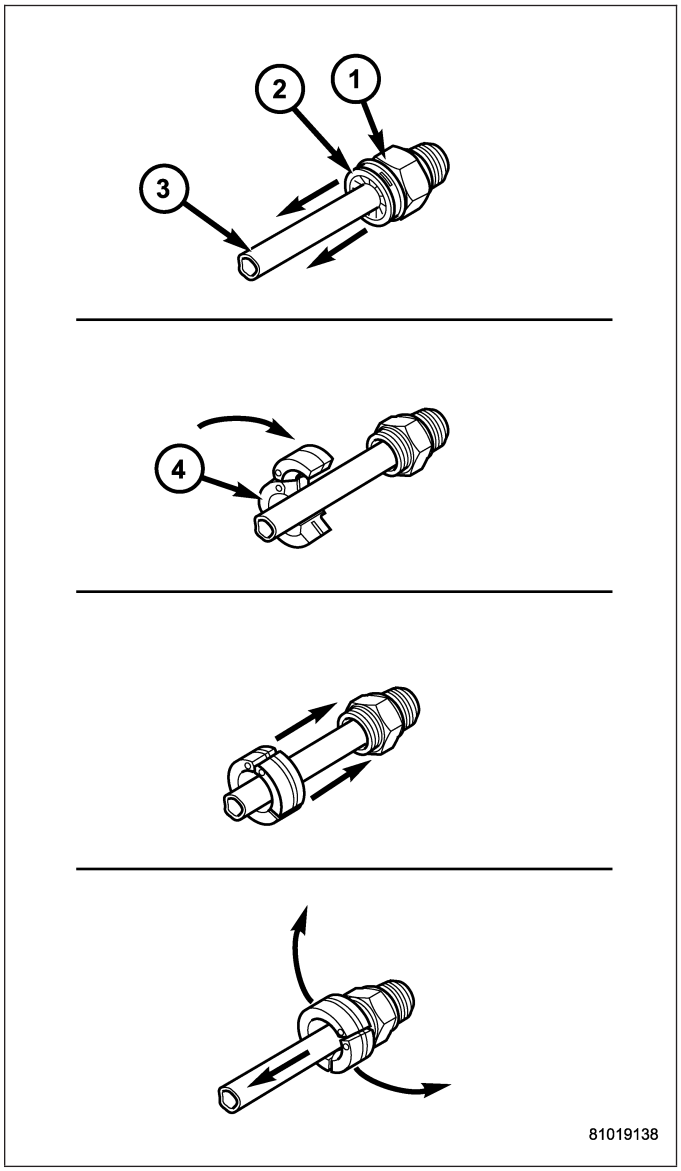
TRANSMISSION

STANDARD PROCEDURE

TRANSMISSION COOLER LINE QUICK CONNECT FITTING DISASSEMBLY/ ASSEMBLY

DISCONNECT

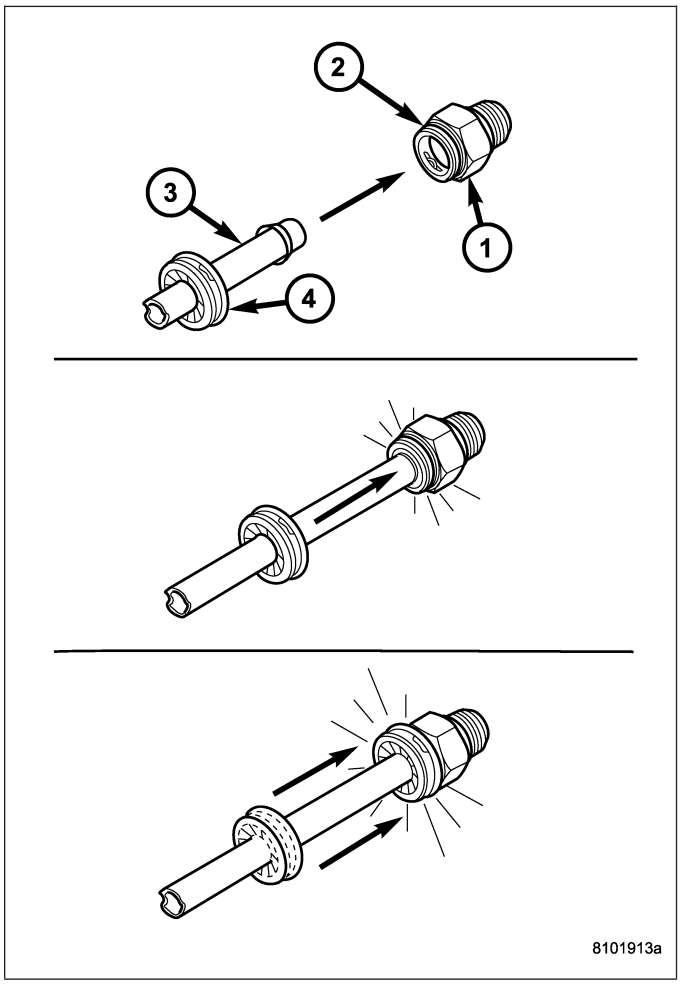
1. Remove dust cap by pulling it straight back off of quick connect fitting.
2. Place disconnect tool Special Tool 8875A onto transmission cooler line with the fingers of the tool facing the quick connect fitting.
3. Slide disconnect tool down the transmission line and engage the fingers of the tool into the retaining clip. When properly engaged in the clip, the tool will fit flush against the quick connect fitting.
4. Rotate the disconnect tool 60° to expand the retaining clip.
5. While holding the disconnect tool against the quick connect fitting, pull back on the transmission cooler line to remove.



CONNECT

1. Align transmission cooler line with quick connect fitting while pushing straight into the fitting.
2. Push in on transmission cooler line until a “click” is heard or felt.
3. Slide dust cap down the transmission cooler line and snap it over the quick connect fitting until it is fully seated and rotates freely. Dust cap will only snap over quick connect fitting when the transmission cooler line is properly installed.

NOTE: If dust cap will not snap into place, repeat assembly step 2.

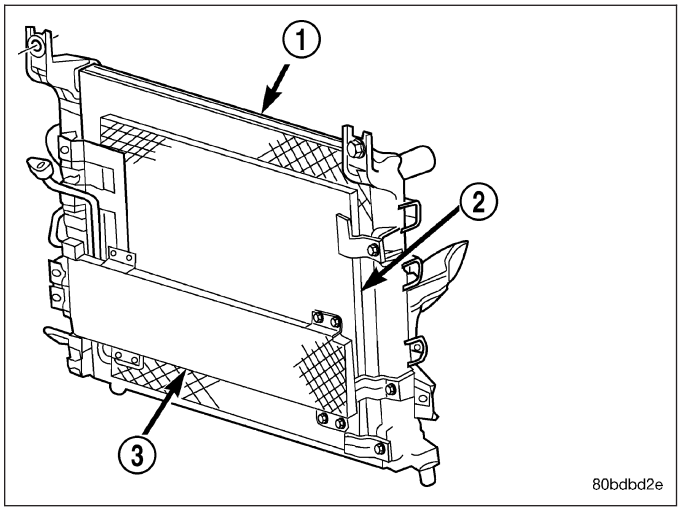


COOLER-TRANSMISSION

DESCRIPTION

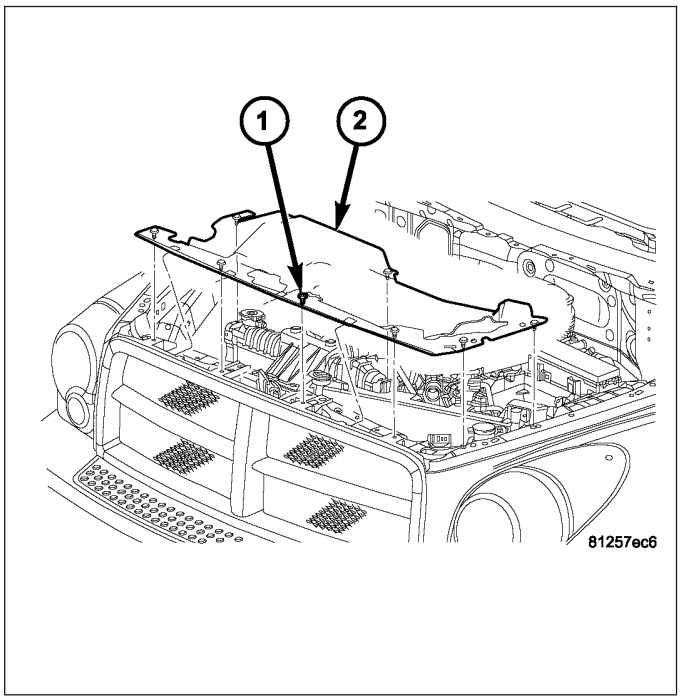
CAUTION: On in-radiator type oil coolers, if transmission oil cooler is leaking, engine coolant may enter cooler, or transmission oil may enter engine cooling system. Both engine cooling system and transmission oil circuit should be drained, flushed, and inspected.

There are two types of transmission oil coolers used. One type of cooler is the in-radiator type or oil to coolant type. This type oil cooler is not serviceable. The second type used is a remote type auxiliary oil cooler or oil to air cooler. The oil to air type cooler (3) is located in front of the radiator, and is serviceable.

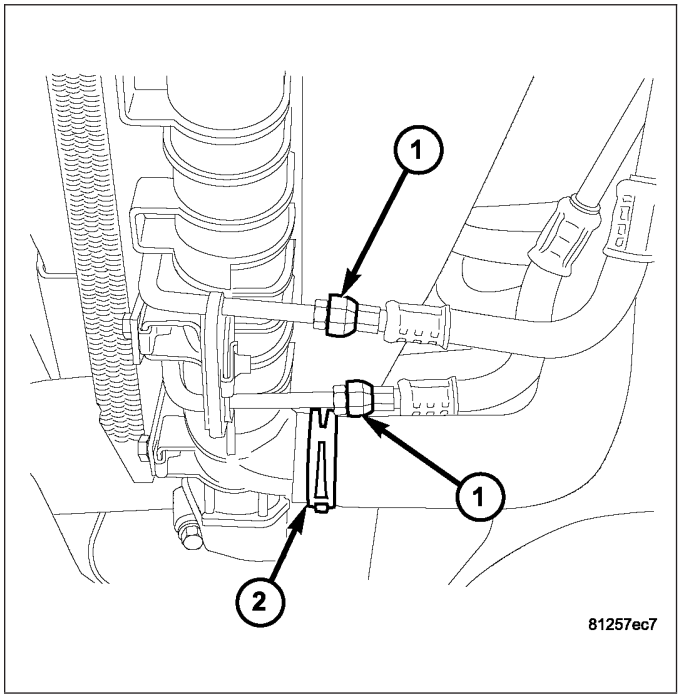


REMOVAL

1. Remove pushpins (1) and the upper condensor/radiator seal (2).

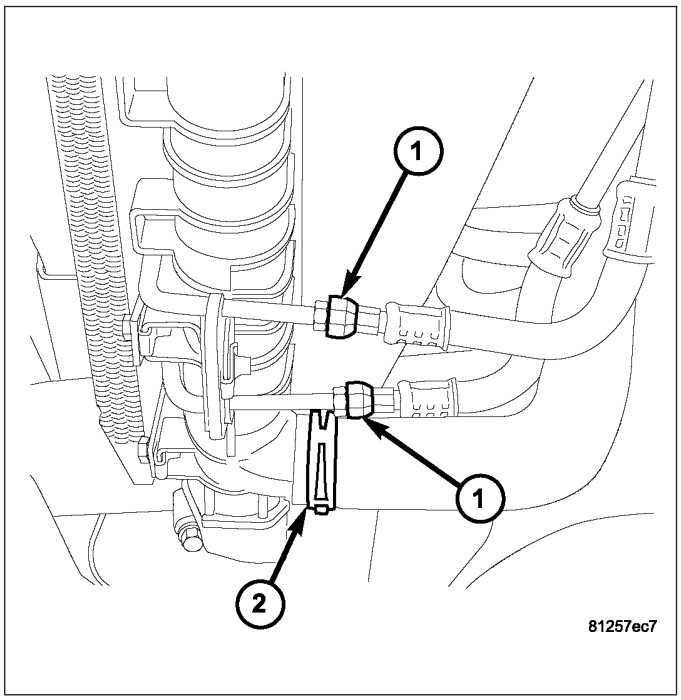


2. Remove upper radiator support.
3. Remove upper transmission cooler mounting bolt.
4. Raise vehicle.
5. Disconnect the transmission cooler lines (1) (Refer to 7 - COOLING/TRANSMISSION - STANDARD PROCEDURE).
6. Remove lower transmission cooler mounting bolts.
7. Remove transmission cooler from vehicle.



INSTALLATION

1. Position tramsmission cooler in vehicle.
2. Install lower transmission cooler mounting bolt. Tighten to 10 N·NM (90 in. lbs.)
3. Connect transmission cooler lines (1).
4. Lower vehicle.
5. Install upper tranmission cooler mounting bolt. Tighten bolt to 10 N·m (90 in. lbs.).
6. Install upper condenser/radiator seal.
7. Check transmission fluid level (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/FLUID - STANDARD PROCEDURE).



AUDIO/VIDEO

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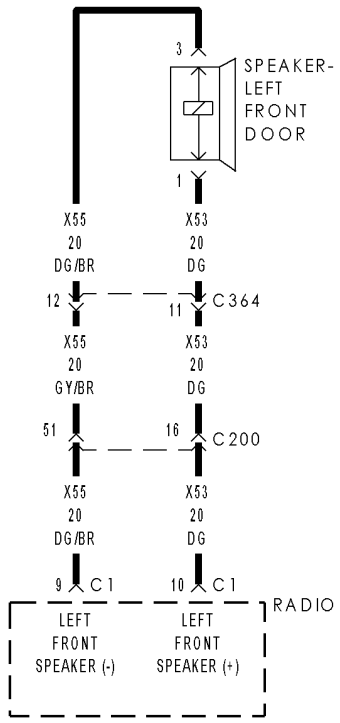
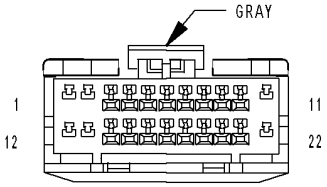
AUDIO/VIDEO SYSTEMS - ELECTRICAL DIAGNOSIS

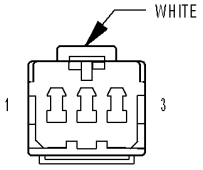
DIAGNOSIS AND TESTING

B1401-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW





RADIO C1



SPEAKER-LEFT
FRONT DOOR

812ce839

B1401-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

For the Audio system circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Radio on.
- **Set Condition:**
- When the Output circuit is LOW for more than 3 seconds.

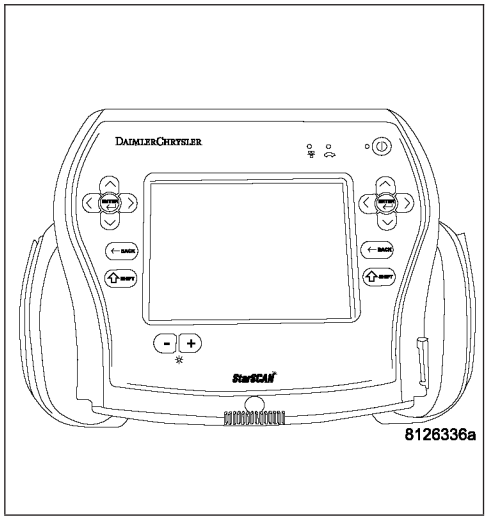
Possible Causes
SPEAKER
(X55) (X53) LEFT FRONT SPEAKER OUTPUT CIRCUIT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all Audio DTC's.
Turn the Radio on.
With the Scan Tool, read the DTC information.



Does the Scan Tool read: B1401-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST VER 1.

---

2. (X53) (X55) SPEAKER OUTPUT CIRCUITS.

Turn the ignition off.
Disconnect the Radio C1 harness connector.
Disconnect the Front Left Audio Speaker connector.
Measure the resistance between ground and each speaker (X53)(+) and (X55)(-) circuit.

Is the resistance below 1000.0 ohms for each circuit?

Yes >> Repair the applicable Speaker (+) or (-) Output circuit for a short to ground condition.

No >> Go To 3

B1401-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

3. SPEAKER

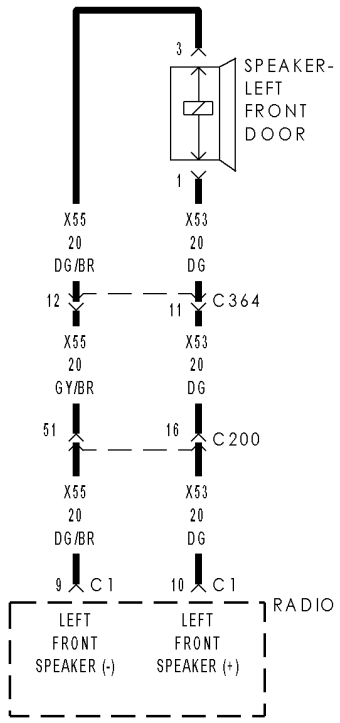
Turn the ignition off.
Disconnect the Front Left Audio Speaker.
Turn the ignition on.
Turn the Radio on.
With the Scan Tool, clear all Audio DTC's.
With the Scan Tool, read the DTC information.

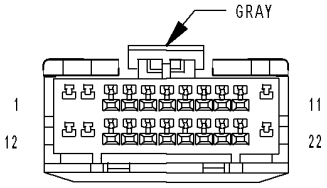
Does the Scan Tool read: B1401-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Replace the Speaker in accordance with the service information.
Perform the BODY VERIFICATION TEST VER 1.

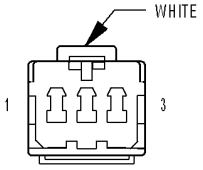
No >> Test Complete.

B1402-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH





RADIO C1



SPEAKER-LEFT
FRONT DOOR

812ce839

B1402-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

For the Audio system circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

Possible Causes
SPEAKER
(X53) SPEAKER OUTPUT CIRCUIT (+)
(X55) SPEAKER OUTPUT CIRCUIT (-)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

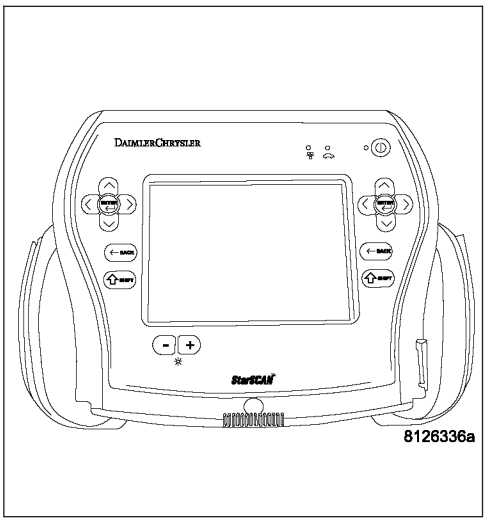
1. INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Radio DTCs.

Does the scan tool display active: B1402-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



B1402-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

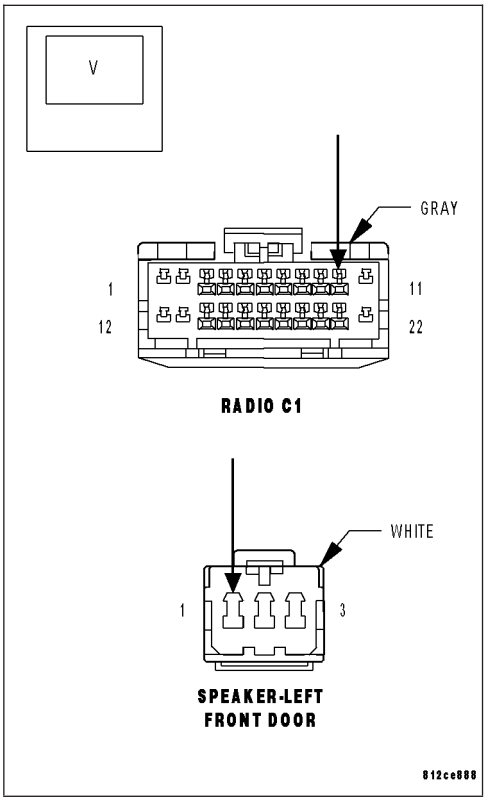
2. CHECK FOR VOLTAGE ON THE (X53) SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Radio C1 harness connector.
Disconnect the Left Front Speaker harness connector.
Measure for voltage on the (X53) Speaker (+) circuit.

Is the voltage above 10.0 volts?

Yes >> Repair the (X53) Speaker (+) circuit for a short to voltage. Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3



B1402-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

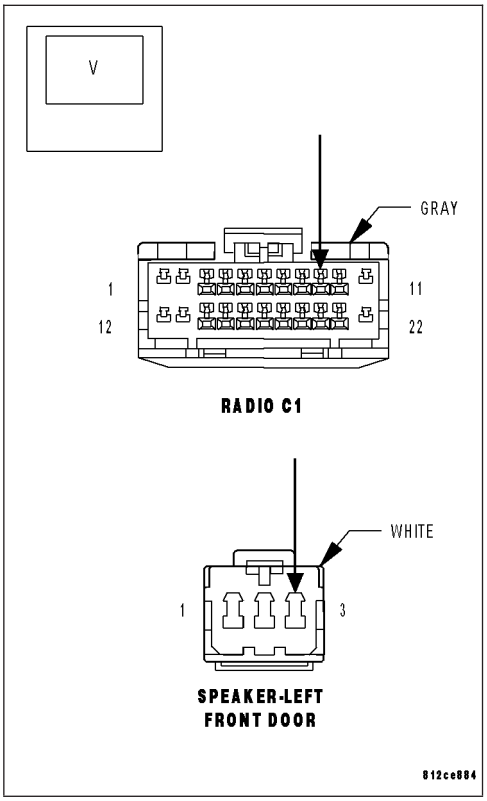
3. CHECK FOR VOLTAGE ON THE (X55) SPEAKER (-) CIRCUIT

Measure for voltage on the (X55) Speaker (-) circuit.

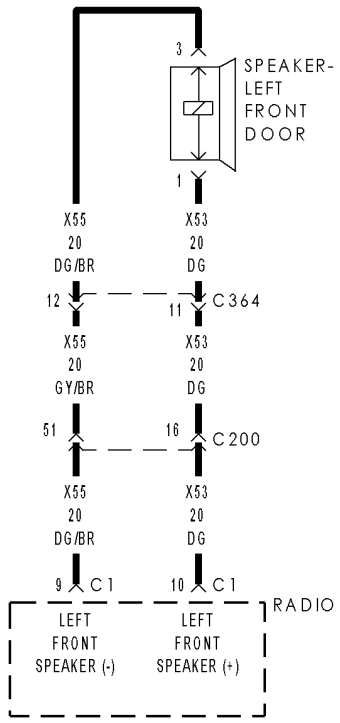
Is the voltage above 10.0 volts?

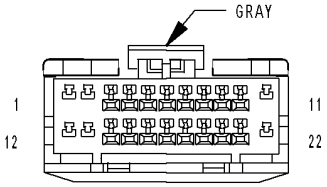
Yes >> Repair the (X55) Speaker (-) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

No >> Replace the Radio in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

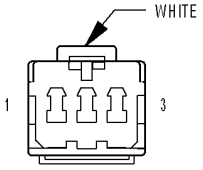


B1403-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN





RADIO C1



SPEAKER-LEFT
FRONT DOOR

812ce839

B1403-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

For the Audio system circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Radio on.
- **Set Condition:**
- When the Output circuit is open for more than 3 seconds. The Radio will not set the fault if the radio confirms an amplifier is on the BUS.

Possible Causes
SPEAKER
(X55) (X53) LEFT FRONT SPEAKER OUTPUT CIRCUIT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

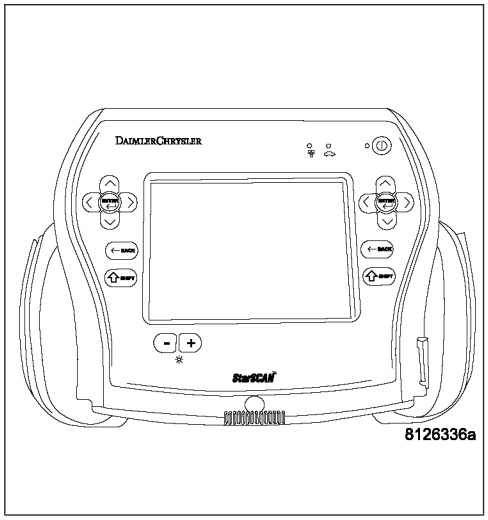
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all Audio DTC's.
Turn the Radio on.
With the Scan Tool, read the DTC information.

Does the Scan Tool read: B1403-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST VER 1.



2. (X55) (X53) SPEAKER OUTPUT CIRCUITS.

Turn the ignition off.
Disconnect the Radio C1 harness connector.
Disconnect the Front Left Audio Speaker connector.
Measure the resistance of each speaker (X53)(+) and (X55)(-) circuit between the Radio and the Speaker.

Is the resistance below 5.0 ohms for each circuit?

Yes >> Go To 3

No >> Repair the applicable Output Speaker circuit for an open condition.
Perform the BODY VERIFICATION TEST VER 1.

B1403-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

3. SPEAKER

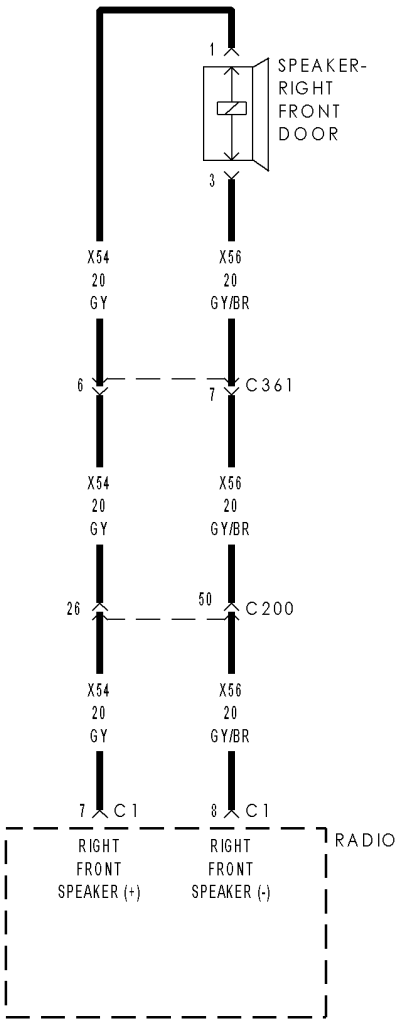
Turn the ignition off.
Disconnect the Front Left Audio Speaker.
Turn the ignition on.
Turn the Radio on.
With the Scan Tool, clear all Audio DTC's.
With the Scan Tool, read the DTC information.

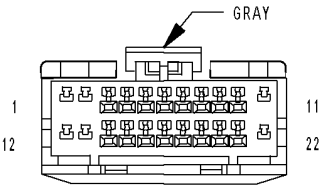
Does the Scan Tool read: B1403-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Replace the Speaker in accordance with the service information.
Perform the BODY VERIFICATION TEST VER 1.

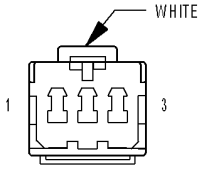
No >> Test Complete.

B1405-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW





RADIO C1



SPEAKER-RIGHT
FRONT DOOR

812cd9b2

B1405-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

For the Audio system circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Radio on.
- **Set Condition:**
- When the Output circuit is LOW for more than 3 seconds.

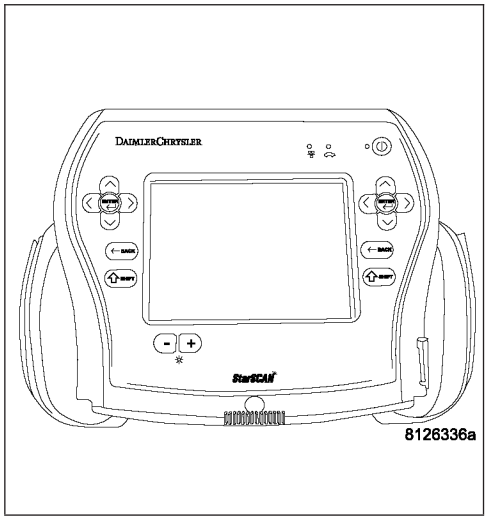
Possible Causes
SPEAKER
(X56) (X54) RIGHT FRONT SPEAKER OUTPUT CIRCUIT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all Audio DTC's.
Turn the Radio on.
With the Scan Tool, read the DTC information.



Does the Scan Tool read: B1405-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST VER 1.

---

2. (X54) (X56) SPEAKER OUTPUT CIRCUITS.

Turn the ignition off.
Disconnect the Radio C1 harness connector.
Disconnect the Front Right Audio Speaker connector.
Measure the resistance between ground and each speaker (X54)(+) and (X56)(-) circuit.

Is the resistance below 1000.0 ohms for each circuit?

Yes >> Repair the applicable Speaker (+) or (-) Output circuit for a short to ground condition.

No >> Go To 3

B1405-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

3. SPEAKER

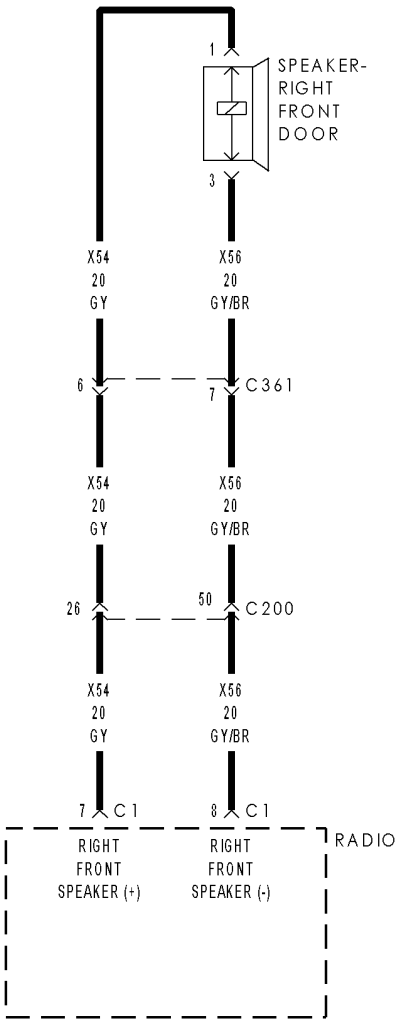
Turn the ignition off.
Disconnect the Front Right Audio Speaker.
Turn the ignition on.
Turn the Radio on.
With the Scan Tool, clear all Audio DTC's.
With the Scan Tool, read the DTC information.

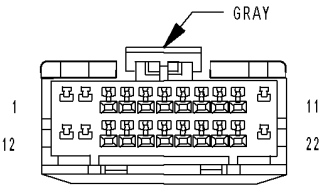
Does the Scan Tool read: B1405-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Replace the Speaker in accordance with the service information.
Perform the BODY VERIFICATION TEST VER 1.

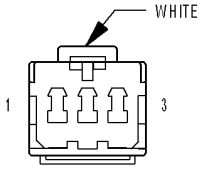
No >> Test Complete.

B1406-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT HIGH





RADIO C1



SPEAKER-RIGHT
FRONT DOOR

812cd9b2

B1406-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

For the Audio system circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

Possible Causes
SPEAKER
(X54) SPEAKER OUTPUT CIRCUIT (+)
(X56) SPEAKER OUTPUT CIRCUIT (-)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

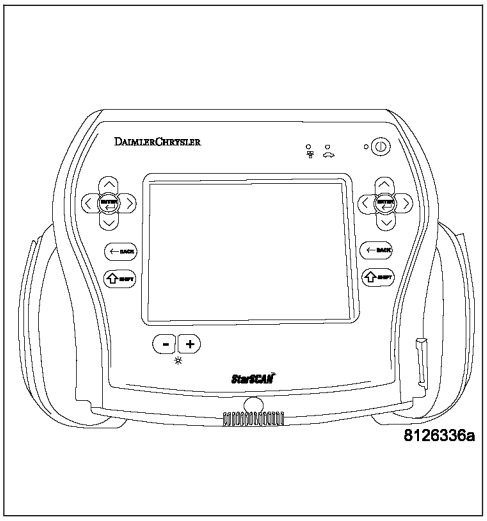
1. INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Radio DTCs.

Does the scan tool display active: B1406-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



B1406-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

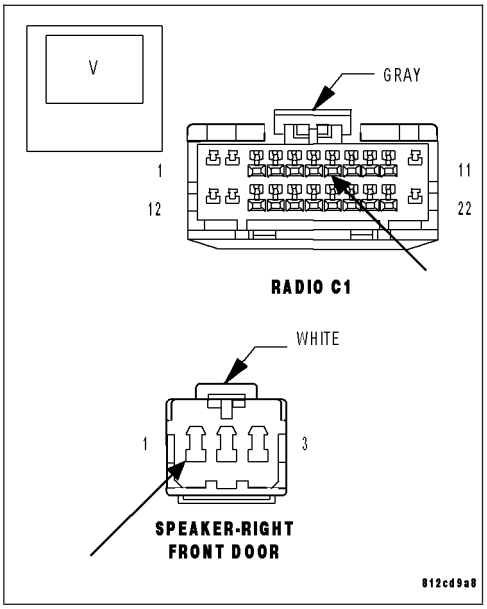
2. CHECK FOR VOLTAGE ON THE (X54) SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Radio C1 harness connector.
Disconnect the Right Rear Speaker harness connector.
Measure for voltage on the (X52) Speaker (+) circuit.

Is the voltage above 10.0 volts?

Yes >> Repair the (X52) Speaker (+) circuit for a short to voltage. Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3



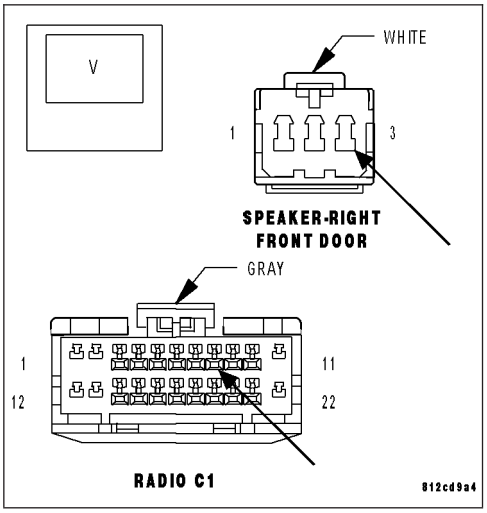
3. CHECK FOR VOLTAGE ON THE (X56) SPEAKER (-) CIRCUIT

Measure for voltage on the (X58) Speaker (-) circuit.

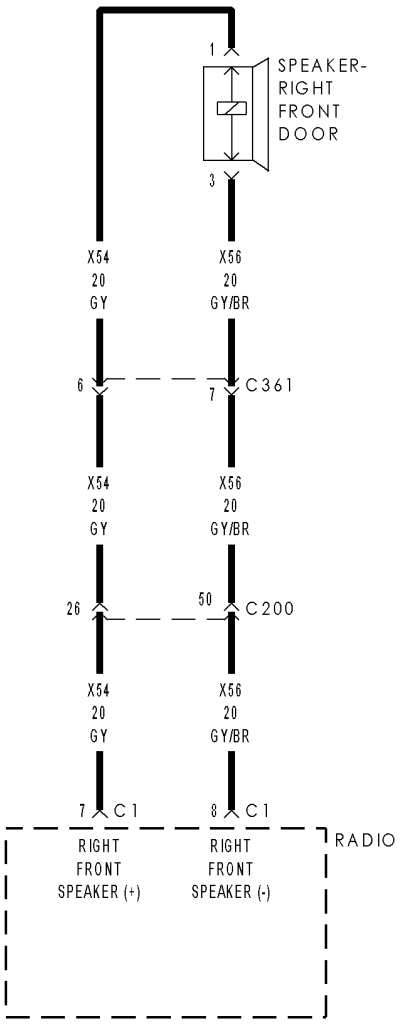
Is the voltage above 10.0 volts?

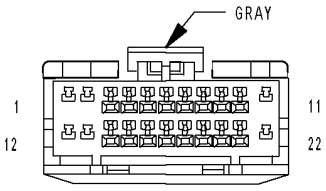
Yes >> Repair the (X58) Speaker (-) circuit for a short to voltage. Perform BODY VERIFICATION TEST VER-1.

No >> Replace the Radio in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

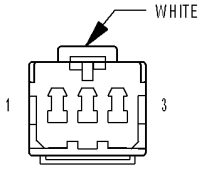


B1407-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN





RADIO C1



SPEAKER-RIGHT
FRONT DOOR

812cd9b2

B1407-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

For the Audio system circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Radio on.
- **Set Condition:**
- When the Output circuit is open for more than 3 seconds. The Radio will not set the fault if the radio confirms an amplifier is on the BUS.

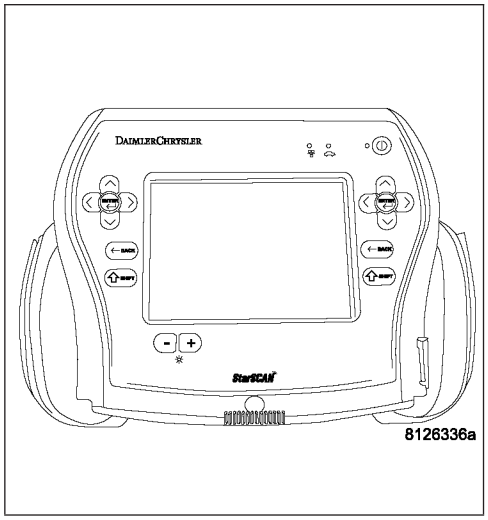
Possible Causes
SPEAKER
(X56) (X54) RIGHT FRONT SPEAKER OUTPUT CIRCUIT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all Audio DTC's.
Turn the Radio on.
With the Scan Tool, read the DTC information.



Does the Scan Tool read: B1407-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST VER 1.

---

2. (X56) (X54) Speaker Output circuits.

Turn the ignition off.
Disconnect the Radio C1 harness connector.
Disconnect the Front Right Audio Speaker connector.
Measure the resistance of each speaker (X54)(+) and (X56)(-) circuit between the Radio and the Speaker.

Is the resistance below 5.0 ohms for each circuit?

Yes >> Go To 3

No >> Repair the applicable Output Speaker circuit for an open condition.
Perform the BODY VERIFICATION TEST VER 1.

B1407-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

3. **Speaker**

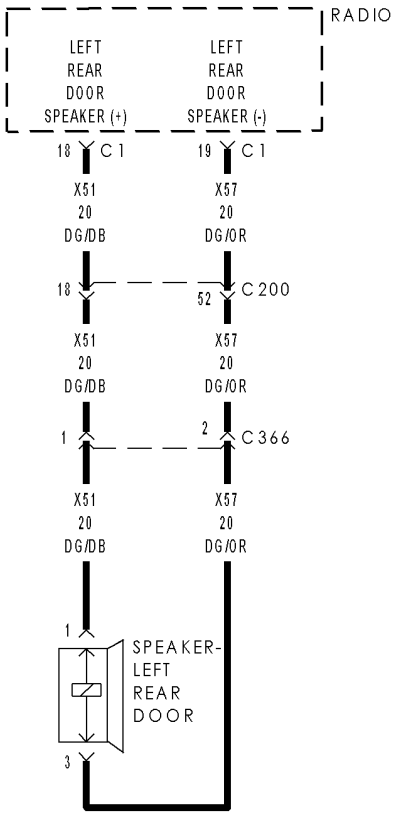
Turn the ignition off.
Disconnect the Front Right Audio Speaker.
Turn the ignition on.
Turn the Radio on.
With the Scan Tool, clear all Audio DTC's.
With the Scan Tool, read the DTC information.

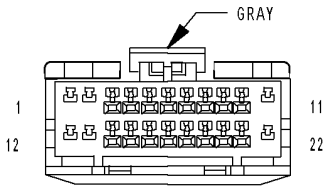
Does the Scan Tool read: B1407-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Replace the Speaker in accordance with the service information.
Perform the BODY VERIFICATION TEST VER 1.

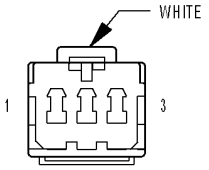
No >> Test Complete.

B1409-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW





RADIO C1



SPEAKER-LEFT REAR DOOR

812cd982

B1409-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

For the Audio system circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Radio on.
- **Set Condition:**
- When the Output circuit is LOW for more than 3 seconds.

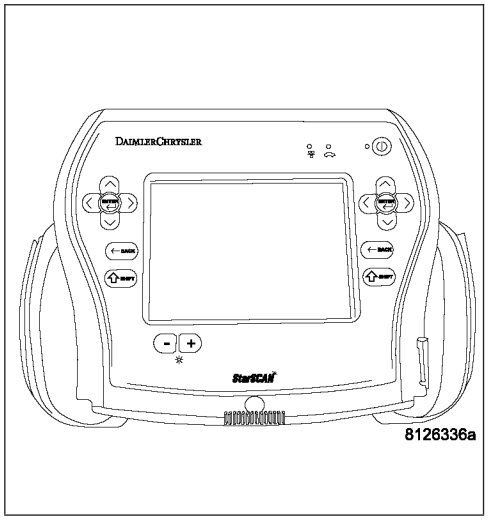
Possible Causes
SPEAKER
(X57) (X51) LEFT REAR SPEAKER OUTPUT CIRCUIT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all Audio DTC's.
Turn the Radio on.
With the Scan Tool, read the DTC information.



Does the Scan Tool read: B1409-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST VER 1.

---

2. (X51) (X57) SPEAKER OUTPUT CIRCUITS.

Turn the ignition off.
Disconnect the Radio C1 harness connector.
Disconnect the Rear Left Audio Speaker connector.
Measure the resistance between ground and each speaker (X51)(+) and (X57)(-) circuit.

Is the resistance below 1000.0 ohms for each circuit?

Yes >> Repair the applicable Speaker (+) or (-) Output circuit for a short to ground condition.

No >> Go To 3

B1409-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

3. SPEAKER

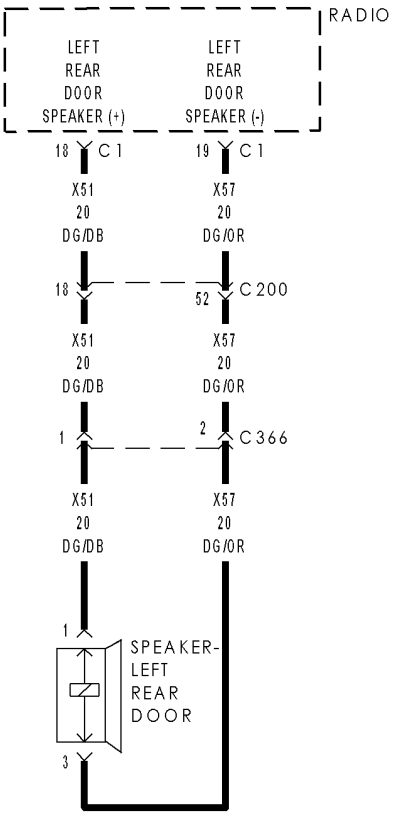
Turn the ignition off.
Disconnect the Rear Left Audio Speaker.
Turn the ignition on.
Turn the Radio on.
With the Scan Tool, clear all Audio DTC's.
With the Scan Tool, read the DTC information.

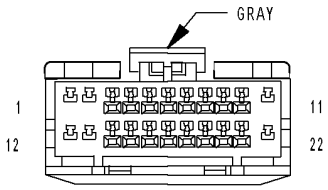
Does the Scan Tool read: B1409-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Replace the Speaker in accordance with the service information.
Perform the BODY VERIFICATION TEST VER 1.

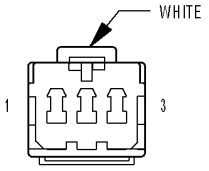
No >> Test Complete.

B140A-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH





RADIO C1



SPEAKER-LEFT REAR DOOR

812cd982

B140A-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

For the Audio system circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

Possible Causes
SPEAKER
(X51) SPEAKER OUTPUT CIRCUIT (+)
(X57) SPEAKER OUTPUT CIRCUIT (-)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

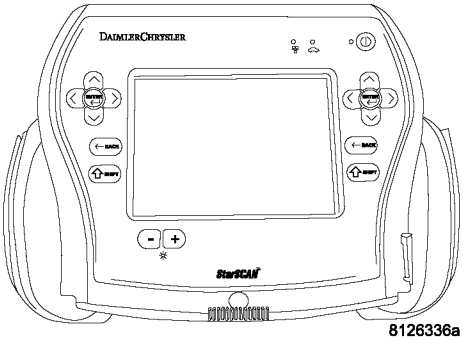
1. INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Radio DTCs.

Does the scan tool display active: B140A-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



B140A-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

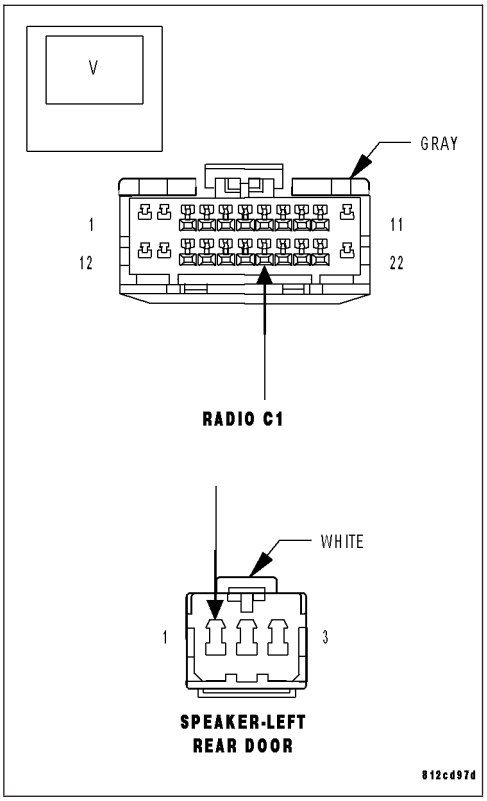
2. CHECK FOR VOLTAGE ON THE (X51) SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Radio C1 harness connector.
Disconnect the Left Rear Speaker harness connector.
Measure for voltage on the (X51) Speaker (+) circuit.

Is the voltage above 10.0 volts?

Yes >> Repair the (X51) Speaker (+) circuit for a short to voltage. Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3



B140A-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

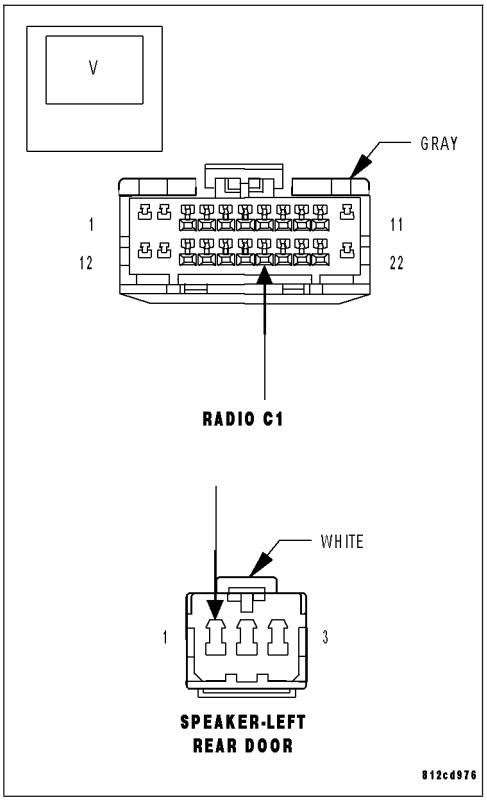
3. CHECK FOR VOLTAGE ON THE (X57) SPEAKER (-) CIRCUIT

Measure for voltage on the (X57) Speaker (-) circuit.

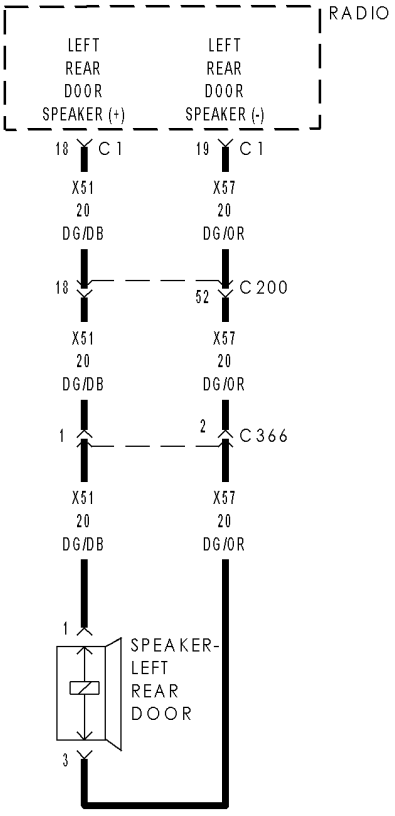
Is the voltage above 10.0 volts?

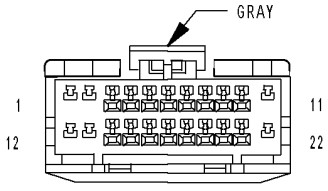
Yes >> Repair the (X57) Speaker (-) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

No >> Replace the Radio in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

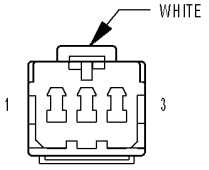


B140B-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN





RADIO C1



SPEAKER-LEFT REAR DOOR

812cd982

B140B-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

For the Audio system circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Radio on.
- **Set Condition:**
- When the Output circuit is open for more than 3 seconds. The Radio will not set the fault if the radio confirms an amplifier is on the BUS.

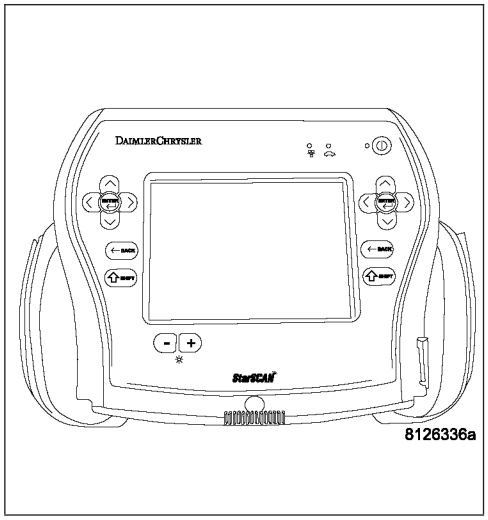
Possible Causes
SPEAKER
(X57) (X51) LEFT REAR SPEAKER OUTPUT CIRCUIT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. Intermittent Condition

Turn the ignition on.
With the Scan Tool, clear all Audio DTC's.
Turn the Radio on.
With the Scan Tool, read the DTC information.



Does the Scan Tool read: B140B-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST VER 1.

---

2. (X57) (X51) Speaker Output circuits.

Turn the ignition off.
Disconnect the Radio C1 harness connector.
Disconnect the Rear Left Audio Speaker connector.
Measure the resistance of each speaker (X51)(+) and (X57)(-) circuit between the Radio and the Speaker.

Is the resistance below 5.0 ohms for each circuit?

Yes >> Go To 3

No >> Repair the applicable Output Speaker circuit for an open condition.
Perform the BODY VERIFICATION TEST VER 1.

B140B-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

3. **Speaker**

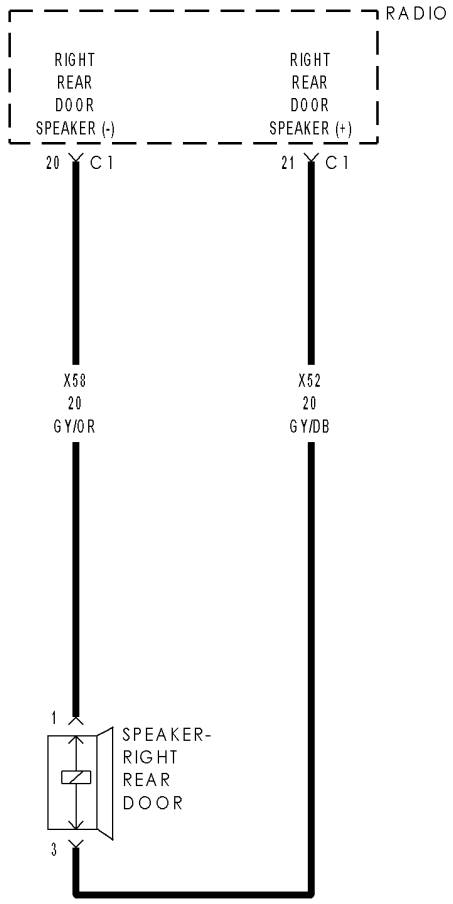
Turn the ignition off.
Disconnect the Rear Left Audio Speaker.
Turn the ignition on.
Turn the Radio on.
With the Scan Tool, clear all Audio DTC's.
With the Scan Tool, read the DTC information.

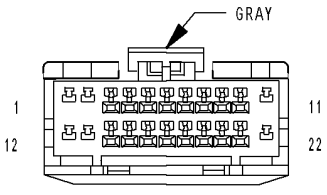
Does the Scan Tool read: B140B-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Replace the Speaker in accordance with the service information.
Perform the BODY VERIFICATION TEST VER 1.

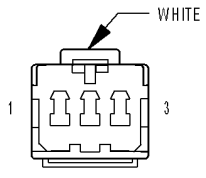
No >> Test Complete.

B140D-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW





RADIO C1



SPEAKER-RIGHT REAR DOOR

812ccbe3

B140D-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

For the Audio system circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Radio on.
- **Set Condition:**
- When the Output circuit is LOW for more than 3 seconds.

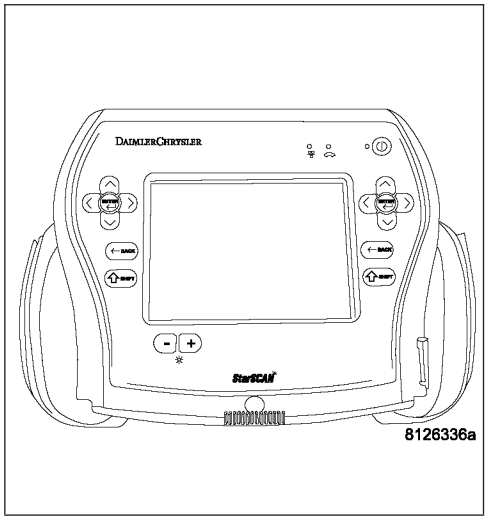
Possible Causes
SPEAKER
(X58) (X52) RIGHT REAR SPEAKER OUTPUT CIRCUIT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. Intermittent Condition

Turn the ignition on.
With the Scan Tool, clear all Audio DTC's.
Turn the Radio on.
With the Scan Tool, read the DTC information.



Does the Scan Tool read: B140D-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST VER 1.

---

2. (X58) (X52) Speaker Output circuits.

Turn the ignition off.
Disconnect the Radio C1 harness connector.
Disconnect the Rear Right Audio Speaker connector.
Measure the resistance between ground and each speaker (X58)(+) and (X52)(-) circuit.

Is the resistance below 1000.0 ohms for each circuit?

Yes >> Repair the applicable Speaker (+) or (-) Output circuit for a short to ground condition.

No >> Go To 3

B140D-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

3. **Speaker**

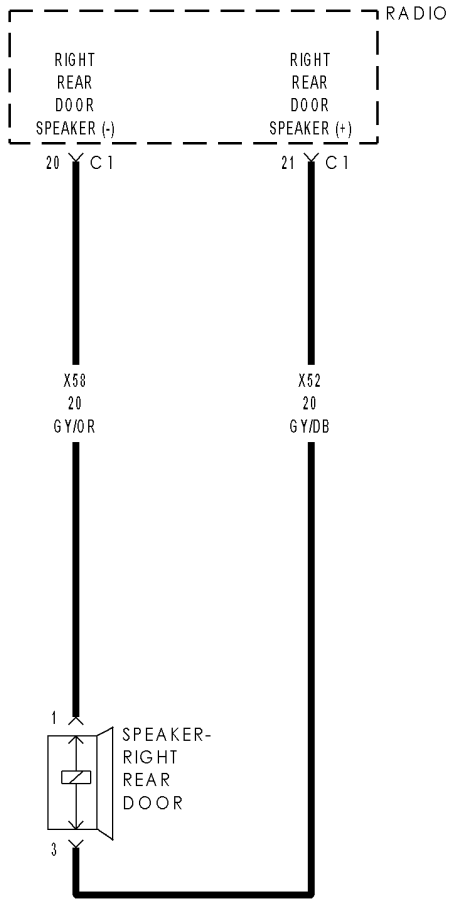
Turn the ignition off.
Disconnect the Rear Right Audio Speaker.
Turn the ignition on.
Turn the Radio on.
With the Scan Tool, clear all Audio DTC's.
With the Scan Tool, read the DTC information.

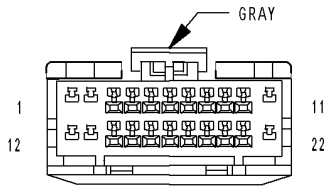
Does the Scan Tool read: B140D-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Replace the Speaker in accordance with the service information.
Perform the BODY VERIFICATION TEST VER 1.

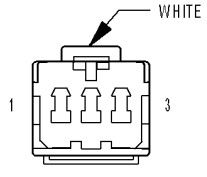
No >> Test Complete.

B140E-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT HIGH





RADIO C1



SPEAKER-RIGHT REAR DOOR

812ccbe3

B140E-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

For the Audio system circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

Possible Causes
SPEAKER
(X52) SPEAKER OUTPUT CIRCUIT (+)
(X58) SPEAKER OUTPUT CIRCUIT (-)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

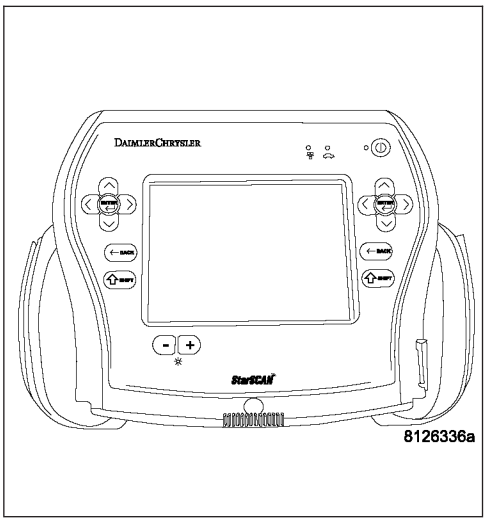
1. INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Radio DTCs.

Does the scan tool display active: B140E-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



B140E-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

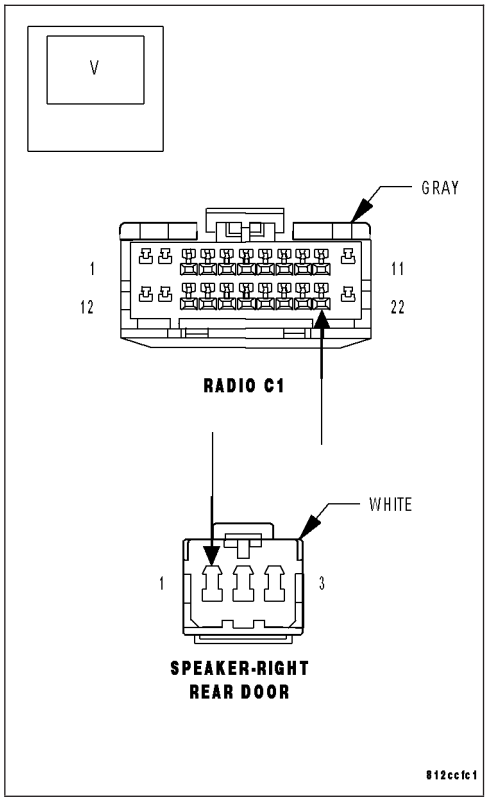
2. CHECK FOR VOLTAGE ON THE (X52) SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Radio C1 harness connector.
Disconnect the Right Rear Speaker harness connector.
Measure for voltage on the (X52) Speaker (+) circuit.

Is the voltage above 10.0 volts?

Yes >> Repair the (X52) Speaker (+) circuit for a short to voltage. Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3



B140E-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

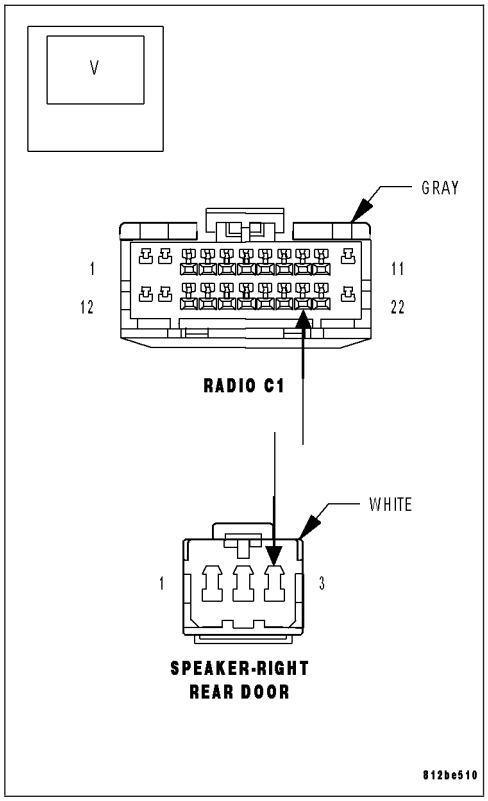
3. CHECK FOR VOLTAGE ON THE (X58) SPEAKER (-) CIRCUIT

Measure for voltage on the (X58) Speaker (-) circuit.

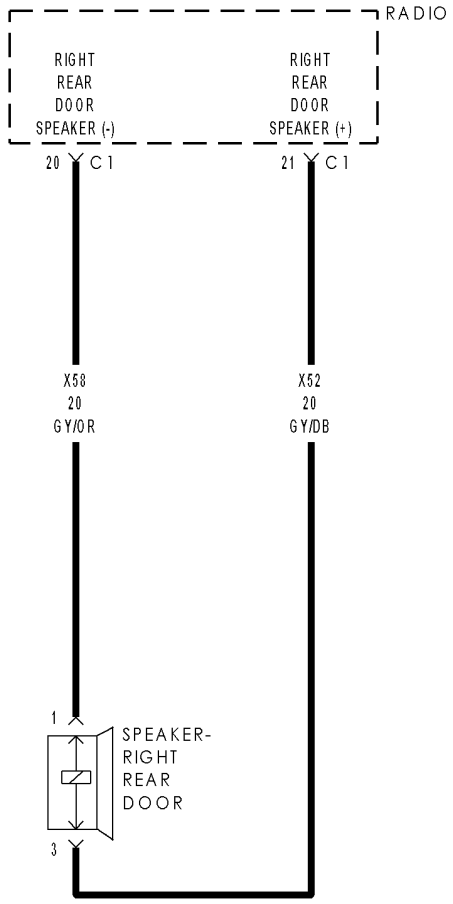
Is the voltage above 10.0 volts?

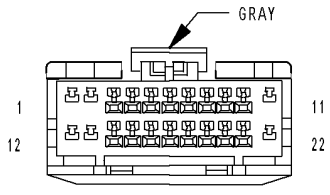
Yes >> Repair the (X58) Speaker (-) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

No >> Replace the Radio in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

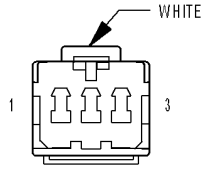


B140F-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN





RADIO C1



SPEAKER-RIGHT REAR DOOR

812ccbe3

B140F-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

For the Audio system circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Radio on.
- **Set Condition:**
- When the Output circuit is open for more than 3 seconds. The Radio will not set the fault if the radio confirms an amplifier is on the BUS.

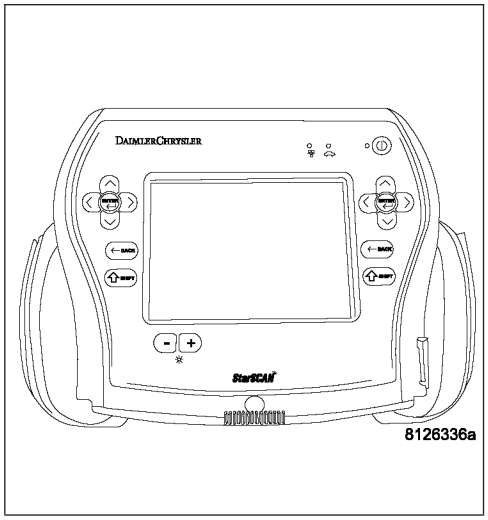
Possible Causes
SPEAKER
(X58) (X52) RIGHT REAR SPEAKER OUTPUT CIRCUIT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. Intermittent Condition

Turn the ignition on.
With the Scan Tool, clear all Audio DTC's.
Turn the Radio on.
With the Scan Tool, read the DTC information.



Does the Scan Tool read: B140F-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST VER 1.

---

2. (X58) (X52) Speaker Output circuits.

Turn the ignition off.
Disconnect the Radio C1 harness connector.
Disconnect the Rear Right Audio Speaker connector.
Measure the resistance of each speaker (X58)(+) and (X52)(-) circuit between the Radio and the Speaker.

Is the resistance below 5.0 ohms for each circuit?

Yes >> Go To 3

No >> Repair the applicable Output Speaker circuit for an open condition.
Perform the BODY VERIFICATION TEST VER 1.

B140F-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

3. **Speaker**

Turn the ignition off.
Disconnect the Rear Right Audio Speaker.
Turn the ignition on.
Turn the Radio on.
With the Scan Tool, clear all Audio DTC's.
With the Scan Tool, read the DTC information.

Does the Scan Tool read: B140F-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Replace the Speaker in accordance with the service information.
Perform the BODY VERIFICATION TEST VER 1.

No >> Test Complete.

B142A-RADIO UNIT HIGH TEMPERATURE

For the Audio System circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- When Monitored:
- Continuously with the ignition and Radio on.
- Set Condition:
- The code will set if the temperature inside the radio is above +65°C (+145°F)

Possible Causes
HIGH TEMPERATURE FAILURE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. VERIFY THAT DTC B142A—RADIO UNIT HIGH TEMPERATURE IS ACTIVE.

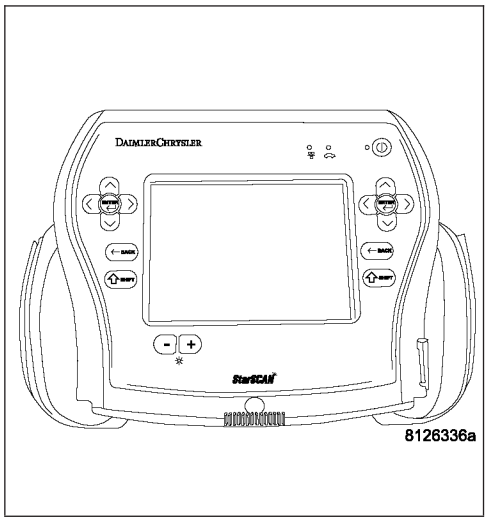
With the Scan Tool, erase the Audio DTC's.

Start the engine and allow the engine to reach normal operating temperature.

If the vehicle has been in the hot sunlight or extreme cold, move the vehicle indoors and open the doors to allow the inside temperature to stabilize.

The Radio should operate between —23°C and 65°C (—10°F and +145°F).

With the Scan Tool, read the DTC's.



Does the Scan Tool display, B142A— Radio Unit High Temperature?

Yes >> Replace the Radio in accordance with the service information.

Perform the BODY VERIFICATION TEST — VER 1.

No >> Test Complete.

B142D-AUDIO ANTENNA NOT CONNECTED

For the Audio System circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the ignition on and the radio in seek mode.
- **Set Condition:**
- With the radio in seek mode for two loops around the band. The radio does not detect an antenna connection or does not receive a radio station signal.

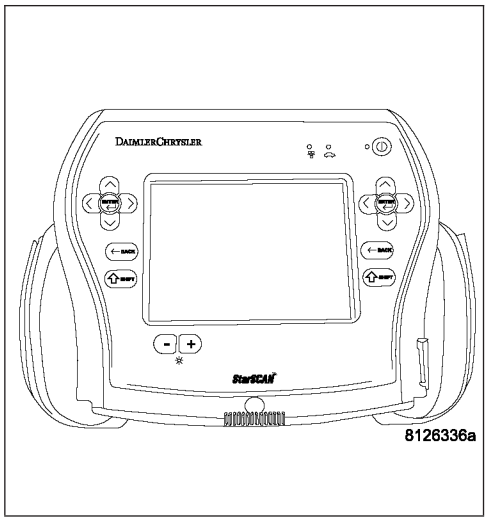
Possible Causes
BAD ANTENNA CONNECTION
RADIO

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. Test Antenna

Turn the ignition off.
Disconnect the Radio Antenna connector.
Inspect the Radio Antenna connection.



Was the Antenna connection clean and secure?

Yes >> Go To 2

No >> Repair the Antenna connection as needed.
Perform the BODY VERIFICATION TEST — VER1.

2. ANTENNA

Refer to the Audio System in the service information and test the antenna in accordance with the service procedure.

Is the Antenna ok?

Yes >> Go To 3

No >> Repair or replace the Antenna assembly as necessary.
Perform the BODY VERIFICATION TEST — VER1.

B142D-AUDIO ANTENNA NOT CONNECTED (CONTINUED)

3. RADIO

NOTE: Reconnect all previously disconnected components.

NOTE: Move vehicle outside approximately 30ft from any structure.

Turn the ignition and radio on.

With the Scan Tool, erase the audio DTC's, put the radio in seek up and down mode for 2 loops around the band cycle before proceeding.

With the Scan Tool, read the audio DTC's.

Did this DTC reset?

Yes >> Replace the radio in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER1.

No >> Test Complete.

B142F-SATELLITE RADIO ANTENNA NOT CONNECTED

For the Audio System circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the ignition on and the Satellite Radio in seek mode.
- **Set Condition:**
- With the radio in seek mode for two loops around the band. The radio does not detect an antenna connection or does not receive a radio satellite signal.

Possible Causes
BAD ANTENNA CONNECTION
SATELLITE RADIO RECEIVER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

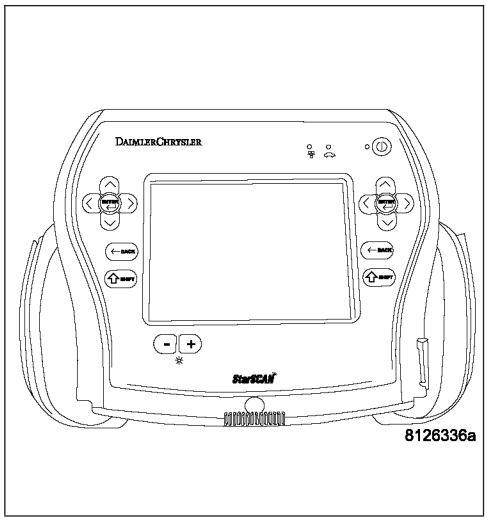
1. Test Antenna

Turn the ignition off.
Disconnect the Satellite Radio Antenna connector.
Inspect the Satellite Radio Antenna connection.

Was the Antenna connection clean and secure?

Yes >> Go To 2

No >> Repair the Antenna connection as needed.
Perform the BODY VERIFICATION TEST — VER1.



2. SATELLITE RADIO ANTENNA

Refer to the Audio System in the service information and test the antenna in accordance with the service procedure.

Is the Antenna ok?

Yes >> Go To 3

No >> Repair or replace the Antenna assembly as necessary.
Perform the BODY VERIFICATION TEST — VER1.

B142F-SATELLITE RADIO ANTENNA NOT CONNECTED (CONTINUED)

3. SATELLITE RADIO RECEIVER

NOTE: Reconnect all previously disconnected components.

NOTE: Move vehicle outside approximately 30ft from any structure.

Turn the ignition and radio on.

With the Scan Tool, erase the audio DTC's, put the satellite radio in seek up and down mode for 2 loops around the band cycle before proceeding.

With the Scan Tool, read the audio DTC's.

Did this DTC reset?

Yes >> Replace the Satellite Radio Receiver in accordance with the service information. Perform the BODY VERIFICATION TEST-VER1.

No >> Test Complete.

B221E-RADIO INTERNAL

For the Audio System circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- When Monitored:
- Continuously with the ignition on and radio turned on.
- Set Condition:
- The code will set if the radio detects a radio internal failure.

Possible Causes
RADIO INTERNAL FAILURE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. Verify DTC B221E-RADIO INTERNAL IS ACTIVE

NOTE: If a DTC is set, erase the DTC and attempt to reset the DTC. If the DTC resets, follow test.

This is an internal radio failure

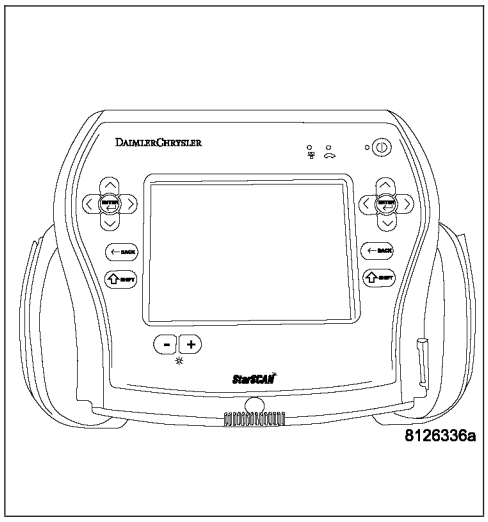
View repair

Does the DTC reset and read B221E-Radio Internal?

Repair

Replace the Radio in accordance with the service information.

Perform the BODY VERIFICATION TEST — VER 1.



B2222-SATELLITE RADIO RECEIVER INTERNAL

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Satellite Radio Receiver detects a software checksum test failure.

Possible Causes
SATELLITE RADIO RECEIVER

Diagnostic Test

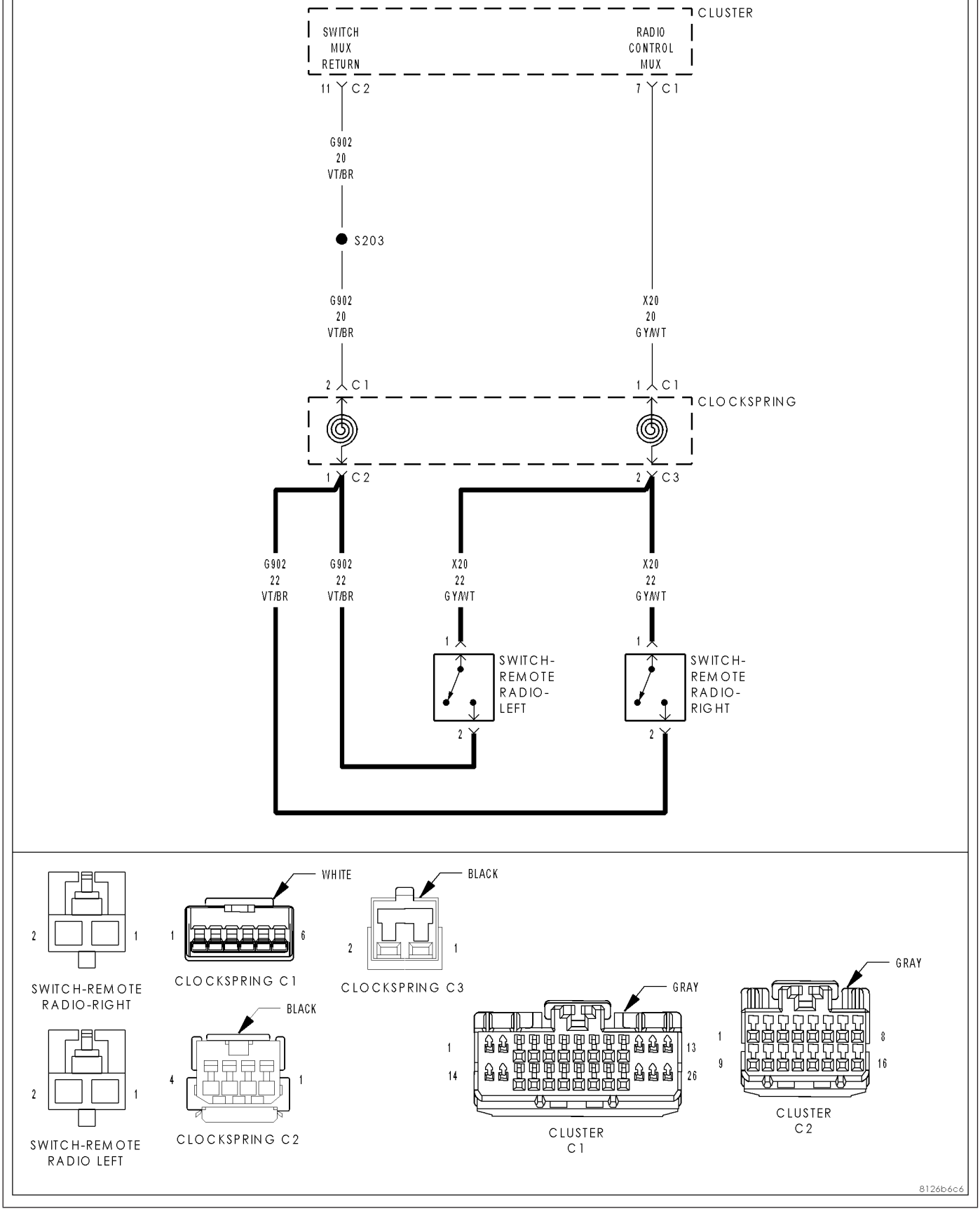
1. REPLACE THE SATELLITE RADIO RECEIVER

When this code is set, the Satellite Radio must be replaced.

Repair

Replace the Satellite Radio Receiver in accordance with the Service Information.
Perform the BODY VERIFICATION TEST-VER 1.

B1428-REMOTE RADIO SWITCH INPUT CIRCUIT STUCK



B1428-REMOTE RADIO SWITCH INPUT CIRCUIT STUCK (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in any position except off.
- **Set Condition:**
  The Instrument Cluster detects a stuck switch state on the (X20) Radio Control MUX circuit for more than 30 seconds.

Possible Causes
(X20) REMOTE CONTROL MUX CIRCUIT SHORT TO GROUND
(X20) REMOTE CONTROL MUX CIRCUIT SHORT TO (G902) SWITCH MUX RETURN CIRCUIT
LEFT REMOTE RADIO SWITCH
RIGHT REMOTE RADIO SWITCH
CLOCKSPRING
INSTRUMENT CLUSTER (CCN)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

---

2. LEFT REMOTE RADIO SWITCH

Turn the ignition off.

Disconnect the Left Remote Radio Switch harness connector.

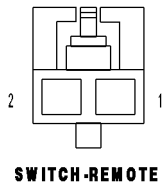
Turn the ignition on.

With the scan tool monitor the Remote Radio Control Switch voltage.

Is the voltage approximately 5.0 volts?

Yes >> Replace the Left Remote Radio Switch in accordance with the service information.
Perform BODY VERIFICATION TEST – VER 1.

No >> Go To 3



SWITCH-REMOTE RADIO LEFT
8126b6c7

B1428-REMOTE RADIO SWITCH INPUT CIRCUIT STUCK (CONTINUED)

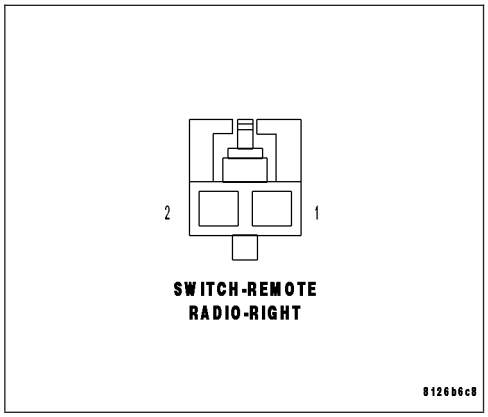
3. RIGHT REMOTE RADIO SWITCH

Turn the ignition off.
Disconnect the Right Remote Radio Switch harness connector.
Turn the ignition on.
With the scan tool monitor the Remote Radio Control Switch voltage.

Is the voltage approximately 5.0 volts?

Yes >> Replace the Right Remote Radio Switch in accordance with the service information.
Perform BODY VERIFICATION TEST – VER 1.

No >> Go To 4



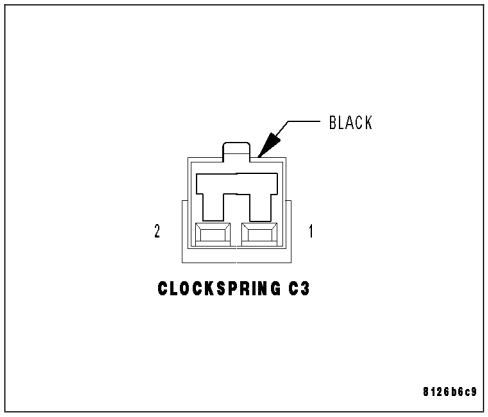
4. CLOCKSPRING

Turn the ignition off.
Disconnect the Clockspring C1 harness connector.
Turn the ignition on.
With the scan tool monitor the Remote Radio Control Switch voltage.

Is the voltage approximately 5.0 volts?

Yes >> Check the (X20) Radio Control MUX circuit for a short between the clockspring and the remote radio switches. If ok, replace the Clockspring in accordance with the service information.
Perform BODY VERIFICATION TEST – VER 1.

No >> Go To 5



B1428-REMOTE RADIO SWITCH INPUT CIRCUIT STUCK (CONTINUED)

5. (X20) RADIO CONTROL MUX CIRCUIT SHORT TO GROUND

Turn the ignition off.

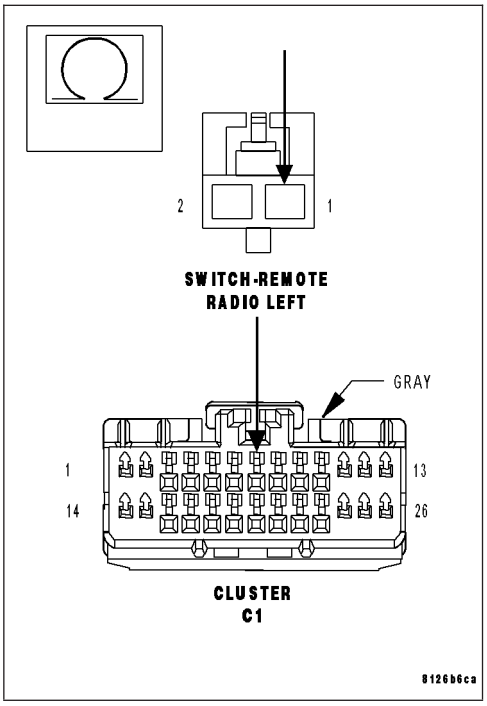
Disconnect the Instrument Cluster C1 harness connector.

Measure the resistance between ground and the (X20) Radio Control MUX circuit.

Is the resistance below 100.0 ohms?

Yes >> Repair the (X20) Radio Control MUX circuit for a short to ground.
Perform BODY VERIFICATION TEST – VER 1.

No >> Go To 6



6. (X20) RADIO CONTROL MUX CIRCUIT SHORT TO (G902) SWITCH MUX RETURN CIRCUIT

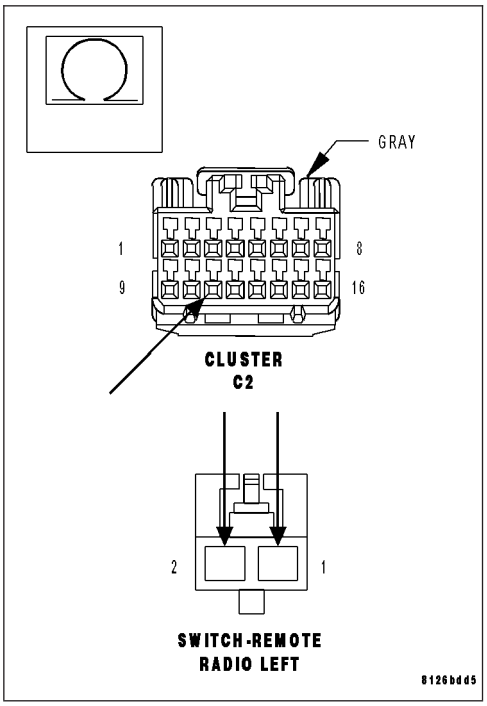
Disconnect the Instrument Cluster C2 harness connector.

Measure the resistance between the (X20) Radio Control MUX circuit and the (G902) Switch MUX Return circuit.

Is the resistance below 100.0 ohms?

Yes >> Repair the (X20) Radio Control MUX circuit for a short to the (G902) Switch MUX Return circuit.
Perform BODY VERIFICATION TEST – VER 1.

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Instrument Cluster (CCN) in accordance with the service information.
Perform BODY VERIFICATION TEST – VER 1.



B1429-RADIO DISPLAY HIGH TEMPERATURE

For the Audio System circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- When Monitored:
- Continuously with the ignition and Navigation Radio on.
- Set Condition:
- The code will set if the temperature inside the display exceeds 158°F

Possible Causes
HIGH TEMPERATURE FAILURE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. VERIFY THAT DTC B1429—RADIO DISPLAY HIGH TEMPERATURE IS ACTIVE.

With the Scan Tool, erase the Audio DTC's.

Start the engine and allow the engine to reach normal operating temperature.

If the vehicle has been in the hot sunlight or extreme cold, move the vehicle indoors and open the doors to allow the inside temperature to stabilize.

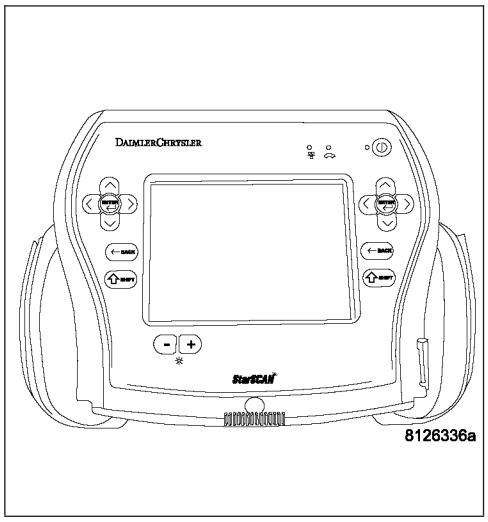
The radio display should operate to 158°F.

With the Scan Tool, read the DTC's.

Does the Scan Tool display, B1429— Radio Display High Temperature?

Yes >> Replace the Radio in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Test Complete.



B142E-GPS ANTENNA NOT CONNECTED

For the Audio System circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the ignition on and the radio in navigation mode.
- **Set Condition:**
- With the radio does not detect GPS antenna connection.

Possible Causes
BAD ANTENNA CONNECTION
RADIO

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

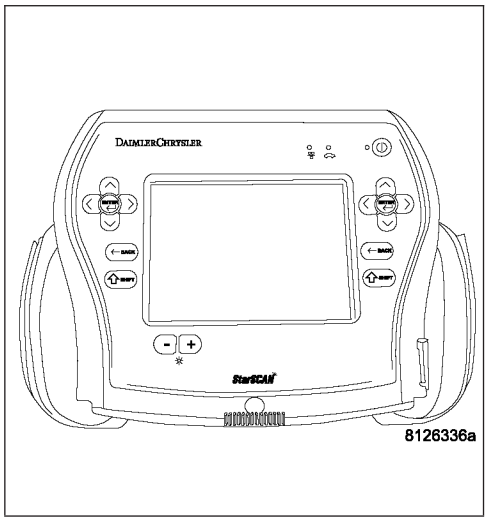
1. TEST ANTENNA

Turn the ignition off.
Disconnect the GPS Antenna connector.
Inspect the GPS Antenna connection.

Was the Antenna connection clean and secure?

Yes >> Go To 2

No >> Repair the Antenna connection as needed.
Perform the BODY VERIFICATION TEST — VER1.



2. ANTENNA

Refer to the Audio System in the service information and test the antenna in accordance with the service procedure.

Is the Antenna ok?

Yes >> Go To 3

No >> Repair or replace the Antenna assembly as necessary.
Perform the BODY VERIFICATION TEST — VER1.

B142E-GPS ANTENNA NOT CONNECTED (CONTINUED)

3. RADIO

NOTE: Reconnect all previously disconnected components.

NOTE: Move vehicle outside approximately 30ft from any structure.

Turn the ignition and radio on.

With the Scan Tool, erase the audio DTC's and operate the navigation system.

With the Scan Tool, read the audio DTC's.

Did this DTC reset?

Yes >> Replace the radio in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER1.

No >> Test Complete.

B1421-AUDIO CD READ ERROR/INOPERABLE DISC

For the Audio System circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- Continuously with the ignition on and the radio CD player turned on.
- **Set Condition:**
- The code will set if a CD that is not formatted as a music CD is installed in the radio CD player.

Possible Causes
CD READ FAILURE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. RADIO

Replace the problem CD with a good, clean,unscratched, music CD.

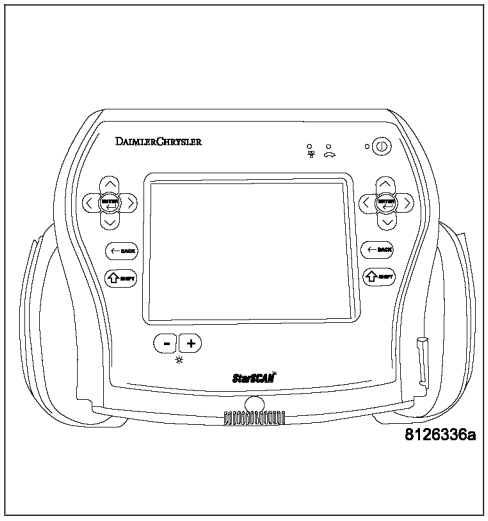
Turn the radio CD player on.

With the Scan Tool, read DTC's.

Does the Scan Tool display: B1421 Audio CD Read Error/Inoperable Disc?

Yes >> Eject the inoperative CD and replace the CD in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Test Complete.



B1422-AUDIO DVD READ ERROR/INOPERABLE DISC

For the Audio System circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- Continuously with the ignition on and the DVD player turned on.
- **Set Condition:**
- The code will set if a DVD that is not formatted as a DVD is installed in the DVD player.

Possible Causes
DVD READ FAILURE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. DVD PLAYER

Replace the problem DVD with a good, clean,unscratched DVD.

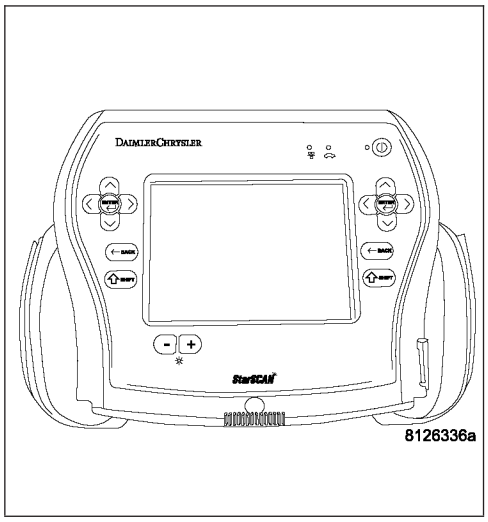
Turn the DVD player on.

With the Scan Tool, read DTC's.

Does the Scan Tool display: B1422 Audio DVD Read Error/Inoperable Disc?

Yes >> Eject the inoperative DVD and replace the DVD in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Test Complete.



B221F-AMPLIFIER INTERNAL

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Amplifier detects a software checksum test failure.

Possible Causes
AMPLIFIER

Diagnostic Test

1. REPLACE THE AMPLIFIER

When this code is set, the Amplifier must be replaced.

Repair

Replace the Amplifier in accordance with the Service Information.
Perform the BODY VERIFICATION TEST-VER 1.

B210D-BATTERY VOLTAGE LOW

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the module detects that the battery voltage is less than 9.0 volts for 1 second.

Possible Causes
VEHICLE CHARGING SYSTEM
AMPLIFIER

Diagnostic Test

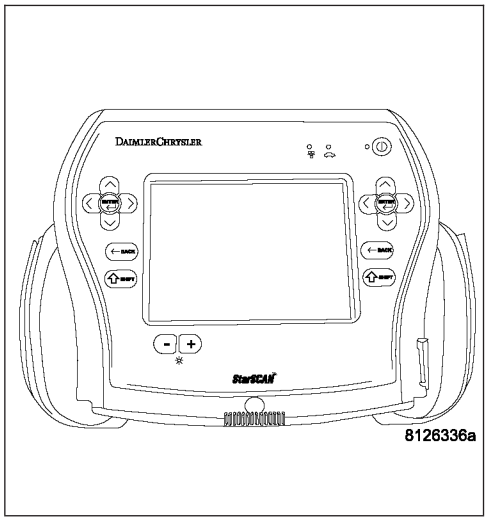
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B210D-BATTERY VOLTAGE LOW?

Yes >> Go To

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



2. CHECK THE BATTERY VOLTAGE TO THE AMPLIFIER

With the scan tool in Data Display, read Amplifier battery voltage.

Is the battery voltage less than 9.0 volts?

Yes >> Go To 3

No >> Replace the Amplifier in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

3. CHECK FOR CHARGING SYSTEM RELATED DTCs IN THE POWERTRAIN CONTROL MODULE (PCM)

With the scan tool in ECU View, select PCM and check for any Charging System related DTCs.

Does the scan tool display any Charging System related DTCs?

Yes >> Diagnose and repair the DTCs. Refer to (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No >> Replace the Amplifier in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

B210E-BATTERY VOLTAGE HIGH

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the module detects that the battery voltage is greater 16.5 volts for 1 second.

Possible Causes
VEHICLE CHARGING SYSTEM
AMPLIFIER

Diagnostic Test

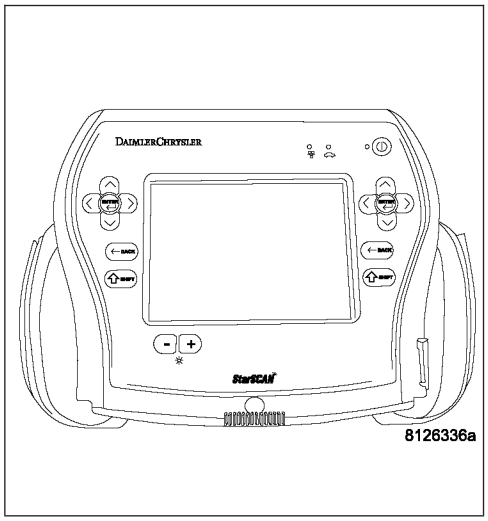
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B210E-BATTERY VOLTAGE HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



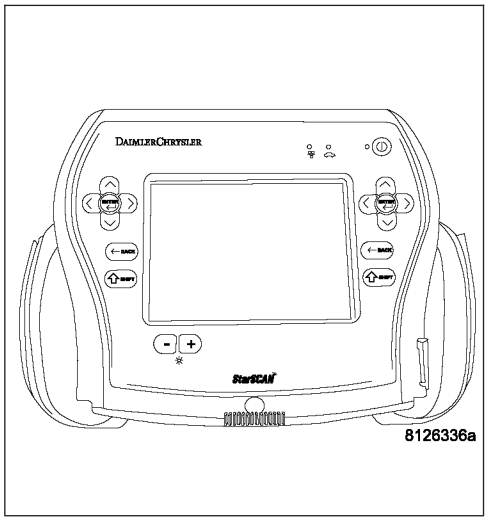
2. CHECK THE BATTERY VOLTAGE TO THE AMPLIFIER

With the scan tool in Data Display, read Amplifier battery voltage.

Is the battery voltage greater than 16.5 volts?

Yes >> Go To 3

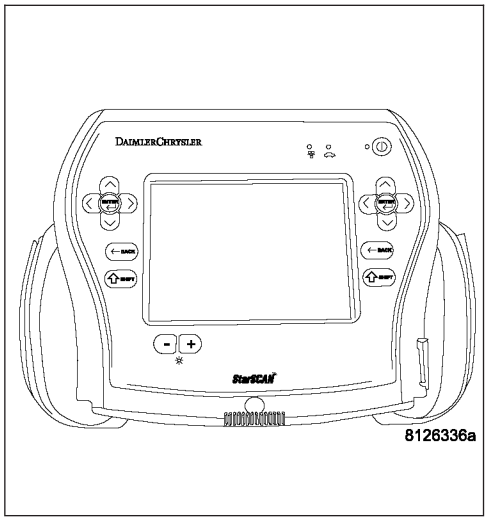
No >> Replace the Amplifier in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.



B210E-BATTERY VOLTAGE HIGH (CONTINUED)

3. CHECK FOR CHARGING SYSTEM RELATED DTCs IN THE POWERTRAIN CONTROL MODULE (PCM)

With the scan tool in ECU View, select PCM and check for any Charging System related DTCs.



Does the scan tool display any Charging System related DTCs?

Yes >> Diagnose and repair the DTCs. Refer to (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No >> Replace the Amplifier in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

B1488–CABIN EQ MISMATCH PERFORMANCE

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

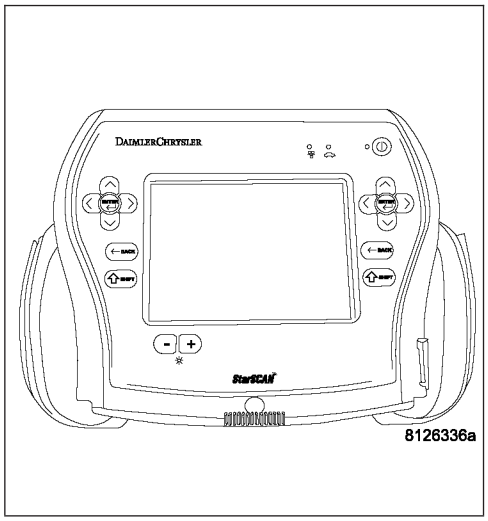
- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the cabin EQ message is incompatible with the EQ's stored in the amplifier for 10 consecutive cycles, then the amplifier will set this DTC.

POSSIBLE CAUSES
NO COMMUNICATION WITH FRONT CONTROL MODULE
ACTIVE FCM DTCs
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on.
Turn the radio on.
With the scan tool, erase Amplifier DTCs.
With the scan tool, reset the amplifier.
With the scan tool, read Amplifier DTCs.



Does the scan tool display active: B1488–CABIN EQ MISMATCH PERFORMANCE?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

---

2. CHECK AMPLIFIER BUSSED INPUTS/OUTPUTS

With the scan tool in Amplifier Data Display, read the Cabin EQ# settings in the Bussed Inputs and Bussed Outputs Sections.

NOTE: The Cabin EQ# settings in the Inputs/Outputs section should match one another. The Cabin EQ# in the Inputs section is the information that is received form the FCM. The Cabin EQ# in the Outputs section is the information that is Stored in the Amplifier's memory.
The Cabin EQ# settings are as follows:

- •$51: HB Premium 1 (w/o Subwoofer)
- •$52: HB Premium 2 (with Subwoofer)

Do the Cabin EQ# settings match one another?

Yes >> Replace the Amplifier in accordance to the service information.
Perform the BODY VERIFICATION TEST-VER 1.

No >> Go To 3

B1488–CABIN EQ MISMATCH PERFORMANCE (CONTINUED)

3. VERIFY COMMUNICATION WITH FRONT CONTROL MODULE

With the scan tool in ECU VIEW, read active modules on the bus.

Does the scan tool show the Front Control Module active on the bus?

Yes >> Go To 4

No >> Refer to the Communication category for the related symptoms.
Perform the BODY VERIFICATION TEST VER 1.

---

4. CHECK FRONT CONTROL MODULE FOR ACTIVE DTCs

With the scan tool, erase FCM DTCs.
Turn the ignition off. Wait approximately 10 seconds.
Turn the ignition on.
With the scan tool, read FCM DTCs.

Are any active DTCs present?

Yes >> Refer to symptom list for problems related to the Front Control Module.
Perform the BODY VERIFICATION TEST VER 1.

No >> Replace the Front Control Module in accordance with the Service Information.
Perform the BODY VERIFICATION TEST-VER.1

B1460-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  This DTC will set if a DC offset occurs on the output channel, the amplifier shall set a DTC after a maturity rate of 5 ±1 sec.

Possible Causes
AMPLIFIER

Diagnostic Test

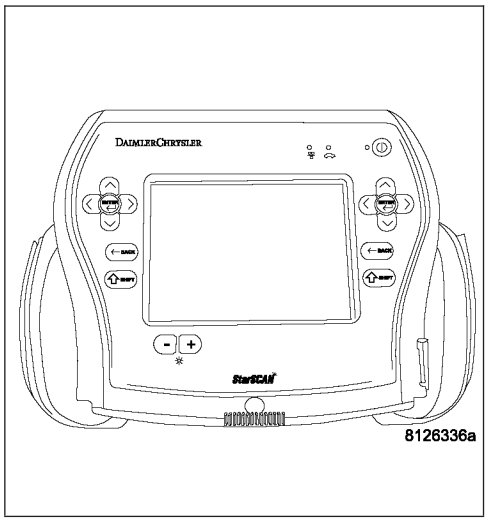
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

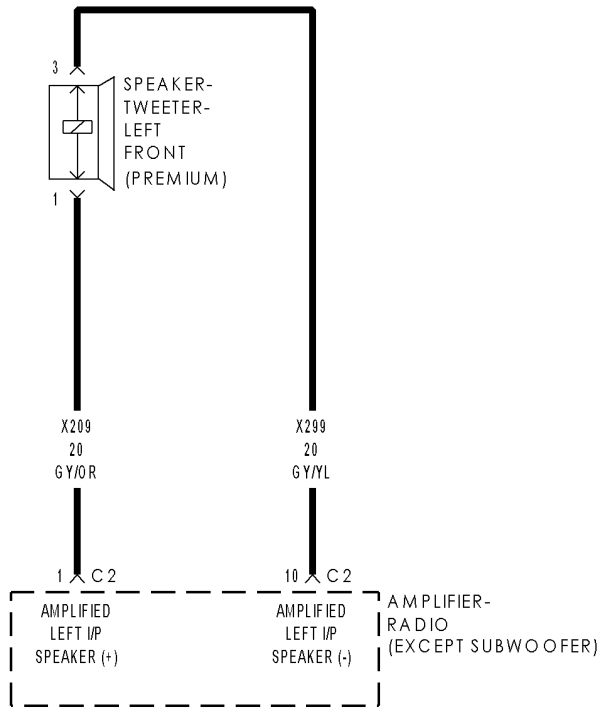
Does the scan tool display active: B1460-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE?

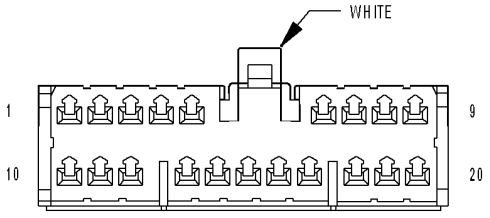
Yes >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

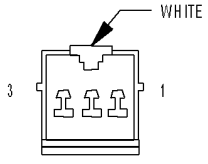


B1461-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT LOW





AMPLIFIER-RADIO
C2
(EXCEPT SUBWOOFER)



SPEAKER-TWEETER
LEFT FRONT
(PREMIUM)

812ceff7

B1461-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Amplifier detects a shorted to ground condition on the speaker output circuit.

Possible Causes
(X209) AMPLIFIED LEFT FRONT I/P SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X299) AMPLIFIED LEFT FRONT I/P SPEAKER (-) CIRCUIT SHORTED TO GROUND
LEFT FRONT I/P SPEAKER
AMPLIFIER

Diagnostic Test

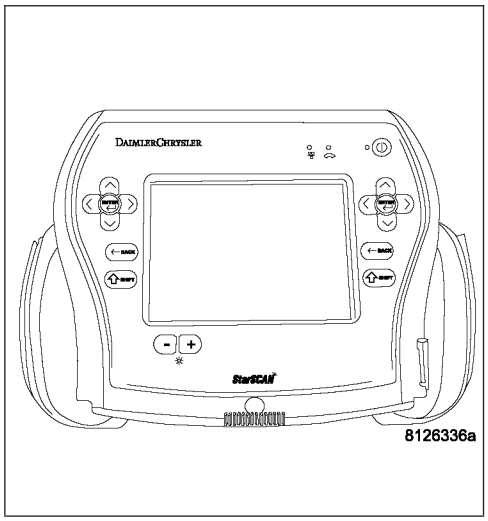
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1461-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



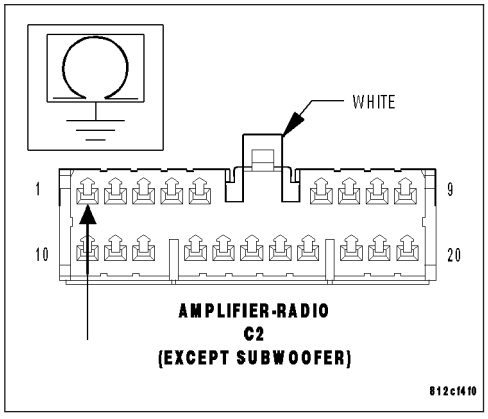
2. CHECK THE (X209) AMPLIFIED LEFT FRONT I/P SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND

Disconnect the Amplifier C2 harness connector.
Measure the resistance between ground and the (X209) Amplified Left Front I/P Speaker (+) circuit.

Is the resistance below 10K ohms?

Yes >> Repair the (X209) Amplified Left Front I/P Speaker (+) circuit for a short to ground.
Perform BODY VERIFICATION TEST VER-1.

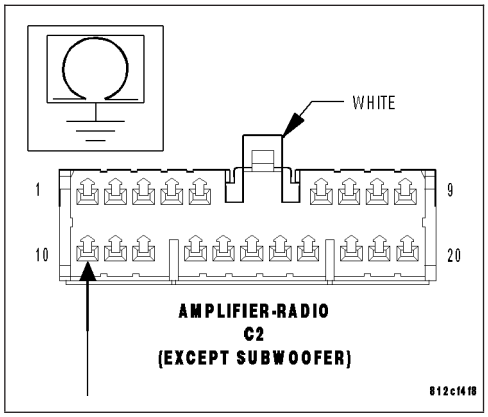
No >> Go To 3



B1461-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

3. CHECK THE (X299) AMPLIFIED LEFT FRONT I/P SPEAKER (-) CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (X299) Amplified Left Front I/P Speaker (-) circuit.



Is the resistance below 10K ohms?

Yes >> Repair the (X299) Amplified Left Front I/P Speaker (-) for a short to ground.
Perform BODY VERIFICATION TEST VER-1.

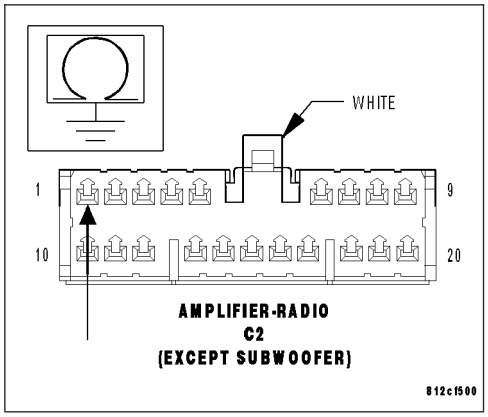
No >> Go To 4

4. CHECK OPERATION OF THE AMPLIFIED LEFT FRONT I/P SPEAKER

Turn the ignition off.

Reconnect and reinstall the Left Front I/P Speaker.

Measure the resistance of the speaker circuit between the Amplifier C2 harness connector and ground.

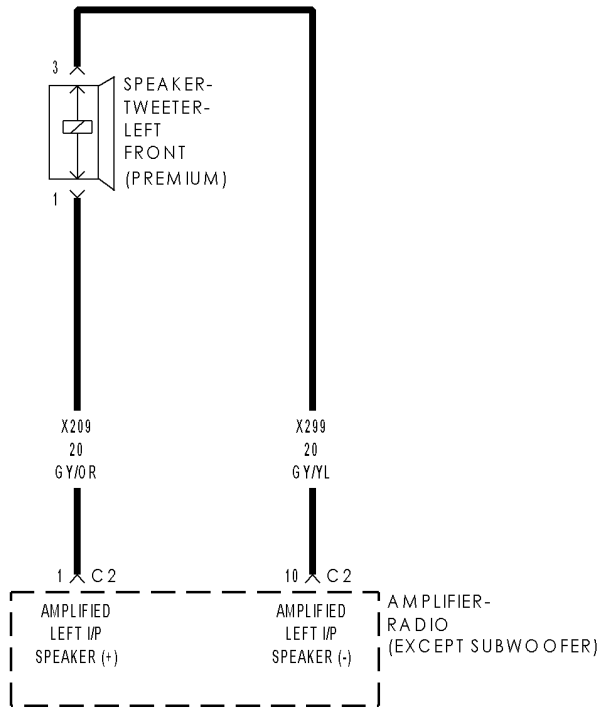


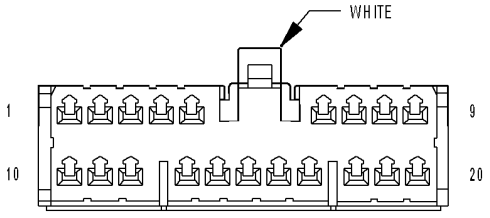
Is the resistance below 10K ohms?

Yes >> Replace the Left Front I/P Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

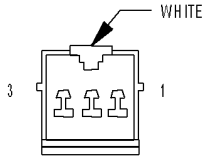
No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

B1462-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT HIGH





AMPLIFIER-RADIO
C2
(EXCEPT SUBWOOFER)



SPEAKER-TWEETER
LEFT FRONT
(PREMIUM)

812ceff7

B1462-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Amplifier detects a short to battery condition on the output circuit.

Possible Causes
(X209) AMPLIFIED LEFT I/P SPEAKER (+) CIRCUIT SHORT TO VOLTAGE
(X299) AMPLIFIED LEFT I/P SPEAKER (-) CIRCUIT SHORT TO VOLTAGE
AMPLIFIER

Diagnostic Test

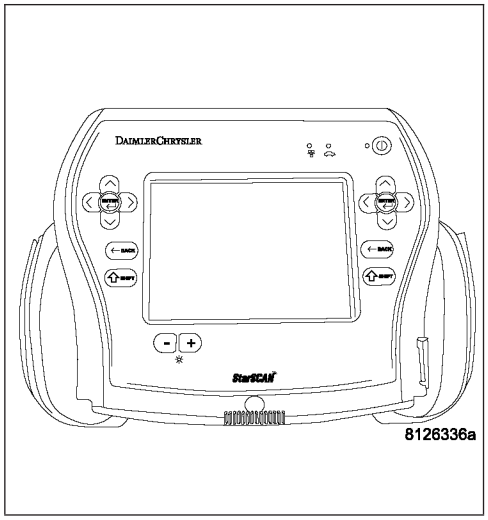
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1462-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



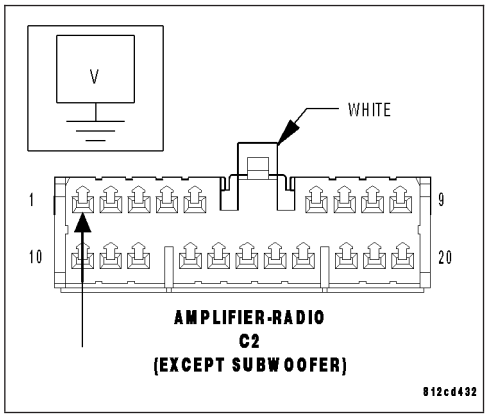
2. CHECK FOR VOLTAGE ON THE (X209) AMPLIFIED LEFT I/P SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Amplifier C2 harness connector.
Disconnect the Amplified Left I/P Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X209) Amplified Left I/P Speaker (+) circuit.

Is the voltage above 10.0 volts?

Yes >> Repair the (X209) Amplified Left I/P Speaker (+) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

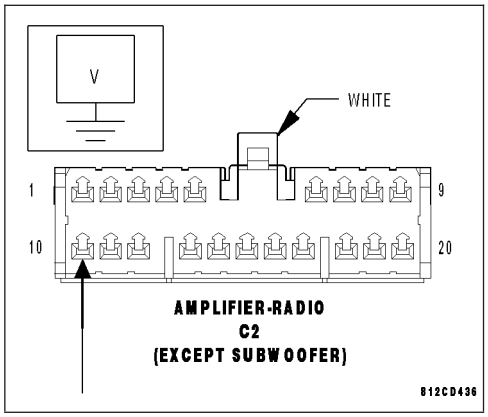
No >> Go To 3



B1462-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

3. CHECK FOR VOLTAGE ON THE (X299) AMPLIFIED LEFT I/P SPEAKER (-) CIRCUIT

Measure for voltage on the (X299) Amplified Left I/P Speaker (-) circuit.

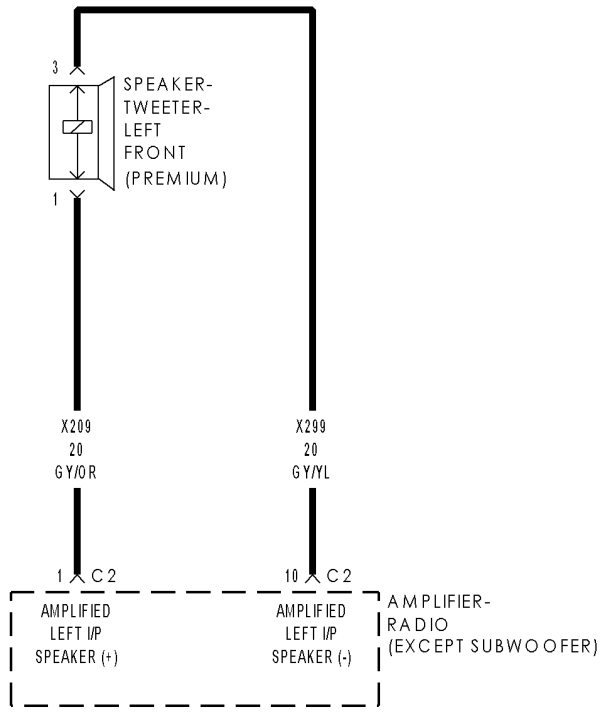


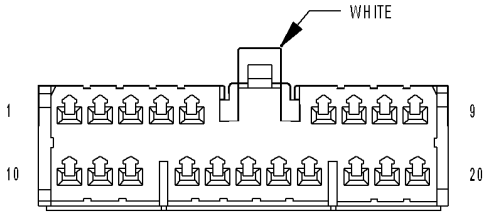
Is the voltage above 10.0 volts?

Yes >> Repair the (X299) Amplified Left I/P Speaker (-) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

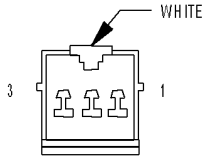
No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

B1463-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT OPEN





AMPLIFIER-RADIO
C2
(EXCEPT SUBWOOFER)



SPEAKER-TWEETER
LEFT FRONT
(PREMIUM)

812ceff7

B1463-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Amplifier Bus wake-up. Amplifier reset with scan tool.
- **Set Condition:**
  The Amplifier detects an open condition on the speaker output circuit.

Possible Causes
(X209) AMPLIFIED LEFT I/P SPEAKER (+) CIRCUIT OPEN
(X299) AMPLIFIED LEFT I/P SPEAKER (-) CIRCUIT OPEN
LEFT FRONT I/P SPEAKER
AMPLIFIER

Diagnostic Test

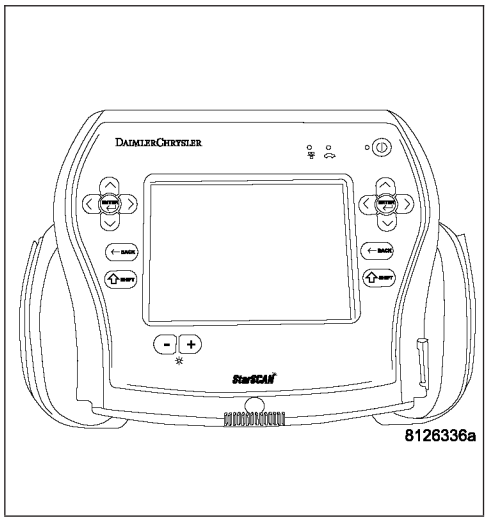
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on.
Turn the radio on.
With the scan tool, erase Amplifier DTCs.
With the scan tool, reset the amplifier.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1463-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



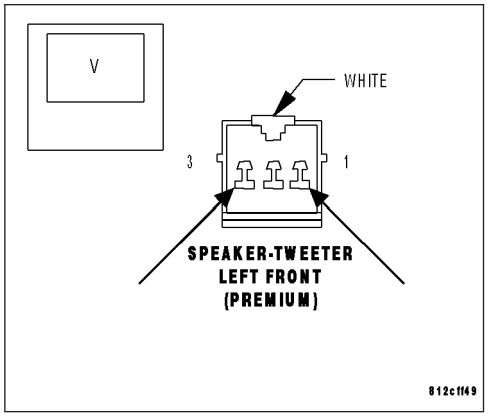
2. CHECK THE OPERATION OF THE LEFT FRONT I/P SPEAKER

Disconnect the Left I/P Speaker harness connector.
Turn the radio on and turn the volume to mid level.
With a voltmeter set to read in A/C voltage, measure the voltage of the Amplified Left I/P Speaker circuits in the Amplified Left I/P Speaker harness connector.

Is the voltage present greater than 1 volt?

Yes >> Replace the Amplified Left I/P Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3



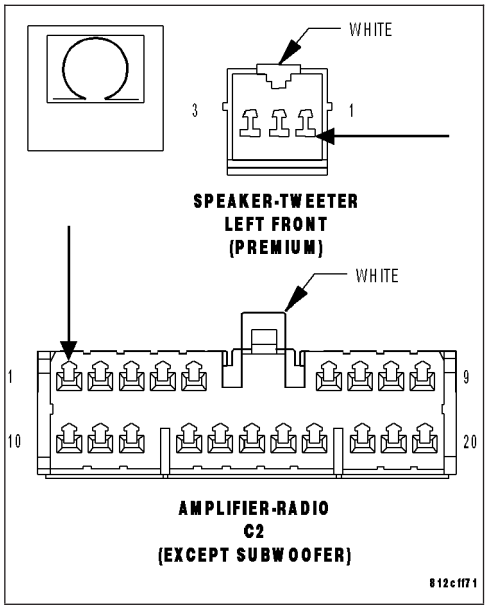
B1463-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

3. CHECK THE (X209) AMPLIFIED LEFT I/P SPEAKER (+) CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the Amplifier C2 harness connector.

Measure the resistance of the (X209) Amplified Left I/P Speaker (+) circuit between the Amplifier C2 harness connector and the Amplified Left I/P Speaker harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 4

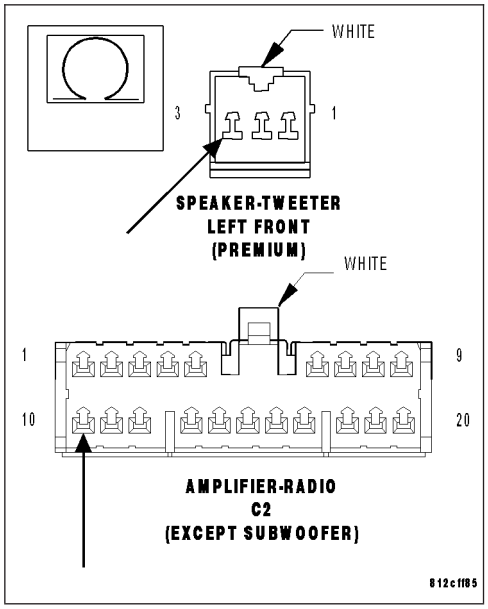
No >> Repair the (X209) Amplified Left I/P Speaker (+) circuit for an open.
Perform BODY VERIFICATION TEST VER-1.

4. CHECK THE (X299) AMPLIFIED LEFT I/P SPEAKER (-) CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the Amplifier C2 harness connector.

Measure the resistance of the (X299) Amplified Left I/P Speaker (-) circuit between the Amplifier C2 harness connector and the Amplified Left I/P Speaker harness connector.

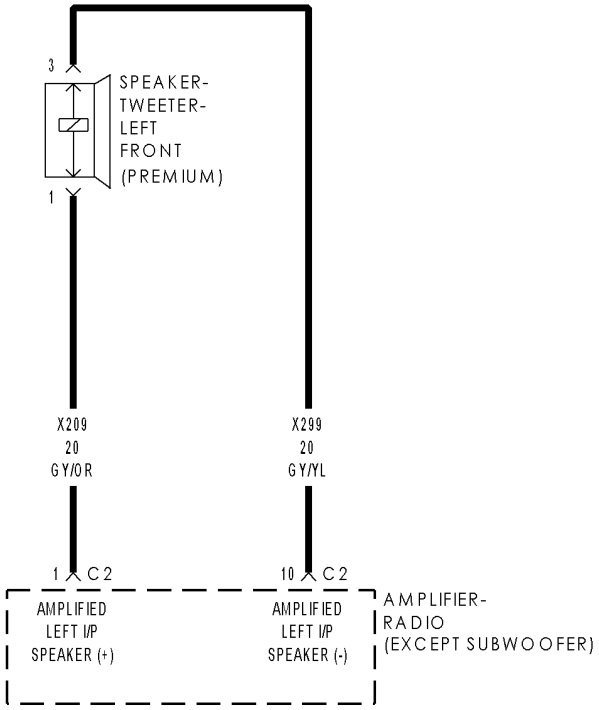


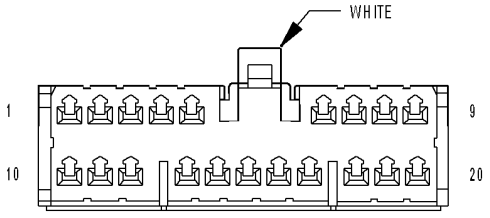
Is the resistance below 5.0 ohms?

Yes >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

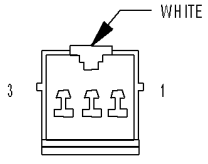
No >> Repair the (X299) Amplified Left I/P Speaker (-) circuit for an open.
Perform BODY VERIFICATION TEST VER-1.

B1464-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER





AMPLIFIER-RADIO
C2
(EXCEPT SUBWOOFER)



SPEAKER-TWEETER
LEFT FRONT
(PREMIUM)

812ceff7

B1464-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

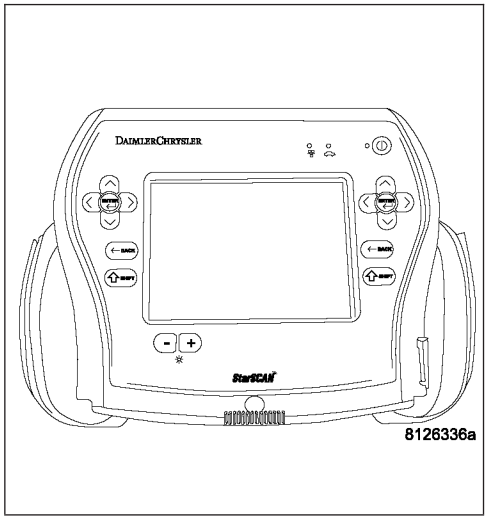
- **When Monitored:**
  With the ignition on. Radio volume at 25 or higher.
- **Set Condition:**
  The amplifier detects that the output circuits are shorted together.

Possible Causes
(X209) AMPLIFIED LEFT I/P SPEAKER (+) CIRCUIT SHORTED TO THE (X299) AMPLIFIED LEFT I/P SPEAKER (-) CIRCUIT
AMPLIFIED LEFT I/P SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, erase Amplifier DTCs.
Turn the radio on.
Turn the volume level to 25.
With the scan tool, read Amplifier DTCs.



Does the scan tool display active: B1464-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

---

2. CHECK THE OPERATION OF THE AMPLIFIED LEFT I/P SPEAKER

Disconnect the Amplified Left I/P Speaker.
Measure the resistance of the speaker between the two terminals.

Is the resistance of the speaker less than 1 ohm?

Yes >> Replace the Amplified Left I/P Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3

B1464-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER (CONTINUED)

3. CHECK THE (X209) AMPLIFIED LEFT I/P SPEAKER (+) CIRCUIT, AND THE (X299) AMPLIFIED LEFT I/P SPEAKER (-) CIRCUITS FOR A SHORT TOGETHER

Turn the ignition off.

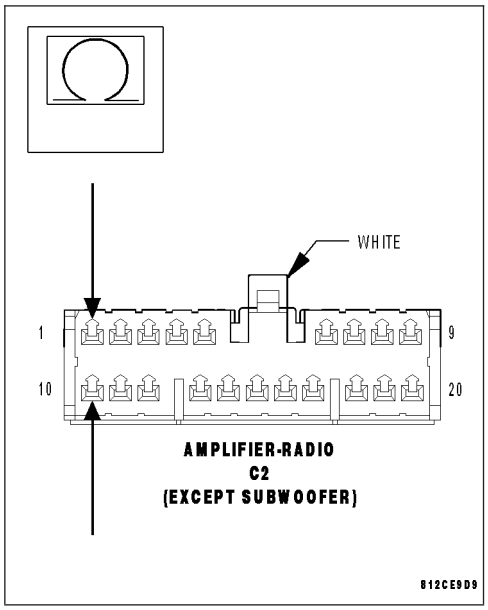
Disconnect the Amplifier C2 harness connector.

Measure the resistance between the (X209) Amplified Left I/P Speaker (+) circuit, and the (X299) Amplified Left I/P Speaker (-) circuit.

Is the resistance below 10K ohms?

Yes >> Repair the (X209) Amplified Left I/P Speaker (+) circuit, and the (X299) Amplified Left I/P Speaker (-) circuit for a short together.
Perform BODY VERIFICATION TEST VER-1.

No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.



B1465-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  This DTC will set if a DC offset occurs on the output channel, the amplifier shall set a DTC after a maturity rate of 5 ±1 sec.

Possible Causes
AMPLIFIER

Diagnostic Test

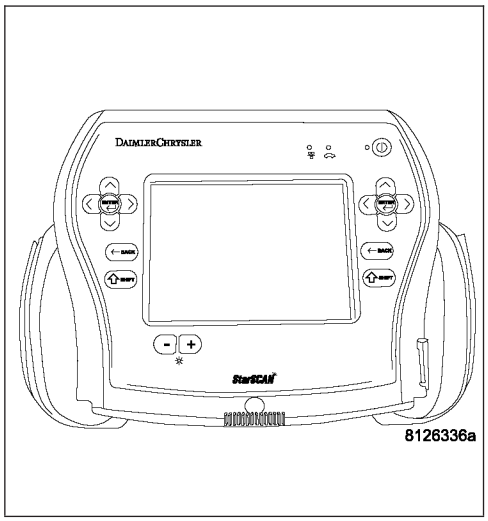
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

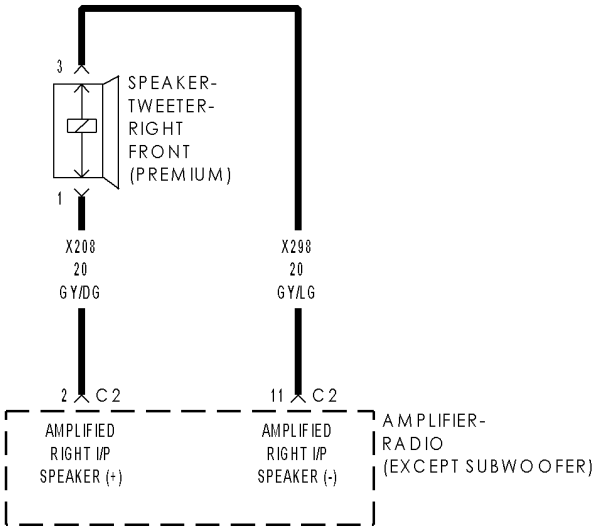
Does the scan tool display active: B1465-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE?

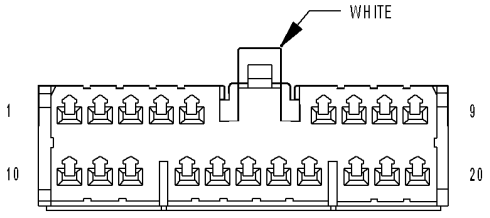
Yes >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

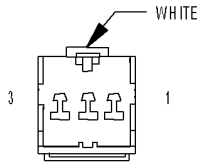


B1466-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT LOW





AMPLIFIER-RADIO
C2
(EXCEPT SUBWOOFER)



SPEAKER-TWEETER-
RIGHT FRONT
(PREMIUM)

812ceffb

B1466-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Amplifier detects a shorted to ground condition on the speaker output circuit.

Possible Causes
(X208) AMPLIFIED RIGHT FRONT I/P SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X298) AMPLIFIED RIGHT FRONT I/P SPEAKER (-) CIRCUIT SHORTED TO GROUND
RIGHT FRONT I/P SPEAKER
AMPLIFIER

Diagnostic Test

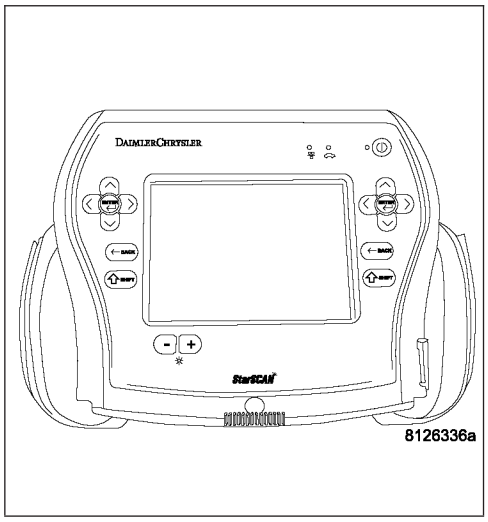
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1466-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



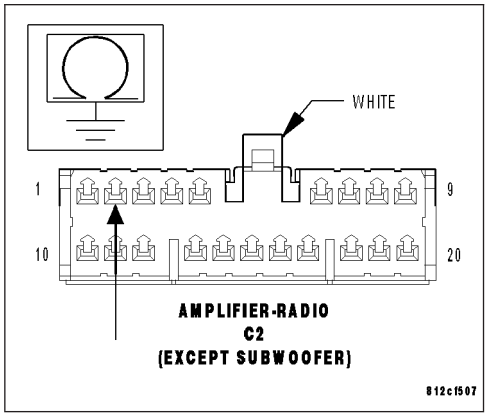
2. CHECK THE (X208) AMPLIFIED RIGHT FRONT I/P SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND

Disconnect the Amplifier C2 harness connector.
Measure the resistance between ground and the (X208) Amplified Right Front I/P Speaker (+) circuit.

Is the resistance below 10K ohms?

Yes >> Repair the (X208) Amplified Right Front I/P Speaker (+) circuit for a short to ground.
Perform BODY VERIFICATION TEST VER-1.

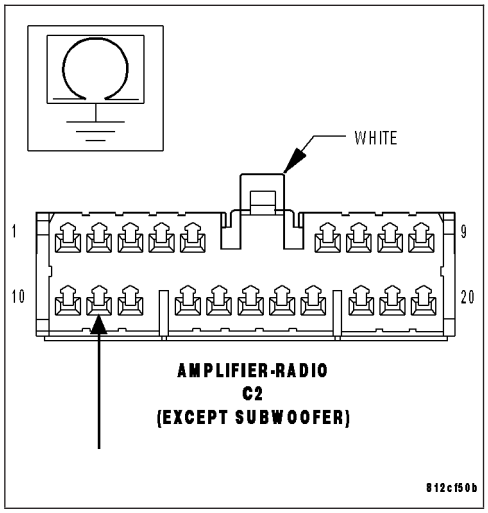
No >> Go To 3



B1466-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

3. CHECK THE (X298) AMPLIFIED RIGHT FRONT I/P SPEAKER (-) CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (X298) Amplified Right Front I/P Speaker (-) circuit.



Is the resistance below 10K ohms?

Yes >> Repair the (X298) Amplified Right Front I/P Speaker (-) for a short to ground.
Perform BODY VERIFICATION TEST VER-1.

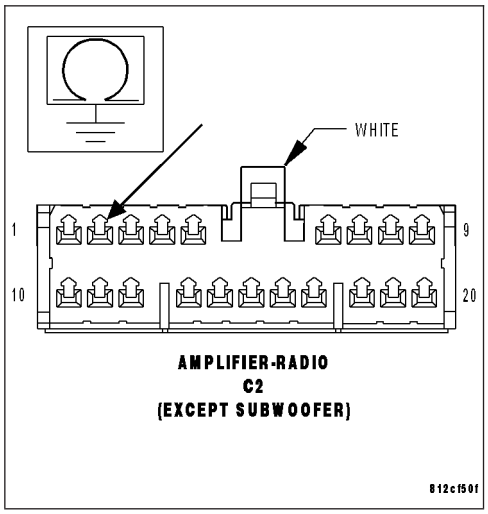
No >> Go To 4

4. CHECK OPERATION OF THE AMPLIFIED RIGHT FRONT I/P SPEAKER

Turn the ignition off.

Reconnect and reinstall the Right Front I/P Speaker.

Measure the resistance of the speaker circuit between the Amplifier C2 harness connector and ground..

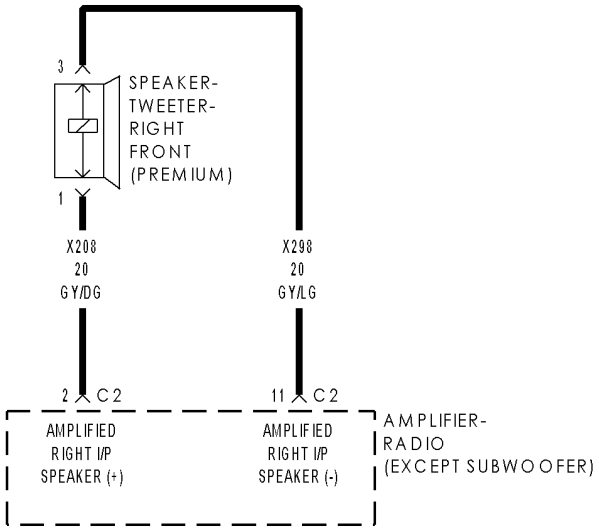


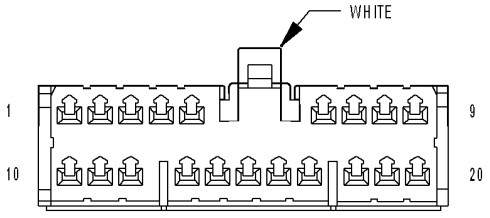
Is the resistance below 10K ohms?

Yes >> Replace the Right Front I/P Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

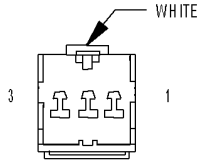
No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

B1467-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT HIGH





AMPLIFIER-RADIO
C2
(EXCEPT SUBWOOFER)



SPEAKER-TWEETER-
RIGHT FRONT
(PREMIUM)

812ceffb

B1467-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Amplifier detects a short to battery condition on the output circuit.

Possible Causes
(X208) AMPLIFIED RIGHT I/P SPEAKER (+) CIRCUIT SHORT TO VOLTAGE
(X298) AMPLIFIED RIGHT I/P SPEAKER (-) CIRCUIT SHORT TO VOLTAGE
AMPLIFIER

Diagnostic Test

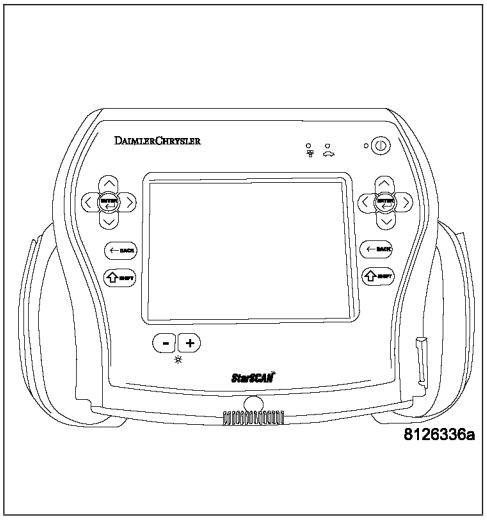
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1467-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



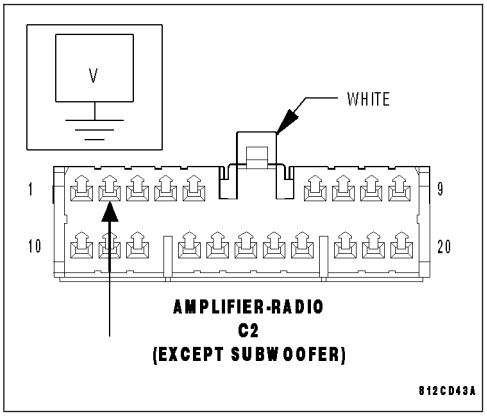
2. CHECK FOR VOLTAGE ON THE (X208) AMPLIFIED RIGHT I/P SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Amplifier C2 harness connector.
Disconnect the Amplified Right I/P Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X208) Amplified Right I/P Speaker (+) circuit.

Is the voltage above 10.0 volts?

Yes >> Repair the (X208) Amplified Right I/P Speaker (+) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

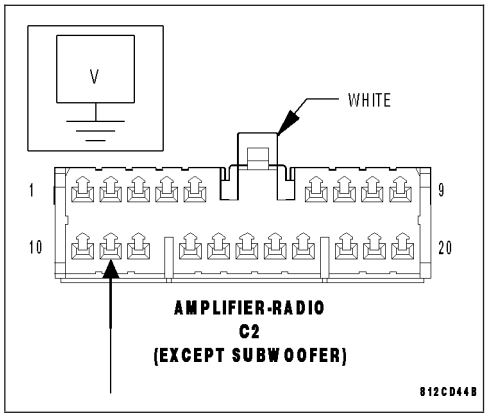
No >> Go To 3



B1467-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

3. CHECK FOR VOLTAGE ON THE (X298) AMPLIFIED RIGHT I/P SPEAKER (-) CIRCUIT

Measure for voltage on the (X298) Amplified Right I/P Speaker (-) circuit.

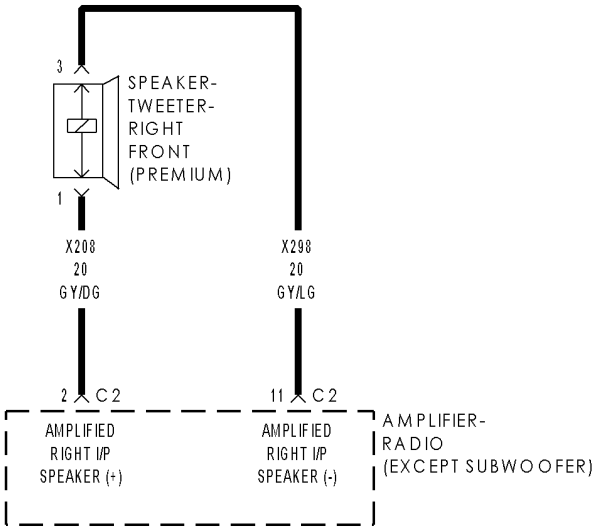


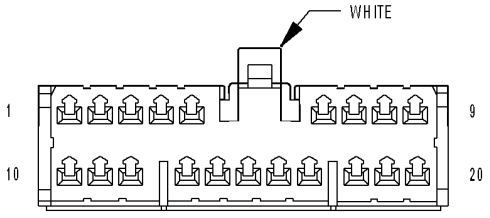
Is the voltage above 10.0 volts?

Yes >> Repair the (X298) Amplified Right I/P Speaker (-) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

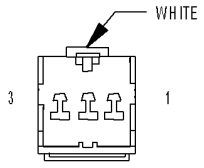
No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

B1468-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT OPEN





AMPLIFIER-RADIO
C2
(EXCEPT SUBWOOFER)



SPEAKER-TWEETER-
RIGHT FRONT
(PREMIUM)

812ceffb

B1468-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Amplifier Bus wake-up. Amplifier reset with scan tool.
- **Set Condition:**
  The Amplifier detects an open condition on the speaker output circuit.

Possible Causes
(X208) AMPLIFIED RIGHT I/P SPEAKER (+) CIRCUIT OPEN
(X298) AMPLIFIED RIGHT I/P SPEAKER (-) CIRCUIT OPEN
RIGHT I/P SPEAKER
AMPLIFIER

Diagnostic Test

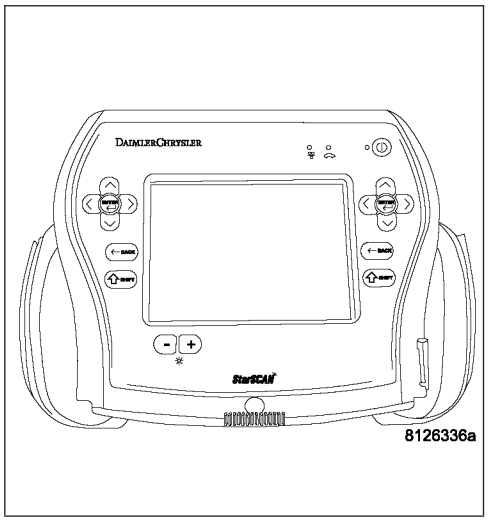
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on.
Turn the radio on.
With the scan tool, erase Amplifier DTCs.
With the scan tool, reset the amplifier.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1468-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



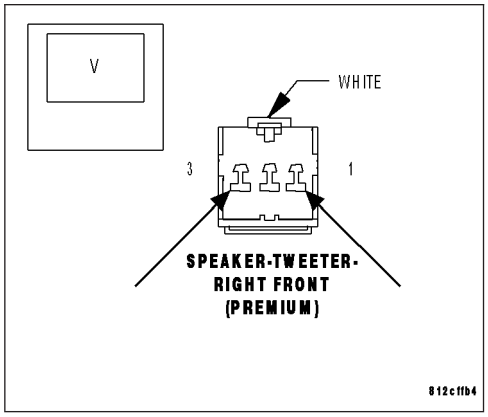
2. CHECK THE OPERATION OF THE RIGHT FRONT I/P SPEAKER

Disconnect the Right I/P Speaker harness connector.
Turn the radio on and turn the volume to mid level.
With a voltmeter set to read in A/C voltage, measure the voltage of the Amplified Right I/P Speaker circuits in the Amplified Right I/P Speaker harness connector.

Is the voltage present greater than 1 volt?

Yes >> Replace the Amplified Right I/P Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3



B1468-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

3. CHECK THE (X208) AMPLIFIED RIGHT I/P SPEAKER (+) CIRCUIT FOR AN OPEN

Turn the ignition off.

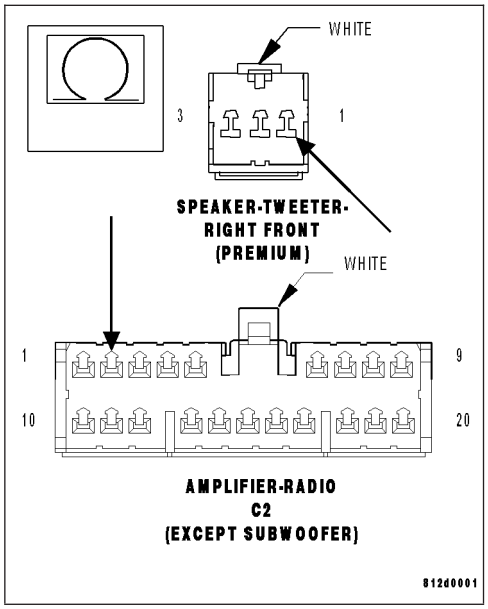
Disconnect the Amplifier C2 harness connector.

Measure the resistance of the (X208) Amplified Right I/P Speaker (+) circuit between the Amplifier C2 harness connector and the Amplified Right I/P Speaker harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the (X208) Amplified Right I/P Speaker (+) circuit for an open.
Perform BODY VERIFICATION TEST VER-1.



4. CHECK THE (X298) AMPLIFIED RIGHT I/P SPEAKER (-) CIRCUIT FOR AN OPEN

Turn the ignition off.

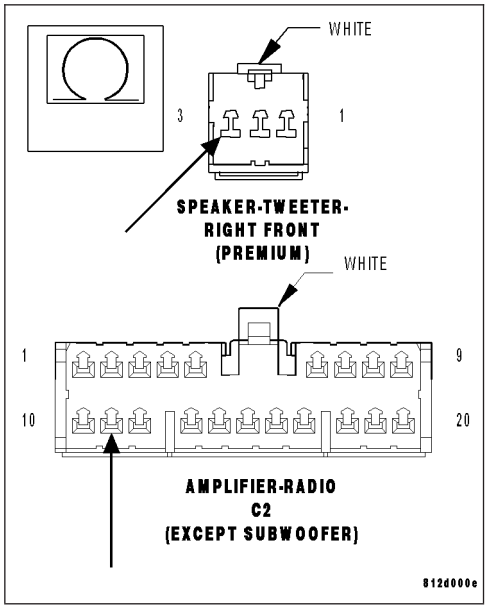
Disconnect the Amplifier C2 harness connector.

Measure the resistance of the (X298) Amplified Right I/P Speaker (-) circuit between the Amplifier C2 harness connector and the Amplified Right I/P Speaker harness connector.

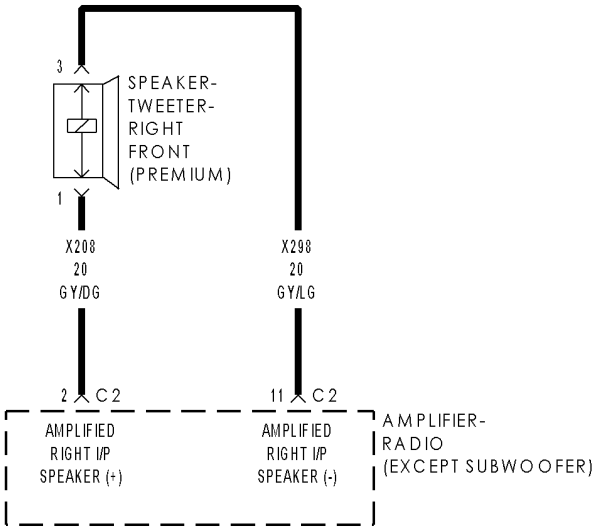
Is the resistance below 5.0 ohms?

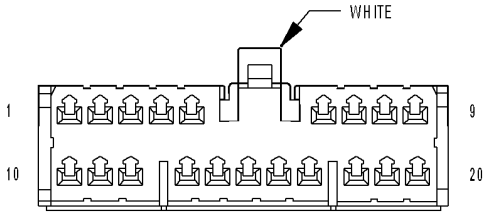
Yes >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Repair the (X298) Amplified Right I/P Speaker (-) circuit for an open.
Perform BODY VERIFICATION TEST VER-1.

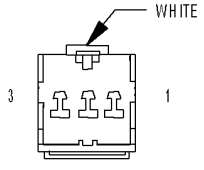


B1469-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER





AMPLIFIER-RADIO
C2
(EXCEPT SUBWOOFER)



SPEAKER-TWEETER-
RIGHT FRONT
(PREMIUM)

812ceffb

B1469-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

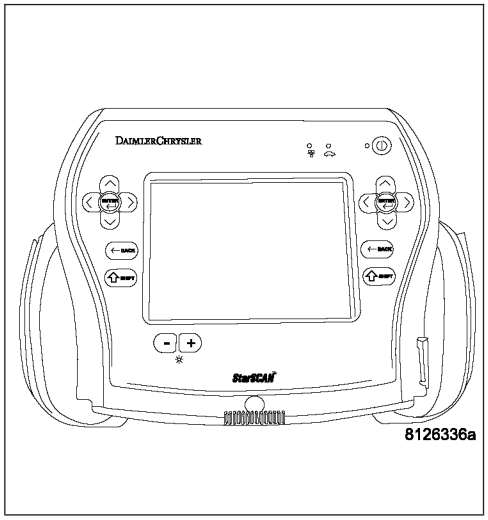
- **When Monitored:**
  With the ignition on. Radio volume at 25 or higher.
- **Set Condition:**
  The amplifier detects that the output circuits are shorted together.

Possible Causes
(X208) AMPLIFIED RIGHT I/P SPEAKER (+) CIRCUIT SHORTED TO THE (X298) AMPLIFIED RIGHT I/P SPEAKER (-) CIRCUIT
AMPLIFIED RIGHT I/P SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, erase Amplifier DTCs.
Turn the radio on.
Turn the volume level to 25.
With the scan tool, read Amplifier DTCs.



Does the scan tool display active: B1469-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

---

2. CHECK THE OPERATION OF THE AMPLIFIED RIGHT I/P SPEAKER

Disconnect the Amplified Right I/P Speaker.
Measure the resistance of the speaker between the two terminals.

Is the resistance of the speaker less than 1 ohm?

Yes >> Replace the Amplified Right I/P Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3

B1469-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER (CONTINUED)

3. CHECK THE (X208) AMPLIFIED RIGHT I/P SPEAKER (+) CIRCUIT, AND THE (X298) AMPLIFIED RIGHT I/P SPEAKER (-) CIRCUITS FOR A SHORT TOGETHER

Turn the ignition off.

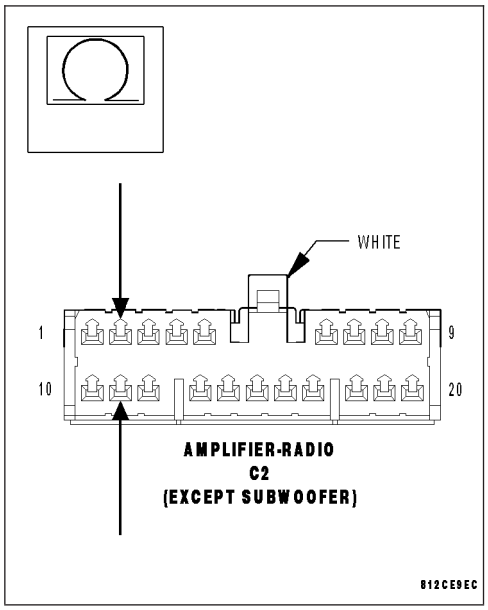
Disconnect the Amplifier C2 harness connector.

Measure the resistance between the (X208) Amplified Right I/P Speaker (+) circuit, and the (X298) Amplified Right I/P Speaker (-) circuit.

Is the resistance below 10K ohms?

Yes >> Repair the (X208) Amplified Right I/P Speaker (+) circuit, and the (X298) Amplified Right I/P Speaker (-) circuit for a short together.
Perform BODY VERIFICATION TEST VER-1.

No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.



B146A-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  This DTC will set if a DC offset occurs on the output channel, the amplifier shall set a DTC after a maturity rate of 5 ±1 sec.

Possible Causes
AMPLIFIER

Diagnostic Test

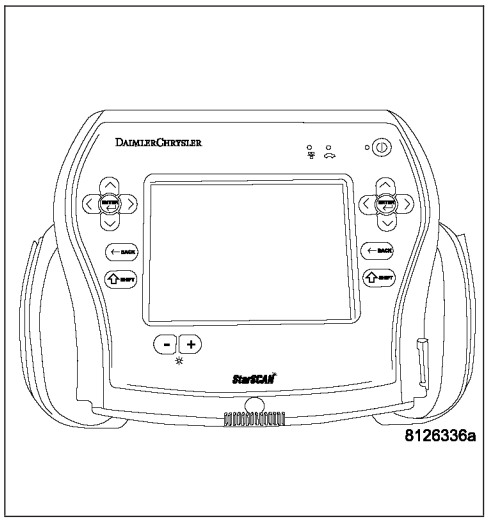
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

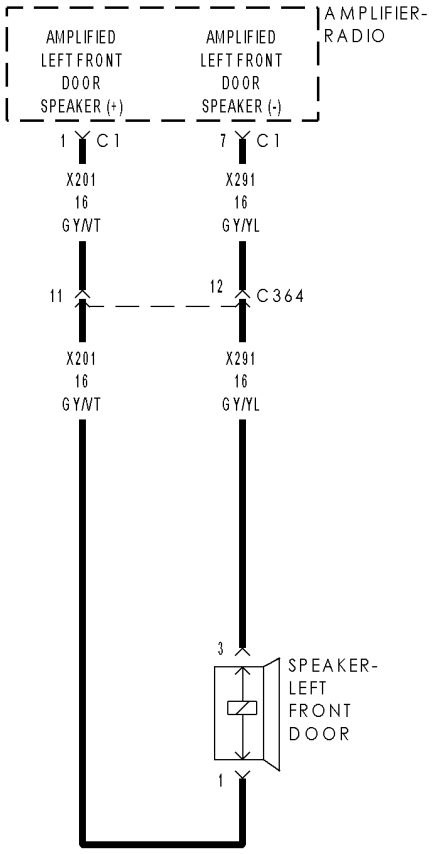
Does the scan tool display active: B146A-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE?

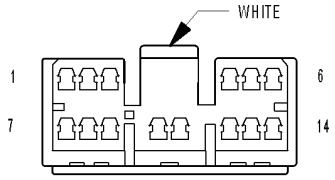
Yes >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

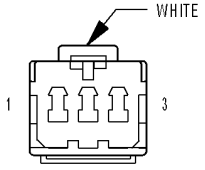


B146B-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT LOW





AMPLIFIER-
RADIO C1



SPEAKER-LEFT
FRONT DOOR

812cf020

B146B-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Amplifier detects a shorted to ground condition on the speaker output circuit.

Possible Causes
(X201) AMPLIFIED LEFT FRONT DOOR SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X291) AMPLIFIED LEFT FRONT DOOR SPEAKER (-) CIRCUIT SHORTED TO GROUND
LEFT FRONT DOOR SPEAKER
AMPLIFIER

Diagnostic Test

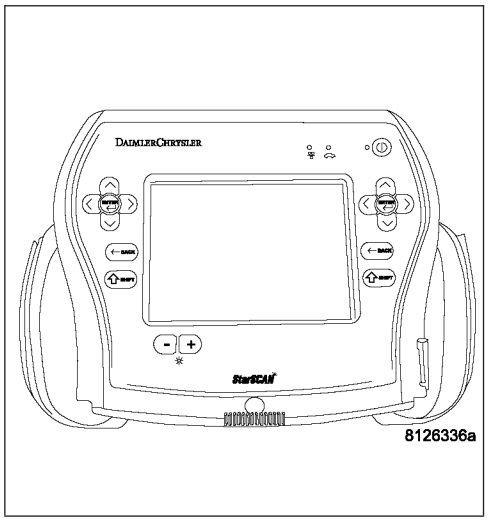
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B146B-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



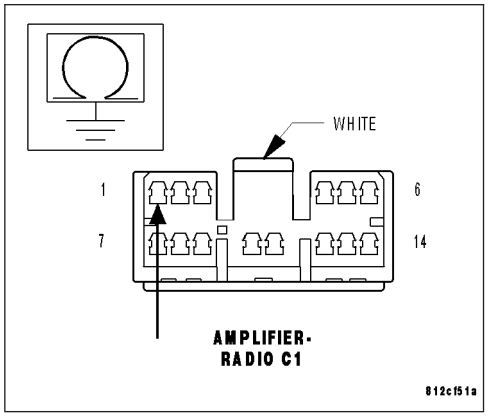
2. CHECK THE (X201) AMPLIFIED LEFT FRONT DOOR SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND

Disconnect the Amplifier C1 harness connector.
Measure the resistance between ground and the (X201) Amplified Left Front Door Speaker (+) circuit.

Is the resistance below 10K ohms?

Yes >> Repair the (X201) Amplified Left Front Door Speaker (+) circuit for a short to ground.
Perform BODY VERIFICATION TEST VER-1.

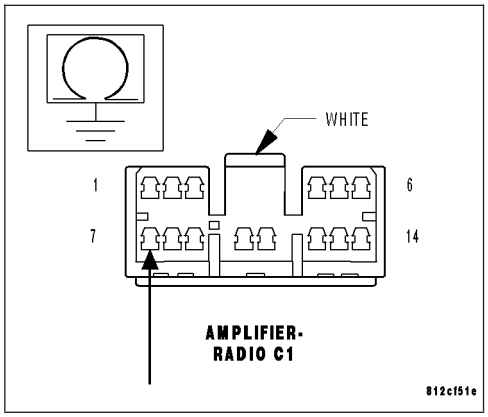
No >> Go To 3



B146B-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

3. CHECK THE (X291) AMPLIFIED LEFT FRONT DOOR SPEAKER (-) CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (X291) Amplified Left Front Door Speaker (-) circuit.



Is the resistance below 10K ohms?

Yes >> Repair the (X291) Amplified Left Front Door Speaker (-) for a short to ground.
Perform BODY VERIFICATION TEST VER-1.

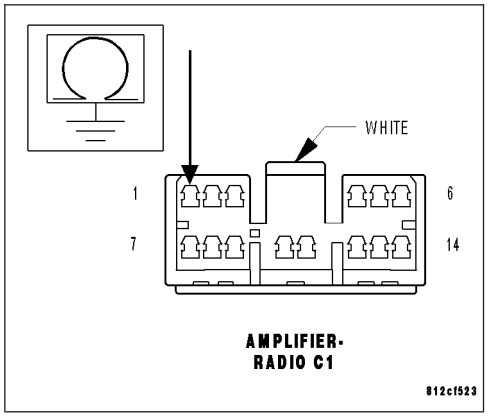
No >> Go To 4

4. CHECK OPERATION OF THE AMPLIFIED LEFT FRONT DOOR SPEAKER

Turn the ignition off.

Reconnect and reinstall the Left Front Door Speaker.

Measure the resistance of the speaker circuit between the Amplifier C1 harness connector and ground..

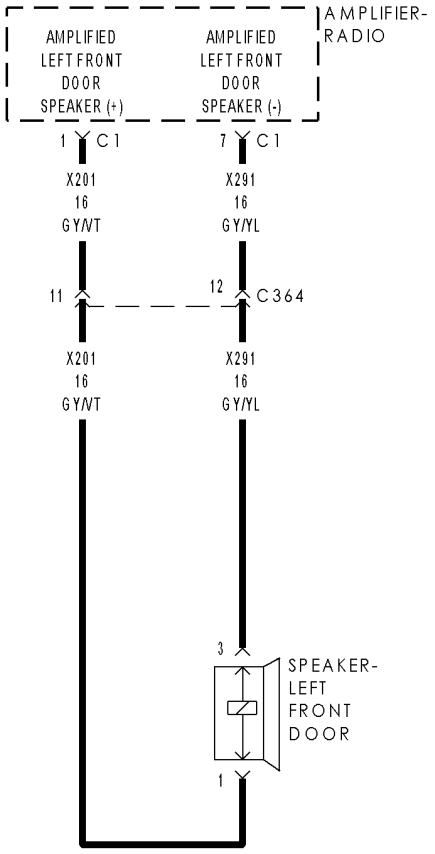


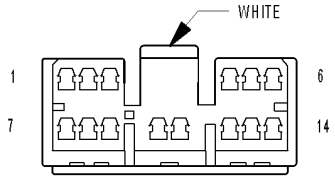
Is the resistance below 10K ohms?

Yes >> Replace the Left Front Door Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

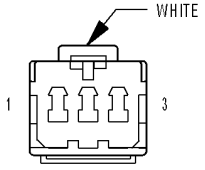
No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

B146C-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT HIGH





AMPLIFIER-
RADIO C1



SPEAKER-LEFT
FRONT DOOR

812cf020

B146C-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Amplifier detects a short to battery condition on the output circuit.

Possible Causes
(X201) AMPLIFIED LEFT FRONT DOOR SPEAKER (+) CIRCUIT SHORT TO VOLTAGE
(X291) AMPLIFIED LEFT FRONT DOOR SPEAKER (-) CIRCUIT SHORT TO VOLTAGE
AMPLIFIER

Diagnostic Test

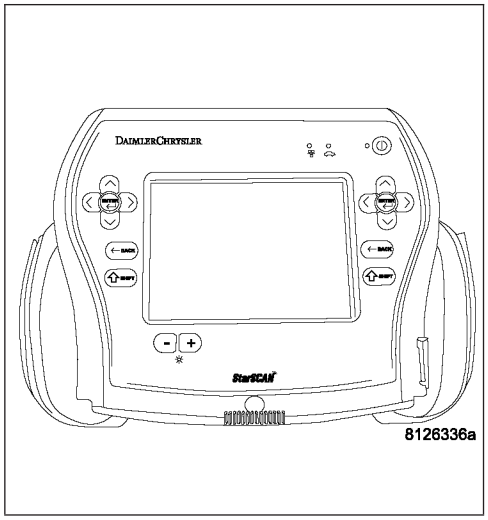
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B146C-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



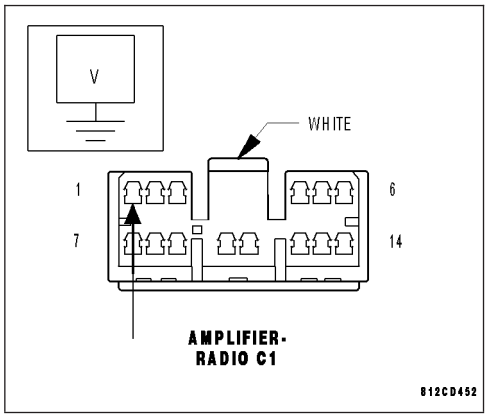
2. CHECK FOR VOLTAGE ON THE (X201) AMPLIFIED LEFT FRONT DOOR SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Amplifier C1 harness connector.
Disconnect the Amplified Left Front Door Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X201) Amplified Left Front Door Speaker (+) circuit.

Is the voltage above 10.0 volts?

Yes >> Repair the (X201) Amplified Left Front Door Speaker (+) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

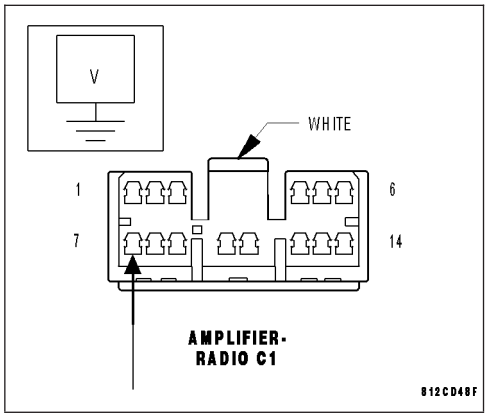
No >> Go To 3



B146C-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

3. CHECK FOR VOLTAGE ON THE (X291) AMPLIFIED LEFT FRONT DOOR SPEAKER (-) CIRCUIT

Measure for voltage on the (X291) Amplified Left Front Door Speaker (-) circuit.

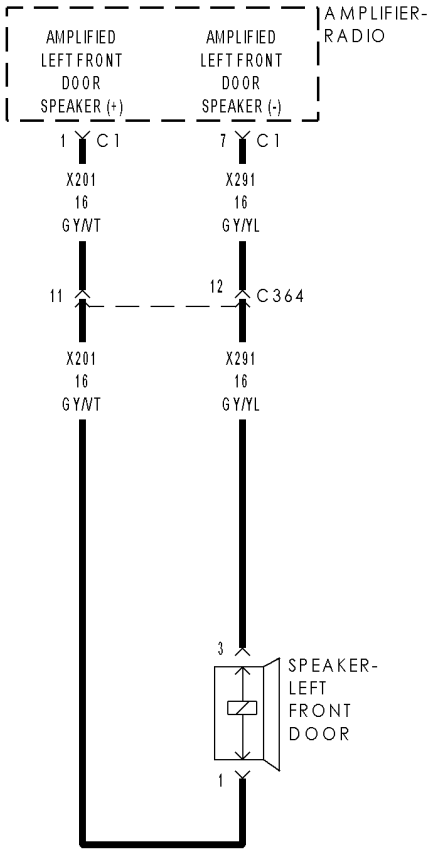


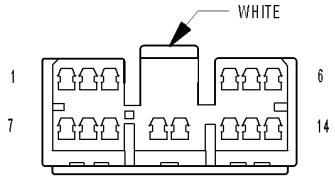
Is the voltage above 10.0 volts?

Yes >> Repair the (X291) Amplified Left Front Door Speaker (-) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

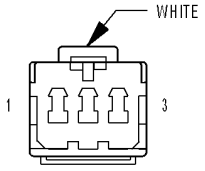
No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

B146D-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT OPEN





AMPLIFIER-
RADIO C1



SPEAKER-LEFT
FRONT DOOR

812cf020

B146D-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Amplifier Bus wake-up. Amplifier reset with scan tool.
- **Set Condition:**
  The Amplifier detects an open condition on the speaker output circuit.

Possible Causes
(X201) AMPLIFIED LEFT REAR DOOR SPEAKER (+) CIRCUIT OPEN
(X291) AMPLIFIED LEFT REAR DOOR SPEAKER (-) CIRCUIT OPEN
LEFT REAR DOOR SPEAKER
AMPLIFIER

Diagnostic Test

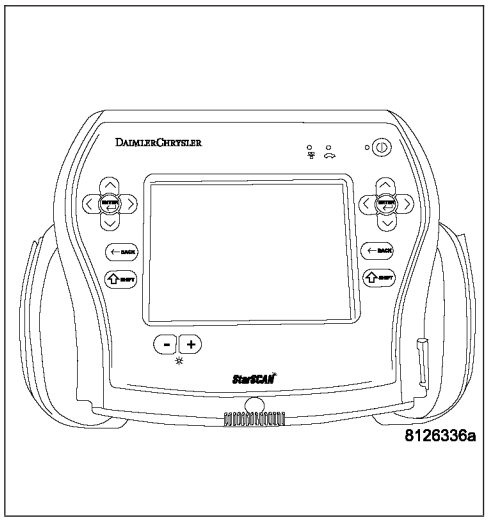
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on.
Turn the radio on.
With the scan tool, erase Amplifier DTCs.
With the scan tool, reset the amplifier.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B146D-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



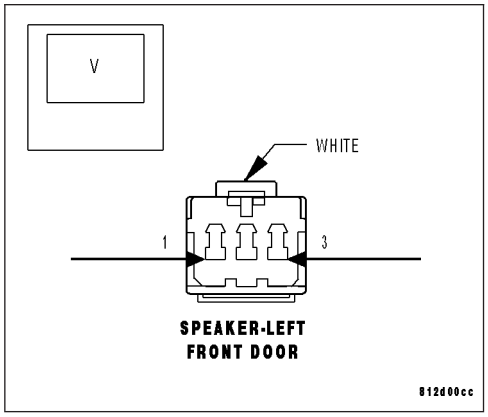
2. CHECK THE OPERATION OF THE LEFT REAR DOOR SPEAKER

Disconnect the Left Rear Door Speaker harness connector.
Turn the radio on and turn the volume to mid level.
With a voltmeter set to read in A/C voltage, measure the voltage of the Amplified Left Rear Door Speaker circuits in the Amplified Left Rear Door Speaker harness connector.

Is the voltage present greater than 1 volt?

Yes >> Replace the Amplified Left Rear Door Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3



B146D-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

3. CHECK THE (X201) AMPLIFIED LEFT REAR DOOR SPEAKER (+) CIRCUIT FOR AN OPEN

Turn the ignition off.

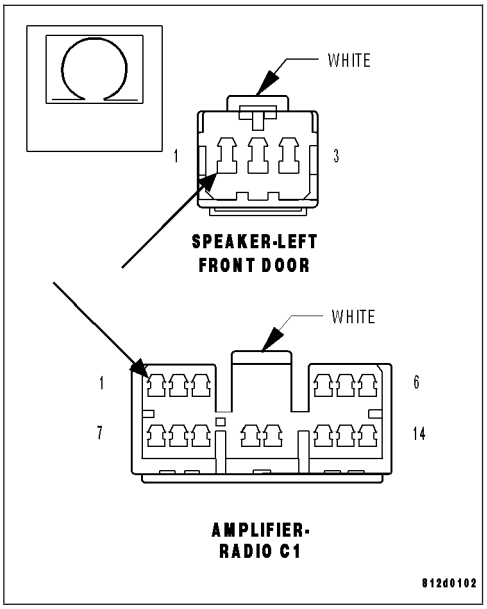
Disconnect the Amplifier C1 harness connector.

Measure the resistance of the (X201) Amplified Left Rear Door Speaker (+) circuit between the Amplifier C1 harness connector and the Amplified Left Rear Door Speaker harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the (X201) Amplified Left Rear Door Speaker (+) circuit for an open.
Perform BODY VERIFICATION TEST VER-1.



4. CHECK THE (X291) AMPLIFIED LEFT REAR DOOR SPEAKER (-) CIRCUIT FOR AN OPEN

Turn the ignition off.

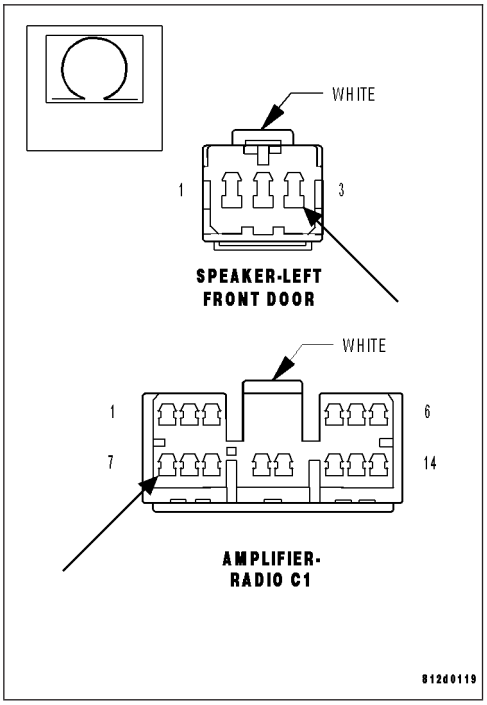
Disconnect the Amplifier C1 harness connector.

Measure the resistance of the (X291) Amplified Left Rear Door Speaker (-) circuit between the Amplifier C1 harness connector and the Amplified Left Rear Door Speaker harness connector.

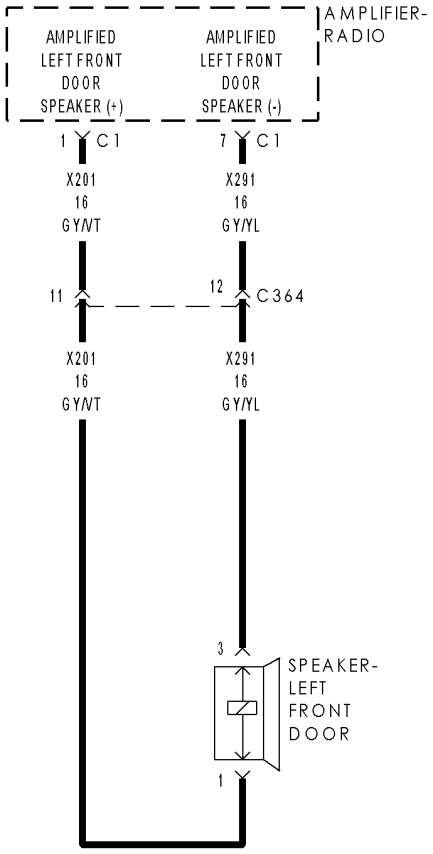
Is the resistance below 5.0 ohms?

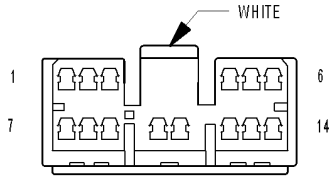
Yes >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Repair the (X291) Amplified Left Rear Door Speaker (-) circuit for an open.
Perform BODY VERIFICATION TEST VER-1.

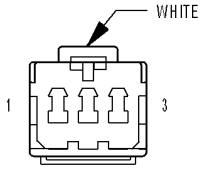


B146E-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER





AMPLIFIER-
RADIO C1



SPEAKER-LEFT
FRONT DOOR

812cf020

B146E-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

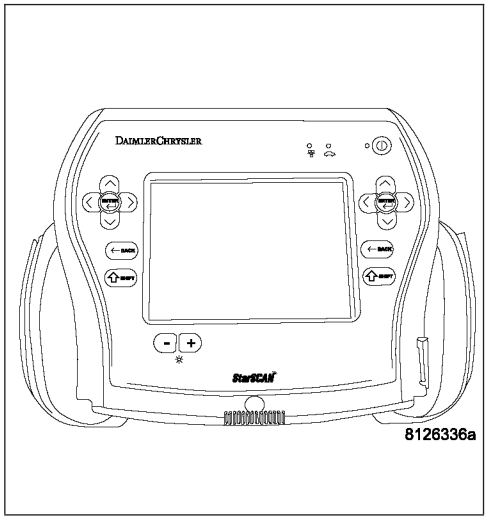
- **When Monitored:**
  With the ignition on. Radio volume at 25 or higher.
- **Set Condition:**
  The amplifier detects that the output circuits are shorted together.

Possible Causes
(X201) AMPLIFIED LEFT FRONT DOOR SPEAKER (+) CIRCUIT SHORTED TO THE (X291) AMPLIFIED LEFT FRONT DOOR SPEAKER (-) CIRCUIT
AMPLIFIED LEFT FRONT DOOR SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, erase Amplifier DTCs.
Turn the radio on.
Turn the volume level to 25.
With the scan tool, read Amplifier DTCs.



Does the scan tool display active: B146E-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

---

2. CHECK THE OPERATION OF THE AMPLIFIED LEFT FRONT DOOR SPEAKER

Disconnect the Amplified Left Front Door Speaker.
Measure the resistance of the speaker between the two terminals.

Is the resistance of the speaker less than 1 ohm?

Yes >> Replace the Amplified Left Front Door Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3

B146E-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER (CONTINUED)

3. CHECK THE (X201) AMPLIFIED LEFT FRONT DOOR SPEAKER (+) CIRCUIT, AND THE (X291) AMPLIFIED LEFT FRONT DOOR SPEAKER (-) CIRCUITS FOR A SHORT TOGETHER

Turn the ignition off.

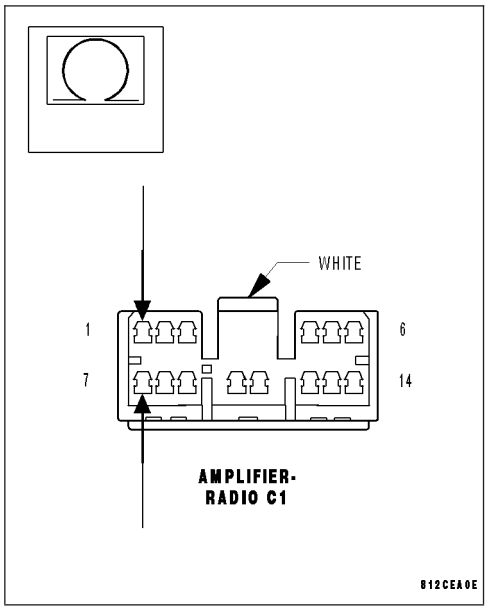
Disconnect the Amplifier C1 harness connector.

Measure the resistance between the (X201) Amplified Left Front Door Speaker (+) circuit, and the (X291) Amplified Left Front Door Speaker (-) circuit.

Is the resistance below 10K ohms?

Yes >> Repair the (X201) Amplified Left Front Door Speaker (+) circuit, and the (X291) Amplified Left Front Door Speaker (-) circuit for a short together.
Perform BODY VERIFICATION TEST VER-1.

No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.



B146F-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  This DTC will set if a DC offset occurs on the output channel, the amplifier shall set a DTC after a maturity rate of 5 ±1 sec.

Possible Causes
AMPLIFIER

Diagnostic Test

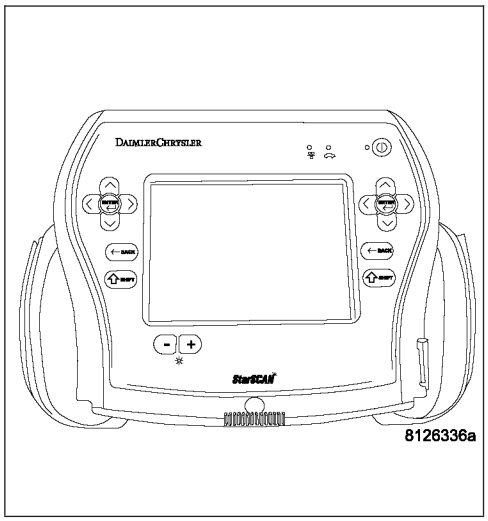
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

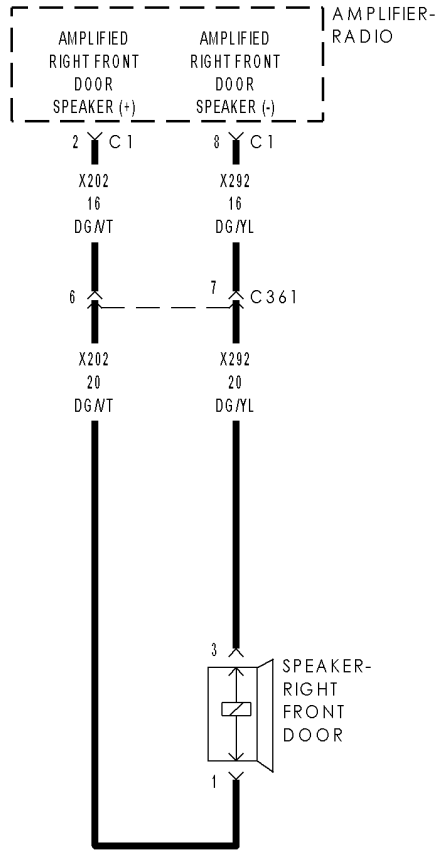
Does the scan tool display active: B146F-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE?

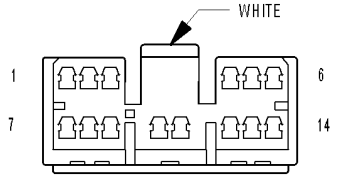
Yes >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

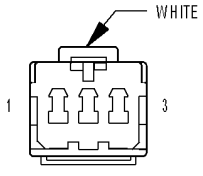


B1470-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT LOW





AMPLIFIER-
RADIO C1



SPEAKER-RIGHT
FRONT DOOR

812cf024

B1470-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Amplifier detects a shorted to ground condition on the speaker output circuit.

Possible Causes
(X202) AMPLIFIED RIGHT FRONT DOOR SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X292) AMPLIFIED RIGHT FRONT DOOR SPEAKER (-) CIRCUIT SHORTED TO GROUND
RIGHT FRONT DOOR SPEAKER
AMPLIFIER

Diagnostic Test

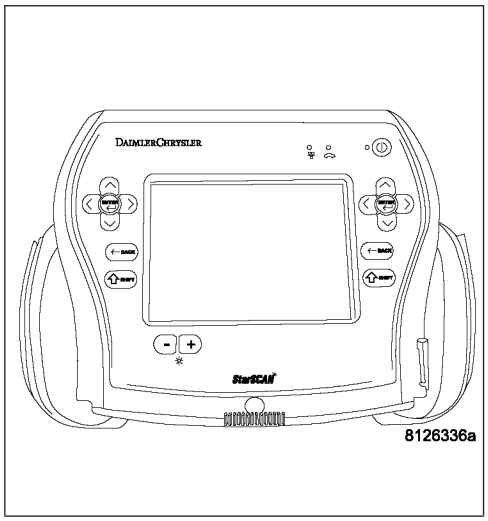
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1470-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



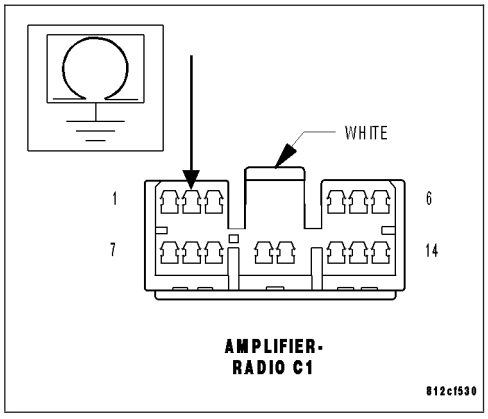
2. CHECK THE (X202) AMPLIFIED RIGHT FRONT DOOR SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND

Disconnect the Amplifier C1 harness connector.
Measure the resistance between ground and the (X202) Amplified Right Front Door Speaker (+) circuit.

Is the resistance below 10K ohms?

Yes >> Repair the (X202) Amplified Left Front Door Speaker (+) circuit for a short to ground.
Perform BODY VERIFICATION TEST VER-1.

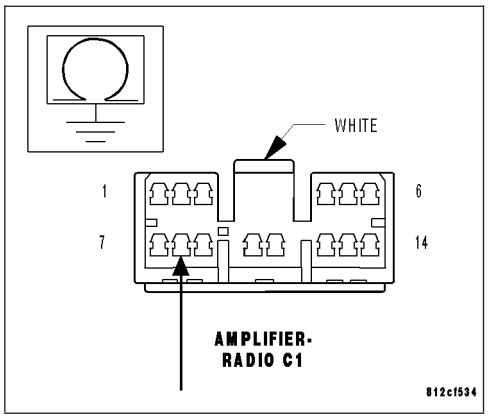
No >> Go To 3



B1470-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

3. CHECK THE (X292) AMPLIFIED RIGHT FRONT DOOR SPEAKER (-) CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (X292) Amplified Right Front Door Speaker (-) circuit.



Is the resistance below 10K ohms?

Yes >> Repair the (X292) Amplified Right Front Door Speaker (-) for a short to ground.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 4

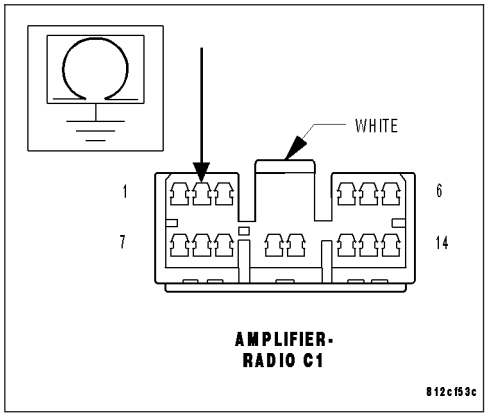
---

4. CHECK OPERATION OF THE AMPLIFIED RIGHT FRONT DOOR SPEAKER

Turn the ignition off.

Reconnect and reinstall the Right Front Door Speaker.

Measure the resistance of the speaker circuit between the Amplifier C1 harness connector and ground..

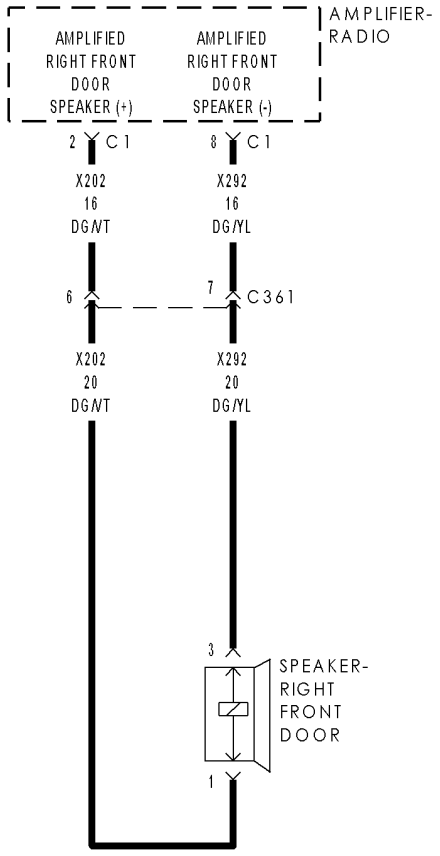


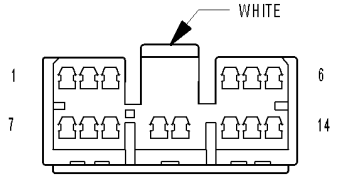
Is the resistance below 10K ohms?

Yes >> Replace the Right Front Door Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

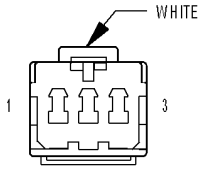
No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

B1471-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT HIGH





AMPLIFIER-
RADIO C1



SPEAKER-RIGHT
FRONT DOOR

812cf024

B1471-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Amplifier detects a short to battery condition on the output circuit.

Possible Causes
(X202) AMPLIFIED RIGHT FRONT DOOR SPEAKER (+) CIRCUIT SHORT TO VOLTAGE
(X292) AMPLIFIED RIGHT FRONT DOOR SPEAKER (-) CIRCUIT SHORT TO VOLTAGE
AMPLIFIER

Diagnostic Test

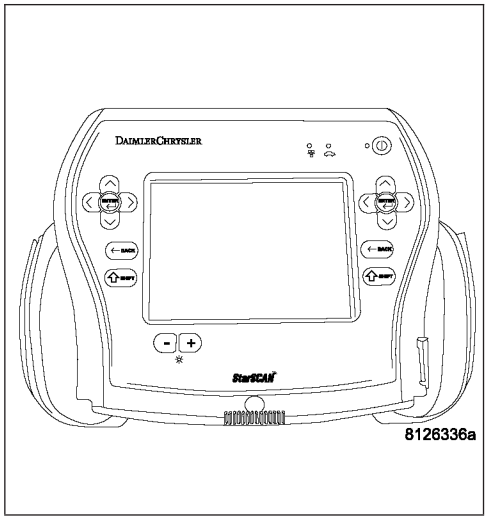
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1471-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



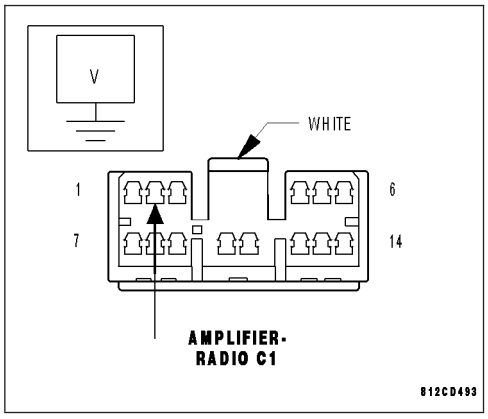
2. CHECK FOR VOLTAGE ON THE (X202) AMPLIFIED RIGHT FRONT DOOR SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Amplifier C1 harness connector.
Disconnect the Amplified Right Front Door Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X202) Amplified Right Front Door Speaker (+) circuit.

Is the voltage above 10.0 volts?

Yes >> Repair the (X202) Amplified Right Front Door Speaker (+) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

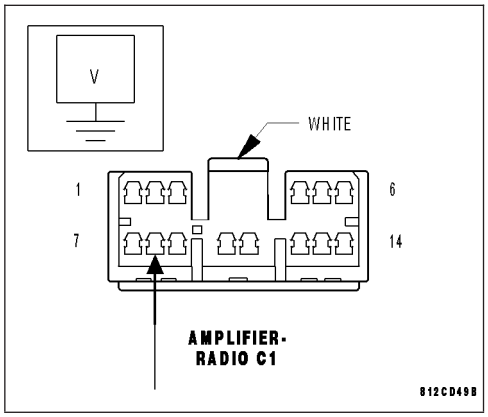
No >> Go To 3



B1471-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

3. CHECK FOR VOLTAGE ON THE (X292) AMPLIFIED RIGHT FRONT DOOR SPEAKER (-) CIRCUIT

Measure for voltage on the (X292) Amplified Right Front Door Speaker (-) circuit.

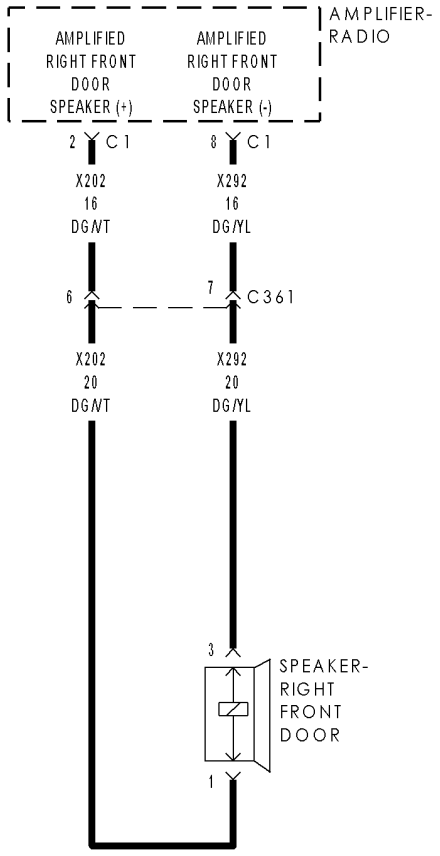


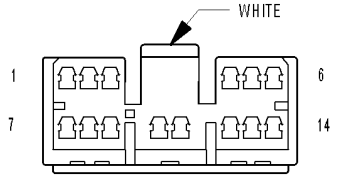
Is the voltage above 10.0 volts?

Yes >> Repair the (X292) Amplified Right Front Door Speaker (-) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

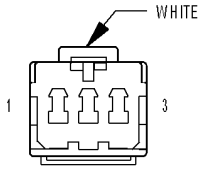
No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

B1472-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT OPEN





AMPLIFIER-
RADIO C1



SPEAKER-RIGHT
FRONT DOOR

812cf024

B1472-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

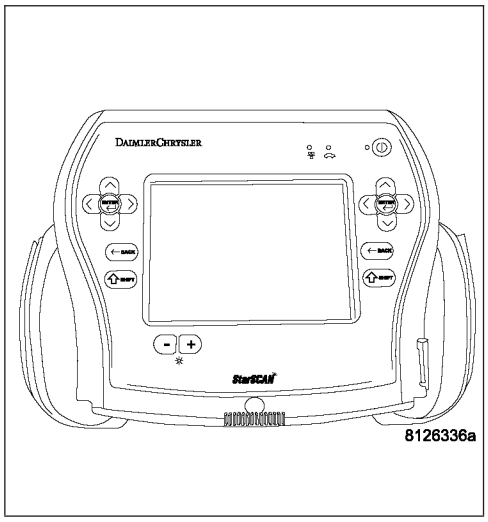
- **When Monitored:**
  Amplifier Bus wake-up. Amplifier reset with scan tool.
- **Set Condition:**
  The Amplifier detects an open condition on the speaker output circuit.

Possible Causes
(X202) AMPLIFIED RIGHT FRONT DOOR SPEAKER (+) CIRCUIT OPEN
(X292) AMPLIFIED RIGHT FRONT DOOR SPEAKER (-) CIRCUIT OPEN
RIGHT FRONT DOOR SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on.
Turn the radio on.
With the scan tool, erase Amplifier DTCs.
With the scan tool, reset the amplifier.
With the scan tool, read Amplifier DTCs.



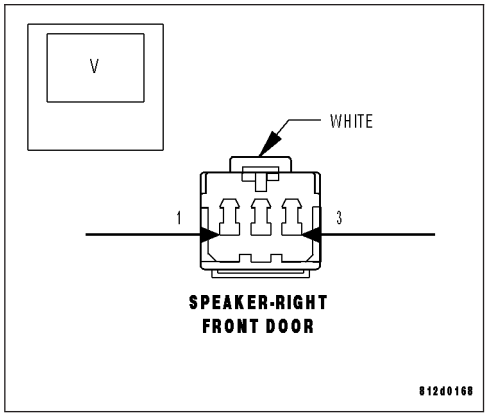
Does the scan tool display active: B1472-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

2. CHECK THE OPERATION OF THE RIGHT FRONT DOOR SPEAKER

Disconnect the Right Front Door Speaker harness connector.
Turn the radio on and turn the volume to mid level.
With a voltmeter set to read in A/C voltage, measure the voltage of the Amplified Right Front Door Speaker circuits in the Amplified Right Front Door Speaker harness connector.



Is the voltage present greater than 1 volt?

Yes >> Replace the Amplified Right Front Door Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3

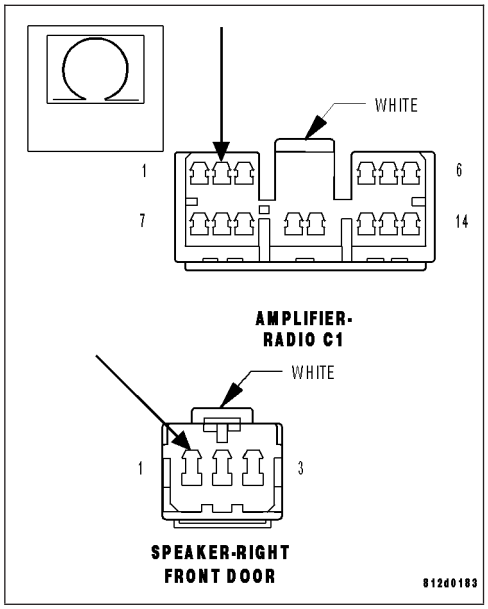
B1472-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

3. CHECK THE (X202) AMPLIFIED RIGHT FRONT DOOR SPEAKER (+) CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the Amplifier C1 harness connector.

Measure the resistance of the (X202) Amplified Right Front Door Speaker (+) circuit between the Amplifier C1 harness connector and the Amplified Right Front Door Speaker harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 4

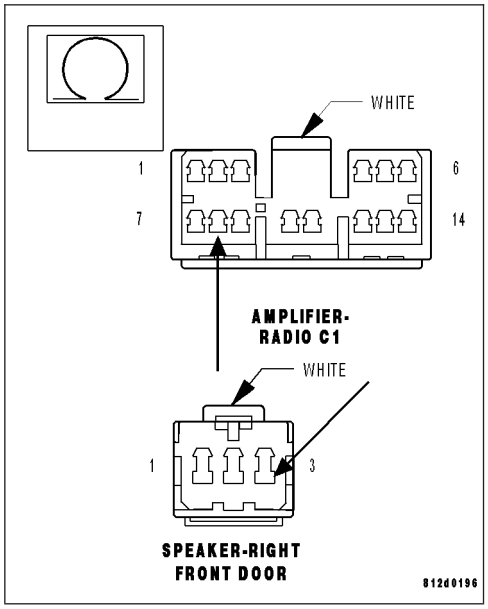
No >> Repair the (X202) Amplified Right Front Door Speaker (+) circuit for an open.
Perform BODY VERIFICATION TEST VER-1.

4. CHECK THE (X292) AMPLIFIED RIGHT FRONT DOOR SPEAKER (-) CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the Amplifier C1 harness connector.

Measure the resistance of the (X292) Amplified Right Front Door Speaker (-) circuit between the Amplifier C1 harness connector and the Amplified Right Front Door Speaker harness connector.

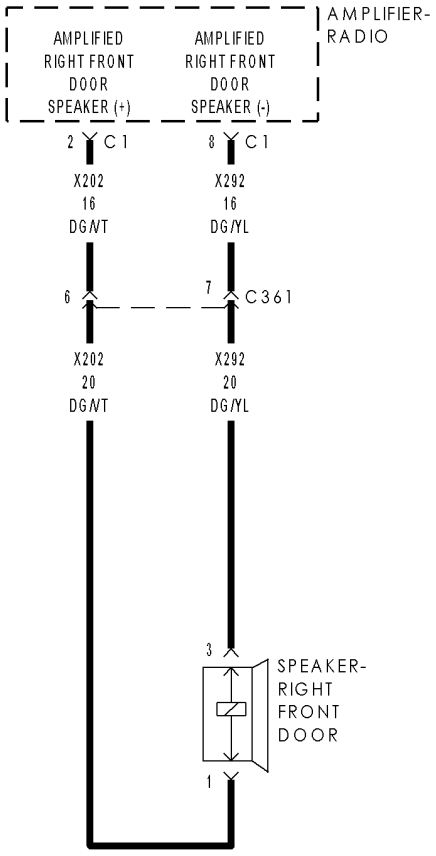


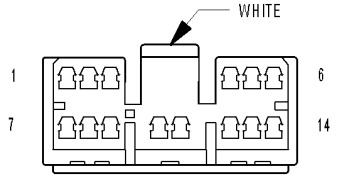
Is the resistance below 5.0 ohms?

Yes >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

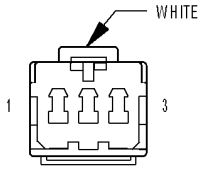
No >> Repair the (X292) Amplified Right Front Door Speaker (-) circuit for an open.
Perform BODY VERIFICATION TEST VER-1.

B1473-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER





AMPLIFIER-
RADIO C1



SPEAKER-RIGHT
FRONT DOOR

812cf024

B1473-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

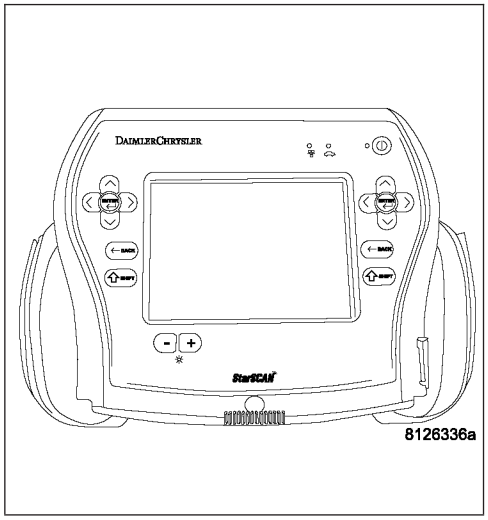
- **When Monitored:**
  With the ignition on. Radio volume at 25 or higher.
- **Set Condition:**
  The amplifier detects that the output circuits are shorted together.

Possible Causes
(X202) AMPLIFIED RIGHT FRONT DOOR SPEAKER (+) CIRCUIT SHORTED TO THE (X292) AMPLIFIED RIGHT FRONT DOOR SPEAKER (-) CIRCUIT
AMPLIFIED RIGHT FRONT DOOR SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, erase Amplifier DTCs.
Turn the radio on.
Turn the volume level to 25.
With the scan tool, read Amplifier DTCs.



Does the scan tool display active: B1473-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

---

2. CHECK THE OPERATION OF THE AMPLIFIED RIGHT FRONT DOOR SPEAKER

Disconnect the Amplified Right Front Door Speaker.
Measure the resistance of the speaker between the two terminals.

Is the resistance of the speaker less than 1 ohm?

Yes >> Replace the Amplified Right Front Door Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3

B1473-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER (CONTINUED)

3. CHECK THE (X202) AMPLIFIED RIGHT FRONT DOOR SPEAKER (+) CIRCUIT, AND THE (X292) AMPLIFIED RIGHT FRONT DOOR SPEAKER (-) CIRCUITS FOR A SHORT TOGETHER

Turn the ignition off.

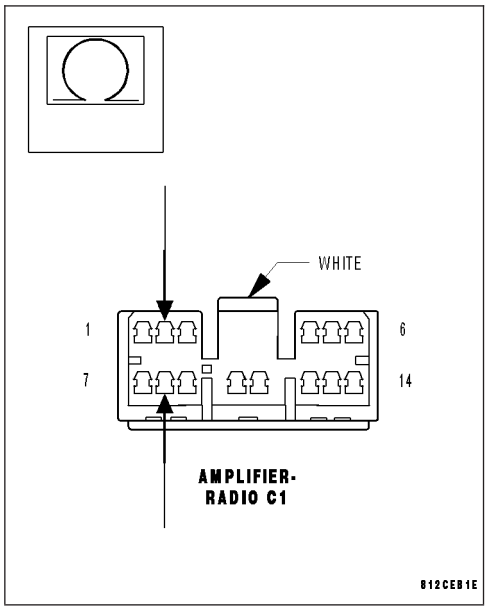
Disconnect the Amplifier C1 harness connector.

Measure the resistance between the (X202) Amplified Right Front Door Speaker (+) circuit, and the (X292) Amplified Right Front Door Speaker (-) circuit.

Is the resistance below 10K ohms?

Yes >> Repair the (X202) Amplified Right Front Door Speaker (+) circuit, and the (X292) Amplified Right Front Door Speaker (-) circuit for a short together.
Perform BODY VERIFICATION TEST VER-1.

No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.



B1474-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  This DTC will set if a DC offset occurs on the output channel, the amplifier shall set a DTC after a maturity rate of 5 ±1 sec.

Possible Causes
AMPLIFIER

Diagnostic Test

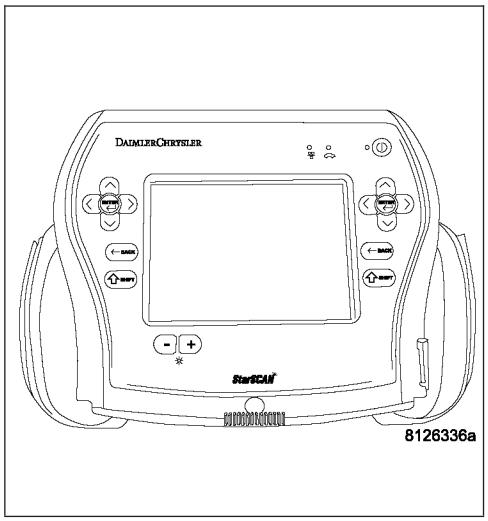
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

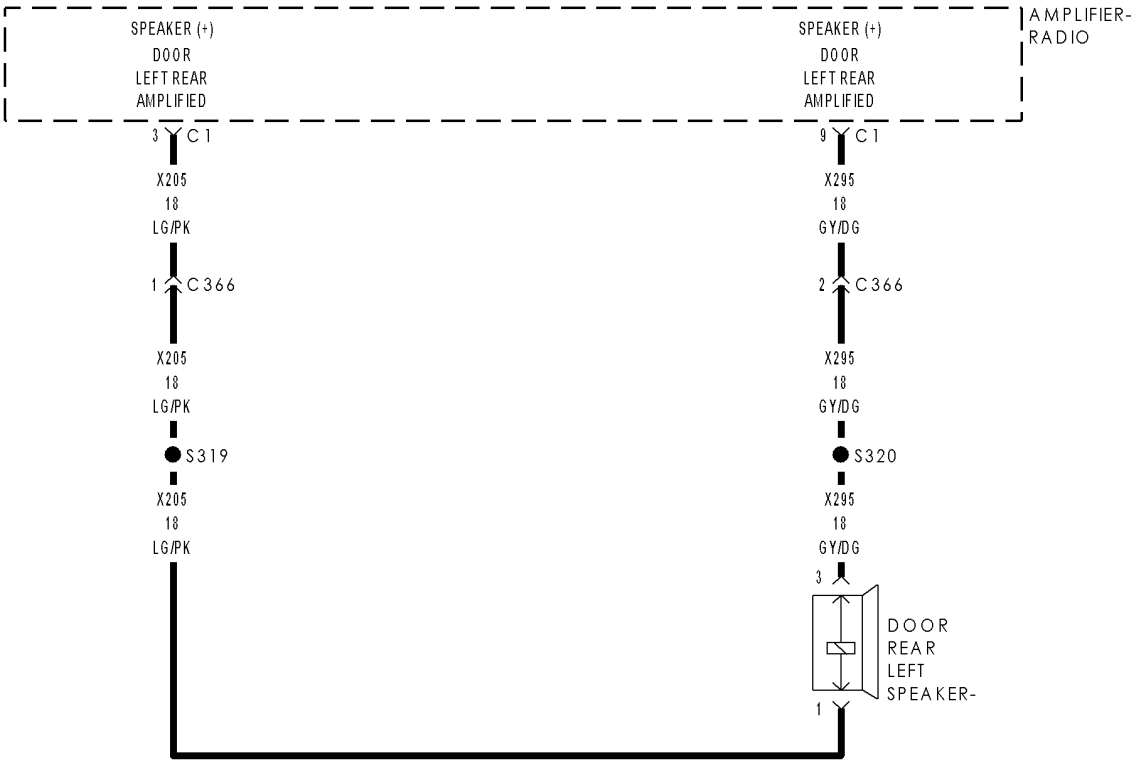
Does the scan tool display active: B1474-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE?

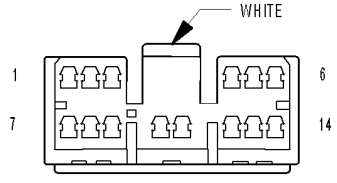
Yes >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

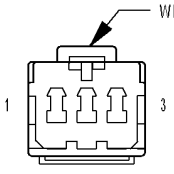


B1475-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT LOW





AMPLIFIER-
RADIO C1



SPEAKER-LEFT
REAR DOOR

812cf028

B1475-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Amplifier detects a shorted to ground condition on the speaker output circuit.

Possible Causes
(X205) AMPLIFIED LEFT REAR DOOR SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X295) AMPLIFIED LEFT REAR DOOR SPEAKER (-) CIRCUIT SHORTED TO GROUND
LEFT REAR DOOR SPEAKER
AMPLIFIER

Diagnostic Test

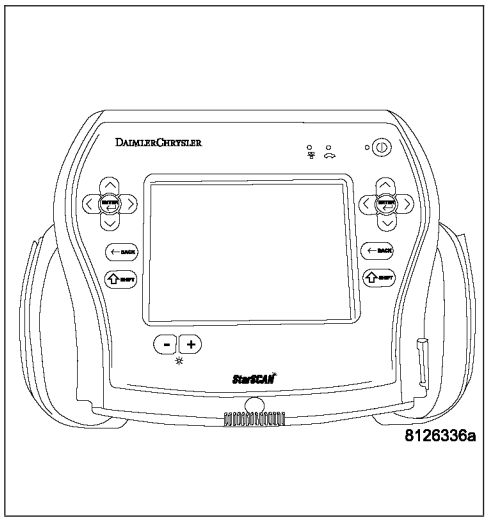
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1475-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



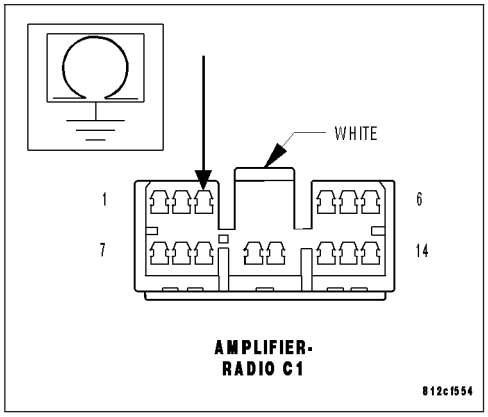
2. CHECK THE (X205) AMPLIFIED LEFT REAR DOOR SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND

Disconnect the Amplifier C1 harness connector.
Measure the resistance between ground and the (X205) Amplified Left Rear Door Speaker (+) circuit.

Is the resistance below 10K ohms?

Yes >> Repair the (X205) Amplified Left Rear Door Speaker (+) circuit for a short to ground.
Perform BODY VERIFICATION TEST VER-1.

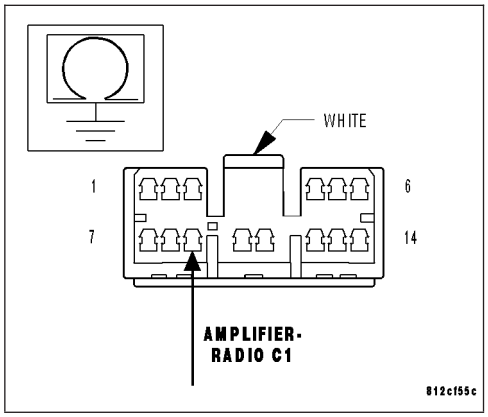
No >> Go To 3



B1475-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

3. CHECK THE (X295) AMPLIFIED LEFT REAR DOOR SPEAKER (-) CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (X295) Amplified Left Rear Door Speaker (-) circuit.



Is the resistance below 10K ohms?

Yes >> Repair the (X295) Amplified Left Rear Door Speaker (-) for a short to ground.
Perform BODY VERIFICATION TEST VER-1.

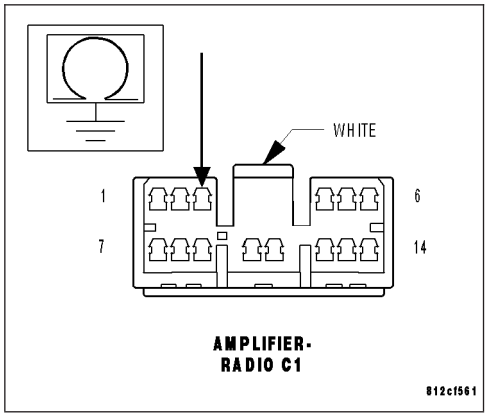
No >> Go To 4

4. CHECK OPERATION OF THE AMPLIFIED LEFT REAR DOOR SPEAKER

Turn the ignition off.

Reconnect and reinstall the Left Rear Door Speaker.

Measure the resistance of the speaker circuit between the Amplifier C1 harness connector and ground..

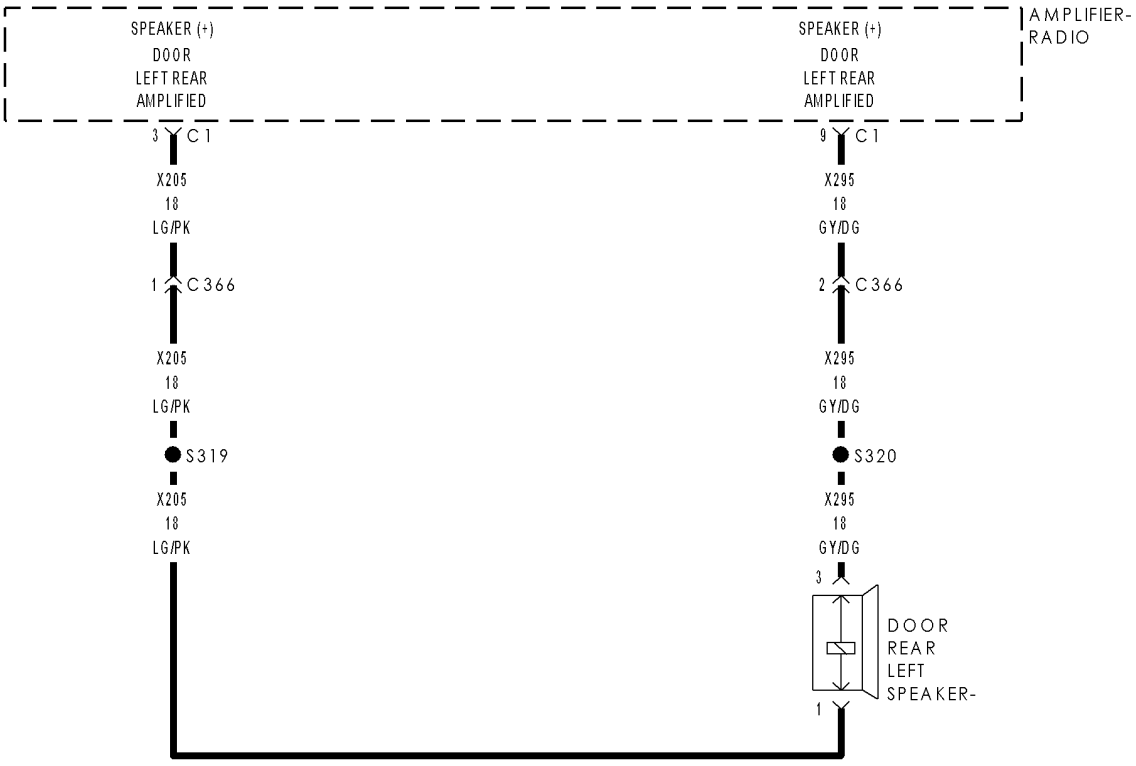


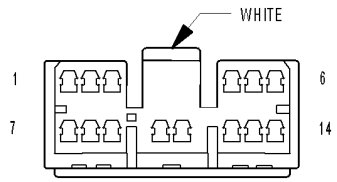
Is the resistance below 10K ohms?

Yes >> Replace the Left Rear Door Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

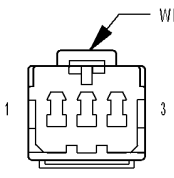
No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

B1476-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT HIGH





AMPLIFIER-
RADIO C1



SPEAKER-LEFT
REAR DOOR

812cf028

B1476-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Amplifier detects a short to battery condition on the output circuit.

Possible Causes
(X205) AMPLIFIED LEFT REAR DOOR SPEAKER (+) CIRCUIT SHORT TO VOLTAGE
(X295) AMPLIFIED LEFT REAR DOOR SPEAKER (-) CIRCUIT SHORT TO VOLTAGE
AMPLIFIER

Diagnostic Test

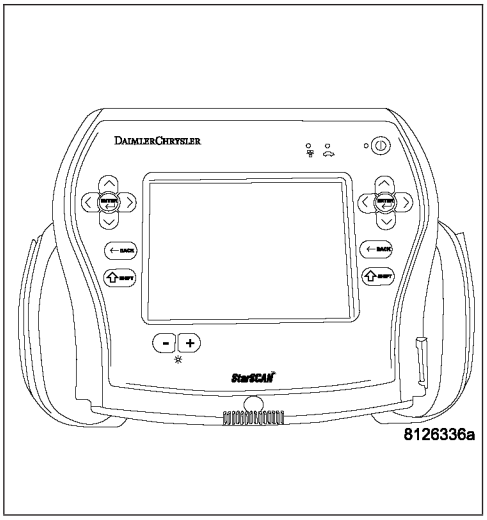
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1476-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



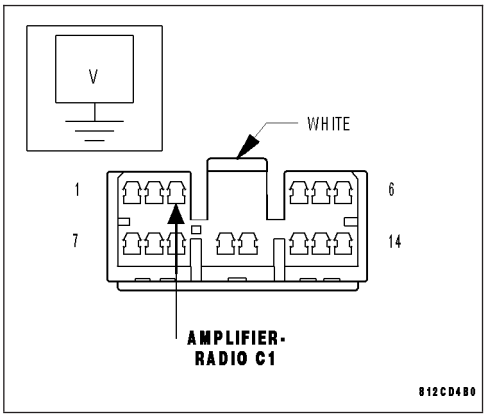
2. CHECK FOR VOLTAGE ON THE (X205) AMPLIFIED LEFT REAR DOOR SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Amplifier C1 harness connector.
Disconnect the Amplified Left Rear Door Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X205) Amplified Left Rear Door Speaker (+) circuit.

Is the voltage above 10.0 volts?

Yes >> Repair the (X205) Amplified Left Rear Door Speaker (+) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

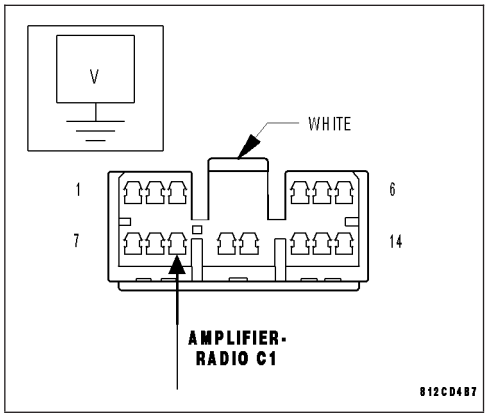
No >> Go To 3



B1476-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

3. CHECK FOR VOLTAGE ON THE (X295) AMPLIFIED LEFT REAR DOOR SPEAKER (-) CIRCUIT

Measure for voltage on the (X295) Amplified Left Rear Door Speaker (-) circuit.

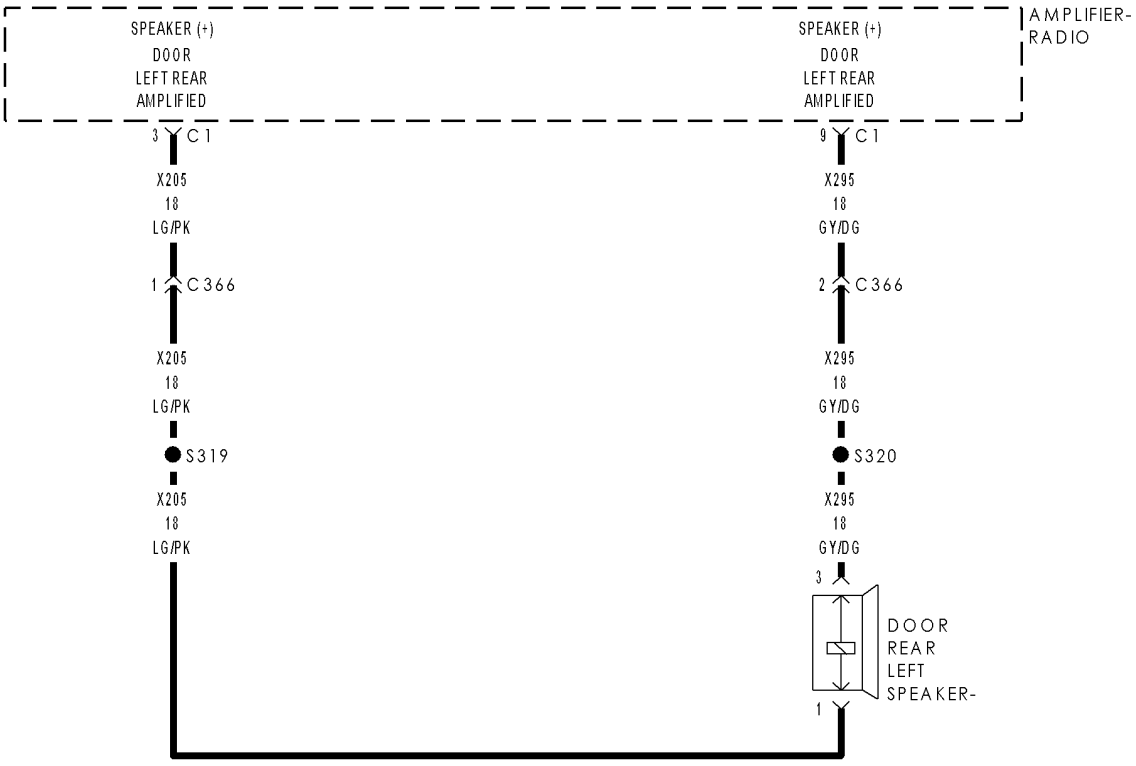


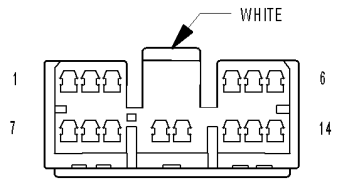
Is the voltage above 10.0 volts?

Yes >> Repair the (X295) Amplified Left Rear Door Speaker (-) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

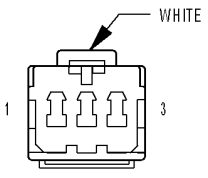
No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

B1477-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT OPEN





AMPLIFIER-
RADIO C1



SPEAKER-LEFT
REAR DOOR

812cf028

B1477-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Amplifier Bus wake-up. Amplifier reset with scan tool.
- **Set Condition:**
  The Amplifier detects an open condition on the speaker output circuit.

Possible Causes
(X205) AMPLIFIED LEFT REAR DOOR SPEAKER (+) CIRCUIT OPEN
(X295) AMPLIFIED LEFT REAR DOOR SPEAKER (-) CIRCUIT OPEN
LEFT REAR DOOR SPEAKER
AMPLIFIER

Diagnostic Test

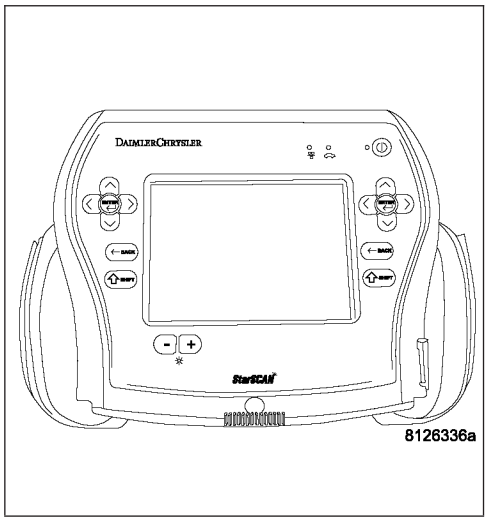
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on.
Turn the radio on.
With the scan tool, erase Amplifier DTCs.
With the scan tool, reset the amplifier.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1477-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



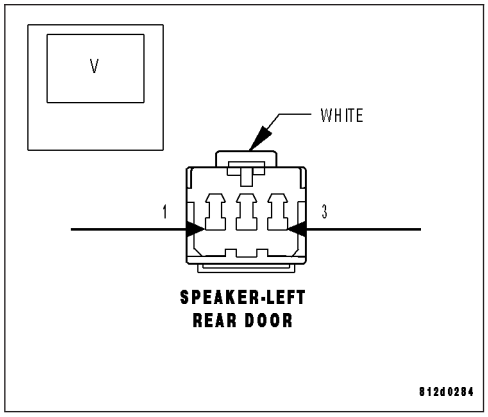
2. CHECK THE OPERATION OF THE LEFT REAR DOOR SPEAKER

Disconnect the Left Rear Door Speaker harness connector.
Turn the radio on and turn the volume to mid level.
With a voltmeter set to read in A/C voltage, measure the voltage of the Amplified Left Rear Door Speaker circuits in the Amplified Left Rear Door Speaker harness connector.

Is the voltage present greater than 1 volt?

Yes >> Replace the Amplified Left I/P Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3



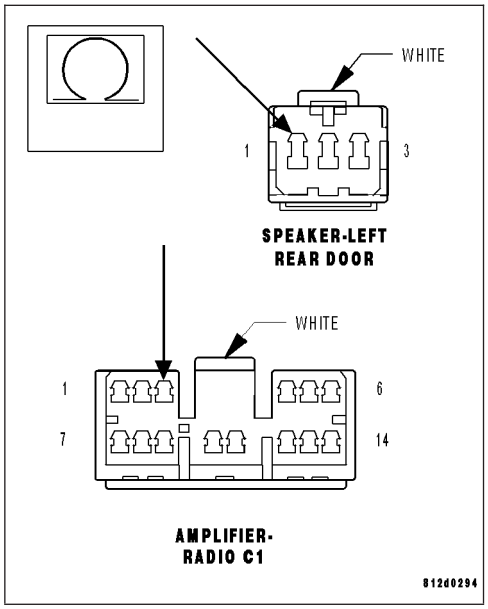
B1477-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

3. CHECK THE (X205) AMPLIFIED LEFT REAR DOOR SPEAKER (+) CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the Amplifier C1 harness connector.

Measure the resistance of the (X205) Amplified Left Rear Door Speaker (+) circuit between the Amplifier C1 harness connector and the Amplified Left Rear Door Speaker harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 4

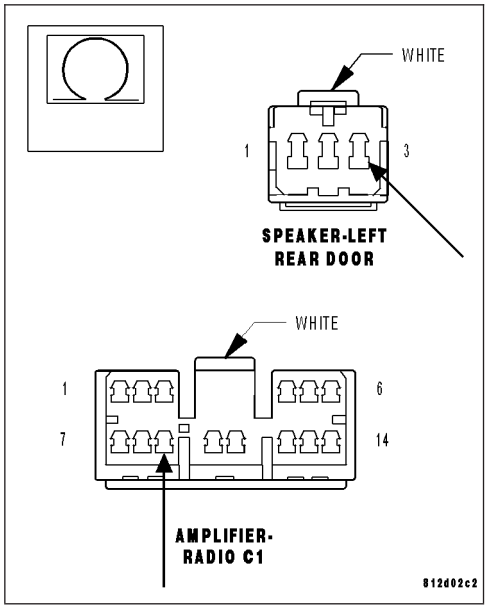
No >> Repair the (X205) Amplified Left Rear Door Speaker (+) circuit for an open.
Perform BODY VERIFICATION TEST VER-1.

4. CHECK THE (X295) AMPLIFIED LEFT REAR DOOR SPEAKER (-) CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the Amplifier C1 harness connector.

Measure the resistance of the (X295) Amplified Left Rear Door Speaker (-) circuit between the Amplifier C1 harness connector and the Amplified Left Rear Door Speaker harness connector.

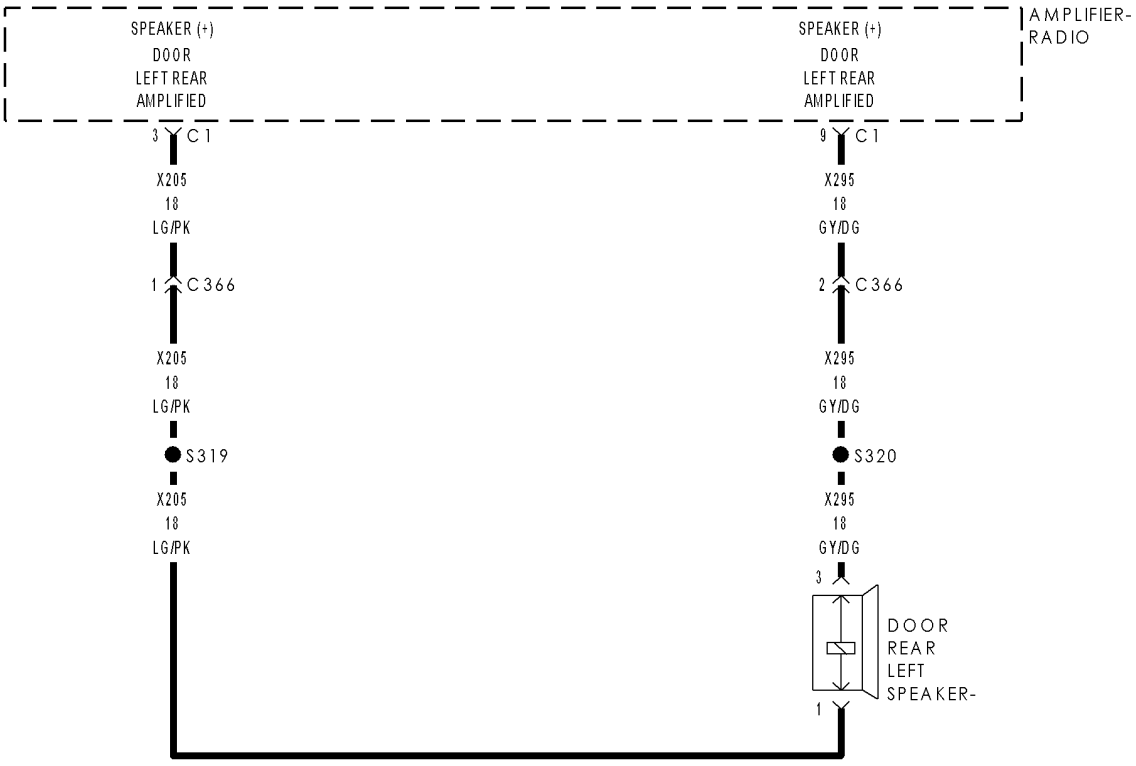


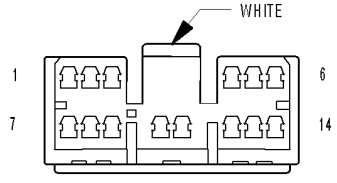
Is the resistance below 5.0 ohms?

Yes >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

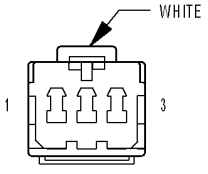
No >> Repair the (X295) Amplified Left Rear Door Speaker (-) circuit for an open.
Perform BODY VERIFICATION TEST VER-1.

B1478-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER





AMPLIFIER-
RADIO C1



SPEAKER-LEFT
REAR DOOR

812cf028

B1478-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

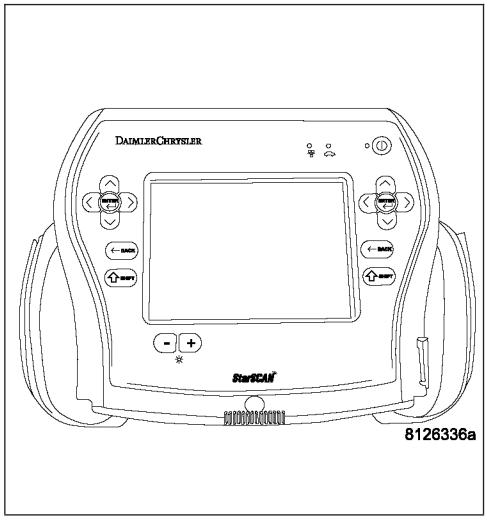
- **When Monitored:**
  With the ignition on. Radio volume at 25 or higher.
- **Set Condition:**
  The amplifier detects that the output circuits are shorted together.

Possible Causes
(X205) AMPLIFIED LEFT REAR DOOR SPEAKER (+) CIRCUIT SHORTED TO THE (X295) AMPLIFIED LEFT REAR DOOR SPEAKER (-) CIRCUIT
AMPLIFIED LEFT REAR DOOR SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, erase Amplifier DTCs.
Turn the radio on.
Turn the volume level to 25.
With the scan tool, read Amplifier DTCs.



Does the scan tool display active: B1478-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

---

2. CHECK THE OPERATION OF THE AMPLIFIED LEFT REAR DOOR SPEAKER

Disconnect the Amplified Left Rear Door Speaker.
Measure the resistance of the speaker between the two terminals.

Is the resistance of the speaker less than 1 ohm?

Yes >> Replace the Amplified Left Rear Door Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3

B1478-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER (CONTINUED)

3. CHECK THE (X205) AMPLIFIED LEFT REAR DOOR SPEAKER (+) CIRCUIT, AND THE (X295) AMPLIFIED LEFT REAR DOOR SPEAKER (-) CIRCUITS FOR A SHORT TOGETHER

Turn the ignition off.

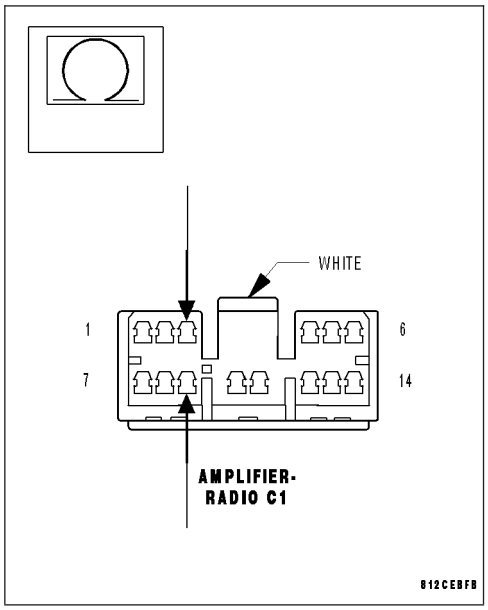
Disconnect the Amplifier C1 harness connector.

Measure the resistance between the (X205) Amplified Left Rear Door Speaker (+) circuit, and the (X295) Amplified Left Rear Door Speaker (-) circuit.

Is the resistance below 10K ohms?

Yes >> Repair the (X205) Amplified Left Rear Door Speaker (+) circuit, and the (X295) Amplified Left Rear Door Speaker (-) circuit for a short together.
Perform BODY VERIFICATION TEST VER-1.

No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.



B1479-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  This DTC will set if a DC offset occurs on the output channel, the amplifier shall set a DTC after a maturity rate of 5 ±1 sec.

Possible Causes
AMPLIFIER

Diagnostic Test

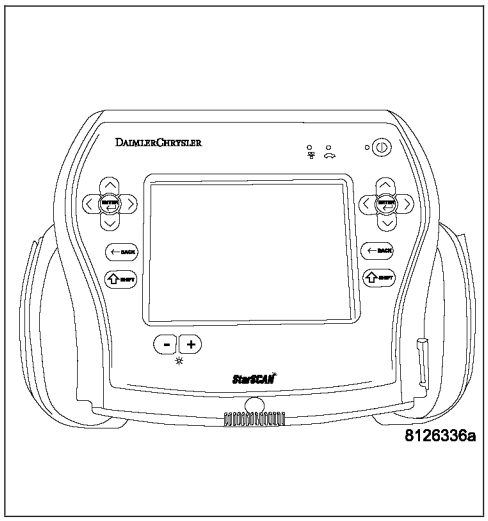
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

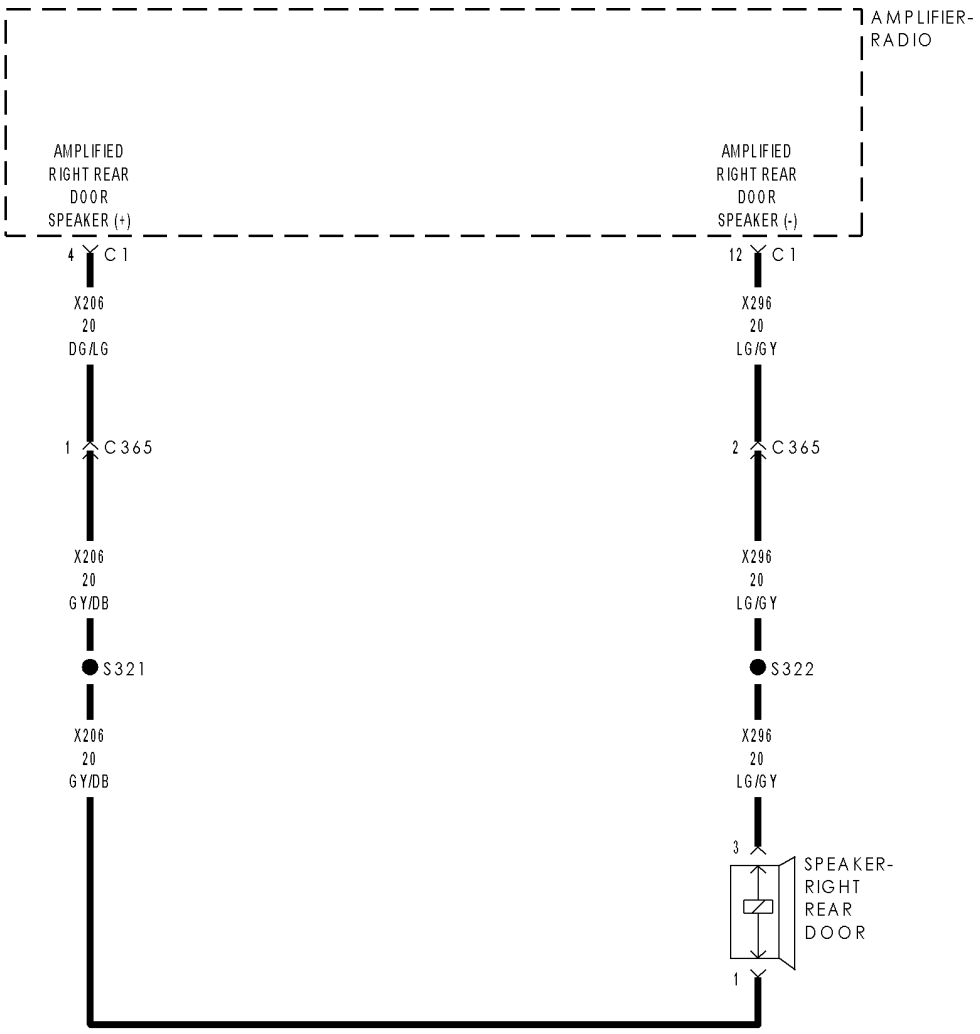
Does the scan tool display active: B1479-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE?

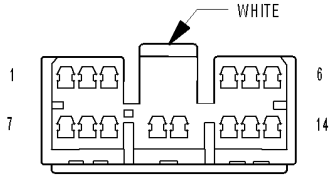
Yes >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

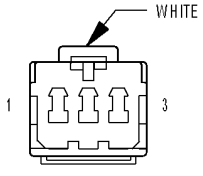


B147A-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT LOW





AMPLIFIER-
RADIO C1



SPEAKER-RIGHT
REAR DOOR

812cf02c

B147A-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Amplifier detects a shorted to ground condition on the speaker output circuit.

Possible Causes
(X206) AMPLIFIED RIGHT REAR DOOR SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X296) AMPLIFIED RIGHT REAR DOOR SPEAKER (-) CIRCUIT SHORTED TO GROUND
RIGHT REAR DOOR SPEAKER
AMPLIFIER

Diagnostic Test

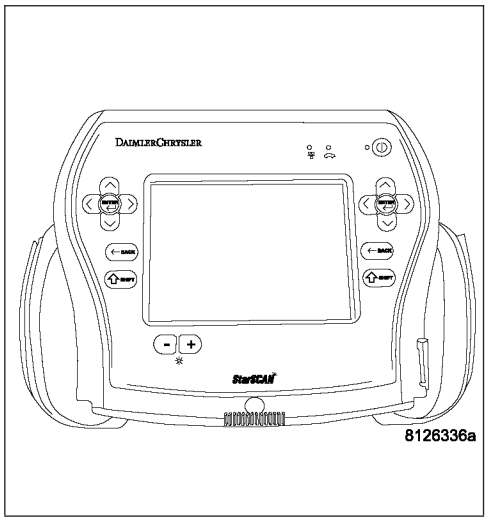
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B147A-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



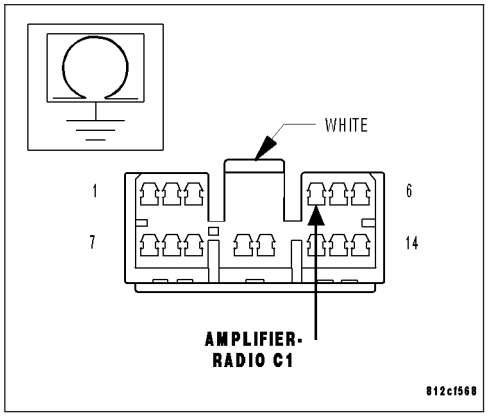
2. CHECK THE (X206) AMPLIFIED RIGHT REAR DOOR SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND

Disconnect the Amplifier C1 harness connector.
Measure the resistance between ground and the (X206) Amplified Right Rear Door Speaker (+) circuit.

Is the resistance below 10K ohms?

Yes >> Repair the (X206) Amplified Right Rear Door Speaker (+) circuit for a short to ground.
Perform BODY VERIFICATION TEST VER-1.

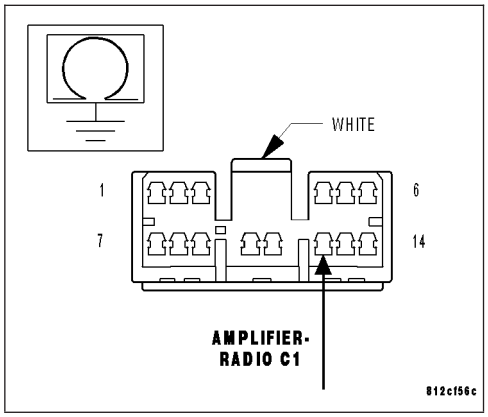
No >> Go To 3



B147A-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT LOW (CONTINUED)

3. CHECK THE (X296) AMPLIFIED RIGHT REAR DOOR SPEAKER (-) CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (X296) Amplified Right Rear Door Speaker (-) circuit.



Is the resistance below 10K ohms?

Yes >> Repair the (X296) Amplified Right Rear Door Speaker (-) for a short to ground.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 4

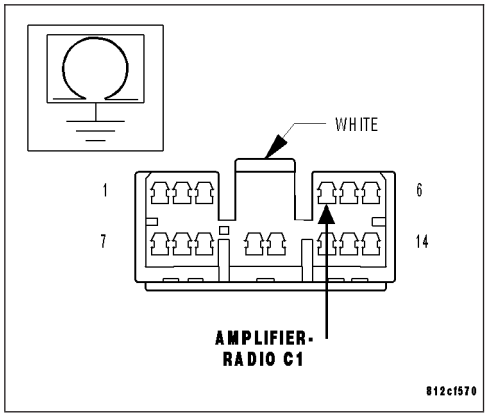
---

4. CHECK OPERATION OF THE AMPLIFIED RIGHT REAR DOOR SPEAKER

Turn the ignition off.

Reconnect and reinstall the Right Rear Door Speaker.

Measure the resistance of the speaker circuit between the Amplifier C1 harness connector and ground..

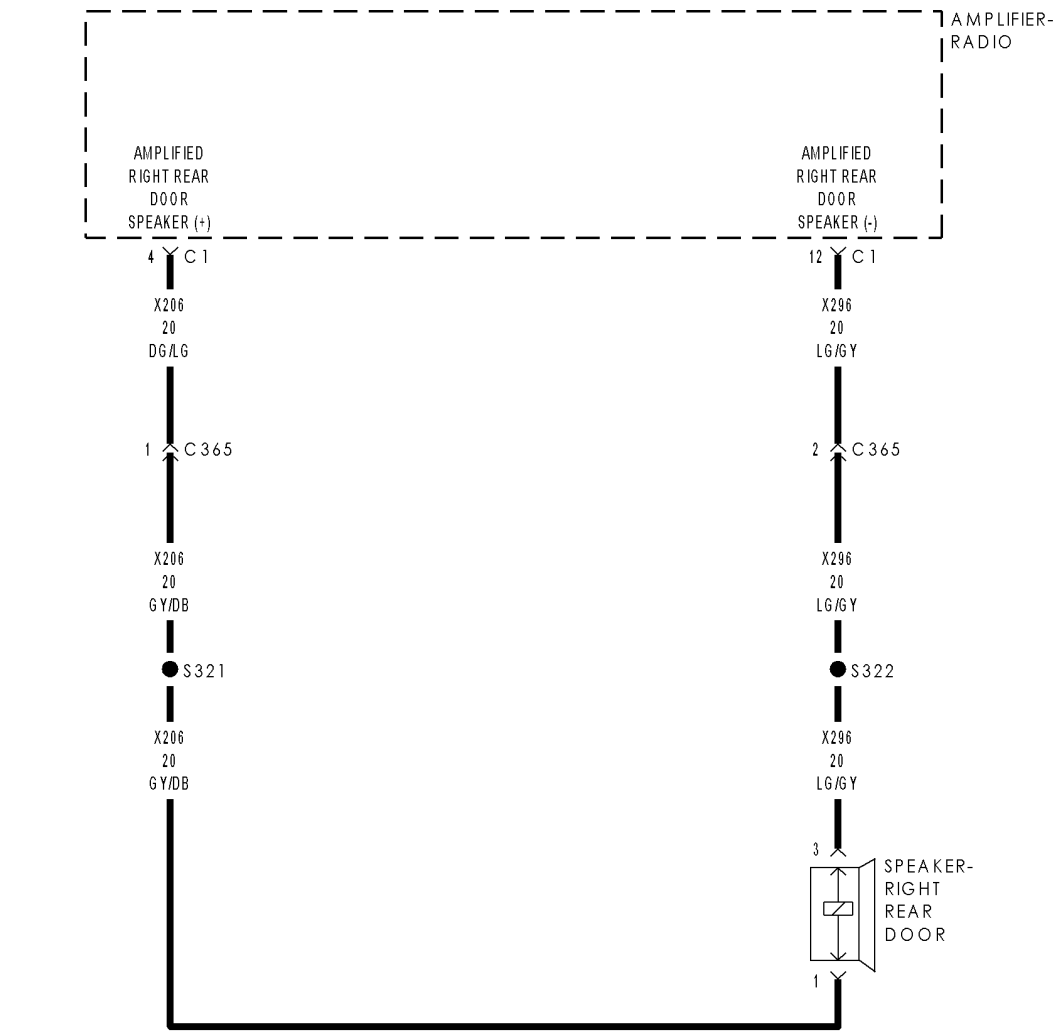


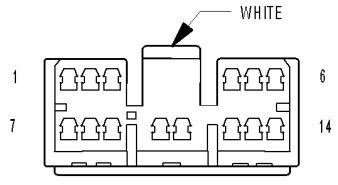
Is the resistance below 10K ohms?

Yes >> Replace the Right Rear Door Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

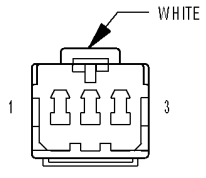
No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

B147B-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT HIGH





AMPLIFIER-
RADIO C1



SPEAKER-RIGHT
REAR DOOR

812cf02c

B147B-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Amplifier detects a short to battery condition on the output circuit.

Possible Causes
(X206) AMPLIFIED RIGHT REAR DOOR SPEAKER (+) CIRCUIT SHORT TO VOLTAGE
(X296) AMPLIFIED RIGHT REAR DOOR SPEAKER (-) CIRCUIT SHORT TO VOLTAGE
AMPLIFIER

Diagnostic Test

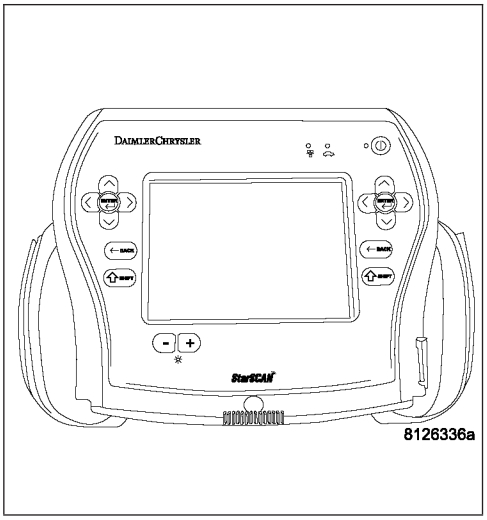
1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B147B-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.



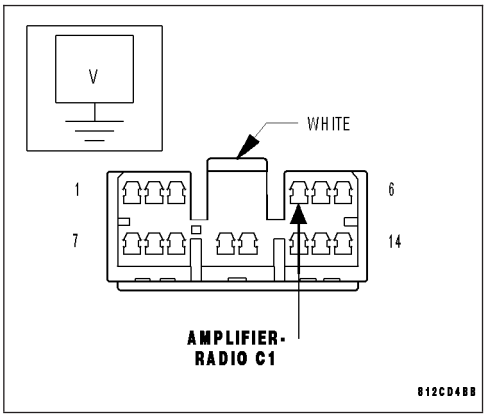
2. CHECK FOR VOLTAGE ON THE (X206) AMPLIFIED RIGHT REAR DOOR SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Amplifier C1 harness connector.
Disconnect the Amplified Right Rear Door Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X206) Amplified Right Rear Door Speaker (+) circuit.

Is the voltage above 10.0 volts?

Yes >> Repair the (X206) Amplified Right Rear Door Speaker (+) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

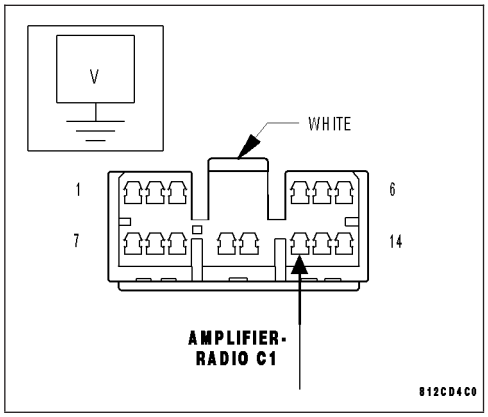
No >> Go To 3



B147B-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT HIGH (CONTINUED)

3. CHECK FOR VOLTAGE ON THE (X296) AMPLIFIED RIGHT REAR SPEAKER SPEAKER (-) CIRCUIT

Measure for voltage on the (X296) Amplified Right Rear Door Speaker (-) circuit.

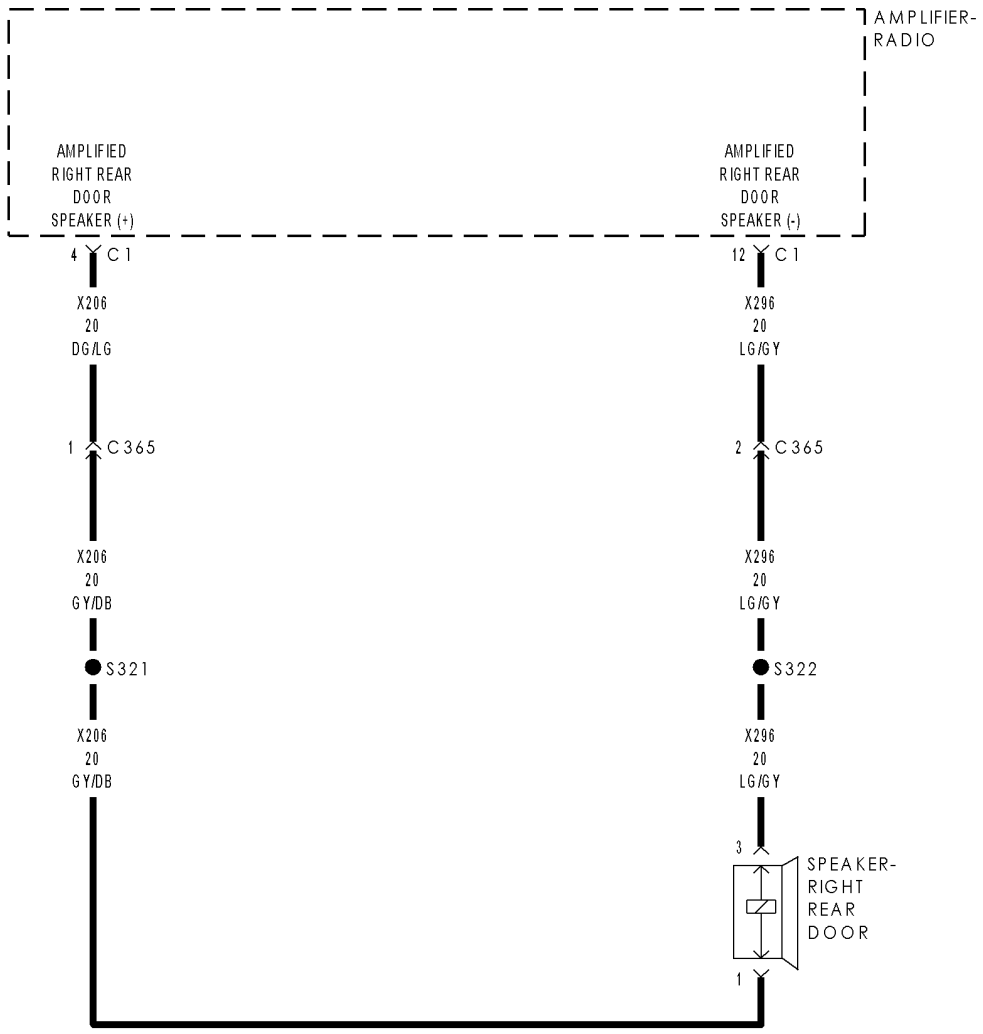


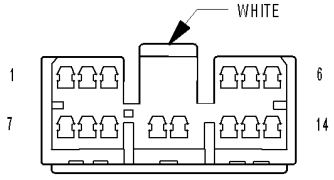
Is the voltage above 10.0 volts?

Yes >> Repair the (X296) Amplified Right Rear Door Speaker (-) circuit for a short to voltage.
Perform BODY VERIFICATION TEST VER-1.

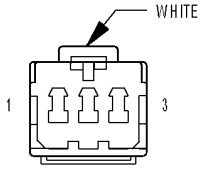
No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

B147C-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT OPEN





AMPLIFIER-
RADIO C1



SPEAKER-RIGHT
REAR DOOR

812cf02c

B147C-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

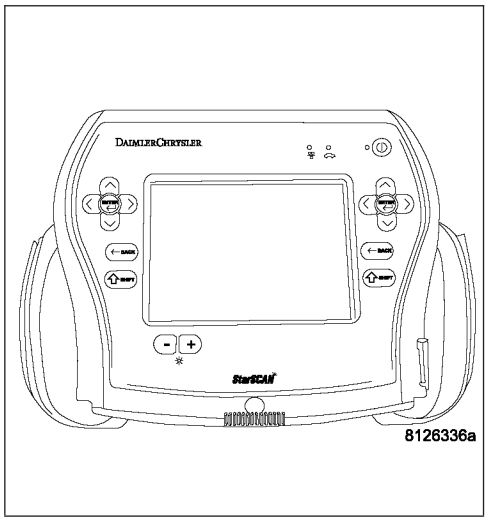
- **When Monitored:**
  Amplifier Bus wake-up. Amplifier reset with scan tool.
- **Set Condition:**
  The Amplifier detects an open condition on the speaker output circuit.

Possible Causes
(X206) AMPLIFIED RIGHT REAR DOOR SPEAKER (+) CIRCUIT OPEN
(X296) AMPLIFIED RIGHT REAR DOOR SPEAKER (-) CIRCUIT OPEN
RIGHT REAR DOOR SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on.
Turn the radio on.
With the scan tool, erase Amplifier DTCs.
With the scan tool, reset the amplifier.
With the scan tool, read Amplifier DTCs.



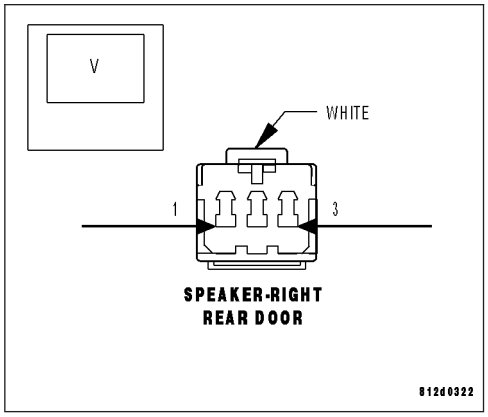
Does the scan tool display active: B147C-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

2. CHECK THE OPERATION OF THE RIGHT REAR DOOR SPEAKER

Disconnect the Right Rear Door Speaker harness connector.
Turn the radio on and turn the volume to mid level.
With a voltmeter set to read in A/C voltage, measure the voltage of the Amplified Right Rear Door Speaker circuits in the Amplified Right Rear Door Speaker harness connector.



Is the voltage present greater than 1 volt?

Yes >> Replace the Amplified Right Rear Door Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3

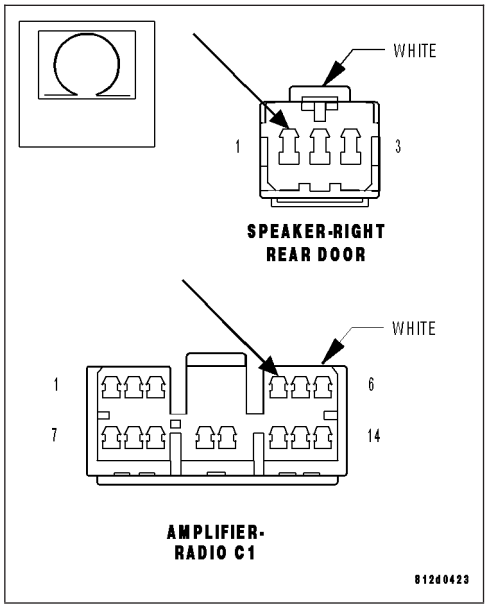
B147C-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT OPEN (CONTINUED)

3. CHECK THE (X206) AMPLIFIED RIGHT REAR DOOR SPEAKER (+) CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the Amplifier C1 harness connector.

Measure the resistance of the (X206) Amplified Right Rear Door Speaker (+) circuit between the Amplifier C1 harness connector and the Amplified Right Rear Door Speaker harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 4

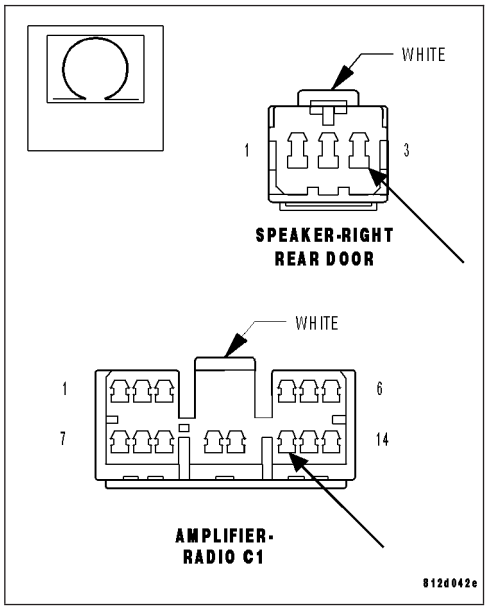
No >> Repair the (X206) Amplified Right Rear Door Speaker (+) circuit for an open.
Perform BODY VERIFICATION TEST VER-1.

4. CHECK THE (X296) AMPLIFIED RIGHT REAR DOOR SPEAKER (-) CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the Amplifier C1 harness connector.

Measure the resistance of the (X296) Amplified Right Rear Door Speaker (-) circuit between the Amplifier C1 harness connector and the Amplified Right Rear Door Speaker harness connector.

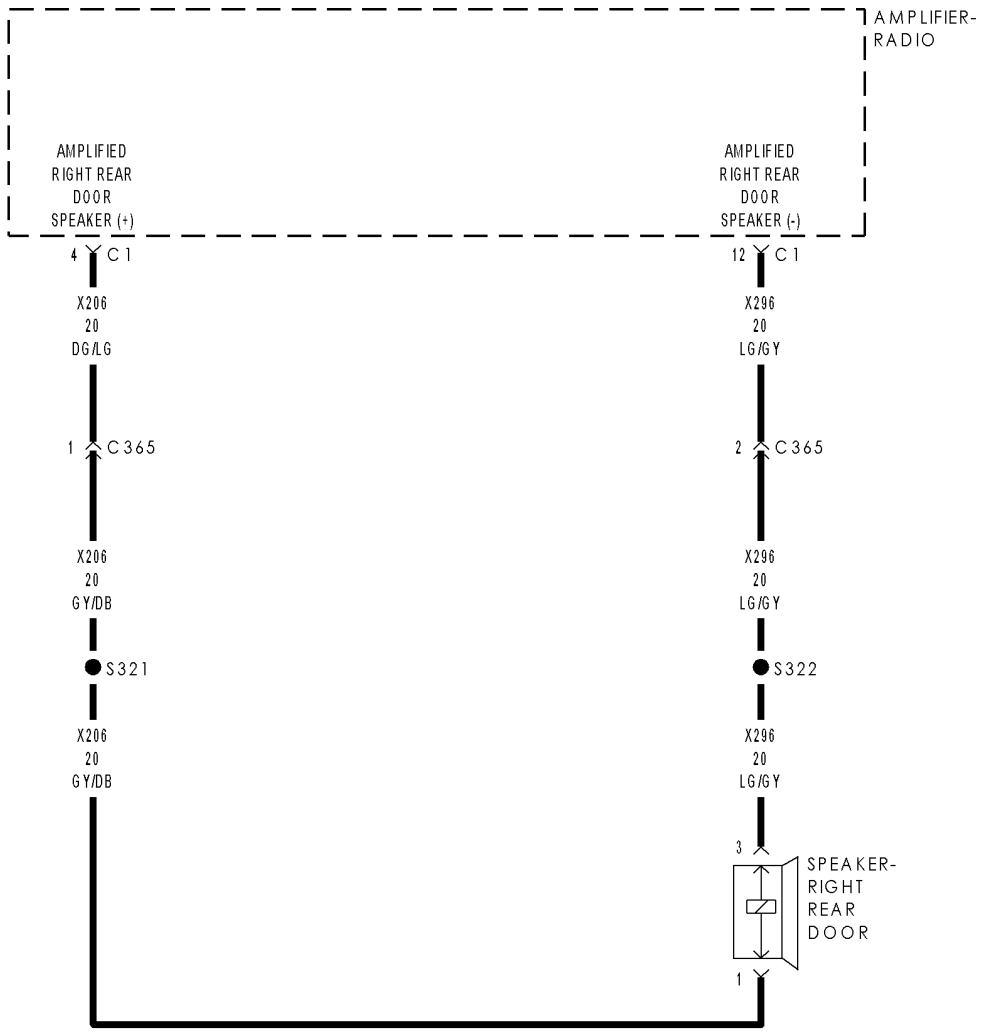


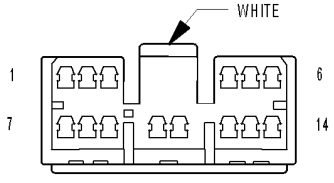
Is the resistance below 5.0 ohms?

Yes >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

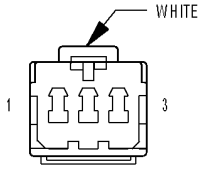
No >> Repair the (X296) Amplified Right Rear Door Speaker (-) circuit for an open.
Perform BODY VERIFICATION TEST VER-1.

B147D-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER





AMPLIFIER-
RADIO C1



SPEAKER-RIGHT
REAR DOOR

812cf02c

B147D-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

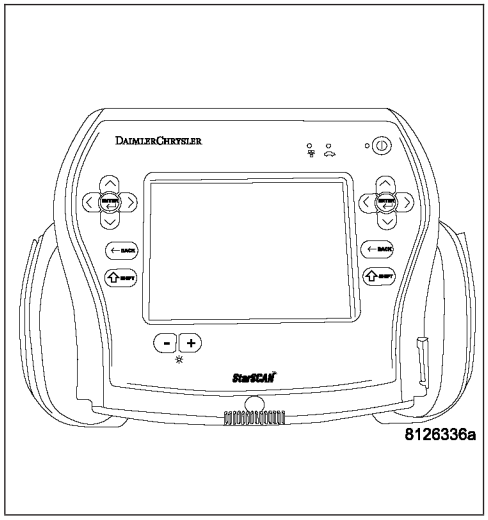
- **When Monitored:**
  With the ignition on. Radio volume at 25 or higher.
- **Set Condition:**
  The amplifier detects that the output circuits are shorted together.

Possible Causes
(X206) AMPLIFIED RIGHT REAR DOOR SPEAKER (+) CIRCUIT SHORTED TO THE (X296) AMPLIFIED RIGHT REAR DOOR SPEAKER (-) CIRCUIT
AMPLIFIED RIGHT REAR DOOR SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, erase Amplifier DTCs.
Turn the radio on.
Turn the volume level to 25.
With the scan tool, read Amplifier DTCs.



Does the scan tool display active: B147D-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST VER-1.

---

2. CHECK THE OPERATION OF THE AMPLIFIED RIGHT REAR DOOR SPEAKER

Disconnect the Amplified Right Rear Door Speaker.
Measure the resistance of the speaker between the two terminals.

Is the resistance of the speaker less than 1 ohm?

Yes >> Replace the Amplified Right Rear Door Speaker in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

No >> Go To 3

B147D-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER (CONTINUED)

3. CHECK THE (X206) AMPLIFIED RIGHT REAR DOOR SPEAKER (+) CIRCUIT, AND THE (X296) AMPLIFIED RIGHT REAR DOOR SPEAKER (-) CIRCUITS FOR A SHORT TOGETHER

Turn the ignition off.

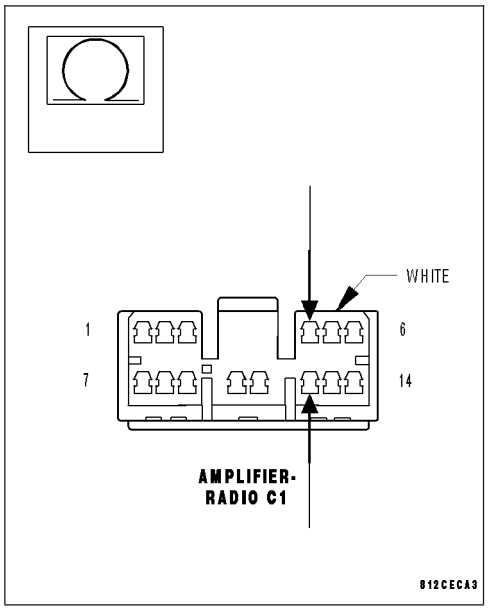
Disconnect the Amplifier C1 harness connector.

Measure the resistance between the (X206) Amplified Right Rear Door Speaker (+) circuit, and the (X296) Amplified Right Rear Door Speaker (-) circuit.

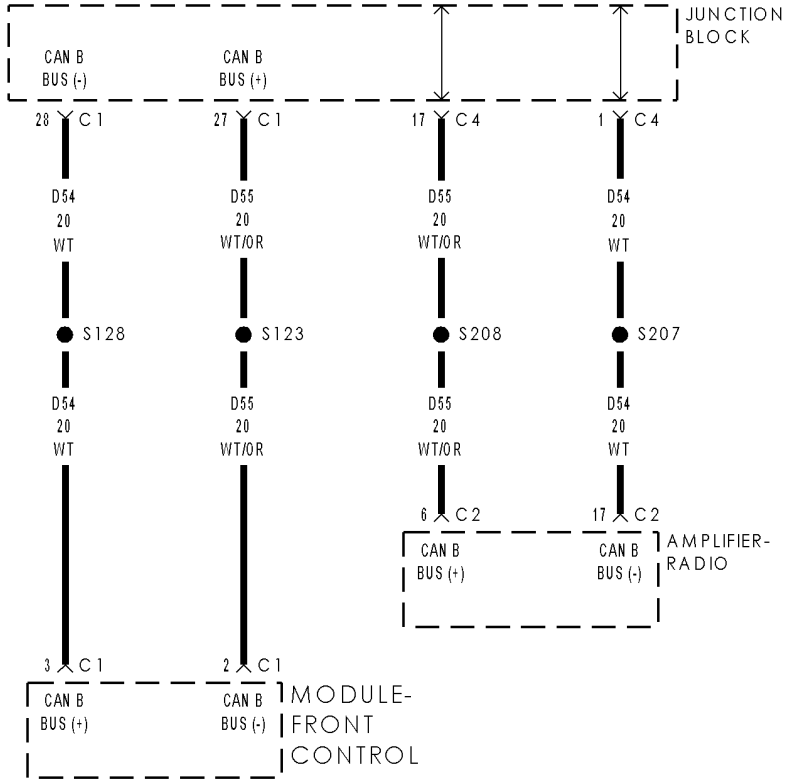
Is the resistance below 10K ohms?

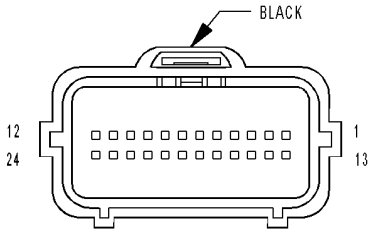
Yes >> Repair the (X206) Amplified Right Rear Door Speaker (+) circuit, and the (X296) Amplified Right Rear Door Speaker (-) circuit for a short together.
Perform BODY VERIFICATION TEST VER-1.

No >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST VER-1.

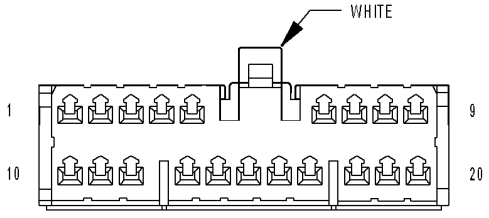


U0019–CAN B BUS





MODULE-FRONT CONTROL C1



AMPLIFIER-RADIO C2 (EXCEPT SUBWOOFER)

812c45ad

U0019–CAN B BUS (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

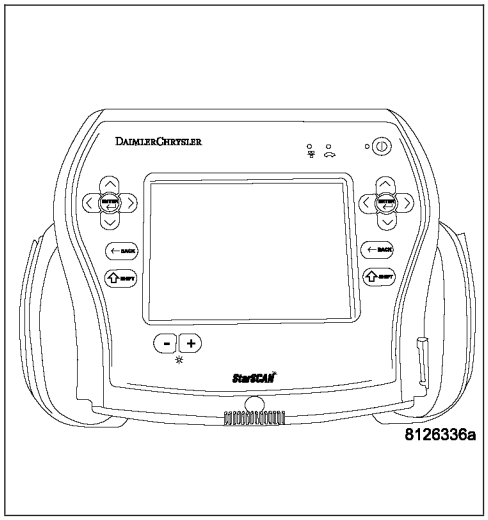
- **When Monitored:**
  Continuously.
- **Set Condition:**
  Whenever the Can B Bus (+) or B Bus (–) circuit is open, shorted to voltage or shorted to ground, this code will set.

Possible Causes
CAN B BUS DTCs IN FRONT CONTROL MODULE
(D54) CAN B BUS (–) CIRCUIT OPEN
(D55) CAN B BUS (+) CIRCUIT OPEN
AMPLIFIER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, record and erase DTCs
Cycle the ignition from on to off 3 times.
Turn the ignition on.
With the scan tool, read DTCs.



Does the scan tool display U0019–CAN B BUS CIRCUIT?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST - VER 1.

---

2. CHECK FRONT CONTROL MODULE DTCs

With the scan tool, read Front Control Module DTCs

Does the scan tool display any CAN B BUS DTCs – ACTIVE?

Yes >> Refer to the symptom list for problems related to Communication in the ELECTRICAL.– ELECTRONIC CONTROL MODULES – ELECTRICAL DIAGNOSES section.

No >> Go to 3

U0019–CAN B BUS (CONTINUED)

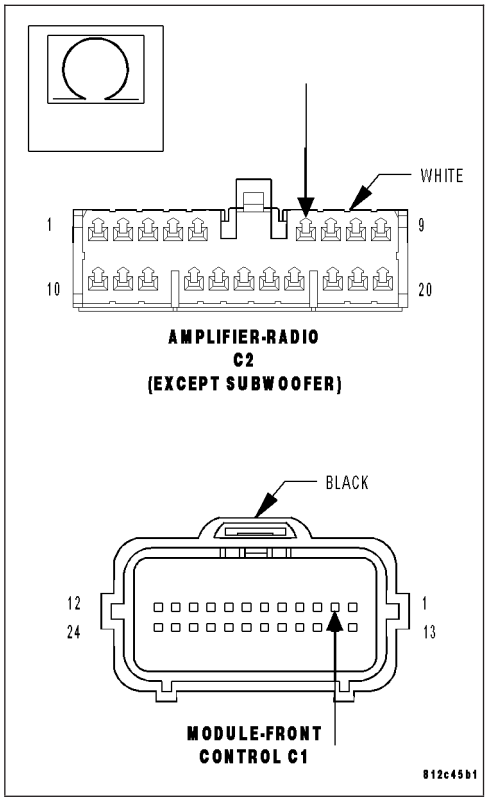
3. CAN B BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Amplifier harness connector.

Disconnect the Front Control Module C1 harness connector.

Measure the resistance of the (D55) Can B Bus (+) circuit between the Front Control Module C1 harness connector and the Amplifier harness connector.



Is the resistance below 2.0 ohms?

Yes >> Go To 4
Perform BODY VERIFICATION TEST - VER 1.

No >> Repair the Can B Bus (+) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.

U0019–CAN B BUS (CONTINUED)

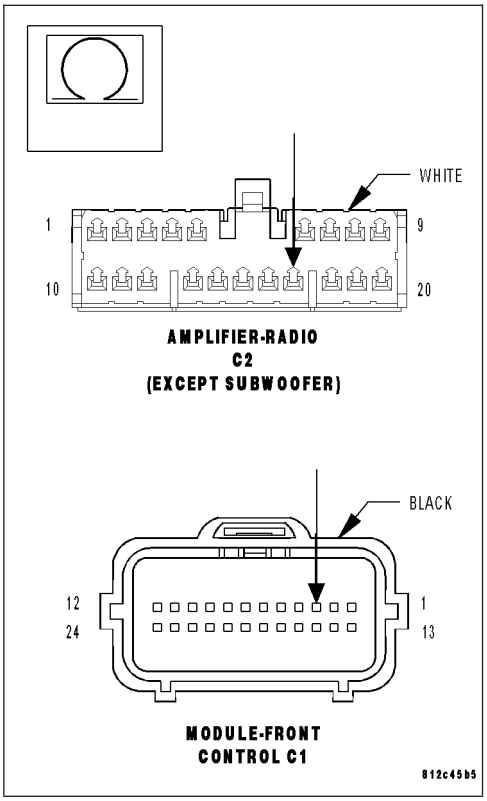
4. CAN B BUS (–) CIRCUIT OPEN

Measure the resistance of the (D54) Can B Bus (–) circuit between the Front Control Module C1 harness connector and the Amplifier harness connector.

Is the resistance below 2.0 ohms?

Yes >> Replace the Amplifier in accordance with the service information..
Perform BODY VERIFICATION TEST - VER 1.

No >> Repair the Can B Bus (–) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.

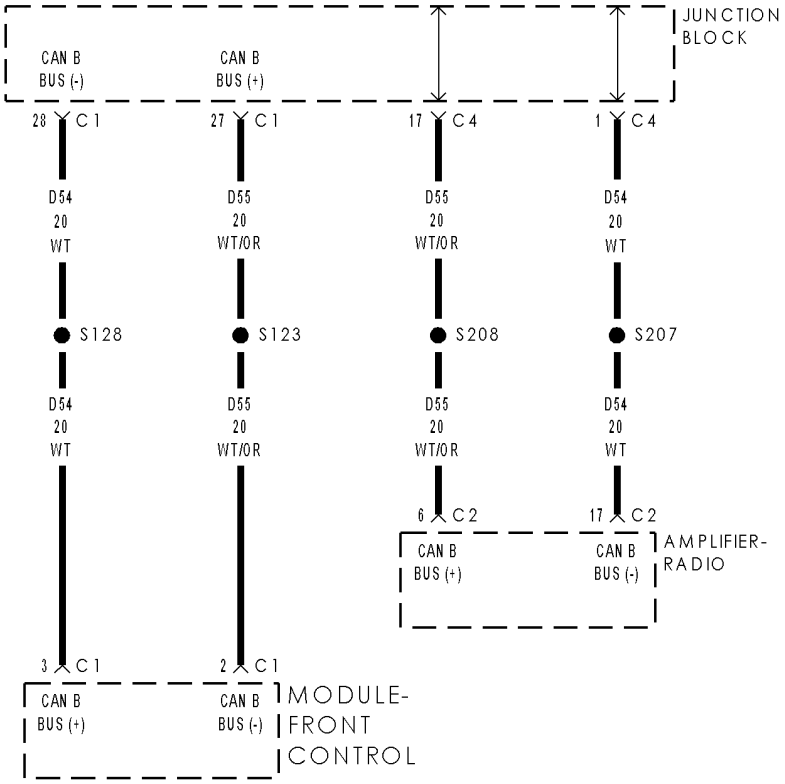


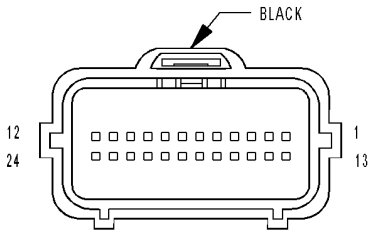
U0020-CAN B BUS OFF PERFORMANCE

For the Amplifier circuit diagram (Refer to 8 - ELECTRICAL/AUDIO - SCHEMATICS AND DIAGRAMS).

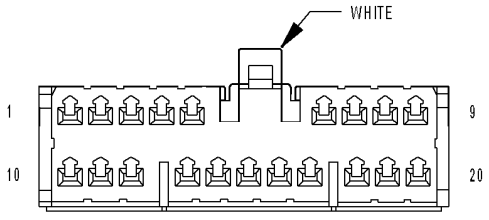
For a complete wiring diagram **Refer to Section 8W**.

U0020-CAN B BUS OFF PERFORMANCE (CONTINUED)





MODULE-FRONT CONTROL C1



AMPLIFIER-RADIO C2 (EXCEPT SUBWOOFER)

812c45ad

U0020-CAN B BUS OFF PERFORMANCE (CONTINUED)

- **When Monitored:**
  Continuously.
- **Set Condition:**
  Whenever the Can B Bus (+) or B Bus (–) circuit is open, shorted to voltage or shorted to ground, this code will set.

Possible Causes
CAN B BUS DTCs IN FRONT CONTROL MODULE
(D54) CAN B BUS (–) CIRCUIT OPEN
(D55) CAN B BUS (+) CIRCUIT OPEN
AMPLIFIER

Diagnostic Test

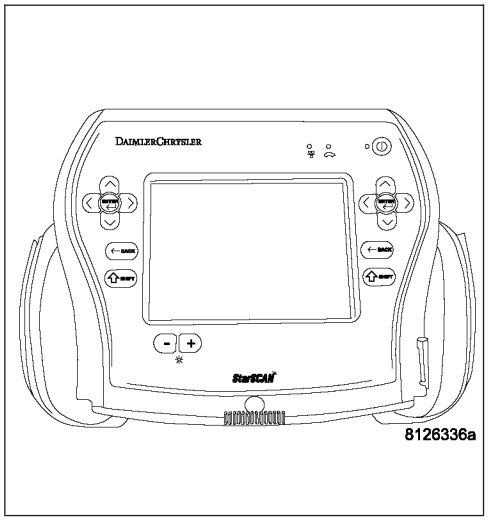
1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, record and erase DTCs
Cycle the ignition from on to off 3 times.
Turn the ignition on.
With the scan tool, read DTCs.

Does the scan tool display U0020-CAN B BUS OFF PERFORMANCE?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST - VER 1.



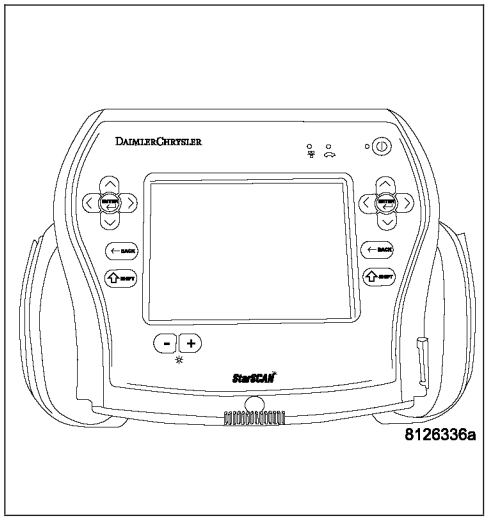
2. CHECK FRONT CONTROL MODULE DTCs

With the scan tool, read Front Control Module DTCs

Does the scan tool display any CAN B BUS DTCs – ACTIVE?

Yes >> Refer to the symptom list for problems related to Communication in the ELECTRICAL.– ELECTRONIC CONTROL MODULES – ELECTRICAL DIAGNOSES section.

No >> Go to 3



U0020-CAN B BUS OFF PERFORMANCE (CONTINUED)

3. CAN B BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Amplifier harness connector.

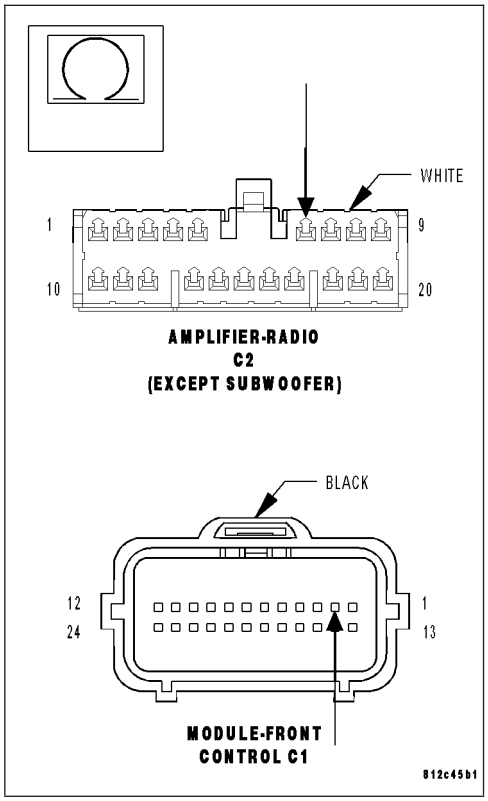
Disconnect the Front Control Module C1 harness connector.

Measure the resistance of the (D55) Can B Bus (+) circuit between the Front Control Module C1 harness connector and the Amplifier harness connector.

Is the resistance below 2.0 ohms?

Yes >> Go To 4
Perform BODY VERIFICATION TEST - VER 1.

No >> Repair the Can B Bus (+) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.



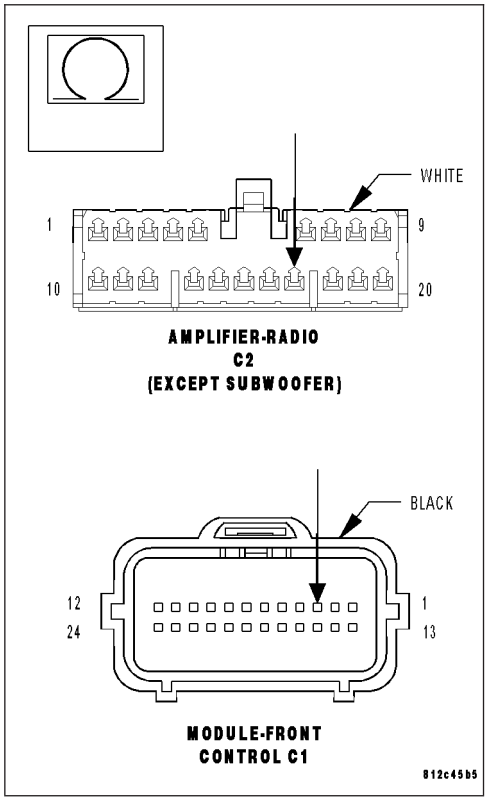
4. CAN B BUS (–) CIRCUIT OPEN

Measure the resistance of the (D54) Can B Bus (–) circuit between the Front Control Module C1 harness connector and the Amplifier harness connector.

Is the resistance below 2.0 ohms?

Yes >> Replace the Amplifier in accordance with the service information..
Perform BODY VERIFICATION TEST - VER 1.

No >> Repair the Can B Bus (–) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.



U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0151-LOST COMMUNICATION WITH OCCUPANT RESTRAINT CONTROLLER (ORC)

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0154-LOST COMMUNICATION WITH OCCUPANT CLASSIFICATION MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0155-LOST COMMUNICATION WITH CLUSTER/CCN

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0156-LOST COMMUNICATION WITH EOM

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0164-LOST COMMUNICATION WITH HVAC CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0168-LOST COMMUNICATION WITH VEHICLE SECURITY CONTROL MODULE (SKREEM/WCM)

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0184-LOST COMMUNICATION WITH RADIO

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0186-LOST COMMUNICATION WITH AUDIO AMPLIFIER

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0197-LOST COMMUNICATION WITH HANDS FREE PHONE MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0199-LOST COMMUNICATION WITH DRIVER DOOR MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0200-LOST COMMUNICATION WITH PASSENGER DOOR MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0208-LOST COMMUNICATION WITH HEATED SEAT CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

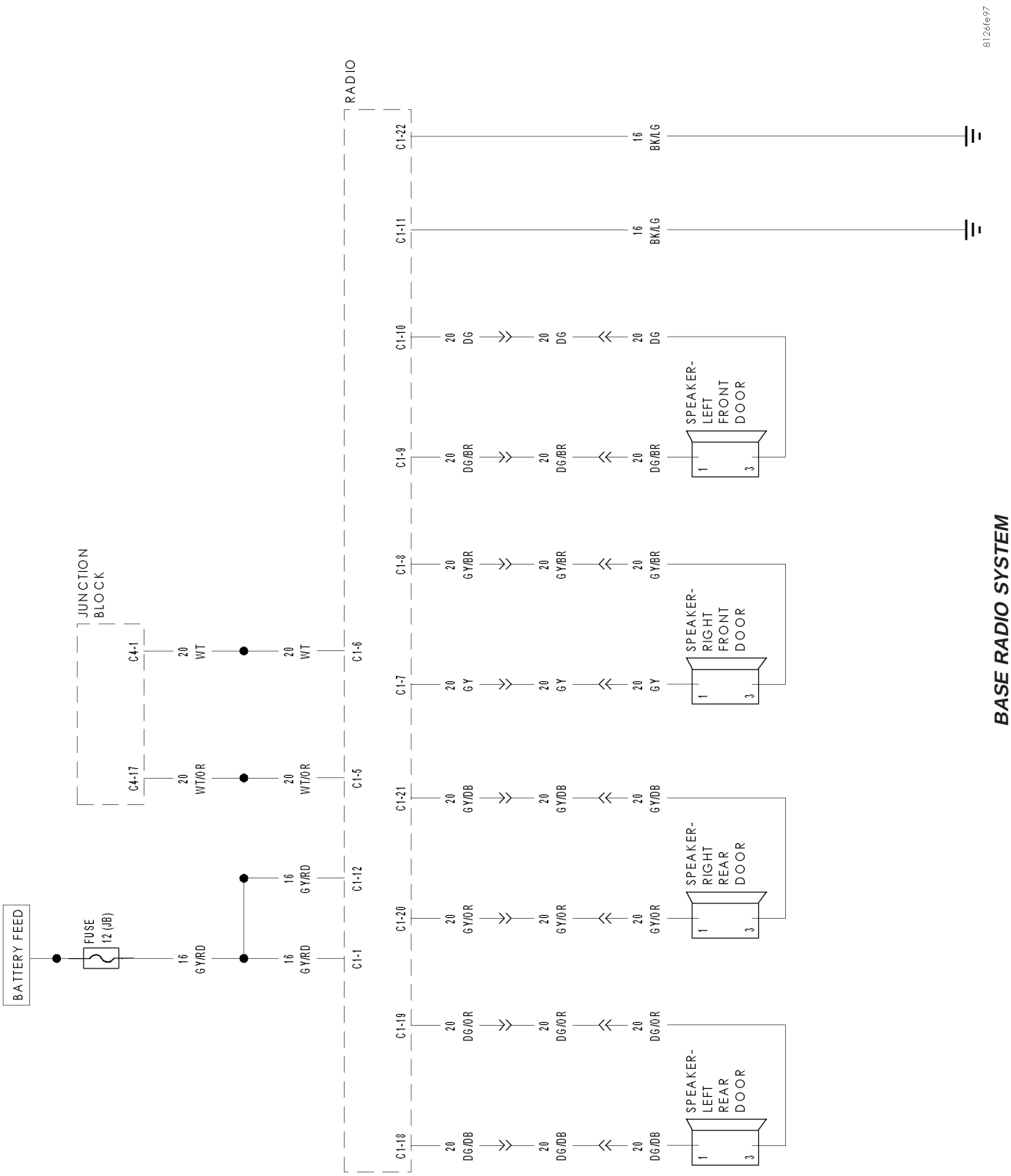
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

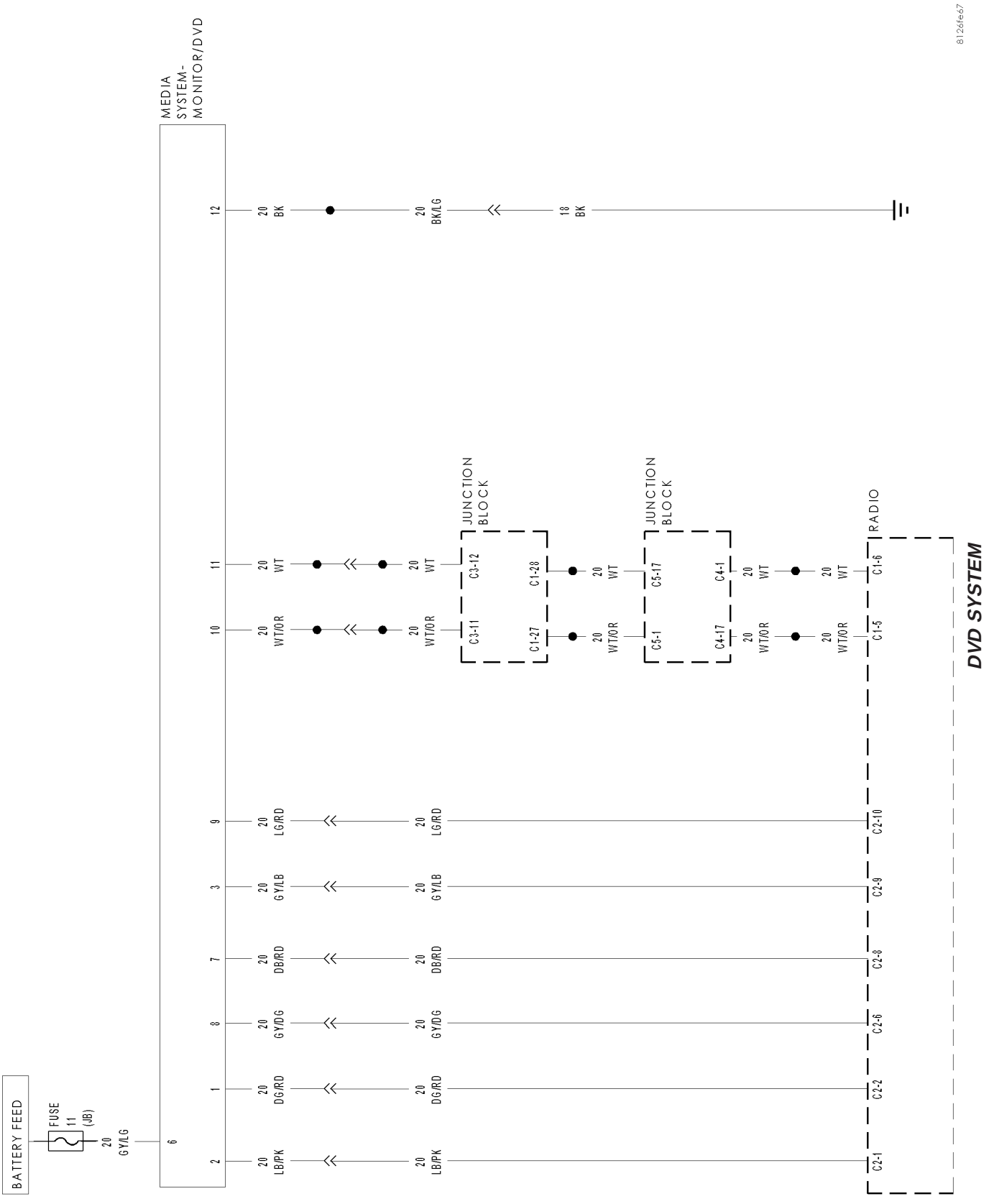
U0209-LOST COMMUNICATION WITH MEMORY SEAT CONTROL MODULE

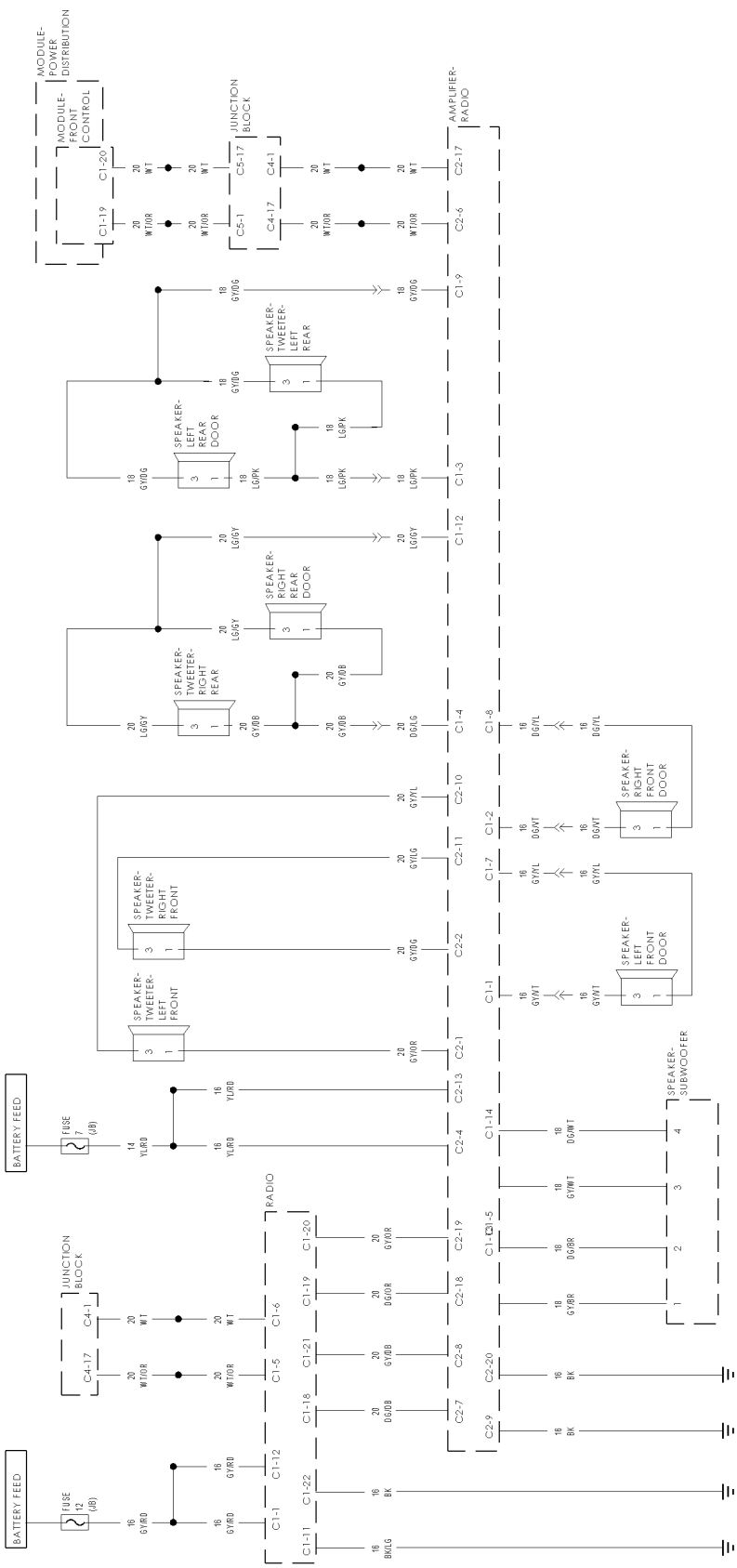
For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

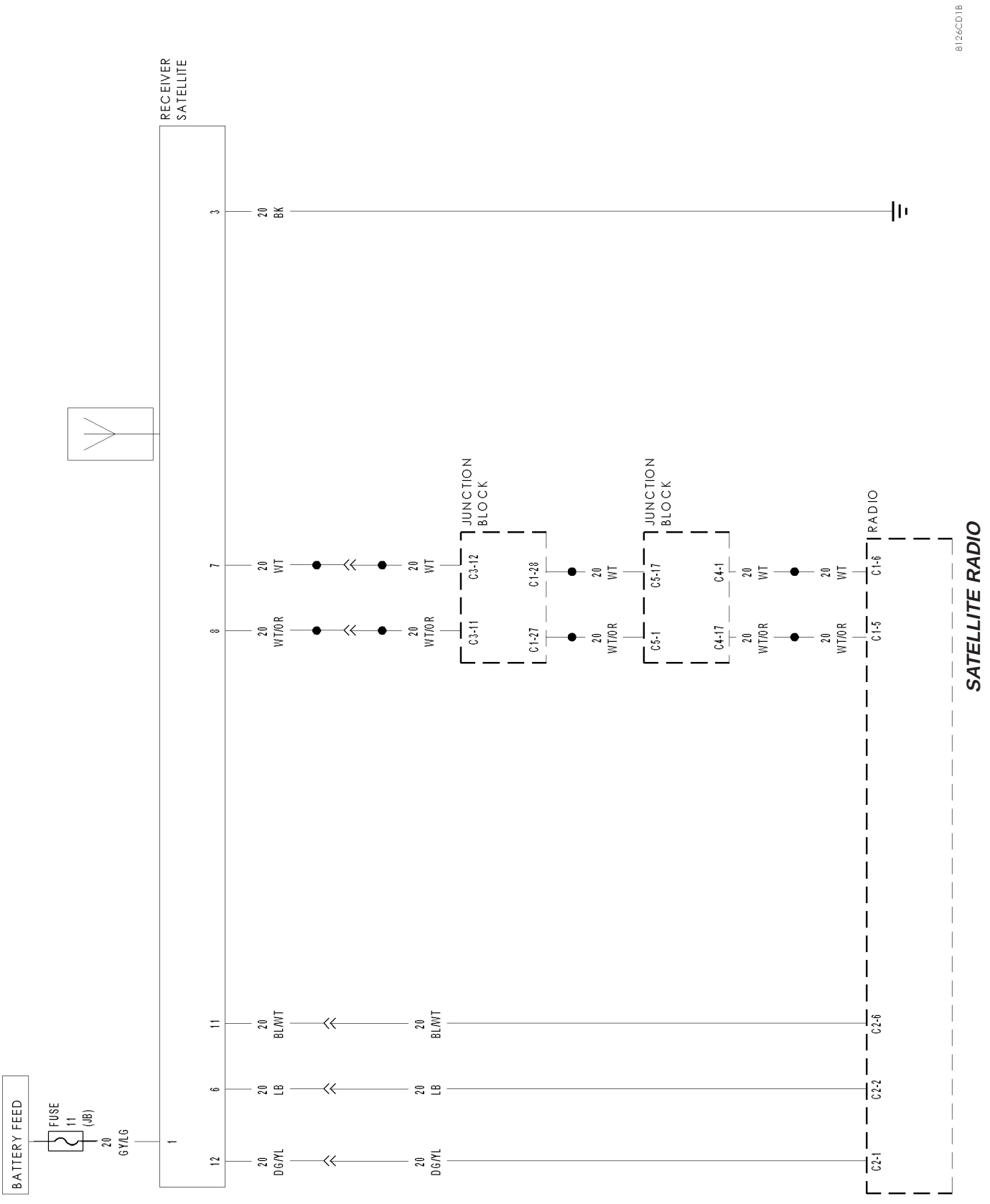
SCHEMATICS AND DIAGRAMS




81261e67
BATTERY FEED
FUSE 11 (JB) 20 GY/LG
MEDIA SYSTEM-MONITOR/DVD
6
2 20 LB/PK
1 20 DG/RD
8 20 GY/DG
7 20 DB/RD
3 20 GY/LB
9 20 LG/RD
10 20 WT/OR
11 20 WT
12 20 BK
20 LB/PK
20 DG/RD
20 GY/DG
20 DB/RD
20 GY/LB
20 LG/RD
20 WT/OR
20 WT
20 BK/LG
18 BK
JUNCTION BLOCK
C3-11
C3-12
C1-27
C1-28
20 WT/OR
20 WT
JUNCTION BLOCK
C5-1
C5-17
C4-17
C4-1
20 WT/OR
20 WT
RADIO
C1-5
C1-6
C2-1
C2-2
C2-6
C2-8
C2-9
C2-10
DVD SYSTEM



PREMIUM RADIO SYSTEM


8126CD1B
RECEIVER SATELLITE
BATTERY FEED
FUSE 11 (JB) 20 GY/LG
1
3 20 BK
7 20 WT
8 20 WT/OR
11 20 BL/WT
6 20 LB
12 20 DG/YL
JUNCTION BLOCK
C3-12
C3-11
C1-28
C1-27
JUNCTION BLOCK
C5-17
C5-1
C4-1
C4-17
RADIO
C1-6
C1-5
C2-6
C2-2
C2-1
SATELLITE RADIO

AUDIO/VIDEO - SERVICE INFORMATION

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AUDIO/VIDEO - SERVICE INFORMATION

DESCRIPTION

Several combinations of radio receivers and speaker systems are offered on this vehicle. The audio system receives fused battery current from a fuse in the Integrated Power Module (IPM). The audio system includes the following components:

- Antenna
- Amplifier
- Clockspring (with remote radio switches only)
- Radio noise suppression components
- Radio receiver
- Remote radio switches (if equipped)
- Speakers

DIAGNOSIS AND TESTING

AUDIO SYSTEM

Any diagnosis of the Audio system should begin with the use of a scan tool and the appropriate Diagnostic Service information.

Refer to the appropriate wiring information.

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

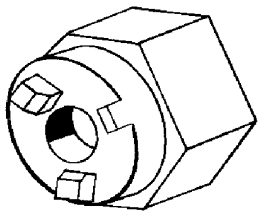
AUDIO SYSTEM DIAGNOSIS TABLE

CONDITION	POSSIBLE CAUSES	CORRECTION
NO AUDIO	1. Fuse inoperative.	1. Check radio fuse and Ignition-Off Draw (IOD) fuse in the Integrated Power Module (IPM). Replace fuses, if required.
	2. Radio/amplifier (if equipped) connector damaged.	2. Check for loose or corroded radio/amplifier connector. Repair, if required.
	3. Wiring damaged.	3. Check for shorted or open wires. Repair wiring, if required.
	4. Radio/amplifier (if equipped) ground damaged.	4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	5. Radio/amplifier (if equipped) inoperative.	5. Refer to appropriate Diagnostic Service Information.
	6. Speakers inoperative.	6. Refer to speaker diagnosis.
NO RADIO DISPLAY	1. Fuse inoperative.	1. Check radio fuse and Ignition-Off Draw (IOD) fuse in Integrated Power Module (IPM). Replace fuses, if required.
	2. Radio connector damaged.	2. Check for loose or corroded radio connector. Repair, if required.
	3. Wiring damaged.	3. Check for battery voltage at radio connector. Repair wiring, if required.
	4. Radio ground damaged.	4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	5. Radio inoperative.	5. Refer to appropriate Diagnostic Service Information.

CONDITION	POSSIBLE CAUSES	CORRECTION
CLOCK WILL NOT KEEP SET TIME	1. Fuse inoperative.	1. Check Ignition-Off Draw (IOD) fuse in the Integrated Power Module (IPM). Replace fuse, if required.
	2. Radio connector damaged.	2. Check for loose or corroded radio connector. Repair, if required.
	3. Wiring damaged.	3. Check for battery voltage at radio connector. Repair wiring, if required.
	4. Radio ground faulty.	4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	5. Radio inoperative.	5. Refer to appropriate Diagnostic Service Information.
POOR RADIO RECEPTION	1. Antenna inoperative.	1. (Refer to 8 - ELECTRICAL/AUDIO/ANTENNA BODY & CABLE - DIAGNOSIS AND TESTING).
	2. Radio ground damaged.	2. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	3. Radio noise suppression damaged.	3. Repair or replace ground strap as necessary.
	4. Radio inoperative.	4. Refer to appropriate Diagnostic Service Information.
SOUND DISTORTION (VIBRATION FROM SPEAKER AREA, BUZZING - HUMMING)	1. Door trim panel loose or missing fasteners.	1. Inspect door trim panel and correct as necessary. Replace any misssing fasteners.
	2. Water shield loose or misaligned.	2. Inspect water shield and adjust as required.
	3. Items placed in door trim panel map pockets vibrating or moving from side to side.	3. Remove items from door trim panel. Ensure that vibration is no longer present.
NO COMPACT DISC OPERATION	1. CD faulty.	1. Insert known good CD and test operation.
	2. Foreign material on CD.	2. Clean CD and test operation.
	3. Condensation on CD or optics.	3. Allow temperature of vehicle interior to stabilize and test operation.
	4. Radio inoperative.	4. Refer to appropriate Diagnostic Service Information.

SPECIAL TOOLS

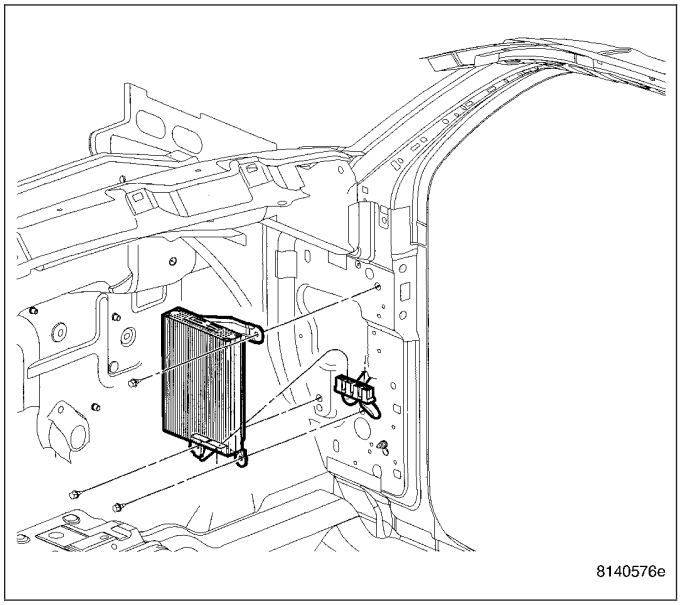
AUDIO SYSTEMS



AMPLIFIER-RADIO

DESCRIPTION

The amplifier is a six channel unit rated at 288 watts. The amplifier is mounted to the cowl side panel under the passenger side of the instrument panel.



OPERATION

The amplifier receives fused battery current from a fuse in the Integrated Power Module (IPM) at all times. The internal circuitry of the amplifier switches the amplifier on based upon a CAN bus message that is received from the radio receiver whenever the radio is turned on. The amplifier receives the sound signal inputs from the left and right rear outputs of the radio, then sends the amplified speaker outputs for each of those channels to the speakers.

DIAGNOSIS AND TESTING

AMPLIFIER

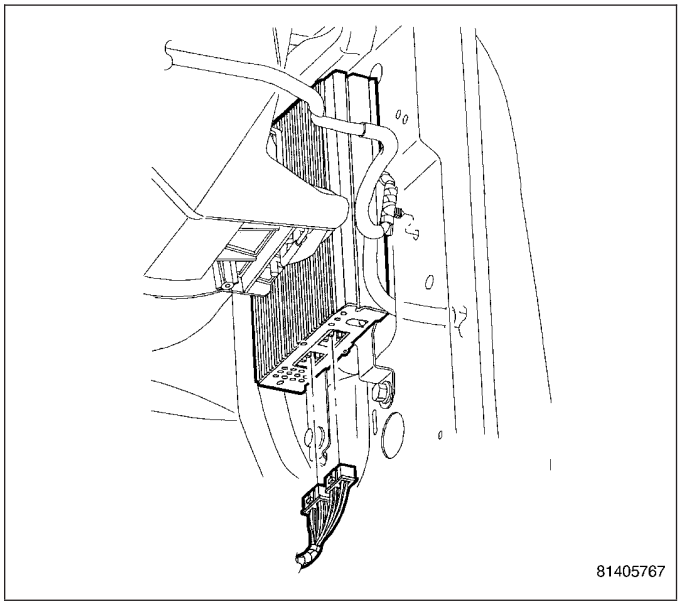
Any diagnosis of the Audio system should begin with the use of a scan tool and the appropriate Diagnostic Service information.

Refer to the appropriate wiring information.

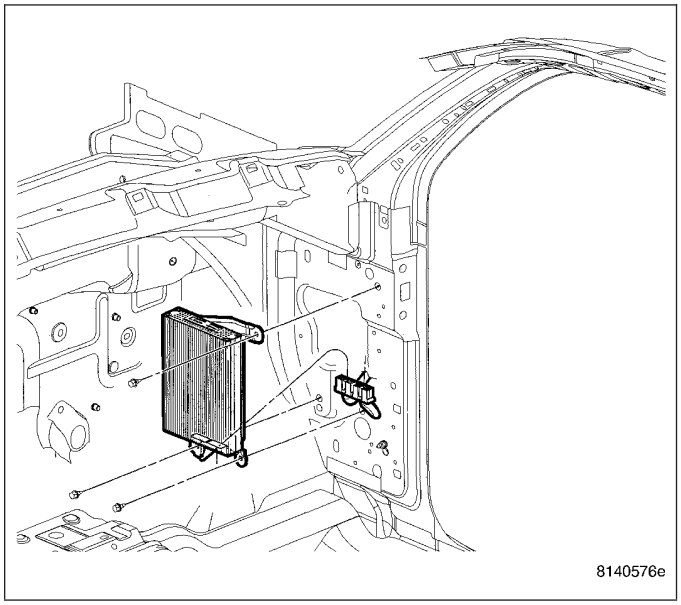
The amplifier unit should be checked if there is no sound output noted from the speakers. For diagnosis of the power amplifier, (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - DIAGNOSIS AND TESTING).

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the right cowl side trim panel.
3. Disconnect electrical harness connectors.

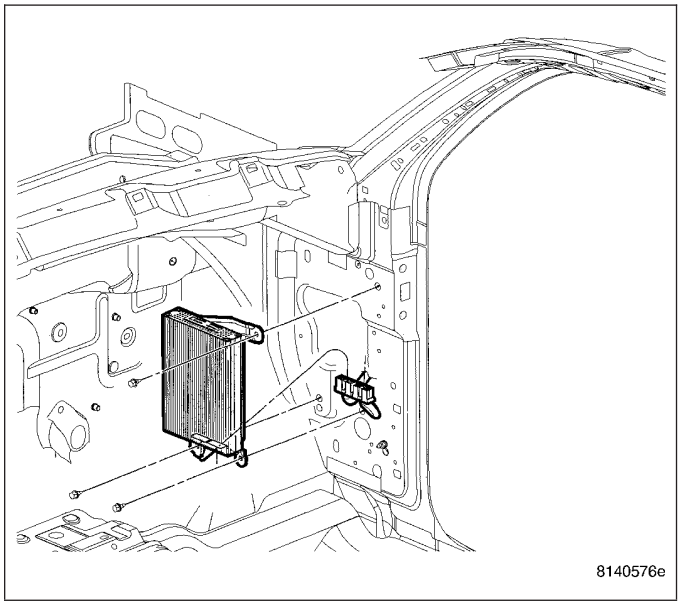


4. Remove mounting fasteners and amplifier.

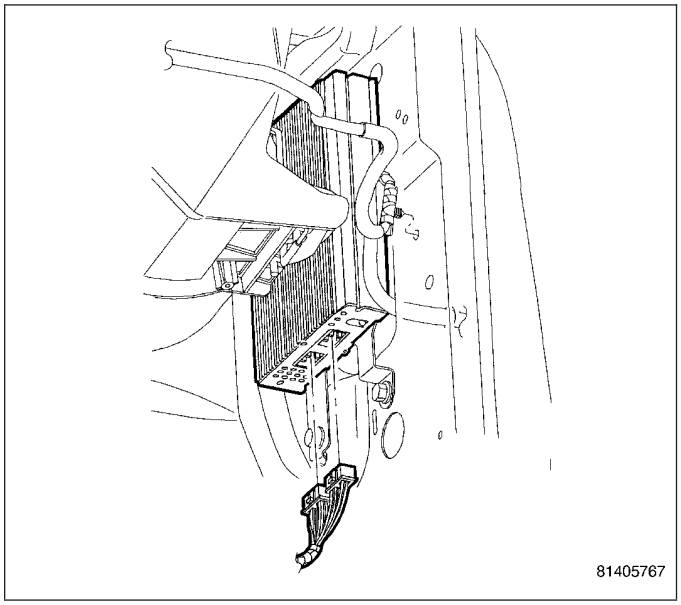


INSTALLATION

1. Place amplifier into position
2. Install and tighten mounting fasteners.



3. Connect wire harness connectors to amplifier.
4. Install right cowl side trim panel.
5. Connect battery negative cable.

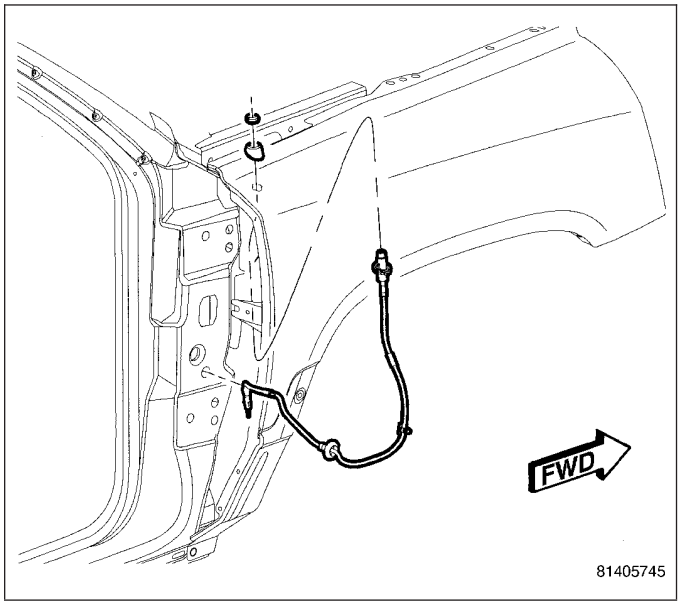


ANTENNA BODY & CABLE

DESCRIPTION

A fixed-length stainless steel antenna mast is used, installed on the right front fender of the vehicle. The antenna mast is connected to the center wire of the coaxial antenna cable, and is not grounded to any part of the vehicle. To eliminate static, the antenna base must have a good ground. The coaxial antenna cable shield (the outer wire mesh of the cable) is grounded to the antenna base and the radio receiver chassis.

The antenna coaxial cable has an additional disconnect, located near the outboard side of the glove box opening on the back side of the lower instrument panel reinforcement.



DIAGNOSIS AND TESTING

ANTENNA BODY AND CABLE

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The following four tests are used to diagnose the antenna with an ohmmeter:

- **Test 1** - Mast to ground test
- **Test 2** - Tip-of-mast to tip-of-conductor test
- **Test 3** - Body ground to battery ground test
- **Test 4** - Body ground to coaxial shield test.

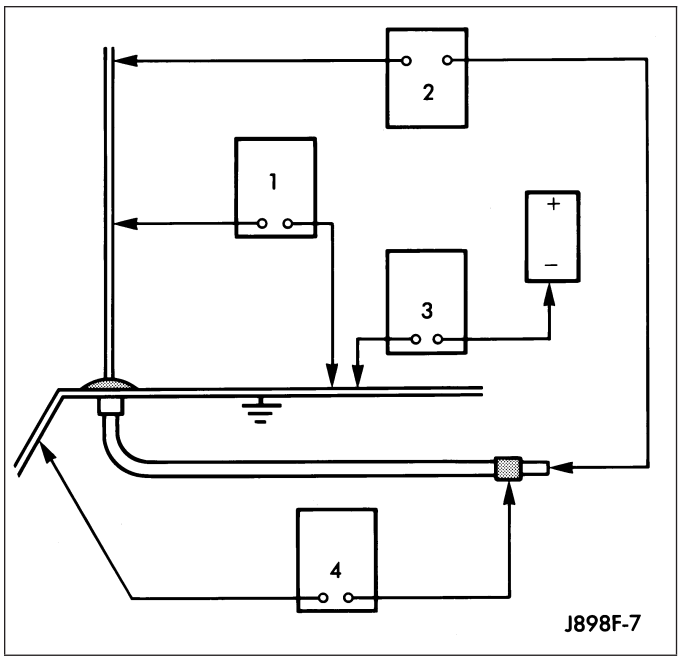
The ohmmeter test lead connections for each test are shown in Antenna Tests.

NOTE: This model has a two-piece antenna coaxial cable. Tests 2 and 4 must be conducted in two steps to isolate a coaxial cable problem; from the coaxial cable connection under the right end of the instrument panel near the outboard side of the glove box opening to the antenna base, and then from the coaxial cable connection to the radio chassis connection.

TEST 1

Test 1 determines if the antenna mast is insulated from the base. Proceed as follows:

1. Disconnect the antenna coaxial cable connector from the radio receiver chassis and isolate.
2. Connect one ohmmeter test lead to the antenna mast in the center of the antenna base. Connect the other test lead to the perimeter of the antenna base. Check for continuity.
3. There should be no continuity. If continuity is found, replace the faulty or damaged antenna base and cable assembly.



TEST 2

Test 2 checks the antenna for an open circuit as follows:

1. Disconnect the antenna coaxial cable connector from the radio receiver chassis.
2. Connect one ohmmeter test lead to the antenna mast in the center of the antenna base. Connect the other test lead to the center pin of the antenna coaxial cable connector.
3. Continuity should exist (the ohmmeter should only register a fraction of an ohm). High or infinite resistance indicates damage to the base and cable assembly. Replace the faulty base and cable, if required.

TEST 3

Test 3 checks the condition of the vehicle body ground connection. This test should be performed with the battery positive cable removed from the battery. Disconnect both battery cables, the negative cable first. Reconnect the battery negative cable and perform the test as follows:

1. Connect one ohmmeter test lead to the vehicle fender. Connect the other test lead to the battery negative terminal post.
2. The resistance should be less than one ohm.
3. If the resistance is more than one ohm, check the braided ground strap(s) connected to the engine and the vehicle body for being loose, corroded, or damaged. Repair the ground strap connections, if required.

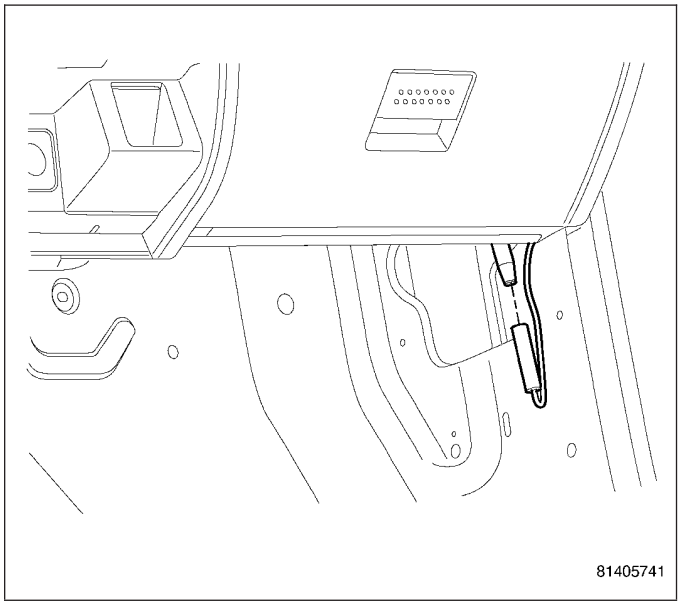
TEST 4

Test 4 checks the condition of the ground between the antenna base and the vehicle body as follows:

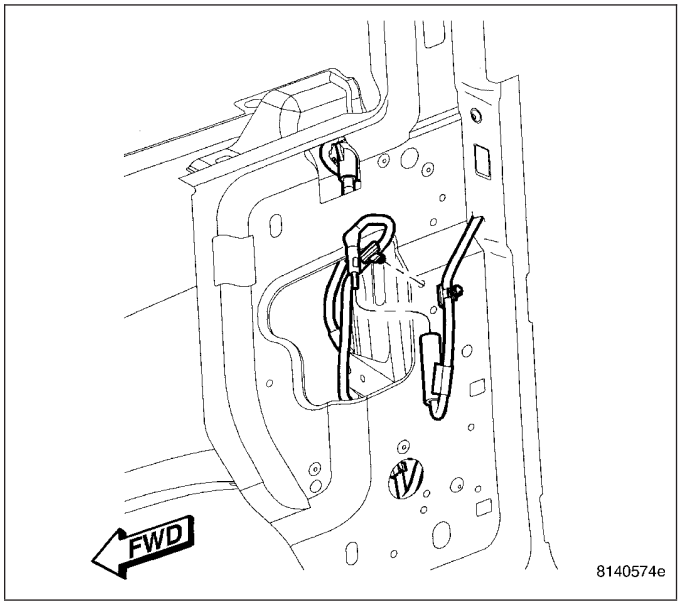
1. Connect one ohmmeter test lead to the vehicle fender. Connect the other test lead to the outer crimp on the antenna coaxial cable connector.
2. The resistance should be less then one ohm.
3. If the resistance is more then one ohm, clean and/or tighten the antenna base to fender mounting hardware.

REMOVAL

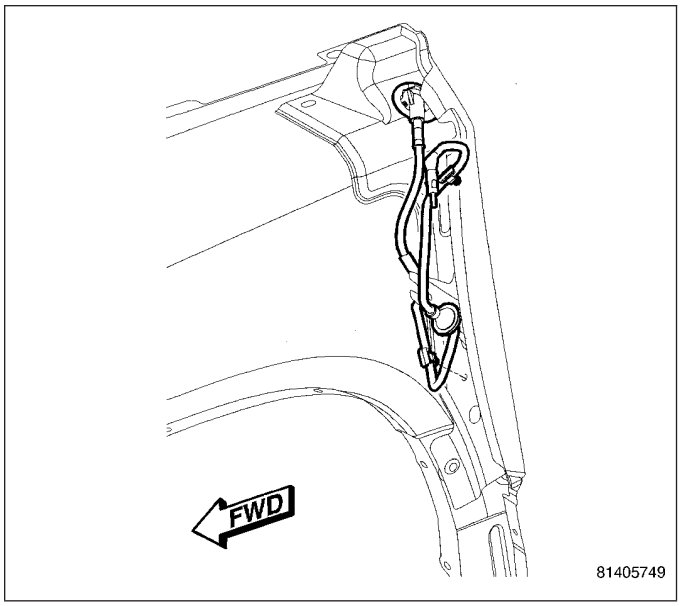
1. Disconnect and isolate the battery negative cable.
2. Remove the right cowl side trim panel.
3. Reach under the instrument panel outboard of the glove box to access and disconnect the antenna coaxial cable connector. Disconnect the connector by pulling it apart while twisting the metal connector halves. Do not pull on the cable.



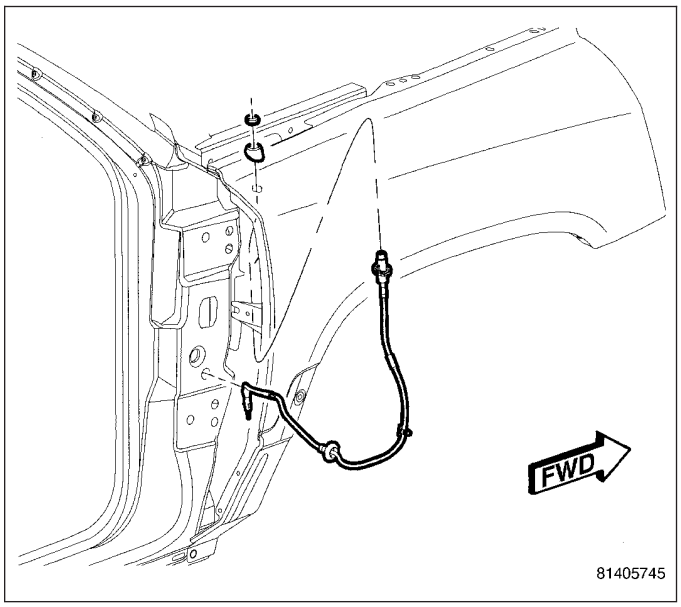
4. Disengage the antenna coaxial cable retainer at the right cowl side inner panel.



5. Remove the right side front fender liner.
6. Unscrew the antenna mast from the antenna body.
7. Remove the antenna cap nut using an antenna nut wrench (Special Tool C-4816)
8. Remove the antenna adapter from the top of the fender.
9. Lower the antenna body through the mounting hole in the top of the fender.

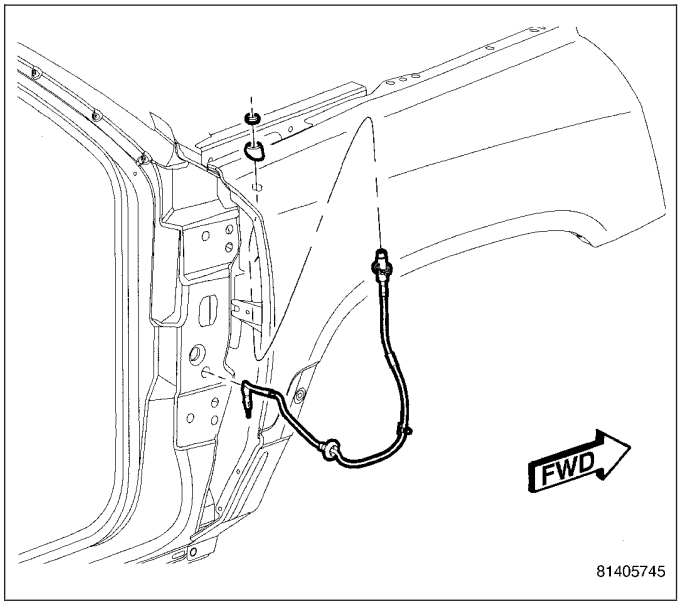


10. Disengage the antenna coaxial cable grommet from the hole in the right cowl side outer panel.
11. Pull the antenna body and cable out through the opening between the right cowl side outer panel and the fender.

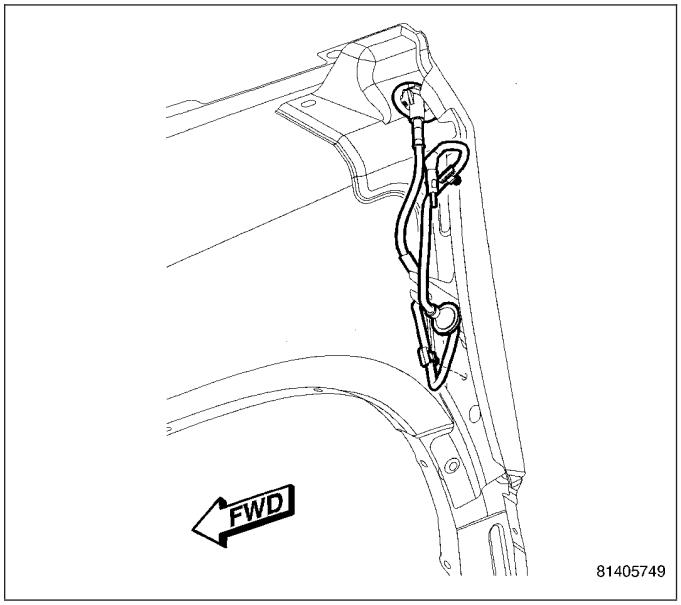


INSTALLATION

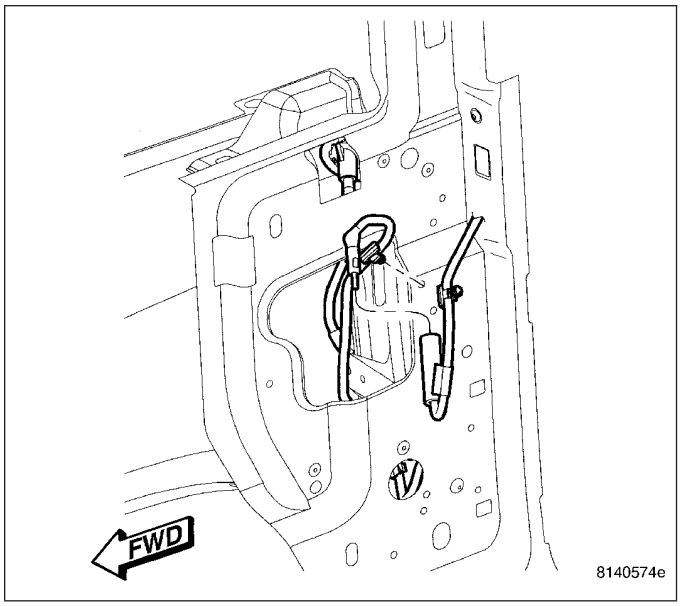
1. Position the antenna body and cable in the opening between the right cowl side outer panel and the fender.
2. Push the antenna coaxial cable into the passenger compartment through the hole in the right cowl side outer panel.
3. Engage the antenna coaxial cable grommet in the hole in the right cowl side outer panel.
4. Position the antenna body through the mounting hole in the top of the fender.



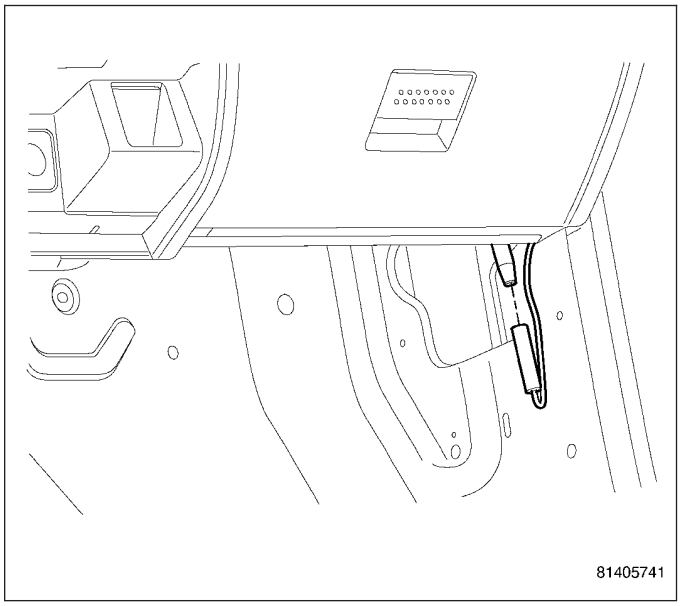
5. Install the adapter over the antenna body from the top of the fender.
6. Install and tighten the antenna cap nut using an antenna nut wrench (Special Tool C-4816).
7. Install and tighten the antenna mast onto the antenna body.



8. Engage the antenna coaxial cable retainers at the right cowl side inner panel and inside the right front fender.
9. Engage the antenna coaxial cable in the retainer clips on the lower instrument panel support and the glovebox.



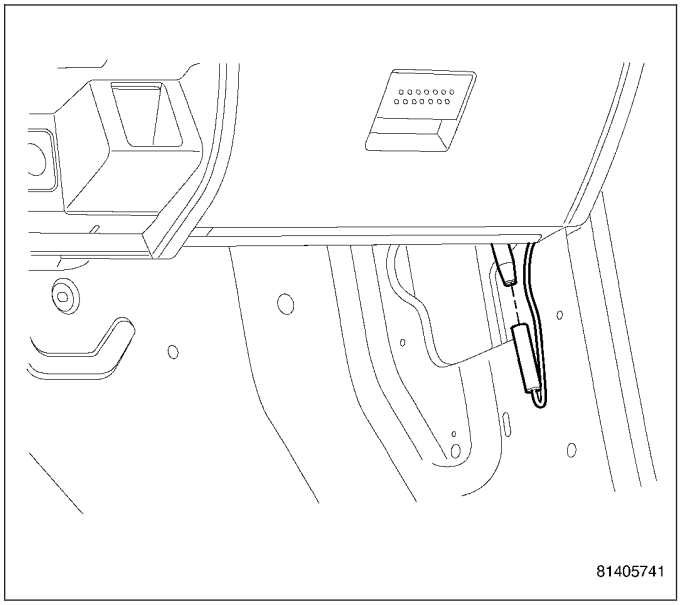
10. Reach under the instrument panel outboard of the glove box to reconnect the antenna coaxial cable connector.
11. Install the right cowl side trim panel.
12. Install the right side front fender liner.
13. Connect the battery negative cable.



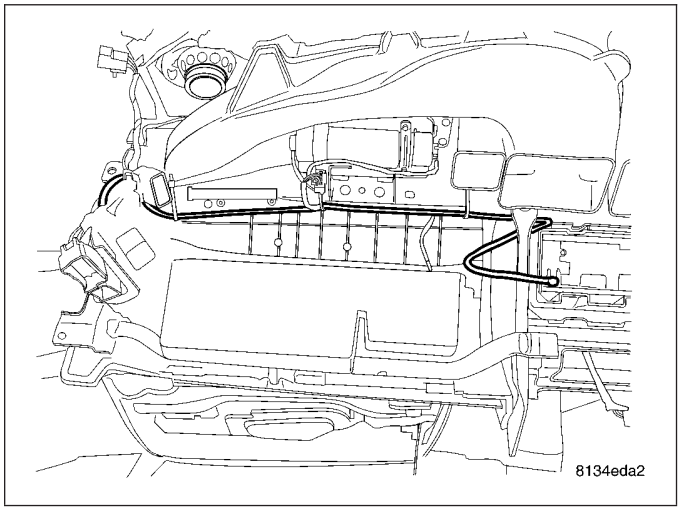
ANTENNA CABLE- INSTRUMENT PANEL

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the right cowl side trim panel.
3. Reach under the instrument panel outboard of the glove box to access and disconnect the antenna coaxial cable connector. Disconnect the connector by pulling it apart while twisting the metal connector halves. Do not pull on the cable.



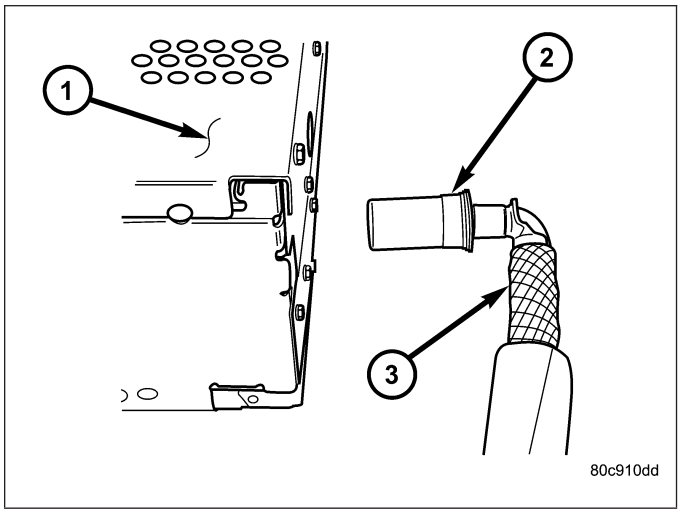
4. Disengage the instrument panel antenna cable from the retainer clips on the glove box opening and instrument panel support.



5. Remove the radio (1) (Refer to 8 - ELECTRICAL/ AUDIO/RADIO - REMOVAL).

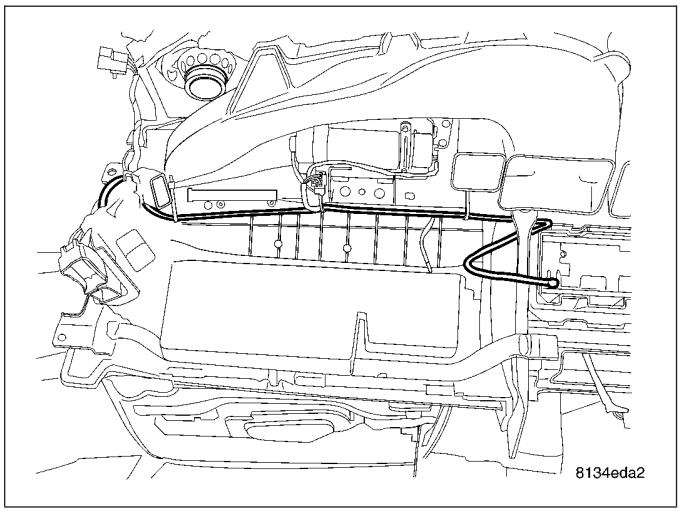
CAUTION: Pulling the antenna cable straight out of the radio without pulling on the locking antenna connector could damage the cable or radio.

6. Disconnect the antenna cable by pulling the locking antenna connector (2) away from the radio.
7. Pull the antenna cable out through the radio opening in the instrument panel.

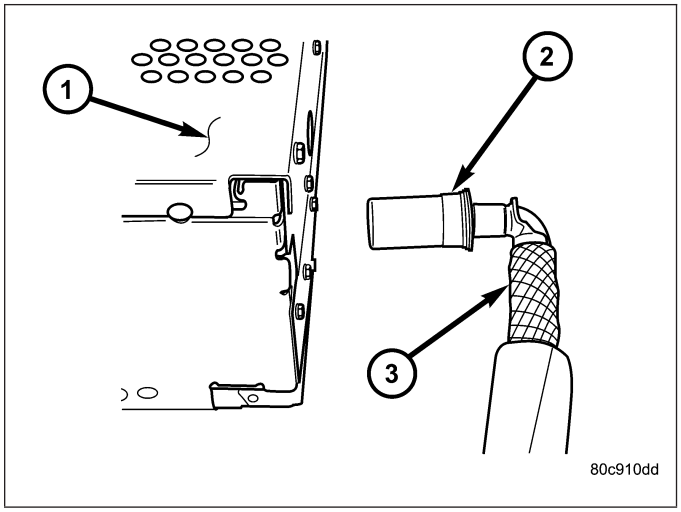


INSTALLATION

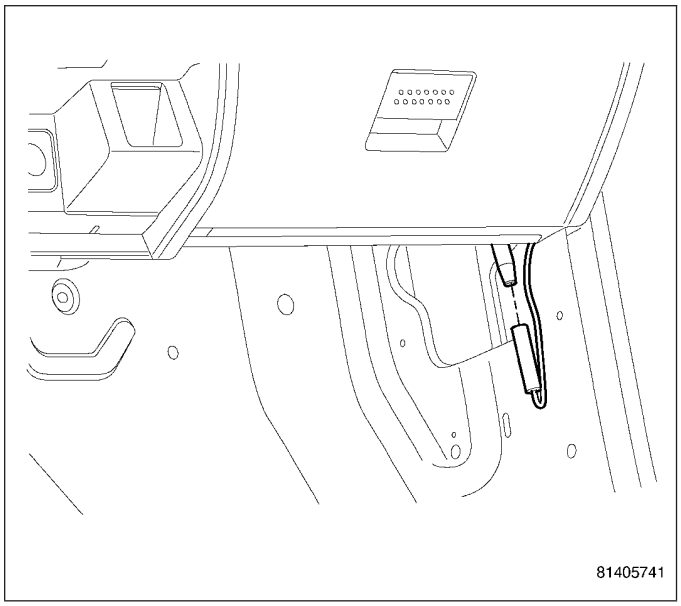
1. Insert cable through radio opening. Route behind glove box and attach to retainers.



2. Connect antenna cable (2) to radio (1).
3. Install the radio.



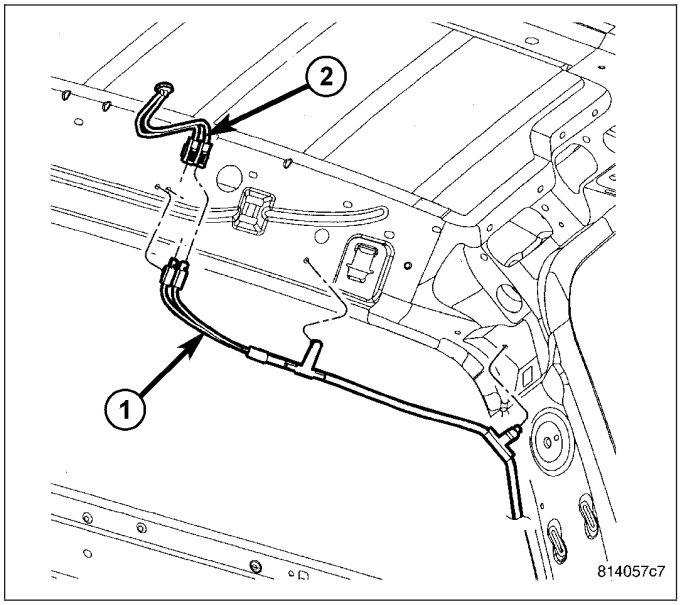
4. Reach under the instrument panel outboard of the glove box to access and connect the antenna coaxial cable connector.
5. Install right cowl side trim panel.
6. Connect the battery negative cable.



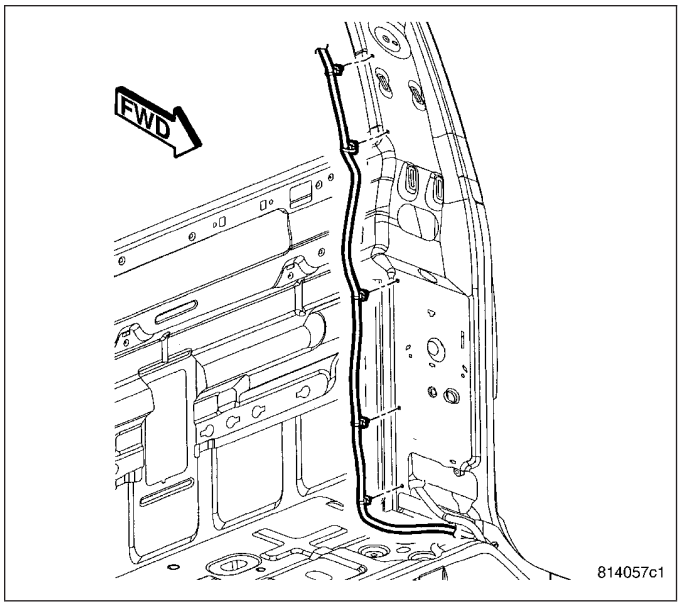
ANTENNA CABLE - SATELLITE RADIO

REMOVAL

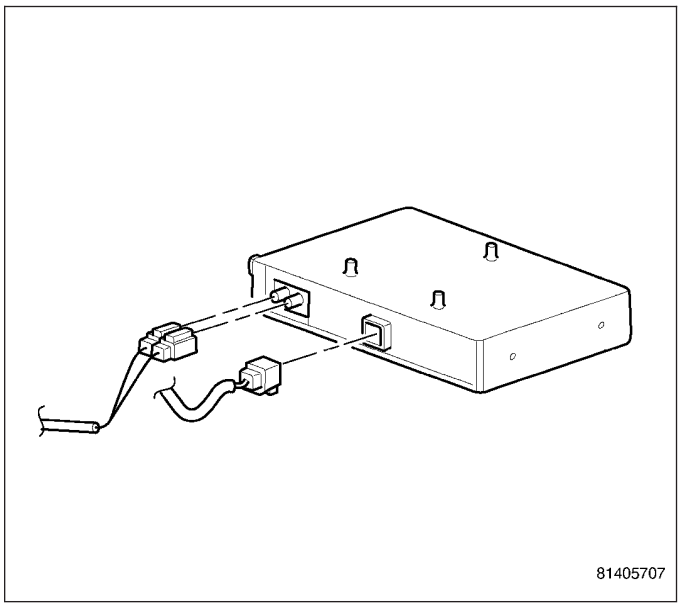
1. Disconnect and isolate the battery cable.
2. Remove headliner (Refer to 23 - BODY/INTERIOR/ HEADLINER - REMOVAL).
3. Disconnect antenna cable (1) from antenna (2).



4. Remove antenna cable retainers from C-pillar and roof panel.

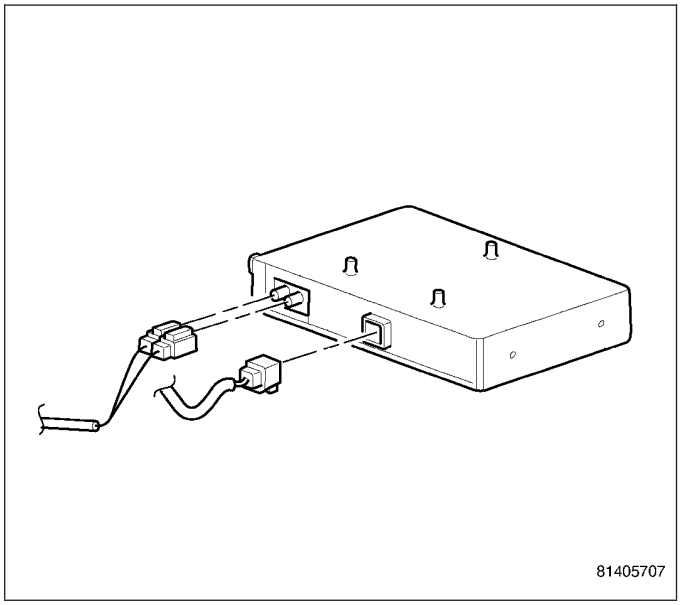


5. Disconnect antenna cable from satellite receiver.

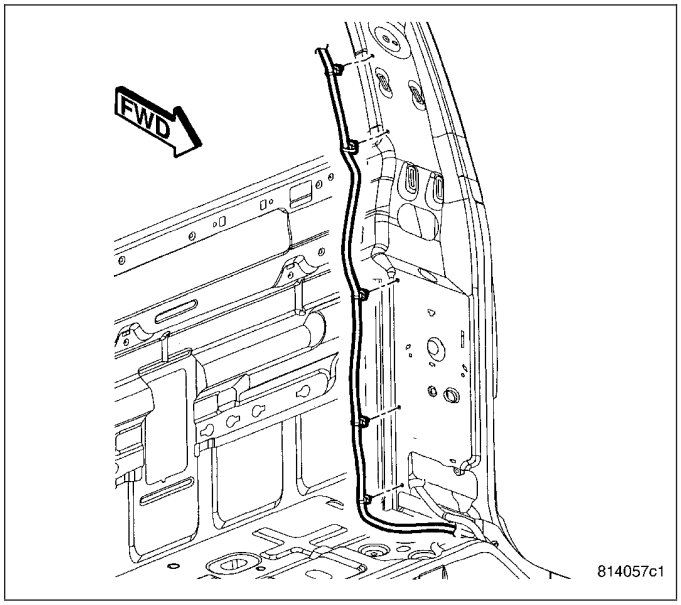


INSTALLATION

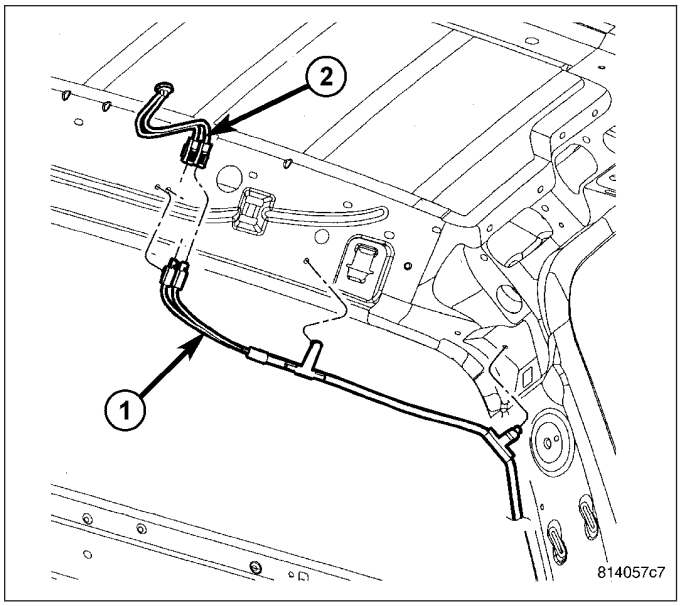
1. Connect antenna cable to satellite receiver.



2. Install antenna cable retainers to C-pillar and roof panel.



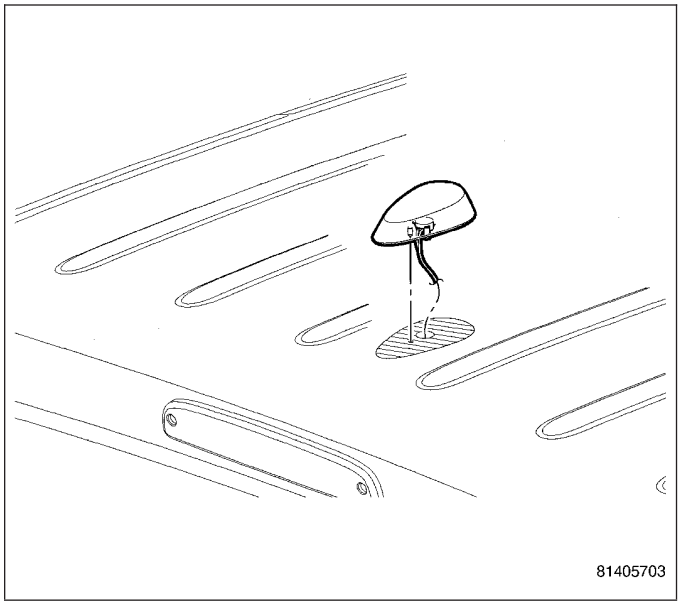
3. Connect antenna cable (1) to satellite antenna (2).
4. Install headliner (Refer to 23 - BODY/INTERIOR/ HEADLINER - INSTALLATION).
5. Connect battery negative cable.



ANTENNA-SATELLITE RADIO

DESCRIPTION

The satellite radio antenna is secured by a threaded fastener and two retainers which protrude through a hole in the roof panel. Two antenna cables from the antenna are connected to the satellite receiver.

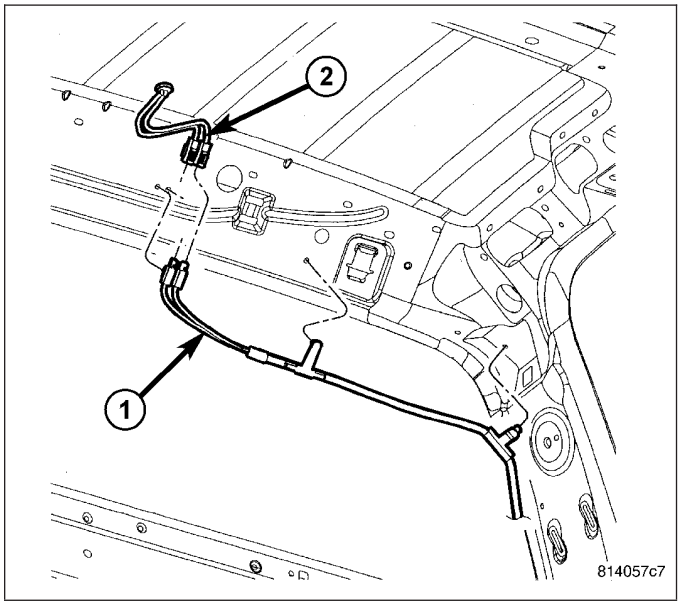


OPERATION

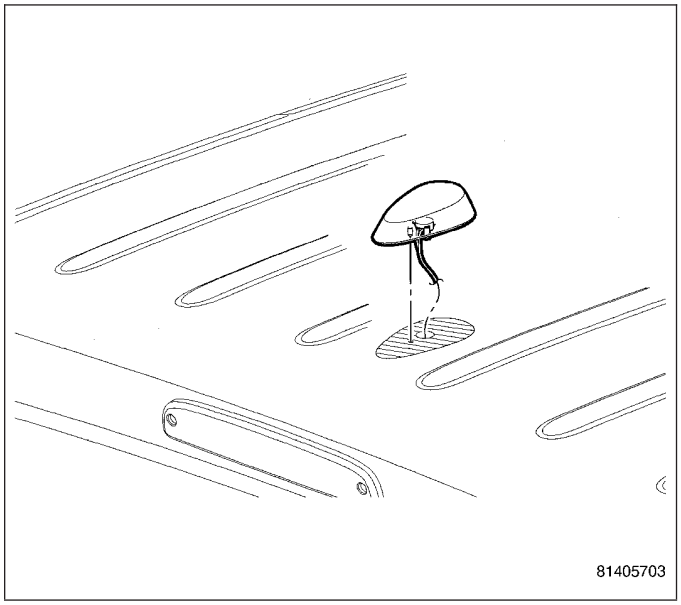
The satellite radio antenna receives signals from orbiting satellites and sends these signals to the satellite receiver module. The satellite radio antenna must have open space in which to operate. Items carried on the roof, parking inside etc. can have an effect on the antenna's ability to receive signals.

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the headliner (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL).
3. Disconnect the antenna cables (1) from the antenna (2).

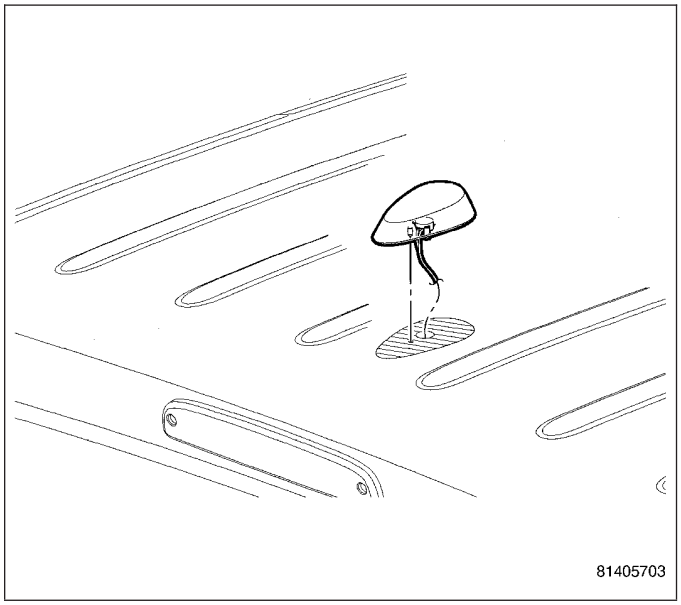


4. Remove the retaining fastener.
5. From inside the vehicle, and using a flat bladed tool, depress one of the retaining tabs on the antenna. Push up the one side of the antenna connector through the roof panel. Depress the other side of the connector and remove the antenna.

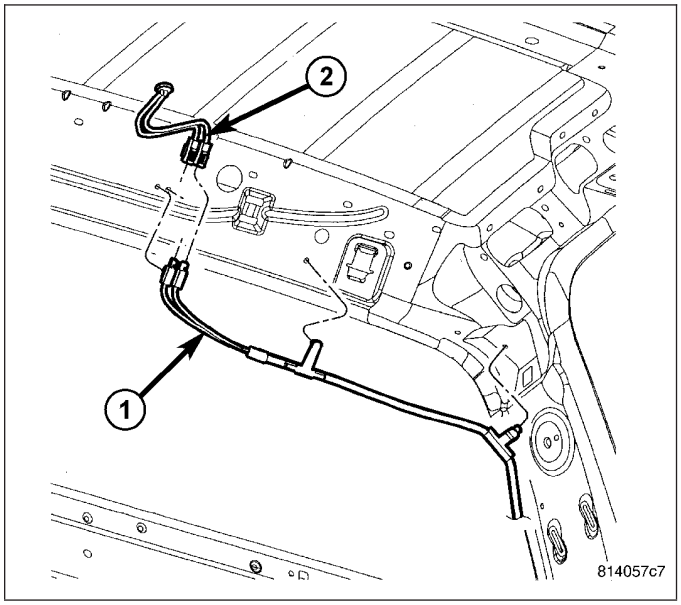


INSTALLATION

1. Insert wire harness through hole in roof panel. Press antenna into position until both retainers snap into place.
2. Install and tighten retaining fastener.



3. Connect antenna cable connectors (1) to antenna (2).
4. Install headliner (Refer to 23 - BODY/INTERIOR/ HEADLINER - INSTALLATION).
5. Connect battery negative cable.

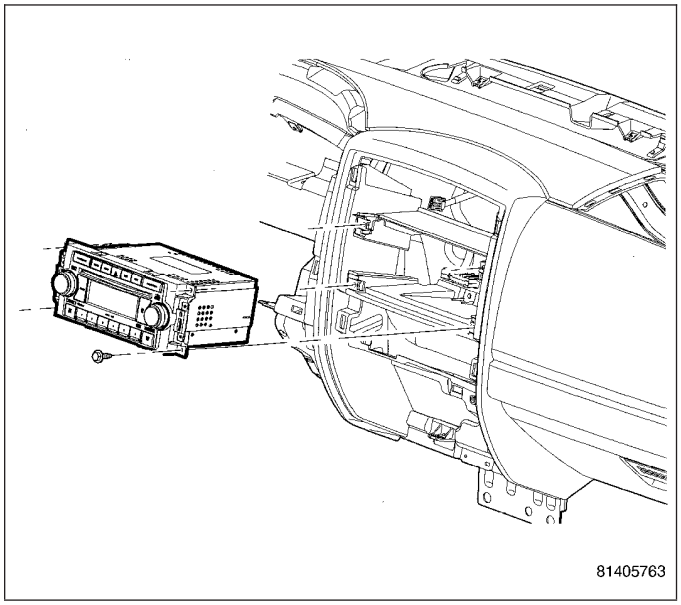


RADIO

DESCRIPTION

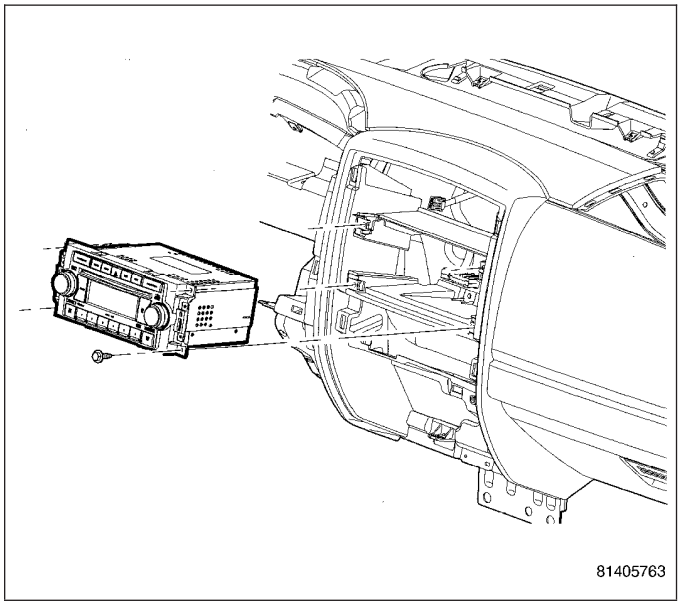
Available radios include:

- AM/FM/CD (REF sales code)
- AM/FM/6 disc CD/MP3 (RAQ sales code)
- AM/FM/CD/RDS (RAR sales code) - export only



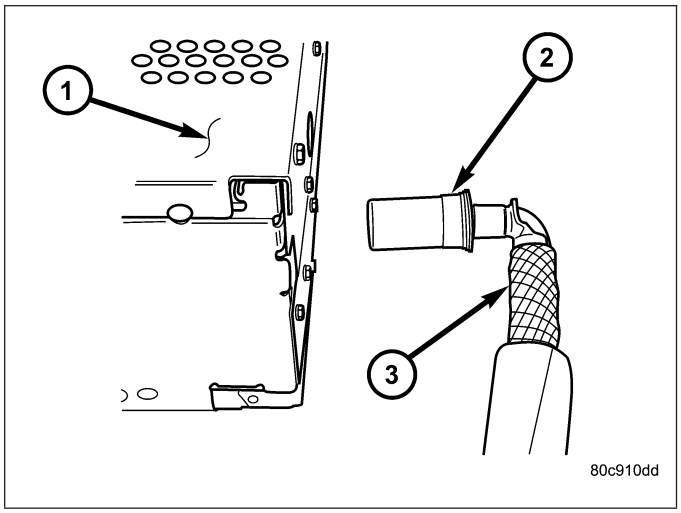
REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the instrument panel center bezel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL).
3. Remove the radio mounting fasteners.

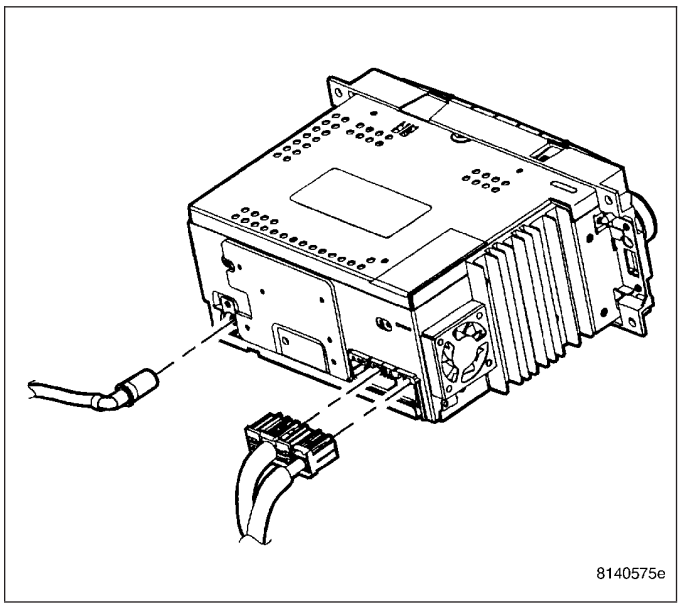


CAUTION: Pulling the antenna cable straight out of the radio without pulling on the locking antenna connector could damage the cable or radio.

4. Disconnect the antenna cable (3) by pulling the locking antenna connector (2) away from the radio (1).

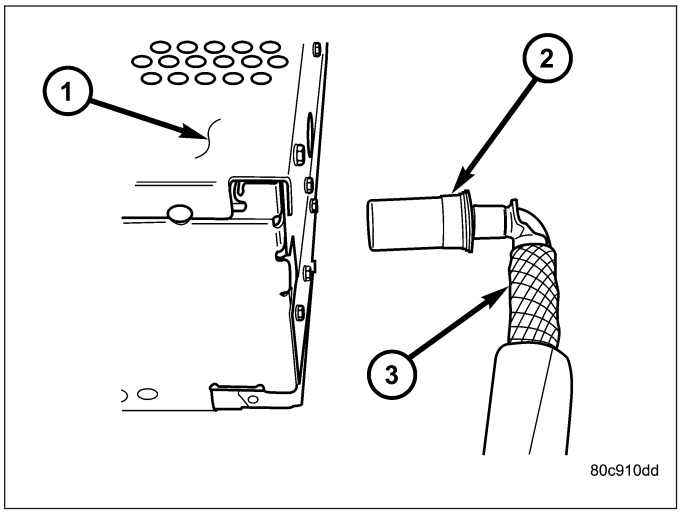


5. Disconnect the electrical harness connector and remove radio.

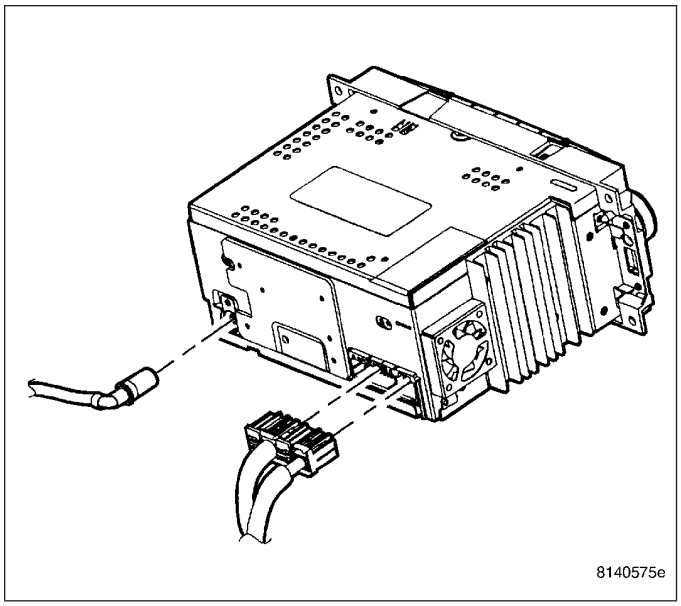


INSTALLATION

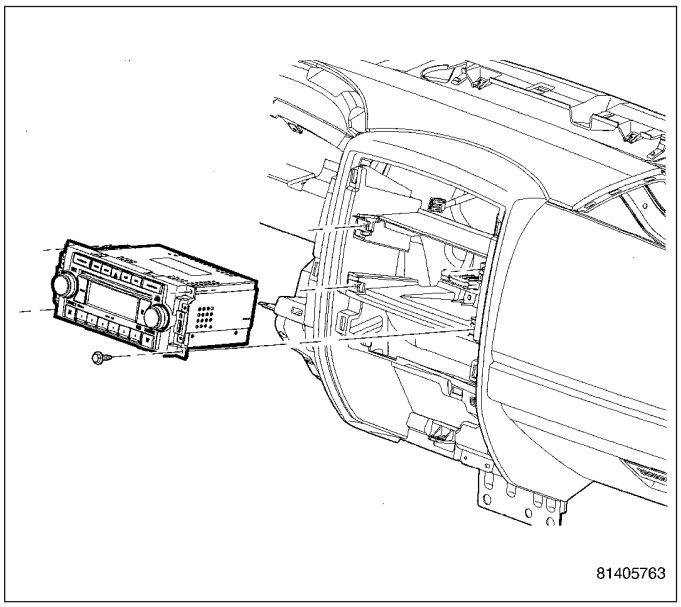
1. Connect the antenna cable (3) to radio.



2. Connect the electrical harness connector to the radio.



3. Position radio to instrument panel. Install and tighten mounting fasteners.
4. Install instrument panel center bezel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).



RADIO NOISE SUPPRESSION COMPONENTS

DESCRIPTION

Radio noise suppression devices are installed on this vehicle. Radio Frequency Interference (RFI) and ElectroMagnetic Interference (EMI) can be produced by any on-board or external source of electromagnetic energy. These electromagnetic energy sources can radiate electromagnetic signals through the air, or conduct them through the vehicle electrical system.

When the audio system converts RFI or EMI to an audible acoustic wave form, it is referred to as radio noise. This undesirable radio noise is generally manifested in the form of “buzzing,” “hissing,” “popping,” “clicking,” “crackling,” and/or “whirring” sounds. In most cases, RFI and EMI radio noise can be suppressed using a combination of vehicle and component grounding, filtering and shielding techniques. This vehicle is equipped with radio noise suppression devices that were designed to minimize exposure to typical sources of RFI and EMI; thereby, minimizing radio noise complaints.

Radio noise suppression is accomplished primarily through circuitry or devices that are integral to the radios, audio power amplifiers and other on-board electrical components such as generators, wiper motors, blower motors, and

fuel pumps that have been found to be potential sources of RFI or EMI. External radio noise suppression devices that are used on this vehicle to control RFI or EMI, and can be serviced, include the following:

- **Engine-to-bulkhead ground strap** - This length of braided ground strap has an eyelet terminal connector crimped to each end. One end is secured to the engine cylinder heads. The other is secured to the bulkhead.
- **Resistor-type spark plugs** - This type of spark plug has an internal resistor connected in series between the spark plug terminal and the center electrode to help reduce the production of electromagnetic radiation that can result in radio noise.
- **Exhaust-to-frame ground strap** - This length of braided ground strap has an eyelet terminal connector crimped to each end. One end is secured to the exhaust pipe. The other is secured to the frame.

OPERATION

There are two common strategies that can be used to suppress Radio Frequency Interference (RFI) and Electro-Magnetic Interference (EMI) radio noise. The first suppression strategy involves preventing the production of RFI and EMI electromagnetic signals at their sources. The second suppression strategy involves preventing the reception of RFI and EMI electromagnetic signals by the audio system components.

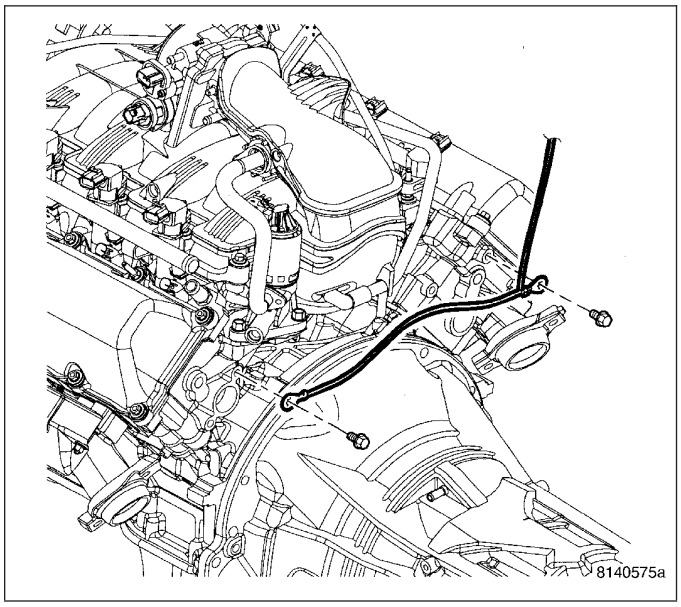
The use of braided ground straps in key locations is part of the RFI and EMI prevention strategy. These ground straps ensure adequate ground paths, particularly for high current components such as many of those found in the starting, charging, ignition, engine control and transmission control systems. An insufficient ground path for any of these high current components may result in radio noise caused by induced voltages created as the high current seeks alternative ground paths through components or circuits intended for use by, or in close proximity to the audio system components or circuits.

Preventing the reception of RFI and EMI is accomplished by ensuring that the audio system components are correctly installed in the vehicle. Loose, corroded or improperly soldered wire harness connections, improperly routed wiring and inadequate audio system component grounding can all contribute to the reception of RFI and EMI. A properly grounded antenna body and radio chassis, as well as a shielded antenna coaxial cable with clean and tight connections will each help reduce the potential for reception of RFI and EMI.

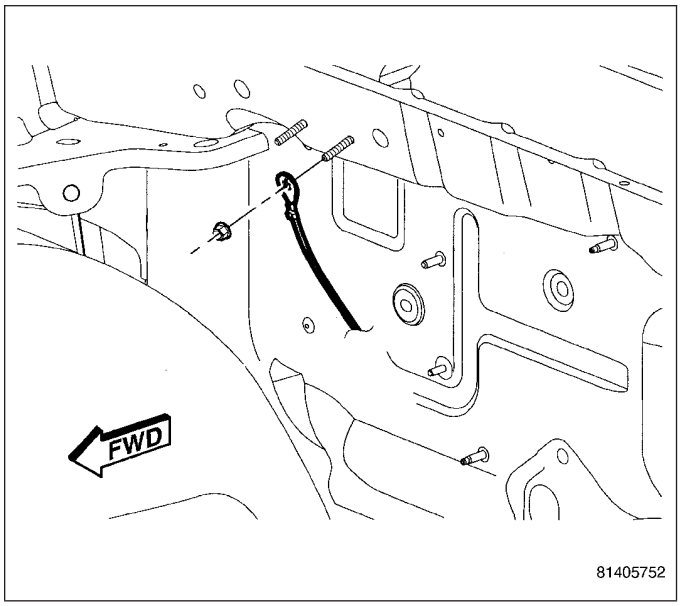
REMOVAL

ENGINE GROUND STRAP

1. Disconnect and isolate the battery negative cable.
2. Remove the mounting fasteners from the engine cylinder heads.

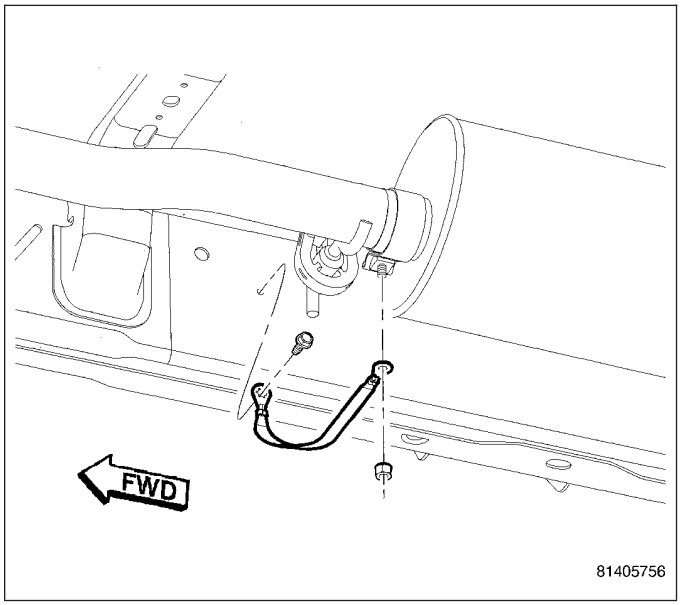


3. Remove mounting fastener from bulkhead and remove strap.



EXHAUST GROUND STRAP

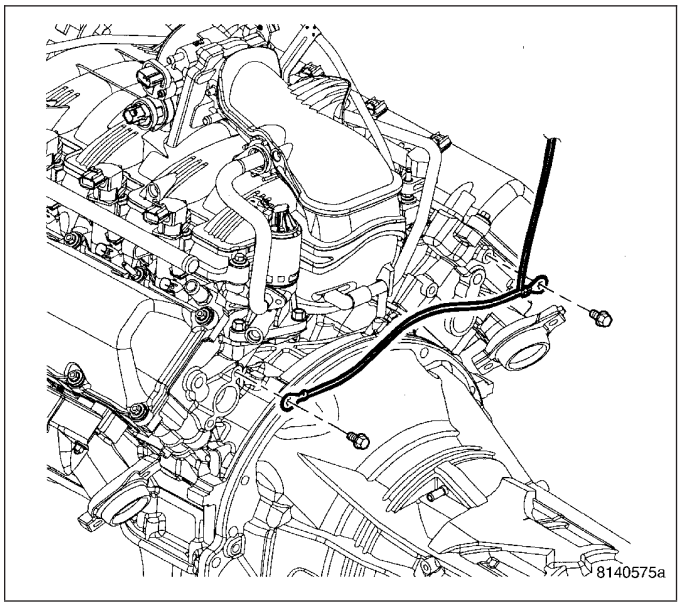
1. Disconnect and isolate the battery negative cable.
2. Remove mounting fastener from exhaust pipe.
3. Remove mounting fastener from frame and remove ground strap.



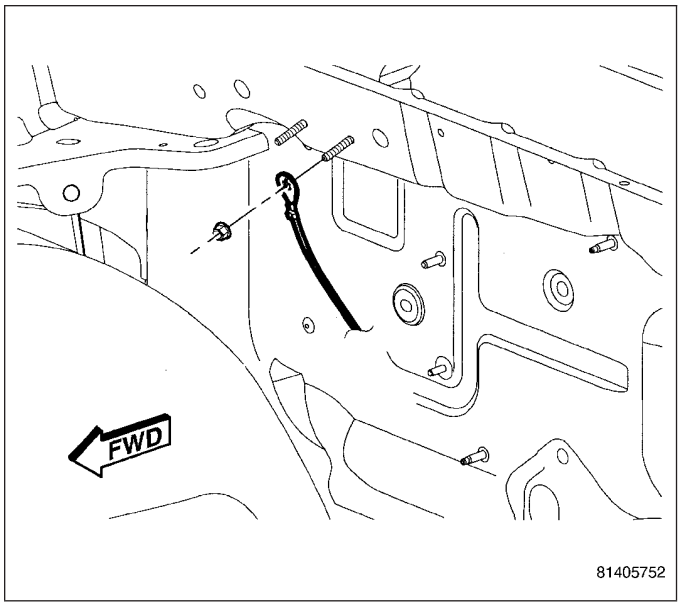
INSTALLATION

ENGINE GROUND STRAP

1. Position ground strap to engine and install mounting fasteners.
2. Tighten mounting fasteners.

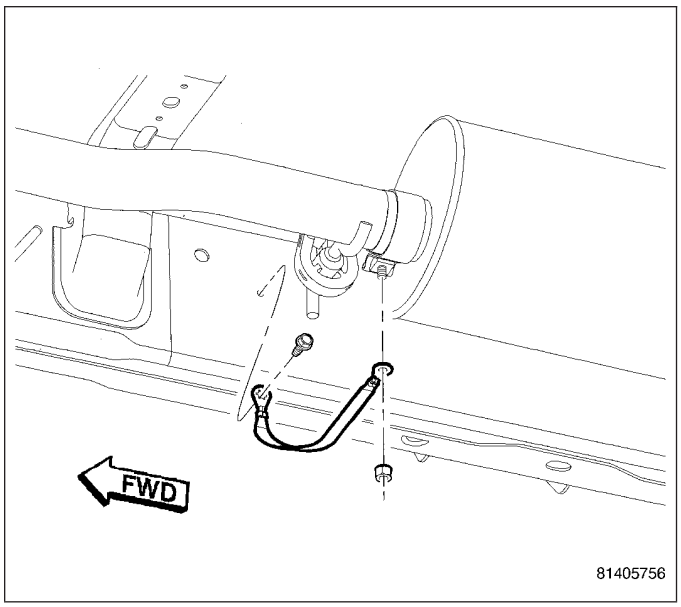


3. Position ground strap to bulkhead and install mounting fastener.
4. Tighten mounting fastener.
5. Connect battery negative cable.



EXHAUST GROUND STRAP

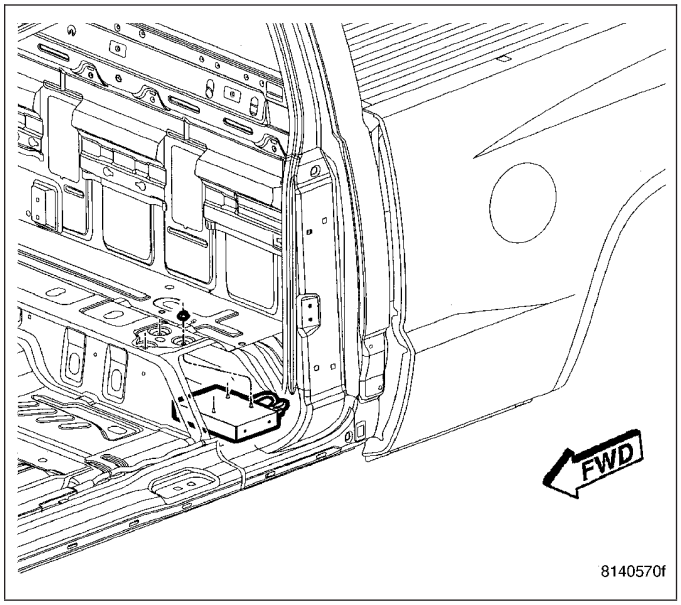
1. Position ground strap to exhaust pipe and install mounting fastener.
2. Tighten mounting fastener.
3. Position ground strap to frame and install mounting fastener.
4. Tighten mounting fastener.
5. Connect battery negative cable.



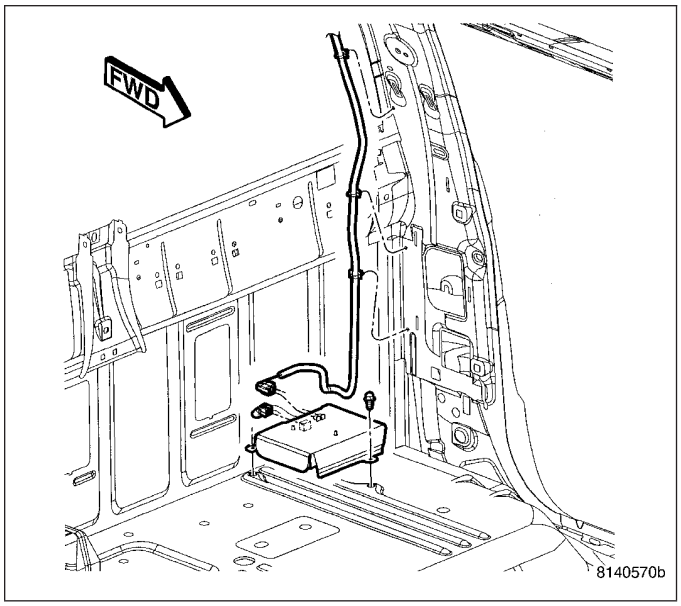
RECEIVER-SATELLITE

DESCRIPTION

The satellite receiver module on the club cab is located below the left rear passenger seat. It is mounted to the underside of the seat support with three mounting fasteners.



The satellite receiver module on the quad cab is located in the left rear corner of the cab, under the rear seat. It is mounted to the floor panel with three mounting fasteners.



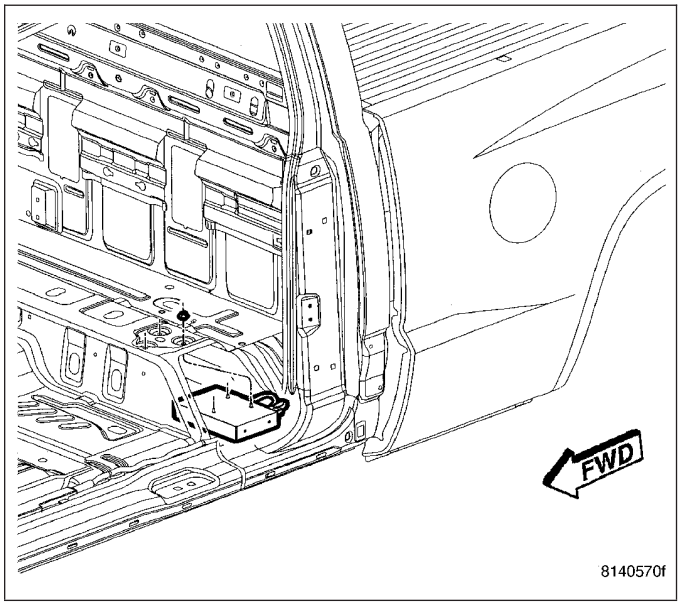
OPERATION

The satellite receiver module receives signals from the roof mounted antenna and processes this information before it is sent to the radio. The module operates on both battery feed circuits and CAN bus messages. It will operate with the ignition key in the run or accessory position only.

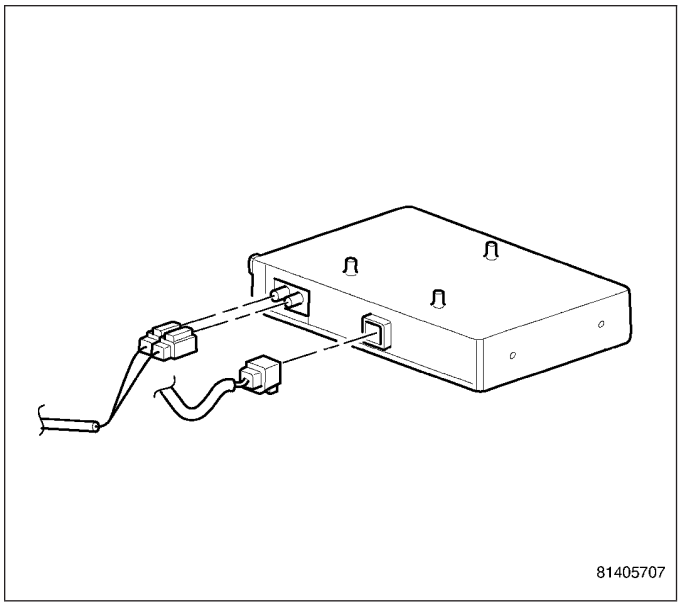
REMOVAL

CLUB CAB

1. Disconnect and isolate the battery negative cable.
2. Remove the left side door scuff plate.
3. Raise carpet to access receiver.
4. Remove the mounting fasteners.

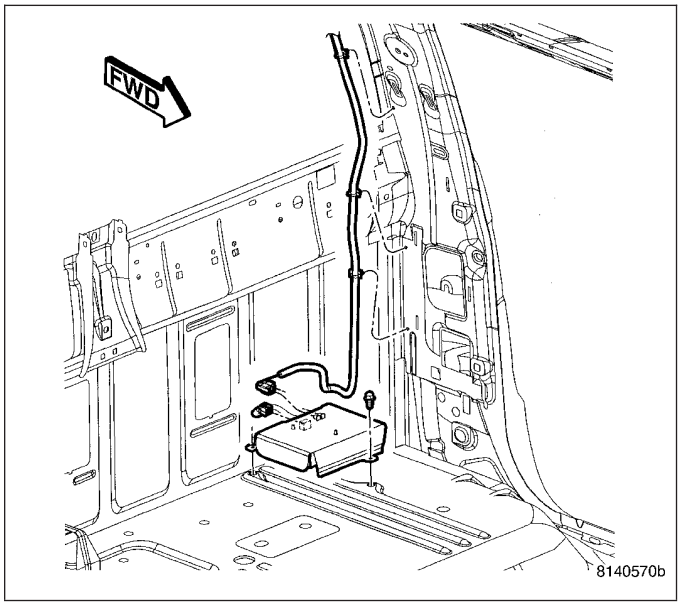


5. Disconnect the antenna and electrical harness connectors. Remove the module.

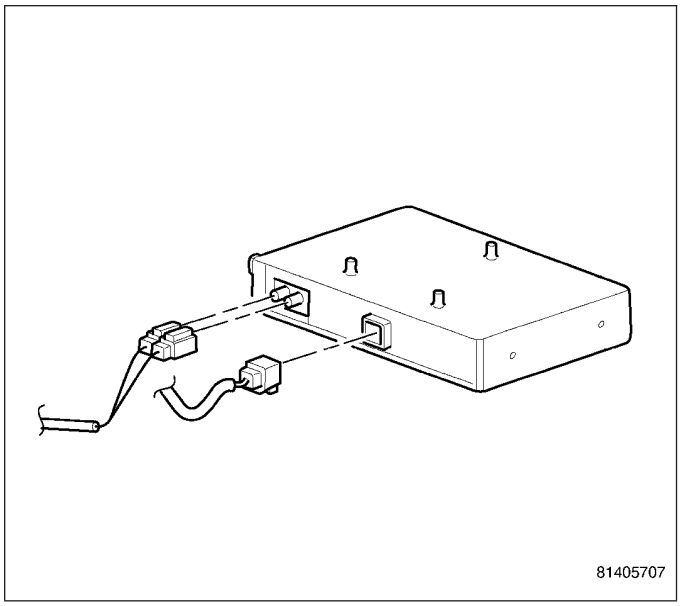


QUAD CAB

1. Disconnect and isolate the battery negative cable.
2. Raise the left rear seat.
3. Remove the mounting fasteners.



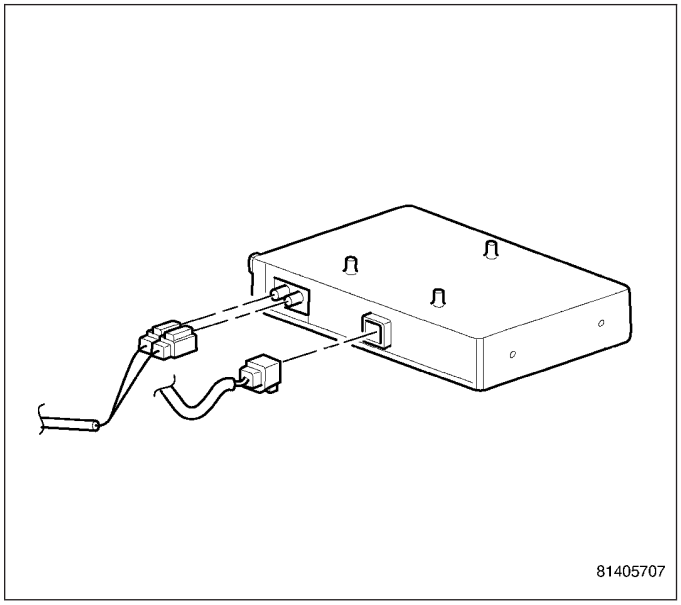
4. Disconnect the antenna and electrical harness connectors. Remove the module.



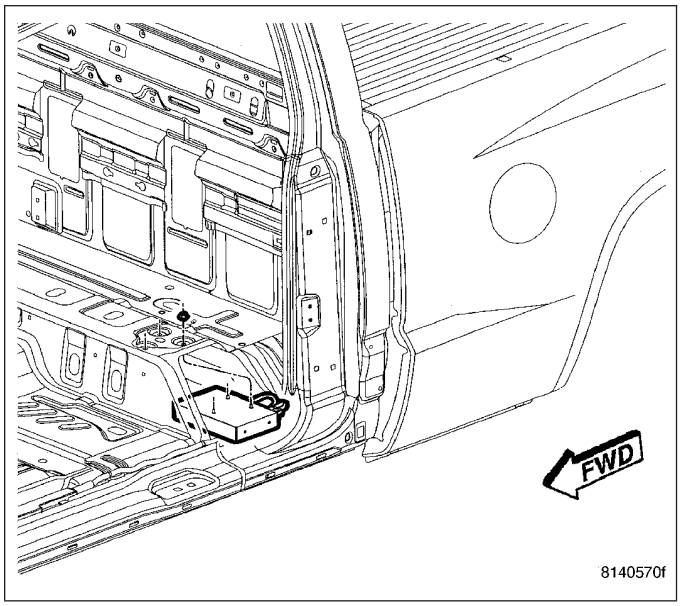
INSTALLATION

CLUB CAB

1. Connect antenna and electrical harness connector to module.

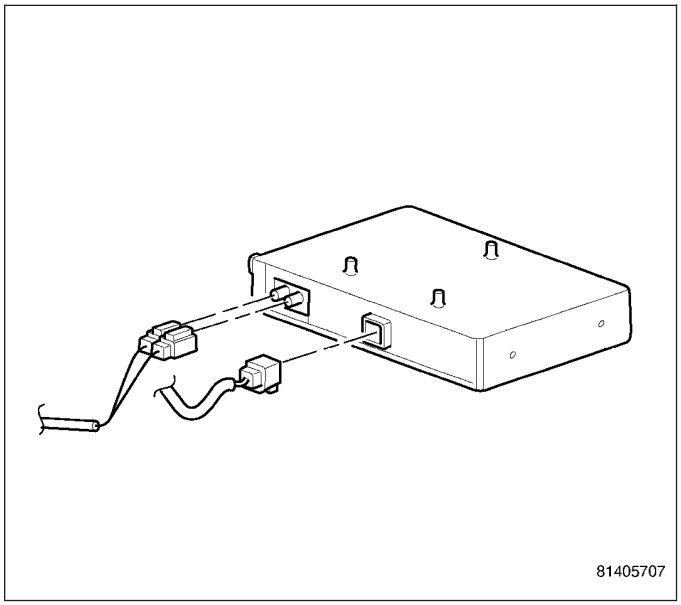


2. Position module and install mounting fasteners. Tighten fasteners.
3. Lower carpet into position.
4. Install the left side door scuff plate.
5. Connect battery negative cable.

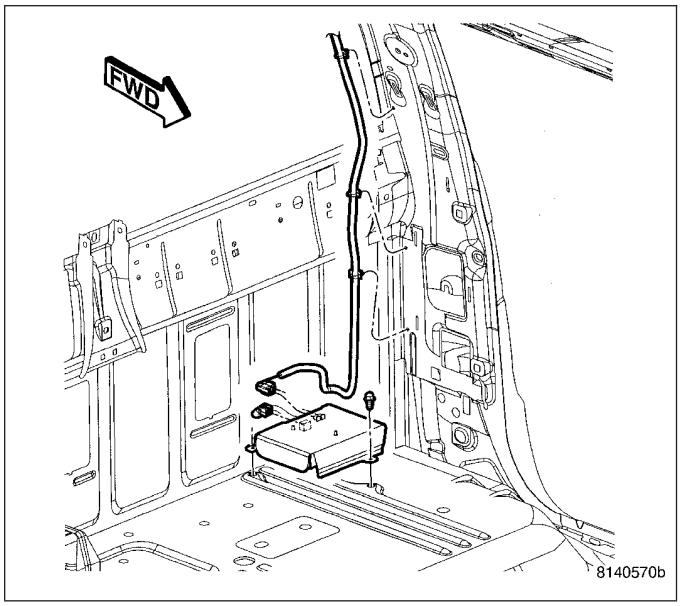


QUAD CAB

1. Connect antenna and electrical harness connector to module.



2. Position module and install mounting fasteners. Tighten fasteners.
3. Lower the left rear seat.
4. Connect battery negative cable.



SPEAKER

DESCRIPTION

STANDARD

The standard equipment speaker system includes speakers in four locations. One 16.5 centimeter (6.5 inch) diameter speaker is located in each front door. One 16.5 centimeter (6.5 inch) diameter speaker is located in each rear door on quad cab vehicles. One 16.5 centimeter (6.5 inch) diameter speaker is located in each C-pillar on club cab vehicles.

INFINITY

The infinity speaker system includes speakers in six locations. One 16.5 centimeter (6.5 inch) diameter speaker is located in each front door. One 16.5 centimeter (6.5 inch) diameter speaker located in each rear door on quad cab vehicles. One 16.5 centimeter (6.5 inch) diameter speaker is located in each C-pillar on club cab vehicles. A 19 millimeter tweeter is mounted high in each front door trim panel. The infinity speaker system includes an amplifier located on the right side cowl panel. The total available power of the infinity speaker system is 288 watts.

DIAGNOSIS AND TESTING

SPEAKER

Any diagnosis of the Audio system should begin with the use of a scan tool and the appropriate Diagnostic Service information.

Refer to the appropriate wiring information.

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

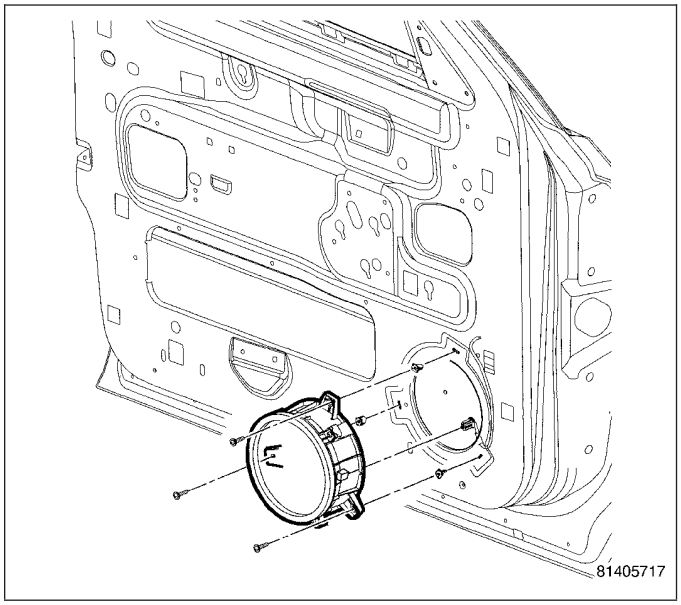
CAUTION: The speaker output of the radio is a “floating ground” system. Do not allow any speaker lead to short to ground, as damage to the radio may result.

1. If all speakers are inoperative, check the radio fuses in the Integrated Power Module (IPM). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
2. Check the amplifier fuse (if equipped) in the Integrated Power Module (IPM). If OK, go to Step 3. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
3. Turn the ignition switch to the ON position. Turn the radio receiver ON. Adjust the balance and fader control controls to check the performance of each individual speaker. Note the speaker locations that are not performing correctly. Go to Step 4.
4. Turn the radio OFF. Turn the ignition OFF. Disconnect and isolate the battery negative cable. If vehicle is **not** equipped with a amplifier, remove the radio receiver. If the vehicle is equipped with an amplifier, disconnect the two wire harness connectors. Go to Step 5.
5. Check both the speaker feed (+) circuit and return (-) circuit cavities for the inoperative speaker at the wire harness connector for continuity to ground. There should be no continuity. If OK, go to Step 6. If not OK, repair the shorted speaker feed (+) and/or return (-) circuits(s) to the speaker as required.
6. Disconnect wire harness connector at the inoperative speaker. Check for continuity between the speaker feed (+) circuit cavities of the radio receiver wire harness connector or if equipped, the amplifier wire harness connector and the speaker wire harness connector. Repeat the check between the speaker return (-) circuit cavities of the radio receiver wire harness connector and the speaker wire harness connector. In each case, there should be continuity. If OK, replace the faulty speaker. If not OK, repair the open speaker feed (+) and/or return (-) circuits(s) as required.

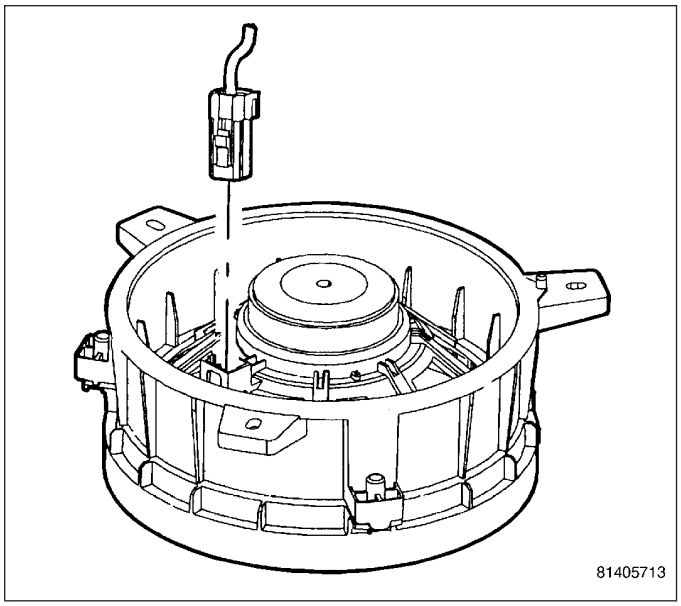
REMOVAL

SPEAKER - FRONT DOOR

1. Disconnect and isolate the battery negative cable.
2. Remove the front door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).
3. Remove the mounting fasteners.

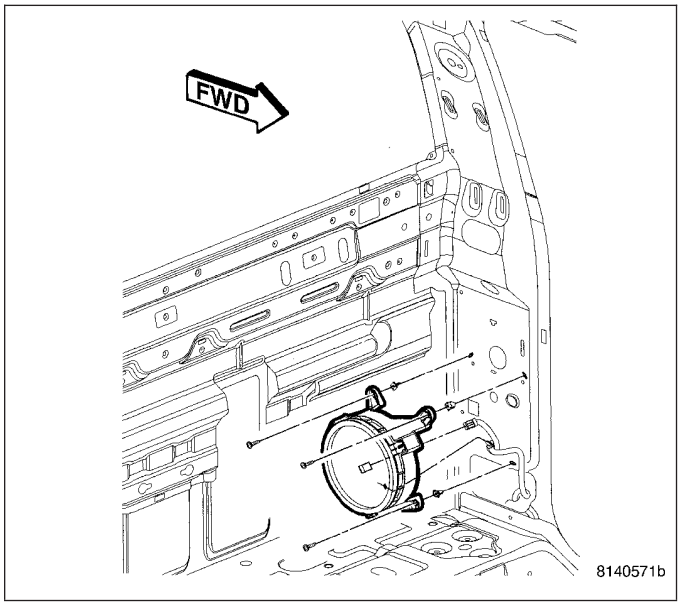


4. Remove speaker and disconnect the electrical harness connector.

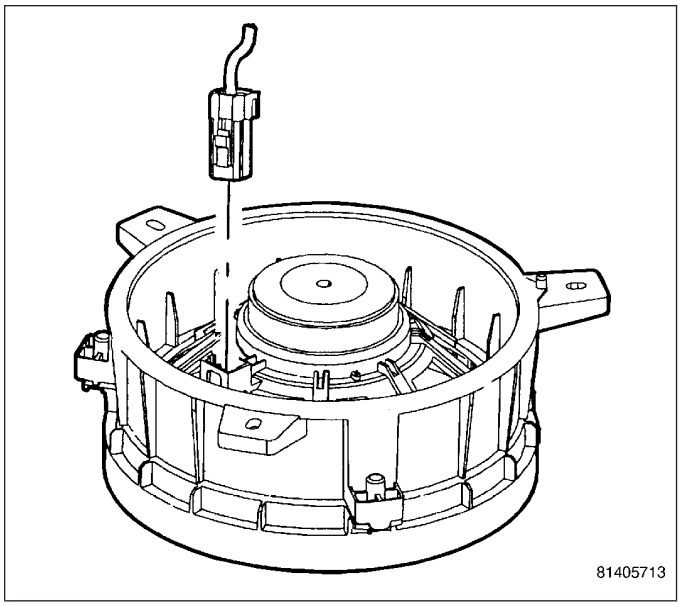


SPEAKER – REAR CLUB CAB

1. Disconnect and isolate the battery negative cable.
2. Remove the C - pillar trim panel (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - REMOVAL).
3. Remove the mounting fasteners.

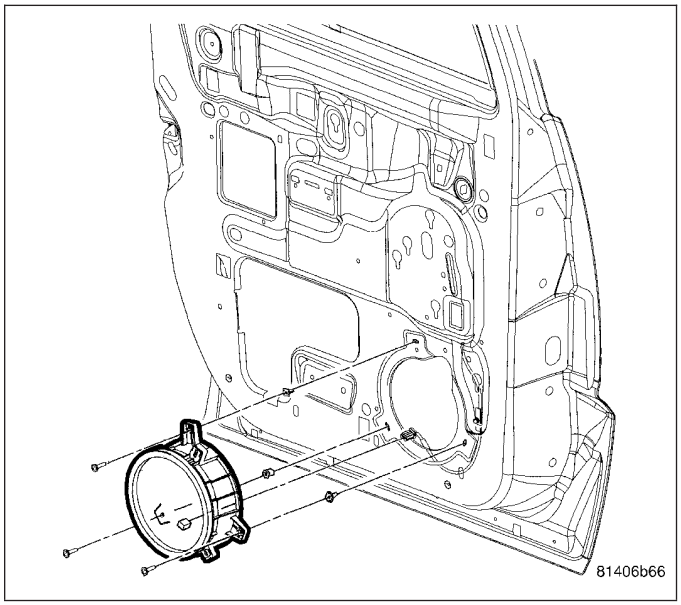


4. Remove speaker and disconnect the electrical harness connector.

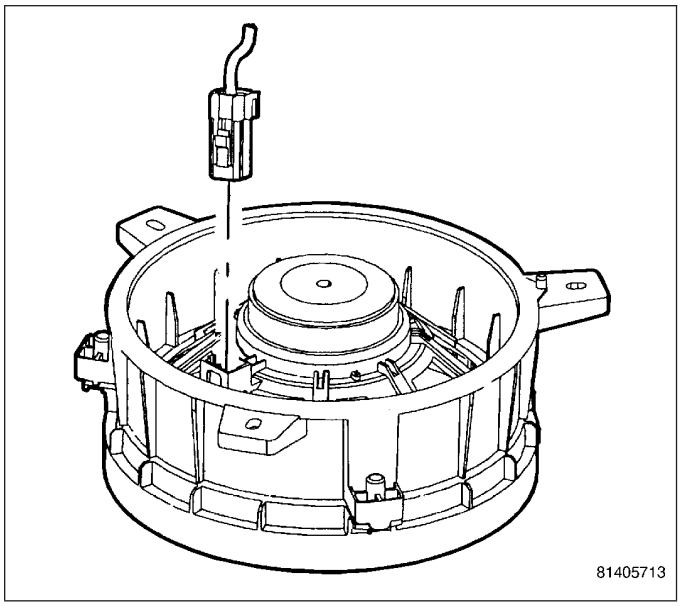


SPEAKER – REAR DOOR

1. Disconnect and isolate the battery negative cable.
2. Remove the rear door trim panel (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL).
3. Remove the mounting fasteners.

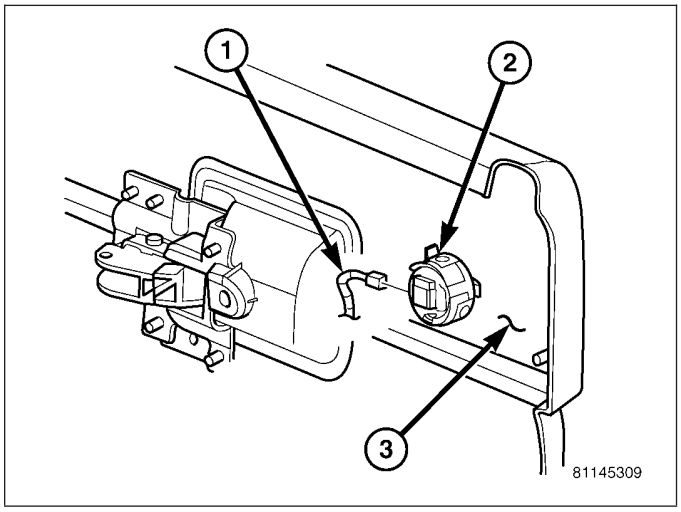


4. Remove speaker and disconnect the electrical harness connector.



SPEAKER - FRONT DOOR TWEETER

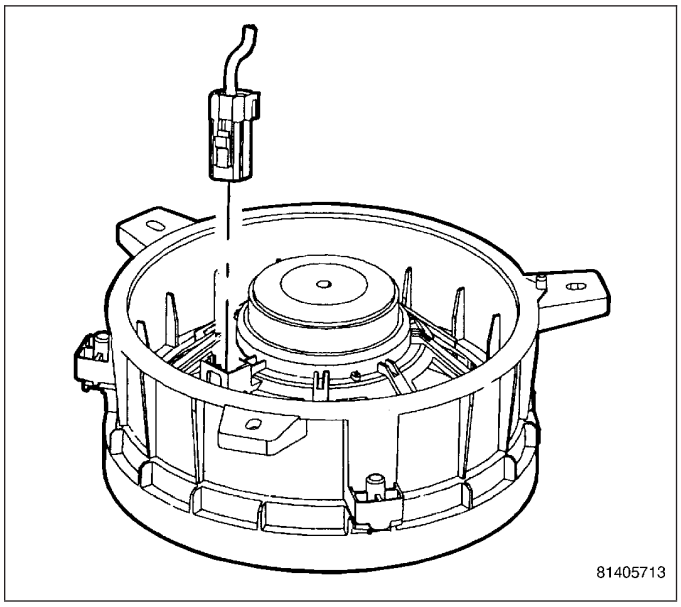
1. Disconnect and isolate the battery negative cable.
2. Remove the front door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).
3. Disconnect the electrical harness connector (1) and remove tweeter (2).



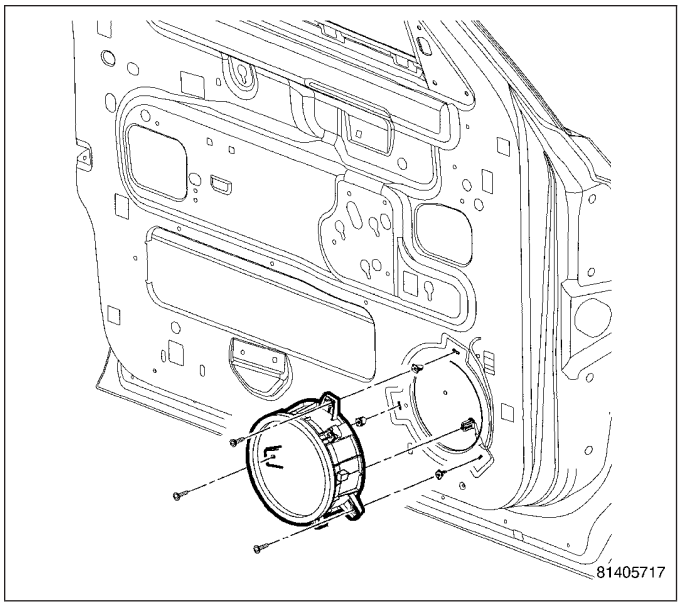
INSTALLATION

SPEAKER – FRONT DOOR

1. Connect electrical harness connector and position speaker to door.

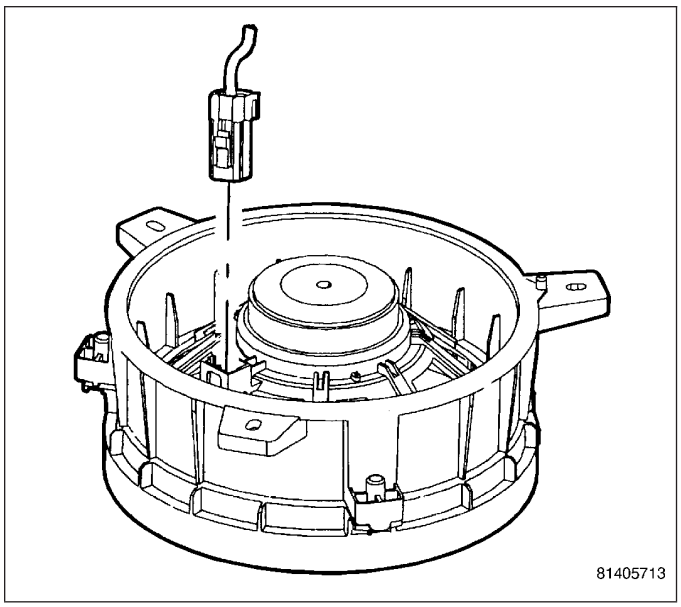


2. Install and tighten mounting fasteners.
3. Install door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION).
4. Connect battery negative cable.

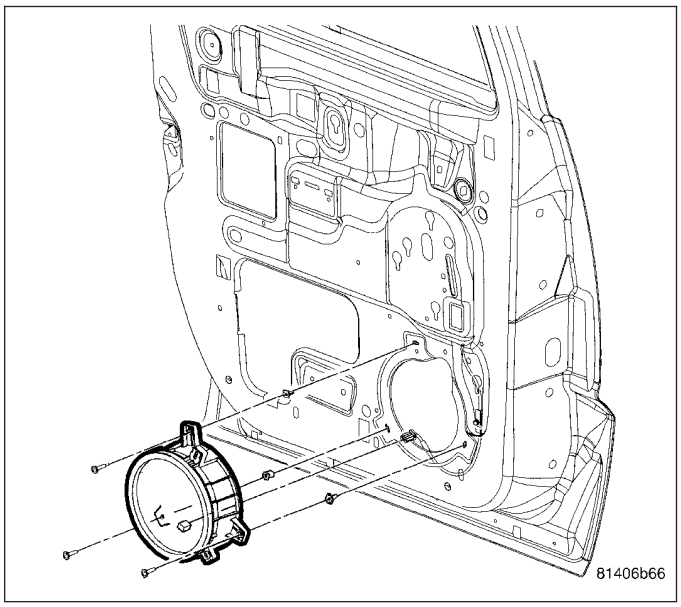


SPEAKER - REAR DOOR

1. Connect electrical harness connector and position speaker to door.

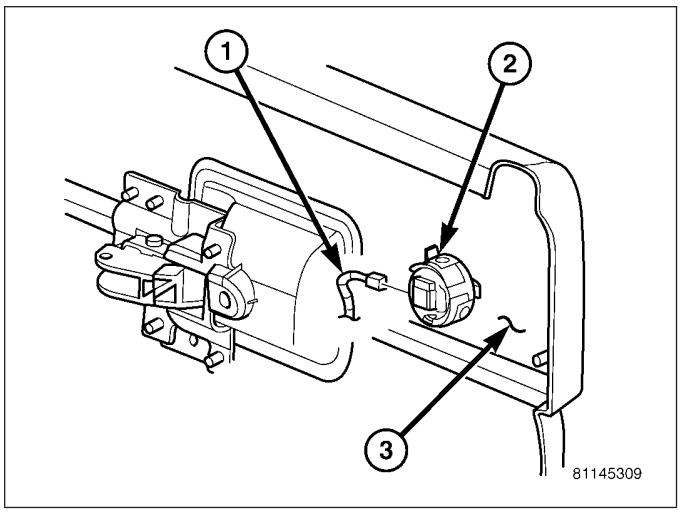


2. Install and tighten mounting fasteners.
3. Install door trim panel (Refer to 23 - BODY/ DOORS - REAR/TRIM PANEL - INSTALLATION).
4. Connect battery negative cable.



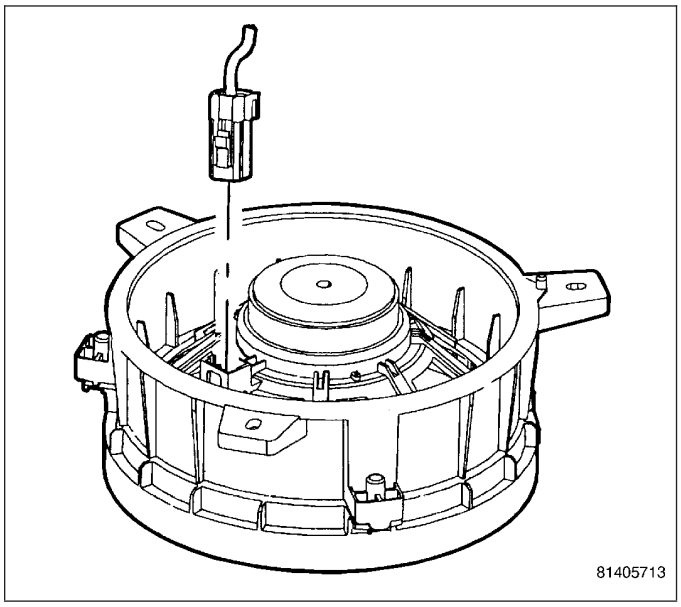
SPEAKER - FRONT DOOR TWEETER

1. Connect electrical harness connector and position speaker to door trim panel.
2. Install and tighten mounting fasteners.
3. Install door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION).
4. Connect battery negative cable.

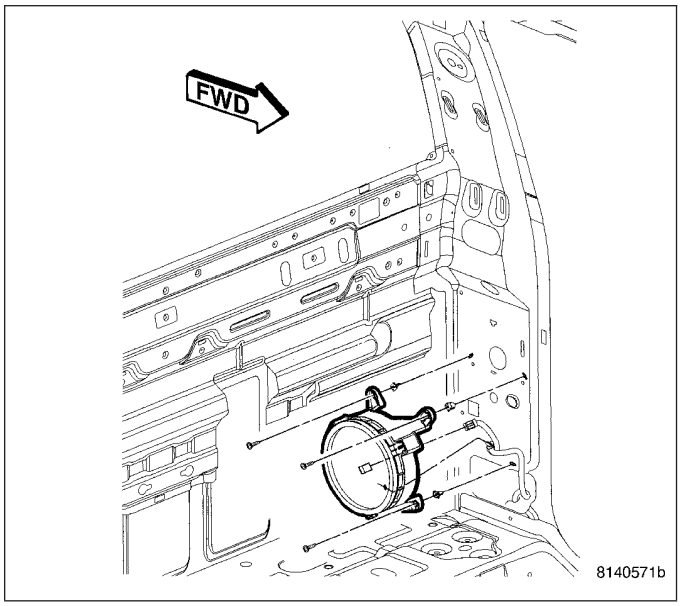


SPEAKER - REAR CLUB CAB

1. Connect electrical harness connector and position speaker C-pillar.



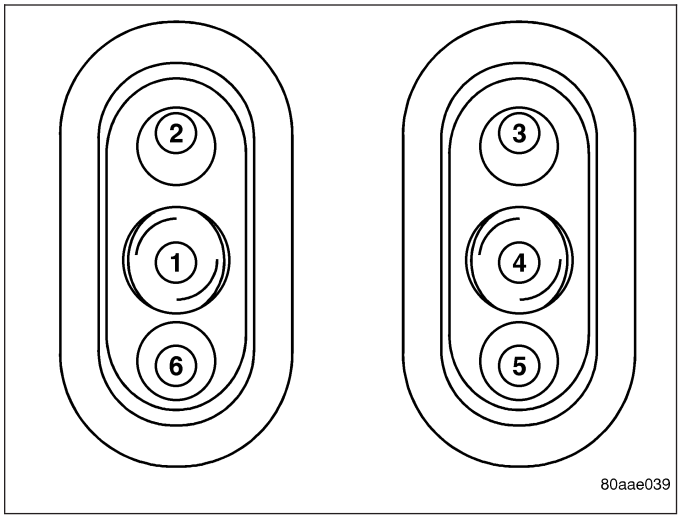
2. Install and tighten mounting fasteners.
3. Install C- pillar trim panel (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - INSTALLATION).
4. Connect battery negative cable.



SWITCH-REMOTE RADIO

DESCRIPTION

Two rocker-type switches are mounted in the sides of the rear (instrument panel side) steering wheel trim cover. The switch on the left spoke is the seek switch and has seek up, seek down, and preset station advance functions. The switch on the right spoke is the volume control switch and has volume up, and volume down functions. The switch on the right spoke also includes a “mode” control that allows the driver to sequentially select AM radio, FM radio, cassette player, CD player or satellite radio.



OPERATION

The six switches in the two remote radio switch units are normally open, resistor multiplexed momentary switches that are hard wired to the Instrument cluster through the clockspring. The instrument cluster sends a five volt reference signal to both switch units on one circuit, and senses the status of all of the switches by reading the voltage drop on a second circuit.

When the instrument cluster senses an input (voltage drop) from any one of the remote radio switches, it sends the proper switch status messages on the Controller Area Network (CAN) data bus to the radio. The electronic circuitry within the radio is programmed to respond to these remote radio switch status messages by adjusting the radio settings as requested.

DIAGNOSIS AND TESTING

REMOTE SWITCHES

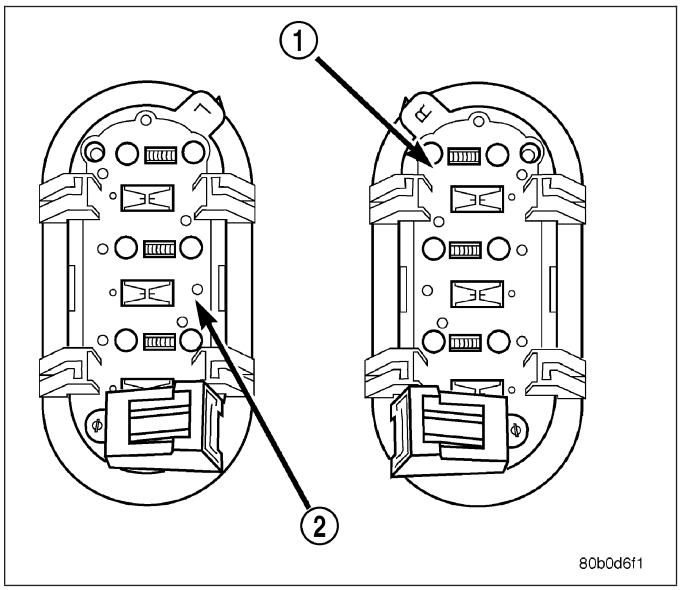
Any diagnosis of the Audio system should begin with the use of a scan tool and the appropriate Diagnostic Service information.

Refer to the appropriate wiring information.

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

1. Remove the remote radio switch(es) (1) and (2) from the steering wheel (Refer to 8 - ELECTRICAL/ AUDIO/REMOTE SWITCHES - REMOVAL).
2. Use an ohmmeter to check the switch resistances as shown in the Remote Radio Switch test table. If the remote radio switch resistances are not as indicated, replace the inoperative switch.

REMOTE RADIO SWITCH TEST

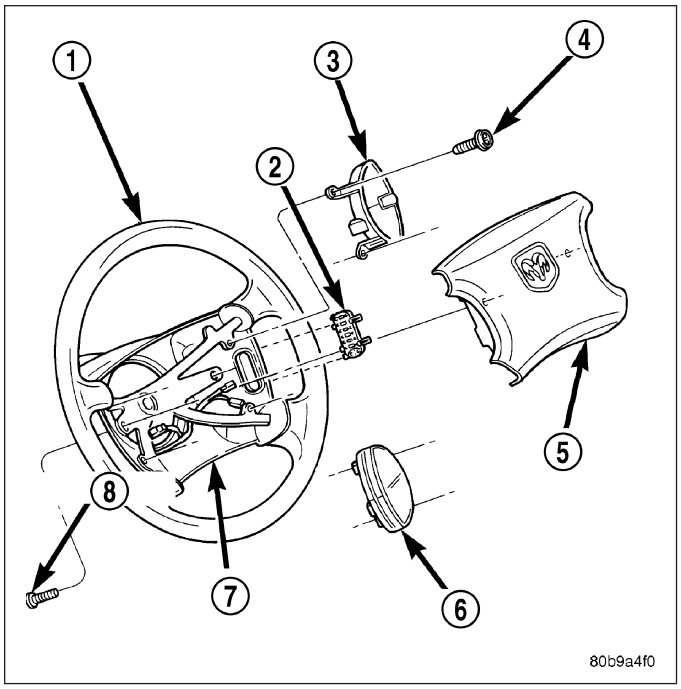


SWITCH	SWITCH POSITION	RESISTANCE
Right or Left	Neutral	24K Ohms ± 5%
Right (White)	Volume Up	6.8K Ohms ± 5%
Right (White)	Volume Down	15.6K Ohms ± 1%
Right (White)	Mode	0 Ohms
Left (Black)	Seek Up	1.2K Ohms ± 5%
Left (Black)	Seek Down	3.3K Ohms ± 5%
Left (Black)	Pre-Set Station Advance	.47K Ohms ± 5%

REMOVAL

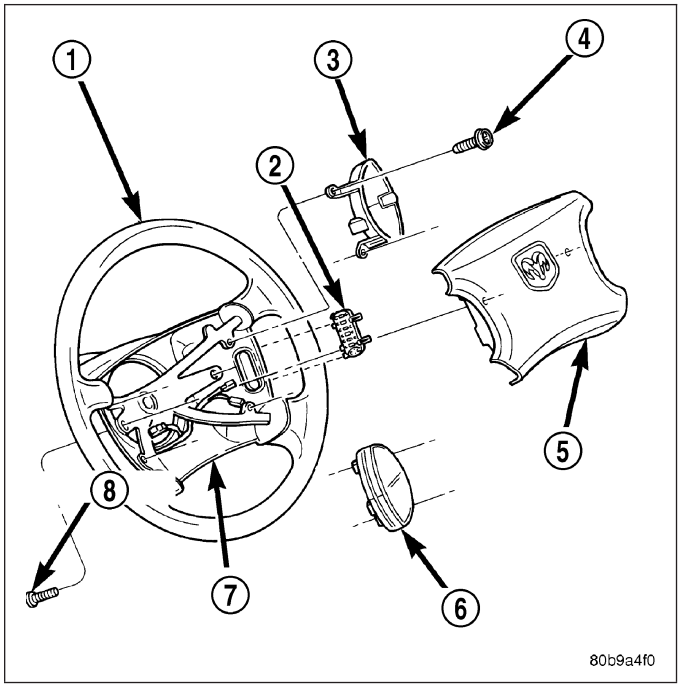
WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

1. Disconnect and isolate the battery negative cable.
2. Remove the driver side airbag (5) from the steering wheel (1) (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).
3. Remove the speed control switch (3) or (6) located on the same side of the steering wheel as the remote radio switch that is being serviced (Refer to 8 - ELECTRICAL/SPEED CONTROL/SWITCH - REMOVAL).
4. Disconnect the steering wheel wire harness connector from the connector receptacle of the remote radio switch.
5. Disengage the four remote radio switch latches that secure the switch to the inside of the mounting hole in the steering wheel rear trim cover.
6. From the outside of the steering wheel rear trim cover, remove the remote radio switch (2) from the trim cover.



INSTALLATION

1. Position the remote radio switch (2) to the mounting hole on the outside of the steering wheel rear trim cover. Be certain that the connector receptacle is oriented toward the bottom of the switch and pointed toward the center of the steering wheel.
2. Press firmly and evenly on the remote radio switch until each of the switch latches is fully engaged in the mounting hole of the steering wheel rear trim cover.
3. Connect the steering wheel wire harness connector to the connector receptacle of the remote radio switch.
4. Install the speed control switch (3) or (6) onto the steering wheel (Refer to 8 - ELECTRICAL/SPEED CONTROL/SWITCH - INSTALLATION).
5. Install the driver side airbag (5) to the steering wheel (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).
6. Connect the battery negative cable.



CHIME/BUZZER

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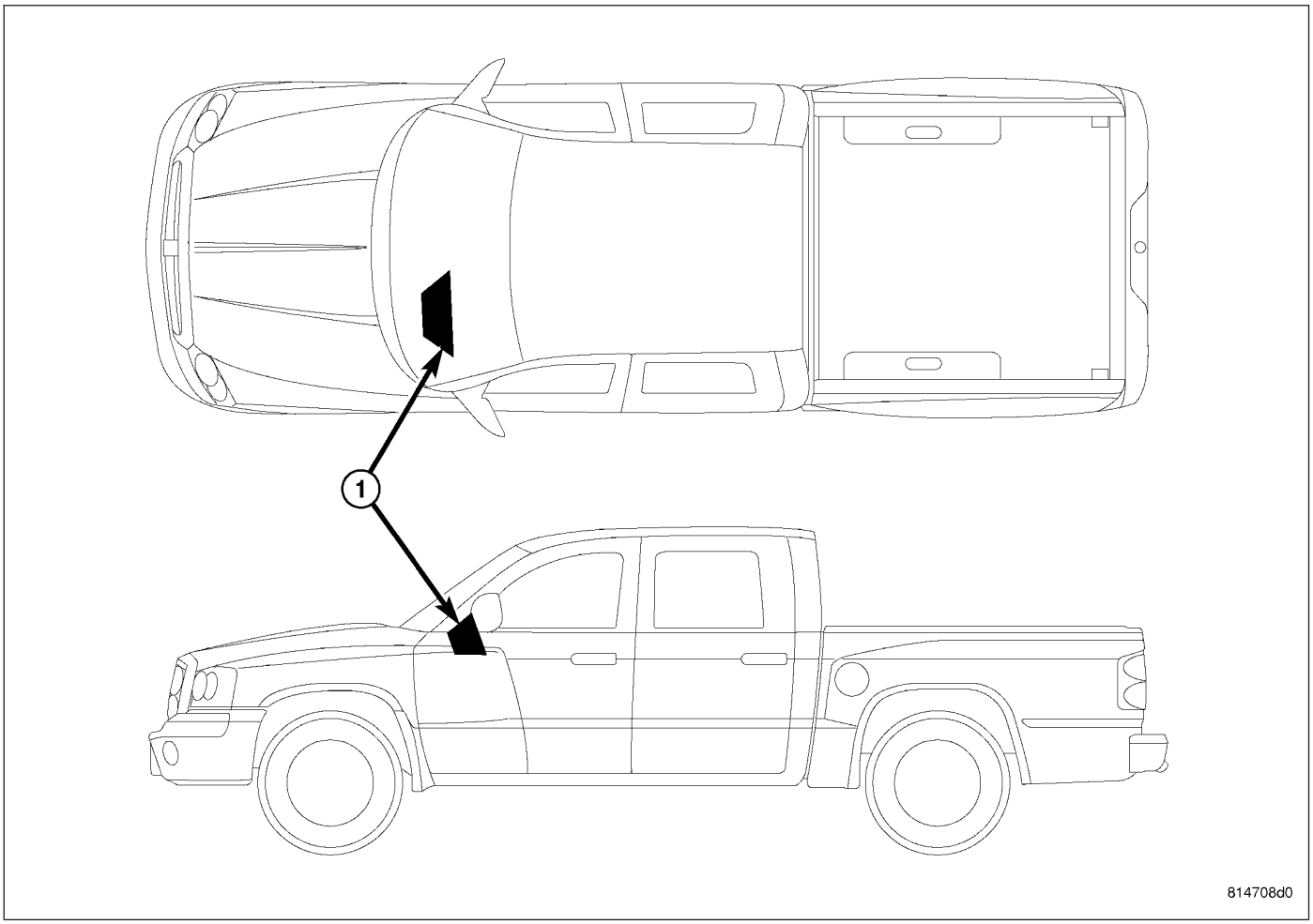
CHIME/BUZZER - SERVICE INFORMATION

DESCRIPTION



A chime warning system is standard factory-installed equipment. The chime warning system uses an electromechanical transducer and an electromechanical relay that are soldered onto the electronic circuit board inside of the ElectroMechanical Instrument Cluster (EMIC) (1) to provide audible indications of various vehicle conditions that may require the attention of the vehicle operator or occupants. The EMIC also includes the hardware and software necessary to serve as the electronic body control module and is sometimes referred to as the Cab Compartment Node or CCN.

The electromechanical transducer generates beep tones and chime tones, while the electromechanical relay generates click tones to emulate the sounds associated with conventional turn signal and hazard warning flasher operation. The microprocessor-based EMIC utilizes electronic chime request messages received from other modules in

the vehicle over the Controller Area Network (CAN) data bus along with hard wired inputs to monitor many sensors and switches throughout the vehicle. In response to those inputs, the circuitry and programming of the EMIC allow it to control the audible outputs that are produced through its on-board transducer and relay.

The EMIC is capable of producing the following audible outputs:

- **Slow Rate Repetitive Click** - Repeated “click” tones that are issued at a slow rate of about 50 clicks per minute.
- **Fast Rate Repetitive Click** - Repeated “click” tones that are issued at a fast rate of more than about 100 clicks per minute.
- **Fixed Duration Beep** - A short, sharp, single tactile “beep” tone.
- **Single Chime Tone** - A single “chime” tone.
- **Slow Rate Repetitive Chime** - Repeated “chime” tones that are issued at a slow rate of about 50 chimes per minute.
- **Fast Rate Repetitive Chime** - Repeated “chime” tones that are issued at a fast rate of about 180 chimes per minute.

Hard wired circuitry connects the EMIC and the various chime warning system switch and sensor inputs to their modules and to each other through the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the EMIC through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

The EMIC chime warning system circuits and components cannot be adjusted or repaired. If the EMIC circuitry, the on-board transducer or the relay are damaged or faulty, the EMIC unit must be replaced.

OPERATION

The chime warning system operates on battery voltage received through a fuse in the Junction Block (JB) on a non-switched fused B(+) circuit so that the system may operate regardless of the ignition switch position. The chime warning system also monitors the ignition switch position so that some chime features are functional only with the ignition switch in the On position, while others are functional regardless of the ignition switch position.

The chime warning system provides an audible indication to the vehicle operator or occupants under the following conditions:

- **Airbag Indicator Warning** - The ElectroMechanical Instrument Cluster (EMIC) transducer will generate one short chime when the ignition switch is in the On position, and an electronic message is received over the Controller Area Network (CAN) data bus from the Occupant Restraint Controller (ORC) requesting “Airbag” indicator illumination. This warning will only occur following completion of the “Airbag” indicator bulb test, and will only occur once during any ignition cycle.
- **Compass Mini-Trip Computer Global Reset** - The EMIC transducer will generate one short chime when the ignition switch is in the On position, and an electronic message is received over the CAN data bus from the optional Compass Mini-Trip Computer (CMTC) requesting that the CMTC average fuel economy, trip odometer and distance to empty data be reset. The CMTC monitors hard wired inputs from the U.S./Metric and Reset button switches to determine the proper reset messages to send to the EMIC.
- **Door Ajar Indicator Warning** - The EMIC transducer will generate one short chime when the ignition switch is in the On position, a hard wired input is received indicating that the status of any door ajar switch has changed, and an electronic message is received over the CAN data bus indicating that the vehicle is moving.
- **Fasten Seat Belt Indicator Warning** - The EMIC transducer will generate repetitive chimes at a slow rate to announce that a hard wired input from the seat belt switch indicates that the driver side front seat belt is not fastened with the ignition switch in the On position. The chime warning system also supports the enhanced seatbelt reminder (beltminder) when this feature is enabled. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/SEATBELT INDICATOR - OPERATION).
- **Head/Park Lamps-On Warning** - The EMIC transducer will generate repetitive chimes at a fast rate to indicate that hard wired inputs from the driver door ajar switch, the headlamp switch, and the ignition switch indicate that the exterior lamps are turned On with the driver side front door opened and the ignition switch in the

Off position. The chimes will continue to sound until the exterior lamps are turned Off, the driver side front door is closed, or the ignition switch is turned to the On position, whichever occurs first.

- **Key-In-Ignition Warning** - The EMIC transducer will generate repetitive chimes at a fast rate to indicate that hard wired inputs from the driver door ajar switch, the ignition switch, and the key-in ignition switch circuitry of the ignition switch indicate that the key is in the ignition lock cylinder with the driver side front door open and the ignition switch in the Off position. The chimes will continue to sound until the key is removed from the ignition lock cylinder, the driver side front door is closed, or the ignition switch is turned to the On position, whichever occurs first.
- **Low Fuel Indicator Warning** - The EMIC transducer will generate one short chime when the low fuel indicator is illuminated by the instrument cluster circuitry. This chime will only occur once during any ignition cycle.
- **Low Wash Indicator Warning** - The EMIC transducer will generate one short chime when the low washer fluid indicator is illuminated by the instrument cluster circuitry. This chime will only occur once during any ignition cycle.
- **Overspeed Warning** - The EMIC transducer will generate repetitive chimes at a slow rate to indicate that the vehicle speed is over a pre-programmed speed value. The EMIC monitors electronic vehicle speed messages received over the CAN data bus. This feature is only enabled on an EMIC that has been programmed with a Middle East Gulf Coast Country (GCC) country code.
- **Park Brake Reminder** - The EMIC transducer will generate one short chime to announce that the hard wired input from the park brake switch and a vehicle speed message input received over the CAN data bus indicate that the park brake is applied and the vehicle is moving. This chime will repeat each time the input conditions are met.
- **Sentry Key “Customer Learn” Mode Announcement** - The EMIC transducer will generate one short chime to confirm that an electronic “Customer Learn” mode message has been received over the CAN data bus to indicate that the Sentry Key Remote Entry Module (SKREEM) is prepared for programming additional sentry key transponders. This chime feature is only active on vehicles equipped with the optional Sentry Key system, and sold in a market where “Customer Learn” programming is an allowed feature.
- **Trans Overtemp Indicator Warning (Automatic Transmission Only)** - The EMIC transducer will generate repetitive chimes at a slow rate when the transmission overtemp indicator is illuminated by the instrument cluster for a high or critical transmission fluid temperature condition. This chime will repeat each time the trans overtemp indicator is cycled from Off to On.
- **Turn Signal/Hazard Warning Flasher Emulation** - The EMIC relay will generate repetitive clicks at a slow rate to emulate an electromechanical flasher when the turn signal or hazard warning system are operating. The EMIC relay will generate repetitive clicks at a fast rate to indicate that the right or left turn signal are operating with one or more bulbs inoperative. In either case, the clicks will continue until the turn signal and hazard warning systems are turned off.
- **Turn Signal On Warning** - The EMIC transducer will generate repetitive chimes at a slow rate to indicate that a turn signal has been active continuously for 1.6 kilometers (1 mile) with the vehicle speed greater than 22 kilometers-per-hour (15 miles-per hour). Vehicles built for markets other than the United States and Canada have a revised distance threshold of 4 kilometers for this feature. The chime will continue until the turn signal input becomes inactive or until the vehicle speed message indicates that the speed is less than 22 kilometers-per-hour (15 miles-per-hour), whichever occurs first. The hazard warning flashers will not activate this chime feature.
- **Warning Indicator Announcement** - The EMIC transducer will generate one short chime each time the check gauges indicator is illuminated by the instrument cluster circuitry. The check gauges indicator may be illuminated when any critical engine or transmission systems are operating outside of their normal parameters. The instrument cluster monitors electronic messages received over the CAN data bus to determine when to illuminate the check gauges indicator.

The EMIC provides chime service for all available features in the chime warning system. The EMIC relies upon its internal programming, numerous hard wired inputs, and electronic message inputs received from other modules over the CAN data bus network to provide the chime warning system features. The internal programming of the EMIC determines the priority of each chime request input that is received, as well as the rate and duration of each chime that is to be generated.

The hard wired chime warning system inputs to the EMIC may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the EMIC, the CAN data bus, or the electronic messages received by the EMIC from other modules. The most reliable, efficient and accurate means to diagnose the EMIC, the CAN data bus, or the electronic message inputs

used for the chime warning system requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING

CHIME WARNING SYSTEM

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

The hard wired chime warning system inputs to the ElectroMechanical Instrument Cluster (EMIC), as well as other hard wired circuits for this system may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the EMIC, the Controller Area Network (CAN) data bus, or the electronic message inputs used by the EMIC to provide chime warning system service. The most reliable, efficient, and accurate means to diagnose the EMIC, the CAN data bus, and the electronic message inputs for the chime warning system requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

ELECTRONIC CONTROL MODULES

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ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B210D-BATTERY VOLTAGE LOW

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Battery voltage less than 9 volts for more than 15 seconds.

Possible Causes
RESISTANCE IN THE (A1) BATTERY POSITIVE CIRCUIT
RESISTANCE IN THE GENERATOR CASE GROUND
GENERATOR OPERATION
(K20) GENERATOR FIELD CONTROL CIRCUIT OPEN
(K20) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO GROUND
(Z20) GROUND CIRCUIT OPEN
PCM

Diagnostic Test

1. CHECK FOR ANY POWERTRAIN CONTROL MODULES DTCS

NOTE: Make sure the Battery is in good condition. Using the Midtronics Battery Tester, test the Battery before continuing.

NOTE: Inspect the vehicle for after market accessories that may exceed the Generator System output.

NOTE: Make sure the generator drive belt is in good operating condition.

NOTE: Inspect the fuses in the IPM. If an open fuse is found, use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.

Turn the ignition on.

With the scan tool, read active PCM DTC's.

Does the scan tool display any active PCM DTC's?

Yes >> (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

No >> Check the above conditions that can cause a low voltage condition. Repair as necessary. Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

B210E-BATTERY VOLTAGE HIGH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Battery voltage greater than 16 volts for more than 15 seconds.

Possible Causes
(K20) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
GENERATOR
PCM

Diagnostic Test

1. CHECK FOR ANY POWERTRAIN CONTROL MODULES DTCS

NOTE: Make sure the Battery is in good condition. Using the Midtronics Battery Tester, test the Battery before continuing.

NOTE: Inspect the vehicle for after market accessories that may exceed the Generator System output.

NOTE: Make sure the generator drive belt is in good operating condition.

NOTE: Inspect the fuses in the IPM. If an open fuse is found, use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.

Turn the ignition on.

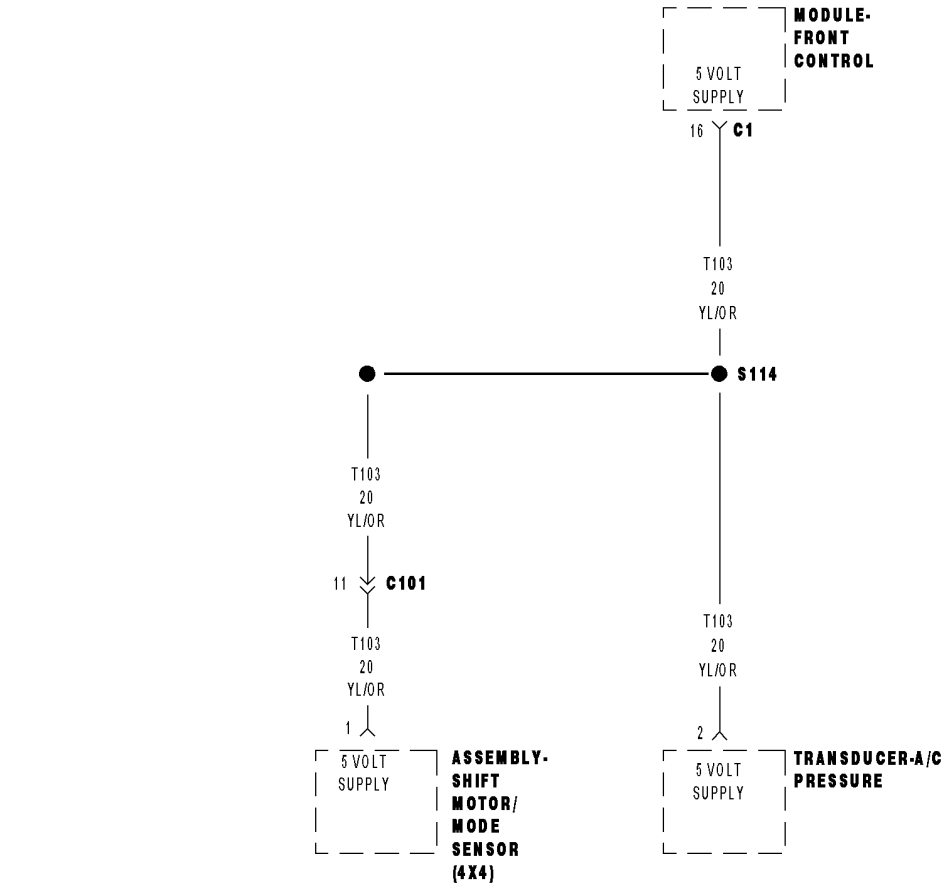
With the scan tool, read active PCM DTC's.

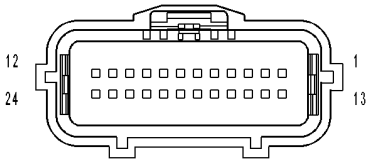
Does the scan tool display any active PCM DTC's?

Yes >> (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

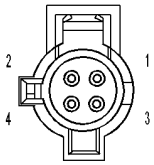
No >> Check the above conditions that can cause a high voltage condition. Repair as necessary.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

B2112-5 VOLT SUPPLY CIRCUIT LOW

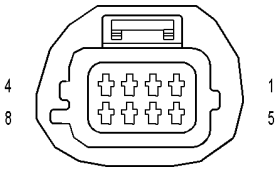




MODULE-
FRONT
CONTROL C1



TRANSDUCER-A/C
PRESSURE



ASSEMBLY-
SHIFT
MOTOR/
MODE
SENSOR
(4X4)

81409972

B2112-5 VOLT SUPPLY CIRCUIT LOW (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Front Control Module detects the (T103) 5 volt supply circuit voltage below 0.3 volts.

Possible Causes
(T103) 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
A/C PRESSURE TRANSDUCER
SHIFT MOTOR/MODE SENSOR ASSEMBLY
FRONT CONTROL MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, read the active DTC's.
Cycle the ignition switch from off to on, leaving the ignition on for a minimum of 90 seconds.
With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

---

2. A/C PRESSURE TRANSDUCER

Turn the ignition off.
Disconnect the A/C Pressure Transducer harness connector.
Cycle the ignition switch from off to on, leaving the ignition on for a minimum of 90 seconds.
With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 3

No >> Replace the A/C Pressure Transducer in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

---

3. SHIFT MOTOR/MODE SENSOR ASSEMBLY

Turn the ignition off.
Disconnect the Shift Motor/Mode Sensor Assembly harness connector.
Cycle the ignition switch from off to on, leaving the ignition on for a minimum of 90 seconds.
With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 4

No >> Replace the Shift Motor/Mode Sensor Assembly in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

B2112-5 VOLT SUPPLY CIRCUIT LOW (CONTINUED)

4. (T103) 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the FCM C1 harness connector.

Measure the resistance between ground and the (T103) 5 Volt Supply circuit.

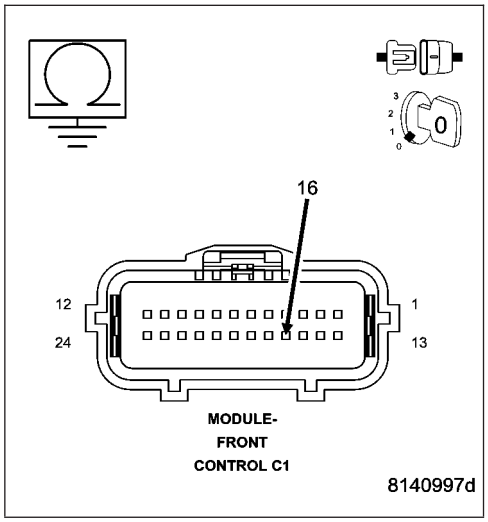
Is the resistance below 1000.0 ohms?

Yes >> Repair the (T103) 5 Volt Supply circuit for a short to ground.

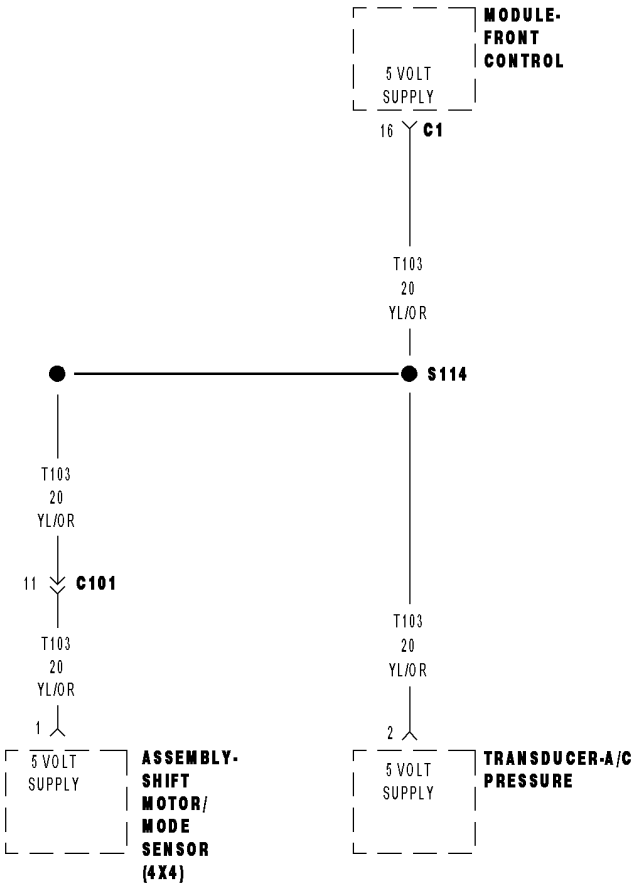
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

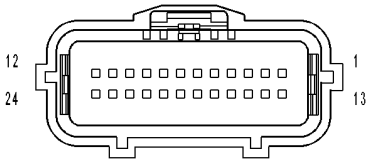
No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Front Control Module in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

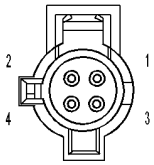


B2113-5 VOLT SUPPLY CIRCUIT HIGH

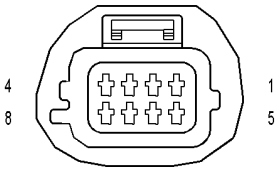




MODULE-
FRONT
CONTROL C1



TRANSDUCER-A/C
PRESSURE



ASSEMBLY-
SHIFT
MOTOR/
MODE
SENSOR
(4X4)

81409972

B2113-5 VOLT SUPPLY CIRCUIT HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Front Control Module detects the (T103) 5 volt supply circuit voltage above 5.0 volts.

Possible Causes
(T103) 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
A/C PRESSURE TRANSDUCER
SHIFT MOTOR/MODE SENSOR ASSEMBLY
FRONT CONTROL MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, read the active DTC's.
Cycle the ignition switch from off to on, leaving the ignition on for a minimum of 90 seconds.
With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

---

2. A/C PRESSURE TRANSDUCER

Turn the ignition off.
Disconnect the A/C Pressure Transducer harness connector.
Cycle the ignition switch from off to on, leaving the ignition on for a minimum of 90 seconds.
With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 3

No >> Replace the A/C Pressure Transducer in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

---

3. SHIFT MOTOR/MODE SENSOR ASSEMBLY

Turn the ignition off.
Disconnect the Shift Motor/Mode Sensor Assembly harness connector.
Cycle the ignition switch from off to on, leaving the ignition on for a minimum of 90 seconds.
With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 4

No >> Replace the Shift Motor/Mode Sensor Assembly in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

B2113-5 VOLT SUPPLY CIRCUIT HIGH (CONTINUED)

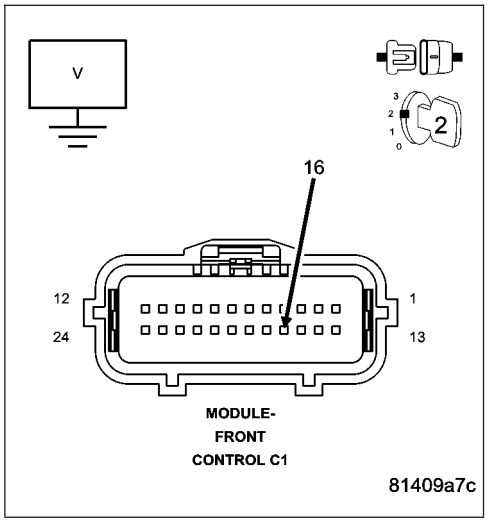
4. (T103) 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the FCM C1 harness connector.
Turn the ignition on.
Measure the voltage of the (T103) 5 Volt Supply circuit.

Is the voltage above 5.5 volts?

Yes >> Repair the (T103) 5 Volt Supply circuit for a short to voltage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



B2215-FRONT CONTROL MODULE INTERNAL

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The Front Control Module detects an internal fault.

Possible Causes
FRONT CONTROL MODULE

Diagnostic Test

1. REPLACE THE FRONT CONTROL MODULE IF DTC IS ACTIVE

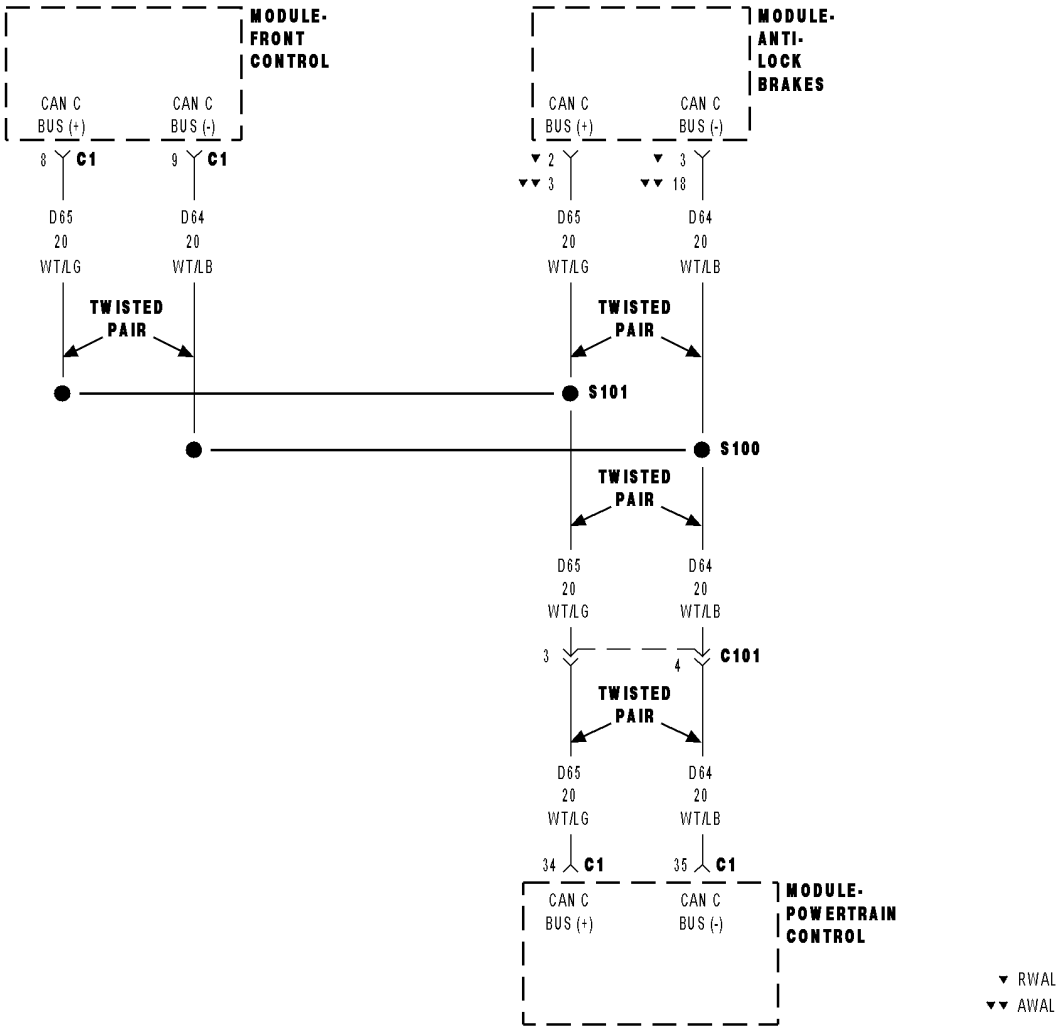
With the scan tool, read the active DTC's.

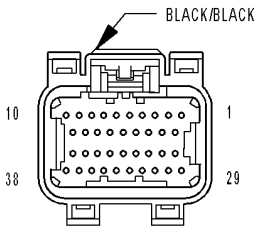
Does the scan tool display this DTC as active?

Yes >> Replace and program the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

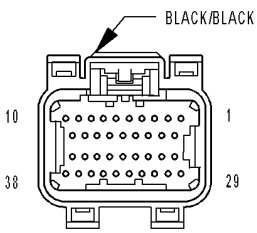
No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

U0001-CAN C BUS CIRCUIT

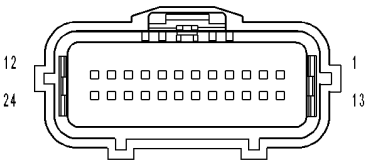




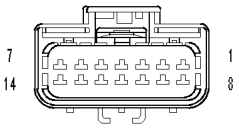
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



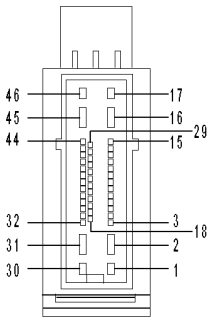
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
FRONT
CONTROL C1



MODULE-
ANTI-
LOCK
BRAKES
(RWAL)



MODULE-
ANTI-LOCK
BRAKES
(AWAL)

8140c024

U0001-CAN C BUS CIRCUIT (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The FCM detects a short in either CAN C Bus circuit.

Possible Causes
(D65) CAN C BUS (+) CIRCUIT SHORTED TO GROUND
(D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND
(D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE
(D64) CAN C BUS (-) CIRCUIT SHORTED TO VOLTAGE
(D65) CAN C BUS (+) CIRCUIT SHORTED TO (D64) CAN C BUS (-) CIRCUIT
ANTILOCK BRAKE MODULE
POWERTRAIN CONTROL MODULE
FRONT CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, record and erase FCM DTC's.
Cycle the ignition from on to off 3 times.
Turn the ignition on.
With the scan tool, read active FCM DTC's.

Does the scan tool display U0001–CAN C BUS CIRCUIT as active?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

---

2. ANTILOCK BRAKE MODULE — INTERNAL SHORT

Turn the ignition off.
Disconnect the Antilock Brake Module harness connector.
Turn the ignition on.
With the scan tool, record and erase FCM DTC's.
Cycle the ignition from on to off 3 times.
Turn the ignition on.
With the scan tool, read active FCM DTC's.

Does the scan tool display U0001–CAN C BUS CIRCUIT as active?

Yes >> Go To 3

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Antilock Brake Module in accordance with the service information.
Perform ABS VERIFICATION TEST — VER 1.

U0001-CAN C BUS CIRCUIT (CONTINUED)

3. POWERTRAIN CONTROL MODULE — INTERNAL SHORT

Turn the ignition off.
Disconnect the Powertrain Control Module C1 harness connector.
Turn the ignition on.
With the scan tool, record and erase FCM DTC's.
Cycle the ignition from on to off 3 times.
Turn the ignition on.
With the scan tool, read active FCM DTC's.

Does the scan tool display U0001–CAN C BUS CIRCUIT as active?

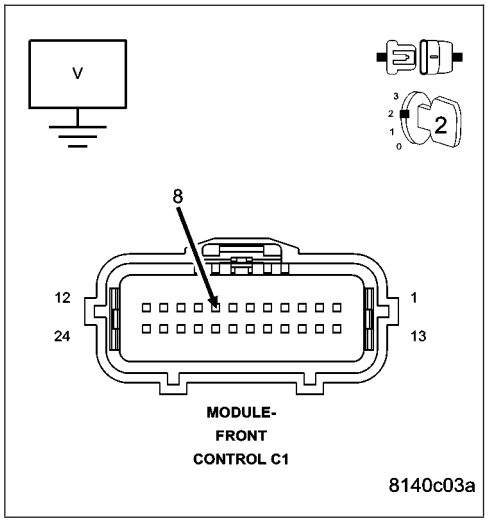
Yes >> Go To 4

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Powertrain Control Module in accordance with the service information.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.

---

4. (D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the Front Control Module C1 harness connector.
Turn the ignition on.
Measure the voltage between the (D65) CAN C Bus (+) circuit and ground.



Is there any voltage present?

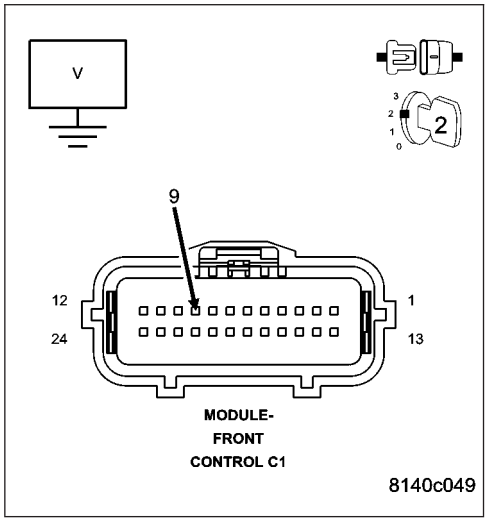
Yes >> Repair the (D65) CAN C Bus (+) circuit for a short to voltage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 5

---

5. (D64) CAN C BUS (-) CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (D64) CAN C Bus (-) circuit and ground.



Is there any voltage present?

Yes >> Repair the (D64) CAN C Bus (-) circuit for a short to voltage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 6

U0001-CAN C BUS CIRCUIT (CONTINUED)

6. (D65) CAN C BUS (+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

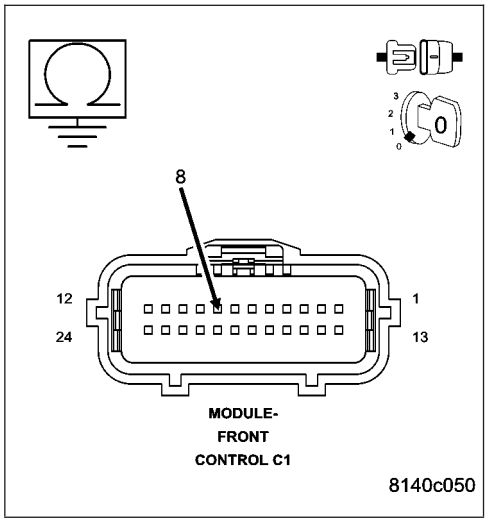
Measure the resistance between ground and the (D65) CAN C Bus (+) circuit.

Is any resistance present?

Yes >> Repair the (D65) CAN C Bus (+) circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 7



7. (D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND

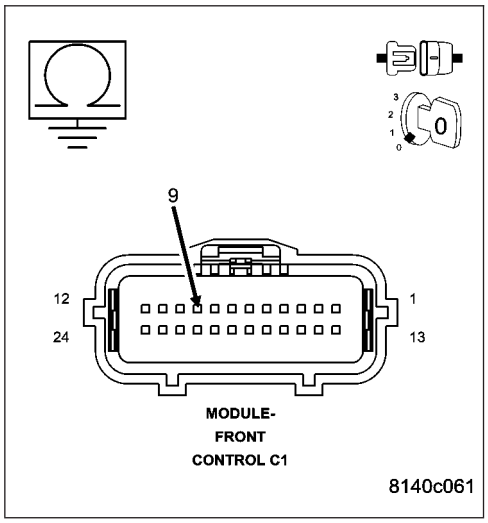
Measure the resistance between ground and the (D64) CAN C Bus (-) circuit.

Is any resistance present?

Yes >> Repair the (D64) CAN C Bus (-) circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

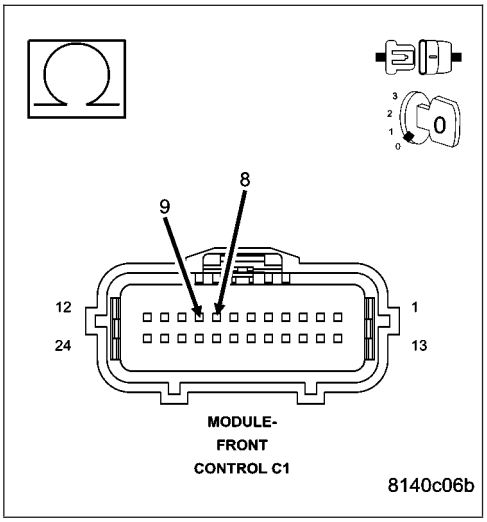
No >> Go To 8



U0001-CAN C BUS CIRCUIT (CONTINUED)

8. (D65) CAN C BUS (+) CIRCUIT SHORTED TO (D64) CAN C BUS (-) CIRCUIT

Measure the resistance between the (D65) CAN C Bus (+) circuit and the (D64) CAN C Bus (-) circuit.



Is any resistance present?

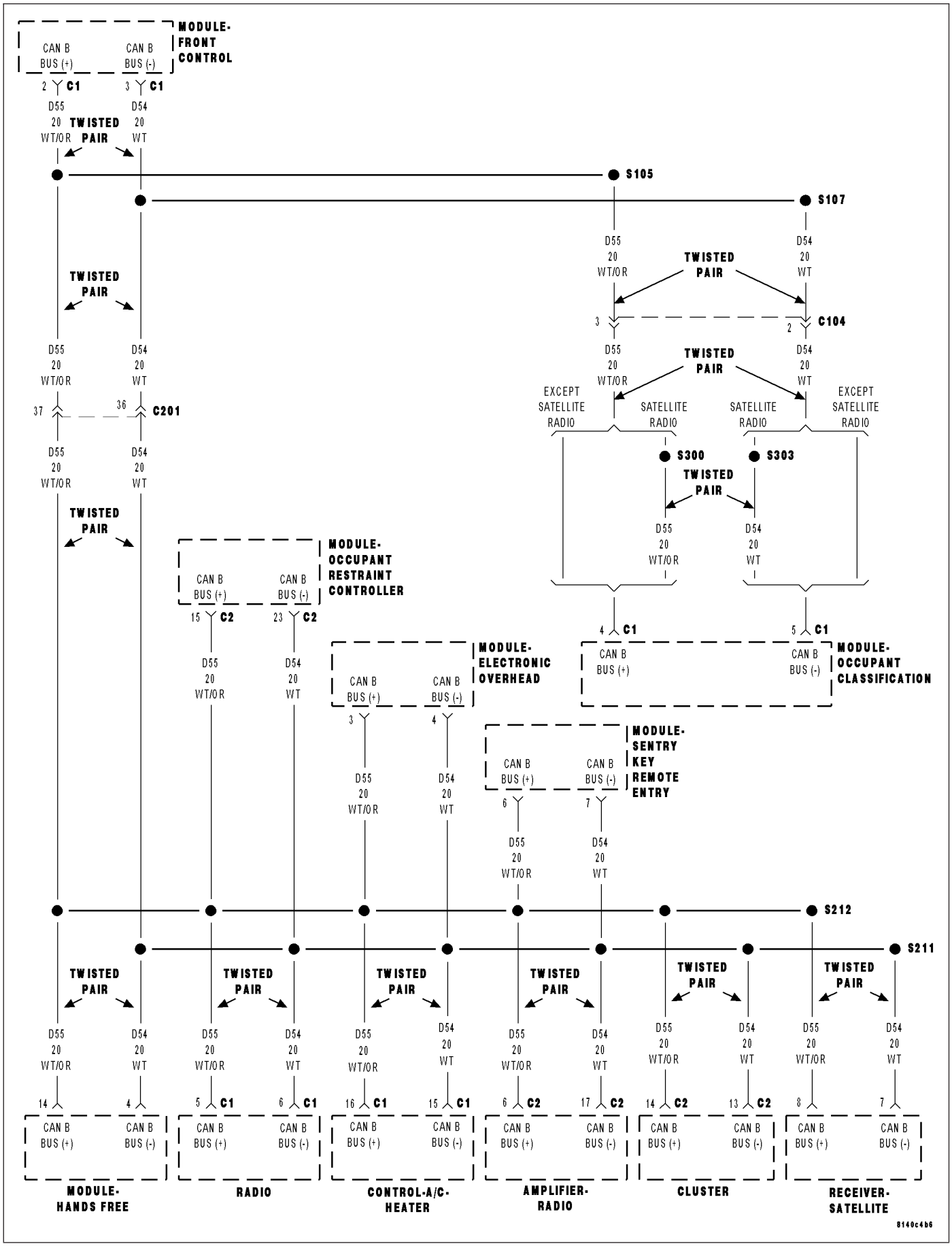
Yes >> Repair the (D65) CAN C Bus (+) circuit for a short to the (D64) CAN C Bus (-) circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Front Control Module in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

U0021-CAN B BUS (+) CIRCUIT OPEN



U0021-CAN B BUS (+) CIRCUIT OPEN (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage between 10 and 16 volts.
- **Set Condition:**
  The FCM detects the (D55) CAN B Bus (+) circuit is open.

Possible Causes
CAN B BUS TERMINAL PUSH OUT
SPREAD CAN B BUS TERMINAL
(D55) CAN B BUS (+) CIRCUIT OPEN
INTERNAL OPEN IN A CAN B BUS MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, record and erase FCM DTC's
Cycle the ignition from on to off 3 times.
Turn the ignition on.
With the scan tool, read active FCM DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

U0021-CAN B BUS (+) CIRCUIT OPEN (CONTINUED)

2. ATTEMPT TO ISOLATE THE OPEN CONDITION

Turn the ignition on.

Verify that all CAN B Bus modules are communicating with the scan tool.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

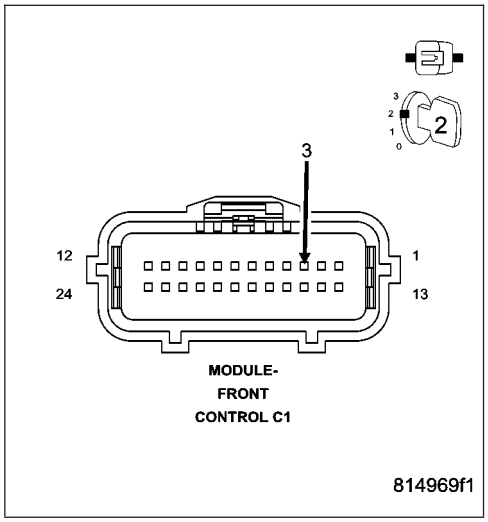
NOTE: If any module is not communicating, perform the appropriate no response test procedure before proceeding.

Turn the ignition off.

Gain access to the Front Control Module C1 harness connector, but do not disconnect.

Using a fused jumper wire, connect one end to ground and with the other end backprobe the CAN B Bus (-) circuit at the FCM C1 harness connector.

Turn the ignition on.



With the scan tool monitor the network status screen and document all modules that display a red X.

Are there any red X's displayed next to the modules?

Yes >> Go To 3

No >> Check backprobe connection to ground, make sure it is proper. The CAN B Bus open DTC may no longer be active, it may be stored. Check all module connections

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

---

3. ATTEMPT TO ISOLATE THE OPEN CONDITION — MULTIPLE RED X'S

With the scan tool continue monitoring the network status screen.

Are there multiple red X's displayed next to the modules?

Yes >> The most likely cause of this condition is an open CAN B Bus (+) circuit between a common CAN B Bus splice and the modules that display the red X next to them. Use the wiring diagrams will help you determine where open condition exists.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 4

U0021-CAN B BUS (+) CIRCUIT OPEN (CONTINUED)

4. (D55) CAN B BUS (+) CIRCUIT OPEN — SINGLE RED X

Turn the ignition off.

Disconnect the module that has the red X displayed next to it.

Turn the ignition on.

Measure the voltage between the (D55) CAN B Bus (+) circuit and ground.

Is there any voltage present?

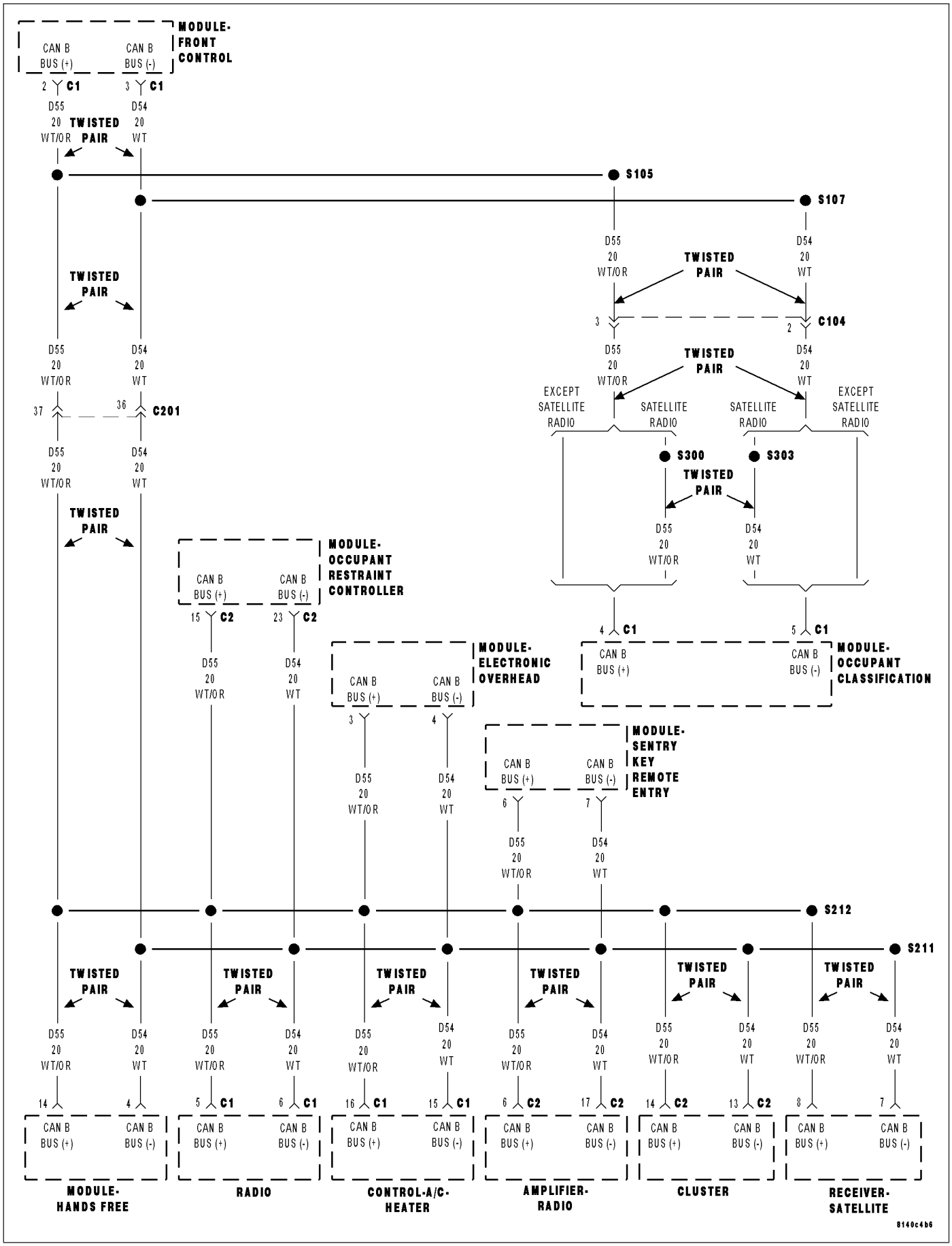
Yes >> Inspect the connector and terminal for damage, inspect for spread terminals, or push out terminals. If ok, replace the module that displayed the red X next to it in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Repair the (D55) CAN B Bus (+) circuit for an open between the next common splice and the module that has the red X displayed next to it. Use the wiring diagrams will help you determine where open condition exists.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

U0022-CAN B BUS (+) CIRCUIT LOW



U0022-CAN B BUS (+) CIRCUIT LOW (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The FCM detects the (D55) CAN B Bus (+) circuit is shorted to ground.

Possible Causes
(D55) CAN B BUS (+) CIRCUIT SHORTED TO GROUND
ANY CAN B BUS MODULE
FRONT CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase FCM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active FCM DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

---

2. CHECK THE (D55) CAN B BUS (+) CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the Front Control Module C1 harness connector.

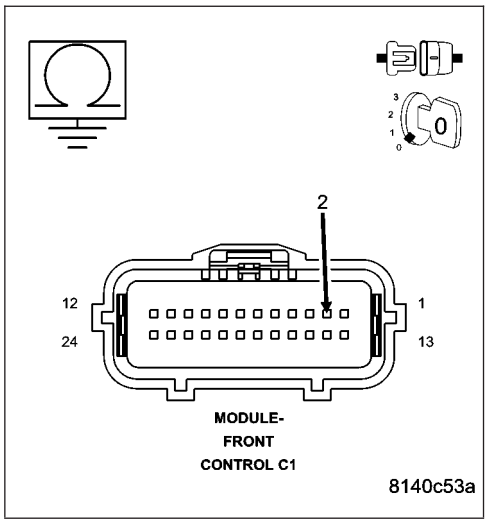
Measure the resistance between ground and the (D55) CAN B Bus (+) circuit.

Is resistance below 1000.0 ohms?

Yes >> Go To 3

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Front Control Module in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



U0022-CAN B BUS (+) CIRCUIT LOW (CONTINUED)

3. (D55) CAN B BUS (+) CIRCUIT SHORTED TO GROUND

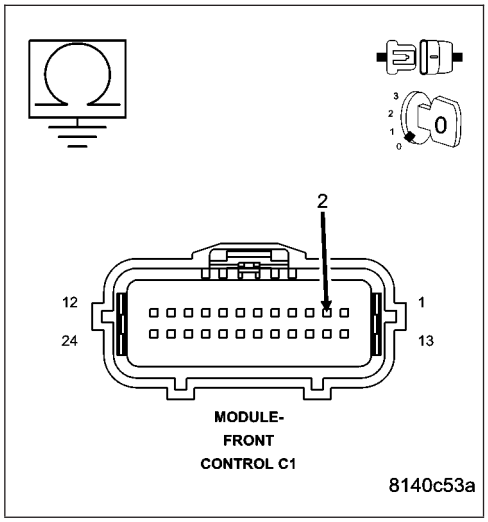
Measure the resistance between ground and the (D55) CAN B Bus (+) circuit.

While monitoring the ohmmeter, disconnect each CAN B Bus module one at a time.

NOTE: This is to determine if the short to ground is internal within a module or if the circuit is shorted.

NOTE: Disconnecting an in-line connector can eliminate a module or group of modules from the list of possible causes for this fault. Refer to the wring diagrams to assist in diagnosis.

Is resistance below 1000.0 ohms with all the CAN B Bus modules disconnected?



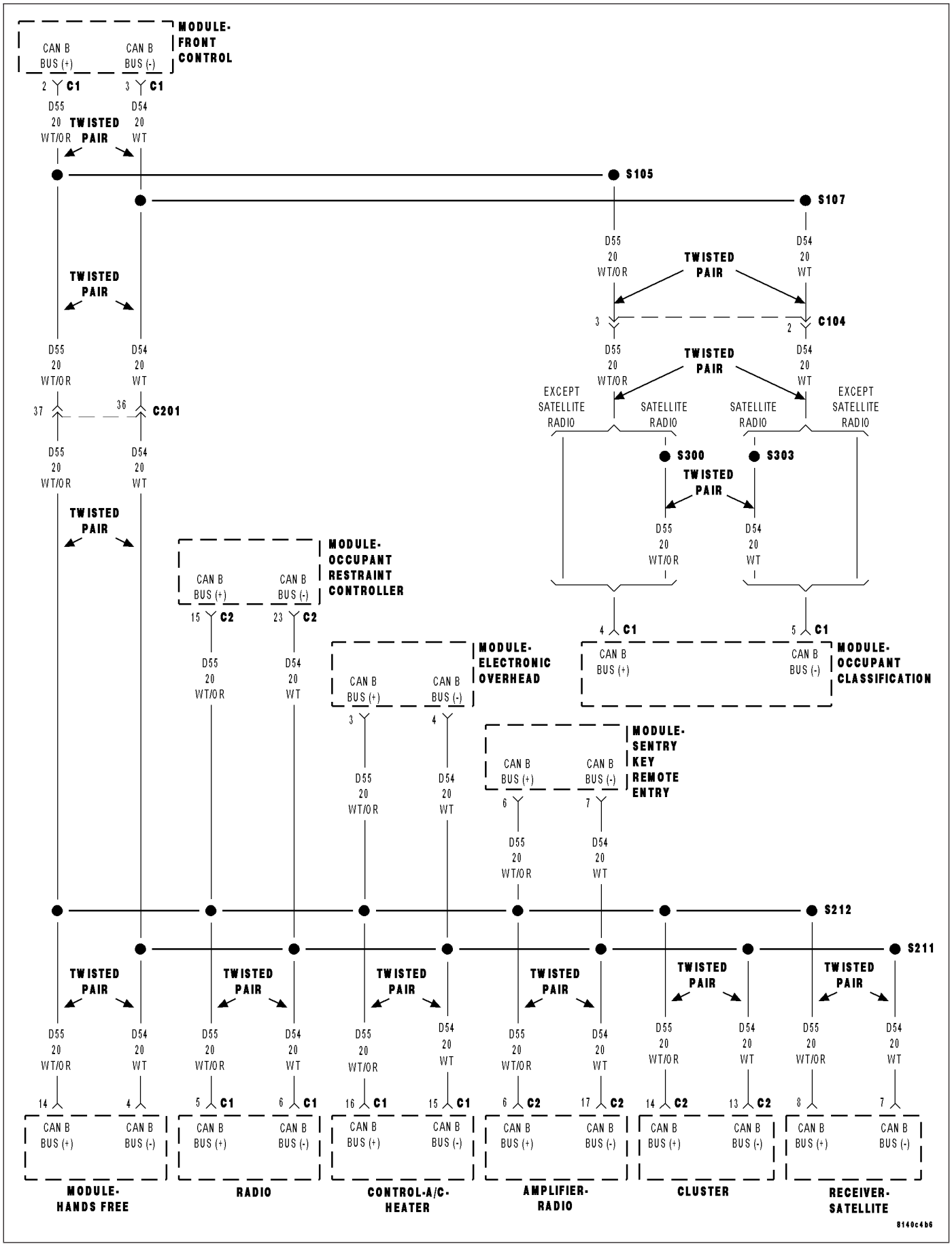
Yes >> Repair the (D55) CAN B Bus (+) circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace the module that when disconnected the short to ground was eliminated, in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

U0023-CAN B BUS (+) CIRCUIT HIGH



U0023-CAN B BUS (+) CIRCUIT HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  The FCM detects the (D55) CAN B Bus (+) circuit is shorted to voltage.

Possible Causes
(D55) CAN B BUS (+) CIRCUIT SHORTED TO VOLTAGE
ANY CAN B BUS MODULE
FRONT CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, record and erase FCM DTC's.
Cycle the ignition from on to off 3 times.
Turn the ignition on.
With the scan tool, read active FCM DTC's.

Does the scan tool display this DTC as active?

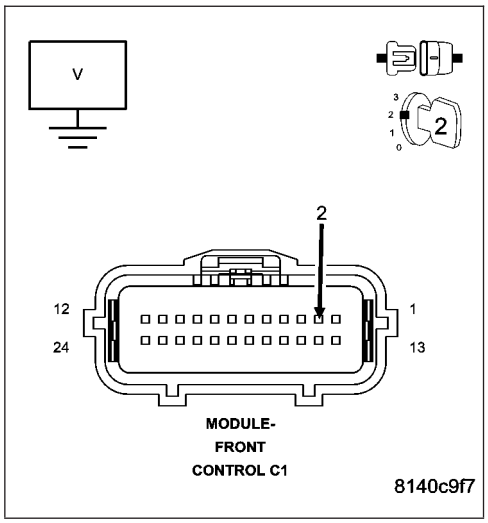
Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

---

2. CHECK THE (D55) CAN B BUS (+) CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off.
Disconnect the Front Control Module C1 harness connector.
Turn the ignition on.
Measure the voltage between the (D55) CAN B Bus (+) circuit and ground.



Is voltage above 10.0 volts?

Yes >> Go To 3

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

U0023-CAN B BUS (+) CIRCUIT HIGH (CONTINUED)

3. (D55) CAN B BUS (+) CIRCUIT SHORTED TO VOLTAGE

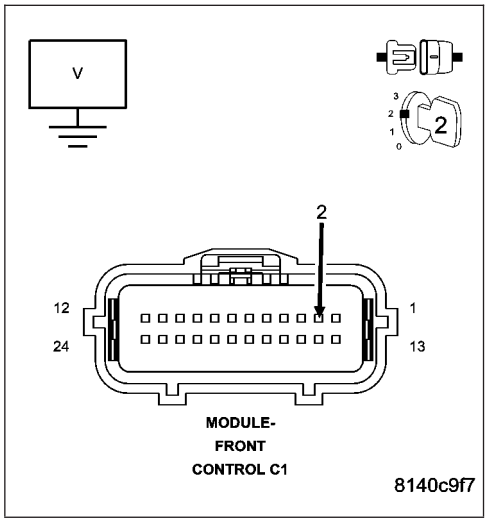
Measure the voltage between the (D55) CAN B Bus (+) circuit and ground.

While monitoring the voltmeter, disconnect each CAN B Bus module one at a time.

NOTE: When performing the above step, turn the ignition off (wait one minute) before disconnecting any module. When the module is disconnected turn the ignition on to check for a short to voltage.

NOTE: This is to determine if the short to voltage is internal within a module or if the circuit is shorted.

NOTE: Disconnecting an in-line connector can eliminate a module or group of modules from the list of possible causes for this fault. Refer to the wring diagrams to assist in diagnosis.

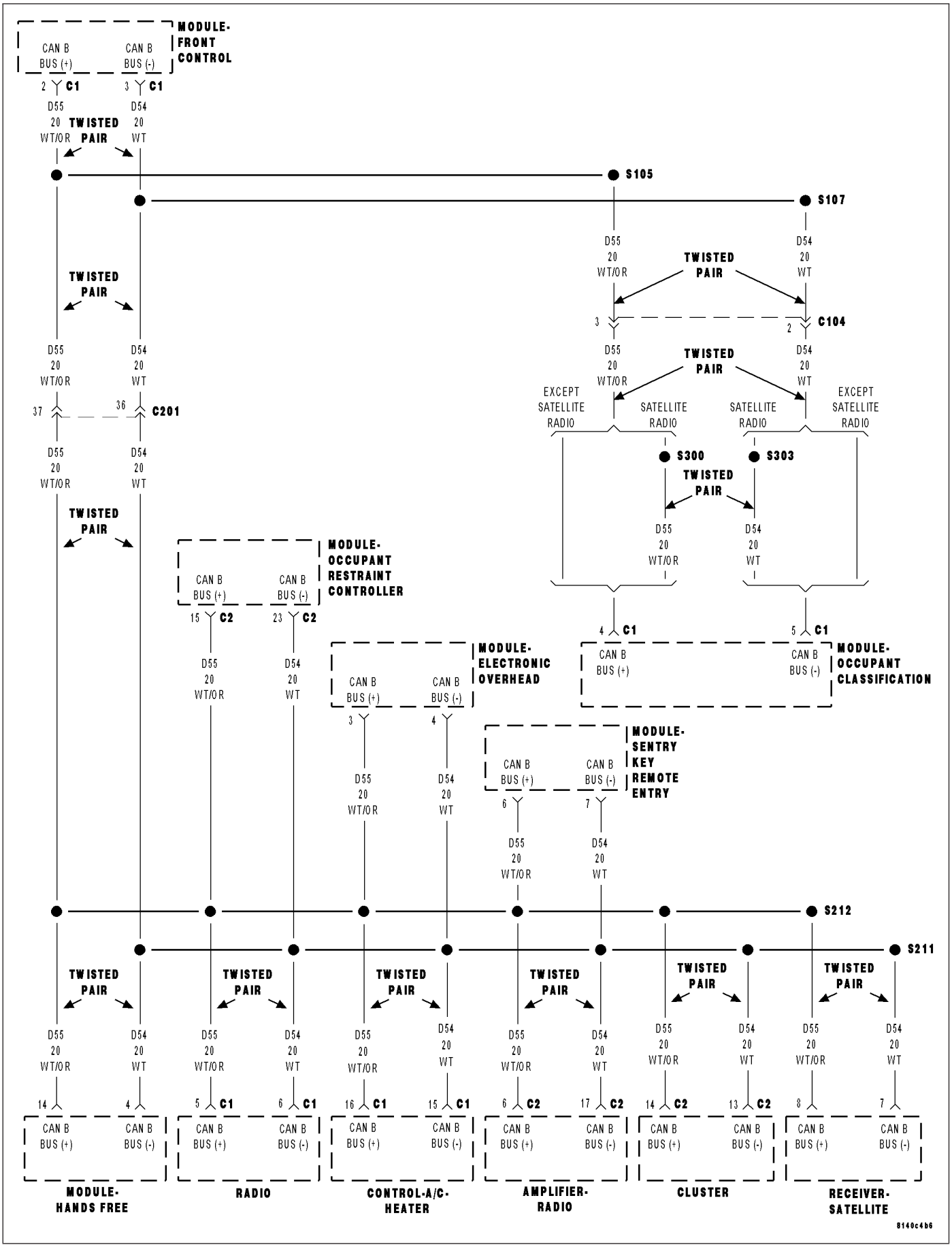


Is the voltage above 10.0 volts with all the CAN B Bus modules disconnected?

Yes >> Repair the (D55) CAN B Bus (+) circuit for a short to voltage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace the module that when disconnected the short to voltage was eliminated, in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

U0024-CAN B BUS (-) CIRCUIT OPEN



U0024-CAN B BUS (-) CIRCUIT OPEN (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage between 10 and 16 volts.
- **Set Condition:**
  The FCM detects the (D54) CAN B Bus (-) circuit is open.

Possible Causes
CAN B BUS TERMINAL PUSH OUT
SPREAD CAN B BUS TERMINAL
(D54) CAN B BUS (-) CIRCUIT OPEN
INTERNAL OPEN IN A CAN B BUS MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, record and erase FCM DTC's
Cycle the ignition from on to off 3 times.
Turn the ignition on.
With the scan tool, read active FCM DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

U0024-CAN B BUS (-) CIRCUIT OPEN (CONTINUED)

2. ATTEMPT TO ISOLATE THE OPEN CONDITION

Turn the ignition on.

Verify that all CAN B Bus modules are communicating with the scan tool.

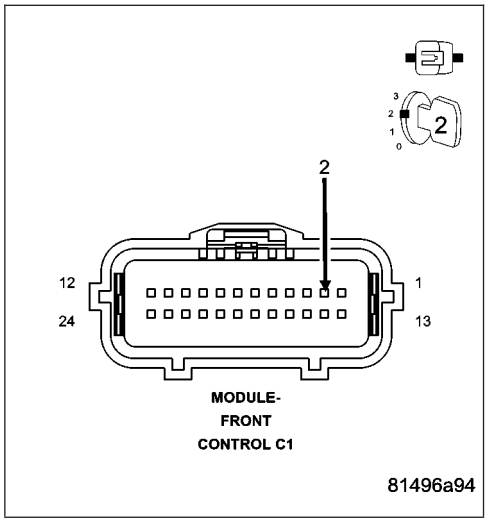
NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

NOTE: If any module is not communicating, perform the appropriate no response test procedure before proceeding.

Turn the ignition off.

Gain access to the Front Control Module C1 harness connector, but do not disconnect.

Using a fused jumper wire, connect one end to ground and with the other end backprobe the CAN B Bus (+) circuit at the FCM C1 harness connector.



Turn the ignition on.

With the scan tool monitor the network status screen and document all modules that display a red X.

Are there any red X's displayed next to the modules?

Yes >> Go To 3

No >> Check backprobe connection to ground, make sure it is proper. The CAN B Bus open DTC may no longer be active, it may be stored. Check all module connections

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

---

3. ATTEMPT TO ISOLATE THE OPEN CONDITION — MULTIPLE RED X'S

With the scan tool continue monitoring the network status screen.

Are there multiple red X's displayed next to the modules?

Yes >> The most likely cause of this condition is an open CAN B Bus (-) circuit between a common CAN B Bus splice and the modules that display the red X next to them. Use the wiring diagrams will help you determine where open condition exists.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 4

U0024-CAN B BUS (-) CIRCUIT OPEN (CONTINUED)

4. (D54) CAN B BUS (-) CIRCUIT OPEN — SINGLE RED X

Turn the ignition off.

Disconnect the module that has the red X displayed next to it.

Turn the ignition on.

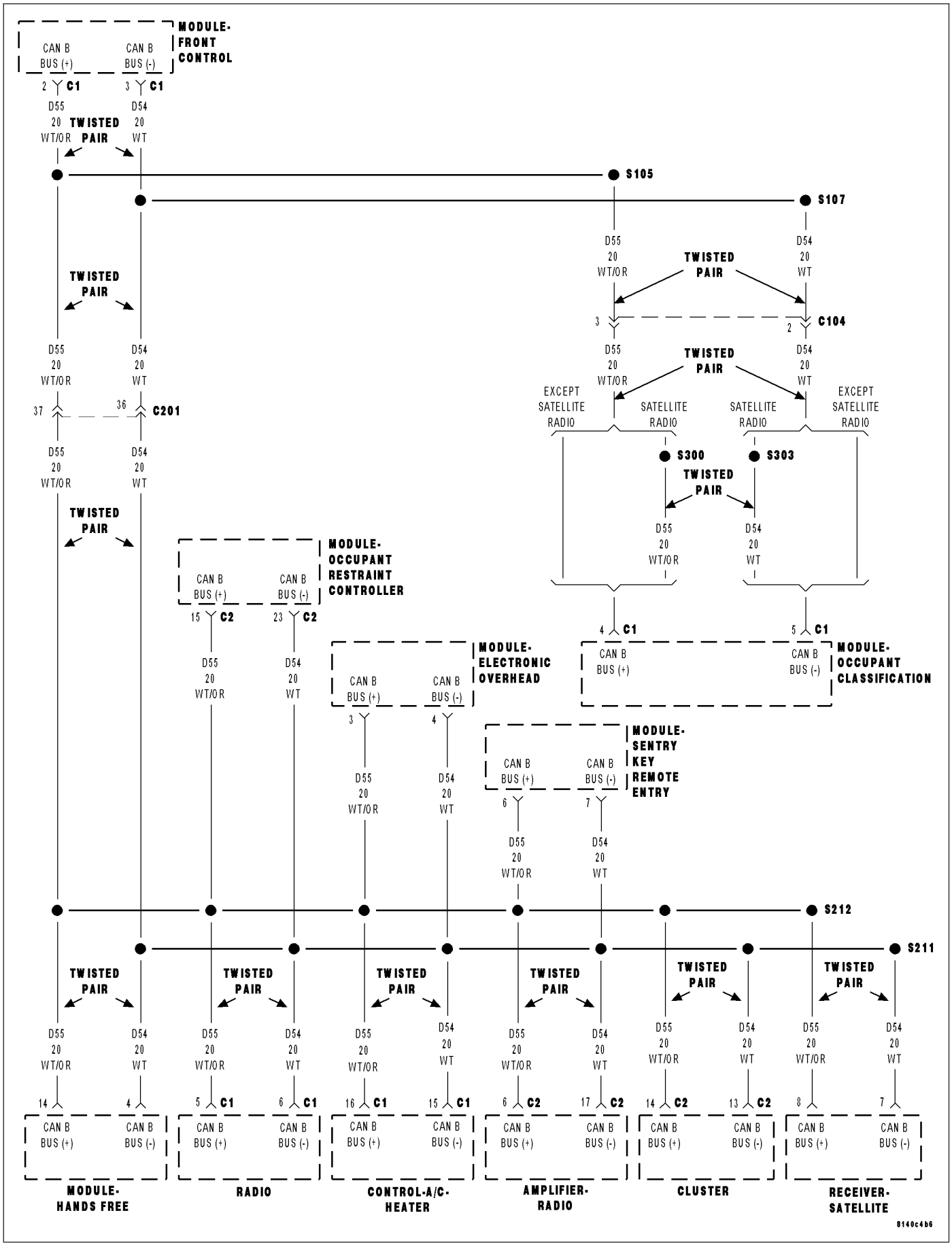
Measure the voltage between the (D54) CAN B Bus (-) circuit and ground.

Is there any voltage present?

Yes >> Inspect the connector and terminal for damage, inspect for spread terminals, or push out terminals. If ok, replace the module that displayed the red X next to it in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Repair the (D54) CAN B Bus (-) circuit for an open between the next common splice and the module that has the red X displayed next to it. Use the wiring diagrams will help you determine where open condition exists.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

U0025-CAN B BUS (-) CIRCUIT LOW



U0025-CAN B BUS (-) CIRCUIT LOW (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  The FCM detects the (D54) CAN B Bus (-) circuit is shorted to ground.

Possible Causes
(D54) CAN B BUS (-) CIRCUIT SHORTED TO GROUND OR TO (D54) CAN B BUS (-) CIRCUIT
ANY CAN B BUS MODULE
FRONT CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, record and erase FCM DTC's.
Cycle the ignition from on to off 3 times.
Turn the ignition on.
With the scan tool, read active FCM DTC's.

Does the scan tool display this DTC as active?

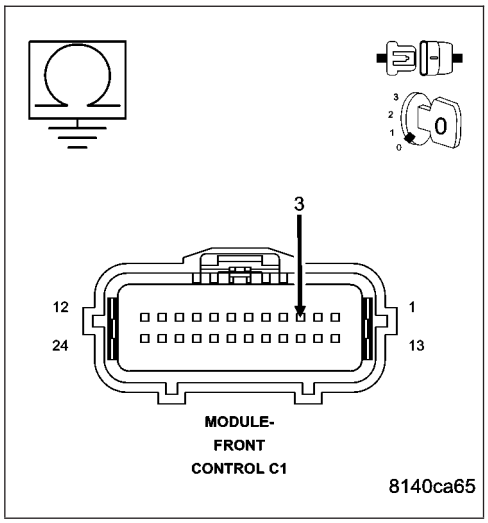
Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

---

2. CHECK THE (D54) CAN B BUS (-) CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
Disconnect the Front Control Module C1 harness connector.
Measure the resistance between ground and the (D54) CAN B Bus (-) circuit.



Is resistance below 1000.0 ohms?

Yes >> Go To 3

No >> Go To 4

U0025-CAN B BUS (-) CIRCUIT LOW (CONTINUED)

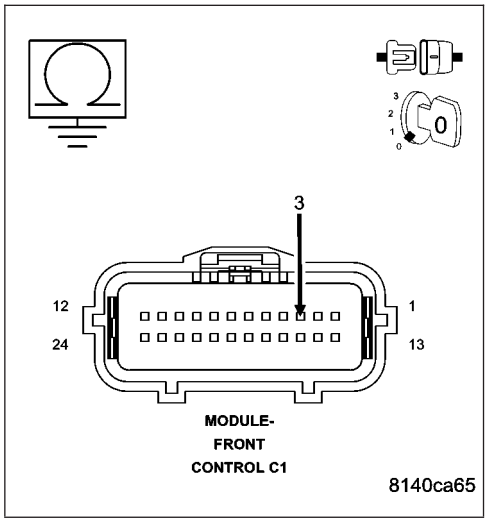
3. (D54) CAN B BUS (-) CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (D54) CAN B Bus (-) circuit.

While monitoring the ohmmeter, disconnect each CAN B Bus module one at a time.

NOTE: This is to determine if the short to ground is internal within a module or if the circuit is shorted.

NOTE: Disconnecting an in-line connector can eliminate a module or group of modules from the list of possible causes for this fault. Refer to the wring diagrams to assist in diagnosis.



Is resistance below 1000.0 ohms with all the CAN B Bus modules disconnected?

Yes >> Repair the (D54) CAN B Bus (-) circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

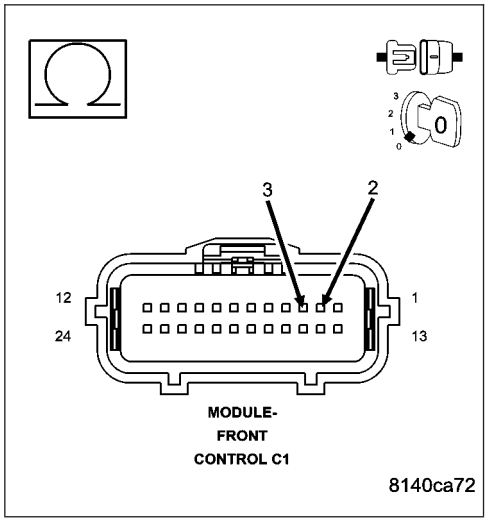
No >> Replace the module that when disconnected the short to ground was eliminated, in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

---

4. CHECK THE (D55) CAN B BUS (+) CIRCUIT FOR A SHORT TO THE (D54) CAN B BUS (-) CIRCUIT

Measure the resistance between the (D55) CAN B Bus (+) circuit and (D54) CAN B Bus (-) circuit.



Is resistance below 1000.0 ohms?

Yes >> Go To 5

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Front Control Module in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

U0025-CAN B BUS (-) CIRCUIT LOW (CONTINUED)

5. (D55) CAN B BUS (+) CIRCUIT SHORTED TO THE (D54) CAN B BUS (-) CIRCUIT

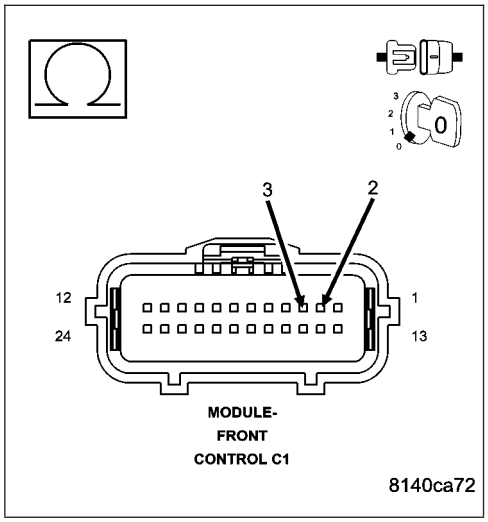
Measure the resistance between the (D55) CAN B Bus (+) circuit and (D54) CAN B Bus (-) circuit.

While monitoring the ohmmeter, disconnect each CAN B Bus module one at a time.

NOTE: This is to determine if the short together is internal within a module or if the circuits are shorted together.

NOTE: Disconnecting an in-line connector can eliminate a module or group of modules from the list of possible causes for this fault. Refer to the wring diagrams to assist in diagnosis.

Is resistance below 1000.0 ohms with all the CAN B Bus modules disconnected?



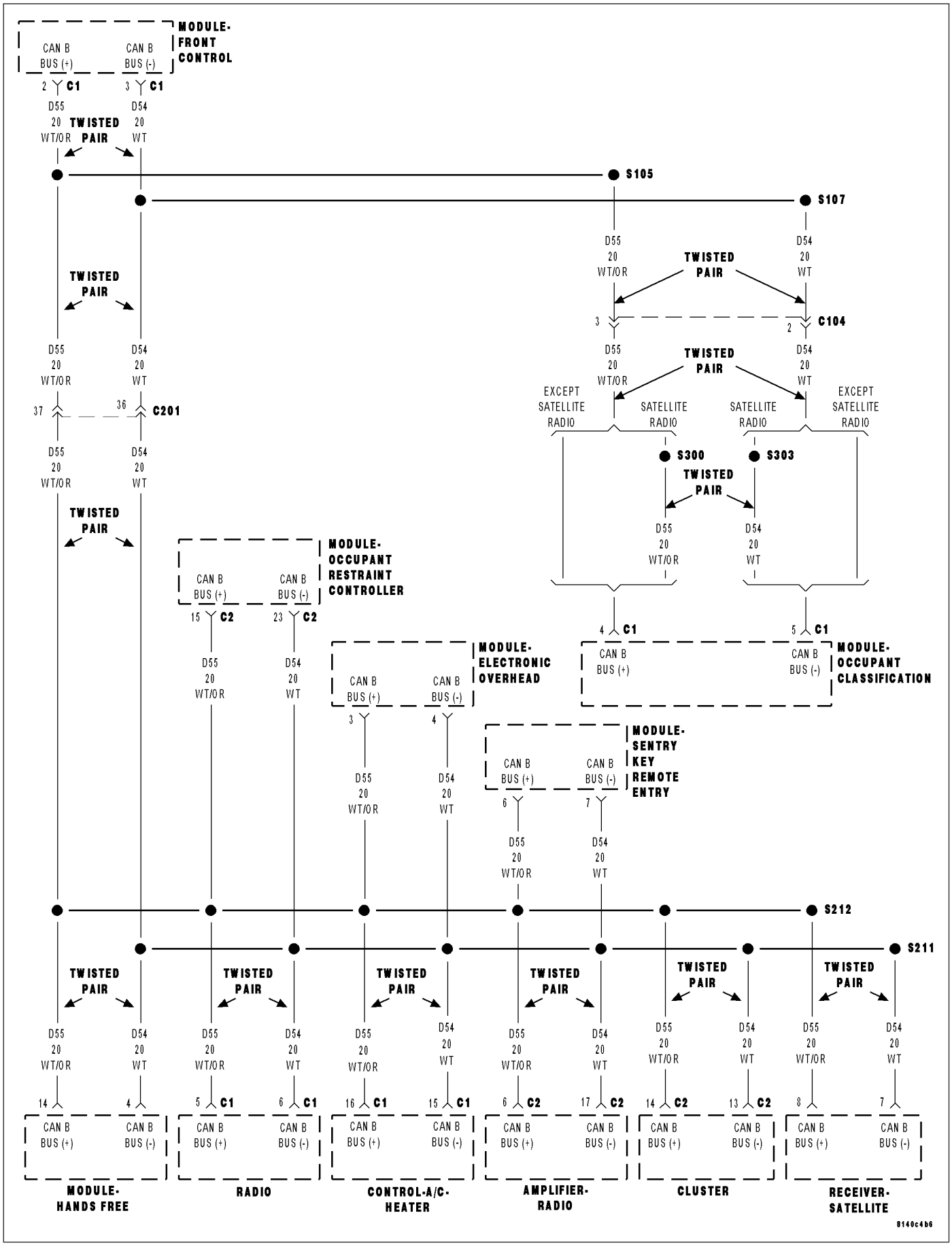
Yes >> Repair the (D55) CAN B Bus (+) circuit for a short to the (D54) CAN B Bus (-) circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace the module that when disconnected the short to ground was eliminated, in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

U0026-CAN B BUS (-) CIRCUIT HIGH



U0026-CAN B BUS (-) CIRCUIT HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  The FCM detects the (D54) CAN B Bus (-) circuit is shorted to voltage.

Possible Causes
(D54) CAN B BUS (-) CIRCUIT SHORTED TO VOLTAGE
ANY CAN B BUS MODULE
FRONT CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase FCM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active FCM DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

---

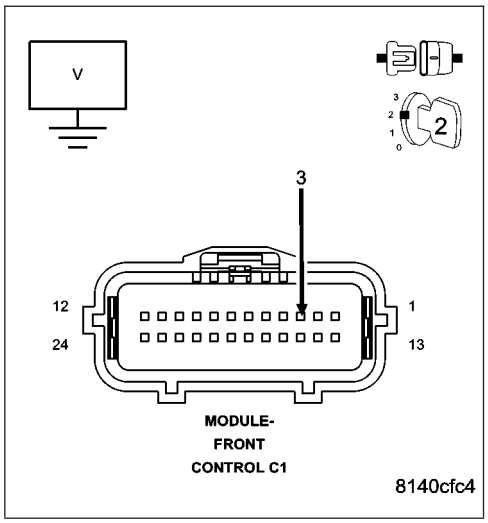
2. CHECK THE (D54) CAN B BUS (-) CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the Front Control Module C1 harness connector.

Turn the ignition on.

Measure the voltage between the (D54) CAN B Bus (-) circuit and ground.



Is voltage above 10.0 volts?

Yes >> Go To 3

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Front Control Module in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

U0026-CAN B BUS (-) CIRCUIT HIGH (CONTINUED)

3. (D54) CAN B BUS (-) CIRCUIT SHORTED TO VOLTAGE

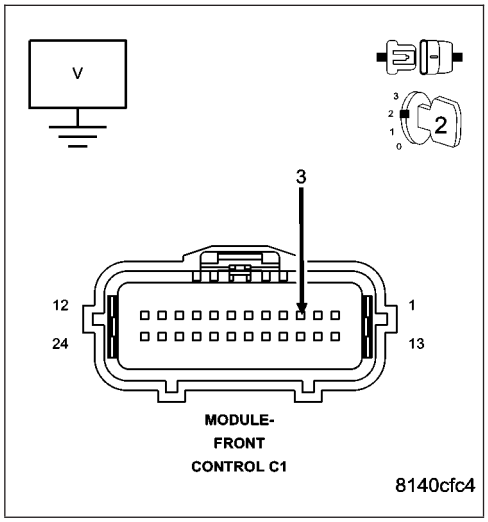
Measure the voltage between the (D54) CAN B Bus (-) circuit and ground.

While monitoring the voltmeter, disconnect each CAN B Bus module one at a time.

NOTE: When performing the above step, turn the ignition off (wait one minute) before disconnecting any module. When the module is disconnected turn the ignition on to check for a short to voltage.

NOTE: This is to determine if the short to voltage is internal within a module or if the circuit is shorted.

NOTE: Disconnecting an in-line connector can eliminate a module or group of modules from the list of possible causes for this fault. Refer to the wring diagrams to assist in diagnosis.

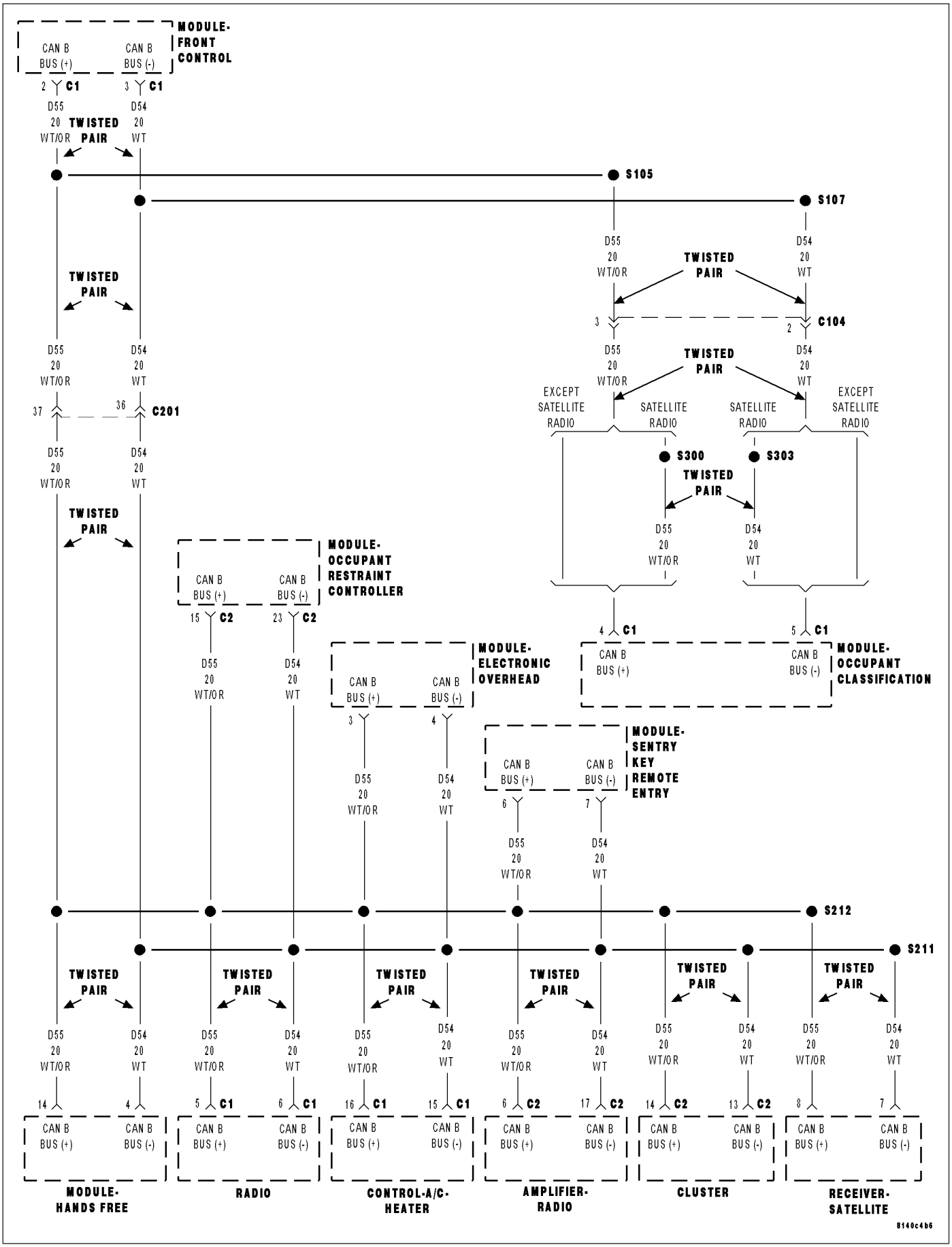


Is the voltage above 10.0 volts with all the CAN B Bus modules disconnected?

Yes >> Repair the (D54) CAN B Bus (-) circuit for a short to voltage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace the module that when disconnected the short to voltage was eliminated, in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

U0027-CAN B BUS (-) SHORTED TO BUS (+)



U0027-CAN B BUS (-) SHORTED TO BUS (+) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  The FCM detects the (D55) CAN B Bus (+) circuit is shorted to the (D54) CAN B Bus (-) circuit.

Possible Causes
(D55) CAN B BUS (+) CIRCUIT SHORTED TO THE (D54) CAN B BUS (-) CIRCUIT
ANY CAN B BUS MODULE
FRONT CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, record and erase FCM DTC's.
Cycle the ignition from on to off 3 times.
Turn the ignition on.
With the scan tool, read active FCM DTC's.

Does the scan tool display this DTC as active?

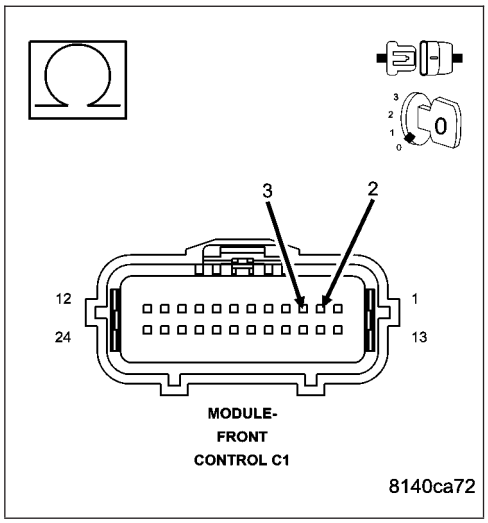
Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

---

2. CHECK THE (D55) CAN B BUS (+) CIRCUIT FOR A SHORT TO THE (D54) CAN B BUS (-) CIRCUIT

Turn the ignition off.
Disconnect the Front Control Module C1 harness connector.
Measure the resistance between the (D55) CAN B Bus (+) circuit and (D54) CAN B Bus (-) circuit.



Is resistance below 1000.0 ohms?

Yes >> Go To 3

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

U0027-CAN B BUS (-) SHORTED TO BUS (+) (CONTINUED)

3. (D55) CAN B BUS (+) CIRCUIT SHORTED TO THE (D54) CAN B BUS (-) CIRCUIT

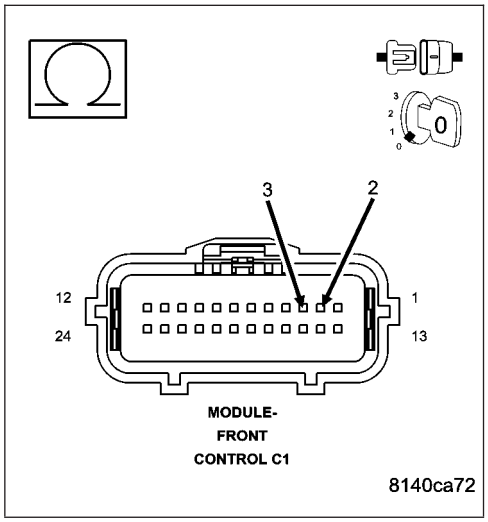
Measure the resistance between the (D55) CAN B Bus (+) circuit and (D54) CAN B Bus (-) circuit.

While monitoring the ohmmeter, disconnect each CAN B Bus module one at a time.

NOTE: This is to determine if the short together is internal within a module or if the circuits are shorted together.

NOTE: Disconnecting an in-line connector can eliminate a module or group of modules from the list of possible causes for this fault. Refer to the wring diagrams to assist in diagnosis.

Is resistance below 1000.0 ohms with all the CAN B Bus modules disconnected?



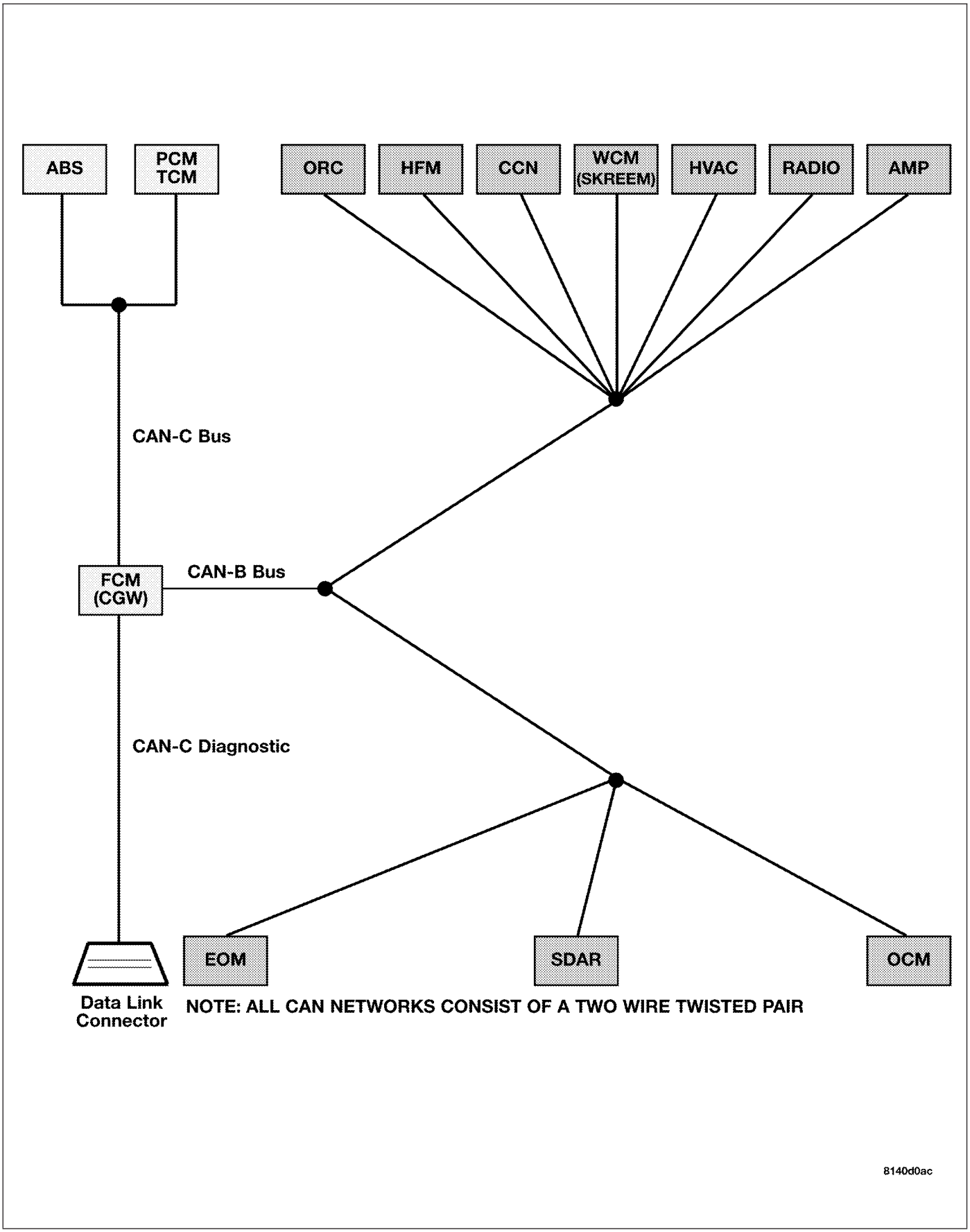
Yes >> Repair the (D55) CAN B Bus (+) circuit for a short to the (D54) CAN B Bus (-) circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace the module that when disconnected the short together was eliminated, in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

U0100-LOST COMMUNICATION WITH ECM/PCM



U0100-LOST COMMUNICATION WITH ECM/PCM (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the ECM/PCM for approximately 2 to 5 seconds.

Possible Causes
CAN B OR CAN C BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
ECM/PCM POWER AND GROUND
ECM/PCM
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE ECM/PCM IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the ECM/PCM is active on the bus.

Is the ECM/PCM active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0100-LOST COMMUNICATION WITH ECM/PCM (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

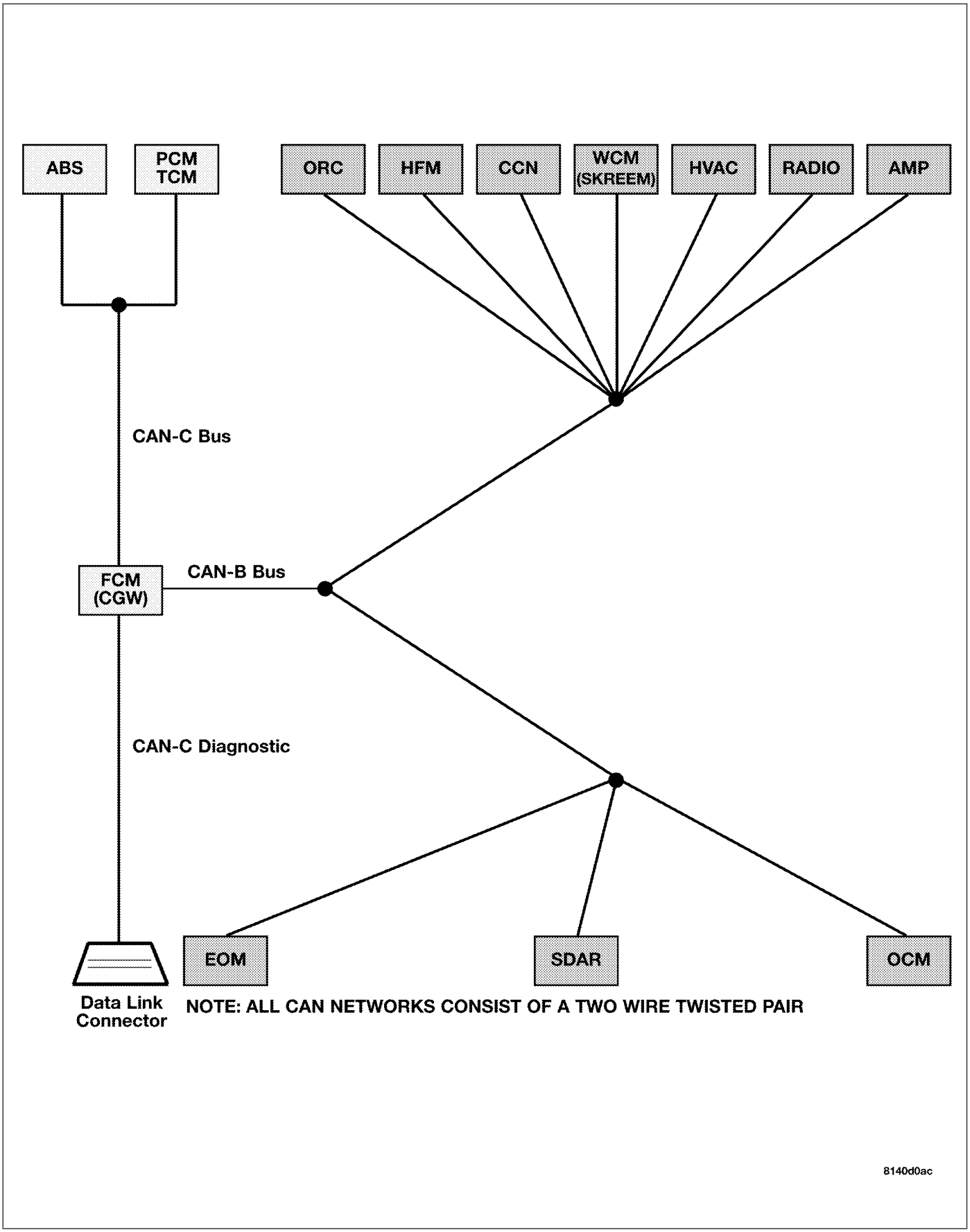
With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs "Logged Against" the ECM/PCM?

Yes >> Replace/update the ECM/PCM in accordance with the service information. Perform the appropriate VERIFICATION TEST.

No >> Replace/update the module that set this DTC in accordance with the service information. Perform the appropriate VERIFICATION TEST.

U0101-LOST COMMUNICATION WITH TCM



U0101-LOST COMMUNICATION WITH TCM (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the TCM for approximately 2 to 5 seconds.

Possible Causes
CAN B OR CAN C BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
TCM POWER AND GROUND
TCM (PCM)
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE TCM IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the TCM is active on the bus.

Is the TCM active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0101-LOST COMMUNICATION WITH TCM (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

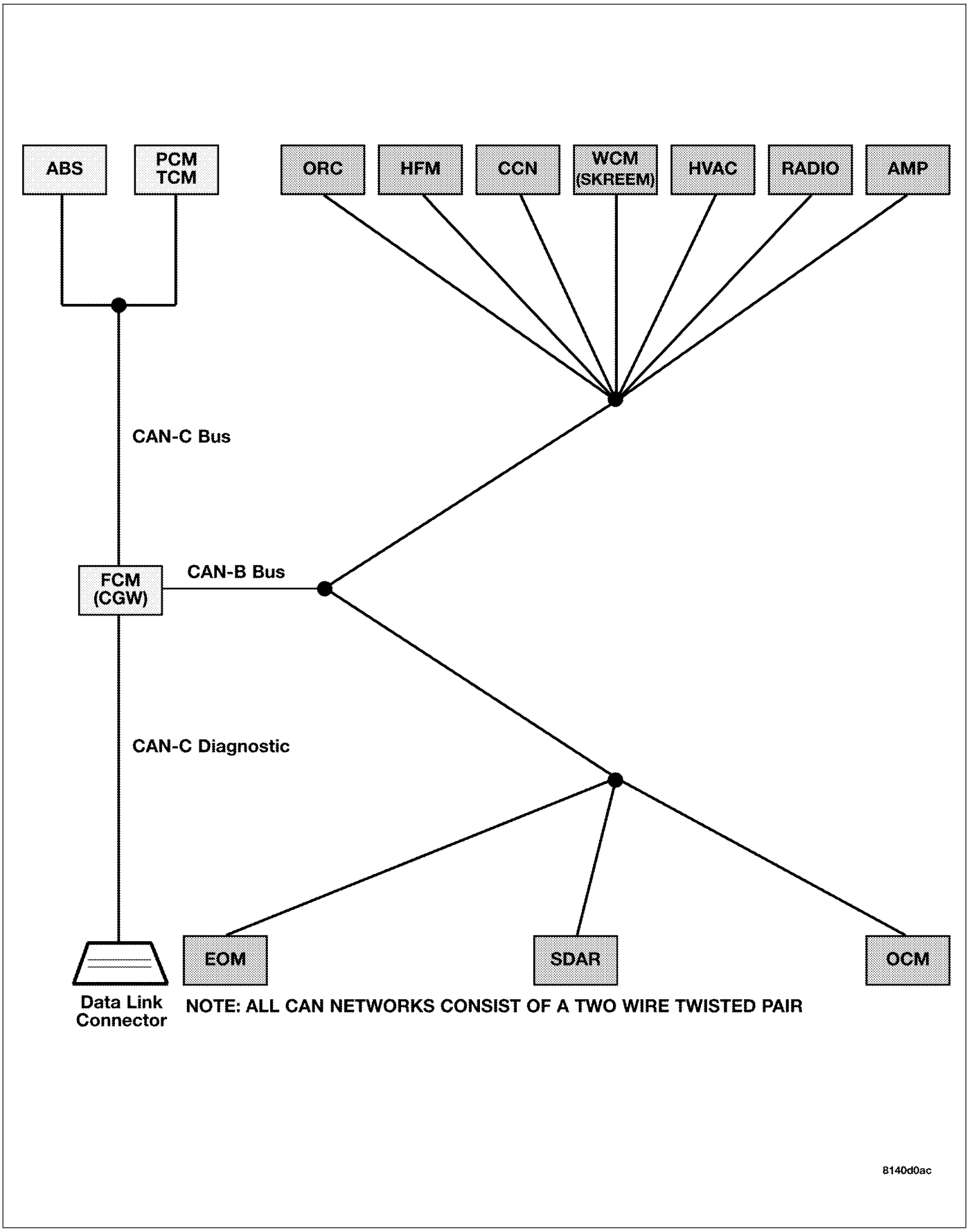
With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs "Logged Against" the TCM?

Yes >> Replace/update the TCM (PCM) in accordance with the service information. Perform the appropriate VERIFICATION TEST.

No >> Replace/update the module that set this DTC in accordance with the service information. Perform the appropriate VERIFICATION TEST.

U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE SYSTEM (ABS) CONTROL MODULE



U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE SYSTEM (ABS) CONTROL MODULE (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the Antilock Brake Module for approximately 2 to 5 seconds.

Possible Causes
CAN B OR CAN C BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
ANTILOCK BRAKE MODULE POWER AND GROUND
ANTILOCK BRAKE MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE ABS IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the ABS is active on the bus.

Is the ABS active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE SYSTEM (ABS) CONTROL MODULE (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

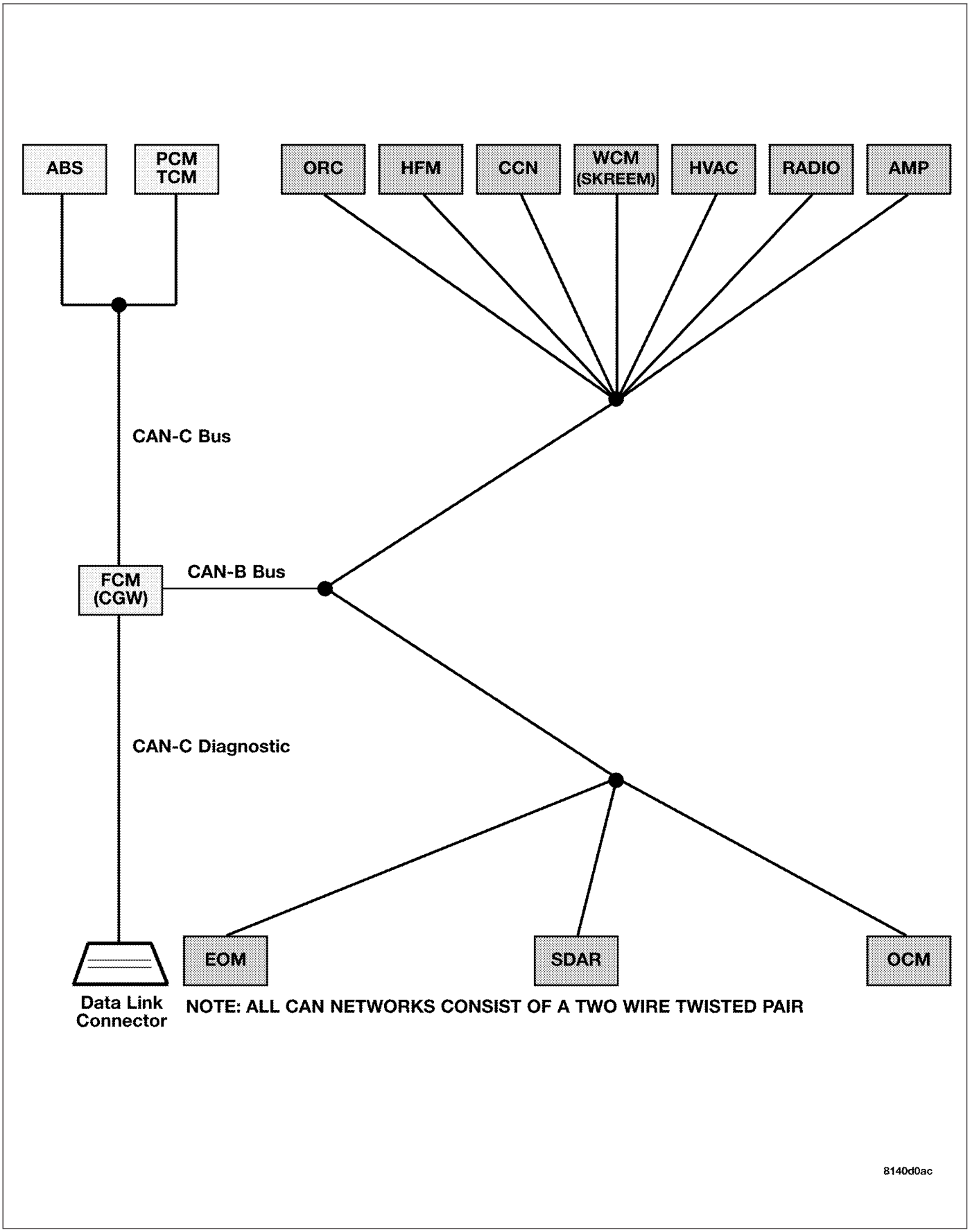
With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the ABS?

Yes >> Replace/update the Antilock Brake Module in accordance with the service information. Perform ABS VERIFICATION TEST - VER 1.

No >> Replace/update the module that set this DTC in accordance with the service information Perform the appropriate VERIFICATION TEST.

U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE



U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the Front Control Module for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
FRONT CONTROL MODULE POWER AND GROUND
FRONT CONTROL MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE FCM IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the FCM is active on the bus.

Is the FCM active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

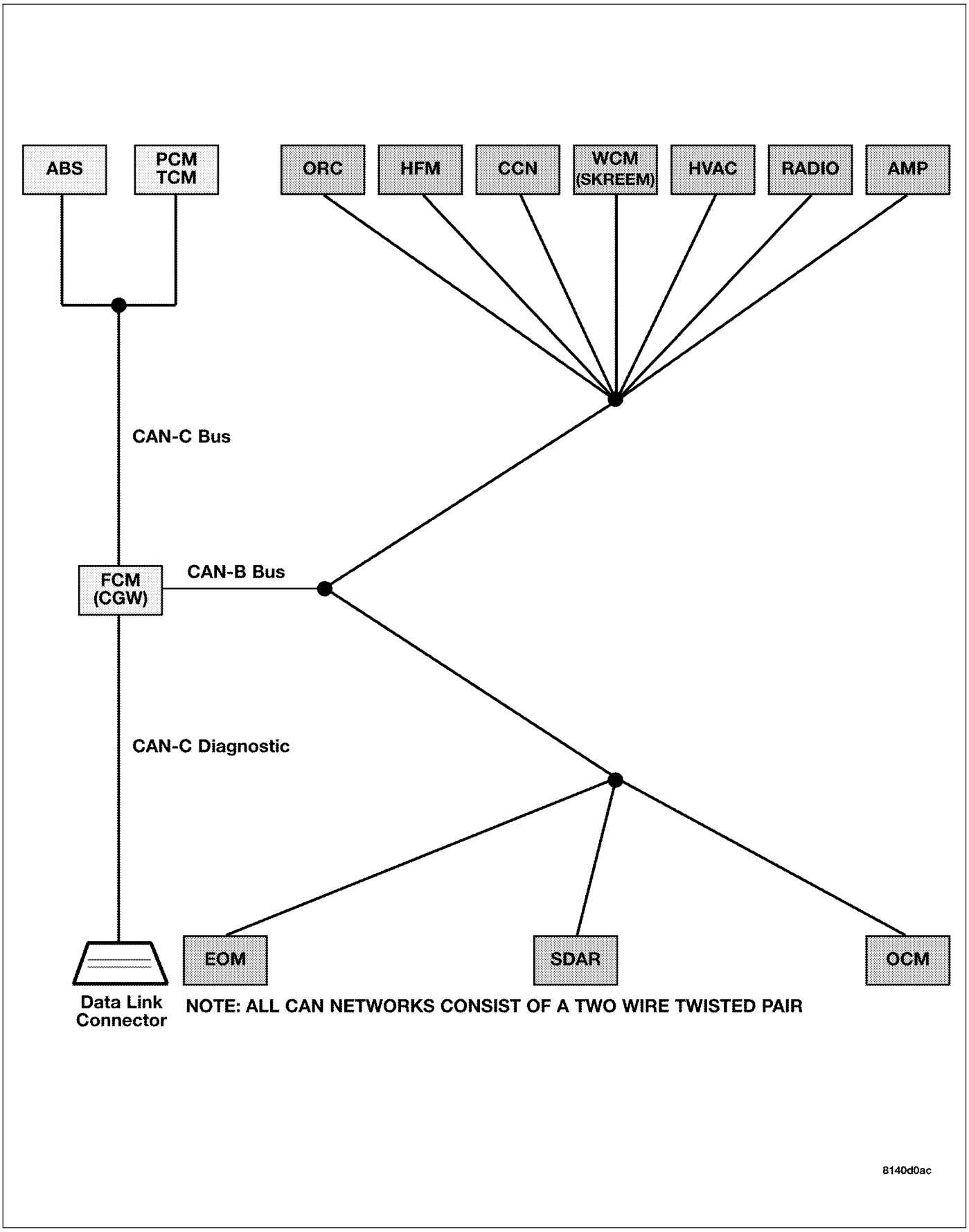
With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the FCM?

Yes >> Replace/update the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace/update the module that set this DTC in accordance with the service information
Perform the appropriate VERIFICATION TEST.

U0151–LOST COMMUNICATION WITH OCCUPANT RESTRAINT CONTROLLER (ORC)



U0151–LOST COMMUNICATION WITH OCCUPANT RESTRAINT CONTROLLER (ORC) (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the Occupant Restraint Controller for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
OCCUPANT RESTRAINT CONTROLLER POWER AND GROUND
OCCUPANT RESTRAINT CONTROLLER
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE ORC IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the ORC is active on the bus.

Is the ORC active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0151–LOST COMMUNICATION WITH OCCUPANT RESTRAINT CONTROLLER (ORC) (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

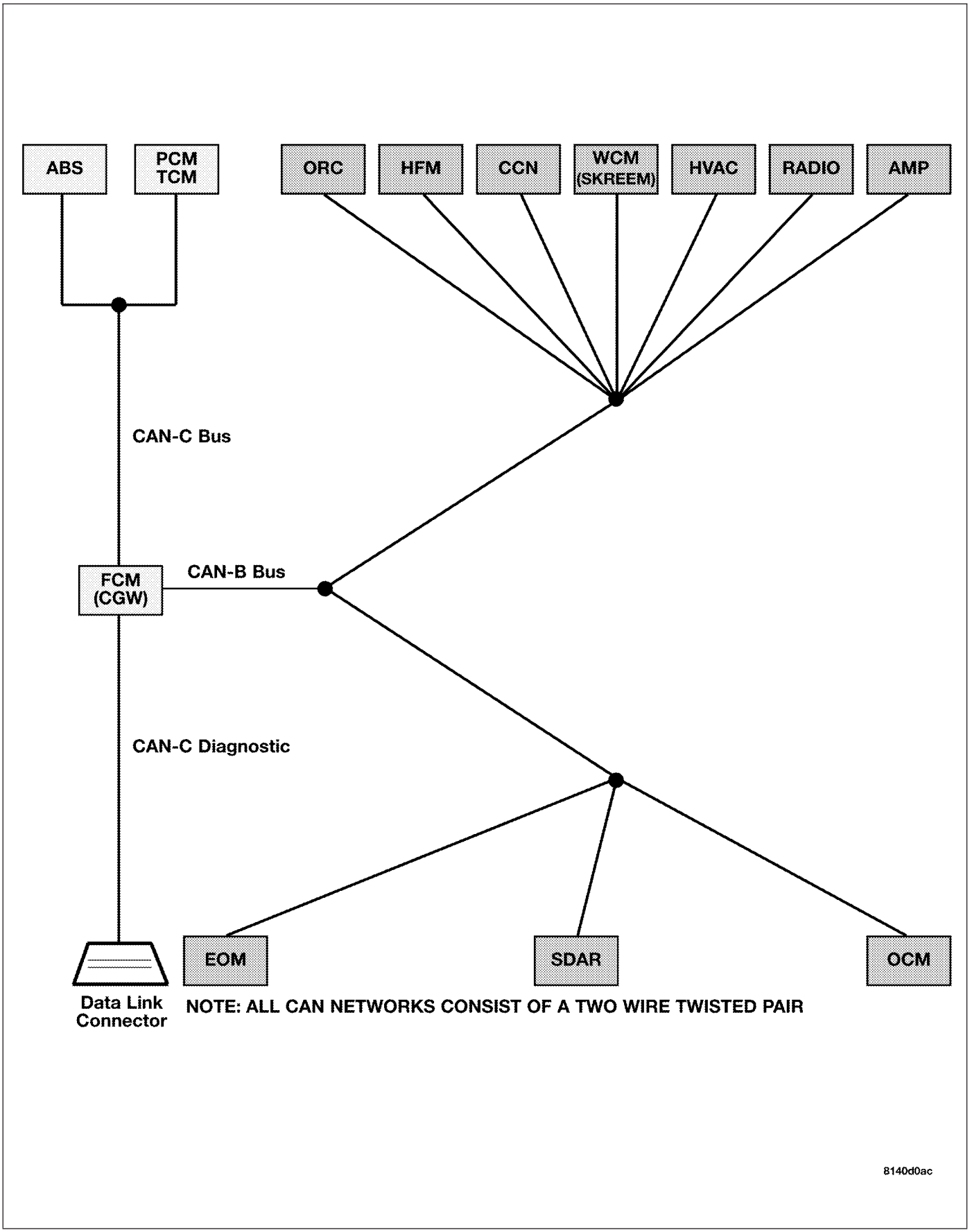
With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs "Logged Against" the ORC?

Yes >> Replace/update the Occupant Restraint Controller in accordance with the service information. Perform AIRBAG VERIFICATION TEST – VER 1.

No >> Replace/update the module that set this DTC in accordance with the service information Perform the appropriate VERIFICATION TEST.

U0154–LOST COMMUNICATION WITH OCCUPANT CLASSIFICATION MODULE



U0154–LOST COMMUNICATION WITH OCCUPANT CLASSIFICATION MODULE (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the Occupant Classification Module for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
OCCUPANT CLASSIFICATION MODULE POWER AND GROUND
OCCUPANT CLASSIFICATION MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE OCM IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the OCM is active on the bus.

Is the OCM active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0154–LOST COMMUNICATION WITH OCCUPANT CLASSIFICATION MODULE (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

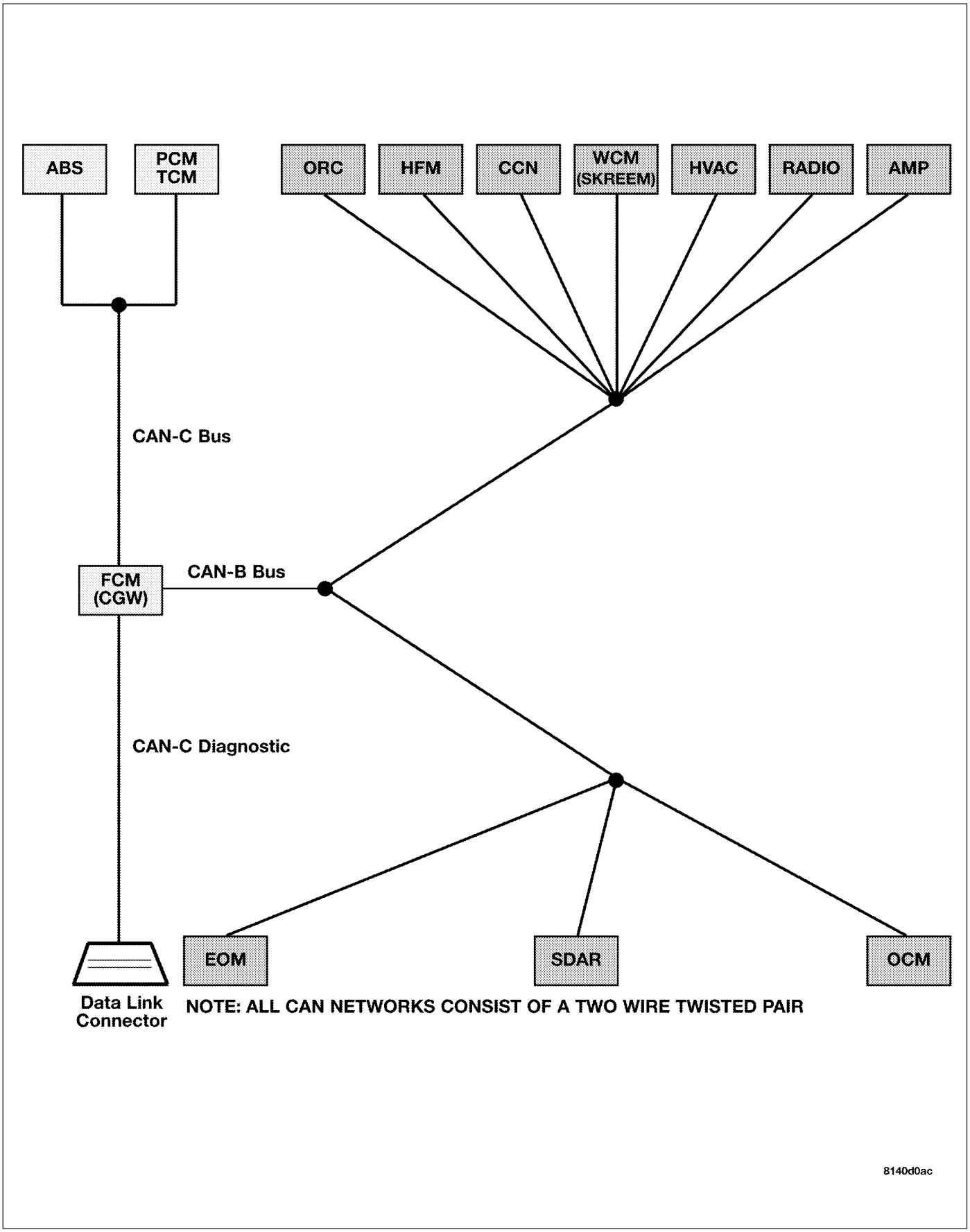
With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the OCM?

Yes >> Replace/update the Occupant Classification Module in accordance with the service information. Perform AIRBAG VERIFICATION TEST – VER 1.

No >> Replace/update the module that set this DTC in accordance with the service information Perform the appropriate VERIFICATION TEST.

U0155-LOST COMMUNICATION WITH CLUSTER/CCN



U0155-LOST COMMUNICATION WITH CLUSTER/CCN (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the Cluster/CCN for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
CLUSTER/CCN POWER AND GROUND
CLUSTER/CCN
MODULE THAT SET THE DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE CCN IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the CCN is active on the bus.

Is the CCN active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0155-LOST COMMUNICATION WITH CLUSTER/CCN (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

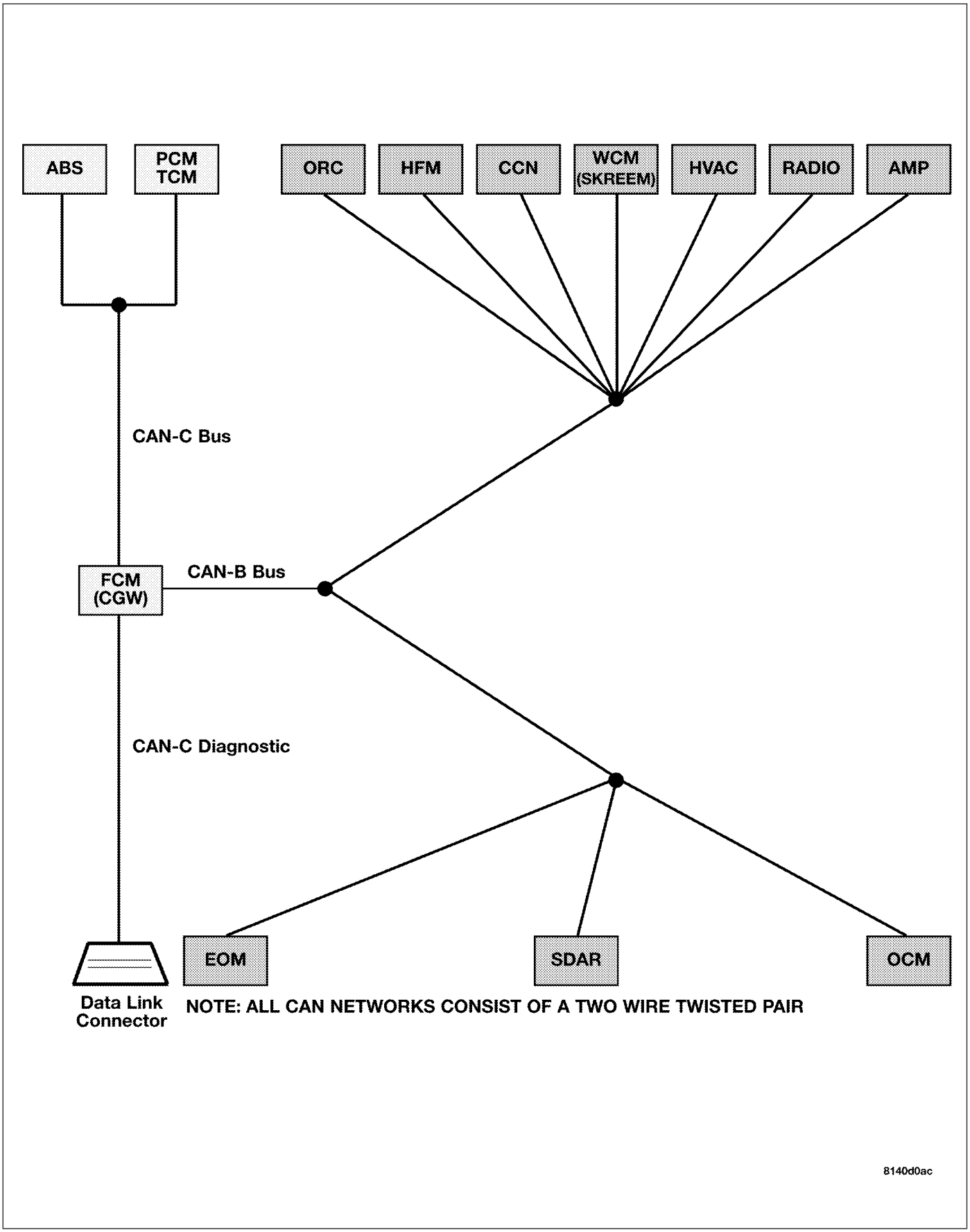
With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs "Logged Against" the CCN?

Yes >> Replace/update the Cluster (CCN) in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace/update the module that set this DTC in accordance with the service information.
Perform the appropriate VERIFICATION TEST.

U0156–LOST COMMUNICATION WITH EOM



U0156–LOST COMMUNICATION WITH EOM (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the Electronic Overhead Module (EOM) for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
ELECTRONIC OVERHEAD MODULE POWER OR GROUND
ELECTRONIC OVERHEAD MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE EOM IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the EOM is active on the bus.

Is the EOM active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0156–LOST COMMUNICATION WITH EOM (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

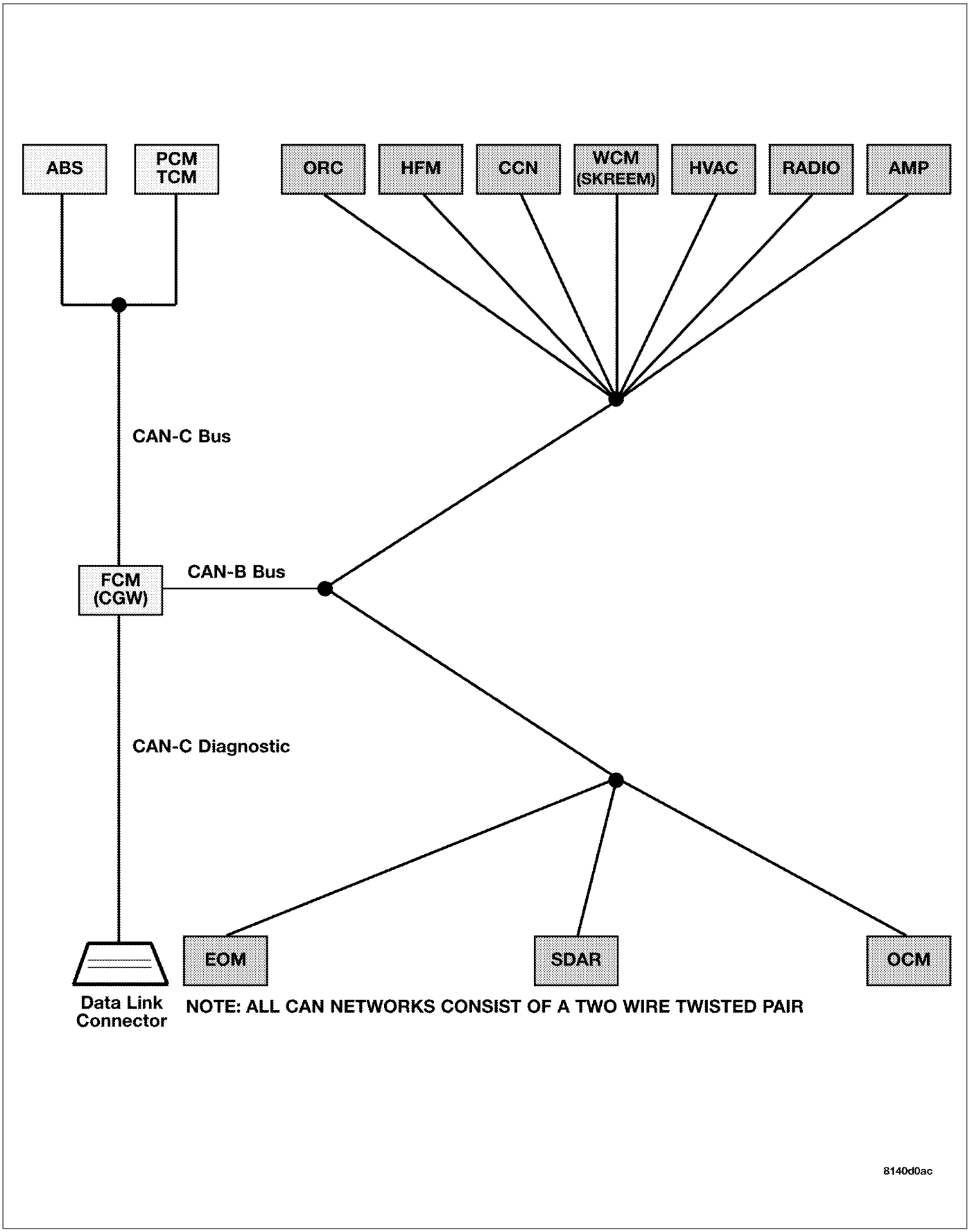
With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the EOM?

Yes >> Replace/update the Electronic Overhead Module (EOM) in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace/update the module that set this DTC in accordance with the service information Perform the appropriate VERIFICATION TEST.

U0164-LOST COMMUNICATION WITH HVAC CONTROL MODULE



U0164-LOST COMMUNICATION WITH HVAC CONTROL MODULE (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the A/C Heater Control (HVAC) for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
A/C HEATER CONTROL POWER AND GROUND
A/C HEATER CONTROL
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE HVAC IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the HVAC is active on the bus.

Is the HVAC active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0164-LOST COMMUNICATION WITH HVAC CONTROL MODULE (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

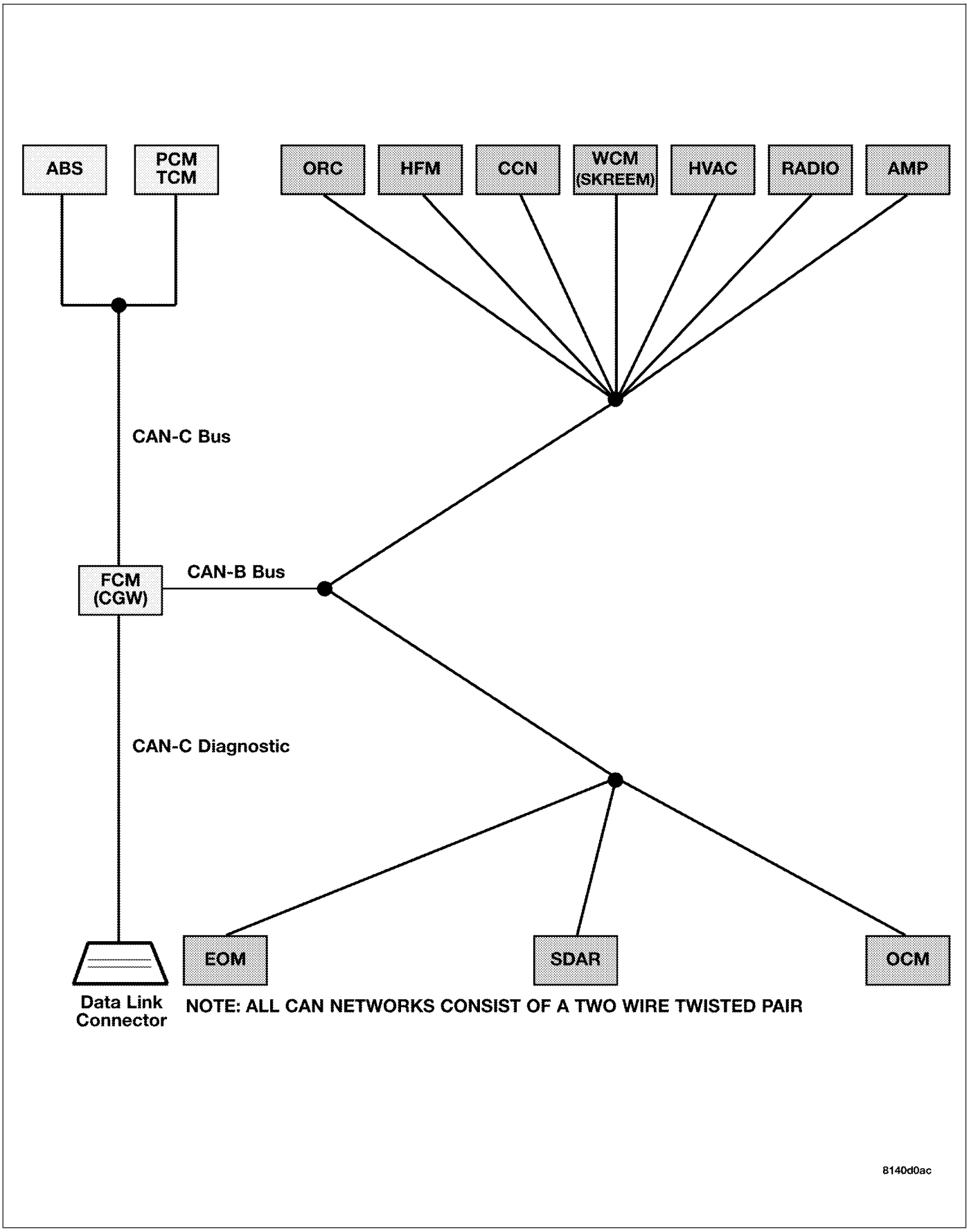
With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs "Logged Against" the HVAC?

Yes >> Replace/update the A/C Heater Control in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace/update the module that set the DTC in accordance with the service information
Perform the appropriate VERIFICATION TEST.

U0168-LOST COMMUNICATION WITH VEHICLE SECURITY CONTROL MODULE (SKREEM/WCM)



U0168-LOST COMMUNICATION WITH VEHICLE SECURITY CONTROL MODULE (SKREEM/WCM) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the Sentry Key Remote Entry Module (WCM) for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
SENTRY KEY REMOTE ENTRY MODULE POWER AND GROUND
SENTRY KEY REMOTE ENTRY MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE WCM IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the WCM is active on the bus.

Is the WCM active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0168-LOST COMMUNICATION WITH VEHICLE SECURITY CONTROL MODULE (SKREEM/WCM) (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

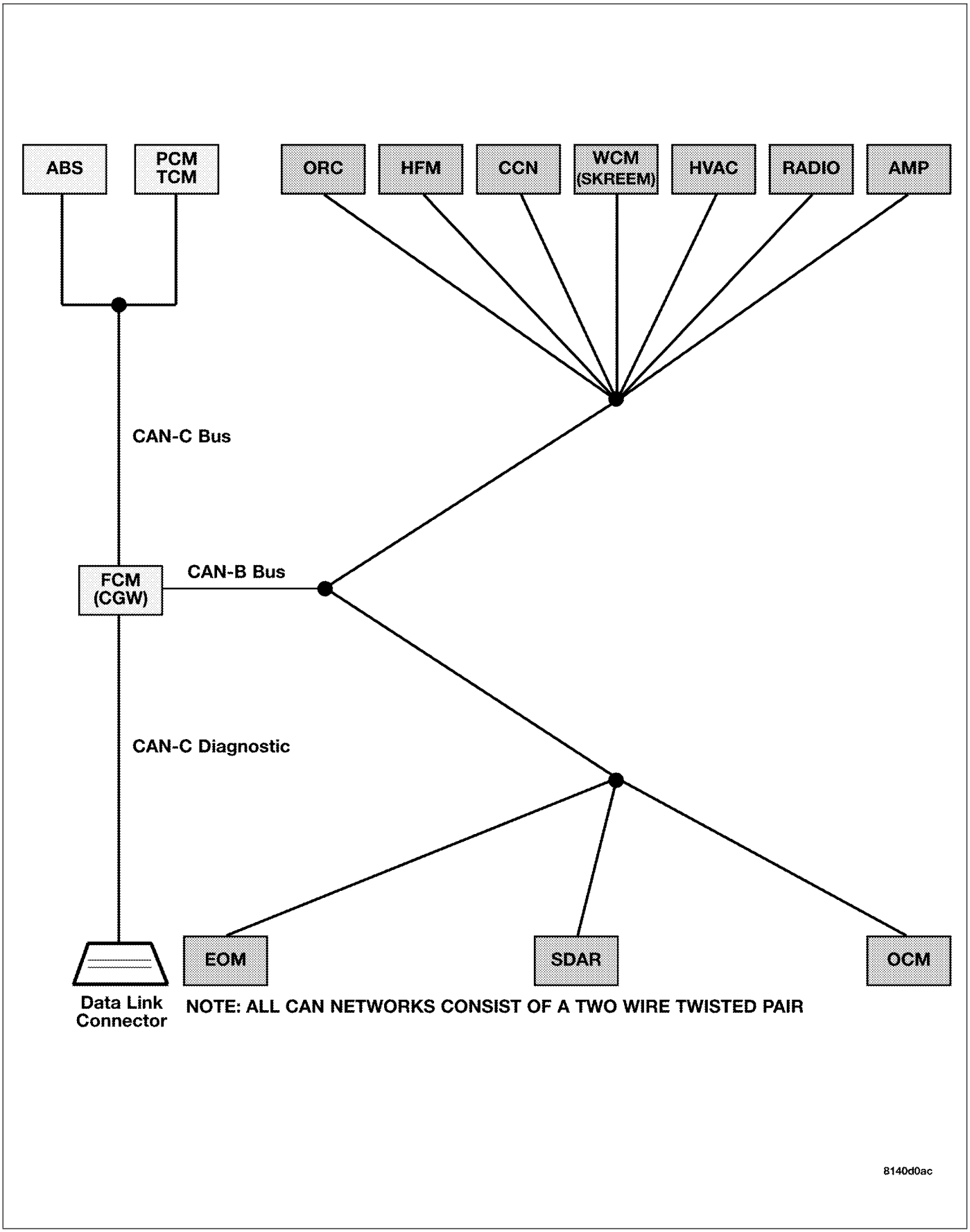
With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the WCM?

Yes >> Replace/update the Sentry Key Remote Entry Module in accordance with the service information. Perform SKREEM VERIFICATION TEST

No >> Replace/update the module that set this DTC in accordance with the service information. Perform the appropriate VERIFICATION TEST.

U0184-LOST COMMUNICATION WITH RADIO



U0184-LOST COMMUNICATION WITH RADIO (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the Radio for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
RADIO POWER AND GROUND
RADIO
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE RADIO IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the Radio is active on the bus.

Is the Radio active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0184-LOST COMMUNICATION WITH RADIO (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

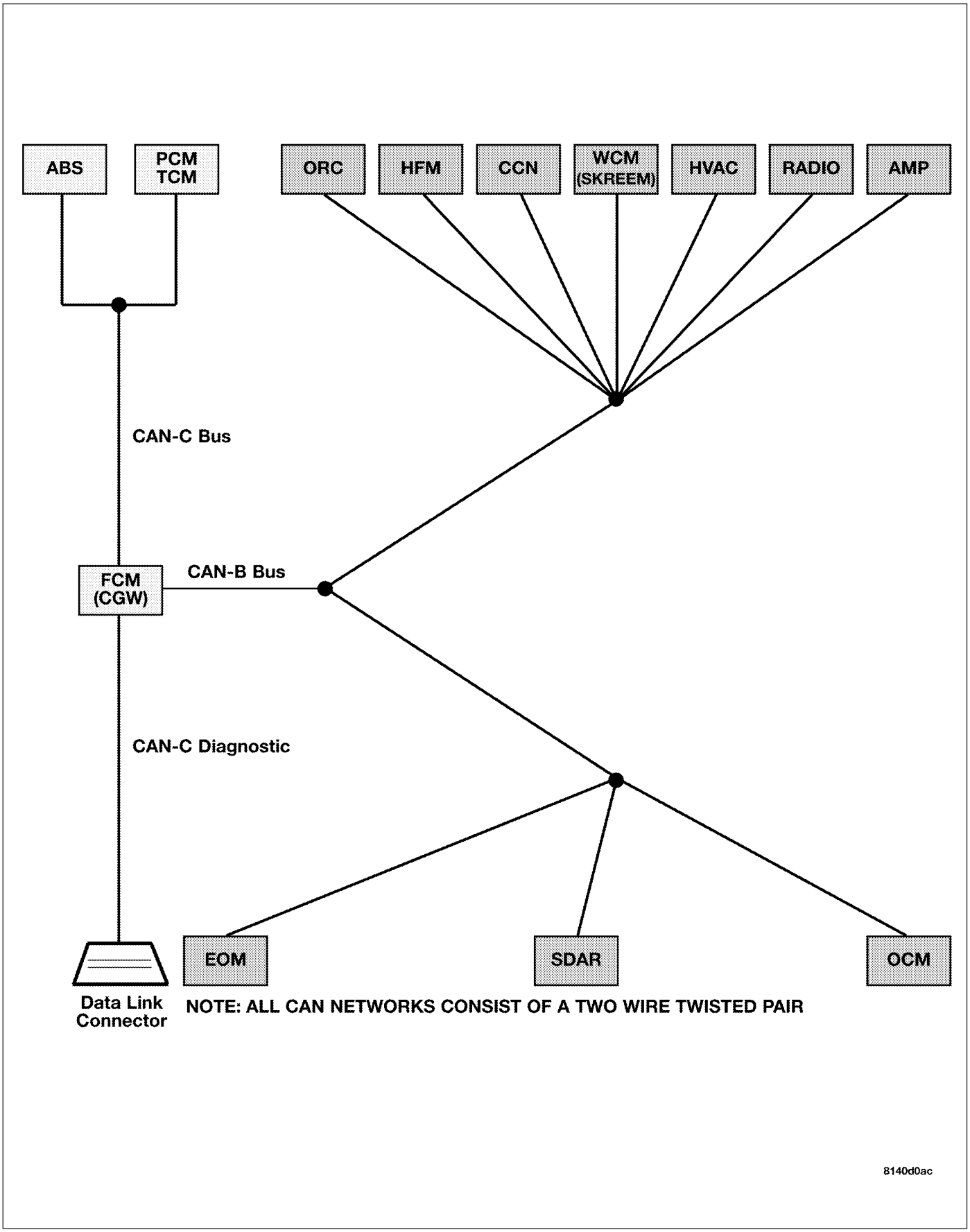
With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs "Logged Against" the Radio?

Yes >> Replace/update the Radio in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace/update the module that set this DTC in accordance with the service information.
Perform the appropriate VERIFICATION TEST.

U0186-LOST COMMUNICATION WITH AUDIO AMPLIFIER



U0186-LOST COMMUNICATION WITH AUDIO AMPLIFIER (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the Amplifier for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
AMPLIFIER POWER AND GROUND
AMPLIFIER
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE AMPLIFIER IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the Amplifier is active on the bus.

Is the Amplifier active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0186-LOST COMMUNICATION WITH AUDIO AMPLIFIER (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

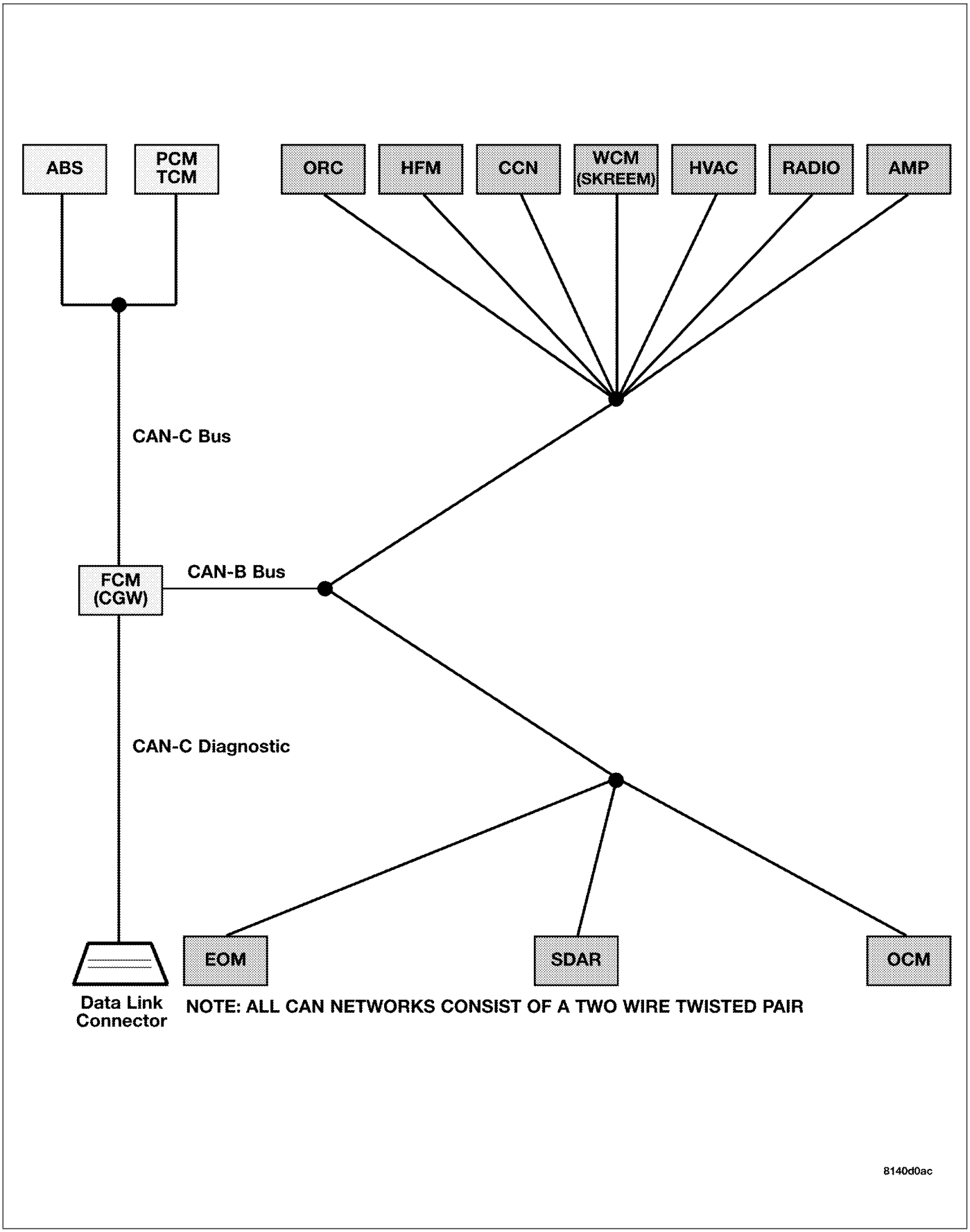
With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the Amplifier?

Yes >> Replace/update the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace/update the module that set this DTC in accordance with the service information.
Perform the appropriate VERIFICATION TEST.

U0195-LOST COMMUNICATION WITH SDARS



U0195-LOST COMMUNICATION WITH SDARS (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the Satellite Receiver (SDAR) for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
SATELLITE RECEIVER POWER AND GROUND
SATELLITE RECEIVER
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE SATELLITE RECEIVER IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the SDARS is active on the bus.

Is the SDARS active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0195-LOST COMMUNICATION WITH SDARS (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

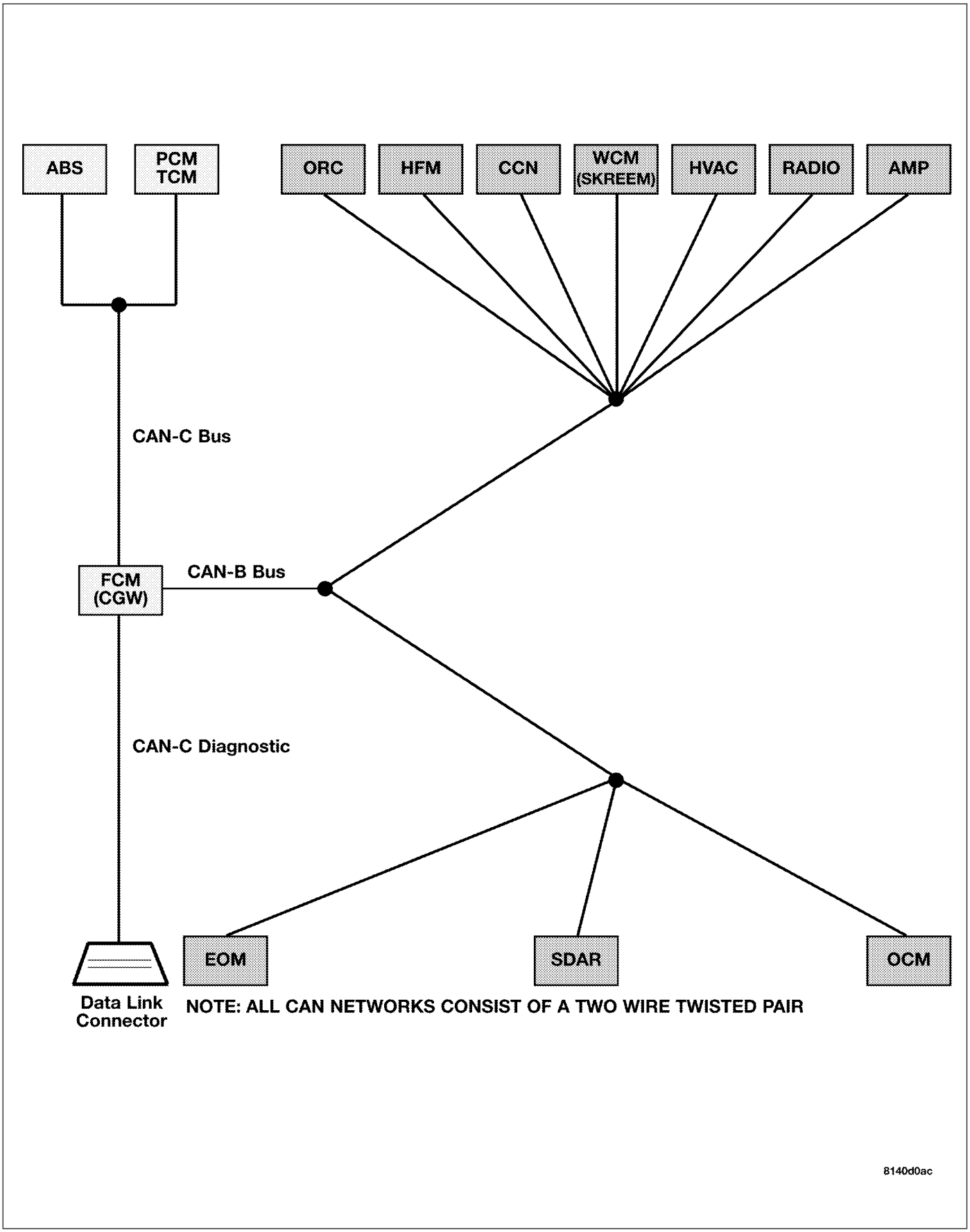
With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs "Logged Against" the SDARS?

Yes >> Replace/update the Satellite Receiver in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace/update the module that set the DTC in accordance with the service information
Perform the appropriate VERIFICATION TEST.

U0197-LOST COMMUNICATION WITH HANDS FREE PHONE MODULE



U0197-LOST COMMUNICATION WITH HANDS FREE PHONE MODULE (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received from the HFM for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
HANDS FREE MODULE POWER AND GROUND
HANDS FREE MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.
With the scan tool, read active DTCs.

Is this DTC active?

Yes >> Go To 2

No >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

---

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for FCM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes >> Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No >> Go To 3

---

3. VERIFY THAT THE HFM IS ACTIVE ON THE BUS

Turn the ignition on.
With the scan tool, select Network Diagnostics.
Verify that the HFM is active on the bus.

Is the HFM active on the bus?

Yes >> Go To 4

No >> Refer to the No Response test procedure. Refer to the table of contents in this section.

U0197-LOST COMMUNICATION WITH HANDS FREE PHONE MODULE (CONTINUED)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the HFM?

Yes >> Replace/update the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace/update the module that set this DTC in accordance with the service information.
Perform the appropriate VERIFICATION TEST.

U1108-ADDITIONAL CAN B ECU DETECTED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The Front Control Module detects an additional CAN B module and requires a reconfiguration.

Possible Causes
ADDITIONAL MODULE ADDED/REMOVED FROM THE CAN B BUS NETWORK

Diagnostic Test

1. RECONFIGURE THE FRONT CONTROL MODULE

Turn the ignition on.

With the scan tool, select network view and press the gateway button. This will list the CAN modules on the vehicle. Read and record the listed modules.

With the scan tool, select FCM, miscellaneous functions then add/remove ECUs.

With the scan tool, add or remove the module that was not configured in the FCM.

With the scan tool, erase DTC's.

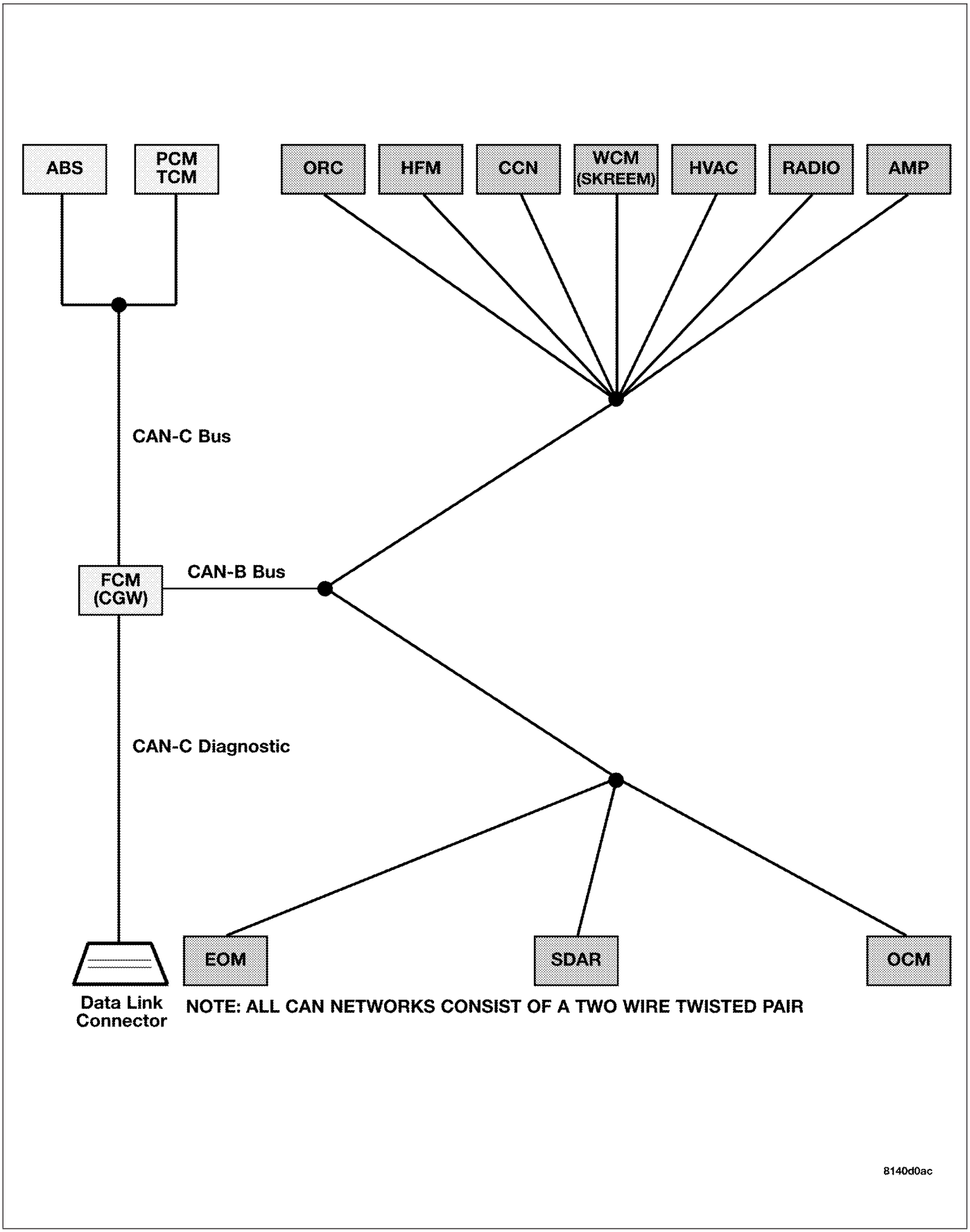
Cycle the ignition from on to off 3 times and read the active FCM DTC's.

Does the scan tool display this DTC as active?

Yes >> Retest system and attempt to reconfigure the FCM.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Repair is complete.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

*STORED LOST COMMUNICATION DTCS



***STORED LOST COMMUNICATION DTCS (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
  - FCM is configured correctly
- **Set Condition:**
  Bus messages not received for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
FCM NOT CONFIGURED CORRECTLY
POWER OR GROUND FROM THE REPORTING MODULE
MODULE THAT SET THIS DTC
PREVIOUS SERVICE PERFORMED WITHIN THE LAST 100 KEY CYCLES (FUSE/RELAYS REMOVED, WIRING SERVICE, BATTERY DISCONNECT)
LOW BATTERY/JUMP START CONDITION
IOD FUSE WAS REMOVED DURING SHIPPING
CHECK FOR RELATED TSBS

Diagnostic Test

1. VERIFY DTC IS STORED

NOTE: Stored faults may indicate a customer perceived intermittent condition.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding. With the scan tool, read stored DTCs.

Is this DTC stored?

Yes >> Go To 2

No >> Diagnose the active DTC. Refer to the Index for a list of the symptoms.

---

2. CHECK THE ENVIRONMENTAL DATA

With the scan tool, read the loss of communication environmental data.

Does the loss of communication environmental odometer data match up to any of the previous service procedures listed in the possible causes or are their any stored CAN B or C hardware electrical, battery, ignition voltage, VIN missing/mismatch, FCM configuration DTCs present with matching environmental data?

Yes >> These DTCs may have been the result of other service procedures performed. Clear DTCs.

No >> Go To 3

***STORED LOST COMMUNICATION DTCS (CONTINUED)**

3. VERIFY INTERMITTENT LOST COMMUNICATION DTC – WIRING CONCERNS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Is there more than one ECU with stored DTCs "Logged Against" the module and one or more lost communication DTCs stored in the offending module?

Yes >> Verify if the vehicle was recently in for this type of service. Otherwise, visually inspect the related wiring harness for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals. Repair as necessary.

No >> Go To 4

---

4. VERIFY INTERMITTENT LOST COMMUNICATION DTC – OFFENDING MODULE

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Is there more than one ECU with stored DTCs "Logged Against" the module and NO lost communication DTCs stored in the offending module?

Yes >> Check for TSB related to this offending module.

No >> Go To 5

---

5. VERIFY INTERMITTENT LOST COMMUNICATION DTC – REPORTING MODULE

Turn the ignition on.

With the scan tool, select Network Diagnostics.

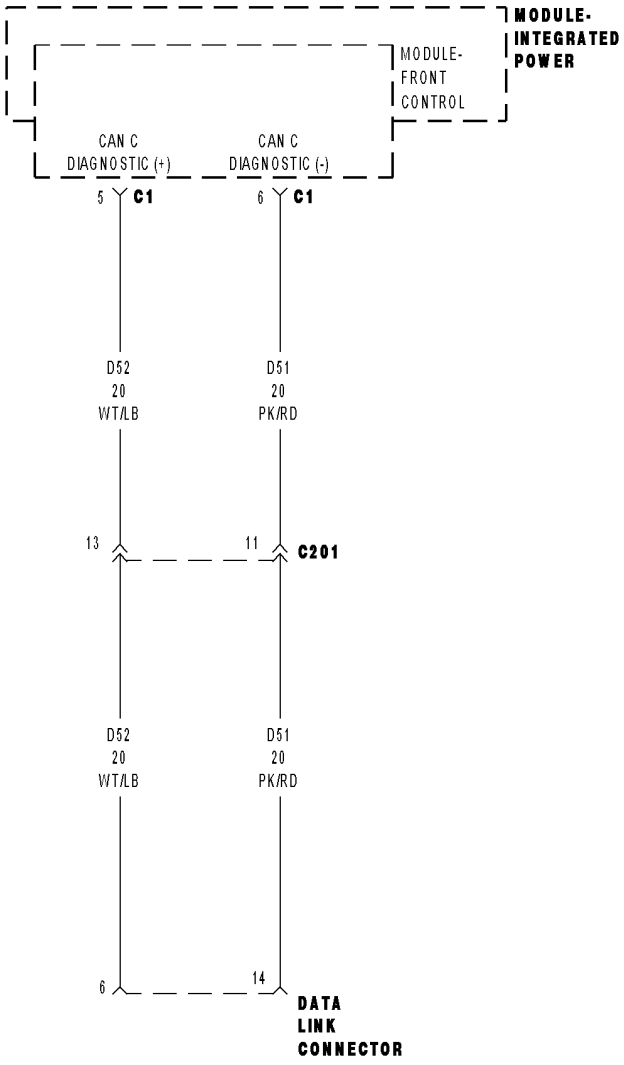
Is there ONLY ONE ECU with stored DTCs "Logged Against" the module?

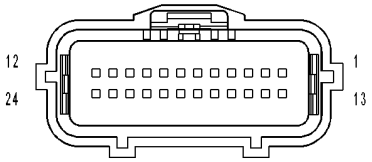
Yes >> Check for TSB related to the module that set this DTC.

No >> Verify if the vehicle was recently in for this type of service. Otherwise, visually inspect the related wiring harness for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals. Repair as necessary.

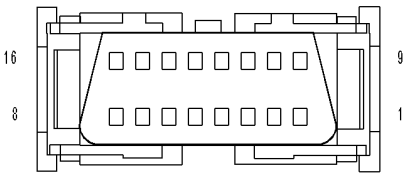
---

*CAN C DIAGNOSTIC (+) AND/OR CAN C DIAGNOSTIC (-) CIRCUITS HIGH





MODULE-
FRONT
CONTROL C1



DATA
LINK
CONNECTOR

81401925

***CAN C DIAGNOSTIC (+) AND/OR CAN C DIAGNOSTIC (-) CIRCUITS HIGH (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the scan tool queries the FCM.
- **Set Condition:**
  The scan tool has detected a shorted high condition on either or both CAN C Diagnostic circuits.

Possible Causes
(D52) CAN C DIAGNOSTIC (+) CIRCUIT SHORTED TO VOLTAGE
(D51) CAN C DIAGNOSTIC (-) CIRCUIT SHORTED TO VOLTAGE
FRONT CONTROL MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.

Disconnect the scan tool from the DLC.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

Does the scan tool display this same error message?

Yes >> Go To 2

No >> The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

---

2. CAN C DIAGNOSTIC CIRCUITS SHORTED TO VOLTAGE

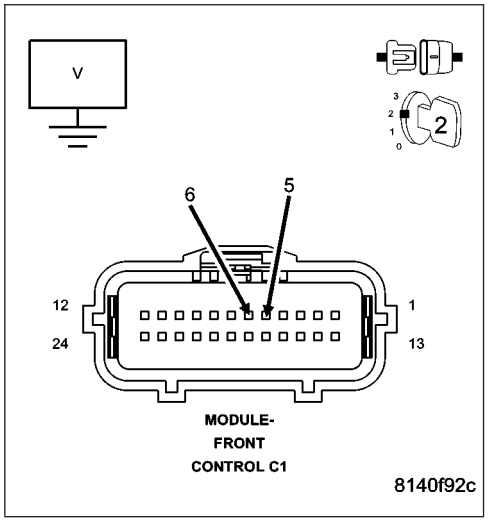
Turn the ignition off.

Disconnect the Front Control Module C1 harness connector.

Disconnect the scan tool from the DLC.

Turn the ignition on.

Measure the voltage of the CAN C Diagnostic circuits.



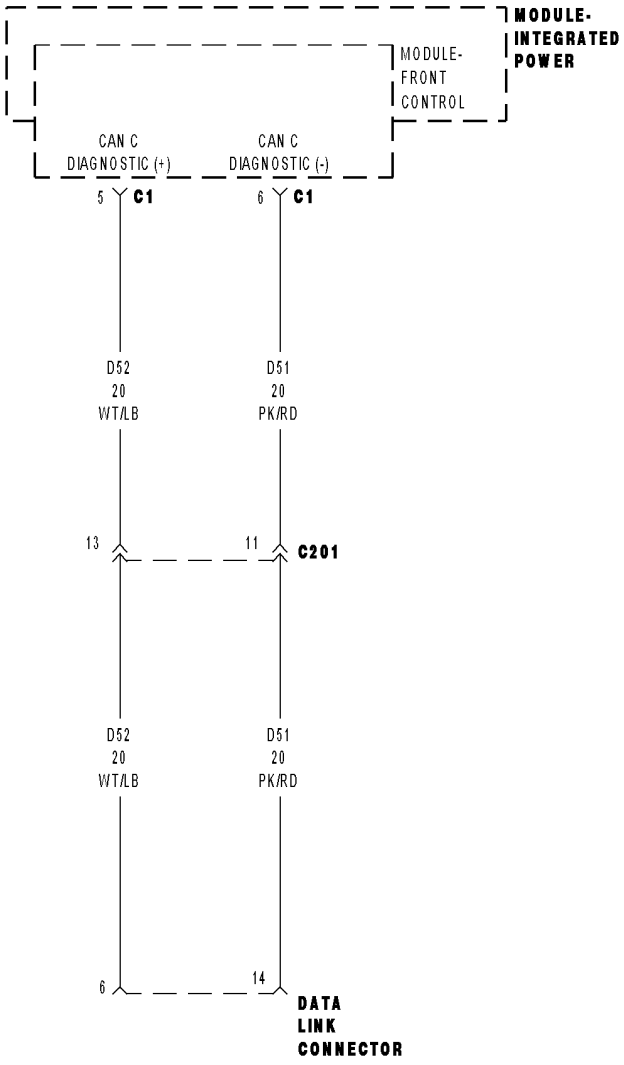
Is the voltage above 6.0 volts for either circuit?

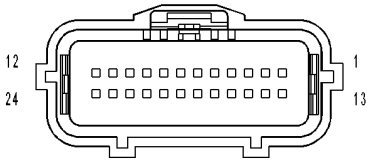
Yes >> Repair the CAN C Diagnostic circuits for a short to voltage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

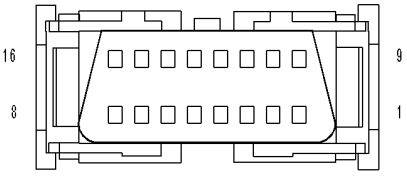
---

*CAN C DIAGNOSTIC (+) CIRCUIT LOW





MODULE-
FRONT
CONTROL C1



DATA
LINK
CONNECTOR

81401925

***CAN C DIAGNOSTIC (+) CIRCUIT LOW (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the scan tool queries the FCM.
- **Set Condition:**
  The scan tool has detected a shorted low condition on the (D52) CAN C Diagnostic (+) circuit.

Possible Causes
(D52) CAN C DIAGNOSTIC (+) CIRCUIT SHORTED TO GROUND
FRONT CONTROL MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.

Disconnect the scan tool from the DLC.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

Does the scan tool display this same error message?

Yes >> Go To 2

No >> The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

---

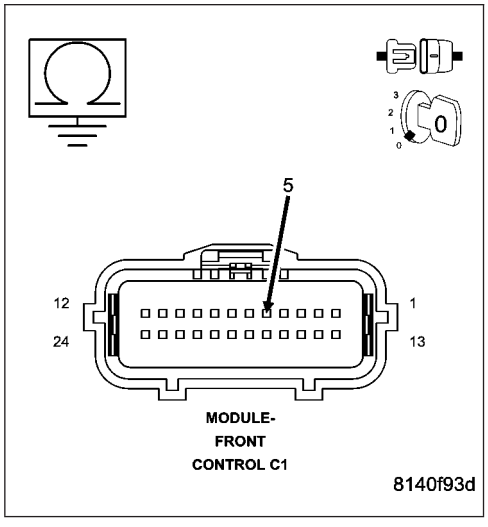
2. (D52) CAN C DIAGNOSTIC (+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Front Control Module C1 harness connector.

Disconnect the scan tool from the DLC.

Measure the resistance between ground and the (D52) CAN C Diagnostic (+) circuit.



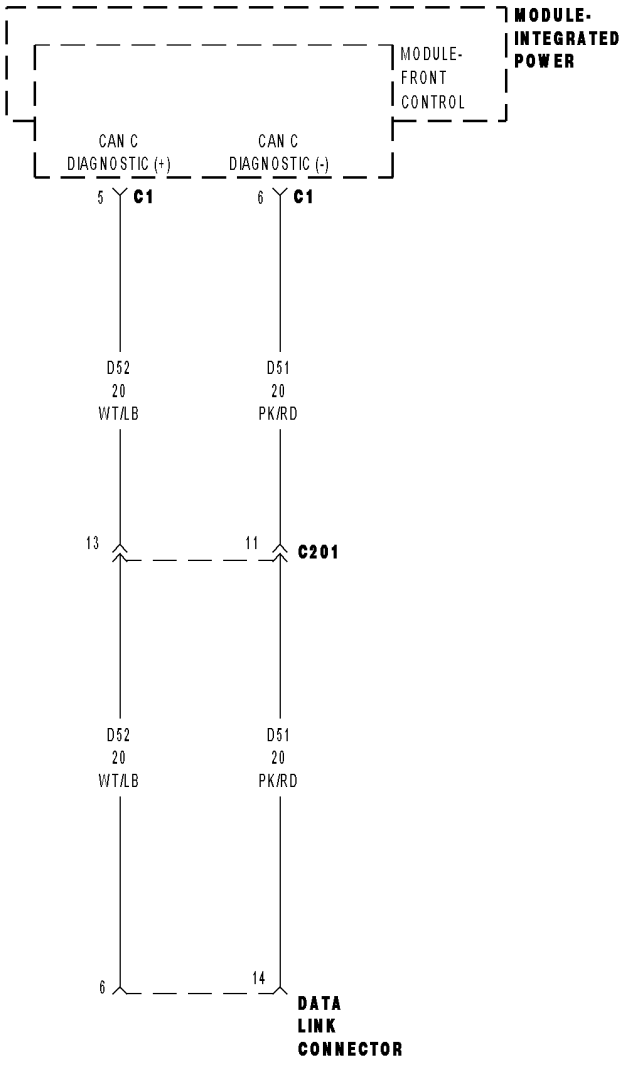
Is the resistance below 100.0 ohms?

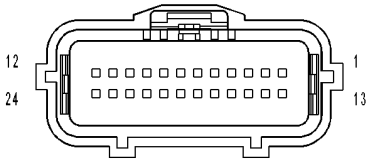
Yes >> Repair the (D52) CAN C Diagnostic (+) circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

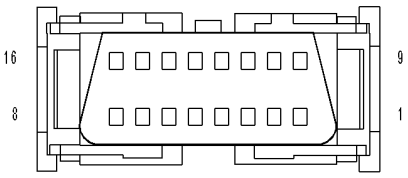
---

*CAN C DIAGNOSTIC (-) CIRCUIT LOW





MODULE-
FRONT
CONTROL C1



DATA
LINK
CONNECTOR

81401925

***CAN C DIAGNOSTIC (-) CIRCUIT LOW (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the scan tool queries the FCM.
- **Set Condition:**
  The scan tool has detected a shorted low condition on the (D51) CAN C Diagnostic (-) circuit.

Possible Causes
(D51) CAN C DIAGNOSTIC (-) CIRCUIT SHORTED TO GROUND
FRONT CONTROL MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.

Disconnect the scan tool from the DLC.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

Does the scan tool display this same error message?

Yes >> Go To 2

No >> The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

---

2. (D51) CAN C DIAGNOSTIC (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Front Control Module C1 harness connector.

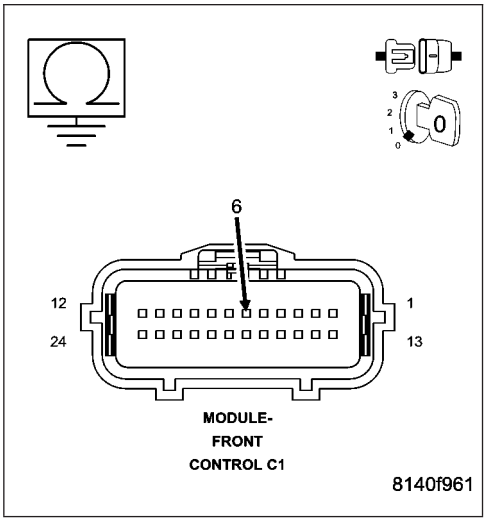
Disconnect the scan tool from the DLC.

Measure the resistance between ground and the (D51) CAN C Diagnostic (-) circuit.

Is the resistance below 100.0 ohms?

Yes >> Repair the (D51) CAN C Diagnostic (-) circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



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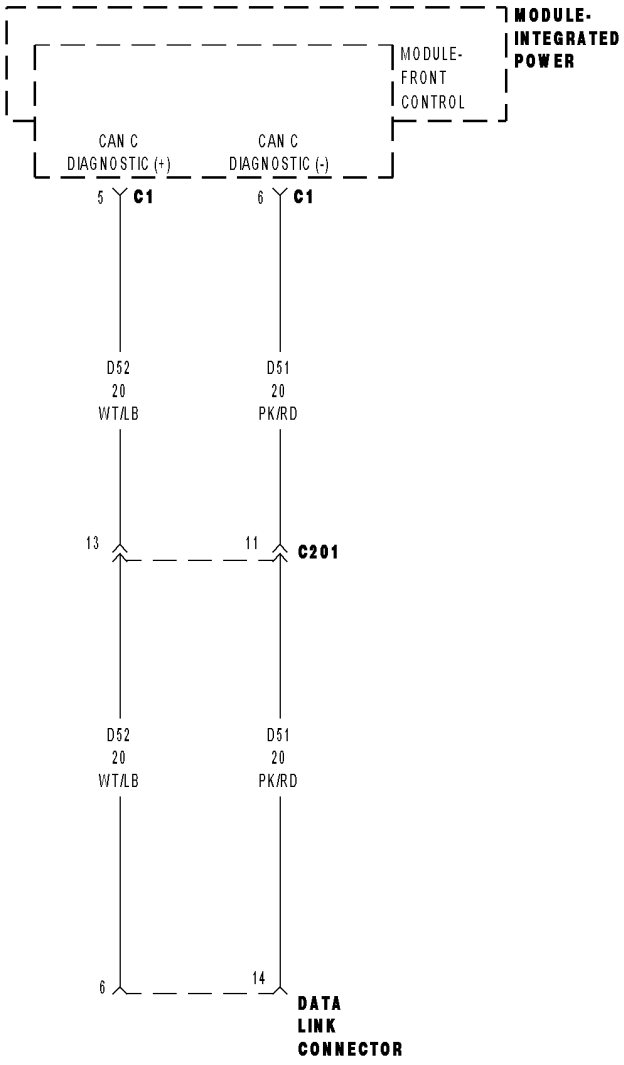
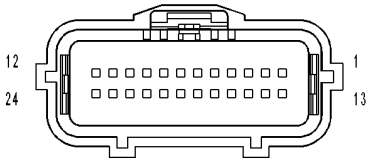
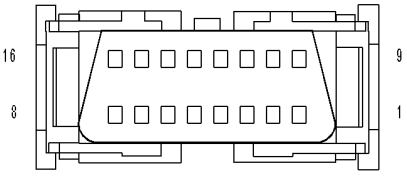
*CAN C DIAGNOSTIC (+) SHORTED TO CAN C DIAGNOSTIC (-)





MODULE-
FRONT
CONTROL C1



DATA
LINK
CONNECTOR

81401925

***CAN C DIAGNOSTIC (+) SHORTED TO CAN C DIAGNOSTIC (-) (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the scan tool queries the FCM.
- **Set Condition:**
  The scan tool has detected a shorted together condition on the CAN C Diagnostic circuits.

Possible Causes
(D52) CAN C DIAGNOSTIC (+) CIRCUIT SHORTED TO (D51) CAN C DIAGNOSTIC (-) CIRCUIT
FRONT CONTROL MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.

Disconnect the scan tool from the DLC.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

Does the scan tool display this same error message?

Yes >> Go To 2

No >> The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

---

2. (D52) CAN C DIAGNOSTIC (+) CIRCUIT SHORTED TO (D51) CAN C DIAGNOSTIC (-) CIRCUIT

Turn the ignition off.

Disconnect the Front Control Module C1 harness connector.

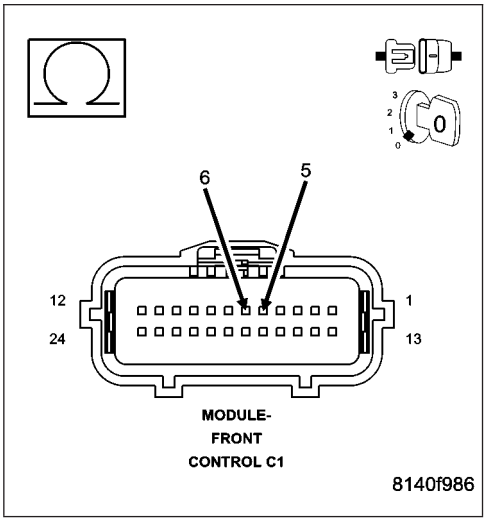
Disconnect the scan tool from the DLC.

Measure the resistance between the (D52) CAN C Diagnostic (+) circuit and the (D51) CAN C Diagnostic (-) circuit.

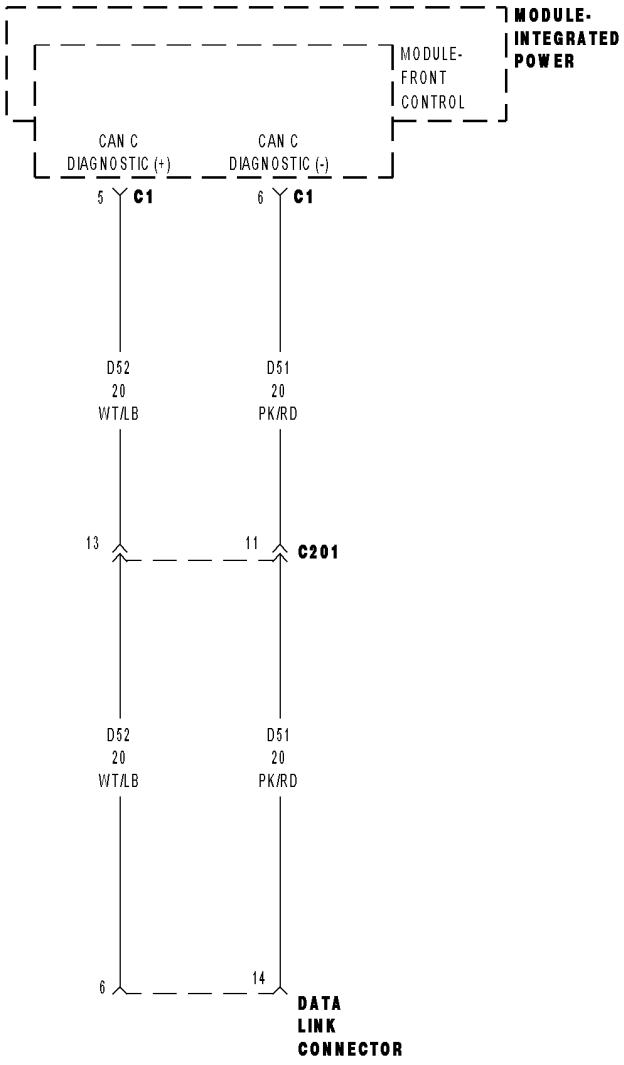
Is the resistance below 100.0 ohms?

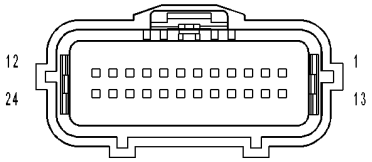
Yes >> Repair the (D52) CAN C Diagnostic (+) circuit for a short to the (D51) CAN C Diagnostic (-) circuit.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

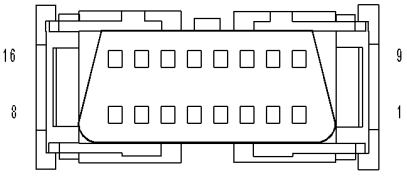


*CAN C DIAGNOSTIC (-) CIRCUIT OPEN





MODULE-
FRONT
CONTROL C1



DATA
LINK
CONNECTOR

81401925

*CAN C DIAGNOSTIC (-) CIRCUIT OPEN (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the scan tool queries the FCM.
- **Set Condition:**
  The scan tool has detected an open condition on the (D51) CAN C Diagnostic (-) circuit.

Possible Causes
(D51) CAN C DIAGNOSTIC (-) CIRCUIT OPEN
FRONT CONTROL MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.

Disconnect the scan tool from the DLC.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

Does the scan tool display this same error message?

Yes >> Go To 2

No >> The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

*CAN C DIAGNOSTIC (-) CIRCUIT OPEN (CONTINUED)

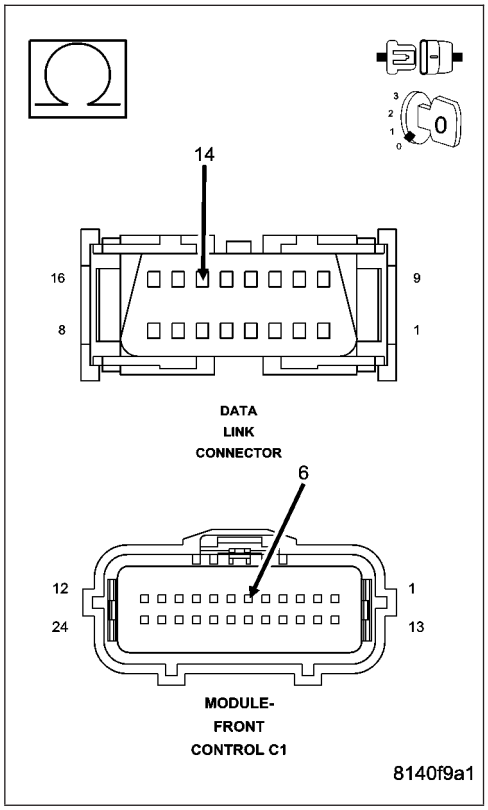
2. (D51) CAN C DIAGNOSTIC (-) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Front Control Module C1 harness connector.

Disconnect the scan tool from the DLC.

Measure the resistance of the (D51) CAN C Diagnostic (-) circuit between the FCM connector and the DLC.

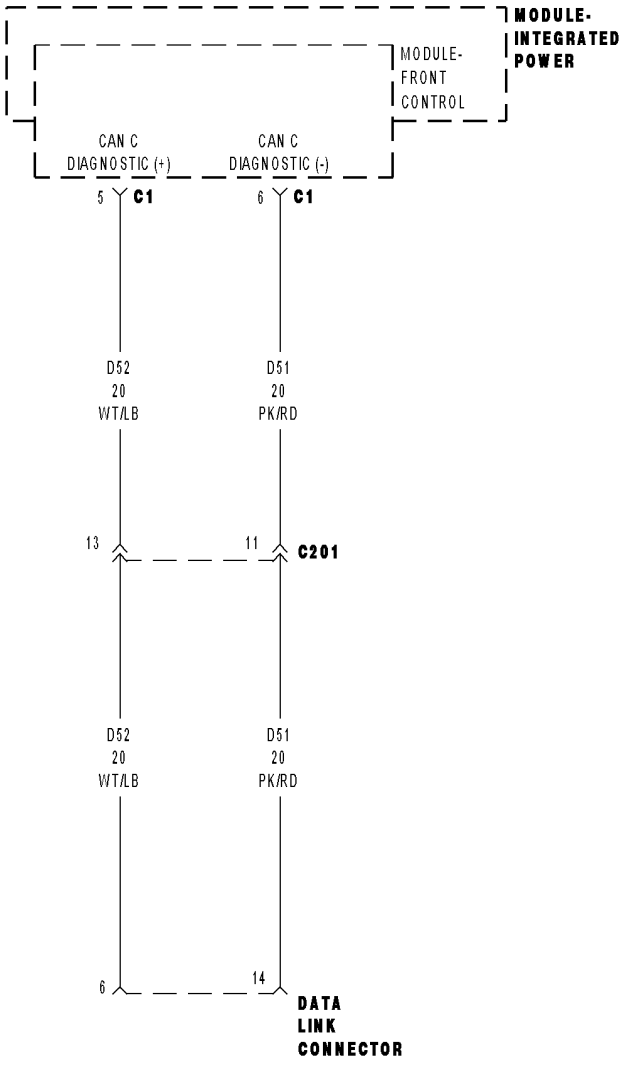


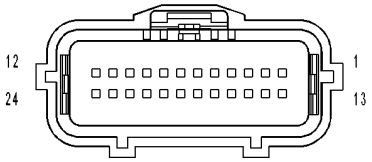
Is the resistance below 5.0 ohms?

Yes >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

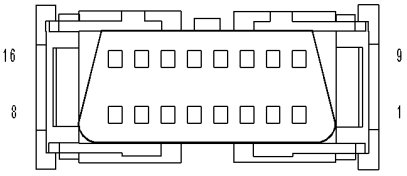
No >> Repair the (D51) CAN C Diagnostic (-) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

*CAN C DIAGNOSTIC (+) CIRCUIT OPEN





MODULE-
FRONT
CONTROL C1



DATA
LINK
CONNECTOR

81401925

***CAN C DIAGNOSTIC (+) CIRCUIT OPEN (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the scan tool queries the FCM.
- **Set Condition:**
  The scan tool has detected an open condition on the (D52) CAN C Diagnostic (+) circuit.

Possible Causes
(D52) CAN C DIAGNOSTIC (+) CIRCUIT OPEN
FRONT CONTROL MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.

Disconnect the scan tool from the DLC.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

Does the scan tool display this same error message?

Yes >> Go To 2

No >> The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

*CAN C DIAGNOSTIC (+) CIRCUIT OPEN (CONTINUED)

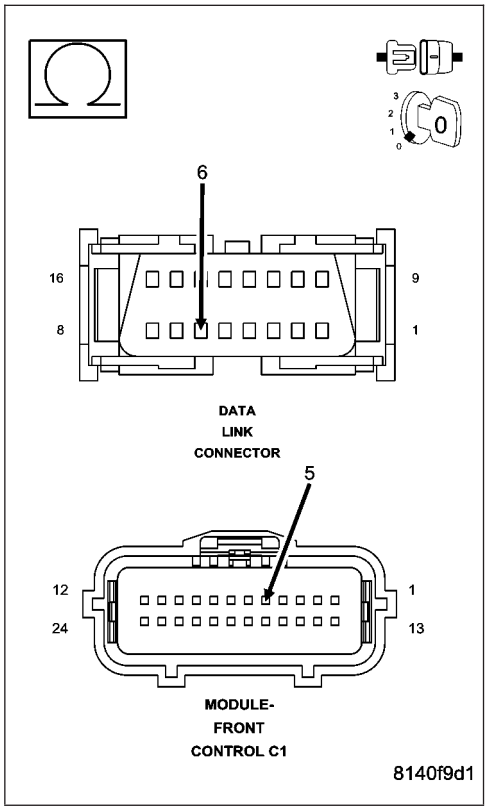
2. (D52) CAN C DIAGNOSTIC (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Front Control Module C1 harness connector.

Disconnect the scan tool from the DLC.

Measure the resistance of the (D52) CAN C Diagnostic (+) circuit between the FCM connector and the DLC.

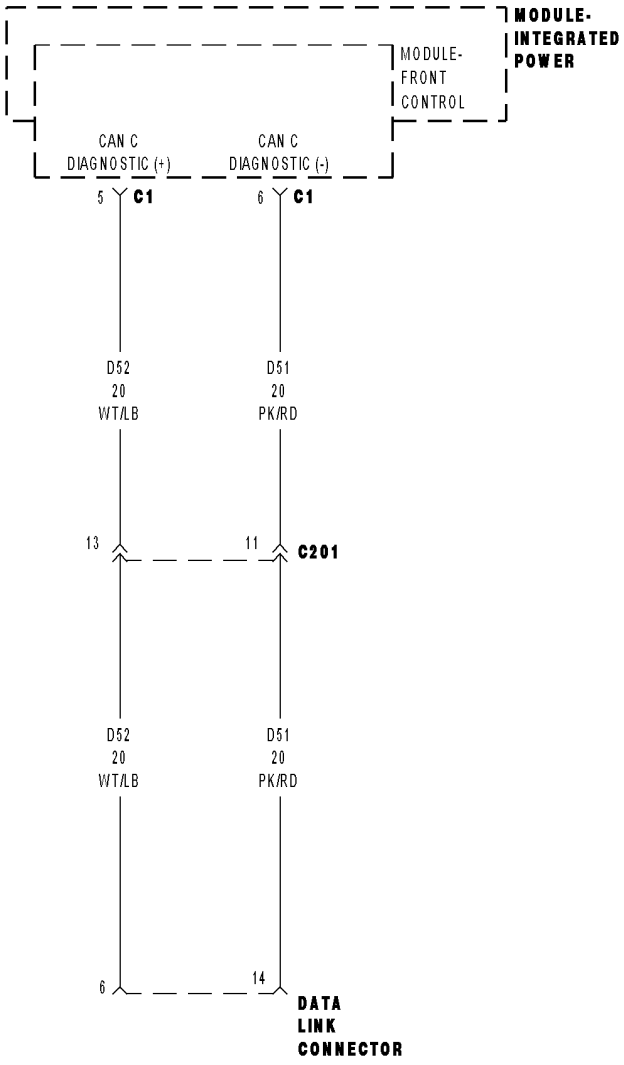


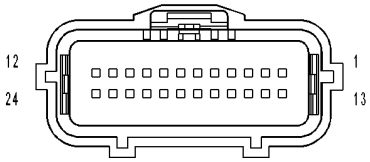
Is the resistance below 5.0 ohms?

Yes >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

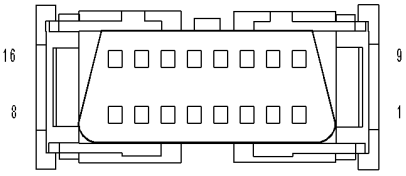
No >> Repair the (D52) CAN C Diagnostic (+) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

*BOTH CAN C DIAGNOSTIC (+) AND CAN C DIAGNOSTIC (-) CIRCUITS OPEN





MODULE-
FRONT
CONTROL C1



DATA
LINK
CONNECTOR

81401925

***BOTH CAN C DIAGNOSTIC (+) AND CAN C DIAGNOSTIC (-) CIRCUITS OPEN (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the scan tool queries the FCM.
- **Set Condition:**
  The scan tool has detected an open condition on both CAN C Diagnostic circuits.

Possible Causes
(D52) CAN C DIAGNOSTIC (+) CIRCUIT OPEN
(D51) CAN C DIAGNOSTIC (-) CIRCUIT OPEN
FRONT CONTROL MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.

Disconnect the scan tool from the DLC.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

Does the scan tool display this same error message?

Yes >> Go To 2

No >> The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

***BOTH CAN C DIAGNOSTIC (+) AND CAN C DIAGNOSTIC (-) CIRCUITS OPEN (CONTINUED)**

2. (D52) CAN C DIAGNOSTIC (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Front Control Module C1 harness connector.

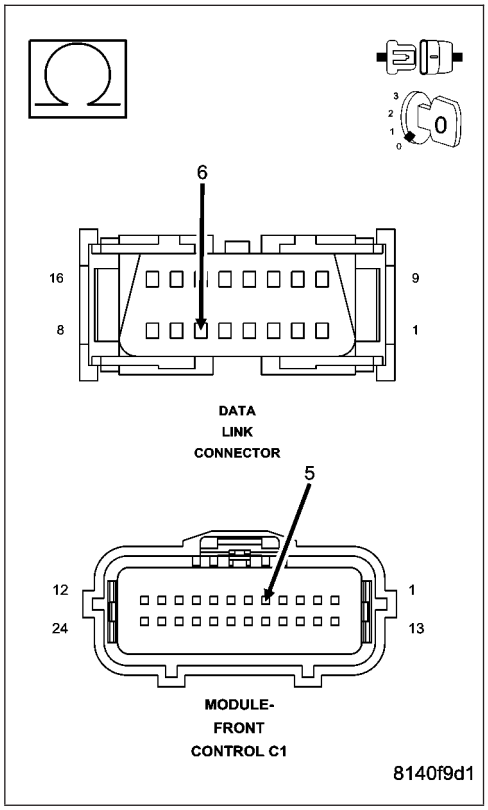
Disconnect the scan tool from the DLC.

NOTE: Check the connectors at both the DLC and the FCM.
Measure the resistance of the (D52) CAN C Diagnostic (+) circuit between the FCM connector and the DLC.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the (D52) CAN C Diagnostic (+) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



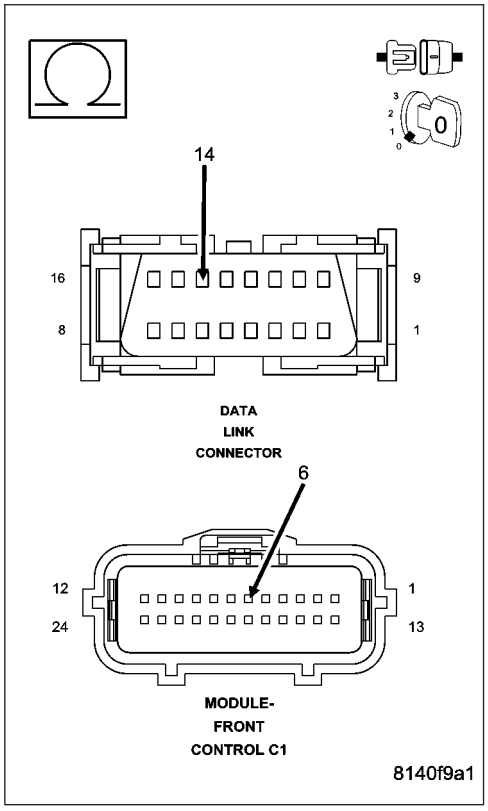
3. (D51) CAN C DIAGNOSTIC (-) CIRCUIT OPEN

Measure the resistance of the (D51) CAN C Diagnostic (-) circuit between the FCM connector and the DLC.

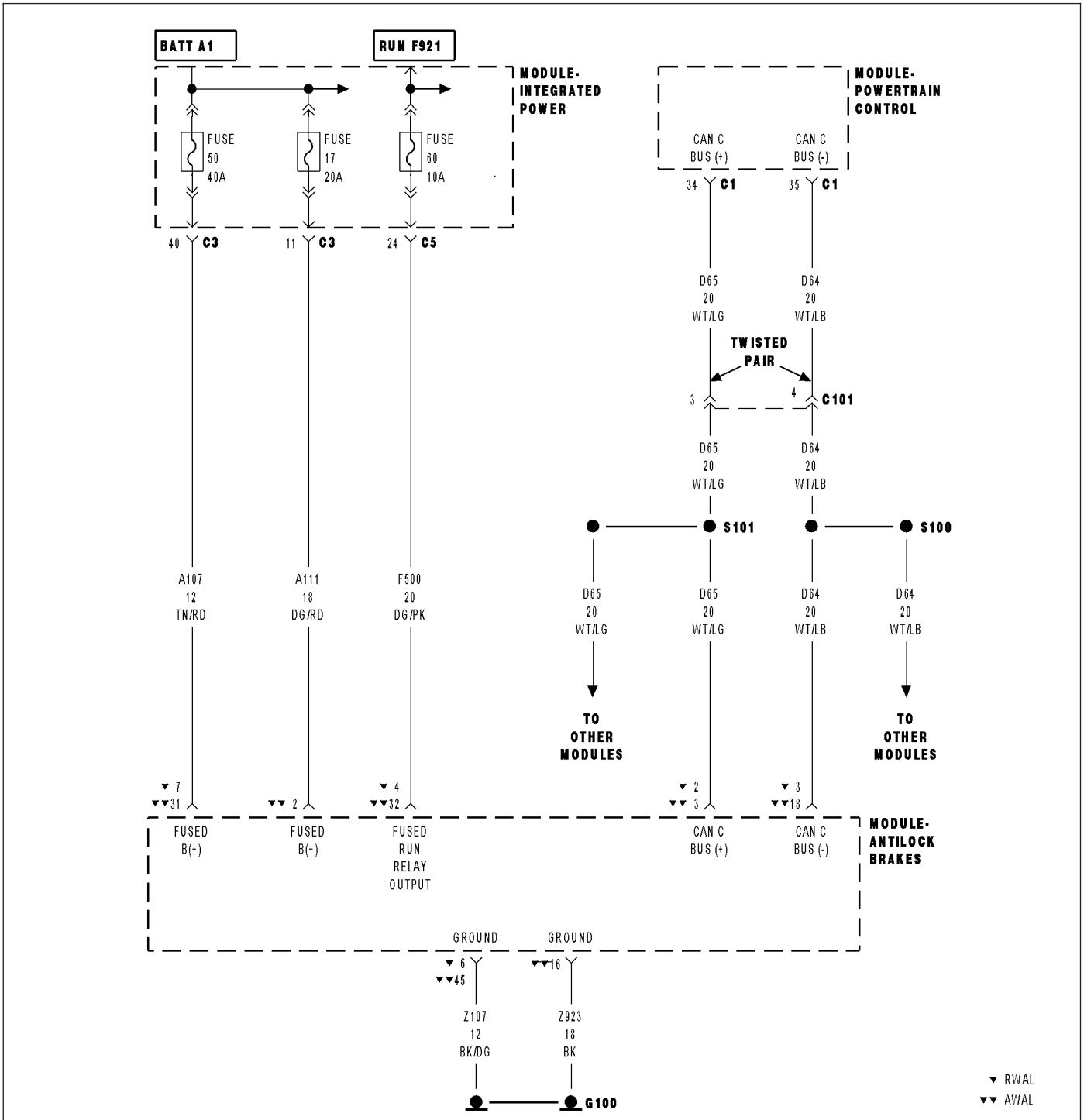
Is the resistance below 5.0 ohms?

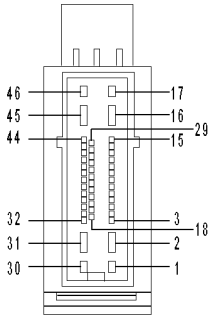
Yes >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Repair the (D51) CAN C Diagnostic (-) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

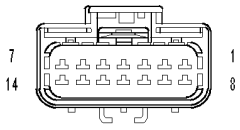


*NO RESPONSE FROM ABS (ANTILOCK BRAKE MODULE)





MODULE-
ANTI-LOCK
BRAKES
(AWAL)



MODULE-
ANTI-
LOCK
BRAKES
(RWAL)

814107aa

***NO RESPONSE FROM ABS (ANTILOCK BRAKE MODULE) (CONTINUED)**
For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A107) (A111) FUSED B(+) CIRCUIT OPEN OR SHORTED
(Z107) (Z923) GROUND CIRCUIT OPEN
(F500) FUSED RUN RELAY OUTPUT CIRCUIT OPEN OR SHORTED
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
ANTILOCK BRAKE MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.
With the scan tool, select ECU view.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

NOTE: Check the FCM for any active CAN C hardware DTCs, perform DTC before proceeding.

Does the scan tool display a red X next to the module?

Yes >> Go To 2

No >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

***NO RESPONSE FROM ABS (ANTILOCK BRAKE MODULE) (CONTINUED)**

2. (A107) (A111) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

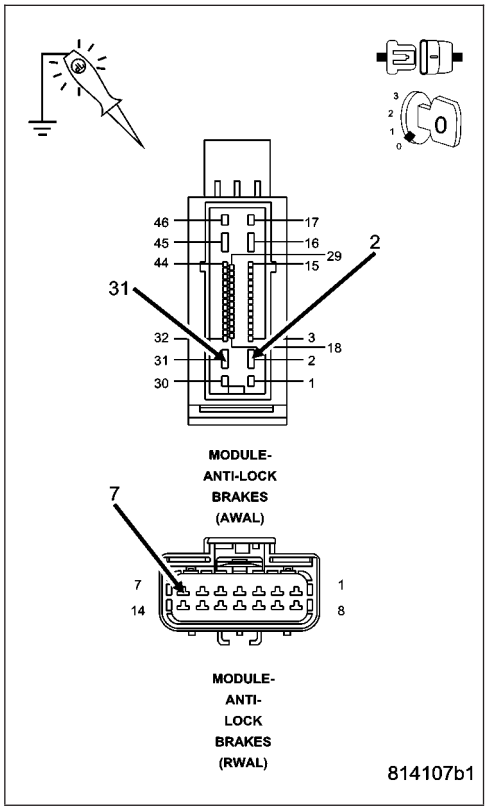
Disconnect the Antilock Brake Module harness connector.

Using a 12-volt test light connected to ground, check each (A107) and (A111 – not equipped on RWAL system) Fused B(+) circuit.

Does the test light illuminate brightly for each circuit?

Yes >> Go To 3

No >> Repair the Fused B(+) circuit for an open or short. Perform ABS VERIFICATION TEST - VER 1.



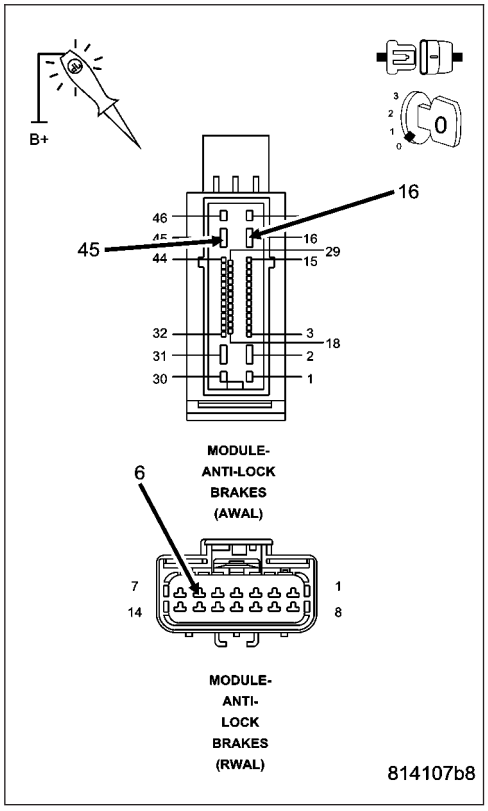
3. (Z107) (Z923) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check each (Z107) and (Z923 – not equipped on RWAL system) ground circuit.

Does the test light illuminate brightly for each circuit?

Yes >> Go To 4

No >> Repair the ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.



***NO RESPONSE FROM ABS (ANTILOCK BRAKE MODULE) (CONTINUED)**

4. (F500) FUSED RUN RELAY OUTPUT CIRCUIT OPEN OR SHORTED

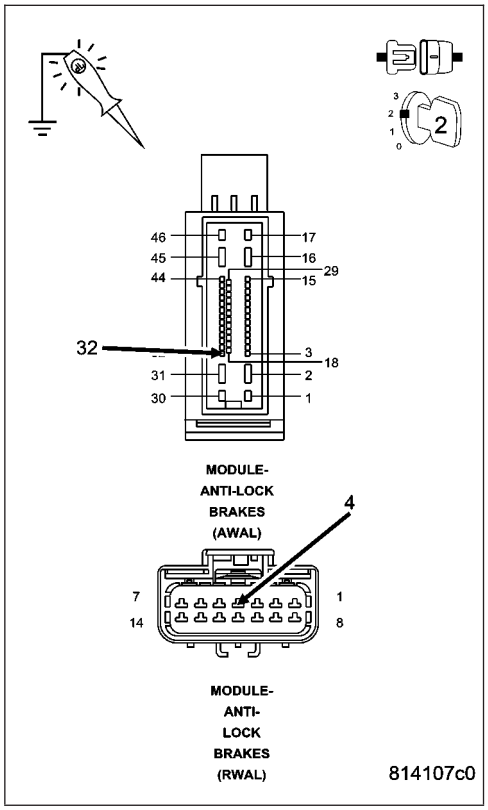
Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F500) Fused Run Relay Output circuit.

Does the test light illuminate brightly?

Yes >> Go To 5

No >> Repair the (F500) Fused Run Relay Output circuit for an open or short.
Perform ABS VERIFICATION TEST - VER 1.



5. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

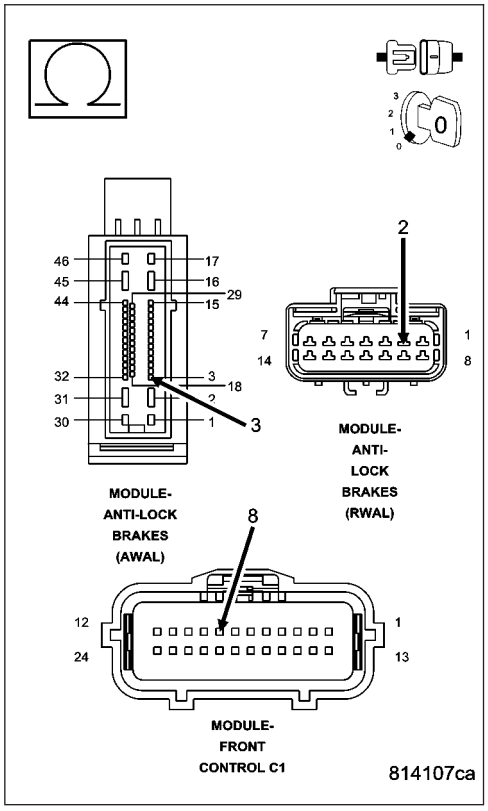
Disconnect the FCM C1 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the FCM connector and the Antilock Brake Module connector.

Is resistance below 5.0 ohms?

Yes >> Go To 6

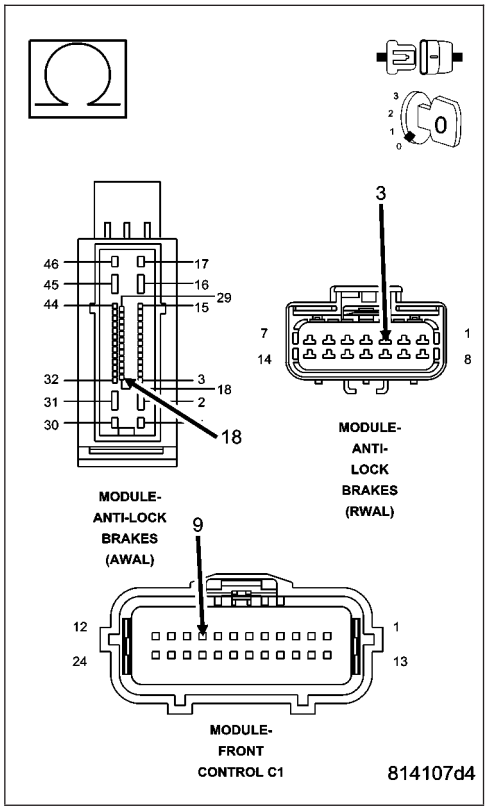
No >> Repair the (D65) CAN C Bus (+) circuit for an open.
Perform ABS VERIFICATION TEST - VER 1.



***NO RESPONSE FROM ABS (ANTILOCK BRAKE MODULE) (CONTINUED)**

6. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the FCM connector and the Antilock Brake Module connector.

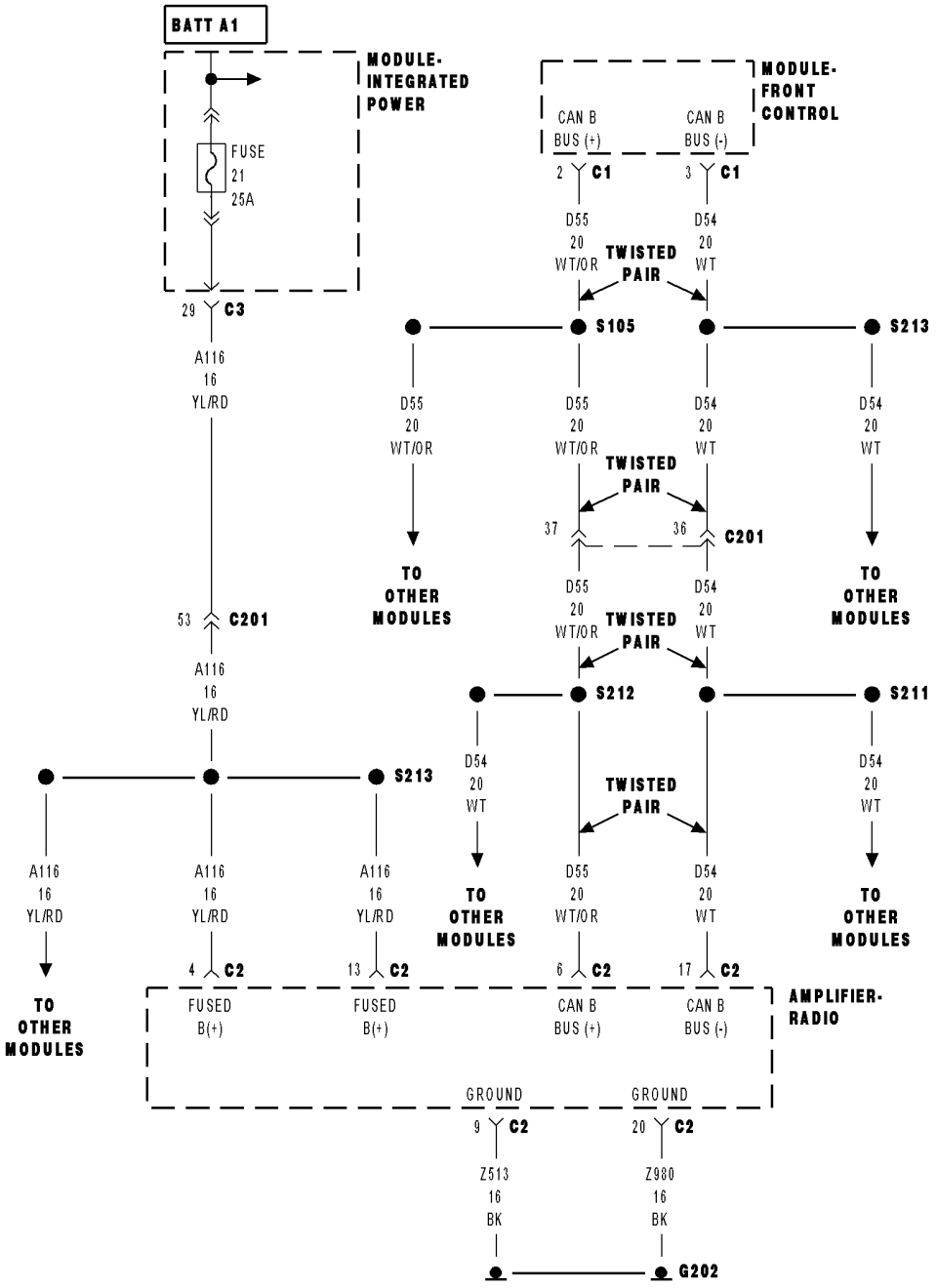


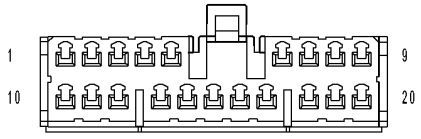
Is resistance below 5.0 ohms?

Yes >> Replace the Antilock Brake Module in accordance with the service information.
Perform ABS VERIFICATION TEST - VER 1.

No >> Repair the (D64) CAN C Bus (-) circuit for an open.
Perform ABS VERIFICATION TEST - VER 1.

*NO RESPONSE FROM AMP (AMPLIFIER)





AMPLIFIER-
RADIO C2
(PREMIUM)

81410949

***NO RESPONSE FROM AMP (AMPLIFIER) (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A116) FUSED B (+) CIRCUIT OPEN OR SHORTED
(Z513) OR (Z980) GROUND CIRCUIT OPEN
(D55) AND (D54) CAN B BUS CIRCUITS OPEN
AMPLIFIER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.
With the scan tool, select ECU view.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes >> Go To 2

No >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

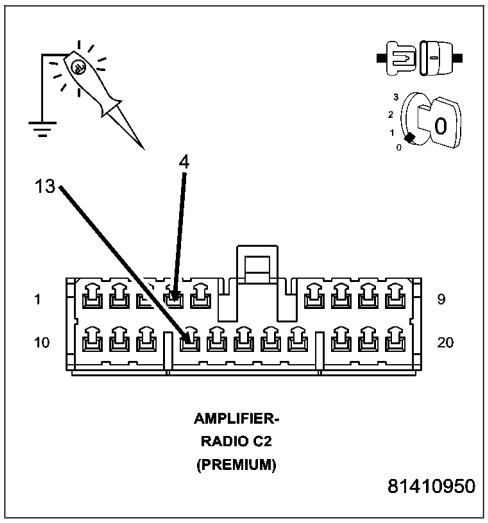
---

2. (A116) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

Disconnect the Radio Amplifier C2 harness connector.

Using a 12-volt test light connected to ground, check each (A116) Fused B(+) circuit.



Does the test light illuminate brightly for each circuit?

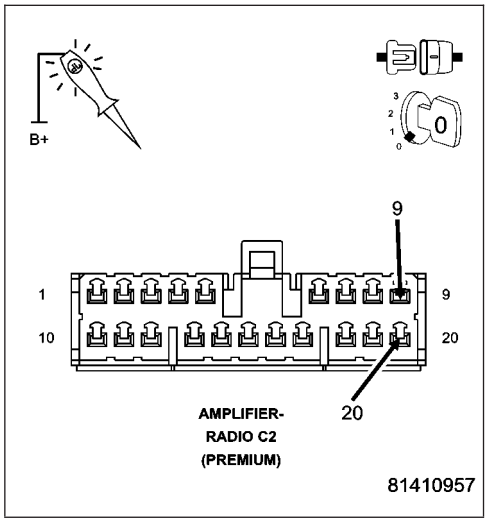
Yes >> Go To 3

No >> Repair the (A116) Fused B(+) circuit for an open or short. Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

***NO RESPONSE FROM AMP (AMPLIFIER) (CONTINUED)**

3. (Z513) OR (Z980) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z513) and (Z939) ground circuits.



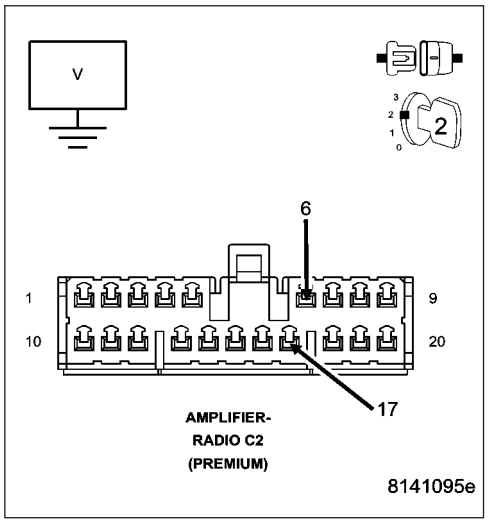
Does the test light illuminate brightly for each circuit?

Yes >> Go To 4

No >> Repair the (Z513) or the (Z939) ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

4. (D55) AND (D54) CAN B BUS CIRCUITS OPEN

NOTE: One open circuit will not cause this condition.
Measure the voltage between the (D54) CAN B Bus (-) circuit and ground.
Measure the voltage between the (D55) CAN B Bus (+) circuit and ground.

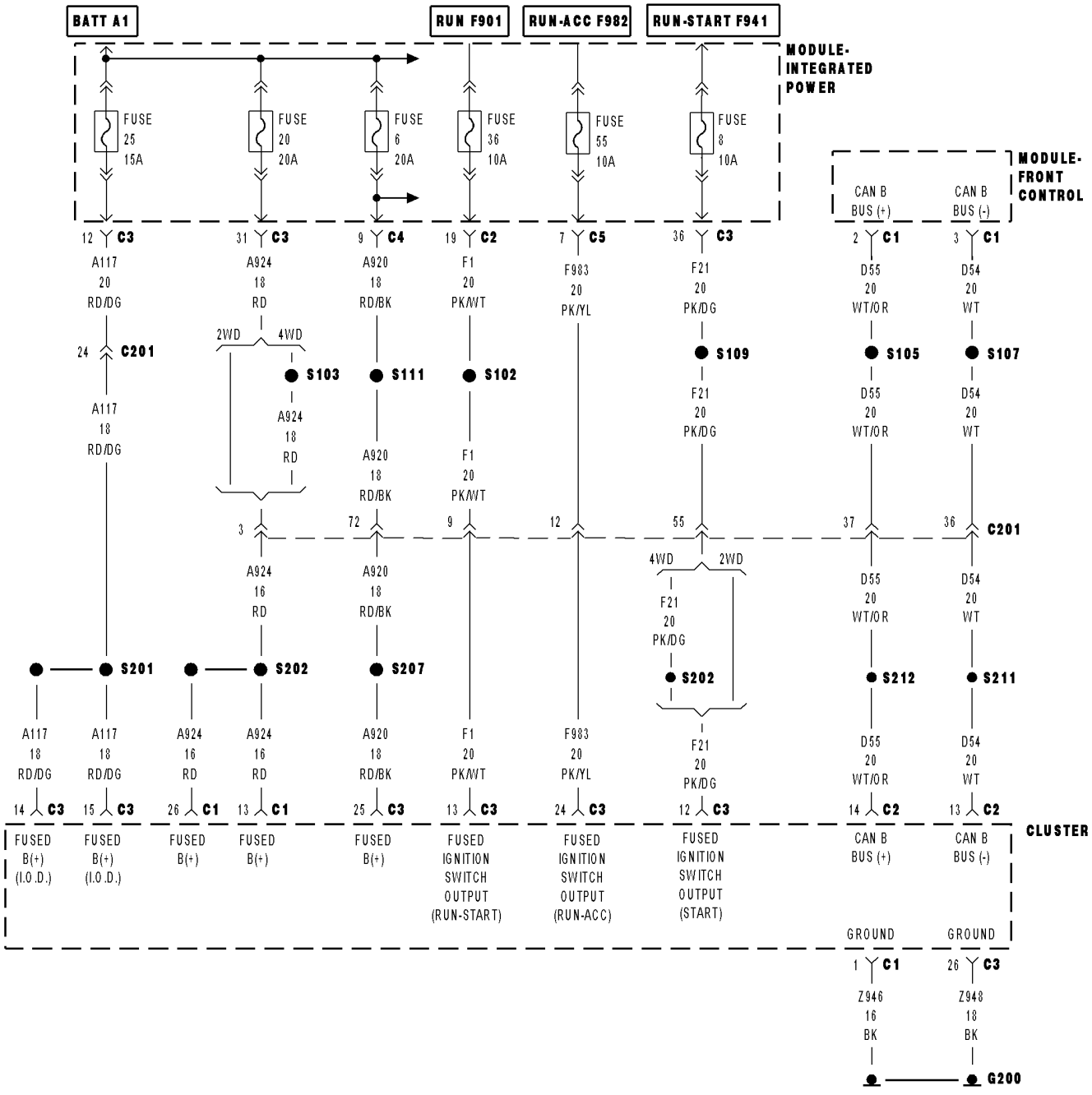


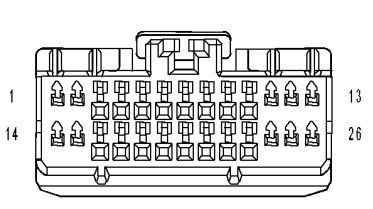
Is there any voltage present on either circuit?

Yes >> Replace the Radio Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

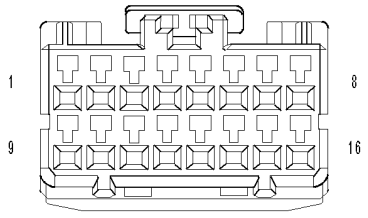
No >> Repair the (D55) and (D54) CAN B Bus circuits for an open. Inspect the connector for damage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

*NO RESPONSE FROM CCN (CLUSTER)

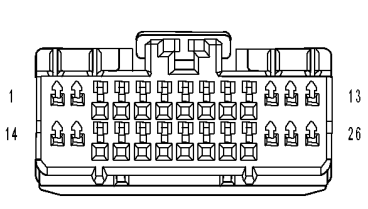




CLUSTER C1



CLUSTER C2



CLUSTER C3

81410a17

***NO RESPONSE FROM CCN (CLUSTER) (CONTINUED)**
For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A924) (A920) (A117) FUSED B(+) CIRCUITS OPEN OR SHORTED
(Z946) (Z948) GROUND CIRCUITS OPEN
(F21) (F983) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED
(D55) AND (D54) CAN B BUS CIRCUITS OPEN
CLUSTER (CCN)

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.
With the scan tool, select ECU view.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes >> Go To 2

No >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

***NO RESPONSE FROM CCN (CLUSTER) (CONTINUED)**

2. (A924) (A920) (A117) FUSED B(+) CIRCUITS OPEN OR SHORTED

Turn the ignition off.

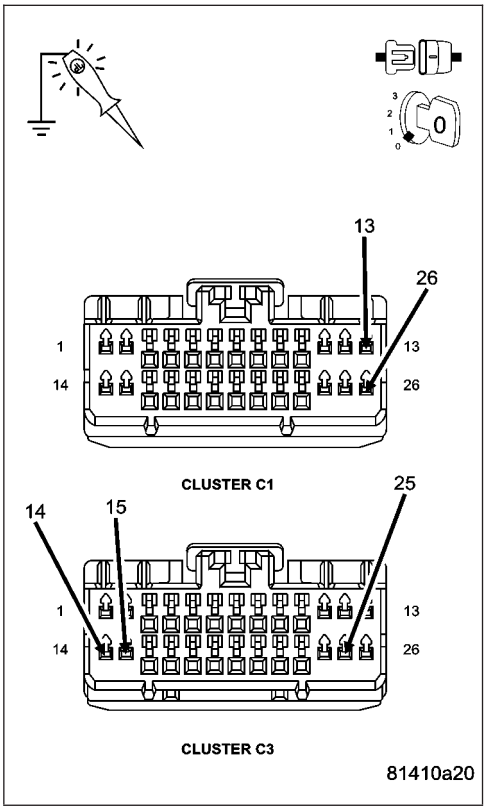
Disconnect the Cluster harness connectors.

Using a 12-volt test light connected to ground, check each (A924) (A920) (A117) Fused B(+) circuit.

Does the test light illuminate brightly for each circuit?

Yes >> Go To 3

No >> Repair the (A924) (A920) (A117) Fused B(+) circuit for an open or short.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



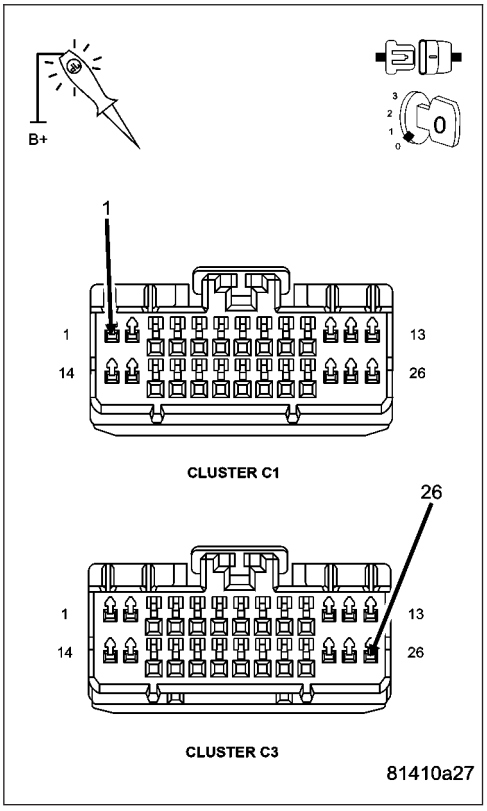
3. (Z946) (Z948) GROUND CIRCUITS OPEN

Using a 12-volt test light connected to 12-volts, check each (Z946) (Z948) ground circuit.

Does the test light illuminate brightly for each circuit?

Yes >> Go To 4

No >> Repair the (Z946) (Z948) ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



***NO RESPONSE FROM CCN (CLUSTER) (CONTINUED)**

4. (F21) (F983) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition on.

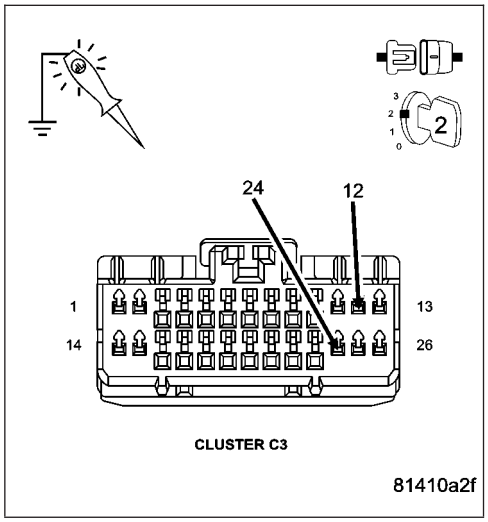
Using a 12-volt test light connected to ground, check each (F21) (F983) Fused Ignition Switch Output circuit.

Does the test light illuminate brightly for each circuit?

Yes >> Go To 5

No >> Repair the (F21) (F983) Fused Ignition Switch Output circuit for an open or short.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



5. (D55) AND (D54) CAN B BUS CIRCUITS OPEN

NOTE: One open circuit will not cause this condition.

Measure the voltage between the (D54) CAN B Bus (-) circuit and ground.

Measure the voltage between the (D55) CAN B Bus (+) circuit and ground.

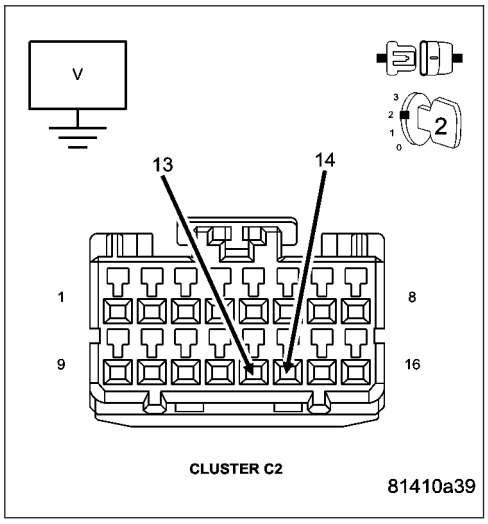
Is there any voltage present on either circuit?

Yes >> Replace the Cluster in accordance with the service information.

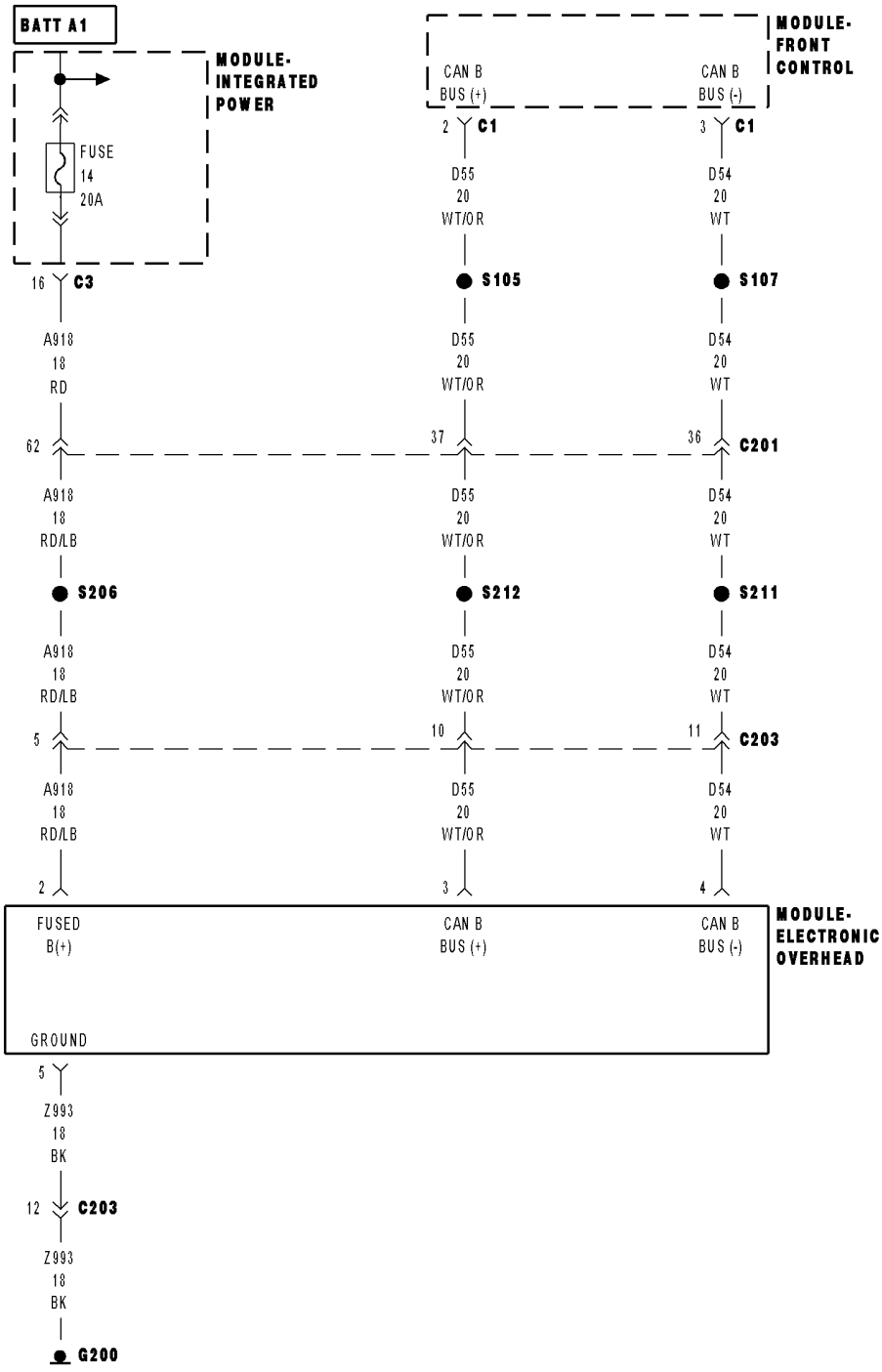
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

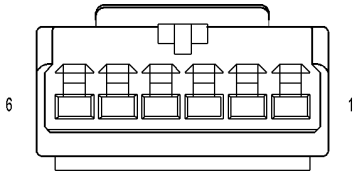
No >> Repair the (D55) and (D54) CAN B Bus circuits for an open. Inspect the connector for damage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



*NO RESPONSE FROM EOM (ELECTRONIC OVERHEAD MODULE)





MODULE-
ELECTRONIC
OVERHEAD

81410b43

***NO RESPONSE FROM EOM (ELECTRONIC OVERHEAD MODULE) (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A918) FUSED B(+) CIRCUIT OPEN OR SHORTED
(Z993) GROUND CIRCUIT OPEN
(D55) AND (D54) CAN B BUS CIRCUITS OPEN
ELECTRONIC OVERHEAD MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.
With the scan tool, select ECU view.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes >> Go To 2

No >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

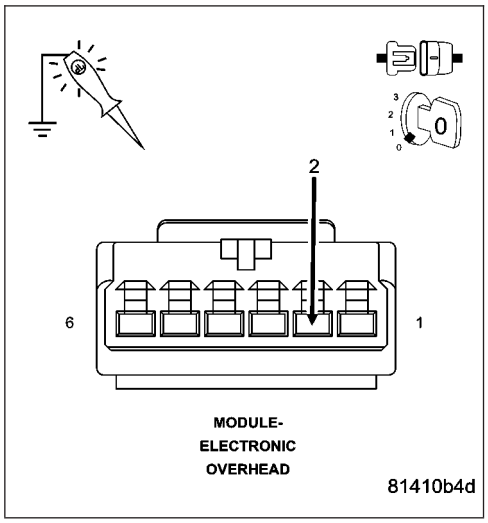
---

2. (A918) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

Disconnect the Electronic Overhead Module harness connector.

Using a 12-volt test light connected to ground, check the (A918) Fused B(+) circuit.



Does the test light illuminate brightly?

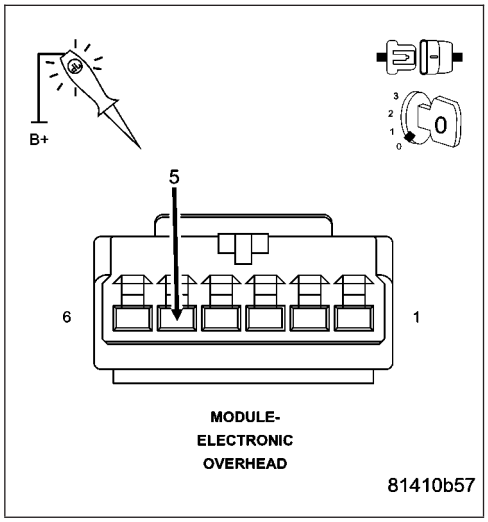
Yes >> Go To 3

No >> Repair the (A918) Fused B(+) circuit for an open or short. Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

***NO RESPONSE FROM EOM (ELECTRONIC OVERHEAD MODULE) (CONTINUED)**

3. (Z993) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z993) ground circuit.



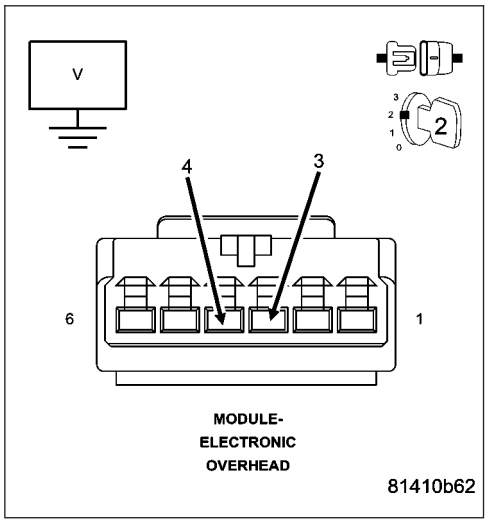
Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the (Z993) ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

4. (D55) AND (D54) CAN B BUS CIRCUITS OPEN

NOTE: One open circuit will not cause this condition.
Measure the voltage between the (D54) CAN B Bus (-) circuit and ground.
Measure the voltage between the (D55) CAN B Bus (+) circuit and ground.

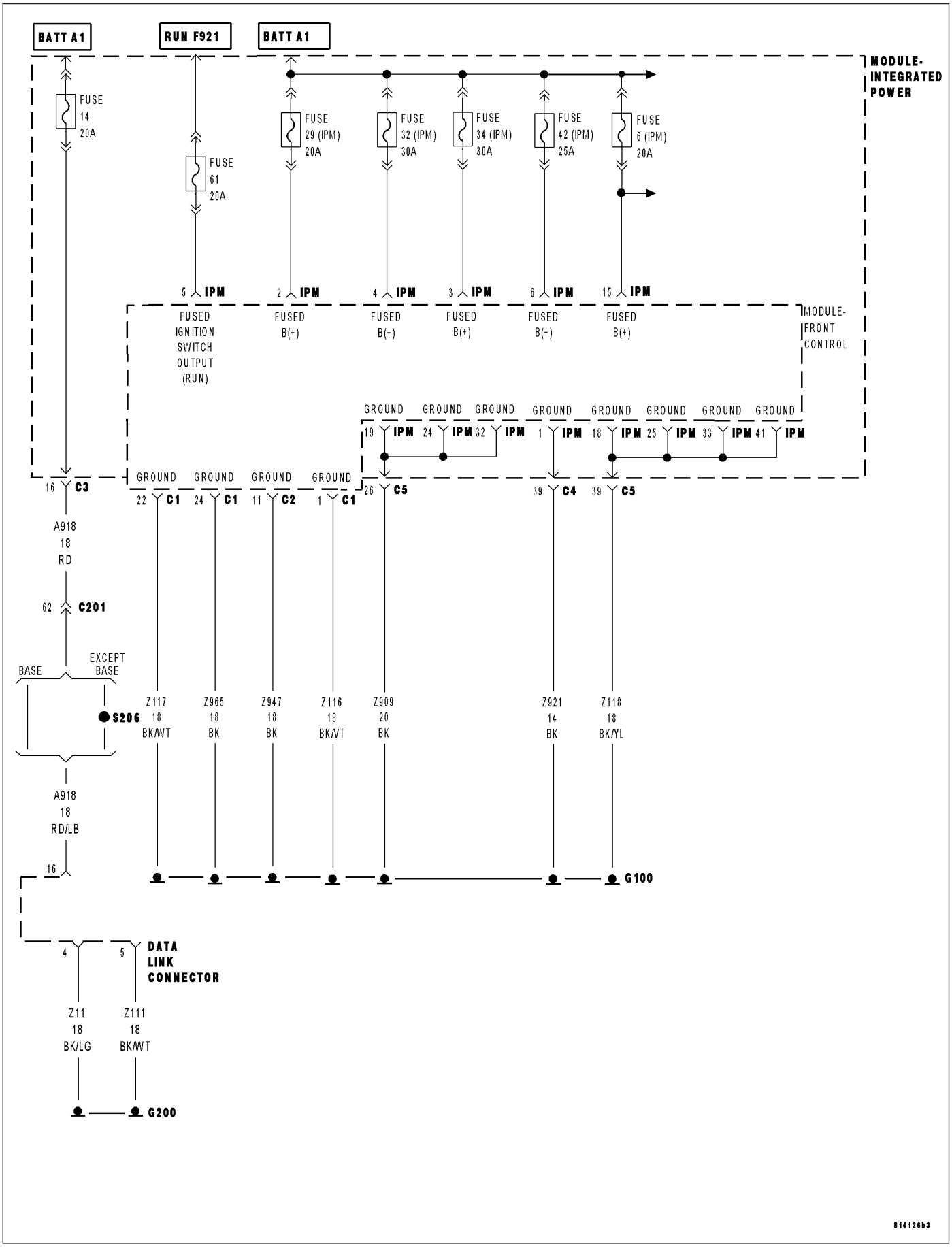


Is there any voltage present on either circuit?

Yes >> Replace the Electronic Overhead Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Repair the (D55) and (D54) CAN B Bus circuits for an open. Inspect the connector for damage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

*NO RESPONSE FROM FCM (FRONT CONTROL MODULE)



***NO RESPONSE FROM FCM (FRONT CONTROL MODULE) (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A918) FUSED B (+) CIRCUIT OPEN AT DLC
(Z11) GROUND CIRCUIT OPEN AT DLC
GROUND CIRCUITS OPEN AT FCM
FUSED B+ CIRCUITS OPEN AT FCM
FRONT CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

NOTE: Ensure the scan tool is updated to the latest software.

NOTE: If the scan tool displays any error messages involving the CAN C Diagnostic circuits, diagnose and repair the error message before proceeding. Refer to the Table of Contents.

NOTE: A loss of communication with the FCM can cause the ECU View button on the scan tool to be inoperative (not highlighted).

With the scan tool, attempt to select ECU view.

Can the scan tool communicate with the FCM?

Yes >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

No >> Go To 2

---

2. (A918) FUSED B(+) CIRCUIT OPEN AT DLC

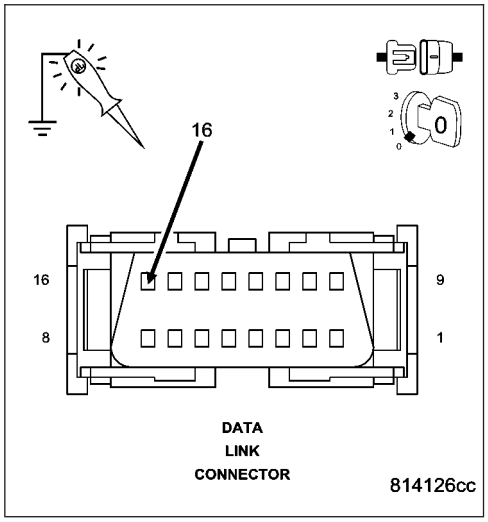
Disconnect the scan tool from the DLC.

Using a 12-volt test light connected to ground, check the (A918) Fused B(+) circuit.

Does the test light illuminate brightly?

Yes >> Go To 3

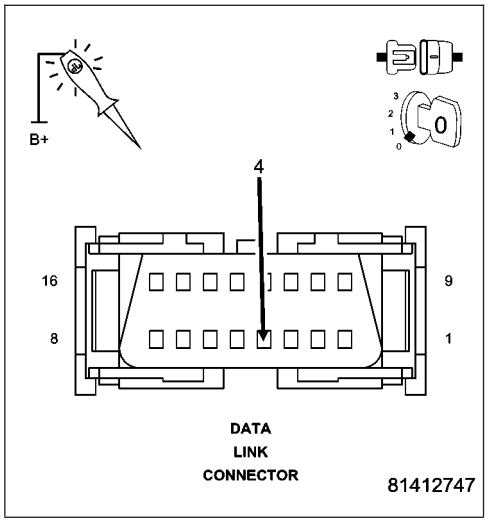
No >> Repair the (A918) Fused B(+) circuit for an open or short. Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



***NO RESPONSE FROM FCM (FRONT CONTROL MODULE) (CONTINUED)**

3. (Z11) GROUND CIRCUIT OPEN AT DLC

Using a 12-volt test light connected to 12-volts, check the (Z11) ground circuit.



Does the test light illuminate brightly?

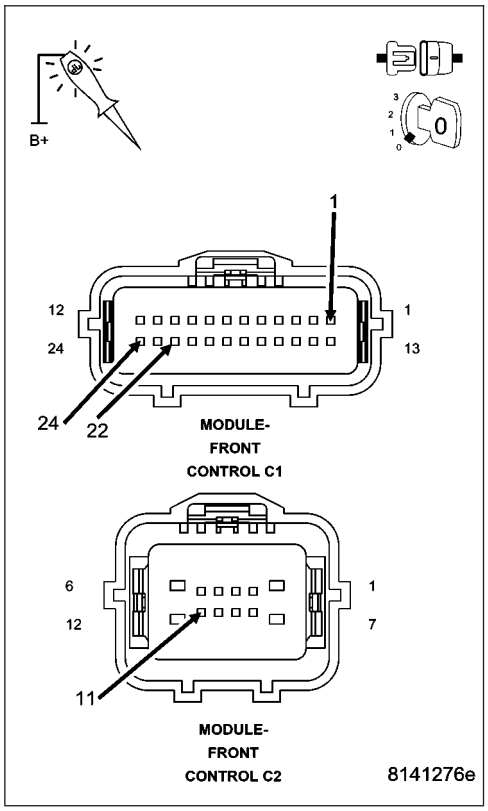
Yes >> Go To 4

No >> Repair the (Z11) ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

4. GROUND CIRCUITS OPEN AT FCM C1 AND C2 CONNECTORS

Disconnect the FCM C1 and C2 harness connectors.

Using a 12-volt test light connected to 12-volts, check each ground circuit.



Does the test light illuminate brightly for each circuit?

Yes >> Go To 5

No >> Repair the ground circuit for an open. Inspect the connector for damage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

***NO RESPONSE FROM FCM (FRONT CONTROL MODULE) (CONTINUED)**

5. GROUND CIRCUITS OPEN AT FCM IPM CONNECTOR

Remove the FCM from the IPM.

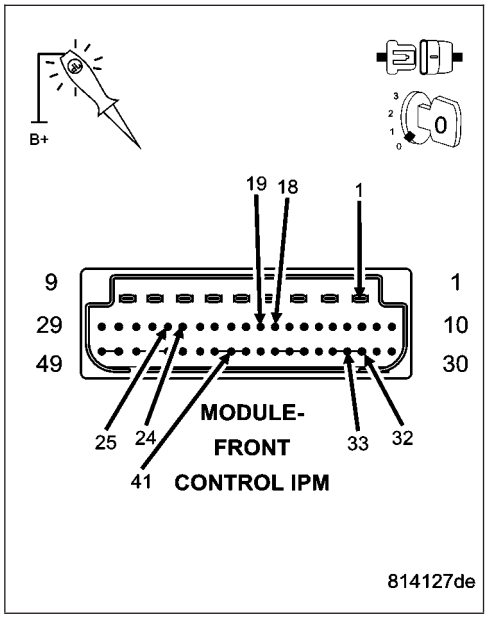
Using a 12-volt test light connected to 12-volts, check each ground circuit.

Does the test light illuminate brightly for each circuit?

Yes >> Go To 6

No >> Repair the ground circuit for an open. Inspect the connector for damage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



6. FUSED B(+) CIRCUITS OPEN AT FCM IPM CONNECTOR

Using a 12-volt test light connected to ground, check each Fused B(+) circuit.

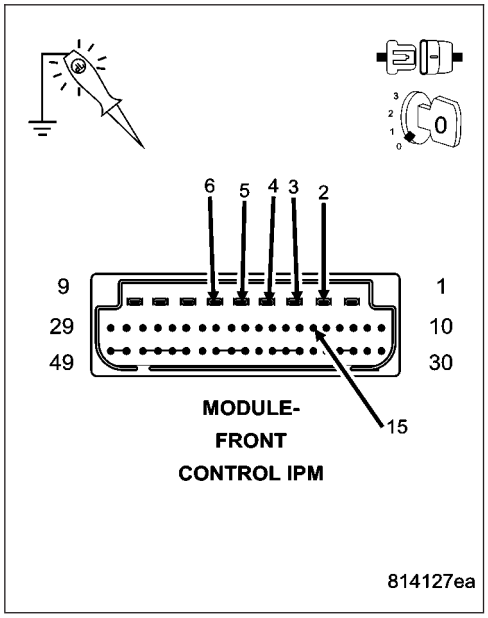
Does the test light illuminate brightly for each circuit?

Yes >> Replace and program the Front Control Module in accordance with the service information.

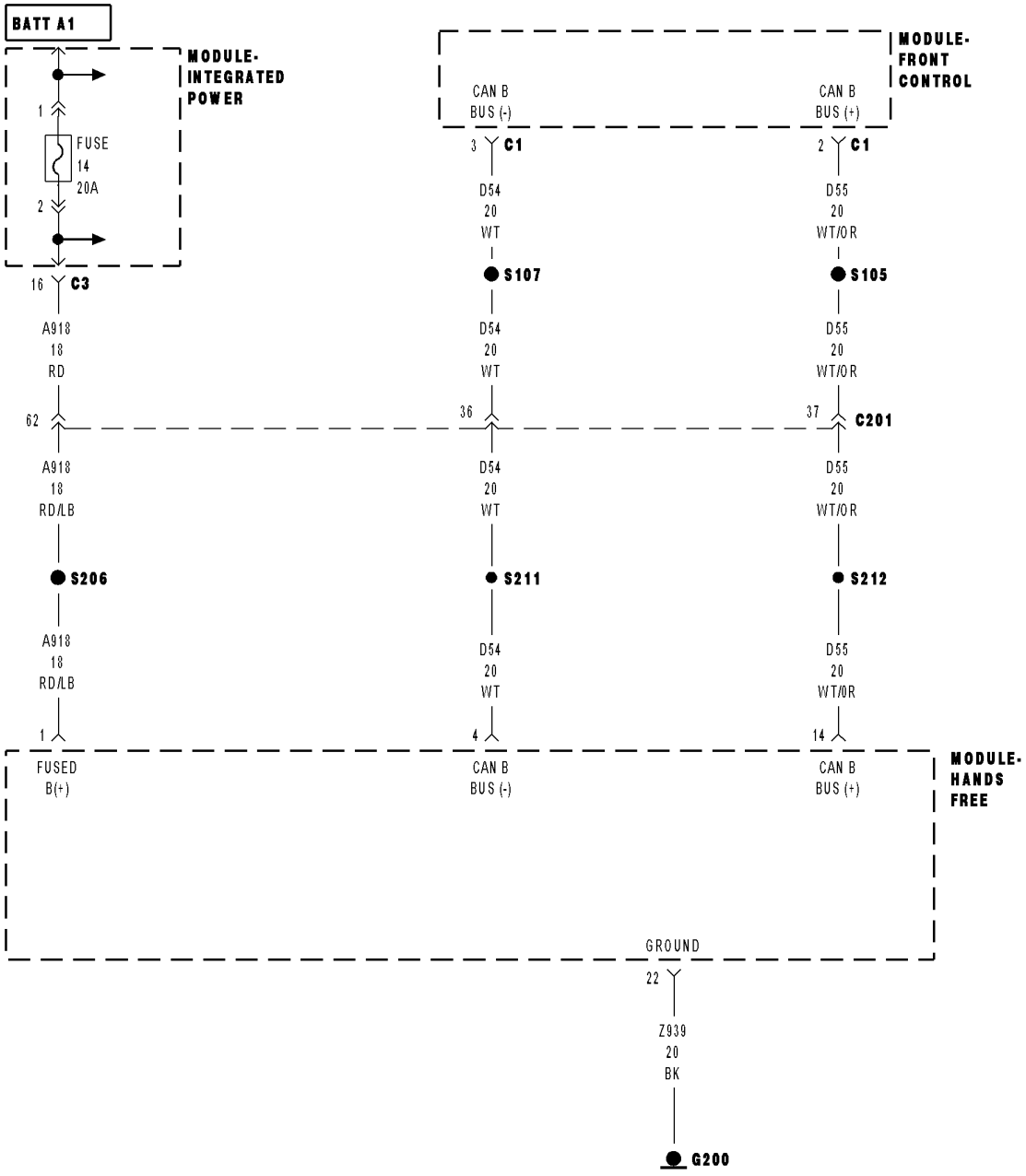
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

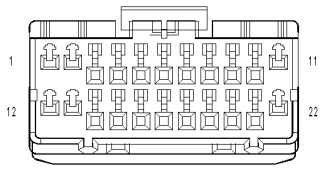
No >> Repair the Fused B(+) circuit for an open. Inspect the connector for damage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



*NO RESPONSE FROM HFM (HANDS FREE MODULE)





MODULE-
HANDS FREE

81413317

***NO RESPONSE FROM HFM (HANDS FREE MODULE) (CONTINUED)**
For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A918) FUSED B(+) CIRCUIT OPEN OR SHORTED
(Z939) GROUND CIRCUIT OPEN
(D55) AND (D54) CAN B BUS CIRCUITS OPEN
HANDS FREE MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.
With the scan tool, select ECU view.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

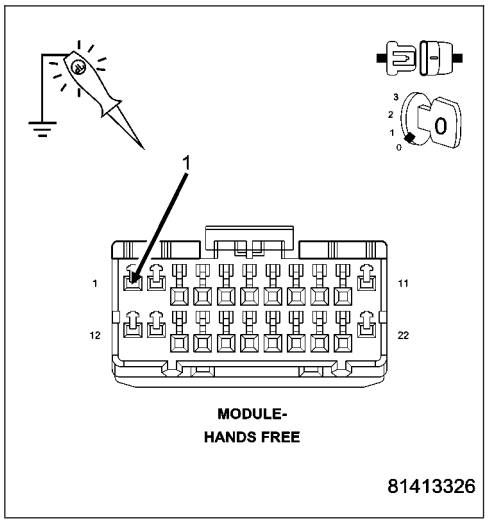
Yes >> Go To 2

No >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

---

2. (A918) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.
Disconnect the Hands Free Module harness connector.
Using a 12-volt test light connected to ground, check the (A918) Fused B(+) circuit.



Does the test light illuminate brightly?

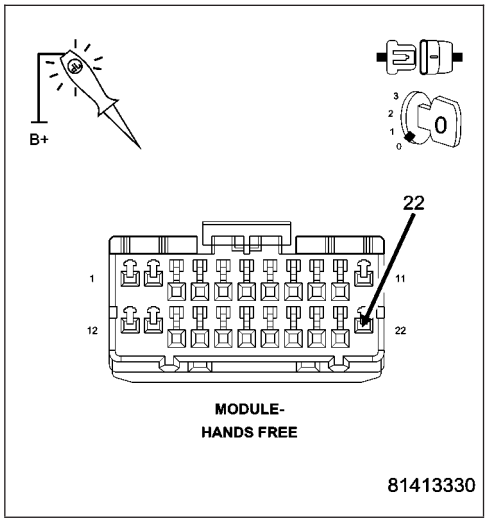
Yes >> Go To 3

No >> Repair the (A918) Fused B(+) circuit for an open or short. Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

***NO RESPONSE FROM HFM (HANDS FREE MODULE) (CONTINUED)**

3. (Z939) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z939) ground circuit.



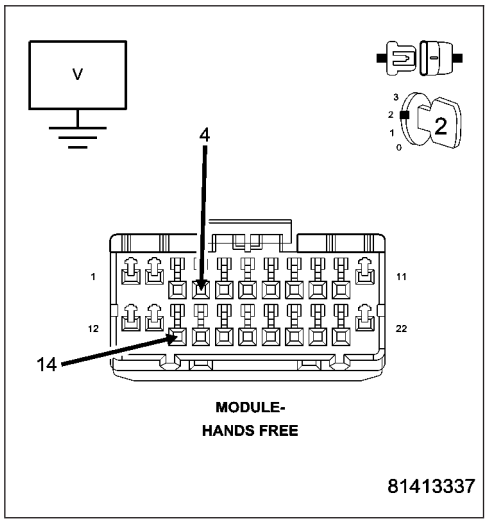
Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the (Z939) ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

4. (D55) AND (D54) CAN B BUS CIRCUITS OPEN

NOTE: One open circuit will not cause this condition.
Measure the voltage between the (D54) CAN B Bus (-) circuit and ground.
Measure the voltage between the (D55) CAN B Bus (+) circuit and ground.

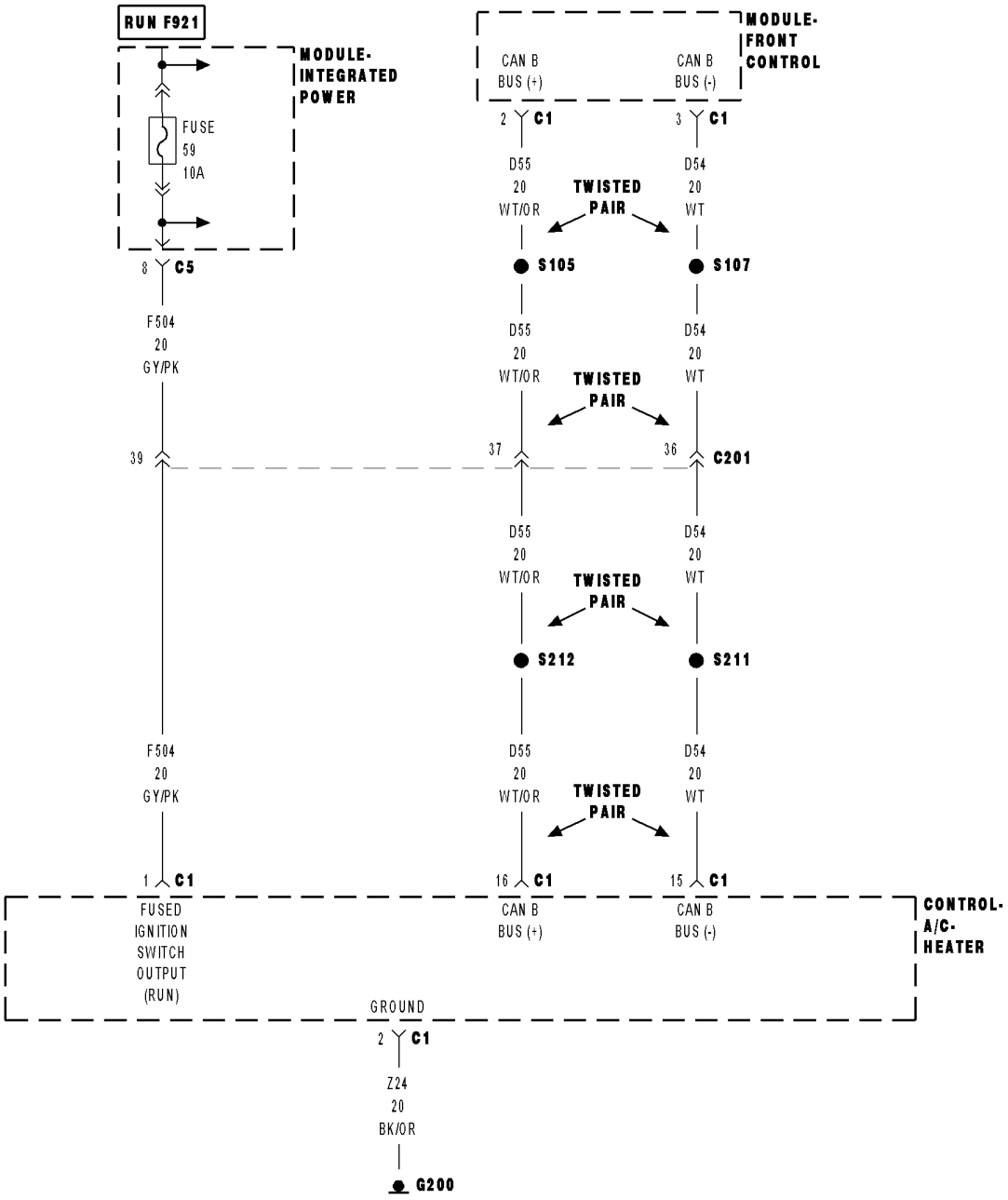


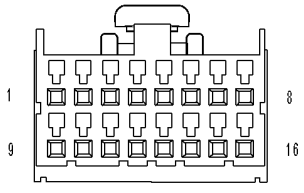
Is there any voltage present on either circuit?

Yes >> Replace the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Repair the (D55) and (D54) CAN B Bus circuits for an open. Inspect the connector for damage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

*NO RESPONSE FROM HVAC (A/C HEATER CONTROL)





CONTROL-A/C-
HEATER C1

814133a3

***NO RESPONSE FROM HVAC (A/C HEATER CONTROL) (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(F504) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED
(Z24) GROUND CIRCUIT OPEN
(D55) AND (D54) CAN B BUS CIRCUITS OPEN
A/C HEATER CONTROL

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.
With the scan tool, select ECU view.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes >> Go To 2

No >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

---

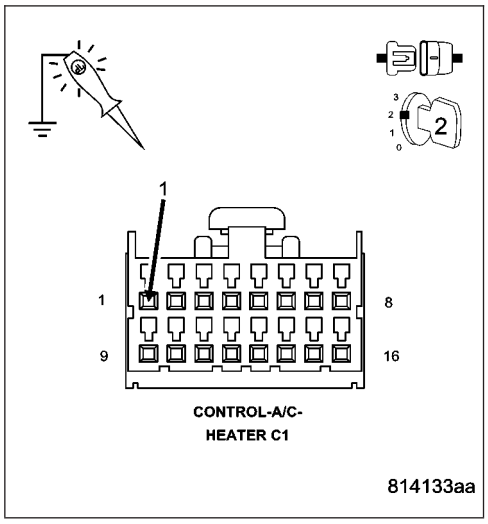
2. (F504) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F504) Fused Ignition Switch Output circuit.



Does the test light illuminate brightly?

Yes >> Go To 3

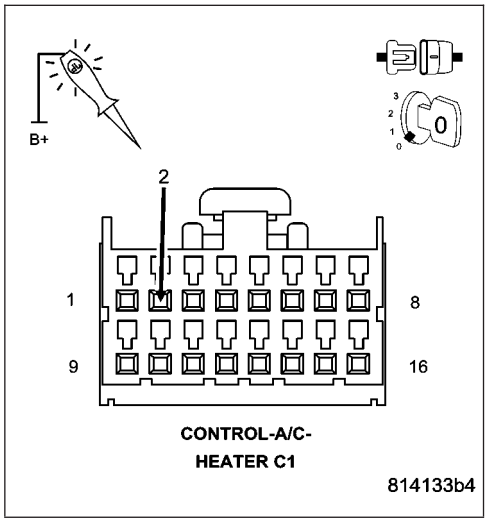
No >> Repair the (F504) Fused Ignition Switch Output circuit for an open or short.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

***NO RESPONSE FROM HVAC (A/C HEATER CONTROL) (CONTINUED)**

3. (Z24) GROUND CIRCUIT OPEN

Turn the ignition off.

Using a 12-volt test light connected to 12-volts, check the (Z24) ground circuit.



Does the test light illuminate brightly?

Yes >> Go To 4

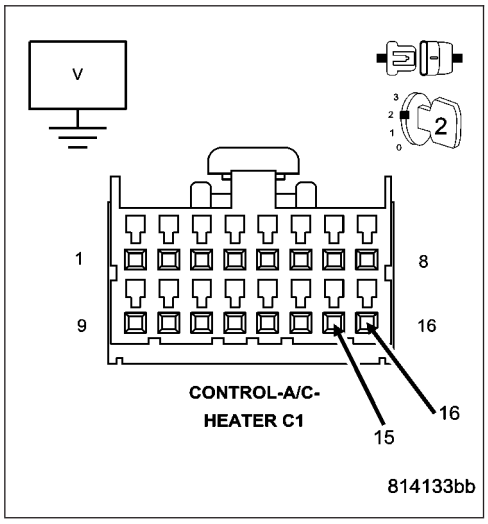
No >> Repair the (Z24) ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

4. (D55) AND (D54) CAN B BUS CIRCUITS OPEN

NOTE: One open circuit will not cause this condition.

Measure the voltage between the (D54) CAN B Bus (-) circuit and ground.

Measure the voltage between the (D55) CAN B Bus (+) circuit and ground.

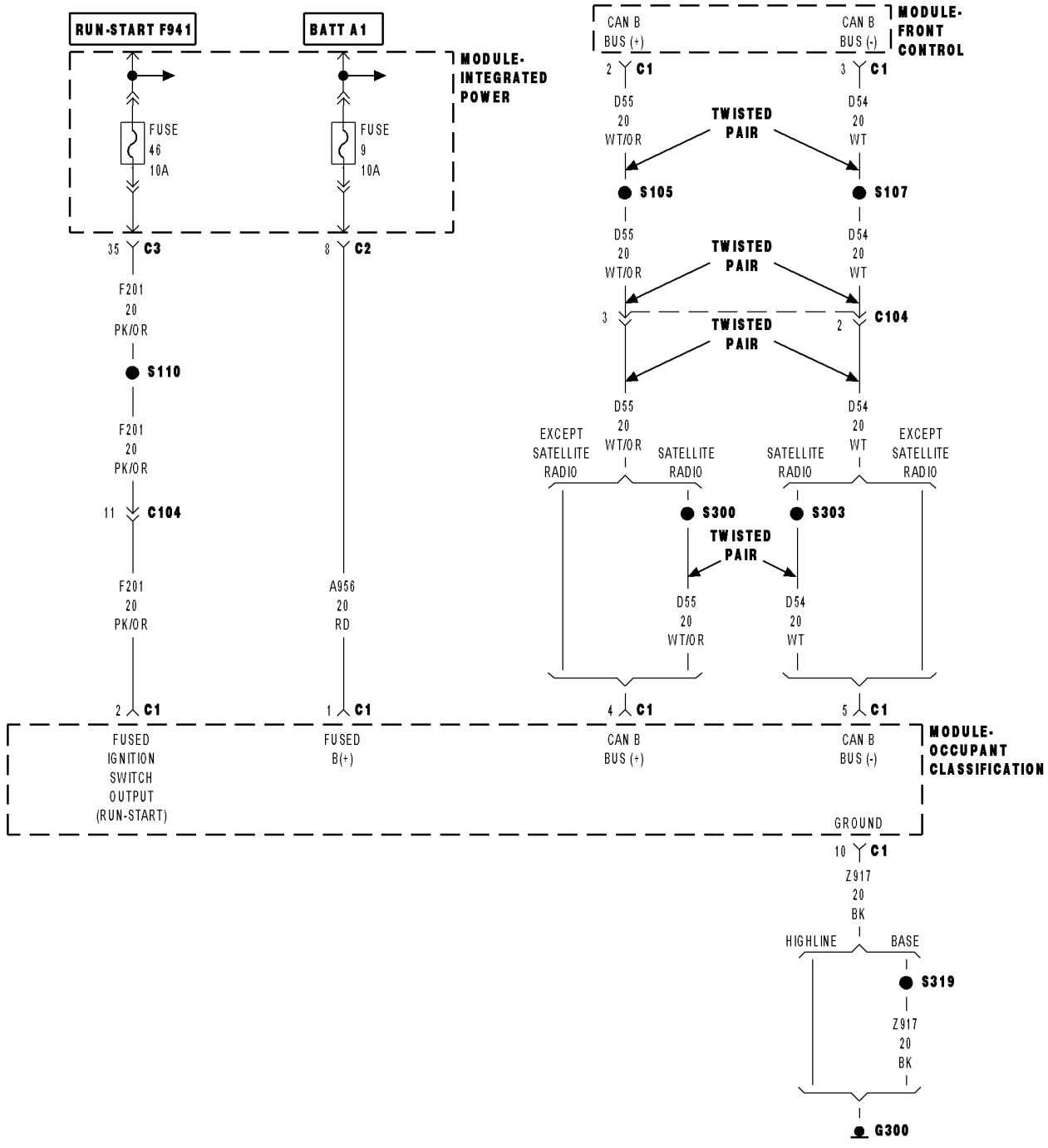


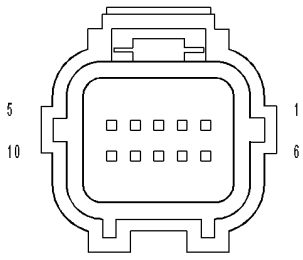
Is there any voltage present on either circuit?

Yes >> Replace the A/C Heater Control in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Repair the (D55) and (D54) CAN B Bus circuits for an open. Inspect the connector for damage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

*NO RESPONSE FROM OCM (OCCUPANT CLASSIFICATION MODULE)





MODULE-
OCCUPANT
CLASSIFICATION C1

81413825

***NO RESPONSE FROM OCM (OCCUPANT CLASSIFICATION MODULE) (CONTINUED)**
For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A956) FUSED B(+) CIRCUIT OPEN OR SHORTED
(Z917) GROUND CIRCUIT OPEN
(F201) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED
(D55) AND (D54) CAN B BUS CIRCUITS OPEN
OCCUPANT CLASSIFICATION MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.
With the scan tool, select ECU view.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes >> Go To 2

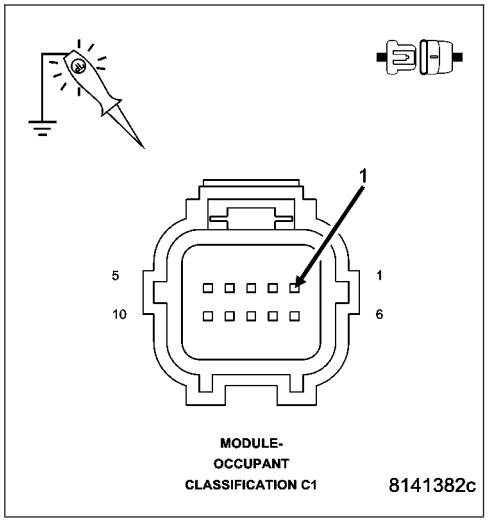
No >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

---

2. (A956) FUSED B(+) CIRCUIT OPEN OR SHORTED

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Occupant Classification Module C1 harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Using a 12-volt test light connected to ground, check the (A956) Fused B(+) circuit.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the (A956) Fused B(+) circuit for an open or short. Perform AIRBAG VERIFICATION TEST - VER 1.

***NO RESPONSE FROM OCM (OCCUPANT CLASSIFICATION MODULE) (CONTINUED)**

3. (Z917) GROUND CIRCUIT OPEN

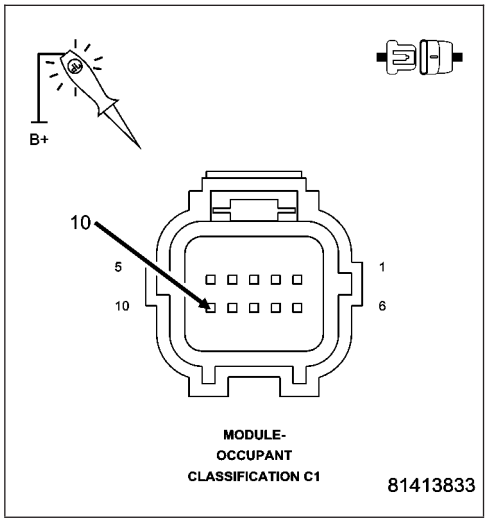
Turn the ignition off.

Using a 12-volt test light connected to 12-volts, check the (Z917) ground circuit.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the (Z917) ground circuit for an open.
Perform AIRBAG VERIFICATION TEST - VER 1.



4. (F201) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED

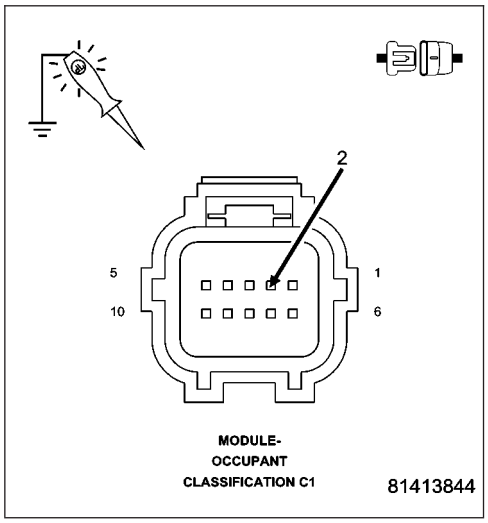
Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F201) Fused Ignition Switch Output circuit.

Does the test light illuminate brightly?

Yes >> Go To 5

No >> Repair the (F201) Fused Ignition Switch Output circuit for an open or short.
Perform AIRBAG VERIFICATION TEST - VER 1.



*NO RESPONSE FROM OCM (OCCUPANT CLASSIFICATION MODULE) (CONTINUED)

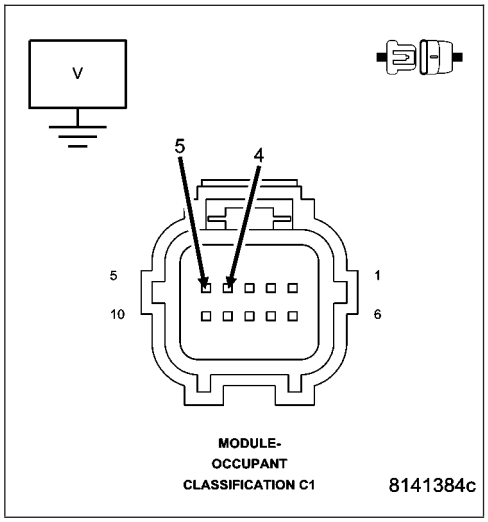
5. (D55) AND (D54) CAN B BUS CIRCUITS OPEN

WARNING: If the Occupant Classification Module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.

NOTE: One open circuit will not cause this condition.

Measure the voltage between the (D54) CAN B Bus (-) circuit and ground.

Measure the voltage between the (D55) CAN B Bus (+) circuit and ground.

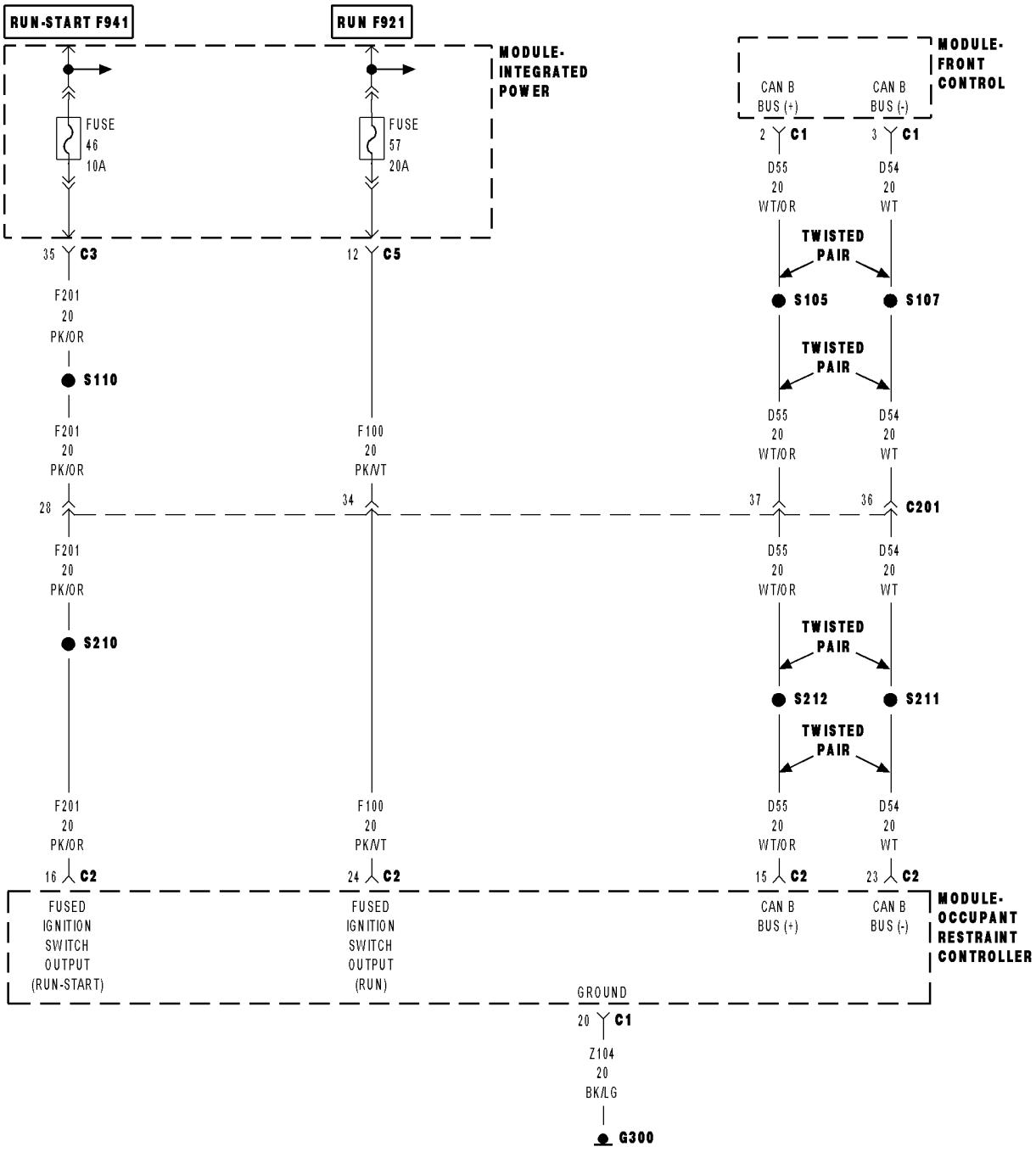


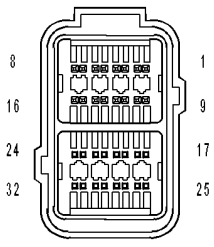
Is there any voltage present on either circuit?

Yes >> Replace the Occupant Classification Module in accordance with the service information.
Perform AIRBAG VERIFICATION TEST - VER 1.

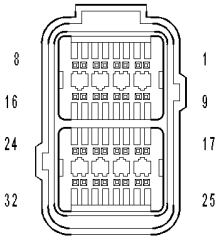
No >> Repair the (D55) and (D54) CAN B Bus circuits for an open. Inspect the connector for damage.
Perform AIRBAG VERIFICATION TEST - VER 1.

*NO RESPONSE FROM ORC (OCCUPANT RESTRAINT CONTROLLER)





MODULE- OCCUPANT RESTRAINT CONTROLLER C1



MODULE- OCCUPANT RESTRAINT CONTROLLER C2

81413944

***NO RESPONSE FROM ORC (OCCUPANT RESTRAINT CONTROLLER) (CONTINUED)**
For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(Z104) GROUND CIRCUIT OPEN
(F100) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR SHORTED
(F201) FUSED IGNITION SWITCH OUTPUT (RUN/START) CIRCUIT OPEN OR SHORTED
(D55) AND (D54) CAN B BUS CIRCUITS OPEN
OCCUPANT RESTRAINT CONTROLLER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.
With the scan tool, select ECU view.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes >> Go To 2

No >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

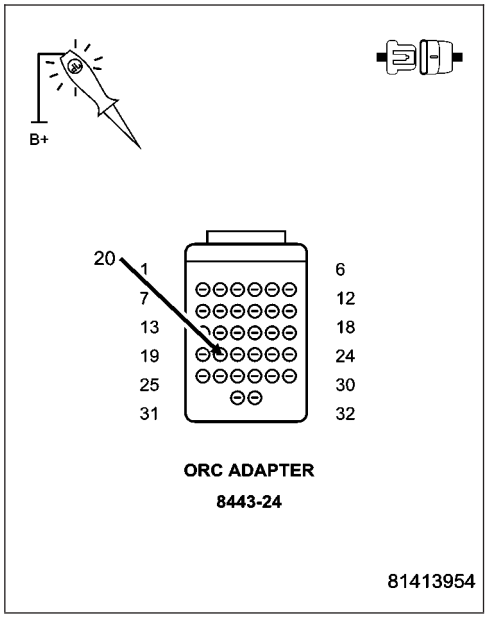
---

2. (Z104) GROUND CIRCUIT OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Occupant Restraint Controller Module harness connectors.

Connect the appropriate Load Tool ACM Adaptor to the ORC connector.

Using a 12-volt test light connected to 12-volts, check the (Z104) ground circuit.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the (Z104) ground circuit for an open.
Perform AIRBAG VERIFICATION TEST - VER 1.

***NO RESPONSE FROM ORC (OCCUPANT RESTRAINT CONTROLLER) (CONTINUED)**

3. (F100) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR SHORTED

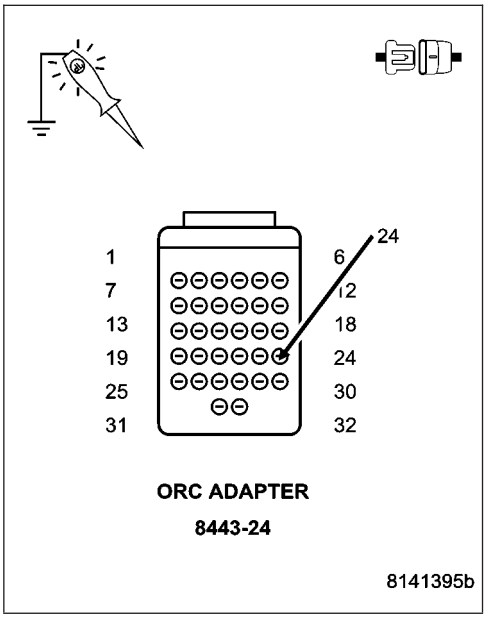
WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

Using a 12-volt test light connected to ground, check the (F100) Fused Ignition Switch Output (RUN) circuit.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the (F100) Fused Ignition Switch Output (RUN) circuit for an open or short.
Perform AIRBAG VERIFICATION TEST - VER 1.



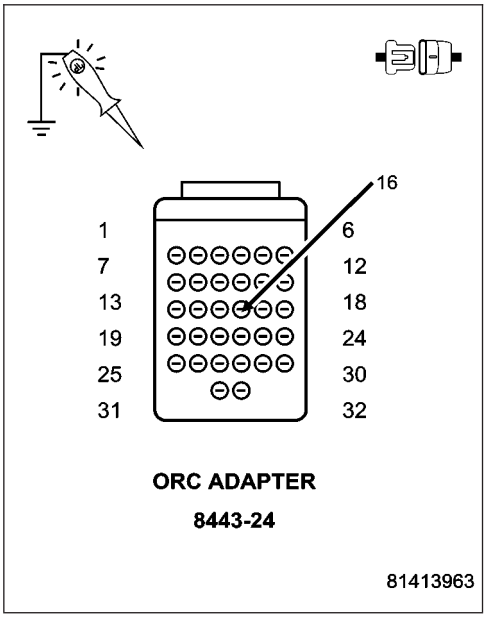
4. (F201) FUSED IGNITION SWITCH OUTPUT (RUN/START) CIRCUIT OPEN OR SHORTED

Using a 12-volt test light connected to ground, check the (F201) Fused Ignition Switch Output (RUN/START) circuit.

Does the test light illuminate brightly?

Yes >> Go To 5

No >> Repair the (F201) Fused Ignition Switch Output (RUN/START) circuit for an open or short.
Perform AIRBAG VERIFICATION TEST - VER 1.



***NO RESPONSE FROM ORC (OCCUPANT RESTRAINT CONTROLLER) (CONTINUED)**

5. (D55) AND (D54) CAN B BUS CIRCUITS OPEN

WARNING: If the Occupant Restraint Controller Module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.

NOTE: One open circuit will not cause this condition.

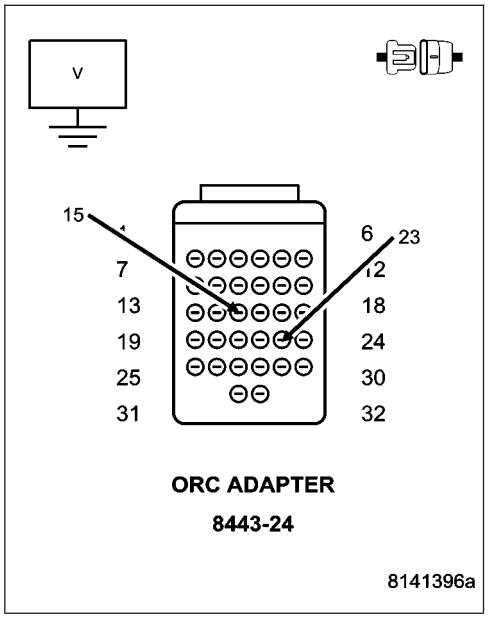
Measure the voltage between the (D54) CAN B Bus (-) circuit and ground.

Measure the voltage between the (D55) CAN B Bus (+) circuit and ground.

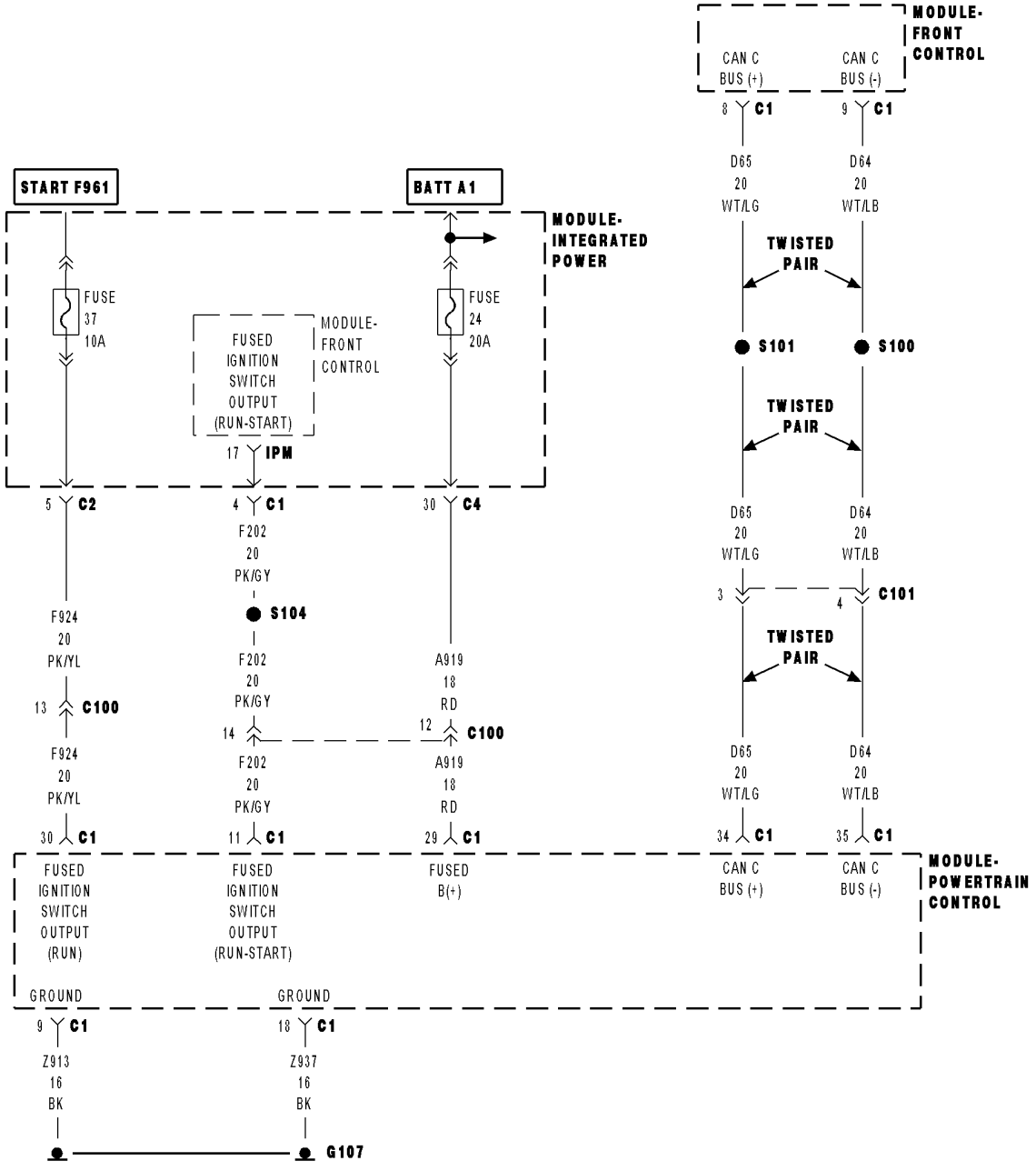
Is there any voltage present on either circuit?

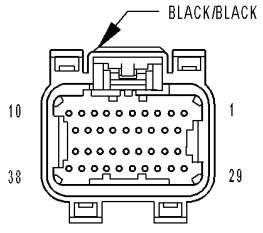
Yes >> Replace the Occupant Restraint Controller Module in accordance with the service information.
Perform AIRBAG VERIFICATION TEST - VER 1.

No >> Repair the (D55) and (D54) CAN B Bus circuits for an open. Inspect the connector for damage.
Perform AIRBAG VERIFICATION TEST - VER 1.

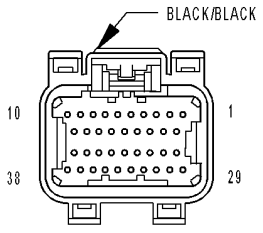


*NO RESPONSE FROM PCM (POWERTRAIN CONTROL MODULE)





MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)

81414483

***NO RESPONSE FROM PCM (POWERTRAIN CONTROL MODULE) (CONTINUED)**
For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A919) FUSED B(+) CIRCUIT OPEN OR SHORTED
(Z937) (Z913) GROUND CIRCUIT OPEN
(F202) (F924) FUSED IGNITION SW OUTPUT CIRCUIT OPEN OR SHORTED
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.
With the scan tool, select ECU view.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

NOTE: Check the FCM for any active CAN C hardware DTCs, perform DTC before proceeding.

Does the scan tool display a red X next to the module?

Yes >> Go To 2

No >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

---

2. (A919) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

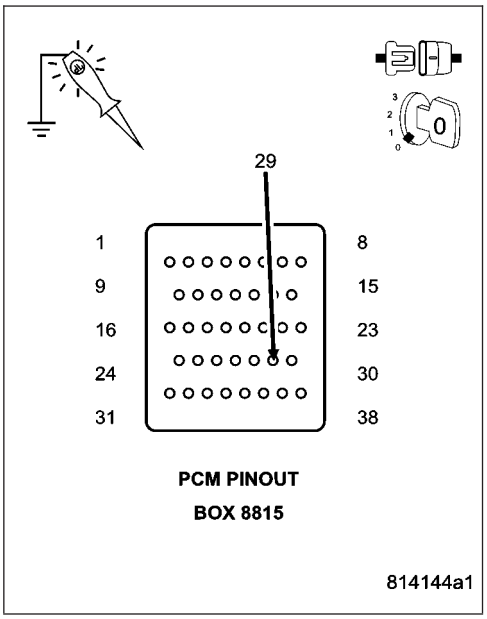
Disconnect the PCM C1 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Using a 12-volt test light connected to ground, check the (A919) Fused B(+) circuit.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the (A919) Fused B(+) circuit for an open or short. Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.



***NO RESPONSE FROM PCM (POWERTRAIN CONTROL MODULE) (CONTINUED)**

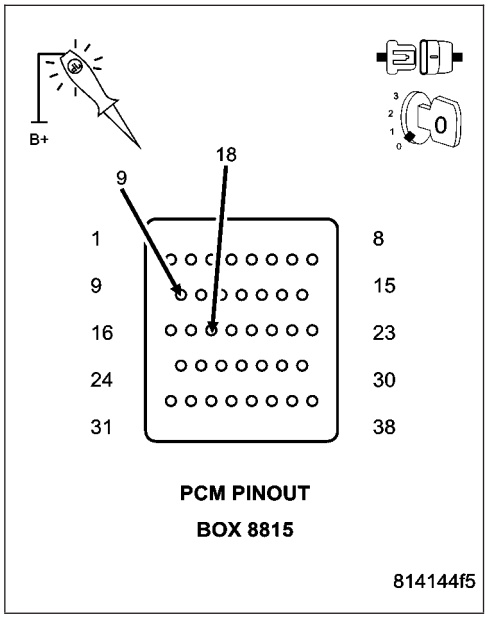
3. (Z913) (Z937) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check each (Z913) and (Z937) ground circuit.

Does the test light illuminate brightly for each circuit?

Yes >> Go To 4

No >> Repair the ground circuit for an open.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.



4. (F202) (F924) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED

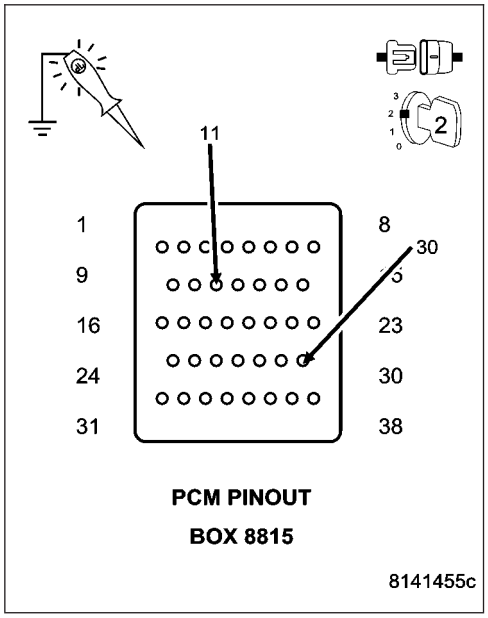
Turn the ignition on.

Using a 12-volt test light connected to ground, check each (F202) and (F924) Fused Ignition Switch Output circuit.

Does the test light illuminate brightly for each circuit?

Yes >> Go To 5

No >> Repair the Fused Ignition Switch Output circuit for an open or short.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.



***NO RESPONSE FROM PCM (POWERTRAIN CONTROL MODULE) (CONTINUED)**

5. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

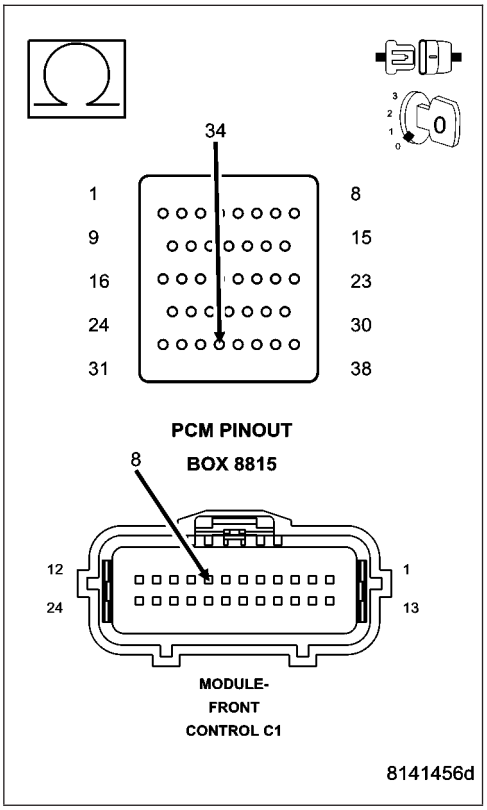
Disconnect the FCM C1 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the FCM connector and the appropriate terminal of the special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the (D65) CAN C Bus (+) circuit for an open.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.



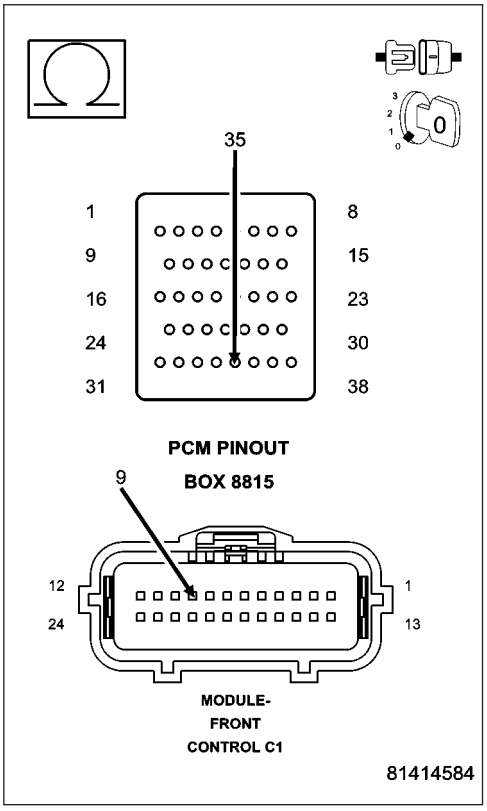
6. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the FCM connector and the appropriate terminal of the special tool #8815.

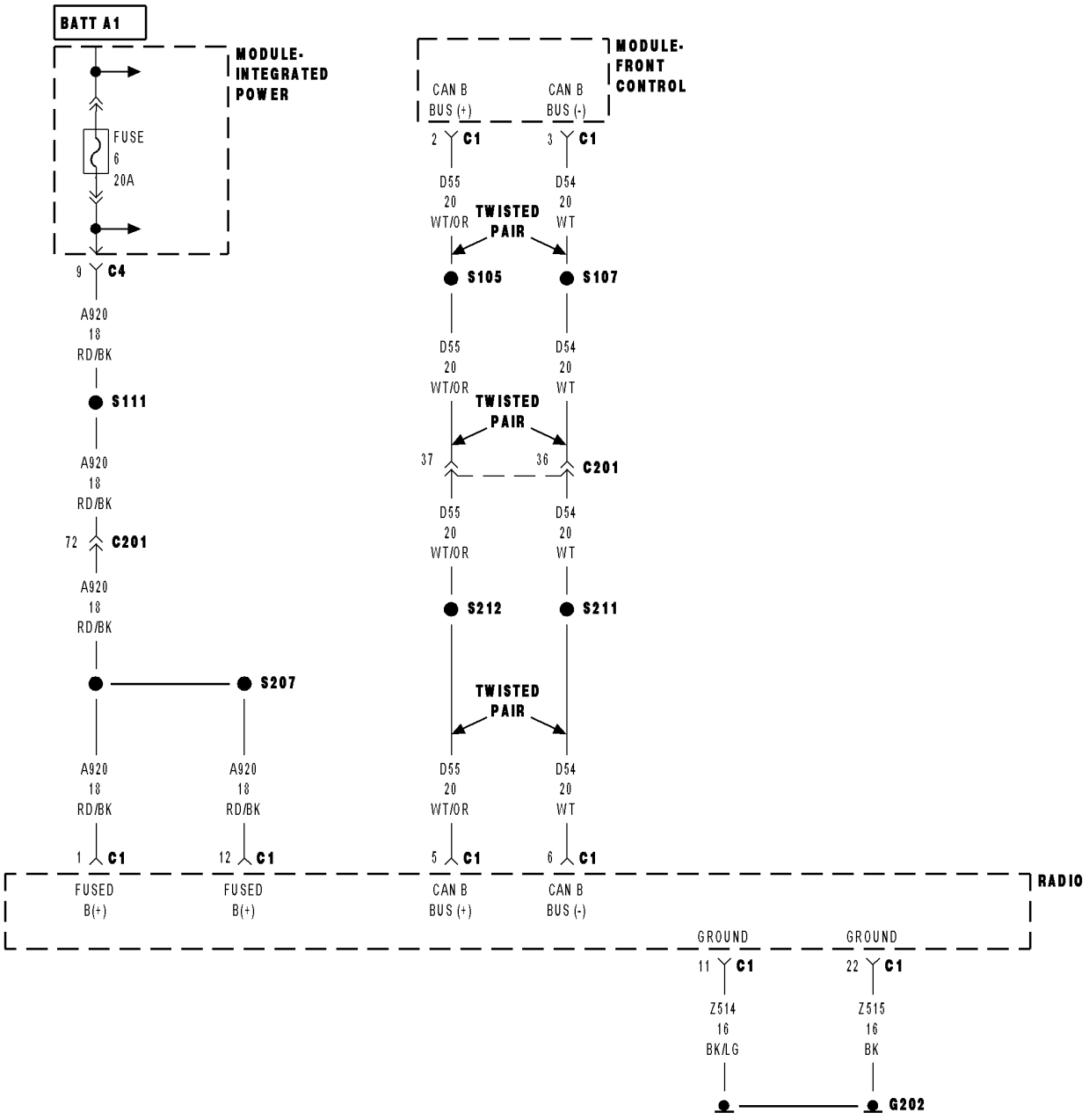
Is the resistance below 5.0 ohms?

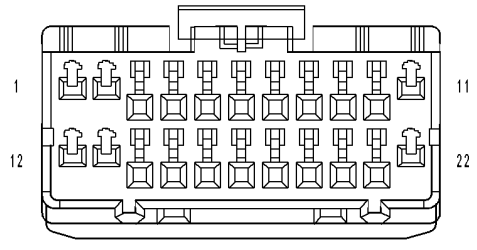
Yes >> Replace and program the Powertrain Control Module in accordance with the service information.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.

No >> Repair the (D64) CAN C Bus (-) circuit for an open.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.



*NO RESPONSE FROM RADIO





RADIO C1

814147de

***NO RESPONSE FROM RADIO (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A920) FUSED B (+) CIRCUIT OPEN OR SHORTED
(Z514) OR (Z515) GROUND CIRCUIT OPEN
(D55) AND (D54) CAN B BUS CIRCUITS OPEN
RADIO

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.
With the scan tool, select ECU view.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes >> Go To 2

No >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

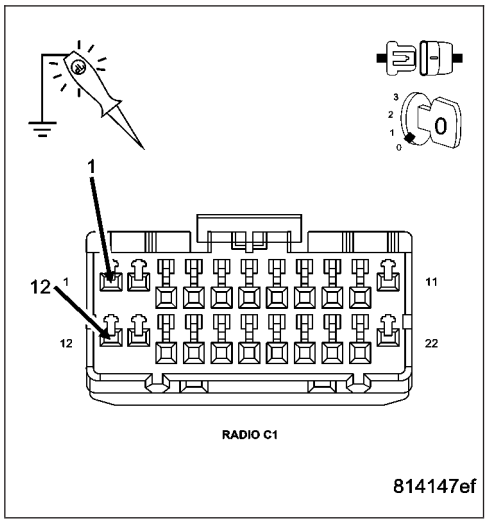
---

2. (A920) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

Disconnect the Radio C1 harness connector.

Using a 12-volt test light connected to ground, check each (A920) Fused B(+) circuit.



Does the test light illuminate brightly for each circuit?

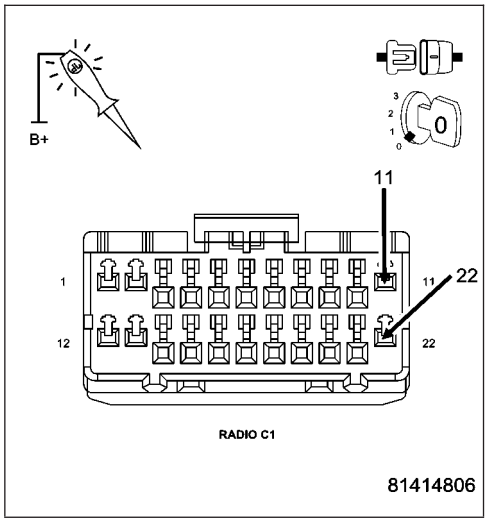
Yes >> Go To 3

No >> Repair the (A920) Fused B(+) circuit for an open or short. Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

***NO RESPONSE FROM RADIO (CONTINUED)**

3. (Z514) OR (Z515) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z514) and (Z515) ground circuits.



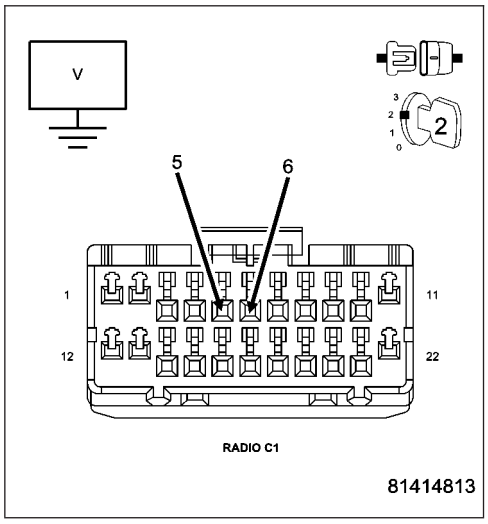
Does the test light illuminate brightly for each circuit?

Yes >> Go To 4

No >> Repair the (Z514) or the (Z515) ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

4. (D55) AND (D54) CAN B BUS CIRCUITS OPEN

NOTE: One open circuit will not cause this condition.
Measure the voltage between the (D54) CAN B Bus (-) circuit and ground.
Measure the voltage between the (D55) CAN B Bus (+) circuit and ground.

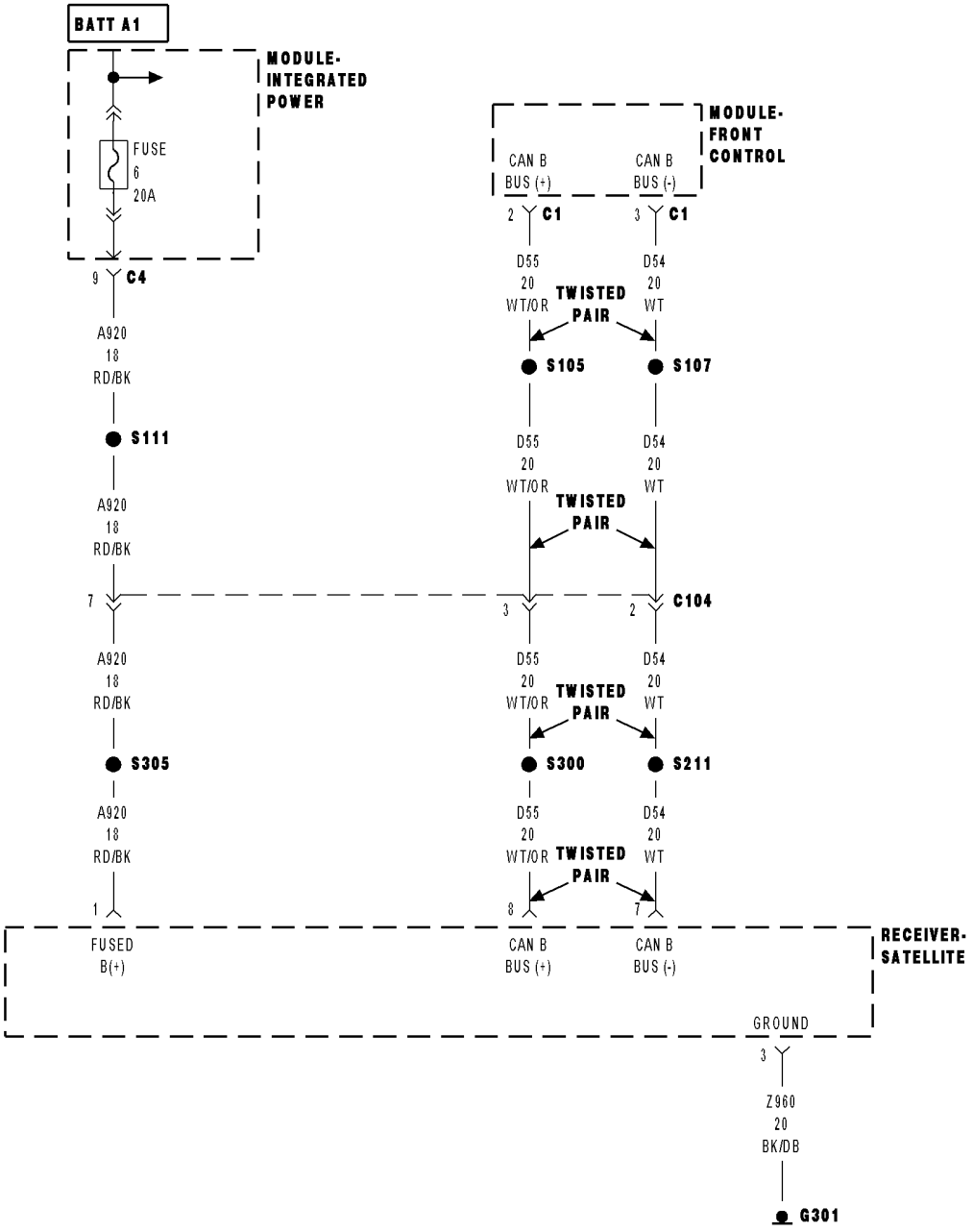


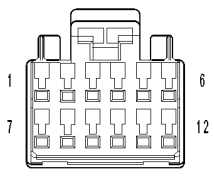
Is there any voltage present on either circuit?

Yes >> Replace the Radio in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Repair the (D55) and (D54) CAN B Bus circuits for an open. Inspect the connector for damage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

*NO RESPONSE FROM SDAR (SATELLITE RECEIVER)





RECEIVER-
SATELLITE

814153b4

***NO RESPONSE FROM SDAR (SATELLITE RECEIVER) (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A920) FUSED B (+) CIRCUIT OPEN OR SHORTED
(Z960) GROUND CIRCUIT OPEN
(D55) AND (D54) CAN B BUS CIRCUITS OPEN
SATELLITE RECEIVER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.
With the scan tool, select ECU view.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes >> Go To 2

No >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

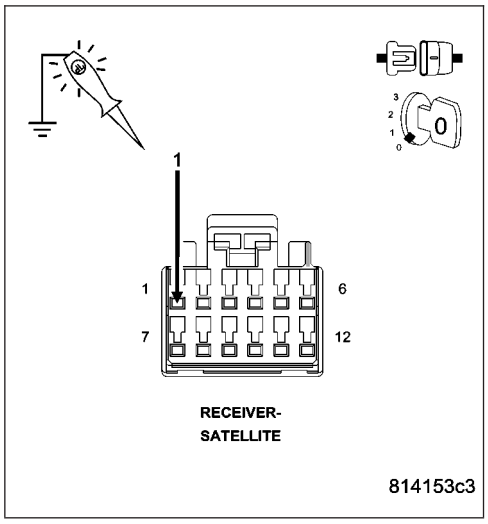
---

2. (A920) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

Disconnect the Satellite Receiver harness connector.

Using a 12-volt test light connected to ground, check the (A920) Fused B(+) circuit.



Does the test light illuminate brightly?

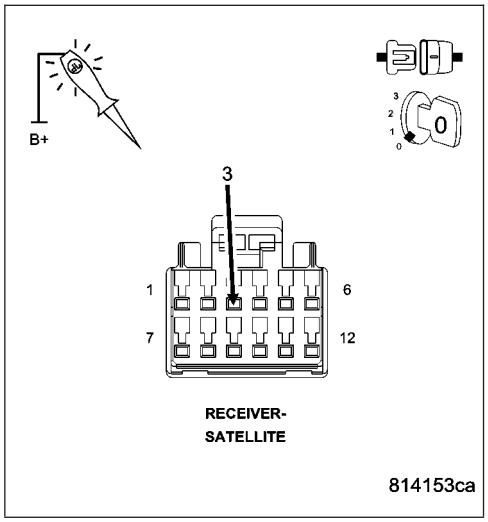
Yes >> Go To 3

No >> Repair the (A920) Fused B(+) circuit for an open or short. Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

***NO RESPONSE FROM SDAR (SATELLITE RECEIVER) (CONTINUED)**

3. (Z960) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z960) ground circuit.



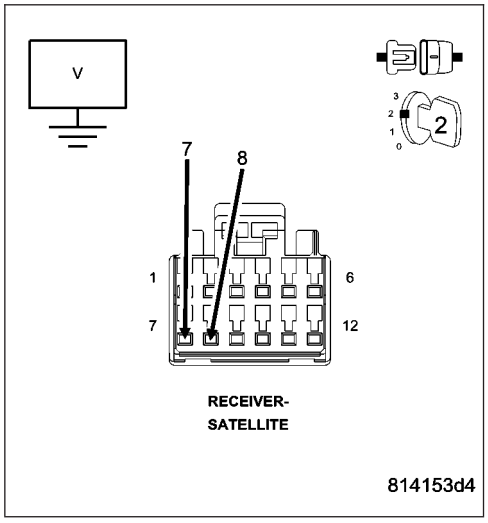
Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the (Z960) ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

4. (D55) AND (D54) CAN B BUS CIRCUITS OPEN

NOTE: One open circuit will not cause this condition.
Measure the voltage between the (D54) CAN B Bus (-) circuit and ground.
Measure the voltage between the (D55) CAN B Bus (+) circuit and ground.

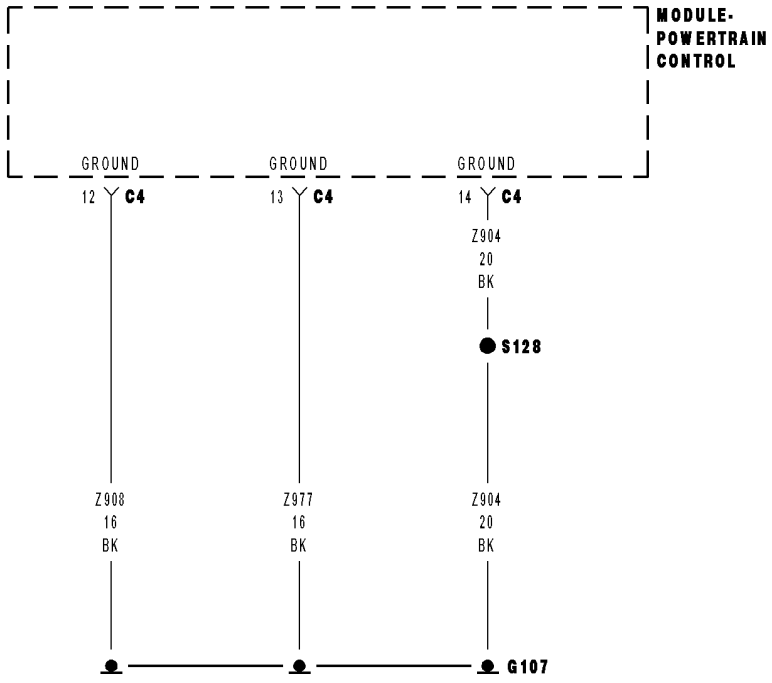


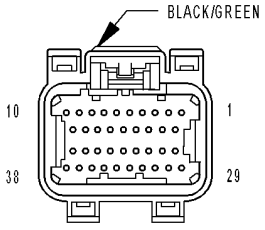
Is there any voltage present on either circuit?

Yes >> Replace the Satellite Receiver in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

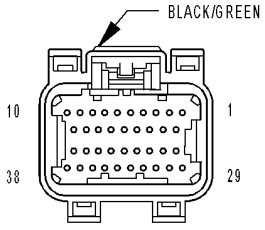
No >> Repair the (D55) and (D54) CAN B Bus circuits for an open. Inspect the connector for damage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

*NO RESPONSE FROM TCM (POWERTRAIN CONTROL MODULE)





MODULE-
POWERTRAIN
CONTROL C4
(42RLE)



MODULE-
POWERTRAIN
CONTROL C4
(545RFE)

8141540b

***NO RESPONSE FROM TCM (POWERTRAIN CONTROL MODULE) (CONTINUED)**
For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A919) FUSED B(+) CIRCUIT OPEN OR SHORTED
(Z908) (Z977) (Z904) GROUND CIRCUIT OPEN
(F202) (F924) FUSED IGNITION SW OUTPUT CIRCUIT OPEN OR SHORTED
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.
With the scan tool, select ECU view.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

NOTE: Check the FCM for any active CAN C hardware DTCs, perform DTC before proceeding.

Does the scan tool display a red X next to the module?

Yes >> Go To 2

No >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

---

2. ATTEMPT TO COMMUNICATE WITH THE PCM

With the scan tool in ECU view, observe the status of the PCM.

Does the scan tool display a red X next to the PCM?

Yes >> Refer to the No Response From PCM test procedure. Refer to the table of contents in this section.

No >> Go To 3

***NO RESPONSE FROM TCM (POWERTRAIN CONTROL MODULE) (CONTINUED)**

3. (Z908) (Z977) (Z904) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM C4 harness connector.

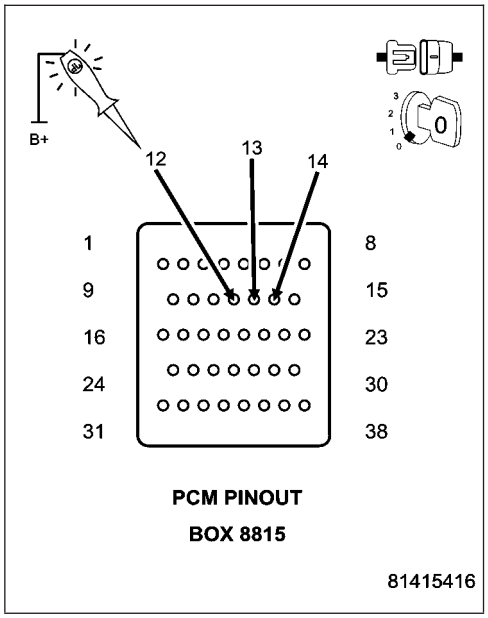
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to 12-volts, check each (Z908), (Z977), and (Z904) ground circuits.

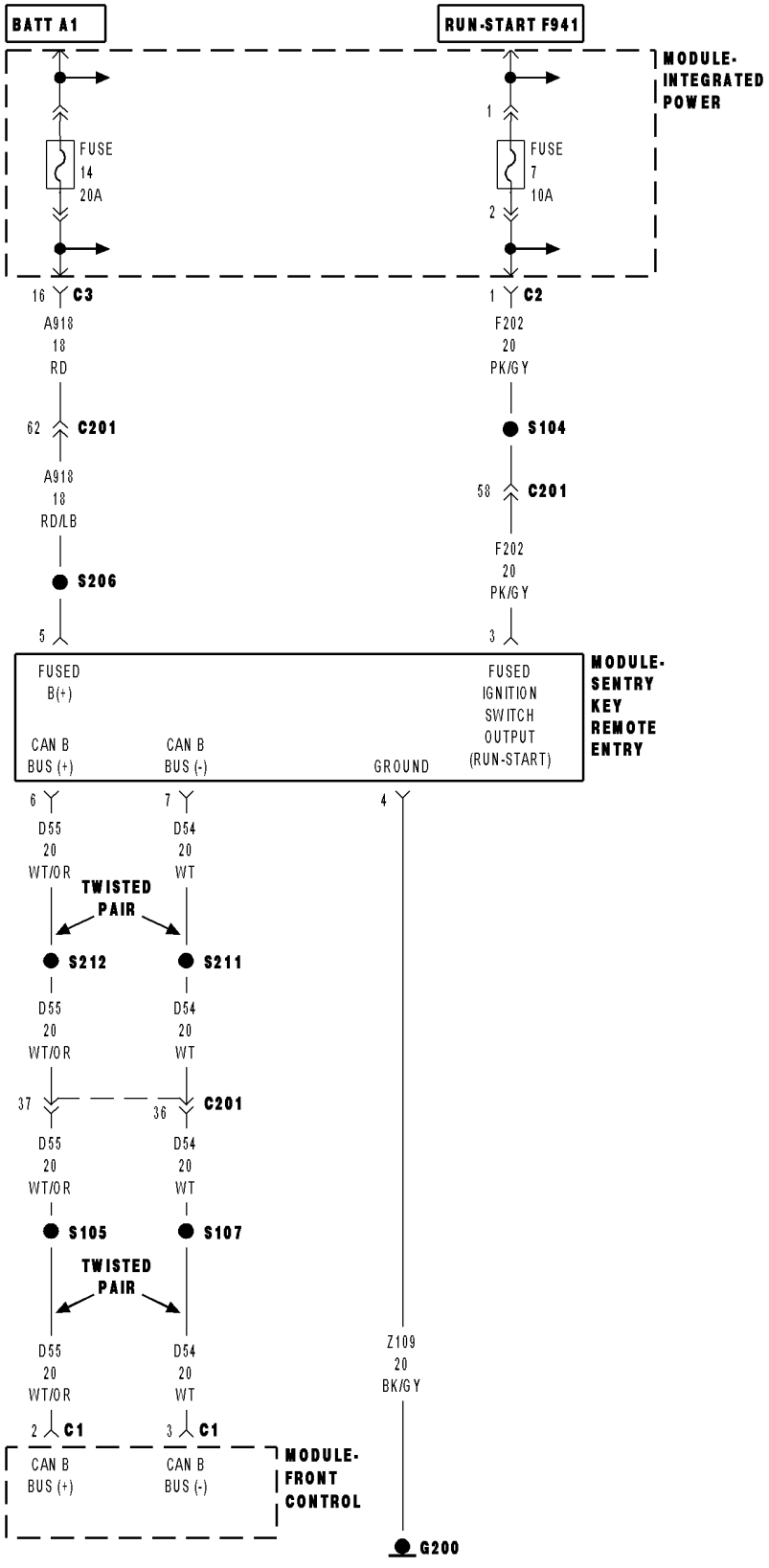
Does the test light illuminate brightly for each circuit?

Yes >> Replace and program the Powertrain Control Module in accordance with the service information.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.

No >> Repair the ground circuit for an open.
Perform the appropriate TRANSMISSION VERIFICATION TEST.



*NO RESPONSE FROM WCM (SENTRY KEY REMOTE ENTRY MODULE)



***NO RESPONSE FROM WCM (SENTRY KEY REMOTE ENTRY MODULE) (CONTINUED)**
For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A918) FUSED B(+) CIRCUIT OPEN OR SHORTED
(Z109) GROUND CIRCUIT OPEN
(F202) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED
(D55) AND (D54) CAN B BUS CIRCUITS OPEN
SENTRY KEY REMOTE ENTRY MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.
With the scan tool, select ECU view.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

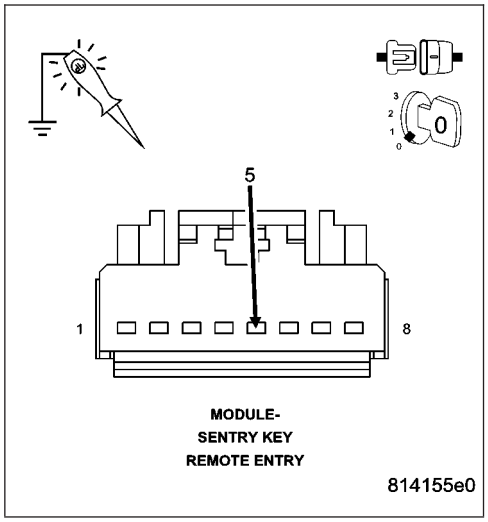
Yes >> Go To 2

No >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

---

2. (A918) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.
Disconnect the Sentry Key Remote Entry Module harness connector.
Using a 12-volt test light connected to ground, check the (A918) Fused B(+) circuit.



Does the test light illuminate brightly?

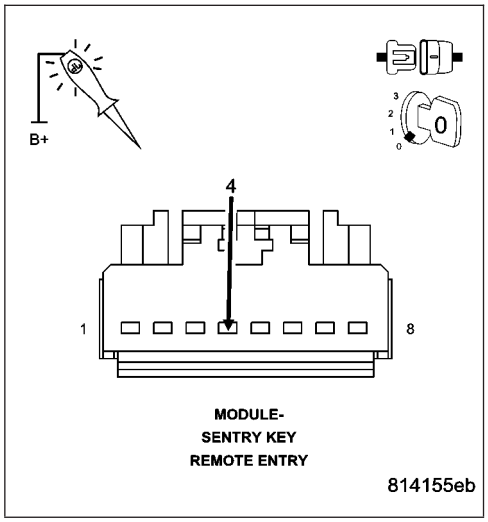
Yes >> Go To 3

No >> Repair the (A918) Fused B(+) circuit for an open or short. Perform SKREEM VERIFICATION TEST

***NO RESPONSE FROM WCM (SENTRY KEY REMOTE ENTRY MODULE) (CONTINUED)**

3. (Z109) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z109) ground circuit.



Does the test light illuminate brightly?

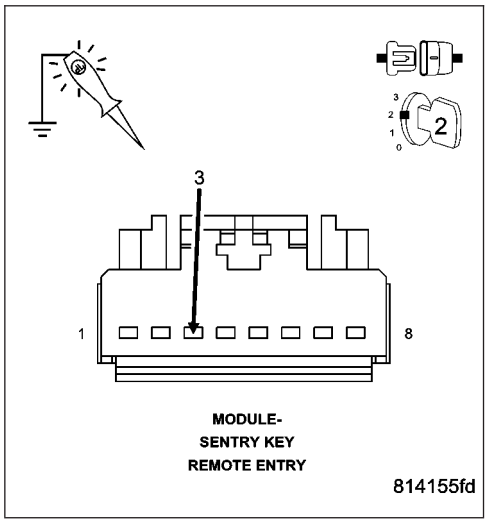
Yes >> Go To 4

No >> Repair the (Z109) ground circuit for an open.
Perform SKREEM VERIFICATION TEST

4. (F202) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F202) Fused Ignition Switch Output circuit.



Does the test light illuminate brightly?

Yes >> Go To 5

No >> Repair the (F202) Fused Ignition Switch Output circuit for an open or short.
Perform SKREEM VERIFICATION TEST

***NO RESPONSE FROM WCM (SENTRY KEY REMOTE ENTRY MODULE) (CONTINUED)**

5. (D55) AND (D54) CAN B BUS CIRCUITS OPEN

NOTE: One open circuit will not cause this condition.

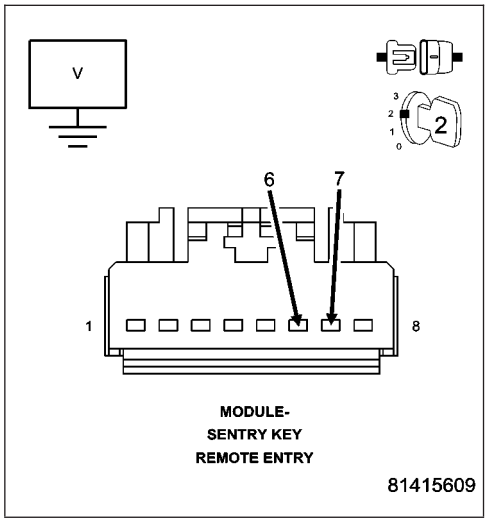
Measure the voltage between the (D54) CAN B Bus (-) circuit and ground.

Measure the voltage between the (D55) CAN B Bus (+) circuit and ground.

Is there any voltage present on either circuit?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the service information.
Perform SKREEM VERIFICATION TEST

No >> Repair the (D55) and (D54) CAN B Bus circuits for an open. Inspect the connector for damage.
Perform SKREEM VERIFICATION TEST



ELECTRONIC CONTROL MODULES - SERVICE INFORMATION

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ELECTRONIC CONTROL MODULES - SERVICE INFORMATION

STANDARD PROCEDURE

PCM/SKREEM PROGRAMMING

NOTE: Before replacing the Powertrain Control Module (PCM), be certain to check the related component/ circuit integrity for failures not detected due to a double fault in the circuit. Most PCM driver/control circuit failures are caused by internal component failures (i.e. relays and solenoids) and shorted circuits (i.e. pull-ups, drivers, and switched circuits). These failures are difficult to detect when a double fault has occurred and only one DTC has been set.

When a Powertrain Control Module (PCM) and the Sentry Key REmote Entry Module (SKREEM) on vehicles equipped with the Sentry Key Immobilizer System (SKIS) are replaced at the same time, perform the following steps in order:

1. Program the new PCM.
2. Program the new SKREEM (also sometimes referred to as the Wireless Control Module or WCM).
3. Replace all ignition keys and program them into the new SKREEM/WCM.

PROGRAMMING THE PCM/SKREEM

The SKIS Secret Key is an ID code that is unique to each SKREEM/WCM. This code is programmed and stored in the SKREEM/WCM, the PCM, and each ignition key transponder chip. When the PCM or SKREEM/WCM is replaced, it is necessary to program the Secret Key into the new module using a diagnostic scan tool. Follow the programming steps outlined in the diagnostic scan tool for “PCM Replaced” or “WCM Replaced” under “Miscellaneous Functions” for the “WCM/Wireless Control Module” menu item as appropriate.

NOTE: Be certain to enter the correct country code for the SKREEM/WCM. If the incorrect country code is programmed into the SKREEM, it cannot be changed and the SKREEM must be replaced.

NOTE: If the PCM and the SKREEM/WCM are replaced at the same time, all vehicle ignition keys will need to be replaced and new keys programmed into the new SKREEM/WCM.

NOTE: Programming the PCM or SKREEM is done using a diagnostic scan tool and a PIN to enter secure access mode. If three attempts are made to enter secure access mode using an incorrect PIN, secure access mode will be locked out for one hour. To exit this lockout mode, turn the ignition to the RUN position for one hour then enter the correct PIN. (Ensure all accessories are turned OFF. Also monitor the battery state and connect a battery charger if necessary).

PROGRAMMING IGNITION KEYS TO THE SKREEM

Each ignition key transponder also has a unique ID code that is assigned at the time the key is manufactured. When a key is programmed into the SKREEM/WCM, the transponder ID code is learned by the module and the transponder acquires the unique Secret Key ID code from the SKREEM/WCM. To program ignition keys into the SKREEM/WCM, follow the programming steps outlined in the diagnostic scan tool for “Program Ignition Keys or Key FOBs” under “Miscellaneous Functions” for the “WCM/Wireless Control Module” menu item.

NOTE: A maximum of eight keys can be learned to each SKREEM. Once a key is learned to a SKREEM, that key has acquired the Secret Key for that SKREEM and cannot be transferred to any other SKREEM or vehicle.

If ignition key programming is unsuccessful, the scan tool will display one of the following error messages:

- **Programming Not Attempted** - The scan tool attempts to read the programmed key status and there are no keys programmed into SKREEM memory.
- **Programming Key Failed (Possible Used Key From Wrong Vehicle)** - SKREEM is unable to program an ignition key transponder due to one of the following:
  - The ignition key transponder is faulty.
  - The ignition key transponder is or has been already programmed to another vehicle.
- **8 Keys Already Learned, Programming Not Done** - The SKREEM transponder ID memory is full.
- **Learned Key In Ignition** - The ID for the ignition key transponder currently in the ignition lock cylinder is already programmed into SKREEM memory.

MODULE-ANTI-LOCK BRAKES

DESCRIPTION

The Antilock Brake Module (ABM) is a microprocessor which handles testing, monitoring and controlling the ABS brake system operation.

The ABM is mounted on the top of the hydraulic control unit (HCU). The ABM operates the ABS system and is separate from other vehicle electrical circuits. ABM voltage source is through CKT A111 (fused B+).

NOTE: If the ABM needs to be replaced, the rear axle type and tire revolutions per mile must be programed into the new ABM. For axle type refer to Group 3 Differential and Driveline. For tire revolutions per mile, (Refer to 22 - TIRES/WHEELS/TIRES - SPECIFICATIONS) . To program the ABM refer to the Appropriate Diagnostic Service Information.

OPERATION

SYSTEM SELF-TEST

When the ignition switch is turned-on the microprocessor is tested. If an error occurs during the test, a DTC will be set into the memory. However it is possible the DTC will not be stored in memory if the error has occurred in the module were the DTC’s are stored.

The ABM contains a self check program that illuminates the ABS warning light when a system fault is detected. Faults are stored in memory and are accessible with the scan tool.

ABS faults remain in memory until cleared, or until after the vehicle is started approximately 50 times. Stored faults are **not** erased if the battery is disconnected.

ABM INPUTS

The ABM continuously monitors the speed of the vehicle by monitoring signals generated by the wheel speed sensors. The ABM determines a wheel locking tendency when it recognizes the axle is decelerating too rapidly. The ABM monitors the following inputs to determine when a wheel locking tendency may exists:

- Wheel Speed Sensors
- Brake Lamp Switch
- Brake Fluid Level Sensor
- G-Sensor
- 4WD Switch (If equipped)

ABM OUTPUTS

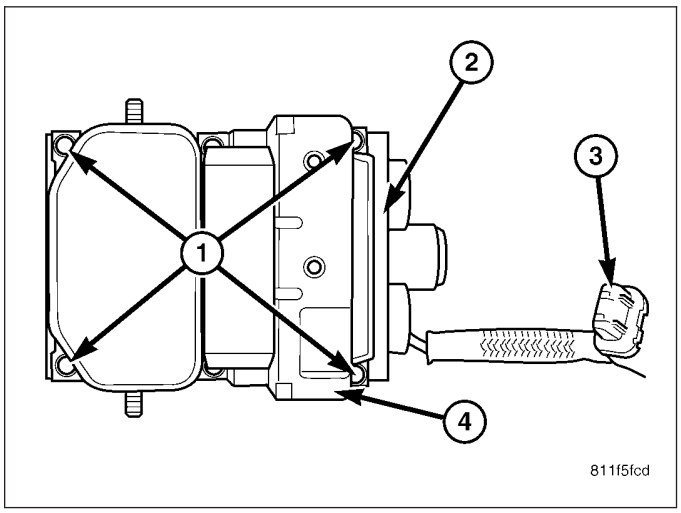
The ABM requests the following outputs for antilock braking and brake warning information from the CCN via CAN C Bus:

- ABS Warning Lamp
- Brake Warning Lamp

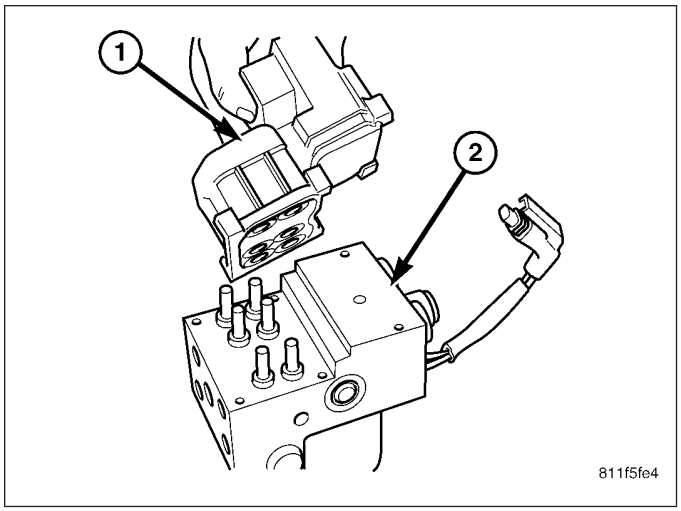
REMOVAL

NOTE: If the ABM needs to be replaced, the rear axle type and tire revolutions per mile must be programed into the new ABM. For axle type refer to Group 3 Differential and Driveline. For tire revolutions per mile, (Refer to 22 - TIRES/WHEELS/TIRES - SPECIFICATIONS). To program the ABM refer to the Appropriate Diagnostic Service Information.

1. Remove the HCU from the vehicle (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/HCU (HYDRAULIC CONTROL UNIT) - REMOVAL).
2. Remove the module mounting screws (1).
3. Disconnect the pump electrical connector (3) from the HCU (2).



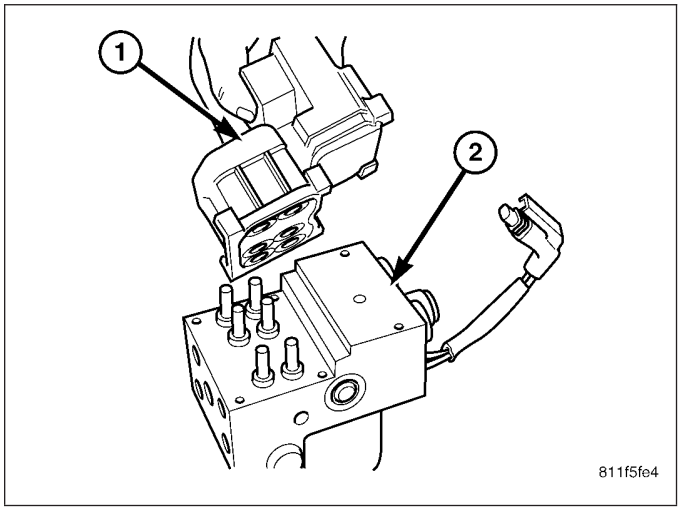
4. Remove the module (1) from the HCU (2).



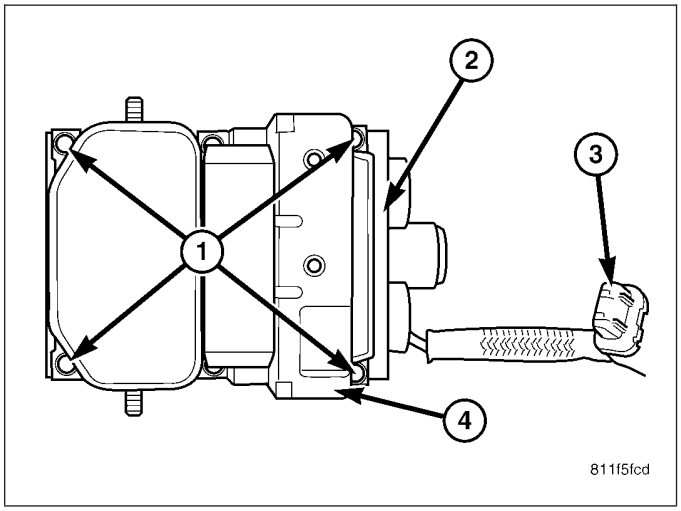
INSTALLATION

NOTE: If the ABM needs to be replaced, the rear axle type and tire revolutions per mile must be programed into the new ABM. For axle type refer to Group 3 Differential and Driveline. For tire revolutions per mile (Refer to 22 - TIRES/WHEELS/TIRES - SPECIFICATIONS). To program the ABM refer to the Appropriate Diagnostic Service Information.

1. Position the module (1) on the HCU (2).



2. Install the mounting screws (1) and tighten to 6 N·m (53 in. lbs).
3. Install the pump electrical connector (3) to the module (4).



4. Install the HCU to the vehicle (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/HCU (HYDRAULIC CONTROL UNIT) - INSTALLATION).

COMMUNICATION

DESCRIPTION

The Controller Area Network (CAN) is a serial data bus communication network used for interconnecting numerous electronic control modules throughout the vehicle in a two-wire multiplexed system. Within this context the term serial refers to electronic data that is transferred bit by bit, while bus refers to the shared wires through which that data is transferred. Multiplexing is any system that enables the transmission of multiple messages over a single channel or circuit. The communication protocol being used is a non-proprietary, open standard adopted from the Bosch CAN Specification 2.0b and uses an 11-bit message identifier.

There are actually three separate CAN bus systems used in the vehicle. They are designated: the CAN-B, the CAN-C and the Diagnostic CAN-C. The CAN-B and CAN-C systems provide on-board communication between all nodes in the vehicle. The CAN-C is the faster of the two systems providing near real-time communication (500 Kbps), but is less fault tolerant than the CAN-B system. The CAN-C is used exclusively for communications between critical powertrain and chassis nodes. The slower (83.3 Kbps), but more fault tolerant CAN-B system is used for communications between body and interior nodes. The CAN-B fault tolerance comes from its ability to revert to a single wire communication mode if there is a fault in the bus wiring.

The Diagnostic CAN-C bus is also capable of 500 Kbps communication, and is sometimes informally referred to as the CAN-D system to differentiate it from the other high speed CAN-C bus. A central gateway or hub integral to the Front Control Module (FCM) physically and electrically isolates the three CAN buses from each other and coordinates the bi-directional transfer of messages between the three buses. The FCM is located on the Integrated Power Module (IPM), which is located in the engine compartment near the battery. The Diagnostic CAN-C is used exclusively for the transmission of diagnostic information between the FCM/gateway and a diagnostic scan tool connected to the industry-standard 16-way Data Link Connector (DLC) located beneath the instrument panel on the driver side of the vehicle.

Each node is connected in parallel to its CAN-B or CAN-C bus using a two-wire twisted pair. These wires are wrapped around each other to provide shielding from unwanted electromagnetic induction interfering with the relatively low voltage signals being carried through them. The twisted pairs have between 33 and 50 twists per meter. While the CAN bus is operating, one of the bus wires will carry a higher voltage and is referred to as the CAN High or CAN bus (+) wire, while the other bus wire will carry a lower voltage and is referred to as the CAN Low or CAN bus (–) wire. Each twisted pair terminates at the FCM/gateway.

The added speed of the CAN data bus is many times faster than previous data bus systems. This added speed facilitates the addition of more electronic control modules or nodes and the incorporation of many new electrical and electronic features in the vehicle. Like prior data bus systems, the CAN data bus minimizes redundant wiring connections; and, at the same time, reduces wire harness complexity, sensor current loads and controller hardware by allowing each sensing device to be connected to only one node. Each node reads, then broadcasts its sensor data over the bus for use by all other nodes requiring that data.

OPERATION

The Controller Area Network (CAN) data bus allows all electronic modules or nodes connected to the bus to share information with each other. Each node can both send and receive serial data simultaneously. The CAN bus signal lines have termination through a termination resistor within each node, either dominant or recessive. The serial data is made up of high and low voltage pulses strung together. Each string of voltage pulses forms a message.

Regardless of whether a message originates from a node on the medium speed CAN-B bus or on the high speed CAN-C bus, the message structure and layout is the same, which allows the Front Control Module (FCM)/Central GateWay (sometimes referred to as the FCMCGW) to process and transfer messages between the buses. The priority of each message is based upon the 11-bit message identifier. Each node uses arbitration to sort the message priority if two competing messages are attempting to be broadcast at the same time.

The FCM used in the CAN system has more control than a non-CAN FCM. Available options are configured into the FCM at the assembly plant, but additional options can be added in the field using the diagnostic scan tool. The configuration settings are stored in non-volatile memory. The FCM also has two 64-bit registers, which register each of the “as-built” and “currently responding” nodes on the CAN-B and CAN-C buses. The FCM stores a Diagnostic Trouble Code (DTC) in one of two caches for any detected active or stored faults in the order in which they occur.

One cache stores powertrain (P-Code), chassis (C-Code) and body (B-Code) DTCs, while the second cache is dedicated to storing network (U-Code) DTCs.

If there are intermittent or active faults in the CAN network, a diagnostic scan tool connected to the Diagnostic CAN-C bus through the 16-way Data Link Connector (DLC) may only be able to communicate with the FCM. To aid in CAN network diagnosis, the FCM will provide CAN-B and CAN-C network status information to the scan tool using certain diagnostic signals. In addition, the transceiver in each node on the CAN-C bus will identify a “bus off hardware failure,” while the transceiver in each node on the CAN-B bus will identify a “general bus hardware failure.” The transceivers for some CAN-B nodes will also identify “bus shorted high,” “bus shorted low,” “bus open” or “bus shorted together” failures for both CAN-B bus signal wires.

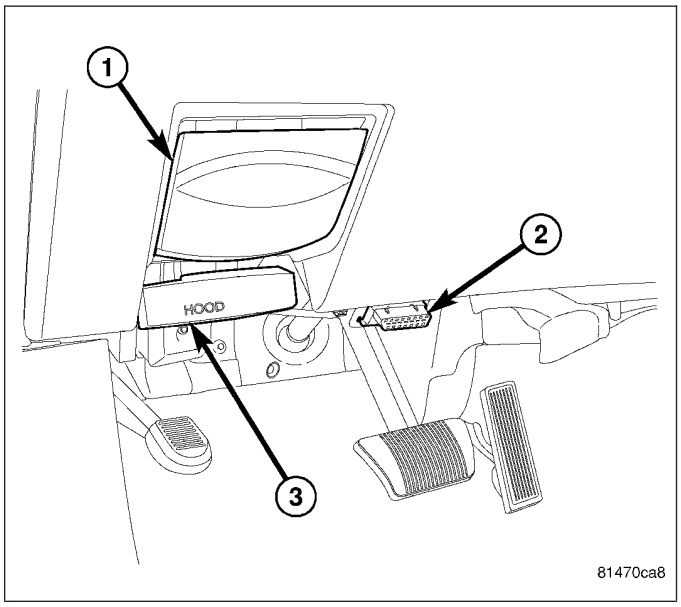
In order to minimize the potential effects of Ignition-Off Draw (IOD), the CAN-B network employs a sleep strategy. However, a network sleep strategy should not be confused with the sleep strategy of the individual nodes on that network, as they may differ. For example: The CAN-C bus network is awake only when the ignition switch is in the On or Start positions; however, the FCM or the Transmission Control Module (TCM), which are on the CAN-C bus, may still be awake with the ignition switch in the Accessory or Unlock positions. The integrated circuitry of an individual node may be capable of processing certain sensor inputs and outputs without the need to utilize network resources.

The CAN-B bus network remains active until all nodes on that network are ready for sleep. This is determined by the network using tokens in a manner similar to polling. When the last node that is active on the network is ready for sleep, and it has already received a token indicating that all other nodes on the bus are ready for sleep, it broadcasts a “bus sleep acknowledgment” message that causes the network to sleep. Once the CAN-B bus network is asleep, any node on the bus can awaken it by transmitting a message on the network. The FCM will keep either the CAN-B or the CAN-C bus awake for a timed interval after it receives a diagnostic message for that bus over the Diagnostic CAN-C bus.

DATA LINK CONNECTOR

DESCRIPTION

The Data Link Connector (DLC) (2) is a 16-way molded plastic connector insulator on a dedicated take out of the instrument panel wire harness. This connector is located at the lower edge of the instrument panel, outboard of the steering column. The connector insulator is retained by integral snap features within a rectangular cutout in the stamped metal lower instrument panel reinforcement, just below the lower edge of the instrument panel steering column opening cover and inboard of the park brake release (1) and inside hood release (3) handles.



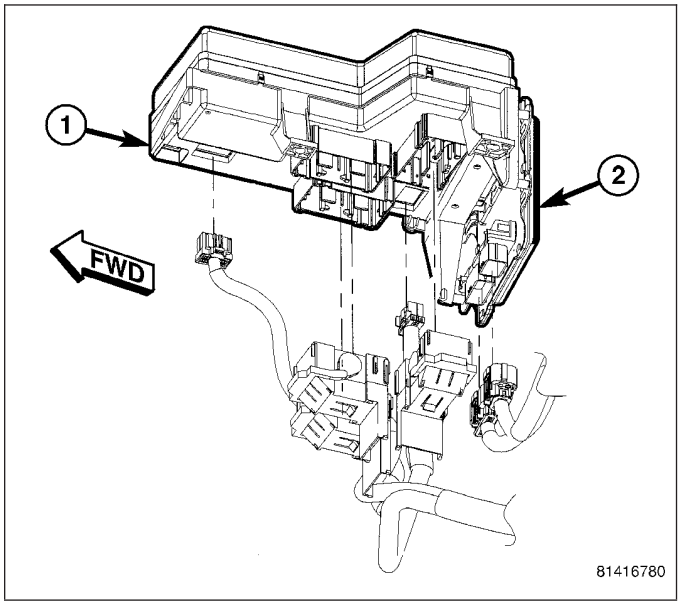
OPERATION

The Data Link Connector (DLC) is an industry-standard 16-way connector that permits the connection of a diagnostic scan tool to the Controller Area Network (CAN) for interfacing with, configuring, and retrieving Diagnostic Trouble Code (DTC) data from the electronic modules that reside on the data bus network of the vehicle.

MODULE-FRONT CONTROL

DESCRIPTION

The Front Control Module (FCM) (2) is a micro controller based module located in the left front corner of the engine compartment. The FCM mates to the Power Distribution Center (PDC) (1) to form the Integrated Power Module (IPM). The IPM connects directly to the battery and provides the primary means of circuit protection and power distribution for all vehicle electrical systems. The front control module controls power to some of these vehicle systems electrical and electromechanical loads based on inputs received from hard wired switch inputs and data received on the Controller Area Network (CAN) bus circuit.



OPERATION

As messages are sent over the Controller Area Network (CAN) bus circuit, the Front Control Module (FCM) reads these messages and controls power to some of the vehicles electrical systems by completing the circuit to ground (low side driver) or completing the circuit to 12 volt power (high side driver). The following functions are controlled by the FCM:

- Front turn signals
- Stop, turn signal and tail lamps
- Front and rear hazard warning lamps
- Headlamps
- Fog Lamps
- Daytime running lamps - if equipped
- Horn
- Windshield and liftgate wiper and washer systems
- Transfer case shifting
- Trailer tow wiring output
- Rear window defroster power and timing

The FCM provides the following features for the above function:

- It operates the electric transfer case mechanism, replacing a stand-alone module.
- It flashes lamps in response to turn signal, Remote Keyless Entry and Vehicle Theft Security Alarm inputs.
- It sounds the horn in response to Remote Keyless Entry and Vehicle Theft Security Alarm inputs.
- It turns off the horn in the event of excessively long operation that could otherwise damage the horn.
- It minimized voltage variations to the headlamps to extend bulb life and to equalize the light output from the lamps, which might otherwise differ due to variations in wiring resistance.
- If the headlamps are left on, it automatically turns them off after eight minutes to protect the battery from discharge.
- It monitors battery voltage and turns off non-essential functions such as the fog lamps, rear window defogger and heated seats if necessary to conserve battery power.
- It operates the high-beam headlamps at reduced intensity by pulse-width modulation of the power supply to provide the daytime running lamps.

- It provides the variable delay intermittent windshield and liftgate wiper time delay features, and the vehicle speed sensitive windshield wiper delay variation.
- It acts as a gateway between the CAN-C network for critical powertrain and anti-lock brake systems and the CAN-B network for body and interior modules. For example it collects battery temperature data and relays it to the PCM.

DIAGNOSIS AND TESTING

BODY VERIFICATION TEST – VER 1

Diagnostic Test

1. Perform Body Verification Test

Disconnect all jumper wires and reconnect all previously disconnected components and connectors.

Ensure that all accessories are turned off.

Ensure that the battery is fully charged.

Turn the ignition on.

With the scan tool, record and erase DTCs from all modules.

If an electronic control module was replaced, select the applicable module from the scan tool menu and press “Misc. Functions”. If the module has programable features, program as necessary.

If repairs were made to any of the HVAC door actuator circuits, with the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. The test must pass before proceeding to the next step.

If repairs were made to any of the HVAC doors, linkage, door actuators, or door actuator circuits, with the scan tool in HVAC, select System Tests and then select Actuator Calibration Test. The test must pass before proceeding to the next step.

Turn the ignition off, wait 10 seconds, and then turn the ignition on.

Operate all functions of the system that caused the original concern.

With the scan tool, select ECU View.

Check for DTCs in the modules.

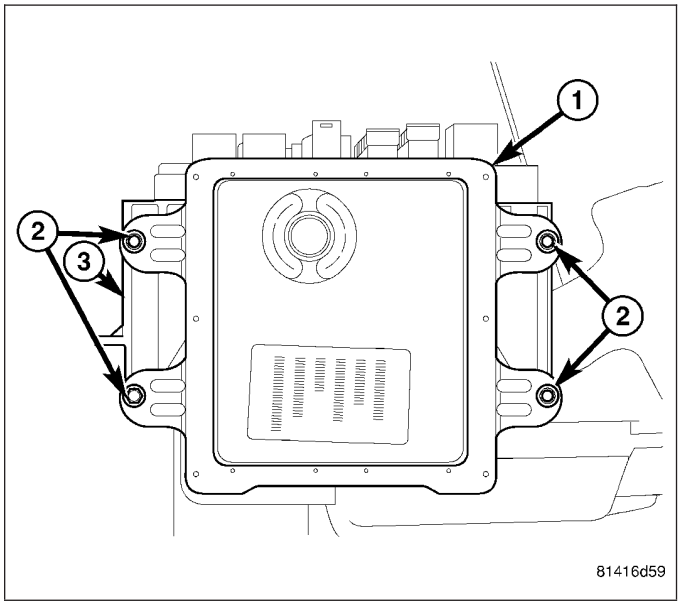
Are DTCs present in any of the modules or is the original condition still present?

Yes >> The repair is not complete. Refer to the related category for the DTC or symptom that is still present.

No >> The repair is complete.

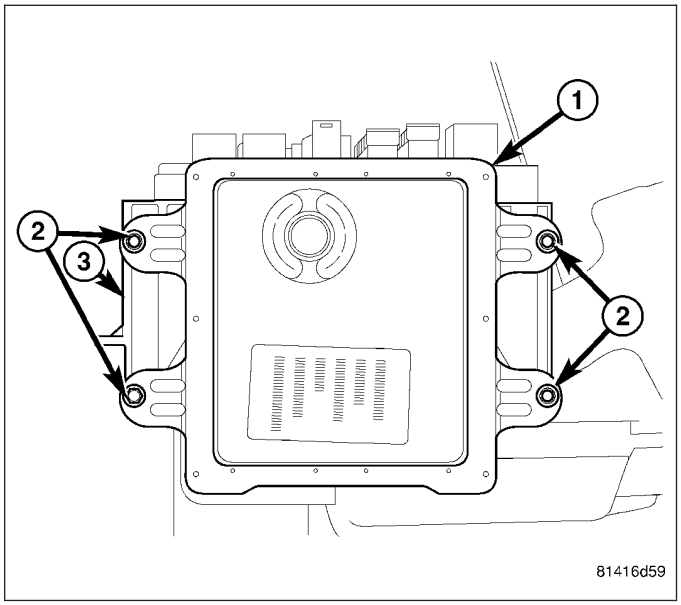
REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the Integrated Power Module (IPM) from the engine compartment, (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - REMOVAL).
3. Remove the four fasteners (2) securing the Front Control Module (FCM) (1) to the Power Distribution Center (PDC) (3).
4. Separate the FCM from the PDC by pulling the two straight away from each other to disengage the electrical connector.



INSTALLATION

1. Connect the Power Distribution Center (PDC) (3) to the Front Control Module (FCM) by lining up the electrical connector and pushing the two together.
2. Install the four fasteners (2) securing the FCM (1) to the PDC (3).
3. Install the Integrated Power Module (IPM), (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - INSTALLATION).
4. Connect the battery negative cable.

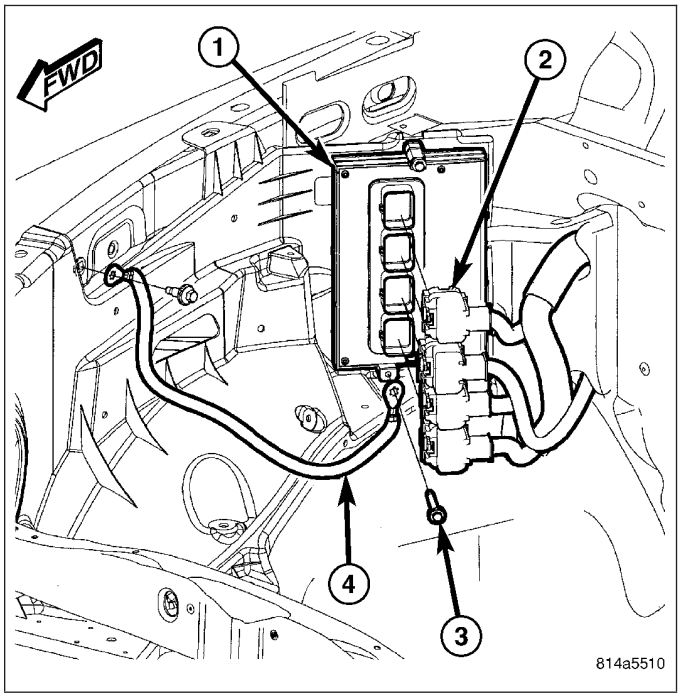


MODULE-POWERTRAIN CONTROL

DESCRIPTION

DESCRIPTION

The PCM (1) is attached to the right-inner corner of the engine compartment.



DESCRIPTION - MODES OF OPERATION

As input signals to the Powertrain Control Module (PCM) change, the PCM adjusts its response to the output devices.

The PCM will operate in two different modes: **Open Loop and Closed Loop**.

During Open Loop modes, the PCM receives input signals and responds only according to preset PCM programming. Input from the oxygen (O2S) sensors is not monitored during Open Loop modes.

During Closed Loop modes, the PCM will monitor the oxygen (O2S) sensors input. This input indicates to the PCM whether or not the calculated injector pulse width results in the ideal air-fuel ratio. This ratio is 14.7 parts air-to-1 part fuel. By monitoring the exhaust oxygen content through the O2S sensor, the PCM can fine tune the injector pulse width. This is done to achieve optimum fuel economy combined with low emission engine performance.

The fuel injection system has the following modes of operation:

- Ignition switch ON
- Engine start-up (crank)
- Engine warm-up
- Idle
- Cruise
- Acceleration
- Deceleration
- Wide open throttle (WOT)
- Ignition switch OFF

The ignition switch On, engine start-up (crank), engine warm-up, acceleration, deceleration and wide open throttle modes are Open Loop modes. The idle and cruise modes, (with the engine at operating temperature) are Closed Loop modes.

IGNITION SWITCH (KEY-ON) MODE

This is an Open Loop mode. When the fuel system is activated by the ignition switch, the following actions occur:

- The PCM pre-positions the idle air control (IAC) motor.
- The PCM determines atmospheric air pressure from the MAP sensor input to determine basic fuel strategy.
- The PCM monitors the engine coolant temperature sensor input. The PCM modifies fuel strategy based on this input.
- Intake manifold air temperature sensor input is monitored.
- Throttle position sensor (TPS) is monitored.
- The auto shutdown (ASD) relay is energized by the PCM for approximately three seconds.
- The fuel pump is energized through the fuel pump relay by the PCM. The fuel pump will operate for approximately three seconds unless the engine is operating or the starter motor is engaged.
- The O2S sensor heater element is energized via the ASD relay. The O2S sensor input is not used by the PCM to calibrate air-fuel ratio during this mode of operation.

ENGINE START-UP MODE

This is an Open Loop mode. The following actions occur when the starter motor is engaged.

The PCM receives inputs from:

- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Starter motor relay
- Camshaft position sensor signal

The PCM monitors the crankshaft position sensor. If the PCM does not receive a crankshaft position sensor signal within 3 seconds of cranking the engine, it will shut down the fuel injection system.

The fuel pump is activated by the PCM through the fuel pump relay.

Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.

The PCM determines the proper ignition timing according to input received from the crankshaft position sensor.

ENGINE WARM-UP MODE

This is an Open Loop mode. During engine warm-up, the PCM receives inputs from:

- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)

Based on these inputs the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM adjusts engine idle speed through the idle air control (IAC) motor and adjusts ignition timing.
- The PCM operates the A/C compressor clutch through the clutch relay. This is done if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

- When engine has reached operating temperature, the PCM will begin monitoring O2S sensor input. The system will then leave the warm-up mode and go into closed loop operation.

IDLE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At idle speed, the PCM receives inputs from:

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal
- Battery voltage
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen sensors

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM monitors the O2S sensor input and adjusts air-fuel ratio by varying injector pulse width. It also adjusts engine idle speed through the idle air control (IAC) motor.
- The PCM adjusts ignition timing by increasing and decreasing spark advance.
- The PCM operates the A/C compressor clutch through the clutch relay. This happens if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

CRUISE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At cruising speed, the PCM receives inputs from:

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen (O2S) sensors

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then adjust the injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM monitors the O2S sensor input and adjusts air-fuel ratio. It also adjusts engine idle speed through the idle air control (IAC) motor.
- The PCM adjusts ignition timing by turning the ground path to the coil on and off.
- The PCM operates the A/C compressor clutch through the clutch relay. This happens if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

ACCELERATION MODE

This is an Open Loop mode. The PCM recognizes an abrupt increase in throttle position or MAP pressure as a demand for increased engine output and vehicle acceleration. The PCM increases injector pulse width in response to increased throttle opening.

DECELERATION MODE

When the engine is at operating temperature, this is an Open Loop mode. During hard deceleration, the PCM receives the following inputs.

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Vehicle speed sensor

If the vehicle is under hard deceleration with the proper rpm and closed throttle conditions, the PCM will ignore the oxygen sensor input signal. The PCM will enter a fuel cut-off strategy in which it will not supply a ground to the injectors. If a hard deceleration does not exist, the PCM will determine the proper injector pulse width and continue injection.

Based on the above inputs, the PCM will adjust engine idle speed through the idle air control (IAC) motor.

The PCM adjusts ignition timing by turning the ground path to the coil on and off.

WIDE OPEN THROTTLE MODE

This is an Open Loop mode. During wide open throttle operation, the PCM receives the following inputs.

- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal

During wide open throttle conditions, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off. The PCM ignores the oxygen sensor input signal and provides a predetermined amount of additional fuel. This is done by adjusting injector pulse width.
- The PCM adjusts ignition timing by turning the ground path to the coil on and off.

IGNITION SWITCH OFF MODE

When ignition switch is turned to OFF position, the PCM stops operating the injectors, ignition coil, ASD relay and fuel pump relay.

OPERATION

The PCM is a pre-programmed, microprocessor digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The PCM can adapt its programming to meet changing operating conditions.

The PCM receives input signals from various switches and sensors. Based on these inputs, the PCM regulates various engine and vehicle operations through different system components. These components are referred to as Powertrain Control Module (PCM) Outputs. The sensors and switches that provide inputs to the PCM are considered Powertrain Control Module (PCM) Inputs.

The PCM adjusts ignition timing based upon inputs it receives from sensors that react to: engine rpm, manifold absolute pressure, engine coolant temperature, throttle position, transmission gear selection (automatic transmission), vehicle speed and the brake switch.

The PCM adjusts idle speed based on inputs it receives from sensors that react to: throttle position, vehicle speed, transmission gear selection, engine coolant temperature and from inputs it receives from the air conditioning clutch switch and brake switch.

Based on inputs that it receives, the PCM adjusts ignition coil dwell. The PCM also adjusts the generator charge rate through control of the generator field and provides speed control operation.

NOTE: PCM Inputs:

- Accelerator pedal position sensor (if equipped)
- A/C request (if equipped with factory A/C)
- A/C select (if equipped with factory A/C)
- Auto shutdown (ASD) sense
- Battery temperature
- Battery voltage
- Brake switch
- CAN bus (+) circuits
- CAN bus (-) circuits
- Camshaft position sensor signal
- Clutch Interlock Switch (if equipped)
- Crankshaft position sensor
- Data link connection for diagnostic scan tool
- EGR position sensor (if equipped)
- Engine coolant temperature sensor
- Fuel level
- Generator (battery voltage) output
- Ignition circuit sense (ignition switch in on/off/crank/run position)
- Intake manifold air temperature sensor
- Knock sensor(s) (if equipped)
- Leak detection pump (switch) sense (if equipped)
- Manifold absolute pressure (MAP) sensor
- Oil pressure sensor
- Output shaft speed sensor
- Overdrive/override switch
- Oxygen sensors
- Park/neutral switch (auto. trans. only)
- Power ground
- Power steering pressure switch (if equipped)
- Sensor return
- Signal ground
- Speed control multiplexed single wire input
- Throttle position sensor
- Transmission governor pressure sensor
- Transmission output speed sensor
- Transmission temperature sensor
- Vehicle speed inputs from ABS or RWAL system

NOTE: PCM Outputs:

- A/C clutch relay
- Auto shutdown (ASD) relay
- CAN bus (+/-) circuits for: speedometer, voltmeter, fuel gauge, oil pressure gauge/lamp, engine temp. gauge and speed control warn. lamp
- Data link connection for diagnostic scan tool
- Double start override (if equipped)
- EGR valve control solenoid (if equipped)
- Electronic throttle control
- EVAP canister purge solenoid
- Five volt sensor supply (primary)
- Five volt sensor supply (secondary)
- Fuel injectors
- Fuel pump relay
- Generator field driver (-)
- Generator field driver (+)
- Generator lamp (if equipped)
- Idle air control (IAC) motor
- Ignition coil(s)
- CAN bus circuits
- Leak detection pump (if equipped)
- Natural Vacuum Leak Detection (NVLD) pump (if equipped)
- Malfunction indicator lamp (Check engine lamp). Driven through CAN bus circuits.
- Overdrive indicator lamp (if equipped)
- Radiator cooling fan (if equipped)
- Speed control vacuum solenoid
- Speed control vent solenoid
- Starter relay
- Tachometer (if equipped). Driven through CAN bus circuits.
- Transmission convertor clutch circuit
- Transmission 3-4 shift solenoid
- Transmission relay
- Transmission temperature lamp (if equipped)
- Transmission variable force solenoid

REMOVAL

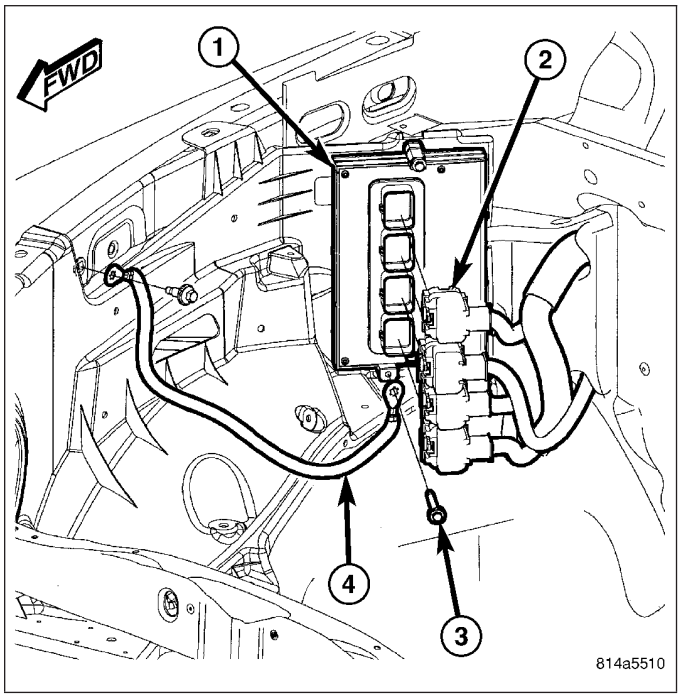
CAUTION: Certain ABS systems rely on having the Powertrain Control Module (PCM) broadcast the Vehicle Identification Number (VIN) over the bus network. To prevent problems of DTCs and other items related to the VIN broadcast, it is recommend that you disconnect the ABS CAB (controller) temporarily when replacing the PCM. Once the PCM is replaced, write the VIN to the PCM using the DRB scan tool. This is done from the engine main menu. Arrow over to the second page to "1. Miscellaneous". Select "Check VIN" from the choices. Make sure it has the correct VIN entered before continuing. When the VIN is complete, turn off the ignition key and reconnect the ABS module connector. This will prevent the setting of DTCs and other items associated with the lack of a VIN detected when you turn the key ON after replacing the PCM.

CAUTION: Use the DRB scan tool to reprogram the new PCM with the vehicles original identification number (VIN) and the vehicles original mileage. If this step is not done, a Diagnostic Trouble Code (DTC) may be set.

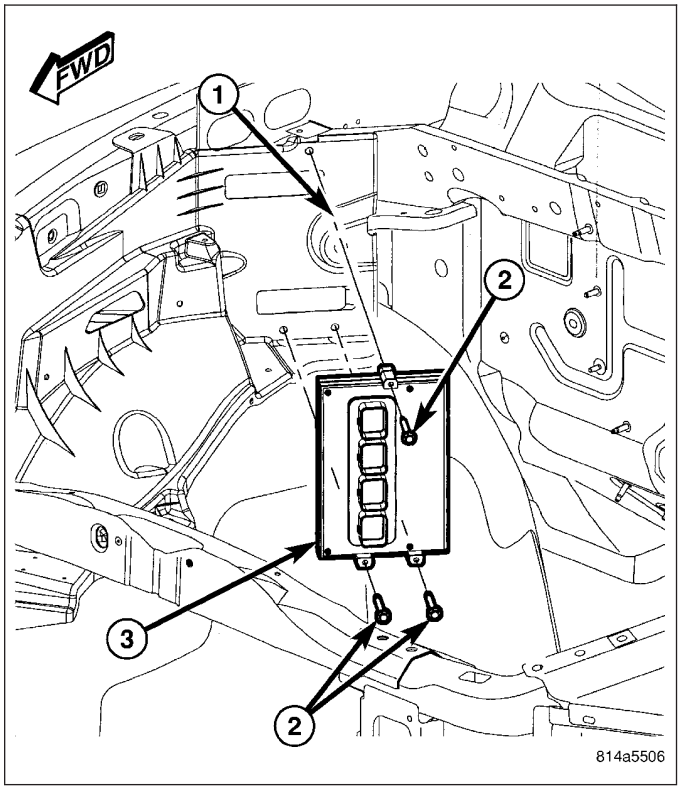
The PCM (1) is attached to the right-inner corner of the engine compartment.

To avoid possible voltage spike damage to the PCM, ignition key must be off, and negative battery cable must be disconnected before unplugging PCM connectors.

1. Disconnect and isolate the negative battery cable.
2. Carefully unplug the four 38-way connectors (2) from PCM.



3. Remove three PCM mounting bolts (2), and position ground strap (4). Remove PCM from vehicle.

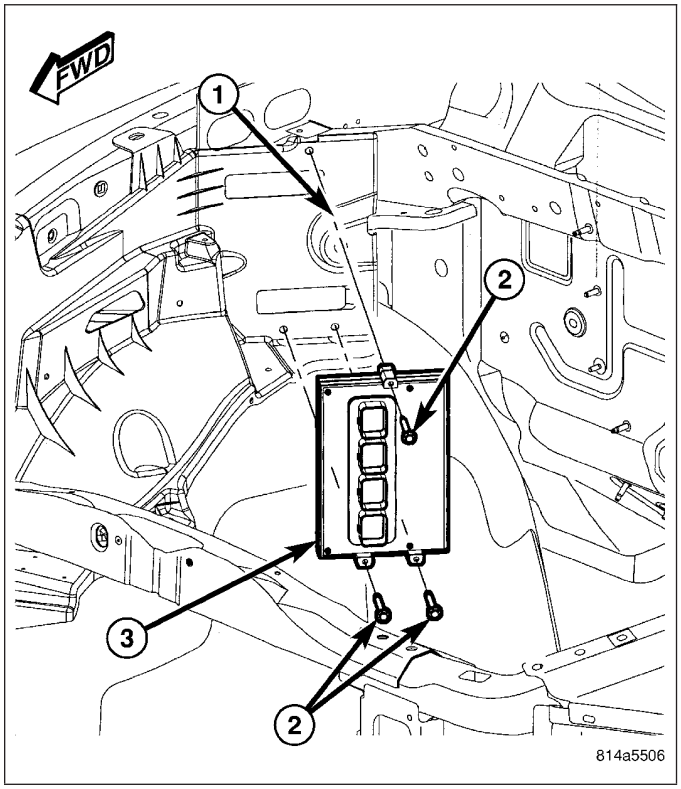


INSTALLATION

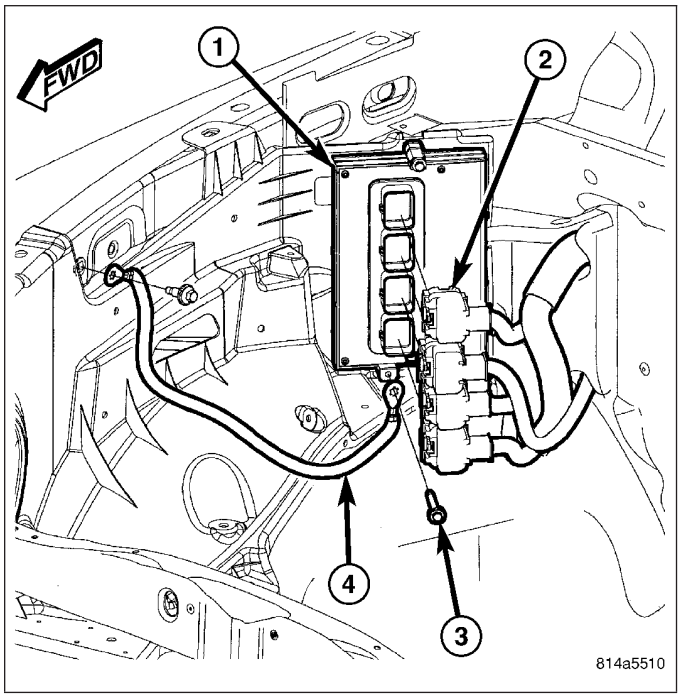
CAUTION: Certain ABS systems rely on having the Powertrain Control Module (PCM) broadcast the Vehicle Identification Number (VIN) over the bus network. To prevent problems of DTCs and other items related to the VIN broadcast, it is recommend that you disconnect the ABS CAB (controller) temporarily when replacing the PCM. Once the PCM is replaced, write the VIN to the PCM using the DRB scan tool. This is done from the engine main menu. Arrow over to the second page to "1. Miscellaneous". Select "Check VIN" from the choices. Make sure it has the correct VIN entered before continuing. When the VIN is complete, turn off the ignition key and reconnect the ABS module connector. This will prevent the setting of DTCs and other items associated with the lack of a VIN detected when you turn the key ON after replacing the PCM.

CAUTION: Use the DRB scan tool to reprogram the new PCM with the vehicles original identification number (VIN) and the vehicles original mileage. If this step is not done, a Diagnostic Trouble Code (DTC) may be set.

1. Position PCM (3) to vehicle.
2. Install three PCM mounting bolts (2).
3. Tighten bolts to 3–5 N·m (30–40 in. lbs.).



4. Be sure ground strap (4) is secured both at bottom of PCM, and at inner-fender.
5. Check pin connectors in the PCM. Also check the four 38–way connectors (2) for corrosion or damage. Repair as necessary.
6. Install the four 38–way connectors (2) to PCM.
7. Connect negative battery cable.
8. **Use the diagnostic scan tool to reprogram new PCM with vehicles original Identification Number (VIN) and original vehicle mileage. If this step is not done, a Diagnostic Trouble Code (DTC) may be set.**

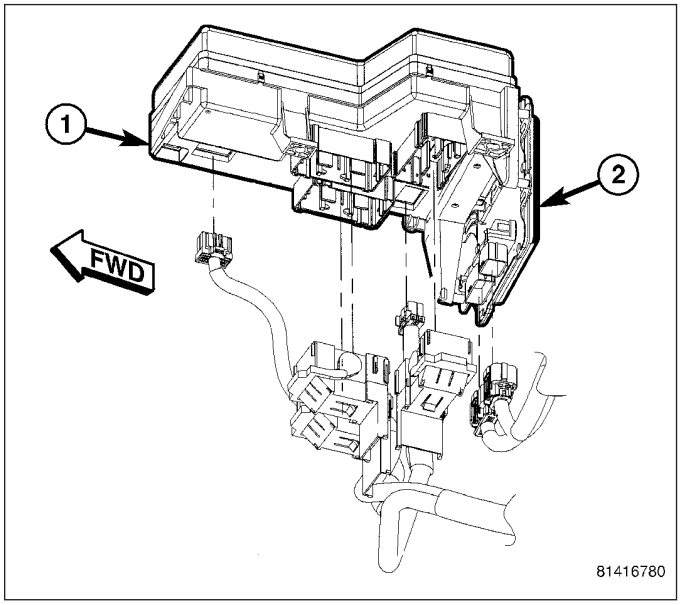


MODULE-TRANSFER CASE CONTROL

DESCRIPTION

The Front Control Module (FCM) (2) contains the software to control the electric shift transfer cases in this vehicle. A separate Transfer Case Control Module (TCCM) is not used. The FCM is a microprocessor-based assembly, controlling the 4X4 transfer case shift functions via the actuation of a shift motor and utilizing the feedback of a mode sensor assembly. Communication is via the CAN bus. Inputs include user selectable 4X4 modes that include AWD, 4LOCK, 4LO, and Neutral.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DESCRIPTION) for additional information.



OPERATION

The Front Control Module (FCM) utilizes the input from the transfer case mounted mode sensor, the instrument panel mounted selector switch, and the following information from the vehicle's CAN bus to determine if a shift is allowed.

- Engine RPM and Vehicle Speed
- Diagnostic Requests
- Manual Transmission Clutch Switch
- Brake Applied
- PRNDL

- Ignition Status
- ABS Messages

Once the FCM determines that a requested shift is allowed, it actuates the bi-directional shift motor as necessary to achieve the desired transfer case operating mode. The FCM also monitors the mode sensor while controlling the shift motor to determine the status of the shift attempt.

Several items can cause the requested shift not to be completed. If the FCM has recognized a fault (DTC) of some variety, it will begin operation in one of four Functionality Levels. These levels are:

- **Level Zero** - Normal Operation.
- **Level One** - Only Mode Shifts Are Allowed.
- **Level Two** - Only Mode Shifts and Shifts Into LOW Are Allowed (No Neutral Shifts Are Allowed).
- **Level Three** - No Shifts Are Allowed

The FCM can also be operating in one of three possible power modes. These power modes are:

- **Full Power Mode** is the normal operational mode of the module. This mode is achieved by normal CAN bus traffic being present and the ignition being in the RUN position.
- **Reduced Power Mode** will be entered when the ignition has been powered off. In this state, the module will shut down power supplied to external devices, and to electronic interface inputs and outputs. From this state the module can enter either Sleep Mode or Full Power Mode. To enter this mode, the module must receive an ignition message denoting that the ignition is off, or not receive any messages for 5 ±0.5 seconds. To exit this mode, the module must receive one ignition message that denotes that the ignition is in the RUN position.
- **Sleep Mode** will be entered, from the Reduced Power Mode, when no CAN traffic has been sensed for 20 ±1 seconds. If during Sleep Mode the module detects CAN bus traffic, it will revert to the Reduced Power mode while monitoring for ignition messages. It will remain in this state as long as there is traffic other than run or start messages, and will return to Sleep mode if the bus goes without traffic for 20 ±1 seconds.

SHIFT REQUIREMENTS

If the FCM is in full power mode and at functionality level zero, it uses the following criteria to determine if a shift is allowed.

If any of the driver controllable conditions are not met once the shift request is recognized, the FCM may illuminate one or more of the 4WD system message icons in the instrument cluster display.

Mode shifts will be allowed regardless of transmission gear or vehicle speed, whenever the following conditions are met:

- Ignition key switch is in the RUN position.
- Front and rear wheel speed are within 21 km/hr (13 mph).
- A change in the Selector switch state indicates that a mode shift has been requested.
- A valid mode sensor signal is being sensed by the FCM.
- Proper transmit/receive messages are occurring on the CAN bus.
- An Anti-lock Brake System (ABS) event is not in progress.

Range shifts will be allowed only if all of the following conditions are met:

- Ignition key switch is in the RUN position.
- Front and rear wheel speed are within 21 km/hr (13 mph).
- A change in the Selector Switch state indicating a range shift has been requested.
- Transmission in NEUTRAL signal must be recognized for at least 1.5 seconds ±100 msec. (Automatic transmissions only)
- Proper transmit/receive messages are occurring on the CAN bus.
- Clutch signal is recognized for 500 msec ± 50 msec (Manual transmissions only).
- Vehicle speed is less than or equal to 4.8 km/hr (3 miles per hour).
- A valid mode sensor signal is being sensed by the FCM.
- An Anti-lock Brake System (ABS) event is not in progress.

A **shift into transfer case Neutral** will be allowed only if all of the following conditions are met:

- Ignition key switch is in the RUN position, engine off.
- Front and rear wheel speed are within 21 km/hr (13 mph).

- The recessed Neutral Selection switch has been depressed continuously for 4.0 seconds ±100 msec while all shift conditions have been continuously met.
- Transmission in NEUTRAL signal recognized from the bus. (Automatic transmissions only)
- Clutch signal is recognized from the bus (Manual transmissions only).
- Proper message transmissions/receptions are occurring on the CAN bus.
- Vehicle speed is less than or equal to 4.8 km/hr (3 miles per hour).
- Foot Brake is applied.
- A valid mode sensor signal is being sensed by the FCM.
- An Anti-lock Brake System (ABS) event is not in progress.

A **shift out of transfer case Neutral** will be allowed only if all of the following conditions are met:

- Ignition key switch is in the RUN position.
- Front and rear wheel speed are within 21 km/hr (13 mph).
- The recessed Neutral Selection switch has been depressed continuously for 1.0 seconds ±100 msec while all shift conditions have been continuously met.
- Transmission in NEUTRAL signal recognized from the bus. (Automatic transmissions only)
- Clutch signal is recognized from the bus (Manual transmissions only).
- Proper message transmissions/receptions are occurring on the CAN bus.
- Vehicle speed is less than or equal to 4.8 km/hr (3 miles per hour).
- A valid mode sensor signal is being sensed by the FCM.
- An Anti-lock Brake System (ABS) event is not in progress.

LAMP STRATEGY

The following strategy for the FCM controlled transfer case system uses the instrument cluster VF display's 4LOCK, 4LO, Service 4WD, and Mode Switch Transfer Case Neutral LED. Flashing any of the lamps or LED is accomplished at a 2Hz rate.

NOTE: There is no lamp for the AWD position. If no 4WD system message icons are illuminated in the instrument cluster, the operator is to assume that the transfer case is in the AWD position.

- AWD to 4LO - Successful shifts will flash 4LO during a shift, then after the 4LO position has been met, display the 4LO lamp solid. In the blocked condition, flash the 4LO lamp during the 5 Phase 1 shift attempts. After 5 unsuccessful attempts, the transfer case remains in AWD and no lamps are illuminated. When shift conditions are not met, no shift attempts are made and the 4LO lamp is flashing.
- AWD to 4LOCK - Successful shifts will flash 4LOCK during a shift, then after the 4LOCK position has been met, display the 4LOCK lamp solid. In the blocked condition, flash the 4LOCK lamp during the 5 Phase 1 shift attempts. After 5 unsuccessful attempts, the transfer case remains in AWD and no lamps are illuminated. When shift conditions are not met, no shift attempts are made and the 4LOCK lamp is flashing.
- 4LOCK to 4LO - Successful shifts will turn off the 4LOCK lamp and flash 4LO during a shift, then after the 4LO position has been met, display the 4LO lamp solid. In the blocked condition, turn off 4LOCK and flash the 4LO lamp during the 5 Phase 1 shift attempts. After 5 unsuccessful attempts, the transfer case remains in 4LOCK and the 4LOCK lamp turns on solid. When shift conditions are not met, the 4LOCK lamp remains illuminated solid and the 4LO lamp is flashing.
- 4LOCK to AWD - Successful shifts will flash the 4LOCK lamp during a shift, then after the AWD position has been met, turn off the 4LOCK lamp. In the blocked condition, flash the 4LOCK lamp during the 5 Phase 1 shift attempts. After 5 unsuccessful attempts, the transfer case remains in 4LOCK and the 4LOCK lamp turns on solid. When shift conditions are not met, no shift attempts are made and the 4LOCK lamp is flashing.
- 4LO to AWD - Successful shifts will flash the 4LO lamp during a shift, then after the AWD position has been met, turn off the 4LO lamp. In the blocked condition, flash the 4LO lamp during the 5 Phase 1 shift attempts. After 5 unsuccessful attempts, the transfer case remains in 4LO and the 4LO lamp turns on solid. When shift conditions are not met, no shift attempts are made and the 4LO lamp is flashing.
- 4LO to 4LOCK - Successful shifts will turn off the 4LO lamp and flash 4LOCK during a shift, then after the 4LOCK position has been met, display the 4LOCK lamp solid. In the blocked condition, turn off 4LO and flash the 4LOCK lamp during the 5 Phase 1 shift attempts. After 5 unsuccessful attempts, the transfer case remains in 4LO and the 4LO lamp turns on solid. When shift conditions are not met, the 4LO lamp remains illuminated solid and 4LOCK is flashing.

- AWD to NEUTRAL - Successful shifts have no lamps illuminated, then after the NEUTRAL position has been met, display the NEUTRAL LED solid. In the blocked condition, no lamps are illuminated during the 5 Phase 1 attempts. After 5 unsuccessful attempts, the transfer case remains in AWD and no lamps are illuminated. When shift conditions are not met, flash the NEUTRAL lamp while the push button is depressed.
- 4LOCK to NEUTRAL - Successful shifts have no lamps illuminated, then after the NEUTRAL position has been met, display the NEUTRAL LED solid. In the blocked condition, no lamps are illuminated during the 5 Phase 1 attempts. After 5 unsuccessful attempts, the transfer case remains in 4LOCK and the 4LOCK lamp is illuminated. When shift conditions are not met, flash the NEUTRAL lamp while the push button is depressed.
- 4LO to NEUTRAL - Successful shifts have no lamps illuminated, then after the NEUTRAL position has been met, display the NEUTRAL LED solid. In the blocked condition, no lamps are illuminated during the 5 Phase 1 attempts. After 5 unsuccessful attempts, the transfer case remains in 4LO and the 4LO lamp is illuminated. When shift conditions are not met, flash the NEUTRAL lamp while the push button is depressed.
- NEUTRAL to AWD - Successful shifts have no lamps illuminated, then after the AWD position has been met, no lamps are illuminated. In the blocked condition, no lamps are illuminated during the 5 Phase 1 attempts. After 5 unsuccessful attempts, Phase 2 shifting will continue until the transfer case is in the AWD or 4LO position. If the final position is AWD, no lamp is illuminated, if the final position is 4LO, illuminate the 4LO lamp. When shift conditions are not met, flash the 4LOCK and 4LO lamps and the NEUTRAL LED remains solid while the push button is depressed,
- Neutral to 4LOCK - Successful shifts will flash the 4LOCK lamp during a shift, then after the 4LOCK position has been met, display the 4LOCK lamp solid. In a blocked condition, the 4LOCK lamp will flash during the 5 Phase 1 attempts. After 5 unsuccessful attempts, continue to flash the 4LOCK, Phase 2 shifting will continue until the transfer case is in the AWD or 4LO position. If the final position is AWD, turn off the 4LOCK lamp, if the final position is 4LO, illuminate the 4LO lamp. When shift conditions are not met, flash the 4LOCK and 4LO lamps and the NEUTRAL LED remains solid while the push button is depressed.
- NEUTRAL to 4LO - Successful shifts will flash the 4LO lamp during a shift, then after the 4LOCK position has been met, display the 4LO lamp solid. In a blocked condition, the 4LO lamp will flash during the 5 Phase 1 attempts. After 5 unsuccessful attempts, continue to flash 4LO, Phase 2 shifting will continue until transfer case is in the AWD or 4LO position. If the final position is AWD, turn off the 4LO lamp, if the final position is 4LO, illuminate the 4LO lamp solid. When shift conditions are not met, flash the 4LOCK and 4LO lamps and the NEUTRAL LED remains solid while push the button is depressed.

SHIFT SEQUENCES (PHASE 1 SHIFTS)

Once all the driver controllable conditions for the requested shift have been met, the FCM begins a shift timer with a maximum duration of 1 second per mode sensor target segment. If the shift timer expires before the FCM recognizes to correct mode sensor position, the shift is considered to have been blocked. The blocked shift will increment the blocked shift counter by one. The FCM strategy for handling blocked shifts will be described later. The process the FCM performs for the various shifts will be described first.

RANGE AND MODE SHIFTS

The process for performing all the range and mode shifts are the same. The following steps describe the process.

- Allow time for Selector Switch debounce; 250 msec ±50 msec.
- Activate/deactivate the 4WD system message icons in the instrument cluster as necessary.
- Engage the shift motor for a maximum of 1 second ±100 msec per mode sensor target segment in the destination gear's direction while monitoring the mode sensor.
- Disengage the shift motor when the correct mode sensor position is recognized.
- Solidly illuminate the achieved position's instrument panel icon, unless the target is AWD.
- Transmit a bus message that the transfer case shift is complete.
- If the desired mode sensor position is not reached after the shift timer expires (i.e.: a blocked shift motor or other condition exists), the FCM will stop driving the motor and wait for 200 msec ±50 msec. The shift motor is then reversed in the direction back toward the source gear for up to 1.0 seconds ±100 msec. per mode sensor target segment. The FCM waits for 2.0 seconds ±50 msec. and repeats the attempt to shift to the desired position.

The exception to the preceding sequence is when a shift from 4LO to AWD is requested. If AWD is requested from the 4LO position, the transfer case is first driven to the 4LOCK position. If the 4LOCK position is reached, the transfer case is then driven back to the AWD position and the shift is considered complete.

SHIFT OUT OF NEUTRAL

The following steps describe the process for a shift out of NEUTRAL.

- Extinguish the Neutral LED.
- Engage the shift motor for a maximum of 1 second ±100 msec toward the transfer case 4LOCK mode position while monitoring the mode sensor position.
- Disengage the shift motor when the correct mode sensor position is recognized.
- Extinguish the Neutral LED.
- Transmit a bus message that the transfer case shift is complete.
- If the desired mode sensor position is not received after the shift timer expires (i.e. a blocked or other condition exists), stop driving the motor and wait for 200 msec ±50 msec. The shift motor is then reversed in the direction back toward the source gear for up to 1.0 seconds 100 msec. The FCM waits for 2.0 seconds ±50 msec. and repeats the attempt to shift to the desired position.
- When the Neutral button is released, if the 4LOCK position is the desired position, the shift is complete. Illuminate the 4LOCK message icon.
- Otherwise when the Neutral button is released, if all of the shift requirements are being met then engage the shift motor towards the desired position for 1 second ±100 msec per 'D' channel. (if requirements for shifting are not met, illuminate the 4LOCK message icon and flash the destination message icon as an indication to the driver that all of the driver controllable shift conditions are not being met). If this requires another range or mode shift, begin the range/mode shift process.
- If the desired mode sensor position is not achieved after the shift timer expires (i.e. a blocked or other condition exists), refer to the section on Blocked Shift Strategy, also known as Phase 2 shifts.

NEUTRAL BLOCKED SHIFT STRATEGY (PHASE 2 SHIFTS)

When a shift is commanded out of neutral, the shift motor will be driven towards its destination position, except in the case of shifting out of NEUTRAL if 4LO was selected (the transfer case will shift to the 4LOCK position first, before proceeding to 4LO). If the shift is blocked on the way to the destination, the FCM may attempt to drive the motor back to the original position. This process will be allowed to occur 5 times. If the transfer case has reached a non-NEUTRAL position during the shift re-attempts, the message icon for the achieved gear position is illuminated and the shift attempts are stopped. To re-attempt the desired shift, the selector switch will need to be rotated to the current position until the switch debounce timer expires then a shift will need to be requested again.

At the end of the 5th blocked attempt, the shift motor is driven towards the last known mode sensor position. If this motor drive allows the transfer case to reach the AWD position, the shift is considered complete and the shift attempts are ended.

If the mode sensor is in the NEUTRAL region at the expiration of the shift timer, the FCM will continue to make the shift attempts according to the blocked shift strategy independent of whether or not the driver controlled conditions are met.

For shifts from NEUTRAL, if all 5 attempts fail to reach the desired position (which by default is 4LOCK), the motor will be driven to stall in the direction of 4LOCK or 4LO, depending on the achieved position. Otherwise, the transfer case will be driven in the direction opposite the last attempt with the desired target being 4LOCK or 4LO.

If the transfer case reaches the AWD position when being driven in the 4LOCK direction, then one final 1.0 second drive toward 4LOCK is attempted. If the transfer case then reaches the 4LOCK position, the shift is considered complete and the 4LOCK message icon is illuminated. If the transfer case is still the AWD position, the shift is considered complete and all message icons are extinguished.

NEUTRAL DRIFT SHIFT STRATEGY (PHASE 3 SHIFTS)

NOTE: If after the 5th blocked shift and reversal attempt, if the transfer case position is in the NEUTRAL or other undesired region, shift attempts will continue until a non-NEUTRAL or a desired position is reached.

Phase 3 is a series of shifts whose intent is to escape from an undesired position that has been reached outside of a shift. A perceived drift of the transfer case into a non-target region without the FCM driving the shift motor will initiate a phase III shift. Phase 3 will be initiated by any non-target region with the exception of a position greater then encoder_4LO_min or less then encoder_4LOCK_max. Whenever these encoder readings have been seen for defined period of time, Phase III shifting will begin.

The shifts in a given Phase 3 shifting event are always in a single-direction, toward the target region from which the drift occurred. These shifts are performed without regard to shift conditions. The timing of each shift should follow the outline of the Phase 1 forward attempts, allowing the shift timer to reach the target. Between each attempt, there is a calibrated delay. After each attempt the shift counter and the Phase 3 max shifts counter will be updated.

SHIFT REVERSAL TARGETS

If the shift timer expires (1.0 seconds per mode sensor position) and the transfer case has not reached the desired position, all shifts will attempt to return to their original position with the exceptions of:

- If the intended shift is going to the High rail from Low and can't make it, but it can make the AWD position, the motor stops at that position. The FCM will not attempt to cross back over NEUTRAL if it does not have to. This means that there was a block on the first attempt to go to 4LOCK and the transfer case has made it through NEUTRAL to a known good position, then the motor will go back only to the AWD position and execute the remainder of the attempts from there.
- For shifts out of NEUTRAL, any time a shift is commanded out of NEUTRAL, the system needs to get out. The FCM should never go to NEUTRAL unless the driver is commanding it and all required conditions are being met.

ENCODER DRIFT CORRECTION

Whenever a shift is completed, the FCM stores the position in memory as the transfer case's intended position. The FCM continuously monitors the mode sensor and if the mode sensor drifts toward into a NEUTRAL region sensor position for 2.0 seconds, the FCM will perform a motor drive to correct the drift. The transfer case will be driven toward the intended position for 1.0 seconds ±100 msec. The FCM will wait for 2.0 seconds ±50 msec. and repeat the attempt to shift to the desired position. This will continue until the intended position is reached.

SHIFT MOTOR CONTROL

The FCM will have the ability to vary the speed of the transfer case motor through pulse width modulation (PWM). It is recommended to PWM from 0 to 100% at 100Hz.

The PWM will function as follows:

- Apply an initial duty cycle to shift motor control wires.
- Control the acceleration of the shift motor by increasing the applied duty cycle at a specified rate.
- Control the deceleration of the shift motor by updating the applied duty cycle to the shift motor control wires at a specified rate based upon the difference between the desired position and the current position.

SHIFT MOTOR BRAKING

Static shift motor braking is utilized under the following conditions:

- Whenever the transfer case is in the AWD or 4LO position.
- Whenever an invalid mode sensor code is present.

Static motor braking is achieved by applying +12V on both shift motor wires.

NOTE: Static Shift Motor Braking is independent of ignition key position.

SHIFT ATTEMPT LIMIT

To protect the transfer case system, the FCM will impose a limit on the number of shifts that can occur over a calibrated time period. The system will monitor the number of mode sensor position changes that occur in any 30 second time period. If the number of changes is 25 or greater, the system will go into a default mode. The default mode of operation for shifting is that the number of allowed changes permitted to occur will be 3 over each 15 second ±100 msec calibrated window of time. After 5 minutes ±100 msec, the motor can be assumed to have cooled down and the system will revert to normal operation. The following rules also apply to the shift limit:

- The attempt limit will not prevent shifts coming out of NEUTRAL, they will be allowed regardless of the counter/timer.
- Any shift that is in progress when the counter reaches a maximum count in time will be allowed to complete before the default mode is entered. Position changes during this period will not be counted towards the default mode limit.

- A block, regardless of the direction, whether towards destination or back towards reversal target (shift timer expiring), will count as a value of 2 position changes towards the 30 position changes to go into default mode as defined above. Current attempt limit values are 25 transitions in 30 seconds and default mode values are 3 transitions every 15 seconds for 5 minutes.

DIAGNOSIS AND TESTING

TRANSFER CASE VERIFICATION TEST VER 1

Diagnostic Test

1. TRANSFER CASE VERIFICATION TEST— VER 1

Disconnect all jumper wires and reconnect all previously disconnected components and connectors.

With the scan tool, Clear DTCs.

Make sure that all accessories are turned off and that the battery is fully charged.

Move the Transfer Case Selector Switch to the desired position.

Test drive the vehicle in each Transfer Case range and verify proper operation in each range.

NOTE: To select or deselect 2WD, AWD or 4HI mode, vehicle speed must be below 55 MPH (88 KM/H) with all wheels at vehicle speed.

NOTE: Shifts will not take place with a wheel speed difference of greater than 13 MPH between the front and rear wheels.

NOTE: To select or deselect 4LO (if equipped), vehicle speed must be below 3 MPH (5 KM/H) with the ignition ON and the transmission in neutral (auto trans) or the clutch pedal pressed (man trans).

NOTE: To select or deselect Transfer Case Neutral, vehicle speed must be 0 MPH with the ignition ON, engine OFF, the brake pedal applied, and the transmission in neutral (auto trans) or the clutch pedal pressed (man trans). Press the Neutral button (if equipped) on the Transfer Case Selector Switch until the Neutral Indicator is illuminated.

WARNING: Apply the parking brake. The vehicle may roll with the Transfer Case in neutral.

NOTE: To verify that the Transfer Case is in Neutral, shift the automatic transmission into reverse and release the brake pedal for three seconds or shift the manual transmission into gear and slowly release the clutch pedal. There should be no vehicle movement if the Transfer Case is in Neutral.

With the scan tool, read DTCs in the Front Control Module (FCM) and the Instrument Cluster Module (CCN).

Are there any Transfer Case DTCs present in the Front Control Module (FCM) or the Instrument Cluster Module (CCN)?

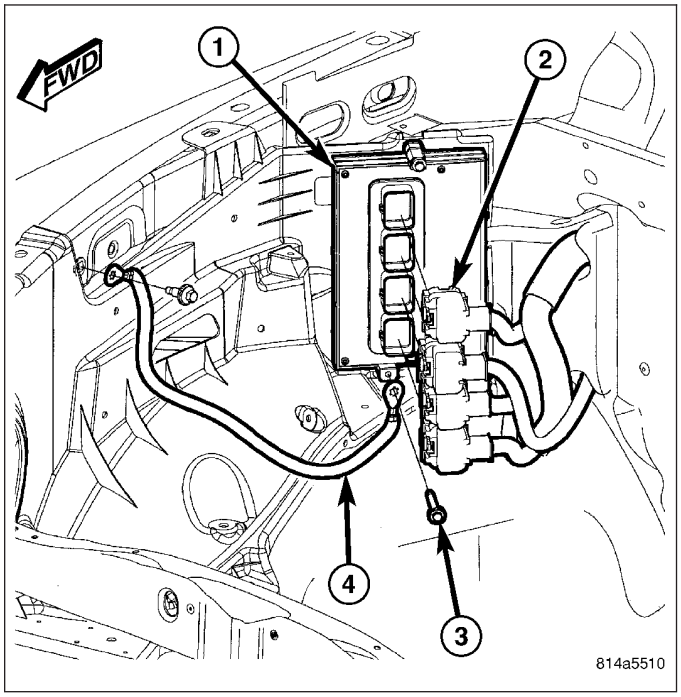
Yes >> Return to the symptom list and perform the appropriate diagnostic test.

No >> Repair is complete.

MODULE-TRANSMISSION CONTROL

DESCRIPTION

The Transmission Control Module (TCM) is a sub-module within the Powertrain Control Module (PCM) (1). The PCM is attached to the right-inner corner of the engine compartment.



OPERATION

The Transmission Control Module (TCM) controls all electronic operations of the transmission. The TCM receives information regarding vehicle operation from both direct and indirect inputs, and selects the operational mode of the transmission. Direct inputs are hard wired to, and used specifically by the TCM. Indirect inputs are shared with the TCM via the vehicle communication bus.

Some examples of **direct inputs** to the TCM are:

- Battery (B+) voltage
- Ignition “ON” voltage
- Transmission Control Relay (Switched B+)
- Throttle Position Sensor
- Crankshaft Position Sensor
- Transmission Range Sensor
- Pressure Switches
- Transmission Temperature Sensor
- Input Shaft Speed Sensor
- Output Shaft Speed Sensor
- Line Pressure Sensor

Some examples of **indirect inputs** to the TCM are:

- Engine/Body Identification
- Manifold Pressure
- Target Idle
- Torque Reduction Confirmation
- Engine Coolant Temperature
- Ambient/Battery Temperature
- Scan Tool Communication

Based on the information received from these various inputs, the TCM determines the appropriate shift schedule and shift points, depending on the present operating conditions and driver demand. This is possible through the control of various direct and indirect outputs.

Some examples of TCM **direct outputs** are:

- Transmission Control Relay
- Solenoids
- Torque Reduction Request

Some examples of TCM **indirect outputs** are:

- Transmission Temperature (to PCM)
- PRNDL Position (to cluster/CCN)

In addition to monitoring inputs and controlling outputs, the TCM has other important responsibilities and functions:

- Storing and maintaining Clutch Volume Indexes (CVI)
- Storing and selecting appropriate Shift Schedules
- System self-diagnostics
- Diagnostic capabilities (with scan tool)

NOTE: If the TCM has been replaced, the "Quick Learn Procedure" must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

BATTERY FEED

A fused, direct battery feed to the TCM is used for continuous power. This battery voltage is necessary to retain memory in the TCM. When the battery (B+) is disconnected, this memory is lost. When the battery (B+) is restored, this memory loss is detected by the TCM and a Diagnostic Trouble Code (DTC) is set.

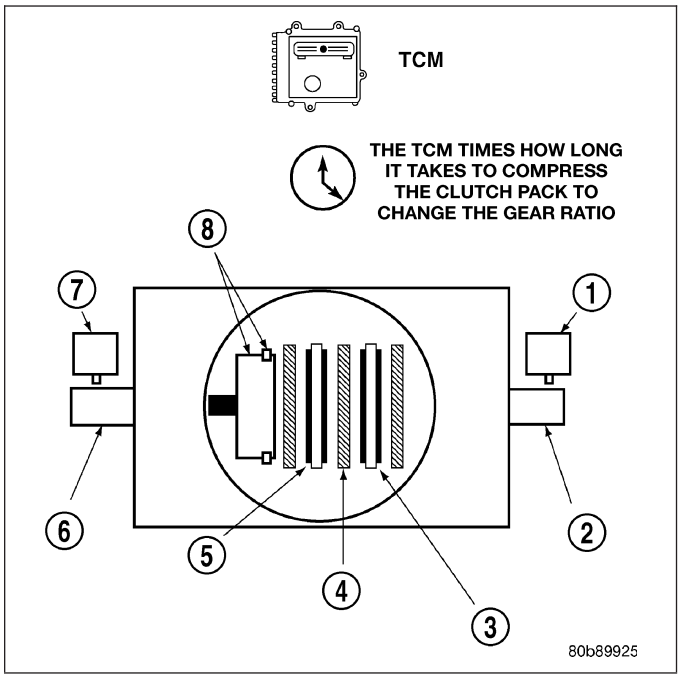
CLUTCH VOLUME INDEXES (CVI)

An important function of the TCM is to monitor Clutch Volume Indexes (CVI). CVIs represent the volume of fluid needed to compress a clutch pack.

The TCM monitors gear ratio changes by monitoring the Input and Output Speed Sensors. The Input, or Turbine Speed Sensor sends an electrical signal to the TCM that represents input shaft rpm. The Output Speed Sensor provides the TCM with output shaft speed information.

By comparing the two inputs, the TCM can determine transmission gear position. This is important to the CVI calculation because the TCM determines CVIs by monitoring how long it takes for a gear change to occur.

Gear ratios can be determined by using the Scan Tool and reading the Input/Output Speed Sensor values in the "Monitors" display. Gear ratio can be obtained by dividing the Input Speed Sensor value by the Output Speed Sensor value.



For example, if the input shaft is rotating at 1000 rpm and the output shaft is rotating at 500 rpm, then the TCM can determine that the gear ratio is 2:1. In direct drive (3rd gear), the gear ratio changes to 1:1. The gear ratio changes as clutches are applied and released. By monitoring the length of time it takes for the gear ratio to change following a shift request, the TCM can determine the volume of fluid used to apply or release a friction element.

The volume of transmission fluid needed to apply the friction elements are continuously updated for adaptive controls. As friction material wears, the volume of fluid need to apply the element increases.

Certain mechanical problems within the input clutch assembly can cause inadequate or out-of-range element volumes. Also, defective Input/Output Speed Sensors and wiring can cause these conditions. The following chart identifies the appropriate clutch volumes and when they are monitored/updated:

CLUTCH VOLUMES		
Clutch	**When Updated**	**Proper Clutch Volume**
L/R	2-1 or 3-1 downshift	45 to 134
2C	3-2 kickdown shift	25 to 85
OD	2-3 upshift	30 to 100
4C	3-4 upshift	30 to 85
UD	4-3 kickdown shift	30 to 100

SHIFT SCHEDULES

As mentioned earlier, the TCM has programming that allows it to select a variety of shift schedules. Shift schedule selection is dependent on the following:

- Shift lever position
- Throttle position
- Engine load
- Fluid temperature
- Software level

As driving conditions change, the TCM appropriately adjusts the shift schedule. Refer to the following chart to determine the appropriate operation expected, depending on driving conditions.

Schedule	Condition	Expected Operation
Extreme Cold	Oil temperature below -16° F	-Park, Reverse, Neutral and 1st and 3rd gear only in D position, 2nd gear only in Manual 2 or L -No EMCC
Super Cold	Oil temperature between -12° F and 10° F	- Delayed 2-3 upshift - Delayed 3-4 upshift - Early 4-3 coastdown shift - High speed 4-2, 3-2, 2-1 kickdown shifts are prevented -Shifts at high throttle openings willl be early. - No EMCC
Cold	Oil temperature between 10° F and 36° F	-Shift schedule is the same as Super Cold except that the 2-3 upshifts are not delayed.
Warm	Oil temperature between 40° F and 80° F	- Normal operation (upshift, kickdowns, and coastdowns) - No EMCC
Hot	Oil temperature between 80° F and 240° F	- Normal operation (upshift, kickdowns, and coastdowns) - Normal EMCC operation

Schedule	Condition	Expected Operation
Overheat	Oil temperature above 240° F or engine coolant temperature above 244° F	- Delayed 2-3 upshift - Delayed 3-4 upshift - 3rd gear FEMCC from 30-48 mph - 3rd gear PEMCC above 35 mph - Above 25 mph the torque converter will not unlock unless the throttle is closed or if a wide open throttle 2nd PEMCC to 1 kickdown is made

STANDARD PROCEDURE

TCM QUICK LEARN

The quick learn procedure requires the use of the scan tool.

This program allows the electronic transmission system to recalibrate itself. This will provide the proper transmission operation. The quick learn procedure should be performed if any of the following procedures are performed:

- Transmission Assembly Replacement
- Transmission Control Module Replacement
- Solenoid Pack Replacement
- Clutch Plate and/or Seal Replacement
- Valve Body Replacement or Recondition

To perform the Quick Learn Procedure, the following conditions must be met:

- The brakes must be applied
- The engine speed must be above 500 rpm
- The throttle angle (TPS) must be less than 3 degrees
- The shift lever position must stay in PARK until prompted to shift to overdrive
- The shift lever position must stay in overdrive after the Shift to Overdrive prompt until the scan tool indicates the procedure is complete.
- The calculated oil temperature must be above 60° and below 200°

DRIVE LEARN

When a transmission is repaired and a Quick Learn procedure has been performed on the Transmission Control Module (TCM), the following Drive Learn procedure can be performed to fine tune any shifts which are particularly objectionable.

NOTE: It is not necessary to perform the complete Drive Learn procedure every time the TCM is Quick Learned. Perform only the portions which target the objectionable shift.

LEARN A SMOOTH 1ST NEUTRAL TO DRIVE SHIFT

Perform this procedure only if the complaint is for a delayed or harsh shift the first time the transmission is put into gear after the vehicle is allowed to set with the engine not running for at least 10 minutes. Use the following steps to have the TCM learn the 1st N-D UD CVI.

NOTE: The transmission oil temperature must be between 80 - 110°F (27 - 43°C).

1. Start the engine only when the engine and ignition have been off for at least ten (10) minutes.
2. With the vehicle at a stop and the service brake applied, record the 1st N-D UD CVI while performing a Neutral to Drive shift. The 1st N-D UD CVI accounts for air entrapment in the UD clutch that may occur after the engine has been off for a period of time.
3. Repeat Step 1 and Step 2 until the recorded 1st N-D UD CVI value stabilizes.

NOTE: It is important that this procedure be performed when the transmission temperature is between 80 - 110°F (27 - 43°C). If this procedure takes too long to complete fully for the allowed transmission oil temperature, the vehicle may be returned to the customer with an explanation that the shift will improve daily during normal vehicle usage. The TCM also learns at higher oil temperatures, but these values (line pressure correction values) are not available for viewing on the scan tool.

LEARN A SMOOTH NEUTRAL TO DRIVE GARAGE SHIFT

Perform this procedure if the complaint is for a delayed or harsh shift when the transmission is put into gear after the vehicle has had its first shift. Use the following steps to have the TCM learn the Norm N-D UD CVI.

NOTE: The transmission oil temperature must be between 80 - 110°F (27 - 43°C) to learn the UD CVI. Additional learning occurs at temperatures as low as 0°F and as high as 200°F. This procedure may be performed at any temperature that experiences poor shift quality. Although the UD CVI may not change, shift quality should improve.

1. Start the vehicle engine and shift to drive.
2. Move the vehicle forward to a speed of at least 16 km/h (10 MPH) and come to a stop. This ensures no air is present in the UD hydraulic circuit.
3. Perform repeated N-D shifts at a stop while pausing in Neutral for at least 2-3 seconds and monitor Norm N-D UD CVI volume until the value stabilizes. The value will change during the N-D shift. This is normal since the UD value is different for the N-D shift then the normal value shown which is used for 4-3 coastdown and kickdowns. Perform repeated shifts in this temperature range until the Norm N-D UD CVI value stabilizes and the N-D shifts become smooth.

LEARN THE 1ST 2-3 SHIFT AFTER A RESTART OR SHIFT TO REVERSE

Use the following steps to have the TCM learn the 1st 2-3 shift OD CVI.

NOTE: The transmission oil temperature must be above 80°F (27°C).

1. With the vehicle engine running, select reverse gear for over 2 seconds.
2. Shift the transmission to Drive and accelerate the vehicle from a stop at a steady 15 degree throttle opening and perform a 2-3 shift while noting the 1st 2-3 OD CVI.
3. Repeat Step 1 and Step 2 until the 1st 2-3 upshift becomes smooth and the 1st 2-3 OD CVI stabilizes.

LEARN A SMOOTH 2-3 AND 3-4 UPSHIFT

NOTE: The transmission oil temperature must be above 110°F (43°C).

Use the following steps to have the TCM learn the OD and 4C CVI's.

1. Accelerate the vehicle from a stop at a steady 15 degree throttle opening and perform multiple 1-2, 2-3, and 3-4 upshifts. The 2nd 2-3 shift following a restart or shift to reverse will be shown during the shift as a value between the 1st 2-3 OD CVI and the normal OD CVI. Updates to the normal OD CVI will occur after the 2nd shift into 3rd gear, following a restart or shift to reverse.
2. Repeat Step 1 until the 2-3 and 3-4 shifts become smooth and the OD and 4C CVI become stable.

LEARN A SMOOTH 4-3 COASTDOWN AND PART THROTTLE 4-3 KICKDOWN

NOTE: The transmission oil temperature must be above 110°F (43°C).

Use the following steps to have the TCM learn the UD shift volume.

1. At a vehicle speed between 64-97 km/h (40-60 MPH), perform repeated 4-3 kickdown shifts.
2. Repeat Step 1 until the UD volume becomes somewhat stable and the shift becomes smooth.

LEARN A SMOOTH 1-2 UPSHIFT AND 3-2 KICKDOWN

Use the following steps to have the TCM learn the 2C shift volume.

NOTE: The transmission oil temperature must be above 110°F (43°C).

1. With a vehicle speed below 48 km/h (30 MPH) and the transmission in 3rd gear, perform multiple 3-2 kickdowns.
2. Repeat Step 1 until the 3-2 kickdowns become smooth and the 2C CVI becomes stable.

LEARN A SMOOTH MANUAL 2-1 PULLDOWN SHIFT AS WELL AS A NEUTRAL TO REVERSE SHIFT

NOTE: The transmission oil temperature must be above 110°F (43°C).

Use the following steps to have the TCM learn the LR volume.

1. With the vehicle speed around 40-48 km/h (25-30 MPH) in Manual 2nd, perform manual pulldowns to Low or 1st gear at closed throttle.
2. Repeat Step 1 until the LR CVI becomes stable and the manual 2-1 becomes smooth.

LEARN A SMOOTH NEUTRAL TO REVERSE SHIFT

NOTE: The transmission oil temperature must be above 110°F (43°C).

1. With the vehicle at a stop, perform Neutral to Reverse shifts until the shift is smooth. An unlearned Neutral to Reverse shift may be harsh or exhibit a double bump.
2. If any of the shifts are still not smooth after the clutch volume stabilizes, an internal transmission problem may be present.

LEARN A SMOOTH 4-5 UPSHIFT

NOTE: The transmission oil temperature must be above 110°F (43°C).

Use the following steps to have the TCM learn the Alt 2C CVI.

1. Accelerate the vehicle through 88 km/h (55mph) at a steady 10-15 degree throttle opening and perform multiple 4-5 upshifts.
2. Repeat Step 1 until the 4-5 shift become smooth and theAlt 2C CVI become stable. There is a separate 2C volume used and learned for 4-5 shifts, 2CA. It is independent of the 2C CVI learned on 3-2 kickdowns.

ENGINE SYSTEMS

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BATTERY SYSTEM

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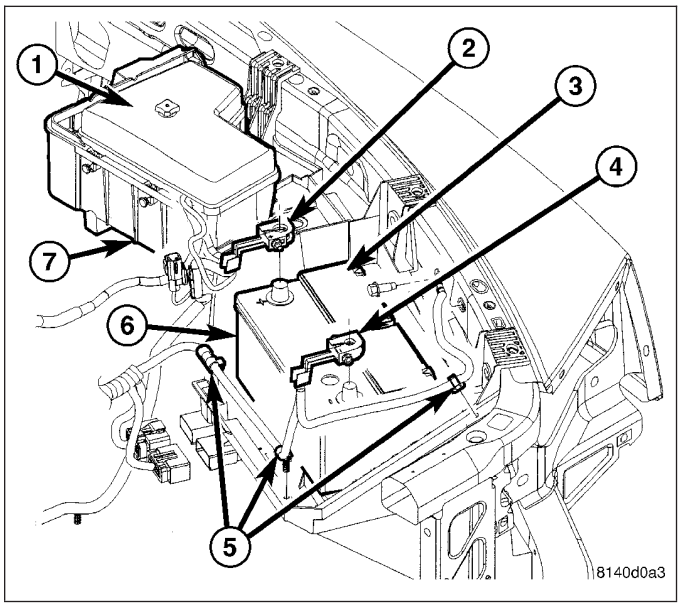
BATTERY SYSTEM

DESCRIPTION

This vehicle is equipped with a single 12-volt battery. All of the components of the battery system are located within the engine compartment. The battery system for this vehicle covers the following related components:



- **Battery (3)** - The storage battery provides a reliable means of storing a renewable source of electrical energy within the vehicle.
- **Positive Battery cable (2)** - The positive battery cable connects the battery positive terminal post to the vehicle electrical system, starter and alternator.
- **Negative Battery Cable (4)** - The negative battery cable connects the battery negative terminal post to the vehicle electrical system through body, chassis and engine grounding points.
- **Battery Thermal Guard (6)** - A thermal guard wraps around the battery case to enclose the sides of the battery. The thermal guard consists of a heavy black plastic outer skin and two lighter plies of plastic that have been formed into a sheet with hundreds of small air pockets entrapped between them.
- **Battery Holddown** - The battery holddown hardware secures the battery in the battery tray in the engine compartment.
- **Battery Tray (7)** - The battery tray provides a secure mounting location in the vehicle for the battery and an anchor point for the battery holddown hardware as well as a mounting location for the Integrated Power Module (IPM).

For battery system maintenance schedules (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION). (Refer to LUBRICATION & MAINTENANCE/JUMP STARTING - STANDARD PROCEDURE - JUMP STARTING) for the proper jump starting procedure. The battery must be fully-charged before any battery system diagnosis or testing procedures can be performed.

OPERATION

The battery system is designed to provide a safe, efficient, reliable and mobile means of delivering and storing electrical energy. This electrical energy is required to operate the engine starting system, as well as many of the other vehicle accessory systems for limited durations while the engine and/or the charging system are not operating. The battery system is also designed to provide a reserve of electrical energy to supplement the charging system for short durations while the engine is running and the electrical current demands of the vehicle exceed the output of the charging system. In addition to delivering, and storing electrical energy for the vehicle, the battery system serves as a capacitor and voltage stabilizer for the vehicle electrical system. It absorbs most abnormal or transient voltages caused by the switching of any of the electrical components or circuits in the vehicle.

DIAGNOSIS AND TESTING

BATTERY SYSTEM

The battery, starting, and charging systems in the vehicle operate with one another and must be tested as a complete system. In order for the engine to start and the battery to maintain its charge properly, all of the components that are used in these systems must perform within specifications. It is important that the battery, starting, and charging systems be thoroughly tested and inspected any time a battery needs to be charged or replaced. The cause of abnormal battery discharge, overcharging or early battery failure must be diagnosed and corrected before a battery is replaced and before a vehicle is returned to service. The service information for these systems has been separated within this service manual to make it easier to locate the specific information you are seeking. How-

ever, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used for the battery, starting, and charging systems include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, a volt/ohmmeter, a battery charger, a carbon pile rheostat (load tester) and a 12-volt test lamp may be required. All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any inoperative system it detects. (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING) for the proper charging system on-board diagnostic test procedures.

MICRO 420 BATTERY TESTER

The Micro 420 automotive battery system tester is designed to help diagnose the cause of a defective battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER) for directions on using the Micro 420 battery tester.

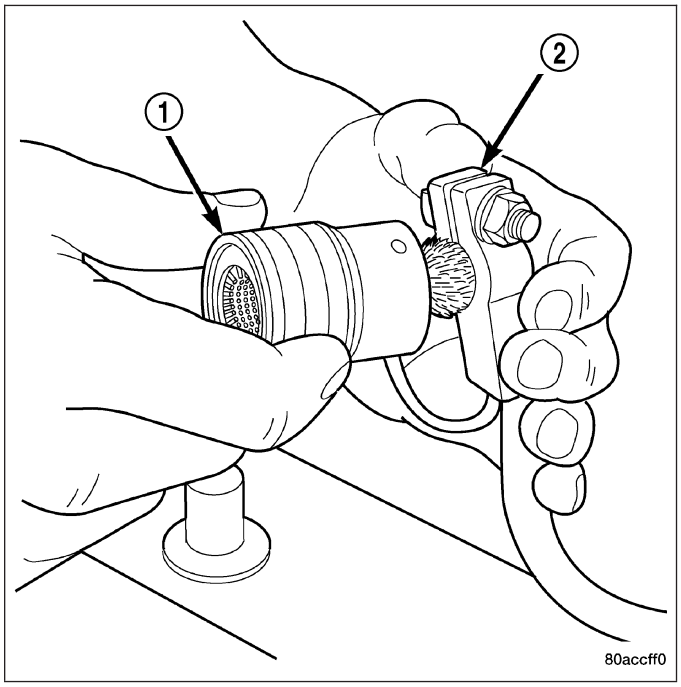
BATTERY SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION
THE BATTERY SEEMS WEAK OR DEAD WHEN ATTEMPTING TO START THE ENGINE.	1. The electrical system ignition-off draw is excessive.	1. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - IGNITION-OFF DRAW TEST) for the proper test procedures. Repair the excessive ignition-off draw, as required.
	2. The charging system is inoperative.	2. Determine if the charging system is performing to specifications, (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING). Repair the inoperative charging system, as required.
	3. The battery is discharged.	3. Determine the battery state-of-charge using the Micro 420 battery tester, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER). Charge the battery as required.
	4. The battery terminal connections are loose or corroded.	4. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - DIAGNOSIS AND TESTING). Clean and tighten the battery terminal connections, as required.
	5. The battery has an incorrect size or rating for this vehicle.	5. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - SPECIFICATIONS) for the proper size and rating. Replace an incorrect battery, as required.
	6. The battery is inoperative.	6. Determine the battery cranking capacity using the Micro 420 battery tester, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER). Replace the inoperative battery, as required.
	7. The starting system is inoperative.	7. Determine if the starting system is performing to specifications, (Refer to 8 - ELECTRICAL/STARTING - DIAGNOSIS AND TESTING). Repair the inoperative starting system, as required.
	8. The battery is physically damaged.	8. Inspect the battery for loose terminal posts or a cracked and leaking case. Replace the damaged battery, as required.

BATTERY SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION
THE BATTERY STATE OF CHARGE CANNOT BE MAINTAINED.	1. The battery has an incorrect size or rating for this vehicle.	1. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - SPECIFICATIONS) for the proper size and rating. Replace an incorrect battery, as required.
	2. The battery terminal connections are loose or corroded.	2. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - DIAGNOSIS AND TESTING). Clean and tighten the battery terminal connections, as required.
	3. The electrical system ignition-off draw is excessive.	3. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - IGNITION-OFF DRAW TEST) for the proper test procedures. Repair the inoperative electrical system, as required.
	4. The battery is inoperative.	4. Test the battery using the Micro 420 battery tester, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER). Replace the inoperative battery, as required.
	5. The starting system is inoperative.	5. Determine if the starting system is performing to specifications, (Refer to 8 - ELECTRICAL/ STARTING - DIAGNOSIS AND TESTING). Repair the inoperative starting system, as required.
	6. The charging system is inoperative.	6. Determine if the charging system is performing to specifications, (Refer to 8 - ELECTRICAL/ CHARGING - DIAGNOSIS AND TESTING). Repair the inoperative charging system, as required.
	7. Electrical loads exceed the output of the charging system.	7. Inspect the vehicle for aftermarket electrical equipment which might cause excessive electrical loads.
	8. Slow driving or prolonged idling with high-amperage draw systems in use.	8. Advise the vehicle operator, as required.
THE BATTERY WILL NOT ACCEPT A CHARGE.	1. The battery is inoperative.	1. Test the battery using the Micro 420 battery tester, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER). Replace the inoperative battery, as required.

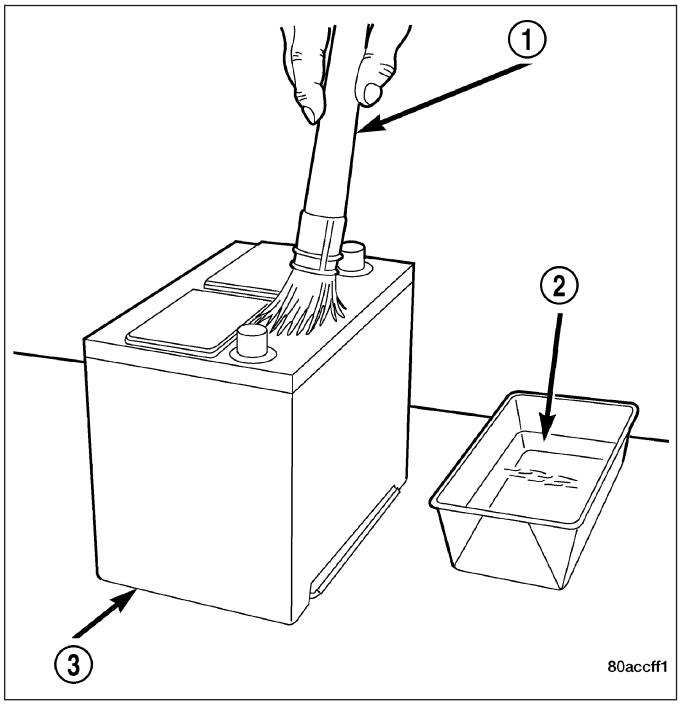
CLEANING

The following information details the recommended cleaning procedures for the battery and related components. In addition to the maintenance schedules found in this service manual, (Refer to LUBRICATION & MAINTENANCE/ MAINTENANCE SCHEDULES - DESCRIPTION) it is recommended that these procedures be performed any time the battery or related components must be removed for vehicle service.

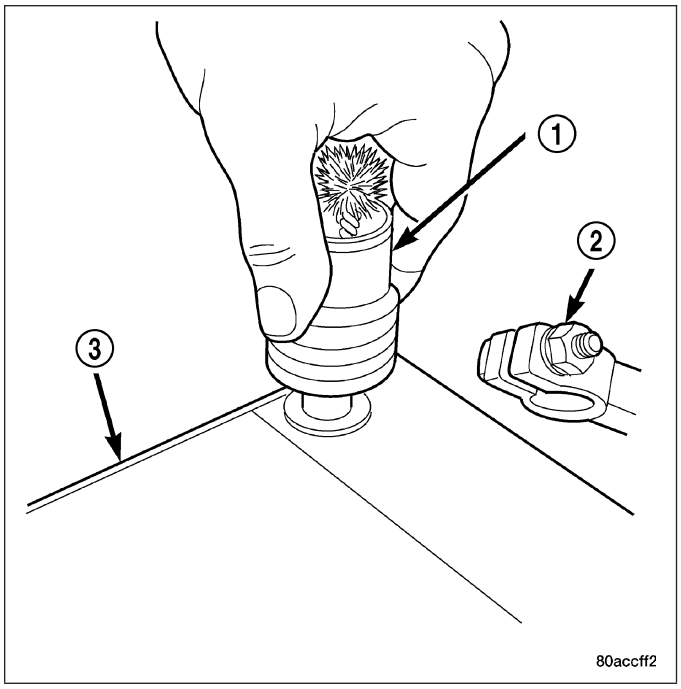
1. Clean the battery cable terminal clamps (2) of all corrosion. Remove any corrosion using a wire brush or a post and terminal cleaning tool (1), and a sodium bicarbonate (baking soda) and warm water cleaning solution.



2. Clean the battery tray and battery hold down hardware of all corrosion. Remove any corrosion using a wire brush and a sodium bicarbonate (baking soda) and warm water cleaning solution (2). Paint any exposed bare metal.
3. If the removed battery is to be reinstalled, clean the outside of the battery case (3) and the top cover with a sodium bicarbonate (baking soda) and warm water cleaning solution (2) using a stiff bristle parts cleaning brush (1) to remove any acid film. Rinse the battery with clean water. Ensure that the cleaning solution does not enter the battery cells through the vent holes. If the battery is being replaced, confirm that the replacement battery is the correct size and has the correct ratings for the vehicle.
4. Clean the battery thermal guard with a sodium bicarbonate (baking soda) and warm water cleaning solution (2) using a stiff bristle parts cleaning brush (1) to remove any acid film.



5. Clean any corrosion from the battery terminal posts with a wire brush or a post and terminal cleaner (1) and a sodium bicarbonate (baking soda) and warm water cleaning solution.



INSPECTION

The following information details the recommended inspection procedures for the battery and related components. In addition to the maintenance schedules, (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION), it is recommended that these procedures be performed any time the battery or related components are removed for vehicle service.

1. Inspect the battery cable terminal clamps for damage. Replace any battery cable that has a damaged or deformed terminal clamp.
2. Inspect the battery tray and battery hold down hardware for damage. Replace any damaged parts.
3. Slide the thermal guard off of the battery case, if equipped. Inspect the battery case for cracks or other damage that could result in electrolyte leaks. Also, check the battery terminal posts for looseness. Batteries with damaged cases or loose terminal posts must be replaced.
4. Inspect the battery thermal guard for tears, cracks, deformation or other damage. Replace any battery thermal guard that has been damaged.
5. Inspect the battery built-in test indicator sight glass (if equipped) for an indication of the battery condition. If the battery is discharged, charge as required, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - BATTERY CHARGING).

SPECIFICATIONS

BATTERY

The battery Group Size number, the Cold Cranking Amperage (CCA) rating, and the Reserve Capacity (RC) rating or Ampere-Hours (AH) rating can be found on the original equipment battery label. Be certain that a replacement battery has the correct Group Size number, as well as CCA, and RC or AH ratings that equal or exceed the original equipment specification for the vehicle being serviced. Battery sizes and ratings are discussed in more detail below.

- **Group Size** - The outside dimensions and terminal placement of the battery conform to standards established by the Battery Council International (BCI). Each battery is assigned a BCI Group Size number to help identify a correctly-sized replacement.
- **Cold Cranking Amperage** - The Cold Cranking Amperage (CCA) rating specifies how much current (in amperes) the battery can deliver for thirty seconds at -18° C (0° F). Terminal voltage must not fall below 7.2 volts during or after the thirty second discharge period. The CCA required is generally higher as engine displacement increases, depending also upon the starter current draw requirements.
- **Reserve Capacity** - The Reserve Capacity (RC) rating specifies the time (in minutes) it takes for battery terminal voltage to fall below 10.5 volts, at a discharge rate of 25 amperes. RC is determined with the battery

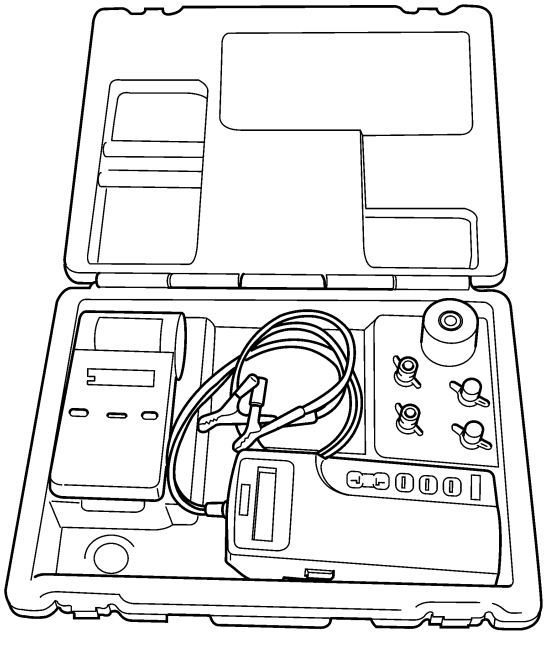
fully-charged at 26.7° C (80° F). This rating estimates how long the battery might last after a charging system failure, under minimum electrical load.

- **Ampere-Hours** - The Ampere-Hours (AH) rating specifies the current (in amperes) that a battery can deliver steadily for twenty hours, with the voltage in the battery not falling below 10.5 volts. This rating is also sometimes identified as the twenty-hour discharge rating.

BATTERY CLASSIFICATIONS & RATINGS					
Part Number	BCI Group Size Classification	Cold Cranking Amperage	Reserve Capacity	Ampere - Hours	Load Test Amperage
56029449AC	65	600	120 Minutes	66	300
56029451AC	65	750	150 Minutes	75	375

SPECIAL TOOLS

BATTERY SYSTEM SPECIAL TOOLS



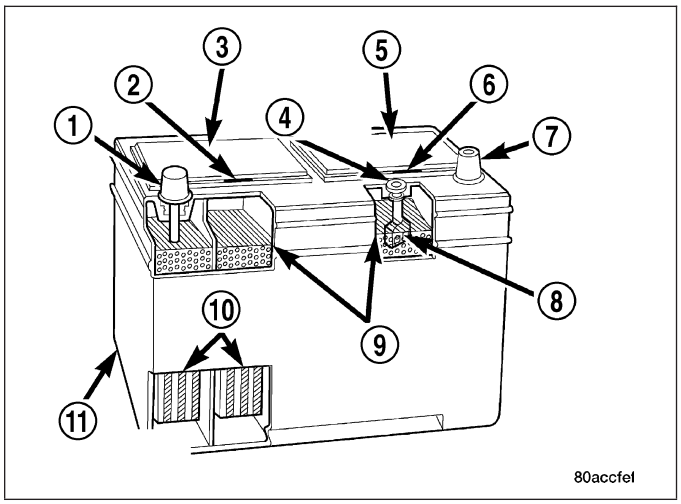
MICRO 420 BATTERY TESTER

BATTERY

DESCRIPTION

This vehicle is equipped with a single, 12-volt, maintenance-free battery located in the engine compartment. The battery is comprised of the following components:

- Positive Post (1)
- Vent (2)
- Cell Cap (3)
- Vent (4)
- Cell Cap (5)
- Vent (6)
- Negative Post (7)
- Indicator Eye (8) if equipped
- Electrolyte Level (9)
- Plate Groups (10)
- Maintenance Free Battery assembly (11)



This battery is designed to provide a safe, efficient and reliable means of storing electrical energy in a chemical form. This means of energy storage allows the battery to produce the electrical energy required to operate the engine starting system, as well as to operate many of the other vehicle accessory systems for limited durations while the engine and/or the charging system are not operating. The battery is made up of six individual cells that are connected in series. Each cell contains positively charged plate groups that are connected with lead straps to the positive terminal post, and negatively charged plate groups that are connected with lead straps to the negative terminal post. Each plate consists of a stiff mesh framework or grid coated with lead dioxide (positive plate) or sponge lead (negative plate). Insulators or plate separators made of a non-conductive material are inserted between the positive and negative plates to prevent them from contacting or shorting against one another. These dissimilar metal plates are submerged in a sulfuric acid and water solution called an electrolyte.

The battery Group Size number, the Cold Cranking Amperage (CCA) rating, and the Reserve Capacity (RC) rating or Ampere-Hours (AH) rating can be found on the original equipment battery label. Be certain that a replacement battery has the correct Group Size number, as well as CCA, and RC or AH ratings that equal or exceed the original equipment specification for the vehicle being serviced. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - SPECIFICATIONS) for the proper factory-installed battery specifications.

OPERATION

The battery is designed to store electrical energy in a chemical form. When an electrical load is applied to the terminals of the battery, an electrochemical reaction occurs. This reaction causes the battery to discharge electrical current from its terminals. As the battery discharges, a gradual chemical change takes place within each cell. The sulfuric acid in the electrolyte combines with the plate materials, causing both plates to slowly change to lead sulfate. At the same time, oxygen from the positive plate material combines with hydrogen from the sulfuric acid, causing the electrolyte to become mainly water. The chemical changes within the battery are caused by the movement of excess or free electrons between the positive and negative plate groups. This movement of electrons produces a flow of electrical current through the load device attached to the battery terminals.

As the plate materials become more similar chemically, and the electrolyte becomes less acid, the voltage potential of each cell is reduced. However, by charging the battery with a voltage higher than that of the battery itself, the battery discharging process is reversed. Charging the battery gradually changes the sulfated lead plates back into sponge lead and lead dioxide, and the water back into sulfuric acid. This action restores the difference in the electron charges deposited on the plates, and the voltage potential of the battery cells. For a battery to remain useful, it must be able to produce high-amperage current over an extended period. A battery must also be able to accept a charge, so that its voltage potential may be restored.

The battery is vented to release excess hydrogen gas that is created when the battery is being charged or discharged. However, even with these vents, hydrogen gas can collect in or around the battery. If hydrogen gas is exposed to flame or sparks, it may ignite. If the electrolyte level is low, the battery may arc internally and explode. If the battery cell caps cannot be removed, the battery must be replaced if the electrolyte level becomes low.

DIAGNOSIS AND TESTING

BATTERY

The battery must be completely charged and the terminals should be properly cleaned and inspected before diagnostic procedures are performed. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING) and (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - INSPECTION) for the proper battery cleaning and inspection procedures. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - BATTERY CHARGING) for the proper battery charging procedures.

MICRO 420 BATTERY TESTER

The Micro 420 automotive battery tester is designed to help diagnose the cause of an inoperative battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER) for instructions on the use of the Micro 420 battery tester.

WARNING: IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING OR LOOSE POSTS, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

WARNING: EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

WARNING: THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

A battery that will not accept a charge is inoperative, and must be replaced. Further testing is not required. A fully-charged battery must be load tested to determine its cranking capacity. A battery that is fully-charged, but does not pass the load test, is inoperative and must be replaced.

NOTE: Completely discharged batteries may take several hours to accept a charge. Refer to Standard Procedures for the proper battery charging procedures.

STANDARD PROCEDURE

BATTERY CHARGING

Battery charging is the means by which the battery can be restored to its full voltage potential. A battery is fully-charged when:

- Micro 420 electrical system tester indicates battery is OK.
- All of the battery cells are gassing freely during battery charging.
- Open-circuit voltage of the battery is 12.4 volts or above.

WARNING: NEVER EXCEED TWENTY AMPERES WHEN CHARGING A COLD (-1° C [30° F] OR LOWER) BATTERY. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

WARNING: IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

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WARNING: THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

WARNING: IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.

CAUTION: Always disconnect and isolate the battery negative cable before charging a battery. Do not exceed sixteen volts while charging a battery. Damage to the vehicle electrical system components may result.

CAUTION: Battery electrolyte will bubble inside the battery case during normal battery charging. Electrolyte boiling or being discharged from the battery vents indicates a battery overcharging condition. Immediately reduce the charging rate or turn off the charger to evaluate the battery condition. Damage to the battery may result from overcharging.

CAUTION: The battery should not be hot to the touch. If the battery feels hot to the touch, turn off the charger and let the battery cool before continuing the charging operation. Damage to the battery may result.

After the battery has been charged to 12.4 volts or greater, perform a load test to determine the battery cranking capacity, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER) for the proper battery load test procedures. If the battery will endure a load test, return the battery to service. If the battery will not endure a load test, it is inoperative and must be replaced.

Clean and inspect the battery hold downs, tray, terminals, posts, and top before completing battery service. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING) and (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - INSPECTION) for the proper battery system cleaning and inspection procedures.

CHARGING A COMPLETELY DISCHARGED BATTERY

The following procedure should be used to recharge a completely discharged battery. Unless this procedure is properly followed, a good battery may be needlessly replaced.

1. Measure the voltage at the battery posts with a voltmeter, accurate to 1/10 (0.10) volt. If the reading is below ten volts, the battery charging current will be low. It could take some time before the battery accepts a current greater than a few milliamperes. Such low current may not be detectable on the ammeters built into many battery chargers.
2. Disconnect and isolate the battery negative cable. Connect the battery charger leads. Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the battery charger and the battery from being damaged if they are improperly connected. If the battery state-of-charge is too low for the polarity-sensing circuitry to detect, the battery charger will not operate. This makes it appear that the battery will not accept charging current. See the instructions provided by the manufacturer of the battery charger for details on how to bypass the polarity-sensing circuitry.
3. Battery chargers vary in the amount of voltage and current they provide. The amount of time required for a battery to accept measurable charging current at various voltages is shown in the Charge Rate Table. If the charging current is still not measurable at the end of the charging time, the battery is inoperative and must be replaced. If the charging current is measurable during the charging time, the battery may be good and the charging should be completed in the normal manner.

CHARGE RATE TABLE	
Voltage	Hours
16.0 volts maximum	up to 4 hours
14.0 to 15.9 volts	up to 8 hours
13.9 volts or less	up to 16 hours

CHARGING TIME REQUIRED

The time required to charge a battery will vary, depending upon the following factors:

- **Battery Capacity** - A completely discharged heavy-duty battery requires twice the charging time of a small capacity battery.
- **Temperature** - A longer time will be needed to charge a battery at -18° C (0° F) than at 27° C (80° F). When a fast battery charger is connected to a cold battery, the current accepted by the battery will be very low at first. As the battery warms, it will accept a higher charging current rate (amperage).
- **Charger Capacity** - A battery charger that supplies only five amperes will require a longer charging time. A battery charger that supplies twenty amperes or more will require a shorter charging time.
- **State-Of-Charge** - A completely discharged battery requires more charging time than a partially discharged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current (amperage) will be low. As the battery charges, the specific gravity of the electrolyte will gradually rise.

The Battery Charging Time Table gives an indication of the time required to charge a typical battery at room temperature based upon the battery state-of-charge and the charger capacity.

BATTERY CHARGING TIME TABLE			
Charging Amperage	5 Amps	10 Amps	20 Amps
Open Circuit Voltage	Hours Charging @ 21° C (70° F)		
12.25 to 12.49	6 hours	3 hours	1.5 hours
12.00 to 12.24	10 hours	5 hours	2.5 hours
10.00 to 11.99	14 hours	7 hours	3.5 hours
Below 10.00	18 hours	9 hours	4.5 hours

IGNITION-OFF DRAW TEST

The term Ignition-Off Draw (IOD) identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. A normal vehicle electrical system will draw from five to thirty-five milliamperes (0.005 to 0.035 ampere) with the ignition switch in the Off position, and all non-ignition controlled circuits in proper working order. Up to thirty-five milliamperes are needed to enable the memory functions for the Powertrain Control Module (PCM), digital clock, electronically tuned radio, and other modules which may vary with the vehicle equipment.

A vehicle that has not been operated for approximately twenty days, may discharge the battery to an inadequate level. When a vehicle will not be used for twenty days or more (stored), remove the IOD fuse from the Junction Block (JB). This will reduce battery discharging.

Excessive IOD can be caused by:

- Electrical items left on.
- Inoperative or improperly adjusted switches.
- Inoperative or shorted electronic modules and components.
- An internally shorted generator.
- Intermittent shorts in the wiring.

If the IOD is over thirty-five milliamperes, the problem must be found and corrected before replacing a battery. In most cases, the battery can be charged and returned to service after the excessive IOD condition has been corrected.

1. Verify that all electrical accessories are off. Turn off all lamps, remove the ignition key, and close all doors. If the vehicle is equipped with an illuminated entry system or an electronically tuned radio, allow the electronic timer function of these systems to automatically shut off (time out). This may take up to three minutes. See the Electronic Module Ignition-Off Draw Table for more information.

ELECTRONIC MODULE IGNITION-OFF DRAW (IOD) TABLE			
Module	Time Out? (If Yes, Interval And Wake-Up Input)	IOD	IOD After Time Out
Radio	No	1 to 3 milliamperes	N/A
Audio Power Amplifier	No	up to 1 milliampere	N/A
Central Timer Module (CTM)	No	4.75 milliamperes (max.)	N/A
Powertrain Control Module (PCM)	No	0.95 milliampere	N/A
ElectroMechanical Instrument Cluster (EMIC)	No	0.44 milliampere	N/A
Combination Flasher	No	0.08 milliampere	N/A

2. Determine that the underhood lamp is operating properly, then disconnect the lamp wire harness connector or remove the lamp bulb.
3. Disconnect the battery negative cable.
4. Set an electronic digital multi-meter to its highest amperage scale. Connect the multi-meter between the disconnected battery negative cable terminal clamp and the battery negative terminal post. Make sure that the doors remain closed so that the illuminated entry system is not activated. The multi-meter amperage reading may remain high for up to three minutes, or may not give any reading at all while set in the highest amperage scale, depending upon the electrical equipment in the vehicle. The multi-meter leads must be securely clamped to the battery negative cable terminal clamp and the battery negative terminal post. If continuity between the battery negative terminal post and the negative cable terminal clamp is lost during any part of the IOD test, the electronic timer function will be activated and all of the tests will have to be repeated.
5. After about three minutes, the high-amperage IOD reading on the multi-meter should become very low or nonexistent, depending upon the electrical equipment in the vehicle. If the amperage reading remains high, remove and replace each fuse or circuit breaker in the Power Distribution Center (PDC) and then in the Junction Block (JB), one at a time until the amperage reading becomes very low, or nonexistent. Refer to the appropriate wiring information for complete PDC and JB fuse, circuit breaker, and circuit identification. This will isolate each circuit and identify the circuit that is the source of the high-amperage IOD. If the amperage reading remains high after removing and replacing each fuse and circuit breaker, disconnect the wire harness from the generator. If the amperage reading now becomes very low or nonexistent, diagnose and repair the Charging System as necessary. After the high-amperage IOD has been corrected, switch the multi-meter to progressively lower amperage scales and, if necessary, repeat the fuse and circuit breaker remove-and-replace process to identify and correct all sources of excessive IOD. It is now safe to select the lowest milliampere scale of the multi-meter to check the low-amperage IOD.

CAUTION: Do not open any doors, or turn on any electrical accessories with the lowest milliampere scale selected, or the multi-meter may be damaged.

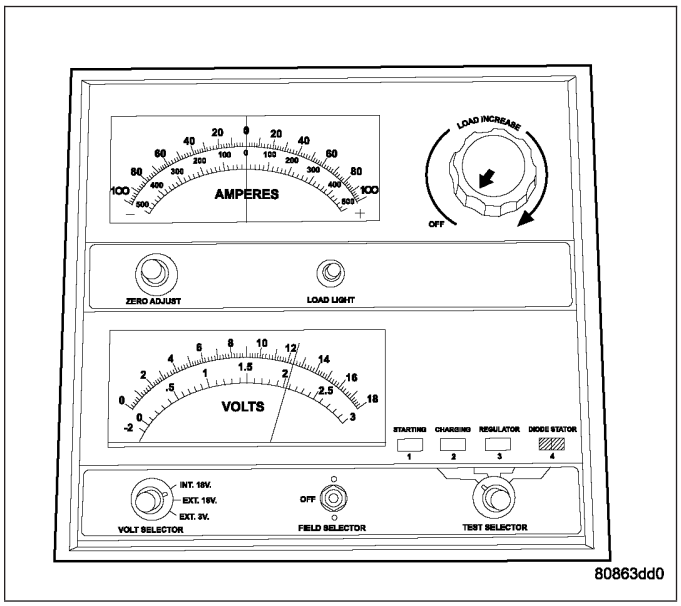
6. Observe the multi-meter reading. The low-amperage IOD should not exceed thirty-five milliamperes (0.035 ampere). If the current draw exceeds thirty-five milliamperes, isolate each circuit using the fuse and circuit breaker remove-and-replace process in Step 5. The multi-meter reading will drop to within the acceptable limit when the source of the excessive current draw is disconnected. Repair this circuit as required; whether a wiring short, incorrect switch adjustment, or an inoperative component is the cause.

OPEN-CIRCUIT VOLTAGE TEST

A battery open-circuit voltage (no load) test will show the approximate state-of-charge of a battery. This test can be used in place of the hydrometer test when a hydrometer is not available, or for maintenance-free batteries with non-removable cell caps.

Before proceeding with this test, completely charge the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - BATTERY CHARGING).

1. Before measuring the open-circuit voltage, the surface charge must be removed from the battery. Turn on the headlamps for fifteen seconds, then allow up to five minutes for the battery voltage to stabilize.
2. Disconnect and isolate both battery cables, negative cable first.
3. Using a voltmeter connected to the battery posts (see the instructions provided by the manufacturer of the voltmeter), measure the open-circuit voltage.

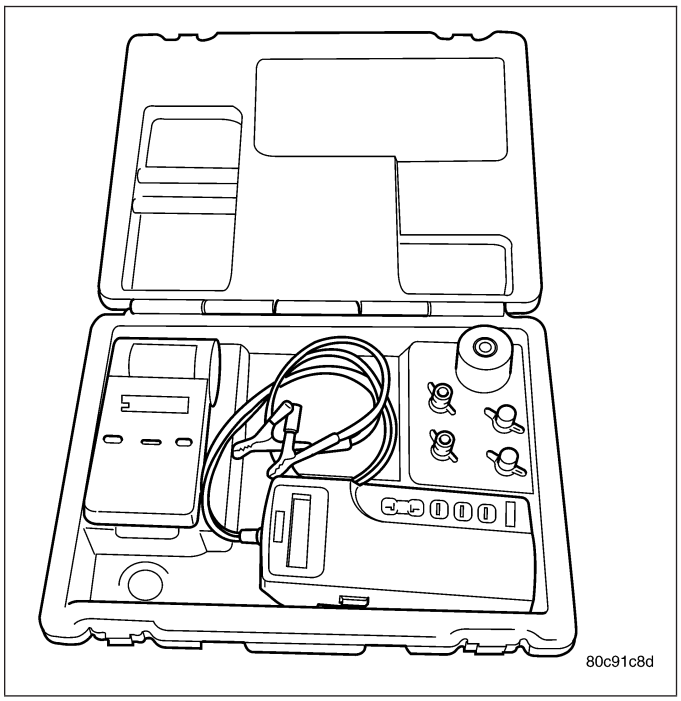


See the Open-Circuit Voltage Table. This voltage reading will indicate the battery state-of-charge, but will not reveal its cranking capacity. If a battery has an open-circuit voltage reading of 12.4 volts or greater, it may be load tested to reveal its cranking capacity (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER).

OPEN CIRCUIT VOLTAGE TABLE	
Open Circuit Voltage	Charge Percentage
11.7 volts or less	0%
12.0 volts	25%
12.3 volts	50%
12.6 volts	75%
12.8 volts or more	100%

MICRO 420 BATTERY TESTER

Always use the Micro 420 Instruction Manual that was supplied with the tester as a reference. If the Instruction Manual is not available the following procedure can be used:



WARNING: ALWAYS WEAR APPROPRIATE EYE PROTECTION AND USE EXTREME CAUTION WHEN WORKING WITH BATTERIES.

BATTERY TESTING

1. If testing the battery OUT-OF-VEHICLE, clean the battery terminals with a wire brush before testing, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING). If the battery is equipped with side post terminals, install and tighten the supplied lead terminal stud adapters. Do not use steel bolts. Failure to properly install the stud adapters, or using stud adapters that are dirty or worn-out may result in false test readings.
2. If testing the battery IN-THE-VEHICLE, make certain all of the vehicle accessory loads are OFF, including the ignition. **The preferred test position is at the battery terminal**. If the battery is not accessible, you may test using both the positive and negative jumper posts. Select TESTING AT JUMPER POST when connecting to that location.
3. Connect the tester to the battery or jumper posts, the red clamp to positive (+) and the black clamp to negative (–).

NOTE: Multiple batteries connected in parallel must have the ground cable disconnected to perform a battery test. Failure to disconnect may result in false battery test readings.

4. Using the ARROW key select **in** or **out** of vehicle testing and press ENTER to make a selection.
5. If not selected, choose the Cold Cranking Amp (CCA) battery rating. Or select the appropriate battery rating for your area (see menu). The tester will then run its self programmed test of the battery and display the results. Refer to the test result table noted below.

CAUTION: If REPLACE BATTERY is the result of the test, this may mean a poor connection between the vehicle's cables and battery exists. After disconnecting the vehicle's battery cables from the battery, retest the battery using the OUT-OF-VEHICLE test before replacing.

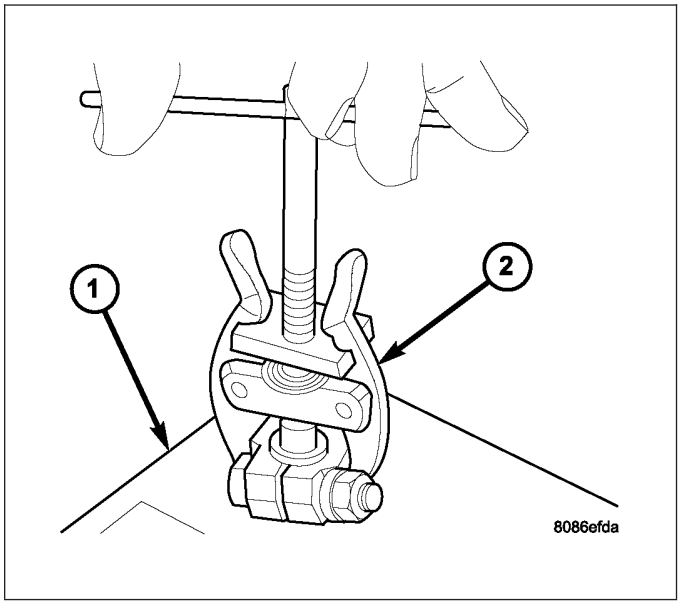
6. While viewing the battery test result, press the CODE button and the tester will prompt you for the last 4 digits of the VIN. Use the UP/DOWN arrow buttons to scroll to the correct character; then press ENTER to select and move to the next digit. Then press the ENTER button to view the SERVICE CODE. Pressing the CODE button a second time will return you to the test results.

BATTERY TEST RESULTS	
GOOD BATTERY	Return to service
GOOD - RECHARGE	Fully charge battery and return to service
CHARGE & RETEST	Fully charge battery and retest battery
REPLACE BATTERY	Replace the battery and retest complete system
BAD-CELL REPLACE	Replace the battery and retest complete system

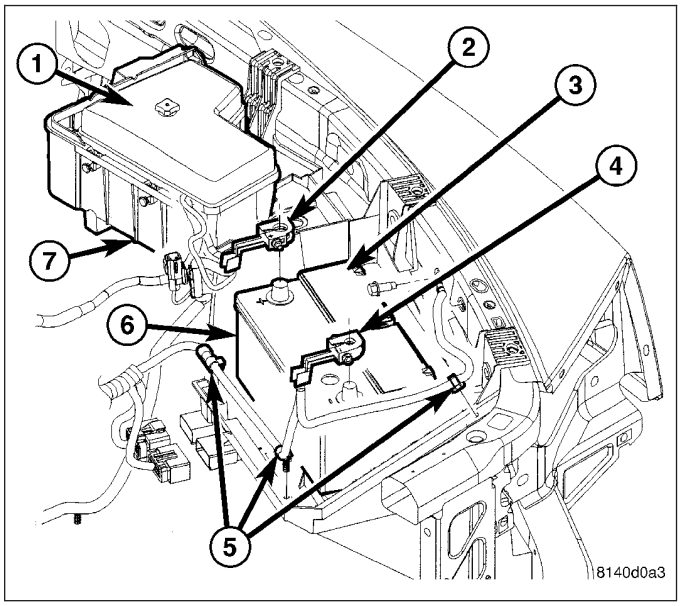
NOTE: The SERVICE CODE is required on every warranty claim submitted for battery replacement.

REMOVAL

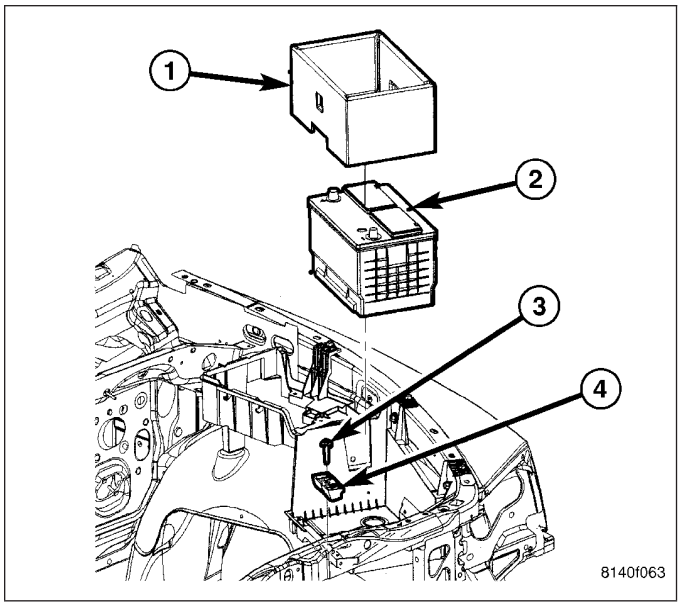
NOTE: It may be necessary to use a battery terminal puller (2) if the battery cable terminal clamps are seized on to the battery posts.



1. Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.
2. Loosen the battery negative cable terminal (4) clamp pinch-bolt hex nut.
3. Disconnect the battery negative cable terminal clamp from the battery negative terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.
4. Loosen the battery positive cable terminal (2) clamp pinch-bolt hex nut.
5. Disconnect the battery positive cable terminal clamp from the battery positive terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.



6. Remove the battery thermal guard (1).
7. Remove the battery hold down (4) and bolt (3) from the battery (2).

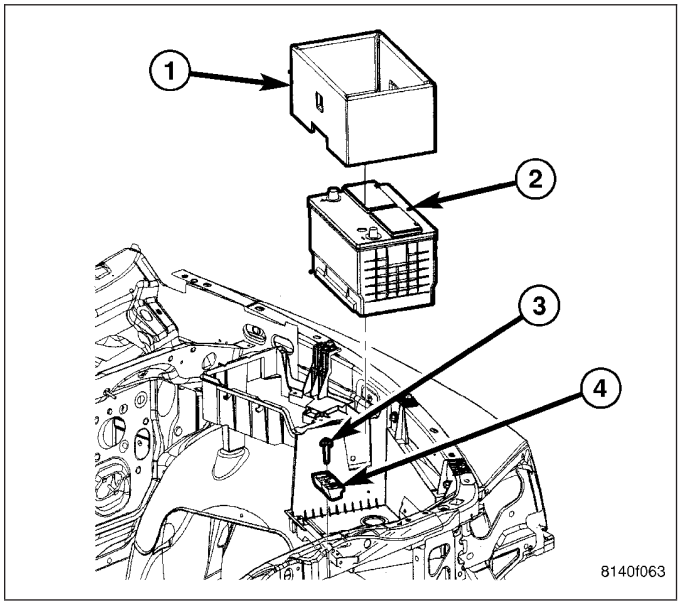


WARNING: WEAR A SUITABLE PAIR OF RUBBER GLOVES WHEN REMOVING A BATTERY BY HAND. SAFETY GLASSES SHOULD ALSO BE WORN. IF THE BATTERY IS CRACKED OR LEAKING, THE ELECTROLYTE CAN BURN THE SKIN AND EYES.

8. Remove the battery (2) from the vehicle.

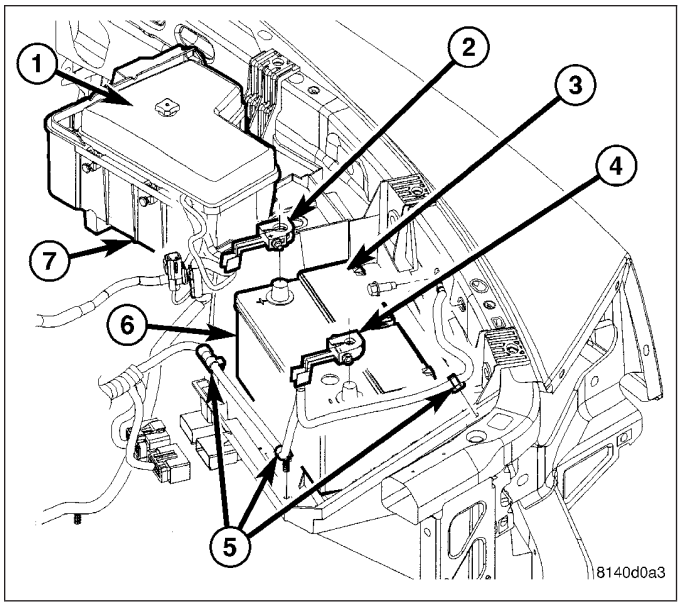
INSTALLATION

1. Clean and inspect the battery case, terminal posts and battery cable clamps, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING).
2. Position the battery (2) into the vehicle. Ensure that the battery positive and negative terminal posts are correctly positioned. The battery cable terminal clamps must reach the correct battery terminal post without stretching the cables.
3. Install the thermal guard (1) and slide battery toward fender.
4. Install the battery hold down (4) and bolt (3) onto the battery.



CAUTION: Be certain that the battery cable terminal clamps are connected to the correct battery terminal posts. Reverse battery polarity may damage electrical components of the vehicle.

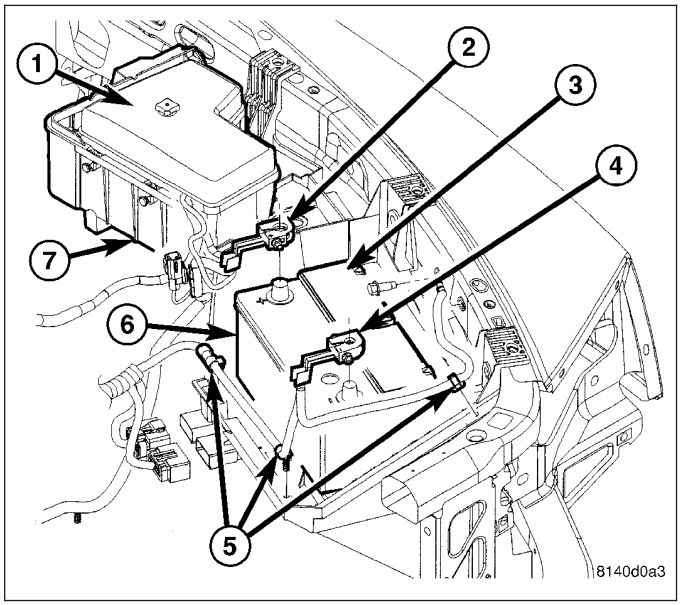
5. Connect the battery positive cable terminal clamp (2) to the battery positive terminal post.
6. Connect the battery negative cable terminal clamp (4) to the battery negative terminal post.
7. Apply a thin coating of petroleum jelly or chassis grease to the exposed surfaces of the battery cable terminal clamps and the battery terminal posts.



BATTERY CABLES

DESCRIPTION

The battery cables (2) and (4) are large gauge, stranded copper wires sheathed within a heavy plastic or synthetic rubber insulating jacket. The wire used in the battery cables combines excellent flexibility and reliability with high electrical current carrying capacity. The battery cables feature a stamped brass clamping type female battery terminal crimped onto one end of the battery cable wire and then solder-dipped. A square headed pinch-bolt and hex nut are installed at the open end of the female battery terminal clamp. Large eyelet type terminals are crimped onto the opposite end of the battery cable wire and then solder-dipped. The battery positive cable wires (2) have a red insulating jacket to provide visual identification and feature a larger female battery terminal clamp to allow connection to the larger battery positive terminal post. The battery negative cable wires (4) have a black insulating jacket and a smaller female battery terminal clamp.



The battery cables cannot be repaired and, if damaged or faulty they must be replaced. Both the battery positive and negative cables are available for service replacement. The replacement parts may include portions of the wiring circuits for the generator and other components on some models. Refer to the appropriate wiring information for the location of the proper battery cable wire harness diagrams. The wiring information also includes proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

The battery cables connect the battery terminal posts to the vehicle electrical system. These cables also provide a return path for electrical current generated by the charging system for restoring the voltage potential of the battery. The female battery terminal clamps on the ends of the battery cable wires provide a strong and reliable connection of the battery cable to the battery terminal posts. The terminal pinch bolts allow the female terminal clamps to be tightened around the male terminal posts on the top of the battery. The eyelet terminals secured to the ends of the

battery cable wires opposite the female battery terminal clamps provide secure and reliable connection of the battery to the vehicle electrical system.

DIAGNOSIS AND TESTING

BATTERY CABLES

A voltage drop test will determine if there is excessive resistance in the battery cable terminal connections or the battery cables. If excessive resistance is found in the battery cable connections, the connection point should be disassembled, cleaned of all corrosion or foreign material, then reassembled. Following reassembly, check the voltage drop for the battery cable connection and the battery cable again to confirm repair.

When performing the voltage drop test, it is important to remember that the voltage drop is giving an indication of the resistance between the two points at which the voltmeter probes are attached. **EXAMPLE:** When testing the resistance of the battery positive cable, touch the voltmeter leads to the battery positive cable terminal clamp and to the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud. If you probe the battery positive terminal post and the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud, you are reading the combined voltage drop in the battery positive cable terminal clamp-to-terminal post connection and the battery positive cable.

TESTING

VOLTAGE DROP TEST

WARNING: IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

WARNING: EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

WARNING: THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

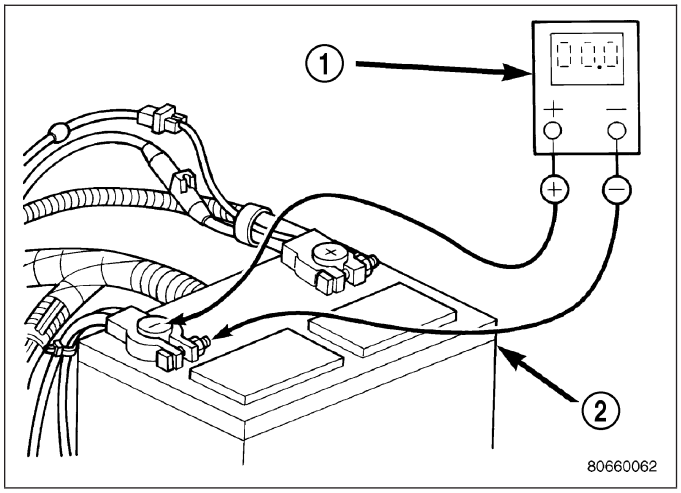
WARNING: IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.

The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing this test, be certain that the following procedures are accomplished:

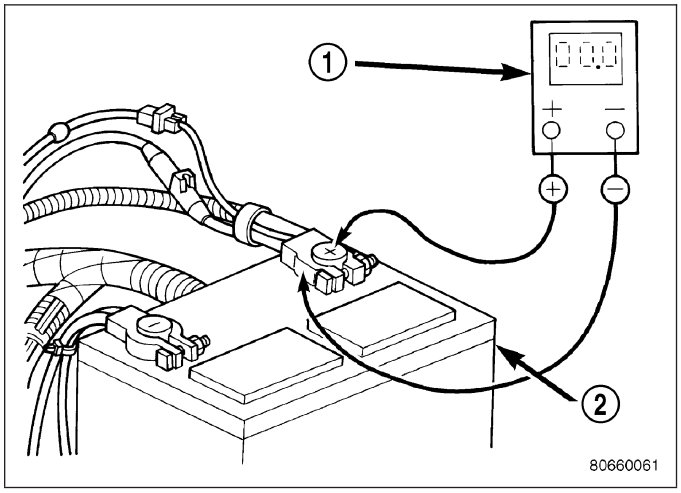
- The battery is fully-charged and tested, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER).
- Fully engage the parking brake.
- If the vehicle is equipped with an automatic transmission, place the gearshift selector lever in the Park position. If the vehicle is equipped with a manual transmission, place the gearshift selector lever in the Neutral position and block the clutch pedal in the fully depressed position.
- Verify that all lamps and accessories are turned off.

- To prevent a gasoline engine from starting, remove the Automatic ShutDown (ASD) relay. The ASD relay is located in the Integrated Power Module (IPM), in the engine compartment. See the fuse and relay layout label on the underside of the IPM cover for ASD relay identification and location.

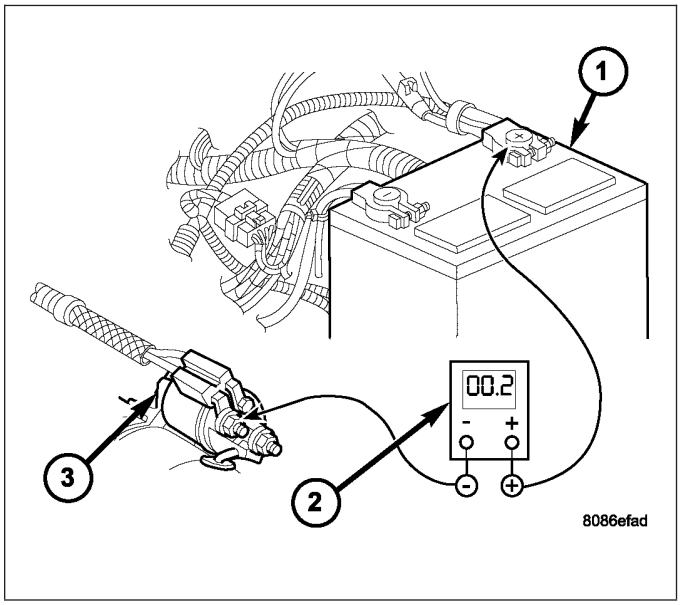
1. Connect the positive lead of the voltmeter (1) to the battery negative terminal post. Connect the negative lead of the voltmeter (1) to the battery negative cable terminal clamp. Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery negative cable terminal clamp and the battery negative terminal post.



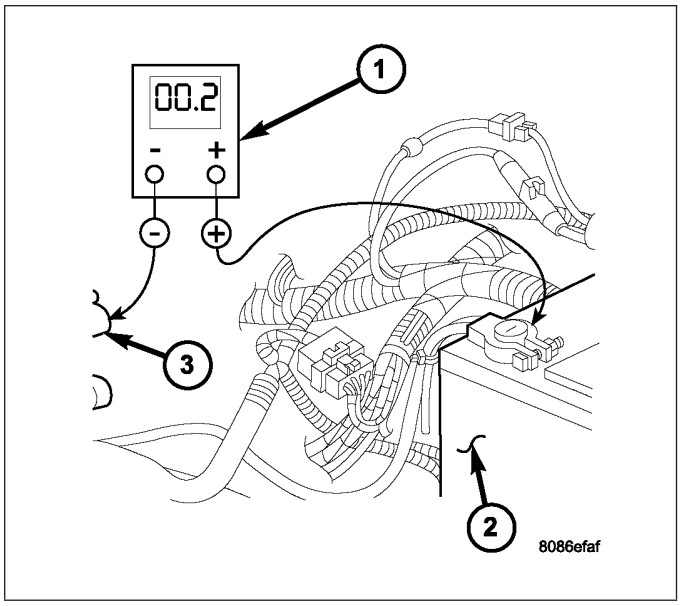
2. Connect the positive lead of the voltmeter (1) to the battery positive terminal post. Connect the negative lead of the voltmeter to the battery positive cable terminal clamp. Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery positive cable terminal clamp and the battery positive terminal post.



3. Connect the voltmeter (2) to measure between the battery positive cable terminal clamp (1) and the starter solenoid (3) B(+) terminal stud. Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery positive cable eyelet terminal connection at the starter solenoid B(+) terminal stud. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery positive cable.



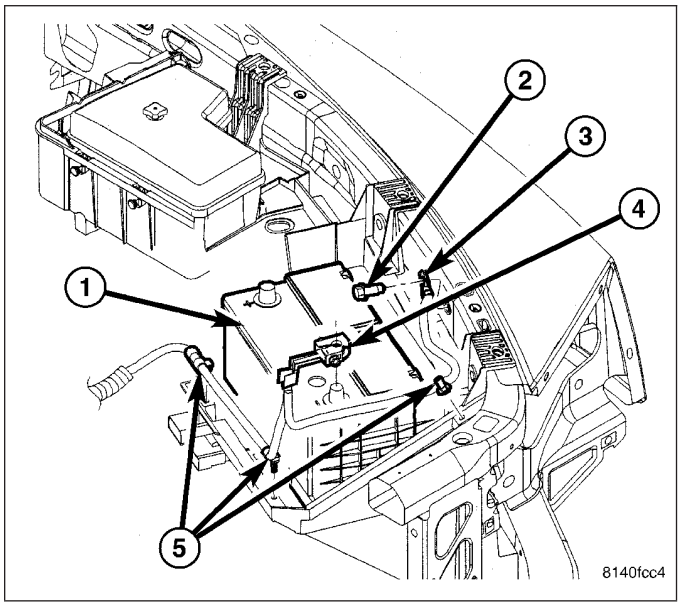
4. Connect the voltmeter (1) to measure between the battery (2) negative cable terminal clamp and a good clean ground (3) on the engine block. Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery negative cable eyelet terminal connection to the engine block. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery negative cable.



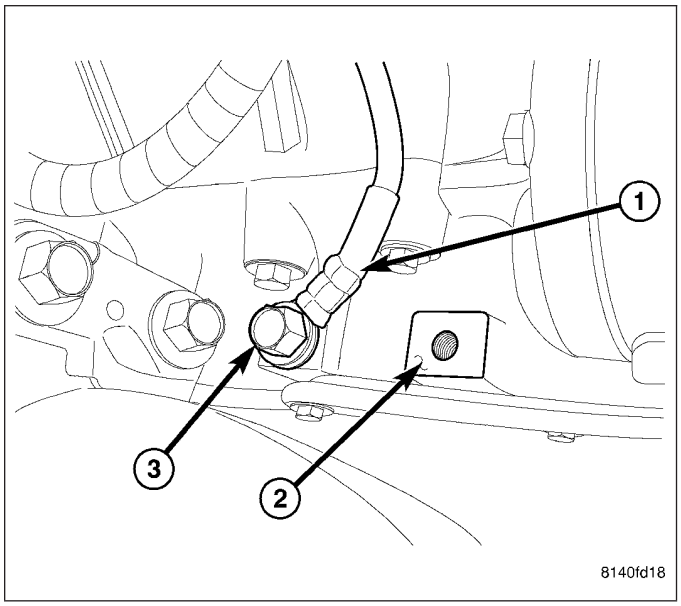
REMOVAL

NEGATIVE

1. Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.
2. Disconnect and isolate the battery negative cable terminal clamp (4).
3. Remove the bolt (2) securing the negative cable eyelet (3) to the left front fender.
4. One at a time, trace the battery cable retaining pushpins (5) , fasteners and routing clips until the cable is free from the vehicle.

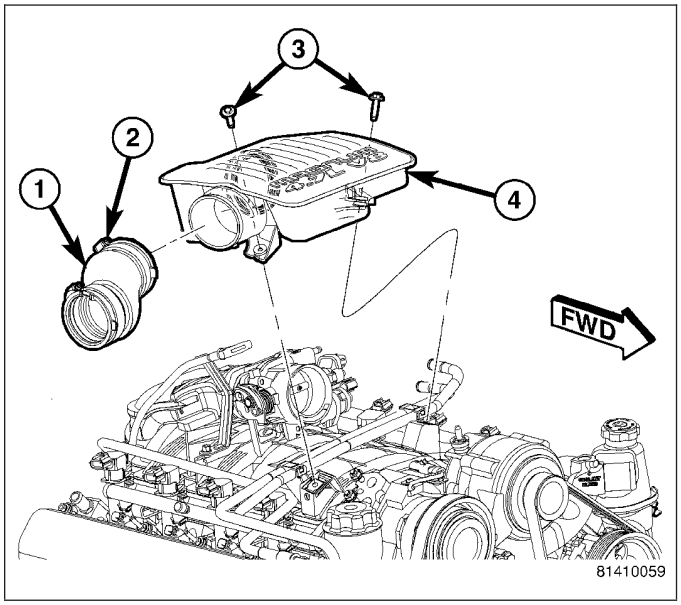


5. Raise the vehicle on a hoist, (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)
6. Remove the bolt (3) securing the negative cable (1) to the engine (2).
7. Separate the cable from the engine harness conduit.
8. Remove the battery negative cable from the vehicle.

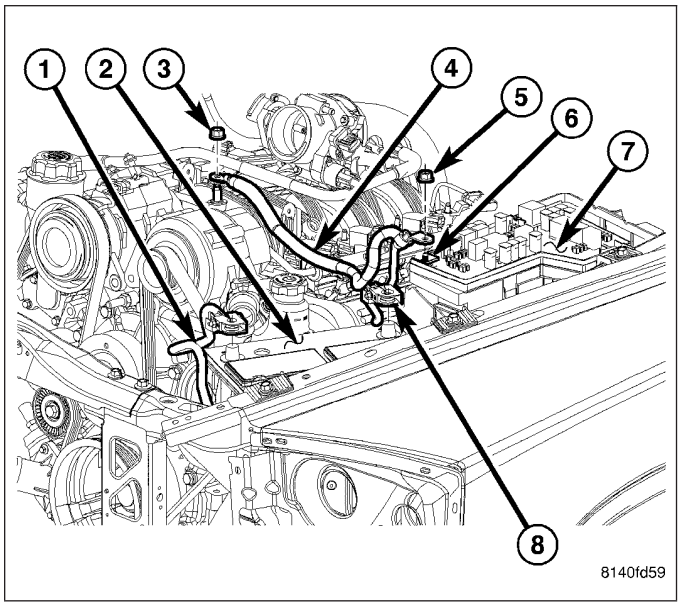


POSITIVE

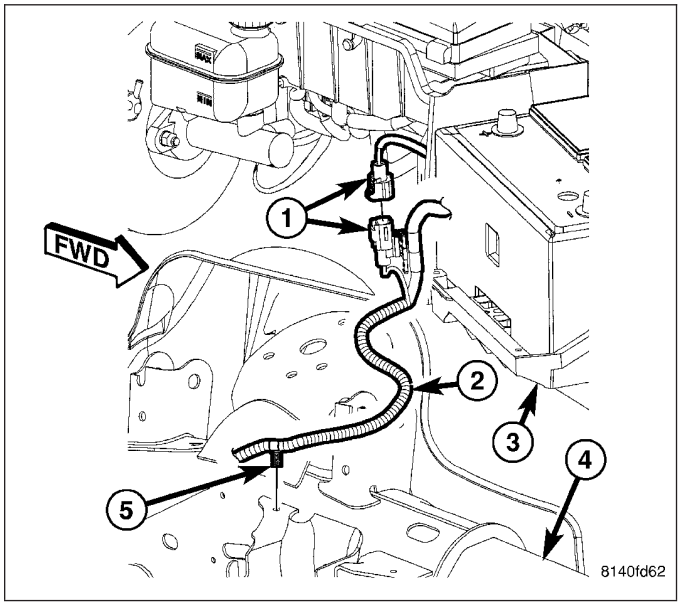
1. Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.
2. Disconnect and isolate the battery negative cable.
3. Loosen the band clamp (2) on the air inlet tube (1) and remove the bolts (3) from the air intake resonator (4). Remove the resonator from the vehicle.



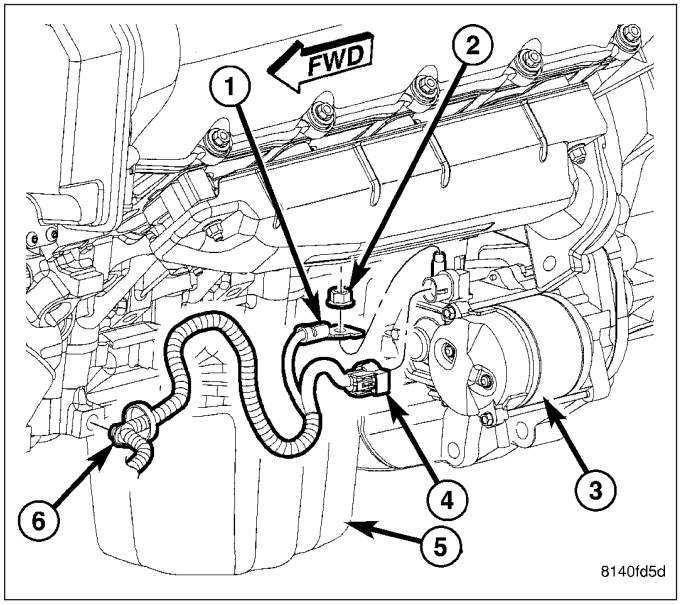
4. Disconnect the battery positive cable terminal clamp (8).
5. Remove the nut (5) securing the cable to the Integrated Power Module (IPM) (7) stud (6).
6. Lift the terminal cap and remove the nut (3) securing the cable (4) to the alternator.



7. Disconnect the starter solenoid wire harness connector (1).
8. Disconnect the battery cable retaining pushpin (5) securing the cable to the left frame rail (4).



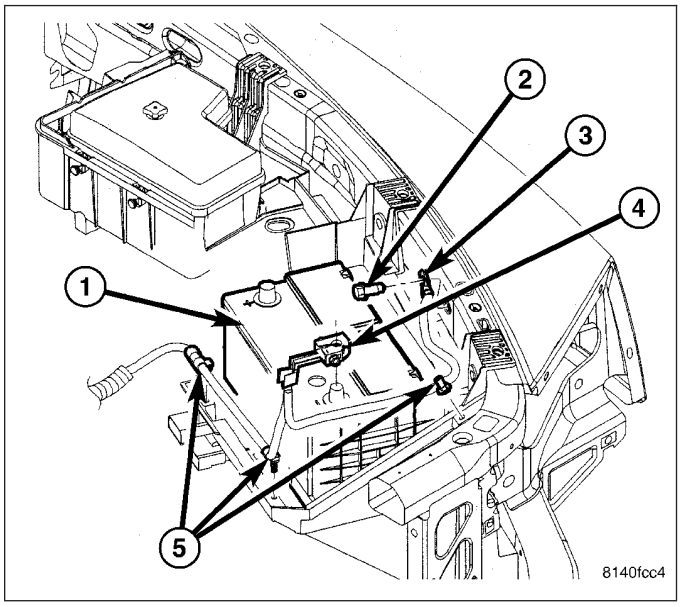
9. Raise the vehicle on a hoist, (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE).
10. Remove the nut (2) securing the cable (1) to the starter solenoid (3).
11. Disconnect the battery cable retaining pushpin (6) securing the cable to the engine block.
12. Lower the vehicle.
13. Remove the battery positive cable from the vehicle.



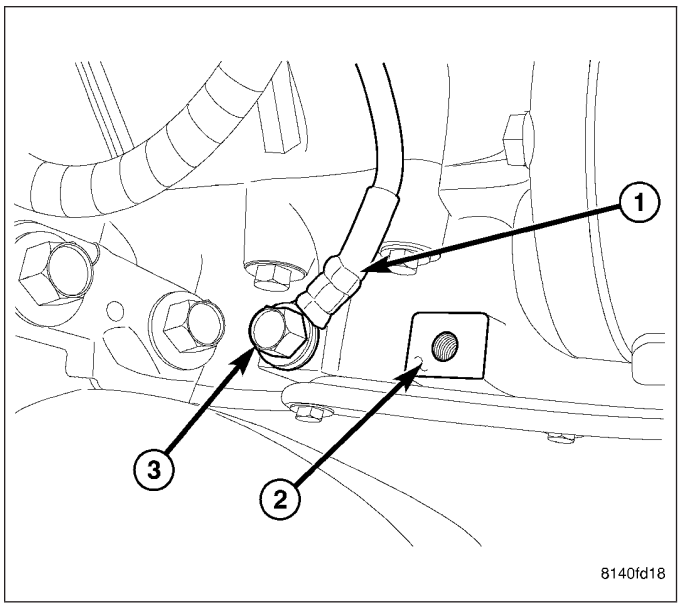
INSTALLATION

NEGATIVE

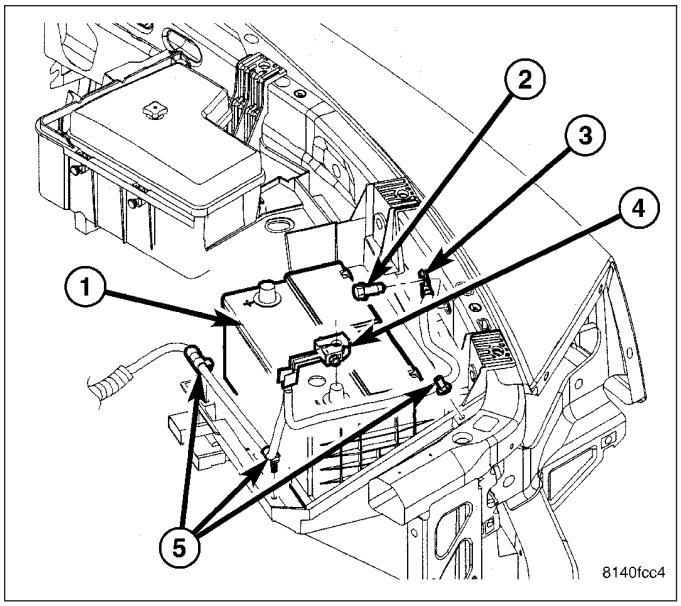
1. Position the battery negative cable (4) in the vehicle and into the engine harness conduit.
2. One at a time, install the battery cable retaining pushpins (5) , fasteners and routing clips until the cable is secure in the vehicle.
3. Install the bolt (2) securing the negative cable eyelet (3) to the left front fender.



4. Raise the vehicle on a hoist, (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE).
5. Install the bolt (3) securing the negative cable (1) to the engine block (2).

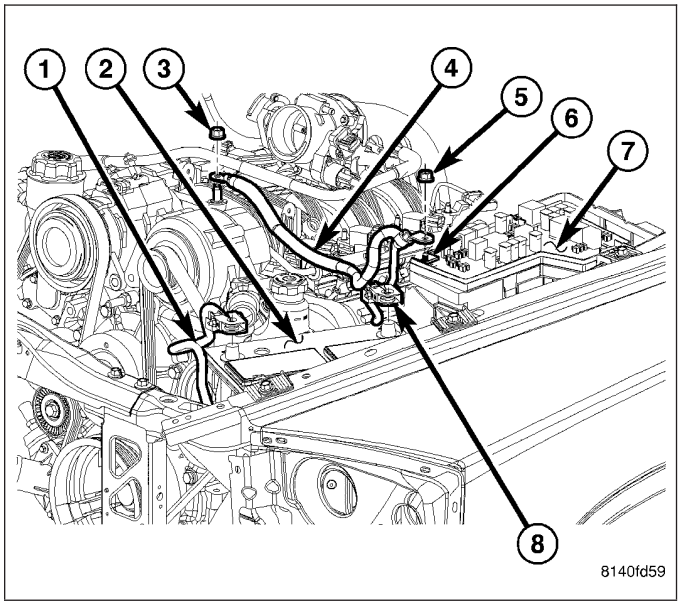


6. Lower the vehicle.
7. Connect the battery negative cable terminal clamp (4).
8. Check the vehicle for normal operation.

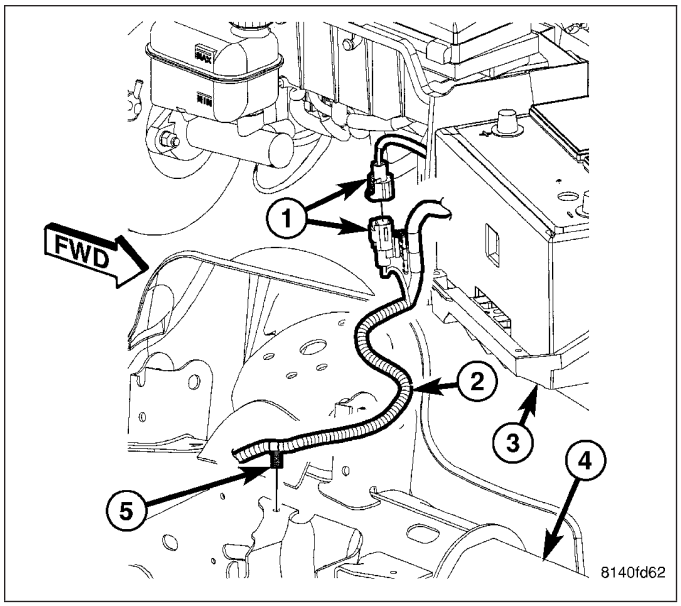


POSITIVE

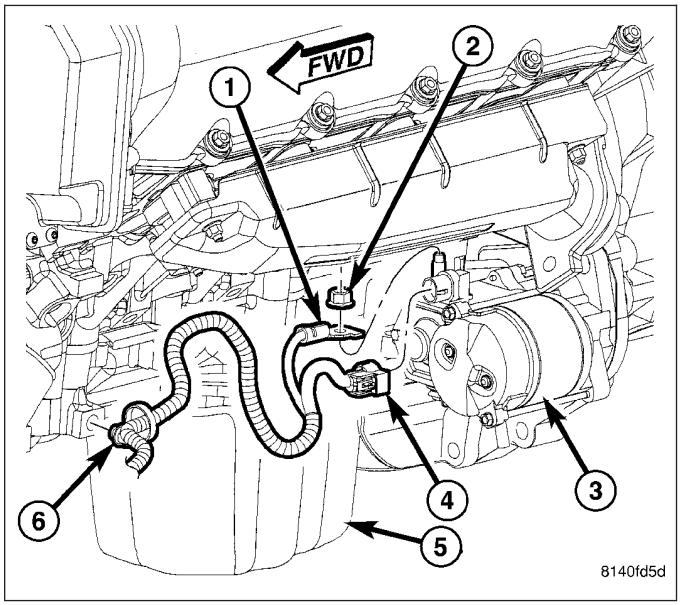
1. Position the battery positive cable (4 and 8) in the vehicle.
2. Install the nut (5) securing the cable to the Integrated Power Module (IPM) (7) stud (6).
3. Install the nut (3) securing the cable (4) to the alternator.



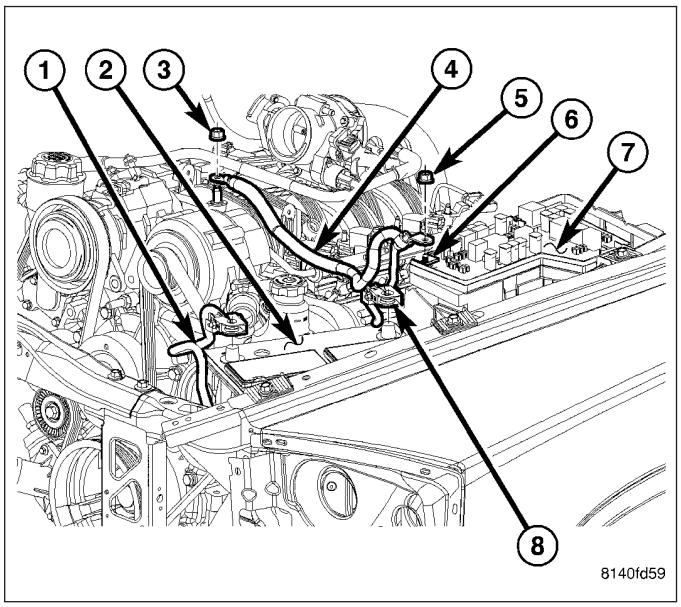
4. Install the cable (5) pushpin into the left frame rail (4).
5. Connect the starter solenoid wire harness connector (1).



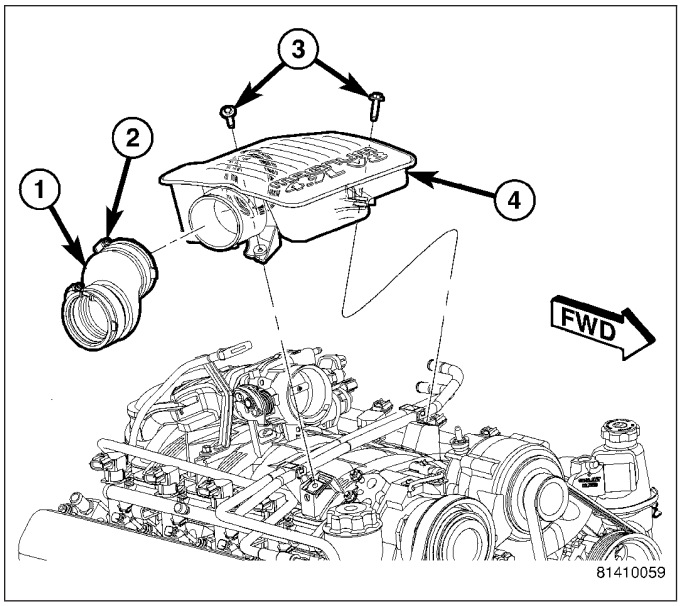
6. Raise the vehicle on a hoist, (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE).
7. Install the nut (2) securing the cable (1) to the starter solenoid (3).
8. Connect the battery cable retaining pushpin (6) securing the cable to the engine block.
9. Lower the vehicle.



10. Connect the battery positive cable terminal clamp (8).



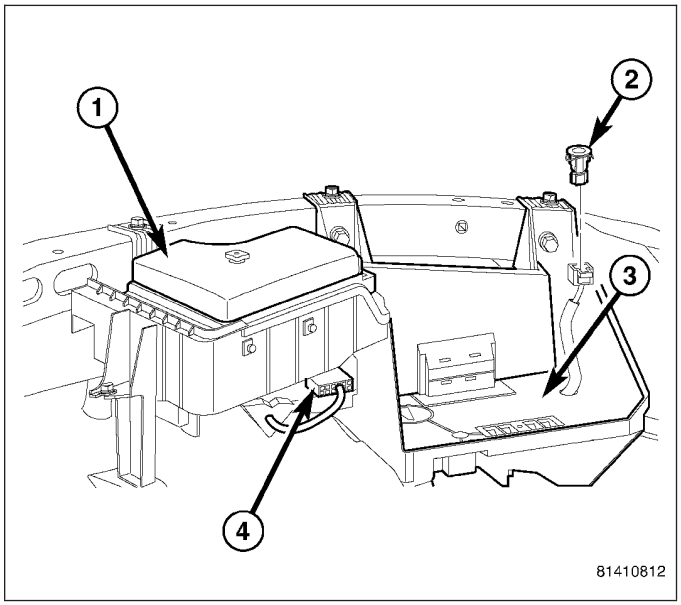
11. Position the resonator (4) into the vehicle. Install the bolts (3) into the air intake resonator (4) and tighten the band clamp (2) on the air inlet tube (1).
12. Connect the battery negative cable terminal clamp.
13. Check the vehicle for normal operation.



BATTERY TRAY

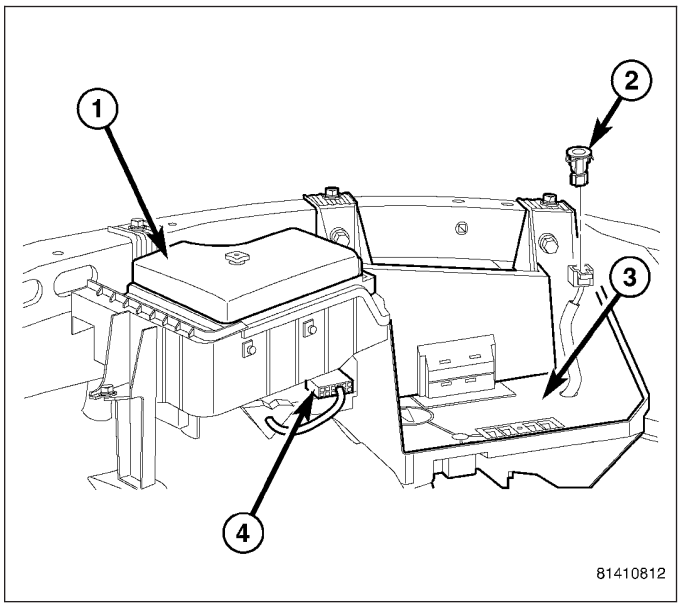
DESCRIPTION

The molded plastic battery tray (3) is located in the left front corner of the engine compartment. On this vehicle, the battery tray also provides an anchor point for the anti-lock brake controller (4), battery temperature sensor (2) and the Integrated Power Module (IPM) (1). The battery hold down hardware is contained within the battery tray. A hole in the bottom of the battery tray is fitted with a battery temperature sensor. (Refer to 8 - ELECTRICAL/CHARGING/BATTERY TEMPERATURE SENSOR - DESCRIPTION) for additional information on the battery temperature sensor.

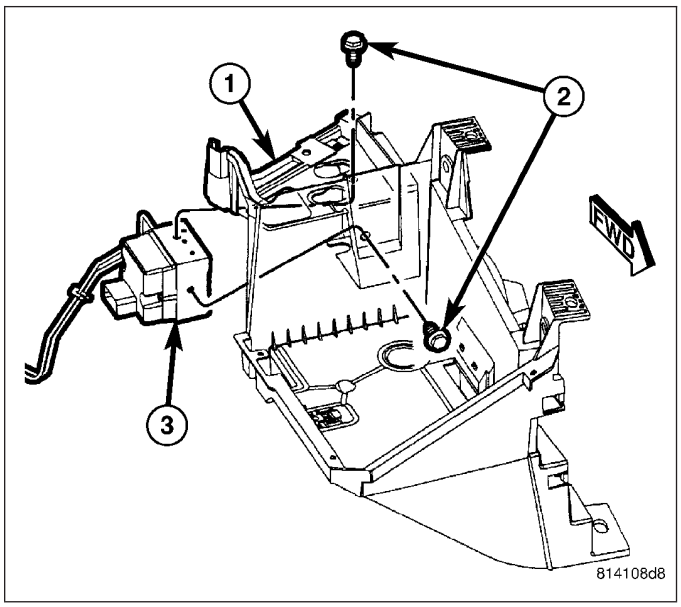


REMOVAL

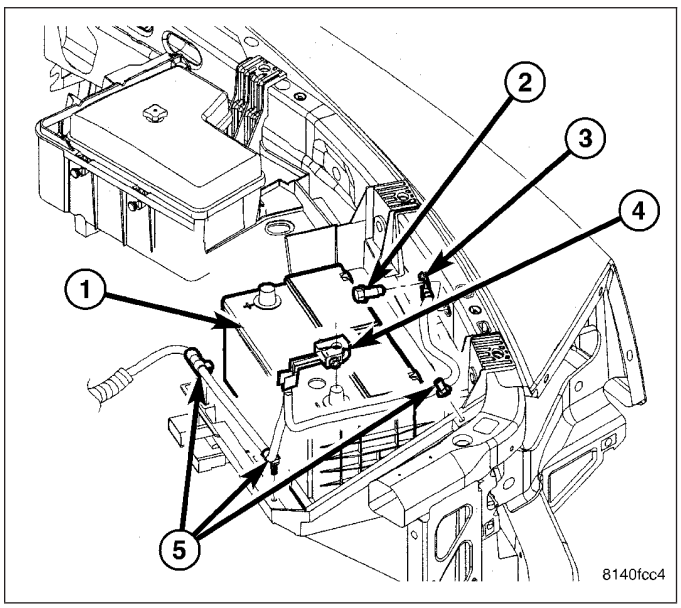
1. Disconnect and isolate the battery negative cable.
2. Remove the battery, (Refer to 8 - ELECTRICAL/ BATTERY SYSTEM/BATTERY - REMOVAL).
3. Remove the battery temperature sensor (2) from the battery tray (3), (Refer to 8 - ELECTRICAL/ CHARGING/BATTERY TEMPERATURE SENSOR - REMOVAL).
4. Remove the Integrated Power Module (IPM) (1), (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - REMOVAL).



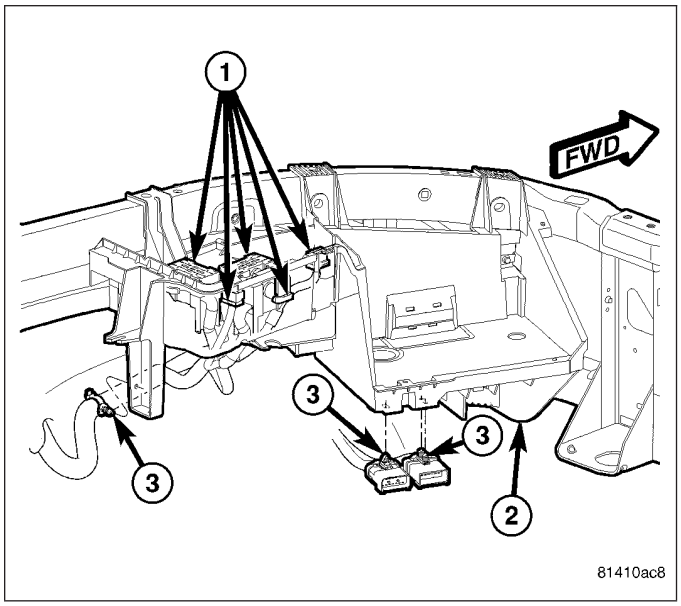
5. Remove the Antilock Brake System (ABS) Hydraulic Control Unit (HCU) (3) bolts (2) from the battery tray (1).



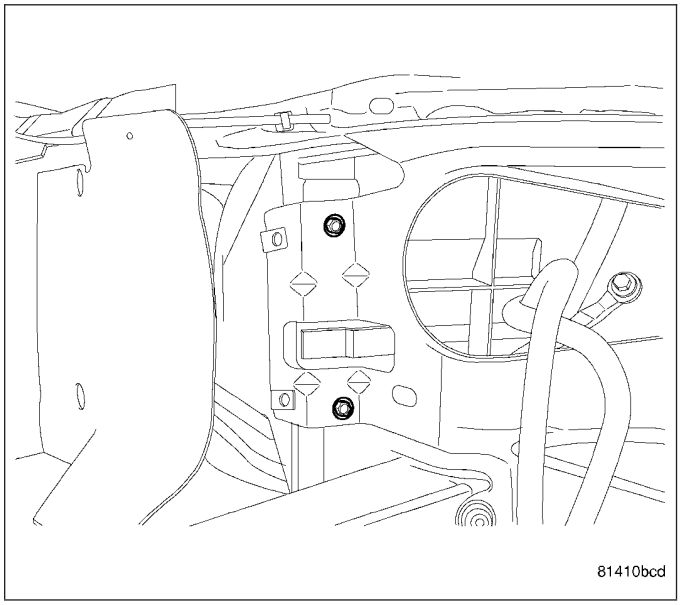
6. Remove the battery negative cable retaining push-pins (5) from the battery tray.



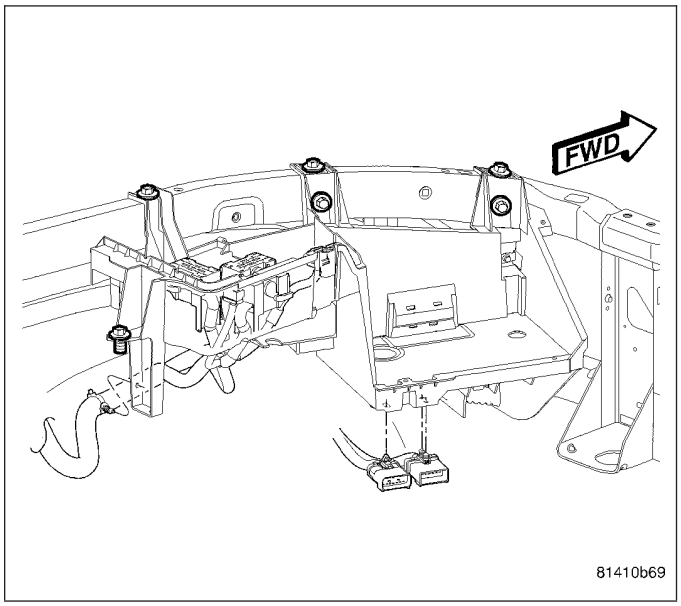
7. Remove the engine compartment wire harness retaining pushpins (3) from the battery tray (2).



8. Remove the left headlamp assembly, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/ HEADLAMP UNIT - REMOVAL).
9. Remove the battery tray bolts.



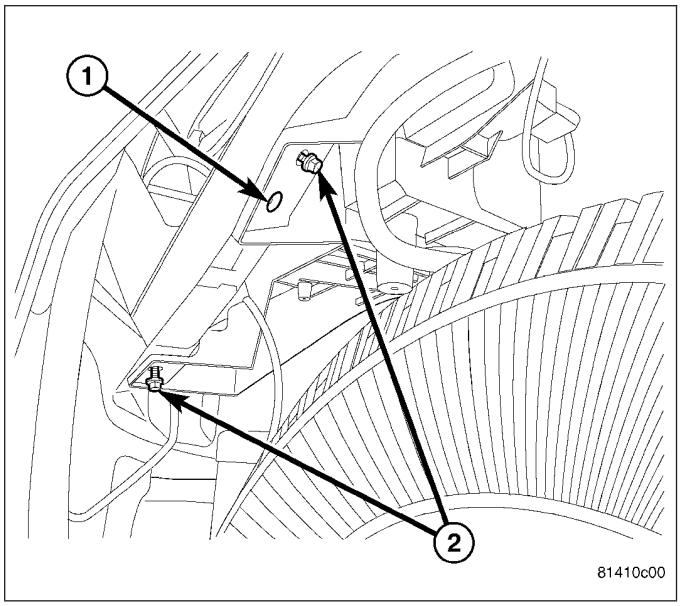
10. Remove the six upper battery tray bolts.



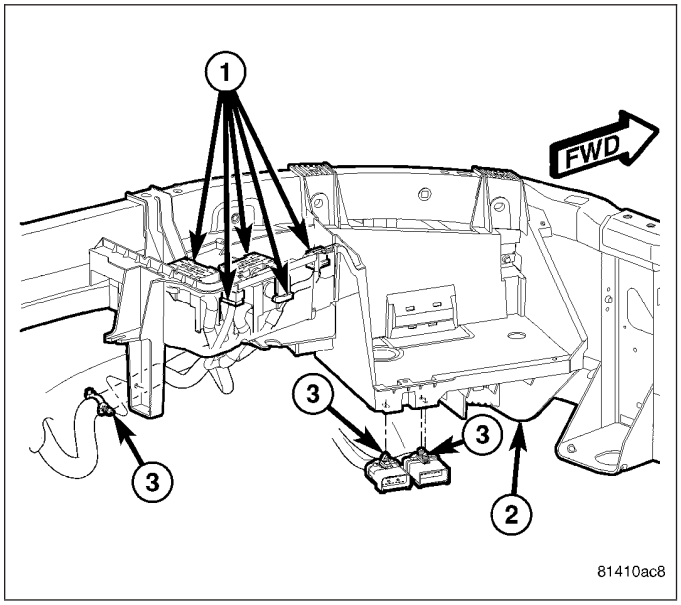
11. Raise the vehicle on a hoist, (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)
12. Remove the left front fender liner, (Refer to 23 - BODY/EXTERIOR/LF WHEELHOUSE SPLASH SHIELD - DESCRIPTION).

NOTE: The middle bolt hole is to remain open for a front fender liner fastener (1).

13. Remove the lower battery tray mounting bolts (2).

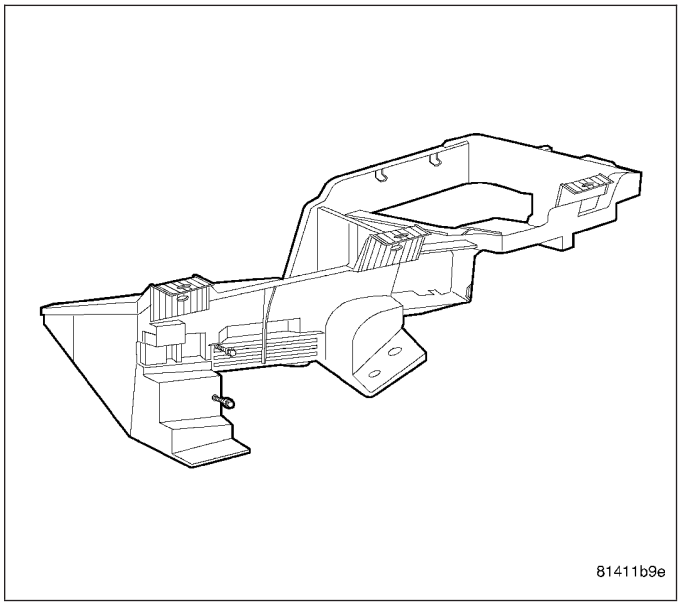


14. Lower the vehicle.
15. Remove the battery tray (2) from the vehicle.

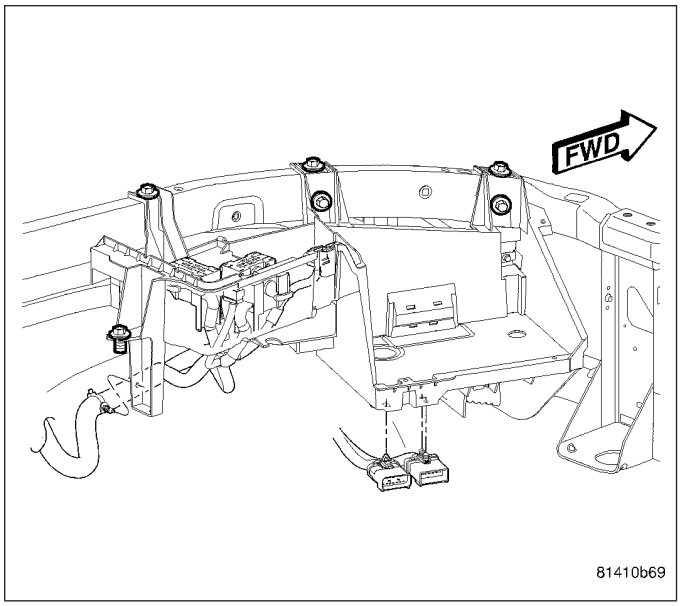


INSTALLATION

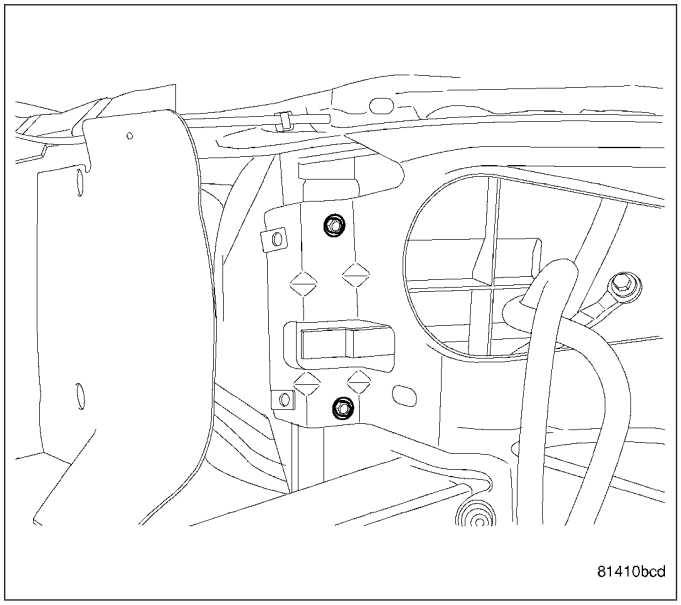
1. Clean and inspect the battery tray, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING).



2. Position the battery tray into the vehicle.
3. Install the six upper battery tray bolts hand tight.



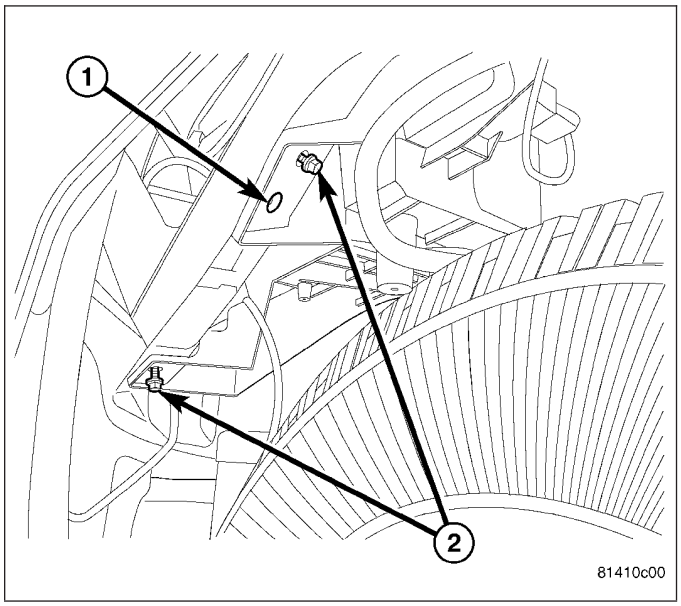
4. Install the two front battery tray bolts hand tight.



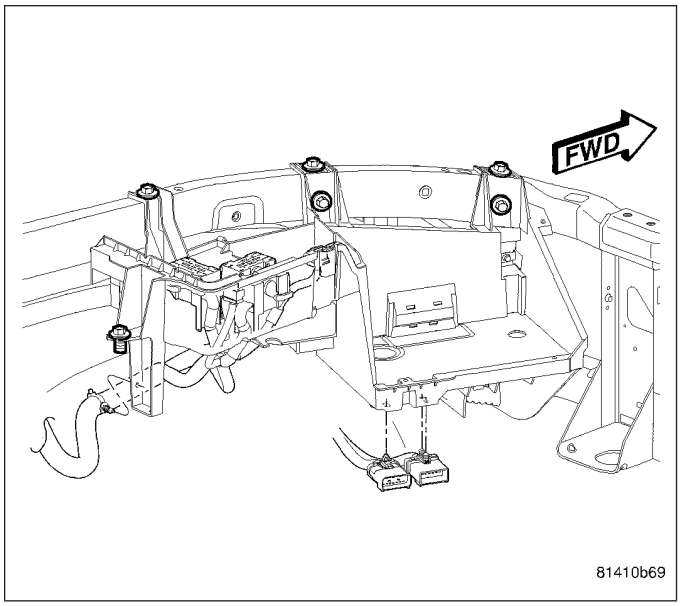
5. Raise the vehicle on a hoist, (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)

NOTE: The middle bolt hole is to remain open for a front fender liner fastener (1).

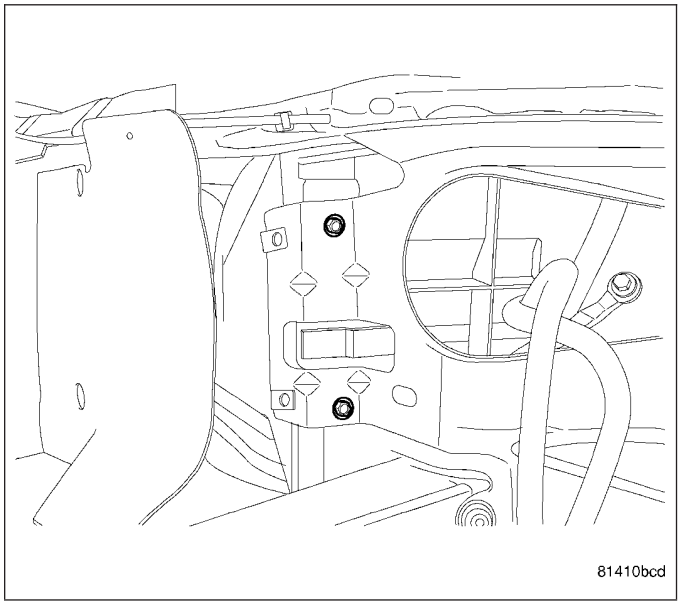
6. Install the two lower battery tray bolts (2). Tighten the bolts to 10.2 N·m (90 in. lbs.).
7. Install the left front fender liner, (Refer to 23 - BODY/EXTERIOR/LF WHEELHOUSE SPLASH SHIELD - DESCRIPTION).



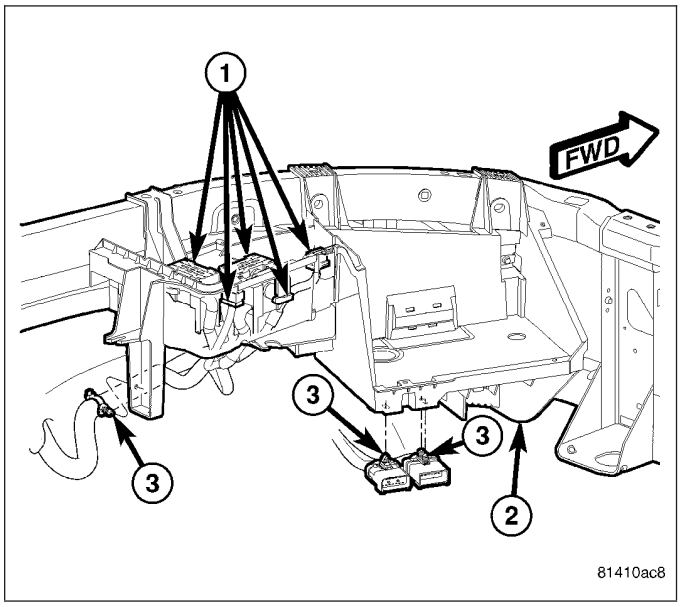
8. Lower the vehicle.
9. Tighten the upper battery tray bolts to 10.2 N·m (90 in. lbs.).



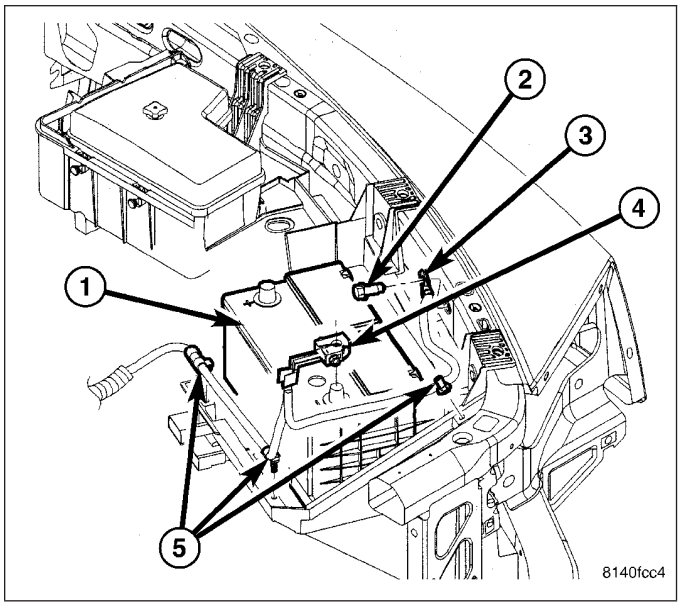
10. Tighten the two front battery tray bolts to 8.5 N·m (75 in. lbs.).



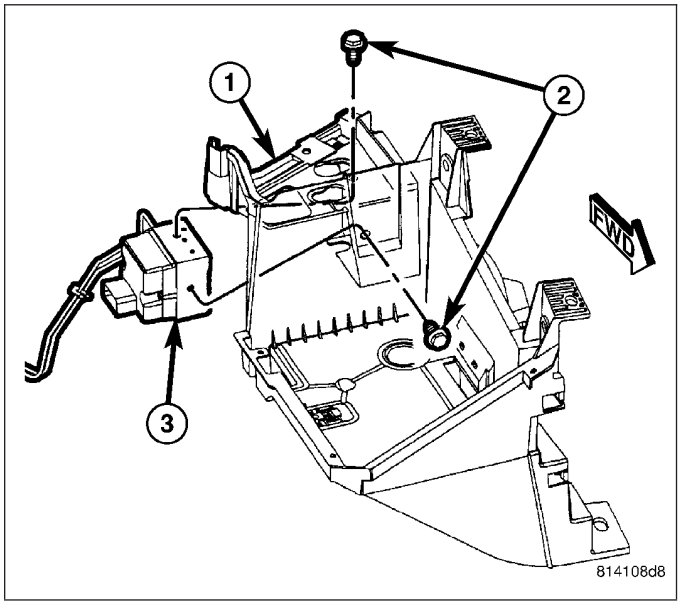
11. Install the engine compartment wire harness retaining pushpins (3) to the battery tray (2).



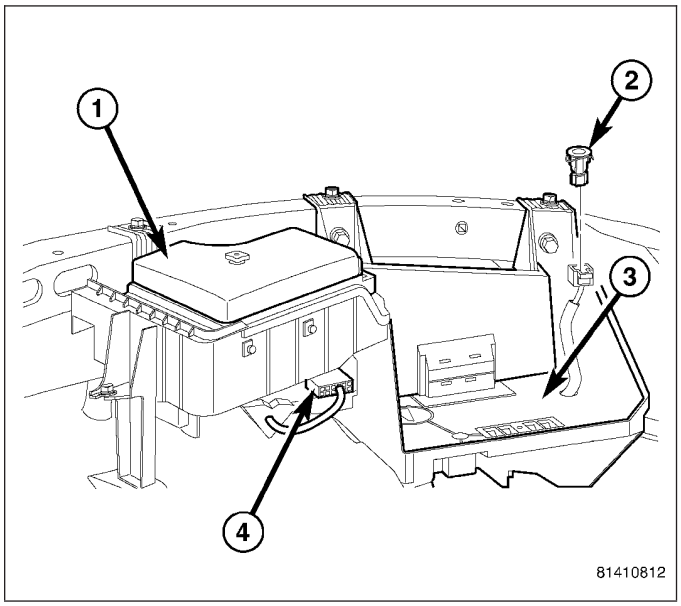
12. Install the battery negative cable retaining push-pins (5) to the battery tray.



13. Install the Antilock Brake System (ABS) Hydraulic Control Unit (HCU) (3) bolts (2) into the battery tray (1). Tighten the bolts to 18 N·m (160 in. lbs.).



14. Install the battery temperature sensor (2) into the battery tray (3).
15. Install the Integrated Power Module (IPM) (1), (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - INSTALLATION).
16. Install the battery, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).
17. Verify proper vehicle operation.



CHARGING

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CHARGING

DESCRIPTION

The charging system consists of:

- Generator
- Generator decoupler pulley (if equipped)
- Electronic Voltage Regulator (EVR) circuitry within the Powertrain Control Module (PCM)
- Ignition switch
- Battery (refer to Battery for information)
- Battery temperature sensor
- Generator lamp (if equipped)
- Check gauges lamp (if equipped)
- Voltmeter (refer to Instrument Cluster for information)
- Wiring harness and connections (refer to Wiring for information)

OPERATION

The charging system is turned on and off with the ignition switch. The system is on when the engine is running and the ASD relay is energized. When the ASD relay is on, voltage is supplied to the ASD relay sense circuit at the PCM. This voltage is connected through the PCM and supplied to one of the generator field terminals (Gen. Source +) at the back of the generator.

The amount of DC current produced by the generator is controlled by the EVR (field control) circuitry contained within the PCM. This circuitry is connected in series with the second rotor field terminal and ground.

A battery temperature sensor, located in the battery tray housing, is used to sense battery temperature. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. This is done by cycling the ground path to control the strength of the rotor magnetic field. The PCM then compensates and regulates generator current output accordingly.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including EVR (field control) circuitry, are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for certain failures it detects.

The Check Gauges Lamp (if equipped) monitors: **charging system voltage,** engine coolant temperature and engine oil pressure. If an extreme condition is indicated, the lamp will be illuminated. This is done as a reminder to check the three gauges. The signal to activate the lamp is sent via the CAN bus circuits. The lamp is located on the instrument panel. Refer to Instrument Cluster for additional information.

DIAGNOSIS AND TESTING - CHARGING SYSTEM

The following procedures may be used to diagnose the charging system if:

- the check gauges lamp (if equipped) is illuminated with the engine running
- the voltmeter (if equipped) does not register properly
- an undercharged or overcharged battery condition occurs.

Remember that an undercharged battery is often caused by:

- accessories being left on with the engine not running
- a faulty or improperly adjusted switch that allows a lamp to stay on. Refer to Ignition-Off Draw Test in the Battery section for more information.

INSPECTION

The Powertrain Control Module (PCM) monitors critical input and output circuits of the charging system, making sure they are operational. A Diagnostic Trouble Code (DTC) is assigned to each input and output circuit monitored by the On-Board Diagnostic (OBD) system. Some charging system circuits are checked continuously, and some are checked only under certain conditions.

Refer to Diagnostic Trouble Codes in; Powertrain Control Module; Electronic Control Modules for more DTC information. This will include a complete list of DTC's including DTC's for the charging system.

To perform a complete test of the charging system, refer to the appropriate Diagnostic Test Procedures and use a diagnostic scan tool. Perform the following inspections before attaching the scan tool.

1. Inspect the battery condition. Refer to Battery for procedures.
2. Inspect condition of battery cable terminals, battery posts, connections at engine block, starter solenoid and relay. They should be clean and tight. Repair as required.
3. Inspect all fuses in both the fuseblock and Power Distribution Center (PDC) for tightness in receptacles. They should be properly installed and tight. Repair or replace as required.
4. Inspect generator mounting bolts for tightness. Replace or tighten bolts if required. Refer to the Generator Removal/Installation section of this group for torque specifications.
5. Inspect generator drive belt condition and tension. Tighten or replace belt as required. Refer to Belt Tension Specifications in Cooling System.
6. Inspect automatic belt tensioner (if equipped). Refer to Cooling System for information.
7. Inspect generator electrical connections at generator field, battery output, and ground terminal (if equipped). Also check generator ground wire connection at engine (if equipped). They should all be clean and tight. Repair as required.

SPECIFICATIONS

GENERATOR RATINGS

TYPE	PART NUMBER	RATED SAE AMPS	ENGINES
DENSO	56029700AA	136	3.7L / 4.7L
DENSO	56029914AA	160	3.7L / 4.7L
BOSCH	56041120AC	136	3.7L / 4.7L

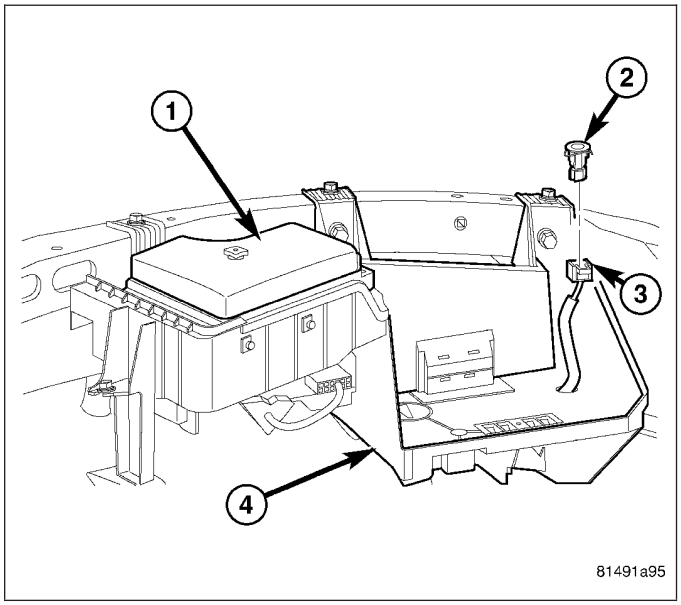
TORQUE - CHARGING SYSTEM

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Generator Vertical Mounting Bolt - 3.7L / 4.7L Engines	55	40	-
Generator (long) Horizontal Mounting Bolt - 3.7L / 4.7L Engines	55	40	-
Generator (short) Horizontal Mounting Bolt - 3.7L / 4.7L Engines	74	55	-
Generator B+ Output Cable Terminal Nut	12	-	108

SENSOR-BATTERY TEMPERATURE

DESCRIPTION

The Battery Temperature Sensor (BTS) (2) is attached to the battery tray (4) located under the battery.



OPERATION

The Battery Temperature Sensor (BTS) is used to determine the battery temperature and control battery charging rate. This temperature data, along with data from monitored line voltage, is used by the Powertrain Control Module (PCM) to vary the battery charging rate. System voltage will be higher at colder temperatures and is gradually reduced at warmer temperatures.

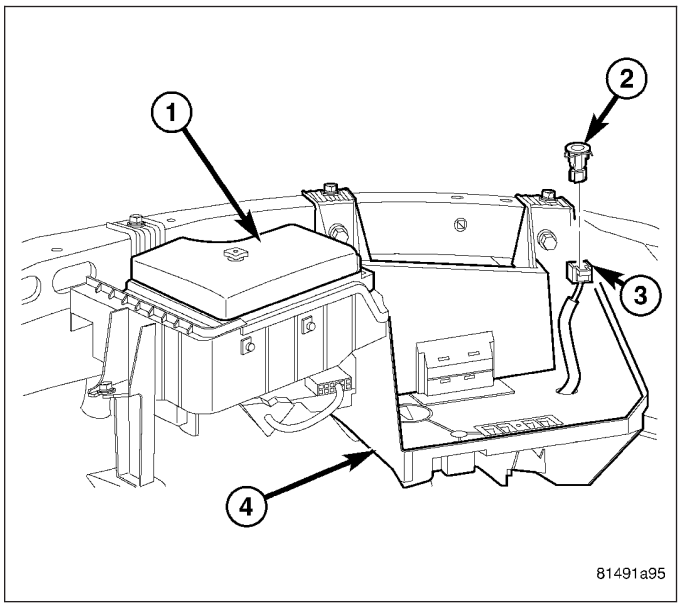
The PCM sends 5 volts to the sensor and is grounded through the sensor return line. As temperature increases, resistance in the sensor decreases and the detection voltage at the PCM increases.

The BTS is also used for OBD II diagnostics. Certain faults and OBD II monitors are either enabled or disabled, depending upon BTS input (for example, disable purge and enable Leak Detection Pump (LDP) and O2 sensor heater tests). Most OBD II monitors are disabled below 20 degrees F.

REMOVAL

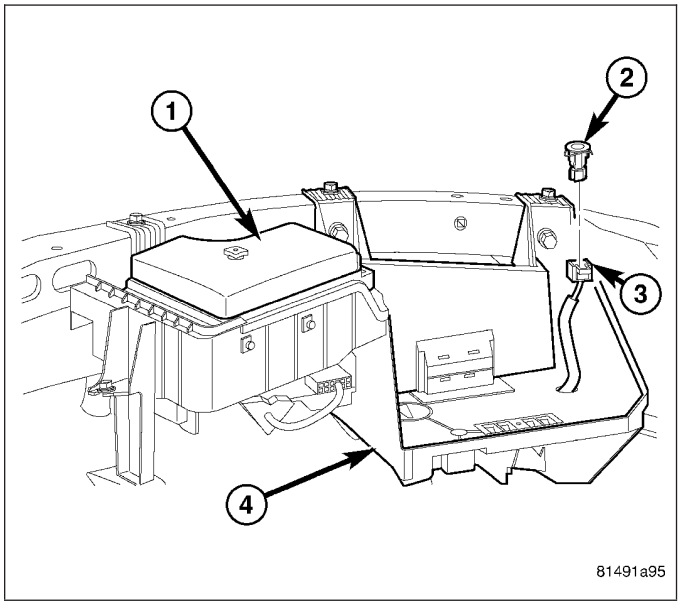
The battery temperature sensor (2) is located under vehicle battery and is attached to a mounting hole on battery tray (4).

1. Remove battery. Refer to Battery for procedures.
2. Disconnect sensor (2) from engine wire harness (3).
3. Pry sensor straight up from battery tray mounting hole.



INSTALLATION

1. Feed engine wire harness (3) through hole in top of battery tray and attach sensor (2).
2. Press sensor (2) into hole of battery tray (4).
3. Install battery. Refer to Battery for procedures.



GENERATOR

DESCRIPTION

The generator is belt-driven by the engine using a serpentine type drive belt. It is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced.

OPERATION

As the energized rotor begins to rotate within the generator, the spinning magnetic field induces a current into the windings of the stator coil. Once the generator begins producing sufficient current, it also provides the current needed to energize the rotor.

The stator winding connections deliver the induced alternating current to 3 positive and 3 negative diodes for rectification. From the diodes, rectified direct current is delivered to the vehicle electrical system through the generator battery terminal.

Although the generators appear the same externally, different generators with different output ratings are used on this vehicle. Be certain that the replacement generator has the same output rating and part number as the original unit. Refer to Generator Ratings for amperage ratings and part numbers.

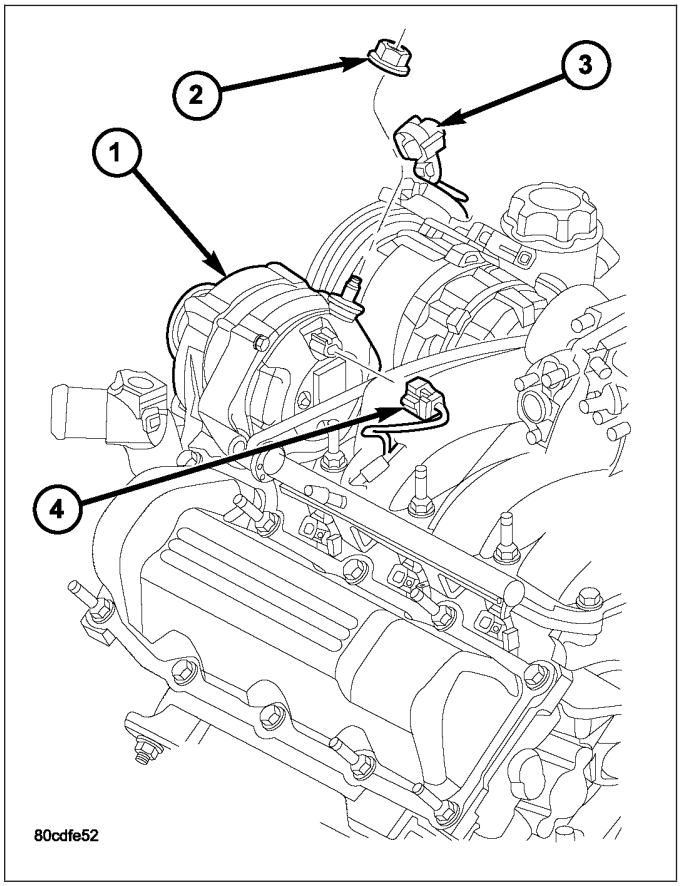
Noise emitting from the generator may be caused by: worn, loose or defective bearings; a loose or defective drive pulley; incorrect, worn, damaged or misadjusted fan drive belt; loose mounting bolts; a misaligned drive pulley or a defective stator or diode.

REMOVAL

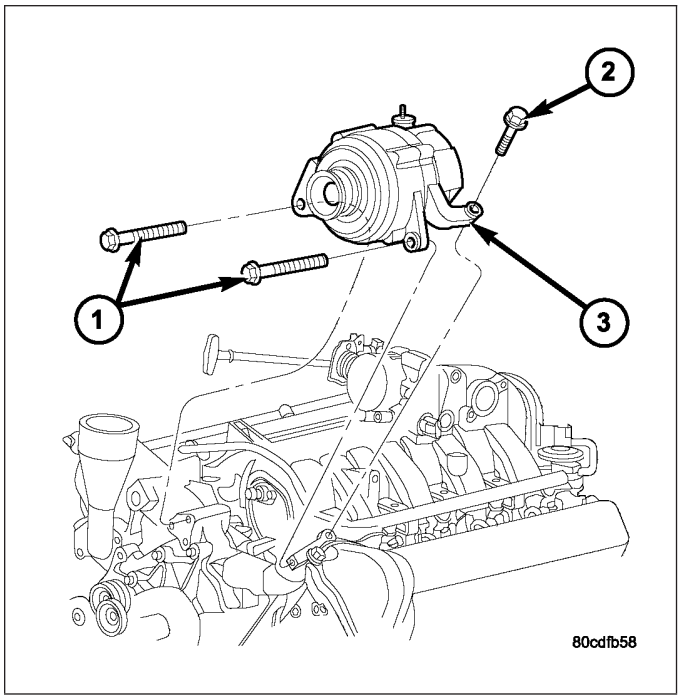
3.7L / 4.7L

WARNING: DISCONNECT NEGATIVE CABLE FROM BATTERY BEFORE REMOVING BATTERY OUTPUT WIRE (B+ WIRE) FROM GENERATOR. FAILURE TO DO SO CAN RESULT IN INJURY OR DAMAGE TO ELECTRICAL SYSTEM.

1. Disconnect negative battery cable at battery.
2. Remove generator drive belt. Refer to 7, Cooling System for procedure.
3. Unsnap plastic insulator cap (3) from B+ output terminal.
4. Remove B+ terminal mounting nut (2) at rear of generator. Disconnect terminal from generator.
5. Disconnect field wire connector (4) at rear of generator by pushing on connector tab.



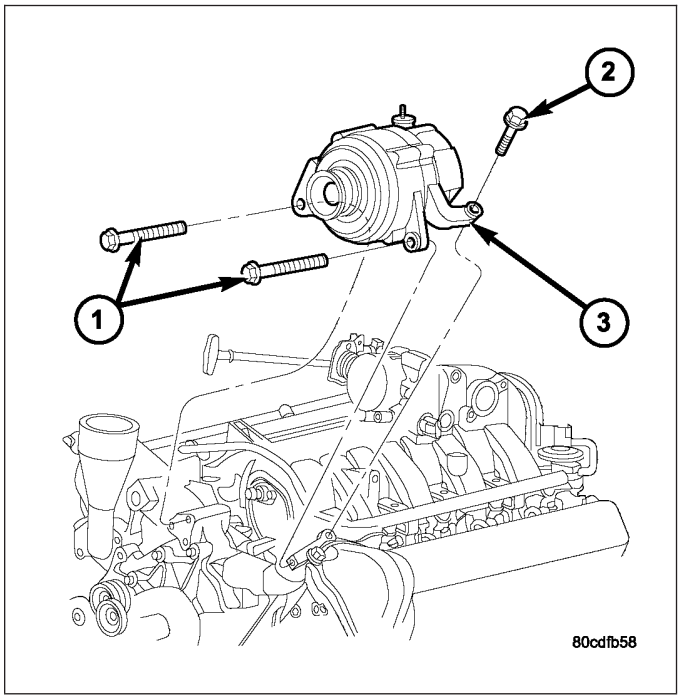
6. Remove 1 rear vertical generator mounting bolt (2).
7. Remove 2 front horizontal generator mounting bolts (1).
8. Remove generator from vehicle.



INSTALLATION

3.7L / 4.7L

1. Position generator (3) to engine and install 2 horizontal bolts (1) and 1 vertical bolt (2).
2. Tighten all 3 bolts. Refer to Torque Specifications.

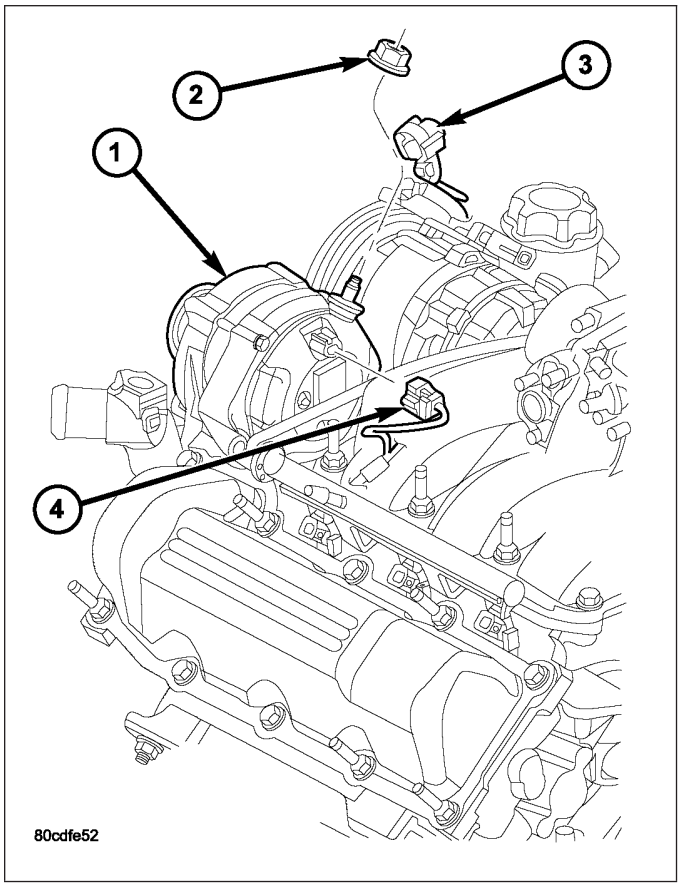


3. Snap field wire connector (4) into rear of generator.
4. Install B+ terminal eyelet to generator output stud. Tighten mounting nut (2). Refer to Torque Specifications.

CAUTION: Never force a belt over a pulley rim using a screwdriver. The synthetic fiber of the belt can be damaged.

CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. The water pump may be rotating in the wrong direction if the belt is installed incorrectly, causing the engine to overheat. Refer to belt routing label in engine compartment, or refer to Belt Schematics in 7, Cooling System.

5. Install generator drive belt. Refer to 7, Cooling System for procedure.
6. Install negative battery cable to battery.



REGULATOR, VOLTAGE

DESCRIPTION

The Electronic Voltage Regulator (EVR) is not a separate component. It is actually a voltage regulating circuit located within the Powertrain Control Module (PCM). The EVR is not serviced separately. If replacement is necessary, the PCM must be replaced.

OPERATION

The amount of DC current produced by the generator is controlled by EVR circuitry contained within the PCM. This circuitry is connected in series with the generators second rotor field terminal and its ground.

Voltage is regulated by cycling the ground path to control the strength of the rotor magnetic field. The EVR circuitry monitors system line voltage (B+) and battery temperature (refer to Battery Temperature Sensor for more information). It then determines a target charging voltage. If sensed battery voltage is 0.5 volts or lower than the target voltage, the PCM grounds the field winding until sensed battery voltage is 0.5 volts above target voltage. A circuit in the PCM cycles the ground side of the generator field up to 100 times per second (100Hz), but has the capability to ground the field control wire 100% of the time (full field) to achieve the target voltage. If the charging rate cannot be monitored (limp-in), a duty cycle of 25% is used by the PCM in order to have some generator output.

STARTING

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STARTING

DESCRIPTION

The starting system consists of:

- Starter relay
- Starter motor (including an integral starter solenoid)

Other components to be considered as part of starting system are:

- Battery
- Battery cables
- Ignition switch and key lock cylinder
- Clutch pedal position switch (manual transmission)
- Park/neutral position switch (automatic transmission)
- Wire harnesses and connections.

The Battery, Starting, and Charging systems operate in conjunction with one another, and must be tested as a complete system. For correct operation of starting/charging systems, all components used in these 3 systems must perform within specifications. When attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used in each of these groups include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

Certain starting system components are monitored by the PCM and may produce a Diagnostic Trouble Code (DTC).

OPERATION

The starting system components form two separate circuits. A high-amperage feed circuit that feeds the starter motor between 150 and 350 amperes (700 amperes - diesel engine), and a low-amperage control circuit that operates on less than 20 amperes. The high-amperage feed circuit components include the battery, the battery cables, the contact disc portion of the starter solenoid, and the starter motor. The low-amperage control circuit components include the ignition switch, the clutch pedal position switch (manual transmission), the park/neutral position switch (automatic transmission), the starter relay, the electromagnetic windings of the starter solenoid, and the connecting wire harness components.

If the vehicle is equipped with a manual transmission, it has a clutch pedal position switch installed in series between the ignition switch and the coil battery terminal of the starter relay. This normally open switch prevents the starter relay from being energized when the ignition switch is turned to the Start position, unless the clutch pedal is

depressed. This feature prevents starter motor operation while the clutch disc and the flywheel are engaged. The starter relay coil ground terminal is always grounded on vehicles with a manual transmission.

If the vehicle is equipped with an automatic transmission, battery voltage is supplied through the low-amperage control circuit to the coil battery terminal of the starter relay when the ignition switch is turned to the Start position. The park/neutral position switch is installed in series between the starter relay coil ground terminal and ground. This normally open switch prevents the starter relay from being energized and the starter motor from operating unless the automatic transmission gear selector is in the Neutral or Park positions.

When the starter relay coil is energized, the normally open relay contacts close. The relay contacts connect the relay common feed terminal to the relay normally open terminal. The closed relay contacts energize the starter solenoid coil windings.

The energized solenoid pull-in coil pulls in the solenoid plunger. The solenoid plunger pulls the shift lever in the starter motor. This engages the starter overrunning clutch and pinion gear with the starter ring gear.

As the solenoid plunger reaches the end of its travel, the solenoid contact disc completes the high-amperage starter feed circuit and energizes the solenoid plunger hold-in coil. Current now flows between the solenoid battery terminal and the starter motor, energizing the starter.

Once the engine starts, the overrunning clutch protects the starter motor from damage by allowing the starter pinion gear to spin faster than the pinion shaft. When the ignition switch is released to the On position, the starter relay coil is de-energized. This causes the relay contacts to open. When the relay contacts open, the starter solenoid plunger hold-in coil is de-energized.

When the solenoid plunger hold-in coil is de-energized, the solenoid plunger return spring returns the plunger to its relaxed position. This causes the contact disc to open the starter feed circuit, and the shift lever to disengage the overrunning clutch and pinion gear from the starter ring gear.

DIAGNOSIS AND TESTING - STARTING SYSTEM

The battery, starting, and charging systems operate in conjunction with one another, and must be tested as a complete system. For correct starting/charging system operation, all of the components involved in these 3 systems must perform within specifications.

Starting System Diagnosis		
CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER FAILS TO OPERATE.	1. Battery discharged or faulty.	1. Refer to Battery. Charge or replace battery, if required.
	2. Starting circuit wiring faulty.	2. Refer to 8, Wiring Diagrams. Test and repair starter feed and/or control circuits, if required.
	3. Starter relay faulty.	3. Refer to Starter Relay in Diagnosis and Testing. Replace starter relay if required.
	4. Ignition switch faulty.	4. Refer to Ignition Switch and Key Lock Cylinder. Replace ignition switch if required.
	5. Clutch pedal position switch faulty.	5. Refer to Clutch Pedal Position Switch.
	6. Park/Neutral position switch faulty or misadjusted.	6. Refer to Park/Neutral Position Switch. Replace park/neutral position switch if required.
	7. Starter solenoid faulty.	7. Refer to Starter Motor. Replace starter motor assembly if required.
	8. Starter motor faulty.	8. If all other starting system components and circuits test OK, replace starter motor.

Starting System Diagnosis		
CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER ENGAGES, FAILS TO TURN ENGINE.	1. Battery discharged or faulty.	1. Refer to Battery. Charge or replace battery if required.
	2. Starting circuit wiring faulty.	2. Refer to 8, Wiring Diagrams. Test and repair starter feed and/or control circuits if required.
	3. Starter motor faulty.	3. If all other starting system components and circuits test OK, replace starter motor assembly.
	4. Engine seized.	4. Refer to Engine Diagnosis in the Diagnosis and Testing section of 9, Engine.
STARTER ENGAGES, SPINS OUT BEFORE ENGINE STARTS.	1. Starter ring gear faulty.	1. Refer to Starter Motor Removal and Installation. Remove starter motor to inspect starter ring gear. Replace starter ring gear if required.
	2. Starter motor faulty.	2. If all other starting system components and circuits test OK, replace starter motor assembly.
STARTER DOES NOT DISENGAGE.	1. Starter motor improperly installed.	1. Refer to Starter Motor Removal and Installation. Tighten starter mounting hardware to correct torque specifications.
	2. Starter relay faulty.	2. Refer to Starter Relay Diagnosis and Testing. Replace starter relay if required.
	3. Ignition switch faulty.	3. Refer to Ignition Switch and Key Lock Cylinder. Replace ignition switch if required.
	4. Starter motor faulty.	4. If all other starting system components and circuits test OK, replace starter motor.

INSPECTION

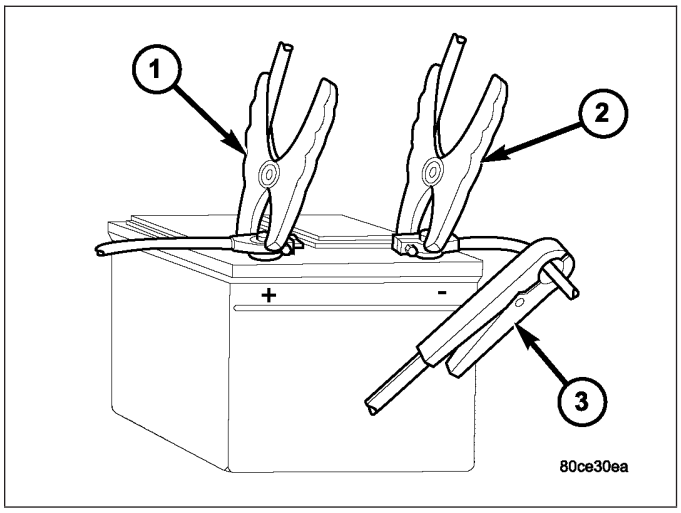
For complete starter wiring circuit diagrams, refer to 8, Wiring Diagrams. Before removing any unit from starting system for repair or diagnosis, perform the following inspections:

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO 8, PASSIVE RESTRAINT SYSTEMS, BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

- **Battery** - Visually inspect battery for indications of physical damage and loose or corroded cable connections. Determine state-of-charge and cranking capacity of battery. Charge or replace battery if required. Refer to **Battery** in 8, Battery. **Note: If equipped with diesel engine, a dual battery system may be used, and both batteries must be inspected.**
- **Ignition Switch** - Visually inspect ignition switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Ignition Switch and Key Lock Cylinder.**
- **Clutch Pedal Position Switch** - If equipped with manual transmission, visually inspect clutch pedal position switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Clutch Pedal Position Switch** in 6, Clutch.
- **Park/Neutral Position Switch** - If equipped with automatic transmission, visually inspect park/neutral position switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Park/Neutral Position Switch** in 21, Transmission.
- **Starter Relay** - Visually inspect starter relay for indications of physical damage and loose or corroded wire harness connections.
- **Starter Motor** - Visually inspect starter motor for indications of physical damage and loose or corroded wire harness connections.
- **Starter Solenoid** - Visually inspect starter solenoid for indications of physical damage and loose or corroded wire harness connections.
- **Wiring** - Visually inspect wire harnesses for damage. Repair or replace any faulty wiring, as required. Refer to 8, Wiring Diagrams.

TESTING

COLD CRANKING TEST



For complete starter wiring circuit diagrams, refer to 8, Wiring Diagrams. The battery must be fully-charged and load-tested before proceeding. Refer to **Battery** in Battery.

1. Connect volt-ampere tester to battery terminals (1), (2) and (3). See instructions provided by manufacturer of volt-ampere tester being used. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, tester should be connected to battery on left side of vehicle only. Also, tester current reading must be taken from positive battery cable lead that connects to starter motor.**
2. Fully engage parking brake.
3. If equipped with manual transmission, place gearshift selector lever in Neutral position and block clutch pedal in fully depressed position. If equipped with automatic transmission, place gearshift selector lever in Park position.
4. Verify that all lamps and accessories are turned off.
5. To prevent a gasoline engine from starting, remove Automatic ShutDown (ASD) relay. To prevent a diesel engine from starting, remove Fuel Pump Relay. These relays are located in Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

WARNING: IF EQUIPPED WITH DIESEL ENGINE, ATTEMPT TO START ENGINE A FEW TIMES BEFORE PROCEEDING WITH FOLLOWING STEP.

6. Rotate and hold ignition switch in Start position. Note cranking voltage and current (amperage) draw readings shown on volt-ampere tester.
   a. If voltage reads below 9.6 volts, refer to **Starter Motor** in Diagnosis and Testing. If starter motor is OK, refer to **Engine Diagnosis** in 9, Engine for further testing of engine. If starter motor is not OK, replace faulty starter motor.
   b. If voltage reads above 9.6 volts and current (amperage) draw reads below specifications, refer to **Feed Circuit Test** in this section.
   c. If voltage reads 12.5 volts or greater and starter motor does not turn, refer to **Control Circuit Testing** in this section.
   d. If voltage reads 12.5 volts or greater and starter motor turns very slowly, refer to **Feed Circuit Test** in this section.

NOTE: A cold engine will increase starter current (amperage) draw reading, and reduce battery voltage reading.

FEED CIRCUIT TEST

The starter feed circuit test (voltage drop method) will determine if there is excessive resistance in high-amperage feed circuit. For complete starter wiring circuit diagrams, refer 8, Wiring Diagrams.

When performing these tests, it is important to remember that voltage drop is giving an indication of resistance between two points at which voltmeter probes are attached.

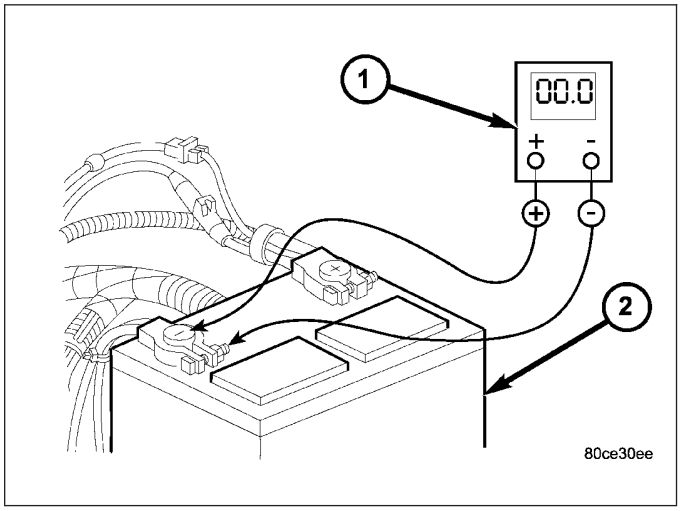
Example: When testing resistance of positive battery cable, touch voltmeter leads to positive battery cable clamp and cable connector at starter solenoid. If you probe positive battery terminal post and cable connector at starter

solenoid, you are reading combined voltage drop in positive battery cable clamp-to-terminal post connection and positive battery cable.

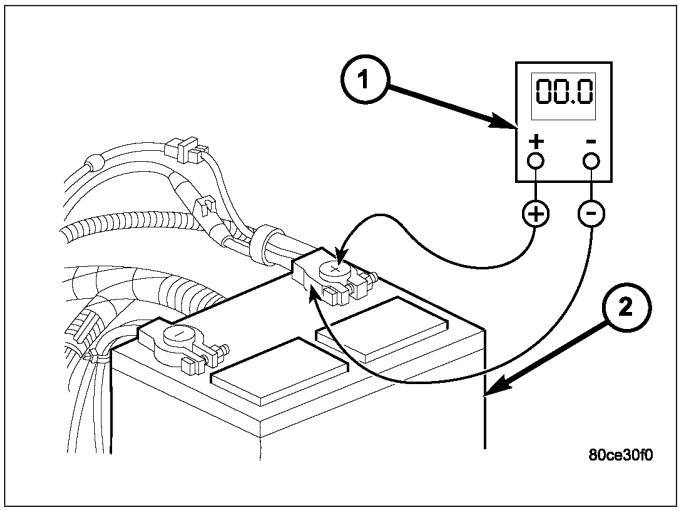
The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing tests, be certain that following procedures are accomplished:

- Battery is fully-charged and load-tested. Refer to **Battery** in 8, Battery.
- Fully engage parking brake.
- If equipped with manual transmission, place gearshift selector lever in Neutral position and block clutch pedal in fully depressed position. If equipped with automatic transmission, place gearshift selector lever in Park position.
- Verify that all lamps and accessories are turned off.
- To prevent a gasoline engine from starting, remove Automatic ShutDown (ASD) relay. To prevent a diesel engine from starting, remove Fuel Pump Relay. These relays are located in Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

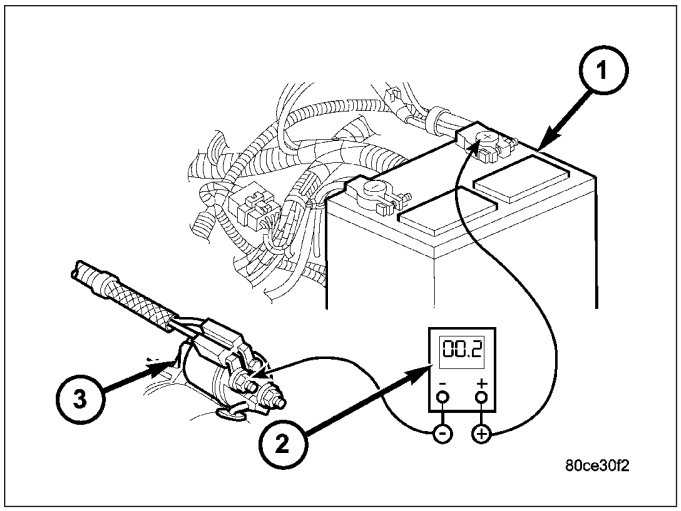
1. Connect positive lead of voltmeter (1) to negative battery cable terminal post. Connect negative lead of voltmeter to negative battery cable clamp. Rotate and hold ignition switch in Start position. Observe voltmeter (1). If voltage is detected, correct poor contact between cable clamp and terminal post. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, procedure must be performed twice, once for each battery.**



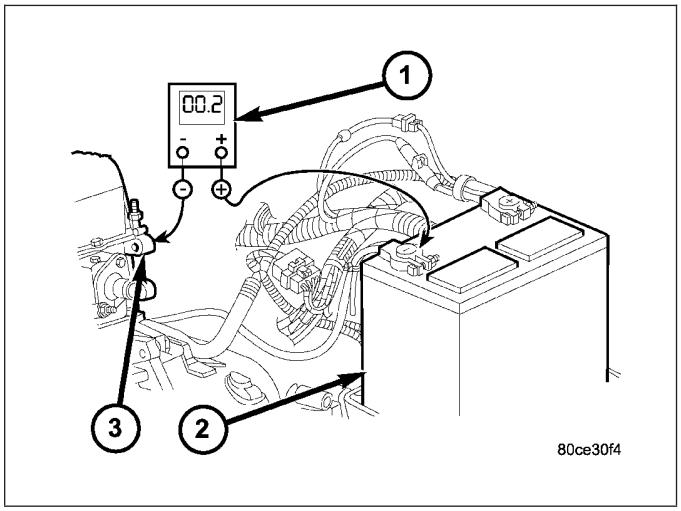
2. Connect positive lead of voltmeter (1) to positive battery terminal post. Connect negative lead of voltmeter to battery positive cable clamp. Rotate and hold ignition switch in Start position. Observe voltmeter (1). If voltage is detected, correct poor contact between cable clamp and terminal post. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, this procedure must be performed twice, once for each battery.**



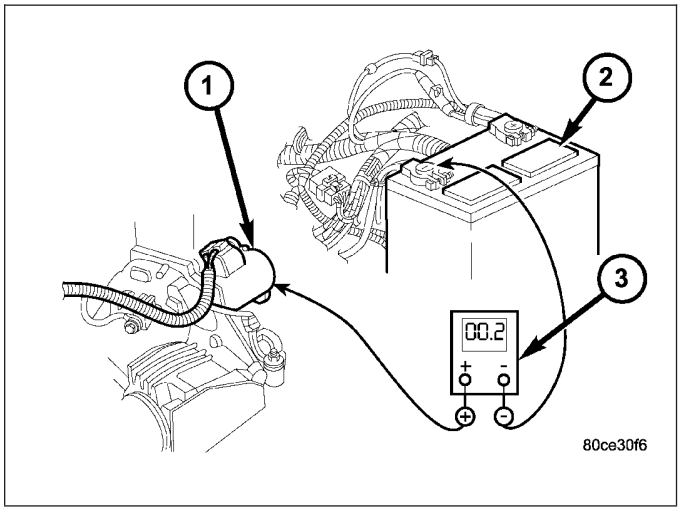
3. Connect voltmeter (2) to measure between battery positive terminal post and starter solenoid battery terminal stud (3). Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, clean and tighten battery cable connection at solenoid. Repeat test. If reading is still above 0.2 volt, replace faulty positive battery cable. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, this procedure must be performed on driver side battery only.**



4. Connect voltmeter (1) to measure between negative battery terminal post and a good clean ground on engine block (3). Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, clean and tighten negative battery cable attachment on engine block. Repeat test. If reading is still above 0.2 volt, replace faulty negative battery cable. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, this procedure must be performed twice, once for each battery.**



5. Connect positive lead of voltmeter (3) to starter housing (1). Connect negative lead of voltmeter to negative battery terminal post. Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, correct poor starter to engine block ground contact. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, this procedure must be performed on driver side battery only.**
6. If equipped with dual battery system (certain diesel equipped models), connect positive lead of voltmeter to positive battery cable clamp on battery located on left side of vehicle. Connect negative lead of voltmeter to positive battery terminal post on battery located on right side of vehicle. Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, clean and tighten battery cables at both batteries. Repeat test. If reading is still above 0.2 volt, replace faulty positive battery cable.



If resistance tests detect no feed circuit problems, refer to **Starter Motor** in the Diagnosis and Testing.

CONTROL CIRCUIT TESTING

The starter control circuit components should be tested in the order in which they are listed, as follows:

- **Starter Relay** - Refer to **Starter Relay** Diagnosis and Testing.
- **Starter Solenoid** - Refer to **Starter Motor** Diagnosis and Testing.
- **Ignition Switch** - Refer to **Ignition Switch and Key Lock Cylinder**
- **Clutch Pedal Position Switch** - If equipped with manual transmission, refer to **Clutch Pedal Position Switch** in 6, Clutch.
- **Park/Neutral Position Switch** - If equipped with automatic transmission, refer to **Park/Neutral Position Switch** in 21, Transmission.
- **Wire harnesses and connections** - Refer to 8, Wiring Diagrams.

SPECIFICATIONS

STARTING SYSTEM

Starter Motor and Solenoid	
Manufacturer	Denso
Part Number	56028715AD
Engine Application	3.7L / 4.7L
Power Rating	1.4 Kilowatt / 1.9 Horsepower
Voltage	12 Volts
Number of Brushes	4
Drive Type	Gear Reduction
Free Running Test Voltage	11 Volts
Free Running Test Amperage Draw	73 Amperes
Free Running Test Minimum Speed	3601 rpm
Solenoid Closing Maximum Voltage Required	7.5 Volts
* Cranking Amperage Draw Test	125 - 250 Amperes
* Test at operating temperature. Cold engine, tight (new) engine, or heavy oil will increase starter amperage draw.	

SPECIFICATIONS - TORQUE - STARTING SYSTEM

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Battery Cable Eyelet Nut at Solenoid (large nut)	25	19	221
Starter Solenoid Nut (small nut)	6	-	55
Starter Mounting Bolts	68	50	-
Starter Mounting Nut	68	50	-

STARTER

DIAGNOSIS AND TESTING - STARTER MOTOR

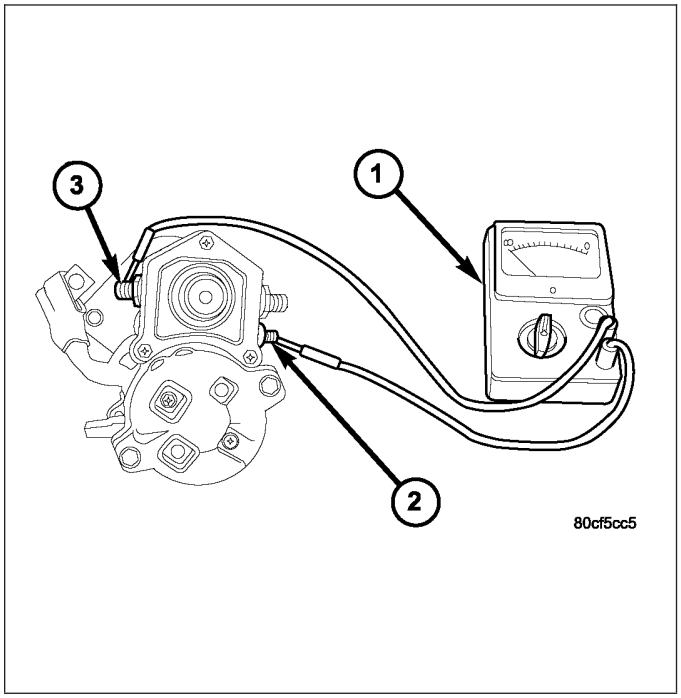
Correct starter motor operation can be confirmed by performing the following free running bench test. This test can only be performed with starter motor removed from vehicle. Refer to Specifications for starter motor specifications.

1. Remove starter motor from vehicle. Refer to Starter Motor Removal and Installation.
2. Mount starter motor securely in a soft-jawed bench vise. The vise jaws should be clamped on the mounting flange of starter motor. Never clamp on starter motor by field frame.
3. Connect a suitable volt-ampere tester and a 12-volt battery to starter motor in series, and set ammeter to 100 ampere scale. See instructions provided by manufacturer of volt-ampere tester being used.
4. Install jumper wire from solenoid terminal to solenoid battery terminal. The starter motor should operate. If starter motor fails to operate, replace faulty starter motor assembly.
5. Adjust carbon pile load of tester to obtain free running test voltage. Refer to Specifications for starter motor free running test voltage specifications.
6. Note reading on ammeter and compare reading to free running test maximum amperage draw. Refer to Specifications for starter motor free running test maximum amperage draw specifications.
7. If ammeter reading exceeds maximum amperage draw specification, replace faulty starter motor assembly.

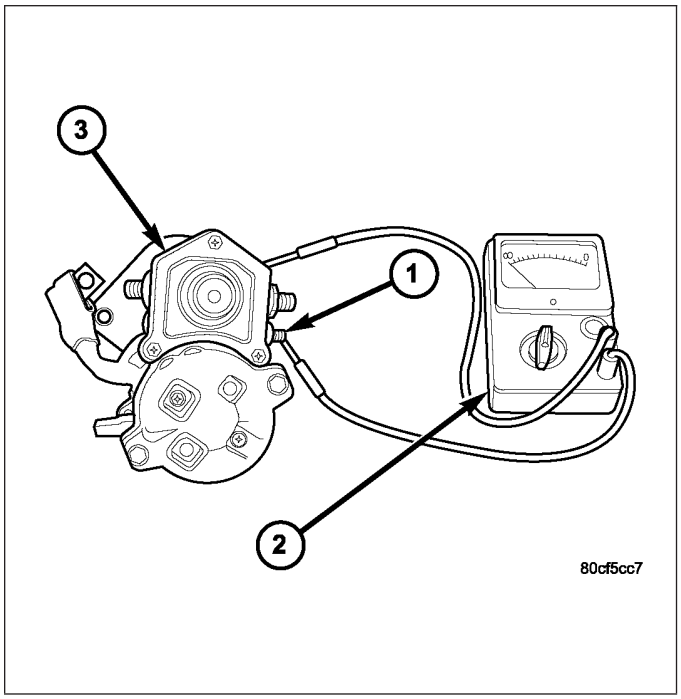
STARTER SOLENOID

This test can only be performed with starter motor removed from vehicle.

1. Remove starter motor from vehicle. Refer to Starter Motor Removal and Installation.
2. Disconnect wire from solenoid field coil terminal.
3. Check for continuity between solenoid terminal (3) and solenoid field coil terminal (2) with a continuity tester (1). There should be continuity. If OK, go to Step 4. If not OK, replace faulty starter motor assembly.



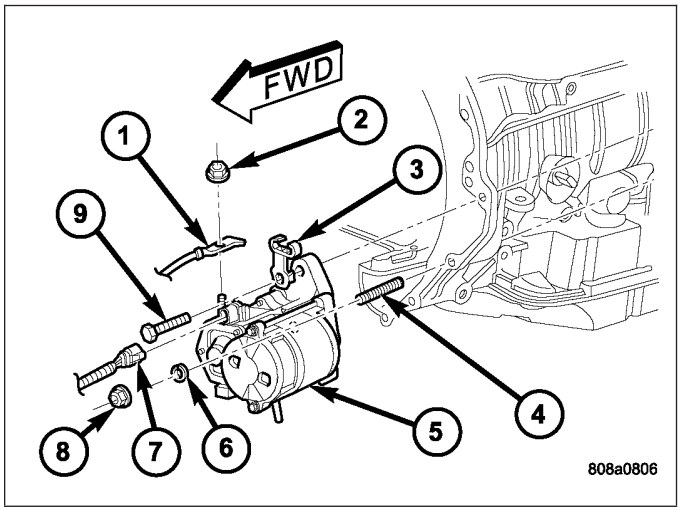
4. Check for continuity between solenoid terminal (1) and solenoid case. There should be continuity. If not OK, replace faulty starter motor assembly.



REMOVAL

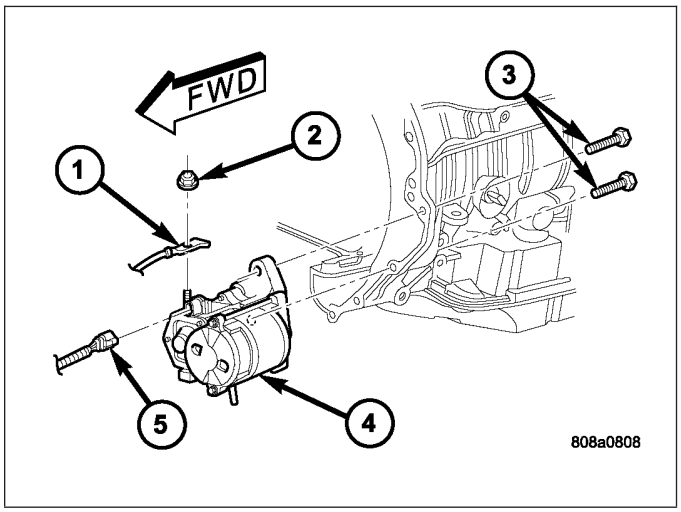
3.7L / 4.7L With Manual Trans.

1. Disconnect and isolate negative battery cable.
2. Raise and support vehicle.
3. Note: If equipped with 4WD and certain transmissions, a support bracket is used between front axle and side of transmission. Remove 2 support bracket bolts at transmission. Pry support bracket slightly to gain access to lower starter mounting bolt.
4. Remove one bolt (9) and one nut (8) if equipped with a manual transmission.
5. Move starter motor (5) towards front of vehicle far enough for nose of starter pinion housing to clear housing. Always support starter motor during this process, do not let starter motor hang from wire harness.



6. Tilt nose downwards and lower starter motor far enough to access and remove nut (2) that secures battery positive cable wire harness connector eyelet to solenoid battery terminal stud. Do not let starter motor hang from wire harness.
7. Remove battery positive cable wire harness connector eyelet (1) from solenoid battery terminal stud.
8. Disconnect battery positive cable wire harness connector (7) from solenoid terminal connector receptacle.
9. Remove starter motor.

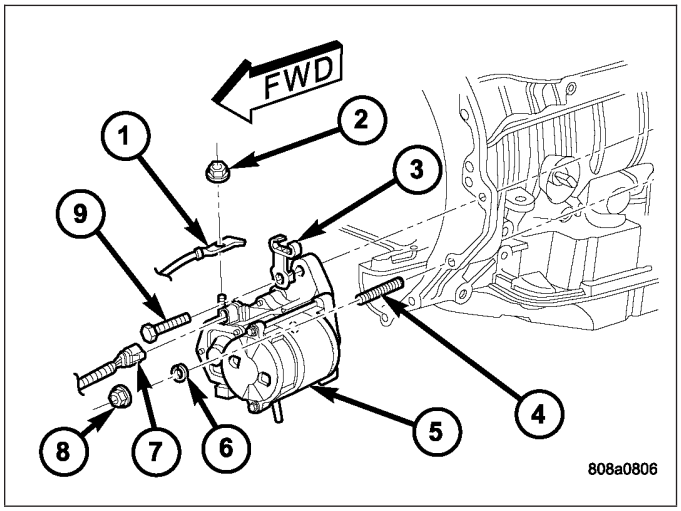
3.7L / 4.7L With Auto. Trans.



1. Disconnect and isolate negative battery cable.
2. Raise and support vehicle.
3. Note: If equipped with 4WD and certain transmissions, a support bracket is used between front axle and side of transmission. Remove 2 support bracket bolts at transmission. Pry support bracket slightly to gain access to lower starter mounting bolt.
4. Remove two bolts (3) if equipped with an automatic transmission.
5. Move starter motor (4) towards front of vehicle far enough for nose of starter pinion housing to clear housing. Always support starter motor during this process, do not let starter motor hang from wire harness.
6. Tilt nose downwards and lower starter motor far enough to access and remove nut (2) that secures battery positive cable wire harness connector eyelet (1) to solenoid battery terminal stud. Do not let starter motor hang from wire harness.
7. Remove battery positive cable wire harness connector eyelet (5) from solenoid battery terminal stud.
8. Disconnect battery positive cable wire harness connector from solenoid terminal connector receptacle.
9. Remove starter motor.

INSTALLATION

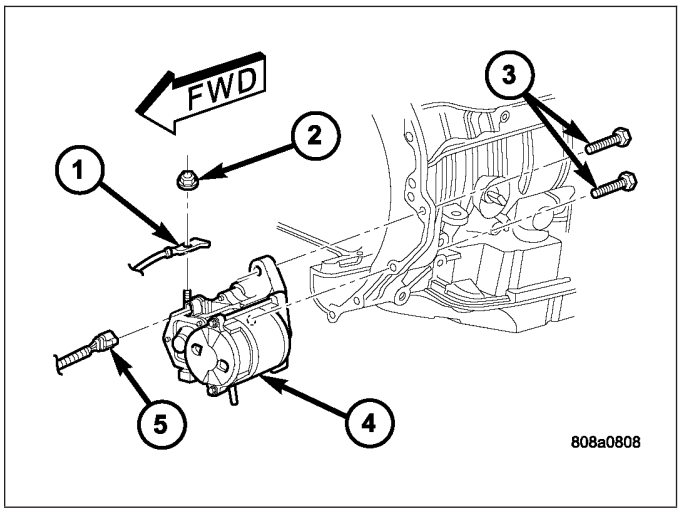
3.7L / 4.7L With Manual Trans.



1. Connect solenoid wire to starter motor (snaps on).
2. Position battery cable (1) to solenoid stud. Install and tighten battery cable eyelet nut (2). Refer to Torque Specifications. Do not allow starter motor to hang from wire harness.
3. Position starter motor (5) to transmission.
4. Install and tighten lockwasher (6) nut (8) and bolt (9). Refer to Torque Specifications.
5. Lower vehicle.
6. Connect negative battery cable.

3.7L / 4.7L With Auto. Trans.

1. Connect solenoid wire to starter motor (snaps on).
2. Position battery cable (1) to solenoid stud. Install and tighten battery cable eyelet nut (2). Refer to Torque Specifications. Do not allow starter motor to hang from wire harness.
3. Position starter motor (4) to transmission.
4. If equipped with automatic transmission, slide cooler tube bracket into position.
5. Install and tighten both bolts (3). Refer to Torque Specifications.
6. Lower vehicle.
7. Connect negative battery cable.



RELAY-STARTER MOTOR

DESCRIPTION

The starter relay is an electromechanical device that switches battery current to the pull-in coil of the starter solenoid when the ignition switch is turned to the Start position. The starter relay is located in the Power Distribution Center (PDC) in the engine compartment. See the PDC cover for relay identification and location.

The starter relay is a International Standards Organization (ISO) relay. Relays conforming to ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions.

The starter relay cannot be repaired or adjusted. If faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When electromagnetic coil is energized, it draws the movable contact away from normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When electromagnetic coil is de-energized, spring pressure returns movable contact to normally closed position. The resistor or diode is connected in parallel with electromagnetic coil within relay, and helps to dissipate voltage spikes produced when coil is de-energized.

REMOVAL

The starter relay is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

1. Disconnect and isolate negative battery cable.
2. Remove cover from Power Distribution Center (PDC) for relay identification and location.
3. Remove starter relay from PDC.
4. Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.
5. Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

INSTALLATION

1. Push down firmly on starter relay until terminals are fully seated into PDC receptacle.
2. Install PDC cover.
3. Connect battery cable.

HEATED SYSTEMS

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HEATED GLASS - ELECTRICAL DIAGNOSTICS

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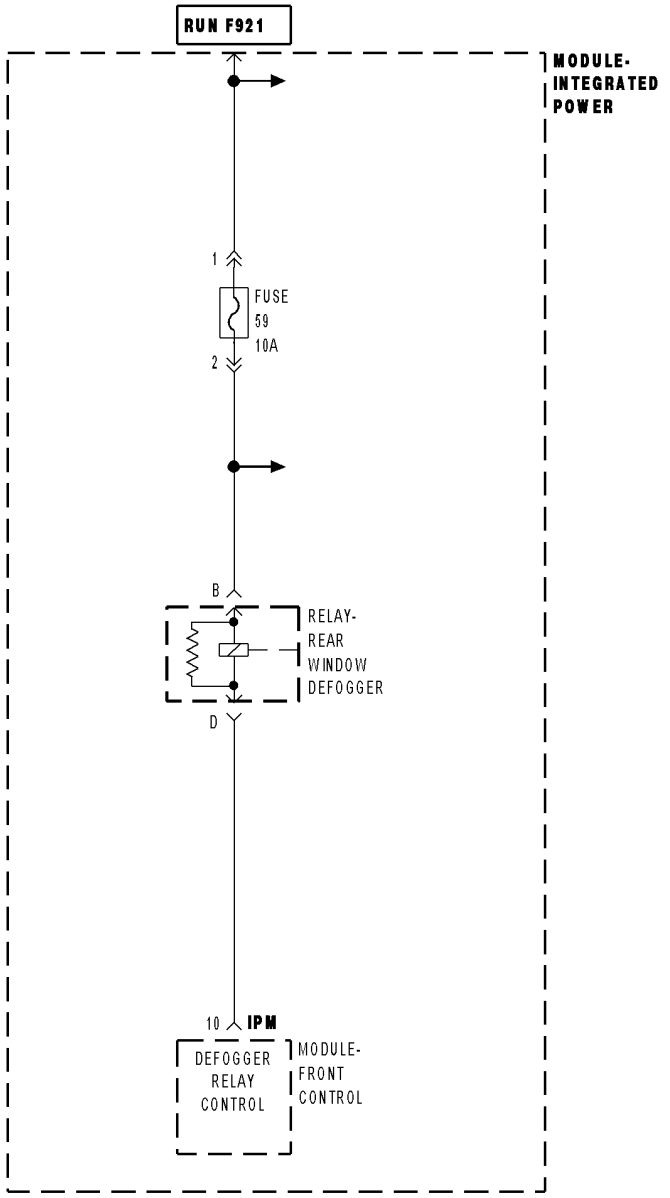
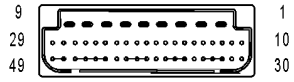
HEATED GLASS - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B106B,B106D–REAR DEFROST CONTROL CIRCUIT LOW/OPEN – FCM





MODULE-
FRONT
CONTROL
(IPM)

814309c3

B106B,B106D–REAR DEFROST CONTROL CIRCUIT LOW/OPEN – FCM (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  When the Front Control Module does not detect voltage on the Defogger Relay Control circuit.1

Possible Causes
REAR DEFOGGER INTEGRATED POWER MODULE (IPM) FUSE
REAR WINDOW DEFOGGER RELAY
IGNITION SWITCH OUTPUT OPEN
(C115) DEFOGGER RELAY CONTROL (PDC)
FRONT CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase DTC's
Operate the Rear Defogger Switch several times.
Cycle the ignition from on to off 3 times and leave on.
With the scan tool, read DTC's.

Does the scan tool display the same DTC?

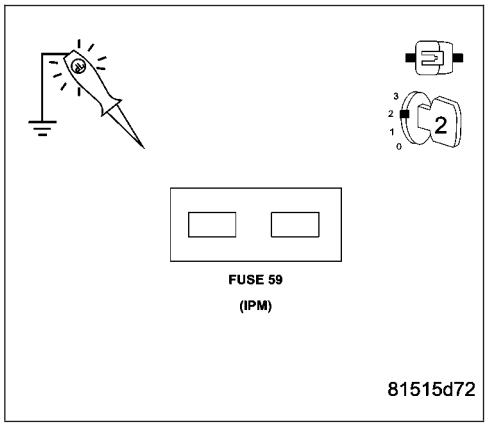
Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST - VER 1.

---

2. IPM FUSE

Turn the ignition on.
Using a 12-volt test light connected to ground, check the Rear Window Defogger fuse in the IPM.



Does the test light illuminate and was the fuse OK?

No >> Repair the Ignition Switch Output (Run) circuit for an open or replace the fuse if open and check for a shorted Defogger Relay.
Perform BODY VERIFICATION TEST - VER 1.

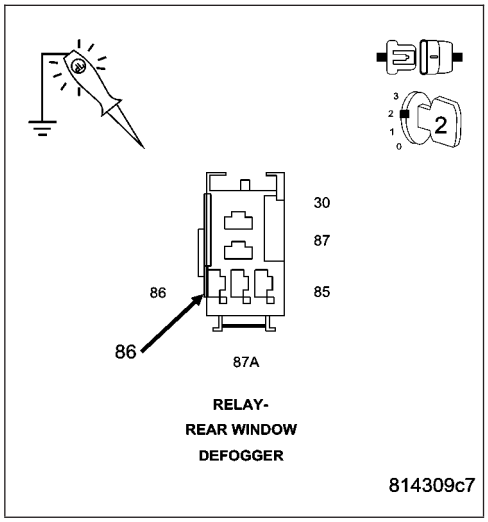
Yes >> Go To 3

B106B,B106D–REAR DEFROST CONTROL CIRCUIT LOW/OPEN – FCM (CONTINUED)

3. OPEN IGNITION SWITCH OUTPUT (RUN) TO RELAY

Remove the Rear Defogger Relay from the IPM.

Using a 12-volt test light connected to ground, check the Ignition Switch Output circuit at the relay connector.



Does the test light illuminate?

No >> Replace the Power Distribution Center in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1.

Yes >> Go To 4

4. REAR WINDOW DEFOGGER RELAY

Install a known good relay in place of the Rear Window Defogger Relay.

With the scan tool erase DTC's

Operate the Rear Window Defogger several times.

Cycle the ignition from on to off 3 times and leave on.

With the scan tool, read DTC's.

Does the scan tool display the same DTC?

No >> Replace the original Rear Window Defogger Relay.
Perform BODY VERIFICATION TEST - VER 1.

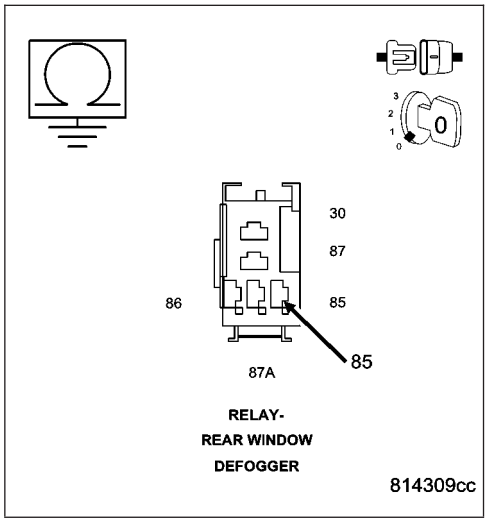
Yes >> Go To 5

5. CHECK THE (C115)DEFOGGER RELAY CONTROL CIRCUIT FOR A SHORT TO GROUND

Remove the Rear Window Defogger Relay from the IPM.

Disconnect the Front Control Module from the IPM 49 – way connector.

Measure the resistance between ground and the (C115) Defogger Relay Control circuit at the relay.



Is the resistance below 1000.0 ohms?

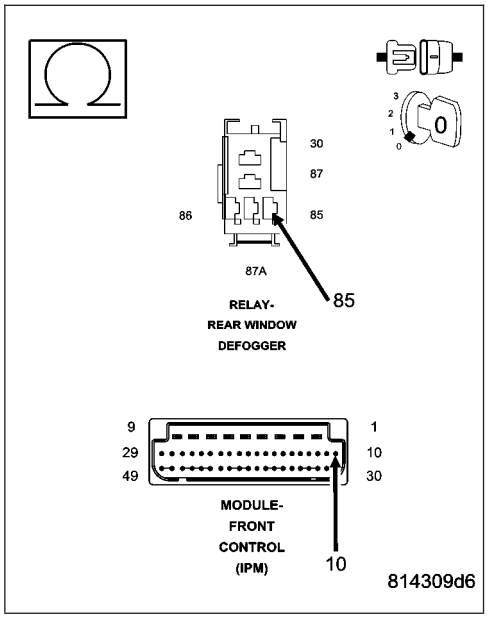
Yes >> Replace the Power Distribution Center in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1.

No >> Go To 6

B106B,B106D–REAR DEFROST CONTROL CIRCUIT LOW/OPEN – FCM (CONTINUED)

6. CHECK THE (C115)DEFOGGER RELAY CONTROL CIRCUIT FOR AN OPEN

Measure the resistance of the (C115) Defogger Relay Control circuit from the relay connector to FCM connector.

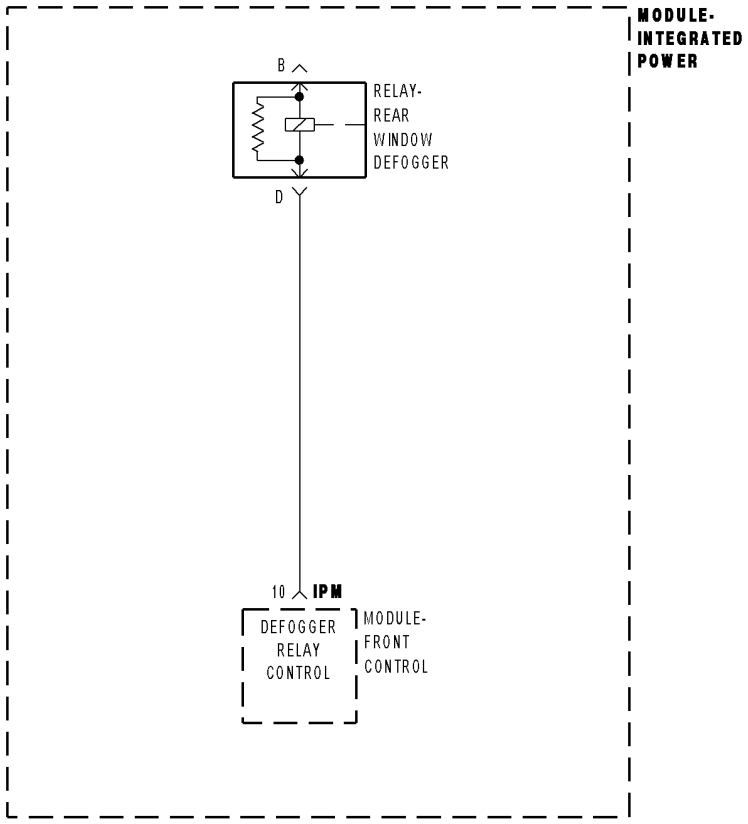


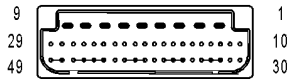
Is the resistance below 3.0 ohms?

Yes >> Replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1.

No >> Replace the Power Distribution Center in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1.

B106C–REAR DEFROST CONTROL CIRCUIT HIGH – FCM





MODULE-
FRONT
CONTROL
(IPM)

814309db

B106C–REAR DEFROST CONTROL CIRCUIT HIGH – FCM (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  When the Front Control Module detects a short to battery on the Defogger Relay Control circuit.

Possible Causes
REAR WINDOW DEFOGGER RELAY
(C115) DEFOGGER RELAY CONTROL (PDC)
FRONT CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase DTC's
Operate the Rear Window Defogger switch several times.
Cycle the ignition from on to off 3 times and leave on.
With the scan tool, read DTC's.

Does the scan tool display B106C – REAR DEFROST CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST - VER 1.

---

2. REAR DEFOGGER RELAY

Turn the ignition off.
Install a known good relay in place of the Rear Window Defogger Relay.
With the scan tool erase DTC's
Operate the Rear Window Defogger Switch several times.
Cycle the ignition from on to off 3 times and leave on.
With the scan tool, read DTC's.

Does the scan tool display B106C – REAR DEFROST CONTROL CIRCUIT HIGH?

No >> Replace the original Rear Window Defogger Relay.
Perform BODY VERIFICATION TEST - VER 1.

Yes >> Go To 3

B106C–REAR DEFROST CONTROL CIRCUIT HIGH – FCM (CONTINUED)

3. (C115)–DEFOGGER RELAY CONTROL CIRCUIT

Remove the Rear Window Defogger Relay the IPM.

Disconnect the Front Control Module from the PDC 49 – way connector.

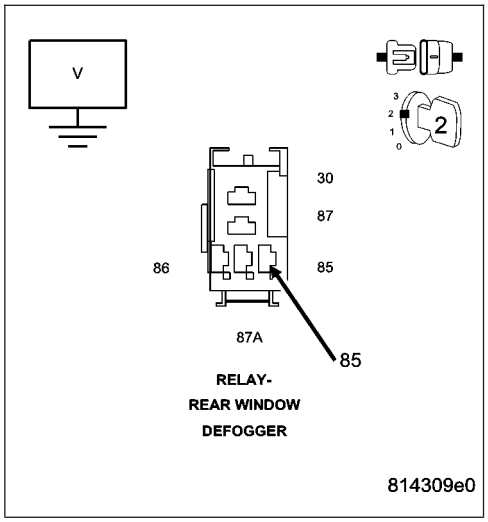
Turn the ignition on.

Measure the voltage between (C115) Defogger Relay Control circuit and ground.

Is there any voltage present?

Yes >> Replace the Power Distribution Center in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1.

No >> Replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1.



BODY VERIFICATION TEST – VER 1

Diagnostic Test

1. Perform Body Verification Test

Disconnect all jumper wires and reconnect all previously disconnected components and connectors.

Ensure that all accessories are turned off.

Ensure that the battery is fully charged.

Turn the ignition on.

With the scan tool, record and erase DTCs from all modules.

If an electronic control module was replaced, select the applicable module from the scan tool menu and press “Misc. Functions”. If the module has programable features, program as necessary.

If repairs were made to any of the HVAC door actuator circuits, with the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. The test must pass before proceeding to the next step.

If repairs were made to any of the HVAC doors, linkage, door actuators, or door actuator circuits, with the scan tool in HVAC, select System Tests and then select Actuator Calibration Test. The test must pass before proceeding to the next step.

Turn the ignition off, wait 10 seconds, and then turn the ignition on.

Operate all functions of the system that caused the original concern.

With the scan tool, select ECU View.

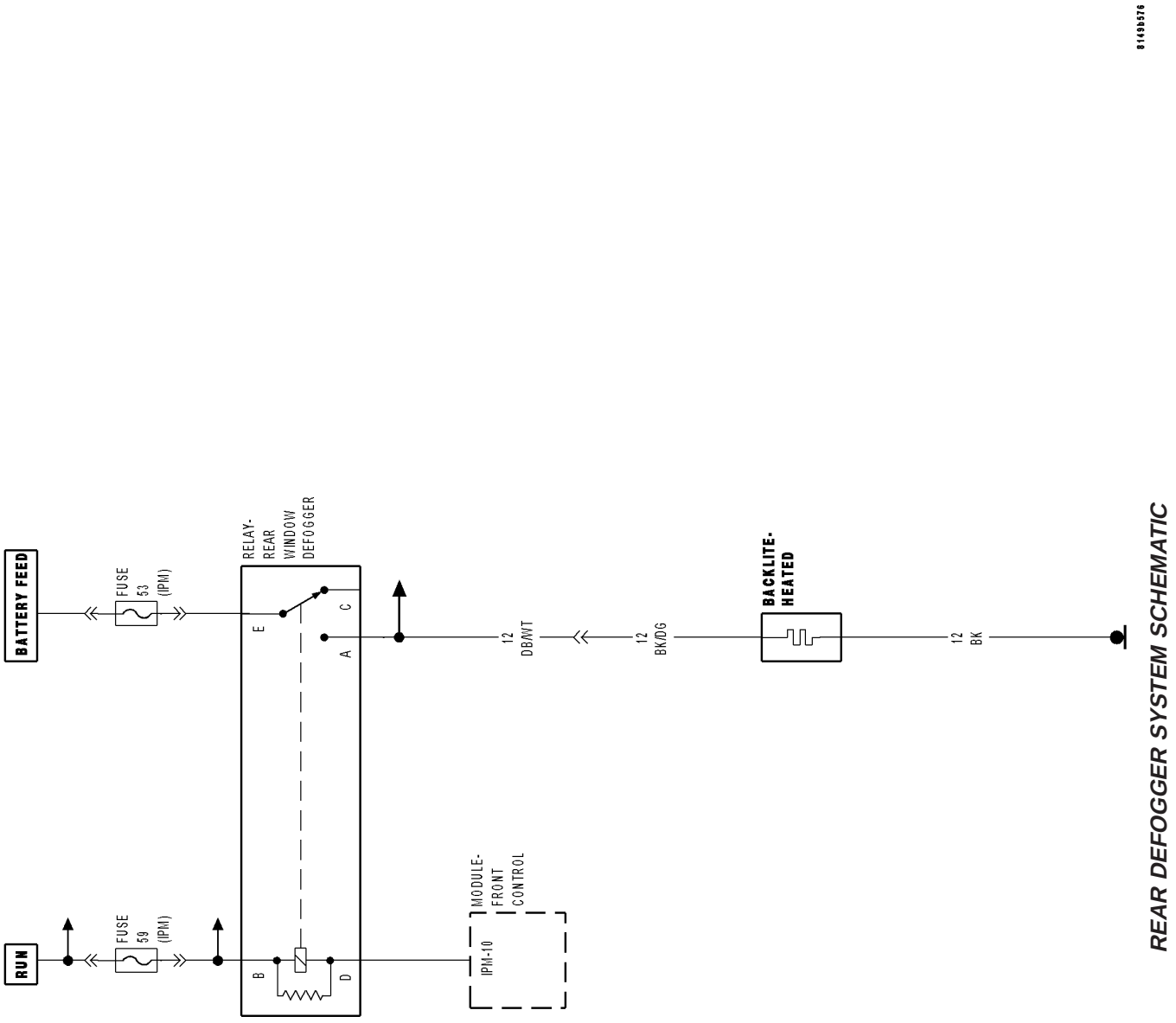
Check for DTCs in the modules.

Are DTCs present in any of the modules or is the original condition still present?

Yes >> The repair is not complete. Refer to the related category for the DTC or symptom that is still present.

No >> The repair is complete.

SCHEMATICS AND DIAGRAMS



HEATED GLASS - SERVICE INFORMATION

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HEATED GLASS - SERVICE INFORMATION

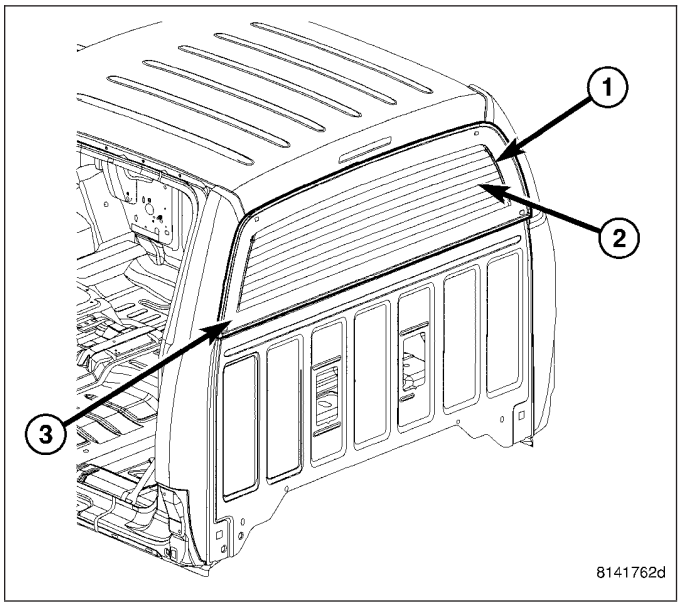
DESCRIPTION

CAUTION: Grid lines can be damaged or scraped off with sharp instruments. Care should be taken in cleaning glass or removing foreign materials, decals or stickers. Normal glass cleaning solvents or hot water used with rags or toweling is recommended.

The rear window defogger system, also known as electric backlight (EBL), consists of two vertical bus bars (1) linked by a series of grid lines (2) fired onto the inside surface of the rear window (3).

The EBL system is turned On or Off by a switch in the A/C-heater control located at the center of the instrument panel and by a timing circuit integral to the front control module (FCM).

Circuit protection is provided by two cartridge fuses located in the integrated power module (IPM) in the engine compartment. One fuse is for the control circuit and the other fuse is for the heated grid circuit.

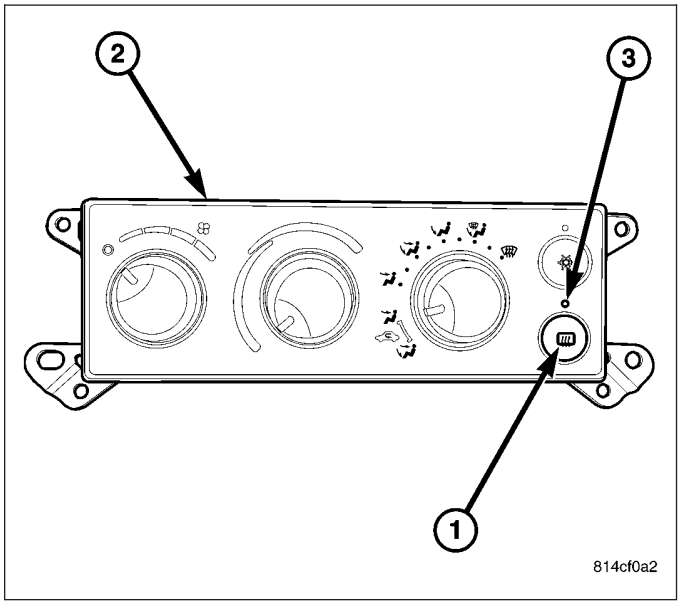


OPERATION

The electric backlight (EBL) system is controlled by a momentary switch (1) located in the A/C-heater control (2) on the instrument panel. When the rear window defogger switch is pressed to the On position, the front control module (FCM) energizes the rear window defogger (EBL) relay, which then directs fused battery current through the relay and to the rear defogger grid lines and the heated side view mirrors, when equipped. The grid lines heat the glass to help clear the rear window and side mirror surfaces of fog or frost.

An amber indicator (3) in the rear window defogger switch will illuminate to indicate when the EBL system is turned on. The FCM contains the EBL system control circuitry including the timer logic.

NOTE: The EBL system turns off automatically after approximately ten minutes of initial operation. Each following activation cycle of the EBL system will last approximately five minutes.



The EBL system will be automatically turned off after an initial programmed time interval of about ten minutes. After the initial time interval has expired, if the rear window defogger switch is turned on again during the same ignition cycle, the EBL system will automatically turn off after about five minutes. The EBL system will automatically shut off if the ignition switch is turned to the Off position, or it can be turned off manually by pressing the rear window defogger switch a second time.

Repair of the rear defogger grid lines, bus bars, terminals or pigtail wires can be accomplished using the Mopar Rear Window Defogger Repair Kit (Part Number 04549275) or equivalent (Refer to 8 - ELECTRICAL/HEATED GLASS/REAR WINDOW DEFOGGER GRID - STANDARD PROCEDURE - GRID LINE AND TERMINAL REPAIR).

DIAGNOSIS AND TESTING

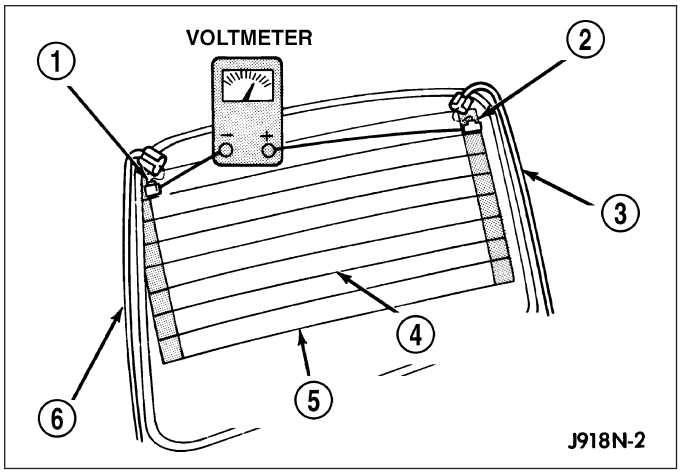
ELECTRIC BACKLIGHT (EBL) SYSTEM

NOTE: Illumination of the defogger switch indicator lamp does not necessary mean that electrical current is reaching the rear glass heating grid lines.

NOTE: For circuit descriptions and diagrams of the rear window defogger system, refer to 8W - WIRING DIAGRAM INFORMATION.

Operation of the electrical backlight (EBL) system can be confirmed by the following:

1. Using a scan tool, check for diagnostic trouble codes (DTCs) related to the A/C-heater control and the front control module (FCM) (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING - HVAC SELF DIAGNOSTICS). If no DTCs are found, go to Step 2. If any DTCs are found, repair as required, then proceed to Step 2
2. Turn the ignition switch to the On position. Set the rear window defogger switch in the On position. The rear window defogger operation can be checked by feeling the rear window glass or the heated outside rear view mirror glass. A distinct difference in temperature between the grid lines (4 and 5) and the adjacent clear glass or the mirror glass should be detected within three to four minutes of operation.



3. If a temperature difference is not detected, use a 12-volt DC voltmeter and contact the rear glass heating grid terminal A (1) with the negative lead, and terminal B (2) with the positive lead. The voltmeter should read battery voltage. If the voltmeter does not read battery voltage, check the following:
   - Confirm that the ignition switch is in the On position.
   - Make sure that the rear glass heating grid feed wire (3) and ground wire (6) are connected to the terminals. Confirm that the ground wire has continuity to ground.
   - Check the EBL relay and fuses located in the integrated power module (IPM) in the engine compartment. The relay and fuses must be tight in their receptacles and all electrical connections must be secure. Refer to the appropriate wiring information for diagnosis and testing of the ISO-standard relay.

When the above steps have been completed and the rear glass heating grid is still inoperative, one or more of the following is faulty:

- Rear window defogger switch in the A/C-heater control.
- Rear window defogger grid lines (all grid lines would have to be broken, or the power feed or the ground wire disconnected, for the entire heating grid to be inoperative).

4. If the EBL system operation has been verified but the rear window defogger LED indicator does not illuminate, replace the A/C-heater control (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CONTROL-A/C HEATER - REMOVAL).

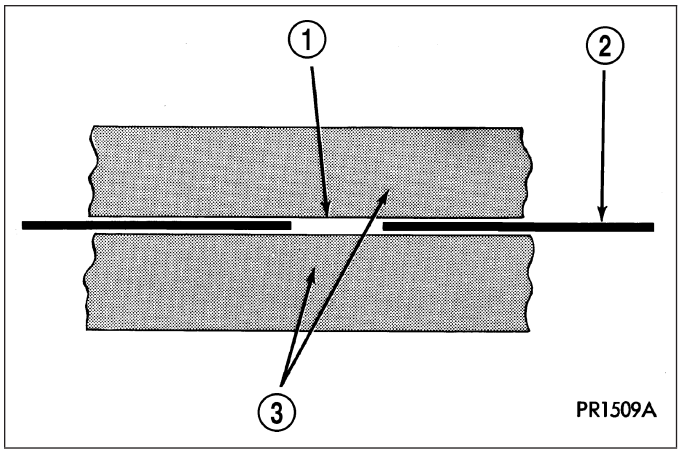
GRID-REAR WINDOW DEFOGGER

STANDARD PROCEDURE

GRID LINE AND TERMINAL REPAIR

WARNING: Materials contained in the Repair Kit (Part Number 04549275) may cause skin or eye irritation. The kit contains epoxy resin and amine type hardener, which are harmful if swallowed. Avoid contact with the skin and eyes. For skin contact, wash the affected areas with soap and water. For contact with the eyes, flush with plenty of water. Do not take internally. If taken internally, induce vomiting and call a physician immediately. Use with adequate ventilation. Do not use near fire or flame. Contains flammable solvents. Keep out of the reach of children. Failure to follow the warnings could result in possible personal injury or death.

Repair of the rear glass heating grid lines, bus bars, terminals or pigtail wires can be accomplished using the Mopar Rear Window Defogger Repair Kit (Part Number 04549275) or equivalent.



1. Mask the repair area with masking tape (3) so that the conductive epoxy can be applied neatly. Extend the epoxy application onto the grid line (2) or the bus bar on each side of the break (1).
2. Follow the instructions in the repair kit for preparing the damaged area.
3. Remove the package separator clamp and mix the two conductive epoxy components thoroughly within the packaging. Fold the package in half and cut the center corner to dispense the epoxy.
4. For grid line repairs, mask the area to be repaired with masking tape or use a template.
5. Apply the epoxy through the slit in the masking tape or template. Overlap both ends of the break by at least 19 millimeters (0.75 inch).
6. For a terminal or pigtail wire replacement, mask the adjacent areas so the epoxy can be extended onto the adjacent grid line as well as the bus bar. Apply a thin layer of epoxy to the area where the terminal or pigtail wire was fastened and onto the adjacent grid line.
7. Apply a thin layer of conductive epoxy to the terminal or bare wire end of the pigtail and place it in the proper location on the bus bar. To prevent the terminal or pigtail wire from moving while the epoxy is curing, it must be wedged or clamped.
8. Carefully remove the masking tape or template.

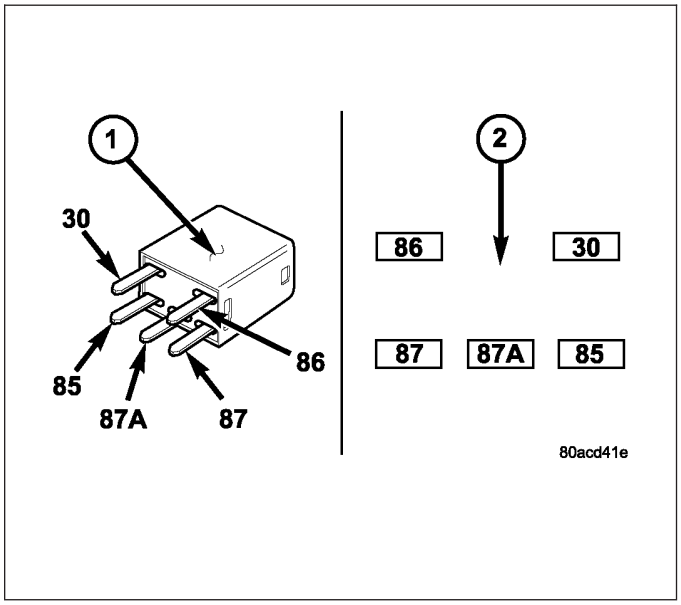
CAUTION: Do not allow the glass surface to exceed 204° C (400° F) when using a heat gun, or the glass may fracture.

9. Allow the epoxy to cure 24 hours at room temperature, or carefully use a heat gun for fifteen minutes. When using a heat gun, hold it approximately 25.4 centimeters (10 inches) from the repair and do not allow the glass surface to exceed 204° C (400° F).
10. After the conductive epoxy is properly cured, remove the wedge or clamp from the terminal or pigtail wire.
11. Connect the wire harness leads to the grid terminals or pigtail wires and verify EBL operation.

RELAY-REAR WINDOW DEFOGGER

DESCRIPTION

The rear window defogger (EBL) relay (1) is a International Standards Organization (ISO) micro-relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal functions and patterns (2). The ISO micro-relay terminal functions are the same as a conventional ISO relay. However, the ISO micro-relay terminal pattern (or footprint) is different, the current capacity is lower, and the physical dimensions are smaller than those of the conventional ISO relay. The EBL relay is a electro-mechanical device that switches battery current through a fuse in the integrated power module (IPM) to the rear window defogger grid and when equipped, switches battery current through another fuse located in the IPM to the outside mirror heating grids. The EBL relay is energized when the relay coil is provided a ground path by the control circuitry within the front control module (FCM).



The EBL relay is located in the IPM in the engine compartment.

OPERATION

The ISO-standard rear window defogger (EBL) micro-relay is an electromechanical switch that uses a low current input controlled by the front control module (FCM) to control the high current output to the rear window defogger grid lines. The movable, common feed relay contact is held against the fixed, normally closed relay contact by spring pressure. When the electromagnetic relay coil is energized, it draws the movable common feed relay contact away from the fixed, normally closed relay contact and, holds it against the fixed, normally open relay contact. This action allows high current to flow to the rear window defogger grid lines.

When the relay coil is de-energized, spring pressure returns the movable relay contact back against the fixed, normally closed contact point. The resistor or diode is connected in parallel with the relay coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

The EBL relay terminals are connected to the vehicle electrical system through a receptacle in the integrated power module (IPM). The inputs and outputs of the EBL relay include:

- Terminal (E) receives a battery current input from a fuse in the IPM through a B(+) circuit at all times.
- Trminal (D) receives a ground through the EBL relay control circuit only when the FCM electronically pulls the circuit to ground.
- Terminal (B) receives a battery current input from a fuse in the IPM through a ignition switch output circuit only when the ignition switch is in the Run position.
- Terminal (A) provides battery current to the rear window defogger grid lines through the EBL relay output circuit only when the EBL relay coil is energized.
- Terminal (C) is not connected to any circuit in this application, but provides a battery current output only when the EBL relay coil is de-energized.

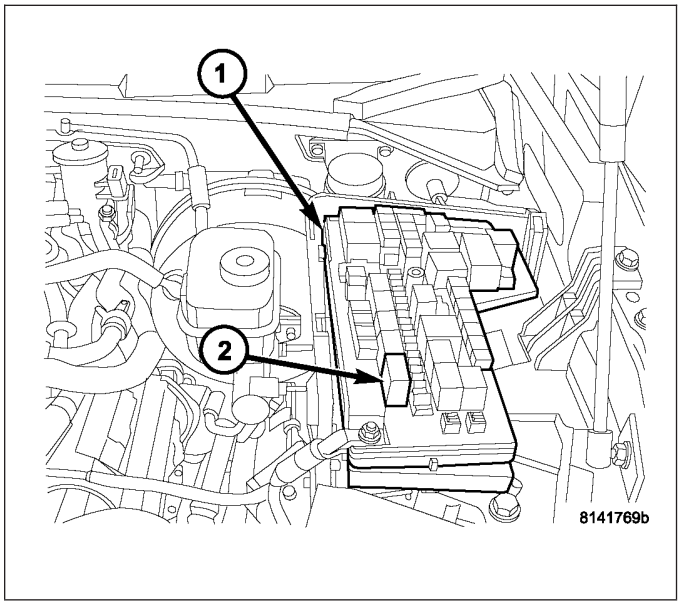
The EBL micro-relay cannot be repaired and, if faulty or damaged, it must be replaced. Refer to the appropriate wiring information for diagnosis and testing of the ISO-standard micro-relay and for complete rear window defogger (EBL) wiring diagrams.

REMOVAL

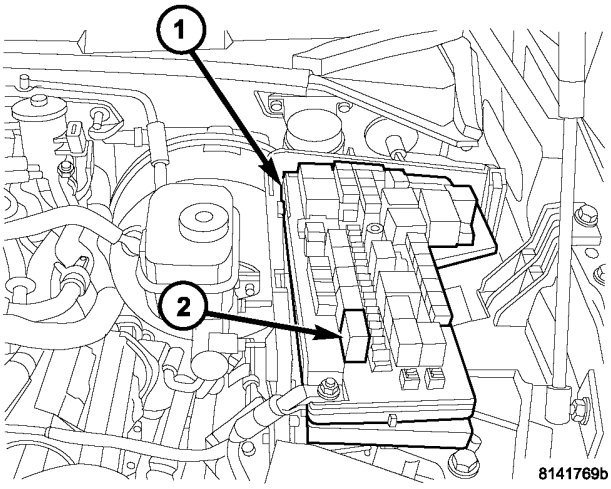
1. Disconnect and isolate the negative battery cable.
2. Open the cover of the integrated power module (IPM) (1) located in the engine compartment.

NOTE: Refer to the fuse and relay layout map on the IPM cover for EBL relay location.

3. Remove the EBL relay (2) from the IPM.



INSTALLATION



NOTE: Refer to the fuse and relay layout map on the integrated power module (IPM) cover for EBL relay location.

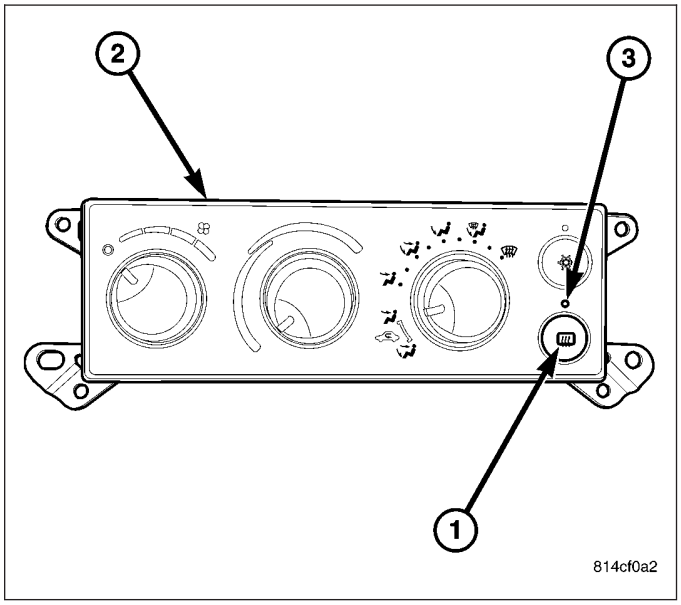
1. Position the EBL relay (2) into the proper receptacle of the IPM (1) located in the engine compartment.
2. Align the EBL relay terminals with the terminal cavities in the IPM receptacle and push down firmly on the relay until the terminals are fully seated.
3. Close the cover of the IPM.
4. Reconnect the negative battery cable.

SWITCH-REAR WINDOW DEFOGGER

DESCRIPTION

The switch for the rear window defogger (EBL) system (1) is integrated into the A/C-heater control (2) which is located in the center of the instrument panel. When the rear window defogger switch is activated, the A/C-heater control requests the front control module (FCM) to operate the rear window defogger (EBL) relay and the LED indicator (3) will illuminate.

When the EBL relay is activated, current is directed to the rear defogger grid lines and the heated side view mirrors (if equipped). The grid lines heat the glass to help clear the surface of fog or frost.



OPERATION

An LED indicator will illuminate when the rear window defogger switch is activated. When the switch is activated, the A/C-heater control operates the rear window defogger (EBL) relay. The EBL relay controls the current flow to the heating grid of the rear window and when equipped, the heated outside rear view mirrors.

NOTE: The EBL system turns off automatically after ten minutes of initial operation. Each following activation cycle of the EBL system will last five minutes.

The EBL system will initially be on for approximately ten minutes or until the rear window defogger switch or the ignition switch is turned off. After the initial time interval has expired, if the defogger switch is turned On again during the same ignition cycle, the EBL system will automatically turn off after about five minutes.

The rear window defogger switch and the rear window defogger LED indicator cannot be repaired and, if faulty or damaged, the A/C-heater control must be replaced (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/ CONTROL-A/C HEATER - REMOVAL).

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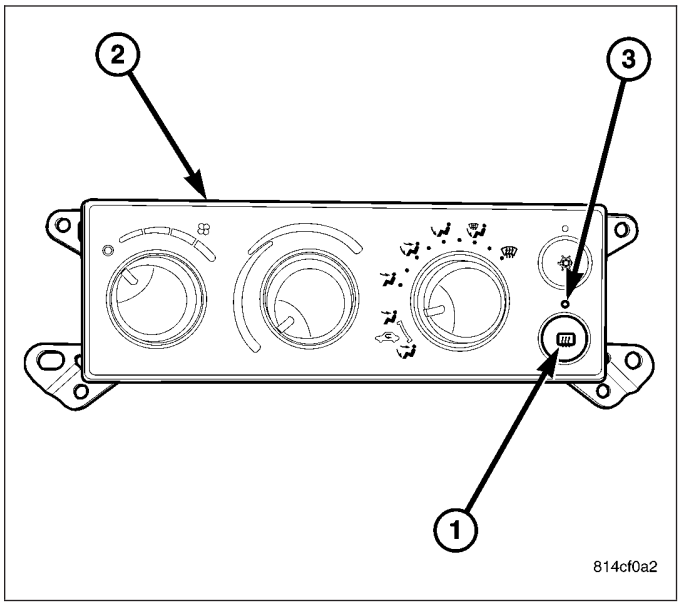
HEATED MIRRORS - SERVICE INFORMATION

DESCRIPTION

The optional heated mirror system is controlled by the momentary rear window defogger switch (1) which is integral to the A/C-heater control (2). An amber indicator lamp in the switch (3) will illuminate to indicate when the rear window defogger (EBL) system is turned on.



The heated mirror system only operates in concert with the EBL system, and will be automatically shut off after a programmed time interval of about ten minutes. After the initial time interval has expired, if the defogger switch is turned on again during the same ignition cycle, the heated mirror system will automatically shut off after about five minutes.

The heated mirror system will automatically shut off if the ignition switch is turned to the Off position, or it can be shut off manually by pressing the rear window defogger switch a second time.

Circuit protection is provided by a cartridge fuse located in the integrated power module (IPM) in the engine compartment.

OPERATION

When the rear window defogger switch is pressed, the rear window defogger (EBL) system becomes activated and an electric heater grid located behind the glass of each of the outside rear view mirrors is energized. When energized, each of these heater grids produce heat to help clear the outside rear view mirrors of ice, snow, or fog.

If the outside mirror heating grids are both inoperative, refer to 8 - ELECTRICAL/HEATED GLASS - DIAGNOSIS AND TESTING in this group. If only one of the outside mirror heating grids is inoperative, refer to 8 - ELECTRICAL/ POWER MIRRORS - DIAGNOSIS AND TESTING.

The heating grid behind each outside mirror glass cannot be repaired and, if faulty or damaged, the mirror glass must be replaced (Refer to 23 - BODY/EXTERIOR/MIRROR-SIDE VIEW - GLASS - REMOVAL).

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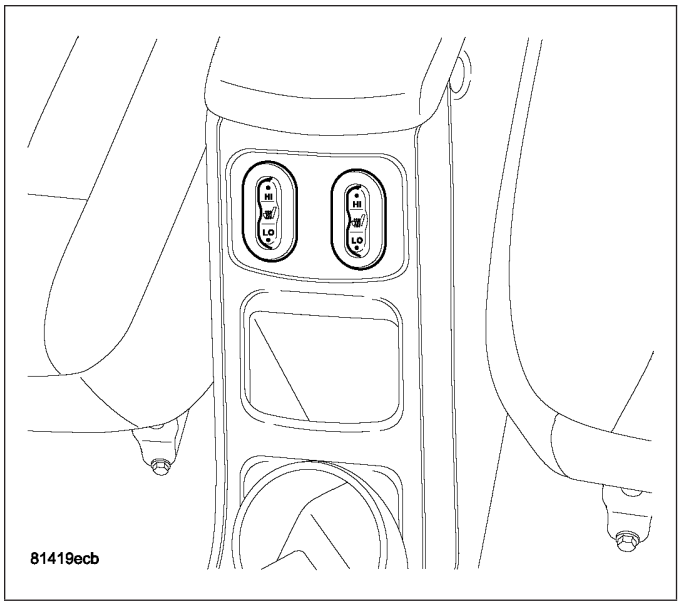
HEATED SEATS - SERVICE INFORMATION

DESCRIPTION

HEATED SEAT SYSTEM

WARNING: The front passenger seat assembly contains critical components that affect the front passenger airbag deployment. Correctly functioning front passenger seat components are critical for the Occupant Classification System (OCS) to properly classify the front passenger and calculate the proper airbag deployment. Unapproved modifications or service procedures to the front passenger seat assembly, its related components, or trim cover may inadvertently change the airbag deployment in case of a frontal crash. This could result in death or serious injury to the front seat passenger if the vehicle is involved in an accident. The following requirements must be strictly adhered to:

- **Do not modify the front passenger seat assembly or components in any way.**
- **Do not modify the front seat center console or center position seat in any way.**
- **Do not use prior or future model year seat trim covers not designated for the specific model being repaired. Always use the correct seat trim cover specified for the vehicle.**
- **Do not replace the seat trim cover with an aftermarket trim cover.**
- **Do not add a secondary trim cover other than those approved by DaimlerChrysler/Mopar.**
- **At no time should any Supplemental Restraint System (SRS) component or SRS related component or fastener be modified or replaced with any part except those which are approved by DaimlerChrysler/Mopar.**



Vehicles with the heated seat option can be visually identified by the two heated seat switches located in the center floor console. The heated seat system allows the driver and front seat passenger to select from two different levels of electrical seat heating (HI/LO). The heated seat system for this vehicle includes the following major components:

- **Heated Seat Switches** - Two heated seat switches are used per vehicle, including two Light-Emitting Diode (LED) indicator lamps and three LED lamps for back lighting each switch. One switch for the driver and one for the passenger front seats. The switches are mounted in the front center floor console.
- **Heated Seat Module** - The heated seat module contains the solid state electronic control and diagnostic logic circuitry for the heated seat system. One heated seat module is used per vehicle and is mounted inside the center floor console on the backside of the power outlet panel. (Refer to 8 - ELECTRICAL/HEATED SEATS/HEATED SEAT MODULE - DESCRIPTION) for additional heated seat module information.
- **Heated Seat Elements** - Four heated seat elements are used per vehicle, one for each front seat back and one for each front seat cushion. The elements are integral to the individual front seat and seat back cushions and cannot be removed from the cushions, once installed at the factory.
- **Heated Seat Sensors** - Two heated seat sensors are used per vehicle, one for each front seat. The sensors are integral to the individual front seat heating elements.

OPERATION

HEATED SEAT SYSTEM

The heated seat system operates on battery current received through a fuse in the Integrated Power Module (IPM). Fused ignition switch output (run-acc) circuits are used, so that the heated seat system will only operate when the ignition switch is in the On or Accessory positions. The heated seat elements will only operate when the surface temperature of the seat cushion is below the designed temperature set points of the system.

The heated seat system will also be turned off automatically whenever the ignition switch is turned to any position except On. If the ignition switch is turned to the Off position while a heated seat is turned ON, the heated seat will remain Off after the ignition switch is turned back “ON” until a heated seat switch is depressed again.

The heated seat module monitors inputs from the heated seat sensors and the heated seat switches. In response to these inputs the heated seat module uses its internal programming to control outputs to the heated seat elements in both front seats and to control the heated seat LED indicator lamps located in both of the heated seat switches. The heated seat module is also programmed to provide self-diagnostic capability. When the module detects certain failures within the heated seat system, it will provide a visual indication of the failure by flashing the indicator lamps in the affected heated seat switch. The heated seat module will automatically turn off the heated seat elements if it detects a short or open in the heated seat element circuit or a heated seat sensor value that is out of range.

DIAGNOSIS AND TESTING

HEATED SEAT SYSTEM

HEATED SEAT SYSTEM SELF-DIAGNOSIS

The heated seat system is capable of performing some self-diagnostics. The following table depicts the various monitored failures which will be reported to the vehicle operator or technician by flashing the individual heated seat switch Light Emitting Diode (LED) indicator lamps. Refer to the Heated Seat System Self-Diagnosis table for failure identification. The driver side heated seat switch indicator lamps will flash if a failure occurs in the driver side heated seat, and the passenger side heated seat switch indicator lamps will flash for a passenger side heated seat failure.

If a monitored heated seat system failure occurs, the switch indicator lamps will flash at a pulse rate of about one-half second on, followed by about one-half second off for a duration of about one minute after the switch for the faulty heated seat is depressed in either the Low or High direction. This process will repeat every time the faulty heated seat switch is actuated until the problem has been corrected.

Before testing the individual components in the heated seat system, check the vehicles battery open-circuit voltage and charging system performance. If the vehicles electrical system is defective or weak it may not be suppling sufficient energy to operate the heated seat system.

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

Heated Seat System Self-Diagnosis		
Monitored Failure	Switch High Indicator Lamp	Switch Low Indicator Lamp
Heated Seat Element Shorted	Flashing	Flashing
Heated Seat Element Open	Flashing	Off
Heated Seat Sensor Value Out of Range	Off	Flashing

Diagnostic logic is built into the heated seat module to help locate the problem by the most efficient means possible. Anytime a problem is suspected, locate the diagnosis and testing procedure for the component in question and follow the steps until the specific problem is located and resolved. Once the problem is thought to be corrected, verify correct system operation. If the heated seat system is functioning correctly return the vehicle to service.

If a problem could not be verified such as not finding anything wrong when following the diagnostic procedure, this is a good indication that a INTERMITTENT problem may be present. You must then attempt to find the intermittent problem, such as moving the heating element within the seat while testing continuity or wiggling the wire harness's/ electrical connectors under the seat while testing continuity. Always, eliminate all other potential problems before attempting to replace the heated seat module.

PRELIMINARY TEST

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

- If the heated seat switch back lighting and the cluster illumination lamps do not illuminate with the headlamps or park lamps turned on, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING) for the cluster illumination lamp diagnosis and testing procedures. If the heated seat switch back lighting does not illuminate, but the cluster illumination lamps do illuminate with the headlamps or park lamps turned on, (Refer to 8 - ELECTRICAL/HEATED SEATS/SEAT SWITCH - DIAGNOSIS AND TESTING) for the heated seat switch diagnosis and testing procedures.
- If a single LED indicator lamp for one heated seat switch does not operate and the heated seat elements do heat, (Refer to 8 - ELECTRICAL/HEATED SEATS/SEAT SWITCH - DIAGNOSIS AND TESTING) for the heated seat switch diagnosis and testing procedures.
- If both LED indicator lamps for a heated seat switch operate, but the heated seat elements do not heat, (Refer to 8 - ELECTRICAL/HEATED SEATS/HEATED SEAT MODULE - DIAGNOSIS AND TESTING) for heated seat module diagnosis and testing procedures.
- If the indicator lamp on either heated seat switch remains illuminated after the heated seat has been turned Off, (Refer to 8 - ELECTRICAL/HEATED SEATS/HEATED SEAT MODULE - DIAGNOSIS AND TESTING) for heated seat module diagnosis and testing procedures.

HEATER-CUSHION PAD

DESCRIPTION

Vehicles equipped with the optional heated seat system have two, carbon fiber heated seat elements, located in each front seat. One heating element is used for each seat cushion and another for each seat back.

Each of the heated seat element consists of multiple heating circuits operating in parallel throughout the carbon fiber element. The heated seat elements are captured between the leather trim cover and the seat cushion assembly. If a malfunction occurs in one or more of the individual carbon fiber circuits, the others will continue to provide heat.

The heated seat elements cannot be repaired. If found to be damaged or inoperative, a new heating element assembly must be installed.

OPERATION

One end of the heated seat element is connected to ground at all times through a splice under the seat. Battery current is directed to the other end of the heated seat element by the heated seat module. The heated seat module will energize the heated seat element when the heated seat switch is depressed in the Low or High position.

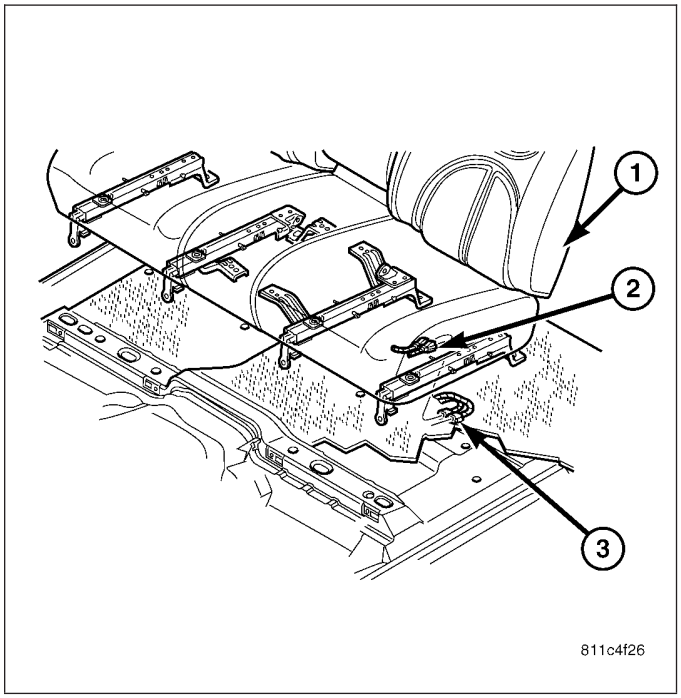
As electrical current passes through the heated seat element, the resistance of the wire used in the element disperses some of the electrical current in the form of heat. The heat produced by the heated seat element then radiates through the underside of the seat cushion and seat back trim covers, warming the seat cover and its occupant.

DIAGNOSIS AND TESTING

HEATED SEAT ELEMENT

Refer to the appropriate wiring information for complete circuit schematic or connector pin-out information.

The wire harness connectors (2&3) for the heating elements are located under the seat (1).



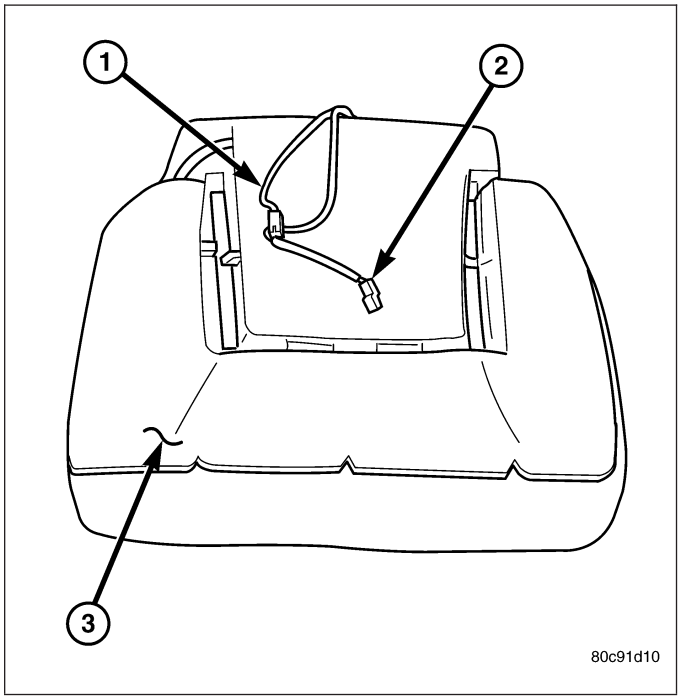
NOTE: When checking heated seat elements for continuity, be certain to move the heating element being checked. Moving the element, such as sitting in the seat will eliminate the possibility of an intermittent open in the element which would only be evident if the element was in a certain position. Failure to check the element in various positions could result in an incomplete test.

1. Locate and disconnect the seat electrical connector.
2. Check the resistance between the circuit leading in and out of the suspect heated seat element. The resistance should be between 3.8 - 4.8 ohms for a seat cushion element and 4.3 - 5.4 ohms for a seat back element. If OK, (Refer to 8 - ELECTRICAL/ HEATED SEATS - DIAGNOSIS AND TESTING). If not OK, replace the inoperative heated seat element.

REMOVAL

NOTE: Do not remove the factory installed heating elements (3) from the seat or seat back cushions. The original element is permanently attached and cannot be removed without permanent damage. The replacement heating element is designed to be applied directly on top of the inoperative factory installed heating element.

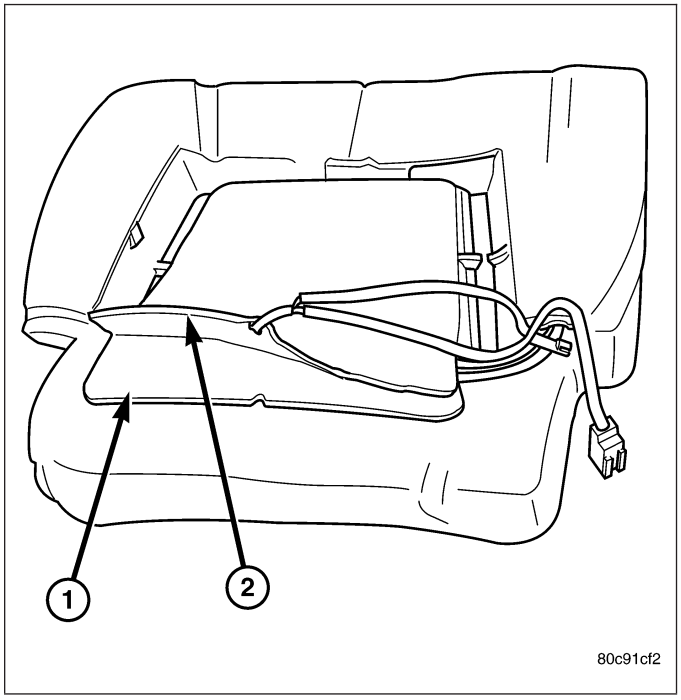
1. Disconnect and isolate the negative battery cable.
2. Remove the appropriate seat cushion, (Refer to 23 - BODY/SEATS/SEAT CUSHION COVER - REMOVAL) or seat back trim cover, (Refer to 23 - BODY/SEATS/SEAT BACK CUSHION / COVER - REMOVAL).
3. Disconnect the inoperative heated seat cushion or seat back element electrical connectors (2).
4. Locate the wires leading from the inoperative heating element and cut them off flush with the edge of the original heating element.



INSTALLATION

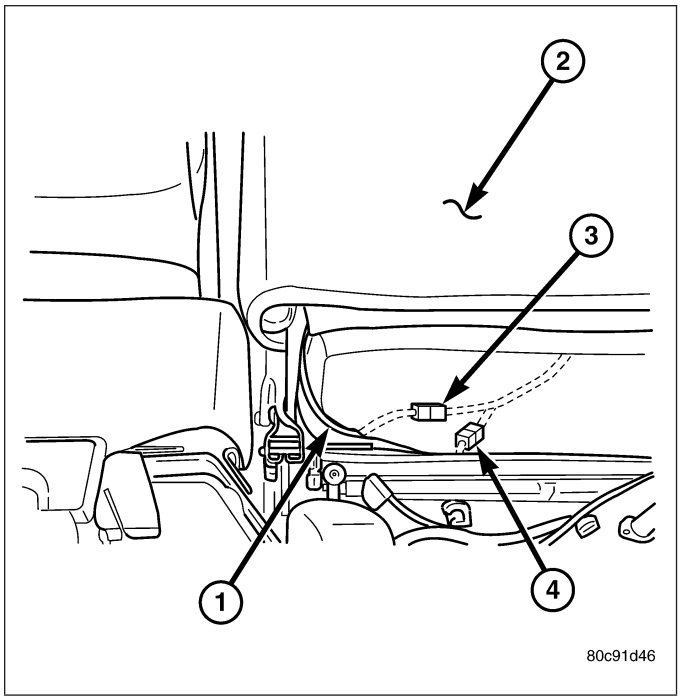
1. Peel off the adhesive backing on the back of the replacement heating element (2) and stick directly on top of the factory installed heating element (1).

CAUTION: During the installation of the replacement heating element, be careful not to fold or crease the element assembly. Folds or creases will cause premature failure.



2. Connect the new heating element electrical connectors (3&4).
3. Connect the battery negative cable.
4. Verify heated seat system operation.
5. Install the appropriate seat cushion, (Refer to 23 - BODY/SEATS/SEAT CUSHION COVER - INSTALLATION) or seat back trim cover, (Refer to 23 - BODY/SEATS/SEAT BACK CUSHION / COVER - INSTALLATION).

NOTE: Make certain the seat wire harness is correctly routed through the seat and seat back. The excess wire between the cushion and back elements should be securely tucked between the rear of the cushion foam and the rear carpet flap of the trim cover.



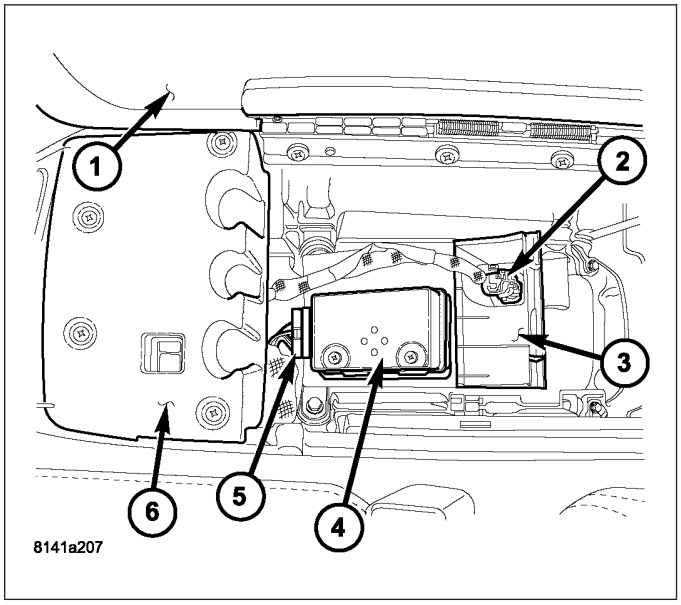
MODULE-HEATED SEAT

DESCRIPTION

The heated seat module (4) is an electronic microprocessor controlled device designed and programmed to use inputs from the heated seat relay, the two heated seat switches and the two heated seat sensors to operate and control the heated seat elements in both front seats and the two heated seat indicator lamp Light-Emitting Diodes (LEDs) in each heated seat switch. The heated seat module is also programmed to perform self-diagnosis of certain heated seat system functions and provide feedback of that diagnosis through the heated seat switch indicator lamps.

The heated seat module (4) is mounted inside the center floor console (5) on the backside of the power outlet panel (3). The heated seat module has a single connector receptacle that allows the module to be connected to all of the required inputs and outputs through the seat wire harness.

The heated seat module cannot be repaired. If the heated seat module is damaged or inoperative, the entire module must be replaced.



OPERATION

The heated seat module operates on fused battery current received from a fuse in the Integrated Power Module (IPM). The module is grounded at all times. Inputs to the module include a resistor multiplexed heated seat switch request circuit for each of the two heated seat switches and the heated seat sensor inputs from the seat cushions of each front seat. In response to those inputs, the heated seat module controls battery current to the heated seat elements and sensors, and controls the ground for the heated seat switch indicator lamps (LED's).

When a heated seat switch (Driver or Passenger) is depressed a signal is received by the heated seat module, the module energizes the proper indicator LED (Low or High) in the switch by grounding the indicator lamp circuit to indicate that the heated seat system is operating. At the same time, the heated seat module energizes the selected heated seat sensor circuit and the sensor provides the module with an input indicating the surface temperature of the selected seat cushion.

The Low heat set point is about 36° C (96.8° F), and the High heat set point is about 42° C (107.6° F). If the seat cushion surface temperature input is below the temperature set point for the selected temperature setting, the heated seat module energizes an N-channel Field Effect Transistor (N-FET) within the module which energizes the heated seat elements in the selected seat cushion and back. When the sensor input to the module indicates the correct temperature set point has been achieved, the module de-energizes the N-FET which de-energizes the heated seat elements. The heated seat module will continue to cycle the N-FET as needed to maintain the selected temperature set point.

If the heated seat module detects a heated seat sensor value input that is out of range or a shorted or open heated seat element circuit, it will communicate this condition by flashing the High and/or Low indicator lamps in the affected heated seat switch. (Refer to 8 - ELECTRICAL/HEATED SEATS - DIAGNOSIS AND TESTING) for flashing LED diagnosis and testing procedures.

DIAGNOSIS AND TESTING

HEATED SEAT MODULE

NOTE: Before testing the individual components in the heated seat system, check the vehicles battery open-circuit voltage and charging system performance. If the vehicles electrical system is defective or weak it may not be suppling sufficient energy to operate the heated seat system.

If a heated seat fails to heat and one or both of the indicator lamps on a heated seat switch flash, (Refer to 8 - ELECTRICAL/HEATED SEATS - DIAGNOSIS AND TESTING) for flashing LED diagnosis and testing procedures-.**For complete circuit diagrams, refer to the appropriate wiring information.** The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

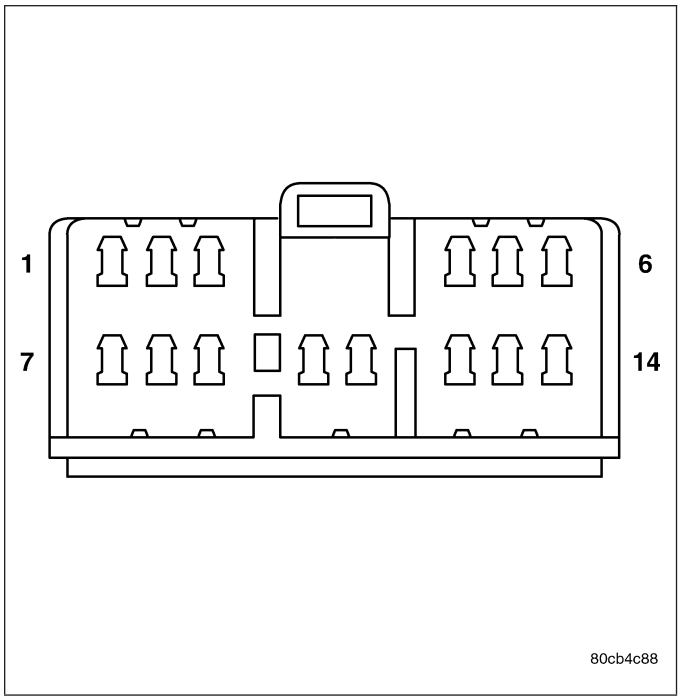
1. Remove the heated seat module from its mounting location (Refer to 8 - ELECTRICAL/HEATED SEATS/ HEATED SEAT MODULE - REMOVAL).

NOTE: ANY RESISTANCE VALUES (OHMS Ω) GIVEN IN THE FOLLOWING TEXT ARE SUPPLIED USING THE AUTOMATIC RANGE GENERATED BY A FLUKE® AUTOMOTIVE METER. IF ANOTHER TYPE OF MEASURING DEVICE IS USED THE VALUES GENERATED MAY NOT BE THE SAME AS THE RESULTS SHOWN HERE, OR MAY HAVE TO BE CONVERTED TO THE RANGE USED HERE.

RIGHT SEAT HEATER INOPERATIVE

1. If a heated seat heats but one or both indicator lamps (LED's) on the heated seat switch fail to illuminate, check the driver circuit with the inoperative LED for a short to ground. If OK, replace the heated seat switch. If NOT OK repair the short to ground as required and than replace the heated seat switch.

NOTE: IF THE RIGHT SEAT CUSHION IS ALREADY WARM THE FOLLOWING STEP WILL NOT PROVE CONCLUSIVE.



2. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #3 for battery voltage when the right heated seat switch is turned "ON", voltage should be present, If OK go to Step 3 If NOT OK, test the right heated seat switch (Refer to 8 - ELECTRICAL/HEATED SEATS/SEAT SWITCH - DIAGNOSIS AND TESTING). If the switch tests OK, check for continuity between the switch and control module on the MUX circuit, If OK replace the heated seat control module. If NOT OK, repair the open or shorted MUX circuit as required.
3. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #10 for battery voltage, while observing the voltmeter depress the right heated seat switch **low** setting twice, voltage should toggle between approx. 12v and 8v, If OK go to Step 4. If NOT OK check for continuity between the switch and control module on the low heat driver circuit, If OK replace the heated seat control module. If NOT OK, repair the open or shorted circuit as required.
4. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #11 for battery voltage, while observing the voltmeter depress the right heated seat switch **high** setting twice, voltage should toggle between approx.12v and 8v, If OK go to Step 5. If NOT OK check for continuity between the switch and control module on the high heat driver circuit, If OK replace the heated seat control module. If NOT OK, repair the open or shorted circuit as required.
5. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #2 for approx. 5v, voltage should be present, If OK go to Step 6. If NOT OK replace the heated seat control module.
6. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #7 for a range in voltage from 1.72v (warm seat) – 3.0v (cold seat). It should be within this range, If OK replace the heated seat module. If NOT OK test the Heated Seat Sensor. If NOT OK, replace the right heated seat element and sensor assembly. If the heated seat sensor tests OK, check for continuity between the right heated seat cushion connector and control module connector on the 5v supply circuit, If NOT OK, repair the open or shorted 5v supply circuit as required. If OK check for continuity between the right heated seat cushion connector and control module connector on the temperature sensor input circuit. If NOT OK, repair the open or shorted temperature sensor input circuit as required. If OK replace the heated seat control module.

LEFT SEAT HEATER INOPERATIVE

1. If a heated seat heats but one or both indicator lamps (LED's) on the heated seat switch fail to illuminate, check the driver circuit with the inoperative LED for a short to ground. If OK, replace the heated seat switch. If NOT OK repair the short to ground as required and than replace the heated seat switch.

NOTE: IF THE LEFT SEAT CUSHION IS ALREADY WARM THE FOLLOWING STEP WILL NOT PROVE CONCLUSIVE.

2. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #5 for battery voltage when the left heated seat switch is turned “ON”, voltage should be present, If OK go to Step 3 If NOT OK, test the left heated seat switch (Refer to 8 - ELECTRICAL/HEATED SEATS/SEAT SWITCH - DIAGNOSIS AND TESTING). If the switch tests OK, check for continuity between the switch and control module on the MUX circuit, If OK replace the heated seat control module. If NOT OK, repair the open or shorted MUX circuit as required.
3. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #12 for battery voltage, while observing the voltmeter depress the left heated seat switch **low** setting twice, voltage should toggle between approx.12v and 8v, If OK go to Step 4. If NOT OK check for continuity between the switch and control module on the low heat driver circuit, If OK replace the heated seat control module. If NOT OK, repair the open or shorted circuit as required.
4. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #14 for battery voltage, while observing the voltmeter depress the left heated seat switch **high** setting twice, voltage should toggle between approx.12v and 8v, If OK go to Step 5. If NOT OK check for continuity between the switch and control module on the high heat driver circuit, If OK replace the heated seat control module. If NOT OK, repair the open or shorted circuit as required.
5. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #2 for approx. 5v, 5 voltage should be present, If OK go to Step 6. If NOT OK replace the heated seat control module.
6. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #8 for a range in voltage from 1.72v (warm seat) – 3.0v (cold seat). It should be within this range, If OK replace the heated seat control module. If NOT OK, test the Heated Seat Sensor. If NOT OK, replace the left heated seat element and sensor assembly. If the heated seat sensor tests OK, check for continuity between the left heated seat cushion connector and control module connector on the 5v supply circuit, If NOT OK, repair the open or shorted 5v supply circuit as required. If OK check for continuity between the left heated seat cushion connector and control module connector on the temperature sensor input circuit. If NOT OK, repair the open or shorted temperature sensor input circuit as required. If OK replace the heated seat control module.

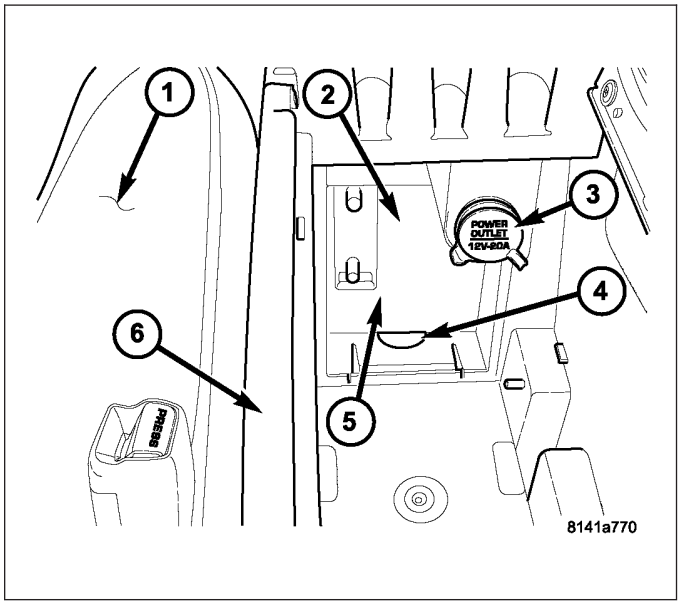
BOTH SEATS INOPERATIVE

If both seats (driver and passenger) fail to heat and the indicator lamps on the heated seat switches for both seats fail to operate, test the heated seat fuses in the Integrated Power Module (IPM). If the heated seat fuses check OK, go to Step 1.

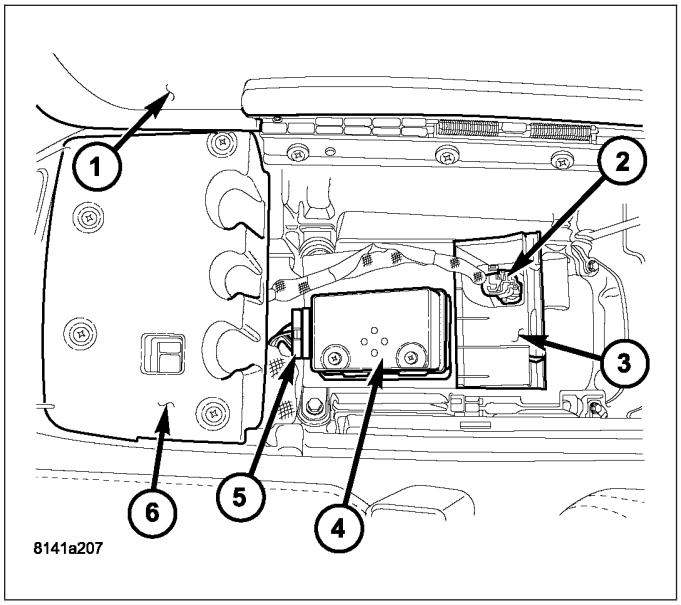
1. Back-probe the heated seat module wire harness connector, do not disconnect. Check for continuity between the ground circuit cavity #13 of the heated seat module connector and a good ground. If OK go to Step 2. If NOT OK, repair the open or shorted ground circuit as required.
2. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #4 and #6 for battery voltage, voltage should be present, If OK go to Step 3. If NOT OK repair the open or shorted fused B(+) circuit as required.
3. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #2 for approx. 5v, voltage should be present, replace the heated seat control module with a known good module and verify system operation.

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Open the center floor console and remove the base mat.
3. Remove the power outlet panel (5) by grasping the lower access slot (4) and lifting up and rearward to release it from the console.

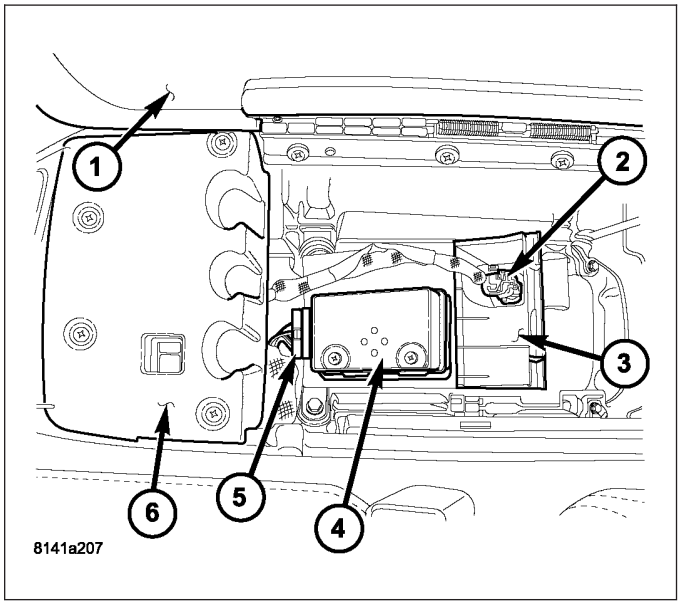


4. Lay the power outlet panel (3) down to access the module fasteners.
5. Remove the two fasteners securing the module (4).
6. Disconnect the wire harness connector (5) from the heated seat module (4).
7. Remove the heated seat module (4) from the vehicle.

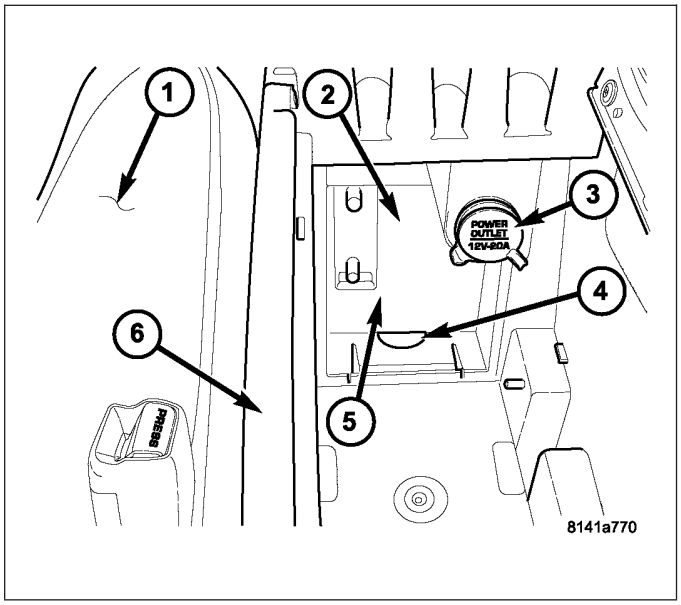


INSTALLATION

1. Position the heated seat module (4) into the vehicle center floor console (6).
2. Connect the wire harness connector (5) to the heated seat module (4).
3. Install the two fasteners securing the module (4) to the power outlet panel (3).
4. Reconnect the negative battery cable.
5. Check the heated seat system for proper operation.



6. Install the power outlet panel (5) by engaging the upper tabs into the console (6) and pushing the bottom forward until it snaps into place.
7. Install the console base mat.

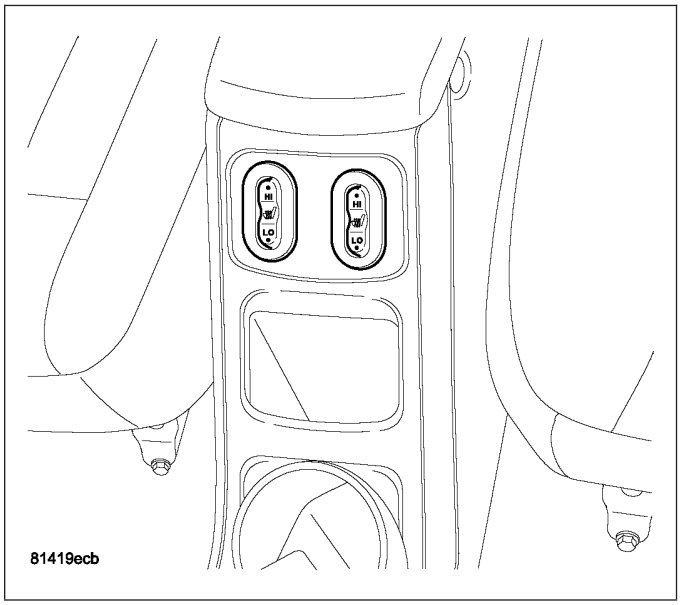


SWITCH-HEATED SEAT

DESCRIPTION

HEATED SEAT SWITCH

Momentary contact rocker switches mounted in the front face of the center console storage bin operate the heated seat system. Each heated seat switch has two Light-Emitting Diode (LED) indicator lamps, which indicate the selected level (Low or High) of the seat heater. Pressing either end of the rocker initiates heat. Pressing the same end turns off heat. When heat is on, pressing the opposite end of the rocker switches the heat level. Heat remains on until switched off or until the ignition is turned off. If switched off by the ignition, a switch must be pressed to restart heating.



Each momentary, bidirectional rocker-type heated seat switch provides a resistor-multiplexed signal to the heated seat module. Each switch has a center neutral position and momentary Low and High positions so that the driver and the front seat passenger can select a preferred seat heating level. Each switch also has three LED lamps for back lighting of the switch when the ignition switch is in the Run position.

The LED indicator lamps in each heated seat switch cannot be repaired. If the LED lamps are faulty or damaged, or the switch is inoperative or damaged the individual heated seat switch assembly must be replaced. (Refer to 8 - ELECTRICAL/HEATED SEATS/SEAT SWITCH - REMOVAL) for the switch replacement procedure.

OPERATION

HEATED SEAT SWITCH

The heated seat switches receive battery current through a fused ignition switch output (run) circuit when the ignition switch is in the On position. Depressing the heated seat switch rocker to its momentary High or Low position provides a hard-wired resistor multiplexed signal to the heated seat module. This signals the module to power the heated seat element of the selected seat and maintain the temperature setting.

If the heated seat switch is depressed to a different position (Low or High) than the currently selected state, the heated seat module will go through the process again to change the temperature setting. If a heated seat switch is depressed a second time to the same position as the currently selected state, the heated seat module interprets the second input as a request to turn the seat heater OFF. The heated seat module will then turn the heated seat elements for that seat off.

The backlighting Light-Emitting Diodes (LEDs) in each of the heated seat switches receive battery current through a fused ignition switch output (run) circuit when the ignition switch is in the On position. The ground side of the indicator lamp is divided by a separate lamp driver circuit in the heated seat module.

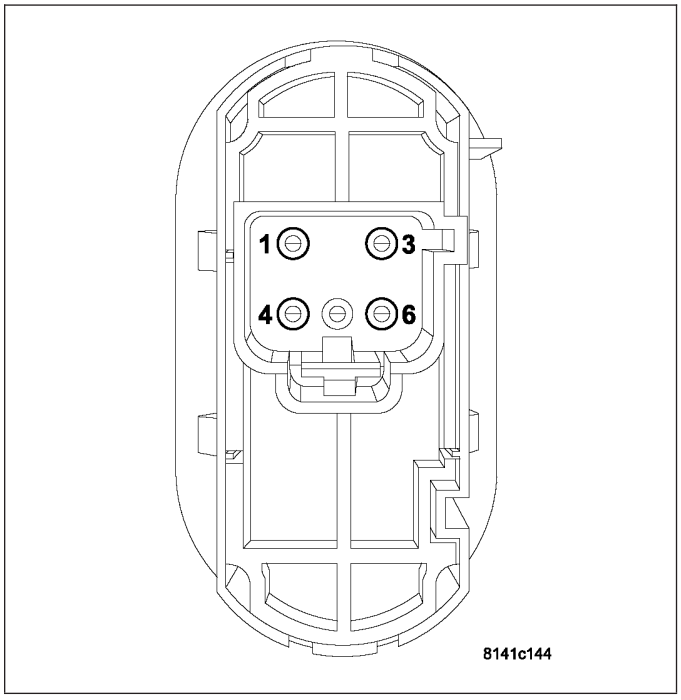
DIAGNOSIS AND TESTING

HEATED SEAT SWITCH

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

1. If the problem being diagnosed involves inoperative heated seat switch back lighting and the heated seat elements do heat, disconnect the inoperative switch and check for continuity between the ground pin at the heated seat switch connector and ground. If there is no continuity, repair an open wire between ground and the heated seat switch connector. If there is continuity, replace the inoperative heated seat switch, (Refer to 8 - ELECTRICAL/HEATED SEATS/SEAT SWITCH - REMOVAL).
2. Check the fused ignition switch output (run) fuse in the Integrated Power Module (IPM). If OK, go to Step 3. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
3. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) fuse in the IPM. If OK, go to Step 4. If not OK, repair the open fused ignition switch output (run) circuit to the ignition switch as required.
4. Disconnect and isolate the battery negative cable. Disconnect the wire harness connector from the connector receptacle on the back of the heated seat switch to be tested. Reconnect the battery negative cable. Turn the ignition switch to the Run position. Check for battery voltage at the fused ignition switch output (run) circuit cavity of the heated seat switch. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (run) circuit to the IPM fuse as required.
5. Check the continuity and resistance values of the heated seat switch in the Neutral, Low and High positions as shown in the Heated Seat Switch Continuity chart below. If OK, (Refer to 8 - ELECTRICAL/HEATED SEATS/HEATED SEAT MODULE - DIAGNOSIS AND TESTING) for additional diagnosis and testing procedures. If not OK, replace the faulty heated seat switch, (Refer to 8 - ELECTRICAL/HEATED SEATS/SEAT SWITCH - REMOVAL).



HEATED SEAT SWITCH CONTINUITY CHART

Switch Position	Continuity Between	Resistance
Neutral	4 & 6	2.2 Kilohms
Low	4 & 6	415 Ohms
High	4 & 6	33 Ohms
ALL RESISTANCE VALUES ARE ± FIVE PERCENT		

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Using an appropriate flat bladed tool, remove the heated seat switch from the console by gently prying up from the top edge of the switch. Take care not to scratch or damage the console or switch in any way.
3. Disconnect the switch electrical connector.
4. Remove the heated seat switch from the vehicle.

INSTALLATION

1. Connect the switch electrical connector.
2. Gently push the heated seat switch into the mounting hole in the center console until it is securely in place.
3. Connect the battery negative cable.
4. Verify heated seat system operation.

HORN

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HORN SYSTEM - ELECTRICAL DIAGNOSTICS

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HORN SYSTEM - ELECTRICAL DIAGNOSTICS
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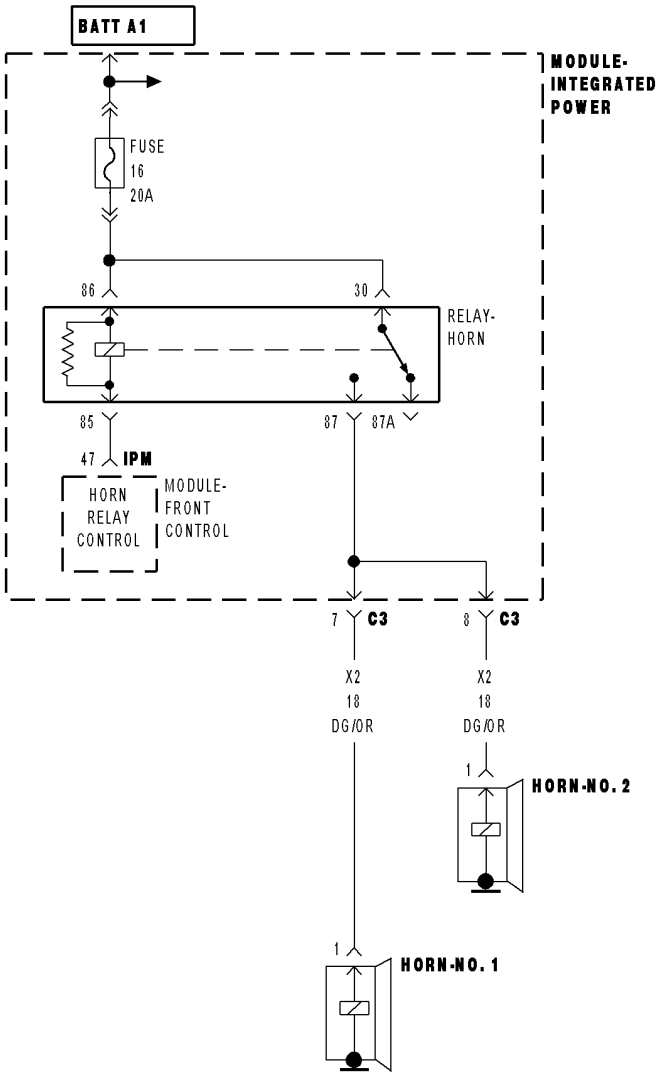
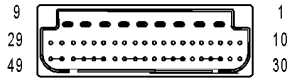
HORN SYSTEM - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B2337–HORN CONTROL CIRCUIT HIGH – FCM





MODULE-
FRONT
CONTROL
(IPM)

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B2337–HORN CONTROL CIRCUIT HIGH – FCM (CONTINUED)

For the Horn System circuit diagram (Refer to 8 - ELECTRICAL/HORN SYSTEM - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  When the Front Control Module detects a short to battery on the Horn Relay Control circuit.

Possible Causes
HORN RELAY
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase DTC's
Operate the Horn Switch several times.
Cycle the ignition from on to off 3 times and leave on.
With the scan tool, read DTC's.

Does the scan tool display B2337 – HORN CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

---

2. HORN RELAY

Turn the ignition off.
Install a known good relay in place of the Horn Relay.
With the scan tool erase DTC's
Operate the Horn Switch several times.
Cycle the ignition from on to off 3 times and leave on.
With the scan tool, read DTC's.

Does the scan tool display B2337 – HORN CONTROL CIRCUIT HIGH?

No >> Replace the original Horn Relay.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

Yes >> Go To 3

B2337–HORN CONTROL CIRCUIT HIGH – FCM (CONTINUED)

3. SHORTED POWER DISTRIBUTION CENTER

Remove the Horn Relay.

Disconnect the Front Control Module from the IPM 49 – way connector.

Turn the ignition on.

Measure the voltage between (X4) Horn Relay Control circuit and ground.

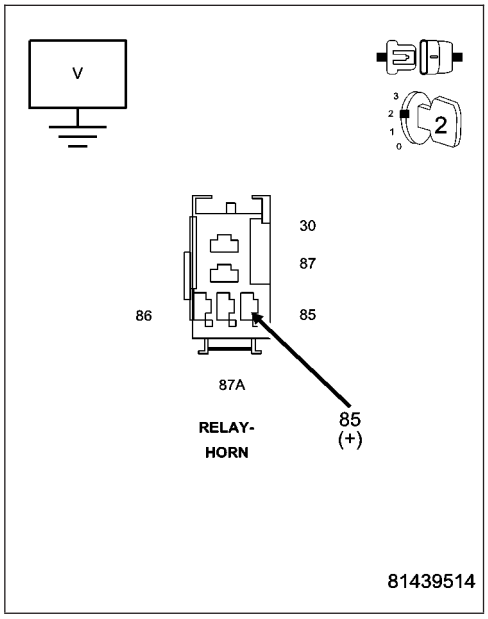
Is there any voltage present?

Yes >> Replace the Power Distribution Center in accordance with the service information.

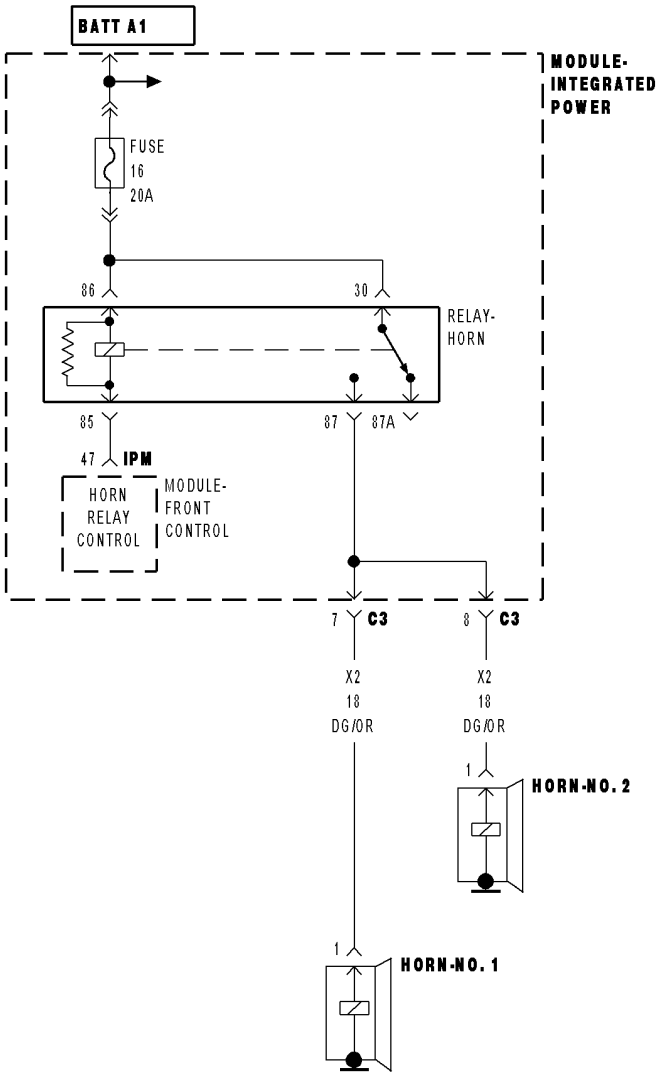
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

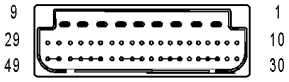
No >> Replace the Front Control Module in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)



B2336,B2338–HORN CONTROL CIRCUIT LOW/OPEN – FCM





MODULE-
FRONT
CONTROL
(IPM)

81433b61

B2336,B2338–HORN CONTROL CIRCUIT LOW/OPEN – FCM (CONTINUED)

For the Horn System circuit diagram (Refer to 8 - ELECTRICAL/HORN SYSTEM - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  When the Front Control Module does not detect voltage on the Horn Relay Control circuit.

Possible Causes
HORN FUSE
B(+) OPEN
RELAY
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase DTC's

Operate the Horn Switch several times.

Cycle the ignition from on to off 3 times and leave on.

With the scan tool, read DTC's.

Does the scan tool display the same DTC?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

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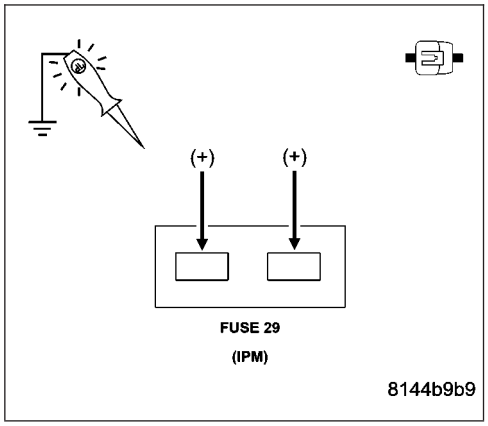
2. HORN FUSE

Using a 12-volt test light connected to ground, check for voltage on both sides of the Horn fuse.



Does the test light illuminate and was the fuse OK?

No >> Replace the horn fuse if open and check for a short to ground on the Horn Relay Output circuit or correct the open B(+) circuit to the fuse.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

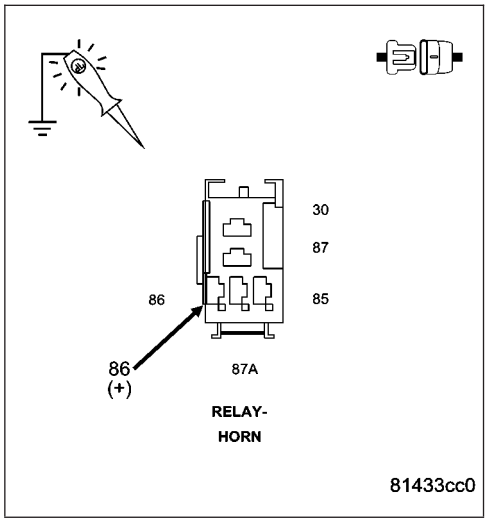
Yes >> Go To 3

B2336,B2338–HORN CONTROL CIRCUIT LOW/OPEN – FCM (CONTINUED)

3. OPEN FUSED B(+) TO RELAY

Remove the Horn Relay from the PDC.

Using a 12-volt test light connected to ground, check the Fused B(+) circuit at the relay connector.



Does the test light illuminate?

No >> Replace the Power Distribution Center in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

Yes >> Go To 4

4. HORN RELAY

Install a known good relay in place of the Horn Relay.

With the scan tool erase DTC's

Operate the Horn Switch several times.

Cycle the ignition from on to off 3 times and leave on.

With the scan tool, read DTC's.

Does the scan tool display the same DTC?

No >> Replace the original Horn Relay.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

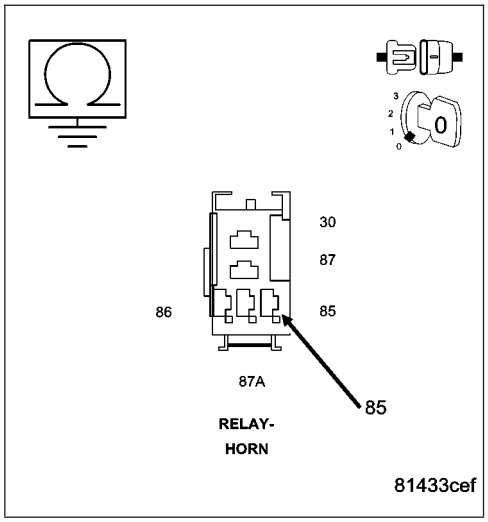
Yes >> Go To 5

5. (X4) HORN RELAY CONTROL SHORTED

Remove the Horn Relay.

Disconnect the Front Control Module from the PDC 49 – way connector.

Measure the resistance between ground and the (X4) Horn Relay Control circuit at the relay.



Is the resistance below 1000.0 ohms?

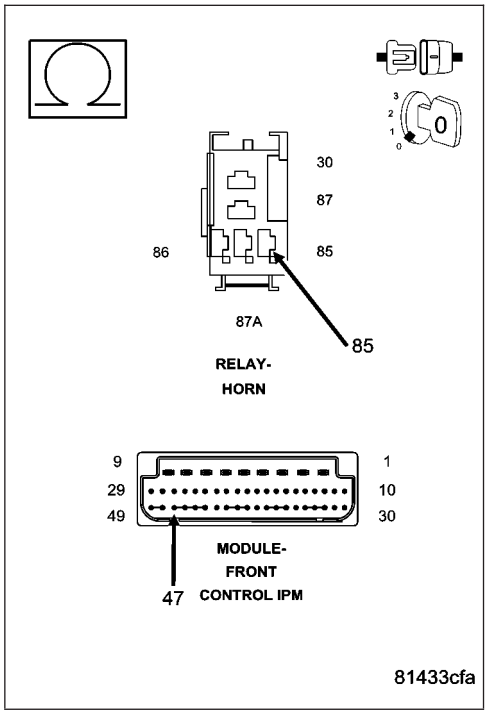
Yes >> Replace the Power Distribution Center in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

No >> Go To 6

B2336,B2338–HORN CONTROL CIRCUIT LOW/OPEN – FCM (CONTINUED)

6. (X4)HORN RELAY CONTROL OPEN

Measure the resistance of the (X4)Horn Relay Control circuit from the relay connector to FCM connector.



Is the resistance below 3.0 ohms?

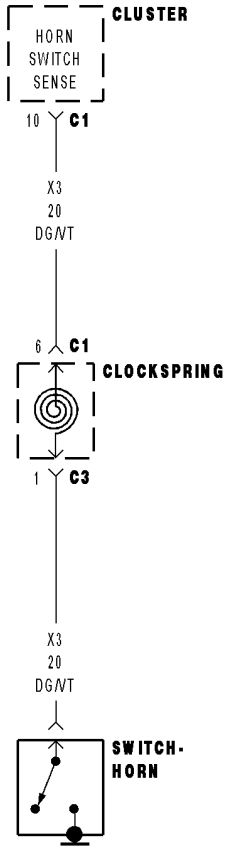
Yes >> Replace the Front Control Module in accordance with the service information.

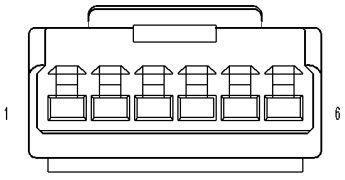
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

No >> Replace the Power Distribution Center in accordance with the service information.

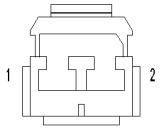
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

B2339–HORN SWITCH STUCK – CLUSTER

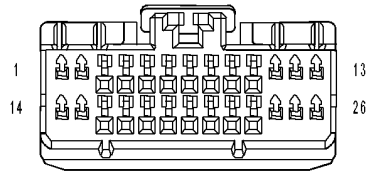




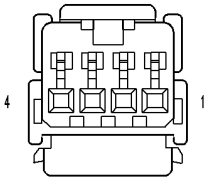
CLOCKSPRING C1



SWITCH-
HORN



CLUSTER C1



CLOCKSPRING C3

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B2339–HORN SWITCH STUCK – CLUSTER (CONTINUED)

For the Horn System circuit diagram (Refer to 8 - ELECTRICAL/HORN SYSTEM - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  When the Cluster senses the Horn Switch input for over 30 seconds, this code will set.

Possible Causes
HORN SWITCH
CLOCKSPRING
(X3)HORN SWITCH SENSE CIRCUIT SHORTED TO GROUND
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase DTC's

Operate the Horn Switch several times.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read DTC's.

Does the scan tool display HORN SWITCH STUCK?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

---

2. (X3)HORN SWITCH SENSE SHORTED

Turn the ignition off.

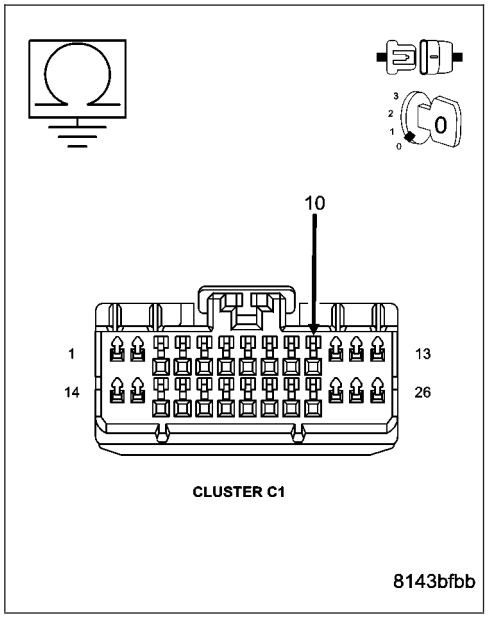
Disconnect the Cluster C1connector.

Measure the resistance between ground and the (X3) Horn Switch Sense circuit.

Is the resistance below 1000.0 ohms?

No >> Replace the Cluster.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

Yes >> Go To 3



B2339–HORN SWITCH STUCK – CLUSTER (CONTINUED)

3. HORN SWITCH SHORTED

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Horn switch connector.

Measure the resistance between ground and the (X3) Horn Switch Sense circuit.

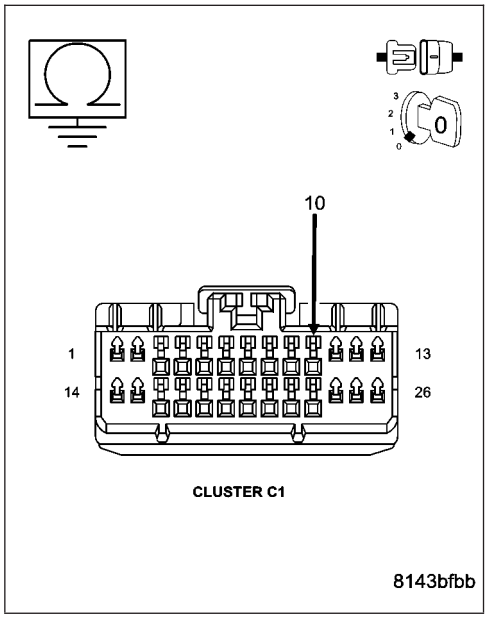
Is the resistance below 1000.0 ohms?

Yes >> Go To 4

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

No >> Replace the Horn Switch.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)



4. CLOCKSPRING SHORTED

Disconnect the Clockspring C1connector.

Measure the resistance between ground and the (X3) Horn Switch Sense circuit.

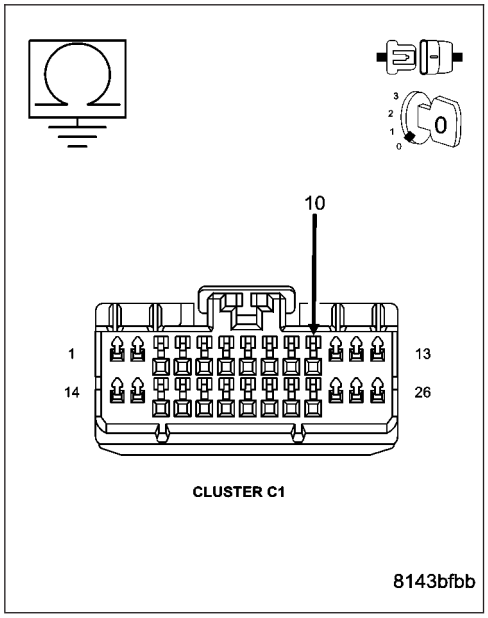
Is the resistance below 1000.0 ohms?

Yes >> Repair the Horn Switch Sense circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)

No >> Replace the Clockspring.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/HORN - DIAGNOSIS AND TESTING)



BODY VERIFICATION TEST – VER 1

Diagnostic Test

1. Perform Body Verification Test

Disconnect all jumper wires and reconnect all previously disconnected components and connectors.

Ensure that all accessories are turned off.

Ensure that the battery is fully charged.

Turn the ignition on.

With the scan tool, record and erase DTCs from all modules.

If an electronic control module was replaced, select the applicable module from the scan tool menu and press “Misc. Functions”. If the module has programable features, program as necessary.

If repairs were made to any of the HVAC door actuator circuits, with the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. The test must pass before proceeding to the next step.

If repairs were made to any of the HVAC doors, linkage, door actuators, or door actuator circuits, with the scan tool in HVAC, select System Tests and then select Actuator Calibration Test. The test must pass before proceeding to the next step.

Turn the ignition off, wait 10 seconds, and then turn the ignition on.

Operate all functions of the system that caused the original concern.

With the scan tool, select ECU View.

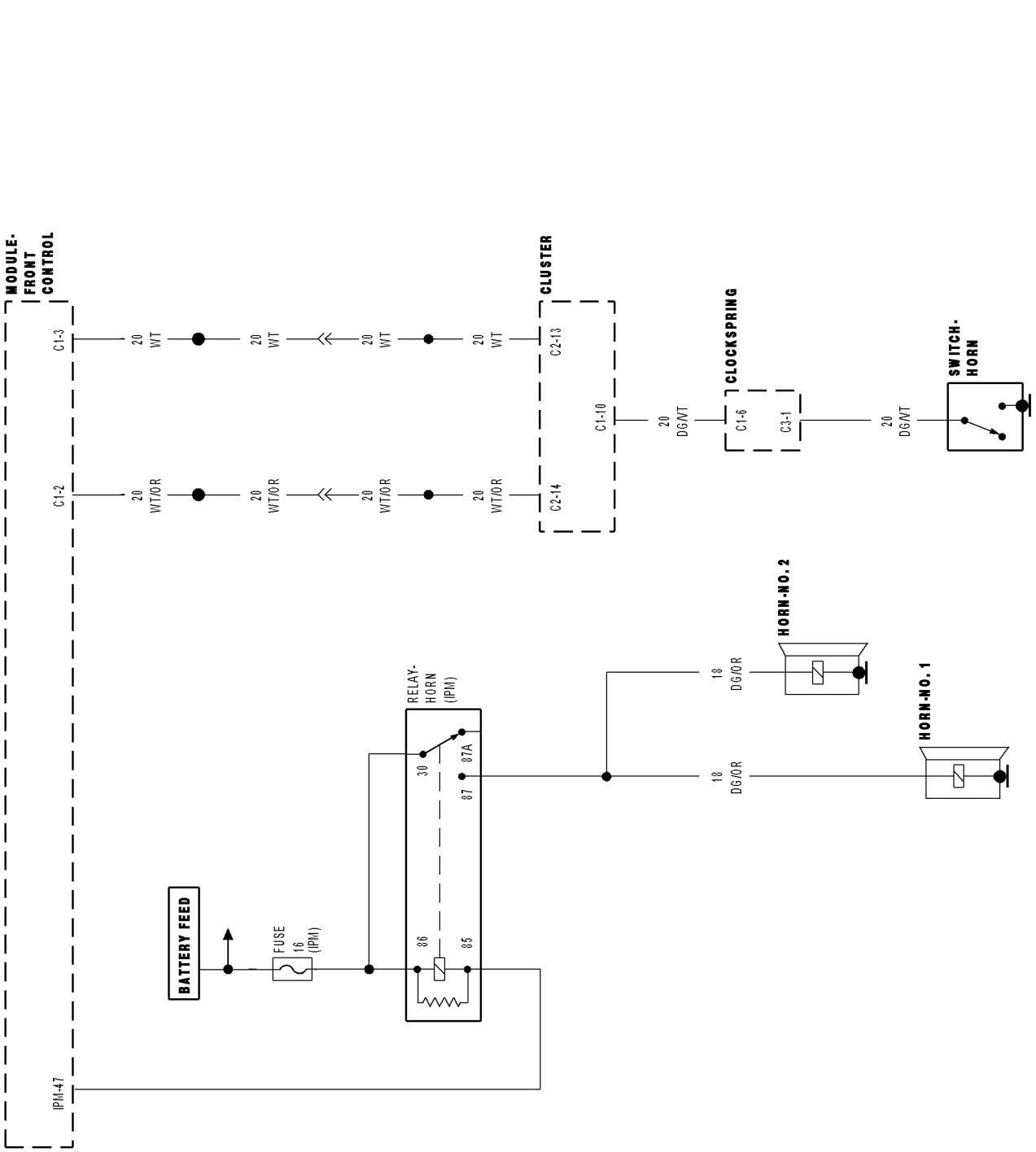
Check for DTCs in the modules.

Are DTCs present in any of the modules or is the original condition still present?

Yes >> The repair is not complete. Refer to the related category for the DTC or symptom that is still present.

No >> The repair is complete.

SCHEMATICS AND DIAGRAMS



HORN SYSTEM SCHEMATIC

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DESCRIPTION 16
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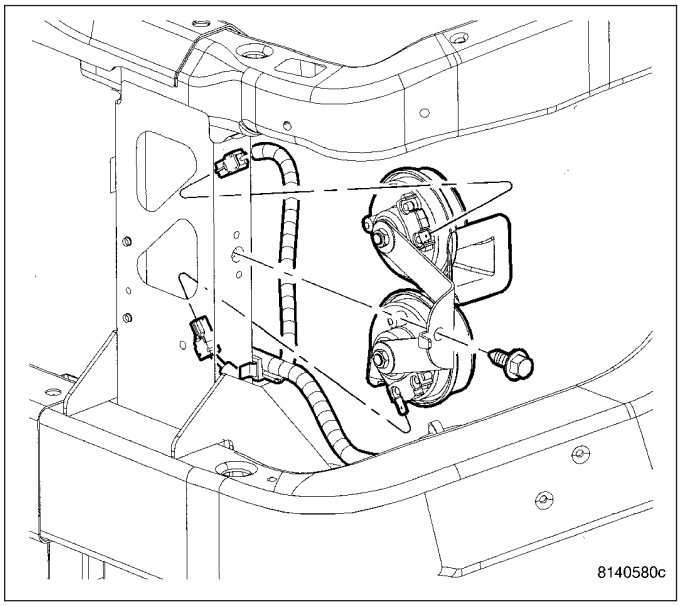
HORN SWITCH 16

HORN SYSTEM - SERVICE INFORMATION

DESCRIPTION

The dual-note horn system features two electromagnetic horn units. The horn system includes the following major components:

- **Horn** - The two horns are located on the left side of the engine compartment near the battery.
- **Horn Switch** - The horn switch is molded into the driver airbag trim cover.



OPERATION

The horn system operates on battery current received through a fuse in the Integrated Power Module (IPM). The horn system circuit is designed so that the system will remain operational, regardless of the ignition switch position.

DIAGNOSIS AND TESTING

HORN SYSTEM

The most reliable, efficient, and accurate means to diagnose the horn system requires the use of a scan tool and the proper Diagnostic Procedures information.

Refer to the appropriate wiring information.

In most cases, any problem involving continually sounding horns can be quickly alleviated by removing the horn fuse from the Integrated Power Module (IPM).

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

HORN

DIAGNOSIS AND TESTING

HORN

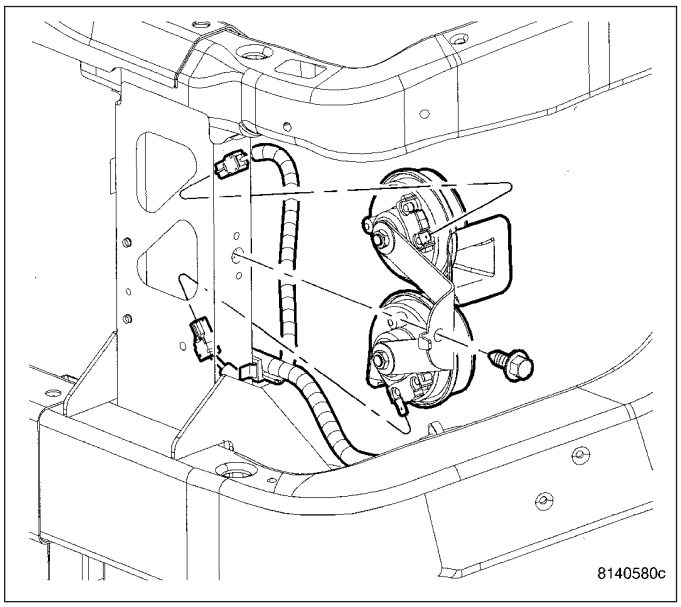
The most reliable, efficient, and accurate means to diagnose the horn system requires the use of a scan tool and the proper Diagnostic Procedures information.

Refer to the appropriate wiring information.

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

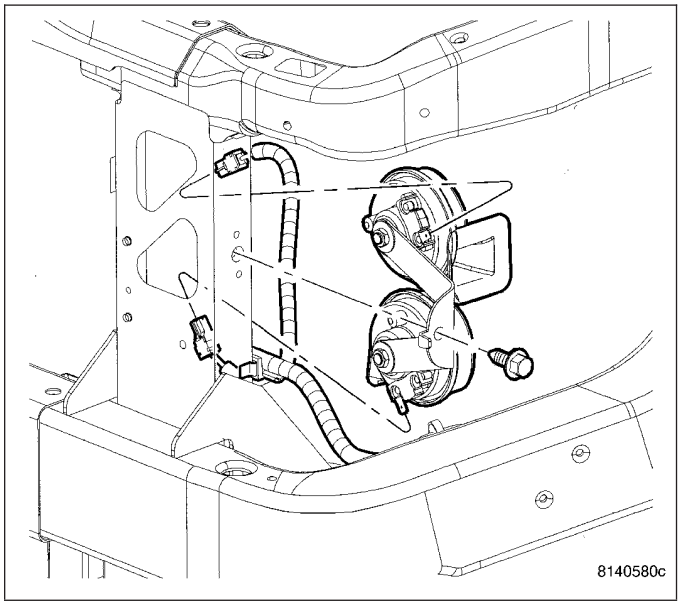
REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the horn mounting fasteners.
3. Disconnect the electrical harness connector and remove the horns.



INSTALLATION

1. Connect the electrical harness connector to the horns.
2. Position horns and install mounting fastener. Tighten fastener.
3. Connect battery negative cable.



SWITCH-HORN

DESCRIPTION

The horn switch is molded into the driver airbag cover. The horn switch can not be serviced separately (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - DESCRIPTION).

DIAGNOSIS AND TESTING

HORN SWITCH

The most reliable, efficient, and accurate means to diagnose the horn system requires the use of a scan tool and the proper Diagnostic Procedures information.

For complete circuit diagrams, refer to the appropriate wiring information.

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

IGNITION CONTROL

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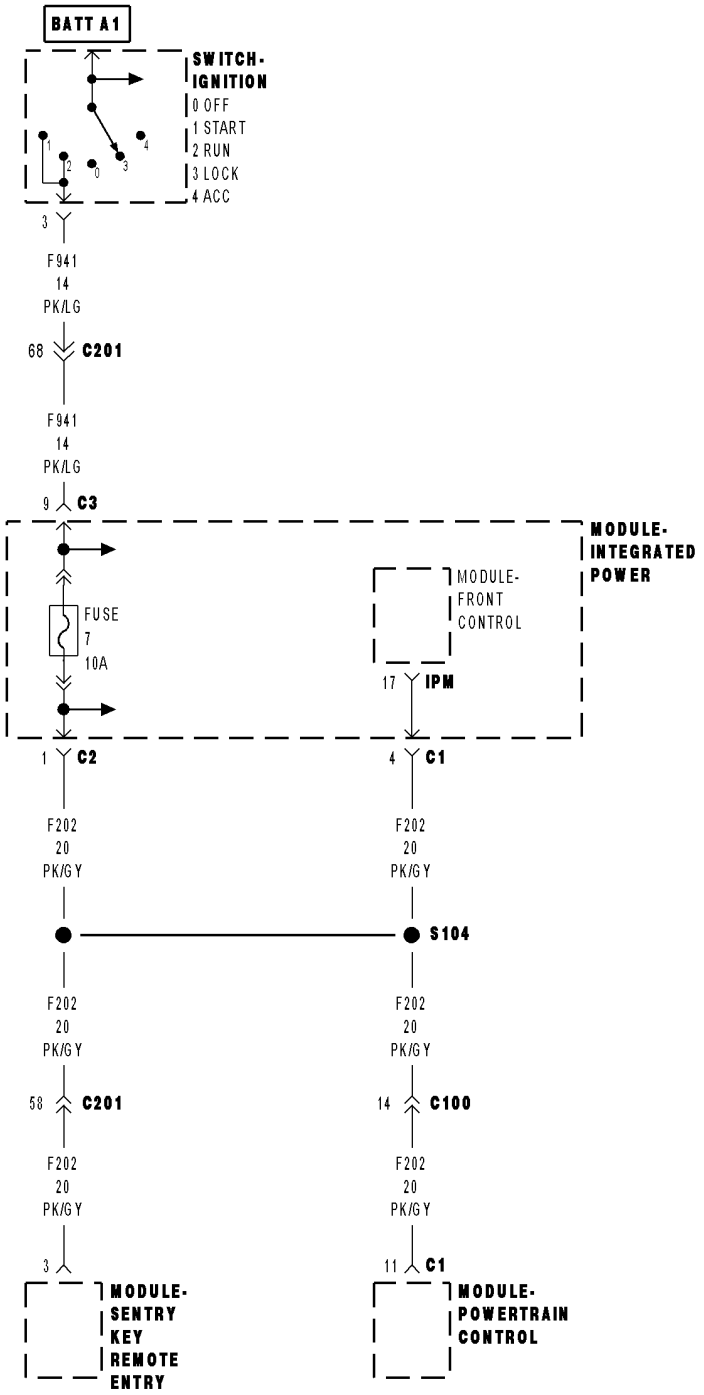
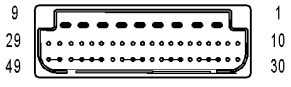
IGNITION SYSTEM - ELECTRICAL DIAGNOSTICS

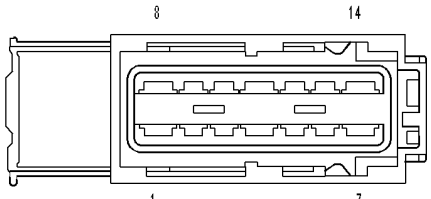
DIAGNOSIS AND TESTING

B2100-IGNITION RUN/START INPUT CIRCUIT PERFORMANCE





MODULE-FRONT CONTROL (IPM)



SWITCH-IGNITION

814085db

B2100-IGNITION RUN/START INPUT CIRCUIT PERFORMANCE (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Front Control Module will set this DTC if the CAN bus message and the hardwired ignition switch circuit do not match the position of the ignition switch.

Possible Causes
INTERGRATED POWER MODULE FUSE
(F941) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
INTERGRATED POWER MODULE
FRONT CONTROL MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on, leaving the ignition on for a minimum of 90 seconds.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

---

2. INSPECT ALL IPM FUSES

Turn the ignition off.

Inspect the IPM fuses.

Are any fuses open?

Yes >> Replace fuse and retest.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 3

B2100-IGNITION RUN/START INPUT CIRCUIT PERFORMANCE (CONTINUED)

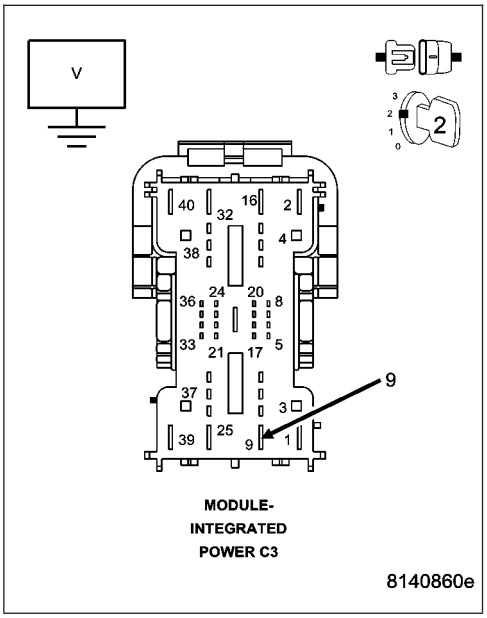
3. (F941) IGNITION SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition off.
Disconnect the Integrated Power Module C3 harness connector.
Turn the ignition on.
Measure the voltage of the (F941) Ignition Switch Output circuit.

Is the voltage above 10.0 volts?

Yes >> Go To 4

No >> Repair the (F941) Ignition Switch Output circuit for an open. Refer to the wiring diagrams located in 8W.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



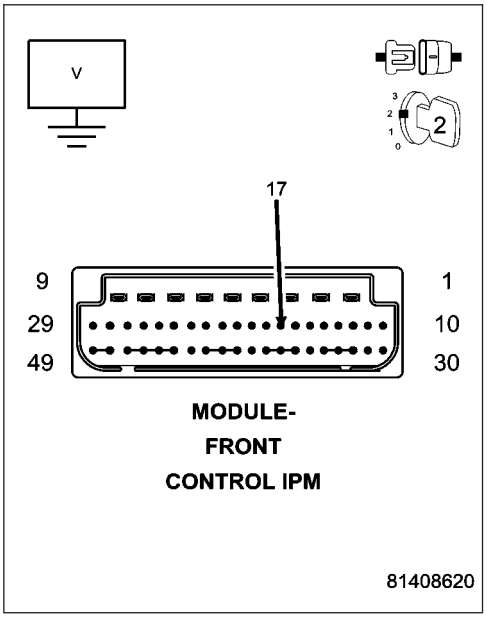
4. (F202) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition off.
Reconnect the Integrated Power Module C3 harness connector.
Remove the FCM from the IPM.
Turn the ignition on.
Measure the voltage of the (F202) Fused Ignition Switch Output circuit.

Is the voltage above 10.0 volts?

Yes >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace the Integrated Power Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



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IGNITION SYSTEM - SERVICE INFORMATION

DESCRIPTION

The ignition system is controlled by the Powertrain Control Module (PCM) on all engines.

3.7L V-6 ENGINE

The 3.7L V-6 engine uses a separate ignition coil for each cylinder. The one-piece coil bolts directly to the cylinder head. Rubber boots seal the secondary terminal ends of the coils to the top of all 6 spark plugs. A separate electrical connector is used for each coil.

Because of coil design, spark plug cables (secondary cables) are not used. A distributor is not used with the 3.7L engine.

Two knock sensors (one for each cylinder bank) are used to help control spark knock.

The Auto Shutdown (ASD) relay provides battery voltage to each ignition coil.

The ignition system consists of:

- 6 Spark Plugs
- 6 Separate Ignition Coils
- 2 Knock Sensors
- Powertrain Control Module (PCM)
- Also to be considered part of the ignition system are certain inputs from the Crankshaft Position, Camshaft Position, Throttle Position, 2 knock and MAP Sensors

4.7L V-8 ENGINE

The 4.7L V-8 engine uses a separate ignition coil for each cylinder. The one-piece coil bolts directly to the cylinder head. Rubber boots seal the secondary terminal ends of the coils to the top of all 8 spark plugs. A separate electrical connector is used for each coil.

Because of coil design, spark plug cables (secondary cables) are not used. A distributor is not used with the 4.7L engine.

Two knock sensors (one for each cylinder bank) are used to help control spark knock.

The Auto Shutdown (ASD) relay provides battery voltage to each ignition coil.

The ignition system consists of:

- 8 Spark Plugs
- 8 Separate Ignition Coils
- 2 Knock Sensors
- Powertrain Control Module (PCM)
- Also to be considered part of the ignition system are certain inputs from the Crankshaft Position, Camshaft Position, Throttle Position, 2 knock and MAP Sensors

SPECIFICATIONS

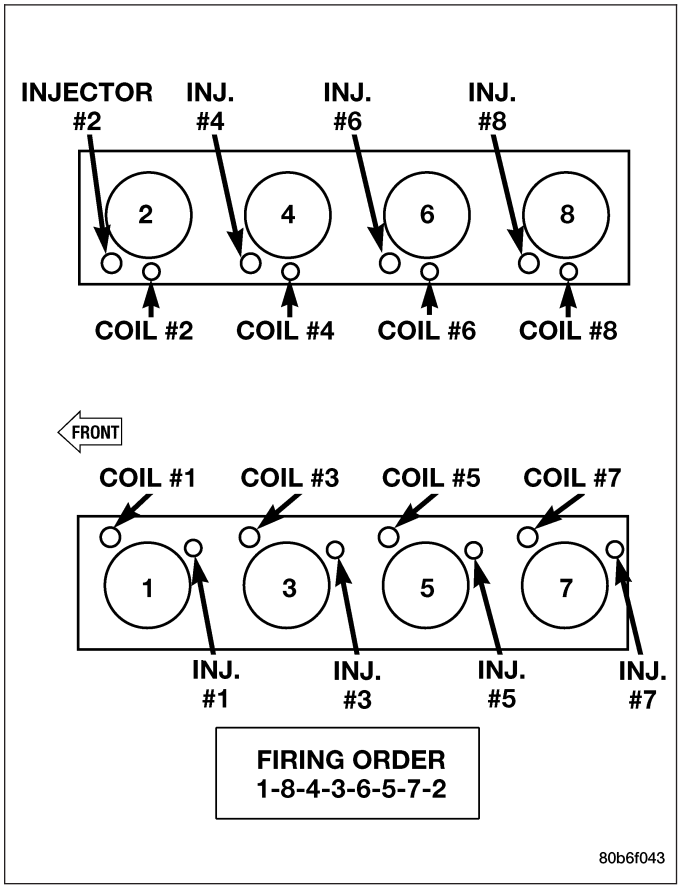
SPECIFICATIONS - TORQUE - IGNITION

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft Position Sensor - 3.7L V-6 Engine	12	-	106
Camshaft Position Sensor - 4.7L V-8 Engine	12	-	106
Crankshaft Position Sensor - 3.7L V-6 Engine	28	21	205
Crankshaft Position Sensor - 4.7L V-8 Engine	28	21	205
Ignition Coil Mounting - 3.7L V-6 Engine	8	-	70
Ignition Coil Mounting - 4.7L V-8 Engine	8	-	70
* Knock Sensor - 3.7L V-6 Engine	20	15	176
* Knock Sensor - 4.7L V-8 Engine	20	15	176
Spark Plugs - 3.7L V-6 Engine	27	20	-
Spark Plugs - 4.7L V-8 Engine	27	20	-
* Do not apply any sealant, thread-locker or adhesive to bolts. Poor sensor performance may result.			
** Torque critical tapered design. Do not exceed 15 ft. lbs.			

ENGINE FIRING ORDER - 3.7L V-6

1 - 6 - 5 - 4 - 3 - 2

ENGINE FIRING ORDER – 4.7L V-8



SPARK PLUG CABLE RESISTANCE

MINIMUM	MAXIMUM
250 Ohms Per Inch	1000 Ohms Per Inch
3000 Ohms Per Foot	12,000 Ohms Per Foot

SPARK PLUGS

ENGINE	PLUG TYPE	ELECTRODE GAP
3.7L V-6	ZFR6F - 11G (NGK)	1.1 (0.042 in.)
4.7L V-8	RC12MCC4	1.01 mm (.040 in.)

IGNITION COIL RESISTANCE - 3.7L V-6

PRIMARY RESISTANCE 21-27°C (70-80°F)	SECONDARY RESISTANCE 21-27°C (70-80°F)
0.6 - 0.9 Ohms	6,000 - 9,000 Ohms

IGNITION COIL RESISTANCE - 4.7L V-8

PRIMARY RESISTANCE 21-27°C (70-80°F)	SECONDARY RESISTANCE 21-27°C (70-80°F)
0.6 - 0.9 Ohms	6,000 - 9,000 Ohms

IGNITION TIMING

Ignition timing is not adjustable on any engine.

RELAY-AUTO SHUT DOWN

DESCRIPTION - PCM OUTPUT

The 5–pin, 12–volt, Automatic Shutdown (ASD) relay is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

OPERATION

PCM OUTPUT

The ASD relay supplies battery voltage (12+ volts) to the fuel injectors and ignition coil(s). With certain emissions packages it also supplies 12–volts to the oxygen sensor heating elements.

The ground circuit for the coil within the ASD relay is controlled by the Powertrain Control Module (PCM). The PCM operates the ASD relay by switching its ground circuit on and off.

The ASD relay will be shut–down, meaning the 12–volt power supply to the ASD relay will be de-activated by the PCM if:

- the ignition key is left in the ON position. This is if the engine has not been running for approximately 1.8 seconds.
- there is a crankshaft position sensor signal to the PCM that is lower than pre-determined values.

ASD SENSE - PCM INPUT

A 12 volt signal at this input indicates to the PCM that the ASD has been activated. The relay is used to connect the oxygen sensor heater element, ignition coil and fuel injectors to 12 volt + power supply.

This input is used only to sense that the ASD relay is energized. If the Powertrain Control Module (PCM) does not see 12 volts at this input when the ASD should be activated, it will set a Diagnostic Trouble Code (DTC).

REMOVAL

The ASD relay is located in the engine compartment within the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

1. Remove PDC cover.
2. Remove relay from PDC.
3. Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.
4. Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

INSTALLATION

The ASD relay is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

1. Install relay to PDC.
2. Install cover to PDC.

SENSOR-CAMSHAFT POSITION

DESCRIPTION

3.7L V-6

The Camshaft Position Sensor (CMP) on the 3.7L 6-cylinder engine is bolted to the right-front side of the right cylinder head.

4.7L V-8

The Camshaft Position Sensor (CMP) on the 4.7L V-8 engine is bolted to the right-front side of the right cylinder head.

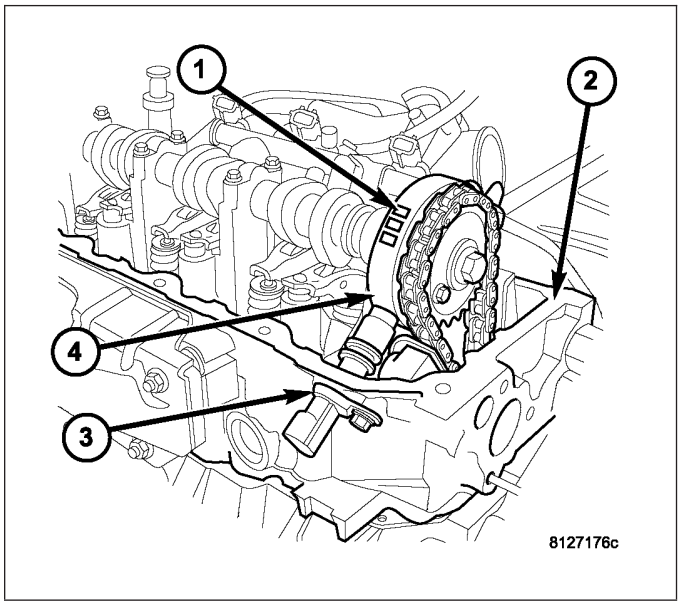
OPERATION

3.7L V-6

The Camshaft Position Sensor (CMP) sensor on the 3.7L V-6 engine (3) contains a hall effect device referred to as a sync signal generator. A rotating target wheel (tonewheel) for the CMP is located (4) at the front of the camshaft for the right cylinder head (2). This sync signal generator detects notches (1) located on a tonewheel. As the tonewheel rotates, the notches pass through the sync signal generator. The signal from the CMP sensor is used in conjunction with the Crankshaft Position Sensor (CKP) to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

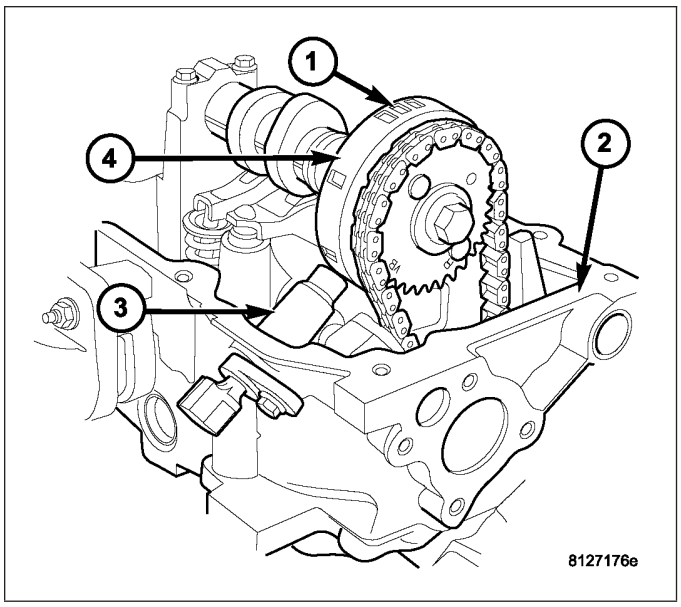
When the leading edge of the tonewheel notch enters the tip of the CMP, the interruption of magnetic field causes the voltage to switch high, resulting in a sync signal of approximately 5 volts.

When the trailing edge of the tonewheel notch leaves then tip of the CMP, the change of the magnetic field causes the sync signal voltage to switch low to 0 volts.



4.7L V-8

The CMP sensor on the 4.7L engine contains a hall effect device called a sync signal generator to generate a fuel sync signal. This sync signal generator detects notches located on a tonewheel. The tonewheel (4) is located at the front of the camshaft for the right cylinder head (2). As the tonewheel rotates, the notches (1) pass through the sync signal generator. The pattern of the notches (viewed counter-clockwise from front of engine) is: 1 notch, 2 notches, 3 notches, 3 notches, 2 notches 1 notch, 3 notches and 1 notch. The signal from the CMP sensor is used in conjunction with the crankshaft position sensor to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

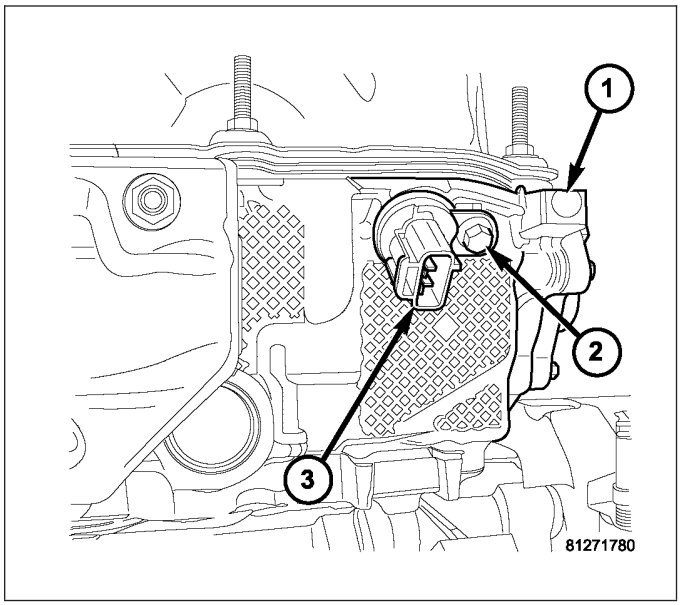


REMOVAL

3.7L V-6

The Camshaft Position Sensor (CMP) on the 3.7L V-6 engine (3) is bolted to the front/top of the right cylinder head (1).

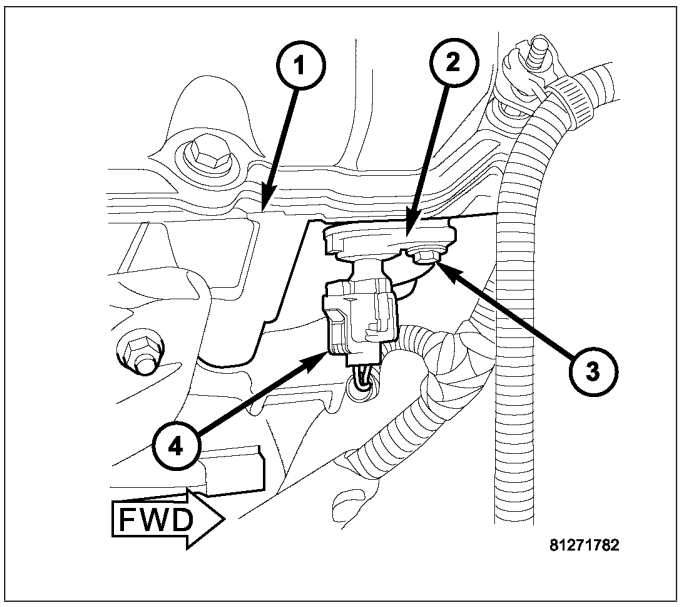
1. Disconnect electrical connector at CMP sensor.
2. Remove sensor mounting bolt (2).
3. Carefully twist sensor from cylinder head.
4. Check condition of sensor o-ring.



4.7L V-8

The Camshaft Position Sensor (CMP) on the 4.7L V–8 engine (2) is bolted to the front/top of the right cylinder head (1).

1. Raise and support vehicle.
2. Disconnect electrical connector (4) at CMP sensor.
3. Remove sensor mounting bolt (3).
4. Carefully twist sensor from cylinder head.
5. Check condition of sensor o-ring.



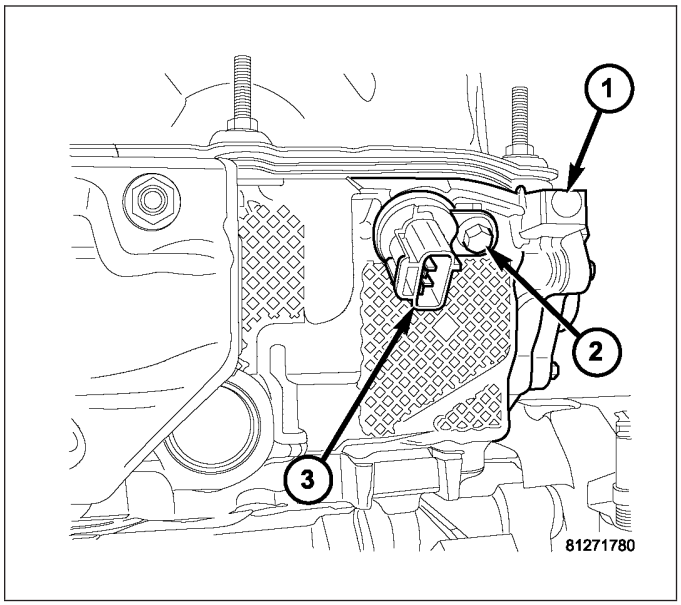
INSTALLATION

3.7L V-6

1. Clean out machined hole in cylinder head.
2. Apply a small amount of engine oil to sensor o-ring.
3. Install sensor (3) into cylinder head with a slight rocking and twisting action.

CAUTION: Before tightening sensor mounting bolt (2), be sure sensor is completely flush to cylinder head. If sensor is not flush, damage to sensor mounting tang may result.

4. Install mounting bolt (2) and tighten. Refer to torque specifications.
5. Connect electrical connector to sensor.

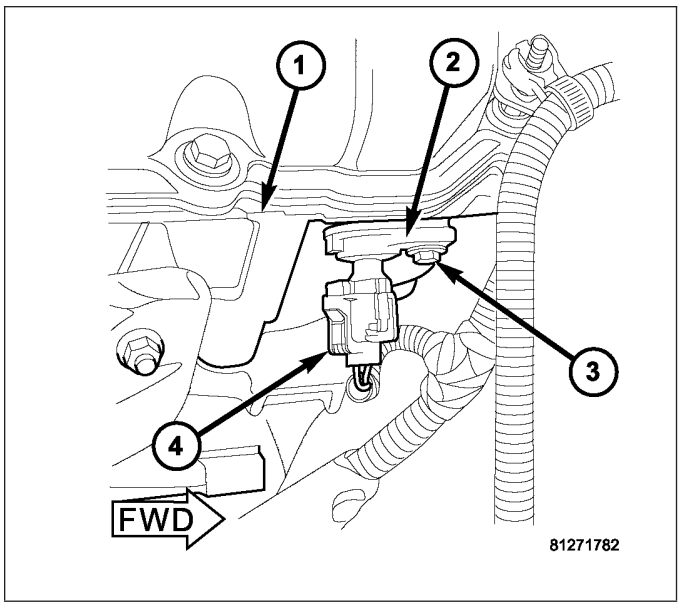


4.7L V-8

1. Clean out machined hole in cylinder head.
2. Apply a small amount of engine oil to sensor o-ring.
3. Install sensor (2) into cylinder head with a slight rocking action. Do not twist sensor into position as damage to o-ring may result.

CAUTION: Before tightening sensor mounting bolt (3), be sure sensor is completely flush to cylinder head. If sensor is not flush, damage to sensor mounting tang may result.

4. Install mounting bolt (3) and tighten. Refer to Torque Specifications.
5. Connect electrical connector (4) to sensor.

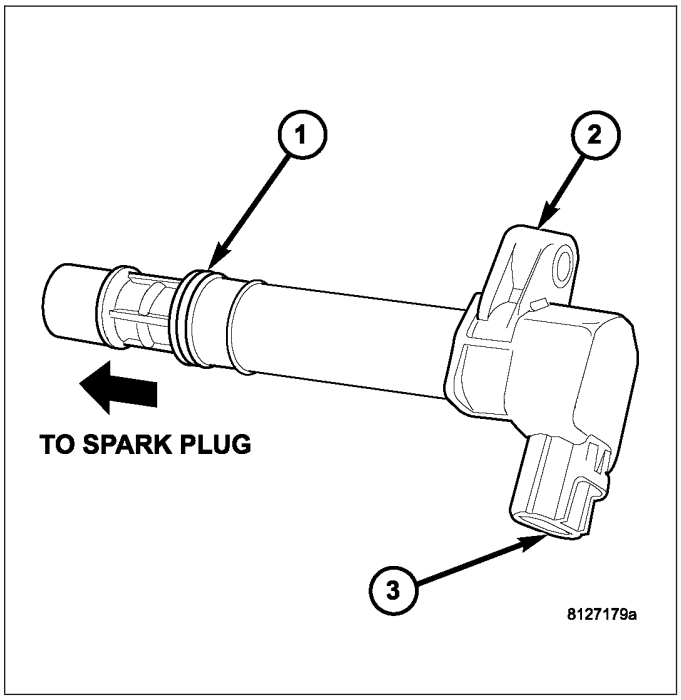


COIL-IGNITION

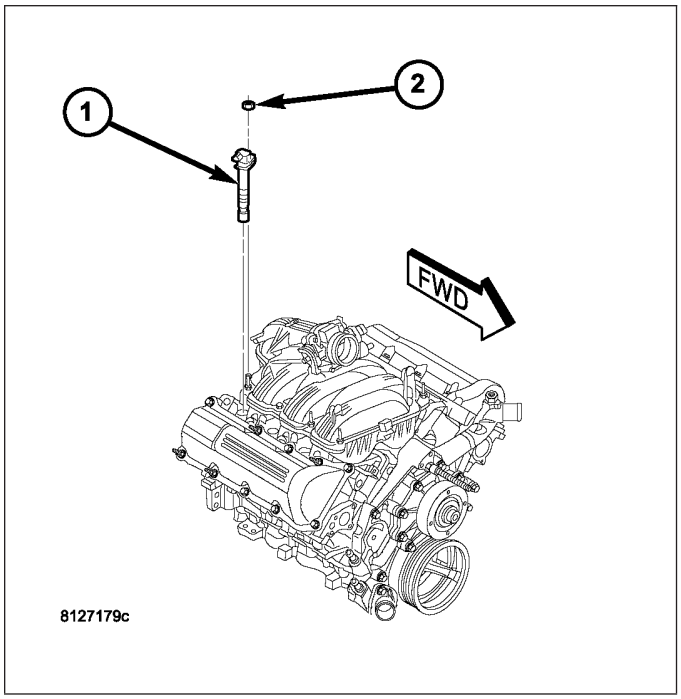
DESCRIPTION

3.7L V-6

The 3.7L V-6 engine uses 6 dedicated, and individually fired coil for each spark plug (2).

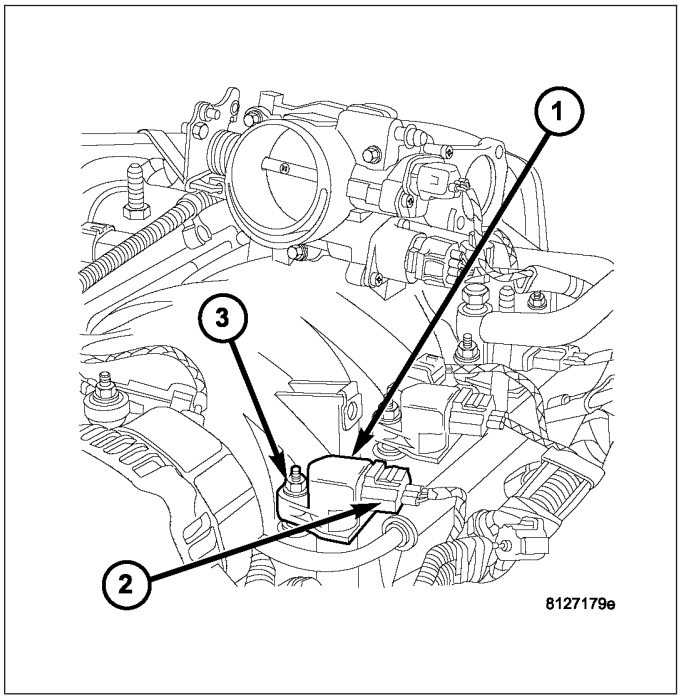


Each coil (1) is mounted directly into the cylinder head and onto the top of each spark plug.



4.7L V-8

The 4.7L V–8 engine uses 8 dedicated, and individually fired coil (1) for each spark plug. Each coil is mounted directly to the top of each spark plug.



OPERATION

3.7L V-6

Battery voltage is supplied to the 6 individual ignition coils from the ASD relay. The Powertrain Control Module (PCM) opens and closes each ignition coil ground circuit at a determined time for ignition coil operation.

Base ignition timing is not adjustable. By controlling the coil ground circuit, the PCM is able to set the base timing and adjust the ignition timing advance. This is done to meet changing engine operating conditions.

The ignition coil is not oil filled. The windings are embedded in an epoxy compound. This provides heat and vibration resistance that allows the ignition coil to be mounted on the engine.

Because of coil design, spark plug cables (secondary cables) are not used with the 3.7L V-6 engine.

4.7L V-8

Battery voltage is supplied to the 8 individual ignition coils from the ASD relay. The Powertrain Control Module (PCM) opens and closes each ignition coil ground circuit at a determined time for ignition coil operation.

Base ignition timing is not adjustable. By controlling the coil ground circuit, the PCM is able to set the base timing and adjust the ignition timing advance. This is done to meet changing engine operating conditions.

The ignition coil is not oil filled. The windings are embedded in an epoxy compound. This provides heat and vibration resistance that allows the ignition coil to be mounted on the engine.

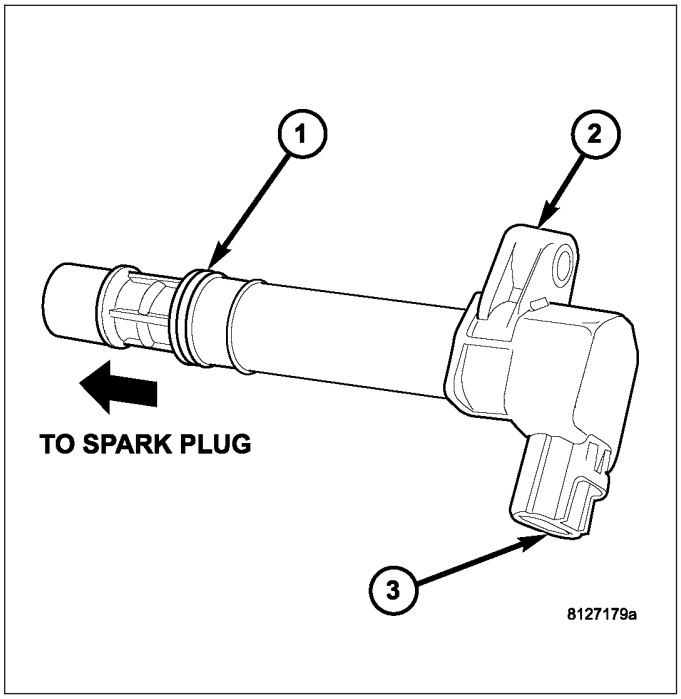
Because of coil design, spark plug cables (secondary cables) are not used with the 4.7L V-8 engine.

REMOVAL

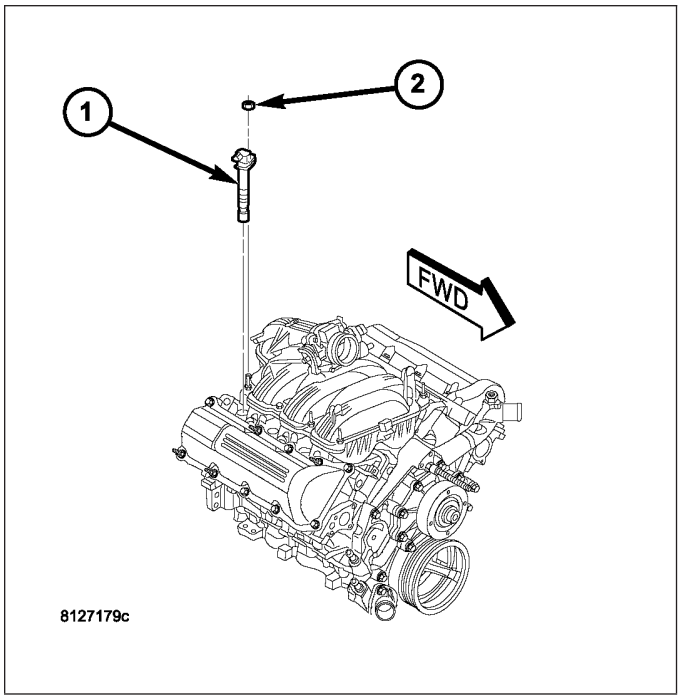
3.7L V-6

An individual ignition coil is used for each spark plug (2). The coil fits into machined holes in the cylinder head. A mounting stud/nut secures each coil to the top of the intake manifold. The bottom of the coil is equipped with a rubber boot to seal the spark plug to the coil. Inside each rubber boot is a spring. The spring is used for a mechanical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately. An o-ring (1) is used to seal the coil at the opening into the cylinder head.

1. Depending on which coil is being removed, the throttle body air intake tube or intake box may need to be removed to gain access to coil.
2. Disconnect electrical connector from coil by pushing downward on release lock on top of connector and pull connector from coil.
3. Clean area at base of coil with compressed air before removal.



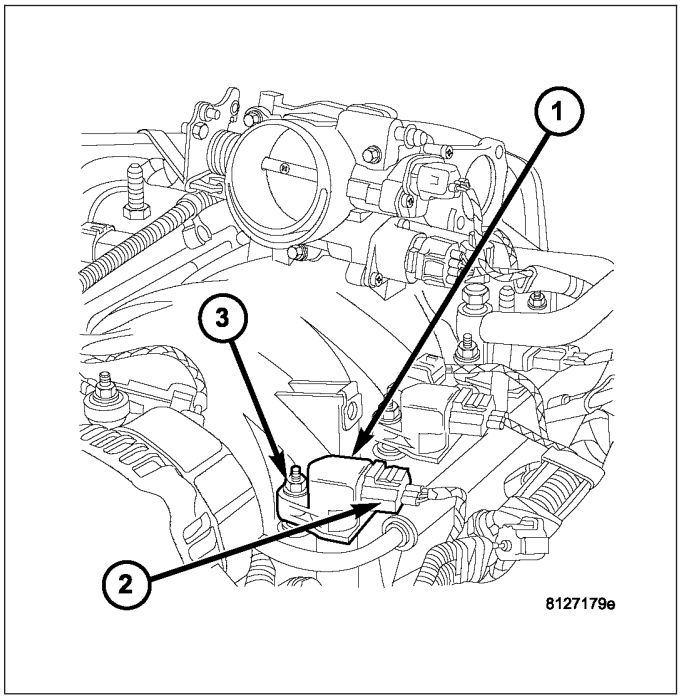
4. Remove coil mounting nut (2) from mounting stud.
5. Carefully pull up coil from cylinder head opening with a slight twisting action.
6. Remove coil from vehicle.



4.7L V-8

An individual ignition coil (1) is used for each spark plug. The coil fits into machined holes in the cylinder head. A mounting stud/nut (3) secures each coil to the top of the intake manifold . The bottom of the coil is equipped with a rubber boot to seal the spark plug to the coil. Inside each rubber boot is a spring. The spring is used for a mechanical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately. An o-ring is used to seal the coil at the opening into the cylinder head.

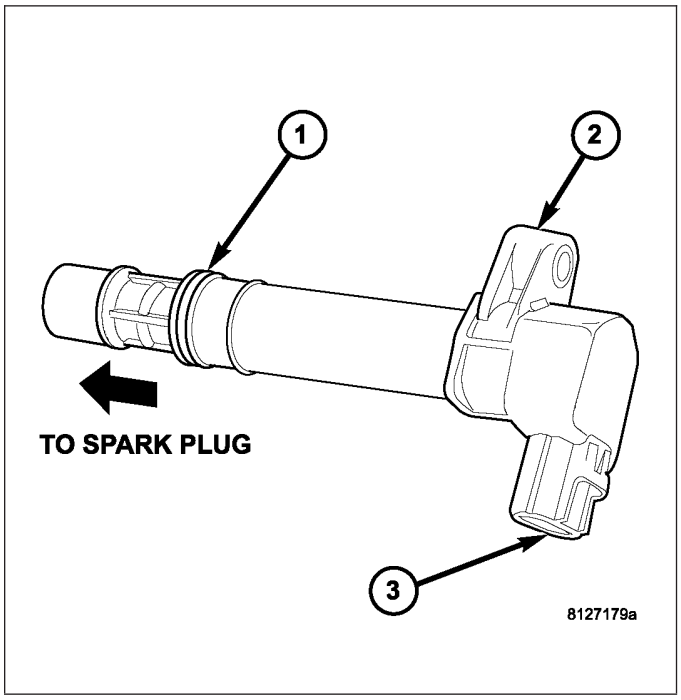
1. Depending on which coil is being removed, the throttle body air intake tube or intake box may need to be removed to gain access to coil.
2. Disconnect electrical connector (2) from coil by pushing downward on release lock on top of connector and pull connector from coil.
3. Clean area at base of coil with compressed air before removal.
4. Remove coil mounting nut (3) from mounting stud.
5. Carefully pull up coil from cylinder head opening with a slight twisting action.
6. Remove coil from vehicle.

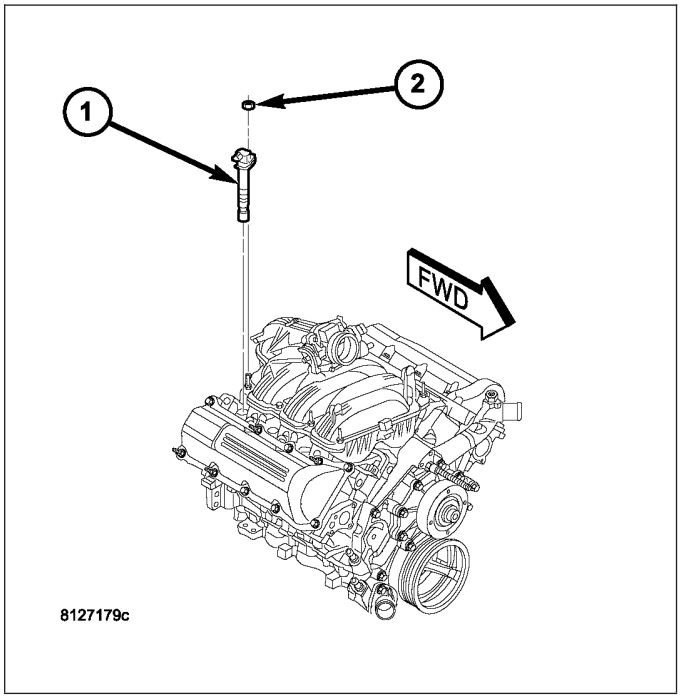


INSTALLATION

3.7L V-6

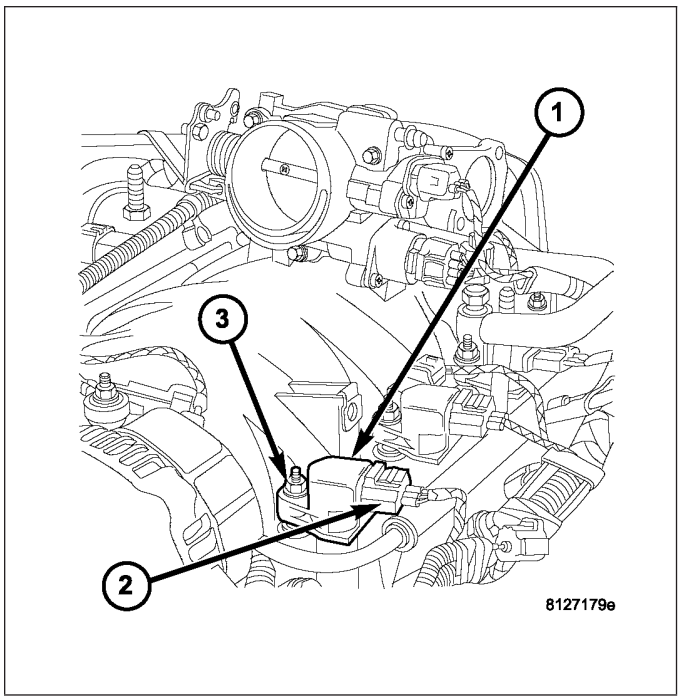
1. Using compressed air, blow out any dirt or contaminants from around top of spark plug.
2. Check condition of coil o-ring and replace as necessary. To aid in coil installation, apply silicone to coil o-ring.
3. Position ignition coil (1) into cylinder head opening and push onto spark plug. Do this while guiding coil base over mounting stud.
4. Install coil mounting stud nut (2). Refer to torque specifications.
5. Connect electrical connector to coil by snapping into position.
6. If necessary, install throttle body air tube.





4.7L V-8

1. Using compressed air, blow out any dirt or contaminants from around top of spark plug.
2. Check condition of coil o-ring and replace as necessary. To aid in coil installation, apply silicone to coil o-ring.
3. Position ignition coil into cylinder head opening and push onto spark plug. Do this while guiding coil base over mounting stud.
4. Install coil mounting stud nut (3). Refer to torque specifications.
5. Connect electrical connector (2) to coil by snapping into position.
6. If necessary, install throttle body air tube.



SENSOR-KNOCK

DESCRIPTION

On 3.7L V-6 and 4.7L V-8 engines, the 2 knock sensors are bolted into the cylinder block under the intake manifold.

OPERATION

3.7L V-6 / 4.7L V-8 Engines

Two knock sensors are used; one for each cylinder bank. When the knock sensor detects a knock in one of the cylinders on the corresponding bank, it sends an input signal to the Powertrain Control Module (PCM). In response, the PCM retards ignition timing for all cylinders by a scheduled amount.

Knock sensors contain a piezoelectric material which constantly vibrates and sends an input voltage (signal) to the PCM while the engine operates. As the intensity of the crystal's vibration increases, the knock sensor output voltage also increases.

The voltage signal produced by the knock sensor increases with the amplitude of vibration. The PCM receives the knock sensor voltage signal as an input. If the signal rises above a predetermined level, the PCM will store that value in memory and retard ignition timing to reduce engine knock. If the knock sensor voltage exceeds a preset value, the PCM retards ignition timing for all cylinders. It is not a selective cylinder retard.

The PCM ignores knock sensor input during engine idle conditions. Once the engine speed exceeds a specified value, knock retard is allowed.

Knock retard uses its own short term and long term memory program.

Long term memory stores previous detonation information in its battery-backed RAM. The maximum authority that long term memory has over timing retard can be calibrated.

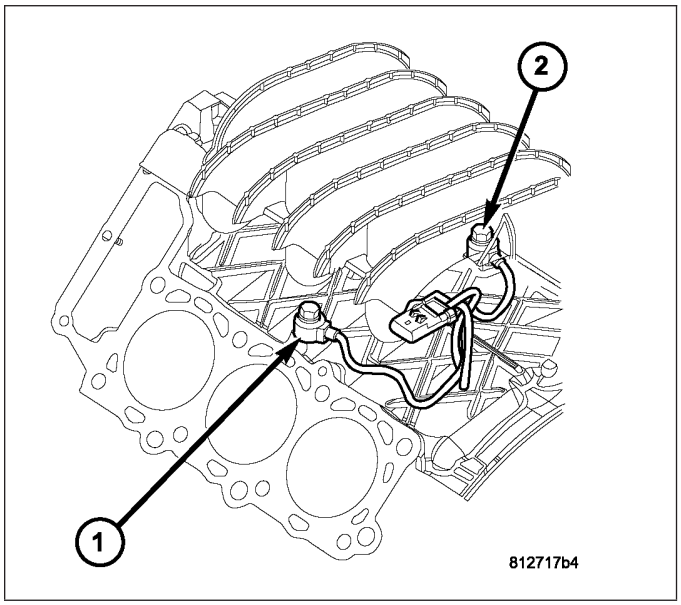
Short term memory is allowed to retard timing up to a preset amount under all operating conditions (as long as rpm is above the minimum rpm) except at Wide Open Throttle (WOT). The PCM, using short term memory, can respond quickly to retard timing when engine knock is detected. Short term memory is lost any time the ignition key is turned off.

NOTE: Over or under tightening the sensor mounting bolts will affect knock sensor performance, possibly causing improper spark control. Always use the specified torque when installing the knock sensors.

REMOVAL

3.7L V-6

The 2 knock sensors are bolted into the cylinder block under the intake manifold (1) and (2).

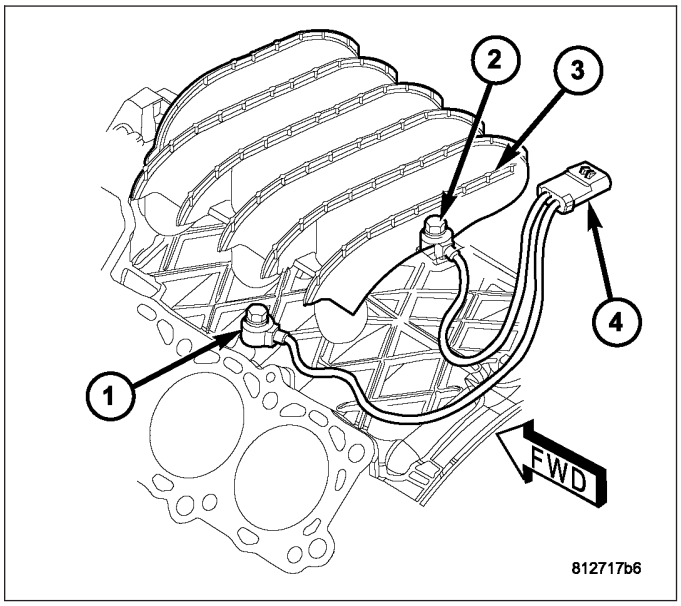


NOTE: The left sensor is identified by an identification tag (LEFT). It is also identified by a larger bolt head. The Powertrain Control Module (PCM) must have and know the correct sensor left/right positions. Do not mix the sensor locations.

1. Disconnect knock sensor dual pigtail harness from engine wiring harness. This connection is made near rear of engine.
2. Remove intake manifold. Refer to Engine section.
3. Remove sensor mounting bolts (2). Note foam strip on bolt threads. This foam is used only to retain the bolts to sensors for plant assembly. It is not used as a sealant. Do not apply any adhesive, sealant or thread locking compound to these bolts.
4. Remove sensors from engine.

4.7L V-8

The two knock sensors (1) are bolted into the cylinder block under the intake manifold (3).



NOTE: The left sensor is identified by an identification tag (LEFT). It is also identified by a larger bolt head. The Powertrain Control Module (PCM) must have and know the correct sensor left/right positions. Do not mix the sensor locations.

1. Disconnect knock sensor dual pigtail harness from engine wiring harness. This connection is made near rear of engine.
2. Remove intake manifold. Refer to Engine section.
3. Remove sensor mounting bolts (2). Note foam strip on bolt threads. This foam is used only to retain the bolts to sensors for plant assembly. It is not used as a sealant. Do not apply any adhesive, sealant or thread locking compound to these bolts.
4. Remove sensors from engine.

INSTALLATION

3.7L V-6 / 4.7L V-8

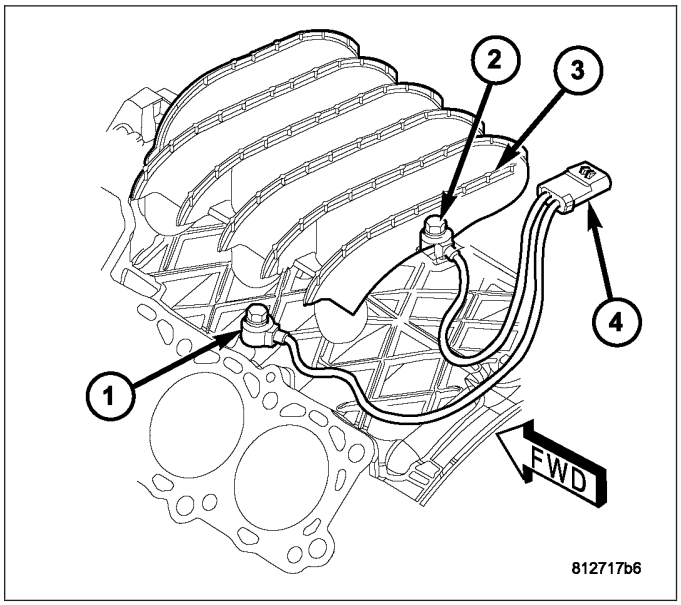
NOTE: The left sensor is identified by an identification tag (LEFT). It is also identified by a larger bolt head. The Powertrain Control Module (PCM) must have and know the correct sensor left/right positions. Do not mix the sensor locations.

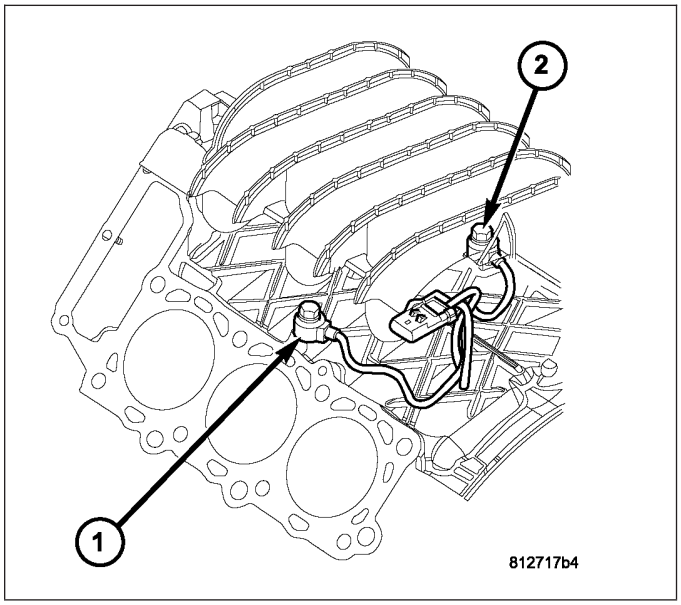
1. Thoroughly clean knock sensor mounting holes.
2. Install sensors (1) into cylinder block.

NOTE: Over or under tightening the sensor mounting bolts (2) will affect knock sensor performance, possibly causing improper spark control. Always use the specified torque when installing the knock sensors. The torque for the knock senor bolt is relatively light for an 8mm bolt.

NOTE: Note foam strip on bolt threads. This foam is used only to retain the bolts to sensors for plant assembly. It is not used as a sealant. Do not apply any adhesive, sealant or thread locking compound to these bolts.

3. Install and tighten mounting bolts. Refer to torque specification.
4. Install intake manifold. Refer to Engine section.
5. Connect knock sensor wiring harness to engine harness at rear of intake manifold.





SPARK PLUG

DESCRIPTION

Resistor type spark plugs are used on all engines.

REMOVAL

3.7L V-6

Each individual spark plug is located under each ignition coil. Each individual ignition coil must be removed to gain access to each spark plug. Refer to Ignition Coil Removal/Installation.

1. Remove necessary air filter tubing at throttle body.
2. Prior to removing ignition coil, spray compressed air around coil base at cylinder head.

3. Prior to removing spark plug, spray compressed air into cylinder head opening. This will help prevent foreign material from entering combustion chamber.
4. Remove spark plug from cylinder head using a quality socket with a rubber or foam insert. Also check condition of ignition coil o-ring and replace as necessary.
5. Inspect spark plug condition.

4.7L V-8

Each individual spark plug is located under each ignition coil. Each individual ignition coil must be removed to gain access to each spark plug. Refer to Ignition Coil Removal/Installation.

1. Remove necessary air filter tubing at throttle body.
2. Prior to removing ignition coil, spray compressed air around coil base at cylinder head.
3. Prior to removing spark plug, spray compressed air into cylinder head opening. This will help prevent foreign material from entering combustion chamber.
4. Remove spark plug from cylinder head using a quality socket with a rubber or foam insert. Also check condition of ignition coil o-ring and replace as necessary.
5. Inspect spark plug condition.

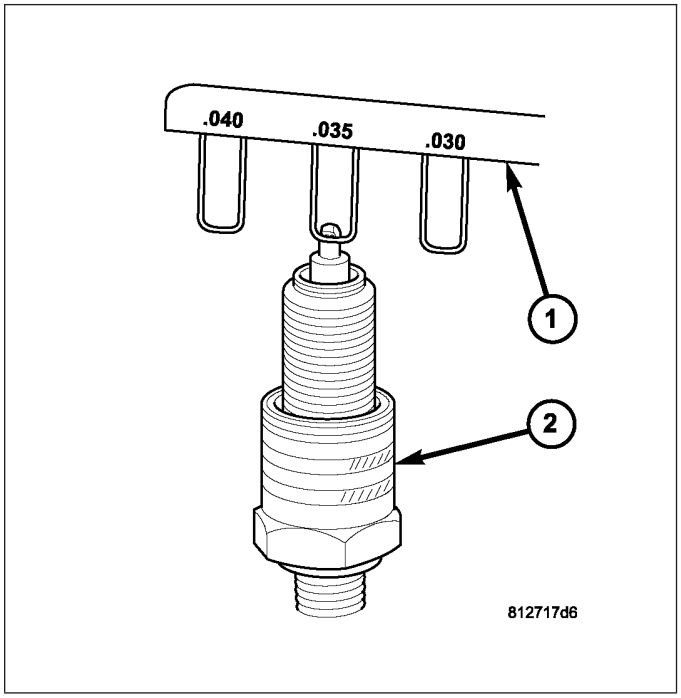
CLEANING

CLEANING AND ADJUSTMENT

The plugs may be cleaned using commercially available spark plug cleaning equipment. After cleaning, file center electrode flat with a small point file or jewelers file before adjusting gap.

CAUTION: Never use a motorized wire wheel brush to clean spark plugs. Metallic deposits will remain on spark plug insulator and will cause plug misfire.

Adjust spark plug gap with a gap gauging tool (1).



INSTALLATION

3.7L V-6

Special care should be taken when installing spark plugs into the cylinder head spark plug wells. Be sure the plugs do not drop into the plug wells as electrodes can be damaged.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap or a cracked porcelain insulator.

1. Start the spark plug into the cylinder head by hand to avoid cross threading.
2. Tighten spark plugs. Refer to torque specifications.

3. Before installing ignition coil(s), check condition of coil o-ring and replace as necessary. To aid in coil installation, apply silicone to coil o-ring.
4. Install ignition coil(s). Refer to Ignition Coil Removal/Installation.

4.7L V-8

CAUTION: The 4.7L V–8 engine is equipped with copper core ground electrode spark plugs. They must be replaced with the same type/number spark plug as the original. If another spark plug is substituted, pre-ignition will result.

Special care should be taken when installing spark plugs into the cylinder head spark plug wells. Be sure the plugs do not drop into the plug wells as electrodes can be damaged.

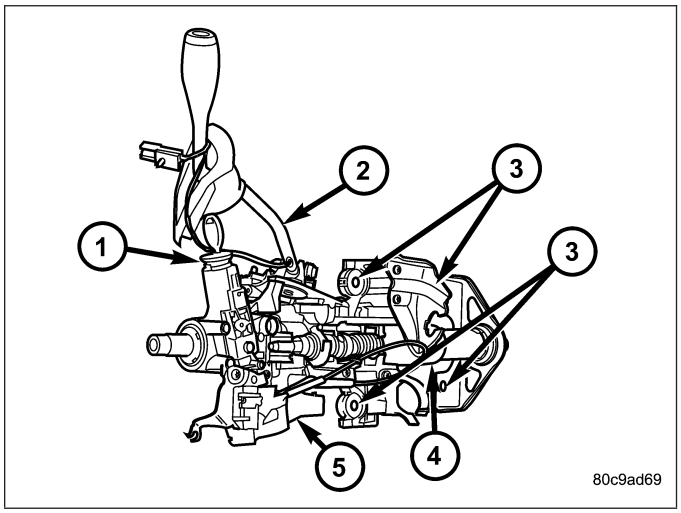
Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap or a cracked porcelain insulator.

1. Start the spark plug into the cylinder head by hand to avoid cross threading.
2. Tighten spark plugs. Refer to torque specifications.
3. Before installing ignition coil(s), check condition of coil o-ring and replace as necessary. To aid in coil installation, apply silicone to coil o-ring.
4. Install ignition coil(s). Refer to Ignition Coil Removal/Installation.

SWITCH-IGNITION

DESCRIPTION

The ignition switch (5) is located on the steering column (4). It is used as the main on/off switching device for most electrical components. The mechanical key cylinder is used to engage/disengage the electrical ignition switch.



OPERATION

Vehicles equipped with an automatic transmission and a steering column mounted shifter: an interlock device is located within the shift cable. This interlock device is used to lock the transmission shifter in the PARK position when the key cylinder is in any position and the brake pedal is not depressed.

DIAGNOSIS AND TESTING

IGNITION SWITCH

TEST AND REPAIR

If the key removal effort is excessive on a vehicle with a automatic transmission first adjust the shift linkage, (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 46RE/GEAR SHIFT CABLE - ADJUSTMENTS).

If the ignition switch effort is excessive remove the ignition key cylinder from the steering column. (Refer to 19 - STEERING/COLUMN/LOCK CYLINDER HOUSING - REMOVAL). Check the turning effort of the key cylinder. If the ignition key cylinder effort is excessive replace the key cylinder. If the ignition key cylinder operates properly look for the following conditions.

REMOVAL

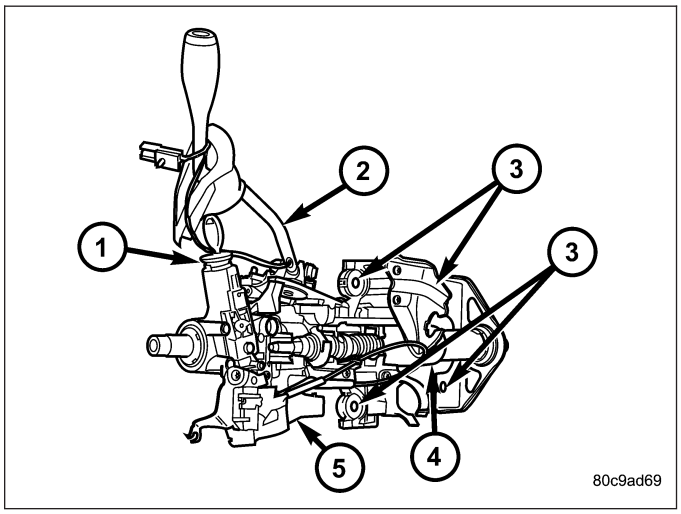
SERVICE PRECAUTIONS

NOTE: The steering column on vehicles equipped with an automatic transmission is not equipped with an internal locking shaft with the ignition cylinder. Alternative methods of locking the steering wheel for service will have to be used.

The tilt and standard column (4) have been designed to be serviced as an assembly; without wiring, switches, shrouds, steering wheel, etc. Most steering column components can be serviced without removing the steering column from the vehicle.

Safety goggles should be worn at all times when working on steering columns.

To service the steering wheel, switches or airbag, Refer to Electrical Restraints and follow all WARNINGS and CAUTIONS.



WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIRBAG SYSTEM COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY. THE FASTENERS, SCREWS, AND BOLTS, ORIGINALLY USED FOR THE AIRBAG COMPONENTS, HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANYTIME A NEW FASTENER IS NEEDED, REPLACE WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR FASTENERS LISTED IN THE PARTS BOOKS.

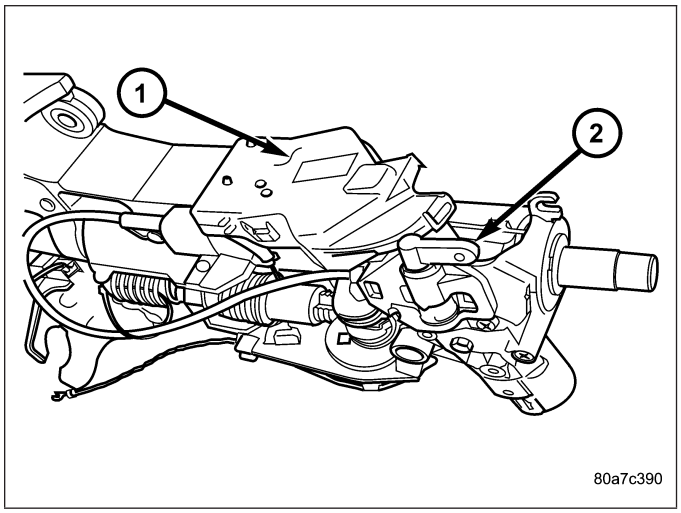
CAUTION: Do not hammer on steering column shaft. This may cause damage to the shaft or bearing.

CAUTION: Do not attempt to remove the pivot bolts to disassemble the tilting mechanism.

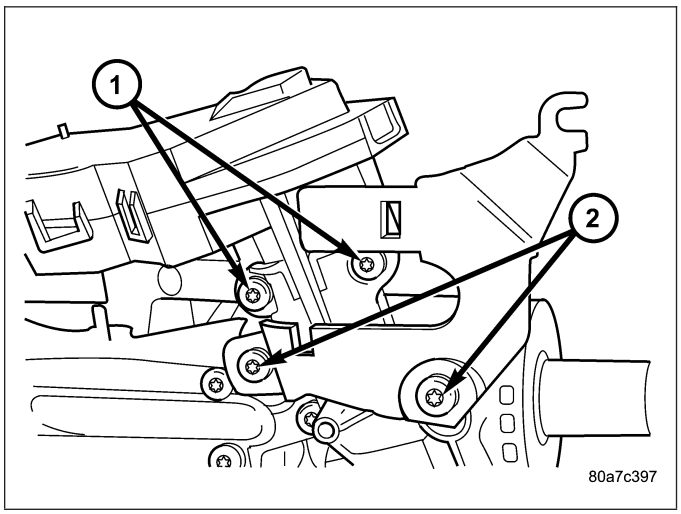
The ignition key must be in the key cylinder for cylinder removal. The key cylinder must be removed first before removing ignition switch.

1. Remove the negative (ground) cable from the battery.
2. Disable the airbag, (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).
3. Remove the lower and upper shrouds.
4. Remove key cylinder. (Refer to 19 - STEERING/COLUMN/LOCK CYLINDER HOUSING - REMOVAL).
5. Disconnect the lower clockspring connectors.
6. Remove the wire retainer from the tilt lever bracket.

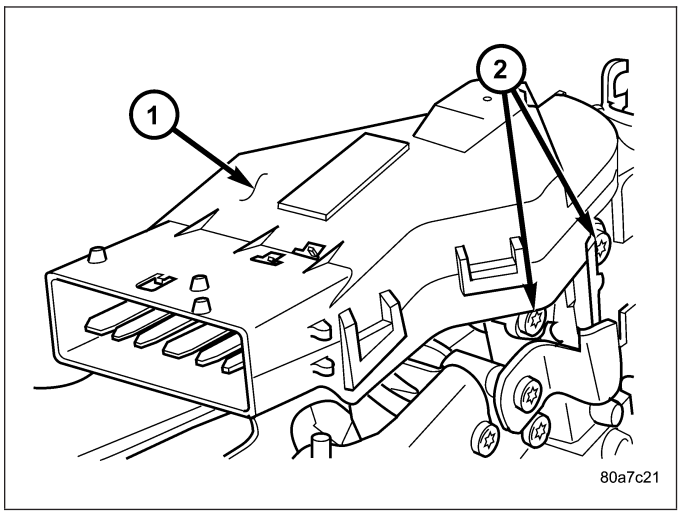
7. Remove the tilt lever mounting screws to gain access to the ignition switch (1) mounting screws.



8. For columns without tilt remove the bracket (2) to gain access to the ignition switch mounting screws (2).



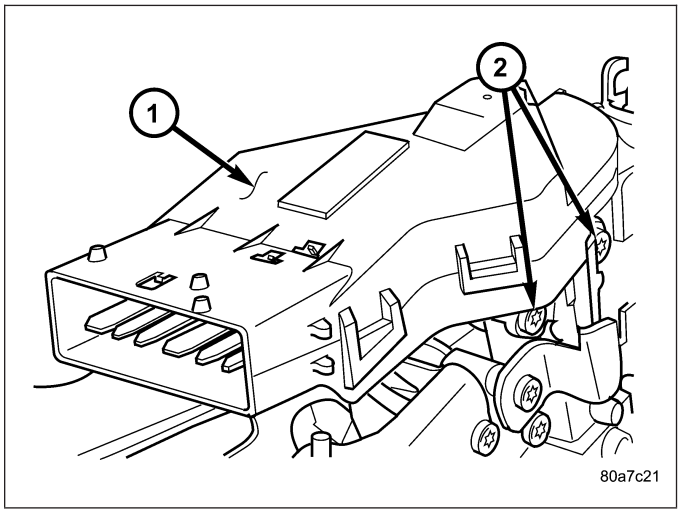
9. Disconnect the electrical connector at rear of ignition switch (1).
10. Remove ignition switch mounting screw (2).
11. Using a small screwdriver, push on locking tab and remove switch from steering column.



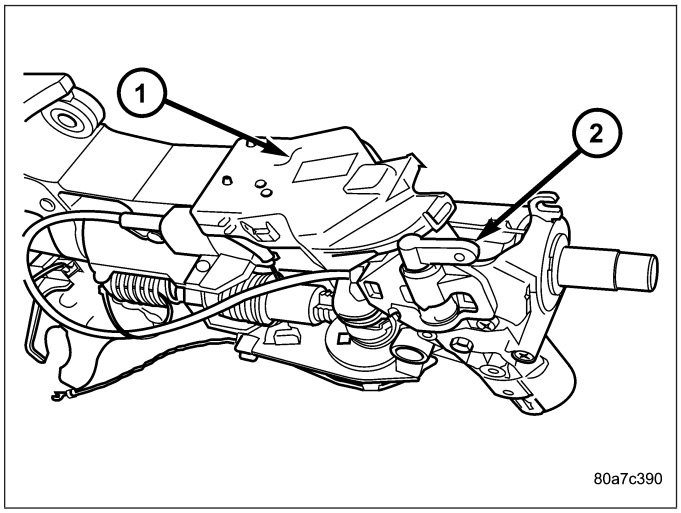
INSTALLATION

The ignition key must be in the key cylinder for cylinder removal. The key cylinder must be removed first before installing ignition switch.

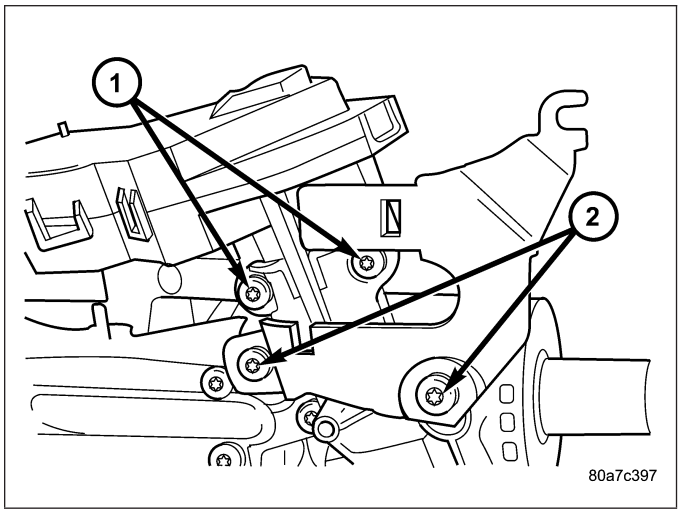
1. Before installing ignition switch, rotate the slot in the switch to the ON position.
2. Connect the electrical connector to rear of the ignition switch. Make sure that locking tabs are fully seated into wiring connector.
3. Position switch (1) to column and install the mounting screw (2). Tighten screw to 3 N·m (26 in. lbs.).



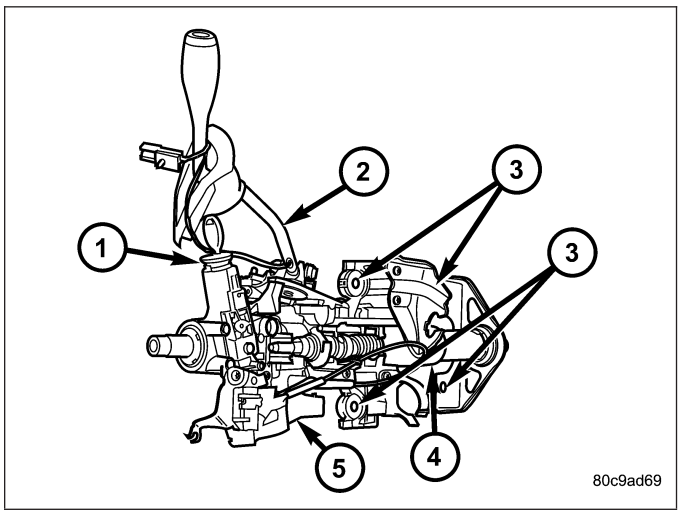
4. Install the tilt lever bracket (2) mounting screws. Tighten screws to 4.5 N·m (40 in. lbs.).



5. If the column is non-tilt install the bracket (2). Tighten screws to 4.5 N·m (40 in. lbs.)



6. Position the wire retainer into the tilt lever bracket.
7. Reconnect the lower clockspring connectors.
8. Install the key cylinder (1)
9. Install steering column upper and lower shrouds.
10. Enable the airbag system. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).



SWITCH-KEY-IN IGNITION

DESCRIPTION

The key-in ignition switch is integral to the ignition switch, which is mounted on the left side of the steering column. It closes a path to ground for the Central Timer Module (CTM) when the ignition key is inserted in the ignition key cylinder and the driver door ajar switch is closed (driver door is open). The key-in ignition switch opens the ground path when the key is removed from the ignition key cylinder. The ground path is also opened when the driver door ajar switch is open (driver door is closed).

The key-in ignition switch cannot be repaired and, if faulty or damaged, the entire ignition switch must be replaced, (Refer to 19 - STEERING/COLUMN/IGNITION SWITCH - REMOVAL).

DIAGNOSIS AND TESTING

IGNITION SWITCH AND KEY LOCK CYLINDER

ELECTRICAL DIAGNOSIS

For ignition switch electrical schematics, refer to Ignition Switch in the appropriate section of Electrical Wiring Diagrams.

MECHANICAL DIAGNOSIS (KEY DIFFICULT TO ROTATE)

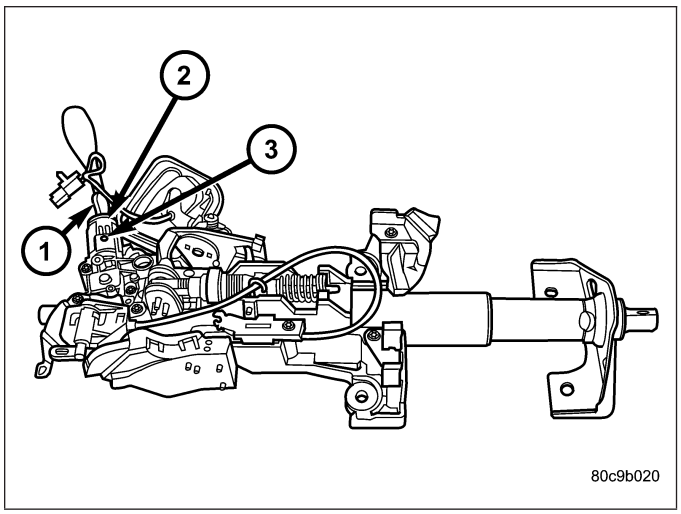
(Refer to 19 - STEERING/COLUMN/IGNITION SWITCH - DIAGNOSIS AND TESTING).

CYLINDER-KEY/LOCK

REMOVAL

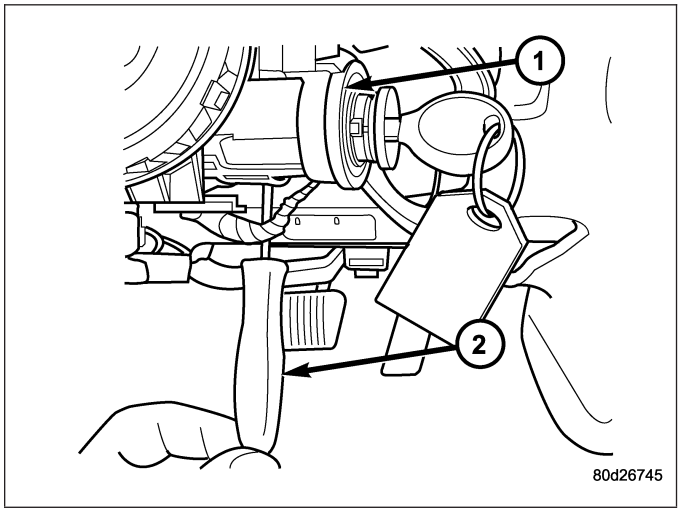
The ignition key (1) must be in the key cylinder (2) for cylinder removal.

1. Disconnect negative cable from battery.
2. Remove upper and lower covers (shrouds) from steering column.
3. Place shifter in PARK position.
4. A retaining pin is located at side of key cylinder assembly (2).



a. Rotate key to RUN position.

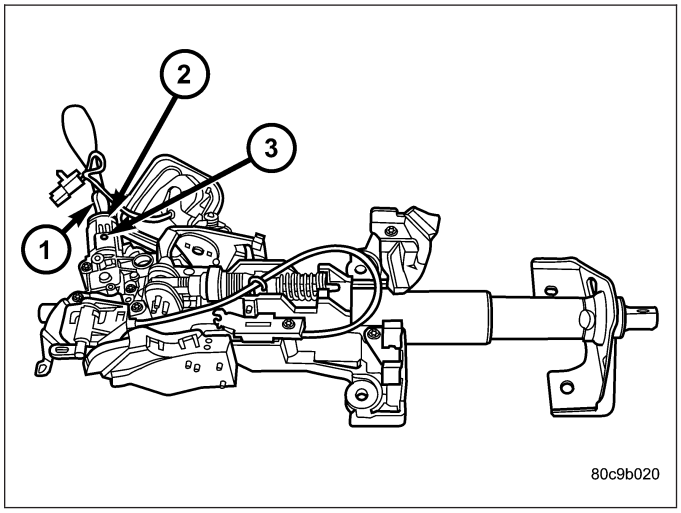
b. Press in on retaining pin while pulling key cylinder (1) from ignition switch.



INSTALLATION

The ignition key (1) must be in the key cylinder (2) for cylinder installation.

1. Install the key cylinder into the housing using care to align the end of the key cylinder (2) with the ignition switch.
2. Push the key cylinder (2) in until it clicks.
3. Replace the upper and lower shrouds.
4. Reconnect the battery.



INSTRUMENT CLUSTER

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INSTRUMENT CLUSTER - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B1200-AIRBAG WARNING INDICATOR CIRCUIT LOW

For a complete wiring diagram **Refer to section 8W**.

- **When Monitored:**
  With the ignition on and when requested to turn on by the Occupant Restraint Controller (ORC).
- **Set Condition:**
  The Instrument Cluster software detects the voltage across the Airbag Lamp is below 0.3 volts when ON.

Possible Causes
INSTRUMENT CLUSTER

Diagnostic Test

1. CHECK THE INSTRUMENT CLUSTER FOR DTC B1200-AIRBAG WARNING INDICATOR CIRCUIT LOW

NOTE: The Instrument Cluster performs internal tests on the Airbag Lamp during each ignition cycle.

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

Wait for the Instrument Cluster to perform the bulb check.

With the scan tool, read DTCs.

Did the DTC B1200-AIRBAG WARNING INDICATOR CIRCUIT LOW reset?

Yes >> Replace and program the Instrument Cluster in accordance with the Service Information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Test complete.

B1201-AIRBAG WARNING INDICATOR CIRCUIT HIGH

For a complete wiring diagram **Refer to section 8W**.

- **When Monitored:**
  With the ignition on and when requested to turn on by the Occupant Restraint Controller (ORC).
- **Set Condition:**
  The Instrument Cluster software detects the voltage across the Airbag Lamp is above 5.0 volts when ON.

Possible Causes
INSTRUMENT CLUSTER

Diagnostic Test

1. CHECK THE INSTRUMENT CLUSTER FOR DTC B1201-AIRBAG WARNING INDICATOR CIRCUIT HIGH

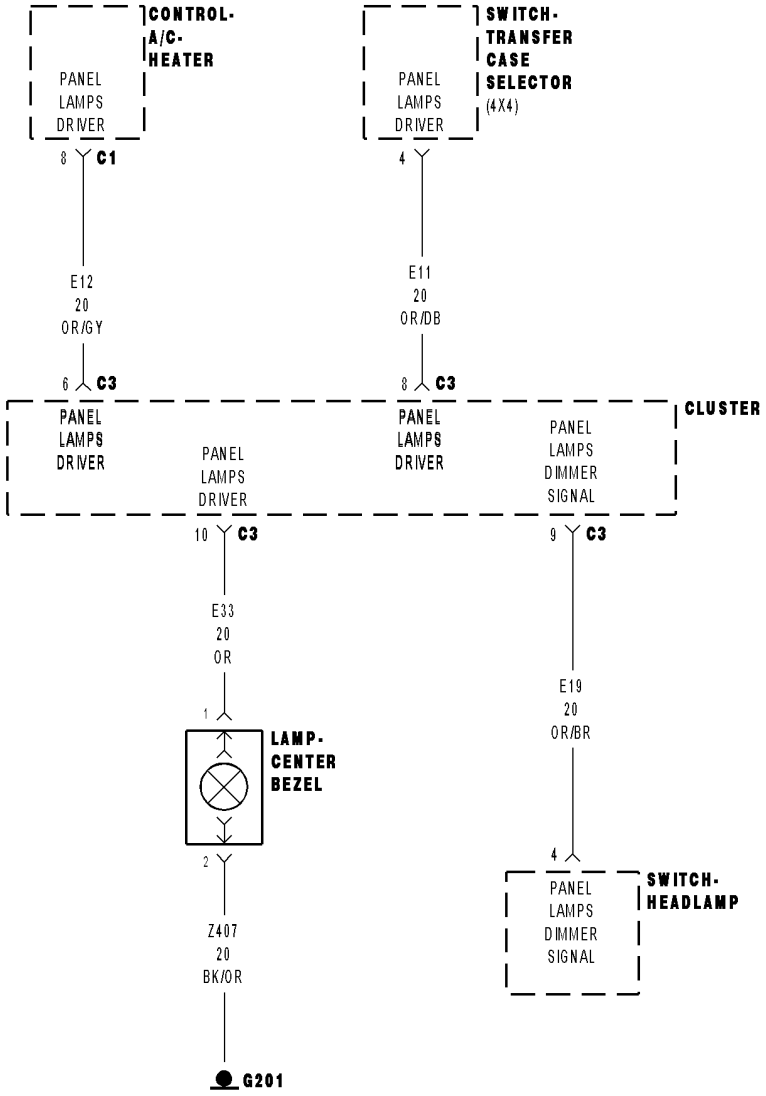
NOTE: The Instrument Cluster performs internal tests on the Airbag Lamp during each ignition cycle.
With the scan tool, erase DTCs.
Turn the ignition off, wait 10 seconds, then turn the ignition on.
Wait for the Instrument Cluster to perform the bulb check.
With the scan tool, read DTCs.

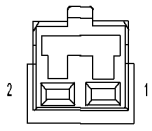
Did the DTC B1201-AIRBAG WARNING INDICATOR CIRCUIT HIGH reset?

Yes >> Replace and program the Instrument Cluster in accordance with the Service Information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

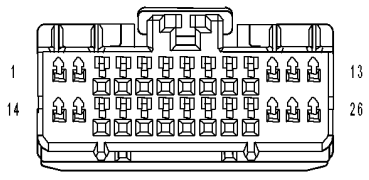
No >> Test complete.

B1613-PANEL ILLUMINATION CONTROL CIRCUIT LOW

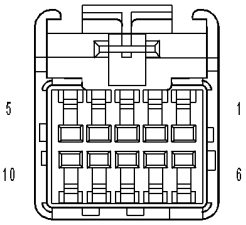




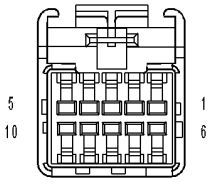
LAMP-CENTER BEZEL



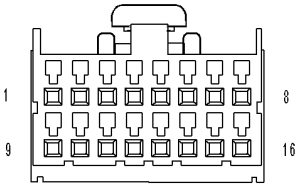
CLUSTER C3



SWITCH-HEADLAMP



SWITCH-TRANSFER CASE SELECTOR (4X4)



CONTROL-A/C-HEATER C1

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B1613-PANEL ILLUMINATION CONTROL CIRCUIT LOW (CONTINUED)

For the Instrument Cluster circuit diagram (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Instrument Cluster detects a short to ground condition on the Panel Illumination circuit.

Possible Causes
PANEL LAMPS DIMMER CIRCUIT SHORTED TO GROUND
DIMMED COMPONENT INTERNALLY SHORTED
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, record and erase DTCs.
Turn the ignition off, wait 10 seconds then turn the ignition on.
Turn the headlamps on.
With the scan tool, read DTCs.

Does the scan tool display: B1613-PANEL ILLUMINATION CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused this code to set is not present at this time. Using the wiring diagram as a guide, inspect the wiring and connectors for an intermittent condition. Operate the system several times and recheck for active DTCs.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

---

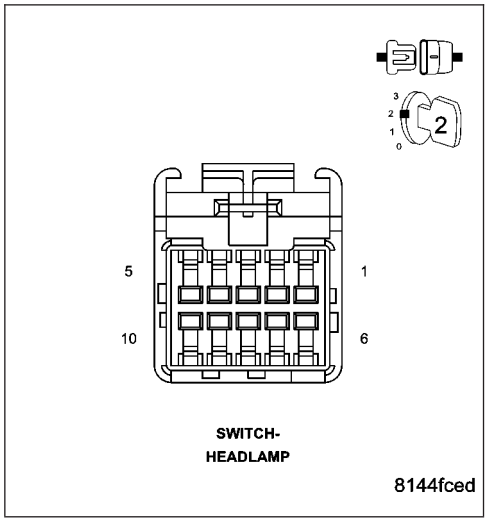
2. CHECK THE HEADLAMP SWITCH FOR AN INTERNAL SHORT

With the scan tool, erase Instrument Cluster DTCs.
Turn the ignition off.
Disconnect the Headlamp Switch harness connector.
Turn the ignition on.
With the scan tool, read DTCs.

Does the scan tool display B1613-PANEL ILLUMINATION CONTROL CIRCUIT LOW?

Yes >> Go To 3

No >> Replace the Headlamp Switch in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)



B1613-PANEL ILLUMINATION CONTROL CIRCUIT LOW (CONTINUED)

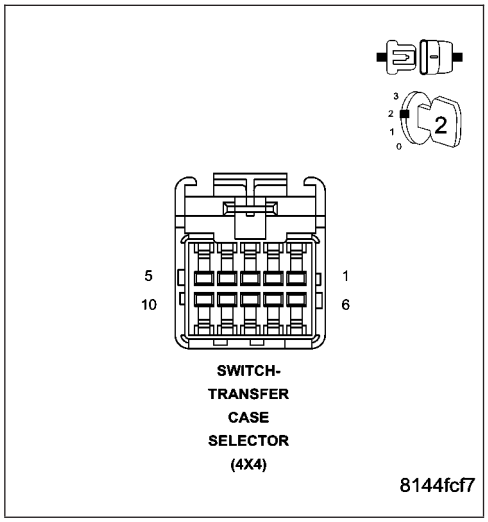
3. CHECK THE TRANSFER CASE SELECTOR SWITCH FOR AN INTERNAL SHORT

Reconnect the Headlamp Switch harness connector.
With the scan tool, erase Instrument Cluster DTCs.
Turn the ignition off.
Disconnect the Transfer Case Selector Switch harness connector.
Turn the ignition on.
With the scan tool, read DTCs.

Does the scan tool display B1613-PANEL ILLUMINATION CONTROL CIRCUIT LOW?

Yes >> Go To 4

No >> Replace the Transfer Case Selector Switch in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)



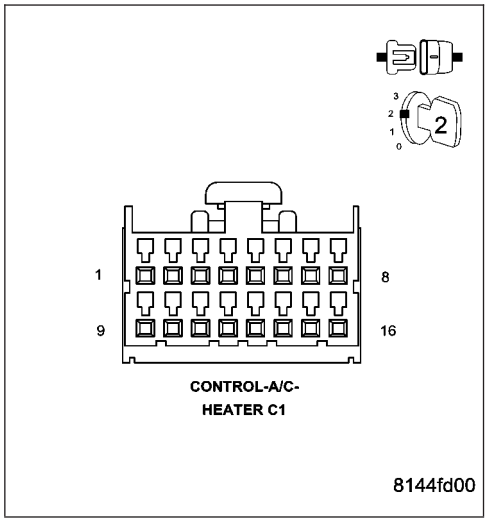
4. CHECK THE A/C HEATER CONTROL FOR AN INTERNAL SHORT

Reconnect the Heated Seat Passenger Switch harness connector.
With the scan tool, erase Instrument Cluster DTCs.
Turn the ignition off.
Disconnect the A/C Heater Control C1 harness connector.
Turn the ignition on.
With the scan tool, read DTCs.

Does the scan tool display B1613-PANEL ILLUMINATION CONTROL CIRCUIT LOW?

Yes >> Go To 5

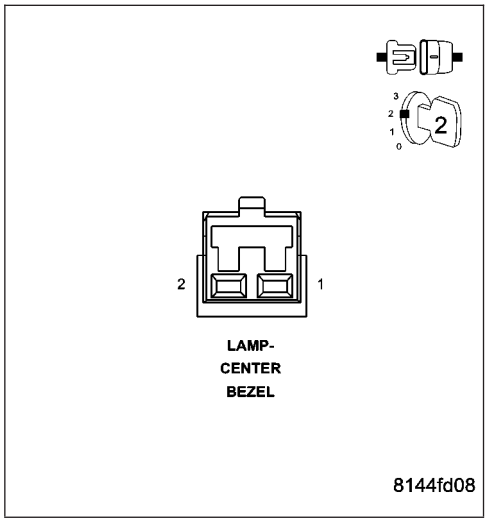
No >> Replace the A/C Heater Control in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)



B1613-PANEL ILLUMINATION CONTROL CIRCUIT LOW (CONTINUED)

5. CHECK THE CENTER BEZEL LAMP FOR AN INTERNAL SHORT

Reconnect the Rear A/C Heater Control harness connector.
With the scan tool, erase Instrument Cluster DTCs.
Turn the ignition off.
Disconnect the Center Bezel Lamp harness connector.
Turn the ignition on.
With the scan tool, read DTCs.



Does the scan tool display B1613-PANEL ILLUMINATION CONTROL CIRCUIT LOW?

Yes >> Go To 6

No >> Replace the Center Bezel Lamp in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

6. PANEL LAMPS DIMMING CIRCUIT SHORTED TO GROUND

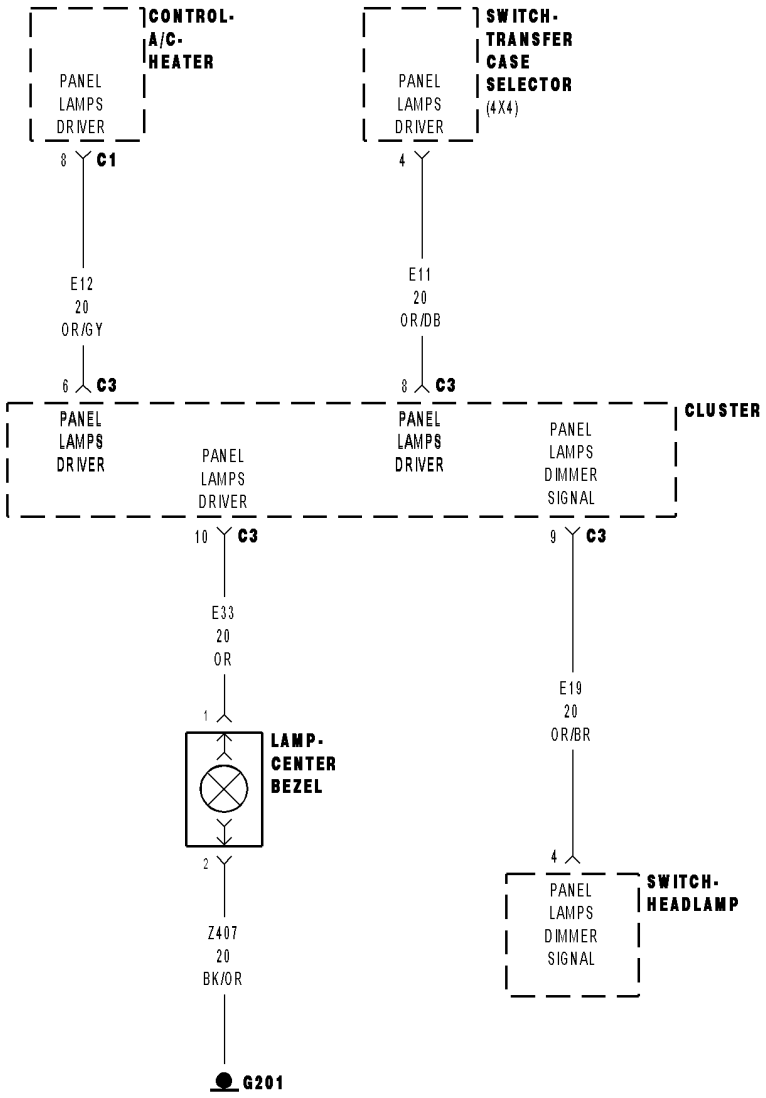
Turn the ignition off.
Disconnect the Instrument Cluster C3 harness connector.
Using the wiring diagram as a guide, disconnect each dimmed component and measure the resistance of the Panel Illumination Control Circuits from the Cluster C3 harness connector to ground.

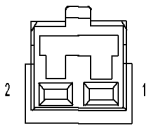
Was there a short to ground condition found?

Yes >> Repair the correct Panel Illumination Circuit for a short to ground.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

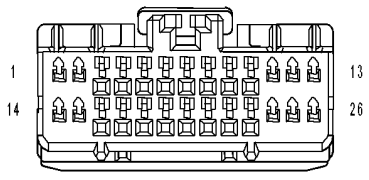
No >> Replace the Instrument Cluster in accordance with the Service Information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

B1615-PANEL ILLUMINATION CONTROL CIRCUIT OPEN

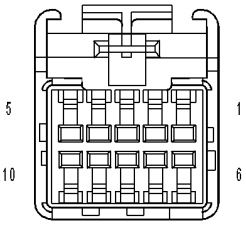




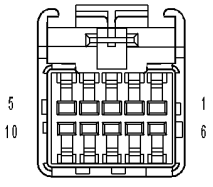
LAMP-CENTER BEZEL



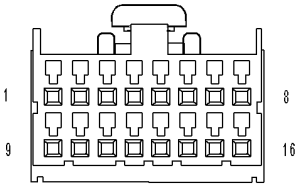
CLUSTER C3



SWITCH-HEADLAMP



SWITCH-TRANSFER CASE SELECTOR (4X4)



CONTROL-A/C-HEATER C1

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B1615-PANEL ILLUMINATION CONTROL CIRCUIT OPEN (CONTINUED)

For the Instrument Cluster circuit diagram (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Instrument Cluster detects an all open condition on the Panel Illumination Control circuits.

Possible Causes
ALL PANEL ILLUMINATON CIRCUITS OPEN
INSTRUMENT CLUSTER

Theory of Operation

The Panel Illumination Control Circuits share a common 12 volt driver from the Instrument Cluster. In order for this DTC to be set, ALL Panel Illumination circuits must be open.

Diagnostic Test

1. TEST FOR AN INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase DTCs.

Turn the ignition off, wait 10 seconds then turn the ignition on.

Turn the headlamps on.

With the scan tool, read DTCs.

Does the scan tool display: B1615-PANEL ILLUMINATION CONTROL CIRCUIT OPEN?

Yes >> Go To 2

No >> The condition that caused this code to set is not present at this time. Using the wiring diagram as a guide, inspect the wiring and connectors for an intermittent condition. Operate the system several times and recheck for active DTCs.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

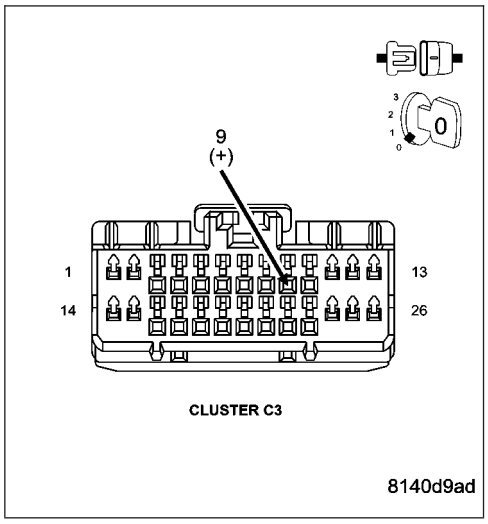
B1615-PANEL ILLUMINATION CONTROL CIRCUIT OPEN (CONTINUED)

2. CHECK CONDITION OF THE WIRING AND CONNECTORS ASSOCIATED WITH THE PANEL ILLUMINATION OUTPUT CIRCUITS

Turn the ignition off.

Disconnect the Instrument Cluster C3 harness connector and inspect the connector and associated wiring for the Panel Illumination System.

Using a fused jumper wire, probe cavity 9 of the Instrument Cluster C3 connector.



Did the illumination of the Headlamp Switch illuminate?

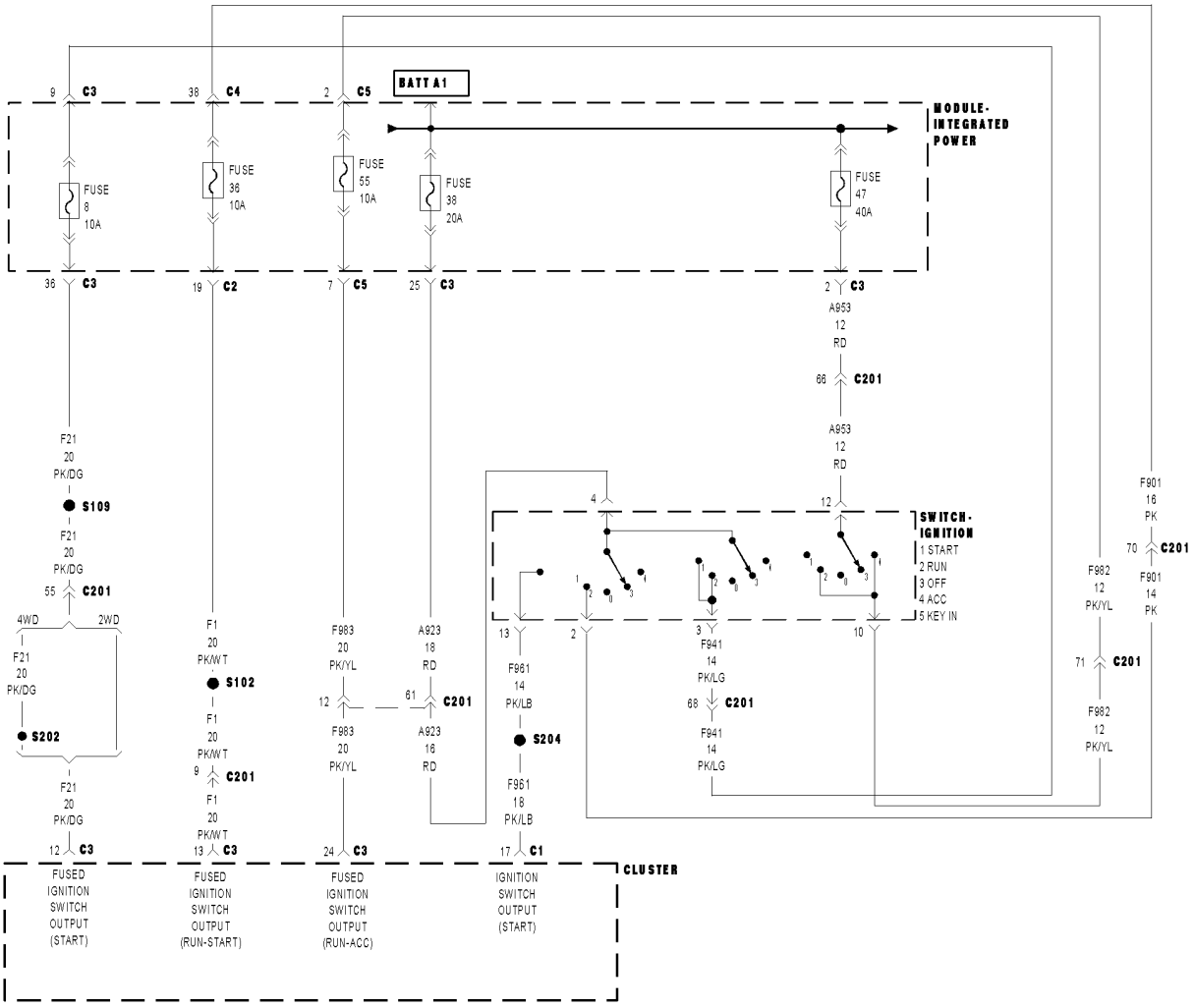
Yes >> Replace the Instrument Cluster in accordance with the Service Information.

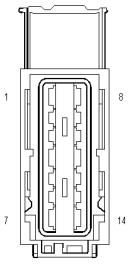
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Repair the faulty wire(s)/connector(s).

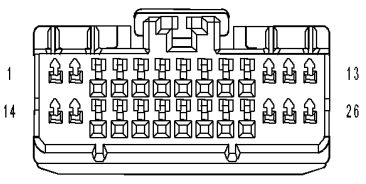
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

B2107–IGNITION SWITCH SENSE INPUT CIRCUIT/PERFORMANCE

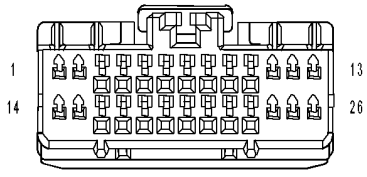




SWITCH-IGNITION



CLUSTER C1



CLUSTER C3

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B2107–IGNITION SWITCH SENSE INPUT CIRCUIT/PERFORMANCE (CONTINUED)

For the Instrument Cluster circuit diagram (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Cluster detects an Ignition Switch performance fault.

Possible Causes
OPEN IGNITION SWITCH OUTPUT FUSE(S)
(F21) IGNITION SWITCH OUTPUT (OFF/RUN/START) CIRCUIT OPEN OR SHORTED TO GROUND
(F1) IGNITION SWITCH OUTPUT (RUN/START) CIRCUIT OPEN OR SHORTED TO GROUND
(F961) IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR SHORTED TO GROUND
(F983) IGNITION SWITCH OUTPUT (RUN/ACC) CIRCUIT OPEN OR SHORTED TO GROUND
(A953) IGNITION (RUN/ACC) CIRCUIT OPEN OR SHORTED TO GROUND
IGNITION SWITCH
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR AN INTERMITTENT CONDITION

NOTE: Troubleshoot any Ignition, Battery, or Cluster DTCs before proceeding.

Turn the ignition on.

Using the scan tool, record and erase DTCs.

Turn the ignition off, wait 10 seconds then turn the ignition on.

Using the scan tool, read DTCs.

Does the scan tool display: B2107–IGNITION SWITCH SENSE INPUT CIRCUIT/PERFORMANCE?

Yes >> Go To 2

No >> The condition that caused this code to set is not present at this time. Using the wiring diagram as a guide, inspect the wiring and connectors for an intermittent condition. Operate the system several times and recheck for active DTCs.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

B2107–IGNITION SWITCH SENSE INPUT CIRCUIT/PERFORMANCE (CONTINUED)

2. CHECK FOR OPEN IGNITION SWITCH OUTPUT FUSES

Turn the ignition off.

Using the wiring/circuit diagrams, check the following fuses for an open:

- IPM fuse #8
- IPM fuse #36
- IPM fuse #38
- IPM fuse #47
- IPM fuse #55

Are any of the fuses open?

Yes >> Go To 3

No >> Go To 4

---

3. CHECK FOR OPEN IGNITION SWITCH OUTPUT FUSES

Replace the open fuse(s).

Cycle the ignition through ALL positions.

Turn the ignition off.

Check each fuse that was replaced for an open.

NOTE: Perform the diagnostic procedure for each fuse that is open before making any repairs. Doing so will identify all possible conditions causing this DTC to set.

Was any replaced fuse open? (Select from the following)

IPM fuse #55
Go To 9

IPM fuse #8
Go To 10

IPM fuse #36
Go To 11

IPM fuse #38
Go To 12

IPM fuse #47
Go To 15

No fuses open
The condition that caused the fuse(s) to open is not present at this time. Using the wiring diagram as a guide, inspect the wiring and connectors for an intermittent condition. Operate the system several times and recheck for active DTCs.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

B2107–IGNITION SWITCH SENSE INPUT CIRCUIT/PERFORMANCE (CONTINUED)

4. CHECK VOLTAGE OF THE IGNITION SWITCH OUTPUT CIRCUITS AT THE INSTRUMENT CLUSTER C1 AND C3 CONNECTORS

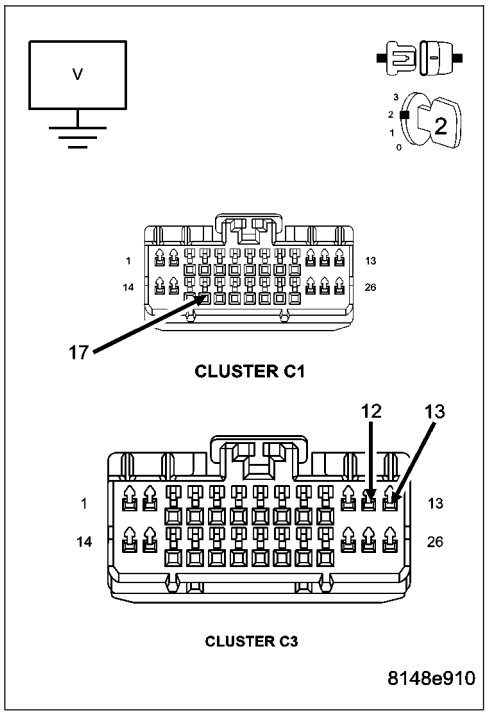
NOTE: Remove the starter relay.
Disconnect the Instrument Cluster C1 and C3 harness connectors.
Turn the ignition on.
Measure the voltage of the following circuits:

- (F21) Ignition Switch Output (RUN/START) circuit with the ignition in the RUN, and START positions.
- (F1) Ignition Switch Output (RUN/START) circuit with the ignition in the RUN position.
- (F961) Ignition Switch Output (START) circuit with the ignition in the START position.

Is the voltage above 10.0 volts on each circuit?

Yes >> Go To 5

No >> Go To 5



5. CHECK VOLTAGE OF THE (F983) IGNITION SWITCH OUTPUT (RUN/ACC) CIRCUIT AT THE INSTRUMENT CLUSTER C3 HARNESS CONNECTOR

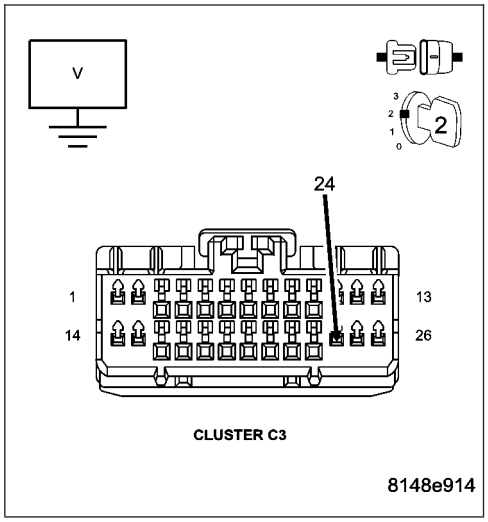
NOTE: Reinstall the Starter Relay.
Measure the voltage of the (F983) Ignition Switch Output (RUN/ACC) circuit with the ignition in the RUN and ACC positions.

Is the voltage above 10.0 volts on all the circuits tested in steps 4 and 5?

Yes >> Replace the Instrument Cluster in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No: (F21) (F961) or (F1) below 10.0 volts
Go To 6

No: (F983) below 10.0 volts
Go To 7



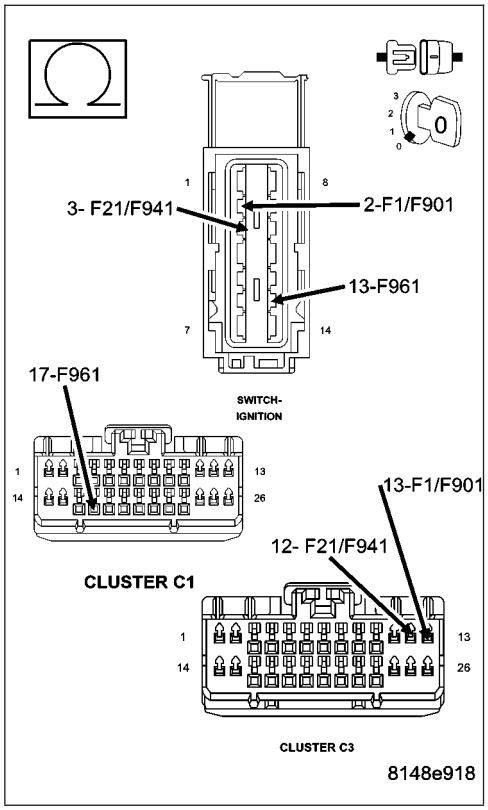
B2107–IGNITION SWITCH SENSE INPUT CIRCUIT/PERFORMANCE (CONTINUED)

6. CHECK THE IGNITION SWITCH OUTPUT CIRCUITS WITH VOLTAGE BELOW 10.0 VOLTS FOR AN OPEN

Turn the ignition off.

Disconnect the Ignition Switch harness connector.

Measure the resistance of the Ignition Switch Output circuit(s) (F21/F941), (F961), (F1/F901) (from step 5, the circuit(s) below 10.0 volts) between the Ignition Switch harness connector and the Instrument Cluster C1/C3 harness connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the Ignition Switch in accordance with the service information.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Repair the circuit(s) with a resistance above 5.0 ohms.

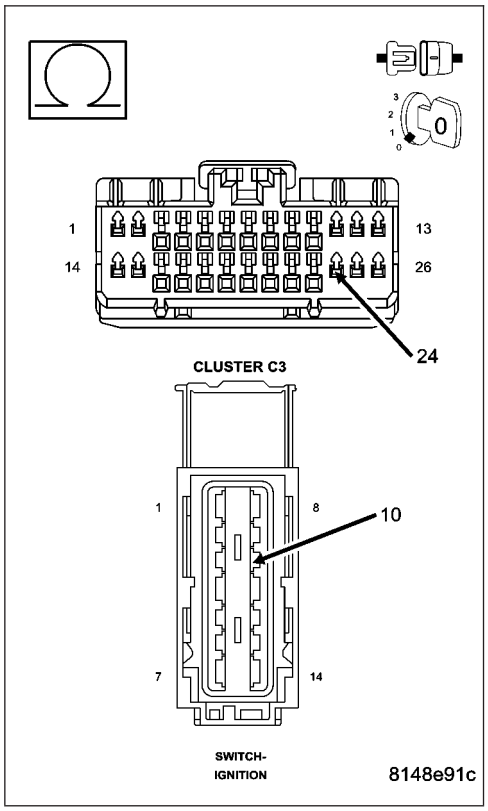
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

7. CHECK THE (F983) IGNITION SWITCH OUTPUT (RUN/ACC) CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the Ignition Switch harness connector.

Measure the resistance of the (F983/F982) Ignition Switch Output (RUN/ACC) circuit between the Ignition Switch harness connector and the Instrument Cluster C3 harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 8

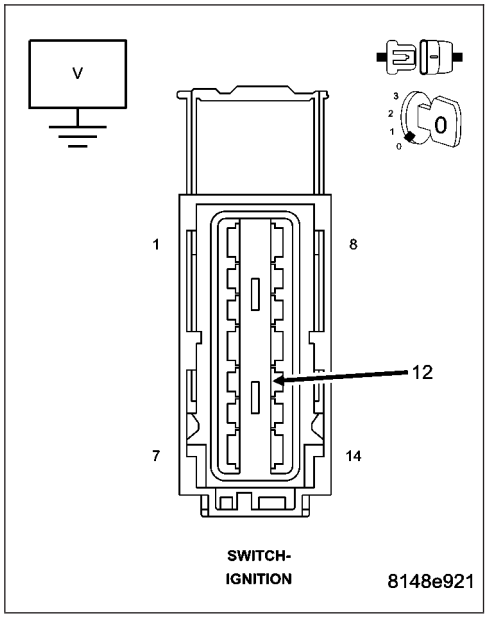
No >> Repair the (F983/F982) Ignition Switch Output (RUN/ACC) circuit for an open.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

B2107–IGNITION SWITCH SENSE INPUT CIRCUIT/PERFORMANCE (CONTINUED)

8. CHECK VOLTAGE OF THE (A953) IGNITION (RUN/ACC) CIRCUIT AT THE IGNITION SWITCH HARNESS CONNECTOR

Measure the voltage of the (A953) Ignition (RUN/ACC) circuit at the ignition switch harness connector.



Is the voltage above 10.0 volts?

Yes >> Replace the Ignition Switch in accordance with the service information.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Repair the (A953) Ignition (RUN/ACC) circuit for an open.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

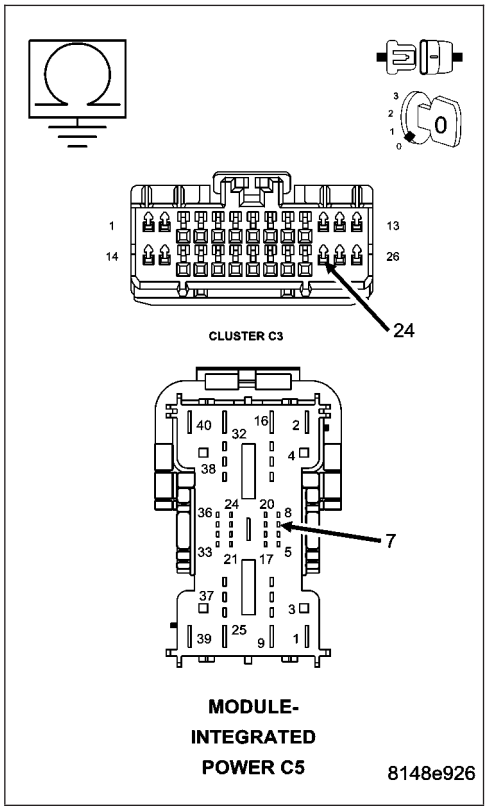
9. CHECK (F983) IGNITION SWITCH OUTPUT (RUN/ACC) CIRCUIT FOR A SHORT TO GROUND

Disconnect the Ignition Switch harness connector.

Disconnect the IPM C5 harness connector.

Disconnect the Instrument Cluster C3 harness connector.

Measure the resistance between ground and the (F983) Ignition Switch Output (RUN/ACC) circuit.



Is the resistance below 10K ohms?

YES >> Repair the (F983) Ignition Switch Output (RUN/ACC) circuit for a short to ground.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

NO >> Replace the Instrument Cluster in accordance with the service information.

B2107–IGNITION SWITCH SENSE INPUT CIRCUIT/PERFORMANCE (CONTINUED)

10. CHECK (F21) IGNITION SWITCH OUTPUT (RUN/START) CIRCUIT FOR A SHORT TO GROUND

Disconnect the IPM C3 harness connector.

Disconnect the Instrument Cluster C3 harness connector.

Measure the resistance between ground and the (F21) Ignition Switch Output (RUN/START) circuit.

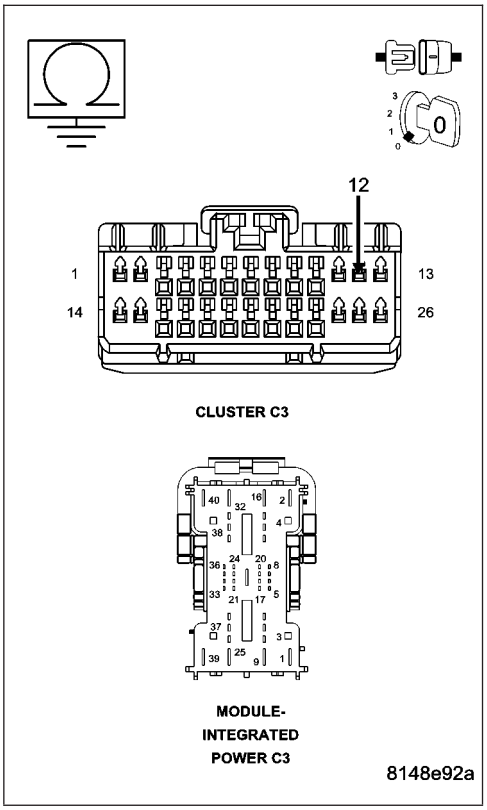
Is the resistance below 10K ohms?

YES >> Repair the (F21) Ignition Switch Output (RUN/START) circuit for a short to ground.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

NO >> Replace the Instrument Cluster in accordance with the service information.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)



11. CHECK (F1) IGNITION SWITCH OUTPUT (RUN/START) CIRCUIT FOR A SHORT TO GROUND

Disconnect the IPM C2 harness connector.

Disconnect the Instrument Cluster C3 harness connector.

Measure the resistance between ground and the (F1) Ignition Switch Output (RUN/START) circuit.

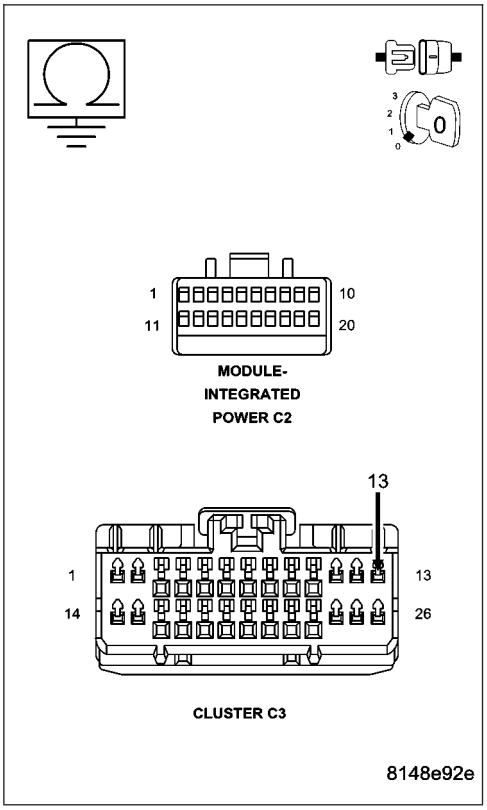
Is the resistance below 10K ohms?

YES >> Repair the (F1) Ignition Switch Output (RUN/START) for a short to ground.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

NO >> Replace the Instrument Cluster in accordance with the service information.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)



B2107–IGNITION SWITCH SENSE INPUT CIRCUIT/PERFORMANCE (CONTINUED)

12. CHECK (F961) IGNITION SWITCH OUTPUT (RUN) CIRCUIT FOR A SHORT TO GROUND

Disconnect the Instrument Cluster C1 harness connector.

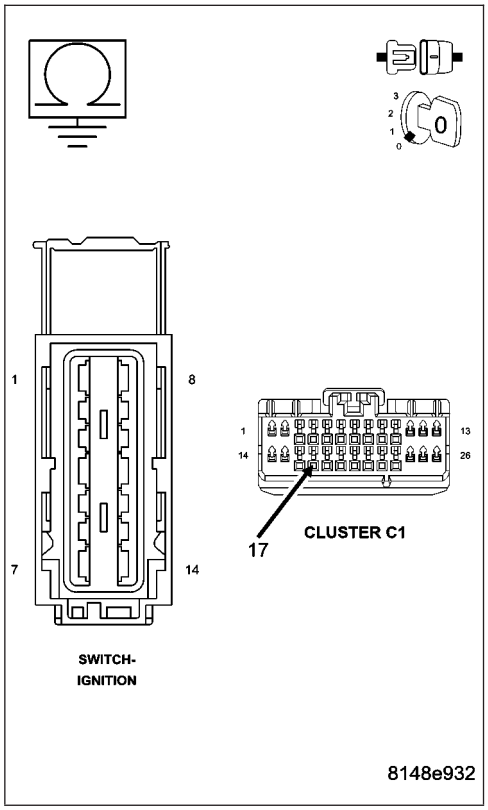
Disconnect the ignition switch harness connector.

Measure the resistance between ground and the (F924) Ignition Switch Output (RUN) circuit.

Is the resistance below 10K ohms?

YES >> Repair the (F961) Ignition Switch Output (RUN) circuit for a short to ground.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

NO >> Go To 13



13. CHECK (A923) FUSED B+ CIRCUIT FOR A SHORT TO GROUND

Disconnect the IPM C3 harness connector.

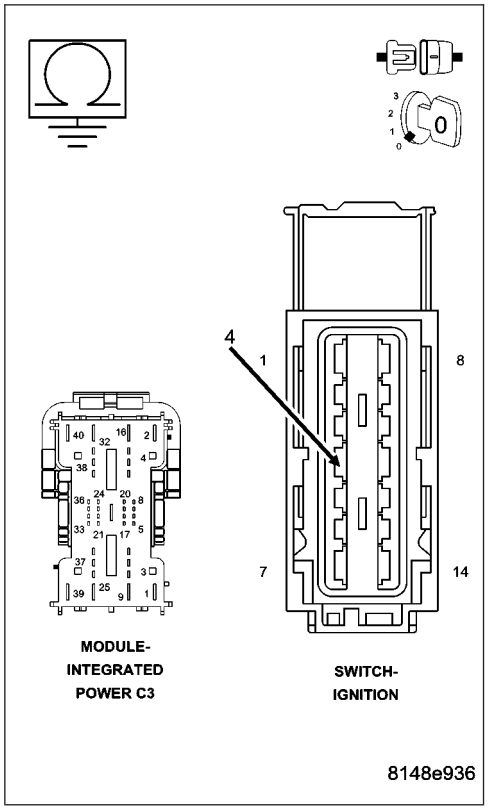
Disconnect the Ignition Switch harness connector.

Measure the resistance between ground and the (A923) Fused B+ circuit.

Is the resistance below 10K ohms?

YES >> Repair the (A923) Fused B+ circuit for a short to ground.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

NO >> Go To 14



B2107–IGNITION SWITCH SENSE INPUT CIRCUIT/PERFORMANCE (CONTINUED)

14. CHECK CIRCUITS F901, F941, FOR A SHORT TO GROUND

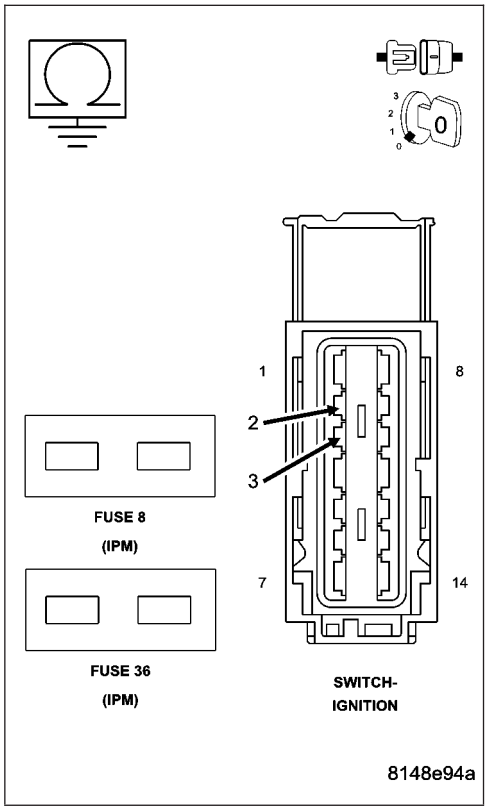
Remove JB fuses: 8, 36.

Using the wiring diagrams, measure the resistance between ground and the F901 and F941 circuits.

Is the resistance below 10K ohms on any one of these circuits?

YES >> Repair the appropriate circuit for a short to ground.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

NO >> Replace the Ignition Switch in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)



15. CHECK CIRCUIT (A953) FOR A SHORT TO GROUND

Disconnect the IPM C3 harness connector.

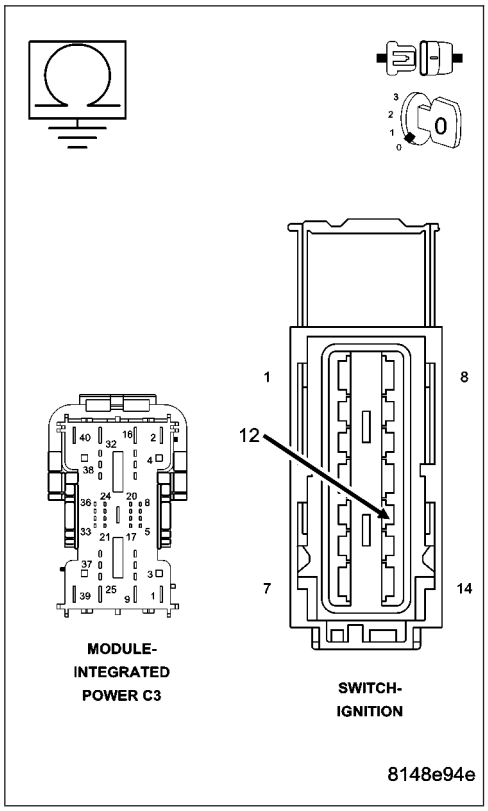
Disconnect the Ignition Switch harness connector

Using the wiring diagrams, measure the resistance between ground and the (A953) circuit.

Is the resistance below 10K ohms?

YES >> Repair circuit (A953) for a short to ground.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

NO >> Go To 16



B2107–IGNITION SWITCH SENSE INPUT CIRCUIT/PERFORMANCE (CONTINUED)

16. CHECK CIRCUIT (F982) FOR A SHORT TO GROUND

Remove IPM fuse #55.

Using the wiring diagrams, measure the resistance between ground and the (F982) circuit.

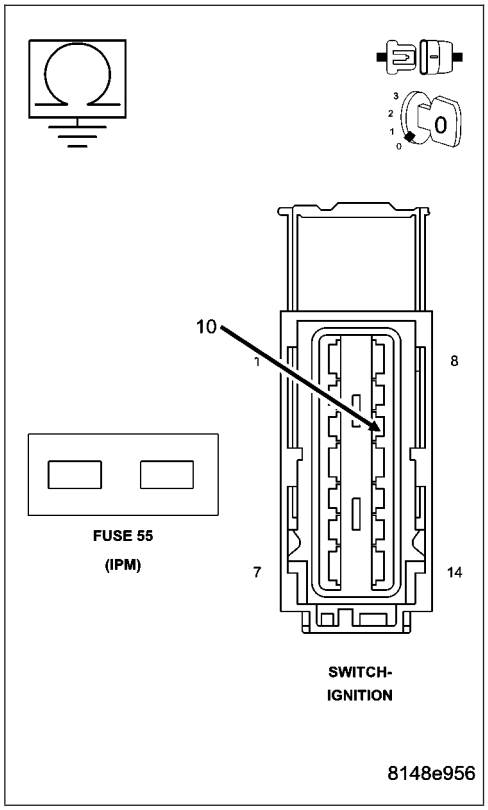
Is the resistance below 10K ohms?

YES >> Repair circuit (F982) for a short to ground.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

NO >> Replace the Ignition Switch in accordance with the service information.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)



B2213–CABIN COMPARTMENT NODE/CLUSTER INTERNAL

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Instrument Cluster detects an internal failure.

Possible Causes
INSTRUMENT CLUSTER

Diagnostic Test

1. VERIFY INSTRUMENT CLUSTER OPERATION

NOTE: When this DTC is active and the Instrument Cluster Backlighting is inoperative, the Instrument Cluster must be replaced.

Is DTC: B2213–CABIN COMPARTMENT NODE/CLUSTER INTERNAL active AND the Instrument Cluster Backlighting inoperative?

YES >> Replace the Instrument Cluster in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

NO >> Disregard DTC, test complete.

B222C-VEHICLE CONFIGURATION NOT PROGRAMMED

For the Instrument Cluster circuit diagram (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Vehicle configuration information not programmed into the Instrument Cluster.

POSSIBLE CAUSES
NO COMMUNICATION WITH FRONT CONTROL MODULE
ACTIVE FCM DTCs
INSTRUMENT CLUSTER
FRONT CONTROL MODULE

Diagnostic Test

1. TEST FOR AN INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, record and erase any Instrument Cluster DTCs.
Turn the ignition off, wait 10 seconds then turn the ignition on.
With the scan tool, read DTCs.

Does the scan tool display: B222C-VEHICLE CONFIGURATION NOT PROGRAMMED?

Yes >> Go To 2

No >> The condition that caused this code to set is not present at this time. Using the wiring diagram as a guide, inspect the wiring and connectors for an intermittent condition. Operate the system several times and recheck for active DTCs.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

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2. VERIFY COMMUNICATION WITH FRONT CONTROL MODULE

With the scan tool in ECU VIEW, read active modules on the bus.

Does the scan tool show the Front Control Module active on the bus?

Yes >> Go To 3

No >> Refer to the Communication category for the related symptoms.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

B222C-VEHICLE CONFIGURATION NOT PROGRAMMED (CONTINUED)

3. CHECK FRONT CONTROL MODULE FOR ACTIVE DTCS

With the scan tool, erase FCM DTCs.

Turn the ignition off. Wait approximately 10 seconds.

Turn the ignition on.

With the scan tool, read FCM DTCs.

Are any active DTCs present?

Yes >> Refer to symptom list for problems related to the Front Control Module.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

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4. CHECK CLUSTER VEHICLE INFORMATION WITH SCAN TOOL

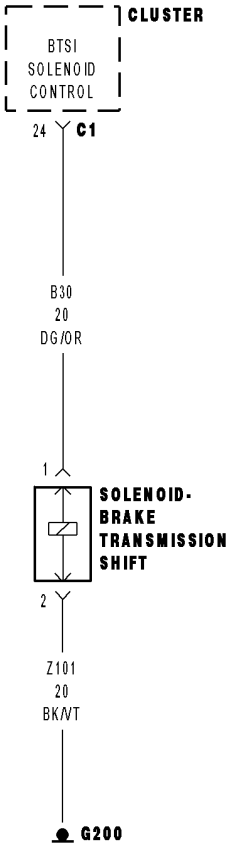
With the scan tool in Cluster ECU Identification, read the Original and Current VINs, and the Body Style of the vehicle.

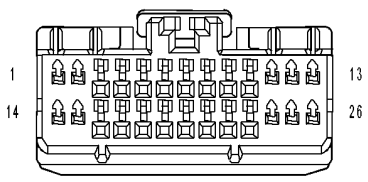
Does the information displayed match the vehicle?

Yes >> Replace the Instrument Cluster in accordance with the Service Information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

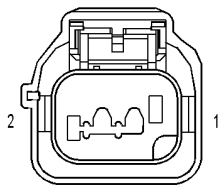
No >> Replace the Front Control Module in accordance with the Service Information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

P0930-BTSI CONTROL CIRCUIT LOW





CLUSTER C1



SOLENOID-
BRAKE
TRANSMISSION
SHIFT

8140da98

P0930-BTSI CONTROL CIRCUIT LOW (CONTINUED)

For the Instrument Cluster circuit diagram (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Unlock or Run position and the driver's foot applied to the brake pedal.
- **Set Condition:**
  The Instrument Cluster detects a low value on the BTSI Solenoid Control circuit.

Possible Causes
(B30) BTSI SOLENOID CONTROL CIRCUIT SHORTED TO THE (Z101) BTSI SOLENOID GROUND CIRCUIT
(B30) BTSI SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
TRANSMISSION UNLOCK SOLENOID (BTSI)
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase DTCs.

Turn the ignition off, wait 10 seconds then turn the ignition on.

Apply and release the brakes.

With the scan tool, read DTCs.

Does the scan tool display: P0930-BTSI CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused this code to set is not present at this time. Using the wiring diagram as a guide, inspect the wiring and connectors for an intermittent condition. Operate the system several times and recheck for active DTCs.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

P0930-BTSI CONTROL CIRCUIT LOW (CONTINUED)

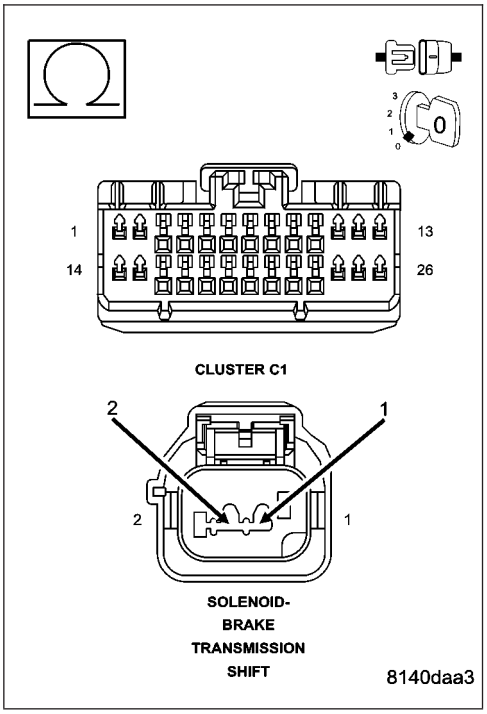
2. CHECK THE (B30) BTSI SOLENOID CONTROL CIRCUIT FOR A SHORT TO THE (Z101) BTSI SOLENOID GROUND CIRCUIT.

Turn the ignition off.

Disconnect the BTSI solenoid harness connector.

Disconnect the Instrument Cluster C1 harness connector.

Measure the resistance between the (B30) BTSI Solenoid Control Circuit and the (Z101) BTSI Solenoid Ground Circuit.



Is the resistance below 5.0 ohms?

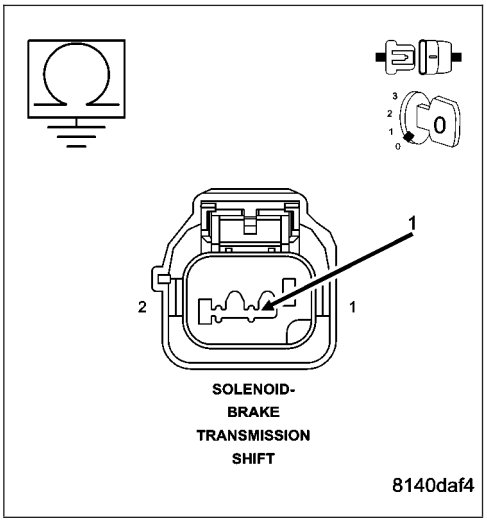
Yes >> Repair the (B30) BTSI Solenoid Control circuit for a short to the (Z101) BTSI Solenoid Ground Circuit.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

3. CHECK THE (B30) BTSI SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (B30) BTSI Solenoid Control circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (B30) BTSI Solenoid Control circuit for a short to ground.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

P0930-BTSI CONTROL CIRCUIT LOW (CONTINUED)

4. CHECK OPERATION OF THE BTSI SOLENOID

Reconnect the Instrument Cluster C1 harness connector.

Turn the ignition on.

Using a 12–volt test light connected to ground, check the BTSI Solenoid Control circuit.

With the scan tool, actuate the BTSI Solenoid.

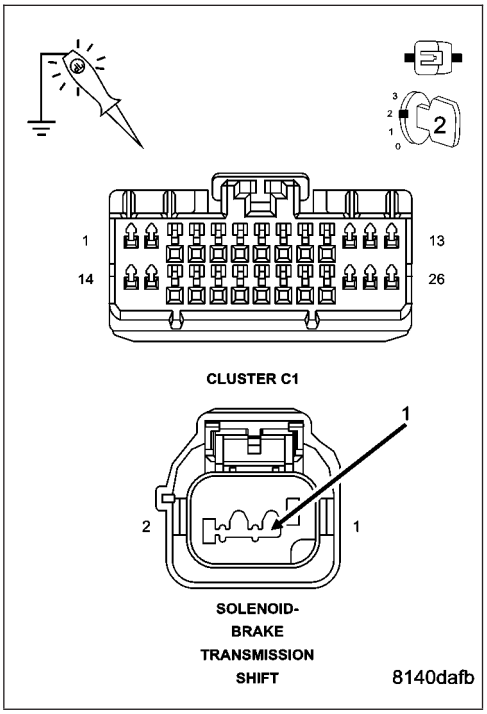
Does the test light illuminate brightly?

Yes >> Replace the Transmission Unlock (BTSI) Solenoid in accordance with the Service Information.

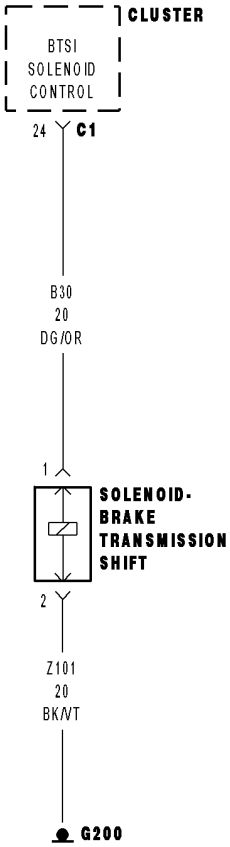
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

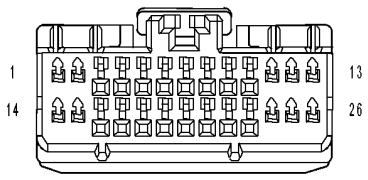
No >> Replace the Instrument Cluster in accordance with the Service Information.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

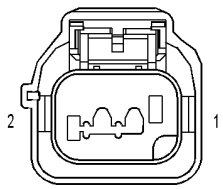


P0931-BTSI CONTROL CIRCUIT HIGH





CLUSTER C1



SOLENOID-
BRAKE
TRANSMISSION
SHIFT

8140da98

P0931-BTSI CONTROL CIRCUIT HIGH (CONTINUED)

For the Instrument Cluster Solenoid circuit diagram (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Unlock or Run position and the driver's foot applied to the brake pedal.
- **Set Condition:**
  The Instrument Cluster detects a high value on the BTSI Solenoid Control circuit.

Possible Causes
(Z101) BTSI SOLENOID GROUND CIRCUIT OPEN
(B30) BTSI SOLENOID CONTROL CIRCUIT OPEN
TRANSMISSION UNLOCK SOLENOID (BTSI)
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase DTCs.

Turn the ignition off, wait 10 seconds then turn the ignition on.

Apply and release the brakes.

With the scan tool, read DTCs.

Does the scan tool display: P0931-BTSI CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused this code to set is not present at this time. Using the wiring diagram as a guide, inspect the wiring and connectors for an intermittent condition. Operate the system several times and recheck for active DTCs.

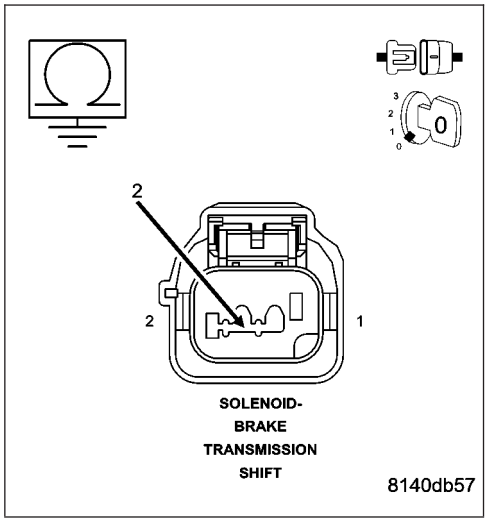
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

2. CHECK THE (Z101) BTSI SOLENOID GROUND CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the BTSI Solenoid harness connector.

Measure the resistance between ground and the (Z101) BTSI Solenoid Ground circuit.



Is the resistance above 5.0 ohms?

Yes >> Repair the (Z101) BTSI Solenoid Ground circuit for an open.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0931-BTSI CONTROL CIRCUIT HIGH (CONTINUED)

3. CHECK THE (B30) BTSI SOLENOID CONTROL CIRCUIT FOR AN OPEN

Disconnect the Instrument Cluster C1 harness connector.

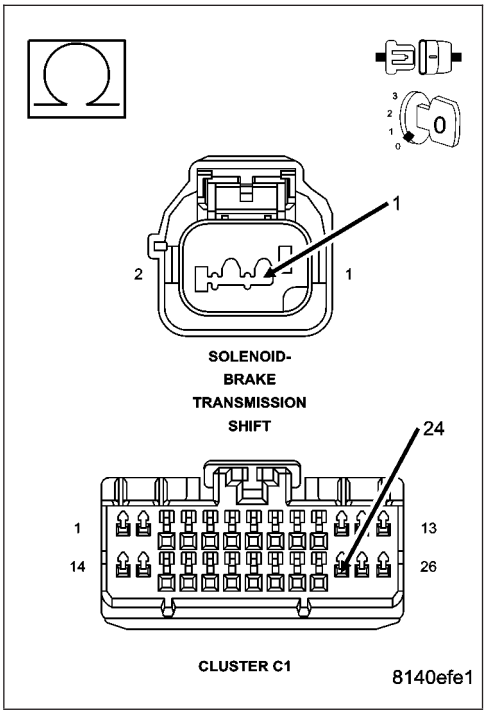
Measure the resistance of the (B30) BTSI Solenoid Control circuit between the BTSI Solenoid harness connector and the Instrument Cluster C1 harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (B30) BTSI Solenoid Control circuit for an open.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4



4. CHECK THE OPERATION OF THE BTSI SOLENOID

Reconnect the Instrument Cluster C1 harness connector.

Turn the ignition on.

Using a 12–volt test light connected to ground, check the (B30) BTSI Solenoid Control circuit.

With the scan tool, actuate the BTSI Solenoid.

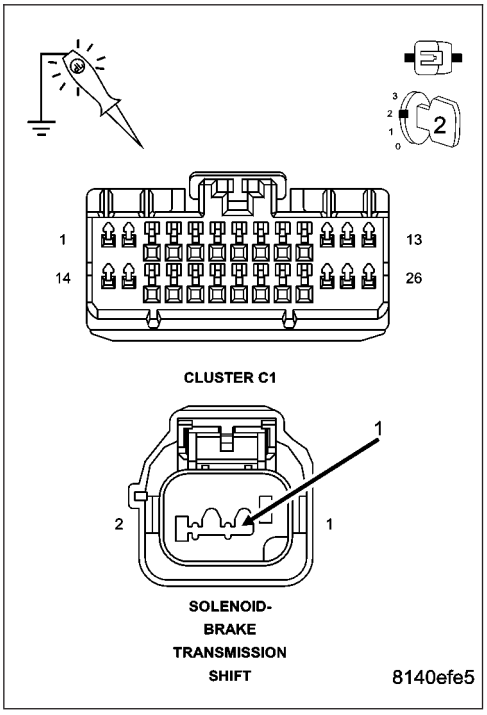
Does the test light illuminate brightly?

Yes >> Replace the Transmission Unlock (BTSI)Solenoid in accordance with the Service Information.

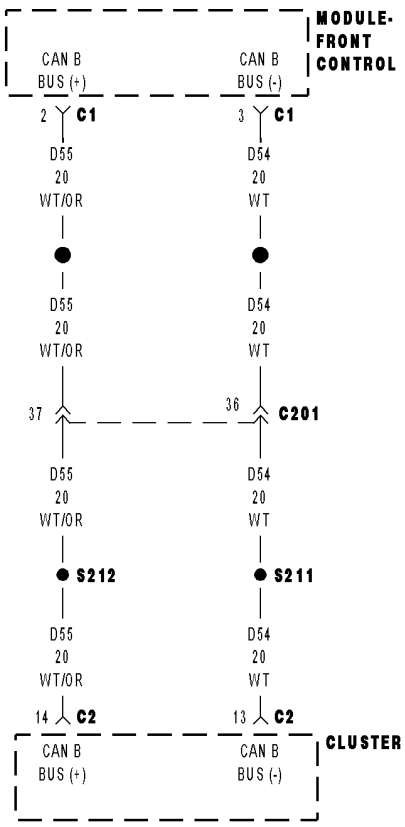
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

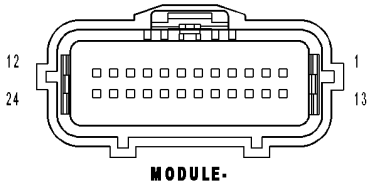
No >> Replace the Instrument Cluster in accordance with the Service Information.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

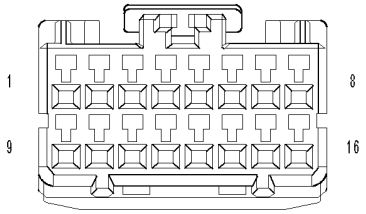


U0019–CAN B BUS





MODULE-
FRONT
CONTROL C1



CLUSTER C2

8145290a

U0019–CAN B BUS (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  Whenever the Can B Bus (+) or B Bus (–) circuit is open, shorted to voltage or shorted to ground, this code will set.

Possible Causes
CAN B BUS DTCs IN FRONT CONTROL MODULE
(D54) CAN B BUS (–) CIRCUIT OPEN
(D55) CAN B BUS (+) CIRCUIT OPEN
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, record and erase DTCs
Cycle the ignition from on to off 3 times.
Turn the ignition on.
With the scan tool, read DTCs.

Does the scan tool display U0019–CAN B BUS CIRCUIT?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. CHECK FRONT CONTROL MODULE DTCs

With the scan tool, read Front Control Module DTCs

Does the scan tool display any CAN B BUS DTCs – ACTIVE?

Yes >> Refer to the symptom list for problems related to Communication in the ELECTRICAL.– ELECTRONIC CONTROL MODULES – ELECTRICAL DIAGNOSES section.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 3

U0019–CAN B BUS (CONTINUED)

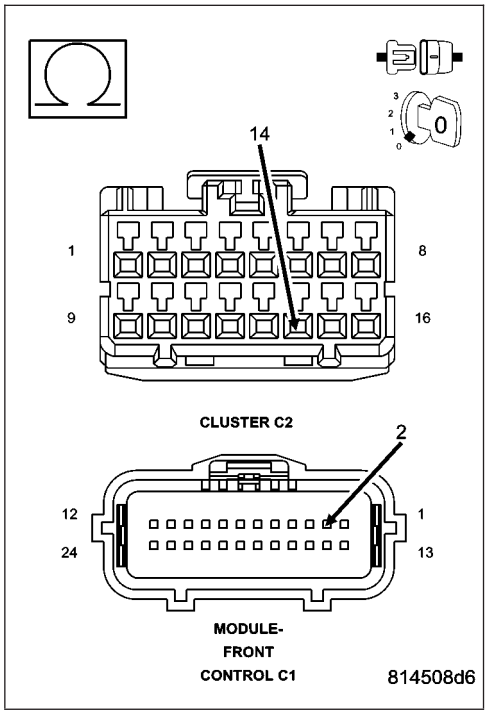
3. CAN B BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Instrument Cluster C2 harness connector.

Disconnect the Front Control Module C1 harness connector.

Measure the resistance of the (D55) Can B Bus (+) circuit between the Front Control Module C1 harness connector and the Instrument Cluster C2 harness connector.



Is the resistance below 2.0 ohms?

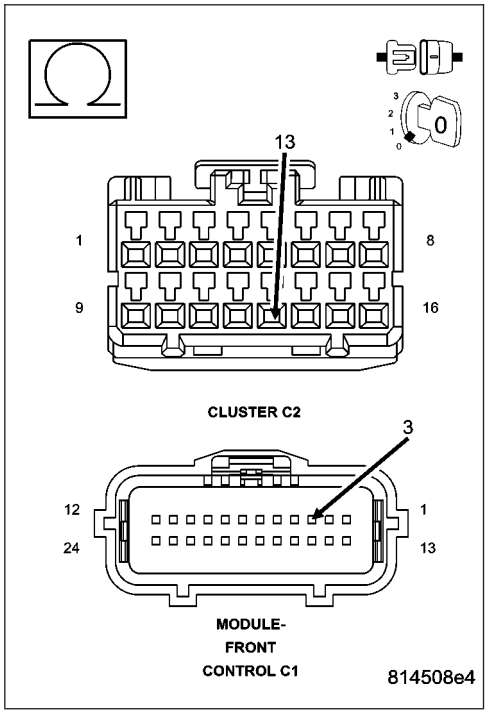
Yes >> Go To 4

No >> Repair the Can B Bus (+) circuit for an open.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

4. CAN B BUS (–) CIRCUIT OPEN

Measure the resistance of the (D54) Can B Bus (–) circuit between the Front Control Module C1 harness connector and the Instrument Cluster C2 harness connector.



Is the resistance below 2.0 ohms?

Yes >> Replace the Instrument Cluster in accordance with the service information.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Repair the Can B Bus (–) circuit for an open.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0151-LOST COMMUNICATION WITH OCCUPANT RESTRAINT CONTROLLER

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0156-LOST COMMUNICATION WITH EOM

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0168-LOST COMMUNICATION WITH VEHICLE SECURITY CONTROL MODULE (SKREEM/WCM)

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0184-LOST COMMUNICATION WITH RADIO

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0199-LOST COMMUNICATION WITH DRIVER DOOR MODULE

For a complete wiring diagram **Refer to Section 8W**.

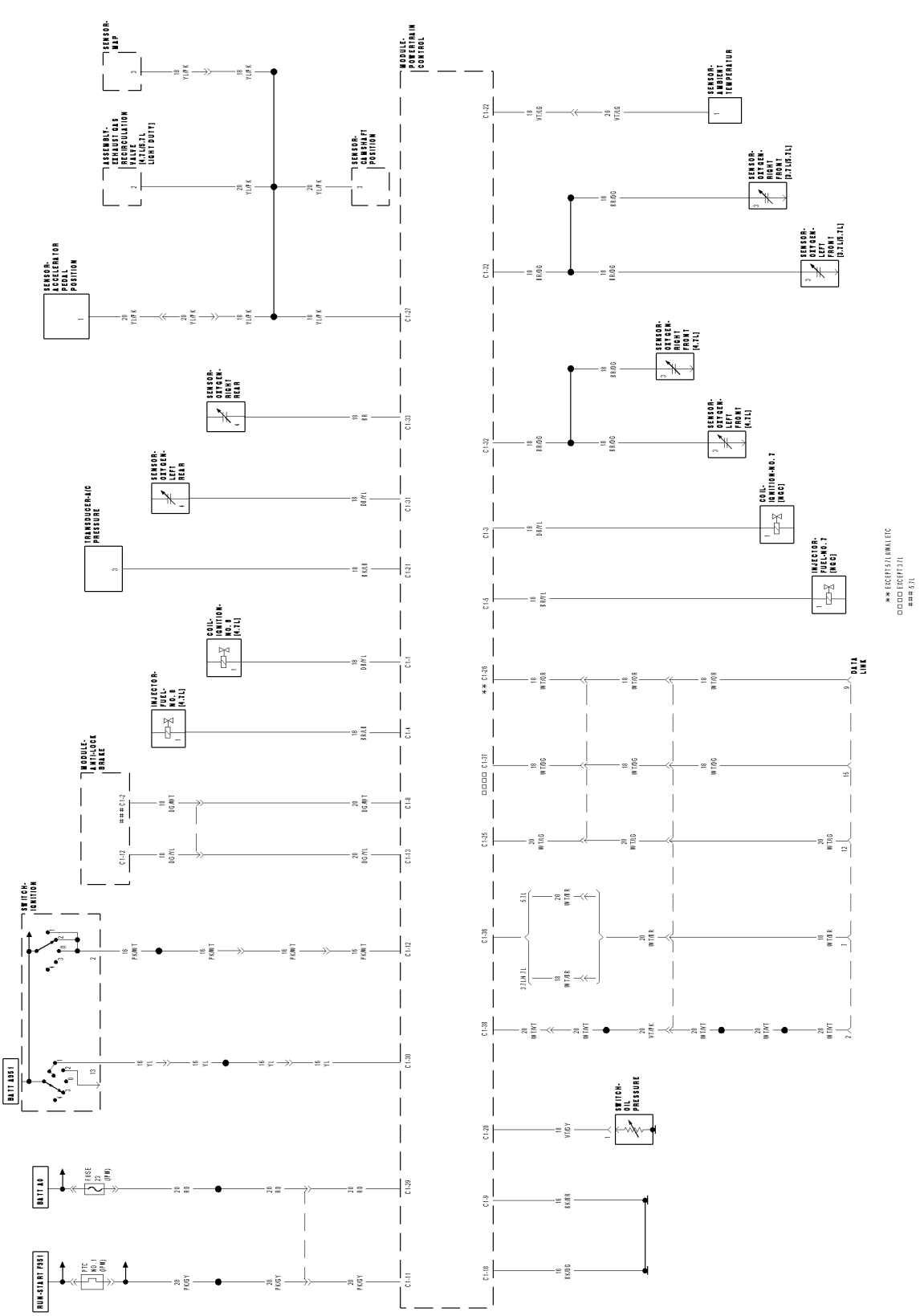
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0208-LOST COMMUNICATION WITH HEATED SEAT CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

SCHEMATICS AND DIAGRAMS



CLUSTER

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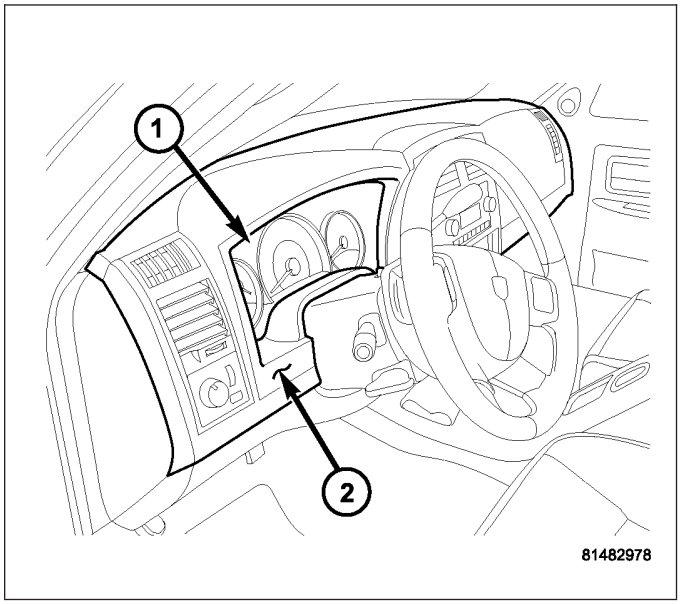
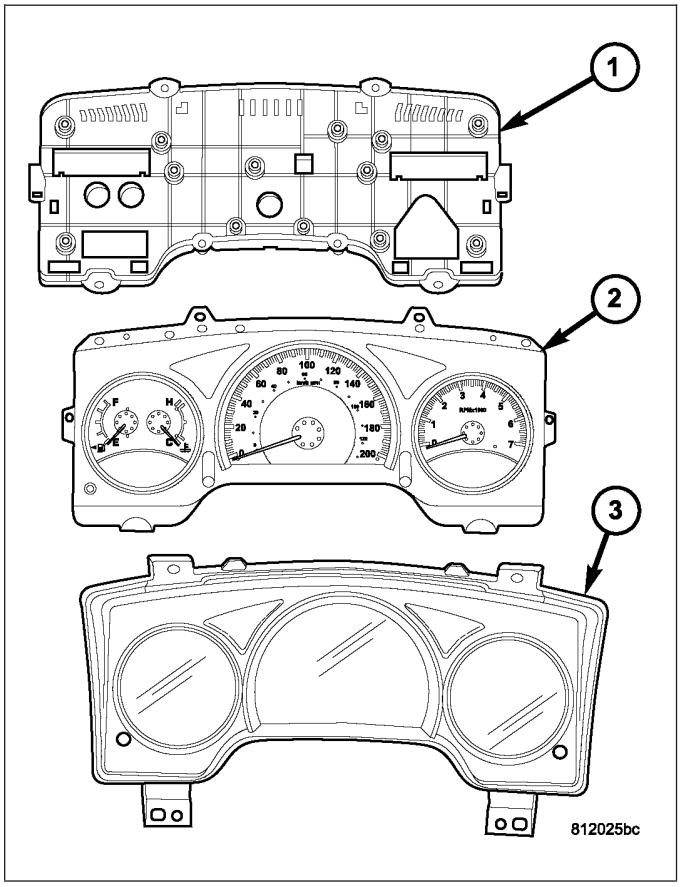
CLUSTER

DESCRIPTION

The instrument cluster (1) for this model is an Electro-Mechanical Instrument Cluster (EMIC) that is located in the instrument panel above the steering column opening, directly in front of the driver. The remainder of the EMIC, including the mounts and the electrical connections, are concealed within the instrument panel behind the cluster bezel (2). Besides analog gauges and indicators, the EMIC module incorporates a single blue-green digital Vacuum Fluorescent Display (VFD) unit for displaying odometer/trip odometer information, engine hours, automatic transmission gear selector position (PRNDL), several warning or reminder indications and certain diagnostic information. The instrument cluster for this model also includes the hardware and software necessary to serve as the electronic body control module and is sometimes referred to as the Cab Compartment Node or CCN.



The EMIC gauges and indicators are visible through a dedicated opening in the cluster bezel on the instrument panel and are protected by a clear plastic cluster lens that is integral to a cluster lens, hood and mask unit (3). Just behind the cluster lens is the cluster hood and an integral cluster mask, which are constructed of molded black plastic. Two different masks are used, one with black rings and one with silver rings around the gauge openings. The cluster hood serves as a visor and shields the face of the cluster from ambient light and reflections to reduce glare, while the cluster mask serves to separate and define the individual gauges and indicators of the EMIC. A black plastic odometer/trip odometer switch button protrudes through dedicated holes in the cluster mask and the cluster lens, located near the lower edge of the cluster just to the left of the fuel gauge. The molded plastic EMIC lens, hood and mask unit has four integral mounting tabs, two each on the upper and lower edges of the unit. These mounting tabs are used to secure the EMIC to the molded plastic instrument panel cluster carrier with four screws.



The rear of the cluster housing and the EMIC electronic circuitry are protected by a molded plastic rear cover (1), which is secured to the cluster housing with fourteen screws, while eight screws installed around the outside perimeter of the rear cover secure it to the cluster lens, hood and mask unit. The rear cover includes clearance holes for the cluster connector receptacles. The connector receptacles on the back of the cluster electronic circuit board connect the EMIC to the vehicle electrical system through three take outs with connectors from the instrument panel wire harness.

Sandwiched between the rear cover and the lens, hood and mask unit is the cluster housing (2). The molded plastic cluster housing serves as the carrier for the cluster circuit board and circuitry, the cluster connector receptacles, the gauges, a Light Emitting Diode (LED) for each cluster indicator, the VFD unit, an audible tone transducer, an electro-luminescent lamp for general cluster illumination, the cluster overlay, the gauge pointers, the odometer/trip odometer switch and the switch button.

The cluster overlay is a laminated plastic unit. The dark, visible, outer surface of the overlay is marked with all of the gauge dial faces and graduations, but this layer is also translucent. The darkness of this outer layer prevents the cluster from appearing cluttered or busy by concealing the cluster indicators that are not illuminated, while the translucence of this layer allows those indicators and icons that are illuminated to be readily visible. The underlying layer of the overlay is opaque and allows light from the LED for each of the various indicators and an electro-luminescent lamp behind it to be visible through the outer layer of the overlay only through predetermined stencil-like cutouts. A rectangular opening in the overlay at the base of the tachometer dial face has a smoked clear lens through which the illuminated VFD unit can be viewed.

Several versions of the EMIC module are offered on this model. These versions accommodate all of the variations of optional equipment and regulatory requirements for the various markets in which the vehicle will be offered. The microprocessor-based EMIC utilizes integrated circuitry and information carried on the Controller Area Network (CAN) data bus along with several hard wired analog and multiplexed inputs to monitor sensors and switches throughout the vehicle. In response to those inputs, the internal circuitry and programming of the EMIC allow it to control and integrate many electronic functions and features of the vehicle through both hard wired outputs and the transmission of electronic message outputs to other electronic modules in the vehicle over the CAN data bus. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - DESCRIPTION - CAN BUS).

Besides typical instrument cluster gauge and indicator support, the electronic functions and features that the EMIC supports or controls include the following:

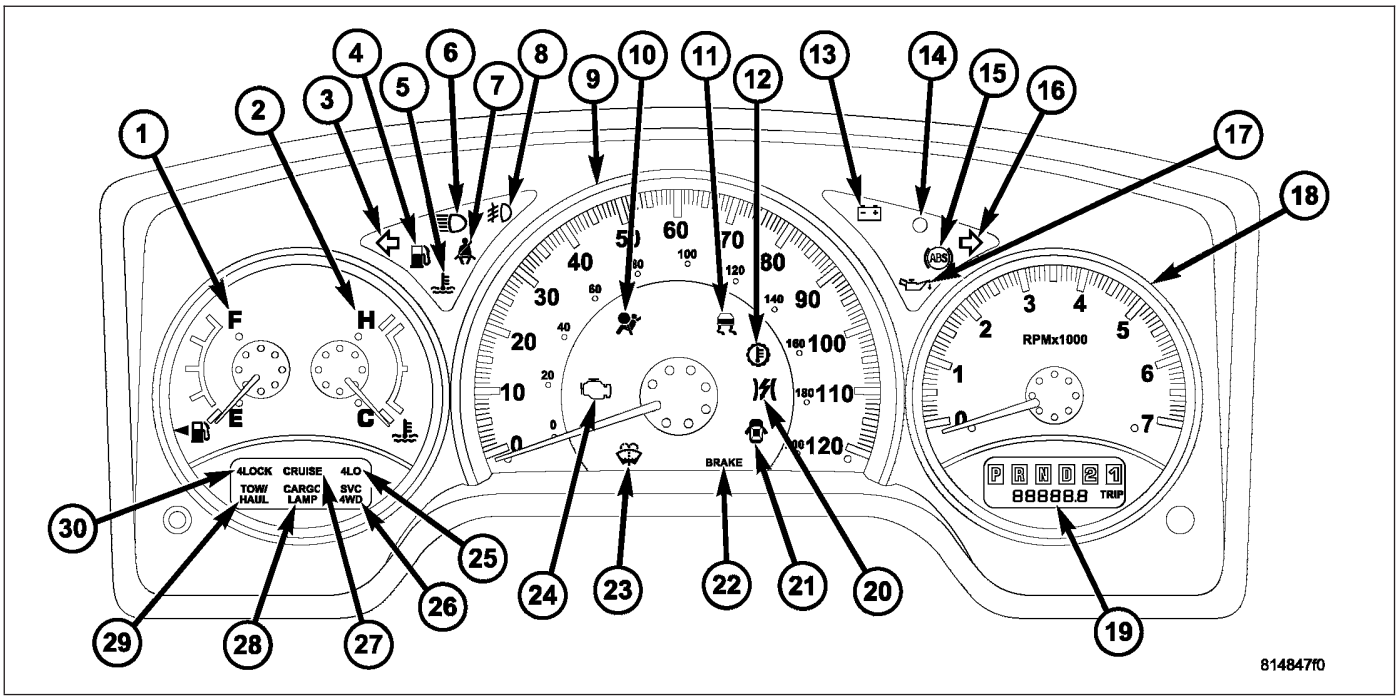
- **Audible Warnings** - The EMIC electronic circuit board is equipped with an audible tone transducer and programming that allows it to provide various audible alerts to the vehicle operator, including chime tones and beep tones. An electromechanical relay is also soldered onto the circuit board to produce audible clicks that emulate the sound of a conventional turn signal or hazard warning flasher. (Refer to 8 - ELECTRICAL/CHIME/BUZZER - DESCRIPTION).
- **Automatic Headlamps Control** - On models equipped with optional automatic headlamps, the EMIC monitors inputs from both the headlamp switch and a sun load sensor located on the top of the instrument panel to provide automatic headlamps.
- **Brake Lamp Control** - The EMIC provides electronic brake lamp request messages to the Front Control Module (FCM) located on the Integrated Power Module (IPM) for brake lamp control, excluding control of the Center High Mounted Stop Lamp (CHMSL), which remains controlled by a direct hard wired output of the brake lamp switch.
- **Brake Transmission Shift Interlock Control** - On vehicles with an optional automatic transmission the EMIC monitors inputs from the brake lamp switch, ignition switch, and the Transmission Range Sensor (TRS), then controls a high-side driver output to operate the Brake Transmission Shift Interlock (BTSI) solenoid that locks and unlocks the automatic transmission gearshift selector lever on the steering column.
- **Cargo Lamp Control** - The EMIC provides direct control of cargo lamp operation with a load shedding (battery saver) feature which will automatically turn off the cargo lamp if it remains on after a timed interval.
- **Compass Mini Trip Computer Support** - The EMIC provides support for the optional Compass Mini Trip Computer (CMTC) by calculating average fuel economy, distance to empty and outside temperature values and storing trip odometer and elapsed ignition on time data. The EMIC receives data and reset requests from the CMTC and transmits the appropriate information for the CMTC to display using electronic messaging.
- **Electronic Transfer Case Interface** - On vehicles equipped with an electronic four-wheel drive transfer case, the EMIC monitors a hard wired multiplex input from the transfer case mode switch and then provides the appropriate electronic data bus messages to the Front Control Module (FCM) located on the Integrated Power Module (IPM) for transfer case control. After the transfer case shift is completed, the FCM provides an electronic message to the EMIC and the EMIC responds by activating the appropriate 4WD indicators within the cluster or in the transfer case switch.
- **Enhanced Accident Response Support** - The EMIC monitors an input from the Occupant Restraint Controller (ORC) and, following an airbag deployment, will immediately disable the power lock output, unlock all doors by activating the power unlock output, then enables the power lock output if the power lock switch input remains inactive for two seconds. The EMIC also monitors an input from the Powertrain Control Module (PCM) to automatically turn on the interior lighting after an airbag deployment event, ten seconds after the vehicle speed is zero. The interior lighting remains illuminated until the ignition switch is turned to the Off position, at which time

the interior lighting returns to normal operation and control. These Enhanced Accident Response System (EARS) features are each dependent upon a functional vehicle electrical system following the vehicle impact event.

- **Exterior Lighting Control** - The EMIC provides electronic head lamp and/or park lamp request messages to the Front Control Module (FCM) located on the Integrated Power Module (IPM) for the appropriate exterior lamp control of standard head and park lamps, as well as optional front fog lamps. This includes support for headlamp beam selection and the optical horn feature, also known as flash-to-pass.
- **Exterior Lighting Fail-safe** - In the absence of a headlamp switch input, the EMIC will turn on the cluster illumination lamp and provide electronic headlamp low beam and park lamp request messages to the Front Control Module (FCM) located on the Integrated Power Module (IPM) for default exterior lamp operation. The FCM will also provide default park lamp and headlamp low beam operation and the EMIC will turn on the cluster general illumination lighting at full intensity if there is a failure of the electronic data bus communication between the EMIC and the FCM.
- **Fuel Level Data Support** - The EMIC provides a current source for and receives a hard wired analog input from the fuel level sending unit located on the fuel pump module in the fuel tank. The EMIC uses this input to calculate the proper fuel gauge needle position and low fuel indicator operation. Based upon this input, the EMIC also calculates fuel level, average fuel economy and distance to empty data, then uses electronic messaging to transmit this data over the CAN data bus for use by other electronic modules in the vehicle.
- **Heated Seat Control** - The EMIC monitors inputs from the ignition switch and electronic engine speed messages from the Powertrain Control Module (PCM) to control a high side driver output to the heated seat switch Light Emitting Diode (LED) indicators. This input allows the heated seat switches to wake up the heated seat module if the switch is actuated. The EMIC will de-energize the heated seat switch LED indicators, which deactivates the heated seat system, if the ignition switch is turned to any position except On or Start, or if the engine speed message indicates zero. (Refer to 8 - ELECTRICAL/HEATED SEATS - DESCRIPTION).
- **Horn Control** - The EMIC monitors an input from the horn switch and provides electronic horn request messages to the Front Control Module (FCM) located on the Integrated Power Module (IPM) for horn relay control.
- **Interior Lamp Load Shedding** - The EMIC provides a battery saver feature which will automatically turn off all interior lamps and the cargo lamps if they remain on after a timed interval of about five minutes.
- **Interior Lighting Control** - The EMIC monitors inputs from the interior lighting switch, the door ajar switches, the cargo lamp switch, the reading lamp switches, and the Sentry Key Remote Entry Module (SKREEM) to provide courtesy lamp control. This includes support for timed illuminated entry with theater-style fade-to-off and courtesy illumination defeat features.
- **Panel Lamps Dimming Control** - The EMIC monitors hard wired multiplexed inputs from the headlamp switch on the instrument panel, then provides a hard wired 12-volt Pulse-Width Modulated (PWM) output that synchronizes the dimming level of all panel lamps dimmer controlled lamps with that of the cluster illumination lamp.
- **Power Locks** - The EMIC monitors inputs from the power lock switches and the Sentry Key REmote Entry Module (SKREEM) to provide control of the power lock motors through high side driver outputs to the motors. This includes support for rolling door locks (also known as automatic door locks), automatic door unlock, briefcase lock mode, and a door lock inhibit mode. (Refer to 8 - ELECTRICAL/POWER LOCKS - DESCRIPTION).
- **Remote Keyless Entry** - The EMIC supports the standard Remote Keyless Entry (RKE) system features, including support for the RKE Lock, Unlock (with optional driver-door-only unlock, and unlock-all-doors), Panic, audible chirp, optical chirp, illuminated entry modes, an RKE programming mode, as well as optional Vehicle Theft Security System (VTSS) arming (when the proper VTSS arming conditions are met) and disarming.
- **Remote Radio Switch Interface** - The EMIC monitors inputs from the optional remote radio switches and then provides the appropriate electronic data bus messages to the radio to select the radio or optional hands-free cellular system operating mode, volume control, preset station scan and station seek features.
- **Turn Signal & Hazard Warning Lamp Control** - The EMIC monitors hard wired multiplexed inputs from the multi-function switch on the steering column, then provides electronic turn and hazard lamp request messages to the Front Control Module (FCM) located on the Integrated Power Module (IPM) for turn and hazard lamp control. The EMIC also provides an audible click at one of two rates to emulate normal and bulb out turn or hazard flasher operation based upon electronic lamp outage messages from the FCM, and provides an audible turn signal on chime warning if a turn is signalled continuously for more than about 1.6 kilometers (one mile) and the vehicle speed remains greater than about twenty-four kilometers-per-hour (fifteen miles-per-hour).
- **Vacuum Fluorescent Display Synchronization** - The EMIC monitors hard wired multiplexed inputs from the headlamp switch on the instrument panel, then transmits electronic panel lamp dimming level messages which allows all other electronic modules on the CAN data bus with Vacuum Fluorescent Display (VFD) units to coor-

dinate their illumination intensity with that of the EMIC VFD unit. This includes a parade mode (also known as funeral mode) that allows all VFD units in the vehicle to be illuminated at full (daytime) intensity while driving during daylight hours with the exterior lamps turned On.

- **Vehicle Theft Security System Control** - The EMIC monitors inputs from the door ajar switches, the ignition switch, and the Sentry Key REmote Entry Module (SKREEM), then provides electronic horn and lighting request messages to the Front Control Module (FCM) located on the Integrated Power Module (IPM) for the appropriate VTSS alarm output features.
- **Wiper/Washer System Control** - The EMIC monitors hard wired multiplexed inputs from the wiper and washer switches in the multi-function switch on the steering column, then provides electronic wiper and/or washer request messages to the Front Control Module (FCM) located on the Integrated Power Module (IPM) for the appropriate wiper and washer system features. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - DESCRIPTION).



The EMIC houses four analog gauges and has provisions for up to twenty-five indicators. Some of the EMIC indicators are automatically configured when the EMIC is connected to the vehicle electrical system for compatibility with certain optional equipment or equipment required for regulatory purposes in certain markets. While each EMIC may have provisions for indicators to support every available option, the configurable indicators will not be functional in a vehicle that does not have the equipment that an indicator supports.

The EMIC includes the following analog gauges:

- **Engine Temperature Gauge (2)**
- **Fuel Gauge (1)**
- **Speedometer (9)**
- **Tachometer (18)**

The EMIC includes the following VFD unit:

- **Gear Selector/Odometer/Trip Indicator (19)**

The EMIC includes provisions for the following indicators:

- **Airbag Indicator (10)**
- **Antilock Brake System (ABS) Indicator (15)**
- **Brake Indicator (22)**
- **Cargo Lamp Indicator (28)**
- **Charging Indicator (13)**
- **Cruise Indicator (27)**
- **Door Ajar Indicator (21)**

- **Electronic Throttle Control (ETC) Indicator (20)**
- **Engine Temperature Indicator (5)**
- **Fog Lamp Indicator (8)**
- **Four-Wheel Drive Low Indicator (25)**
- **Four-Wheel Drive Lock Indicator (30)**
- **High Beam Indicator (6)**
- **Low Fuel Indicator (4)**
- **Low Oil Pressure Indicator (17)**
- **Malfunction Indicator Lamp (MIL) (24)**
- **Seatbelt Indicator (7)**
- **Security Indicator (14)**
- **Service Four-Wheel Drive Indicator (26)**
- **Tow/Haul Indicator (29)**
- **Traction Control Indicator (11)**
- **Transmission Overtemp Indicator (12)**
- **Turn Signal (Right and Left) Indicators (3 & 16)**
- **Washer Fluid Indicator (23)**

Each indicator in the EMIC, except those located within a VFD unit, is illuminated by a dedicated LED that is soldered onto the EMIC electronic circuit board. Cluster illumination is accomplished by a dimmable electro-luminescent lamp, which illuminates each of the gauge dial faces for visibility when the exterior lighting is turned on. The LED units and the electro-luminescent lamp unit are not available for service replacement and, if damaged or faulty, the entire EMIC must be replaced.

Hard wired circuitry connects the EMIC to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the EMIC through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

The EMIC module for this model is serviced only as a complete unit. The EMIC module cannot be adjusted or repaired. If a gauge, an LED indicator, a VFD unit, the electronic circuit board, the circuit board hardware, the cluster overlay, or the EMIC housing are damaged or faulty, the entire EMIC module must be replaced. The cluster lens, hood and mask unit is available for separate service replacement.

OPERATION

The ElectroMechanical Instrument Cluster (EMIC) in this model also includes the hardware and software necessary to serve as the electronic body control module and is sometimes referred to as the Cab Compartment Node or CCN. The following information deals primarily with the instrument cluster functions of this unit. Additional details of the electronic body control functions of this unit may be found within the service information for the system or component that the EMIC controls. For example: Additional details of the audible warning functions of the EMIC are found within the Chime/Buzzer service information.

The EMIC is designed to allow the vehicle operator to monitor the conditions of many of the vehicle components and operating systems. The gauges and indicators in the EMIC provide valuable information about the various standard and optional powertrains, fuel and emissions systems, cooling systems, lighting systems, safety systems and many other convenience items. The EMIC is installed in the instrument panel so that all of these monitors can be easily viewed by the vehicle operator when driving, while still allowing relative ease of access for service.

The microprocessor-based EMIC hardware and software uses various inputs to control the gauges and indicators visible on the face of the cluster. Some of these inputs are hard wired, but most are in the form of electronic messages that are transmitted by other electronic modules over the Controller Area Network (CAN) data bus. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - OPERATION).

The EMIC microprocessor smooths the input data using algorithms to provide gauge readings that are accurate, stable and responsive to operating conditions. These algorithms are designed to provide gauge readings during normal operation that are consistent with customer expectations. However, when abnormal conditions exist such as

high coolant temperature, the algorithm can drive the gauge pointer to an extreme position and the microprocessor can sound a chime through the on-board audible tone transducer to provide distinct visual and audible indications of a problem to the vehicle operator. The EMIC may also produce audible warnings for other electronic modules in the vehicle based upon electronic tone request messages received over the CAN data bus. Each audible warning is intended to provide the vehicle operator with an audible alert to supplement a visual indication.

The EMIC circuitry operates on battery current received through a fused B(+) fuse on a non-switched fused B(+) circuit, and on battery current received through a fused ignition switch output (run-start) fuse on a fused ignition switch output (run-start) circuit. This arrangement allows the EMIC to provide some features regardless of the ignition switch position, while other features will operate only with the ignition switch in the On or Start positions. The EMIC circuitry is grounded through a ground circuit and take out of the instrument panel wire harness with an eyelet terminal connector that is secured by a ground screw to a ground location near the center of the instrument panel structural support.

The EMIC also has a self-diagnostic actuator test capability, which will test each of the CAN bus message-controlled functions of the cluster by lighting the appropriate indicators, positioning the gauge needles at several predetermined calibration points across the gauge faces, and illuminating all segments of the gear selector/odometer/trip odometer Vacuum-Fluorescent Display (VFD) unit. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

GAUGES

All gauges receive battery current through the EMIC circuitry only when the ignition switch is in the On or Start positions. With the ignition switch in the Off position battery current is not supplied to any gauges, and the EMIC circuitry is programmed to move all of the gauge needles back to the low end of their respective scales. Therefore, the gauges do not accurately indicate any vehicle condition unless the ignition switch is in the On or Start positions.

All of the EMIC gauges are air core magnetic units. Two fixed electromagnetic coils are located within each gauge. These coils are wrapped at right angles to each other around a movable permanent magnet. The movable magnet is suspended within the coils on one end of a pivot shaft, while the gauge needle is attached to the other end of the shaft. One of the coils has a fixed current flowing through it to maintain a constant magnetic field strength. Current flow through the second coil changes, which causes changes in its magnetic field strength. The current flowing through the second coil is changed by the EMIC circuitry in response to messages received over the CAN data bus. The gauge needle moves as the movable permanent magnet aligns itself to the changing magnetic fields created around it by the electromagnets.

The gauges are diagnosed using the EMIC self-diagnostic actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the CAN data bus and the electronic data bus message inputs to the EMIC that control each gauge require the use of a diagnostic scan tool. Refer to the appropriate diagnostic information. Specific operation details for each gauge may be found elsewhere in this service information.

VACUUM-FLUORESCENT DISPLAY

The Vacuum-Fluorescent Display (VFD) unit is soldered to the EMIC electronic circuit board. With the ignition switch in the Off or Accessory positions, the odometer display is activated when the driver door is opened (Rental Car mode) and is deactivated when the driver door is closed. Otherwise, the display unit is active when the ignition switch is in the On or Start positions, and inactive when the ignition switch is in the Off or Accessory positions.

The illumination intensity of the VFD unit is controlled by the EMIC circuitry based upon an input from the headlamp switch and a dimming level input received from the panel dimmer switch. The EMIC synchronizes the illumination intensity of other VFD units with that of the unit in the EMIC by sending electronic dimming level messages to other electronic modules in the vehicle over the CAN data bus.

The EMIC VFD unit has several display capabilities including odometer, trip odometer, engine hours, gear selector indication (PRNDL), several warning or reminder indications, and various diagnostic information when certain fault conditions exist. An odometer/trip odometer switch on the EMIC circuit board is used to control some of the display modes. This switch is actuated manually by depressing the odometer/trip odometer switch button that extends through the lower edge of the cluster lens, just left of the minor gauge set. Actuating this switch momentarily with the ignition switch in the On position will toggle the VFD between the odometer and trip odometer modes. Depressing the switch button for about two seconds while the VFD is in the trip odometer mode will reset the trip odometer value to zero.

While in the odometer mode with the ignition switch in the On position and the engine not running, depressing the odometer/trip odometer switch for about six seconds will display the engine hours information. Holding this switch

depressed while turning the ignition switch from the Off position to the On position will initiate the EMIC self-diagnostic actuator test. Refer to the instrument cluster diagnosis and testing service information for additional details on this cluster function. The EMIC microprocessor remembers which display mode is active when the ignition switch is turned to the Off position, and returns the VFD display to that mode when the ignition switch is turned On again.

The VFD unit is diagnosed using the EMIC self-diagnostic actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the CAN data bus and the electronic data bus message inputs to the EMIC that control some of the VFD functions requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information. Specific operation details for the odometer, the trip odometer, the gear selector indicator and the various warning and reminder indicator functions of the VFD unit may be found elsewhere in this service information.

INDICATORS

Indicators are located in various positions within the EMIC and are all connected to the EMIC electronic circuit board. The door ajar indicator, cargo lamp indicator, high beam indicator, and turn signal indicators operate based upon hard wired inputs to the EMIC. The brake indicator is controlled by CAN data bus messages from the Controller Antilock Brake (CAB) as well as by hard wired park brake switch inputs to the EMIC. The seatbelt indicator is controlled by the EMIC programming, CAN data bus messages from the Occupant Restraint Controller (ORC), and a hard wired seat belt switch input to the EMIC. The Malfunction Indicator Lamp (MIL) is normally controlled by CAN data bus messages from the Powertrain Control Module (PCM); however, if the EMIC loses CAN data bus communication, the EMIC circuitry will automatically turn the MIL on until CAN data bus communication is restored. The EMIC uses CAN data bus messages from the Front Control Module (FCM), the PCM, the ORC, the CAB, and the Sentry Key REmote Entry Module (SKREEM) to control all of the remaining indicators.

The various EMIC indicators are controlled by different strategies; some receive fused ignition switch output from the EMIC circuitry and have a switched ground, while others are grounded through the EMIC circuitry and have a switched battery feed. However, all indicators are completely controlled by the EMIC microprocessor based upon various hard wired and electronic message inputs. The cruise, four low, four lock and tow/haul indicators and those located within the VFD unit are dimmable. All other indicators are illuminated at a fixed intensity, which is not affected by the selected illumination intensity of the electro-luminescent EMIC general illumination lamp. The illumination intensity of the dimmable indicators is synchronized with that of the EMIC general illumination lamp.

In addition, certain indicators in this instrument cluster are automatically configured or self-configured. This feature allows the configurable indicators to be enabled by the EMIC circuitry for compatibility with certain optional equipment. The EMIC defaults for the ABS indicator and airbag indicator are enabled, and these configuration settings must be programmatically disabled in the EMIC using a diagnostic scan tool for vehicles that do not have this equipment. The automatically configured or self-configured indicators remain latent in each EMIC at all times and will be active only when the EMIC receives the appropriate CAN message inputs for that optional system or equipment.

The hard wired indicator inputs may be diagnosed using conventional diagnostic methods. However, the EMIC circuitry and CAN bus message controlled indicators are diagnosed using the EMIC self-diagnostic actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the CAN data bus and the electronic message inputs to the EMIC that control an indicator requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information. Specific details of the operation for each indicator may be found elsewhere in this service information.

CLUSTER ILLUMINATION

The EMIC has a single electro-luminescent lamp that provides cluster back lighting whenever the exterior lighting is turned On. The illumination intensity of this lamp is adjusted when the interior lighting thumbwheel on the headlamp switch is rotated (down to dim, up to brighten) to one of six available minor detent positions. The EMIC monitors a resistor multiplexed input from the headlamp switch on a dimmer input circuit. In response to that input, the EMIC electronic circuitry converts a fused 12-volt input it receives on a hard wired panel lamps dimmer switch signal circuit into a 12-volt Pulse Width Modulated (PWM) output.

The EMIC uses this PWM output to control the illumination intensity of the electro-luminescent cluster illumination lamp and the VFD unit on the EMIC circuit board, then provides a synchronized PWM output on various hard wired fused panel lamps dimmer switch signal circuits to control and synchronize the illumination intensity of other incandescent illumination lamps in the vehicle. The EMIC also transmits electronic dimming level messages over the CAN data bus to other electronic modules in the vehicle to control and synchronize the illumination intensity of their VFD units to that of the EMIC VFD unit.

In addition, the thumbwheel on the headlamp switch has a Parade Mode position to provide a parade or funeral mode. The EMIC monitors the request for this mode from the headlamp switch, then transmits an electronic dimming level message to illuminate all VFD units in the vehicle at full (daytime) intensity for easier visibility when driving in daylight with the exterior lighting turned On.

The electro-luminescent lamp unit consists of layers of phosphor, carbon, idium tin oxide, and dielectric applied by a silk-screen process between two polyester membranes and includes a short pigtail wire and connector. The lamp pigtail wire is connected to a connector receptacle on the EMIC circuit board. The EMIC powers this lamp with an Alternating Current (AC) rated at 80 volts rms (root mean squared) and 415 Hertz produced by a transformer on the circuit board, which excites the phosphor particles causing them to luminesce.

The hard wired headlamp switch and panel lamps dimmer inputs to and outputs from the EMIC may be diagnosed using conventional diagnostic methods. However, proper testing of the PWM processing of the EMIC and the electronic dimming level messages sent by the EMIC over the CAN data bus requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING

INSTRUMENT CLUSTER

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

If all of the instrument cluster gauges and indicators are inoperative, be certain to check the instrument cluster fused B(+) fuse and the instrument cluster fused B(+) and ground circuits for shorts or opens. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

If an individual hard wired gauge or indicator is inoperative, refer to the diagnosis and testing service information for that specific gauge or indicator. If an individual Controller Area Network (CAN) data bus message-controlled gauge or indicator is inoperative, perform the Actuator Test as follows:

CAUTION: Instrument clusters used in this model automatically configure themselves for compatibility with the features and optional equipment in the vehicle in which they are initially installed. The instrument cluster is programmed to do this by embedding the Vehicle Identification Number (VIN) and other information critical to proper cluster operation into electronic memory. This embedded information is learned through electronic messages received from other electronic modules in the vehicle over the Controller Area Network (CAN) data bus, and through certain hard wired inputs received when the cluster is connected to the vehicle electrically. Once configured, the instrument cluster memory may be irreparably damaged and certain irreversible configuration errors may occur if the cluster is connected electrically to another vehicle; or, if an electronic module from another vehicle is connected that provides data to the instrument cluster (including odometer values) that conflicts with that which was previously learned and stored. Therefore, the practice of exchanging (swapping) instrument clusters and other electronic modules in this vehicle with those removed from another vehicle must always be avoided. Failure to observe this caution may result in instrument cluster damage, which is not reimbursable under the terms of the product warranty. Service replacement instrument clusters are provided with the correct VIN, and the certified odometer and engine hours values embedded into cluster memory, but will otherwise be automatically configured for compatibility with the features and optional equipment in the vehicle in which they are initially installed.

NOTE: Certain indicators in this instrument cluster are automatically configured. This feature allows those indicators to be activated or deactivated for compatibility with certain optional equipment. If the problem being diagnosed involves improper illumination of the cruise indicator, the electronic throttle control indicator, the tow/haul indicator, the service four-wheel drive indicator, the four-wheel drive low indicator, the four-wheel drive lock indicator, the transmission overtemp indicator, the security indicator or the gear selector indicator, disconnect and isolate the battery negative cable. After about five minutes, reconnect the battery negative cable and turn the ignition switch to the On position. The instrument cluster should automatically relearn the equipment in the vehicle and properly configure the configurable indicators accordingly.

ACTUATOR TEST

The instrument cluster actuator test will put the instrument cluster into its self-diagnostic mode. In this mode the instrument cluster can perform a self-diagnostic test that will confirm that the instrument cluster circuitry, the gauges, and the indicators are capable of operating as designed. During the actuator test the instrument cluster circuitry will position each of the gauge needles at various calibration points and illuminate all of the segments in the Vacuum Fluorescent Display (VFD) unit.

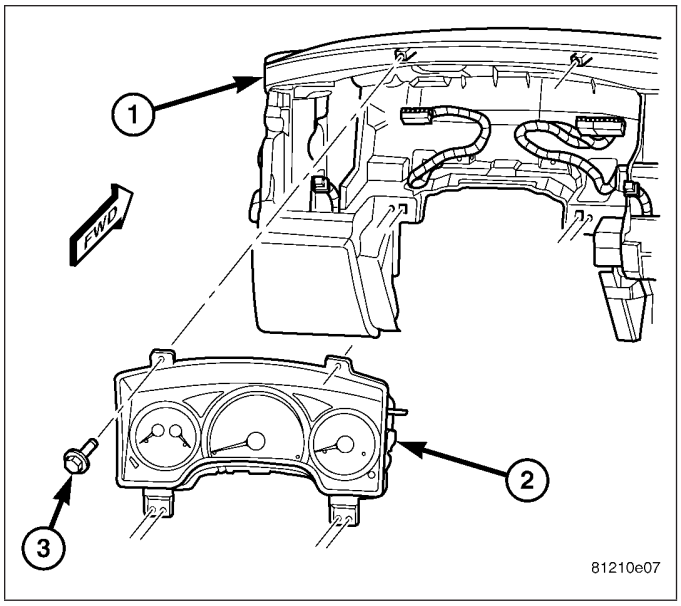
Successful completion of the actuator test will confirm that the instrument cluster is operational. However, there may still be a problem with the CAN data bus, the Powertrain Control Module (PCM), the Front Control Module (FCM), the Transmission Control Module (TCM), the Occupant Restraint Controller (ORC), the Controller Anti-lock Brake (CAB), or the hard wired inputs to one of these electronic control modules. Use a diagnostic scan tool to diagnose these components. Refer to the appropriate diagnostic information.

1. Begin the test with the ignition switch in the Off position.
2. Depress the odometer/trip odometer switch button.
3. While still holding the odometer/trip odometer switch button depressed, turn the ignition switch to the On position, but do not start the engine.
4. Release the odometer/trip odometer switch button.
5. The instrument cluster will simultaneously begin to illuminate all of the operational segments in the VFD unit, and perform a bulb check of each operational LED indicator. The VFD segments and LED indicators remain illuminated as each gauge needle is swept to several calibration points and back. If a VFD segment or an LED indicator fails to illuminate, or if a gauge needle fails to sweep through the calibration points and back during this test, the instrument cluster must be replaced.
6. The actuator test is now completed. The instrument cluster will automatically exit the self-diagnostic mode and return to normal operation at the completion of the test. The actuator test will be aborted if the ignition switch is turned to the Off position, or if a vehicle speed message indicating that the vehicle is moving is received from the PCM over the CAN data bus during the test.
7. Go back to Step 1 to repeat the test, if necessary.

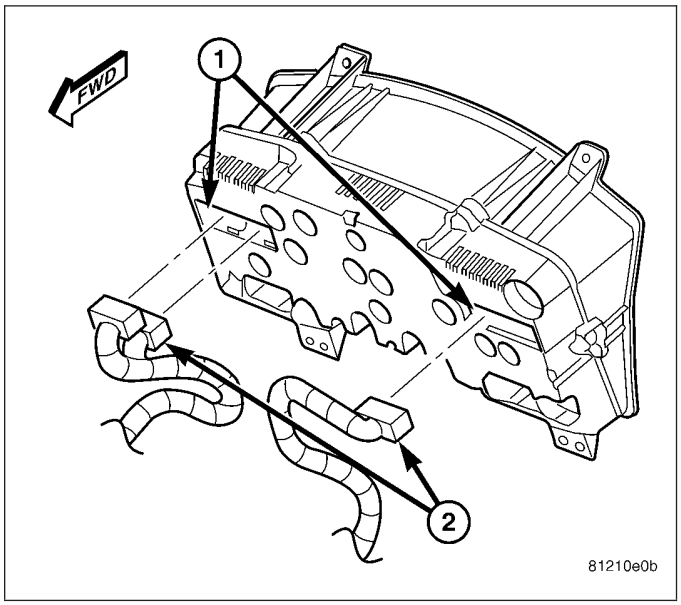
REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.
2. Remove the cluster bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ CLUSTER BEZEL - REMOVAL).
3. Remove the four screws (3) that secure the instrument cluster (2) to the instrument panel structural support (1).



4. Pull the instrument cluster rearward far enough to access and disconnect the instrument panel wire harness connectors (2) from the connector receptacles (1) on the back of the cluster housing.
5. Remove the instrument cluster from the instrument panel.



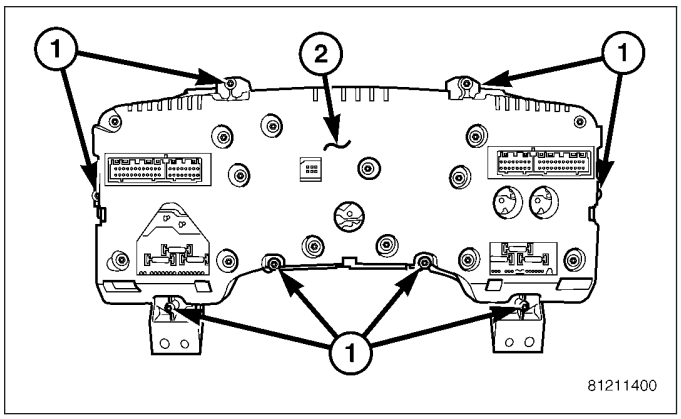
DISASSEMBLY

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

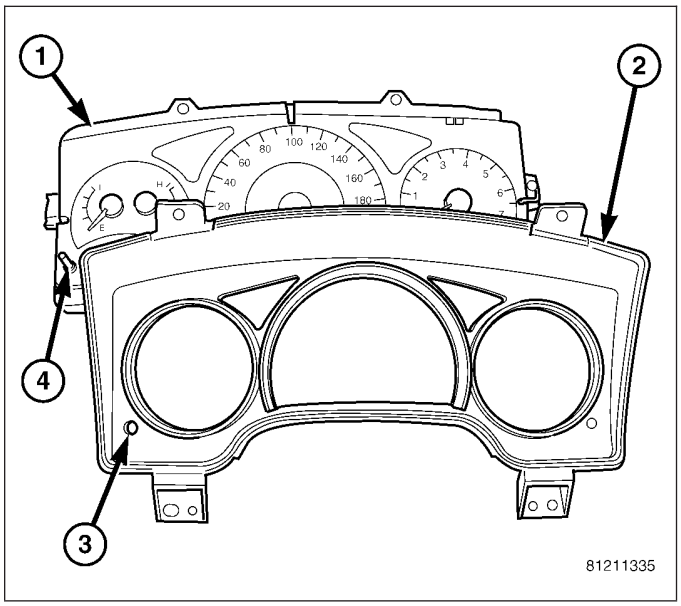
NOTE: The cluster lens, hood and mask unit is the only component of the instrument cluster used in this vehicle that is serviced separately. Following is the procedure for disassembling this component from the instrument cluster.

CLUSTER LENS, HOOD, AND MASK

1. Disconnect and isolate the battery negative cable.
2. Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).
3. From the back of the instrument cluster (2), remove the eight screws (1) around the outer perimeter of the rear cover that secure the lens, hood, and mask unit to the cluster housing.



4. Remove the lens, hood, and mask unit (2) from the face of the instrument cluster (1).



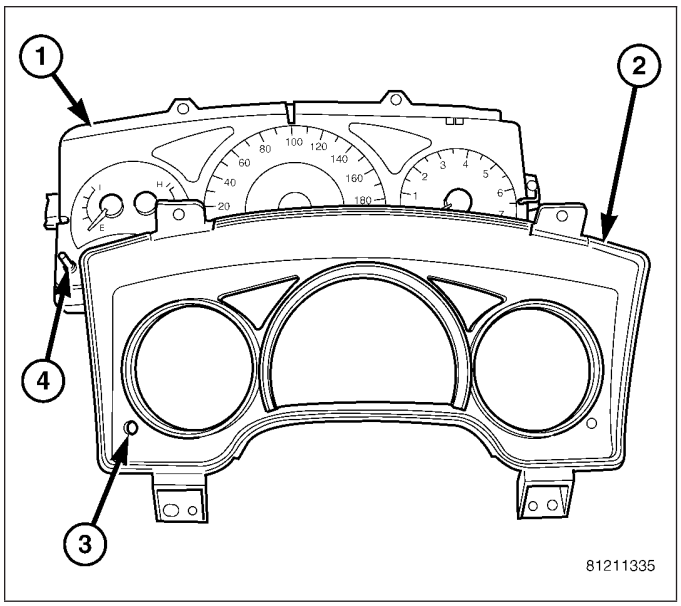
ASSEMBLY

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

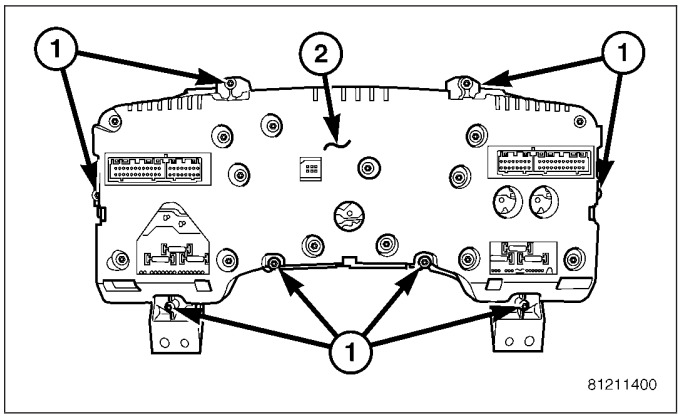
NOTE: The cluster lens, hood and mask unit is the only component of the instrument cluster used in this vehicle that is serviced separately. Following is the procedure for assembling this component to the instrument cluster.

CLUSTER LENS, HOOD, AND MASK

1. Position the cluster lens, hood, and mask unit (2) over the face of the instrument cluster (1). Be certain that the odometer/trip odometer switch button (4) is inserted through the proper clearance holes (3) in the mask and the lens.



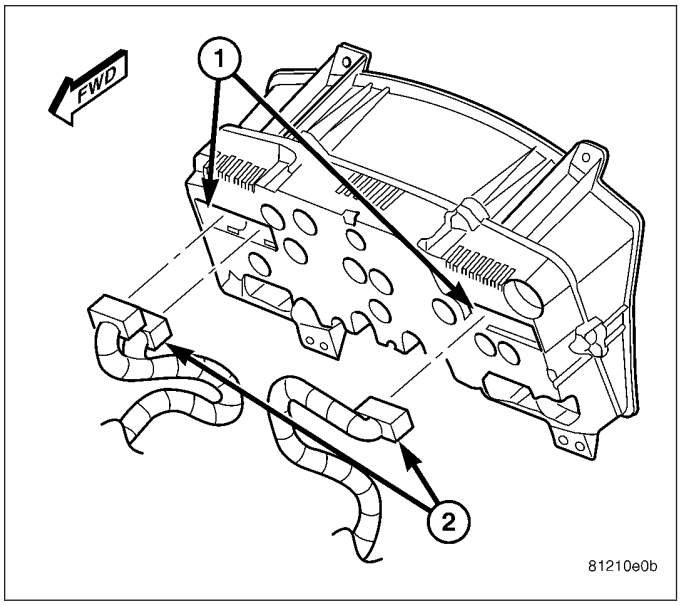
2. From the back of the instrument cluster (2), install and tighten the eight screws (1) around the outer perimeter of the rear cover that secure the lens, hood, and mask unit to the cluster housing. Tighten the screws to 1 N·m (10 in. lbs.).
3. Reinstall the instrument cluster onto the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).
4. Reconnect the battery negative cable.



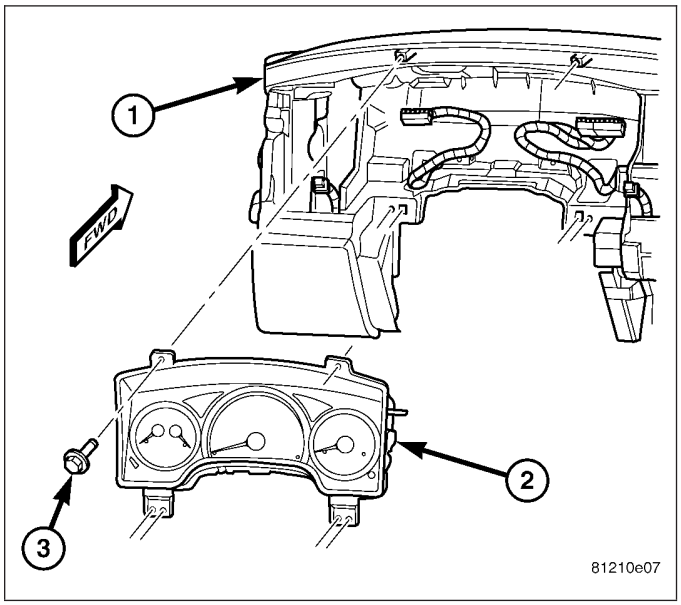
INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Position the instrument cluster close enough to the instrument panel to reconnect the instrument panel wire harness connectors (2) to the connector receptacles (1) on the back of the cluster housing.



2. Position the instrument cluster (2) into the instrument panel (1).
3. Install and tighten the four screws (3) that secure the instrument cluster to the instrument panel. Tighten the screws to 2 N·m (17 in. lbs.).
4. Reinstall the cluster bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ CLUSTER BEZEL - INSTALLATION).
5. Reconnect the battery negative cable.



NOTE: Certain indicators in this instrument cluster are automatically configured. This feature allows those indicators to be activated or deactivated for compatibility with certain optional equipment. If a problem is noted that involves improper illumination of the cruise indicator, the electronic throttle control indicator, the tow/haul indicator, the service four-wheel drive indicator, the four-wheel drive low indicator, the four-wheel drive lock indicator, the transmission overtemp indicator, the security indicator or the gear selector indicator, disconnect and isolate the battery negative cable. After about five minutes, reconnect the battery negative cable and turn the ignition switch to the On position. The instrument cluster should automatically relearn the equipment in the vehicle and properly configure the configurable indicators accordingly.

ABS INDICATOR

DESCRIPTION

An Antilock Brake System (ABS) indicator is standard equipment on all instrument clusters. This indicator serves both the standard equipment Rear Wheel Anti-Lock (RWAL) and optional equipment 4-Wheel Anti-Lock (4WAL) brake systems. This indicator is located near the upper edge of the instrument cluster, between the tachometer and the speedometer.

The ABS indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Failure of Anti-lock Braking System” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The ABS indicator is serviced as a unit with the instrument cluster.

OPERATION

The ABS indicator gives an indication to the vehicle operator when the ABS system is faulty or inoperative. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Controller Antilock Brake (CAB) over the Controller Area Network (CAN) data bus.

The ABS indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the ABS indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the ABS indicator is illuminated for about four seconds as a bulb test. The entire bulb test is a function of the CAB.
- **ABS Lamp-On Message** - Each time the cluster receives a lamp-on message from the CAB, the ABS indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-off message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - If the cluster receives no lamp-on or lamp-off messages from the CAB for five consecutive message cycles, the ABS indicator is illuminated. The indicator remains illuminated until the cluster receives a valid message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the instrument cluster is put through the actuator test, the ABS indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.
- **ABS Diagnostic Test** - The ABS indicator is blinked on and off by lamp-on and lamp-off messages from the CAB during the performance of the ABS diagnostic tests.

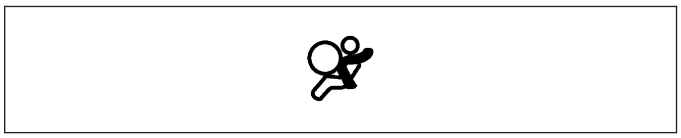
The CAB continually monitors the ABS circuits and sensors to decide whether the system is in good operating condition. The CAB then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the CAB sends a lamp-on message after the bulb test, it indicates that the CAB has detected a system malfunction and/or that the ABS system has become inoperative. The CAB will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. Each time the ABS indicator fails to light due to an open or short in the cluster ABS indicator circuit, the cluster sends a message notifying the CAB of the condition, then the instrument cluster and the CAB will each store a DTC.

For proper diagnosis of the antilock brake system, the CAB, the CAN data bus, or the electronic message inputs to the instrument cluster that control the ABS indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

AIRBAG INDICATOR

DESCRIPTION

An airbag indicator is standard equipment on all instrument clusters. However, the instrument cluster can be programmed to disable this indicator on vehicles that are not equipped with the airbag system, which is not available in some markets. This indicator is located in the center of the speedometer, in the area above and left of the speedometer needle hub.



The airbag indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Airbag” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from

being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The airbag indicator is serviced as a unit with the instrument cluster.

OPERATION

The airbag indicator gives an indication to the vehicle operator when the airbag system is faulty or inoperative. The airbag indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Occupant Restraint Controller (ORC) over the Controller Area Network (CAN) data bus.

The airbag indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the airbag indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the airbag indicator is illuminated for about six to eight seconds. The entire bulb test is a function of the ORC.
- **ORC Lamp-On Message** - Each time the cluster receives a lamp-on message from the ORC, the airbag indicator will be illuminated. The indicator remains illuminated for about twelve seconds or until the cluster receives a lamp-off message from the ORC, whichever is longer.
- **Communication Error** - If the cluster receives no airbag messages for ten consecutive message cycles, the airbag indicator is illuminated. The indicator remains illuminated until the cluster receives a single lamp-off message from the ORC.
- **Actuator Test** - Each time the cluster is put through the actuator test, the airbag indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry. The actuator test illumination of the airbag indicator is a function of the instrument cluster.

The ORC continually monitors the airbag system circuits and sensors to decide whether the system is in good operating condition. The ORC then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the ORC sends a lamp-on message after the bulb test, it indicates that the ORC has detected a system malfunction and/or that the airbags and seat belt tensioners may not deploy when required, or may deploy when not required. The ORC will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. Each time the airbag indicator fails to illuminate due to an open or short in the cluster airbag indicator circuit, the cluster sends a message notifying the ORC of the condition, the instrument cluster and the ORC will each store a DTC, and the cluster will flash the seatbelt indicator on and off as a backup to notify the vehicle operator.

For proper diagnosis of the airbag system, the ORC, the CAN data bus, or the electronic message inputs to the instrument cluster that control the airbag indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

BRAKE/PARK BRAKE INDICATOR

DESCRIPTION

A brake indicator is standard equipment on all instrument clusters. This indicator is located in the center of the speedometer, in the area below and right of the speedometer needle hub.

The brake indicator consists of a stencil-like cutout of the word “BRAKE” (all clusters with a miles-per-hour primary speedometer scale), or the International Control and Display Symbol icon for “Brake Failure” (all clusters with a kilometers-per-hour primary scale) in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “BRAKE” text or the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The brake indicator is serviced as a unit with the instrument cluster.

OPERATION

The brake indicator gives an indication to the vehicle operator when the parking brake is applied, when there are certain brake hydraulic system malfunctions as indicated by a low brake hydraulic fluid level condition, or when the brake fluid level switch is disconnected. The brake indicator can also give an indication when certain faults are detected in the Antilock Brake System (ABS). This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming, electronic messages received by the cluster from the Controller Antilock Brake (CAB) over the Controller Area Network (CAN) data bus, and a hard wired input from the park brake switch.

The brake indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the brake indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the brake indicator is illuminated for about four seconds as a bulb test. The entire bulb test is a function of the CAB.
- **Brake Lamp-On Message** - Each time the cluster receives a lamp-on message from the CAB, the brake indicator will be illuminated. The CAB can also send brake lamp-on messages as feedback during ABS diagnostic procedures. The indicator remains illuminated until the cluster receives a lamp-off message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Park Brake Switch Input** - Each time the cluster detects ground on the park brake switch sense circuit (park brake switch closed = park brake applied or not fully released) while the ignition switch is in the On position, the brake indicator flashes on and off. The indicator continues to flash until the park brake switch sense input to the cluster is an open circuit (park brake switch open = park brake fully released), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the instrument cluster is put through the actuator test, the brake indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The park brake switch on the park brake pedal mechanism provides a hard wired ground input to the instrument cluster circuitry through the park brake switch sense circuit whenever the park brake is applied or not fully released. The CAB continually monitors the ABS system circuits and sensors, including the brake fluid level switch on the brake master cylinder reservoir, to decide whether the system is in good operating condition. The CAB then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the CAB sends a lamp-on message after the bulb test, it indicates that the CAB has detected a brake hydraulic system malfunction and/or that the ABS system has become inoperative. The CAB will store a Diagnostic Trouble Code (DTC) for any malfunction it detects.

For further diagnosis of the brake indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). The park brake switch input to the instrument cluster may be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information. For proper diagnosis of the brake fluid level switch, the ABS, the CAB, the CAN data bus, or the electronic message inputs to the instrument cluster that control the brake indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING

BRAKE INDICATOR

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

The hard wired park brake switch input to the EMIC may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the EMIC, the Controller Antilock Brake (CAB), the Controller Area Network (CAN) data bus, or the electronic message inputs also used by the EMIC to provide brake indicator operation. The most reliable, efficient, and accurate means to diagnose the EMIC, the CAB, the CAN data bus, and the electronic message inputs for the brake indicator operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

CARGO LAMP INDICATOR

DESCRIPTION

A cargo lamp indicator is standard equipment on all instrument clusters. The cargo lamp indicator is located below the minor gauge set on the left side of the cluster.

The cargo lamp indicator consists of a stencil-like cutout of the words “CARGO LAMP” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “CARGO LAMP” text to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The cargo lamp indicator is serviced as a unit with the instrument cluster.

OPERATION

The cargo lamp indicator gives an indication to the vehicle operator when the exterior cargo lamp is illuminated. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming, a hard wired multiplex input received by the cluster from the cargo lamp switch on the headlamp dimmer switch mux circuit, and electronic unlock request messages received from the optional Sentry Key REmote Entry (SKREEM) module.

The cargo lamp indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the cargo lamp indicator for the following reasons:

- **Cargo Lamp-On Input** - Each time the cluster detects a cargo lamp-on input from the headlamp switch on the headlamp dimmer switch mux circuit, the cargo lamp and the cargo lamp indicator will be illuminated. The cargo lamp and indicator remain illuminated until the cluster receives a cargo lamp-off input from the headlamp switch, until the cluster has completed an interior lamps load shed (about five minutes), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the cargo lamp indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The instrument cluster continually monitors the headlamp dimmer switch circuit to determine the proper interior lamps features and panel lamps illumination levels to provide. The cluster then energizes and de-energizes a low side driver circuit to control the exterior cargo lamp. Each time the instrument cluster energizes the cargo lamp driver and the ignition switch is in the On or Start positions, the cluster also turns on the cargo lamp indicator. For further diagnosis of the cargo lamp indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the cargo lamp or the headlamp switch inputs to the instrument cluster that control the cargo lamp indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

CHARGING INDICATOR

DESCRIPTION

A charging indicator is standard equipment on all instrument clusters. This indicator is located near the upper edge of the instrument cluster, between the tachometer and the speedometer.

The charging indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Battery Charging Condition” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The charging indicator is serviced as a unit with the instrument cluster.

OPERATION

The charging indicator gives an indication to the vehicle operator when the electrical system voltage is too low or too high. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The charging indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the charging indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the charging indicator is illuminated by the instrument cluster for about two seconds as a bulb test.
- **Voltage Low Message** - Each time the cluster receives a message from the PCM indicating the electrical system voltage is low (less than about 11.5 volts is a charge fail condition), the charging indicator will be illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating the electrical system voltage is normal (greater than about 12.0 volts, but less than 16.0 volts), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Voltage High Message** - Each time the cluster receives a message from the PCM indicating the electrical system voltage is high (greater than about 16.0 volts), the charging indicator will be illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating the electrical system voltage is normal (less than about 15.5 volts, but greater than 11.5 volts), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the charging indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the electrical system voltage to control the generator output. The PCM then sends the proper system voltage messages to the instrument cluster. If the instrument cluster turns on the charging indicator due to a charge fail or voltage high condition, it may indicate that the charging system requires service. For further diagnosis of the charging indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the charging system, the PCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the charging indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

CRUISE INDICATOR

DESCRIPTION

A cruise indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional speed control system, this indicator is electronically disabled. The cruise indicator is located below the minor gauge set on the left side of the cluster.

The cruise indicator consists of a stencil-like cutout of the word “CRUISE” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A green Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “CRUISE” text to appear in green through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

When the exterior lighting is turned On, the illumination intensity of the cruise indicator is dimmable, which is adjusted along with the cluster illumination lamp using the panel lamps dimmer thumbwheel on the headlamp switch. The cruise indicator is serviced as a unit with the instrument cluster.

OPERATION

The cruise indicator gives an indication to the vehicle operator when the speed control system is turned On, regardless of whether the speed control is engaged. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The cruise indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the cruise indicator for the following reasons:

- **Cruise Lamp-On Message** - Each time the cluster receives a cruise lamp-on message from the PCM indicating the speed control system has been turned On, the cruise indicator is illuminated. The indicator remains illuminated until the cluster receives a cruise lamp-off message from the PCM or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the cruise indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the speed control switches to determine the proper outputs to the speed control servo. The PCM then sends the proper cruise indicator lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the cruise indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the speed control system, the PCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the cruise indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

DOOR AJAR INDICATOR

DESCRIPTION

A door ajar indicator is standard equipment on all instrument clusters. This indicator is located in the center of the speedometer, in the area below and right of the speedometer needle hub.

The door ajar indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Door(s) Ajar” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the

indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The door ajar indicator is serviced as a unit with the instrument cluster.

OPERATION

The door ajar indicator gives an indication to the vehicle operator that one or more of the passenger compartment doors may be open or not completely latched. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and hard wired inputs received by the cluster from the door ajar switches located in each door latch unit.

The door ajar indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the door ajar indicator for the following reasons:

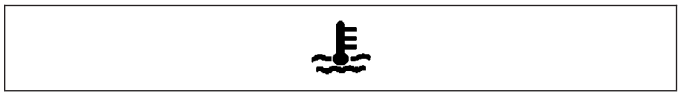
- **Door Ajar Switch Input** - Each time the cluster detects ground on any one of the door ajar switch sense circuits (door ajar switch closed = door is open or not completely latched) the door ajar indicator will be illuminated. The indicator remains illuminated until all of the door ajar switch sense inputs to the cluster are an open circuit (door ajar switch open = door fully closed), until the cluster has completed an interior lamps load shed (about five minutes), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the door ajar indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The instrument cluster continually monitors the door ajar switches to determine the status of the doors. For further diagnosis of the door ajar indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the door ajar switches and circuits, refer to the appropriate wiring information.

ENGINE TEMPERATURE GAUGE

DESCRIPTION



An engine coolant temperature gauge is standard equipment on all instrument clusters. This gauge is part of the minor gauge set with the fuel gauge located on the left side of the instrument cluster, just left of the speedometer. The gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree gauge scale on the cluster overlay that reads bottom-to-top from “C” (or Cold) to “H” (or Hot). An International Control and Display Symbol icon for “Engine Coolant Temperature” is located on the cluster overlay, directly below the bottom end of the scale.

The engine coolant temperature gauge graphics are black against a white field except for a single red graduation at the high end of the gauge scale, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white gauge dial face appears blue-green with the black graphics silhouetted against the illuminated background and the red graphics and the red gauge needle still appear red. Gauge illumination is provided by an integral electro-luminescent lamp that is serviced as a unit with the instrument cluster. The engine coolant temperature gauge is serviced as a unit with the instrument cluster.

OPERATION

The engine coolant temperature gauge gives an indication to the vehicle operator of the engine coolant temperature. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The engine coolant temperature gauge is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Engine Temperature Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is between the low end of normal [about 54° C (130° F)] and the high end of normal [about 122° C (252° F)], the gauge needle is moved to the actual relative temperature position on the gauge scale.
- **Engine Temperature Low Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is below the low end of normal [about 54° C (130° F)], the gauge needle is held at the “C” increment at low end of the gauge scale. The gauge needle remains at the low end of the gauge scale until the cluster receives a message from the PCM indicating that the engine temperature is above about 54° C (130° F), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Engine Temperature High Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is above about 122° C (252° F), the gauge needle is moved into the red zone on the gauge scale, the engine temperature indicator is illuminated, and a single chime tone is sounded. The gauge needle remains in the red zone and the engine temperature indicator remains illuminated until the cluster receives a message from the PCM indicating that the engine temperature is below about 122° C (252° F), or until the ignition switch is turned to the Off position, whichever occurs first. The chime tone feature will only repeat during the same ignition cycle if the engine temperature indicator is cycled off and then on again by the appropriate engine temperature messages from the PCM.
- **Communication Error** - If the cluster fails to receive an engine temperature message, it will hold the gauge needle at the last indication for about five seconds or until the ignition switch is turned to the Off position, whichever occurs first. After five seconds, the cluster will move the gauge needle to the low end of the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the engine coolant temperature gauge needle will be swept to several calibration points on the gauge scale in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the engine coolant temperature sensor to determine the engine operating temperature. The PCM then sends the proper engine coolant temperature messages to the instrument cluster. For further diagnosis of the engine coolant temperature gauge or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the engine temperature indicator due to a high engine temperature gauge reading, it may indicate that the engine or the engine cooling system requires service.

For proper diagnosis of the engine coolant temperature sensor, the PCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the engine coolant temperature gauge, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

ENGINE TEMPERATURE INDICATOR

DESCRIPTION

An engine temperature indicator is standard equipment only on all instrument clusters. This indicator is located near the upper edge of the instrument cluster, between the minor gauge set and the speedometer.

The engine temperature indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Engine Coolant Temperature” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The engine temperature indicator is serviced as a unit with the instrument cluster.

OPERATION

The engine temperature indicator gives an indication to the vehicle operator when the engine temperature gauge reading reflects a condition requiring immediate attention. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The engine temperature indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the engine temperature indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the engine temperature indicator is illuminated for about two seconds as a bulb test. The entire bulb test is a function of the PCM.
- **Engine Temperature High Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is above about 122° C (252° F), the engine temperature indicator will be illuminated and a single chime tone is sounded. The indicator remains illuminated until the cluster receives a message from the PCM indicating that the engine coolant temperature is below about 119° C (246° F), or until the ignition switch is turned to the Off position, whichever occurs first. The chime tone feature will only repeat during the same ignition cycle if the engine temperature indicator is cycled off and then on again by the appropriate engine temperature messages from the PCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the engine temperature indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the engine coolant temperature sensor to determine the engine operating temperature. The PCM then sends the proper engine coolant temperature messages to the instrument cluster. For further diagnosis of the engine temperature indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the engine temperature indicator due to a high engine temperature gauge reading, it may indicate that the engine or the engine cooling system requires service.

For proper diagnosis of the engine coolant temperature sensor, the PCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the engine temperature indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

ETC INDICATOR

DESCRIPTION

An Electronic Throttle Control (ETC) indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional 5.7 liter engine, this indicator is electronically disabled. This indicator is located in the center of the speedometer, in the area to the right of the speedometer needle hub.

The ETC indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Electronic Throttle Control” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The ETC indicator is serviced as a unit with the instrument cluster.

OPERATION

The Electronic Throttle Control (ETC) indicator gives an indication to the vehicle operator when the ETC system is faulty or inoperative. The ETC indicator is controlled by a transistor on the instrument cluster circuit board based

upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The ETC indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the ETC indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the ETC indicator is illuminated for about fifteen seconds. The entire bulb test is a function of the PCM.
- **ETC Lamp-On Message** - Each time the cluster receives a lamp-on message from the PCM, the ETC indicator will be illuminated. The indicator can be flashed on and off, or illuminated solid, as dictated by the PCM message. The indicator remains illuminated solid or continues to flash for about twelve seconds or until the cluster receives a lamp-off message from the PCM, whichever is longer. If the indicator is illuminated solid with the engine running the vehicle will usually remain drivable. If the indicator is flashing with the engine running the vehicle may require towing. A flashing indicator means the ETC system requires immediate service.
- **Actuator Test** - Each time the cluster is put through the actuator test, the ETC indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry. The actuator test illumination of the ETC indicator is a function of the PCM.

The PCM continually monitors the ETC system circuits and sensors to decide whether the system is in good operating condition. The PCM then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the PCM sends a lamp-on message after the bulb test, it indicates that the PCM has detected an ETC system malfunction and/or that the ETC system is inoperative. The PCM will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. Each time the ETC indicator fails to illuminate due to an open or short in the cluster ETC indicator circuit, the cluster sends a message notifying the PCM of the condition, the instrument cluster and the PCM will each store a DTC.

For proper diagnosis of the ETC system, the PCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the ETC indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

FOG LAMP INDICATOR

DESCRIPTION

A fog lamp indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with optional fog lamps, this indicator is electronically disabled. This indicator is located near the upper edge of the instrument cluster, between the minor gauge set and the speedometer.

The fog lamp indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Front Fog Light” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A green Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in green through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The fog lamp indicator is serviced as a unit with the instrument cluster.

OPERATION

The fog lamp indicator gives an indication to the vehicle operator whenever the optional fog lamps are illuminated. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Front Control Module (FCM) (also known as the Integrated Power Module/IPM) over the Controller Area Network (CAN) data bus.

The fog lamp indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The LED only

illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the fog lamp indicator for the following reasons:

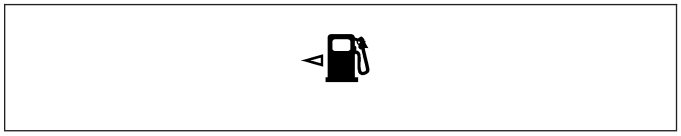
- **Fog Lamp-On Message** - Each time the cluster receives a fog lamp-on message from the FCM indicating the fog lamp relay is energized, the fog lamp indicator will be illuminated. The indicator remains illuminated until the cluster receives a fog lamp-off message from the FCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the fog lamp indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The instrument cluster continually monitors a hard wired input from the headlamp switch to determine the selected fog lamp switch status. The instrument cluster then sends the proper fog lamp-on and lamp-off messages to the FCM over the CAN data bus. The FCM activates the fog lamp relay then sends the proper fog lamp indicator lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the fog lamp indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the fog lamp system, the FCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the fog lamp indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

FUEL GAUGE

DESCRIPTION



A fuel gauge is standard equipment on all instrument clusters. This gauge is part of the minor gauge set with the engine coolant temperature gauge located on the left side of the instrument cluster, just left of the speedometer. This gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree gauge scale on the cluster overlay that reads bottom-to-top from “E” (or Empty) to “F” (or Full). An International Control and Display Symbol icon for “Fuel” is located on the cluster overlay, in the center of the gauge directly below the bottom end of the scale. An arrowhead pointed to the left side of the vehicle is imprinted on the cluster overlay next to the “Fuel” icon on the gauge to provide the driver with a reminder as to the location of the fuel filler access.

The fuel gauge graphics are black against a white field except for a single red graduation at the low end of the gauge scale, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white gauge dial face appears blue-green with the black graphics silhouetted against the illuminated background and the red graphics and the red gauge needle still appear red. Gauge illumination is provided by an integral electro-luminescent lamp that is serviced as a unit with the instrument cluster. The fuel gauge is serviced as a unit with the instrument cluster.

OPERATION

The fuel gauge gives an indication to the vehicle operator of the level of fuel in the fuel tank. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and a hard wired input received by the cluster from the fuel level sending unit on the fuel pump module in the fuel tank.

The fuel gauge is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Fuel Level Sending Unit Input** - The cluster provides a constant current source to the fuel level sending unit and monitors a return input on a fuel level sense circuit. The resistance through the fuel level sending unit increases as the fuel level falls and decreases as the fuel level rises causing changes in the sense input voltage. The cluster programming applies an algorithm to calculate the proper fuel gauge needle position based upon the fuel level sense input, then moves the gauge needle to the proper relative position on the gauge

scale. This algorithm is used to dampen gauge needle movement against the negative effect that fuel sloshing within the fuel tank can have on accurate inputs from the fuel tank sending unit to the cluster.

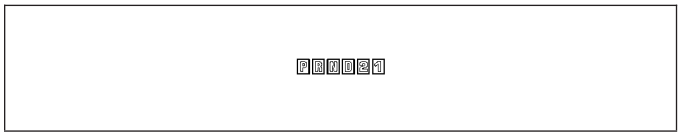
- **Less Than Fourteen Percent Tank Full Input** - Each time the fuel level sense input to the cluster indicates the fuel tank is about fourteen percent full or less for ten consecutive seconds and the vehicle speed is zero, or for sixty consecutive seconds and the vehicle speed is greater than zero, the gauge needle is moved to about the one-sixteenth graduation on the gauge scale, the low fuel indicator is illuminated, and a single chime tone is sounded. The low fuel indicator remains illuminated until the fuel level sense input indicates that the fuel tank is greater than about seventeen percent full for ten consecutive seconds and the vehicle speed is zero, or for sixty consecutive seconds and the vehicle speed is greater than zero, or until the ignition switch is turned to the Off position, whichever occurs first. The chime tone feature will only repeat during the same ignition cycle if the low fuel indicator is cycled off and then on again by the appropriate inputs from the fuel level sending unit.
- **Less Than Empty Stop Input** - Each time the cluster receives a fuel level sense input that indicates the fuel level in the fuel tank is less than the Empty gauge needle stop position, the gauge needle is moved to the low end of the gauge scale and the low fuel indicator is illuminated immediately. This input would indicate that the fuel level sense input to the cluster is a short circuit.
- **More Than Full Stop Input** - Each time the cluster receives a fuel level sense input that indicates the fuel level in the fuel tank is more than the Full gauge needle stop position, the gauge needle is moved to the low end of the gauge scale and the low fuel indicator is illuminated immediately. This input would indicate that the fuel level sense input to the cluster is an open circuit.
- **Actuator Test** - Each time the cluster is put through the actuator test, the fuel gauge needle will be swept to several calibration points on the gauge scale in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

The instrument cluster continually monitors the fuel tank sending unit to determine the level of fuel in the fuel tank. The cluster then sends the proper fuel level messages to other electronic modules in the vehicle over the Controller Area Network (CAN) data bus. For further diagnosis of the fuel gauge or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the fuel tank sending unit, the CAN data bus, or the electronic fuel level message outputs of the instrument cluster, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

GEAR SELECTOR INDICATOR

DESCRIPTION



An electronic automatic transmission gear selector indicator is standard factory-installed equipment on this model. However, on vehicles not equipped with an optional automatic transmission, this indicator is electronically disabled. The gear selector indicator information is displayed in an electronic, blue-green odometer/trip odometer Vacuum-Fluorescent Display (VFD) unit. This VFD unit is soldered onto the cluster electronic circuit board and is visible through a window with a smoked clear lens located below the tachometer in the lower right area of the cluster overlay. The dark lens over the VFD prevents the indicator from being clearly visible when it is not illuminated.

The odometer/trip odometer VFD displays the following gear selector indicator characters from left to right: “P,” “R,” “N,” “D,” “2,” and “1.” Respectively, these characters represent the park, reverse, neutral, drive, second gear, and first gear positions of the transmission gear selector lever on the steering column. The VFD illuminates a rectangular box around the character that represents the currently selected lever position.

During daylight hours (exterior lamps are Off) the odometer/trip odometer VFD is illuminated at full brightness for clear visibility. At night (exterior lamps are On), the VFD lighting level is adjusted with the other cluster illumination lamps using the panel lamps dimmer thumbwheel on the headlamp switch. However, a “Parade” mode position of the panel lamps dimmer thumbwheel allows the VFD to be illuminated at full brightness if the exterior lamps are turned On during daylight hours. The odometer/trip odometer VFD is serviced as a unit with the instrument cluster.

OPERATION

The electronic gear selector indicator gives an indication to the vehicle operator of the transmission gear that has been selected with the automatic transmission gear selector lever. This indicator is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The gear selector indicator information is displayed by the odometer/trip odometer Vacuum Fluorescent Display (VFD) unit soldered onto the instrument cluster electronic circuit board, and the VFD will not display the gear selector indicator information after the ignition switch is turned to the Off position. Each time the cluster is disconnected from battery current for more than about five minutes, it must configure itself for the automatic transmission model that is in the vehicle once it is reconnected to battery current. The instrument cluster circuitry operates the gear selector indicator to provide the following features:

- **Selected Gear Message** - Each time the cluster receives a selected gear message from the PCM, a box will be illuminated around the appropriate character in the gear selector indicator. The box will remain illuminated until the cluster receives a different selected gear message, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - If the cluster fails to receive a selected gear message from the PCM within three seconds, the instrument cluster circuitry will display all gear selector positions boxed (selected) until a valid selected gear message is received or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the odometer/trip odometer VFD will display all of its characters at once, then step through each character segment individually during the VFD portion of the test to confirm the functionality of the VFD and the cluster control circuitry.

The PCM continually monitors a hard wired multiplex input from the Transmission Range Sensor (TRS), then sends the proper selected gear messages to the instrument cluster. For further diagnosis of the gear selector indicator or the instrument cluster circuitry that controls this function, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the TRS, the PCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the gear selector indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

HIGH BEAM INDICATOR

DESCRIPTION

A high beam indicator is standard equipment on all instrument clusters. This indicator is located near the upper edge of the instrument cluster, between the minor gauge set and the speedometer.

The high beam indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “High Beam” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A blue Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in blue through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The high beam indicator is serviced as a unit with the instrument cluster.

OPERATION

The high beam indicator gives an indication to the vehicle operator whenever the headlamp high beams are illuminated. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and a hard wired multiplex input received by the cluster from the headlamp beam select switch circuitry of the multi-function switch on the washer/beam select switch mux circuit.

The high beam indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The LED only

illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the high beam indicator for the following reasons:

- **High Beam Headlamps-On Input** - Each time the cluster detects a high beam headlamps-on input from the headlamp beam select switch circuitry of the multi-function switch on the washer/beam select switch mux circuit, the headlamp high beams and the high beam indicator will be illuminated. The headlamp high beams and the high beam indicator remain illuminated until the cluster receives a high beam headlamps-off input from the multi-function switch, or until the exterior lamp load shedding (battery saver) timed interval expires, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the high beam indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The instrument cluster continually monitors the headlamp switch and the multi-function switch to determine the proper headlamp low beam and high beam control. The instrument cluster then sends the proper low beam and high beam lamp-on and lamp-off messages to the Front Control Module (FCM) over the Controller Area Network (CAN) data bus and turns the high beam indicator on or off accordingly. For further diagnosis of the high beam indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the headlamps, or the headlamp switch and multi-function switch inputs to the instrument cluster that control the high beam indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

LOW FUEL INDICATOR

DESCRIPTION

A low fuel indicator is standard equipment on all instrument clusters. This indicator is located near the upper edge of the instrument cluster, between the minor gauge set and the speedometer.

The low fuel indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Fuel” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The low fuel indicator is serviced as a unit with the instrument cluster.

OPERATION

The low fuel indicator gives an indication to the vehicle operator when the level of fuel in the fuel tank becomes low. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and a hard wired input received by the cluster from the fuel level sending unit on the fuel pump module in the fuel tank.

The low fuel indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the low fuel indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the low fuel indicator is illuminated for about two seconds as a bulb test.
- **Less Than Fourteen Percent Tank Full Input** - The cluster provides a constant current source to the fuel level sending unit and monitors a return input on a fuel level sense circuit. The resistance through the fuel level sending unit increases as the fuel level falls and decreases as the fuel level rises causing changes in the sense input voltage. Each time the fuel level sense input to the cluster indicates the fuel tank is about fourteen percent full or less for ten consecutive seconds and the vehicle speed is zero, or for sixty consecutive seconds and the vehicle speed is greater than zero, the fuel gauge needle is moved to about the one-sixteenth grad-

uation on the gauge scale, the low fuel indicator is illuminated, and a single chime tone is sounded. The low fuel indicator remains illuminated until the fuel level sense input indicates that the fuel tank is greater than about seventeen percent full for ten consecutive seconds and the vehicle speed is zero, or for sixty consecutive seconds and the vehicle speed is greater than zero, or until the ignition switch is turned to the Off position, whichever occurs first. The chime tone feature will only repeat during the same ignition cycle if the low fuel indicator is cycled off and then on again by the appropriate inputs from the fuel level sending unit.

- **Less Than Empty Stop Input** - Each time the cluster receives a fuel level sense input that indicates the fuel level in the fuel tank is less than the Empty gauge needle stop position, the gauge needle is moved to the low end of the gauge scale and the low fuel indicator is illuminated immediately. This input would indicate that the fuel level sense input to the cluster is a short circuit.
- **More Than Full Stop Input** - Each time the cluster receives a fuel level sense input that indicates the fuel level in the fuel tank is more than the Full gauge needle stop position, the gauge needle is moved to the low end of the gauge scale and the low fuel indicator is illuminated immediately. This input would indicate that the fuel level sense input to the cluster is an open circuit.
- **Actuator Test** - Each time the cluster is put through the actuator test, the low fuel indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The instrument cluster continually monitors the fuel tank sending unit to determine the level of fuel in the fuel tank. The cluster then sends the proper fuel level messages to other electronic modules in the vehicle over the Controller Area Network (CAN) data bus. For further diagnosis of the low fuel indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the fuel tank sending unit, the CAN data bus, or the electronic fuel level message outputs of the instrument cluster, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

LOW OIL PRESSURE INDICATOR

DESCRIPTION

A low oil pressure indicator is standard equipment on all instrument clusters. This indicator is located near the upper edge of the instrument cluster, between the tachometer and the speedometer.

The low oil pressure indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Engine Oil” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The low oil pressure indicator is serviced as a unit with the instrument cluster.

OPERATION

The low oil pressure indicator gives an indication to the vehicle operator when the engine oil pressure reading reflects a condition requiring immediate attention. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The low oil pressure indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the low oil pressure indicator for the following reasons:

- **Engine Oil Pressure Low Message** - Each time the cluster receives a message from the PCM indicating the engine oil pressure is about 6.9 kPa (1 psi) or lower, the low oil pressure indicator will be illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating that the engine oil pressure is above about 6.9 kPa (1 psi), or until the ignition switch is turned to the Off position, whichever

occurs first. The cluster will only turn the indicator on in response to an engine oil pressure low message if the engine speed is greater than zero.

- **Actuator Test** - Each time the cluster is put through the actuator test, the low oil pressure indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

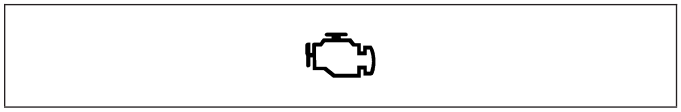
The PCM continually monitors the engine oil pressure sensor to determine the engine oil pressure. The PCM then sends the proper engine oil pressure messages to the instrument cluster. For further diagnosis of the low oil pressure indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the engine oil pressure sensor, the PCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the low oil pressure indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

MALFUNCTION INDICATOR LAMP (MIL)

DESCRIPTION

A Malfunction Indicator Lamp (MIL) is standard equipment on all instrument clusters. This indicator is located in the center of the speedometer, in the area to the left of the speedometer needle hub.



The MIL consists of a stencil-like cutout of the International Control and Display Symbol icon for “Engine” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The MIL is serviced as a unit with the instrument cluster.

OPERATION

The Malfunction Indicator Lamp (MIL) gives an indication to the vehicle operator when the Powertrain Control Module (PCM) has recorded a Diagnostic Trouble Code (DTC) for an On-Board Diagnostics II (OBDII) emissions-related circuit or component malfunction. The MIL is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the PCM over the Controller Area Network (CAN) data bus.

The MIL Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the MIL for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the indicator is illuminated for about fifteen seconds as a bulb test. The entire bulb test is a function of the PCM.
- **MIL Lamp-On Message** - Each time the cluster receives a MIL lamp-on message from the PCM, the indicator will be illuminated. The indicator can be flashed on and off, or illuminated solid, as dictated by the PCM message. For some DTC’s, if a problem does not recur, the PCM will send a lamp-off message automatically. Other DTC’s may require that a fault be repaired and the PCM be reset before a lamp-off message will be sent. For more information on the PCM, and the DTC set and reset parameters, (Refer to 25 - EMISSIONS CONTROL - OPERATION).
- **Communication Error** - If the cluster receives no messages from the PCM for ten consecutive message cycles, the MIL is illuminated by the instrument cluster to indicate a loss of bus communication. The indicator remains controlled and illuminated by the cluster until a valid message is received from the PCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the MIL indicator will be turned on during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the fuel and emissions system circuits and sensors to decide whether the system is in good operating condition. The PCM then sends the proper lamp-on or lamp-off messages to the instrument clus-

ter. For further diagnosis of the MIL or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the MIL after the bulb test, it may indicate that a malfunction has occurred and that the fuel and emissions systems may require service.

For proper diagnosis of the fuel and emissions systems, the PCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the MIL, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

ODOMETER

DESCRIPTION

An odometer and trip odometer are standard equipment in all instrument clusters. The odometer, trip odometer, and engine hours information are displayed in a common electronic, blue-green Vacuum-Fluorescent Display (VFD) unit. This VFD unit is soldered onto the cluster electronic circuit board and is visible through a window with a smoked clear lens located below the tachometer in the lower right area of the cluster overlay. The dark lens over the VFD prevents the indicator from being clearly visible when it is not illuminated.

The odometer, trip odometer, and engine hours information are not displayed simultaneously. The trip odometer reset switch on the instrument cluster circuit board toggles the display between odometer and trip odometer modes by depressing the odometer/trip odometer switch button that extends through the lower edge of the cluster lens, just left of the minor gauge set. When the trip odometer information is displayed, the word “TRIP” is also illuminated in the lower right corner of the odometer/trip odometer VFD in a blue-green color and at the same lighting level as the trip odometer information. The engine hours information replaces the selected odometer or trip odometer information whenever the ignition switch is in the On position and the engine is not running.

The odometer, trip odometer, and engine hours information is stored in the instrument cluster memory. This information can be increased when the proper inputs are provided to the instrument cluster, but the information cannot be decreased. The odometer can display values up to 999,999 kilometers (999,999 miles). The odometer latches at these values, and will not roll over to zero. The trip odometer can display values up to 999.9 kilometers (999.9 miles) before it rolls over to zero. Engine hours are displayed in the format, “hr9999”. The cluster will accumulate values up to 9,999 hours before the display rolls over to zero.

The odometer display does not have a decimal point and will not show values less than a full unit (kilometer or mile), while the trip odometer display does have a decimal point and will show tenths of a unit (kilometer or mile). The unit of measure (kilometers or miles) for the odometer and trip odometer display is not shown in the VFD. The unit of measure for the instrument cluster odometer/trip odometer is selected at the time that it is manufactured, and cannot be changed. The odometer also has a “Rental Car” mode, which will illuminate the odometer information in the VFD whenever the driver side front door is opened with the ignition switch in the Off or Accessory positions.

During daylight hours (exterior lamps are Off) the odometer VFD is illuminated at full brightness for clear visibility. At night (exterior lamps are On), the VFD lighting level is adjusted with the other cluster illumination lamps using the panel lamps dimmer thumbwheel on the headlamp switch. However, a “Parade” mode position of the panel lamps dimmer thumbwheel allows the VFD to be illuminated at full brightness if the exterior lamps are turned On during daylight hours.

The odometer/trip odometer VFD, the trip odometer switch, and the trip odometer switch button are serviced as a unit with the instrument cluster.

OPERATION

The odometer and trip odometer give an indication to the vehicle operator of the distance the vehicle has traveled. The engine hours give an indication of the cumulative engine-on time. This indicator is controlled by the instrument cluster circuitry based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The odometer, trip odometer and engine hours information is displayed by the instrument cluster odometer/trip odometer Vacuum Fluorescent Display (VFD). The VFD will display the odometer information whenever any door is

opened with the ignition switch in the Off or Accessory positions, and will display the last previously selected odometer or trip odometer information when the ignition switch is turned to the On or Start positions. The instrument cluster circuitry controls the VFD and provides the following features:

- **Odometer/Trip Odometer Display Toggling** - Actuating the trip odometer reset switch button momentarily with the VFD illuminated will toggle the display between the odometer and trip odometer information. Each time the VFD is illuminated with the ignition switch in the On or Start positions, the display will automatically return to the last mode previously selected (odometer or trip odometer).
- **Engine Hours Display Toggling** - When the trip odometer reset switch button is pressed and held for longer than about six seconds with the ignition switch in the On position and the engine speed message from the PCM is zero, the trip odometer information will be momentarily displayed, then the engine hours information will be displayed. The VFD must be displaying the odometer information when the trip odometer reset switch button is pressed in order to toggle to the engine hours display. The engine hours will remain displayed for about thirty seconds, until the engine speed message is greater than zero, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Trip Odometer Reset** - When the trip odometer reset switch button is pressed and held for longer than about two seconds with the ignition switch in the On or Start positions, the trip odometer will be reset to 0.0 kilometers (miles). The VFD must be displaying the trip odometer information in order for the trip odometer information to be reset.
- **“GASCAP” Message Display** - On vehicles manufactured with a United States country code, each time the cluster receives an electronic message from the PCM indicating a monitored leak in the evaporative emissions system, the cluster replaces the displayed odometer/trip odometer value with the text message “GASCAP.” This message serves as a reminder to the vehicle operator to check that the gas cap is properly installed and tightened, but could also indicate another source of air leakage in the on-board evaporative and vapor recovery emissions systems. Unless the leak is corrected, this message will latch and remain displayed during the current and each subsequent ignition cycle until the trip odometer reset button is pressed and released momentarily, which will revert the display to the odometer/trip odometer information that was last displayed for the remainder of that ignition cycle. Once the source of a leak has been corrected, either momentarily pressing the trip odometer reset button or cycling the ignition switch will unlatch the message and return the odometer/trip odometer to normal operation.
- **Communication Error** - If the cluster fails to receive a distance message during normal operation, it will hold and display the last data received until the ignition switch is turned to the Off position. If the cluster does not receive a distance message within one second after the ignition switch is turned to the On position, it will display the last distance message stored in the cluster memory. If the cluster is unable to display distance information due to an error internal to the cluster, the VFD will display “Error.”
- **Actuator Test** - Each time the cluster is put through the actuator test, the odometer VFD will display all of its segments simultaneously, then step through each character segment individually during the VFD portion of the test to confirm the functionality of the VFD and the cluster control circuitry.

The PCM continually monitors the vehicle speed pulse information received from the vehicle speed sensor and engine speed pulse information received from the crankshaft position sensor, then sends the proper distance and engine speed messages to the instrument cluster. For further diagnosis of the odometer/trip odometer or the instrument cluster circuitry that controls these functions, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the vehicle speed sensor, the crankshaft position sensor, the PCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the odometer/trip odometer, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

SEATBELT INDICATOR

DESCRIPTION

A seatbelt indicator is standard equipment on all instrument clusters. This indicator is located near the upper edge of the instrument cluster, between the minor gauge set and the speedometer.

The seatbelt indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Seat Belt” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The seatbelt indicator is serviced as a unit with the instrument cluster.

OPERATION

The seatbelt indicator gives an indication to the vehicle operator of the status of the driver side front seatbelt. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and a hard wired input from the seatbelt switch in the driver side front seatbelt retractor through the seat belt indicator driver circuit.

The seatbelt indicator also includes a programmable enhanced seatbelt reminder or “beltminder” feature that is enabled when the vehicle is shipped from the factory. This beltminder feature can be disabled and enabled by the customer using a specific programming event sequence, or by the dealer using a diagnostic scan tool.

The seatbelt indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the seatbelt indicator for the following reasons:

- **Seatbelt Reminder Function** - Each time the cluster receives a battery current input on the fused ignition switch output (run-start) circuit, the indicator will be illuminated as a seatbelt reminder for about six seconds, or until the ignition switch is turned to the Off position, whichever occurs first. This reminder function will occur regardless of the status of the seatbelt switch input to the cluster.
- **Driver Side Front Seatbelt Not Buckled - Beltminder Active** - Following the seatbelt reminder function, each time the cluster detects an open circuit on the seat belt indicator driver circuit (seatbelt switch open = seatbelt unbuckled) with the ignition switch in the Start or On positions, the indicator will be illuminated. In addition, if the driver side front seat belt remains unbuckled about sixty seconds after the conclusion of the seatbelt reminder function with the vehicle speed greater than about 8 kilometers-per-hour (5 miles-per-hour), the seatbelt indicator will begin to cycle between flashing on and off for three seconds, then lighting solid for two seconds. The seatbelt indicator will continue to cycle between flashing and solid illumination for thirteen complete cycles, until the seat belt indicator driver input to the cluster is closed to ground (seatbelt switch closed = seatbelt buckled), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Driver Side Front Seatbelt Not Buckled - Beltminder Inactive** - Following the seatbelt reminder function, each time the cluster detects an open circuit on the seat belt indicator driver circuit (seatbelt switch open = seatbelt unbuckled) with the ignition switch in the Start or On positions, the indicator will be illuminated. The seatbelt indicator remains illuminated until the seat belt indicator driver input to the cluster is closed to ground (seatbelt switch closed = seatbelt buckled), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Airbag Indicator Backup** - If the instrument cluster detects a fault in the airbag indicator circuit it will send a message indicating the fault to the Occupant Restraint Controller (ORC), then flash the seatbelt indicator on and off. The cluster will continue to flash the seatbelt indicator until the airbag indicator circuit fault is resolved, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the seatbelt indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The seatbelt switch is connected in series between ground and the seat belt indicator driver input to the instrument cluster. The seatbelt switch input to the instrument cluster circuitry may be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information.

For further diagnosis of the seatbelt indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

STANDARD PROCEDURE

ENHANCED SEATBELT REMINDER PROGRAMMING

The seatbelt indicator also includes a programmable enhanced seatbelt reminder or “beltminder” feature that is enabled when the vehicle is shipped from the factory. This beltminder feature provides extended and modified visual seatbelt indicator and audible chime warning responses to an unbuckled driver side front seat belt. The beltminder feature may be disabled or enabled by the customer using the programming sequence that follows, or by the dealer using a diagnostic scan tool.

CUSTOMER PROGRAMMING SEQUENCE

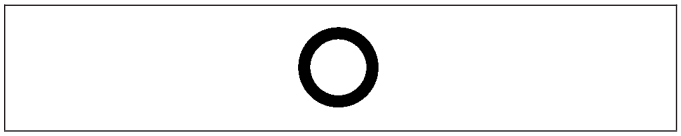
NOTE: The following sequence of events must occur within sixty (60) seconds of the ignition switch being placed in the On position in order for the programming to be completed successfully.

1. With the ignition switch in any position except On or Start, buckle the driver side front seat belt.
2. Turn the ignition switch to the On position and wait for the seatbelt indicator reminder function to conclude (about six seconds).
3. Unbuckle and buckle the driver side front seat belt three or more times, ending with the belt buckled.
4. Turn the ignition switch to any position except On or Start to toggle the beltminder feature from its current setting (from active to inactive, or from inactive to active). A single chime tone will provide an audible confirmation that the programming sequence has been successfully completed.

SECURITY INDICATOR

DESCRIPTION

A security indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional Vehicle Theft Security System (VTSS), this indicator is electronically disabled. This indicator is located near the upper edge of the instrument cluster, between the tachometer and the speedometer.



The security indicator consists of a small round cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in red through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The security indicator is serviced as a unit with the instrument cluster.

OPERATION

The security indicator gives an indication to the vehicle operator when the Vehicle Theft Security System (VTSS) is arming or is armed. On models equipped with the Sentry Key Immobilizer System (SKIS), the security indicator also gives an indication to the vehicle operator of the status of the SKIS. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming, hard wired inputs to the cluster from the various security system components, and electronic messages received by the cluster from the Sentry Key REmote Entry Module (SKREEM) over the Controller Area Network (CAN) data bus.

The security indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the security indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the security indicator illuminates for about two seconds as a bulb test. The entire bulb test is a function of the SKREEM.

- **VTSS Indication** - During the sixteen second VTSS arming function, the cluster will flash the security indicator on and off repeatedly at a steady, fast rate to indicate that the VTSS is in the process of arming. Following successful VTSS arming, the cluster flashes the security indicator on and off continuously at a slower rate to indicate that the VTSS is armed. The security indicator continues flashing at the slower rate until the VTSS is disarmed or triggered. If the VTSS has alarmed and rearmed, the cluster will flash the security indicator at a steady, slow rate for about thirty seconds after the VTSS is disarmed.
- **SKIS Lamp-On Message** - Each time the cluster receives a SKIS lamp-on message from the SKREEM, the security indicator will be illuminated. The indicator can be flashed on and off, or illuminated solid, as dictated by the SKREEM message. The indicator remains illuminated solid or continues to flash until the cluster receives a SKIS lamp-off message from the SKREEM, or until the ignition switch is turned to the Off position, whichever occurs first. For more information on the SKIS and the security indicator control parameters, (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/SENTRY KEY IMMOBILIZER SYSTEM - OPERATION).
- **Communication Error** - If the cluster receives no SKIS lamp-on or lamp-off messages from the SKREEM for ten consecutive message cycles, the security indicator is illuminated by the instrument cluster. The indicator remains controlled and illuminated by the cluster until a valid SKIS lamp-on or lamp-off message is received from the SKREEM.
- **Actuator Test** - Each time the instrument cluster is put through the actuator test, the security indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The instrument cluster circuitry controls the security indicator whenever the ignition switch is in the Off position and the VTSS is arming, armed, or alarming. Whenever the ignition switch is in the On or Start positions, the SKREEM performs a self-test to decide whether the SKIS is in good operating condition and whether a valid key is present in the ignition lock cylinder. The SKREEM then sends the proper lamp-on or lamp-off messages to the instrument cluster. For further diagnosis of the security indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster flashes the security indicator upon ignition On, or turns on the security indicator solid after the bulb test, it indicates that a SKIS malfunction has occurred or that the SKIS is inoperative.

For proper diagnosis of the VTSS, the SKIS, the SKREEM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the security indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

SERVICE 4WD INDICATOR

DESCRIPTION

A service 4WD indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional four-wheel drive system and electronically shifted transfer case, this indicator is electronically disabled. The service 4WD indicator is located below the minor gauge set on the left side of the cluster.

The service 4WD indicator consists of a stencil-like cutout of the text “SVC 4WD” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “SVC 4WD” text to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The service 4WD indicator is serviced as a unit with the instrument cluster.

OPERATION

The service 4WD indicator gives an indication to the vehicle operator when the Front Control Module (FCM) (also known as the Integrated Power Module/IPM) has recorded a Diagnostic Trouble Code (DTC) for an electronic transfer case circuit or component malfunction. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the FCM over the Controller Area Network (CAN) data bus.

The service 4WD indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the service 4WD indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the service 4WD indicator is illuminated for about two seconds as a bulb test.
- **Service 4WD Lamp-On Message** - Each time the cluster receives a service 4WD lamp-on message from the FCM, the service 4WD indicator will be illuminated. The indicator remains illuminated until the cluster receives a service 4WD lamp-off message from the FCM, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - If the cluster receives no messages from the FCM for ten seconds, the service 4WD indicator is illuminated by the instrument cluster to indicate a loss of FCM communication. The indicator remains controlled and illuminated by the cluster until a valid message is received from the FCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the service 4WD indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The FCM continually monitors the electronic transfer case control circuits and transfer case shift motor/mode sensor assembly to determine the condition of the system. The FCM then sends the proper lamp-on or lamp-off messages to the instrument cluster. For further diagnosis of the service 4WD indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

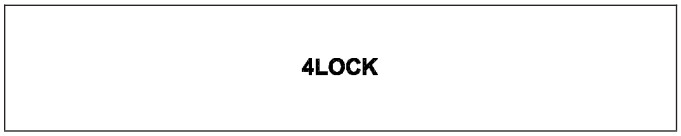
For proper diagnosis of the FCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the service 4WD indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

SHIFT INDICATOR (TRANSFER CASE)

DESCRIPTION

4WD LOCK INDICATOR

A 4WD lock indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional four-wheel drive system and electronically shifted transfer case, this indicator is electronically disabled. The 4WD lock indicator is located below the minor gauge set on the left side of the cluster.



The 4WD lock indicator consists of a stencil-like cutout of the text “4LOCK” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “4LOCK” text to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

When the exterior lighting is turned On, the illumination intensity of the 4WD lock indicator is dimmable, which is adjusted along with the cluster illumination lamp using the panel lamps dimmer thumbwheel on the headlamp switch. The 4WD lock indicator is serviced as a unit with the instrument cluster.

4WD LOW INDICATOR

A 4WD low indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional four-wheel drive system and electronically shifted transfer case, this indicator is electronically disabled. The 4WD low indicator is located below the minor gauge set on the left side of the cluster.

The 4WD low indicator consists of a stencil-like cutout of the text “4LO” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “4LO” text to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

When the exterior lighting is turned On, the illumination intensity of the 4WD low indicator is dimmable, which is adjusted along with the cluster illumination lamp using the panel lamps dimmer thumbwheel on the headlamp switch. The 4WD low indicator is serviced as a unit with the instrument cluster.

OPERATION

4WD LOCK INDICATOR

The 4WD lock indicator gives an indication to the vehicle operator when the electronic transfer case has been shifted into the 4WD lock mode. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Front Control Module (FCM) (also known as the Integrated Power Module/IPM) over the Controller Area Network (CAN) data bus.

The 4WD lock indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the 4WD lock indicator for the following reasons:

- **4WD Lock Lamp-On Message** - Each time the cluster receives a 4WD lock lamp-on message from the FCM, the indicator will be illuminated. The indicator remains illuminated until the cluster receives a 4WD lock lamp-off message from the FCM, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the 4WD lock indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The FCM continually monitors the electronic transfer case through the transfer case shift motor/mode sensor assembly to determine when the 4WD lock mode is engaged. The FCM then sends the proper lamp-on or lamp-off messages to the instrument cluster. For further diagnosis of the 4WD lock indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the transfer case shift motor/mode sensor, the FCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the 4WD lock indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

4WD LOW INDICATOR

The 4WD low indicator gives an indication to the vehicle operator when the electronic transfer case has been shifted into the 4WD low mode. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Front Control Module (FCM) (also known as the Integrated Power Module/IPM) over the Controller Area Network (CAN) data bus.

The 4WD low indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the 4WD low indicator for the following reasons:

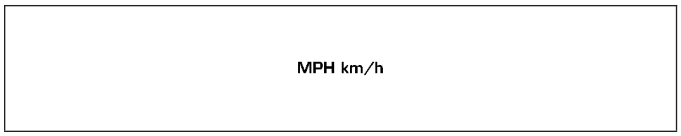
- **4WD Low Lamp-On Message** - Each time the cluster receives a 4WD low lamp-on message from the FCM, the indicator will be illuminated. The indicator remains illuminated until the cluster receives a 4WD low lamp-off message from the FCM, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the 4WD low indicator will be turned on, then off again during the LED portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The FCM continually monitors the electronic transfer case through the transfer case shift motor/mode sensor assembly to determine when the 4WD low mode is engaged. The FCM then sends the proper lamp-on or lamp-off messages to the instrument cluster. For further diagnosis of the 4WD low indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the transfer case shift motor/mode sensor, the FCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the 4WD low indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

SPEEDOMETER

DESCRIPTION



A speedometer is standard equipment on all instrument clusters. The speedometer is located in the center of the instrument cluster, between the tachometer and the minor gauge set. The speedometer consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 210 degree primary scale on the gauge dial face that reads left-to-right either from “0” to “120” mph, or from “0” to “200” km/h, depending upon the market for which the vehicle is manufactured. Each version also has a secondary inner scale on the gauge dial face that provides the equivalent opposite units from the primary scale. Text appearing on the cluster overlay above the hub of the speedometer needle abbreviates the unit of measure for the primary scale (i.e.: MPH or km/h), followed by the unit of measure for the secondary scale.

The speedometer graphics are black (primary scale) and blue (secondary scale) against a white field, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white gauge dial face appears blue-green with the black and blue graphics silhouetted against the illuminated background and the red gauge needle still appears red. Gauge illumination is provided by an integral electro-luminescent lamp that is serviced as a unit with the instrument cluster. The speedometer is serviced as a unit with the instrument cluster.

OPERATION

The speedometer gives an indication to the vehicle operator of the vehicle road speed. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The speedometer is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

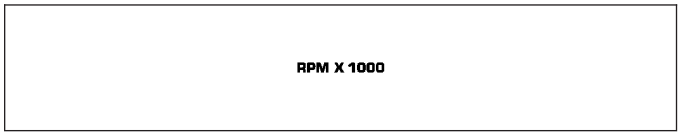
- **Vehicle Speed Message** - Each time the cluster receives a vehicle speed message from the PCM it will calculate the correct vehicle speed reading and position the gauge needle at that relative speed position on the gauge scale. The cluster will receive a new vehicle speed message and reposition the gauge pointer accordingly about every 88 milliseconds. The gauge needle will continually be positioned at the relative vehicle speed position on the gauge scale until the vehicle stops moving, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - If the cluster fails to receive a speedometer message, it will hold the gauge needle at the last indication for about three seconds, or until the ignition switch is turned to the Off position, whichever occurs first. After three seconds, the gauge needle will return to the left end of the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the speedometer needle will be swept to several calibration points on the gauge scale in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the vehicle speed sensor to determine the vehicle road speed. The PCM then sends the proper vehicle speed messages to the instrument cluster. For further diagnosis of the speedometer or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the vehicle speed sensor, the PCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the speedometer, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

TACHOMETER

DESCRIPTION



A tachometer is standard equipment on all instrument clusters. The tachometer is located to the right side of the instrument cluster, just right of the speedometer. The tachometer consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 210 degree scale on the gauge dial face that reads left-to-right from “0” to “7”. The text “RPM X 1000” imprinted on the cluster overlay directly above the hub of the tachometer needle identifies that each number on the tachometer scale is to be multiplied by 1000 rpm.

The tachometer graphics are black against a white field, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white gauge dial face appears blue-green with the black graphics silhouetted against the illuminated background and the red gauge needle still appears red. Gauge illumination is provided by an integral electro-luminescent lamp that is serviced as a unit with the instrument cluster. The tachometer is serviced as a unit with the instrument cluster.

OPERATION

The tachometer gives an indication to the vehicle operator of the engine speed. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The tachometer is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Engine Speed Message** - Each time the cluster receives an engine speed message from the PCM it will calculate the correct engine speed reading and position the gauge needle at that relative speed position on the gauge scale. The cluster will receive a new engine speed message and reposition the gauge pointer accordingly about every 88 milliseconds. The gauge needle will continually be repositioned at the relative engine speed position on the gauge scale until the engine stops running, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - If the cluster fails to receive an engine speed message, it will hold the gauge needle at the last indication for about three seconds, or until the ignition switch is turned to the Off position, whichever occurs first. After three seconds, the gauge needle will return to the left end of the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the tachometer needle will be swept to several calibration points on the gauge scale in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the crankshaft position sensor to determine the engine speed. The PCM then sends the proper engine speed messages to the instrument cluster. For further diagnosis of the tachometer or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the crankshaft position sensor, the PCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the tachometer, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

TOW/HAUL INDICATOR

DESCRIPTION

A tow/haul indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional overdrive automatic transmission, this indicator is electronically disabled. The tow/haul indicator is located below the minor gauge set on the left side of the cluster.

The tow/haul indicator consists of a stencil-like cutout of the text “TOW/HAUL” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “TOW/HAUL” text to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

When the exterior lighting is turned On, the illumination intensity of the tow/haul indicator is dimmable, which is adjusted along with the cluster illumination lamp using the panel lamps dimmer thumbwheel on the headlamp switch. The tow/haul indicator is serviced as a unit with the instrument cluster.

OPERATION

The tow/haul indicator gives an indication to the vehicle operator when the Off position of the tow/haul switch has been selected, disabling the electronically controlled overdrive feature of the automatic transmission. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The tow/haul indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the tow/haul indicator for the following reasons:

- **Tow/Haul Lamp-On Message** - Each time the cluster receives a tow/haul lamp-on message from the PCM indicating that the Off position of the tow/haul switch has been selected, the indicator will be illuminated. The indicator remains illuminated until the cluster receives a tow/haul lamp-off message from the PCM, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the tow/haul indicator will be turned on, then off again during the LED portion of the test to confirm the functionality of the LED and the cluster control circuitry.

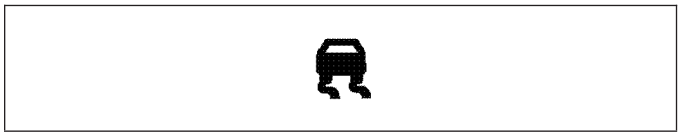
The PCM continually monitors the tow/haul switch to determine the proper outputs to the automatic transmission. The PCM then sends the proper lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the tow/haul indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the overdrive control system, the PCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the tow/haul indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

TRACTION CONTROL INDICATOR

DESCRIPTION

A traction control indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional Traction Control System (TCS), this indicator is electronically disabled. This



indicator is located in the center of the speedometer, in the area above and to the right of the speedometer needle hub.

The traction control indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Stability - Anti-Spin” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The traction control indicator is serviced as a unit with the instrument cluster.

OPERATION

The traction control indicator gives an indication to the vehicle operator when the electronic Traction Control System (TCS) has been activated. This indicator is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Controller Antilock Brake (CAB) over the Controller Area Network (CAN) data bus.

The traction control indicator is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The indicator only illuminates when it is switched to ground by the instrument cluster circuitry. The instrument cluster will turn on the traction control indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the traction control indicator is illuminated for about four seconds as a bulb test. The entire bulb test is a function of the CAB.
- **Traction Control Lamp-On Message** - Each time the cluster receives a traction control lamp-on message from the CAB indicating that the TCS has been activated, the traction control indicator will be illuminated. The indicator remains illuminated until the cluster receives a traction control lamp-off message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the traction control indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

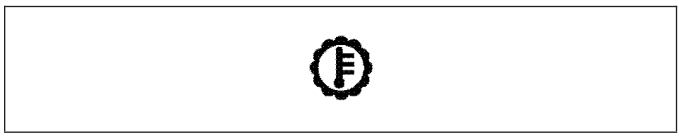
The CAB continually monitors the traction control switch to determine the proper outputs to the components of the Antilock Brake System (ABS). The CAB then sends the proper traction control lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the traction control indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the traction control switch, the ABS, the CAB, the CAN data bus, or the electronic message inputs to the instrument cluster that control the traction control indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

TRANS TEMP INDICATOR

DESCRIPTION

A transmission over-temperature indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with an optional automatic transmission, this indicator is electronically disabled. This indicator is located in the center of the speedometer, in the area above and to the right of the speedometer needle hub.



The transmission over-temperature indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Transmission Temperature” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The transmission over-temperature indicator is serviced as a unit with the instrument cluster.

OPERATION

The transmission over-temperature indicator gives an indication to the vehicle operator when the transmission fluid temperature is excessive, which may lead to accelerated transmission component wear or failure. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The transmission over-temperature indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the transmission over-temperature indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the transmission over-temperature indicator is illuminated for about two seconds as a bulb test.
- **Trans Over-Temp Lamp-On Message** - Each time the cluster receives a trans over-temp lamp-on message from the PCM indicating that the transmission fluid temperature is 135° C (275° F) or higher, the indicator will be illuminated and a single chime tone is sounded. The indicator remains illuminated until the cluster receives a trans over-temp lamp-off message from the PCM, or until the ignition switch is turned to the Off position, whichever occurs first. The chime tone feature will only repeat during the same ignition cycle if the transmission over-temperature indicator is cycled off and then on again by the appropriate trans over-temp messages from the PCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the transmission over-temperature indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

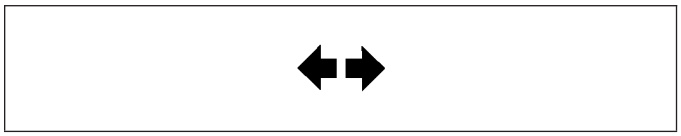
The PCM continually monitors the transmission temperature sensor to determine the transmission operating condition. The PCM then sends the proper trans over-temp lamp-on or lamp-off messages to the instrument cluster. If the instrument cluster turns on the transmission over-temperature indicator due to a high transmission oil temperature condition, it may indicate that the transmission and/or the transmission cooling system are being overloaded or that they require service. For further diagnosis of the transmission over-temperature indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the transmission temperature sensor, the PCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the transmission over-temperature indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

TURN SIGNAL INDICATOR

DESCRIPTION

Two turn signal indicators, one right and one left, are standard equipment on all instrument clusters. The turn signal indicators are located near the upper edge of the instrument cluster, the right one is between the speedometer and the tachometer, and the left one is between the speedometer and the minor gauge set.



Each turn signal indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Turn Warning” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents these icons from being clearly visible when they are not illuminated. A green Light Emitting Diode (LED) behind each cutout in the opaque layer of the overlay causes the icon to appear in green through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The turn signal indicators are serviced as a unit with the instrument cluster.

OPERATION

The turn signal indicators give an indication to the vehicle operator that the turn signal (left or right indicator flashing) or hazard warning (both left and right indicators flashing) have been selected and are operating. These indi-

cators are controlled by transistors on the instrument cluster electronic circuit board based upon the cluster programming, a hard wired multiplex input received by the cluster from the turn signal and hazard warning switch circuitry of the multi-function switch on the turn/hazard switch mux circuit, and electronic messages received from the Front Control Module (FCM) (also known as the Integrated Power Module/IPM) over the Controller Area Network (CAN) data bus.

Each turn signal indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, each LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the turn signal indicators for the following reasons:

- **Turn Signal-On Input** - Each time the cluster detects a turn signal-on input from the turn signal switch circuitry of the multi-function switch on the turn/hazard switch mux circuit, it sends the appropriate electronic turn signal switch status messages to the FCM over the CAN data bus. The FCM responds to these messages by controlling a battery voltage output and the flash rate for either the right or left turn signal lamps. The FCM also sends the appropriate electronic messages back to the EMIC to control the illumination and flash rate of the right or left turn signal indicators, as well as to control the click rate of an electromechanical relay soldered onto the EMIC electronic circuit board that emulates the sound emitted by a conventional turn signal flasher. The turn signals and the turn signal indicators continue to flash on and off until the cluster receives a turn signal-off input from the multi-function switch, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Hazard Warning-On Input** - Each time the cluster detects a hazard warning-on input from the hazard warning switch circuitry of the multi-function switch on the turn/hazard switch mux circuit, it sends the appropriate electronic hazard switch status messages to the FCM over the CAN data bus. The FCM responds to these messages by controlling a battery voltage output and the flash rate for each of the right and left turn signal lamps. The FCM also sends the appropriate electronic messages back to the EMIC to control the illumination and flash rate of the right and left turn signal indicators, as well as to control the click rate of an electromechanical relay soldered onto the EMIC electronic circuit board that emulates the sound emitted by a conventional hazard warning flasher. The turn signals and the turn signal indicators continue to flash on and off until the cluster receives a hazard warning-off input from the multi-function switch.
- **Lamp Out Mode** - The instrument cluster also sends electronic turn signal on and off messages to the FCM over the CAN data bus, and the FCM flashes the appropriate exterior turn signal lamps. If the FCM detects an inoperative turn signal lamp or circuit, it increases the flash rate for the remaining operative turn signals and sends an electronic message back to the instrument cluster. The instrument cluster then increases the flash rate of the turn signal indicator(s) and the clicking rate of the electromechanical relay to provide an indication of the problem to the vehicle operator.
- **Actuator Test** - Each time the cluster is put through the actuator test, the turn signal indicators will be turned on, then off again during the bulb check portion of the test to confirm the functionality of each LED and the cluster control circuitry.

The instrument cluster continually monitors the multi-function switch and electronic messages from the FCM to determine the proper turn signal and hazard warning system control. For further diagnosis of the turn signal indicators or the instrument cluster circuitry that controls the indicators, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the turn signal and hazard warning system, the multi-function switch, the FCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the turn signal indicators, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

WASHER FLUID INDICATOR

DESCRIPTION

A washer fluid indicator is standard equipment on all instrument clusters. This indicator is located in the center of the speedometer, in the area below and to the left of the speedometer needle hub.

The washer fluid indicator consists of a stencil-like cutout of the International Control and Display Symbol Icon for “Windscreen Washer Fluid Level” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The washer fluid indicator is serviced as a unit with the instrument cluster.

OPERATION

The washer fluid indicator gives an indication to the vehicle operator that the fluid level in the washer reservoir is low. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Front Control Module (FCM) (also known as the Integrated Power Module/IPM or Power Distribution Center/PDC) over the Controller Area Network (CAN) data bus.

The washer fluid indicator is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the washer fluid indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the washer fluid indicator is illuminated for about two seconds as a bulb test.
- **Washer Fluid Indicator Lamp-On Message** - Each time the cluster receives a washer fluid indicator lamp-on message from the FCM indicating that a low washer condition has been detected for sixty consecutive seconds, the washer fluid indicator is illuminated and a single chime tone is sounded. The indicator remains illuminated until the cluster receives a washer fluid indicator lamp-off message for sixty consecutive seconds from the FCM or until the ignition switch is turned to the Off position, whichever occurs first. The chime tone feature will only repeat during the same ignition cycle if the washer fluid indicator is cycled off and then on again by the appropriate washer fluid lamp messages from the FCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the washer fluid indicator will be turned on, then off again during the LED portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The FCM continually monitors the washer fluid level switch in the washer reservoir to determine the level of the washer fluid. The FCM then sends the proper lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the washer fluid indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the washer fluid level switch, the FCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the washer fluid indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

LAMPS

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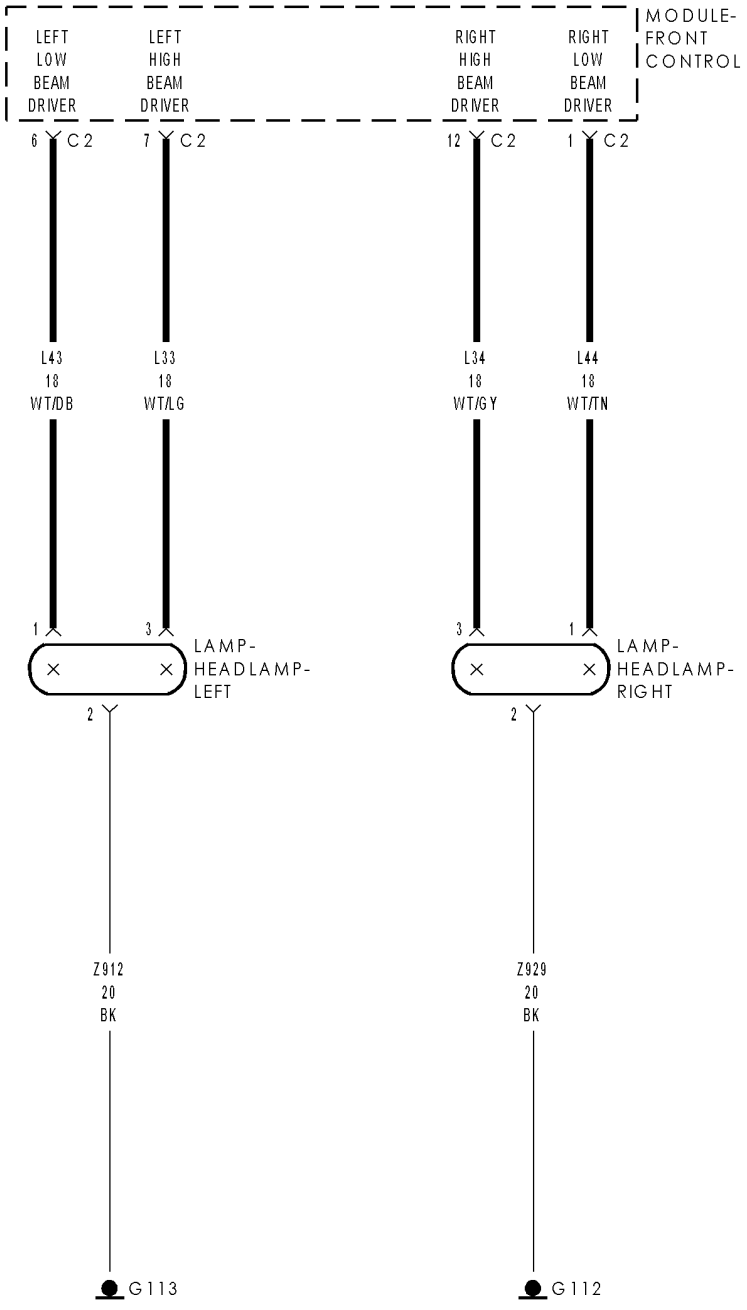
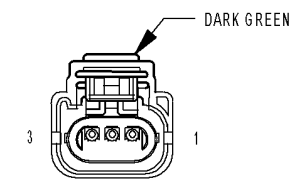
LAMPS/LIGHTING - EXTERIOR - ELECTRICAL DIAGNOSTICS

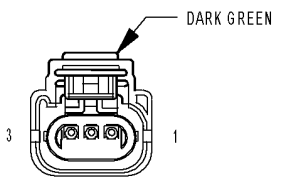
DIAGNOSIS AND TESTING

B162B-LEFT LOW BEAM CONTROL CIRCUIT LOW

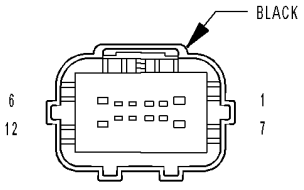




LAMP-HEADLAMP-LEFT



LAMP-HEADLAMP-RIGHT



MODULE-FRONT CONTROL C2

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B162B-LEFT LOW BEAM CONTROL CIRCUIT LOW (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Headlamps activated.
- **Set Condition:**
- When the FCM detects a LOW condition.

Possible Causes
(L43) LEFT LOW BEAM CONTROL CIRCUIT
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

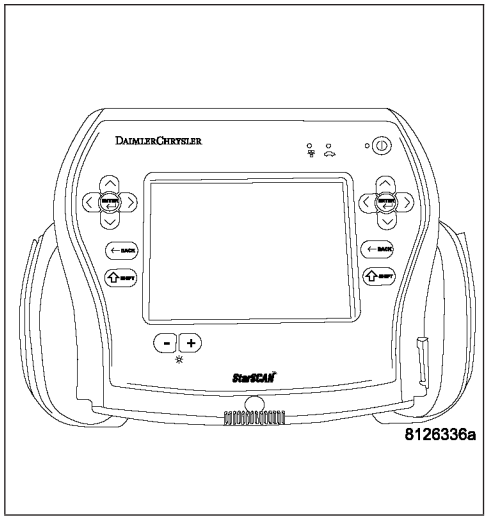
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Turn the Headlamps on.
With the Scan Tool read the DTC information.

Does the Scan Tool read: B162B-LEFT LOW BEAM CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST - VER 1.



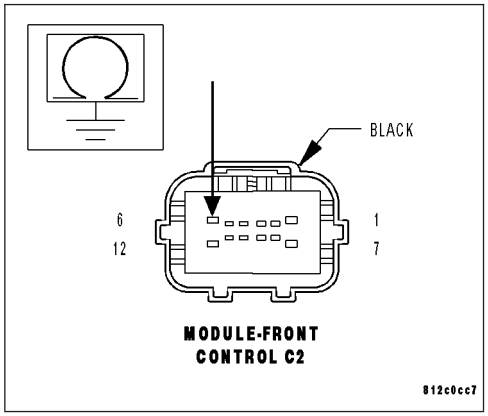
2. (L43) LEFT LOW BEAM CONTROL CIRCUIT

Turn the ignition off.
Disconnect the FCM C2 harness connector.
Measure the resistance between ground and the (L43) Left Low Beam Control circuit.

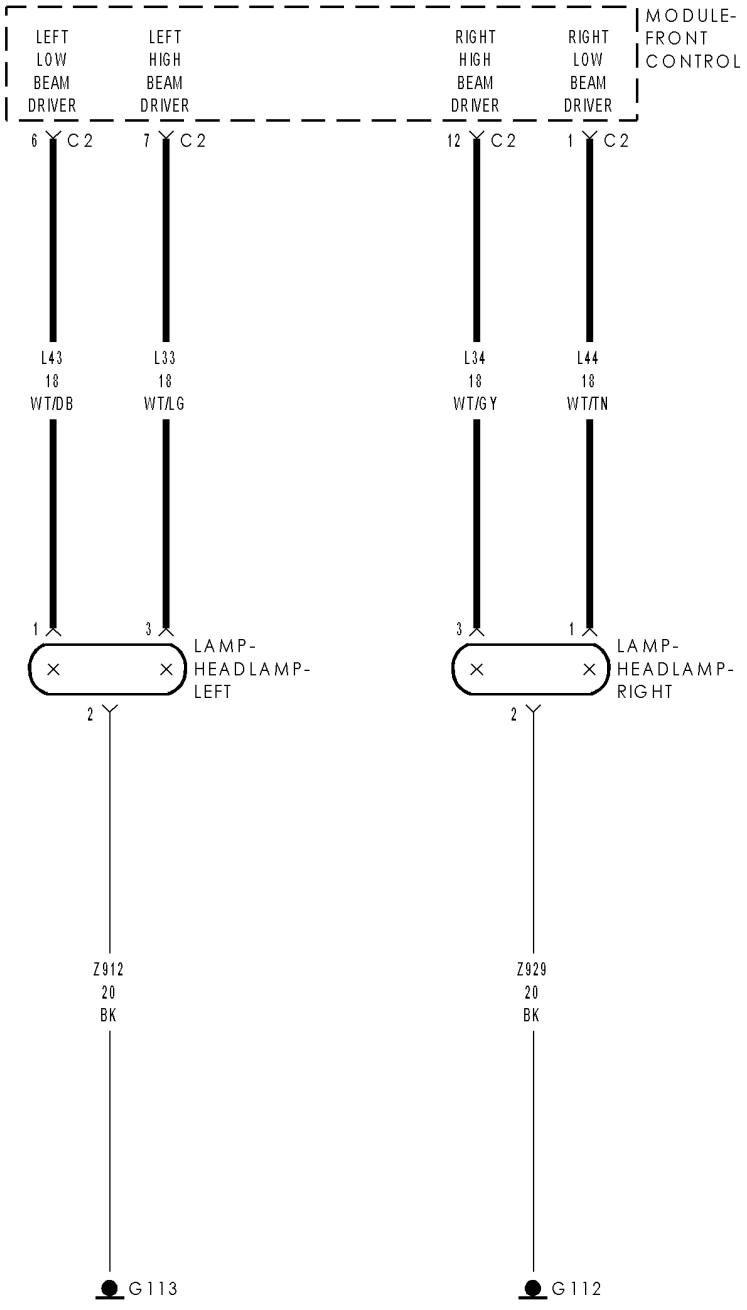
Is the resistance below 5.0 ohms?

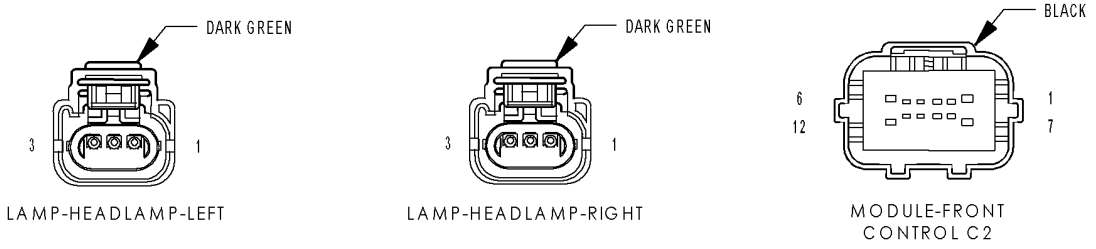
Yes >> Replace the Front Control Module (FCM) in accordance with the service information.
Perform the BODY VERIFICATION TEST - VER 1.

No >> Repair the (L43) Left Low Beam Control circuit for a short to ground condition.
Perform the BODY VERIFICATION TEST - VER 1.



B162F-RIGHT LOW BEAM CONTROL CIRCUIT LOW





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B162F-RIGHT LOW BEAM CONTROL CIRCUIT LOW (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Headlamps activated.
- **Set Condition:**
- When the FCM detects a LOW condition.

Possible Causes
(L44) RIGHT LOW BEAM CONTROL CIRCUIT
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, clear all FCM DTC's.

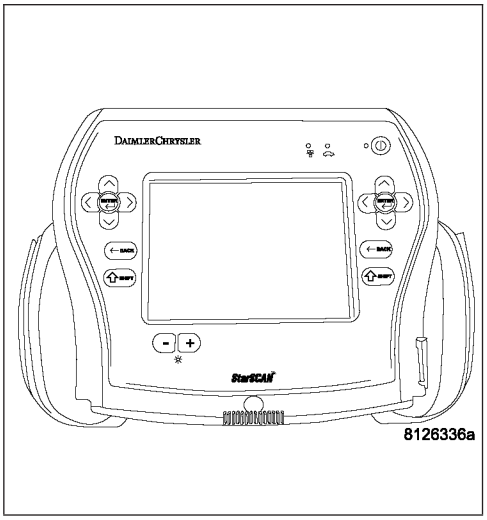
Turn the Headlamps on.

With the Scan Tool read the DTC information.

Does the Scan Tool read: B162F-RIGHT LOW BEAM CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST - VER 1.



2. (L44) RIGHT LOW BEAM CONTROL CIRCUIT

Turn the ignition off.

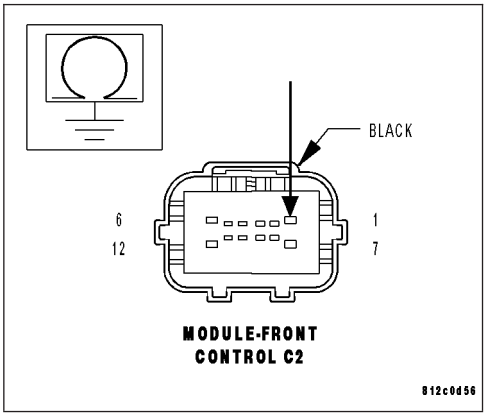
Disconnect the FCM C2 harness connector.

Measure the resistance between ground and the (L44) Right Low Beam Control circuit.

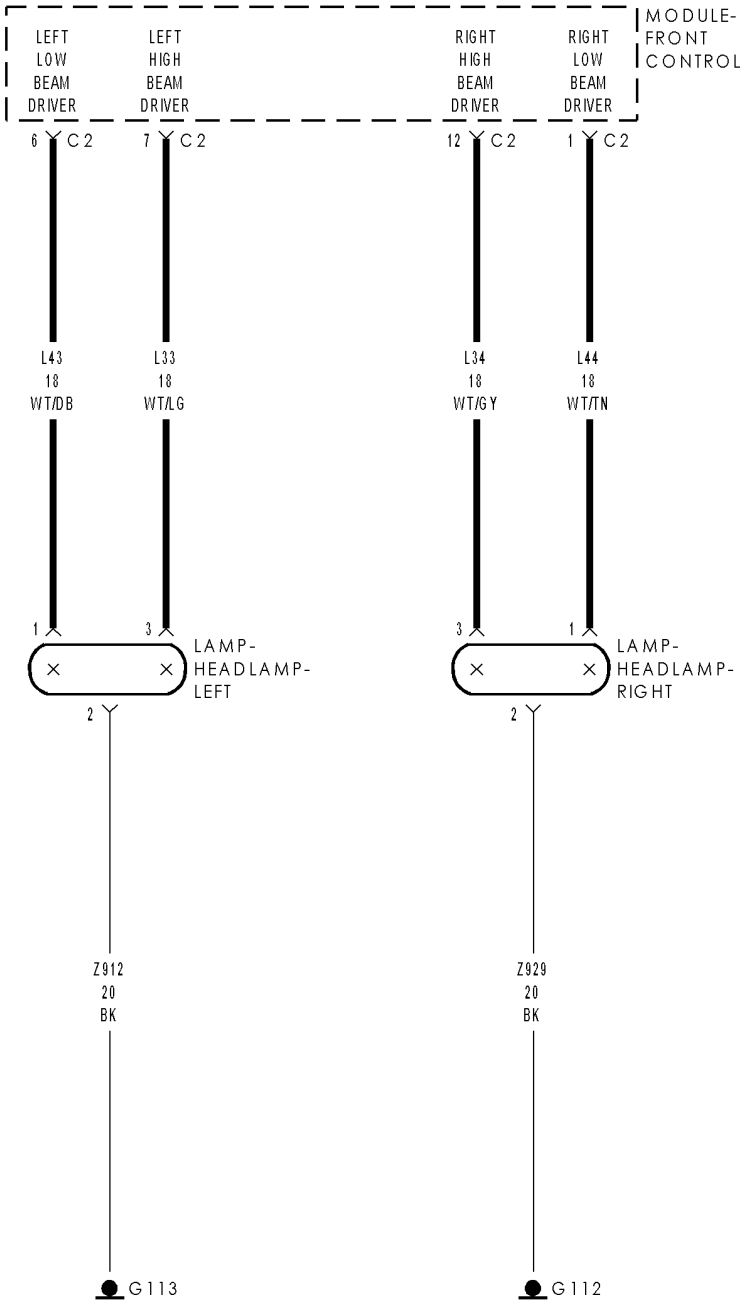
Is the resistance below 5.0 ohms?

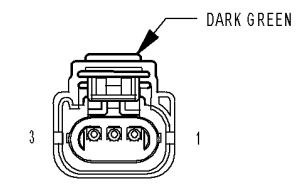
Yes >> Replace the Front Control Module (FCM) in accordance with the service information.
Perform the BODY VERIFICATION TEST - VER 1.

No >> Repair the (L44) Right Low Beam Control circuit for a short to ground condition.
Perform the BODY VERIFICATION TEST - VER 1.

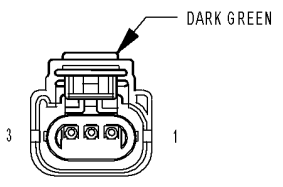


B1630-RIGHT LOW BEAM CONTROL CIRCUIT HIGH

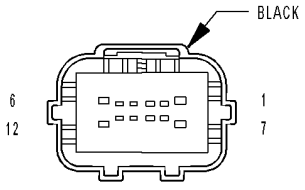




LAMP-HEADLAMP-LEFT



LAMP-HEADLAMP-RIGHT



MODULE-FRONT CONTROL C2

812c5291

B1630-RIGHT LOW BEAM CONTROL CIRCUIT HIGH (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Headlamps activated.
- **Set Condition:**
- When the FCM detects a LOW condition.

Possible Causes
(L44) RIGHT LOW BEAM CONTROL CIRCUIT
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

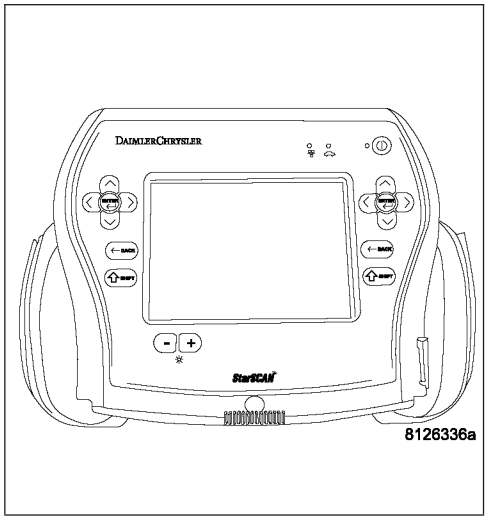
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Turn the Headlamps on.
With the Scan Tool read the DTC information.

Does the Scan Tool read: B1630-RIGHT LOW BEAM CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST - VER 1.



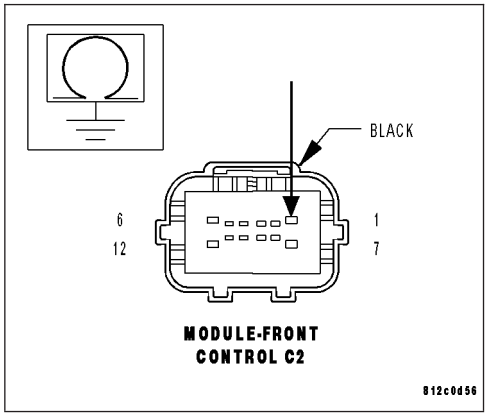
2. (L44) RIGHT LOW BEAM CONTROL CIRCUIT

Turn the ignition off.
Disconnect the FCM C2 harness connector.
Measure the resistance of the (L44) Right Low Beam Control circuit.

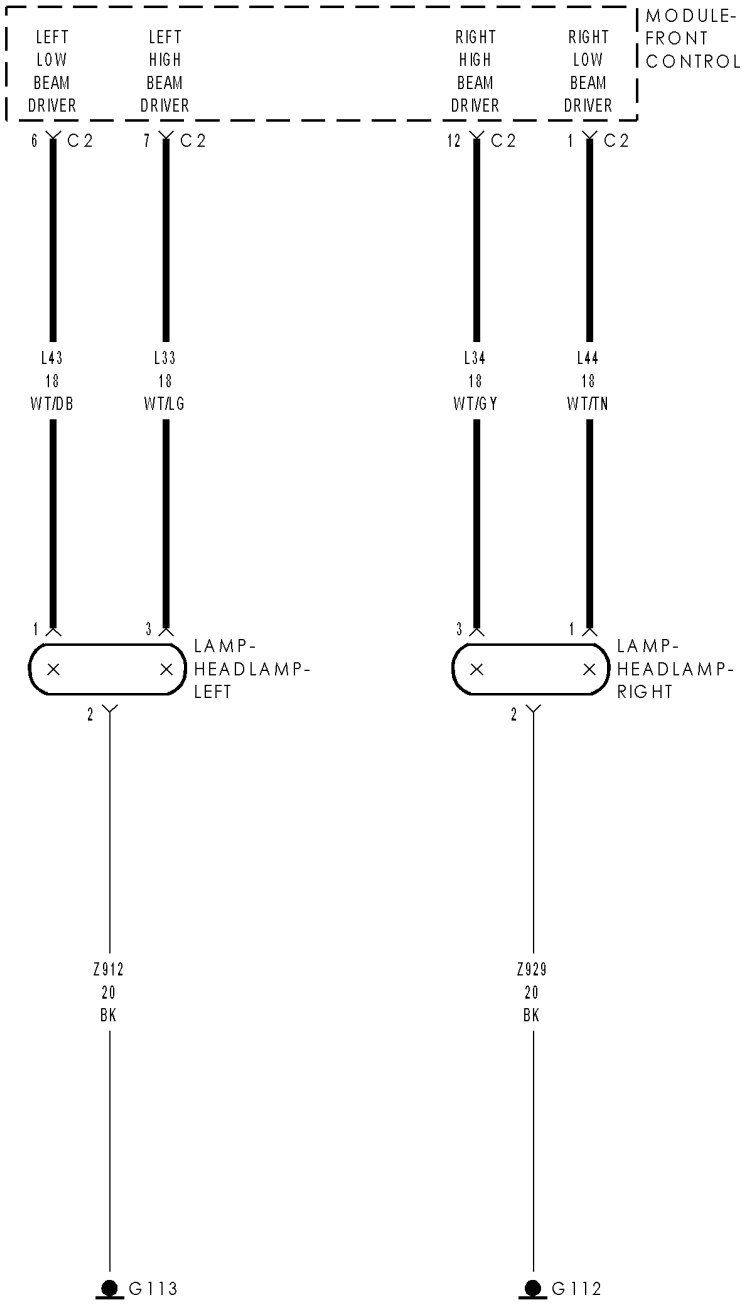
Is the resistance above 5.0 ohms?

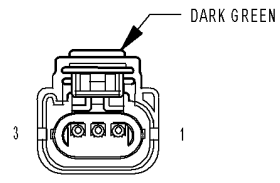
Yes >> Repair the (L44) Right Low Beam Control circuit for a short to battery condition.
Perform the BODY VERIFICATION TEST - VER 1.

No >> Replace the Front Control Module (FCM) in accordance with the service information.
Perform the BODY VERIFICATION TEST - VER 1.

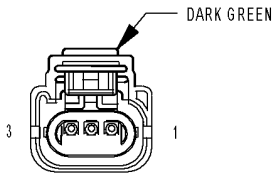


B1633-LEFT HI BEAM CONTROL CIRCUIT LOW

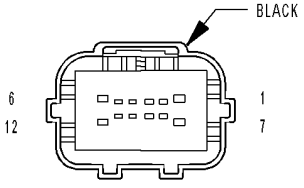




LAMP-HEADLAMP-LEFT



LAMP-HEADLAMP-RIGHT



MODULE-FRONT
CONTROL C2

812c5291

B1633-LEFT HI BEAM CONTROL CIRCUIT LOW (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Headlamps activated.
- **Set Condition:**
- When the FCM detects a LOW condition.

Possible Causes
(L33) LEFT HIGHBEAM OUTPUT CIRCUIT
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, clear all FCM DTC's.

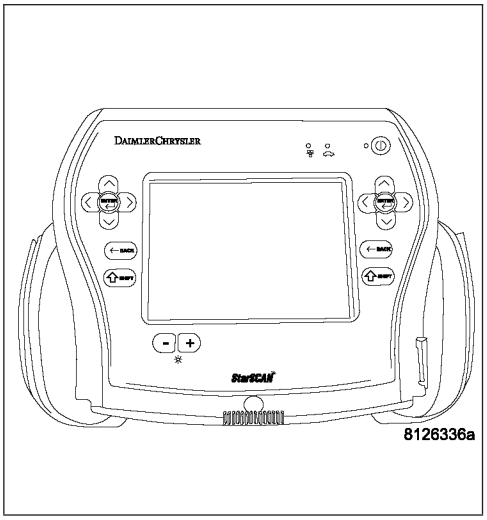
Turn the Highbeam Headlamps on.

With the Scan Tool read the DTC information.

Does the Scan Tool read: B1633-LEFT HI BEAM CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST - VER 1.



2. (L33) LEFT HIGHBEAM OUTPUT CIRCUIT

Turn the ignition off.

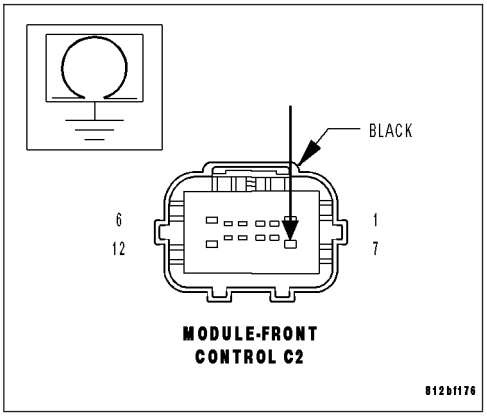
Disconnect the FCM C2 harness connector.

Measure the resistance between ground and the Left Highbeam Output circuit.

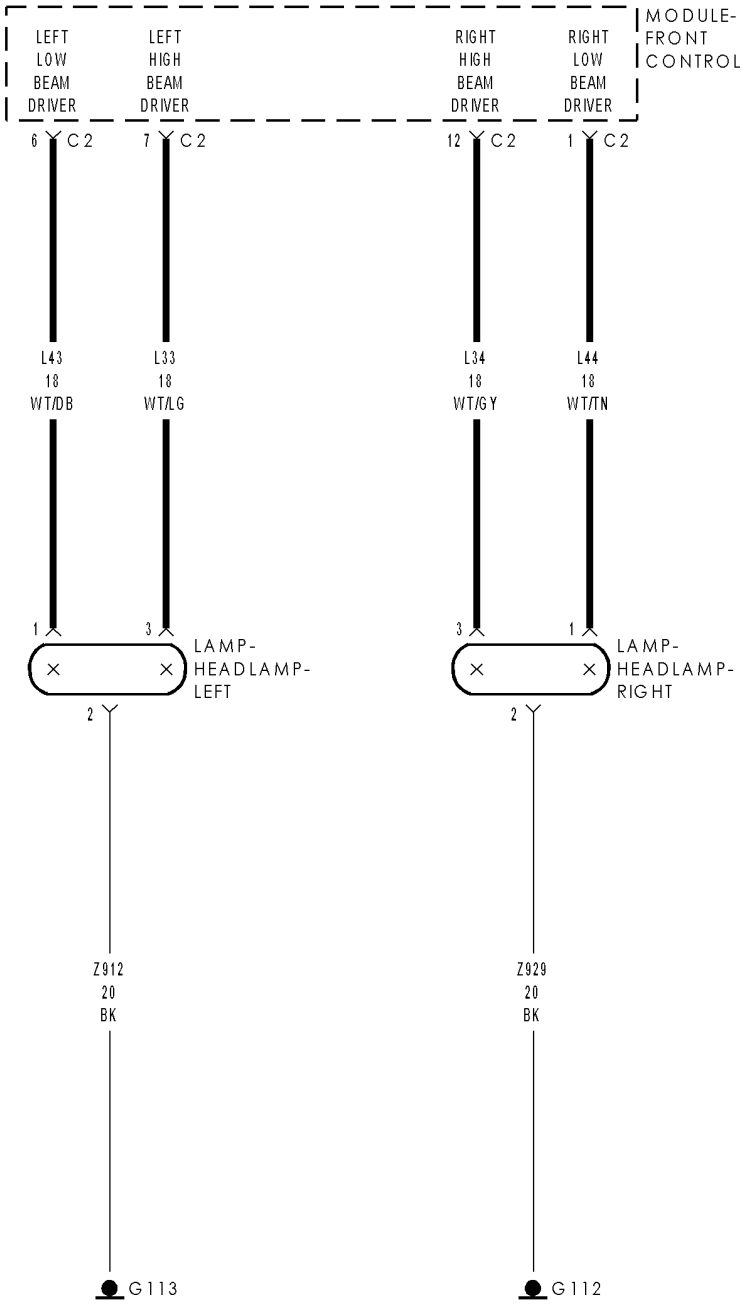
Is the resistance below 5.0 ohms?

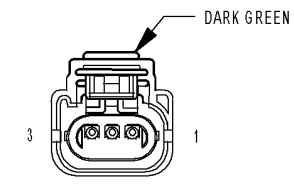
Yes >> Replace the Front Control Module (FCM) in accordance with the service information.
Perform the BODY VERIFICATION TEST - VER 1.

No >> Repair the (L33) Left Highbeam Output circuit for a short to ground condition.
Perform the BODY VERIFICATION TEST - VER 1.

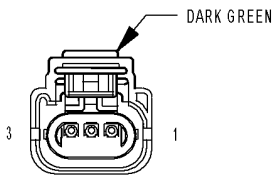


B1634-LEFT HI BEAM CONTROL CIRCUIT HIGH

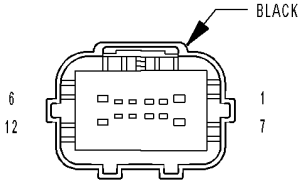




LAMP-HEADLAMP-LEFT



LAMP-HEADLAMP-RIGHT



MODULE-FRONT CONTROL C2

812c5291

B1634-LEFT HI BEAM CONTROL CIRCUIT HIGH (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Headlamps activated.
- **Set Condition:**
- When the FCM detects a HIGH condition.

Possible Causes
(L33) HIGH BEAM CONTROL CIRCUIT
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

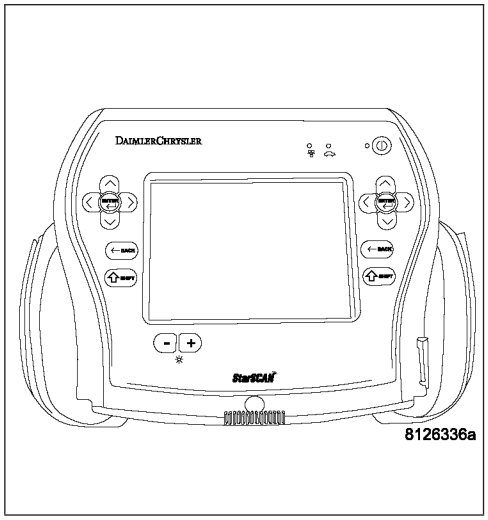
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Turn the Headlamps on.
With the Scan Tool read the DTC information.

Does the Scan Tool read: B1634-LEFT HI BEAM CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST - VER 1.



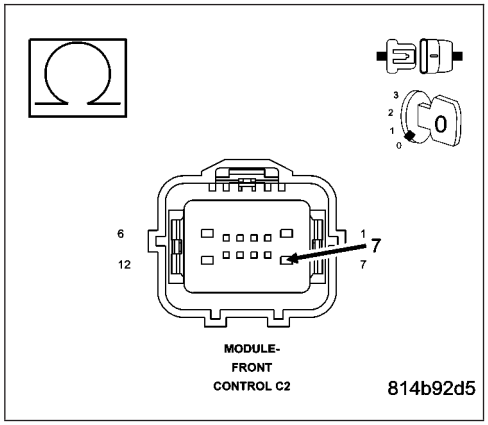
2. (L33) HIGH BEAM CONTROL CIRCUIT

Turn the ignition off.
Disconnect the FCM C2 harness connector.
Measure the resistance of the (L33) High Beam Control circuit.

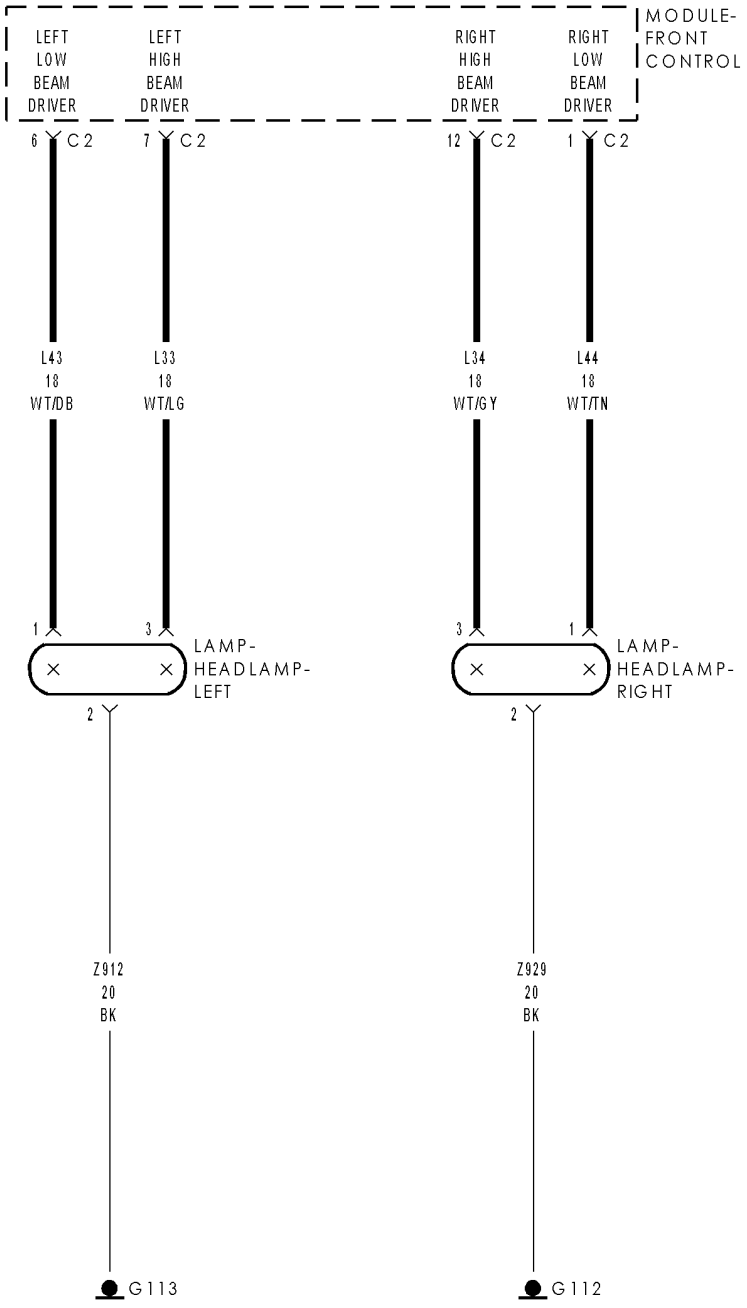
Is the resistance above 5.0 ohms?

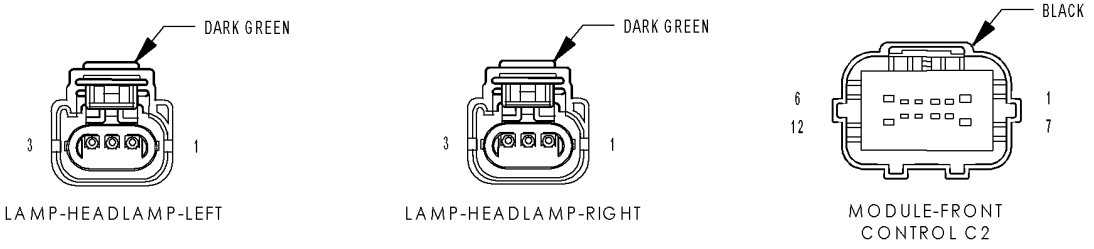
Yes >> Repair the (L33) High Beam Control circuit for a short to battery condition.
Perform the BODY VERIFICATION TEST - VER 1.

No >> Replace the Front Control Module (FCM) in accordance with the service information.
Perform the BODY VERIFICATION TEST - VER 1.



B1637-RIGHT HI BEAM CONTROL CIRCUIT LOW





812c5291

B1637-RIGHT HI BEAM CONTROL CIRCUIT LOW (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Highbeam Headlamps activated.
- **Set Condition:**
- When the FCM detects a High condition.

Possible Causes
(L34) RIGHT HIGHBEAM OUTPUT CIRCUIT
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, clear all FCM DTC's.

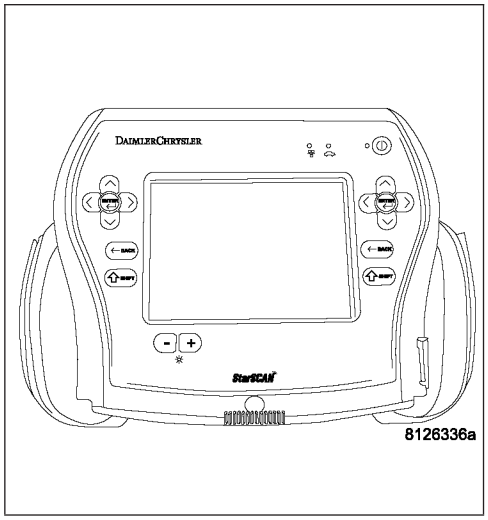
Turn the Highbeam Headlamps on.

With the Scan Tool read the DTC information.

Does the Scan Tool read: B1637-RIGHT HI BEAM CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST - VER 1.



2. (L34) RIGHT HIGHBEAM OUTPUT CIRCUIT

Turn the ignition off.

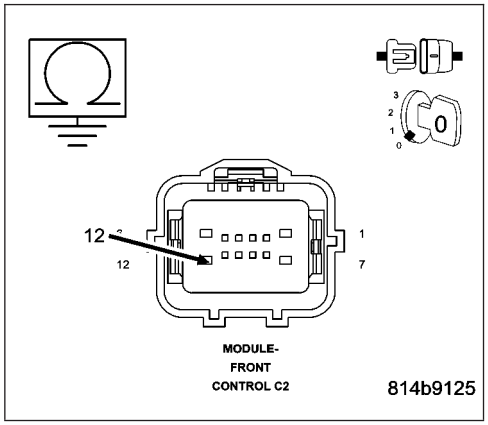
Disconnect the FCM C2 harness connector.

Measure the resistance between ground and the Right Highbeam Output circuit.

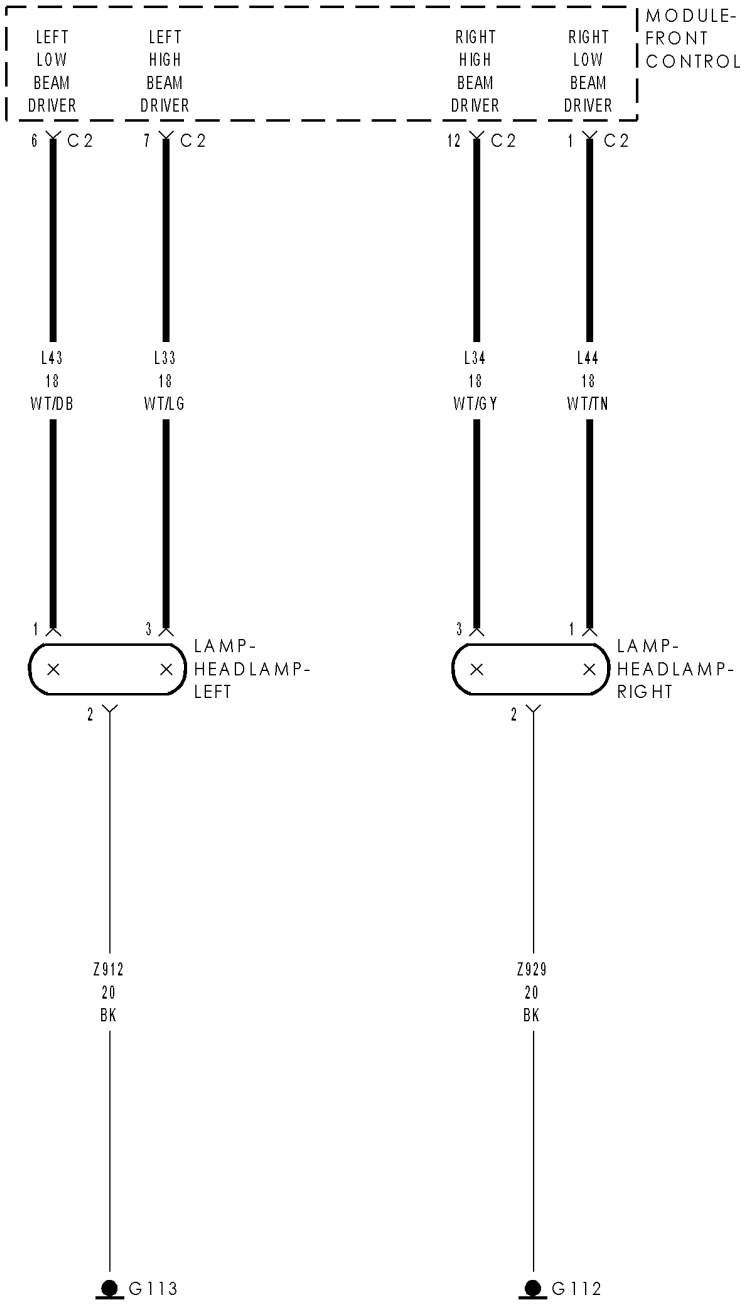
Is the resistance below 5.0 ohms?

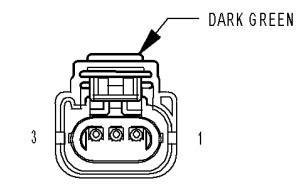
Yes >> Replace the Front Control Module (FCM) in accordance with the service information.
Perform the BODY VERIFICATION TEST - VER 1.

No >> Repair the (L34) Right Highbeam Output circuit for a short to ground condition.
Perform the BODY VERIFICATION TEST - VER 1.

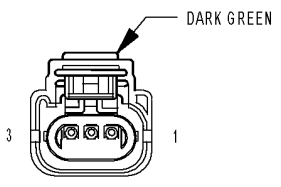


B1638-RIGHT HI BEAM CONTROL CIRCUIT HIGH

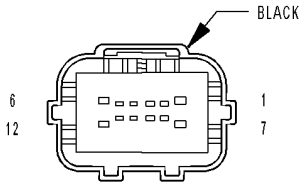




LAMP-HEADLAMP-LEFT



LAMP-HEADLAMP-RIGHT



MODULE-FRONT CONTROL C2

812c5291

B1638-RIGHT HI BEAM CONTROL CIRCUIT HIGH (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Headlamps activated.
- **Set Condition:**
- When the FCM detects a HIGH condition.

Possible Causes
(L34) HIGH BEAM CONTROL CIRCUIT
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

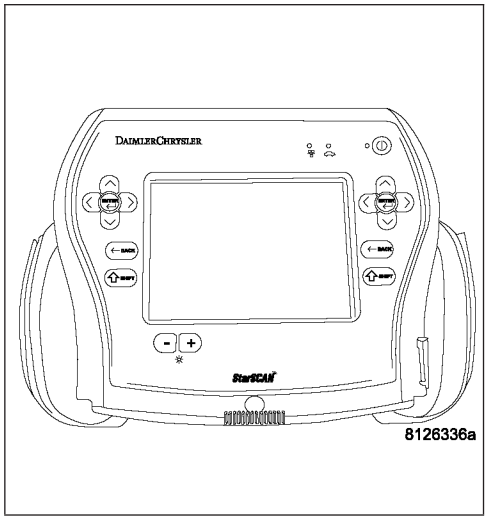
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Turn the Headlamps on.
With the Scan Tool read the DTC information.

Does the Scan Tool read: B1638-RIGHT HI BEAM CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST - VER 1.



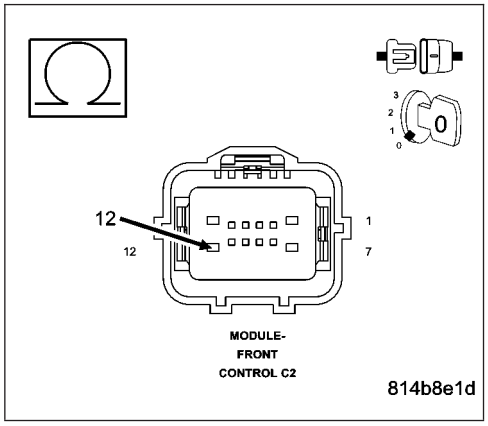
2. (L34) HIGH BEAM CONTROL CIRCUIT

Turn the ignition off.
Disconnect the FCM C2 harness connector.
Measure the resistance of the (L34) High Beam Control circuit.

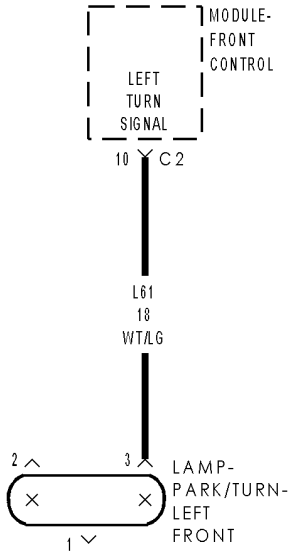
Is the resistance above 5.0 ohms?

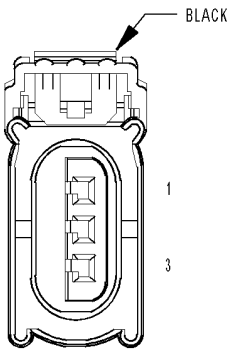
Yes >> Repair the (L34) High Beam Control circuit for a short to battery condition.
Perform the BODY VERIFICATION TEST - VER 1.

No >> Replace the Front Control Module (FCM) in accordance with the service information.
Perform the BODY VERIFICATION TEST - VER 1.

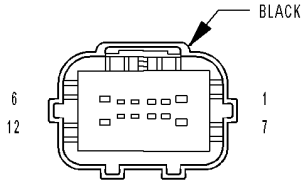


B163B-FRONT LEFT TURN CONTROL CIRCUIT LOW





LAMP-PARK/TURN-LEFT FRONT



MODULE-FRONT CONTROL C2

812d12ba

B163B-FRONT LEFT TURN CONTROL CIRCUIT LOW (CONTINUED)

For the Exterior Lighting circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

Possible Causes
(L61) FRONT LEFT TURN SIGNAL CONTROL CIRCUIT
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, clear all FCM DTC's.

Turn the Left Turn Signals on.

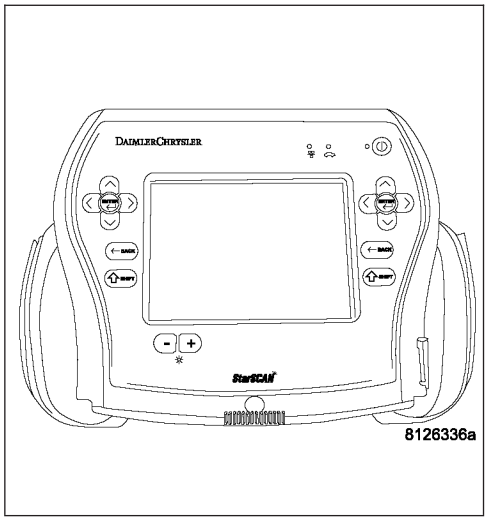
With the Scan Tool read the DTC information.

Does the Scan Tool read: B163B-FRONT LEFT TURN CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Perform the BODY VERIFICATION TEST - VER 1.



2. L61 FRONT LEFT TURN SIGNAL CONTROL CIRCUIT

Turn the ignition off.

Disconnect the FCM C2 connector.

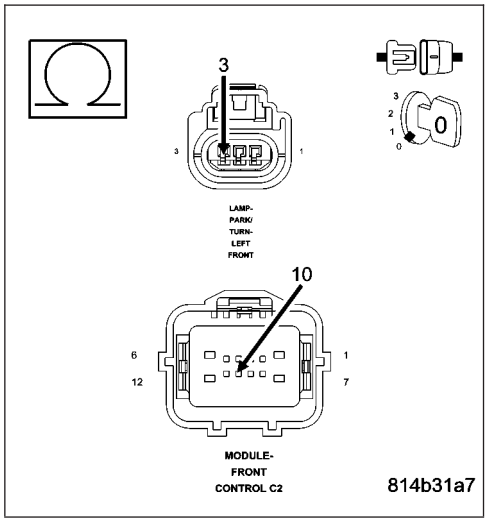
Measure the resistance between ground and the (L61) Front Left Turn Signal Control circuit.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the (L61) Front Left Turn Signal Control circuit for a short to ground.

Perform the BODY VERIFICATION TEST - VER 1.



B163B-FRONT LEFT TURN CONTROL CIRCUIT LOW (CONTINUED)

3. **FRONT CONTROL MODULE**

Turn the ignition off.

Disconnect the FCM C2 connector.

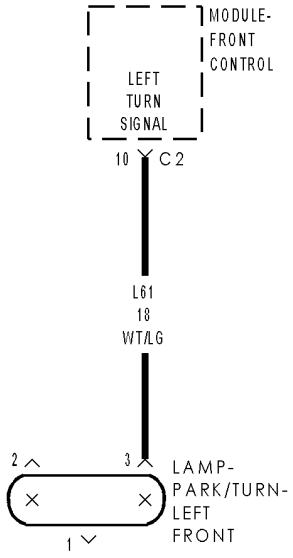
Measure the resistance between ground and the (L61) Front Left Turn Signal Control circuit in the FCM.

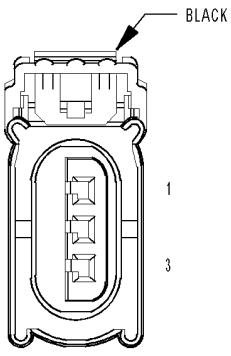
Is the resistance below 5.0 ohms?

Yes >> Replace the Power Distribution Center in accordance with the service information.
Perform the BODY VERIFICATION TEST - VER 1.

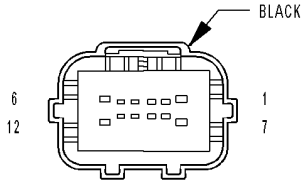
No >> Replace the Front Control Module in accordance with the service information.
Perform the BODY VERIFICATION TEST - VER 1.

B163C-FRONT LEFT TURN CONTROL CIRCUIT HIGH





LAMP-PARK/TURN-LEFT FRONT



MODULE-FRONT CONTROL C2

812d12ba

B163C-FRONT LEFT TURN CONTROL CIRCUIT HIGH (CONTINUED)

For the Exterior Lighting circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  When the Front Control Module detects a short to battery on the Control circuit.

Possible Causes
(L61) TURN SIGNAL CONTROL CIRCUIT
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Diagnostic Test

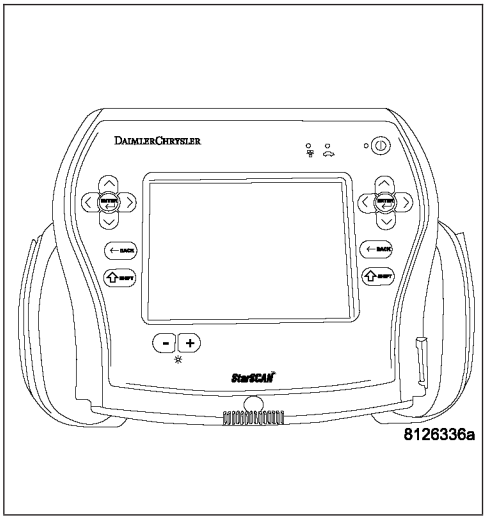
1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
Clear all FCM DTC's
Turn the Left Turn Signal on.
With the scan tool, read DTC's.

Does the scan tool read: B163C-FRONT LEFT TURN CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST - VER 1.



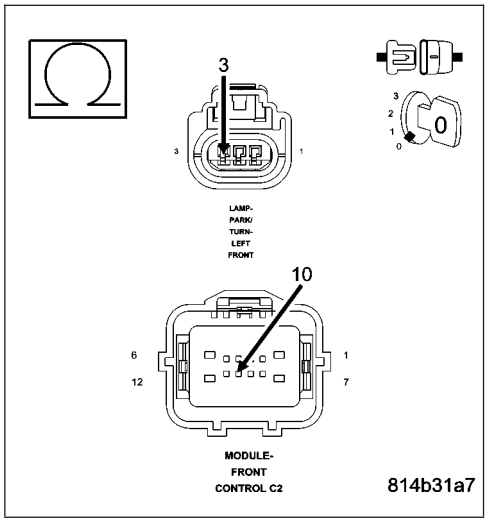
B163C-FRONT LEFT TURN CONTROL CIRCUIT HIGH (CONTINUED)

2. L61 LEFT TURN SIGNAL CONTROL CIRCUIT

Turn the ignition off.

Disconnect the FCM C2 connector.

Measure the resistance of the (L61) Front Left Turn Signal Control circuit.



Is the resistance above 5.0 ohms?

No >> Repair the (L61) Turn Signal Control circuit.
Perform BODY VERIFICATION TEST - VER 1.

Yes >> Go To 3

---

3. FRONT CONTROL MODULE

Turn the ignition off.

Disconnect the Front Control Module from the PDC 49-way connector.

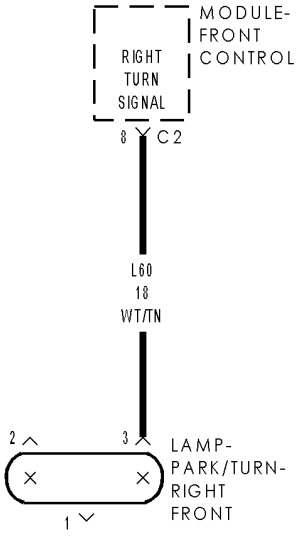
Measure the voltage between (L61) Front Left Turn Signal Control circuit and ground.

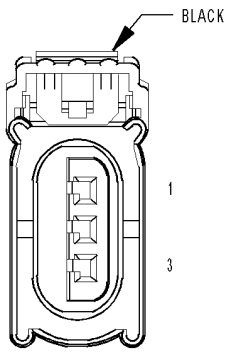
Is there any voltage present?

Yes >> Replace the Power Distribution Center in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1.

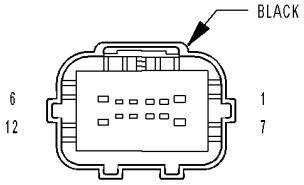
No >> Replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1.

B163F-FRONT RIGHT TURN CONTROL CIRCUIT LOW





LAMP-PARK/TURN-RIGHT
FRONT



MODULE-FRONT
CONTROL C2

812d1286

B163F-FRONT RIGHT TURN CONTROL CIRCUIT LOW (CONTINUED)

For the Exterior Lighting circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

Possible Causes
(L60) FRONT RIGHT TURN SIGNAL CONTROL CIRCUIT
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

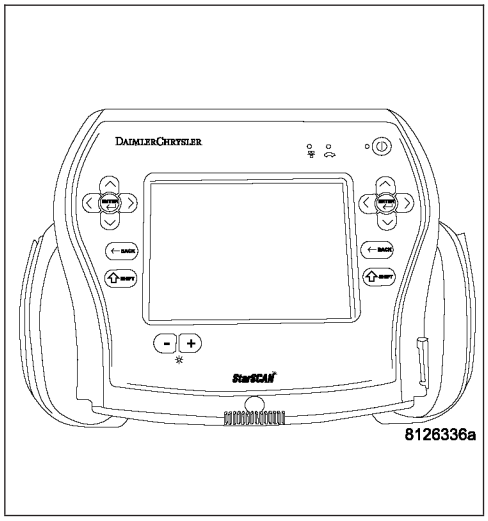
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Turn the Right Turn Signals on.
With the Scan Tool read the DTC information.

Does the Scan Tool read: B163F-FRONT RIGHT TURN CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST - VER 1.



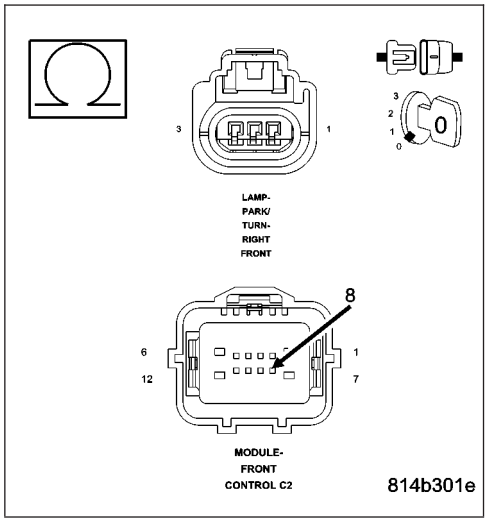
2. L60 FRONT RIGHT TURN SIGNAL CONTROL CIRCUIT

Turn the ignition off.
Disconnect the FCM C2 harness connector.
Measure the resistance between ground and the (L60) Front Turn Signal Control circuit.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the (L60) Front Right Turn Signal Control circuit for a short to ground.
Perform the BODY VERIFICATION TEST - VER 1.



B163F-FRONT RIGHT TURN CONTROL CIRCUIT LOW (CONTINUED)

3. FRONT CONTROL MODULE

Turn the ignition off.

Disconnect the FCM connector.

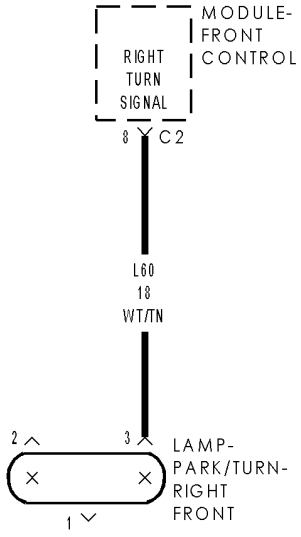
Measure the resistance between ground and the (L60) Front Right Turn Signal Control circuit in the FCM.

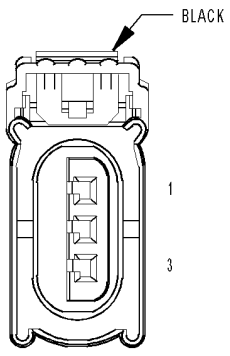
Is the resistance below 5.0 ohms?

Yes >> Replace the Power Distribution Center in accordance with the service information.
Perform the BODY VERIFICATION TEST - VER 1.

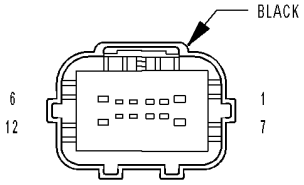
No >> Replace the Front Control Module in accordance with the service information.
Perform the BODY VERIFICATION TEST - VER 1.

B1640-FRONT RIGHT TURN CONTROL CIRCUIT HIGH





LAMP-PARK/TURN-RIGHT
FRONT



MODULE-FRONT
CONTROL C2

812d1286

B1640-FRONT RIGHT TURN CONTROL CIRCUIT HIGH (CONTINUED)

For the Exterior Lighting circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

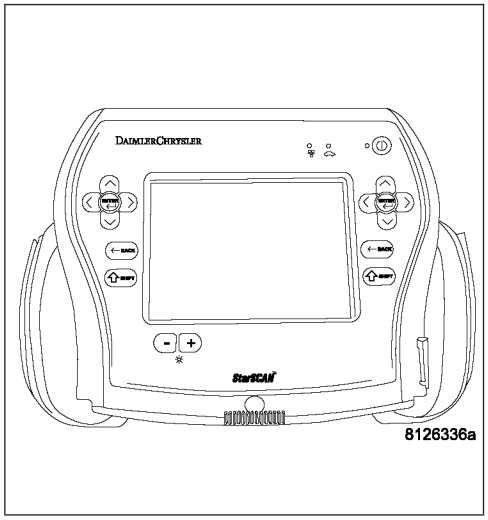
- **When Monitored:**
  Continuously
- **Set Condition:**
  When the Front Control Module detects a short to battery on the Control circuit.

Possible Causes
(L60) TURN SIGNAL CONTROL CIRCUIT
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
Clear all FCM DTC's
Turn the Right Turn Signal on.
With the scan tool, read DTC's.



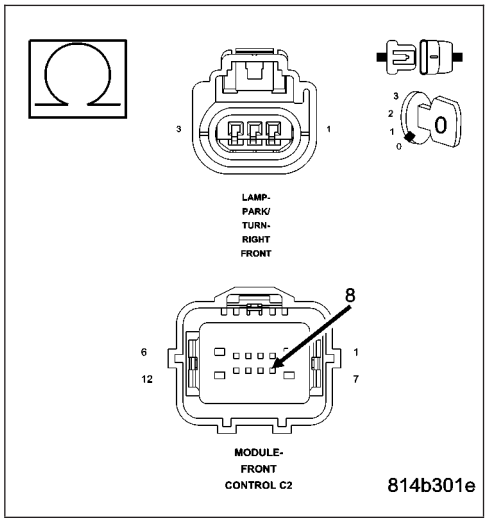
Does the scan tool read: B1640-FRONT RIGHT TURN CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST - VER 1.

2. L60 RIGHT TURN SIGNAL CONTROL CIRCUIT

Turn the ignition off.
Disconnect the PDC connector from the FCM.
Measure the resistance of the (L60) Front Right Turn Signal Control circuit.



Is the resistance above 5.0 ohms?

No >> Repair the (L60) Turn Signal Control circuit.
Perform BODY VERIFICATION TEST - VER 1.

Yes >> Go To 3

B1640-FRONT RIGHT TURN CONTROL CIRCUIT HIGH (CONTINUED)

3. FRONT CONTROL MODULE

Turn the ignition off.

Disconnect the Front Control Module from the PDC 49 way connector.

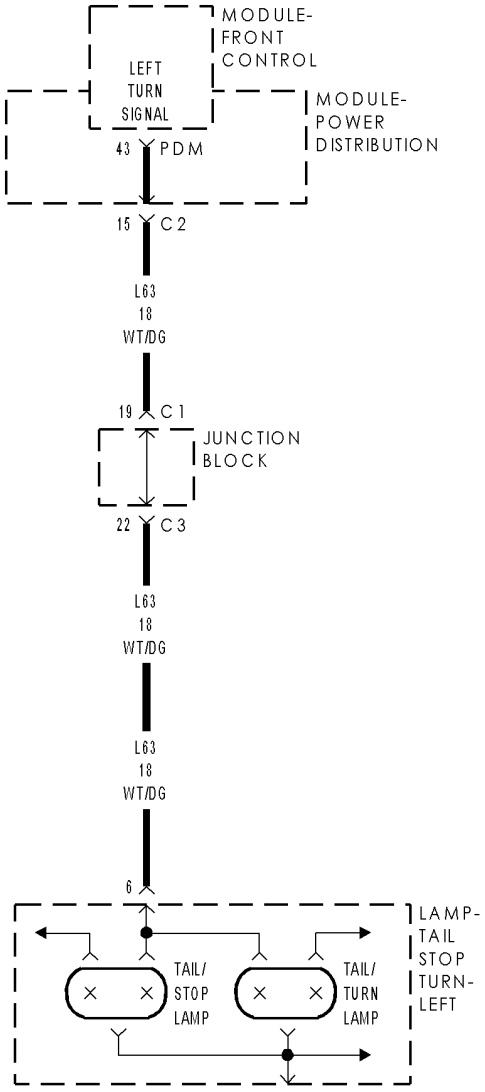
Measure the voltage between (L60) Front Right Turn Signal Control circuit and ground.

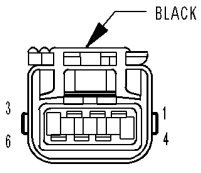
Is there any voltage present?

Yes >> Replace the Power Distribution Center.
Perform BODY VERIFICATION TEST - VER 1.

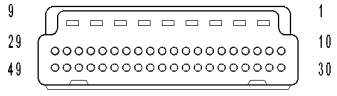
No >> Replace the Front Control Module.
Perform BODY VERIFICATION TEST - VER 1.

B1643-REAR LEFT TURN CONTROL CIRCUIT LOW





LAMP-TAIL
STOP
TURN-LEFT



MODULE-
FRONT
CONTROL
PDM

812d117b

B1643-REAR LEFT TURN CONTROL CIRCUIT LOW (CONTINUED)

For the Exterior Lighting circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

Possible Causes
(L63) REAR LEFT TURN SIGNAL CONTROL CIRCUIT
MODULE POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, clear all FCM DTC's.

Turn the Left Turn Signals on.

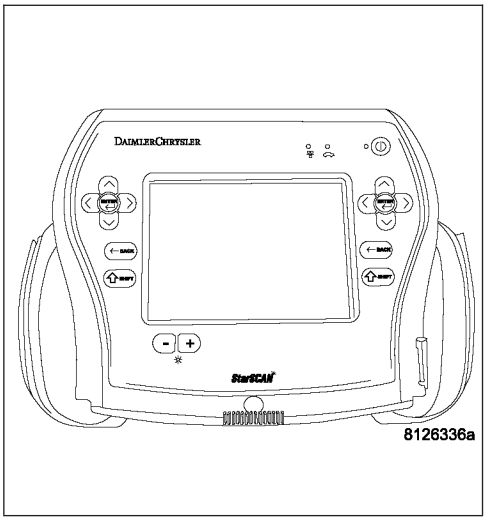
With the Scan Tool read the DTC information.

Does the Scan Tool read: B1643-REAR LEFT TURN CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Perform the BODY VERIFICATION TEST-VER1.



2. L63 LEFT TURN SIGNAL CONTROL CIRCUIT

Turn the ignition off.

Disconnect the FCM PDM connector.

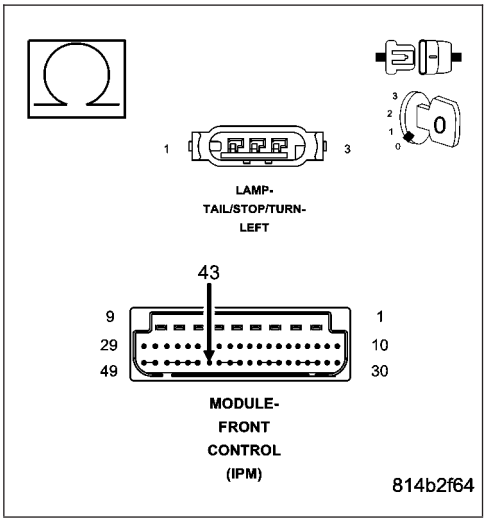
Measure the resistance between ground and the (L63) Rear Left Turn Signal Control circuit.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the (L63) Rear Left Turn Signal Control circuit for a short to ground.

Perform the BODY VERIFICATION TEST-VER1.



B1643-REAR LEFT TURN CONTROL CIRCUIT LOW (CONTINUED)

3. **FRONT CONTROL MODULE**

Turn the ignition off.

Disconnect the FCM connector.

Disconnect the PDM connector.

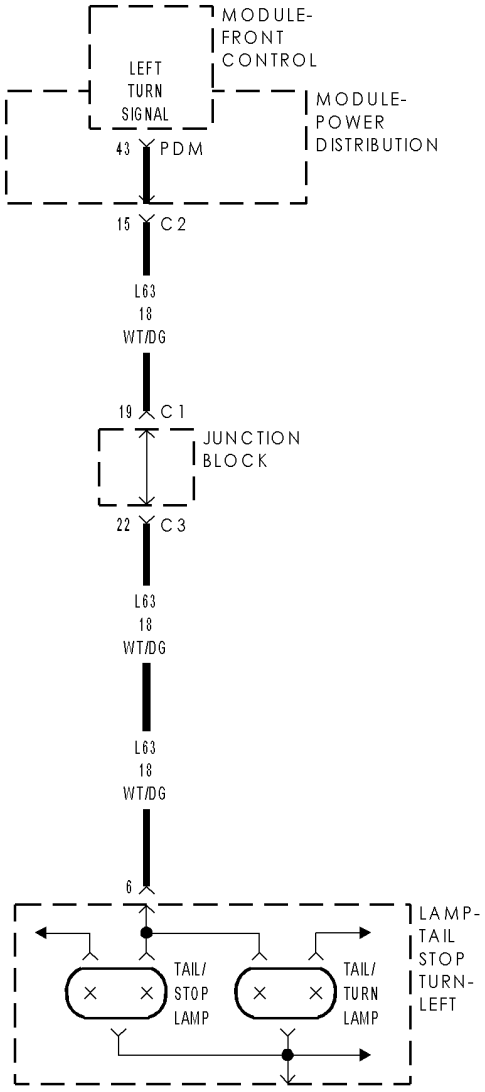
Measure the resistance between ground and the (L63) Left Turn Signal Control circuit in the PDM.

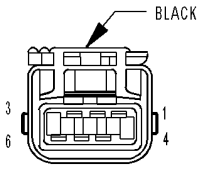
Is the resistance below 5.0 ohms?

Yes >> Replace the Module Power Distribution Center in accordance with the service information. Perform the BODY VERIFICATION TEST-VER1.

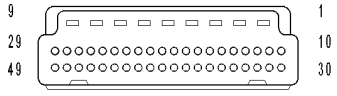
No >> Replace the Front Control Module in accordance with the service information. Perform the BODY VERIFICATION TEST-VER1.

B1644-REAR LEFT TURN CONTROL CIRCUIT HIGH





LAMP-TAIL
STOP
TURN-LEFT



MODULE-
FRONT
CONTROL
PDM

812d117b

B1644-REAR LEFT TURN CONTROL CIRCUIT HIGH (CONTINUED)

For the Exterior Lighting System circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  When the Front Control Module detects a short to battery on the Control circuit.

Possible Causes
(L63) TURN SIGNAL CONTROL CIRCUIT
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Diagnostic Test

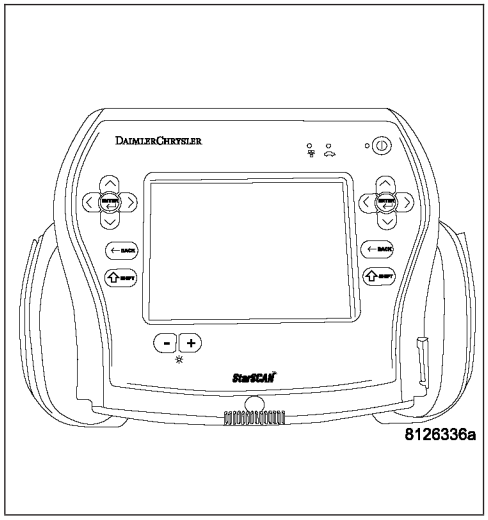
1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
Clear all FCM DTC's
Turn the Left Turn Signal on.
With the scan tool, read DTC's.

Does the scan tool read: B1644-REAR LEFT TURN CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST - VER 1.



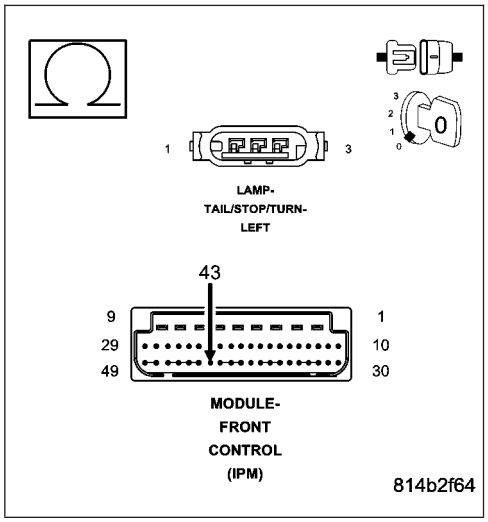
2. L63 LEFT TURN SIGNAL CONTROL CIRCUIT

Turn the ignition off.
Disconnect the PDM connector from the FCM.
Measure the resistance of the (L63) Left Rear Turn Signal Control circuit.

Is the resistance above 5.0 ohms?

No >> Repair the (L63) Turn Signal Control circuit.
Perform BODY VERIFICATION TEST - VER 1.

Yes >> Go To 3



B1644-REAR LEFT TURN CONTROL CIRCUIT HIGH (CONTINUED)

3. FRONT CONTROL MODULE

Turn the ignition off.

Disconnect the Front Control Module from the PDM 49 way connector.

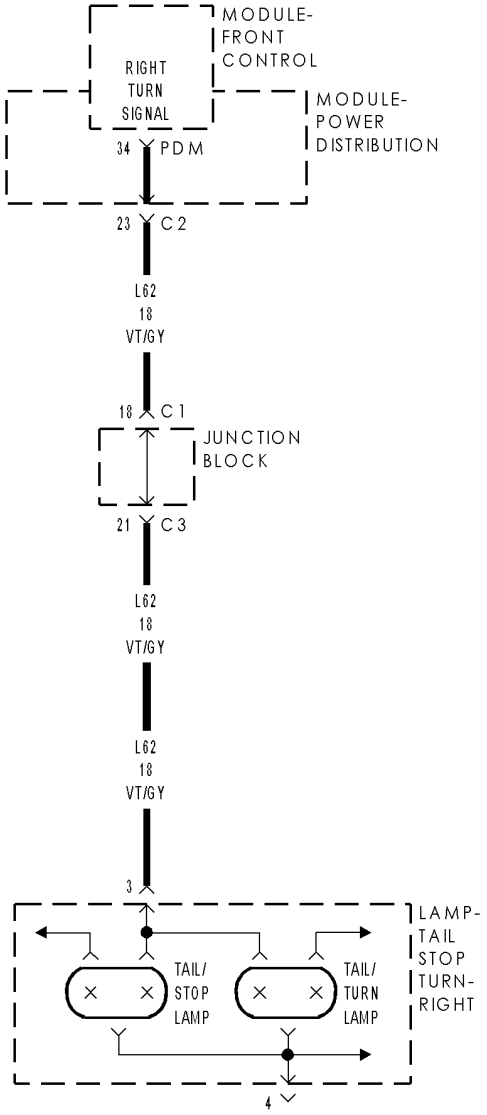
Measure the voltage between (L63) Left Rear Turn Signal Control circuit and ground.

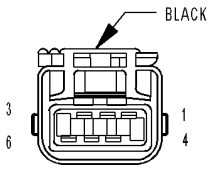
Is there any voltage present?

Yes >> Replace the Power Distribution Center.
Perform BODY VERIFICATION TEST - VER 1.

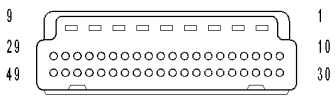
No >> Replace the Front Control Module.
Perform BODY VERIFICATION TEST - VER 1.

B1647-REAR RIGHT TURN CONTROL CIRCUIT LOW





LAMP-TAIL
STOP
TURN-RIGHT



MODULE-
FRONT
CONTROL
PDM

812d10bb

B1647-REAR RIGHT TURN CONTROL CIRCUIT LOW (CONTINUED)

For the Exterior Lighting circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

Possible Causes
(L62) REAR RIGHT TURN SIGNAL CONTROL CIRCUIT
MODULE POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

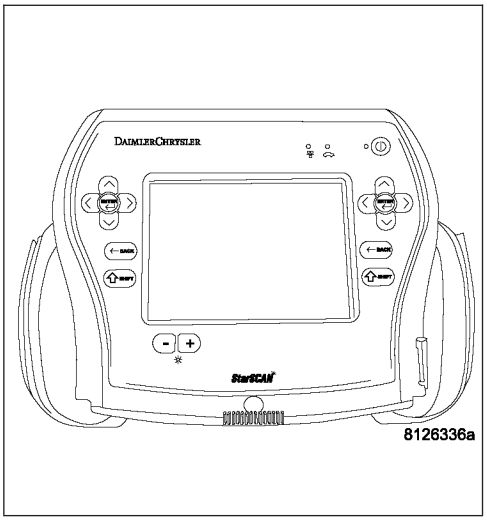
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Turn the Right Turn Signals on.
With the Scan Tool read the DTC information.

Does the Scan Tool read: B1647-REAR RIGHT TURN CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST-VER1.



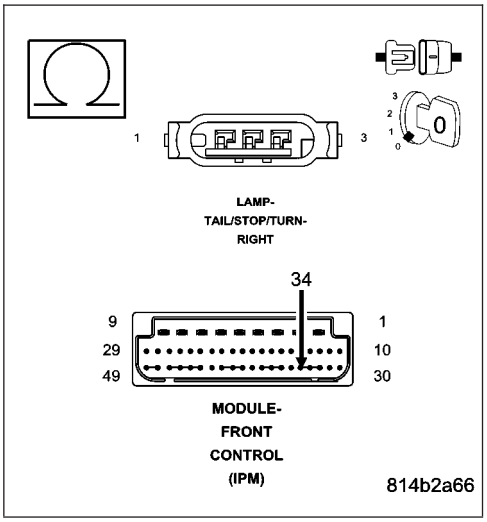
2. L62 RIGHT TURN SIGNAL CONTROL CIRCUIT

Turn the ignition off.
Disconnect the FCM PDM connector.
Measure the resistance between ground and the (L62) Rear Turn Signal Control circuit.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the (L62) Rear Right Turn Signal Control circuit for a short to ground.
Perform the BODY VERIFICATION TEST-VER1.



B1647-REAR RIGHT TURN CONTROL CIRCUIT LOW (CONTINUED)

3. FRONT CONTROL MODULE

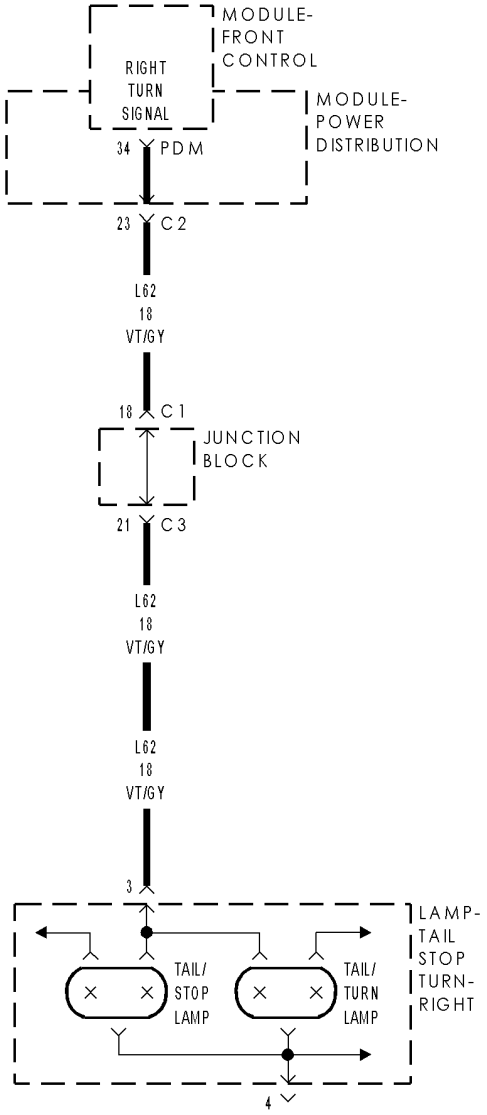
Turn the ignition off.
Disconnect the FCM connector.
Disconnect the PDM connector.
Measure the resistance between ground and the (L62) Right Turn Signal Control circuit in the PDM.

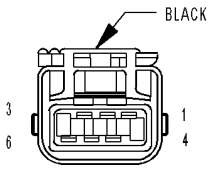
Is the resistance below 5.0 ohms?

Yes >> Replace the Module Power Distribution Center in accordance with the service information. Perform the BODY VERIFICATION TEST-VER1.

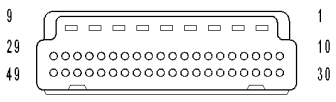
No >> Replace the Front Control Module in accordance with the service information. Perform the BODY VERIFICATION TEST-VER1.

B1648-REAR RIGHT TURN CONTROL CIRCUIT HIGH





LAMP-TAIL
STOP
TURN-RIGHT



MODULE-
FRONT
CONTROL
PDM

812d10bb

B1648-REAR RIGHT TURN CONTROL CIRCUIT HIGH (CONTINUED)

For the Exterior Lighting System circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  When the Front Control Module detects a short to battery on the Control circuit.

Possible Causes
(L62) TURN SIGNAL CONTROL CIRCUIT
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Diagnostic Test

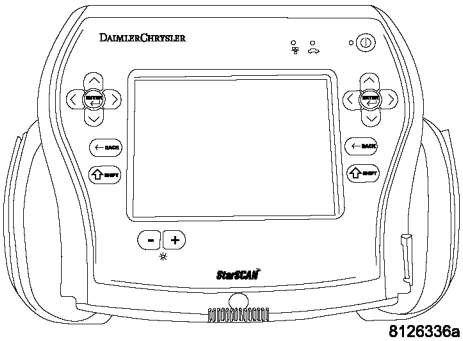
1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
Clear all FCM DTC's
Turn the Right Turn Signal on.
With the scan tool, read DTC's.

Does the scan tool read: B1648-REAR RIGHT TURN CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST - VER 1.



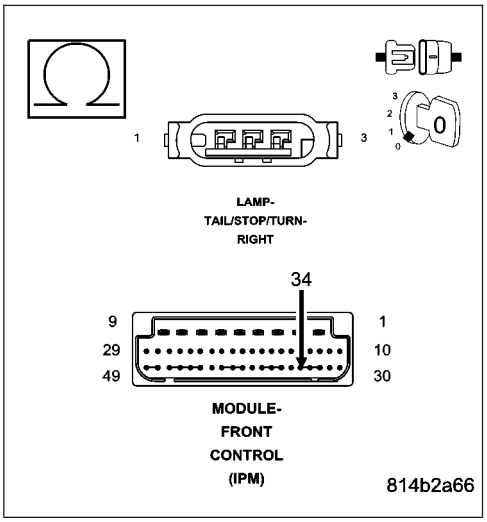
2. L62 RIGHT TURN SIGNAL CONTROL CIRCUIT

Turn the ignition off.
Disconnect the PDM connector from the FCM.
Measure the resistance of the (L62) Right Rear Turn Signal Control circuit.

Is the resistance above 5.0 ohms?

No >> Repair the (L62) Turn Signal Control circuit.
Perform BODY VERIFICATION TEST - VER 1.

Yes >> Go To 3



B1648-REAR RIGHT TURN CONTROL CIRCUIT HIGH (CONTINUED)

3. FRONT CONTROL MODULE

Turn the ignition off.

Disconnect the Front Control Module from the PDM 49 way connector.

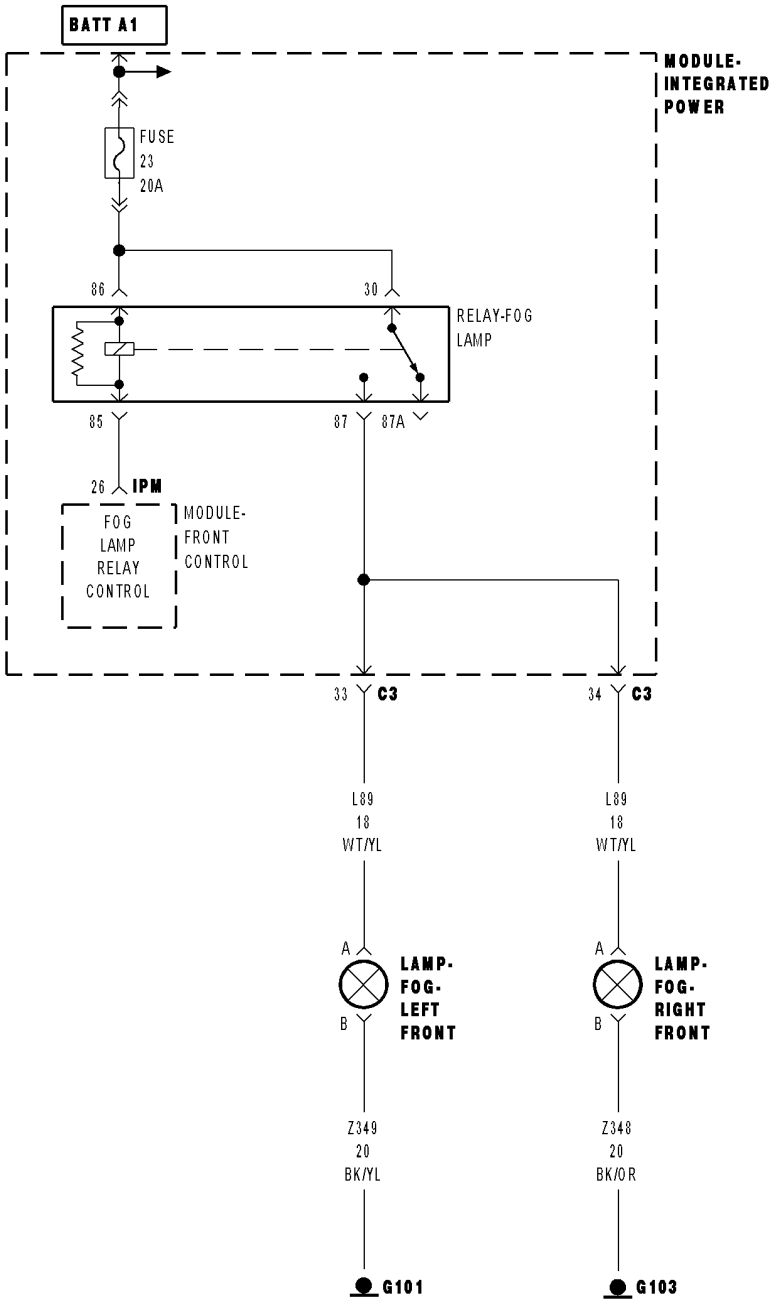
Measure the voltage between (L62) Right Rear Turn Signal Control circuit and ground.

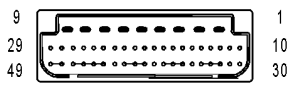
Is there any voltage present?

Yes >> Replace the Power Distribution Center.
Perform BODY VERIFICATION TEST - VER 1.

No >> Replace the Front Control Module.
Perform BODY VERIFICATION TEST - VER 1.

B1659-FRONT FOG LAMP CONTROL CIRCUIT LOW





MODULE-
FRONT
CONTROL
(IPM)

814b2389

B1659-FRONT FOG LAMP CONTROL CIRCUIT LOW (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Fog Lamps activated.
- **Set Condition:**
- When the FCM detects a LOW condition.

Possible Causes
(L139) FOG LAMP CONTROL CIRCUIT
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

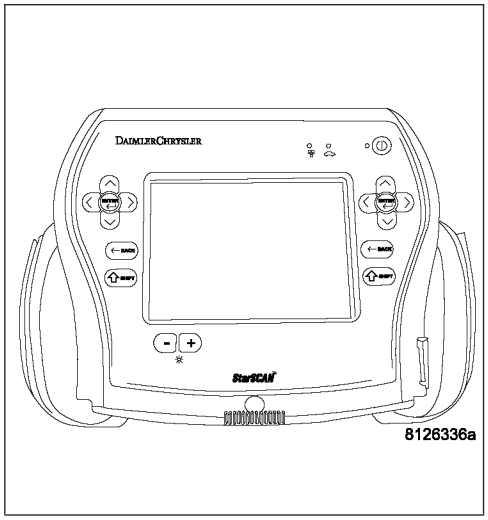
1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, clear all FCM DTC's.

Turn the Fog Lamps on.

With the Scan Tool read the DTC information.



Does the Scan Tool read: B1659-FRONT FOG LAMP CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

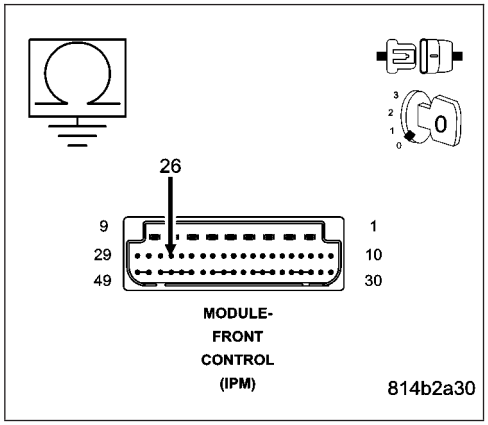
Perform the BODY VERIFICATION TEST-VER1.

2. (L139) FOG LAMP CONTROL CIRCUIT

Turn the ignition off.

Disconnect the FCM PDM harness connector.

Measure the resistance between ground and the (L139) Fog Lamp Control circuit.



Is the resistance below 5.0 ohms?

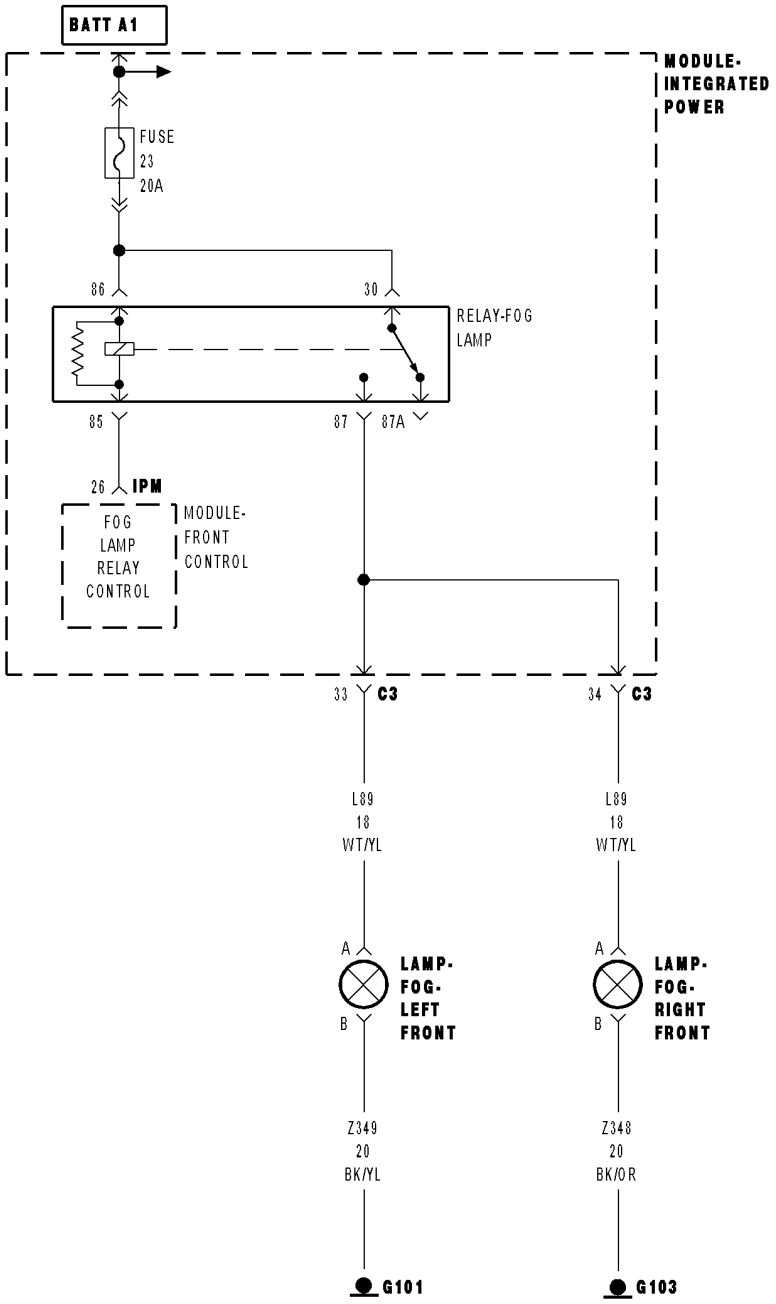
Yes >> Replace the Front Control Module (FCM) in accordance with the service information.

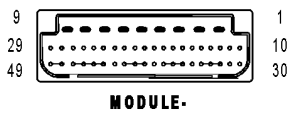
Perform the BODY VERIFICATION TEST VER1.

No >> Repair the (L139) Fog Lamp Control circuit for a short to ground condition.

Perform the BODY VERIFICATION TEST VER1.

B1660-FRONT FOG LAMP CONTROL CIRCUIT HIGH





MODULE-
FRONT
CONTROL
(IPM)

814b2389

B1660-FRONT FOG LAMP CONTROL CIRCUIT HIGH (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Front Fog Lamps activated.
- **Set Condition:**
- When the FCM detects a HIGH condition.

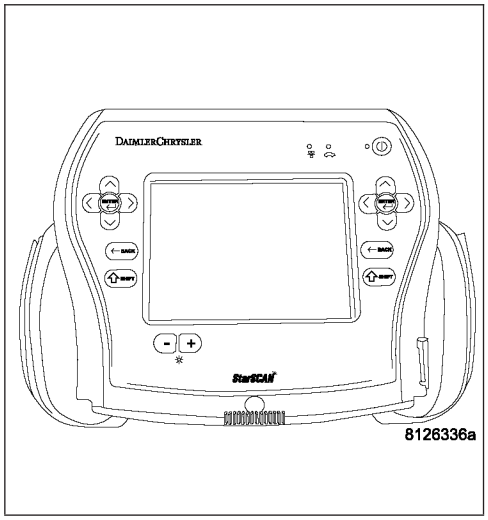
Possible Causes
FRONT FOG LAMP RELAY
MODULE-POWER DISTRIBUTION
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Actuate the Front Fog Lamps.
With the Scan Tool read the DTC information.



Does the Scan Tool read: B1660-FRONT FOG LAMP CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST-VER1.

---

2. FRONT FOG LAMP RELAY

Turn the ignition off.
Remove and install a known good relay in place of the Front Fog Lamp Relay.

Do the Front Fog Lamps operate normally?

Yes >> Replace the Front Fog Lamp Relay in accordance with the service information.
Perform the BODY VERIFICATION TEST VER1.

No >> Go To 3

B1660-FRONT FOG LAMP CONTROL CIRCUIT HIGH (CONTINUED)

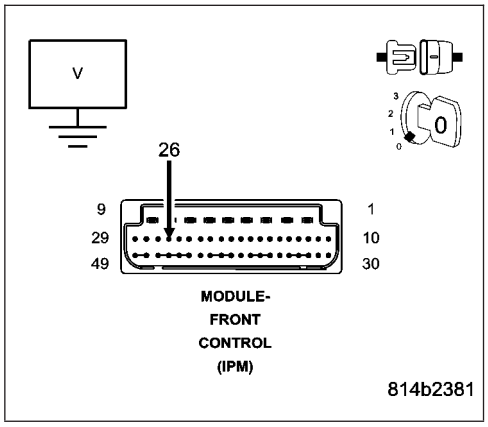
3. FRONT CONTROL MODULE

Turn the ignition off.

Remove the Front Fog Lamp Relay from the MPD.

Remove the FCM from the Module Power Distribution.

Measure the voltage of the (L139) Front Fog Lamp Relay Output circuit and ground.

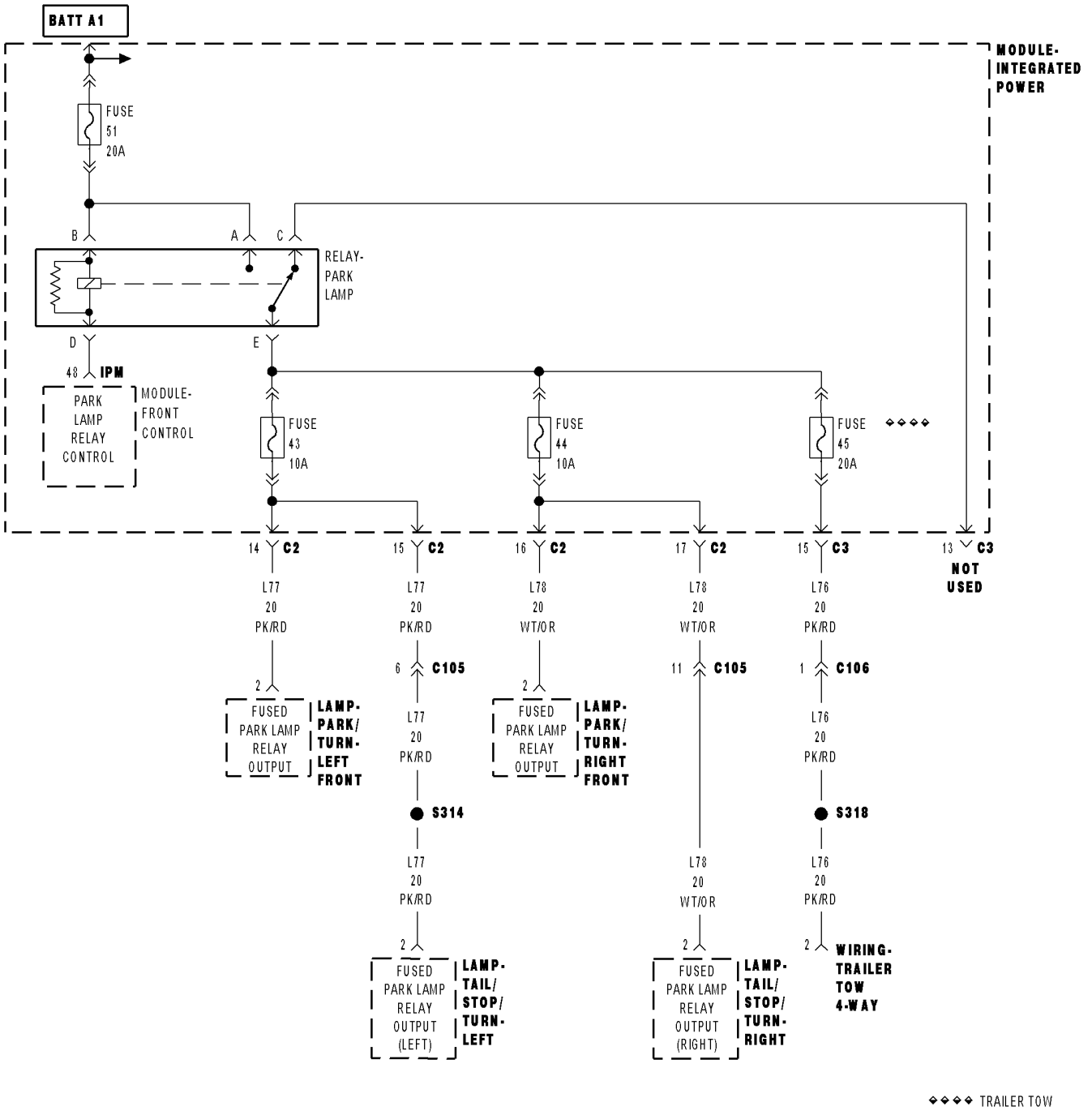


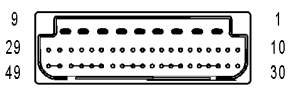
Is the voltage above 1.0 volts?

Yes >> Replace the Module Power Distribution center in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER1.

No >> Replace the Module Front Control in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER1.

B165C-PARK LAMP CONTROL CIRCUIT LOW





814b1053

B165C-PARK LAMP CONTROL CIRCUIT LOW (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Park Lamps activated.
- **Set Condition:**
- When the FCM detects a LOW condition.

Possible Causes
(L779) PARK LAMP CONTROL CIRCUIT
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

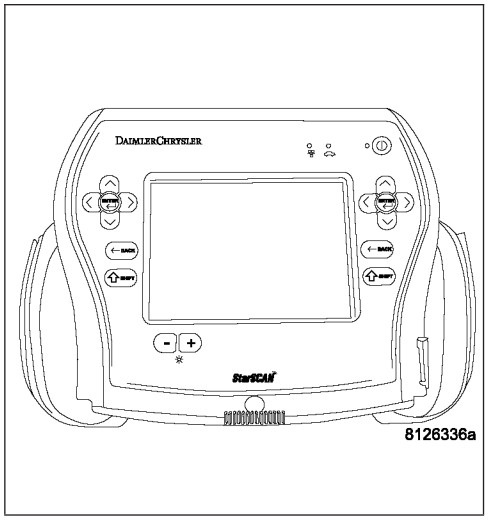
1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, clear all FCM DTC's.

Turn the Park Lamps on.

With the Scan Tool read the DTC information.



Does the Scan Tool read: B165C-PARK LAMP CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

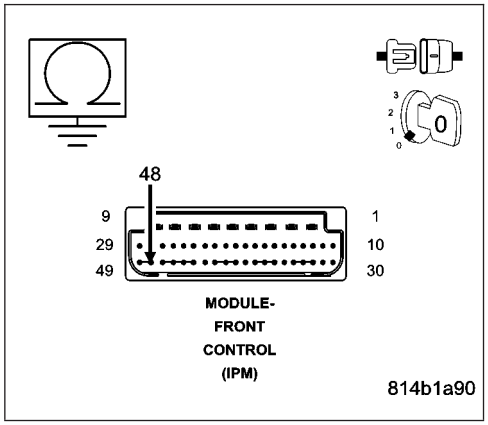
Perform the BODY VERIFICATION TEST-VER1.

2. (L779) PARK LAMP CONTROL CIRCUIT

Turn the ignition off.

Disconnect the FCM PDM harness connector.

Measure the resistance between ground and the (L779) Park Lamp Control circuit.



Is the resistance below 5.0 ohms?

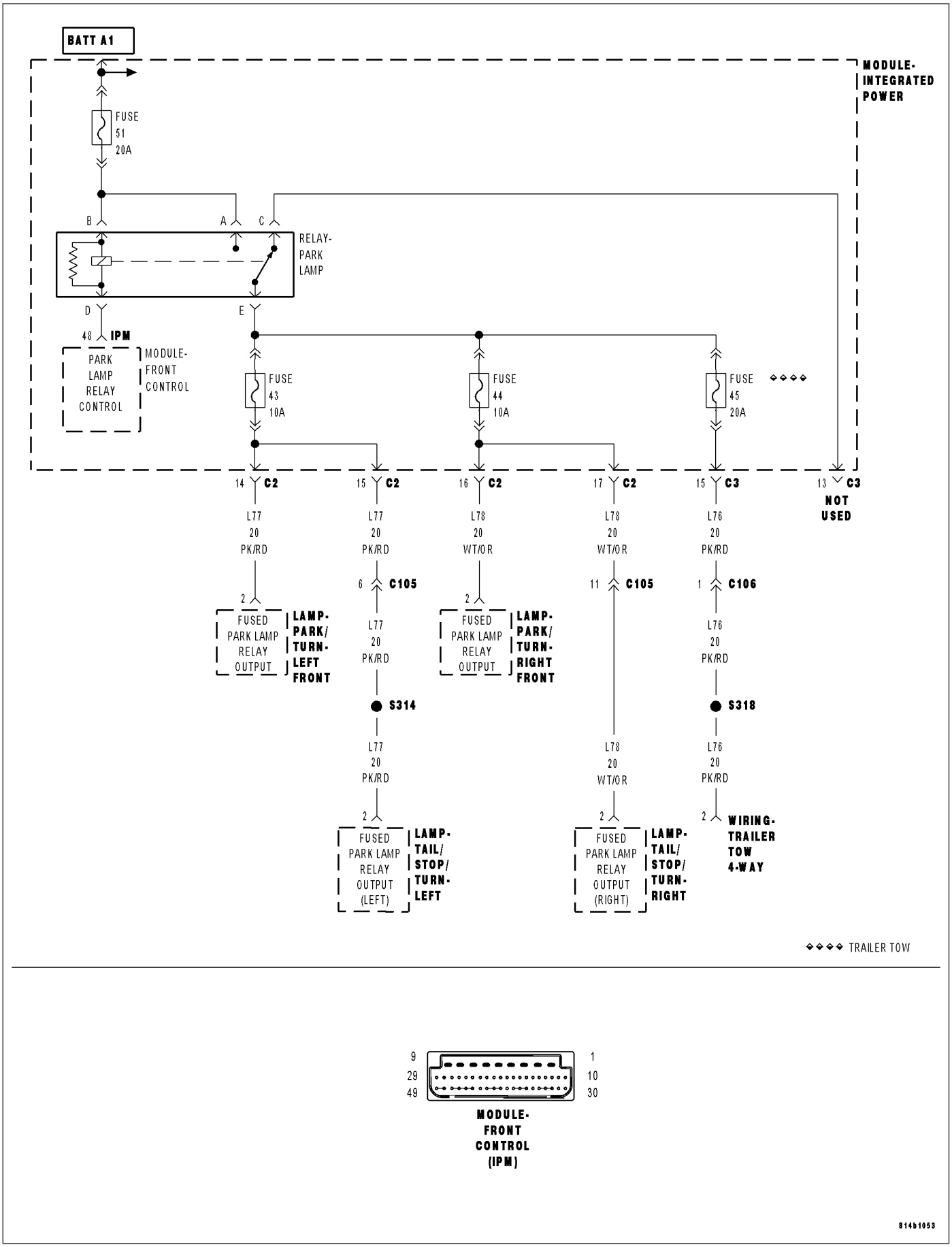
Yes >> Replace the Front Control Module (FCM) in accordance with the service information.

Perform the BODY VERIFICATION TEST VER1.

No >> Repair the (L779) Park Lamp Control circuit for a short to ground condition.

Perform the BODY VERIFICATION TEST VER1.

B165D-PARK LAMP CONTROL CIRCUIT HIGH



B165D-PARK LAMP CONTROL CIRCUIT HIGH (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Front Fog Lamps activated.
- **Set Condition:**
- When the FCM detects a HIGH condition.

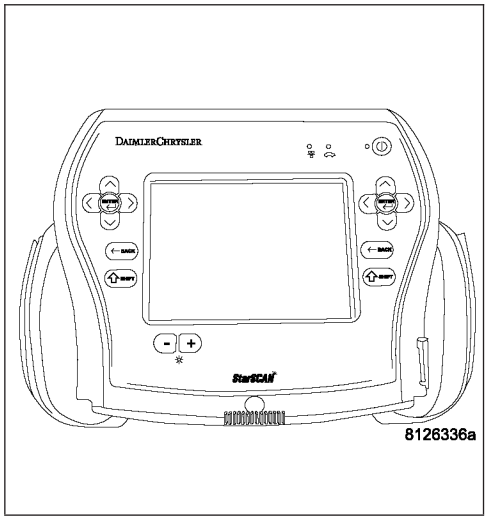
Possible Causes
PARK LAMP RELAY
MODULE-POWER DISTRIBUTION
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Actuate the Park Lamps.
With the Scan Tool read the DTC information.



Does the Scan Tool read: B165D-PARK LAMP CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST-VER1.

---

2. PARK LAMP RELAY

Turn the ignition off.
Remove and install a known good relay in place of the Park Lamp Relay.

Do the Front Fog Lamps operate normally?

Yes >> Replace the Park Lamp Relay in accordance with the service information.
Perform the BODY VERIFICATION TEST VER1.

No >> Go To 3

B165D-PARK LAMP CONTROL CIRCUIT HIGH (CONTINUED)

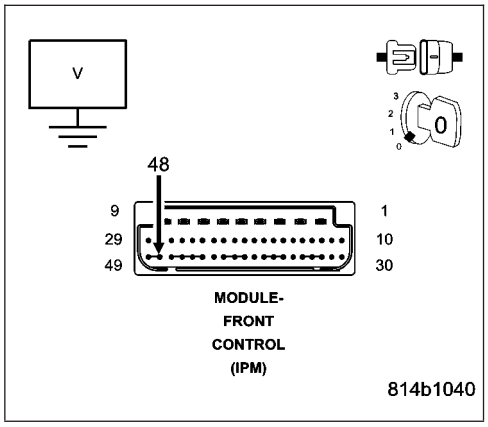
3. FRONT CONTROL MODULE

Turn the ignition off.

Remove the Park Lamp Relay from the MPD.

Remove the FCM from the Module Power Distribution.

Measure the voltage of the (L779) Park Lamp Relay Output circuit and ground.

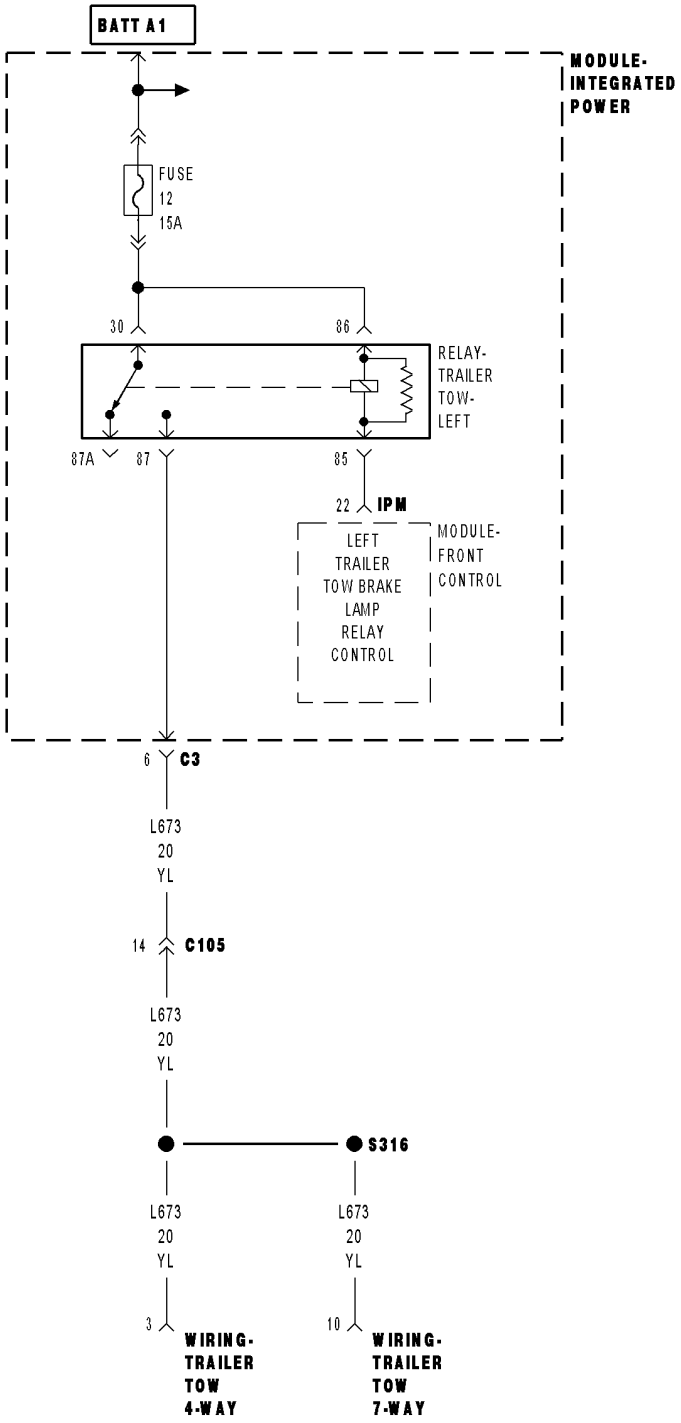


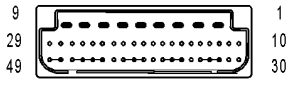
Is the voltage above 1.0 volts?

Yes >> Replace the Module Power Distribution center in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER1.

No >> Replace the Module Front Control in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER1.

B166B-LEFT TRAILER TOW LAMP CONTROL CIRCUIT LOW





MODULE-
FRONT
CONTROL
(IPM)

814afdb6

B166B-LEFT TRAILER TOW LAMP CONTROL CIRCUIT LOW (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Trailer Tow Lamps activated.
- **Set Condition:**
- When the FCM detects a LOW condition.

Possible Causes
(L655) TRAILER TOW CONTROL CIRCUIT
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

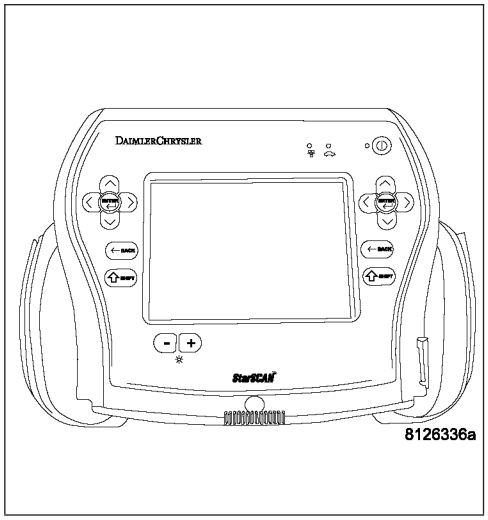
1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, clear all FCM DTC's.

Turn the Trailer Tow Lamps on.

With the Scan Tool read the DTC information.



Does the Scan Tool read: B166B-LEFT TRAILER TOW LAMP CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

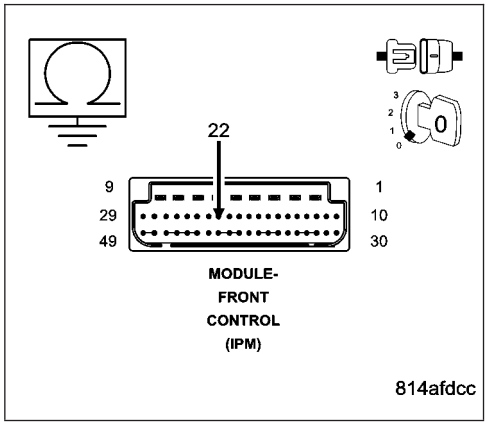
Perform the BODY VERIFICATION TEST-VER1.

2. (L655) TRAILER TOW CONTROL CIRCUIT

Turn the ignition off.

Disconnect the FCM PDM harness connector.

Measure the resistance between ground and the (L655) Left Trailer Tow Control circuit.



Is the resistance below 5.0 ohms?

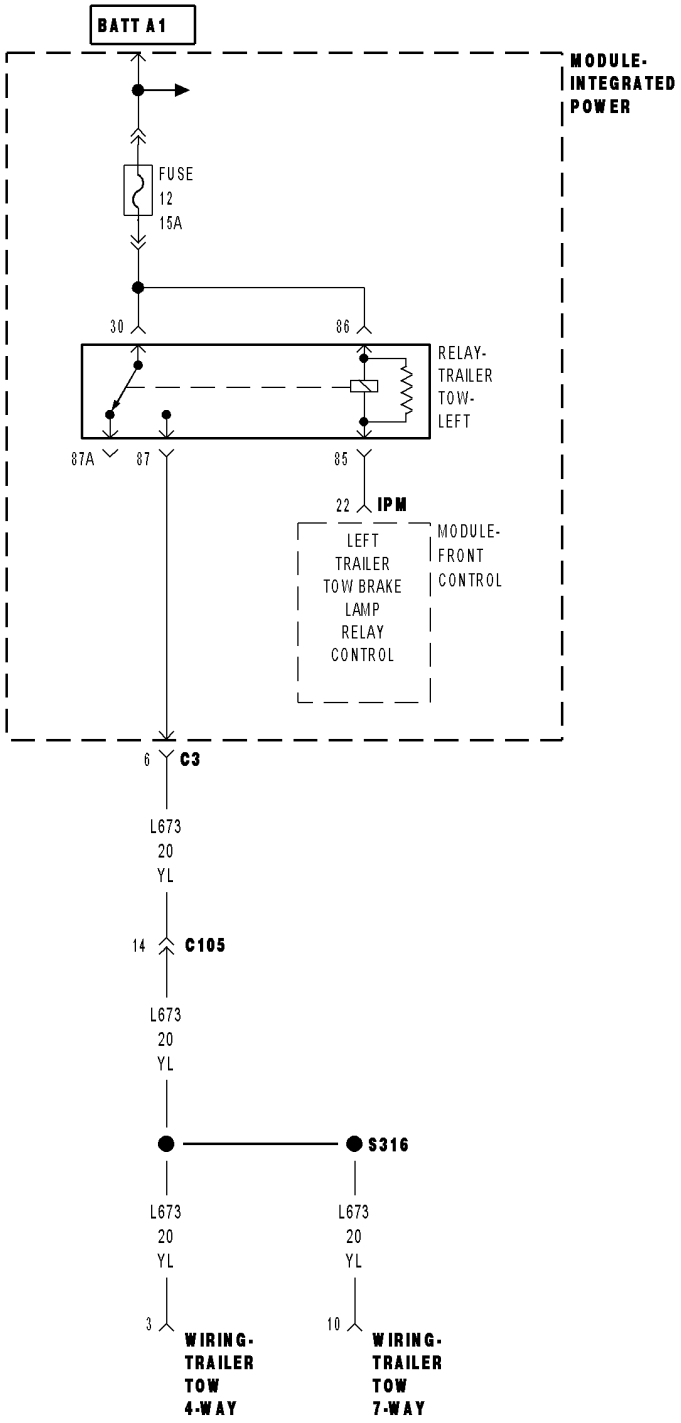
Yes >> Replace the Front Control Module (FCM) in accordance with the service information.

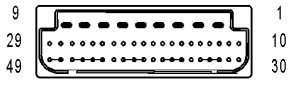
Perform the BODY VERIFICATION TEST VER1.

No >> Repair the (L655) Left Trailer Tow Control circuit for a short to ground condition.

Perform the BODY VERIFICATION TEST VER1.

B166C-LEFT TRAILER TOW LAMP CONTROL CIRCUIT HIGH





MODULE-
FRONT
CONTROL
(IPM)

814afdb6

B166C-LEFT TRAILER TOW LAMP CONTROL CIRCUIT HIGH (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Trailer Tow Lamps activated.
- **Set Condition:**
- When the FCM detects a LOW condition.

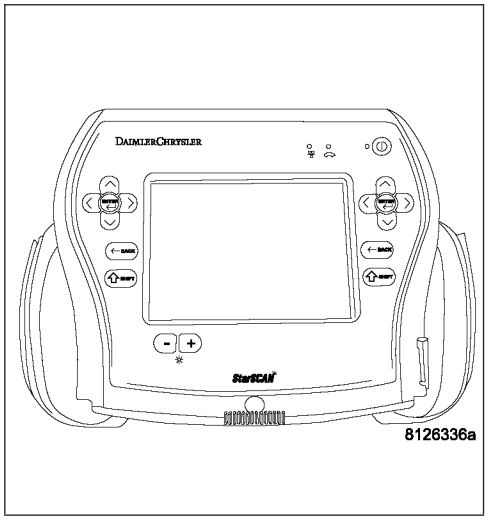
Possible Causes
LEFT TRAILER TOW RELAY
MODULE-POWER DISTRIBUTION
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Actuate the Trailer Tow Lamps.
With the Scan Tool read the DTC information.



Does the Scan Tool read: B166C-LEFT TRAILER TOW LAMP CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST-VER1.

---

2. LEFT TRAILER TOW RELAY

Turn the ignition off.
Remove and install a known good relay in place of the Left Trailer Tow Relay.

Do the Trailer Tow Lamps operate normally?

Yes >> Replace the Left Trailer Tow Relay in accordance with the service information.
Perform the BODY VERIFICATION TEST VER1.

No >> Go To 3

B166C-LEFT TRAILER TOW LAMP CONTROL CIRCUIT HIGH (CONTINUED)

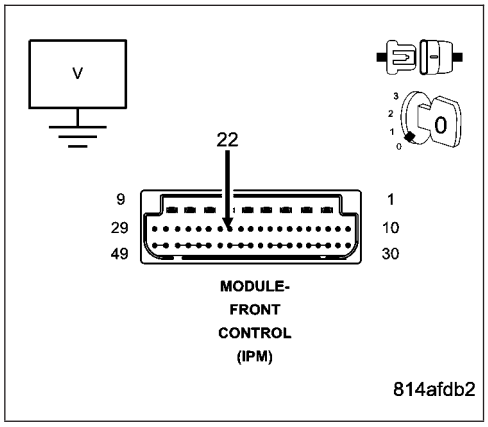
3. FRONT CONTROL MODULE

Turn the ignition off.

Remove the Left Trailer Tow Relay from the MPD.

Remove the FCM from the Module Power Distribution.

Measure the voltage of the (L655) Left Trailer Tow Relay Output circuit and ground.

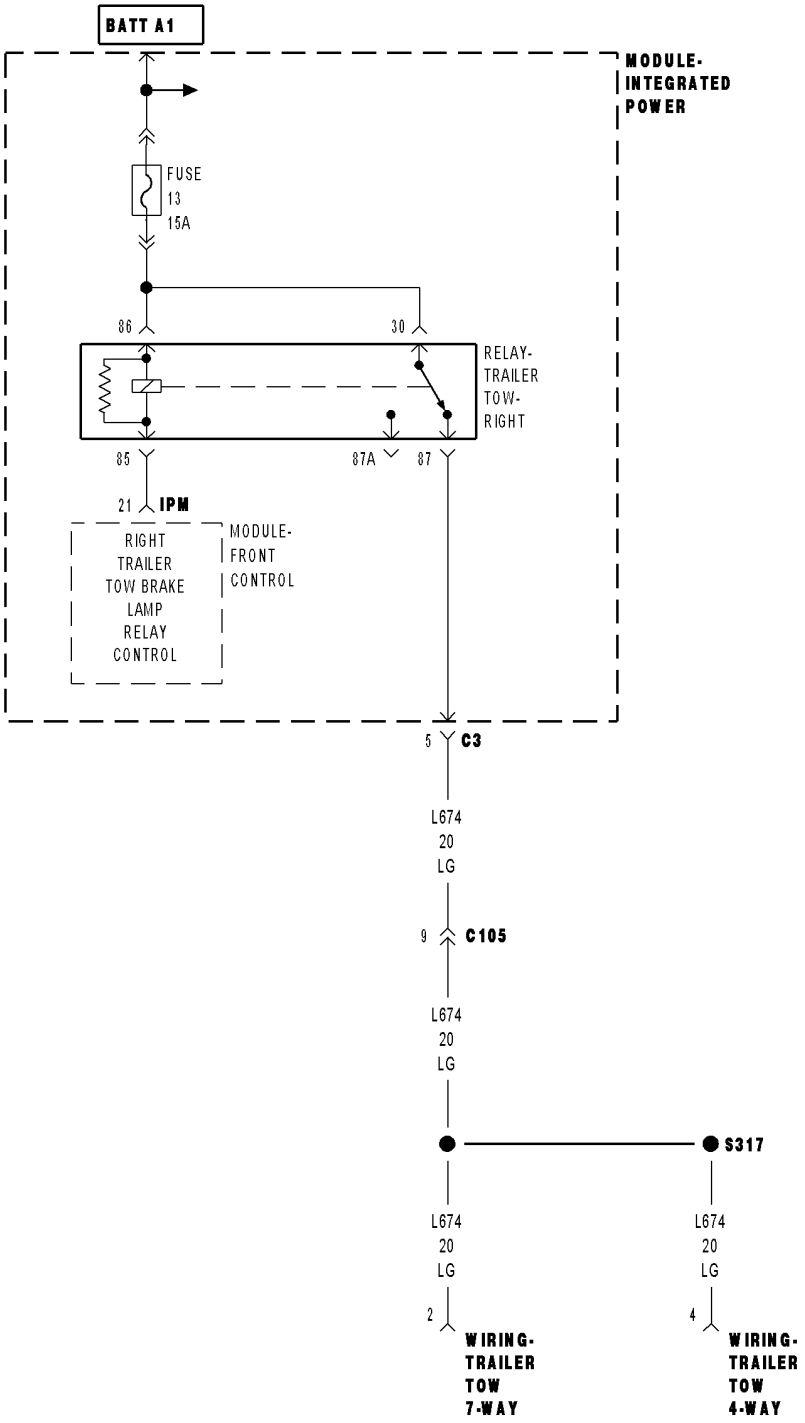


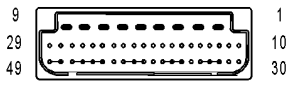
Is the voltage above 1.0 volts?

Yes >> Replace the Module Power Distribution center in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER1.

No >> Replace the Module Front Control in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER1.

B166F-RIGHT TRAILER TOW LAMP CONTROL CIRCUIT LOW





MODULE-
FRONT
CONTROL
(IPM)

814afc91

B166F-RIGHT TRAILER TOW LAMP CONTROL CIRCUIT LOW (CONTINUED)

For the Exterior Lighting System circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  When the Front Control Module does not detect voltage on the Trailer Tow Relay Control circuit.

Possible Causes
PDM FUSE 21
B(+) OPEN
RIGHT TRAILER TOW RELAY
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Diagnostic Test

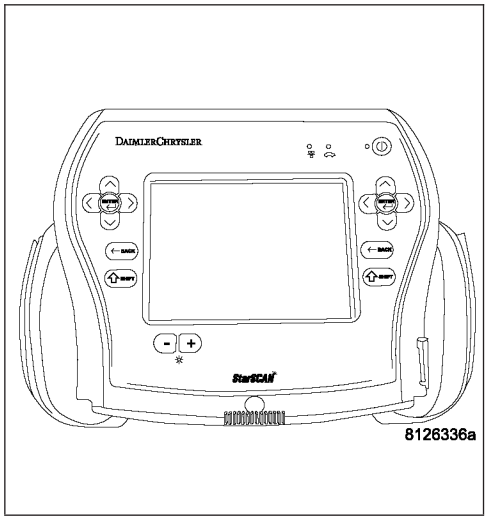
1. INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, clear all FCM DTC's
Actuate the Trailer Tow Lamps.
With the scan tool, read DTC's.

Does the scan tool read: B166F-RIGHT TRAILER TOW LAMP CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform BODY VERIFICATION TEST - VER 1.



2. PDM FUSE 21

Using a 12-volt test light connected to ground, check the PDM Fuse 21.

Does the test light illuminate and was the fuse OK?

No >> Replace the PDM Fuse 21 if open and check for a short to ground on the Relay Output circuit or correct the open B(+) circuit to the fuse.
Perform BODY VERIFICATION TEST - VER 1.

Yes >> Go To 3

B166F-RIGHT TRAILER TOW LAMP CONTROL CIRCUIT LOW (CONTINUED)

3. OPEN FUSED B(+) TO RELAY

Remove the Trailer Tow Relay from the PDC.

Using a 12-volt test light connected to ground, check the Fused B(+) circuit at the relay connector.

Does the test light illuminate?

No >> Replace the Power Distribution Center.
Perform BODY VERIFICATION TEST - VER 1.

Yes >> Go To 4

---

4. RIGHT TRAILER TOW RELAY

Install a known good relay in place of the Trailer Tow Relay.

With the scan tool erase DTC's

Cycle the ignition from on to off 3 times and leave on.

With the scan tool, read DTC's.

Does the scan tool display the same DTC?

No >> Replace the original Trailer Tow Relay.
Perform BODY VERIFICATION TEST - VER 1.

Yes >> Go To 5

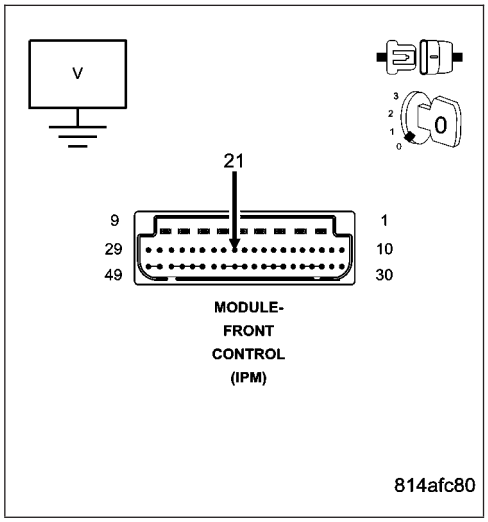
---

5. (L656) TRAILER TOW RELAY CONTROL SHORTED

Remove the Right Trailer Tow Relay.

Disconnect the Front Control Module from the PDC 49 – way connector.

Measure the resistance between ground and the (L656) Trailer Tow Relay Control circuit at the relay.



Is the resistance below 1000.0 ohms?

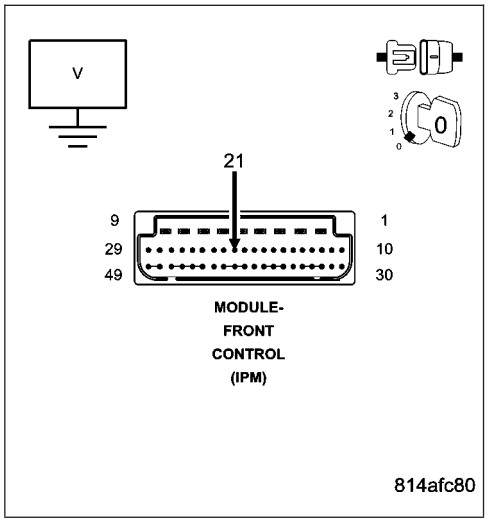
Yes >> Replace the Power Distribution Center.
Perform BODY VERIFICATION TEST - VER 1.

No >> Go To 6

B166F-RIGHT TRAILER TOW LAMP CONTROL CIRCUIT LOW (CONTINUED)

6. (L656) TRAILER TOW RELAY CONTROL OPEN

Measure the resistance of the (L656) Trailer Tow Relay Control circuit from the relay connector to FCM connector.

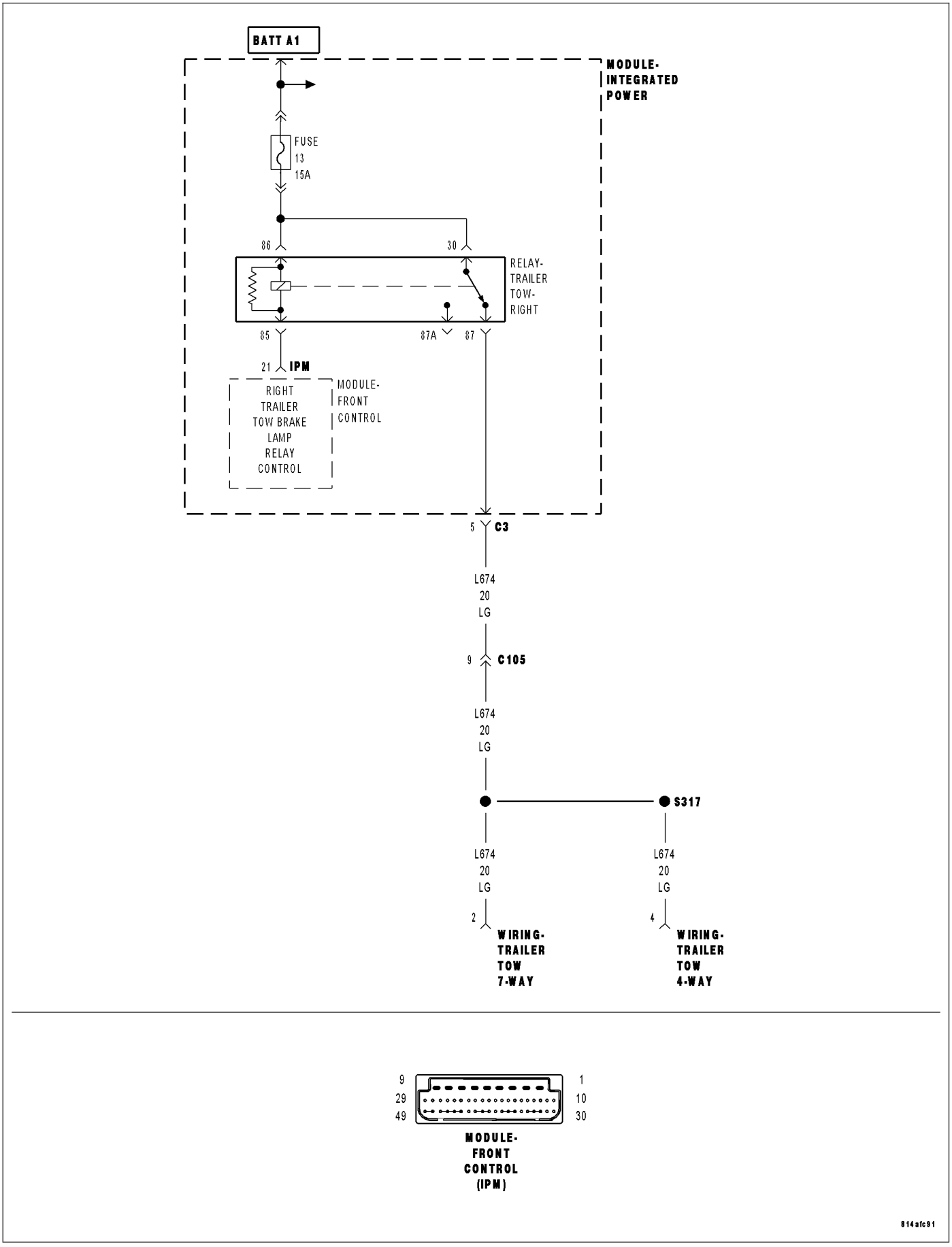


Is the resistance below 3.0 ohms?

Yes >> Replace the Front Control Module.
Perform BODY VERIFICATION TEST - VER 1.

No >> Replace the Power Distribution Center.
Perform BODY VERIFICATION TEST - VER 1.

B1670-RIGHT TRAILER TOW LAMP CONTROL CIRCUIT HIGH



B1670-RIGHT TRAILER TOW LAMP CONTROL CIRCUIT HIGH (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the Trailer Tow Lamps activated.
- **Set Condition:**
- When the FCM detects a HIGH condition.

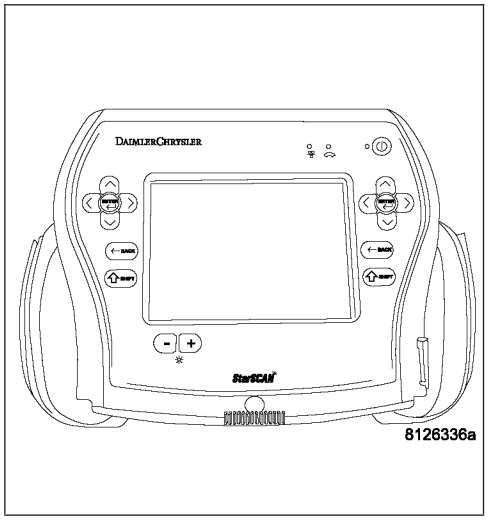
Possible Causes
RIGHT TRAILER TOW RELAY
MODULE-POWER DISTRIBUTION
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Actuate the Trailer Tow Lamps.
With the Scan Tool read the DTC information.



Does the Scan Tool read: B1670-RIGHT TRAILER TOW LAMP CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST-VER1.

---

2. TRAILER TOW RELAY

Turn the ignition off.
Remove and install a known good relay in place of the Right Trailer Tow Relay.

Do the Trailer Tow Lamps operate normally?

Yes >> Replace the Right Trailer Tow Relay in accordance with the service information.
Perform the BODY VERIFICATION TEST VER1.

No >> Go To 3

B1670-RIGHT TRAILER TOW LAMP CONTROL CIRCUIT HIGH (CONTINUED)

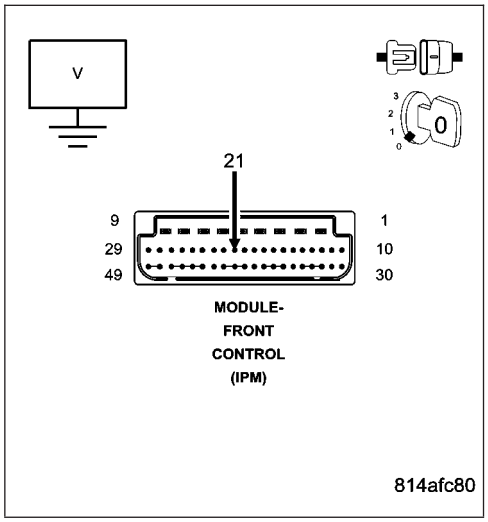
3. FRONT CONTROL MODULE

Turn the ignition off.

Remove the Right Trailer Tow Relay from the MPD.

Remove the FCM from the Module Power Distribution.

Measure the voltage of the (L656) Right Trailer Tow Relay Output circuit and ground.

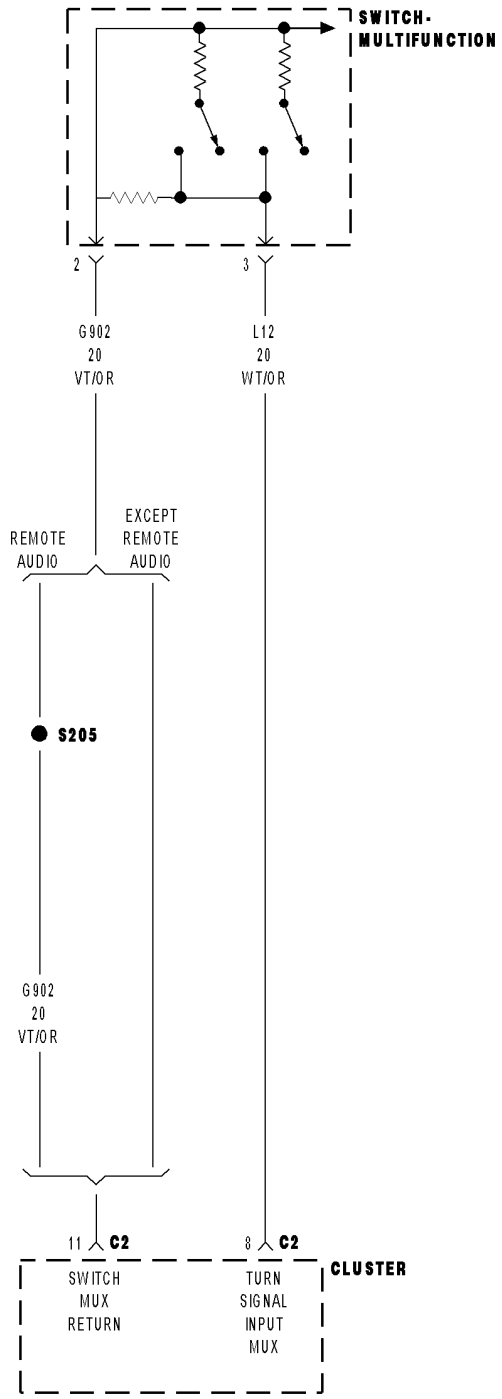


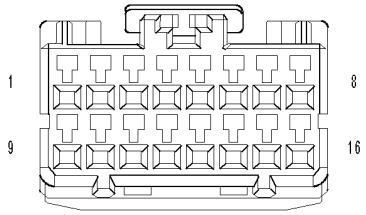
Is the voltage above 1.0 volts?

Yes >> Replace the Module Power Distribution center in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER1.

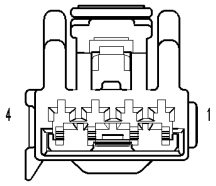
No >> Replace the Module Front Control in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER1.

B160D-TURN/HAZARD SWITCH INPUT CIRCUIT LOW





CLUSTER C2



SWITCH-
MULTIFUNCTION

814af8ed

B160D-TURN/HAZARD SWITCH INPUT CIRCUIT LOW (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

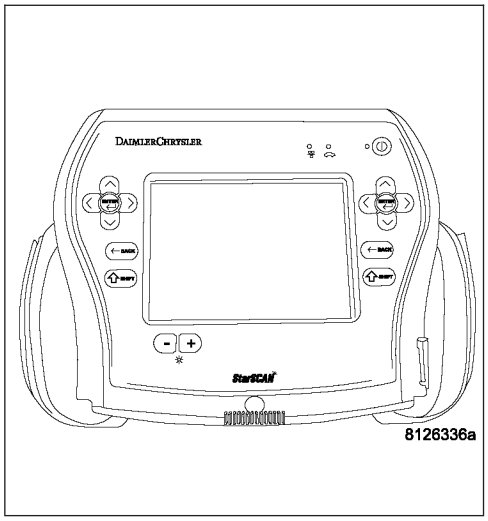
Possible Causes
MULTIFUNCTION SWITCH
(G902) MUX RETURN CIRCUIT
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all CCN DTC's.
Actuate the Hazard Lamps.
With the Scan Tool, read the DTC information.



Does the Scan Tool read: B160D-TURN/HAZARD SWITCH INPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.

---

2. MULTIFUNCTION SWITCH

Disconnect the Multifunction Switch connector.
Turn the ignition on.
Measure the voltage of the (G902) MUX Return circuit.

Does the voltage read 5.0 volts?

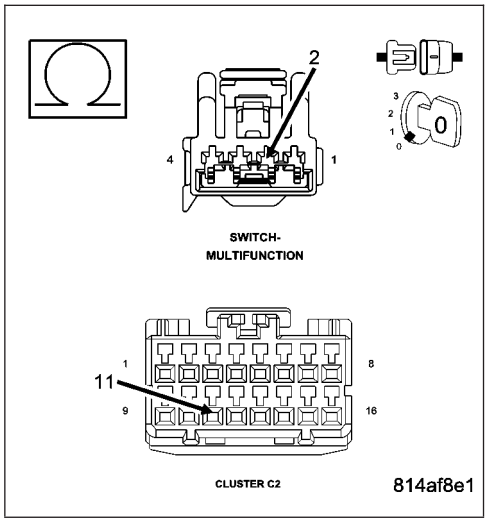
Yes >> Go To 3
Perform the BODY VERIFICATION TEST — VER 1.

No >> Replace the Multifunction Switch in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

B160D-TURN/HAZARD SWITCH INPUT CIRCUIT LOW (CONTINUED)

3. (G902) MUX RETURN CIRCUIT

Turn the ignition off.
Disconnect the Multifunction Switch connector.
Disconnect the Instrument Cluster C2 connector.
Measure the resistance of the (G902) MUX Return circuit to ground.

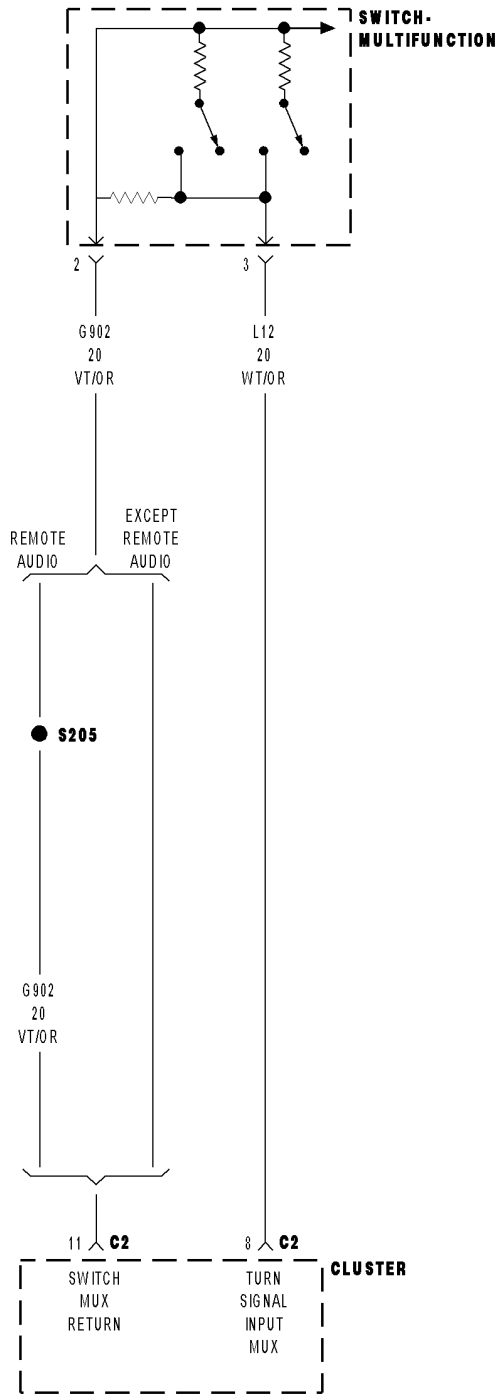


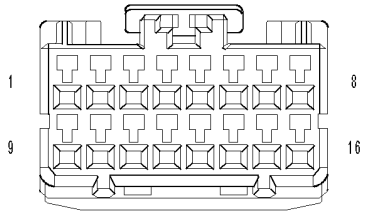
Is the resistance below 5.0 ohms?

Yes >> Repair the (G902) MUX return circuit.
Perform the BODY VERIFICATION TEST — VER 1.

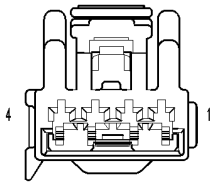
No >> Replace the Instrument Cluster in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

B160E-TURN/HAZARD SWITCH INPUT CIRCUIT HIGH





CLUSTER C2



SWITCH-
MULTIFUNCTION

814af8ed

B160E-TURN/HAZARD SWITCH INPUT CIRCUIT HIGH (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

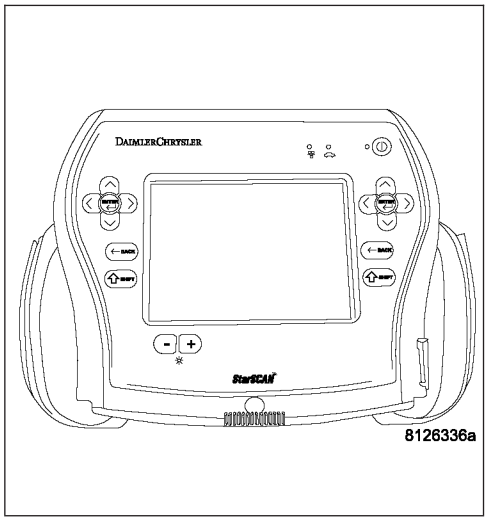
Possible Causes
MULTIFUNCTION SWITCH
(G902) MUX RETURN CIRCUIT
(L12) MUX INPUT CIRCUIT
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all CCN DTC's.
Actuate the Hazard Lamps.
With the Scan Tool, read the DTC information.



Does the Scan Tool read: B160E-TURN/HAZARD SWITCH INPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.

---

2. MULTIFUNCTION SWITCH

Disconnect the Multifunction Switch connector.
Turn the ignition on.
Measure the voltage between the (G902) MUX Return circuit and (L12) Turn Signal Input MUX circuit.

Does the voltage read 0.0 volts?

Yes >> Replace the Multifunction Switch in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Go To 3

B160E-TURN/HAZARD SWITCH INPUT CIRCUIT HIGH (CONTINUED)

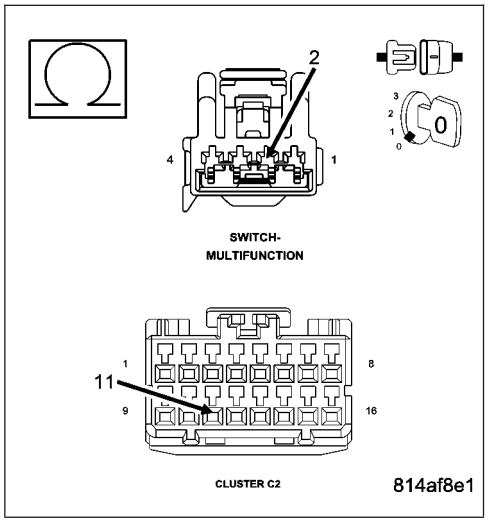
3. (G902) MUX RETURN CIRCUIT

Turn the ignition off.
Disconnect the Multifunction Switch connector.
Disconnect the Instrument Cluster C2 connector.
Measure the resistance of the (G902) MUX Return circuit.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the (G902) MUX Return circuit.
Perform the BODY VERIFICATION TEST — VER 1.



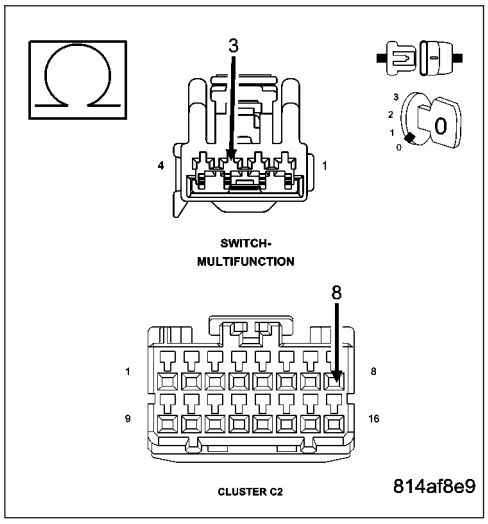
4. INSTRUMENT CLUSTER

Turn the ignition off.
Disconnect the Multifunction Switch connector.
Disconnect the Instrument Cluster C2 connector.
Measure the resistance of the (L12) Turn Signal Input MUX circuit.

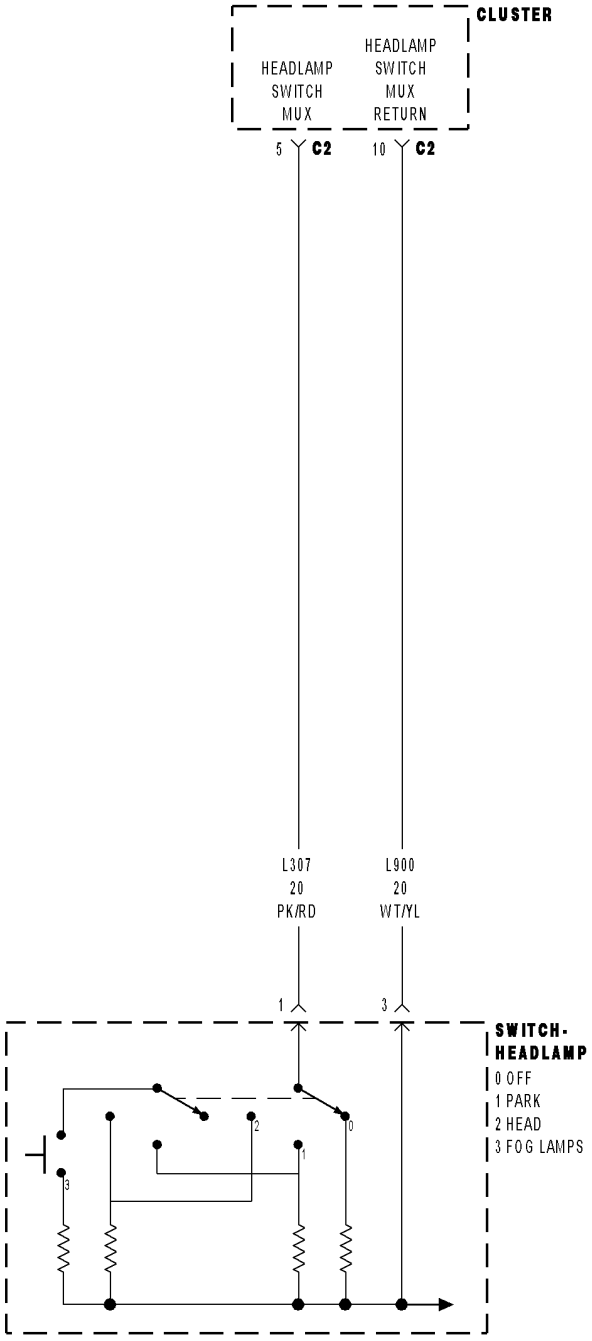
Is the resistance below 5.0 ohms?

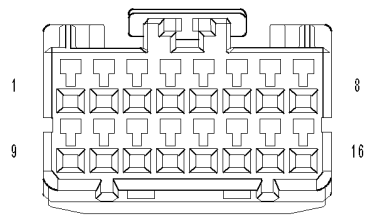
Yes >> Replace the instrument Cluster in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Repair the (L12) Turn Signal Input MUX circuit.
Perform the BODY VERIFICATION TEST — VER 1.

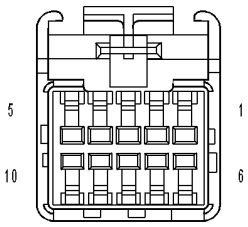


B1607-HEADLAMP SWITCH INPUT CIRCUIT LOW





CLUSTER C2



SWITCH-HEADLAMP

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B1607-HEADLAMP SWITCH INPUT CIRCUIT LOW (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

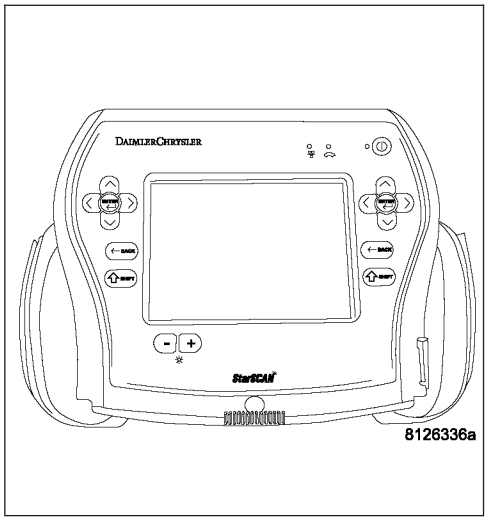
Possible Causes
HEADLAMP SWITCH
(L900) MUX RETURN CIRCUIT
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all CCN DTC's.
Turn the Headlamps on.
With the Scan Tool, read the DTC information.



Does the Scan Tool read: B1607-HEADLAMP SWITCH INPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.

---

2. HEADLAMP SWITCH

Disconnect the Headlamp Switch connector.
Turn the ignition on.
Measure the voltage of the (L900) MUX Return circuit.

Does the voltage read 5.0 volts?

Yes >> Go To 3
Perform the BODY VERIFICATION TEST — VER 1.

No >> Replace the Headlamp Switch in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

B1607-HEADLAMP SWITCH INPUT CIRCUIT LOW (CONTINUED)

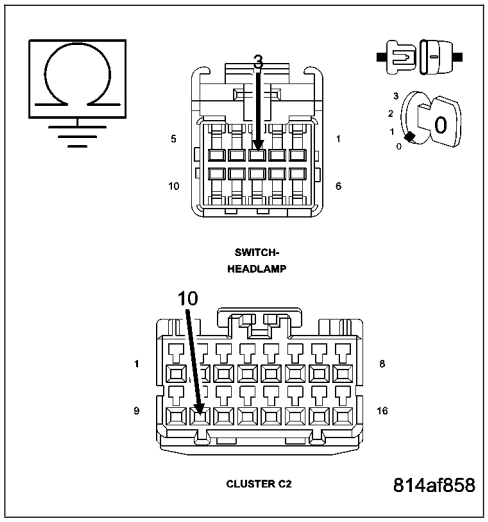
3. (L900) MUX RETURN CIRCUIT

Turn the ignition off.
Disconnect the Headlamp Switch connector.
Disconnect the Instrument Cluster C2 connector.
Measure the resistance of the (L900) MUX Return circuit to ground.

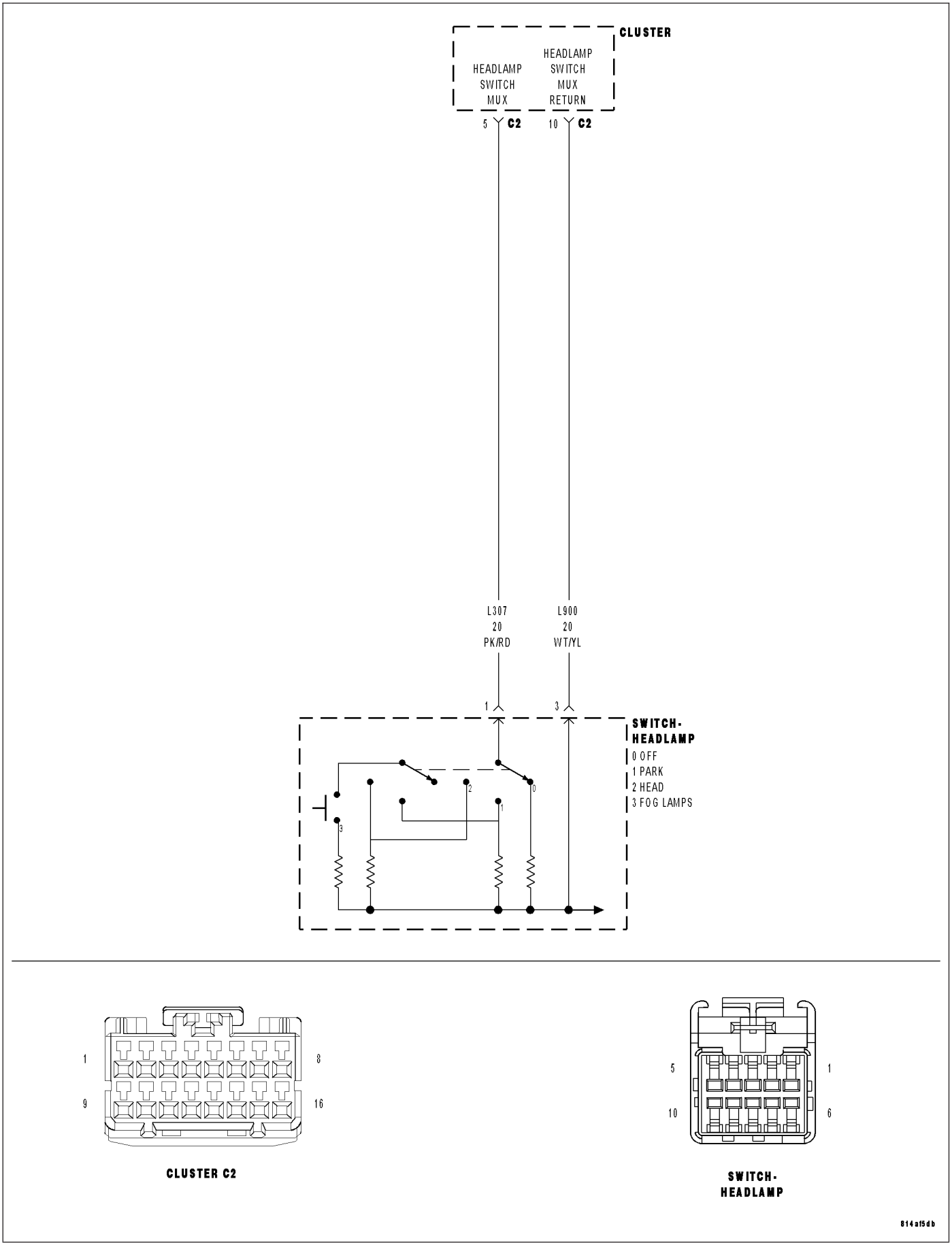
Is the resistance below 5.0 ohms?

Yes >> Repair the (L900) Headlamp MUX return circuit.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Replace the Instrument Cluster in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.



B1608-HEADLAMP SWITCH INPUT CIRCUIT HIGH



B1608-HEADLAMP SWITCH INPUT CIRCUIT HIGH (CONTINUED)

For the Exterior Lighting system circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

Possible Causes
HEADLAMP SWITCH
(L900) HEADLAMP MUX RETURN CIRCUIT
(L307) HEADLAMP MUX INPUT CIRCUIT
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

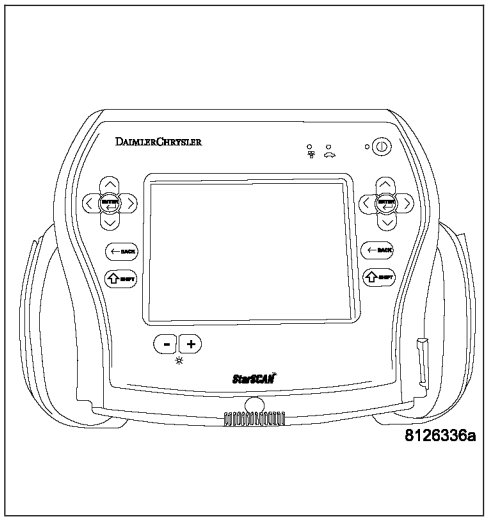
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all CCN DTC's.
Turn the Headlamps on.
With the Scan Tool, read the DTC information.

Does the Scan Tool read: B1608-HEADLAMP SWITCH INPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.



2. HEADLAMP SWITCH

Disconnect the Headlamp Switch connector.
Turn the ignition on.
Measure the voltage between the (L900) Headlamp MUX Return circuit and (L307) Headlamp Input MUX circuit.

Does the voltage read 0.0 volts?

Yes >> Replace the Headlamp Switch in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Go To 3

B1608-HEADLAMP SWITCH INPUT CIRCUIT HIGH (CONTINUED)

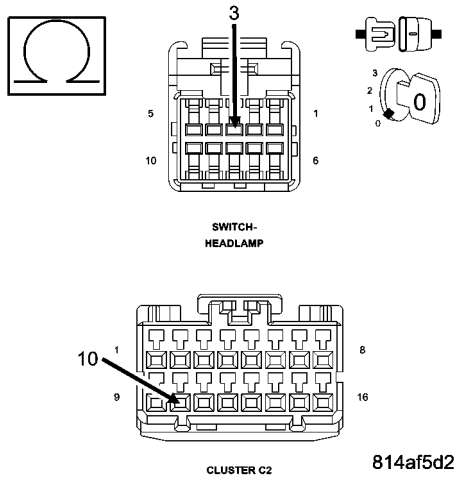
3. (L900) MUX RETURN CIRCUIT

Turn the ignition off.
Disconnect the Headlamp Switch connector.
Disconnect the Instrument Cluster C2 connector.
Measure the resistance of the (L900) Headlamp MUX Return circuit.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the (L900) Headlamp MUX Return circuit.
Perform the BODY VERIFICATION TEST — VER 1.



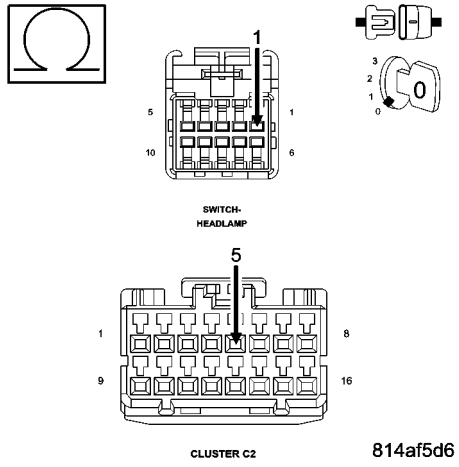
4. INSTRUMENT CLUSTER

Turn the ignition off.
Disconnect the Headlamp Switch connector.
Disconnect the Instrument Cluster C2 connector.
Measure the resistance of the (L307) Headlamp MUX circuit.

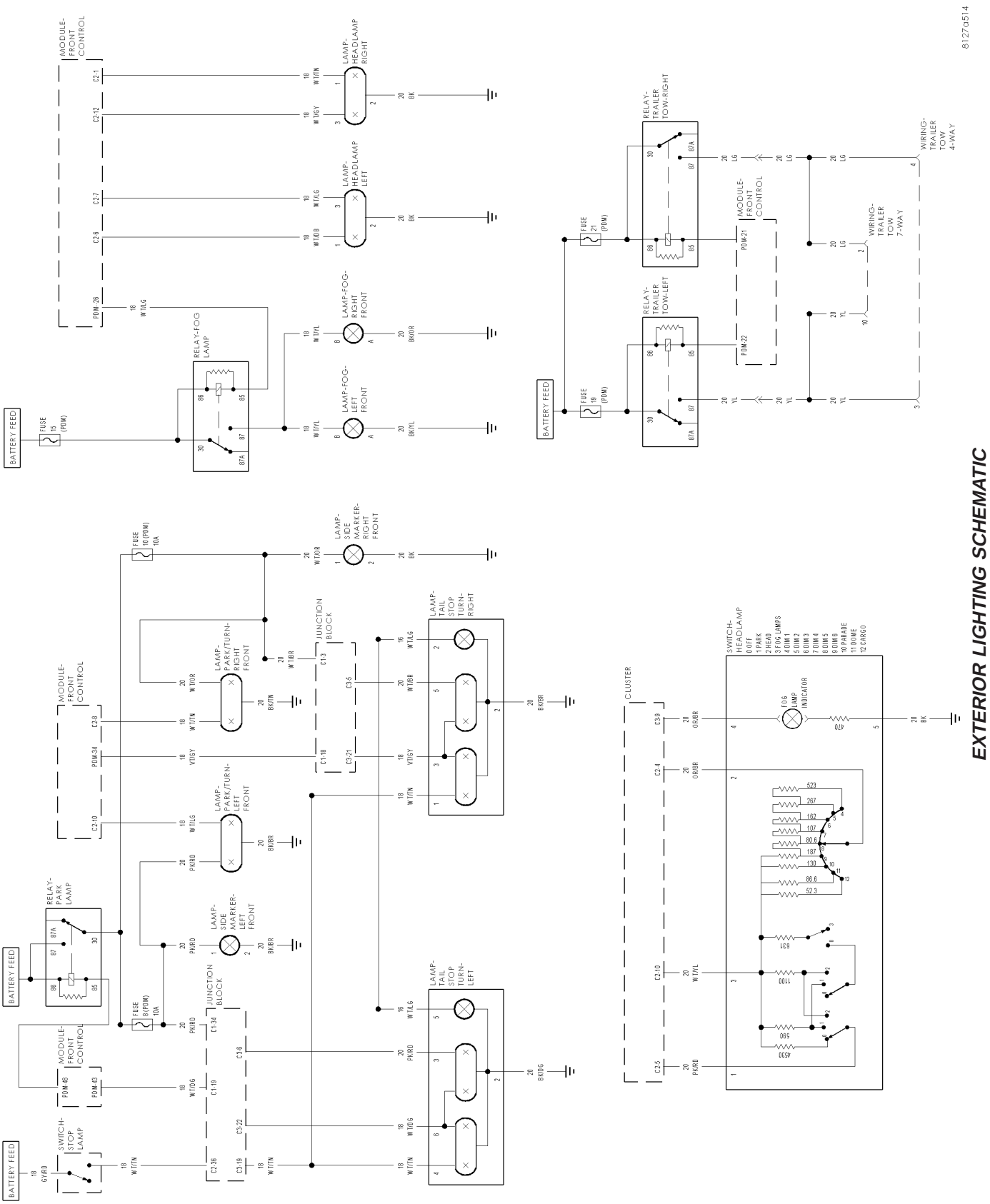
Is the resistance below 5.0 ohms?

Yes >> Replace the instrument Cluster in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Repair the (L307) Headlamp MUX circuit.
Perform the BODY VERIFICATION TEST — VER 1.



SCHEMATICS AND DIAGRAMS



LAMPS/LIGHTING - EXTERIOR - SERVICE INFORMATION

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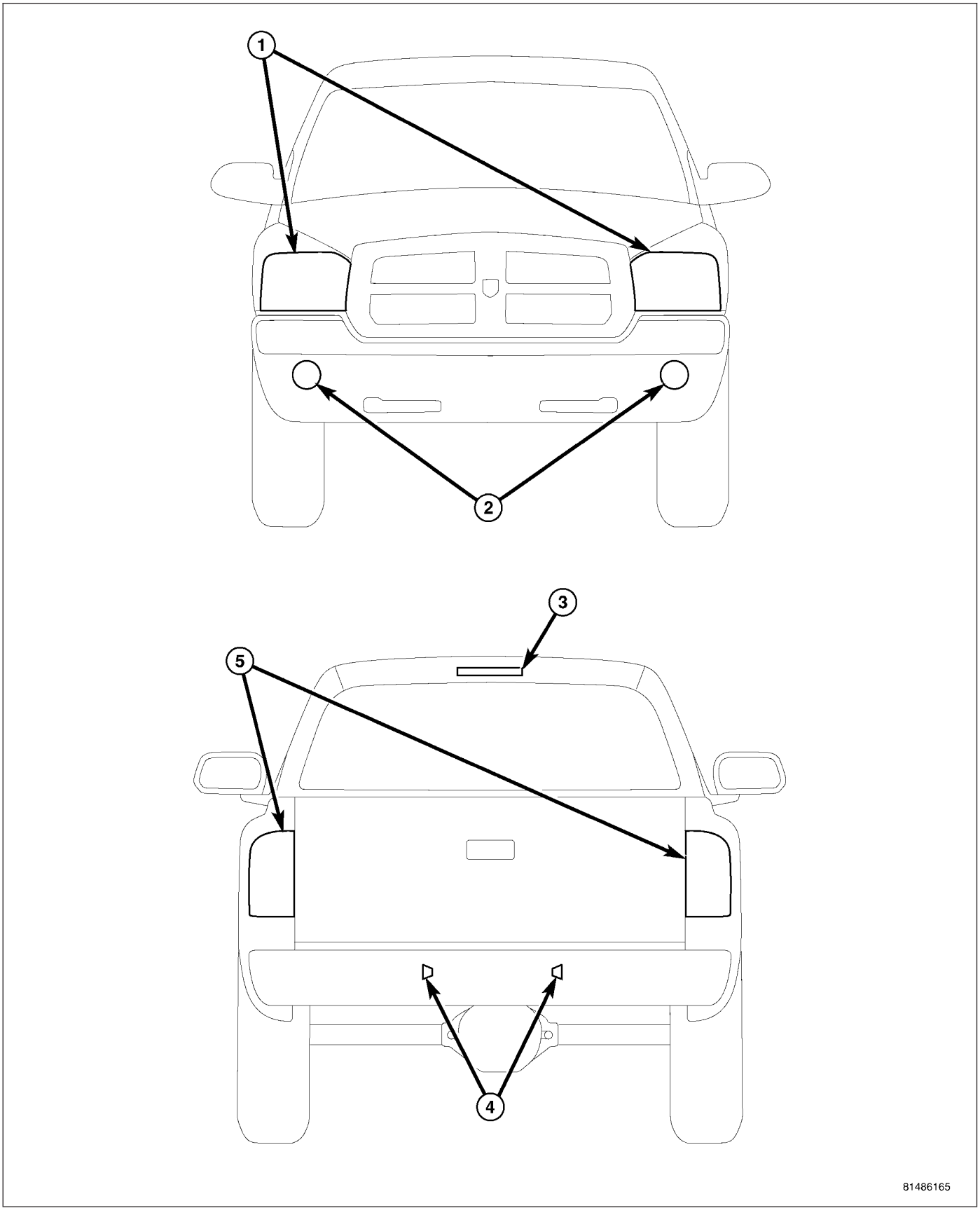
LAMPS/LIGHTING - EXTERIOR - SERVICE INFORMATION

DESCRIPTION



The exterior lighting system for this model includes the following exterior lamp units:

- **Center High Mounted Stop Lamp (3)** - A standard equipment Center High Mounted Stop Lamp (CHMSL) is centered on the cab roof header panel just above the glass opening at the rear of the cab. This CHMSL also incorporates two integral cargo lamps, one located at each outboard side of the CHMSL.
- **Front Fog Lamps (2)** - Vehicles equipped with this option have a fog lamp unit mounted near each outboard end of the front bumper support, behind the lower portion of the front fascia.
- **Front Lamp Units (1)** - A standard equipment front lamp unit is mounted to the front of each front fender panel on either side of the grille opening.
- **License Plate Lamp (4)** - A standard equipment rear license plate lamp unit is mounted to each outboard vertical surface of the license plate tub formation in the center of the rear bumper.
- **Rear Lamp Units (5)** - A standard equipment rear lamp unit is mounted to the rear of each quarter panel on either side of the tailgate opening.

These exterior lighting lamp units and their controls are combined to provide the following exterior lighting features:

- **Automatic Headlamps** - Vehicles with the automatic headlamps option are equipped with a unique headlamp switch that includes an automatic position and a sun load sensor located on the top of the instrument panel to sense ambient light levels. When the Auto position of the headlamp switch is selected, the headlamps are turned On automatically when ambient light levels are low.
- **Backup Lamps** - The backup (or reverse) lamps include a bulb, reflector and lens that are integral to each rear lamp unit.
- **Brake Lamps** - The brake (or stop) lamps include a bulb, reflector and lens that are integral to each rear lamp unit, and the CHMSL bulb and lens.
- **Daytime Running Lamps** - Vehicles manufactured for sale in Canada illuminate the high beam filament of the headlamp bulb in each front lamp unit to serve as the Daytime Running Lamps (DRL). Fleet vehicles manufactured for sale in the United States illuminate the low beam filament of the headlamp bulb in each front lamp unit to serve as the DRL.
- **Exterior Lamp Fail-Safe Operation** - The EMIC provides a fail-safe feature which will automatically turn on the low beam headlamps and all park lamps when the ignition switch is in the On position and there is no detected input from the headlamp switch.
- **Exterior Lamp Load Shedding** - The Front Control Module (FCM) provides a battery saver feature which will automatically turn off all exterior lamps that remain on with the ignition switch in the Lock position after a timed interval of about eight minutes.
- **Front Fog Lamps** - The optional front fog lamps include the bulb, reflector and lens of each adjustable front fog lamp unit.
- **Hazard Warning Lamps** - The hazard warning lamps include the right and left turn signal bulbs, reflectors and lenses of each front and rear lamp unit.
- **Headlamps** - The headlamps include a single, dual filament halogen bulb, an adjustable reflector and a clear lens integral to each front lamp unit.
- **Optical Horn** - Also known as flash-to-pass, the beam selection function of the multi-function switch control stalk has a momentary intermediate position that allows the headlamp high beams to be flashed momentarily, without changing the headlamp beam selection.
- **Park Lamps** - The park lamps include the park and side marker bulbs, reflectors and lenses integral to each front and rear lamp unit as well as the bulbs and lenses of the rear license plate lamps.
- **Turn Signal Lamps** - The turn signal lamps include the turn signal bulbs, reflectors and lenses that are integral to the right and left front and rear lamp units.

Other components of the exterior lighting system for this model include:

- **Backup Lamp Switch** - A plunger-type backup lamp switch is installed through the transmission housing of vehicles equipped with a manual transmission and is actuated by the shifter mechanism within the transmission when Reverse gear is selected. Depending upon the transmission model, either a stand-alone Transmission Range Sensor (TRS), or a TRS that is integral to the solenoid pack on the valve body performs the backup lamp switch function on vehicles with an automatic transmission.
- **Brake Lamp Switch** - A plunger-type brake lamp switch is located on the steering column support bracket under the instrument panel and is actuated by the brake pedal arm when the brake pedal is depressed.
- **Front Control Module** - The Front Control Module (FCM) is integral to the Integrated Power Module (IPM). The FCM/IPM is located in the engine compartment, near the battery and the Power Distribution Center (PDC). (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION - DESCRIPTION).

- **Front Fog Lamp Relay** - Vehicles equipped with optional front fog lamps have a front fog lamp relay located in the Power Distribution Center (PDC).
- **Headlamp Switch** - A headlamp switch is located on the left side of the instrument panel, below and outboard of the steering column. The headlamp switch includes a rotary knob that is rotated to turn the park lamps and headlamps On or Off, and a push button switch for selecting the cargo lamps. The rotary knob is pushed inward for selecting the optional front fog lamps on vehicles so equipped. The headlamp switch also features a vertical thumbwheel for selecting the panel lamps dimming level, a Parade mode to illuminate all Vacuum Fluorescent Display (VFD) units at full brightness for visibility when driving in daylight with the exterior lighting turned On, and for interior lighting control.
- **Instrument Cluster** - The ElectroMechanical Instrument Cluster (EMIC) is also known as the Cab Control Node (CCN) in this vehicle. The EMIC/CCN is located in the instrument panel above the steering column opening, directly in front of the driver. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DESCRIPTION).
- **Multi-Function Switch** - The multi-function switch is located on the steering column, just below the steering wheel. A control stalk that extends from the left side of the switch is used to select the turn signal lamps (right or left) and to select the headlamp beam (low, high or optical horn). A push button that extends from the top of the switch is used to select the hazard warning lamps.
- **Park Brake Switch** - A park brake switch is located on the park brake lever mechanism on the cowl side inner panel below the instrument panel, to the left of the steering column.
- **Park Lamp Relay** - A park lamp relay is located in the Power Distribution Center (PDC) of all vehicles.
- **Trailer Tow Relays** - Vehicles equipped with a factory-installed trailer towing package have two trailer tow relays installed in the Power Distribution Center (PDC) in the engine compartment, one for the trailer right turn and brake lamps and the other for the trailer left turn and brake lamps.
- **Trailer Tow Wiring** - Vehicles equipped with a factory-installed trailer towing package have a trailer tow wire harness and both a 4-way and a heavy duty 7-way trailer tow connector installed on a bracket on the trailer hitch receiver. This package also includes an electric trailer brake wiring provision that terminates at a connector located on top of the large body harness connection under the instrument panel to the left of the brake pedal, as well as an electric trailer brake pigtail harness and an instruction card that are stored in the glove box when the vehicle is shipped from the factory.

Hard wired circuitry connects the exterior lighting system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the exterior lighting components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

Following are paragraphs that briefly describe the operation of each of the major exterior lighting systems. The hard wired circuits and components of the exterior lighting systems may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Control Node/CCN), the Front Control Module (FCM) (also known as the Integrated Power Module/IPM), the Powertrain Control Module (PCM) or the Controller Area Network (CAN) data bus. The most reliable, efficient, and accurate means to diagnose the EMIC, the FCM, the PCM, the CAN data bus or the electronic bus message inputs and outputs related to the various exterior lighting systems requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

BACKUP LAMPS

The backup (or reverse) lamps have a path to ground at all times through a takeout and eyelet terminal of the left headlamp and dash wire harness that is secured by a ground screw to the left inboard side of the hydroform within the engine compartment. On vehicles with a manual transmission, the backup lamp switch provides an input to the Front Control Module (FCM) and the FCM provides battery voltage to the backup lamps on the backup lamp feed circuit whenever the ignition switch is in the On position and the Reverse position is selected with the transmission shift linkage.

On vehicles with an automatic transmission, the PCM continually monitors a hard wired multiplex input from the Transmission Range Sensor (TRS), then sends the proper transmission gear selector status messages to other electronic modules over the CAN data bus. When the FCM receives an electronic message indicating the status of the transmission gear selector is Reverse, it provides a battery voltage output to the backup lamps on the backup lamp feed circuit.

BRAKE LAMPS

The brake (or stop) lamps each have a path to ground at all times through a takeout and eyelet terminal of the left headlamp and dash wire harness that is secured by a ground screw to the left inner fender support within the engine compartment. The Center High Mounted Stop Lamp (CHMSL) has a path to ground at all times through a takeout and eyelet terminal of the body wire harness that is secured by a nut to a ground stud to the left sill at the base of the cowl side inner panel. The brake lamps and CHMSL receive battery voltage on the brake lamp switch feed circuit when the brake lamp switch is closed by the brake pedal arm. The CHMSL and brake lamps are connected to a hard wired output from the brake lamp switch. The brake lamp function of the trailer tow stop/turn relays is controlled by an output from the Front Control Module (FCM) based upon a hard wired input from the brake lamp switch.

DAYTIME RUNNING LAMPS

Vehicles manufactured for sale in Canada illuminate the high beam filament of both headlamp bulbs at a reduced intensity when the engine is running and the exterior lamps are turned off. Fleet vehicles manufactured for sale in the United States illuminate the low beam filament of both headlamp bulbs at a reduced intensity when the engine is running, the parking brakes are released and the exterior lamps are turned off. The FCM must be programmed appropriately for this feature to be enabled. Once enabled, anytime the FCM receives electronic messages over the CAN data bus from the PCM indicating the engine is running and from the EMIC indicating the status of the headlamp switch exterior lighting input is Off and that the parking brakes are released, the FCM provides a pulse width modulated voltage output to the proper headlamp bulb filaments through the right and left beam feed circuits to produce illumination at a reduced intensity.

FRONT FOG LAMPS

Vehicles equipped with optional front fog lamps include a front fog lamp relay installed in the PDC, and a front fog lamp switch integral to the headlamp switch on the instrument panel. The front fog lamps have a path to ground at all times through their connection to the headlamp and dash wire harness. The headlamp and dash wire harness has takeouts with eyelet terminals that are secured by ground screws to the right (right fog lamp) and left (left fog lamp) inboard sides of the hydroform within the engine compartment. The EMIC monitors a hard wired multiplex input from the headlamp switch to determine whether the fog lamps are selected, then sends electronic fog lamp switch status messages to the FCM over the CAN data bus.

When the FCM receives a fog lamp status message it then controls front fog lamp operation by energizing or de-energizing the front fog lamp relay control coil. The FCM also sends the appropriate electronic message back to the EMIC to illuminate or extinguish the front fog lamp indicator. When the front fog lamp relay is energized, it provides battery voltage from a fused B(+) fuse in the PDC to the fog lamps through the fog lamp relay output circuit. The FCM will automatically de-energize the front fog lamps relay any time the headlamp high beams are selected. The FCM also provides a battery saver (load shedding) feature for the front fog lamps, which will turn these lamps off if they are left on for more than about eight minutes with the ignition switch in the Lock position. Each front fog lamp includes an integral adjustment screw to be used for static aiming of the fog lamp beams.

HAZARD WARNING LAMPS

The hazard warning system includes the EMIC, the FCM and the multi-function switch on the steering column. The EMIC monitors a hard wired multiplex input from the multi-function switch to determine the status of the hazard warning switch, then sends the appropriate electronic hazard switch status messages to the FCM over the CAN data bus. The FCM responds to these messages by controlling a battery voltage output and the flash rate for each of the right and left turn signal lamps. The FCM also sends the appropriate electronic messages back to the EMIC to control the illumination and flash rate of the right and left turn signal indicators, as well as to control the click rate of an electromechanical relay soldered onto the EMIC electronic circuit board that emulates the sound emitted by a conventional hazard warning flasher.

HEADLAMPS

The headlamp system includes the EMIC, the FCM, the multi-function switch on the steering column and the headlamp switch on the instrument panel. The headlamp bulbs have a path to ground at all times through their connection to the headlamp and dash wire harness. The headlamp and dash wire harness has takeouts with eyelet terminals that are secured by ground screws to the right (right headlamp bulb) and left (left headlamp bulb) inboard sides of the hydroform within the engine compartment.

The EMIC monitors a hard wired multiplex input to determine the status of the headlamp switch, and a hard wired multiplex input from the multi-function switch to determine whether the high or low beams are selected. The EMIC then sends the appropriate electronic headlamp switch and headlamp beam select switch status messages to the FCM over the CAN data bus. The FCM responds to these messages by providing a pulse width modulated voltage output to the proper headlamp bulb through the right and left low and high beam feed circuits to illuminate the selected headlamp filaments.

The FCM also remembers which beams (low or high) were selected when the headlamps were last turned Off, and energizes those beams again the next time the headlamps are turned On. The FCM provides a battery saver (load shedding) feature for the headlamps, which will turn these lamps off if they are left on for more than about eight minutes with the ignition switch in the Lock position. The EMIC provides a fail-safe feature for the headlamps, which will send an electronic message to the FCM to turn the low beam headlamps On automatically if it detects no input from the headlamp switch. Each headlamp includes an integral reflector adjustment screw to be used for static aiming of the headlamps.

PARK LAMPS

The park lamps system includes the EMIC, the FCM, a park lamp relay installed in the PDC, and the headlamp switch on the instrument panel. The front park lamp and side marker lamp bulbs each have a path to ground at all times through their connection to the headlamp and dash wire harness. The headlamp and dash wire harness has takeouts with eyelet terminals that are secured by ground screws to the right (right park lamp and side marker lamp bulbs) and left (left park lamp and side marker lamp bulbs) inboard sides of the hydroform within the engine compartment. The rear park lamp, side marker lamp and license plate lamp bulbs have a path to ground at all times through a takeout and eyelet terminal of the left headlamp and dash wire harness that is secured by a ground screw to the left inboard side of the hydroform within the engine compartment.

The EMIC monitors a hard wired multiplex input from the headlamp switch, then sends the appropriate electronic headlamp switch status messages to the FCM over the CAN data bus. The FCM responds to these messages by energizing or de-energizing the park lamp relay. When the park lamp relay is energized, it provides battery voltage from a fuse in the PDC through a park lamp relay output circuit to the appropriate lamp bulbs. The FCM provides a battery saver (load shedding) feature for the park lamps, which will turn these lamps off if they are left on for more than about eight minutes with the ignition switch in the Lock position. The EMIC provides a fail-safe feature for the park lamps, which will send an electronic message to the FCM to turn these lamps on automatically if it detects no input from the headlamp switch.

TRAILER TOW WIRING

In addition to the trailer tow wiring provisions, vehicles equipped with an optional trailer tow package include right and left trailer tow stop/turn relays installed in the PDC. When the FCM receives the appropriate inputs for normal turn signal, hazard warning or brake lamp operation, it responds by also energizing or de-energizing these trailer tow relays. When a trailer tow relay is energized, it provides battery voltage from a fused B(+) fuse to the trailer lamps through the trailer tow wiring to synchronize the illumination and flash rate of the trailer brake and turn signal lamps with those of the tow vehicle.

TURN SIGNAL LAMPS

The turn signal lamps system includes the EMIC, the FCM and the multi-function switch on the steering column. The front turn signal lamp bulbs each have a path to ground at all times through their connection to the headlamp and dash wire harness. The headlamp and dash wire harness has takeouts with eyelet terminals that are secured by ground screws to the right (right front turn signal lamp bulb) and left (left front turn signal lamp bulb) inboard sides of the hydroform within the engine compartment. The rear turn signal lamp bulbs have a path to ground at all times through a takeout and eyelet terminal of the left headlamp and dash wire harness that is secured by a ground screw to the left inboard side of the hydroform within the engine compartment.

The EMIC monitors a hard wired multiplex input from the multi-function switch to determine the status of the turn signal switch, then sends the appropriate electronic turn signal switch status messages to the FCM over the CAN

data bus. The FCM responds to these messages by controlling a battery voltage output and the flash rate for either the right or left turn signal lamps. The FCM also sends the appropriate electronic messages back to the EMIC to control the illumination and flash rate of the right or left turn signal indicators, as well as to control the click rate of an electromechanical relay soldered onto the EMIC electronic circuit board that emulates the sound emitted by a conventional turn signal flasher.

The EMIC also provides a “turn signal on warning” that will generate repetitive chimes to indicate that a turn signal has been active continuously for 1.6 kilometers (1 mile) with the vehicle speed greater than 22 kilometers-per-hour (15 miles-per hour). Vehicles built for markets other than the United States and Canada have a revised distance threshold of 4 kilometers for this feature. The chime will continue until the turn signal input becomes inactive or until the vehicle speed message indicates that the speed is less than 22 kilometers-per-hour (15 miles-per-hour), whichever occurs first.

WARNING

WARNINGS - LAMPS/LIGHTING - EXTERIOR

WARNING:: To avoid personal injury or death, eye protection should be used when servicing any glass components.

CAUTION: Do not contaminate the glass of halogen bulbs with fingerprints or allow contact with other possibly oily surfaces. Reduced bulb life will result.

CAUTION: Do not use bulbs with higher candle power than indicated in the Bulb Application table (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SPECIFICATIONS). In addition, do not use fuses, circuit breakers or relays having greater amperage value than indicated on the fuse panel or in the Owner’s Manual. Damage to lamps, lenses, wiring and other related electrical components can result.

DIAGNOSIS AND TESTING

LAMPS/LIGHTING - EXTERIOR

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: When diagnosing the exterior lighting circuits, remember that high generator output can burn out bulbs rapidly and repeatedly; and, that dim or flickering bulbs can be caused by low generator output or poor battery condition. If one of these symptoms is a problem on the vehicle, be certain to diagnose the battery and charging system, then repair as necessary.

NOTE: A good ground is necessary for proper lighting operation. If a lighting problem is being diagnosed that involves multiple symptoms, systems, or components, the problem can often be traced to a loose, corroded, or open ground.

The hard wired exterior lamp and lighting circuits may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the ElectroMechanical Instrument Cluster (EMIC), the Front Control Module (FCM), the Integrated Power Module (IPM), the Power Distribution Center (PDC), the Powertrain Control Module (PCM), the Controller Area Network (CAN) data bus, or the electronic message inputs used to provide exterior lamp and lighting service or many of the electronic features of the exterior lamp and lighting systems. The most reliable, efficient, and accurate means to diagnose the EMIC, the

FCM, the IPM, the PDC, the PCM, the CAN data bus, and the electronic message inputs for the exterior lamps and lighting system requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

BACKUP LAMPS

CONDITION	POSSIBLE CAUSES	CORRECTION
BACKUP LAMP DOES NOT ILLUMINATE	1. Faulty or missing fuse.	1. Test and replace backup lamp fuse as required.
	2. Faulty or missing bulb.	2. Test and replace backup lamp bulb as required.
	3. Faulty ground circuit.	3. Test and repair backup lamp ground circuit as required.
	4. Faulty supply circuit.	4. Test and repair open back-up lamp supply circuit as required.
	5. Faulty switch.	5. Test and replace back-up lamp switch (manual transmission) or transmission range sensor (automatic transmission) as required.
	6. Faulty FCM inputs or outputs.	6. Use a diagnostic scan tool to test the FCM inputs and outputs. Refer to the appropriate diagnostic information.
BACKUP LAMP DOES NOT EXTINGUISH	1. Faulty supply circuit.	1. Test and repair shorted back-up lamp supply circuit as required.
	2. Faulty switch.	2. Test and replace back-up lamp switch (manual transmission) or transmission range sensor (automatic transmission) as required.
	3. Faulty FCM inputs or outputs.	3. Use a diagnostic scan tool to test the FCM inputs and outputs. Refer to the appropriate diagnostic information.

BRAKE LAMPS

CONDITION	POSSIBLE CAUSES	CORRECTION
BRAKE LAMP DOES NOT ILLUMINATE	1. Faulty or missing fuse.	1. Test and replace brake lamp fuse as required.
	2. Faulty or missing bulb.	2. Test and replace brake lamp bulb as required.
	3. Faulty ground circuit.	3. Test and repair brake lamp ground circuit as required.
	4. Faulty supply circuit.	4. Test and repair open brake lamp switch output circuit as required.
	5. Faulty switch.	5. Test and replace brake lamp switch as required.
BRAKE LAMP DOES NOT EXTINGUISH	1. Faulty supply circuit.	1. Test and repair shorted brake lamp switch output circuit as required.
	2. Faulty switch.	2. Test and replace brake lamp switch as required.

DAYTIME RUNNING LAMPS

NOTE: Before performing the following tests, determine whether the headlamp low and high beams operate. If the headlamp low and high beams are also inoperative, diagnose and repair that problem before attempting to repair the Daytime Running Lamps.

CONDITION	POSSIBLE CAUSES	CORRECTION
DAYTIME RUNNING LAMPS WILL NOT ILLUMINATE	1. Incorrect FCM programming.	1. Use a diagnostic scan tool to check and correct the FCM programming as required. Refer to the appropriate diagnostic information.
	2. Faulty FCM inputs or outputs.	2. Use a diagnostic scan tool to test the FCM inputs and outputs. Refer to the appropriate diagnostic information.

FRONT FOG LAMPS

CONDITION	POSSIBLE CAUSES	CORRECTION
FRONT FOG LAMP DOES NOT ILLUMINATE	1. Faulty or missing fuse.	1. Test and replace front fog lamp fuse as required.
	2. Faulty or missing bulb.	2. Test and replace front fog lamp bulb as required.
	3. Faulty ground circuit.	3. Test and repair front fog lamp ground circuit as required.
	4. Faulty supply circuit.	4. Test and repair open front fog lamp relay output circuit as required.
	5. Faulty or missing relay.	5. Test and replace front fog lamp relay as required.
	6. Faulty switch.	6. Test and replace headlamp switch as required.
FRONT FOG LAMP DOES NOT EXTINGUISH	1. Faulty supply circuit.	1. Test and repair shorted front fog lamp relay output circuit as required.
	2. Faulty relay.	2. Test and replace front fog lamp relay as required.
	3. Faulty switch.	3. Test and replace headlamp switch as required.

HAZARD WARNING LAMPS

NOTE: Before performing the following tests, confirm whether the left and right turn signals operate satisfactorily. If the turn signals are inoperative or operate improperly, diagnose and repair that problem before attempting to repair the Hazard Warning Lamps.

CONDITION	POSSIBLE CAUSES	CORRECTION
HAZARD WARNING LAMPS DO NOT FLASH	1. Faulty switch.	1. Test and replace multi-function switch as required.
HAZARD WARNING LAMPS DO NOT STOP FLASHING	1. Faulty switch.	1. Test and replace multi-function switch as required.

HEADLAMPS

NOTE: As part of the exterior lighting failsafe feature, upon ignition On the park lamps and the headlamp low beams will illuminate regardless of the headlamp switch position if the instrument cluster cannot detect an input from the headlamp switch, or if there is a loss of data bus communication.

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMP DOES NOT ILLUMINATE	1. Faulty or missing bulb.	1. Test and replace headlamp bulb as required.
	2. Faulty ground circuit.	2. Test and repair open headlamp ground circuit as required.
	3. Faulty supply circuit.	3. Test and repair open headlamp low beam or high beam circuit as required.
	4. Faulty switch.	4. Test and replace headlamp switch as required.
HEADLAMP DOES NOT EXTINGUISH	1. Faulty supply circuit.	1. Test and repair shorted headlamp low beam or high beam circuit as required.
	2. Faulty switch.	2. Test and replace headlamp switch as required.
HEADLAMPS ILLUMINATE WITH IGNITION ON AND HEADLAMP SWITCH OFF (FAIL-SAFE OPERATION)	1. Faulty circuits between headlamp switch and instrument cluster.	1. Test and repair headlamp switch mux and return circuits as required.
	2. Loss of data bus communication.	2. Use a diagnostic scan tool to test the data bus. Refer to the appropriate diagnostic information.
	3. Faulty switch.	3. Test and replace headlamp switch as required.
HEADLAMPS WILL NOT SWITCH FROM HIGH TO LOW BEAMS, OR FROM LOW TO HIGH BEAMS	1. Faulty circuits between multi-function switch and instrument cluster.	1. Test and repair wash/beam select mux and multi-function switch return circuits as required.
	2. Faulty switch.	2. Test and replace multi-function switch as required.
AUTO HEADLAMPS INOPERATIVE	1. Faulty circuits between sun load sensor and instrument cluster.	1. Test and repair sun sensor and sun sensor return circuits as required.
	2. Faulty sun load sensor.	2. Test and replace sun load sensor as required.

PARK LAMPS

NOTE: As part of the exterior lighting failsafe feature, upon ignition On the park lamps and the headlamp low beams will illuminate regardless of the headlamp switch position if the instrument cluster cannot detect an input from the headlamp switch, or if there is a loss of data bus communication.

CONDITION	POSSIBLE CAUSES	CORRECTION
PARK LAMP DOES NOT ILLUMINATE	1. Faulty or missing fuse.	1. Test and replace park lamp fuse as required.
	2. Faulty or missing bulb.	2. Test and replace park lamp bulb as required.
	3. Faulty or missing relay.	3. Test and replace park lamp relay as required.
	4. Faulty ground circuit.	4. Test and repair open park lamp ground circuit as required.
	5. Faulty supply circuit.	5. Test and repair open park lamp relay output circuit as required.
	6. Faulty switch.	6. Test and replace headlamp switch as required.
PARK LAMP DOES NOT EXTINGUISH	1. Faulty supply circuit.	1. Test and repair shorted park lamp relay output circuit as required.
	2. Faulty relay.	2. Test and replace park lamp relay as required.
	3. Faulty switch.	3. Test and replace headlamp switch as required.

TURN SIGNAL LAMPS

CONDITION	POSSIBLE CAUSES	CORRECTION
ONE TURN SIGNAL LAMP DOES NOT ILLUMINATE	1. Faulty or missing bulb.	1. Test and replace turn signal bulb as required.
	2. Faulty ground circuit.	2. Test and repair open ground circuit as required.
	3. Faulty supply circuit.	3. Test and repair open right or left turn signal circuit as required.
ALL RIGHT SIDE AND/OR ALL LEFT SIDE TURN SIGNAL LAMPS DO NOT FLASH	1. Faulty switch.	1. Test and replace multi-function switch as required.
	2. Faulty signal circuit.	2. Test and repair open right or left turn signal circuit as required.
ALL RIGHT SIDE OR ALL LEFT SIDE TURN SIGNALS FLASH TOO RAPIDLY (MORE THAN 100 FLASHES PER MINUTE)	1. Faulty or missing bulb.	1. Test and replace faulty bulb as required.
	2. Faulty ground circuit.	2. Test and repair open ground circuit as required.
	3. Faulty signal circuit.	3. Test and repair open right or left turn signal circuit as required.

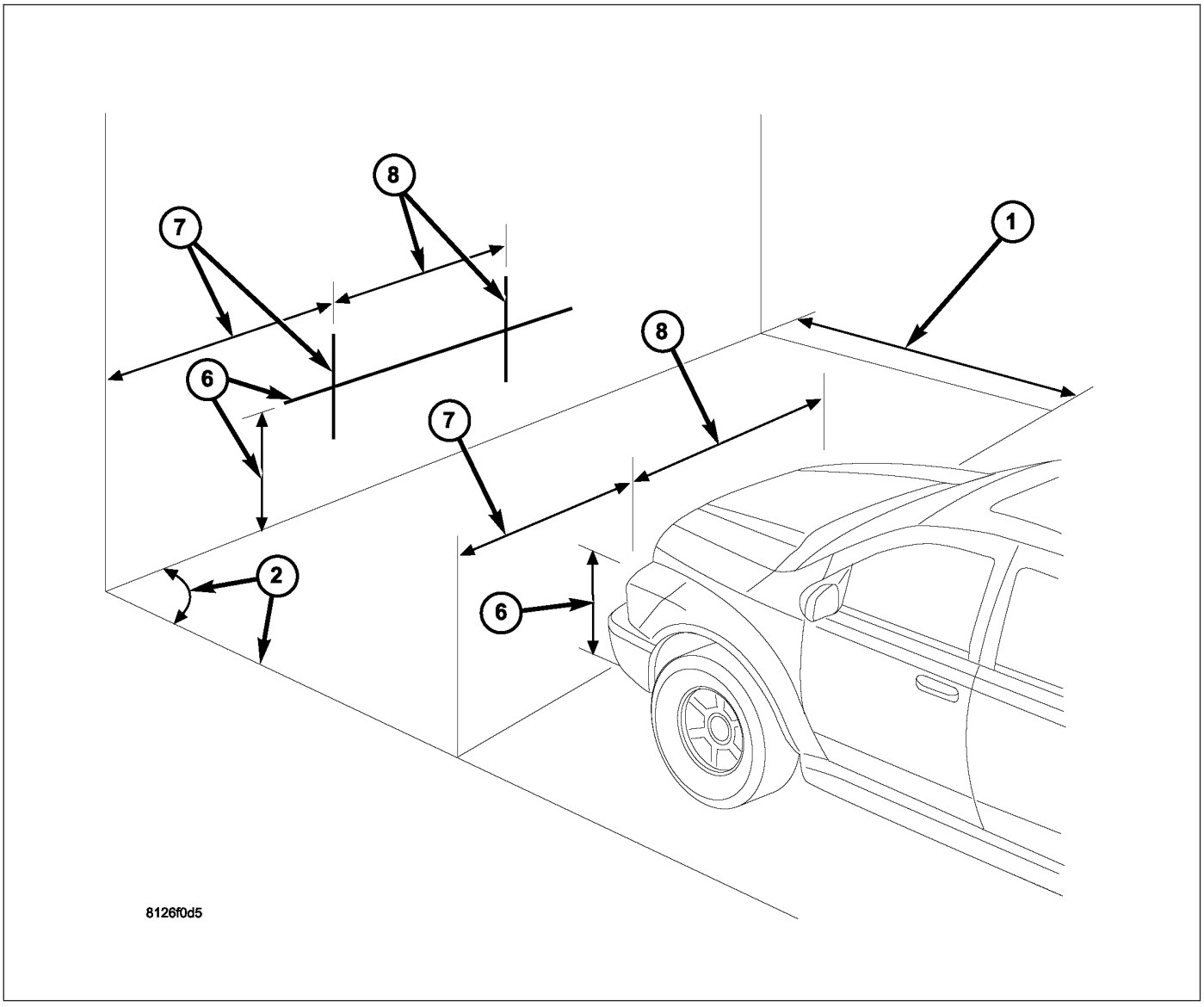
STANDARD PROCEDURE

FRONT LAMP AIMING

VEHICLE PREPARATION FOR LAMP ALIGNMENT

1. Check for and correct any burnt out bulbs.
2. Repair or replace any faulty, worn or damaged body or suspension components that could hinder proper lamp alignment.
3. Verify proper tire inflation pressures.
4. Remove any accumulations of mud, snow or ice from the vehicle underbody and clean the front lamp lenses.
5. Verify that there is no load in the vehicle (cargo or passengers), except for the driver.
6. The fuel tank should be Full. Add 2.94 kilograms (6.5 pounds) of weight over the fuel tank for each estimated gallon of missing fuel.
7. Verify correct vehicle suspension height.

LAMP ALIGNMENT SCREEN PREPARATION



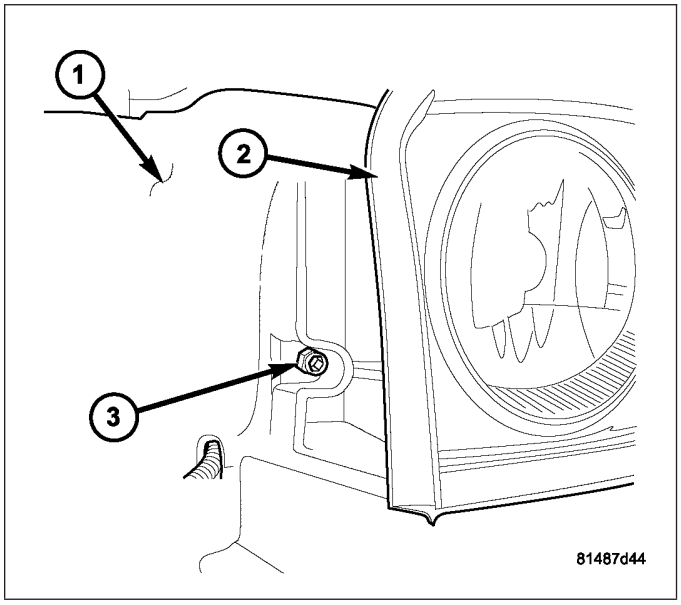
The procedure that follows will prepare a suitable front lamp alignment screen.

1. Tape a line on a level floor 7.62 meters (25 feet) away from and parallel to the flat wall that will be used as the lamp alignment screen. The level floor will be used as the horizontal zero reference.
2. An adjacent wall or floor member that is perpendicular to the alignment screen can be used as the vertical zero reference. If there is no adjacent wall or floor member that is perpendicular to the screen, tape a second line on the floor perpendicular to both the alignment screen and the first line, and outboard of either side of where the vehicle will be positioned. This will be used as the vertical zero reference.
3. Position the vehicle so that the side of the vehicle is parallel to the vertical zero reference, and so that the front of the lamp lenses are in the vertical plane of the parallel line taped on the floor 7.62 meters (25 feet) away from the screen.
4. Rock the vehicle side-to-side three times to allow the suspension to stabilize.
5. Jounce the front suspension three times by pushing downward on the front bumper and releasing.
6. Measure the distance between the optical center of one of the lamps being aimed (head or fog) and the floor (horizontal zero reference). Transfer this measurement to the alignment screen with a piece of tape placed horizontally to the floor. This line will be used as the lamp horizontal reference.
7. Measure the distance between the vertical zero reference and the optical center of the nearest lamp being aimed (head or fog). Transfer this measurement to the alignment screen with a piece of tape placed vertically across the appropriate (head or fog) lamp horizontal reference. This is the centerline reference for the first lamp.
8. Measure the distance on center between the first and the second lamp being aimed. Transfer this measurement to the alignment screen with a second piece of tape placed vertically across the appropriate (head or fog) lamp horizontal reference. This is the centerline reference for the second lamp.

HEADLAMP ALIGNMENT

NOTE: Due to the linear nature of the headlamp cutoff, a properly aimed low beam headlamp will project the top edge of the high intensity pattern on the alignment screen from the horizontal line to 50 millimeters (2 inches) below the horizontal line. No horizontal (right/left) adjustment is required for this headlamp beam pattern. The high beam pattern will be correct when the low beams are properly aimed.

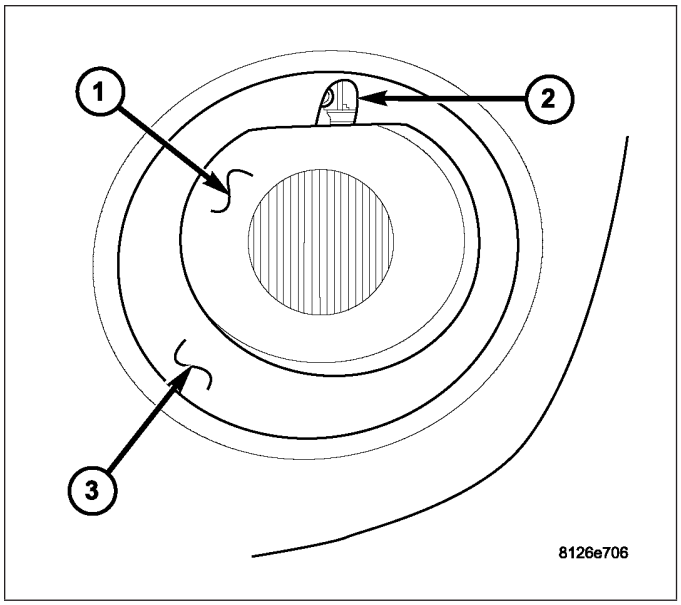
1. Turn the headlamps On and select the Low beams.
2. Open the hood and move aside the air shield (1) from the inboard side of the front lamp unit (2) as needed to access the headlamp vertical adjustment screw (3).
3. Rotate the adjustment screw on each lamp to adjust the beam height as required.



FOG LAMP ALIGNMENT

NOTE: A properly aimed front fog lamp will project a pattern on the alignment screen 100 millimeters (4 inches) below the fog lamp centerline and straight ahead of the lamp.

1. Turn the fog lamps On.
2. Rotate the fog lamp vertical adjustment screw (2) on each lamp to adjust the beam height as required.



SPECIFICATIONS

LAMPS/LIGHTING - EXTERIOR

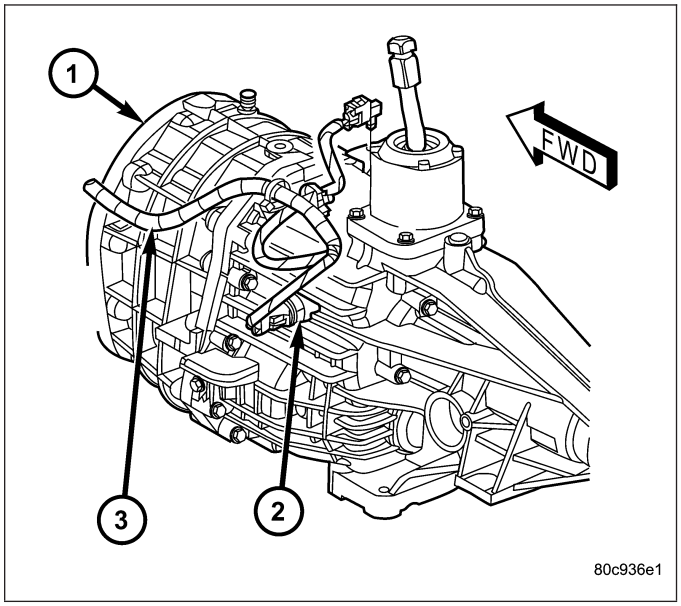
BULB APPLICATION TABLE	
LAMP	**BULB**
BACKUP	3157K
BRAKE	3157K
CENTER HIGH MOUNTED STOP	921
FRONT FOG	9145
FRONT PARK	3157NA
FRONT SIDE MARKER	3157NA
FRONT TURN SIGNAL	3157NA
HEADLAMP	H13
LICENSE PLATE	168
REAR PARK	3157K
REAR SIDE MARKER	3157K
REAR TAIL	3157K
REAR TURN SIGNAL	3157K

SWITCH-BACK UP LAMP

DESCRIPTION

Vehicles equipped with a manual transmission have a normally open, spring-loaded plunger type backup lamp switch (2). Vehicles with an optional electronic automatic transmission have a Transmission Range Sensor (TRS) that is used to perform several functions, including that of the backup lamp switch. The TRS is described in further detail elsewhere in this service information.

The backup lamp switch is located in a threaded hole on the side of the manual transmission housing. The switch has a threaded body and a hex formation near the plunger end of the switch. An integral connector receptacle at the end of the switch opposite the plunger connects the switch to the vehicle electrical system through a take out and connector of the engine wire harness. When installed, only the switch connector and the hex formation are visible on the outside of the transmission housing. The backup lamp switch cannot be adjusted or repaired and, if faulty or damaged, the entire switch unit must be replaced.



OPERATION

The backup lamp switch controls the flow of battery voltage to the backup lamp bulbs through an output on the backup lamp feed circuit. The switch plunger is mechanically actuated by the gearshift mechanism within the transmission, which will depress the switch plunger and close the switch contacts whenever the reverse gear has been selected. The switch receives battery voltage through a fuse in the Integrated Power Module (IPM) on a fused ignition switch output (run) circuit whenever the ignition switch is in the On position. The backup lamp switch and circuits can be tested using conventional diagnostic tools and methods.

DIAGNOSIS AND TESTING

BACKUP LAMP SWITCH

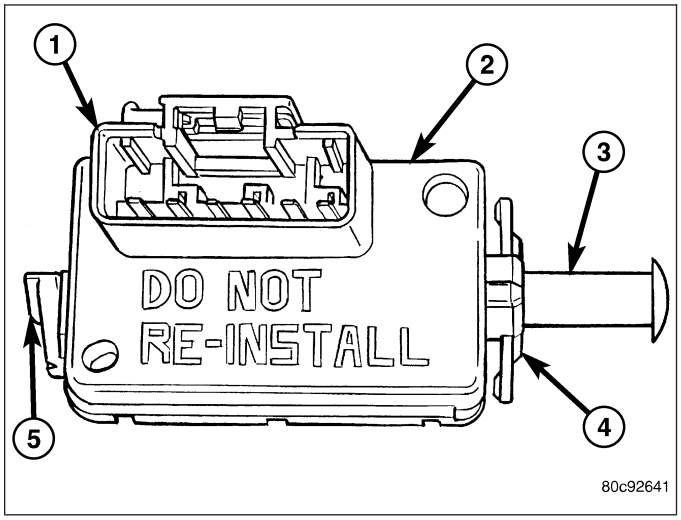
1. Disconnect and isolate the battery negative cable.
2. Raise and support the vehicle.
3. Locate and disconnect the engine wire harness connector for the backup lamp switch.
4. Check for continuity between the two terminal pins in the backup lamp switch connector receptacle.
   a. With the gear selector lever in the Reverse position, there should be continuity.
   b. With the gear selector lever in any position other than Reverse, there should be no continuity.
5. If the switch fails either of these two continuity tests, replace the faulty backup lamp switch.

SWITCH-STOP LAMP

DESCRIPTION

The brake lamp switch (2) is a three circuit, spring-loaded plunger actuated switch that is secured to the steering column support bracket under the instrument panel on the driver side of the vehicle. The molded plastic switch housing has an integral connector receptacle (1) containing six terminal pins and featuring a Connector Position Assurance (CPA) lock. The switch is connected to the vehicle electrical system through a dedicated take out of the instrument panel wire harness.

The switch plunger (3) extends through a mounting collar (4) on one end of the switch housing. The plunger has a one time telescoping self-adjustment feature that is activated after the switch is installed by moving an adjustment release lever (5) on the opposite end of the switch housing clockwise, until it locks into a position that is horizontal and parallel to the connector receptacle.



An installed brake lamp switch cannot be readjusted or repaired. If the switch is damaged, faulty, or removed from its mounting position for any reason, it must be replaced with a new unit.

OPERATION

The brake lamp switch controls three independent circuits. These circuits are described as follows:

- **Brake Lamp Switch Circuit** - A normally open brake lamp switch circuit receives a battery voltage input, and supplies this battery voltage to the brake lamps and the Controller Antilock Brake (CAB) on a brake lamp switch output circuit only when the brake pedal is depressed (brake lamp switch plunger released).
- **Brake Lamp Switch Signal Circuit** - A normally closed brake lamp switch signal circuit receives a direct path to ground, and supplies this ground input to the Powertrain Control Module (PCM) on a brake lamp switch sense circuit only when the brake pedal is released (brake lamp switch plunger is depressed).
- **Speed Control Circuit** - A normally closed speed control circuit receives a battery voltage input from the Powertrain Control Module on a speed control supply circuit, and supplies this battery voltage to the speed control servo solenoids (dump, vacuum, and vent) on a speed control brake switch output circuit only when the speed control system is turned On and the brake pedal is released (brake lamp switch plunger is depressed).

The components of the self-adjusting brake switch plunger consist of a two-piece telescoping plunger, a split plunger locking collar, and a release wedge. The release lever has a shaft with a wedge that spreads the plunger locking collar to an open or released position. After the switch is installed and the brake pedal is released, the plunger telescopes to the correct adjustment position. When the release lever is moved to the release position, the wedge is disengaged from the locking collar causing the collar to apply a clamping pressure to the two plunger halves, fixing the plunger length.

The brake lamp switch is diagnosed using conventional diagnostic tools and methods.

DIAGNOSIS AND TESTING

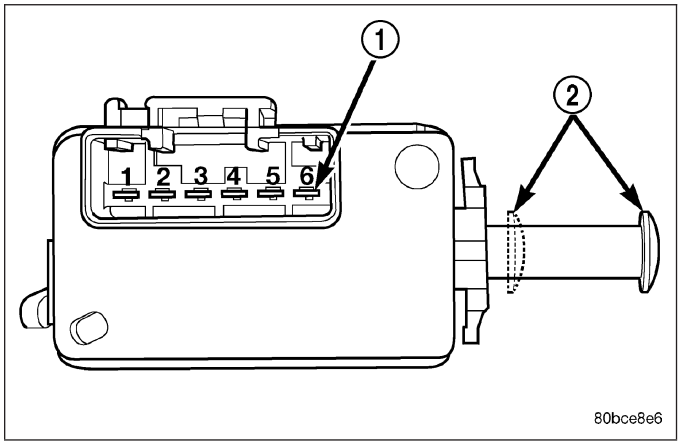
BRAKE LAMP SWITCH

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.

CAUTION: Do not remove the brake lamp switch from the mounting bracket. The self-adjusting switch plunger is a one time only feature. If the switch is removed from the mounting bracket, it MUST be replaced with a new switch.

2. Disconnect the wire harness connector from the brake lamp switch.
3. Using an ohmmeter, perform the continuity tests at the terminal pins (1) in the brake lamp switch connector receptacle as shown in the Brake Lamp Switch Tests table.



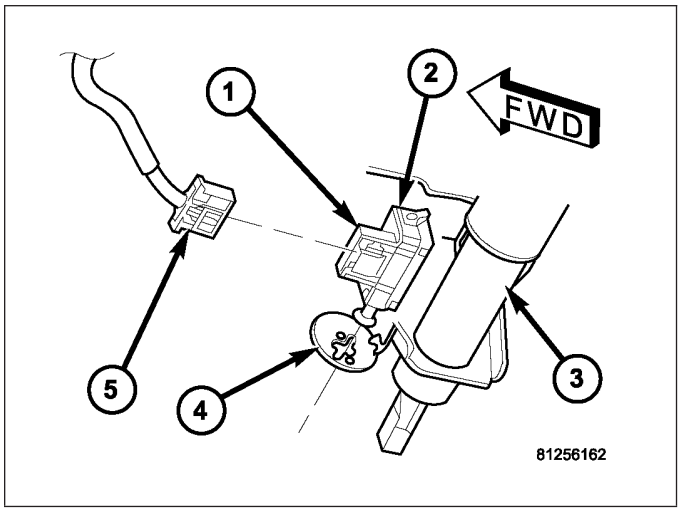
BRAKE LAMP SWITCH TESTS	
PLUNGER POSITION (2)	**CONTINUITY BETWEEN**
Released (Extended)	Pins 1 & 2
Compressed (Depressed)	Pins 3 & 4, 5 & 6

4. If the switch fails any of the continuity tests, replace the faulty brake lamp switch as required.

REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.
2. Locate the brake lamp switch (1) near the support bracket on the lower steering column (3).
3. Disconnect the wire harness connector (5) from the brake lamp switch.
4. Rotate the brake lamp switch housing clockwise about 30 degrees to align the tabs on the switch locking collar with the keyed hole in the switch mounting bracket (4).
5. Pull the switch straight back from the keyed hole to remove it from the bracket.



CAUTION: The brake lamp switch self-adjusting switch plunger is a one time only feature. If the switch is removed from the mounting bracket, it MUST be replaced with a new switch.

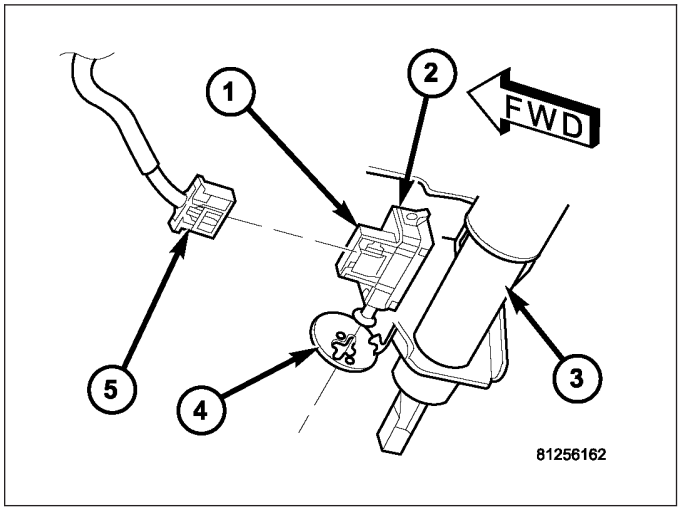
6. Discard the removed brake lamp switch
.

INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

CAUTION: The brake lamp switch self-adjusting switch plunger is a one time only feature. If the switch is removed from the mounting bracket, it MUST be replaced with a new switch.

1. Depress and hold the brake pedal in the depressed position.
2. Align the tabs on the brake lamp switch locking collar with the keyed hole in the switch mounting bracket (4) on the lower steering column (3).
3. Insert the tabs on the brake lamp switch locking collar through the keyed hole in the switch mounting bracket until the switch housing (1) is firmly seated against the bracket.
4. Rotate the switch housing counterclockwise about 30 degrees to engage the tabs on the locking collar with the switch mounting bracket.



CAUTION: Do not release or pull up on the brake pedal before the switch plunger adjustment has been completed.

5. Release the brake pedal, but do not pull it upward.
6. Rotate the plunger adjustment release lever (2) clockwise until it locks into place. The lever should be parallel to the brake lamp switch connector receptacle. This action will set the switch plunger length to a final adjustment position and cannot be undone. If not performed properly the first time, a new brake lamp switch **must** be installed.
7. Reconnect the wire harness connector (5) to the brake lamp switch.

8. Reconnect the battery negative cable.

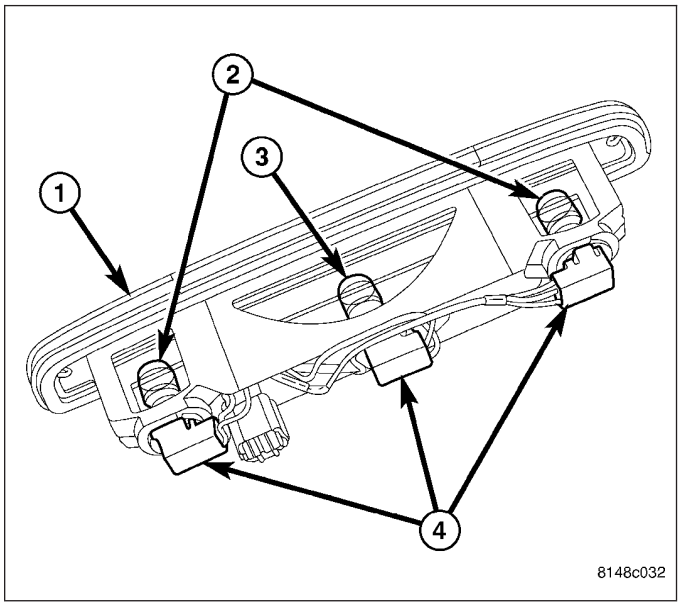
LAMP-HIGH MOUNTED STOP

REMOVAL

BULB

NOTE: The Center High Mounted Stop Lamp (CHMSL) houses three bulbs. The center bulb is the CHMSL bulb and illuminates through a red lens, while the two outboard bulbs are for the cargo lamps and illuminate through clear lenses. The bulb types and service procedures are identical for all three of these bulbs.

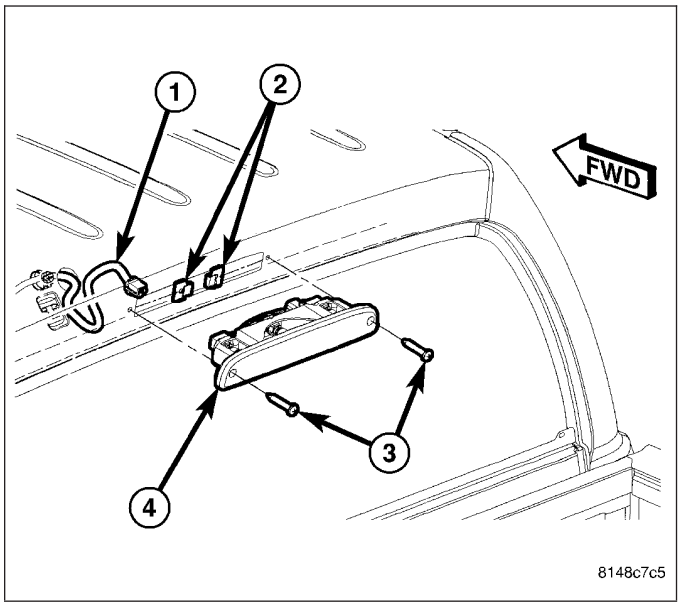
1. Disconnect and isolate the battery negative cable.
2. Remove the two screws that secure the CHMSL to the rear cab roof header panel.
3. Pull the CHMSL lens and housing (1) away from the header panel far enough to access the lamp wiring and bulb sockets (4) on the back of the lamp.
4. Firmly grasp the center socket on the back of the lamp housing and rotate it counterclockwise about 30 degrees to unlock it.
5. Pull the socket and bulb straight out from the keyed opening in the housing.
6. Pull the base of the bulb (3) straight out of the socket.



LAMP

NOTE: The Center High Mounted Stop Lamp (CHMSL) for this model incorporates two integral cargo lamps. The center bulb is the CHMSL bulb and illuminates through a red lens, while the two outboard bulbs are for the cargo lamps and illuminate through clear lenses.

1. Disconnect and isolate the battery negative cable.
2. Remove the two screws (3) that secure the Center High Mounted Stop Lamp (CHMSL) (4) to the rear roof header panel.
3. Pull the CHMSL away from the opening in the roof header far enough to access and disconnect the wire harness connector (1) from the pigtail connector on the back of the lamp housing.
4. Remove the CHMSL from the roof header.



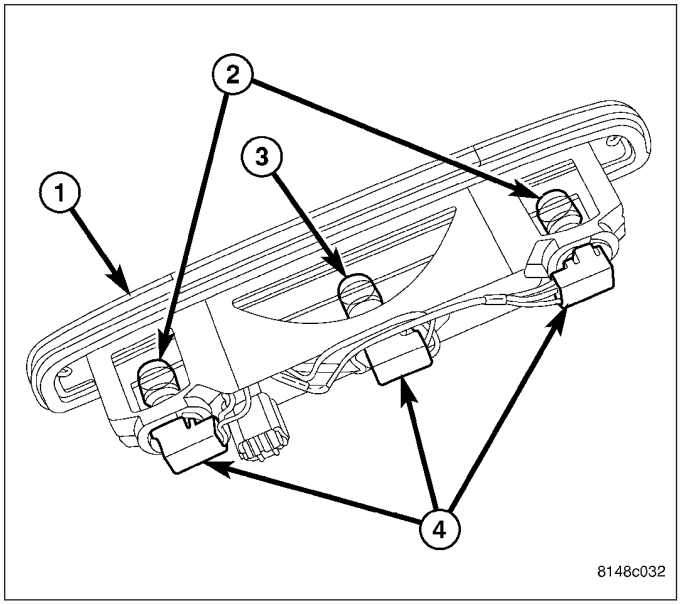
INSTALLATION

BULB

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

NOTE: The Center High Mounted Stop Lamp (CHMSL) houses three bulbs. The center bulb is the CHMSL bulb and illuminates through a red lens, while the two outboard bulbs are for the cargo lamps and illuminate through clear lenses. The bulb types and service procedures are identical for all three of these bulbs.

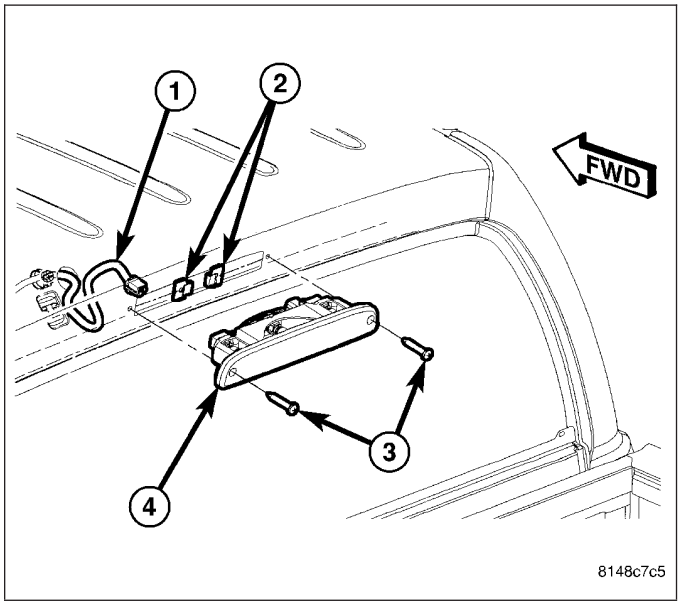
1. Align the base of the CHMSL bulb (3) with the socket (4).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of CHMSL housing (1).
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Position the CHMSL into the opening in the rear cab roof header panel.
7. Install and tighten the two screws that secure the CHMSL to the header panel. Tighten the screws to 2 N·m (20 in. lbs.).
8. Reconnect the battery negative cable.



LAMP

NOTE: The Center High Mounted Stop Lamp (CHMSL) for this model incorporates two integral cargo lamps. The center bulb is the CHMSL bulb and illuminates through a red lens, while the two outboard bulbs are for the cargo lamps and illuminate through clear lenses.

1. Check to be certain that the two J-nuts (2) are properly positioned on the rear roof header inner panel.
2. Position the Center High Mounted Stop Lamp (CHMSL) (4) near the rear roof header panel opening.
3. Reconnect the wire harness connector (1) to the pigtail connector on the back of the CHMSL housing.
4. Install and tighten the two screws (3) that secure the CHMSL to the rear roof header inner panel. Tighten the screws to 2 N·m (20 in. lbs.).
5. Reconnect the battery negative cable.



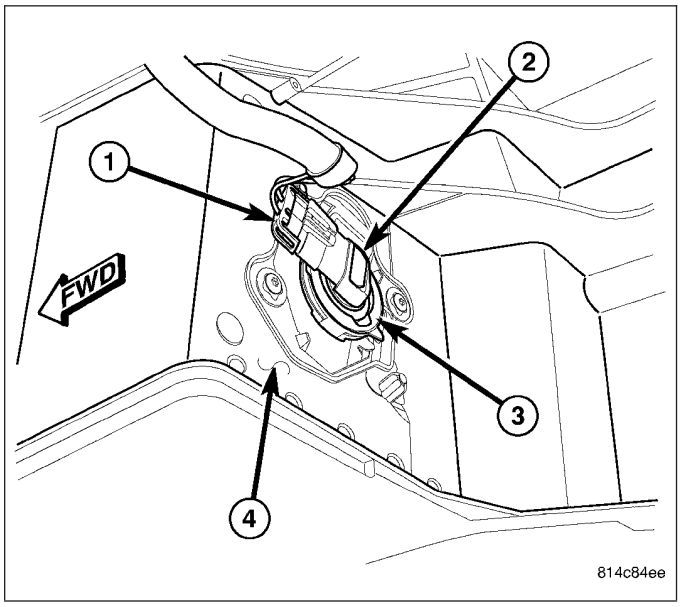
FRONT FOG LAMP

REMOVAL

BULB

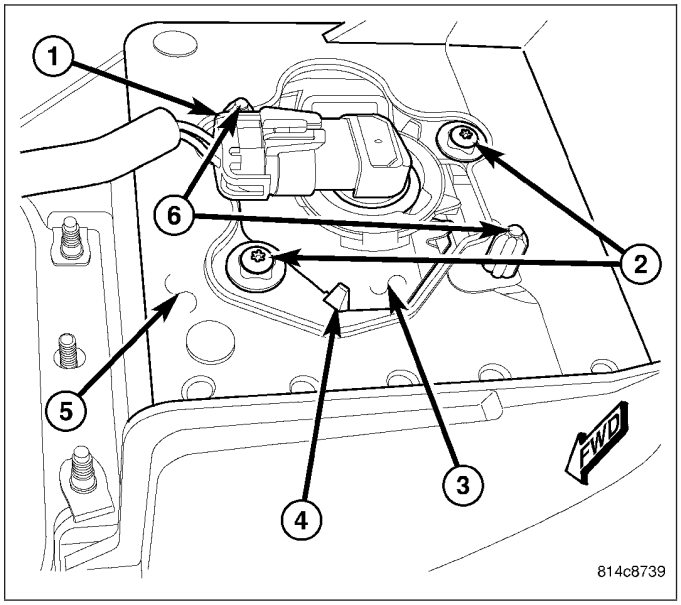
CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.

1. Disconnect and isolate the battery negative cable.
2. Reach under and behind the front fascia to access the front fog lamp housing (3) on the back of the front bumper support (4).
3. Disconnect the wire harness connector (1) from the fog lamp socket (2).
4. Firmly grasp the socket on the back of the housing and rotate it counterclockwise about 30 degrees to unlock it.
5. Pull the socket and bulb straight out from the keyed opening in the housing.
6. Pull the base of the bulb straight out of the socket.



LAMP

1. Disconnect and isolate the battery negative cable.
2. Remove the front fascia from the front bumper support. (Refer to 13 - FRAME & BUMPERS/ BUMPERS/FRONT FASCIA - REMOVAL).
3. Reach under and behind the front of the vehicle to access the front fog lamp housing (3) on the back of the front bumper support (5).
4. Disconnect the wire harness connector (1) from the fog lamp bulb socket.
5. Remove the two screws (2) that secure the fog lamp mounting bracket to the bumper support.
6. Release the three integral latch clips (4) that secure the fog lamp mounting bracket to the opening in the bumper support.
7. Remove the lamp and mounting bracket as a unit from the seat in the face of the bumper support.



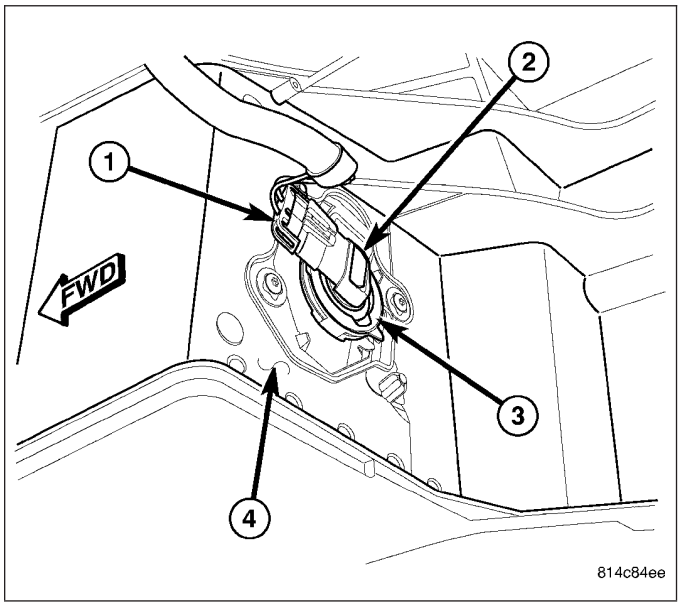
INSTALLATION

BULB

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

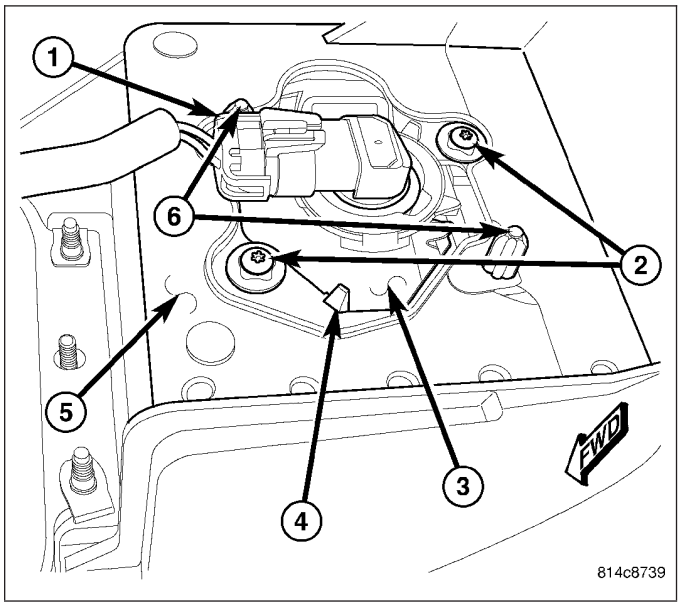
CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.

1. Align the base of the bulb with the front fog lamp socket (2).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of the front fog lamp housing (3).
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place. The socket connector receptacle should be in a horizontal orientation.
6. Reconnect the wire harness connector (1) to the socket.
7. Reconnect the battery negative cable.



LAMP

1. Position the front fog lamp (3) and mounting bracket as a unit into the seat on the face of the front bumper support (5).
2. Be certain that the alignment pins (6) on the back of the lamp mounting bracket are inserted through the alignment holes in the back of the seat, then press on the front of the lamp using hand pressure until the three latch clips (4) on the mounting bracket are fully engaged in the opening in the bumper support.
3. From the back of the bumper support, install and tighten the two screws (2) that secure the lamp mounting bracket to the bumper support. Tighten the screws to 2 N·m (14 in. lbs.).
4. Reconnect the wire harness connector (1) to the fog lamp bulb socket.
5. Reinstall the front fascia onto the bumper support. (Refer to 13 - FRAME & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION).
6. Reconnect the battery negative cable.
7. Confirm proper front fog lamp alignment. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - STANDARD PROCEDURE - FRONT LAMP AIMING).

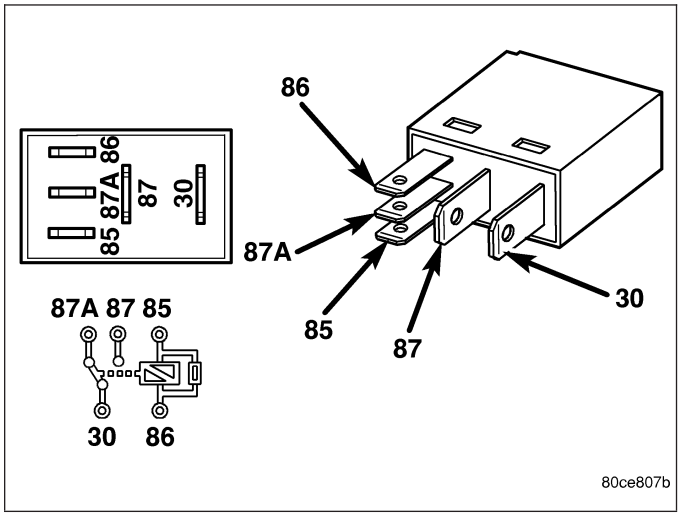


RELAY-FRONT FOG LAMP

DESCRIPTION

The front fog lamp relay is a conventional International Standards Organization (ISO) micro relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. This relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs through five integral male spade-type terminals that extend from the relay base plate.

The front fog lamp relay is located in the Power Distribution Center (PDC) in the engine compartment near the battery. Refer to the layout label on the underside of the PDC cover for specific relay cavity assignment information. The front fog lamp relay cannot be adjusted or repaired and, if faulty or damaged, the unit must be replaced.



OPERATION

The front fog lamp relay is an electromechanical switch that uses a low current input from the Front Control Module (FCM) (also referred to as the Integrated Power Module/IPM) to control a high current output to the front fog lamps. Within the relay are an electromagnetic coil, a movable contact and two fixed contact points. A resistor is connected in parallel with the coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the field of the relay coil collapses.

The movable common supply contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This field draws the movable contact away from the normally closed contact, and holds it against the normally open contact. When the relay coil is de-energized, spring pressure returns the movable contact back against the normally closed contact.

The inputs and outputs of the front fog lamp relay include:

- **Common Supply Terminal (30)** - The common feed terminal is connected to a fused B(+) circuit at all times.
- **Coil Ground Terminal (85)** - The coil ground terminal is connected to a fused B(+) circuit at all times.
- **Coil Battery Terminal (86)** - The coil battery terminal is connected to a control output of the FCM through a fog lamp relay control circuit. The FCM controls front fog lamp operation by controlling a ground path through this circuit.
- **Normally Open Terminal (87)** - The normally open terminal is connected to the front fog lamps through a fog lamp relay output circuit and provides battery voltage to the front fog lamps whenever the relay is energized.
- **Normally Closed Terminal (87A)** - The normally closed terminal is not connected to any circuit in this application, but will have battery voltage present whenever the relay is de-energized.

The front fog lamp relay can be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information.

LAMP-FRONT COMBINATION

STANDARD PROCEDURE

FRONT LAMP UNIT MOISTURE CLEARING

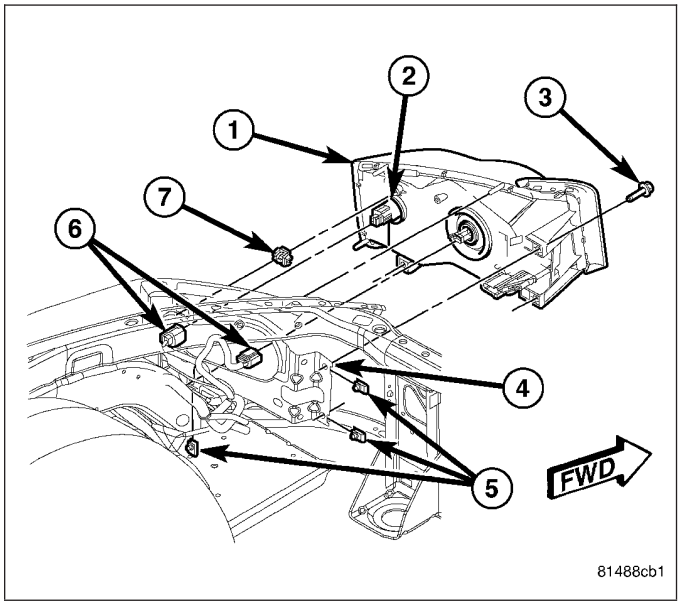
Some moisture accumulation inside a vented front lamp unit is normal. This normal moisture will appear as a fogging on the inside of the lamp lens, similar to the fog that sometimes appears on the inside of a windshield. This moisture may be removed by activating the headlamps on high beam for 15 minutes.

If water droplets larger than 1 millimeter in size have accumulated on the inside of the lamp lens, the front lamp unit should be replaced.

REMOVAL

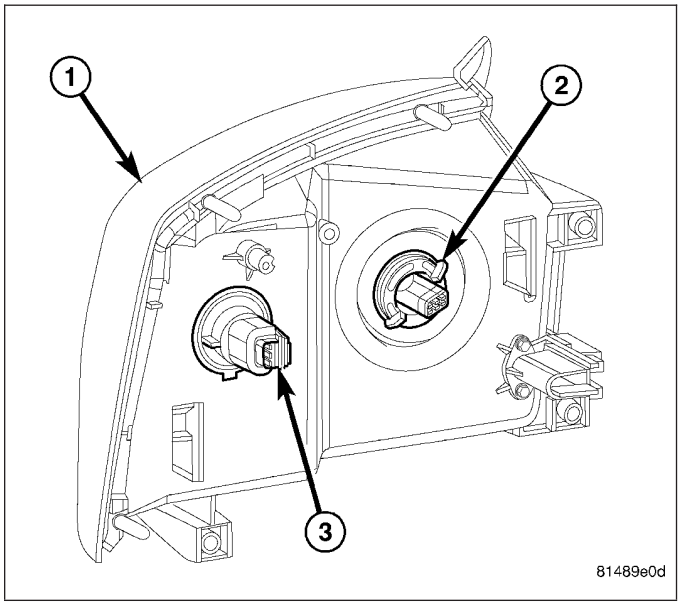
LAMP

1. Disconnect and isolate the battery negative cable.
2. Remove the three screws (3) that secure the inboard and lower mounts of the front lamp unit (1) to the front fender headlamp bracket (4).
3. Grasp the lamp firmly and pull straight forward to disengage the ball stud (2) on the back of the upper outboard corner of the lamp from the plastic grommet (7) in the fender bracket.
4. Pull the lamp away from the front fender far enough to access and disconnect the two wire harness connections (6) from the headlamp bulb and the front park/turn signal/side marker bulb socket on the back of the lamp.
5. Remove the front lamp unit from the fender.



BULB - PARK/TURN SIGNAL/SIDE MARKER

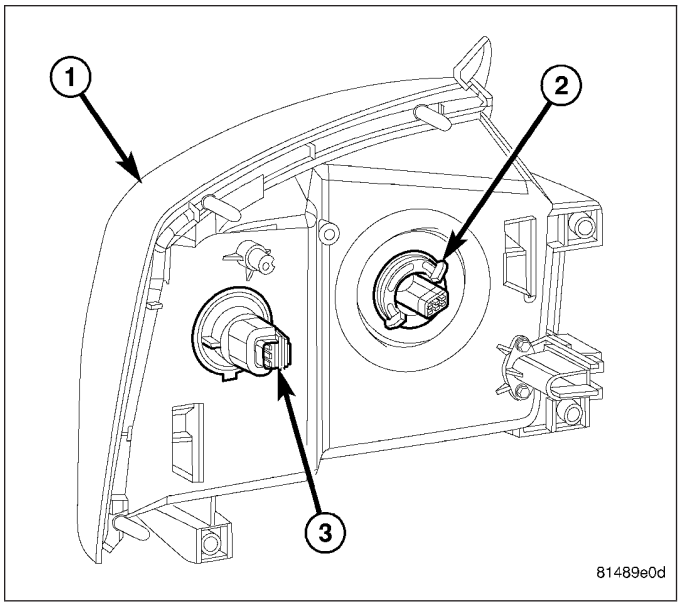
1. Disconnect and isolate the battery negative cable.
2. Remove the front lamp unit (1) from the front fender. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/FRONT LAMP UNIT - REMOVAL).
3. Firmly grasp the park/turn signal/side marker bulb socket (3) on the back of the front lamp unit housing and rotate it counterclockwise about 30 degrees to unlock it.
4. Pull the socket and bulb straight out from the keyed opening in the housing.
5. Pull the base of the bulb straight out of the socket.



BULB - HEADLAMP

CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.

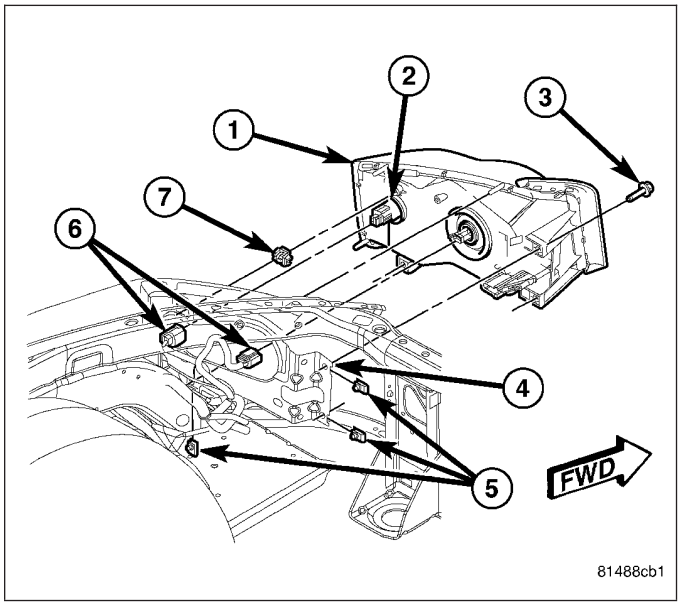
1. Disconnect and isolate the battery negative cable.
2. Remove the front lamp unit (1) from the front fender. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/FRONT LAMP UNIT - REMOVAL).
3. Firmly grasp the headlamp bulb socket (2) on the back of the front lamp unit housing and rotate it counterclockwise about 30 degrees to unlock it.
4. Pull the socket and bulb unit straight out from the keyed opening in the housing.



INSTALLATION

LAMP

1. Check to be certain that the three front lamp unit U-nuts (5) and the plastic grommet (7) are in good condition and properly positioned on the front fender headlamp bracket (4).
2. Position the lamp close enough to the front fender to access and reconnect the two wire harness connections (6) to the headlamp bulb and the front park/turn signal/side marker bulb socket on the back of the lamp.
3. Rearrange the wire harnesses as necessary to prevent them from becoming pinched between the back of the lamp housing and the fender.
4. Align the ball stud (3) on the back of the upper outboard corner of the lamp with the grommet in the fender bracket.
5. Using hand pressure, press the lamp firmly and evenly rearward until the ball stud snaps into the grommet.

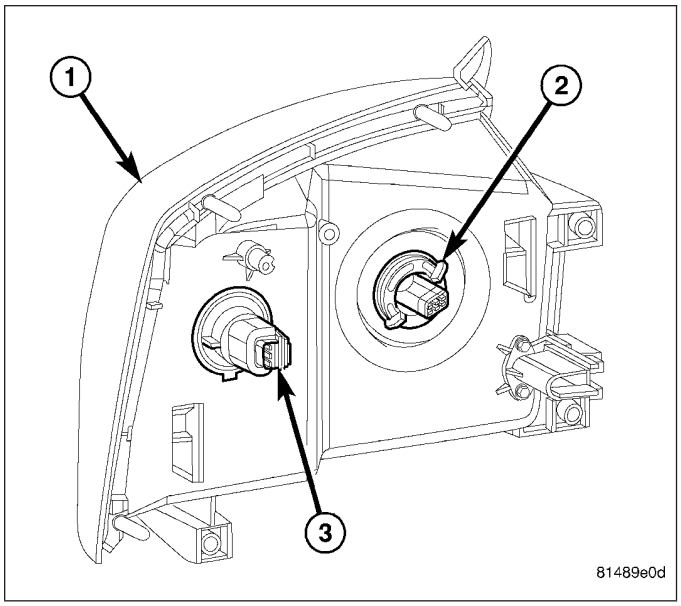


6. Install the three screws (3) that secure the inboard and lower mounts of the lamp to the U-nuts on the fender bracket. Tighten the screws in Tighten the screws in sequence beginning with the outboard lower, then the inboard upper and finally the inboard lower. Tighten the screws to 7 N·m (65 in. lbs.).
7. Reconnect the battery negative cable.
8. Confirm proper headlamp alignment. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - STANDARD PROCEDURE - FRONT LAMP AIMING).

BULB - PARK/TURN SIGNAL/SIDE MARKER

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

1. Align the base of the bulb with the park/turn signal/ side marker bulb socket (3).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of the front lamp unit housing (1).
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Reinstall the front lamp unit onto the front fender. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/FRONT LAMP UNIT - INSTALLATION).
7. Reconnect the battery negative cable.

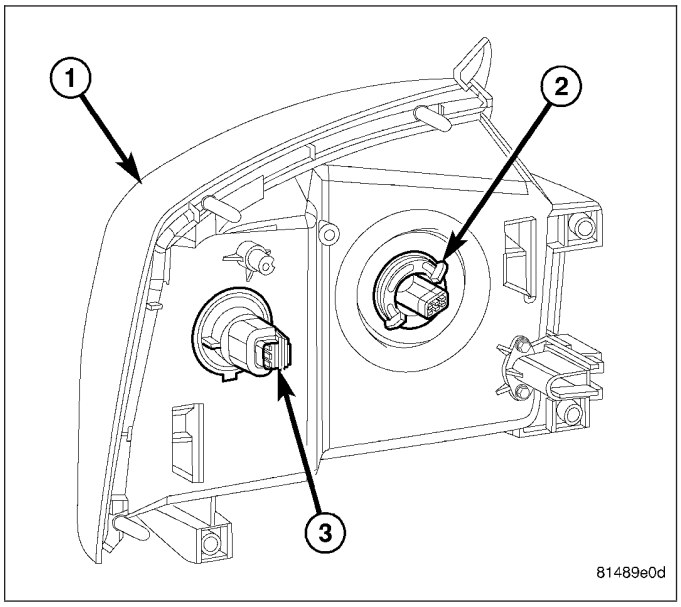


BULB - HEADLAMP

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

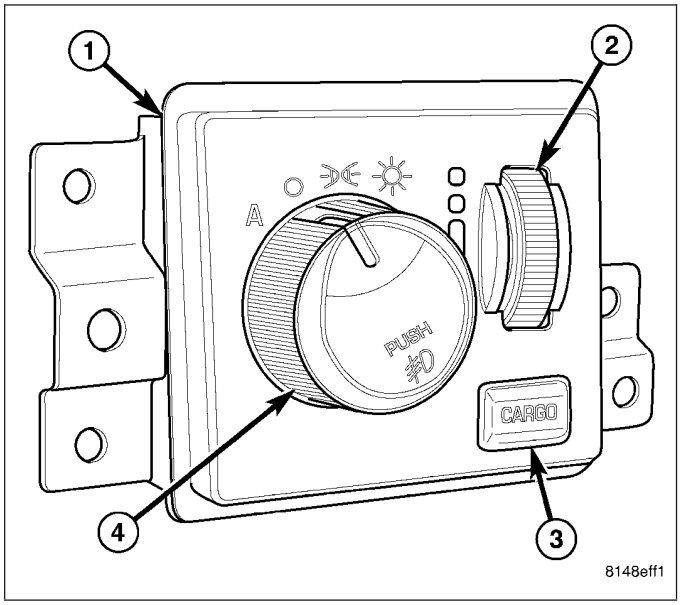
CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.

1. Align the headlamp socket and bulb unit (2) with the keyed opening on the back of the front lamp unit housing (1).
2. Insert the socket and bulb into the housing until the socket is firmly seated.
3. Rotate the socket clockwise about 30 degrees to lock it into place.
4. Reinstall the front lamp unit onto the front fender. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/FRONT LAMP UNIT - INSTALLATION).
5. Reconnect the battery negative cable.



SWITCH-HEADLAMP

DESCRIPTION



The headlamp switch (1) is located on the instrument panel, to the left of the steering column. Three different switches are used. The standard switch features a three detent position rotary knob (4) for exterior lighting control, a thumbwheel (2) for panel lamps dimming and interior lighting control, and a momentary push button (3) for cargo lamp control. An optional switch has a momentary “Push” function added to the rotary knob for front fog lamp control. A second optional switch has the same thumbwheel and momentary push button, but has a fourth detent position added to the rotary knob for selecting the optional automatic headlamps feature.

Each of these switches is constructed of molded plastic. The rotary knob is molded plastic and knurled around its circumference to ease operator control. On models with optional fog lamps the rotary knob also has the text “PUSH” and an International Control and Display Symbol icon for “Front Fog Light” applied to it. The thumbwheel is also plastic and knurled. The cargo lamp push button is plastic with a smooth finish and the text “CARGO” applied to it. The switch face plate is also labeled with graphics and icons to clearly identify the many functions of the rotary knob and thumbwheel.

Three screws secure the switch to the back of the cluster bezel through integral mounting flanges that are molded to each side of the switch housing. The back of the switch housing has an integral connector receptacle containing terminal pins that connect the switch to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness. A panel dimmer controlled incandescent bulb soldered to the circuit board within the switch provides back lighting for visibility at night, but is not serviceable. The headlamp switch cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

The headlamp switch uses two resistor multiplexed outputs and one conventional output to control the many functions and features it provides. The switch receives a clean ground from the ElectroMechanical Instrument Cluster (EMIC) (also sometimes referred to as the Cab Control Node/CCN) on a headlamp switch return circuit. It then provides outputs to the EMIC on a headlamp switch signal circuit to control exterior lighting functions, on a panel lamps dimmer signal circuit to control panel dimmer and interior lighting functions, and on a cargo lamp return circuit to control the cargo lamps.

The switch illumination circuit receives a path to ground at all times through the left instrument panel ground circuit. The illumination level is controlled by a Pulse-Width Modulated (PWM) output received from the EMIC on a headlamp switch illumination control circuit. The EMIC controls this output based upon the dimmer signal select mux input from the headlamp switch.

The headlamp switch operates as follows:

- **Cargo Lamps Control** - The cargo lamp push button on the headlamp switch is depressed to activate or deactivate the cargo lamps. The headlamp switch provides an output to the EMIC, and the EMIC responds by providing the appropriate cargo lighting control outputs through its internal cargo lamp driver circuit.
- **Front Fog Lamps Control** - For vehicles so equipped, the rotary knob on the headlamp switch is depressed to activate or deactivate the optional front fog lamps. The headlamp switch provides an output to the EMIC, and the EMIC responds by sending electronic fog lamp switch status messages to the Front Control Module (FCM) over the Controller Area Network (CAN) data bus. The FCM responds by energizing or de-energizing the front fog lamp relay in the Power Distribution Center (PDC).
- **Exterior Lighting Control** - The rotary knob on the headlamp switch is rotated to a detent position to activate or deactivate the exterior lighting. The headlamp switch provides an output to the EMIC, and the EMIC

responds by sending electronic exterior lighting switch status messages to the FCM over the CAN data bus. The FCM responds by energizing or de-energizing the park lamp relay in the PDC and the high or low beam headlamp circuits. The FCM remembers which headlamp beams were last selected using the multi-function switch, and energizes those beams by default the next time the headlamps are turned On. If the vehicle is equipped with optional automatic headlamps and the Auto position is selected, the EMIC also monitors an input from a sun load sensor on the instrument panel and, based upon the monitored ambient light levels, responds by automatically sending appropriate messages to the FCM to turn the exterior lighting On or Off while the ignition switch is in the On position.

- **Interior Lighting Control** - The thumbwheel on the headlamp switch is rotated to the dome defeat, dome on, parade/funeral mode, or one of the six panel dimmer detent positions to control the interior courtesy/dome and panel lamps. The headlamp switch provides an output to the EMIC, and the EMIC responds by providing the appropriate interior lighting control outputs through its internal courtesy lamp driver circuits, electronic dimming level messages to other modules over the CAN data bus, and/or the proper PWM outputs to control dimming levels through several panel dimmer illumination control driver circuits.

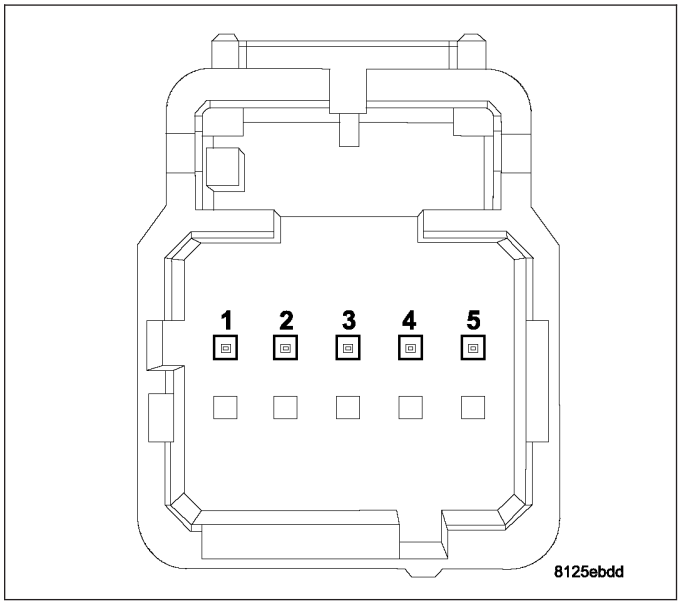
The headlamp switch can be diagnosed using conventional diagnostic tools and methods. However, proper testing of the multiplexed inputs to and PWM processing of the EMIC requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING

HEADLAMP SWITCH

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Remove the cluster bezel from the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/ CLUSTER BEZEL - REMOVAL).
2. Disconnect the wire harness connector from the back of the headlamp switch.
3. Using an ohmmeter, test the resistance or continuity between the terminals of the switch as shown in the Headlamp Switch Tests table.



HEADLAMP SWITCH TESTS	
SWITCH POSITION (PINS)	**RESISTANCE RANGE (OHMS)**
AUTO (1 & 3)	4028.0 - 4457.0
OFF (1 & 3)	1938.0 - 2147.0
PARK (1 & 3)	1073.0 - 1191.5
HEADLAMP (1 & 3)	627.0 - 698.0
FOG LAMP - AUTO (1 & 3)	347.2 - 388.8

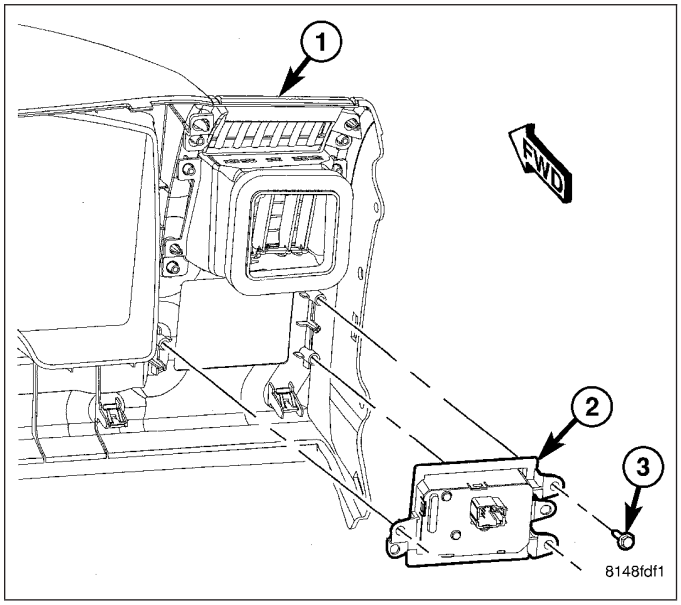
HEADLAMP SWITCH TESTS	
SWITCH POSITION (PINS)	**RESISTANCE RANGE (OHMS)**
FOG LAMP - OFF (1 & 3)	317.7 - 356.1
FOG LAMP - PARK (1 & 3)	280.7 - 315.2
FOG LAMP - HEADLAMP (1 & 3)	236.6 - 266.5
DOME DEFEAT (2 & 3)	14143.6 - 15610.4
PANEL DIMMER 1 (2 & 3)	5498.6 - 6055.4
PANEL DIMMER 2 (2 & 3)	2933.6 - 3220.4
PANEL DIMMER 3 (2 & 3)	1793.6 - 1960.4
PANEL DIMMER 4 (2 & 3)	1147.6 - 1246.4
PANEL DIMMER 5 (2 & 3)	739.1 - 794.9
PANEL DIMMER 6 (2 & 3)	482.6 - 511.4
PARADE/FUNERAL MODE (2 & 3)	301.9 - 327.1
DOME ON (2 & 3)	166.3 - 188.8
CARGO (3 & 6)	MOMENTARY CONTINUITY
SWITCH ILLUMINATION (4 & 5)	CONTINUITY AT ALL TIMES

4. If the switch fails any of the tests, replace the faulty headlamp switch as required.

REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

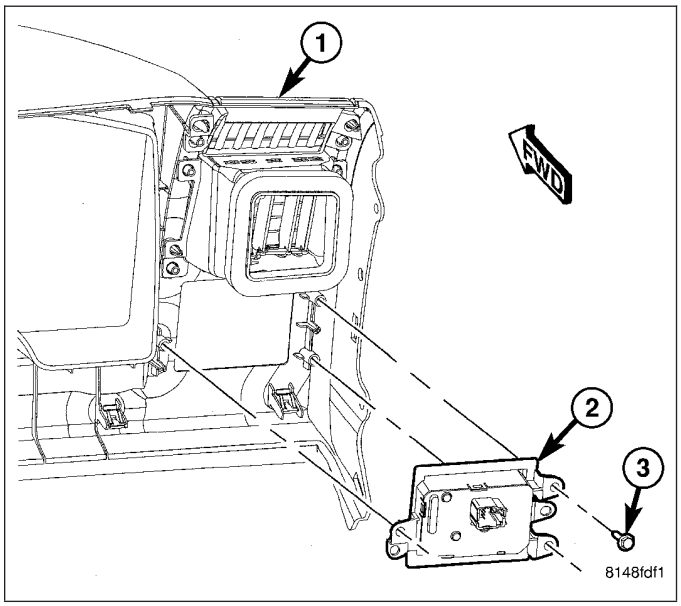
1. Disconnect and isolate the battery negative cable.
2. Remove the cluster bezel (1) from the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/ CLUSTER BEZEL - REMOVAL).
3. Disconnect the wire harness connector from the back of the headlamp switch (2).
4. Remove the three screws (3) that secure the headlamp switch to the back of the cluster bezel.
5. Remove the headlamp switch from the cluster bezel.



INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Position the headlamp switch (2) to the back of the cluster bezel (1).
2. Install and tighten the three screws (3) that secure the headlamp switch to the cluster bezel. Tighten the screws to 2 N·m (17 in. lbs.).
3. Reconnect the wire harness connector to the back of the headlamp switch.
4. Reinstall the cluster bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ CLUSTER BEZEL - INSTALLATION).
5. Reconnect the battery negative cable.

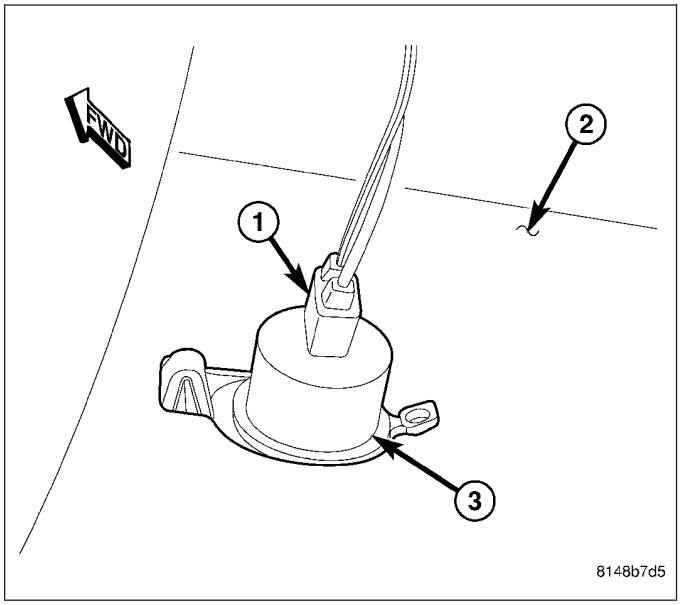


LICENSE PLATE LAMP

REMOVAL

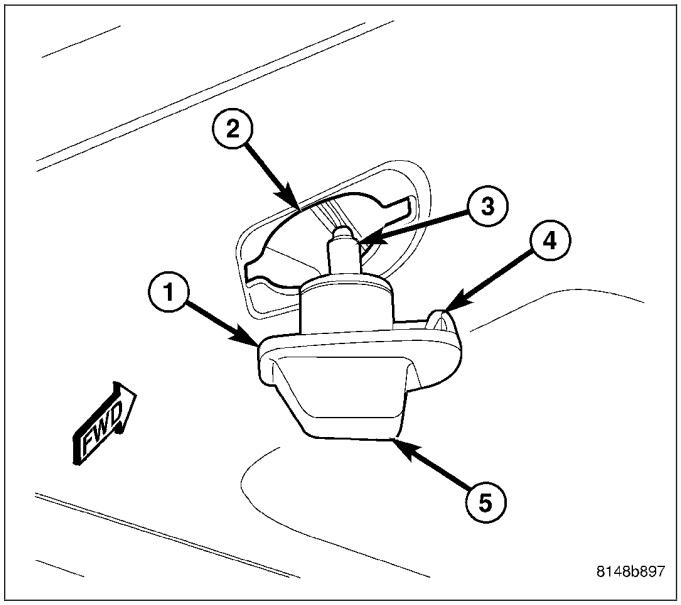
BULB

1. Disconnect and isolate the battery negative cable.
2. Reach under the rear bumper (2) near the center to access the back of either of the two license plate lamp housings (3).
3. Firmly grasp the socket (1) on the back of the housing and rotate it counterclockwise about 30 degrees to unlock it.
4. Pull the socket and bulb straight out from the keyed opening in the housing.
5. Pull the base of the bulb straight out of the socket.



LAMP

1. Disconnect and isolate the battery negative cable.
2. Using hand pressure, press the rear edge of the license plate lamp lens/housing (5) toward the front of the vehicle against the spring pressure of the retaining clip (4), then pull the rear edge of the lamp outward to disengage it from the mounting hole (2) in the rear bumper.
3. Pull the lamp out from the rear bumper far enough to access the bulb socket (3) on the back of the lamp lens/housing.
4. Firmly grasp the socket on the back of the housing and rotate it counterclockwise about 30 degrees to unlock it.
5. Pull the socket and bulb straight out from the keyed opening in the lamp housing.
6. Remove the lamp from the rear bumper.

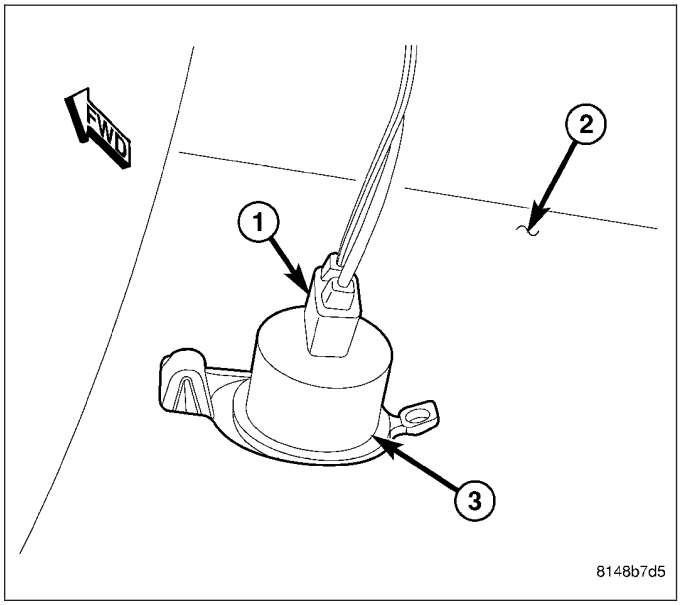


INSTALLATION

BULB

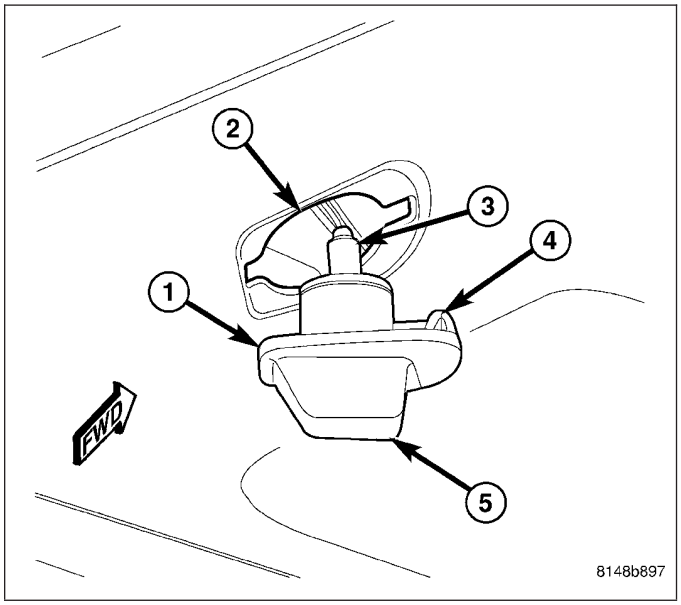
CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

1. Align the base of the bulb with the license plate lamp socket (1).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of the license plate lamp housing (3).
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Reconnect the battery negative cable.



LAMP

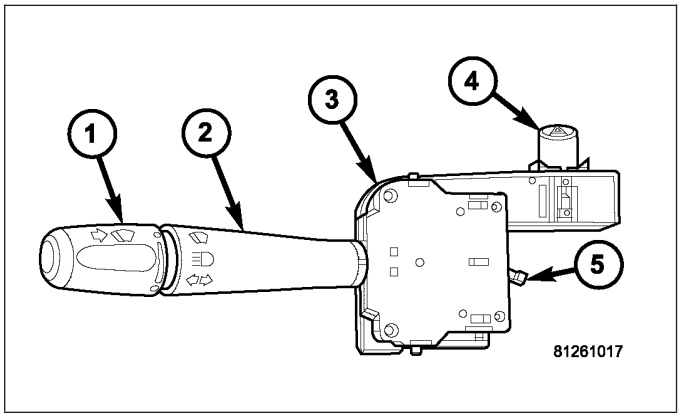
1. Align the socket and bulb (3) with the keyed opening on the back of the license plate lamp lens/ housing (5).
2. Insert the socket and bulb into the housing until the socket is firmly seated.
3. Rotate the socket clockwise about 30 degrees to lock it into place.
4. Engage the retaining clip (4) on the front edge of the lamp housing into the notch at the forward edge of the mounting hole (2) in the rear bumper.
5. Using hand pressure, press the rear edge of the lamp housing toward the front of the vehicle against the spring pressure of the retaining clip, then push the rear edge of the lamp into the rear of the mounting hole in the rear bumper until the tab (1) on the rear of the lamp is engaged in the mounting hole.
6. Reconnect the battery negative cable.



SWITCH-MULTIFUNCTION

DESCRIPTION

The multi-function switch (3) is located on the steering column, just below the steering wheel. The only visible components of the multi-function switch are the control stalk (2) and control knob (1) that extend through the steering column shrouds on the left side of the column, and the hazard warning push button (4) that extends through the shroud on the top of the column. The remainder of the switch including its mounting provisions, its electrical connection, and the turn signal cancel actuator (5) are concealed beneath the shrouds.



The switch housing and controls are constructed of molded black plastic. Each of the switch controls has white International Control and Display Symbol graphics applied to it, which clearly identify its many functions. Three integral locating posts on the switch housing, one on the top and two on the bottom, slide into channels in a receptacle on the left side of the multi-function switch mounting housing near the top of the steering column to ensure proper positioning of the switch. Then two screws secure the switch to the mounting housing. A single integral connector receptacle containing four terminal pins on the back of the switch housing connects the switch to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness.

The multi-function switch provides the vehicle operator with a control interface for the following functions:

- **Hazard Warning Control** - The multi-function switch hazard warning push button provides two detent positions (On and Off) to control the hazard warning lamps.
- **Headlamp Beam Selection** - The multi-function switch control stalk provides detent switching for selection of the headlamp high or low beams. There is also an intermediate momentary position that allows the headlamp high beam circuits to be momentarily flashed to provide an optical horn feature (sometimes referred to as flash-to-pass) as an optical signalling device.

- **Turn Signal Control** - The multi-function switch control stalk provides momentary non-detent (lane change) switching or detent switching with automatic cancellation for both the left and right turn signal lamps.
- **Washer Control** - The multi-function switch control knob provides a momentary position for washer system operation.
- **Wiper Control** - The multi-function switch control knob provides two continuous wipe switch positions, low speed or high speed; and, an intermittent wipe mode with five delay interval positions.

The multi-function switch cannot be adjusted or repaired. If any function of the switch is faulty, or if the switch is damaged, the entire switch must be replaced as a unit.

OPERATION

The multi-function switch uses resistor multiplexing to control the many functions and features it provides using only three hard wired output circuits. The switch receives a clean ground from the ElectroMechanical Instrument Cluster (EMIC) (also sometimes referred to as the Cab Control Node/CCN) on a multi-function switch return circuit. It then provides outputs to the EMIC on a wash/beam select switch signal circuit to control washer and headlamp beam selection, on an intermittent wiper switch signal circuit to control wipers, and on a turn lamps switch signal circuit to control turn signal and hazard warning functions.

The multi-function switch operates as follows:

- **Hazard Warning Control** - The hazard warning push button of the multi-function switch is depressed to activate the hazard warning system, and depressed again to turn the system Off. When the push button is actuated, the multi-function switch provides an output to the EMIC, and the EMIC responds by sending electronic hazard switch status messages to the FCM over the CAN data bus. The FCM then energizes and flashes or de-energizes both the left and right turn signal circuits to provide the visual hazard warning.
- **Headlamp Beam Selection** - The control stalk of the multi-function switch is pulled towards the steering wheel past a detent to actuate the integral beam select switch circuitry, or to an intermediate, momentary position before the detent to actuate the optical horn feature. Each time the control stalk is actuated to a detent position, the opposite headlamp beam from what is currently selected will be energized. Each time the control stalk is actuated to the momentary position with the headlamps turned off, the headlamp high beams will be illuminated for as long as the control stalk is held in this position. The multi-function switch provides an output to the EMIC, and the EMIC responds by sending electronic beam select switch status messages to the FCM over the CAN data bus. The FCM energizes or de-energizes the selected low or high beam circuits.
- **Turn Signal Control** - The control stalk of the multi-function switch is moved upward to activate the right turn signal circuitry, and, downward to activate the left turn signal circuitry. The turn signal switch has a detent position in each direction that provides turn signals with automatic cancellation, and an intermediate, momentary position in each direction that provides turn signals only until the control stalk is released. When the control stalk is moved to a detent turn signal switch position, the cancel actuator extends toward the center of the steering column. A turn signal cancel cam that is integral to the clockspring rotates with the steering wheel and the cam lobes contact the cancel actuator when it is extended from the multi-function switch. When the steering wheel is rotated during a turning maneuver, one of the two turn signal cancel cam lobes will contact the turn signal cancel actuator. The cancel actuator latches against the cancel cam rotation in the direction opposite that which is signaled. If the left turn signal detent is selected, the lobes of the cancel cam will ratchet past the cancel actuator when the steering wheel is rotated to the left, but will unlatch the cancel actuator as the steering wheel rotates to the right and returns to center, which will cancel the turn signal event and release the control stalk from the detent so it returns to the neutral Off position. When a turn signal is activated, the multi-function switch provides an output to the EMIC, and the EMIC responds by sending electronic turn signal switch status messages to the FCM over the CAN data bus. The FCM energizes and flashes or de-energizes the selected left or right turn signal circuits.
- **Washer Control** - The control knob on the end of the multi-function switch control stalk is depressed towards the steering column to momentarily activate the washer pump in the washer mode. The washer pump will continue to operate in the washer mode until the control knob is released. The multi-function switch provides an output to the EMIC, and the EMIC responds by sending electronic washer switch status messages to the Front Control Module (FCM) over the Controller Area Network (CAN) data bus. The FCM responds by energizing or de-energizing the washer pump in the washer mode.
- **Wiper Control** - The control knob on the end of the multi-function switch control stalk is rotated to one of the continuous wiper detents, to one of five intermittent wiper detents, or to the Off position to select the wiper mode. The multi-function switch provides an output to the EMIC, and the EMIC responds by sending electronic wiper switch status messages to the FCM over the CAN data bus. The FCM responds by energizing or de-

energizing the wiper on/off and high/low relays in the Power Distribution Center (PDC) for wiper system control.

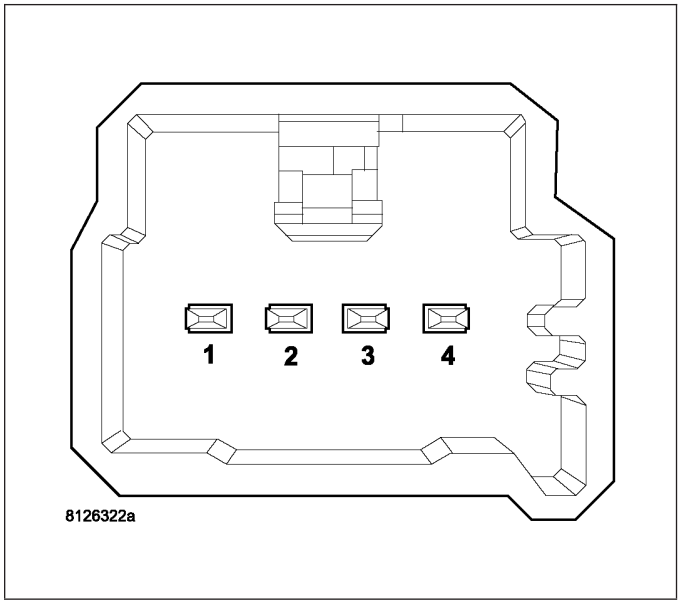
The multi-function switch can be diagnosed using conventional diagnostic tools and methods. However, proper testing of the multiplexed inputs to the EMIC requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING

MULTI-FUNCTION SWITCH

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Remove the multi-function switch from the switch mounting housing on the steering column. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/ MULTI-FUNCTION SWITCH - REMOVAL).
2. Disconnect the wire harness connector from the back of the multi-function switch.
3. Using an ohmmeter, test the resistance between the terminals of the switch as shown in the Multi-Function Switch Tests table.



MULTI-FUNCTION SWITCH TESTS	
SWITCH POSITION (PINS)	***RESISTANCE RANGE (OHMS)**
BEAM SELECT/WASHER NEUTRAL (1 & 2)	OPEN CIRCUIT
BEAM SELECT ON (1 & 2)	518 - 575
OPTICAL HORN ON (1 & 2)	1257 - 1397
FRONT WASHER ON (1 & 2)	2584 - 2871
TURN/HAZARD OFF (2 & 3)	2643 - 2937
HAZARD ON (2 & 3)	115 - 128
LEFT TURN SIGNAL ON (2 & 3)	345 - 384
RIGHT TURN SIGNAL ON (2 & 3)	786 - 873
FRONT WIPER OFF (2 & 4)	6910 - 7678
FRONT WIPER DELAY 1 (2 & 4)	2128 - 2365
FRONT WIPER DELAY 2 (2 & 4)	1089 - 1210
FRONT WIPER DELAY 3 (2 & 4)	627 - 697
FRONT WIPER DELAY 4 (2 & 4)	388 - 431
FRONT WIPER DELAY 5 (2 & 4)	234 - 261
FRONT WIPER LOW (2 & 4)	125 - 140

MULTI-FUNCTION SWITCH TESTS	
SWITCH POSITION (PINS)	***RESISTANCE RANGE (OHMS)**
FRONT WIPER HIGH (2 & 4)	50 - 56
*** All Resistance Values Given Are ±10 Percent**	

4. If the switch fails any of the tests, replace the faulty multi-function switch as required.

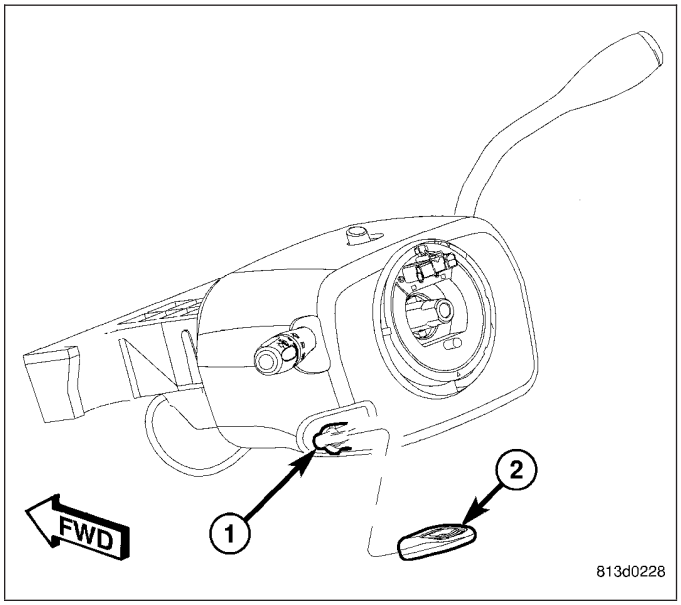
REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

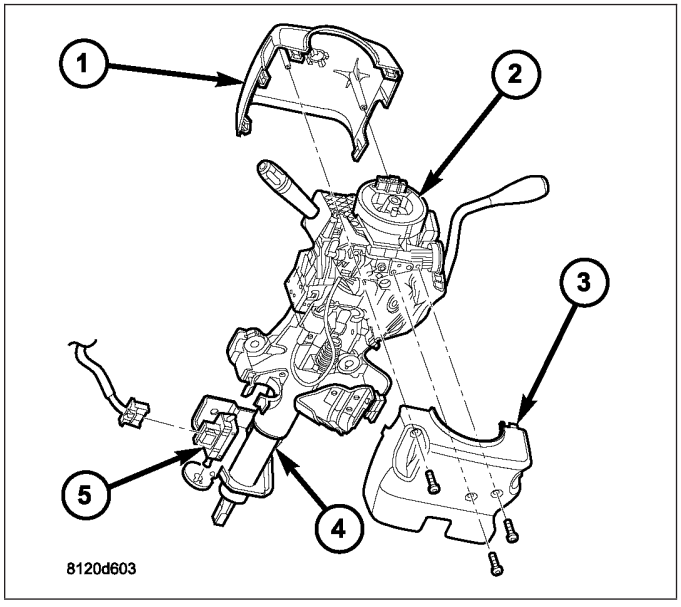
1. Disconnect and isolate the battery negative cable.
2. Remove the driver airbag from the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).
3. Disconnect the steering wheel wire harness connectors from the upper clockspring connector receptacles.

CAUTION: Be certain that the screws that secure the steering wheel puller to the steering wheel are fully engaged in the steering wheel armature without passing through the steering wheel and damaging the clockspring.

4. Remove the steering wheel from the steering column. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - REMOVAL).
5. Grasp the tilt steering column knob (2) firmly and pull it straight rearward to remove it from the tilt adjuster lever (1) on the left side of the column.

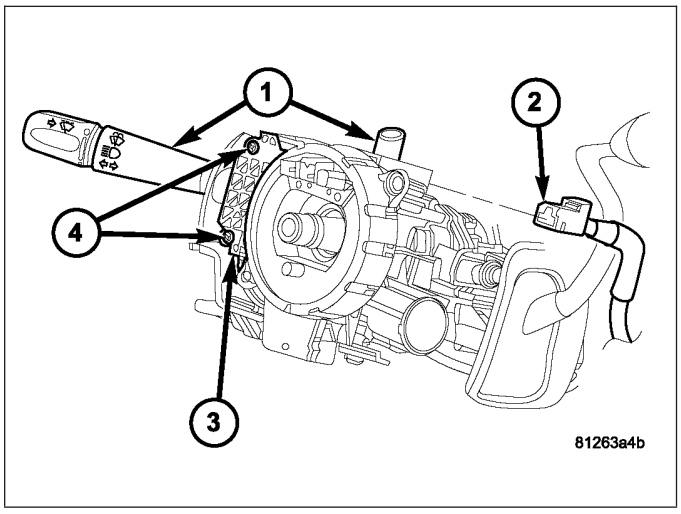


6. From below the steering column, remove the two outboard screws that secure the upper column shroud (1) to the lower shroud (3).
7. Using hand pressure, press inward on both sides of the upper shroud above the parting line of the lower shroud to release the snap features that secure the two shroud halves to each other.
8. Remove the upper shroud from the lower shroud and the steering column.
9. Remove the one center screw that secures the lower shroud to the steering column (4).



10. Remove the lower shroud from the steering column.

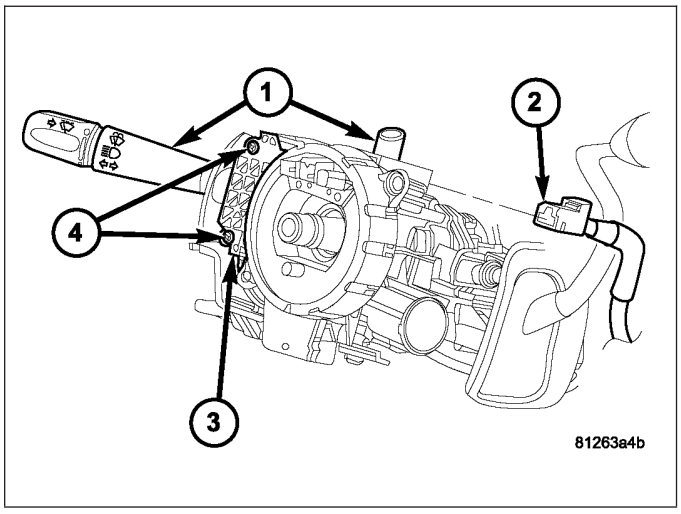
11. Disconnect the wire harness connector (2) from the back of the multi-function switch housing (1).
12. Remove the two screws (4) that secure the switch to the multi-function switch mounting housing (3).
13. Grasp the switch control stalk and pull it toward the left side of the vehicle to remove the switch from the mounting housing.



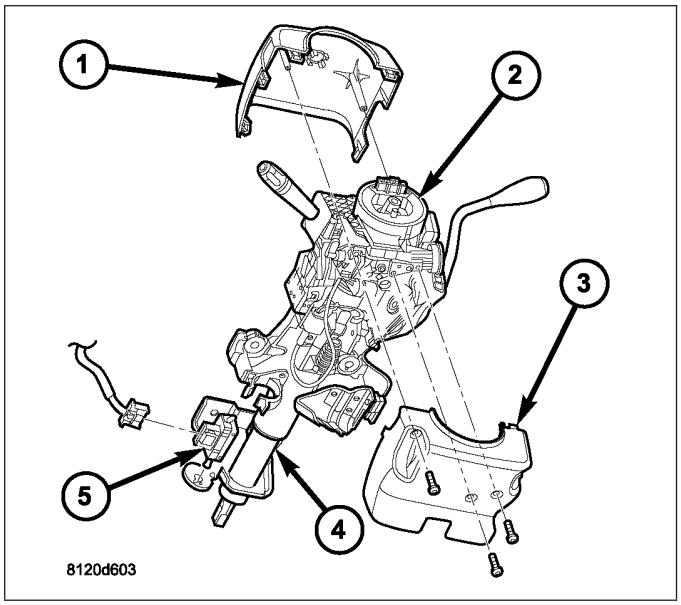
INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Slide the multi-function switch (1) into the multi-function switch mounting housing (3) from the left side. Be certain that the alignment pins on the top and bottom of the switch are properly engaged in the channels of the mounting housing.
2. Install and tighten the two screws (4) that secure the switch to the mounting housing. Tighten the screws to 2 N·m (20 in. lbs.).
3. Reconnect the wire harness connector (2) to the back of the switch.



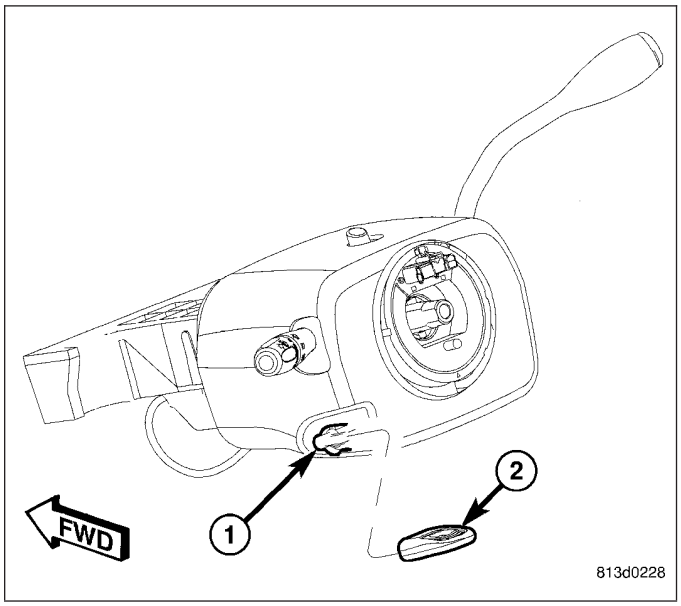
4. Position the lower shroud (3) onto the steering column (4).
5. From below the steering column, install and tighten the one center screw that secures the lower shroud to the steering column. Tighten the screw to 2 N·m (20 in. lbs.).
6. Position the upper shroud (1) onto the steering column over the lower shroud. Be certain to engage the gearshift lever gap hider into the opening in the right side of both shroud halves.
7. Align the snap features on the upper shroud with the receptacles in the lower shroud and apply hand pressure to snap them together.
8. Install and tighten the two outboard screws that secure the upper shroud to the lower shroud. Tighten the screws to 2 N·m (20 in. lbs.).



9. Align the tilt steering column knob (2) with the tilt adjuster lever (1) on the left side of the steering column and use hand pressure to snap it back into place.

NOTE: When reinstalling the steering wheel, be certain to index the yellow rubber booted engagement dowel on the upper surface of the clockspring rotor between the two fins cast into the lower surface of the steering wheel armature hub.

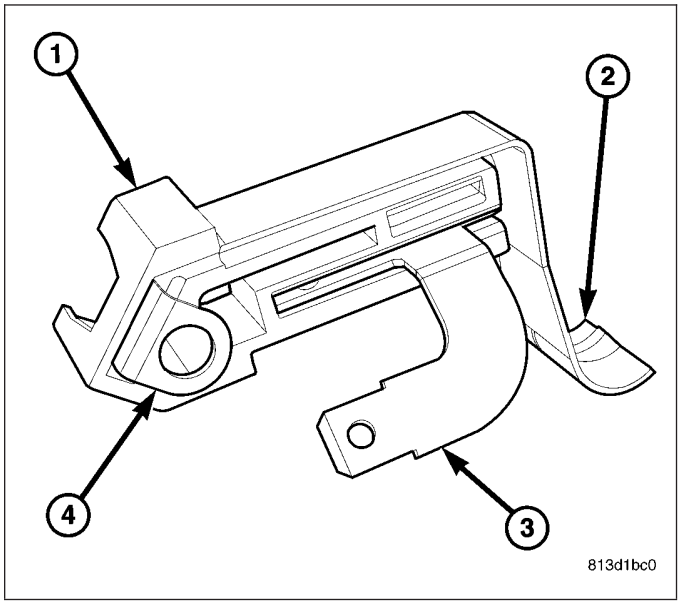
10. Reinstall the steering wheel onto the steering column. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - INSTALLATION).
11. Reconnect the steering wheel wire harness connectors to the upper clockspring connector receptacles. Be certain that the steering wheel wire harness is routed between the steering wheel back trim cover and the steering wheel armature.
12. Reinstall the driver airbag onto the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).
13. Reconnect the battery negative cable.



SWITCH-PARKING BRAKE

DESCRIPTION

The park brake switch (1) is located on the park brake lever mechanism on the cowl side inner panel below the instrument panel, to the left of the steering column. This switch includes a spade-type output terminal (3) that connects the switch to the vehicle electrical system through a dedicated take out and connector of the body wire harness. The output terminal is integral to the stationary contact within a molded plastic insulator.



A locating tab on the insulator engages a slot in the park brake lever mechanism for positive switch location. External to the insulator is a movable leaf contact with an integral grounding lug (4) on one end and an integral actuating lever and follower (2) on the opposite end. The switch is secured to and grounded by a single screw to the park brake lever mechanism. The park brake switch cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

The park brake switch is a normally closed, mechanically actuated leaf contact switch that is operated by the park brake lever mechanism. The switch is grounded through its mounting to the park brake lever mechanism and provides a ground input to the ElectroMechanical Instrument Cluster (EMIC) (also sometimes referred to as the Cab Control Node/CCN) on a park brake switch sense circuit whenever the park brake is applied, and opens this circuit whenever the park brake is released. The park brake switch sense input to the EMIC is used for control of the brake indicator and may also be used as a logic input for other electronic features in the vehicle.

The park brake switch can be diagnosed using conventional diagnostic tools and methods. However, proper testing of the EMIC processing of the park brake switch sense input requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING

PARK BRAKE SWITCH

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: If the brake indicator stays on with the ignition switch in the On position and the park brake released, or comes on while driving, the brake system must be diagnosed and repaired prior to performing the following tests. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING). If no brake system problem is found, the following procedures will help to locate a shorted or open park brake switch sense circuit, or a faulty park brake switch.

INDICATOR ILLUMINATES DURING BULB TEST, BUT DOES NOT WHEN PARK BRAKE APPLIED

1. Disconnect and isolate the battery negative cable. Disconnect the body wire harness connector for the park brake switch from the switch terminal. Apply the parking brake. Check for continuity between the park brake switch terminal and a good ground. There should be continuity. If OK, go to Step 2. If not OK, replace the faulty park brake switch.
2. Disconnect the instrument panel wire harness connector (Connector C1) for the instrument cluster from the cluster connector receptacle. Check for continuity between the park brake switch sense circuit cavities of the body wire harness connector for the park brake switch and the instrument panel wire harness connector for the instrument cluster. There should be continuity. If not OK, repair the open park brake switch sense circuit between the park brake switch and the instrument cluster as required.

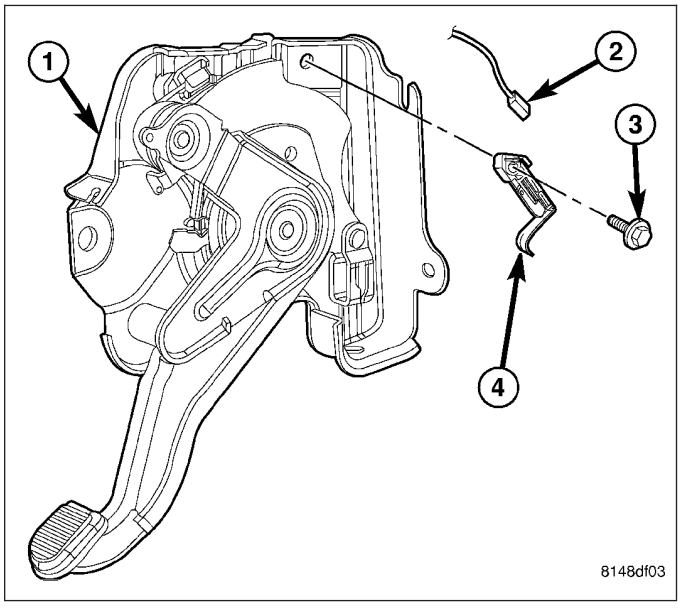
INDICATOR REMAINS ILLUMINATED - BRAKE SYSTEM CHECKS OK

1. Disconnect and isolate the battery negative cable. Disconnect the body wire harness connector for the park brake switch from the switch terminal. Check for continuity between the terminal of the park brake switch and a good ground. There should be no continuity with the park brake released, and continuity with the park brake applied. If OK, go to Step 2. If not OK, replace the faulty park brake switch.
2. Disconnect the instrument panel wire harness connector (Connector C1) for the instrument cluster from the cluster connector receptacle. Check for continuity between the park brake switch sense circuit cavity of the body wire harness connector for the park brake switch and a good ground. There should be no continuity. If not OK, repair the shorted park brake switch sense circuit between the park brake switch and the instrument cluster as required.

REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

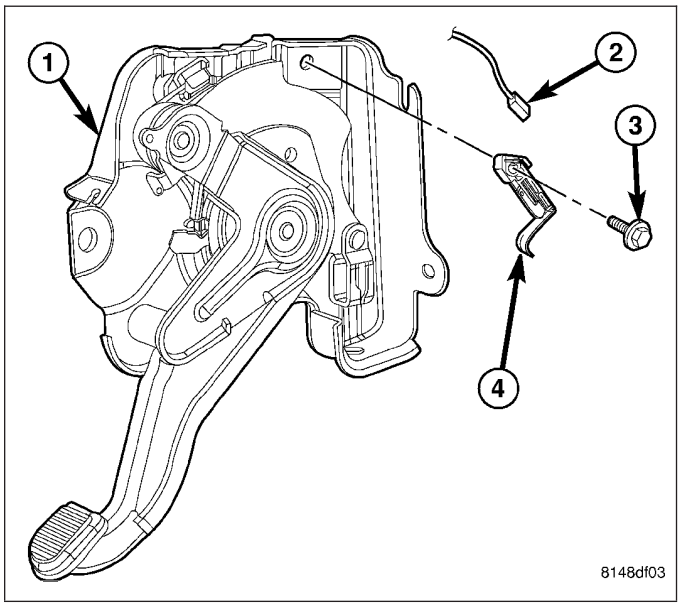
1. Disconnect and isolate the battery negative cable.
2. Apply the parking brake.
3. Reach under the left end of the instrument panel to access and disconnect the body wire harness connector (2) from the terminal of the park brake switch (4) located on the park brake lever mechanism (1) on the left cowl side inner panel.
4. Remove the screw (3) that secures the park brake switch to the park brake lever mechanism.
5. Remove the switch from the park brake lever mechanism.



INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Reach under the left end of the instrument panel to position park brake switch (4) onto the park brake lever mechanism (1) on the left cowl side inner panel. Be certain to engage the locating pin on the back of the switch insulator into the locating slot in the lever mechanism bracket.
2. Install and tighten the screw (3) that secures the park brake switch to the park brake lever mechanism. Tighten the screw to 3 N·m (24 in. lbs.).
3. Reconnect the body wire harness connector (2) to the terminal of the park brake switch.
4. Reconnect the battery negative cable.
5. Turn the ignition switch to the On position and check for proper brake indicator operation with the parking brake applied, then release the parking brake and check that the brake indicator extinguishes.

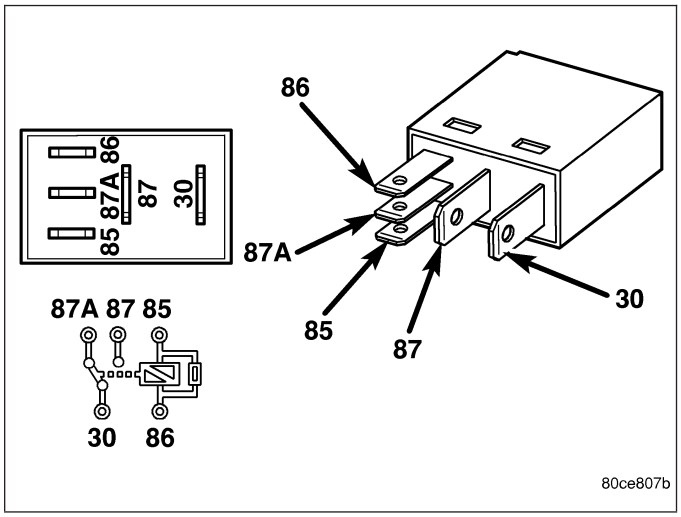


RELAY-PARK LAMP

DESCRIPTION

The park lamp relay is a conventional International Standards Organization (ISO) micro relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. This relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs through five integral male spade-type terminals that extend from the relay base plate.

The park lamp relay is located in the Power Distribution Center (PDC) in the engine compartment near the battery. Refer to the layout label on the underside of the PDC cover for specific relay cavity assignment information. The park lamp relay cannot be adjusted or repaired and, if faulty or damaged, the unit must be replaced.



OPERATION

The park lamp relay is an electromechanical switch that uses a low current input from the Front Control Module (FCM) (also referred to as the Integrated Power Module/IPM) to control a high current output to the park lamps. Within the relay are an electromagnetic coil, a movable contact and two fixed contact points. A resistor is connected

in parallel with the coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the field of the relay coil collapses.

The movable common supply contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This field draws the movable contact away from the normally closed contact, and holds it against the normally open contact. When the relay coil is de-energized, spring pressure returns the movable contact back against the normally closed contact.

The inputs and outputs of the park lamp relay include:

- **Common Supply Terminal (30)** - The common feed terminal is connected to a fused B(+) circuit at all times.
- **Coil Ground Terminal (85)** - The coil ground terminal is connected to a fused B(+) circuit at all times.
- **Coil Battery Terminal (86)** - The coil battery terminal is connected to a control output of the FCM through a park lamp relay control circuit. The FCM controls park lamp operation by controlling a ground path through this circuit.
- **Normally Open Terminal (87)** - The normally open terminal is connected to the park lamps through a park lamp relay output circuit and provides battery voltage to the park lamps whenever the relay is energized.
- **Normally Closed Terminal (87A)** - The normally closed terminal is not connected to any circuit in this application, but will have battery voltage present whenever the relay is de-energized.

The park lamp relay can be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information.

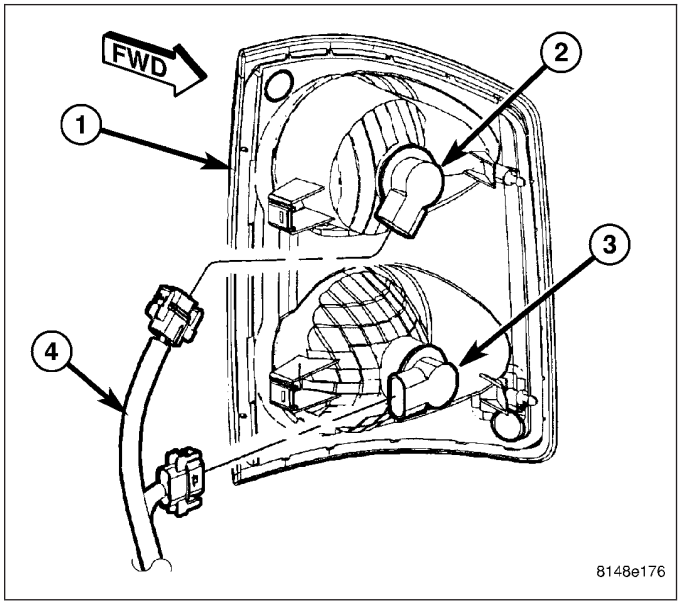
REAR LAMP UNIT

REMOVAL

BULB

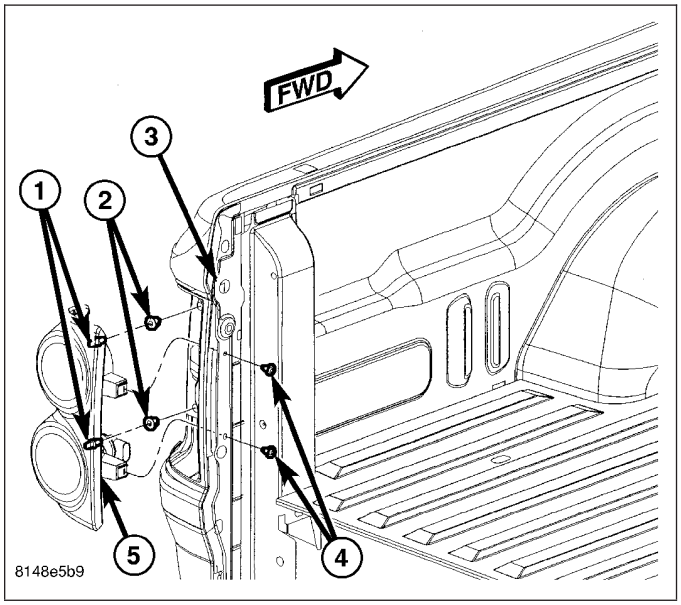
NOTE: The rear lamp unit contains two bulbs: park/turn signal/side marker and backup. The service procedures for each bulb are the same, only the bulb sizes and types may differ.

1. Disconnect and isolate the battery negative cable.
2. Remove the rear lamp unit (1) from the end of the quarter panel. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/REAR LAMP - REMOVAL).
3. Disconnect the wire harness connector (4) from the park/turn signal/side marker (2) or the backup (3) bulb socket on the back of the lamp housing.
4. Firmly grasp the socket on the back of the housing and rotate it counterclockwise about 30 degrees to unlock it.
5. Pull the socket and bulb straight out from the keyed opening in the housing.
6. Pull the base of the bulb straight out of the socket.



LAMP

1. Disconnect and isolate the battery negative cable.
2. Lower the tailgate to access and remove the two screws (4) that secure the rear lamp unit (5) to the side jamb (3) of the tailgate opening.
3. Pull the outboard side of the rear lamp unit rearward far enough to unsnap the two ball studs on the outboard side of the lamp housing from the two round grommets (2) in the outer box side panel.
4. Pull the lamp away from the vehicle far enough to access and disconnect the two wire harness connectors from the two bulb sockets on the back of the lamp housing.
5. Remove the lamp from the lamp opening of the outer box side panel.



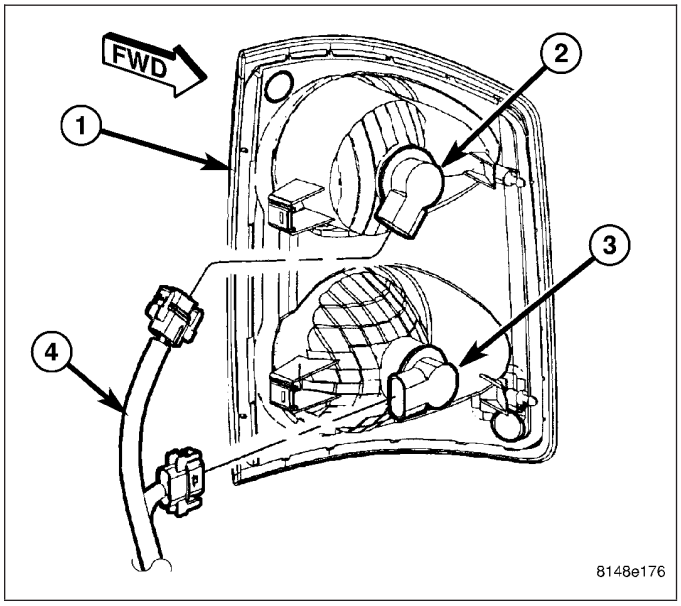
INSTALLATION

BULB

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

NOTE: The rear lamp unit contains two bulbs: park/turn signal/side marker and backup. The service procedures for each bulb are the same, only the bulb sizes and types may differ.

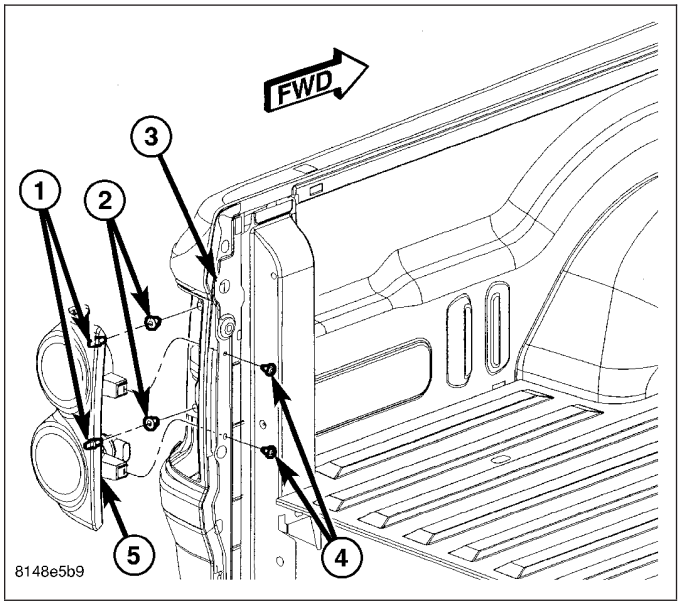
1. Align the base of the bulb with the park/turn signal/side marker (2) or the backup (3) bulb socket.
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of the rear lamp unit housing (1).
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Reconnect the wire harness connector (4) to the socket.



7. Reinstall the rear lamp unit onto the end of the quarter panel. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/REAR LAMP - INSTALLATION).
8. Reconnect the battery negative cable.

LAMP

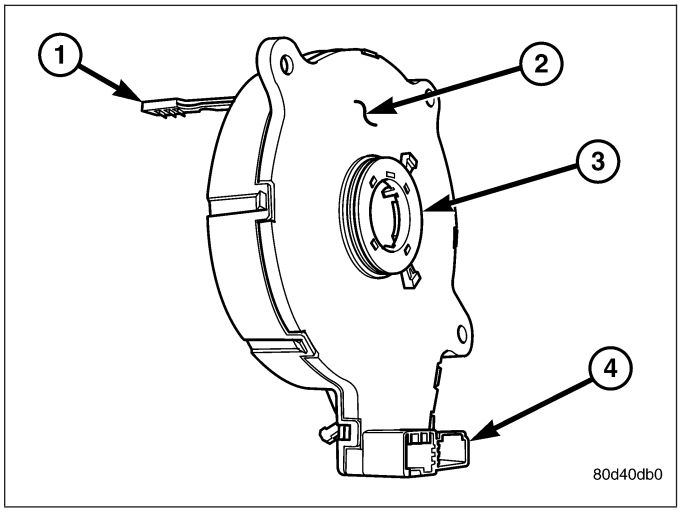
1. Check to be certain that the two rubber grommets (2) are in good condition and properly installed in the outer box side panel.
2. Position the rear lamp unit (5) to the lamp opening of the outer box side panel.
3. Reconnect the two wire harness connectors to the two bulb sockets on the back of the lamp housing.
4. Align the two ball studs (1) on the outboard side of the lamp housing with the two rubber grommets in the outer box side panel.
5. Using hand pressure, push firmly and evenly on the outboard side of the lamp until both ball studs snap into the rubber grommets.
6. Install and tighten the two screws (4) that secure the rear lamp unit to the side jamb (3) of the tailgate opening. Tighten the screws to 2 N·m (19 in. lbs.).
7. Reconnect the battery negative cable.



CAM-TURN SIGNAL CANCEL

DESCRIPTION

The turn signal cancel cam (3) is concealed within the steering column. The turn signal cancel cam consists of two lobes on a molded plastic ring that is snapped into the lower hub of the clockspring rotor. The clockspring mechanism provides turn signal cancellation as well as a constant electrical connection between the horn switch, driver airbag, speed control switches, and remote radio switches on the steering wheel and the instrument panel wire harness on the steering column. The housing of the clockspring (2) is secured to the multi-function switch mounting housing on the steering column and remains stationary. The rotor of the clockspring, including the turn signal cancel cam lobes rotate with the steering wheel.



The turn signal cancel cam is serviced as a unit with the clockspring and cannot be repaired. If faulty or damaged, the entire clockspring unit must be replaced. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

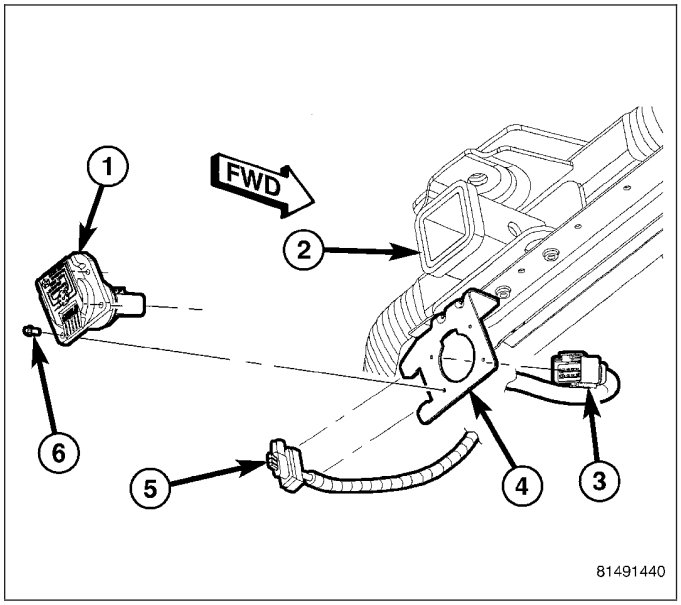
OPERATION

When the multi-function switch control stalk is moved to a latched turn signal position, a turn signal cancel actuator is extended from the inside surface of the switch housing toward the turn signal cancel cam. As the steering wheel is rotated to complete the turn, one of the two cam lobes will contact the actuator, automatically cancelling the turn signal event and releasing the latched multi-function switch control stalk to the neutral position.

CONNECTOR TRAILER TOW

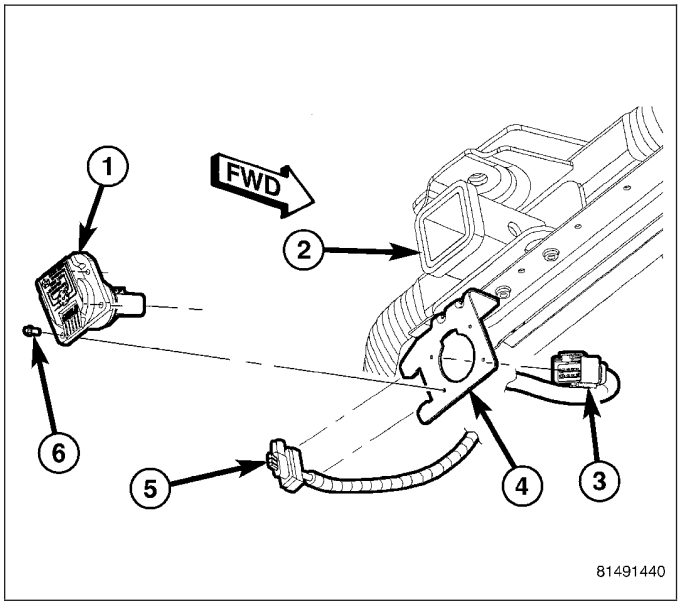
REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Reach behind the bracket (4) on the trailer hitch receiver (2) to access and disconnect the connector (3) of the body wire harness from the 7-way trailer tow connector (1), or to disengage the 4-way trailer tow connector (5) from the bracket.
3. Remove the four screws (6) that secure the 7-way trailer tow connector to the bracket.
4. Remove the 7-way trailer tow connector from the bracket.



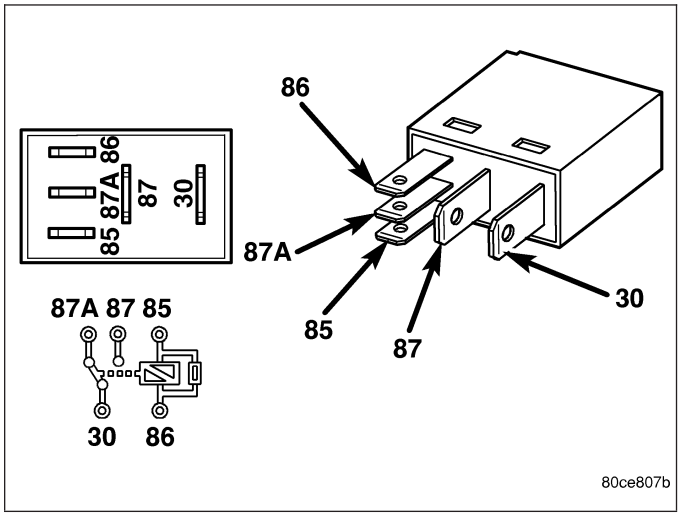
INSTALLATION

1. Position the 7-way trailer tow connector (1) into the bracket (4) on the trailer hitch receiver (2).
2. Install and tighten the four screws (6) that secure the 7-way trailer tow connector to the bracket. Tighten the screws to 4 N·m (35 in. lbs.).
3. Reach behind the bracket to access and reconnect the connector (3) of the body wire harness from the 7-way trailer tow connector, or to engage the 4-way trailer tow connector (5) to the bracket.
4. Reconnect the battery negative cable.



RELAY-TRAILER TOW

DESCRIPTION



Vehicles equipped with an optional factory-installed trailer towing package have two trailer tow relays, one for the trailer right turn and brake lamps and the other for the trailer left turn and brake lamps. The trailer tow relays are conventional International Standards Organization (ISO) micro relays. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. Each relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs through five integral male spade-type terminals that extend from the relay base plate.

The trailer tow relays are located in the Power Distribution Center (PDC) in the engine compartment near the battery. Refer to the layout label on the underside of the PDC cover for specific relay cavity assignment information. A trailer tow relay cannot be adjusted or repaired and, if faulty or damaged, the unit must be replaced.

OPERATION

The trailer tow relays are electromechanical switches that use a low current input from the Front Control Module (FCM) (also referred to as the Integrated Power Module/IPM) to control a high current output to trailer brake and turn signal lamps. Within each relay are an electromagnetic coil, a movable contact and two fixed contact points. A resistor is connected in parallel with the coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the field of the relay coil collapses.

The movable common supply contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This field draws the movable contact away from the normally closed contact, and holds it against the normally open contact. When the relay coil is de-energized, spring pressure returns the movable contact back against the normally closed contact.

The inputs and outputs of the trailer tow relays include:

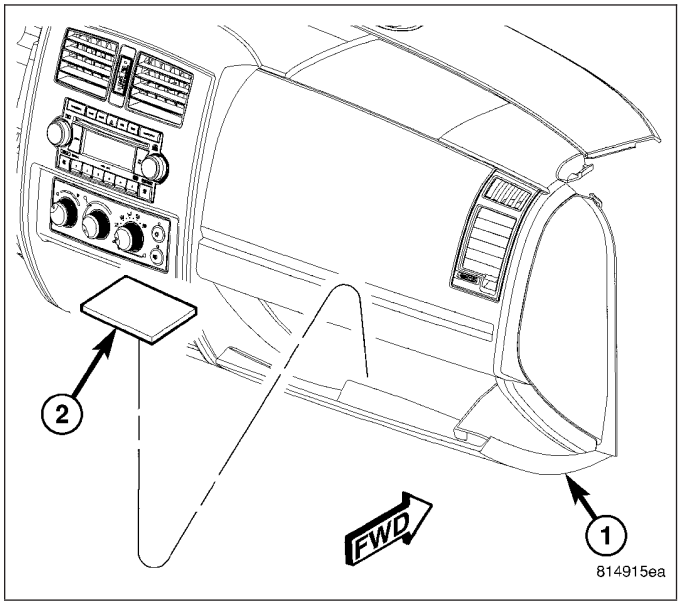
- **Common Supply Terminal (30)** - The common feed terminal is connected to a fused B(+) circuit at all times.
- **Coil Ground Terminal (85)** - The coil ground terminal is connected to a fused B(+) circuit at all times.
- **Coil Battery Terminal (86)** - The coil battery terminal is connected to a control output of the FCM through a right or left trailer tow turn relay control circuit. The FCM controls trailer brake and turn lamp operation by controlling a ground path through this circuit.
- **Normally Open Terminal (87)** - The normally open terminal is connected to the trailer lamps through a right or left trailer tow turn relay output circuit and provides battery voltage to the right or left trailer brake and turn lamps whenever the relay is energized.
- **Normally Closed Terminal (87A)** - The normally closed terminal is not connected to any circuit in this application, but will have battery voltage present whenever the relay is de-energized.

The trailer tow relays can be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information.

WIRING-TRAILER TOW

DESCRIPTION

Vehicles equipped with a factory-installed trailer tow package include an electric trailer brake wiring provision that terminates at a connector located on top of the large body harness connection under the instrument panel to the left of the brake pedal, as well as an electric trailer brake pigtail harness and an instruction card (2) that are stored in the glove box (1) when the vehicle is shipped from the factory.



OPERATION

If an aftermarket electric brake controller is used, the electric brake pigtail harness supplied will make installation easier. The connection (blue 4-way connector) for the harness is located under the instrument panel to the left of the brake pedal on top of the large body harness connection. Refer to the appropriate wiring information.

The battery line of this harness may be used to charge the trailer battery. However, a battery isolation unit is not supplied and the trailer battery may discharge the truck battery when the engine is not running. The battery line is protected by a fuse or a circuit breaker. Refer to the owner's manual in the vehicle glove box for type, location, and ampere rating.

LAMPS/LIGHTING - INTERIOR - ELECTRICAL DIAGNOSTICS

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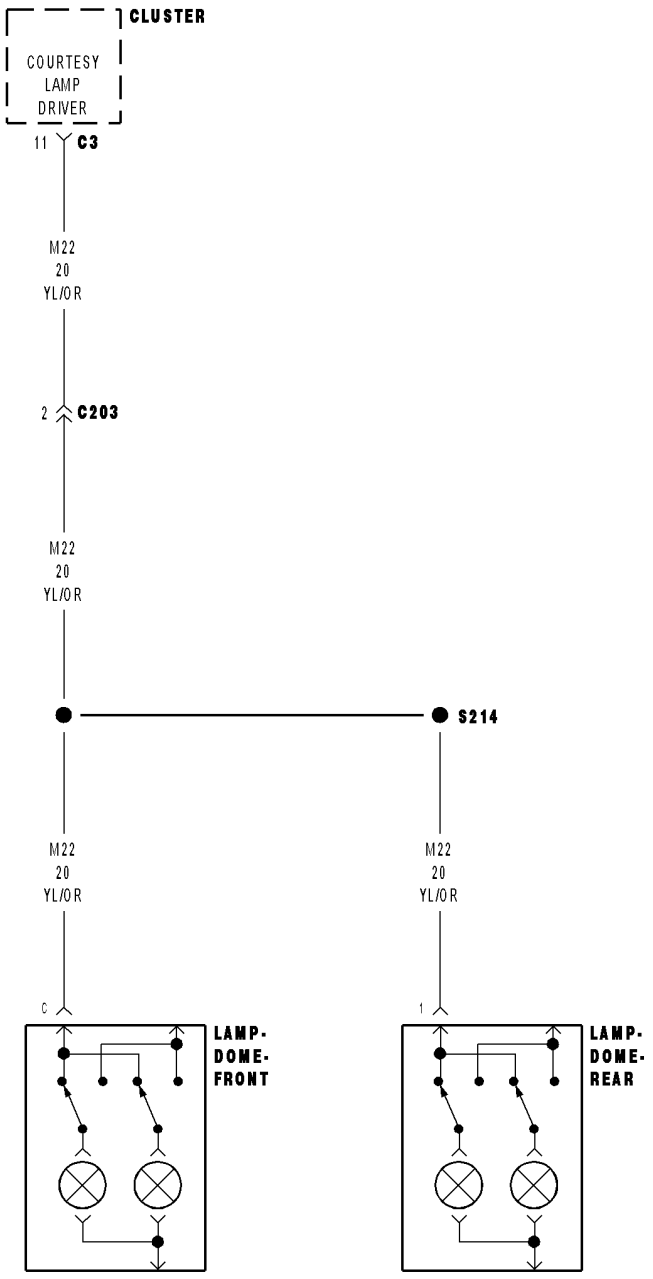
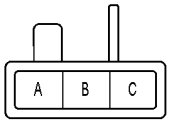
LAMPS/LIGHTING - INTERIOR - ELECTRICAL DIAGNOSTICS

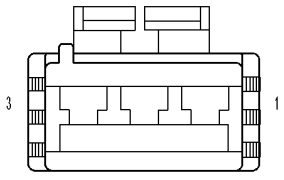
DIAGNOSIS AND TESTING

B161B-COURTESY/DOME LAMP OUTPUT CIRCUIT SHORT TO GROUND

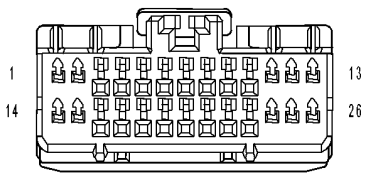




LAMP-
DOME-
FRONT



LAMP-
DOME-
REAR



CLUSTER C3

814a0c78

B161B-COURTESY/DOME LAMP OUTPUT CIRCUIT SHORT TO GROUND (CONTINUED)

For the Interior Lighting circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

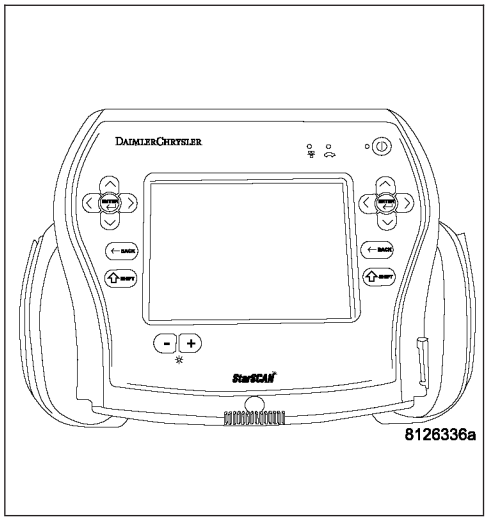
Possible Causes
HEADLAMP SWITCH
(M22) COURTESY LAMP OUTPUT CIRCUIT SHORT TO GROUND
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all CCN DTC's.
Turn the Dome Lamps on.
With the Scan Tool, read the DTC information.



Does the Scan Tool read: B161B-COURTESY/DOME LAMP OUTPUT CIRCUIT SHORT TO GROUND?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present.
Inspect the related wiring for a possible intermittent condition.
Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.

---

2. HEADLAMP SWITCH

Disconnect the Headlamp Switch connector.
Turn the Ignition on.
Using the Scan Tool.

Does the Scan Tool display Headlamp Switch 5.0 volts?

Yes >> Go To 3

No >> Replace the Headlamp Switch in accordance with the service information.

B161B-COURTESY/DOME LAMP OUTPUT CIRCUIT SHORT TO GROUND (CONTINUED)

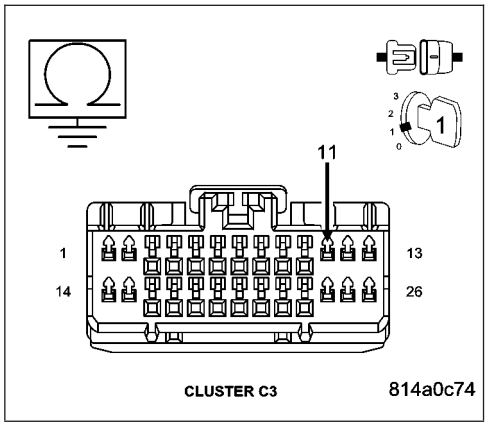
3. INSTRUMENT CLUSTER/OUTPUT CIRCUIT SHORT

Turn the ignition on.

Disconnect the Headlamp Switch connector.

Disconnect the Instrument Cluster C3 connector.

Measure the resistance of the (M22) Courtesy Lamp Output circuit to ground.

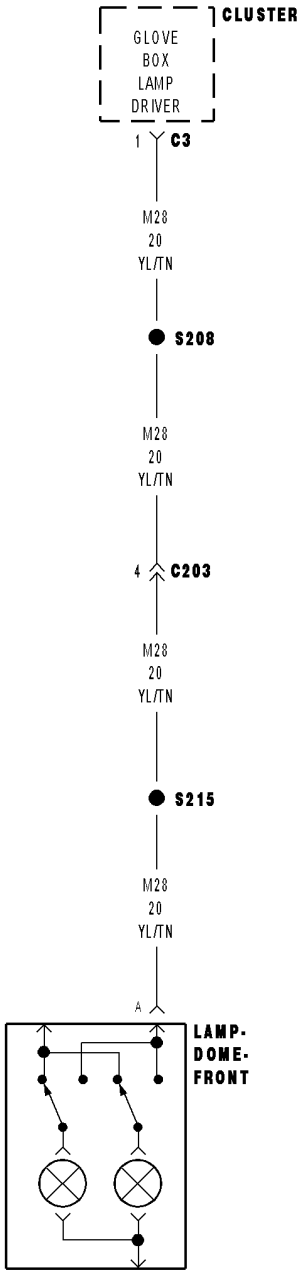


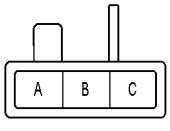
Is the resistance below 5.0 ohms?

Yes >> Repair the (M22) Courtesy lamp Output circuit.
Perform the BODY VERIFICATION TEST — VER 1.

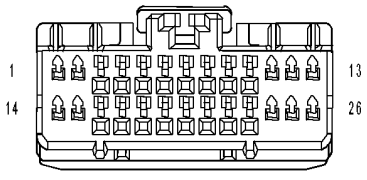
No >> Replace the Instrument Cluster in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

B1623-GLOVEBOX/MAP LAMP OUTPUT CIRCUIT SHORT TO GROUND





LAMP-
DOME-
FRONT



CLUSTER C3

814a0c45

B1623-GLOVEBOX/MAP LAMP OUTPUT CIRCUIT SHORT TO GROUND (CONTINUED)

For the Interior Lighting circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

Possible Causes
(M28) GLOVE BOX/MAP LAMP OUTPUT CIRCUIT SHORT TO GROUND
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

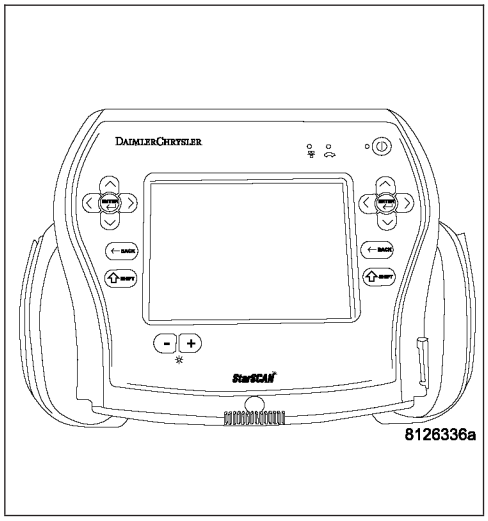
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all CCN DTC's.
Turn the Glove Box lamps on.
With the Scan Tool, read the DTC information.

Does the Scan Tool read: B1623-GLOVEBOX/MAP LAMP OUTPUT CIRCUIT SHORT TO GROUND?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.



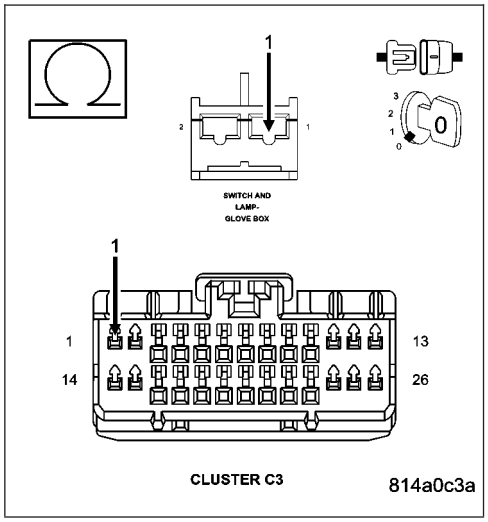
2. INSTRUMENT CLUSTER

Turn the ignition off.
Disconnect the Glovebox Lamp Switch harness connector.
Disconnect the Instrument Cluster C3 connector.
Measure the resistance of the (M28) Glovebox Lamp Output circuit to ground.

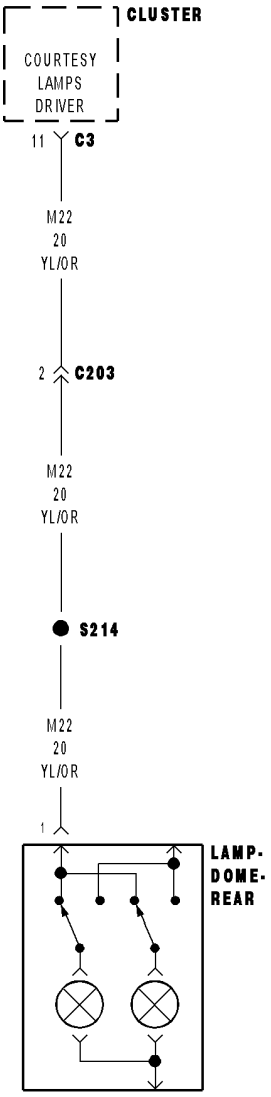
Is the resistance below 5.0 ohms?

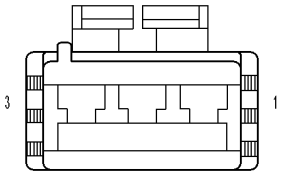
Yes >> Repair the (M28) Glovebox-Map Lamp Output circuit.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Replace the Instrument Cluster in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

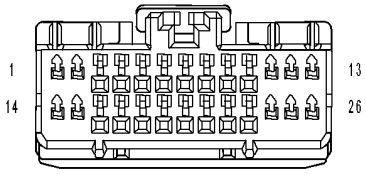


B1627-CARGO LAMP OUTPUT CIRCUIT SHORT TO GROUND





LAMP-
DOME-
REAR



CLUSTER C3

814a0a5b

B1627-CARGO LAMP OUTPUT CIRCUIT SHORT TO GROUND (CONTINUED)

For the Interior Lighting circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

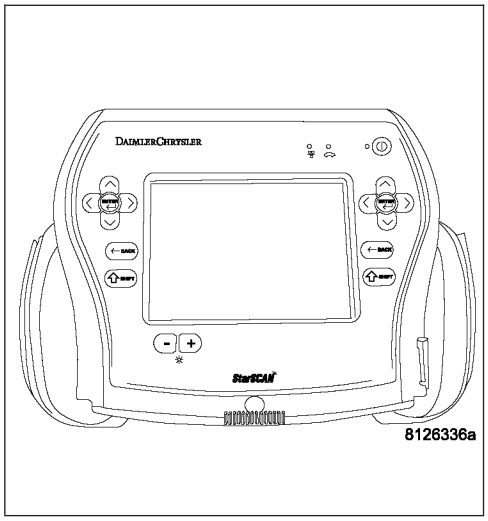
Possible Causes
Headlamp Switch
(M22) Cargo Lamp Output Circuit Short to Ground
Instrument Cluster

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. Intermittent Condition

turn the ignition on.
With the Scan Tool, clear all CCN DTC's.
Turn the Cargo Lamps on.
With the Scan Tool, read the DTC information.



Does the SCan Tool read: B1627-CARGO LAMP OUTPUT CIRCUIT SHORT TO GROUND?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.

---

2. Headlamp Switch

Disconnect the Headlamp Switch connector.
Turn the ignition on.
Using the Scan Tool, read DTC's.

Does the Scan Tool display Headlamp Switch 5.0 volts?

Yes >> Go To 3

No >> Replace the Headlamp Switch.
Perform the BODY VERIFICATION TEST VER — 1.

B1627-CARGO LAMP OUTPUT CIRCUIT SHORT TO GROUND (CONTINUED)

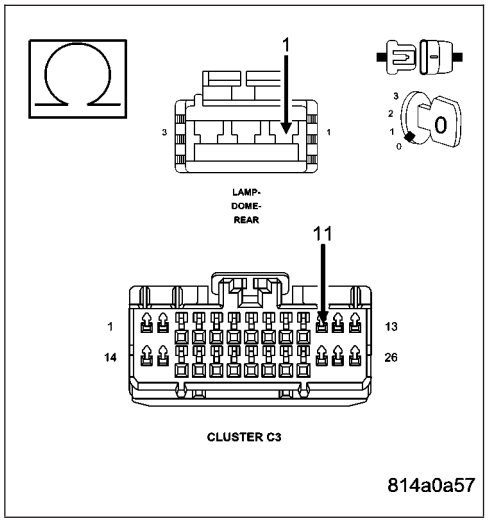
3. Instrument Cluster

Turn the ignition off.

Disconnect the Headlamp Switch connector.

Disconnect the Instrument Cluster C3 connector.

Measure the resistance of the of the (M22) Cargo Lamp Output circuit to ground.

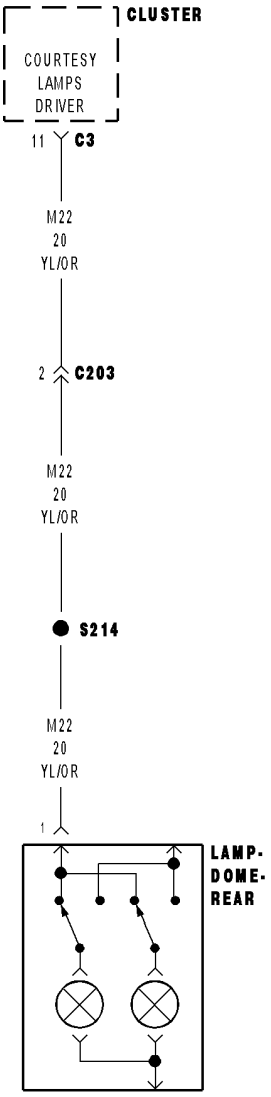


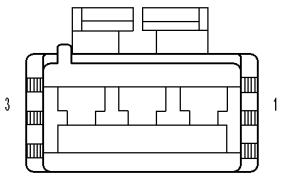
Is the resistance below 5.0 ohms?

Yes >> Repair the Cargo Lamp Output circuit.
Perform the BODY VERIFICATION TEST VER — 1.

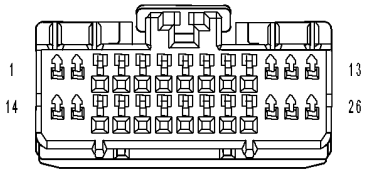
No >> Replace the Instrument Cluster in accordance with the service information.
Perform the BODY VERIFICATION TEST VER — 1.

B1629-CARGO LAMP OUTPUT CIRCUIT OPEN





LAMP-
DOME-
REAR



CLUSTER C3

814a0a5b

B1629-CARGO LAMP OUTPUT CIRCUIT OPEN (CONTINUED)

For the Interior Lighting circuit diagram (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

Possible Causes
HEADLAMP SWITCH
(M22) CARGO LAMP OUTPUT CIRCUIT OPEN
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

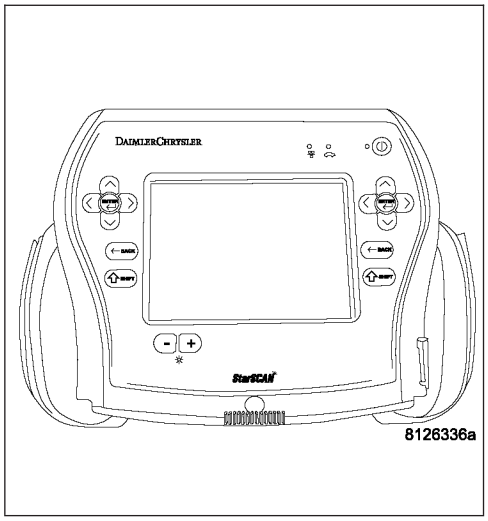
1. INTERMITTENT CONDITION

turn the ignition on.
With the Scan Tool, clear all CCN DTC's.
Turn the Cargo Lamps on.
With the Scan Tool, read the DTC information.

Does the SCan Tool read: B1629-CARGO LAMP OUTPUT CIRCUIT OPEN?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.



2. HEADLAMP SWITCH

Disconnect the Headlamp Switch connector.
Turn the ignition on.
Using the Scan Tool, read DTC's.

Does the Scan Tool display Headlamp Switch 5.0 volts?

Yes >> Go To 3

No >> Replace the Headlamp Switch.
Perform the BODY VERIFICATION TEST VER — 1.

B1629-CARGO LAMP OUTPUT CIRCUIT OPEN (CONTINUED)

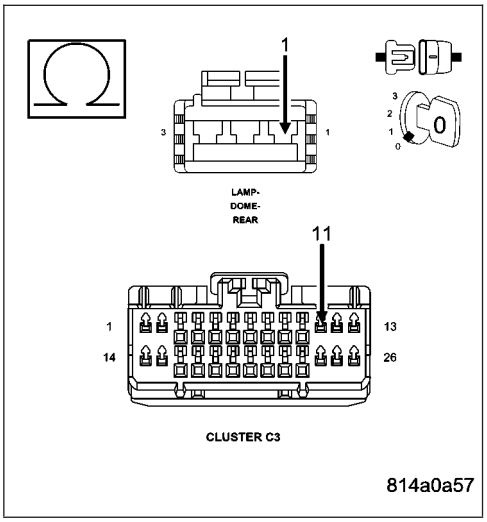
3. INSTRUMENT CLUSTER

Turn the ignition off.
Disconnect the Headlamp Switch connector.
Disconnect the Instrument Cluster C3 connector.
Measure the resistance of the of the (M22) Cargo Lamp Output circuit.

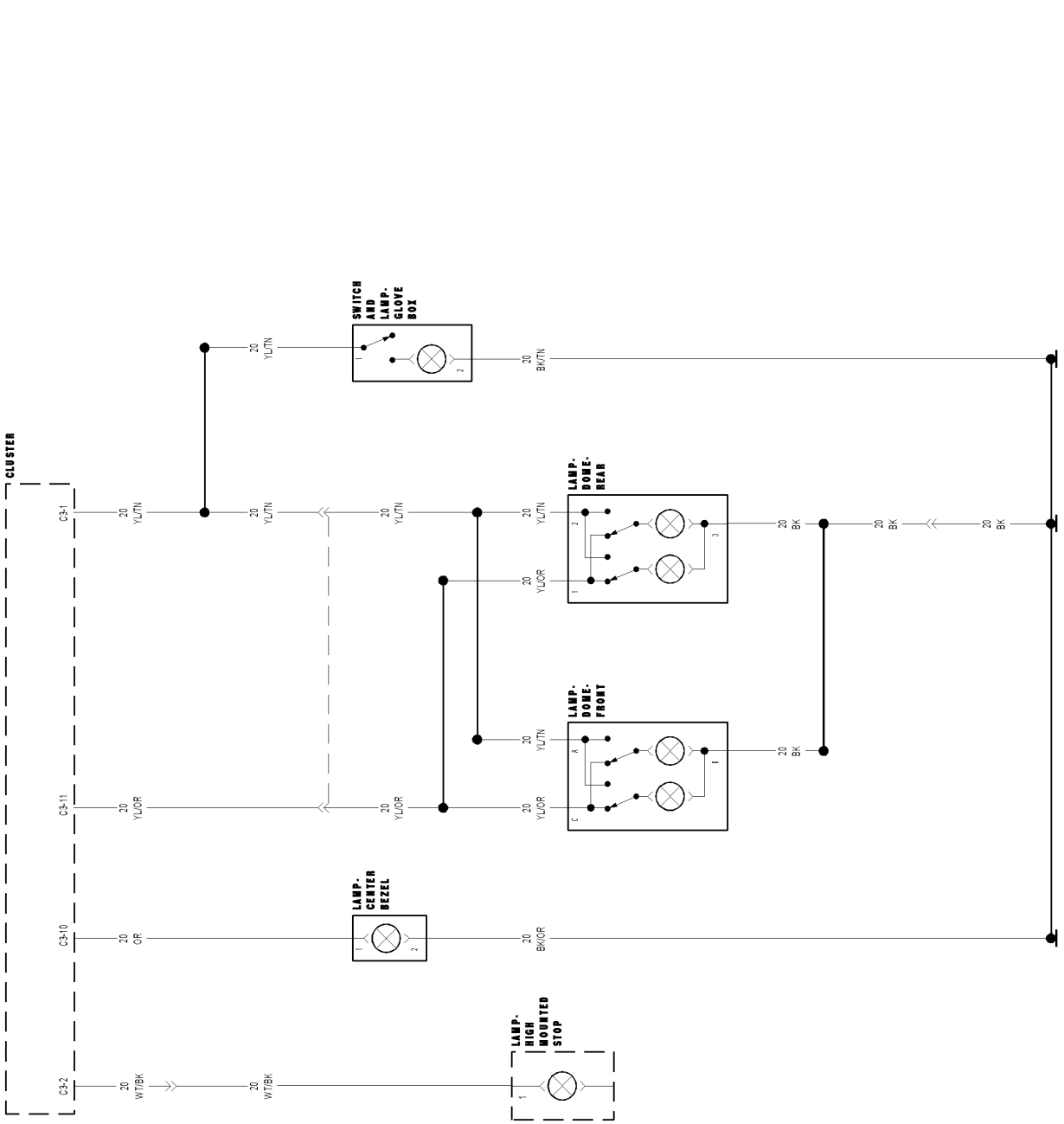
Is the resistance above 5.0 ohms?

Yes >> Repair the (M22) Cargo Lamp Output circuit.
Perform the BODY VERIFICATION TEST VER — 1.

No >> Replace the Instrument Cluster in accordance with the service information.
Perform the BODY VERIFICATION TEST VER — 1.



SCHEMATICS AND DIAGRAMS



INTERIOR LIGHTING SCHEMATIC

LAMPS/LIGHTING - INTERIOR - SERVICE INFORMATION

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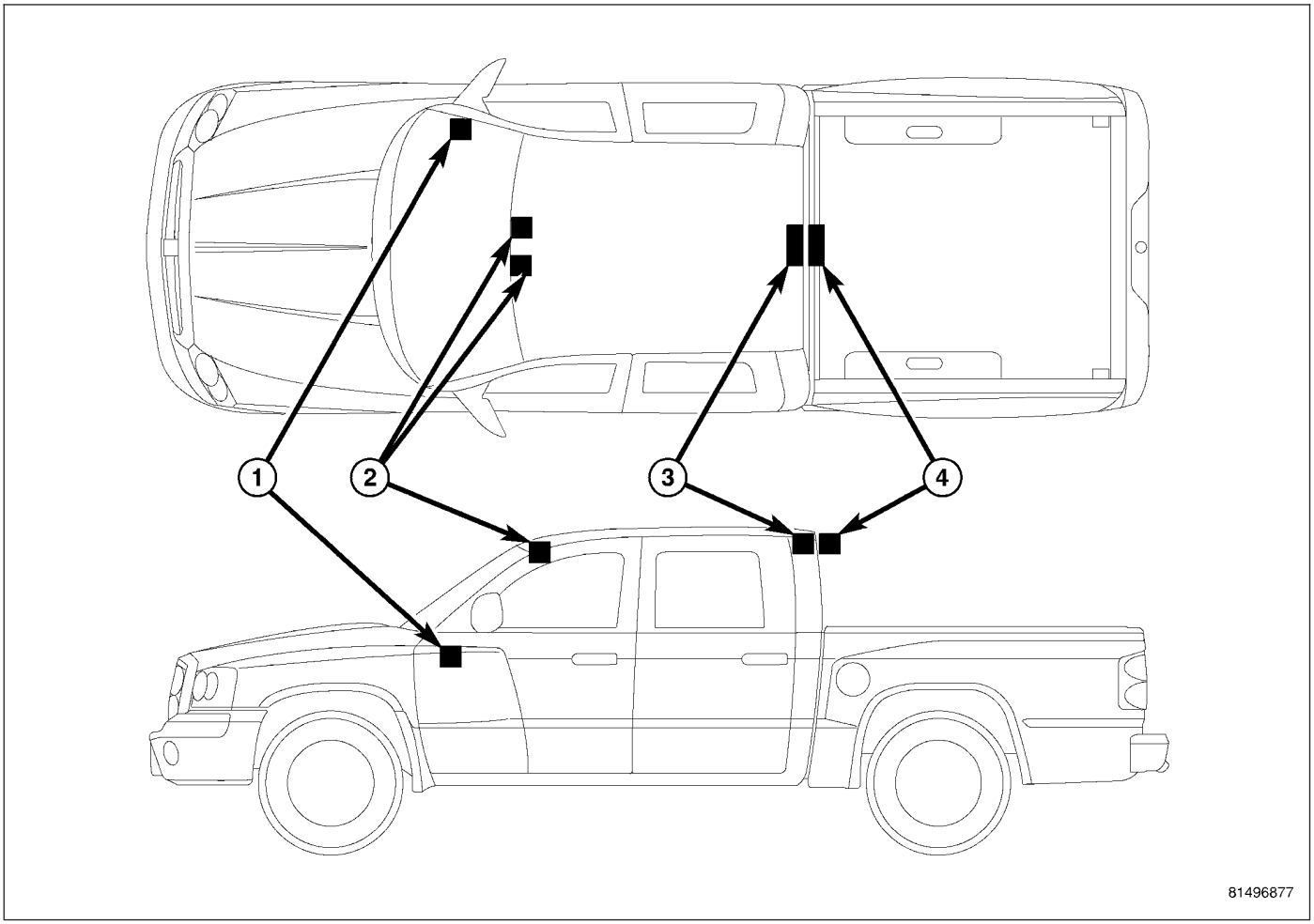
INSTALLATION - BULB 154

LAMPS/LIGHTING - INTERIOR - SERVICE INFORMATION

DESCRIPTION



The interior lighting system for this model includes incandescent lighting on two separate circuits: the dome/courtesy lamp circuit and the panel lamps dimmer circuit. The lamps on the dome/courtesy circuit include:

- **Cargo Lamps (4)** - The standard equipment cargo lamps are integral to the Center High Mounted Stop Lamp (CHMSL) located on the roof rear header above the rear glass on the back of the cab. One cargo lamp bulb is behind a clear lens on each outboard side of the center red lens of the CHMSL. The cargo lamps are manually activated or deactivated by depressing the momentary cargo lamps push button of the headlamp switch on the instrument panel to illuminate the cargo area of the pick-up box.
- **Glove Box Lamp (1)** - A glove box lamp with an integral switch is standard equipment on quad cab models. The lamp and switch are located at the upper right corner of the instrument panel glove box opening and illuminates whenever the glove box is opened.
- **Front Dome/Reading Lamps (2)** - The standard front dome/reading lamp includes two bulbs and two integral push button actuated switches. This lamp is located in the center of the headliner near the windshield header. In vehicles with an optional overhead console these lamps are replaced by two dome/reading lamps that are integral to the overhead console. The overhead console lamps have switches that are actuated by depressing the lamp lenses.
- **Rear Dome/Reading Lamps (4)** - A standard rear dome lamp is located in the headliner at the back of the cab above the rear window. On club cab models this lamp is activated by the door ajar switches or the interior lighting thumbwheel on the headlamp switch. On quad cab models the standard rear dome lamp is replaced with a rear dome/reading lamp that includes a switch that is actuated by depressing the lamp lens.

Most controls on the instrument panel and other controls located elsewhere on the interior of the vehicle are illuminated for night visibility. Some have miniature incandescent bulbs or Light-Emitting Diode (LED) units that are

soldered to internal circuit boards and are not serviceable. The replaceable incandescent bulbs or bulb/bulb holder units in this vehicle include:

- **Center Bezel Lamp** - An optional center bezel lamp with a replaceable bulb is located on the underside of the instrument panel center bezel below the heater/air conditioner control to illuminate an optional center console forward storage bin and cup holders.
- **Compass Mini-Trip Control Illumination Lamps** - The optional Compass Mini-Trip Computer (CMTC) has three replaceable bulb/bulb holder units to illuminate its controls.
- **Front Heater-Air Conditioner Control Illumination Lamps** - The heater-air conditioner control panel has two replaceable bulb/bulb holder units to illuminate its controls.

Other components of the interior lighting system for this model include:

- **Door Ajar Switches** - A door ajar switch is integral to the door latch mechanism of each front and rear door.
- **Headlamp Switch** - A headlamp switch is located on the left side of the instrument panel, below and outboard of the steering column. The headlamp switch includes a vertical thumbwheel for selecting the panel lamps dimming level and for interior lighting control. A Parade position of the thumbwheel illuminates all Vacuum Fluorescent Display (VFD) units at full brightness for visibility when driving in daylight with the exterior lighting turned On. There are also detent positions to turn on all interior courtesy lighting, and a Defeat position that overrides door ajar switch control of interior lighting. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP SWITCH - DESCRIPTION).
- **Instrument Cluster** - The ElectroMechanical Instrument Cluster (EMIC) is also known as the Cab Control Node (CCN) in this vehicle. The EMIC/CCN is located in the instrument panel above the steering column opening, directly in front of the driver. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DESCRIPTION).

Hard wired circuitry connects the interior lighting system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the interior lighting components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

The interior lighting systems can be divided into two general classifications based upon the circuit that controls their operation: The courtesy lamp circuit, or the panel lamps dimmer circuit. The hard wired circuits and components of the interior lighting systems may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the ElectroMechanical Instrument Cluster (EMIC), or the Controller Area Network (CAN) data bus. The most reliable, efficient, and accurate means to diagnose the EMIC, the CAN data bus, or the electronic bus message inputs and outputs related to the various interior lighting systems requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

COURTESY LAMP CIRCUIT

Depending upon the selected vehicle options the courtesy lamp circuit may include the dome and dome/reading lamps located in the headliner near the windshield and above rear window at the back of the cab, the cargo lamps located near the center of the rear roof header, and the glove box lamp in the top of the glove box opening in the instrument panel. The lamps in the courtesy lamp circuit are provided with a path to ground at all times. The EMIC controls the output of battery voltage for the courtesy lamps in this circuit based upon hard wired inputs from the door ajar switches, the headlamp switch and the ignition switch.

After all of the ajar switch inputs to the EMIC transition to open, the EMIC will keep the courtesy lamps illuminated for about 30 seconds, then fade the lamps to off (theater dimming) over about three seconds. The EMIC also provides courtesy lamp operation based upon a resistor multiplexed input from the vertical thumbwheel on the headlamp switch, and provides an illuminated entry feature in response to certain electronic message inputs received from the Sentry Key REmote Entry Module (SKREEM) and the Occupant Restraint Controller (ORC) over the CAN data bus. A resistor multiplexed courtesy lamp defeat input from the vertical thumbwheel of the headlamp switch will cause the EMIC to override normal courtesy lamp operation based upon inputs from all of the ajar switches.

For those lamps on the courtesy lamp circuit with independent switching such as the standard or optional map/reading lamps and the glove box lamp the EMIC provides a battery voltage output to the switches through a separate circuit. The EMIC provides a battery saver (load shedding) feature for all courtesy lamps, which will automatically turn these lamps off if they are left on for more than about eight minutes with the ignition switch in the Off position.

PANEL LAMPS DIMMER CIRCUIT

The panel lamps dimmer circuit actually includes several circuits. These circuits control the illumination and dimming level of the headlamp switch, the heater-air conditioner controls, the four-wheel drive selector switch and the center bezel lamp. All lamps in the panel lamps dimmer circuits are provided a path to ground at all times through a hard wired ground circuit. These lamps illuminate based upon inputs to the EMIC from the rotary control knob and vertical thumbwheel of the headlamp switch. The control knob on the headlamp switch selects the exterior lights, while the thumbwheel selects the panel lamps intensity (dimming) level.

When the exterior lighting is turned On, the EMIC provides electronic dimming level messages to the radio and the Compass Mini-Trip Computer (CMTC) over the CAN data bus. The EMIC also supplies a 12-volt Pulse Width Modulated (PWM) output to all of the incandescent lamps in the panel lamps dimmer circuits over the several panel lamps dimmer circuits. This shared PWM output synchronizes the selected illumination intensity level of all of the lamps in the panel lamps dimmer circuit.

The radio and the CMTC each use the dimming level messages to control the illumination intensity of both their Vacuum Fluorescent Display (VFD) units and their control lighting. In addition, when the thumbwheel of the headlamp switch is moved to the Parade/Funeral Mode detent position, all of the VFD units are illuminated at their full intensity levels for increased visibility when the vehicle is driven during daylight hours with the exterior lights turned On.

WARNING

WARNINGS - LAMPS/LIGHTING - INTERIOR

WARNING:: To avoid personal injury or death, eye protection should be used when servicing any glass components.

CAUTION: Do not use bulbs with higher candle power than indicated in the Bulb Application table (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - SPECIFICATIONS). In addition, do not use fuses, circuit breakers or relays having greater amperage value than indicated on the fuse panel or in the Owner's Manual. Damage to lamps, lenses, wiring and other related electrical components can result.

DIAGNOSIS AND TESTING

LAMPS/LIGHTING - INTERIOR

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: When diagnosing the interior lighting circuits, remember that high generator output can burn out bulbs rapidly and repeatedly; and, that dim or flickering bulbs can be caused by low generator output or poor battery condition. If one of these symptoms is a problem on the vehicle, be certain to diagnose the battery and charging system, then repair as necessary.

NOTE: A good ground is necessary for proper lighting operation. If a lighting problem is being diagnosed that involves multiple symptoms, systems, or components, the problem can often be traced to a loose, corroded, or open ground.

The hard wired interior lamp and lighting circuits may be diagnosed and tested using conventional diagnostic tools and methods. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the ElectroMechanical Instrument Cluster (EMIC), the Controller Area Network (CAN) data bus, or the electronic message inputs used to provide interior lamp and lighting service or many of the electronic features of the interior lamp and lighting systems. The most reliable, efficient, and accurate means to diagnose the EMIC, the CAN data bus, and the electronic message inputs for the interior lamps and lighting system requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

COURTESY LAMP CIRCUIT

CONDITION	POSSIBLE CAUSES	CORRECTION
A SINGLE LAMP IN THE COURTESY LAMP CIRCUIT DOES NOT ILLUMINATE	1. Faulty or missing bulb.	1. Test and replace the courtesy lamp bulb as required.
	2. Faulty lamp switch.	2. Test and replace a faulty dome lamp switch, dome/reading lamp switch, cargo lamp switch, or glove box lamp switch as required.
	3. Faulty ground circuit.	3. Test and repair the open ground circuit as required.
	4. Faulty feed circuit.	4. Test and repair the open feed circuit as required.
ALL LAMPS IN THE COURTESY LAMP CIRCUIT DO NOT ILLUMINATE	1. Faulty or missing fuse.	1. Test and replace the fuse as required.
	2. Faulty ground circuit.	2. Test and repair the open ground circuit as required.
	3. Courtesy defeat feature turned On.	3. Turn courtesy defeat feature Off.
	4. Faulty courtesy lamp control circuit.	4. Test and repair the courtesy lamp control circuit as required.
	5. Faulty headlamp switch.	5. Test and replace the headlamp switch as required.
	6. Faulty ElectroMechanical Instrument Cluster (EMIC), EMIC input, or EMIC output.	6. Use a diagnostic scan tool to test the EMIC, its inputs, and its outputs. Refer to the appropriate diagnostic information.
A SINGLE LAMP IN THE COURTESY LAMP CIRCUIT DOES NOT EXTINGUISH	1. Faulty lamp switch.	1. Test and replace a faulty dome lamp switch, dome/reading lamp switch, cargo lamp switch, or glove box lamp switch as required.
ALL LAMPS IN THE COURTESY LAMP CIRCUIT DO NOT EXTINGUISH	1. Faulty ajar switch.	1. Test and replace a faulty door ajar switch as required.
	2. Faulty ajar switch sense circuit.	2. Test and repair the shorted ajar switch sense circuit as required.
	3. Faulty ElectroMechanical Instrument Cluster (EMIC), EMIC input, or EMIC output.	3. Use a diagnostic scan tool to test the EMIC, its inputs, and its outputs. Refer to the appropriate diagnostic information.

PANEL LAMPS DIMMER CIRCUIT

NOTE: As part of the exterior lighting failsafe feature, upon ignition On all of the panel lamps dimmer circuit lamps will illuminate at full intensity and the exterior park lamps and headlamp low beams will illuminate regardless of the headlamp switch position if the instrument cluster cannot detect an input from the headlamp switch, or if there is a loss of data bus communication.

CONDITION	POSSIBLE CAUSES	CORRECTION
A SINGLE LAMP DOES NOT ILLUMINATE	1. Faulty or missing bulb.	1. Test and replace lamp bulb as required.
	2. Faulty ground circuit.	2. Test and repair lamp ground circuit as required.
	3. Faulty feed circuit.	3. Test and repair open feed circuit as required.
A SINGLE LAMP DOES NOT EXTINGUISH	1. Faulty feed circuit.	1. Test and repair shorted feed circuit as required.
ALL LAMPS DO NOT ILLUMINATE	1. Faulty headlamp switch.	1. Test and replace the headlamp switch as required.
	2. Faulty ElectroMechanical Instrument Cluster (EMIC), EMIC input, or EMIC output.	2. Use a diagnostic scan tool to test the EMIC, its inputs, and its outputs. Refer to the appropriate diagnostic information.
ALL LAMPS ILLUMINATE AT FULL INTENSITY AT IGNITION ON	1. Loss of data bus communication.	1. Use a diagnostic scan tool to test the data bus. Refer to the appropriate diagnostic information.

SPECIFICATIONS

LAMPS/LIGHTING - INTERIOR

COURTESY LAMPS

BULB APPLICATION TABLE	
LAMP	**BULB**
CARGO LAMP	912
FRONT DOME/READING EXCEPT WITH OVERHEAD CONSOLE	578
FRONT DOME/READING WITH OVERHEAD CONSOLE	192
GLOVE BOX LAMP	194
REAR DOME LAMP (NON-SWITCHED OR SWITCHED)	578

PANEL LAMPS

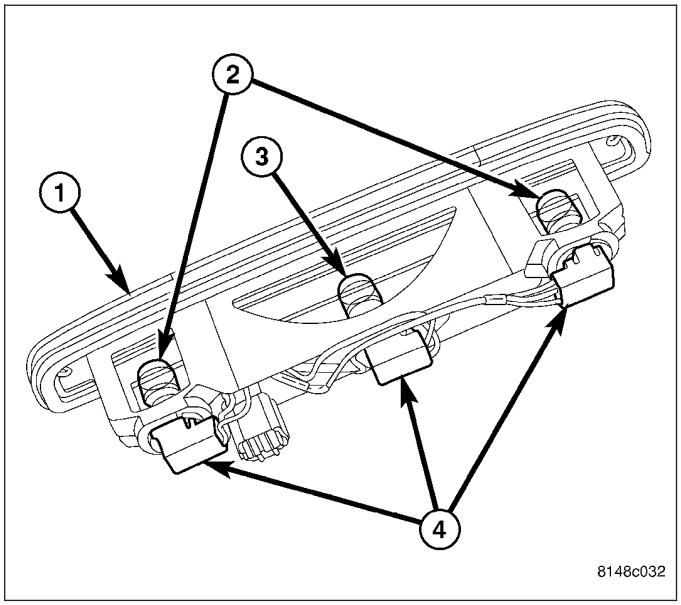
BULB APPLICATION TABLE	
LAMP	**BULB**
CENTER BEZEL LAMP	37
COMPASS MINI-TRIP CONTROL	MOPAR 04437661
A/C-HEAT CONTROL	MOPAR 05135537AA

CARGO LAMP

REMOVAL

NOTE: The Center High Mounted Stop Lamp (CHMSL) houses three bulbs. The center bulb is the CHMSL bulb and illuminates through a red lens, while the two outboard bulbs are for the cargo lamps and illuminate through clear lenses. The bulb types and service procedures are identical for all three of these bulbs.

1. Disconnect and isolate the battery negative cable.
2. Remove the two screws that secure the CHMSL to the rear cab roof header panel.
3. Pull the CHMSL lens and housing (1) away from the header panel far enough to access the lamp wiring and bulb sockets (4) on the back of the lamp.
4. Firmly grasp the center socket on the back of the lamp housing and rotate it counterclockwise about 30 degrees to unlock it.
5. Pull the socket and bulb straight out from the keyed opening in the housing.
6. Pull the base of the bulb (2) straight out of the socket.

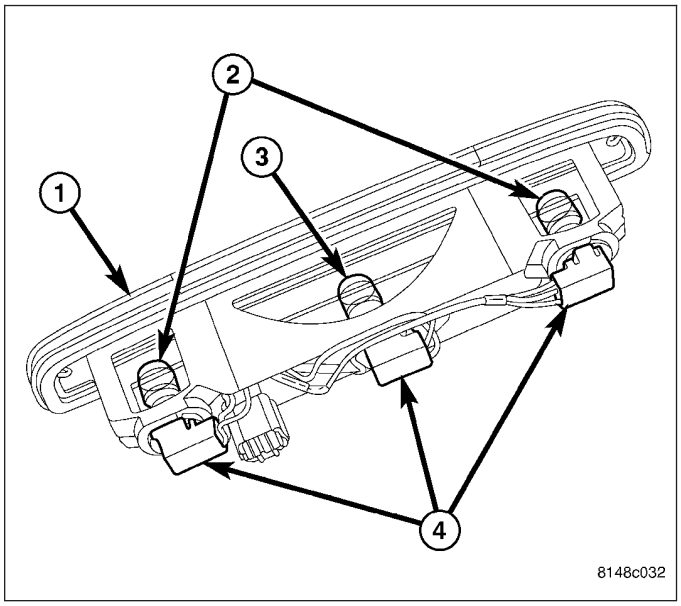


INSTALLATION

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

NOTE: The Center High Mounted Stop Lamp (CHMSL) houses three bulbs. The center bulb is the CHMSL bulb and illuminates through a red lens, while the two outboard bulbs are for the cargo lamps and illuminate through clear lenses. The bulb types and service procedures are identical for all three of these bulbs.

1. Align the base of the cargo lamp bulb (2) with the socket (4).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of CHMSL housing (1).
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Position the CHMSL into the opening in the rear cab roof header panel.
7. Install and tighten the two screws that secure the CHMSL to the header panel. Tighten the screws to 2 N·m (20 in. lbs.).
8. Reconnect the battery negative cable.



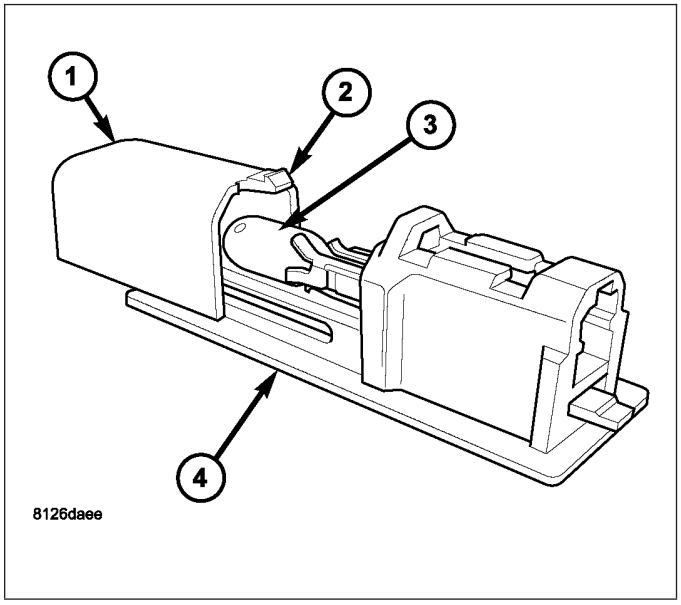
CENTER BEZEL LAMP

REMOVAL

BULB

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

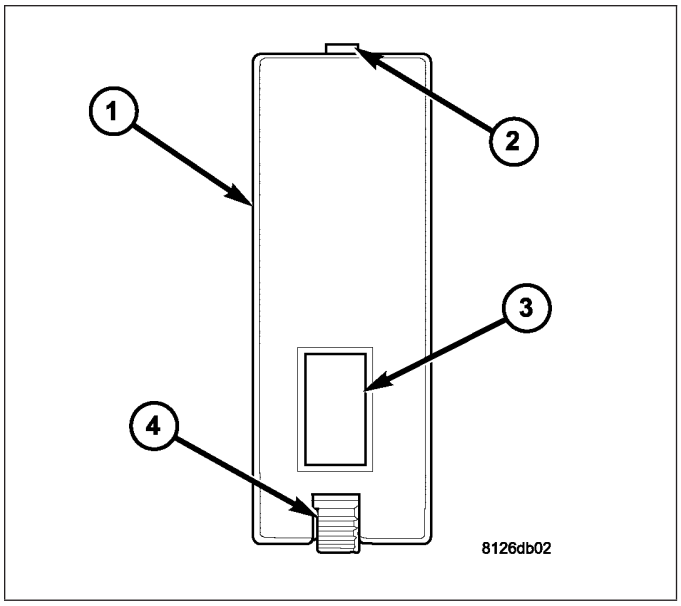
1. Disconnect and isolate the battery negative cable.
2. Remove the center bezel lamp (4) from the instrument panel center bezel. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/CENTER BEZEL LAMP - REMOVAL).
3. Depress the latch tab (2) and slide the hood (1) off of the end of the lamp housing.
4. Pull the base of the bulb (3) straight out of the bulb holder within the lamp housing.



LAMP

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.
2. The center bezel lamp (1) is located on the underside of the instrument panel center bezel below the heater-air conditioner controls, above the center floor console forward storage bin. Use a small thin-bladed screwdriver to depress the lamp retaining latch (4) on the end of the lamp housing nearest the lens (3).
3. Pull the lamp down and move it toward the latch end to disengage the fixed retainer (2) from the mounting hole.
4. Disconnect the wire harness connector from the lamp connector.
5. Remove the lamp unit from the center bezel.



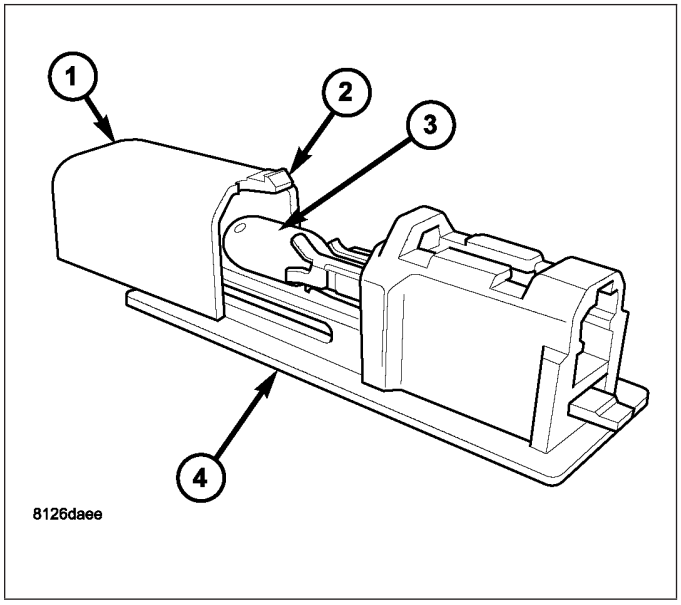
INSTALLATION

BULB

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

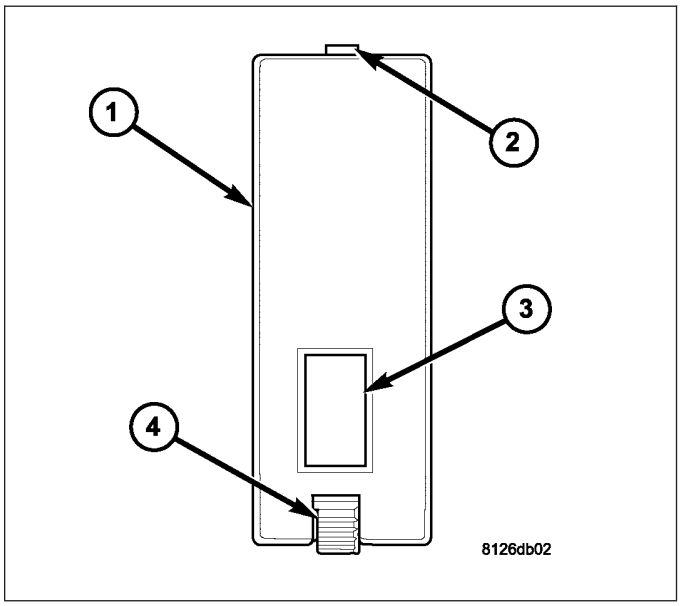
1. Align the base of the center bezel lamp bulb (3) with the bulb holder within the lamp housing (4).
2. Push the bulb straight into the bulb holder until the base is firmly seated.
3. Slide the hood (1) over the end of the lamp housing until the latch tab (2) snaps into place.
4. Reinstall the lamp unit into the instrument panel. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/CENTER BEZEL LAMP - INSTALLATION).
5. Reconnect the battery negative cable.



LAMP

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Position the center bezel lamp (1) to the mounting hole in the center bezel above the forward storage bin of the center floor console.
2. Reconnect the wire harness connector to the lamp connector.
3. Engage the fixed retainer (2) of the lamp with one edge of the mounting hole in the center bezel.
4. Push the opposite end of the lamp upward until the retaining latch (4) snaps into the mounting hole.
5. Reconnect the battery negative cable.

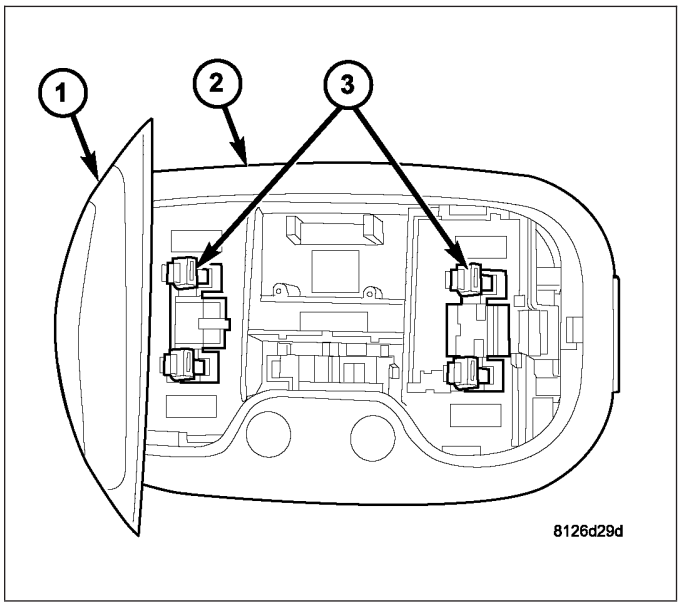


DOME LAMP

REMOVAL

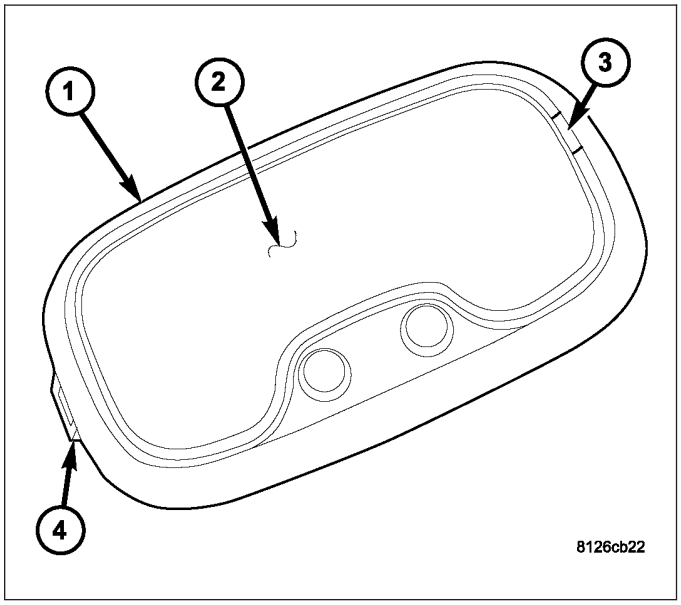
BULB - FRONT

1. Disconnect and isolate the battery negative cable.
2. Remove the front dome lamp (2) from the headliner. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/FRONT DOME LAMP - REMOVAL).
3. With the lamp lens (1) in the open position, carefully unsnap the bulb (3) from the two bulb holders within the front dome lamp housing.



LAMP - FRONT

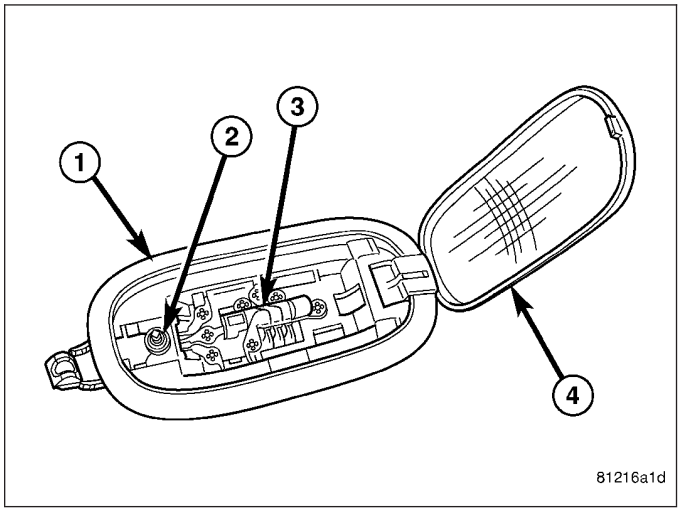
1. Disconnect and isolate the battery negative cable.
2. Insert the tip of a small flat bladed screwdriver into the notch (3) between the lens (2) and the housing (1) on one side of the dome lamp unit.
3. Gently pry the end of the lens downward until it unsnaps from the housing.
4. Swing the lens downward until it is perpendicular to the housing.
5. Pull the lens hinge/retainer end (4) of the housing downward slightly from the headliner, then slide the lowered end of the housing away from the mounting hole far enough to disengage the fixed retainer on the notched end from the headliner.
6. Pull the lamp away from the headliner mounting hole far enough to disconnect the wire harness connector from the back of the lamp.
7. Remove the lamp from the vehicle.



BULB - REAR

NOTE: There are two types of dome lamps available in this model: one with a switch (2) that is activated by depressing the lamp lens, and one without a switch. The bulb types and service procedures are identical for both of these lamps.

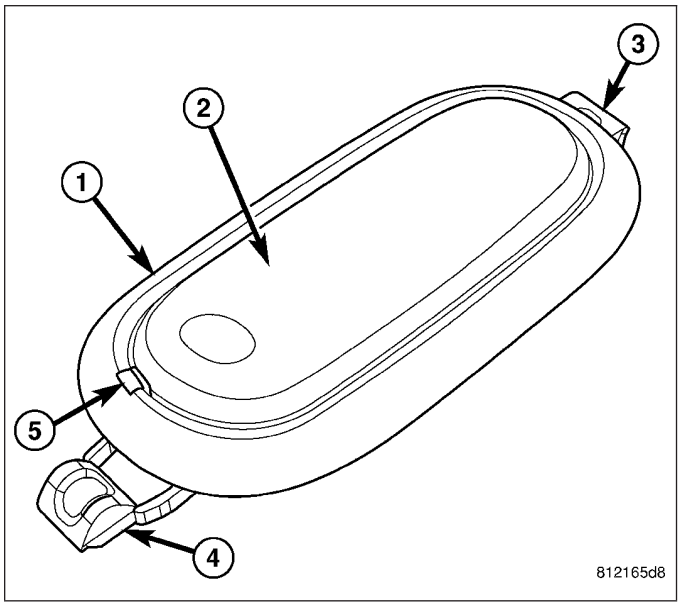
1. Disconnect and isolate the battery negative cable.
2. Insert the tip of a small flat-bladed screwdriver into the notch on one side of the rear dome lamp between the lens (4) and the lamp housing (1).
3. Gently pry the notched edge of the lens downward until it unsnaps from the housing.
4. Swing the notched end of the lens downward far enough to access the bulb (3).
5. Carefully unsnap the bulb from the two bulb holders within the rear dome lamp housing.



LAMP - REAR

NOTE: There are two types of dome lamps available in this model: one with a switch that is activated by depressing the lamp lens, and one without a switch. The bulb types and service procedures are identical for both of these lamps.

1. Disconnect and isolate the battery negative cable.
2. Insert the tip of a small flat bladed screwdriver into the notch (5) between the lens (2) and the housing (1) on one side of the dome lamp.
3. Gently pry the end of the lens outward until it unsnaps from the housing.
4. Swing the lens outward until it is perpendicular to the housing.
5. Pull the lens hinge/retainer end (3) of the housing outward slightly from the headliner, then slide the exposed end of the housing away from the mounting hole far enough to disengage the fixed retainer (4) on the notched end from the headliner.
6. Pull the lamp away from the headliner mounting hole far enough to access and disconnect the wire harness connector from the back of the lamp.
7. Remove the lamp from the vehicle.

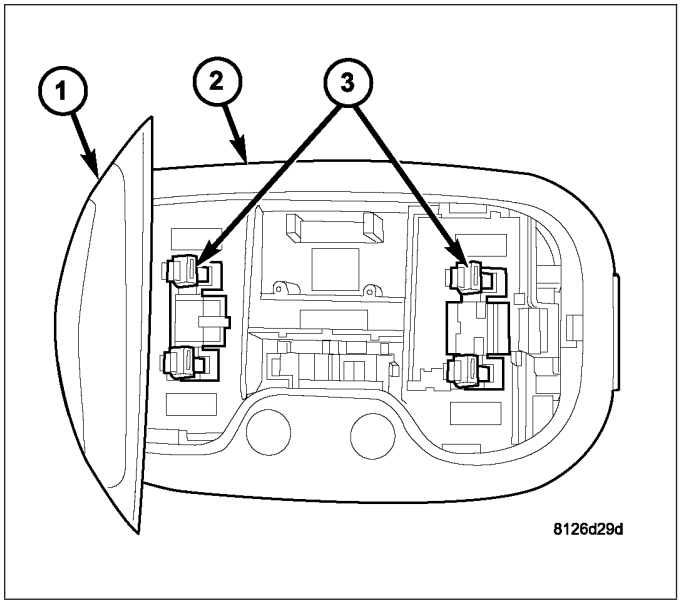


INSTALLATION

BULB - FRONT

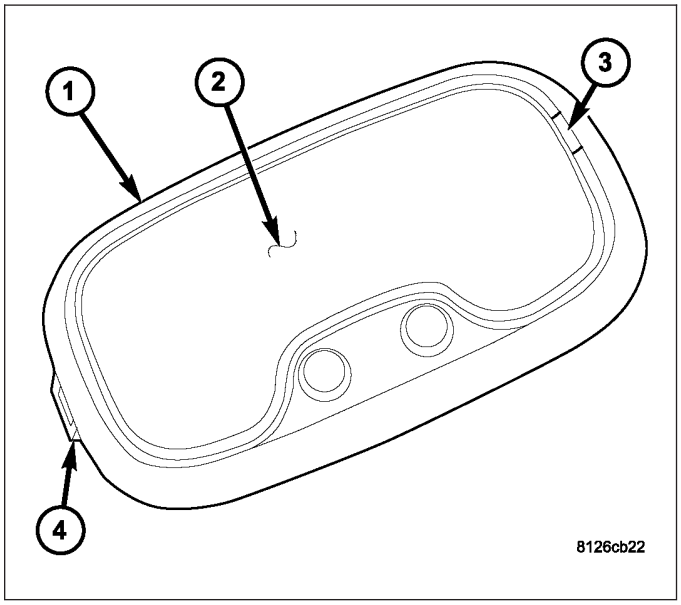
CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

1. With the dome lamp lens (1) in the open position, align the ends of the bulb (3) with the two bulb holders within the front dome lamp housing (2).
2. Carefully press the bulb firmly and evenly into the bulb holders until it snaps into place.
3. Reinstall the lamp into the headliner. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/ FRONT DOME LAMP - INSTALLATION).
4. Reconnect the battery negative cable.



LAMP - FRONT

1. Position the dome lamp unit (1) to the mounting hole in the headliner.
2. Reconnect the wire harness connector to the connector on the back of the lamp.
3. Insert the fixed retainer on the notched end (3) of the lamp housing up into one side of the mounting hole in the headliner.
4. Slide the notched end of the housing into the mounting hole far enough to engage the lens hinge/retainer (4) into the opposite side of the hole in the headliner.
5. Gently and evenly press the lens hinge/retainer end of the lamp upward into the mounting hole until the bezel of the lamp housing is flush with the headliner.
6. Swing the notched end of the lamp lens (2) up into position against the lamp housing, then press upward on the lens firmly and evenly until it snaps into the housing.
7. Reconnect the battery negative cable.

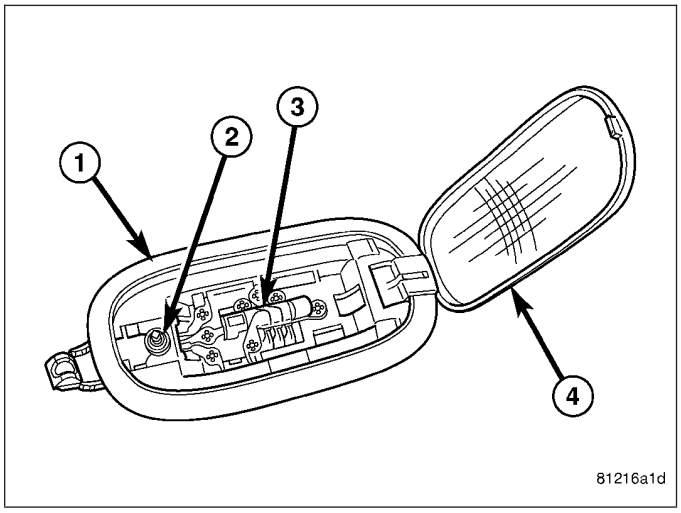


BULB - REAR

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

NOTE: There are two types of dome lamps available in this model: one with a switch (2) that is activated by depressing the lamp lens, and one without a switch. The bulb types and service procedures are identical for both of these lamps.

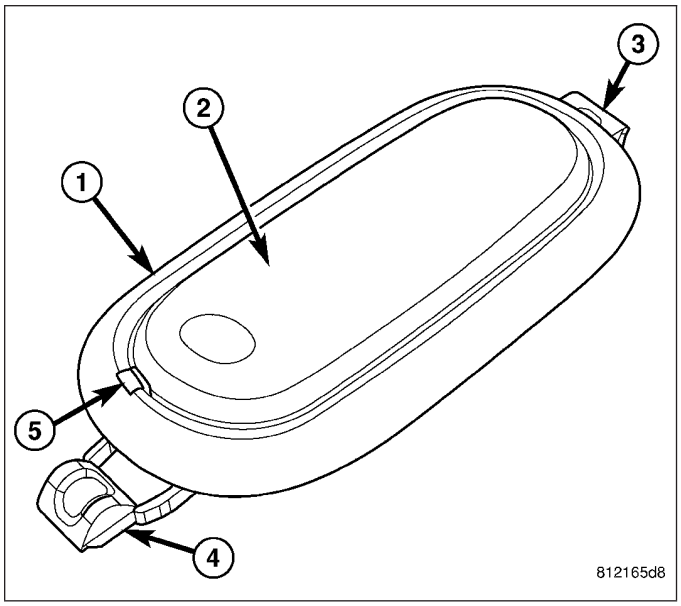
1. Align the ends of the bulb (3) with the two bulb holders within the rear dome lamp housing (1).
2. Carefully press the bulb firmly and evenly into the bulb holders until it snaps into place.
3. Swing the notched end of the lens (4) up into position against the housing, then press upward on the lens firmly and evenly until it snaps into the housing.
4. Reconnect the battery negative cable.



LAMP - REAR

NOTE: There are two types of dome lamps available in this model: one with a switch that is activated by depressing the lamp lens, and one without a switch. The bulb types and service procedures are identical for both of these lamps.

1. Position the dome lamp (1) to the mounting hole in the headliner.
2. Reconnect the wire harness connector to the connector on the back of the lamp.
3. Insert the fixed retainer on the notched end (4) of the lamp housing up into one side of the mounting hole in the headliner.
4. Slide the notched end of the housing into the mounting hole far enough to engage the lens hinge/retainer (3) into the opposite side of the hole in the headliner.
5. Gently and evenly press the lens hinge/retainer end of the lamp into the mounting hole until the bezel of the lamp housing is flush with the headliner.
6. Swing the notched end of the lamp lens (2) into position against the lamp housing, then press on the lens firmly and evenly until it snaps into the housing.
7. Reconnect the battery negative cable.



DOOR AJAR SWITCH

DESCRIPTION

This vehicle has up to four door ajar switches, one for each full door. Each switch is concealed within and integral to its respective door latch unit. The switches are momentary leaf contact-type units that are actuated by the mechanisms internal to the door latch. A short pigtail wire and connector on each door latch connects the door ajar switch to the vehicle electrical system through its respective door wire harness. The door ajar switches cannot be adjusted or repaired and, if faulty or damaged, the door latch unit must be replaced. (Refer to 23 - BODY/DOOR - FRONT/LATCH - REMOVAL) or (Refer to 23 - BODY/DOOR - REAR/LATCH - REMOVAL).

OPERATION

The door ajar switches are actuated by the mechanisms internal to the door latch. When a door is closed and properly latched, its door ajar switch is an open circuit. When a door is open or only partially latched, the door ajar switch is a closed circuit. The door ajar switches are hard wired in series between a body ground and the Electro-Mechanical Instrument Cluster (EMIC).

The EMIC reads the hard wired door ajar switch inputs through internal pull-ups, then uses these inputs to control many electronic functions and features of the vehicle. The EMIC also sends the proper switch status messages to other electronic modules over the Controller Area Network (CAN) data bus.

The door ajar switches can be diagnosed and tested using conventional diagnostic tools and methods. Refer to the appropriate wiring information. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the EMIC, the CAN data bus, or the electronic message inputs or outputs used to convey door ajar switch status to other modules in the vehicle. The most reliable, efficient, and accurate means to diagnose the EMIC, the CAN data bus, and both the hard wired and electronic message inputs and outputs affected by the door ajar switch inputs requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

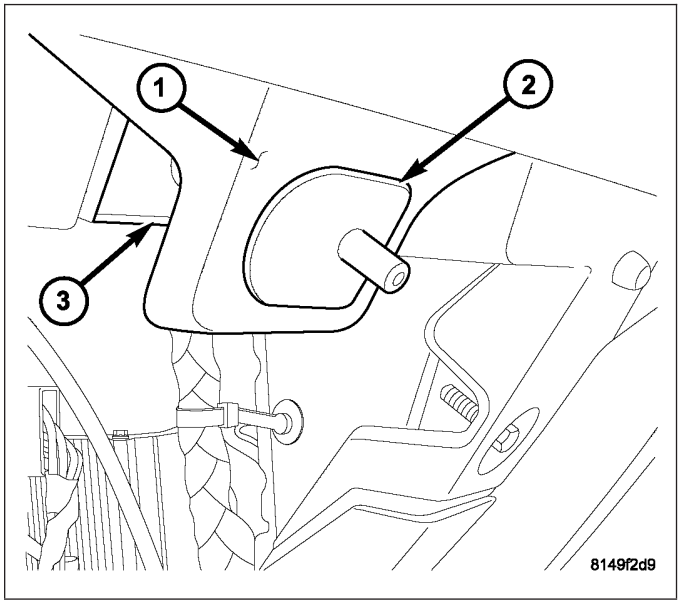
LAMP-GLOVE BOX

REMOVAL

BULB

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

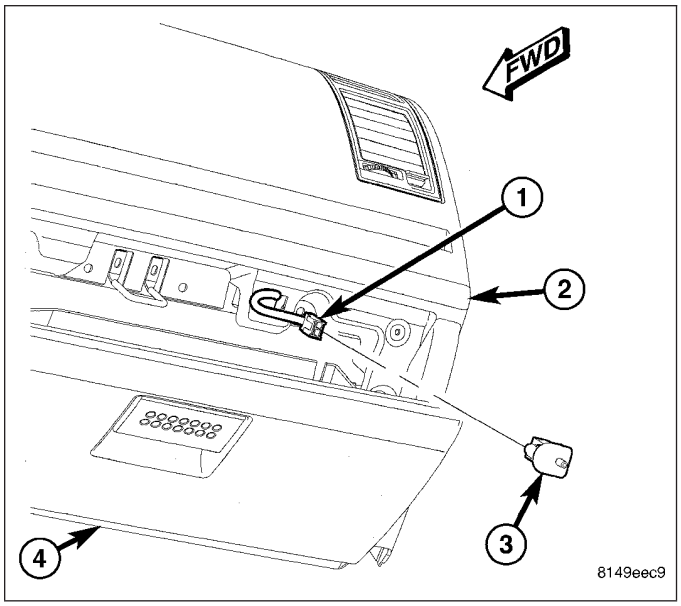
1. Disconnect and isolate the battery negative cable.
2. Remove the glove box from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ GLOVE BOX - REMOVAL).
3. Reach through the window (3) behind the instrument panel glove box opening (1) to access the bulb on the glove box lamp and switch (2).
4. Pull the base of the bulb straight out of the bulb holder.



LAMP/SWITCH

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.
2. Remove the glove box (4) from the instrument panel (2). (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).
3. Reach behind the upper glove box opening to access and depress the retaining latch on either side of the glove box lamp and switch (3).
4. While holding the retaining latch depressed, push the glove box lamp and switch unit out through the mounting hole in the face of the instrument panel.
5. Disconnect the wire harness connector (1) from the glove box lamp and switch.
6. Remove the lamp and switch from the instrument panel.



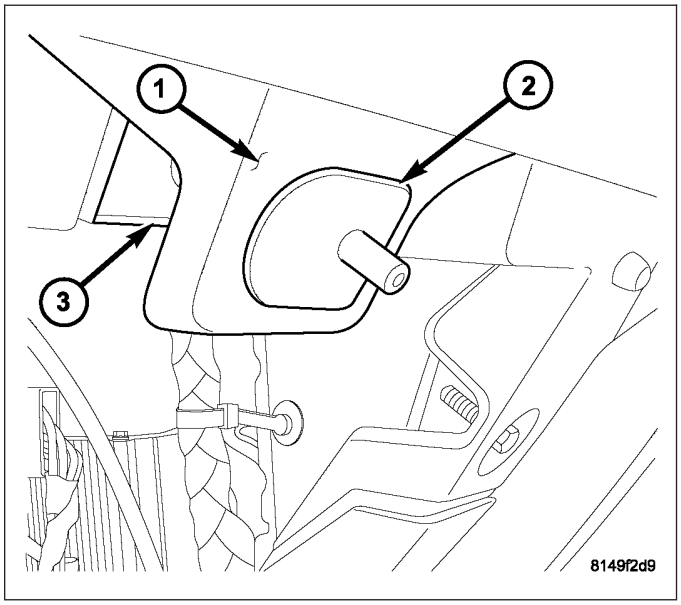
INSTALLATION

BULB

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

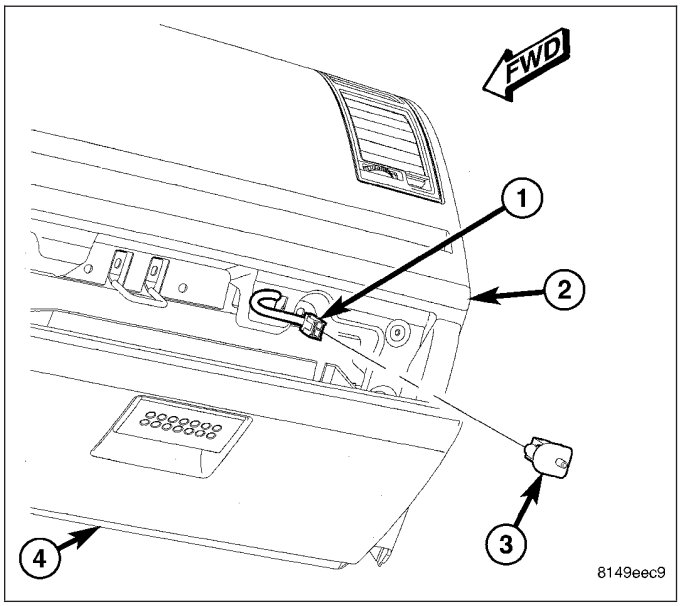
1. Reach through the window (3) behind the instrument panel glove box opening (1) to align the base of the bulb with the bulb holder on the glove box lamp and switch (2).
2. Push the bulb straight into the bulb holder until the base is firmly seated.
3. Reinstall the glove box into the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).
4. Reconnect the battery negative cable.



LAMP/SWITCH

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Position the glove box lamp and switch (3) to the mounting hole in the instrument panel (2).
2. Reconnect the wire harness connector (1) to the lamp and switch.
3. Feed the wire harness back through the switch mounting hole.
4. Align the lamp and switch with the mounting hole in the instrument panel.
5. Using hand pressure, push the lamp and switch firmly and evenly into the mounting hole until it is fully seated.
6. Reinstall the glove box (4) into the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ GLOVE BOX - INSTALLATION).
7. Reconnect the battery negative cable.



ILLUMINATION LAMP

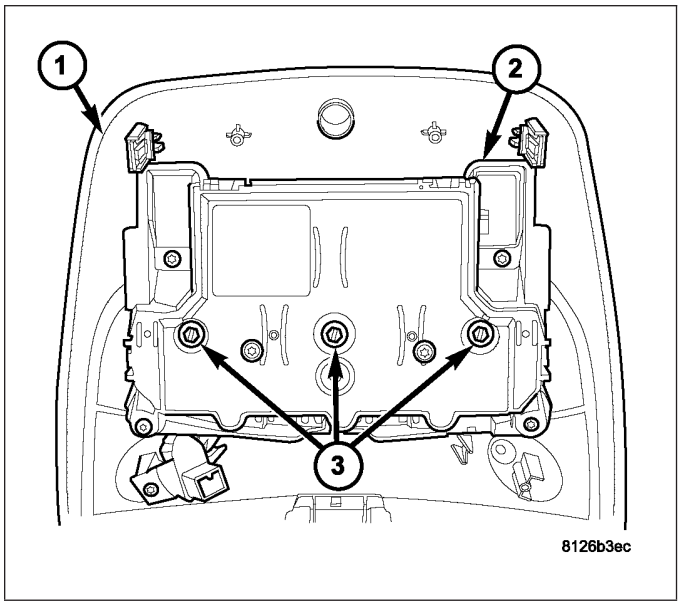
REMOVAL

BULB - CMTC CONTROL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: There are provisions for three bulb/bulb holder units on the Compass Mini-Trip Computer (CMTC) circuit board. The two outboard bulbs illuminate the CMTC push buttons, while the center bulb illuminates the optional universal transmitter push buttons. Therefore, the center bulb location is only populated on vehicles equipped with the optional universal transmitter.

1. Disconnect and isolate the battery negative cable.
2. Remove the overhead console (1) from the headliner. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).
3. Use a small thin-bladed screwdriver to rotate the bulb holder (3) counterclockwise about 30 degrees to unlock it from the keyed opening in the Compass Mini-Trip Computer (CMTC) unit (2) circuit board.
4. Pull the bulb holder and bulb straight out of the circuit board.

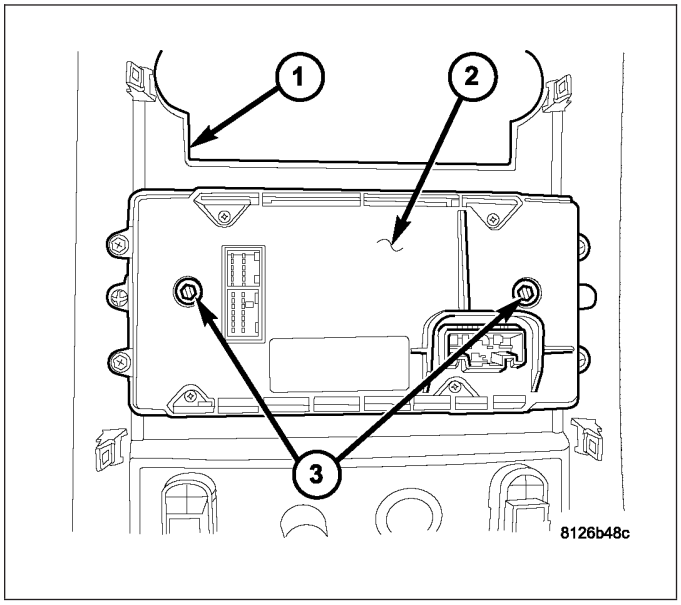


BULB - A/C-HEAT CONTROL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: There may be minor variations in the locations of the bulb/bulb holder units on the back of the A/C-heater control as a result of various optional A/C-heater control units. However, the bulb types and service procedures are identical for all of these bulbs.

1. Disconnect and isolate the battery negative cable.
2. Remove the center bezel (1) from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ INSTRUMENT PANEL CENTER BEZEL - REMOVAL).
3. Use a small thin-bladed screwdriver to rotate the bulb holder (3) counterclockwise about 30 degrees to unlock it from the keyed opening in the front A/C-heater control (2) circuit board.
4. Pull the bulb holder and bulb straight out of the circuit board.



INSTALLATION

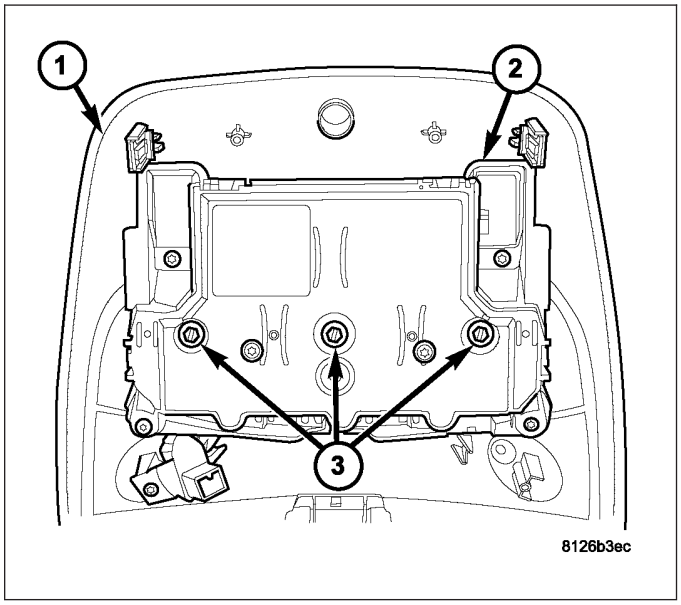
BULB - CMTC CONTROL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

NOTE: There are provisions for three bulb/bulb holder units on the Compass Mini-Trip Computer (CMTC) circuit board. The two outboard bulbs illuminate the CMTC push buttons, while the center bulb illuminates the optional universal transmitter push buttons. Therefore, the center bulb location is only populated on vehicles equipped with the optional universal transmitter.

1. Align the bulb holder and bulb (3) with the keyed opening in the circuit board of the Compass Mini-Trip Computer (CMTC) (2).
2. Insert the bulb holder and bulb straight into the circuit board until the bulb holder is firmly seated.
3. Using a small thin-bladed screwdriver, rotate the bulb holder clockwise about 30 degrees on the circuit board to lock it into place.
4. Reinstall the overhead console (1) onto the headliner. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION).
5. Reconnect the battery negative cable.



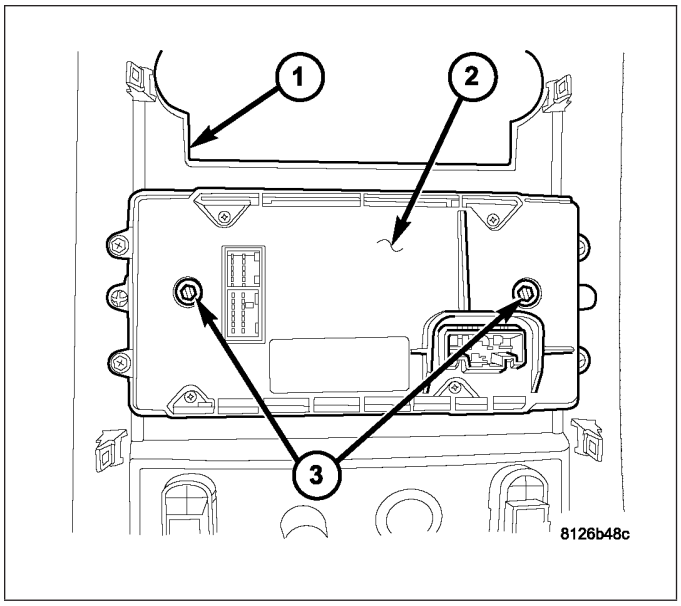
BULB - A/C-HEAT CONTROL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

NOTE: There may be minor variations in the locations of the bulb/bulb holder units on the back of the A/C-heater control as a result of various optional A/C-heater control units. However, the bulb types and service procedures are identical for all of these bulbs.

1. Align the bulb holder and bulb (3) with the keyed opening in the circuit board of the front A/C-heater control (2).
2. Insert the bulb holder and bulb straight into the circuit board until the bulb holder is firmly seated.
3. Using a small thin-bladed screwdriver, rotate the bulb holder clockwise about 30 degrees on the circuit board to lock it into place.
4. Reinstall the center bezel (1) onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).
5. Reconnect the battery negative cable.

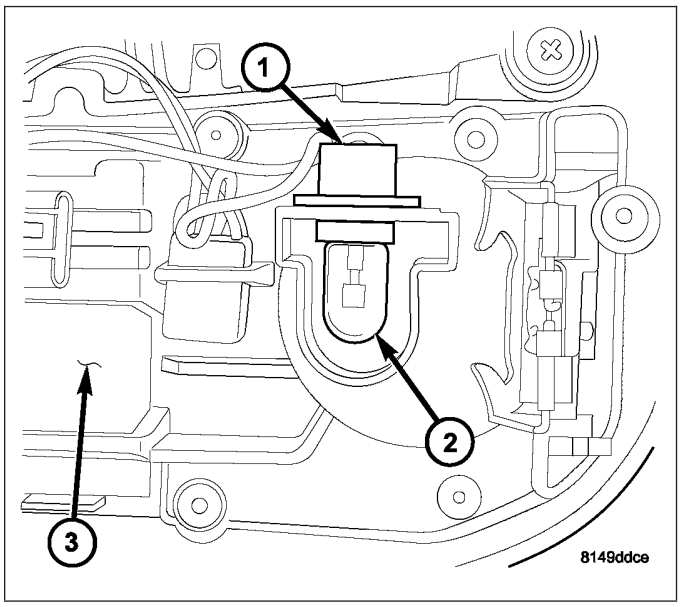


READING LAMP

REMOVAL - BULB

NOTE: On vehicles equipped with an optional overhead console the standard front dome lamp is replaced by two combination dome and reading lamps that are integral to the console housing. Each of these lamps is controlled by the door ajar switches on the courtesy lamp circuit, but also are independently controlled by a switch that is activated by depressing the lamp lens. The bulb types and service procedures are identical for both of these lamps.

1. Disconnect and isolate the battery negative cable.
2. Remove the overhead console (3) from the headliner. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).
3. Firmly grasp the back of the reading lamp bulb socket (1) and unsnap it from the overhead console lamp housing.
4. Pull the socket and bulb (2) straight out from the keyed opening in the lamp housing.
5. Pull the base of the bulb straight out of the socket.

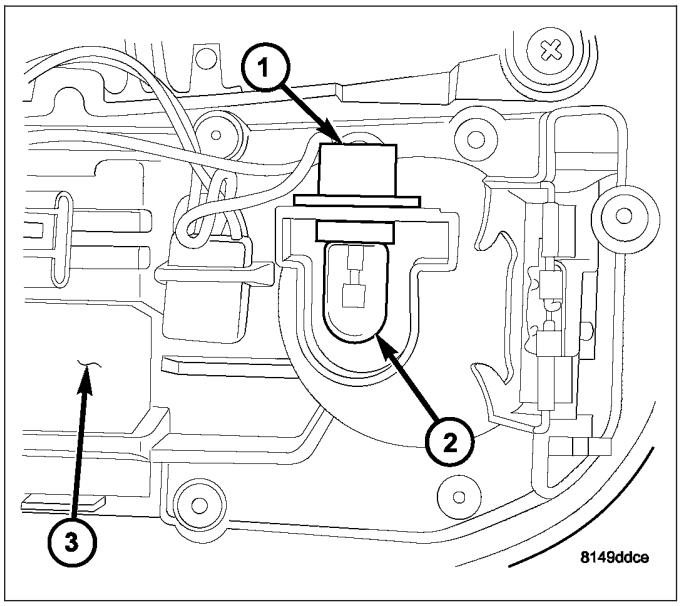


INSTALLATION - BULB

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.

NOTE: On vehicles equipped with an optional overhead console the standard front dome lamp is replaced by two combination dome and reading lamps that are integral to the console housing. Each of these lamps is controlled by the door ajar switches on the courtesy lamp circuit, but also are independently controlled by a switch that is activated by depressing the lamp lens. The bulb types and service procedures are identical for both of these lamps.

1. Align the base of the overhead console reading lamp bulb (2) with the socket (1).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of lamp housing in the overhead console.
4. Insert the socket and bulb into the housing and press firmly on the back of the socket until it snaps into place and is firmly seated.
5. Reinstall the overhead console onto the headliner. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION).
6. Reconnect the battery negative cable.



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OVERHEAD CONSOLE - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B1A32-UNIVERSAL GARAGE DOOR SWITCH 1 STUCK

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Electronic Overhead Module detects an internal switch failure.

Possible Causes
ELECTRONIC OVERHEAD MODULE

Diagnostic Test

1. REPLACE THE ELECTRONIC OVERHEAD MODULE

When this code is set, the Electronic Overhead Module must be replaced.

Repair

Replace theElectronic Overhead Module in accordance with the Service Information.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

B1A33-UNIVERSAL GARAGE DOOR SWITCH 2 STUCK

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Electronic Overhead Module detects an internal switch failure.

Refer to B1A32-UNIVERSAL GARAGE DOOR SWITCH 1 STUCK for the diagnostic procedure.

B1A34-UNIVERSAL GARAGE DOOR SWITCH 3 STUCK

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  TheElectronic Overhead Module detects an internal switch failure.

Refer to B1A32-UNIVERSAL GARAGE DOOR SWITCH 1 STUCK for the diagnostic test procedure.

B2217 - EVIC/EOM/CMTC INTERNAL

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Electronic Overhead Module detects an internal failure.

Possible Causes
ELECTRONIC OVERHEAD MODULE

Diagnostic Test

1. VERIFY OPERATION OF THE ELECTRONIC OVERHEAD MODULE

Turn the ignition on.
With the scan tool, erase Electronic Overhead Module DTCs.
With the scan tool, activate the Electronic Overhead Module self test.
With the scan tool, read Electronic Overhead Module DTCs.

Does the scan tool display DTC B2217–EVIC/EOM/CMTC INTERNAL?

YES >> Replace the Electronic Overhead Module in accordance with the service information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

NO >> Test complete.

B222D - ECU UNABLE TO CONFIGURE / CONFIGURATION NOT LEARNED

For the Electronic Overhead Module circuit diagram (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Electronic Overhead Module does not receive the configuration information from the Front Control Module.

POSSIBLE CAUSES
NO COMMUNICATION WITH FRONT CONTROL MODULE
ACTIVE FCM DTCs
ELECTRONIC OVERHEAD MODULE

Diagnostic Test

1. TEST FOR AN INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase any Electronic Overhead Module DTCs.

Turn the ignition off, wait 10 seconds then turn the ignition on.

With the scan tool, read DTCs.

Does the scan tool display: B222D - ECU UNABLE TO CONFIGURE / CONFIGURATION NOT LEARNED?

Yes >> Go To 2

No >> The condition that caused this code to set is not present at this time. Using the wiring diagram as a guide, inspect the wiring and connectors for an intermittent condition. Operate the system several times and recheck for active DTCs.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. VERIFY COMMUNICATION WITH FRONT CONTROL MODULE

With the scan tool in ECU VIEW, read active modules on the bus.

Does the scan tool show the Front Control Module active on the bus?

Yes >> Go To 3

No >> Refer to the Communication category for the related symptoms.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

B222D - ECU UNABLE TO CONFIGURE / CONFIGURATION NOT LEARNED (CONTINUED)

3. CHECK FRONT CONTROL MODULE FOR ACTIVE DTCs

With the scan tool, erase FCM DTCs.

Turn the ignition off. Wait approximately 10 seconds.

Turn the ignition on.

With the scan tool, read FCM DTCs.

Are any active DTCs present?

Yes >> Refer to symptom list for problems related to the Front Control Module.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the Front Control Module in accordance with the Service Information.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

B2331–VEHICLE NEEDS DEGAUSSED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The magnetic feild around the vehicle is greater than 2.4 guass.

Diagnostic Test

1. PERFORM THE VEHICLE DEMAGNITIZING PROCEDURE

NOTE: A blank compass display indicates that vehicle degaussing is required.

NOTE: After demagnitizing, the vehicle will enter Auto Fast-Cal when the ignition is turned on.

NOTE: Ensure that the correct compass variance is stored in the compass memory. See "Setting Compass Variance in the Service Information."

Refer to the Service Information for the Compass Demagnitizing Standard Procedure.

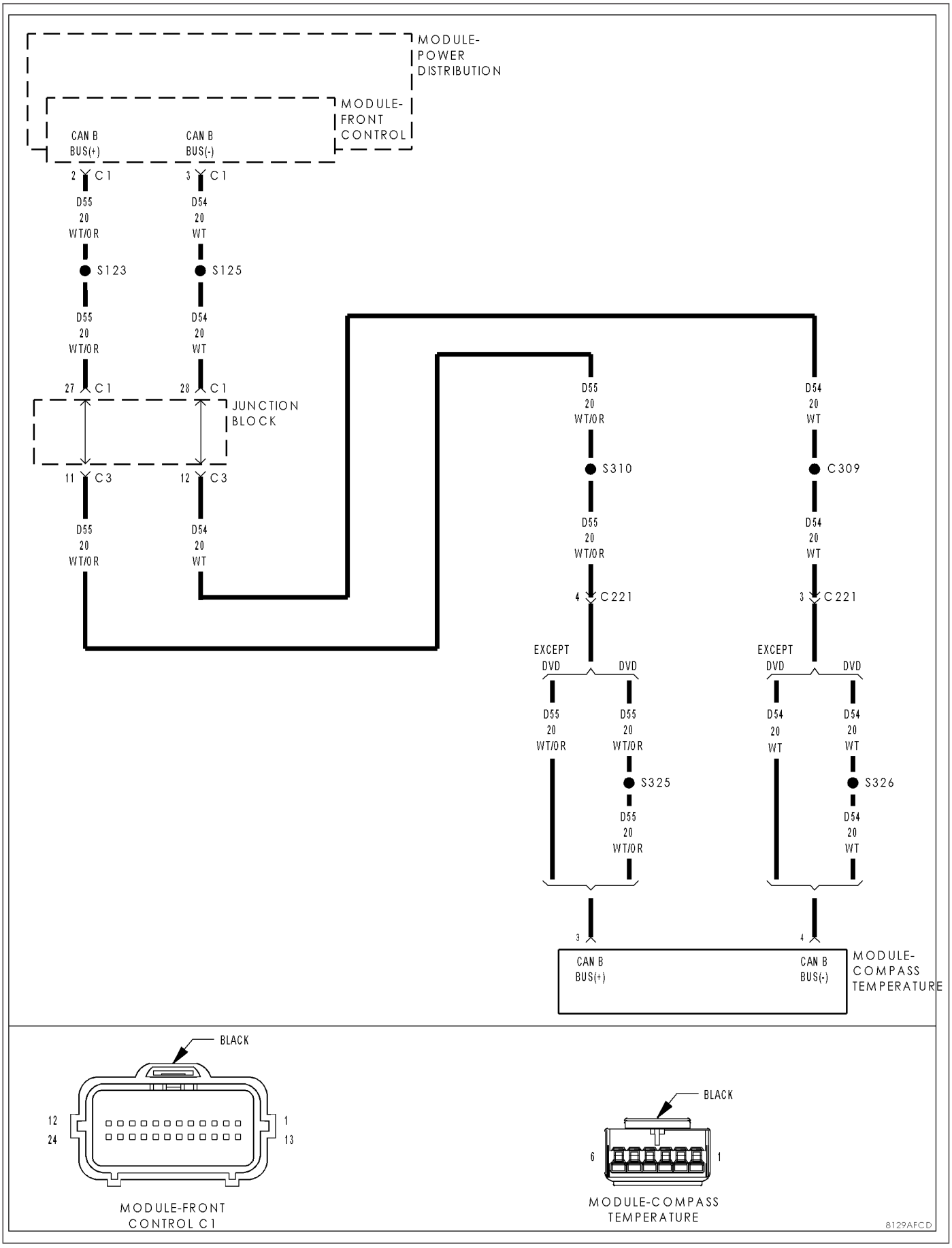
View repair.

Repair

When the Demagnitizing Procedure is complete, perform the Verification Test.

Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

U0019–CAN B BUS



U0019–CAN B BUS (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  Whenever the Can B Bus (+) or Can B Bus (–) circuit is open, shorted to voltage or shorted to ground, this code will set.

Possible Causes
CAN B BUS DTCs IN FRONT CONTROL MODULE
(D54) CAN B BUS (–) CIRCUIT OPEN
(D55) CAN B BUS (+) CIRCUIT OPEN
ELECTRONIC OVERHEAD MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, record and erase DTCs
Cycle the ignition from on to off 3 times.
Turn the ignition on.
With the scan tool, read DTCs.

Does the scan tool display U0019–CAN B BUS CIRCUIT?

Yes >> Go To 2

No >> The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. CHECK FRONT CONTROL MODULE DTCs

With the scan tool, read Front Control Module DTCs.

Does the scan tool display any CAN B BUS DTCs – ACTIVE?

Yes >> Refer to the symptom list for problems related to Communication in the ELECTRICAL.– ELECTRONIC CONTROL MODULES – ELECTRICAL DIAGNOSES section.

No >> Go to 3

U0019–CAN B BUS (CONTINUED)

3. CAN B BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Electronic Overhead Module harness connector.

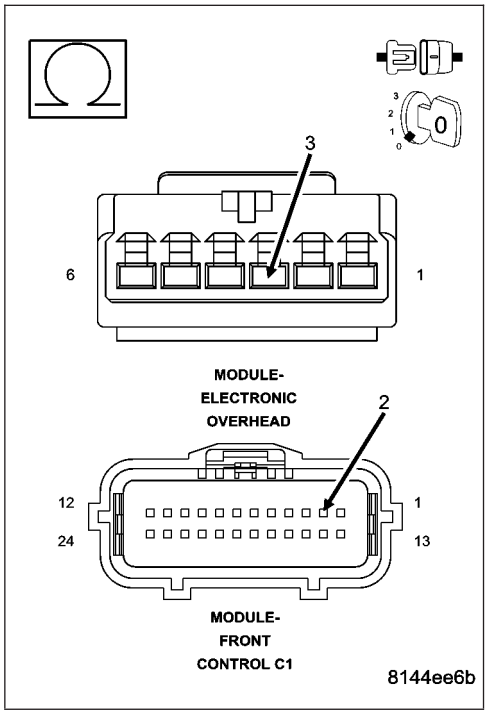
Disconnect the Front Control Module C1 harness connector.

Measure the resistance of the (D55) Can B Bus (+) circuit between the Front Control Module C1 harness connector and the Electronic Overhead Module harness connector.

Is the resistance below 2.0 ohms?

Yes >> Go To 4

No >> Repair the Can B Bus (+) circuit for an open.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)



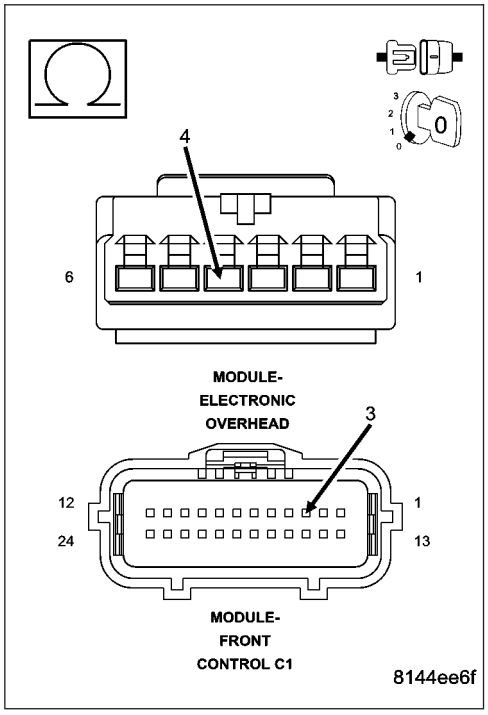
4. CAN B BUS (–) CIRCUIT OPEN

Measure the resistance of the (D54) Can B Bus (–) circuit between the Front Control Module C1 harness connector and the Electronic Overhead Module harness connector.

Is the resistance below 2.0 ohms?

Yes >> Replace the Electronic Overhead Module.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Repair the Can B Bus (–) circuit for an open.
Perform the BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)



U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0155-LOST COMMUNICATION WITH CLUSTER/CCN

For a complete wiring diagram **Refer to Section 8W**.

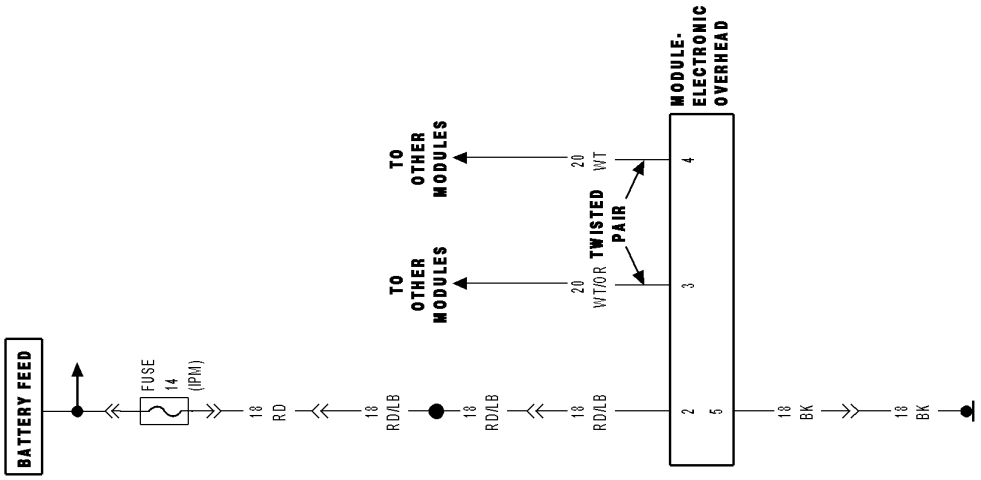
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0212-LOST COMMUNICATION WITH SCCM

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

SCHEMATICS AND DIAGRAMS



ND-EOM SYSTEM SCHEMATIC

OVERHEAD CONSOLE - SERVICE INFORMATION

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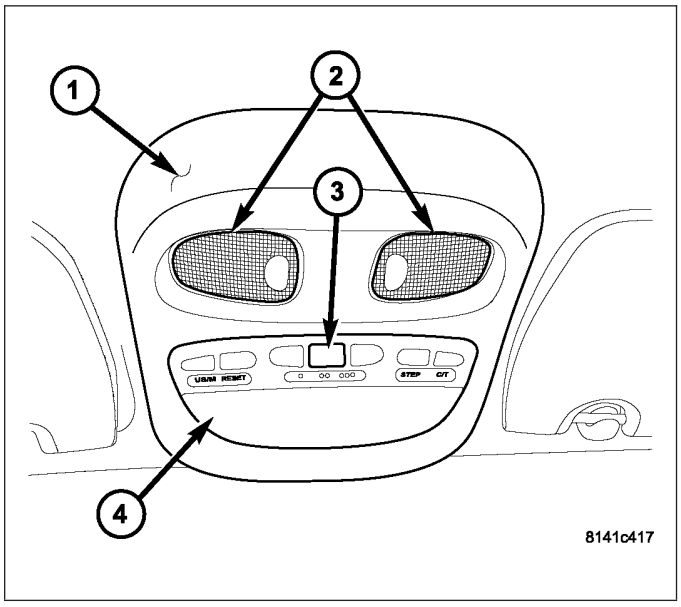
OVERHEAD CONSOLE - SERVICE INFORMATION

DESCRIPTION

An overhead console (1) is standard on this vehicle and includes the following components:

- Front map/reading lamps (2)
- Electronic Overhead Module (EOM)

The EOM consists of the trip computer with a blue-green vacuum-fluorescent display screen (4) and the Universal Transmitter (3). The overhead console assembly is mounted by two snap clips and one screw securing it to a molded plastic retainer bracket located above the headliner. The EOM is secured to the overhead console with four screws.



DIAGNOSIS AND TESTING - OVERHEAD CONSOLE

NOTE: The overhead console data is obtained from several components on the Controller Area Network (CAN) Data Bus circuit. The overhead console will not function properly if the bus messages from any of these components is not receive. If no overhead console data is displayed, check the CAN Data Bus circuit communications, the Instrument Cluster functions and the Front Control Module (FCM).

The most reliable, efficient, and accurate means to diagnose the overhead console or related system requires the use of a scan tool and the appropriate diagnostic information. The scan tool can provide vital information to find a problem with a overhead console component. Diagnostic logic is built into the Electronic Overhead Module (EOM) to help locate the problem by the most efficient means possible. Anytime a problem is suspected, a scan tool must be used to retrieve any stored fault codes in the EOM. If diagnostic fault codes are present in the module, record them on a piece of paper immediately before proceeding any further. Then, use these fault codes to identify the problem by verifying the fault code. Example, If the EOM records "**B1034 - INFRARED TEMPERATURE SENSOR INPUT CIRCUIT LOW**" fault, locate the diagnostic procedure for this code in the appropriate diagnostic information and follow the flow chart until the specific problem is located and resolved. Once the problem is thought to be corrected, erase the stored fault code using the scan tool and verify correct system operation. If the temperature reading is functioning correctly, verify that there are no other stored codes in the module and return the vehicle to service.

If the fault code could not be verified, such as not finding anything wrong when following the diagnostic flow chart in the appropriate diagnostic information. This is a good indication that an INTERMITTENT problem may be present. You must than attempt to find the intermittent problem, such as loose or corroded wire connections, shorted wire harnesses, or similar wiring problems. Always, eliminate all other potential problems before attempting to replace the EOM.

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

TESTING VOLTAGE AND GROUND SUPPLY TO OVERHEAD CONSOLE

1. Remove the overhead console from the headliner (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL). Disconnect the overhead console electrical connector. Check the fused B(+) circuit in the overhead console electrical connector. If OK, go to Step 2. If not OK, repair the open circuit or component as required.
2. Check the IGN RUN B(+) circuit in the overhead console electrical connector. If OK, go to Step 3. If not OK, repair the open IGN RUN B(+) circuit as required.
3. Check the Ground circuit in the overhead console electrical connector. If OK, go to the appropriate diagnostic information for final diagnosis. If not OK, repair the open ground circuit as required.

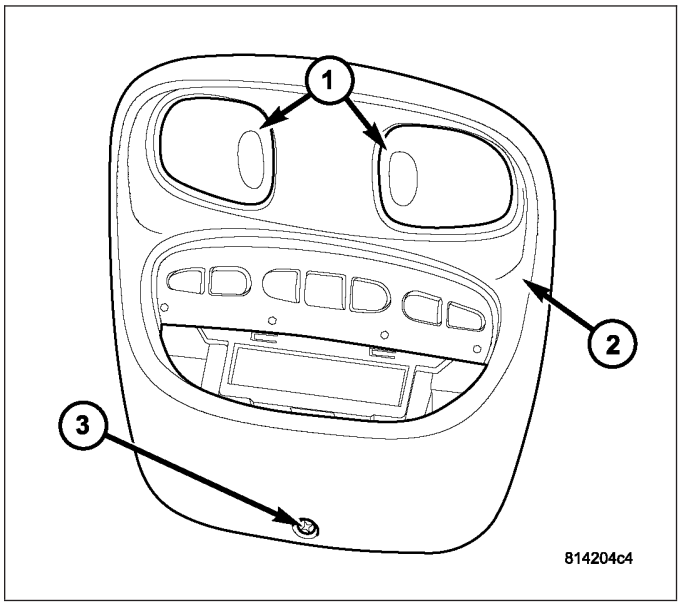
NOTE: If the compass functions, but accuracy is suspect, it may be necessary to perform a variation adjustment. This procedure allows the compass unit to accommodate variations in the earth's magnetic field strength, based on geographic location. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/COMPASS/MINI-TRIP COMPUTER - STANDARD PROCEDURE - COMPASS VARIATION ADJUSTMENT).

NOTE: If the compass reading displays dashes, and only "CAL" appears in the display, demagnetizing may be necessary to remove excessive residual magnetic fields from the vehicle. (Refer to 8 - ELECTRICAL/ OVERHEAD CONSOLE/COMPASS/MINI-TRIP COMPUTER - STANDARD PROCEDURE - COMPASS DEMAGNETIZING).

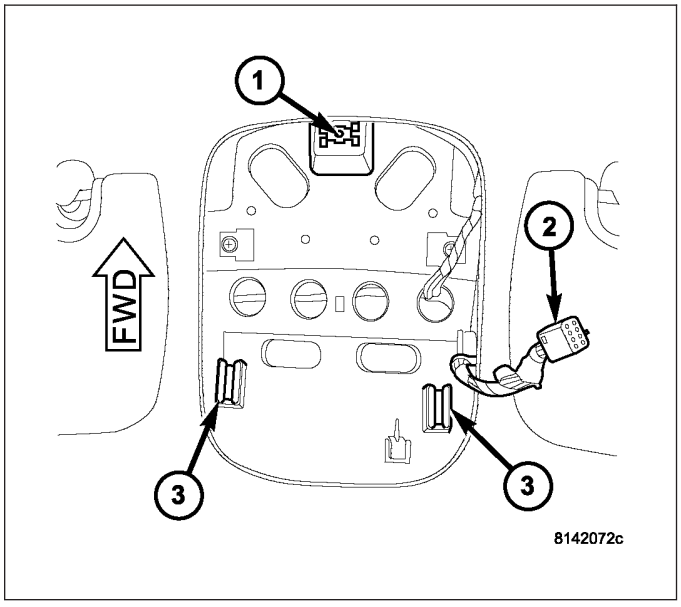
REMOVAL

OVERHEAD CONSOLE

1. Disconnect and isolate the battery negative cable.
2. Remove the overhead console retaining screw (3), located in the front of console near the windshield.
3. Using your fingertips, grasp the sides of the overhead console (2) and pull straight down evenly to disengage the two snap clips at the rear of the unit.



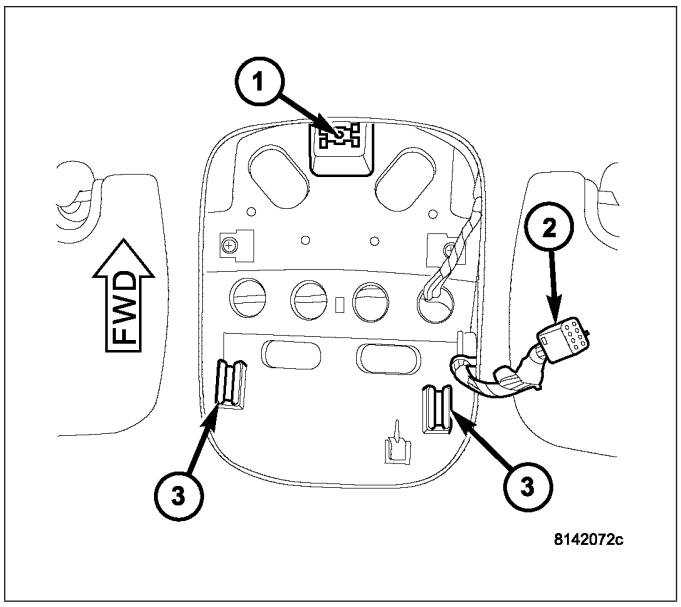
4. Lower the overhead console from the headliner far enough to access the wire harness connector (2).
5. Disconnect the roof wire harness connector (2) from the electronic overhead module.
6. Remove the overhead console from the vehicle.



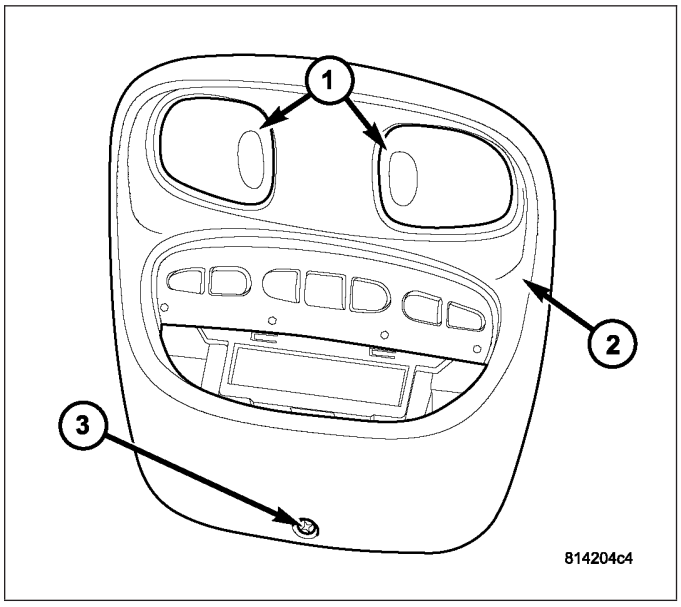
INSTALLATION

OVERHEAD CONSOLE

1. Position the overhead console near the mounting location on the headliner.
2. Reconnect the roof wire harness connector (2) to the electronic overhead module.
3. Align the snap clips on the overhead console housing with their receptacles (3) in the overhead console bracket.
4. Push upward firmly and evenly on the sides of the overhead console housing over the snap clip locations until the snap clips are fully engaged with the receptacles in the overhead console bracket.



5. Install the overhead console retaining screw (3), located in the front of console near the windshield.
6. Reconnect the battery negative cable.



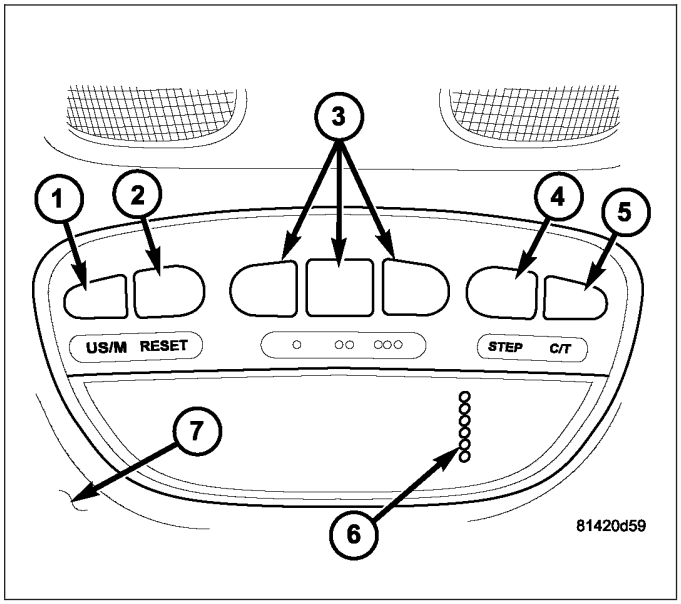
MODULE-ELECTRONIC OVERHEAD

DESCRIPTION

The Electronic Overhead Module (EOM) is located in the overhead console (7) and consists of the following components:

- Compass mini-trip computer (on vehicles equipped with this option)
- Vacuum-Fluorescent Display (VFD) (6)
- Push button function switches (1, 2, 3, 4 and 5)

The EOM contains a central processing unit and interfaces with other electronic modules in the vehicle on the Controller Area Network (CAN) data bus. The CAN data bus allows the sharing of sensor information. This helps to reduce wire harness complexity, reduce internal controller hardware, and reduce component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. If any of the components of the EOM are damaged or inoperative the entire EOM must be replaced,.



The EOM provides several electronic functions and features. Some of the functions and features that the EOM supports and/or controls, include the following display options:

- **Compass and temperature** - provides the outside temperature and one of eight compass readings to indicate the direction the vehicle is facing.
- **Trip odometer (TRIP ODO)** - shows the distance travelled since the last trip computer reset.
- **Average fuel economy (AVG ECO)** - shows the average fuel economy since the last trip computer reset.
- **Distance to empty (DTE)** - shows the estimated distance that can be travelled with the fuel remaining in the fuel tank. This estimated distance is computed using the level of the fuel in the tank and a weighted average of long term and recent Average Fuel Economy.
- **Elapsed time (ET)** - shows the accumulated ignition-on time since the last trip computer reset.
- **Blank screen** - the compass mini-trip VFD is turned off.

The ambient temperature sensor is hard wired to the Front Control Module (FCM). The instrument cluster, also known as the Cab Compartment Node (CCN) averages and filters the ambient temperature signal and supplies it to other modules on the CAN data bus. Data input for all other compass mini-trip computer functions, including VFD dimming level, is received through CAN data bus messages. The maximum temperature displayed is 66°C (140° F). It could take several miles for the accurate temperature to be displayed as the CCN filters out heat from the engine compartment.

The EOM uses its internal programming and all of these inputs to calculate and display the requested data. If the data displayed is incorrect, perform the self-diagnostic tests as described in this group. If these tests prove inconclusive, the use of a scan tool and the proper Diagnostic Procedures Information are recommended for further testing of the EOM and the CAN data bus.

The EOM cannot be repaired, and is available for service only as a unit. This unit includes the push button switches, the Universal Garage Door Transmitter and the plastic module and display lens. If any of these components is inoperative or damaged, the complete EOM must be replaced, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/COMPASS/MINI-TRIP COMPUTER - REMOVAL).

COMPASS

While in the compass/temperature mode, the compass will display the direction in which the vehicle is pointed using the eight major compass headings (Examples: north is N, northeast is NE). The self-calibrating compass unit requires no adjusting in normal use. The only calibration that may prove necessary is to drive the vehicle in one or two complete circles, on level ground, in not less than 16 seconds. This will reorient the compass unit to its vehicle.

The compass unit also will compensate for magnetism the body of the vehicle may acquire during normal use. However, avoid placing anything magnetic directly on the roof of the vehicle. Magnetic mounts for an antenna, a repair order hat, or a funeral procession flag can exceed the compensating ability of the compass unit if placed on the roof panel. Magnetic bit drivers used on the fasteners that hold the overhead console assembly to the roof header can also affect compass operation. If the vehicle roof should become magnetized, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/COMPASS/MINI-TRIP COMPUTER - STANDARD PROCEDURE - COMPASS DEMAGNETIZING) to restore proper compass operation.

TEMPERATURE

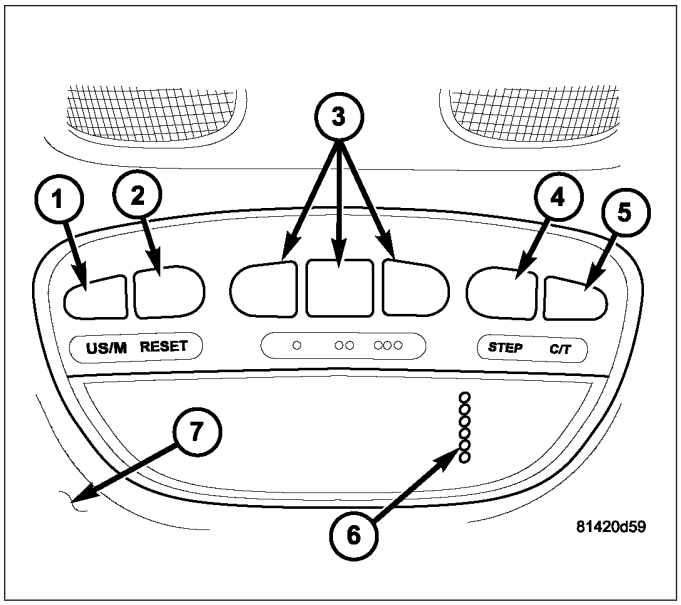
The temperature displays the outside ambient temperature in whole degrees. The temperature display can be changed from Fahrenheit to Celsius using the U.S./Metric push button. The displayed temperature is not an instant reading of conditions, but an average temperature. It may take the temperature display several miles to respond to a major temperature change, such as driving out of a heated garage into winter temperatures.

When the ignition switch is turned to the Off position, the last displayed temperature reading stays in the temperature unit memory. When the ignition switch is turned to the On position again, the temperature will display the memory temperature if the engine OFF time is less than 90 minutes. If the engine OFF time is more than 90 minutes, the temperature will display the actual temperature sensed by the ambient temperature sensor. The temperature display update interval varies with the vehicle speed.

The temperature function is supported by an ambient temperature sensor. The sensor is mounted outside the passenger compartment near the front and center of the vehicle, and is hard wired to the FCM, which sends temperature over the CAN data bus circuit. The ambient temperature sensor is available as a separate service item, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/AMBIENT TEMP SENSOR - DESCRIPTION).

NOTE: The EOM will display min and max temperatures of -40° C (-40° F) and 66°C (140° F).

OPERATION



The Electronic Overhead Module (EOM) only operates with the ignition switch in the On position. When the ignition switch is turned to the On position, the Vacuum-Fluorescent Display (VFD) will return to the last function being displayed before the ignition was turned to the Off position. With the ignition switch in the On position, momentarily depressing and releasing the Step push button (4) will cause the EOM to change its mode of operation. Momentarily depressing and releasing the U.S./Metric push button (1) will cause the unit to toggle between U.S. and Metric measurements. Momentarily depressing and releasing the C/T (compass/temperature) push button (5) will cause the EOM to return to the compass/temperature display mode from any other mode.

This EOM features several functions that can be reset. If the RESET push button (2) is depressed for more than one second with the ignition switch in the On position, the trip computer information that can be reset is reset. However, the reset will only occur if the function currently displayed is a function that can be reset. The functions that can be reset are: TRIP ODO, AVG ECO, and ET. All three of these functions can be reset at once by pressing the RESET button twice within 3 seconds while any one of the three functions is selected.

DIAGNOSIS AND TESTING

ELECTRONIC OVERHEAD MODULE

If the problem with the Electronic Overhead Module (EOM) is an inaccurate or scrambled display, refer to **Self-Diagnostic Test** below. If the problem with the EOM is incorrect Vacuum Fluorescent Display (VFD) dimming levels,

use a scan tool and the proper Diagnostic Procedures information to test for the correct dimming message inputs being received from the instrument cluster over the Controller Area Network (CAN) data bus. If the problem is a no-display condition, use the following procedures.

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

1. Check the fused ignition switch output (run/start) fuse in the Integrated Power Module (IPM). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
2. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) fuse in the IPM. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.
3. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the overhead console, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL). Check for continuity between the ground circuit cavities of the roof wire harness connector for the overhead console and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.
4. Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the roof wire harness connector for the overhead console. If OK, refer to **Self-Diagnostic Test** below, for further diagnosis of the Electronic Overhead Module (EOM) and the CAN data bus. If not OK, repair the open fused ignition switch output (run/start) circuit to the junction block as required.

SELF- DIAGNOSTIC TEST

A self-diagnostic test is used to determine that the EOM is operating properly electrically. Initiate the self-diagnostic test as follows:

NOTE: The EOM self - test can also be performed using a scan tool. Refer to Auto Self Test under the System Tests.

1. With the ignition switch in the Off position, simultaneously depress and hold the STEP and RESET buttons while rotating the ignition switch to the Run/On position.
2. Continue to hold both buttons depressed until the EOM enters the display segment test. In this test, all of the Vacuum Fluorescent Display (VFD) segments are lighted while the EOM performs the following checks:
   - Non-Volatile Memory Status (NVM)
   - RAM Status
   - ROM Status
   - ASIC Communication Test Status
   - Compass Test Status
   - DC Status
   - CAN data bus Communications Test

NOTE: If module is equipped with the Universal Transmitter, the module also checks “Universal Transmitter Communication Test Status”

3. Following completion of these tests, the EOM will display one of two messages: “FAIL” or “PASS.” Press RESET or STEP to exit and enter normal mode. Respond to these test results as follows:
   - If no test result message is displayed, but EOM operation is still improper, the use of a scan tool and the proper Diagnostic Procedures Information are required for further diagnosis.
   - If the “FAIL” message is displayed, the EOM is inoperative and must be replaced.
   - If the “PASS” message is displayed, the EOM is OK, no faults are present.
   - If any VFD segment does not light during the display segment test, the EOM is inoperative and must be replaced.
4. If the first seven tests pass, the EOM shall verify that all the required CAN bus messages are present on the CAN bus. If all required messages are present on the CAN bus, or if the ignition switch is turned to the Off position, the EOM will automatically return to normal operation. The required CAN bus messages are:
   - Dimming message

- Average fuel economy message
- Trip Odometer
- Distance to empty message
- VIN (Vehicle Identification Number)
- Ignition “ON” time message
- Average Ambient Temperature message

NOTE: The Fuel Used message shall be ignored if the engine type is Diesel or Compressed Natural Gas.

NOTE: Pressing the STEP or RESET switches during any portion of the testing procedure will cause the EOM to exit diagnostics and return to compass/temperature mode.

NOTE: If the compass functions, but accuracy is suspect, it may be necessary to perform a variation adjustment. This procedure allows the compass unit to accommodate variations in the earth’s magnetic field strength, based on geographic location.

NOTE: If the compass reading has blanked out, and only “CAL” appears in the display, demagnetizing may be necessary to remove excessive residual magnetic fields from the vehicle.

STANDARD PROCEDURE

COMPASS CALIBRATION

CAUTION: Do not place any external magnets, such as magnetic roof mount antennas, in the vicinity of the compass. Do not use magnetic tools when servicing the overhead console.

The electronic compass unit features a self-calibrating design, which simplifies the calibration procedure. This feature automatically updates the compass calibration while the vehicle is being driven. This allows the compass unit to compensate for small changes in the residual magnetism that the vehicle may acquire during normal use. If the compass readings appear to be erratic or out of calibration, perform the following calibration procedure. Also, new service replacement compass mini-trip computer modules must have their compass calibrated using this procedure. Do not attempt to calibrate the compass near large metal objects such as other vehicles, large buildings, or bridges; or, near overhead or underground power lines.

NOTE: Whenever the compass is calibrated manually, the variation number must also be reset. See Compass Variation Adjustment in the Service Procedures section of this group.

Calibrate the compass manually as follows:

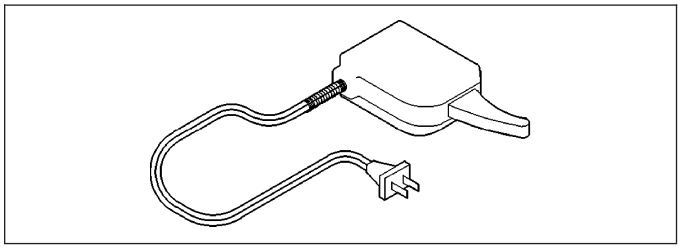
1. Turn the ignition switch to the On position. If the compass/temperature data is not currently being displayed, momentarily depress and release the C/T push button to step through the display options until you have reached the compass/temperature display.
2. Depress and hold the RESET push button. Hold the push buttons down until “CAL” appears in the display. This takes about ten seconds.
3. Drive the vehicle on a level surface, away from large metal objects and power lines, through one or two**complete** circles in not less than 16 seconds. The “CAL” message will disappear from the display to indicate that the compass is now calibrated.

NOTE: A blank compass display indicates that vehicle degaussing (demagnetizing) is necessary.

NOTE: If the “CAL” message remains in the display, either there is excessive magnetism near the compass, or the unit is faulty. Repeat the calibration procedure at least one more time.

NOTE: If the wrong direction is still indicated in the compass display, the area selected for calibration may be too close to a strong magnetic field. Repeat the calibration procedure in another location.

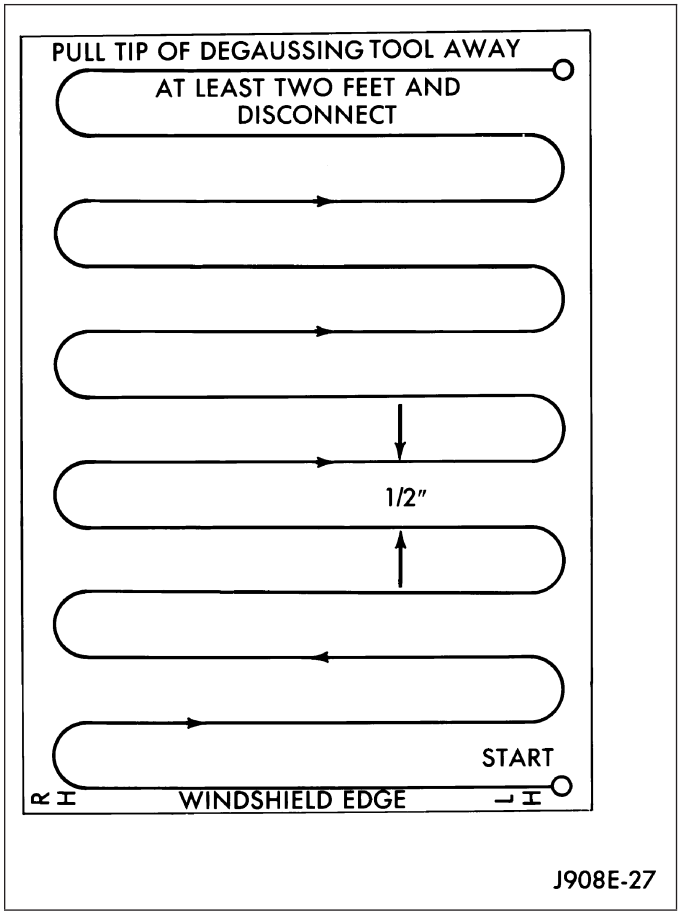
COMPASS DEMAGNETIZING



A degaussing tool (Special Tool 6029) is used to demagnetize, or degauss, the overhead console forward mounting screw and the roof panel above the overhead console. Equivalent units must be rated as continuous duty for 110/115 volts and 60 Hz. They must also have a field strength of over 350 gauss at 7 millimeters (0.25 inch) beyond the tip of the probe.

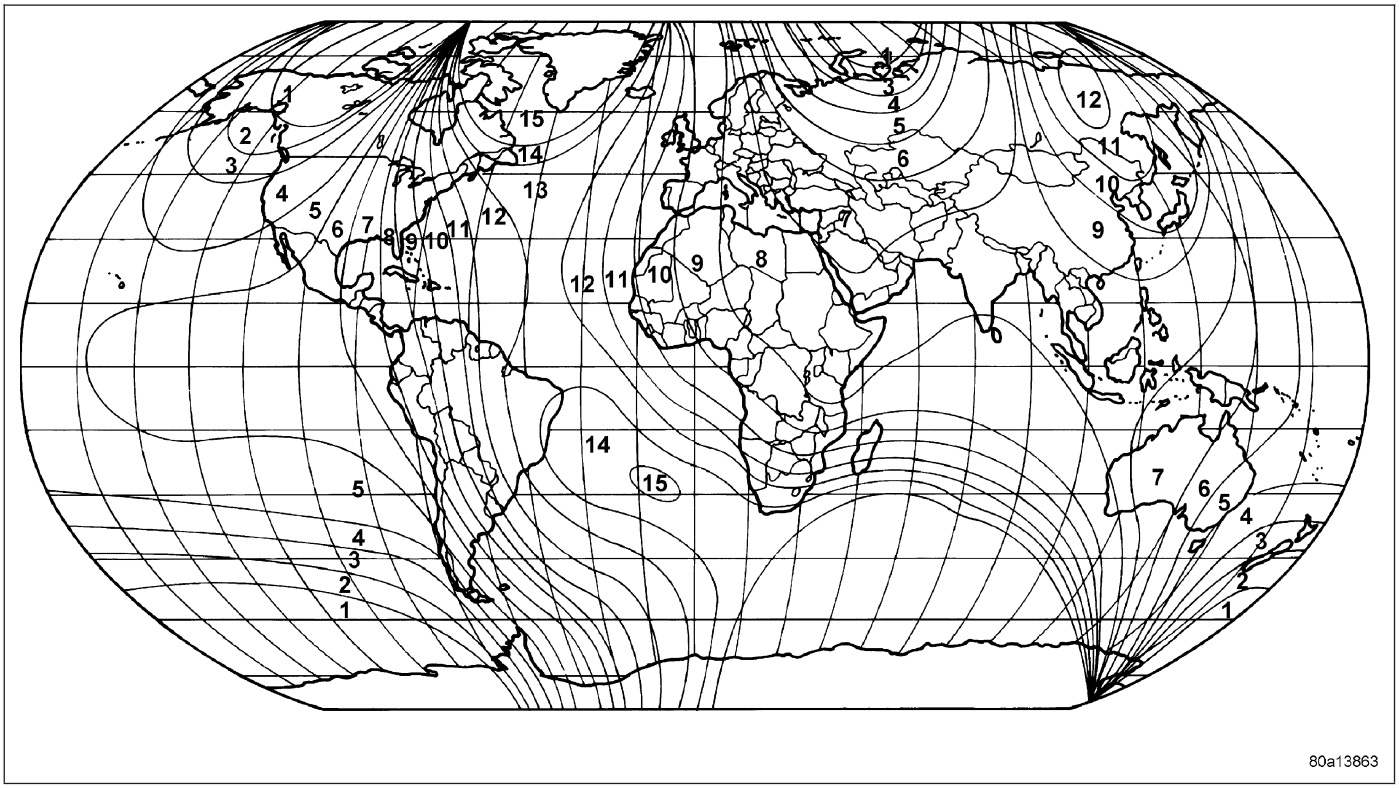
To demagnetize the roof panel and the overhead console forward mounting screw, proceed as follows:

1. Be certain that the ignition switch is in the Off position, before you begin the demagnetizing procedure.
2. Connect the degaussing tool to an electrical outlet, while keeping the tool at least 61 centimeters (2 feet) away from the compass unit.
3. Slowly approach the head of the overhead console forward mounting screw with the degaussing tool connected.
4. Contact the head of the screw with the plastic coated tip of the degaussing tool for about two seconds.
5. With the degaussing tool still energized, slowly back it away from the screw. When the tip of the tool is at least 61 centimeters (2 feet) from the screw head, disconnect the tool.



6. Place a piece of paper approximately 22 by 28 centimeters (8.5 by 11 inches), oriented on the vehicle lengthwise from front to rear, on the center line of the roof at the windshield header. The purpose of the paper is to protect the roof panel from scratches, and to define the area to be demagnetized.
7. Connect the degaussing tool to an electrical outlet, while keeping the tool at least 61 centimeters (2 feet) away from the compass unit.
8. Slowly approach the center line of the roof panel at the windshield header, with the degaussing tool connected.
9. Contact the roof panel with the plastic coated tip of the degaussing tool. Be sure that the template is in place to avoid scratching the roof panel. Using a slow, back-and-forth sweeping motion, and allowing 13 millimeters (0.50 inch) between passes, move the tool at least 11 centimeters (4 inches) to each side of the roof center line, and 28 centimeters (11 inches) back from the windshield header.
10. With the degaussing tool still energized, slowly back it away from the roof panel. When the tip of the tool is at least 61 centimeters (2 feet) from the roof panel, disconnect the tool.
11. Calibrate the compass, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/COMPASS/MINI-TRIP COMPUTER - STANDARD PROCEDURE - COMPASS CALIBRATION) and adjust the compass variance, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/COMPASS/MINI-TRIP COMPUTER - STANDARD PROCEDURE - COMPASS VARIATION ADJUSTMENT).

COMPASS VARIATION ADJUSTMENT



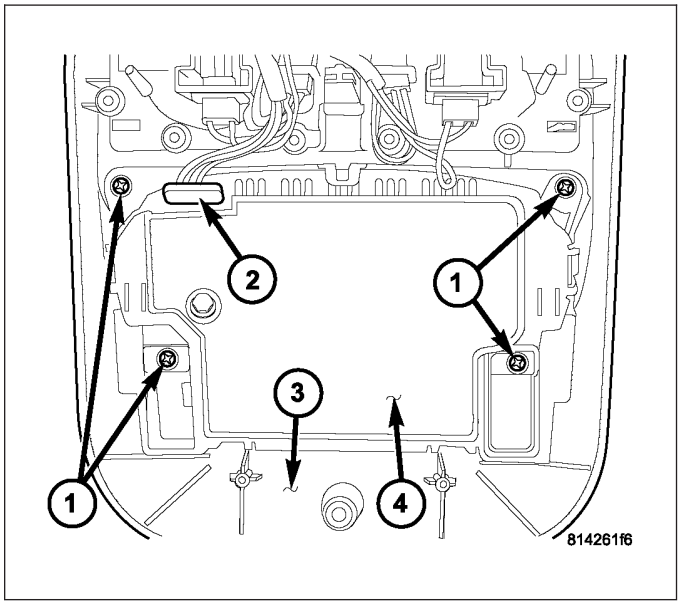
Compass variance, also known as magnetic declination, is the difference in angle between magnetic north and true geographic north. In some geographic locations, the difference between magnetic and geographic north is great enough to cause the compass to give false readings. If this problem occurs, the compass variance must be set.

To set the compass variance:

1. Using the Variance Settings map, find your geographic location and note the zone number.
2. Turn the ignition switch to the On/Run position. If the compass/temperature data is not currently being displayed, momentarily depress and release the C/T push button to step through the display options until you have reached the compass/temperature display.
3. Press and hold the Reset push button down until “VAR” appears in the display. This takes about five seconds.
4. Momentarily depress and release the STEP push button to step through the zone numbers (1-15), until the zone number for your geographic location appears in the display.
5. Momentarily depress and release the Reset push button to enter the displayed zone number into the compass unit memory.
6. Confirm that the correct directions are now indicated by the compass.

REMOVAL

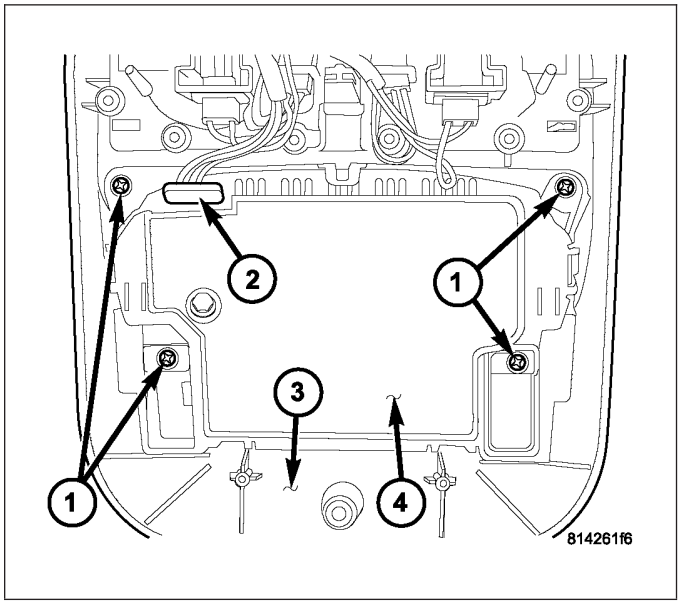
1. Disconnect and isolate the battery negative cable.
2. Remove the overhead console (3) from the headliner (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).
3. Remove the screws (1) that secure the Electronic Overhead Module (EOM) (4) to the overhead console housing (3).
4. Disconnect the overhead console wire harness connector from the EOM connector receptacle (2).
5. Remove the compass EOM (4) from the overhead console housing (3).



INSTALLATION

NOTE: If a new Electronic overhead Module (EOM) has been installed, the compass will have to be calibrated and the variance set. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/COMPASS/MINI-TRIP COMPUTER - STANDARD PROCEDURE - COMPASS CALIBRATION) and (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/COMPASS/MINI-TRIP COMPUTER - STANDARD PROCEDURE - COMPASS VARIATION ADJUSTMENT) for the appropriate procedures.

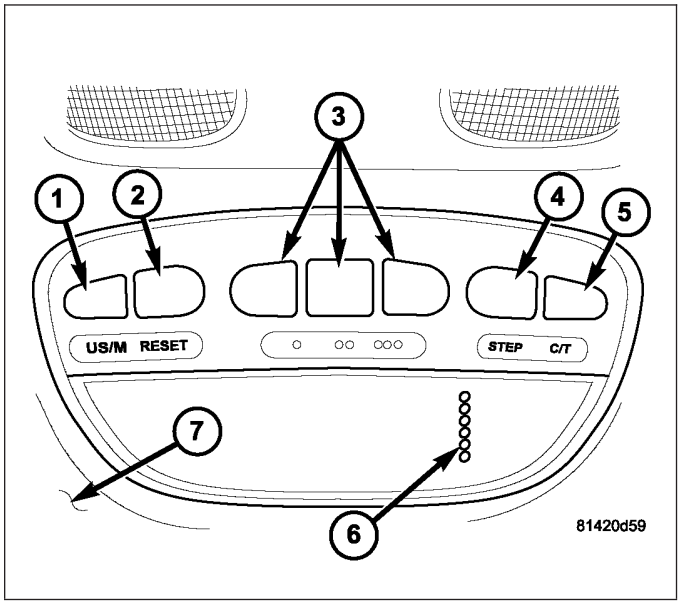
1. Position the Electronic overhead Module (EOM) (4) onto the overhead console housing (3).
2. Reconnect the overhead console wire harness connector to the EOM connector receptacle (2).
3. Install the screws (1) that secure the EOM (4) to the overhead console housing (3). Tighten the screws to 2.2 N·m (20 in. lbs.).
4. Install the overhead console (3) onto the headliner (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION).
5. Reconnect the battery negative cable.



UNIVERSAL TRANSMITTER

DESCRIPTION

The universal transmitter transceiver is integral to the overhead console (7). The only visible component of the universal transmitter are the three transmitter push buttons (3). The buttons are marked with one, two or three dots, respectively, for identification of each channel.



Each of the three universal transmitter push buttons controls an independent radio transmitter channel. Each of these three channels can be trained to transmit a different radio frequency signal for the remote operation of garage door openers, motorized gate openers, home or office lighting, security systems or just about any other device that can be equipped with a radio receiver in the 286 to 399 MegaHertz (MHz) frequency range for remote operation. The universal transmitter is capable of operating systems using either rolling code or non-rolling code technology.

The universal transmitter cannot be repaired, and is available for service only as part of the Electronic Overhead Module (EOM). This unit includes the push button switches for both the transmitter and compass mini trip computer, The Vacuum-Fluorescent Display (VFD) and the plastic module case. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/COMPASS/MINI-TRIP COMPUTER - REMOVAL) for EOM replacement.

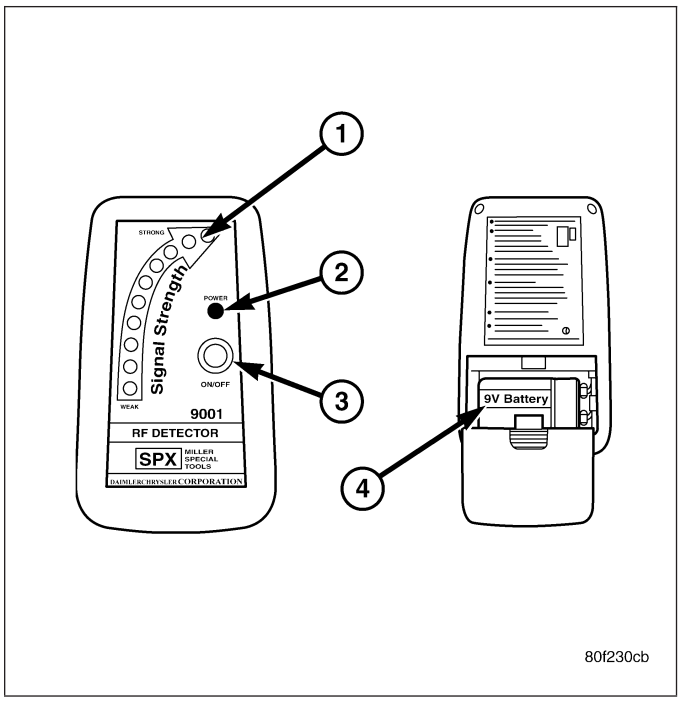
OPERATION

The universal transmitter operates on a non-switched source of battery current so the unit will remain functional, regardless of the ignition switch position. It can learn and store three separate transmitter radio frequency codes to operate garage door openers, security gates and security lighting. The overhead console display provides visual feedback to the driver, showing which transmitter button is pressed. The system will not send operating signals if the vehicle theft security alarm is armed. This prevents a perpetrator from breaking into a vehicle parked outside a home and using the transmitter system to enter the home.

DIAGNOSIS AND TESTING

UNIVERSAL TRANSMITTER

If both the Transmitter and the compass mini trip computer display are inoperative, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/COMPASS/MINI-TRIP COMPUTER - DIAGNOSIS AND TESTING) for further diagnosis. If the Universal Transmitter is inoperative, but the compass mini trip computer display is operating normally, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/UNIVERSAL TRANSMITTER - STANDARD PROCEDURE) for instructions on training the Transmitter. Retrain the Transmitter with a known good transmitter as instructed and test the Transmitter operation again. If the unit is still inoperative, test the universal transmitter with the Radio Frequency Detector special tool as described below:



1. Turn the Radio Frequency (RF) Detector ON. A “chirp” will sound and the green power LED will light. If the green LED does not light, replace the battery.
2. Hold the RF detector within one inch of the TRAINED universal transmitter and press any of the transmitters buttons.
3. The red signal detection LEDs will light and the tool will beep if a radio signal is detected. Repeat this test for each button. If any button is inoperative, replace the universal transmitter assembly, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/COMPASS/MINI-TRIP COMPUTER - REMOVAL).

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

STANDARD PROCEDURE

PROGRAMMING TRANSMITTER CODES

CAUTION: Vehicle exhaust contains carbon monoxide, a dangerous gas. Do not run the vehicle’s exhaust while training the transceiver. Exhaust gas can cause serious injury or death.

CAUTION: Your motorized door or gate will open and close while you are training the Universal Transceiver. Do not train the transceiver if people or pets are in the path of the door or gate. A moving door or gate can cause serious injury or death to people and pets or damage to objects.

1. Press and hold the two outer HomeLink buttons, and release only when the EVIC display shows “Channels Cleared” (after 20 seconds). **Do not** hold the buttons for longer than 30 seconds and **do not** repeat step one to program a second and/or third hand-held transmitter to the remaining two HomeLink buttons.
2. Position the end of your hand-held transmitter 1-3 inches (3-8 cm) away from the HomeLink buttons.
3. Simultaneously press and hold both the HomeLink button that you want to train and the hand-held transmitter buttons. **Do not release the buttons until step 4 has been completed.**
4. The EVIC display will show “Channel X Training” (where X is Channel 1, 2, or 3). Release both buttons after the EVIC display shows “Channel X Trained”.

NOTE: If the EVIC display shows “Did Not Train” repeat steps 2–4.

5. Press and hold the just trained HomeLink button and observe the EVIC display. If the EVIC display shows "Channel X Transmit" (where X is Channel 1, 2, or 3), programming is complete and your device should activate when the HomeLink button is pressed and released.

NOTE: To program the remaining two HomeLink buttons, begin with ″Programming″ step two. Do not repeat step one.

NOTE: If your hand-held transmitter appears to program the universal transceiver, but your garage door does not operate using the transmitter and your garage door opener was manufactured after 1995, your garage door opener may have a multiple security code system (rolling code system). Please proceed to steps 6–8 to complete the programming of a rolling code equipped device (most common garage door openers require this step.

6. At the garage door opener receiver (motor-head unit) in the garage, locate the ″learn″ or ″smart″ button. This can usually be found where the hanging antenna wire is attached to the motor-head unit.
7. Firmly press and release the ″learn″ or ″smart″ button. (The name and color of the button may vary by manufacturer.)

NOTE: There are 30 seconds in which to initiate step eight.

8. Return to the vehicle and firmly **press, hold for two seconds and release** the programmed HomeLink button. Repeat the **″press/hold/release″** sequence a second time, and, depending on the brand of the garage door opener (or other rolling code equipped device), repeat this sequence a third time to complete the programming.
9. HomeLink should now activate your rolling code equipped device.
10. To program the remaining two HomeLink buttons, begin with ″Programming″ **step two. Do not repeat step one.**

ERASING TRANSMITTER CODES

NOTE: Individual channels cannot be erased. Erasing the transmitter codes will erase ALL programmed codes.

To erase programming from the three buttons (individual buttons cannot be erased but can be ″reprogrammed″), follow the step noted:

- Press and hold the two outer HomeLink buttons until the indicator light begins to flash-after 20 seconds. Release both buttons. Do not hold for longer that 30 seconds. HomeLink is now in the train (or learning) mode and can be programmed at any time beginning with ″Programming″ (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/UNIVERSAL TRANSMITTER - STANDARD PROCEDURE).

REPROGRAMMING TRANSMITTER CODES

CAUTION: Vehicle exhaust contains carbon monoxide, a dangerous gas. Do not run the vehicle's exhaust while training the transceiver. Exhaust gas can cause serious injury or death.

CAUTION: Your motorized door or gate will open and close while you are training the Universal Transceiver. Do not train the transceiver if people or pets are in the path of the door or gate. A moving door or gate can cause serious injury or death to people and pets or damage to objects.

To program a device to HomeLink using a HomeLink button previously trained, follow these steps:

1. Press and hold the desired HomeLink button. **Do NOT** release the button.
2. The EVIC display will show "Channel X Transmit" (where X is Channel 1, 2, or 3) for 20 seconds and then change to "Channel X Training". Without releasing the HomeLink button, proceed to step 3.
3. Position the end of your hand-held transmitter 1-3 inches (3-8 cm) away from the HomeLink buttons.
4. Simultaneously press and hold both the HomeLink button that you want to train and the hand-held transmitter buttons. **Do not release the buttons until step 4 has been completed.**

5. Press and hold the just trained HomeLink button and observe the EVIC display. If the EVIC display shows “Channel X Transmit” (where X is Channel 1, 2, or 3), programming is complete and your device should activate when the HomeLink button is pressed and released.

NOTE: To program the remaining two HomeLink buttons, begin with ″Programming″ step two. Do not repeat step one.

NOTE: If your hand-held transmitter appears to program the universal transceiver, but your garage door does not operate using the transmitter and your garage door opener was manufactured after 1995, your garage door opener may have a multiple security code system (rolling code system). Please proceed to steps 6–8 to complete the programming of a rolling code equipped device (most common garage door openers require this step.

6. At the garage door opener receiver (motor-head unit) in the garage, locate the ″learn″ or ″smart″ button. This can usually be found where the hanging antenna wire is attached to the motor-head unit.
7. Firmly press and release the ″learn″ or ″smart″ button. (The name and color of the button may vary by manufacturer.)

NOTE: There are 30 seconds in which to initiate step eight.

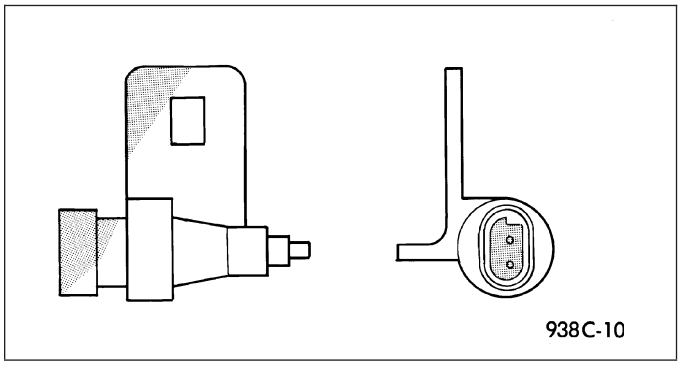
8. Return to the vehicle and firmly **press, hold for two seconds and release** the programmed HomeLink button. Repeat the **″press/hold/release″** sequence a second time, and, depending on the brand of the garage door opener (or other rolling code equipped device), repeat this sequence a third time to complete the programming.
9. HomeLink should now activate your rolling code equipped device.

SENSOR-AMBIENT AIR TEMPERATURE

DESCRIPTION

The ambient temperature sensor is a variable resistor mounted to a bracket that is secured with a screw to the left side of the radiator yoke, behind the radiator grille and in front of the engine compartment.

The ambient temperature sensor cannot be adjusted or repaired and, if inoperative or damaged, it must be replaced.



OPERATION

The ambient temperature sensor is a variable resistor that operates on a five-volt reference signal sent by the Front Control Module (FCM). The resistance in the sensor changes as temperature changes, changing the temperature sensor signal circuit voltage to the FCM. Based upon the resistance in the sensor, the FCM senses a specific voltage on the temperature sensor signal circuit. The FCM then translates the voltage into a temperature reading that it sent over the Controller Area Network (CAN) data bus to other modules utilizing temperature information.

DIAGNOSIS AND TESTING

AMBIENT TEMPERATURE SENSOR

The temperature function is supported by the ambient temperature sensor, a wiring circuit, and Front Control Module (FCM). If any portion of the ambient temperature sensor circuit fails or if Controller Area Network (CAN) Data Bus information is missing, a (– –) will appear in the display in place of the temperature. When the sensor is exposed to temperatures above 55° C (130° F), or if the sensor circuit is shorted, 55° C (130° F) will appear in the display

in place of the temperature, when the sensor is exposed to temperatures below - 40° C (- 40° F) or if the sensor circuit is open, - 40° C (- 40° F) will appear in the display.

The ambient temperature sensor circuit can also be diagnosed using the following Sensor Test, and Sensor Circuit Test. If the temperature sensor and circuit are confirmed to be OK, but the temperature display is inoperative or incorrect, test the compass mini-trip computer (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/COMPASS/MINI-TRIP COMPUTER - DIAGNOSIS AND TESTING).

SENSOR TEST

1. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the ambient temperature sensor harness connector.
2. Measure the resistance of the ambient temperature sensor. At - 40° C (- 40° F), the sensor resistance is 336 kilohms. At 55° C (130° F), the sensor resistance is 2.488 kilohms. The sensor resistance should read between these two values. If OK, refer to Sensor Circuit Test in this group. If not OK, replace the inoperative ambient temperature sensor.

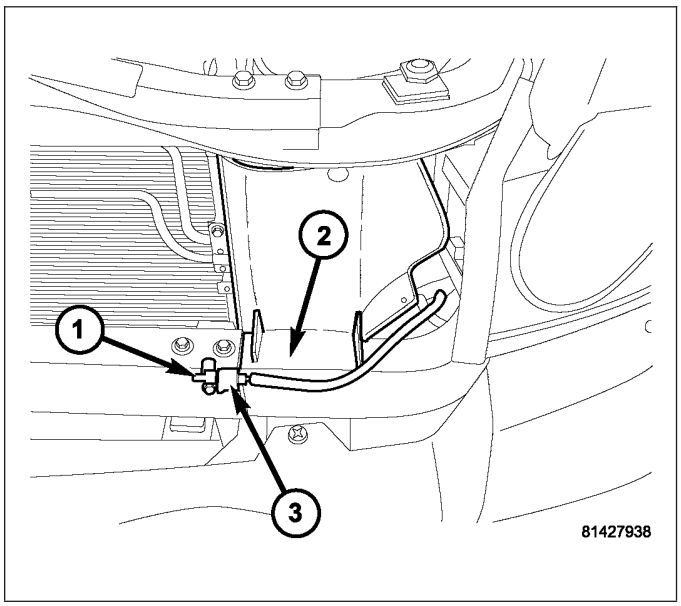
SENSOR CIRCUIT TEST

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

1. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the wire harness connectors from the ambient temperature sensor and the FCM.
2. Connect a jumper wire between the two terminals in the body half of the ambient temperature sensor harness connector.
3. Check for continuity between the sensor return circuit and the ambient temperature sensor signal circuit cavities of the FCM harness connector. There should be continuity. If OK, go to Step 4. If not OK, repair the open sensor return circuit or ambient temperature sensor signal circuit to the ambient temperature sensor as required.
4. Check for continuity between the ambient temperature sensor signal circuit cavity of the FCM harness connector and a good ground. There should be no continuity. If OK, test the compass mini-trip computer operation, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/COMPASS/MINI-TRIP COMPUTER - DIAGNOSIS AND TESTING). If not OK, repair the shorted ambient temperature sensor signal circuit as required.

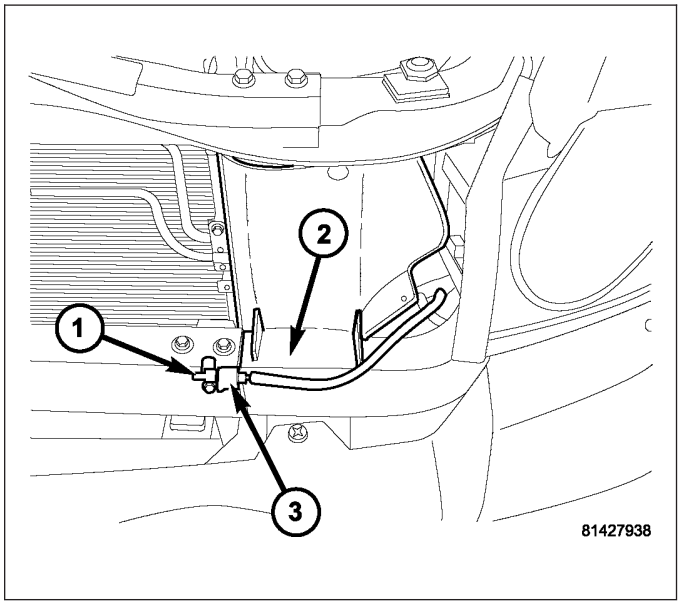
REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Locate the ambient temperature sensor (1), on the left side of the radiator yoke (2) behind the grille.
3. Disconnect the wire harness connector (3) from the ambient temperature sensor connector receptacle.
4. Remove the one screw that secures the ambient temperature sensor bracket to the radiator yoke.
5. Remove the ambient temperature sensor from the radiator yoke.



INSTALLATION

1. Position the ambient temperature sensor (1) onto the radiator yoke (2).
2. Install the screw that secures the ambient temperature sensor to the radiator yoke. Tighten the screw to 5.6 N·m (50 in. lbs.).
3. Connect the wire harness connector (3) to the ambient temperature sensor (1).
4. Reconnect the battery negative cable.



POWER SYSTEMS

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POWER LOCKS - ELECTRICAL DIAGNOSTICS

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POWER LOCKS - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

BODY VERIFICATION TEST – VER 1

Diagnostic Test

1. Perform Body Verification Test

Disconnect all jumper wires and reconnect all previously disconnected components and connectors.

Ensure that all accessories are turned off.

Ensure that the battery is fully charged.

Turn the ignition on.

With the scan tool, record and erase DTCs from all modules.

If an electronic control module was replaced, select the applicable module from the scan tool menu and press “Misc. Functions”. If the module has programable features, program as necessary.

If repairs were made to any of the HVAC door actuator circuits, with the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. The test must pass before proceeding to the next step.

If repairs were made to any of the HVAC doors, linkage, door actuators, or door actuator circuits, with the scan tool in HVAC, select System Tests and then select Actuator Calibration Test. The test must pass before proceeding to the next step.

Turn the ignition off, wait 10 seconds, and then turn the ignition on.

Operate all functions of the system that caused the original concern.

With the scan tool, select ECU View.

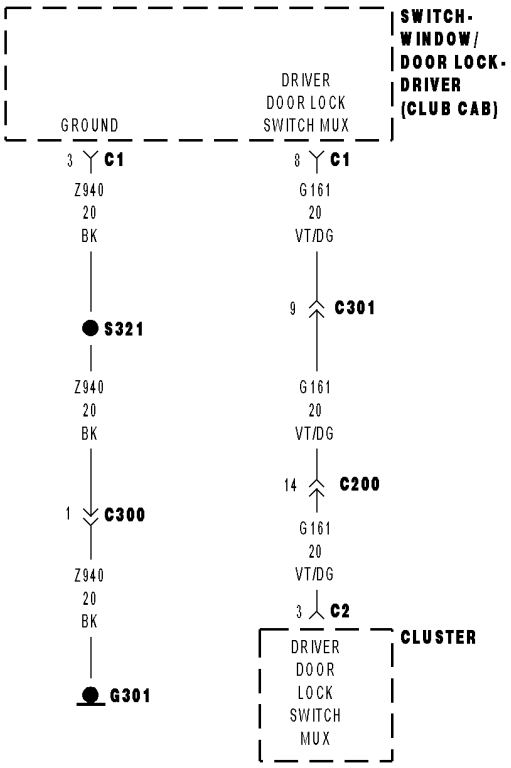
Check for DTCs in the modules.

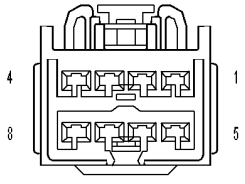
Are DTCs present in any of the modules or is the original condition still present?

Yes >> The repair is not complete. Refer to the related category for the DTC or symptom that is still present.

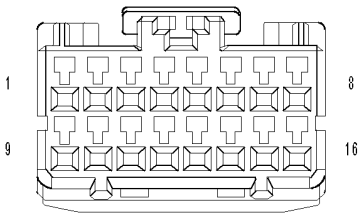
No >> The repair is complete.

*DRIVER DOOR LOCK/UNLOCK SWITCH INPUT CIRCUIT LOW





SWITCH-
WINDOW/
DOOR LOCK-
DRIVER C1
(CLUB CAB)



CLUSTER C2

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***DRIVER DOOR LOCK/UNLOCK SWITCH INPUT CIRCUIT LOW (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(G161) DRIVER DOOR LOCK SWITCH MUX CIRCUIT SHORT TO GROUND
DOOR LOCK SWITCH SHORT TO GROUND
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR TROUBLE CODES

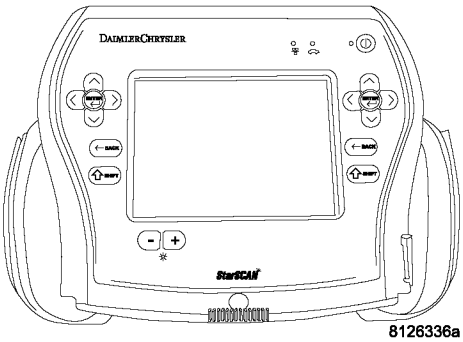
Turn the ignition on.

With the scan tool, read DTC's

Does the scan tool display any Body related DTC's?

No >> Go To 2

Yes >> Refer to the symptom list and repair any DTC's before proceeding.



2. DOOR LOCK SWITCH SHORTED

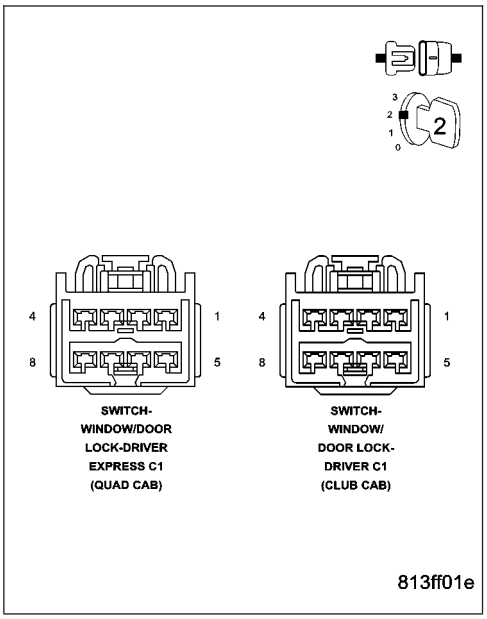
Disconnect the Driver Window/Door Lock Switch connector.

With the scan tool in sensors, read the DRIVER DOOR LOCK SWITCH voltage.

Is the voltage approximately 5.0?

Yes >> Replace the Driver Window/Door Lock Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Go To 3



***DRIVER DOOR LOCK/UNLOCK SWITCH INPUT CIRCUIT LOW (CONTINUED)**

3. DRIVER DOOR LOCK SWITCH MUX CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Cluster C2 connector.

Measure the resistance between ground and the (G161) Driver Door Lock Switch Mux circuit.

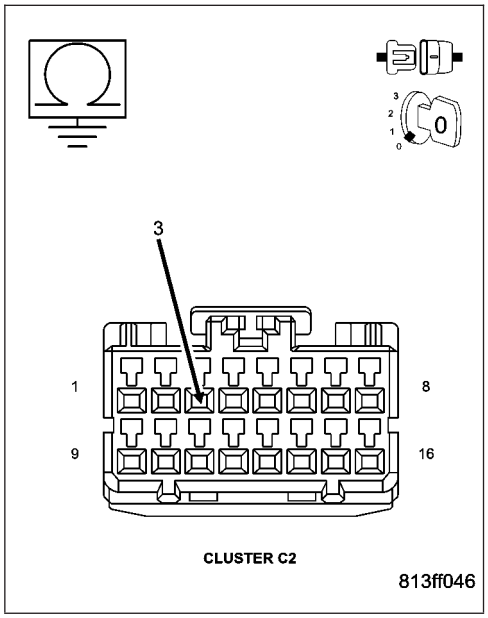
Is the resistance below 10000.0 ohms?

Yes >> Repair the (G161) Driver Door Lock Switch Mux circuit for a short to ground.

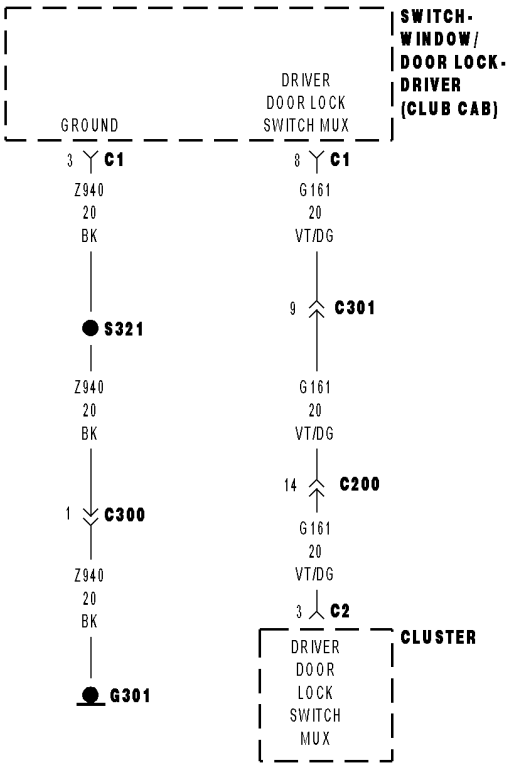
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

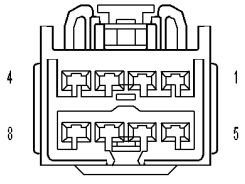
No >> Replace the Instrument Cluster.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

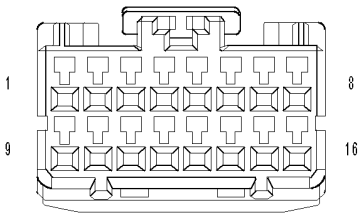


*DRIVER DOOR LOCK/UNLOCK SWITCH INPUT STUCK LOCK





SWITCH-
WINDOW/
DOOR LOCK-
DRIVER C1
(CLUB CAB)



CLUSTER C2

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***DRIVER DOOR LOCK/UNLOCK SWITCH INPUT STUCK LOCK (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(G161) DRIVER DOOR LOCK SWITCH MUX CIRCUIT PARTIAL SHORT TO GROUND
DOOR LOCK SWITCH STUCK
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR TROUBLE CODES

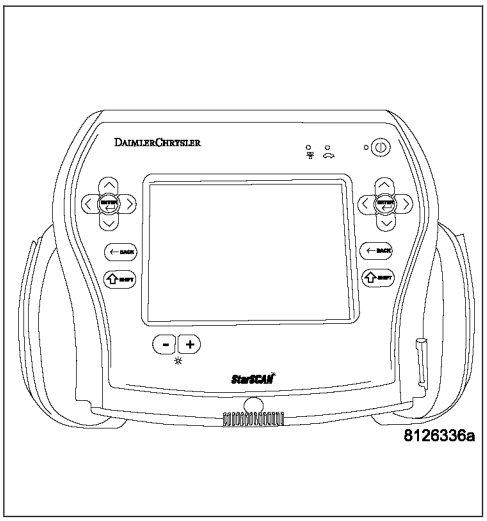
Turn the ignition on.

With the scan tool, read DTC's

Are there any Body related DTC's?

No >> Go To 2

Yes >> Refer to the symptom list and repair any DTC's before proceeding



2. DOOR LOCK SWITCH SHORTED

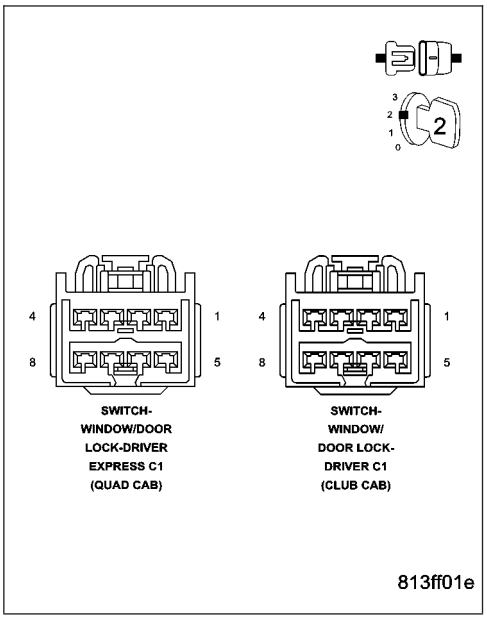
Disconnect the Driver Window/Door Lock Switch connector.

With the scan tool in sensors, read the DRIVER DOOR LOCK SWITCH voltage.

Is the voltage approximately 5.0 volts?

Yes >> Replace the Driver Window/Door Lock Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Go To 3



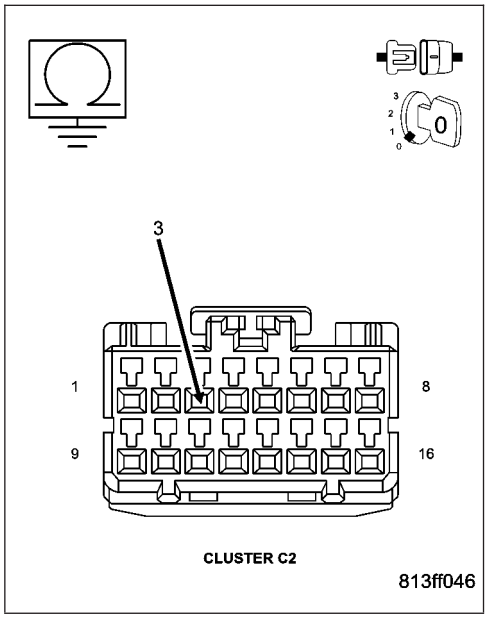
***DRIVER DOOR LOCK/UNLOCK SWITCH INPUT STUCK LOCK (CONTINUED)**

3. (G161) DRIVER DOOR LOCK SWITCH MUX CIRCUIT PARTIAL SHORT TO GROUND

Turn the ignition off.

Disconnect the Cluster C2 connector.

Measure the resistance between ground and the (G161) Driver Door Lock Switch Mux circuit.



Is the resistance below 10000.0 ohms?

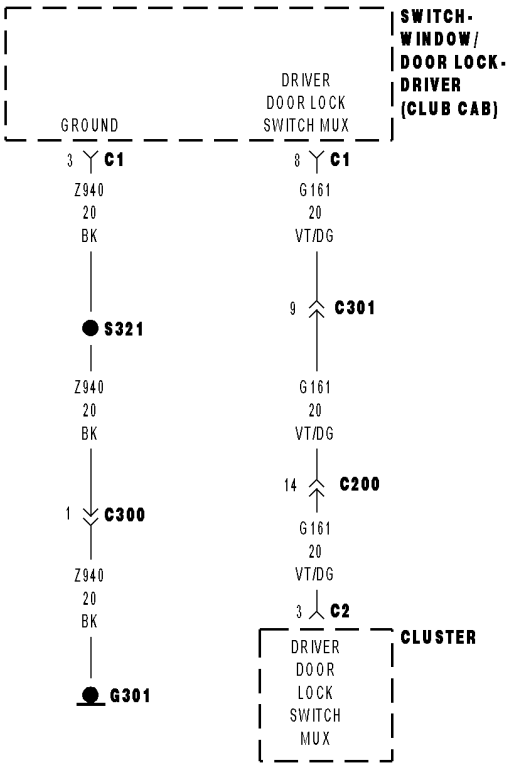
Yes >> Repair the (G161) Driver Door Lock Switch Mux circuit for a short to ground.

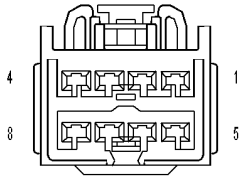
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Replace the Instrument Cluster.

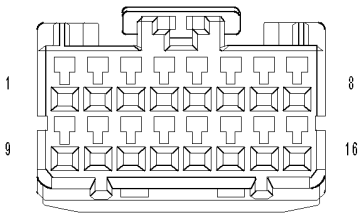
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

*DRIVER DOOR LOCK/UNLOCK SWITCH INPUT STUCK UNLOCK





SWITCH-
WINDOW/
DOOR LOCK-
DRIVER C1
(CLUB CAB)



CLUSTER C2

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***DRIVER DOOR LOCK/UNLOCK SWITCH INPUT STUCK UNLOCK (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(G161) DRIVER DOOR LOCK SWITCH MUX CIRCUIT PARTIAL SHORT TO GROUND
DRIVER DOOR LOCK SWITCH STUCK
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR TROUBLE CODES

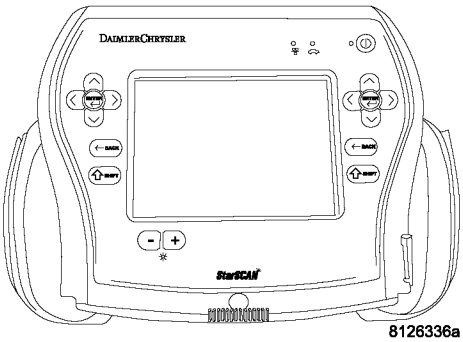
Turn the ignition on.

With the scan tool, read DTC's

Are there any Body related DTC's?

No >> Go To 2

Yes >> Refer to the symptom list and repair any DTC's before proceeding.



2. DOOR LOCK SWITCH SHORTED

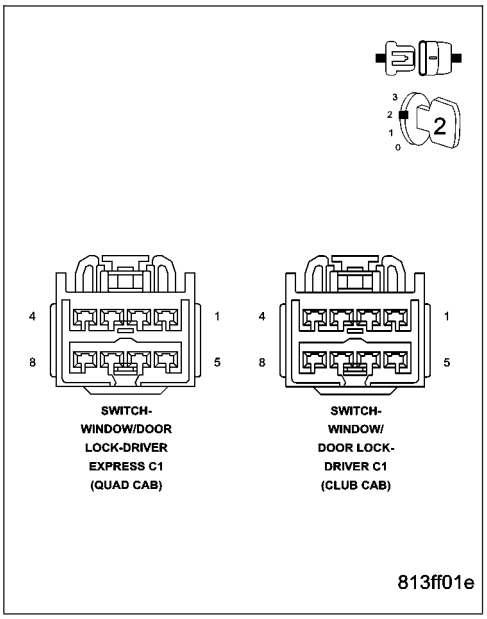
Disconnect the Driver Window/Door Lock Switch connector.

With the scan tool in sensors, read the DRIVER DOOR LOCK SWITCH voltage.

Is the voltage approximately 5.0 volts?

Yes >> Replace the Driver Window/Door Lock Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Go To 3



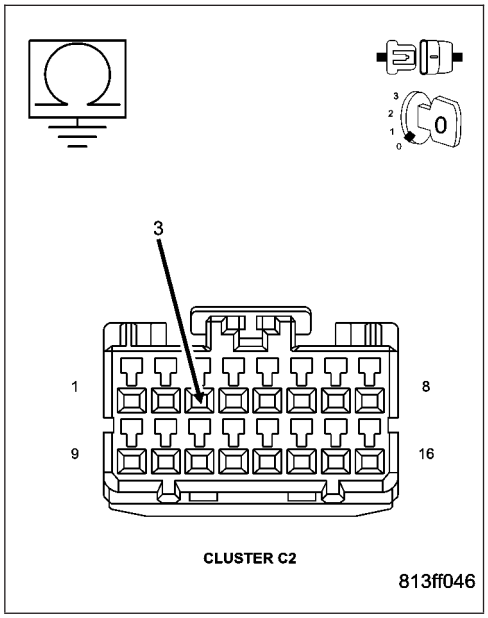
***DRIVER DOOR LOCK/UNLOCK SWITCH INPUT STUCK UNLOCK (CONTINUED)**

3. (G161) DRIVER DOOR LOCK SWITCH MUX CIRCUIT PARTIAL SHORT TO GROUND

Turn the ignition off.

Disconnect the Cluster C2 connector.

Measure the resistance between ground and the (G161) Driver Door Lock Switch Mux circuit.



Is the resistance below 10000.0 ohms?

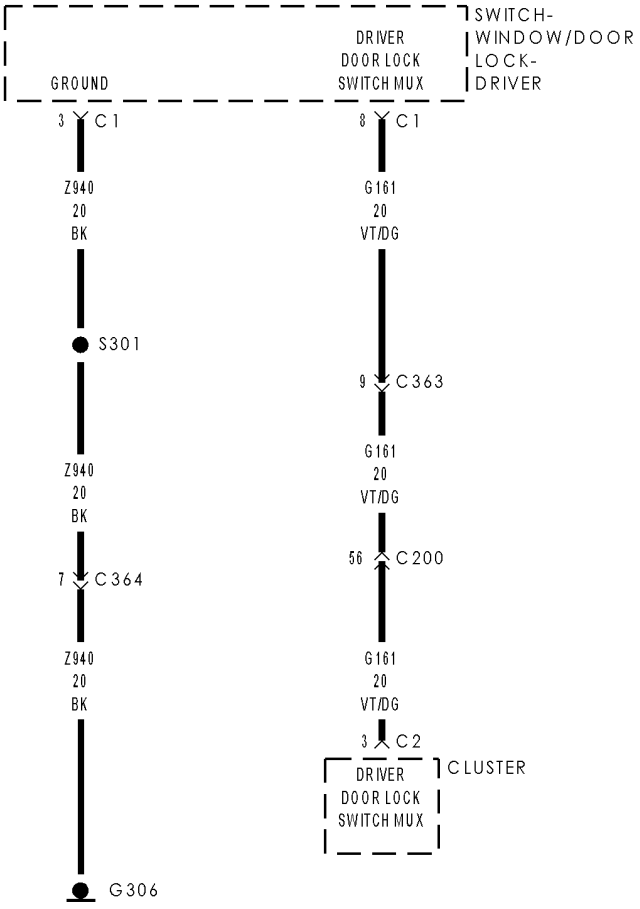
Yes >> Repair the (G161) Driver Door Lock Switch Mux circuit for a short to ground.

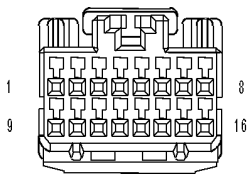
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Replace the Instrument Cluster.

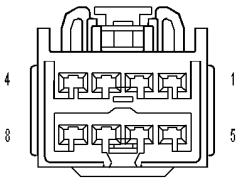
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

*DRIVER DOOR LOCK SWITCH INOPERATIVE





CLUSTER
C2



SWITCH-WINDOW/DOOR LOCK-DRIVER C1

811FF193

***DRIVER DOOR LOCK SWITCH INOPERATIVE (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(G161) DRIVER DOOR LOCK SWITCH MUX CIRCUIT SHORT TO GROUND
(G161) DRIVER DOOR LOCK SWITCH MUX CIRCUIT OPEN
(Z940 GROUND CIRCUIT OPEN
DOOR LOCK SWITCH SWITCH
INSTRUMENT CLUSTER

Theory of Operation

This test is only for vehicles that do not have the Memory System.

Diagnostic Test

1. (Z940) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Driver Window/Door Lock Switch C2 connector.

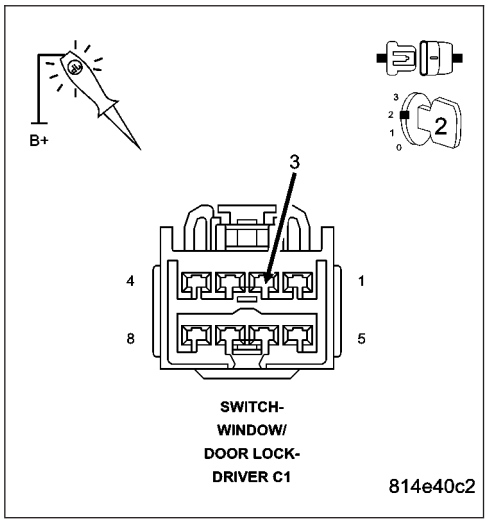
Turn the ignition on.

Using a 12–volt test light connected to 12–volts, check the (Z940) Ground circuit

Does the Test Light illuminate brightly?

Yes >> Go To 2

No >> Repair the (Z940) Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)



*DRIVER DOOR LOCK SWITCH INOPERATIVE (CONTINUED)

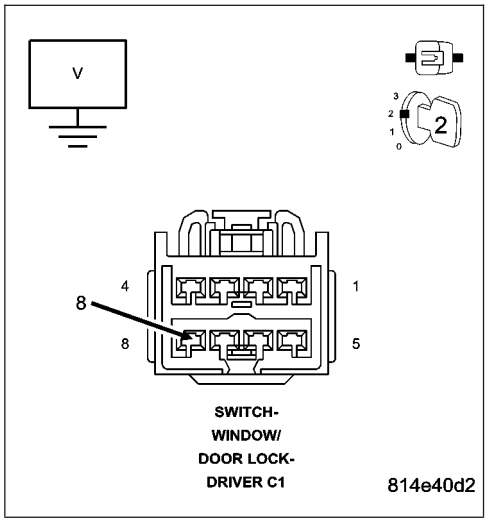
2. DOOR LOCK SWITCH SHORTED

Measure the voltage of the (G161) Driver Door Lock Switch Mux circuit.

Is the voltage approximately 5.0 volts?

Yes >> Replace the Driver Window/Door Lock Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Go To 3



3. DRIVER DOOR LOCK SWITCH MUX CIRCUIT SHORT TO GROUND

Turn the ignition off.

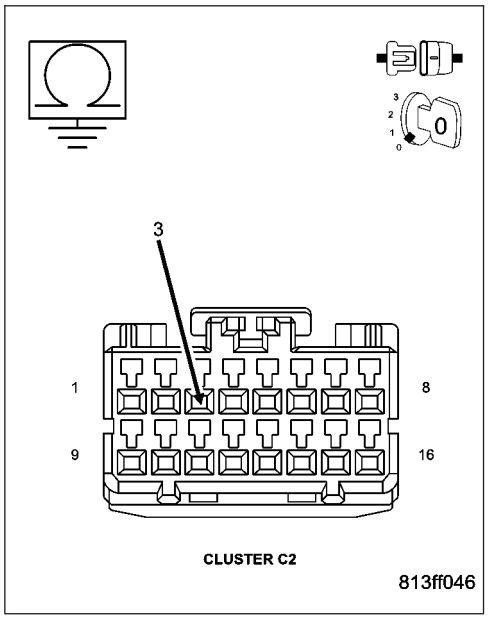
Disconnect the Cluster C2 connector.

Measure the resistance between ground and the (G161) Driver Door Lock Switch Mux circuit.

Is the resistance below 10000.0 ohms?

Yes >> Repair the (G161) Driver Door Lock Switch Mux circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Go To 4



*DRIVER DOOR LOCK SWITCH INOPERATIVE (CONTINUED)

4. DRIVER DOOR LOCK SWITCH MUX CIRCUIT OPEN

Measure the resistance of the (G161) Driver Door Lock Switch Mux circuit between the Cluster C2 connector and the Driver Window/Door Lock Switch C1 connector.

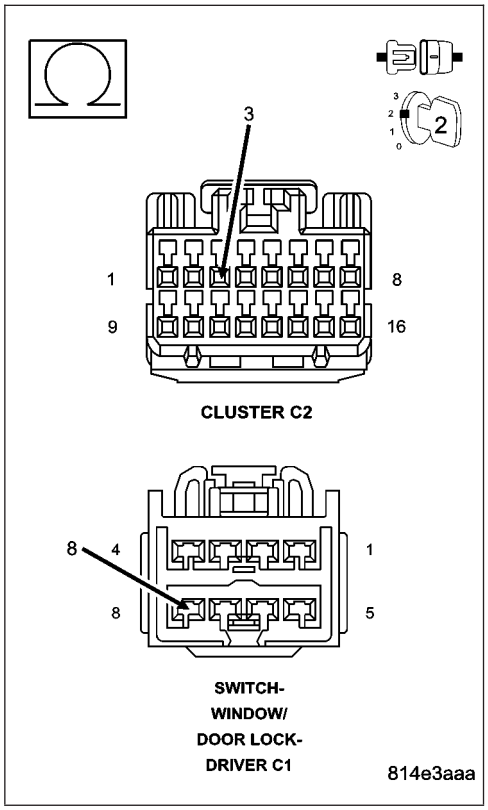
Is the resistance below 5.0 ohms?

No >> Repair the (G161) Driver Door Lock Switch Mux circuit for an open.

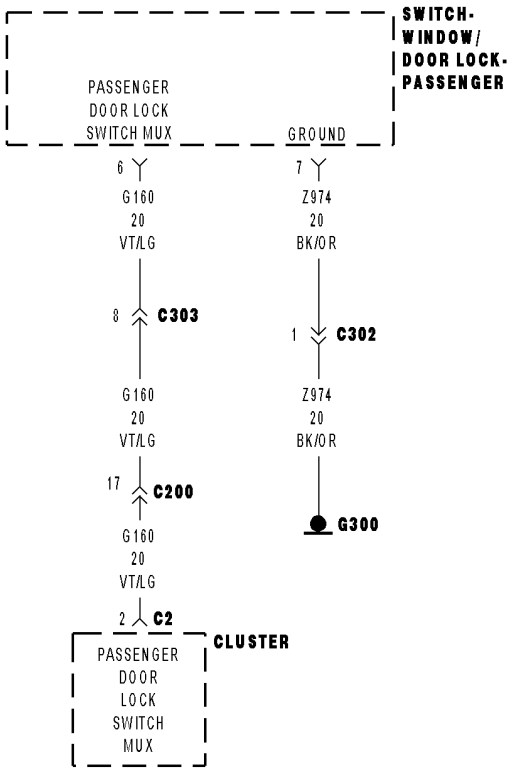
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

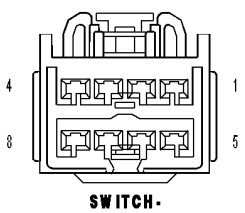
Yes >> Replace the Instrument Cluster.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

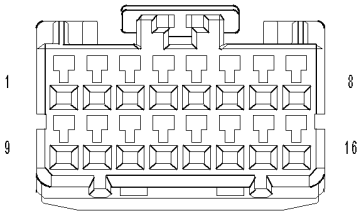


*PASSENGER DOOR LOCK/UNLOCK SWITCH INPUT CIRCUIT LOW





SWITCH-
WINDOW/
DOOR
LOCK-
PASSENGER



CLUSTER C2

813ffa5d

***PASSENGER DOOR LOCK/UNLOCK SWITCH INPUT CIRCUIT LOW (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(G160) PASSENGER DOOR LOCK SWITCH MUXCIRCUIT SHORT TO GROUND
DOOR LOCK SWITCH SHORT TO GROUND
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR TROUBLE CODES

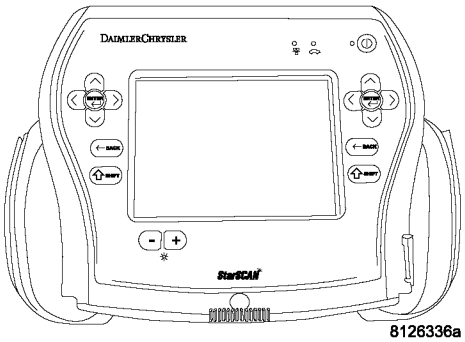
Turn the ignition on.

With the scan tool, read DTC's

Are there any Body related DTC's

No >> Go To 2

Yes >> Refer to the symptom list and repair any DTC's before proceeding.



2. DOOR LOCK SWITCH SHORTED

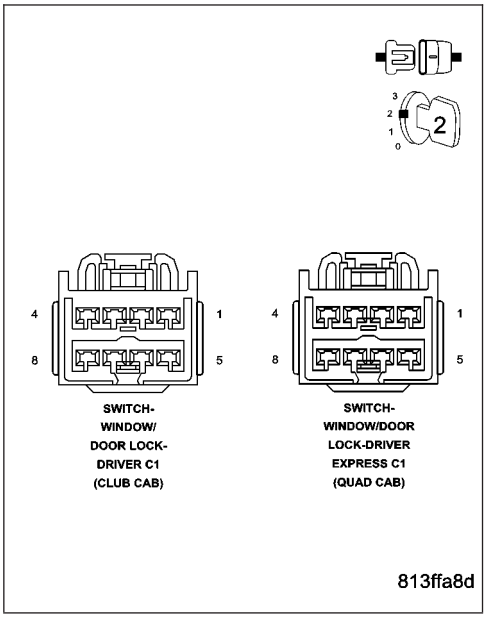
Disconnect the Passenger Window/Door Lock Switch connector.

With the scan tool in sensors, read the PASSENGER DOOR LOCK SWITCH voltage.

Is the voltage approximately 5.0 volts?

Yes >> Replace the Passenger Window/Door Lock Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Go To 3



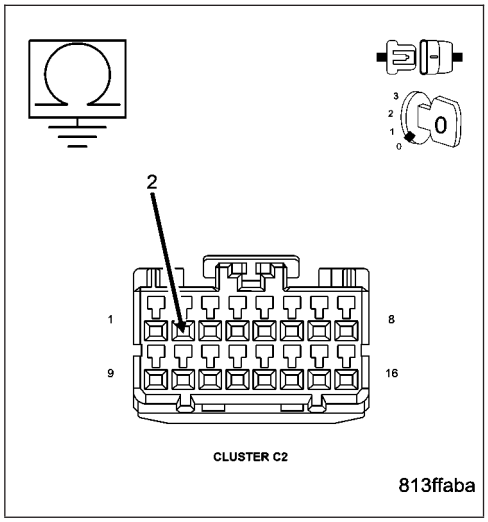
***PASSENGER DOOR LOCK/UNLOCK SWITCH INPUT CIRCUIT LOW (CONTINUED)**

3. DRIVER DOOR LOCK SWITCH MUX CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Cluster C2 connector.

Measure the resistance between ground and the Passenger Door Lock Switch Mux circuit.



Is the resistance below 10000.0 ohms?

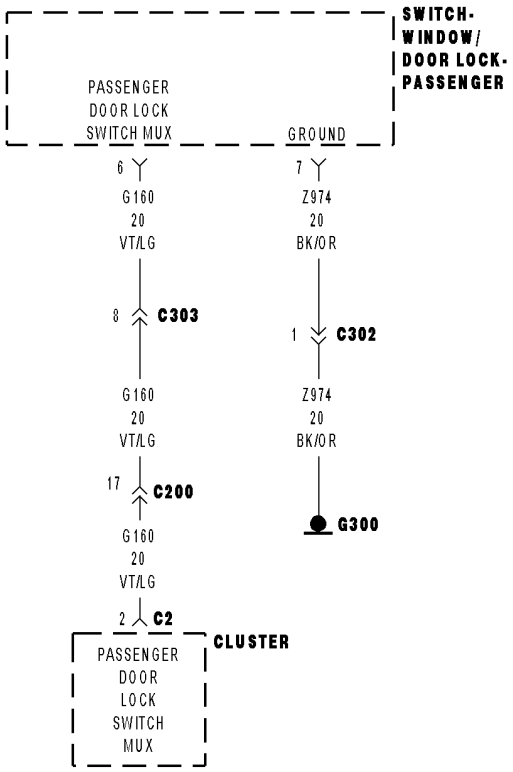
Yes >> Repair the Passenger Door Lock Switch Mux circuit for a short to ground.

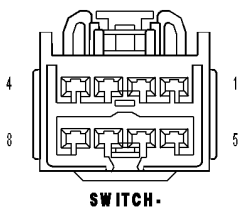
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Replace the Instrument Cluster.

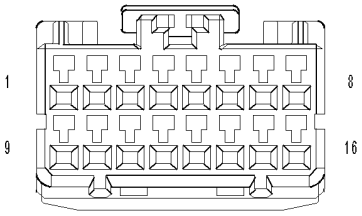
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

*PASSENGER DOOR LOCK/UNLOCK SWITCH INPUT STUCK LOCK





SWITCH-
WINDOW/
DOOR
LOCK-
PASSENGER



CLUSTER C2

813ffa5d

***PASSENGER DOOR LOCK/UNLOCK SWITCH INPUT STUCK LOCK (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(G160) PASSENGER DOOR LOCK SWITCH MUX CIRCUIT PARTIAL SHORT TO GROUND
DOOR LOCK SWITCH STUCK
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR TROUBLE CODES

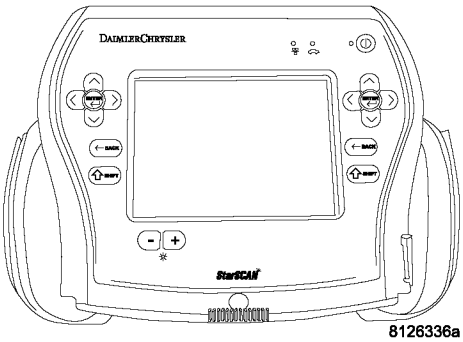
Turn the ignition on.

With the scan tool, read DTC's

Are there any Body related DTC's?

No >> Go To 2

Yes >> Refer to the symptom list and repair any DTC's before proceeding.



2. DOOR LOCK SWITCH SHORTED

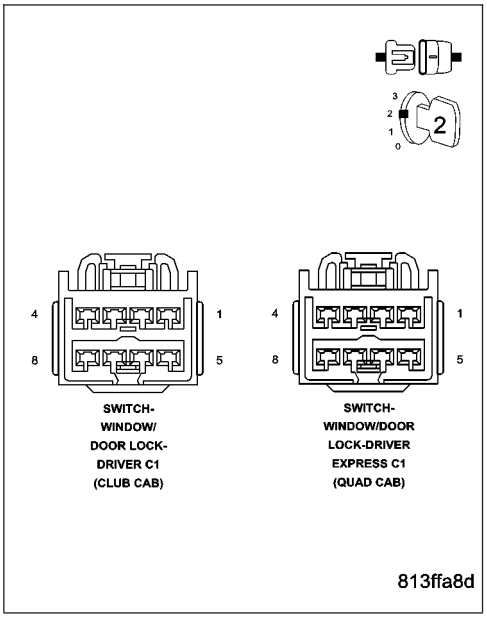
Disconnect the Passenger Window/Door Lock Switch connector.

With the scan tool in sensors, read the PASSENGER DOOR LOCK SWITCH voltage.

Is the voltage approximately 5.0 volts?

Yes >> Replace the Passenger Window/Door Lock Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Go To 3



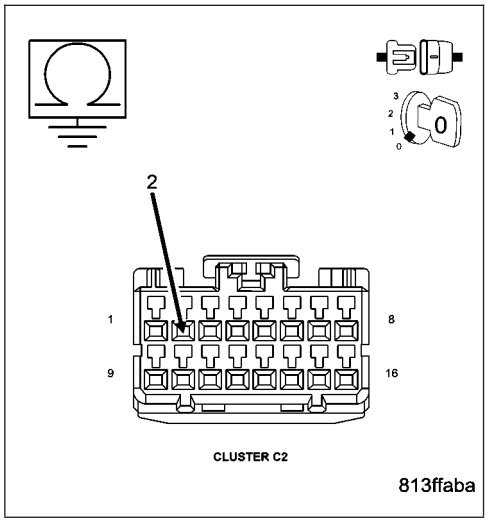
***PASSENGER DOOR LOCK/UNLOCK SWITCH INPUT STUCK LOCK (CONTINUED)**

3. (G160) PASSENGER DOOR LOCK SWITCH MUX CIRCUIT PARTIAL SHORT TO GROUND

Turn the ignition off.

Disconnect the Cluster C2 connector.

Measure the resistance between ground and the (G160) Passenger Door Lock Switch Mux circuit.



Is the resistance below 10000.0 ohms?

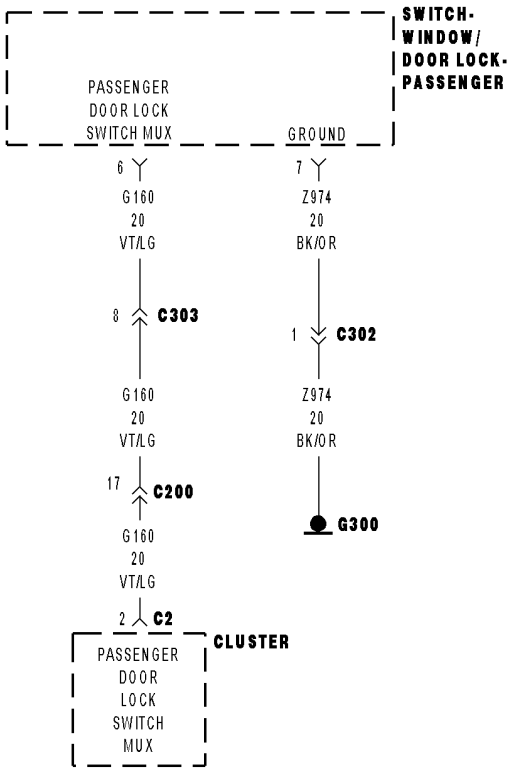
Yes >> Repair the (G160) Passenger Door Lock Switch Mux circuit for a short to ground.

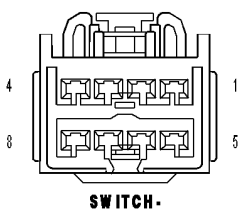
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Replace the Instrument Cluster.

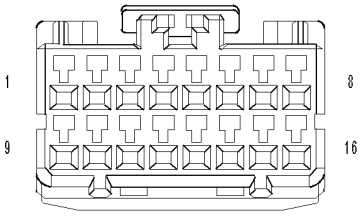
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

*PASSENGER DOOR LOCK/UNLOCK SWITCH INPUT STUCK LOCK





SWITCH-
WINDOW/
DOOR
LOCK-
PASSENGER



CLUSTER C2

813ffa5d

***PASSENGER DOOR LOCK/UNLOCK SWITCH INPUT STUCK LOCK (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(G160) PASSENGER DOOR LOCK SWITCH MUX CIRCUIT PARTIAL SHORT TO GROUND
DOOR LOCK SWITCH STUCK
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR TROUBLE CODES

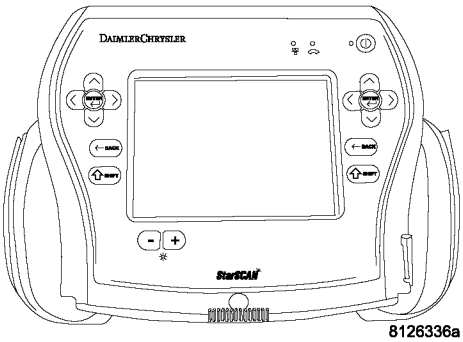
Turn the ignition on.

With the scan tool, read DTC's.

Are there any Body related DTC's?

No >> Go To 2

Yes >> Refer to the symptom list and repair any DTC's before proceeding.



2. DOOR LOCK SWITCH SHORTED

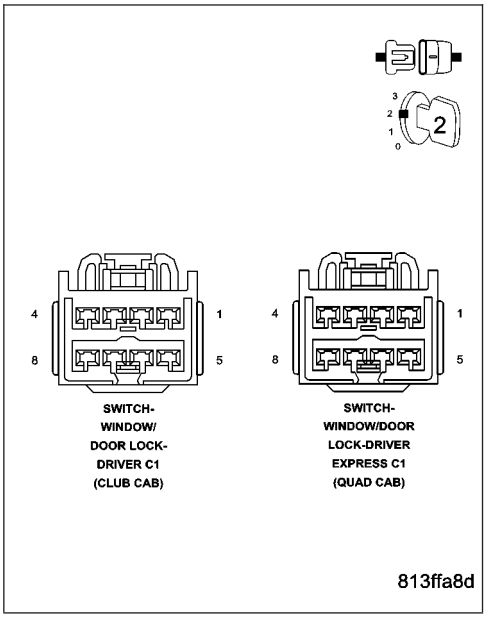
Disconnect the Passenger Window/Door Lock Switch connector.

With the scan tool in sensors, read the PASSENGER DOOR LOCK SWITCH voltage.

Is the voltage approximately 5.0 volts?

Yes >> Replace the Passenger Window/Door Lock Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Go To 3



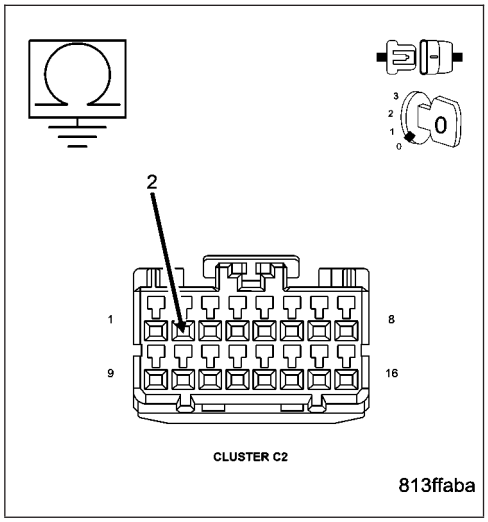
***PASSENGER DOOR LOCK/UNLOCK SWITCH INPUT STUCK LOCK (CONTINUED)**

3. (G160) PASSENGER DOOR LOCK SWITCH MUX CIRCUIT PARTIAL SHORT TO GROUND

Turn the ignition off.

Disconnect the Cluster C2 connector.

Measure the resistance between ground and the (G160) Passenger Door Lock Switch Mux circuit.



Is the resistance below 10000.0 ohms?

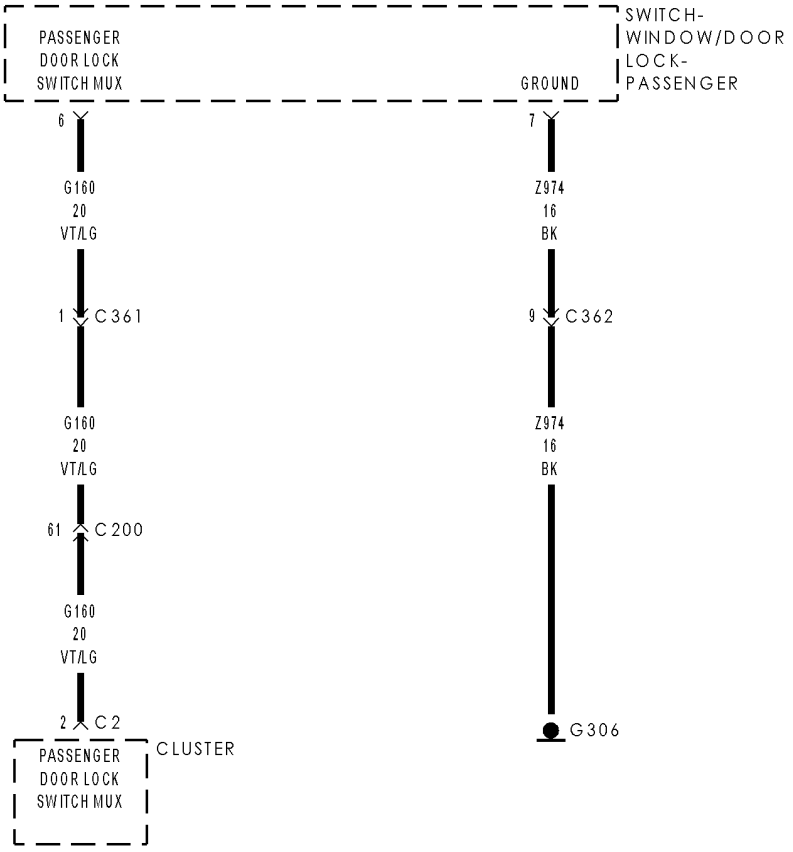
Yes >> Repair the (G160) Passenger Door Lock Switch Mux circuit for a short to ground.

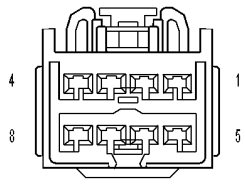
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Replace the Instrument Cluster.

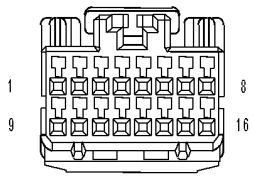
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

*PASSENGER DOOR LOCK SWITCH INOPERATIVE





SWITCH-WINDOW/DOOR LOCK-PASSENGER



CLUSTER C2

812570D4

***PASSENGER DOOR LOCK SWITCH INOPERATIVE (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(G161) DRIVER DOOR LOCK SWITCH MUX CIRCUIT SHORT TO GROUND
(G161) DRIVER DOOR LOCK SWITCH MUX CIRCUIT OPEN
(Z940) GROUND CIRCUIT OPEN
DOOR LOCK SWITCH
INSTRUMENT CLUSTER

Theory of Operation

This test is only for vehicles that do not have the Memory System.

Diagnostic Test

1. (Z974) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Passenger Window/Door Lock Switch connector.

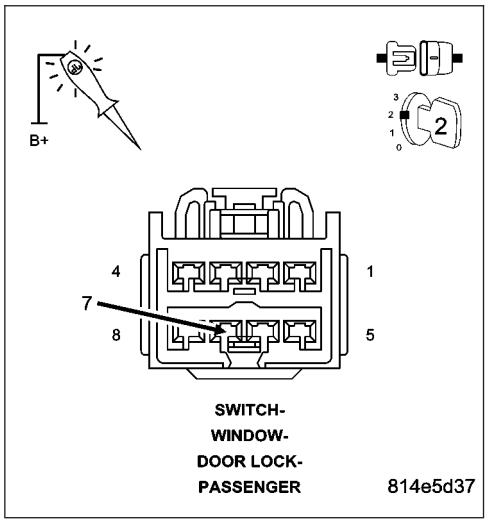
Turn the ignition on.

Using a 12–volt test light connected to 12–volts, check the (Z974) Ground circuit

Does the Test Light illuminate brightly?

Yes >> Go To 2

No >> Repair the (Z974) Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)



***PASSENGER DOOR LOCK SWITCH INOPERATIVE (CONTINUED)**

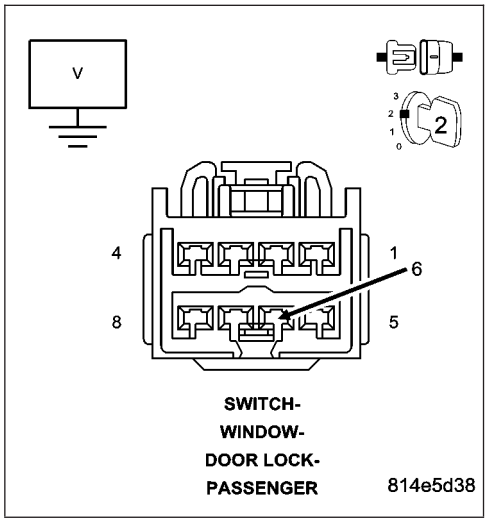
2. DOOR LOCK SWITCH SHORTED

Measure the voltage of the (G160) Passenger Door Lock Switch Mux circuit.

Is the voltage approximately 5.0 volts?

Yes >> Replace the Passenger Window/Door Lock Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Go To 3



3. (G160) PASSENGER DOOR LOCK SWITCH MUX CIRCUIT SHORT TO GROUND

Turn the ignition off.

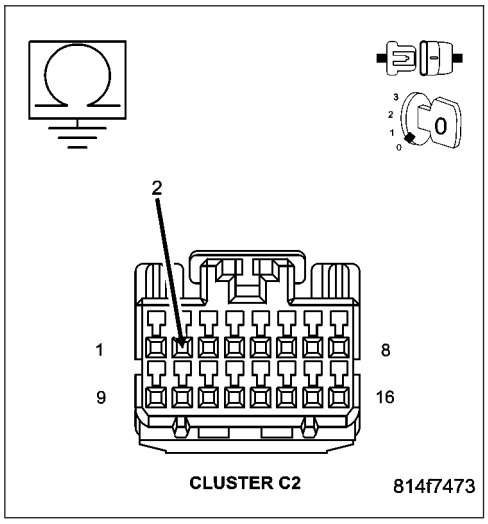
Disconnect the Cluster C2 connector.

Measure the resistance between ground and the (G160) Passenger Door Lock Switch Mux circuit.

Is the resistance below 10000.0 ohms?

Yes >> Repair the (G160) Passenger Door Lock Switch Mux circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Go To 4



***PASSENGER DOOR LOCK SWITCH INOPERATIVE (CONTINUED)**

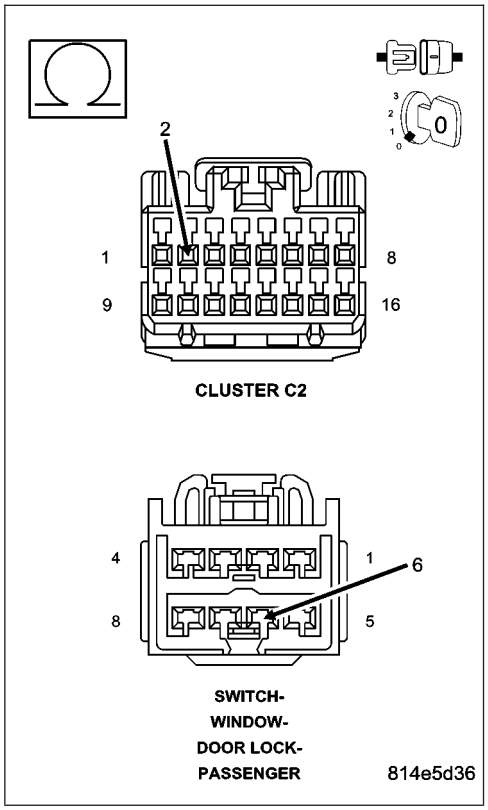
4. (G160) PASSENGER DOOR LOCK SWITCH MUX CIRCUIT OPEN

Measure the resistance of the (G160) Passenger Door Lock Switch Mux circuit between the Cluster C2 connector and the Passenger Window/Door Lock Switch connector.

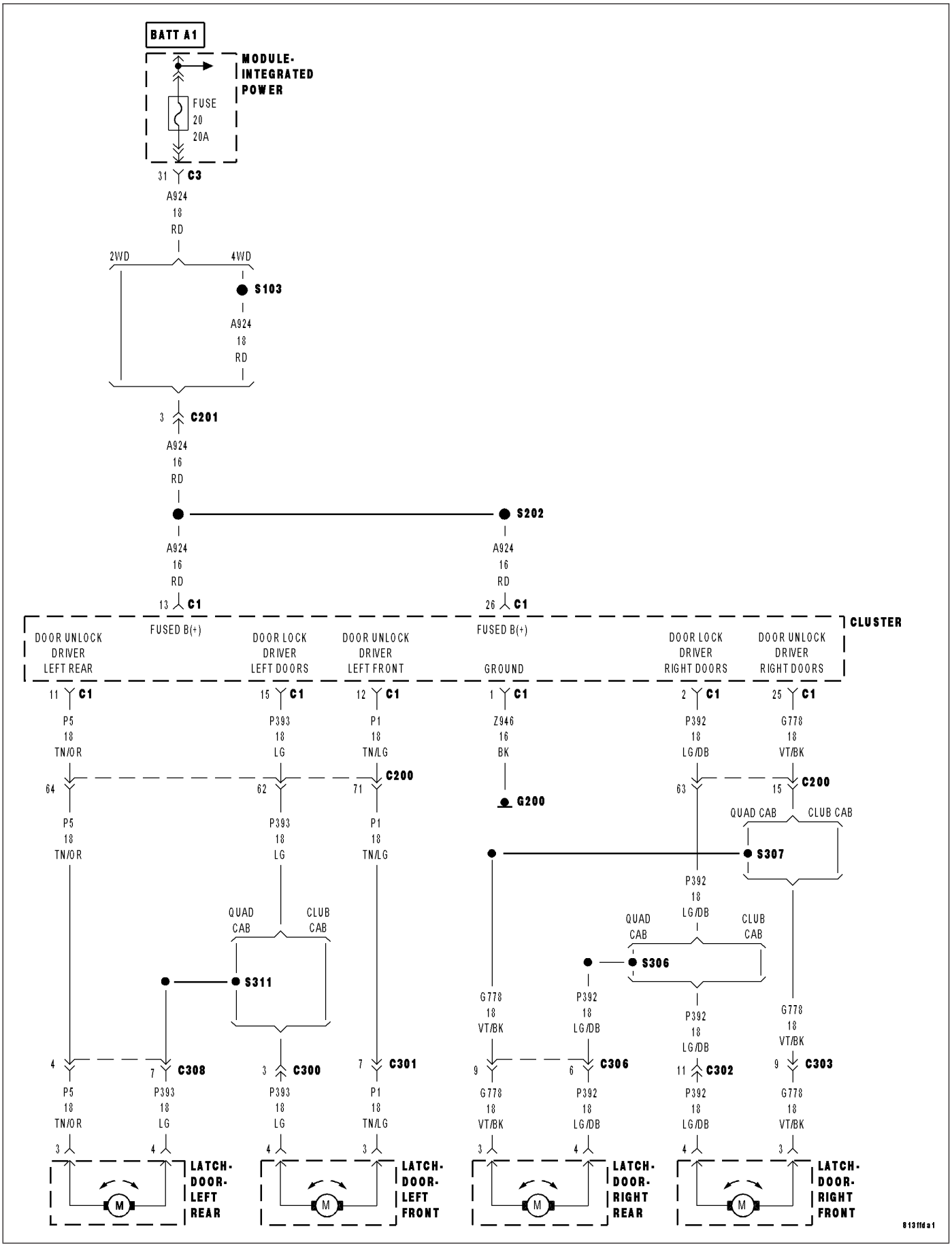
Is the resistance below 5.0 ohms?

No >> Repair the (G160) Passenger Door Lock Switch Mux circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

Yes >> Replace the Instrument Cluster.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)



*ALL DOOR LOCK OUTPUT CIRCUIT SHORTED TO GROUND



***ALL DOOR LOCK OUTPUT CIRCUIT SHORTED TO GROUND (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(P392) DOOR LOCK DRIVER RIGHT DOORS CIRCUIT SHORT TO GROUND
(P393) DOOR LOCK DRIVER LEFT DOORS CIRCUIT SHORT TO GROUND
(P392) DOOR LOCK DRIVER RIGHT DOORS SHORT TO (G778) DOOR UNLOCK DRIVER RIGHT DOORS
(P393) DOOR LOCK DRIVER LEFT DOORS SHORT TO (P5) DOOR UNLOCK DRIVER LEFT REAR
(P393) DOOR LOCK DRIVER LEFT DOORS SHORT TO (P1) DOOR UNLOCK DRIVER LEFT FRONT CLUSTER

Theory of Operation

The Door Lock Driver Right Doors circuit and the Door Lock Driver Left Doors circuits are connected together inside the module. Therefore any circuit that is connected to either one cause this problem.

Diagnostic Test

1. CHECK FOR TROUBLE CODES.

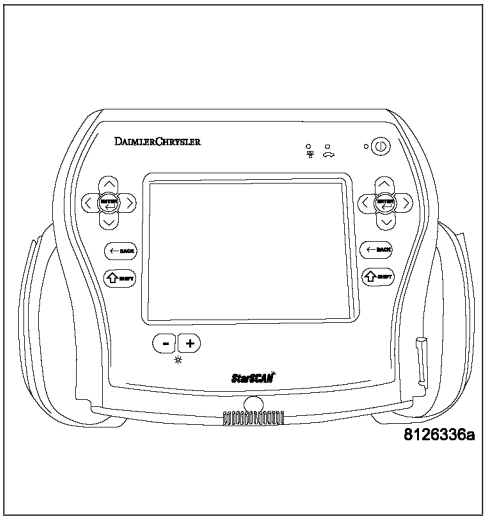
Turn the ignition on.

With the scan tool, read DTC's.

Does the scan tool display and Body related DTC's?

No >> Go To 2

Yes >> Refer to the symptom list and repair any DTC's before proceeding.



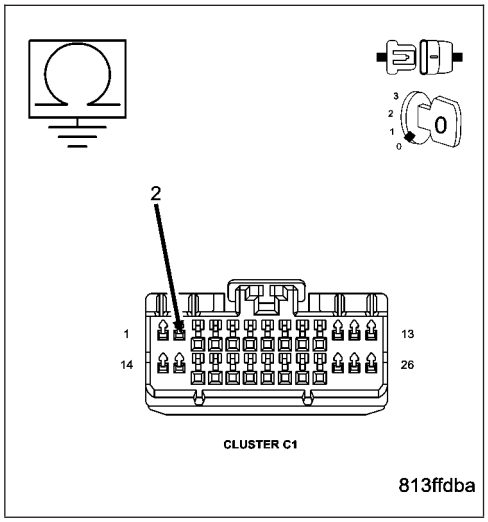
***ALL DOOR LOCK OUTPUT CIRCUIT SHORTED TO GROUND (CONTINUED)**

2. CHECK (P392) DOOR LOCK DRIVER RIGHT DOORS FOR SHORT TO GROUND

Turn the ignition off.

Disconnect the Cluster C1 connector.

Measure the resistance between ground and the (P392) Door Lock Driver Right Doors circuit.



Is the resistance below 1000.0 ohms?

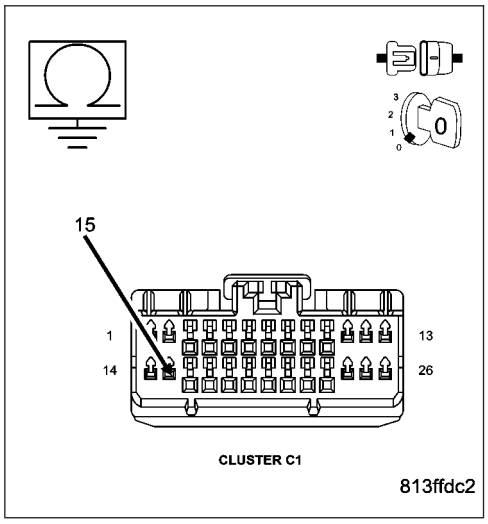
No >> Go To 3

Yes >> Repair the (P392) Door Lock Driver Right Doors circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

3. CHECK (P393) DOOR LOCK DRIVER LEFT DOORS CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (P393) Door Lock Driver Left Doors circuit.



Is the resistance below 1000.0 ohms?

No >> Go To 4

Yes >> Repair the (P393) Door Lock Driver Left Doors circuit for a short to ground.

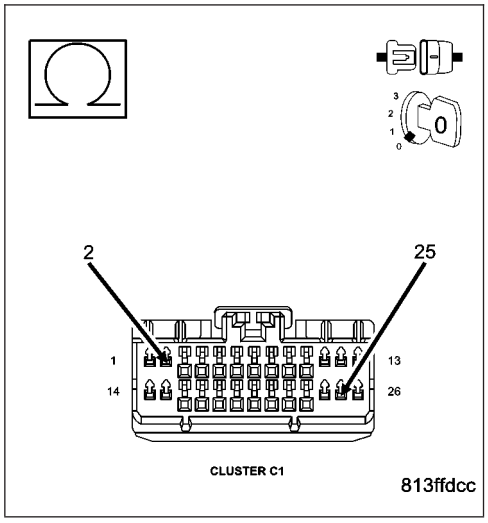
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

***ALL DOOR LOCK OUTPUT CIRCUIT SHORTED TO GROUND (CONTINUED)**

4. CHECK THE (P392) DOOR LOCK DRIVER RIGHT DOORS CIRCUIT FOR A SHORT TO THE (G778) DOOR UNLOCK DRIVER RIGHT DOORS CIRCUIT

Measure the resistance between the (P392) Door Lock Driver Right Doors circuit and the (G778) Door Unlock Driver Right Doors circuit.

Is the resistance below 1.6 ohms?



No >> Go To 5

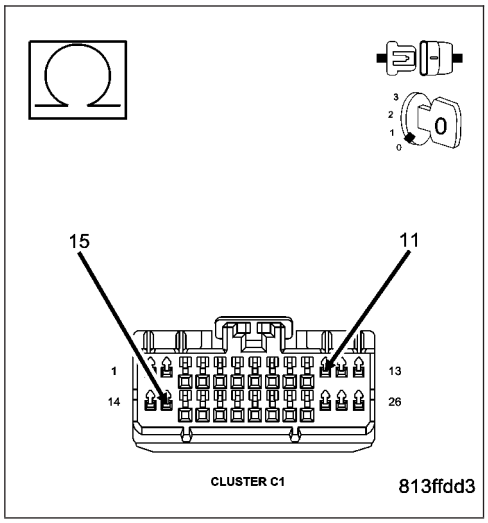
Yes >> Repair the (P392) Door Lock Driver Right Doors circuit for a short to the (G778) Door Unlock Driver Right Doors circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

5. CHECK THE (P393) DOOR LOCK DRIVER LEFT DOORS CIRCUIT FOR A SHORT TO THE (P5) DOOR UNLOCK DRIVER LEFT REAR CIRCUIT

Measure the resistance between the (P393) Door Lock Driver Left Doors circuit and the (P5) Door Unlock Driver Left Rear circuit.

Is the resistance below 1.6 ohms?



No >> Go To 6

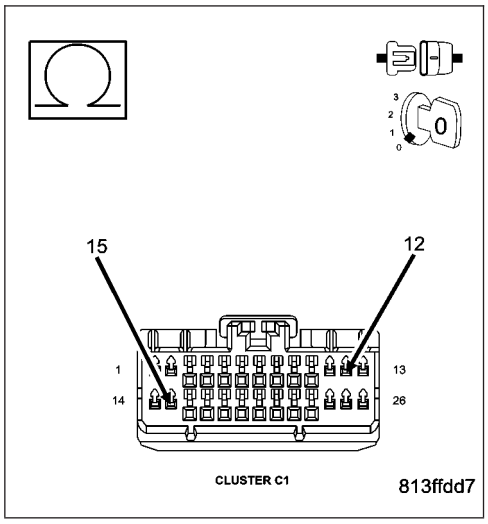
Yes >> Repair the (P393) Door Lock Driver Left Doors circuit for a short to the (P5) Door Unlock Driver Left Rear circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

***ALL DOOR LOCK OUTPUT CIRCUIT SHORTED TO GROUND (CONTINUED)**

6. CHECK THE (P393) DOOR LOCK DRIVER LEFT DOORS CIRCUIT FOR A SHORT TO THE (P1) DOOR UNLOCK DRIVER LEFT FRONT CIRCUIT

Measure the resistance between the (P393) Door Lock Driver Left Doors circuit and the (P1) Door Unlock Driver Left Front circuit.



Is the resistance below 2.5 ohms?

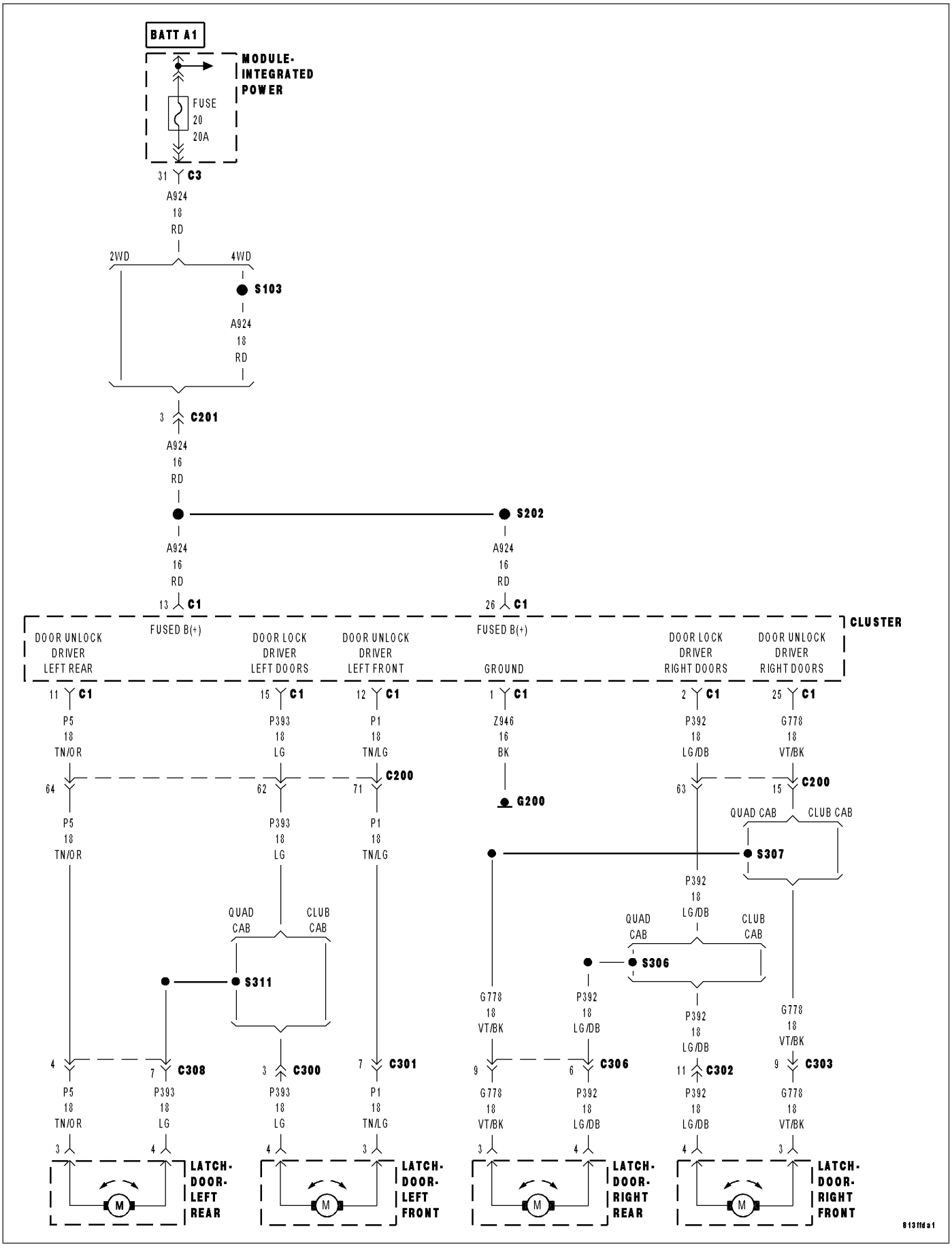
No >> Replace the Cluster in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

Yes >> Repair the (P393) Door Lock Driver Left Doors circuit for a short to the (P1) Door Unlock Driver Left Front circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

*ALL DOOR UNLOCK OUTPUT CIRCUIT SHORTED TO GROUND



***ALL DOOR UNLOCK OUTPUT CIRCUIT SHORTED TO GROUND (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(G778) DOOR UNLOCK DRIVER RIGHT DOORS CIRCUIT SHORTED TO GROUND
(P5) DOOR UNLOCK DRIVER LEFT REAR CIRCUIT SHORTED TO GROUND
(G778) DOOR UNLOCK DRIVER RIGHT DOORS SHORT TO (P392) DOOR LOCK DRIVER RIGHT DOORS
(P393) DOOR LOCK DRIVER LEFT DOORS SHORT TO (P5) DOOR UNLOCK DRIVER LEFT REAR CLUSTER

Theory of Operation

The Door Unlock Driver Right Doors circuit and the Door Unlock Driver Left Rear circuits are connected together inside the module. Therefore any circuit that is connected to either one can cause this problem.

Diagnostic Test

1. CHECK FOR TROUBLE CODES

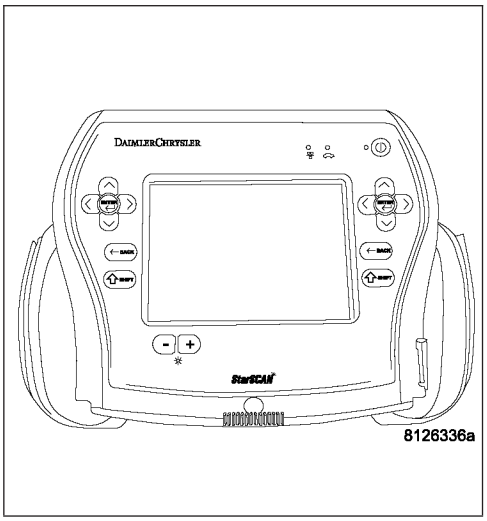
Turn the ignition on.

With the scan tool, read DTC's.

Does the scan tool display: any Body related DTC's

No >> Go To 2

Yes >> Refer to the symptom list and repair any DTC's before proceeding.



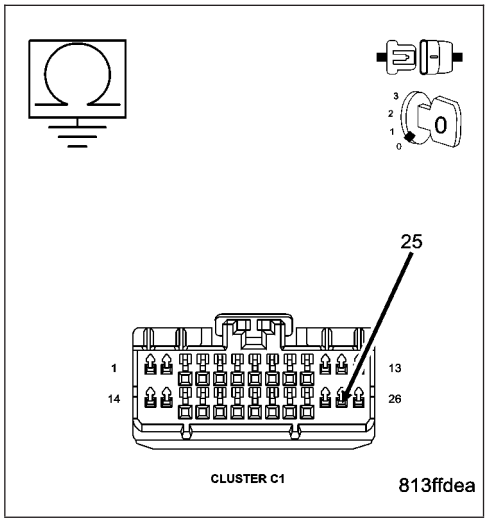
***ALL DOOR UNLOCK OUTPUT CIRCUIT SHORTED TO GROUND (CONTINUED)**

2. CHECK (G778) DOOR UNLOCK DRIVER RIGHT DOORS FOR SHORT TO GROUND

Turn the ignition off.

Disconnect the Cluster C1 connector.

Measure the resistance between ground and the (G778) Door Unlock Driver Right Doors circuit.



Is the resistance below 1000.0 ohms?

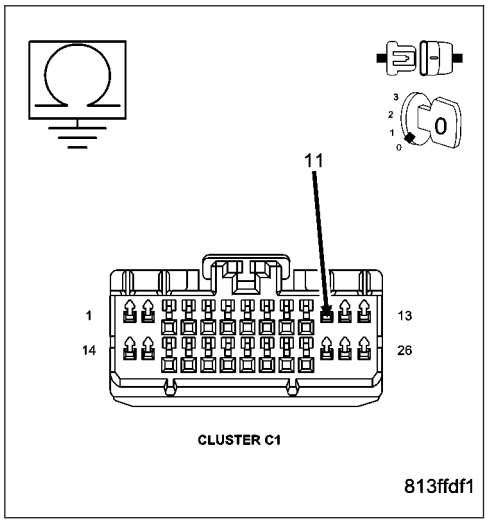
No >> Go To 3

Yes >> Repair the (G778) Door Unlock Driver Right Doors circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

3. CHECK THE (P5) DOOR UNLOCK DRIVER LEFT REAR FOR A SHORT TO GROUND

Measure the resistance between ground and the (P5) Door Unlock Driver Left Rear circuit.



Is the resistance below 1000.0 ohms?

No >> Go To 4

Yes >> Repair the (P5) Door Unlock Driver Left Rear circuit for a short to ground.

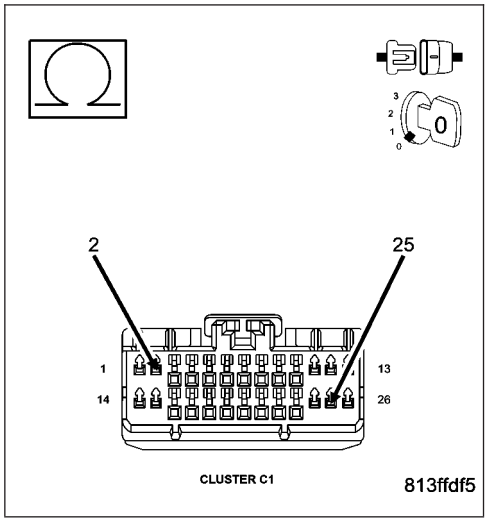
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

***ALL DOOR UNLOCK OUTPUT CIRCUIT SHORTED TO GROUND (CONTINUED)**

4. CHECK THE (P392) DOOR LOCK DRIVER RIGHT DOORS CIRCUIT FOR A SHORT TO THE (G778) DOOR UNLOCK DRIVER RIGHT DOORS CIRCUIT

Measure the resistance between the (P392) Door Lock Driver Right Doors circuit and the (G778)Door Unlock Driver Right Doors circuit.

Is the resistance below 1.6 ohms?



No >> Go To 5

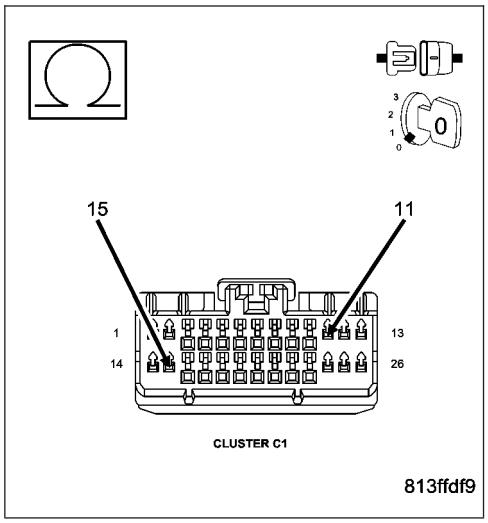
Yes >> Repair the (P392) Door Lock Driver Right Doors circuit for a short to the (G778) Door Unlock Driver Right Doors circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

5. CHECK THE (P393) DOOR LOCK DRIVER LEFT DOORS CIRCUIT FOR A SHORT TO THE (P5) DOOR UNLOCK DRIVER LEFT REAR CIRCUIT

Measure the resistance between the (P393) Door Lock Driver Left Doors circuit and the (P5) Door Unlock Driver Left Rear circuit.

Is the resistance below 1.6 ohms?



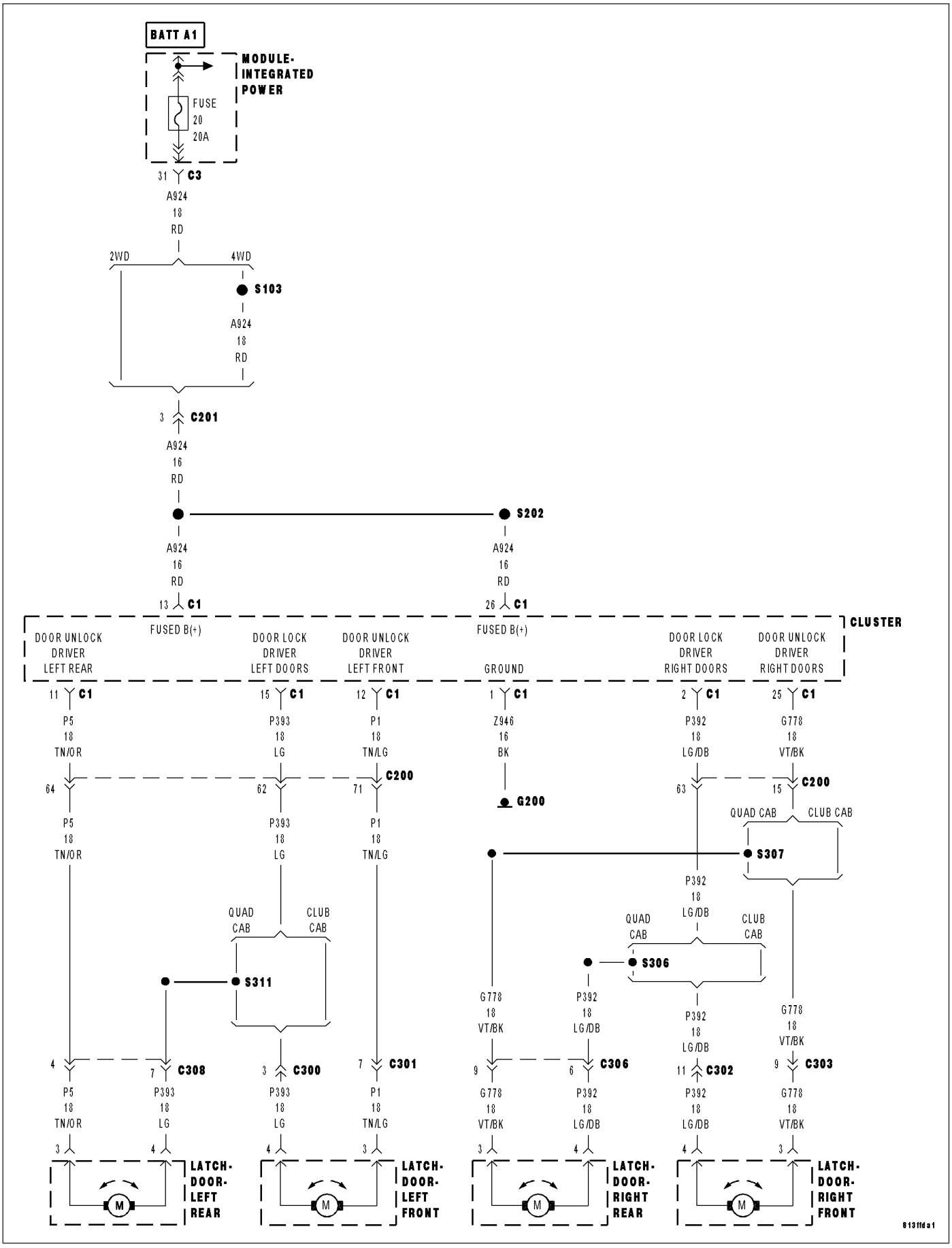
No >> Replace the Cluster in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

Yes >> Repair the (P393) Door Lock Driver Left Doors circuit for a short to the (P5) Door Unlock Driver Left Rear circuit.

Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

*DRIVER DOOR UNLOCK OUTPUT CIRCUIT SHORTED TO GROUND



***DRIVER DOOR UNLOCK OUTPUT CIRCUIT SHORTED TO GROUND (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(P1) DOOR UNLOCK DRIVER LEFT FRONT CIRCUIT SHORTED TO GROUND
(P1) DOOR UNLOCK DRIVER LEFT FRONT CIRCUIT SHORTED TO (P5) DOOR UNLOCK DRIVER LEFT REAR CIRCUIT
(P1) DOOR UNLOCK DRIVER LEFT FRONT SHORTED TO (P393) DOOR LOCK DRIVER LEFT DOORS
INSTRUMENT CLUSTER

Diagnostic Test

1. CHECK FOR TROUBLE CODES

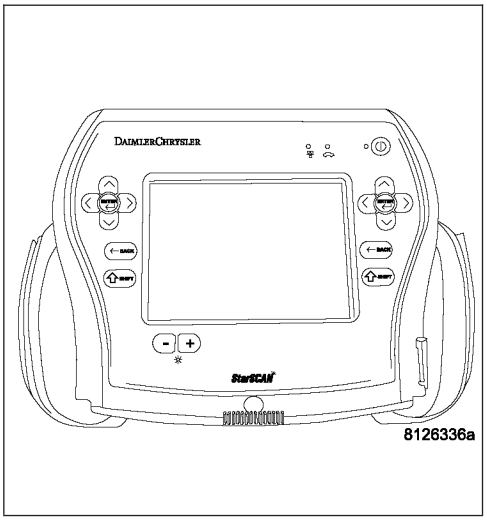
Turn the ignition on.

With the scan tool, read DTC's.

Does the scan tool display and Body related DTC's?

No >> Go To 2

Yes >> Refer to the symptom list and repair any DTC's before proceeding.



***DRIVER DOOR UNLOCK OUTPUT CIRCUIT SHORTED TO GROUND (CONTINUED)**

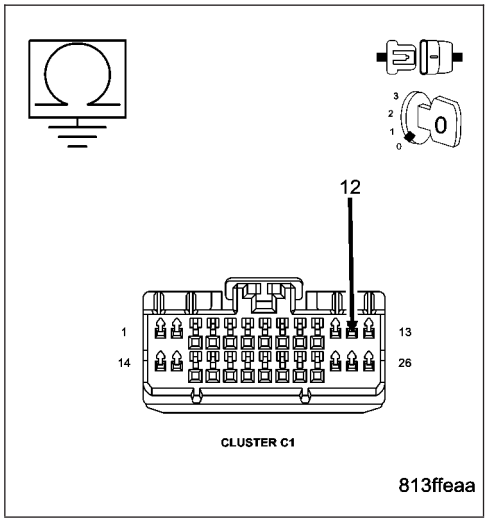
2. CHECK (P1) DOOR UNLOCK DRIVER LEFT FRONT FOR SHORT TO GROUND

NOTE: If only one motor is inoperative when the door locks are actuated, disconnect that motor and retest to see if the DTC is still present. If it is not, replace the defective motor.

Turn the ignition off.

Disconnect the Cluster C1 connector.

Measure the resistance between ground and the (P1) Door Unlock Driver Left Front circuit.



Is the resistance below 1000.0 ohms?

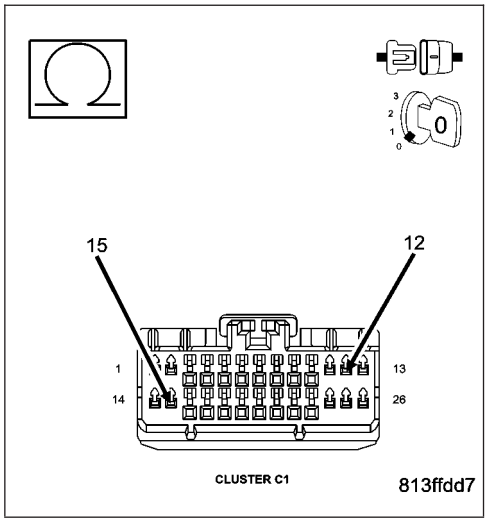
No >> Go To 3

Yes >> Repair the (P1) Door Unlock Driver Left Front circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

3. CHECK THE (P1) DOOR UNLOCK DRIVER LEFT FRONT FOR A SHORT TO THE (P393) DOOR LOCK DRIVER LEFT DOORS

Measure the resistance between the (P1) Door Unlock Driver Left Front and the (P393) Door Lock Driver Left Doors circuits.



Is the resistance below 2.0 ohms?

No >> Go To 4

Yes >> Repair the (P1) Door Unlock Driver Left Front circuit for a short to the (P393) Door Lock Driver Left Doors circuit.

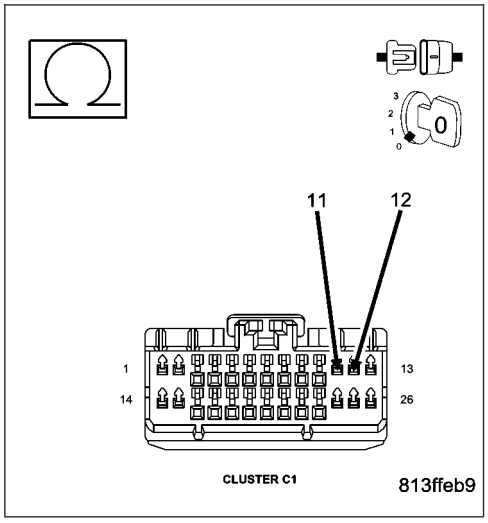
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

***DRIVER DOOR UNLOCK OUTPUT CIRCUIT SHORTED TO GROUND (CONTINUED)**

4. CHECK THE (P1) DOOR UNLOCK DRIVER LEFT FRONT CIRCUIT FOR A SHORT TO THE (P5) DOOR UNLOCK DRIVER LEFT REAR CIRCUIT

Measure the resistance between the (P1) Door Unlock Driver Left Front circuit and the (P5) Door Unlock Driver Left Rear circuit.

Is the resistance below 3.0 ohms?

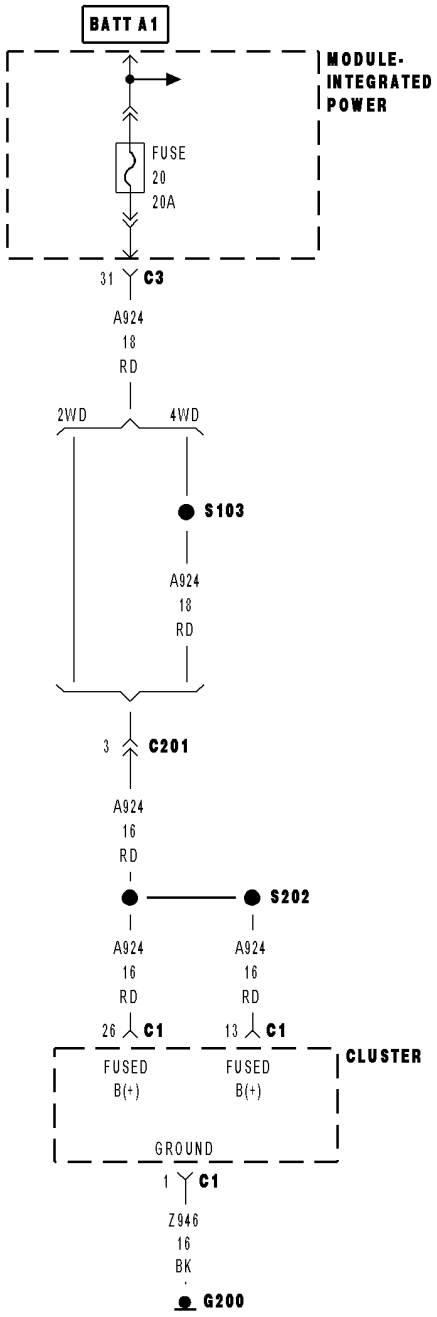


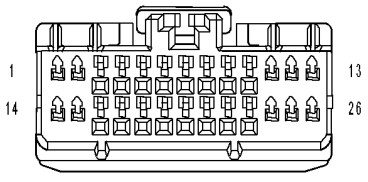
No >> Replace the Instrument Cluster in accordance with service information.Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

Yes >> Repair the (P1) Door Unlock Driver Left Front circuit for a short to the (P5) Door Unlock Driver Left Rear circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

*ALL DOOR LOCKS INOPERATIVE





CLUSTER C1

8140c40c

***ALL DOOR LOCKS INOPERATIVE (CONTINUED)**

For the Power Door Locks circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
DTC PRESENT
FUSE #20 OPEN
(A924) FUSE B+ CIRCUIT OPEN
(Z946) GROUND CIRCUIT OPEN
INSTRUMENT CLUSTER

Diagnostic Test

1. DTC PRESENT

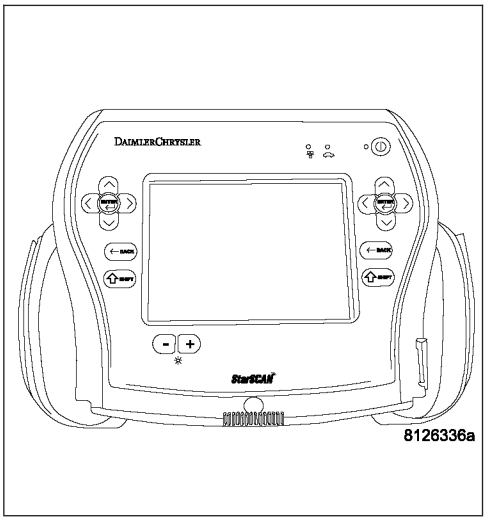
Turn the ignition on.

With the scan tool , read DTC's.

Does the scan tool display any Door Lock or Cluster related DTC's?

Yes >> Refer to the Table of Contents in this section and repair the DTC's.

No >> Go To 2



2. FUSE #20 OPEN

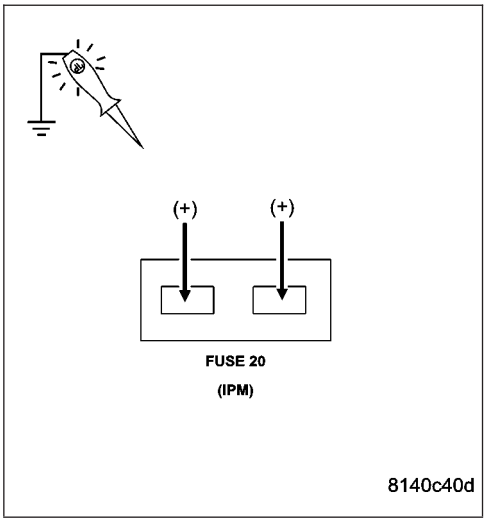
With the fuse installed, test both sides of fuse #20 in the IPM.

Is there 12 volts on both sides of the fuse?

Yes >> Go To 3

No >> Replace the fuse if open and retry the system. If the fuse blows, locate and repair a short to the Instrument Cluster. The 12 volt supply to the fuse is a bus bar in the IPM.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)



***ALL DOOR LOCKS INOPERATIVE (CONTINUED)**

3. (A924) FUSED B+ CIRCUIT OPEN

Turn the ignition off.

Disconnect the Cluster C1 connector.

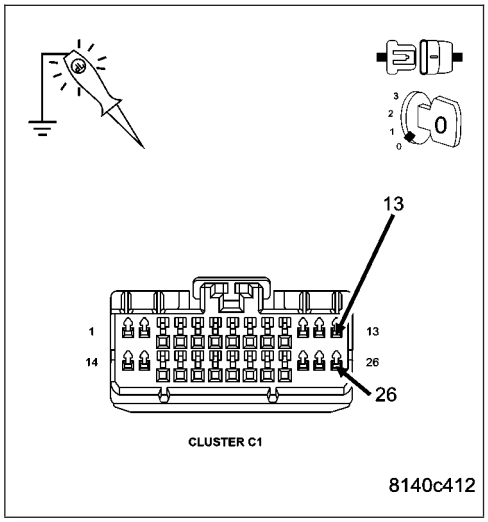
Using a 12-volt test light connected to ground, check both (A924) Fused B+ circuits in the Cluster connector.

Does the test light illuminate brightly at both terminals?

Yes >> Go to 4

No >> Repair the Fused B+ circuits for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)



4. (Z946) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z946) Ground circuit in the Cluster connector.

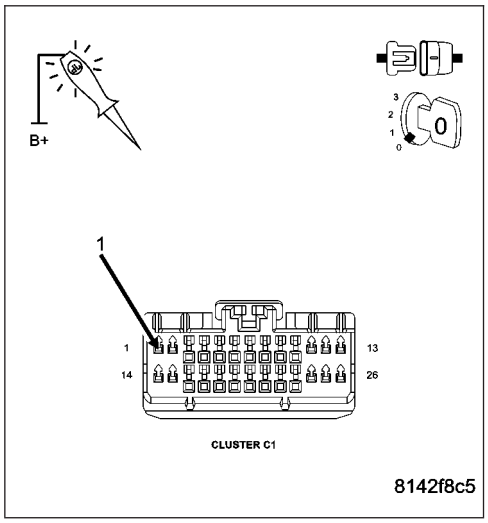
Does the test light illuminate brightly?

Yes >> Replace the Instrument Cluster.

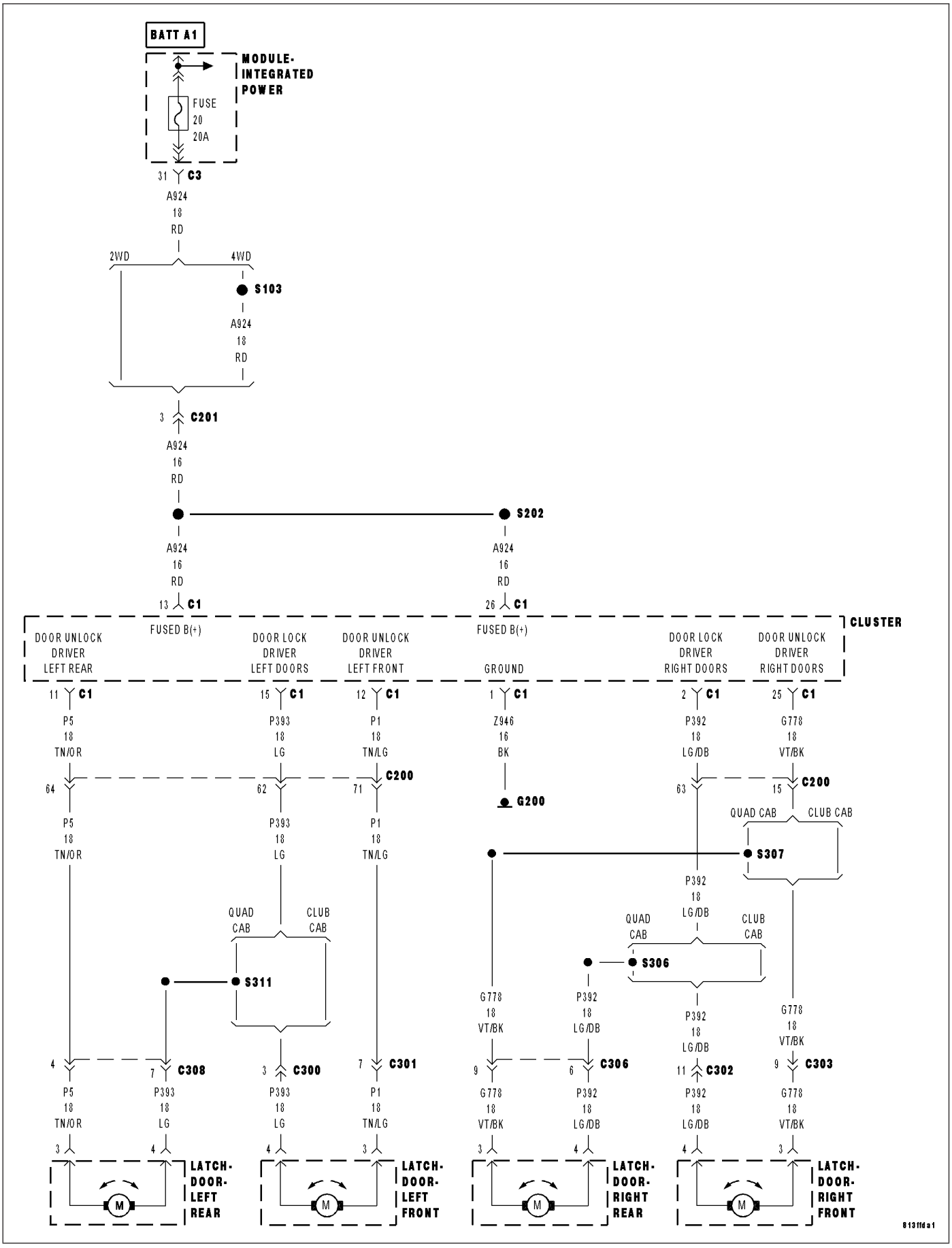
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Repair the (Z946) Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)



*ONE DOOR LOCK INOPERATIVE



***ONE DOOR LOCK INOPERATIVE (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
DTC's PRESENT
DOOR LOCK DRIVER OR DOOR UNLOCK DRIVER CIRCUIT OPEN
DOOR LATCH

Diagnostic Test

1. TEST FOR DIAGNOSTIC TROUBLE CODES

Turn the ignition on.

With the scan tool, record and erase DTC's

Operate the Driver Door Lock Switch in all positions several times.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read the active DTC's.

Does the scan tool display any Power Door Lock related DTC's?

No >> Go To 2

Yes >> Refer to the Table of Contents in this section to diagnose and repair the DTC's.

---

2. CHECK DOOR LOCK MOTOR CIRCUIT

Turn the ignition off.

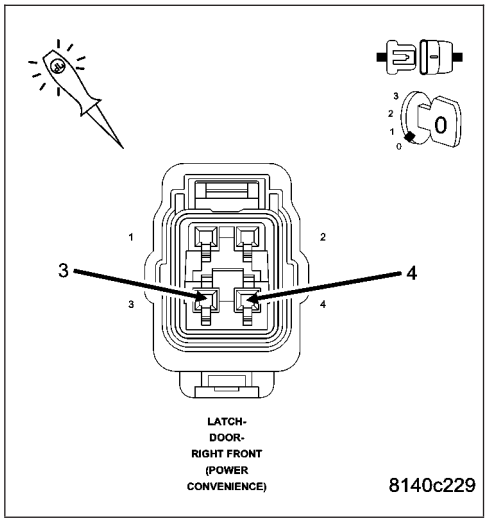
Disconnect the inoperative Door Latch connector.

Connect a 12 volt test light between the Door Lock Driver and the Door Unlock Driver circuits in the latch connector.

NOTE: Graphic shows Right Front Latch – all others similar.

Remove the key from the ignition switch.

Operate the door locks several times in the lock and unlock positions from a door lock switch and observe the test light.



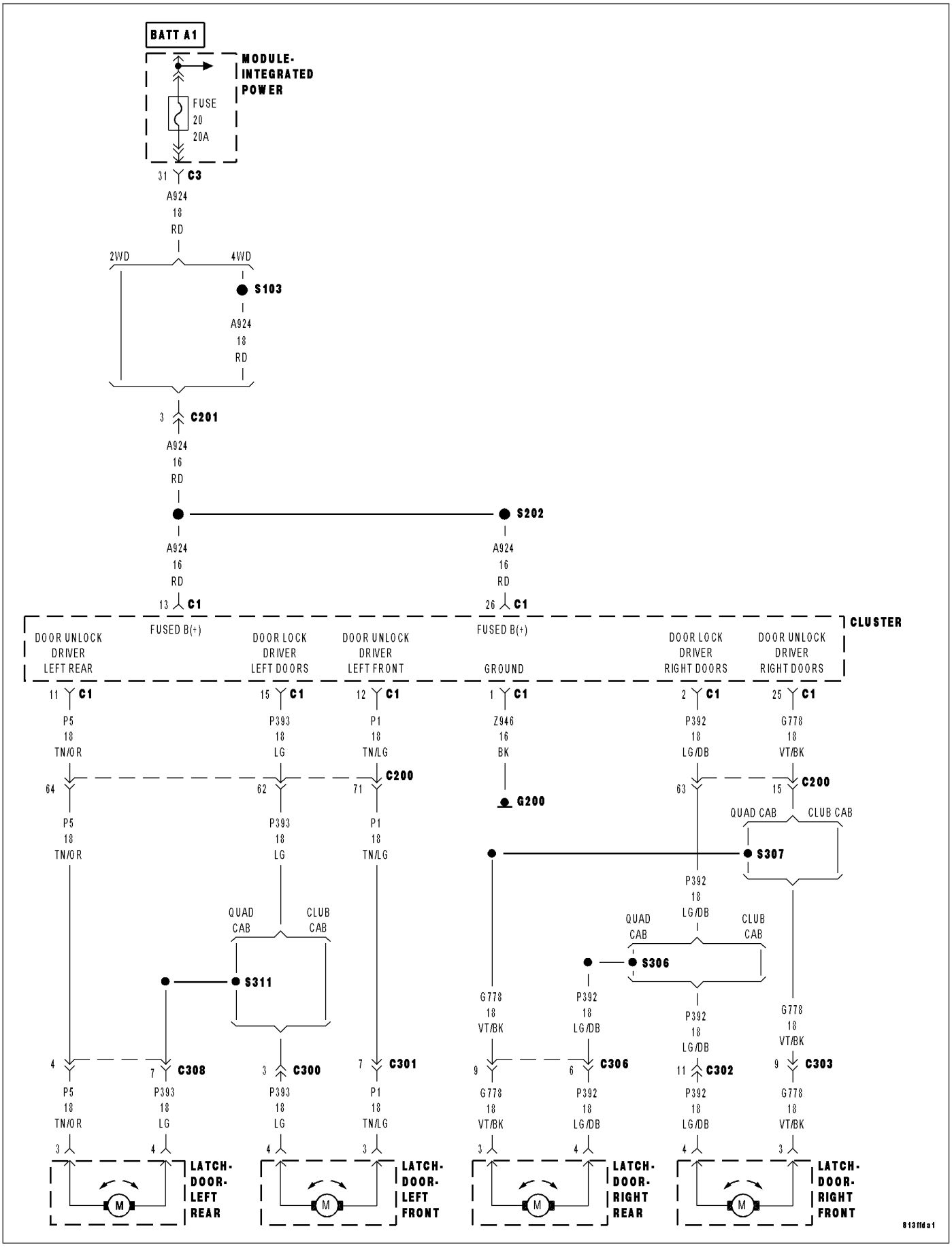
Does the test light illuminate brightly when the locks are actuated in both directions?

Yes >> Replace the Door latch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

No >> Using the wiring diagram/schematic as a guide, repair the appropriate Door Lock Driver or Door Unlock Driver circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

---

*LEFT FRONT LOCKS ONLY – ALL OTHERS INOPERATIVE



***LEFT FRONT LOCKS ONLY – ALL OTHERS INOPERATIVE (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(P1) DOOR UNLOCK DRIVER LEFT FRONT CIRCUIT SHORTED TO GROUND
(P392) DOOR LOCK DRIVER RIGHT DOORS CIRCUIT SHORTED TO (G778) DOOR UNLOCK DRIVER RIGHT DOORS
(P5) DOOR UNLOCK DRIVER LEFT REAR SHORTED TO (P393) DOOR LOCK DRIVER LEFT DOORS
INSTRUMENT CLUSTER

Diagnostic Test

1. CHECK FOR ACTIVE DTC's

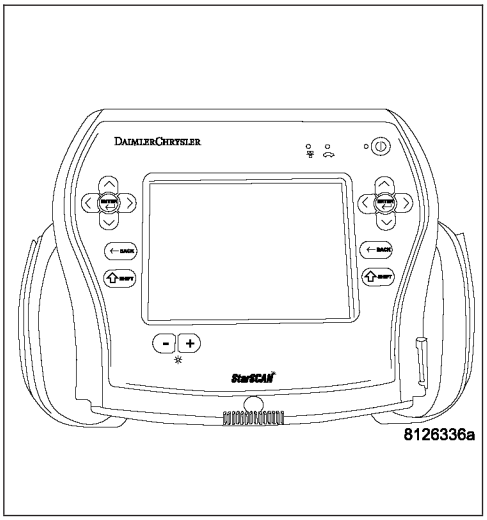
Turn the ignition on.

With the scan tool, read active DTC's.

Does the scan tool display any door lock related DTC's?

No >> Go To 2

Yes >> Refer to symptom list for problems related to Power Door Locks. Diagnose and repair the DTC's



2. CHECK (P1) DOOR UNLOCK DRIVER LEFT FRONT FOR SHORT TO GROUND

Turn the ignition off.

Disconnect the Cluster C1 connector.

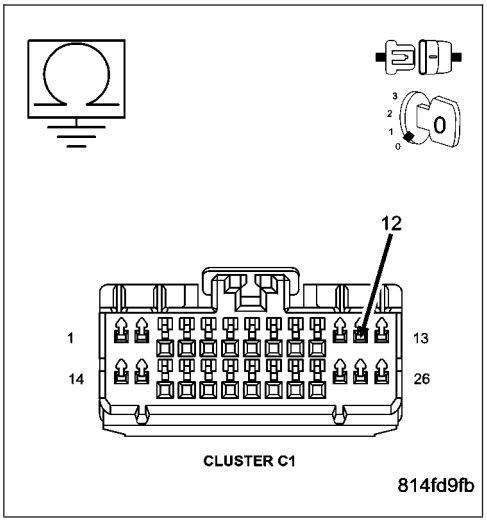
Measure the resistance between ground and the (P1) Door Unlock Driver Left Front circuit.

Is the resistance below 1000.0 ohms?

No >> Go To 3

Yes >> Repair the (P1) Door Unlock Driver Left Front circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)



***LEFT FRONT LOCKS ONLY – ALL OTHERS INOPERATIVE (CONTINUED)**

3. CHECK THE (P5) DOOR UNLOCK DRIVER LEFT REAR FOR A SHORT TO THE (P393) DOOR LOCK DRIVER LEFT DOORS

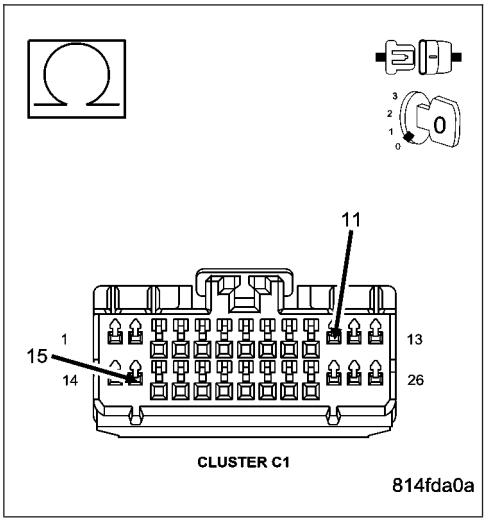
Measure the resistance between the (P5) Door Unlock Driver Left Rear/Liftgate and the (P393) Door Lock Driver Left Doors circuits.

Is the resistance below 2.0 ohms?

No >> Go To 4

Yes >> Repair the (P5) Door Unlock Driver Left Rear circuit for a short to the (P393) Door Lock Driver Left Doors circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)



4. CHECK THE (P392) DOOR LOCK DRIVER RIGHT DOORS CIRCUIT FOR A SHORT TO THE (G778) DOOR UNLOCK DRIVER RIGHT DOORS CIRCUIT

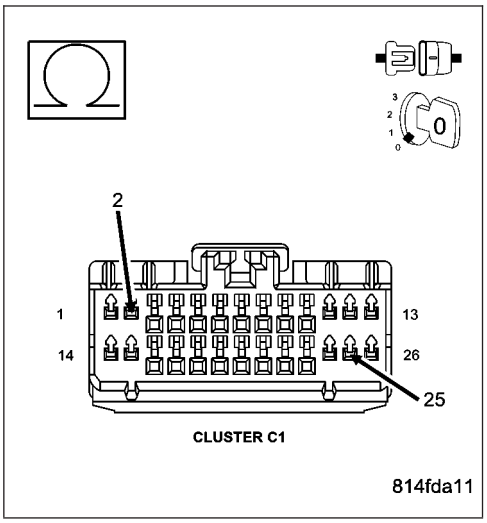
Measure the resistance between the (P392) Door Lock Driver Right Doors circuit and the (G778) Door Unlock Driver Right Doors circuit.

Is the resistance below 2.0 ohms?

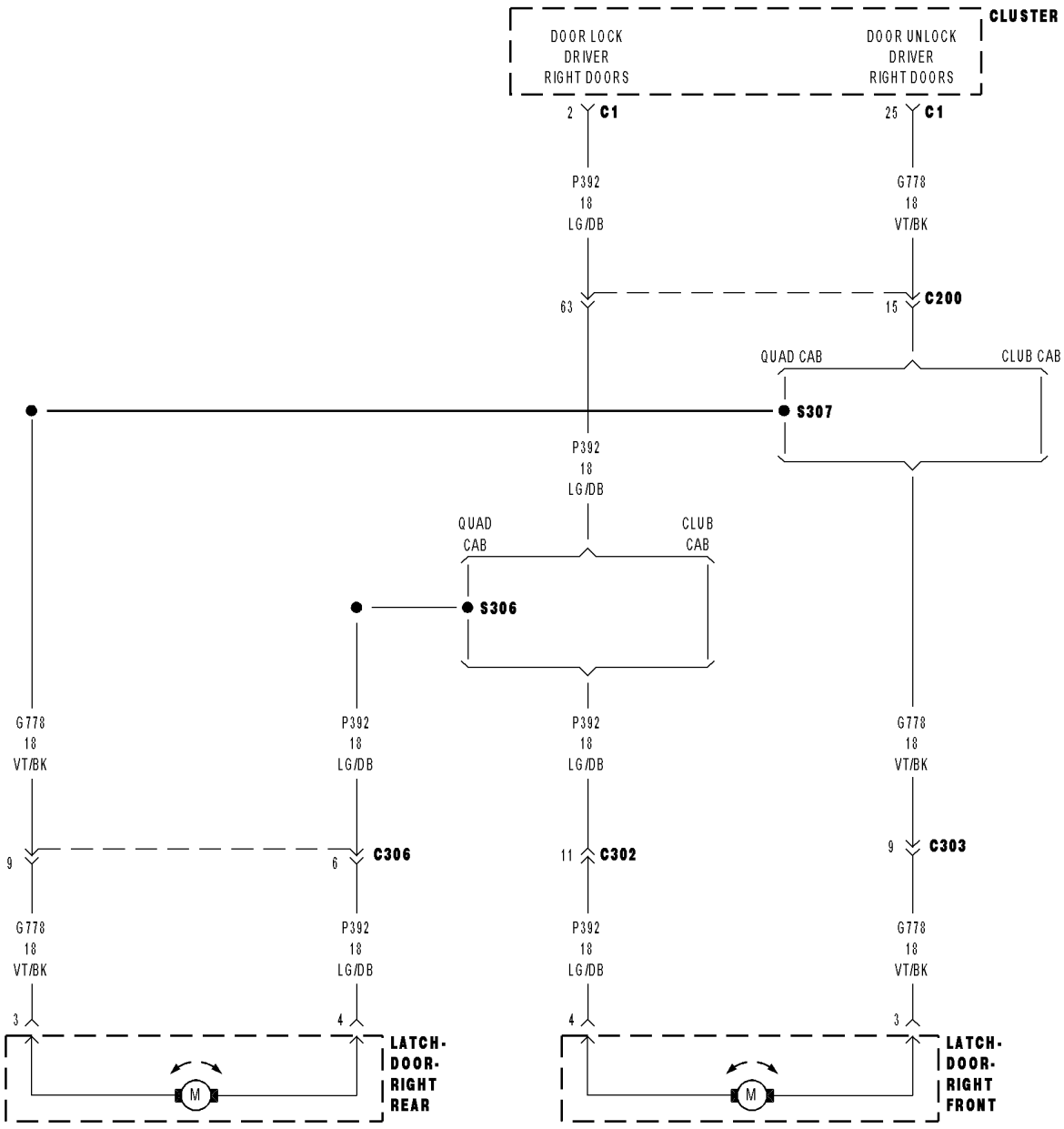
No >> Replace the Instrument Cluster in accordance with service information. Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

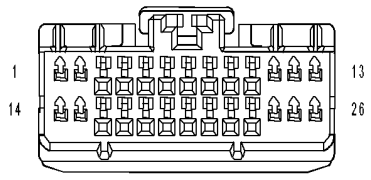
Yes >> Repair the (P392) Door Lock Driver Right Doors circuit for a short to the (G778) Door Unlock Driver Right Doors circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

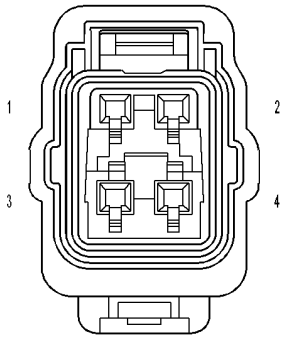


*RIGHT DOORS FAIL TO LOCK AND UNLOCK – QUAD CAB

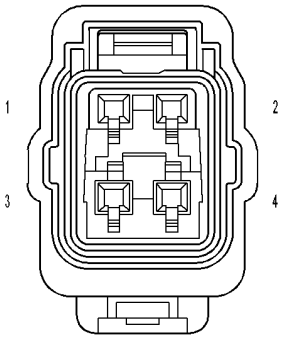




CLUSTER C1



LATCH- DOOR- RIGHT FRONT (POWER CONVENIENCE)



LATCH- DOOR- RIGHT REAR (QUAD CAB POWER CONVENIENCE)

8140c491

***RIGHT DOORS FAIL TO LOCK AND UNLOCK – QUAD CAB (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
DTC PRESENT
(P392) DOOR LOCK DRIVER RIGHT DOORS WIRE OPEN
(G778) DOOR UNLOCK DRIVER RIGHT DOORS WIRE OPEN
DOOR LATCH
INSTRUMENT CLUSTER

Diagnostic Test

1. DTC PRESENT

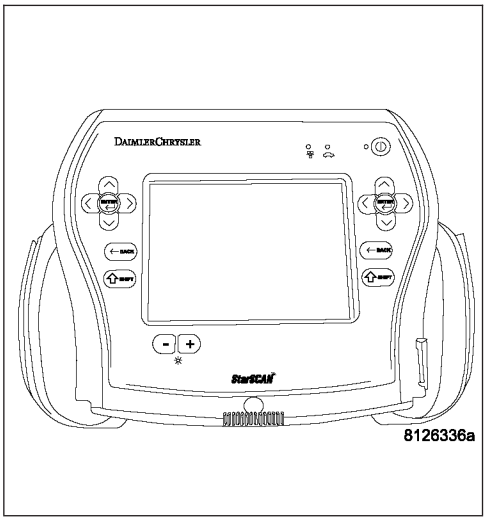
Turn the ignition on.

With the scan tool, read DTC's.

Does the scan tool display any Door Lock related DTC's?

Yes >> Refer to symptom list for problems related to Power Door Locks and diagnose and repair DTC's.

No >> Go To 2



2. INSTRUMENT CLUSTER

Turn the ignition off.

Disconnect the Instrument Cluster C1 connector.

Connect a jumper wire between the (G778) Door Unlock Driver Right Doors circuit in the Instrument Cluster C1 connector and ground.

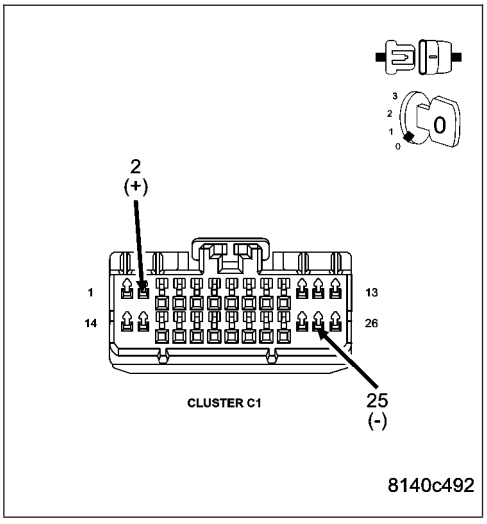
Momentarily connect a fused jumper wire between the Fused B+ circuit and the (P392) Door Lock Driver Right Doors circuit in the Instrument Cluster C1 connector.

Reverse the jumper wires to drive the motors in the opposite direction.

Did the Right Doors lock and unlock?

Yes >> Replace the Instrument Cluster.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Go To 3



*RIGHT DOORS FAIL TO LOCK AND UNLOCK – QUAD CAB (CONTINUED)

3. (P392) DOOR LOCK DRIVER RIGHT DOORS WIRE OPEN

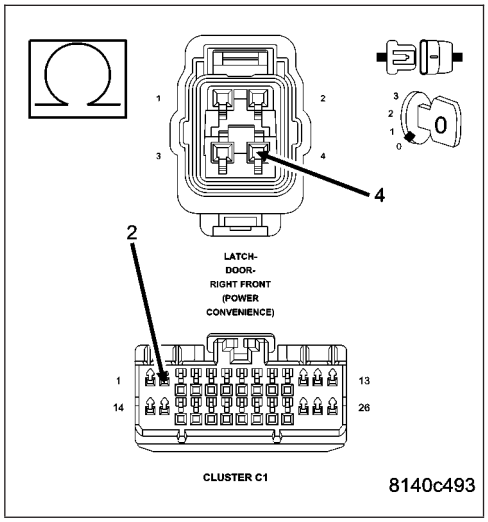
Disconnect the Right Front Door Latch connector.

Measure the resistance of the (P392) Door Lock Driver Right Doors circuit between the Instrument Cluster C1 connector and the Right Front Door Latch connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the (P392) Door Lock Driver Right Doors wire for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



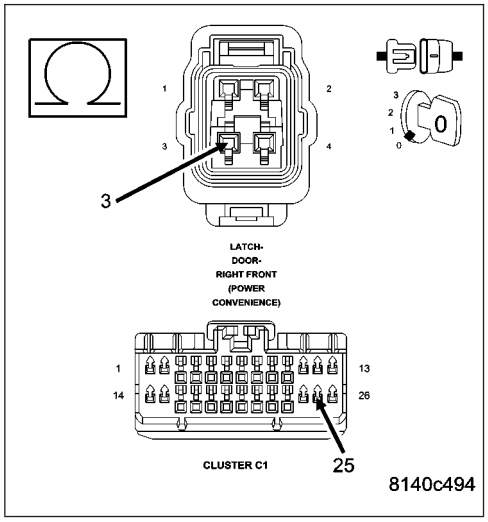
4. (G778) DOOR UNLOCK DRIVER RIGHT DOORS WIRE OPEN

Measure the resistance of the (G778) Door Unlock Driver Right Doors circuit between the Instrument Cluster C1 connector and the Right Front Door Latch connector.

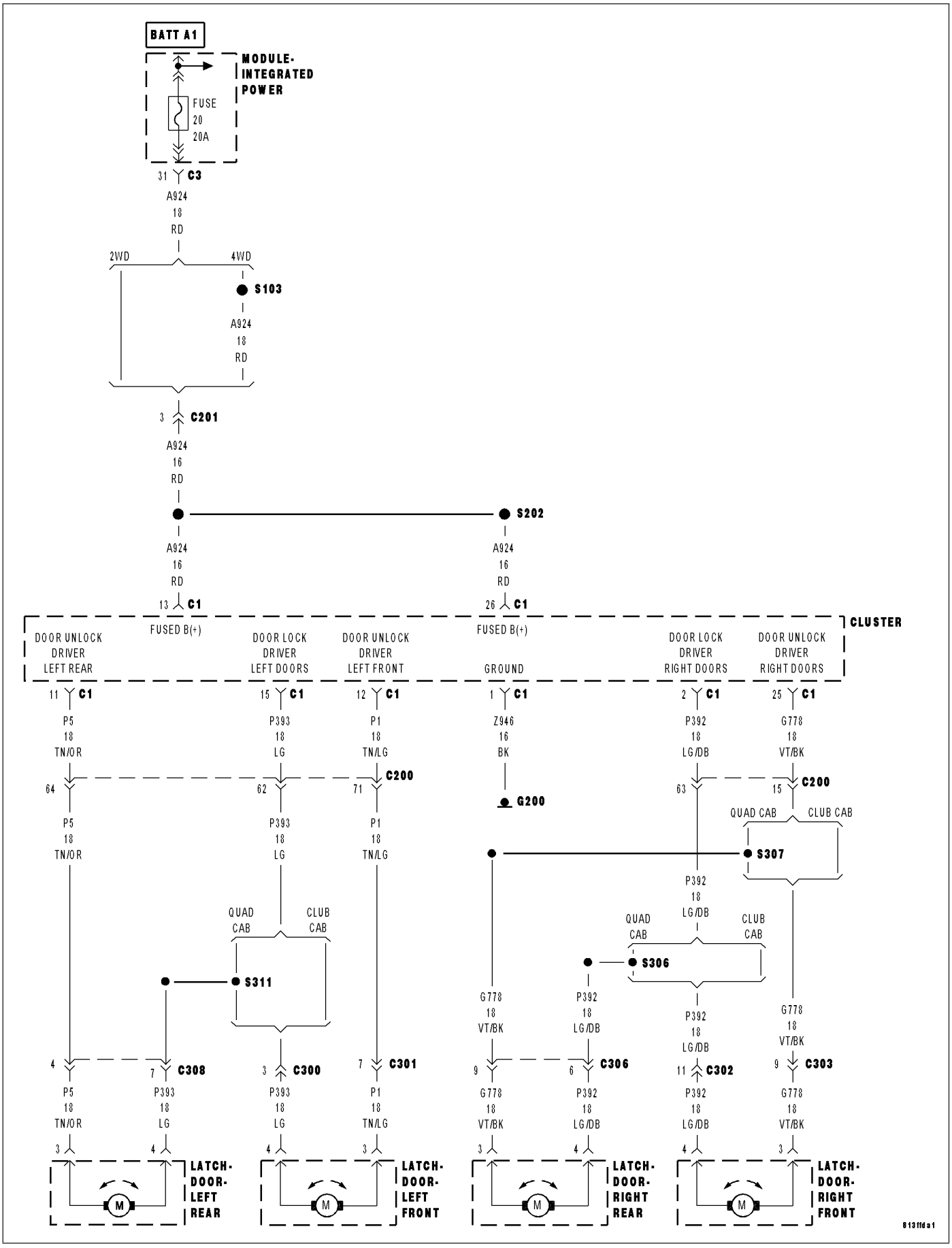
Is the resistance below 5.0 ohms?

Yes >> Replace the Door Latch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Repair the (G778) Door Unlock Driver Right Doors wire for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



*RIGHT DOORS UNLOCK ONLY – QUAD CAB



***RIGHT DOORS UNLOCK ONLY – QUAD CAB (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

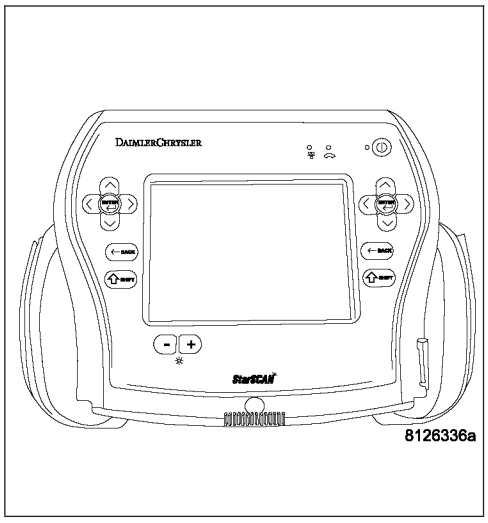
Possible Causes
(P392) DOOR LOCK DRIVER RIGHT DOORS CIRCUIT SHORT TO GROUND
CLUSTER

Diagnostic Test

1. CHECK FOR ACTIVE DTC B182D-ALL DOOR LOCK OUTPUT CIRCUIT SHORTED TO GROUND

Turn the ignition on.

With the scan tool, read active DTC's.



Does the scan tool display any Door Lock related DTC's?

No >> Go To 2

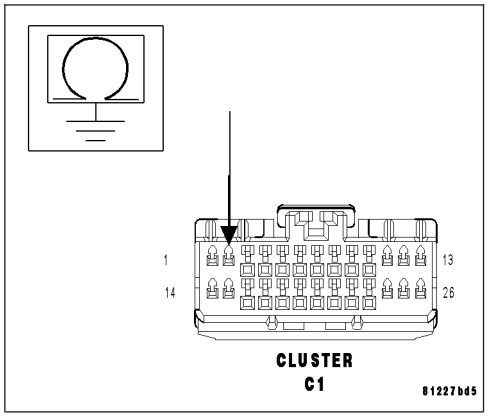
Yes >> Refer to the symptom list for problems related to Power Door Locks. Diagnose and repair the DTC's

2. CHECK (P392) DOOR LOCK DRIVER RIGHT DOORS FOR SHORT TO GROUND

Turn the ignition off.

Disconnect the Cluster C1 connector.

Measure the resistance between ground and the (P392) Door Lock Driver Right Doors circuit.



Is the resistance below 1000.0 ohms?

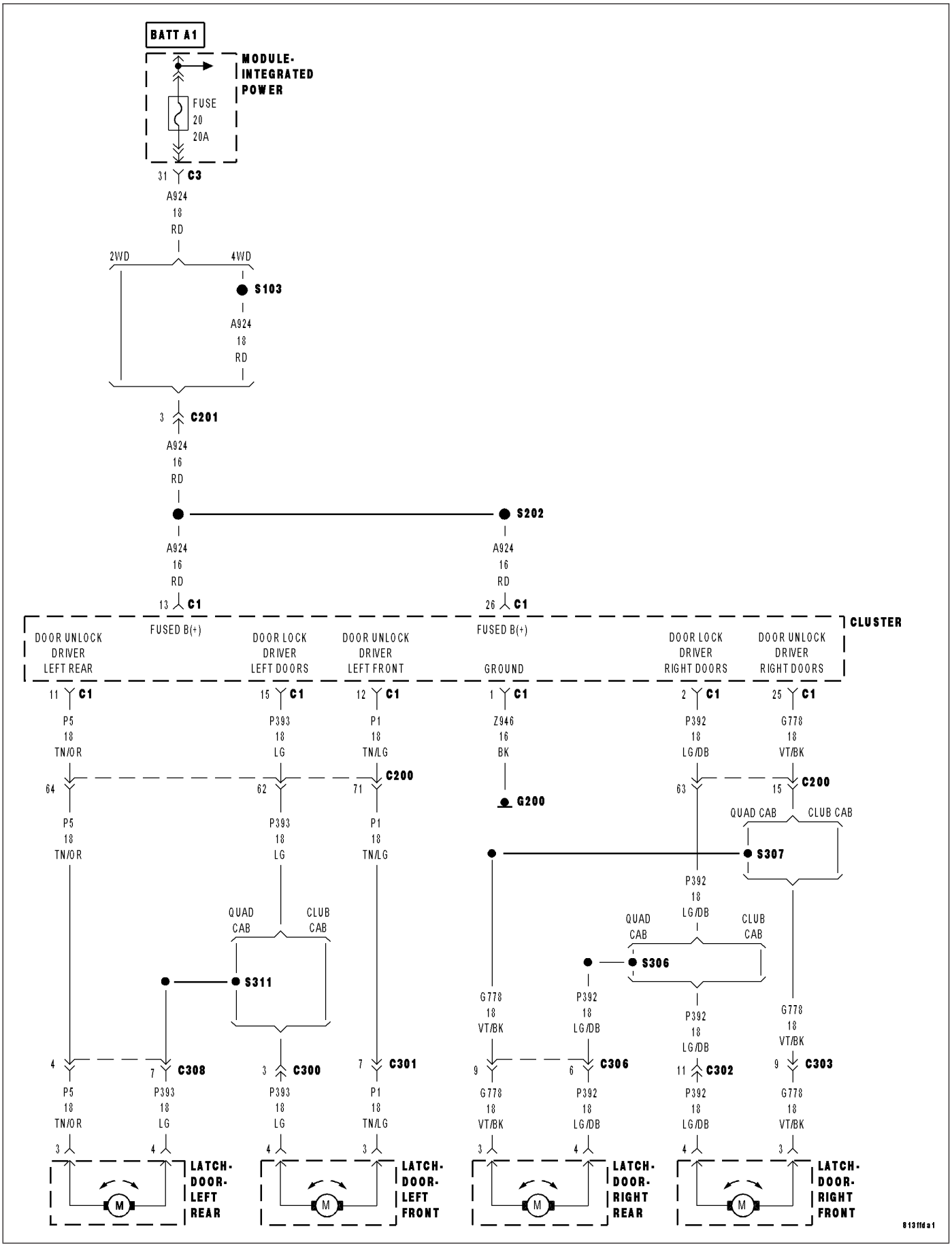
No >> Replace the Cluster in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

Yes >> Repair the (P392) Door Lock Driver Right Doors circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

*RIGHT DOORS LOCK ONLY – QUAD CAB



***RIGHT DOORS LOCK ONLY – QUAD CAB (CONTINUED)**

For the Power Door Lock circuit diagram (Refer to 8 - ELECTRICAL/POWER LOCKS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(G778) DOOR UNLOCK DRIVER RIGHT DOORS CIRCUIT SHORTED TO GROUND
CLUSTER

Diagnostic Test

1. CHECK FOR ACTIVE DTC's

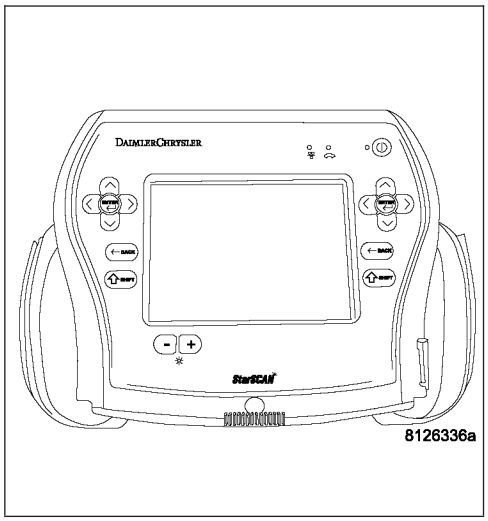
Turn the ignition on.

With the scan tool, read active DTC's.

Does the scan tool display any Door Lock related DTC's?

No >> Go To 2

Yes >> Refer to the symptom list for problems related to Power Door Locks. Diagnose and repair the DTC's.



2. CHECK THE (G778) DOOR UNLOCK DRIVER RIGHT DOORS CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the Cluster C1 connector.

Measure the resistance between ground and the (G778) Door Unlock Driver Right Doors circuit.

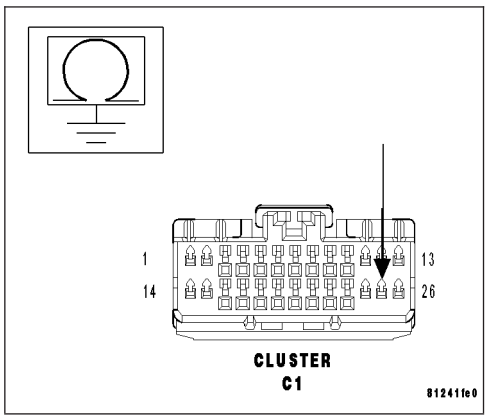
Is the resistance below 1000.0 ohms?

No >> Replace the Cluster in accordance with service information.

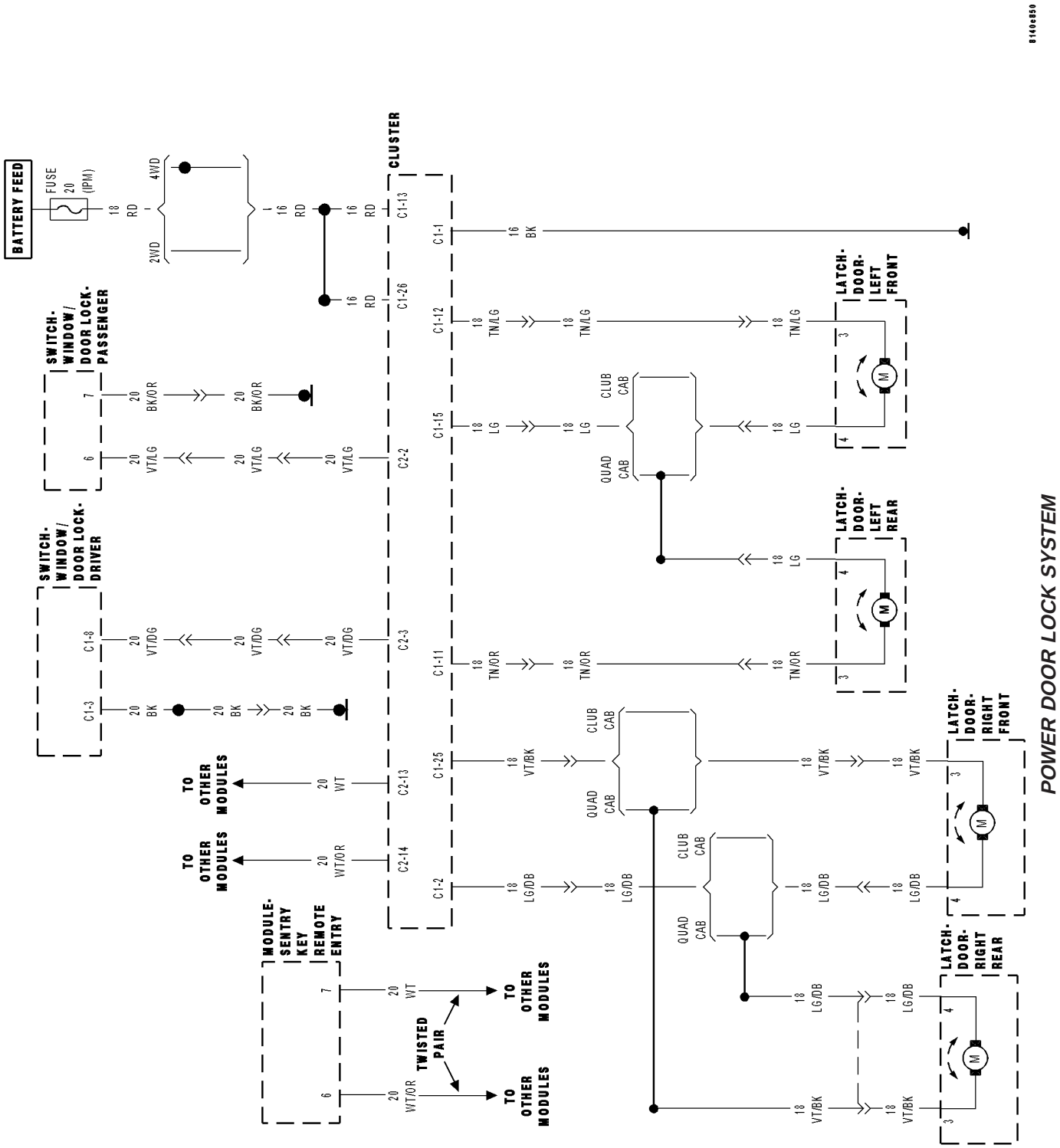
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)

Yes >> Repair the (G778) Door Unlock Driver Right Doors circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING)



SCHEMATICS AND DIAGRAMS



POWER LOCKS - SERVICE INFORMATION

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POWER LOCKS - SERVICE INFORMATION

DESCRIPTION

POWER LOCKS

The power lock system allows all of the doors to be locked or unlocked electrically by operating a switch on either front door trim panel. The power lock system receives non-switched battery current through a fuse in the Integrated Power Module (IPM), so that the power locks remain operational, regardless of the ignition switch position.

The instrument cluster locks the doors automatically when the vehicle is driven beyond the speed of 25.7 Km/h (15 mph), all doors are closed, and the accelerator pedal is depressed. The rolling door lock feature can be disabled if desired.

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences.

The power lock system for this vehicle can also be operated remotely using the Remote Keyless Entry (RKE) transmitters.

DOOR LOCK MOTORS

The lock mechanisms are actuated by a reversible electric motor mounted within each door. The power lock motors are integral to the door latch units.

The power lock motors cannot be adjusted or repaired and, if faulty or damaged, the door latch unit must be replaced.

AUTOMATIC LOCKING/UNLOCKING

The automatic locking system controls powered operation of the door locks and the illuminated entry system. Automatic locking includes the following features:

- Automatic locking of the doors when the vehicle speed exceeds 13 km/h (8 mph).
- Locking prevention with a door lock switch or the RKE transmitter if the key is in the ignition switch and the driver's door is open.
- Driver selectable unlocking mode: unlock only the driver's door or all doors with one press of the RKE transmitter unlock button.
- Automatic illumination of interior courtesy lamps when the vehicle is unlocked.

- Locking all doors by pressing the lock button on the RKE transmitter, or by pressing a lock switch on one of the front doors.

ENHANCED ACCIDENT RESPONSE

In the event of an impact that causes airbag deployment, the Enhanced Accident Response System switches on the interior lamps and unlocks the doors after the vehicle has stopped. This helps emergency personnel render appropriate assistance. The lamps remain on as long as the battery has power or until the ignition key is removed.

REMOTE KEYLESS ENTRY

The Remote Keyless Entry (RKE) system locks and unlocks doors, turns on interior lamps, and arms and disarms the Vehicle Theft Security System (if equipped). The RKE system operates on non-switched battery current through a fuse in the Integrated Power Module (IPM), so that the system remains operational, regardless of the ignition switch position.

The RKE transmitters are also equipped with a Panic button. If the Panic button on the RKE transmitter is depressed, the horn will sound and the exterior lights will flash on the vehicle for about three minutes, or until the Panic button is depressed a second time. A vehicle speed of about 25.7 kilometers-per-hour (15 miles-per-hour) will also cancel the panic event.

The RKE system can also perform other functions on this vehicle. If the vehicle is equipped with the optional Vehicle Theft Security System (VTSS), the RKE transmitter will arm the VTSS when the Lock button is depressed, and disarm the VTSS when the Unlock button is depressed.

The RKE system includes two transmitters when the vehicle is shipped from the factory, but the system can retain the vehicle access codes of up to a total of four transmitters. The transmitter codes are retained in the RKE module memory, even if the battery is disconnected. If an RKE transmitter is inoperative or lost, new transmitter vehicle access codes can be programmed into the system using a scan tool.

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences. Customer programmable feature options affecting the RKE system include:

- **Remote Unlock Sequence** - Allows the option of having only the driver side front door unlock when the RKE transmitter unlock button is depressed the first time. The remaining doors unlock when the button is depressed a second time within 5 seconds of the first unlock press. Another option is having all doors unlock upon the first depression of the RKE transmitter unlock button.
- **Sound Horn on Lock** - Allows the option of having the horn sound a short chirp as an audible verification that the RKE system received a valid lock request from the RKE transmitter, or having no audible verification.
- **Flash Lights with Lock and Unlock** - Allows the option of having the park lamps flash as an optical verification that the RKE system received a valid lock request or unlock request from the RKE transmitter, or having no optical verification.
- **Programming Additional Transmitters** - Allows up to a total of four transmitter vehicle access codes to be stored in the receiver memory.

Certain functions and features of the RKE system rely upon resources shared with other electronic modules in the vehicle over the CAN data bus network. For diagnosis of these electronic modules or of the data bus network, the use of a scan tool and the appropriate diagnostic information are required.

OPERATION

POWER LOCKS

The instrument cluster locks or unlocks the doors when an actuation input signal from a door lock switch is received. The instrument cluster turns on the output drivers and provides a voltage level to the door lock motor for a specified time. All doors can be locked or unlocked using a mechanical button mounted on the door trim panel. The drivers door can be locked or unlocked by using the key cylinder.

DOOR LOCK MOTORS

The door lock motors are controlled by the instrument cluster. A positive and negative battery connection to the two motor terminals will cause the motor to move in one direction. Reversing the current will cause the motor to move in the opposite direction.

REMOTE KEYLESS ENTRY

- **LOCK**: Pressing the LOCK button locks all doors, sounds horn (chirp) once if enabled, flashes the park lamps once if enabled, and arms the Vehicle Theft Security System (VTSS), if enabled. The chirp verifies that the instrument cluster has sent a message for door lock operation. If a door has not been closed before pressing the LOCK button, the vehicle may not be secured and the VTSS (if equipped) will not arm until the door is closed.
- **UNLOCK**: Pressing the UNLOCK button once will unlock the driver's door first if enabled, flashes the park lamps twice if enabled, activates the illuminated entry system, and disarms the Vehicle Theft Security System (VTSS), if equipped. Pressing the UNLOCK button twice within five seconds will unlock all doors, if driver's door first is enabled.
- **PANIC**: Pressing the PANIC button sounds the horns at half second intervals, flashes the exterior lamps, and turns ON the interior lamps. The panic alarm will remain on for three minutes, until the PANIC button is actuated again, or the vehicle speed exceeds 25.7 Km/h (15 mph).

DIAGNOSIS AND TESTING

POWER LOCKS

The most reliable, efficient, and accurate means to diagnose the power lock system requires the use of a scan tool and the proper Diagnostic Procedures information.

Refer to the appropriate wiring information.

Following are tests that will help to diagnose the hard wired components and circuits of the power lock system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the power lock system, the CAN data bus network must be checked.

PRELIMINARY DIAGNOSIS

As a preliminary diagnosis for the power lock system, note the system operation while you actuate both the Lock and Unlock functions with the power lock switches and with the Remote Keyless Entry (RKE) transmitter. Then, proceed as follows:

- If the entire power lock system fails to function with either the power lock switches or the RKE transmitter, check the fuse in the Integrated Power Module (IPM).
- If the power lock system functions with both power lock switches, but not with the RKE transmitter, proceed to diagnosis of the Remote Keyless Entry (RKE) system.
- If the power lock system functions with the RKE transmitter, but not with one or both power lock switches, proceed to diagnosis of the door lock switches.
- If the driver side power lock switch operates only the driver side front door power lock motor, but all other power lock motors operate with the passenger side power lock switch or the RKE transmitter, use a scan tool and the appropriate diagnostic information to diagnose the CAN data bus.
- If only one power lock motor fails to operate with both power lock switches and the RKE transmitter, use a scan tool and the appropriate diagnostic information to diagnose the CAN data bus.

POWER LOCK MOTOR

DESCRIPTION

The lock mechanisms are actuated by a reversible electric motor mounted within each door. The power lock motors are integral to the door latch units.

The power lock motors cannot be adjusted or repaired and, if faulty or damaged, the door latch unit must be replaced.

OPERATION

The door lock motors are controlled by the instrument cluster. A positive and negative battery connection to the two motor terminals will cause the motor to move in one direction. Reversing the current will cause the motor to move in the opposite direction.

DIAGNOSIS AND TESTING

POWER LOCK MOTOR

The most reliable, efficient, and accurate means to diagnose the power lock system requires the use of a scan tool and the proper Diagnostic Procedures information.

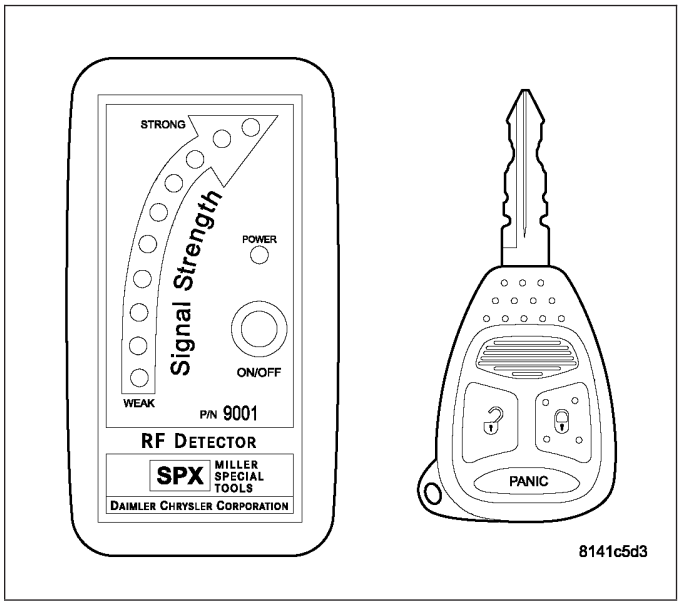
Refer to the appropriate wiring information.

REMOTE KEYLESS ENTRY TRANSMITTER

DIAGNOSIS AND TESTING

REMOTE KEYLESS ENTRY TRANSMITTER

Using special tool 9001, first test to ensure that the transmitter is functioning. Typical testing distance is 2.5 centimeters (1 inch) for Asian transmitters and 30.5 centimeters (12 inches) for all others. To test, position the transmitter as shown. Press any transmitter button, then test each button individually. The tool will beep if a radio signal strength that lights five or more LED's is detected. Repeat this test three times. If transmitter fails any of the test refer to the proper Diagnostic Procedures information.



STANDARD PROCEDURE

REMOTE KEYLESS ENTRY CUSTOMER PREFERENCES

HORN CHIRP DISABLING/ENABLING

The horn chirp can be toggled using a scan tool or by using the Remote Keyless Entry (RKE) transmitter.

To DISABLE (cancel) the horn chirp feature: With the ignition in the ON position, press and hold the transmitter LOCK button for four seconds. While pressing the LOCK button in, press the PANIC button within 6 seconds. Release both buttons when a single chime is heard.

To ENABLE the horn chirp feature, repeat the above procedure.

UNLOCK SEQUENCE

The unlock sequence can be toggled using a scan tool or by using the following procedure.

1. Place the key in the ignition.
2. Within 10 seconds, cycle the key from the OFF position to the ON position four times, ending in the ON position (Do not start the engine).
3. Within 30 seconds, press the driver's door lock switch in the UNLOCK direction. A single chime will be heard to indicate the feature has been disabled.

This will toggle between Driver door first and Unlock all doors function.

To ENABLE this feature, repeat the above procedure.

REMOTE KEYLESS ENTRY TRANSMITTER BATTERIES

The Remote Keyless Entry (RKE) transmitter case snaps open and shut for battery access. To replace the RKE transmitter batteries:

1. Using a trim stick or a thin coin, gently pry at the notch in the center seam of the RKE transmitter case halves until the two halves unsnap.
2. Lift the back half of the transmitter case off of the RKE transmitter.
3. Remove the two batteries from the RKE transmitter.
4. Replace the battery with a new CR2032. Be certain that the battery is installed with the polarity correctly oriented.
5. Align the two RKE transmitter case halves with each other, and squeeze them firmly and evenly together using hand pressure until they snap back into place.

REMOTE KEYLESS ENTRY TRANSMITTER PROGRAMMING

If vehicle is not equipped with Sentry Key Theft Deterrent, new Remote Keyless Entry (RKE) transmitters can be programed using a scan tool and the proper Diagnostic Procedures manual. If vehicle is equipped with Sentry Key Theft Deterrent, the transmitter is automatically programmed when the Sentry Key transponder is programmed (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

SPECIFICATIONS

REMOTE KEYLESS ENTRY TRANSMITTER

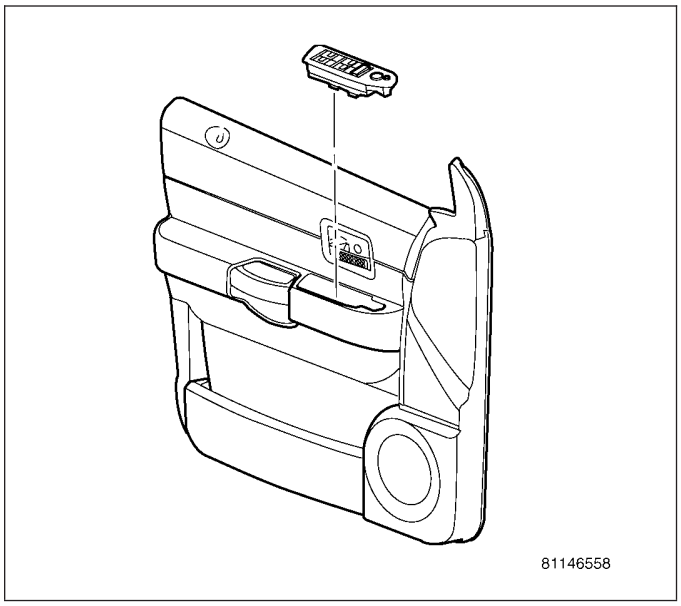
Normal operation range is up to 20 meters (60 feet) of the vehicle. Range may be better or worse depending on the environment around the vehicle.

SWITCH-WINDOW/DOOR LOCK

DESCRIPTION

A window/lock switch located in each front door trim panel. The driver's side window/lock switch includes the following:

- **Lock Switch** - A two-way, momentary, resistor multiplexed switch to control the power lock system.
- **Window Lockout Switch** - A two-way, latching, push-button switch allows the vehicle operator to lock out the window switches on each passenger door so that the passenger door power windows may be operated only from the drivers door switch.
- **Window Switches** - A two-way, momentary window switch for the driver side front door also has a second detent in the Down direction and internal circuitry to provide an Auto-Down feature for the driver side front door window. In addition to the window switch for its own door, the window/lock switch houses individual switches for each passenger door window.



The passenger side window/lock switch includes the following:

- **Lock Switch** - A two-way, momentary, resistor multiplexed switch to control the lock system.
- **Window Switch** - A two-way, momentary window switch for the passenger side front door.

OPERATION

The driver side window/lock switch combines a lock switch, a driver window switch with an Auto-down feature, master switches for each passenger door window, and a window lockout switch.

Lock Switch

The lock switch circuitry is connected in series between ground and the driver door switch mux input of the instrument cluster. Each lock switch position (Lock, Unlock, and Neutral) provides a different resistance value to the instrument cluster input, which allows the instrument cluster to sense the switch position. Based upon the lock switch input, the instrument cluster controls the battery and ground feed outputs to the individual lock motors to lock or unlock the door latches. The Light-Emitting Diode (LED) in the lock switch is connected to battery current through the window circuit breaker in the Integrated Power Module (IPM) on a fused ignition switch output (run-acc) circuit so that the switch will be illuminated whenever the ignition switch is in the On or Accessory positions.

Window Switches

The window switch circuitry is connected to battery current through a circuit breaker in the Integrated Power Module (IPM) on a fused ignition switch output (run-acc) circuit so that the windows will operate whenever the ignition switch is in the On or Accessory positions. Each two-way, momentary master passenger window switch in the window/lock switch provides battery current and ground to the individual window switches on each passenger door so that the window switch controls the battery current and ground feeds to its respective window motor. The switch for the driver side front door window includes an auto-down feature. When this switch is depressed to a second momentary detent position and released, the driver door window is automatically operated through an internal circuit and relay to its fully lowered position. The Auto-down event is cancelled if the switch paddle is depressed a second time in either the Up or Down direction. When the two position window lockout switch in the window/lock switch is depressed and latched in the lockout position, the battery current feed to each of the individual passenger window switches is interrupted so that the passenger door power windows can only be operated from the switches in the window/lock switch. The window lockout switch also controls the battery current feed for the LED in each passenger window switch so that the switch will not be illuminated when it is locked out.

DIAGNOSIS AND TESTING

WINDOW/DOOR LOCK SWITCH

Refer to the appropriate wiring information.

The Light-Emitting Diode (LED) illumination lamps for all of the window/lock switch window and lock switches receive battery current through the circuit breaker in the Integrated Power Module (IPM). If only one LED in the switch is inoperative, replace the switch. If the driver side front door window operates in a normal manner, but the Auto-Down feature is inoperative, replace the window/lock switch.

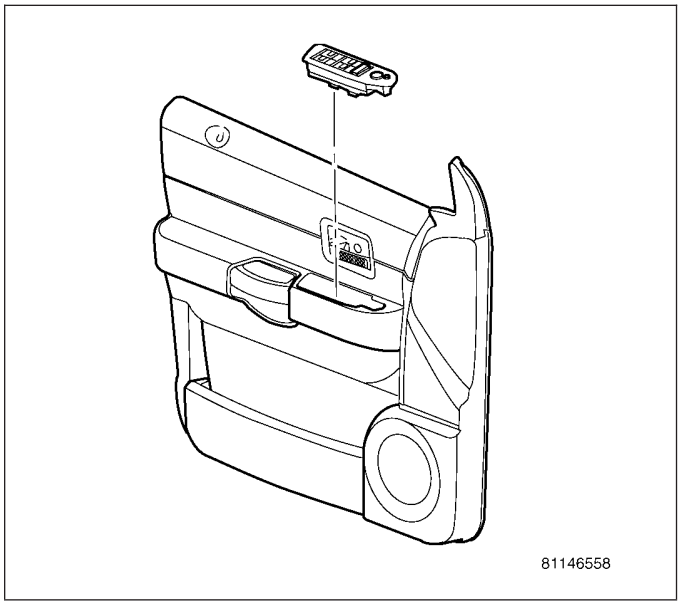
1. Disconnect and isolate the battery negative cable.
2. Remove the window/lock switch from the door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).
3. Disconnect the door wire harness connectors from the switch.
4. Test the switch continuity. See the Switch Tests chart to determine if the continuity is correct for the suspect switches in each switch position. If not OK, replace the window/lock switch as required.

WINDOW/DOOR LOCK SWITCH TEST

POWER LOCK SWITCH	
SWITCH POSITION	**RESISTANCE BETWEEN C-1 PINS 8 & 3**
LOCK	330 OHMS ± 5%
UNLOCK	100 OHMS ± 5%
POWER WINDOW SWITCHES - DRIVER DOOR	
SWITCH POSITION	**CONTINUITY BETWEEN PINS OF C-1**
NEUTRAL	PINS 4 (C1) & 6 (C2) PINS 4 (C1) & 5 (C2) PINS 4 (C1) & 1 (C2) PINS 4 (C1) & 4 (C2) PINS 4 (C1) & 2 (C2)
LEFT FRONT UP	PINS 2 & 7 (C1)
LEFT FRONT DOWN	PINS 2 & 6 (C1)
RIGHT FRONT UP	PINS 2 (C1) & 6 (C2)
RIGHT FRONT DOWN	PINS 2 (C1) & 5 (C2)
LEFT REAR UP	PINS 2 (C1) & 1 (C2)
LEFT REAR DOWN	PINS 2 (C1) & 4 (C2)
RIGHT REAR UP	PINS 2 (C1) & 2 (C2)
RIGHT REAR DOWN	PINS 2 (C1) & 3 (C2)
POWER WINDOW SWITCH - PASSENGER DOOR	
UP	PINS 4 & 3
DOWN	PINS 4 & 2
NEUTRAL	PINS 1 & 2 AND 3 & 8
POWER WINDOW LOCKOUT SWITCH	
SWITCH POSITION	**CONTINUITY BETWEEN**
OFF (SWITCH BUTTON RAISED - NOT DEPRESSED)	PINS 2 AND 5 OF C-1

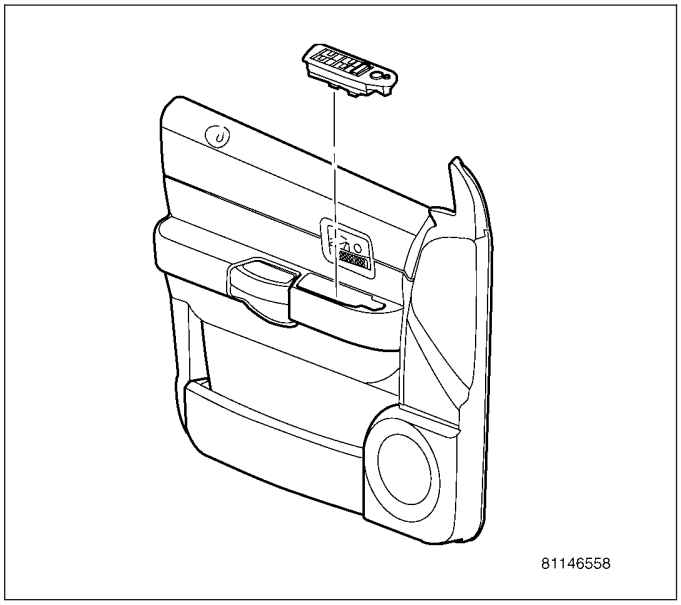
REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Using a trim stick, start at the rear of the switch and pry up to remove from door trim panel.
3. Disconnect electrical harness connectors from switch.



INSTALLATION

1. Connect electrical harness connectors to switch.
2. Insert front end of switch into door trim panel opening. Press into place.
3. Connect battery negative cable.



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POWER MIRRORS - SERVICE INFORMATION

DESCRIPTION

AUTOMATIC DAY/NIGHT MIRROR

The automatic day/night mirror system is able to automatically change the reflectance of the inside rear view mirror in order to reduce the glare of headlamps approaching the vehicle from the rear. The automatic day/night rear view mirror receives battery current through a fuse in the junction block only when the ignition switch is in the On position.

OUTSIDE REAR VIEW MIRROR

The power operated rear view mirrors allow the driver to adjust both outside mirrors electrically from the driver side front seat position by operating a switch on the driver side front door trim panel. The power mirrors receive a non-switched battery feed through a fuse in the junction block so that the system will remain operational, regardless of the ignition switch position.

OPERATION

AUTOMATIC DAY/NIGHT MIRROR

A switch located on the bottom of the automatic day/night mirror housing allows the vehicle operator to select whether the automatic dimming feature is operational. When the automatic day/night mirror is turned on, the mirror switch is lighted by an integral Light-Emitting Diode (LED). The mirror will automatically disable its self-dimming feature whenever the vehicle is being driven in reverse.

DIAGNOSIS AND TESTING

POWER MIRRORS

For complete circuit diagrams, refer to the appropriate wiring information.

1. Check the fuses in the Integrated Power Module (IPM). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse(s).
2. Check for battery voltage at the fuse in the IPM. If OK, go to Step 3. If not OK, repair the open circuit to the IPM as required.
3. Disconnect and isolate the battery negative cable. Remove the wire harness connector from the power mirror switch. Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity in the door wire harness half of the power mirror switch wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit to the IPM as required.

4. Disconnect and isolate the battery negative cable. Check for continuity between the ground circuit cavity in the door wire harness half of the power mirror switch wire harness connector and a good ground. There should be continuity. If OK, (Refer to 8 - ELECTRICAL/POWER MIRRORS/POWER MIRROR SWITCH - DIAGNOSIS AND TESTING) . If not OK, repair open in the ground circuit.

MIRROR-INSIDE REARVIEW

DESCRIPTION

The automatic day/night mirror uses a thin layer of electrochromic material between two pieces of conductive glass to make up the face of the mirror. When the mirror switch is in the On position, two photocell sensors are used by the mirror circuitry to monitor external light levels and adjust the reflectance of the mirror.

OPERATION

The ambient photocell sensor is located on the forward-facing (windshield side) of the rear view mirror housing, and detects the ambient light levels outside of the vehicle. The headlamp photocell sensor is located inside the rear view mirror housing behind the mirror glass and faces rearward, to detect the level of the light being received at the rear window side of the mirror. When the circuitry of the automatic day/night mirror detects that the difference between the two light levels is too great (the light level received at the rear of the mirror is much higher than that at the front of the mirror), it begins to darken the mirror.

The automatic day/night mirror circuitry also monitors the transmission using an input from the backup lamp circuit. The mirror circuitry is programmed to automatically disable its self-dimming feature whenever it senses that the transmission backup lamp circuit is energized.

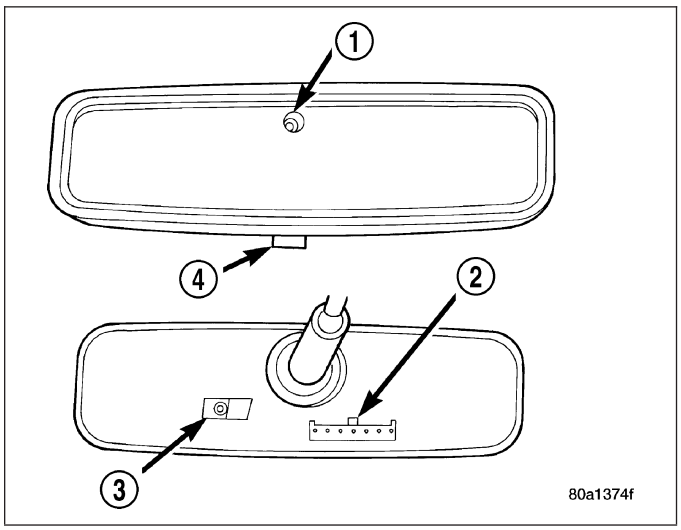
The automatic day/night mirror is a completely self-contained unit and cannot be repaired. If inoperative or damaged, the entire mirror assembly must be replaced.

DIAGNOSIS AND TESTING

MIRROR - INSIDE REARVIEW

For complete circuit diagrams, refer to the appropriate wiring information.

1. Check the fuse in the Integrated Power Module (IPM). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
2. Turn the ignition switch to the On position. Check for battery voltage at the fuse in the junction block. If OK, go to Step 3. If not OK, repair the open circuit to the ignition switch as required.
3. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Unplug the wire harness connector from the mirror. Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the automatic day/night mirror wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit to the IPM as required.
4. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Check for continuity between the ground circuit cavity of the automatic day/night mirror wire harness connector and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the circuit to ground as required.
5. Connect the battery negative cable. Turn the ignition switch to the On position. Apply the parking brake. Place the transmission gear selector lever in the Reverse position. Check for battery voltage at the backup lamp switch output circuit cavity of the mirror wire harness connector. If OK, go to Step 6. If not OK, repair the open circuit as required.
6. Turn the ignition switch to the Off position. Disconnect the battery negative cable. Plug in the mirror



wire harness connector. Connect the battery negative cable. Turn the ignition switch to the On position. Place the transmission gear selector lever in the Neutral position. Place the mirror switch in the On (the LED in the mirror switch is lighted) position. Cover the forward facing ambient photocell sensor to keep out any ambient light.

NOTE: The ambient photocell sensor must be covered completely, so that no light reaches the sensor. Use a finger pressed tightly against the sensor, or cover the sensor completely with electrical tape.

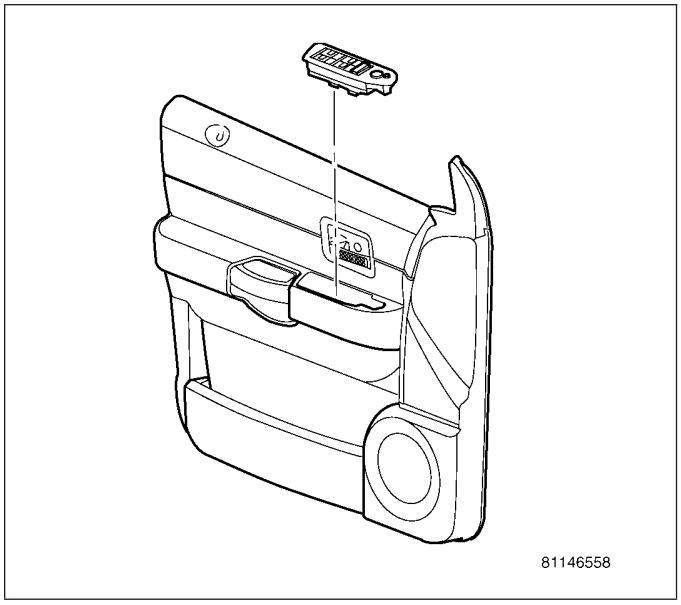
7. Shine a light into the rearward facing headlamp photocell sensor. The mirror glass should darken. If OK, go to Step 8. If not OK, replace the inoperative mirror.
8. With the mirror glass darkened, place the transmission gear selector lever in the Reverse position. The mirror should return to its normal reflectance. If not OK, replace the inoperative mirror.

SWITCH-MIRROR

DESCRIPTION

A power mirror switch is located on the driver's door trim panel, attached to the window/lock switch. The power mirror switch includes the following:

- **Power Mirror Selector Switch -** A three-position rotary joystick switch selects the right or left power mirror for adjustment, or turns the power mirror system Off in the center position.
- **Power Mirror Adjustment Switch -** A momentary joystick directional switch allows the driver to adjust the selected power mirror in the Up, Down, Right or Left directions.



OPERATION

The power mirror switch circuitry is connected to battery current through a fuse in the IPM on a fused B(+) circuit so that the power mirrors remain operational regardless of the ignition switch position. A rotary joystick selector switch has three positions, one to select the right mirror, one to select the left mirror, and a center Off position. After the right or left mirror is selected, the joystick is moved to move the selected mirror Up, Down, Right or Left. The power mirror switch controls the battery current and ground feeds to each of the four (two in each mirror head) power mirror motors.

DIAGNOSIS AND TESTING

SWITCH - MIRROR

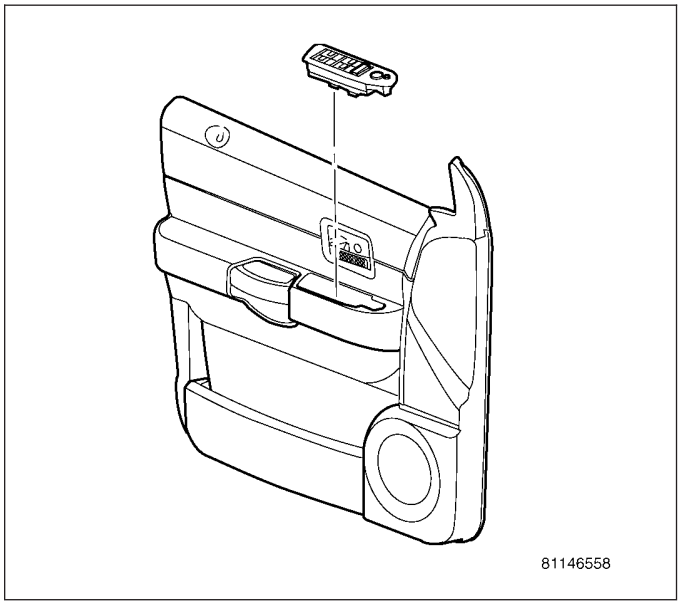
1. Disconnect and isolate the battery negative cable.
2. Remove the power mirror switch (Refer to 8 - ELECTRICAL/POWER MIRRORS/POWER MIRROR SWITCH - REMOVAL).
3. Disconnect the wire harness connector from the switch.
4. Test the switch continuity. See the Switch Tests chart to determine if the continuity is correct for the suspect switch in each switch position. If not OK, replace the inoperative switch as required.

POWER MIRROR SWITCH TEST

SWITCH POSITION	CONTINUITY BETWEEN PINS OF MIRROR SWITCH
LEFT MIRROR SELECTED	
UP	PINS 5 & 7, PINS 4 & 3
DOWN	PINS 4 & 7, PINS 5 & 3
RIGHT	PINS 4 & 9, PINS 5 & 3
LEFT	PINS 4 & 3, PINS 5 & 9
RIGHT MIRROR SELECTED	
UP	PINS 4 & 3, PINS 5 & 6
DOWN	PINS 4 & 6, PINS 5 & 3
RIGHT	PINS 4 & 8, PINS 5 & 3
LEFT	PINS 4 & 3, PINS 5 & 8

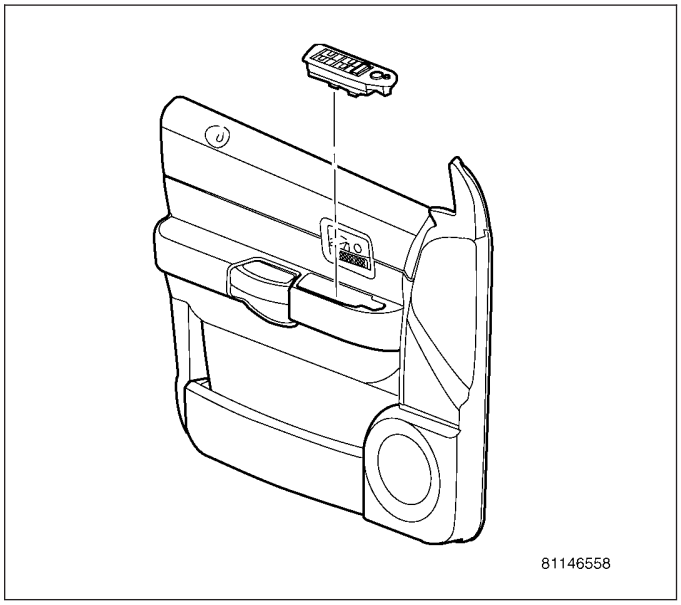
REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the window/lock switch (Refer to 8 - ELECTRICAL/POWER LOCKS/POWER LOCK SWITCH - REMOVAL).
3. Remove the mirror switch from the window/lock switch assembly by twisting switch.



INSTALLATION

1. Install mirror switch to window/lock switch assembly.
2. Connect wire harness connectors to switches.
3. Install window/lock switch assembly (Refer to 8 - ELECTRICAL/POWER LOCKS/POWER LOCK SWITCH - INSTALLATION).
4. Connect battery negative cable.



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POWER SEATS - SERVICE INFORMATION

DESCRIPTION

The power seat system option allows the driver to electrically adjust his seating position for optimum control and comfort using the power seat switches located on the outboard seat cushion side shield. The power seat system allows the seating position to be adjusted forward, rearward, front up, front down, rear up, or rear down. The power seat system receives battery current through a fuse in the Integrated Power Module (IPM), regardless of the ignition switch position. The following components are included in the power seat system:

- Power Seat Switch
- Power Seat Track

OPERATION

When a power seat switch control knob or knobs are actuated, a battery feed and a ground path are applied through the switch contacts to the power seat track. The selected adjuster motor operates to move the seat track through its drive unit in the selected direction until the switch is released, or until the travel limit of the adjuster is reached. When the switch is moved in the opposite direction, the battery feed and ground path to the motor are reversed through the switch contacts. This causes the adjuster motor to run in the opposite direction.

DIAGNOSIS AND TESTING - POWER SEAT SYSTEM

NOTE: Before any testing of the power seat system is attempted, the battery should be fully-charged and all wire harness connections and pins checked to ensure proper continuity and grounds.

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

With the dome lamp on, apply the power seat switch in the direction of the failure. If the dome lamp dims, the seat may be jamming. Check under and behind the seat for binding or obstructions. If the dome lamp does not dim, proceed with testing of the individual components and circuits.

POWER SEAT TRACK

DESCRIPTION

Vehicles equipped with the power seat option, utilize a power seat track. Three reversible DC motors are incorporated into the power seat track. The motors are connected to worm-drive gearboxes that move the seat track through a combination of screw-type drive units.

The front and rear of the seat are operated by different motors. They can be raised or lowered independently of each other. When the center power seat switch is pushed in the Up or Down direction, both the front and rear motors operate in unison.

Each motor contains a self-resetting circuit breaker to protect it from overload. Consecutive or frequent resetting of the circuit breakers must not be allowed to continue, or the motors may be damaged.

The power seat track cannot be repaired, and is serviced only as a complete assembly. If any component in this assembly is inoperative or damaged, the entire power seat track must be replaced, (Refer to 8 - ELECTRICAL/ POWER SEATS/POWER SEAT TRACK - REMOVAL).

OPERATION

When a power seat switch is actuated, a battery feed and a ground path are applied through the power seat switch contacts to the appropriate motor or motors. The motor and drive unit operate to move the seat in the selected direction until the switch is released, or until the travel limit of the power seat track is reached. When the switch is moved in the opposite direction, the battery feed and ground path to the motor is reversed through the switch contacts. This causes the motor to run in the opposite direction.

DIAGNOSIS AND TESTING - POWER SEAT TRACK

NOTE: Before any testing of the power seat system is attempted, the battery should be fully-charged and all wire harness connections and pins checked to ensure proper continuity and grounds.

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

Operate the power seat switch to move all three seat motors in each direction. The seat should move in each of the selected directions. If the power seat track fails to operate in only one direction, move the seat track a short distance in the opposite direction and test again to be certain that the track is not at its travel limit. If the power seat track still fails to operate in only one direction, (Refer to 8 - ELECTRICAL/POWER SEATS/SEAT SWITCH - DIAGNOSIS AND TESTING). If the power seat track fails to operate in more than one direction, proceed as follows:

1. Check the power seat fuse in the power distribution center. If OK, go to Step 2. If not OK, replace the faulty fuse.
2. Remove the power seat switch from the seat. Check for battery voltage at the fused B(+) circuit cavity of the power seat switch wire harness connector. If OK, go to Step 3. If not OK, repair the open circuit to the power distribution center as required.
3. Check for continuity between the ground circuit cavity of the power seat switch wire harness connector and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open circuit to ground as required.
4. Test the power seat switch as described in this group. If the switch tests OK, check the wire harness between the power seat switch and the motor for shorts or opens. If the circuits check OK, replace the faulty power seat track (adjuster) assembly. If the circuits are not OK, repair the wire harness as required.

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the driver side seat assembly from the vehicle (Refer to 23 - BODY/SEATS/SEAT - REMOVAL).
3. Disconnect the power seat wire harness connectors.
4. Disconnect the power seat wire harness retainers from the seat track assembly.
5. Remove the four bolts that secure the power seat track assembly to the seat cushion frame.
6. If the vehicle is equipped with a split bench seat, remove the fasteners that secure the center seat cushion section to the brackets on the power seat track assembly.
7. Remove the power seat track assembly from the seat cushion frame.

CAUTION: Before installing the seat into the vehicle, be certain to adjust the seat fully rearward on its tracks. Then install and tighten the front track mounting screws before installing the rear screws or the tracks may be damaged.

INSTALLATION

1. Position the power seat track assembly on the seat cushion frame and compare the old and replacement seat tracks to be certain the correct part is available.
2. If the vehicle is equipped with a split bench seat, Install the fasteners that secure the center seat cushion section to the brackets on the power seat track assembly.
3. Install the four bolts that secure the power seat track assembly to the seat cushion frame. Torque the bolts to 27 N·m (20 ft. lbs.).
4. Install the power seat wire harness retainers on the seat track assembly.
5. Connect the power seat wire harness connectors.
6. Install the driver side seat assembly in the vehicle. (Refer to 23 - BODY/SEATS/SEAT - INSTALLATION) for the procedure.
7. Connect the battery negative cable.

SWITCH-SEAT-DRIVER

DESCRIPTION

The power seat can be adjusted in six different ways using the power seat switch. The switch is located on the outboard side of the seat cushion side shield.

The individual switches in the power seat switch unit cannot be repaired. If one switch is damaged or inoperative, the entire power seat switch assembly must be replaced.

OPERATION

When a power switch control knob or knobs are actuated, a battery feed and a ground path are applied through the switch contacts to the power seat track or recliner adjuster motor. The selected adjuster motor operates to move the seat track or recliner through its drive unit in the selected direction until the switch is released, or until the travel limit of the adjuster is reached. When the switch is moved in the opposite direction, the battery feed and ground path to the motor are reversed through the switch contacts. This causes the adjuster motor to run in the opposite direction.

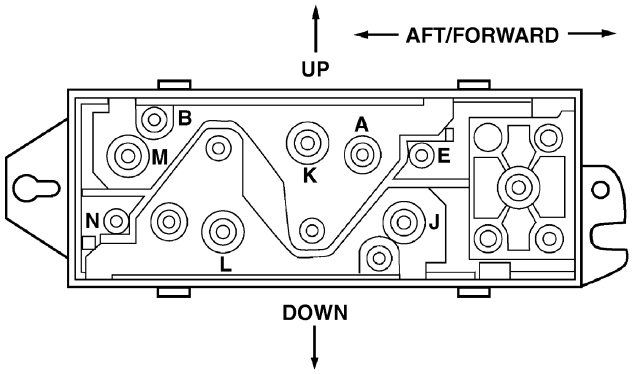
No power seat switch should be held applied in any direction after the adjuster has reached its travel limit. The power seat adjuster motors each contain a self-resetting circuit breaker to protect them from overload. However, consecutive or frequent resetting of the circuit breaker must not be allowed to continue, or the motor may be damaged.

DIAGNOSIS AND TESTING

POWER SEAT SWITCH

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

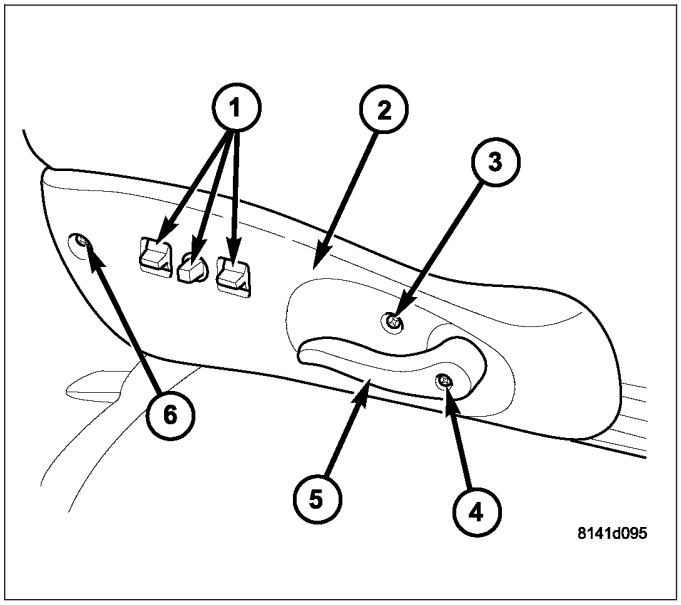
1. Disconnect and isolate the battery negative cable.
2. Remove the power seat switch from the power seat. (Refer to 8 - ELECTRICAL/POWER SEATS/ SEAT SWITCH - REMOVAL) for the appropriate procedure.
3. With assistance from another person, use an ohmmeter to test the continuity of the power seat switches in each position. See the Power Seat Switch schematic and Continuity chart. If OK, (Refer to 8 - ELECTRICAL/POWER SEATS/ POWER SEAT TRACK - DIAGNOSIS AND TESTING) for additional diagnostic procedures. If not OK, replace the inoperative power seat switch assembly.



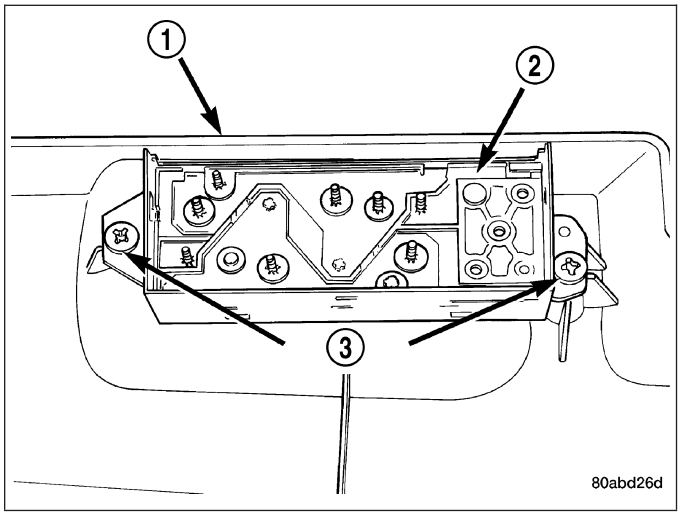
POWER SEAT SWITCH TEST TABLE	
SWITCH POSITION	CONTINUITY BETWEEN
OFF	B & N, B & J, B & M, B & E, B & L, B & K
VERTICAL UP	A & J, A & N, B & M, B &E
VERTICAL DOWN	A & E, A & M, B & N, B & J
HORIZONTAL FORWARD	A & K, B & L
HORIZONTAL AFT	A & L, B & K
FRONT TILT UP	A & J, B & E
FRONT TILT DOWN	A & E, B & J
REAR TILT UP	A & N, B & M
REAR TILT DOWN	A & M, B & N

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the screw (4) that secures the recliner lever (5) to the recliner mechanism release shaft on the outboard side of the driver side front seat cushion side shield (2).
3. Pull the recliner lever (5) off of the recliner mechanism release shaft.
4. Remove the two screws (3) and (6) that secure the driver side seat cushion side shield (2) to the outboard seat cushion frame.
5. Pull the driver side seat cushion side shield (2) away from the seat cushion frame far enough to access the power seat switch assembly (1) wire harness connector.

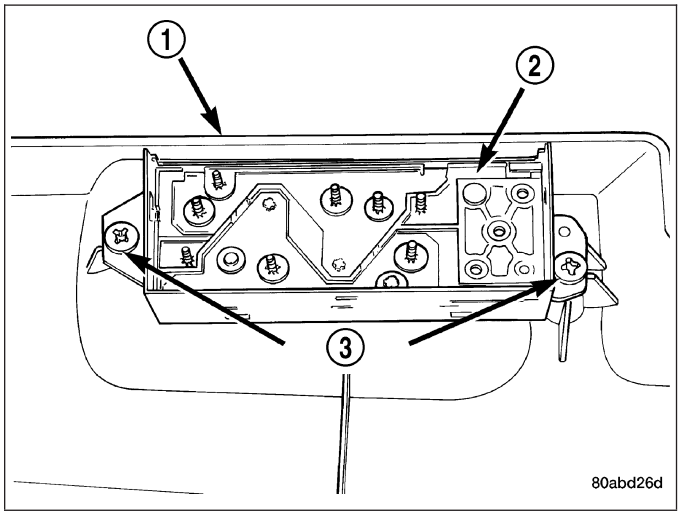


6. Unplug the wire harness connector from the power seat switch module.
7. Remove the seat cushion side shield and power seat switch module from the seat as a unit.
8. Remove the two screws (3) that secure the power seat switch (2) to the inside of the seat cushion side shield (1).
9. Remove the power seat switch from the seat cushion side shield.

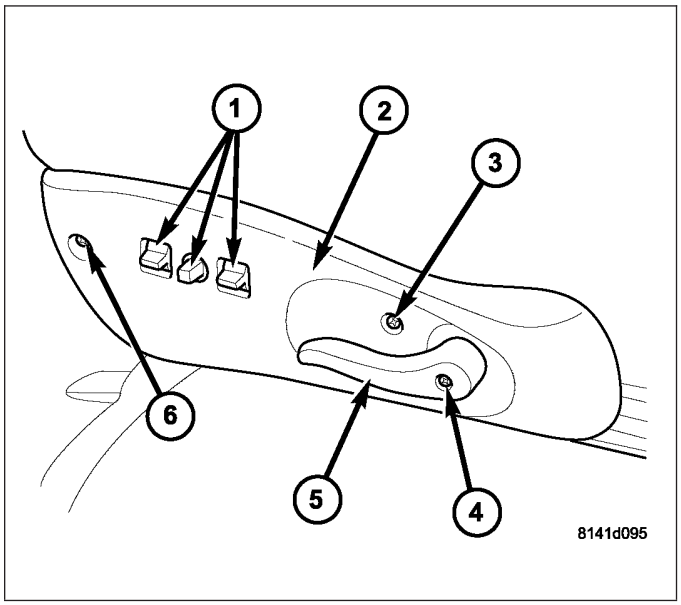


INSTALLATION

1. Install the two screws (3) that secure the power seat switch (2) to the inside of the seat cushion side shield (1).
2. Install the wire harness connector on the power seat switch assembly.



3. position the seat cushion side shield (2) and power seat switch assembly (1) onto the seat frame.
4. Install the seat cushion side shield screws (3) and (6).
5. Install the recliner lever (5) on the recliner mechanism release shaft.
6. Install the screw (4) that secures the recliner lever (5) to the recliner mechanism release shaft on the outboard side of the driver side front seat.
7. Connect the battery negative cable.



POWER WINDOWS

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POWER WINDOWS

DESCRIPTION

The power window system allows each of the door windows to be raised and lowered electrically by actuating a switch on the trim panel of each respective door. A master switch on the driver side front door trim panel allows the driver to raise or lower each of the passenger door windows and to lock out the individual switches on the passenger doors from operation. The power window system receives battery feed through a circuit breaker in the Junction Block (JB), only when the ignition switch is in the On position.

The power window system includes the power window switches on each door trim panel, the circuit breaker, and the power window motors inside each door.

The power window motor and mechanism is integral to the power window regulator unit. If the power window motor or mechanism is inoperative or damaged, the entire power window regulator unit must be replaced. (Refer to 23 - BODY/DOOR - FRONT/WINDOW REGULATOR - REMOVAL) or (Refer to 23 - BODY/DOORS - REAR/WINDOW REGULATOR - REMOVAL) for the window regulator service procedures.

OPERATION

POWER WINDOW SWITCH

The power windows are controlled by a window/lock switch on the trim panel of each front door. Switches in the driver door window/lock switch allows the driver to control the passenger window (s).

The power window switch for the driver side front door window has a second detent position beyond the normal Down position that provides an automatic one-touch window down feature. This feature is controlled by the window/lock switch.

The power window switches control the battery and ground feeds to the power window motors. All of the passenger door power window switches receive their battery and ground feeds through the circuitry of the window/lock switch. When the power window lockout switch is in the Lock position, the battery feed for the individual passenger door power window switches is interrupted.

POWER WINDOW MOTOR

A permanent magnet reversible motor moves the window regulator through an integral gearbox mechanism. A positive and negative battery connection to the two motor terminals will cause the motor to rotate in one direction. Reversing the current through these same two connections will cause the motor to rotate in the opposite direction.

In addition, each power window motor is equipped with an integral self-resetting circuit breaker to protect the motor from overloads. The power window motor and gearbox assembly cannot be repaired and, if inoperative or damaged, the power window regulator must be replaced.

DIAGNOSIS AND TESTING

POWER WINDOWS

For complete circuit diagrams, refer to the appropriate wiring information.

ALL WINDOWS INOPERATIVE

1. Check the circuit breaker. If OK, go to Step 2. If not OK, replace the inoperative circuit breaker.
2. Disconnect and isolate the battery negative cable. Remove the window/lock switch from the driver side front door trim panel. Unplug the wire harness connector.
3. Check for continuity between the ground circuit cavity of the door module wire harness connector and a good ground. If OK, go to Step 4. If not OK, repair the circuit to ground as required.
4. Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) circuit cavity of the window/lock switch wire harness connector. If OK, (Refer to 8 - ELECTRICAL/POWER LOCKS/POWER LOCK SWITCH - DIAGNOSIS AND TESTING). If not OK, repair the circuit as required.

ONE WINDOW INOPERATIVE

The window glass must be free to slide up and down for the power window motor to function properly. If the glass is not free to move up and down, the motor will overload and trip the integral circuit breaker. To determine if the glass is free, disconnect the regulator from the glass. Then slide the window up and down by hand.

There is an alternate method to check if the glass is free. Position the glass between the up and down stops. Then, shake the glass in the door. Check that the glass can be moved slightly from side to side, front to rear, and up and down. Then check that the glass is not bound tight in the tracks. If the glass is free, proceed with the diagnosis that follows. If the glass is not free, determine the cause of the condition.

If the only inoperative window is in the driver or passenger side front door and the preceding checks have not identified a problem, (Refer to 8 - ELECTRICAL/POWER WINDOWS/WINDOW MOTOR - DIAGNOSIS AND TESTING). If the problem being diagnosed involves only the Auto-down feature for the driver side front door window, but all of the power windows are operational, replace the driver's side window/lock switch. For diagnosis of the window/lock switch, (Refer to 8 - ELECTRICAL/POWER LOCKS/POWER LOCK SWITCH - DIAGNOSIS AND TESTING). For a rear power window problem proceed with the following:

1. Disconnect and isolate the battery negative cable. Unplug the wire harness connector from the power window switch unit on the door with the inoperative power window. Check for continuity between the ground circuit cavity of the power window switch wire harness connector and a good ground. There should be continuity. If OK, go to Step 2. If not OK, repair the open circuit to the power window and door lock master switch as required.
2. Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) circuit cavity in the body half of the power window switch unit wire harness connector. If OK, go to Step 3. If not OK, repair the open circuit to the window / door lock switch as required.
3. Test the power window switch continuity (Refer to 8 - ELECTRICAL/POWER LOCKS/POWER LOCK SWITCH - DIAGNOSIS AND TESTING) or (Refer to 8 - ELECTRICAL/POWER WINDOWS/POWER WINDOW SWITCH - DIAGNOSIS AND TESTING). If OK, go to Step 4. If not OK, replace the power window switch.
4. Check the continuity in each circuit between the inoperative power window switch wire harness connector cavities and the corresponding power window motor wire harness connector cavities. If OK, (Refer to 8 - ELECTRICAL/POWER WINDOWS/WINDOW MOTOR - DIAGNOSIS AND TESTING). If not OK, repair the open circuit(s) as required.

NOTE: All passenger door power window switches receive their battery and ground feed for operating the passenger door power window motors through the driver side power window and lock master switch and wire harness connector.

SWITCH-POWER WINDOW

DIAGNOSIS AND TESTING

POWER WINDOW SWITCH

For complete circuit diagrams, refer to the appropriate wiring information.

The front door power window switches are included in the window/lock switch (Refer to 8 - ELECTRICAL/ POWER LOCKS/POWER LOCK SWITCH - DIAGNOSIS AND TESTING).

The Light-Emitting Diode (LED) illumination lamps for all of the power window switch knobs receive battery current through the power window circuit breaker in the junction block. If all of the LEDs are inoperative in the power window switch and the power windows are inoperative, (Refer to 8 - ELECTRICAL/POWER WINDOWS - DIAGNOSIS AND TESTING). If the power windows operate, but any or all of the LEDs are inoperative, the power window and lock switch units with the inoperative LED(s) must be replaced.

1. Check the fuse and the circuit breaker. If OK, go to Step 2. If not OK, replace the fuse or circuit breaker.
2. Turn the ignition switch to the On position. Check for battery voltage at the fuse in the Integrated Power Module (IPM). If OK, turn the ignition switch to the Off position and go to Step 3. If not OK, check circuit breaker and repair the circuit to the ignition switch as required.
3. Disconnect and isolate the battery negative cable. Remove the power window switch from the door trim panel. Unplug the wire harness connector from the switch.
4. Test the power window switch continuity. See the Power Window Switch Continuity chart to determine if the continuity is correct in the Neutral, Up and Down switch positions. If OK, (Refer to 8 - ELECTRICAL/POWER WINDOWS - DIAGNOSIS AND TESTING). If not OK, replace the inoperative switch.

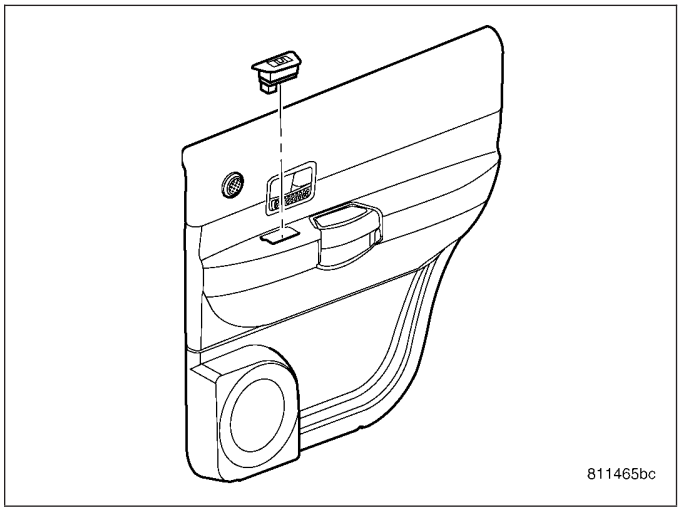
REAR POWER WINDOW SWITCH CONTINUITY CHART

SWITCH POSITION	CONTINUITY BETWEEN
NEUTRAL	PIN 3 & 4, PIN 1 & 2
UP	PIN 6 & 3, PIN 1 & 2
DOWN	PIN 6 & 2, PIN 3 & 4

REMOVAL

The driver and front passenger side power window switch is included in the window/lock switch. (Refer to 8 - ELECTRICAL/POWER LOCKS/POWER LOCK SWITCH - REMOVAL) for the service procedures.

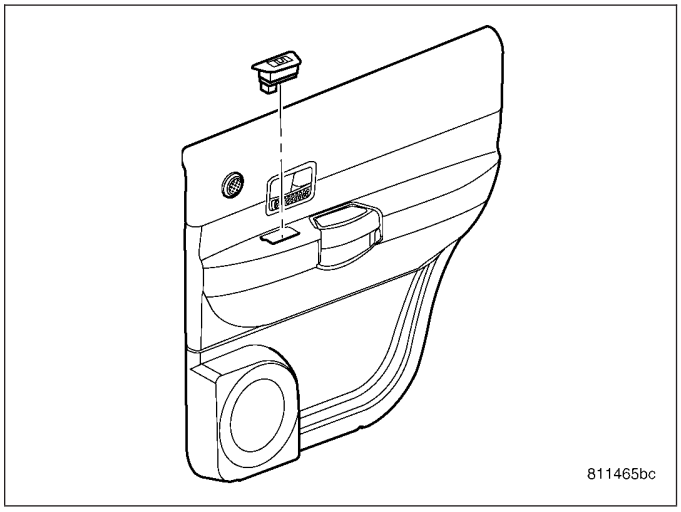
1. Disconnect and isolate the battery negative cable.
2. Remove the door trim panel (Refer to 23 - BODY/ DOORS - REAR/TRIM PANEL - REMOVAL).
3. Remove switch from door trim panel.



INSTALLATION

The driver and front passenger side power window switch is included in the window/lock switch. (Refer to 8 - ELECTRICAL/POWER LOCKS/POWER LOCK SWITCH - INSTALLATION).

1. Install the switch to the door trim panel.
2. Install the door trim panel (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION).
3. Connect the battery negative cable.



MOTOR-WINDOW

DIAGNOSIS AND TESTING

WINDOW MOTOR

For complete circuit diagrams, refer to the appropriate wiring information.

1. Disconnect and isolate the battery negative cable. Remove the trim panel from the door with the inoperative power window.
2. Unplug the power window motor wire harness connector. Apply 12 volts across the motor terminals to check its operation in one direction. Reverse the connections across the motor terminals to check the operation in the other direction. If the window is in the full up or full down position, the motor will not operate in that direction by design. If OK, repair the circuits from the power window motor to the power window switch as required. If not OK, replace the inoperative motor.
3. If the motor operates in both directions, check the operation of the window glass and lift mechanism through its complete up and down travel. There should be no binding or sticking of the window glass or lift mechanism through the entire travel range. If not OK, check the window glass, tracks, and regulator for sticking, binding, or improper adjustment.

REMOVAL

The power window motor is integral to the power window regulator unit. If the power window motor is inoperative or damaged, the entire power window regulator unit must be replaced. (Refer to 23 - BODY/DOOR - FRONT/WINDOW REGULATOR - REMOVAL) or (Refer to 23 - BODY/DOORS - REAR/WINDOW REGULATOR - REMOVAL) for the window regulator service procedures.

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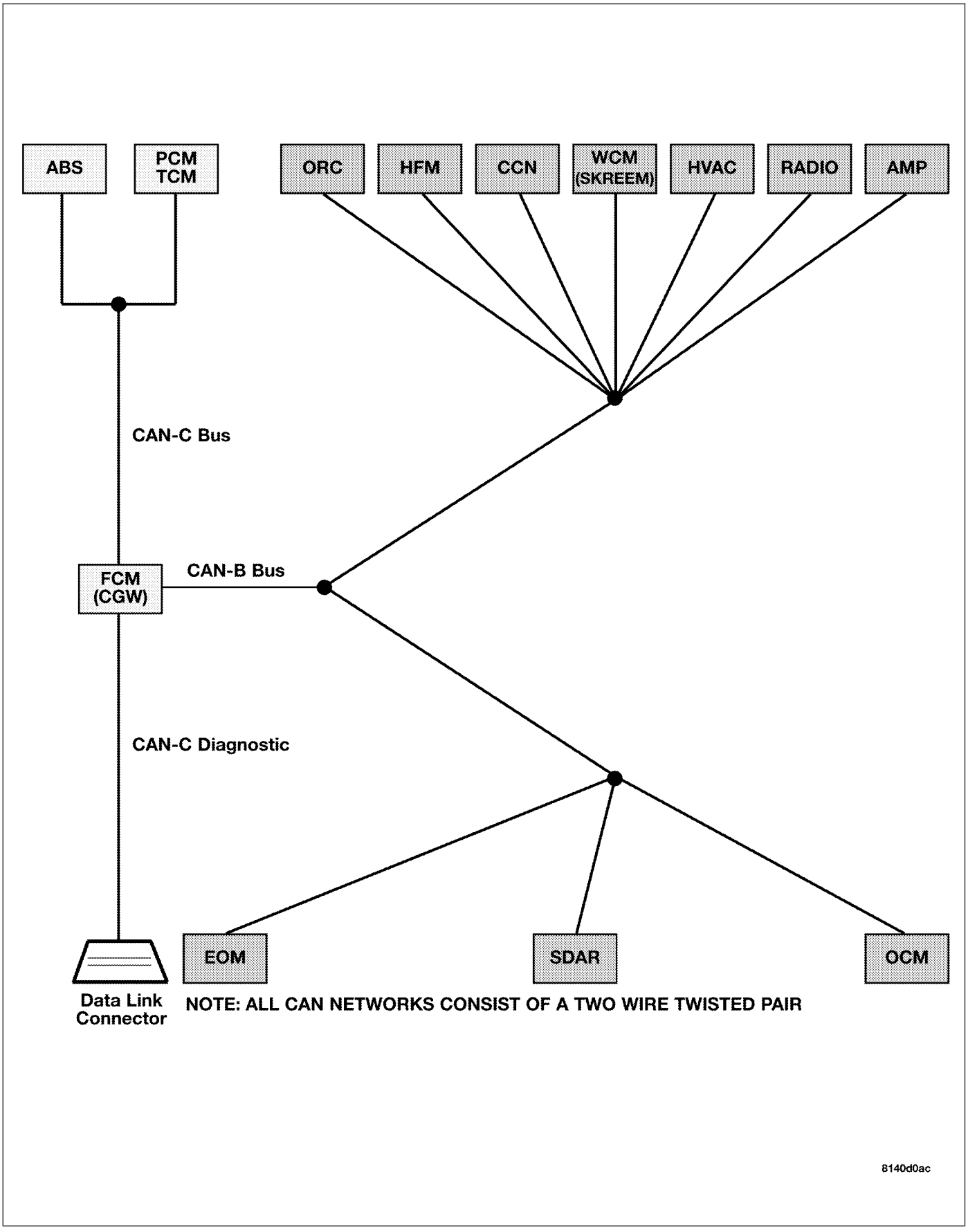
DIAGNOSIS AND TESTING

B1203-SRS WARNING INDICATOR CIRCUIT/PERFORMANCE



B1203-SRS WARNING INDICATOR CIRCUIT/PERFORMANCE (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the CAN B bus for a message from the Instrument Cluster containing the airbag warning indicator status. The ORC requests the warning lamp status from the Instrument Cluster once every second.
- **Set Condition:**
  This DTC will set immediately if the indicator status is LOW or HIGH.

Possible Causes
INSTRUMENT CLUSTER ACTIVE DTCs
ORC

Diagnostic Test

1. CHECK FOR AN ACTIVE DTC

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.
With the scan tool, read ORC DTCs.

Select DTC type.

Active
Go To 2

Stored
Go To 4

---

2. CHECK FOR INSTRUMENT CLUSTER DTCs

With the scan tool, read Instrument Cluster DTCs.

Does the scan tool display any Instrument Cluster DTCs?

Yes >> Refer to the symptom list for problems related to the Instrument Cluster.
Perform the ORC VERIFICATION TEST-VER 1.

No >> Go To 3

---

3. REPLACE THE ORC

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

Repair
Replace the ORC in accordance with the service information.
Perform the ORC VERIFICATION TEST-VER 1.

B1203-SRS WARNING INDICATOR CIRCUIT/PERFORMANCE (CONTINUED)

4. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

Does the scan tool display any ACTIVE DTCs?

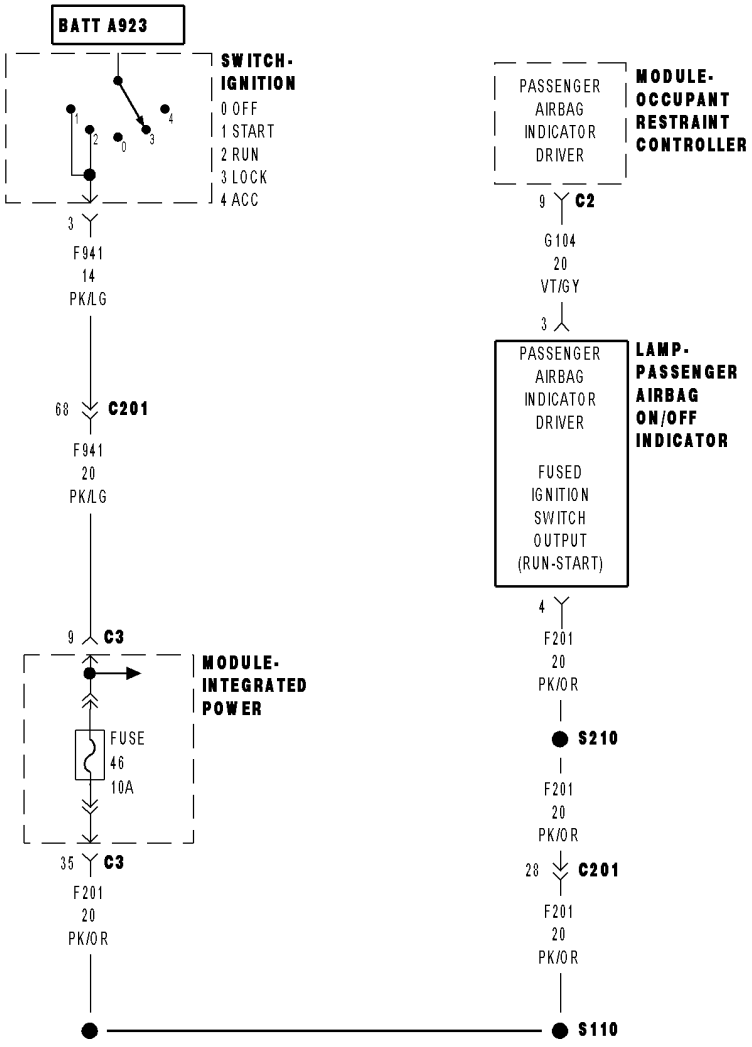
Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

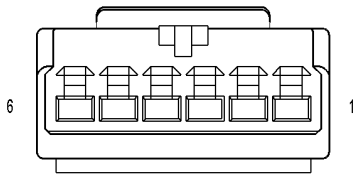
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1204-PASSENGER AIRBAG INDICATOR CIRCUIT LOW

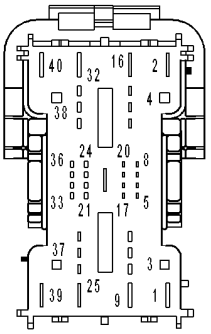
Perform the B1206-PASSENGER AIRBAG INDICATOR CIRCUIT OPEN test. (Refer to 8 - ELECTRICAL/RESTRAINTS - DIAGNOSIS AND TESTING)

B1205-PASSENGER AIRBAG INDICATOR CIRCUIT HIGH

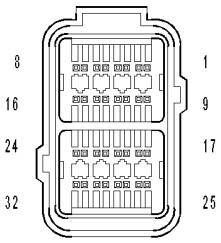




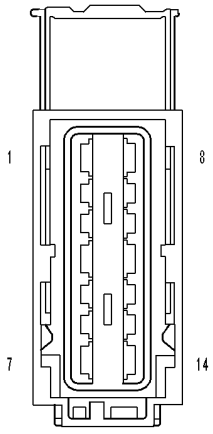
LAMP-
PASSENGER
AIRBAG
ON/OFF
INDICATOR



MODULE-
INTEGRATED
POWER C3



MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2



SWITCH-
IGNITION

8142d9b1

B1205-PASSENGER AIRBAG INDICATOR CIRCUIT HIGH (CONTINUED)

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  1. If the Occupant Restraint Controller (ORC) senses a low resistance to battery voltage on the (G104) Passenger Airbag Indicator Driver circuit. **NOTE: Use the B1205-PASSENGER AIRBAG INDICATOR CIRCUIT HIGH diagnostic test to repair the B1207-PASSENGER AIRBAG INDICATOR CIRCUIT SHORTED TOGETHER trouble code. The Scan Tool will display both DTCs for a single problem.**

Possible Causes
(G104) PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT SHORTED TO (F23) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT
(G104) PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT SHORTED TO VOLTAGE
PASSENGER AIRBAG ON/OFF INDICATOR LAMP
ORC

Diagnostic Test

1. VERIFY THAT DTC B1205 PASSENGER AIRBAG INDICATOR CIRCUIT HIGH IS ACTIVE

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read ORC DTCs.

NOTE: B1207-PASSENGER AIRBAG INDICATOR CIRCUIT SHORTED TOGETHER

Does the scan tool display active: B1205 PASSENGER AIRBAG INDICATOR CIRCUIT HIGH?

Yes >> Go To 2

No >> Go To 6

B1205-PASSENGER AIRBAG INDICATOR CIRCUIT HIGH (CONTINUED)

2. CHECK (G104) PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT FOR A SHORT TO (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

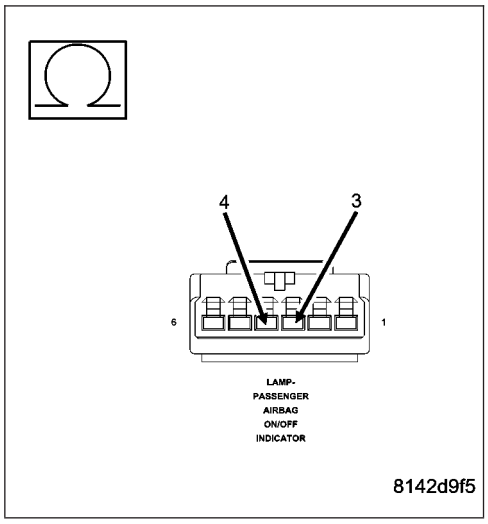
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Remove the Airbag Run-Start Fuse from the PDC.

Disconnect the ORC C1 and C2 connectors.

Disconnect the OCM C1 connector.

Disconnect the Switch Bank connector.



NOTE: Check connectors - Clean and repair as necessary.

Connect the appropriate Load Tool ORC Adaptor to the ORC connectors.

Measure the resistance between the (G104) Passenger Airbag Indicator Driver circuit and the (F201) Fused Ignition Switch Output (Run-Start) circuit in the Switch Bank connector.

Is the resistance below 100.0 ohms?

Yes >> Repair the (G104) Passenger Airbag Indicator Driver circuit for a short to the (F201) Fused Ignition Switch Output (Run-Start) circuit.
Perform ORC VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. CHECK (G104) PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT FOR A SHORT TO VOLTAGE

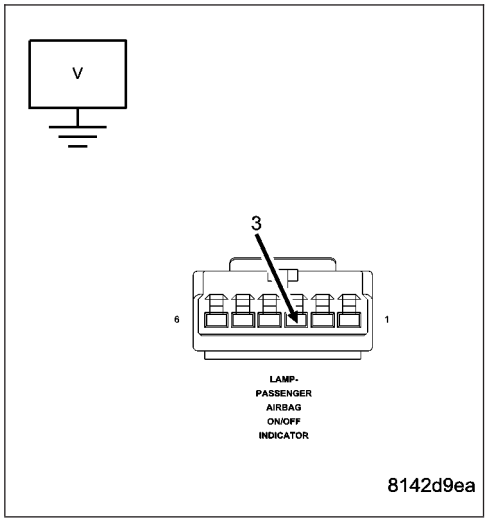
WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

Measure the voltage of the (G104) Passenger Airbag Indicator Driver circuit.

Is there any voltage present?

Yes >> Repair the (G104) Passenger Airbag Indicator Driver circuit for a short to voltage.
Perform ORC VERIFICATION TEST - VER 1.

No >> Go To 4



B1205-PASSENGER AIRBAG INDICATOR CIRCUIT HIGH (CONTINUED)

4. CHECK FOR ACTIVE DTC B1205 PASSENGER AIRBAG INDICATOR CIRCUIT HIGH WITH SWITCH BANK CONNECTOR DISCONNECTED

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Remove the Load Tool ORC Adaptor from the ORC connectors.

Reconnect the ORC C1 and C2 connectors.

Reconnect the OCM C1 connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, erase ORC DTCs.

Turn the ignition off, wait 10 seconds, and then turn the ignition on.

With the scan tool, read ORC DTCs.

Does the scan tool display active: B1205 PASSENGER AIRBAG INDICATOR CIRCUIT HIGH?

Yes >> Go To 5

No >> Replace the Passenger Airbag On/Off Indicator Lamp in accordance with the Service Information. Perform ORC VERIFICATION TEST - VER 1.

---

5. REPLACE THE ORC

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

Repair

Replace the ORC in accordance with the service information.

Perform the ORC VERIFICATION TEST-VER 1.

B1205-PASSENGER AIRBAG INDICATOR CIRCUIT HIGH (CONTINUED)

6. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

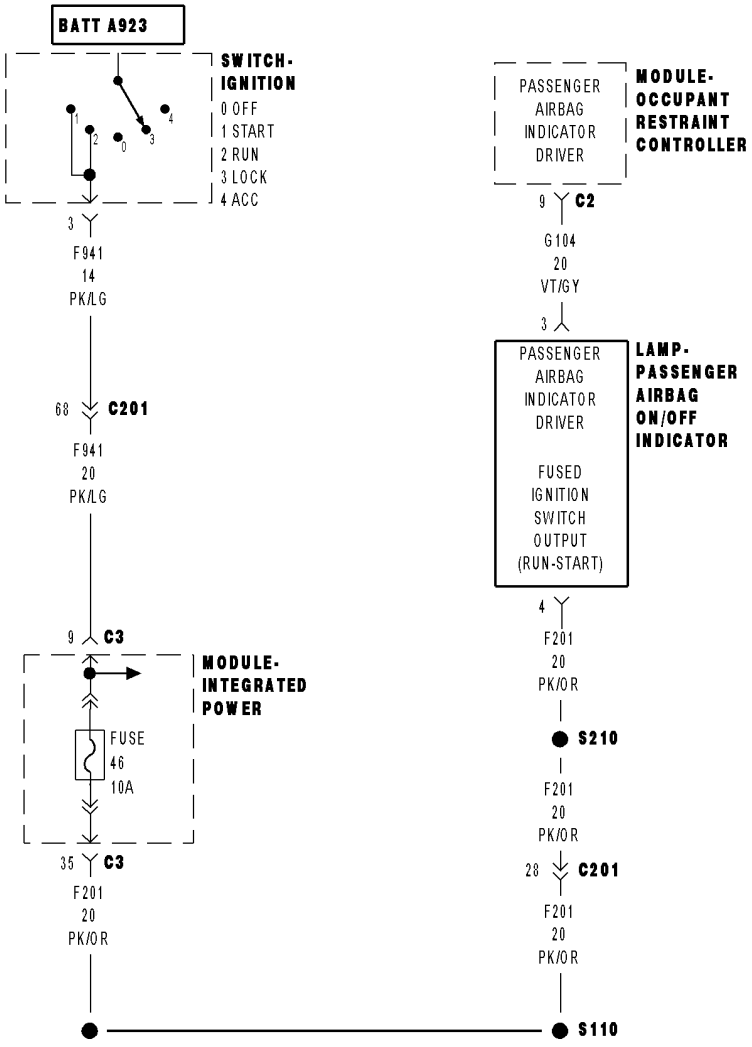
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

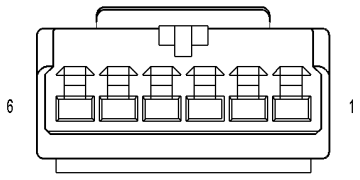
Does the scan tool display any ACTIVE DTCs?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

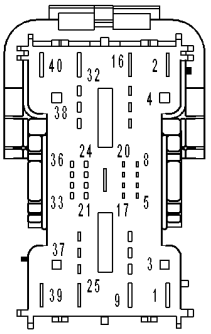
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1206-PASSENGER AIRBAG INDICATOR CIRCUIT OPEN

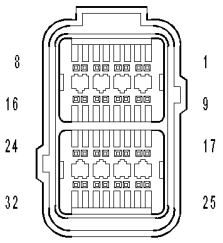




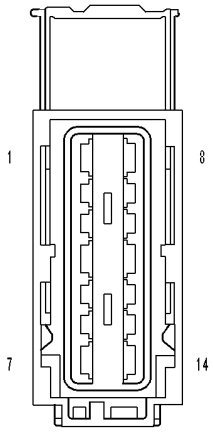
LAMP-PASSENGER AIRBAG ON/OFF INDICATOR



MODULE-INTEGRATED POWER C3



MODULE-OCCUPANT RESTRAINT CONTROLLER C2



SWITCH-IGNITION

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B1206-PASSENGER AIRBAG INDICATOR CIRCUIT OPEN (CONTINUED)

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Occupant Restraint Controller (ORC) senses a loss of voltage on the (G104) Passenger Airbag Indicator Driver circuit.**NOTE: Use the B1206-PASSENGER AIRBAG INDICATOR CIRCUIT OPEN diagnostic test to repair the B1204-PASSENGER AIRBAG INDICATOR CIRCUIT LOW trouble code. The Scan Tool will display both DTCs for a single problem.**

Possible Causes
LAMP-PASSENGER AIRBAG ON/OFF INDICATOR CONNECTOR DISCONNECTED
(G104) PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT OPEN
(G104) PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT SHORTED TO GROUND
LAMP-PASSENGER AIRBAG ON/OFF INDICATOR
ORC

Diagnostic Test

1. VERIFY THAT DTC B1206 PASSENGER AIRBAG INDICATOR CIRCUIT OPEN IS ACTIVE

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read ORC DTCs.

Does the scan tool display active: B1206 PASSENGER AIRBAG INDICATOR CIRCUIT OPEN?

Yes >> Go To 2

No >> Go To 7

---

2. VERIFY THAT LAMP-PASSENGER AIRBAG ON/OFF INDICATOR CONNECTOR IS CONNECTED

Turn the ignition off.

Gain access to the Lamp-Passenger Airbag On/Off Indicator connector.

Is the Lamp-Passenger Airbag On/Off Indicator connected to the dash harness?

Yes >> Go To 3

No >> Connect the Lamp-Passenger Airbag On/Off Indicator to the dash harness. Perform ORC VERIFICATION TEST - VER 1.

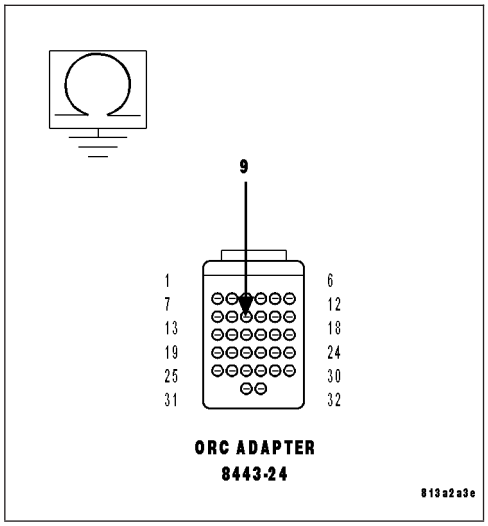
B1206-PASSENGER AIRBAG INDICATOR CIRCUIT OPEN (CONTINUED)

3. CHECK (G104) PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Lamp Passenger Airbag On/Off Indicator connector.
Disconnect the both ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.
Connect the appropriate Load Tool ORC Adaptor to the ORC C2 connector.
Measure the resistance of the (G104) Passenger Airbag Indicator Driver circuit between ground and the ORC Adaptor.



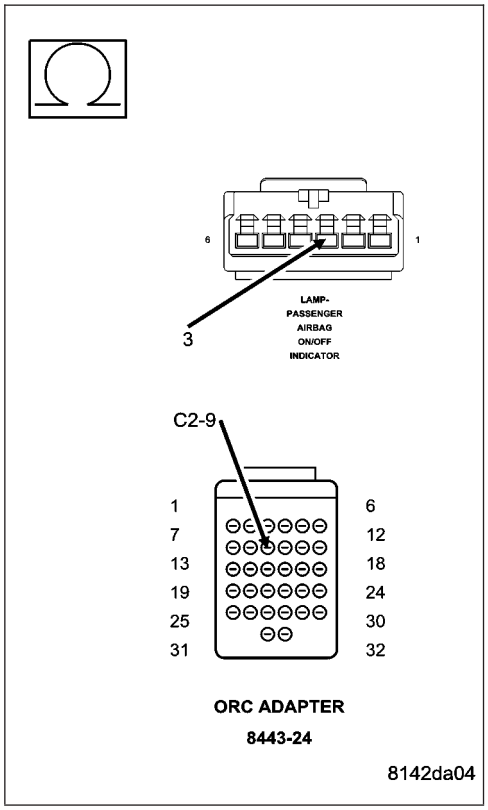
Is the resistance below 100.0 ohms?

Yes >> Repair the (G104) Passenger Airbag Indicator Driver circuit for a short to ground.
Perform ORC VERIFICATION TEST - VER 1.

No >> Go To 4

4. CHECK (G104) PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT FOR AN OPEN

Measure the resistance of the (G104) Passenger Airbag Indicator Driver circuit between the ORC Adaptor and the Lamp-Passenger Airbag On/Off Indicator connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the (G104) Passenger Airbag Indicator Driver circuit for an open.
Perform ORC VERIFICATION TEST - VER 1.

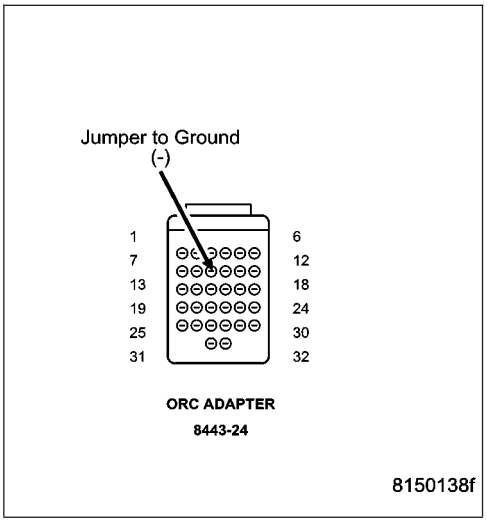
B1206-PASSENGER AIRBAG INDICATOR CIRCUIT OPEN (CONTINUED)

5. CHECK (G104) PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT FOR A SHORT TO GROUND

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

Reconnect the Lamp-Passenger Airbag On/Off Indicator connector.

Connect a jumper wire between the (G104) Passenger Airbag Indicator Driver circuit in the ORC Adaptor 8443-25 (terminal 9) and ground.



Is the Passenger Airbag On/Off Indicator on?

Yes >> Go To 6

Perform ORC VERIFICATION TEST - VER 1.

No >> Replace the Lamp-Passenger Airbag On/Off Indicator.

---

6. REPLACE THE ORC

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

Repair

Replace the ORC in accordance with the service information.

Perform the ORC VERIFICATION TEST-VER 1.

B1206-PASSENGER AIRBAG INDICATOR CIRCUIT OPEN (CONTINUED)

7. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

Does the scan tool display any ACTIVE DTCs?

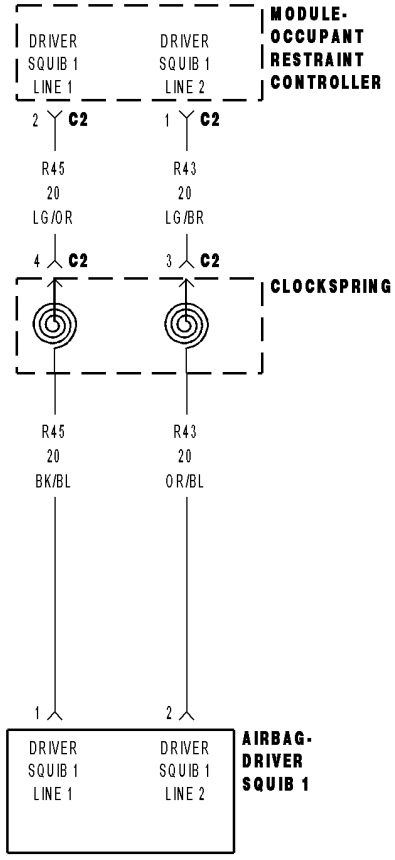
Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

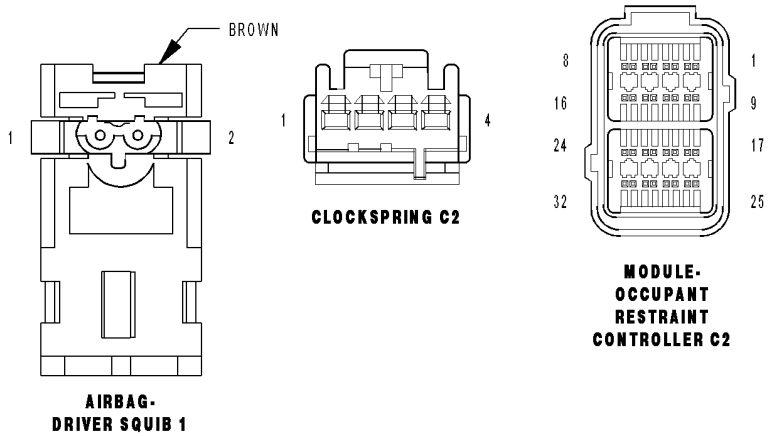
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1207-PASSENGER AIRBAG INDICATOR CIRCUIT SHORTED TOGETHER

Perform the B1205-PASSENGER AIRBAG INDICATOR CIRCUIT HIGH test. (Refer to 8 - ELECTRICAL/RESTRAINTS - DIAGNOSIS AND TESTING)

B1B00-DRIVER AIRBAG SQUIB 1 CIRCUIT LOW





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B1B00-DRIVER AIRBAG SQUIB 1 CIRCUIT LOW (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 1 circuits.
- **Set Condition:**
  The ORC has detected low resistance on the Driver Squib 1 circuits.

Possible Causes
(R43) DRIVER SQUIB 1 LINE 2 CIRCUIT OR (R45) DRIVER SQUIB 1 LINE 1 CIRCUIT SHORTED TO GROUND
CLOCKSPRING
DRIVER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 6

B1B00-DRIVER AIRBAG SQUIB 1 CIRCUIT LOW (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

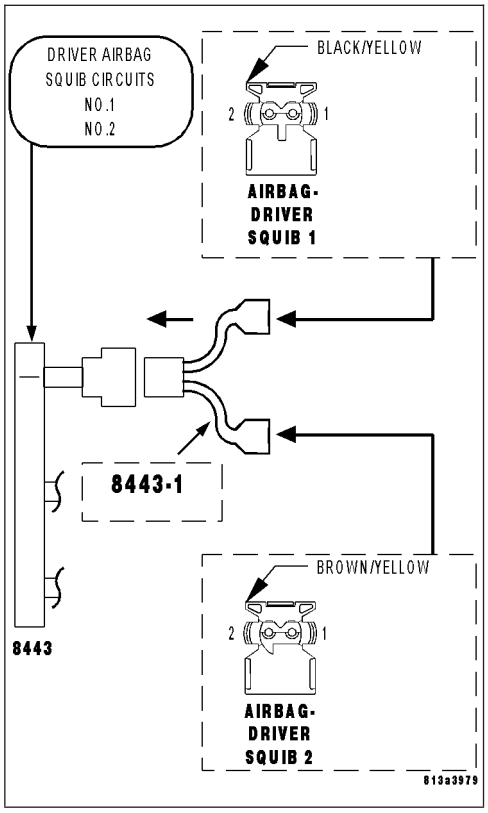
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B00 DRIVER AIRBAG SQUIB 1 CIRCUIT LOW?

Yes >> Go To 3

No >> Replace the Driver Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



B1B00-DRIVER AIRBAG SQUIB 1 CIRCUIT LOW (CONTINUED)

3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool Jumper from the Driver Airbag Squib connectors.

Remove the Steering Control Module from the steering column in accordance with the Service Information.

Disconnect the Steering Control Module connector.

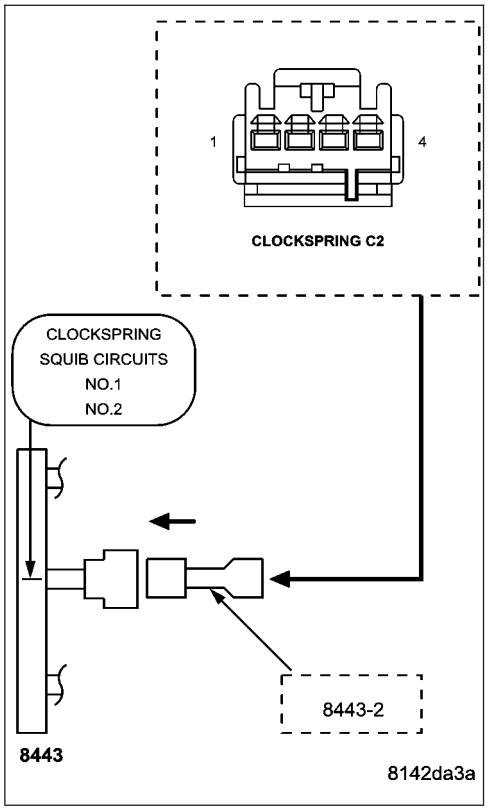
NOTE: Check connectors - Clean and repair as necessary.
With the Steering Control Module Connector attached to the steering column, connect the 8443 Load Tool and appropriate Jumper to the Steering Control Module connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B00 DRIVER AIRBAG SQUIB 1 CIRCUIT LOW?

Yes >> Go To 4

No >> Replace the Clockspring in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



4. CHECK (R43) DRIVER SQUIB 1 LINE 2 CIRCUIT AND (R45) DRIVER SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Steering Control Module connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

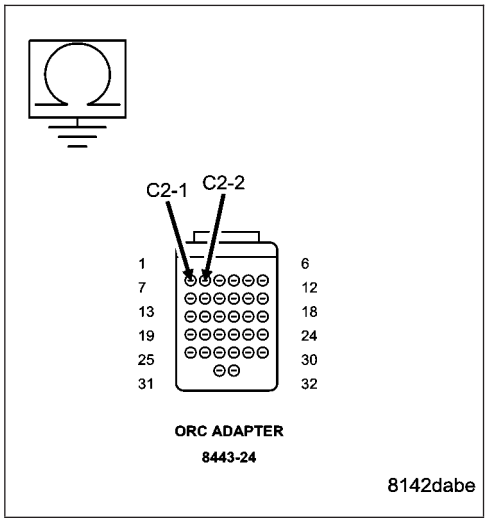
Measure the resistance of the (R43) Driver Squib 1 Line 2 circuit between ground and the Steering Column Module connector.

Measure the resistance of the (R45) Driver Squib 1 Line 1 circuit between ground and the Steering Column Module connector.

Is the resistance below 10K ohms for either measurement?

Yes >> Repair the Driver Squib 1 circuits with a resistance below 10K ohms for a short to ground.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 5



B1B00-DRIVER AIRBAG SQUIB 1 CIRCUIT LOW (CONTINUED)

5. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

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6. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

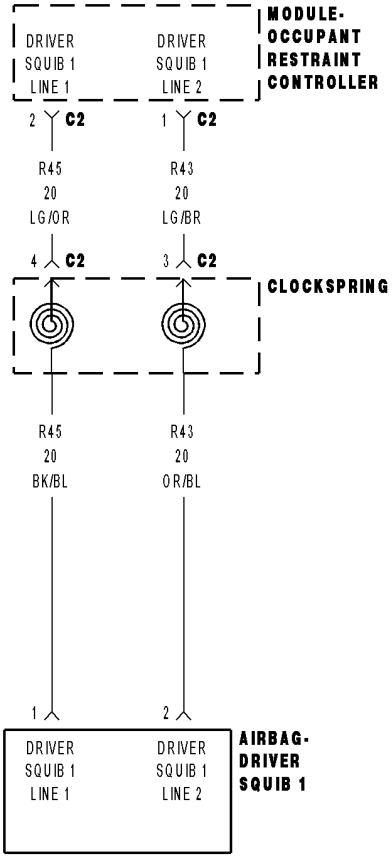
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

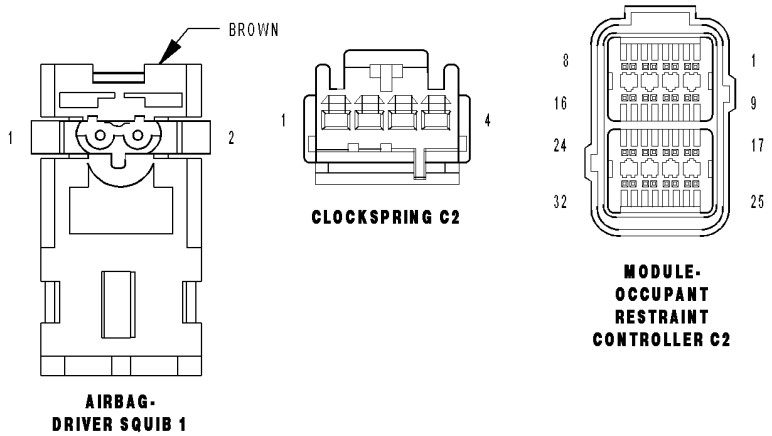
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B01-DRIVER AIRBAG SQUIB 1 CIRCUIT HIGH





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B1B01-DRIVER AIRBAG SQUIB 1 CIRCUIT HIGH (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the voltage on the Driver Squib 1 circuits.
- **Set Condition:**
  The ORC has detected voltage on the Driver Squib 1 circuits.

Possible Causes
(R43) DRIVER SQUIB 1 LINE 2 CIRCUIT OR (R45) DRIVER SQUIB 1 LINE 1 CIRCUIT SHORTED TO BATTERY
CLOCKSPRING
DRIVER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 6

B1B01-DRIVER AIRBAG SQUIB 1 CIRCUIT HIGH (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

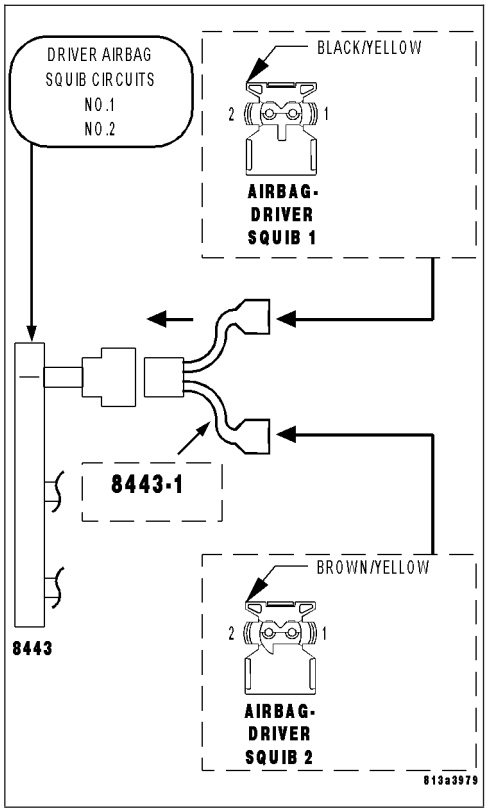
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B01 DRIVER AIRBAG SQUIB 1 CIRCUIT HIGH?

Yes >> Go To 3

No >> Replace the Driver Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



B1B01-DRIVER AIRBAG SQUIB 1 CIRCUIT HIGH (CONTINUED)

3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR A SHORT TO BATTERY

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Driver Airbag Squib connectors.

Remove the Steering Control Module from the steering column in accordance with the Service Information.

Disconnect the Steering Control Module connector.

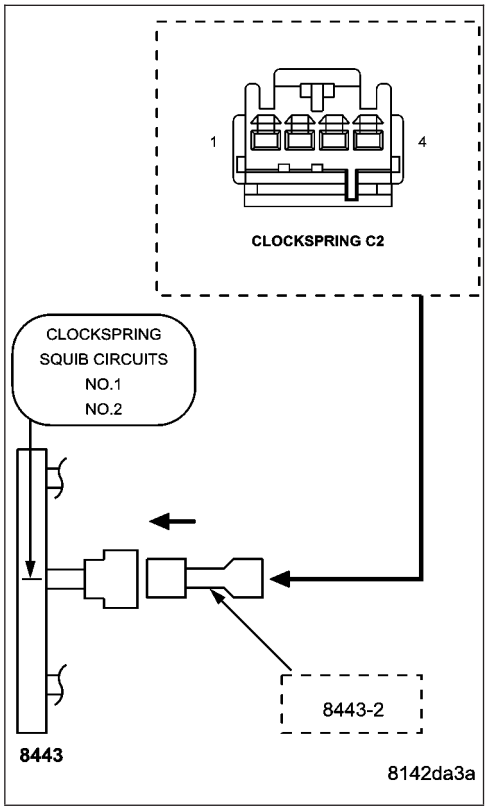
NOTE: Check connectors - Clean and repair as necessary.
With the Steering Control Module Connector attached to the steering column, connect the 8443 Load Tool and appropriate Jumper to the Steering Control Module connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B01 DRIVER AIRBAG SQUIB 1 CIRCUIT HIGH?

Yes >> Go To 4

No >> Replace the Clockspring in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



4. CHECK (R43) DRIVER SQUIB 1 LINE 2 CIRCUIT AND (R45) DRIVER SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO BATTERY

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Steering Control Module connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

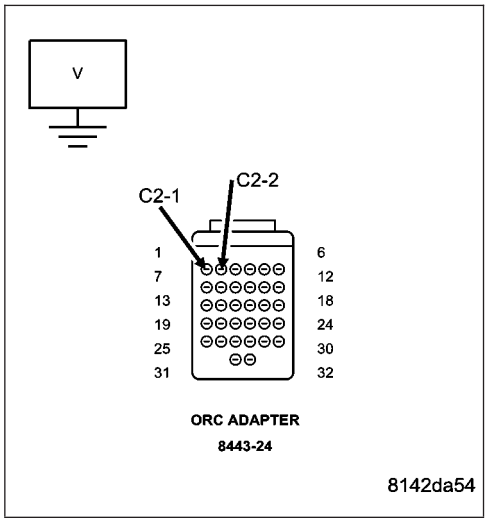
WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R43) Driver Squib 1 Line 2 circuit between the Steering Control Module connector and ground.

Measure the voltage of the (R45) Driver Squib 1 Line 1 circuit between the Steering Control Module connector and ground.

Is there any voltage present for either measurement?

Yes >> Repair the Driver Squib 1 circuits with voltage present for a short to Battery.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 5



B1B01-DRIVER AIRBAG SQUIB 1 CIRCUIT HIGH (CONTINUED)

5. REPLACE THE ORC

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

6. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

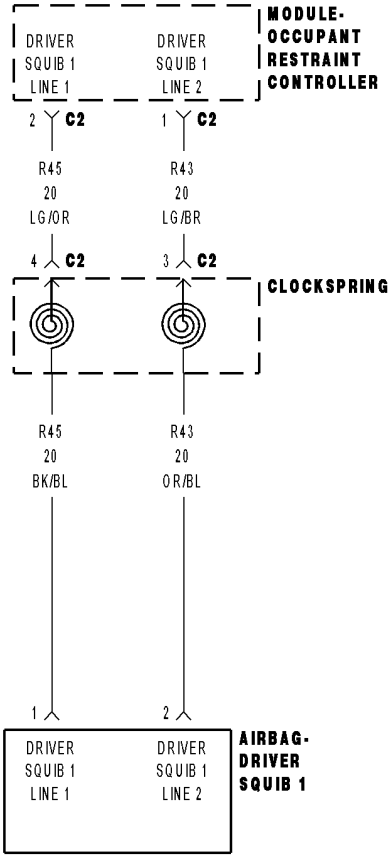
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC's in question.

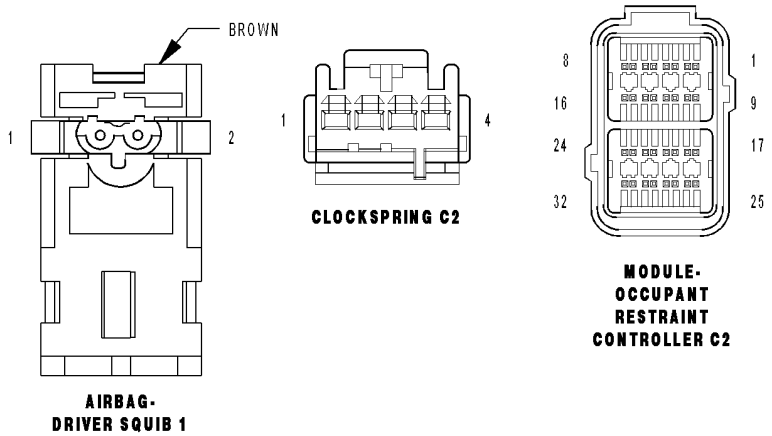
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B02-DRIVER AIRBAG SQUIB 1 CIRCUIT OPEN





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B1B02-DRIVER AIRBAG SQUIB 1 CIRCUIT OPEN (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 1 circuits.
- **Set Condition:**
  The ORC has detected an open or high resistance on the Driver Squib 1 circuits.

Possible Causes
(R43) DRIVER SQUIB 1 LINE 2 CIRCUIT OPEN
(R45) DRIVER SQUIB 1 LINE 1 CIRCUIT OPEN
CLOCKSPRING
DRIVER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 7

B1B02-DRIVER AIRBAG SQUIB 1 CIRCUIT OPEN (CONTINUED)

2. CHECK FOR OPEN SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

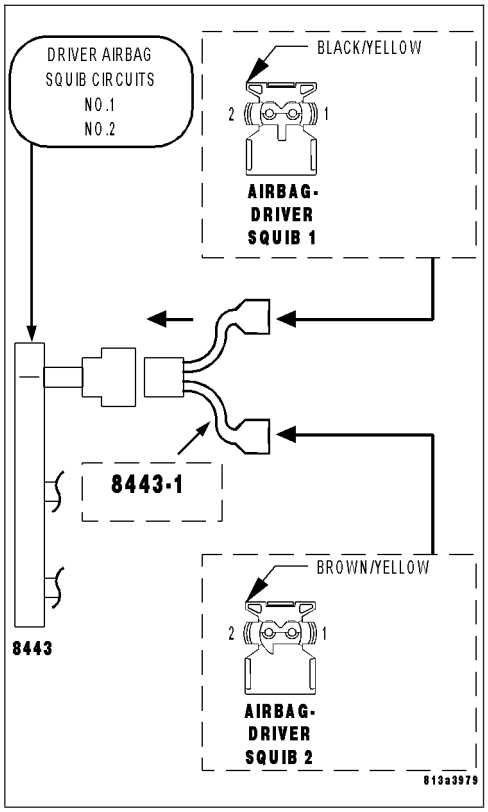
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B02 DRIVER AIRBAG SQUIB 1 CIRCUIT OPEN?

Yes >> Go To 3

No >> Replace the Driver Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



B1B02-DRIVER AIRBAG SQUIB 1 CIRCUIT OPEN (CONTINUED)

3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Driver Airbag Squib connectors.

Remove the Steering Control Module from the steering column in accordance with the Service Information.

Disconnect the Steering Control Module connector.

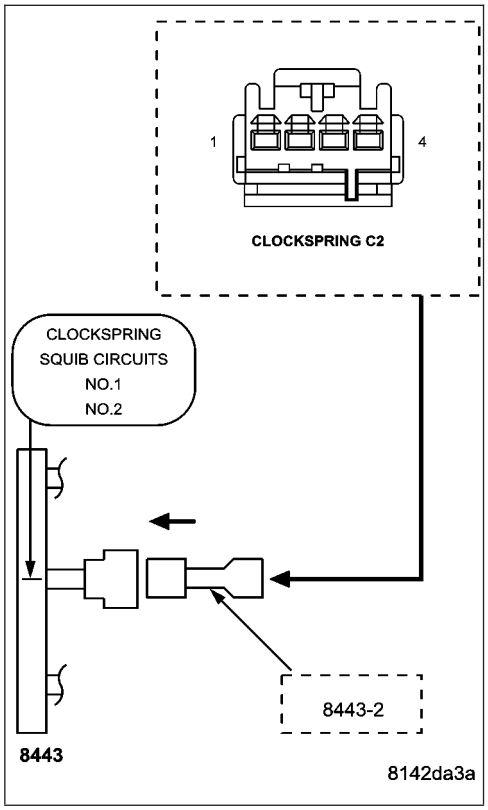
NOTE: Check connectors - Clean and repair as necessary.
With the Steering Control Module Connector attached to the steering column, connect the 8443 Load Tool and appropriate Jumper to the Steering Control Module connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B02 DRIVER AIRBAG SQUIB 1 CIRCUIT OPEN?

Yes >> Go To 4

No >> Replace the Clockspring in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



B1B02-DRIVER AIRBAG SQUIB 1 CIRCUIT OPEN (CONTINUED)

4. CHECK (R43) DRIVER SQUIB 1 LINE 2 CIRCUIT FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Steering Control Module connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

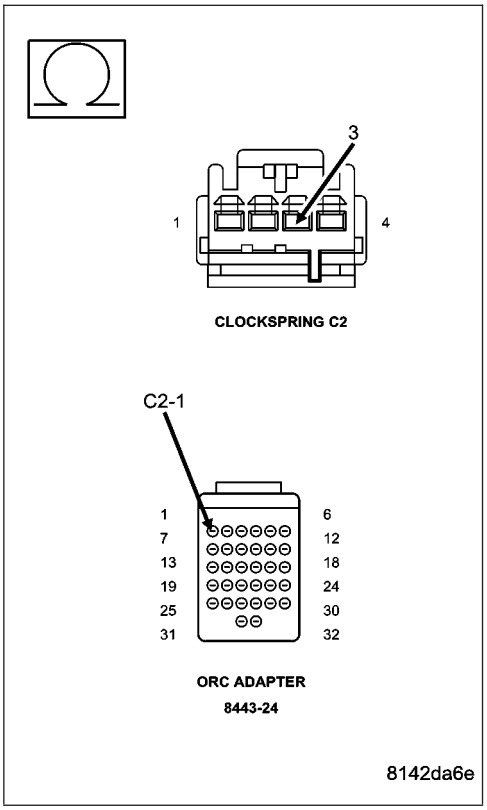
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

Measure the resistance of the (R43) Driver Squib 1 Line 2 circuit between the Steering Control Module connector and the ORC Load Tool Adaptor.

Is the resistance below 1.0 ohm?

Yes >> Go To 5

No >> Repair the (R43) Driver Squib 1 Line 2 circuit for an open. Then, Go To 5



B1B02-DRIVER AIRBAG SQUIB 1 CIRCUIT OPEN (CONTINUED)

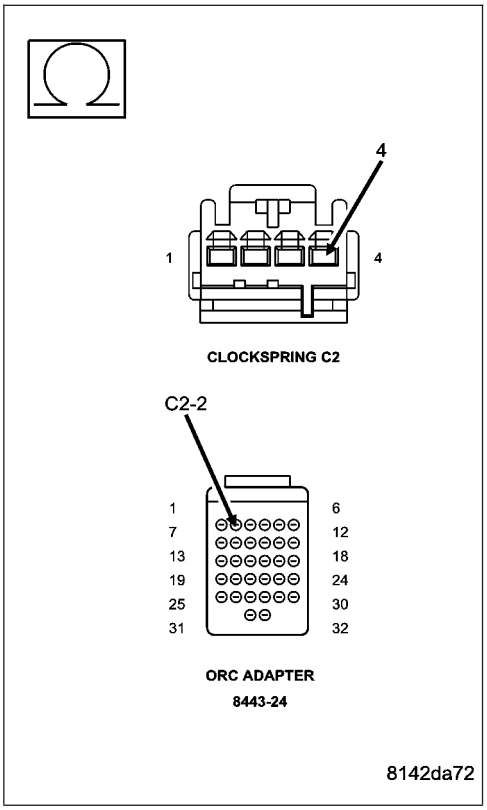
5. CHECK (R45) DRIVER SQUIB 1 LINE 1 CIRCUIT FOR AN OPEN

Measure the resistance of the (R45) Driver Squib 1 Line 1 circuit between the Steering Control Module connector and the ORC Load Tool Adaptor.

Is the resistance below 1.0 ohm?

Yes >> Go To 6

No >> Repair the (R45) Driver Squib 1 Line 1 circuit for an open.
Perform ORC VERIFICATION TEST - VER 1



6. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

B1B02-DRIVER AIRBAG SQUIB 1 CIRCUIT OPEN (CONTINUED)

7. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

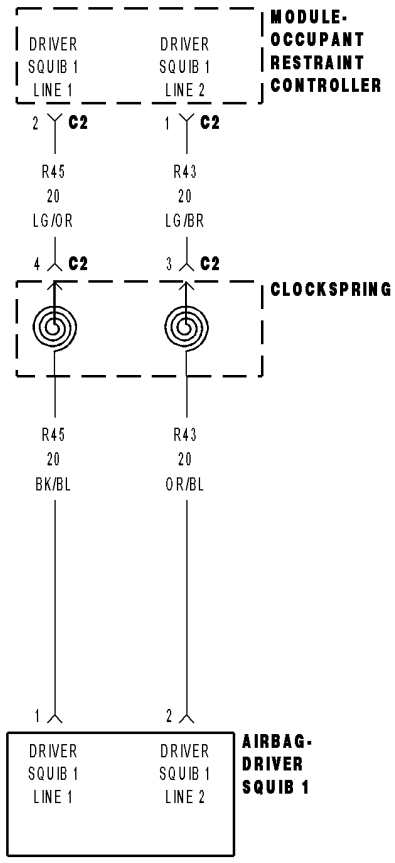
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

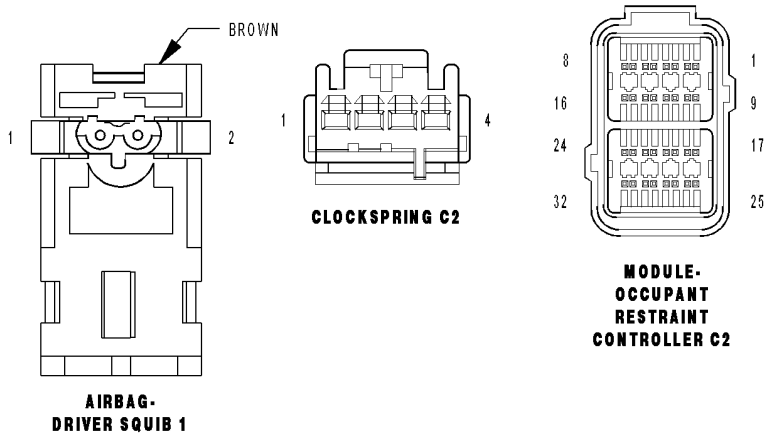
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B03-DRIVER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER





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B1B03-DRIVER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 1 circuits.
- **Set Condition:**
  The ORC has detected low resistance between the Driver Squib 1 circuits.

Possible Causes
(R43) DRIVER SQUIB 1 LINE 2 CIRCUIT SHORTED TO (R45) DRIVER SQUIB 1 LINE 1 CIRCUIT
CLOCKSPRING
DRIVER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 6

B1B03-DRIVER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.
Disconnect the Driver Airbag Squib connectors.

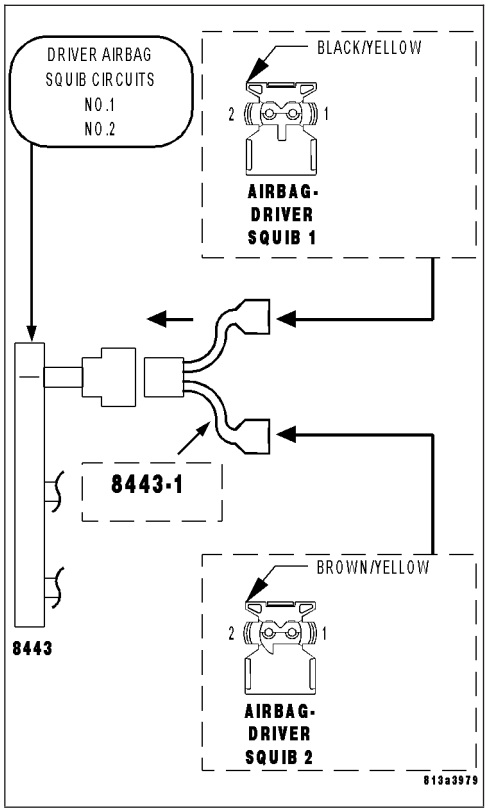
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B03 DRIVER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER?

Yes >> Go To 3

No >> Replace the Driver Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



B1B03-DRIVER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER (CONTINUED)

3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR A SHORT TOGETHER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool ORC from the Driver Airbag Squib connectors.

Disconnect the Steering Control Module connector.

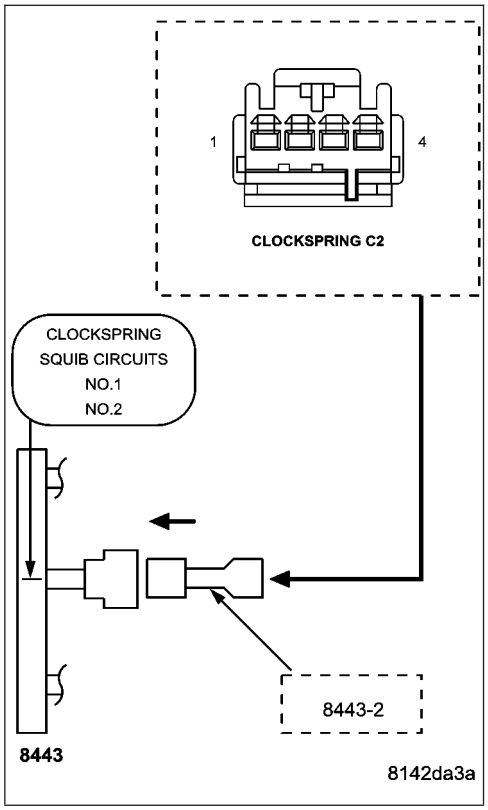
NOTE: Check connectors - Clean and repair as necessary.
Disconnect the Clockspring C2 connector and connect the 8443 Load Tool and appropriate Jumper to the Clockspring connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B03 DRIVER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER?

Yes >> Go To 4

No >> Replace the Clockspring in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



4. CHECK (R43) DRIVER SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO (R45) DRIVER SQUIB 1 LINE 1 CIRCUIT

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Steering Control Module connector.

Disconnect the ORC connectors.

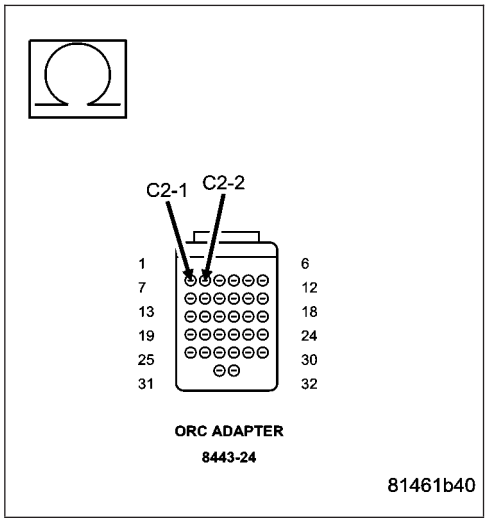
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

Measure the resistance between the (R43) Driver Squib 1 Line 2 circuit and the (R45) Driver Squib 1 Line 1 circuit at the ORC C2 connector.

Is the resistance below 10K ohms?

Yes >> Repair the (R43) Driver Squib 1 Line 2 circuit for a short to the (R45) Driver Squib 1 Line 1 circuit.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 5



B1B03-DRIVER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER (CONTINUED)

5. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

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6. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

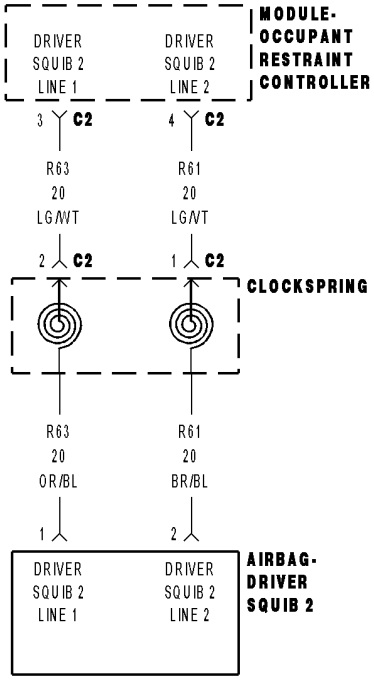
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

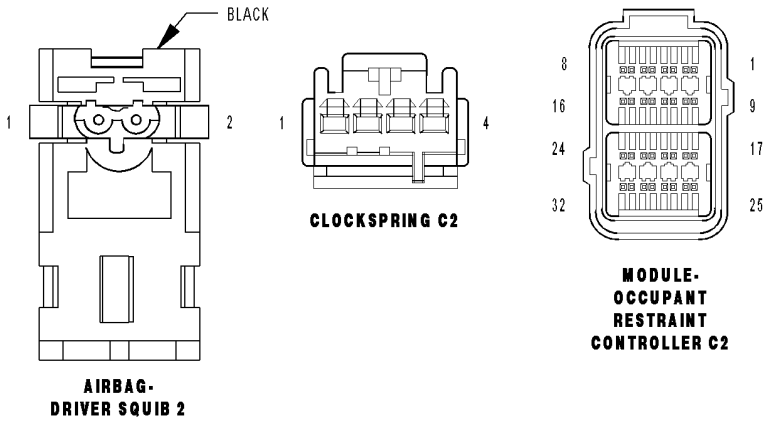
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B04-DRIVER AIRBAG SQUIB 2 CIRCUIT LOW





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B1B04-DRIVER AIRBAG SQUIB 2 CIRCUIT LOW (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 2 circuits.
- **Set Condition:**
  The ORC has detected low resistance on the Driver Squib 2 circuits.

Possible Causes
(R63) DRIVER SQUIB 2 LINE 1 CIRCUIT OR (R61) DRIVER SQUIB 2 LINE 2 CIRCUIT SHORTED TO GROUND
CLOCKSPRING
DRIVER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 6

B1B04-DRIVER AIRBAG SQUIB 2 CIRCUIT LOW (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

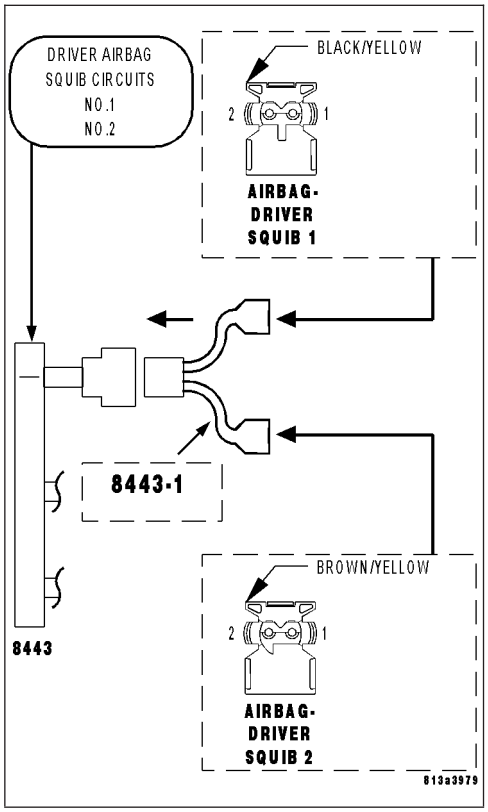
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B04 DRIVER AIRBAG SQUIB 2 CIRCUIT LOW?

Yes >> Go To 3

No >> Replace the Driver Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



B1B04-DRIVER AIRBAG SQUIB 2 CIRCUIT LOW (CONTINUED)

3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool Jumper from the Driver Airbag Squib connectors.

Remove the Steering Control Module from the steering column in accordance with the Service Information.

Disconnect the Steering Control Module connector.

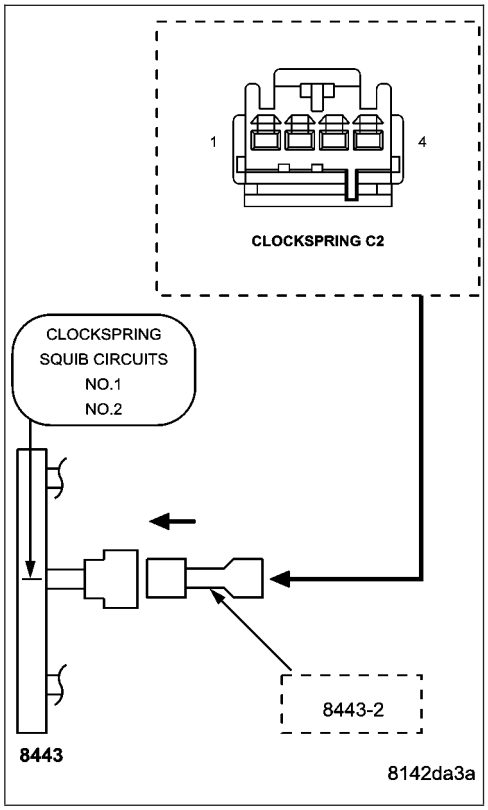
NOTE: Check connectors - Clean and repair as necessary.
With the Steering Control Module Connector attached to the steering column, connect the 8443 Load Tool and appropriate Jumper to the Steering Control Module connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B04 DRIVER AIRBAG SQUIB 2 CIRCUIT LOW?

Yes >> Go To 4

No >> Replace the Clockspring in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



4. CHECK (R63) DRIVER SQUIB 2 LINE 1 CIRCUIT AND (R61) DRIVER SQUIB 2 LINE 2 CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Steering Control Module connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

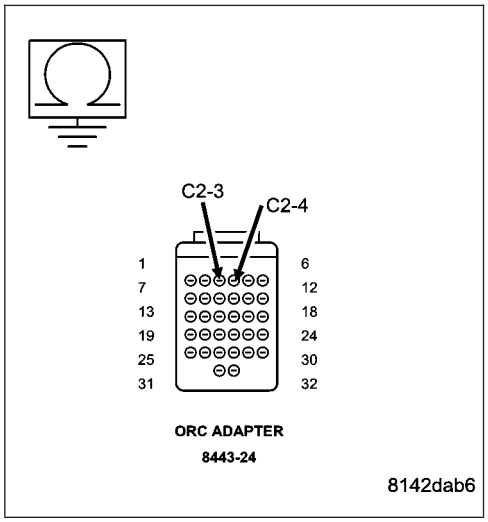
Measure the resistance of the (R63) Driver Squib 2 Line 1 circuit between ground and the Steering Column Module connector.

Measure the resistance of the (R61) Driver Squib 2 Line 2 circuit between ground and the Steering Column Module connector.

Is the resistance below 10K ohms for either measurement?

Yes >> Repair the Driver Squib 2 circuits with a resistance below 10K ohms for a short to ground.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 5



B1B04-DRIVER AIRBAG SQUIB 2 CIRCUIT LOW (CONTINUED)

5. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

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6. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

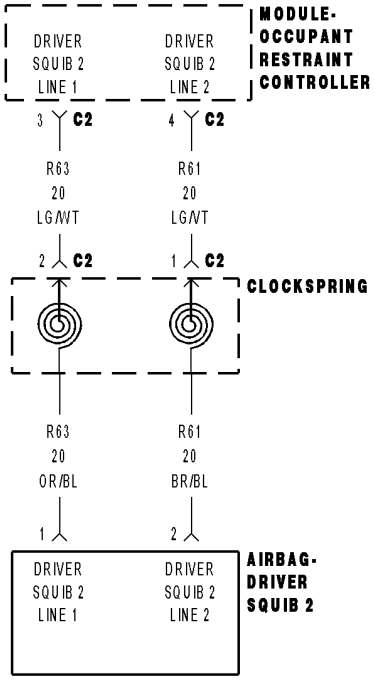
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

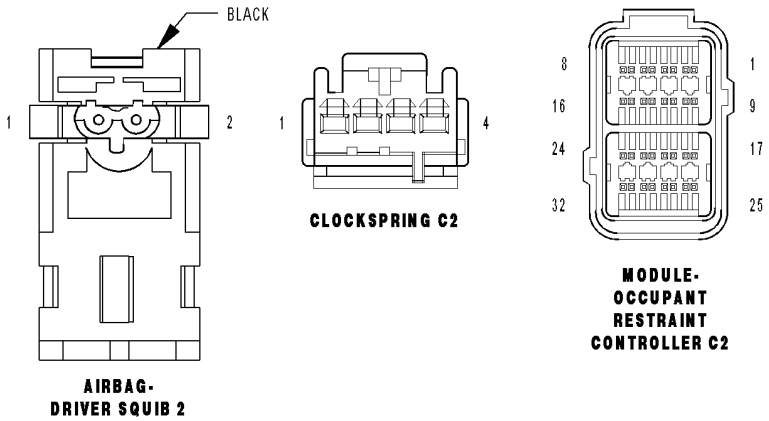
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B05-DRIVER AIRBAG SQUIB 2 CIRCUIT HIGH





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B1B05-DRIVER AIRBAG SQUIB 2 CIRCUIT HIGH (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the voltage on the Driver Squib 2 circuits.
- **Set Condition:**
  The ORC has detected voltage on the Driver Squib 2 circuits.

Possible Causes
(R63) DRIVER SQUIB 2 LINE 1 CIRCUIT OR (R61) DRIVER SQUIB 2 LINE 2 CIRCUIT SHORTED TO BATTERY
CLOCKSPRING
DRIVER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The Scan Tool, SRS Airbag Load Tool MRL 8443 and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 6

B1B05-DRIVER AIRBAG SQUIB 2 CIRCUIT HIGH (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

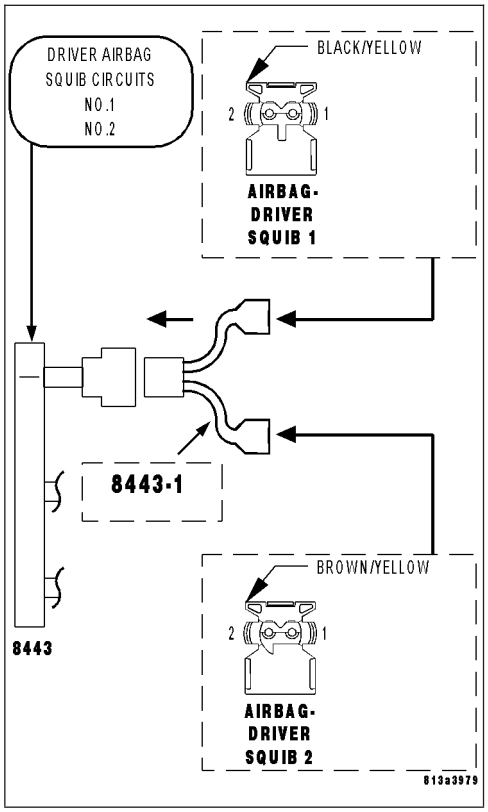
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B05 DRIVER AIRBAG SQUIB 2 CIRCUIT HIGH?

Yes >> Go To 3

No >> Replace the Driver Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR A SHORT TO BATTERY

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Driver Airbag Squib connectors.

Remove the Steering Control Module from the steering column in accordance with the Service Information.

Disconnect the Steering Control Module connector.

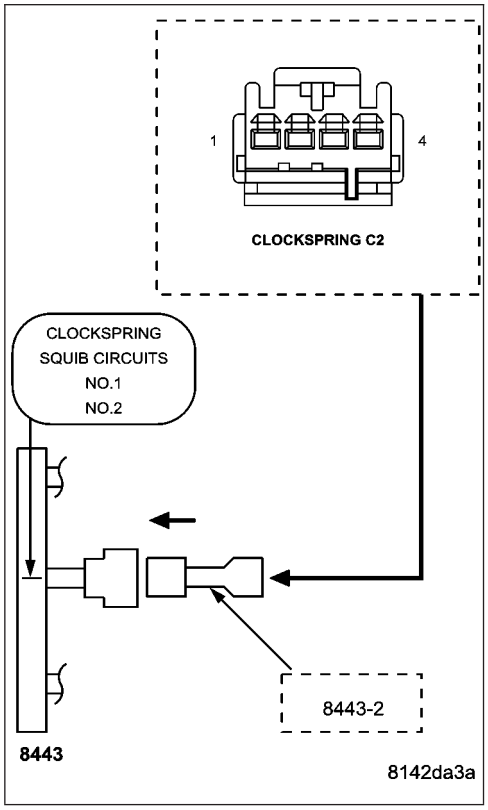
NOTE: Check connectors - Clean and repair as necessary.
With the Steering Control Module connector attached to the steering column, connect the 8443 Load Tool and appropriate Jumper to the Steering Control Module connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B05 DRIVER AIRBAG SQUIB 2 CIRCUIT HIGH?

Yes >> Go To 4

No >> Replace the Clockspring in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



B1B05-DRIVER AIRBAG SQUIB 2 CIRCUIT HIGH (CONTINUED)

4. CHECK (R63) DRIVER SQUIB 2 LINE 1 CIRCUIT AND (R61) DRIVER SQUIB 2 LINE 2 CIRCUIT FOR A SHORT TO BATTERY

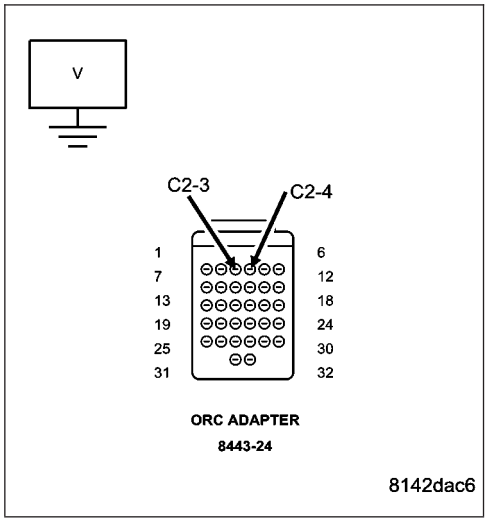
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Steering Control Module connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R63) Driver Squib 2 Line 1 circuit between the Steering Control Module connector and ground.

Measure the voltage of the (R61) Driver Squib 2 Line 2 circuit between the Steering Control Module connector and ground.



Is there any voltage present for either measurement?

Yes >> Repair the Driver Squib 2 circuits with voltage present for a short to Battery.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 5

---

5. REPLACE THE ORC

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

B1B05-DRIVER AIRBAG SQUIB 2 CIRCUIT HIGH (CONTINUED)

6. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

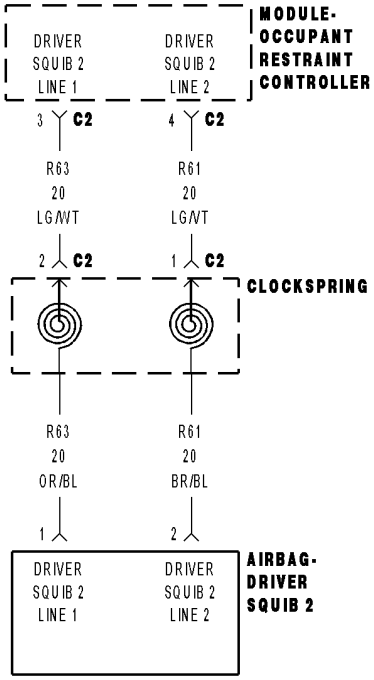
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC's in question.

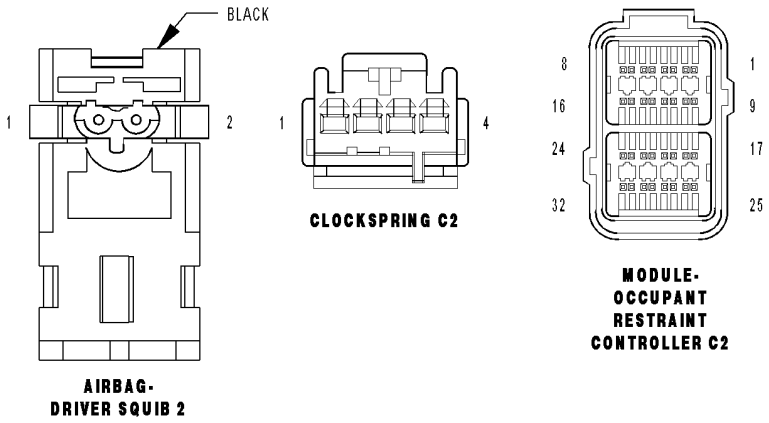
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B06-DRIVER AIRBAG SQUIB 2 CIRCUIT OPEN





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B1B06-DRIVER AIRBAG SQUIB 2 CIRCUIT OPEN (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 2 circuits.
- **Set Condition:**
  The ORC has detected an open or high resistance on the Driver Squib 2 circuits.

Possible Causes
(R63) DRIVER SQUIB 2 LINE 1 CIRCUIT OPEN
(R61) DRIVER SQUIB 2 LINE 2 CIRCUIT OPEN
CLOCKSPRING
DRIVER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 7

B1B06-DRIVER AIRBAG SQUIB 2 CIRCUIT OPEN (CONTINUED)

2. CHECK FOR OPEN SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

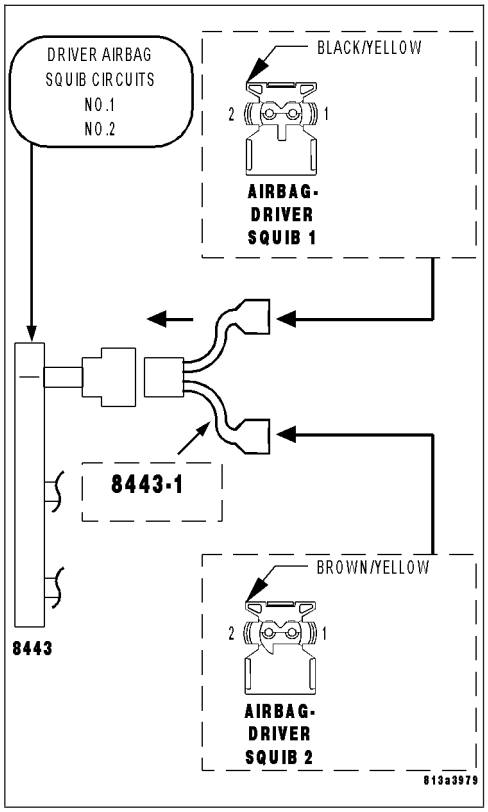
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B06 DRIVER AIRBAG SQUIB 2 CIRCUIT OPEN?

Yes >> Go To 3

No >> Replace the Driver Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Driver Airbag Squib connectors.

Remove the Steering Control Module from the steering column in accordance with the Service Information.

Disconnect the Steering Control Module connector.

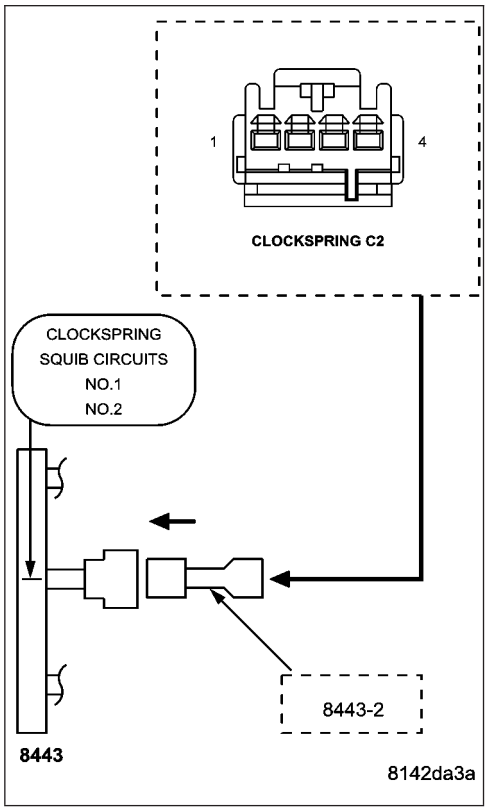
NOTE: Check connectors - Clean and repair as necessary.
With the Steering Control Module connector attached to the steering column, connect the 8443 Load Tool and appropriate Jumper to the Steering Control Module connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B06 DRIVER AIRBAG SQUIB 2 CIRCUIT OPEN?

Yes >> Go To 4

No >> Replace the Clockspring in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



B1B06-DRIVER AIRBAG SQUIB 2 CIRCUIT OPEN (CONTINUED)

4. CHECK (R63) DRIVER SQUIB 2 LINE 1 CIRCUIT FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Steering Control Module connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

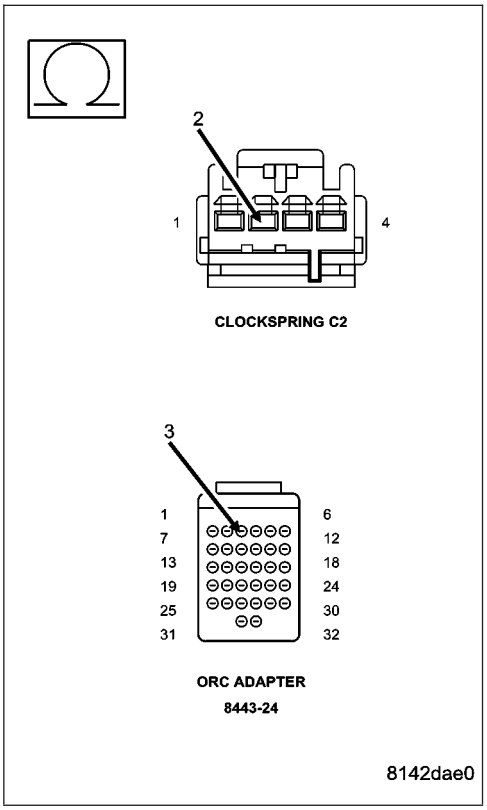
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

Measure the resistance of the (R63) Driver Squib 2 Line 1 circuit between the Steering Control Module connector and the ORC Load Tool Adaptor.

Is the resistance below 1.0 ohm?

Yes >> Go To 5

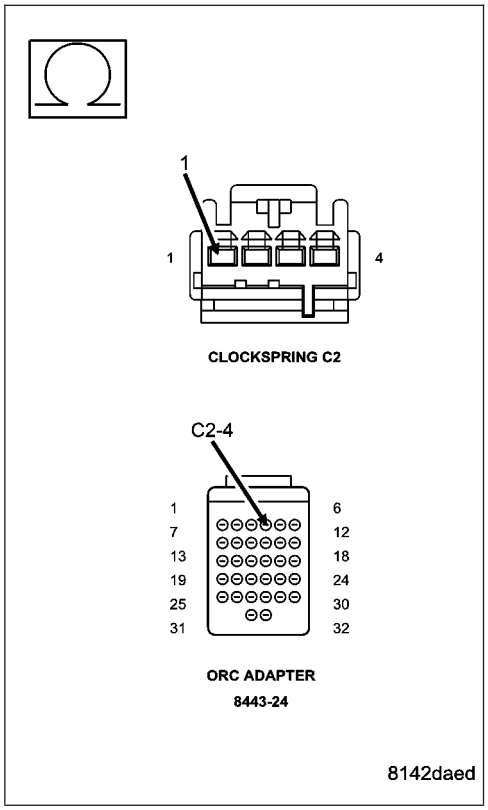
No >> Repair the (R63) Driver Squib 2 Line 1 circuit for an open. Then, Go To 5
Perform ORC VERIFICATION TEST - VER 1



B1B06-DRIVER AIRBAG SQUIB 2 CIRCUIT OPEN (CONTINUED)

5. CHECK (R61) DRIVER SQUIB 2 LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R61) Driver Squib 2 Line 2 circuit between the Steering Control Module connector and the ORC Load Tool Adaptor.



Is the resistance below 1.0 ohm?

Yes >> Go To 6

No >> Repair the (R61) Driver Squib 2 Line 2 circuit for an open.
Perform ORC VERIFICATION TEST - VER 1

6. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

B1B06-DRIVER AIRBAG SQUIB 2 CIRCUIT OPEN (CONTINUED)

7. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

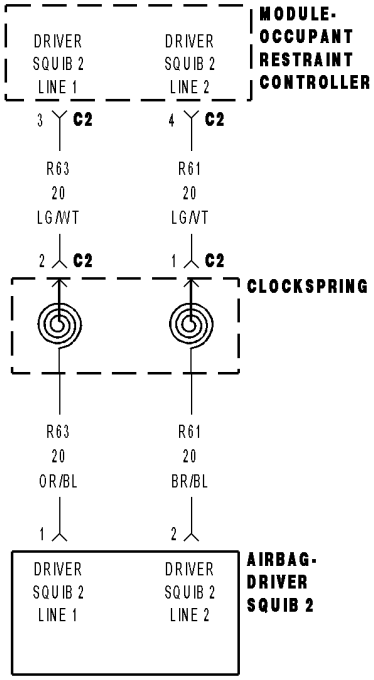
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

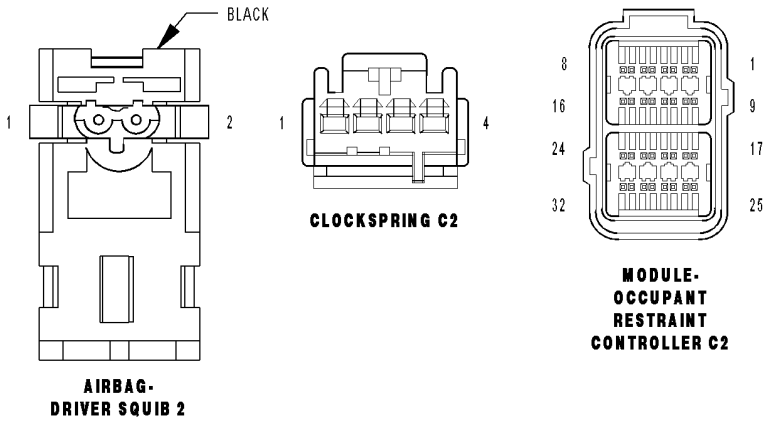
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B07-DRIVER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER





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B1B07-DRIVER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 2 circuits.
- **Set Condition:**
  The ORC has detected low resistance between the Driver Squib 2 circuits.

Possible Causes
(R63) DRIVER SQUIB 2 LINE 1 CIRCUIT SHORTED TO (R61) DRIVER SQUIB 2 LINE 2 CIRCUIT
CLOCKSPRING
DRIVER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The Scan Tool, SRS Airbag Load Tool MRL 8443 and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 6

B1B07-DRIVER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

Disconnect the Driver Airbag Squib connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

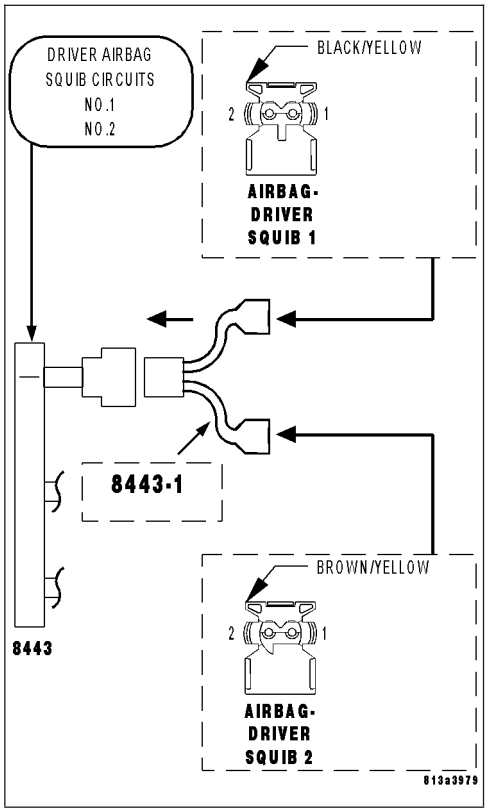
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B07 DRIVER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER?

Yes >> Go To 3

No >> Replace the Driver Airbag in accordance with the Service Information.

Perform ORC VERIFICATION TEST - VER 1



3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR A SHORT TOGETHER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool ORC from the Driver Airbag Squib connectors.

Remove the Steering Control Module from the steering column in accordance with the Service Information.

Disconnect the Steering Control Module connector.

NOTE: Check connectors - Clean and repair as necessary.

With the Steering Control Module connector attached to the steering column, connect the 8443 Load Tool and appropriate Jumper to the Steering Control Module connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

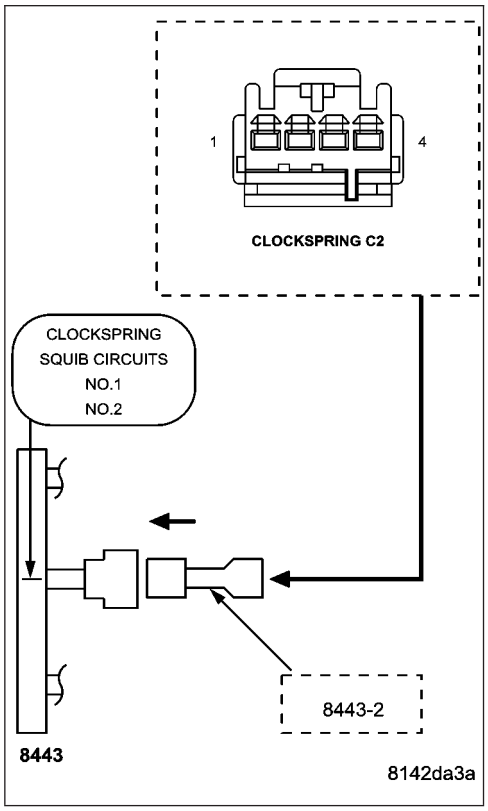
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B07 DRIVER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER?

Yes >> Go To 4

No >> Replace the Clockspring in accordance with the Service Information.

Perform ORC VERIFICATION TEST - VER 1



B1B07-DRIVER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER (CONTINUED)

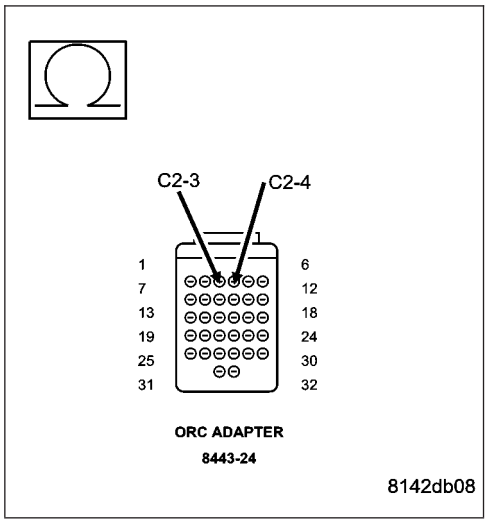
4. CHECK (R63) DRIVER SQUIB 2 LINE 1 CIRCUIT FOR A SHORT TO (R61) DRIVER SQUIB 2 LINE 2 CIRCUIT

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Steering Control Module connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

Measure the resistance between the (R63) Driver Squib 2 Line 1 circuit and the (R61) Driver Squib 2 Line 2 circuit at the Steering Control Module connector.



Is the resistance below 10K ohms?

Yes >> Repair the (R63) Driver Squib 2 Line 1 circuit for a short to the (R61) Driver Squib 2 Line 2 circuit.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 5

---

5. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

B1B07-DRIVER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER (CONTINUED)

6. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

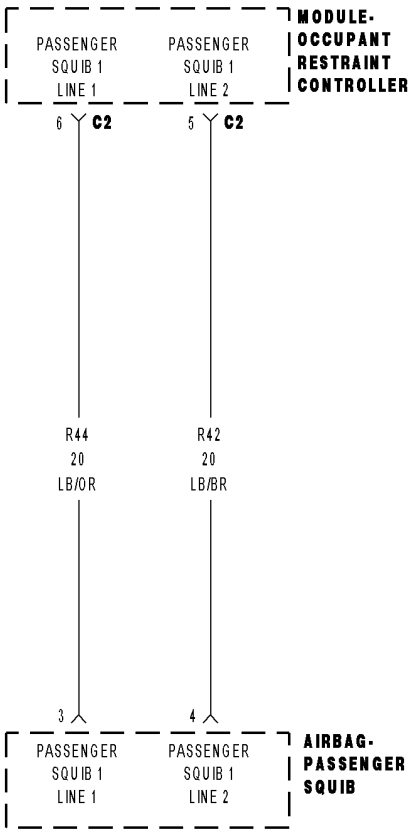
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

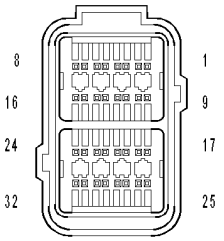
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

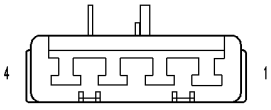
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B08-PASSENGER AIRBAG SQUIB 1 CIRCUIT LOW





MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2



AIRBAG-
PASSENGER
SQUIB

8142db2d

B1B08-PASSENGER AIRBAG SQUIB 1 CIRCUIT LOW (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 1 circuits.
- **Set Condition:**
  The ORC has detected low resistance on the Passenger Squib 1 circuits.

Possible Causes
(R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT OR (R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT SHORTED TO GROUND
PASSENGER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B08-PASSENGER AIRBAG SQUIB 1 CIRCUIT LOW (CONTINUED)

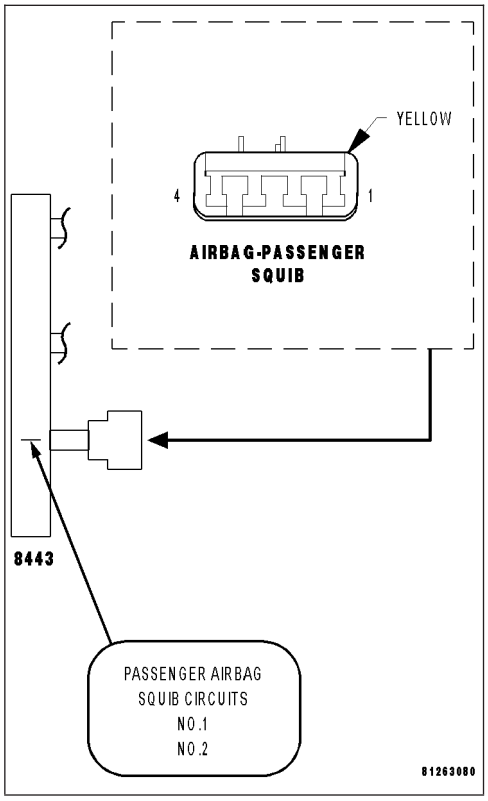
2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.



Does the scan tool display: B1B08 PASSENGER AIRBAG SQUIB 1 CIRCUIT LOW?

Yes >> Go To 3

No >> Replace the Passenger Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

3. CHECK (R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT AND (R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO GROUND

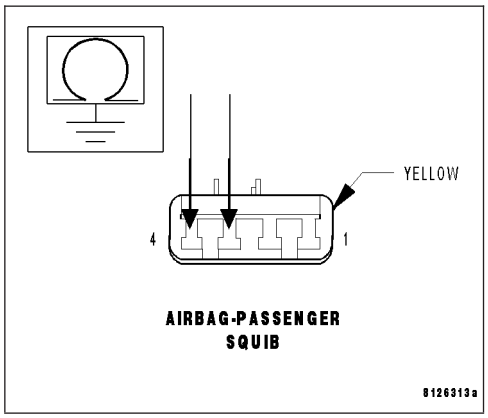
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

Measure the resistance of the (R42) Passenger Squib 1 Line 2 circuit between ground and the Passenger Airbag Squib connector.

Measure the resistance of the (R44) Passenger Squib 1 Line 1 circuit between ground and the Passenger Airbag Squib connector.



Is the resistance below 10K ohms on either circuit?

Yes >> Repair the Passenger Squib 1 circuits with a resistance below 10K ohms for a short to ground.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 4

B1B08-PASSENGER AIRBAG SQUIB 1 CIRCUIT LOW (CONTINUED)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

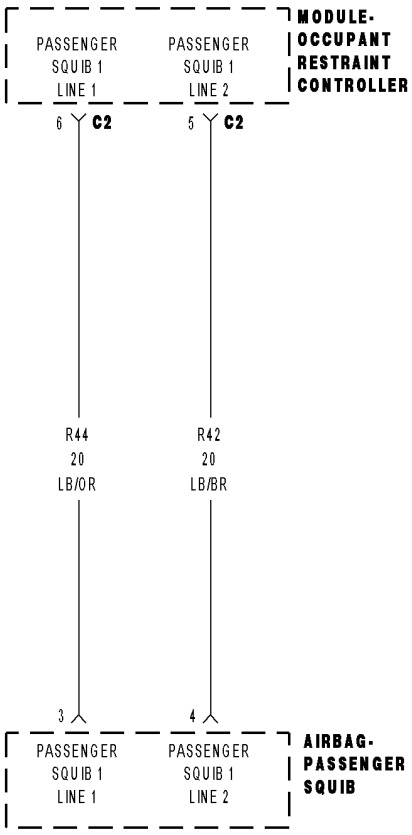
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

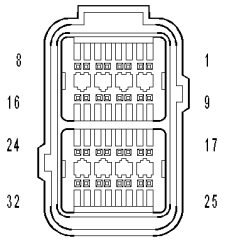
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

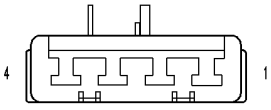
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B09-PASSENGER AIRBAG SQUIB 1 CIRCUIT HIGH





MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2



AIRBAG-
PASSENGER
SQUIB

8142db2d

B1B09-PASSENGER AIRBAG SQUIB 1 CIRCUIT HIGH (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the voltage on the Passenger Squib 1 circuits.
- **Set Condition:**
  When the ORC has detected voltage on the Passenger Squib 1 circuits.

Possible Causes
(R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT OR (R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT SHORTED TO BATTERY
PASSENGER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B09-PASSENGER AIRBAG SQUIB 1 CIRCUIT HIGH (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

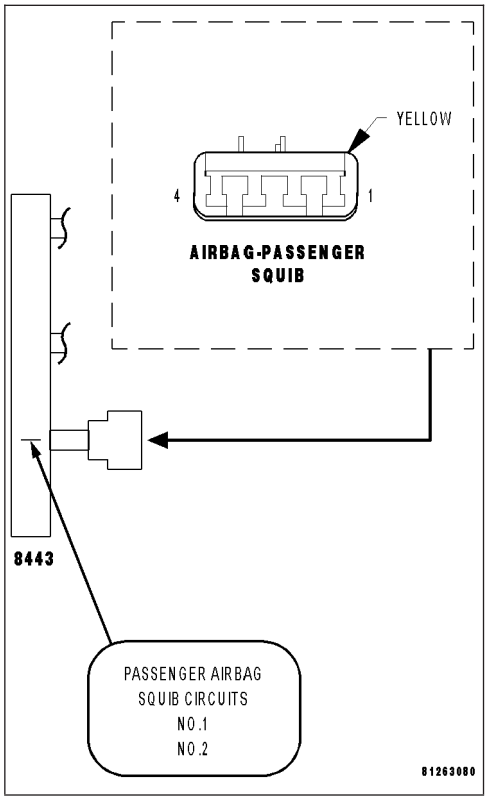
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B09 PASSENGER AIRBAG SQUIB 1 CIRCUIT HIGH?

Yes >> Go To 3

No >> Replace the Passenger Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT AND (R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO BATTERY

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

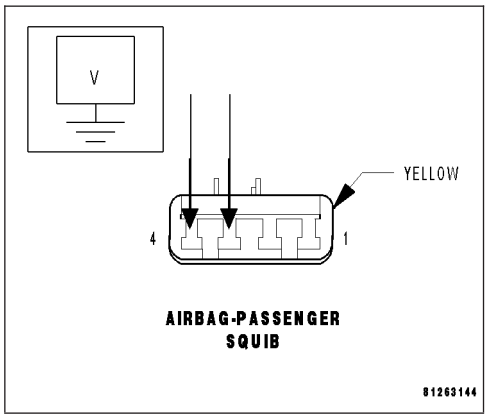
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

Measure the voltage of the (R42) Passenger Squib 1 Line 2 circuit between the Passenger Airbag Squib connector and ground.

Measure the voltage of the (R44) Passenger Squib 1 Line 1 circuit between the Passenger Airbag Squib connector and ground.

Is there any voltage present on either circuit?



Yes >> Repair the Passenger Squib 1 circuits with voltage present for a short to battery.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 4

B1B09-PASSENGER AIRBAG SQUIB 1 CIRCUIT HIGH (CONTINUED)

4. REPLACE THE ORC

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

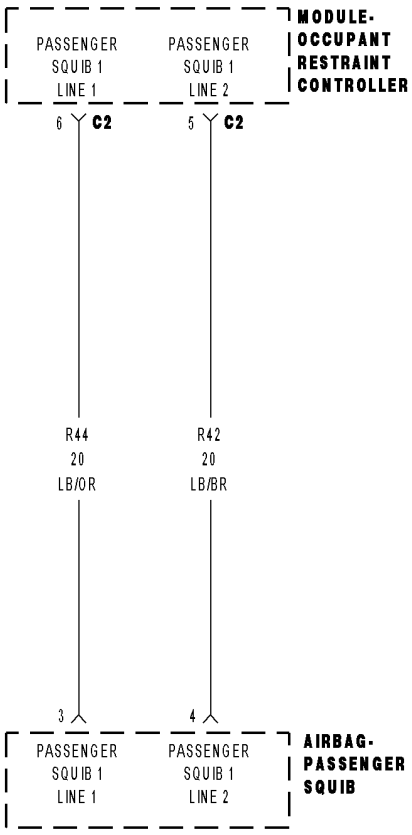
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

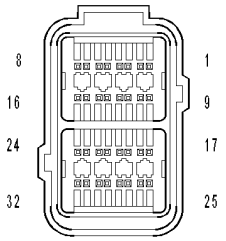
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

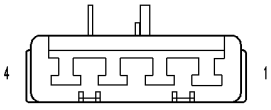
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B0A-PASSENGER AIRBAG SQUIB 1 CIRCUIT OPEN





MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2



AIRBAG-
PASSENGER
SQUIB

8142db2d

B1B0A-PASSENGER AIRBAG SQUIB 1 CIRCUIT OPEN (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 1 circuits.
- **Set Condition:**
  The ORC has detected an open or high resistance on the Passenger Squib 1 circuits.

Possible Causes
(R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT OPEN
(R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT OPEN
PASSENGER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 6

B1B0A-PASSENGER AIRBAG SQUIB 1 CIRCUIT OPEN (CONTINUED)

2. CHECK FOR OPEN SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Passenger Airbag Squib connector.

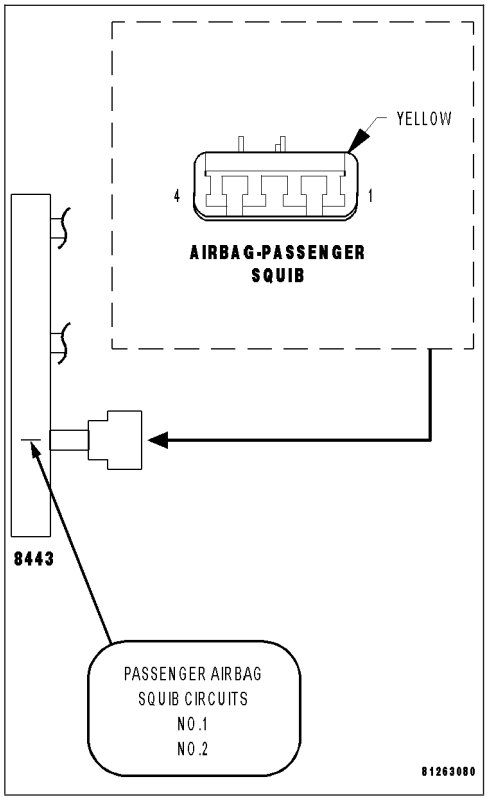
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B0A PASSENGER AIRBAG SQUIB 1 CIRCUIT OPEN?

Yes >> Go To 3

No >> Replace the Passenger Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

Disconnect the ORC connectors.

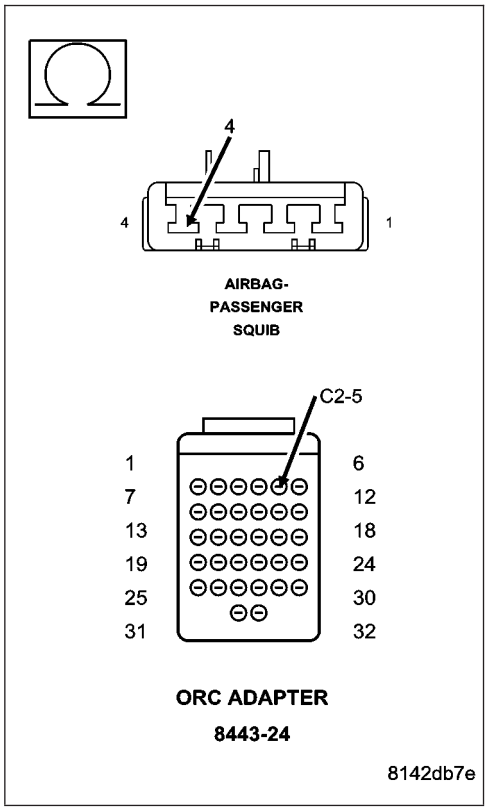
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

Measure the resistance of the (R42) Passenger Squib 1 Line 2 circuit between the Passenger Airbag Squib connector and the 8443 ORC Adaptor.

Is the resistance below 1.0 ohm?

Yes >> Go To 4

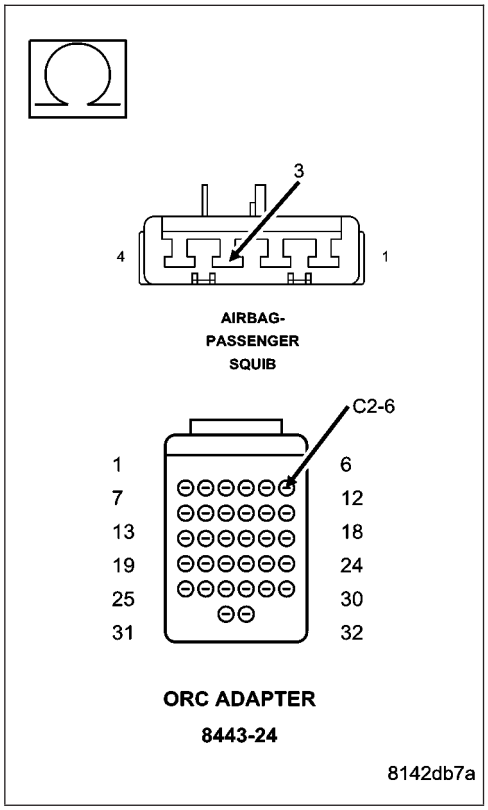
No >> Repair the (R42) Passenger Squib 1 Line 2 circuit for and open. Then, Go To 4



B1B0A-PASSENGER AIRBAG SQUIB 1 CIRCUIT OPEN (CONTINUED)

4. CHECK (R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT FOR AN OPEN

Measure the resistance of the (R44) Passenger Squib 1 Line 1 circuit between the Passenger Airbag Squib connector and the 8443 ORC Adaptor.



Is the resistance below 1.0 ohm?

Yes >> Go To 5

No >> Repair the (R44) Passenger Squib 1 Line 1 circuit for an open.
Perform ORC VERIFICATION TEST - VER 1

5. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

If there are no possible causes remaining, view repair.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

B1B0A-PASSENGER AIRBAG SQUIB 1 CIRCUIT OPEN (CONTINUED)

6. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

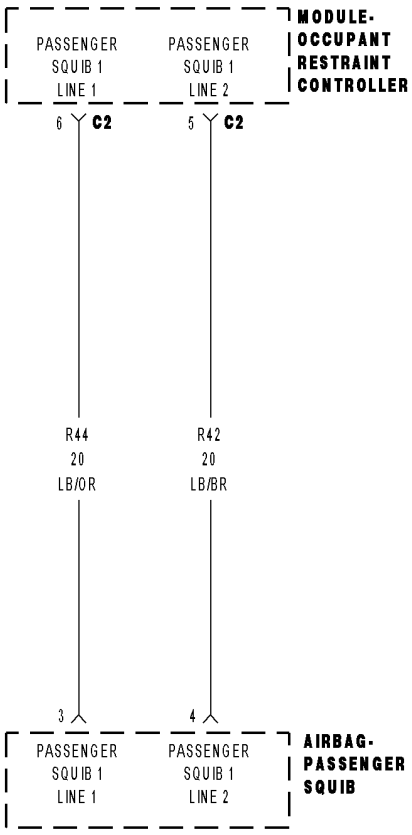
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

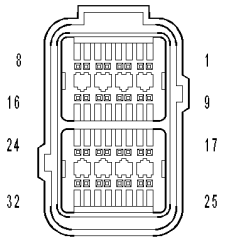
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

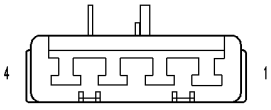
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B0B-PASSENGER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER





MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2



AIRBAG-
PASSENGER
SQUIB

8142db2d

B1B0B-PASSENGER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 1 circuits.
- **Set Condition:**
  The ORC has detected low resistance between the Passenger Squib 1 circuits.

Possible Causes
(R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT SHORTED TO (R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT
PASSENGER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B0B-PASSENGER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Passenger Airbag Squib connector.

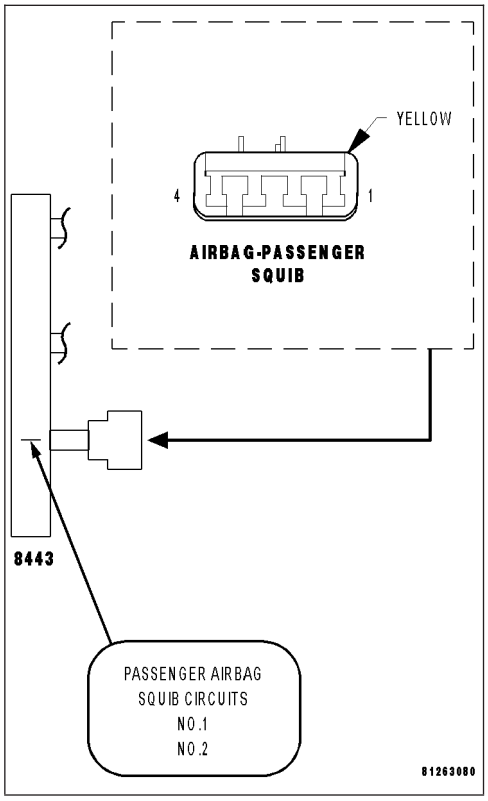
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B0B PASSENGER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER?

Yes >> Go To 3

No >> Replace the Passenger Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO (R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

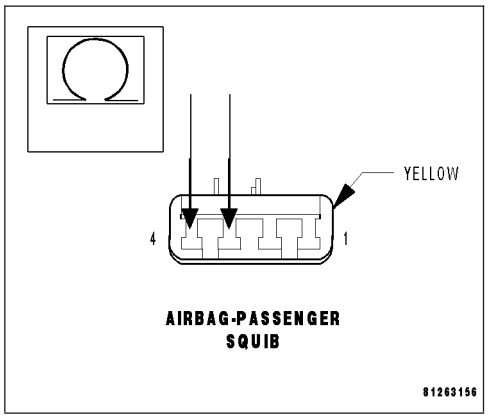
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.
Measure the resistance between the (R42) Passenger Squib 1 Line 2 circuit and the (R44) Passenger Squib 1 Line 1 circuit at the Passenger Airbag Squib connector.

Is the resistance below 10K ohms?

Yes >> Repair the (R42) Passenger Squib 1 Line 2 circuit for a short to the (R44) Passenger Squib 1 Line 1 circuit.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 4



B1B0B-PASSENGER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER (CONTINUED)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

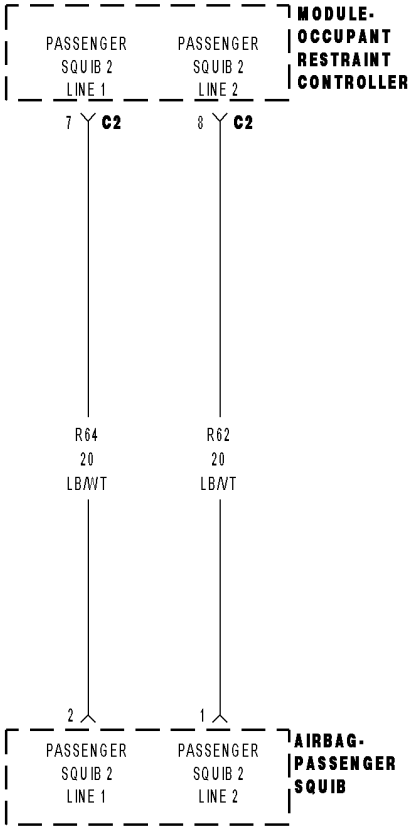
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

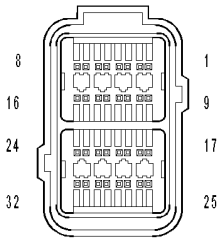
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

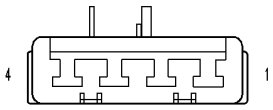
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B0C-PASSENGER AIRBAG SQUIB 2 CIRCUIT LOW





MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2



AIRBAG-
PASSENGER
SQUIB

8142dba5

B1B0C-PASSENGER AIRBAG SQUIB 2 CIRCUIT LOW (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 2 circuits.
- **Set Condition:**
  The ORC has detected low resistance on the Passenger Squib 2 circuits.

Possible Causes
(R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT OR (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT SHORTED TO GROUND
PASSENGER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B0C-PASSENGER AIRBAG SQUIB 2 CIRCUIT LOW (CONTINUED)

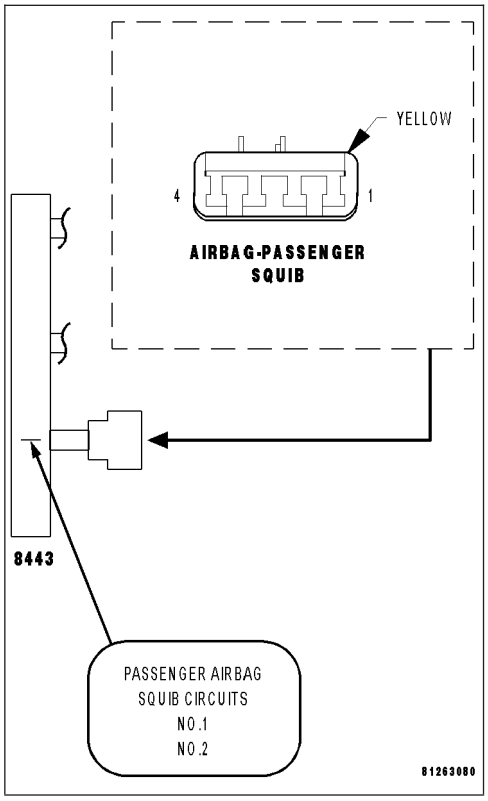
2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.



Does the scan tool display: B1B0C PASSENGER AIRBAG SQUIB 2 CIRCUIT LOW?

Yes >> Go To 3

No >> Replace the Passenger Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

3. CHECK (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT AND (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT FOR A SHORT TO GROUND

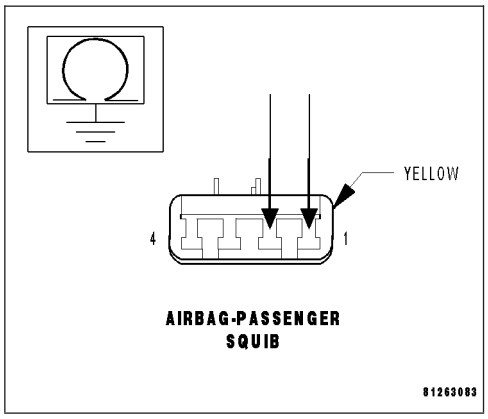
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

Measure the resistance of the (R64) Passenger Squib 2 Line 1 circuit between ground and the Passenger Airbag Squib connector.

Measure the resistance of the (R62) Passenger Squib 2 Line 2 circuit between ground and the Passenger Airbag Squib connector.



Is the resistance below 10K ohms on either circuit?

Yes >> Repair the Passenger Squib 2 circuits with a resistance below 10K ohms for a short to ground.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 4

B1B0C-PASSENGER AIRBAG SQUIB 2 CIRCUIT LOW (CONTINUED)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

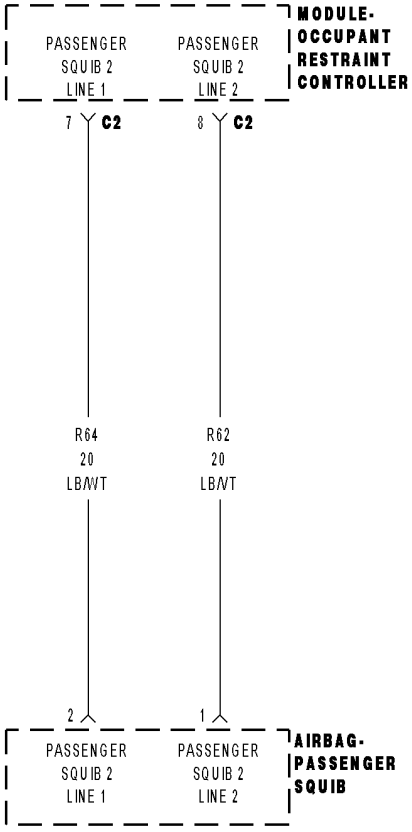
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

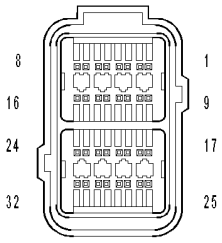
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

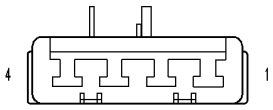
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B0D-PASSENGER AIRBAG SQUIB 2 CIRCUIT HIGH





MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2



AIRBAG-
PASSENGER
SQUIB

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B1B0D-PASSENGER AIRBAG SQUIB 2 CIRCUIT HIGH (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the voltage of the Passenger Squib 2 circuits.
- **Set Condition:**
  The ORC has detected voltage on the Passenger Squib 2 circuits.

Possible Causes
(R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT OR (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT SHORTED TO BATTERY
PASSENGER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B0D-PASSENGER AIRBAG SQUIB 2 CIRCUIT HIGH (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

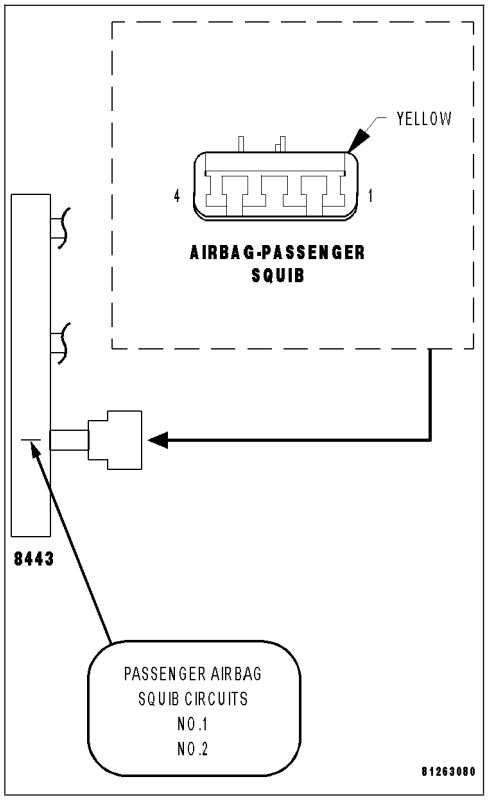
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B0D PASSENGER AIRBAG SQUIB 2 CIRCUIT HIGH?

Yes >> Go To 3

No >> Replace the Passenger Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT AND (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT FOR A SHORT TO BATTERY

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

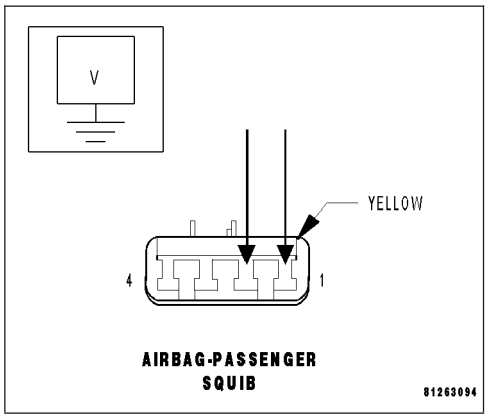
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

Measure the voltage of the (R64) Passenger Squib 2 Line 1 circuit between the Passenger Airbag Squib connector and ground.

Measure the voltage of the (R62) Passenger Squib 2 Line 2 circuit between the Passenger Airbag Squib connector and ground.

Is there any voltage present on either circuit?



Yes >> Repair the Passenger Squib 2 circuits with voltage present for a short to battery.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 4

B1B0D-PASSENGER AIRBAG SQUIB 2 CIRCUIT HIGH (CONTINUED)

4. REPLACE THE ORC

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

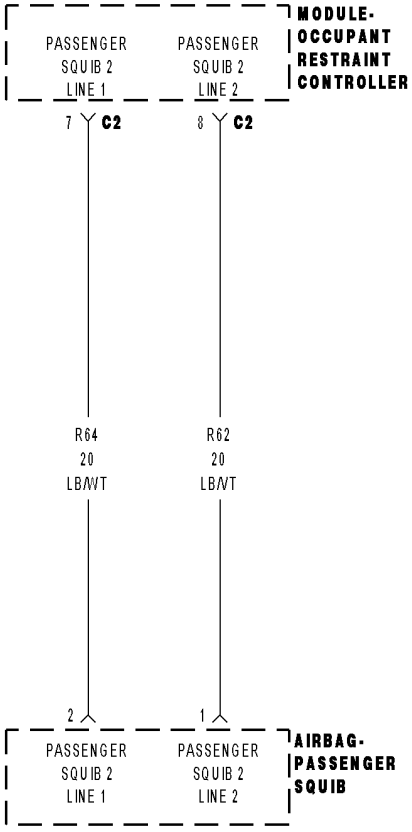
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

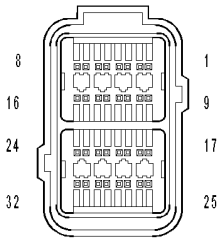
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

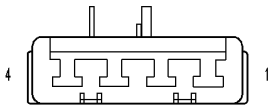
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B0E-PASSENGER AIRBAG SQUIB 2 CIRCUIT OPEN





MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2



AIRBAG-
PASSENGER
SQUIB

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B1B0E-PASSENGER AIRBAG SQUIB 2 CIRCUIT OPEN (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 2 circuits.
- **Set Condition:**
  The ORC has detected an open or high resistance on the Passenger Squib 2 circuits.

Possible Causes
(R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT OPEN
(R62) PASSENGER SQUIB 2 LINE 2 CIRUCIT OPEN
PASSENGER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 6

B1B0E-PASSENGER AIRBAG SQUIB 2 CIRCUIT OPEN (CONTINUED)

2. CHECK FOR OPEN SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

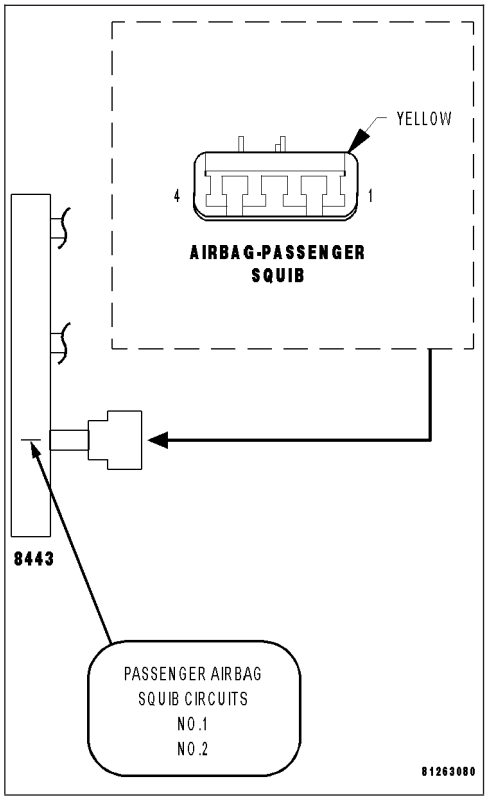
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B0E PASSENGER AIRBAG SQUIB CIRCUIT OPEN?

Yes >> Go To 3

No >> Replace the Passenger Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

Disconnect the ORC connectors.

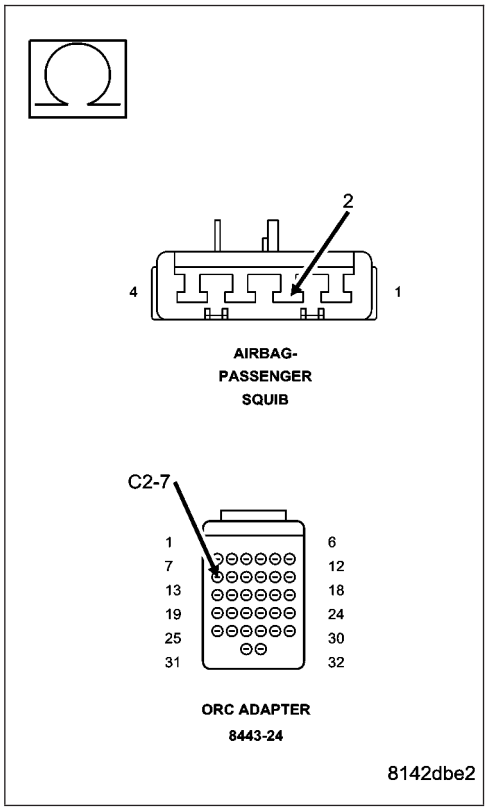
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

Measure the resistance of the (R64) Passenger Squib 2 Line 1 circuit between the Passenger Airbag Squib connector and the 8443 Load Tool ORC Adaptor.

Is the resistance below 1.0 ohm?

Yes >> Go to 4

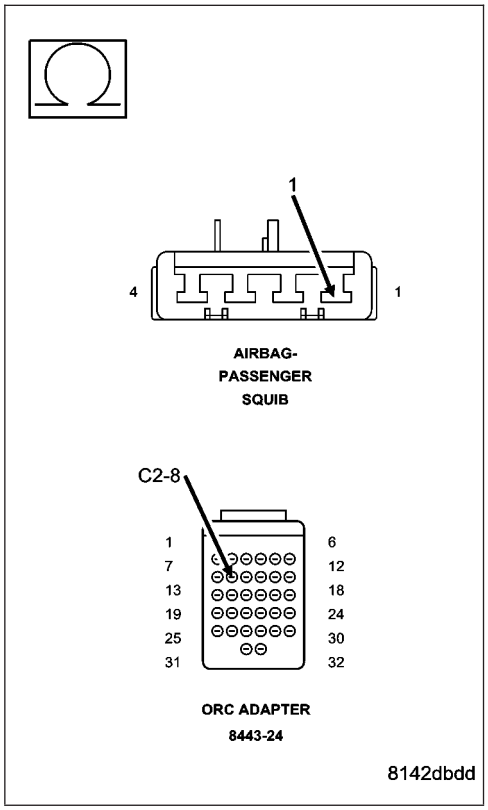
No >> Repair the (R64) Passenger Squib 2 Line 1 circuit for an open. Then, Go To 4



B1B0E-PASSENGER AIRBAG SQUIB 2 CIRCUIT OPEN (CONTINUED)

4. CHECK (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R62) Passenger Squib 2 Line 2 circuit between the Passenger Airbag Squib connector and the 8443 Load Tool ORC Adaptor.



Is the resistance below 1.0 ohm?

Yes >> Go To 5

No >> Repair the (R62) Passenger Squib 2 Line 2 circuit for an open.
Perform ORC VERIFICATION TEST - VER 1

5. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

B1B0E-PASSENGER AIRBAG SQUIB 2 CIRCUIT OPEN (CONTINUED)

6. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Passenger Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

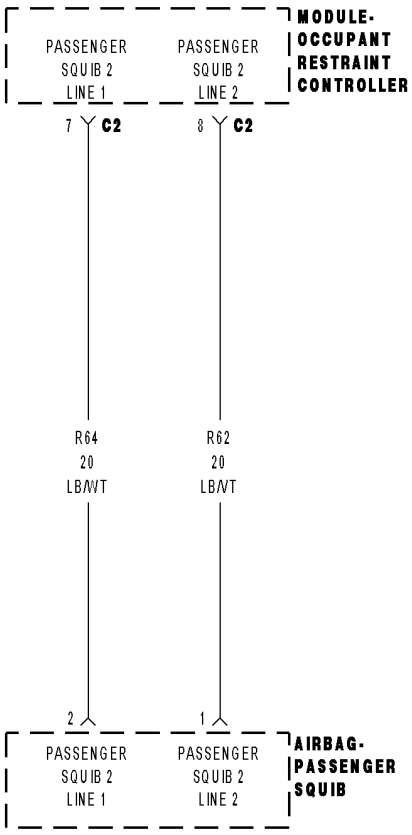
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

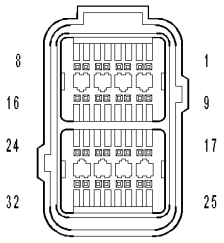
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

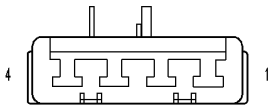
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B0F-PASSENGER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER





MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2



AIRBAG-
PASSENGER
SQUIB

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B1B0F-PASSENGER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 2 circuits.
- **Set Condition:**
  The ORC has detected low resistance between the Passenger Squib 2 circuits.

Possible Causes
(R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT SHORTED TO (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT
PASSENGER AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B0F-PASSENGER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

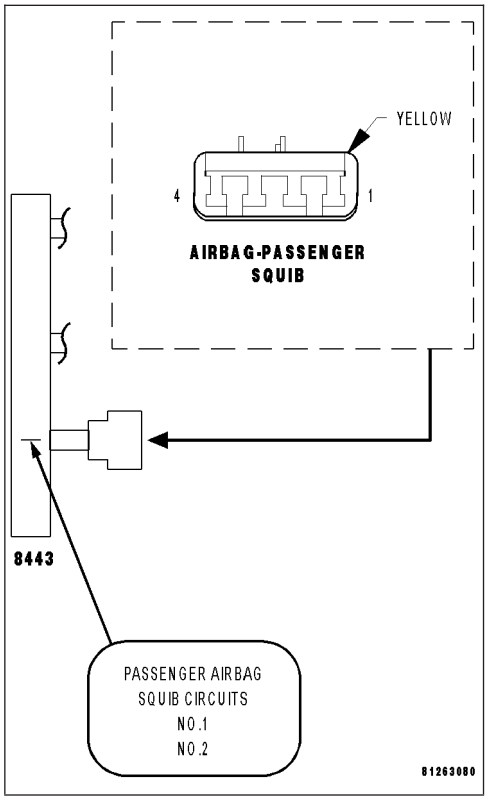
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B0F PASSENGER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER?

Yes >> Go To 3

No >> Replace the Passenger Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT FOR A SHORT TO (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

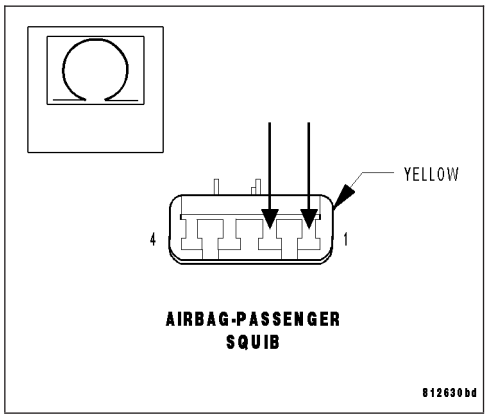
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.
Measure the resistance between the (R64) Passenger Squib 2 Line 1 circuit and the (R62) Passenger Squib 2 Line 2 circuit at the Passenger Airbag Squib connector.

Is the resistance below 10K ohms?

Yes >> Repair the (R64) Passenger Squib 2 Line 1 circuit for a short to the (R62) Passenger Squib 2 Line 2 circuit.
Perform ORC VERIFICATION TEST - VER 1

No >> Go to 4



B1B0F-PASSENGER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER (CONTINUED)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

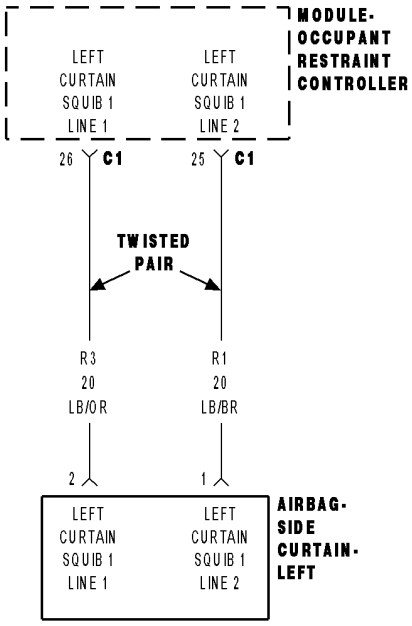
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

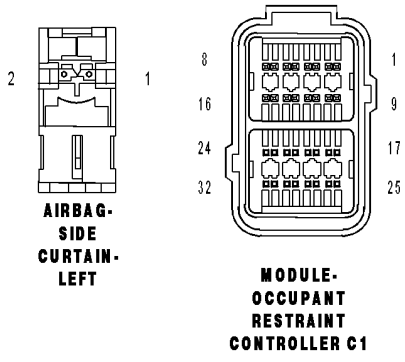
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B18-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT LOW





8142dc04

B1B18-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT LOW (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Left Curtain Squib 1 circuits.
- **Set Condition:**
  The ORC has detected low resistance of the Left Curtain Squib 1 circuits.

Possible Causes
(R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT OR (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT SHORTED TO GROUND
LEFT SIDE CURTAIN AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B18-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT LOW (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN LEFT SIDE CURTAIN AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Left Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, do not place an intact undeployed curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

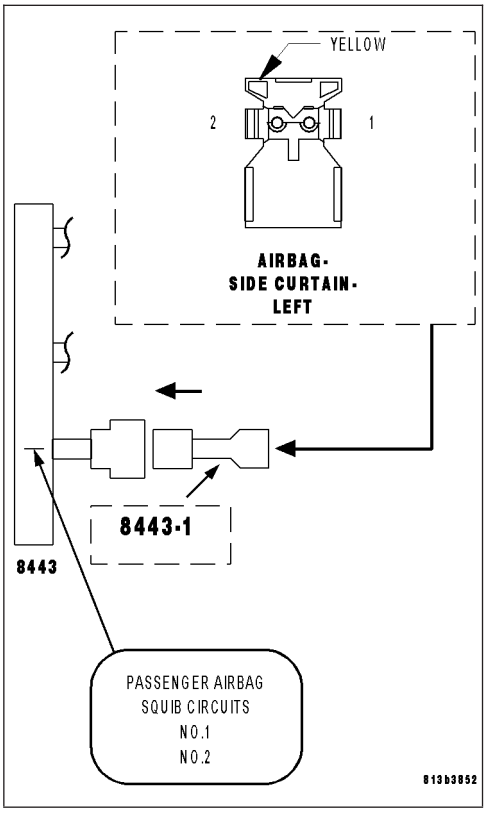
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Left Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B18 LEFT SIDE CURTAIN SQUIB 1 CIRCUIT LOW?

Yes >> Go To 3

No >> Replace the Left Side Curtain Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT AND (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Left Side Curtain Airbag connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.

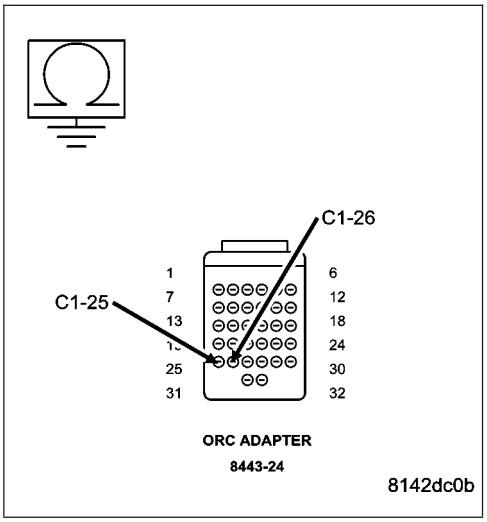
Measure the resistance of the (R3) Left Curtain Squib 1 Line 1 circuit between ground and the 8443 Load Tool ORC Adaptor.

Measure the resistance of the (R1) Left Curtain Squib 1 Line 2 circuit between ground and the 8443 Load Tool ORC Adaptor.

Is the resistance below 10K ohms on either circuit?

Yes >> Repair the Left Curtain Squib 1 circuits with a resistance below 10K ohms for a short to ground.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 4



B1B18-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT LOW (CONTINUED)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

IF only stored codes return continue the test until the problem area has been isolated.

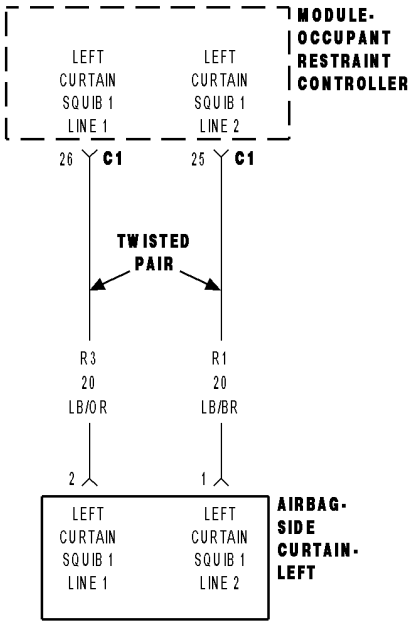
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

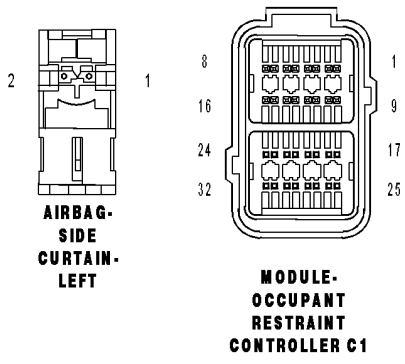
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B19-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT HIGH





8142dc04

B1B19-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT HIGH (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the voltage on the Left Curtain Squib 1 circuits.
- **Set Condition:**
  The ORC has detected voltage on the Left Curtain Squib 1 circuits.

Possible Causes
(R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT OR (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT SHORTED TO BATTERY
LEFT SIDE CURTAIN AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B19-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT HIGH (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN LEFT SIDE CURTAIN AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Left Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, do not place an intact undeployed curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

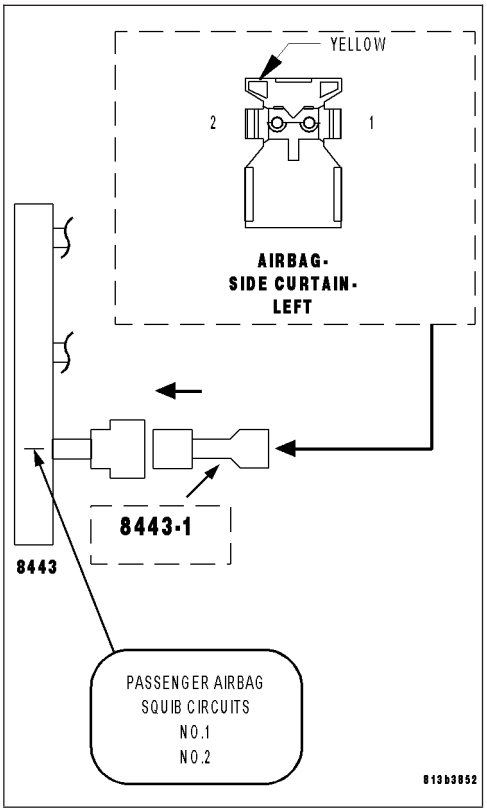
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Left Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B19 LEFT SIDE CURTAIN SQUIB 1 CIRCUIT HIGH?

Yes >> Go To 3

No >> Replace the Left Side Curtain Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT AND (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO BATTERY

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Left Side Curtain Airbag connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.

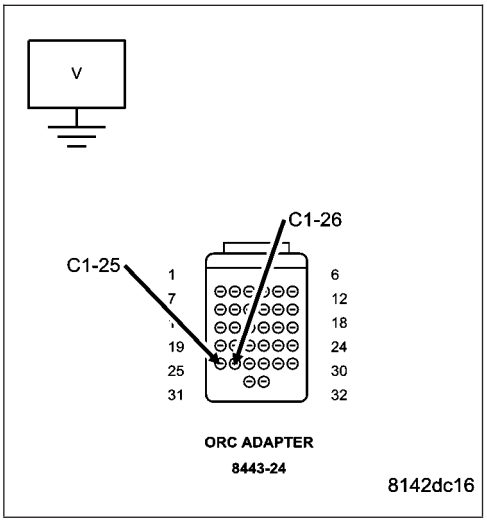
Measure the voltage of the (R3) Left Curtain Squib 1 Line 1 circuit between the Left Side Curtain Airbag connector and ground.

Measure the voltage of the (R1) Left Curtain Squib 1 Line 2 circuit between the Left Side Curtain Airbag connector and ground.

Is there any voltage present on either circuit?

Yes >> Repair the Left Curtain Squib 1 circuits with voltage present for a short to battery.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 4



B1B19-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT HIGH (CONTINUED)

4. REPLACE THE ORC

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off then disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

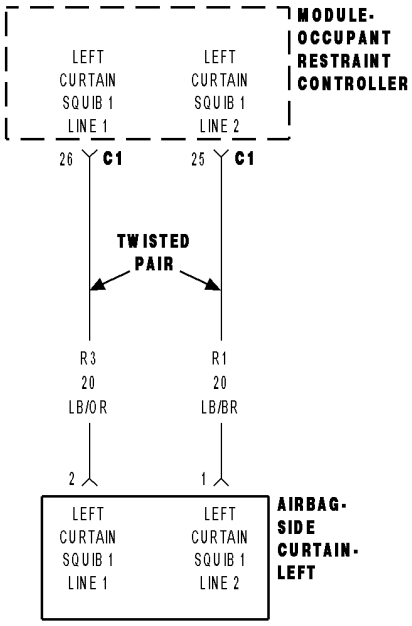
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

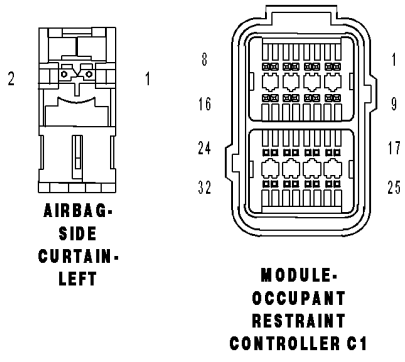
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B1A-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT OPEN





8142dc04

B1B1A-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT OPEN (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Left Curtain Squib 1 circuits.
- **Set Condition:**
  The ORC has detected an open or high resistance on the Left Curtain Squib 1 circuits.

Possible Causes
(R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT OPEN
(R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT OPEN
LEFT SIDE CURTAIN AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 6

B1B1A-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT OPEN (CONTINUED)

2. CHECK FOR OPEN SQUIB CIRCUITS IN LEFT SIDE CURTAIN AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Left Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, do not place an intact undeployed curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

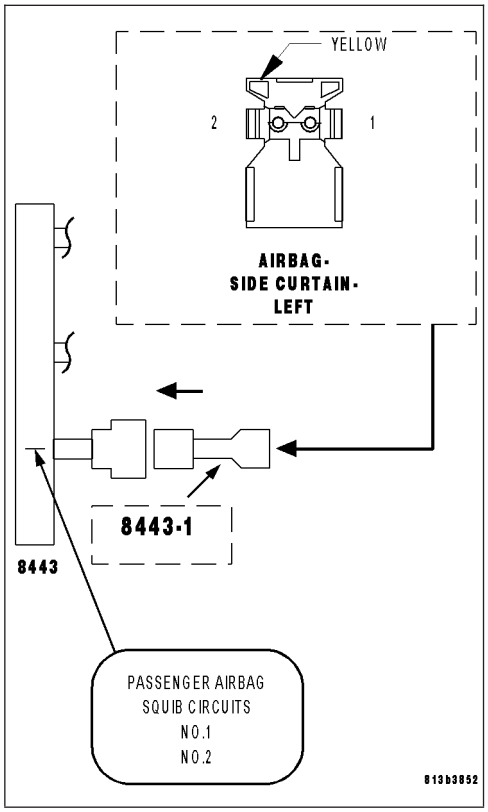
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Left Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B1A LEFT SIDE CURTAIN SQUIB 1 CIRCUIT OPEN?

Yes >> Go To 3

No >> Replace the Left Side Curtain Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Left Side Curtain Airbag connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.
Measure the resistance of the (R3) Left Curtain Squib 1 Line 1 circuit between the Left Side Curtain Airbag connector and the Load Tool ORC Adaptor.

Is the resistance below 1.0 ohm?

Yes >> Go To 4

No >> Repair the (R3) Left Curtain Squib 1 Line 1 circuit for an open. Then, Go To 4

4. CHECK (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R1) Left Curtain Squib 1 Line 2 circuit between the Left Side Curtain Airbag connector and the Load Tool ORC Adaptor.

Is the resistance below 1.0 ohm?

Yes >> Go To 5

No >> Repair the (R1) Left Curtain Squib 1 Line 2 circuit for an open.
Perform ORC VERIFICATION TEST - VER 1

B1B1A-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT OPEN (CONTINUED)

5. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

6. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

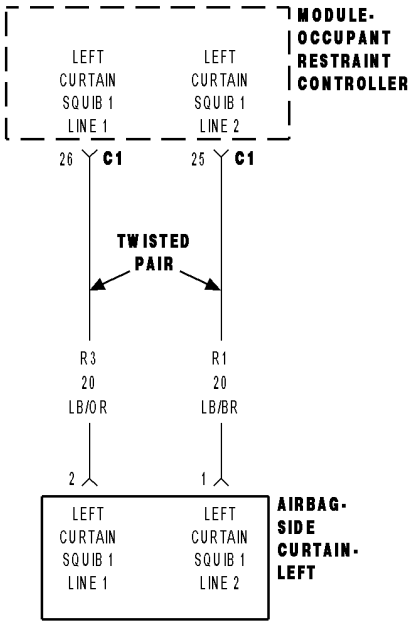
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

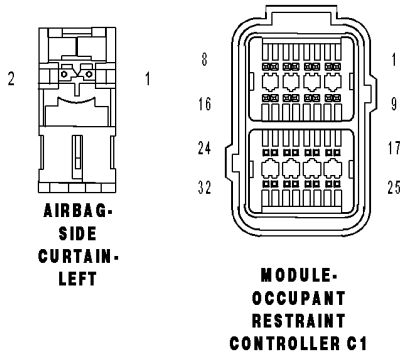
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B1B-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT SHORTED TOGETHER





8142dc04

B1B1B-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Left Curtain Squib 1 circuits.
- **Set Condition:**
  The ORC has detected low resistance between the Left Curtain Squib 1 circuits.

Possible Causes
(R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT SHORTED TO (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT
LEFT SIDE CURTAIN AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B1B-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT SHORTED TOGETHER (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN LEFT SIDE CURTAIN AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Left Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, do not place an intact undeployed curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

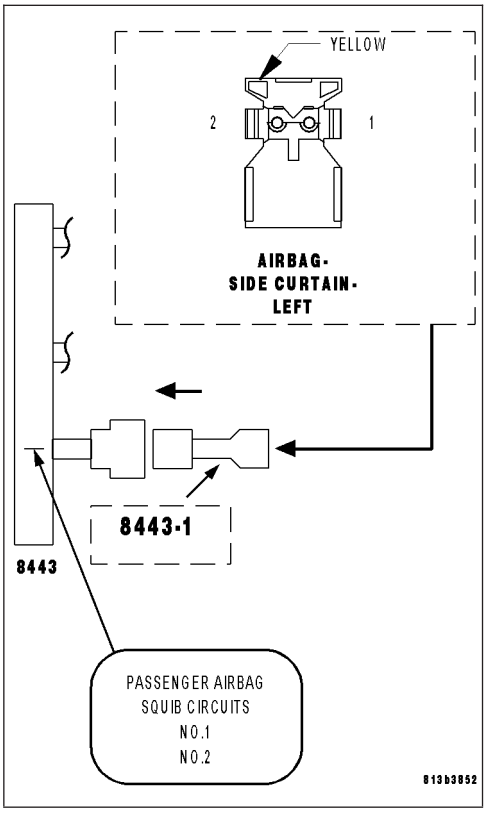
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Left Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B1B LEFT SIDE CURTAIN SQUIB 1 CIRCUIT SHORTED TOGETHER?

Yes >> Go To 3

No >> Replace the Left Side Curtain Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Left Side Curtain Airbag connector.

Disconnect the ORC connectors.

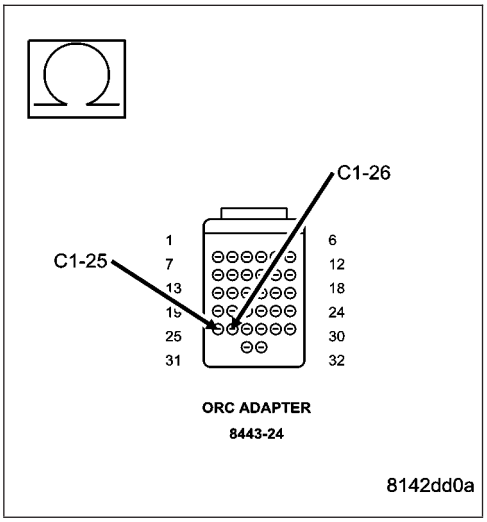
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.

Measure the resistance between the (R3) Left Curtain Squib 1 Line 1 circuit and the (R1) Left Curtain Squib 1 Line 2 circuit at the Left Side Curtain Airbag connector.

Is the resistance below 10K ohms?

Yes >> Repair the (R3) Left Curtain Squib 1 Line 1 circuit for a short to the (R1) Left Curtain Squib 1 Line 2 circuit.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 4



B1B1B-LEFT SIDE CURTAIN SQUIB 1 CIRCUIT SHORTED TOGETHER (CONTINUED)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

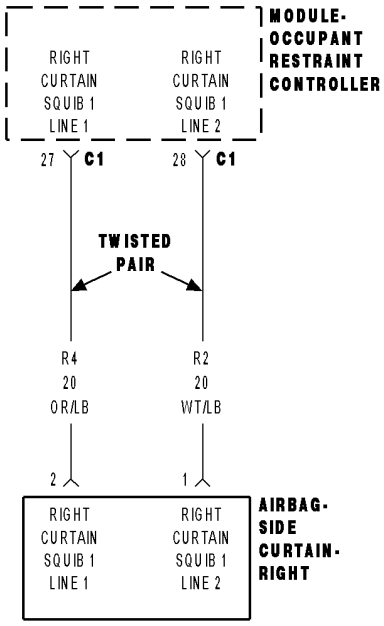
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

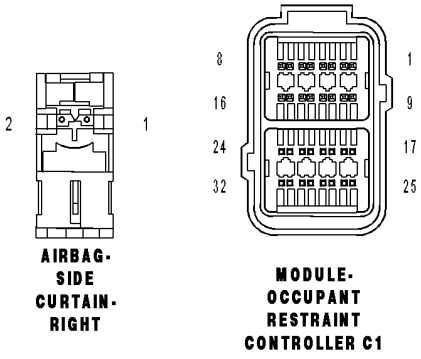
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B20-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT LOW





8142de3d

B1B20-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT LOW (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Right Curtain Squib 1 circuits.
- **Set Condition:**
  The ORC has detected low resistance on the Right Curtain Squib 1 circuits.

Possible Causes
(R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT OR (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT SHORTED TO GROUND
RIGHT SIDE CURTAIN AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B20-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT LOW (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN RIGHT SIDE CURTAIN AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Right Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, do not place an intact undeployed curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

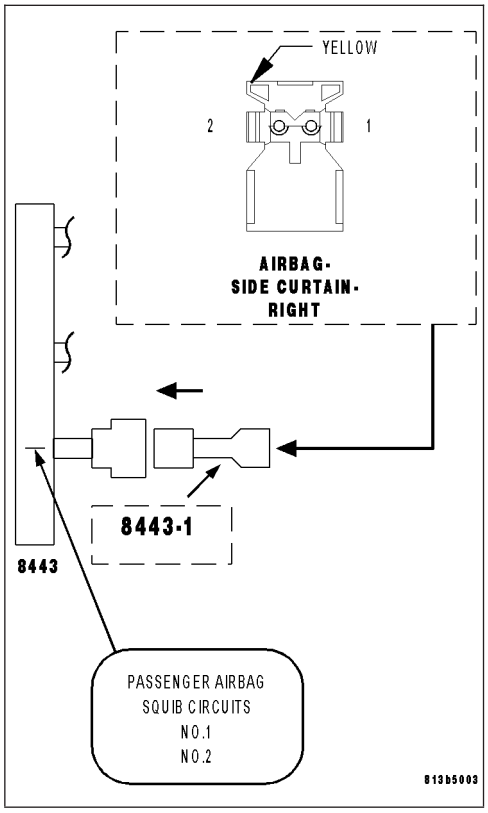
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Right Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B20 RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT LOW?

Yes >> Go To 3

No >> Replace the Right Side Curtain Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT AND (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Right Side Curtain Airbag connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.

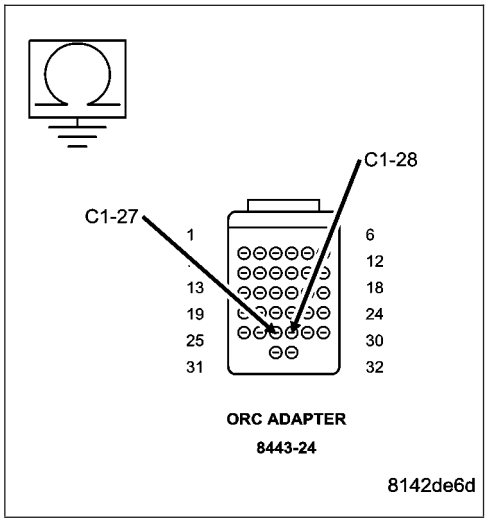
Measure the resistance of the (R4) Right Curtain Squib 1 Line 1 circuit between ground and the Right Side Curtain Airbag connector.

Measure the resistance of the (R2) Right Curtain Squib 1 Line 2 circuit between ground and the Right Side Curtain Airbag connector.

Is the resistance below 10K ohms on either circuit?

Yes >> Repair the Right Curtain Squib 1 circuits with a resistance below 10K ohms for a short to ground.
Perform ORC VERIFICATION TEST - VER 1

No >> Go to 4



B1B20-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT LOW (CONTINUED)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

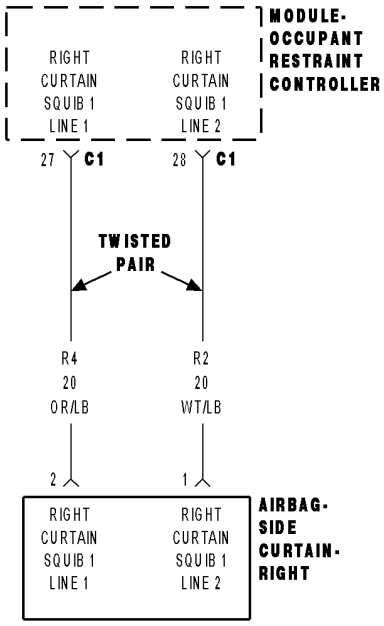
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

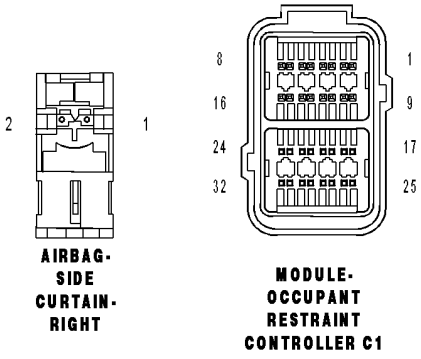
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B21-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT HIGH





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B1B21-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT HIGH (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the voltage on the Right Curtain Squib 1 circuits.
- **Set Condition:**
  When the ORC detects voltage on the Right Curtain Squib 1 circuits.

Possible Causes
(R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT OR (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT SHORTED TO BATTERY
RIGHT SIDE CURTAIN AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B21-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT HIGH (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN RIGHT SIDE CURTAIN AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Right Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, do not place an intact uncoupled curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

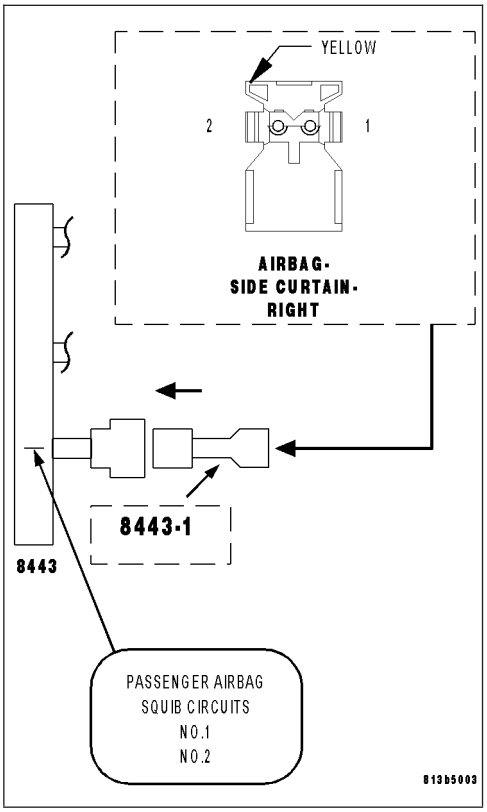
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Right Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B21 RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT HIGH?

Yes >> Go To 3

No >> Replace the Right Side Curtain Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT AND (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO BATTERY

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Right Side Curtain Airbag connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.

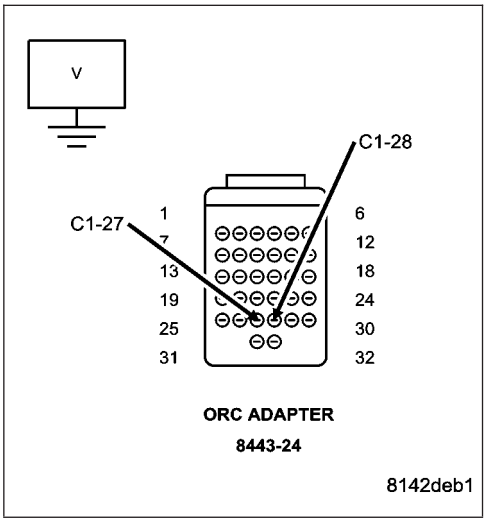
Measure the voltage of the (R4) Right Curtain Squib 1 Line 1 circuit between the Right Side Curtain Airbag connector and ground.

Measure the voltage of the (R2) Right Curtain Squib 1 Line 2 circuit between the Right Side Curtain Airbag connector and ground.

Is there any voltage present on either circuit?

Yes >> Repair the Right Curtain Squib 1 circuits with voltage present for a short to battery.
Perform ORC VERIFICATION TEST - VER 1

No >> Go to 4



B1B21-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT HIGH (CONTINUED)

4. REPLACE THE ORC

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

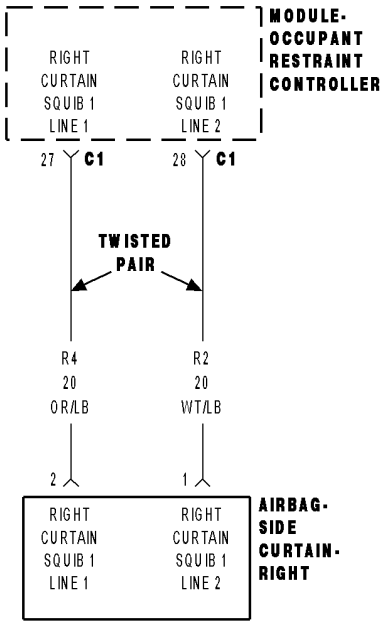
Are any ACTIVE DTCs present?

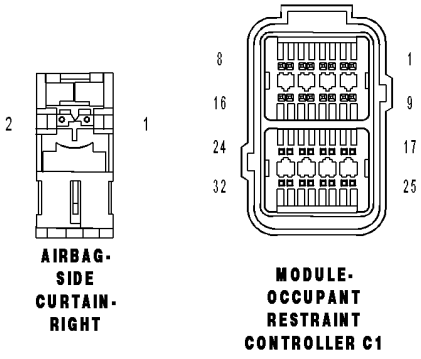
Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer

---

B1B22-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT OPEN





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B1B22-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT OPEN (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Right Curtain Squib 1 circuits.
- **Set Condition:**
  When the ORC has detects an open or high resistance on the Right Curtain Squib 1 circuits.

Possible Causes
(R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT OPEN
(R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT OPEN
RIGHT SIDE CURTAIN AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When connecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 6

B1B22-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT OPEN (CONTINUED)

2. CHECK FOR OPEN SQUIB CIRCUITS IN RIGHT SIDE CURTAIN AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Right Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, do not place an intact uncoupled curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

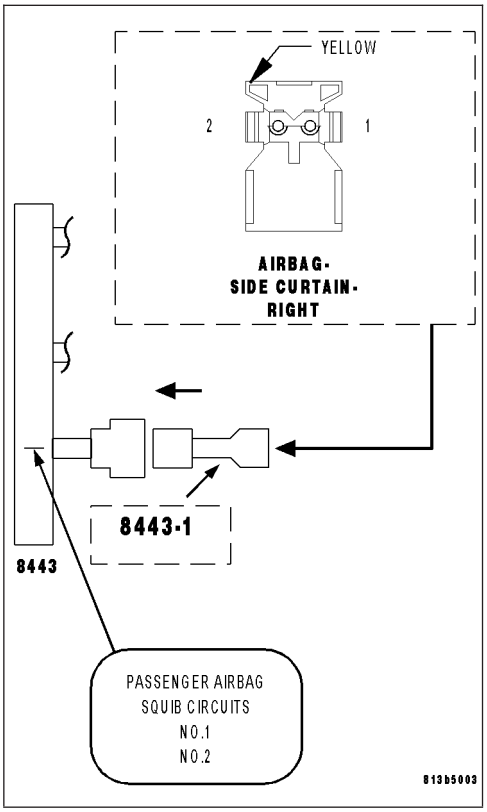
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Right Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B22 RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT OPEN?

Yes >> Go to 3

No >> Replace the Right Side Curtain Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT FOR AN OPEN

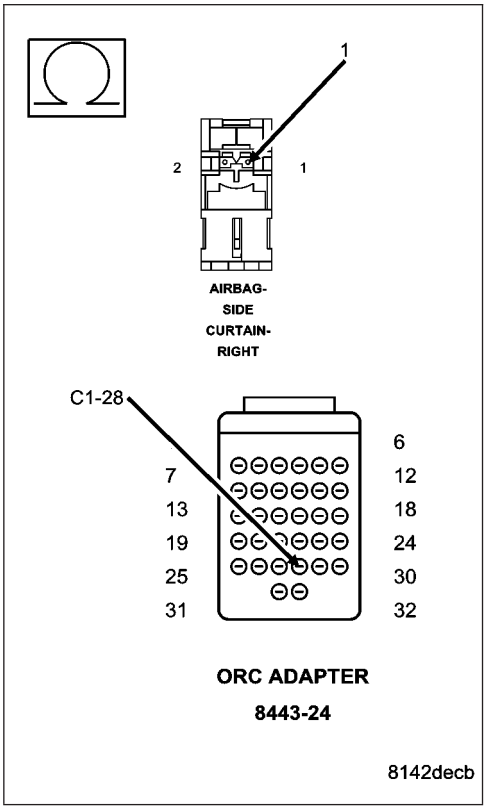
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Right Side Curtain Airbag connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.
Measure the resistance of the (R4) Right Curtain Squib 1 Line 1 circuit between the Right Side Curtain Airbag connector and the 8443 ORC Adaptor.

Is the resistance below 1.0 ohm?

Yes >> Go To 4

No >> Repair the (R4) Right Curtain Squib 1 Line 1 circuit for an open. Then, Go To 4



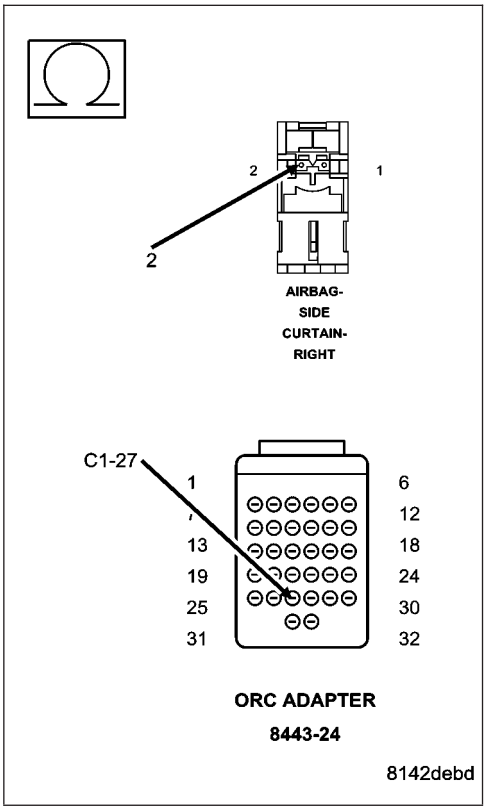
B1B22-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT OPEN (CONTINUED)

4. CHECK (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT FOR AN OPEN

Is the resistance below 1.0 ohm?

Yes >> Go To 5

No >> Repair the (R2) Right Curtain Squib 1 Line 2 circuit for an open.
Perform ORC VERIFICATION TEST - VER 1



5. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

B1B22-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT OPEN (CONTINUED)

6. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

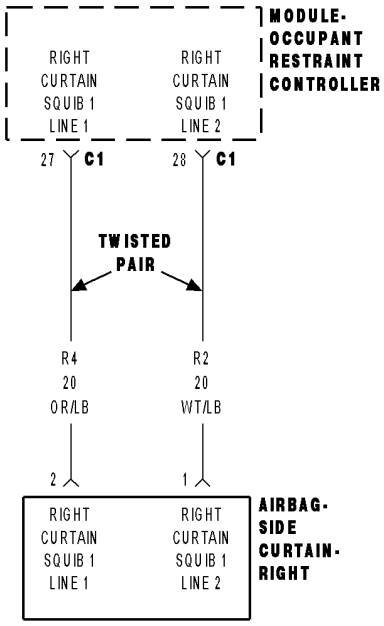
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

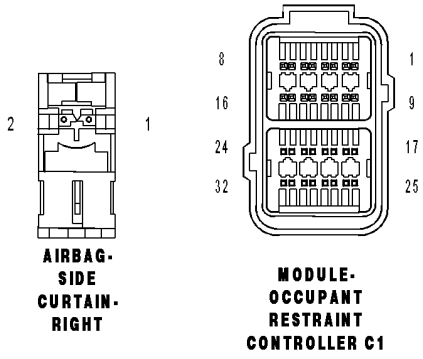
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B23-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT SHORTED TOGETHER





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B1B23-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Right Curtain Squib 1 circuits.
- **Set Condition:**
  The ORC has detected low resistance between the Right Curtain Squib 1 circuits.

Possible Causes
(R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT SHORTED TO (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT
RIGHT SIDE CURTAIN AIRBAG
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B23-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT SHORTED TOGETHER (CONTINUED)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN RIGHT SIDE CURTAIN AIRBAG

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Right Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, do not place an intact uncoupled curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

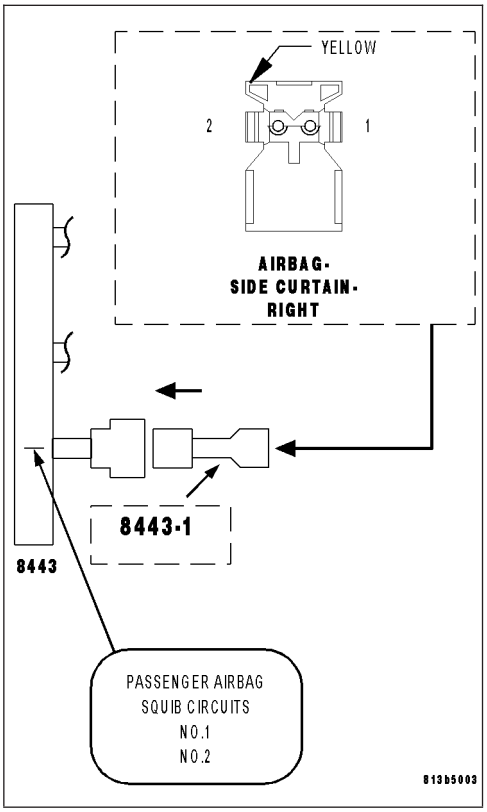
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Right Side Curtain Airbag connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B23 RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT SHORTED TOGETHER?

Yes >> Go to 3

No >> Replace the Right Side Curtain Airbag in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Right Side Curtain Airbag connector.

Disconnect the ORC connectors.

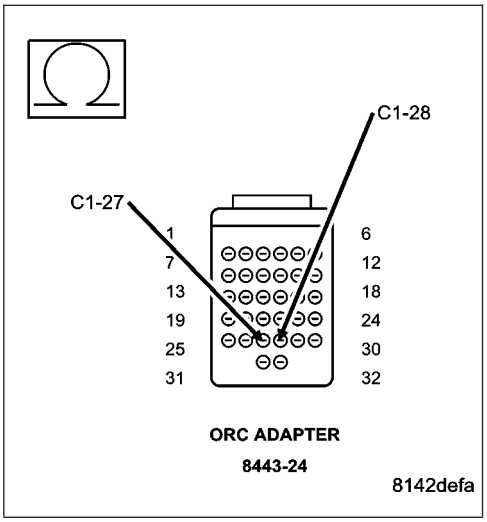
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.

Measure the resistance between the (R4) Right Curtain Squib 1 Line 1 circuit and the (R2) Right Curtain Squib 1 Line 2 circuit at the Right Side Curtain Airbag connector.

Is the resistance below 10K ohms?

Yes >> Repair the (R4) Right Curtain Squib 1 Line 1 circuit for a short to the (R2) Right Curtain Squib 1 Line 2 circuit.
Perform ORC VERIFICATION TEST - VER 1

No >> Go to 4



B1B23-RIGHT SIDE CURTAIN SQUIB 1 CIRCUIT SHORTED TOGETHER (CONTINUED)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

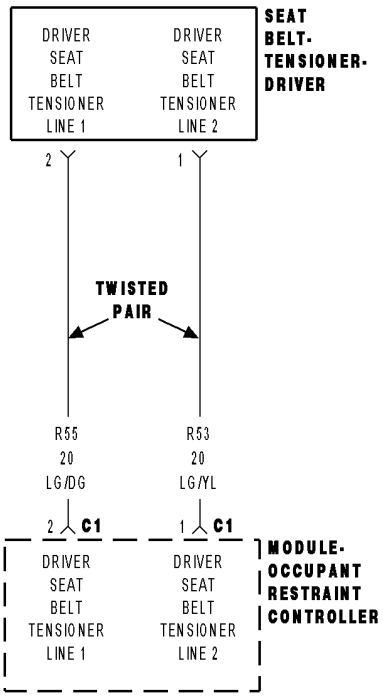
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

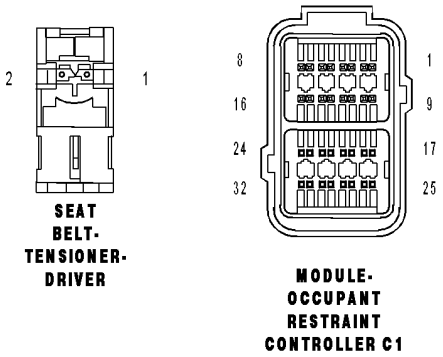
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B28-1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT LOW





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B1B28-1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT LOW (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Driver Seat Belt Tensioner circuits.
- **Set Condition:**
  The ORC has detected low resistance on the Driver Seat Belt Tensioner circuits.

Possible Causes
(R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT OR (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT SHORTED TO GROUND
DRIVER SEAT BELT PRETENSIONER
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B28-1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT LOW (CONTINUED)

2. CHECK FOR SHORTED DRIVER SEAT BELT PRETENSIONER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Driver Seat Belt Pretensioner connector.

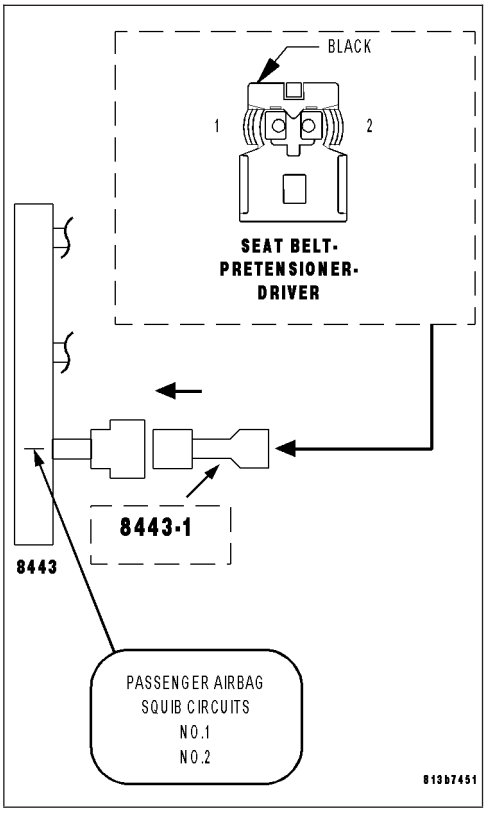
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Driver Seat Belt Pretensioner connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B28 1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT LOW?

Yes >> Go To 3

No >> Replace the Driver Seat Belt Pretensioner in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT AND (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Driver Seat Belt Pretensioner connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.

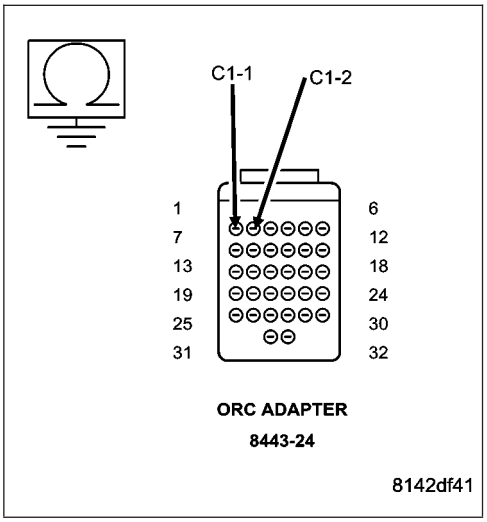
Measure the resistance of the (R55) Driver Seat Belt Tensioner Line 1 circuit between ground and the Driver Seat Belt Pretensioner connector.

Measure the resistance of the (R53) Driver Seat Belt Tensioner Line 2 circuit between ground and the Driver Seat Belt Pretensioner connector.

Is the resistance below 10K ohms on either circuit?

Yes >> Repair the Driver Seat Belt Tensioner circuits with a resistance below 10K ohms for a short to ground.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 4



B1B28-1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT LOW (CONTINUED)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

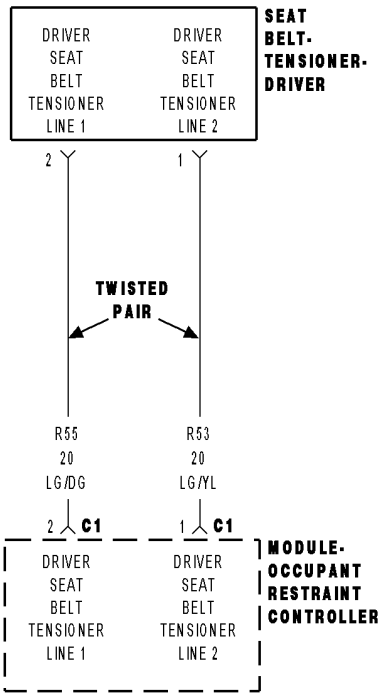
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

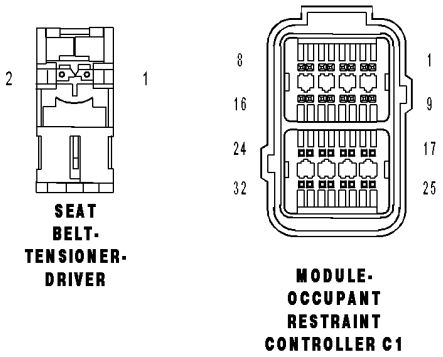
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B29-1ST ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT HIGH





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B1B29-1ST ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT HIGH (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the voltage on the Driver Seat Belt Tensioner circuits.
- **Set Condition:**
  The ORC detects voltage on the Driver Seat Belt Tensioner circuits.

Possible Causes
(R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT OR (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT SHORTED TO BATTERY
DRIVER SEAT BELT PRETENSIONER
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B29-1ST ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT HIGH (CONTINUED)

2. CHECK FOR SHORTED DRIVER SEAT BELT PRETENSIONER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Driver Seat Belt Pretensioner connector.

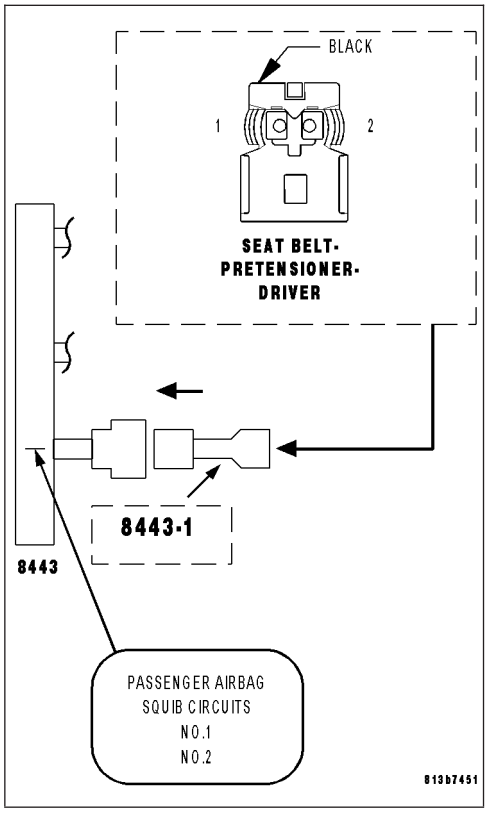
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Driver Seat Belt Pretensioner connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B29 1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT HIGH?

Yes >> Go To 3

No >> Replace the Driver Seat Belt Pretensioner in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT AND (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT FOR A SHORT TO BATTERY

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Driver Seat Belt Pretensioner connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.

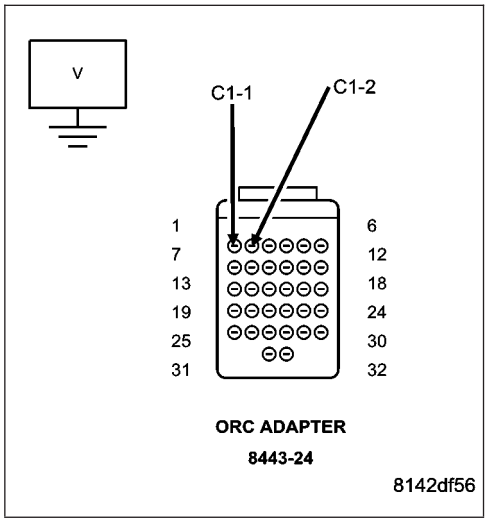
Measure the voltage of the (R55) Driver Seat Belt Tensioner Line 1 circuit between the Driver Seat Belt Pretensioner connector and ground.

Measure the voltage of the (R53) Driver Seat Belt Tensioner Line 2 circuit between the Driver Seat Belt Pretensioner connector and ground.

Is there any voltage present on either circuit?

Yes >> Repair the Driver Seat Belt Tensioner circuits with voltage present for a short to battery.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 4



B1B29-1ST ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT HIGH (CONTINUED)

4. REPLACE THE ORC

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

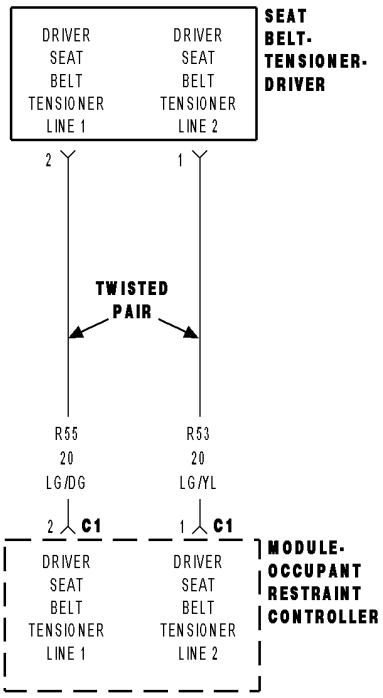
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

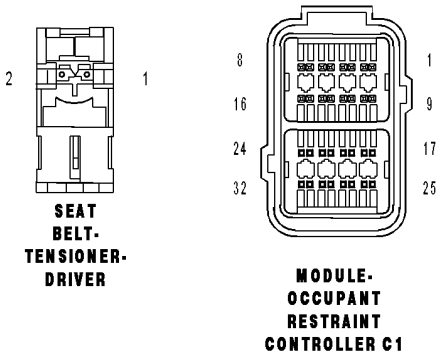
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B2A-1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT OPEN





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B1B2A-1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT OPEN (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Driver Seat Belt Tensioner circuits.
- **Set Condition:**
  The ORC has detected an open or high resistance on the Driver Seat Belt Tensioner circuits.

Possible Causes
(R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT OR (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT OPEN
DRIVER SEAT BELT PRETENSIONER
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 6

B1B2A-1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT OPEN (CONTINUED)

2. CHECK FOR OPEN DRIVER SEAT BELT PRETENSIONER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Driver Seat Belt Pretensioner connector.

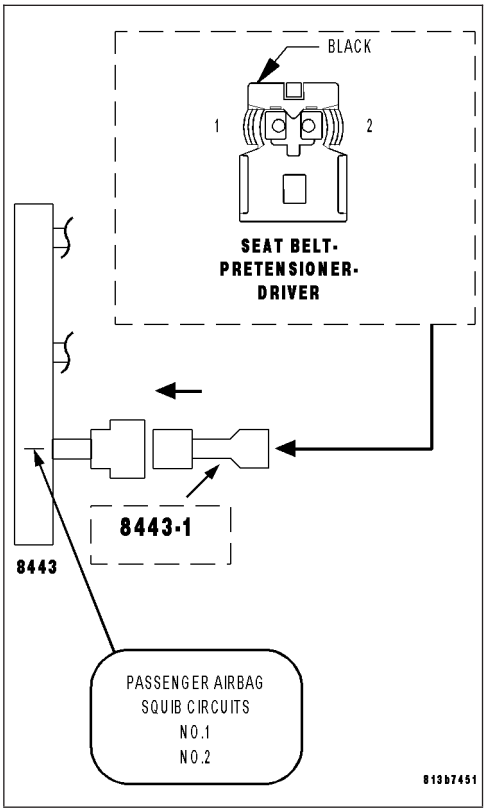
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Driver Seat Belt Pretensioner connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B2A 1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT OPEN?

Yes >> Go To 3

No >> Replace the Driver Seat Belt Pretensioner in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT FOR AN OPEN

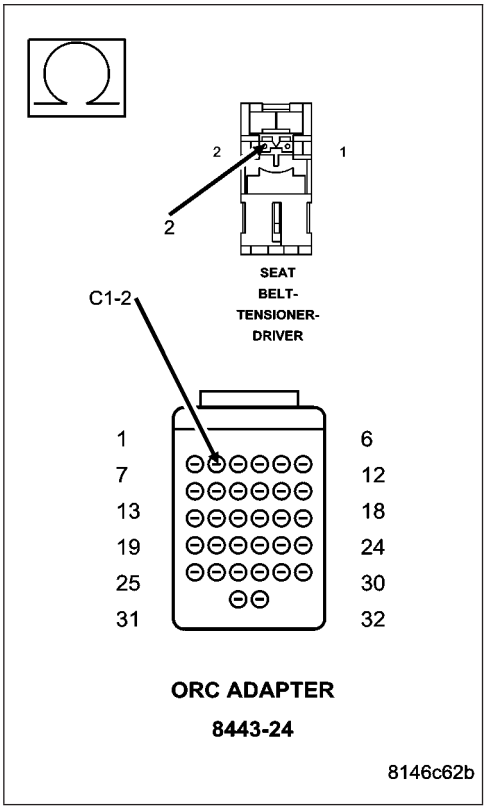
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Driver Seat Belt Pretensioner connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.
Measure the resistance of the (R55) Driver Seat Belt Tensioner Line 1 circuit between the Driver Seat Belt Pretensioner connector and the 8443 ORC Adaptor.

Is the resistance below 1.0 ohm?

Yes >> Go To 4

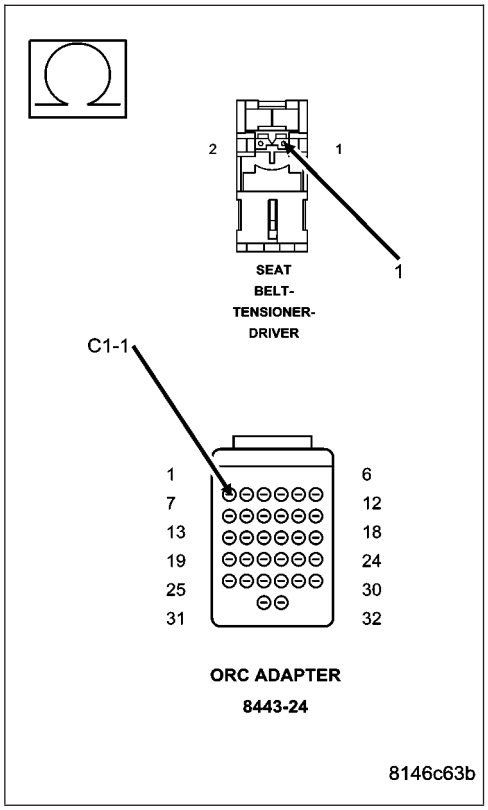
No >> Repair the (R55) Driver Seat Belt Tensioner Line 1 circuit for and open.



B1B2A-1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT OPEN (CONTINUED)

4. CHECK (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R53) Driver Seat Belt Tensioner Line 2 circuit between the Driver Seat Belt Pretensioner connector and the 8443 ORC Adaptor.



Is the resistance below 1.0 ohm?

Yes >> Go To 5

No >> Repair the (R53) Driver Seat Belt Tensioner Line 2 circuit for and open.
Perform ORC VERIFICATION TEST - VER 1

---

5. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with Service Information.
Perform ORC VERIFICATION TEST - VER 1

B1B2A-1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT OPEN (CONTINUED)

6. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

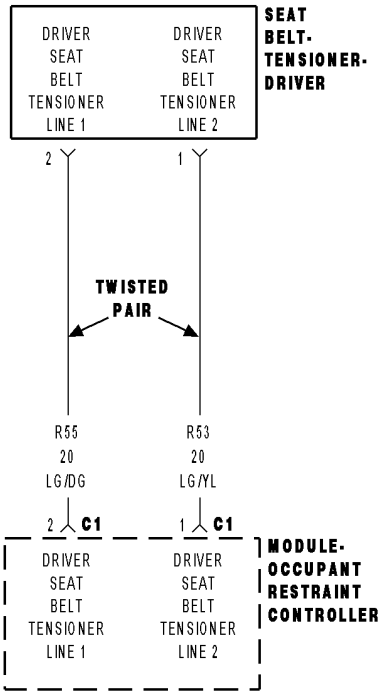
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

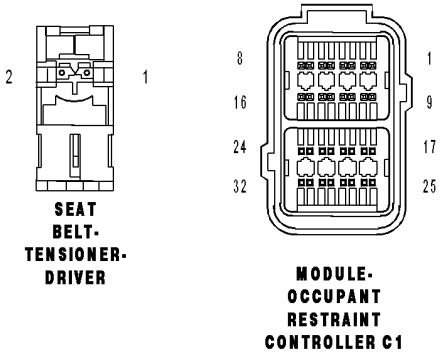
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B2B-1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT SHORTED TOGETHER





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B1B2B-1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Driver Seat Belt Tensioner circuits.
- **Set Condition:**
  The ORC has detected low resistance between the Driver Seat Belt Tensioner circuits.

Possible Causes
(R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT SHORTED TO (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT
DRIVER SEAT BELT PRETENSIONER
ORC

Diagnostic Test

1. SELECT ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B2B-1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT SHORTED TOGETHER (CONTINUED)

2. CHECK FOR SHORTED DRIVER SEAT BELT PRETENSIONER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Driver Seat Belt Pretensioner connector.

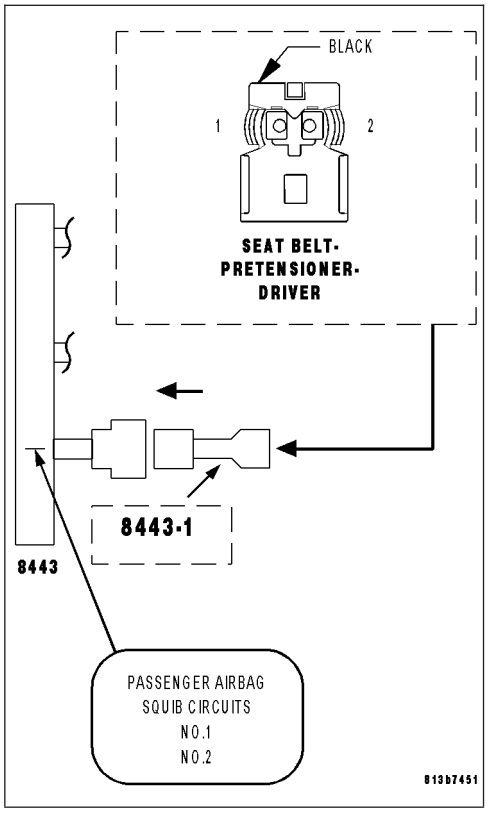
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Driver Seat Belt Pretensioner connector.

WARNING: To avoid personal injury or death, turn the ignition on then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B2B 1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT SHORTED TOGETHER?

Yes >> Go To 3

No >> Replace the Driver Seat Belt Pretensioner in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT FOR A SHORT TO (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Driver Seat Belt Pretensioner connector.

Disconnect the ORC connectors.

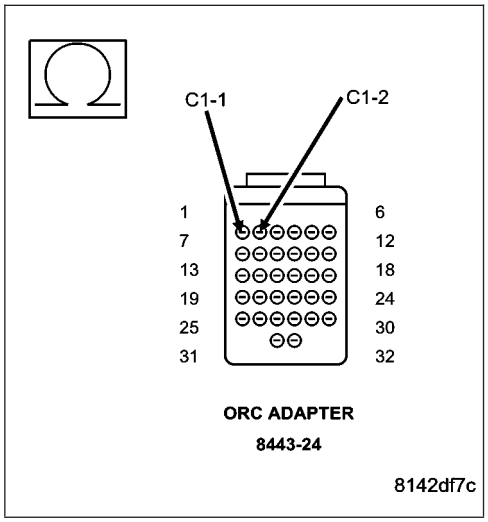
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.

Measure the resistance between the (R55) Driver Seat Belt Tensioner Line 1 circuit and the (R53) Driver Seat Belt Tensioner Line 2 circuit at the Driver Seat Belt Pretensioner connector.

Is the resistance below 10K ohms?

Yes >> Repair the (R55) Driver Seat Belt Tensioner Line 1 circuit for a short to the (R53) Driver Seat Belt Tensioner Line 2 circuit.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 4



B1B2B-1st ROW DRIVER SEAT BELT PRETENSIONER CIRCUIT SHORTED TOGETHER (CONTINUED)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

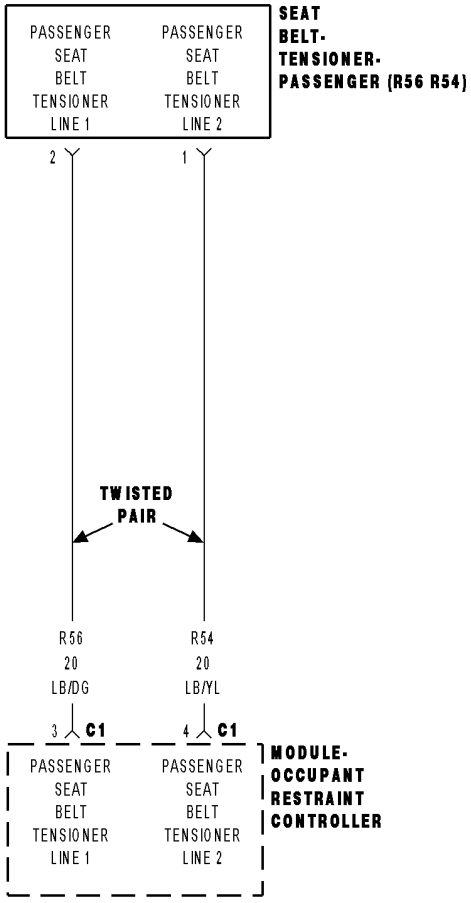
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

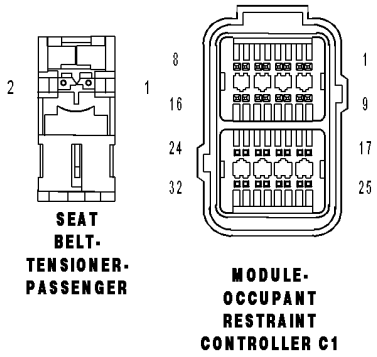
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B2C-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT LOW





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B1B2C-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT LOW (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Seat Belt Tensioner circuits.
- **Set Condition:**
  The ORC has detected low resistance on the Passenger Seat Belt Tensioner circuits.

Possible Causes
(R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT OR (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT SHORTED TO GROUND
PASSENGER SEAT BELT PRETENSIONER
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B2C-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT LOW (CONTINUED)

2. CHECK FOR SHORTED PASSENGER SEAT BELT PRETENSIONER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Passenger Seat Belt Pretensioner connector.

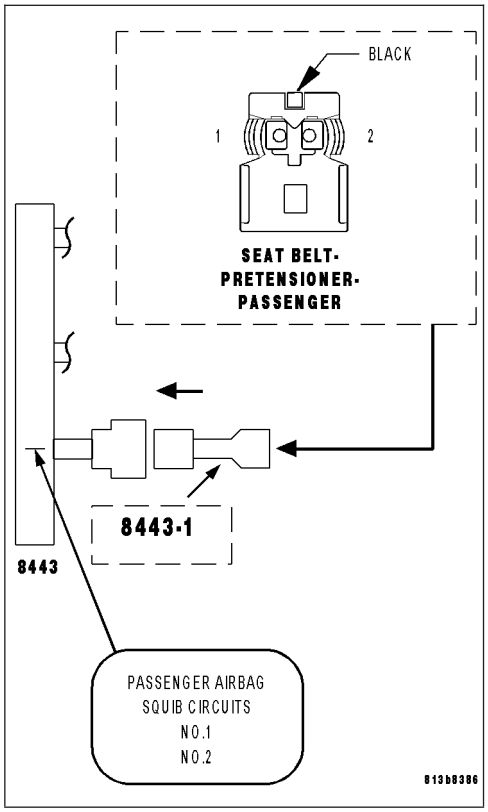
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Passenger Seat Belt Pretensioner connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B2C 1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT LOW?

Yes >> Go To 3

No >> Replace the Passenger Seat Belt Pretensioner in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT AND (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Passenger Seat Belt Pretensioner connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.

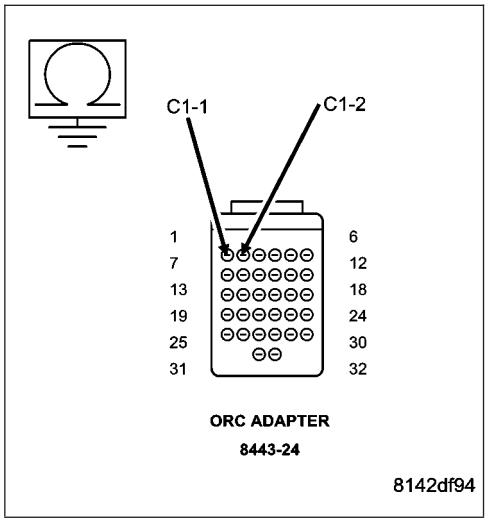
Measure the resistance of the (R56) Passenger Seat Belt Tensioner Line 1 circuit between ground and the Passenger Seat Belt Pretensioner connector.

Measure the resistance of the (R54) Passenger Seat Belt Tensioner Line 2 circuit between ground and the Passenger Seat Belt Pretensioner connector.

Is the resistance below 10K ohms on either circuit?

Yes >> Repair the Passenger Seat Belt Tensioner circuits with a resistance below 10k ohms for a short to ground.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 4



B1B2C-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT LOW (CONTINUED)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

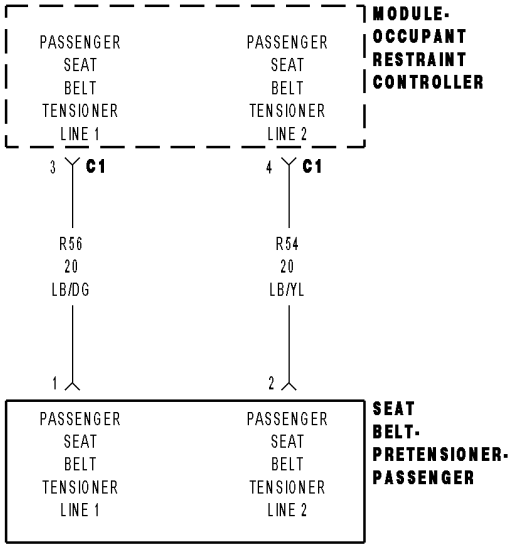
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

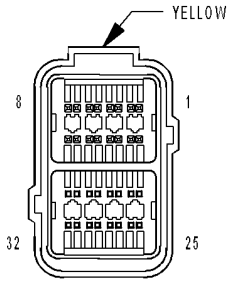
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

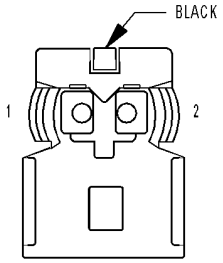
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B2D-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT HIGH





MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C1



SEAT BELT-
PRETENSIONER-
PASSENGER

8133a0e2

B1B2D-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT HIGH (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the voltage on the Passenger Seat Belt Tensioner circuits.
- **Set Condition:**
  The ORC detects voltage on the Passenger Seat Belt Tensioner circuits.

Possible Causes
(R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT OR (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT SHORTED TO BATTERY
PASSENGER SEAT BELT PRETENSIONER
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B2D-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT HIGH (CONTINUED)

2. CHECK FOR SHORTED PASSENGER SEAT BELT PRETENSIONER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Passenger Seat Belt Pretensioner connector.

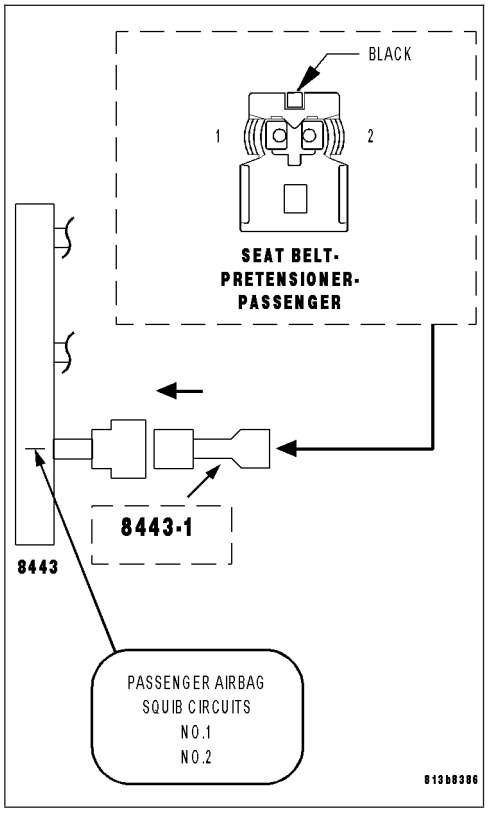
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Passenger Seat Belt Pretensioner connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B2D 1st ROW PASSENGER SEAT BELT TENSIONER CIRCUIT HIGH?

Yes >> Go To 3

No >> Replace the Passenger Seat Belt Pretensioner in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT AND (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT FOR A SHORT TO BATTERY

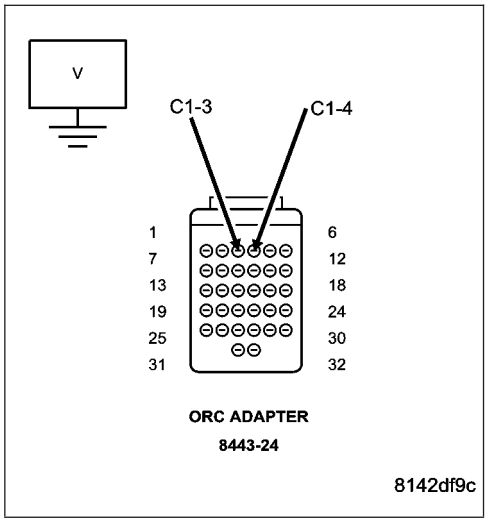
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Passenger Seat Belt Pretensioner connector.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R56) Passenger Seat Belt Tensioner Line 1 circuit between the Passenger Seat Belt Pretensioner connector and ground.

Measure the voltage of the (R54) Passenger Seat Belt Tensioner Line 2 circuit between the Passenger Seat Belt Pretensioner connector and ground.



Is there any voltage present on either circuit?

Yes >> Repair the Passenger Seat Belt Tensioner circuits with voltage present for a short to battery.
Perform ORC VERIFICATION TEST - VER 1

No >> Go To 4

B1B2D-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT HIGH (CONTINUED)

4. OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

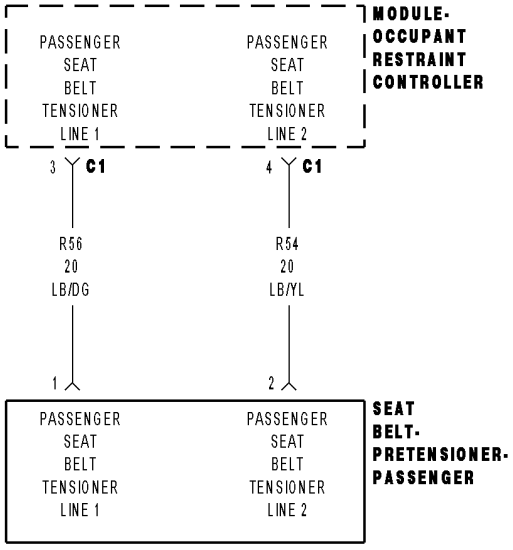
Are any ACTIVE DTCs present?

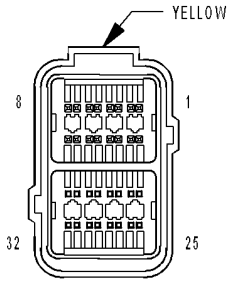
Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer

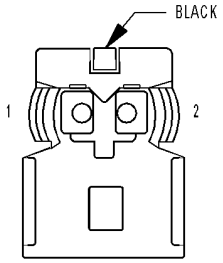
---

B1B2E-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT OPEN





MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C1



SEAT BELT-
PRETENSIONER-
PASSENGER

8133a0e2

B1B2E-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT OPEN (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Seat Belt Tensioner circuits.
- **Set Condition:**
  The ORC has detected an open or high resistance on the Passenger Seat Belt Tensioner circuits.

Possible Causes
(R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT OR (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT OPEN
PASSENGER SEAT BELT PRETENSIONER
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 6

B1B2E-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT OPEN (CONTINUED)

2. CHECK FOR OPEN PASSENGER SEAT BELT PRETENSIONER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Passenger Seat Belt Pretensioner connector.

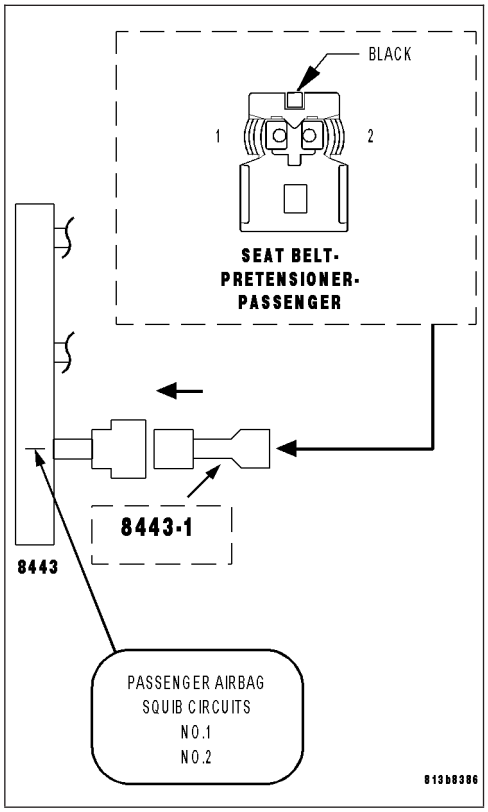
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Passenger Seat Belt Pretensioner connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B2E 1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT OPEN?

Yes >> Go To 3

No >> Replace the Passenger Seat Belt Pretensioner in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT FOR AN OPEN

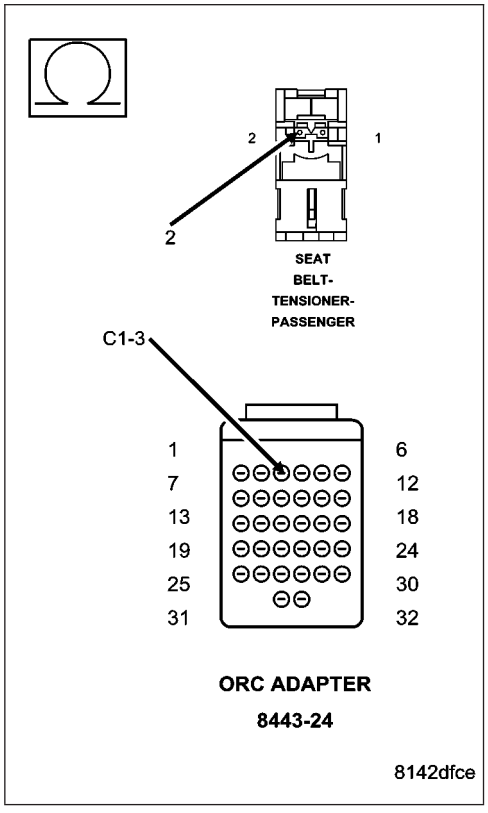
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Passenger Seat Belt Pretensioner connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.
Measure the resistance of the (R56) Passenger Seat Belt Tensioner Line 1 circuit between the Passenger Seat Belt Pretensioner connector and the 8443 ORC Adaptor.

Is the resistance below 1.0 ohm?

Yes >> Go To 4

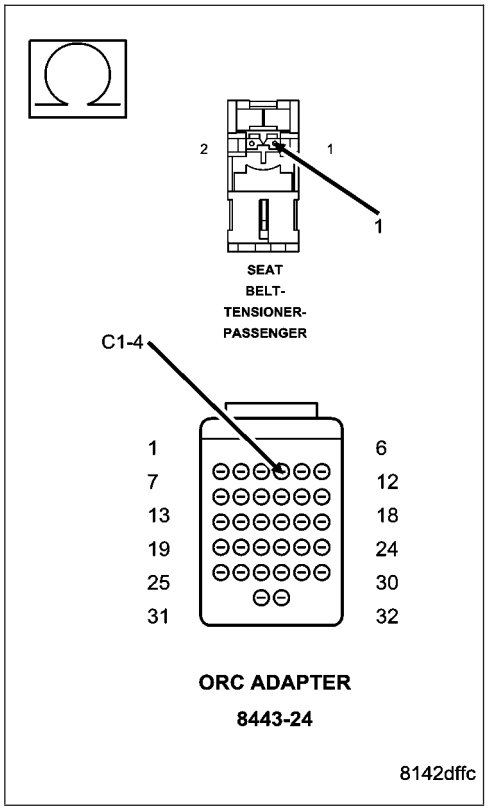
No >> Repair the (R56) Passenger Seat Belt Tensioner Line 1 circuit for an open. Then Go To 4



B1B2E-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT OPEN (CONTINUED)

4. CHECK (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R54) Passenger Seat Belt Tensioner Line 2 circuit between the Passenger Seat Belt Pretensioner connector and the 8443 ORC Adaptor.



Is the resistance below 1.0 ohm?

Yes >> Go to 5

No >> Repair the (R54) Passenger Seat Belt Tensioner Line 2 circuit for an open.
Perform ORC VERIFICATION TEST - VER 1

5. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with Service Information.
Perform ORC VERIFICATION TEST - VER 1

B1B2E-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT OPEN (CONTINUED)

6. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

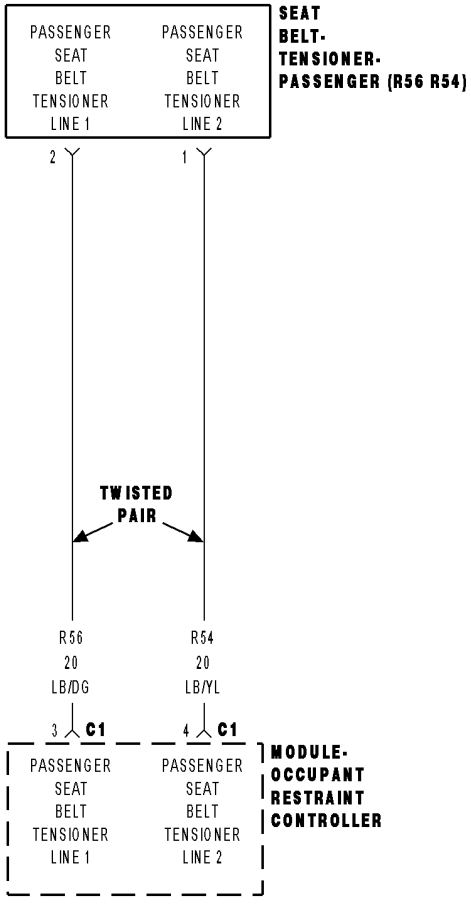
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

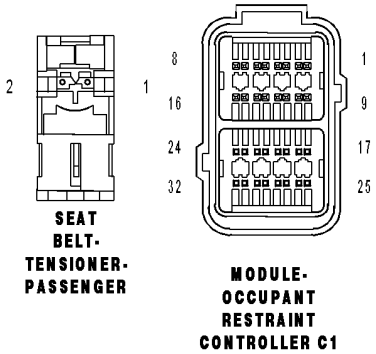
Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B2F-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT SHORTED TOGETHER





8142df90

B1B2F-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT SHORTED TOGETHER (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Seat Belt Tensioner circuits.
- **Set Condition:**
  The ORC has detected low resistance between the Passenger Seat Belt Tensioner circuits.

Possible Causes
(R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT SHORTED TO (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT
PASSENGER SEAT BELT PRETENSIONER
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 5

B1B2F-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT SHORTED TOGETHER (CONTINUED)

2. CHECK FOR SHORTED PASSENGER SEAT BELT PRETENSIONER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Passenger Seat Belt Pretensioner connector.

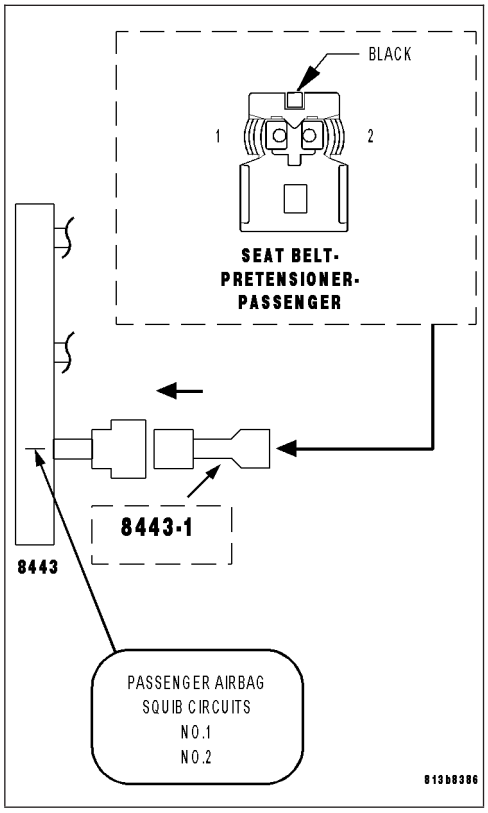
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool and appropriate Jumper to the Passenger Seat Belt Pretensioner connector.

WARNING: To avoid personal injury or death, turn the ignition on then reconnect the battery.
With the scan tool, read the active ORC DTC's.

Does the scan tool display: B1B2F 1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT SHORTED TOGETHER?

Yes >> Go To 3

No >> Replace the Passenger Seat Belt Pretensioner in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1



3. CHECK (R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT FOR A SHORT TO THE (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the 8443 Load Tool and Jumper from the Passenger Seat Belt Pretensioner connector.

Disconnect the ORC connectors.

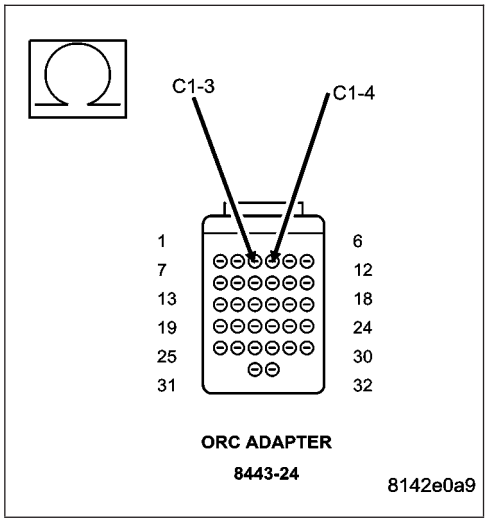
NOTE: Check connectors - Clean and repair as necessary.
Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.

Measure the resistance between the (R56) Passenger Seat Belt Tensioner Line 1 circuit and the (R54) Passenger Seat Belt Tensioner Line 2 circuit at the Passenger Seat Belt Pretensioner connector.

Is the resistance below 10K ohms?

Yes >> Repair the (R56) Passenger Seat Belt Tensioner Line 1 circuit for a short to the (R54) Passenger Seat Belt Tensioner Line 2 circuit.
Perform ORC VERIFICATION TEST - VER 1

No >> Go to 4



B1B2F-1st ROW PASSENGER SEAT BELT PRETENSIONER CIRCUIT SHORTED TOGETHER (CONTINUED)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1

---

5. STORED ORC DTC

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

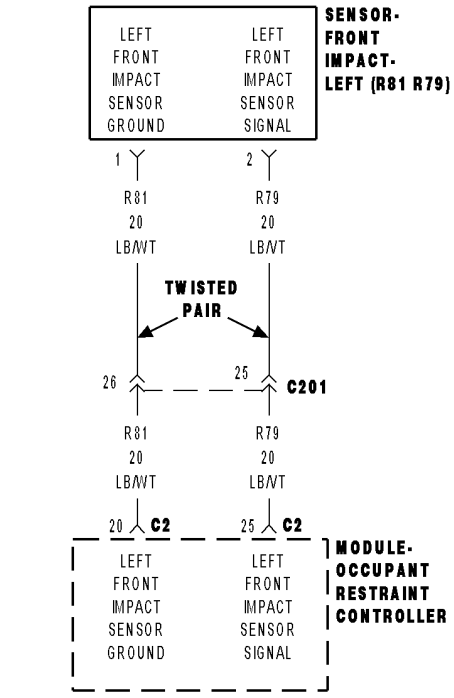
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

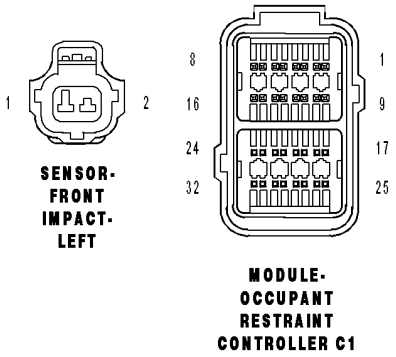
Are any ACTIVE DTC's present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B70-UP-FRONT LEFT SATELLITE ACCELERATION SENSOR INTERNAL





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B1B70-UP-FRONT LEFT SATELLITE ACCELERATION SENSOR INTERNAL (CONTINUED)

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Occupant Restraint Controller (ORC) continuously communicates with the Front Left Impact Sensor over the sensor signal circuit. The sensor communication and on board diagnostics are powered by the ORC signal.
- **Set Condition:**
  This code will set, if the ORC and the Front Left Impact Sensor do not establish and maintain valid data communications.

Possible Causes
(R79) SIGNAL CIRCUIT SHORTED TO BATTERY
(R79) SIGNAL CIRCUIT SHORTED TO GROUND
(R79, R81) FRONT LEFT IMPACT SENSOR CIRCUITS SHORTED TOGETHER
(R81) FRONT LEFT IMPACT SENSOR GROUND CIRCUIT OPEN
(R79) FRONT LEFT IMPACT SENSOR SIGNAL CIRCUIT OPEN
ORC, FRONT LEFT IMPACT SENSOR

Diagnostic Test

1. VERIFY THAT DTC B1B70-UP-FRONT LEFT SATELLITE ACCELERATION SENSOR INTERNAL IS ACTIVE

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read ORC DTCs.

Does the scan tool display active: B1B70-UP-FRONT LEFT SATELLITE ACCELERATION SENSOR INTERNAL?

Yes >> Go To 2

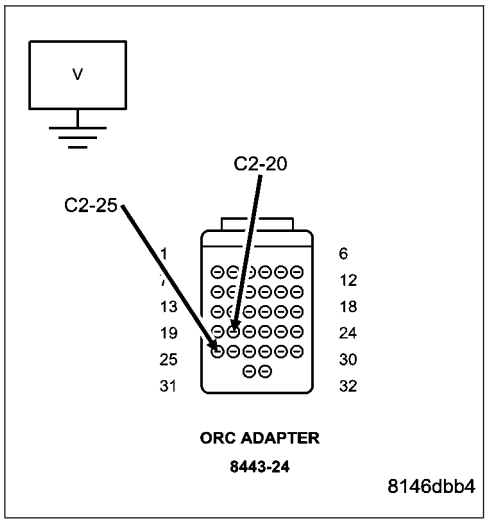
No >> Go To 9

B1B70-UP-FRONT LEFT SATELLITE ACCELERATION SENSOR INTERNAL (CONTINUED)

2. CHECK THE (R79, R81) FRONT LEFT IMPACT SENSOR SIGNAL AND GROUND CIRCUITS FOR A SHORT TO BATTERY

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Front Left Impact Sensor connector.
Disconnect the ORC connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R79) Front Left Impact Sensor Signal circuit and (R81) Sensor Ground circuit at the Front Left Impact Sensor connector and ground.



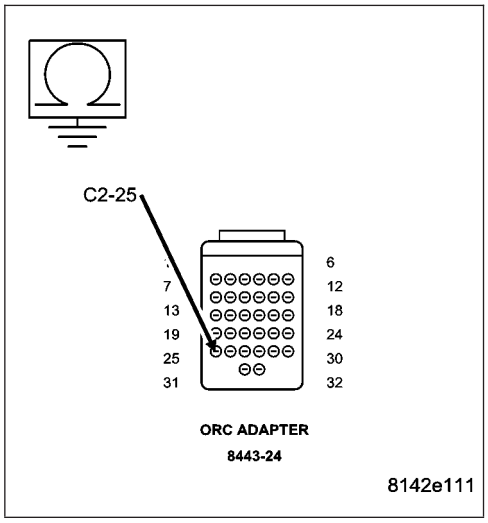
Is there any voltage present?

Yes >> Repair the (R79, R81) Front Left Impact Sensor circuits for a short to battery.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 3

3. CHECK THE (R79) FRONT LEFT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Measure the resistance of the (R79) Front Left Impact Sensor Signal circuit between the Front Left Impact Sensor connector and ground.



Is the resistance below 100K ohms?

Yes >> Repair the (R79) Front Left Impact Sensor Signal circuit for a short to ground.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 4

B1B70-UP-FRONT LEFT SATELLITE ACCELERATION SENSOR INTERNAL (CONTINUED)

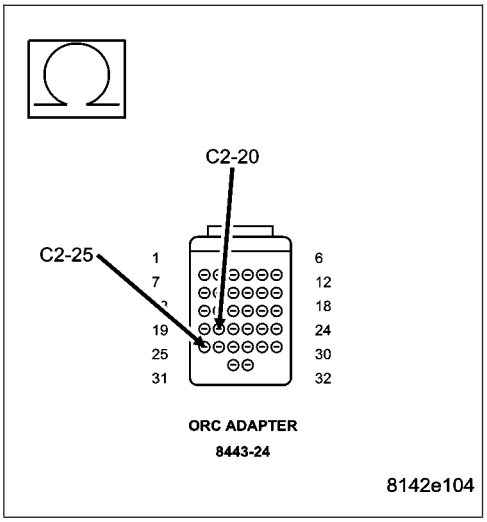
4. CHECK THE (R79, R81) FRONT LEFT IMPACT SENSOR CIRCUITS FOR A SHORT TOGETHER

Measure the resistance between the (R79) Front Left Impact Sensor Signal and (R81) Sensor Ground circuits at the Front Left Impact Sensor connector.

Is the resistance below 100K ohms?

Yes >> Repair the (R79, R81) Front Left Impact Sensor circuits shorted together.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 5



5. CHECK THE (R81) FRONT LEFT IMPACT SENSOR GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

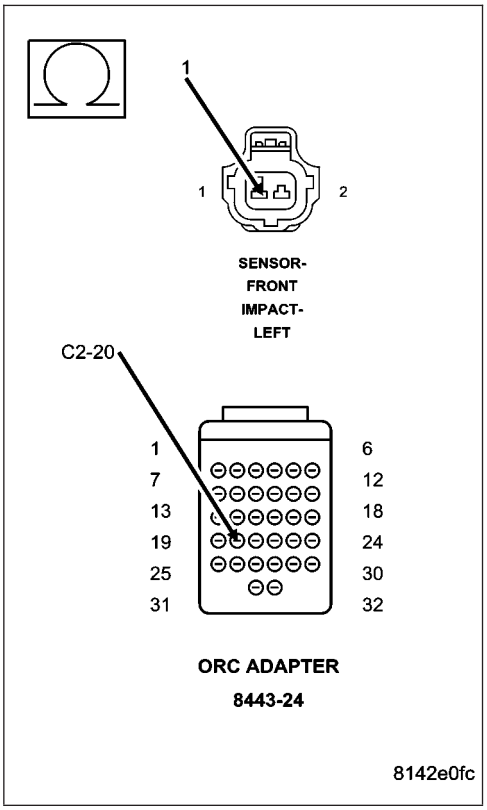
Connect the 8443 Load Tool ORC Adaptor to the Occupant Restraint Control Module connector.

Measure the resistance of the (R81) Front Left Impact Sensor Ground circuit between the Front Left Impact Sensor connector and the 8443 Load Tool ORC Adaptor.

Is the resistance below 1 ohm?

Yes >> Go To 6

No >> Repair the (R81) Front Left Impact Sensor 1 Ground circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.



B1B70-UP-FRONT LEFT SATELLITE ACCELERATION SENSOR INTERNAL (CONTINUED)

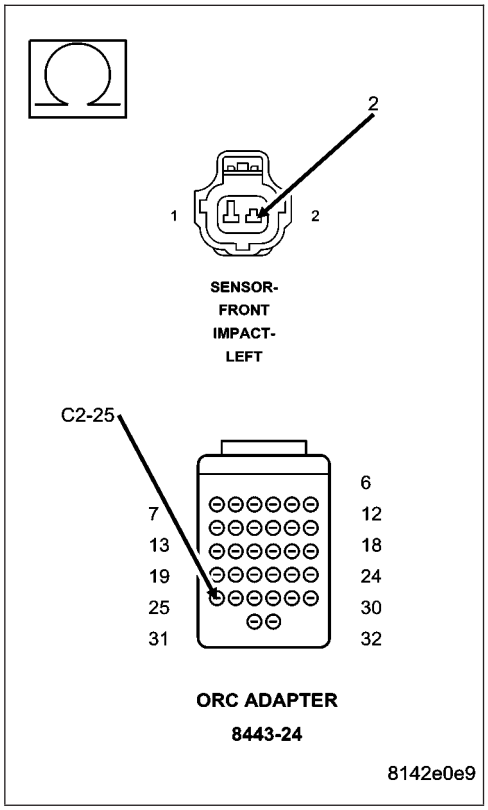
6. CHECK THE (R79) FRONT LEFT IMPACT SENSOR CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R79) Front Left Impact Sensor Ground circuit between the Front Left Impact Sensor connector and the 8443 Load Tool ORC Adaptor.

Is the resistance below 1 ohm?

Yes >> Go To 7

No >> Repair the (R79) Front Left Impact Sensor Signal circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.



7. CHECK OPERATION OF THE FRONT LEFT IMPACT SENSOR

Replace the Front Left Impact Sensor.

Reconnect the vehicle body harness to the impact sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Connect the scan tool to the Data Link Connector - use the most current software available.

Use the scan tool and erase the stored codes in all airbag system modules.

Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.

Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active Front Left Impact Sensor DTC return?

Yes >> Go To 8

No >> Repair is complete.
Perform the ORC VERIFICATION TEST - VER 1.

B1B70-UP-FRONT LEFT SATELLITE ACCELERATION SENSOR INTERNAL (CONTINUED)

8. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.

If there are no possible causes remaining, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with Service Information.
Perform the ORC VERIFICATION TEST - VER 1.

---

9. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

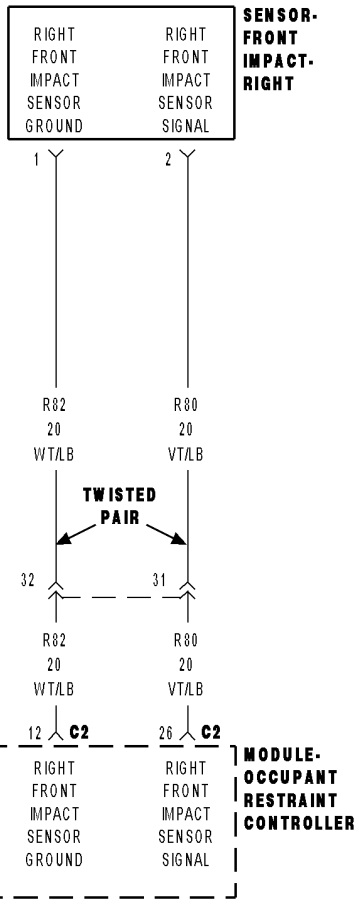
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

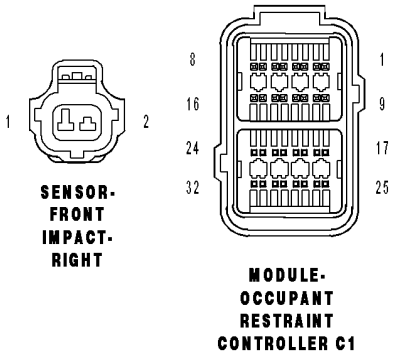
Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B71-UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR INTERNAL





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B1B71-UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR INTERNAL (CONTINUED)

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Occupant Restraint Controller (ORC) continuously communicates with the Front Right Impact Sensor over the sensor signal circuit. The sensor communication and on board diagnostics are powered by the ORC signal.
- **Set Condition:**
  This code will set, if the ORC and the Front Right Impact Sensor do not establish and maintain valid data communications.

Possible Causes
(R80) SIGNAL CIRCUIT SHORTED TO BATTERY
(R80) SIGNAL CIRCUIT SHORTED TO GROUND
(R80, R82) FRONT RIGHT IMPACT SENSOR CIRCUITS SHORTED TOGETHER
(R82) FRONT RIGHT IMPACT SENSOR GROUND CIRCUIT OPEN
(R80) FRONT RIGHT IMPACT SENSOR SIGNAL CIRCUIT OPEN
ORC, FRONT RIGHT IMPACT SENSOR

Diagnostic Test

1. VERIFY THAT DTC B1B71-UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR INTERNAL IS ACTIVE

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read ORC DTCs.

Does the scan tool display active: B1B71-UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR INTERNAL?

Yes >> Go To 2

No >> Go To 9

B1B71-UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR INTERNAL (CONTINUED)

2. CHECK THE (R80, R82) FRONT RIGHT IMPACT SENSOR SIGNAL AND GROUND CIRCUITS FOR A SHORT TO BATTERY

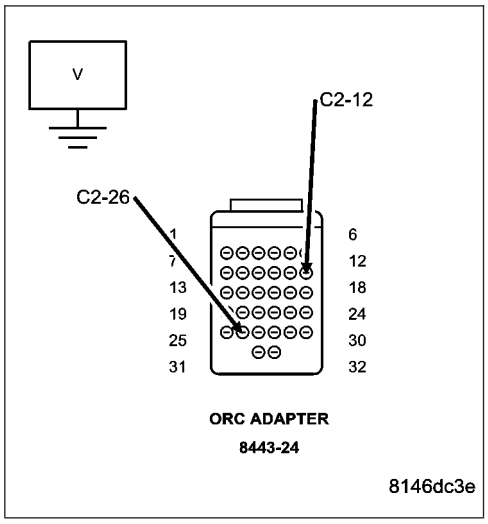
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Front Right Impact Sensor connector.
Disconnect the ORC connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R80) Front Right Impact Sensor Signal circuit and (R82) Sensor Ground circuit at the Front Right Impact Sensor connector and ground.

Is there any voltage present?

Yes >> Repair the (R80, R82) Front Right Impact Sensor circuits for a short to battery.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 3



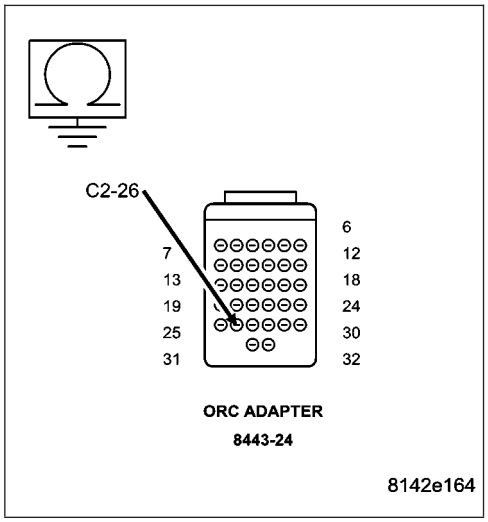
3. CHECK THE (R80) FRONT RIGHT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn ignition on, then reconnect the battery.
Measure the resistance of the (R80) Front Right Impact Sensor Signal circuit between the Front Right Impact Sensor connector and ground.

Is the resistance below 100K ohms?

Yes >> Repair the (R80) Front Right Impact Sensor Signal circuit for a short to ground.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 4



B1B71-UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR INTERNAL (CONTINUED)

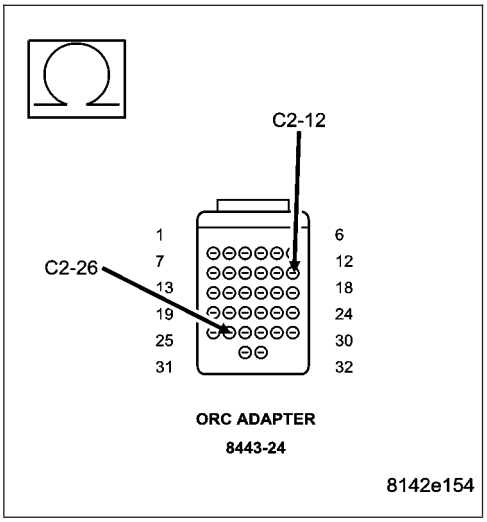
4. CHECK THE (R80, R82) FRONT RIGHT IMPACT SENSOR CIRCUITS FOR A SHORT TOGETHER

Measure the resistance between the (R80) Front Right Impact Sensor Signal and (R82) Sensor Ground circuits at the Front Right Impact Sensor connector.

Is the resistance below 100K ohms?

Yes >> Repair the (R80, R82) Front Right Impact Sensor circuits shorted together.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 5



5. CHECK THE (R82) FRONT RIGHT IMPACT SENSOR GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

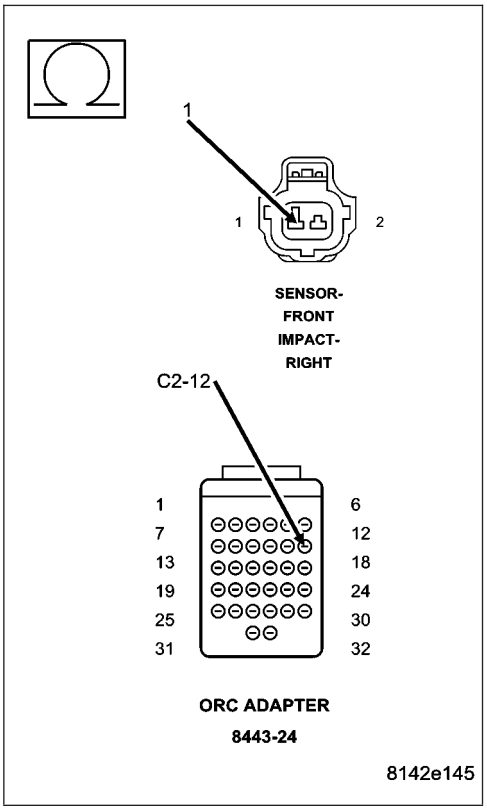
Connect the 8443 Load Tool ORC Adaptor to the Occupant Control Module connector.

Measure the resistance of the (R82) Front Right Impact Sensor Ground circuit between the Front Right Impact Sensor connector and the 8443 Load Tool ORC Adaptor.

Is the resistance below 1 ohm?

Yes >> Go To 6

No >> Repair the (R82) Front Right Impact Sensor 2 Ground circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.



B1B71-UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR INTERNAL (CONTINUED)

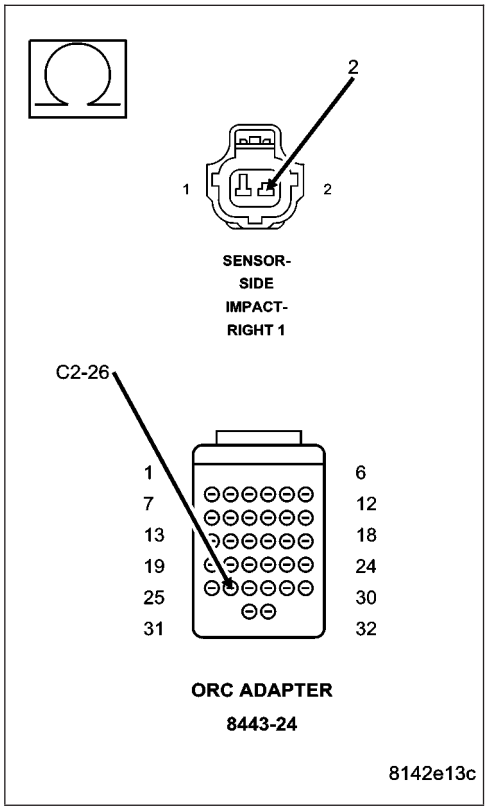
6. CHECK THE (R80) FRONT RIGHT IMPACT SENSOR CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R80) Front Right Impact Sensor Signal circuit between the Front Right Impact Sensor connector and the 8443 Load Tool ORC Adaptor.

Is the resistance below 1 ohm?

Yes >> Go To 7

No >> Repair the (R80) Front Right Impact Sensor Signal circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.



7. CHECK OPERATION OF THE FRONT RIGHT IMPACT SENSOR

Replace the Front Right Impact Sensor.

Reconnect the vehicle body harness to the impact sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Connect the scan tool to the Data Link Connector - use the most current software available.

Use the scan tool and erase the stored codes in all airbag system modules.

Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.

Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active Front Right Impact Sensor DTC return?

Yes >> Go To 8

No >> Repair is complete.
Perform the ORC VERIFICATION TEST - VER 1.

B1B71-UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR INTERNAL (CONTINUED)

8. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.

If there are no possible causes remaining, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with Service Instructions.
Perform the ORC VERIFICATION TEST - VER 1.

---

9. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

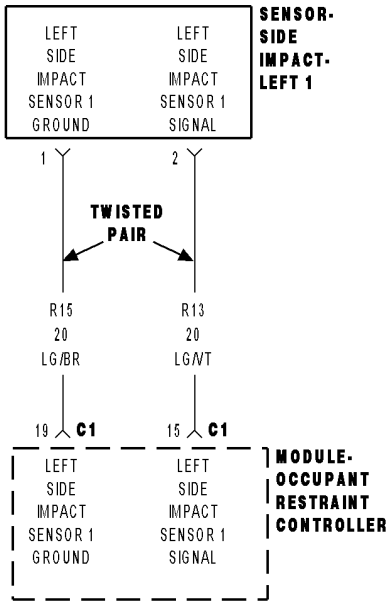
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

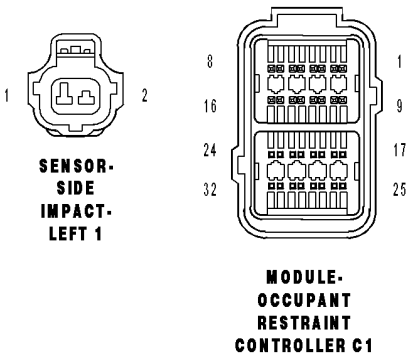
Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B72-LEFT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL





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B1B72-LEFT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL (CONTINUED)

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Occupant Restraint Controller (ORC) continuously communicates with the Left Side Impact Sensor 1 over the sensor signal circuit. The sensor communication and on board diagnostics are powered by the ORC signal.
- **Set Condition:**
  This code will set, if the ORC and the Left Side Impact Sensor 1 do not establish and maintain valid data communications.

Possible Causes
(R13) SIGNAL CIRCUIT SHORTED TO BATTERY
(R13) SIGNAL CIRCUIT SHORTED TO GROUND
(R13, R15) LEFT SIDE IMPACT SENSOR 1 CIRCUITS SHORTED TOGETHER
(R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT OPEN
(R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT OPEN
ORC, LEFT SIDE IMPACT SENSOR 1

Diagnostic Test

1. VERIFY THAT DTC B1B72-LEFT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL 1 IS ACTIVE

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read ORC DTCs.

Does the scan tool display active: B1B72-LEFT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL?

Yes >> Go To 2

No >> Go To 9

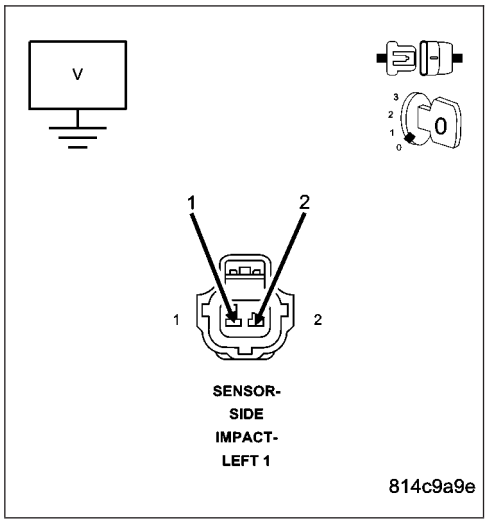
B1B72-LEFT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL (CONTINUED)

2. CHECK THE (R13, R15) LEFT SIDE IMPACT SENSOR 1 SIGNAL AND GROUND CIRCUITS FOR A SHORT TO BATTERY

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Left front Impact Sensor 1 connector.

Disconnect the ORC connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R13) Left Side Impact Sensor 1 Signal circuit and (R15) Sensor Ground circuit at the Left Side Impact Sensor 1 connector and ground.



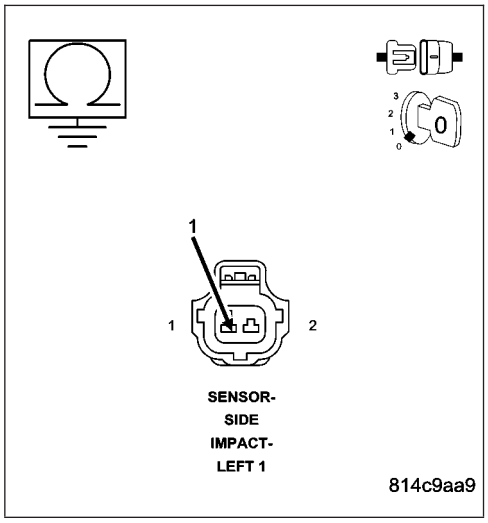
Is there any voltage present?

Yes >> Repair the (R13, R15) Left Side Impact Sensor 1 circuits for a short to battery.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 3

3. CHECK THE (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn ignition on, then reconnect the battery.
Measure the resistance of the (R13) Left Side Impact Sensor 1 Signal circuit between the Left Side Impact Sensor 1 connector and ground.



Is the resistance below 100K ohms?

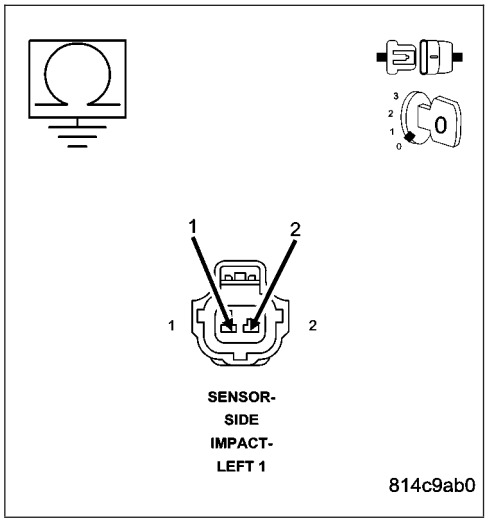
Yes >> Repair the (R13) Left Side Impact Sensor 1 Signal circuit for a short to ground.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 4

B1B72-LEFT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL (CONTINUED)

4. CHECK THE (R13, R15) LEFT SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TOGETHER

Measure the resistance between the (R13) Left Side Impact Sensor 1 Signal and (R15) Sensor Ground circuits at the Left Side Impact Sensor 1 connector.



Is the resistance below 100K ohms?

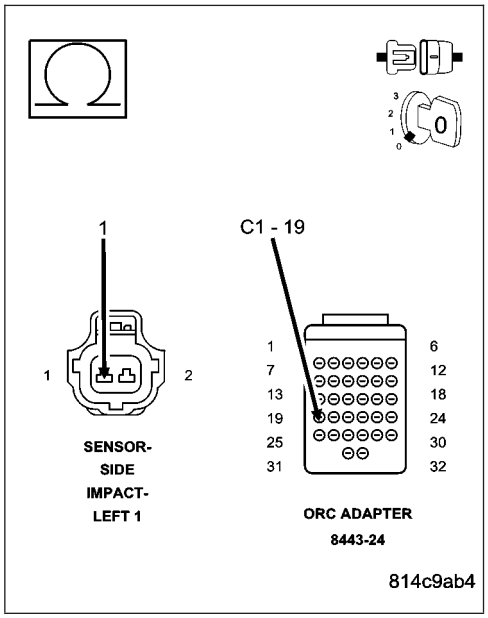
Yes >> Repair the (R13, R15) Left Side Impact Sensor 1 circuits shorted together.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 5

5. CHECK THE (R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Connect the 8443 Load Tool ORC Adaptor to the Occupant Control Module connector.

Measure the resistance of the (R15) Left Side Impact Sensor 1 Ground circuit between the Left Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.



Is the resistance below 1 ohm?

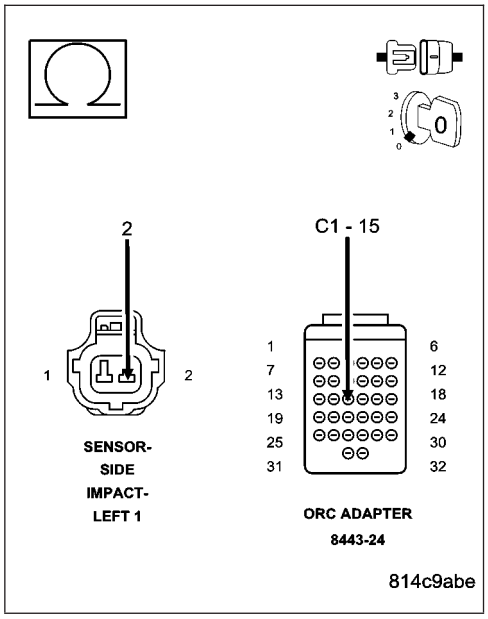
Yes >> Go To 6

No >> Repair the (R15) Left Side Impact Sensor 1 Ground circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.

B1B72-LEFT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL (CONTINUED)

6. CHECK THE (R13) LEFT SIDE IMPACT SENSOR 1 CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R13) Left Side Impact Sensor 1 Signal circuit between the Left Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.



Is the resistance below 1 ohm?

Yes >> Go To 7

No >> Repair the (R13) Left Side Impact Sensor 1 Signal circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.

7. CHECK OPERATION OF THE LEFT SIDE IMPACT SENSOR 1

Replace the Left Side Impact Sensor 1.

Reconnect the vehicle body harness to the impact sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

Connect the scan tool to the Data Link Connector - use the most current software available.

Use the scan tool and erase the stored codes in all airbag system modules.

Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.

Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active Left Side Impact Sensor 1 DTC return?

Yes >> Go To 8

No >> Repair is complete.
Perform the ORC VERIFICATION TEST - VER 1.

8. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.

If there are no possible causes remaining, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with Service Instructions.
Perform the ORC VERIFICATION TEST - VER 1.

B1B72-LEFT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL (CONTINUED)

9. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

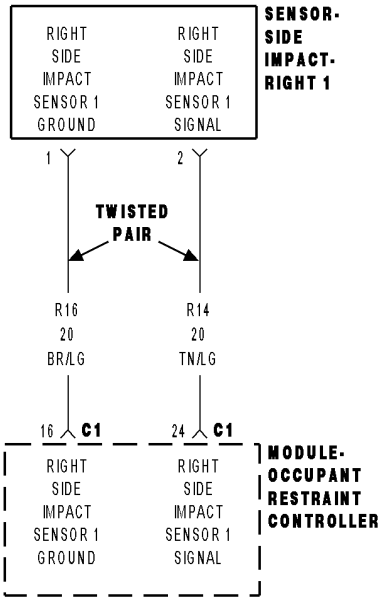
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

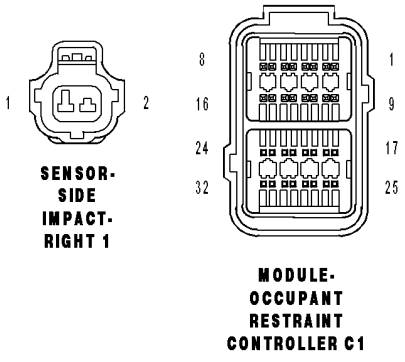
Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B75-RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL





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B1B75-RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL (CONTINUED)

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Occupant Restraint Controller (ORC) continuously communicates with the Right Side Impact Sensor 1 over the sensor signal circuit. The sensor communication and on board diagnostics are powered by the ORC signal.
- **Set Condition:**
  This code will set, if the ORC and the Right Side Impact Sensor 1 do not establish and maintain valid data communications.

Possible Causes
(R14) SIGNAL CIRCUIT SHORTED TO BATTERY
(R14) SIGNAL CIRCUIT SHORTED TO GROUND
(R14, R16) RIGHT SIDE IMPACT SENSOR 1 CIRCUITS SHORTED TOGETHER
(R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT OPEN
(R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT OPEN
ORC, RIGHT SIDE IMPACT SENSOR 1

Diagnostic Test

1. VERIFY THAT DTC B1B75-RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read ORC DTCs.

Does the scan tool display active: B1B75-RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL?

Yes >> Go To 2

No >> Go To 9

B1B75-RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL (CONTINUED)

2. CHECK THE (R14, R16) RIGHT SIDE IMPACT SENSOR 1 SIGNAL AND GROUND CIRCUITS FOR A SHORT TO BATTERY

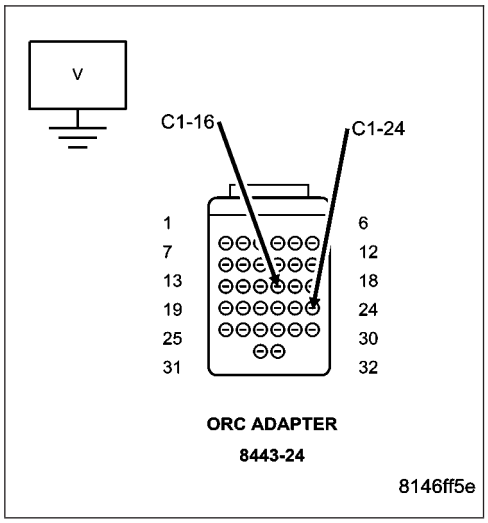
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Right front Impact Sensor 1 connector.
Disconnect the ORC connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R14) Right Side Impact Sensor 1 Signal circuit and (R16) Sensor Ground circuit at the Right Side Impact Sensor 1 connector and ground.

Is there any voltage present?

Yes >> Repair the (R14, R16) Right Side Impact Sensor 1 circuits for a short to battery.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 3



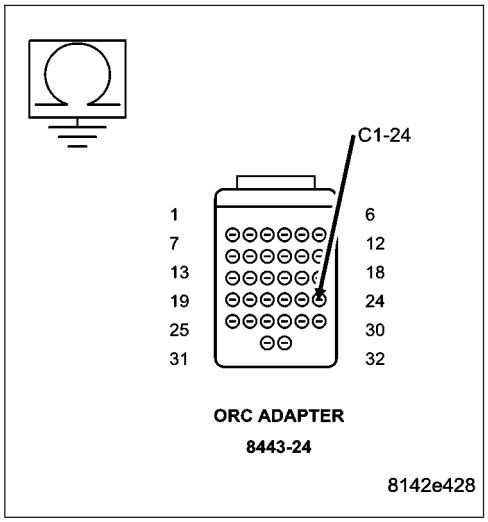
3. CHECK THE (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn ignition on, then reconnect the battery.
Measure the resistance of the (R14) Right Side Impact Sensor 1 Signal circuit between the Right Side Impact Sensor 1 connector and ground.

Is the resistance below 100K ohms?

Yes >> Repair the (R14) Right Side Impact Sensor 1 Signal circuit for a short to ground.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 4



B1B75-RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL (CONTINUED)

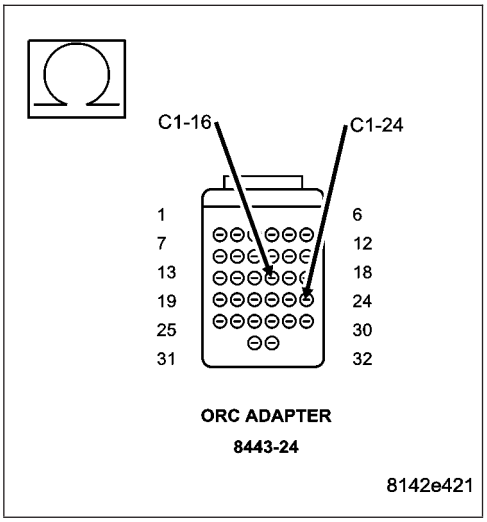
4. CHECK THE (R14, R16) RIGHT SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TOGETHER

Measure the resistance between the (R14) Right Side Impact Sensor 1 Signal and (R16) Sensor Ground circuits at the Right Side Impact Sensor 1 connector.

Is the resistance below 100K ohms?

Yes >> Repair the (R14, R16) Right Side Impact Sensor 1 circuits shorted together.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 5



5. CHECK THE (R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

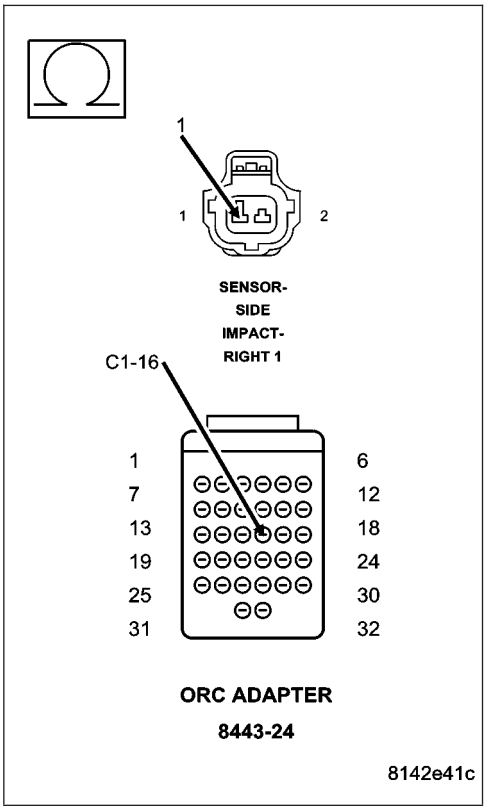
Connect the 8443 Load Tool ORC Adaptor to the Occupant Control Module connector.

Measure the resistance of the (R16) Right Side Impact Sensor 1 Ground circuit between the Right Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.

Is the resistance below 1 ohm?

Yes >> Go To 6

No >> Repair the (R16) Right Side Impact Sensor 1 Ground circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.



B1B75-RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL (CONTINUED)

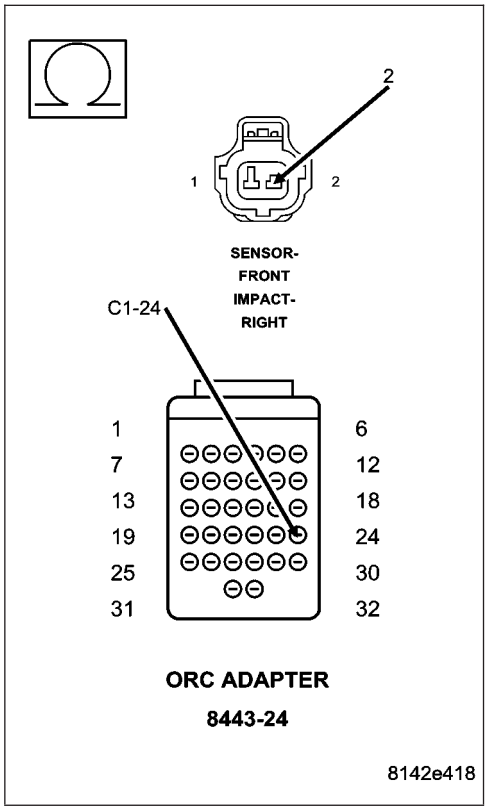
6. CHECK THE (R14) RIGHT SIDE IMPACT SENSOR 1 CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R14) Right Side Impact Sensor 1 Signal circuit between the Right Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.

Is the resistance below 1 ohm?

Yes >> Go To 7

No >> Repair the (R14) Right Side Impact Sensor 1 Signal circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.



7. CHECK OPERATION OF THE RIGHT SIDE IMPACT SENSOR 1

Replace the Right Side Impact Sensor 1.

Reconnect the vehicle body harness to the impact sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Connect the scan tool to the Data Link Connector - use the most current software available.

Use the scan tool and erase the stored codes in all airbag system modules.

Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.

Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active Right Side Impact Sensor 1 DTC return?

Yes >> Go To 8

No >> Repair is complete.
Perform the ORC VERIFICATION TEST - VER 1.

B1B75-RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL (CONTINUED)

8. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.

If there are no possible causes remaining, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with Service Instructions.
Perform the ORC VERIFICATION TEST - VER 1.

---

9. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

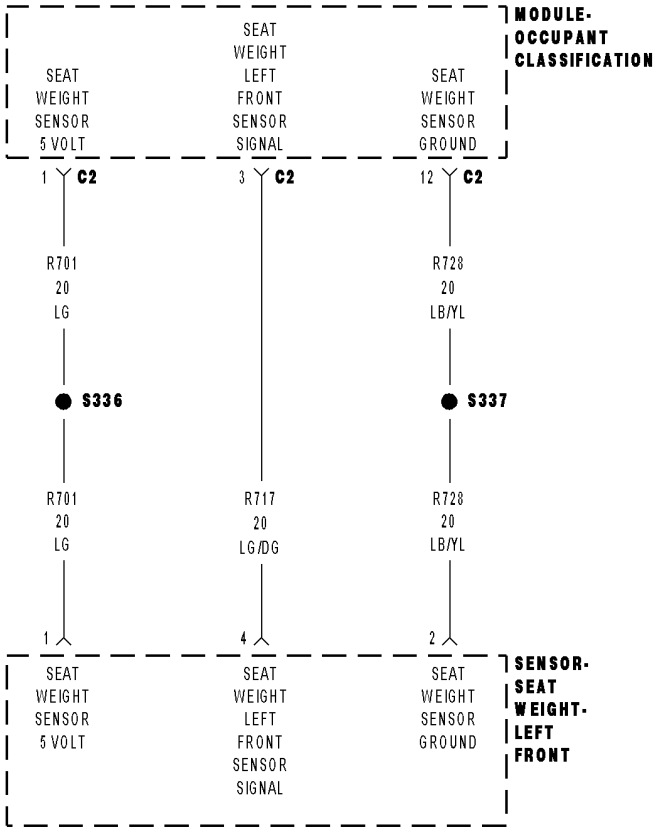
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

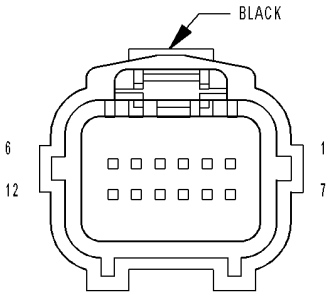
Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

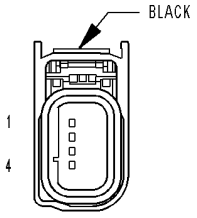
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B78-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT PERFORMANCE





MODULE-
OCCUPANT
CLASSIFICATION C2



SENSOR-
SEAT WEIGHT-
LEFT FRONT

8133acea

B1B78-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT PERFORMANCE (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When CAN ignitions status is Run or SNA, during auto zero and while performing the Occupant Classification Module System Verification Test.
- **Set Condition:**
  During the occupant classification verification test: if the module detects that the sensor input is less than 1.4 volts or greater than 3.6 volts. During auto zero: if the module detects that the sensor input is less than 1 volt or greater than 4 volts.

Possible Causes
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
LEFT-FRONT PASSENGER SEAT WEIGHT SENSOR
DAMAGE TO THE PASSENGER SEAT STRUCTURE, RISER ASSEMBLY, CROSSMEMBERS, SEAT TRACKS, FLOOR PAN
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B78–PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT PERFORMANCE IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B78–PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT PERFORMANCE?

Yes >> Go To 3

No >> Go To 5

B1B78-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT PERFORMANCE (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

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4. PERFORM OCCUPANT CLASSIFICATION MODULE SYSTEM VERIFICATION TEST

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, wait two minutes, and then proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display any active PASSENGER SEAT WEIGHT SENSOR PERFORMANCE DTCs?

Yes >> Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.

Perform OCS VERIFICATION TEST - VER 1.

No - But Other DTCs Present

Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No Active DTCs Present

Perform OCS VERIFICATION TEST - VER 1.

B1B78-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT PERFORMANCE (CONTINUED)

5. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

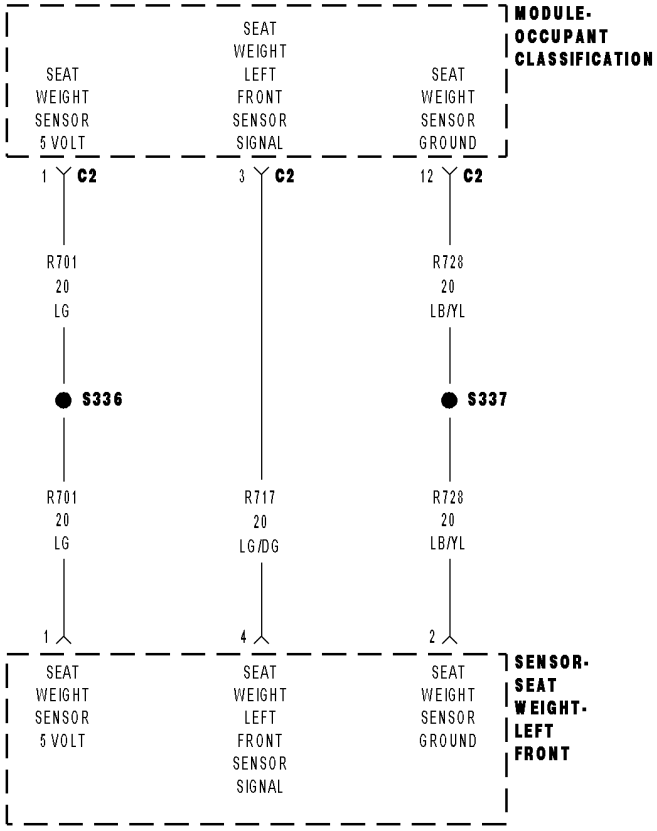
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

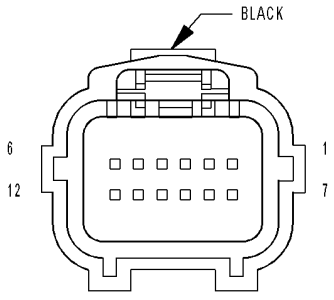
Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

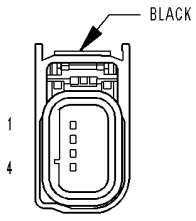
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B79-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT LOW





MODULE-
OCCUPANT
CLASSIFICATION C2



SENSOR-
SEAT WEIGHT-
LEFT FRONT

8133acea

B1B79-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT LOW (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN, the module checks the sensor input ranges.
- **Set Condition:**
  If the module detects that the sensor input is less than 3.4 ± .6% of the (R701) Seat Weight Sensor 5 Volt circuit voltage. This DTC will also set if the (R701) Seat Weight Sensor 5 Volt circuit is shorted to ground. However, this condition would prevent communication with the OCM and cause a Lost Communication With OCM DTC to set in other modules.

Possible Causes
PASSENGER SEAT HARNESS IMPROPERLY ROUTED
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R717) LT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(R717) LT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT OPEN
(R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT OPEN
LEFT-FRONT SEAT WEIGHT SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B79–PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT LOW IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B79–PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT LOW?

Yes >> Go To 3

No >> Go To 10

B1B79-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT LOW (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. VERIFY THAT PASSENGER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the Passenger Seat Harness is routed correctly.

Is the Passenger Seat Harness routed correctly?

Yes >> Go To 5

No >> Reroute the Passenger Seat Harness as necessary. Then, Go To 5

---

5. CHECK IF MORE THAN ONE PASSENGER SEAT WEIGHT SENSOR DTC IS ACTIVE

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, wait two minutes, and then proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display any active PASSENGER SEAT WEIGHT SENSOR DTCs?

Yes - More Than One PASSENGER SEAT WEIGHT SENSOR DTC Is Active.

Perform the Diagnosis/Checkout Procedure For Seat Weight Sensors.

Perform OCS VERIFICATION TEST - VER 1

Yes - Only DTC B1B79 Is Active.

Go To 6

No - But Other DTCs Present.

Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No - No Active DTCs Present.

Perform OCS VERIFICATION TEST - VER 1.

B1B79-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT LOW (CONTINUED)

6. CHECK VOLTAGE OF (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT

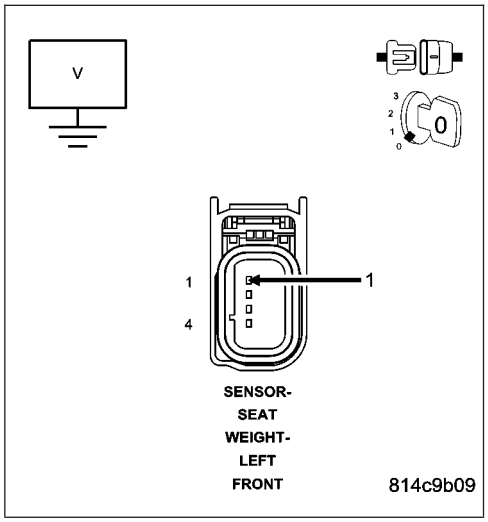
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Left-Front Seat Weight Sensor connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R701) Seat Weight Sensor 5 Volt circuit.

Is the voltage above 4.8 volts?

Yes >> Go To 7

No >> Go To 9



7. CHECK (R717) LT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the OCM C2 connector.

Measure the resistance of the (R717) LT-FT Seat Weight Sensor Signal circuit between ground and the OCM C2 connector.

Is the resistance below 10k ohms?

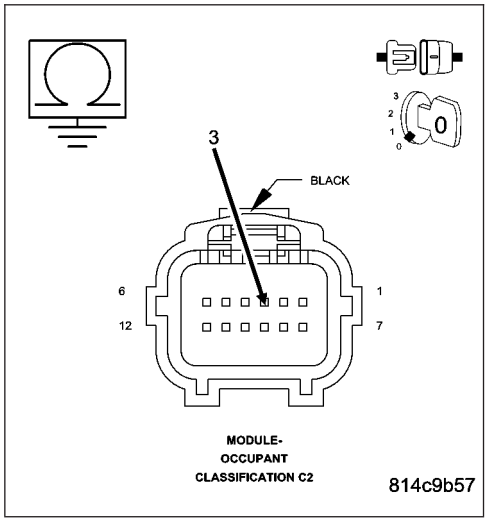
Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

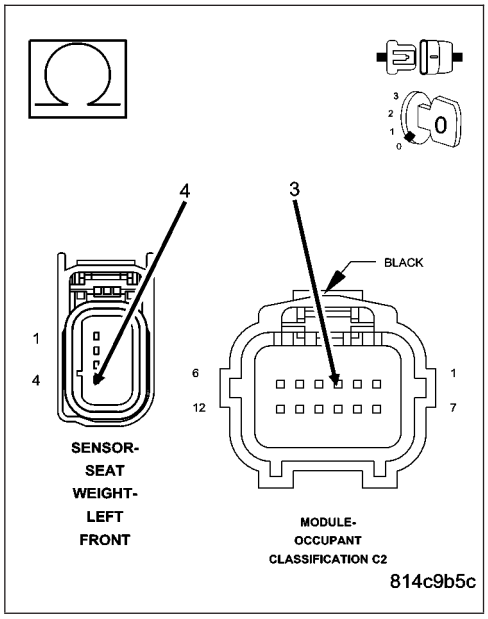
No >> Go To 8



B1B79-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT LOW (CONTINUED)

8. CHECK (R717) LT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR AN OPEN

Measure the resistance of the (R717) LT-FT Seat Weight Sensor Signal circuit between the OCM C2 connector and the Left-Front Seat Weight Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the Left-Front Seat Weight Sensor in accordance with the Service Information. Perform OCS VERIFICATION TEST - VER 1. If DTC B1B79–PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT LOW returns active, replace the OCM in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

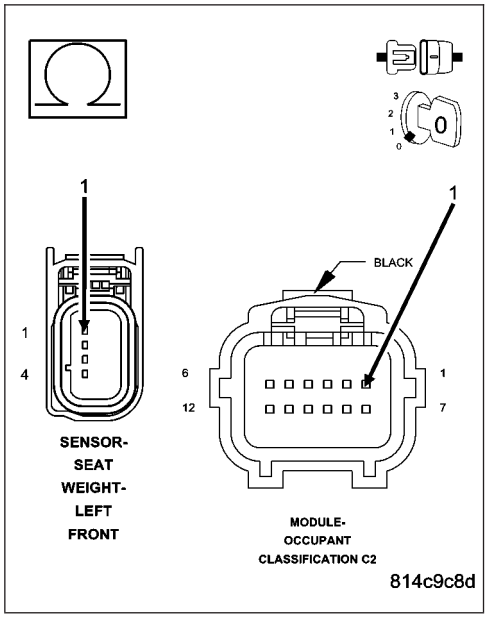
Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

9. CHECK (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the OCM C2 connector.

Measure the resistance of the (R701) Seat Weight Sensor 5 Volt circuit between the OCM C2 connector and the Left-Front Seat Weight Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the OCM in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

B1B79-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT LOW (CONTINUED)

10. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

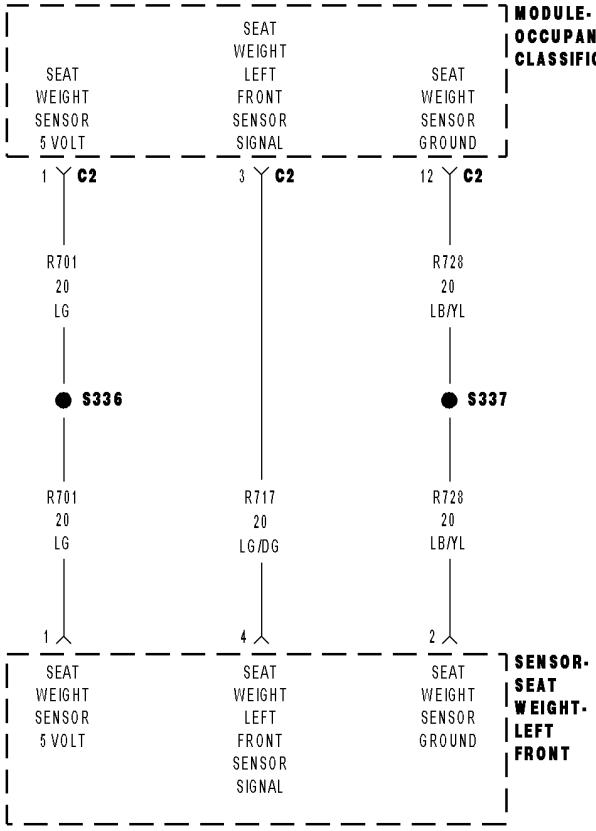
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

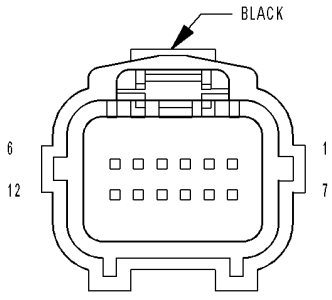
Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

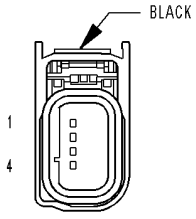
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B7A-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT HIGH





MODULE-
OCCUPANT
CLASSIFICATION C2



SENSOR-
SEAT WEIGHT-
LEFT FRONT

8133acea

B1B7A-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT HIGH (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN, the module checks the sensor input ranges.
- **Set Condition:**
  If the module detects that the sensor input is greater than 96 ± 0.6% of the (R701) Seat Weight Sensor 5 Volt circuit voltage.

Possible Causes
PASSENGER SEAT HARNESS IMPROPERLY ROUTED
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R717) LT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(R717) LT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT SHORTED TO (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT
(R728) SEAT WEIGHT SENSOR GROUND CIRCUIT OPEN
LEFT-FRONT SEAT WEIGHT SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B7A–PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT HIGH IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B7A–PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT HIGH?

Yes >> Go To 3

No >> Go To 9

B1B7A-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT HIGH (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. VERIFY THAT PASSENGER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the Passenger Seat Harness is routed correctly.

Is the Passenger Seat Harness routed correctly?

Yes >> Go To 5

No >> Reroute the Passenger Seat Harness as necessary.

Perform OCS VERIFICATION TEST - VER 1.

---

5. CHECK IF MORE THAN ONE PASSENGER SEAT WEIGHT SENSOR DTC IS ACTIVE

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, wait two minutes, and then proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display any active PASSENGER SEAT WEIGHT SENSOR DTCs?

Yes >> More Than One PASSENGER SEAT WEIGHT SENSOR DTC Is Active?Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.

Perform OCS VERIFICATION TEST - VER 1.

Yes >> Only DTC B1B7A Is Active?Go To 6

No >> But Other DTCs Present? Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> No Active DTCs Present? Perform OCS VERIFICATION TEST - VER 1.

B1B7A-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT HIGH (CONTINUED)

6. CHECK (R717) LT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the OCM C2 connector.

Disconnect the Left-Front Seat Weight Sensor connector.

Measure the voltage of the (R717) LT-FT Seat Weight Sensor Signal circuit.

Is the voltage above 0.2 volts?

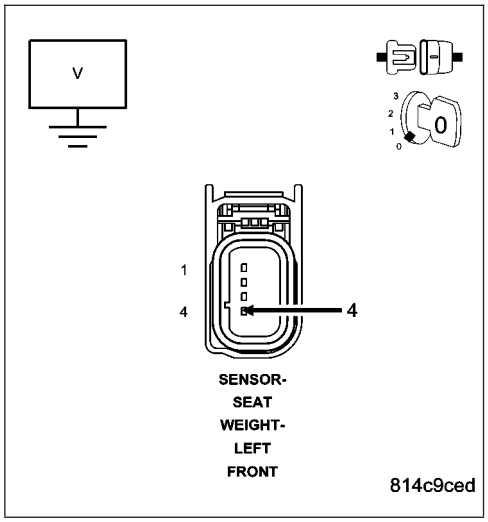
Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 7



7. CHECK (R717) LT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR A SHORT TO (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT

Measure the resistance between the (R717) LT-FT Seat Weight Sensor Signal circuit and the (R701) Seat Weight Sensor 5 Volt circuit.

Is the resistance below 10K ohms?

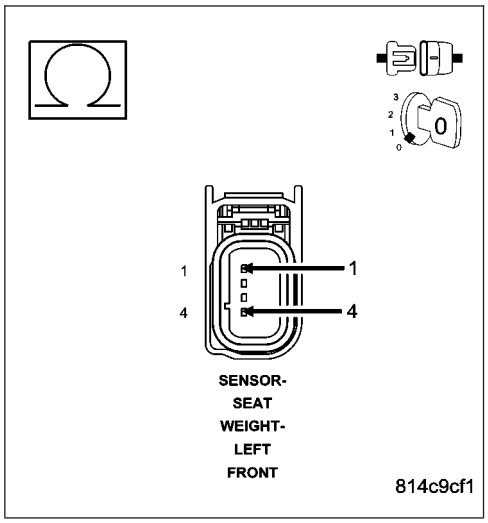
Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

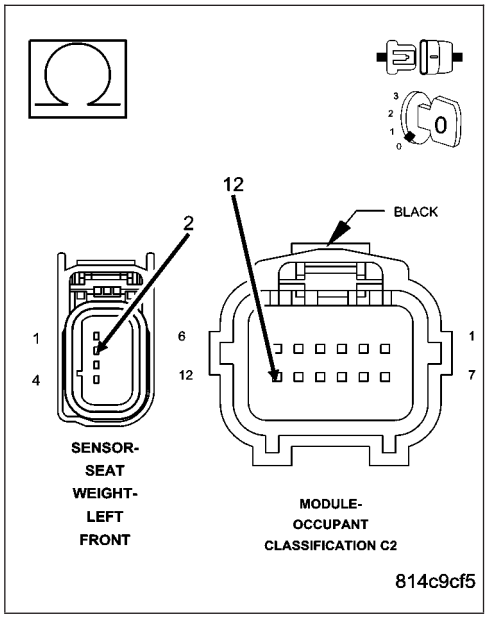
No >> Go To 8



B1B7A-PASSENGER SEAT WEIGHT SENSOR 3 - LEFT FRONT INPUT CIRCUIT HIGH (CONTINUED)

8. CHECK (R728) SEAT WEIGHT SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the (R728) Seat Weight Sensor Ground circuit between the OCM C2 connector and the Left-Front Seat Weight Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the OCM in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

No >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

---

9. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

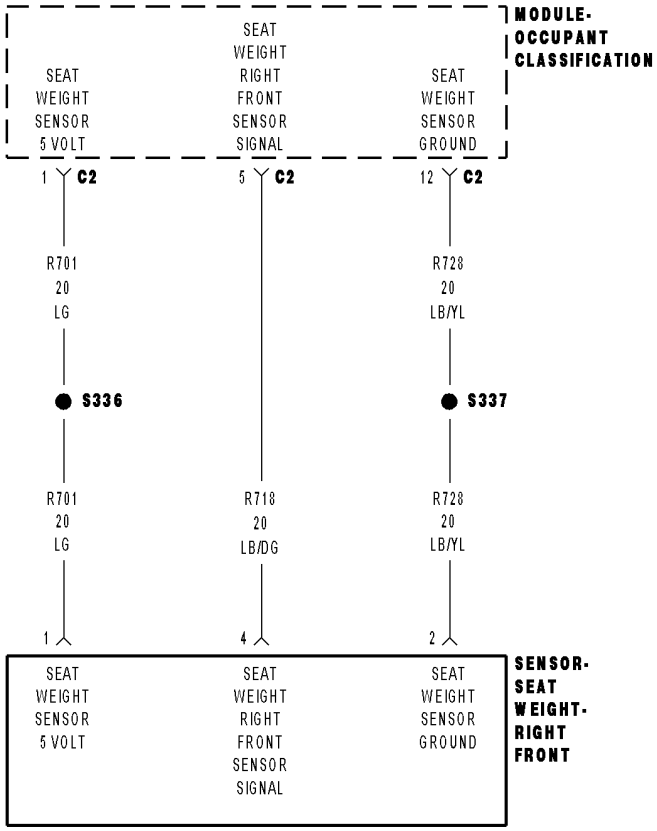
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

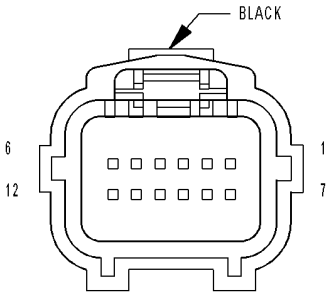
Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

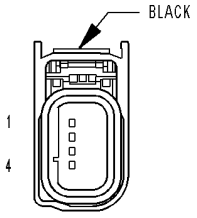
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B7D-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT PERFORMANCE





MODULE-
OCCUPANT
CLASSIFICATION C2



SENSOR-
SEAT WEIGHT-
RIGHT FRONT

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B1B7D-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT PERFORMANCE (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When CAN ignitions status is Run or SNA, during auto zero and while performing the Occupant Classification Module System Verification Test.
- **Set Condition:**
  During the occupant classification verification test: if the module detects that the sensor input is less than 1.4 volts or greater than 3.6 volts. During auto zero: if the module detects that the sensor input is less than 1 volt or greater than 4 volts.

Possible Causes
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
RIGHT-FRONT PASSENGER SEAT WEIGHT SENSOR
DAMAGE TO THE PASSENGER SEAT STRUCTURE, RISER ASSEMBLY, CROSSMEMBERS, SEAT TRACKS, FLOOR PAN
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B7D–PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT PERFORMANCE IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B7D–PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT PERFORMANCE?

Yes >> Go To 3

No >> Go To 5

B1B7D-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT PERFORMANCE (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. PERFORM OCCUPANT CLASSIFICATION MODULE SYSTEM VERIFICATION TEST

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, wait two minutes, and then proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display any active PASSENGER SEAT WEIGHT SENSOR PERFORMANCE DTCs?

Yes >> Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.

Perform OCS VERIFICATION TEST - VER 1.

No, But Other DTCs Present

Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No Active DTCs Present

Perform OCS VERIFICATION TEST - VER 1.

B1B7D-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT PERFORMANCE (CONTINUED)

5. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

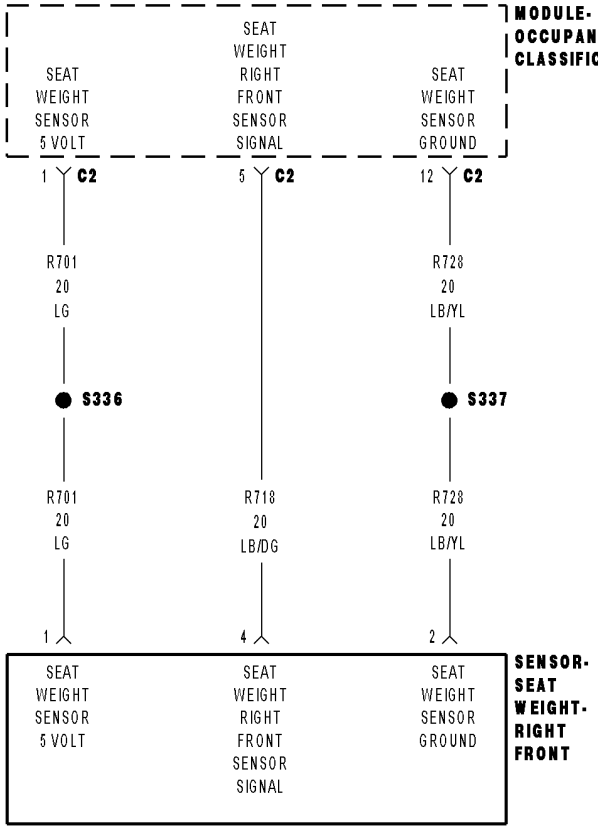
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

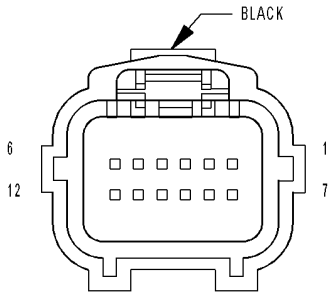
Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

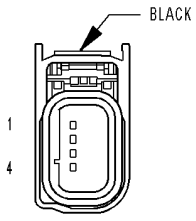
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B7E-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT LOW





MODULE-
OCCUPANT
CLASSIFICATION C2



SENSOR-
SEAT WEIGHT-
RIGHT FRONT

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B1B7E-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT LOW (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN, the module checks the sensor input ranges.
- **Set Condition:**
  If the module detects that the sensor input is less than 3.4 ± 0.6% of the (R701) Seat Weight Sensor 5 Volt circuit voltage. This DTC will also set if the (R701) Seat Weight Sensor 5 Volt circuit is shorted to ground. However, this condition would prevent communication with the OCM and cause a Lost Communication With OCM DTC to set in other modules.

Possible Causes
PASSENGER SEAT HARNESS IMPROPERLY ROUTED
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R718) RT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(R718) RT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT OPEN
(R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT OPEN
RIGHT-FRONT SEAT WEIGHT SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B7E–PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT LOW IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B7E–PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT LOW?

Yes >> Go To 3

No >> Go To 10

B1B7E-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT LOW (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. VERIFY THAT PASSENGER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the Passenger Seat Harness is routed correctly.

Is the Passenger Seat Harness routed correctly?

Yes >> Go To 5

No >> Reroute the Passenger Seat Harness as necessary. Then, Go To 5

---

5. CHECK IF MORE THAN ONE PASSENGER SEAT WEIGHT SENSOR DTC IS ACTIVE

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, wait two minutes, and then proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display any active PASSENGER SEAT WEIGHT SENSOR DTCs?

Yes - More Than One PASSENGER SEAT WEIGHT SENSOR DTC Is Active

Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.

Perform OCS VERIFICATION TEST - VER 1.

Yes - Only DTC B1B7E Is Active

Go To 6

No - But Other DTCs Present

Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No - No Active DTCs Present

Perform OCS VERIFICATION TEST - VER 1.

B1B7E-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT LOW (CONTINUED)

6. CHECK VOLTAGE OF (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT

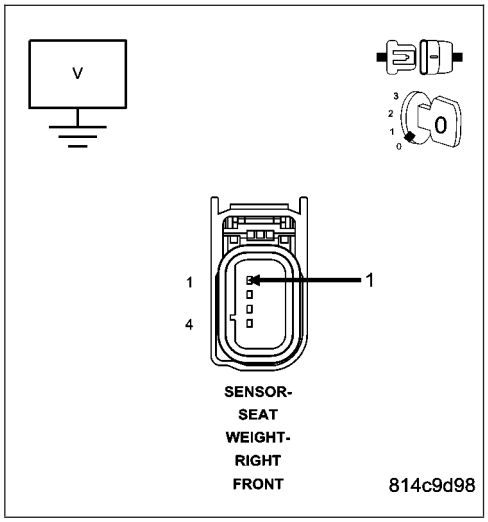
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Right-Front Seat Weight Sensor connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R701) Seat Weight Sensor 5 Volt circuit.

Is the voltage above 4.8 volts?

Yes >> Go To 7

No >> Go To 9



7. CHECK (R718) RT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the OCM C2 connector.

Measure the resistance of the (R718) RT-FT Seat Weight Sensor Signal circuit between ground and the OCM C2 connector.

Is the resistance below 10k ohms?

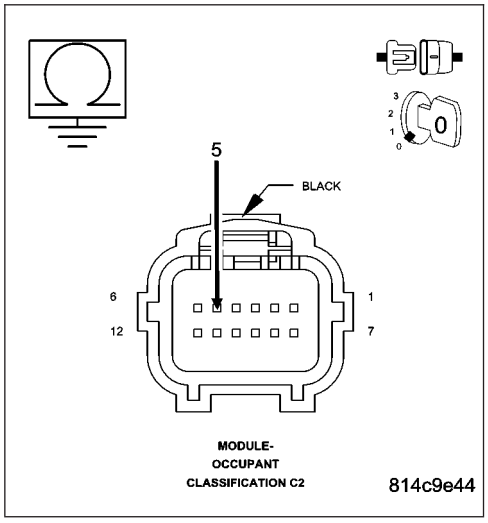
Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

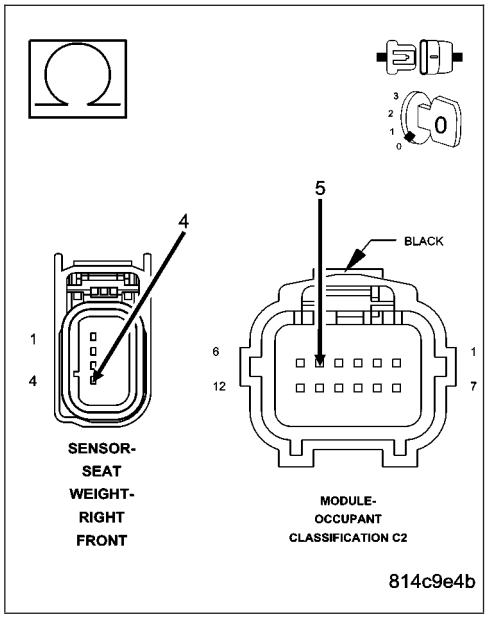
No >> Go To 8



B1B7E-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT LOW (CONTINUED)

8. CHECK (R718) RT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR AN OPEN

Measure the resistance of the (R718) RT-FT Seat Weight Sensor Signal circuit between the OCM C2 connector and the Right-Front Seat Weight Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the Right-Front Seat Weight Sensor in accordance with the Service Information. Perform OCS VERIFICATION TEST - VER 1. If DTC B1B7E–PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT LOW returns active, replace the OCM in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

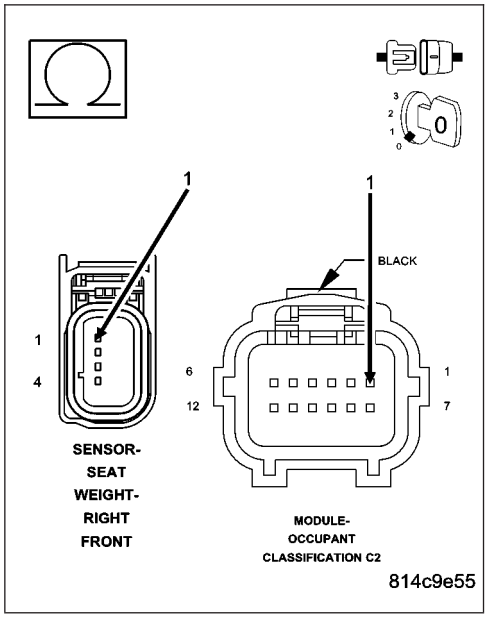
Perform OCS VERIFICATION TEST - VER 1.

---

9. CHECK (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the OCM C2 connector.

Measure the resistance of the (R701) Seat Weight Sensor 5 Volt circuit between the OCM C2 connector and the Right-Front Seat Weight Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the OCM in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

B1B7E-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT LOW (CONTINUED)

10. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

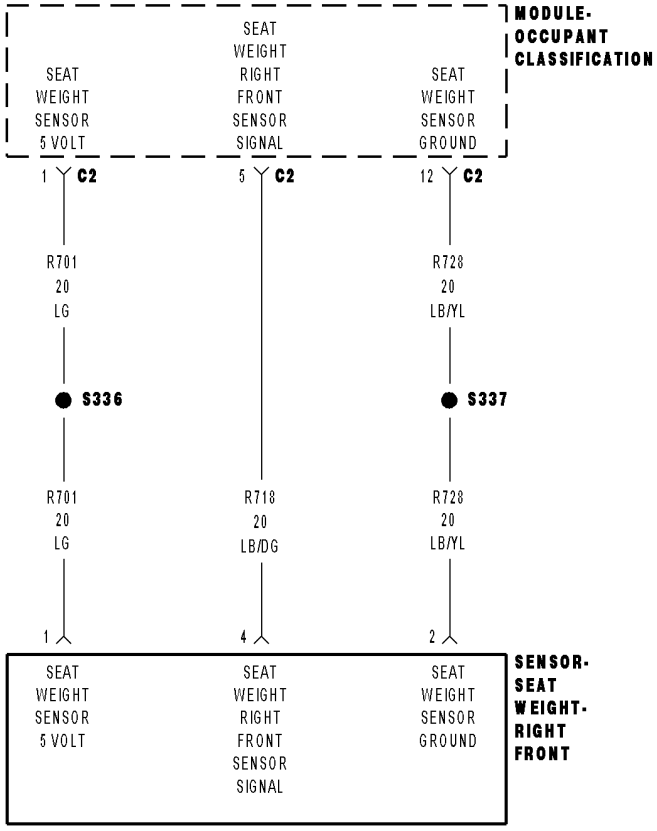
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

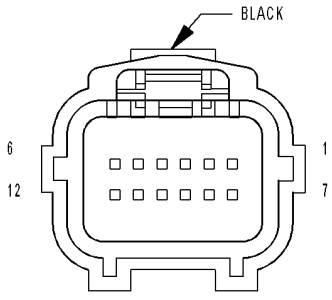
Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

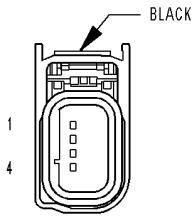
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B7F-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT HIGH





MODULE-
OCCUPANT
CLASSIFICATION C2



SENSOR-
SEAT WEIGHT-
RIGHT FRONT

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B1B7F-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT HIGH (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN, the module checks the sensor input ranges.
- **Set Condition:**
  If the module detects that the sensor input is greater than 96 ± 0.6% of the (R701) Seat Weight Sensor 5 Volt circuit voltage.

Possible Causes
PASSENGER SEAT HARNESS IMPROPERLY ROUTED
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R718) RT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(R718) RT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT SHORTED TO (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT
(R728) SEAT WEIGHT SENSOR GROUND CIRCUIT OPEN
RIGHT-FRONT SEAT WEIGHT SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B7F–PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT HIGH IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B7F–PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT HIGH?

Yes >> Go To 3

No >> Go To 9

B1B7F-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT HIGH (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. VERIFY THAT PASSENGER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the Passenger Seat Harness is routed correctly.

Is the Passenger Seat Harness routed correctly?

Yes >> Go To 5

No >> Reroute the Passenger Seat Harness as necessary.

Perform OCS VERIFICATION TEST - VER 1.

---

5. CHECK IF MORE THAN ONE PASSENGER SEAT WEIGHT SENSOR DTC IS ACTIVE

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, wait two minutes, and then proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display any active PASSENGER SEAT WEIGHT SENSOR DTCs?

Yes >> More Than One PASSENGER SEAT WEIGHT SENSOR DTC Is Active?Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.

Perform OCS VERIFICATION TEST - VER 1.

Yes >> Only DTC B1B7F Is Active?Go To 6

No >> But Other DTCs Present?Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Perform OCS VERIFICATION TEST - VER 1.

B1B7F-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT HIGH (CONTINUED)

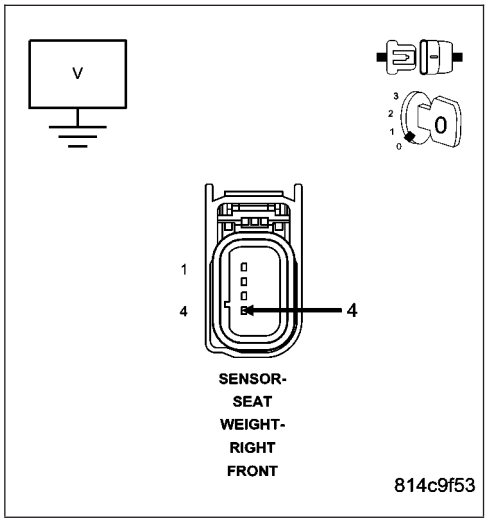
6. CHECK (R718) RT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the OCM C2 connector.

Disconnect the Right-Front Seat Weight Sensor connector.

Measure the voltage of the (R718) RT-FT Seat Weight Sensor Signal circuit.



Is the voltage above 0.2 volts?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

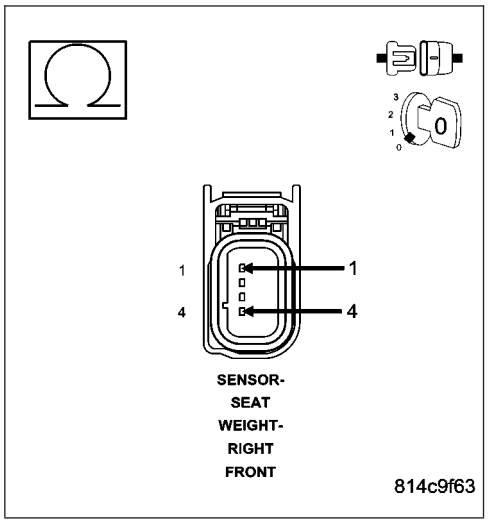
Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 7

7. CHECK (R718) RT-FT SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR A SHORT TO (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT

Measure the resistance between the (R718) RT-FT Seat Weight Sensor Signal circuit and the (R701) Seat Weight Sensor 5 Volt circuit.



Is the resistance below 10K ohms?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

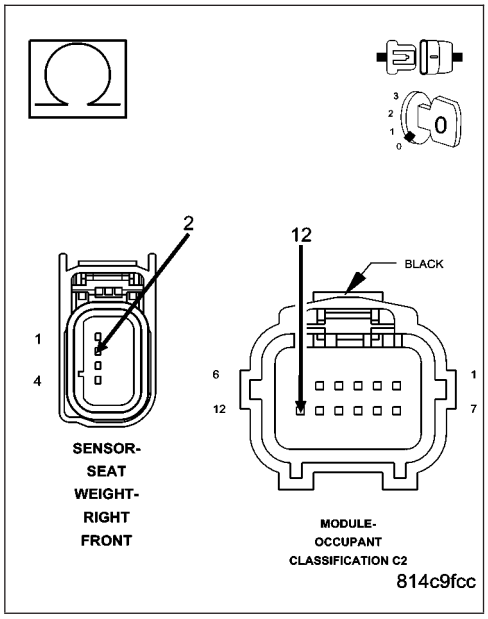
Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 8

B1B7F-PASSENGER SEAT WEIGHT SENSOR 2 - RIGHT FRONT INPUT CIRCUIT HIGH (CONTINUED)

8. CHECK (R728) SEAT WEIGHT SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the (R728) Seat Weight Sensor Ground circuit between the OCM C2 connector and the Right-Front Seat Weight Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the OCM in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

No >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

---

9. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

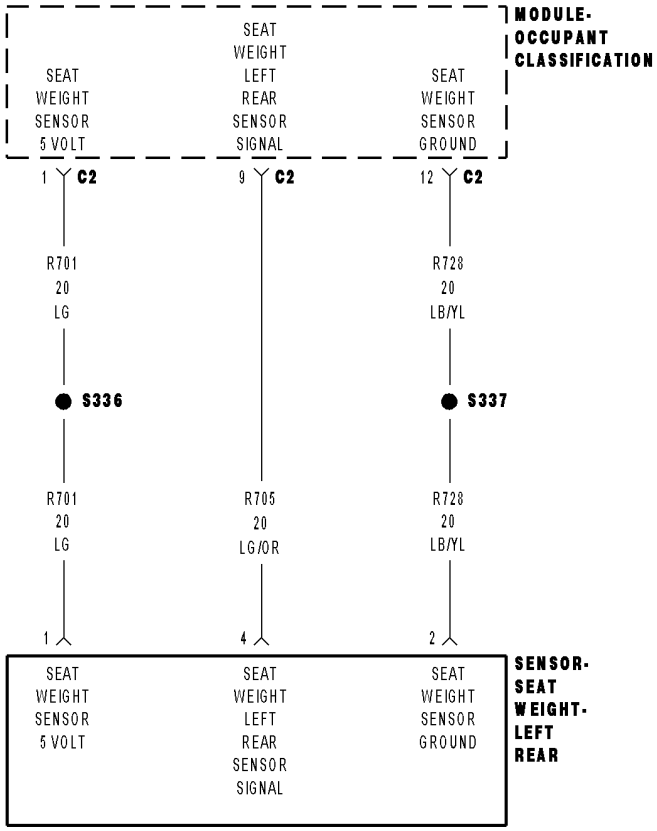
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

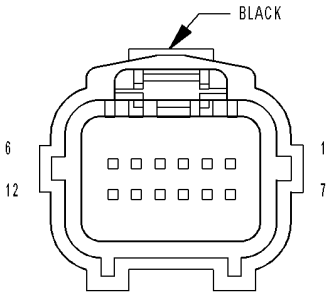
Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

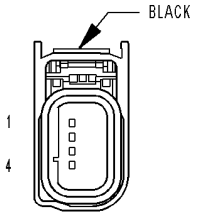
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B82-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR PERFORMANCE





MODULE-
OCCUPANT
CLASSIFICATION C2



SENSOR-
SEAT WEIGHT-
LEFT REAR

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B1B82-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR PERFORMANCE (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When CAN ignitions status is Run or SNA, during auto zero and while performing the Occupant Classification Module System Verification Test.
- **Set Condition:**
  During the occupant classification verification test: if the module detects that the sensor input is less than 1.4 volts or greater than 3.6 volts. During auto zero: if the module detects that the sensor input is less than 1 volt or greater than 4 volts.

Possible Causes
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
LEFT-REAR PASSENGER SEAT WEIGHT SENSOR
DAMAGE TO THE PASSENGER SEAT STRUCTURE, RISER ASSEMBLY, CROSSMEMBERS, SEAT TRACKS, FLOOR PAN
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B82–PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR PERFORMANCE IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B82–PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR PERFORMANCE?

Yes >> Go To 3

No >> Go To 5

B1B82-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR PERFORMANCE (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. PERFORM OCCUPANT CLASSIFICATION MODULE SYSTEM VERIFICATION TEST

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, wait two minutes, and then proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display any active PASSENGER SEAT WEIGHT SENSOR PERFORMANCE DTCs?

Yes >> Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.

No - But Other DTCs Present

Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No - No Active DTCs Present

Perform OCS VERIFICATION TEST - VER 1.

B1B82-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR PERFORMANCE (CONTINUED)

5. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

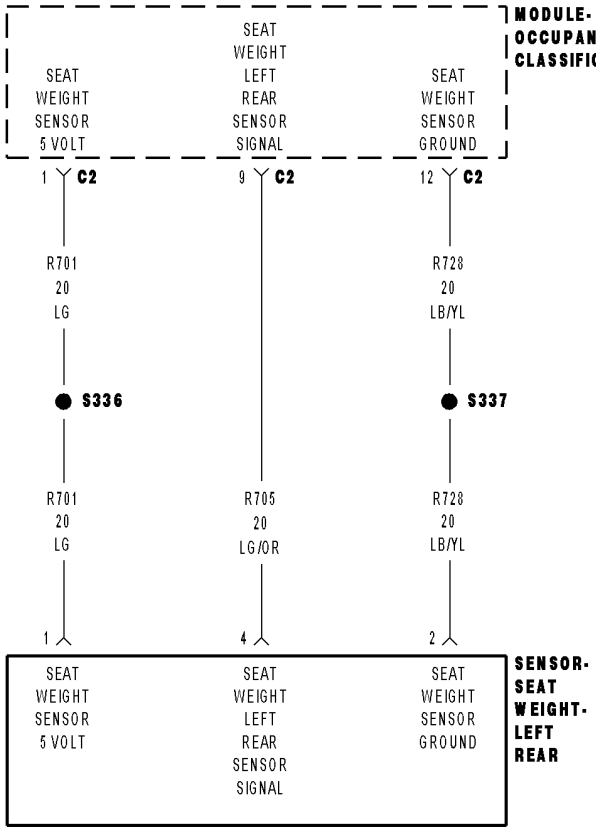
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

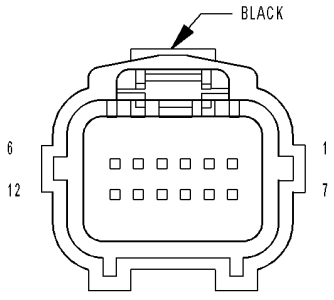
Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

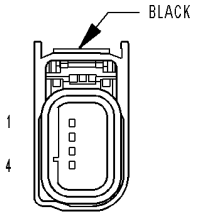
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B83-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT LOW





MODULE-
OCCUPANT
CLASSIFICATION C2



SENSOR-
SEAT WEIGHT-
LEFT REAR

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B1B83-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT LOW (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN, the module checks the sensor input ranges.
- **Set Condition:**
  If the module detects that the sensor input is less than 3.4 ± 0.6% of the (R701) Seat Weight Sensor 5 Volt circuit voltage. This DTC will also set if the (R701) Seat Weight Sensor 5 Volt circuit is shorted to ground. However, this condition would prevent communication with the OCM and cause a Lost Communication With OCM DTC to set in other modules.

Possible Causes
PASSENGER SEAT HARNESS IMPROPERLY ROUTED
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R705) LT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(R705) LT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT OPEN
(R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT OPEN
LEFT-REAR SEAT WEIGHT SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B83–PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT LOW IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B83–PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT LOW?

Yes >> Go To 3

No >> Go To 10

B1B83-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT LOW (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. VERIFY THAT PASSENGER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the Passenger Seat Harness is routed correctly.

Is the Passenger Seat Harness routed correctly?

Yes >> Go To 5

No >> Reroute the Passenger Seat Harness as necessary.

Perform OCS VERIFICATION TEST - VER 1.

---

5. CHECK IF MORE THAN ONE PASSENGER SEAT WEIGHT SENSOR DTC IS ACTIVE

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, wait two minutes, and then proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display any active PASSENGER SEAT WEIGHT SENSOR DTCs?

Yes - More Than One PASSENGER SEAT WEIGHT SENSOR DTC Is Active

Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.

Perform OCS VERIFICATION TEST - VER 1.

Yes - Only DTC B1B83 Is Active

Go To 6

No - But Other DTCs Present

Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No - No Active DTCs Present

Perform OCS VERIFICATION TEST - VER 1.

B1B83-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT LOW (CONTINUED)

6. CHECK VOLTAGE OF (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT

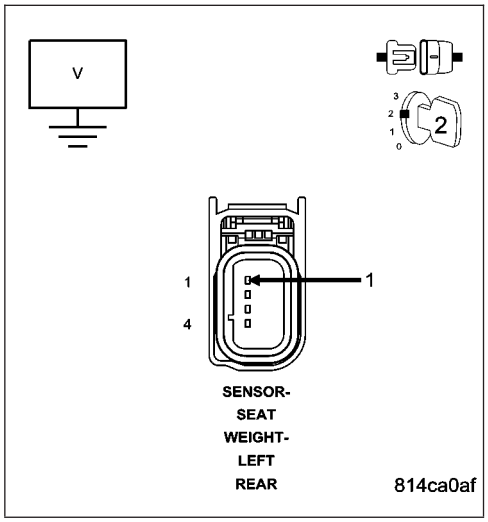
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Left-Rear Seat Weight Sensor connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R701) Seat Weight Sensor 5 Volt circuit.

Is the voltage above 4.8 volts?

Yes >> Go To 7

No >> Go To 9



7. CHECK (R705) LT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the OCM C2 connector.

Measure the resistance of the (R705) LT-RR Seat Weight Sensor Signal circuit between ground and the OCM C2 connector.

Is the resistance below 10k ohms?

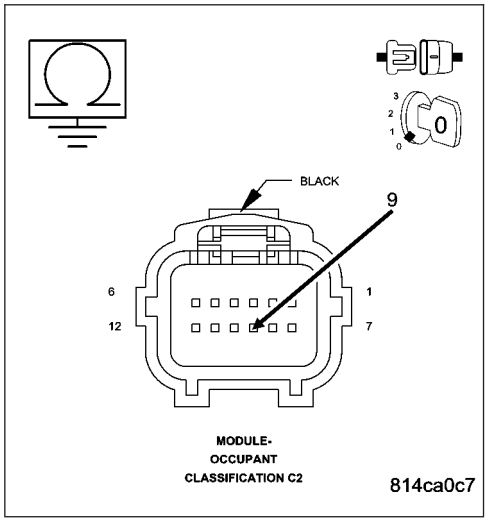
Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

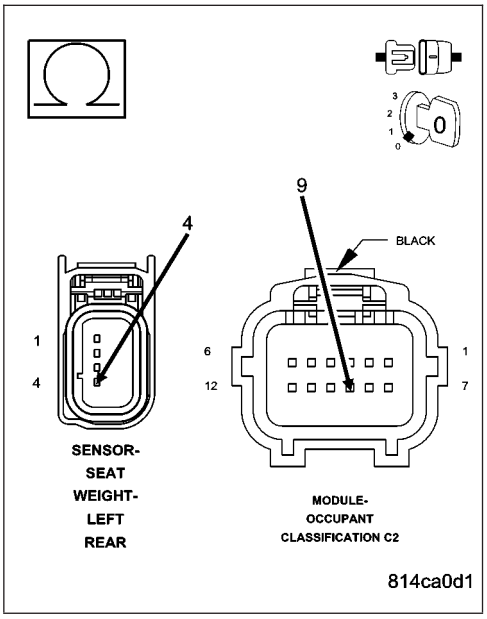
No >> Go To 8



B1B83-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT LOW (CONTINUED)

8. CHECK (R705) LT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR AN OPEN

Measure the resistance of the (R705) LT-RR Seat Weight Sensor Signal circuit between the OCM C2 connector and the Left-Rear Seat Weight Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the Left-Rear Seat Weight Sensor in accordance with the Service Information. Perform OCS VERIFICATION TEST - VER 1. If DTC B1B83-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT LOW returns active, replace the OCM in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

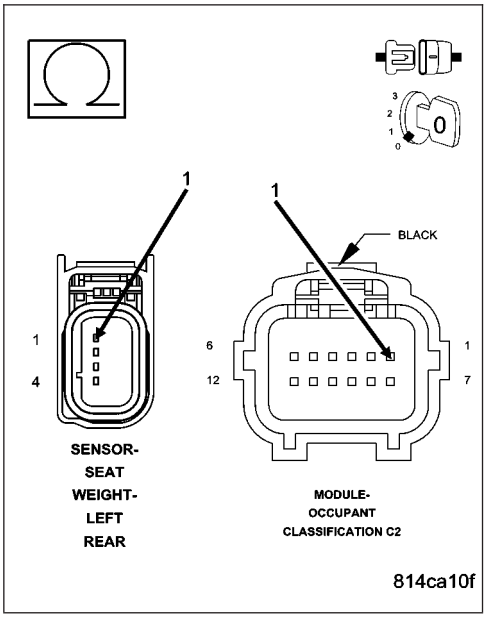
Perform OCS VERIFICATION TEST - VER 1.

---

9. CHECK (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the OCM C2 connector.

Measure the resistance of the (R701) Seat Weight Sensor 5 Volt circuit between the OCM C2 connector and the Left-Rear Seat Weight Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the OCM in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

B1B83-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT LOW (CONTINUED)

10. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

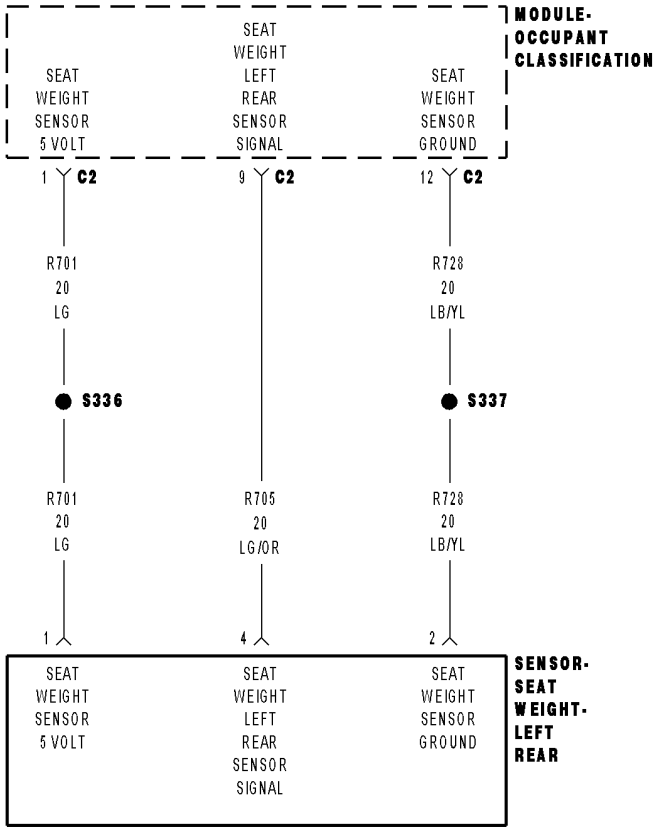
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

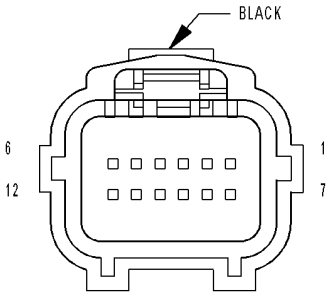
Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

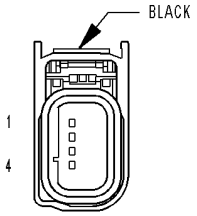
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B84-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT HIGH





MODULE-
OCCUPANT
CLASSIFICATION C2



SENSOR-
SEAT WEIGHT-
LEFT REAR

8133afa0

B1B84-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT HIGH (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN, the module checks the sensor input ranges.
- **Set Condition:**
  If the module detects that the sensor input is greater than 96 ± 0.6% of the (R701) Seat Weight Sensor 5 Volt circuit voltage.

Possible Causes
PASSENGER SEAT HARNESS IMPROPERLY ROUTED
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R705) LT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(R705) LT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT SHORTED TO (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT
(R728) SEAT WEIGHT SENSOR GROUND CIRCUIT OPEN
LEFT-REAR SEAT WEIGHT SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B84–PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT HIGH IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B84–PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT HIGH?

Yes >> Go To 3

No >> Go To 9

B1B84-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT HIGH (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. VERIFY THAT PASSENGER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the Passenger Seat Harness is routed correctly.

Is the Passenger Seat Harness routed correctly?

Yes >> Go To 5

No >> Reroute the Passenger Seat Harness as necessary.

Perform OCS VERIFICATION TEST - VER 1.

---

5. CHECK IF MORE THAN ONE PASSENGER SEAT WEIGHT SENSOR DTC IS ACTIVE

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, wait two minutes, and then proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display any active PASSENGER SEAT WEIGHT SENSOR DTCs?

Yes >> More Than One PASSENGER SEAT WEIGHT SENSOR DTC Is Active? Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.

Perform OCS VERIFICATION TEST - VER 1.

Yes >> Only DTC B1B84 Is Active? Go To 6

No >> But Other DTCs Present? Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Perform OCS VERIFICATION TEST - VER 1.

B1B84-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT HIGH (CONTINUED)

6. CHECK (R705) LT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the OCM C2 connector.

Measure the voltage of the (R705) LT-RR Seat Weight Sensor Signal circuit.

Is the voltage above 0.2 volts?

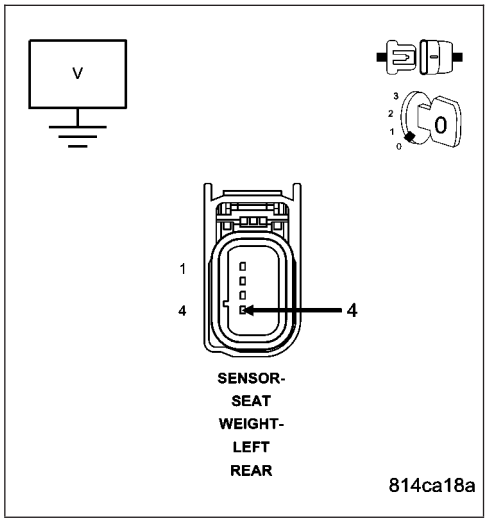
Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 7



7. CHECK (R705) LT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR A SHORT TO (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT

Disconnect the Left-Rear Seat Weight Sensor connector.

Measure the resistance between the (R705) LT-RR Seat Weight Sensor Signal circuit and the (R701) Seat Weight Sensor 5 Volt circuit.

Is the resistance below 10K ohms?

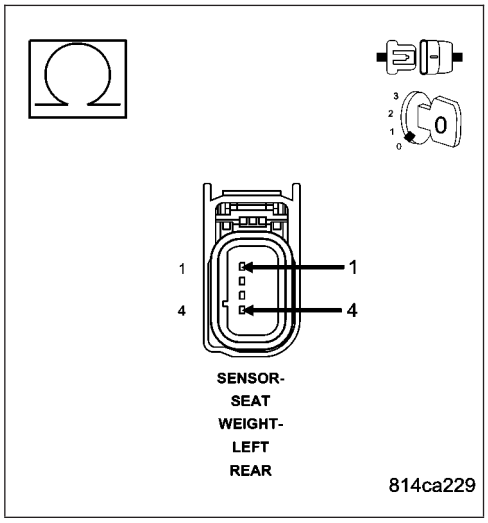
Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

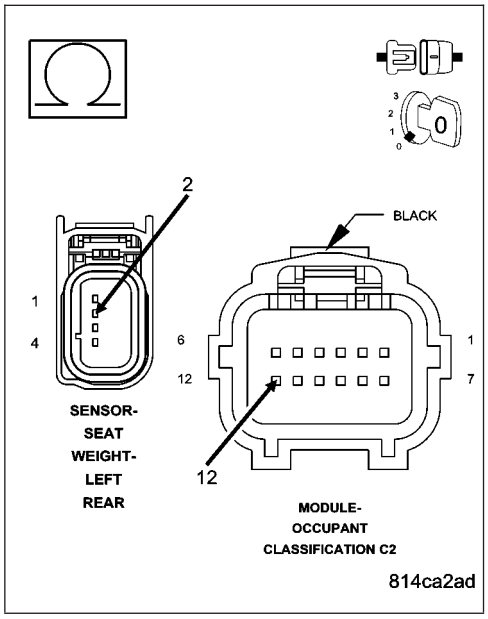
No >> Go To 8



B1B84-PASSENGER SEAT WEIGHT SENSOR 4 - LEFT REAR INPUT CIRCUIT HIGH (CONTINUED)

8. CHECK (R728) SEAT WEIGHT SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the (R728) Seat Weight Sensor Ground circuit between the OCM C2 connector and the Left-Rear Seat Weight Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the OCM in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

No >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

---

9. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

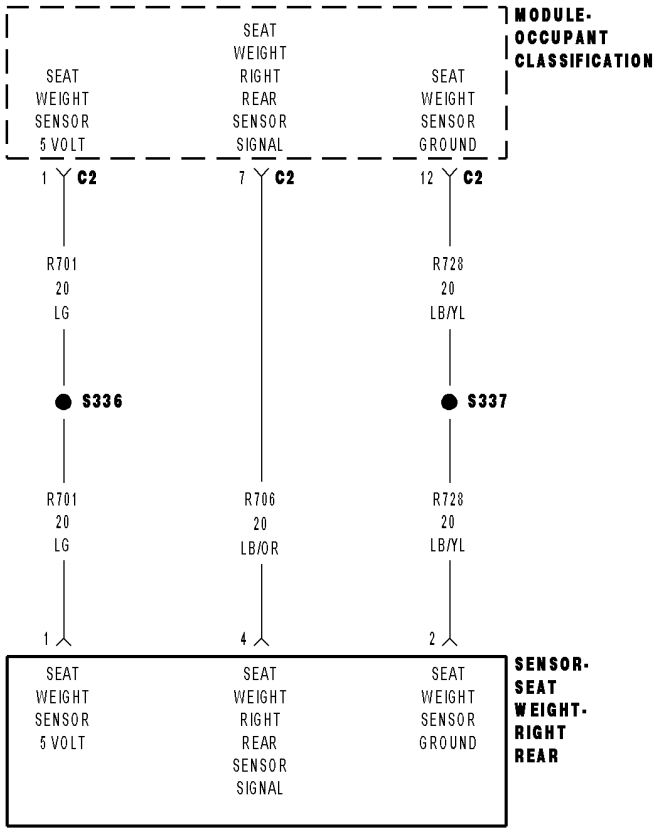
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

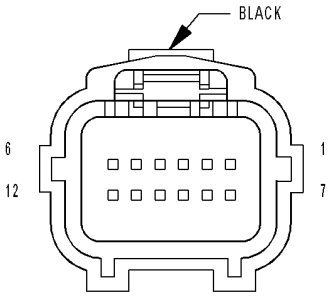
Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

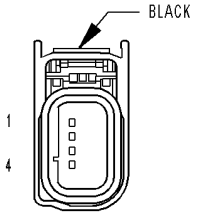
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B87-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR PERFORMANCE





MODULE-
OCCUPANT
CLASSIFICATION C2



SENSOR-
SEAT WEIGHT-
RIGHT REAR

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B1B87-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR PERFORMANCE (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When CAN ignitions status is Run or SNA, during auto zero and while performing the Occupant Classification Module System Verification Test.
- **Set Condition:**
  During the occupant classification verification test: if the module detects that the sensor input is less than 1.4 volts or greater than 3.6 volts. During auto zero: if the module detects that the sensor input is less than 1 volt or greater than 4 volts.

Possible Causes
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
RIGHT-REAR PASSENGER SEAT WEIGHT SENSOR
DAMAGE TO THE PASSENGER SEAT STRUCTURE, RISER ASSEMBLY, CROSSMEMBERS, SEAT TRACKS, FLOOR PAN
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B87–PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR PERFORMANCE IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B87–PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR PERFORMANCE?

Yes >> Go To 3

No >> Go To 5

B1B87-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR PERFORMANCE (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. PERFORM OCCUPANT CLASSIFICATION MODULE SYSTEM VERIFICATION TEST

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, wait two minutes, and then proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display any active PASSENGER SEAT WEIGHT SENSOR PERFORMANCE DTCs?

Yes >> Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.

Perform OCS VERIFICATION TEST - VER 1.

No - But Other DTCs Present

Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> No Active DTCs Present?Perform OCS VERIFICATION TEST - VER 1.

B1B87-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR PERFORMANCE (CONTINUED)

5. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

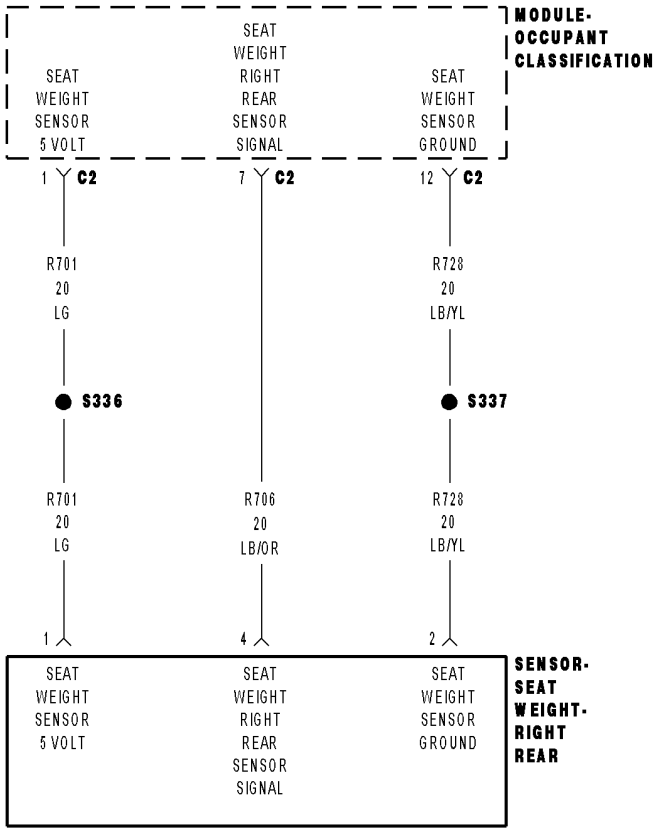
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

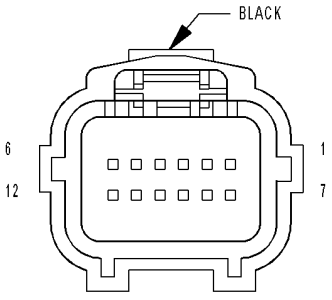
Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

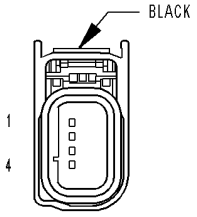
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B88-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT LOW





MODULE-
OCCUPANT
CLASSIFICATION C2



SENSOR-
SEAT WEIGHT-
RIGHT REAR

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B1B88-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT LOW (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN, the module checks the sensor input ranges.
- **Set Condition:**
  If the module detects that the sensor input is less than 3.4 ± 0.6% of the (R701) Seat Weight Sensor 5 Volt circuit voltage. This DTC will also set if the (R701) Seat Weight Sensor 5 Volt circuit is shorted to ground. However, this condition would prevent communication with the OCM and cause a Lost Communication With OCM DTC to set in other modules.

Possible Causes
PASSENGER SEAT HARNESS IMPROPERLY ROUTED
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R706) RT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(R706) RT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT OPEN
(R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT OPEN
RIGHT-REAR SEAT WEIGHT SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B88–PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT LOW IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B88–PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT LOW?

Yes >> Go To 3

No >> Go To 10

B1B88-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT LOW (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. VERIFY THAT PASSENGER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the Passenger Seat Harness is routed correctly.

Is the Passenger Seat Harness routed correctly?

Yes >> Go To 5

No >> Reroute the Passenger Seat Harness as necessary.

Perform OCS VERIFICATION TEST - VER 1.

---

5. CHECK IF MORE THAN ONE PASSENGER SEAT WEIGHT SENSOR DTC IS ACTIVE

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, wait two minutes, and then proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display any active PASSENGER SEAT WEIGHT SENSOR DTCs?

Yes >> More Than One PASSENGER SEAT WEIGHT SENSOR DTC Is Active? Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.

Perform OCS VERIFICATION TEST - VER 1.

Yes >> Only DTC B1B88 Is Active? Go To 6

No >> But Other DTCs Present? Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> No Active DTCs Present? Perform OCS VERIFICATION TEST - VER 1.

B1B88-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT LOW (CONTINUED)

6. CHECK VOLTAGE OF (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT

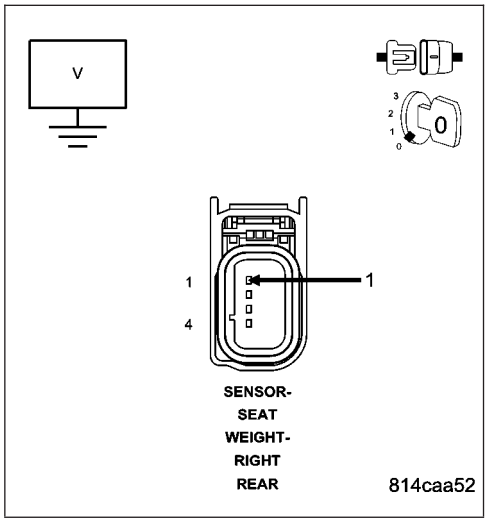
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Right-Rear Seat Weight Sensor connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R701) Seat Weight Sensor 5 Volt circuit.

Is the voltage above 4.8 volts?

Yes >> Go To 7

No >> Go To 9



7. CHECK (R706) RT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the OCM C2 connector.

Measure the resistance of the (R706) RT-RR Seat Weight Sensor Signal circuit between ground and the OCM C2 connector.

Is the resistance below 10k ohms?

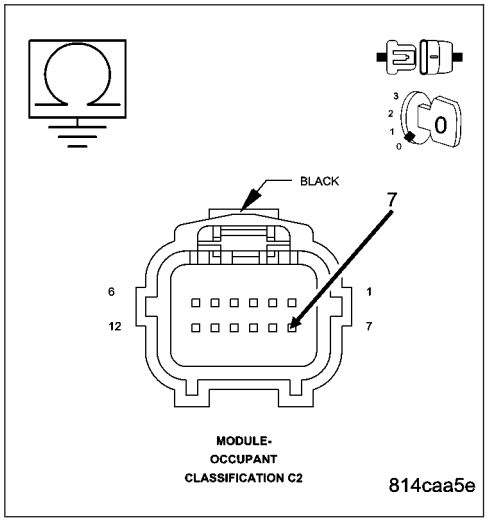
Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

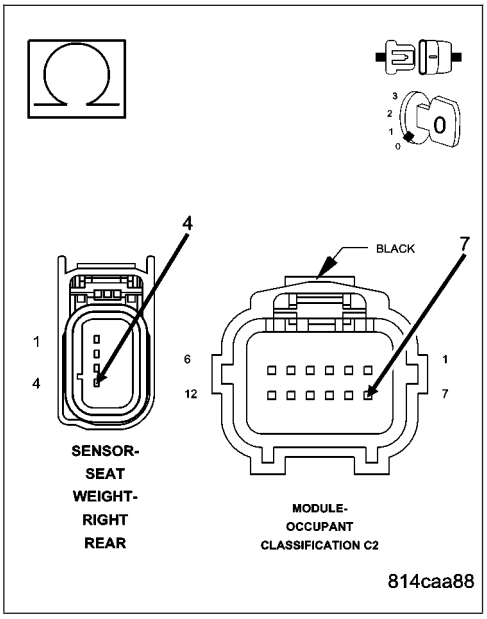
No >> Go To 8



B1B88-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT LOW (CONTINUED)

8. CHECK (R706) RT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR AN OPEN

Measure the resistance of the (R706) RT-RR Seat Weight Sensor Signal circuit between the OCM C2 connector and the Right-Rear Seat Weight Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the Right-Rear Seat Weight Sensor in accordance with the Service Information. Perform OCS VERIFICATION TEST - VER 1. If DTC B1B88–PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT LOW returns active, replace the OCM in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

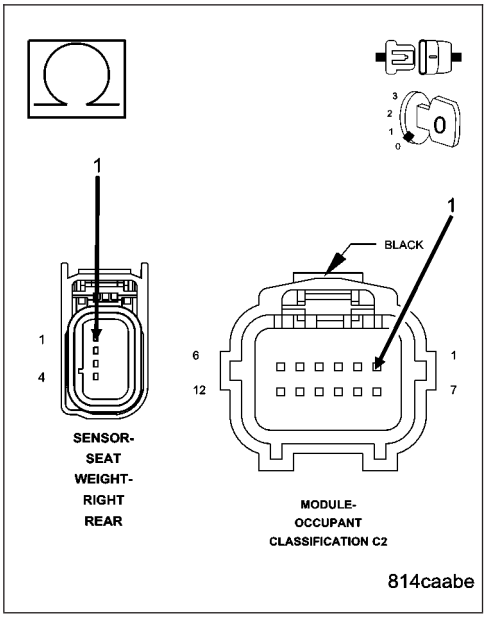
Perform OCS VERIFICATION TEST - VER 1.

---

9. CHECK (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the OCM C2 connector.

Measure the resistance of the (R701) Seat Weight Sensor 5 Volt circuit between the OCM C2 connector and the Right-Rear Seat Weight Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the OCM in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

B1B88-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT LOW (CONTINUED)

10. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

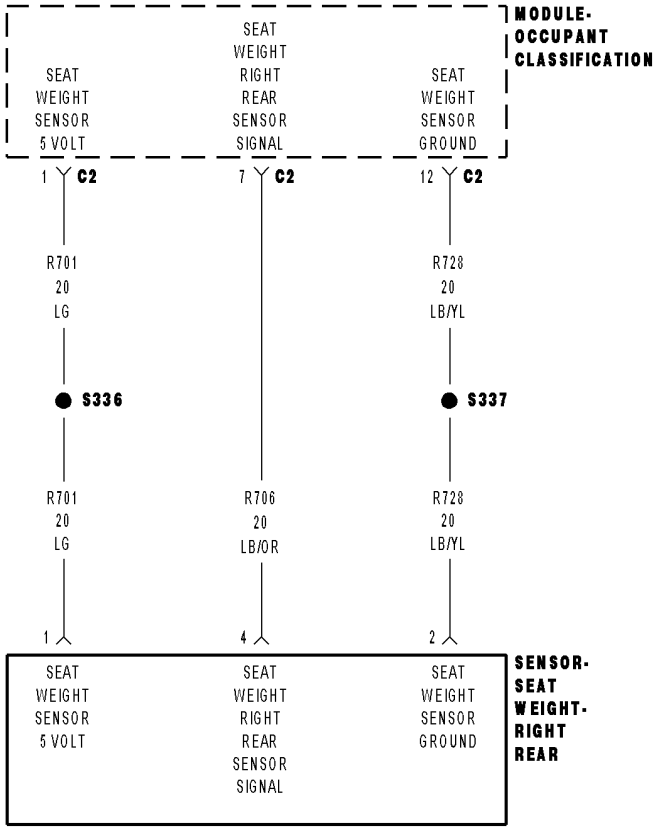
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

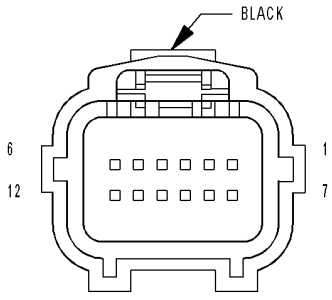
Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

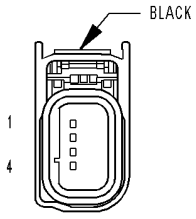
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B89-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT HIGH





MODULE-
OCCUPANT
CLASSIFICATION C2



SENSOR-
SEAT WEIGHT-
RIGHT REAR

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B1B89-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT HIGH (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN, the module checks the sensor input ranges.
- **Set Condition:**
  If the module detects that the sensor input is greater than 96 ± 0.6% of the (R701) Seat Weight Sensor 5 Volt circuit voltage.

Possible Causes
PASSENGER SEAT HARNESS IMPROPERLY ROUTED
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R706) RT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(R706) RT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT SHORTED TO (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT
(R728) SEAT WEIGHT SENSOR GROUND CIRCUIT OPEN
RIGHT-REAR SEAT WEIGHT SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B89–PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT HIGH IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B89–PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT HIGH?

Yes >> Go To 3

No >> Go To 9

B1B89-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT HIGH (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. VERIFY THAT PASSENGER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the Passenger Seat Harness is routed correctly.

Is the Passenger Seat Harness routed correctly?

Yes >> Go To 5

No >> Reroute the Passenger Seat Harness as necessary.

Perform OCS VERIFICATION TEST - VER 1.

---

5. CHECK IF MORE THAN ONE PASSENGER SEAT WEIGHT SENSOR DTC IS ACTIVE

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, wait two minutes, and then proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display any active PASSENGER SEAT WEIGHT SENSOR DTCs?

Yes >> More Than One PASSENGER SEAT WEIGHT SENSOR DTC Is Active? Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.

Perform OCS VERIFICATION TEST - VER 1.

Yes >> Only DTC B1B89 Is Active? Go To 6

No >> Other active DTCs are Present-To Diagnose and repair the DTCs refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Perform OCS VERIFICATION TEST - VER 1.

B1B89-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT HIGH (CONTINUED)

6. CHECK (R706) RT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the OCM C2 connector.

Disconnect the Right-Rear Seat Weight Sensor connector.

Measure the voltage of the (R706) RT-RR Seat Weight Sensor Signal circuit.

Is the voltage above 0.2 volts?

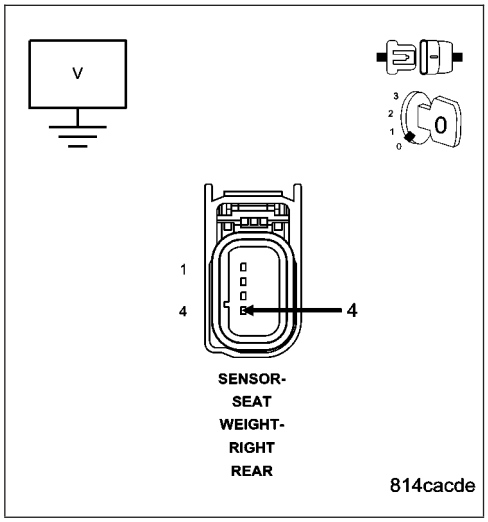
Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 7



7. CHECK (R706) RT-RR SEAT WEIGHT SENSOR SIGNAL CIRCUIT FOR A SHORT TO (R701) SEAT WEIGHT SENSOR 5 VOLT CIRCUIT

Measure the resistance between the (R706) RT-RR Seat Weight Sensor Signal circuit and the (R701) Seat Weight Sensor 5 Volt circuit.

Is the resistance below 10K ohms?

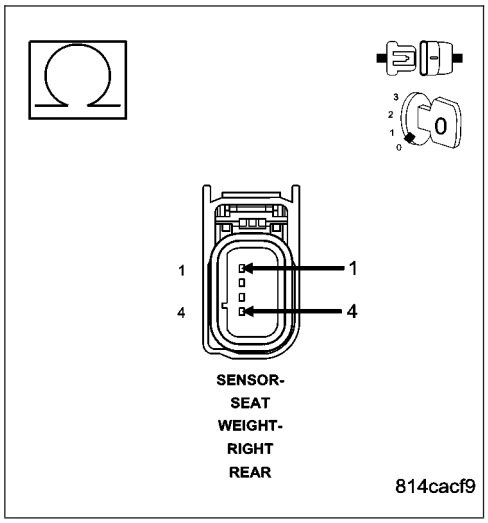
Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

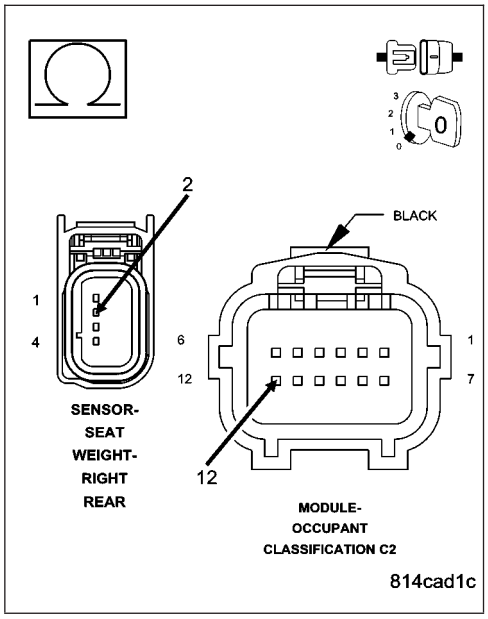
No >> Go To 8



B1B89-PASSENGER SEAT WEIGHT SENSOR 1 - RIGHT REAR INPUT CIRCUIT HIGH (CONTINUED)

8. CHECK (R728) SEAT WEIGHT SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the (R728) Seat Weight Sensor Ground circuit between the OCM C2 connector and the Right-Rear Seat Weight Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the OCM in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

No >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

9. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

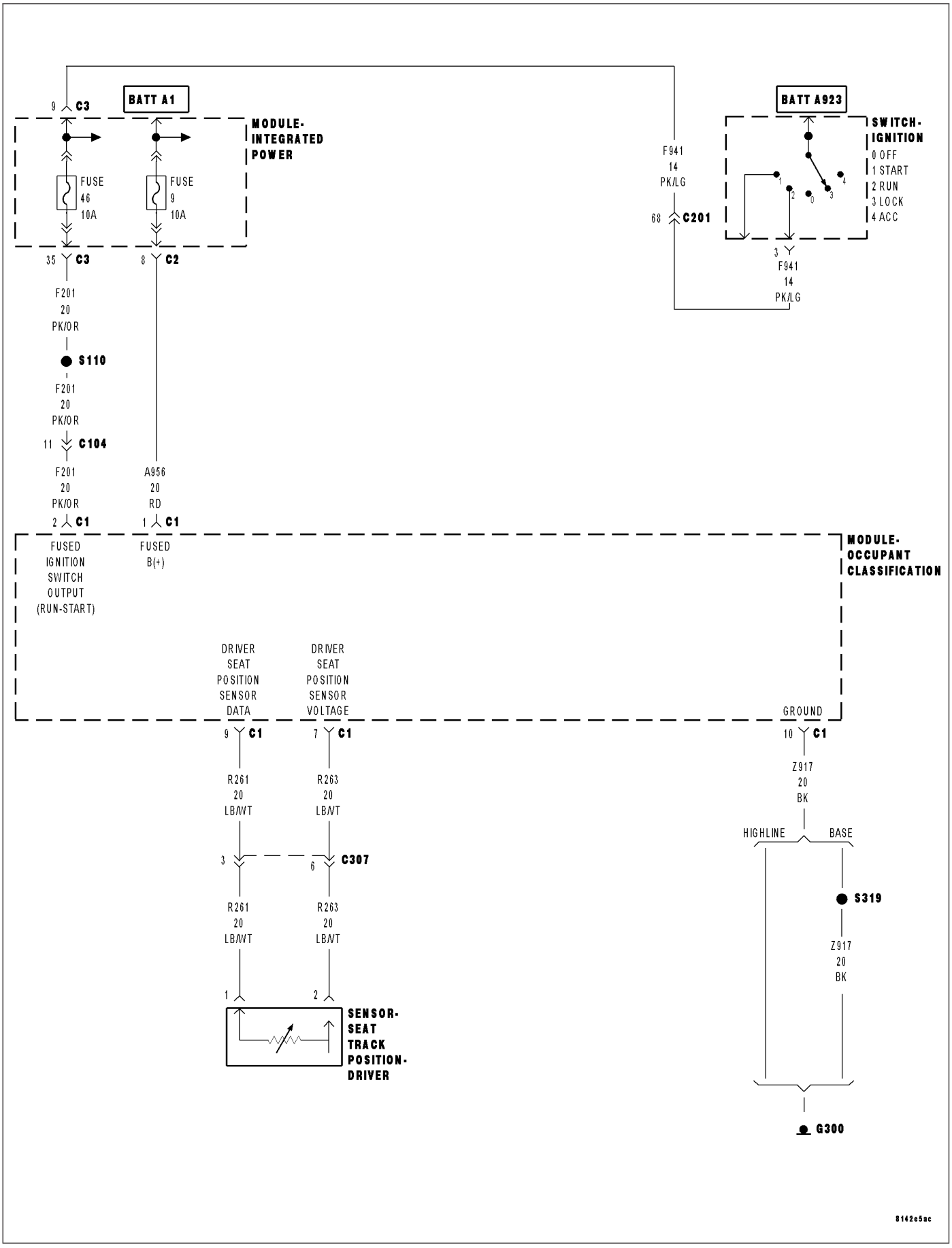
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B8C-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE



B1B8C-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN, the module checks the sensor input ranges.
- **Set Condition:**
  If the module detects that the sensor input is between 8 and 12 mA.

Possible Causes
DRIVER SEAT TRACK POSITION SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, BATTERY FAULTS, & SEAT TRACK POSITION SENSOR CIRCUIT HIGH OR LOW FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, battery faults, or Seat Track Position Sensor Circuit High or Low faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT B1B8C-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B8C-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE?

Yes >> Go To 3

No >> Go To 4

B1B8C-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE (CONTINUED)

3. PERFORM SEAT TRACK POSITION SENSOR PERFORMANCE TEST

With the scan tool, erase OCM DTCs.

Turn the ignition off, wait 10 seconds and then turn the ignition on.

Cycle the driver seat to the full forward position and then to the full rearward position.

Return the driver seat to its approximate original position.

Wait two minutes, and then with the scan tool, read OCM DTCs.

Does the scan tool display active: B1B8C-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE?

Yes >> Replace the Driver Seat Track Position Sensor in accordance with the Service Information.
Perform the OCS VERIFICATION TEST-VER 1. If DTC B1B8C-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE returns active, replace the OCM in accordance with the Service Information.

No >> Perform the OCS VERIFICATION TEST-VER 1.

---

4. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from the OCM.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return continue the test until the problem area has been isolated.

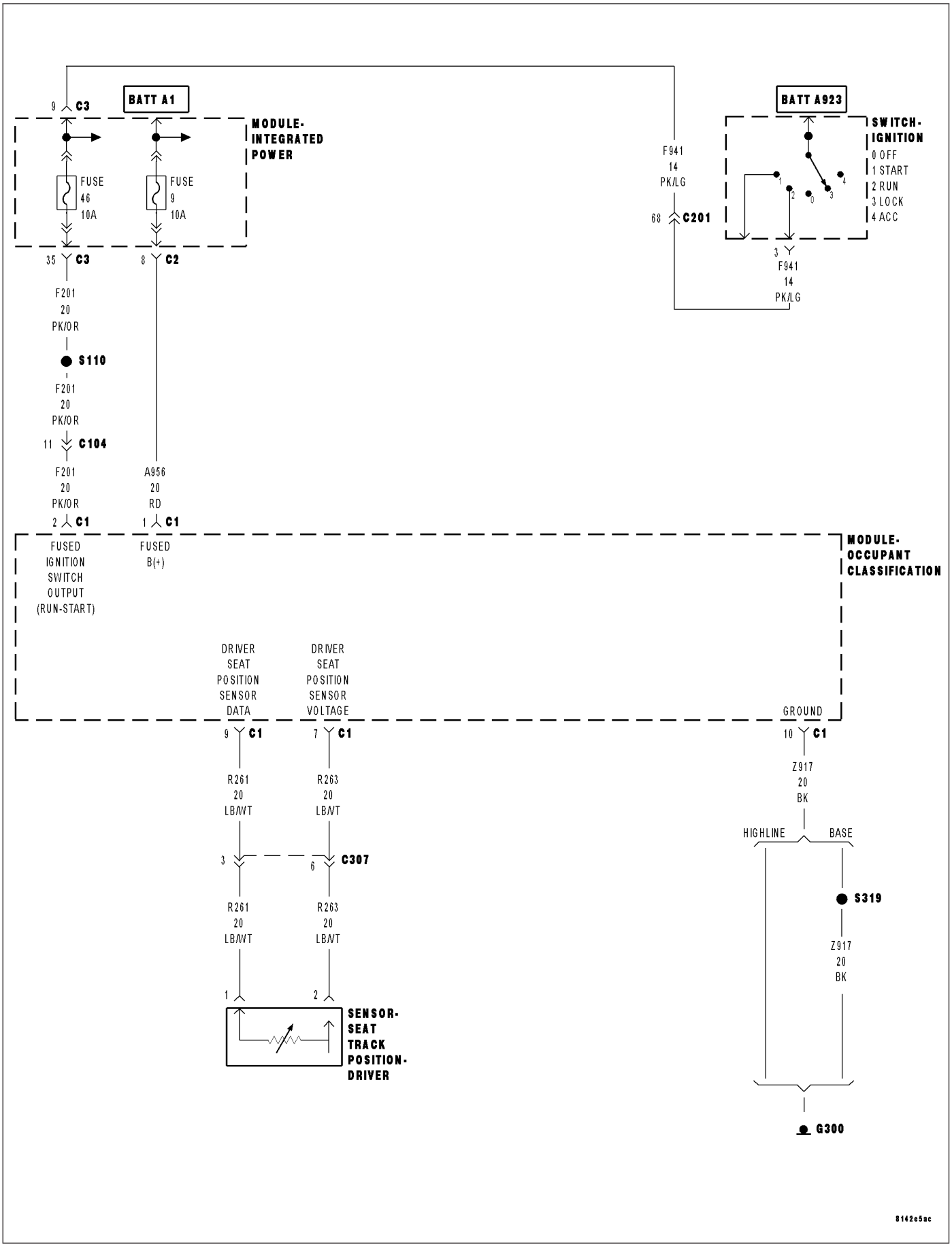
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B8D-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT LOW



B1B8D-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT LOW (CONTINUED)

For the Occupant Classification circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN and the module is configured for a Seat Track Position Sensor, the module checks the sensor input current ranges.
- **Set Condition:**
  If the module detects that the sensor input is less than or equal to 0.3 ma. This DTC may set when the current is between 0.3 mA and 2.0 mA.

Possible Causes
DRIVER SEAT HARNESS IMPROPERLY ROUTED
DRIVER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
DRIVER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT, PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R261) SEAT POSITION SENSOR DATA-DRIVER CIRCUIT SHORTED TO GROUND
(R263) SEAT POSITION SENSOR VOLTAGE-DRIVER CIRCUIT SHORTED TO GROUND
(R261) SEAT POSITION SENSOR DATA-DRIVER CIRCUIT OPEN
(R263) SEAT POSITION SENSOR VOLTAGE-DRIVER CIRCUIT OPEN
DRIVER SEAT TRACK POSITION SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B8D-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT LOW IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B8D-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT LOW?

Yes >> Go To 3

No >> Go To 7

B1B8D-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT LOW (CONTINUED)

3. INSPECT DRIVER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Driver Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Driver Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. VERIFY THAT DRIVER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the Driver Seat Harness is routed correctly.

Is the Driver Seat Harness routed correctly?

Yes >> Go To 5

No >> Reroute the Driver Seat Harness as necessary.

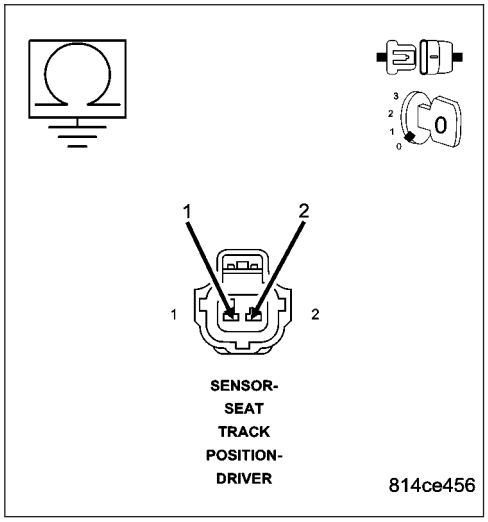
Perform OCS VERIFICATION TEST - VER 1.

---

5. CHECK (R261) SEAT POSITION SENSOR DATA-DRIVER CIRCUIT & (R263) SEAT POSITION SENSOR VOLTAGE-DRIVER CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (R261) Seat Position Sensor Data-Driver circuit.

Measure the resistance between ground and the (R263) Seat Position Sensor Voltage-Driver circuit.



Is the resistance below 10k ohms on either circuit?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Driver Seat Harness in accordance with the service information.

Perform the OCS VERIFICATION TEST-VER 1.

No >> Go To 6

B1B8D-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT LOW (CONTINUED)

6. CHECK (R261) SEAT POSITION SENSOR DATA-DRIVER CIRCUIT & (R263) SEAT POSITION SENSOR VOLTAGE-DRIVER CIRCUIT FOR AN OPEN

Disconnect the OCM C1 connector.

Measure the resistance of the (R261) Seat Position Sensor Data-Driver circuit between the OCM C1 connector and the Driver Seat Track Position Sensor connector.

Measure the resistance of the (R263) Seat Position Sensor Voltage-Driver circuit between the OCM C1 connector and the Driver Seat Track Position Sensor connector.

Is the resistance of either circuit above 5.0 ohms?

Yes >>

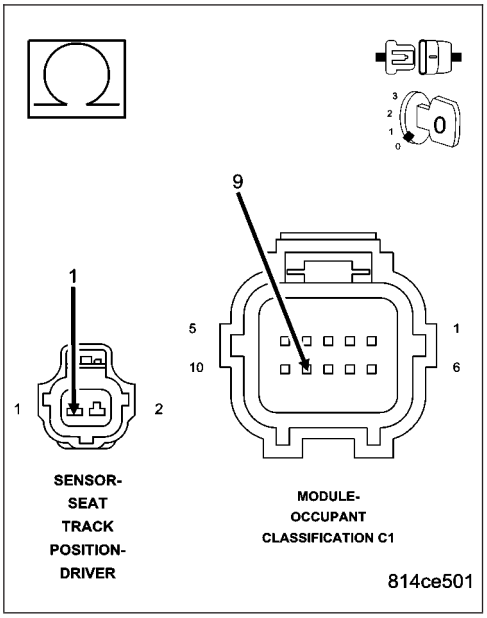
NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

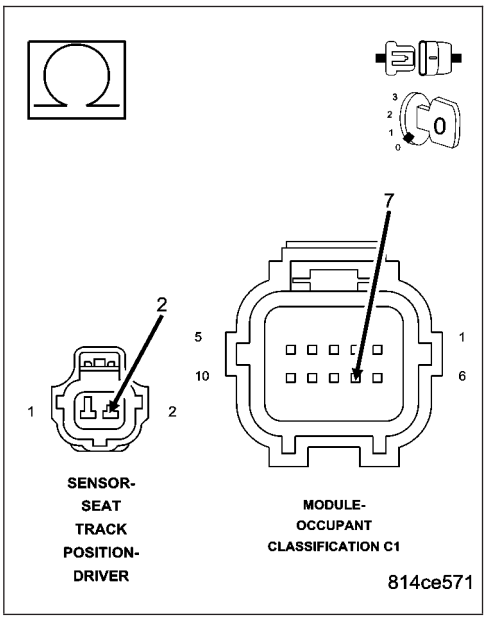
Replace the Driver Seat Harness in accordance with the Service Information.

Perform the OCS VERIFICATION TEST-VER 1.

No >> Replace the OCM in accordance with the service information.

Perform the OCS VERIFICATION TEST-VER 1.





B1B8D-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT LOW (CONTINUED)

7. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from the OCM.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return continue the test until the problem area has been isolated.

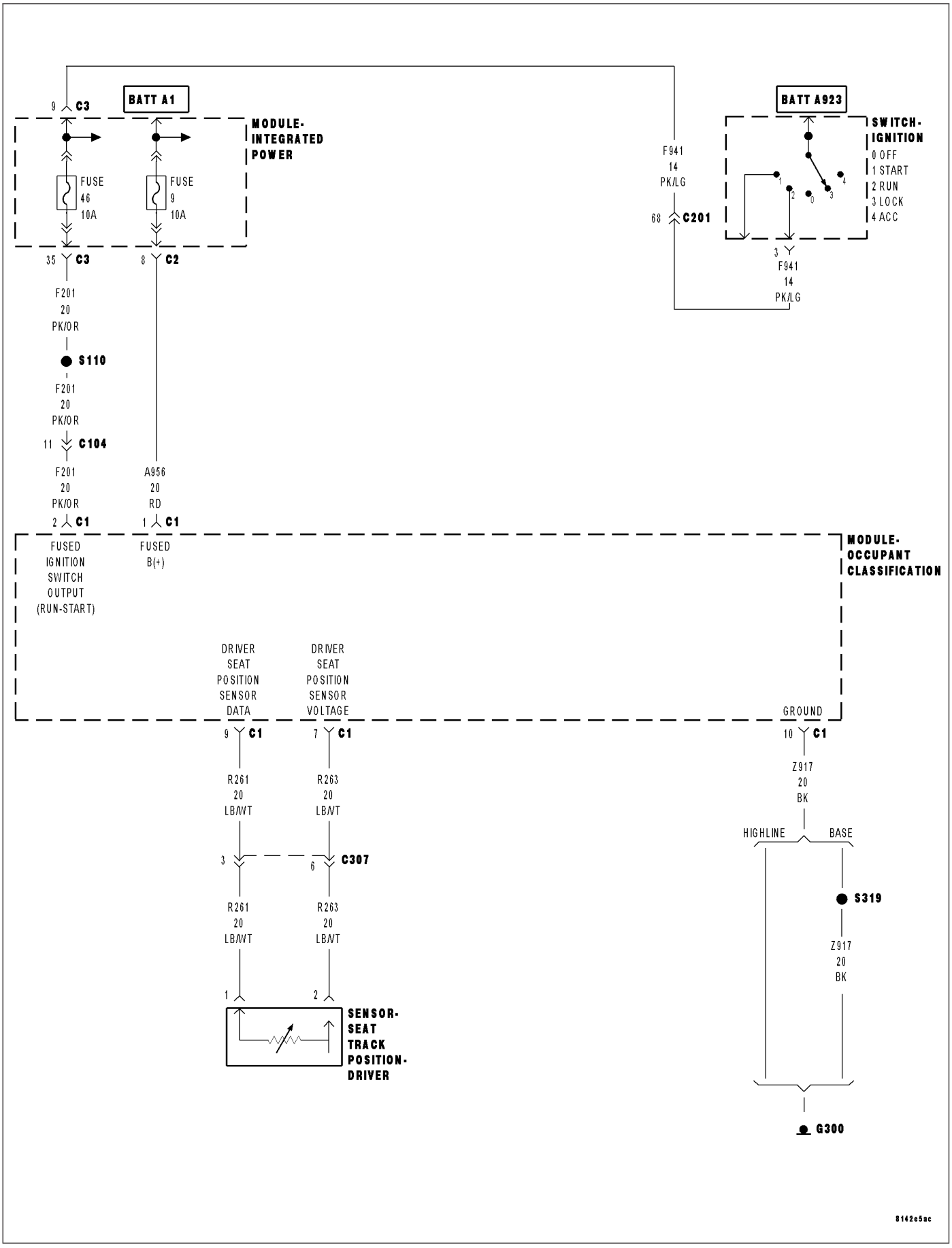
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B8E-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT HIGH



B1B8E-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT HIGH (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN and the module is configured for a Seat Track Position Sensor, the module checks the sensor input current ranges.
- **Set Condition:**
  If the module detects that the sensor input is greater than or equal to 20.5 mA. This DTC may set when the current is between 17 mA and 20.5 mA.

Possible Causes
DRIVER SEAT HARNESS IMPROPERLY ROUTED
DRIVER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
DRIVER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT, PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R261) SEAT POSITION SENSOR DATA-DRIVER CIRCUIT SHORTED TO VOLTAGE
(R263) SEAT POSITION SENSOR VOLTAGE-DRIVER CIRCUIT SHORTED TO VOLTAGE
(R261) SEAT POSITION SENSOR DATA-DRIVER CIRCUIT SHORTED TO (R263) SEAT POSITION SENSOR VOLTAGE-DRVER CIRCUIT
DRIVER SEAT TRACK POSITION SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B8E-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT HIGH IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B8E-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT HIGH?

Yes >> Go To 3

No >> Go To 8

B1B8E-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT HIGH (CONTINUED)

3. INSPECT DRIVER SEAT HARNESS WIRES & CONNECTORS

With the scan tool, erase OCM DTCs.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Driver Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Driver Seat Harness in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. VERIFY THAT DRIVER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the Driver Seat Harness is routed correctly.

Is the Driver Seat Harness routed correctly?

Yes >> Go To 5

No >> Reroute the Driver Seat Harness as necessary.
Perform OCS VERIFICATION TEST - VER 1.

---

5. CHECK FOR DTC B1B8E-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT HIGH WITH DRIVER SEAT TRACK POSITION SENSOR DISCONNECTED

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Driver Seat Track Position Sensor connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

Wait two minutes, and then with the scan tool, read OCM DTCs.

Does the scan tool display: B1B8E-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT HIGH?

Yes >> Go To 6

No >> Replace the Driver Seat Track Position Sensor in accordance with the service information.
Perform the OCS VERIFICATION TEST-VER 1.

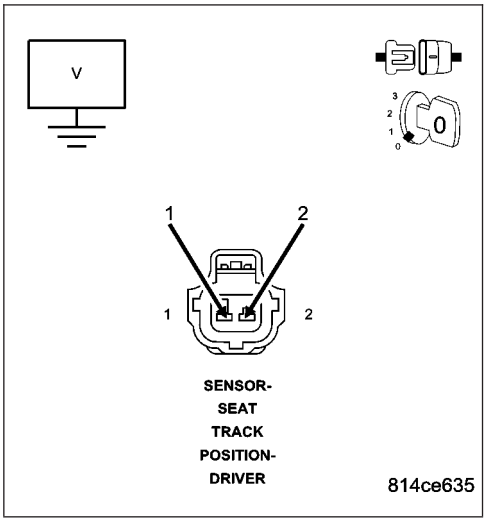
B1B8E-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT HIGH (CONTINUED)

6. CHECK (R261) SEAT POSITION SENSOR DATA-DRIVER CIRCUIT & (R263) SEAT POSITION SENSOR VOLTAGE-DRIVER CIRCUIT FOR A SHORT TO VOLTAGE

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the OCM C1 connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R261) Seat Position Sensor Data-Driver circuit.

Measure the voltage of the (R263) Seat Position Sensor Voltage-Driver circuit.



Is the voltage above 0.2 volts on either circuit?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Driver Seat Harness in accordance with the Service Information.

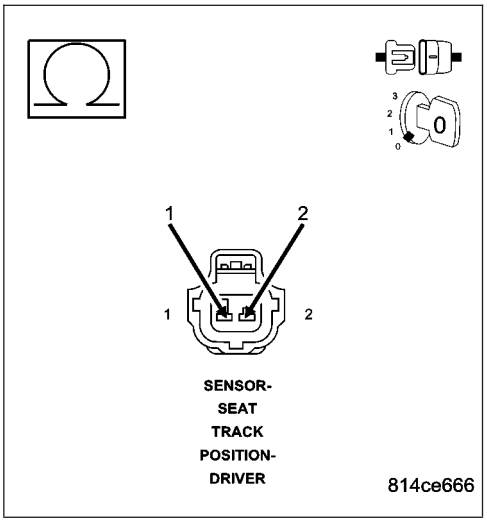
Perform the OCS VERIFICATION TEST-VER 1.

No >> Go To 7

---

7. CHECK (R261) SEAT POSITION SENSOR DATA-DRIVER CIRCUIT FOR A SHORT TO (R263) SEAT POSITION SENSOR VOLTAGE-DRIVER CIRCUIT

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Measure the resistance between the (R261) Seat Position Sensor Data-Driver circuit and the (R263) Seat Position Sensor Voltage-Driver circuit.



Is the resistance below 10k ohms?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Driver Seat Harness in accordance with the service information.

Perform the OCS VERIFICATION TEST-VER 1.

No >> Replace the OCM in accordance with the Service information.

Perform the OCS VERIFICATION TEST-VER 1.

B1B8E-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT HIGH (CONTINUED)

8. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from the OCM.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return continue the test until the problem area has been isolated.

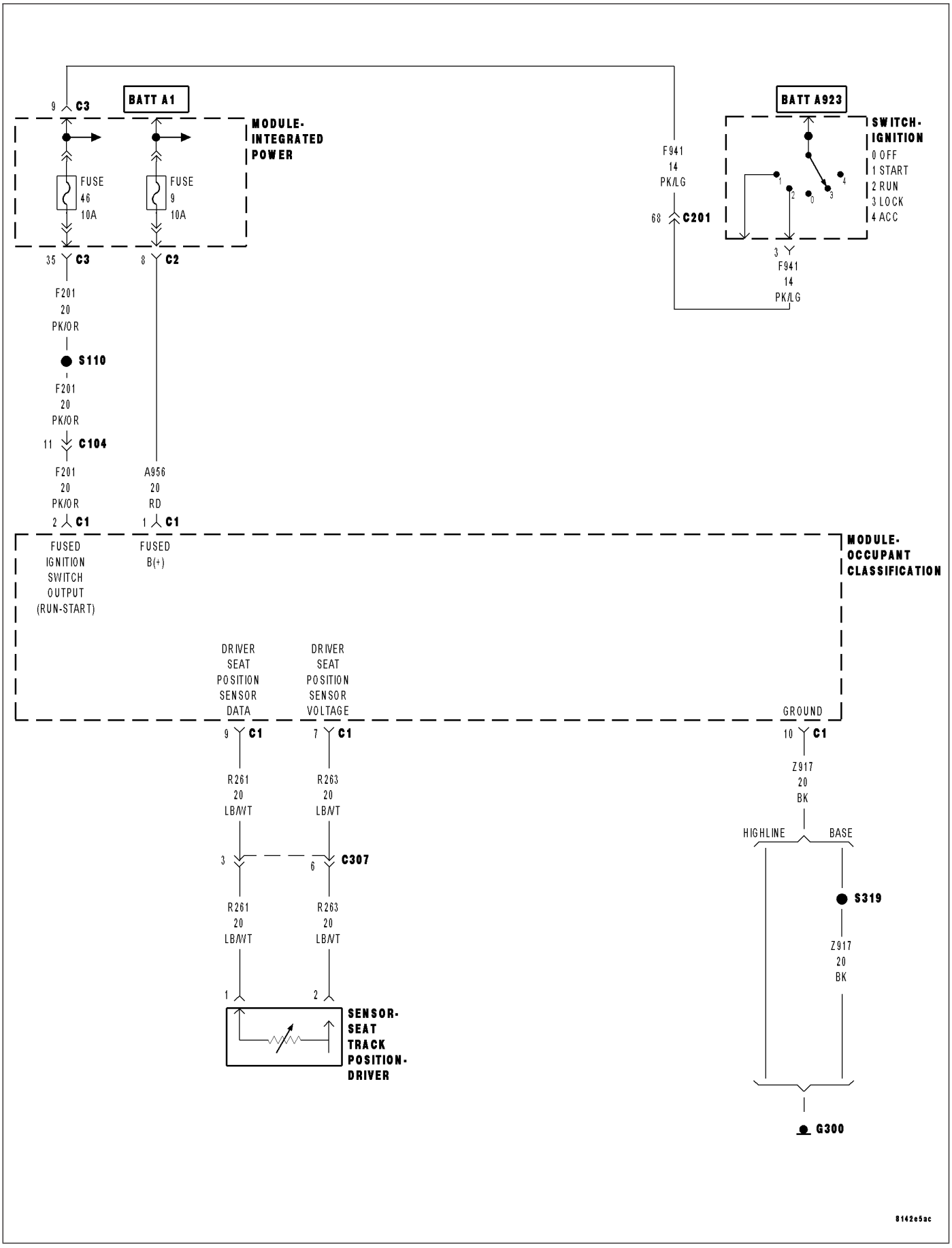
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B91-DRIVER SEAT TRACK POSITION SENSOR CONFIGURATION MISMATCH



B1B91-DRIVER SEAT TRACK POSITION SENSOR CONFIGURATION MISMATCH (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on the OCM monitors the Seat Track Position Sensors circuits.
- **Set Condition:**
  If the module detects current on the Seat Track Position Sensors circuits and the module is not configured for STPS.

Possible Causes
SENSORS
WIRING
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT B1B91-DRIVER SEAT TRACK POSITION SENSOR CONFIGURATION MISMATCH IS ACTIVE

With the scan tool, erase OCM DTCs.

Turn the ignition off, wait 10 seconds and then turn the ignition on.

Wait 2 minutes, and then with the scan tool, read OCM DTCs.

Does the scan tool display active: B1B91-DRIVER SEAT TRACK POSITION SENSOR CONFIGURATION MISMATCH?

Yes >> Go To 3

No >> Perform the OCS VERIFICATION TEST-VER. 1

B1B91-DRIVER SEAT TRACK POSITION SENSOR CONFIGURATION MISMATCH (CONTINUED)

3. VERIFY WIRING

Turn the ignition off.

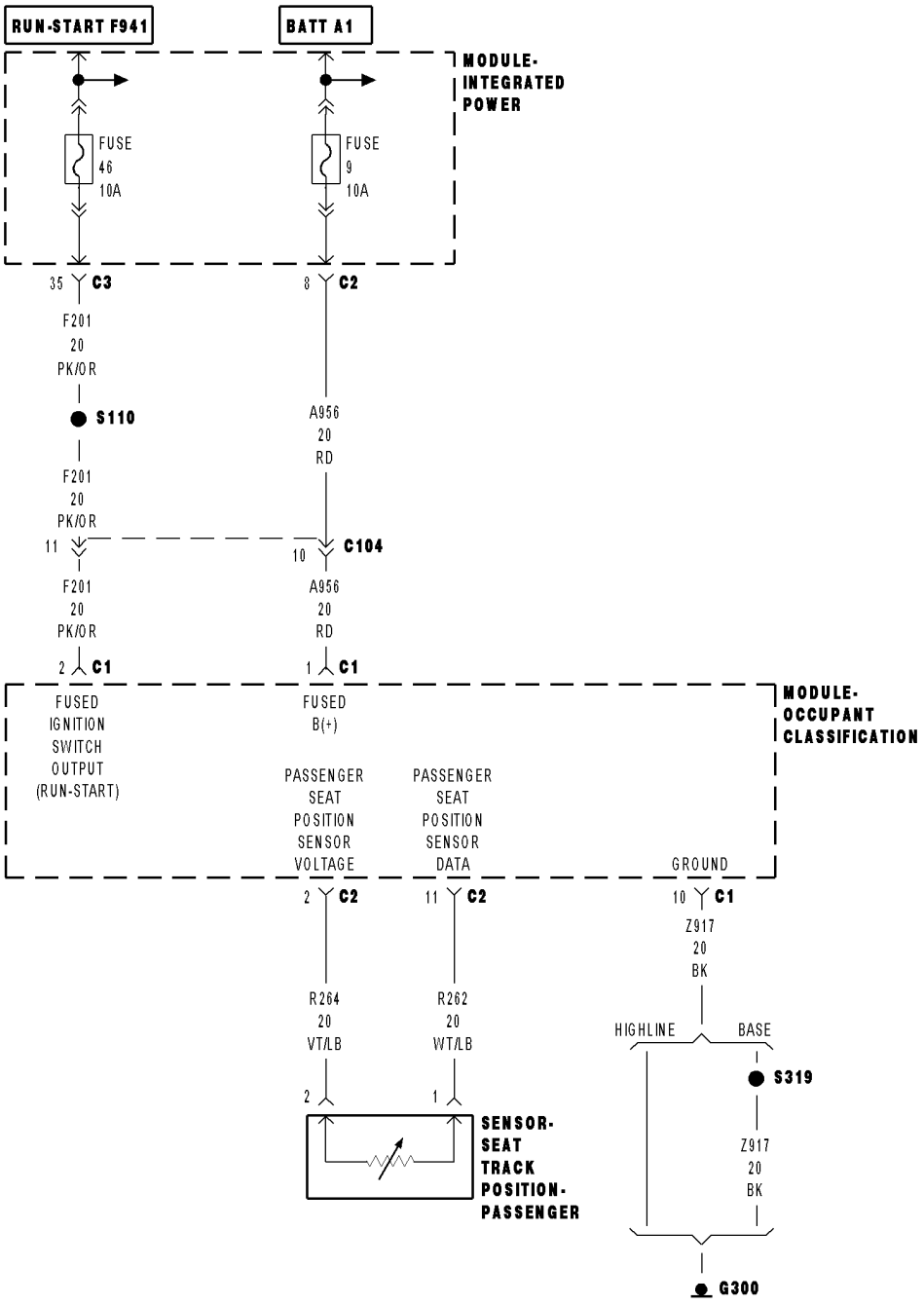
Inspect the driver and passenger seat wiring for Seat Position Sensors.

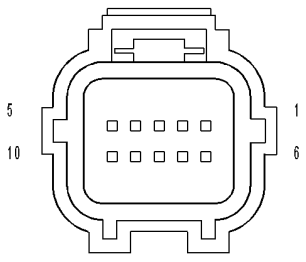
Are Seat Position Sensor(s) present?

Yes >> Replace the OCM in accordance with the Service Information.
Perform the OCS VERIFICATION TEST-VER. 1

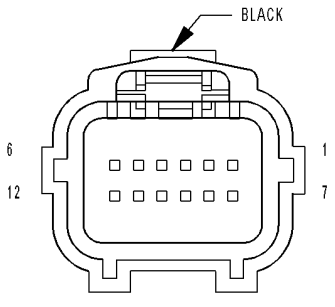
No >> Perform the OCS VERIFICATION TEST-VER. 1

B1B92-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE





MODULE-
OCCUPANT
CLASSIFICATION C1



MODULE-
OCCUPANT
CLASSIFICATION C2

814ce75d

B1B92-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN, the module checks the sensor input ranges.
- **Set Condition:**
  If the module detects that the sensor input is between 8 and 12 mA.

Possible Causes
DRIVER SEAT TRACK POSITION SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, BATTERY FAULTS, & SEAT TRACK POSITION SENSOR CIRCUIT HIGH OR LOW FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, battery faults, or Seat Track Position Sensor Circuit High or Low faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT B1B8C-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B8C-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE?

Yes >> Go To 3

No >> Go To 4

B1B92-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE (CONTINUED)

3. PERFORM SEAT TRACK POSITION SENSOR PERFORMANCE TEST

With the scan tool, erase OCM DTCs.

Turn the ignition off, wait 10 seconds and then turn the ignition on.

Cycle the passenger seat to the full forward position and then to the full rearward position.

Return the passenger seat to its approximate original position.

Wait two minutes, and then with the scan tool, read OCM DTCs.

Does the scan tool display active: B1B8C-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE?

Yes >> Replace the Passenger Seat Track Position Sensor in accordance with the Service Information.
Perform the OCS VERIFICATION TEST-VER 1. If DTC B1B8C-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT PERFORMANCE returns active, replace the OCM in accordance with the Service Information.

No >> Perform the OCS VERIFICATION TEST-VER 1.

---

4. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from the OCM.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return continue the test until the problem area has been isolated.

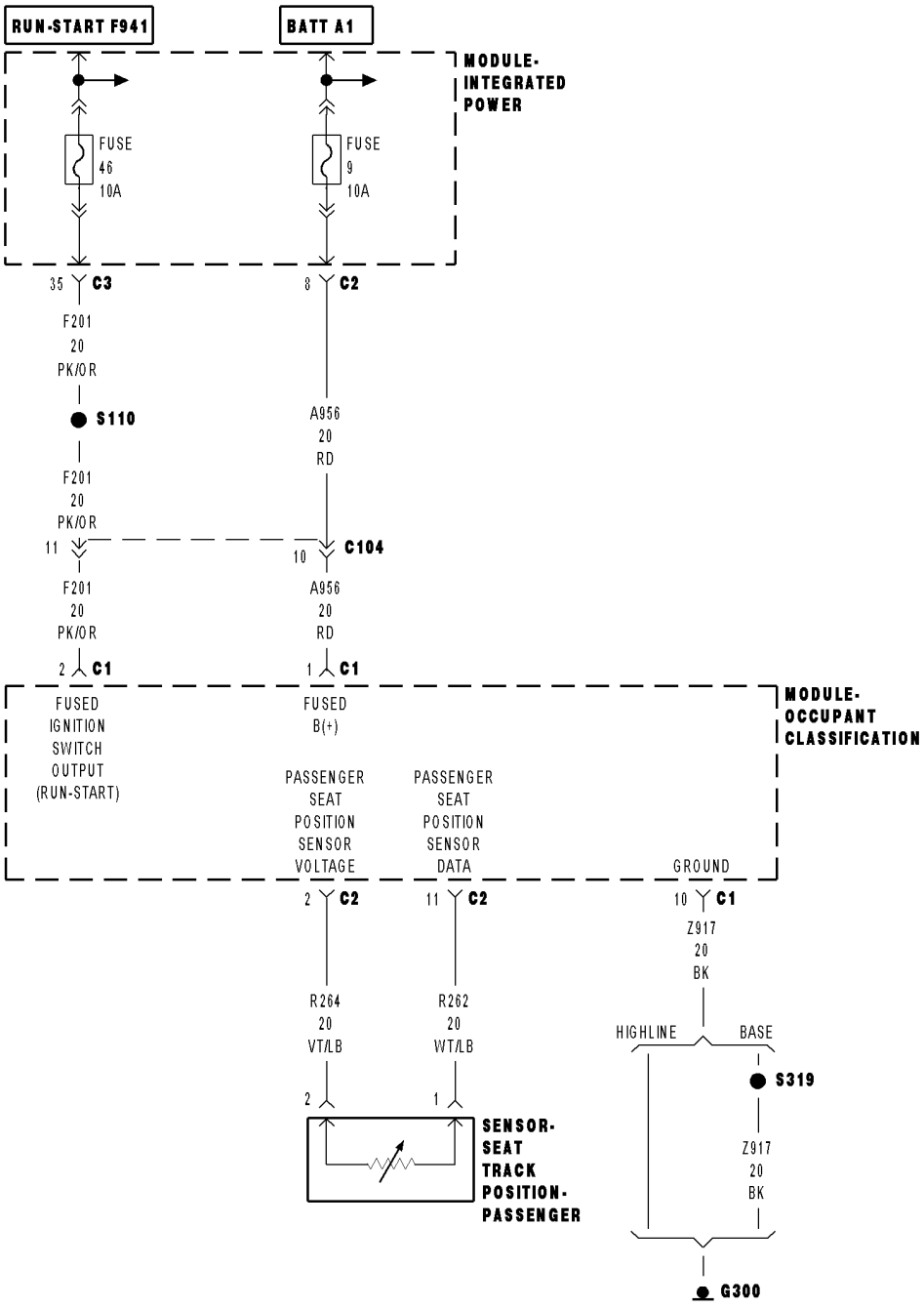
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

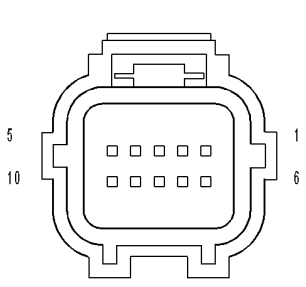
Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

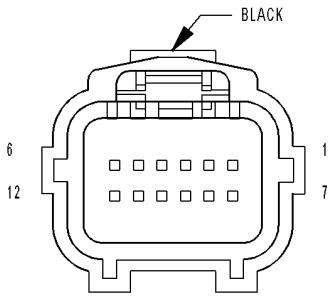
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B93-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT LOW





MODULE-
OCCUPANT
CLASSIFICATION C1



MODULE-
OCCUPANT
CLASSIFICATION C2

814ce75d

B1B93-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT LOW (CONTINUED)

For the Occupant Classification circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN and the module is configured for a Seat Track Position Sensor, the module checks the sensor input current ranges.
- **Set Condition:**
  If the module detects that the sensor input is less than or equal to 0.3 ma. This DTC may set when the current is between 0.3 mA and 2.0 mA.

Possible Causes
PASSENGER SEAT HARNESS IMPROPERLY ROUTED
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT, PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R262) SEAT POSITION SENSOR DATA-PASSENGER CIRCUIT SHORTED TO GROUND
(R264) SEAT POSITION SENSOR VOLTAGE-PASSENGER CIRCUIT SHORTED TO GROUND
(R262) SEAT POSITION SENSOR DATA-PASSENGER CIRCUIT OPEN
(R264) SEAT POSITION SENSOR VOLTAGE-PASSENGER CIRCUIT OPEN
PASSENGER SEAT TRACK POSITION SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B8D-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT LOW IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B8D-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT LOW?

Yes >> Go To 3

No >> Go To 7

B1B93-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT LOW (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. VERIFY THAT PASSENGER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the Passenger Seat Harness is routed correctly.

Is the Passenger Seat Harness routed correctly?

Yes >> Go To 5

No >> Reroute the Passenger Seat Harness as necessary.

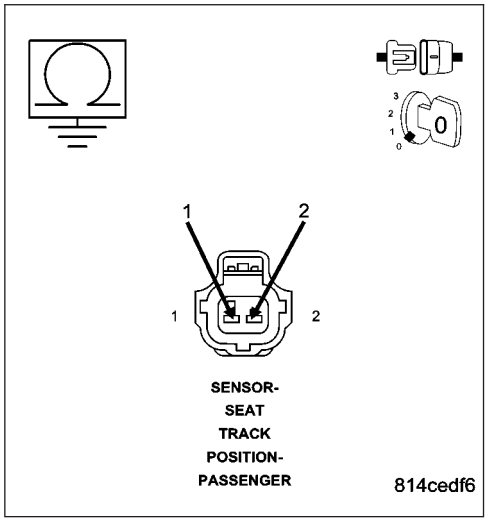
Perform OCS VERIFICATION TEST - VER 1.

---

5. CHECK (R262) SEAT POSITION SENSOR DATA-PASSENGER CIRCUIT & (R264) SEAT POSITION SENSOR VOLTAGE-PASSENGER CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (R262) Seat Position Sensor Data-Passenger circuit.

Measure the resistance between ground and the (R264) Seat Position Sensor Voltage-Passenger circuit.



Is the resistance below 10k ohms on either circuit?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the service information.

Perform the OCS VERIFICATION TEST-VER 1.

No >> Go To 6

B1B93-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT LOW (CONTINUED)

6. CHECK (R262) SEAT POSITION SENSOR DATA-PASSENGER CIRCUIT & (R264) SEAT POSITION SENSOR VOLTAGE-PASSENGER CIRCUIT FOR AN OPEN

Disconnect the OCM C1 connector.

Measure the resistance of the (R262) Seat Position Sensor Data-Passenger circuit between the OCM C1 connector and the Passenger Seat Track Position Sensor connector.

Measure the resistance of the (R264) Seat Position Sensor Voltage-Passenger circuit between the OCM C1 connector and the Passenger Seat Track Position Sensor connector.

Is the resistance of either circuit above 5.0 ohms?

Yes >>

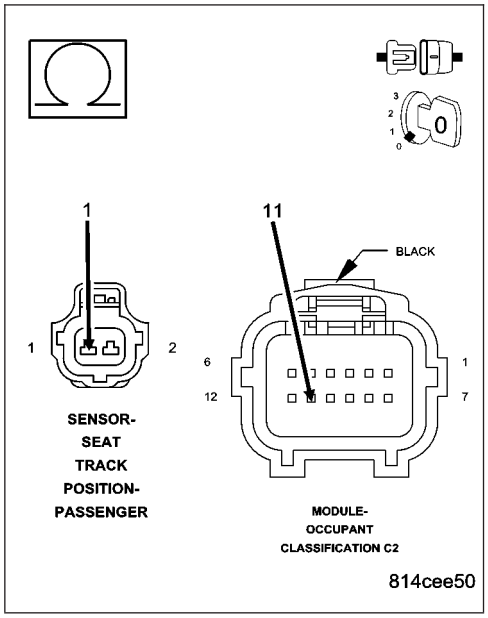
NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

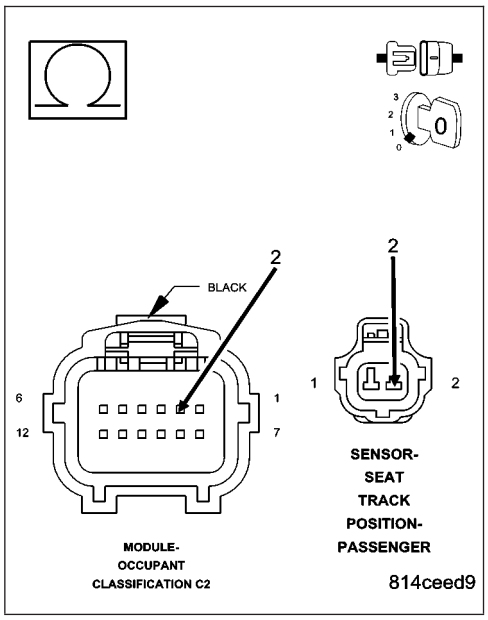
Replace the Passenger Seat Harness in accordance with the Service Information.

Perform the OCS VERIFICATION TEST-VER 1.

No >> Replace the OCM in accordance with the service information.

Perform the OCS VERIFICATION TEST-VER 1.





B1B93-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT LOW (CONTINUED)

7. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from the OCM.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return continue the test until the problem area has been isolated.

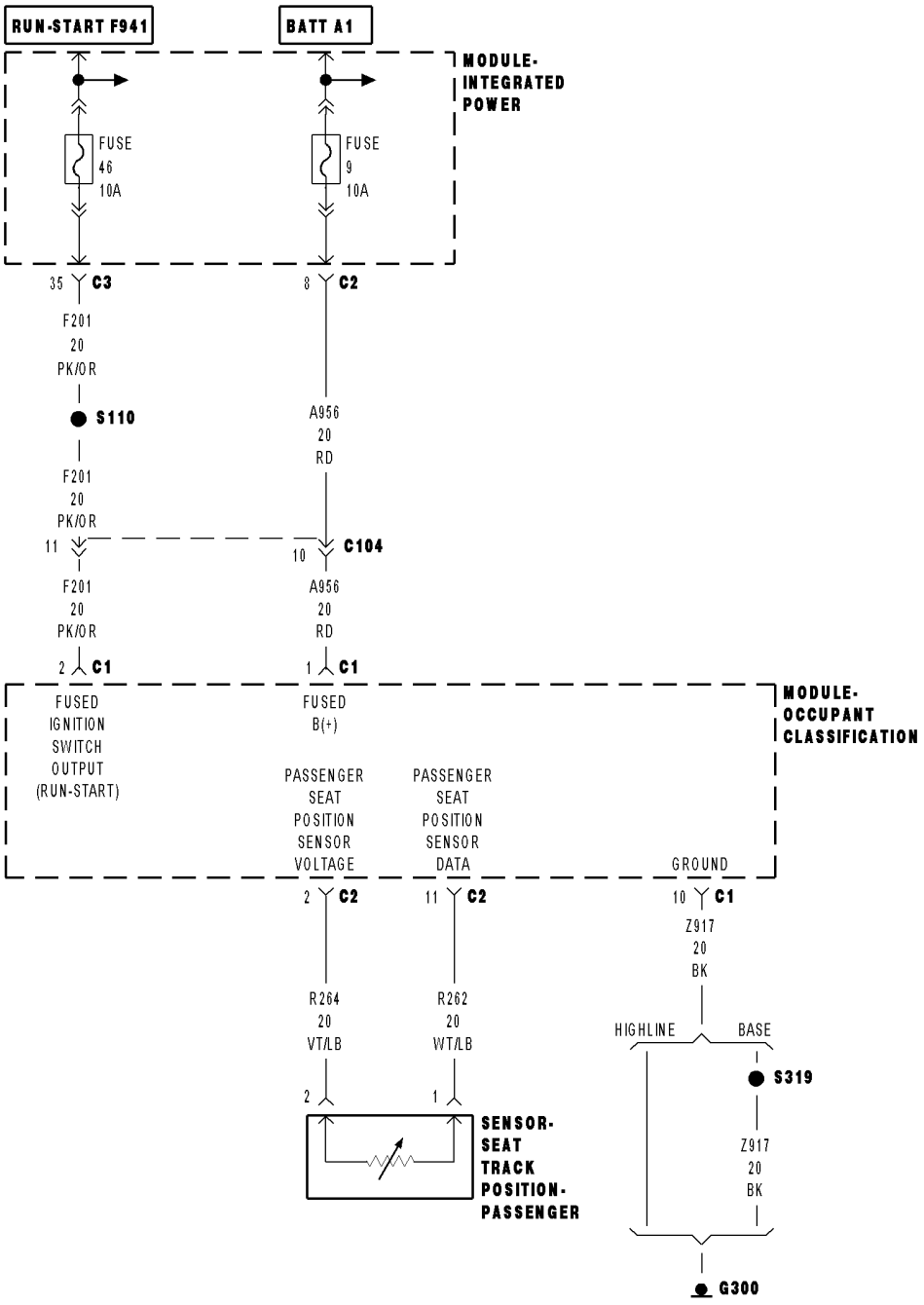
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

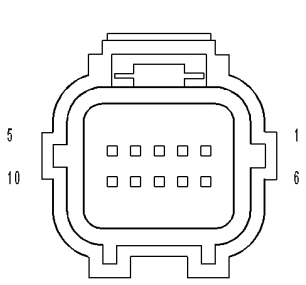
Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

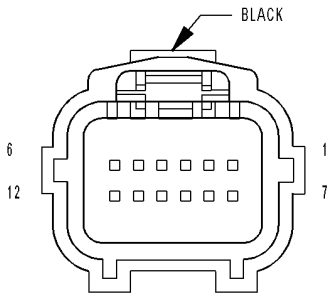
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B94-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT HIGH





MODULE-
OCCUPANT
CLASSIFICATION C1



MODULE-
OCCUPANT
CLASSIFICATION C2

814ce75d

B1B94-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT HIGH (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN and the module is configured for a Seat Track Position Sensor, the module checks the sensor input current ranges.
- **Set Condition:**
  If the module detects that the sensor input is greater than or equal to 20.5 mA. This DTC may set when the current is between 17 mA and 20.5 mA.

Possible Causes
PASSENGER SEAT HARNESS IMPROPERLY ROUTED
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT, PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R262) SEAT POSITION SENSOR DATA-PASSENGER CIRCUIT SHORTED TO VOLTAGE
(R264) SEAT POSITION SENSOR VOLTAGE-PASSENGER CIRCUIT SHORTED TO VOLTAGE
(R262) SEAT POSITION SENSOR DATA-PASSENGER CIRCUIT SHORTED TO (R264) SEAT POSITION SENSOR VOLTAGE-PASSENGER CIRCUIT
PASSENGER SEAT TRACK POSITION SENSOR
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1B8E-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT HIGH IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1B8E-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT HIGH?

Yes >> Go To 3

No >> Go To 8

B1B94-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT HIGH (CONTINUED)

3. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

With the scan tool, erase OCM DTCs.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. VERIFY THAT PASSENGER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the Passenger Seat Harness is routed correctly.

Is the Passenger Seat Harness routed correctly?

Yes >> Go To 5

No >> Reroute the Passenger Seat Harness as necessary.
Perform OCS VERIFICATION TEST - VER 1.

---

5. CHECK FOR DTC B1B8E-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT HIGH WITH PASSENGER SEAT TRACK POSITION SENSOR DISCONNECTED

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Passenger Seat Track Position Sensor connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

Wait two minutes, and then with the scan tool, read OCM DTCs.

Does the scan tool display: B1B8E-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT HIGH?

Yes >> Go To 6

No >> Replace the Passenger Seat Track Position Sensor in accordance with the service information.
Perform the OCS VERIFICATION TEST-VER 1.

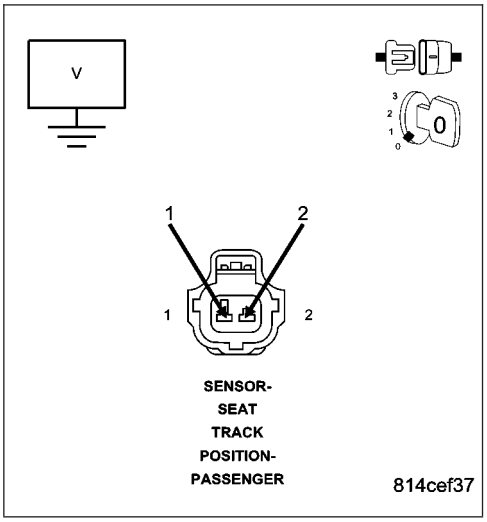
B1B94-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT HIGH (CONTINUED)

6. CHECK (R262) SEAT POSITION SENSOR DATA-PASSENGER CIRCUIT & (R264) SEAT POSITION SENSOR VOLTAGE-PASSENGER CIRCUIT FOR A SHORT TO VOLTAGE

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the OCM C1 connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R262) Seat Position Sensor Data-Passenger circuit.

Measure the voltage of the (R264) Seat Position Sensor Voltage-Passenger circuit.



Is the voltage above 0.2 volts on either circuit?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

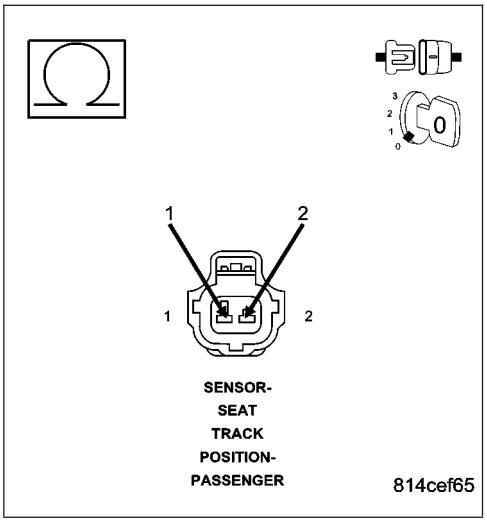
Perform the OCS VERIFICATION TEST-VER 1.

No >> Go To 7

---

7. CHECK (R262) SEAT POSITION SENSOR DATA-PASSENGER CIRCUIT FOR A SHORT TO (R264) SEAT POSITION SENSOR VOLTAGE-PASSENGER CIRCUIT

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Measure the resistance between the (R262) Seat Position Sensor Data-Passenger circuit and the (R264) Seat Position Sensor Voltage-Passenger circuit.



Is the resistance below 10k ohms?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the service information.

Perform the OCS VERIFICATION TEST-VER 1.

No >> Replace the OCM in accordance with the Service information.

Perform the OCS VERIFICATION TEST-VER 1.

B1B94-PASSENGER SEAT TRACK POSITION SENSOR CIRCUIT HIGH (CONTINUED)

8. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from the OCM.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return continue the test until the problem area has been isolated.

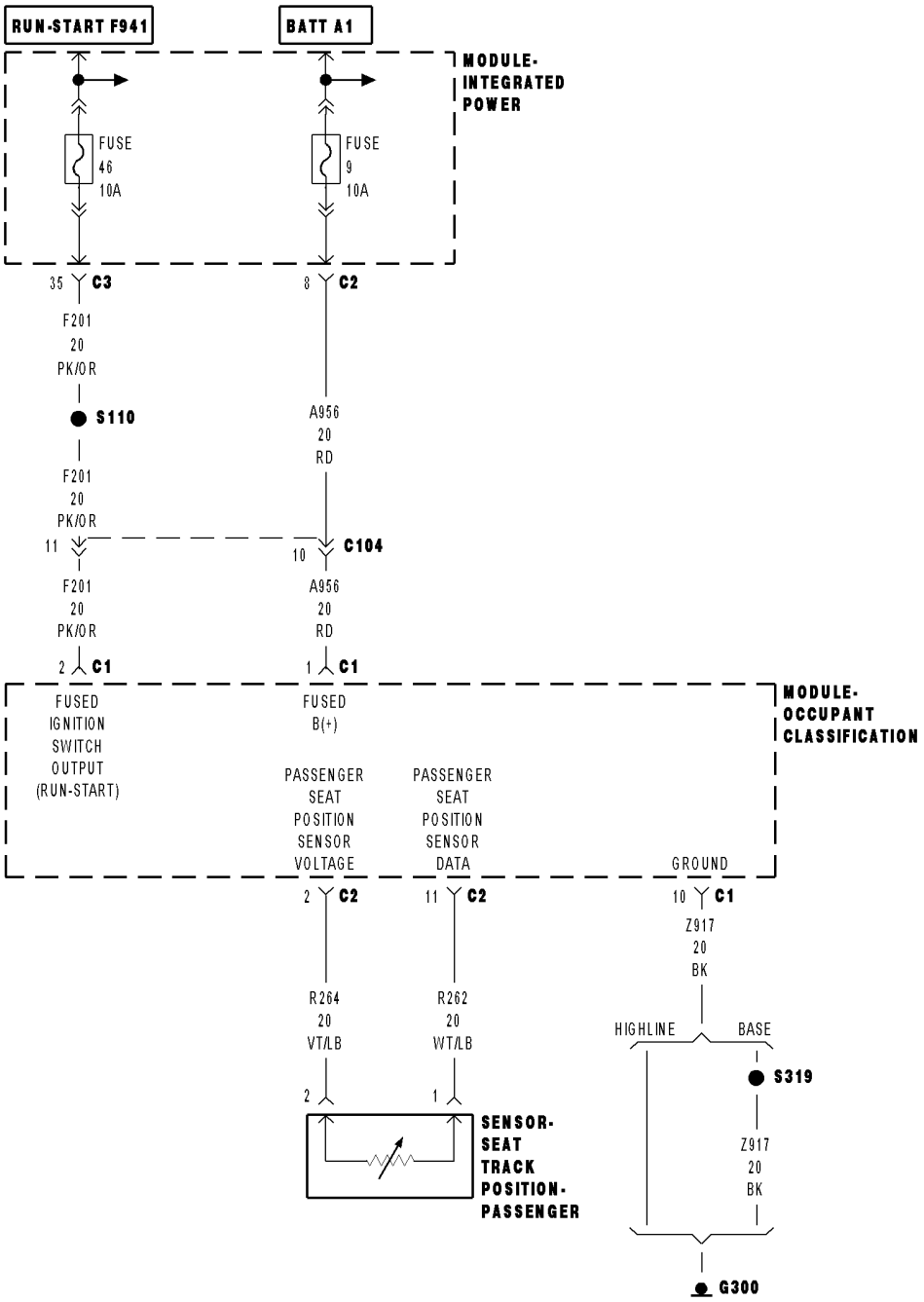
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

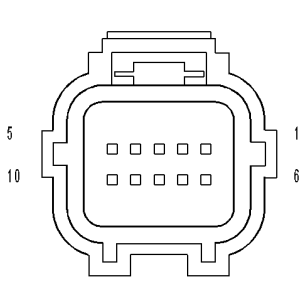
Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

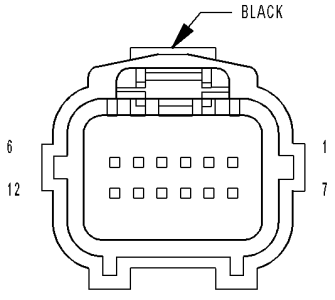
No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1B97-PASSENGER SEAT TRACK POSITION SENSOR CONFIGURATION MISMATCH





MODULE-
OCCUPANT
CLASSIFICATION C1



MODULE-
OCCUPANT
CLASSIFICATION C2

814ce75d

B1B97-PASSENGER SEAT TRACK POSITION SENSOR CONFIGURATION MISMATCH (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on the OCM monitors the Seat Track Position Sensors circuits.
- **Set Condition:**
  If the module detects current on the Seat Track Position Sensors circuits and the module is not configured for STPS.

Possible Causes
SENSORS
WIRING
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT B1B91-PASSENGER SEAT TRACK POSITION SENSOR CONFIGURATION MISMATCH IS ACTIVE

With the scan tool, erase OCM DTCs.

Turn the ignition off, wait 10 seconds and then turn the ignition on.

Wait 2 minutes, and then with the scan tool, read OCM DTCs.

Does the scan tool display active: B1B91-PASSENGER SEAT TRACK POSITION SENSOR CONFIGURATION MISMATCH?

Yes >> Go To 3

No >> Perform the OCS VERIFICATION TEST-VER. 1

B1B97-PASSENGER SEAT TRACK POSITION SENSOR CONFIGURATION MISMATCH (CONTINUED)

3. VERIFY WIRING

Turn the ignition off.

Inspect the Passenger and passenger seat wiring for Seat Position Sensors.

Are Seat Position Sensor(s) present?

Yes >> Replace the OCM in accordance with the Service Information.
Perform the OCS VERIFICATION TEST-VER. 1

No >> Perform the OCS VERIFICATION TEST-VER. 1

B1BA5-AIRBAG SQUIB CONFIGURATION MISMATCH

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If an Occupant Restraint Controller (ORC) configured for vehicles without side airbags is installed in a vehicle with side airbags.

Possible Causes
POWERTRAIN CONTROL MODULE (PCM)
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC B1BA5 AIRBAG SQUIB CONFIGURATION MISMATCH IS ACTIVE

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read ORC DTCs.

Does the scan tool display active: B1BA5 AIRBAG SQUIB CONFIGURATION MISMATCH?

Yes >> Go To 2

No >> Go To 5

---

2. VERIFY THAT VEHICLE IS EQUIPPED WITH OCCUPANT CLASSIFICATION SYSTEM (OCS)

Vehicles equipped with a Occupant Classification System (OCS) will have a Passenger Airbag On/Off Indicator Lamp mounted to the dashboard. Verify that the vehicle is equipped with this indicator lamp.

With the scan tool, select ECU View and check that the Occupant Classification Module (OCM) is active on the bus.

Is the vehicle equipped with an Occupant Classification System (OCS)?

Yes >> Go To 3

No >> Replace the ORC in accordance with Service Information.
Perform ORC VERIFICATION TEST - VER 1.

---

3. CHECK ORC PART NUMBER WITH SCAN TOOL

With the scan tool, select ECU View, select ORC, select ECU Details, and read the ORC part number.

Is the part number correct for the vehicle?

Yes >> Go To 4

No >> Replace the ORC in accordance with Service Information.
Perform ORC VERIFICATION TEST - VER 1.

B1BA5-AIRBAG SQUIB CONFIGURATION MISMATCH (CONTINUED)

4. CHECK VIN WITH SCAN TOOL

With the scan tool, read the VIN.

Is the correct VIN displayed?

Yes >> Replace the ORC in accordance with Service Information.
Perform ORC VERIFICATION TEST - VER 1.

No >> Replace the Powertrain Control Module (PCM) in accordance with Service Information.
Perform ORC VERIFICATION TEST - VER 1.

---

5. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1BA6-OCCUPANT CLASSIFICATION UNDETERMINED

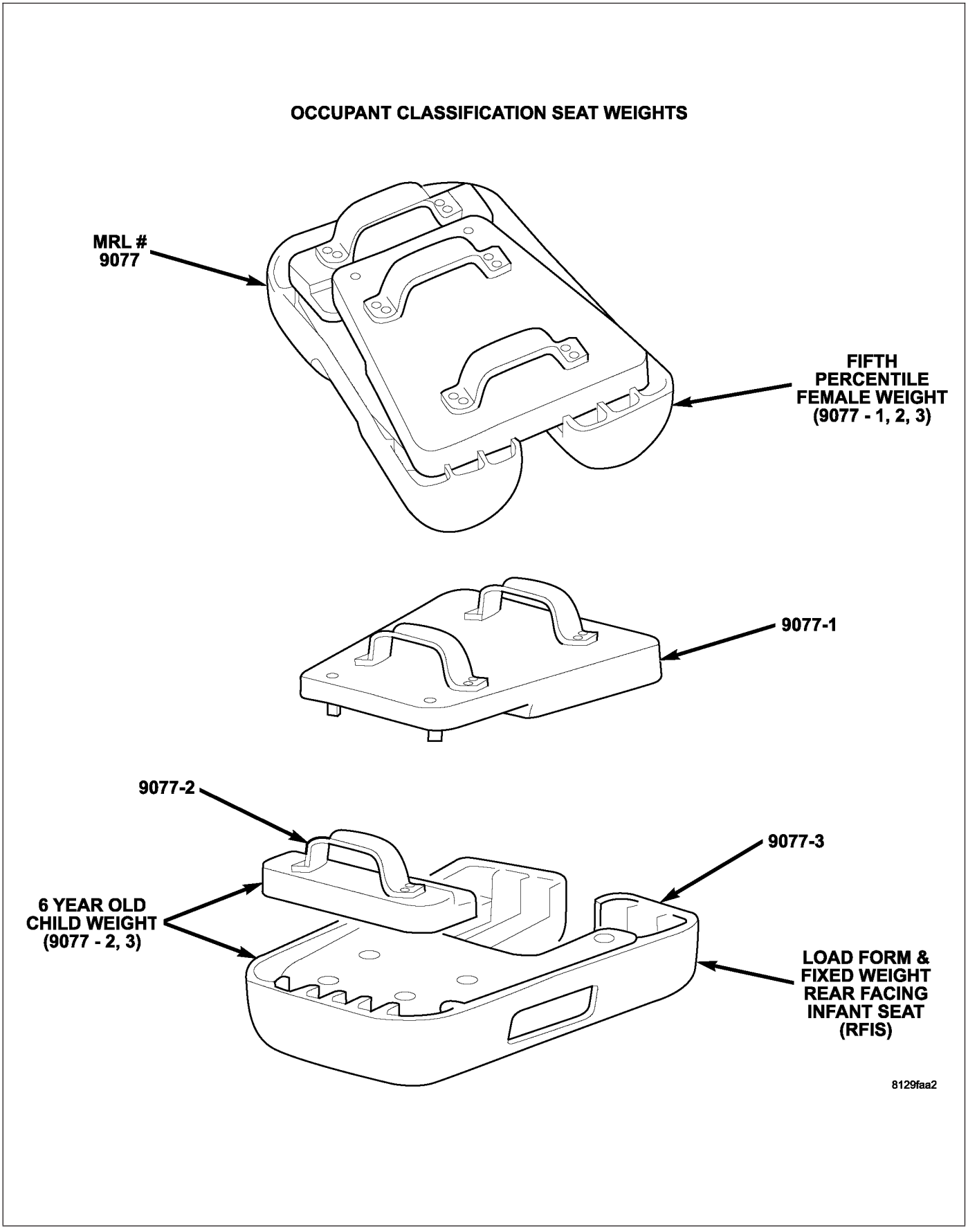
For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on or off.
- **Set Condition:**
  Because other DTCs have made occupant detection impossible. This DTC will set in addition to all sensor and module DTCs and will be erased when the repairs are completed.

Refer to **B1BA7–OCCUPANT CLASSIFICATION SYSTEM VERIFICATION REQUIRED** for the diagnostic test procedure.

B1BA7-OCCUPANT CLASSIFICATION SYSTEM VERIFICATION REQUIRED



OCS SEAT WEIGHTS MRL #9077

B1BA7-OCCUPANT CLASSIFICATION SYSTEM VERIFICATION REQUIRED (CONTINUED)

- **When Monitored:**
  With the CAN ignition status as IGN_RUN, the module tries to detect potentially damaging events and monitors the CAN Bus for the X Impact messages (crash event causing one or more airbag or pretensioner to deploy) or upon detecting an Offset Event (if equipped).
- **Set Condition:**
  This DTC will set if the module detects a potentially damaging event or the X Impact messages from the CAN Bus input.

Possible Causes
B1BA7-OCS VERIFICATION REQUIRED DTC ACTIVE

Diagnostic Test

1. CHECK FOR OCCUPANT CLASSIFICATION MODULE (OCM) ACTIVE DTCs:

- ACTIVE INTERNAL FAULTS
- IGNITION FAULTS
- BATTERY FAULT
- SEAT WEIGHT SENSOR DTCs

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs listed above?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1BA7–OCCUPANT CLASSIFICATION SYSTEM VERIFICATION REQUIRED IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1BA7–OCCUPANT CLASSIFICATION SYSTEM VERIFICATION REQUIRED?

Yes >> Go To 3

No >> Go To 4

B1BA7-OCCUPANT CLASSIFICATION SYSTEM VERIFICATION REQUIRED (CONTINUED)

3. PERFORM OCCUPANT CLASSIFICATION MODULE SYSTEM VERIFICATION TEST

Verify that the passenger seat is empty.

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

NOTE: Failure to follow the test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1BA7–OCCUPANT CLASSIFICATION SYSTEM VERIFICATION REQUIRED?

Yes >> Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.
Perform OCS VERIFICATION TEST - VER 1.

No >> Other DTCs Present? Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Perform OCS VERIFICATION TEST - VER 1.

---

4. CHECK FOR ACTIVE DTC B1BA8–OCM SYSTEM OUT OF CALIBRATION/NOT CALIBRATED

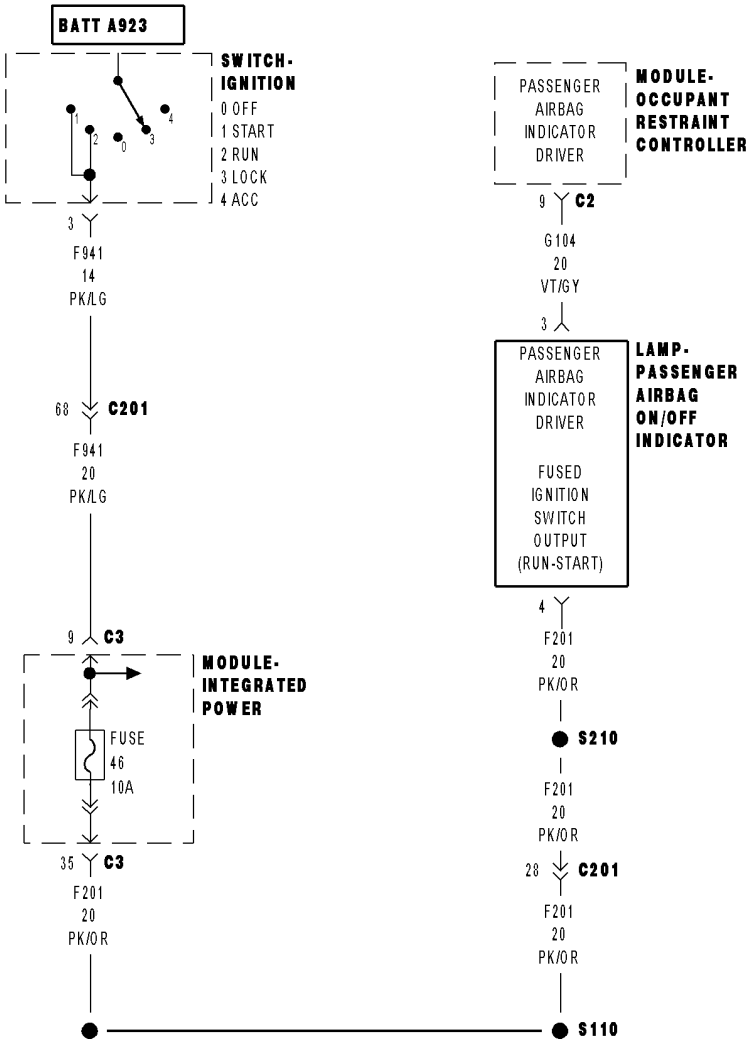
With the scan tool, read OCM DTCs.

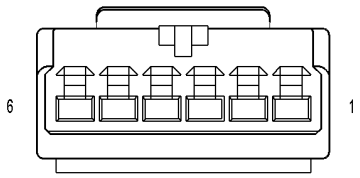
Does the scan tool display active: B1BA8–OCM SYSTEM OUT OF CALIBRATION/NOT CALIBRATED?

Yes >> Diagnose and repair the DTC. Refer to the Table of Contents in this Section for a complete list of symptoms.

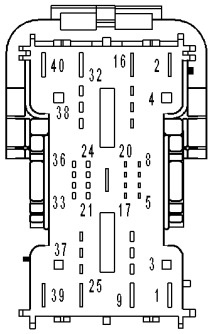
No >> Perform OCS VERIFICATION TEST - VER 1.

B1BB7-PASSENGER AIRBAG DISABLE SWITCH CONFIGURATION

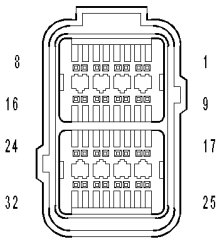




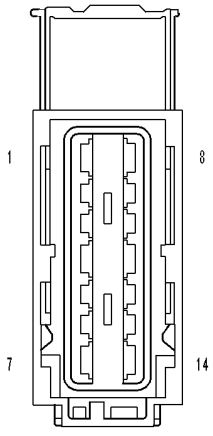
LAMP-
PASSENGER
AIRBAG
ON/OFF
INDICATOR



MODULE-
INTEGRATED
POWER C3



MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2



SWITCH-
IGNITION

8142d9b1

B1BB7-PASSENGER AIRBAG DISABLE SWITCH CONFIGURATION (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ORC is not configured for an ON - OFF switch, the ORC monitors the Passenger Airbag On - Off Switch inputs to determine if a switch is present.
- **Set Condition**
  The code will set, if the ORC detects a Passenger Airbag ON - OFF Switch connected to the Airbag Control Module.
  ORC is not configured for an ON - OFF switch, the ORC monitors the Passenger Airbag On - Off Switch inputs to determine if a switch is present.

Possible Causes
ACM NOT CONFIGURED FOR PAB OFF SWITCH
ACM, MODULE NOT CONFIGURED FOR PAB OFF SWITCH
PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT SHORT
PAB MUX SWITCH CIRCUIT SHORT TO GROUND
PAB MUX SWITCH CIRCUIT SHORT TOGETHER
ACM, PAB ON - OFF SWITCH CIRCUIT SHORTED
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODES PRESENT

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

Turn the ignition on.

Ensure the battery is fully charged.

NOTE: For the purpose of this test, the AECM and ACM modules will be referred to as an ORC.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

SELECT ACTIVE or STORED DTC:

ORC - ACTIVE DTC
Go To 2

ORC - STORED DTC
Go To 9

---

2. VERIFY EQUIPMENT

Inspect vehicle for a Passenger Airbag On - Off Switch located in the center of the instrument panel.

Is this vehicle equipped with a Passenger Airbag On - OFF Switch?

Yes >> Go To 3

No >> Go To 4

B1BB7-PASSENGER AIRBAG DISABLE SWITCH CONFIGURATION (CONTINUED)

3. ORC NOT CONFIGURED FOR PAB ON - OFF SWITCH

Select Restraints, Airbag and then Miscellaneous from the Scan Tool menu.

Follow instructions to verify the ORC switch configuration.

Does the Scan Tool show Configured for PAB OFF Switch?

Yes >> Go To 8

No >> Follow instructions on the Scan Tool to configured the Occupant Restraint Controller to support the Passenger Airbag Switch On - Off Switch.
Perform AIRBAG VERIFICATION TEST - VER 1.

---

4. VERIFY CIRCUITS

Inspect vehicle for a Passenger Airbag On - Off Switch wiring at the ORC connector.

NOTE: Some vehicles may have the wiring for the Passenger Airbag Off Switch and no switch.

Is this vehicle equipped with a Passenger Airbag On - OFF Switch wiring?

Yes >> Go To 5

No >> Go To 8

---

5. PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT SHORT

WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.

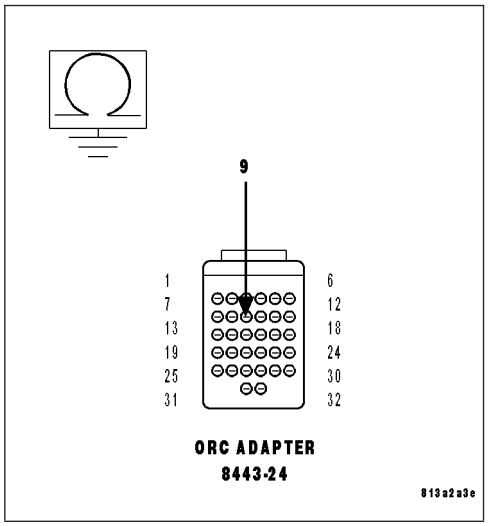
Disconnect the Occupant Restraint Controller connector(s).

NOTE: Check connectors - Clean and repair as necessary.

WARNING: IF THE OCCUPANT RESTRAINT CONTROLLER IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.

Connect the appropriate Load Tool ORC Adaptor to the Occupant Restraint Controller connector.

Measure the resistance of the PAB Indicator Driver circuit between the ORC Adaptor and ground.



Is the resistance below 10K ohms?

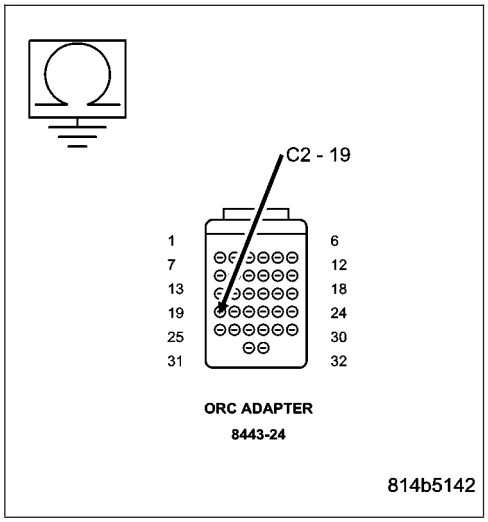
Yes >> Repair the Passenger Airbag Indicator Driver circuit short to ground.
Perform AIRBAG VERIFICATION TEST - VER 1.

No >> Go To 6

B1BB7-PASSENGER AIRBAG DISABLE SWITCH CONFIGURATION (CONTINUED)

6. PAB MUX SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance of the PAB MUX Switch Sense circuit between the ORC Adaptor and ground.



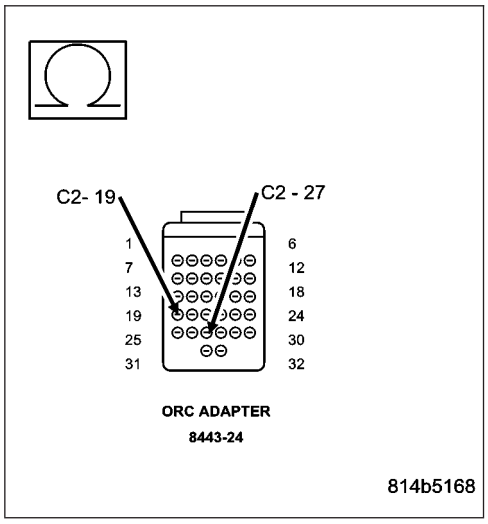
Is the resistance below 10K ohms?

Yes >> Repair the Passenger Airbag MUX Switch Sense circuit short to ground.Perform AIRBAG VERIFICATION TEST - VER 1.

No >> Go To 7

7. PAB MUX SWITCH CIRCUITS SHORT TOGETHER

Measure the resistance between the PAB MUX Switch Sense circuit and the PAB MUX Switch Return circuit at the ORC Adaptor.



Is the resistance below 10K ohms?

Yes >> Repair the Passenger Airbag MUX Switch circuits shorted together.
Perform AIRBAG VERIFICATION TEST - VER 1.

No >> Go To 8

8. ORC, MODULE NOT CONFIGURED FOR PAB OFF SWITCH

WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.

WARNING: IF THE OCCUPANT RESTRAINT CONTROLLER IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.

If there are no possible causes remaining, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with Service Instructions.
Perform AIRBAG VERIFICATION TEST - VER 1.

B1BB7-PASSENGER AIRBAG DISABLE SWITCH CONFIGURATION (CONTINUED)

9. STORED CODE OR INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

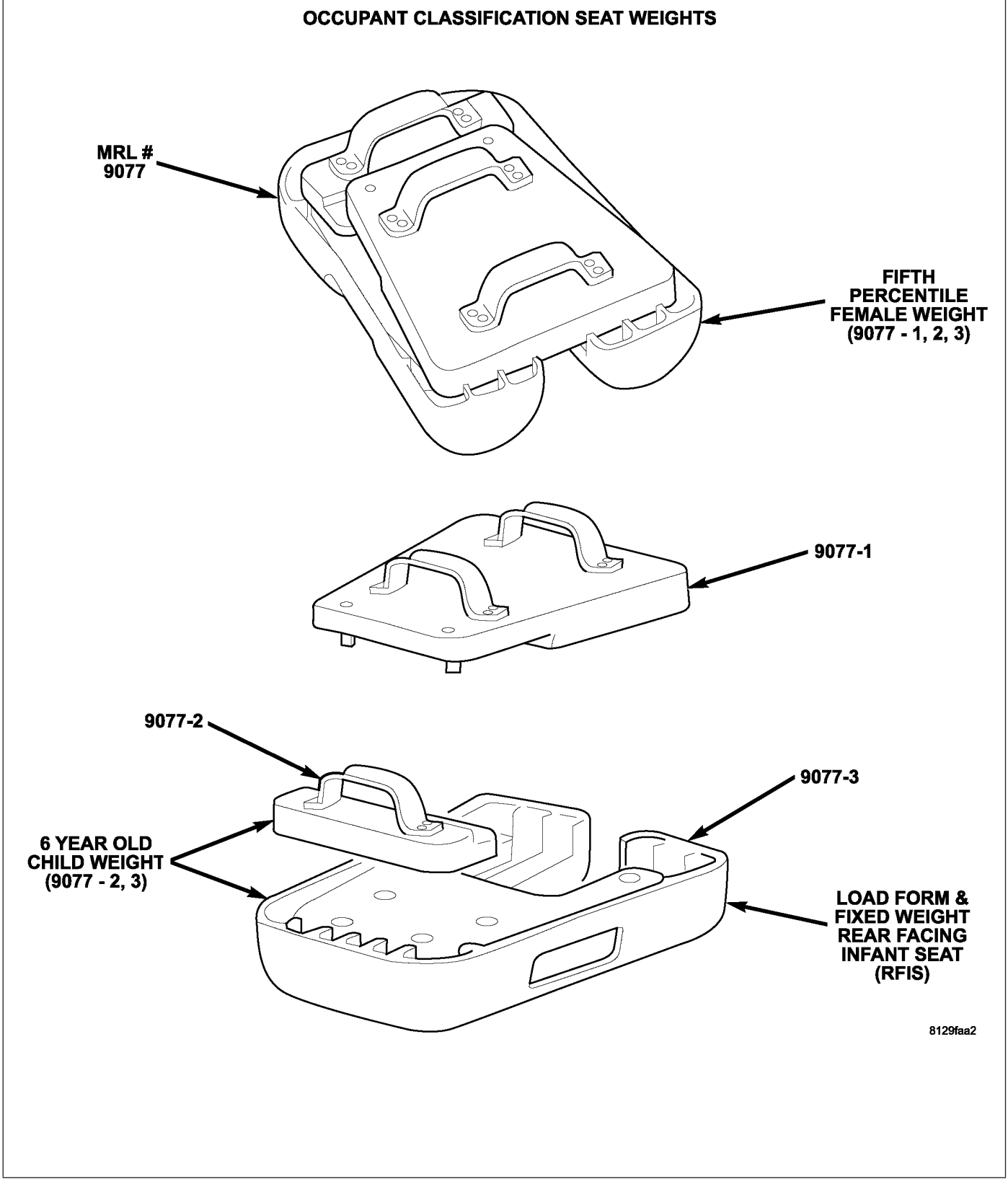
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTCs present?

Yes >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1BA8-OCM SYSTEM OUT OF CALIBRATION/NOT CALIBRATED



B1BA8-OCM SYSTEM OUT OF CALIBRATION/NOT CALIBRATED (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is IGN-RUN or the signal is not available.
- **Set Condition:**
  This DTC will set if the module has initiated a rezero and did not successfully complete the system verification, a system verification routine has been aborted or a update option table from the flash routine has been completed.

Diagnostic Test

1. PERFORM OCCUPANT CLASSIFICATION MODULE SYSTEM VERIFICATION TEST

Verify that the passenger seat is empty.

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

NOTE: Failure to follow the test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, proceed as follows.

With the scan tool, read OCM DTCs.

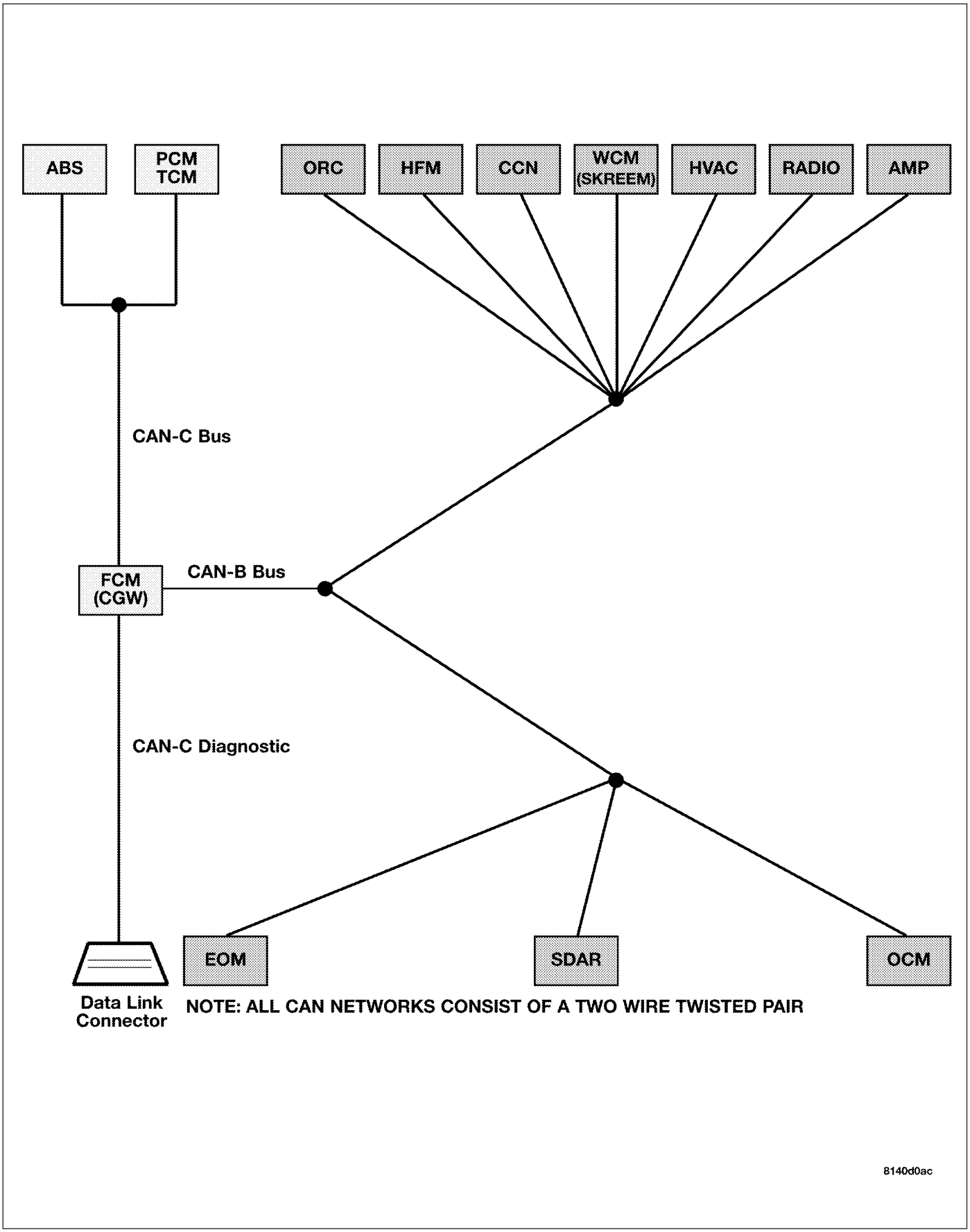
Does the scan tool display any active DTCs?

Yes >> B1BA8 DTC Returned? Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.

Yes >> But Other DTCs Present? Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Perform OCS VERIFICATION TEST - VER 1.

B1BB8-SRS WARNING INDICATOR STATUS MISMATCH



B1BB8-SRS WARNING INDICATOR STATUS MISMATCH (CONTINUED)

For the Airbag circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  After the Instrument Cluster bulb check is completed, the ORC compares the lamp request by the ORC (On or Off) and the Lamp On request by the Instrument Cluster (On or Off) Can bus messages. Each message is transmitted one time per second or when a change in the lap state occurs.
- **Set Condition:**
  If the lamp request by the ORC (On or Off), and the Lamp On by the Instrument Cluster (On or Off), messages do not match, this code will set.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER, INSTRUMENT CLUSTER MESSAGE MISMATCH
INSTRUMENT CLUSTER
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. CHECK FOR AN ACTIVE DTC

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Restraint Controller (ORC) DTCs.

Select DTC type.

Active

Go To 2

Stored

Go To 5

---

2. CHECK FOR ACTIVE INSTRUMENT CLUSTER DTCs

With the scan tool, read Instrument Cluster DTCs.

Does the scan tool display and active Instrument Cluster DTCs?

Yes >> Refer to symptom list for problems related to the Instrument Cluster. Perform the ORC VERIFICATION TEST-VER 1.

No >> Go To 3

B1BB8-SRS WARNING INDICATOR STATUS MISMATCH (CONTINUED)

3. CHECK THE ORC AND INSTRUMENT CLUSTER FOR LAMP STATUS

With the scan tool view the Instrument Cluster Data Display.

Cycle the ignition key and observe the SRS Indicator Lamp Request status (Set/Not Set) during the Instrument Cluster bulb check.

With the scan tool view the ORC Data Display.

Cycle the ignition key and observe the SRS Indicator Lamp Status (Lamp On/Lamp Off) during the Instrument Cluster bulb check.

Did the Data Display information match the operation of the lamp?

Yes >> Go To 4

No >> Replace the Instrument Cluster in accordance with the service information.
Perform the ORC VERIFICATION TEST-VER 1.

---

4. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.

If there are no possible causes remaining, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with the service information.
Perform the ORC VERIFICATION TEST-VER 1.

---

5. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

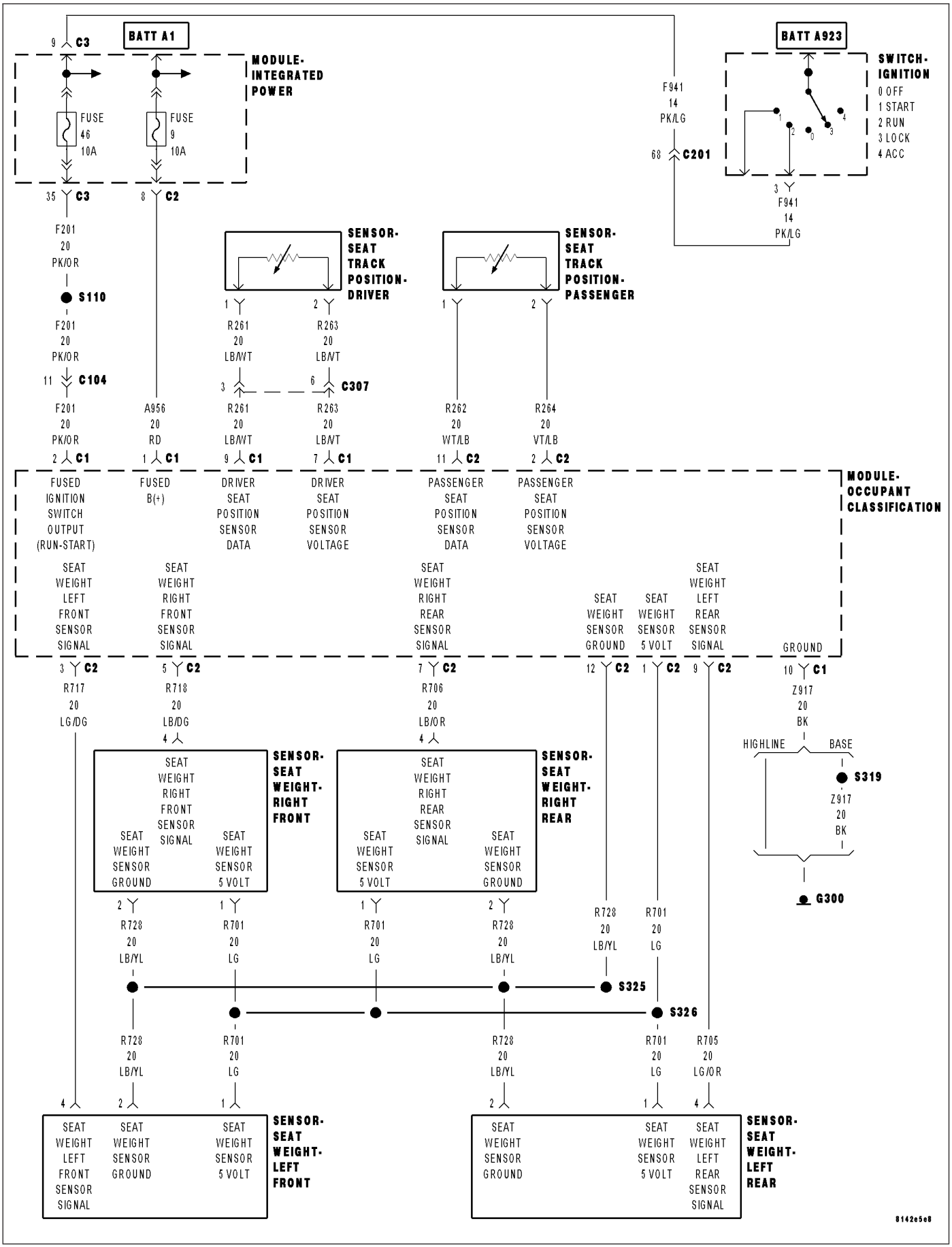
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1BBA-PASSENGER SEAT WEIGHT SENSOR SUPPLY CIRCUIT



B1BBA-PASSENGER SEAT WEIGHT SENSOR SUPPLY CIRCUIT (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN, the module checks the sensor supply.
- **Set Condition:**
  If the OCM detects that the sensor supply shorted. **NOTE: A shorted supply circuit will cause a 'NO RESPONSE FROM OCM" condition.**

Possible Causes
OCS SUPPLY CIRCUIT SHORTED
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. VERIFY THAT B1BBA-PASSENGER SEAT WEIGHT SENSOR SUPPLY CIRCUIT DTC IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1BBA-PASSENGER SEAT WEIGHT SENSOR SUPPLY CIRCUIT?

Yes >> Replace the OCM in accordance with the Service Information.
Perform the OCS VERIFICATION REQUIRED procedure.

No >> Go To 2

---

2. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.
Replace the Passenger Seat Harness in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 3

B1BBA-PASSENGER SEAT WEIGHT SENSOR SUPPLY CIRCUIT (CONTINUED)

3. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from the OCM.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return continue the test until the problem area has been isolated.

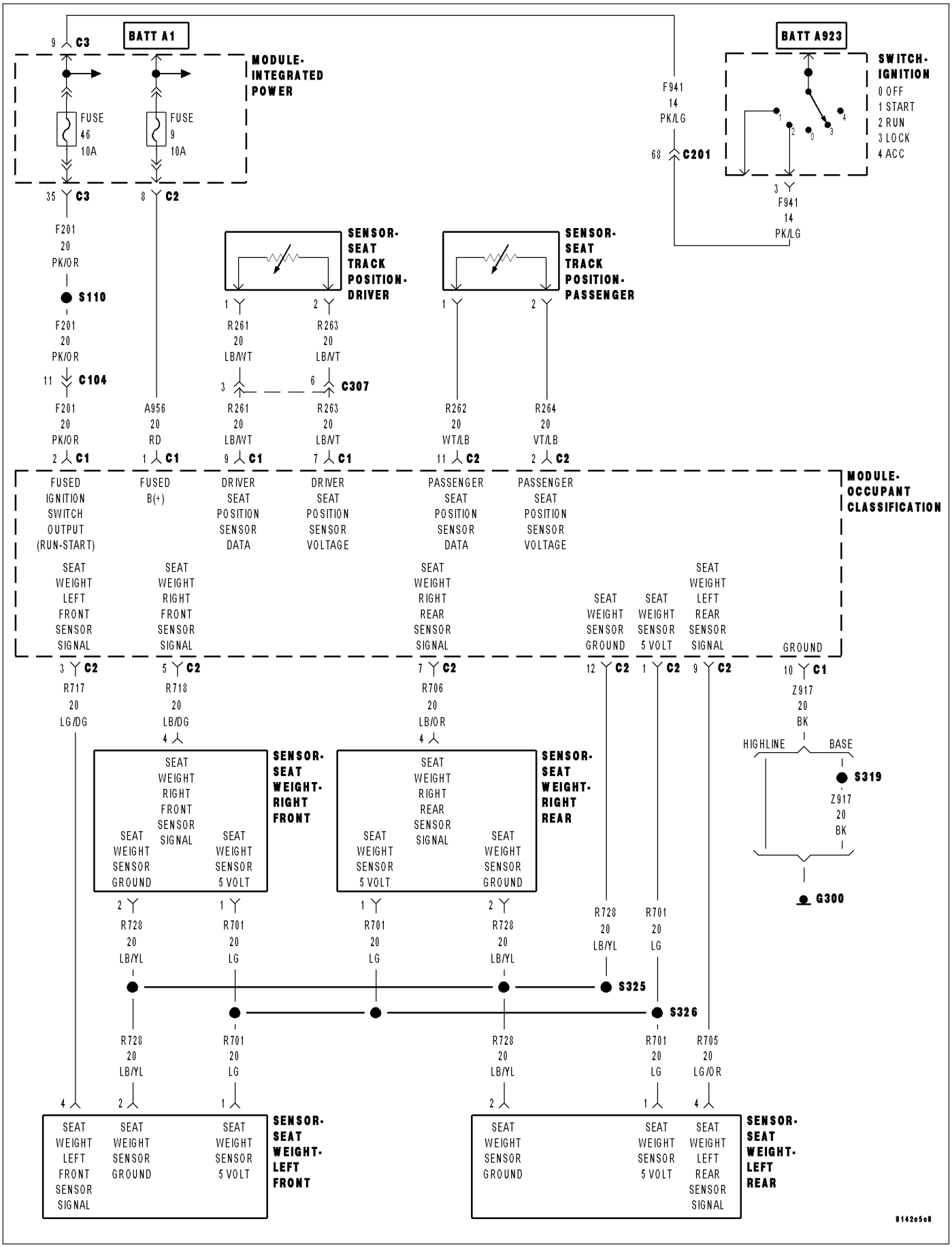
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1BBB-PASSENGER SEAT WEIGHT SENSOR INPUTS SHORTED TOGETHER



B1BBB-PASSENGER SEAT WEIGHT SENSOR INPUTS SHORTED TOGETHER (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN.
- **Set Condition:**
  If the OCM detects any two sensors voltages below 20mV for 10 minutes while any other sensor is greater than 40mV. Note: 1 a/d count is equal to 5mV.**NOTE: A shorted supply circuit will cause a 'NO RESPONSE FROM OCM" condition.**

Possible Causes
OCS SENSOR CIRCUITS SHORTED TOGETHER
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. VERIFY THAT B1BBA-PASSENGER SEAT WEIGHT SENSOR SUPPLY CIRCUIT DTC IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1BBB-PASSENGER SEAT WEIGHT SENSOR INPUTS SHORTED TOGETHER ?

Yes >> Replace the OCM in accordance with the Service Information.
Perform the OCS VERIFICATION REQUIRED procedure.

No >> Go To 2

---

2. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.
Replace the Passenger Seat Harness in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 3

B1BBB-PASSENGER SEAT WEIGHT SENSOR INPUTS SHORTED TOGETHER (CONTINUED)

3. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from the OCM.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return continue the test until the problem area has been isolated.

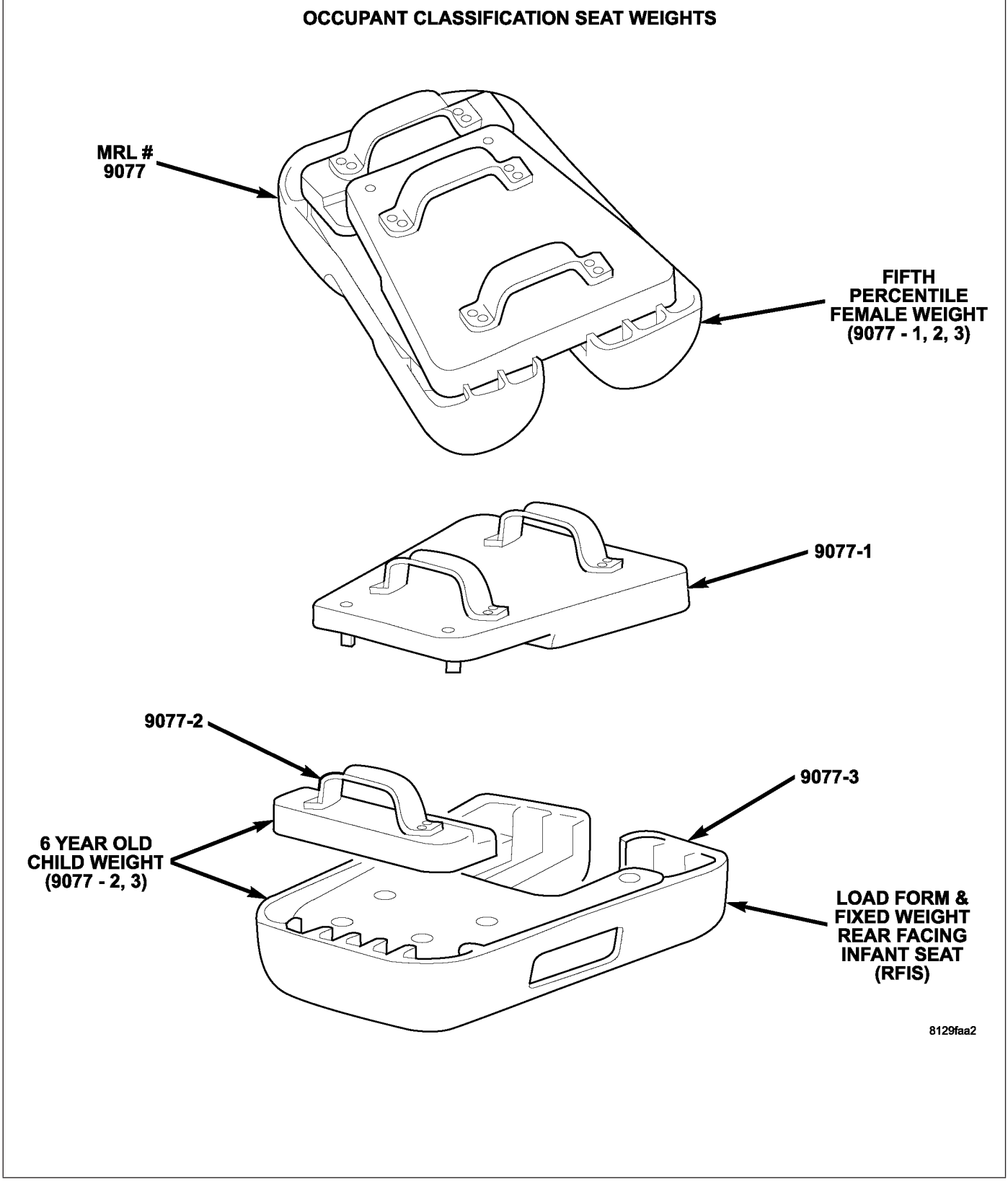
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1BBC-OCS NEGATIVE SYSTEM WEIGHT



OCS SEAT WEIGHTS MRL #9077

B1BBC-OCS NEGATIVE SYSTEM WEIGHT (CONTINUED)

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN, the module checks the sensor input ranges.
- **Set Condition:**
  If the module detects a seat weight sensor input with the total seat weight below -6.5 kg +/- 1kg.

Possible Causes
DAMAGE TO THE PASSENGER SEAT STRUCTURE, RISER ASSEMBLY, CROSSMEMBERS, SEAT TRACKS, FLOOR PAN
OBJECT UNDER SEAT OR REAR SEAT FOLDED DOWN AND RESTING AGAINST PASSENGER SEAT
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. TEST CONDITIONS

- ACTIVE INTERNAL DTC
- IGNITION DTC
- BATTERY DTC
- SEAT WEIGHT SENSOR DTC

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs listed above?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. ACTIVE OR STORED DTC

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1BBC–NEGATIVE SYSTEM WEIGHT?

Yes >> Go To 3

No >> Go To 4

B1BBC-OCS NEGATIVE SYSTEM WEIGHT (CONTINUED)

3. PERFORM OCCUPANT CLASSIFICATION MODULE SYSTEM VERIFICATION TEST

Verify that the passenger seat is empty.

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

NOTE: Failure to follow the test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1BA8–OCS NOT CALIBRATED DTC?

Yes >> Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors. Perform OCS VERIFICATION TEST - VER 1.

No >> But Other DTCs Present? Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Perform OCS VERIFICATION TEST - VER 1.

---

4. STORED B1BBC-OCS NEGATIVE SYSTEM WEIGHT DTC

With the scan tool, record and erase all DTC’s from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

IF only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC’s present?

Yes >> Select appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B1BBD-OCM CURRENT CONFIGURATION TABLE UNPROGRAMMED

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  If the Configuration Table is not programmed at the supplier or when the checksum is invalid.
- **Set Condition:**
  This DTC will set if the module was received unprogrammed from the supplier, the vehicle line was not identified correctly or if the flash procedure was not completed successfully

Possible Causes
NEW OCCUPANT CLASSIFICATION MODULE
INTERNAL CHECKSUM FAILURE

Diagnostic Test

1. MODULE CONFIGURATION

Does the scan tool display B1BBD-OCM CURRENT CONFIGURATION TABLE UNPROGRAMMED?

Yes >> Perform the B1BA7–OCS VERIFICATION REQUIRED diagnostic procedure.

No >> Replace the Occupant Classification Module in accordance with the service information. With the scan tool, perform the OCM SYSTEM VERIFICATION procedure.

B1BC7-DEPLOYMENT DATA RECORD FULL

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.
- **Set Condition:**
  This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Turn the ignition on.
With the scan tool, read ORC DTCs.

Is the Deployment Data Record Full DTC active?

Yes >> Go To 2

No >> Perform the ORC VERIFICATION TEST-VER. 1.

---

2. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

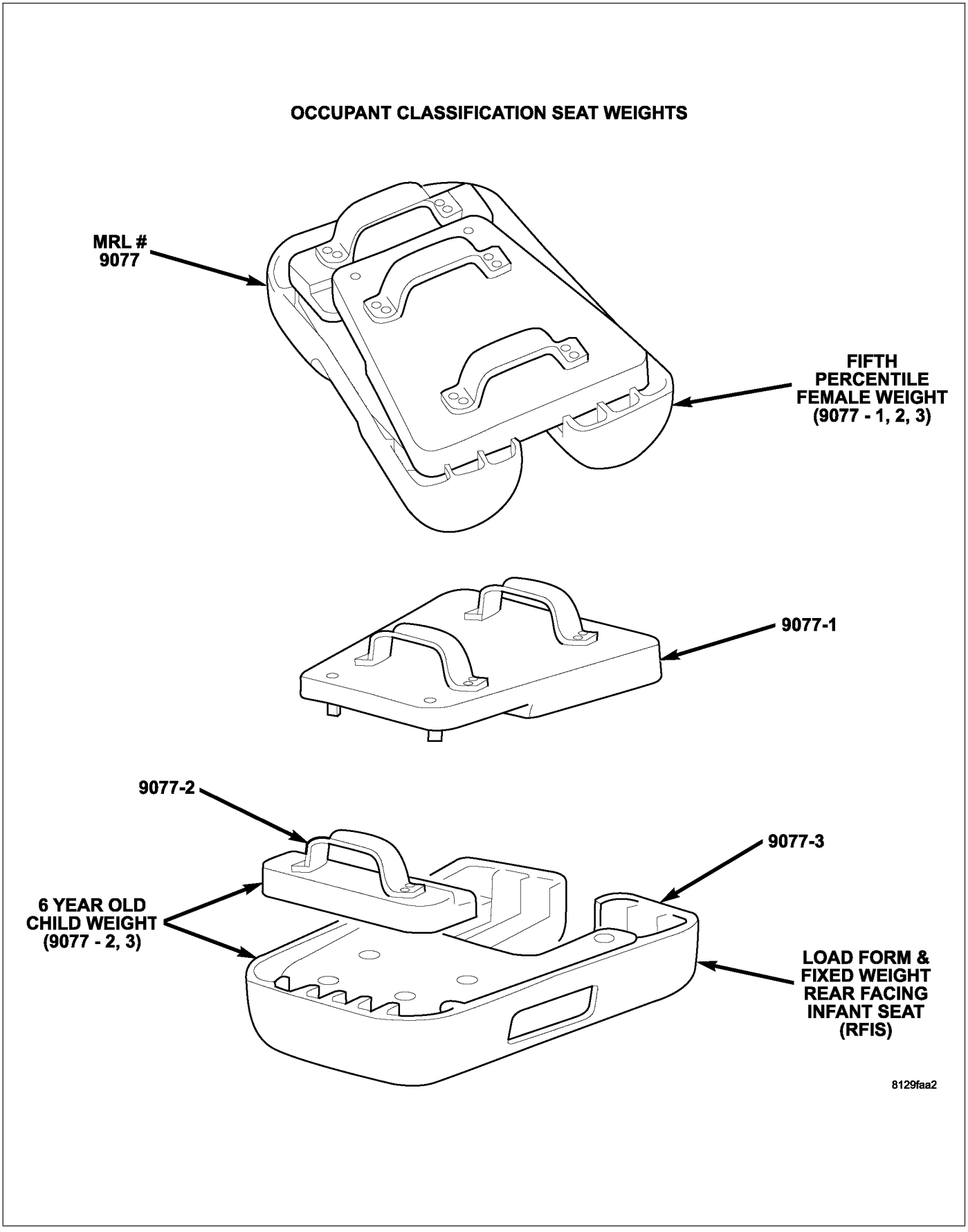
WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

View repair.

Repair

Replace the Occupant Restraint Controller in accordance with the service information.
Perform the ORC VERIFICATION TEST-VER 1.

B1BC8-PASSENGER SEAT WEIGHT SENSORS PERFORMANCE



OCS SEAT WEIGHTS MRL #9077

B1BC8-PASSENGER SEAT WEIGHT SENSORS PERFORMANCE (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is in IGN_RUN, the module checks the sensor input ranges.
- **Set Condition:**
  If the module detects the difference between 2 sensors is less than 3 A/D (15 mV) counts for 10 consecutive minutes while at least one sensor count is changing and greater than 8 A/D (40 mV) counts.

Possible Causes
OTHER SEAT WEIGHT SENSOR FAULTS ACTIVE IN THE OCM
PASSENGER SEAT HARNESS WIRES CHAFFED, PIERCED, PINCHED, PARTIALLY BROKEN
PASSENGER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
PASSENGER SEAT WEIGHT SENSORS
DAMAGE TO THE PASSENGER SEAT STRUCTURE, RISER ASSEMBLY, CROSSMEMBERS, SEAT TRACKS, FLOOR PAN
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, & BATTERY FAULTS IN THE OCCUPANT CLASSIFICATION MODULE (OCM)

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.
Turn the ignition on, then off, and then on again.

NOTE: This DTC will take 10 minutes to mature, allow plenty of time for the code to mature between as you work through the test steps.
With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display any active DTCs relating to internal faults, ignition faults, or battery faults?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 2

---

2. VERIFY THAT DTC B1BC8–PASSENGER SEAT WEIGHT SENSORS PERFORMANCE IS ACTIVE

With the scan tool, read OCM DTCs.

Does the scan tool display active: B1BC8–PASSENGER SEAT WEIGHT SENSORS PERFORMANCE?

Yes >> Go To 3

No >> Go To 6

B1BC8-PASSENGER SEAT WEIGHT SENSORS PERFORMANCE (CONTINUED)

3. CHECK FOR OTHER ACTIVE PASSENGER SEAT WEIGHT SENSOR FAULTS IN THE OCM

With the scan tool, read OCM DTCs.

Does the scan tool display any other active Seat Weight Sensor DTCs?

Yes >> Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Go To 4

---

4. INSPECT PASSENGER SEAT HARNESS WIRES & CONNECTORS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Passenger Seat Harness wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes >>

NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.

Replace the Passenger Seat Harness in accordance with the Service Information.

Perform OCS VERIFICATION TEST - VER 1.

No >> Go To 5

---

5. PERFORM OCCUPANT CLASSIFICATION MODULE SYSTEM VERIFICATION TEST

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, wait two minutes, and then proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display any active PASSENGER SEAT WEIGHT SENSOR PERFORMANCE DTCs?

Yes >> Perform the *Diagnosis/Checkout Procedure For Seat Weight Sensors.

Perform OCS VERIFICATION TEST - VER 1.

No >> Other DTCs ACTIVE? Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Perform OCS VERIFICATION TEST - VER 1.

B1BC8-PASSENGER SEAT WEIGHT SENSORS PERFORMANCE (CONTINUED)

6. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

NOTE: This DTC will take 10 minutes to mature, allow plenty of time for the code to mature between as you work through the test steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

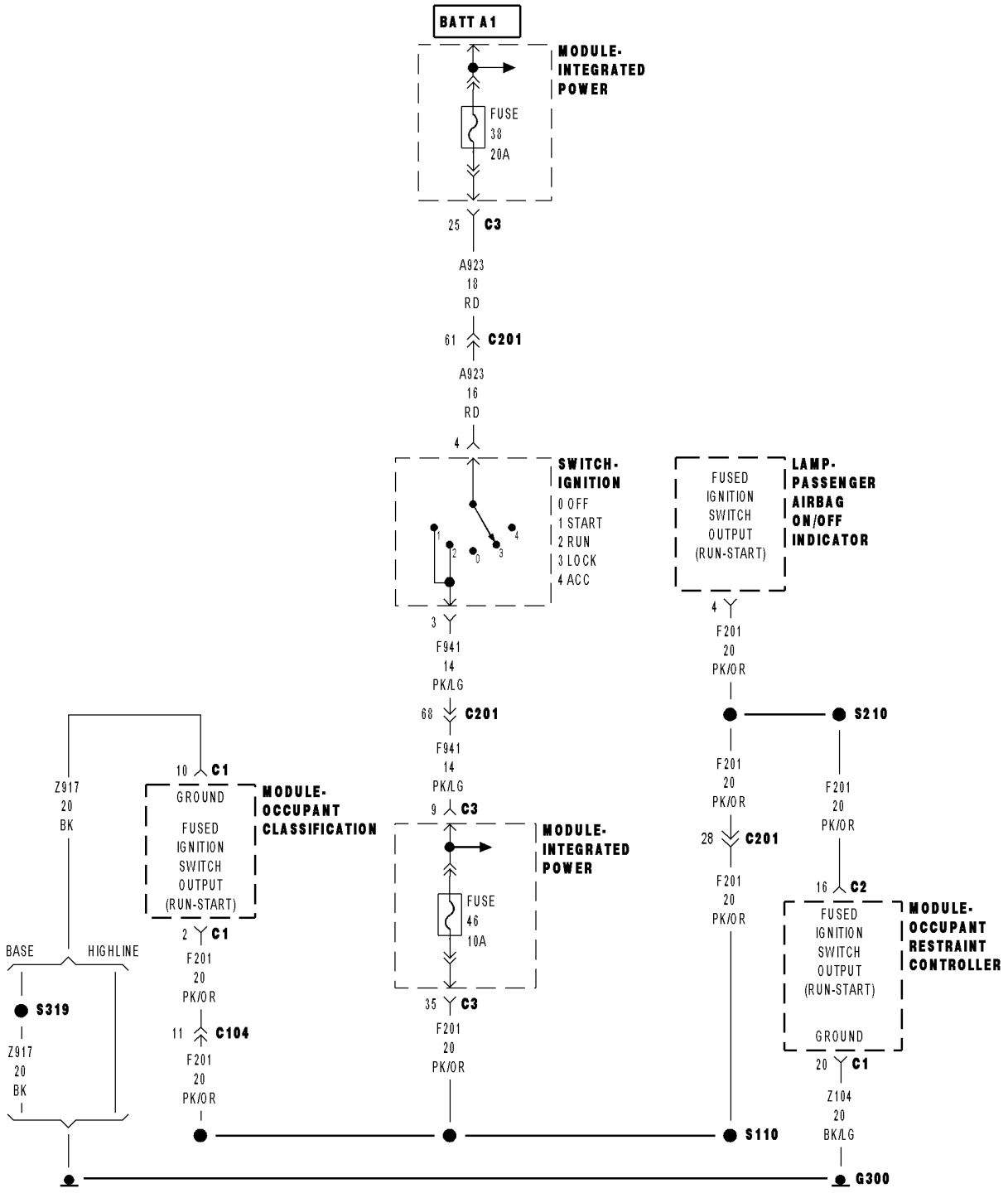
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

B2101-IGNITION RUN/START INPUT CIRCUIT LOW



B2101-IGNITION RUN/START INPUT CIRCUIT LOW (CONTINUED)

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus is RUN or SNA and the IOD status is “IN”. The module checks the (F201) Fused Ignition Switch Output (Run-Start) circuit voltage input range.
- **Set Condition:**
  With the ignition on, if voltage on the (F201) Fused Ignition Switch Output (Run-Start) circuit is equal to or below 6.25 ± 0.25 volts. Within 60 seconds of turning the ignition off, if the (F201) Fused Ignition Switch Output (Run-Start) circuit is 2.4 to 5.0 volts.

Possible Causes
(F20) IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN
(F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT SHORTED TO GROUND
OPEN FUSE (27)
(F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN
OCCUPANT CLASSIFICATION MODULE (OCM)
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC B2101 IGNITION RUN/START INPUT CIRCUIT LOW IS ACTIVE IN THE ORC.

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read Occupant Restraint Controller (ORC) DTCs.

Does the scan tool display active: B2101 IGNITION RUN/START INPUT CIRCUIT LOW?

Yes >> Go To 3

No >> Go To 2

---

2. CHECK FOR ACTIVE DTC B2101 IGNITION RUN/START INPUT CIRCUIT LOW IN OCM.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display active: B2101 IGNITION RUN/START INPUT CIRCUIT LOW?

Yes >> Go To 3

No >> Go To 9

---

3. INSPECT AIRBAG RUN-START FUSE

Turn the ignition off.

Remove the Airbag Run-Start Fuse from the rear Integrated Power Module and inspect the fuse.

NOTE: Check connectors - Clean and repair as necessary.

Is the Run/Start fuse open?

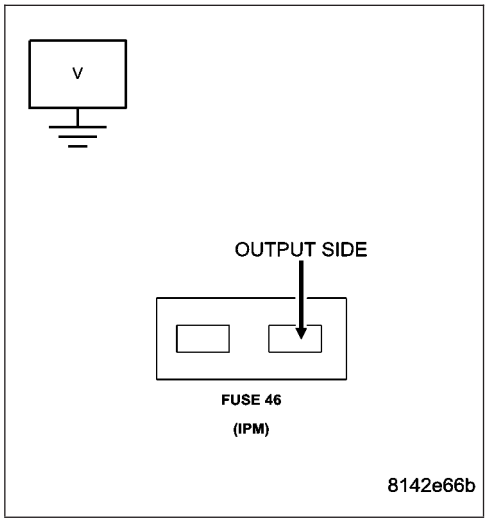
Yes >> Go To 4

No >> Go To 7

B2101-IGNITION RUN/START INPUT CIRCUIT LOW (CONTINUED)

4. CHECK (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT RESISTANCE

Measure the resistance of the (F201) Fused Ignition Switch Output (Run-Start) circuit between ground and the Airbag Run-Start fuse terminal (output side).



Is the resistance below 100.0 ohms?

Yes >> Go To 5

No >> Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.
Replace Airbag Run-Start Fuse.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1.

---

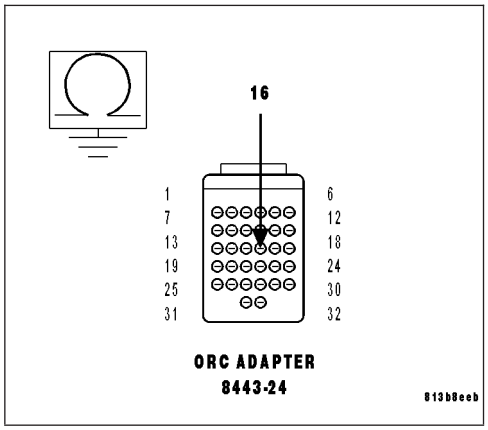
5. CHECK (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT RESISTANCE WITH ORC CONNECTORS DISCONNECTED

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the both ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the Load Tool ORC 8443–24 Adaptor to the ORC C2 connector.

Measure the resistance of the (F201) Fused Ignition Switch Output (Run-Start) circuit between 8443–24 adaptor and ground).



Is the resistance below 100.0 ohms?

Yes >> Go To 6

No >> Replace the ORC in accordance with the Service Information.
Replace the Airbag Run-Start Fuse.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1.

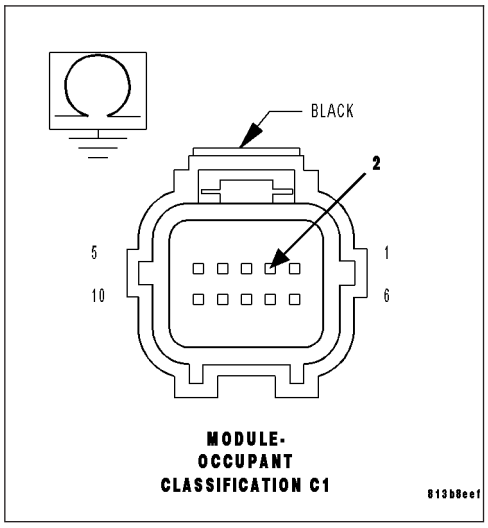
B2101-IGNITION RUN/START INPUT CIRCUIT LOW (CONTINUED)

6. CHECK (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT RESISTANCE WITH OCM C1 CONNECTOR DISCONNECTED

WARNING: If the Occupant Classification Module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

Disconnect the OCM C1 connector.

Measure the resistance of the (F201) Fused Ignition Switch Output (Run-Start) circuit between ground and the Occupant Classification Module C1 connector.



Is the resistance below 100.0 ohms?

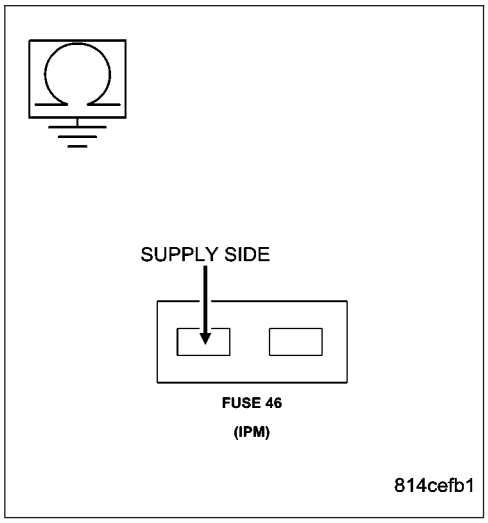
Yes >> Repair the (F201) Fused Ignition Switch Output (Run-Start) circuit for a short to ground.
Replace the Airbag Run-Start Fuse.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1.

No >> Replace the OCM in accordance with the Service Information.
Replace the Airbag Run-Start Fuse.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1.

7. CHECK (F201) IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT FOR AN OPEN

Turn the ignition on.

Measure the voltage of the (F201) Ignition Switch Output (Run-Start) circuit at the Airbag Run-Start fuse terminal (supply side).



Is the voltage above 6.0 volts?

Yes >> Go To 8

No >> Repair the open (F20) Ignition Switch Output (Run-Start) circuit.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1.

B2101-IGNITION RUN/START INPUT CIRCUIT LOW (CONTINUED)

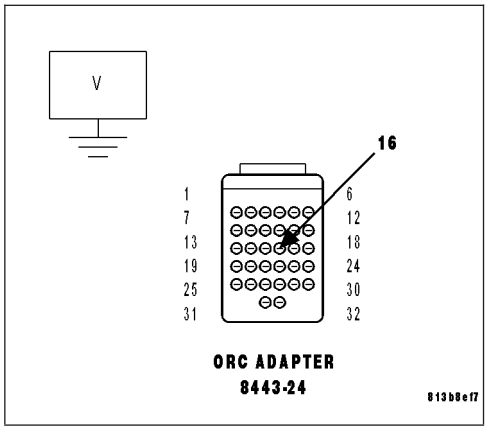
8. CHECK (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Reinstall the Airbag Run-Start Fuse.

Disconnect the both ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Install the Airbag Load tool ORC 8443–24 adaptor to the ORC C2 connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (F201) Fused Ignition Switch Output (Run-Start) Circuit between the 8443–24 connector and ground.



Is the voltage above 6.0 volts?

Yes >> Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1 if DTC B2101 IGNITION RUN/START INPUT CIRCUIT LOW was Active in the OCM.

No >> Repair the open (F201) Fused Ignition Switch Output (Run-Start) circuit.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1 if DTC B2101 IGNITION RUN/START INPUT CIRCUIT LOW was Active in the OCM.

---

9. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.
Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

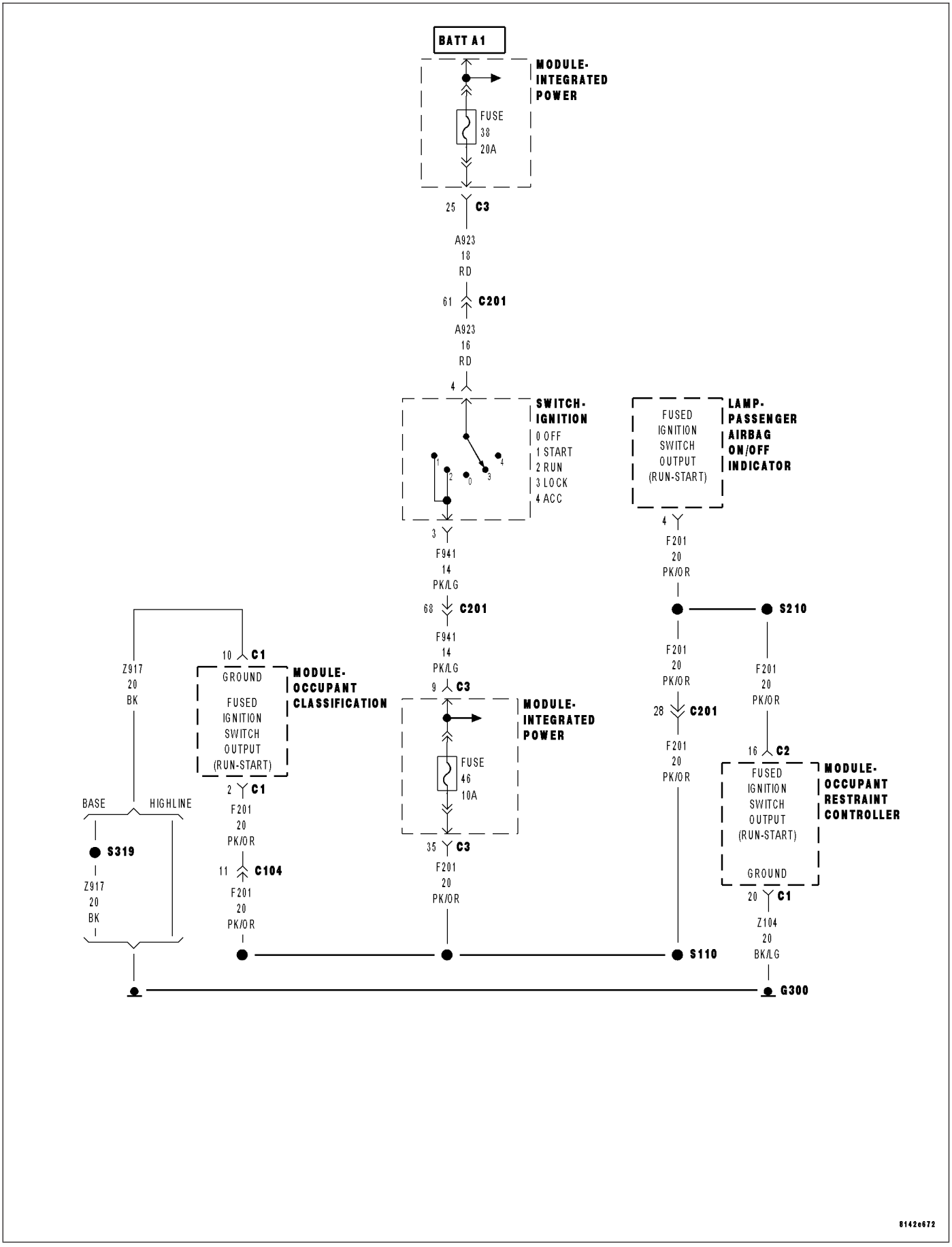
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

No >> No problem found Erase all codes before returning vehicle to customer.

B2102-IGNITION RUN/START INPUT CIRCUIT HIGH



B2102-IGNITION RUN/START INPUT CIRCUIT HIGH (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status is RUN or missing and the IOD status is ″IN″. The module checks the (F201) Fused Ignition Switch Output (Run-Start) circuit voltage input range.
- **Set Condition:**
  If the module detects that the ignition voltage is greater than 24.25 volts ±0.25 volts for 10 seconds.

Possible Causes
VEHICLE CHARGING SYSTEM
VEHICLE WIRING & HARNESS CONNECTORS
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. VERIFY THAT DTC B2102-IGNITION RUN/START INPUT CIRCUIT HIGH IS ACTIVE

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on, then off, and then on again.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display active: B2102-IGNITION RUN/START INPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> Go To 3

---

2. CHECK FOR CHARGING SYSTEM RELATED DTCs IN THE POWERTRAIN CONTROL MODULE (PCM)

With the scan tool in ECU View, select PCM and check for any Charging System related DTCs.

Does the scan tool display any Charging System related DTCs?

Yes >> Diagnose and repair the DTCs. Refer to (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No >> Replace the ORC in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

B2102-IGNITION RUN/START INPUT CIRCUIT HIGH (CONTINUED)

3. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

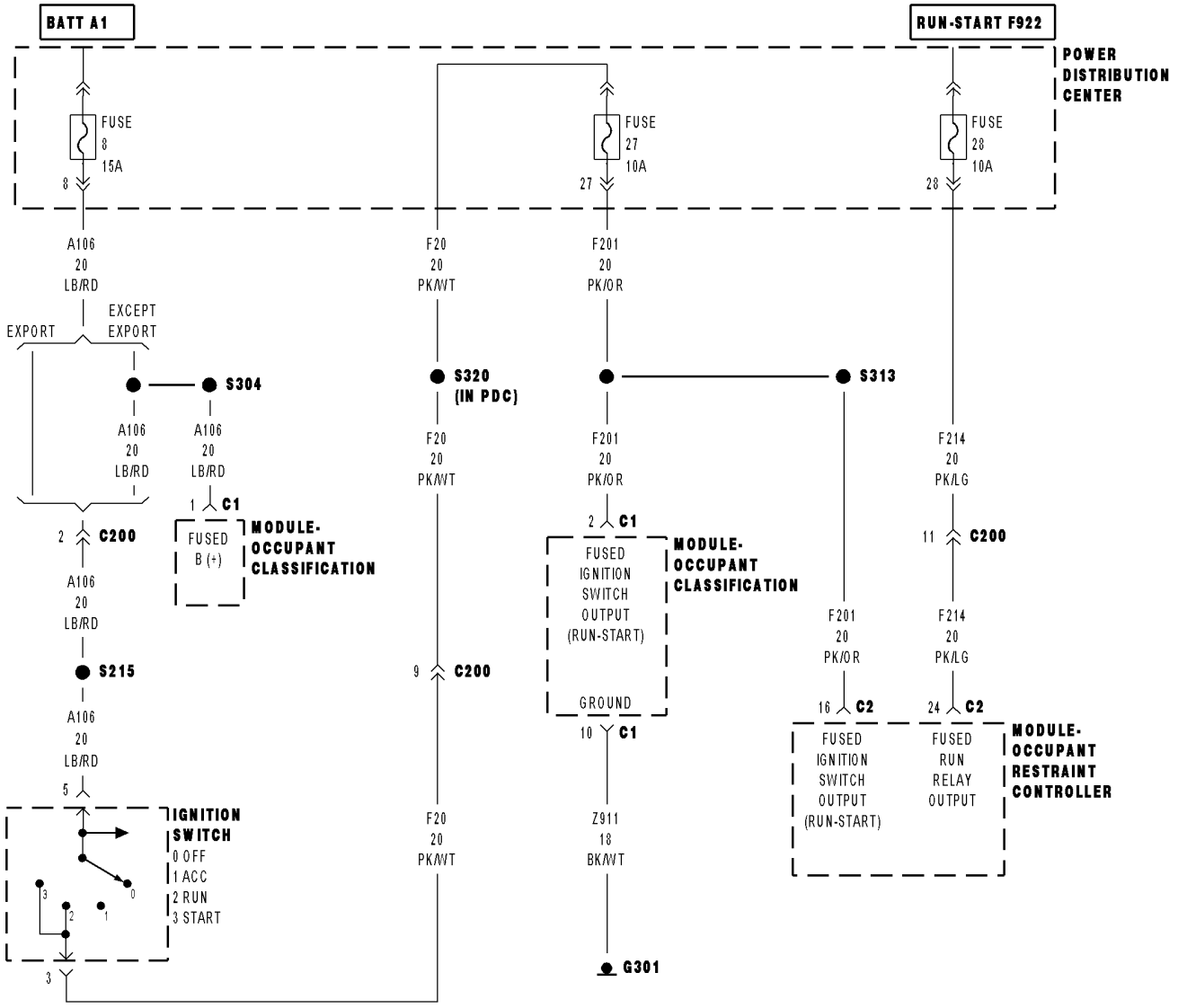
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

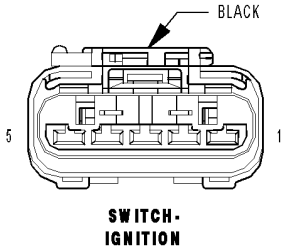
Does the scan tool display any ACTIVE DTCs?

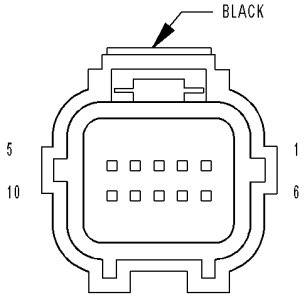
Yes >> Select appropriate symptom from Symptom List.

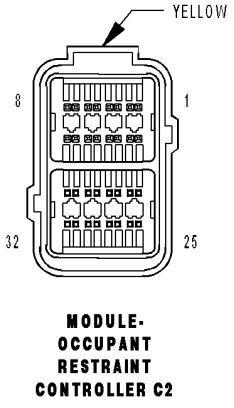
No >> No problem found Erase all codes before returning vehicle to customer.

B210D-BATTERY VOLTAGE LOW









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B210D-BATTERY VOLTAGE LOW (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  OCM-While the CAN bus ignition status received is RUN or missing, the module checks the (A956) Fused B+ circuit voltage input range and the (F201) Fused Ignition Switch Output Run Only circuit voltage input range.
- **Set Condition:**
  OCM-If the module detects that the battery voltage is less than or equal to 6.25 volts ±0.25 volts.
- **When Monitored:**
  ORC-While the CAN bus ignition status received is RUN or missing, the module checks the (F201) Fused Ignition Switch Output (RUN/START) circuit and the (F100) Fused Run Relay Output (RUN ONLY) circuit voltage input range.
- **Set Condition:**
  ORC-If the module detects that the battery voltage is less than or equal to 6.25 volts ±0.25 volts on either the F201 or F100 circuits.

Possible Causes
OCM (A956) FUSED B(+) CIRCUIT
ORC (F201) FUSED IGNITION SWITCH OUTPUT (RUN/START) CIRCUIT OPEN
ORC (F100) FUSED IGNITION SWITCH RUN OUTPUT CIRCUIT OPEN
VEHICLE CHARGING SYSTEM
OCCUPANT CLASSIFICATION MODULE
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. CHECK FOR AN ACTIVE DTC

NOTE: Ensure the battery is fully charged.

NOTE: Troubleshoot any PCM charging/cranking DTCs before proceeding.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read Occupant Restraint Controller (ORC) DTCs.

Select module and DTC type.

OCM Active
Go To 2

OCM Stored
Go To 4

ORC Active
Go To 3

ORC Stored
Go To 4

B210D-BATTERY VOLTAGE LOW (CONTINUED)

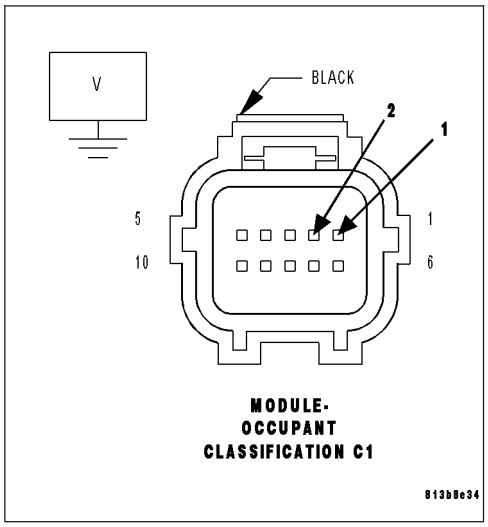
2. TEST THE VOLTAGE OF OCM (A956) FUSED B(+) AND (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUITS.

WARNING: WARNING:To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the OCM C1 connector.

NOTE: Check connectors - Clean and repair as necessary.

WARNING: WARNING:To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (F201) Fused Ignition Switch Output (Run-Start) circuit.

Measure the voltage of the (A956) Fused B+ circuit.



Is the voltage above 6.75 volts on both circuits?

Yes >> Replace the OCM in accordance with the service information. Perform the Occupant Classification Module System Verification Test.
Perform OCS VERIFICATION TEST - VER 1.

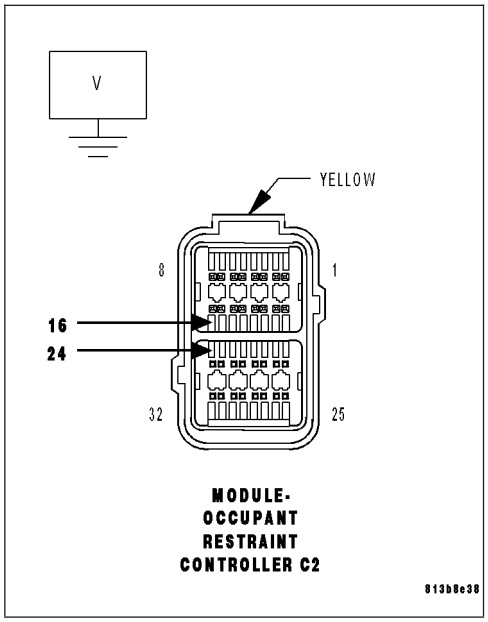
No >> Repair the (A956) FUSED B(+) and/or (F201) Fused Ignition Switch Output (Run-Start) circuits for an open.
Perform OCS VERIFICATION TEST - VER 1.

---

3. MEASURE THE VOLTAGE OF ORC (F201) FUSED IGNITION SWITCH OUTPUT (RUN/START) AND (F100) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUITS

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the ORC C2 connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the F201 and F100 circuits.



Is the voltage above 6.75 volts on both circuits?

Yes >> Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1.

No >> Repair the appropriate circuit or circuits for an open.
Perform ORC VERIFICATION TEST - VER 1.

B210D-BATTERY VOLTAGE LOW (CONTINUED)

4. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

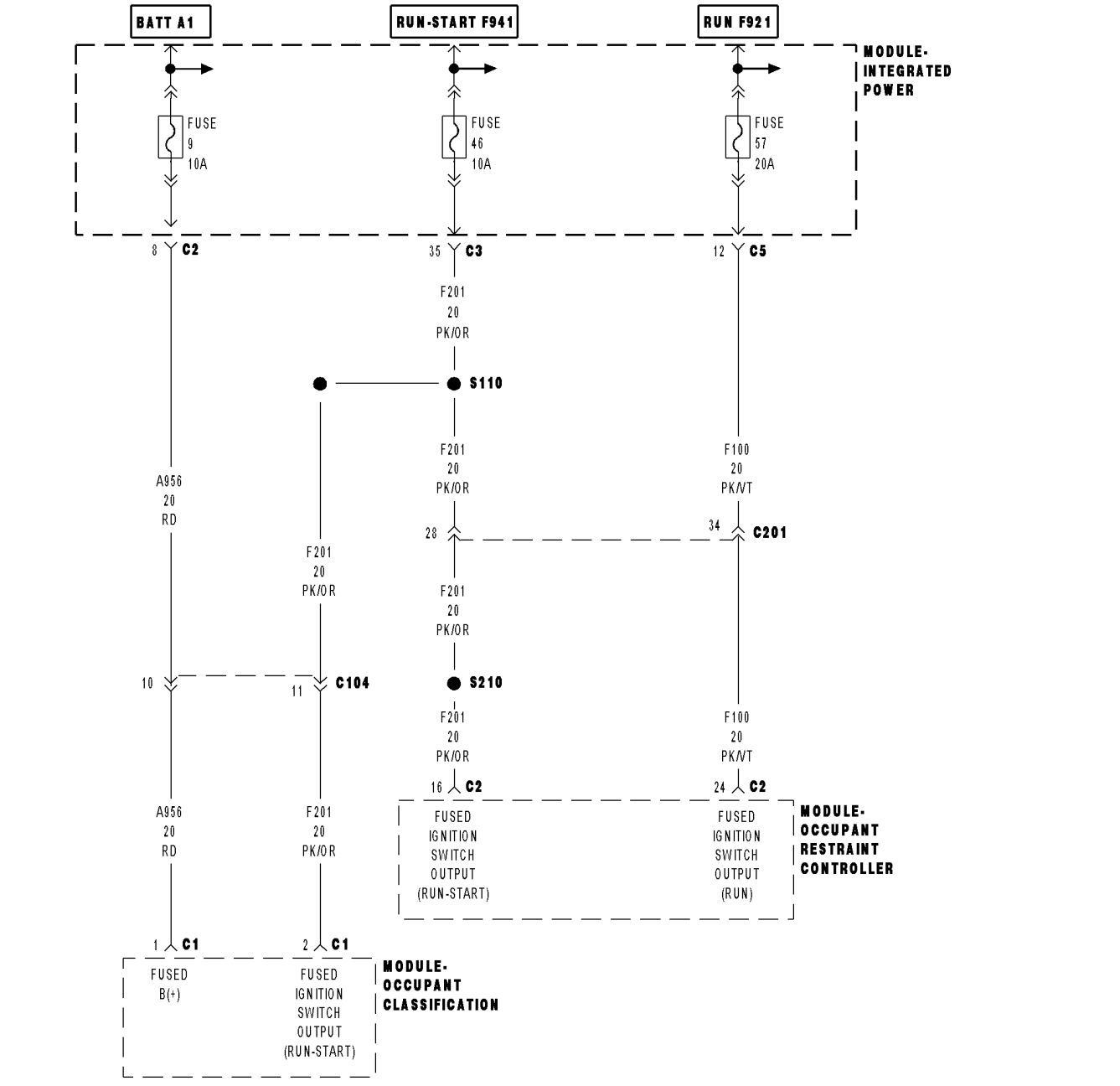
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

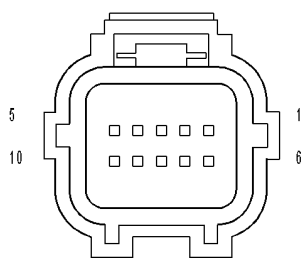
Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

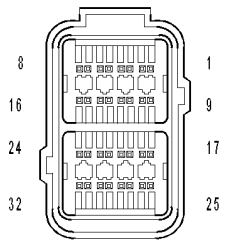
No >> No problem found Erase all codedxcs before returning vehicle to customer.

B210E-BATTERY VOLTAGE HIGH

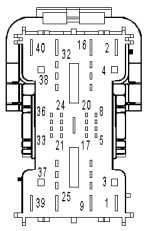




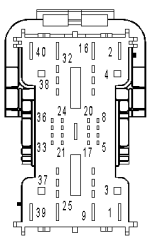
MODULE-
OCCUPANT
CLASSIFICATION C1



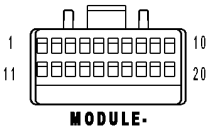
MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2



MODULE-
INTEGRATED
POWER C3



MODULE-
INTEGRATED
POWER C5



MODULE-
INTEGRATED
POWER C2

8142e649

B210E-BATTERY VOLTAGE HIGH (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the CAN bus ignition status received is RUN or SNA, the module checks the (A956) Fused B+ circuit voltage input range.
- **Set Condition:**
  If the module detects that the battery voltage is greater than or equal to 24.25 volts ±0.25 volts for 10 seconds.

Possible Causes
VEHICLE CHARGING SYSTEM
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. CHECK FOR AN ACTIVE DTC

Turn the ignition on, then off, and then on again.

With the scan tool, read OCM DTCs.

Does the scan tool display active: B210E-BATTERY VOLTAGE HIGH?

Yes >> Go To 2

No >> Go To 4

---

2. CHECK THE BATTERY VOLTAGE TO THE OCCUPANT CLASSIFICATION MODULE

With the scan tool in Data Display, read OCM battery voltage.

Is the battery voltage greater than 24.25 volts ±0.25 volts?

Yes >> Go To 3

No >> Replace the OCM in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

---

3. CHECK FOR CHARGING SYSTEM RELATED DTCs IN THE POWERTRAIN CONTROL MODULE (PCM)

With the scan tool in ECU View, select PCM and check for any Charging System related DTCs.

Does the scan tool display any Charging System related DTCs?

Yes >> Diagnose and repair the DTCs. Refer to (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No >> Replace the OCM in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

B210E-BATTERY VOLTAGE HIGH (CONTINUED)

4. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

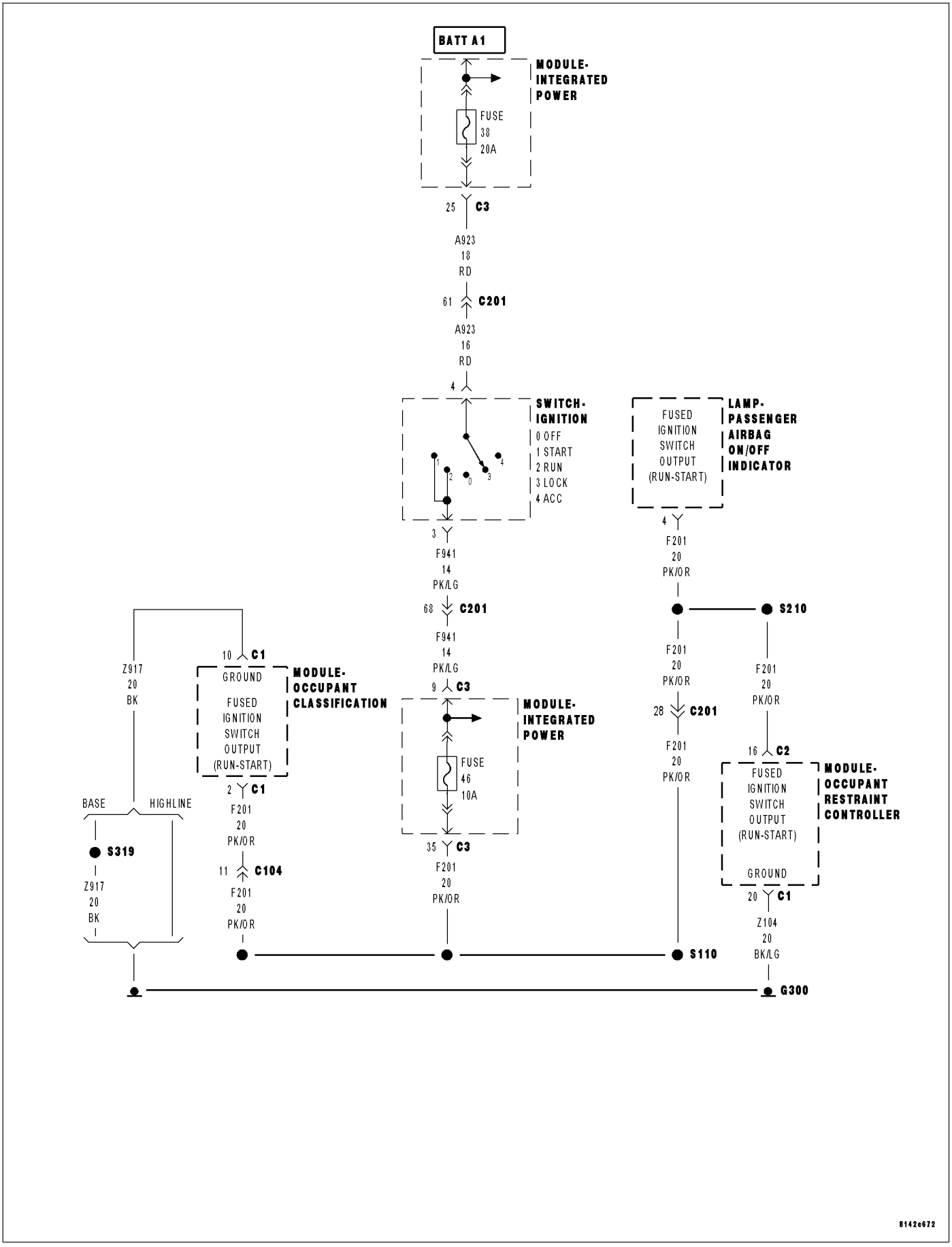
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

No >> No problem found Erase all codes before returning vehicle to customer.

B212C-IGNITION RUN/START INPUT CIRCUIT OPEN



B212C-IGNITION RUN/START INPUT CIRCUIT OPEN (CONTINUED)

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run-Start position.
- **Set Condition:**
  If voltage on the (F201) Fused Ignition Switch Output (Run-Start) circuit drops below 6.0 volts.

Possible Causes
(F20) IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN
(F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT SHORTED TO GROUND
OPEN FUSE (27)
(F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN
OCCUPANT CLASSIFICATION MODULE (OCM)
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC B212C IGNITION RUN/START INPUT CIRCUIT OPEN IS ACTIVE IN THE ORC.

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read Occupant Restraint Controller (ORC) DTCs.

Does the scan tool display active: B212C IGNITION RUN/START INPUT CIRCUIT OPEN?

Yes >> Go To 3

No >> Go To 2

---

2. CHECK FOR ACTIVE DTC B212C IGNITION RUN/START INPUT CIRCUIT OPEN IN OCM.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display active: B212C IGNITION RUN/START INPUT CIRCUIT OPEN?

Yes >> Go To 3

No >> Go To 11

---

3. INSPECT AIRBAG RUN-START FUSE

Turn the ignition off.

Remove the Airbag Run-Start Fuse from the rear Power Distribution Center and inspect the fuse.

NOTE: Check connectors - Clean and repair as necessary.

Is the Run/Start fuse open?

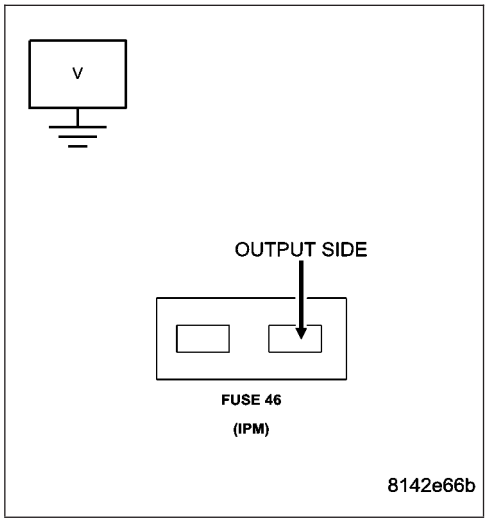
Yes >> Go To 4

No >> Go To 7

B212C-IGNITION RUN/START INPUT CIRCUIT OPEN (CONTINUED)

4. CHECK (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT RESISTANCE

Measure the resistance of the (F201) Fused Ignition Switch Output (Run-Start) circuit between ground and the Airbag Run-Start fuse terminal (output side).



Is the resistance below 100.0 ohms?

Yes >> Go To 5

No >> Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.
Replace Airbag Run-Start Fuse.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1.

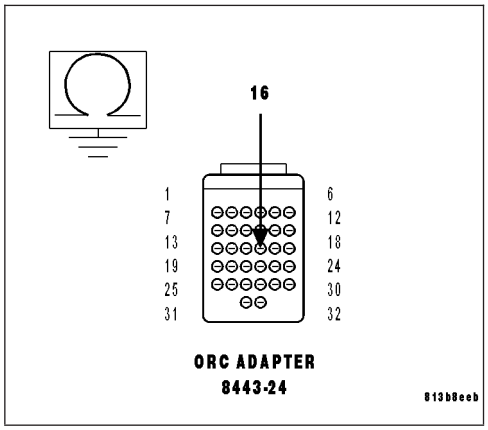
5. CHECK (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT RESISTANCE WITH ORC CONNECTORS DISCONNECTED

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the both ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Connect the Load Tool ORC 8443–24 Adaptor to the ORC C2 connector.

Measure the resistance of the (F201) Fused Ignition Switch Output (Run-Start) circuit between 8443–24 adaptor and ground).



Is the resistance below 100.0 ohms?

Yes >> Go To 6

No >> Replace the ORC in accordance with the Service Information.
Replace the Airbag Run-Start Fuse.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1.

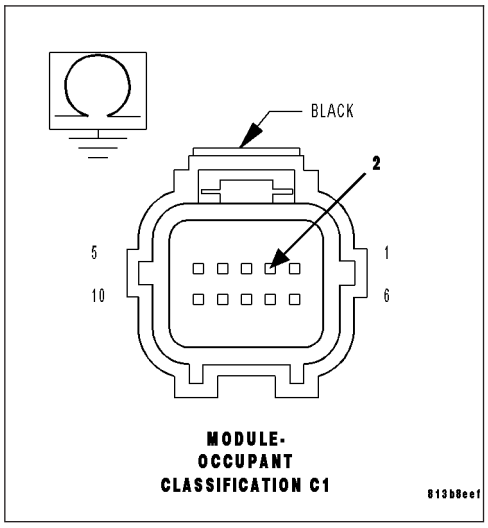
B212C-IGNITION RUN/START INPUT CIRCUIT OPEN (CONTINUED)

6. CHECK (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT RESISTANCE WITH OCM C1 CONNECTOR DISCONNECTED

WARNING: If the Occupant Classification Module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

Disconnect the OCM C1 connector.

Measure the resistance of the (F201) Fused Ignition Switch Output (Run-Start) circuit between ground and the Airbag Run-Start fuse terminal (output side).



Is the resistance below 100.0 ohms?

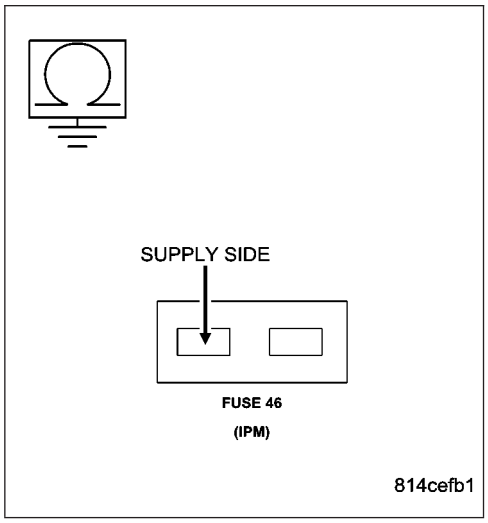
Yes >> Repair the (F201) Fused Ignition Switch Output (Run-Start) circuit for a short to ground.
Replace the Airbag Run-Start Fuse.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1.

No >> Replace the OCM in accordance with the Service Information.
Replace the Airbag Run-Start Fuse.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1.

7. CHECK (F201) IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT FOR AN OPEN

Turn the ignition on.

Measure the voltage of the (F201) Ignition Switch Output (Run-Start) circuit at the Airbag Run-Start fuse terminal (supply side).



Is the voltage above 6.0 volts?

Yes >> Go To 8

No >> Repair the open (F201) Ignition Switch Output (Run-Start) circuit.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1.

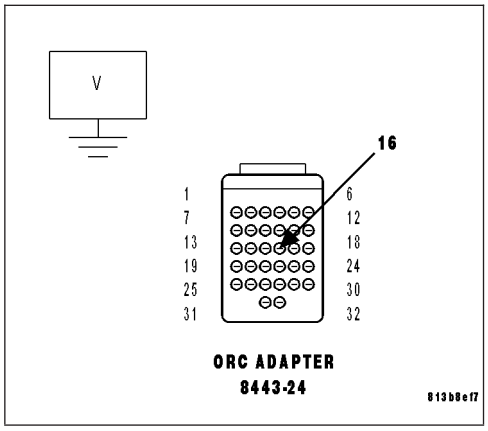
B212C-IGNITION RUN/START INPUT CIRCUIT OPEN (CONTINUED)

8. CHECK (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Reinstall the Airbag Run-Start Fuse.
Disconnect the both ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.
Install the Airbag Load tool ORC 8443–24 adaptor to the ORC C2 connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (F201) Fused Ignition Switch Output (Run-Start) Circuit between the 8443–24 connector and ground.



Is the voltage above 6.0 volts?

Yes >> Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1 if DTC B210C IGNITION RUN/START INPUT CIRCUIT OPEN was Active in the OCM.

No >> Repair the open (F201) Fused Ignition Switch Output (Run-Start) circuit.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1 if DTC B210C IGNITION RUN/START INPUT CIRCUIT OPEN was Active in the OCM.

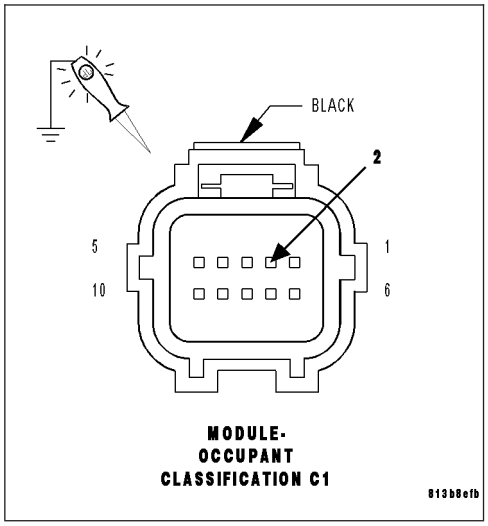
---

9. CHECK (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Reinstall the Airbag Run-Start Fuse.
Disconnect the both Occupant Classification Module (OCM) connectors.

NOTE: Check connectors - Clean and repair as necessary.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (F201) Fused Ignition Switch Output (Run-Start) Circuit between the OCM connector and ground.



Is the voltage above 6.0 volts?

Yes >> Go To 10

No >> Repair the open (F201) Fused Ignition Switch Output (Run-Start) circuit between the OCM and the splice.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1.

B212C-IGNITION RUN/START INPUT CIRCUIT OPEN (CONTINUED)

10. VERIFY THAT DTC B212C IGNITION RUN/START DTC IS ACTIVE.

Reconnect both Occupant Restraints Controller (ORC) connectors.

Reconnect both Occupant Classification Module (OCM) connectors.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, read Occupant Restraint Controller (ORC) DTCs and Occupant Classification Module (OCM) DTCs.

Select the module displaying the active: B212C IGNITION RUN/START INPUT CIRCUIT OPEN?

ORC >> Replace the Occupant Restraint Controller (ORC) in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1 if DTC B212C IGNITION RUN/START INPUT CIRCUIT OPEN was Active in the OCM.

OCM >> Replace the Occupant Classification Module (OCM) in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1.
Perform OCS VERIFICATION TEST - VER 1 if DTC B212C IGNITION RUN/START INPUT CIRCUIT OPEN was Active in the OCM.

---

11. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.
Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

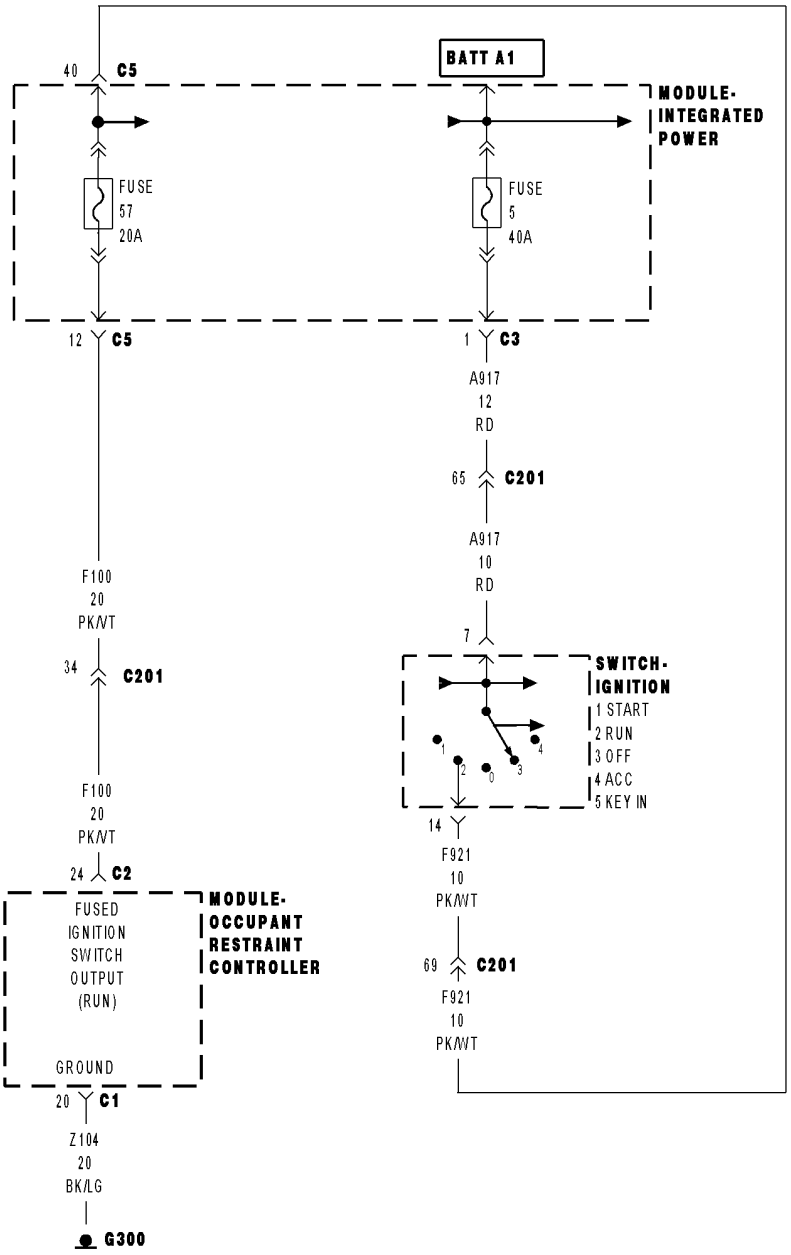
In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

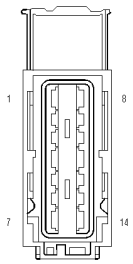
Does the scan tool display any ACTIVE DTCs?

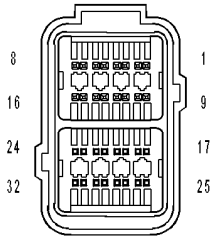
Yes >> Select appropriate symptom from Symptom List.

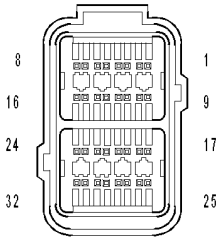
No >> No problem found Erase all codes before returning vehicle to customer.

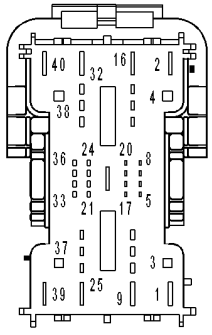
B212D-IGNITION RUN ONLY INPUT CIRCUIT OPEN

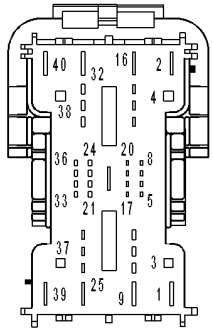



SWITCH-
IGNITION


MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C1


MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2


MODULE-
INTEGRATED
POWER C3


MODULE-
INTEGRATED
POWER C5

8142e650

B212D-IGNITION RUN ONLY INPUT CIRCUIT OPEN (CONTINUED)

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run position.
- **Set Condition:**
  If voltage on the (F100) Fused Ignition Switch Output Run Only circuit drops below 6.0 volts.

Possible Causes
(F100) FUSED IGNITION SWITCH OUTPUT RUN ONLY CIRCUIT OPEN
IGINTION SWITCH OUTPUT RUN CIRCUIT VOLTAGE LOW
FUSE 57 OPEN
(F100) FUSED IGNITION SWITCH OUTPUT RUN ONLY SHORTED TO GROUND
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC B212D IGNITION RUN ONLY INPUT CIRCUIT OPEN IS ACTIVE

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read Occupant Restraint Controller (ORC) DTCs.

Does the scan tool display active: B212D IGNITION RUN ONLY INPUT CIRCUIT OPEN?

Yes >> Go To 2

No >> Go To 7

---

2. INSPECT AIRBAG RUN CIRCUIT FUSE

Turn the ignition off.

Remove the Airbag Run Circuit Fuse No. 57 from the Integrated Power Module.

NOTE: Check connectors - Clean and repair as necessary.

Inspect the fuse.

Is the fuse open?

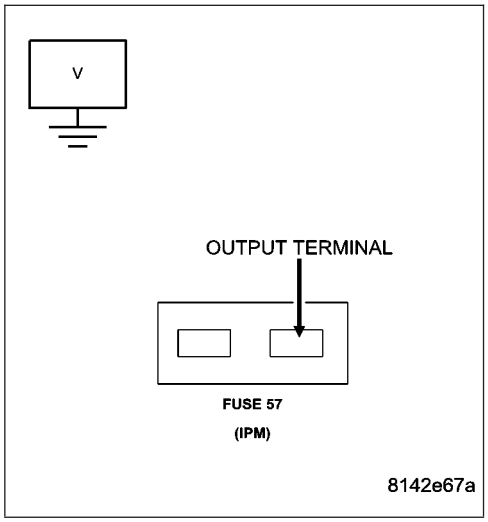
Yes >> Go To 3

No >> Go To 5

B212D-IGNITION RUN ONLY INPUT CIRCUIT OPEN (CONTINUED)

3. CHECK (F100) FUSED IGNITION SWITCH OUTPUT RUN CIRCUIT RESISTANCE

Measure the resistance of the (F100) Run Ignition Switch Output Run between the fuse No. 57 Output terminal and ground.



Is the resistance below 100.0 ohms?

Yes >> Go To 4

No >> Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.
Replace Airbag Run Circuit Fuse.
Perform ORC VERIFICATION TEST - VER 1.

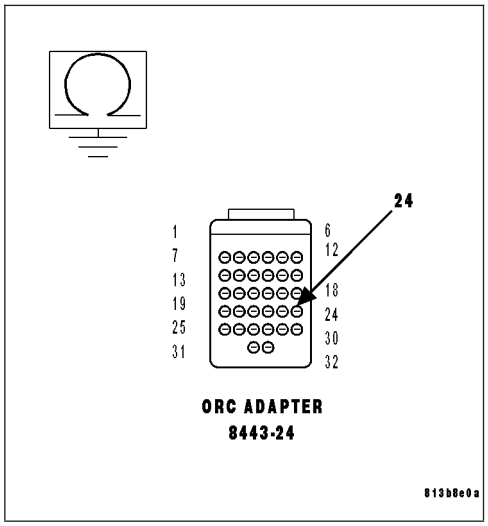
4. CHECK (F100) FUSED IGNITION SWITCH OUTPUT RUN CIRCUIT RESISTANCE WITH ORC C2 CONNECTOR DISCONNECTED

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the ORC C2 connector.

NOTE: Check connectors - Clean and repair as necessary.
Connect the appropriate Load Tool ORC 8443-24 Adaptor to the ORC C2 connector.

Measure the resistance of the (F100) Fused Ignition Switch Output Run circuit between 8443-24 adaptor and ground.



Is the resistance below 100.0 ohms?

Yes >> Repair the (F100) Fused Ignition Switch Output Run circuit for a short to ground.
Replace the Airbag Run Circuit Fuse.
Perform ORC VERIFICATION TEST - VER 1.

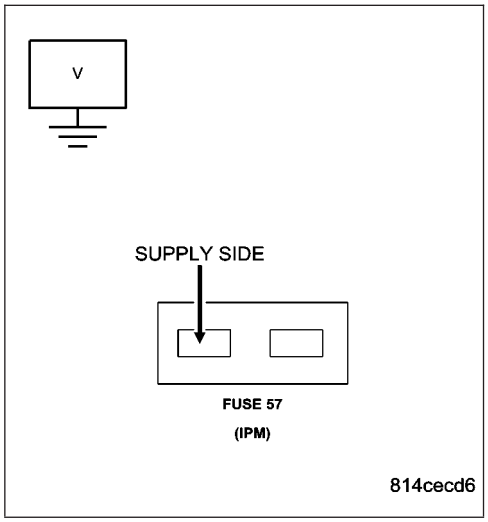
No >> Replace the ORC in accordance with the Service Information.
Replace the Airbag Run Circuit Fuse.
Perform ORC VERIFICATION TEST - VER 1.

B212D-IGNITION RUN ONLY INPUT CIRCUIT OPEN (CONTINUED)

5. CHECK IGNITION SWITCH OUTPUT RUN CIRCUIT VOLTAGE

Turn the ignition on.

Measure the voltage of the Ignition Switch Output Run circuit at the Airbag Run circuit fuse terminal (supply side).



Is the voltage above 6.0 volts?

Yes >> Go To 6

No >> Repair the open Ignition Switch Output Run circuit.Perform ORC VERIFICATION TEST - VER 1.

6. CHECK (F100) FUSED IGNITION SWITCH OUTPUT RUN CIRCUIT FOR AN OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Reinstall the Airbag Run Circuit Fuse.

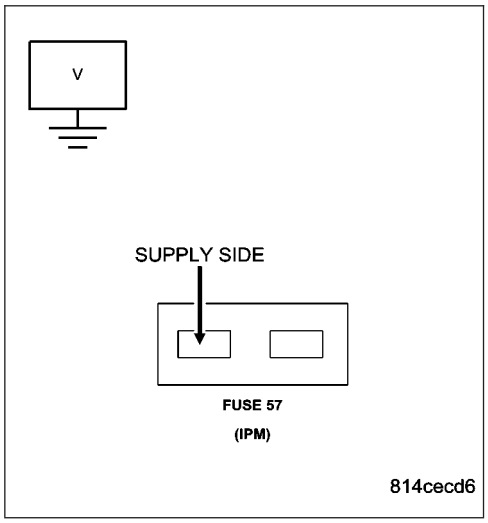
Disconnect the ORC C2 connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the Airbag Load Tool ORC 8443-24 Adaptor to the ORC C2 harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

Measure the voltage of the (F100) Fused Ignition Switch Output Run circuit between the 8443–24 adaptor and ground.



Is the voltage above 6.0 volts?

Yes >> Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1.

No >> Repair the open (F100) Fused Ignition Switch Output Run circuit.
Perform ORC VERIFICATION TEST - VER 1.

B212D-IGNITION RUN ONLY INPUT CIRCUIT OPEN (CONTINUED)

7. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTCs from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return, continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

Does the scan tool display any ACTIVE DTCs?

Yes >> Select appropriate symptom from Symptom List.

No >> No problem found Erase all codes before returning vehicle to customer.

B2201-CALIBRATION MISMATCH

- **When Monitored:**
  With the Ignition on.
- **Set Condition:**
  This DTC will be set when the VIN stored in the PCM does not match the VIN stored in the Occupant Restraint Controller (ORC). The ORC does not support a stored B2201 DTC.

Possible Causes
INCORRECT PCM
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC B2201-CALIBRATION MISMATCH IS ACTIVE

Turn the ignition on.

With the scan tool, read ORC DTCs.

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Does the scan tool display active: B2201-CALIBRATION MISMATCH?

Yes >> Go To 2

No >> Test Complete.

---

2. CHECK VIN IN PCM

With the scan tool compare the VIN that is programmed into the PCM to the VIN stored in the ORC.

Does the VIN programmed into the PCM match the VIN stored in the ORC?

Yes >> Go To 3

No >> Replace and program the Powertrain Control Module in accordance with the service information. Ensure the PCM is replaced with the correct vehicle line PCM.
Perform the POWERTRAIN VERIFICATION TEST.

---

3. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

View repair.

Repair

Replace the Occupant Restraint Controller in accordance with the service information.
Perform the ORC VERIFICATION TEST-VER 1.

B2205-ORIGINAL VIN MISSING/MISMATCH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller will receive and monitor the VIN message from the PCM and record the VIN if different from the last VIN.

Possible Causes
INCORRECT VIN PROGRAMMED IN PCM
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. VERIFY THAT DTC B2205-ORIGINAL VIN MISSING/MISMATCH

Turn the ignition on.

With the scan tool, read ORC DTCs.

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Does the scan tool display active :B2205-ORIGINAL VIN MISSING/MISMATCH?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

---

2. CHECK VIN IN PCM

With the scan tool compare the VIN that is programmed into the PCM to the VIN on the vehicle.

Does the VIN programmed into the PCM match the vehicles VIN?

Yes >> Go To 3

No >> Replace the Powertrain Control Module in accordance with Service Information.
Perform the POWERTRAIN VERIFICATION TEST.

---

3. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

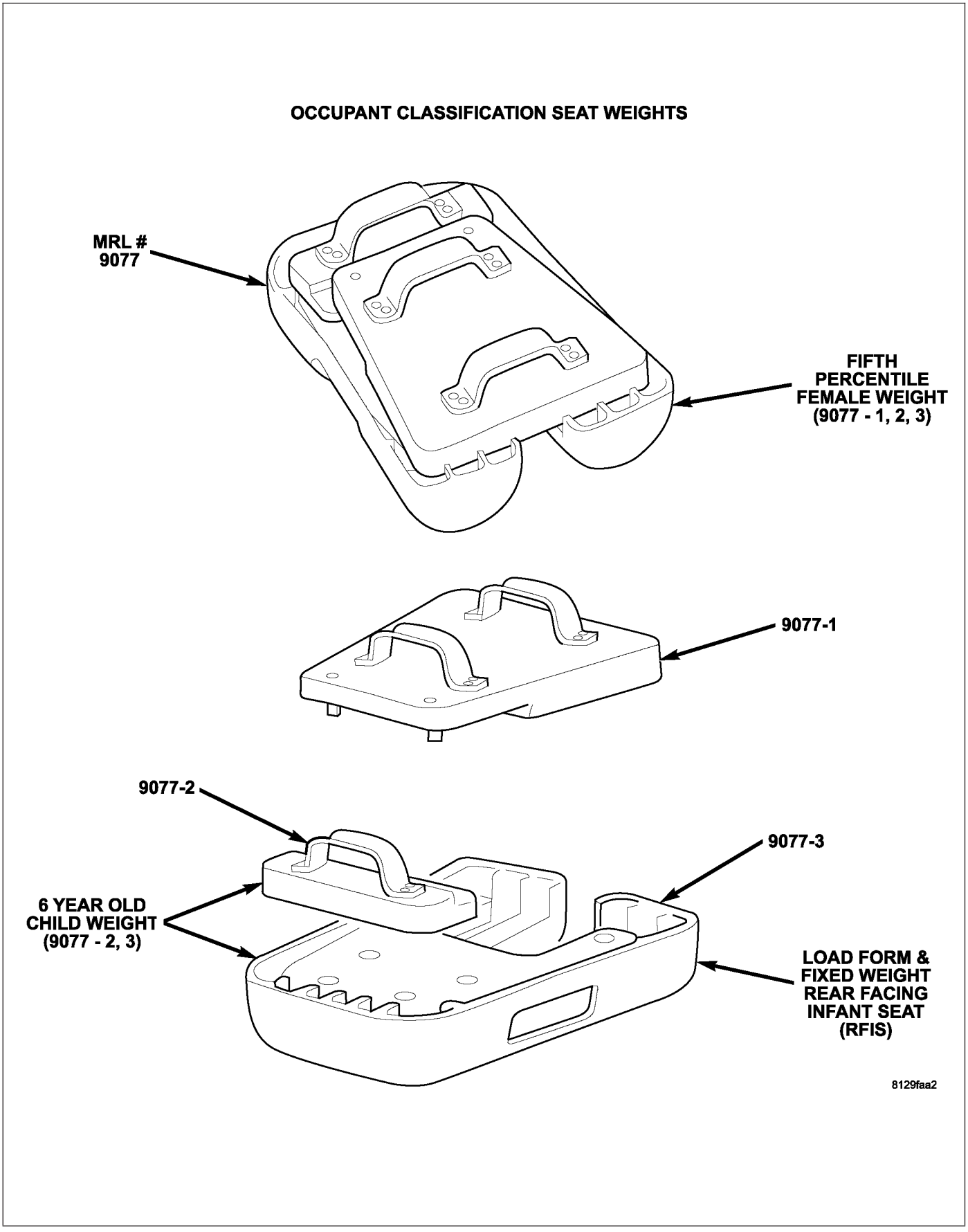
WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

View repair.

Repair

Replace the Occupant Restraint Controller in accordance with the service information.
Perform the ORC VERIFICATION TEST-VER 1.

B2206-CURRENT VIN MISSING/MISMATCH



OCS SEAT WEIGHTS MRL #9077

B2206-CURRENT VIN MISSING/MISMATCH (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During power-up, the ORC and OCM monitors the CAN bus for the VIN message.
- **Set Condition:**
  This DTC will set if the VIN information received from the PCM is different from the stored VIN.

Possible Causes
INCORRECT VIN PROGRAMMED INTO THE PCM
OCCUPANT CLASSIFICATION MODULE (OCM)
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: Troubleshoot any Ignition, Battery, Seat Weight Sensor, or OCM Internal DTCs BEFORE proceeding
NOTE: Ensure that the battery is fully charged.
With the scan tool, read DTCs.

Select the module and DTC type.

OCM-Active
Go To 2

OCM-Stored
Erase stored code(s) with scan tool, test complete.

ORC-Active
Go To 4

ORC-Stored
Erase stored code(s) with scan tool, test complete.

---

2. CHECK THE VIN STORED IN THE PCM

With the scan tool, compare the VIN that is stored in the PCM to the VIN of the vehicle's VIN plate.

Does the VIN stored in the PCM match the vehicle's VIN?

Yes >> Go To 3

No >> Replace and Configure the Powertrain Control Module in accordance with the service information. Perform POWERTRAIN VERIFICATION TEST VER - 5. Refer to (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

B2206-CURRENT VIN MISSING/MISMATCH (CONTINUED)

3. PERFORM OCCUPANT CLASSIFICATION MODULE SYSTEM VERIFICATION TEST

Verify that the passenger seat is empty.

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

NOTE: Failure to follow the test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, proceed as follows.

With the scan tool, read OCM DTCs.

Does the scan tool display active: B2206-CURRENT VIN MISSING/MISMATCH?

Yes >> Replace the OCM in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

No - But Other DTCs Present
Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No - No Active DTCs Present
Perform OCS VERIFICATION TEST - VER 1.

---

4. CHECK THE VIN STORED IN THE PCM

With the scan tool, compare the VIN that is stored in the PCM to the VIN of the vehicle's VIN plate.

Does the VIN stored in the PCM match the vehicle's VIN?

Yes >> Go To 5

No >> Replace and Configure the Powertrain Control Module in accordance with the service information.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5. Refer to (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

---

5. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

View repair.

Repair
Replace the Occupant Restraint Controller in accordance with the service information.
Perform the ORC VERIFICATION TEST-VER 1.

B2207-OCCUPANT RESTRAINT CONTROLLER INTERNAL 1

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.
- **Set Condition:**
  This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

With the scan tool, erase and read ORC DTCs.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and personal injury or death.

When this code is set, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with the Service Information.

Perform the ORC VERIFICATION TEST-VER. 1.

B2208-OCCUPANT RESTRAINT CONTROLLER INTERNAL 2

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.
- **Set Condition:**
  This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

With the scan tool, erase and read ORC DTCs.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and personal injury or death.

When this code is set, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with the Service Information.

Perform the ORC VERIFICATION TEST-VER. 1.

B2209-OCCUPANT RESTRAINT CONTROLLER INTERNAL 3

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.
- **Set Condition:**
  This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

With the scan tool, erase and read ORC DTCs.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and personal injury or death.

When this code is set, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with the Service Information.

Perform the ORC VERIFICATION TEST-VER. 1.

B220A-OCCUPANT RESTRAINT CONTROLLER INTERNAL 4

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.
- **Set Condition:**
  This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

With the scan tool, erase and read ORC DTCs.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and personal injury or death.

When this code is set, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with the Service Information.

Perform the ORC VERIFICATION TEST-VER. 1.

B220B-OCCUPANT RESTRAINT CONTROLLER FIRING STORED ENERGY

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.
- **Set Condition:**
  This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

With the scan tool, erase and read ORC DTCs.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions can result in accidental airbag deployment and personal injury or death.

When this code is set, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with the Service Information.

Perform the ORC VERIFICATION TEST-VER. 1.

B220C-OCCUPANT RESTRAINT CONTROLLER ACCELEROMETER 1 INTERNAL

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.
- **Set Condition:**
  This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

With the scan tool, erase and read ORC DTCs.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions can result in accidental airbag deployment and personal injury or death.

When this code is set, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with the Service Information.

Perform the ORC VERIFICATION TEST-VER. 1.

B220D-OCCUPANT RESTRAINT CONTROLLER ACCELEROMETER 2 INTERNAL

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.
- **Set Condition:**
  This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

With the scan tool, erase and read ORC DTCs.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions can result in accidental airbag deployment and personal injury or death.

When this code is set, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with the Service Information.

Perform the ORC VERIFICATION TEST-VER. 1.

B220F-OCCUPANT RESTRAINT CONTROLLER CONTROL DRIVER 1

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.
- **Set Condition:**
  This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

With the scan tool, erase and read ORC DTCs.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions can result in accidental airbag deployment and personal injury or death.

When this code is set, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with the Service Information.

Perform the ORC VERIFICATION TEST-VER. 1

B2210-OCCUPANT RESTRAINT CONTROLLER CONTROL DRIVER 2

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.
- **Set Condition:**
  This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

With the scan tool, erase and read ORC DTCs.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions can result in accidental airbag deployment and personal injury or death.

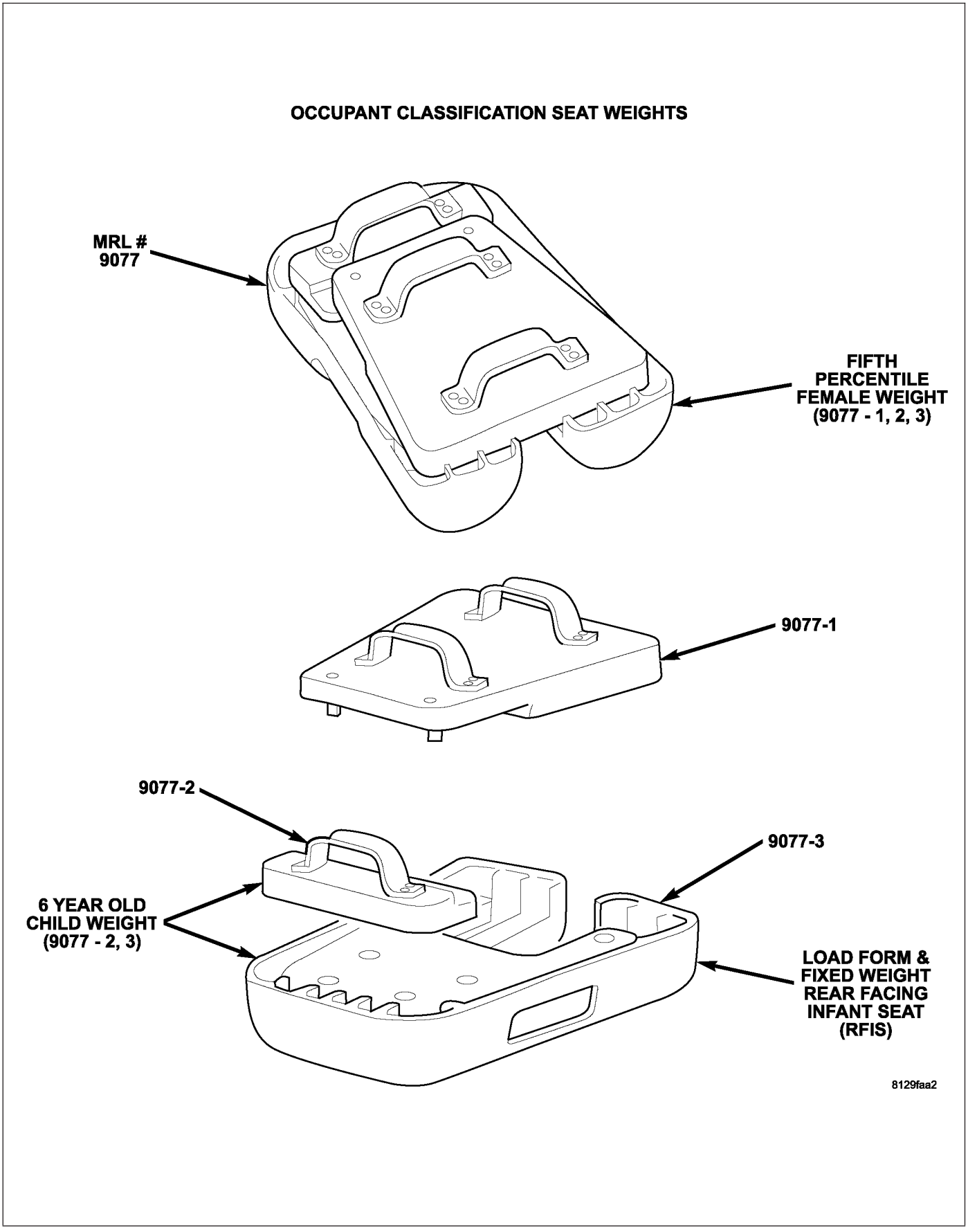
When this code is set, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with the Service Information.

Perform the ORC VERIFICATION TEST-VER. 1

B2212-OCCUPANT CLASSIFICATION MODULE INTERNAL



OCS SEAT WEIGHTS MRL #9077

B2212-OCCUPANT CLASSIFICATION MODULE INTERNAL (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the IGN status is RUN or SNA, while the CAN bus system voltage is between 10 and 16 volts, and during the OCS Verification Test.
- **Set Condition:**
  This DTC will set if the module detects an internal failure.

Possible Causes
OCCUPANT CLASSIFICATION MODULE

Diagnostic Test

1. PERFORM THE OCCUPANT CLASSIFICATION MODULE VERIFICATION TEST

NOTE: Ensure that the passenger seat is empty.

NOTE: Ensure that all seat and strain gauge sensor bolts are properly torqued.

With the scan tool, erase OCM DTCs.

Turn the ignition off, wait 10 seconds and turn ignition on.

With the scan tool, read OCM DTCs.

Did the DTC: B2212-OCCUPANT CLASSIFICATION MODULE INTERNAL reset?

Yes >> Go To 2

No >> Perform the OCS VERIFICATION TEST-VER 1.

---

2. PERFORM OCCUPANT CLASSIFICATION MODULE SYSTEM VERIFICATION TEST

Verify that the passenger seat is empty.

Verify that all of the Seat Weight Sensor mounting screws are torqued to specification. Refer to 23 - BODY/SEATS.

NOTE: Failure to follow the test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed on the scan tool. When the test is complete, proceed as follows.

With the scan tool, read OCM DTCs.

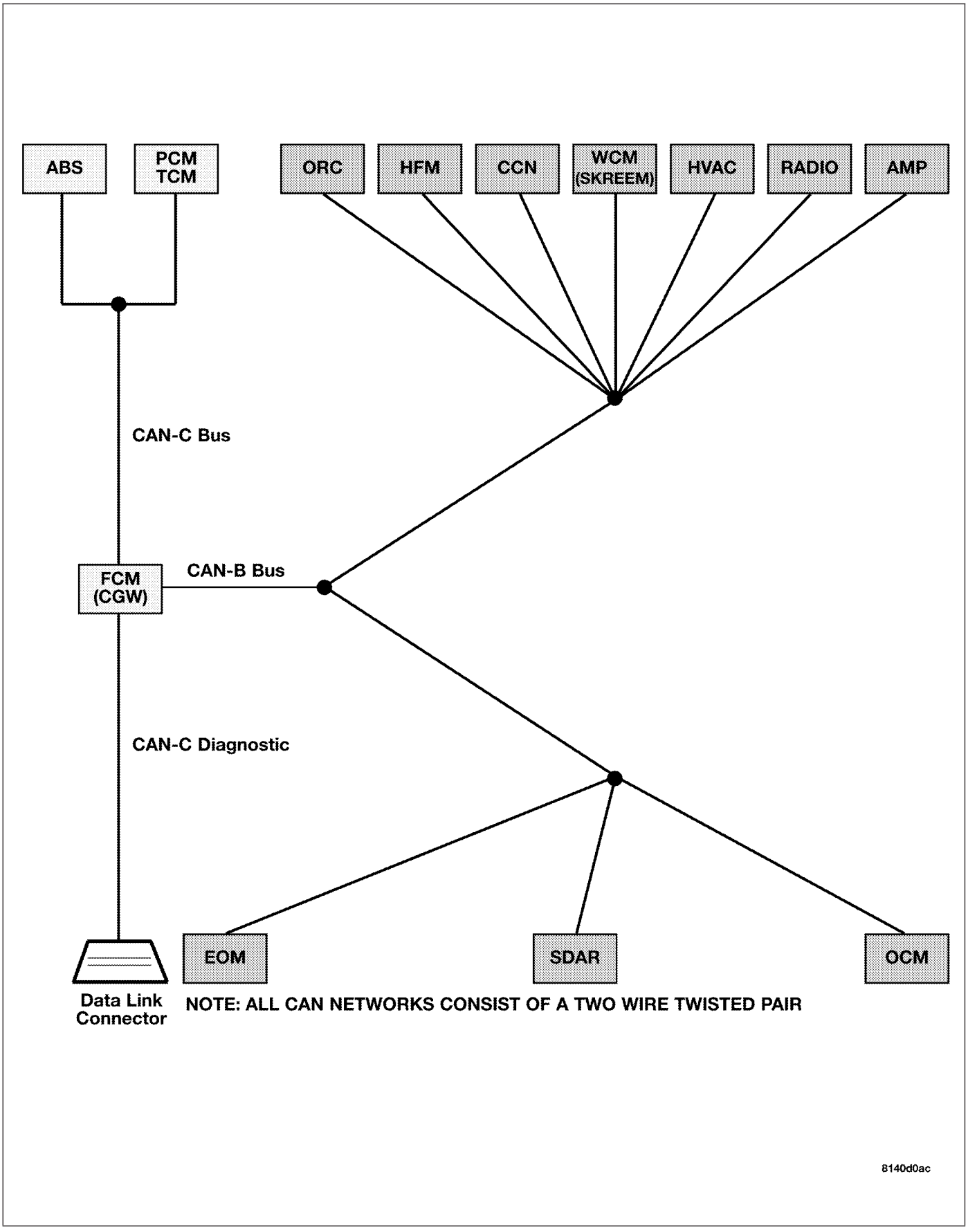
Does the scan tool display any active DTCs?

Yes >> B2212 is ACTIVE? Replace the Occupant Classification Module in accordance with the service information.

Yes >> Other DTCs ACTIVE? Diagnose and repair the DTCs. Refer to the Table of Contents in this Section for a complete list of symptoms.

No >> Perform OCS VERIFICATION TEST - VER 1.

B223B-VEHICLE CONFIGURATION MISMATCH



B223B-VEHICLE CONFIGURATION MISMATCH (CONTINUED)

For the Airbag circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Front Control Module sends a message to the Occupant Restraint Controller (ORC) that the vehicle is not equipped with an Occupant Classification Module (OCM) but the ORC is receiving OCM messages over the Can B bus.

Possible Causes
INCORRECT PCM
OCCUPANT RESTRAINT CONTROLLER

Diagnostic Test

1. VERIFY THAT DTC B223B-VEHICLE CONFIGURATION MISMATCH IS ACTIVE

Turn the ignition on.

With the scan tool, read ORC DTCs.

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Does the scan tool display active: B223B-VEHICLE CONFIGURATION MISMATCH?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.
Perform the ORC VERIFICATION TEST-VER. 1

---

2. COMPARE STORED VINS IN THE PCM AND ORC

With the scan tool, read and record the VIN that is stored in the PCM.

With the scan tool, read and record the VIN that is stored in the ORC.

Do the VINs stored in the PCM and ORC match?

Yes >> Go To 3

No >> Replace and program the Powertrain Control Module in accordance with the Service Information. Ensure the PCM is replaced with the correct VIN.

---

3. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

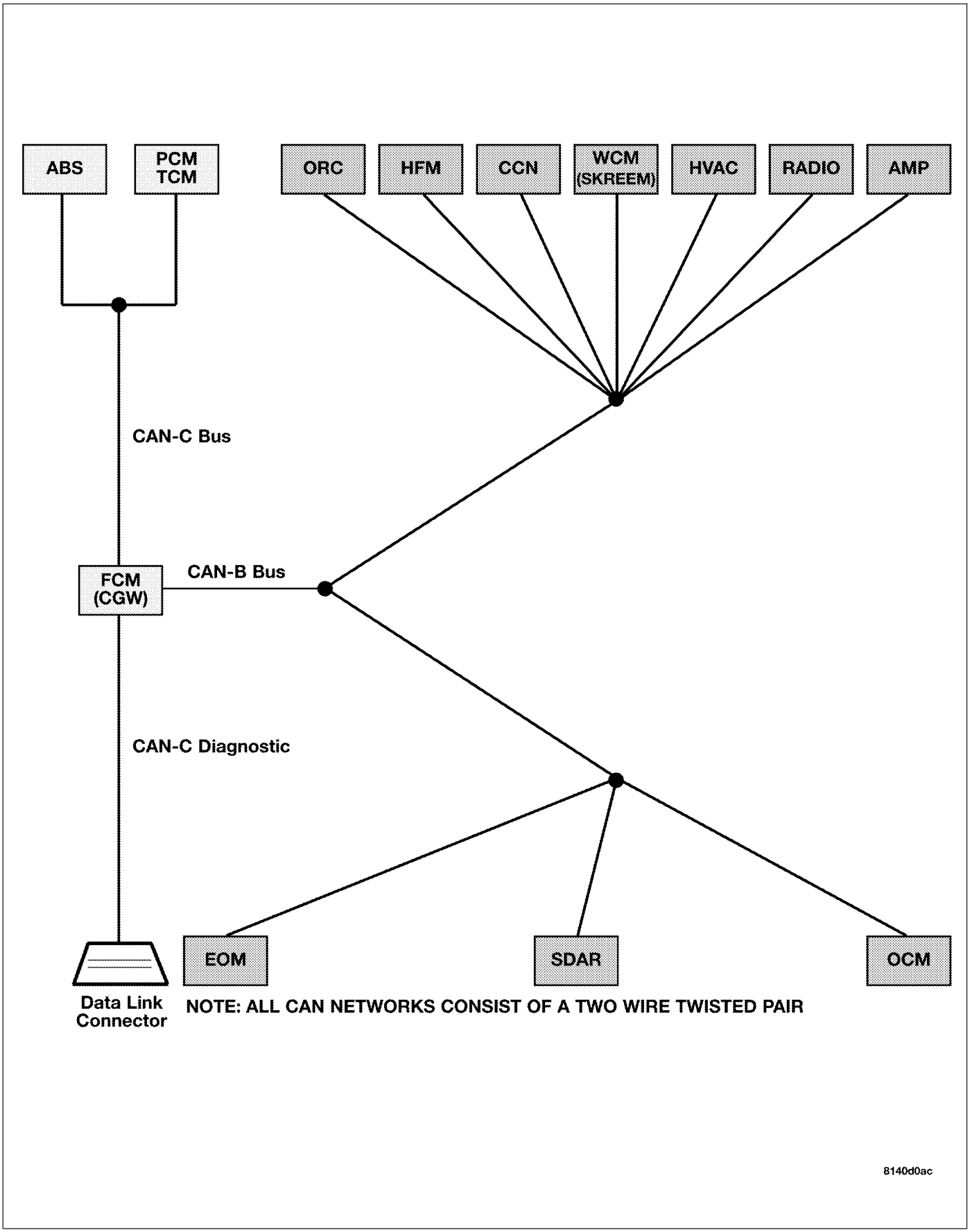
WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

View repair

Repair

Replace the Occupant Restraint Controller in accordance with the service information.
Perform the ORC VERIFICATION TEST-VER 1.

B223D-OCCUPANT CLASSIFICATION MODULE DTC PRESENT



B223D-OCCUPANT CLASSIFICATION MODULE DTC PRESENT (CONTINUED)

For the Occupant Classification System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  This DTC will set if the ORC receives a bus message with the active OCM DTC Present bit set.

Possible Causes
ACTIVE DTC IN OCCUPANT CLASSIFICATION MODULE
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. ACTIVE OR STORED DTC

With the scan tool, read the OCCUPANT RESTRAINT CONTROLLER active DTCs.

Is the B223D-OCCUPANT CLASSIFICATION MODULE DTC active?

Yes >> Go To 2

No >> With the scan tool, perform the ORC VERIFICATION TEST VER 1.

---

2. ACTIVE DTC IN OCCUPANT CLASSIFICATION MODULE

With the scan tool, read the OCCUPANT CLASSIFICATION MODULE active DTCs.

Are there any active DTC present?

Yes >> Refer to the symptom list for problems related to the OCCUPANT CLASSIFICATION MODULE (OCM).

No >> Go To 3

---

3. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

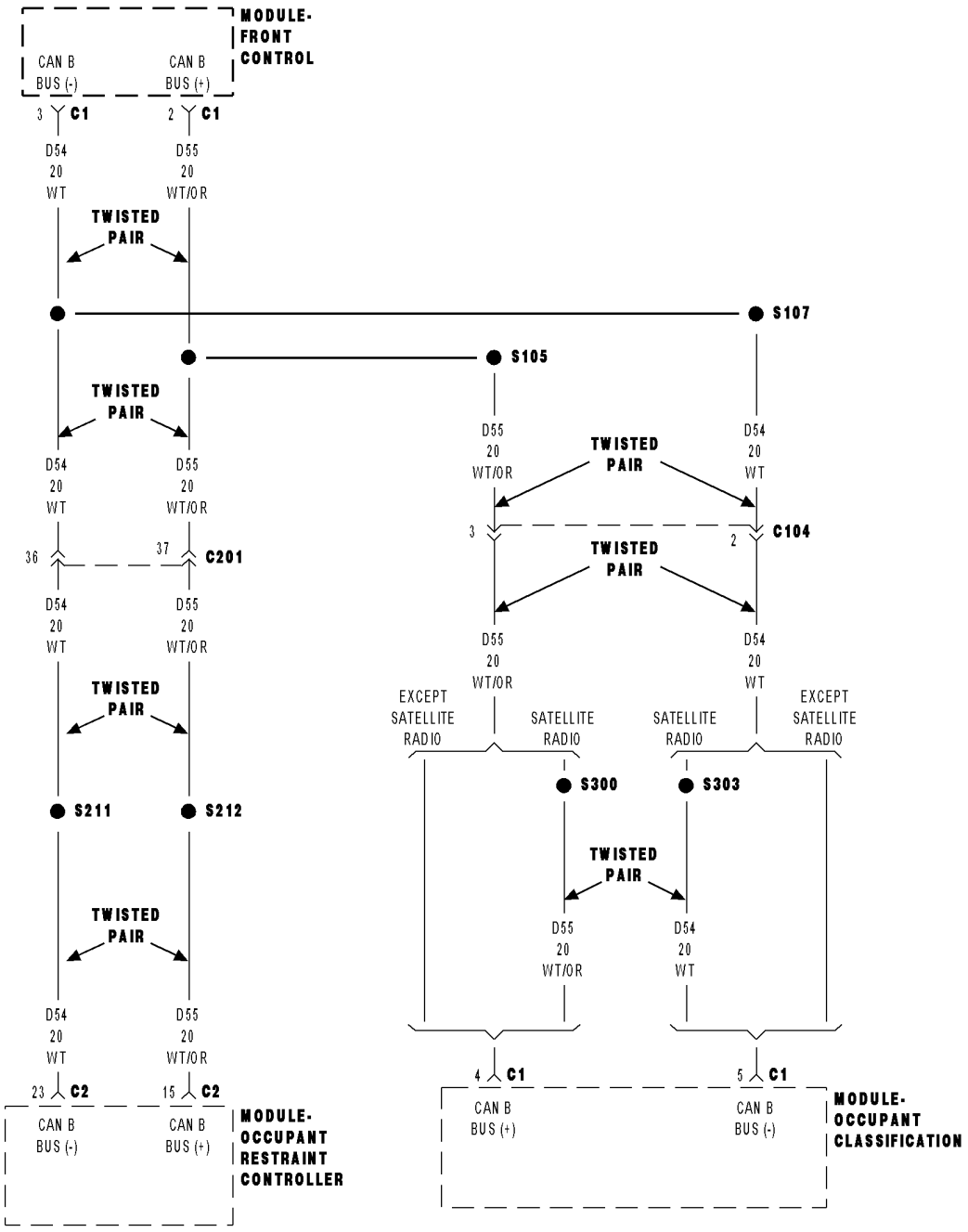
WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

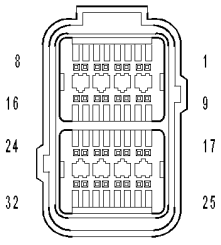
If there are no possible causes remaining, view repair.

Repair

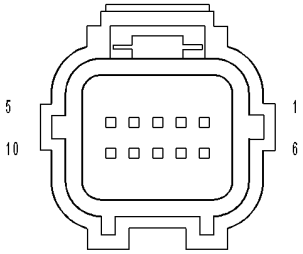
Replace the Occupant Restraint Controller in accordance with Service Instructions.
Perform the ORC VERIFICATION TEST - VER 1.

U0019–CAN B BUS

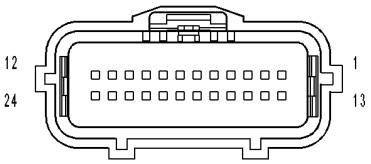




MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2



MODULE-
OCCUPANT
CLASSIFICATION C1



MODULE-
FRONT
CONTROL C1

814cf1c1

U0019–CAN B BUS (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  Whenever the CAN B Bus (+) or CAN B Bus (-) circuit is open, shorted to voltage, or shorted to ground.

Possible Causes
ACTIVE U0019 CAN B BUS DTC IN FRONT CONTROL MODULE
(D55) CAN B BUS (+) CIRCUIT OPEN
(D54) CAN B BUS (-) CIRCUIT OPEN
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY DTC U0019–CAN B BUS IS ACTIVE

Turn the ignition on.

With the scan tool, read Occupant Restraint Controller (ORC) DTCs.

Does the scan tool display active: U0019–CAN B BUS?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition by inspecting the related wiring harness for chaffed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.
Perform ORC VERIFICATION TEST – VER 1.

---

2. CHECK FOR ACTIVE CAN B BUS RELATED DTCS IN THE FRONT CONTROL MODULE (FCM)

With the scan tool, read Front Control Module (FCM) DTCs

Does the scan tool display any active CAN B BUS related DTCs?

Yes >> Diagnose and repair the DTC(s). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

No >> Go To 3

U0019–CAN B BUS (CONTINUED)

3. CHECK (D55) CAN B BUS (+) CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the negative battery cable.

Disconnect the ORC C2 connector.

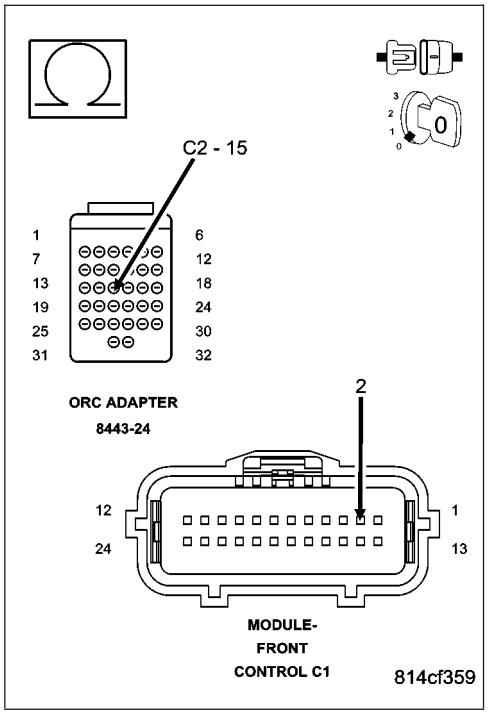
Disconnect the Front Control Module (FCM) C1 connector.

Measure the resistance of the (D55) CAN B Bus (+) circuit between the Front Control Module C1 connector and the ORC C2 connector.

Is the resistance below 2.0 ohms?

Yes >> Go To 4

No >> Repair the (D55) CAN B Bus (+) circuit for an open.
Perform ORC VERIFICATION TEST - VER 1.



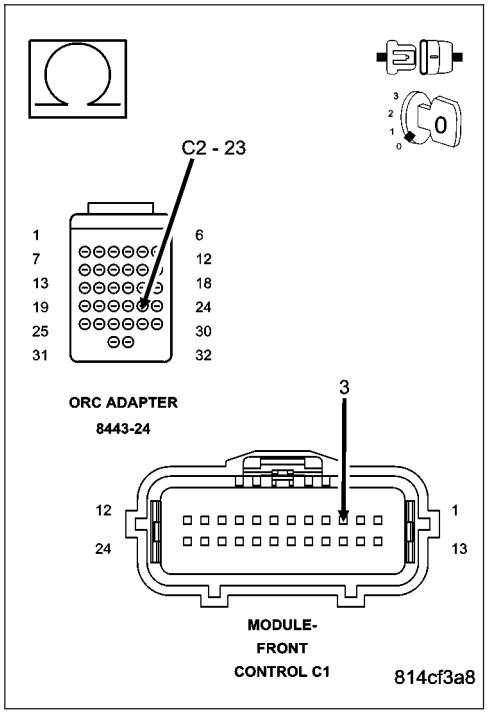
4. CHECK (D54) CAN B BUS (–) CIRCUIT FOR AN OPEN

Measure the resistance of the (D54) CAN B Bus (–) circuit between the Front Control Module C1 connector and the ORC C2 connector.

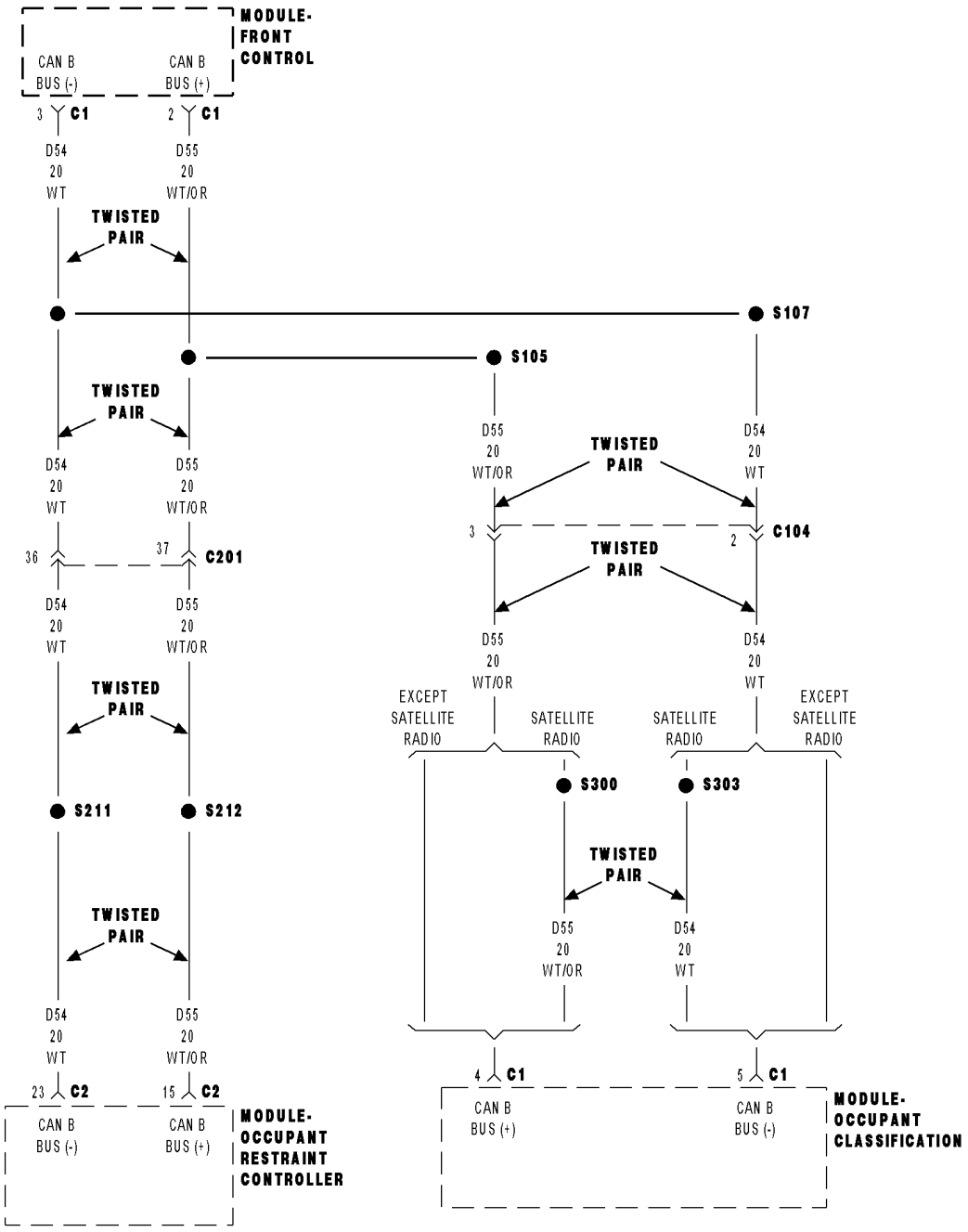
Is the resistance below 2.0 ohms?

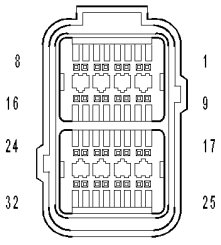
Yes >> Replace the ORC in accordance with the Service Information.
Perform ORC VERIFICATION TEST - VER 1.

No >> Repair the (D54) CAN B Bus (–) circuit for an open.
Perform ORC VERIFICATION TEST - VER 1.

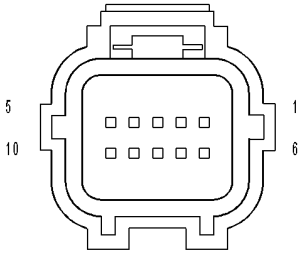


U0020-CAN B BUS OFF PERFORMANCE

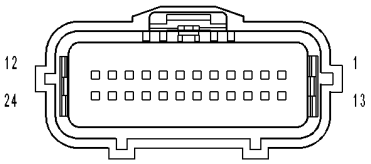




MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2



MODULE-
OCCUPANT
CLASSIFICATION C1



MODULE-
FRONT
CONTROL C1

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U0020-CAN B BUS OFF PERFORMANCE (CONTINUED)

For the Air Bag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  Whenever the CAN B Bus (+) or CAN B Bus (-) circuit is open, shorted to voltage, or shorted to ground.

Possible Causes
ACTIVE U0020 CAN B BUS DTC IN OCCUPANT CLASSIFICATION MODULE
(D55) CAN B BUS (+) CIRCUIT OPEN
(D54) CAN B BUS (-) CIRCUIT OPEN
OCCUPANT CLASSIFICATION MODULE (OCM)

Diagnostic Test

1. VERIFY DTC U0020–CAN B BUS IS ACTIVE

Turn the ignition on.

With the scan tool, read Occupant Classification Module (OCM) DTCs.

Does the scan tool display active: U0019–CAN B BUS?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition by inspecting the related wiring harness for chaffed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.
Perform ORC VERIFICATION TEST – VER 1.

---

2. CHECK FOR ACTIVE CAN B BUS RELATED DTCS IN THE FRONT CONTROL MODULE (FCM)

With the scan tool, read Front Control Module (FCM) DTCs

Does the scan tool display any active CAN B BUS related DTCs?

Yes >> Diagnose and repair the DTC(s). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).

No >> Go To 3

U0020-CAN B BUS OFF PERFORMANCE (CONTINUED)

3. CHECK (D55) CAN B BUS (+) CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the negative battery cable.

Disconnect the OCM C1 connector.

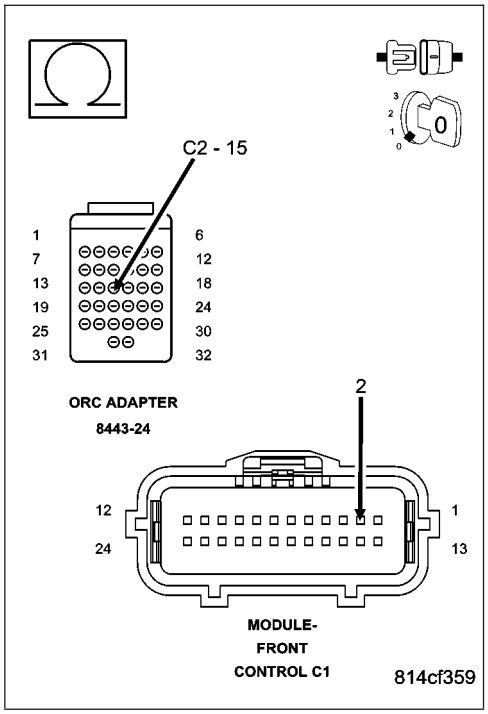
Disconnect the Front Control Module (FCM) C1 connector.

Measure the resistance of the (D55) CAN B Bus (+) circuit between the Front Control Module C1 connector and the OCM C1 connector.

Is the resistance below 2.0 ohms?

Yes >> Go To 4

No >> Repair the (D55) CAN B Bus (+) circuit for an open.
Perform ORC VERIFICATION TEST - VER 1.



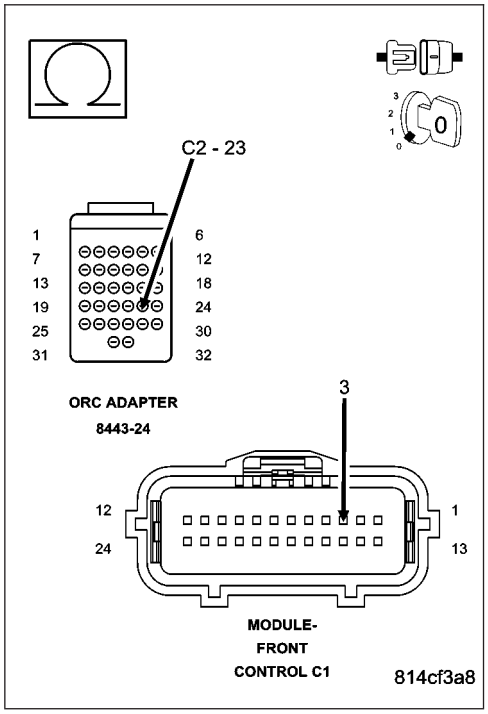
4. CHECK (D54) CAN B BUS (–) CIRCUIT FOR AN OPEN

Measure the resistance of the (D54) CAN B Bus (–) circuit between the Front Control Module C1 connector and the OCM C1 connector.

Is the resistance below 2.0 ohms?

Yes >> Replace the OCM in accordance with the Service Information.
Perform OCS VERIFICATION TEST - VER 1.

No >> Repair the (D54) CAN B Bus (–) circuit for an open.
Perform ORC VERIFICATION TEST - VER 1.



U0022-CAN B BUS (+) CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0023-CAN B BUS (+) CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0026-CAN B BUS (-) CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE SYSTEM (ABS) CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0151-LOST COMMUNICATION WITH OCCUPANT RESTRAINT CONTROLLER (ORC)

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0154-LOST COMMUNICATION WITH OCCUPANT CLASSIFICATION MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0155-LOST COMMUNICATION WITH CLUSTER/CCN

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0156-LOST COMMUNICATION WITH EOM

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0164-LOST COMMUNICATION WITH HVAC CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

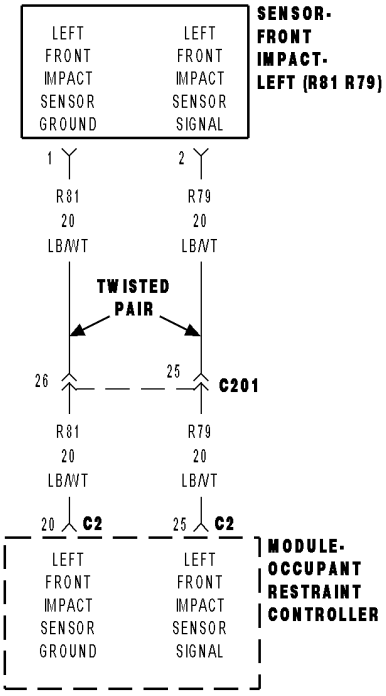
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

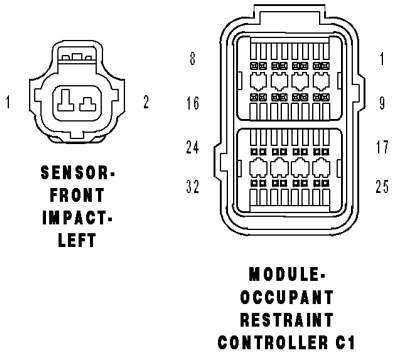
U0168-LOST COMMUNICATION WITH VEHICLE SECURITY CONTROL MODULE (SKREEM/WCM)

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0170-LOST COMMUNICATION W/UP-FRONT LEFT SATELLITE ACCELERATION SENSOR





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U0170-LOST COMMUNICATION W/UP-FRONT LEFT SATELLITE ACCELERATION SENSOR (CONTINUED)

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Occupant Restraint Controller (ORC) continuously communicates with the Front Left Impact Sensor over the sensor signal circuit. The sensor communication and on board diagnostics are powered by the ORC signal.
- **Set Condition:**
  This code will set, if the ORC and the Front Left Impact Sensor do not establish and maintain valid data communications.

Possible Causes
(R79) SIGNAL CIRCUIT SHORTED TO BATTERY
(R79) SIGNAL CIRCUIT SHORTED TO GROUND
(R79, R81) FRONT LEFT IMPACT SENSOR CIRCUITS SHORTED TOGETHER
(R81) FRONT LEFT IMPACT SENSOR GROUND CIRCUIT OPEN
(R79) FRONT LEFT IMPACT SENSOR SIGNAL CIRCUIT OPEN
ORC, FRONT LEFT IMPACT SENSOR

Diagnostic Test

1. VERIFY THAT DTC U0170-LOST COMMUNICATION W/UP-FRONT LEFT SATELLITE ACCELERATION SENSOR IS ACTIVE

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read ORC DTCs.

Does the scan tool display active:U0170-LOST COMMUNICATION W/UP-FRONT LEFT SATELLITE ACCELERATION SENSOR?

Yes >> Go To 2

No >> Go To 9

U0170-LOST COMMUNICATION W/UP-FRONT LEFT SATELLITE ACCELERATION SENSOR (CONTINUED)

2. CHECK THE (R79, R81) FRONT LEFT IMPACT SENSOR SIGNAL AND GROUND CIRCUITS FOR A SHORT TO BATTERY

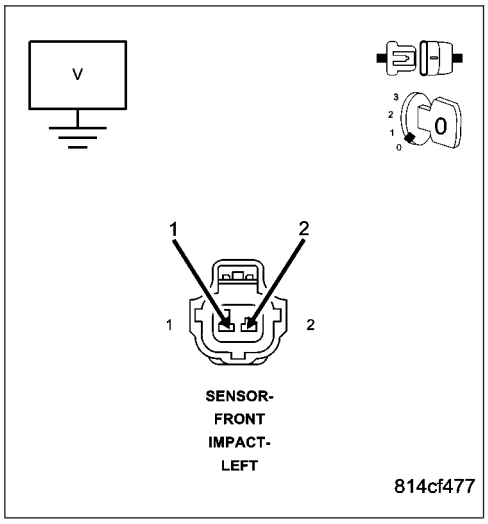
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Front Left Impact Sensor connector.
Disconnect the ORC connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R79) Front Left Impact Sensor Signal circuit and (R81) Sensor Ground circuit at the Front Left Impact Sensor connector and ground.

Is there any voltage present?

Yes >> Repair the (R79, R81) Front Left Impact Sensor circuits for a short to battery.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 3



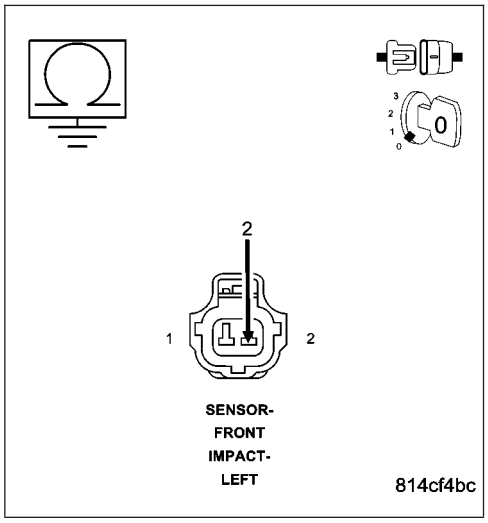
3. CHECK THE (R79) FRONT LEFT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Measure the resistance of the (R79) Front Left Impact Sensor Signal circuit between the Front Left Impact Sensor connector and ground.

Is the resistance below 100K ohms?

Yes >> Repair the (R79) Front Left Impact Sensor Signal circuit for a short to ground.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 4



U0170-LOST COMMUNICATION W/UP-FRONT LEFT SATELLITE ACCELERATION SENSOR (CONTINUED)

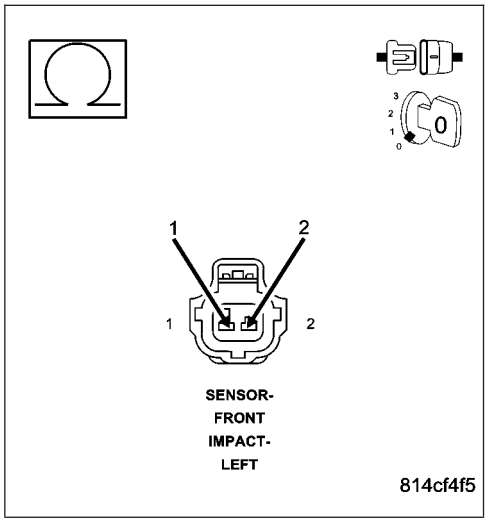
4. CHECK THE (R79, R81) FRONT LEFT IMPACT SENSOR CIRCUITS FOR A SHORT TOGETHER

Measure the resistance between the (R79) Front Left Impact Sensor Signal and (R81) Sensor Ground circuits at the Front Left Impact Sensor connector.

Is the resistance below 100K ohms?

Yes >> Repair the (R79, R81) Front Left Impact Sensor circuits shorted together.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 5



5. CHECK THE (R81) FRONT LEFT IMPACT SENSOR GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

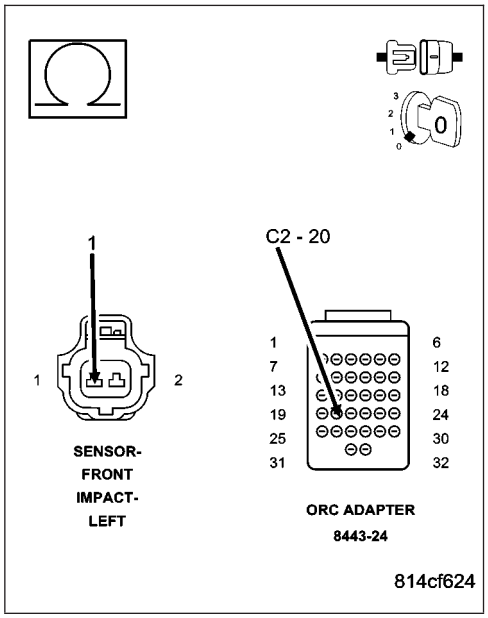
Connect the 8443 Load Tool ORC Adaptor to the Occupant Restraint Control Module connector.

Measure the resistance of the (R81) Front Left Impact Sensor Ground circuit between the Front Left Impact Sensor connector and the 8443 Load Tool ORC Adaptor.

Is the resistance below 1 ohm?

Yes >> Go To 6

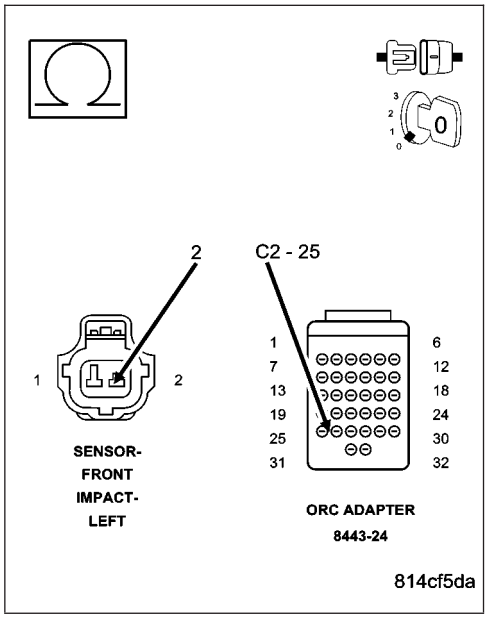
No >> Repair the (R81) Front Left Impact Sensor 1 Ground circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.



U0170-LOST COMMUNICATION W/UP-FRONT LEFT SATELLITE ACCELERATION SENSOR (CONTINUED)

6. CHECK THE (R79) FRONT LEFT IMPACT SENSOR CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R79) Front Left Impact Sensor Ground circuit between the Front Left Impact Sensor connector and the 8443 Load Tool ORC Adaptor.



Is the resistance below 1 ohm?

Yes >> Go To 7

No >> Repair the (R79) Front Left Impact Sensor Signal circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.

7. CHECK OPERATION OF THE FRONT LEFT IMPACT SENSOR

Replace the Front Left Impact Sensor.

Reconnect the vehicle body harness to the impact sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

Connect the scan tool to the Data Link Connector - use the most current software available.

Use the scan tool and erase the stored codes in all airbag system modules.

Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.

Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active Front Left Impact Sensor DTC return?

Yes >> Go To 8

No >> Repair is complete.
Perform the ORC VERIFICATION TEST - VER 1.

8. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

View repair

Repair

Replace the Occupant Restraint Controller in accordance with Service Information.
Perform the ORC VERIFICATION TEST - VER 1.

U0170-LOST COMMUNICATION W/UP-FRONT LEFT SATELLITE ACCELERATION SENSOR (CONTINUED)

9. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

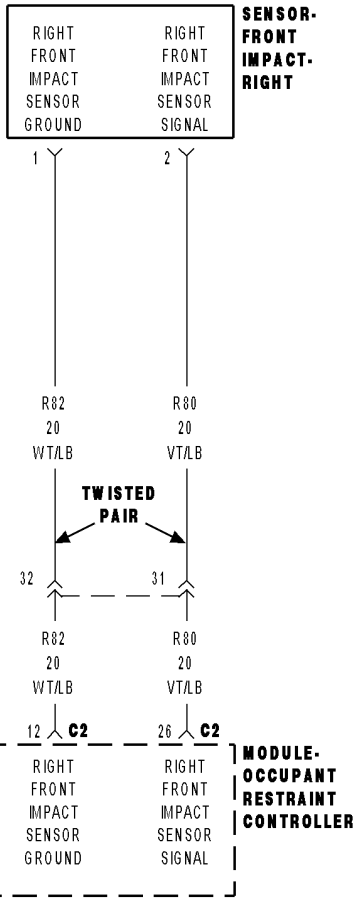
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

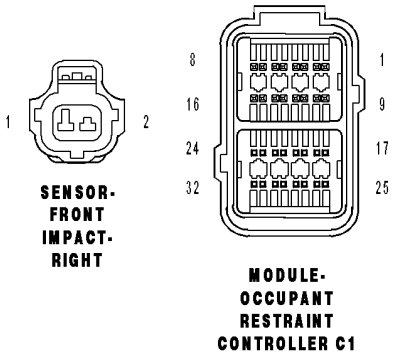
Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

U0171-LOST COMMUNICATION W/UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR





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U0171-LOST COMMUNICATION W/UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR (CONTINUED)

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Occupant Restraint Controller (ORC) continuously communicates with the Front Right Impact Sensor over the sensor signal circuit. The sensor communication and on board diagnostics are powered by the ORC signal.
- **Set Condition:**
  This code will set, if the ORC and the Front Right Impact Sensor do not establish and maintain valid data communications.

Possible Causes
(R80) SIGNAL CIRCUIT SHORTED TO BATTERY
(R80) SIGNAL CIRCUIT SHORTED TO GROUND
(R80, R82) FRONT RIGHT IMPACT SENSOR CIRCUITS SHORTED TOGETHER
(R82) FRONT RIGHT IMPACT SENSOR GROUND CIRCUIT OPEN
(R80) FRONT RIGHT IMPACT SENSOR SIGNAL CIRCUIT OPEN
ORC, FRONT RIGHT IMPACT SENSOR

Diagnostic Test

1. VERIFY THAT DTC U0171-LOST COMMUNICATION W/UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR IS ACTIVE

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read ORC DTCs.

Does the scan tool display active: U0171-LOST COMMUNICATION W/UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR?

Yes >> Go To 2

No >> Go To 9

U0171-LOST COMMUNICATION W/UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR (CONTINUED)

2. CHECK THE (R80, R82) FRONT RIGHT IMPACT SENSOR SIGNAL AND GROUND CIRCUITS FOR A SHORT TO BATTERY

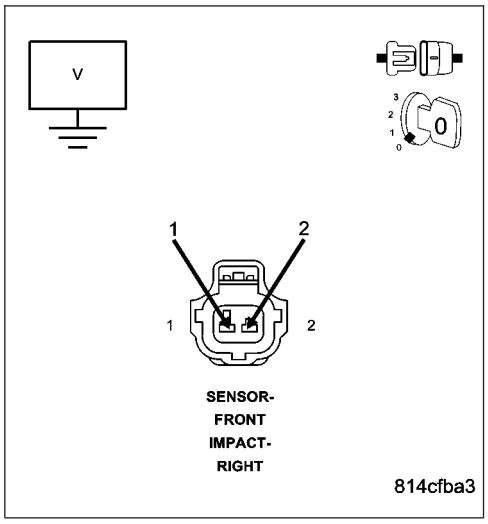
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Front Right Impact Sensor connector.
Disconnect the ORC connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R80) Front Right Impact Sensor Signal circuit and (R82) Sensor Ground circuit at the Front Right Impact Sensor connector and ground.

Is there any voltage present?

Yes >> Repair the (R80, R82) Front Right Impact Sensor circuits for a short to battery.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 3



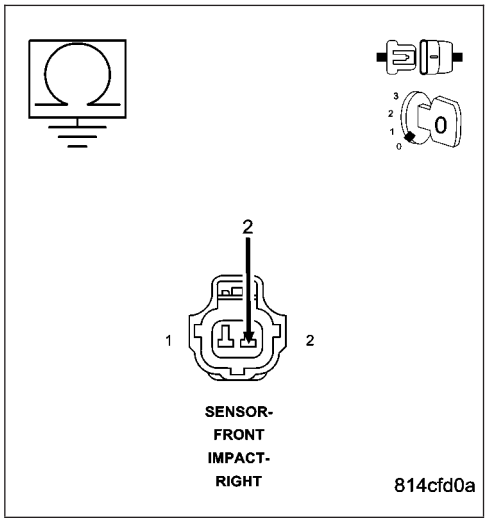
3. CHECK THE (R80) FRONT RIGHT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn ignition on, then reconnect the battery.
Measure the resistance of the (R80) Front Right Impact Sensor Signal circuit between the Front Right Impact Sensor connector and ground.

Is the resistance below 100K ohms?

Yes >> Repair the (R80) Front Right Impact Sensor Signal circuit for a short to ground.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 4



U0171-LOST COMMUNICATION W/UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR (CONTINUED)

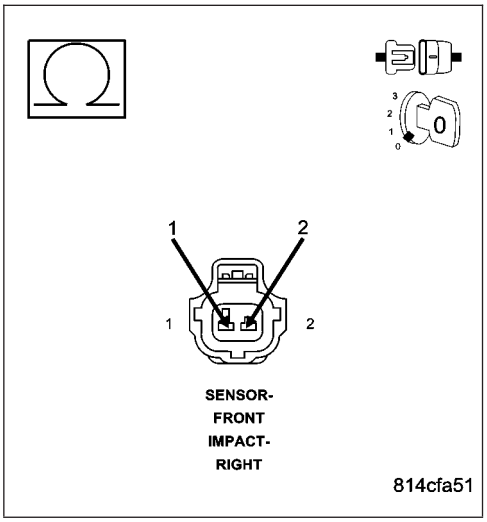
4. CHECK THE (R80, R82) FRONT RIGHT IMPACT SENSOR CIRCUITS FOR A SHORT TOGETHER

Measure the resistance between the (R80) Front Right Impact Sensor Signal and (R82) Sensor Ground circuits at the Front Right Impact Sensor connector.

Is the resistance below 100K ohms?

Yes >> Repair the (R80, R82) Front Right Impact Sensor circuits shorted together.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 5



5. CHECK THE (R82) FRONT RIGHT IMPACT SENSOR GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

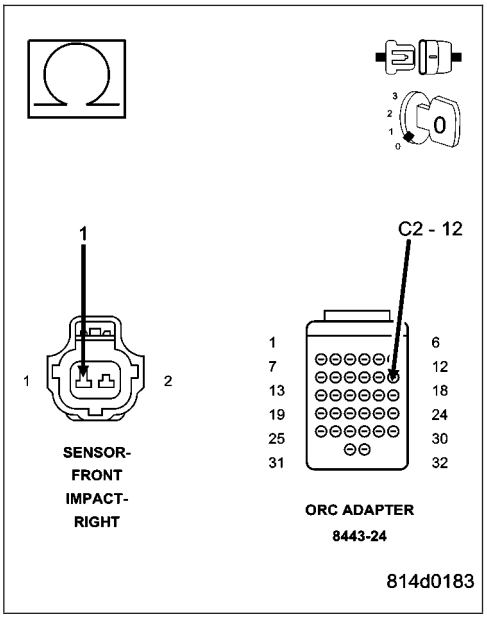
Connect the 8443 Load Tool ORC Adaptor to the Occupant Control Module connector.

Measure the resistance of the (R82) Front Right Impact Sensor Ground circuit between the Front Right Impact Sensor connector and the 8443 Load Tool ORC Adaptor.

Is the resistance below 1 ohm?

Yes >> Go To 6

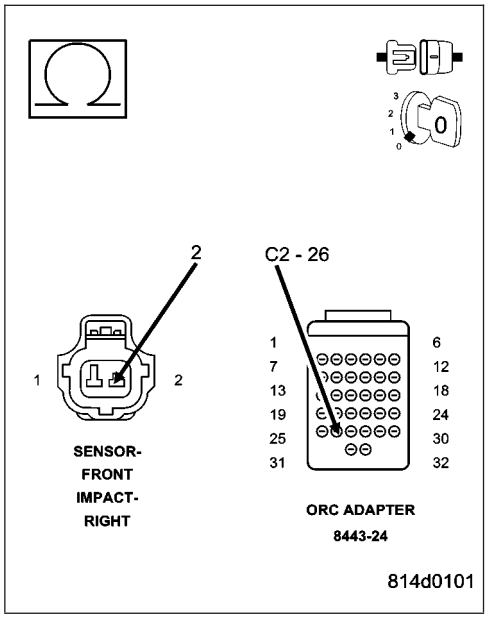
No >> Repair the (R82) Front Right Impact Sensor 2 Ground circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.



U0171-LOST COMMUNICATION W/UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR (CONTINUED)

6. CHECK THE (R80) FRONT RIGHT IMPACT SENSOR CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R80) Front Right Impact Sensor Signal circuit between the Front Right Impact Sensor connector and the 8443 Load Tool ORC Adaptor.



Is the resistance below 1 ohm?

Yes >> Go To 7

No >> Repair the (R80) Front Right Impact Sensor Signal circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.

7. CHECK OPERATION OF THE FRONT RIGHT IMPACT SENSOR

Replace the Front Right Impact Sensor.

Reconnect the vehicle body harness to the impact sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

Connect the scan tool to the Data Link Connector - use the most current software available.

Use the scan tool and erase the stored codes in all airbag system modules.

Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.

Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active Front Right Impact Sensor DTC return?

Yes >> Go To 8

No >> Repair is complete.
Perform the ORC VERIFICATION TEST - VER 1.

8. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

View repair

Repair

Replace the Occupant Restraint Controller in accordance with Service Instructions.
Perform the ORC VERIFICATION TEST - VER 1.

U0171-LOST COMMUNICATION W/UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR (CONTINUED)

9. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

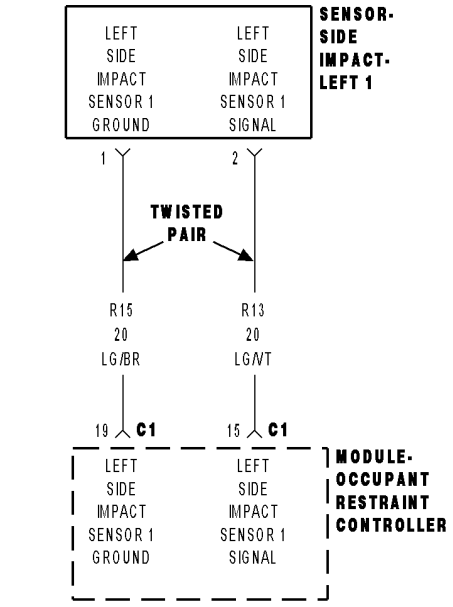
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

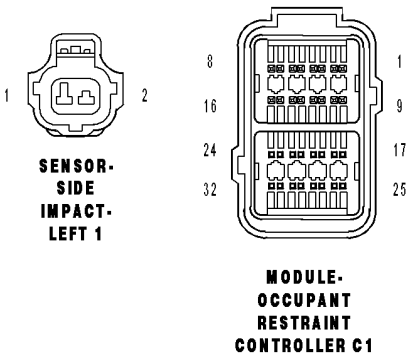
Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

U0172-LOST COMMUNICATION W/LEFT SIDE SATELLITE ACCELERATION SENSOR 1





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U0172-LOST COMMUNICATION W/LEFT SIDE SATELLITE ACCELERATION SENSOR 1 (CONTINUED)

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Occupant Restraint Controller (ORC) continuously communicates with the Left Side Impact Sensor 1 over the sensor signal circuit. The sensor communication and on board diagnostics are powered by the ORC signal.
- **Set Condition:**
  This code will set, if the ORC and the Left Side Impact Sensor 1 do not establish and maintain valid data communications.

Possible Causes
(R13) SIGNAL CIRCUIT SHORTED TO BATTERY
(R13) SIGNAL CIRCUIT SHORTED TO GROUND
(R13, R15) LEFT SIDE IMPACT SENSOR 1 CIRCUITS SHORTED TOGETHER
(R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT OPEN
(R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT OPEN
ORC, LEFT SIDE IMPACT SENSOR 1

Diagnostic Test

1. VERIFY THAT DTC U0172-LOST COMMUNICATION W/LEFT SIDE SATELLITE ACCELERATION SENSOR 1 IS ACTIVE

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read ORC DTCs.

Does the scan tool display active: U0172-LOST COMMUNICATION W/LEFT SIDE IMPACT SENSOR 1?

Yes >> Go To 2

No >> Go To 9

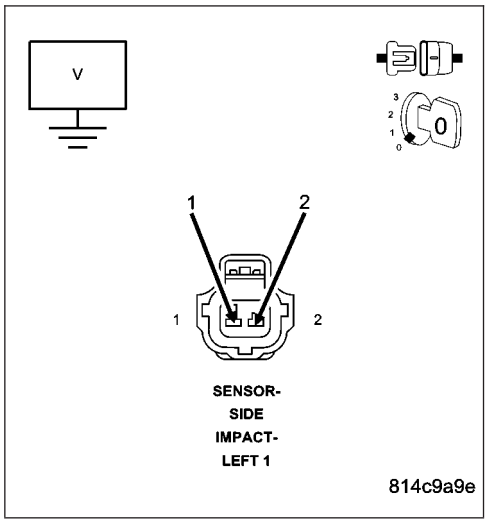
U0172-LOST COMMUNICATION W/LEFT SIDE SATELLITE ACCELERATION SENSOR 1 (CONTINUED)

2. CHECK THE (R13, R15) LEFT SIDE IMPACT SENSOR 1 SIGNAL AND GROUND CIRCUITS FOR A SHORT TO BATTERY

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Left front Impact Sensor 1 connector.

Disconnect the ORC connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R13) Left Side Impact Sensor 1 Signal circuit and (R15) Sensor Ground circuit at the Left Side Impact Sensor 1 connector and ground.



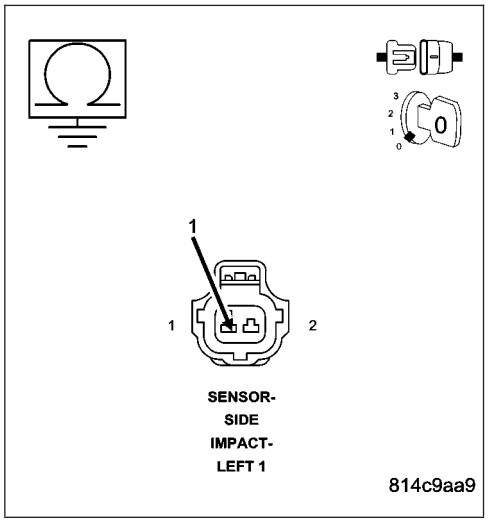
Is there any voltage present?

Yes >> Repair the (R13, R15) Left Side Impact Sensor 1 circuits for a short to battery.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 3

3. CHECK THE (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn ignition on, then reconnect the battery.
Measure the resistance of the (R13) Left Side Impact Sensor 1 Signal circuit between the Left Side Impact Sensor 1 connector and ground.



Is the resistance below 100K ohms?

Yes >> Repair the (R13) Left Side Impact Sensor 1 Signal circuit for a short to ground.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 4

U0172-LOST COMMUNICATION W/LEFT SIDE SATELLITE ACCELERATION SENSOR 1 (CONTINUED)

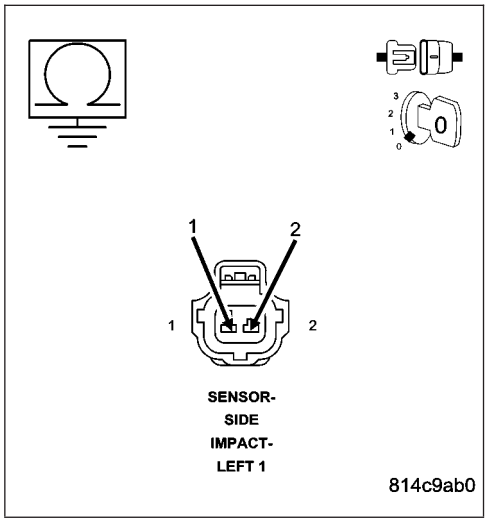
4. CHECK THE (R13, R15) LEFT SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TOGETHER

Measure the resistance between the (R13) Left Side Impact Sensor 1 Signal and (R15) Sensor Ground circuits at the Left Side Impact Sensor 1 connector.

Is the resistance below 100K ohms?

Yes >> Repair the (R13, R15) Left Side Impact Sensor 1 circuits shorted together.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 5



5. CHECK THE (R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

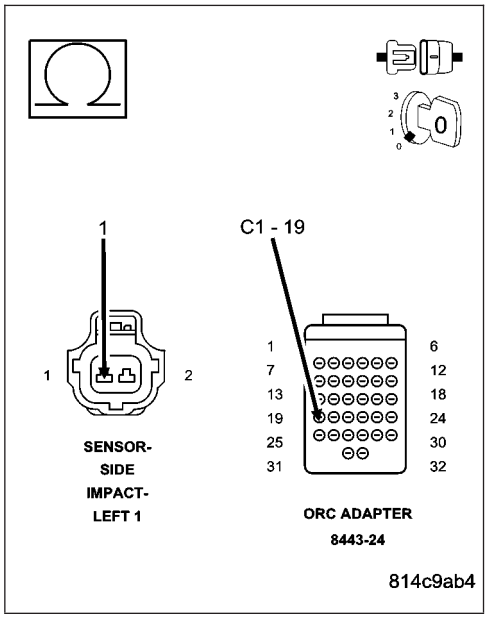
Connect the 8443 Load Tool ORC Adaptor to the Occupant Control Module connector.

Measure the resistance of the (R15) Left Side Impact Sensor 1 Ground circuit between the Left Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.

Is the resistance below 1 ohm?

Yes >> Go To 6

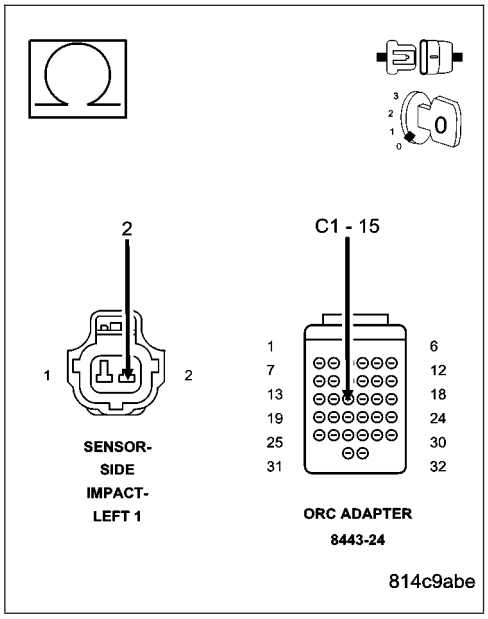
No >> Repair the (R15) Left Side Impact Sensor 1 Ground circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.



U0172-LOST COMMUNICATION W/LEFT SIDE SATELLITE ACCELERATION SENSOR 1 (CONTINUED)

6. CHECK THE (R13) LEFT SIDE IMPACT SENSOR 1 CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R13) Left Side Impact Sensor 1 Signal circuit between the Left Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.



Is the resistance below 1 ohm?

Yes >> Go To 7

No >> Repair the (R13) Left Side Impact Sensor 1 Signal circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.

7. CHECK OPERATION OF THE LEFT SIDE IMPACT SENSOR 1

Replace the Left Side Impact Sensor 1.

Reconnect the vehicle body harness to the impact sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

Connect the scan tool to the Data Link Connector - use the most current software available.

Use the scan tool and erase the stored codes in all airbag system modules.

Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.

Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active Left Side Impact Sensor 1 DTC return?

Yes >> Go To 8

No >> Repair is complete.
Perform the ORC VERIFICATION TEST - VER 1.

8. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

If there are no possible causes remaining, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with Service Instructions.
Perform the ORC VERIFICATION TEST - VER 1.

U0172-LOST COMMUNICATION W/LEFT SIDE SATELLITE ACCELERATION SENSOR 1 (CONTINUED)

9. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

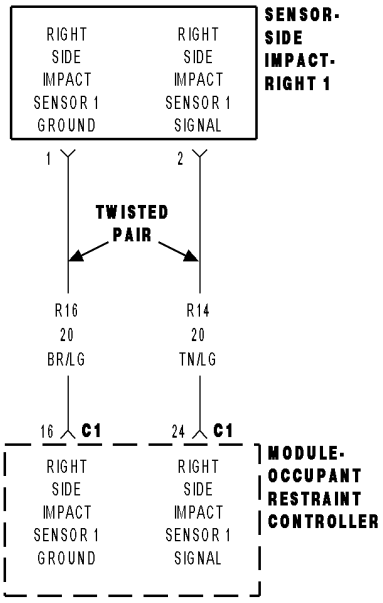
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

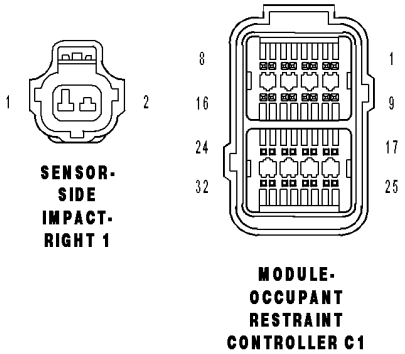
Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

U0175-LOST COMMUNICATION W/RIGHT SIDE SATELLITE ACCELERATION SENSOR 1





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U0175-LOST COMMUNICATION W/RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 (CONTINUED)

For the Airbag System circuit diagram (Refer to 8 - ELECTRICAL/RESTRAINTS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Occupant Restraint Controller (ORC) continuously communicates with the Right Side Impact Sensor 1 over the sensor signal circuit. The sensor communication and on board diagnostics are powered by the ORC signal.
- **Set Condition:**
  This code will set, if the ORC and the Right Side Impact Sensor 1 do not establish and maintain valid data communications.

Possible Causes
(R14) SIGNAL CIRCUIT SHORTED TO BATTERY
(R14) SIGNAL CIRCUIT SHORTED TO GROUND
(R14, R16) RIGHT SIDE IMPACT SENSOR 1 CIRCUITS SHORTED TOGETHER
(R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT OPEN
(R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT OPEN
ORC, RIGHT SIDE IMPACT SENSOR 1

Diagnostic Test

1. VERIFY THAT DTC U0175-LOST COMMUNICATION W/RIGHT SIDE SATELLITE ACCELERATION SENSOR 1

NOTE: Ensure the battery is fully charged.

NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.

Turn the ignition on.

With the scan tool, read ORC DTCs.

Does the scan tool display active: U0175- LOST COMMUNICATION W/RIGHT SIDE SATELLITE ACCELERATION SENSOR 1?

Yes >> Go To 2

No >> Go To 9

U0175-LOST COMMUNICATION W/RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 (CONTINUED)

2. CHECK THE (R14, R16) RIGHT SIDE IMPACT SENSOR 1 SIGNAL AND GROUND CIRCUITS FOR A SHORT TO BATTERY

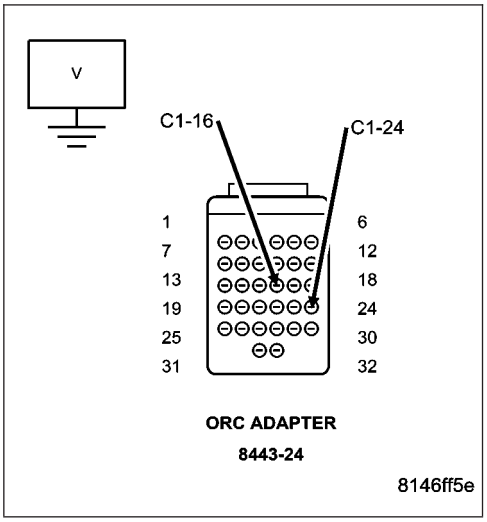
WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
Disconnect the Right front Impact Sensor 1 connector.
Disconnect the ORC connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.
Measure the voltage of the (R14) Right Side Impact Sensor 1 Signal circuit and (R16) Sensor Ground circuit at the Right Side Impact Sensor 1 connector and ground.

Is there any voltage present?

Yes >> Repair the (R14, R16) Right Side Impact Sensor 1 circuits for a short to battery.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 3



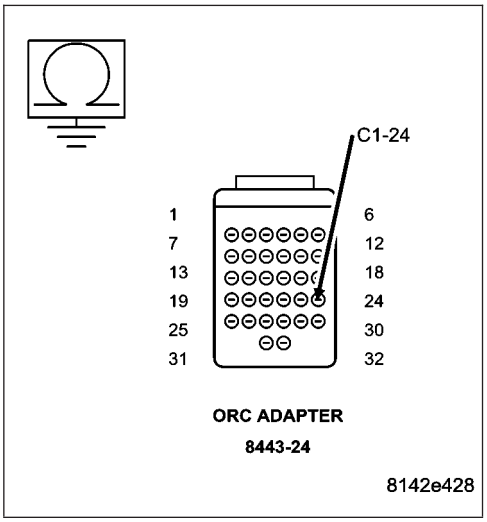
3. CHECK THE (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid personal injury or death, turn ignition on, then reconnect the battery.
Measure the resistance of the (R14) Right Side Impact Sensor 1 Signal circuit between the Right Side Impact Sensor 1 connector and ground.

Is the resistance below 100K ohms?

Yes >> Repair the (R14) Right Side Impact Sensor 1 Signal circuit for a short to ground.
Perform the ORC VERIFICATION TEST - VER 1.

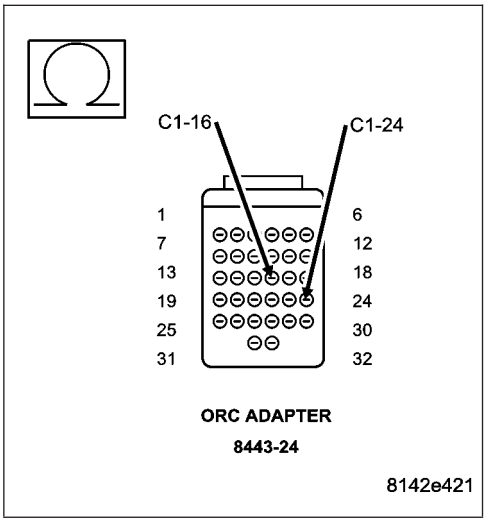
No >> Go To 4



U0175-LOST COMMUNICATION W/RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 (CONTINUED)

4. CHECK THE (R14, R16) RIGHT SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TOGETHER

Measure the resistance between the (R14) Right Side Impact Sensor 1 Signal and (R16) Sensor Ground circuits at the Right Side Impact Sensor 1 connector.



Is the resistance below 100K ohms?

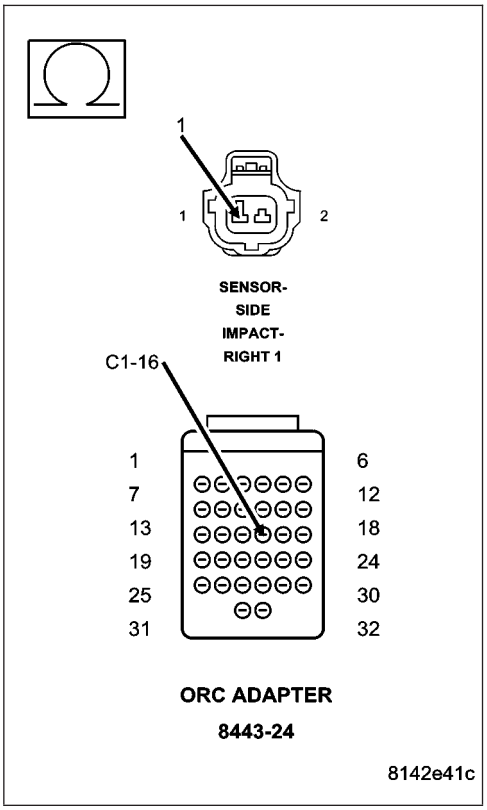
Yes >> Repair the (R14, R16) Right Side Impact Sensor 1 circuits shorted together.
Perform the ORC VERIFICATION TEST - VER 1.

No >> Go To 5

5. CHECK THE (R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Connect the 8443 Load Tool ORC Adaptor to the Occupant Control Module connector.

Measure the resistance of the (R16) Right Side Impact Sensor 1 Ground circuit between the Right Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.



Is the resistance below 1 ohm?

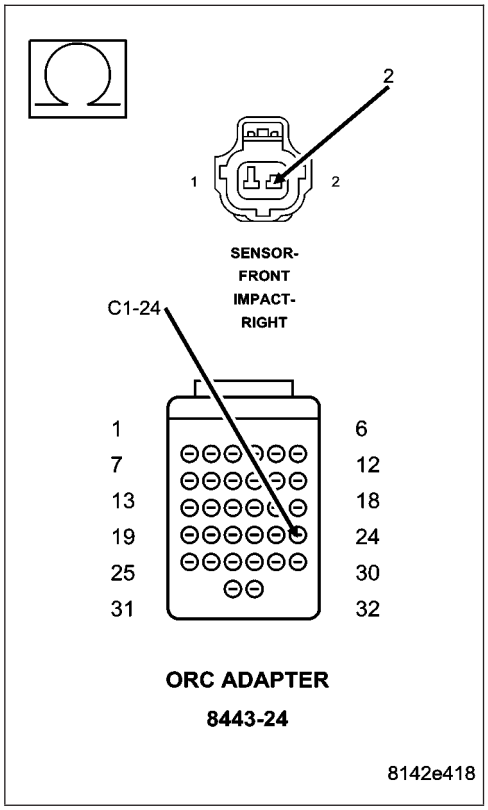
Yes >> Go To 6

No >> Repair the (R16) Right Side Impact Sensor 1 Ground circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.

U0175-LOST COMMUNICATION W/RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 (CONTINUED)

6. CHECK THE (R14) RIGHT SIDE IMPACT SENSOR 1 CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R14) Right Side Impact Sensor 1 Signal circuit between the Right Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.



Is the resistance below 1 ohm?

Yes >> Go To 7

No >> Repair the (R14) Right Side Impact Sensor 1 Signal circuit for an open or high resistance.
Perform the ORC VERIFICATION TEST - VER 1.

7. CHECK OPERATION OF THE RIGHT SIDE IMPACT SENSOR 1

Replace the Right Side Impact Sensor 1.

Reconnect the vehicle body harness to the impact sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

Connect the scan tool to the Data Link Connector - use the most current software available.

Use the scan tool and erase the stored codes in all airbag system modules.

Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.

Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active Right Side Impact Sensor 1 DTC return?

Yes >> Go To 8

No >> Repair is complete.
Perform the ORC VERIFICATION TEST - VER 1.

U0175-LOST COMMUNICATION W/RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 (CONTINUED)

8. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.

If there are no possible causes remaining, view repair.

Repair

Replace the Occupant Restraint Controller in accordance with Service Instructions.
Perform the ORC VERIFICATION TEST - VER 1.

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9. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC's from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid personal injury or death, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTCs present?

Yes >> Select the appropriate symptom from Symptom List.

No >> No problem found at this time. Erase all codes before returning vehicle to customer.

U0184-LOST COMMUNICATION WITH RADIO

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0186-LOST COMMUNICATION WITH AUDIO AMPLIFIER

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0195-LOST COMMUNICATION WITH SDARS

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0196-LOST COMMUNICATION WITH VEHICLE ENTERTAINMENT CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0197-LOST COMMUNICATION WITH HANDS FREE PHONE MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0199-LOST COMMUNICATION WITH DRIVER DOOR MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0200-LOST COMMUNICATION WITH PASSENGER DOOR MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0208-LOST COMMUNICATION WITH HEATED SEAT CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0209-LOST COMMUNICATION WITH MEMORY SEAT CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U1414-IMPLAUSIBLE/MISSING ECU CONFIGURATION DATA

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. The ORC on board diagnostics continuously monitors the CAN Bus message from the FCM containing the ORC Configuration Data.
- **Set Condition:**
  This DTC will set if the appropriate CAN Bus message is not received by the ORC.

Possible Causes
FRONT CONTROL MODULE

Diagnostic Test

1. FRONT CONTROL MODULE FAILURE

Turn the ignition on.

With the scan tool, read FCM DTCs.

Does the scan tool display any Front Control Module DTCs?

Yes >> Select appropriate symptom from Symptom List. Repair all FCM active DTCs and before diagnosing the ORC DTCs.

No >> Replace the Front Control Module in accordance with the Service Information.
Perform the ORC VERIFICATION TEST-VER. 1

U1415-IMPLAUSIBLE/MISSING VEHICLE CONFIGURATION DATA

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. The ORC on board diagnostics loads the ORC Configuration Data from the FCM CAN Bus message.
- **Set Condition:**
  This DTC will set if the CAN Bus message was received but the information is invalid or corrupt.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.

Disconnect the ORC harness connector(s).

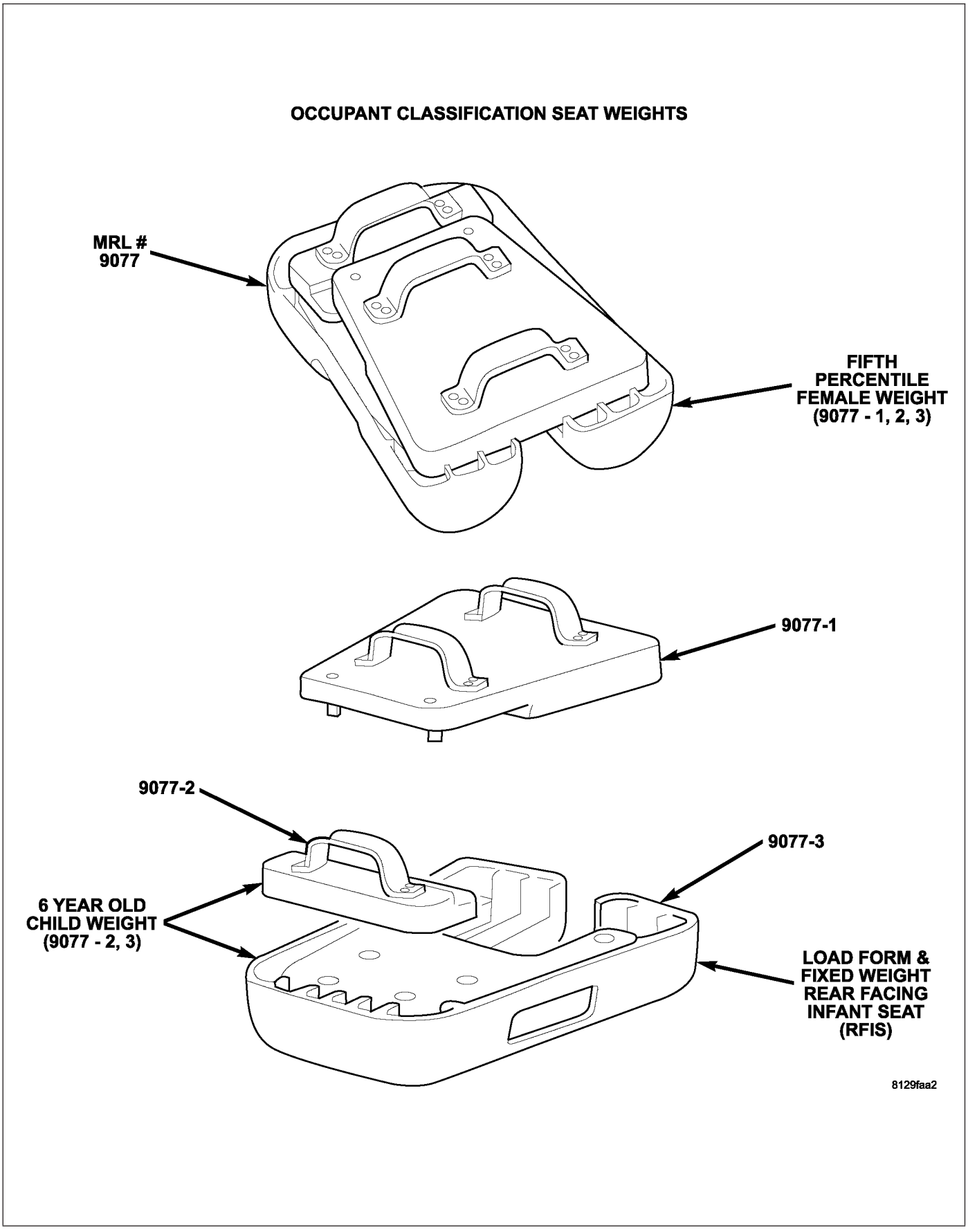
NOTE: Check connectors - Clean and repair as necessary.

NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.

Repair

Replace the Occupant Restraint Controller in accordance with Service Information.Perform the ORC VERIFICATION TEST-VER. 1

*DIAGNOSIS AND CHECKOUT PROCEDURE FOR SEAT WEIGHT SENSORS



OCS SEAT WEIGHTS MRL #9077

***DIAGNOSIS AND CHECKOUT PROCEDURE FOR SEAT WEIGHT SENSORS (CONTINUED)**

1. VERIFY COMPLAINT

Turn the ignition off.

Move the front passenger seat to the full rear position. Verify that the seat is empty, the seat back is in the normal upright position, and that the seat is not interfering with any interior components.

Verify that all related connectors are properly seated and locked.

Turn the ignition on.

With the scan tool in OCM, select Data Display and note the Passenger Seat Weight Sensor voltage for all four sensors (Left Front, Right Front, Left Rear and Right Rear).

Move the front passenger seat to the mid track position.

Using the scan tool, note the Passenger Seat Weight Sensor voltage for all four sensors.

Move the front passenger seat to the full forward position.

Using the scan tool, note the Passenger Seat Weight Sensor voltage for all four sensors. The voltage should be from 1.4 to 3.6 volts for each sensor in each position (full rear, mid track, and full forward).

Is any sensor's voltage reading out of the acceptable range in any position?

Yes >> Go To 2

No >> Perform test B1BA7 Occupant Classification System Verification Required. If the test passes, the seat weight sensing system is working properly. Return to the procedure that directed you to this procedure.

---

2. CHECKING FOR BENT FLOOR PAN

Turn the ignition off.

Loosen all of the mounting screws retaining the front passenger seat to the vehicle crossmembers, but do not remove them. Verify that the seat is loose and that no binding exists between the seat and the crossmembers.

Move the front passenger seat to the full rear position and then to the full forward position.

Tighten all of the mounting screws to specification. Refer to 23 - BODY/SEATS.

Move the front passenger seat to the full rear position.

Turn the ignition on.

Using the scan tool, note the Passenger Seat Weight Sensor voltage for all four sensors.

Move the front passenger seat to the mid track position.

Using the scan tool, note the Passenger Seat Weight Sensor voltage for all four sensors.

Move the front passenger seat to the full forward position.

Using the scan tool, note the Passenger Seat Weight Sensor voltage for all four sensors. The voltage should be from 1.4 to 3.6 volts for each sensor in each position.

Is any sensor's voltage reading out of the acceptable range in any position?

Yes >> Go To 3

No >> Perform test B1BA7 Occupant Classification System Verification Required. If the test passes, the seat weight sensing system is working properly. Return to the procedure that directed you to this procedure.

***DIAGNOSIS AND CHECKOUT PROCEDURE FOR SEAT WEIGHT SENSORS (CONTINUED)**

3. CHECKING SEAT TO RISER STRESS

Turn the ignition off.

Loosen all of the mounting screws retaining the front passenger seat track to the riser, but do not remove them. Verify that the seat track is loose and that no binding exists between the seat track and the risers.

Turn the ignition on.

Using the scan tool, note the Passenger Seat Weight Sensor voltage for all four sensors. The voltage should be from 1.5 to 3.5 volts for each sensor.

Is any sensor's voltage reading out of the acceptable range?

Yes >> Go To 4

No >> Visually inspect for damaged or bent risers and crossmembers. Also, verify that the riser holes line up with the seat mounts in the crossmembers.

If riser damage is apparent, replace the risers in accordance with the Service Information. Then, reinstall the Seat Weight Sensors, and Go To 6.

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

If crossmember or floorpan damage is present, repair or replace the components as necessary in accordance with the Service Information. Reinstall the seat in the vehicle in accordance with the Service Information. Turn the ignition on. With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the directions displayed on the scan tool. When the test is complete, Go To 1.

---

4. TEST SEAT FRAME

Turn the ignition off.

Remove the front passenger seat from the risers in accordance with the Service Information. Return the risers to their normal mounting position.

Turn the ignition on.

Using the scan tool, note the Passenger Seat Weight Sensor voltage for all four sensors. The voltage should be from 1.4 to 3.6 volts for each sensor.

Is any sensor's voltage reading out of the acceptable range?

Yes >> Go To 5

No >> Visually inspect for damaged or bent risers, a damaged or bent seat and seat structure, and damaged or bent seat tracks. Also, verify that the holes in the center of the sensors line up with the seat track holes and that the seat track position locating tabs are locked in the same parallel slots. If riser damage is apparent, replace the risers in accordance with the Service Information. Then, reinstall the Seat Weight Sensors, and Go To 6.

If seat or seat track damage is present, replace the components as necessary in accordance with the Service Information. Then, Go To 7

***DIAGNOSIS AND CHECKOUT PROCEDURE FOR SEAT WEIGHT SENSORS (CONTINUED)**

5. TEST SENSOR

Turn the ignition off.

Loosen the mounting screws of all of the Seat Weight Sensors, but do not remove them. Verify that the sensors are loose and that no binding exists between the sensors and the risers.

Turn the ignition on.

Using the scan tool, note the Passenger Seat Weight Sensor voltage for all four sensors. The voltage should be from 1.4 to 3.6 volts for each sensor.

Is any sensor's voltage reading out of the acceptable range?

Yes >> Replace any Seat Weight Sensors that have an unacceptable voltage reading in accordance with the Service Information. Then, Go To 6.

No >> Replace the risers in accordance with the Service Information. Then, reinstall the Seat Weight Sensors, and Go To 6

---

6. CHECKING FOR IMPROPER SEAT WEIGHT SENSOR TORQUE

Turn the ignition off.

Tighten all of the Seat Weight Sensor mounting screws to specification. Refer to 23 - BODY/SEATS.

Turn the ignition on.

Using the scan tool, note the Passenger Seat Weight Sensor voltage for all four sensors. The voltage should be from 1.4 to 3.6 volts for each sensor.

Is any sensor's voltage reading out of the acceptable range?

Yes >> Loosen the mounting screws of all Seat Weight Sensors with an unacceptable voltage reading, and repeat Steps 5 and 6.

No >> Go To 7

---

7. TEST SEAT TRACKS

Turn the ignition off.

Mount the front passenger seat on the risers in accordance with service information.

Turn the ignition on.

Using the scan tool, note the Passenger Seat Weight Sensor voltage for all four sensors. The voltage should be from 1.4 to 3.6 volts for each sensor.

Is any sensor's voltage reading out of the acceptable range?

Yes >> Replace the seat track in accordance with the Service Information. Verify that no binding exists between the seat and risers. Then, repeat Steps 6 and 7.

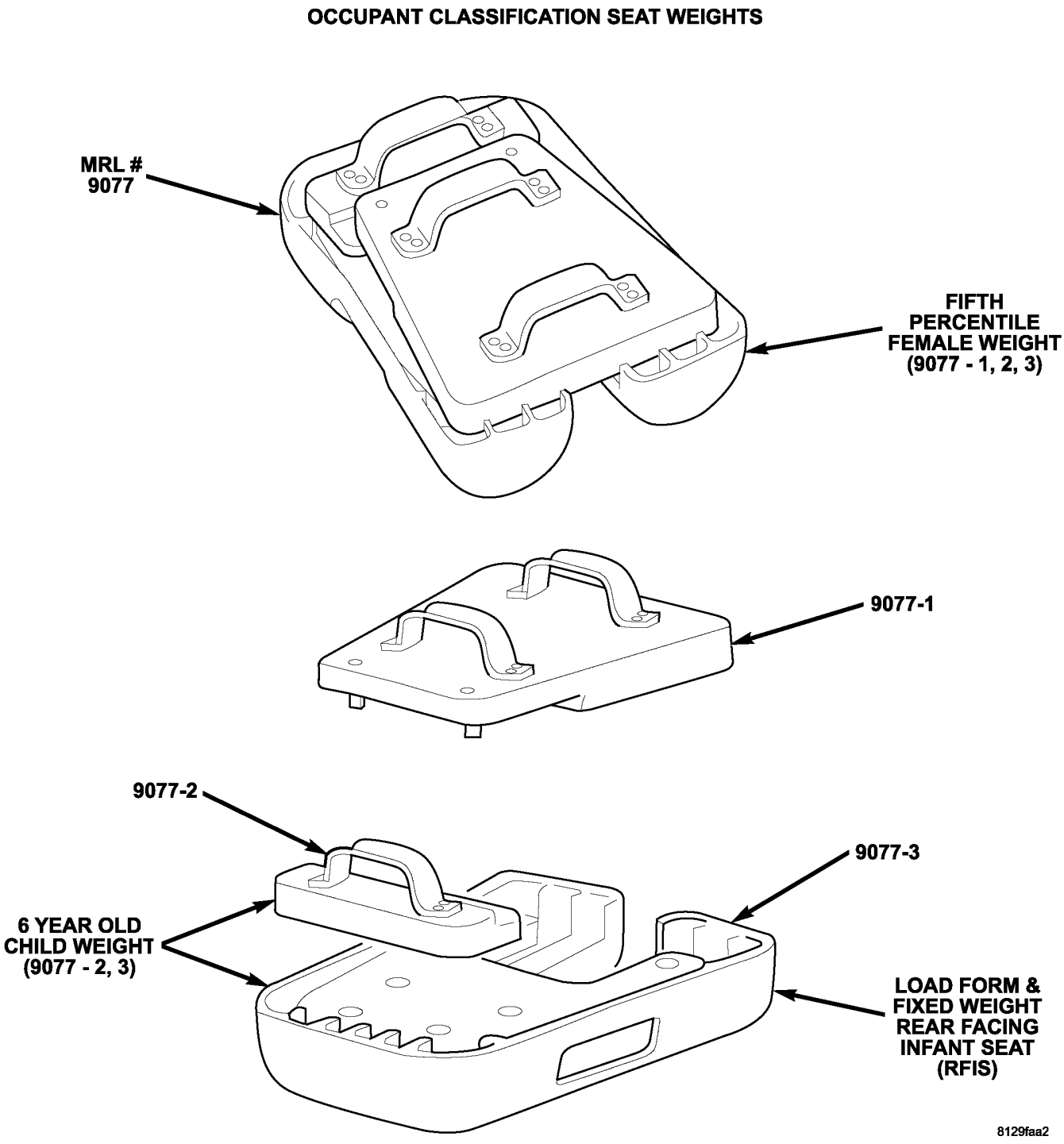
No >>

NOTE: Failure to follow test instructions or aborting the test will cause faults to set when performing the Occupant Classification Module System Verification Test. To prevent faults due to process errors: Verify That All Tests Steps That Led You Here Were Performed As Directed; Verify That The Ignition Is In Run; Wait 30 Seconds After Changing The Seat Weight Before Proceeding To Allow The System To Stabilize; Only Press Scan Tool Buttons When Directed To Do So; & Perform The Occupant Classification Module System Verification Test To Completion.

Reinstall the seat in the vehicle in accordance with the Service Information. Turn the ignition on. With the scan tool in OCM, select More Options, select System Tests, and select Occupant Classification Module System Verification Test. Run the test by following the instructions displayed by the scan tool. When the test is complete, Go To 1

---

*OCS VERIFICATION TEST - VER 1



OCS SEAT WEIGHTS MRL #9077

*OCS VERIFICATION TEST - VER 1 (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

1. *OCS VERIFICATION TEST - VER 1

1. Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON THEN RECONNECT THE BATTERY.

2. Connect the scan tool to the Data Link Connector - use the most current software available.
3. With the scan tool to erase stored DTCs in all airbag system modules.
4. Turn the ignition off, and wait 15 seconds, then turn the ignition on.
5. Wait one minute, and read active codes and if there are none present read the stored codes.
6. Note: Read the DTC's in all airbag system related modules.
7. If the scan tool shows any active or stored codes, return to the Table of Content and follow path specified for that trouble code. If no active or stored codes are present, the repair is complete.

Are any DTC's present or is the original condition still present?

Yes >> Repair is not complete, refer to appropriate symptom list.

No >> Repair is complete.

*ORC VERIFICATION TEST - VER 1

For a complete wiring diagram **Refer to Section 8W**.

1. *ORC VERIFICATION TEST - VER 1

1. Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

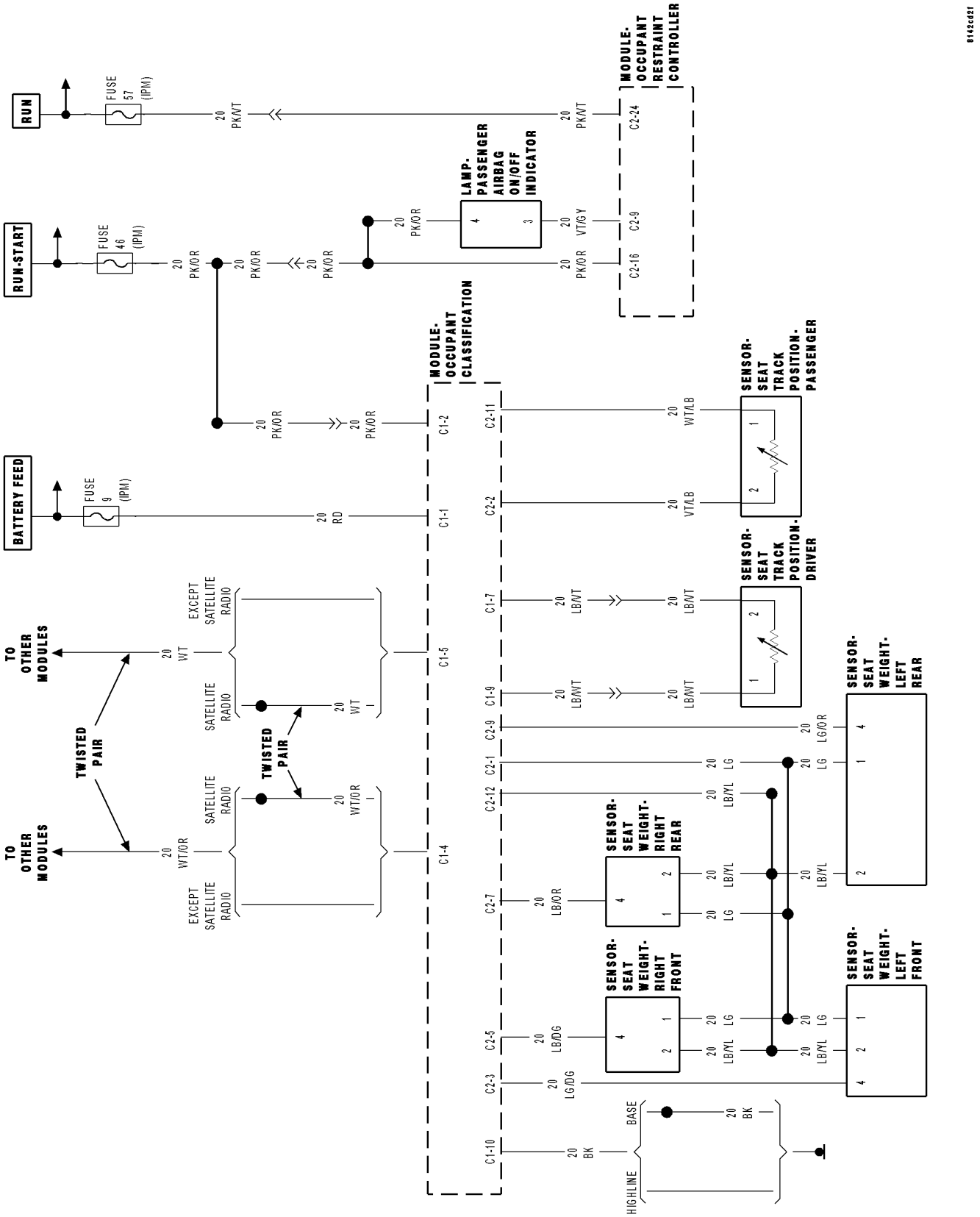
WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON THEN RECONNECT THE BATTERY.

2. Connect the scan tool to the Data Link Connector - use the most current software available.
3. With the scan tool to erase stored DTCs in all airbag system modules.
4. Turn the ignition off, and wait 15 seconds, then turn the ignition on.
5. Wait one minute, and read active codes and if there are none present read the stored codes.
6. Note: If equipped with Airbag On - Off switch, read the DTC's in all switch positions.
7. Note: Read the DTC's in all airbag system related modules.
8. If the scan tool shows any active or stored codes, return to the Table of Contents and follow path specified for that trouble code. If no active or stored codes are present, the repair is complete.

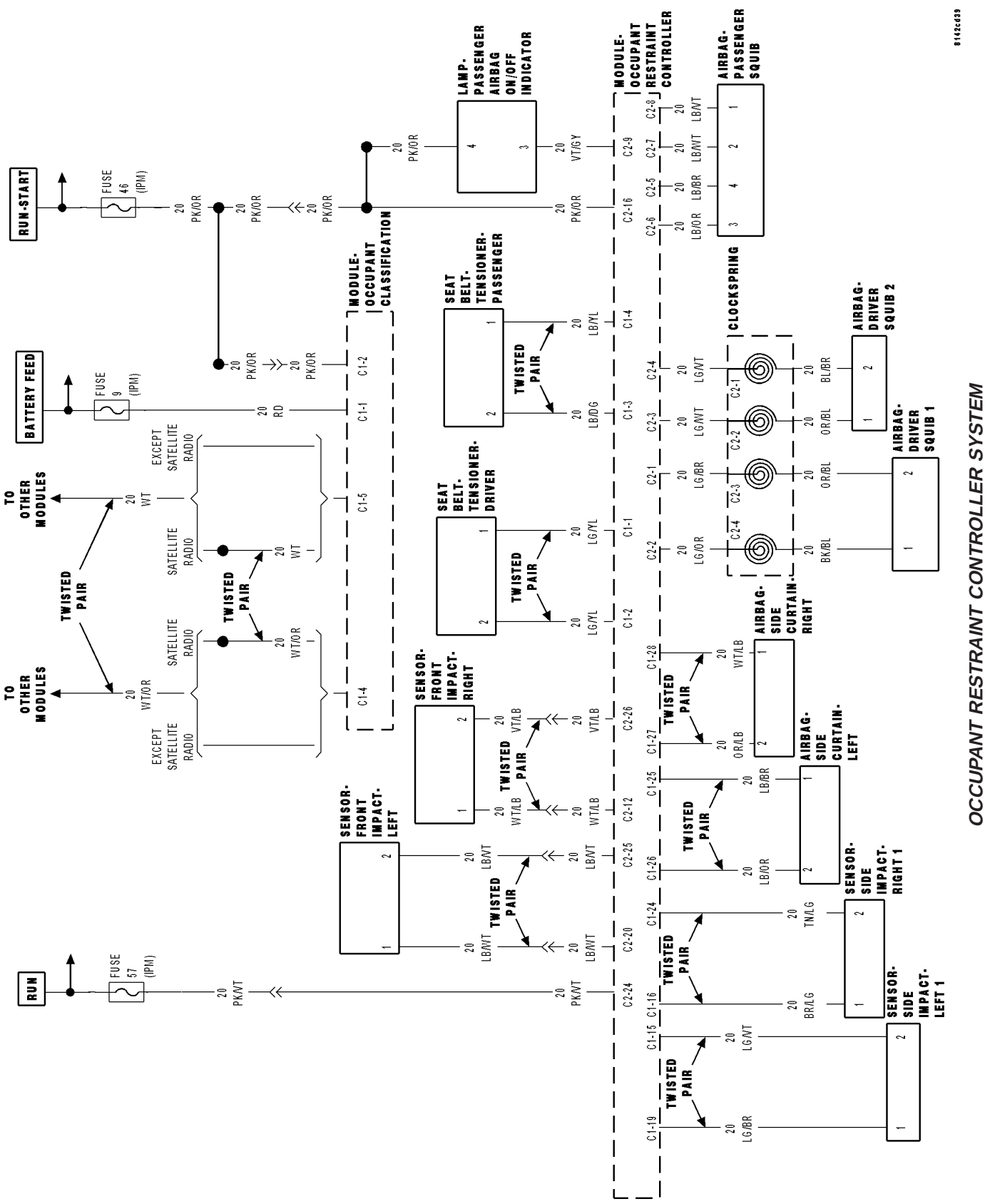
Are any DTC's present or is the original condition still present?

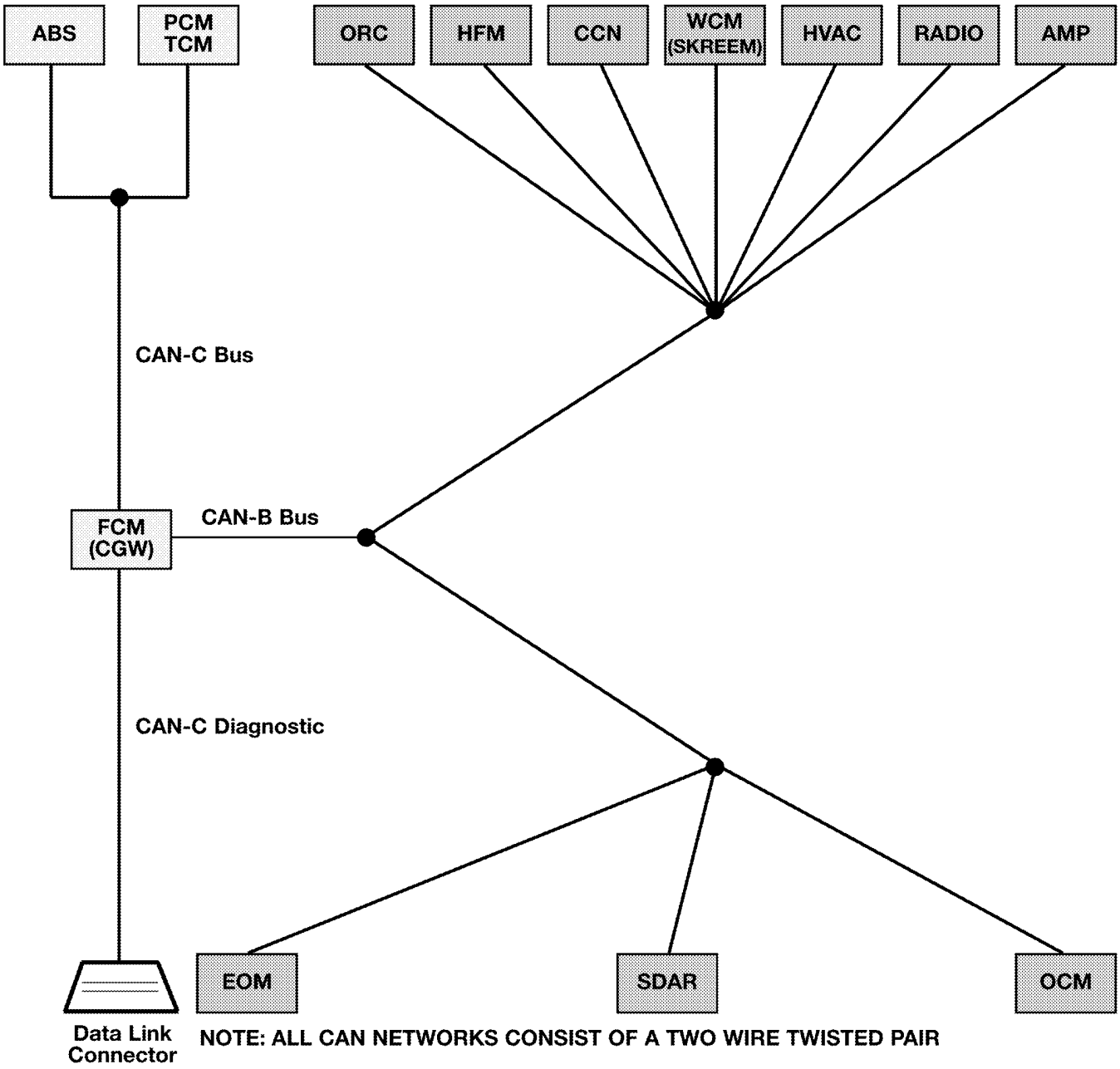
Yes >> Repair is not complete, refer to appropriate symptom list.

No >> Repair is complete.



OCCUPANT CLASSIFICATION SYSTEM


RUN
RUN-START
BATTERY FEED
FUSE 57 (IPM)
FUSE 46 (IPM)
FUSE 9 (IPM)
TO OTHER MODULES
TWISTED PAIR
EXCEPT SATELLITE RADIO
SATELLITE RADIO
MODULE-OCCUPANT CLASSIFICATION
MODULE-OCCUPANT RESTRAINT CONTROLLER
LAMP-PASSENGER AIRBAG ON/OFF INDICATOR
SEAT BELT-TENSIONER-PASSENGER
SEAT BELT-TENSIONER-DRIVER
SENSOR-FRONT IMPACT-LEFT
SENSOR-FRONT IMPACT-RIGHT
AIRBAG-SIDE CURTAIN-RIGHT
AIRBAG-SIDE CURTAIN-LEFT
SENSOR-SIDE IMPACT-RIGHT 1
SENSOR-SIDE IMPACT-LEFT 1
CLOCKSPRING
AIRBAG-PASSENGER SQUIB
AIRBAG-DRIVER SQUIB 1
AIRBAG-DRIVER SQUIB 2
OCCUPANT RESTRAINT CONTROLLER SYSTEM


ABS
PCM
TCM
ORC
HFM
CCN
WCM
(SKREEM)
HVAC
RADIO
AMP
CAN-C Bus
FCM
(CGW)
CAN-B Bus
CAN-C Diagnostic
EOM
SDAR
OCM
Data Link
Connector
NOTE: ALL CAN NETWORKS CONSIST OF A TWO WIRE TWISTED PAIR
8140d0ac

RESTRAINTS - SERVICE INFORMATION

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RESTRAINTS - SERVICE INFORMATION

DESCRIPTION

An occupant restraint system is standard factory-installed safety equipment on this model. Available occupant restraints for this model include both active and passive types. Active restraints are those which require the vehicle occupants to take some action to employ, such as fastening a seat belt; while passive restraints require no action by the vehicle occupants to be employed.

ACTIVE RESTRAINTS

The active restraints for this model include:

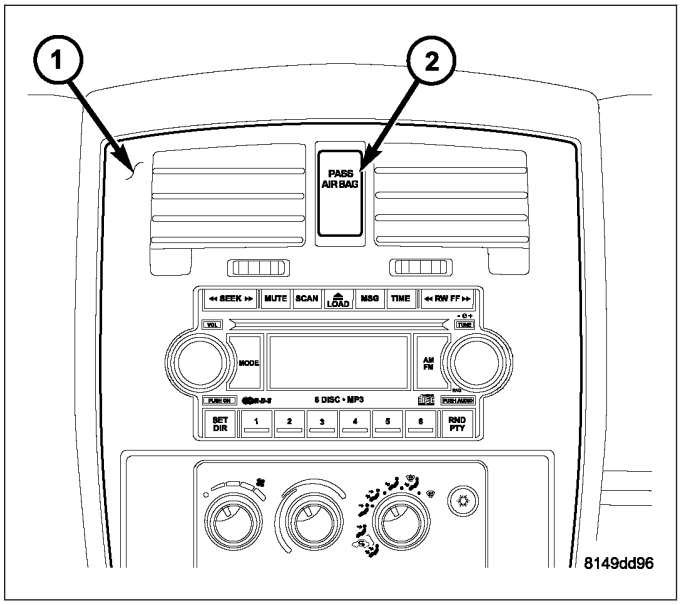
- **Front Seat Belts** - Both outboard front seating positions are equipped with three-point seat belt systems employing floor sill mounted (club cab) or lower B-pillar mounted (quad cab) inertia latch-type emergency locking retractors, height-adjustable roof rail mounted (club cab) or upper B-pillar mounted (quad cab) turning loops, a traveling lower seat belt anchor secured to the outboard side of the seat frame, and a traveling end-release seat belt buckle secured to the inboard side of the seat frame. The driver side front seat belt buckle includes an integral seat belt switch that detects whether the driver side front seat belt has been fastened. A fixed position lap belt and buckle is provided for vehicles with a center front seating position.
- **Rear Seat Belts** - On all vehicles equipped with rear seats, each rear seating position is equipped with a three-point seat belt system. The outboard seating position belts employ lower rear pillar mounted inertia latch-type emergency locking retractors, fixed position upper rear pillar mounted turning loops, self-cinching latch plates for compatibility with child seats and fixed lower seat belt anchors secured to the floor panel (club cab) or lower rear pillar (quad cab). The quad cab rear seat center seating position belt has an inertia latch-type emergency locking retractor secured to the rear floor panel and a routing bracket secured to the top of the cab back panel. Fixed end-release buckles are secured to the floor panel on club cab models. On quad cab models the buckle units for the center and left outboard seating positions are secured to the floor panel with the rear seat mounting hardware, while the center anchor buckle and the right outboard buckle are secured to the floor panel with the center retractor mounting hardware.
- **Child Restraint Anchors** - All vehicles with rear seats are equipped with three child seat upper tether anchors that are secured to the upper cab back panel reinforcement. On club cab models the two outboard anchors are loops of webbing located behind the hinged upper rear seat back pads, while the center anchor is a stamped “D” ring located behind a small hinged access door in the center of the cab back trim panel. On quad cab models all three anchors include a “D” ring covered by a loop of webbing strap located behind the rear seat backs. Club cab models also have an upper tether anchor integral to the back of the passenger side front seat cushion frame. Two lower anchors are also provided for the passenger side outboard front and rear seating positions of club cab models, and for each rear outboard seating position on quad cab models. These lower

anchors are accessed from the front of the seat where the seat back meets the seat cushion. The child seat tether and lower anchors for the front seat are deleted on quad cab models.

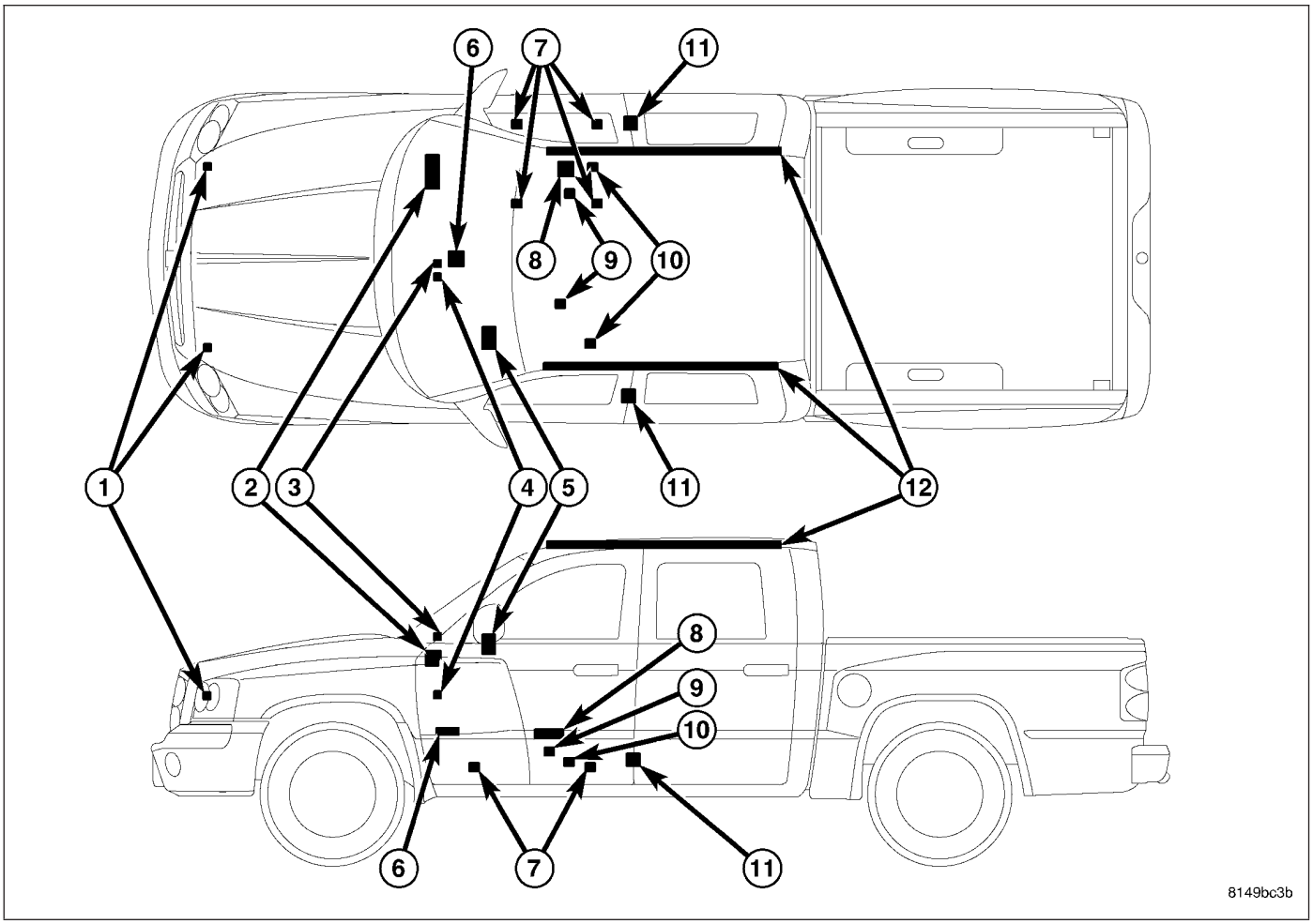
PASSIVE RESTRAINTS

The passive restraints available for this model include the following:

- **Dual Front Airbags** - Multistage driver and front passenger airbags are used in this model. This airbag system is a passive, inflatable, Supplemental Restraint System (SRS) and vehicles with this equipment can be readily identified by the “SRS - AIRBAG” logo molded into the driver airbag trim cover in the center of the steering wheel and also into the passenger airbag door on the top of the instrument panel above the glove box. Vehicles with the airbag system can also be identified by the airbag indicator, which will illuminate in the ElectroMechanical Instrument Cluster (EMIC) for about seven seconds as a bulb test each time the ignition switch is turned to the On position. A pyrotechnic-type seat belt tensioner is also integral to the driver and passenger front seat belt retractors to work in conjunction with the dual front airbags.



- **Occupant Classification System** - Vehicles manufactured for sale in North America (except Mexico) also include an Occupant Classification System (OCS) with components that are located on the front seats. These components include an Occupant Classification Module (OCM) and four seat weight sensors on the passenger seat, and seat track position sensors on both the driver and passenger seats. Vehicles equipped with the OCS components can be readily identified by a passenger airbag on/off indicator (2) located between the two air outlets on the instrument panel center bezel (1) above the radio.
- **Side Curtain Airbags** - Optional side curtain airbags are available for this model when it is also equipped with dual front airbags. This airbag system is a passive, inflatable, Supplemental Restraint System (SRS) and vehicles with this equipment can be readily identified by a molded identification trim button with the “SRS - AIRBAG” logo located on the headliner above each roof rail (club cab) or at the top of the B-pillar (quad cab).



The supplemental restraint system includes the following major components, which are described in further detail elsewhere in this service information:

- **Airbag Indicator** - The airbag indicator is integral to the ElectroMechanical Instrument Cluster (EMIC), which is located on the instrument panel in front of the driver.
- **Clockspring** - The clockspring is located near the top of the steering column, directly beneath the steering wheel.
- **Driver Airbag (5)** - The driver airbag is located in the center of the steering wheel, beneath the driver airbag trim cover.
- **Driver Knee Blocker** - The driver knee blocker is a structural unit secured to the back side of and integral to the instrument panel steering column opening cover.
- **Front Impact Sensor (1)** - Two front impact sensors are used on vehicles equipped with dual front airbags, one left side and one right side. One sensor is located on the back side of each vertical member of the radiator support.
- **Occupant Classification Module (8)** - Vehicles equipped with the Occupant Classification System (OCS) include an Occupant Classification Module (OCM) which is secured to the underside of the passenger side front seat cushion frame.
- **Occupant Restraint Controller (6)** - The Occupant Restraint Controller (ORC) is located on a mount on the floor panel transmission tunnel below the center of the instrument panel.
- **Passenger Airbag (2)** - The passenger airbag is located in the instrument panel, beneath the passenger airbag door on the top of the instrument panel above the glove box on the passenger side of the vehicle.
- **Passenger Airbag On/Off Indicator (3)** - The Occupant Classification System (OCS) includes a passenger airbag on/off indicator which is located between the two outlets on the instrument panel center bezel above the radio.
- **Passenger Airbag On/Off Switch (4)** - Club cab models are equipped with a passenger airbag on/off switch, which is located on the lower left side of the instrument panel center bezel.
- **Passenger Knee Blocker** - The passenger knee blocker is a structural reinforcement that is integral to and concealed within the glove box door.

- **Seat Belt Tensioner (11)** - A seat belt tensioner is integral to both front seat belt retractor units on vehicles equipped with dual front airbags. The seat belt retractor and tensioner units are secured to the right and left floor panel sills on club cab models, or to the right and left inner B-pillars and concealed beneath the lower B-pillar trim on quad cab models.
- **Seat Track Position Sensor (9)** - The Occupant Classification System (OCS) includes two seat track position sensors. One sensor is located on the inboard side of one of the seat adjuster tracks on both the driver and the passenger front seats.
- **Seat Weight Sensor (7)** - Vehicles equipped with the Occupant Classification System (OCS) include four seat weight sensors, one on each corner of the passenger side front seat between the seat cushion frame and the seat track.
- **Side Curtain Airbag (12)** - In vehicles equipped with this option, a side curtain airbag is secured to each inside roof side rail, and extends from the A-pillar to near the cab back panel. The side curtain airbags are concealed above the headliner trim.
- **Side Impact Sensor (10)** - Two side impact sensors are used on vehicles equipped with the optional side curtain airbags, located on the floor panel just behind the front seat crossmember beneath the outboard side of the left and right front seats.

The ORC, the OCM, and the EMIC each contain a microprocessor and programming that allow them to communicate with each other using the Controller Area Network (CAN) data bus. This method of communication is used by the ORC for control of the airbag indicator in the EMIC. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - DESCRIPTION).

Hard wired circuitry connects the supplemental restraint system components to each other through the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system, and to the supplemental restraint system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

ACTIVE RESTRAINTS

The primary passenger restraints in this or any other vehicle are the standard equipment factory-installed seat belts and child restraint anchors. Seat belts and child restraint anchors are referred to as an active restraint because the vehicle occupants are required to physically fasten and properly adjust these restraints in order to benefit from them. See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the factory-installed active restraints.

PASSIVE RESTRAINTS

The passive restraints are referred to as a supplemental restraint system because they were designed and are intended to enhance the protection for the occupants of the vehicle **only** when used in conjunction with the seat belts. They are referred to as passive restraints because the vehicle occupants are not required to do anything to make them operate; however, the vehicle occupants must be wearing their seat belts in order to obtain the maximum safety benefit from the factory-installed supplemental restraint system.

The supplemental restraint system electrical circuits are continuously monitored and controlled by a microprocessor and software contained within the Occupant Restraint Controller (ORC). An airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) illuminates for about seven seconds as a bulb test each time the ignition switch is turned to the On or Start positions. Following the bulb test, the airbag indicator is turned on or off by the ORC to indicate the status of the supplemental restraint system. If the airbag indicator comes on at any time other than during the bulb test, it indicates that there is a problem in the supplemental restraint system electrical circuits. Such a problem may cause airbags not to deploy when required, or to deploy when not required.

Deployment of the supplemental restraints depends upon the angle and severity of an impact. Deployment is not based upon vehicle speed; rather, deployment is based upon the rate of deceleration as measured by the forces of gravity (G force) upon the impact sensors. When an impact is severe enough, the microprocessor in the ORC sig-

nals the inflator of the appropriate airbag units to deploy their airbag cushions. The outboard front seat belt tensioners are provided with a deployment signal by the ORC in conjunction with the front airbags.

During a frontal vehicle impact, the knee blockers work in concert with properly fastened and adjusted seat belts to restrain both the driver and the right front seat passenger in the proper position for an airbag deployment. The knee blockers also absorb and distribute the crash energy from the driver and the right front seat passenger to the structure of the instrument panel. The seat belt tensioners remove the slack from the outboard front seat belts to provide further assurance that the driver and right front seat passenger are properly positioned and restrained for an airbag deployment.

Typically, the vehicle occupants recall more about the events preceding and following a collision than they do of an airbag deployment itself. This is because the airbag deployment and deflation occur very rapidly. In a typical 48 kilometer-per-hour (30 mile-per-hour) barrier impact, from the moment of impact until the airbags are fully inflated takes about 40 milliseconds. Within one to two seconds from the moment of impact, the airbags are almost entirely deflated. The times cited for these events are approximations, which apply only to a barrier impact at the given speed. Actual times will vary somewhat, depending upon the vehicle speed, impact angle, severity of the impact, and the type of collision.

When the ORC monitors a problem in any of the supplemental restraint system circuits or components, including the seat belt tensioners, it stores a fault code or Diagnostic Trouble Code (DTC) in its memory circuit and sends an electronic message to the EMIC to turn on the airbag indicator. Proper testing of the supplemental restraint system components, the Controller Area Network (CAN) data bus, the electronic message inputs to and outputs from the EMIC or the ORC, as well as the retrieval or erasure of a DTC from the ORC or the EMIC requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the factory-installed passive restraints.

OCCUPANT CLASSIFICATION SYSTEM

In vehicles equipped with the Occupant Classification System (OCS), the OCS automatically suppresses or enables passenger airbag and seat belt tensioner operation based upon whether or not the passenger side front seat is occupied and, if the seat is occupied, classifies the size of the occupant and whether the seat is occupied by a child seat.

The OCS has an Occupant Classification Module (OCM) that monitors inputs from the seat weight sensors under the passenger side front seat cushion and from the seat track position sensors on the passenger side and driver side seat adjuster tracks. Based upon those inputs the microprocessor within the OCM classifies the occupant of the passenger side front seat, and the proximity of each front seat to the front airbags. The OCM then sends electronic occupant classification messages to the Occupant Restraint Controller (ORC). The microprocessor and programming of the ORC determines whether to enable or disable the deployment circuits for the passenger airbag and seat belt tensioner; and, if enabled, what force level should be used to deploy each front airbag.

The OCS electrical circuits and components are continuously monitored by the OCM, and the OCM is continuously monitored by the ORC. A passenger airbag on/off indicator is located between the two air outlets near the top of the instrument panel center bezel. This indicator receives battery current whenever the ignition switch is in the On or Start positions, and illuminates only when the ORC pulls the indicator control circuit to ground. The indicator illuminates for about seven seconds as a bulb test each time the ignition switch is turned to the On or Start positions. Following the bulb test, the indicator is turned on or off by the ORC based upon the electronic occupant classification messages received from the OCM. This indicator is illuminated whenever the seat is occupied and passenger airbag and seat belt tensioner operation has been suppressed, and is turned off whenever the seat is empty or when the seat is occupied and the passenger airbag and seat belt tensioner are enabled. On club cab models, the indicator is illuminated by the ORC whenever the ignition switch is in the On or Start positions and the passenger airbag on-off switch is in the Off position, regardless of the input from the OCM.

When the OCM monitors a problem in any of the OCS circuits or components, it stores a fault code or DTC in its memory circuit and sends an electronic message to the ORC. The ORC then sends an electronic message to the ElectroMechanical Instrument Cluster (EMIC) to turn on the airbag indicator. If for any reason the OCM is unable to classify the occupant it sends an electronic message to the ORC, and the ORC suppresses passenger airbag and seat belt tensioner operation. Proper testing of the OCS components, the Controller Area Network (CAN) data bus, the electronic message inputs to and outputs from the OCM, the EMIC or the ORC, as well as the retrieval or erasure of a DTC from the OCM, the ORC or the EMIC requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the OCS.

WARNING

WARNINGS - RESTRAINT SYSTEM

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death on vehicles equipped with airbags, before performing any welding operations disconnect and isolate the battery negative (ground) cable and disconnect all wire harness connectors from the Occupant Restraint Controller (ORC). Failure to take the proper precautions could result in accidental airbag deployment and other possible damage to the supplemental restraint system circuits and components.

WARNING: To avoid personal injury or death, do not attempt to dismantle an airbag unit or tamper with its inflator. Do not puncture, incinerate, or bring into contact with electricity. Do not store at temperatures exceeding 93° C (200° F). An airbag inflator unit may contain sodium azide and potassium nitrate. These materials are poisonous and extremely flammable. Contact with acid, water, or heavy metals may produce harmful and irritating gases (sodium hydroxide is formed in the presence of moisture) or combustible compounds. An airbag inflator unit may also contain a gas canister pressurized to over 2500 psi.

WARNING: To avoid personal injury or death, when handling a seat belt tensioner retractor, proper care should be exercised to keep fingers out from under the retractor cover and away from the seat belt webbing where it exits from the retractor cover.

WARNING: To avoid personal injury or death, replace all restraint system components only with parts specified in the DaimlerChrysler Mopar Parts Catalog. Substitute parts may appear interchangeable, but internal differences may result in inferior occupant protection.

WARNING: To avoid personal injury or death, the fasteners, screws, and bolts originally used for the restraint system components must never be replaced with any substitutes. These fasteners have special coatings and are specifically designed for the restraint system. Any time a new fastener is needed, replace it with the correct fasteners provided in the service package or specified in the DaimlerChrysler Mopar Parts Catalog.

WARNING: To avoid personal injury or death, when a steering column has an airbag unit attached, never place the column on the floor or any other surface with the steering wheel or airbag unit face down.

DIAGNOSIS AND TESTING

SUPPLEMENTAL RESTRAINT SYSTEM

Proper diagnosis and testing of the supplemental restraint system components, the Controller Area Network (CAN) data bus, the data bus electronic message inputs to and outputs from the ElectroMechanical Instrument Cluster (EMIC), the Occupant Restraint Controller (ORC), or the Occupant Classification Module (OCM) as well as the retrieval or erasure of a Diagnostic Trouble Code (DTC) from the ORC or OCM requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

STANDARD PROCEDURE

HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS

At no time should any source of electricity be permitted near the inflator on the back of a non-deployed airbag or seat belt tensioner. When carrying a non-deployed airbag, the trim cover or airbag cushion side of the unit should be pointed away from the body to minimize injury in the event of an accidental deployment. If the airbag unit is placed on a bench or any other surface, the trim cover or airbag cushion side of the unit should be face up to minimize movement in the event of an accidental deployment.

When handling a non-deployed seat belt tensioner, take proper care to keep fingers out from under the retractor cover and away from the seat belt webbing where it exits from the retractor cover. In addition, the supplemental restraint system should be disarmed whenever any steering wheel, steering column, seat belt tensioner, airbag, impact sensor, Occupant Classification System (OCS), or instrument panel components require diagnosis or service. Failure to observe this warning could result in accidental airbag deployment and possible personal injury.

All damaged, faulty or non-deployed airbags and seat belt tensioners which are replaced on vehicles are to be handled and disposed of properly. If an airbag or seat belt tensioner unit is faulty or damaged and non-deployed, refer to the Hazardous Substance Control System for proper disposal. Dispose of all non-deployed and deployed airbags and seat belt tensioners in a manner consistent with state, provincial, local and federal regulations.

SUPPLEMENTAL RESTRAINT STORAGE

Airbags and seat belt tensioners must be stored in their original, special container until they are used for service. Also, they must be stored in a clean, dry environment; away from sources of extreme heat, sparks, and high electrical energy. Always place or store any airbag on a surface with its trim cover or airbag cushion side facing up, to minimize movement in case of an accidental deployment.

SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT

Any vehicle which is to be returned to use following a supplemental restraint deployment, must have the deployed restraints replaced. In addition, if the driver airbag has been deployed, the clockspring must be replaced. If the passenger airbag is deployed, the passenger airbag door must be replaced. The seat belt tensioners are deployed by the same signal that deploys the driver and passenger airbags and must also be replaced if either front airbag has been deployed. If a side curtain airbag has been deployed, the complete airbag unit, the headliner, as well as the upper A, B, and C-pillar trim must be replaced. These components are not intended for reuse and will be damaged or weakened as a result of a supplemental restraint deployment, which may or may not be obvious during a visual inspection.

On vehicles with an optional sunroof, the sunroof drain tubes and hoses must be closely inspected following a side curtain airbag deployment. It is also critical that the mounting surfaces and/or mounting brackets for the Occupant Restraint Controller (ORC), side impact sensors, and front impact sensors be closely inspected and restored to their original conditions following any vehicle impact damage. Because the ORC and each front and side impact sensor

are used by the supplemental restraint system to monitor or confirm the direction and severity of a vehicle impact, improper orientation or insecure fastening of these components may cause airbags not to deploy when required, or to deploy when not required.

All other vehicle components should be closely inspected following any supplemental restraint deployment, but are to be replaced only as required by the extent of the visible damage incurred.

AIRBAG SQUIB STATUS

Multistage airbags with multiple initiators (squibs) must be checked to determine that all squibs were used during the deployment event. The driver and passenger airbags in this model are deployed by electrical signals generated by the Occupant Restraint Controller (ORC) through the driver or passenger squib 1 and squib 2 circuits to the two initiators in the airbag inflators. Typically, both initiators are used and all potentially hazardous chemicals are burned during an airbag deployment event. However, it is possible for only one initiator to be used due to an airbag system fault; therefore, it is always necessary to confirm that both initiators have been used in order to avoid the improper handling or disposal of potentially live pyrotechnic or hazardous materials. The following procedure should be performed using a diagnostic scan tool to verify the status of both airbag squibs before either deployed airbag is removed from the vehicle for disposal.

CAUTION: Deployed front airbags having two initiators (squibs) in the airbag inflator may or may not have live pyrotechnic material within the inflator. Do not dispose of these airbags unless you are sure of complete deployment. Refer to the Hazardous Substance Control System for proper disposal procedures. Dispose of all non-deployed and deployed airbags and seat belt tensioners in a manner consistent with state, provincial, local, and federal regulations.

1. Be certain that the diagnostic scan tool contains the latest version of the proper diagnostic software. Connect the scan tool to the 16-way Data Link Connector (DLC). The DLC is located on the driver side lower edge of the instrument panel, outboard of the steering column.
2. Turn the ignition switch to the On position.
3. Using the scan tool, read and record the active (current) Diagnostic Trouble Code (DTC) data.

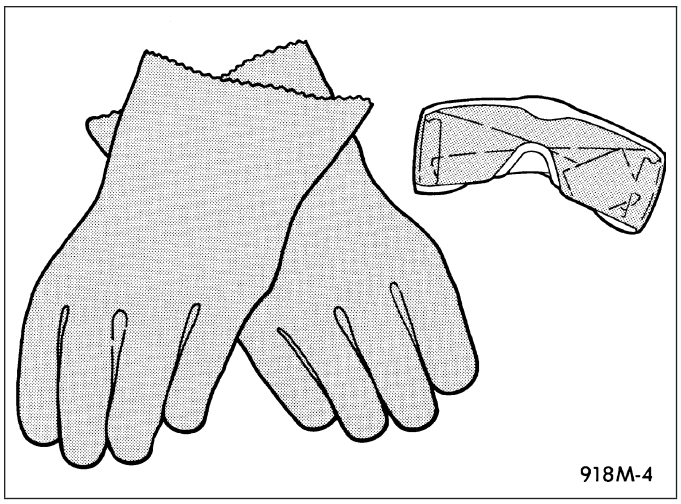
Using the active DTC information, refer to the **Airbag Squib Status** table to determine the status of both driver and/or passenger airbag squibs.

AIRBAG SQUIB STATUS		
IF THE ACTIVE DTC IS:	**CONDITIONS**	**SQUIB STATUS**
Driver or Passenger Squib 1 open Driver or Passenger Squib 2 open	**AND** the stored DTC minutes for both Driver or Passenger squibs are within 15 minutes of each other	Both Squib 1 and 2 were used.
Driver or Passenger Squib 1 open Driver or Passenger Squib 2 open	**AND** the stored DTC minutes for Driver or Passenger Squib 2 open is GREATER than the stored DTC minutes for Driver or Passenger Squib 1 by 15 minutes or more	Squib 1 was used; Squib 2 is live.
Driver or Passenger Squib 1 open Driver or Passenger Squib 2 open	**AND** the stored DTC minutes for Driver or Passenger Squib 1 open is GREATER than the stored DTC minutes for Driver or Passenger Squib 2 by 15 minutes or more	Squib 1 is live; Squib 2 was used.
Driver or Passenger Squib 1 open	**AND** Driver or Passenger Squib 2 open is NOT an active code	Squib 1 was used; Squib 2 is live.
Driver or Passenger Squib 2 open	**AND** Driver or Passenger Squib 1 open is NOT an active code	Squib 1 is live; Squib 2 was used.

NOTE: If none of the Driver or Passenger Squib 1 or 2 open are active codes, the status of the airbag squibs is unknown. In this case the airbag should be handled and disposed of as if the squibs were both live.

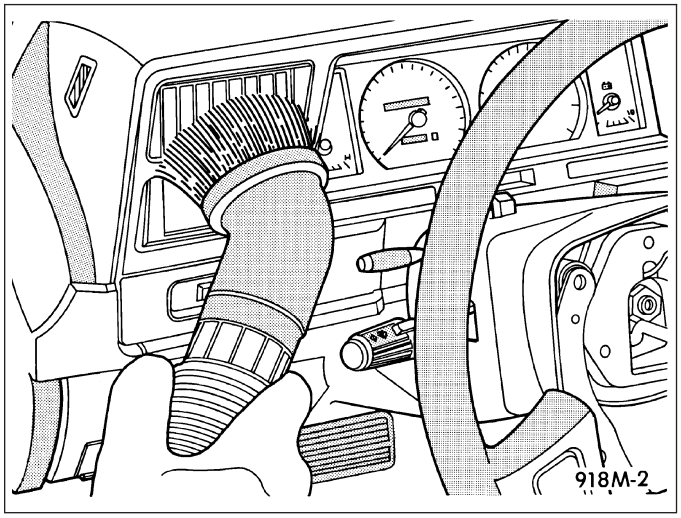
CLEANUP PROCEDURE

Following a supplemental restraint deployment, the vehicle interior will contain a powdery residue. This residue consists primarily of harmless particulate by-products of the small pyrotechnic charge that initiates the propellant used to deploy a supplemental restraint. However, this residue may also contain traces of sodium hydroxide powder, a chemical by-product of the propellant material that is used to generate the inert gas that inflates the airbag. Since sodium hydroxide powder can irritate the skin, eyes, nose, or throat, be certain to wear safety glasses, rubber gloves, and a long-sleeved shirt during cleanup.



WARNING: To avoid personal injury or death, if you experience skin irritation during cleanup, run cool water over the affected area. Also, if you experience irritation of the nose or throat, exit the vehicle for fresh air until the irritation ceases. If irritation continues, see a physician.

1. Begin the cleanup by using a vacuum cleaner to remove any residual powder from the vehicle interior. Clean from outside the vehicle and work your way inside, so that you avoid kneeling or sitting on a non-cleaned area.
2. Be certain to vacuum the heater and air conditioning outlets as well. Run the heater and air conditioner blower on the lowest speed setting and vacuum any powder expelled from the outlets.



CAUTION: Deployed front airbags having two initiators (squibs) in the airbag inflator may or may not have live pyrotechnic material within the inflator. Do not dispose of these airbags unless you are sure of complete deployment. Refer to AIRBAG SQUIB STATUS . All damaged, faulty, or non-deployed supplemental restraints which are replaced on vehicles are to be handled and disposed of properly. If an airbag or seat belt tensioner unit is faulty or damaged and non-deployed, refer to the Hazardous Substance Control System for proper disposal. Be certain to dispose of all non-deployed and deployed supplemental restraints in a manner consistent with state, provincial, local and federal regulations.

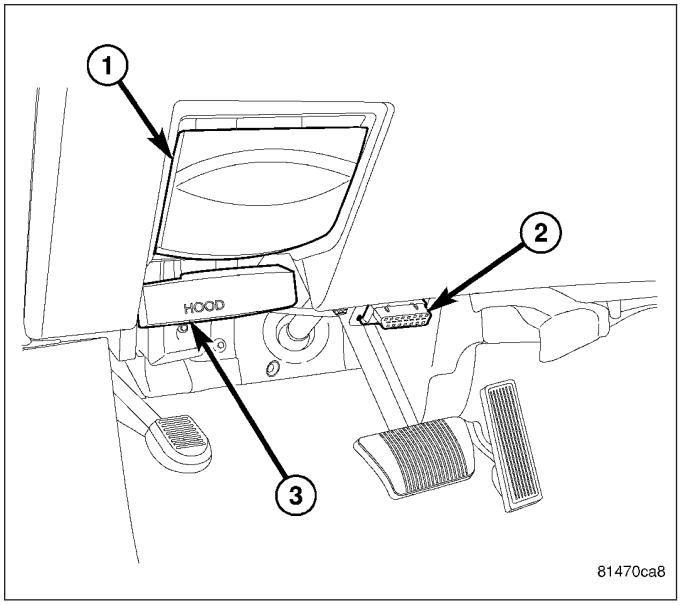
3. Next, remove the deployed supplemental restraints from the vehicle. Refer to the appropriate service removal procedures.
4. You may need to vacuum the interior of the vehicle a second time to recover all of the powder.

SUPPLEMENTAL RESTRAINTS VERIFICATION TEST

NOTE: The following procedure should be performed using a diagnostic scan tool to verify proper supplemental restraint system operation following the service or replacement of any supplemental restraint system component. In addition, if the vehicle is equipped with the Occupant Classification System and one of the passenger front seat supplemental restraint components has been replaced, following successful completion of the supplemental restraint system verification test procedure, perform the Occupant Classification System Verification Test using a diagnostic scan tool. Refer to the appropriate diagnostic procedures.

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

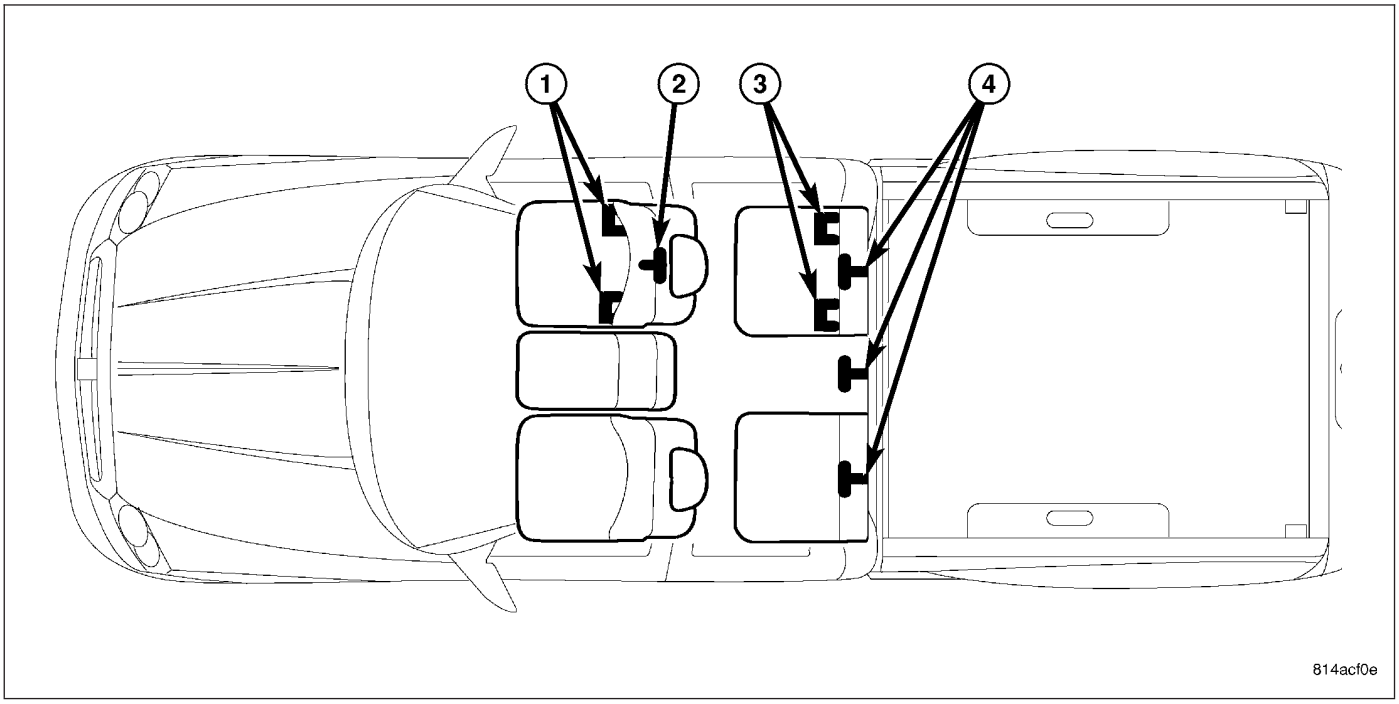
1. During the following test, the battery negative cable remains disconnected and isolated, as it was during the supplemental restraint system component removal and installation procedures.
2. Be certain that the diagnostic scan tool contains the latest version of the proper diagnostic software. Connect the scan tool to the 16-way Data Link Connector (DLC) (2). The DLC is located on the driver side lower edge of the instrument panel, outboard of the steering column.
3. Turn the ignition switch to the On position and exit the vehicle with the scan tool.
4. Check to be certain that nobody is in the vehicle, then reconnect the battery negative cable.
5. Using the scan tool, read and record the active (current) Diagnostic Trouble Code (DTC) data.
6. Next, use the scan tool to read and record any stored (historical) DTC data.



7. If any DTC is found in Step 5 or Step 6, refer to the appropriate diagnostic information.
8. Use the scan tool to erase the stored DTC data. If any problems remain, the stored DTC data will not erase. Refer to the appropriate diagnostic information to diagnose any stored DTC that will not erase. If the stored DTC information is successfully erased, go to Step 9.
9. Turn the ignition switch to the Off position for about fifteen seconds, and then back to the On position. Observe the airbag indicator in the instrument cluster. It should illuminate for six to eight seconds, and then go out. This indicates that the supplemental restraint system is functioning normally and that the repairs are complete. If the airbag indicator fails to light, or lights and stays on, there is still an active supplemental restraint system fault or malfunction. Refer to the appropriate diagnostic information to diagnose the problem.

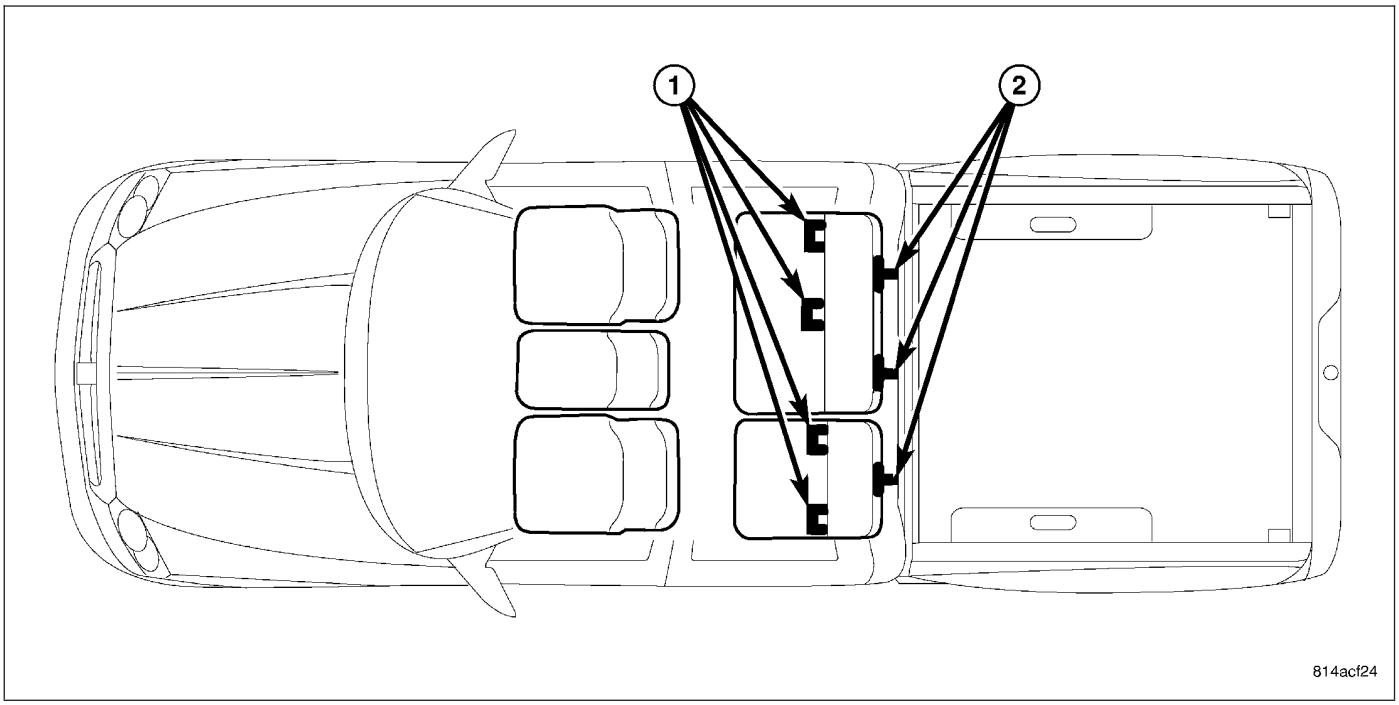
CHILD RESTRAINT ANCHOR

DESCRIPTION



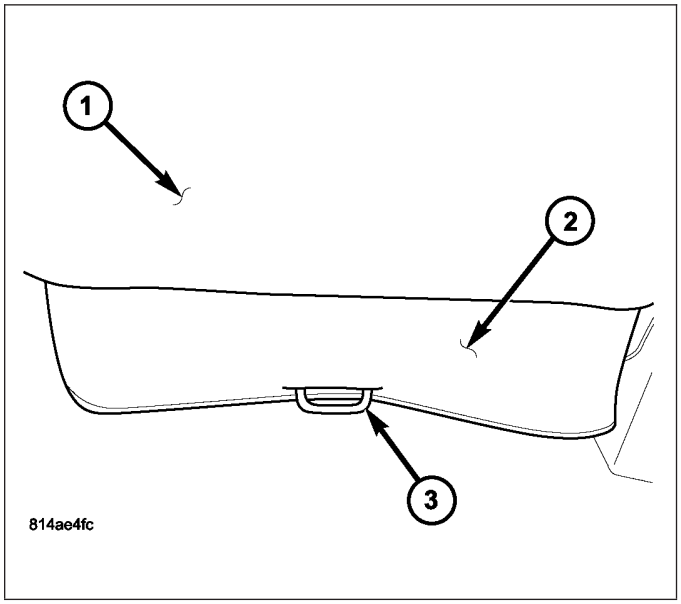
This model is equipped with a Lower Anchors and Tether for CHildren, or LATCH child restraint anchorage system. The LATCH system provides for the installation of suitable child restraints in certain seating positions without using the standard equipment seat belt provided for that seating position.

The outboard front passenger seat of all club cab models is equipped with a fixed-position child restraint upper tether anchor (2) and child restraint lower anchors (1). On club cab models with optional rear seats, two outboard upper tether straps and a center anchor (4) are located on the back of the cab even though only two child seats can be installed. Only the passenger side outboard rear seat has lower anchors (3). On club cabs without a rear seat, the center anchor remains on the cab back for anchoring a child seat from the front center seating position.

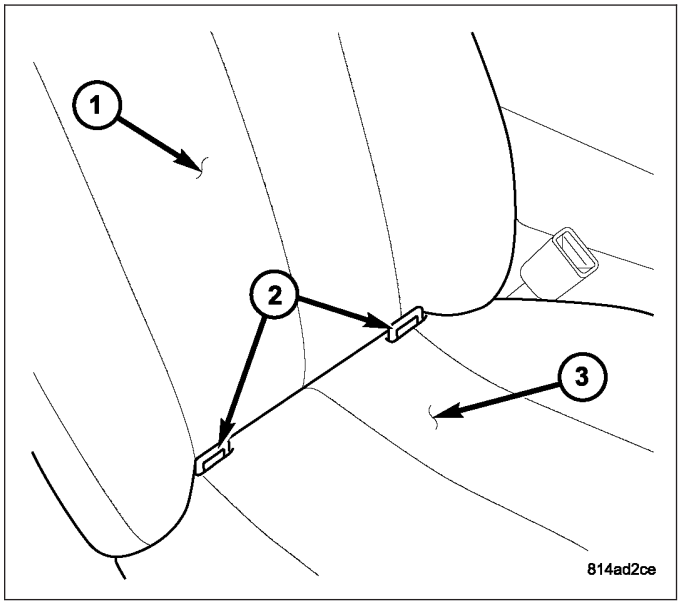


Quad cab models are equipped with a fixed-position child restraint upper tether anchor strap for the rear center and both rear outboard seating positions (2), and child restraint lower anchors for both rear outboard seating positions (1). All front seat child restraint anchors are deleted on quad cab models.

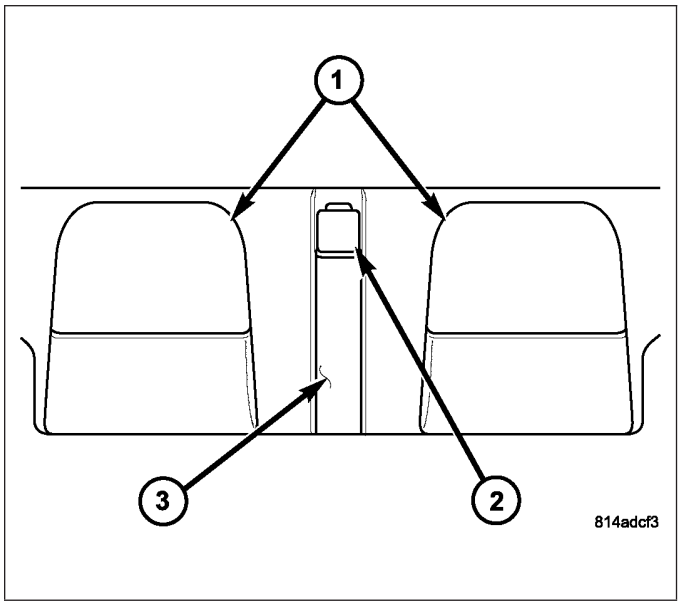
The club cab right outboard front seat upper tether anchor (3) is integral to the front seat cushion (2) frame. This anchor is constructed from round steel bar stock that is formed into a loop, then securely welded at each end to the seat cushion frame. it is accessed from behind the front seat, just below the seat back (1). This anchor cannot be adjusted or repaired and, if faulty or damaged, it must be replaced as a unit with the seat cushion frame.



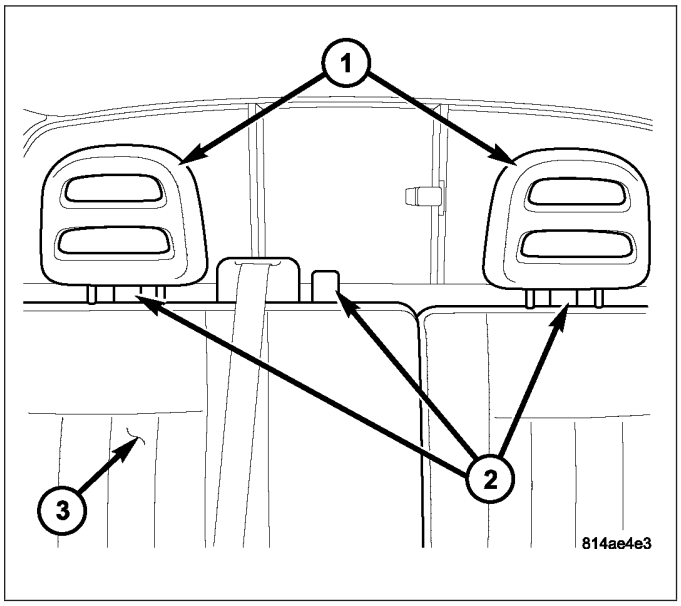
The club cab right outboard front seat lower anchors (2) are also integral to the front seat cushion frame. These lower anchors are each constructed from round steel bar stock that is formed into a loop, then securely welded at each end to the seat cushion frame. They are each accessed from the front of the seat, at each side where the seat back (1) meets the seat cushion (3). These lower anchors cannot be adjusted or repaired and, if faulty or damaged, they must be replaced as a unit with the seat cushion frame.



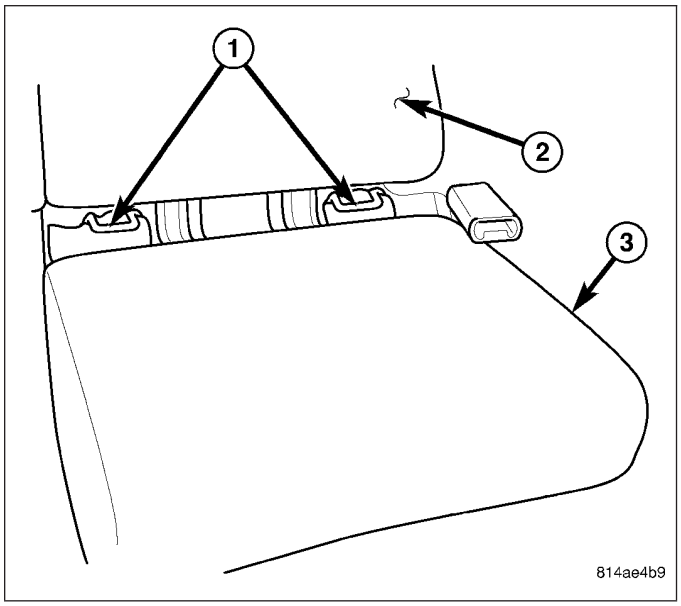
The two rear seat upper tether straps and center anchor for club cab models are secured to the upper cab back panel reinforcement with screws and are concealed behind the cab back trim (3). The outboard tether straps are accessed by folding down the upper rear seat back pads (1), while a hinged access door (2) is opened to access the center anchor. These upper tether straps and the anchor are available for individual service replacement.



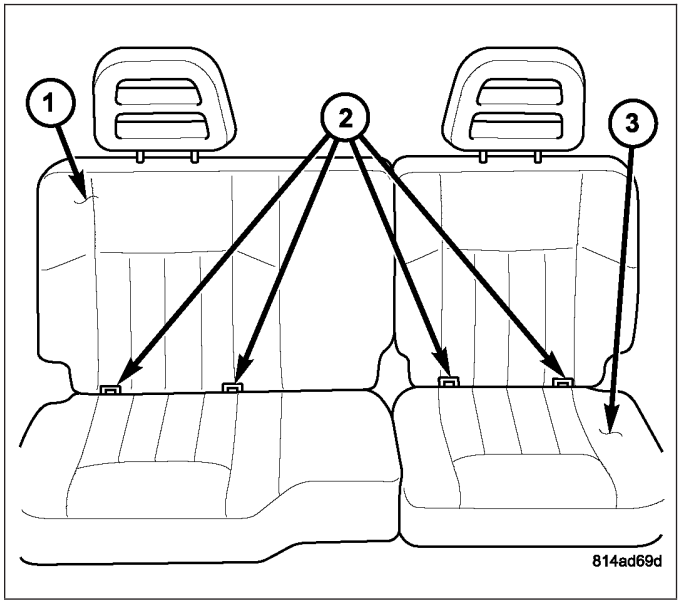
The three upper tether anchor straps (2) for quad cab models are secured to the upper cab back panel reinforcement with screws. These anchor straps are concealed behind the upright rear seat back (3) and the outboard rear seat headrests (1). The upper tether anchor straps are available for individual service replacement.



The two lower anchors (1) for the passenger side rear outboard seating position of club cab models are integral to a mounting bracket that is secured to the cab back panel and the rear floor panel with screws. They are each accessed from the front of the seat, at each side where the seat back (2) meets the seat cushion (3). These lower anchors and their bracket are available for individual service replacement.



The lower anchors (2) for the rear seat of quad cab models are also integral to their respective seat cushion frame. These anchors are also constructed from a heavy-gauge steel wire loop that is securely welded to the seat cushion frame. They are each accessed from the front of their respective seats, at each side where the seat back (1) meets the seat cushion (3). These lower anchors cannot be adjusted or repaired and, if faulty or damaged, they must be replaced as a unit with the second row seat cushion frame unit.



WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

OPERATION

See the owner's manual in the vehicle glove box for more information on the proper use of all of the factory-installed child restraint anchors.

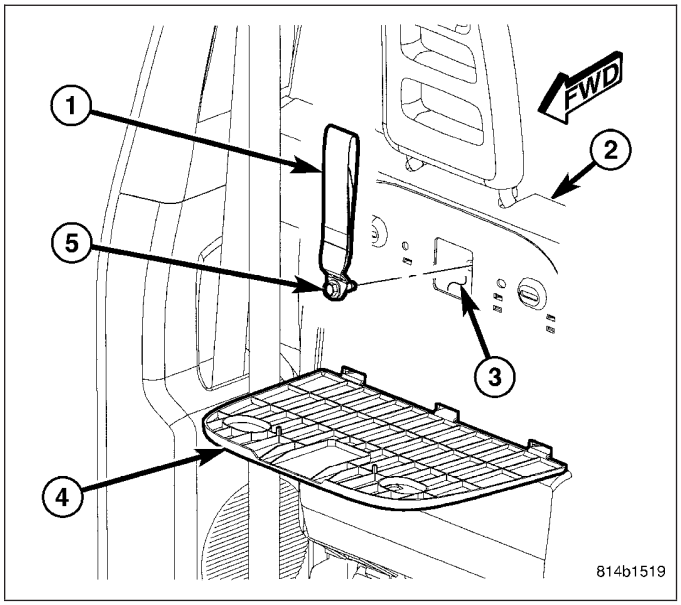
REMOVAL

TETHER STRAP - CLUB CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: The following procedure applies only to the rear seat upper child tether straps used on club cab models equipped with optional rear seats.

1. Fold down the rear seat upper back pad (4) from the cab back trim panel (2) to access the tether strap (1).
2. Remove the screw (5) that secures the child tether strap to the upper cab back panel reinforcement (3).
3. Remove the child tether strap from the cab back.

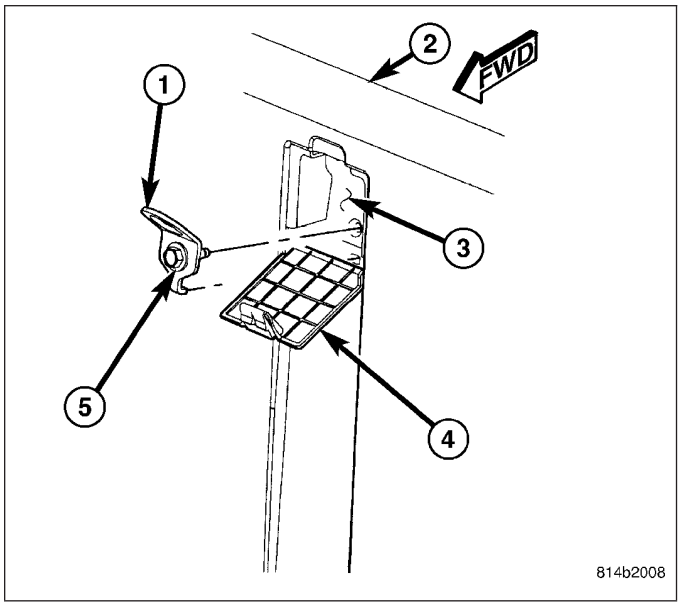


TETHER ANCHOR - CLUB CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: The following procedure applies only to the center upper child tether anchor used on all club cab models.

1. Unlatch and open the access door (4) on the cab back trim panel (2) to access the tether anchor (1).
2. Remove the screw (5) that secures the child tether anchor to the upper cab back panel reinforcement (3).
3. Remove the child tether anchor from the cab back.

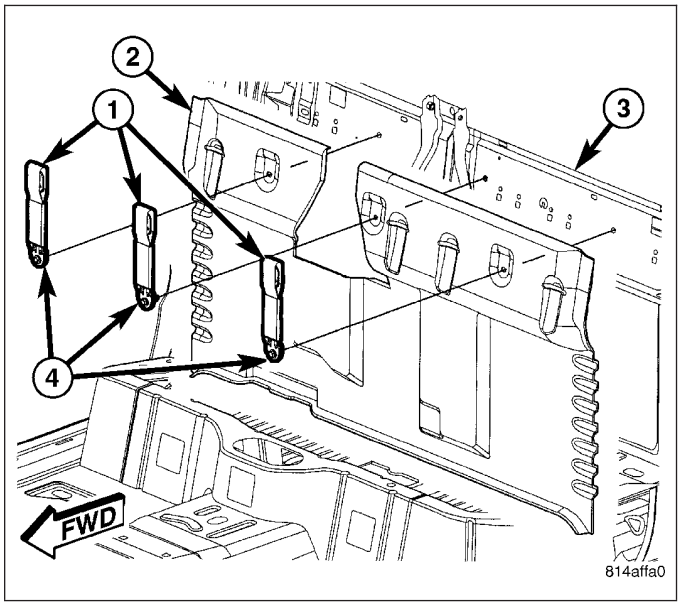


TETHER STRAP - QUAD CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: The following procedure applies only to the rear seat upper child tether straps used on quad cab models.

1. Remove the rear seat from the vehicle. (Refer to 23 - BODY/SEATS/SEAT - REAR - REMOVAL).
2. Remove the screw (4) that secures the child tether strap (1) to the upper cab back panel reinforcement (3).
3. Remove the child tether strap from the cab back trim panel (2).

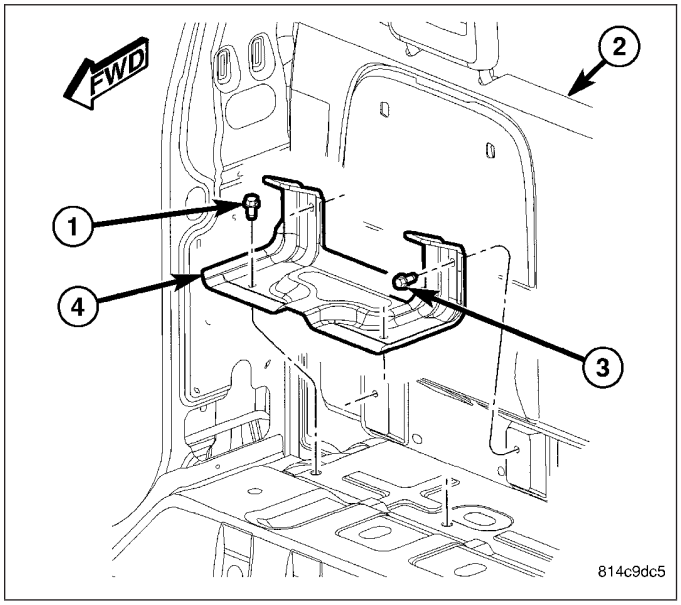


REAR SEAT LOWER ANCHOR BRACKET - CLUB CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: The following procedure applies only to the lower anchor bracket used in the right rear seating position of club cab models.

1. Fold the rear seat cushion up against the cab back panel (2).
2. Pull the floor carpet under the rear seat cushion away from the base of the cab back panel far enough to access the lower anchor bracket (4).
3. Remove the two screws (1) that secure the bracket to the floor panel.
4. Remove the two screws (3) that secure the bracket to the cab back panel.
5. Remove the bracket from the vehicle.



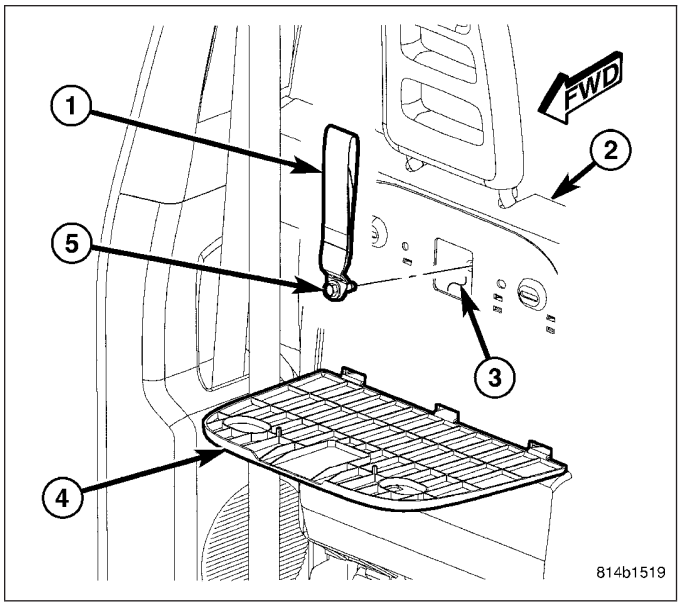
INSTALLATION

TETHER STRAP - CLUB CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: The following procedure applies only to the rear seat upper child tether straps used on club cab models equipped with optional rear seats.

1. Position the child tether strap (1) through the access hole in the cab back trim panel (2) onto the upper cab back panel reinforcement (3).
2. Install and tighten the screw (5) that secures the child tether strap to the cab back. Tighten the screw to 14 N·m (10 ft. lbs.).
3. Fold the rear seat upper back pad (4) back against the cab back trim panel to conceal the tether strap.

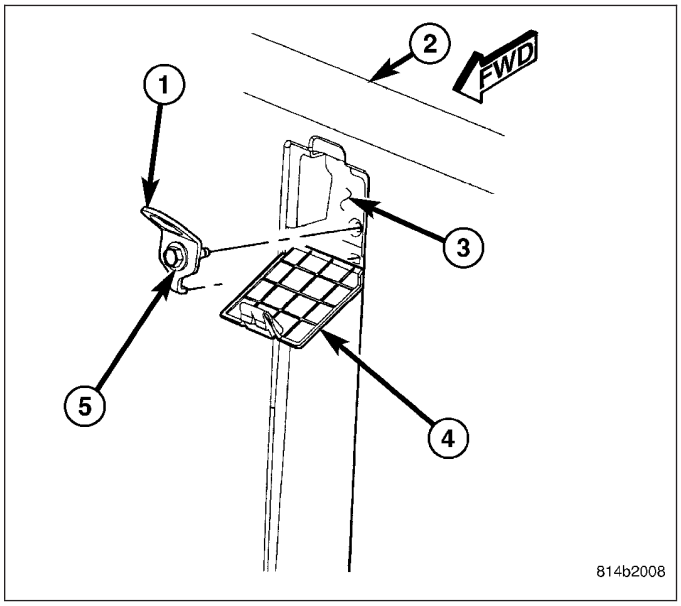


TETHER ANCHOR - CLUB CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: The following procedure applies only to the center upper child tether anchor used on all club cab models.

1. Position the child tether anchor (1) through the access hole in the cab back trim panel (2) onto the upper cab back panel reinforcement (3).
2. Install and tighten the screw (5) that secures the child tether anchor to the cab back. Tighten the screw to 14 N·m (10 ft. lbs.).
3. Fold the access door (4) back against the cab back trim panel to conceal the tether anchor.

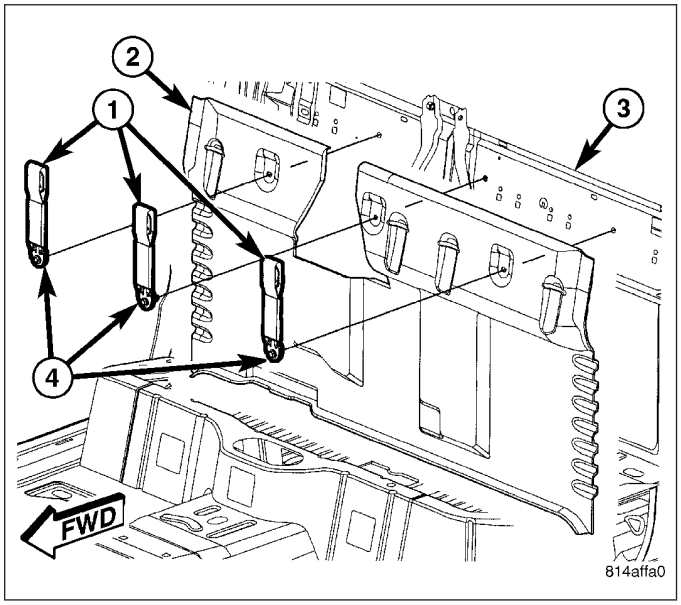


TETHER STRAP - QUAD CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: The following procedure applies only to the rear seat upper child tether straps used on quad cab models.

1. Position the child tether strap (1) onto the cab back trim panel (2).
2. Install and tighten the screw (4) that secures the child tether strap to the upper cab back panel reinforcement (3). Tighten the screw to 14 N·m (10 ft. lbs.).
3. Reinstall the rear seat into the vehicle. (Refer to 23 - BODY/SEATS/SEAT - REAR - INSTALLATION).

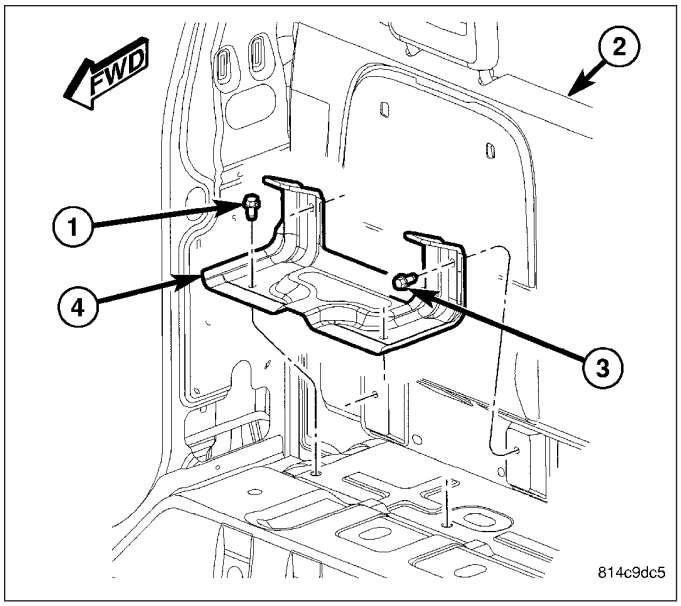


REAR SEAT LOWER ANCHOR BRACKET - CLUB CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: The following procedure applies only to the lower anchor bracket used in the right rear seating position of club cab models.

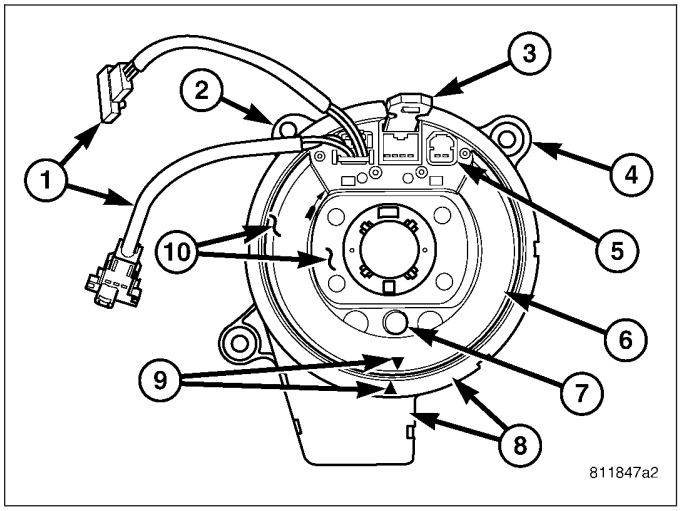
1. Position the lower anchor bracket (4) to the floor panel and the cab back panel (2) under the right rear seat cushion.
2. Loosely install the two screws (3) that secure the bracket to the cab back panel.
3. Install and tighten the two screws (1) that secure the bracket to the floor panel. Tighten the screws to 3 N·m (30 in. lbs.).
4. Tighten the two screws that secure the bracket to the cab back panel. Tighten the screws to 23 N·m (17 ft. lbs.).
5. Restore the floor carpet under the rear seat cushion to the base of the cab back panel.



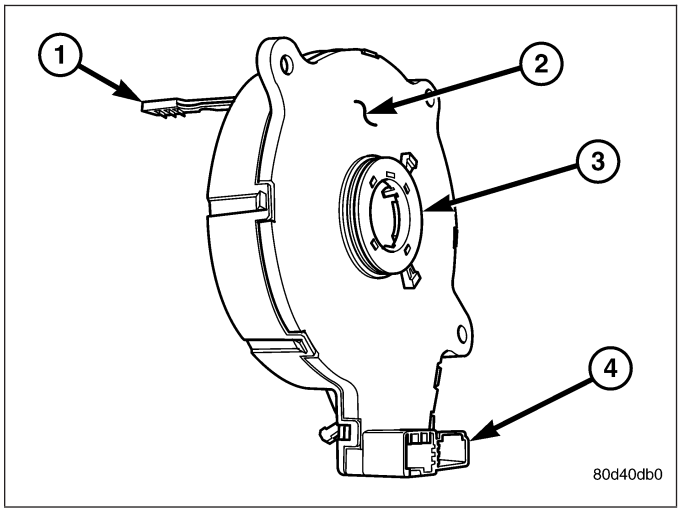
CLOCKSPRING

DESCRIPTION

The clockspring assembly is secured with two screws onto the multi-function switch mounting housing near the top of the steering column behind the steering wheel. The clockspring consists of a flat, round molded plastic case (8) with a stubby tail that hangs below the steering column. The tail contains two connector receptacles that face toward the instrument panel. Within the plastic case is a spool-like molded plastic rotor (10) with a large exposed hub. The upper surface of the rotor hub has a large center hole, two large flats, an engagement dowel with a yellow rubber boot (7), two short pigtail wires with connectors (1), and two connector receptacles (5) that face toward the steering wheel.



The lower surface of the rotor hub has a molded plastic turn signal cancel cam (3) with two lobes that is keyed to the rotor and is secured there with four integral snap features. Within the plastic case and wound around the rotor spool is a long ribbon-like tape that consists of several thin copper wire leads sandwiched between two thin plastic membranes. The outer end of the tape terminates at the connector receptacles (4) that face the instrument panel, while the inner end of the tape terminates at the pigtail wires and connector receptacles on the hub of the clockspring rotor that face the steering wheel.



Service replacement clocksprings are shipped pre-centered and with a molded plastic locking pin (1) that snaps into a receptacle on the rotor and is engaged between two tabs on the upper surface of the rotor case. The locking pin secures the centered clockspring rotor to the clockspring case during shipment and handling, but must be removed from the clockspring after it is installed on the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

The clockspring cannot be repaired. If the clockspring is faulty, damaged, or if the driver airbag has been deployed, the clockspring must be replaced.

OPERATION

The clockspring is a mechanical electrical circuit component that is used to provide continuous electrical continuity between the fixed instrument panel wire harness and the electrical components mounted on or in the rotating steering wheel. On this model the rotating electrical components include the driver airbag, the horn switch, the speed control switches, and the remote radio switches, if the vehicle is so equipped. The clockspring case is positioned and secured to the multi-function switch mounting housing near the top of the steering column. The connector receptacles on the tail of the fixed clockspring case connect the clockspring to the vehicle electrical system through two take outs with connectors from the instrument panel wire harness.

The clockspring rotor is movable and is keyed by an engagement dowel that is molded onto the rotor hub between two fins that are cast into the lower surface of the steering wheel armature. A yellow rubber boot is installed over the engagement dowel to eliminate contact noise between the dowel and the steering wheel. The two lobes on the turn signal cancel cam on the lower surface of the clockspring rotor hub contact a turn signal cancel actuator of the multi-function switch to provide automatic turn signal cancellation.

Two short, yellow-sleeved pigtail wires on the upper surface of the clockspring rotor connect the clockspring to the multistage driver airbag, while a steering wheel wire harness connects the two connector receptacles on the upper surface of the clockspring rotor to the horn switch feed pigtail wire connector and, if the vehicle is so equipped, to the optional speed control and remote radio switches on the steering wheel.

Like the clockspring in a timepiece, the clockspring tape has travel limits and can be damaged by being wound too tightly during full stop-to-stop steering wheel rotation. To prevent this from occurring, the clockspring is centered when it is installed on the steering column. Centering the clockspring indexes the clockspring tape to the movable steering components so that the tape can operate within its designed travel limits. However, if the clockspring is removed from the steering column or if the steering shaft is disconnected from the steering gear, the clockspring spool can change position relative to the movable steering components. The clockspring must be re-centered following completion of this service or the tape may be damaged.

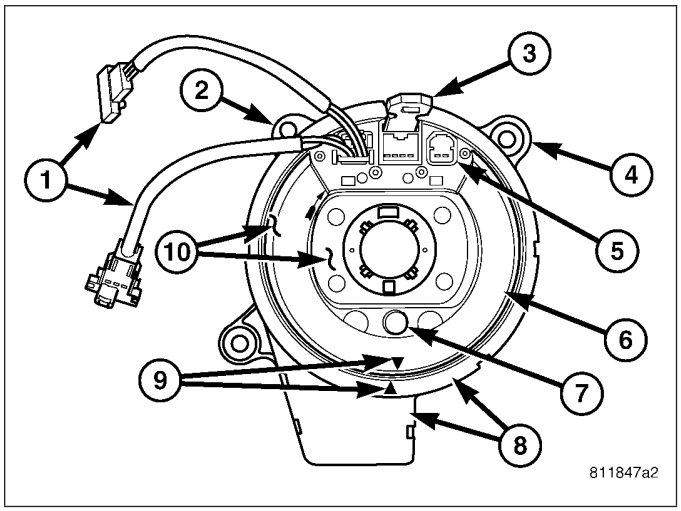
Service replacement clocksprings are shipped pre-centered and with a plastic locking pin installed. This locking pin should not be removed until the clockspring has been installed on the steering column. If the locking pin is removed before the clockspring is installed on a steering column, the clockspring centering procedure must be performed. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

STANDARD PROCEDURE

CLOCKSPRING CENTERING

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

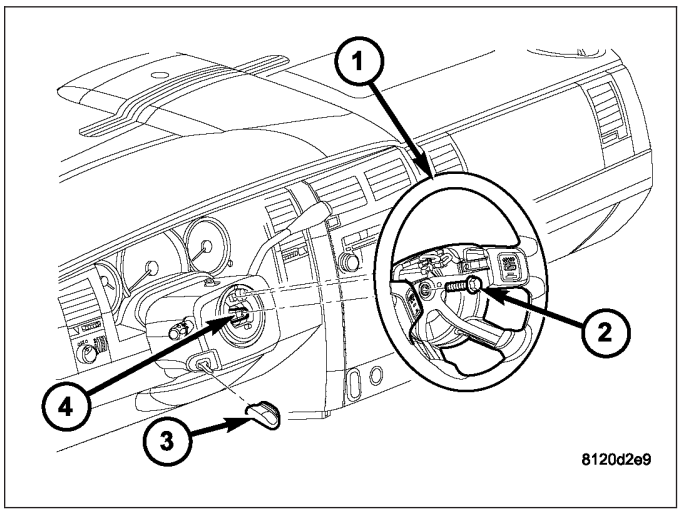


1. Place the front wheels in the straight-ahead position.
2. Remove the clockspring from the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).
3. Rotate the clockspring rotor (10) clockwise to the end of its travel. **Do not apply excessive torque.**
4. From the end of the clockwise travel, rotate the rotor about two and one-half turns counterclockwise. The engagement dowel and yellow rubber boot (7) should end up at the bottom, and the arrows on the clockspring rotor and case (9) should be in alignment.
5. The clockspring is now centered. Secure the clockspring rotor to the clockspring case to maintain clockspring centering until it is reinstalled on the steering column.
6. The front wheels should still be in the straight-ahead position. Reinstall the clockspring onto the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).

REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

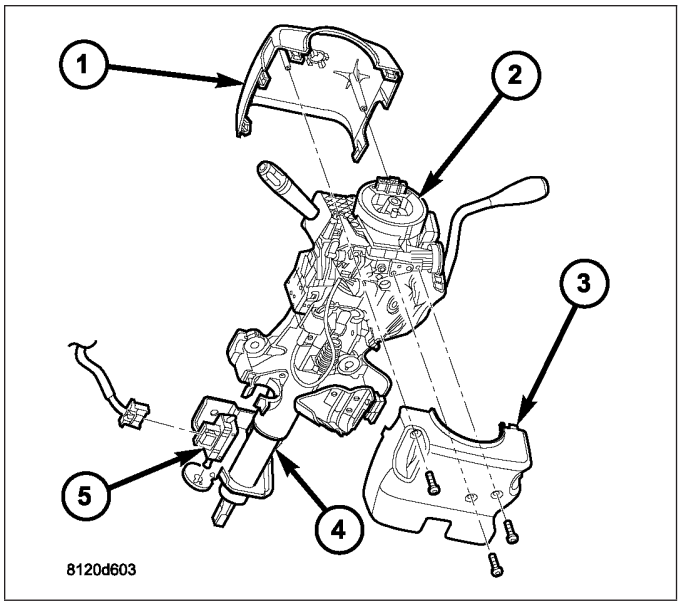


1. Place the front wheels in the straight ahead position.
2. Disconnect and isolate the battery negative cable.
3. Remove the driver airbag from the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).
4. Disconnect the steering wheel wire harness connectors from the upper clockspring connector receptacles.

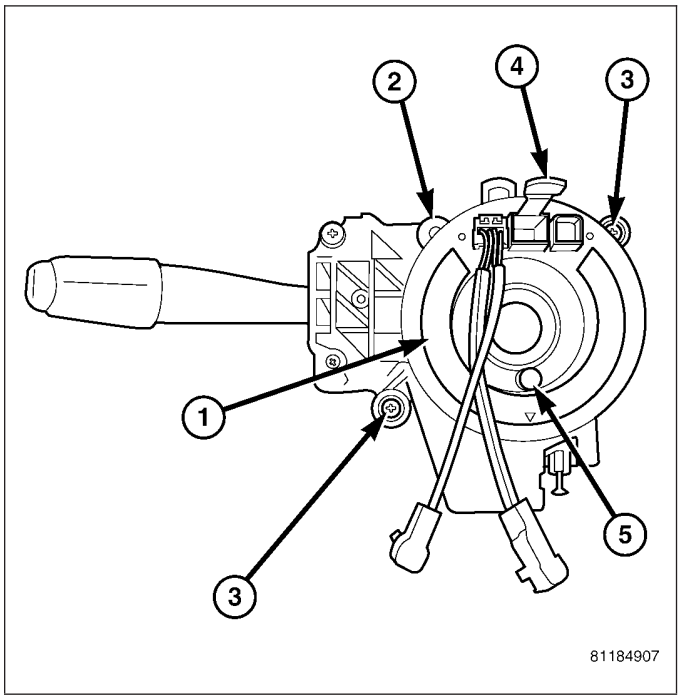
CAUTION: Be certain that the screws that secure the steering wheel puller to the steering wheel are fully engaged in the steering wheel armature without passing through the steering wheel and damaging the clockspring.

5. Remove the steering wheel (1) from the steering column. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - REMOVAL).
6. Grasp the tilt steering column knob (3) firmly and pull it straight rearward to remove it from the tilt adjuster lever on the left side of the column.

7. From below the steering column, remove the two outboard screws that secure the upper column shroud (1) to the lower shroud (3).
8. Using hand pressure, push gently inward on both sides of the upper shroud above the parting line of the lower shroud to release the snap features that secure the two shroud halves to each other.
9. Remove the upper shroud from the lower shroud and the steering column.
10. Remove the one center screw that secures the lower shroud to the steering column (4).
11. Remove the lower shroud from the steering column.
12. Disconnect the two instrument panel wire harness connectors from the two connector receptacles located below the steering column on the back of the clockspring housing.



13. Remove the two screws (3) that secure the clockspring to the multi-function switch mounting housing.
14. Remove the clockspring from the multi-function switch mounting housing. The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver airbag has been deployed.
15. If the removed clockspring is to be reused, be certain to secure the clockspring rotor to the clockspring case to maintain clockspring centering until it is reinstalled on the steering column. If clockspring centering is not maintained, the clockspring must be centered again before it is reinstalled. (Refer to 8 - ELECTRICAL/RESTRAINTS/ CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).



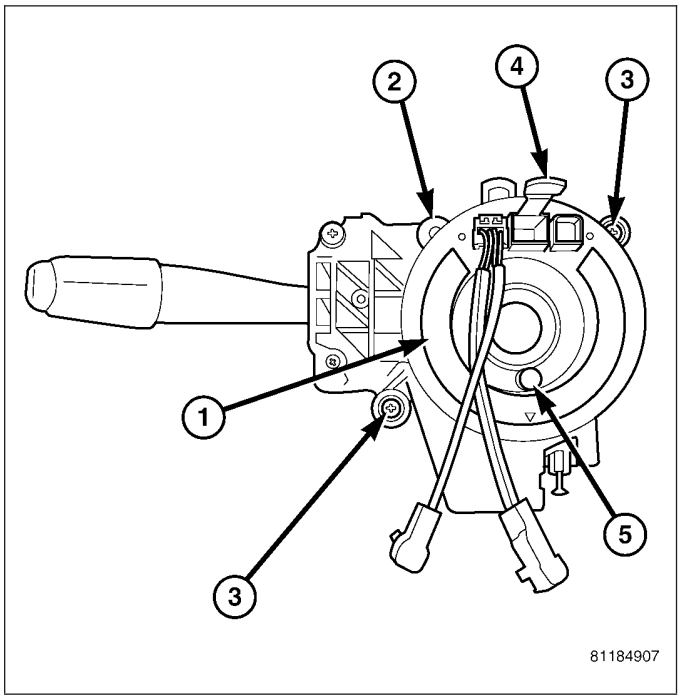
INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

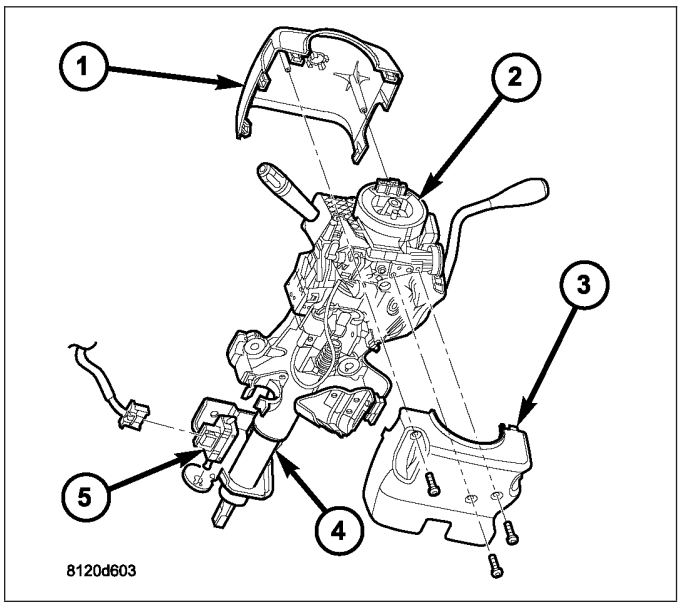
CAUTION: If the clockspring is not properly centered in relation to the steering wheel, steering shaft and steering gear, it may be damaged. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING). Service replacement clocksprings are shipped pre-centered and with a locking pin installed. This locking pin should not be removed until the clockspring has been installed on the steering column. If the locking pin is removed before the clockspring is installed on a steering column, the clockspring centering procedure must be performed.

NOTE: Before starting this procedure, be certain that the front wheels are still in the straight-ahead position.

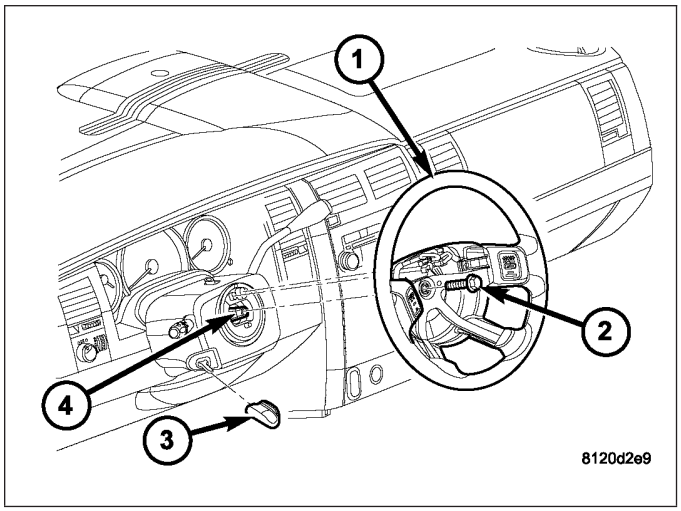
1. While holding the centered clockspring rotor and case stationary in relation to each other, carefully slide the clockspring down over the steering column upper shaft.
2. Align and seat the hole in the locating tab (2) on the clockspring case over the locating pin on the multi-function switch mounting housing.
3. Install and tighten the two screws (3) that secure the clockspring to the multi-function switch mounting housing. Tighten the screws to 2 N·m (20 in. lbs.).
4. Reconnect the two instrument panel wire harness connectors to the two connector receptacles located below the steering column on the back of the clockspring housing.



5. Position the lower shroud (3) onto the steering column (4).
6. From below the steering column, install and tighten the one center screw that secures the lower shroud to the steering column. Tighten the screw to 2 N·m (20 in. lbs.).
7. Position the upper shroud (1) onto the steering column over the lower shroud. Be certain to engage the gearshift lever gap hider into the opening in the right side of both shroud halves.
8. Align the snap features on the upper shroud with the receptacles in the lower shroud and apply hand pressure to snap them together.
9. Install and tighten the two outboard screws that secure the upper shroud to the lower shroud. Tighten the screws to 2 N·m (20 in. lbs.).



10. Align the tilt steering column knob (3) with the tilt adjuster lever on the left side of the steering column and use hand pressure to snap it back into place.
11. If a new clockspring has been installed, remove the plastic locking pin that is securing the clockspring rotor to the clockspring case to maintain clockspring centering.



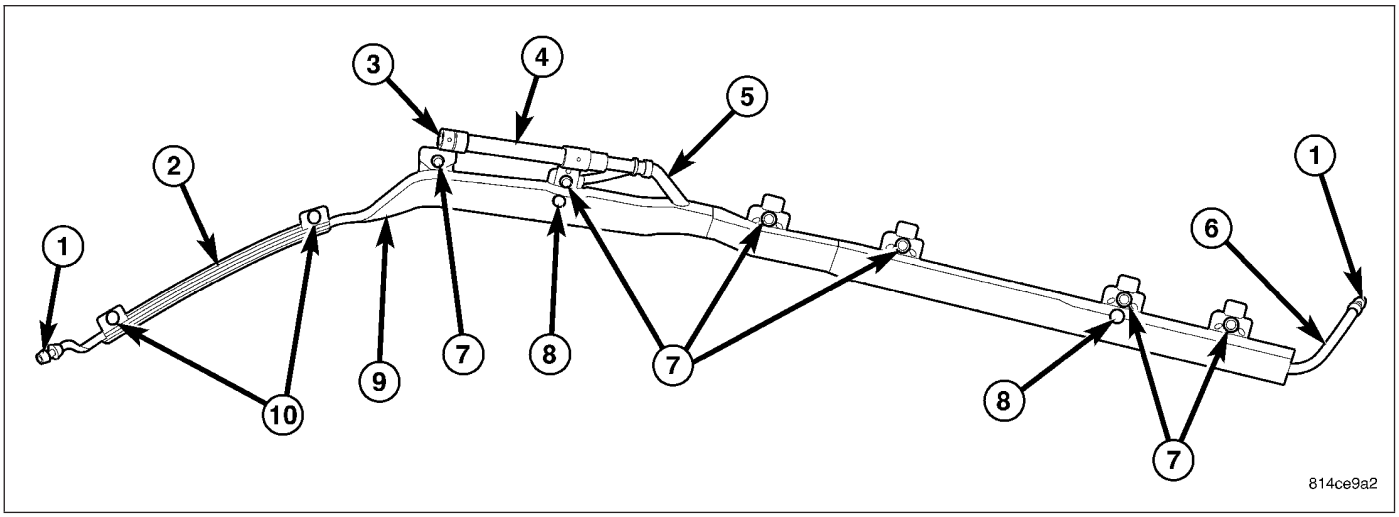
NOTE: When reinstalling the steering wheel, be certain to index the yellow rubber booted engagement dowel on the upper surface of the clockspring rotor between the two fins cast into the lower surface of the steering wheel armature hub.

12. Reinstall the steering wheel (1) onto the steering column. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - INSTALLATION).
13. Reconnect the steering wheel wire harness connectors to the upper clockspring connector receptacles. Be certain that the steering wheel wire harness is routed between the steering wheel back trim cover and the steering wheel armature.
14. Reinstall the driver airbag onto the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).
15. Reconnect the battery negative cable.

AIR BAG-SIDE CURTAIN

DESCRIPTION

Optional side curtain airbags are available for this model when it is also equipped with dual front airbags. These airbags are passive, inflatable, Supplemental Restraint System (SRS) components, and vehicles with this equipment can be readily identified by a molded identification trim button with the “SRS - AIRBAG” logo located on the headliner over the roof side rail (club cab) or near the top of each upper B-pillar trim panel (quad cab). This system is designed to reduce injuries to the vehicle occupants in the event of a side impact collision.



Vehicles equipped with side curtain airbags have two individually controlled curtain airbag units. These airbag units are concealed and mounted above the headliner where they are each secured to one of the roof side rails. Each folded airbag cushion is contained within a long extruded plastic channel (9) that extends along the roof rail from the A-pillar at the front of the vehicle to the pillar at the rear of the vehicle. The channel is initially secured during installation with two plastic push-in fasteners (8) to the roof rail.

A long tether (2) extends down the A-pillar from the front of the airbag cushion, where it is retained to the pillar with plastic push-in routing clips (10) and it is secured to the base of the A-pillar near the belt line with a metal clip (1). A short tether (6) is secured by a second metal clip to the header over the glass at the back of the cab.

The hybrid-type inflator (4) for each airbag is secured to the roof rail at the front of the airbag unit above the front door opening, and is connected to the airbag cushion by a long tubular manifold (5). The entire assembly is secured to six U-nuts spaced along the inside of the roof rail with six screws (7).

A two-wire takeout and connector of the body wire harness is connected directly to the connector receptacle of the initiator (3) near the front of the airbag inflator. The body wire harness connects each curtain airbag unit to the Occupant Restraint Controller (ORC).

The side curtain airbag unit cannot be adjusted or repaired and must be replaced if deployed, faulty, or in any way damaged. Once a side curtain airbag has been deployed, the complete airbag unit, the headliner, the upper A, B, and C-pillar trim, and all other visibly damaged components must be replaced.

OPERATION

Each side curtain airbag is deployed individually by an electrical signal generated by the Occupant Restraint Controller (ORC) to which it is connected through left or right curtain airbag line 1 and line 2 (or squib) circuits. The hybrid-type inflator assembly for each airbag contains a small canister of highly compressed inert gas. When the ORC sends the proper electrical signal to the airbag inflator, the electrical energy creates enough heat to ignite chemical pellets within the inflator.

Once ignited, these chemicals burn rapidly and produce the pressure necessary to rupture a containment disk in the inert gas canister. The inflator and inert gas canister are sealed and connected to a tubular manifold so that all of the released gas is directed into the folded curtain airbag cushion, causing the cushion to inflate. As the airbag cushion inflates it will drop down from the roof rail between the edge of the headliner and the side glass/body pillars to form a curtain-like cushion to protect the vehicle occupants during a side impact collision.

The front and rear tethers keep the side airbag cushion taut to the side of the vehicle, thus ensuring that the bag will deploy in the proper position. Following the airbag deployment, the airbag cushion quickly deflates by venting the inert gas through the loose weave of the cushion fabric, and the deflated cushion hangs down loosely from the roof rail.

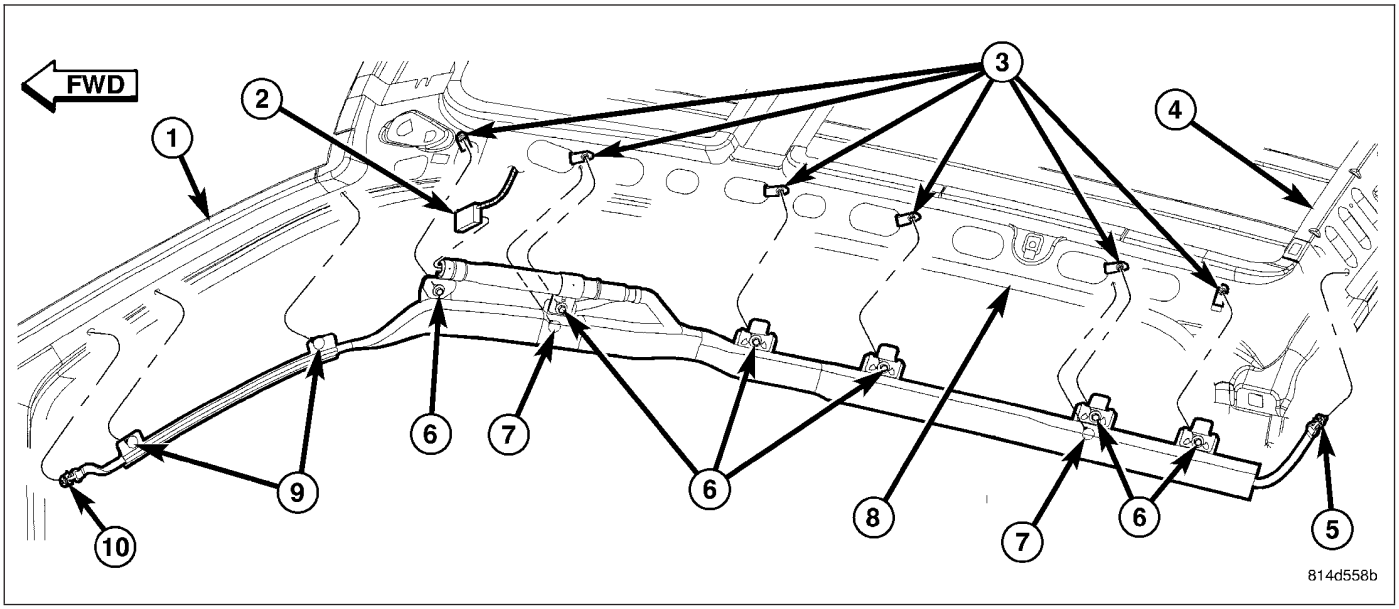
REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death, when removing a deployed airbag, rubber gloves, eye protection, and a long-sleeved shirt should be worn. There may be deposits on the airbag unit and other interior surfaces. In large doses, these deposits may cause irritation to the skin and eyes.

WARNING: To avoid personal injury or death, use extreme care to prevent any foreign material from entering the side curtain airbag, or becoming entrapped between the side curtain airbag cushion and the headliner. Failure to observe this warning could result in occupant injuries upon airbag deployment.

NOTE: The following procedure is for replacement of a faulty or damaged side curtain airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the side curtain airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).



1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the headliner from the vehicle. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL).
3. Disengage the metal clip (5) that secures the side curtain airbag rear tether to the cab roof rear header (4) above the rear window opening.
4. Disengage the two plastic retainers (9), then the metal clip (10) that secure the side curtain airbag front tether to the inner A-pillar (1).
5. Remove the six screws (6) that secure the side curtain airbag to the U-nuts (3) in the inner roof rail (8).
6. Disconnect the body wire harness connector (2) for the side curtain airbag from the connector receptacle at the front of the inflator.
7. Disengage the two plastic retainers (7) from the inner roof rail.

8. Remove the side curtain airbag from the vehicle as a unit.

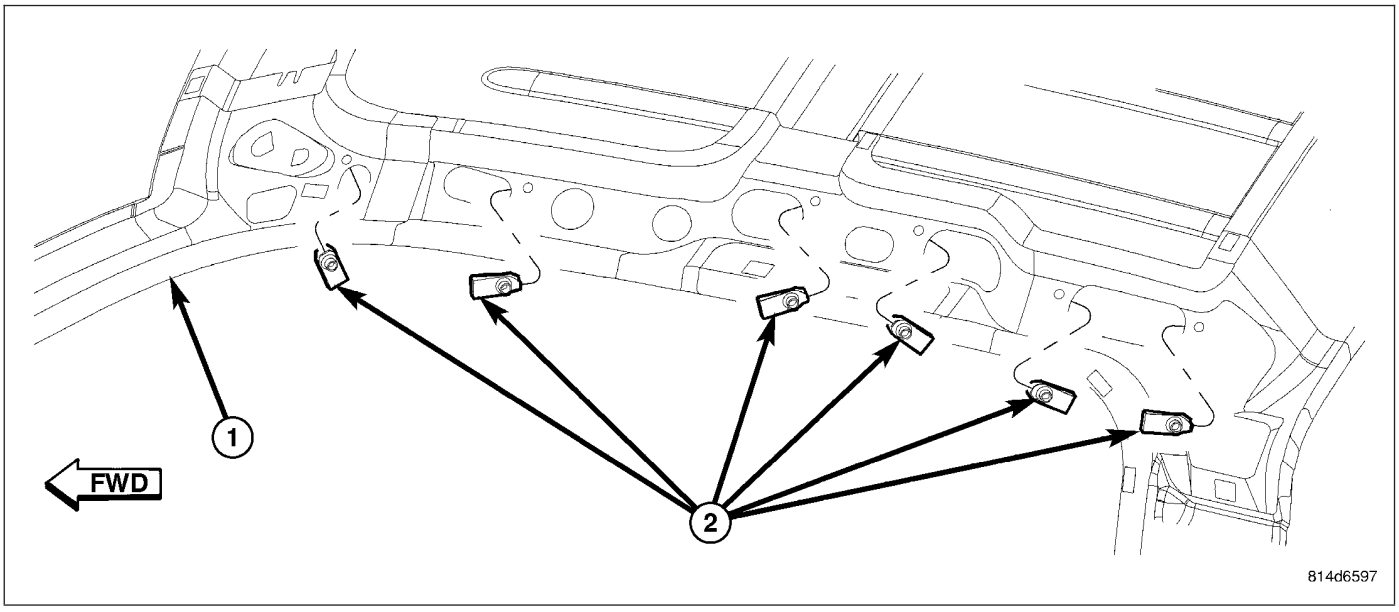
INSTALLATION

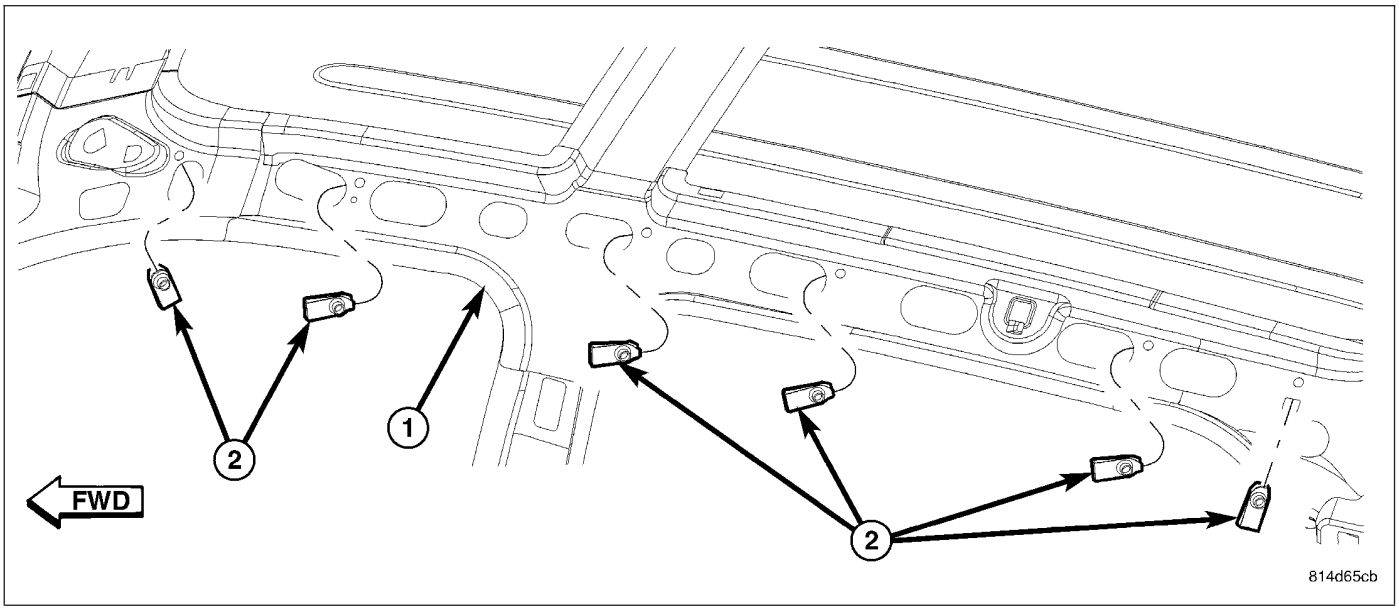
WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death, when removing a deployed airbag, rubber gloves, eye protection, and a long-sleeved shirt should be worn. There may be deposits on the airbag unit and other interior surfaces. In large doses, these deposits may cause irritation to the skin and eyes.

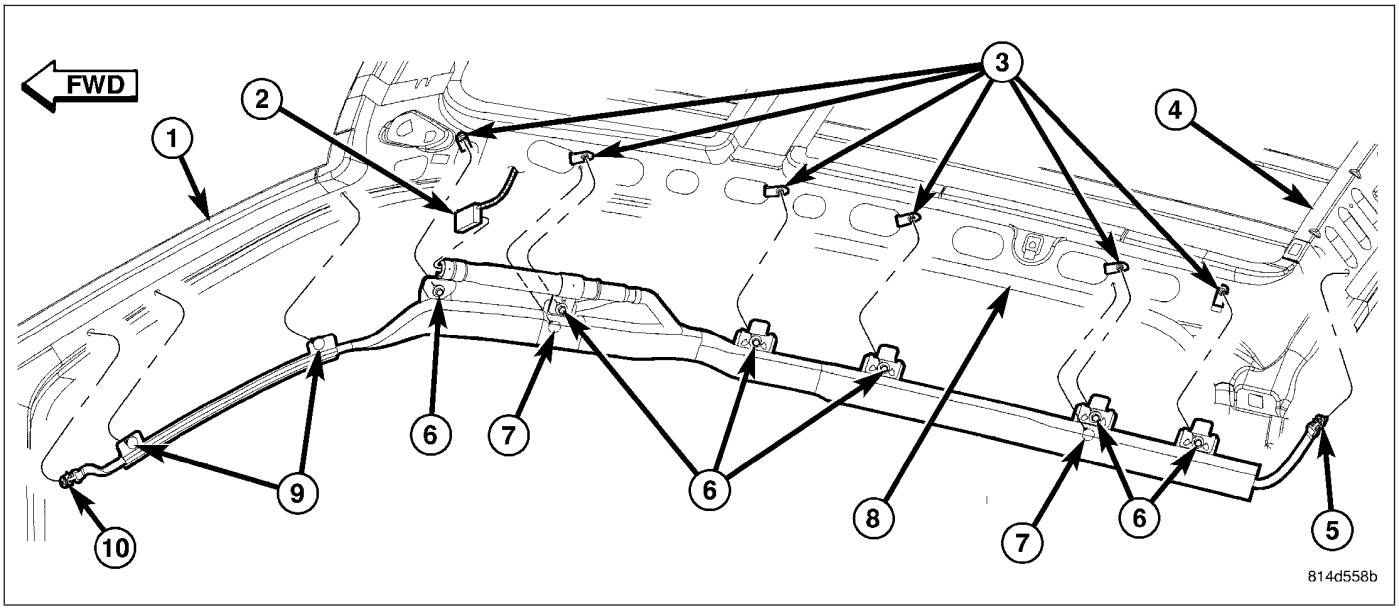
WARNING: To avoid personal injury or death, use extreme care to prevent any foreign material from entering the side curtain airbag, or becoming entrapped between the side curtain airbag cushion and the headliner. Failure to observe this warning could result in occupant injuries upon airbag deployment.

NOTE: The following procedure is for replacement of a faulty or damaged side curtain airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the side curtain airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).





1. Check to be certain that the six U-nuts (2) are properly installed in the inner roof rail (1) and that they are in good condition.



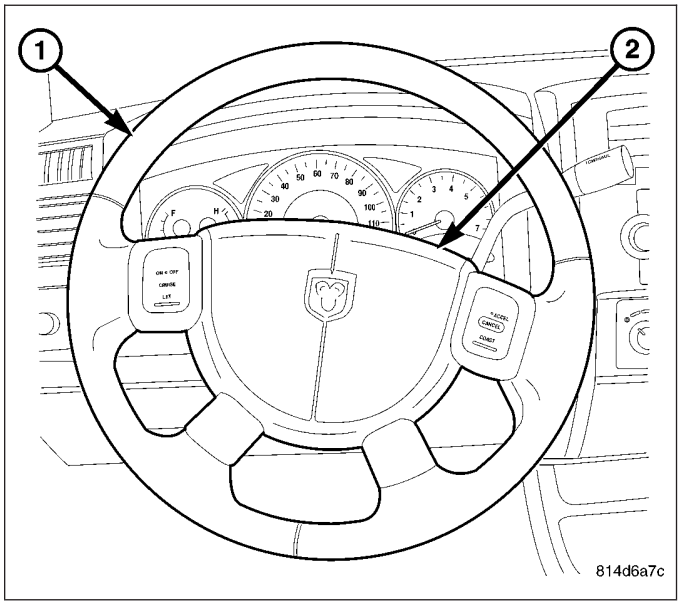
2. Position the side curtain airbag into the vehicle as a unit.
3. Align each of the two plastic push-in fasteners (7) on the airbag channel with their holes in the inner roof side rail and push them straight in until they are fully seated.
4. Reconnect the body wire harness connector (2) for the side curtain airbag to the connector receptacle at the front of the inflator.
5. Loosely install the six screws (6) that secure the side curtain airbag to the U-nuts (3) in the inner roof rail (8).
6. Working from front to back, tighten each of the six screws. Tighten the screws to 6 N·m (50 in. lbs.).
7. Engage the metal clip (5) that secures the side curtain airbag rear tether to the cab roof rear header (4) above the rear window opening.
8. Engage the metal clip (10), then the two plastic retainers (9) that secure the side curtain airbag front tether to the inner A-pillar (1).
9. Reinstall the headliner into the vehicle. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION).

10. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

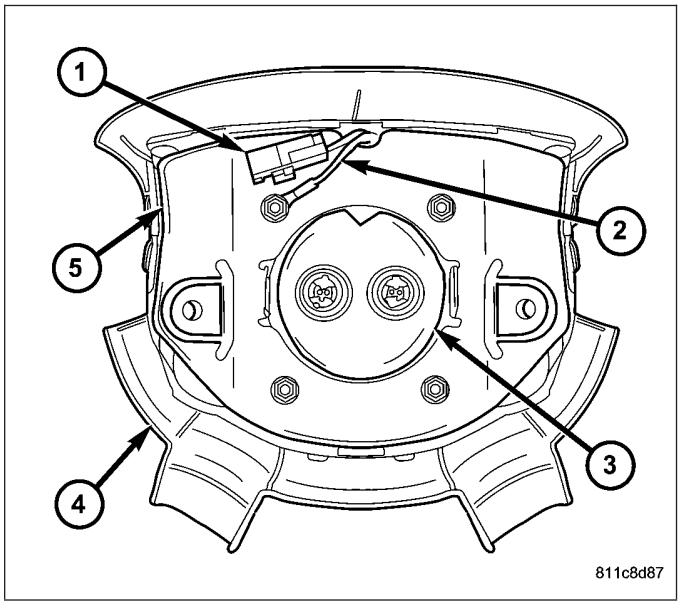
AIR BAG-DRIVER

DESCRIPTION

The color-keyed, injection molded, thermoplastic driver airbag protective trim cover (2) is the most visible part of the driver airbag. The driver airbag is located in the center of the steering wheel (1), where it is secured with two screws to the armature of the four-spoke steering wheel. All models have a chrome Dodge Ram emblem in the center of the trim cover. Concealed beneath the driver airbag trim cover are the horn switch, the folded airbag cushion, the airbag cushion retainer, the airbag housing, the airbag inflator, and the retainers that secure the inflator to the airbag housing.



The airbag cushion, housing (5), and inflator (3) are secured within an integral receptacle molded into the back of the trim cover (4). The four vertical walls of this receptacle have a total of twelve small windows with blocking tabs that are engaged by twelve hook formations around the perimeter of the airbag housing. Each hook is inserted through one of the windows and the blocking tab in each window keeps the hook properly engaged with the trim cover, locking the trim cover securely into place on the airbag housing.



The resistive membrane-type horn switch is secured with heat stakes to the inside surface of the driver airbag trim cover, between the trim cover and the folded airbag cushion. The horn switch ground pigtail wire (2) has an eyelet terminal connector that is captured beneath a flanged nut on the upper right inflator mounting stud on the back of the housing. The horn switch feed pigtail wire has a black, molded plastic insulator (1) that is secured by an integral retainer in a locator hole near the upper right corner of the airbag housing and is connected to the vehicle electrical system through a dedicated take out and connector of the steering wheel wire harness. Both horn switch wires are routed through an integral notch in the center of the upper edge of the airbag housing stamping.

The airbag used in this model is a multistage, Next Generation-type that complies with revised federal airbag standards to deploy with less force than those used in some prior models. A 71 centimeter (28 inch) diameter, radial deploying fabric cushion with internal tethers is used. The airbag inflator is a dual-initiator, non-azide, pyrotechnic-

type unit with four mounting studs and is secured to the stamped metal airbag housing by four flanged hex nuts. Two keyed and color-coded connector receptacles on the driver airbag inflator connect the two inflator initiators to the vehicle electrical system through two yellow-jacketed, two-wire pigtail harnesses of the clockspring.

The driver airbag unit cannot be repaired, and must be replaced if deployed or in any way damaged. The driver airbag trim cover and horn switch unit may be disassembled from the driver airbag unit, and is available for separate service replacement.

OPERATION

The multistage driver airbag is deployed by electrical signals generated by the Occupant Restraint Controller (ORC) through the driver airbag squib 1 and squib 2 circuits to the two initiators in the airbag inflator. By using two initiators, the airbag can be deployed at multiple levels of force. The force level is controlled by the ORC to suit the monitored impact conditions by providing one of three delay intervals between the electrical signals provided to the two initiators. The longer the delay between these signals, the less forcefully the airbag will deploy.

When the ORC sends the proper electrical signals to each initiator, the electrical energy generates enough heat to initiate a small pyrotechnic charge which, in turn ignites chemical pellets within the inflator. Once ignited, these chemical pellets burn rapidly and produce a large quantity of inert gas. The inflator is sealed to the back of the airbag housing and a diffuser in the inflator directs all of the inert gas into the airbag cushion, causing the cushion to inflate. As the cushion inflates, the driver airbag trim cover will split at predetermined breakout lines, then fold back out of the way along with the horn switch unit. Following an airbag deployment, the airbag cushion quickly deflates by venting the inert gas towards the instrument panel through vent holes within the fabric used to construct the back (steering wheel side) panel of the airbag cushion.

Some of the chemicals used to create the inert gas may be considered hazardous while in their solid state before they are burned, but they are securely sealed within the airbag inflator. Typically, both initiators are used and all potentially hazardous chemicals are burned during an airbag deployment event. However, it is possible for only one initiator to be used during a deployment due to an airbag system fault; therefore, it is necessary to always confirm that both initiators have been used in order to avoid the improper disposal of potentially live pyrotechnic or hazardous materials. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

The inert gas that is produced when the chemicals are burned is harmless. However, a small amount of residue from the burned chemicals may cause some temporary discomfort if it contacts the skin, eyes, or breathing passages. If skin or eye irritation is noted, rinse the affected area with plenty of cool, clean water. If breathing passages are irritated, move to another area where there is plenty of clean, fresh air to breath. If the irritation is not alleviated by these actions, contact a physician.

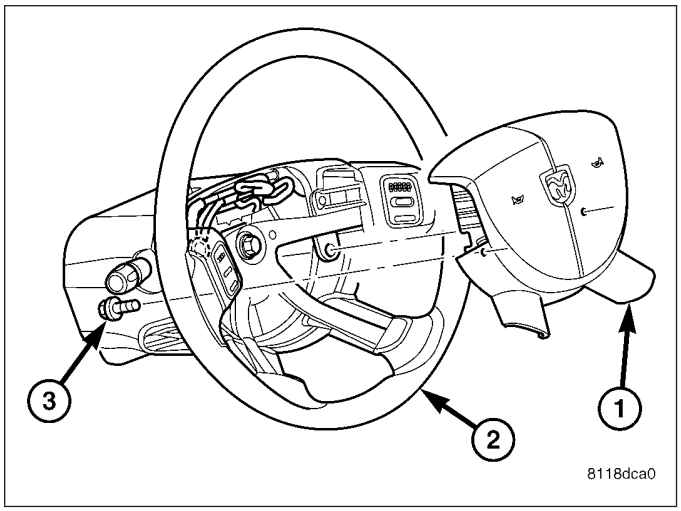
REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death, when removing a deployed airbag, rubber gloves, eye protection, and a long-sleeved shirt should be worn. There may be deposits on the airbag cushion and other interior surfaces. In large doses, these deposits may cause irritation to the skin and eyes.

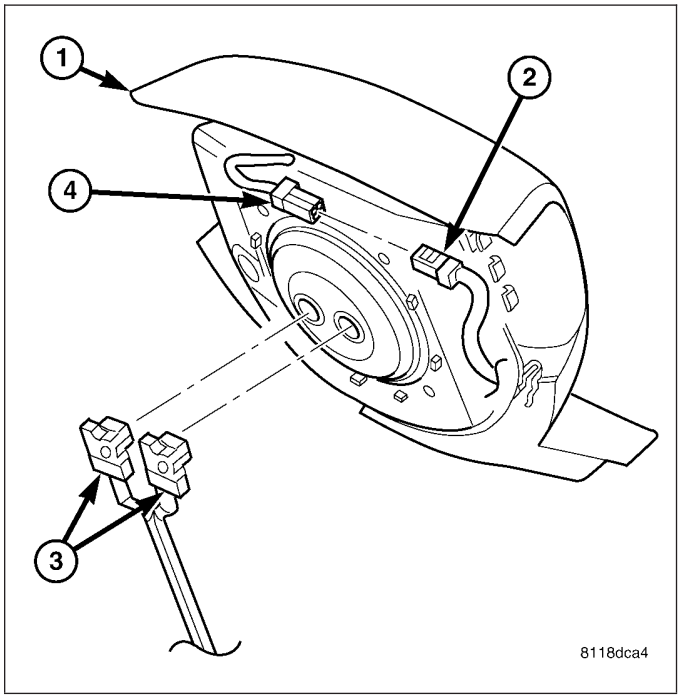
NOTE: The following procedure is for replacement of a faulty or damaged driver airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the driver airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. From the underside of the steering wheel, remove the two screws (3) that secure the driver airbag (1) to the steering wheel armature (2).



CAUTION: Do not pull on the horn switch feed pigtail wire to disengage the connector from the driver airbag housing or to disconnect the horn switch to steering wheel wire harness connection. Improper pulling on this pigtail wire or connection can result in damage to the horn switch membrane or feed circuit.

3. Pull the driver airbag (1) away from the steering wheel far enough to access the three electrical connections on the back of the airbag housing.
4. Disconnect the steering wheel wire harness connector for the horn switch (2) from the horn switch feed pigtail wire connector (4), which is located on the back of the driver airbag housing.



CAUTION: Do not pull on the clockspring pigtail wires or pry on the connector insulator to disengage the connector from the driver airbag inflator connector receptacle. Improper removal of these pigtail wires and their connector insulators can result in damage to the airbag circuits or connector insulators.

5. The clockspring driver airbag pigtail wire connectors (3) are secured by integral latches to the airbag inflator connector receptacles, which are located on the back of the driver airbag housing. Depress the latches on each side of the connector insulator and pull the insulators straight out from the airbag inflator to disconnect them from the connector receptacles.
6. Remove the driver airbag from the steering wheel.
7. If the driver airbag has been deployed, the clockspring must be replaced. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

DISASSEMBLY

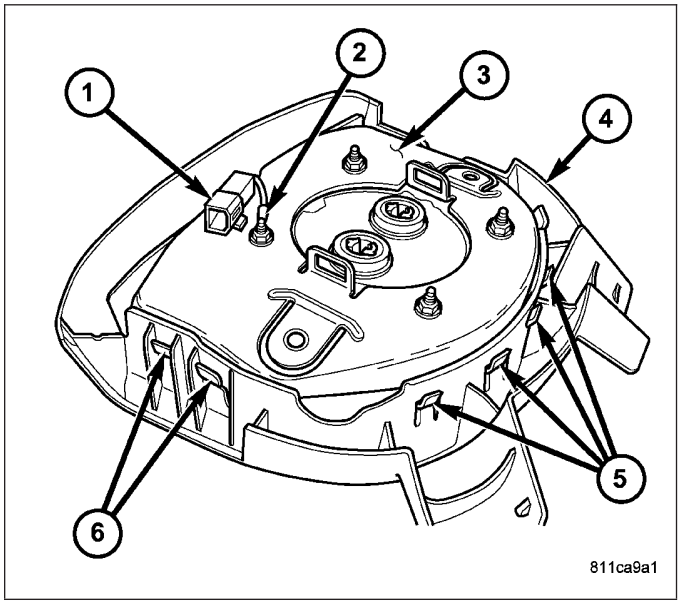
WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death, service of this unit should be performed only by Daimler-Chrysler-trained and authorized dealer service technicians. Failure to take the proper precautions or to follow the proper procedures could result in accidental, incomplete, or improper airbag deployment and possible occupant injuries.

WARNING: To avoid personal injury or death, use extreme care to prevent any foreign material from entering the driver airbag, or becoming entrapped between the driver airbag cushion and the driver airbag trim cover. Failure to observe this warning could result in occupant injuries upon airbag deployment.

WARNING: To avoid personal injury or death, the driver airbag trim cover must never be painted. Replacement trim covers are serviced in the original colors. Paint may change the way in which the material of the trim cover responds to an airbag deployment. Failure to observe this warning could result in occupant injuries upon airbag deployment.

NOTE: The following procedures can be used to replace the driver airbag trim cover and horn switch unit for service. If the driver airbag is faulty or deployed, the entire driver airbag, trim cover and horn switch must be replaced as a unit.



1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the driver airbag from the steering wheel (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).
3. Place the driver airbag on a suitable clean and dry work surface with the trim cover facing down. If the trim cover will be reused, be certain to take the proper precautions to prevent the trim cover from receiving cosmetic damage during the following procedures.
4. Carefully pry the horn switch feed pigtail wire connector (1) away from the back of the driver airbag housing (3) far enough to disengage the integral connector retainer from the locator hole just above the upper right inflator mounting stud.
5. Remove the nut that secures the horn switch ground pigtail wire eyelet terminal (2) to the upper right inflator stud on the back of the driver airbag housing.
6. Remove the horn switch ground pigtail wire eyelet terminal from the upper right inflator stud on the back of the driver airbag housing.
7. Disengage each of the twelve hooks (5 and 6) of the airbag housing from the twelve windows in the vertical walls of the trim cover (4), one wall at a time. Start by disengaging the upper wall, then do each of the two side walls, and finish with the lower wall. To disengage the hooks, use hand pressure to push the adjacent edge of the airbag housing firmly and evenly downward into the trim cover receptacle, while at the same time pushing outward on the upper edge of the receptacle wall.

8. With all of the hooks disengaged, lift the housing, inflator, and cushion as a unit from the receptacle on the back of the driver airbag trim cover.

ASSEMBLY

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

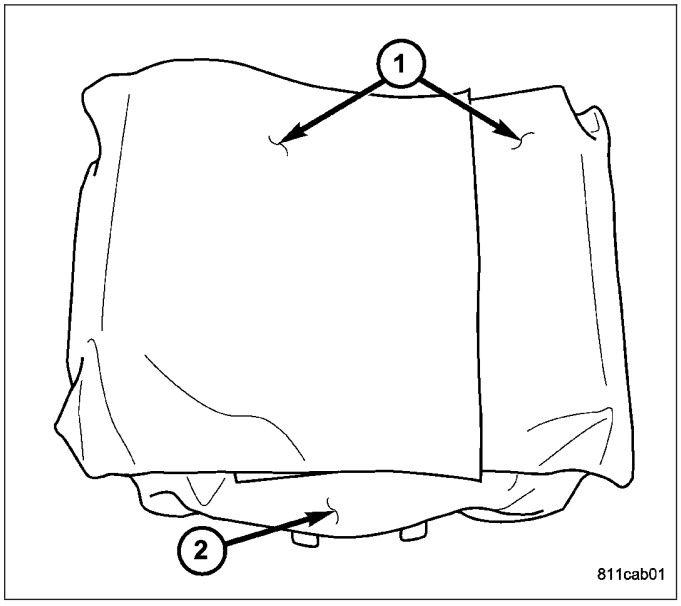
WARNING: To avoid personal injury or death, service of this unit should be performed only by Daimler-Chrysler-trained and authorized dealer service technicians. Failure to take the proper precautions or to follow the proper procedures could result in accidental, incomplete, or improper airbag deployment and possible occupant injuries.

WARNING: To avoid personal injury or death, use extreme care to prevent any foreign material from entering the driver airbag, or becoming entrapped between the driver airbag cushion and the driver airbag trim cover. Failure to observe this warning could result in occupant injuries upon airbag deployment.

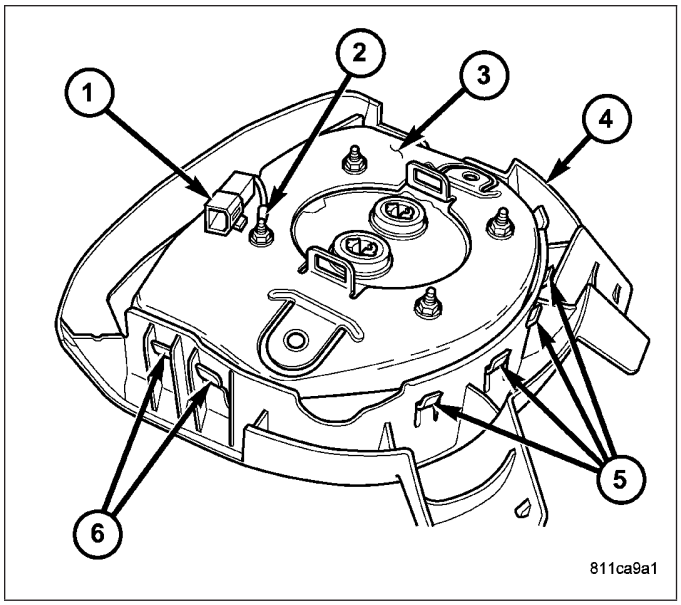
WARNING: To avoid personal injury or death, the driver airbag trim cover must never be painted. Replacement trim covers are serviced in the original colors. Paint may change the way in which the material of the trim cover responds to an airbag deployment. Failure to observe this warning could result in occupant injuries upon airbag deployment.

NOTE: The following procedures can be used to replace the driver airbag trim cover and horn switch unit for service. If the driver airbag is faulty or deployed, the entire driver airbag, trim cover and horn switch must be replaced as a unit.

1. Place the driver airbag on a suitable work surface with the airbag cushion facing up.
2. Fold the two flaps (1) of cushion material up around the sides and over the top of the airbag cushion retainer strap (2).
3. Position the new driver airbag trim cover over the airbag cushion, then push the receptacle of the trim cover down evenly over the cushion. Be certain that the cushion material flaps remain oriented over the cushion retainer strap as they were in Step 2.
4. Turn the driver airbag and the new driver airbag trim cover over as a unit, and place the unit on a suitable clean and dry work surface with the airbag cushion facing down. Be certain to take the proper precautions to prevent the trim cover from receiving cosmetic damage during the following procedures.

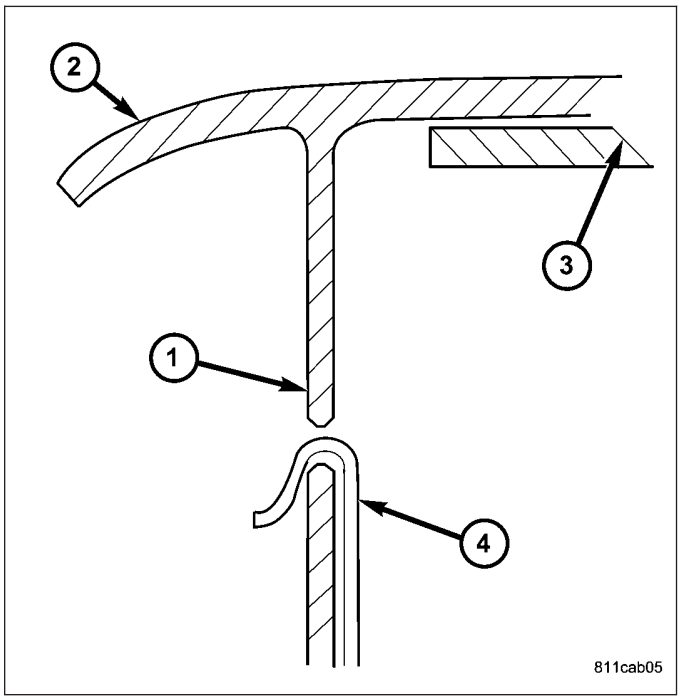


5. Be certain that the horn switch feed and ground pigtail wires are routed through the clearance notch at the top of the airbag housing (3), between the housing and the upper vertical wall of the trim cover receptacle.
6. Work around the perimeter of the unit engaging each of the twelve hooks (5 and 6) on the driver airbag housing through the windows in the walls of the trim cover receptacle.
7. Install the horn switch ground pigtail wire eyelet terminal (2) over the upper right inflator stud on the back of the driver airbag housing.
8. Install and tighten the nut that secures the horn switch ground pigtail wire eyelet terminal to the upper right inflator stud on the back of the driver airbag housing. Tighten the nut to 7 N·m (65 in. lbs.).



9. Using hand pressure, push the integral retainer of the horn switch feed pigtail wire connector (1) into the locator hole just above the upper right inflator mounting stud on the back of the airbag housing.
10. After the driver airbag has been assembled, try pulling the trim cover and the airbag housing away from each other. This action will fully seat the edges of the windows into the cradles of the hooks.

11. Before reinstalling the airbag onto the steering wheel, check that the blocking tab (1) in each of the trim cover windows is oriented over the airbag housing hook (4) as shown.
12. Reinstall the driver airbag onto the steering wheel (Refer to 8 - ELECTRICAL/RESTRAINTS/ DRIVER AIRBAG - INSTALLATION).



INSTALLATION

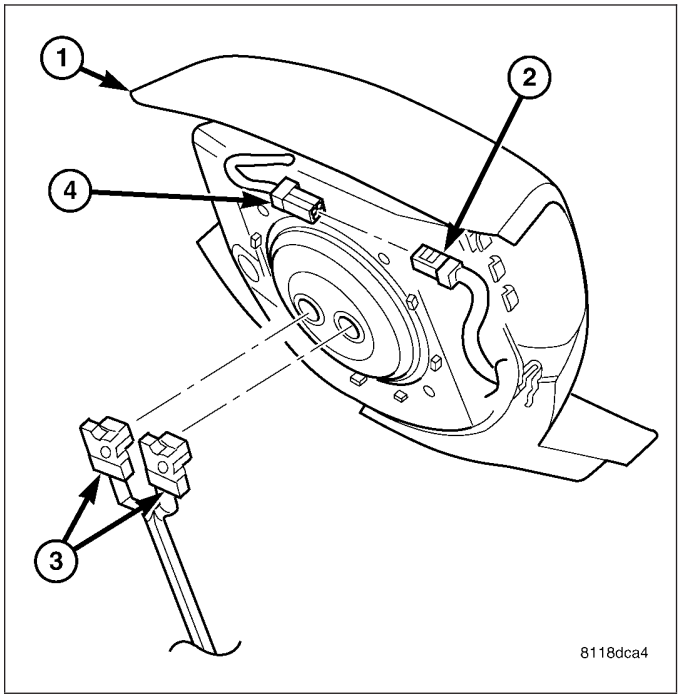
WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death, use extreme care to prevent any foreign material from entering the driver airbag, or becoming entrapped between the driver airbag cushion and the driver airbag trim cover. Failure to observe this warning could result in occupant injuries upon airbag deployment.

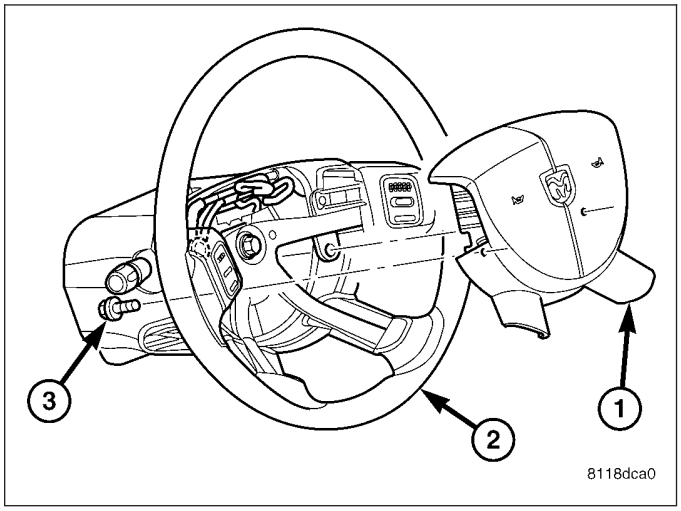
WARNING: To avoid personal injury or death, the driver airbag trim cover must never be painted. Replacement airbags are serviced with trim covers in the original colors. Paint may change the way in which the material of the trim cover responds to an airbag deployment. Failure to observe this warning could result in occupant injuries upon airbag deployment.

NOTE: The following procedure is for replacement of a faulty or damaged driver airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the driver airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

1. Position the driver airbag (1) close enough to the steering wheel to reconnect the three electrical connections on the back of the airbag housing.
2. When installing the driver airbag, reconnect the two clockspring driver airbag pigtail wire connectors (3) to the airbag inflator connector receptacles by pressing straight in on the connector. Be certain to engage each keyed and color-coded connector to the matching connector receptacle. You can be certain that each connector is fully engaged in its receptacle by listening carefully for a distinct, audible click as the connector latches snap into place.
3. Reconnect the steering wheel wire harness connector (2) for the horn switch to the horn switch feed pigtail wire connector (4), which is located on the back of the driver airbag housing.



4. Carefully position the driver airbag (1) in the steering wheel (2). Be certain that the clockspring pigtail wires and the steering wheel wire harness in the steering wheel hub area are not pinched between the driver airbag and the steering wheel armature.
5. From the underside of the steering wheel, install and tighten the two screws (3) that secure the driver airbag to the steering wheel armature. Tighten the screws to 10 N·m (90 in. lbs.).
6. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

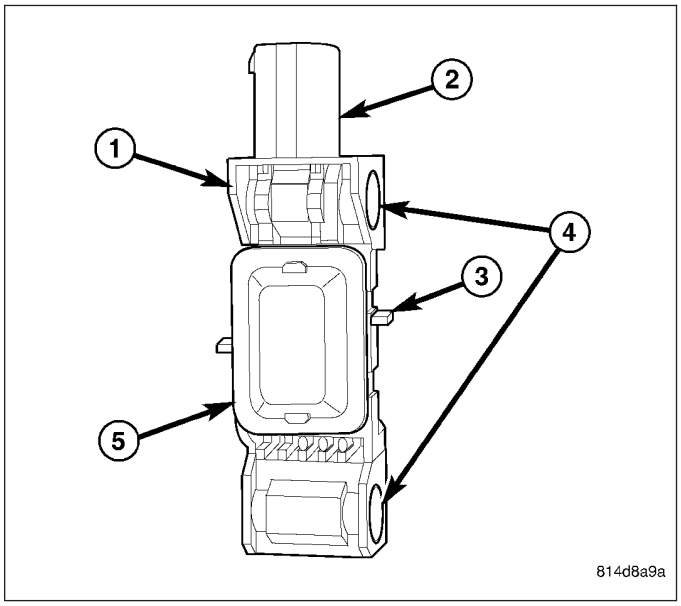


IMPACT SENSOR

DESCRIPTION

FRONT

Two front impact sensors (1) are used on this model, one each for the left and right sides of the vehicle. These sensors are mounted remotely from the impact sensor that is internal to the Occupant Restraint Controller (ORC). Each front sensor is secured with two screws to the backs of the right and left vertical members of the radiator support within the engine compartment. The sensor housing has an integral connector receptacle (2), an integral anti-rotation pin (3), and two integral mounting holes (4) with metal sleeves to provide crush protection.

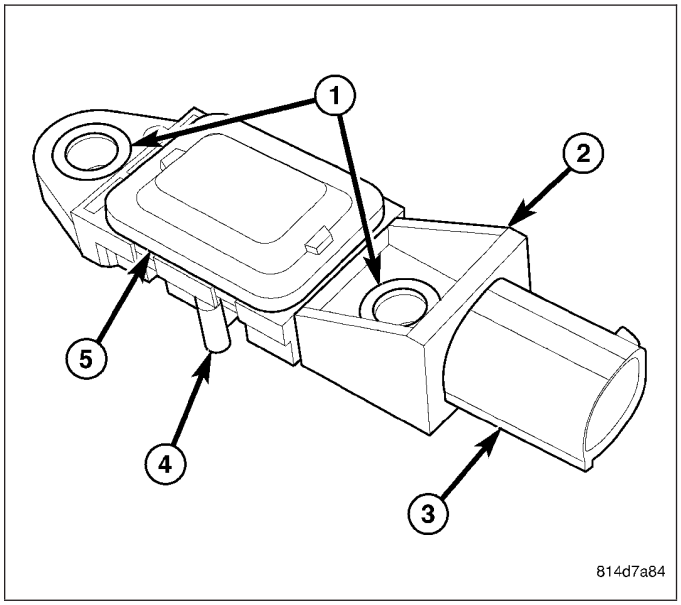


The right and left front impact sensors are identical in construction and calibration. A label on the sensor is imprinted with an arrow, which should always be pointed forward in the vehicle. A cavity in the center of the molded plastic impact sensor housing contains the electronic circuitry of the sensor which includes an electronic communication chip and an electronic impact sensor. Potting material fills the cavity and a stamped cover (5) is crimped over the cavity to seal and protect the internal electronic circuitry and components. The front impact sensors are each connected to the vehicle electrical system through a dedicated take out and connector of the headlamp and dash wire harness.

The impact sensors cannot be repaired or adjusted and, if damaged or faulty, they must be replaced.

SIDE

Two side impact sensors (2) are used on this model when it is equipped with the optional side curtain airbags, one each for the left and right sides of the vehicle. These sensors are mounted remotely from the impact sensor that is internal to the Occupant Restraint Controller (ORC). Each side sensor is secured with two screws to the floor panel beneath the outboard seat adjuster riser within the passenger compartment. The sensor housing has an integral connector receptacle (3), an integral anti-rotation pin (4), and two integral mounting holes (1) with metal sleeves to provide crush protection.



The right and left side impact sensors are identical in construction and calibration. A cavity in the center of the molded plastic impact sensor housing contains the electronic circuitry of the sensor which includes an electronic communication chip and an electronic impact sensor. Potting material fills the cavity and a stamped cover (5) is crimped over the cavity to seal and protect the internal electronic circuitry and components. The side impact sensors are each connected to the vehicle electrical system through a dedicated take out and connector of the body wire harness.

The impact sensors cannot be repaired or adjusted and, if damaged or faulty, they must be replaced.

OPERATION

FRONT

The front impact sensors are electronic accelerometers that sense the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. Each sensor also contains an electronic communication chip that allows the unit to communicate the sensor status as well as sensor fault information to the microprocessor in the Occupant Restraint Controller (ORC).

The ORC microprocessor continuously monitors all of the passive restraint system electrical circuits to determine the system readiness. If the ORC detects a monitored system fault, it sets a Diagnostic Trouble Code (DTC) and controls the airbag indicator operation accordingly. The impact sensors each receive battery current and ground through dedicated left and right sensor plus and minus circuits from the ORC. The impact sensors and the ORC communicate by modulating the voltage in the sensor plus circuit.

The hard wired circuits between the front impact sensors and the ORC may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ORC, the impact sensors, or the electronic message inputs to or outputs from the impact sensors. The most reliable, efficient, and accurate means to diagnose the impact sensors, the ORC, and the electronic message communication between the sensors and the ORC requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

SIDE

The side impact sensors are electronic accelerometers that sense the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. Each sensor also contains an electronic communication chip that allows the unit to communicate the sensor status as well as sensor fault information to the microprocessor in the Occupant Restraint Controller (ORC).

The ORC microprocessor continuously monitors all of the side passive restraint system electrical circuits to determine the system readiness. If the ORC detects a monitored system fault, it sets a Diagnostic Trouble Code (DTC) and controls the airbag indicator operation accordingly. The impact sensors each receive battery current and ground through left or right sensor plus and minus circuits from the ORC. The impact sensors and the ORC communicate by modulating the voltage in the sensor plus circuit.

The hard wired circuits between the side impact sensors and the ORC may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ORC, the impact sensors, or the electronic message inputs to or outputs from the impact sensors. The most reliable, efficient, and accurate means to diagnose the impact sensors, the ORC, and the electronic message communication between the sensors and the ORC requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

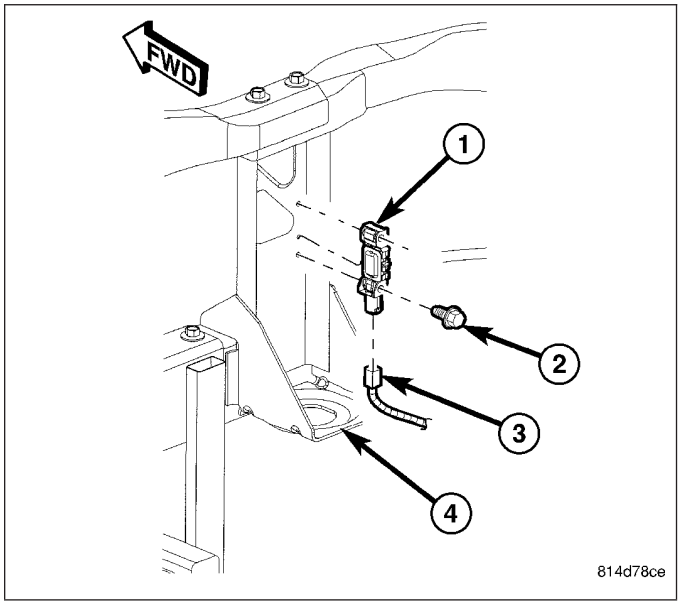
REMOVAL

FRONT

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death, never strike or drop the front impact sensor, as it can damage the impact sensor or affect its calibration. The front impact sensor enables the system to deploy the front supplemental restraints. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper front supplemental restraint deployment.

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the two screws (2) that secure the right or left front impact sensor (1) to the back of the right or left radiator support vertical member (4).
3. Disconnect the headlamp and dash wire harness connector (3) from the sensor connector receptacle.
4. Remove the right or left front impact sensor from the engine compartment.



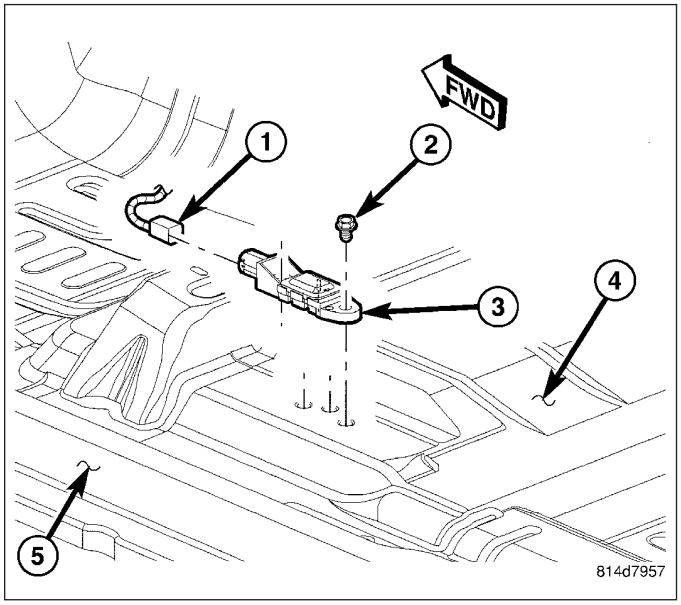
SIDE

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death, never strike or drop the side impact sensor, as it can damage the impact sensor or affect its calibration. The side impact sensor enables the system to deploy the side curtain supplemental restraints. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper front supplemental restraint deployment.

NOTE: Side impact sensors are used only on models equipped with the optional side curtain airbags.

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the scuff plate trim from the right or left front door opening sill (5). (Refer to 23 - BODY/INTERIOR/DOOR SILL SCUFF PLATE - REMOVAL).
3. Lift the floor carpet upward from the sill far enough to access the side impact sensor on the floor panel (4) below the right or left outboard front seat adjuster riser.
4. Remove the two screws (2) that secure the side impact sensor (3) to the floor panel.
5. Disconnect the body wire harness connector (1) from the sensor connector receptacle.
6. Remove the sensor from the floor panel.



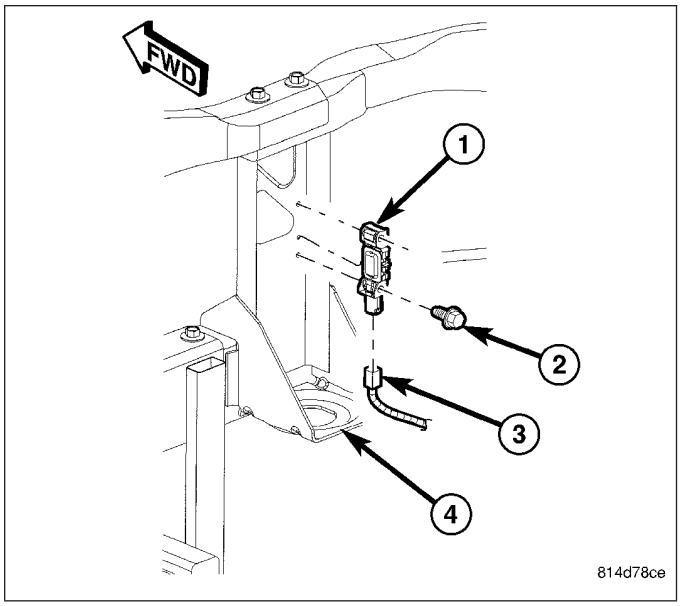
INSTALLATION

FRONT

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death, never strike or drop the front impact sensor, as it can damage the impact sensor or affect its calibration. The front impact sensor enables the system to deploy the front supplemental restraints. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper front supplemental restraint deployment.

1. Position the right or left front impact sensor (1) into the engine compartment.
2. Reconnect the headlamp and dash wire harness connector (3) to the sensor connector receptacle.
3. Carefully position the sensor onto the back of the right or left radiator support vertical member (4). Be certain that the anti-rotation pin on the back of the sensor is engaged in the center clearance hole of the radiator support and the arrow on the sensor label is pointed forward in the vehicle.
4. Install and tighten the two screws (2) that secure the sensor to the back of the support vertical member. Tighten the screws to 10 N·m (90 in. lbs.).
5. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).



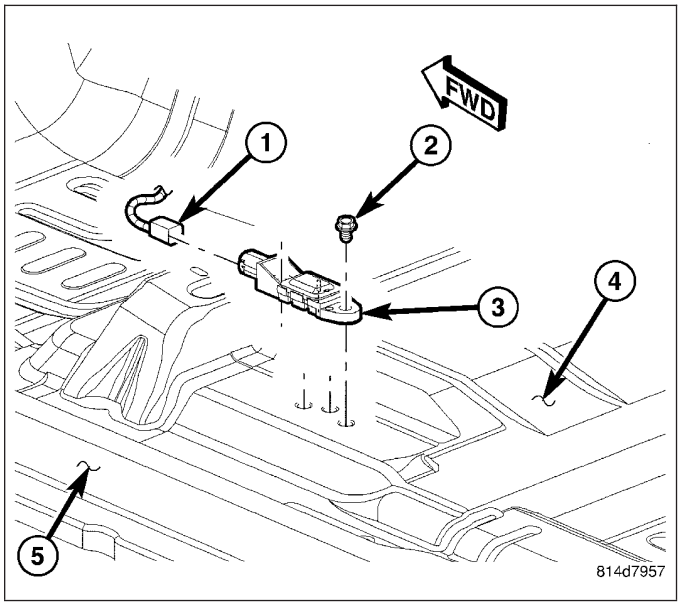
SIDE

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death, never strike or drop the side impact sensor, as it can damage the impact sensor or affect its calibration. The side impact sensor enables the system to deploy the side curtain supplemental restraints. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper front supplemental restraint deployment.

NOTE: Side impact sensors are used only on models equipped with the optional side curtain airbags.

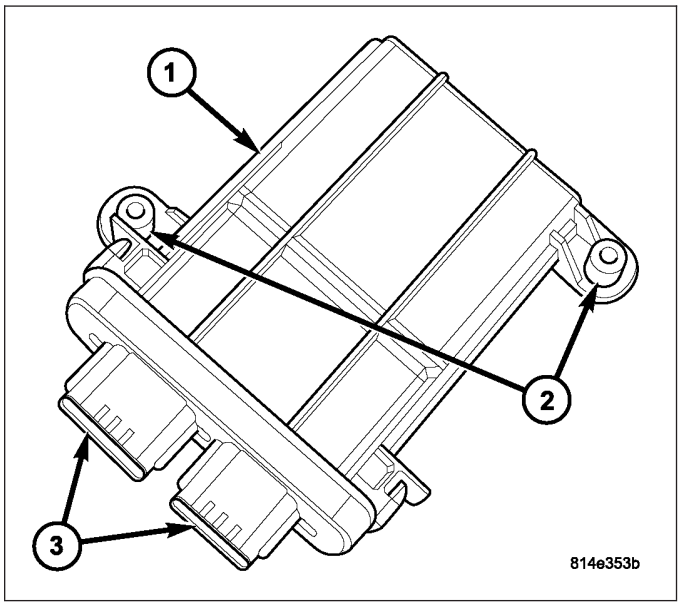
1. Position the side impact sensor (3) near the floor panel (4) below the right or left outboard front seat adjuster riser.
2. Reconnect the body wire harness connector (1) to the sensor connector receptacle.
3. Carefully position the sensor onto the floor panel. Be certain that the anti-rotation pin on the back of the sensor is engaged in the center clearance hole of the floor panel and the arrow on the sensor label is pointed toward the outboard side of the vehicle.
4. Install and tighten the two screws (2) that secure the sensor to the inner B-pillar. Tighten the screw to 8 N·m (75 in. lbs.).
5. Restore the floor carpet over the side impact sensor on the floor panel to the right or left front door opening sill (5).



6. Reinstall the scuff plate trim onto the right or left front door opening sill. (Refer to 23 - BODY/INTERIOR/DOOR SILL SCUFF PLATE - INSTALLATION).
7. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

MODULE-OCCUPANT CLASSIFICATION

DESCRIPTION



The Occupant Classification Module (OCM) (1) is secured with two screws to a stamped metal mount on the underside of the passenger side front seat cushion frame near the center. Concealed within a hollow in the center of the molded plastic OCM housing is a microprocessor and the other electronic circuitry of the module. The module housing is sealed to enclose and protect the internal electronic circuitry. The OCM software is flash programmable.

Two mounting tabs (2) and two connector receptacles (3) are integral to the OCM housing. The connector receptacles contain terminal pins that connect the OCM to the vehicle electrical system through a dedicated take out and connector of the passenger side front seat wire harness, and a second take out and connector of the body wire harness.

A non-calibrated OCM is available for separate service replacement. The OCM and all of the other components of the Occupant Classification System (OCS) including the passenger side front seat, the seat weight sensors, the passenger or driver seat track position sensor and the seat adjusters, cushion, back, frame, foam, springs, and wiring harness are a factory-calibrated and assembled unit. Any time any one of these components is removed or replaced for any reason, the OCM must be re-calibrated using a diagnostic scan tool, the Occupant Classification Seat Weight special tool, and the Occupant Classification System Verification Test. Refer to the appropriate diagnostic procedures.

The OCM cannot be adjusted or repaired and, if damaged or faulty, it must be replaced.

OPERATION

The microprocessor in the Occupant Classification Module (OCM) contains the Occupant Classification System (OCS) logic circuits. The OCM uses On-Board Diagnostics (OBD) and can communicate with other electronic modules in the vehicle as well as with the diagnostic scan tool using the Controller Area Network (CAN) data bus. This method of communication is also used for OCS diagnosis and testing through the 16-way data link connector located on the driver side lower edge of the instrument panel.

The OCM provides voltage to the four seat weight sensors located on the corners of the passenger side front seat, and to the seat track position sensors on the outboard passenger and driver side front seat upper seat tracks. The OCM then monitors return inputs from each of the sensors on dedicated hard wired data communication circuits. The seat weight sensor input allows the OCM to determine whether the passenger side front seat is occupied and the relative size of the occupant by providing a weight-sensing reference to the load on the seat. The seat track position sensor provides an additional logic input to the OCM microprocessor that allows it to determine the position of the front seat passenger and driver relative to the front airbags.

Pre-programmed decision algorithms and OCS calibration allow the OCM microprocessor to determine when passenger airbag protection is appropriate based upon the seat load as signaled by the seat weight sensors. When the programmed conditions are met, the OCM sends the proper electronic occupant classification messages over the CAN data bus to the Occupant Restraint Controller (ORC), and the ORC enables or disables the deployment circuits for the passenger front supplemental restraints. The ORC also provides a control output for the passenger

airbag on/off indicator in the instrument panel based upon the electronic occupant classification messages it receives from the OCM.

The OCM also sends electronic driver and passenger seat track position messages to the ORC over the CAN data bus. The ORC uses the seat track position data as an additional logic input for determining the force level with which to deploy the multistage front airbags.

The OCM microprocessor continuously monitors all of the OCS electrical circuits and components to determine the system readiness. If the OCM detects a monitored system fault, it sets an active and stored Diagnostic Trouble Code (DTC) and sends the appropriate electronic messages to the ORC over the CAN data bus. Then the ORC sets a DTC and sends messages to control the airbag indicator operation accordingly. An active fault only remains for the duration of the fault, or in some cases for the duration of the current ignition switch cycle, while a stored fault causes a DTC to be stored in memory by the OCM and the ORC. For some DTCs, if a fault does not recur for a number of ignition cycles, the OCM will automatically erase the stored DTC. For other internal faults, the stored DTC is latched forever.

The OCM receives battery current on a fused ignition switch output (run-start) circuit through a fuse in the Junction Block (JB). The OCM receives ground through a ground circuit and take out of the body wire harness. These connections allow the OCM to be operational whenever the ignition switch is in the Start or On positions.

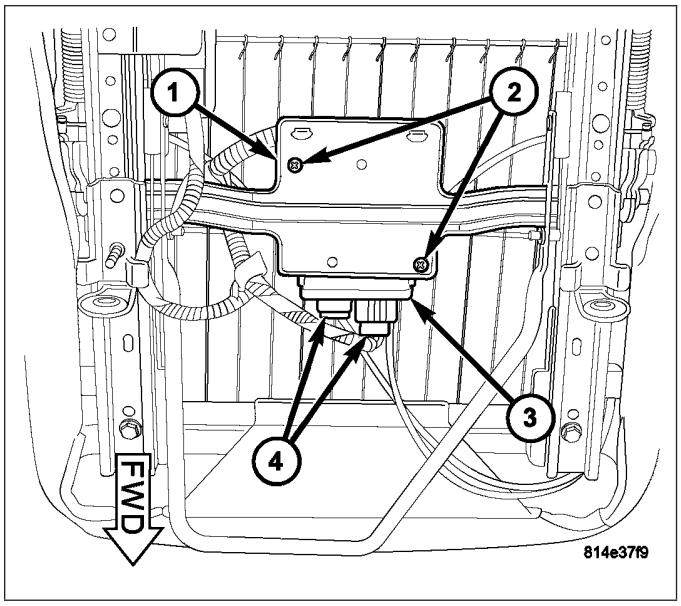
The hard wired inputs and outputs for the OCM may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the OCM, the CAN data bus, or the electronic message inputs to and outputs from the OCM. The most reliable, efficient, and accurate means to diagnose the OCM, the CAN data bus network, and the electronic message inputs to and outputs from the OCM requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: A non-calibrated Occupant Classification Module (OCM) is available for separate service replacement. The OCM and all of the other components of the Occupant Classification System (OCS) including the passenger side front seat, the seat weight sensors, the passenger or driver seat track position sensor and the seat adjusters, cushion, back, frame, foam, springs, and wiring harness are a factory-calibrated and assembled unit. Any time any one of these components is removed or replaced for any reason, the OCM must be re-calibrated using a diagnostic scan tool, the Occupant Classification Seat Weight special tool, and the Occupant Classification System Verification Test. Refer to the appropriate diagnostic procedures.

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Reach under the front edge of the passenger side front seat cushion to access and disconnect the body wire harness and seat wire harness connectors from the Occupant Classification Module (OCM) connector receptacles (4) located on the forward facing end of the module.
3. Remove the two screws (2) that secure the OCM to the OCM bracket (1) on the underside of the passenger side front seat cushion frame.
4. Remove the OCM (3) from under the passenger side front seat.

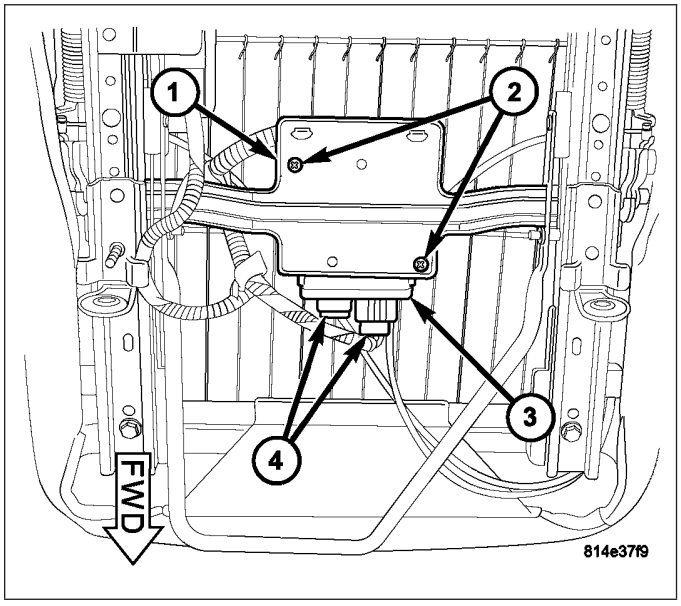


INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: A non-calibrated Occupant Classification Module (OCM) is available for separate service replacement. The OCM and all of the other components of the Occupant Classification System (OCS) including the passenger side front seat, the seat weight sensors, the passenger or driver seat track position sensor and the seat adjusters, cushion, back, frame, foam, springs, and wiring harness are a factory-calibrated and assembled unit. Any time any one of these components is removed or replaced for any reason, the OCM must be re-calibrated using a diagnostic scan tool, the Occupant Classification Seat Weight special tool, and the Occupant Classification System Verification Test. Refer to the appropriate diagnostic procedures.

1. Carefully position the Occupant Classification Module (OCM) (3) to the OCM bracket (1) on the underside of the passenger side front seat cushion frame. When the OCM is correctly positioned, the connector receptacles on the module will be pointed forward in the vehicle.
2. Install and tighten the two screws (2) that secure the OCM to the OCM bracket. Tighten the screws to 2 N·m (15 in. lbs.).
3. Reconnect the body wire harness and seat wire harness connectors to the OCM connector receptacles (4) located on the forward facing end of the module. Be certain that the latches and locks on both connectors are each fully engaged.
4. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

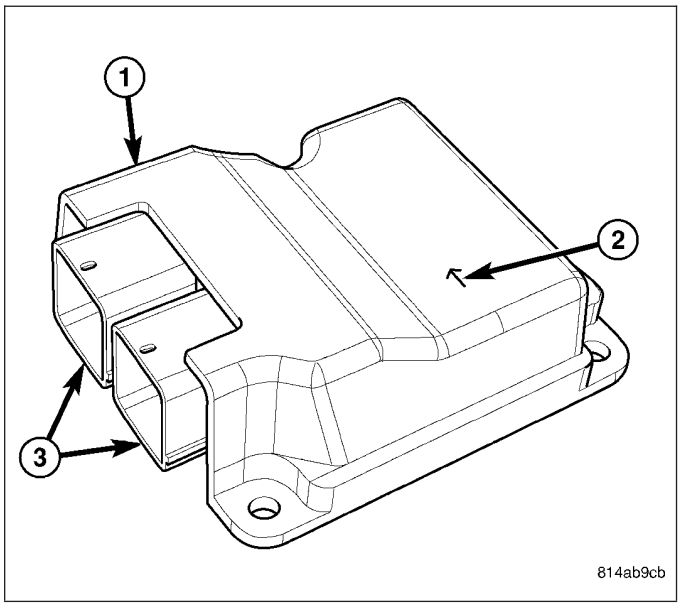


5. Following successful completion of the supplemental restraint system verification test procedure, perform the Occupant Classification System Verification Test using a diagnostic scan tool. Refer to the appropriate diagnostic procedures.

MODULE-OCCUPANT RESTRAINT CONTROLLER

DESCRIPTION

The Occupant Restraint Controller (ORC) (1) is located below the instrument panel center stack in the passenger compartment of the vehicle, where it is secured by three nuts to three studs on a stamped steel mounting bracket welded onto the top of the floor panel transmission tunnel just forward of the instrument panel center support bracket. Concealed within a hollow in the center of the die cast aluminum ORC housing is the electronic circuitry of the ORC which includes a microprocessor, an electronic impact sensor, an electronic safing sensor, and an energy storage capacitor. A stamped metal cover plate is secured to the bottom of the ORC housing with screws to enclose and protect the internal electronic circuitry and components.



An arrow (2) printed on a label on the top of the ORC housing provides a visual verification of the proper orientation of the unit, and should always be pointed toward the front of the vehicle. The ORC housing has three integral flanges with mounting holes. Two are on the corners oriented towards the rear of the vehicle, and one is near the center of the side facing the front of the vehicle. A molded plastic electrical connector (3) with two receptacles, each containing up to thirty-two terminal pins, exits the left facing side of the ORC housing. These terminal pins connect the ORC to the vehicle electrical system through two dedicated take outs and connectors, one each from the instrument panel and the body wire harnesses.

The impact sensor and safing sensor internal to the ORC are calibrated for the specific vehicle, and are only serviced as a unit with the ORC. In addition, there are unique versions of the ORC for vehicles with or without the optional side curtain airbags. The ORC cannot be repaired or adjusted and, if damaged or faulty, it must be replaced.

OPERATION

The microprocessor in the Occupant Restraint Controller (ORC) contains the supplemental restraint system logic circuits and controls all of the supplemental restraint system components. The ORC uses On-Board Diagnostics (OBD) and can communicate with other electronic modules in the vehicle as well as with the diagnostic scan tool using the Controller Area Network (CAN) data bus. This method of communication is used for control of the airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) and for supplemental restraint system diagnosis and testing through the 16-way data link connector located on the driver side lower edge of the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/AIRBAG INDICATOR - OPERATION).

The ORC microprocessor continuously monitors all of the supplemental restraint system electrical circuits to determine the system readiness. If the ORC detects a monitored system fault, it sets an active and stored Diagnostic Trouble Code (DTC) and sends electronic messages to the EMIC over the CAN data bus to turn on the airbag indicator. An active fault only remains for the duration of the fault, or in some cases for the duration of the current ignition switch cycle, while a stored fault causes a DTC to be stored in memory by the ORC. For some DTCs, if a fault does not recur for a number of ignition cycles, the ORC will automatically erase the stored DTC. For other internal faults, the stored DTC is latched forever.

On models equipped with the Occupant Classification System (OCS), the ORC communicates with the Occupant Classification Module (OCM) over the CAN data bus. The ORC will internally disable the passenger airbag and seat

belt tensioner deployment circuits if the OCM detects that the passenger side front seat is unoccupied or that it is occupied by a load that is inappropriate for an airbag deployment. The ORC also provides a control output to the passenger airbag on/off indicator through the passenger airbag indicator driver circuit. The OCM notifies the ORC when it has detected a monitored system fault and stored a DTC in its memory for any faulty OCS component or circuit, then the ORC sets a DTC and controls the airbag indicator operation accordingly.

In club cab models, the ORC also monitors a resistor multiplexed input from the passenger airbag on/off switch. If the passenger airbag on/off switch is set to the Off position, the ORC turns on the passenger airbag on/off indicator and will internally disable the passenger airbag and seat belt tensioner from being deployed, regardless of the status of the input from the OCS.

The ORC receives battery current through two circuits; a fused ignition switch output (run) circuit through a fuse in the Junction Block (JB), and a fused ignition switch output (run-start) circuit through a second fuse in the JB. The ORC receives ground through a ground circuit and take out of the instrument panel wire harness. This take out has a single eyelet terminal connector that is secured by a ground screw to the left side of the floor panel transmission tunnel near the center of the instrument panel center support. These connections allow the ORC to be operational whenever the ignition switch is in the Start or On positions.

The ORC also contains an energy-storage capacitor. When the ignition switch is in the Start or On positions, this capacitor is continually being charged with enough electrical energy to deploy the supplemental restraint components for up to one second following a battery disconnect or failure. The purpose of the capacitor is to provide backup supplemental restraint system protection in case there is a loss of battery current supply to the ORC during an impact.

Two sensors are contained within the ORC, an electronic impact sensor and a safing sensor. The ORC also monitors inputs from two remote front impact sensors located on the back of the right and left vertical members of the radiator support near the front of the vehicle. The electronic impact sensors are accelerometers that sense the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. On vehicles equipped with optional side curtain airbags the ORC also monitors inputs from two additional remote impact sensors located on the floor panel just behind the front seat crossmember beneath the outboard side of the left and right front seats to control deployment of the side curtain airbag units.

The safing sensor is an electronic accelerometer sensor within the ORC that provides an additional logic input to the ORC microprocessor. The safing sensor is used to verify the need for a supplemental restraint deployment by detecting impact energy of a lesser magnitude than that of the primary electronic impact sensors, and must exceed a safing threshold in order for the airbags to deploy. Vehicles equipped with optional side curtain airbags, feature a second safing sensor within the ORC to provide confirmation to the ORC microprocessor of side impact forces. This second safing sensor is a bi-directional unit that detects impact forces from either side of the vehicle.

Pre-programmed decision algorithms in the ORC microprocessor determine when the deceleration rate as signaled by the impact sensors and the safing sensors indicate an impact that is severe enough to require supplemental restraint system protection and, based upon the severity of the monitored impact, determines the level of front airbag deployment force required for each front seating position. When the programmed conditions are met, the ORC sends the proper electrical signals to deploy the dual multistage front airbags at the programmed force levels, the front seat belt tensioners and, if the vehicle is so equipped, either side curtain airbag unit. For vehicles equipped with the OCS, the passenger front airbag and seat belt tensioner will be deployed by the ORC only if enabled by the OCM messages (passenger airbag on/off indicator Off) and, on club cab models, the passenger airbag on/off switch at the time of the impact.

The hard wired inputs and outputs for the ORC may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ORC, the CAN data bus network, or the electronic message inputs to and outputs from the ORC. The most reliable, efficient, and accurate means to diagnose the ORC, the CAN data bus, and the electronic message inputs to and outputs from the ORC requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

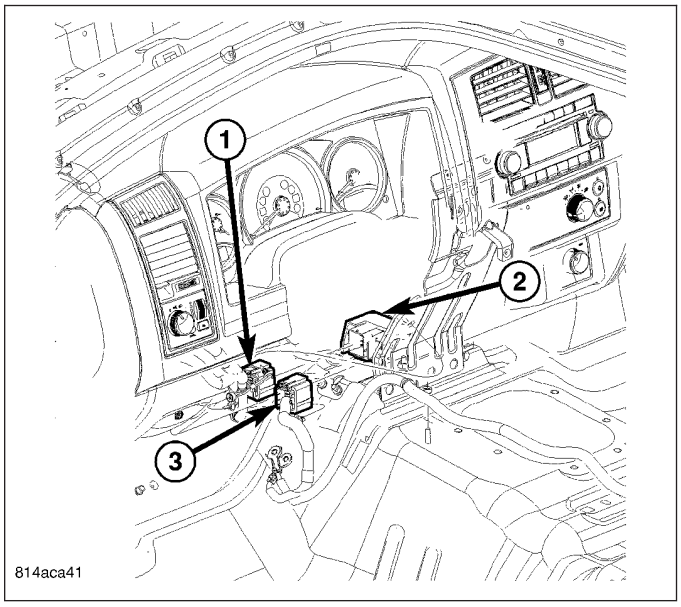
REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

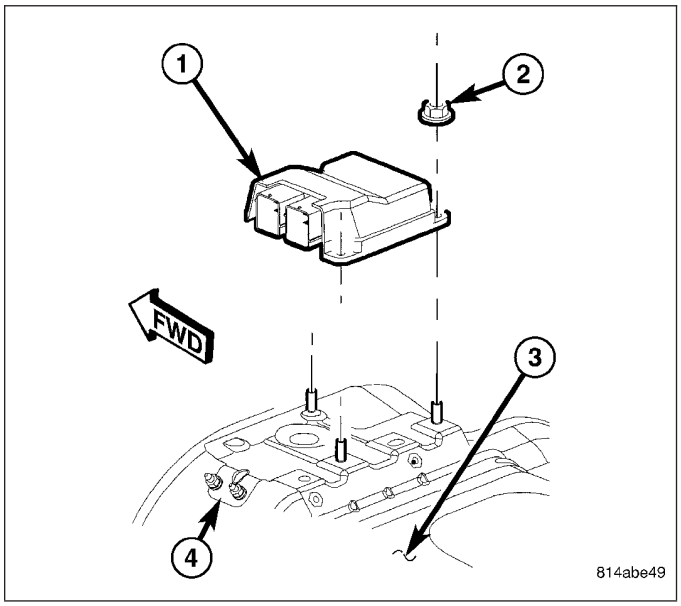
WARNING: To avoid personal injury or death, never strike or drop the occupant restraint controller, as it can damage the impact sensor or affect its calibration. The occupant restraint controller contains the impact sensor, which enables the system to deploy the supplemental restraints. If an occupant restraint controller is accidentally dropped during service, the module must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper supplemental restraint deployment.

CAUTION: On vehicles equipped with the Occupant Classification System (OCS), never replace both the Occupant Restraint Controller (ORC) and the Occupant Classification Module (OCM) at the same time. If both require replacement, replace one. Then perform the supplemental restraint verification test before replacing the other. Both the ORC and the OCM store OCS calibration data, which they transfer to one another when one of them is replaced. If both are replaced at the same time, an irreversible fault will be set in both modules.

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Disconnect the instrument panel (1) and body (3) wire harness connectors from the Occupant Restraint Controller (ORC) (2) connector receptacles located on the left facing side of the module. To disconnect the connectors from the ORC:
   a. Slide the red Connector Position Assurance (CPA) lock on the top of the connector toward the left side of the vehicle.
   b. Depress the edge of the CPA lock closest to the ORC to release the connector latch tab and pull the connector straight away from the ORC connector receptacle.
3. Remove the instrument panel from the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).



4. Remove the floor distribution duct from the bottom of the heater-air conditioner housing. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/FLOOR DISTRIBUTION DUCTS - REMOVAL).
5. Remove the three nuts (2) that secure the ORC (1) to the studs of the ORC mount (4) welded onto the top of the floor panel transmission tunnel (3).
6. Remove the ORC from the ORC mount.



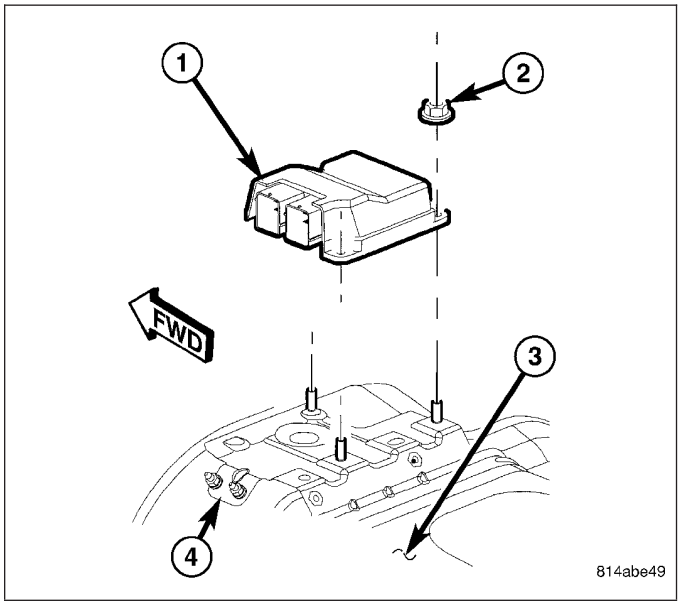
INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

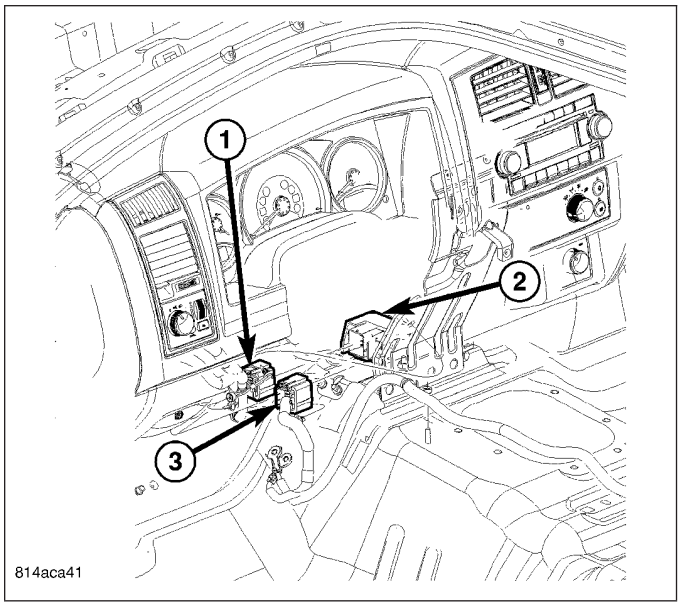
WARNING: To avoid personal injury or death, never strike or drop the occupant restraint controller, as it can damage the impact sensor or affect its calibration. The occupant restraint controller contains the impact sensor, which enables the system to deploy the supplemental restraints. If an occupant restraint controller is accidentally dropped during service, the module must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper supplemental restraint deployment.

CAUTION: On vehicles equipped with the Occupant Classification System (OCS), never replace both the Occupant Restraint Controller (ORC) and the Occupant Classification Module (OCM) at the same time. If both require replacement, replace one. Then perform the supplemental restraint verification test before replacing the other. Both the ORC and the OCM store OCS calibration data, which they transfer to one another when one of them is replaced. If both are replaced at the same time, an irreversible fault will be set in both modules.

1. Carefully position the Occupant Restraint Controller (ORC) (1) onto the studs of the ORC mount (4) on the floor panel transmission tunnel. When the ORC is correctly positioned, the arrow on the ORC label will be pointed forward in the vehicle and the ORC connector receptacles will be facing the left side of the vehicle.
2. Install and tighten the three nuts (2) that secure the ORC to the studs of the ORC mount that is welded onto the floor panel transmission tunnel. Tighten the nuts to 6 N·m (50 in. lbs.).
3. Reinstall the floor distribution duct onto the bottom of the heater-air conditioner housing. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ FLOOR DISTRIBUTION DUCTS - INSTALLATION).
4. Reinstall the instrument panel into the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).



5. Reconnect the instrument panel (1) and body (3) wire harness connectors to the ORC (2) connector receptacles located on the left facing side of the module. Be certain that the latches and the red CPA locks on both connectors are each fully engaged.
6. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

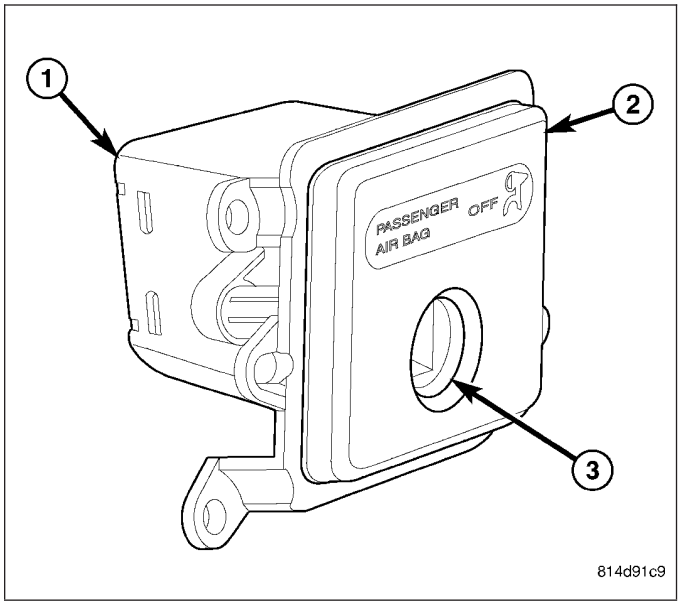


SWITCH-PASSENGER AIRBAG ON/OFF

DESCRIPTION

The passenger airbag on/off switch (1) is standard equipment on all club cab versions of this model when they are equipped with the dual front airbag system. This switch is a two-position, resistor multiplexed switch with a non-coded key cylinder-type actuator. The switch is located in the lower left corner of instrument panel center bezel, near the center of instrument panel.

When the switch is in its installed position, the only components visible through the dedicated opening of the center bezel are the switch bezel (2) and nomenclature, and the key cylinder actuator (3). The ″Off″ position of the switch is designated by text imprinted upon the bezel of the switch, but is not illuminated. The remainder of the switch is concealed behind the switch bezel and the instrument panel center bezel.



The passenger airbag on/off switch housing is constructed of molded plastic and has three integral mounting tabs. These mounting tabs are used to secure the switch to the back of the molded plastic switch bezel with three small screws. The molded plastic switch bezel also has three integral mounting tabs that are used to secure the switch and bezel unit to the instrument panel center bezel with three additional screws.

A molded plastic connector receptacle on the back of the switch housing connects the switch to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness. The molded plastic harness connector insulator is keyed and latched to ensure proper and secure switch electrical connections. The passenger airbag on/off switch cannot be adjusted or repaired and, if faulty or damaged, the switch must be replaced.

OPERATION

The passenger airbag on/off switch allows the customer to turn the passenger airbag function On or Off to accommodate certain uses of the right front seating position where airbag protection may not be desired. See the owner’s manual in the vehicle glove box for specific recommendations on when to enable or disable the passenger airbag.

The passenger airbag on/off indicator located between the two heater and air conditioner outlets near the top of the instrument panel center bezel will be illuminated whenever the switch is turned to the Off position and the ignition switch is in the On position.

The ignition key is the only key or object that should ever be inserted into the key cylinder actuator of the switch. The on/off switch requires only a partial key insertion to fully depress a spring-loaded locking plunger. The spring-loaded locking plunger prevents the user from leaving the key in the switch. The key will be automatically ejected when force is not applied. To actuate the passenger airbag on/off switch, insert the ignition key into the switch key actuator far enough to fully depress the plunger, then rotate the actuator to the desired switch position.

When the switch key actuator is rotated to its clockwise stop (the key actuator slot will be aligned with the Off nomenclature), the on/off indicator is illuminated and the passenger airbag is disabled. When the switch is rotated to its counterclockwise stop (the key actuator slot will be in a vertical position), the illumination of the passenger airbag on/off indicator and the enabling or disabling of the passenger airbag will be controlled by the Occupant Restraint Controller (ORC) based upon the inputs it receives from the Occupant Classification System (OCS) through the Occupant Classification Module (OCM).

The passenger airbag on/off switch connects one of two internal resistors in series between the passenger airbag mux switch sense and passenger airbag mux switch return circuits of the ORC. The ORC continually monitors the resistance in these circuits to determine the switch position that has been selected. When the switch is in the Off position, the ORC provides a ground input to the passenger airbag on/off indicator through the passenger airbag indicator driver circuit, which energizes the Light-Emitting Diode (LED) that illuminates the indicator.

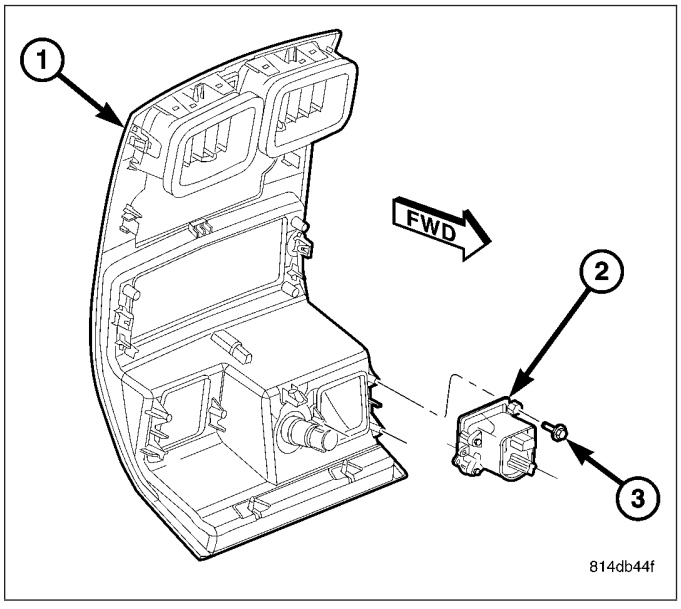
The ORC will store a Diagnostic Trouble Code (DTC) for any fault it detects in the passenger airbag on/off switch or indicator circuits, and will illuminate the airbag indicator in the instrument cluster if a fault is detected. For proper diagnosis of the passenger airbag on/off switch or the ORC, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: A passenger airbag on/off switch is used only on club cab models. Quad cab models have a cubby bin installed in the instrument panel center bezel in place of the on/off switch.

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the center bezel (1) from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ INSTRUMENT PANEL CENTER BEZEL - REMOVAL).
3. From the back of the center bezel, remove the three screws (3) that secure the passenger airbag on/off switch and bezel unit (2) to the back of the center bezel.
4. Remove the passenger airbag on/off switch and bezel from the center bezel as a unit.

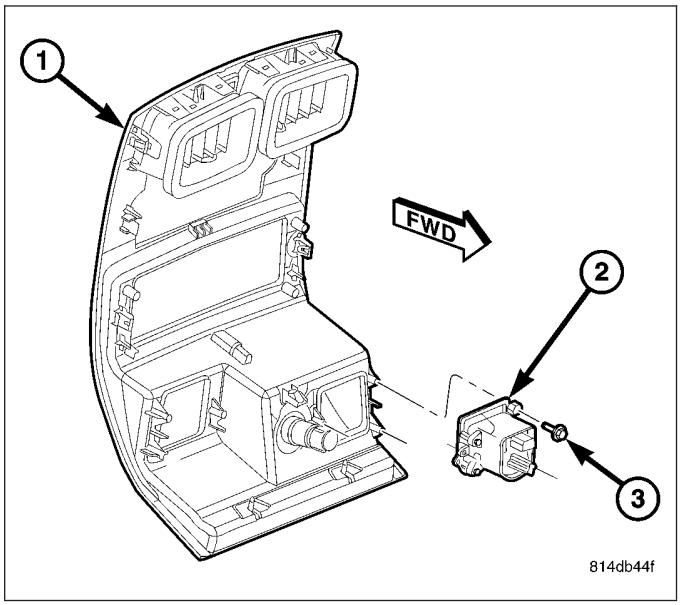


INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: A passenger airbag on/off switch is used only on club cab models. Quad cab models have a cubby bin installed in the instrument panel center bezel in place of the on/off switch.

1. Position the passenger airbag on/off switch and bezel unit (2) to the back of the instrument panel center bezel (1).
2. Install and tighten the three screws (3) that secure the passenger airbag on/off switch bezel to the back of the center bezel. Tighten the screws to 2 N·m (17 in. lbs.).
3. Reinstall the center bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).
4. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

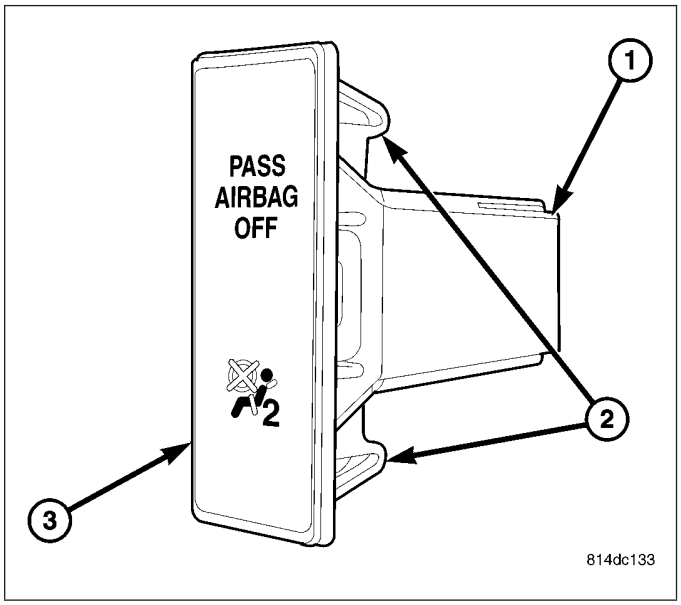


PASSENGER AIRBAG ON/OFF INDICATOR

DESCRIPTION

All vehicles equipped with the Occupant Classification System (OCS) include a passenger airbag on/off indicator (3), which is located between the two heater and air conditioner air outlets near the top of the instrument panel center bezel. The passenger airbag on/off indicator consists of a molded plastic housing with an integral connector receptacle (1) at the back, an integral latch tab (2) at the top and bottom, and a rectangular dark translucent outer lens.

The opaque text “PASS AIRBAG” is imprinted in white and always visible on the outer face of the lens, while the opaque text “OFF” and an opaque International Control and Display Symbol icon for “Passenger Airbag Off or Not Available” are imprinted on the back of the lens within the indicator. The dark outer lens prevents the “OFF” text and icon from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the lens causes the “OFF” text and icon to appear silhouetted against an amber field



through the translucent lens when the indicator is illuminated from behind by the LED.

The passenger airbag on/off indicator cannot be repaired or adjusted and, if faulty or damaged, the indicator unit must be replaced.

OPERATION

In the Occupant Classification System (OCS), the passenger airbag on/off indicator gives an indication when the passenger airbag and seat belt tensioner deployment circuits are disabled by the Occupant Restraint Controller (ORC). This indicator is controlled by a transistor within the ORC through a hard wired output based upon ORC programming, electronic occupant classification messages received by the ORC over the Controller Area Network (CAN) data bus from the Occupant Classification Module (OCM) and, on club cab models only, a hard wired multiplexed input from the passenger airbag on/off switch.

The passenger airbag on/off indicator Light Emitting Diode (LED) is completely controlled by the ORC. The LED receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the ORC transistor. The ORC will turn on the passenger airbag on/off indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the passenger airbag on/off indicator is illuminated for about six seconds.
- **Child Seat Detected (or Load Less Than Minimum Weight Threshold) Occupant Classification Message** - Each time the ORC receives a message from the OCM indicating a child seat has been detected in the passenger side front seat (or that the seat load is less than a minimum weight threshold) the passenger airbag and seat belt tensioner deployment circuits are deactivated and the passenger airbag on/off indicator will be illuminated. The indicator remains illuminated until the ORC receives an occupant classification message indicating that the passenger side front seat is empty, that the seat is occupied by a load equal to or greater than a minimum weight threshold, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Load Undetermined Occupant Classification Message** - Each time the ORC receives a message from the OCM indicating that a load cannot be determined in the passenger side front seat, the passenger airbag and seat belt tensioner deployment circuits are deactivated and the passenger airbag on/off indicator will be illuminated. The indicator remains illuminated until the ORC receives an occupant classification message indicating that the passenger side front seat is empty, that the seat is occupied by a load equal to or greater than a minimum weight threshold, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Passenger Airbag On/Off Switch Off Input (Club Cab Only)** - Each time the ORC receives an input from the passenger airbag on/off switch indicating that the “Off” position of the switch has been selected, the passenger airbag and seat belt tensioner deployment circuits are deactivated and the passenger airbag on/off indicator will be illuminated. The indicator remains illuminated until the ORC receives an input from the on/off switch indicating the “On” position has been selected in conjunction with occupant classification messages indicating that the passenger side front seat is empty, that the seat is occupied by a load equal to or greater than a minimum weight threshold, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - If the ORC receives invalid occupant classification messages or no messages from the OCM, the passenger airbag on/off indicator is illuminated. The indicator remains illuminated until the ORC receives a valid message from the OCM indicating that the passenger side front seat is empty, that the seat is occupied by a load equal to or greater than a minimum weight threshold, or until the ignition switch is turned to the Off position, whichever occurs first.

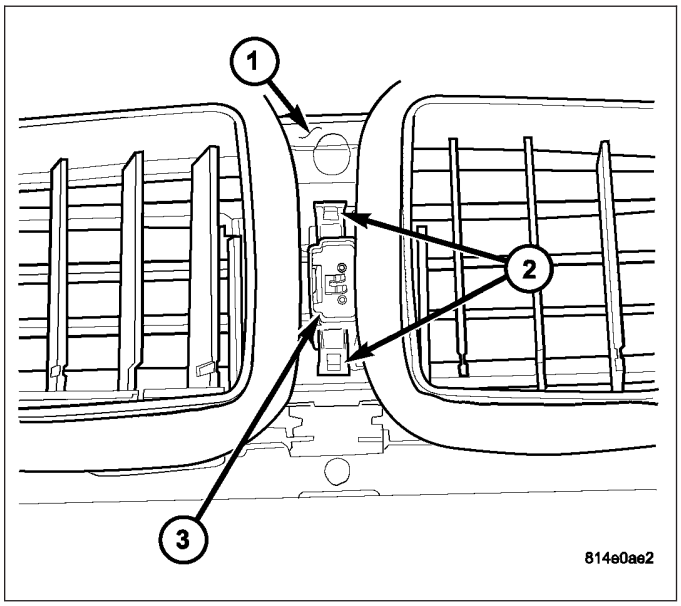
The ORC continually monitors the occupant classification messages from the OCM and, on club cab models only, the multiplexed input from the passenger airbag on/off switch. The ORC uses these inputs to decide whether the passenger airbag and seat belt tensioner deployment circuits should be activated or deactivated. Note that there may be several seconds of delay between changes in the detected occupant status and passenger airbag on/off indications. This is a programmed feature of the OCM used to prevent a flashing indicator condition resulting from the normal shifting of occupant weight on the passenger seat cushion. The ORC then provides the proper control output to turn the passenger airbag on/off indicator on or off.

The ORC will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. For proper diagnosis of the OCM, the ORC, the CAN data bus, the passenger airbag on/off switch or the electronic message inputs to the ORC that control the passenger airbag on/off indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

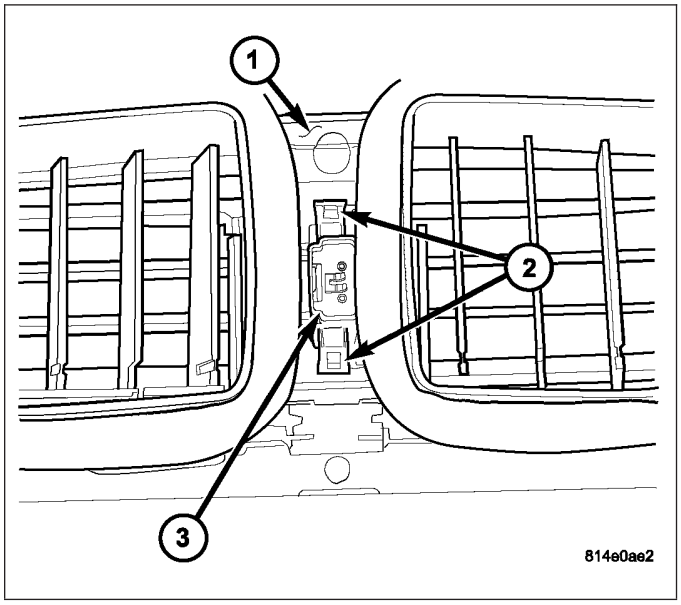
1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the center bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ INSTRUMENT PANEL CENTER BEZEL - REMOVAL).
3. From the back of the center bezel (1), depress the two latches (2) on the top and bottom of the indicator housing (3) and push the indicator out through the face of the bezel.



INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Using hand pressure from the face of the instrument panel center bezel, push the indicator firmly and evenly into the mounting hole until the two latches (2) on the top and bottom of the indicator housing (3) are fully engaged on the back of the bezel (1).
2. Reinstall the center bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).
3. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).
4. Following successful completion of the supplemental restraint system verification test procedure, per-

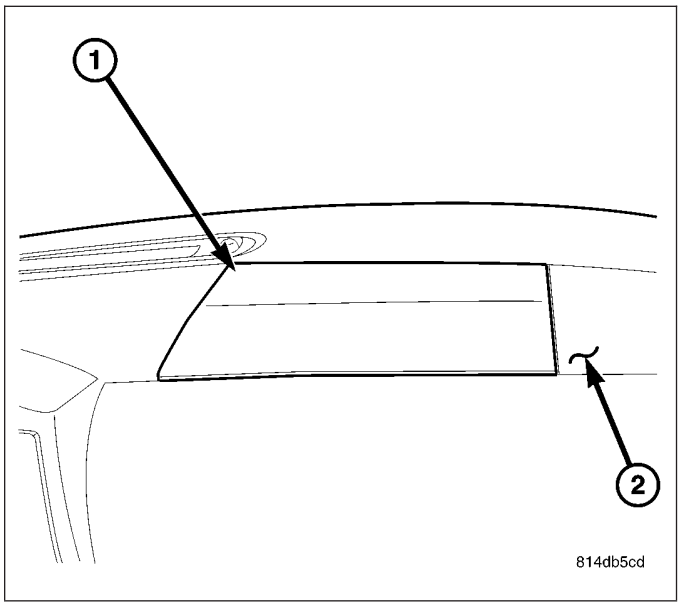


form the Occupant Classification System Verification Test using a diagnostic scan tool. Refer to the appropriate diagnostic procedures.

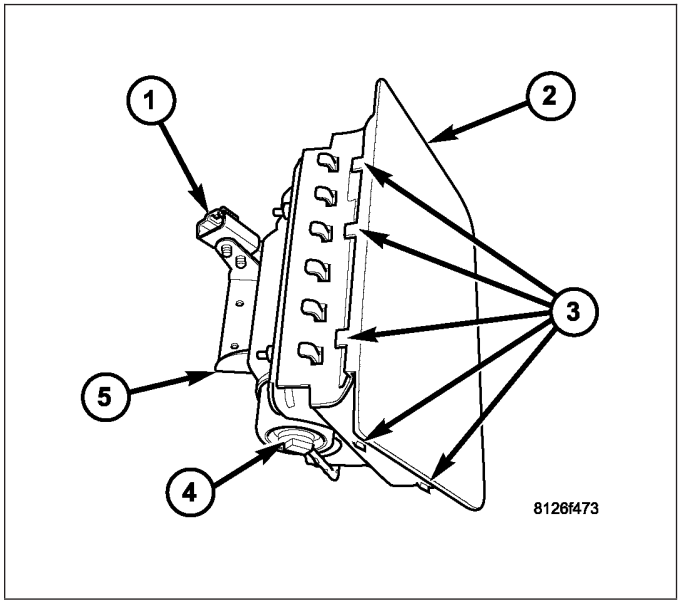
AIR BAG-PASSENGER

DESCRIPTION

The horizontal surface of the injection molded, thermoplastic passenger airbag door (1) is the most visible part of the passenger airbag. The passenger airbag door is located above the glove box opening on the top of the instrument panel (2) in front of the front seat passenger seating position.



The outboard edges of the airbag door are secured with integral snap features (3) to the instrument panel base trim. Located below the passenger airbag door (2) within the instrument panel is the passenger airbag unit. The passenger airbag housing fits into a molded receptacle on the back of the airbag door, where twelve stamped hook formations on the forward and rearward edges of the airbag housing are engaged in mating small window openings on the forward and rearward flanges of the receptacle to secure the airbag door to the airbag housing. These airbag door fasteners and mounting provisions are all concealed beneath the instrument panel base trim. The passenger airbag unit is secured by two screws through a stamped mounting bracket (5) to the instrument panel structural support.



The passenger airbag unit used in this model is a multistage, Next Generation-type that complies with revised federal airbag standards to deploy with less force than those used in some prior models. The passenger airbag unit consists of a stamped and welded metal housing, the airbag cushion, the airbag inflator, and a stamped metal airbag cushion retainer plate that is secured to the airbag housing with four studs and nuts. The airbag housing contains the airbag inflator and the folded airbag cushion. An approximately 80 centimeter (31.5 inch) wide by 90 centimeter (35.5 inch) high rectangular fabric cushion is used.

The airbag inflator (4) is a non-azide, pyrotechnic-type unit that is secured to and sealed within the airbag housing. A short four-wire pigtail harness with a keyed, yellow connector insulator (1) connects the two inflator initiators to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness.

The passenger airbag includes the airbag door. This unit cannot be repaired, and must be replaced if deployed, faulty, or in any way damaged.

OPERATION

The multistage passenger airbag is deployed by electrical signals generated by the Occupant Restraint Controller (ORC) through the passenger airbag squib 1 and squib 2 circuits to the two initiators in the airbag inflator. By using two initiators, the airbag can be deployed at multiple levels of force. The force level is controlled by the ORC to suit the monitored impact conditions by providing one of three delay intervals between the electrical signals provided to the two initiators. The longer the delay between these signals, the less forcefully the airbag will deploy.

When the ORC sends the proper electrical signals to each initiator, the electrical energy generates enough heat to initiate a small pyrotechnic charge which, in turn ignites chemical pellets within the inflator. Once ignited, these chemical pellets burn rapidly and produce a large quantity of inert gas. The inflator is sealed to the airbag cushion and a diffuser in the inflator directs all of the inert gas into the airbag cushion, causing the cushion to inflate. As the cushion inflates, the passenger airbag door will split at predetermined tear seam lines concealed on the inside surface of the door, then the door will pivot up over the top of the instrument panel and out of the way. Following an airbag deployment, the airbag cushion quickly deflates by venting the inert gas through vent holes within the fabric used to construct the back (windshield side) of the airbag cushion.

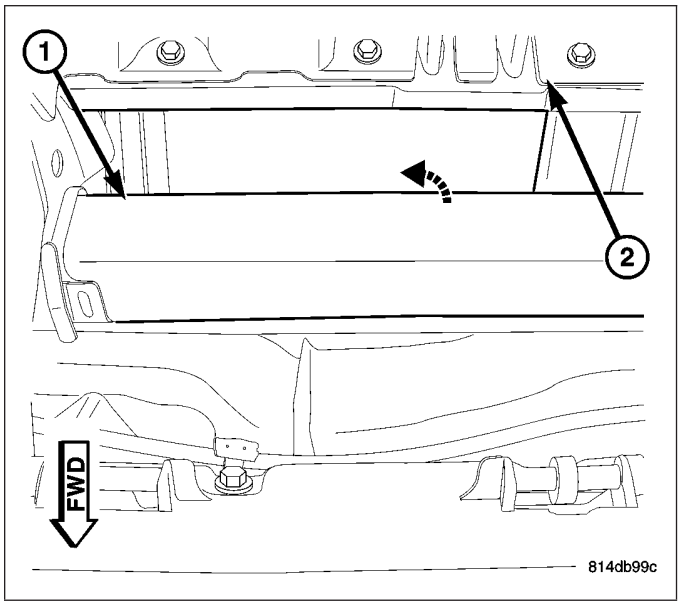
Typically, both initiators are used during an airbag deployment event. However, it is possible for only one initiator to be used during a deployment due to an airbag system fault; therefore, it is necessary to always confirm that both initiators have been used in order to avoid the improper disposal of potentially live pyrotechnic materials. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death, when removing a deployed airbag, rubber gloves, eye protection, and a long-sleeved shirt should be worn. There may be deposits on the airbag unit and other interior surfaces. In large doses, these deposits may cause irritation to the skin and eyes.

NOTE: The following procedure is for replacement of a faulty or damaged passenger airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the passenger airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).



1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the defroster grille from the top of the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/DEFROSTER GRILLE - REMOVAL).
3. Remove the glove box from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).
4. Reach up into the instrument panel between the upper glove box opening reinforcement (2) and the cross car beam (1) to access and remove the two screws that secure the passenger airbag lower bracket to the instrument panel support structure.
5. Using a trim stick or another suitable wide flat-bladed tool, gently pry the edges of the passenger airbag door away from the top of the instrument panel far enough to disengage the snap features on the door from the receptacles in the instrument panel base trim.
6. Pull the passenger airbag out of the instrument panel far enough to access and disconnect the instrument panel wire harness connector from the airbag inflator pigtail wire connector on the right side of the airbag lower mounting bracket. To disconnect the connector:
   a. Slide the red Connector Position Assurance (CPA) lock on the top of the connector toward the side of the connector.
   b. Depress the connector latch tab and pull the two halves of the connector straight away from each other.
7. Remove the passenger airbag from the instrument panel as a unit.

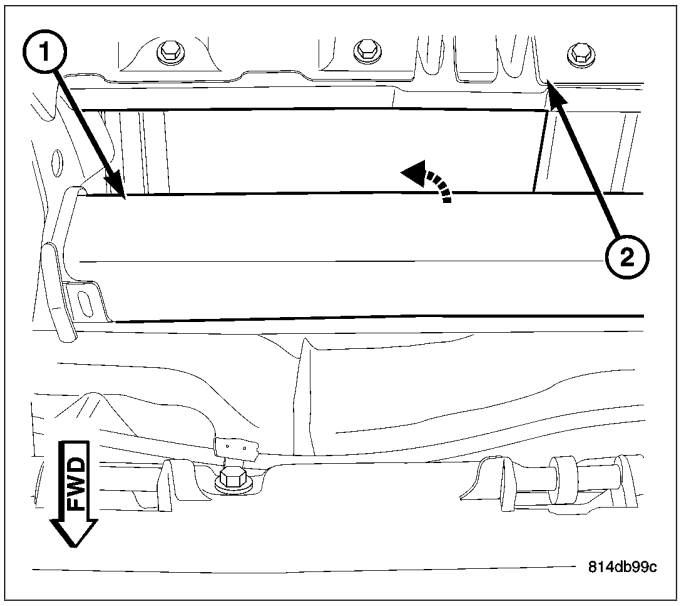
INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death, use extreme care to prevent any foreign material from entering the passenger airbag, or becoming entrapped between the passenger airbag cushion and the passenger airbag door. Failure to observe this warning could result in occupant injuries upon airbag deployment.

WARNING: To avoid personal injury or death, the passenger airbag door must never be painted. Replacement passenger airbags are serviced with doors in the original colors. Paint may change the way in which the material of the airbag door responds to an airbag deployment. Failure to observe this warning could result in occupant injuries upon airbag deployment.

NOTE: The following procedure is for replacement of a faulty or damaged passenger airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the passenger airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).



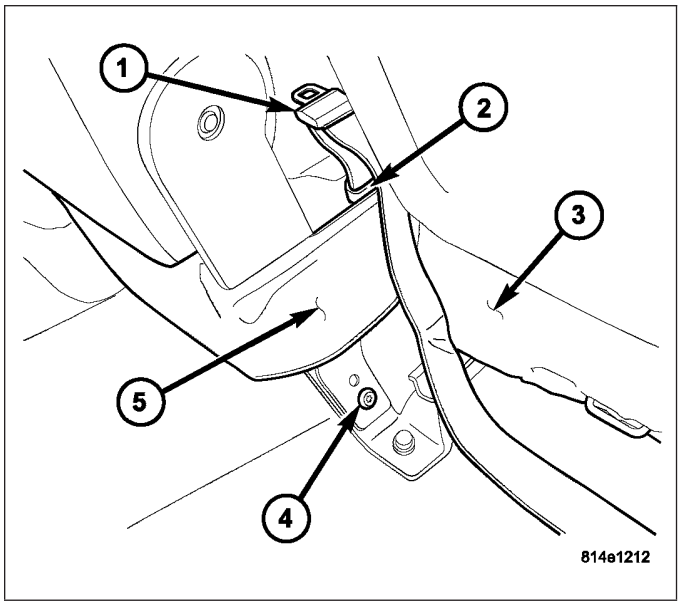
1. Position the passenger airbag unit onto the instrument panel.
2. Reconnect the instrument panel wire harness connector for the airbag to the passenger airbag inflator pigtail wire connector on the right side of the airbag lower mounting bracket. Be certain that the latch on the connector and the red Connector Position Assurance (CPA) lock are each fully engaged.
3. Carefully lower the passenger airbag unit into the instrument panel, being certain that the airbag lower mounting bracket is properly positioned to the instrument panel support structure.
4. Reach up into the instrument panel between the upper glove box opening reinforcement (2) and the cross car beam (1) to install and tighten the two screws that secure the passenger airbag lower mounting bracket to the instrument panel support structure. Tighten the screws to 6 N·m (55 in. lbs.).
5. Using hand pressure, push down on the passenger airbag door over each snap feature until it snaps into its receptacle in the instrument panel base trim.
6. Reinstall the glove box into the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).
7. Reinstall the defroster grille onto the top of the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ DEFROSTER GRILLE - INSTALLATION).
8. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

SEAT BELT

REMOVAL - FRONT CENTER

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

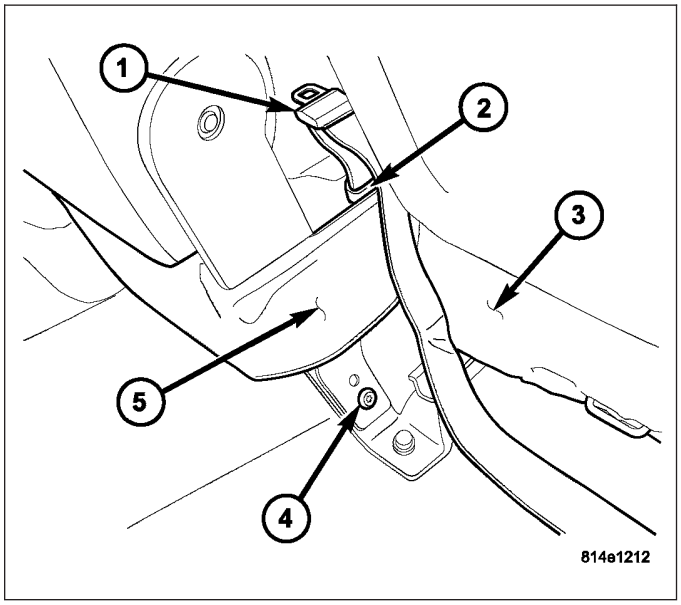
1. Move the right front outboard seat (3) to its most forward position for easiest access to the front center seat belt lower anchor screw (4).
2. From behind the front seat, remove the screw that secures the seat belt lower anchor to the center seat support bracket.
3. From the front of the front seat, disengage the loose end and the tip of the front center seat belt (1) from the elastic strap (2) on the side of the center seat cushion.
4. Remove the seat belt and lower anchor through the opening in the side of the front center seat cushion trim (5).



INSTALLATION - FRONT CENTER

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

1. From the front of the front seat, insert the front center seat belt (1) lower anchor through the opening in the trim (5) on the side of the center seat cushion.
2. Engage the loose end and the tip of the front center seat belt through the elastic strap (2) on the side of the center seat cushion.
3. From behind the front seat, position the seat belt lower anchor to the center seat support bracket. Be certain to engage the anti-rotation tab on the anchor into the corresponding hole in the center seat support bracket.
4. Install and tighten the screw (4) that secures the lower anchor to the center seat support bracket. Tighten the screw to 40 N·m (29 ft. lbs.).
5. Move the adjacent right front outboard seat (3) back to its rearward position.



SEAT BELT BUCKLE

REMOVAL

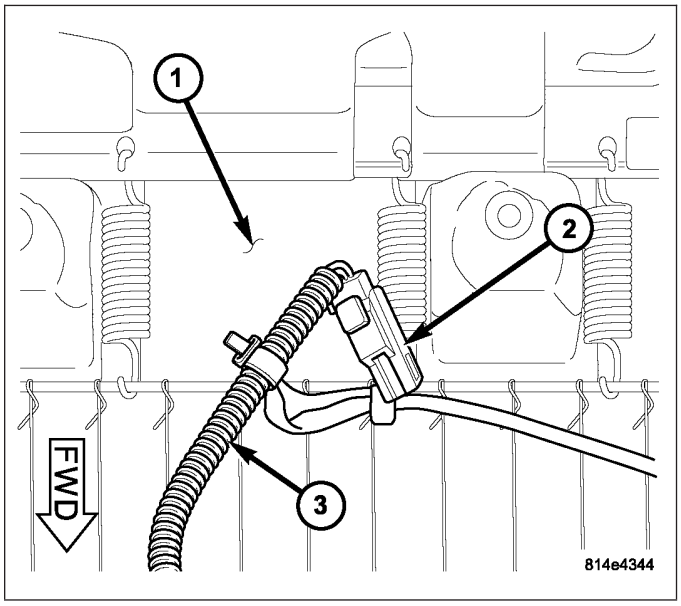
FRONT OUTBOARD

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

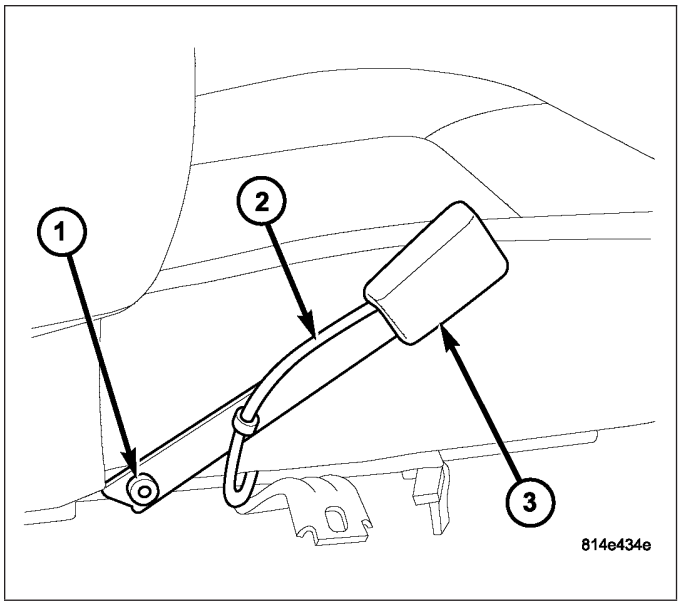
WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: A traveling front outboard seat belt buckle is located on the inboard side of each front outboard seat section (40 percent) used on all models. The seat belt buckle on the driver's side front seat for all models also includes a seat belt switch. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT SWITCH - DESCRIPTION).

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. From behind the front seat on the driver side only, disconnect the seat belt switch pigtail wire connector (2) from the seat wire harness take out and connector for the switch (3) located below the rear of the driver side seat cushion (1).



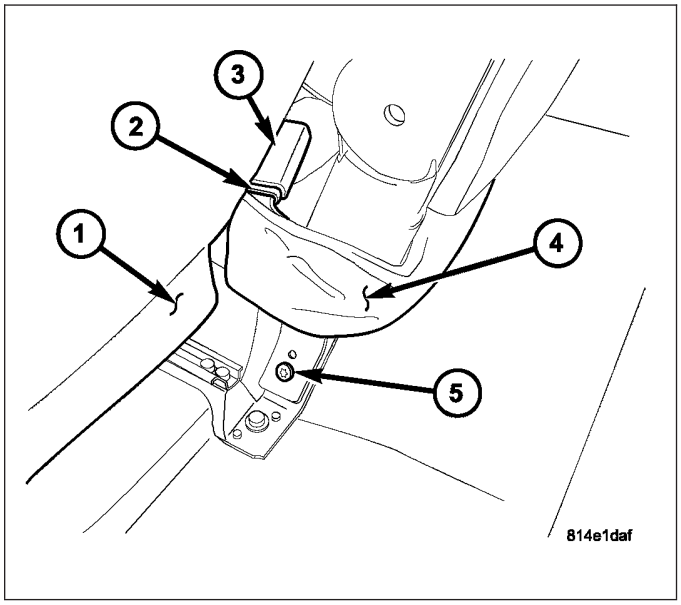
3. Move the right or left front outboard seat section to its most rearward position and tilt the seat back forward for easiest access to the front outboard seat belt buckle lower anchor screw (1).
4. On the driver side only, disengage the disconnected seat belt switch pigtail wire (2) from under the seat cushion and the inboard seat track.
5. Remove the screw that secures the outboard front seat belt buckle (3) anchor near the back of the inboard seat cushion frame.
6. Remove the buckle from the seat.



FRONT CENTER

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

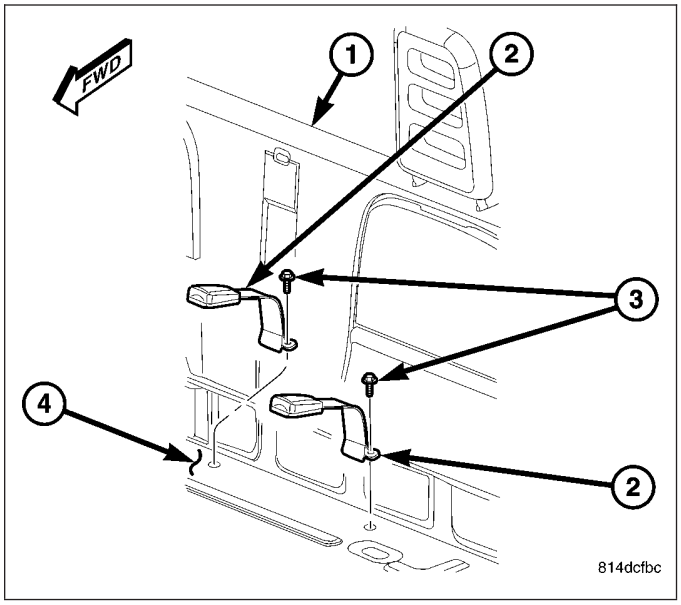
1. Move the left front outboard seat (1) to its most forward position for easiest access to the front center seat belt buckle lower anchor screw (5).
2. From behind the front seat, remove the screw that secures the seat belt buckle lower anchor to the center seat support bracket.
3. From the front of the front seat, disengage the front center seat belt buckle (3) from the elastic strap (2) on the side of the center seat cushion.
4. Remove the seat belt buckle and lower anchor through the opening in the side of the front center seat cushion trim (4).



REAR - CLUB CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

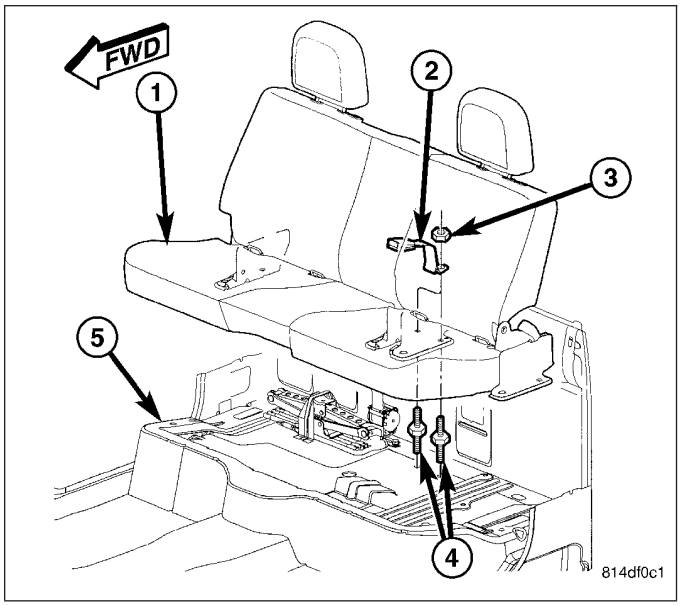
1. Fold the rear seat cushions up against the cab back panel (1).
2. Remove the screw (3) that secures the rear seat belt buckle anchor (2) to the rear floor panel (4).
3. Remove the buckle from the rear floor.



REAR CENTER & LEFT OUTBOARD - QUAD CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

1. Disengage the center or the left outboard occupant buckle unit (2) from the elastic loop on the back of the rear seat cushion (1) and push the buckle back through the crevice between the cushion and the rear seat back.
2. Lift up the seat cushion into its stowed position against the seat back.
3. Remove the nut (3) that secures the buckle unit to the stud (4) on the rear floor panel (5) near the base of the cab back panel. The stud and nut that secures the buckle also secures the inboard rear seat mounting bracket to the rear floor panel.
4. Remove the buckle from the stud and the inboard rear seat mounting bracket.



REAR CENTER ANCHOR & RIGHT OUTBOARD - QUAD CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

INSTALLATION

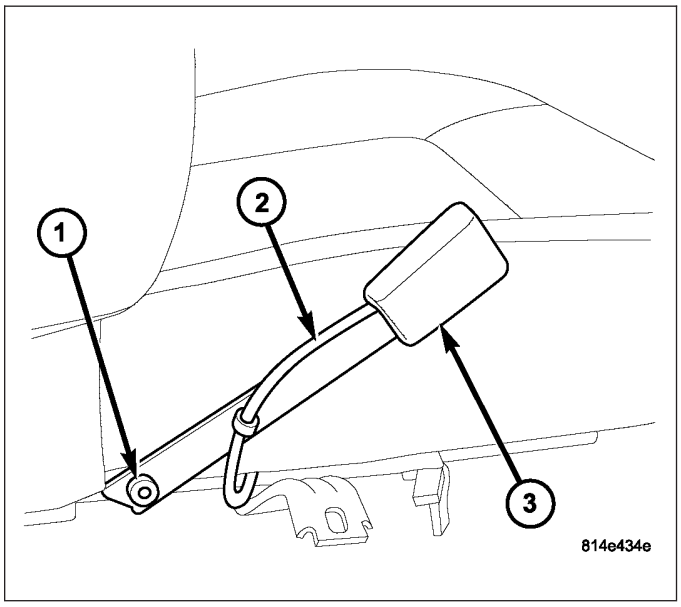
FRONT OUTBOARD

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

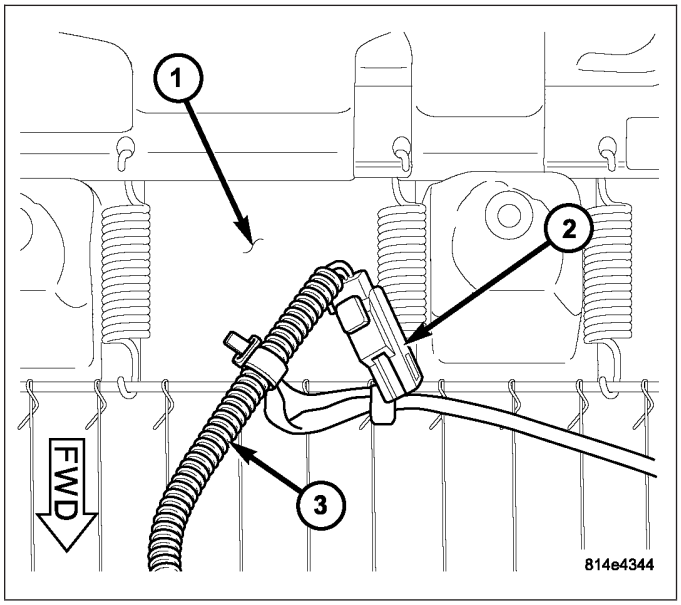
WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: A traveling front outboard seat belt buckle is located on the inboard side of each front outboard seat section (40 percent) used on all models. The seat belt buckle on the driver's side front seat for all models also includes a seat belt switch. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT SWITCH - DESCRIPTION).

1. Position the outboard front seat belt buckle (3) lower anchor to the mounting hole near the rear of the inboard seat cushion frame. Be certain the notch at the base of the anchor engages the anti-rotation tab on the frame.
2. Install and tighten the screw (1) that secures the anchor to the frame. Tighten the screw to 43 N·m (32 ft. lbs.).
3. On the driver side only, route the seat belt switch pigtail wire (2) under the inboard seat track and the seat cushion.
4. On the driver side only, move the front seat to its most forward position and tilt the seat back forward for easiest access to the seat belt switch pigtail wire connection.



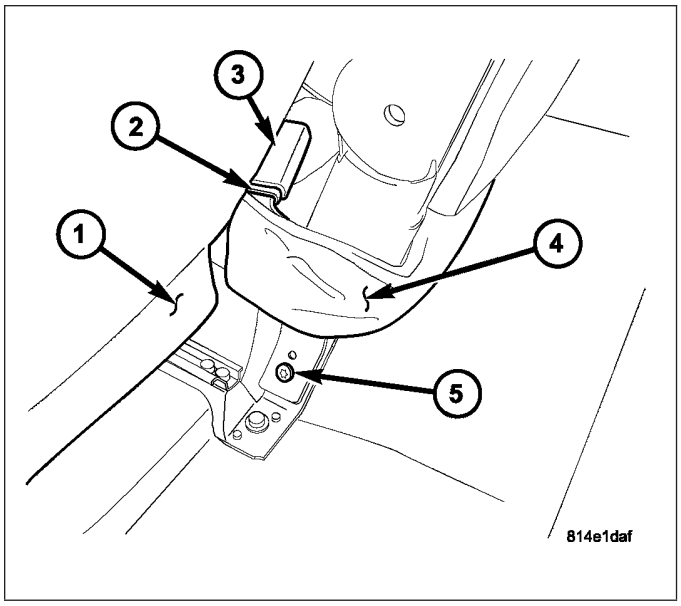
5. From behind the front seat on the driver side only, reconnect the seat belt switch pigtail wire connector (2) to the seat wire harness take out and connector for the switch (3) located below the rear of the driver side seat cushion (1).
6. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).



FRONT CENTER

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

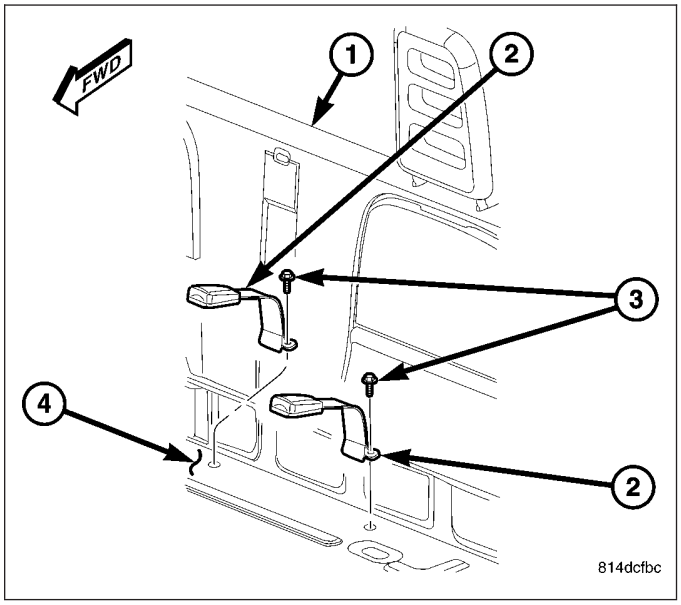
1. From the front of the front seat, insert the front center seat belt buckle (3) lower anchor through the opening in the trim (4) on the side of the center seat cushion.
2. Engage the front center seat belt buckle through the elastic strap (2) on the side of the center seat cushion.
3. From behind the front seat, position the seat belt buckle lower anchor to the center seat support bracket. Be certain to engage the anti-rotation tab on the anchor into the corresponding hole in the center seat support bracket.
4. Install and tighten the screw (5) that secures the lower anchor to the center seat support bracket. Tighten the screw to 40 N·m (29 ft. lbs.).
5. Move the adjacent left front outboard seat (1) back to its rearward position.



REAR - CLUB CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

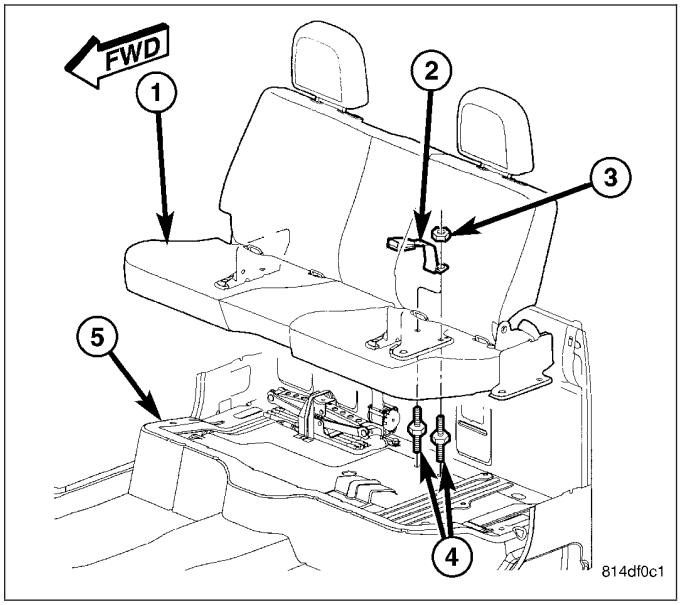
1. Position the lower anchor of the rear seat belt buckle (2) to the rear floor panel (4).
2. Install and tighten the screw (3) that secures the buckle anchor to the floor panel. Tighten the screw to 46 N·m (34 ft. lbs.).
3. Fold down the rear seat cushion from the cab back panel (1) to the seating position.



REAR CENTER & LEFT OUTBOARD - QUAD CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

1. Position the center or the left outboard occupant buckle unit (2) onto the stud (4) near the base of the cab back panel that secures the inboard rear seat mounting bracket to the rear floor panel (5).
2. Install and tighten the nut (3) that secures the buckle unit to the stud. Tighten the nut to 41 N·m (30 ft. lbs.). Be certain to hold the buckle in its properly oriented position while tightening the nut.
3. Push the buckle up through the crevice between the rear seat cushion and the rear seat back.
4. Lower the rear seat cushion back to its normal seating position.
5. Engage the buckle through the elastic loop at the back of the seat cushion.



REAR CENTER ANCHOR & RIGHT OUTBOARD - QUAD CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

SEAT BELT & RETRACTOR

REMOVAL

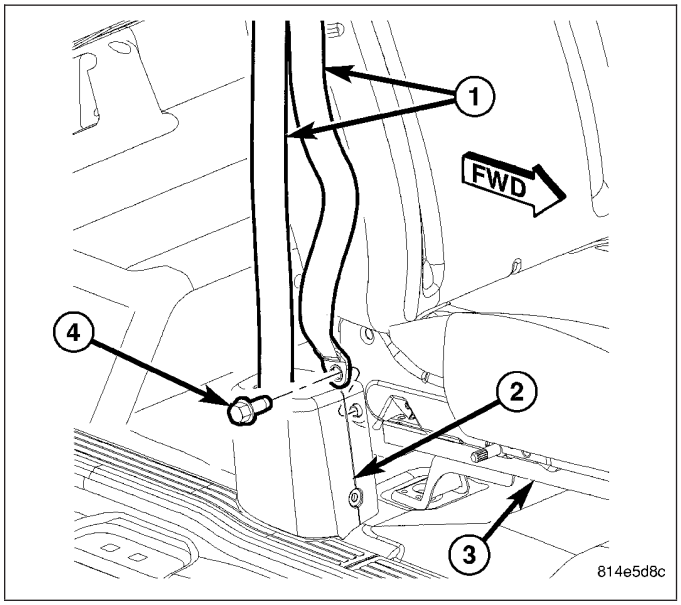
FRONT OUTBOARD - CLUB CAB

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

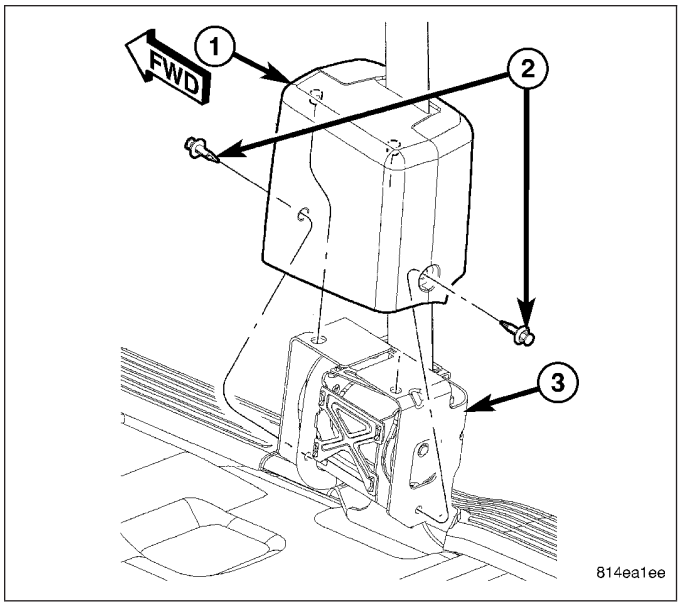
WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: The following procedure is for replacement of a faulty or damaged seat belt and retractor unit. The front retractor also includes a seat belt tensioner. If the front seat belt or retractor is faulty or damaged, but the seat belt tensioner is not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the seat belt tensioner has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the unit from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

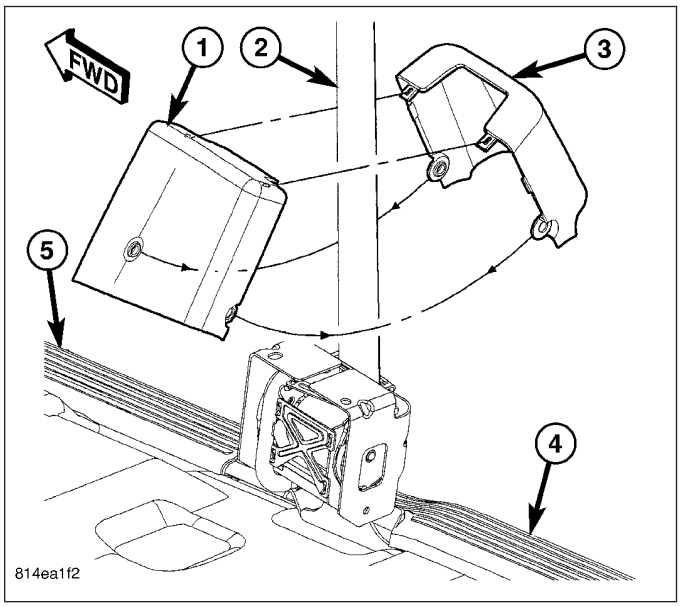
1. Adjust the front seat to its most forward position for easiest access to the front seat belt (1) lower anchor and the retractor (2).
2. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
3. Remove the screw (4) that secures the lower anchor to the outboard side of the front seat cushion frame (3).



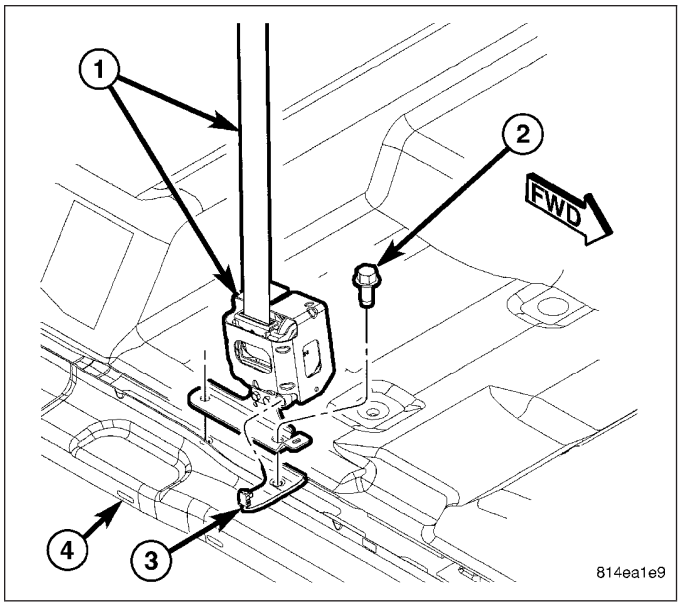
4. Remove the two plastic push-pin retainers (2) that secure the trim cover (1) to the retractor (3) on the floor panel near the door sill.
5. Raise the trim cover up off of the retractor far enough to disengage the two locator pins in the top of the inboard cover half from the locator holes in the top of the retractor.



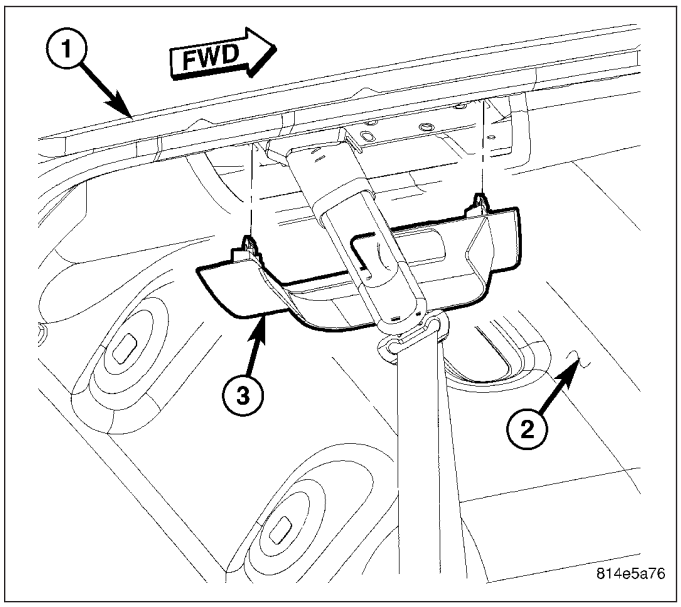
6. Spread apart the lower end of the inboard (1) and outboard (3) trim cover halves far enough to release the snap features that secure the tops of the two halves to each other.
7. Remove the trim cover halves from around the seat belt and retractor (2).
8. Loosen and move aside the front (5) and rear (4) scuff plates from the door sill far enough to access the retractor mounting bracket. (Refer to 23 - BODY/INTERIOR/DOOR SILL SCUFF PLATE - REMOVAL).



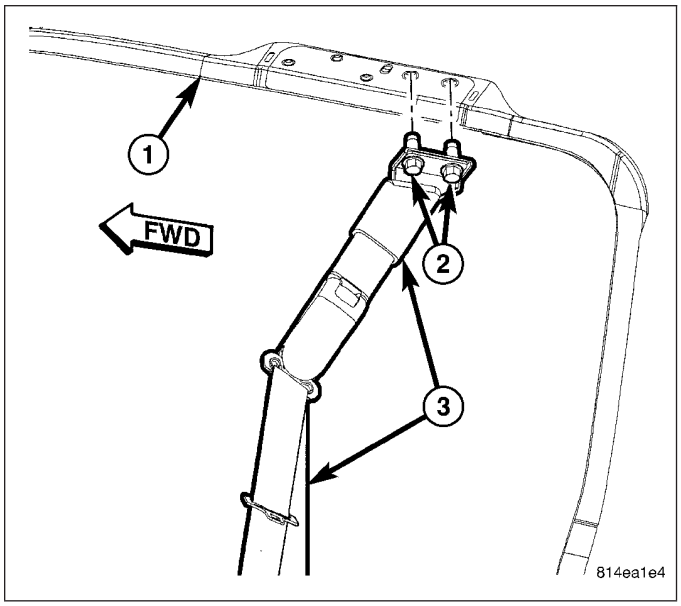
9. Disconnect the body wire harness connector (3) from the seat belt tensioner initiator on the retractor (1).
10. Remove the two screws (2) that secure the retractor mounting bracket to the floor panel inboard of the door sill (4).



11. Using a trim stick or another suitable wide flat-bladed tool, gently pry the edges of the upper door striker trim cover (3) away from the headliner (2) far enough to disengage the two snap clips that secure it to the upper roof rail (1).



12. Remove the two screws (2) that secure the seat belt turning loop and height adjuster (3) bracket to the upper roof rail (1).
13. Remove the front seat belt and retractor from the vehicle as a unit.



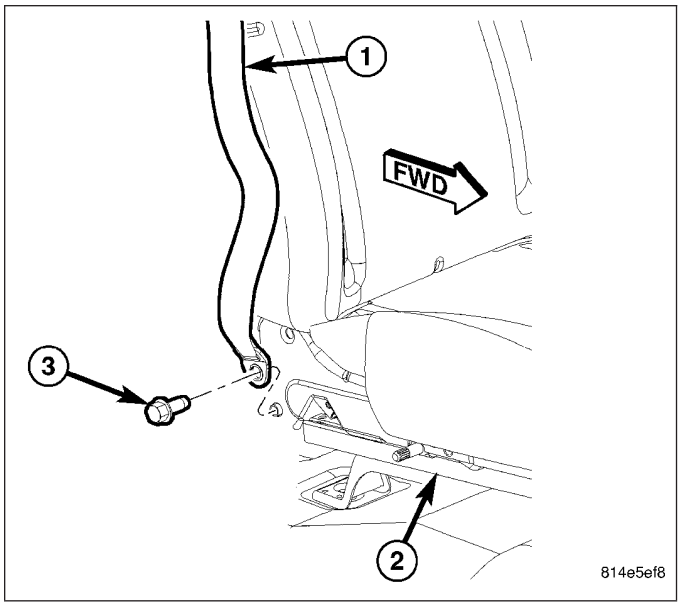
FRONT OUTBOARD - QUAD CAB

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

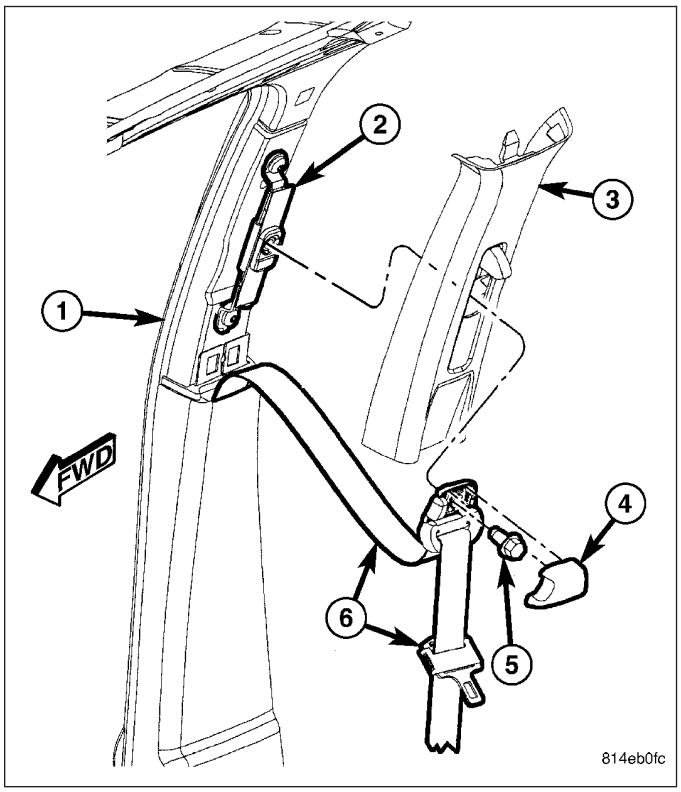
WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: The following procedure is for replacement of a faulty or damaged seat belt and retractor unit. The front retractor also includes a seat belt tensioner. If the front seat belt or retractor is faulty or damaged, but the seat belt tensioner is not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the seat belt tensioner has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the unit from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

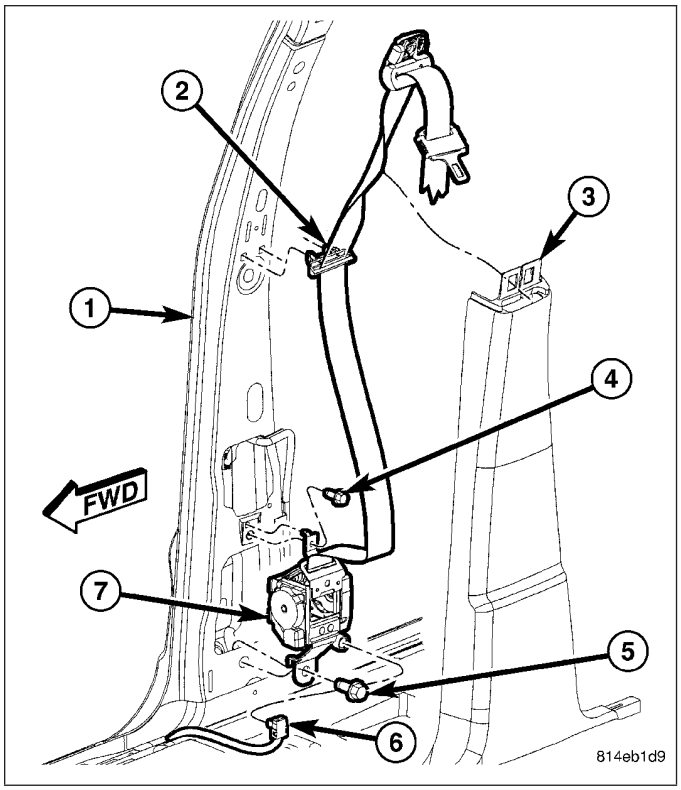
1. Adjust the front seat to its most forward position for easiest access to the front seat belt (1) lower anchor and the B-pillar trim.
2. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
3. Remove the screw (3) that secures the lower anchor to the outboard side of the front seat cushion frame (2).



4. Unsnap the trim cover (4) from the front seat belt (6) turning loop and discard.
5. Remove the screw (5) that secures the seat belt turning loop to the height adjuster (2) on the upper B-pillar (1).
6. Remove the seat belt turning loop from the height adjuster.
7. Remove the upper trim (3) from the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - REMOVAL).



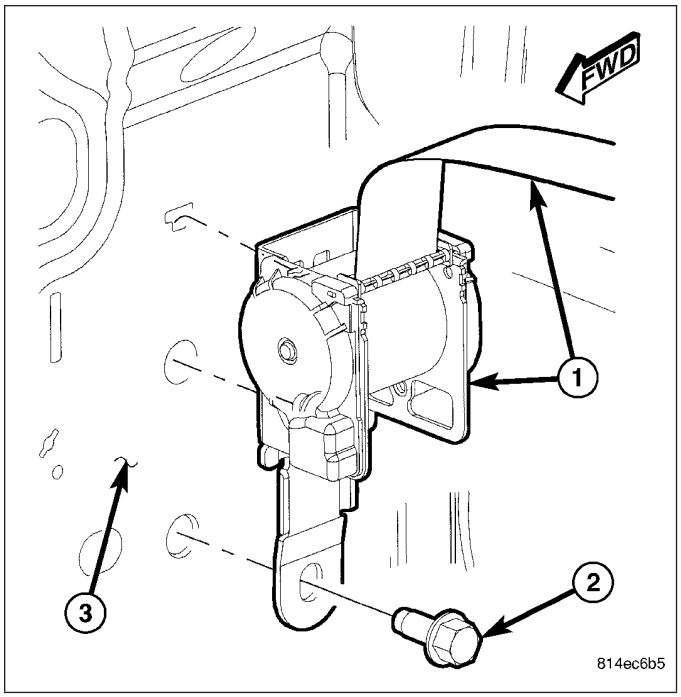
8. Remove the lower trim (3) from the inside of the B-pillar (1). (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL).
9. Disconnect the body wire harness connector (6) from the seat belt tensioner initiator on the retractor (7).
10. Disengage the two clips that secure the belt web guide (2) to the B-pillar.
11. Remove the screw (4) that secures the upper retractor bracket to the B-pillar.
12. Remove the screw (5) that secures the lower retractor bracket to the B-pillar.
13. Disengage the tabs on the retractor bracket from the holes in the inner B-pillar.
14. Remove the front seat belt and retractor from the B-pillar as a unit.



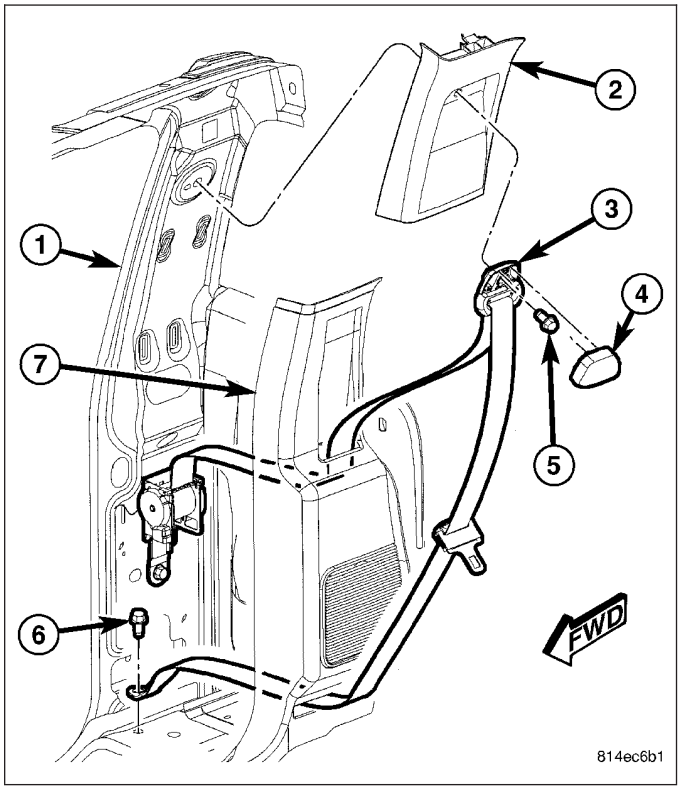
REAR OUTBOARD - CLUB CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

1. Unsnap the trim cover (4) from the rear seat belt turning loop (3) and discard.
2. Remove the screw (5) that secures the seat belt turning loop to the upper C-pillar (1).
3. Remove the seat belt turning loop from the C-pillar.
4. Remove the upper trim (2) from the inside of the C-pillar. (Refer to 23 - BODY/INTERIOR/UPPER C-PILLAR TRIM - REMOVAL - CLUB CAB).
5. Loosen and move the lower trim (7) away from the inside of the C-pillar far enough to access the lower seat belt anchor. (Refer to 23 - BODY/INTERIOR/LOWER C-PILLAR TRIM - REMOVAL - CLUB CAB).
6. Remove the screw (6) that secures the lower anchor to the floor panel near the base of the C-pillar.
7. Disengage the seat belt, lower anchor, latch plate and turning loop from the clearance holes in the lower C-pillar trim and set the lower C-pillar trim aside.



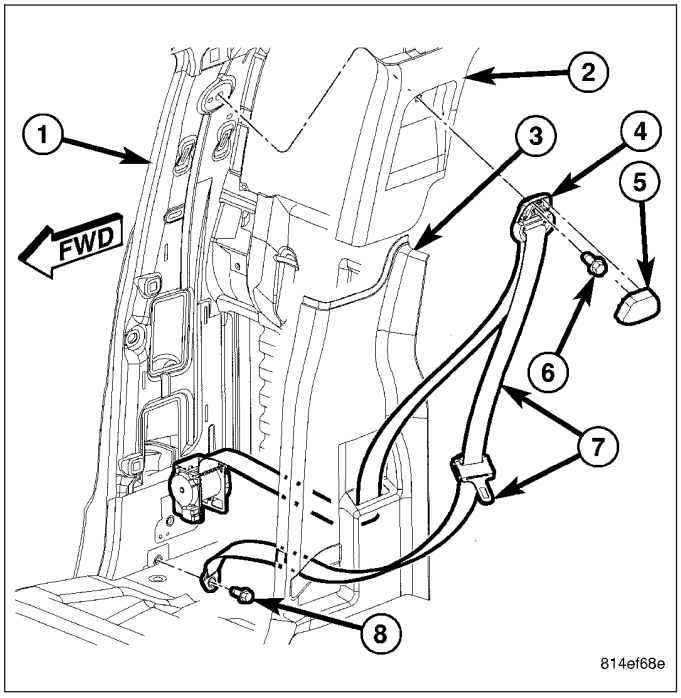
8. Remove the screw (2) that secures the retractor (1) to the inner C-pillar (3).
9. Lift the retractor upward far enough to disengage the tab on the back of the retractor from the T-slot in the inner C-pillar.
10. Remove the rear seat belt and retractor from the vehicle as a unit.



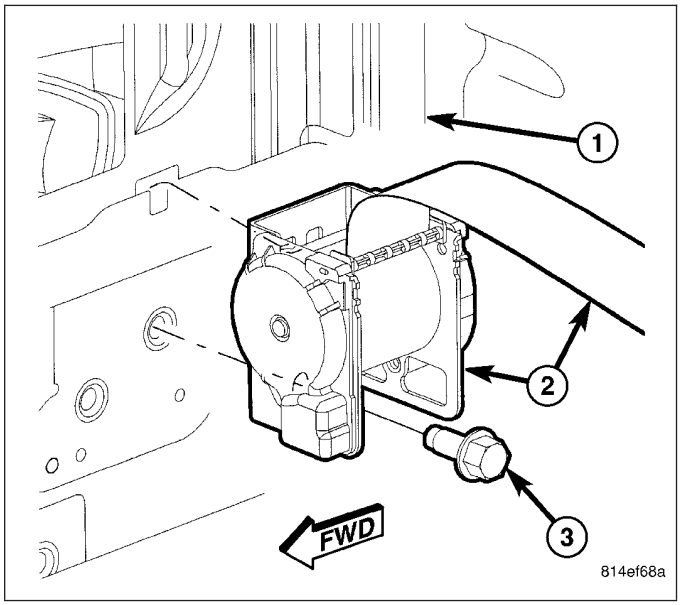
REAR OUTBOARD - QUAD CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

1. Unsnap the trim cover (5) from the rear seat belt turning loop (4) and discard.
2. Remove the screw (6) that secures the seat belt turning loop to the upper C-pillar (1).
3. Remove the seat belt turning loop from the C-pillar.
4. Remove the upper trim (2) from the inside of the C-pillar. (Refer to 23 - BODY/INTERIOR/UPPER C-PILLAR TRIM - REMOVAL - QUAD CAB).
5. Loosen and move the lower trim (3) away from the inside of the C-pillar far enough to access the lower seat belt anchor. (Refer to 23 - BODY/INTERIOR/LOWER C-PILLAR TRIM - REMOVAL - QUAD CAB).
6. Remove the screw (8) that secures the lower anchor near the base of the inner C-pillar.
7. Disengage the seat belt, lower anchor, latch plate (7) and turning loop from the clearance holes in the lower C-pillar trim and set the lower C-pillar trim aside.



8. Remove the screw (3) that secures the retractor (2) to the inner C-pillar (1).
9. Lift the retractor upward far enough to disengage the tab on the back of the retractor from the T-slot in the inner C-pillar.
10. Remove the rear seat belt and retractor from the vehicle as a unit.



REAR CENTER - QUAD CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

INSTALLATION

FRONT OUTBOARD - CLUB CAB

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

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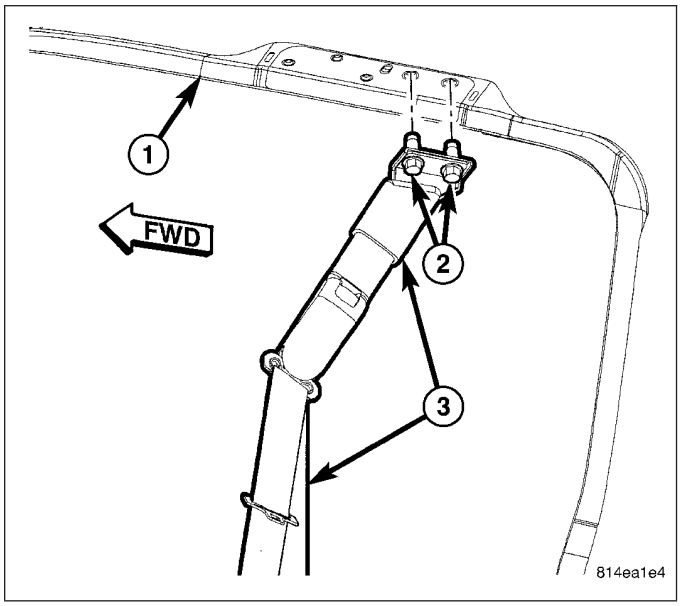
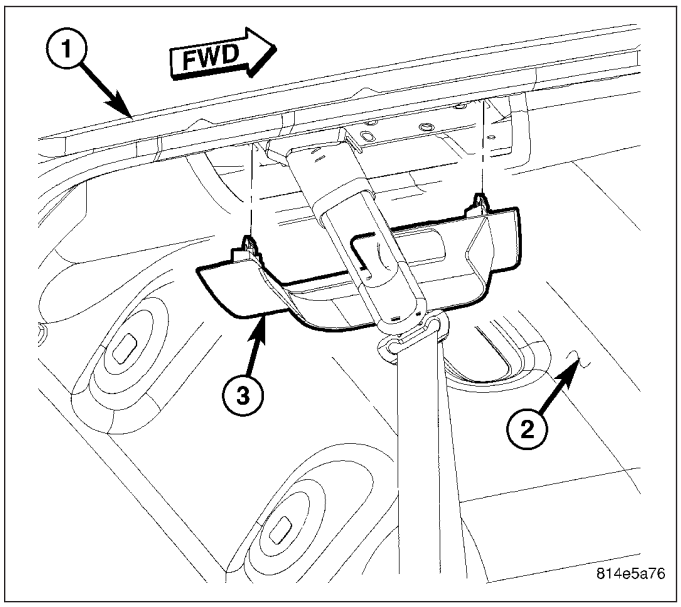
NOTE: The following procedure is for replacement of a faulty or damaged seat belt and retractor unit. The front retractor also includes a seat belt tensioner. If the front seat belt or retractor is faulty or damaged, but the seat belt tensioner is not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the seat belt tensioner has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the unit from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

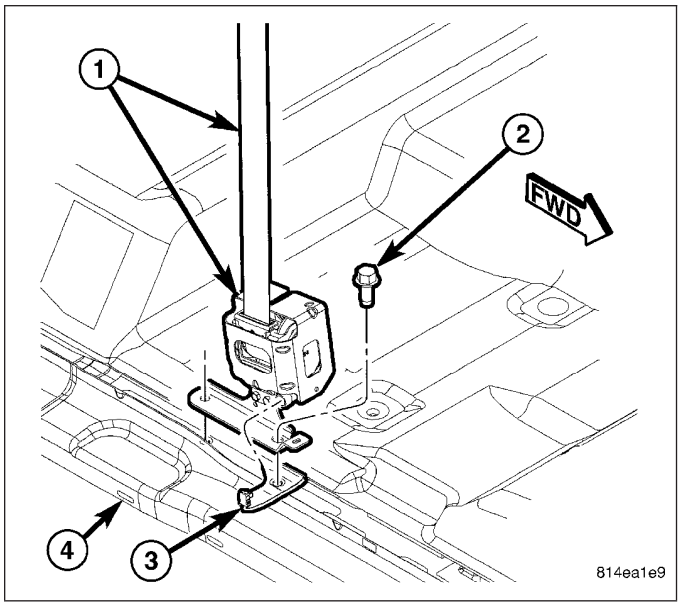
1. Position the seat belt turning loop and height adjuster (3) bracket to the mounting holes in the upper roof rail (1).
2. Install and tighten the two screws (2) that secure the seat belt turning loop and height adjuster bracket to the upper roof rail. Tighten the screws to 39 N·m (29 ft. lbs.).



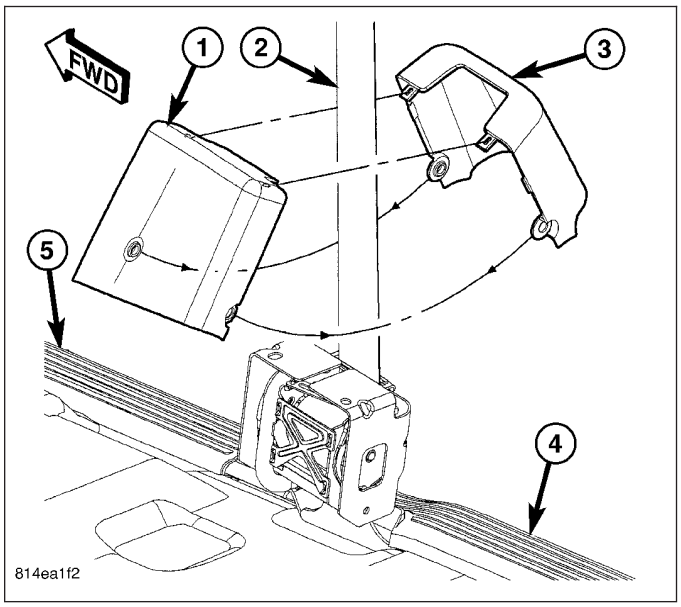
3. Position the trim cover (3) to the headliner (2) opening around the door striker and the seat belt turning loop adjuster bracket on the upper roof rail (1).
4. Using hand pressure, press firmly and evenly on the trim cover until the two snap clips that secure it to the upper roof rail snap into place.



5. Position the retractor (1) mounting bracket to the mounting holes in the floor panel inboard of the door sill (4). Be certain that the seat belt webbing between the retractor and the turning loop is not twisted.
6. Install and tighten the two screws (2) that secure the retractor bracket to the floor panel. Tighten the screws to 39 N·m (29 ft. lbs.).
7. Reconnect the body wire harness connector (3) to the seat belt tensioner initiator on the retractor.

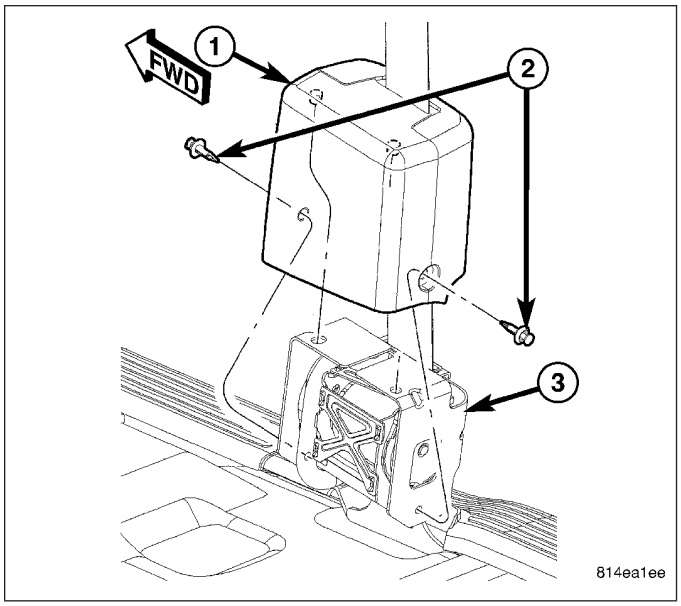


8. Restore the front (5) and rear (4) scuff plates to the door sill over the retractor mounting bracket. (Refer to 23 - BODY/INTERIOR/DOOR SILL SCUFF PLATE - INSTALLATION).

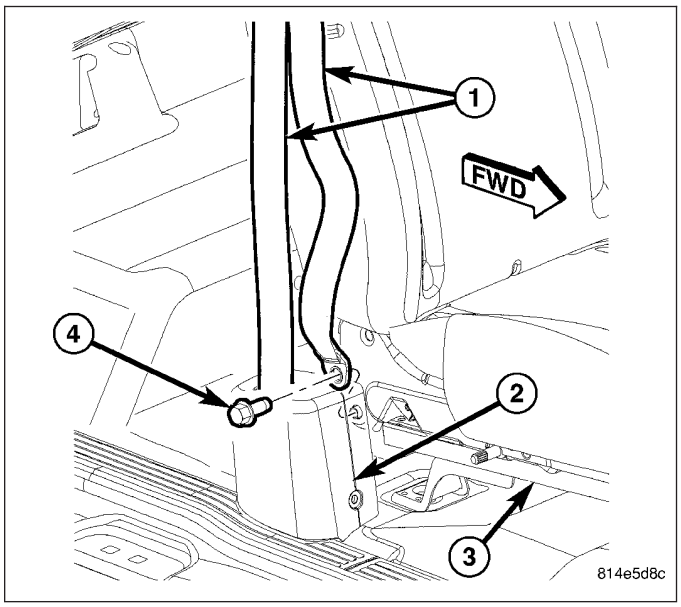


9. Position the inboard (1) and outboard (3) trim cover halves around the seat belt and retractor (2) with the lower end spread open far enough to engage the snap features that secure the tops of the two halves to each other.
10. Close the lower ends of the trim cover halves together.

11. Using hand pressure, push the trim cover (1) down over the retractor (3) far enough to engage the two locator pins in the top of the inboard cover half with the locator holes in the top of the retractor.
12. Reinstall the two plastic push-pin retainers (2) that secure the trim cover to the retractor.



13. Position the seat belt (1) lower anchor to the mounting hole on the outboard side of the front seat cushion frame (3). Be certain that the seat belt webbing between the turning loop and the lower anchor is not twisted.
14. Install and tighten the screw (4) that secures the lower anchor to the seat. Tighten the screw to 39 N·m (29 ft. lbs.).
15. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/ RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).



FRONT OUTBOARD - QUAD CAB

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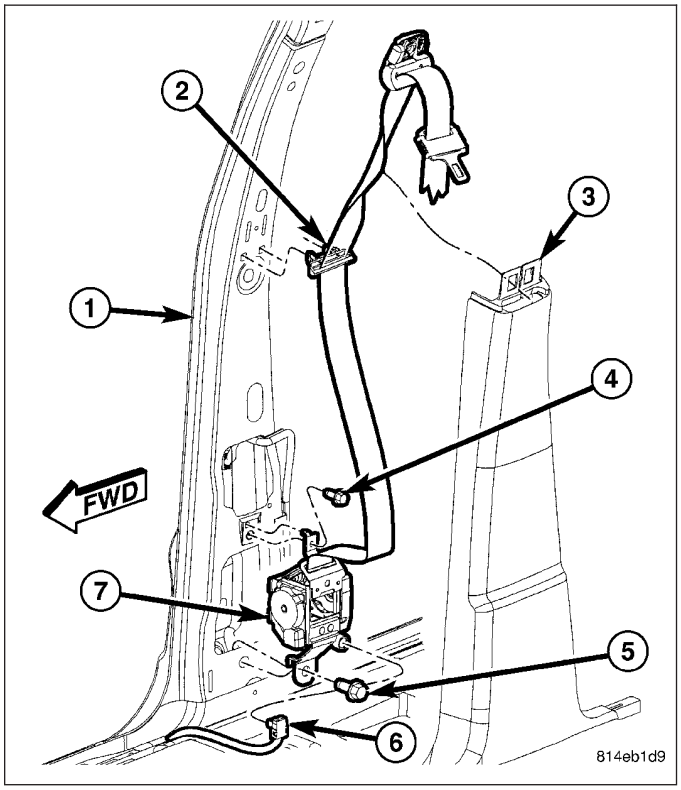
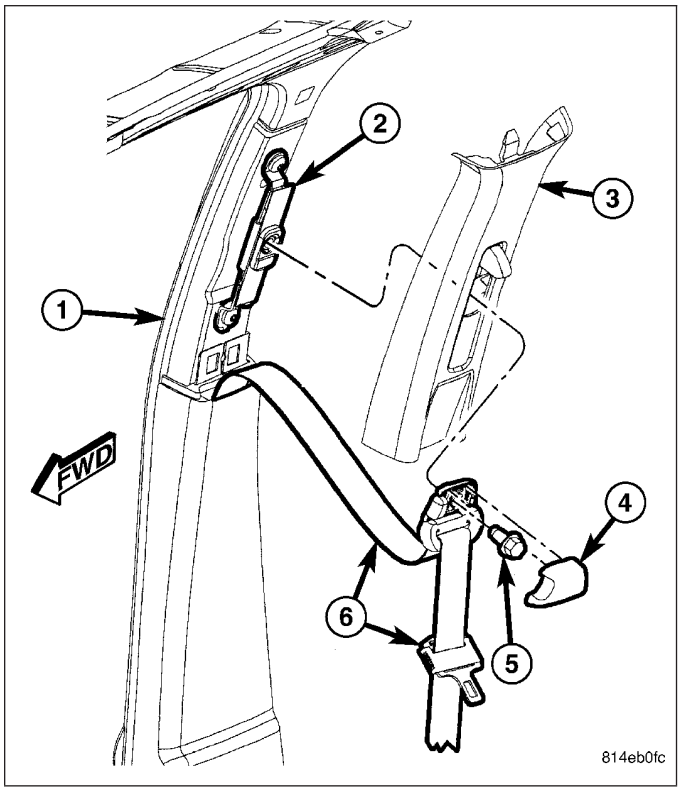
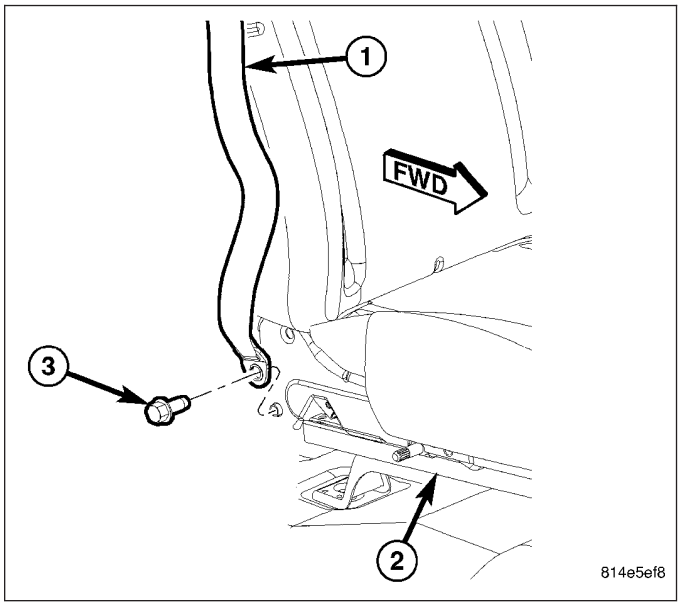
1. Position the front seat belt and retractor (7) to the inner B-pillar (1) as a unit. Be certain to engage the tabs on the retractor bracket into the holes in the B-pillar.
2. Loosely install the screw (5) that secures the lower retractor bracket to the B-pillar.
3. Install and tighten the screw (4) that secures the upper retractor bracket to the B-pillar. Tighten the screw to 3 N·m (25 in. lbs.).
4. Tighten the screw that secures the lower retractor bracket to the B-pillar. Tighten the screw to 39 N·m (29 ft. lbs.).
5. Position the belt web guide (2) to the B-pillar and use hand pressure to press it firmly and evenly until the two clips that secure it snap into place.
6. Reconnect the body wire harness connector (6) to the seat belt tensioner initiator on the retractor.
7. Reinstall the lower trim (3) onto the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - INSTALLATION).



8. Reinstall the upper trim (3) onto the inside of the B-pillar (1). (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - INSTALLATION).
9. Position the seat belt (6) turning loop onto the height adjuster (2) on the upper B-pillar.
10. Install and tighten the screw (5) that secures the turning loop to the height adjuster. Tighten the screw to 39 N·m (29 ft. lbs.).
11. Engage the upper edge of a new trim cover (4) over the top of the turning loop. Then squeeze the lower end of the trim cover and the turning loop together firmly and evenly until the engagement tabs of the trim cover snap into the slots of the turning loop.



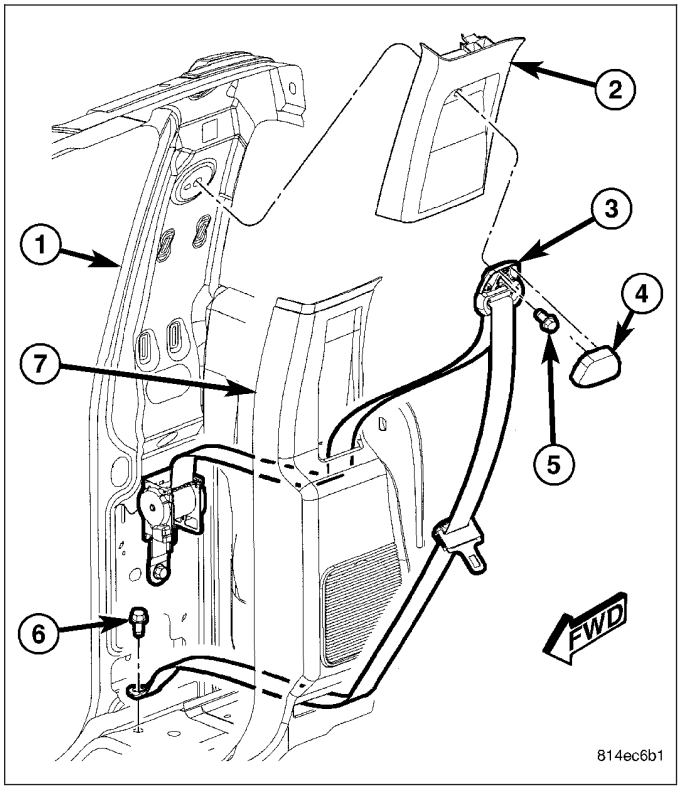
12. Position the seat belt (1) lower anchor to the mounting hole on the outboard side of the front seat cushion frame (2). Be certain that the seat belt webbing between the turning loop and the lower anchor is not twisted.
13. Install and tighten the screw (3) that secures the lower anchor to the seat. Tighten the screw to 39 N·m (29 ft. lbs.).
14. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/ RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).



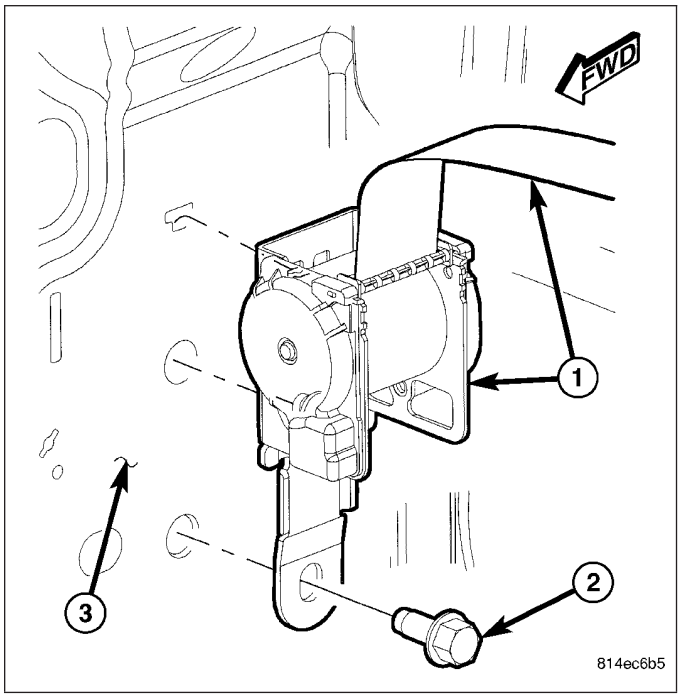
REAR OUTBOARD - CLUB CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

1. Position the rear seat belt and retractor (1) to the inner C-pillar (3).
2. Engage the tab on the back of the retractor into the T-slot in the inner C-pillar.
3. Install and tighten the screw (2) that secures the retractor to the inner C-pillar. Tighten the screw to 39 N·m (29 ft. lbs.).



4. Route the seat belt, lower anchor, latch plate and turning loop (3) through the clearance holes in the lower C-pillar trim (7). Be certain that the seat belt webbing between the retractor and the lower anchor is not twisted.
5. Position the seat belt lower anchor to the mounting hole in the floor panel near the base of the C-pillar.
6. Install and tighten the screw (6) that secures the lower anchor to the floor panel. Tighten the screw to 39 N·m (29 ft. lbs.).
7. Reinstall the lower trim onto the inside of the C-pillar. (Refer to 23 - BODY/INTERIOR/LOWER C-PILLAR TRIM - INSTALLATION - CLUB CAB).
8. Reinstall the upper trim (2) onto the inside of the C-pillar. (Refer to 23 - BODY/INTERIOR/UPPER C-PILLAR TRIM - INSTALLATION - CLUB CAB).
9. Position the seat belt turning loop to the mounting hole in the upper C-pillar.
10. Install and tighten the screw (5) that secures the seat belt turning loop to the C-pillar. Tighten the screw to 39 N·m (29 ft. lbs.).

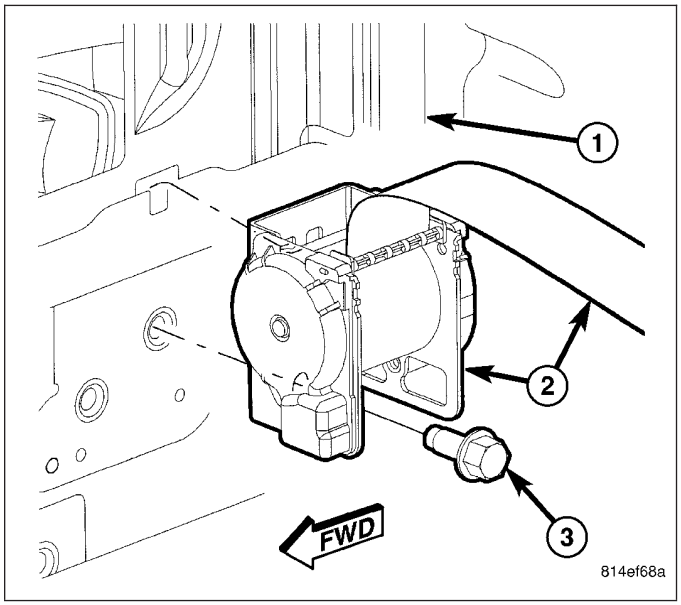


11. Engage the upper edge of a new trim cover (4) over the top of the turning loop. Then squeeze the lower end of the trim cover and the turning loop together firmly and evenly until the engagement tabs of the trim cover snap into the slots of the turning loop.

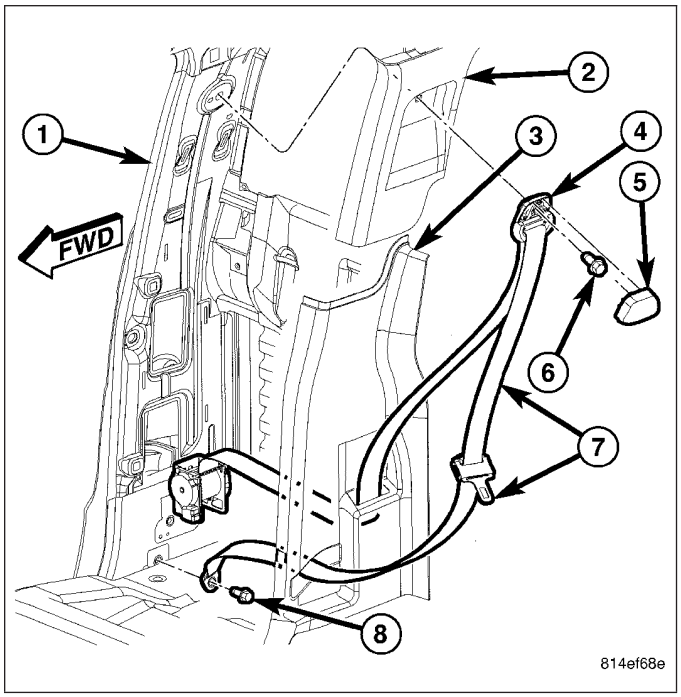
REAR OUTBOARD - QUAD CAB

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

1. Position the rear seat belt and retractor (2) to the inner C-pillar (1).
2. Engage the tab on the back of the retractor into the T-slot in the inner C-pillar.
3. Install and tighten the screw (3) that secures the retractor to the inner C-pillar. Tighten the screw to 39 N·m (29 ft. lbs.).



4. Route the seat belt, lower anchor, latch plate (7) and turning loop (3) through the clearance holes in the lower C-pillar trim (3). Be certain that the seat belt webbing between the retractor and the lower anchor is not twisted.
5. Position the seat belt lower anchor to the mounting hole near the base of the inner C-pillar (1).
6. Install and tighten the screw (8) that secures the lower anchor to the inner C-pillar. Tighten the screw to 39 N·m (29 ft. lbs.).
7. Reinstall the lower trim onto the inside of the C-pillar. (Refer to 23 - BODY/INTERIOR/LOWER C-PILLAR TRIM - INSTALLATION - QUAD CAB).
8. Reinstall the upper trim (2) onto the inside of the C-pillar. (Refer to 23 - BODY/INTERIOR/UPPER C-PILLAR TRIM - INSTALLATION - QUAD CAB).
9. Position the seat belt turning loop to the mounting hole in the upper C-pillar.
10. Install and tighten the screw (6) that secures the seat belt turning loop to the C-pillar. Tighten the screw to 39 N·m (29 ft. lbs.).



11. Engage the upper edge of a new trim cover (5) over the top of the turning loop. Then squeeze the lower end of the trim cover and the turning loop together firmly and evenly until the engagement tabs of the trim cover snap into the slots of the turning loop.

REAR CENTER - QUAD CAB

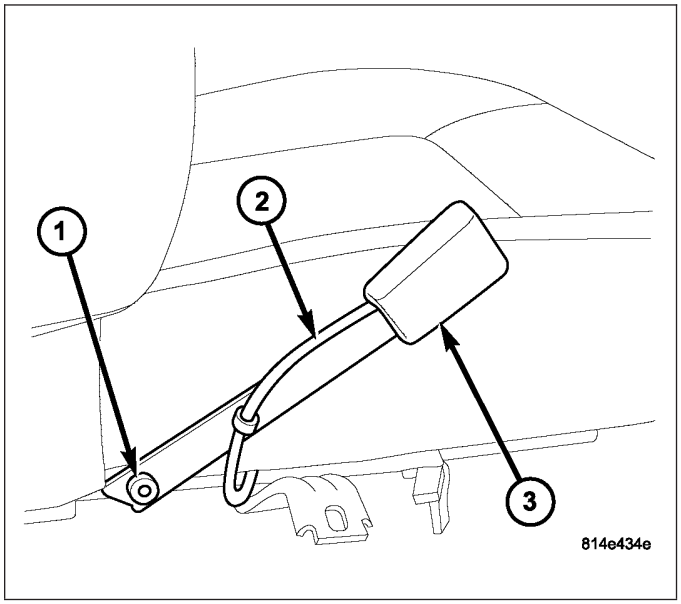
WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

SWITCH-SEAT BELT-DRIVER

DESCRIPTION

The seat belt switch is a small, normally open, single pole, single throw, leaf contact, momentary switch. Only one seat belt switch is installed in the vehicle, and it is integral to the buckle of the driver side front seat belt buckle-half (3), located on the inboard side of the driver side front seat cushion frame. The seat belt switch is connected to the vehicle electrical system through a two-wire pigtail wire (2) and connector on the seat belt buckle-half, which is connected to a wire harness connector and take out of the seat wire harness routed beneath the driver side front seat cushion in the passenger compartment.

The seat belt switch cannot be adjusted or repaired and, if faulty or damaged, the entire driver side front seat belt buckle-half unit must be replaced.



OPERATION

The seat belt switch is designed to control a path to ground for the seat belt switch sense input of the ElectroMechanical Instrument Cluster (EMIC). When the driver side front seat belt tip-half is inserted into the seat belt buckle, the switch closes the path to ground; and, when the driver side front seat belt tip-half is removed from the seat belt buckle, the switch opens the ground path. The switch is actuated by the latch mechanism within the seat belt buckle.

The seat belt switch is connected in series between ground and the seat belt switch sense input of the instrument cluster. The seat belt switch receives ground at all times through its pigtail wire connection to the seat wire harness from a take out of the body wire harness. An eyelet terminal connector on the body wire harness ground take out is secured beneath a ground screw on the left cowl side inner panel, beneath the instrument panel. The seat belt switch may de diagnosed using conventional diagnostic tools and methods.

DIAGNOSIS AND TESTING

SEAT BELT SWITCH

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable. Disconnect the seat belt switch pigtail wire connector from the seat wire harness connector for the seat belt switch beneath the driver side front seat cushion forward of the seat belt buckle-half anchor. Check for continuity between the seat belt switch sense circuit and the ground circuit cavities of the seat belt switch pigtail wire connector. There should be continuity with the seat belt buckled, and no continuity with the seat belt unbuckled. If OK, go to Step 2. If not OK, replace the faulty front seat belt buckle-half assembly.

2. Check for continuity between the ground circuit cavity in the seat wire harness connector for the seat belt switch and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit to ground (G301) as required.
3. Remove the instrument cluster from the instrument panel. Check for continuity between the seat belt switch sense circuit cavity of the seat wire harness connector for the seat belt switch and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the shorted seat belt switch sense circuit between the seat belt switch and the instrument cluster as required.
4. Check for continuity between the seat belt switch sense circuit cavities of the seat wire harness connector for the seat belt switch and the instrument panel wire harness connector for the instrument cluster. There should be continuity. If OK, test and replace the faulty instrument cluster as required. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If not OK, repair the open seat belt switch sense circuit between the seat belt switch and the instrument cluster as required.

PRETENSIONER-SEAT BELT

DESCRIPTION

Seat belt tensioners supplement the dual front airbags for this model. The seat belt tensioners are integral to the front seat belt retractor units, which are secured to the floor panel (club cab) or the inner B-pillar (quad cab) on the right and left sides of the vehicle. On club cab models, the retractor is concealed beneath a clam shell-like trim cover on the floor panel behind the front seat near the door opening sill. On quad cab models, the retractor is concealed beneath the molded plastic inner B-pillar trim.

The seat belt tensioner consists primarily of a sprocket/pinion, a steel tube, a cast metal housing, numerous steel balls, a stamped metal ball trap, a torsion bar and a small pyrotechnically activated gas generator with a connector receptacle. All of these components are located on one side of the retractor spool on the outside of the retractor housing except for the torsion bar, which serves as the spindle upon which the retractor spool rides. The seat belt tensioners are controlled by the Occupant Restraint Controller (ORC) and are connected to the vehicle electrical system through a dedicated take out of the body wire harness by a keyed and latching yellow molded plastic connector insulator to ensure a secure connection.

The seat belt tensioners cannot be repaired and, if faulty or damaged, the entire front seat belt and retractor unit must be replaced. If the front airbags have been deployed, the seat belt tensioners have also been deployed. The seat belt tensioners are not intended for reuse and must be replaced following any front airbag deployment. A growling or grinding sound while attempting to operate the seat belt retractor is a sure indication that the seat belt tensioner has been deployed and requires replacement. (Refer to 8 - ELECTRICAL/RESTRAINTS/FRONT SEAT BELT & RETRACTOR - REMOVAL).

OPERATION

The seat belt tensioners are deployed in conjunction with the dual front airbags by a signal generated by the Occupant Restraint Controller (ORC) through the driver or passenger seat belt tensioner line 1 and line 2 (or squib) circuits. When the ORC sends the proper electrical signal to the tensioners, the electrical energy generates enough heat to initiate a small pyrotechnic gas generator.

The gas generator is installed in one end of a steel tube that contains numerous steel balls. As the gas expands, it pushes the steel balls through the tube into a cast metal housing, where a ball guide directs the balls into engagement with the teeth of a sprocket that is geared to one end of the retractor spool. As the balls drive past the sprocket, the sprocket turns and drives the seat belt retractor spool causing the slack to be removed from the front seat belts. The ball trap captures the balls as they leave the sprocket and are expelled from the housing.

Removing excess slack from the front seat belts not only keeps the occupants properly positioned for an airbag deployment following a frontal impact of the vehicle, but also helps to reduce injuries that the occupant might experience in these situations as a result of harmful contact with the steering wheel, steering column, instrument panel and/or windshield. Also, the seat belt tensioner torsion bar that the retractor spool rides upon is designed to deform in order to control the loading being applied to the occupants by the seat belts during a frontal impact, further reducing the potential for occupant injuries.

The ORC monitors the condition of the seat belt tensioners through circuit resistance, and will illuminate the airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) and store a Diagnostic Trouble Code (DTC) for any fault that is detected. For proper diagnosis of the seat belt tensioners, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

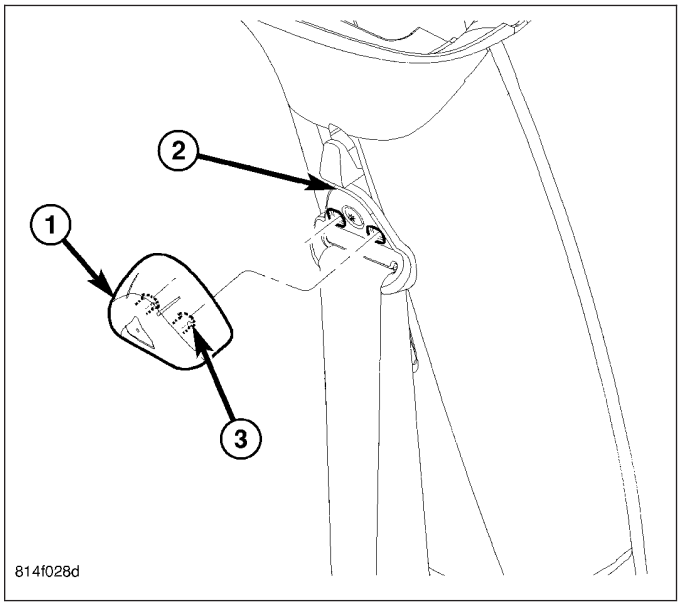
ADJUSTER-SEAT BELT TURNING LOOP

REMOVAL

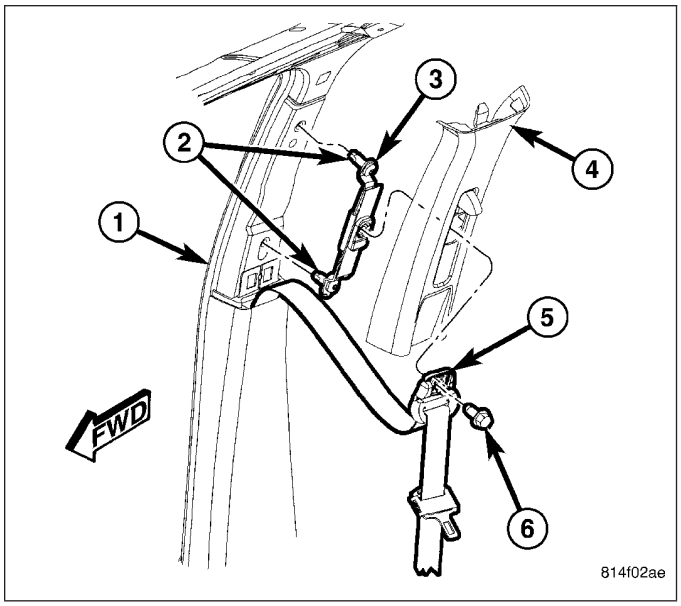
WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: A seat belt turning loop adjuster is used for both front outboard seating positions on all models; however, the following procedure applies only to the B-pillar mounted adjuster used on quad cab models. The telescoping roof rail mounted adjuster used on club cab models is integral to the front outboard seat belt and retractor assembly.

1. Unsnap the trim cover (1) from the front seat belt turning loop (2) and discard.



2. Remove the screw (6) that secures the seat belt turning loop (5) to the height adjuster (3) on the upper B-pillar (1).
3. Remove the seat belt turning loop from the height adjuster.
4. Remove the upper trim (4) from the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - REMOVAL - QUAD CAB).
5. Remove the two screws (2) that secure the height adjuster to the inside of the B-pillar.
6. Remove the adjuster from the B-pillar.

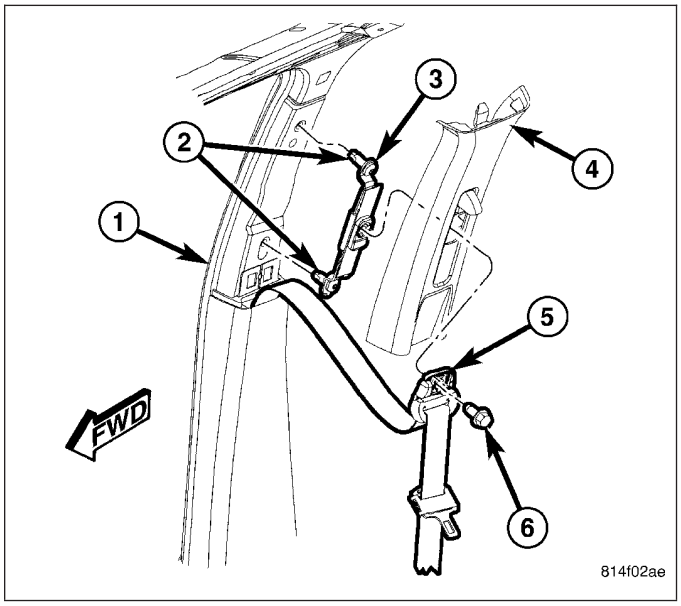


INSTALLATION

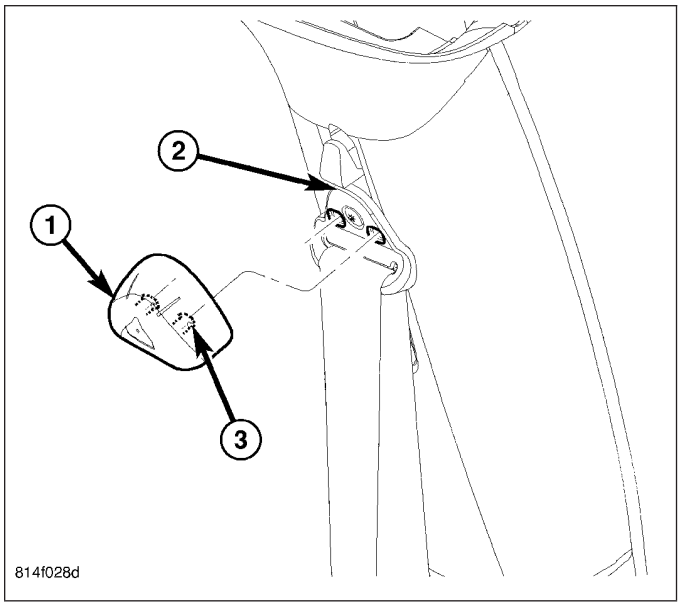
WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: A seat belt turning loop adjuster is used for both front outboard seating positions on all models; however, the following procedure applies only to the B-pillar mounted adjuster used on quad cab models. The telescoping roof rail mounted adjuster used on club cab models is integral to the front outboard seat belt and retractor assembly.

1. Position the seat belt turning loop adjuster (3) to the inside of the B-pillar (1).
2. Install and tighten the two screws (2) that secure the adjuster to the B-pillar. Tighten the screws to 39 N·m (29 ft. lbs.).
3. Reinstall the upper trim (4) onto the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - INSTALLATION - QUAD CAB).
4. Position the seat belt turning loop (5) onto the height adjuster on the upper B-pillar.
5. Install and tighten the screw (6) that secures the turning loop to the height adjuster. Tighten the screw to 39 N·m (29 ft. lbs.).



6. Engage the upper edge of a new trim cover (1) over the top of the turning loop (2). Then squeeze the lower end of the trim cover and the turning loop together firmly and evenly until the engagement tabs (3) of the trim cover snap into the slots of the turning loop.

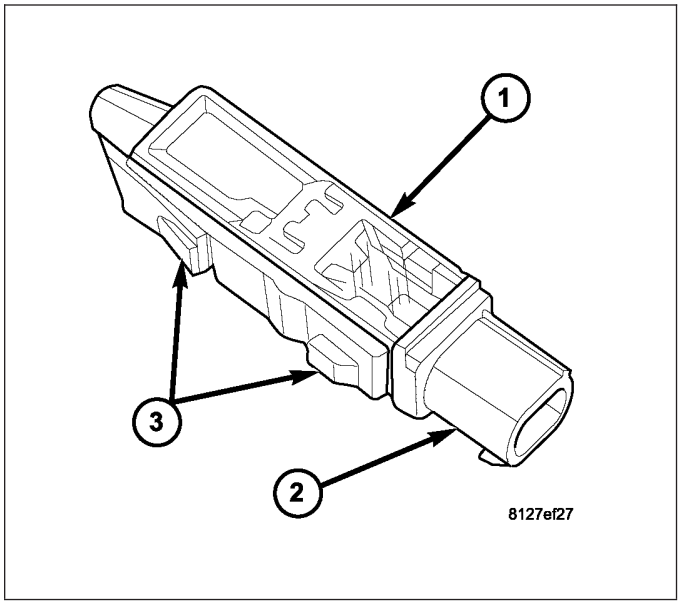


SENSOR-SEAT TRACK POSITION

DESCRIPTION

The seat track position sensor (1) is a Hall Effect-type sensor. This sensor consists of a Hall Effect Integrated Circuit (IC) chip encased in potting material within a cavity of the molded plastic sensor housing. The sensor housing has two integral snap features (3) and snaps into a stamped metal bracket located on the inboard side of one of the seat adjuster tracks on each front seat. A molded connector receptacle (2) integral to the sensor housing is connected to the vehicle electrical system through a connector and take out of the driver or passenger seat wire harness beneath the front seat cushion frame.

The seat track position sensor cannot be adjusted or repaired and, if faulty or damaged, the entire sensor must be replaced.



OPERATION

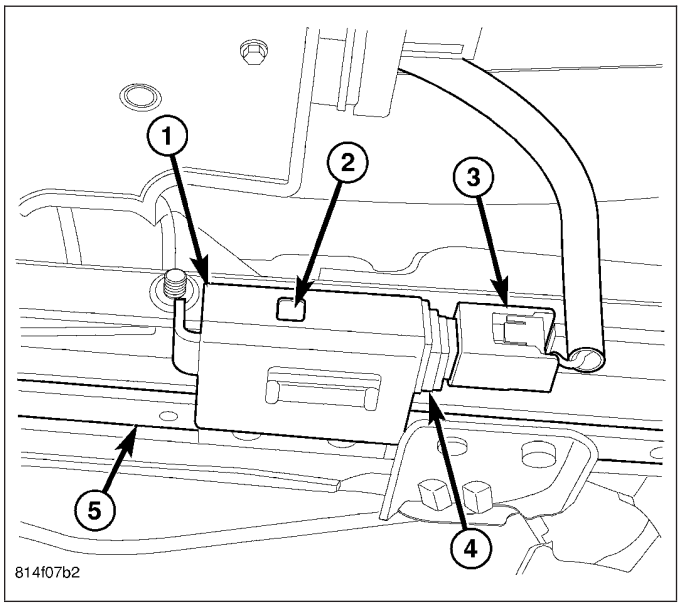
The seat track position sensor is designed to provide a seat position data input to the Occupant Classification Module (OCM) indicating whether the driver side or passenger side front seat is in a full forward or a not full forward position. The OCM sends electronic seat position messages to the Occupant Restraint Controller (ORC) over the Controller Area Network (CAN) data bus. The ORC uses this data as an additional logic input for use in determining the appropriate deployment force to be used when deploying the multistage front airbags.

The seat track position sensor receives a nominal five volt supply from the OCM. The sensor communicates the seat position by modulating the voltage returned to the OCM on a sensor data circuit. The OCM also monitors the condition of the sensor circuits and will store a Diagnostic Trouble Code (DTC) for any fault that is detected, then send messages to the ORC to illuminate the airbag indicator in the instrument cluster. For proper diagnosis of the seat track position sensor, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

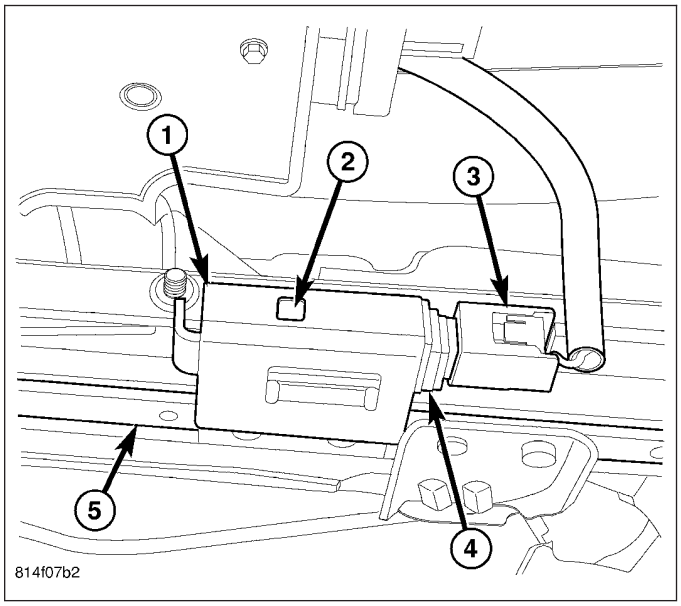
1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Reach under the front seat cushion to access the seat track position sensor (4) in a bracket (1) located on the inboard side of either the inner or outer, driver or passenger seat track (5).
3. Disconnect the seat wire harness connector (3) from the sensor connector receptacle located on the end of the sensor.
4. Using a small screwdriver, depress the snap feature (2) and pull the connector end of the sensor out of the bracket.
5. Remove the sensor from under the front seat.



INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Reach under the front seat cushion to position the seat track position sensor (4) to the open end of the bracket (1) located on the inboard side of either the inner or outer, driver or passenger seat track (5).
2. Push the sensor firmly into the bracket until the snap feature (2) locks into place.
3. Reconnect the seat wire harness connector (3) to the sensor connector receptacle located on the end of the sensor. Be certain that the latch on the connector is fully engaged.
4. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).



5. Following successful completion of the supplemental restraint system verification test procedure, perform the Occupant Classification System Verification Test using a diagnostic scan tool. Refer to the appropriate diagnostic procedures.

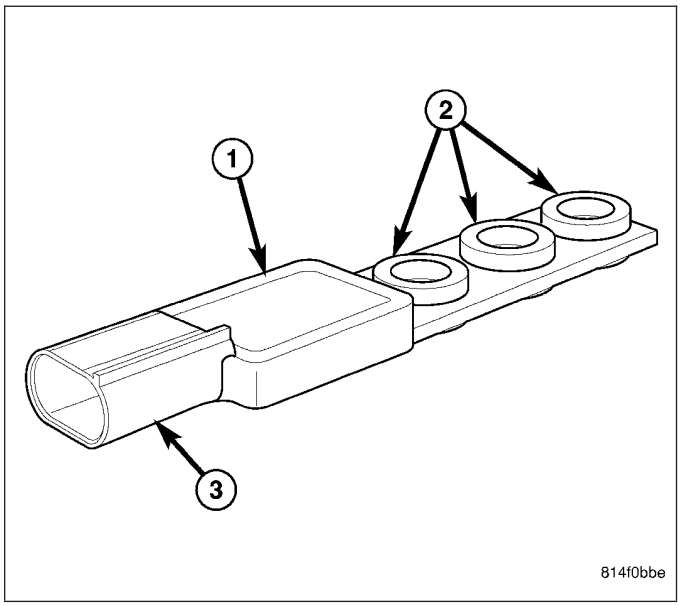
SENSOR-SEAT WEIGHT

DESCRIPTION

The seat weight sensors are strain gauge-type units. The electronic elements of the sensor are encased in a potting material within the molded plastic sensor housing (1). Four sensors are used in the Occupant Classification System (OCS). A sensor is located at each corner of the passenger side front seat.

The strain gauge for each sensor is secured through three mounting bosses (2) by three screws and nuts between the seat cushion frame and the seat adjuster tracks. A molded connector receptacle (3) integral to each sensor housing is connected to the vehicle electrical system through a dedicated connector and take out of the passenger seat wire harness beneath the seat cushion frame.

The seat weight sensors cannot be adjusted or repaired and, if faulty or damaged, the entire sensor must be replaced.



OPERATION

The seat weight sensor units are designed to sense the relative weight of a load applied to the passenger side front seat, which provides a logic input to the microprocessor of the Occupant Classification Module (OCM). When a load is applied to the seat, the strain gauge of each sensor is flexed causing a change of electrical resistance through the strain gauge. These changes in resistance are measured by the sensor and the internal sensor circuitry changes the sensor output voltage.

Each weight sensor receives a nominal five volts and a ground through parallel hard wired circuits from the OCM. The OCM then monitors the output voltage of each sensor on dedicated hard wired data communication circuits. The hard wired circuits between the sensors and the OCM may be diagnosed and tested using conventional diagnostic tools and procedures. However, the most reliable, efficient, and accurate means to diagnose the seat weight sensor inputs to the OCM, and the electronic message communication between the OCM and the Occupant Restraint Controller (ORC) requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death on vehicles equipped with the Occupant Classification System (OCS), do not modify the front passenger seat assembly or center floor console in any way. Do not use any prior year, subsequent year, secondary or aftermarket seat trim covers. At no time should any Supplemental Restraint System (SRS) or OCS component be modified or replaced with any part except those which are specified for the particular vehicle application in the DaimlerChrysler Mopar Parts Catalog. Failure to observe these precautions could cause an OCS miscalibration condition, which may result in the passenger airbag failing to deploy when required or deploying when not required.

WARNING: To avoid personal injury or death, never strike or drop a seat weight sensor or the passenger side front seat assembly to which the sensors are secured as it can damage the sensors or affect their calibration. The seat weight sensors and the passenger side front seat assembly must be handled with care to avoid damage to the sensors. Do not sit upon or place any loads upon a passenger side front seat while it is removed from its mounts in or outside of the vehicle. If an individual sensor is dropped or damaged, replace the sensor with a new and unused unit. If a seat has been dropped during removal or loaded while removed from its mounts, replace each of the seat weight sensors with new and unused units. Failure to observe this warning could result in an accidental, incomplete, or improper passenger side front supplemental restraint deployment.

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the passenger side front seat from the vehicle. (Refer to 23 - BODY/SEATS/SEAT - FRONT - REMOVAL).
3. Remove the seat cushion frame from the seat weight sensors, then remove the seat weight sensors from the seat adjuster. Refer to the front seat service information for the appropriate procedures.

INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death on vehicles equipped with the Occupant Classification System (OCS), do not modify the front passenger seat assembly or center floor console in any way. Do not use any prior year, subsequent year, secondary or aftermarket seat trim covers. At no time should any Supplemental Restraint System (SRS) or OCS component be modified or replaced with any part except those which are specified for the particular vehicle application in the DaimlerChrysler Mopar Parts Catalog. Failure to observe these precautions could cause an OCS miscalibration condition, which may result in the passenger airbag failing to deploy when required or deploying when not required.

WARNING: To avoid personal injury or death, never strike or drop a seat weight sensor or the passenger side front seat assembly to which the sensors are secured as it can damage the sensors or affect their calibration. The seat weight sensors and the passenger side front seat assembly must be handled with care to avoid damage to the sensors. Do not sit upon or place any loads upon a passenger side front seat while it is removed from its mounts in or outside of the vehicle. If an individual sensor is dropped or damaged, replace the sensor with a new and unused unit. If a seat has been dropped during removal or loaded while removed from its mounts, replace each of the seat weight sensors with new and unused units. Failure to observe this warning could result in an accidental, incomplete, or improper passenger side front supplemental restraint deployment.

WARNING: To avoid personal injury or death on vehicles equipped with the Occupant Classification System (OCS), any time the passenger side front seat assembly has been removed or loosened from the vehicle for service of any vehicle component or system the Occupant Classification System Verification Test must be performed using a diagnostic scan tool and the Occupant Classification Seat Weight special tool following reinstallation. Refer to the appropriate diagnostic procedures. Failure to observe this warning could result in an accidental, incomplete, or improper passenger side front supplemental restraint deployment.

1. Reinstall the seat weight sensors to the seat adjuster then the seat cushion frame to the seat weight sensors. Refer to the front seat service information for the appropriate procedures.
2. Reinstall the passenger side front seat into the vehicle. (Refer to 23 - BODY/SEATS/SEAT - INSTALLATION).
3. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).
4. Following successful completion of the supplemental restraint system verification test procedure, perform the Occupant Classification System Verification Test using a diagnostic scan tool and the Occupant Classification Seat Weight special tool. Refer to the appropriate diagnostic procedures.

SPEED CONTROL

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SPEED CONTROL

DESCRIPTION

3.7L/4.7L Engine

The speed control system is operated by the use of a cable and a vacuum controlled servo. Electronic control of the speed control system is integrated into the Powertrain Control Module (PCM). The controls consist of two steering wheel mounted switches. The switches are labeled: ON/OFF, RES/ACCEL, SET, COAST, and CANCEL.

The system is designed to operate at speeds above 30 mph (50 km/h).

OPERATION

When speed control is selected by depressing the ON switch, the PCM (the ECM if equipped with a diesel engine) allows a set speed to be stored in its RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between 35 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:

- Stepping on the brake pedal
- Depressing the OFF switch
- Depressing the CANCEL switch.
- Depressing the clutch pedal (if equipped).

NOTE: Depressing the OFF switch or turning off the ignition switch will erase the set speed stored in the PCM (the ECM with a diesel engine).

For added safety, the speed control system is programmed to disengage for any of the following conditions:

- An indication of Park or Neutral
- A rapid increase rpm (indicates that the clutch has been disengaged)
- Excessive engine rpm (indicates that the transmission may be in a low gear)

- The speed signal increases at a rate of 10 mph per second (indicates that the coefficient of friction between the road surface and tires is extremely low)
- The speed signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)

Once the speed control has been disengaged, depressing the RES/ACCEL switch (when speed is greater than 30 mph) restores the vehicle to the target speed that was stored in the PCM (the ECM with a diesel engine).

While the speed control is engaged, the driver can increase the vehicle speed by depressing the RES/ACCEL switch. The new target speed is stored in the PCM (the ECM with a diesel engine) when the RES/ACCEL is released. The PCM (the ECM with a diesel engine) also has a ″tap-up″ feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the RES/ACCEL switch.

A “tap down” feature is used to decelerate without disengaging the speed control system. To decelerate from an existing recorded target speed, momentarily depress the COAST switch. For each switch activation, speed will be lowered approximately 1 mph.

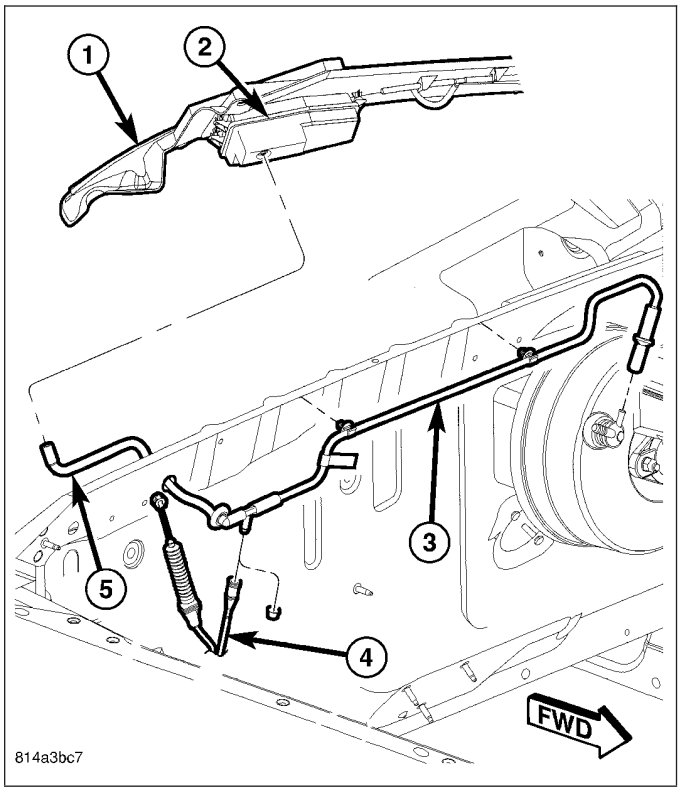
DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - VACUUM SUPPLY TEST

3.7L / 4.7L Engines

Actual engine vacuum, a vacuum reservoir (2) equipped with a one-way check valve, and vacuum lines (3), (4) AND (5) are used to supply vacuum to the speed control servo.

1. Remove rubber air tube between throttle body and air filter housing to gain access to speed control servo.
2. Disconnect vacuum hose at speed control servo and install a vacuum gauge into the disconnected hose.
3. Start engine and observe gauge at idle. Vacuum gauge should read at least ten inches of mercury.
4. If vacuum is less than ten inches of mercury, determine source of leak. Check vacuum lines to engine (3), (4) AND (5) for leaks. Also check actual engine intake manifold vacuum. If manifold vacuum does not meet this requirement, check for poor engine performance and repair as necessary.
5. If vacuum line to engine is not leaking, check for leak at vacuum reservoir. Disconnect vacuum line at reservoir and connect a hand-operated vacuum pump to reservoir fitting. Apply vacuum. Reservoir vacuum should not bleed off. If vacuum is being lost, replace reservoir.



6. The reservoir (2) is equipped with an integral one-way check valve to retain a certain amount of vacuum within the reservoir. Verify operation of one-way check valve and check it for leaks.

DIAGNOSIS AND TESTING - ROAD TEST

Perform a vehicle road test to verify reports of speed control system malfunction. The road test should include attention to the speedometer. Speedometer operation should be smooth and without flutter at all speeds.

Flutter in the speedometer indicates a problem which might cause surging in the speed control system. The cause of any speedometer problems should be corrected before proceeding. Refer to Instrument Cluster for speedometer diagnosis.

If a road test verifies a system problem and the speedometer operates properly, check for:

- A Diagnostic Trouble Code (DTC). If a DTC exists, conduct tests per the Powertrain Diagnostic Procedures service manual.
- A misadjusted brake (stop) lamp switch. This could also cause an intermittent problem.
- Loose, damaged or corroded electrical connections at the servo (if used). Corrosion should be removed from electrical terminals and a light coating of Mopar MultiPurpose Grease, or equivalent, applied.
- Leaking vacuum reservoir (if used).
- Loose or leaking vacuum hoses or connections (if used).
- Defective one-way vacuum check valve (if used).
- Secure attachment of both ends of the speed control servo cable (if used).
- Smooth operation of throttle linkage (if used) and throttle body air valve.
- Failed speed control servo (if used). Do the servo vacuum test.

CAUTION: When test probing for voltage or continuity at electrical connectors, care must be taken not to damage connector, terminals or seals. If these components are damaged, intermittent or complete system failure may occur.

SPECIFICATIONS

TORQUE - SPEED CONTROL

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Servo Mounting Bracket-to-Servo Nuts	7	-	60
Servo Mounting Bracket-to-Battery Tray Screws	4	-	30
Speed Control Switch Mounting Screws	1.7	-	15

CABLE-SPEED CONTROL

DESCRIPTION

The speed control servo cable is connected between the speed control vacuum servo diaphragm and the throttle body control linkage. This cable is used only with 3.7L/4.7L engines.

OPERATION

This cable causes the throttle control linkage to open or close the throttle valve in response to movement of the vacuum servo diaphragm.

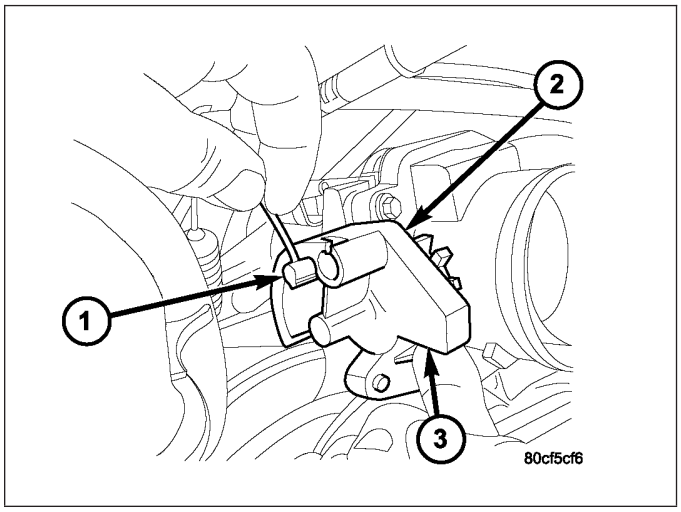
REMOVAL

3.7L / 4.7L ENGINES

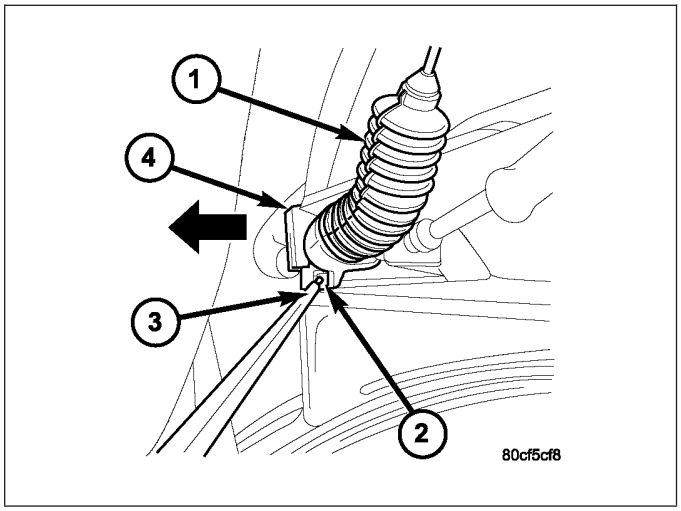
1. Disconnect negative battery cable at battery.
2. Remove air intake tube at top of throttle body.

The accelerator cable must be partially removed to gain access to speed control cable.

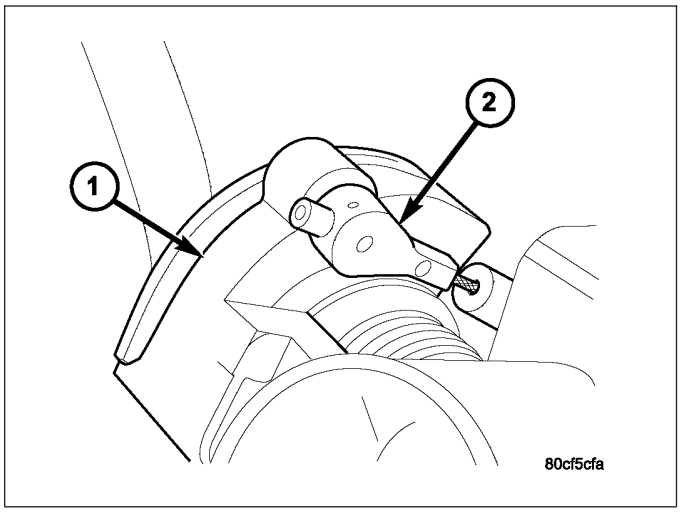
3. Hold throttle in wide open position. While held in this position, slide throttle cable pin (1) from throttle body bellcrank.



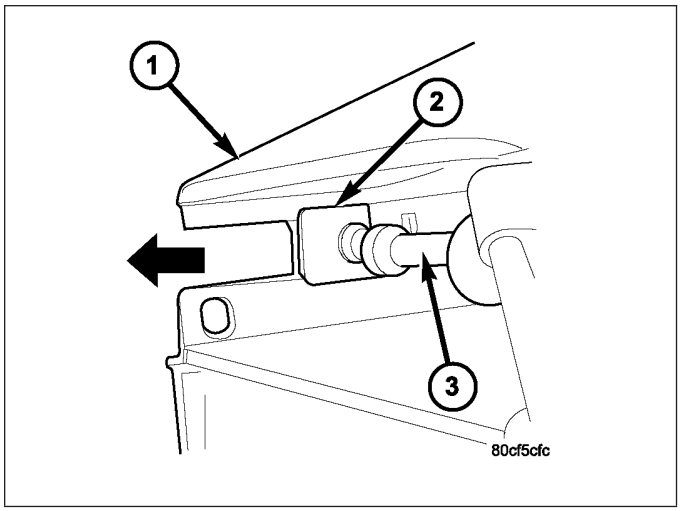
4. Using a pick or small screwdriver, press release tab (2) to release plastic cable mount from bracket. **Press on tab only enough to release cable from bracket. If tab is pressed too much, it will be broken.** Slide plastic mount (4) towards right side of vehicle to remove throttle cable from throttle body bracket.



5. Using finger pressure only, disconnect servo cable connector (2) at throttle body bellcrank pin by pushing connector off bellcrank pin towards front of vehicle. **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**



6. Slide speed control cable plastic mount (2) towards right of vehicle to remove cable from throttle body bracket.
7. Remove servo cable from servo. Refer to Servo Removal/Installation.



INSTALLATION

3.7L / 4.7L ENGINES

1. Install end of cable to speed control servo. Refer to Servo Removal/Installation.
2. Slide speed control cable plastic mount into throttle body bracket.
3. Install speed control cable connector onto throttle body bellcrank pin (push rearward to snap into location).
4. Slide throttle (accelerator) cable plastic mount into throttle body bracket. Continue sliding until cable release tab is aligned to hole in throttle body mounting bracket.
5. While holding throttle to wide open position, place throttle cable pin into throttle body bellcrank.
6. Install air intake tube to top of throttle body.
7. Connect negative battery cable at battery.
8. Before starting engine, operate accelerator pedal to check for any binding.

SERVO-SPEED CONTROL

DESCRIPTION

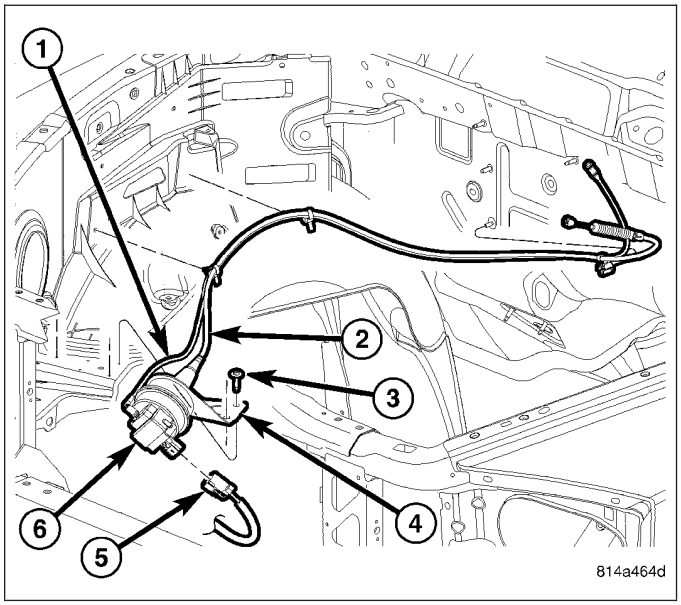
A speed control servo is used only with 3.7L V-6 or 4.7L V-8 engines.

The speed control servo (6) is located in the engine compartment and is attached to the right inner fender.

The servo unit consists of a solenoid valve body, and a vacuum chamber. The solenoid valve body contains three solenoids:

- Vacuum
- Vent
- Dump

The vacuum chamber contains a diaphragm with a cable attached to control the throttle linkage.



OPERATION

A speed control servo is used only with 3.7L V-6 or 4.7L V-8 engines.

The Powertrain Control Module (PCM) controls the solenoid valve body. The solenoid valve body controls the application and release of vacuum to the diaphragm of the vacuum servo. The servo unit cannot be repaired and is serviced only as a complete assembly.

Power is supplied to the servo's by the PCM through the brake switch. The PCM controls the ground path for the vacuum and vent solenoids.

The dump solenoid is energized anytime it receives power. If power to the dump solenoid is interrupted, the solenoid dumps vacuum in the servo. This provides a safety backup to the vent and vacuum solenoids.

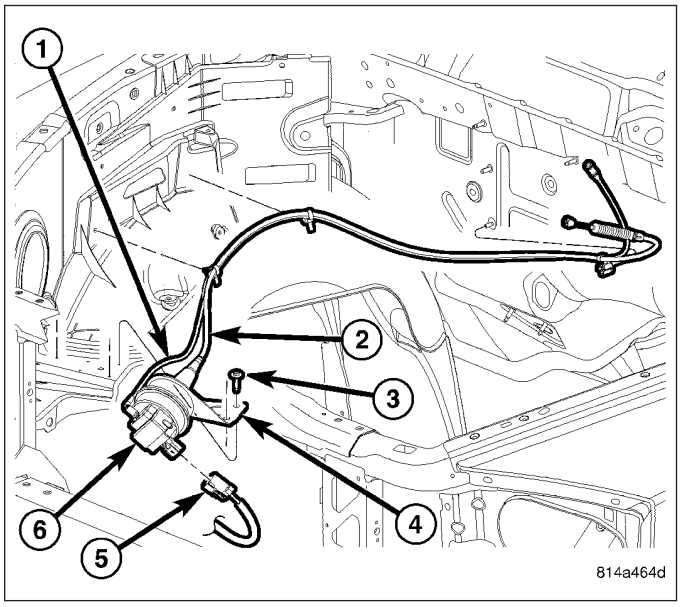
The vacuum and vent solenoids must be grounded at the PCM to operate. When the PCM grounds the vacuum servo solenoid, the solenoid allows vacuum to enter the servo and pull open the throttle plate using the cable. When the PCM breaks the ground, the solenoid closes and no more vacuum is allowed to enter the servo. The PCM also operates the vent solenoid via ground. The vent solenoid opens and closes a passage to bleed or hold vacuum in the servo as required.

The PCM duty cycles the vacuum and vent solenoids to maintain the set speed, or to accelerate and decelerate the vehicle. To increase throttle opening, the PCM grounds the vacuum and vent solenoids. To decrease throttle opening, the PCM removes the grounds from the vacuum and vent solenoids. When the brake is released, if vehicle speed exceeds 30 mph to resume, 35 mph to set, and the RES/ACCEL switch has been depressed, ground for the vent and vacuum circuits is restored.

REMOVAL

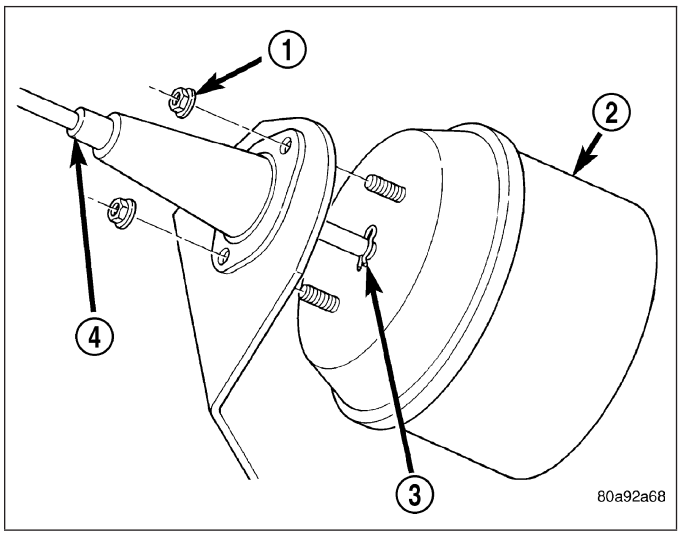
The speed control servo assembly (6) is attached to the right inner fender under the air cleaner filter housing.

1. Disconnect negative battery cable at battery.
2. Remove air cleaner filter housing assembly.
3. Disconnect vacuum line (1) at servo.
4. Disconnect electrical connector (5) at servo.
5. Remove three servo mounting screws (3).
6. Disconnect servo cable at throttle body. Refer to Servo Cable Removal/Installation.



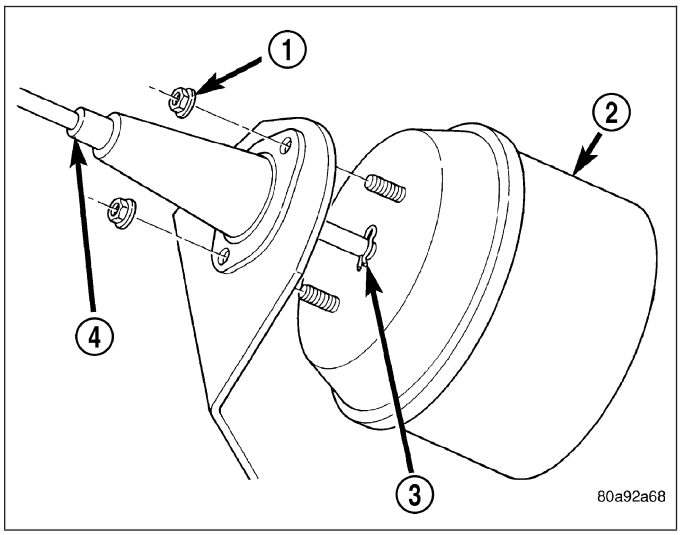
Note: The servo and mounting bracket displayed is a typical unit.

7. Remove 2 mounting nuts (1) holding servo cable sleeve (4) to bracket.
8. Pull speed control cable sleeve and servo away from servo mounting bracket to expose cable retaining clip (3) and remove clip. Note: The servo mounting bracket displayed is a typical bracket and may/may not be applicable to this model vehicle.
9. Remove servo (2) from mounting bracket. While removing, note orientation of servo to bracket.

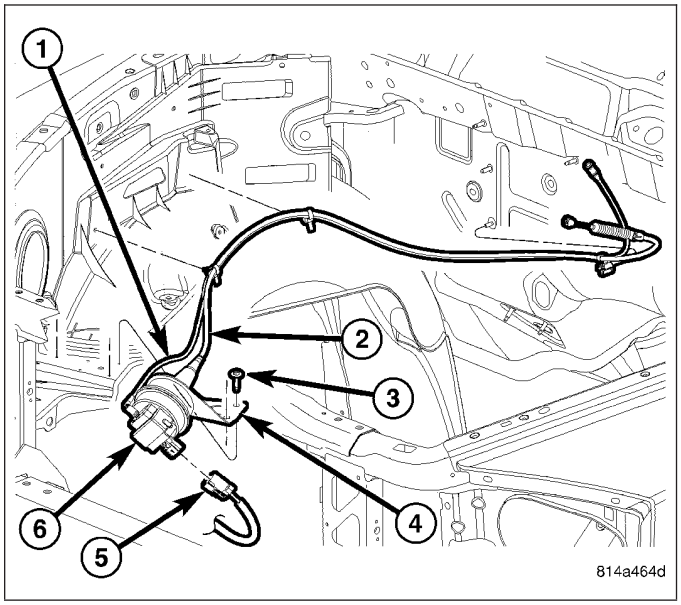


INSTALLATION

1. Position servo (2) to mounting bracket.
2. Align hole in cable connector with hole in servo pin. Install cable-to-servo retaining clip (3).
3. Insert servo mounting studs through holes in servo mounting bracket.
4. Install two servo-to-mounting bracket nuts (1) and tighten. Refer to torque specifications.



5. Position servo assembly (6) to inner fender and install three screws (3). Tighten 3 screws. Refer to torque specifications.
6. Connect vacuum line (1) to servo.
7. Connect electrical connector (5) to servo.
8. Connect servo cable (2) to throttle body. Refer to Servo Cable Removal/Installation.
9. Install air filter housing assembly.
10. Connect negative battery cable to battery.
11. Before starting engine, operate accelerator pedal to check for any binding.



SWITCH-SPEED CONTROL

DESCRIPTION

Two separate switch pods operate the speed control system. The steering-wheel-mounted switches use multiplexed circuits to provide inputs to the PCM for ON, OFF, RESUME, ACCELERATE, SET, DECEL and CANCEL modes. Refer to the owner's manual for more information on speed control switch functions and setting procedures.

The individual switches cannot be repaired. If one switch fails, the entire switch module must be replaced.

OPERATION

When speed control is selected by depressing the ON, OFF switch, the PCM allows a set speed to be stored in its RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between approximately 35 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:

- Stepping on the brake pedal
- Depressing the OFF switch
- Depressing the CANCEL switch.

The speed control can be disengaged also by any of the following conditions:

- An indication of Park or Neutral (auto. trans.)
- The VSS signal increases at a rate of 10 mph per second (indicates that the co-efficient of friction between the road surface and tires is extremely low)
- Depressing the clutch pedal (manual trans.).
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The VSS signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)
- If the actual speed is not within 20 mph of the set speed

The previous disengagement conditions are programmed for added safety.

Once the speed control has been disengaged, depressing the ACCEL switch restores the vehicle to the target speed that was stored in the PCM's RAM

NOTE: Depressing the OFF switch will erase the set speed stored in the PCM's RAM.

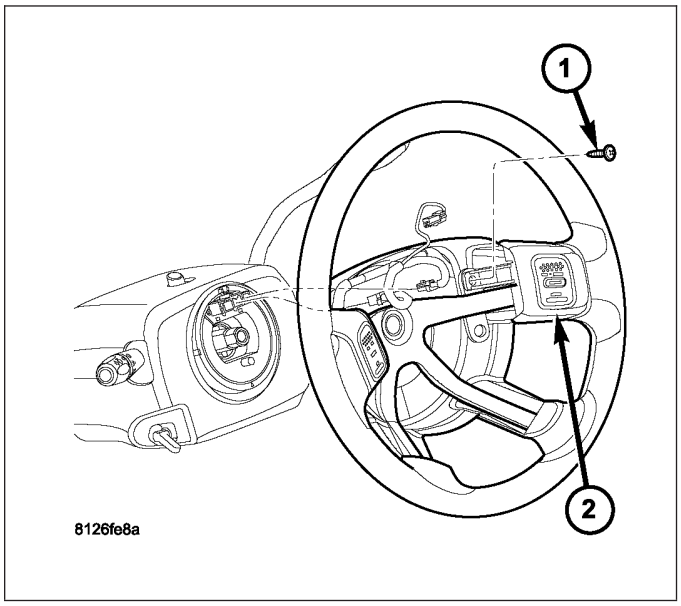
If, while the speed control is engaged, the driver wishes to increase vehicle speed, the PCM is programmed for an acceleration feature. With the ACCEL switch held closed, the vehicle accelerates slowly to the desired speed. The new target speed is stored in the PCM's RAM when the ACCEL switch is released. The PCM also has a ″tap-up″ feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the ACCEL switch.

The PCM also provides a means to decelerate without disengaging speed control. To decelerate from an existing recorded target speed, depress and hold the COAST switch until the desired speed is reached. Then release the switch. The ON, OFF switch operates two components: the PCM's ON, OFF input, and the battery voltage to the brake switch.

REMOVAL

WARNING: BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL AND STEERING COLUMN COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE NEGATIVE (GROUND) BATTERY CABLE. WAIT 2 MINUTES FOR SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

1. Disconnect and isolate negative battery cable from battery.
2. Remove airbag module. Refer to Restraint Systems.
3. Unplug electrical connector.
4. Remove speed control switch mounting screw (1) and remove switch from steering wheel.



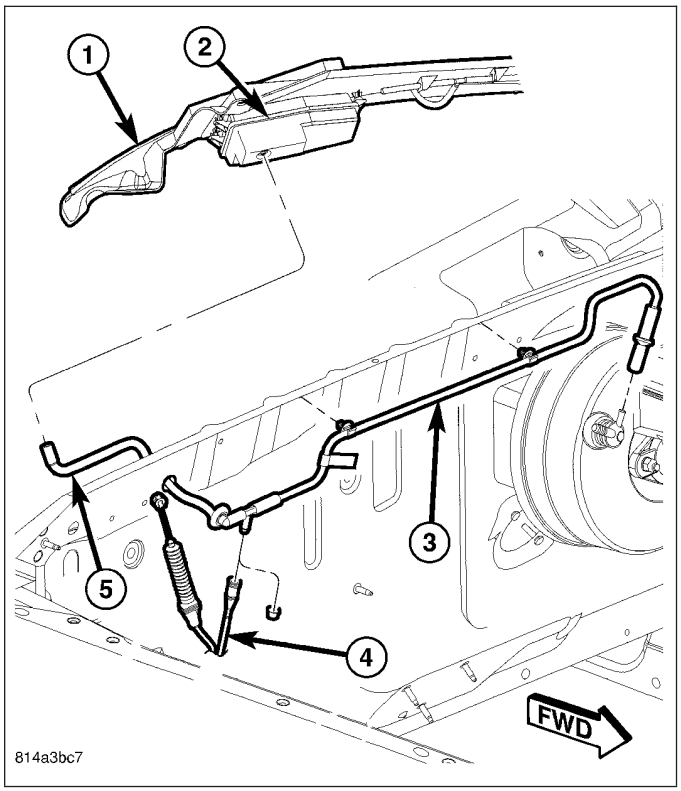
INSTALLATION

1. Position switch to steering wheel.
2. Install switch mounting screw and tighten. Refer to torque specifications.
3. Plug electrical connector into switch.
4. Install airbag module. Refer to Restraint Systems.
5. Connect negative battery cable to battery.

RESERVOIR-VACUUM

DESCRIPTION

The vacuum reservoir (2) is located under the windshield wiper cowel (1).



OPERATION

The vacuum reservoir is used to supply the vacuum needed to maintain proper speed control operation when engine vacuum drops, such as in climbing a grade while driving. A one-way check valve is used in the vacuum line between the reservoir and the vacuum source. This check valve is used to trap engine vacuum in the reservoir. On certain vehicle applications, this reservoir is shared with the heating/air-conditioning system. The vacuum reservoir cannot be repaired and must be replaced if faulty.

DIAGNOSIS AND TESTING - VACUUM RESERVOIR

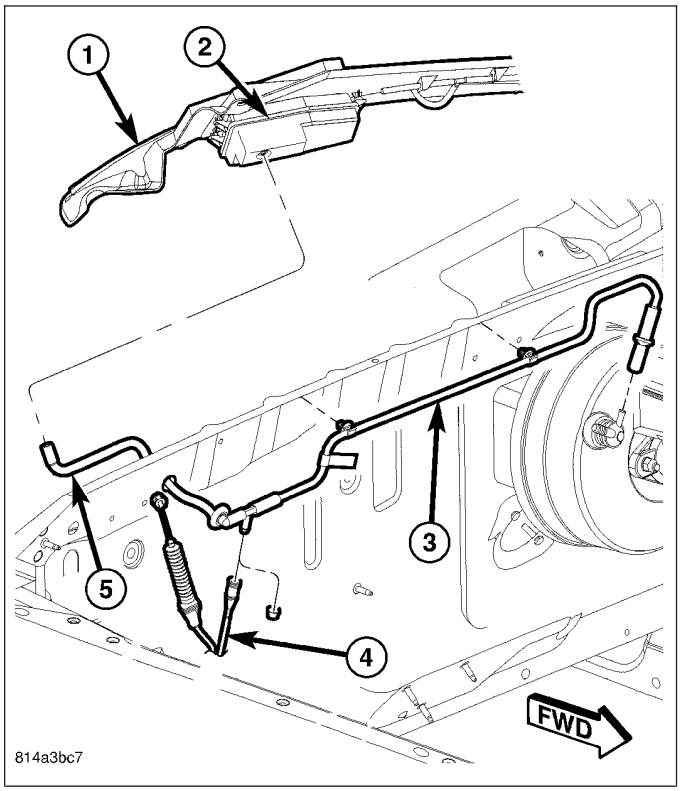
1. Disconnect vacuum hose at speed control servo and install a vacuum gauge into the disconnected hose.
2. Start engine and observe gauge at idle. Vacuum gauge should read at least ten inches of mercury.
3. If vacuum is less than ten inches of mercury, determine source of leak. Check vacuum line to engine for leaks. Also check actual engine intake manifold vacuum. If manifold vacuum does not meet this requirement, check for poor engine performance and repair as necessary.
4. If vacuum line to engine is not leaking, check for leak at vacuum reservoir. To locate and gain access to reservoir, refer to Vacuum Reservoir Removal/Installation in this group. Disconnect vacuum line at reservoir and connect a hand-operated vacuum pump to reservoir fitting. Apply vacuum. Reservoir vacuum should not bleed off. If vacuum is being lost, replace reservoir.
5. Verify operation of one-way check valve and check it for leaks. **Certain models may be equipped with 2 check-valves.**
   a. Locate one-way check valve. The valve is located in vacuum line between vacuum reservoir and engine vacuum source. Disconnect vacuum hoses (lines) at each end of valve.
   b. Connect a hand-operated vacuum pump to reservoir end of check valve. Apply vacuum. Vacuum should not bleed off. If vacuum is being lost, replace one-way check valve.
   c. Connect a hand-operated vacuum pump to vacuum source end of check valve. Apply vacuum. Vacuum should flow through valve. If vacuum is not flowing, replace one-way check valve. Seal the fitting at opposite

end of valve with a finger and apply vacuum. If vacuum will not hold, diaphragm within check valve has ruptured. Replace valve.

REMOVAL

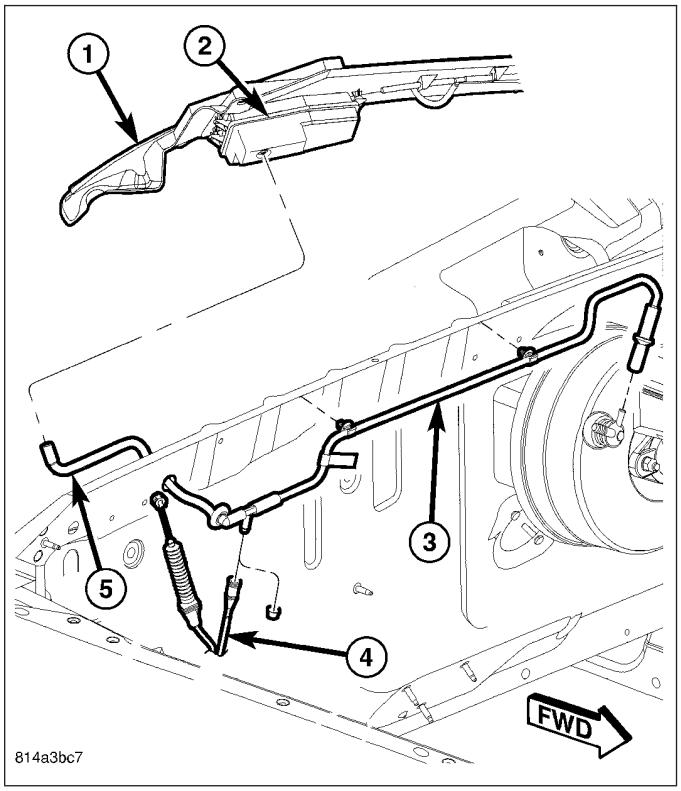
The vacuum reservoir (2) is attached to the bottom of the windshield wiper cowel panel (1).

1. Remove cowel panel.
2. Disconnect vacuum line (5) at reservoir.
3. The reservoir is attached using three clips. Pry out on clips for removal.
4. Remove reservoir from cowel.



INSTALLATION

1. Position reservoir (2) onto windshield wiper cowel (1).
2. Install three clips (2) to reservoir. Attach reservoir to cowel panel by pushing clips into cowel panel (1).
3. Connect vacuum line (5) to reservoir fitting.
4. Install windshield wiper cowel (1).



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VEHICLE THEFT SECURITY - SERVICE INFORMATION

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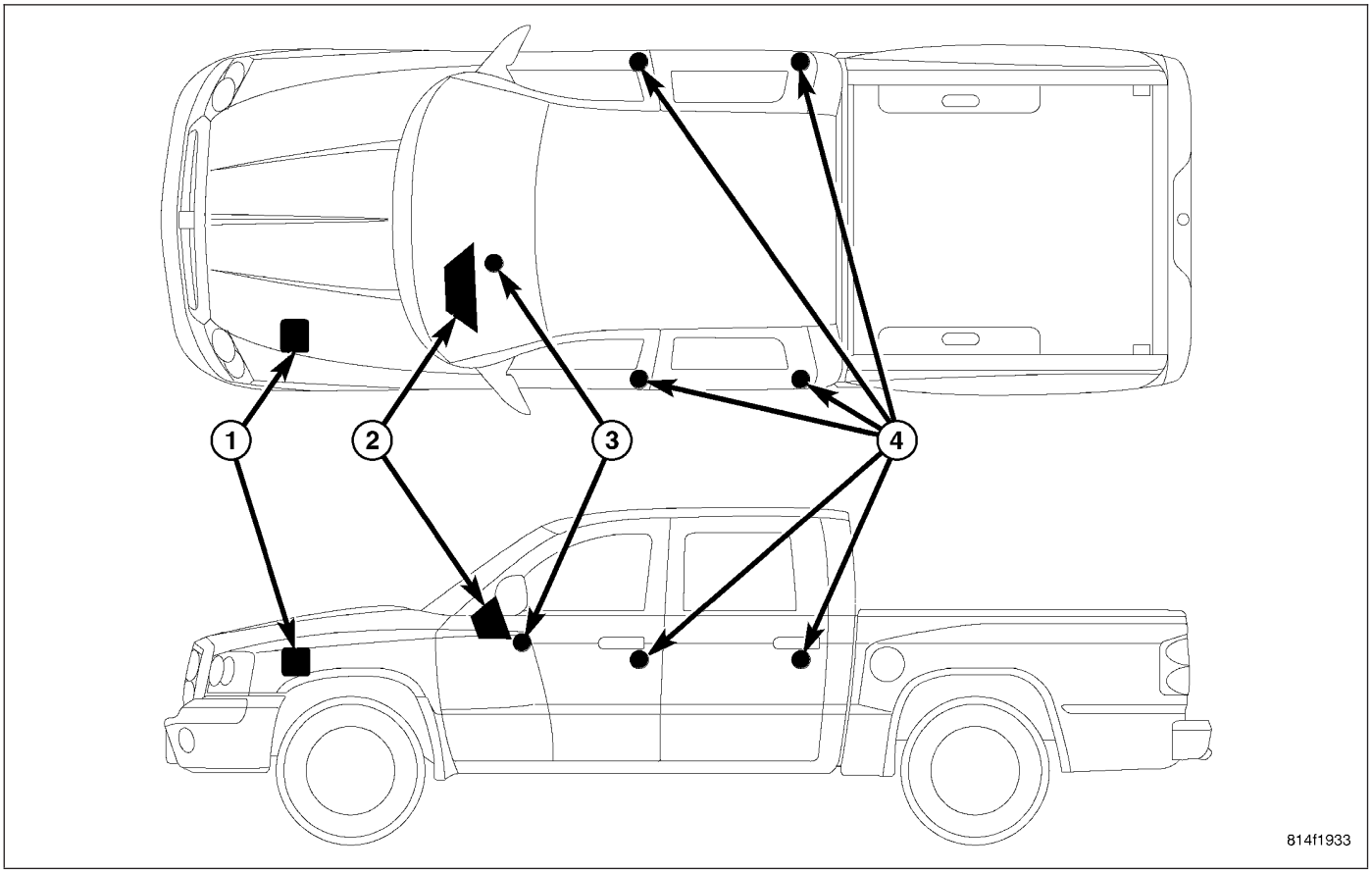
VEHICLE THEFT SECURITY - SERVICE INFORMATION

DESCRIPTION

VEHICLE THEFT SECURITY SYSTEM



The Vehicle Theft Security System (VTSS) is designed to provide perimeter protection against unauthorized use or tampering by monitoring the vehicle door ajar circuits, the power lock and unlock circuits, and the ignition switch circuit. If unauthorized use or tampering is detected, the system responds by pulsing the horn for up to about three minutes and flashing the hazard warning lamps for up to about eighteen minutes.

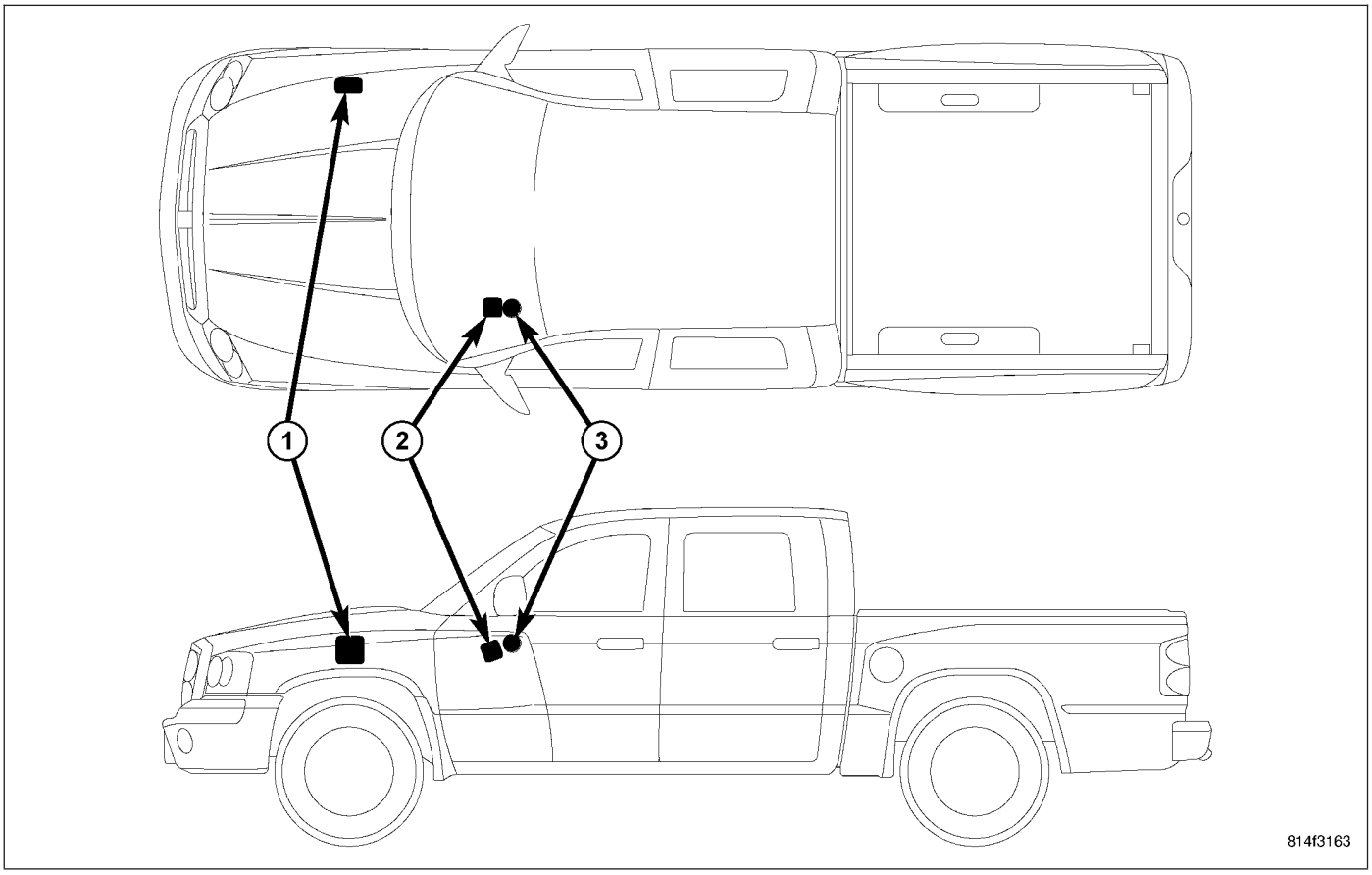
The VTSS includes the following major components, which are described in further detail elsewhere in this service information:

- **Door Ajar Switches (4)** - A door ajar switch is integral to the door latch mechanism of each front door as well as the rear doors on quad cab models. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/DOOR AJAR SWITCH - DESCRIPTION).
- **Front Control Module (1)** - The Front Control Module (FCM) is integral to the Integrated Power Module (IPM). The FCM/IPM is located in the engine compartment, near the battery and the Power Distribution Center (PDC). (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION - DESCRIPTION).
- **Horn Relay** - The horn relay is located in the Power Distribution Center (PDC) in the engine compartment near the battery. (Refer to 8 - ELECTRICAL/HORN/HORN RELAY - DESCRIPTION).
- **Ignition Switch (3)** - The ignition switch is located on the steering column in the passenger compartment. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION SWITCH - DESCRIPTION).
- **Instrument Cluster (2)** - The ElectroMechanical Instrument Cluster (EMIC) is also known as the Cab Control Node (CCN) in this vehicle. The EMIC/CCN is located in the instrument panel above the steering column opening, directly in front of the driver. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DESCRIPTION).
- **Security Indicator** - The security indicator is integral to the instrument cluster. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/SECURITY INDICATOR - DESCRIPTION).

Hard wired circuitry connects the VTSS components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different

methods. These circuits may be connected to each other, to the vehicle electrical system and to the VTSS components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

SENTRY KEY IMMOBILIZER SYSTEM



The Sentry Key Immobilizer System (SKIS) is available as a factory-installed option on this model. Vehicles equipped with this option can be readily identified by the illumination of the security indicator in the instrument cluster for about three seconds after the ignition switch is turned to the On position as a SKIS bulb test.

The SKIS includes the following major components, which are described in further detail elsewhere in this service information:

- **Powertrain Control Module (1)** - The Powertrain Control Module (PCM) is located in the engine compartment. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DESCRIPTION).
- **Sentry Key Remote Entry Module (2)** - The Sentry Key REmote Entry Module (SKREEM) is sometimes referred to as the Wireless Control Module (WCM). The SKREEM is located on the right side of the steering column near the ignition lock cylinder housing and an integral molded plastic antenna ring circles the ignition lock cylinder like a halo. Two SKREEM modules are available: one for vehicles equipped with RKE only, and one for vehicles equipped with RKE and SKIS. The SKREEM and its antenna are concealed beneath the steering column shrouds.
- **Sentry Key Transponder (3)** - The Sentry Key transponder is contained within the Remote Keyless Entry (RKE) transmitter on the ignition key.
- **Security Indicator** - The security indicator is integral to the ElectroMechanical Instrument Cluster. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/SECURITY INDICATOR - DESCRIPTION).

Except for the Sentry Key transponders, which rely upon Radio Frequency (RF) communication, hard wired circuitry connects the SKIS components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These

circuits may be connected to each other, to the vehicle electrical system and to the SKIS components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

VEHICLE THEFT SECURITY SYSTEM

The ElectroMechanical Instrument Cluster (EMIC) is used on this model to control and integrate many of the functions and features included in the Vehicle Theft Security System (VTSS). In the VTSS, the EMIC receives inputs indicating the status of the door ajar switches and the ignition switch. The EMIC will process the information from all of these inputs, internally control the security indicator as appropriate, and send electronic messages to the Front Control Module (FCM) over the Controller Area Network (CAN) data bus. The FCM internally controls the output to the hazard warning lamps and sends a control output to energize or de-energize the horn relay as appropriate.

Following are paragraphs describing the operation of each of the VTSS features.

ENABLING

The EMIC must have the VTSS function electronically enabled in order for the VTSS to perform as designed. The logic in the EMIC keeps its VTSS function dormant until it is enabled using a diagnostic scan tool. The VTSS function of the EMIC is enabled on vehicles equipped with the VTSS option at the factory, but a service replacement EMIC must be VTSS-enabled by the dealer using a diagnostic scan tool. Refer to the appropriate diagnostic information.

ARMING

Passive arming of the VTSS occurs when the vehicle is exited with the key removed from the ignition switch, the headlamps are turned off, and the doors are locked while they are open using the power lock switch. Active arming occurs when the “Lock” button on the Remote Keyless Entry (RKE) transmitter is depressed to lock the vehicle. For active arming to occur, the doors must be closed and the ignition switch must be in the Off position when the RKE transmitter “Lock” button is depressed. The power lock switch will not function if the key is in the ignition switch or the headlamps are turned on with the driver side front door open.

Pre-arming of the VTSS is initiated when a door is open when the vehicle is locked using a power door lock switch or when the RKE transmitter “Lock” button is depressed. Pre-arming will not occur if the key is in the ignition switch or the headlamps are turned on with the driver side front door open. When the VTSS is pre-armed, the arming sequence is delayed until all of the doors have been closed. The VTSS will remain in “Pre-Armed” mode until after all doors have been closed, or until the interior lighting load shed threshold is surpassed (about eight minutes).

Once the VTSS begins the passive or active arming sequence, the security indicator in the instrument cluster will flash rapidly for about seventeen seconds. This indicates that VTSS arming is in progress. If the ignition switch is turned to the On position, a door is opened, a door is unlocked by any means, or the RKE “Panic” button is depressed during the seventeen second arming process, the security indicator will stop flashing and the arming process will abort. Once the seventeen second arming sequence is successfully completed, the security indicator will flash at a slower rate, indicating that the VTSS is armed.

DISARMING

Since this model is not equipped with lock cylinder switches, passive disarming of the VTSS is only possible if the vehicle is equipped with the optional Sentry Key Immobilizer System (SKIS). On vehicles with SKIS, turning the ignition switch to the On position using a valid SKIS key will passively disarm VTSS. Active disarming of the VTSS occurs when the vehicle is unlocked by depressing the “Unlock” button of the RKE transmitter. Once the alarm has been activated, either disarming method will also deactivate the alarm. Depressing the “Panic” button on the RKE transmitter will **not** disarm the VTSS.

POWER-UP MODE

When the armed VTSS senses that the battery has been disconnected and reconnected, it enters its power-up mode. In the power-up mode the alarm system remains armed following a battery failure or disconnect. If the VTSS

was armed prior to a battery disconnect or failure, the technician or vehicle operator will have to actively or passively disarm the alarm system after the battery is reconnected. The power-up mode will also apply if the battery goes dead while the system is armed, and battery jump-starting is attempted. The VTSS will be armed until the technician or vehicle operator has actively or passively disarmed the alarm system. If the VTSS is in the disarmed mode prior to a battery disconnect or failure, it will remain disarmed after the battery is reconnected or replaced, or if jump-starting is attempted.

TAMPER ALERT

The VTSS tamper alert feature will sound the horn three times upon disarming, if the alarm was triggered and has since timed-out (about eighteen minutes) or if the battery has been disconnected and reconnected. This feature alerts the vehicle operator that the VTSS alarm was activated while the vehicle was unattended.

SENTRY KEY IMMOBILIZER SYSTEM

The Sentry Key Immobilizer System (SKIS) is designed to provide passive protection against unauthorized vehicle use by disabling the engine after about two seconds of running, whenever any method other than a valid Sentry Key is used to start the vehicle. The SKIS is considered a passive protection system because it is always active when the ignition system is energized and does not require any customer intervention. The SKIS uses Radio Frequency (RF) communication to obtain confirmation that the key in the ignition switch is a valid key for operating the vehicle. The microprocessor-based SKIS hardware and software also uses electronic messages to communicate with other electronic modules in the vehicle over the Controller Area Network (CAN) data bus. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - OPERATION).

Pre-programmed Sentry Key transponders are provided with the vehicle from the factory. Each Sentry Key REmote Entry Module (SKREEM) will recognize a maximum of eight Sentry Keys. If the customer would like additional keys other than those provided with the vehicle, they may be purchased from any authorized dealer. These additional keys must be programmed to the SKREEM in the vehicle in order for the system to recognize them as valid keys. This can be done by the dealer using a diagnostic scan tool or, if Customer Learn programming is an available SKIS feature in the market where the vehicle was purchased, the customer can program the additional keys, as long as at least two valid Sentry Keys are already available. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - TRANSPONDER PROGRAMMING).

The SKREEM performs a self-test of the SKIS each time the ignition switch is turned to the On position, and will store fault information in the form of a Diagnostic Trouble Code (DTC) if a system malfunction is detected. The SKIS can be diagnosed, and any stored DTC can be retrieved using a diagnostic scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING

VEHICLE THEFT SECURITY SYSTEM

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

The hard wired Vehicle Theft Security System (VTSS) components and circuits may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the ElectroMechanical Instrument Cluster (EMIC), the Front Control Module (FCM), the Controller Area Network (CAN) data bus, or the electronic message inputs used to provide the electronic features of the VTSS. The most reliable, efficient, and accurate means to diagnose the EMIC, the FCM, the CAN data bus, and the electronic message inputs for the VTSS requires the use of a diagnostic scan tool. See the “Vehicle Theft Security System” menu item on the scan tool. Refer to the appropriate diagnostic information.

SENTRY KEY IMMOBILIZER SYSTEM

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

The hard wired Sentry Key Immobilizer System (SKIS) components and circuits may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the Sentry Key REmote Entry Module (SKREEM), the ElectroMechanical Instrument Cluster (EMIC), the Powertrain Control Module (PCM), the Controller Area Network (CAN) data bus, or the electronic message inputs used to provide the electronic features of the SKIS. The most reliable, efficient, and accurate means to diagnose the SKREEM, the EMIC, the PCM, the CAN data bus, and the electronic message inputs for the SKIS requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

SENTRY KEY IMMOBILIZER SYSTEM DIAGNOSIS		
CONDITION	**POSSIBLE CAUSES**	**CORRECTION**
SECURITY INDICATOR FAILS TO LIGHT DURING BULB TEST	1. Light-Emitting Diode (LED) faulty.	1. Perform the instrument cluster actuator test. (Refer to 8 - ELECTRICAL/ INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING - ACTUATOR TEST)..
	2. Fuse faulty.	2. Check the SKREEM fused B(+) fuse and the fused ignition switch output (run-start) fuse in the Junction Block (JB). Replace fuses, if required.
	3. Ground path faulty.	3. Check for continuity to ground at the connector for the SKREEM. Repair wiring, if required.
	4. Battery feed faulty.	4. Check for battery voltage at the connector for the SKREEM. Repair wiring, if required.
	5. Ignition feed faulty.	5. Check for battery voltage at the connector for the SKREEM with the ignition switch in the On position. Repair wiring, if required.
SECURITY INDICATOR FLASHES FOLLOWING BULB TEST	1. Invalid key in ignition switch lock cylinder.	1. Replace the key with a known valid key.
	2. Key-related fault.	2. Use a diagnostic scan tool and the appropriate diagnostic information for further diagnosis.
SECURITY INDICATOR LIGHTS SOLID FOLLOWING BULB TEST	1. SKIS system malfunction/ fault detected.	1. Use a diagnostic scan tool and the appropriate diagnostic information for further diagnosis.
	2. SKIS system inoperative.	2. Use a diagnostic scan tool and the appropriate diagnostic information for further diagnosis.

STANDARD PROCEDURE

SKIS INITIALIZATION

The Sentry Key Immobilizer System (SKIS) must be initialized following a Sentry Key REmote Entry Module (SKREEM) replacement. SKIS initialization requires the use of a diagnostic scan tool. Initialization will also require that you have access to the unique four-digit PIN code that was assigned to the original SKREEM. The PIN code **must** be used to enter the Secured Access Mode in the SKREEM. This PIN number may be obtained from the vehicle owner, from the original vehicle invoice, or from the DaimlerChrysler Customer Center. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE - PCM/SKREEM PROGRAMMING).

NOTE: If a Powertrain Control Module (PCM) is replaced on a vehicle equipped with the Sentry Key Immobilizer System (SKIS), the unique Secret Key data must be transferred from the Sentry Key REmote Entry Module (SKREEM) to the new PCM using the PCM replacement procedure. This procedure also requires the use of a diagnostic scan tool and the unique four-digit PIN code to enter the Secured Access Mode in the SKREEM. Refer to the appropriate diagnostic information for the proper PCM replacement procedures.

SENTRY KEY TRANSPONDER PROGRAMMING

All Sentry Keys included with the vehicle are pre-programmed to work with the Sentry Key Immobilizer System (SKIS) when it is shipped from the factory. The Sentry Key REmote Entry Module (SKREEM) can be programmed to recognize up to a total of eight Sentry Keys. When programming a blank Sentry Key transponder, the key must first be cut to match the ignition switch lock cylinder in the vehicle for which it will be used. Once the additional or new key has been cut, the SKREEM must be programmed to recognize it as a valid key. There are two possible methods to program the SKREEM to recognize a new or additional valid key, the Secured Access Method and the Customer Learn Method. Following are the details of these two programming methods.

SECURED ACCESS METHOD

The Secured Access method applies to all vehicles. This method requires the use of a diagnostic scan tool. This method will also require that you have access to the unique four-digit PIN code that was assigned to the original SKREEM. The PIN code **must** be used to enter the Secured Access Mode in the SKREEM. This PIN number may be obtained from the vehicle owner, from the original vehicle invoice, or from the DaimlerChrysler Customer Center. Refer to the appropriate diagnostic information for the proper Secured Access method programming procedures.

CUSTOMER LEARN METHOD

The Customer Learn feature is only available on domestic vehicles, or those vehicles which have a U.S. country code designator. This programming method also requires access to at least two valid Sentry Keys. If two valid Sentry Keys are not available, or if the vehicle does not have a U.S. country code designator, the Secured Access Method **must** be used to program new or additional valid keys to the SKREEM. The Customer Learn programming method procedures are as follows:

1. Obtain the blank Sentry Key(s) that are to be programmed as valid keys for the vehicle. Cut the blank key(s) to match the ignition switch lock cylinder mechanical key codes.
2. Insert one of the two valid Sentry Keys into the ignition switch and turn the ignition switch to the On position.
3. After the ignition switch has been in the On position for longer than three seconds, but no more than fifteen seconds, cycle the ignition switch back to the Off position. Replace the first valid Sentry Key in the ignition switch lock cylinder with the second valid Sentry Key and turn the ignition switch back to the On position. The second valid Sentry Key must be inserted in the lock cylinder within fifteen seconds of removing the first valid key.
4. About ten seconds after the completion of Step 3, the security indicator in the instrument cluster will start to flash to indicate that the system has entered the Customer Learn programming mode.
5. Within sixty seconds of entering the Customer Learn programming mode, turn the ignition switch to the Off position, replace the valid Sentry Key with a blank Sentry Key transponder, and turn the ignition switch back to the On position.
6. About ten seconds after the completion of Step 5, the security indicator will stop flashing, stay on solid for three seconds, then turn off to indicate that the blank Sentry Key has been successfully programmed. The SKIS will immediately exit the Customer Learn programming mode. After the ignition is cycled the vehicle may be started using the newly programmed valid Sentry Key.

Each of these steps must be repeated and completed in their entirety for each additional Sentry Key that is to be programmed. If the above steps are not completed in the given sequence, or within the allotted time, the SKREEM will exit the Customer Learn programming mode and the programming will be unsuccessful. The SKREEM will also automatically exit the Customer Learn programming mode if it sees a non-blank Sentry Key transponder when it should see a blank, if it has already programmed eight (8) valid Sentry Keys, or if the ignition switch is turned to the Off position for more than about fifty seconds.

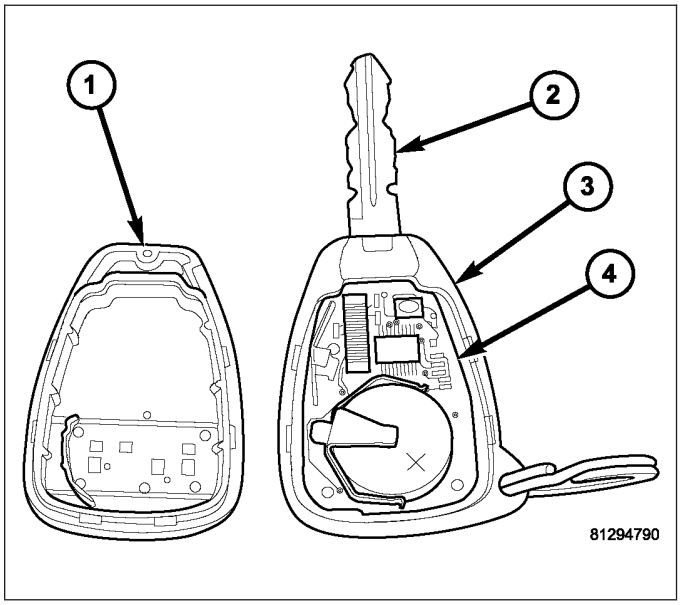
NOTE: If an attempt is made to start the vehicle while in the Customer Learn mode (security indicator flashing), the SKIS will respond as though the vehicle were being started with an invalid key. In other words, the engine will stall after about two seconds of operation. No faults will be set.

NOTE: Once a Sentry Key has been programmed as a valid key to a vehicle, it cannot be programmed as a valid key for use on any other vehicle.

TRANSPONDER KEY

DESCRIPTION

Each ignition key (2) used in the Sentry Key Immobilizer System (SKIS) has a transponder chip included on the circuit board (4) beneath the cover (1) of the integral Remote Keyless Entry (RKE) transmitter (3). In addition to having to be cut to match the mechanical coding of the ignition lock cylinder and programmed for operation of the RKE system, each new Sentry Key has a unique transponder identification code that is permanently programmed into it by the manufacturer, and which must be programmed into the Sentry Key REmote Entry Module (SKREEM) to be recognized by the SKIS as a valid key. The Sentry Key transponder cannot be adjusted or repaired. If faulty or damaged, the entire key and RKE transmitter unit must be replaced.



OPERATION

When the ignition switch is turned to the On position, the Sentry Key REmote Entry Module (SKREEM) communicates through its antenna with the Sentry Key transponder using a Radio Frequency (RF) signal. The SKREEM then listens for a RF response from the transponder through the same antenna. The Sentry Key transponder chip is within the range of the SKREEM transceiver antenna ring when it is inserted into the ignition lock cylinder. The SKREEM determines whether a valid key is present in the ignition lock cylinder based upon the response from the transponder. If a valid key is detected, that fact is communicated by the SKREEM to the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus, and the PCM allows the engine to continue running. If the PCM receives an invalid key message, or receives no message from the SKREEM over the CAN data bus, the engine will be disabled after about two seconds of operation. The ElectroMechanical Instrument Cluster (EMIC) will also respond to the invalid key message on the CAN data bus by flashing the security indicator on and off.

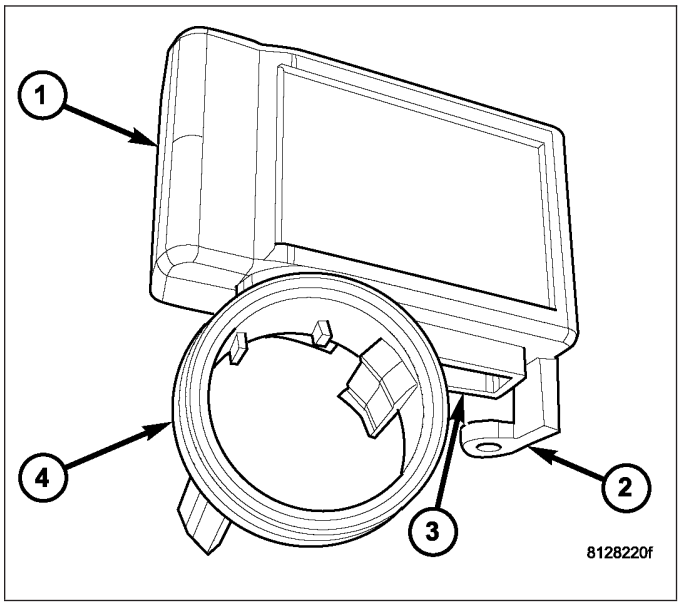
Each Sentry Key has a unique transponder identification code permanently programmed into it by the manufacturer. Likewise, the SKREEM has a unique Secret Key code programmed into it by the manufacturer. When a Sentry Key is programmed into the memory of the SKREEM, the SKREEM stores the transponder identification code from the Sentry Key, and the Sentry Key learns the Secret Key code from the SKREEM. Once the Sentry Key learns the Secret Key code of the SKREEM, it is permanently stored in the memory of the transponder. Therefore, once a Sentry Key has been programmed to a particular vehicle, it cannot be used on any other vehicle. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - TRANSPONDER PROGRAMMING).

The SKIS performs a self-test each time the ignition switch is turned to the On position, and will store key-related fault information in the form of a Diagnostic Trouble Code (DTC) in SKREEM memory if a Sentry Key transponder problem is detected. The Sentry Key transponder chip can be diagnosed, and any stored DTC can be retrieved using a diagnostic scan tool. Refer to the appropriate diagnostic information.

MODULE-SENTRY KEY REMOTE ENTRY

DESCRIPTION

The Sentry Key REmote Entry Module (SKREEM) (1) is sometimes referred to as the Wireless Control Module (WCM). The SKREEM is the primary component of the Sentry Key Immobilizer System (SKIS) and is also the receiver for the Remote Keyless Entry (RKE) system. The SKREEM is located on the right side of the steering column, near the ignition lock cylinder housing and is concealed beneath the steering column shrouds. The molded black plastic housing for the SKREEM has an integral molded plastic halo-like antenna ring (4) that extends from the bottom. When the SKREEM is properly installed on the steering column, the antenna ring is oriented around the circumference of the ignition lock cylinder housing.



A single integral connector receptacle (3) is located just behind the antenna ring on the bottom of the SKREEM housing. An integral molded plastic mounting tab (2) on the rear corner of the SKREEM housing has a hole in the center through which a screw passes to secure the unit to the steering column. The SKREEM is connected to the vehicle electrical system through a single take out and connector of the instrument panel wire harness.

Two SKREEM modules are used: one for vehicles equipped with RKE only, and one for vehicles equipped with RKE and SKIS. The SKREEM cannot be adjusted or repaired. If faulty or damaged, the entire SKREEM unit must be replaced.

OPERATION

The Sentry Key REmote Entry Module (SKREEM) contains a Radio Frequency (RF) transceiver and a microprocessor. The SKREEM transmits RF signals to, and receives RF signals from the Sentry Key transponder through a tuned antenna enclosed within the molded plastic antenna ring integral to the SKREEM housing. If this antenna ring is not mounted properly around the ignition lock cylinder housing, communication problems between the SKREEM and the transponder may arise. These communication problems will result in Sentry Key transponder-related faults. The SKREEM also serves as the Remote Keyless Entry (RKE) RF receiver. (Refer to 8 - ELECTRICAL/POWER LOCKS - DESCRIPTION). The SKREEM communicates over the Controller Area Network (CAN) data bus with the ElectroMechanical Instrument Cluster (EMIC), the Powertrain Control Module (PCM), and/or the diagnostic scan tool.

The SKREEM retains in memory the ID numbers of any Sentry Key transponder that is programmed into it. A maximum of eight Sentry Key transponders can be programmed into the SKREEM. For added system security, each SKREEM is programmed with a unique Secret Key code. This code is stored in memory, sent over the CAN data bus to the PCM, and is encoded to the transponder of every Sentry Key that is programmed into the SKREEM. Therefore, the Secret Key code is a common element that is found in every component of the Sentry Key Immobilizer System (SKIS). Another security code, called a PIN, is used to gain access to the SKREEM Secured Access Mode. The Secured Access Mode is required during service to perform the SKIS initialization and Sentry Key transponder programming procedures. The SKREEM also stores the Vehicle Identification Number (VIN) in its memory, which it learns through a CAN data bus message from the PCM during SKIS initialization.

In the event that a SKREEM replacement is required, the Secret Key code can be transferred to the new SKREEM from the PCM using the diagnostic scan tool and the SKIS initialization procedure. Proper completion of the SKIS

initialization will allow the existing Sentry Keys to be programmed into the new SKREEM so that new keys will not be required. In the event that the original Secret Key code cannot be recovered, SKREEM replacement will also require new Sentry Keys. The diagnostic scan tool will alert the technician during the SKIS initialization procedure if new Sentry Keys are required.

When the ignition switch is turned to the On position, the SKREEM transmits an RF signal to the transponder in the ignition key. The SKREEM then waits for an RF signal response from the transponder. If the response received identifies the key as valid, the SKREEM sends a valid key message to the PCM over the CAN data bus. If the response received identifies the key as invalid or if no response is received from the key transponder, the SKREEM sends an invalid key message to the PCM. The PCM will enable or disable engine operation based upon the status of the SKREEM messages. It is important to note that the default condition in the PCM is an invalid key; therefore, if no message is received from the SKREEM by the PCM, the engine will be disabled and the vehicle immobilized after two seconds of running.

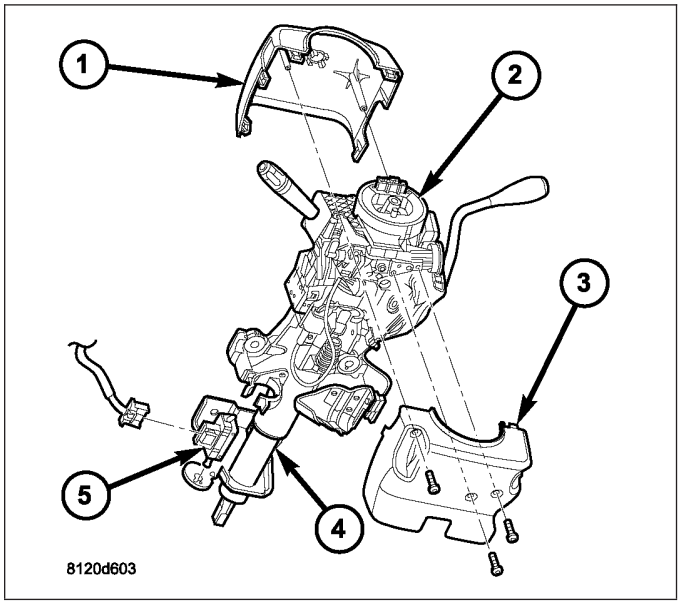
The SKREEM also sends security indicator status messages to the EMIC over the CAN data bus to tell the EMIC how to operate the security indicator. The security indicator status message from the SKREEM tells the EMIC to turn the indicator on for about three seconds each time the ignition switch is turned to the On position as a bulb test. After completion of the bulb test, the SKREEM sends security indicator status messages to the EMIC to turn the indicator off, turn the indicator on, or to flash the indicator on and off. If the security indicator flashes or stays on solid after the bulb test, it signifies a SKIS fault. If the SKREEM detects a system malfunction and/or the SKIS has become inoperative, the security indicator will stay on solid. If the SKREEM detects an invalid key or if a key transponder-related fault exists, the security indicator will flash. If the vehicle is equipped with the Customer Learn transponder programming feature, the SKREEM will also send messages to the EMIC to flash the security indicator whenever the Customer Learn programming mode is being utilized. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - SENTRY KEY TRANSPONDER PROGRAMMING).

The SKIS performs a self-test each time the ignition switch is turned to the On position, and will store fault information in the form of a Diagnostic Trouble Code (DTC) in SKREEM memory if a system malfunction is detected. The SKREEM can be diagnosed, and any stored DTC can be retrieved using a diagnostic scan tool. Refer to the appropriate diagnostic information.

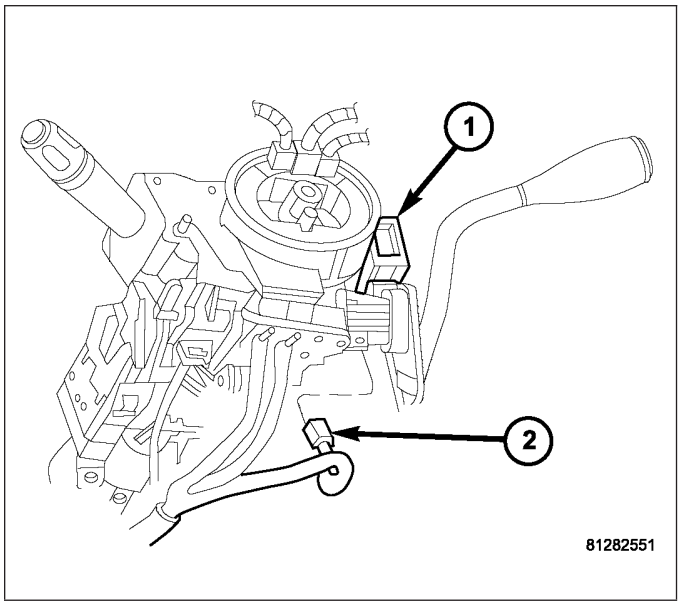
REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

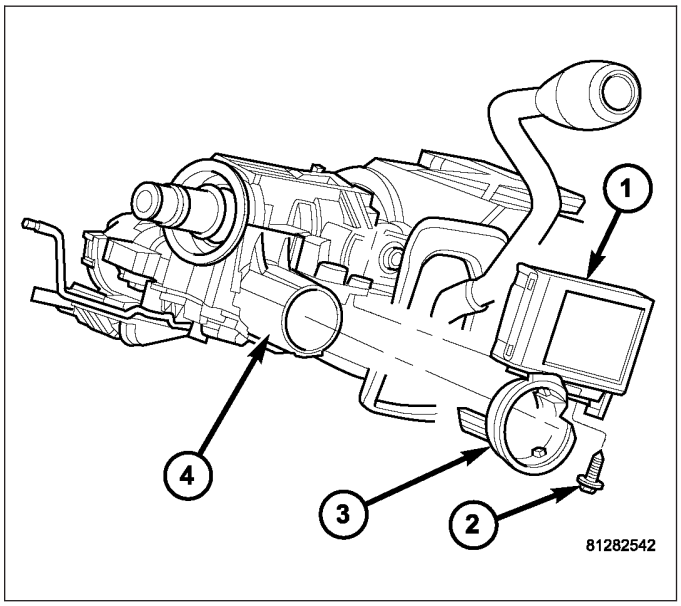
1. Disconnect and isolate the battery negative cable.
2. Grasp the tilt steering column knob firmly and pull it straight rearward to remove it from the tilt adjuster lever on the left side of the column.
3. From below the steering column, remove the two outboard screws that secure the upper column shroud (1) to the lower shroud (3).
4. Using hand pressure, push gently inward on both sides of the upper shroud above the parting line of the lower shroud to release the snap features that secure the two shroud halves to each other.
5. Remove the upper shroud from the lower shroud and the steering column.
6. Remove the one center screw that secures the lower shroud to the steering column (4).
7. Remove the lower shroud from the steering column.



8. Disconnect the wire harness connector (2) from the Sentry Key REmote Entry Module (SKREEM) (1).



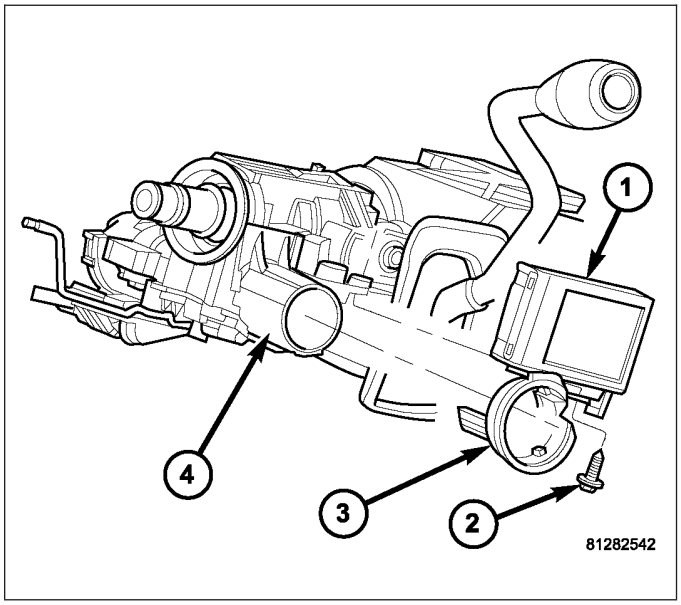
9. Remove the screw (2) that secures the SKREEM (1) to the steering column housing.
10. Disengage the antenna ring (4) from around the ignition lock cylinder housing (3) and remove the SKREEM.



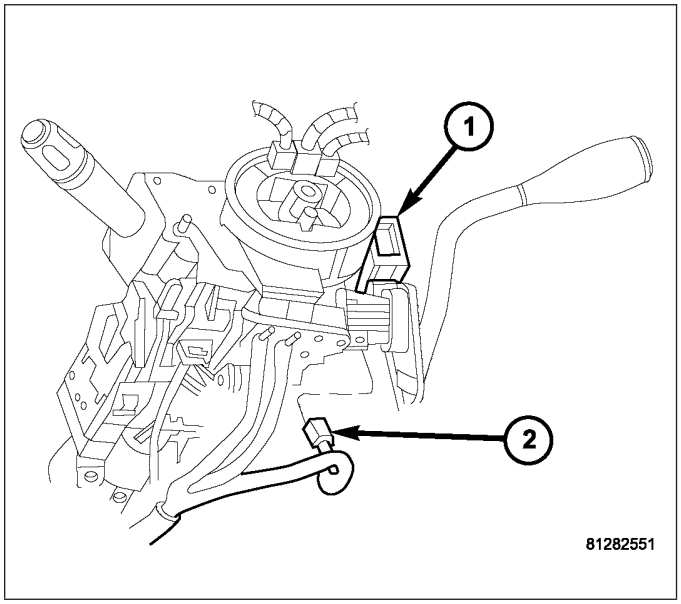
INSTALLATION

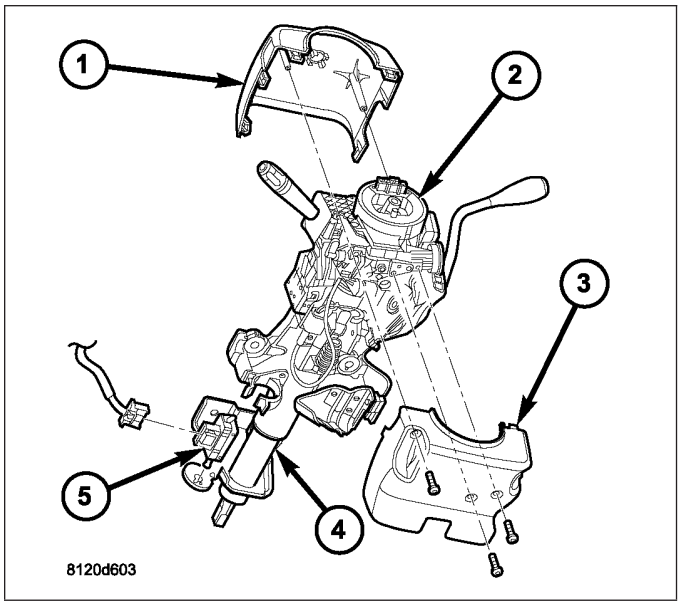
WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

1. Position the Sentry Key REmote Entry Module (SKREEM) (1) onto the steering column with the antenna ring (3) oriented around the ignition lock cylinder housing (4).
2. Install and tighten the screw (2) that secures the SKREEM to the steering column housing. Tighten the screw to 2 N·m (20 in. lbs.).



3. Reconnect the wire harness connector (2) to the SKREEM (1).





4. Position the lower shroud (3) onto the steering column (4).
5. From below the steering column, install and tighten the one center screw that secures the lower shroud to the steering column. Tighten the screw to 2 N·m (20 in. lbs.).
6. Position the upper shroud (1) onto the steering column over the lower shroud. Be certain to engage the gearshift lever gap hider into the opening in the right side of both shroud halves.
7. Align the snap features on the upper shroud with the receptacles in the lower shroud and apply hand pressure to snap them together.
8. Install and tighten the two outboard screws that secure the upper shroud to the lower shroud. Tighten the screws to 2 N·m (20 in. lbs.).
9. Align the tilt steering column knob with the tilt adjuster lever on the left side of the steering column and use hand pressure to snap it back into place.
10. Reconnect the battery negative cable.

NOTE: On vehicles equipped with the optional Sentry Key Immobilizer System (SKIS) if the SKREEM is replaced with a new unit, a diagnostic scan tool MUST be used to initialize the new SKREEM and to program at least two Sentry Key transponders before the vehicle can be operated. (Refer to 8 - ELECTRICAL/ VEHICLE THEFT SECURITY - STANDARD PROCEDURE - SKIS INITIALIZATION).

VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS

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VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B1A24-KEY NOT PROGRAMMED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition switch on.

Possible Causes
KEY NOT PROGRAMMED
SKREEM

Diagnostic Test

1. KEY NOT PROGRAMMED

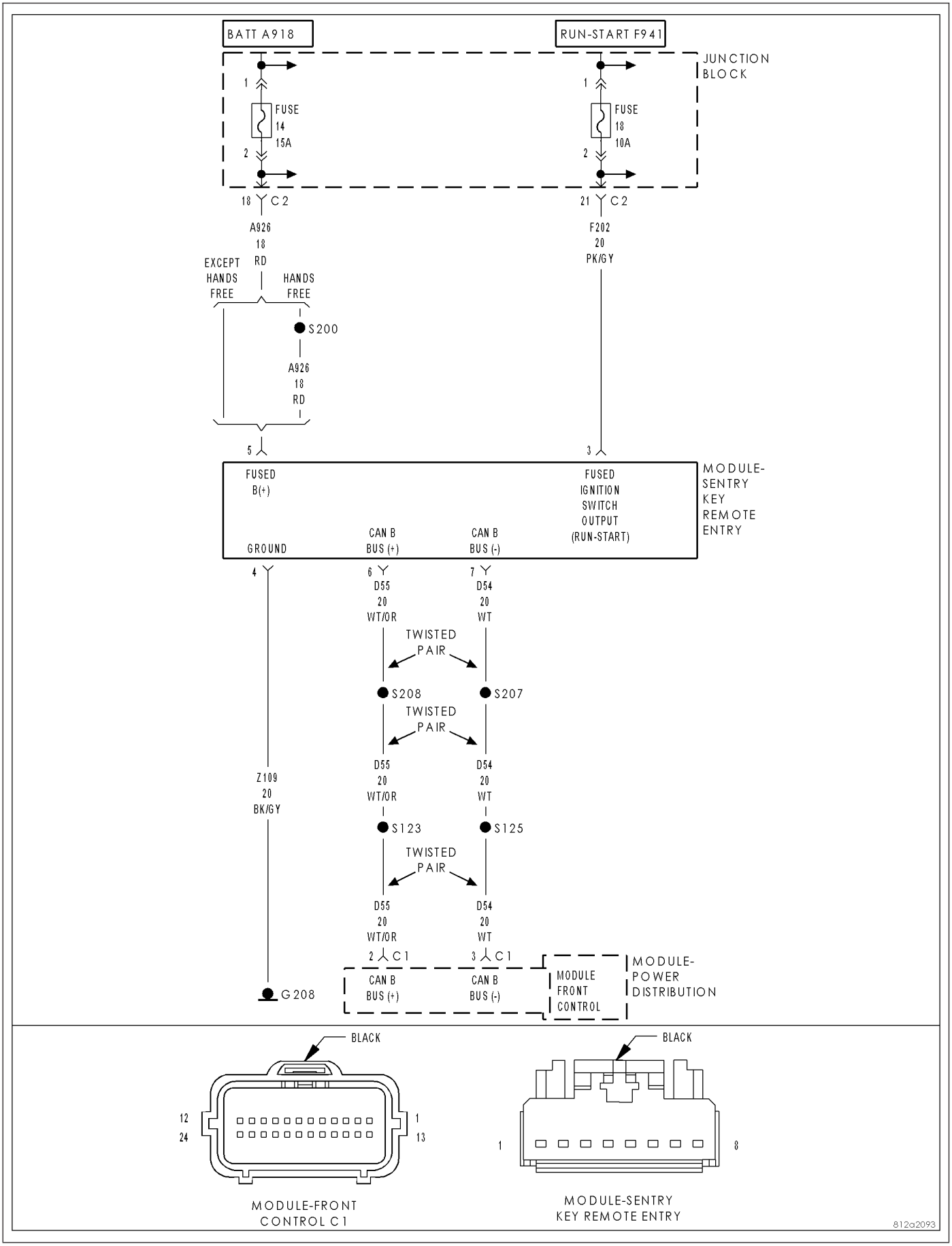
Turn the ignition on.
Using a scan tool, attempt to program the key(s) into the SKREEM.

Was the programming of the key(s) successful?

Yes >> Programming of the key(s) were successful. Test complete.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Replace the ignition key and attempt to program it into the SKREEM. If the DTC resets, replace and program the SKREEM in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

B1A25-INVALID KEY



B1A25-INVALID KEY (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When the SKREEM does not receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds.

Possible Causes
MULTIPLE KEY OPERATION
IGNITION KEY
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, read and record the SKREEM DTCs.

With the scan tool, erase the SKREEM DTCs

NOTE: Perform the following test several times to ensure the DTC is current.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes >> Go To 2

No >> Go To 6

---

2. CHECKING FOR MULTIPLE KEYS

Are there multiple vehicle ignition keys available?

Yes >> Go To 3

No >> Go To 4

B1A25-INVALID KEY (CONTINUED)

3. MULTIPLE KEY OPERATION

NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each of the other vehicle keys, one at a time.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on

With the scan tool, read the SKREEM DTCs.

Is the DTC present for all ignition keys?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Replace the ignition key(s) that cause the SKIM DTC. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. REPROGRAM KEY

With the scan tool, attempt to reprogram the ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Go To 5

No >> Test complete.

---

5. PROGRAM NEW IGNITION KEY

Replace the ignition key with a new key.

With the scan tool, program the new ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test complete.

B1A25-INVALID KEY (CONTINUED)

6. INTERMITTENT WIRING HARNESS PROBLEM

Turn the ignition off.

NOTE: Check the following items:

- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes >> Repair wiring harness/connectors as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

B1A26-MAXIMUM NUMBER OF KEYS PROGRAMMED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition switch on.
- **Set Condition:**
  When the maximum number of key (8) have been programmed into the SKREEM

Possible Causes
MAXIMUM AMOUNT OF KEY PROGRAMMED INTO SKREEM
SKREEM

Diagnostic Test

1. MAXIMUM AMOUNT OF KEYS PROGRAMMED INTO SKREEM

NOTE: The below procedure has you clearing all the key information within the SKREEM. It is important to obtain all the customer's ignition key(s) so they may be reprogrammed into the module.

Turn the ignition on.

Using a scan tool, clear all the key information in the SKREEM.

Program the all the customer key(s) into the SKREEM (up to eight only)

Was the "Maximum Number of Keys Programmed" display again?

Yes >> Replace and program the SKREEM in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Programming of the key(s) were successful. Test complete.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

B1A27-SKREEM PROGRAMMING PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition switch on.

Possible Causes
SKREEM

Diagnostic Test

1. SKREEM

NOTE: Before continuing review and check the following conditions.
- **Review the repair history of the vehicle. Ensure the vehicle has the correct PCM and SKREEM installed. Check the part numbers.**
- **Using a scan tool, ensure the PCM and SKREEM have been programmed correctly. Compare the PCM VIN to the SKREEM VIN and ensure the two VINS match.**

Turn the ignition on.

With the scan tool, clear DTC(s).

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

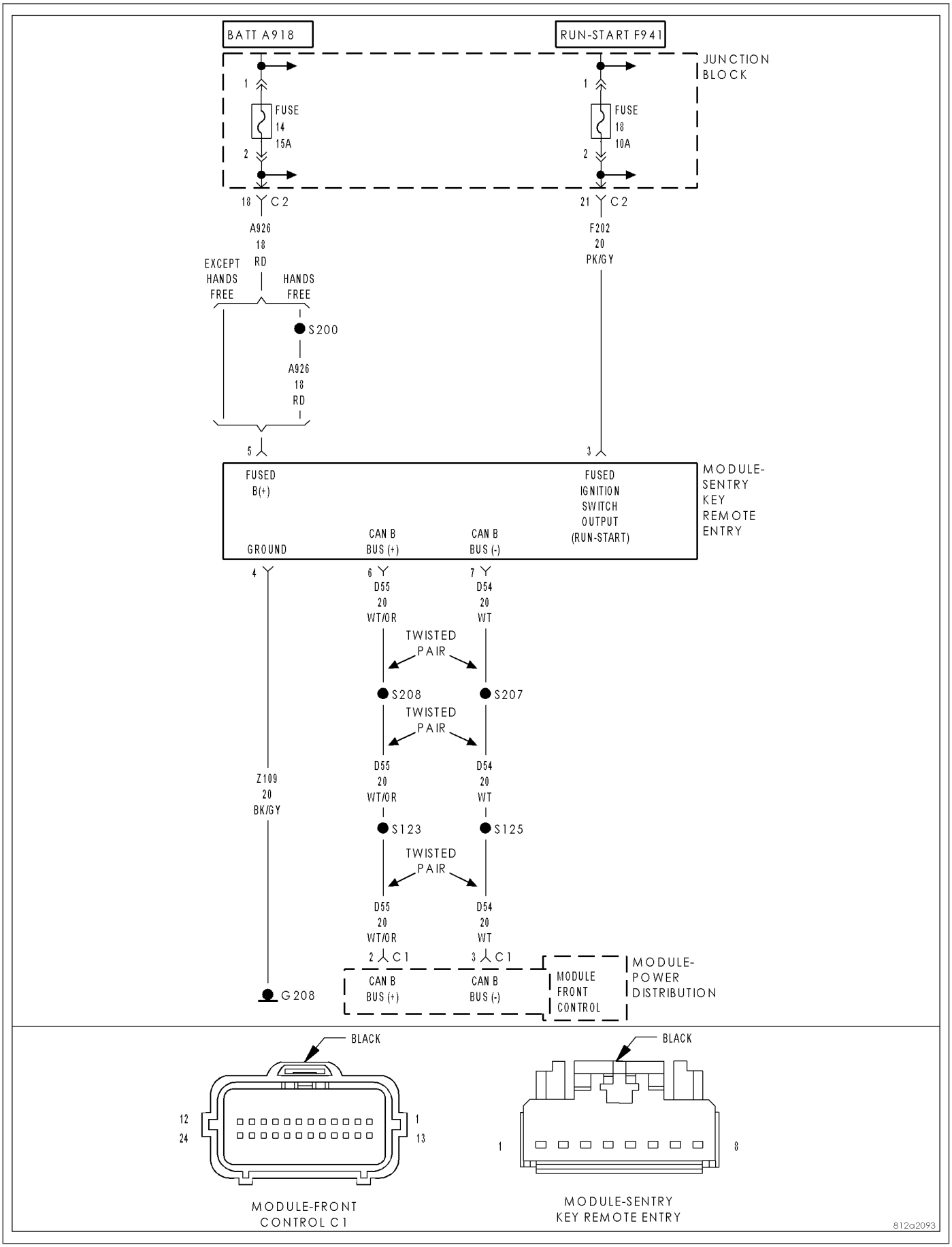
Using the scan tool, read DTC(s).

Does the DTC reset?

Yes >> Replace and program the SKREEM in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> The DTC is not active at this time. Test complete.

B1A28-ECM MISMATCH WITH SKIM



B1A28-ECM MISMATCH WITH SKIM (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on, after ignition on during any rolling code handshake that occurs with the PCM due to a SKIM or PCM reset.
- **Set Condition:**
  When a PCM STATUS message with a Valid Key status is not received by the SKIM within 3.5 seconds of transmitting the last Valid Key Code message to the PCM.

Possible Causes
VERIFYING PCM VIN
REPLACE SKREEM AND CHECK DTC'S
PCM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, erase the SKREEM DTCs.
Turn the ignition off.
Wait 10 seconds.
Turn the ignition on and wait 2 minutes.
With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes >> Go To 2

No >> Go To 4

---

2. VERIFYING THE PCM VIN

Turn the ignition on.
With the scan tool, select Engine system from the main menu.
Display and record the Vehicle Identification Number.

NOTE: Make sure that a VIN has been programmed into the PCM. If a VIN is not displayed, attempt to program the PCM with the correct VIN before continuing.

Does the VIN recorded from the PCM match the VIN of the vehicle?

Yes >> Go To 3

No >> Perform the PCM replaced to update the VIN in the PCM.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

B1A28-ECM MISMATCH WITH SKIM (CONTINUED)

3. REPLACE SKREEM AND CHECK DTC'S

Turn the ignition off.

Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information.

Turn the ignition on.

With the scan tool, display and clear all PCM and SKREEM DTC's.

Perform 5 ignition key cycles leaving the ignition key on for 90 seconds per cycle.

With the scan tool, check for SKREEM DTCs.

Does the scan tool display the same DTC?

Yes >> Replace and program the Powertrain Control Module in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> The repair is complete.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. INTERMITTENT

Turn the ignition off.

NOTE: Check for the following conditions:

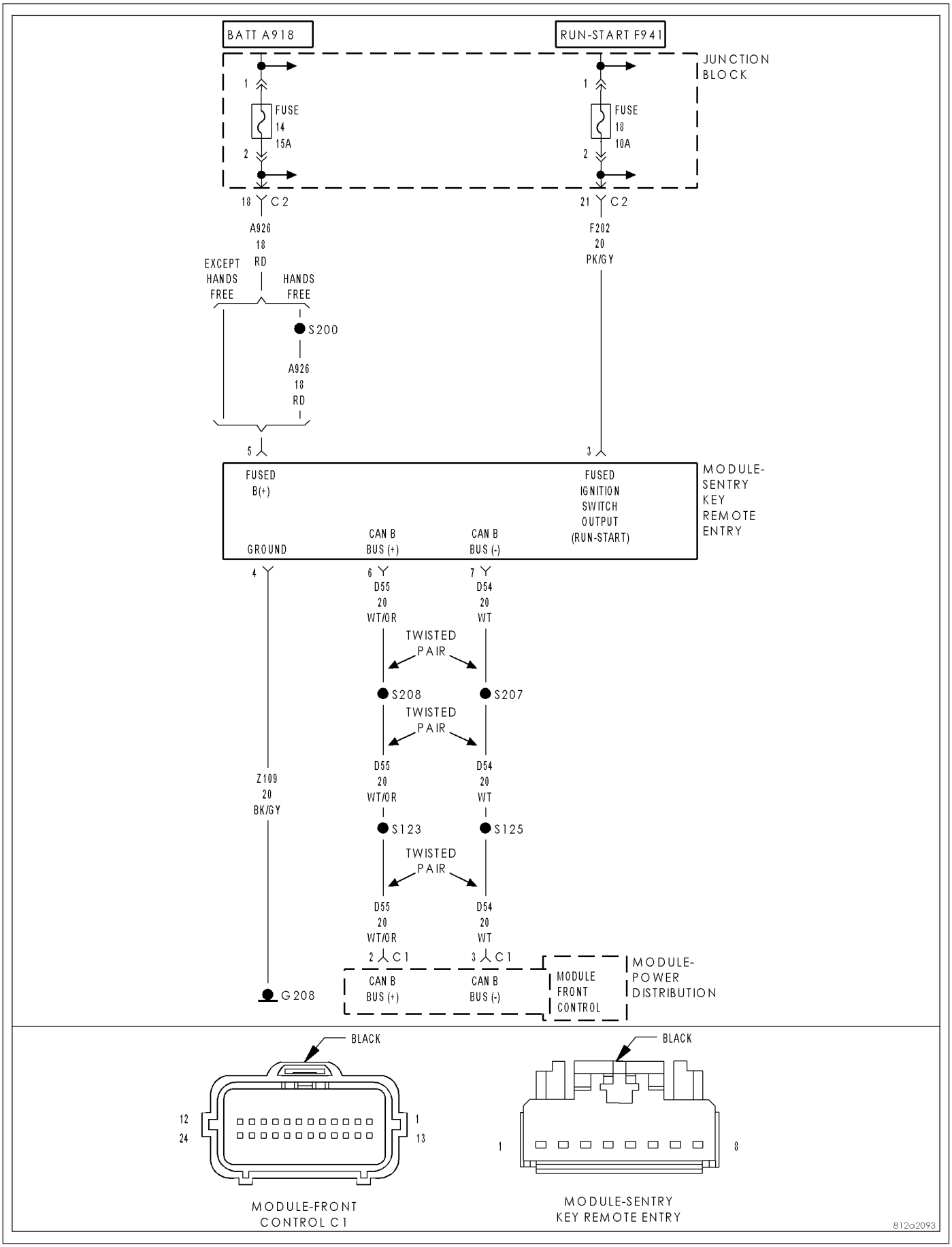
- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes >> Repair wiring harness/connectors as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

B1A29–ECM MISMATCH WITH SKIM



B1A29–ECM MISMATCH WITH SKIM (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on, after ignition on during any rolling code handshake that occurs with the PCM due to a SKIM or PCM reset.
- **Set Condition:**
  When a PCM STATUS message with a Valid Key status is not received by the SKIM within 3.5 seconds of transmitting the last Valid Key Code message to the PCM.

Possible Causes
VERIFYING PCM VIN
REPLACE SKREEM AND CHECK DTC'S
PCM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, erase the SKREEM DTCs.
Turn the ignition off.
Wait 10 seconds.
Turn the ignition on and wait 2 minutes.
With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes >> Go To 2

No >> Go To 4

---

2. VERIFYING THE PCM VIN

Turn the ignition on.
With the scan tool, select Engine system from the main menu.
Display and record the Vehicle Identification Number.

NOTE: Make sure that a VIN has been programmed into the PCM. If a VIN is not displayed, attempt to program the PCM with the correct vehicle VIN before continuing.

Does the VIN recorded from the PCM match the VIN of the vehicle?

Yes >> Go To 3

No >> Perform the PCM replaced to update the VIN in the PCM.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

B1A29–ECM MISMATCH WITH SKIM (CONTINUED)

3. REPLACE SKREEM AND CHECK DTC'S

Turn the ignition off.

Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information.

Turn the ignition on.

With the scan tool, display and clear all PCM and SKREEM DTC's.

Perform 5 ignition key cycles leaving the ignition key on for 90 seconds per cycle.

With the scan tool, check for SKREEM DTCs.

Does the scan tool display the same DTC?

Yes >> Replace and program the Powertrain Control Module in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> The repair is complete.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. INTERMITTENT

Turn the ignition off.

NOTE: Check for the following conditions:

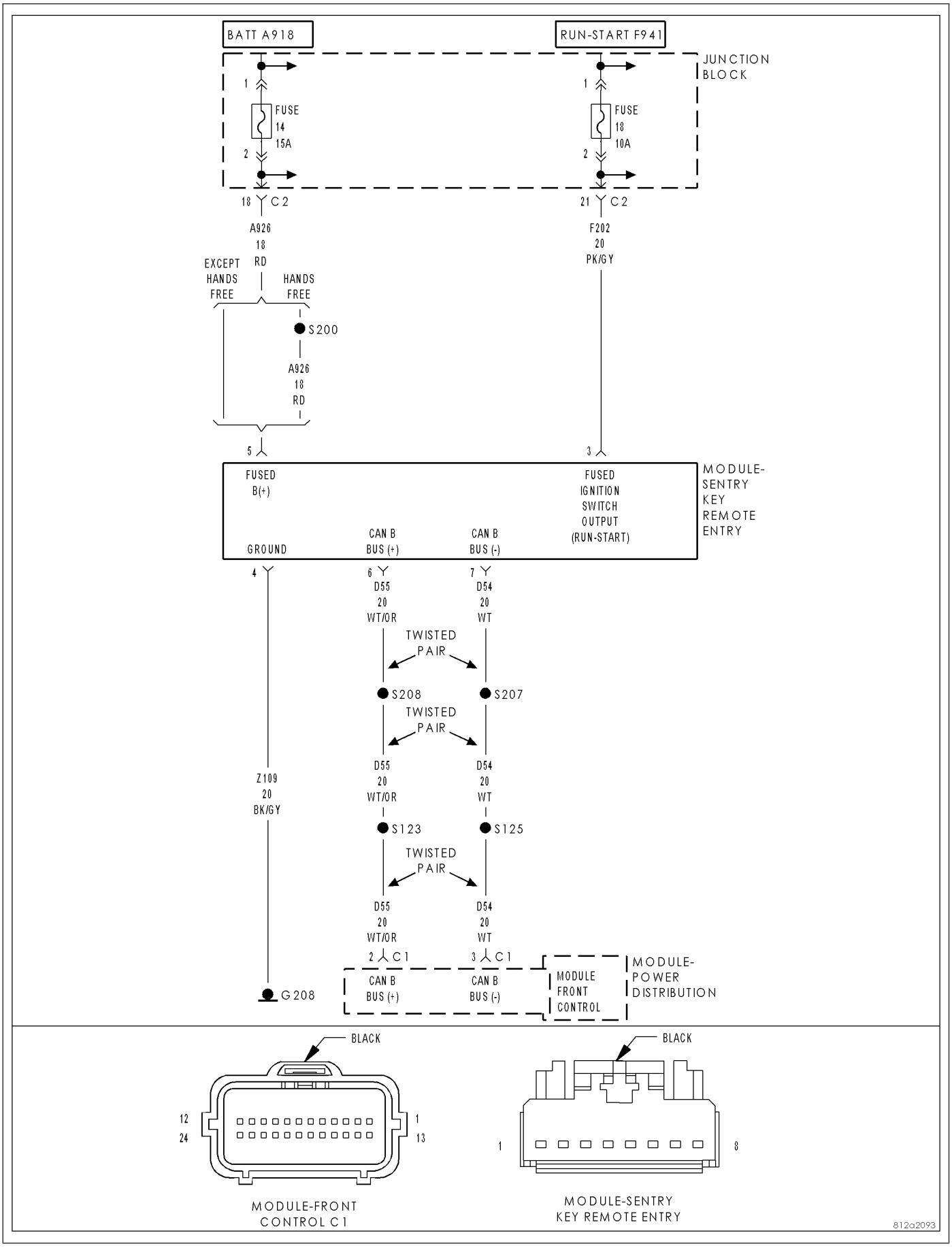
- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes >> Repair wiring harness/connectors as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

B1A2A-KEY 1 COMMUNICATION ERROR



B1A2A-KEY 1 COMMUNICATION ERROR (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When the SKREEM does not receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds.

Possible Causes
MULTIPLE KEY OPERATION
IGNITION KEY
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, read and record the SKREEM DTCs.

With the scan tool, erase the SKREEM DTCs.

NOTE: Perform the following test several times to make sure the DTC is current.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes >> Go To 2

No >> Go To 6

---

2. CHECKING FOR MULTIPLE KEYS

Are there multiple vehicle ignition keys available?

Yes >> Go To 3

No >> Go To 4

B1A2A-KEY 1 COMMUNICATION ERROR (CONTINUED)

3. MULTIPLE KEY OPERATION

NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each of the other vehicle keys, one at a time.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Is the DTC present for all ignition keys?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Replace the ignition key(s) that cause the SKIM DTC. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. REPROGRAM KEY

With the scan tool, attempt to reprogram the ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Go To 5

No >> Test complete.

---

5. PROGRAM NEW IGNITION KEY

Replace the ignition key with a new key.

With the scan tool, program the new ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test complete.

B1A2A-KEY 1 COMMUNICATION ERROR (CONTINUED)

6. INTERMITTENT WIRING HARNESS PROBLEM

Turn the ignition off.

NOTE: Check the following items:

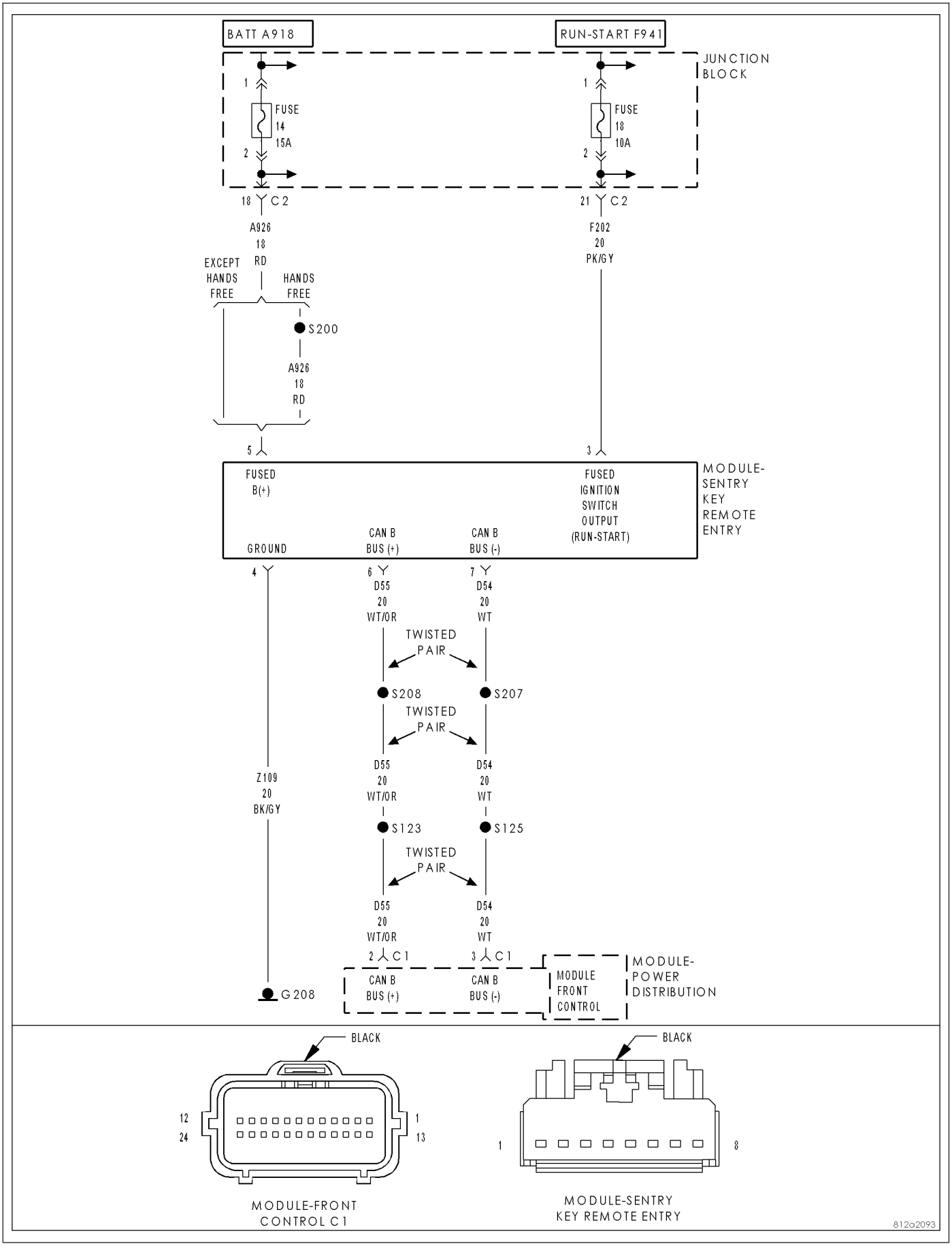
- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes >> Repair wiring harness/connectors as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

B1A2BA-KEY 2 COMMUNICATION ERROR



B1A2BA-KEY 2 COMMUNICATION ERROR (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When the SKREEM does not receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds.

Possible Causes
MULTIPLE KEY OPERATION
IGNITION KEY
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, read and record the SKREEM DTCs.
With the scan tool, erase the SKREEM DTCs

NOTE: Perform the following test several times to make sure the DTC is current.
Turn the ignition off.
Wait 10 seconds.
Turn the ignition on.
With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes >> Go To 2
No >> Go To 6

---

2. CHECKING FOR MULTIPLE KEYS

Are there multiple vehicle ignition keys available?

Yes >> Go To 3
No >> Go To 4

B1A2BA-KEY 2 COMMUNICATION ERROR (CONTINUED)

3. MULTIPLE KEY OPERATION

NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each of the other vehicle keys one at a time.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Is the DTC present for all ignition keys?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Replace the ignition key(s) that cause the SKIM DTC. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. REPROGRAM KEY

With the scan tool, attempt to reprogram the ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Go To 5

No >> Test complete.

---

5. PROGRAM NEW IGNITION KEY

Replace the ignition key with a new key.

With the scan tool, program the new ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test complete.

B1A2BA-KEY 2 COMMUNICATION ERROR (CONTINUED)

6. INTERMITTENT WIRING HARNESS PROBLEM

Turn the ignition off.

NOTE: Check the following items:

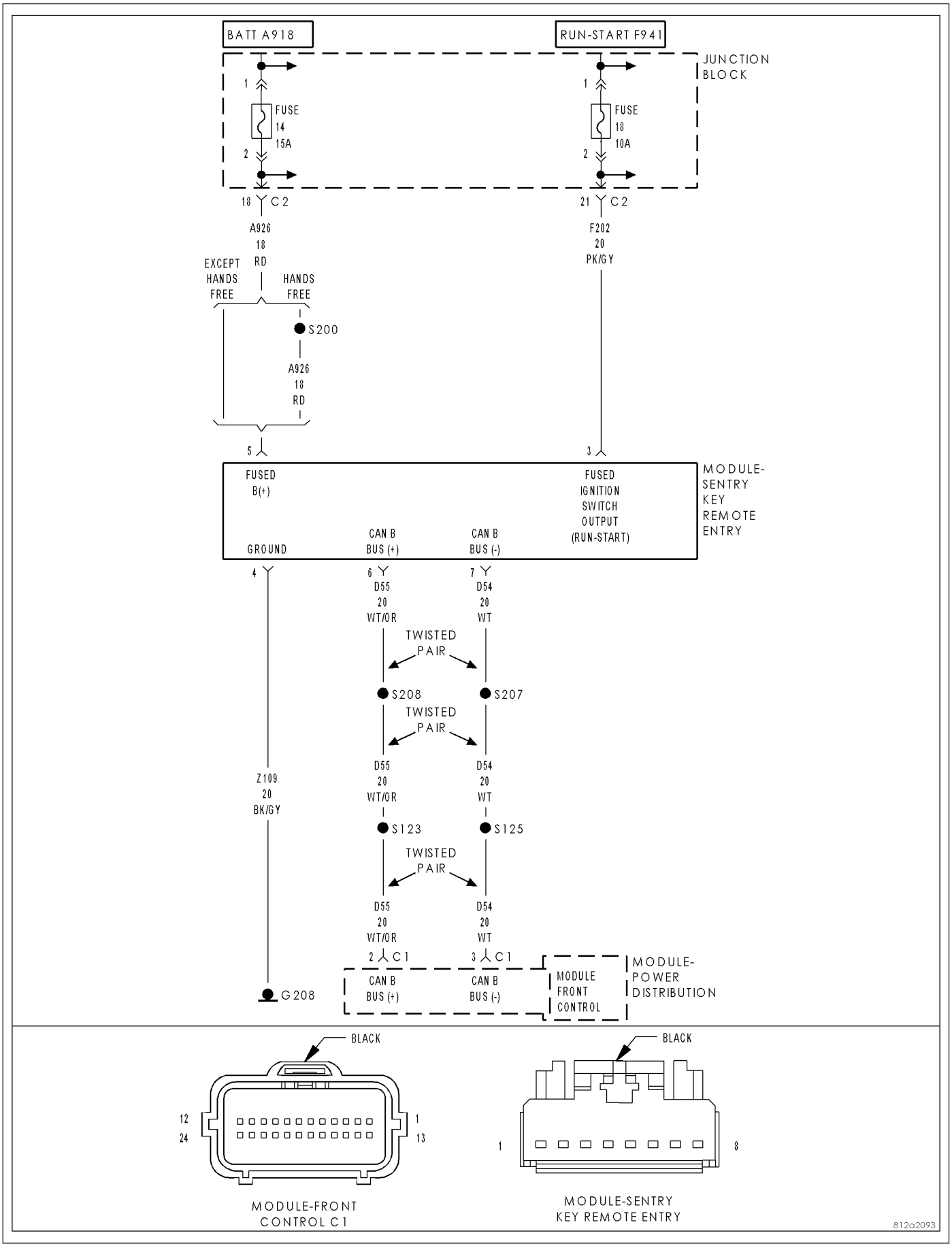
- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes >> Repair wiring harness/connectors as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

B1A2C-KEY 3 COMMUNICATION ERROR



B1A2C-KEY 3 COMMUNICATION ERROR (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When the SKREEM does not receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds.

Possible Causes
MULTIPLE KEY OPERATION
IGNITION KEY
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, read and record the SKREEM DTCs.

With the scan tool, erase the SKREEM DTCs

NOTE: Perform the following test several times to make sure the DTC is current.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes >> Go To 2

No >> Go To 6

---

2. CHECKING FOR MULTIPLE KEYS

Are there multiple vehicle ignition keys available?

Yes >> Go To 3

No >> Go To 4

B1A2C-KEY 3 COMMUNICATION ERROR (CONTINUED)

3. MULTIPLE KEY OPERATION

NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each of the other vehicle keys one at a time.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Is the DTC present for all ignition keys?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Replace the ignition key(s) that cause the SKIM DTC. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. REPROGRAM KEY

With the scan tool, attempt to reprogram the ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Go To 5

No >> Test complete.

---

5. PROGRAM NEW IGNITION KEY

Replace the ignition key with a new key.

With the scan tool, program the new ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test complete.

B1A2C-KEY 3 COMMUNICATION ERROR (CONTINUED)

6. INTERMITTENT WIRING HARNESS PROBLEM

Turn the ignition off.

NOTE: Check the following items:

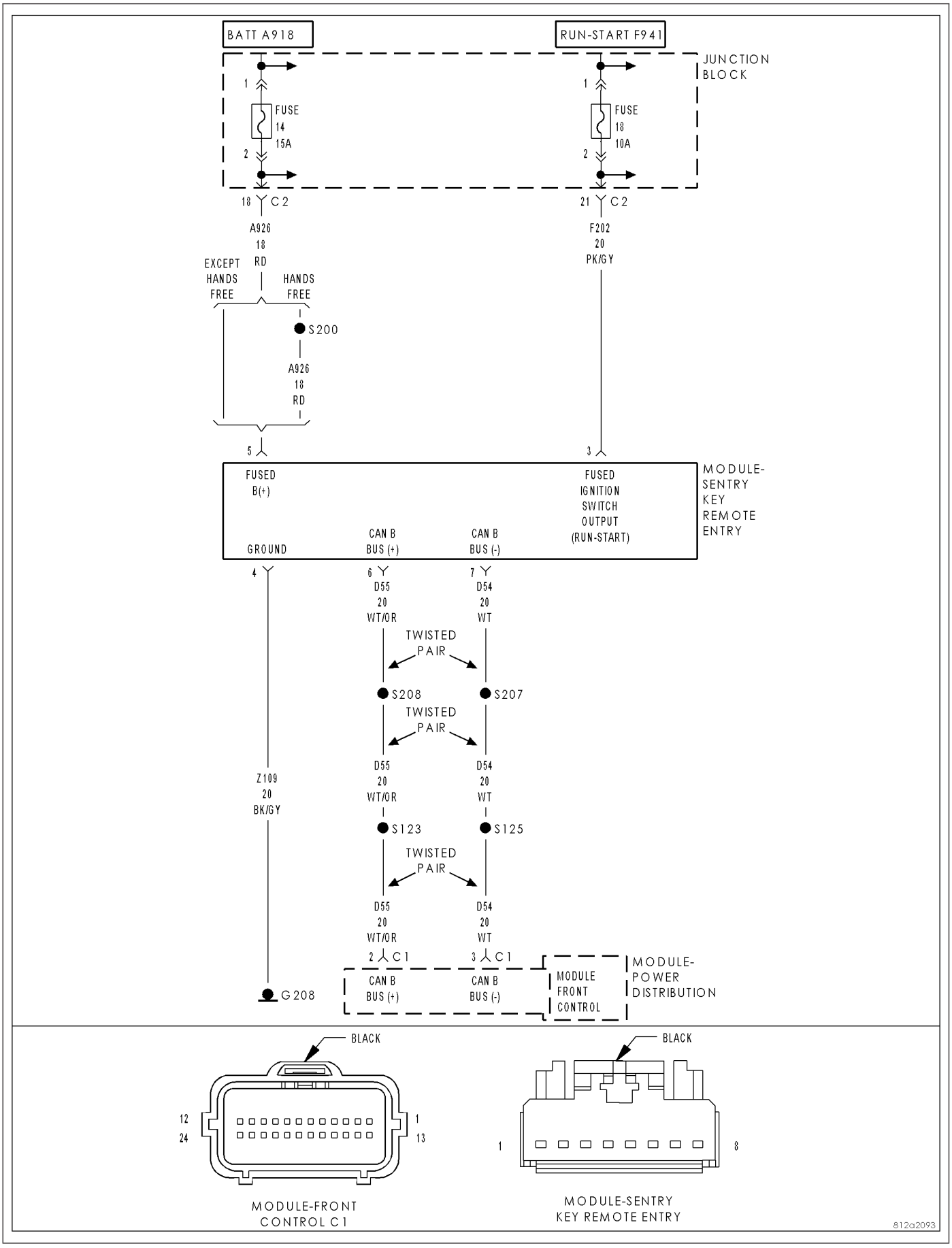
- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes >> Repair wiring harness/connectors as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

B1A2D-KEY 4 COMMUNICATION ERROR



B1A2D-KEY 4 COMMUNICATION ERROR (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When the SKREEM does not receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds.

Possible Causes
MULTIPLE KEY OPERATION
IGNITION KEY
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, read and record the SKREEM DTCs.

With the scan tool, erase the SKREEM DTCs

NOTE: Perform the following test several times to make sure the DTC is current.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes >> Go To 2

No >> Go To 6

---

2. CHECKING FOR MULTIPLE KEYS

Are there multiple vehicle ignition keys available?

Yes >> Go To 3

No >> Go To 4

B1A2D-KEY 4 COMMUNICATION ERROR (CONTINUED)

3. MULTIPLE KEY OPERATION

NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each of the other vehicle keys, one at a time.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Is the DTC present for all ignition keys?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Replace the ignition key(s) that cause the SKIM DTC. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. REPROGRAM KEY

With the scan tool, attempt to reprogram the ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Go To 5

No >> Test complete.

---

5. PROGRAM NEW IGNITION KEY

Replace the ignition key with a new key.

With the scan tool, program the new ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test complete.

B1A2D-KEY 4 COMMUNICATION ERROR (CONTINUED)

6. INTERMITTENT WIRING HARNESS PROBLEM

Turn the ignition off.

NOTE: Check the following items:

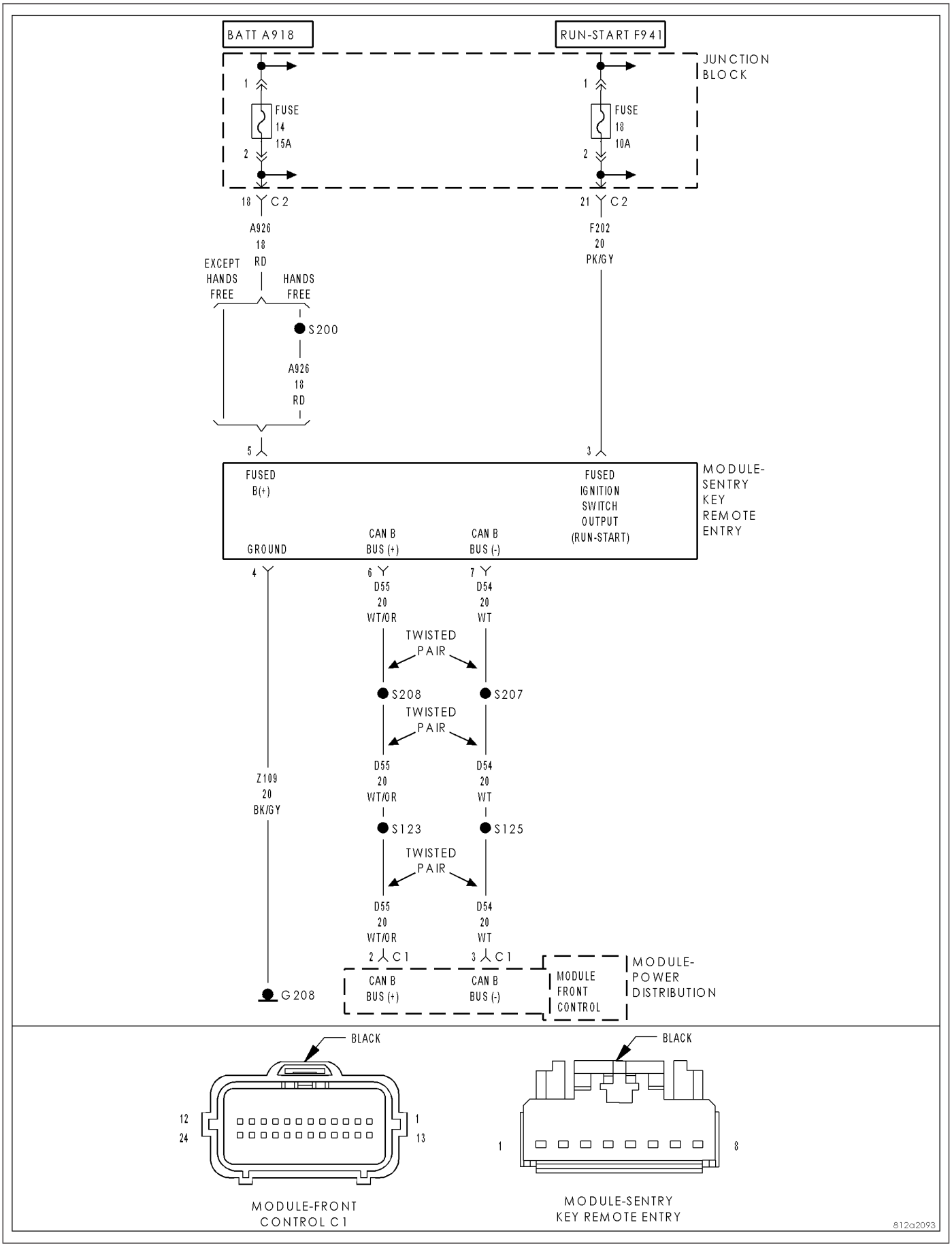
- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes >> Repair wiring harness/connectors as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

B1A2E-KEY 5 COMMUNICATION ERROR



B1A2E-KEY 5 COMMUNICATION ERROR (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When the SKREEM does not receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds.

Possible Causes
MULTIPLE KEY OPERATION
IGNITION KEY
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, read and record the SKREEM DTCs.

With the scan tool, erase the SKREEM DTCs

NOTE: Perform the following test several times to make sure the DTC is current.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes >> Go To 2

No >> Go To 6

---

2. CHECKING FOR MULTIPLE KEYS

Are there multiple vehicle ignition keys available?

Yes >> Go To 3

No >> Go To 4

B1A2E-KEY 5 COMMUNICATION ERROR (CONTINUED)

3. MULTIPLE KEY OPERATION

NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each of the other vehicle keys, one at a time.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Is the DTC present for all ignition keys?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Replace the ignition key(s) that cause the SKIM DTC. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. REPROGRAM KEY

With the scan tool, attempt to reprogram the ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test complete.

---

5. PROGRAM NEW IGNITION KEY

Replace the ignition key with a new key.

With the scan tool, program the new ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test complete.

B1A2E-KEY 5 COMMUNICATION ERROR (CONTINUED)

6. INTERMITTENT WIRING HARNESS PROBLEM

Turn the ignition off.

NOTE: Check the following items:

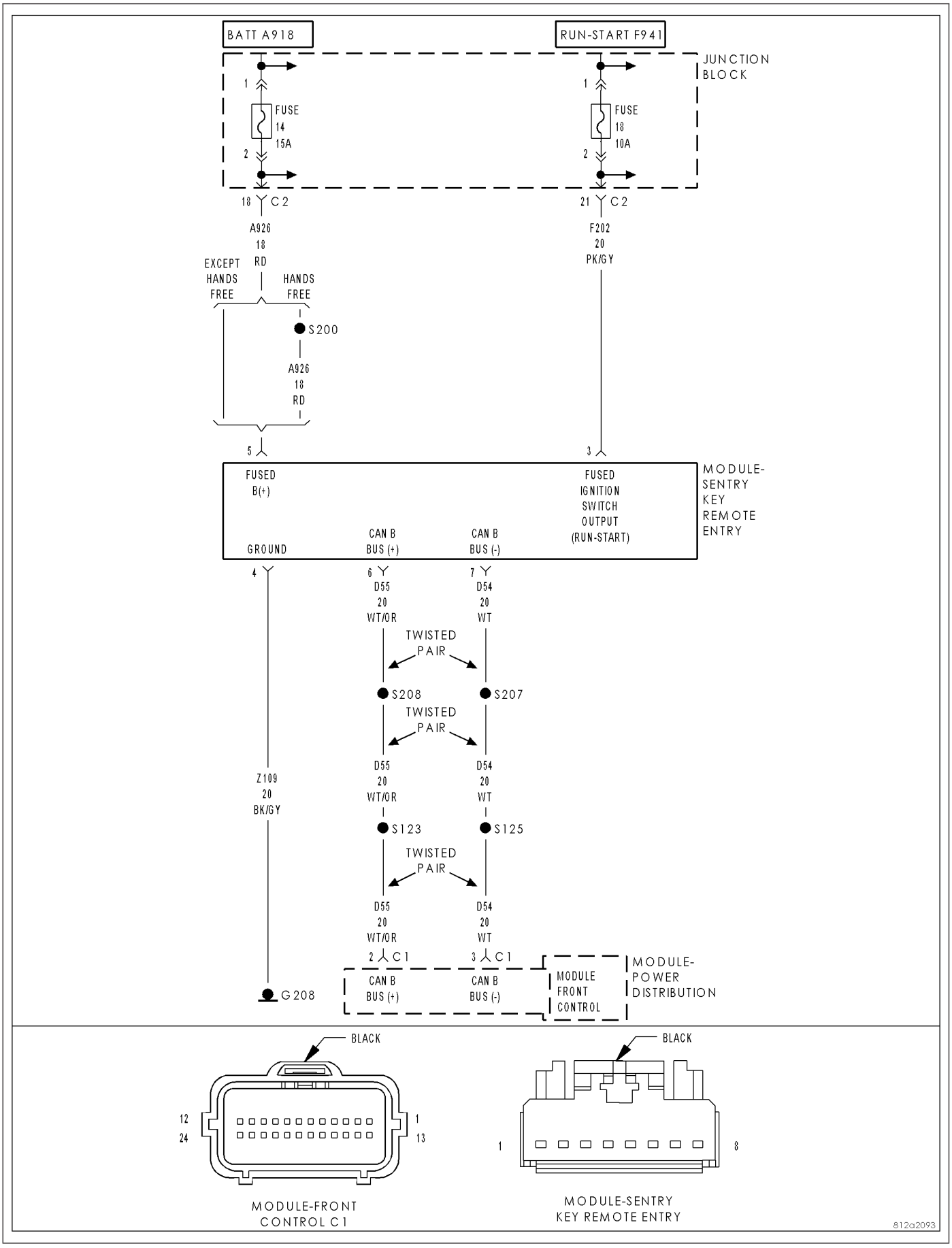
- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes >> Repair wiring harness/connectors as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

B1A2F-KEY 6 COMMUNICATION ERROR



B1A2F-KEY 6 COMMUNICATION ERROR (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When the SKREEM does not receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds.

Possible Causes
MULTIPLE KEY OPERATION
IGNITION KEY
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, read and record the SKREEM DTCs.

With the scan tool, erase the SKREEM DTCs

NOTE: Perform the following test several times to make sure the DTC is current.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes >> Go To 2

No >> Go To 6

---

2. CHECKING FOR MULTIPLE KEYS

Are there multiple vehicle ignition keys available?

Yes >> Go To 3

No >> Go To 4

B1A2F-KEY 6 COMMUNICATION ERROR (CONTINUED)

3. MULTIPLE KEY OPERATION

NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each of the other vehicle keys, one at a time.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Is the DTC present for all ignition keys?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Replace the ignition key(s) that cause the SKIM DTC. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. REPROGRAM KEY

With the scan tool, attempt to reprogram the ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Go To 5

No >> Test complete.

---

5. PROGRAM NEW IGNITION KEY

Replace the ignition key with a new key.

With the scan tool, program the new ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test complete.

B1A2F-KEY 6 COMMUNICATION ERROR (CONTINUED)

6. INTERMITTENT WIRING HARNESS PROBLEM

Turn the ignition off.

NOTE: Check the following items:

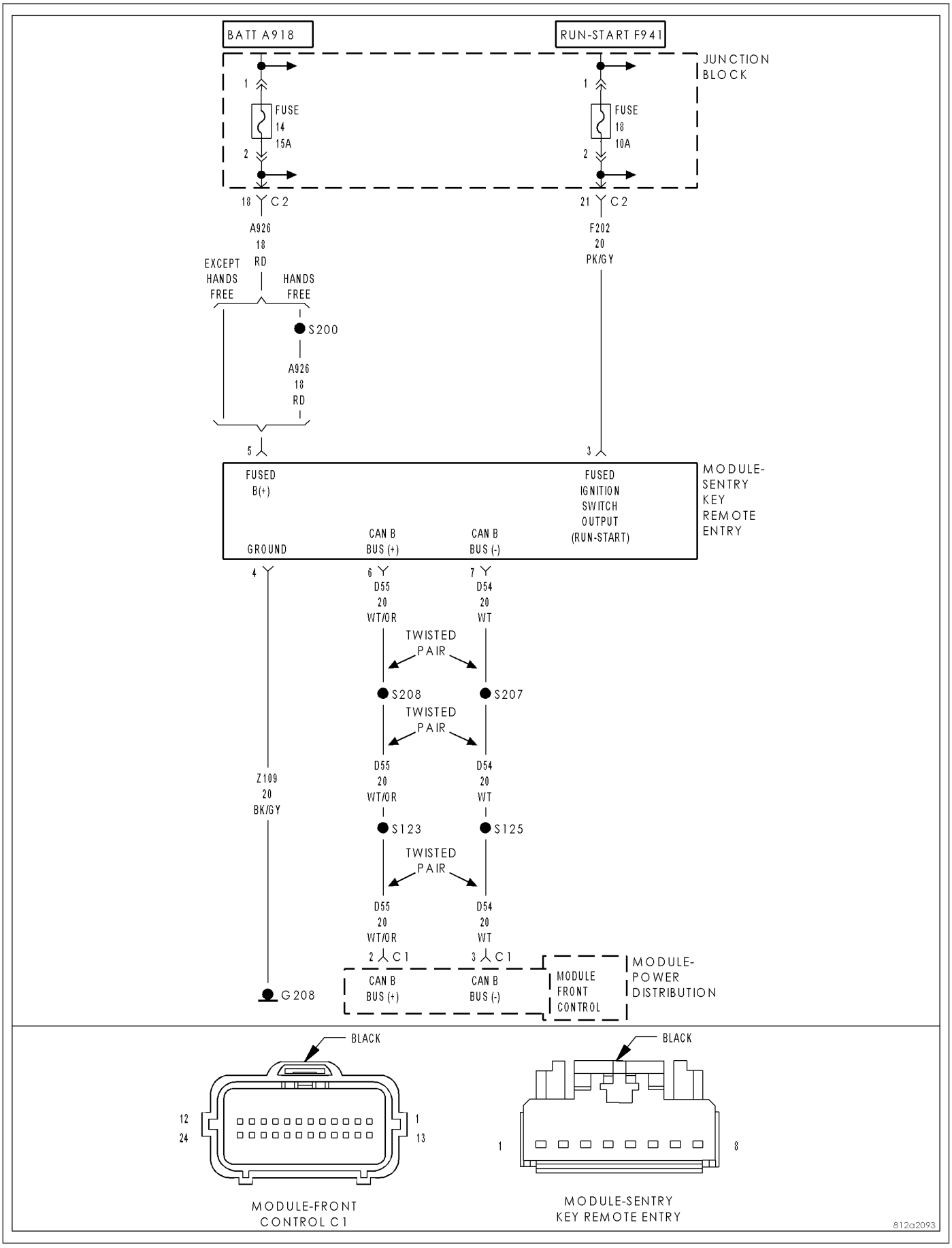
- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes >> Repair wiring harness/connectors as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

B1A30-KEY 7 COMMUNICATION ERROR



B1A30-KEY 7 COMMUNICATION ERROR (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When the SKREEM does not receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds.

Possible Causes
MULTIPLE KEY OPERATION
IGNITION KEY
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, read and record the SKREEM DTCs.
With the scan tool, erase the SKREEM DTCs

NOTE: Perform the following test several times to make sure the DTC is current.
Turn the ignition off.
Wait 10 seconds.
Turn the ignition on.
With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes >> Go To 2
No >> Go To 6

---

2. CHECKING FOR MULTIPLE KEYS

Are there multiple vehicle ignition keys available?

Yes >> Go To 3
No >> Go To 4

B1A30-KEY 7 COMMUNICATION ERROR (CONTINUED)

3. MULTIPLE KEY OPERATION

NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each of the other vehicle keys one at a time.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Is the DTC present for all ignition keys?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Replace the ignition key(s) that cause the SKIM DTC. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. REPROGRAM KEY

With the scan tool, attempt to reprogram the ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Go To 5

No >> Test complete.

---

5. PROGRAM NEW IGNITION KEY

Replace the ignition key with a new key.

With the scan tool, program the new ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test complete.

B1A30-KEY 7 COMMUNICATION ERROR (CONTINUED)

6. INTERMITTENT WIRING HARNESS PROBLEM

Turn the ignition off.

NOTE: Check the following items:

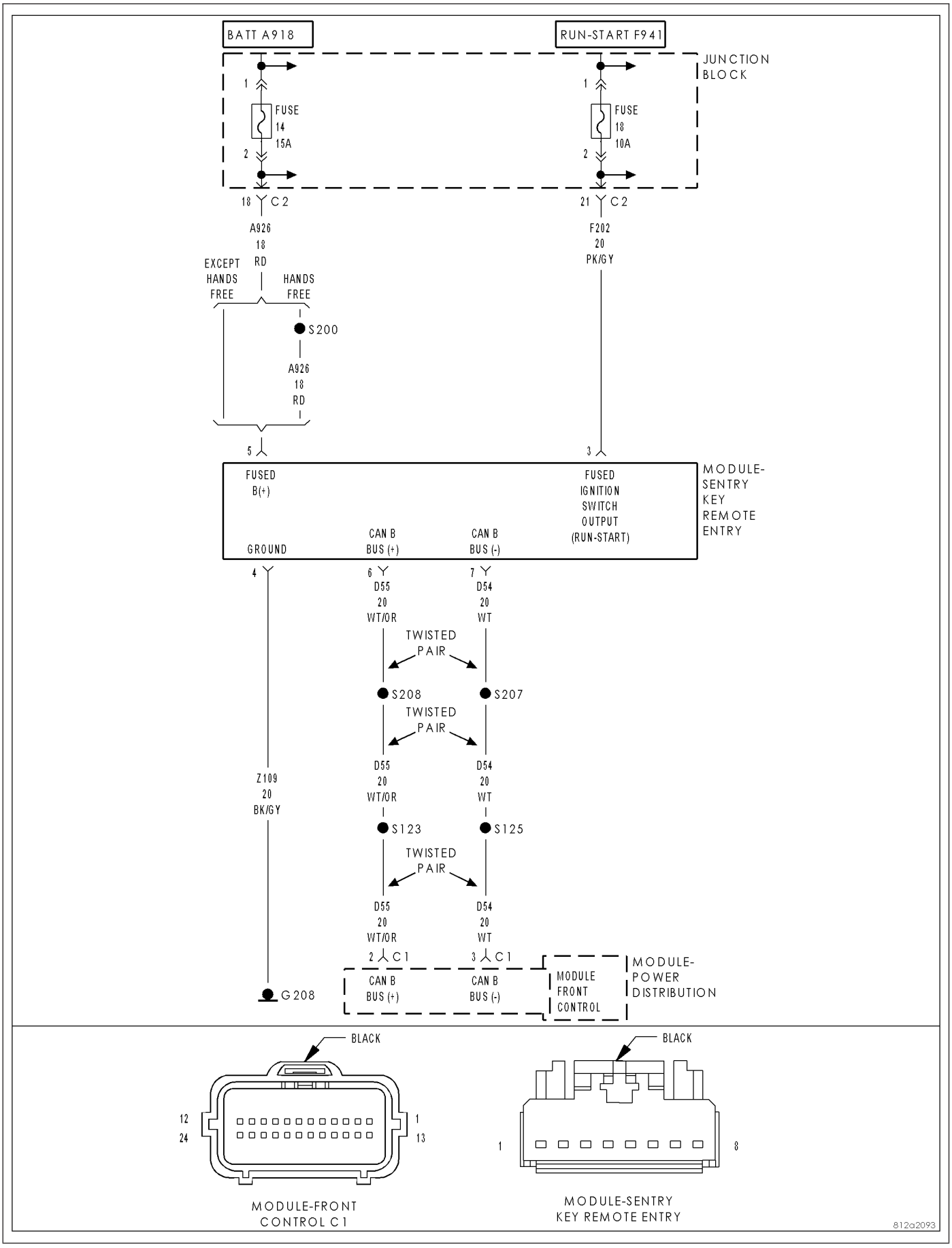
- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes >> Repair wiring harness/connectors as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

B1A31-KEY 8 COMMUNICATION ERROR



B1A31-KEY 8 COMMUNICATION ERROR (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When the SKREEM does not receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds.

Possible Causes
MULTIPLE KEY OPERATION
IGNITION KEY
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, read and record the SKREEM DTCs.

With the scan tool, erase the SKREEM DTCs

NOTE: Perform the following test several times to make sure the DTC is current.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes >> Go To 2

No >> Go To 6

---

2. CHECKING FOR MULTIPLE KEYS

Are there multiple vehicle ignition keys available?

Yes >> Go To 3

No >> Go To 4

B1A31-KEY 8 COMMUNICATION ERROR (CONTINUED)

3. MULTIPLE KEY OPERATION

NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each of the other vehicle keys, one at a time.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Is the DTC present for all ignition keys?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Replace the ignition key(s) that cause the SKIM DTC. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. REPROGRAM KEY

With the scan tool, attempt to reprogram the ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Go To 5

No >> Test complete.

---

5. PROGRAM NEW IGNITION KEY

Replace the ignition key with a new key.

With the scan tool, program the new ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test complete.

B1A31-KEY 8 COMMUNICATION ERROR (CONTINUED)

6. INTERMITTENT WIRING HARNESS PROBLEM

Turn the ignition off.

NOTE: Check the following items:

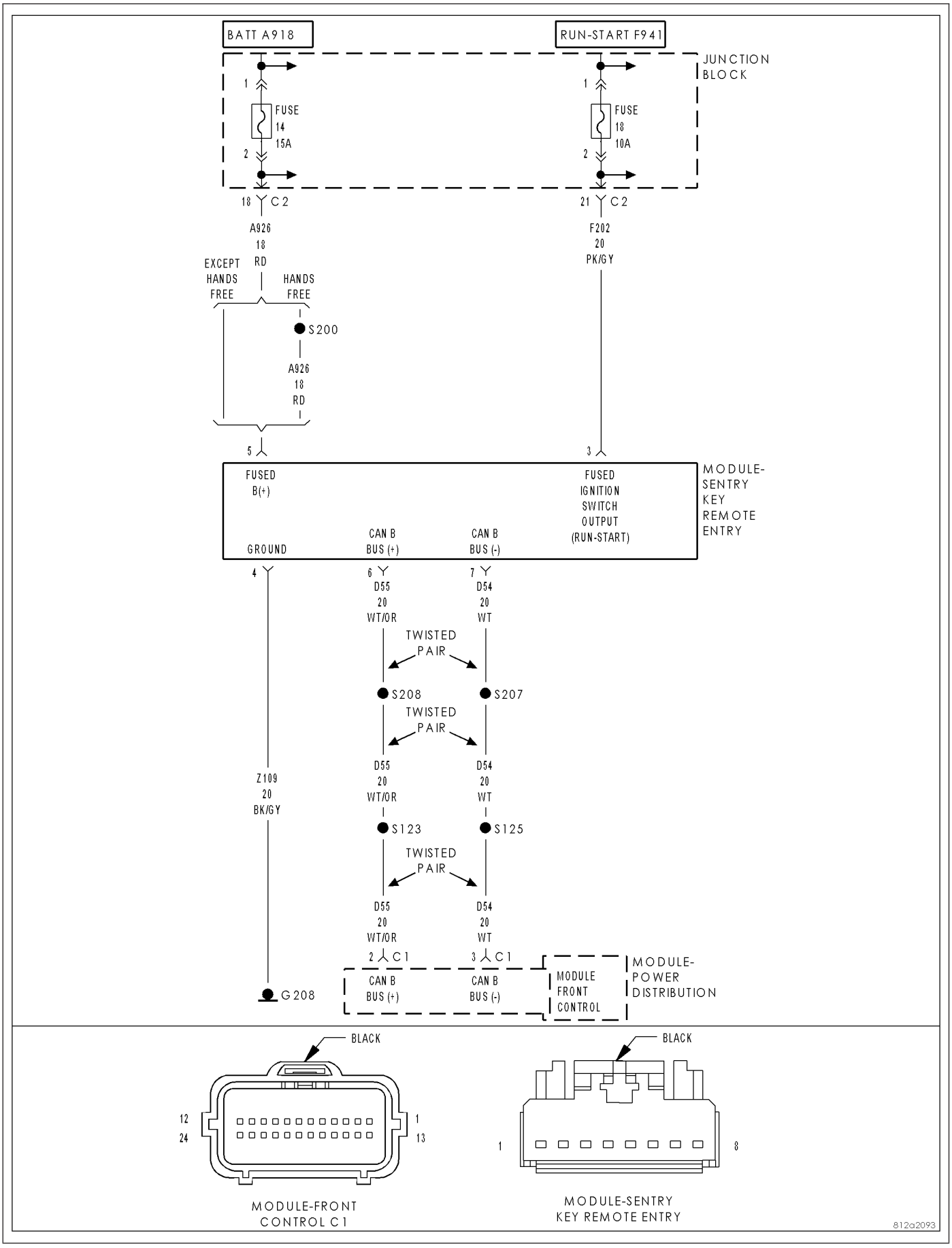
- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes >> Repair wiring harness/connectors as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

B1A35-UNIDENTIFIED KEY COMMUNICATION ERROR



B1A35-UNIDENTIFIED KEY COMMUNICATION ERROR (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When the SKREEM does not receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds.

Possible Causes
MULTIPLE KEY OPERATION
IGNITION KEY
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, read and record the SKREEM DTCs.

With the scan tool, erase the SKREEM DTCs

NOTE: Perform the following test several times to make sure the DTC is current.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes >> Go To 2

No >> Go To 6

---

2. CHECKING FOR MULTIPLE KEYS

Are there multiple vehicle ignition keys available?

Yes >> Go To 3

No >> Go To 4

B1A35-UNIDENTIFIED KEY COMMUNICATION ERROR (CONTINUED)

3. MULTIPLE KEY OPERATION

NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each of the other vehicle keys, one at a time.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Is the DTC present for all ignition keys?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Replace the ignition key(s) that cause the SKIM DTC. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. REPROGRAM KEY

With the scan tool, attempt to reprogram the ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Go To 5

No >> Test complete.

---

5. PROGRAM NEW IGNITION KEY

Replace the ignition key with a new key.

With the scan tool, program the new ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes >> Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information. Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test complete.

B1A35-UNIDENTIFIED KEY COMMUNICATION ERROR (CONTINUED)

6. INTERMITTENT WIRING HARNESS PROBLEM

Turn the ignition off.

NOTE: Check the following items:

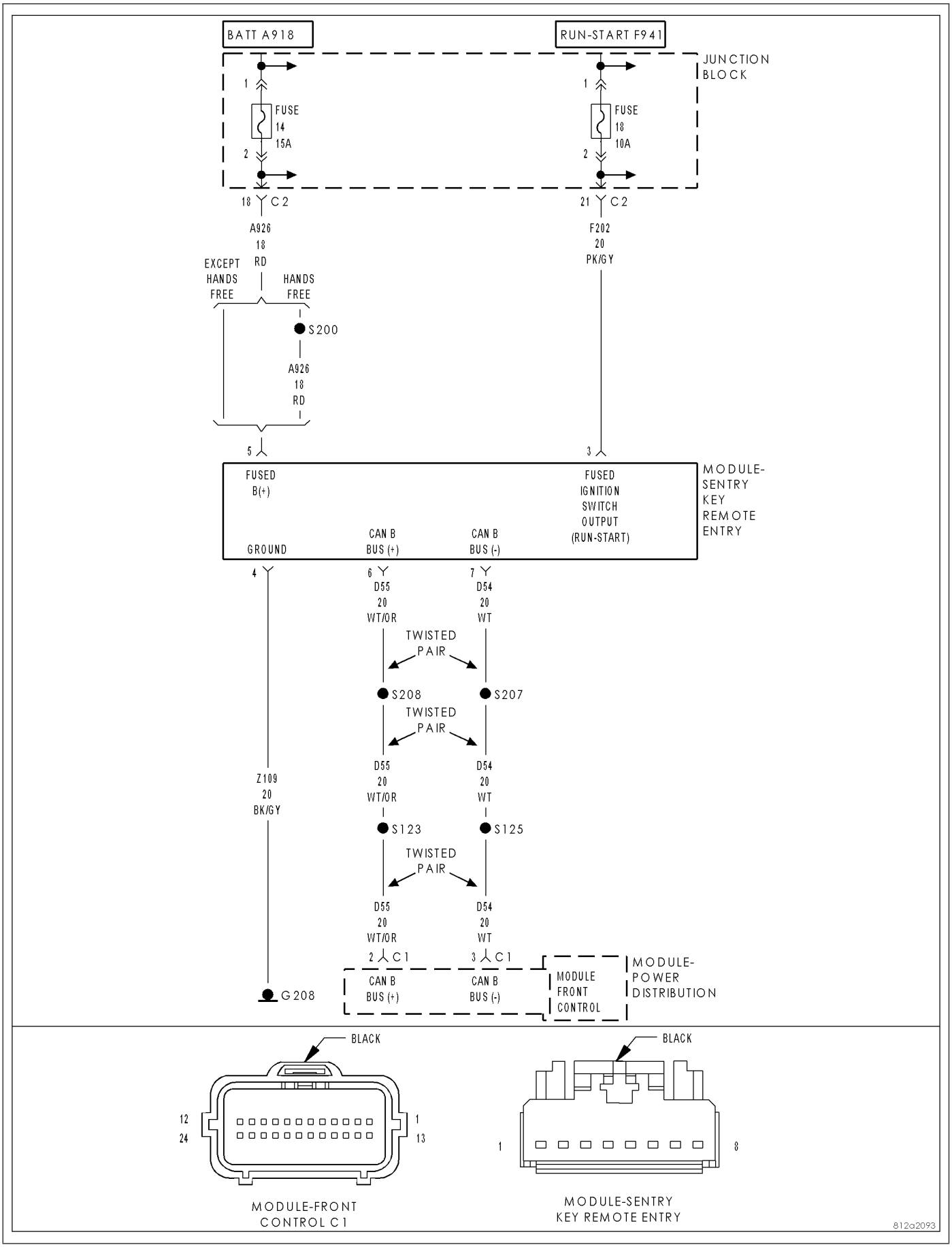
- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes >> Repair wiring harness/connectors as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

B2101-IGNITION RUN/START INPUT LOW



B2101-IGNITION RUN/START INPUT LOW (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition switch on.
- **Set Condition:**
  The SKREEM has detected the ignition switch input voltage below a calibrated value.

Possible Causes
FUSED IGNTION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

NOTE: Diagnose any related Powertrain DTC(s) before continuing.

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

Using the scan tool, read DTC(s).

Does the DTC reset?

Yes >> Go To 3

No >> Go to 2

---

2. INTERMITTENT CONDITION

NOTE: Check for any of the follow conditions:

- **Poor wire to terminal connection**
- **Corroded terminals**
- **Backed out or loose terminals**
- **Broken wire internal to the insulation**
- **Dirty (partial) module ground**

With the ignition on, wiggle the related wires.

Using a scan tool, read DTC(s).

Does the DTC reset?

Yes >> Repair the wiring as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> DTC is not active at this time. Test complete.

B2101-IGNITION RUN/START INPUT LOW (CONTINUED)

3. FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPENED

NOTE: Check the related fuses to the Fused Ignition Switch Output (Run-Start) circuit. If the fuse is found to be open, repair the circuit for a shorted condition.

Turn the ignition off.

Disconnect the SKREEM harness connector.

Turn the ignition on.

Using a 12 volt test light connected to ground, probe the Fused Ignition Switch Output (Run-Start) circuit in the SKREEM harness connector.

Does the test light illuminate brightly?

Yes >> Go to 4

No >> Repair the Fused Ignition Switch Output (Run-Start) circuit for an open.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. SKREEM

NOTE: A dirty (partial) ground can cause abnormal conditions within a system. Ensure the module has a good ground before continuing.

Turn the ignition off.

Reconnect the SKREEM connector

Back probe the Fused Ignition Switch Output (Run-Start) circuit.

Start the engine.

Using the scan tool, view battery voltage under Data Display in the Engine category.

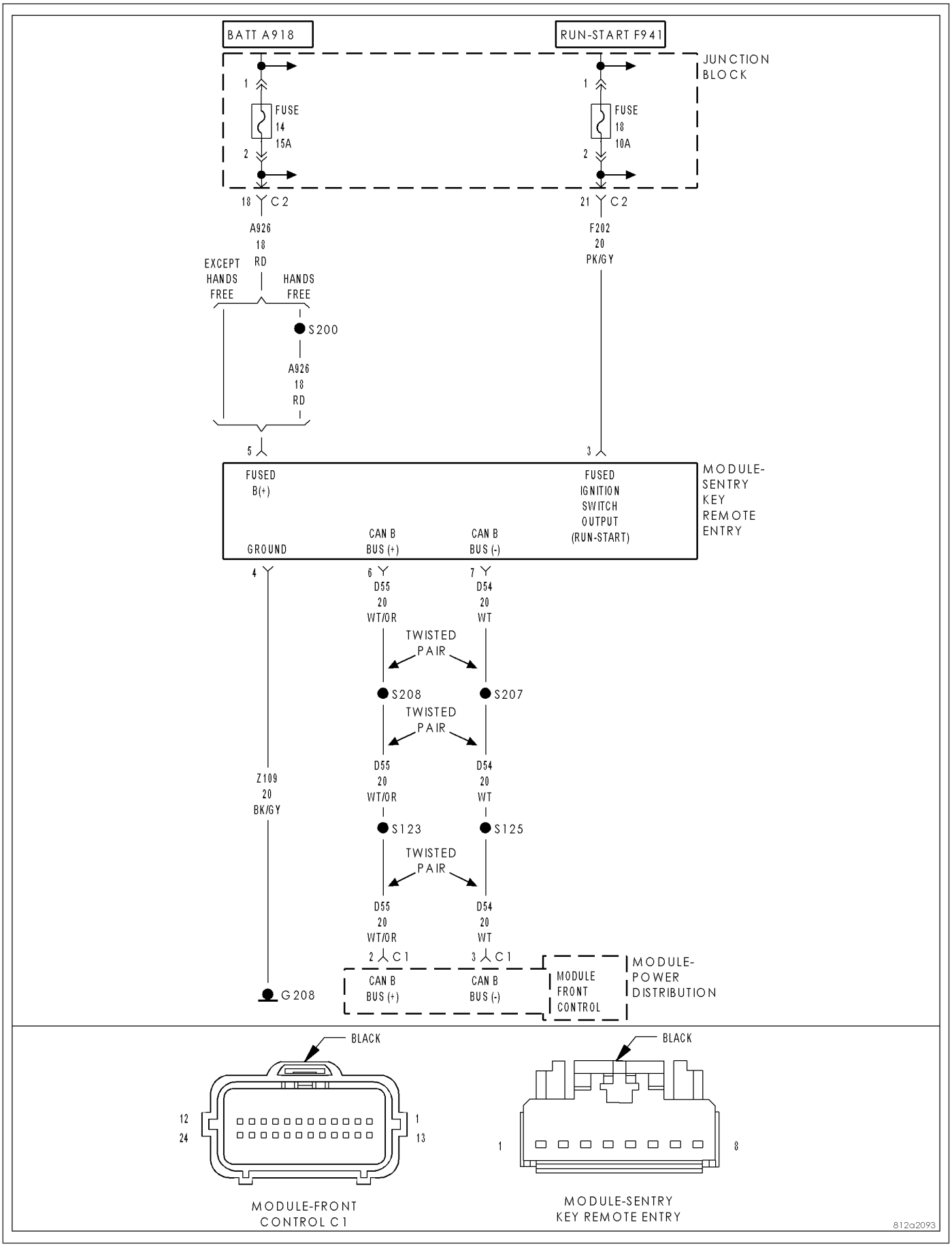
Compare the voltage on the scan tool to the voltage reading on the voltmeter.

Is the voltage on the scan tool equal to the voltmeter reading +/- .5 volt?

Yes >> Replace and program the SKREEM in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Repair the Fused Ignition Switch Output (Run-Start) circuit for high resistance.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

B2102-IGNITION RUN/START INPUT HIGH



B2102-IGNITION RUN/START INPUT HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition switch on.
- **Set Condition:**
  The SKREEM has detected the ignition switch input voltage above a calibrated value.

Possible Causes
FUSED IGNTION SWITCH OUTPUT (RUN-START) CIRCUIT
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

NOTE: Diagnose any related Powertrain DTC(s) before continuing.

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

Using the scan tool, read DTC(s).

Does the DTC reset?

Yes >> Go To 3

No >> Go to 2

---

2. INTERMITTENT CONDITION

NOTE: Check for any of the follow conditions:

- **Poor wire to terminal connection**
- **Corroded terminals**
- **Backed out or loose terminals**
- **Broken wire internal to the insulation**
- **Dirty (partial) module ground**

With the ignition on, wiggle the related wires.

Using a scan tool, read DTC(s).

Does the DTC reset?

Yes >> Repair the wiring as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> DTC is not active at this time. Test complete.

B2102-IGNITION RUN/START INPUT HIGH (CONTINUED)

3. FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT SHORTED TO BATTERY VOLTAGE

NOTE: A dirty (partial) ground can cause abnormal conditions within a system. Ensure the module has a good ground before continuing.

Turn the ignition off.

Disconnect the SKREEM harness connector.

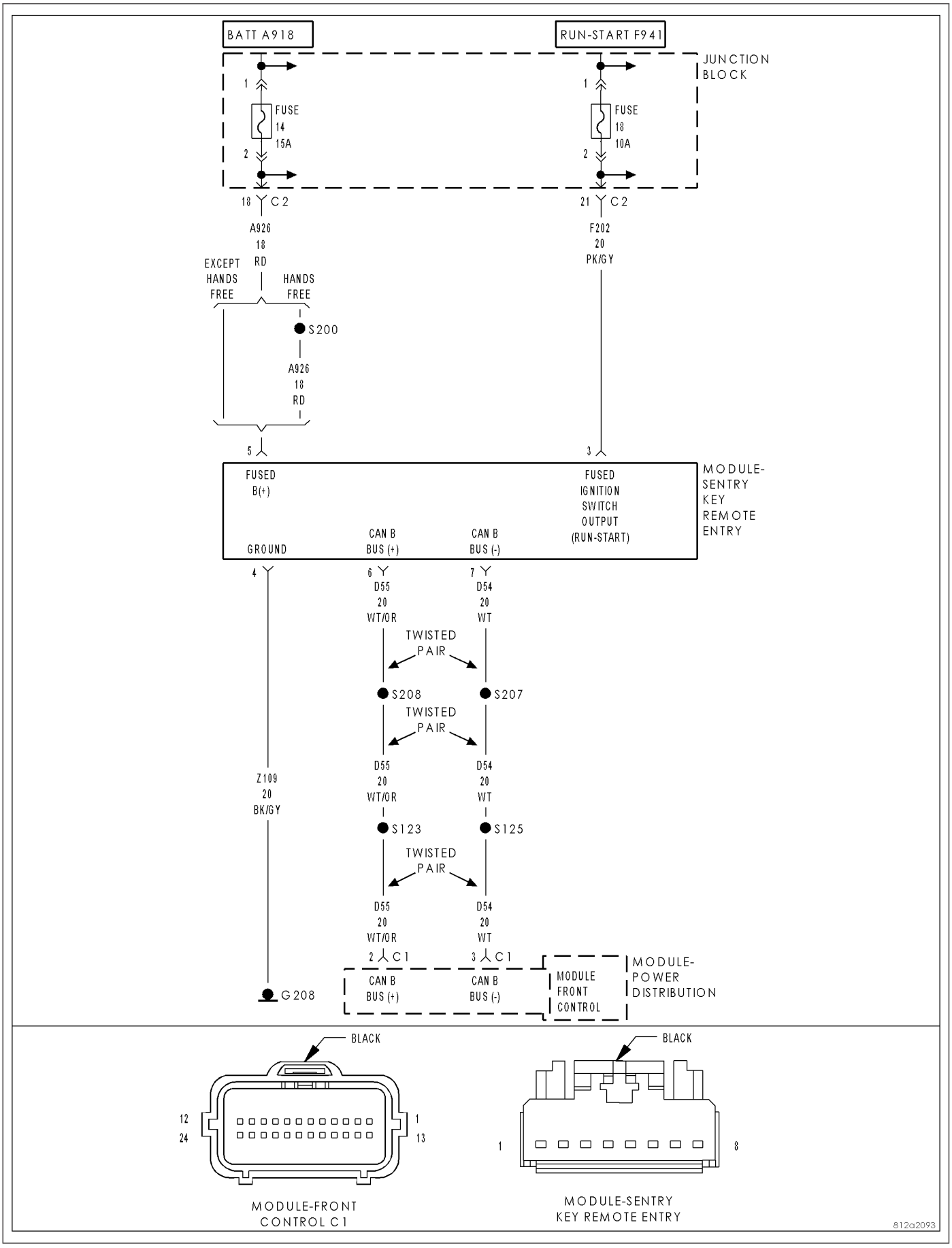
Using a 12 volt test light connected to ground, probe the Fused Ignition Switch Output (Run-Start) circuit in the SKREEM harness connector.

Does the test light illuminate brightly?

Yes >> Repair the Fused Ignition Switch Output (Run-Start) circuit for a short to voltage.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Replace and program the SKREEM in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

B210A-SYSTEM VOLTAGE LOW



B210A-SYSTEM VOLTAGE LOW (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition switch on.
- **Set Condition:**
  The SKREEM has detected the system voltage is below a calibrated value.

Possible Causes
FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN
FUSED (B+) CIRCUIT OPEN
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

NOTE: Diagnose any related Powertrain DTC(s) before continuing.
With a scan tool, read and record DTC(s).
With the scan tool, clear DTC(s).
Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.
Using the scan tool, read DTC(s).

Does the DTC reset?

Yes >> Go To 3

No >> Go to 2

---

2. INTERMITTENT CONDITION

NOTE: Check for any of the follow conditions:
- **Poor wire to terminal connection**
- **Corroded terminals**
- **Backed out or loose terminals**
- **Broken wire internal to the insulation**
- **Dirty (partial) module ground**

With the ignition on, wiggle the related wires.
Using a scan tool, read DTC(s).

Does the DTC reset?

Yes >> Repair the wiring as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> DTC is not active at this time. Test complete.

B210A-SYSTEM VOLTAGE LOW (CONTINUED)

3. FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN

NOTE: Check the related fuses to the Fused Ignition Switch Output (Run-Start) circuit. If the fuse is found to be open repair the circuit for a shorted condition.

Turn the ignition off.

Disconnect the SKREEM harness connector.

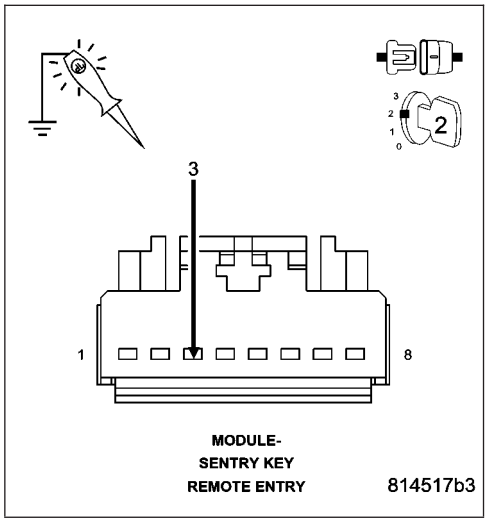
Turn the ignition on.

Using a 12 volt test light connected to ground, probe the Fused Ignition Switch Output (Run-Start) circuit in the SKREEM harness connector.

Does the test light illuminate brightly?

Yes >> Go to 4

No >> Repair the Fused Ignition Switch Output (Run-Start) circuit for an open.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)



4. FUSED (B+) CIRCUIT OPEN

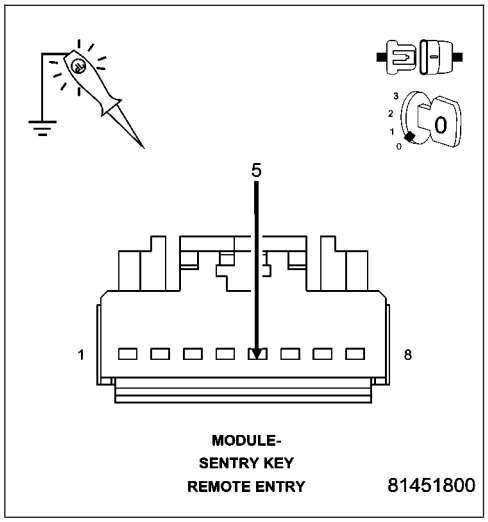
Turn the ignition off.

Using a 12 volt test light connected to ground, probe the Fused (B+) circuit in the SKREEM harness connector.

Does the test light illuminate brightly?

Yes >> Go to 5

No >> Repair the Fused (B+) circuit for an open.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)



B210A-SYSTEM VOLTAGE LOW (CONTINUED)

5. **SKREEM**

NOTE: Repeat the below procedure for both the Fused Ignition Switch Output (Run-Start) circuit and the Fused (B+) circuit.

NOTE: A dirty (partial) ground can cause abnormal conditions within a system. Make sure the module has a good ground before continuing.

Turn the ignition off.

Reconnect the SKREEM connector.

Back probe the Fused Ignition Switch Output (Run-Start) circuit and then the Fused (B+) circuit.

Start the engine.

Using the scan tool, view battery voltage under Data Display in the Engine category.

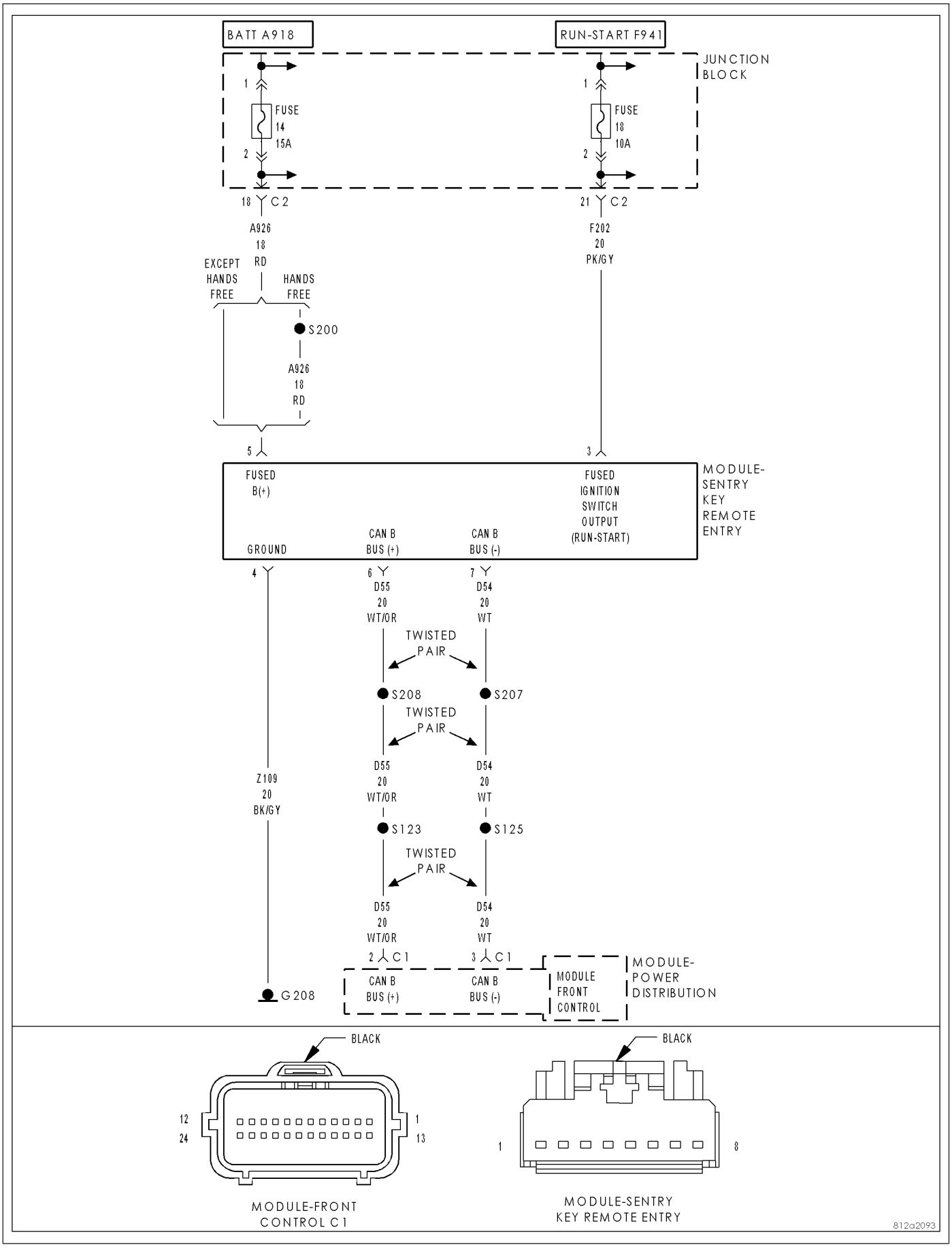
Compare the voltage on the scan tool to the voltage reading on the voltmeter.

Is the voltage on the scan tool equal to the voltmeter reading +/- .5 volt?

Yes >> Replace and program the SKREEM in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Repair the circuit(s) that indicated the incorrect voltage.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

B210D-SYSTEM VOLTAGE HIGH



B210D-SYSTEM VOLTAGE HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition switch on.
- **Set Condition:**
  The SKREEM has detected the system voltage above a calibrated value.

Possible Causes
FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

NOTE: Diagnose any related Powertrain DTC(s) before continuing.

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

Using the scan tool, read DTC(s).

Does the DTC reset?

Yes >> Go To 3

No >> Go to 2

---

2. INTERMITTENT CONDITION

NOTE: Check for any of the follow conditions:

- **Poor wire to terminal connection**
- **Corroded terminals**
- **Backed out or loose terminals**
- **Broken wire internal to the insulation**
- **Dirty (partial) module ground**

With the ignition on, wiggle the related wires.

Using a scan tool, read DTC(s).

Does the DTC reset?

Yes >> Repair the wiring as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> DTC is not active at this time. Test complete.

B210D-SYSTEM VOLTAGE HIGH (CONTINUED)

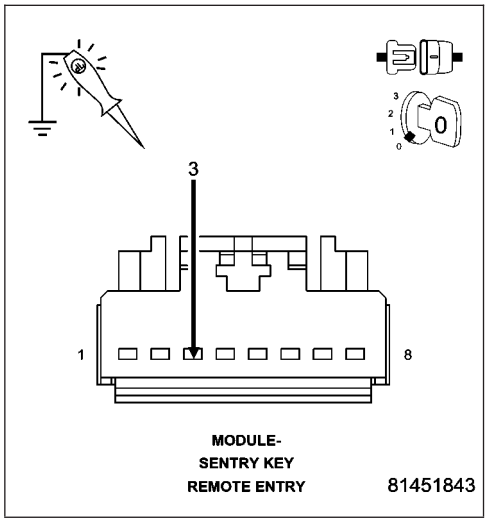
3. FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT SHORTED TO BATTERY VOLTAGE

NOTE: A dirty (partial) ground can cause abnormal conditions within a system. Make sure the module has a good ground before continuing.

Turn the ignition off.

Disconnect the SKREEM harness connector.

Using a 12 volt test light connected to ground, probe the Fused Ignition Switch Output (Run-Start) circuit in the SKREEM harness connector.



Does the test light illuminate brightly?

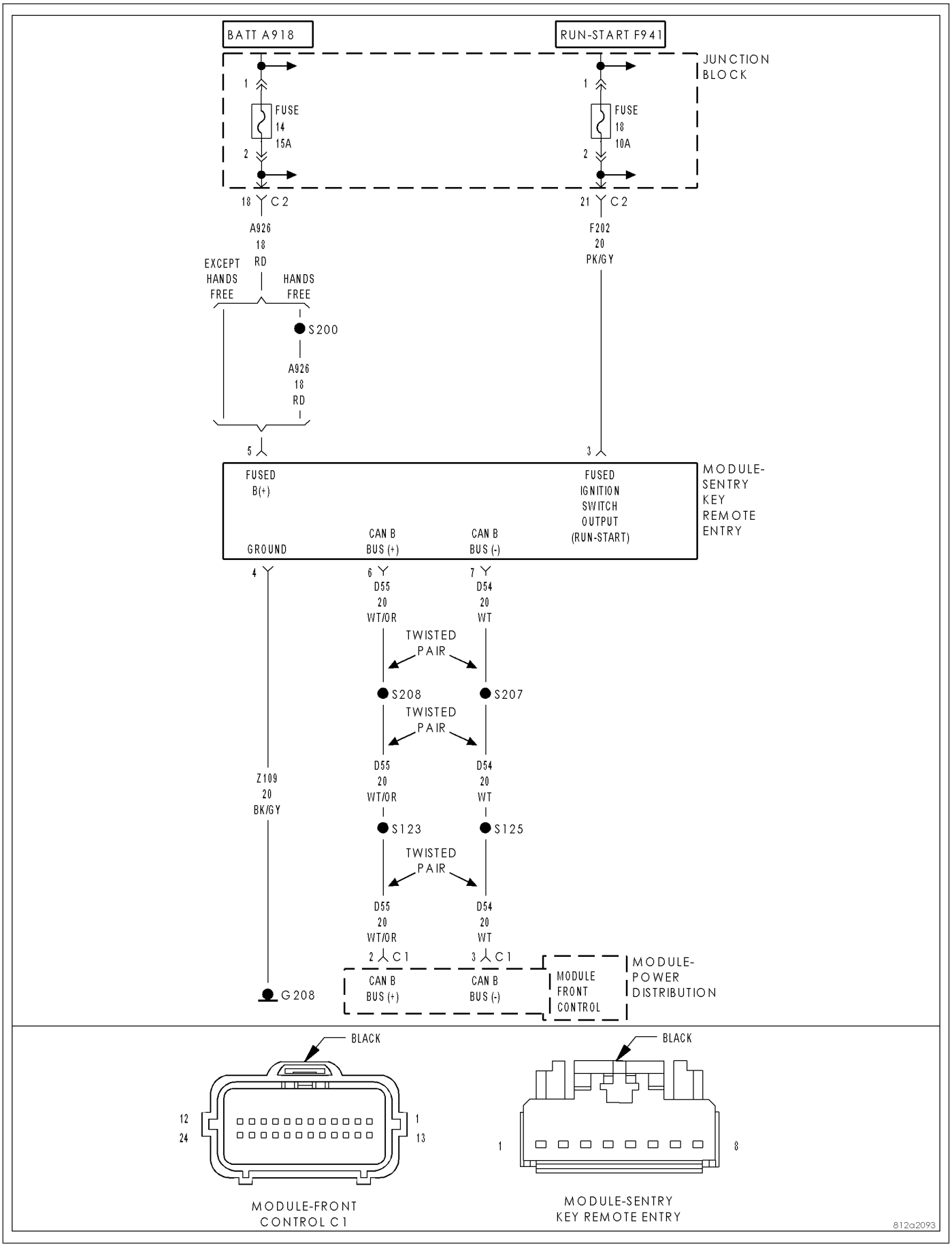
Yes >> Repair the Fused Ignition Switch Output (Run-Start) circuit for a short to voltage.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Replace and reprogram the SKREEM in accordance with the Service Information.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

B210D-BATTERY VOLTAGE LOW



B210D-BATTERY VOLTAGE LOW (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition switch on.
- **Set Condition:**
  The SKREEM has detected the Fused (B+) input voltage below a calibrated value.

Possible Causes
FUSED (B+) CIRCUIT OPEN
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

NOTE: Diagnose any related Powertrain DTC(s) before continuing.

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

Using the scan tool, read DTC(s).

Does the DTC reset?

Yes >> Go To 3

No >> Go to 2

---

2. INTERMITTENT CONDITION

NOTE: Check for any of the follow conditions:

- **Poor wire to terminal connection**
- **Corroded terminals**
- **Backed out or loose terminals**
- **Broken wire internal to the insulation**
- **Dirty (partial) module ground**
- **Dirty (partial) module ground**

With the ignition on, wiggle the related wires.

Using a scan tool, read DTC(s).

Does the DTC reset?

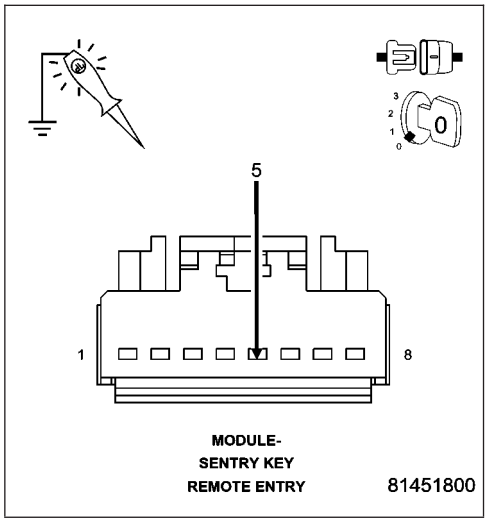
Yes >> Repair the wiring as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> DTC is not active at this time. Test complete.

B210D-BATTERY VOLTAGE LOW (CONTINUED)

3. FUSED (B+) CIRCUIT OPEN

NOTE: Check the related fuses to the Fused (B+) circuit. If the fuse is found to be open repair the circuit for a shorted condition.
Turn the ignition off.
Disconnect the SKREEM harness connector.
Turn the ignition on.
Using a 12 volt test light connected to ground, probe the Fused (B+) circuit in the SKREEM harness connector.



Does the test light illuminate brightly?

Yes >> Go to 4

No >> Repair the Fused (B+) circuit for an open.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

4. SKREEM

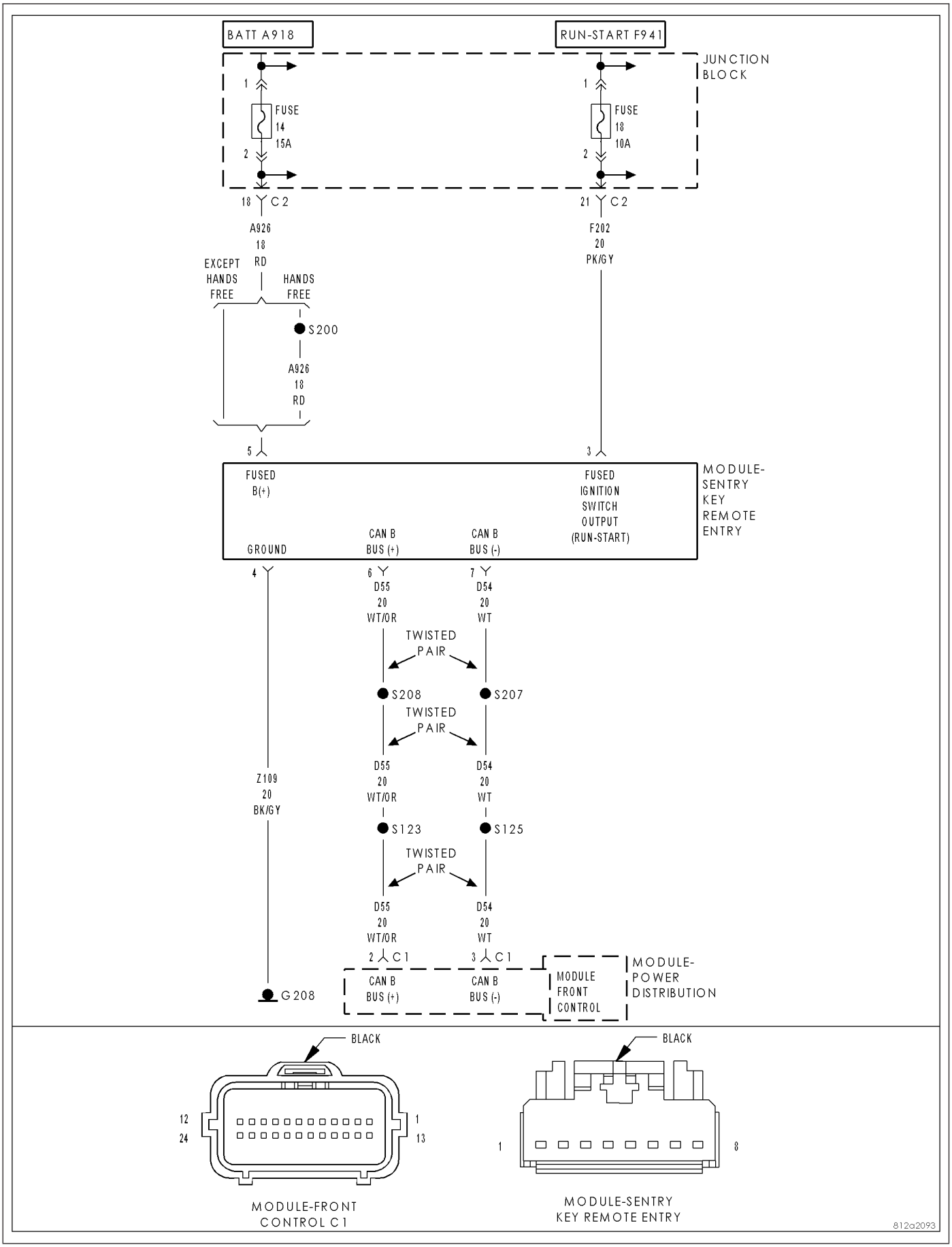
NOTE: A dirty (partial) ground can cause abnormal conditions within a system. Make sure the module has a good ground before continuing.
Turn the ignition off.
Reconnect the SKREEM connector
Back probe the Fused (B+) circuit.
Start the engine.
Using the scan tool, view battery voltage under Data Display in the Engine category.
Compare the voltage on the scan tool to the voltage reading on the voltmeter.

Is the voltage on the scan tool equal to the voltmeter reading +/- .5 volt?

Yes >> Replace and program the SKREEM in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Repair the Fused (B+) circuit for high resistances.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

B210E-BATTERY VOLTAGE HIGH



B210E-BATTERY VOLTAGE HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition switch on.
- **Set Condition:**
  The SKREEM has detected the Fused (B+) input voltage above a calibrated value.

Possible Causes
FUSED (B+) CIRCUIT
SKREEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

NOTE: Diagnose any related Powertrain DTC(s) before continuing.

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

Using the scan tool, read DTC(s).

Does the DTC reset?

Yes >> Go To 3

No >> Go to 2

---

2. INTERMITTENT CONDITION

NOTE: Check for any of the follow conditions:

- **Poor wire to terminal connection**
- **Corroded terminals**
- **Backed out or loose terminals**
- **Broken wire internal to the insulation**
- **Dirty (partial) module ground**

With the ignition on, wiggle the related wires.

Using a scan tool, read DTC(s).

Does the DTC reset?

Yes >> Repair the wiring as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> DTC is not active at this time. Test complete.

B210E-BATTERY VOLTAGE HIGH (CONTINUED)

3. SKREEM

NOTE: A dirty (partial) ground can cause abnormal conditions with a system. Make sure the module has a good ground before continuing.

Turn the ignition off.

Back probe the Fused (B+) circuit in the SKREEM harness connector.

Start the engine.

Using a scan tool, view the battery voltage under Data Display in the Engine category.

Compare the voltage on the scan tool to the voltage reading on the voltmeter.

Is the voltage on the scan tool equal to the voltmeter reading +/- .5 volt?

Yes >> Replace and program the SKREEM in accordance with the Service Information.Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Repair the Fused (B+) circuit.Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

B2204-ECU CONFIGURATION MISMATCH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition switch on.

Possible Causes
SKREEM

Diagnostic Test

1. SKREEM

NOTE: Before continuing review and check the following conditions.
- **Review the repair history of the vehicle. Ensure the vehicle has the correct PCM and SKREEM installed. Check the part numbers.**
- **Using a scan tool, ensure the PCM and SKREEM have been programmed correctly. Compare the PCM VIN to the SKREEM VIN and ensure the two VINS match.**

Turn the ignition on.

With the scan tool, clear DTC(s).

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

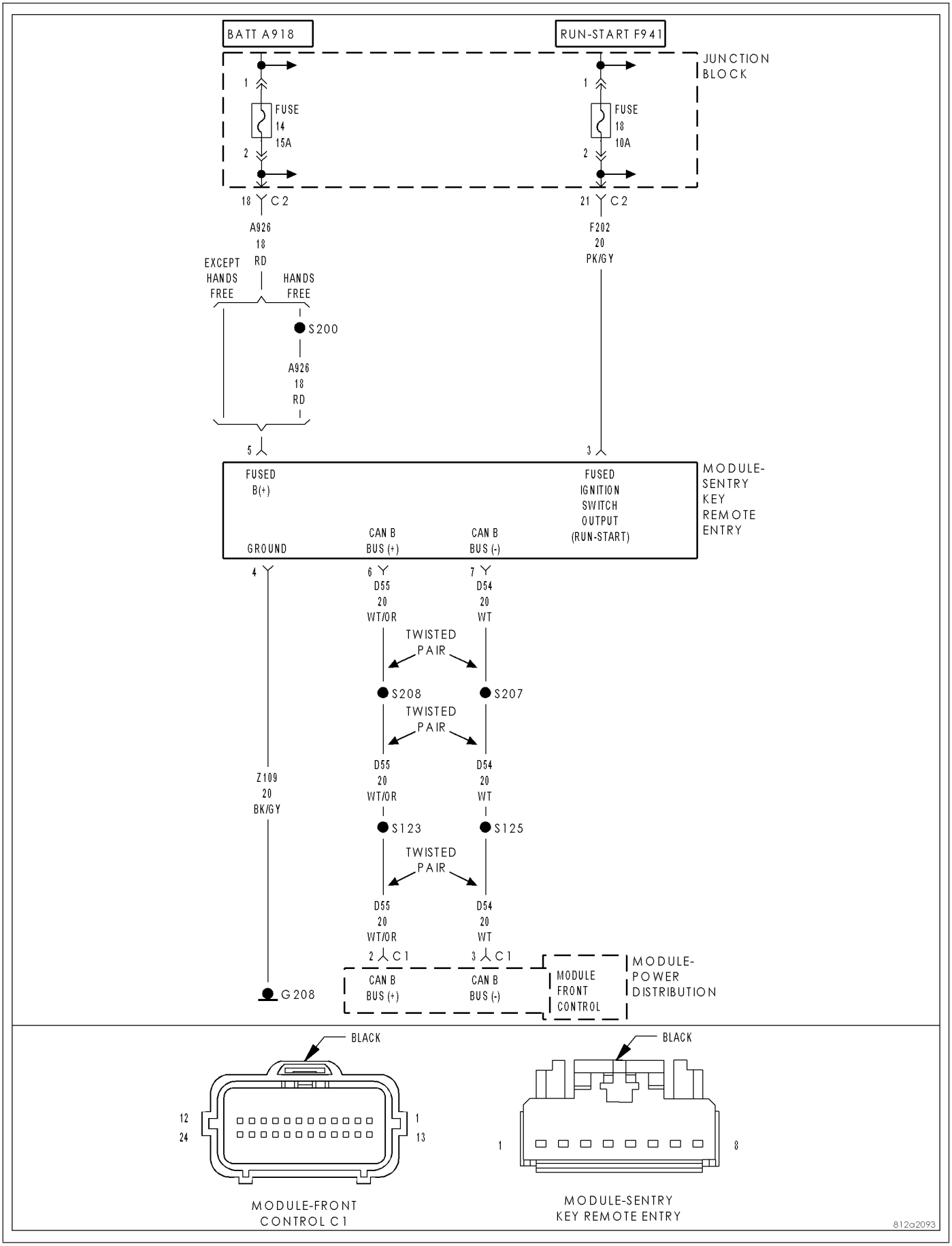
Using the scan tool, read DTC(s).

Does the DTC reset?

Yes >> Replace and program the SKREEM in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> The DTC is not active at this time. Test complete.

B2205-ORIGINAL VIN MISSING/MISMATCH



B2205-ORIGINAL VIN MISSING/MISMATCH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on, after ignition on during any rolling code handshake that occurs with the PCM due to a SKIM or PCM reset.
- **Set Condition:**
  When a PCM STATUS message with a Valid Key status is not received by the SKIM within 3.5 seconds of transmitting the last Valid Key Code message to the PCM.

Possible Causes
VERIFYING PCM VIN
REPLACE SKREEM AND CHECK DTC'S
PCM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, erase the SKREEM DTCs.
Turn the ignition off.
Wait 10 seconds.
Turn the ignition on and wait 2 minutes.
With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes >> Go To 2

No >> Go To 4

---

2. VERIFYING THE PCM VIN

Turn the ignition on.
With the scan tool, select Engine system from the main menu.
Display and record the Vehicle Identification Number.

NOTE: Make sure that a VIN has been programmed into the PCM. If a VIN is not displayed, attempt to program the PCM with the correct VIN before continuing.

Does the VIN recorded from the PCM match the VIN of the vehicle?

Yes >> Go To 3

No >> Perform the PCM replaced to update the VIN in the PCM.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

B2205-ORIGINAL VIN MISSING/MISMATCH (CONTINUED)

3. REPLACE SKREEM AND CHECK DTC'S

Turn the ignition off.

Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information.

Turn the ignition on.

With the scan tool, display and clear all PCM and SKREEM DTC's.

Perform 5 ignition key cycles leaving the ignition key on for 90 seconds per cycle.

With the scan tool, check for SKREEM DTCs.

Does the scan tool display the same DTC?

Yes >> Replace and program the Powertrain Control Module in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> The repair is complete.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. INTERMITTENT

Turn the ignition off.

NOTE: Check for the following conditions:

- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes >> Repair wiring harness/connectors as necessary.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

B2224-SKREEM INTERNAL

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition switch on.

Possible Causes
SKREEM

Diagnostic Test

1. SKREEM

NOTE: Before continuing review and check the following conditions.
- **Review the repair history of the vehicle. Ensure the vehicle has the correct PCM and SKREEM installed. Check the part numbers.**
- **Using a scan tool, ensure the PCM and SKREEM have been programmed correctly. Compare the PCM VIN to the SKREEM VIN and ensure the two VINS match.**

Turn the ignition on.

With the scan tool, clear DTC(s).

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

Using the scan tool, read DTC(s).

Does the DTC reset?

Yes >> Replace and program the SKREEM in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> The DTC is not active at this time. Test complete.

B2228-SKREEM INTERNAL - RKE RECEIVER

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition switch on.

Possible Causes
SKREEM

Diagnostic Test

1. SKREEM

NOTE: Before continuing review and check the following conditions.
- **Review the repair history of the vehicle. Ensure the vehicle has the correct PCM and SKREEM installed. Check the part numbers.**
- **Using a scan tool, ensure the PCM and SKREEM have been programmed correctly. Compare the PCM VIN to the SKREEM VIN and ensure the two VINS match.**

Turn the ignition on.

With the scan tool, clear DTC(s).

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

Using the scan tool, read DTC(s).

Does the DTC reset?

Yes >> Replace and program the SKREEM in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> The DTC is not active at this time. Test complete.

B2229-SKREEM INTERNAL - SKIM IMMOBILIZER

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition switch on.

Possible Causes
SKREEM

Diagnostic Test

1. SKREEM

NOTE: Before continuing review and check the following conditions.
- **Review the repair history of the vehicle. Ensure the vehicle has the correct PCM and SKREEM installed. Check the part numbers.**
- **Using a scan tool, ensure the PCM and SKREEM have been programmed correctly. Compare the PCM VIN to the SKREEM VIN and ensure the two VINS match.**

Turn the ignition on.

With the scan tool, clear DTC(s).

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

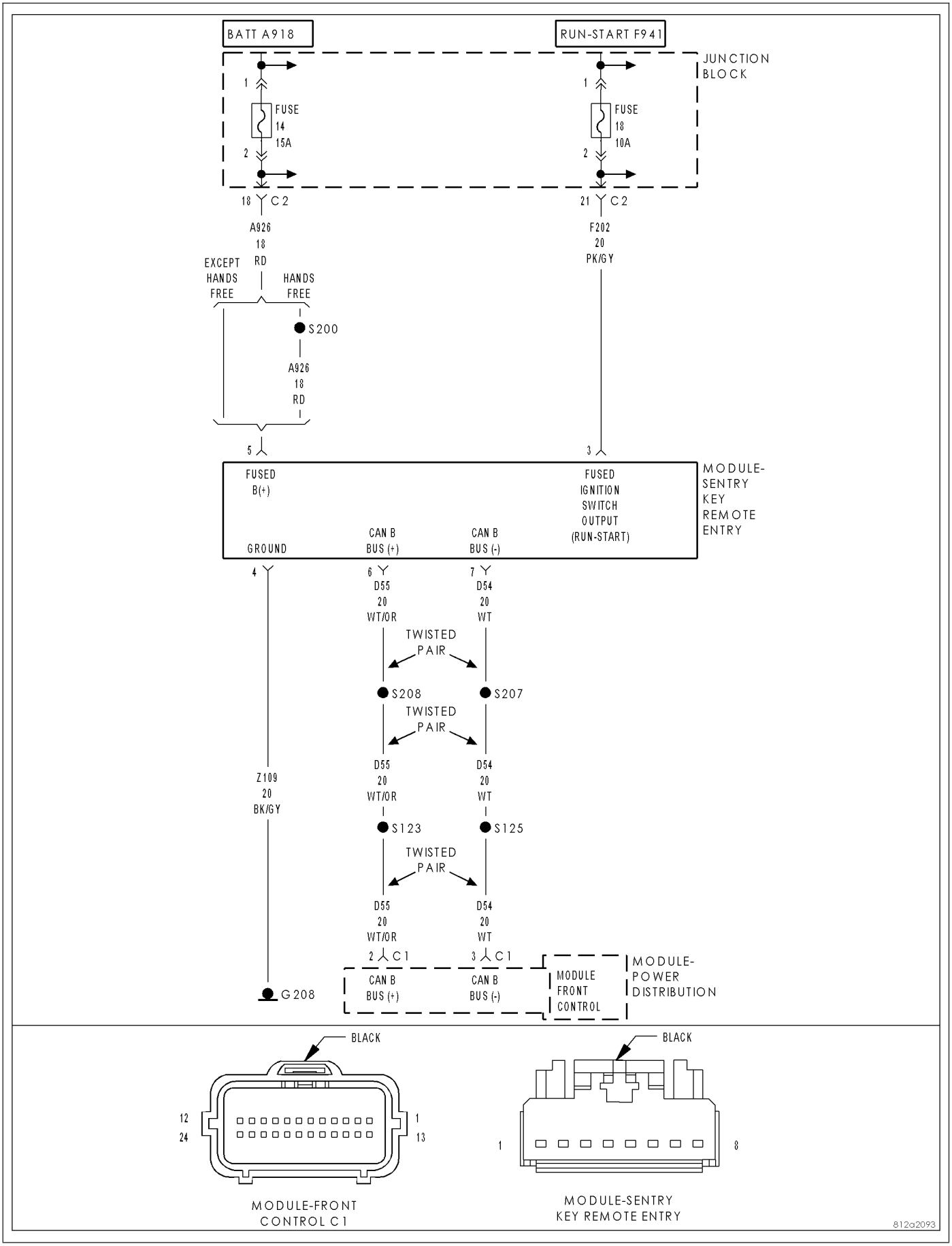
Using the scan tool, read DTC(s).

Does the DTC reset?

Yes >> Replace and program the SKREEM in accordance with the Service Information.
Perform VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> The DTC is not active at this time. Test complete.

U0019–CAN B BUS



U0019–CAN B BUS (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  Whenever the CAN B Bus (+) or CAN B Bus (-) circuit is open, shorted to voltage or shorted to ground.

Possible Causes
CAN B BUS DTC's IN FRONT CONTROL MODULE
(D55) CAN B BUS (+) CIRCUIT OPEN
(D54) CAN B BUS (-) CIRCUIT OPEN
SENTRY KEY REMOTE ENTRY MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTCS

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

---

2. CHECK FRONT CONTROL MODULE DTC's

With the scan tool, read Front Control Module active DTC's

Does the scan tool display any CAN B BUS DTC's – ACTIVE?

Yes >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

No >> Go To 3

U0019–CAN B BUS (CONTINUED)

3. (D55) CAN B BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the negative battery cable.

Disconnect the Sentry Key Remote Entry Module connector.

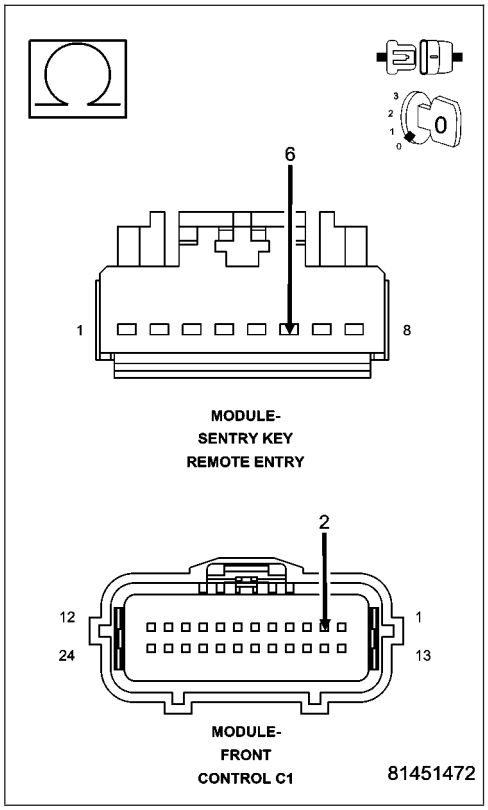
Disconnect the Front Control Module C1 connector.

Measure the resistance of the (D55) CAN B Bus (+) circuit between the Front Control Module C1 connector and the Sentry Key Remote Entry Module connector.

Is the resistance below 2.0 ohms?

Yes >> Go To 4

No >> Repair the (D55) CAN B Bus (+) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.



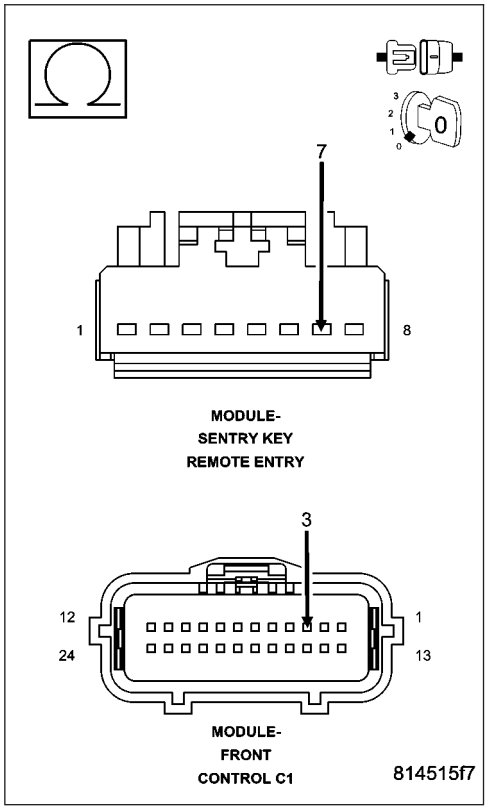
4. (D54) CAN B BUS (–) CIRCUIT OPEN

Measure the resistance of the (D54) CAN B Bus (1) circuit between the Front Control Module C1 connector and the Sentry Key Remote Entry Module connector.

Is the resistance below 2.0 ohms?

Yes >> Replace the Sentry Key Remote Entry Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1.

No >> Repair the (D54) CAN B Bus (–) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.



U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0146-LOST COMMUNICATION WITH CENTRAL GATEWAY

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the U0141-Lost Communication With Front Control Module test for the diagnostic test procedure.

U0155-LOST COMMUNICATION WITH CLUSTER/CCN

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

SKREEM VERIFICATION

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. SKREEM VERIFICATION

NOTE: When entering the PIN, care should be taken because the SKREEM will only allow 3 consecutive attempts to enter the correct PIN. If 3 consecutive incorrect PIN's are entered the SKREEM will Lock Out the scan tool. To exit Lock Mode, the ignition key must remain the Run position for I hour. All accessories must be off. A battery charger connected to the battery during this time period is recommended.

1. Reconnect the previously disconnected components and connectors.
2. Obtain the vehicle's unique Personal Identification Number (PIN) assigned to it's original SKREEM. This number can be obtained from the vehicle invoice or from the DaimlerChrysler Customer Center (Phone 1-800-992-1997).
3. With the scan tool, select Miscellaneous Functions, WCM/Wireless Control Module. Then select the desired procedure and follow the display on the scan tool.
4. If the SKREEM was replaced, ensure all the customer's key have been programmed to the new module.
5. With the scan tool, ease all DTCs. Perform 5 ignition key cycles, leaving the key on for at least 90 seconds per cycle.
6. With the scan tool, read SKREEM DTC(s).

Are there any SKREEM DTC(s) present?

Yes >> Repair not complete, refer to the appropriate symptom.

No >> Repair is complete.

STANDARD PROCEDURE

SKREEM VERIFICATION

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. SKREEM VERIFICATION

NOTE: When entering the PIN, care should be taken because the SKREEM will only allow 3 consecutive attempts to enter the correct PIN. If 3 consecutive incorrect PIN's are entered the SKREEM will Lock Out the scan tool. To exit Lock Mode, the ignition key must remain the Run position for I hour. All accessories must be off. A battery charger connected to the battery during this time period is recommended.

1. Reconnect the previously disconnected components and connectors.
2. Obtain the vehicle's unique Personal Identification Number (PIN) assigned to it's original SKREEM. This number can be obtained from the vehicle invoice or from the DaimlerChrysler Customer Center (Phone 1-800-992-1997).
3. With the scan tool, select Miscellaneous Functions, WCM/Wireless Control Module. Then select the desired procedure and follow the display on the scan tool.
4. If the SKREEM was replaced, ensure all the customer's key have been programmed to the new module.
5. With the scan tool, ease all DTCs. Perform 5 ignition key cycles, leaving the key on for at least 90 seconds per cycle.
6. With the scan tool, read SKREEM DTC(s).

Are there any SKREEM DTC(s) present?

Yes >> Repair not complete, refer to the appropriate symptom.

No >> Repair is complete.

WIPERS/WASHERS

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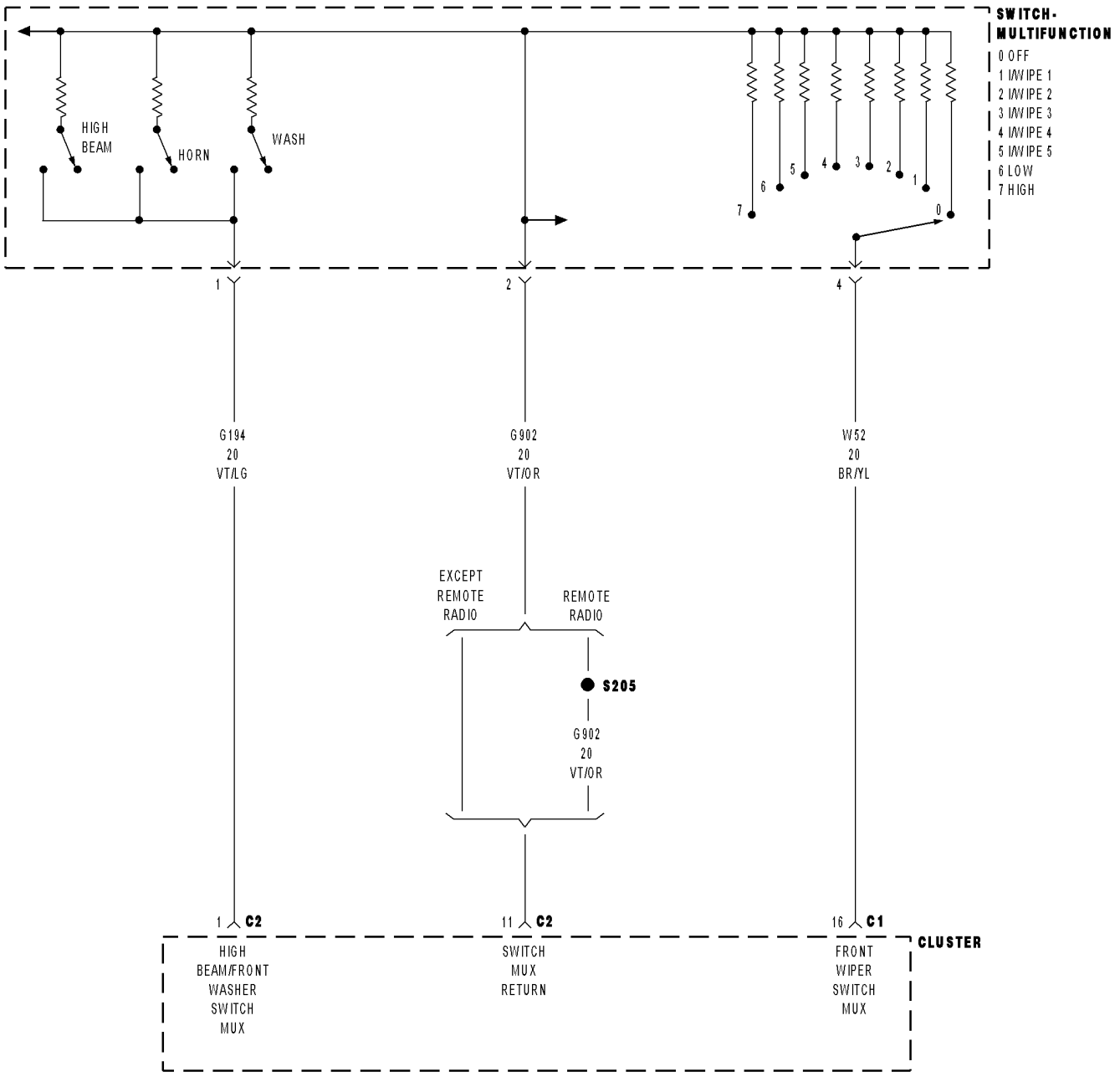
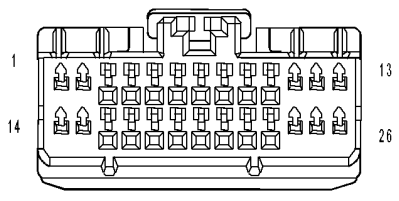
WIPERS/WASHERS - ELECTRICAL DIAGNOSTICS

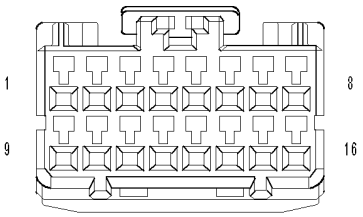
DIAGNOSIS AND TESTING

B2301-WIPER MODE SWITCH INPUT CIRCUIT LOW

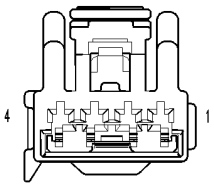




CLUSTER C1



CLUSTER C2



SWITCH-
MULTIFUNCTION

814abedc

B2301-WIPER MODE SWITCH INPUT CIRCUIT LOW (CONTINUED)

For the Wiper/Washer system circuit diagram (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the ignition on.
- **Set Condition:**
- When the Instrument Cluster detects a short/HIGH condition.

Possible Causes
MULTIFUNCTION SWITCH
(W52) MUX CIRCUIT OPEN
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

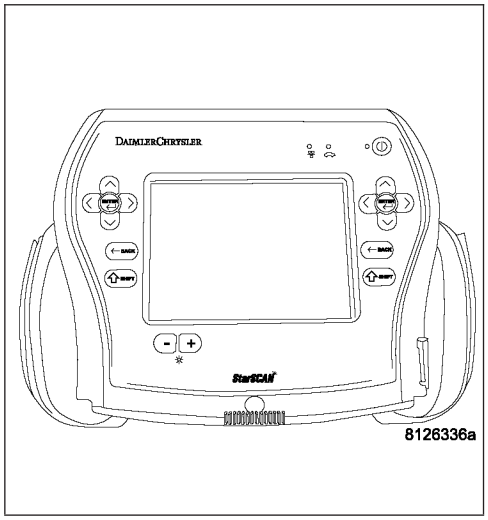
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all CCN DTC's.
Turn the Wipers ON then OFF.
With the Scan Tool, read the Wiper DTC's.

Does the Scan Tool read: B2301-WIPER MODE SWITCH INPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.



2. MULTIFUNCTION SWITCH

Turn the ignition off.
Disconnect the Multifunction Switch harness connector.
Ensure the switch is in the OFF position.
Measure the internal resistance of the Multifunction Switch between the G902 and W52 circuits.

Does the Switch measure more than 5.0 ohms?

Yes >> Replace the Multifunction Switch in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Go To 3

B2301-WIPER MODE SWITCH INPUT CIRCUIT LOW (CONTINUED)

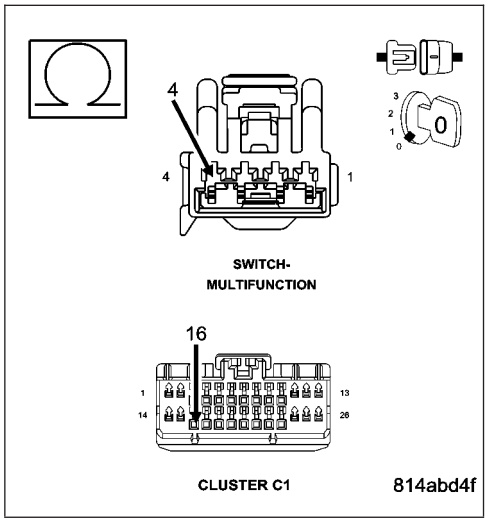
3. INSTRUMENT CLUSTER

Turn the ignition off.
Disconnect the Multifunction Switch connector.
Disconnect the Instrument Cluster C1 harness connector.
Measure the resistance of the (W52) MUX circuit to ground.

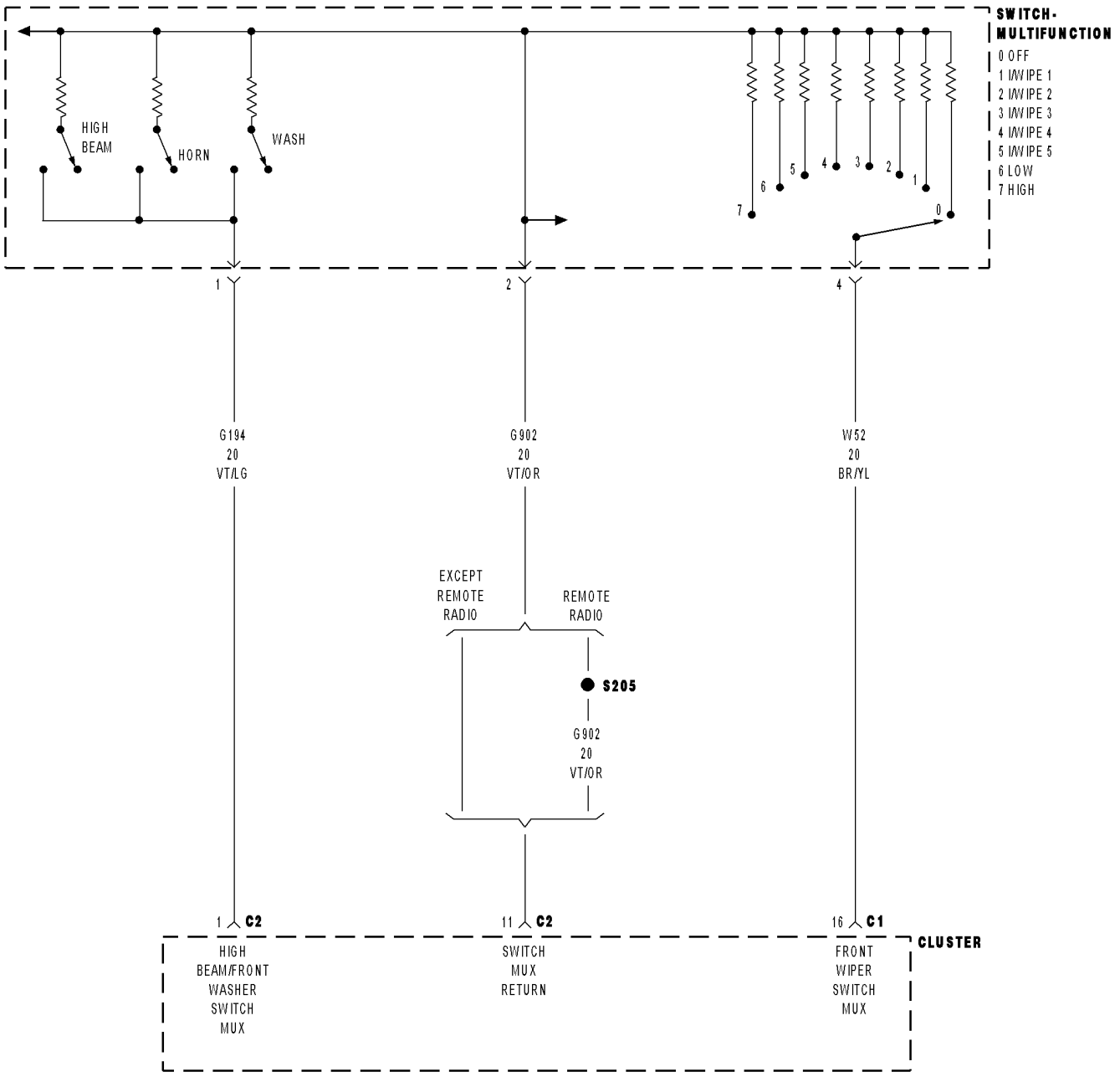
Is the resistance below 5.0 ohms?

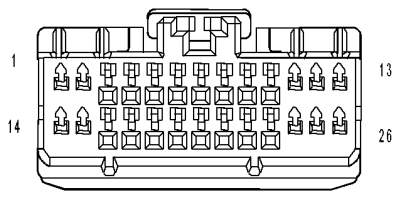
Yes >> Repair the (W52) MUX circuit for a short to ground condition.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Replace the Instrument Cluster in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

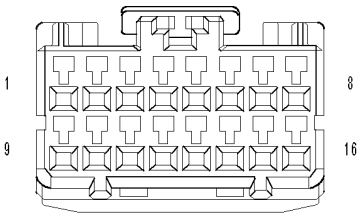


B2302-WIPER MODE SWITCH INPUT CIRCUIT HIGH

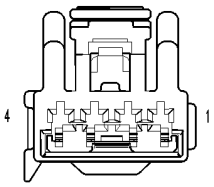




CLUSTER C1



CLUSTER C2



SWITCH-
MULTIFUNCTION

814abedc

B2302-WIPER MODE SWITCH INPUT CIRCUIT HIGH (CONTINUED)

For the Wiper/Washer system circuit diagram (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the ignition on.
- **Set Condition:**
- When the Instrument Cluster detects a short/HIGH condition.

Possible Causes
MULTIFUNCTION SWITCH
(W52) MUX CIRCUIT OPEN
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

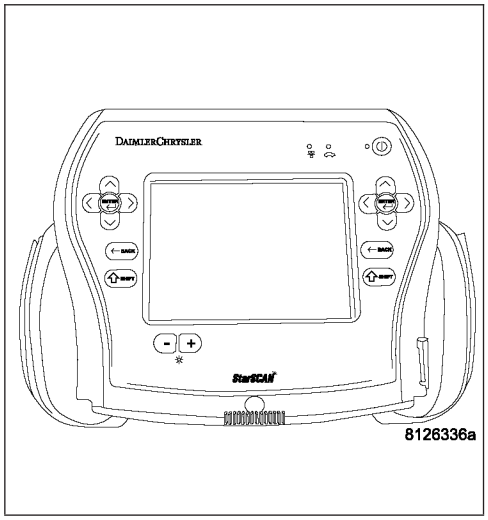
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all CCN DTC's.
Turn the Wipers ON then OFF.
With the Scan Tool, read the Wiper DTC's.

Does the Scan Tool read: B2302-WIPER MODE SWITCH INPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.



2. MULTIFUNCTION SWITCH

Turn the ignition off.
Disconnect the Multifunction Switch harness connector.
Ensure the switch is in the OFF position.
Measure the internal resistance of the Multifunction Switch between the G902 and W52 circuits.

Does the Switch measure more than 5.0 ohms?

Yes >> Replace the Multifunction Switch in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Go To 3

B2302-WIPER MODE SWITCH INPUT CIRCUIT HIGH (CONTINUED)

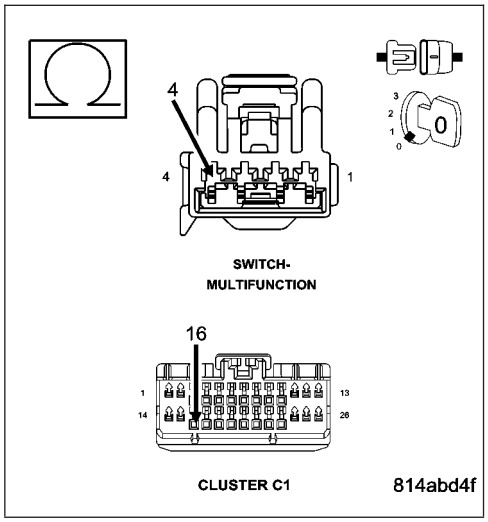
3. INSTRUMENT CLUSTER

Turn the ignition off.
Disconnect the Multifunction Switch connector.
Disconnect the Instrument Cluster C1 harness connector.
Measure the resistance of the (W52) MUX circuit.

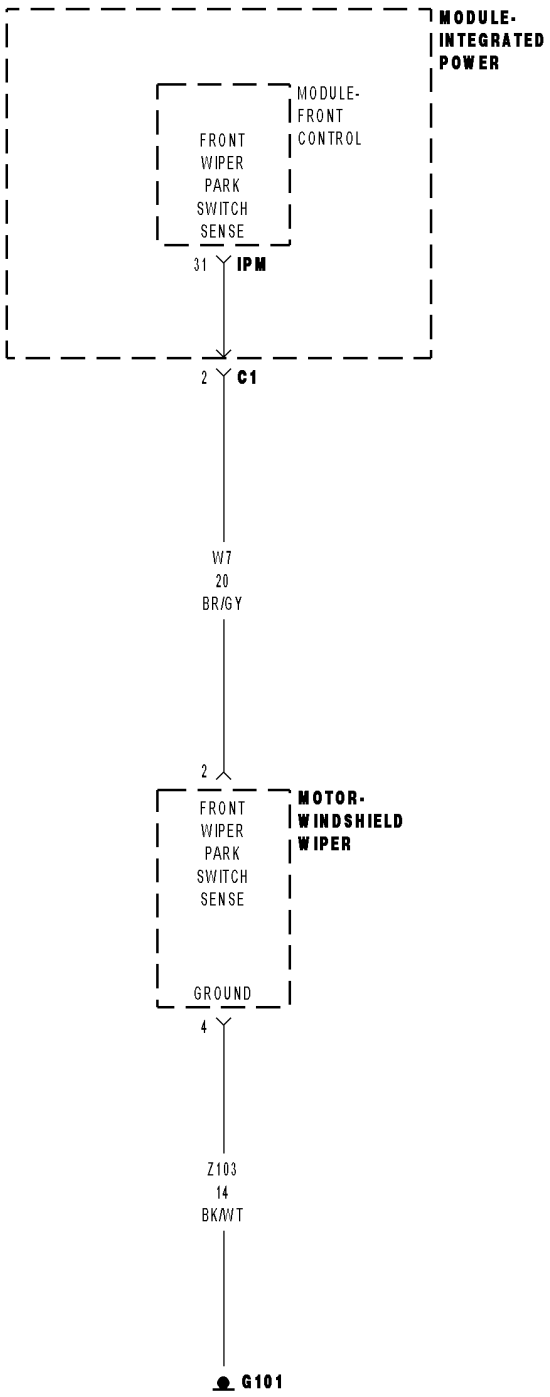
Is the resistance above 5.0 ohms?

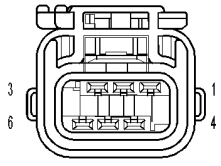
Yes >> Repair the (W52) MUX circuit for an open condition.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Replace the Instrument Cluster in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

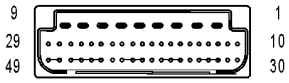


B2304-WIPER PARK SWITCH INPUT CIRCUIT LOW





MOTOR-
WINDSHIELD
WIPER



MODULE-
FRONT
CONTROL
(IPM)

814aba8f

B2304-WIPER PARK SWITCH INPUT CIRCUIT LOW (CONTINUED)

For the Front/Rear Wipers/Washers circuit diagram (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

Possible Causes
MULTIFUNCTION SWITCH
(W7) FRONT WIPER PARK SWITCH SENSE CIRCUIT LOW
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

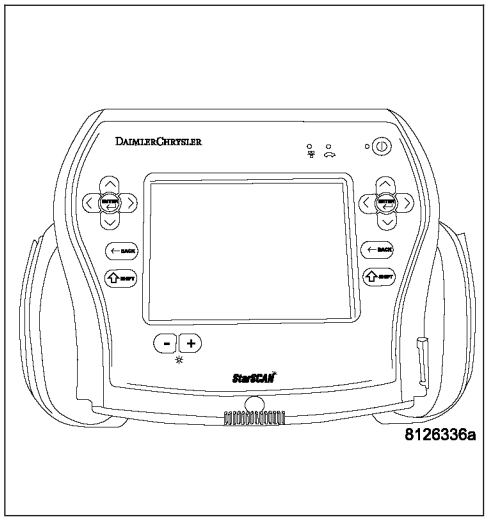
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Turn the Wipers on.
With the Scan Tool, read the Wiper DTC's.

Does the Scan Tool read: B2304-WIPER PARK SWITCH INPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.



2. MULTIFUNCTION SWITCH

Turn the ignition off.
Disconnect the Multifunction Switch connector.
Measure the internal resistance of the Multifunction Switch between cavity 1 and 4 of the switch.

Is the resistance above 5.0 ohms?

Yes >> Replace the Multifunction Switch in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Go To 3

B2304-WIPER PARK SWITCH INPUT CIRCUIT LOW (CONTINUED)

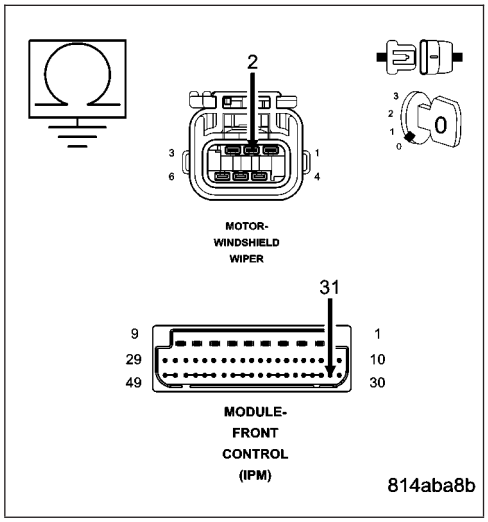
3. FRONT CONTROL MODULE

Turn the ignition off.

Disconnect the Multifunction Switch connector.

Disconnect the FCM C1 harness connector.

Measure the resistance between ground and the (W7) Front Wiper Park Switch Sense circuit.



Is the resistance below 5.0 ohms?

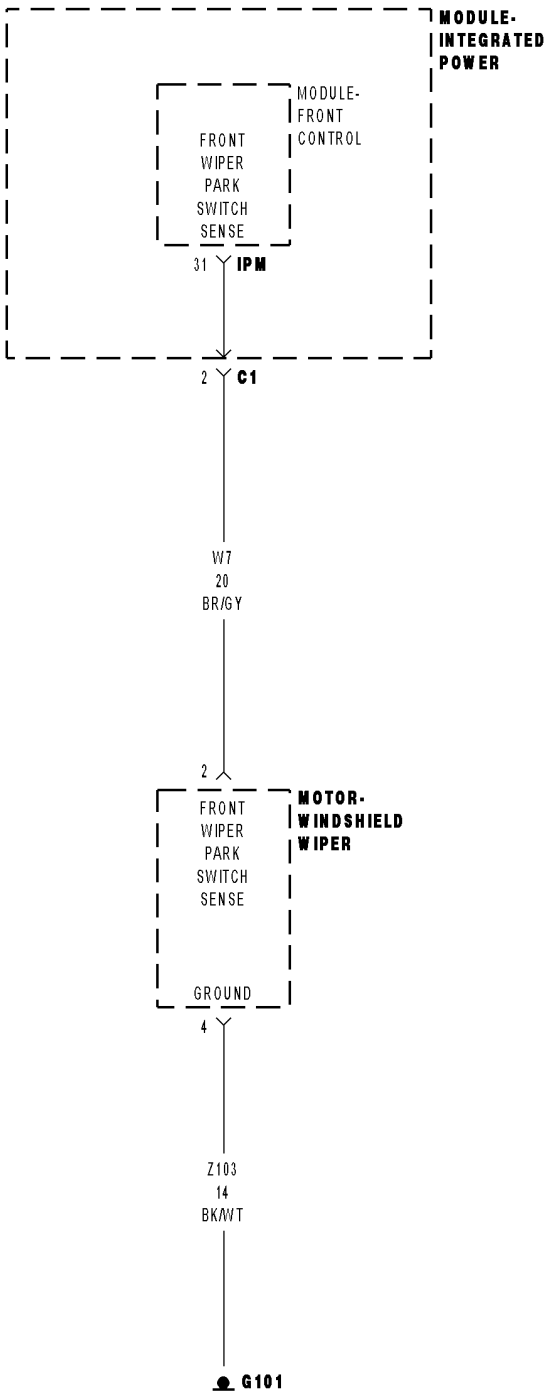
Yes >> Repair the (W7) Front Wiper Park Switch Sense circuit for a short condition.

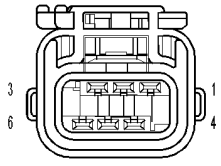
Perform the BODY VERIFICATION TEST — VER 1.

No >> Replace the Front Control Module in accordance with the service information.

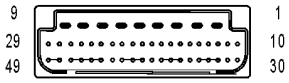
Perform the BODY VERIFICATION TEST — VER 1.

B2305-WIPER PARK SWITCH INPUT CIRCUIT HIGH





MOTOR-
WINDSHIELD
WIPER



MODULE-
FRONT
CONTROL
(IPM)

814aba8f

B2305-WIPER PARK SWITCH INPUT CIRCUIT HIGH (CONTINUED)

For the Rear Wipers/Washers circuit diagram (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- **Set Condition:**

Possible Causes
MULTIFUNCTION SWITCH
(W7) FRONT WIPER PARK SWITCH SENSE CIRCUIT HIGH
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

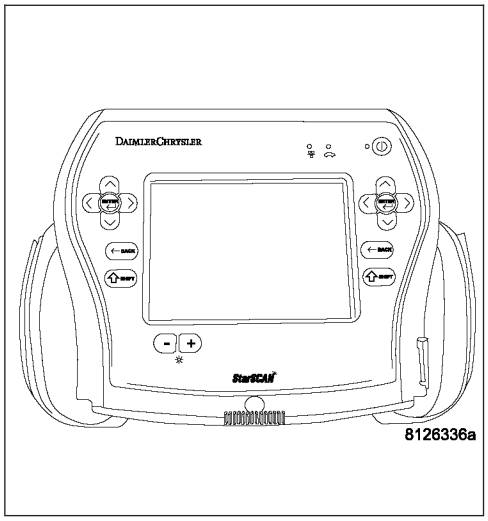
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Turn the Front Wipers on.
With the Scan Tool, read the Front Wiper DTC's.

Does the Scan Tool read: B2305-WIPER PARK SWITCH INPUT CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.



2. MULTIFUNCTION SWITCH

Turn the ignition off.
Disconnect the Multifunction Switch connector.
Measure the internal resistance of the Multifunction Switch between cavity 2 and 4 of the switch.

Is the resistance above 5.0 ohms?

Yes >> Replace the Multifunction Switch in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Go To 3

B2305-WIPER PARK SWITCH INPUT CIRCUIT HIGH (CONTINUED)

3. FRONT CONTROL MODULE

Turn the ignition off.

Disconnect the Multifunction Switch connector.

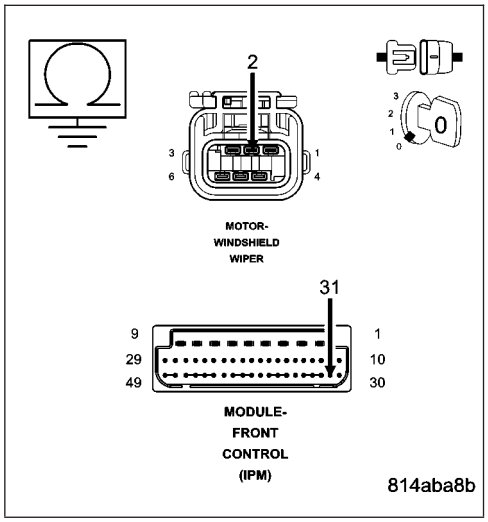
Disconnect the FCM C1 harness connector.

Measure the resistance of the (W7) Front Wiper Park Switch Sense circuit.

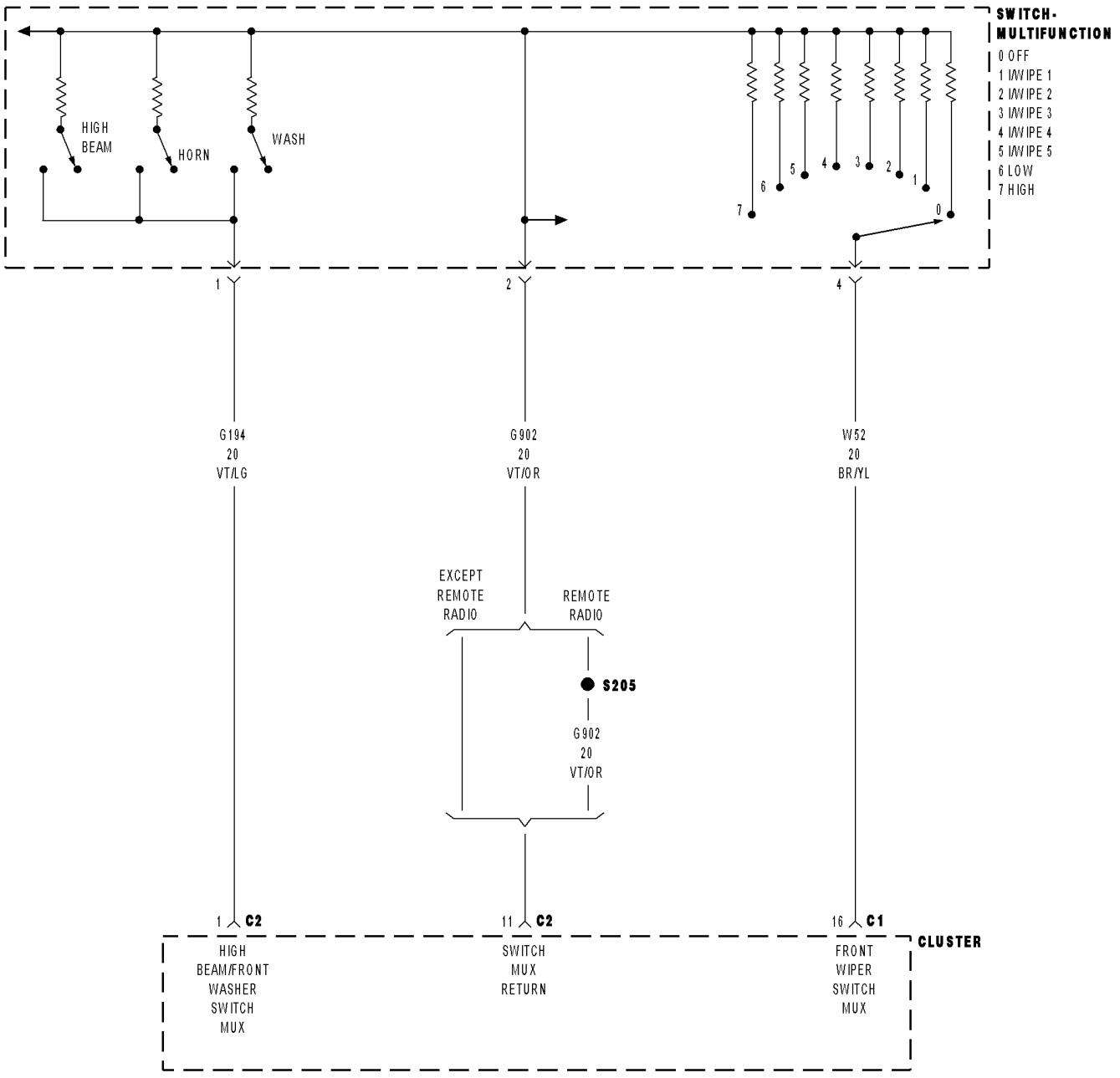
Is the resistance above 5.0 ohms?

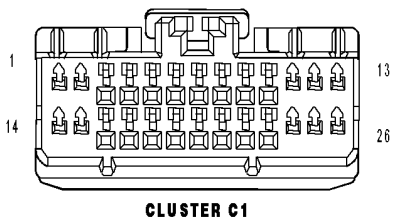
Yes >> Repair the (W7) Front Wiper Park Switch Sense circuit for an open condition.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Replace the Front Control Module in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

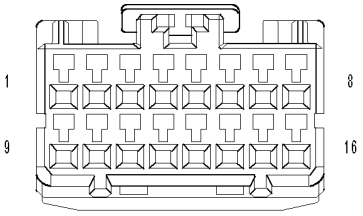


B2307-WASHER SWITCH INPUT CIRCUIT LOW

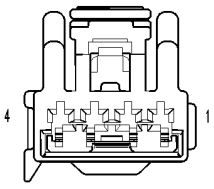




CLUSTER C1



CLUSTER C2



SWITCH-
MULTIFUNCTION

814ab99c

B2307-WASHER SWITCH INPUT CIRCUIT LOW (CONTINUED)

For the Wiper/Washer system circuit diagram (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the ignition on.
- **Set Condition:**
- When the Instrument Cluster detects a short condition.

Possible Causes
MULTIFUNCTION SWITCH
(G194) SWITCH MUX CIRCUIT OPEN
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

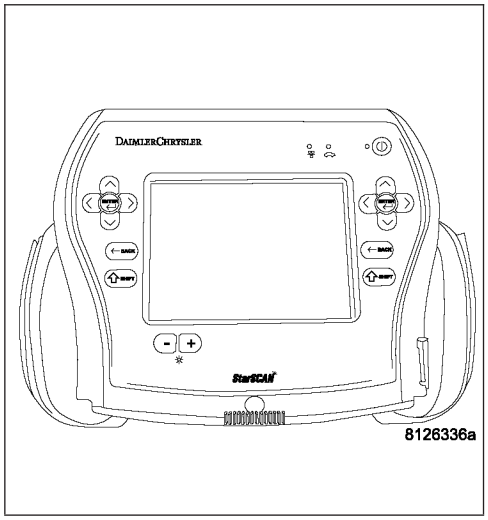
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all CCN DTC's.
Turn the Washers ON then OFF.
With the Scan Tool, read the Washer DTC's.

Does the Scan Tool read: B2301-WIPER MODE SWITCH INPUT CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.



2. MULTIFUNCTION SWITCH

Turn the ignition off.
Disconnect the Multifunction Switch harness connector.
Ensure the switch is in the OFF position.
Measure the internal resistance of the Multifunction Switch between the G902 and G194 circuits.

Does the Switch measure more than 5.0 ohms?

Yes >> Replace the Multifunction Switch in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Go To 3

B2307-WASHER SWITCH INPUT CIRCUIT LOW (CONTINUED)

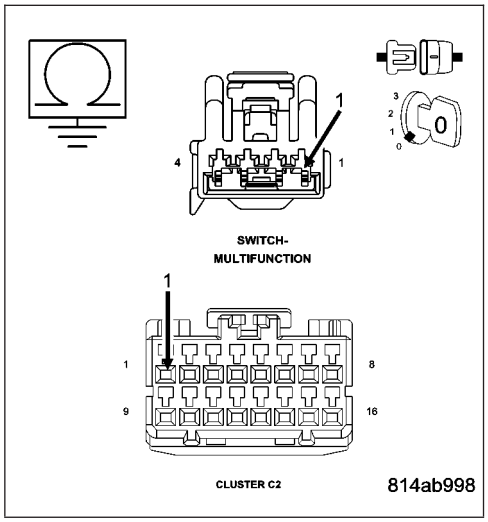
3. INSTRUMENT CLUSTER

Turn the ignition off.
Disconnect the Multifunction Switch connector.
Disconnect the Instrument Cluster C2 harness connector.
Measure the resistance of the (G194) MUX circuit to ground.

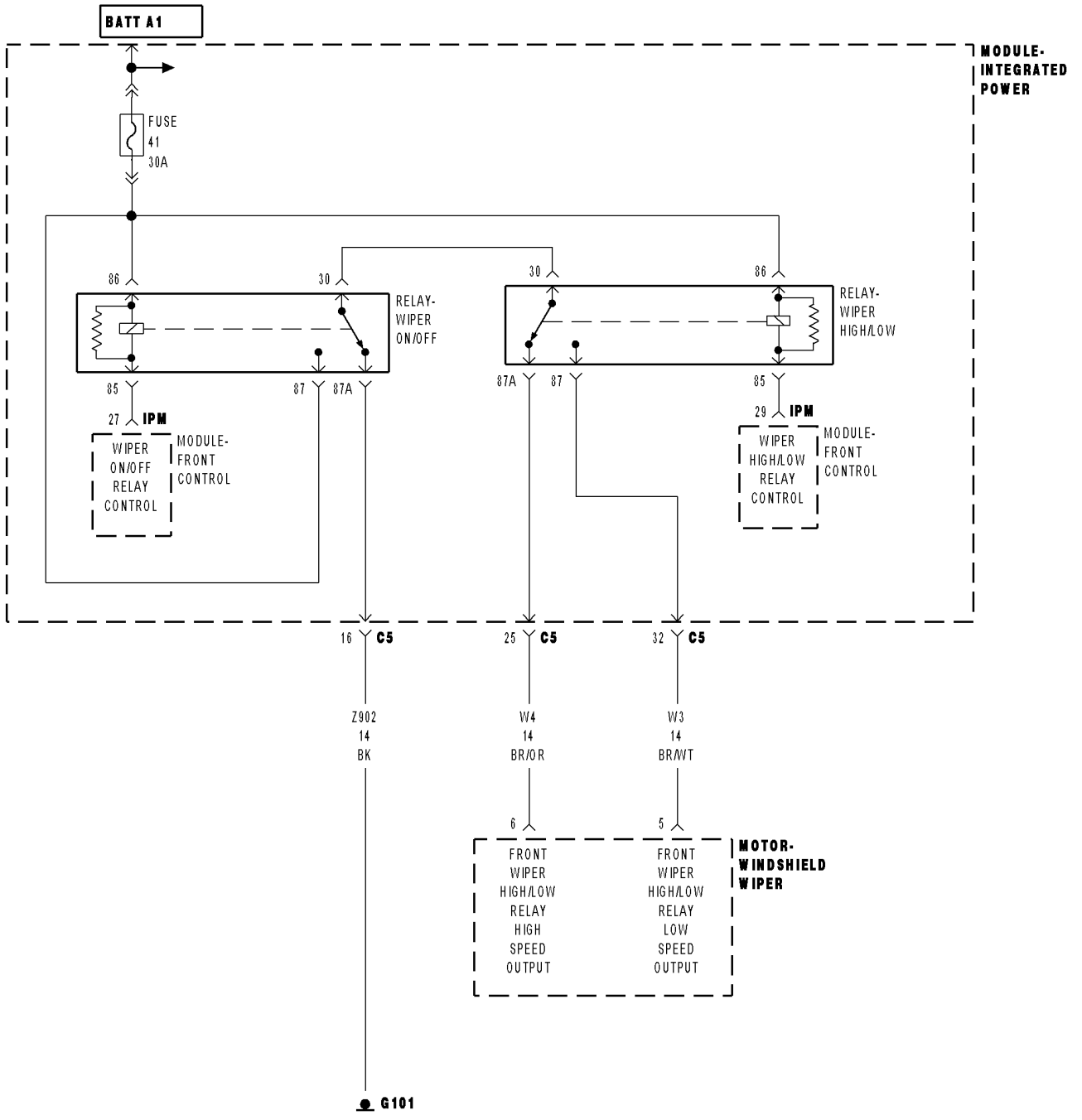
Is the resistance below 5.0 ohms?

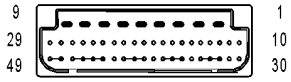
Yes >> Repair the (G194) MUX circuit for a short to ground condition.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Replace the Instrument Cluster in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.



B2313-WIPER ON/OFF CONTROL CIRCUIT LOW





MODULE-
FRONT
CONTROL
(IPM)

814ab904

B2313-WIPER ON/OFF CONTROL CIRCUIT LOW (CONTINUED)

For the Wiper/Washer system circuit diagram (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the ignition on.
- **Set Condition:**
- When the FCM detects a short/low condition.

Possible Causes
WIPER ON/OFF RELAY
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

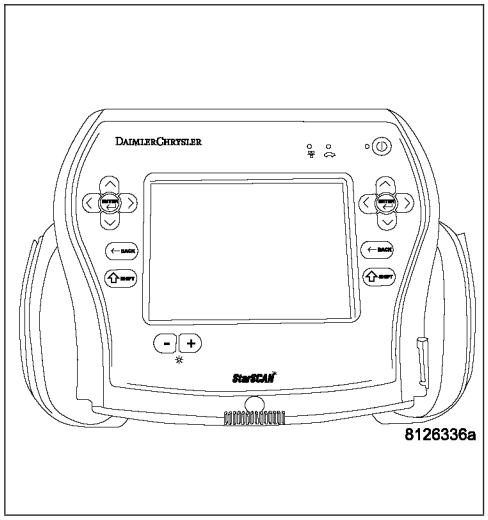
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Turn the Wipers ON then OFF.
With the Scan Tool, read the Wiper DTC's.

Does the Scan Tool read: B2313-WIPER ON/OFF CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.



2. WIPER ON/OFF RELAY

Turn the ignition off.
Install a substitute relay in place of the Wiper On/Off Relay.
Turn the ignition on.
With the Scan Tool, read the DTC's.

Does the Scan Tool read: B2313-WIPER ON/OFF CONTROL CIRCUIT LOW?

Yes >> Go To 3

No >> Replace the Wiper On/Off Relay in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

B2313-WIPER ON/OFF CONTROL CIRCUIT LOW (CONTINUED)

3. Front Control Module

Turn the ignition off.

Remove the Wiper On/Off Relay.

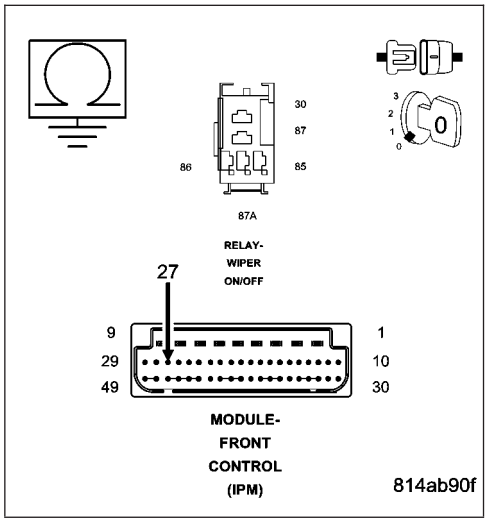
Disconnect the FCM IPM harness connector.

Measure the resistance between ground and the (W5) Wiper On/Off Relay Control circuit in the PDC.

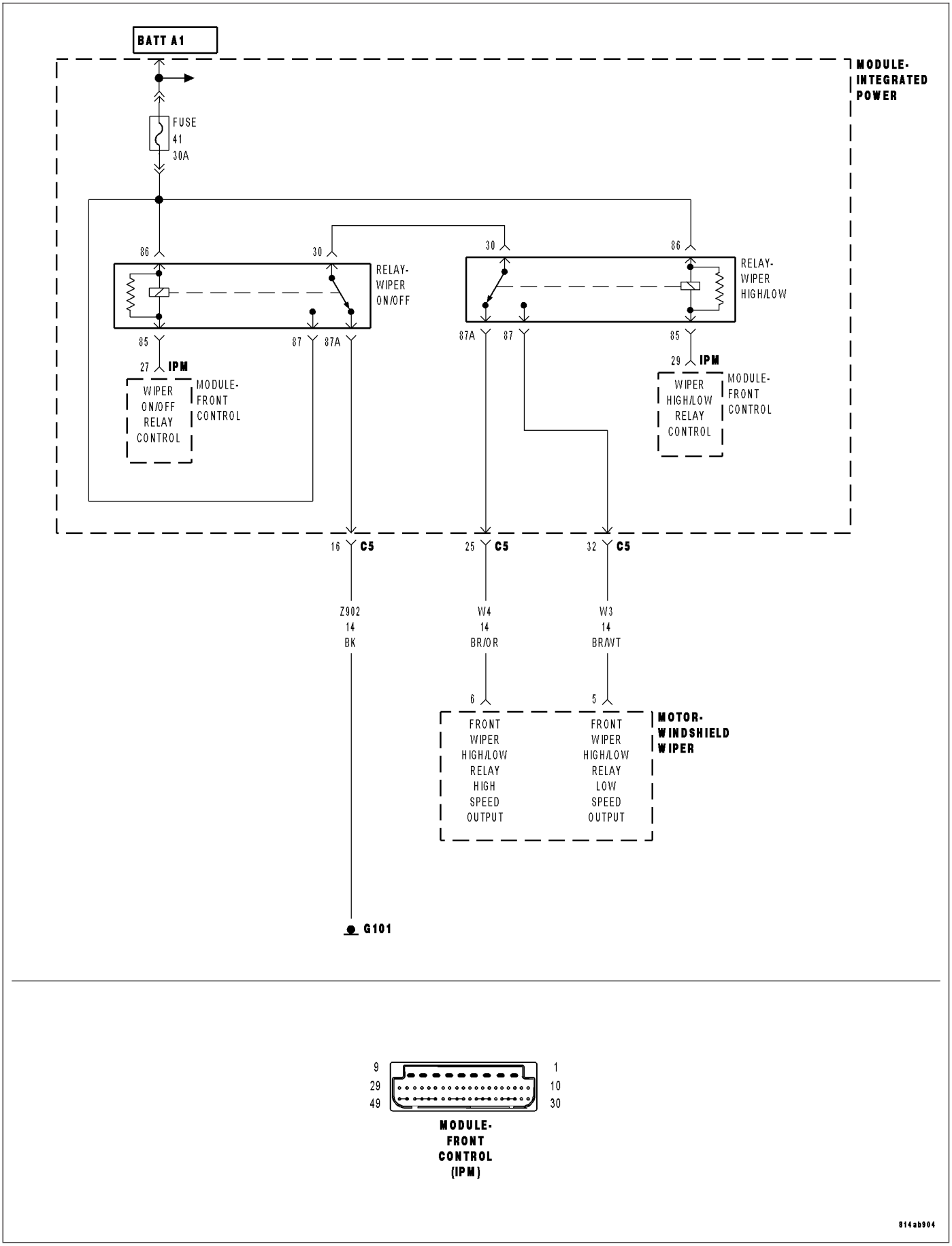
Is the resistance below 5.0 ohms?

Yes >> Replace the Power Distribution Center in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Replace the Front Control Module in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.



B2314-WIPER ON/OFF CONTROL CIRCUIT HIGH



B2314-WIPER ON/OFF CONTROL CIRCUIT HIGH (CONTINUED)

For the Wiper/Washer system circuit diagram (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the ignition on.
- **Set Condition:**
- When the FCM detects a short/HIGH condition.

Possible Causes
WIPER ON/OFF RELAY
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

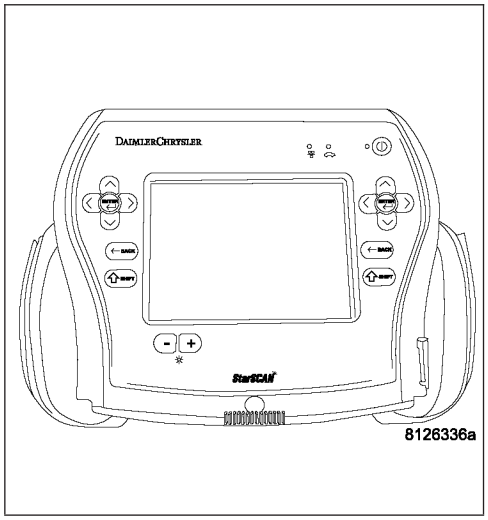
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Turn the Wipers ON then OFF.
With the Scan Tool, read the Wiper DTC's.

Does the Scan Tool read: B2314-WIPER ON/OFF CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.



2. WIPER ON/OFF RELAY

Turn the ignition off.
Remove the Wiper On/Off Relay.
Turn the ignition on.
Activate the Wiper Switch to all speed positions.
With the Scan Tool, read the DTC's.

Does the Scan Tool read: B2314-WIPER ON/OFF CONTROL CIRCUIT HIGH?

Yes >> Replace the Wiper On/Off Relay in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Go To 3

B2314-WIPER ON/OFF CONTROL CIRCUIT HIGH (CONTINUED)

3. FRONT CONTROL MODULE

Turn the ignition off.

Remove the Wiper On/Off Relay.

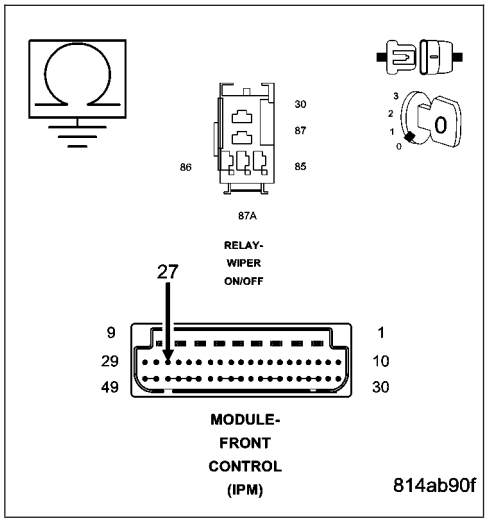
Disconnect the FCM IPM harness connector.

Measure the voltage between ground and the (W5) Wiper On/Off Relay Control circuit in the PDC.

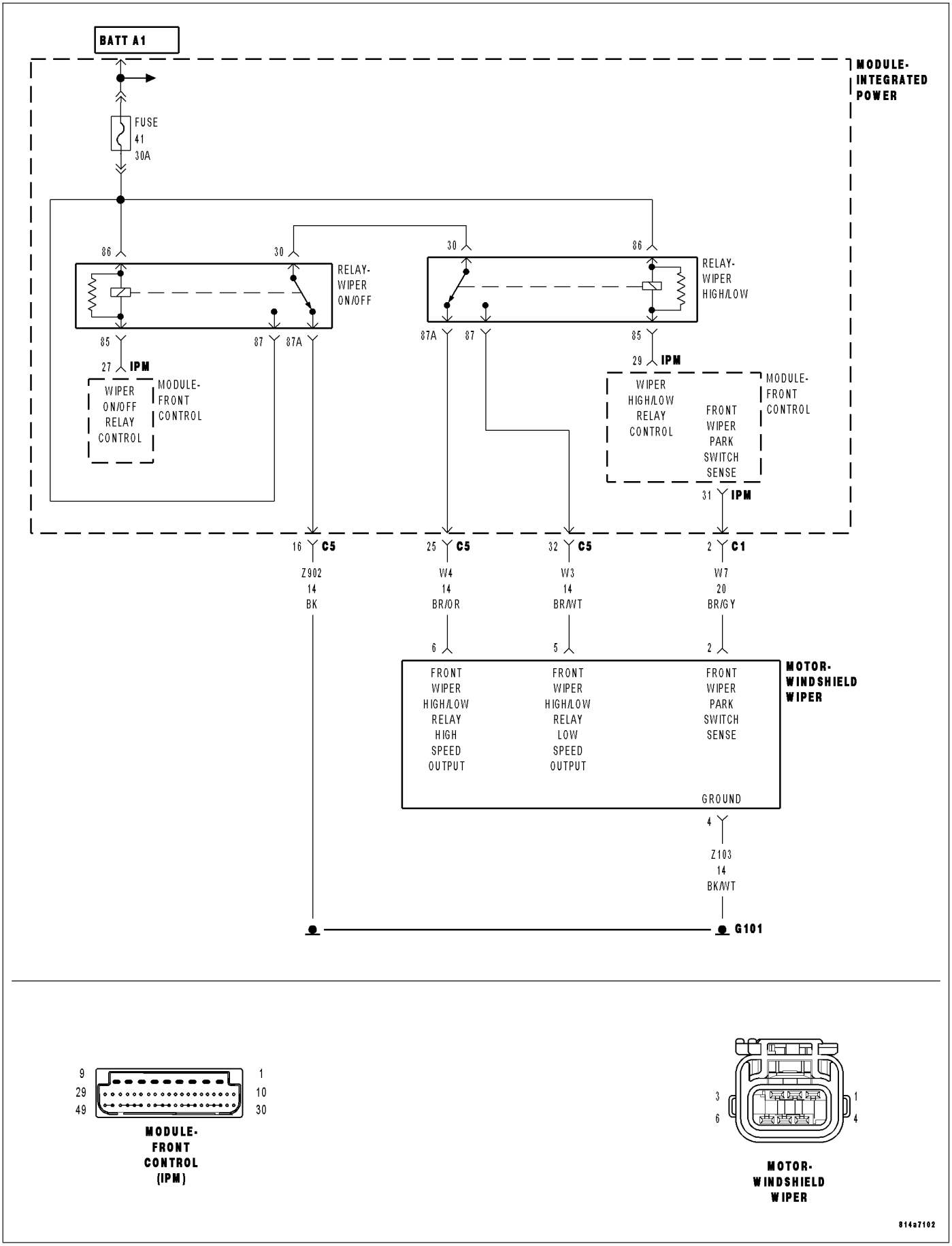
Is there any voltage present?

Yes >> Replace the Power Distribution Center in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Replace the Front Control Module in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.



B2317-WIPER HI/LOW CONTROL CIRCUIT LOW



MODULE-
FRONT
CONTROL
(IPM)

MOTOR-
WINDSHIELD
WIPER

814a7102

B2317-WIPER HI/LOW CONTROL CIRCUIT LOW (CONTINUED)

For the Wiper/Washer system circuit diagram (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the ignition on.
- **Set Condition:**
- When the FCM detects a short/low condition.

Possible Causes
(W2) WIPER HIGH/LOW RELAY
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

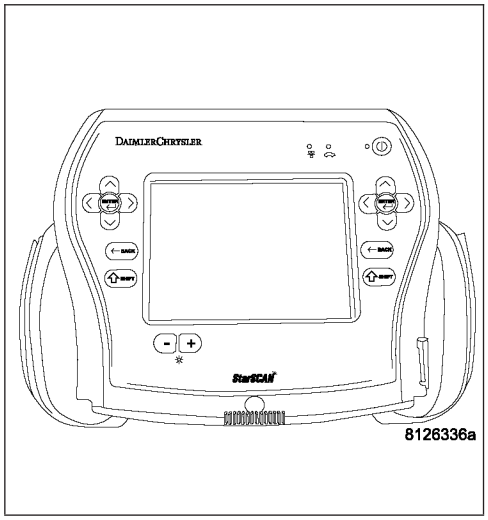
1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Turn the Wipers from High to Low.
With the Scan Tool, read the Wiper DTC's.

Does the Scan Tool read: B2317-WIPER HI/LOW CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.



2. WIPER HI/LOW RELAY

Turn the ignition off.
Install a substitute relay in place of the Wiper Hi/Low Relay.
Turn the ignition on.
With the Scan Tool, read the DTC's.

Does the Scan Tool read: B2317-WIPER HI/LOW CONTROL CIRCUIT LOW?

Yes >> Go To 3

No >> Replace the Wiper Hi/Low Relay in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

B2317-WIPER HI/LOW CONTROL CIRCUIT LOW (CONTINUED)

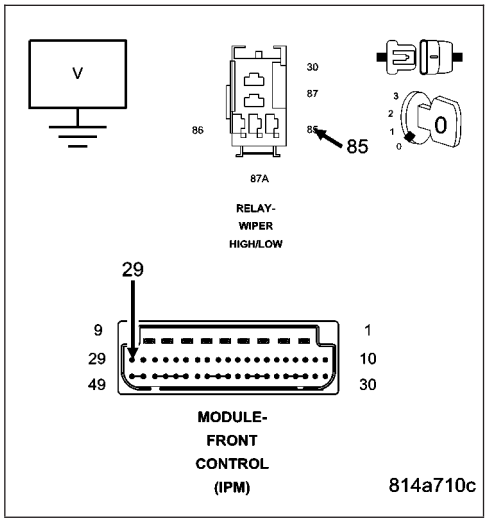
3. FRONT CONTROL MODULE

Turn the ignition off.

Remove the Wiper Hi/Low Relay.

Disconnect the FCM C3 harness connector.

Measure the resistance between ground and the Wiper Hi/Low Relay Control circuit in the PDC.

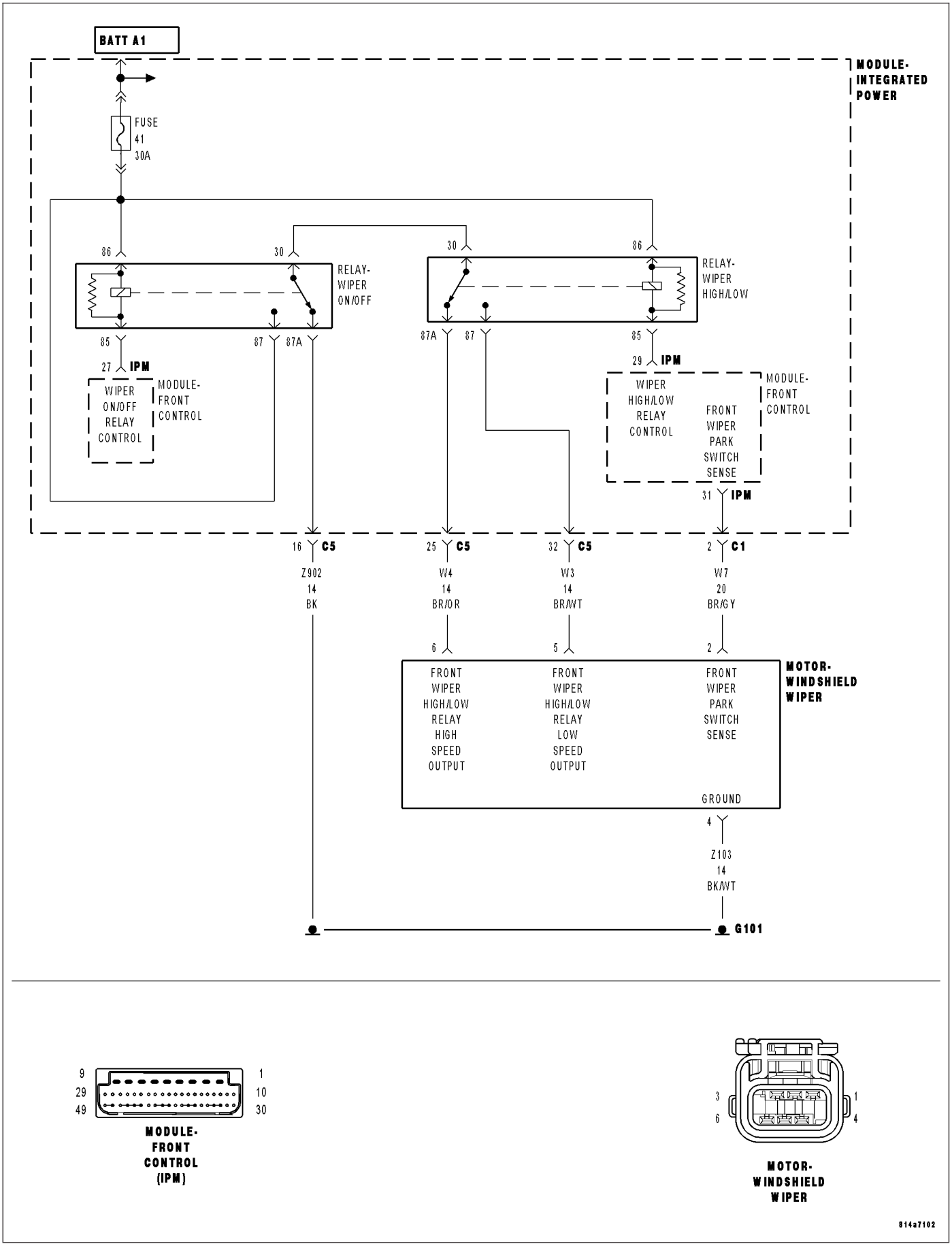


Is the resistance below 5.0 ohms?

Yes >> Replace the Power Distribution Center in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Replace the Front Control Module in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

B2318-WIPER HI/LOW CONTROL CIRCUIT HIGH



MODULE-
FRONT
CONTROL
(IPM)

MOTOR-
WINDSHIELD
WIPER

814a7102

B2318-WIPER HI/LOW CONTROL CIRCUIT HIGH (CONTINUED)

For the Wiper/Washer system circuit diagram (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the ignition on.
- **Set Condition:**
- When the FCM detects a short/HIGH condition.

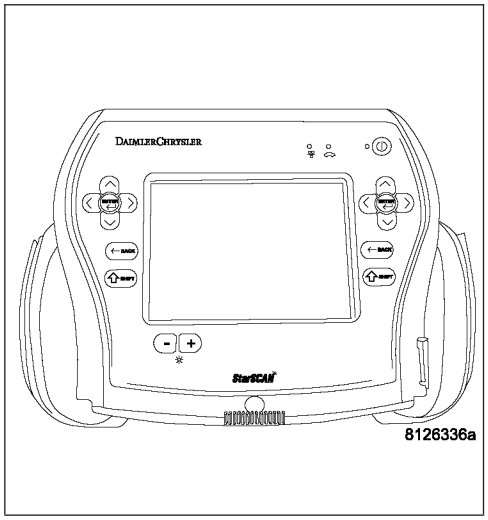
Possible Causes
(W2) WIPER HIGH/LOW RELAY
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the Scan Tool, clear all FCM DTC's.
Turn the Wipers to Low then High.
With the Scan Tool, read the Wiper DTC's.



Does the Scan Tool read: B2318-WIPER HI/LOW CONTROL CIRCUIT HIGH?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.

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2. WIPER HIGH/LOW RELAY

Turn the ignition off.
Remove the Wiper Hi/Low Relay.
Turn the ignition on.
Activate the Wiper Switch to all speed positions.
With the Scan Tool, read the DTC's.

Does the Scan Tool read: B2318-WIPER HI/LOW CONTROL CIRCUIT HIGH?

Yes >> Replace the Wiper Hi/Low Relay in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Go To 3

B2318-WIPER HI/LOW CONTROL CIRCUIT HIGH (CONTINUED)

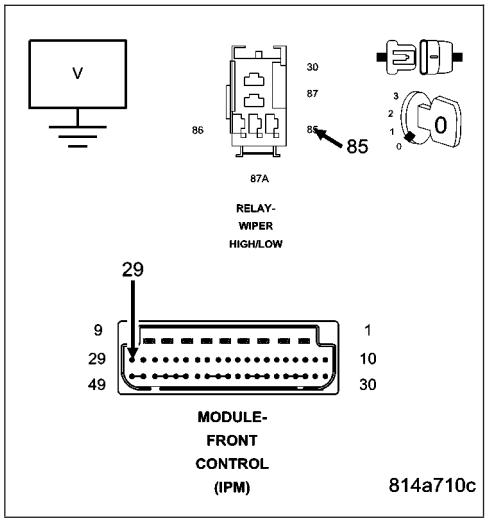
3. FRONT CONTROL MODULE

Turn the ignition off.

Remove the Wiper Hi/Low Relay.

Disconnect the FCM C3 harness connector.

Measure the voltage between ground and the (W2) Wiper Hi/Low Relay Control circuit in the PDC.

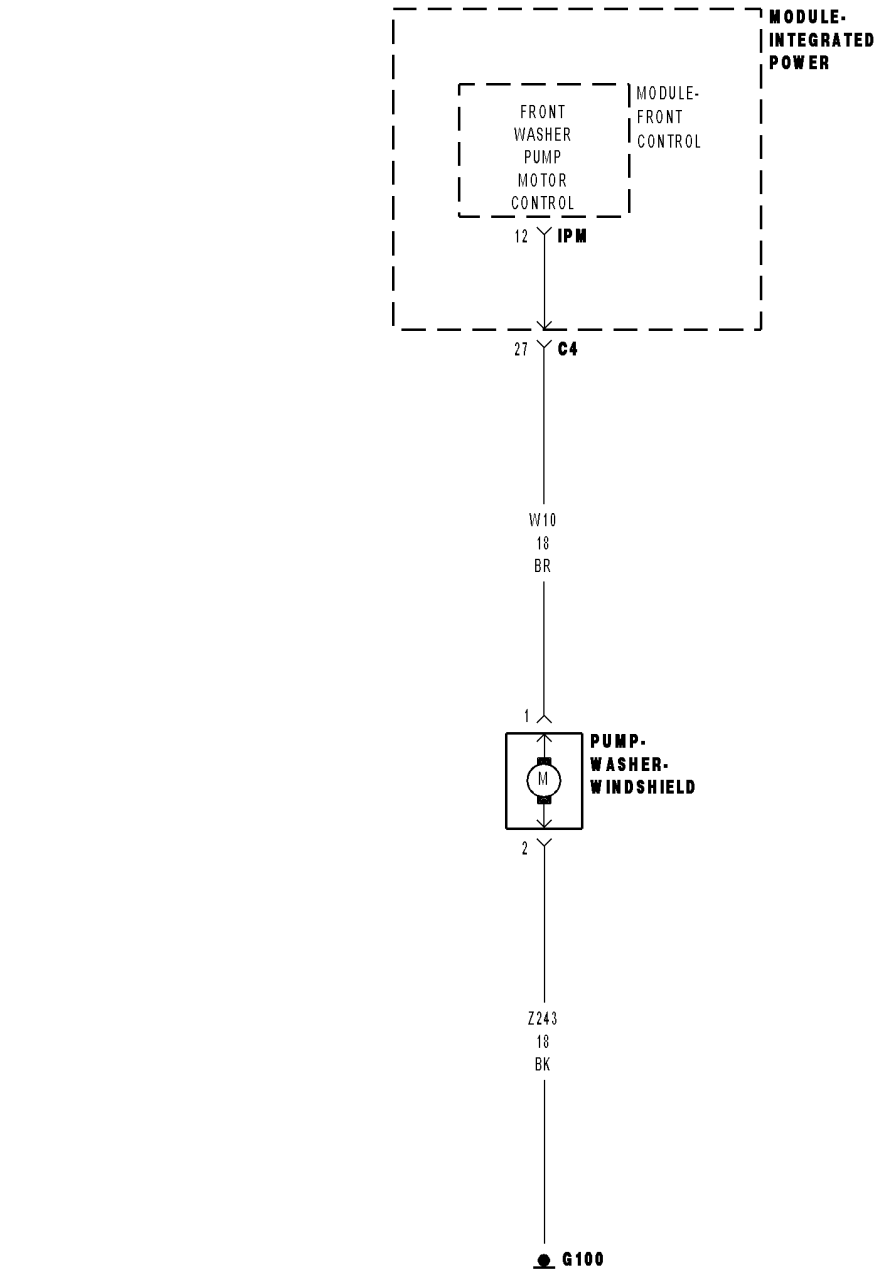


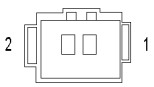
Is there any voltage present?

Yes >> Replace the Power Distribution Center in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

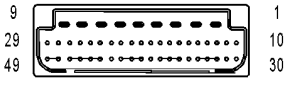
No >> Replace the Front Control Module in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

B231F-FRONT/REAR WASHER MOTOR CONTROL CIRCUIT LOW





PUMP-
WASHER-
WINDSHIELD



MODULE-
FRONT
CONTROL
(IPM)

814a6c22

B231F-FRONT/REAR WASHER MOTOR CONTROL CIRCUIT LOW (CONTINUED)

For the Wiper/Washer system circuit diagram (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
- With the ignition on.
- **Set Condition:**
- When the FCM detects a short/low condition on the washer Pump Motor Control circuit.

Possible Causes
(W10) WASHER PUMP MOTOR CONTROL CIRCUIT
WIPER WASHER PUMP
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, clear all FCM DTC's.

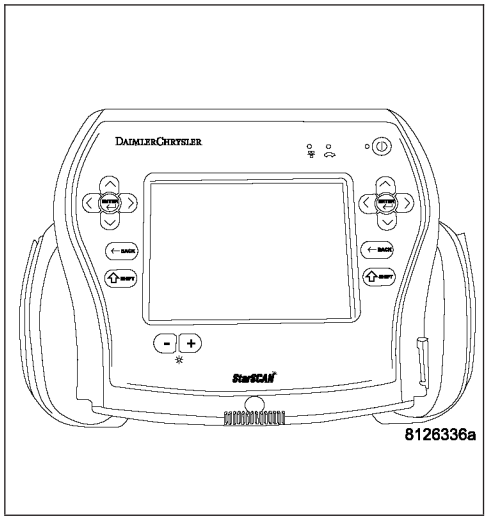
Turn the Washers on.

With the Scan Tool, read the Wiper/Washers DTC's.

Does the Scan Tool read: B231F-FRONT/REAR WASHER MOTOR CONTROL CIRCUIT LOW?

Yes >> Go To 2

No >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Perform the BODY VERIFICATION TEST — VER 1.



2. WASHER PUMP MOTOR

Turn the ignition off.

Disconnect the Washer Pump Motor connector.

Turn the ignition on.

With the Scan Tool, read the DTC's.

Does the Scan Tool read:B231F-FRONT/REAR WASHER MOTOR CONTROL CIRCUIT LOW?

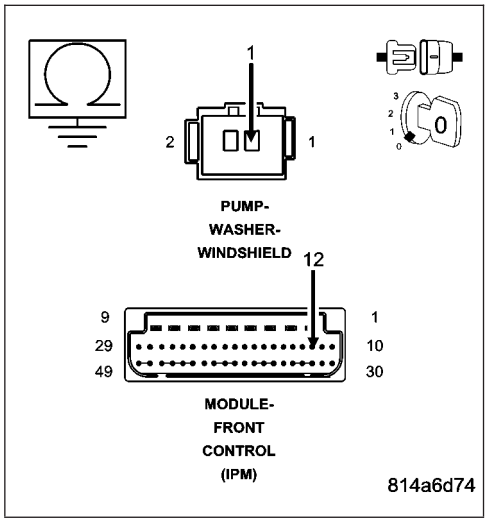
Yes >> Replace the Washer Pump Motor in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Go To 3

B231F-FRONT/REAR WASHER MOTOR CONTROL CIRCUIT LOW (CONTINUED)

3. WASHER PUMP MOTOR CONTROL CIRCUIT

Turn the ignition off.
Disconnect the Washer Pump Motor harness connector.
Disconnect the FCM C3 harness connector.
Measure the resistance between ground and the (W10) Washer Pump Motor Control circuit in the.



Is the resistance below 5.0 ohms?

Yes >> Repair the Washer Pump Motor Control circuit.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Go To 4

---

4. FRONT CONTROL MODULE

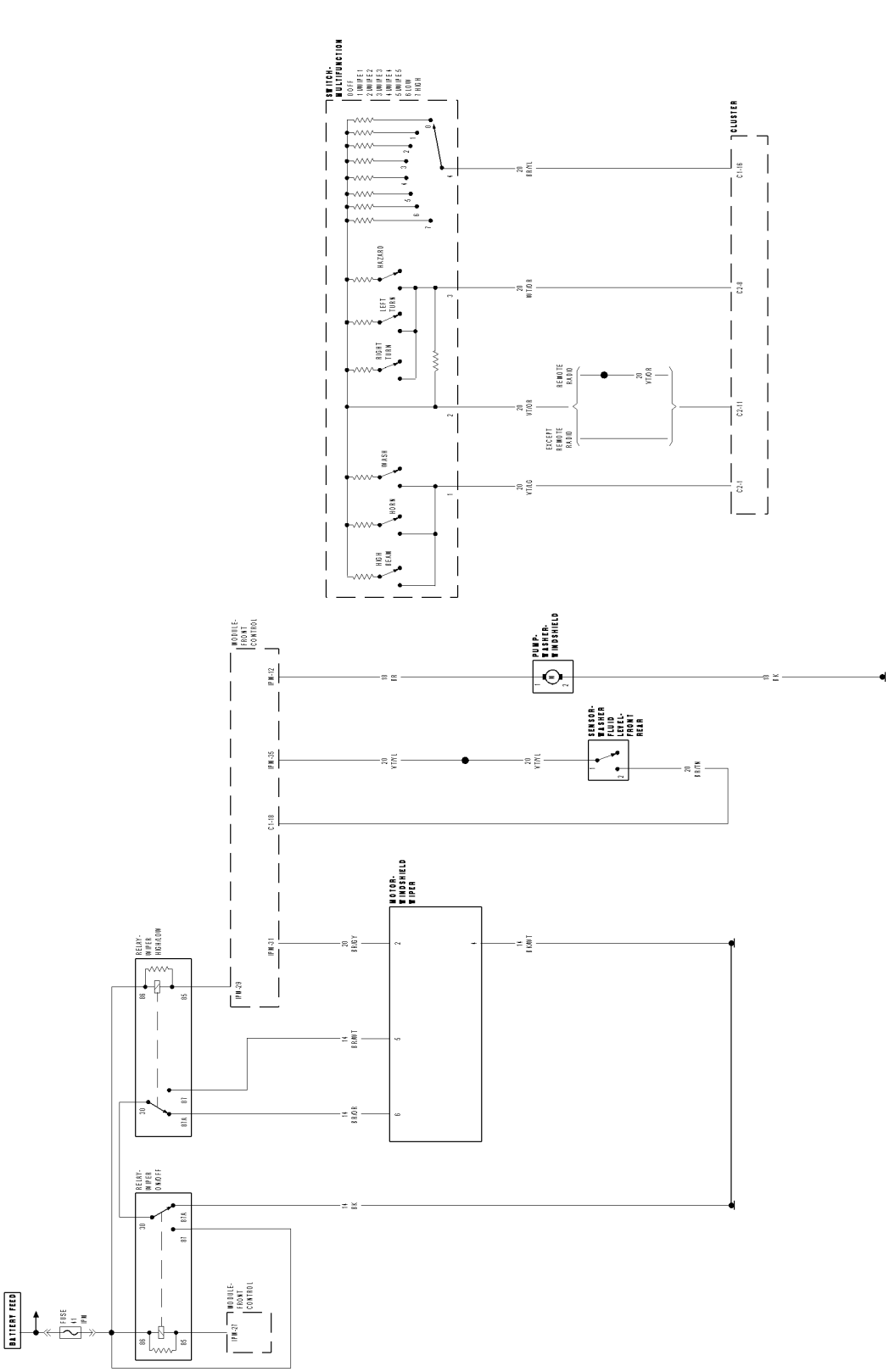
Turn the ignition off.
Disconnect the FCM from the PDC.
Measure the resistance between ground and the (W10) Washer Pump Motor Control circuit.

Is the resistance below 5.0 ohms?

Yes >> Replace the Power Distribution Center in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

No >> Replace the Front Control Module in accordance with the service information.
Perform the BODY VERIFICATION TEST — VER 1.

SCHEMATICS AND DIAGRAMS



FRONT WIPER SCHEMATIC

WIPERS/WASHERS - SERVICE INFORMATION

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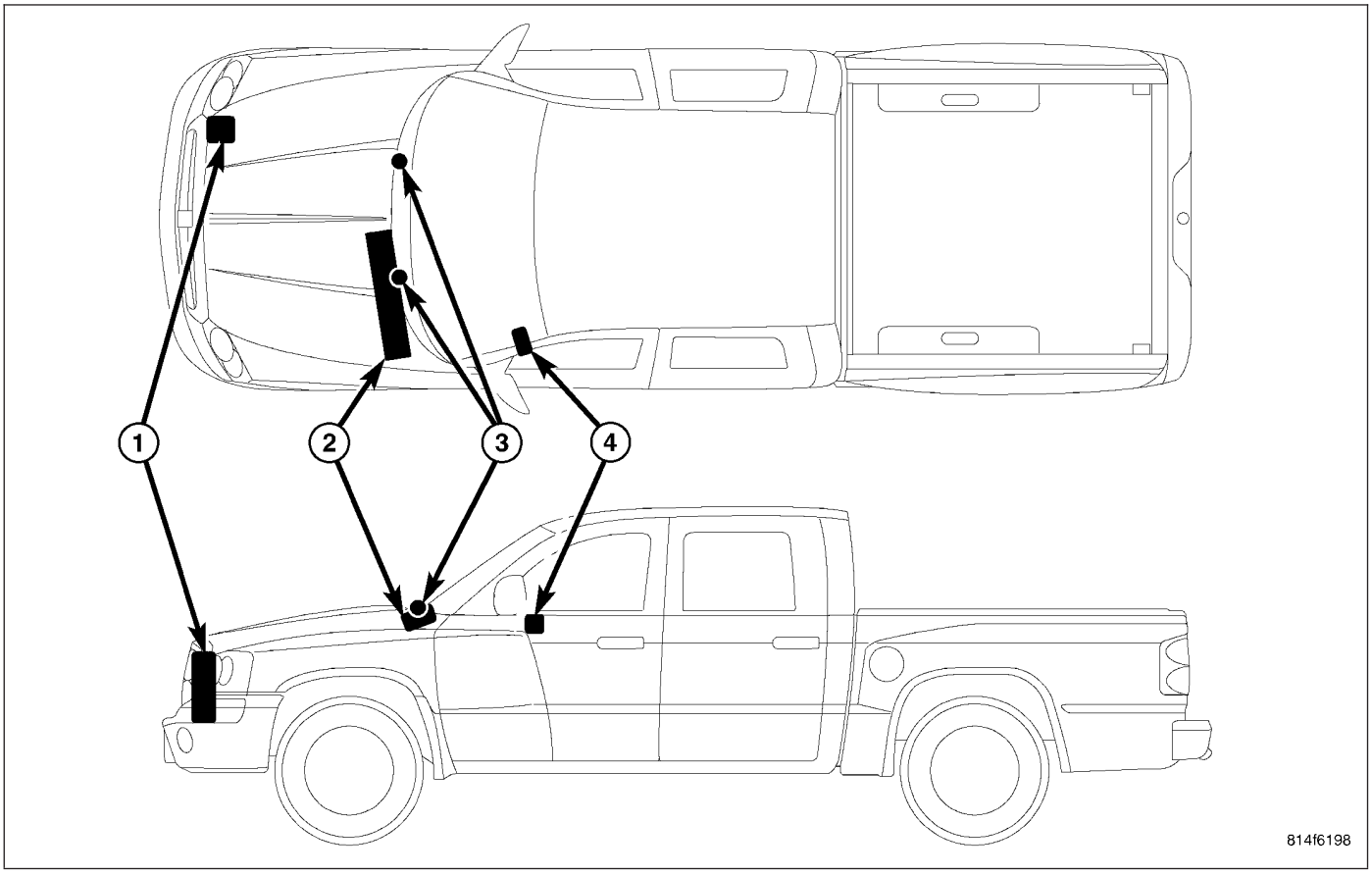
WIPERS/WASHERS - SERVICE INFORMATION

DESCRIPTION



An electrically operated intermittent wiper and washer system is standard factory-installed safety equipment on this model. The wiper and washer system includes the following major components, which are described in further detail elsewhere in this service information:

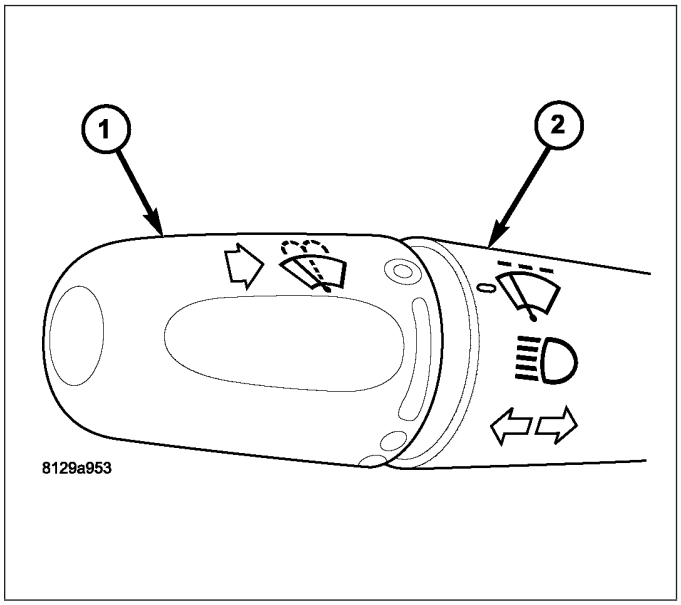
- **Check Valve** - The washer system check valve is integral to the wye fitting located in the washer plumbing between the cowl plenum washer hose and the washer nozzles, and is concealed beneath the cowl plenum cover/grille panel at the base of the windshield.
- **Front Control Module** - The Front Control Module (FCM) is integral to the Integrated Power Module (IPM)/ Power Distribution Center (PDC). The FCM/IPM/PDC is located in the engine compartment, near the battery. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - DESCRIPTION).
- **Instrument Cluster** - The ElectroMechanical Instrument Cluster (EMIC) is also referred to as the Cab Control Node (CCN) in this vehicle. The EMIC/CCN is located in the instrument panel above the steering column opening, directly in front of the driver. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DESCRIPTION).
- **Multi-Function Switch (4)** - The multi-function switch is located on the top of the steering column, just below the steering wheel. A control stalk that extends from the left side of the switch has a control knob on the end that is dedicated to providing all of the driver controls for the front wiper and washer systems. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/MULTI-FUNCTION SWITCH - DESCRIPTION).
- **Washer Fluid Level Switch** - The washer fluid level switch is located in a dedicated hole on the lower, outboard surface of the washer reservoir, ahead of the right front wheel house splash shield.
- **Washer Nozzle (3)** - Two fluidic washer nozzles are secured with integral latch features to dedicated openings in the cowl plenum cover/grille panel located near the base of the windshield.
- **Washer Plumbing** - The plumbing for the washer system consists of rubber hoses and molded plastic fittings. The plumbing is routed along the right side of the engine compartment from the washer reservoir, and through a rubber grommet and hole near the right end of the cowl plenum panel to the washer nozzle fittings on the underside of the cowl plenum cover/grille panel.

- **Washer Pump/Motor** - The electric washer pump/motor unit is located in a dedicated hole on the outboard surface of the washer reservoir, ahead of the right front wheel house splash shield.
- **Washer Reservoir (1)** - The washer reservoir is combined with the engine coolant reserve bottle located on the radiator support to the right of the engine cooling/air conditioning condenser module in the engine compartment. This combined reservoir has separate, clearly identified washer fluid and engine coolant filler caps that are accessed from the right front corner of the engine compartment. (Refer to 7 - COOLING/ENGINE/ COOLANT RECOVERY CONTAINER - DESCRIPTION).
- **Wiper Arm & Blade** - The two wiper arms are secured with nuts to the threaded ends of the two wiper pivot shafts, which extend through the cowl plenum cover/grille panel located near the base of the windshield. The two wiper blades are secured to the two wiper arms with an integral latch, and are parked on the glass near the bottom of the windshield when the wiper system is not in operation.
- **Wiper High/Low Relay** - The wiper high/low relay is an International Standards Organization (ISO) micro relay located in the Integrated Power Module (IPM)/Power Distribution Center (PDC) in the engine compartment near the battery.
- **Wiper Module (2)** - The wiper pivot shafts are the only visible components of the wiper module. The remainder of the module is concealed within the cowl plenum area beneath the cowl plenum cover/grille panel. The wiper module includes the wiper module bracket, four rubber-isolated wiper module mounts, the wiper motor, the wiper motor crank arm, the two wiper drive links, and the two wiper pivots.
- **Wiper On/Off Relay** - The wiper on/off relay is an International Standards Organization (ISO) micro relay located in the Integrated Power Module (IPM)/Power Distribution Center (PDC) in the engine compartment near the battery.

Hard wired circuitry connects the wiper and washer system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the wiper and washer system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

The wiper and washer system is designed to provide the vehicle operator with a convenient, safe, and reliable means of maintaining visibility through the windshield glass. The various components of this system are designed to convert electrical energy produced by the vehicle electrical system into the mechanical action of the wiper blades to wipe the outside surface of the glass, as well as into the hydraulic action of the washer system to apply washer fluid stored in an onboard reservoir to the area of the glass to be wiped. When combined, these components provide the means to effectively maintain clear visibility for the vehicle operator by removing excess accumulations of rain, snow, bugs, mud, or other minor debris from the outside windshield glass surface that might be encountered while driving the vehicle under numerous types of inclement operating conditions.



The vehicle operator initiates all wiper and washer system functions with the control knob (1) on the end of the control stalk (2) of the multi-function switch that extends from the left side of the steering column, just below the steering wheel. Rotating the control knob on the end of the control stalk, selects the Off, Delay, Low, or High wiper system operating modes. In the Delay mode, the control knob also allows the vehicle operator to select from one of

five intermittent wipe Delay intervals. Depressing the control knob towards the steering column actuates the momentary washer system switch, which selects the Wash, and Wipe-After-Wash Modes depending upon when and how long the switch is held closed. The multi-function switch provides hard wired resistor multiplexed inputs to the ElectroMechanical Instrument Cluster (EMIC) for all of the wiper and washer system functions. The EMIC then sends electronic messages to the Front Control Module (FCM) over the Controller Area Network (CAN) data bus requesting the appropriate wiper and washer system operating modes.

Wiper and washer system operation are completely controlled by the instrument cluster and FCM logic circuits, and that logic will only allow these systems to operate when the ignition switch is in the Accessory or On positions. Battery current is directed from a B(+) fuse in the Integrated Power Module (IPM)/Power Distribution Center (PDC) to the wiper on/off relay and the wiper high/low relay in the IPM/PDC through a fused B(+) circuit. The FCM uses low side drivers to control wiper system operation by energizing or de-energizing the wiper high/low and wiper on/off relays. The FCM uses a high side driver to control the operation of the washer pump/motor unit. The multi-function switch circuitry receives a clean ground output from the instrument cluster on a multi-function switch return circuit, then provides resistor multiplexed inputs to the instrument cluster on an intermittent wipe mux circuit to indicate the selected wiper system mode and on a wash/beam select mux circuit to indicate the selected washer system mode.

The hard wired circuits and components of the wiper and washer system may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the EMIC, the FCM, or the electronic message inputs to or outputs from the EMIC or the FCM that control the wiper and washer system operating modes. The most reliable, efficient, and accurate means to diagnose the EMIC or the FCM inputs and outputs related to the various wiper and washer system operating modes requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

OPERATING MODES

Following are paragraphs that briefly describe the operation of each of the wiper and washer system operating modes.

CONTINUOUS WIPE MODE

When the Low position of the control knob on the control stalk of the multi-function switch is selected the EMIC sends an electronic wiper switch low message to the FCM, then the FCM energizes the wiper on/off relay. This directs battery current through the normally open contacts of the energized wiper on/off relay and the normally closed contacts of the de-energized wiper high/low relay to the low speed brush of the wiper motor, causing the wipers to cycle at low speed.

When the High position of the control knob is selected the EMIC sends an electronic wiper switch high message to the FCM, then the FCM energizes both the wiper on/off relay and the wiper high/low relay. This directs battery current through the normally open contacts of the energized wiper on/off relay and the normally open contacts of the energized wiper high/low relay to the high speed brush of the wiper motor, causing the wipers to cycle at high speed.

When the Off position of the multi-function switch control knob is selected, the EMIC sends an electronic wiper switch off message to the FCM. If the wiper motor was operating at high speed, the FCM immediately de-energizes the wiper high/low relay causing the wiper motor to return to low speed operation. Then one of two events will occur. The event that occurs depends upon the position of the wiper blades on the windshield at the moment that the control knob Off position is selected.

If the wiper blades are in the down position on the windshield when the Off position is selected, the park switch that is integral to the wiper motor is closed to ground and provides a hard wired park switch sense input to the FCM. The FCM then de-energizes the wiper on/off relay and the wiper motor ceases to operate. If the wiper blades are not in the down position on the windshield at the moment the Off position is selected, the park switch is an open circuit and the FCM keeps the wiper on/off relay energized, which causes the wiper motor to continue running at low speed until the wiper blades are in the down position on the windshield and the park switch input to the FCM is again closed to ground.

INTERMITTENT WIPE MODE

When the control knob on the control stalk of the multi-function switch is moved to one of the Delay interval positions the EMIC sends an electronic wiper switch delay message to the FCM, then the FCM electronic intermittent wipe logic circuit responds by calculating the correct length of time between wiper sweeps based upon the selected delay interval input. The FCM monitors the changing state of the wiper motor park switch through a hard wired park

switch sense input. This input allows the FCM to determine the proper intervals at which to energize and de-energize the wiper on/off relay to operate the wiper motor intermittently for one low speed cycle at a time.

The FCM logic is also programmed to provide vehicle speed sensitivity to the selected intermittent wipe delay intervals. In order to provide this feature the FCM monitors electronic vehicle speed messages from the Powertrain Control Module (PCM) and doubles the selected delay interval whenever the vehicle speed is about sixteen kilometers-per-hour (ten miles-per-hour) or less.

WASH MODE

When the control knob on the control stalk of the multi-function switch is depressed to the momentary Wash position for more than about one-half second, the EMIC sends an electronic washer switch message to the FCM, then the FCM directs battery current to the washer pump/motor unit. This will cause the washer pump/motor unit to be energized for as long as the Wash switch is held closed up to about ten seconds, and to de-energize when the Wash switch is released.

When the control knob is depressed to the momentary Wash position while the wiper system is operating in one of the Delay interval positions, the washer pump/motor operation is the same. However, the FCM also energizes the wiper on/off relay to override the selected delay interval and operate the wiper motor in a continuous low speed mode for as long as the control knob is held depressed, then de-energizes the relay and reverts to the selected delay mode interval several wipe cycles after the control knob is released. If the control knob is held depressed for more than about ten seconds, the FCM will suspend washer pump/motor operation until the knob is released for about two seconds, then cycled back to the Wash position.

WIPE-AFTER-WASH MODE

When the control knob on the control stalk of the multi-function switch is depressed to the momentary Wash position for more than about one-half second while the wiper system is not operating, the EMIC sends an electronic washer switch message to the FCM, then the FCM directs battery current to the washer pump/motor unit and energizes the wiper on/off relay. This will cause the washer pump/motor unit to be energized and operate the wiper motor in a continuous low speed mode for as long as the Wash switch is held closed up to about ten seconds. When the control knob is released, the FCM de-energizes the washer pump/motor unit, but allows the wiper motor to operate for several additional wipe cycles before it de-energizes the wiper on/off relay and parks the wiper blades near the base of the windshield.

If the control knob is held depressed for more than about ten seconds, the FCM will suspend washer pump/motor operation until the knob is released for about two seconds, then cycled back to the Wash position; however, the wipers will continue to operate for as long as the Wash switch is held closed. The FCM monitors the changing state of the wiper motor park switch through a hard wired wiper park switch sense circuit input. This input allows the FCM to count the number of wipe cycles that occur after the Wash switch is released, and to determine the proper interval at which to de-energize the wiper on/off relay to complete the wipe-after-wash mode cycle.

DIAGNOSIS AND TESTING

WIPER & WASHER SYSTEM

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

If the wiper motor operates, but the wipers do not move on the windshield, replace the faulty wiper module. If the washer pump/motor operates, but no washer fluid is dispensed on the glass; or, if the wipers operate, but chatter, lift, or do not clear the glass, clean and inspect the wiper and washer system components as required. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING) and (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - INSPECTION).

The hard wired wiper and washer system circuits and components may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring

diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the ElectroMechanical Instrument Cluster (EMIC), the Front Control Module (FCM), the Integrated Power Module (IPM), the Power Distribution Center (PDC), the Controller Area Network (CAN) data bus, or the electronic message inputs or outputs used to provide wiper and washer system service or many of the electronic features of the wiper and washer systems. The most reliable, efficient, and accurate means to diagnose the EMIC, the FCM, the IPM, the PDC, the CAN data bus, and the electronic message inputs and outputs for the wiper and washer system requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

CLEANING - WIPER & WASHER SYSTEM

WIPER SYSTEM

CAUTION: Protect the rubber squeegees of the wiper blades from any petroleum-based cleaners, solvents, or contaminants. These products can rapidly deteriorate the rubber squeegees.

The squeegees of wiper blades exposed to the elements for a long time tend to lose their wiping effectiveness. Periodic cleaning of the squeegees is suggested to remove any deposits of salt or road film. The wiper blades, arms, and windshield glass should only be cleaned using a sponge or soft cloth and windshield washer fluid, a mild detergent, or a non-abrasive cleaner. If the wiper blades continue to leave streaks, smears, hazing, or beading on the glass after thorough cleaning of the squeegees and the glass, the entire wiper blade assembly must be replaced.

WASHER SYSTEM

CAUTION: Never introduce petroleum-based cleaners, solvents, or contaminants into the washer system. These products can rapidly deteriorate the rubber seals and hoses of the washer system, as well as the rubber squeegees of the wiper blades.

CAUTION: Never use compressed air to flush the washer system plumbing. Compressed air pressures are too great for the washer system plumbing components and will result in further system damage. Never use sharp instruments to clear a plugged washer nozzle or damage to the nozzle orifice and improper nozzle spray patterns will result.

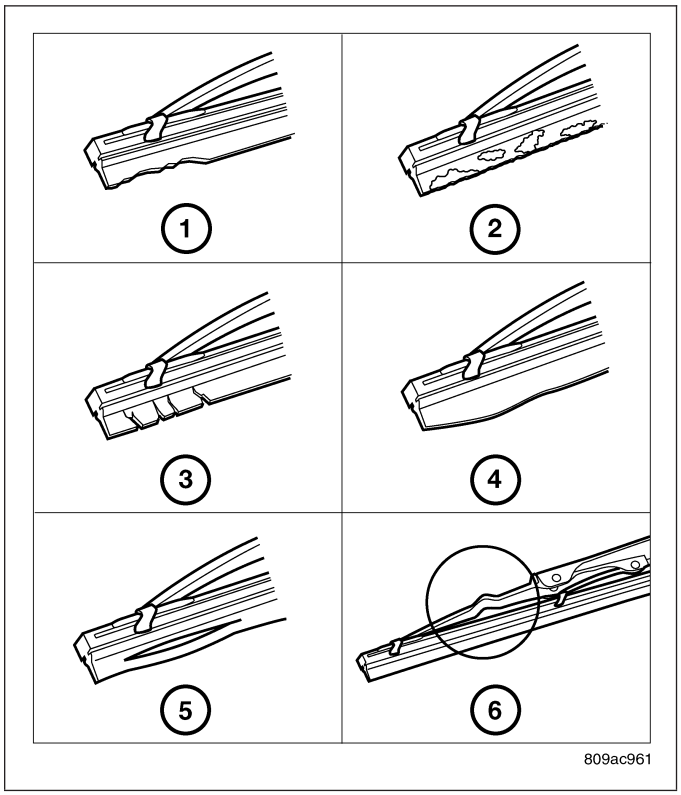
If the washer system is contaminated with foreign material, drain the washer reservoir by removing the windshield washer pump from the reservoir. Clean foreign material from the inside of the washer pump inlet filter screen and the washer reservoir using clean washer fluid, a mild detergent, or a non-abrasive cleaner. Flush foreign material from the washer system plumbing by first disconnecting the washer hoses from the washer nozzles, then running the washer pump to run clean washer fluid or water through the system. Plugged or restricted washer nozzles should be carefully back-flushed using compressed air. If the washer nozzle obstruction cannot be cleared, replace the washer nozzle.

INSPECTION - WIPER & WASHER SYSTEM

WIPER SYSTEM

The wiper blades and wiper arms should be inspected periodically, not just when wiper performance problems are experienced. This inspection should include the following points:

1. Carefully inspect the wiper blades for any indications of worn or uneven edges (1), foreign material deposits (2), hardening or cracking (3), deformation or fatigue (4), or splitting (5). Inspect the wiper blade support components and the wiper arms for damage (6) or corrosion. If the wiper arms and blades are contaminated with any foreign material, clean them and the glass as required. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING). If a wiper blade or arm is damaged, or if corrosion is evident, replace the affected wiper arm or blade with a new unit. Do not attempt to repair a wiper arm or blade that is damaged or corroded.
2. Carefully lift the wiper blade off of the glass. Note the action of the wiper arm hinge. The wiper arm should pivot freely at the hinge, but with no lateral looseness evident. If there is any binding evident in the wiper arm hinge, or there is evident lateral play in the wiper arm hinge, replace the wiper arm.



CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

3. Once proper hinge action of the wiper arm is confirmed, check the hinge for proper spring tension. Remove the wiper blade from the wiper arm. Either place a small postal scale between the blade end of the wiper arm and the glass, or carefully lift the blade end of the arm away from the glass using a small fish scale. Compare the scale readings between the right and left wiper arms. Replace a wiper arm if it has comparatively lower spring tension, as evidenced by a lower scale reading.
4. After cleaning and inspecting the wiper components and the glass, if the wiper blade still fails to clear the glass without smearing, streaking, chattering, hazing, or beading, replace the wiper blade.

WASHER SYSTEM

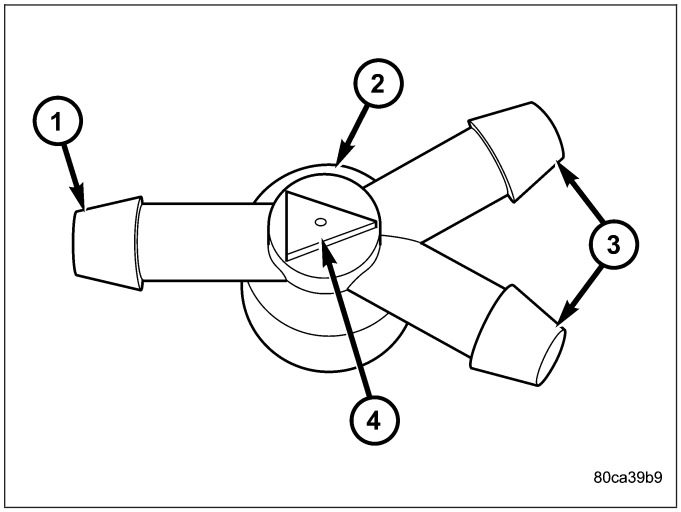
The washer system components should be inspected periodically, not just when washer performance problems are experienced. This inspection should include the following points:

1. Check for ice or other foreign material in the washer reservoir. If contaminated, clean and flush the washer system. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING).
2. Inspect the washer plumbing for pinched, leaking, deteriorated, or incorrectly routed hoses and damaged or disconnected hose fittings. Replace damaged or deteriorated hoses and hose fittings. Leaking washer hoses can sometimes be repaired by cutting the hose at the leak and splicing it back together using an in-line connector fitting. Similarly, sections of deteriorated hose can be cut out and replaced by splicing in new sections of hose using in-line connector fittings. Whenever routing a washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts. Also, sharp bends that might pinch the washer hose must be avoided.

CHECK VALVE

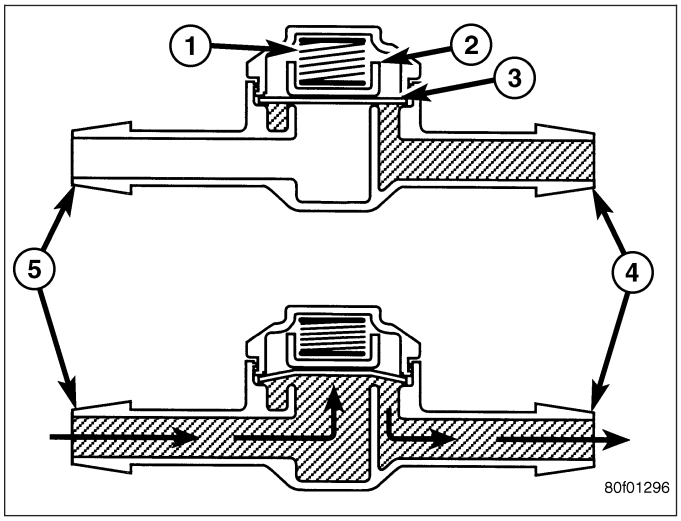
DESCRIPTION

A single washer system check valve is standard equipment on this model, and is installed in the washer system plumbing. The check valve is integral to the washer nozzle plumbing wye fitting (2) located in the cowl plenum area beneath the cowl plenum cover/grille panel near the base of the windshield. The check valve consists of a molded plastic body with a raised arrowhead (4) molded into its center section that indicates the direction of the flow through the valve, and three barbed hose nipples (1 and 3) formed in a wye configuration on the outside circumference of the center section of the valve body. The check valve cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.



OPERATION

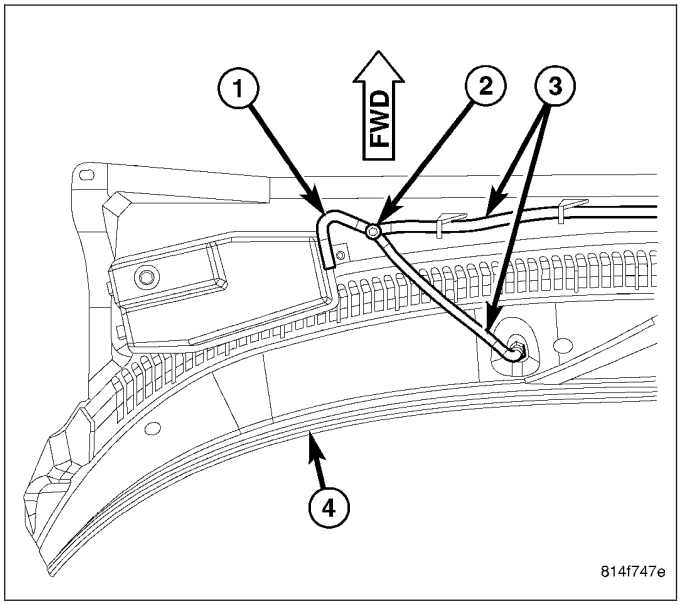
The check valve provides more than one function in this application. It serves as a wye connector fitting between the engine compartment and washer nozzle sections of the washer supply hose. It prevents washer fluid from draining out of the washer supply hoses back to the washer reservoir. This drain-back would result in a lengthy delay from when the washer switch is actuated until washer fluid was dispensed through the washer nozzles, because the washer pump would have to refill the washer plumbing from the reservoir to the nozzles. Such a drain-back condition could also result in water, dirt, or other outside contaminants being siphoned into the washer system through the washer nozzle orifice. This water could subsequently freeze and plug the nozzle, while other contaminants could interfere with proper nozzle operation and cause improper nozzle spray patterns. In addition, the check valve prevents washer fluid from siphoning through the washer nozzles after the washer system is turned Off.



When the washer pump pressurizes and pumps washer fluid from the reservoir through the washer plumbing, the fluid pressure (5) unseats a diaphragm (3) from over a sump well within the valve by overriding the pressure applied to a piston (2) by a spring (1). With the diaphragm unseated, washer fluid is allowed to flow toward the two washer nozzles (4). When the washer pump stops operating, the spring pressure on the piston seats the diaphragm over the sump well in the valve and fluid flow in either direction within the washer plumbing is prevented. The check valve cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

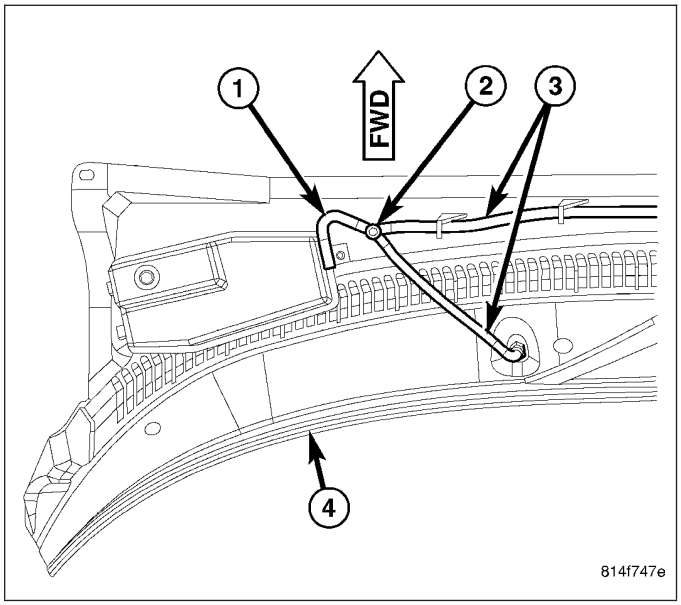
REMOVAL

1. Remove both wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/ WIPER ARM - REMOVAL).
2. Unlatch and open the hood.
3. Remove the cowl plenum cover/grille panel from over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - REMOVAL).
4. From the underside of the cowl plenum cover/grille panel (4), disconnect the cowl plenum (1) and washer nozzle (3) hoses from the three barbed nipples of the check valve (2).
5. Remove the check valve from the underside of the cowl plenum cover/grille panel.



INSTALLATION

1. Position the check valve (2) to the underside of the cowl plenum cover/grille panel (4). Be certain that the flow direction arrow molded into the check valve body is oriented towards the washer nozzles.
2. From the underside of the cowl plenum cover/grille panel, reconnect the cowl plenum (1) and washer nozzle (3) hoses to the three barbed nipples of the check valve.
3. Reinstall the cowl plenum cover/grille panel over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/ COWL GRILLE - INSTALLATION).
4. Close and latch the hood.
5. Reinstall both wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/ WIPER ARM - INSTALLATION).

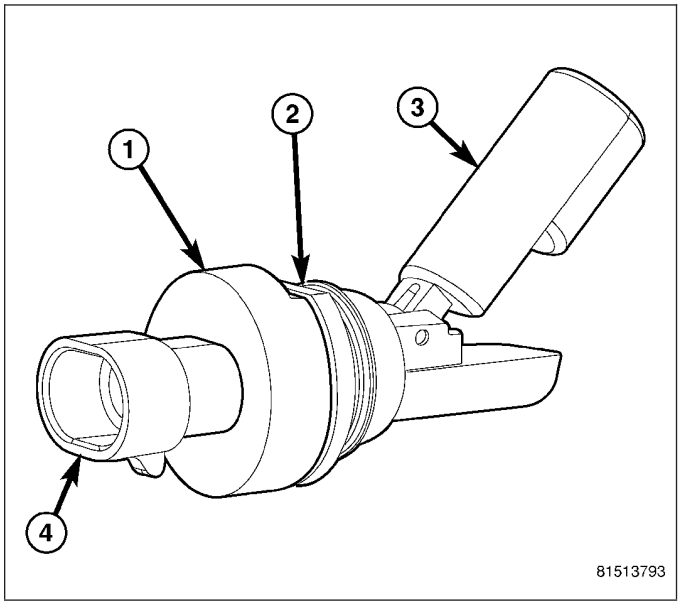


SENSOR-WASHER FLUID LEVEL

DESCRIPTION

The washer fluid level switch (1) is a single pole, single throw reed-type switch mounted on the outboard facing side of the washer reservoir, just forward of the washer pump. Only the molded plastic switch mounting flange and the integral connector receptacle (4) are visible when the switch is installed in the reservoir. A short nipple formation extends from the inner surface of the switch mounting flange, and a barb on the nipple is pressed through a rubber grommet seal (2) installed in the mounting hole of the reservoir.

A small, molded plastic float (3) pivots on hinge stanchions that extend toward the float from the nipple formation. A small magnet is secured within the end of the float nearest the nipple, and a reed switch is concealed within the nipple. A diagnostic resistor is connected between the two switch terminals within the switch mounting flange. The washer fluid level switch cannot be adjusted or repaired. If faulty or damaged, the switch must be replaced.



OPERATION

The washer fluid level switch uses a pivoting, oblong float to monitor the level of the washer fluid in the washer reservoir. The float contains a small magnet. When the float pivots, the proximity of this magnet to a stationary reed switch within the nipple formation of the switch changes. When the fluid level in the washer reservoir is at or above the float level, the float moves to a vertical position, the influence of the float magnetic field is removed from the reed switch, and the normally open reed switch contacts open. When the fluid level in the washer reservoir falls below the level of the pivoting float, the float moves to a horizontal position, the influence of the float magnetic field is applied to the reed switch, and the contacts of the normally open reed switch close.

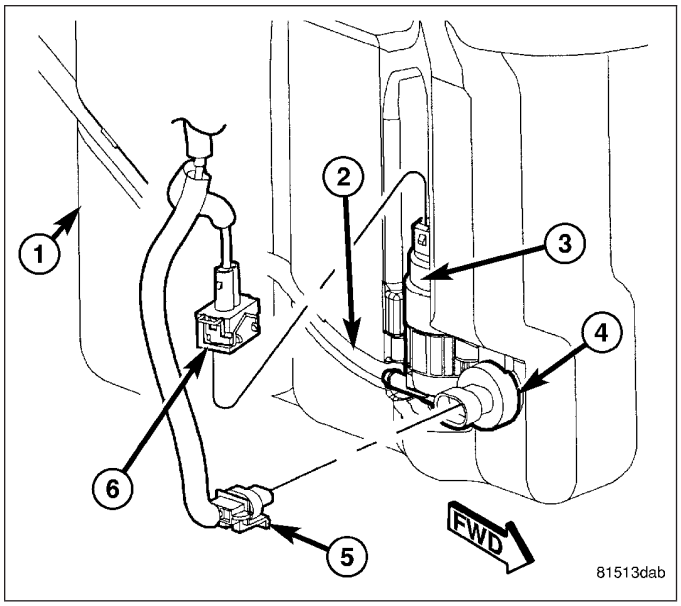
The washer fluid level switch is connected to the vehicle electrical system through a dedicated take out and connector of the headlamp and dash wire harness. The switch is connected in series between a clean ground output of the Front Control Module (FCM) on a sensor return circuit and the washer fluid switch sense input to the FCM. When the switch closes, the FCM senses the ground on the washer fluid switch sense circuit. The FCM is programmed to respond to this input by sending an electronic washer fluid indicator lamp-on message to the instrument cluster over the Controller Area Network (CAN) data bus. The instrument cluster responds to this message by illuminating the washer fluid indicator and by sounding an audible chime tone warning.

The washer fluid level switch may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the instrument cluster, the FCM, or the electronic message inputs to or outputs from the instrument cluster and the FCM that control the operation of the washer fluid visual and/or audible indicators. The most reliable, efficient, and accurate means to diagnose the washer fluid level indicator, the instrument cluster, the FCM, or the electronic message inputs and outputs related to the washer fluid indicator requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

NOTE: The washer fluid level switch can be removed from the washer reservoir without removing the reservoir from the vehicle.

1. Disconnect and isolate the battery negative cable.
2. Siphon the washer fluid from the washer reservoir into a clean container for reuse.
3. Raise and support the vehicle.
4. Reach between the front of the right front wheel house splash shield and the right front bumper support to access the outboard facing lower surface of the combination washer reservoir/coolant reserve bottle (1).
5. Disconnect the wire harness connector (5) from the washer fluid level switch unit (4).

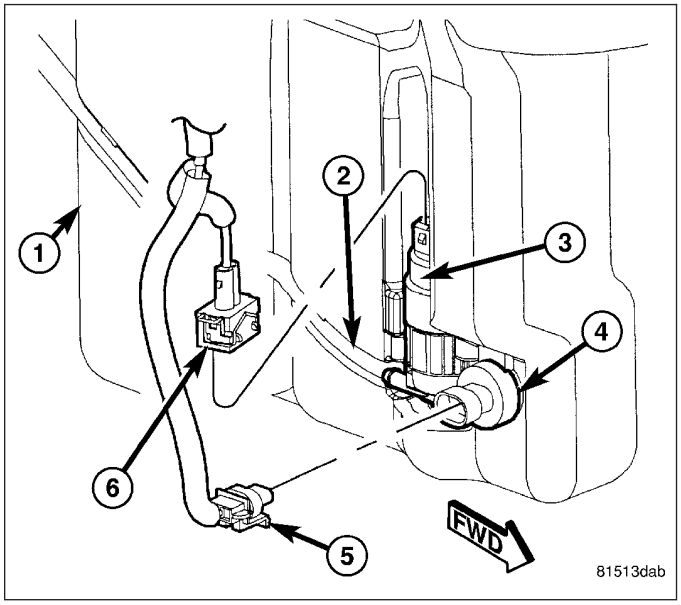


NOTE: The pivoting float of the washer fluid level switch must be in a horizontal position within the reservoir in order to be removed. With the reservoir empty and in an upright position, the pivoting float will orient itself to the horizontal position when the flat of the indexing notch on the top of the switch housing is also in a horizontal position.

6. Using a trim stick or another suitable wide flat-bladed tool, gently pry the barbed nipple of the washer fluid level switch out of the rubber grommet seal in the reservoir. Care must be taken not to damage the reservoir.
7. Remove the switch and float from the reservoir.
8. Remove the rubber grommet seal from the mounting hole in the washer reservoir and discard.

INSTALLATION

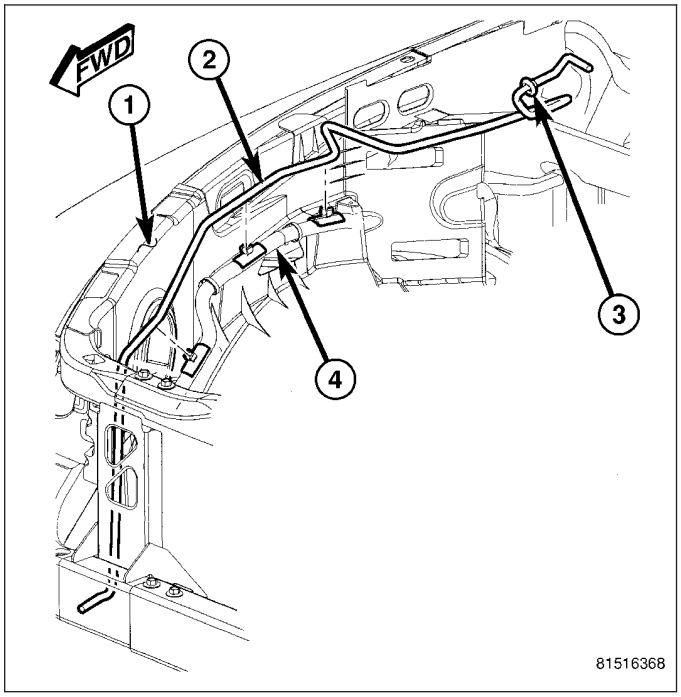
1. Install a new rubber grommet seal into the washer fluid level switch mounting hole in the outboard facing side of the combination washer reservoir/coolant reserve bottle (1). Always use a new rubber grommet seal on the reservoir.
2. Insert the float of the switch (4) through the rubber grommet seal in the reservoir.
3. Using hand pressure, press firmly and evenly on the switch until the barbed nipple is fully seated in the rubber grommet seal in the reservoir. The index notch should be at the top of the switch housing and engage the index rib molded into the reservoir above the switch mounting hole.
4. Reconnect the wire harness connector (5) to the switch connector receptacle.
5. Lower the vehicle.
6. Refill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.
7. Reconnect the battery negative cable.



WASHER HOSES/TUBES

DESCRIPTION

The washer plumbing consists of a small diameter rubber reservoir washer hose that is routed from the barbed outlet nipple of the electric washer pump/motor unit on the combination washer reservoir/coolant reserve bottle through a trough molded into the outboard side of the reservoir/bottle unit above the washer pump to the engine compartment washer hose (2). The engine compartment washer hose is secured in routing clips located along the length of the headlamp and dash wire harness (2), which is routed through the engine compartment along the top of the right front inner fender shield (1) from the headlamp support to the dash panel. This hose is connected to the washer reservoir washer hose with a molded plastic in-line fitting that has a barbed nipple on each end.



The engine compartment washer hose passes through a hole protected with a rubber grommet (3) in the right side of the cowl plenum panel. In the cowl plenum the engine compartment hose is connected to the cowl plenum washer hose by another molded plastic in-line fitting. The cowl plenum washer hose is connected to the washer system check valve/wye fitting on the underside of the cowl plenum cover/grille panel. The cowl plenum washer hose and the two washer nozzle hoses are routed through integral routing clips on the underside of the cowl plenum cover/grille panel. The cowl plenum washer hose is connected to one nipple on the wye fitting and the two washer nozzle hoses are connected to the other two nipples. The washer nozzle hoses are then routed along the underside of the cowl plenum cover/grille panel to the two washer nozzles.

Washer hose is available for service only as roll stock, which must then be cut to length. The molded plastic washer hose fittings cannot be repaired. If these fittings are faulty or damaged, they must be replaced.

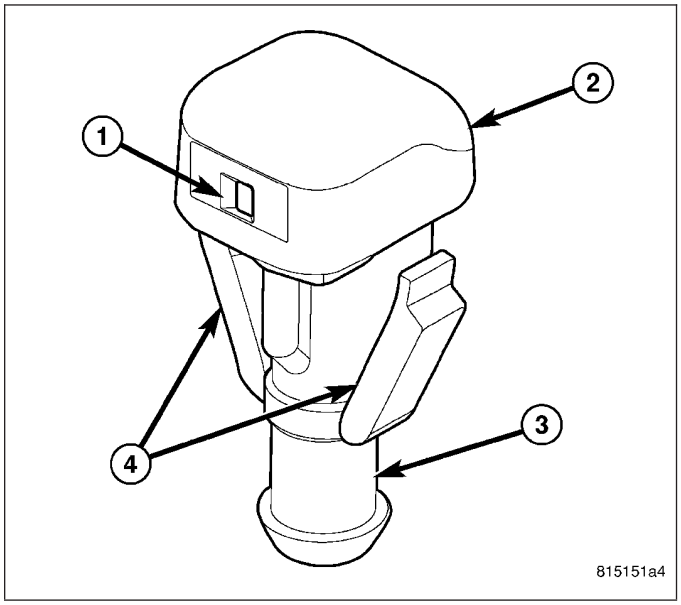
OPERATION

Washer fluid in the washer reservoir is pressurized and fed by the washer pump/motor unit through the washer system plumbing and fittings to the two washer nozzles. Whenever routing the washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts; and, sharp bends that might pinch the hose must be avoided.

NOZZLE-WINDSHIELD WASHER

DESCRIPTION

The fluidic washer nozzles (2) are constructed of molded plastic. Each nozzle has two integral latches (4) and an anti-rotation tab that secure them in dedicated holes in the cowl plenum cover/grille panel located near the base of the windshield The domed upper surface of the washer nozzle is visible on the top of the plenum cover/grille panel, and the nozzle orifice (1) is oriented towards the windshield glass. The washer plumbing fittings (3) for the washer nozzles extend below the cowl plenum cover/grille panel. The cowl plenum cover/grille panel must be removed from the vehicle to access the nozzles for service. The washer nozzles cannot be adjusted or repaired. If faulty or damaged, they must be replaced.

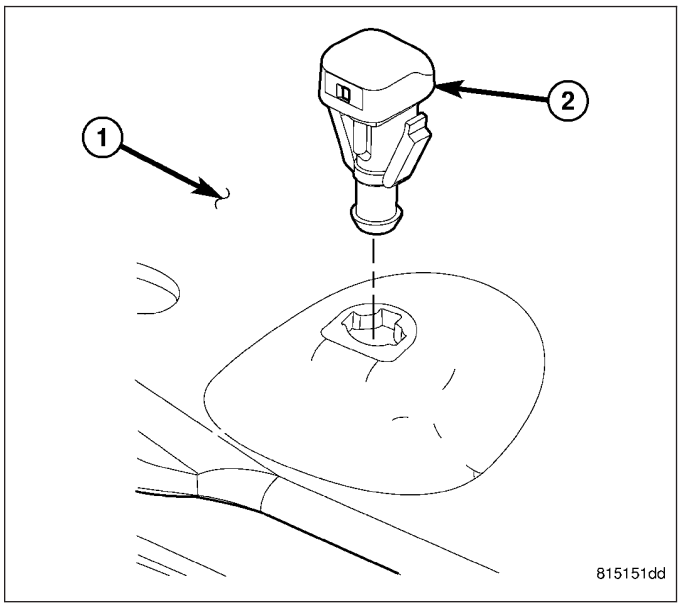


OPERATION

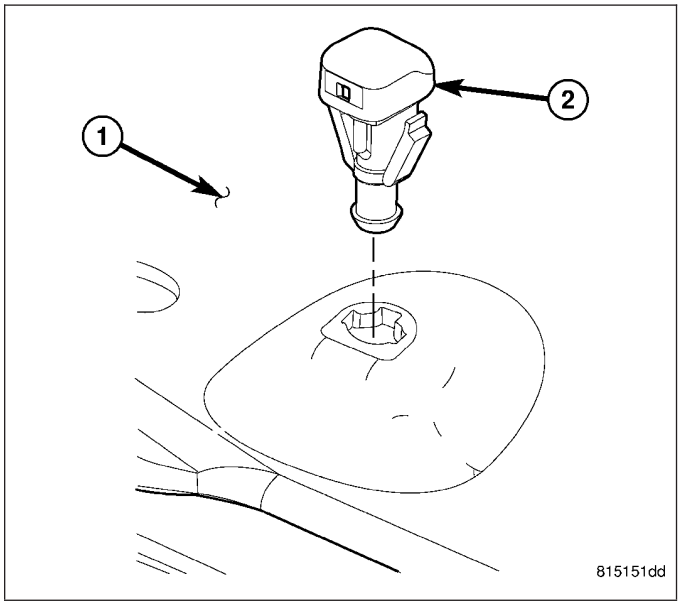
The two washer nozzles are designed to dispense washer fluid into the wiper pattern area on the outside of the windshield glass. Pressurized washer fluid is fed to each nozzle from the washer reservoir by the washer pump/motor unit through a single hose, which is attached to a barbed nipple on each washer nozzle below the cowl plenum cover/grille panel. A fluidic matrix within the washer nozzle causes the pressurized washer fluid to be emitted from the nozzle orifice as an oscillating stream to more effectively cover a larger area of the glass to be cleaned.

REMOVAL

1. Remove both wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARM - REMOVAL).
2. Unlatch and open the hood.
3. Remove the cowl plenum cover/grille panel from over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - REMOVAL).
4. From the underside of the cowl plenum cover/grille panel (1), disconnect the washer nozzle hose from the barbed nipple of the washer nozzle (2).
5. From the underside of the cowl plenum cover/grille panel, release the integral latch features of the washer nozzle and push the nozzle out through the mounting hole toward the top side of the cowl plenum cover/grille panel.
6. Remove the washer nozzle from the top of the cowl plenum cover/grille panel.



INSTALLATION



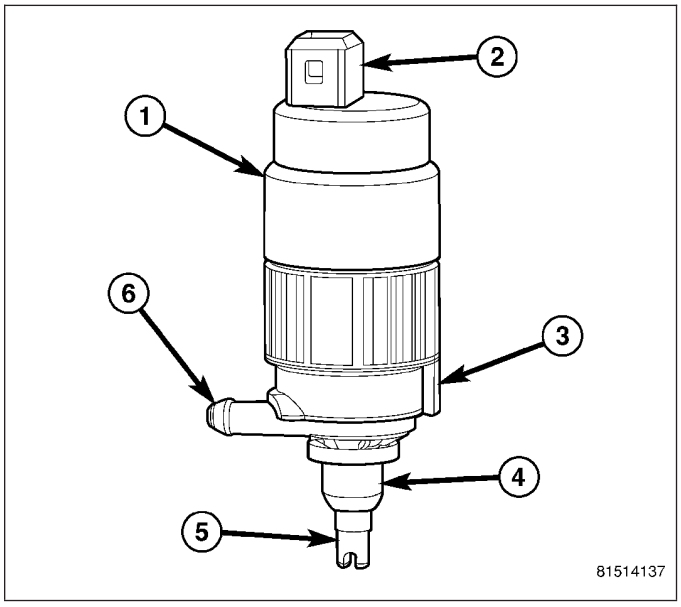
1. From the top of the cowl plenum cover/grille panel (1), position the nipple end of the washer nozzle (2) through the mounting hole and engage the anti-rotation tab of the nozzle into the anti-rotation key-way in the mounting hole.
2. Using hand pressure, push firmly and evenly on the top of the washer nozzle until the integral latch features lock into place on the underside of the cowl plenum cover/grille panel.
3. From the underside of the cowl plenum cover/grille panel, reconnect the washer hose to the barbed nipple of the washer nozzle.
4. Reinstall the washer nozzle hose into its routing clips on the underside of the cowl plenum cover/grille panel.
5. Reinstall the cowl plenum cover/grille panel over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - INSTALLATION).
6. Close and latch the hood.
7. Reinstall both wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARM - INSTALLATION).

PUMP-WASHER-WINDSHIELD

DESCRIPTION

The washer pump/motor unit (1) is located on the top of a sump area on the outward facing side of the combination washer reservoir/coolant reserve bottle, ahead of the right front fender wheel house splash shield. A small permanently lubricated and sealed reversible electric motor is coupled to the rotor-type washer pump (3).

An inlet nipple (5) on the bottom of the pump housing passes through a rubber grommet seal (4) installed in a dedicated mounting hole of the washer reservoir. When the pump is installed in the reservoir the barbed outlet nipple (6) on the pump valve body housing points rearward and connects the unit to the reservoir washer hose, which is engaged in an integral trough molded into the reservoir/bottle unit.



The washer pump/motor unit is retained on the reservoir by the interference fit between the pump inlet nipple and the grommet seal, which is a light press fit. The top of the washer pump is also secured to the washer reservoir by the use of a snap fit into a receptacle molded into the reservoir that allows for mounting of the washer pump without the use of fasteners. An integral connector receptacle (2) on the top of the motor housing connects the unit to the vehicle electrical system through a dedicated take out and connector of the headlamp and dash wire harness.

The washer pump/motor unit cannot be repaired. If faulty or damaged, the entire washer pump/motor unit must be replaced.

OPERATION

The washer pump/motor unit features a small Direct Current (DC) electric motor. The motor is connected to the vehicle electrical system through a single take out and two-cavity connector of the headlamp and dash wire harness. The motor is grounded at all times through another take out of the headlamp and dash wire harness with a single eyelet terminal connector that is secured by a nut to a ground stud located on the right front fender inner shield in the engine compartment.

The motor receives battery current on a washer pump/motor control circuit. The washer pump/motor control circuit is energized through a high side driver within the Front Control Module (FCM) whenever the FCM receives an electronic message requesting washer system operation from the ElectroMechanical Instrument Cluster (EMIC) over the Controller Area Network (CAN) data bus. The EMIC monitors a resistor multiplexed hard wired input from the momentary washer switch contacts within the multi-function switch on the steering column to determine when it should issue the electronic message requesting washer system operation.

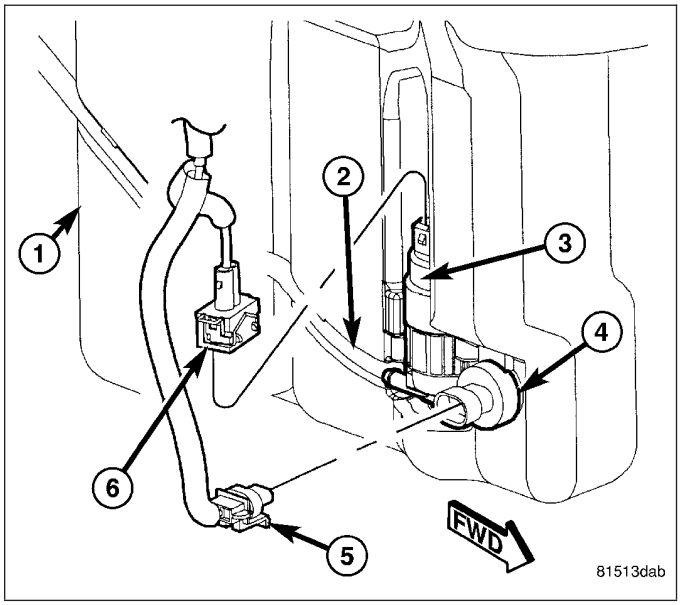
Washer fluid is gravity-fed from the washer reservoir to the inlet side of the washer pump. When the pump motor is energized, the motor spins the rotor within the washer pump. The spinning pump rotor pressurizes the washer fluid and forces it through the pump outlet nipple, the washer plumbing, and the washer nozzles onto the windshield glass.

The washer pump/motor unit and the hard wired motor control circuit from the FCM may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the FCM, the EMIC, the CAN data bus, or the electronic messages used to provide washer pump/motor unit control. The most reliable, efficient, and accurate means to diagnose the FCM, the EMIC, the CAN data bus, and the electronic messages for the washer pump/motor unit control requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

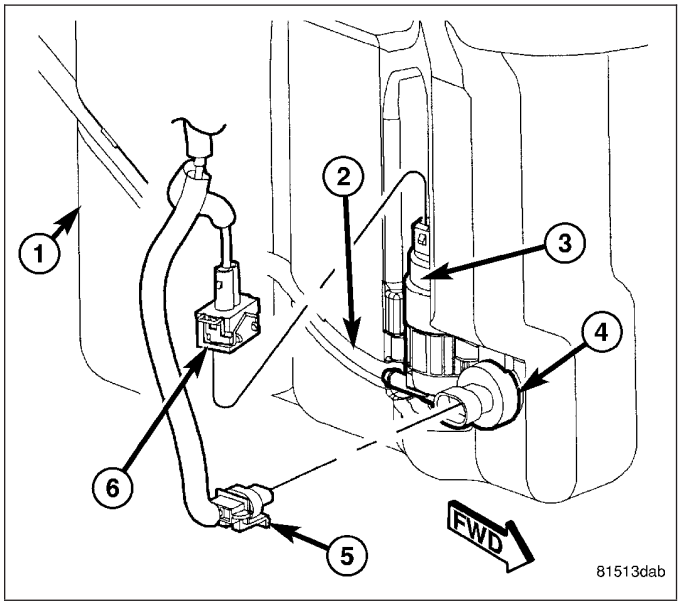
NOTE: The washer pump/motor unit can be removed from the washer reservoir without removing the reservoir from the vehicle.

1. Disconnect and isolate the battery negative cable.
2. Siphon the washer fluid from the washer reservoir into a clean container for reuse.
3. Raise and support the vehicle.
4. Reach between the front of the right front wheel house splash shield and the right front bumper support to access the outboard facing lower surface of the combination washer reservoir/coolant reserve bottle (1).
5. Disconnect the wire harness connector (6) from the washer pump/motor unit (3).
6. Disconnect the washer hose (2) from the pump outlet nipple.
7. Grasp the top of the washer pump/motor housing and pull it firmly rearward far enough to disengage the snap fit between the motor housing and the molded motor receptacle in the reservoir.



8. Using a trim stick or another suitable wide flat-bladed tool, gently pry the inlet nipple of the washer pump out of the rubber grommet seal in the reservoir sump. Care must be taken not to damage the reservoir.
9. Remove the rubber grommet seal from the washer pump mounting hole in the reservoir and discard.

INSTALLATION

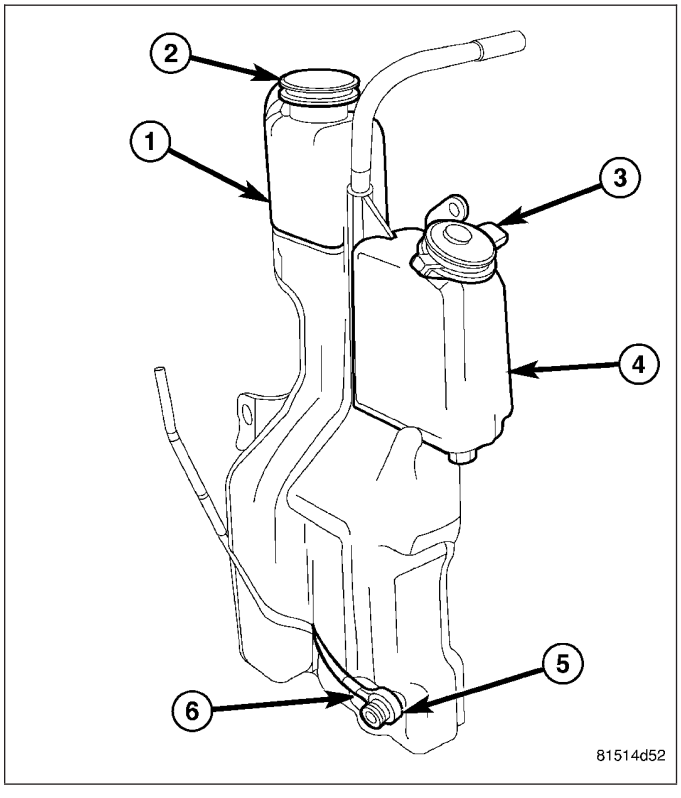


1. Install a new rubber grommet seal into the washer pump mounting hole in the sump on the outboard facing side of the combination washer reservoir/ coolant reserve bottle (1). Always use a new rubber grommet seal on the reservoir.
2. Position the inlet nipple of the washer pump/motor unit (3) to the rubber grommet seal in the reservoir.
3. Using hand pressure, press firmly and evenly downward on the washer pump/motor unit until the inlet nipple is fully seated in the rubber grommet seal in the pump mounting hole of the reservoir.
4. Align the top of the washer pump/motor housing with the molded motor receptacle in the washer reservoir.
5. Using hand pressure, press firmly and evenly on the top of washer pump/motor unit until the motor housing snaps into the receptacle.
6. Reconnect the reservoir washer hose (2) to the pump outlet nipple.
7. Reconnect the wire harness connector (6) to the connector receptacle on the top of the pump motor.
8. Lower the vehicle.
9. Refill the washer reservoir with the washer fluid siphoned from the reservoir during the removal procedure.
10. Reconnect the battery negative cable.

RESERVOIR-WASHER

DESCRIPTION

The molded plastic washer fluid reservoir (4) is integral to the engine coolant overflow bottle (1) located directly behind the grille to the right of the engine cooling module in the engine compartment. The reservoir is constructed of a translucent plastic that allows the washer fluid level or engine coolant level to be inspected without removing the reservoir caps. A bright yellow plastic filler cap (3) with a rubber seal and an International Control and Display Symbol icon for “Windshield Washer” molded into it snaps over the open end of the filler neck. The cap hinges on and is secured to the reservoir by an integral bail strap and retaining collar that is snapped over the filler neck when it is removed for inspecting or adjusting the fluid level in the reservoir.



The washer reservoir is secured to the front end support structure by an integral locator pin at the bottom and through two integral mounting brackets, one at the top and one at the back, by screws. There are separate, dedicated holes on the lower outboard facing side of the reservoir provided for the mounting of the washer/pump motor unit and the washer fluid level switch. A receptacle for the washer pump is molded into the reservoir that provides a snap fit that allows mounting of the washer pump/motor unit without the use of fasteners. A trough molded into the outboard side of the reservoir and the coolant overflow bottle secures and routes the reservoir washer hose from the pump rearward and upward into the engine compartment.

The washer reservoir is serviced only as a unit with the engine coolant reserve bottle. The washer reservoir cannot be repaired and, if faulty or damaged, the coolant reserve bottle/washer reservoir unit must be replaced. (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - REMOVAL). The grommet seals for the washer pump/motor unit and the washer fluid level switch, and the filler cap are each available for individual service replacement.

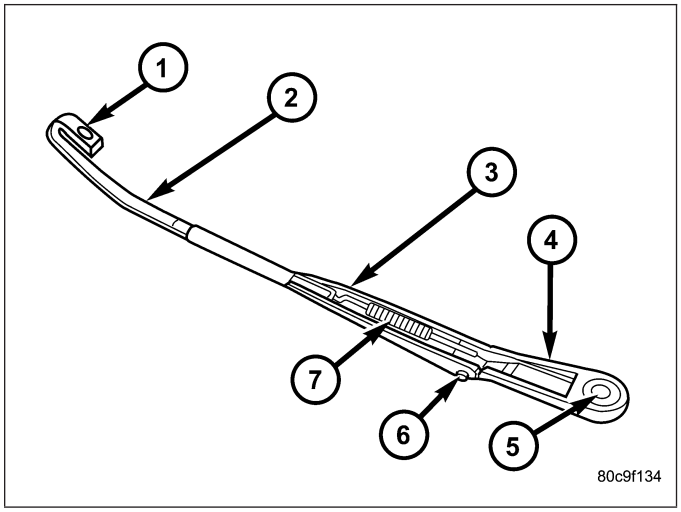
OPERATION

The washer fluid reservoir provides a secure, on-vehicle storage location for a large reserve of washer fluid for operation of the washer system. The washer reservoir filler neck provides a clearly marked and readily accessible point from which to add washer fluid to the reservoir.

The washer/pump motor unit is located in a sump area near the bottom of the reservoir to be certain that washer fluid will be available to the pump as the fluid level in the reservoir becomes depleted. The washer fluid level switch is mounted just above the sump area of the reservoir so that there will be adequate warning to the vehicle operator that the washer fluid level is low, before the washer system will no longer operate.

WIPER ARM

DESCRIPTION



The wiper arms are the rigid members located between the wiper pivots protruding from the cowl plenum cover/grille panel near the base of the windshield and the wiper blades on the windshield glass. Both wiper arms feature an over-center hinge (6) that allows easy access to the windshield glass for cleaning. The wiper arms each have a die cast metal pivot end (4) with a large tapered mounting hole (5) at one end. A molded black plastic cap fits over the wiper arm retaining nut to conceal the nut and this mounting hole following wiper arm installation.

The wide end of a tapered, stamped steel channel (3) hinges on and is secured with a hinge pin to the blade end of the wiper arm pivot end. One end of a long, rigid, stamped steel strap (2), with a small hole near its pivot end, is riveted and crimped within the narrow end of the stamped steel channel. The tip of the wiper blade end of this strap is bent back under itself to form a small hook (1). Concealed within the stamped steel channel, one end of a long spring (7) is engaged with a wire hook on the underside of the die cast pivot end, while the other end of the spring is hooked through the small hole in the steel strap. The entire wiper arm has a satin black finish applied to all of its visible surfaces.

The right and left wiper arms are unique and are not interchangeable. A wiper arm cannot be adjusted or repaired. If damaged or faulty, the entire wiper arm unit must be replaced.

OPERATION

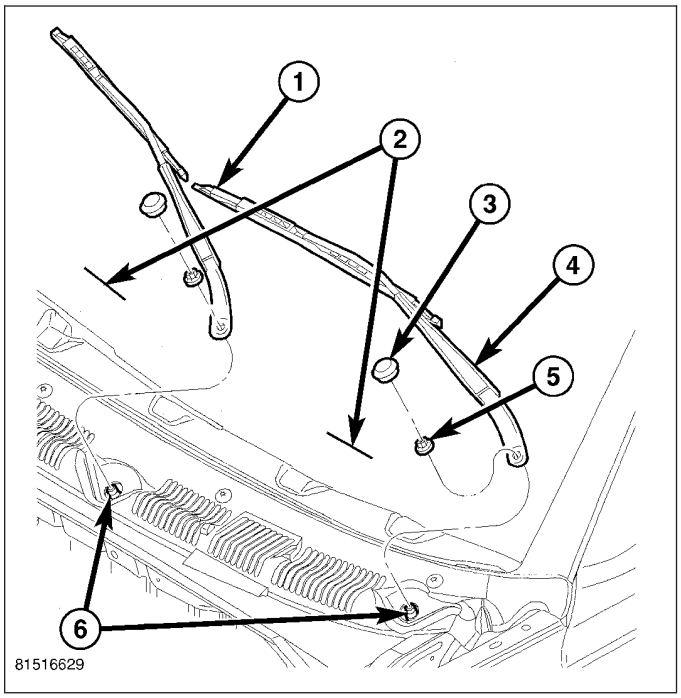
The wiper arms are designed to mechanically transmit the motion from the wiper pivots to the wiper blades. The wiper arm must be properly indexed to the wiper pivot in order to maintain the proper wiper blade travel on the glass. The tapered mounting hole in the wiper arm pivot end interlocks with the serrations on the tapered outer

circumference of the wiper pivot shaft, allowing positive engagement and finite adjustment of this connection. The mounting nut locks the wiper arm to the threaded stud of the wiper pivot shaft.

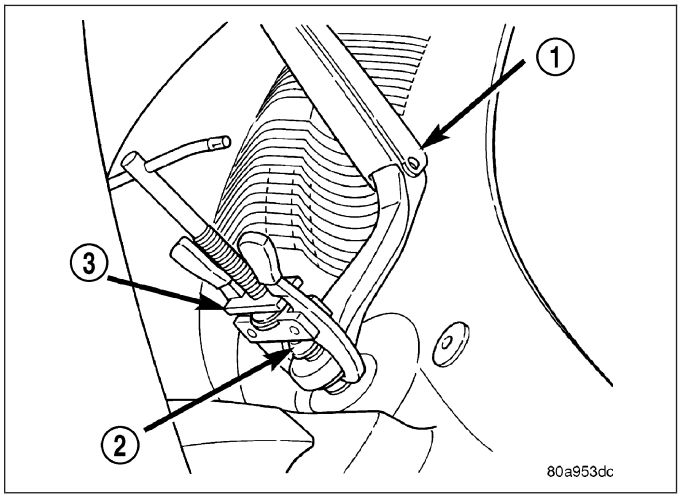
The spring-loaded wiper arm hinge controls the down-force applied through the tip of the wiper arm to the wiper blade on the glass. The hook formation on the tip of the wiper arm provides a cradle for securing and latching the wiper blade pivot block to the wiper arm.

REMOVAL

1. Lift the wiper arm (4) to its over-center position to hold the wiper blade (1) off of the glass and relieve the spring tension on the wiper arm to wiper pivot shaft (6) connection.
2. Carefully pry the plastic nut cap (3) off of the pivot end of the wiper arm.
3. Remove the nut (5) that secures the wiper arm to the pivot shaft.



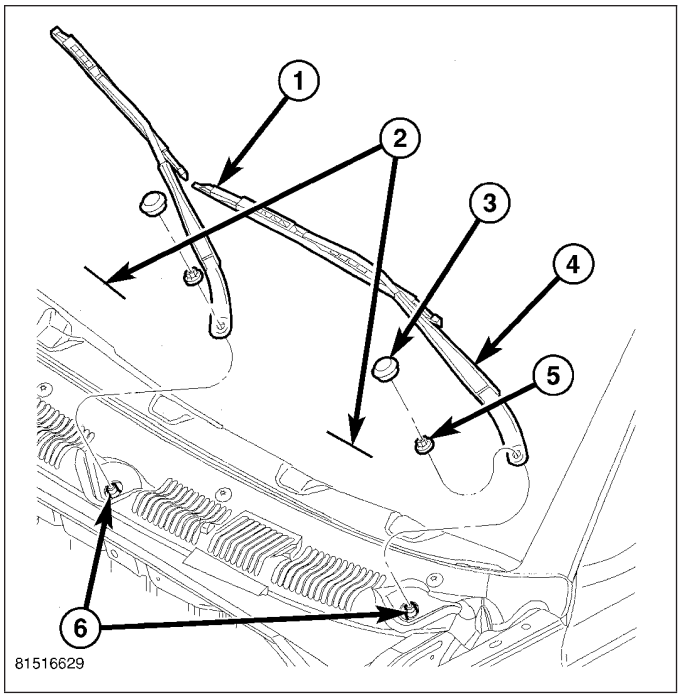
4. If necessary, use a suitable battery terminal puller (3) to disengage the wiper arm (1) from the pivot shaft (2).
5. Remove the wiper arm pivot end from the pivot shaft.



INSTALLATION

NOTE: Be certain that the wiper motor is in the park position before attempting to install the wiper arms. Turn the ignition switch to the On position and move the multi-function switch control knob to its Off position. If the wiper pivots move, wait until they stop moving, then turn the ignition switch back to the Off position. The wiper motor is now in its park position.

1. The wiper arms (4) must be indexed to the pivot shafts (6) with the wiper motor in the park position to be properly installed. Position the wiper arm pivot end onto the pivot shaft so that the lower edge of the wiper blade (1) is aligned with the wiper alignment lines (2) concealed in the upper margin of the lower windshield blackout area.
2. Once the wiper blade is aligned, lift the wiper arm away from the windshield slightly to relieve the spring tension on the pivot end and push the arm down over the pivot shaft.
3. Install and tighten the nut (5) that secures the wiper arm to the pivot shaft. Tighten the nut to 24 N·m (18 ft. lbs.).
4. Wet the windshield glass, then operate the wipers. Turn the wiper switch to the Off position, then check for the correct wiper arm position and readjust as required.
5. Reinstall the plastic nut cap (3) onto the wiper arm pivot nut.

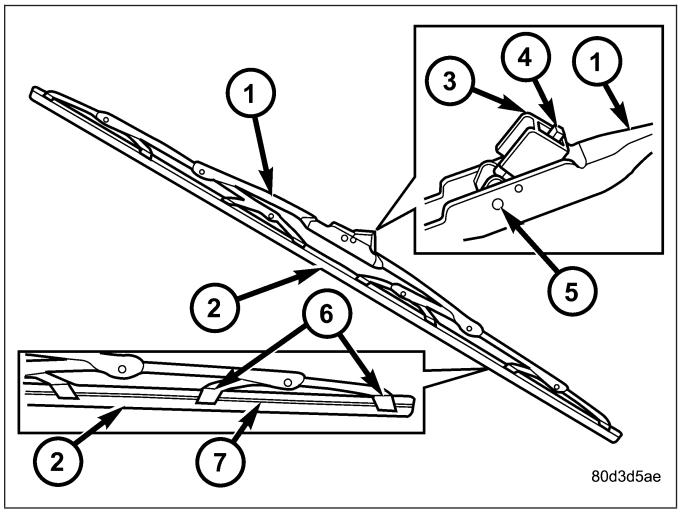


WIPER BLADE

DESCRIPTION

Each wiper blade is secured by an integral latching pivot block (3) to the hook formation on the tip of each wiper arm, and rests on the glass near the base of the windshield when the wipers are not in operation. The wiper blade consists of the following components:

- **Superstructure (1)** - The superstructure includes several stamped steel bridges and links with claw formations that grip the wiper blade element. Also included in this unit is the latching, molded plastic pivot block that secures the superstructure to the wiper arm. All of the metal components of the wiper blade have a satin black finish applied.
- **Element (2)** - The wiper element or squeegee is the resilient rubber member of the wiper blade that contacts the glass.



- **Flexor (7)** - The flexor is a rigid metal component running along the length of each side of the wiper element where it is gripped by the claws (6) of the superstructure.

The right and left wiper blades are 50.00 centimeters (19.69 inches) long, and are interchangeable. They have non-replaceable rubber elements (squeegees). The wiper blades cannot be adjusted or repaired. If faulty, worn, or damaged the entire wiper blade unit must be replaced.

OPERATION

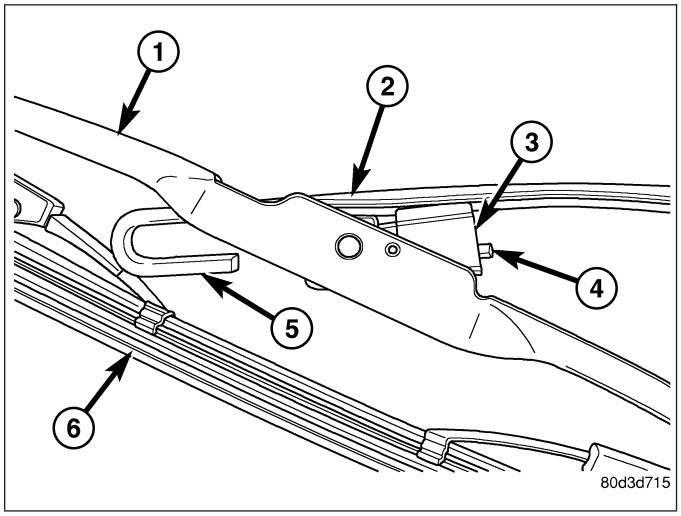
The wiper blades are moved back and forth across the glass by the wiper arms when the wipers are being operated. The wiper blade superstructure is the flexible frame that grips the wiper blade element and evenly distributes the force of the spring-loaded wiper arm along the length of the element. The combination of the wiper arm force and the flexibility of the superstructure makes the element conform to and maintain proper contact with the glass, even as the blade is moved over the varied curvature that may be encountered across the glass surface.

The wiper element flexor provides the claws of the blade superstructure with a rigid, yet flexible component on the element which can be gripped. The rubber element is designed to be stiff enough to maintain an even cleaning edge as it is drawn across the glass, yet resilient enough to conform to the glass surface and flip from one cleaning edge to the other each time the wiper blade changes directions.

REMOVAL

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.

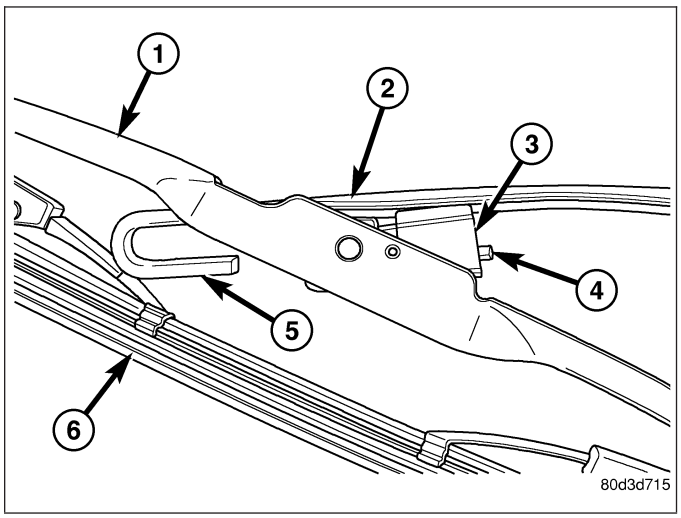


1. Lift the wiper arm (2) to raise the wiper blade and element (6) off of the glass, until the wiper arm hinge is in its over-center position.
2. To remove the blade from the arm, depress the latch release tab (4) on the pivot block (3) under the tip of the arm and slide the blade away from the tip towards the pivot end of the arm far enough to disengage the pivot block from the hook formation (5) on the end of the arm.
3. Extract the hook formation on the tip of the wiper arm through the opening in the wiper blade superstructure (1) just ahead of the pivot block.
4. Gently lower the tip of the wiper arm onto the glass.

INSTALLATION

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.



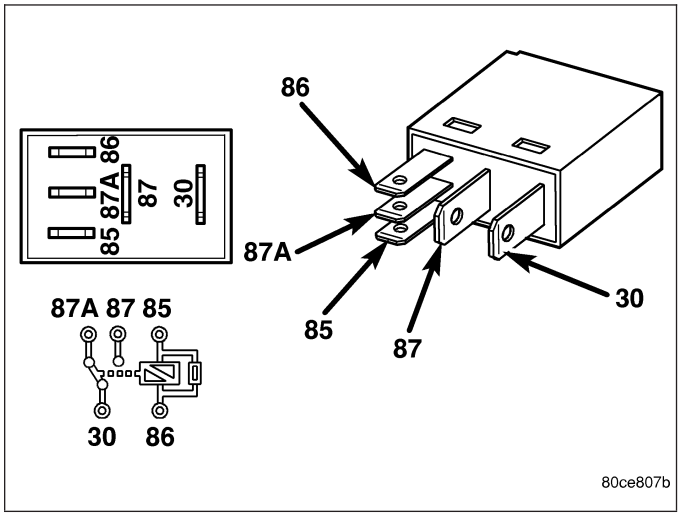
1. Lift the wiper arm (2) off of the windshield glass, until the wiper arm hinge is in its over-center position.
2. Position the wiper blade near the hook formation (5) on the tip of the arm with the notched end of the wiper element flexor oriented towards the end of the wiper arm that is nearest to the wiper pivot.
3. Insert the hook formation on the tip of the arm through the opening in the blade superstructure (1) ahead of the pivot block (3) far enough to engage the pivot block into the hook.
4. Slide the pivot block up into the hook formation on the tip of the wiper arm until the latch release tab (4) snaps into its locked position. Latch engagement will be accompanied by an audible click.
5. Gently lower the wiper blade and element (6) onto the glass.

RELAY-WIPER HIGH/LOW

DESCRIPTION

The wiper high/low relay is a conventional International Standards Organization (ISO) micro relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. This relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs through five integral male spade-type terminals that extend from the relay base plate.

The wiper high/low relay is located in the Power Distribution Center (PDC) in the engine compartment near the battery. Refer to the layout label on the underside of the PDC cover for specific relay cavity assignment information. The wiper high/low relay cannot be adjusted or repaired and, if faulty or damaged, the unit must be replaced.



OPERATION

The wiper high/low relay is an electromechanical switch that uses a low current input from the Front Control Module (FCM) to control a high current output to the front wiper motor. The movable common feed contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This electromagnetic field draws the movable relay contact point away from the fixed normally closed contact point, and holds it against the fixed normally open contact point. When the relay coil is de-energized, spring pressure returns the movable contact point back against the fixed normally closed contact point. A resistor is connected in parallel with the relay coil in the relay, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

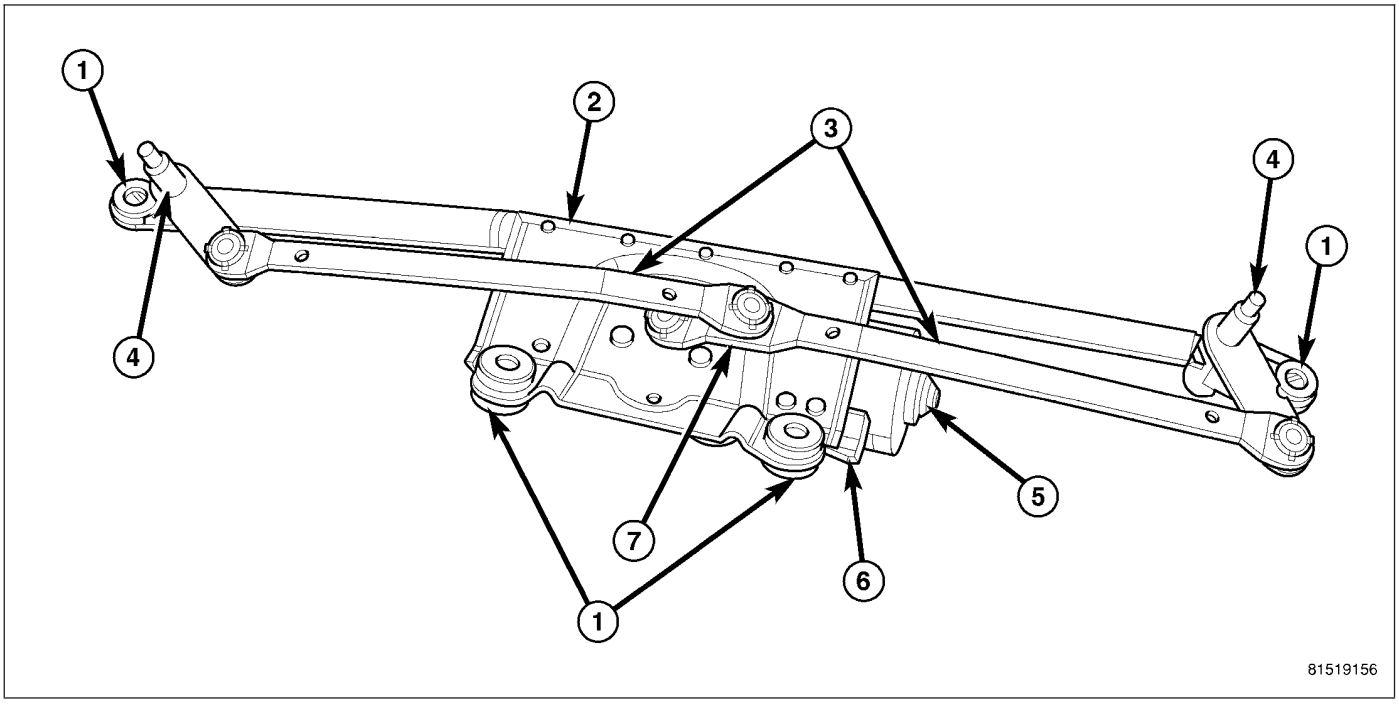
The wiper high/low relay terminals are connected to the vehicle electrical system through a connector receptacle in the Power Distribution Center (PDC). The inputs and outputs of the wiper high/low relay include:

- **Common Feed Terminal** - The common feed terminal (30) is connected to the output of the wiper on/off relay at all times through the wiper on/off relay output circuit.
- **Coil Ground Terminal** - The coil ground terminal (85) is connected to a control output of the Front Control Module (FCM) through a wiper high/low relay control circuit. The FCM controls wiper motor operation by controlling a ground path through this circuit.
- **Coil Battery Terminal** - The coil battery terminal (86) receives battery current when the ignition switch is in the On or Accessory positions from a fuse in the PDC through a fused ignition switch output (run-acc) circuit.
- **Normally Open Terminal** - The normally open terminal (87) is connected to the high speed brush of the wiper motor through a wiper high/low relay high speed output circuit, and is connected to the high speed brush whenever the relay is energized.
- **Normally Closed Terminal** - The normally closed terminal (87A) is connected to the low speed brush of the wiper motor through a wiper high/low relay low speed output circuit, and is connected to the low speed brush whenever the relay is de-energized.

The wiper high/low relay can be diagnosed using conventional diagnostic tools and methods. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the ElectroMechanical Instrument Cluster (EMIC), the FCM, or the electronic message inputs to or outputs from the EMIC and the FCM that control the operation of the wiper high/low relay. The most reliable, efficient, and accurate means to diagnose the wiper high/low relay, the EMIC, the FCM, or the electronic message inputs and outputs related to the wiper high/low relay operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

WIPER MODULE

DESCRIPTION



The wiper module is secured with screws through four rubber grommet-type insulators (1) to the cowl plenum panel. The module is concealed beneath the molded plastic cowl plenum cover/grille panel between the base of the windshield and the rear edge of the hood panel. The ends of the pivot shafts protruding through openings in the cowl plenum cover/grille panel to drive the wiper arms and blades are the only visible components of the wiper module. The wiper module consists of the following major components:

- **Bracket** - The wiper module bracket (2) consists of a long tubular steel main member that has a die cast pivot bracket at each end to which the two wiper pivots (4) are secured. A stamped steel motor bracket is welded near the center of the tubular member to which the wiper motor (5) is secured.
- **Crank Arm (7)** - The wiper motor crank arm is a stamped steel unit with a slotted hole on the driven end that is secured to the wiper motor output shaft with a nut, and has a ball stud secured to the drive end.
- **Linkage (3)** - Two stamped steel drive links connect the wiper motor crank arm to the wiper pivot lever arms. The right side drive link has a plastic socket-type bushing on each end. The left side drive link has a plastic socket-type bushing on one end, and a plastic sleeve-type bushing on the other end. The socket-type bushing on one end of each drive link is snap-fit over the ball stud on the lever arm of its respective pivot. The left side drive link sleeve-type bushing end is then fit over the motor crank arm ball stud, and the other socket-type bushing of the right side drive link is snap-fit over the exposed end of the wiper motor crank arm ball stud.
- **Motor (5)** - The wiper motor features a transmission housing from which the wiper motor output shaft exits and three threaded holes that mount the motor to the module bracket with three screws. A nut secures the wiper motor crank arm to the motor output shaft. The two-speed permanent magnet wiper motor features an integral transmission, an internal park switch, and an internal automatic resetting circuit breaker. A short pigtail wire and connector (6) connect the wiper motor to the vehicle electrical system through a dedicated take out and connector of the headlamp and dash wire harness.
- **Pivots (4)** - The two wiper pivots are secured within the die cast pivot brackets on the outboard ends of the wiper module main member. The lever arms that extend from the center of the pivot shafts each have a ball stud on their end. The upper end of each pivot shaft where the wiper arms will be fastened each has a serrated driver with a threaded stud. The lower ends of the pivot shafts are installed through lubricated bushings in the pivot brackets and are secured with snap rings.

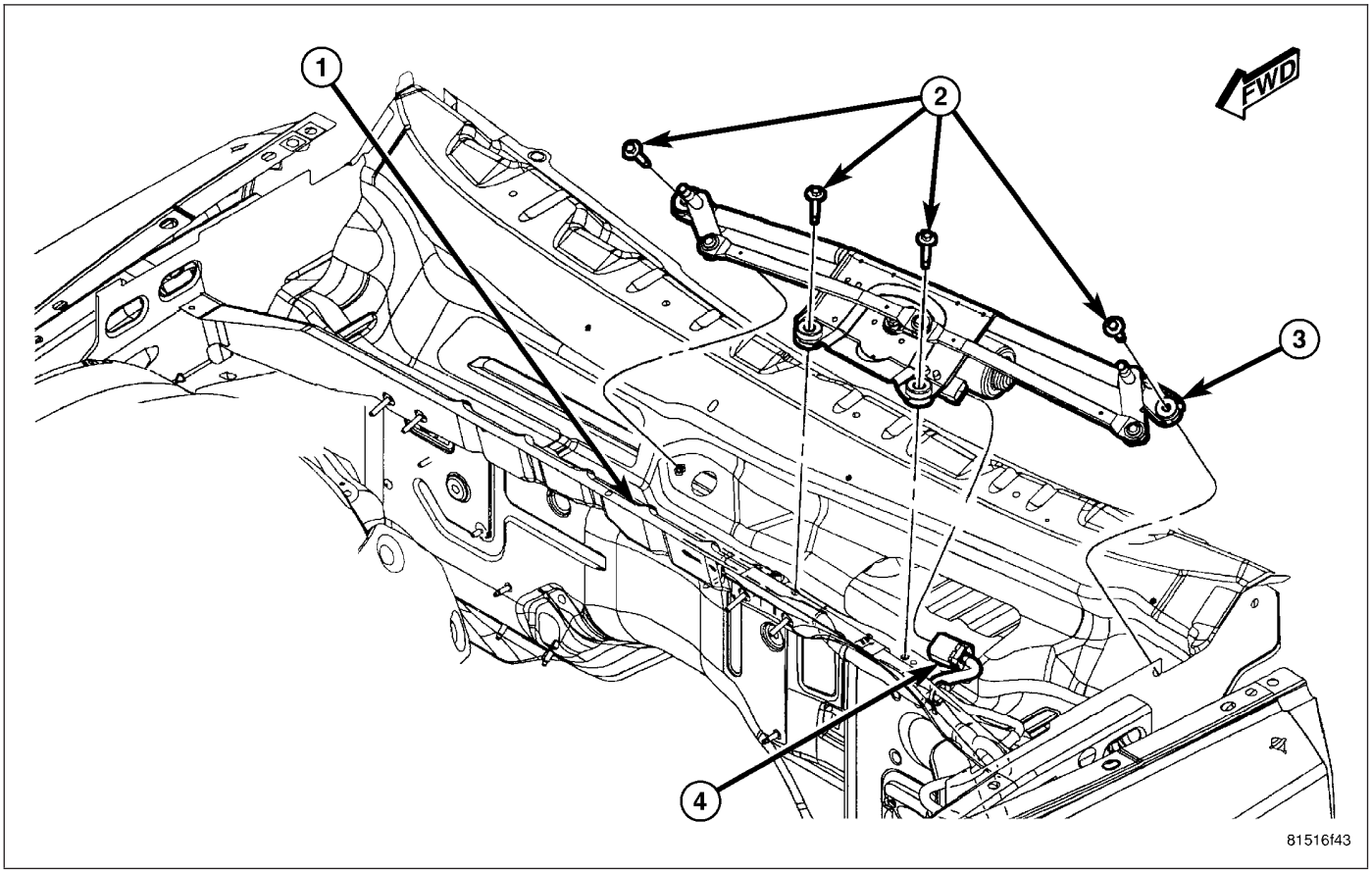
The wiper module cannot be adjusted or repaired. If any component of the module is faulty or damaged, the entire wiper module unit must be replaced.

OPERATION

The wiper module operation is controlled by the battery current inputs received by the wiper motor through the wiper on/off and wiper high/low relays. The wiper motor speed is controlled by current flow to either the low speed or the high speed set of brushes. The park switch is a single pole, single throw, momentary switch within the wiper motor that is mechanically actuated by the wiper motor transmission components. The park switch alternately opens and closes the wiper park switch sense circuit to ground, depending upon the position of the wipers on the glass. This feature allows the motor to complete its current wipe cycle after the wiper system has been turned Off, and to park the wiper blades in the lowest portion of the wipe pattern. The automatic resetting circuit breaker protects the motor from overloads.

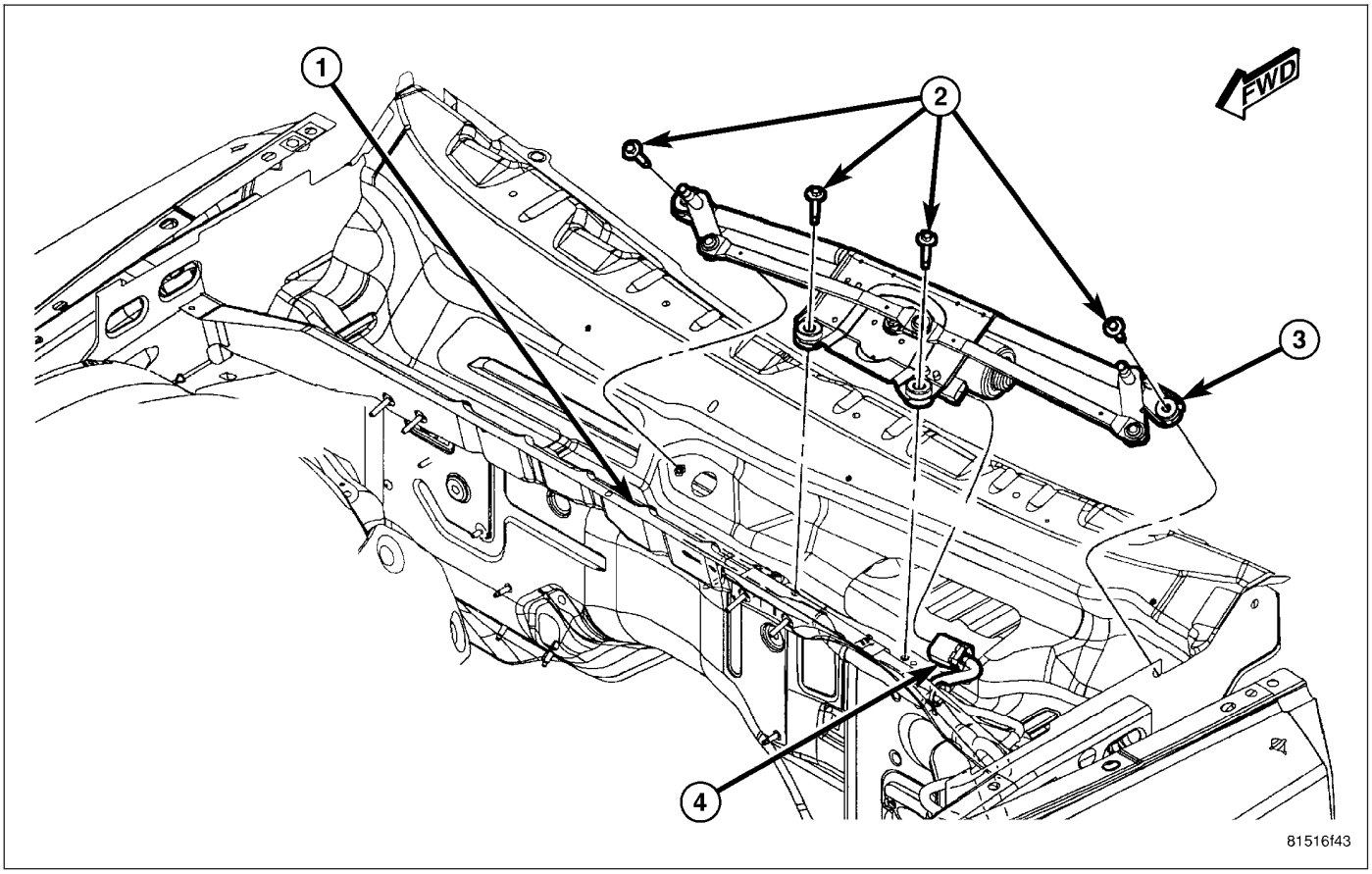
The wiper motor crank arm, the two wiper linkage members, and the two driven wiper pivots mechanically convert the rotary output of the wiper motor to the back and forth wiping motion of the wiper arms and blades on the glass.

REMOVAL



1. Remove both wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARM - REMOVAL).
2. Unlatch and open the hood.
3. Disconnect and isolate the battery negative cable.
4. Remove the cowl plenum cover/grille panel from over the cowl plenum (1). (Refer to 23 - BODY/EXTERIOR/ COWL GRILLE - REMOVAL).
5. Remove the four screws (2) that secure the wiper module (3) to the cowl plenum panel.
6. Disconnect the headlamp and dash wire harness connector (4) for the wiper motor from the motor pigtail wire connector.
7. Remove the wiper module from the cowl plenum panel as a unit.

INSTALLATION



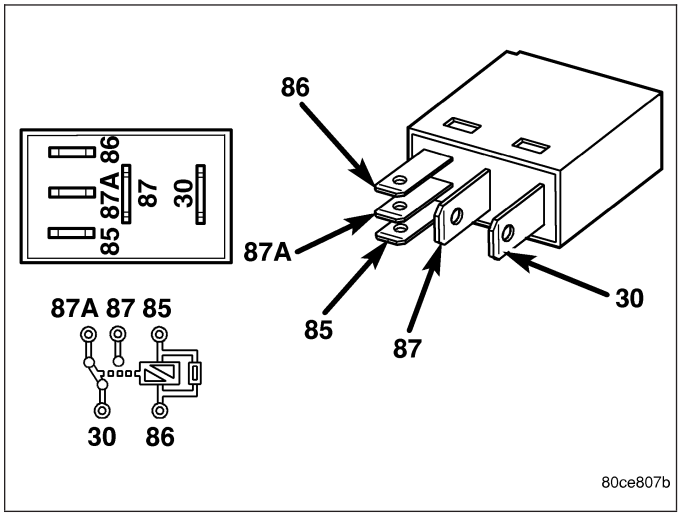
1. Position the wiper module (3) into the cowl plenum (1) as a unit.
2. Reconnect the headlamp and dash wire harness connector (4) for the wiper motor to the motor pigtail wire connector.
3. Loosely install the four screws (2) that secure the wiper module to the cowl plenum panel.
4. Tighten the screws that secure the wiper module near the pivot brackets, driver side first followed by the passenger side. Tighten the screws to 8 N·m (72 in. lbs.).
5. Tighten the screws that secure the wiper module near the motor bracket, passenger side first followed by the driver side. Tighten the screws to 8 N·m (72 in. lbs.).
6. Reinstall the cowl plenum cover/grille panel over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - INSTALLATION).
7. Reconnect the battery negative cable.
8. Close and latch the hood.
9. Reinstall both wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - INSTALLATION).

RELAY-WIPER ON/OFF

DESCRIPTION

The wiper on/off relay is a conventional International Standards Organization (ISO) micro relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. This relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs through five integral male spade-type terminals that extend from the relay base plate.

The wiper on/off relay is located in the Power Distribution Center (PDC) in the engine compartment near the battery. Refer to the layout label on the underside of the PDC cover for specific relay cavity assignment information. The wiper on/off relay cannot be adjusted or repaired and, if faulty or damaged, the unit must be replaced.



OPERATION

The wiper on/off relay is an electromechanical switch that uses a low current input from the Front Control Module (FCM) to control a high current output to the wiper motor. The movable common feed contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This electromagnetic field draws the movable relay contact point away from the fixed normally closed contact point, and holds it against the fixed normally open contact point. When the relay coil is de-energized, spring pressure returns the movable contact point back against the fixed normally closed contact point. A resistor is connected in parallel with the relay coil in the relay, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

The wiper on/off relay terminals are connected to the vehicle electrical system through a connector receptacle in the Power Distribution Center (PDC). The inputs and outputs of the wiper on/off relay include:

- **Common Feed Terminal** - The common feed terminal (30) is connected to the common feed terminal of the wiper high/low relay at all times through the wiper on/off relay output circuit.
- **Coil Ground Terminal** - The coil ground terminal (85) is connected to a control output of the Front Control Module (FCM) through a wiper on/off relay control circuit. The FCM controls wiper motor operation by controlling a ground path through this circuit.
- **Coil Battery Terminal** - The coil battery terminal (86) receives battery current at all times from a fuse in the PDC through a fused ignition switch output (run-acc) circuit.
- **Normally Open Terminal** - The normally open terminal (87) receives battery current at all times from a fuse in the PDC through a fused ignition switch output (run-acc) circuit, and provides battery current to the wiper on/off relay output circuit whenever the relay is energized.
- **Normally Closed Terminal** - The normally closed terminal (87A) is connected to ground at all times through a take out of the headlamp and dash wire harness with an eyelet terminal connector that is secured by a screw to the front end sheet metal, and is connected to the wiper on/off relay output circuit whenever the relay is de-energized.

The wiper on/off relay may be diagnosed using conventional diagnostic tools and methods. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the ElectroMechanical Instrument Cluster (EMIC), the FCM, or the electronic message inputs to or outputs from the EMIC and the FCM that control the operation of the wiper on/off relay. The most reliable, efficient, and accurate means to diagnose the wiper on/off relay, the EMIC, the FCM, or the electronic message inputs and outputs related to the wiper on/off relay operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

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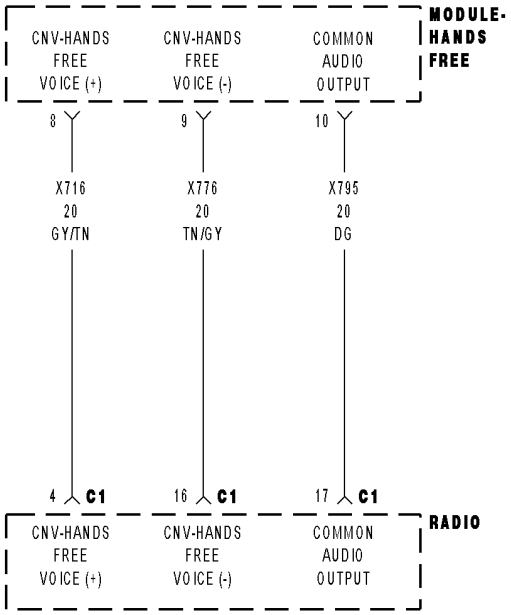
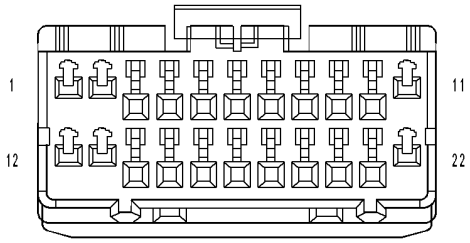
NAVIGATION/TELECOMMUNICATION - ELECTRICAL DIAGNOSTICS

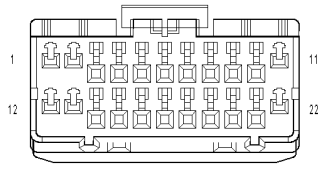
DIAGNOSIS AND TESTING

B1411-HFM LEFT AUDIO OUTPUT CIRCUIT LOW





RADIO C1



MODULE-
HANDS FREE

81404e14

B1411-HFM LEFT AUDIO OUTPUT CIRCUIT LOW (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects low voltage on the (X716) CNV Hands Free Voice (+) circuit.

Possible Causes
(X716) CNV HANDS FREE VOICE (+) CIRCUIT OPEN
(X716) CNV HANDS FREE VOICE (+) CIRCUIT SHORT TO GROUND
(X795) COMMON AUDIO OUTPUT CIRCUIT OPEN
(X716) CNV HANDS FREE VOICE (+) CIRCUIT SHORT TO (X795) COMMON AUDIO OUTPUT CIRCUIT
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

B1411-HFM LEFT AUDIO OUTPUT CIRCUIT LOW (CONTINUED)

2. (X716) CNV HANDS FREE VOICE (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

Disconnect the Radio C1 harness connector.

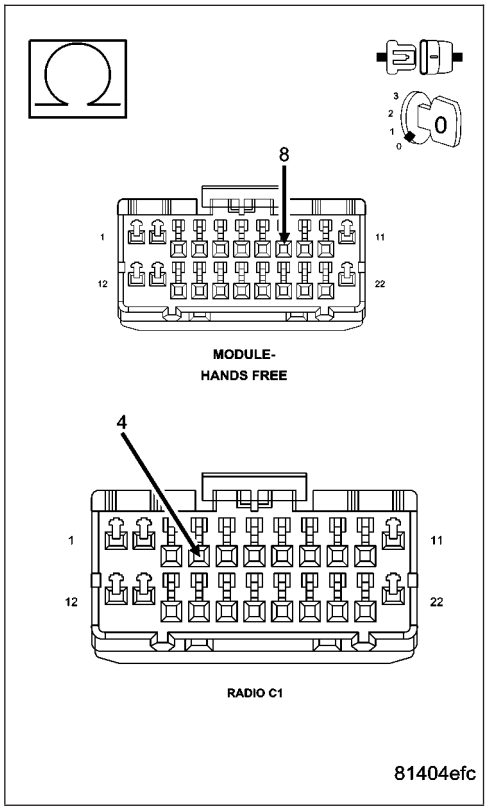
Measure the resistance of the (X716) CNV Hands Free Voice (+) circuit between the HFM connector and the radio connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the (X716) CNV Hands Free Voice (+) circuit for an open

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



3. (X716) CNV HANDS FREE VOICE (+) CIRCUIT SHORT TO GROUND

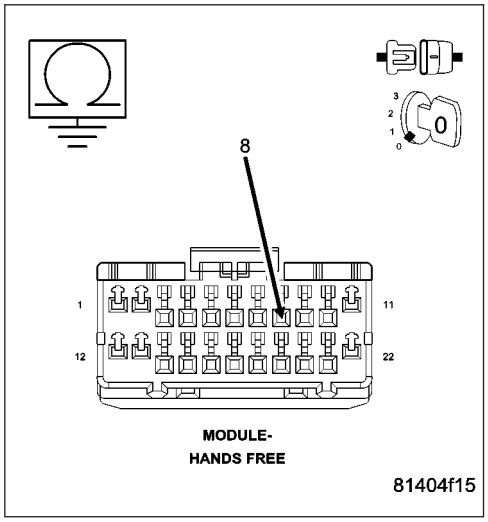
Measure the resistance between ground and the (X716) CNV Hands Free Voice (+) circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (X716) CNV Hands Free Voice (+) circuit for short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 4



B1411-HFM LEFT AUDIO OUTPUT CIRCUIT LOW (CONTINUED)

4. (X795) COMMON AUDIO OUTPUT CIRCUIT OPEN

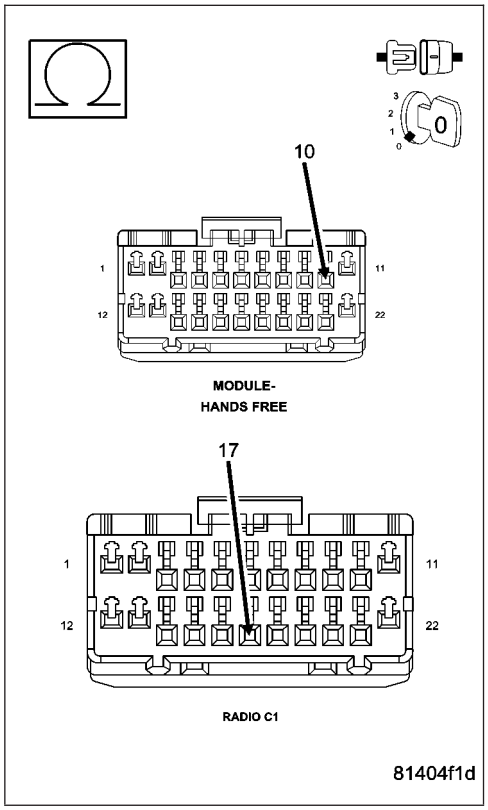
Measure the resistance of the (X795) Common Audio Output circuit between the HFM connector and the radio connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the (X795) Common Audio Output circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



5. (X716) CNV HANDS FREE VOICE (+) CIRCUIT SHORT TO (X795) COMMON AUDIO OUTPUT CIRCUIT

Measure the resistance between the (X716) CNV Hands Free Voice (+) circuit and the (X795) Common Audio Output circuit.

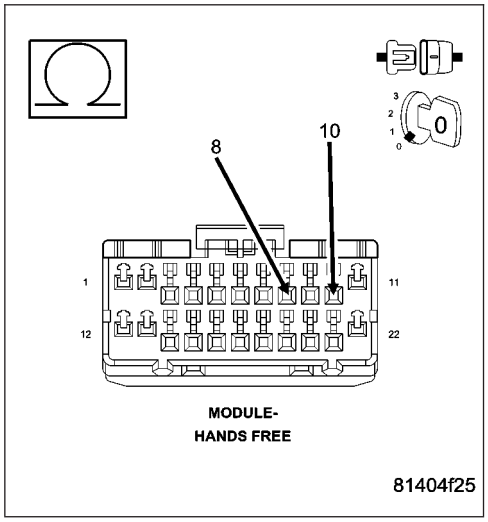
Is the resistance below 5.0 ohms?

Yes >> Repair the (X716) CNV Hands Free Voice (+) circuit for a short to the (X795) Common Audio Output circuit.

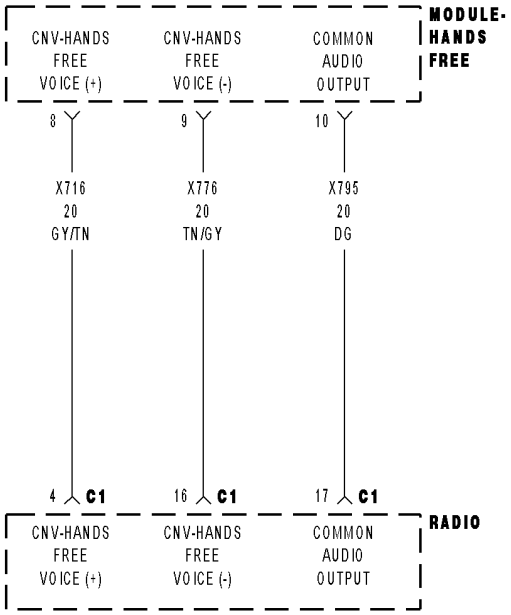
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

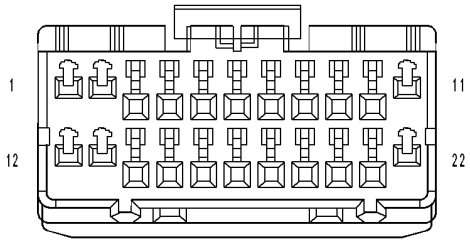
No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

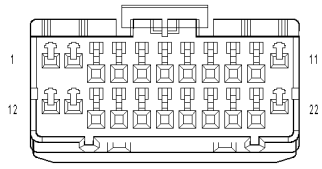


B1412-HFM LEFT AUDIO OUTPUT CIRCUIT HIGH





RADIO C1



MODULE-
HANDS FREE

81404ef4

B1412-HFM LEFT AUDIO OUTPUT CIRCUIT HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects high voltage on the (X716) CNV Hands Free Voice (+) circuit.

Possible Causes
(X716) CNV HANDS FREE VOICE (+) CIRCUIT OPEN
(X795) COMMON AUDIO OUTPUT CIRCUIT OPEN
(X716) CNV HANDS FREE VOICE (+) CIRCUIT SHORT TO VOLTAGE
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

B1412-HFM LEFT AUDIO OUTPUT CIRCUIT HIGH (CONTINUED)

2. (X716) CNV HANDS FREE VOICE (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

Disconnect the Radio C1 harness connector.

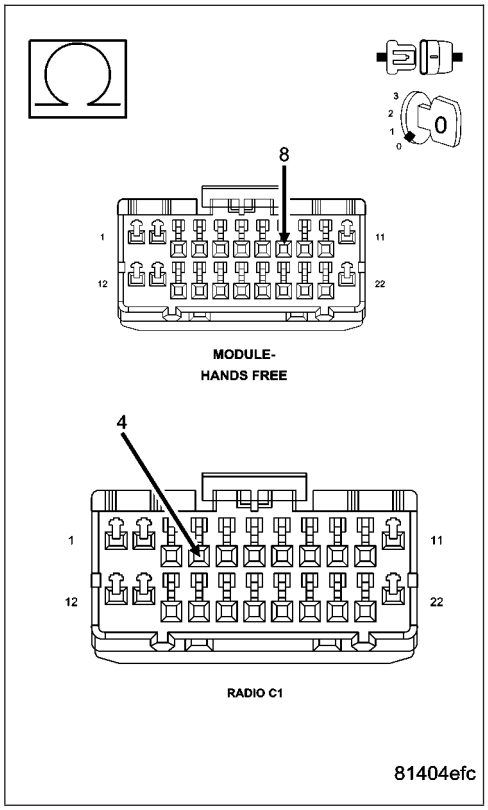
Measure the resistance of the (X716) CNV Hands Free Voice (+) circuit between the HFM connector and the radio connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the (X716) CNV Hands Free Voice (+) circuit for an open

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



3. (X795) COMMON AUDIO OUTPUT CIRCUIT OPEN

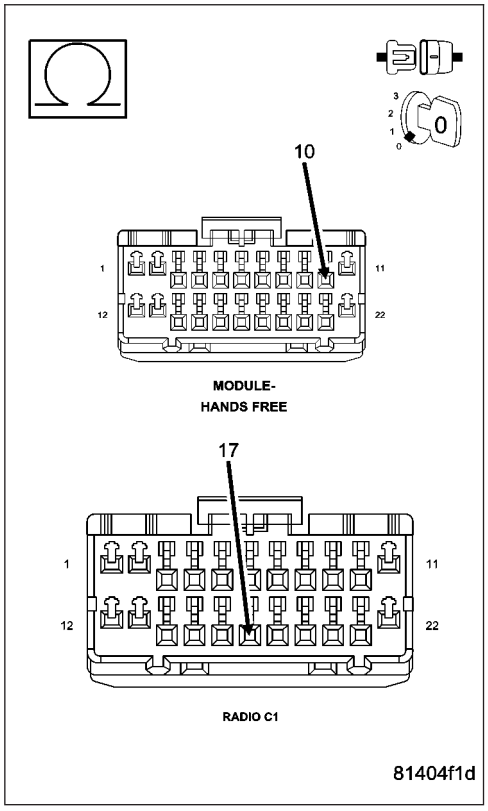
Measure the resistance of the (X795) Common Audio Output circuit between the HFM connector and the radio connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the (X795) Common Audio Output circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



B1412-HFM LEFT AUDIO OUTPUT CIRCUIT HIGH (CONTINUED)

4. (X716) CNV HANDS FREE VOICE (+) CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (X716) CNV Hands Free Voice (+) circuit.

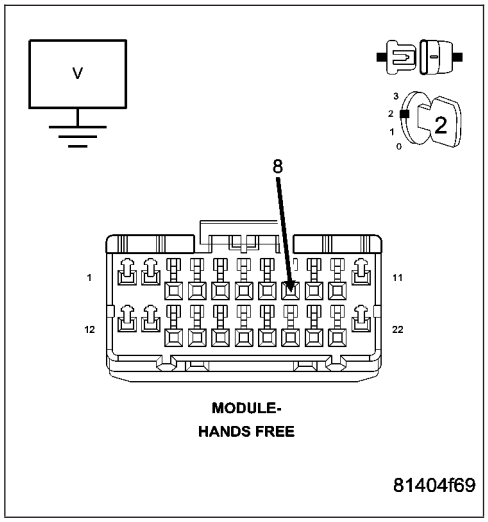
Is the voltage above 1.0 volts?

Yes >> Repair the (X716) CNV Hands Free Voice (+) circuit for a short to voltage.

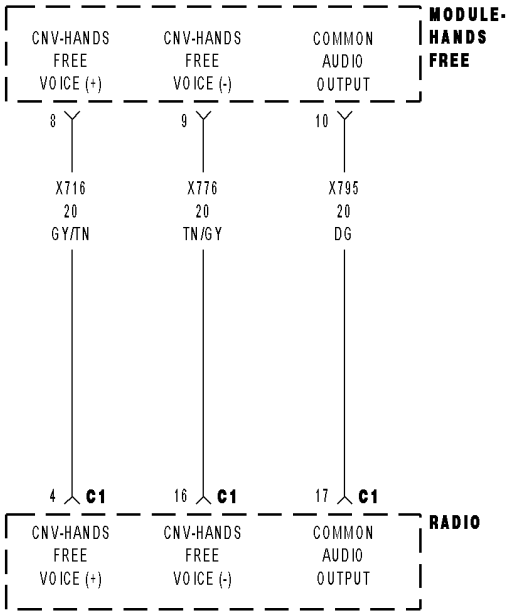
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

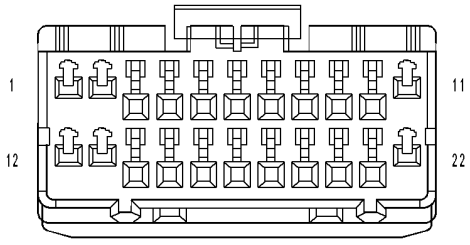
No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

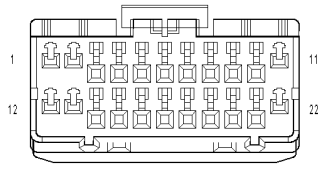


B1415-HFM RIGHT AUDIO OUTPUT CIRCUIT LOW





RADIO C1



MODULE-
HANDS FREE

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B1415-HFM RIGHT AUDIO OUTPUT CIRCUIT LOW (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects low voltage on the (X776) CNV Hands Free Voice (-) circuit.

Possible Causes
(X776) CNV HANDS FREE VOICE (-) CIRCUIT OPEN
(X776) CNV HANDS FREE VOICE (-) CIRCUIT SHORT TO GROUND
(X795) COMMON AUDIO OUTPUT CIRCUIT OPEN
(X776) CNV HANDS FREE VOICE (-) CIRCUIT SHORT TO (X795) COMMON AUDIO OUTPUT CIRCUIT
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

B1415-HFM RIGHT AUDIO OUTPUT CIRCUIT LOW (CONTINUED)

2. (X776) CNV HANDS FREE VOICE (-) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

Disconnect the Radio C1 harness connector.

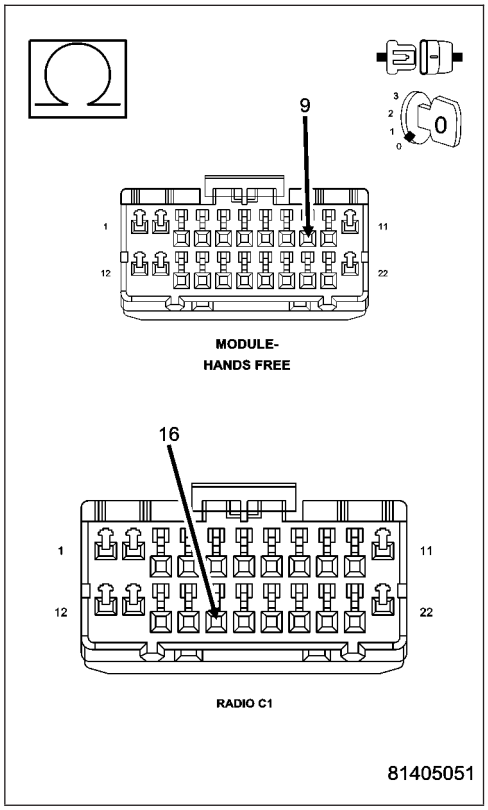
Measure the resistance of the (X776) CNV Hands Free Voice (-) circuit between the HFM connector and the radio connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the (X776) CNV Hands Free Voice (-) circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



3. (X776) CNV HANDS FREE VOICE (-) CIRCUIT SHORT TO GROUND

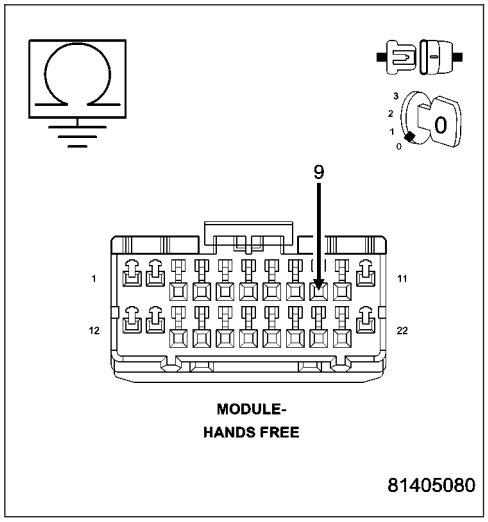
Measure the resistance between ground and the (X776) CNV Hands Free Voice (-) circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (X776) CNV Hands Free Voice (-) circuit for short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 4



B1415-HFM RIGHT AUDIO OUTPUT CIRCUIT LOW (CONTINUED)

4. (X795) COMMON AUDIO OUTPUT CIRCUIT OPEN

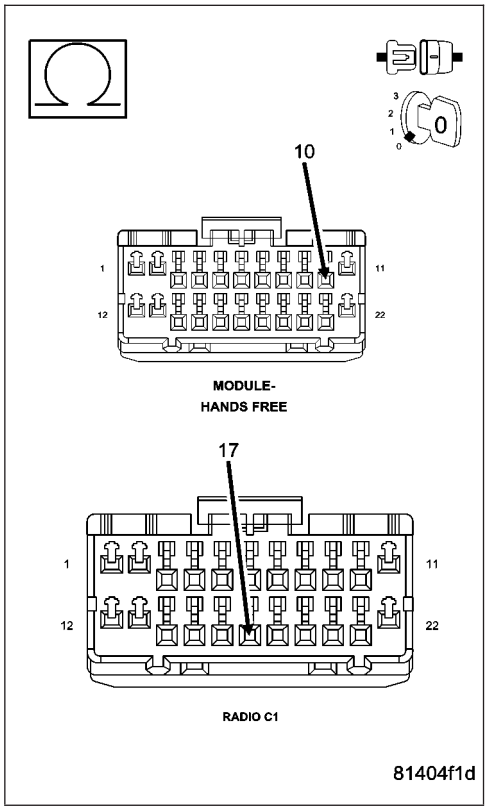
Measure the resistance of the (X795) Common Audio Output circuit between the HFM connector and the radio connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the (X795) Common Audio Output circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



5. (X776) CNV HANDS FREE VOICE (-) CIRCUIT SHORT TO (X795) COMMON AUDIO OUTPUT CIRCUIT

Measure the resistance between the (X776) CNV Hands Free Voice (-) circuit and the (X795) Common Audio Output circuit.

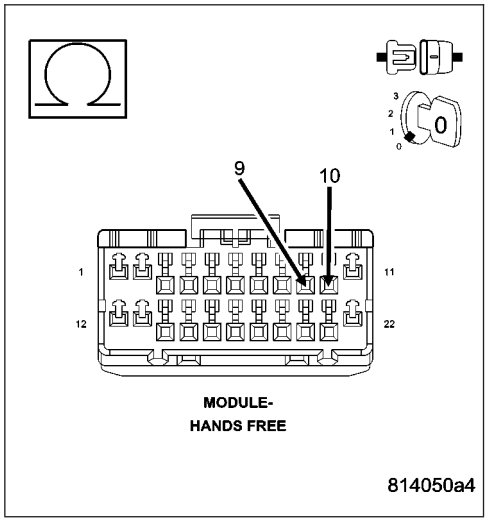
Is the resistance below 5.0 ohms?

Yes >> Repair the (X776) CNV Hands Free Voice (-) circuit for a short to the (X795) Common Audio Output circuit.

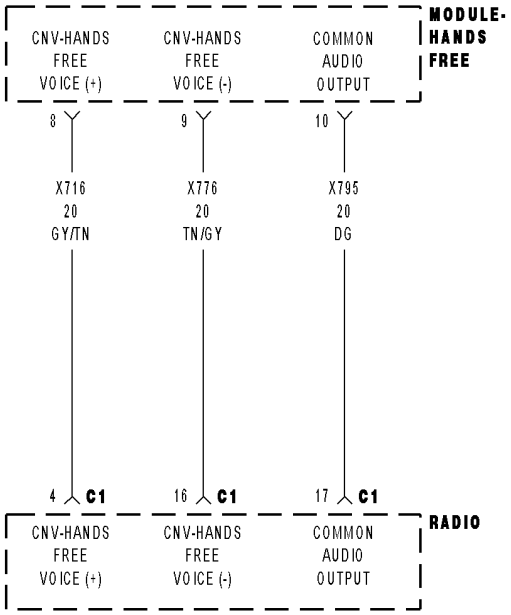
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

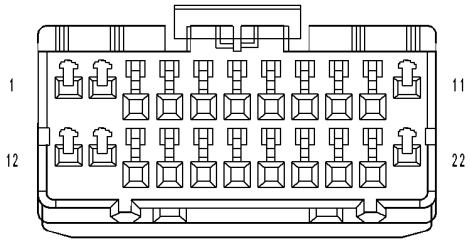
No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

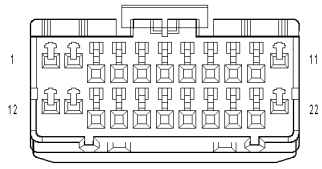


B1416-HFM RIGHT AUDIO OUTPUT CIRCUIT HIGH





RADIO C1



MODULE-
HANDS FREE

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B1416-HFM RIGHT AUDIO OUTPUT CIRCUIT HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects high voltage on the (X776) CNV Hands Free Voice (-) circuit.

Possible Causes
(X776) CNV HANDS FREE VOICE (-) CIRCUIT OPEN
(X795) COMMON AUDIO OUTPUT CIRCUIT OPEN
(X776) CNV HANDS FREE VOICE (-) CIRCUIT SHORT TO VOLTAGE
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

B1416-HFM RIGHT AUDIO OUTPUT CIRCUIT HIGH (CONTINUED)

2. (X776) CNV HANDS FREE VOICE (-) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

Disconnect the Radio C1 harness connector.

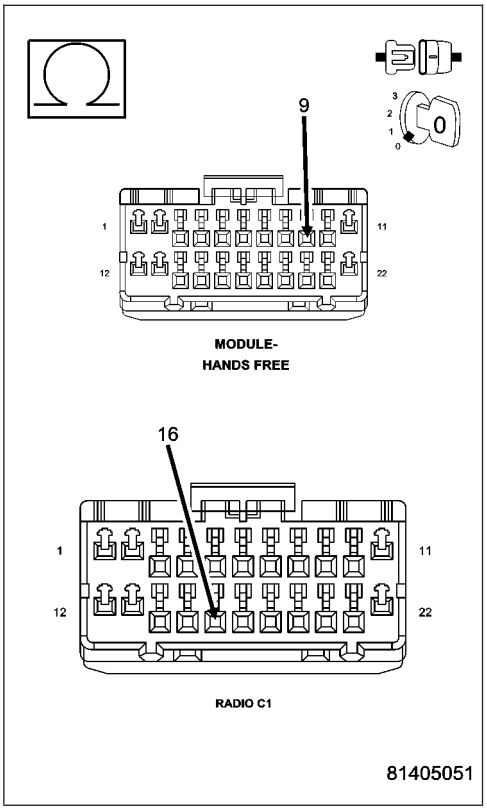
Measure the resistance of the (X776) CNV Hands Free Voice (-) circuit between the HFM connector and the radio connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the (X776) CNV Hands Free Voice (-) circuit for an open

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



3. (X795) COMMON AUDIO OUTPUT CIRCUIT OPEN

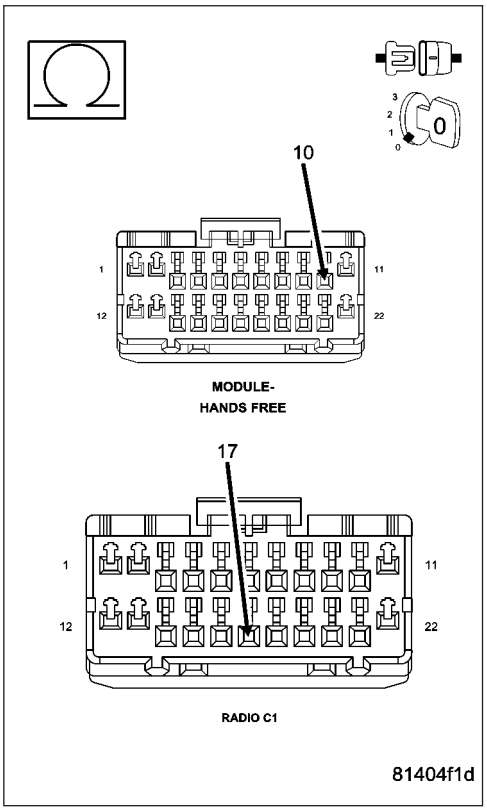
Measure the resistance of the (X795) Common Audio Output circuit between the HFM connector and the radio connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the (X795) Common Audio Output circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



B1416-HFM RIGHT AUDIO OUTPUT CIRCUIT HIGH (CONTINUED)

4. (X776) CNV HANDS FREE VOICE (-) CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (X776) CNV Hands Free Voice (-) circuit.

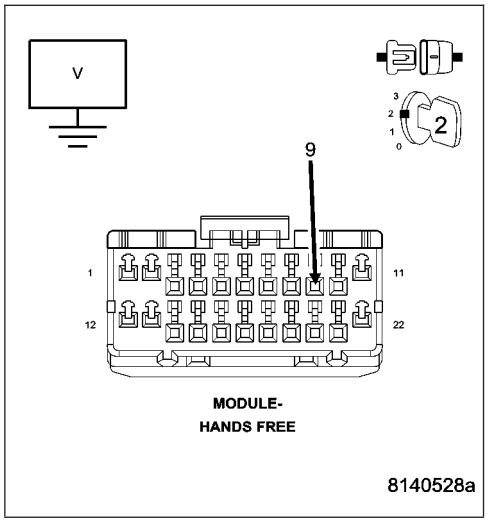
Is the voltage above 1.0 volts?

Yes >> Repair the (X776) CNV Hands Free Voice (-) circuit for a short to voltage.

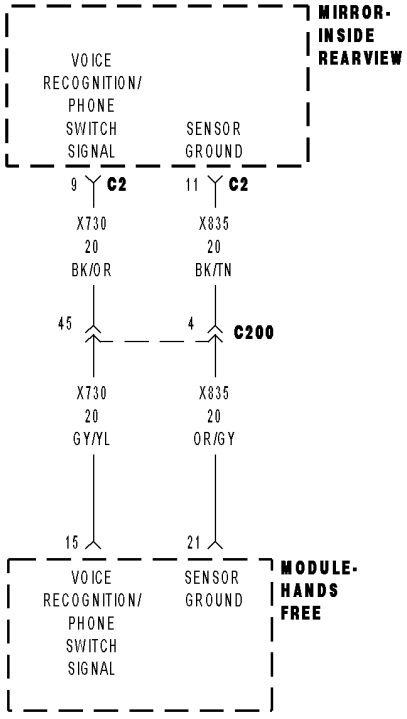
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

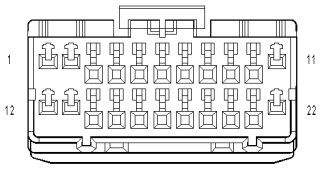
No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

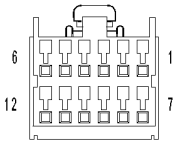


B1435-VOICE RECOGNITION /PHONE SWITCH INPUT CIRCUIT PERFORMANCE





MODULE-
HANDS FREE



MIRROR-
INSIDE
REARVIEW C2
(HANDS FREE)

81405bac

B1435-VOICE RECOGNITION /PHONE SWITCH INPUT CIRCUIT PERFORMANCE (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects an invalid voltage signal on the (X730) Voice Recognition/Phone Switch Signal circuit.

Possible Causes
INSIDE REARVIEW MIRROR
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTCS

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

---

2. CHECK THE VOLTAGE OF THE (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL

Turn the ignition off.

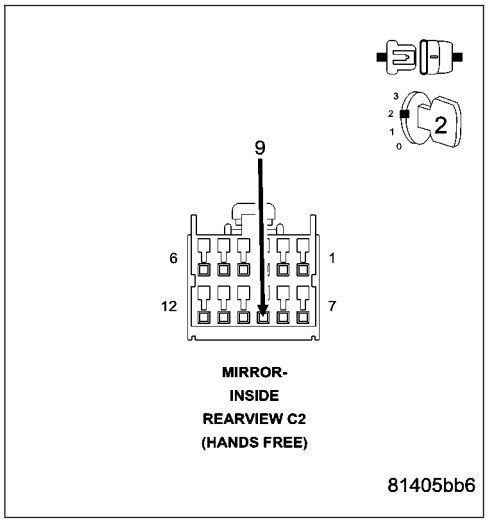
Disconnect the Inside Rearview Mirror C2 harness connector.

Turn the ignition on.

With the scan tool, monitor the VR Phone Switch voltage.

While monitoring the VR Phone Switch voltage, momentarily connect a jumper wire between (X730) Voice Recognition/Phone Switch Signal circuit and ground.

NOTE: The scan tool sensor voltage should switch from above 4.7 volts when the jumper is not connected to below 0.6 volts when the jumper is connected.

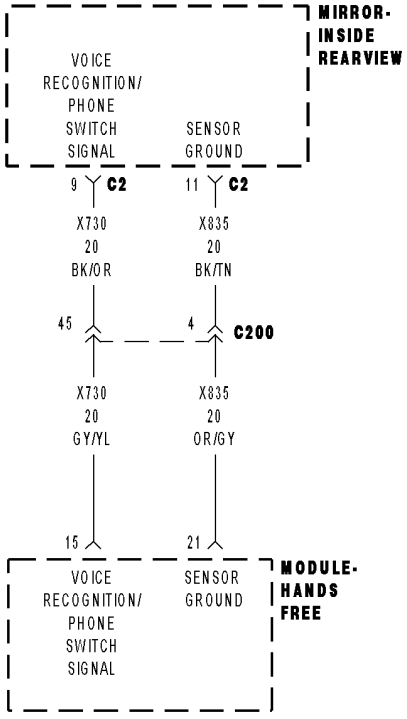


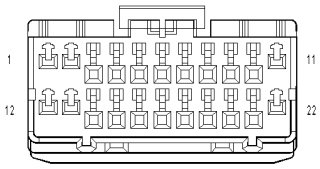
Does the sensor voltage switch from above 4.7 volts to below 0.6 volt as described?

Yes >> Replace the Inside Rearview Mirror in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

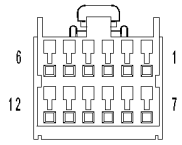
No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

B1436-VOICE RECOGNITION/PHONE SWITCH INPUT CIRCUIT LOW





MODULE-
HANDS FREE



MIRROR-
INSIDE
REARVIEW C2
(HANDS FREE)

81405bac

B1436-VOICE RECOGNITION/PHONE SWITCH INPUT CIRCUIT LOW (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects voltage below 0.6 volts on the (X730) Voice Recognition/Phone Switch Signal circuit.

Possible Causes
(X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT SHORT TO (X835) SENSOR GROUND CIRCUIT
(X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT SHORT TO GROUND
INSIDE REARVIEW MIRROR
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTCS

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

2. CHECK THE VOLTAGE OF THE (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL

Turn the ignition off.

Disconnect the Inside Rearview Mirror C2 harness connector.

Turn the ignition on.

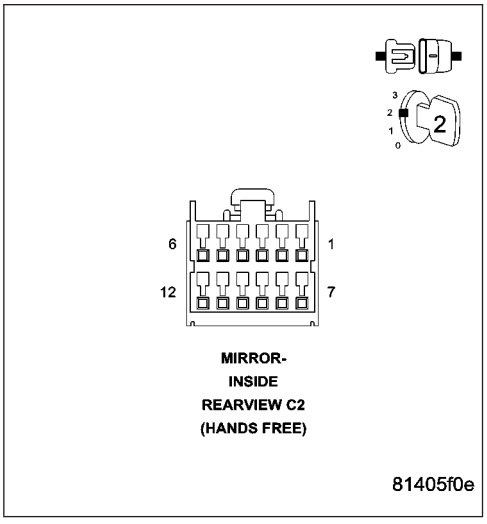
With the scan tool, monitor the VR Phone Switch voltage.

Is the voltage above 4.7 volts?

Yes >> Replace the Inside Rearview Mirror in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 3



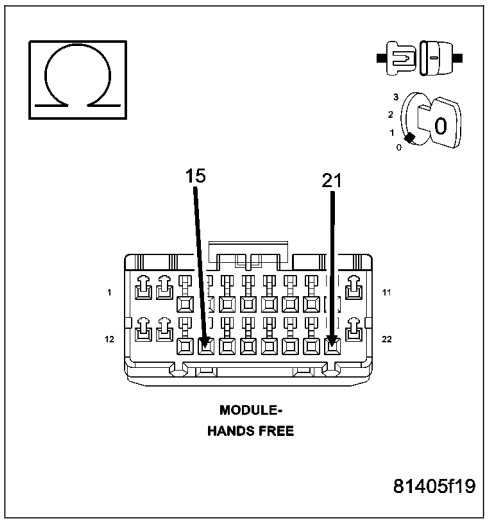
B1436-VOICE RECOGNITION/PHONE SWITCH INPUT CIRCUIT LOW (CONTINUED)

3. (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT SHORT TO THE (X835) SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

Measure the resistance between the (X730) Voice Recognition/Phone Switch Signal circuit and the (X835) Sensor Ground circuit



Is the resistance below 100.0 ohms?

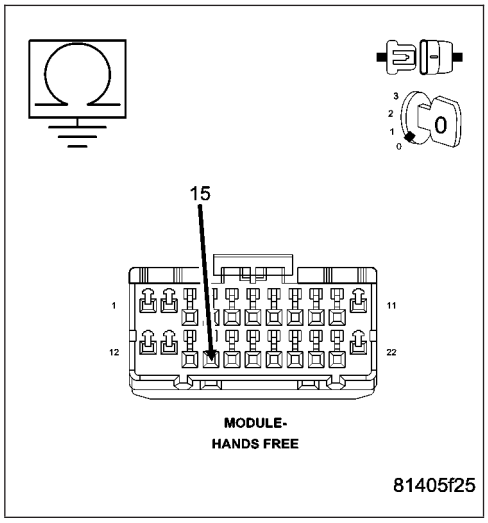
Yes >> Repair the (X730) Voice Recognition/Phone Switch Signal circuit for a short to the (X835) Sensor Ground circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 4

4. (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (X730) Voice Recognition/Phone Switch Signal circuit.



Is the resistance below 100.0 ohms?

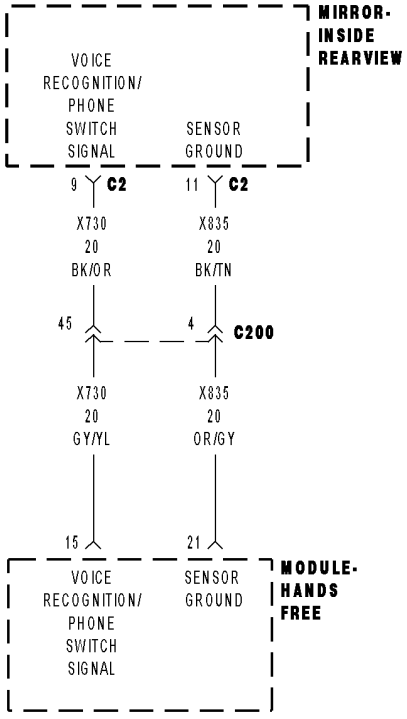
Yes >> Repair the (X730) Voice Recognition/Phone Switch Signal circuit for a short to ground

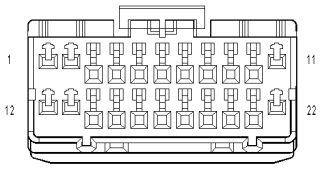
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

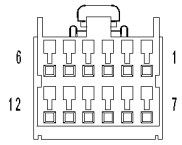
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

B1437-VOICE RECOGNITION/PHONE SWITCH INPUT CIRCUIT HIGH





MODULE-
HANDS FREE



MIRROR-
INSIDE
REARVIEW C2
(HANDS FREE)

81405bac

B1437-VOICE RECOGNITION/PHONE SWITCH INPUT CIRCUIT HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects voltage above 4.7 volts on the (X730) Voice Recognition/Phone Switch Signal circuit.

Possible Causes
(X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT SHORT TO VOLTAGE
(X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT OPEN
(X835) SENSOR GROUND CIRCUIT OPEN
INSIDE REARVIEW MIRROR
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTCS

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

---

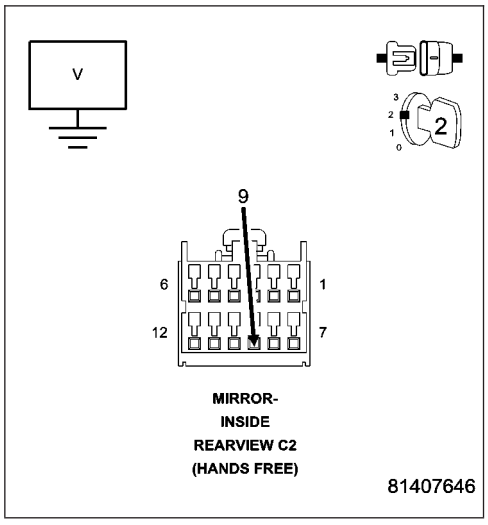
2. CHECK THE VOLTAGE OF THE (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL

Turn the ignition off.

Disconnect the Inside Rearview Mirror C2 harness connector.

Turn the ignition on.

Measure the voltage of the (X730) Voice Recognition/Phone Switch Signal circuit.



Is the voltage above 5.3 volts?

Yes >> Repair the (X730) Voice Recognition/Phone Switch Signal circuit for a short to voltage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 3

B1437-VOICE RECOGNITION/PHONE SWITCH INPUT CIRCUIT HIGH (CONTINUED)

3. INSIDE REARVIEW MIRROR

Turn the ignition off.

Connect a jumper wire between (X730) Voice Recognition/Phone Switch Signal circuit and the (X835) Sensor Ground circuit.

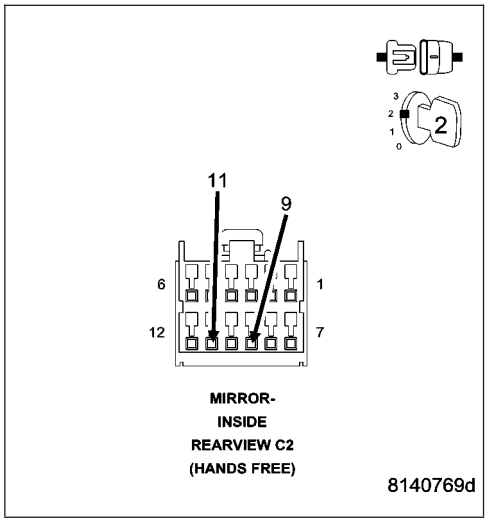
Turn the ignition on.

With the scan tool, monitor the VR Phone Switch Voltage.

Is the voltage approximately 0 volts?

Yes >> Replace the Inside Rearview Mirror in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 4



4. (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT OPEN

Turn the ignition off.

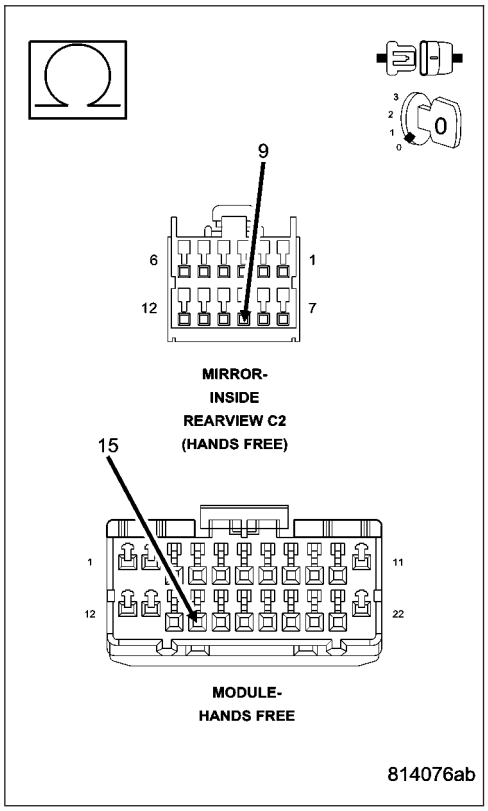
Disconnect the Hands Free Module harness connector.

Measure the resistance of the (X730) Voice Recognition/Phone Switch Signal circuit between the HFM connector and the inside rearview mirror connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the (X730) Voice Recognition/Phone Switch Signal circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



B1437-VOICE RECOGNITION/PHONE SWITCH INPUT CIRCUIT HIGH (CONTINUED)

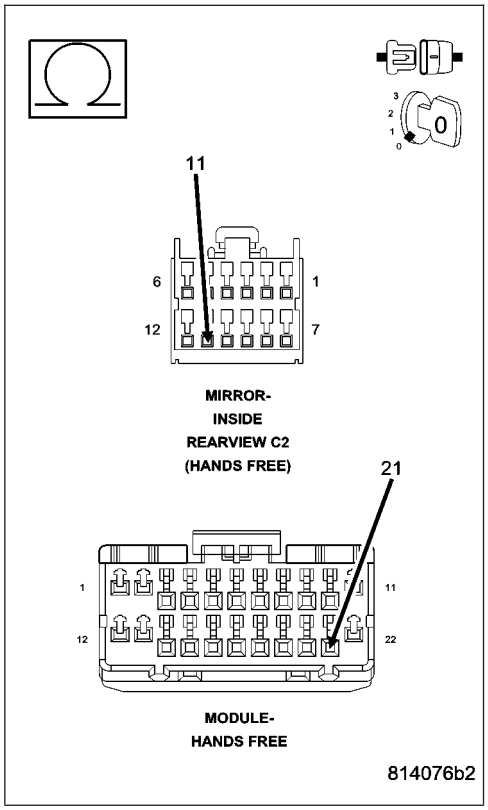
5. (X835) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (X835) Sensor Ground circuit between the HFM connector and the inside rearview mirror connector.

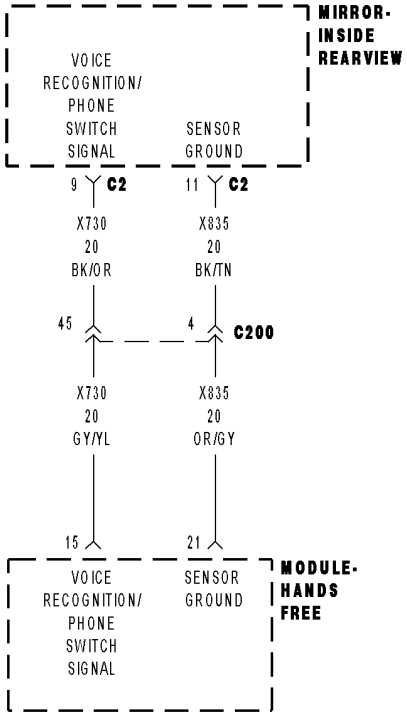
Is the resistance below 5.0 ohms?

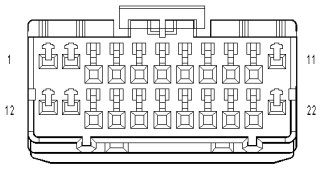
Yes >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Repair the (X835) Sensor Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

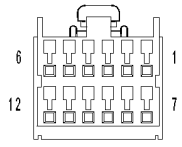


B1438–VOICE RECOGNITION SWITCH STUCK





MODULE-
HANDS FREE



MIRROR-
INSIDE
REARVIEW C2
(HANDS FREE)

81405bac

B1438–VOICE RECOGNITION SWITCH STUCK (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects voltage between 3.5 volts and 4.0 volts on the (X730) Voice Recognition/ Phone Switch Signal circuit for more than 30 seconds.

Possible Causes
INSIDE REARVIEW MIRROR
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTCS

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

---

2. CHECK THE VOLTAGE OF THE (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL

Turn the ignition off.

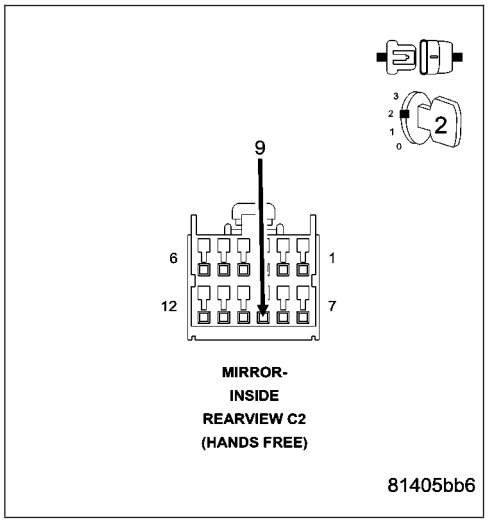
Disconnect the Inside Rearview Mirror C2 harness connector.

Turn the ignition on.

With the scan tool, monitor the VR Phone Switch voltage.

While monitoring the VR Phone Switch voltage, momentarily connect a jumper wire between (X730) Voice Recognition/Phone Switch Signal circuit and ground.

NOTE: The scan tool sensor voltage should switch from above 4.7 volts when the jumper is not connected to below 0.6 volts when the jumper is connected.

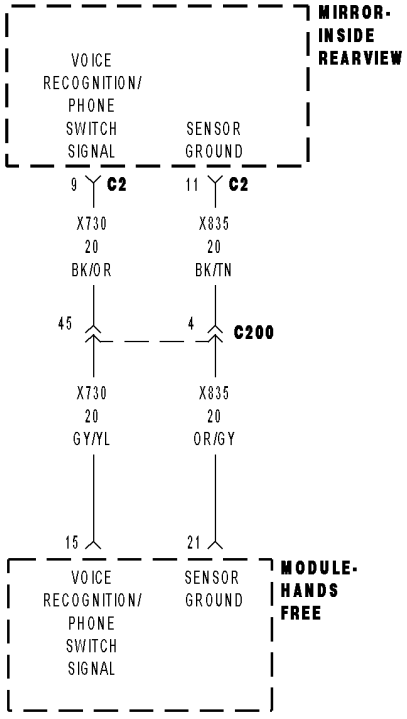


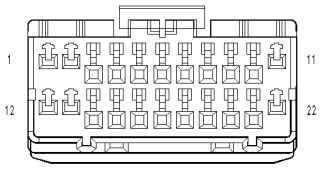
Does the sensor voltage switch from above 4.7 volts to below 0.6 volt as described?

Yes >> Replace the Inside Rearview Mirror in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

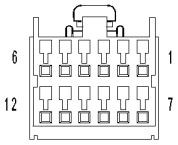
No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

B1439-PHONE SWITCH STUCK





MODULE-
HANDS FREE



MIRROR-
INSIDE
REARVIEW C2
(HANDS FREE)

81405bac

B1439-PHONE SWITCH STUCK (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects voltage between 2.8 volts and 3.3 volts on the (X730) Voice Recognition/ Phone Switch Signal circuit for more than 30 seconds.

Possible Causes
INSIDE REARVIEW MIRROR
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTCS

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

---

2. CHECK THE VOLTAGE OF THE (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL

Turn the ignition off.

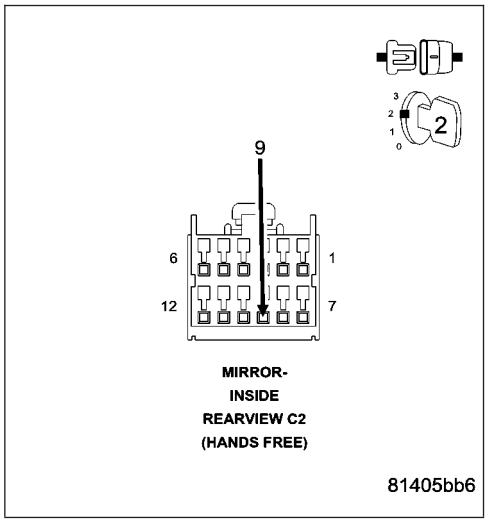
Disconnect the Inside Rearview Mirror C2 harness connector.

Turn the ignition on.

With the scan tool, monitor the VR Phone Switch voltage.

While monitoring the VR Phone Switch voltage, momentarily connect a jumper wire between (X730) Voice Recognition/Phone Switch Signal circuit and ground.

NOTE: The scan tool sensor voltage should switch from above 4.7 volts when the jumper is not connected to below 0.6 volts when the jumper is connected.

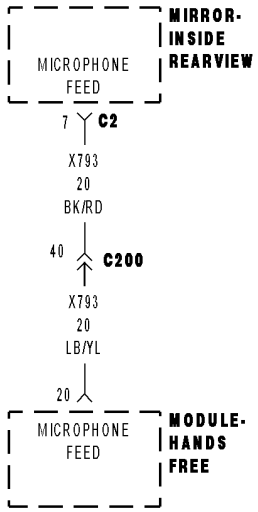


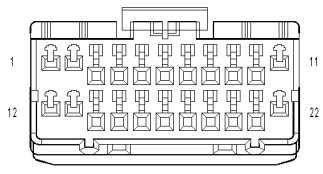
Does the sensor voltage switch from above 4.7 volts to below 0.6 volt as described?

Yes >> Replace the Inside Rearview Mirror in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

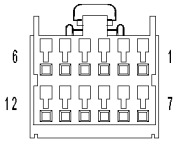
No >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

B145A-TELEMATICS MIRROR CONTROL CIRCUIT HIGH





MODULE-
HANDS FREE



MIRROR-
INSIDE
REARVIEW C2
(HANDS FREE)

814052bc

B145A-TELEMATICS MIRROR CONTROL CIRCUIT HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects high voltage on the (X793) Microphone Feed circuit.

Possible Causes
(X793) MICROPHONE FEED CIRCUIT OPEN
(X793) MICROPHONE FEED CIRCUIT SHORT TO VOLTAGE
INSIDE REARVIEW MIRROR
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

Attempt to make a phone call with the system.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

B145A-TELEMATICS MIRROR CONTROL CIRCUIT HIGH (CONTINUED)

2. (X793) MICROPHONE FEED CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

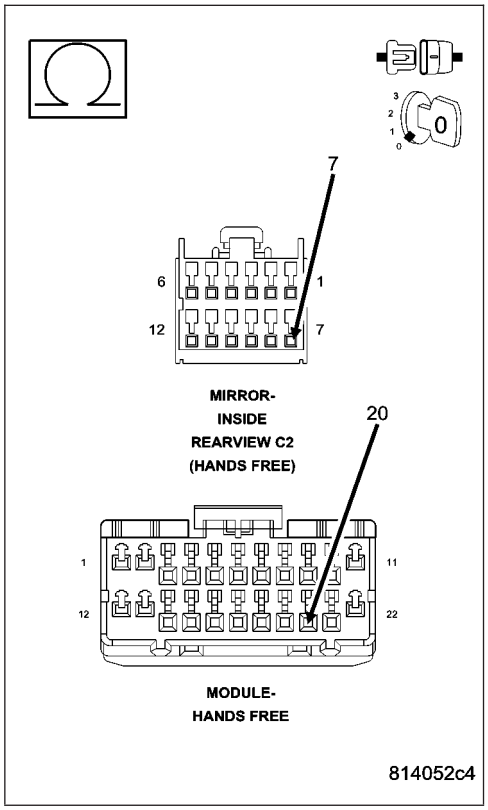
Disconnect the Inside Rearview Mirror C2 harness connector.

Measure the resistance of the (X793) Microphone Feed circuit between the HFM connector and the inside rearview mirror connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the (X793) Microphone Feed circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



3. (X793) MICROPHONE FEED CIRCUIT SHORT TO VOLTAGE

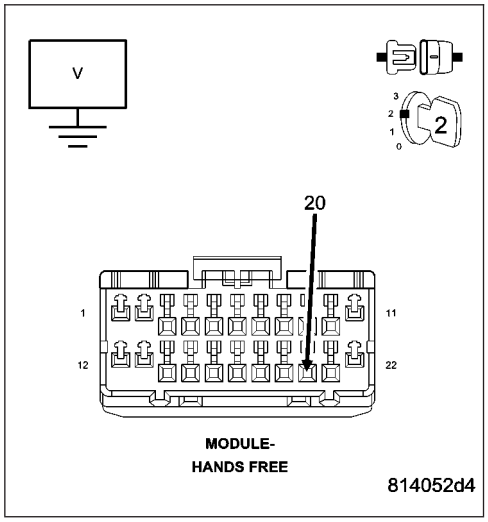
Turn the ignition on.

Measure the voltage of the (X793) Microphone Feed circuit.

Is the voltage above 1.0 volt?

Yes >> Repair the (X793) Microphone Feed circuit for short to voltage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 4



B145A-TELEMATICS MIRROR CONTROL CIRCUIT HIGH (CONTINUED)

4. INSIDE REARVIEW MIRROR

Replace the Inside Rearview Mirror in accordance with the service information.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

Attempt to make a phone call with the system.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

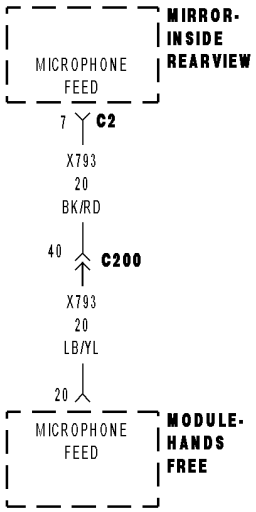
Yes >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

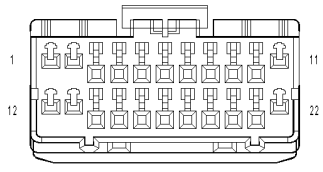
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Repair is complete.

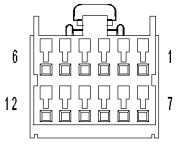
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

B1459-TELEMATICS MIRROR CONTROL CIRCUIT LOW





MODULE-
HANDS FREE



MIRROR-
INSIDE
REARVIEW C2
(HANDS FREE)

814052bc

B1459-TELEMATICS MIRROR CONTROL CIRCUIT LOW (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects low voltage on the (X793) Microphone Feed circuit.

Possible Causes
(X793) MICROPHONE FEED CIRCUIT OPEN
(X793) MICROPHONE FEED CIRCUIT SHORT TO GROUND
INSIDE REARVIEW MIRROR
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

Attempt to make a phone call with the system.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

B1459-TELEMATICS MIRROR CONTROL CIRCUIT LOW (CONTINUED)

2. (X793) MICROPHONE FEED CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

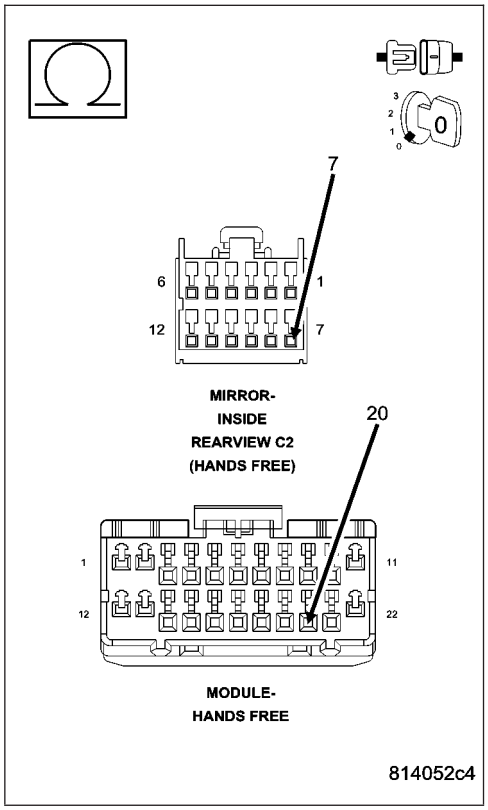
Disconnect the Inside Rearview Mirror C2 harness connector.

Measure the resistance of the (X793) Microphone Feed circuit between the HFM connector and the inside rearview mirror connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the (X793) Microphone Feed circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



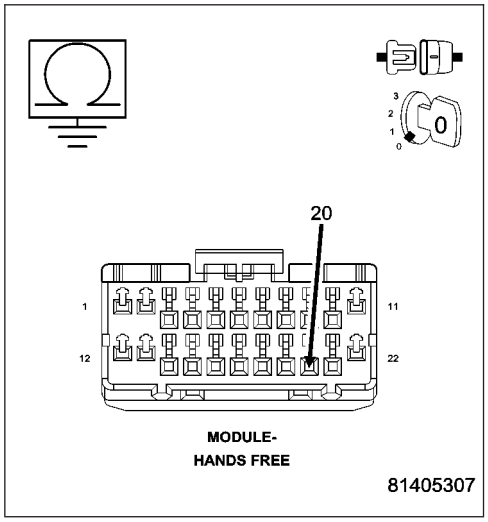
3. (X793) MICROPHONE FEED CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (X793) Microphone Feed circuit.

Is the resistance below 100.0 ohms?

Yes >> Repair the (X793) Microphone Feed circuit for short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 4



B1459-TELEMATICS MIRROR CONTROL CIRCUIT LOW (CONTINUED)

4. INSIDE REARVIEW MIRROR

Replace the Inside Rearview Mirror in accordance with the service information.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

Attempt to make a phone call with the system.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

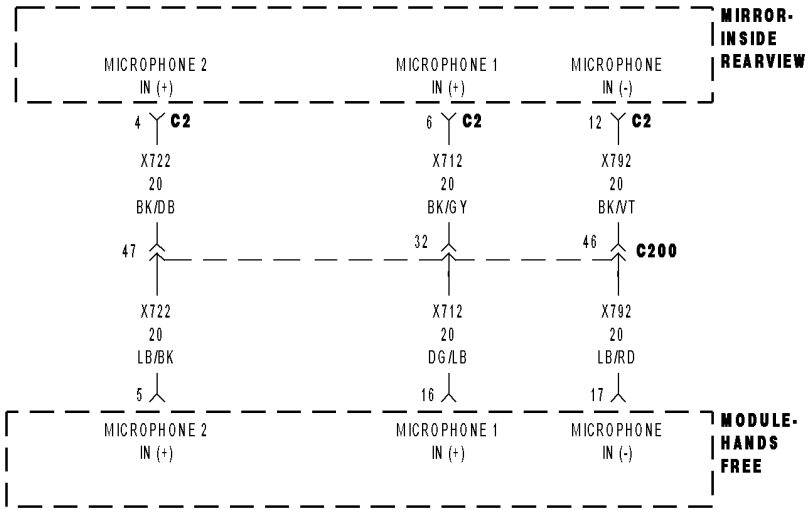
Yes >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

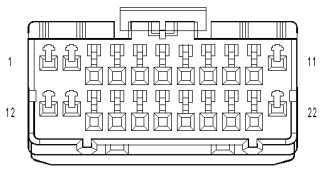
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Repair is complete.

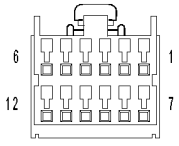
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

B1492–GENERAL MICROPHONE PERFORMANCE





MODULE-
HANDS FREE



MIRROR-
INSIDE
REARVIEW C2
(HANDS FREE)

81404c38

B1492–GENERAL MICROPHONE PERFORMANCE (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a fault in any of the microphone circuits.

Possible Causes
(X712) MICROPHONE 1 IN (+) CIRCUIT OPEN
(X722) MICROPHONE 2 IN (+) CIRCUIT OPEN
(X792) MICROPHONE IN (-) CIRCUIT OPEN
(X712) (X722) (X792) MICROPHONE CIRCUITS SHORTED TO GROUND
(X712) (X722) (X792) MICROPHONE CIRCUITS SHORTED TO VOLTAGE
(X712) (X722) (X792) MICROPHONE CIRCUITS SHORTED TOGETHER
INSIDE REARVIEW MIRROR
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

Attempt to make a phone call with the system.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

B1492–GENERAL MICROPHONE PERFORMANCE (CONTINUED)

2. (X712) MICROPHONE 1 IN (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

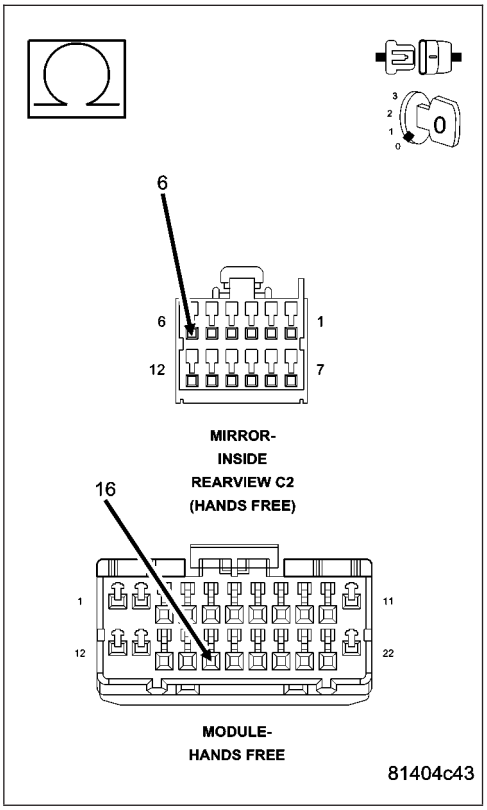
Disconnect the Inside Rearview Mirror C2 harness connector.

Measure the resistance of the (X712) Microphone 1 IN (+) circuit between the HFM connector and the inside rearview mirror connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the (X712) Microphone 1 IN (+) circuit for an open. Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



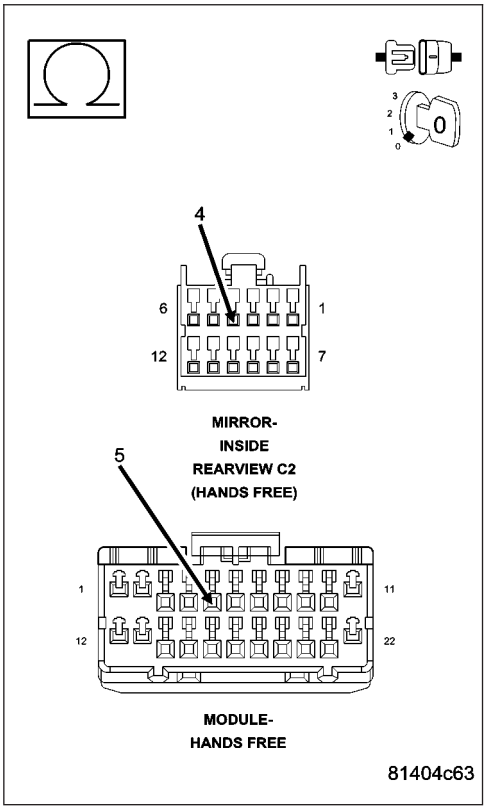
3. (X722) MICROPHONE 2 IN (+) CIRCUIT OPEN

Measure the resistance of the (X722) Microphone 2 IN (+) circuit between the HFM connector and the inside rearview mirror connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the (X722) Microphone 2 IN (+) circuit for an open. Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



B1492–GENERAL MICROPHONE PERFORMANCE (CONTINUED)

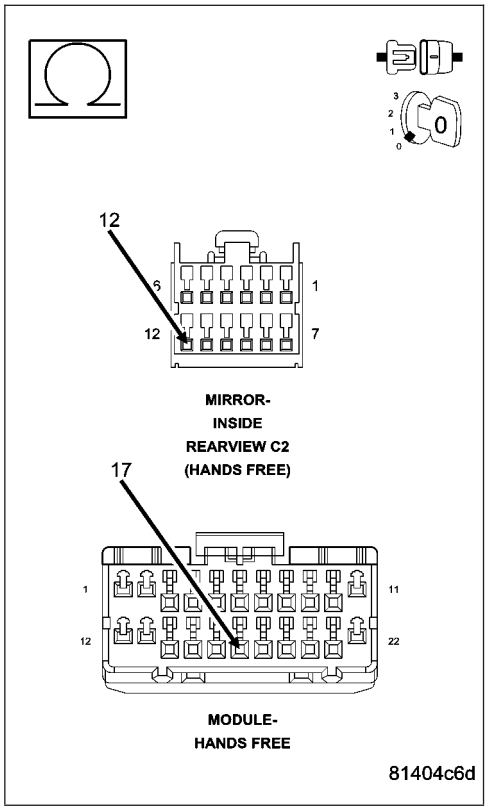
4. (X792) MICROPHONE IN (-) CIRCUIT OPEN

Measure the resistance of the (X792) Microphone IN (-) circuit between the HFM connector and the inside rearview mirror connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the (X792) Microphone IN (-) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



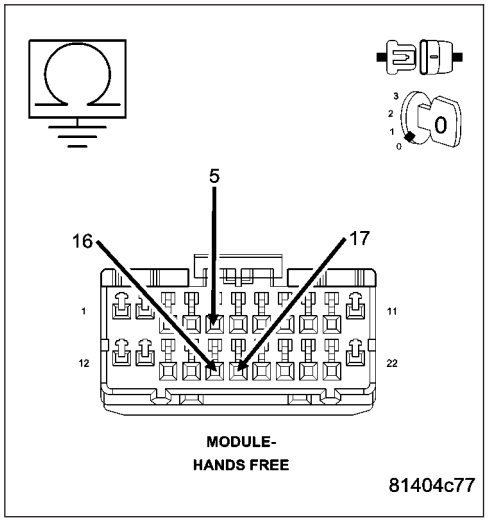
5. (X712) (X722) (X792) MICROPHONE CIRCUITS SHORTED TO GROUND

Measure the resistance between ground and each (X712) (X722) (X792) Microphone circuit.

Is the resistance below 100.0 ohms?

Yes >> Repair the Microphone circuit that measured below 100.0 ohms for short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 6

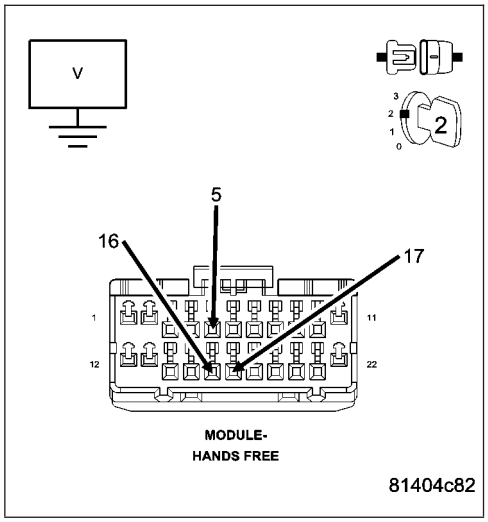


B1492–GENERAL MICROPHONE PERFORMANCE (CONTINUED)

6. (X712) (X722) (X792) MICROPHONE CIRCUITS SHORTED TO VOLTAGE

Turn the ignition on.

Measure the voltage of each (X712) (X722) (X792) Microphone circuit.



Is the voltage above 1.0 volt?

Yes >> Repair the Microphone circuit that measured above 1.0 volt for short to voltage.

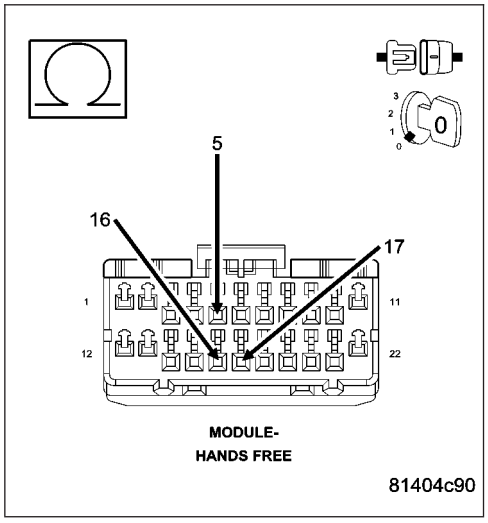
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 7

7. (X712) (X722) (X792) MICROPHONE CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Measure the resistance between each (X712) (X722) (X792) Microphone circuit.



Is the resistance below 100.0 ohms?

Yes >> Repair the Microphone circuit that measured below 100.0 ohms for a short together.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Go To 8

8. INSIDE REARVIEW MIRROR

Replace the Inside Rearview Mirror in accordance with the service information.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

Attempt to make a phone call with the system.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Repair is complete.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

B2203–ROM CHECKSUM PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a fault during an internal diagnostic check.

Possible Causes
HANDS FREE MODULE

Diagnostic Test

1. REPLACE THE HANDS FREE MODULE IF DTC IS ACTIVE

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Replace and program the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

B2205–ORIGINAL VIN MISSING/MISMATCH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module will receive and monitor the VIN message from the PCM and record the VIN if different from the last VIN.

Possible Causes
INCORRECT VIN PROGRAMMED IN PCM
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTCS

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

---

2. CHECK VIN IN PCM

With the scan tool compare the VIN that is programmed into the PCM to the VIN on the vehicle.

Does the VIN programmed into the PCM match the vehicles VIN?

Yes >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Program the correct VIN in the PCM and retest the HFM system.

B222A-VEHICLE LINE MISMATCH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module will receive and monitor the vehicle line message from the PCM and record the vehicle line if different from the last vehicle line.

Possible Causes
INCORRECT PCM
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

---

2. CHECK VEHICLE LINE IN PCM

With the scan tool compare the vehicle line that is programmed into the PCM to the vehicle line of the vehicle.

Does the vehicle line programmed into the PCM match the vehicle?

Yes >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Replace and program the Powertrain Control Module in accordance with the service information. Ensure the PCM is replaced with the correct vehicle line PCM.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.

B222E–FLASH CHECKSUM PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a fault during an internal diagnostic check.

Possible Causes
HANDS FREE MODULE

Diagnostic Test

1. REPLACE THE HANDS FREE MODULE IF DTC IS ACTIVE

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Replace and program the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

B222F–FLASH WRITE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a fault during an internal diagnostic check.

Possible Causes
HANDS FREE MODULE

Diagnostic Test

1. REPLACE THE HANDS FREE MODULE IF DTC IS ACTIVE

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Replace and program the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

B2223-(HFM) HANDS FREE PHONE INTERNAL

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a fault during an internal diagnostic check.

Possible Causes
HANDS FREE MODULE

Diagnostic Test

1. REPLACE THE HANDS FREE MODULE IF DTC IS ACTIVE

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Replace and program the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

B2230–RAM WRITE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a fault during an internal diagnostic check.

Possible Causes
HANDS FREE MODULE

Diagnostic Test

1. REPLACE THE HANDS FREE MODULE IF DTC IS ACTIVE

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

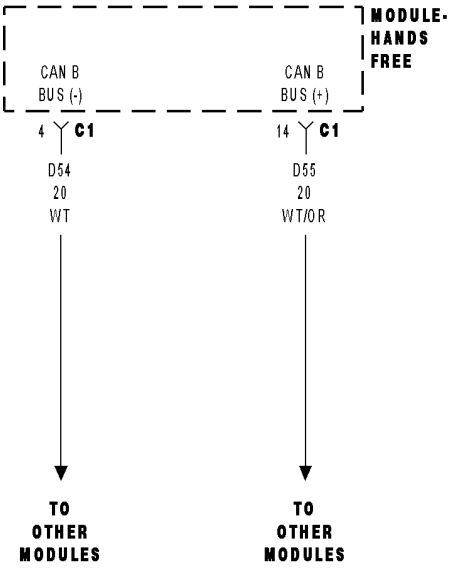
With the scan tool, read the active DTC's.

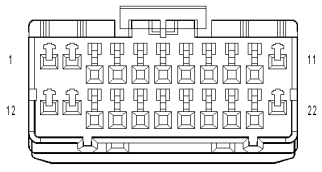
Does the scan tool display this DTC as active?

Yes >> Replace and program the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

U0019–CAN B BUS





MODULE-
HANDS FREE

U0019–CAN B BUS (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  Whenever the CAN B Bus (+) or CAN B Bus (-) circuit is open, shorted to voltage or shorted to ground.

Possible Causes
CAN B BUS DTC's IN FRONT CONTROL MODULE
(D55) CAN B BUS (+) CIRCUIT OPEN
(D54) CAN B BUS (-) CIRCUIT OPEN
HANDS FREE MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTCS

With the scan tool, read the active DTC's.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

---

2. CHECK FRONT CONTROL MODULE DTC's

With the scan tool, read Front Control Module active DTC's

Does the scan tool display any CAN B BUS DTC's – ACTIVE?

Yes >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the appropriate DTC.

No >> Go To 3

U0019–CAN B BUS (CONTINUED)

3. (D55) CAN B BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the negative battery cable.

Disconnect the Hands Free Module connector.

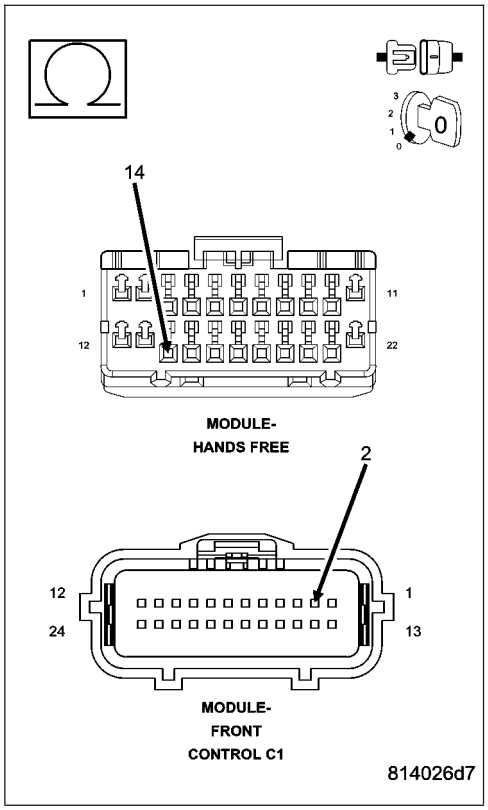
Disconnect the Front Control Module C1 connector.

Measure the resistance of the (D55) CAN B Bus (+) circuit between the Front Control Module C1 connector and the Hands Free Module connector.

Is the resistance below 2.0 ohms?

Yes >> Go To 4

No >> Repair the (D55) CAN B Bus (+) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



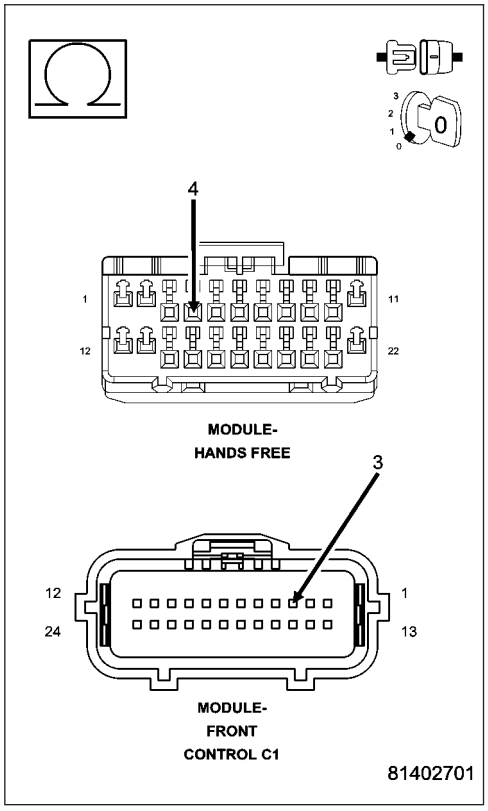
4. (D54) CAN B BUS (–) CIRCUIT OPEN

Measure the resistance of the (D54) CAN B Bus (–) circuit between the Front Control Module C1 connector and the Hands Free Module connector.

Is the resistance below 2.0 ohms?

Yes >> Replace and program the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).

No >> Repair the (D54) CAN B Bus (–) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1).



U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0151-LOST COMMUNICATION WITH OCCUPANT RESTRAINT CONTROLLER

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0154-LOST COMMUNICATION WITH OCCUPANT CLASSIFICATION MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0155-LOST COMMUNICATION WITH CLUSTER/CCN

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0156-LOST COMMUNICATION WITH EOM

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0164-LOST COMMUNICATION WITH HVAC CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0168-LOST COMMUNICATION WITH VEHICLE SECURITY CONTROL MODULE (SKREEM/WCM)

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0184-LOST COMMUNICATION WITH RADIO

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0186-LOST COMMUNICATION WITH AUDIO AMPLIFIER

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0195-LOST COMMUNICATION WITH SDARS

For a complete wiring diagram **Refer to Section 8W**.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

NAVIGATION/TELECOMMUNICATION - SERVICE INFORMATION

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NAVIGATION/TELECOMMUNICATION - SERVICE INFORMATION

DESCRIPTION

TELECOMMUNICATIONS

The hands-free cellular system uses Bluetooth™ technology to provide wireless communication between the operator's compatible cellular telephone and the vehicle's on-board receiver.

The system uses voice recognition technology to control operation. The incoming voice is broadcast through the vehicle's radio speakers, automatically overriding any other audio signals on the front speakers when the hands-free system is in use. A microphone in the rear view mirror picks up vehicle occupant's voices. If a call is in progress when the ignition is switched off, the hands-free system will continue to operate for up to 45 seconds as part of the Accessory Relay Delay function. Thereafter, the call can continue on the hand-held telephone.

The system will communicate with a telephone that is anywhere within the vehicle. However, covering the hand held phone or the hands-free phone module with a metal object may block the signal. The system will recognize up to seven telephones, each of which is given a spoken identification by the user during the setup process. The system includes Spanish and French voice recognition in addition to English.

Two buttons on the rearview mirror, identified with ISO icons, control the system: A ″phone″ button turns the system on and off; a ″voice recognition″ (or voice command) button prompts the hands-free system to listen for a voice command.

OPERATION

TELECOMMUNICATION

Two buttons on the rearview mirror, identified with ISO icons, control the system: A ″phone″ button turns the system on and off; a ″voice recognition″ (or voice command) button prompts the hands-free system to listen for a voice command. The system includes the following features:

- Phonebook - Stores telephone numbers for later recall by name or other verbal identification, called a voice tag, and memory location.
- Four memory locations - Home, Work, Cellular and Pager. A maximum of 32 unique names or voice tags may be stored at the same time, with a different number in each of the four memory locations.
- Voice tag dialing - Dials the number associated with a voice tag and memory location.
- Digit dialing - Dials the telephone number by recognizing the names of the digits as they are spoken.
- Receiving calls - A voice prompt notifies the user of an incoming call. A voice response accepts or rejects the call without manual intervention.
- Privacy Mode - Switches the call to the handheld telephone and the hands-free system and back again using the “voice recognition” (or “voice command”) button and a voice command, if desired.

DIAGNOSIS AND TESTING

TELECOMMUNICATION

Any diagnosis of the Telecommunication system should begin with the use of scan tool. For information on the use of the scan tool, refer to the appropriate Diagnostic Service information.

For complete circuit diagrams, refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

TELECOMMUNICATION SYSTEM DIAGNOSIS

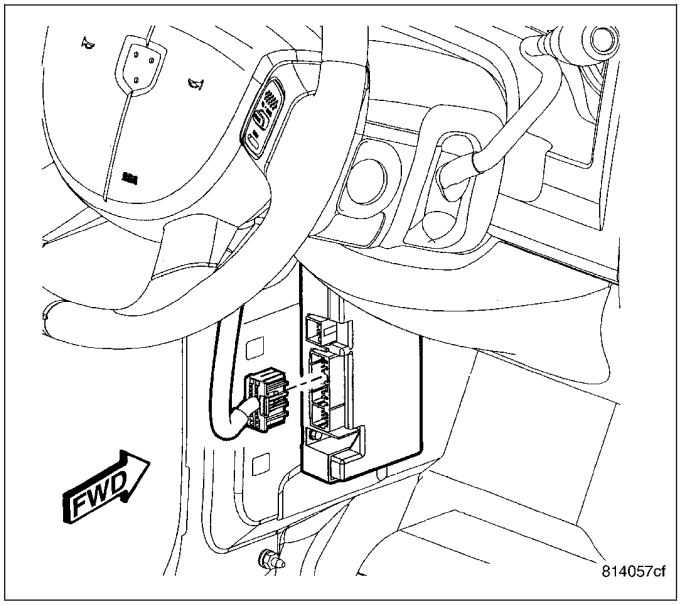
CONDITION	POSSIBLE CAUSE	CORRECTION
Phone Not Available	1. Bluetooth phone not paired to the system.	1. Ensure that phone(s) are paired to the system.
	2. Bluetooth phone not present or turned OFF.	2. Make sure paired phone is present, turned ON and that the Bluetooth option is enabled on the phone.
	3. Bluetooth phone has low battery.	3. At low battery levels, some phones will turn off Bluetooth functionality. Ensure cellular phone is charged to an adequate level.
Phone Pairing Failed	1. Phone does not support Hands Free Profile	1. The Telecommunication system requires the cellular phone to be Bluetooth™ enabled, as well as supporting the Hands Free Profile. The customer will have to upgrade their phone to one supporting Hands Free Profile. A list of suggested phones is available at: http://www.chrysler.com/uconnect.
	2. Phone not Bluetooth enabled.	2. The Telecommunication system requires the cellular phone to be Bluetooth™ enabled. A list of suggested phones is available at: http://www.chrysler.com/uconnect.
	3. PIN entered on the phone is not the same as PIN spoken to the system.	3. The PIN spoken to the system must be the same PIN entered into the phone.
	4. Phone has reached maximum number of allowed devices paired.	4. Remove one of the previously paired devices from it's list.
Poor Voice Recognition	1. Microphone failure	1. Using a scan tool, check for microphone fault codes.
	2. Customer not waiting for the beep before speaking.	2. Ensure customer is waiting for the system ″beep″ prior to beginning the speech to be recognized.
	3. Customer not speaking in a smooth normal manner.	3. Verify that the customer is attempting to use the system with a smooth consistent voice. The system is designed to accept normal speech spoken at a normal tone, some people tend to speak to a computer loud and slow, which results in reduced performance.
	4. Rear view mirror not properly attached to mounting.	4. Mirror must be firmly mounted to the mounting location. Ensure that mirror is tightened to the specified torque.
	5. High levels of noise in vehicle compartment	5. System performance is increased when noise conditions in the vehicle are lowered. Ideal conditions include windows closed.

CONDITION	POSSIBLE CAUSE	CORRECTION
	6. Object interfering with microphone input	6. Verify that there is no object, hanging from the mirror, that could be obstructing the microphone.
	7. User not saying ″send″ after a pager dialing request	7. User must say ″send″ at the end of a Pager Dialing request.
	8. Other passengers talking while customer is attempting to use the system	8. Although designed for primary use by the driver, the microphone will pick up passengers in any seat of the vehicle. System performance is increased in low noise environments.
Phonebook names not recognized consistently	1. Phonebook names recorded in high noise conditions	1. For increased system performance, it is recommended that the phone book entries are recorded in a low noise environment. That is, vehicle in park, with windows up.
	2. Phonebook name(s) short	2. For increased performance it is recommended that the user use both first and last name as a phonebook entry. Example ″ James Johnson″ as opposed to ″James″.
	3. Phonebook names recorded by another user	3. It is recommended that each user of the system record their own phonebook entries. This will increase the recognition performance.
	4. Similar names in phonebook	4. For increased system performance it is recommended that the user do not enter similar sounding names in the phonebook.
	5. Object interfering with microphone input	5. Object interfering with microphone input.
Poor Phone audio quality.	1. Microphone failure	1. Use a scan tool, and check for Microphone faults.
	2. Rear view mirror not properly fixed to mounting button	2. Mirror must be firmly mounted to the mounting location. Tighten mirror to the specified torque.
	3. System being used in high noise conditions	3. System performance is increased when noise conditions in the vehicle are lowered. Ideal conditions include windows closed.
No Phone Audio	1. Phone setting cause phone audio to be routed to handset.	1. Route audio to ″Hands free″ device.

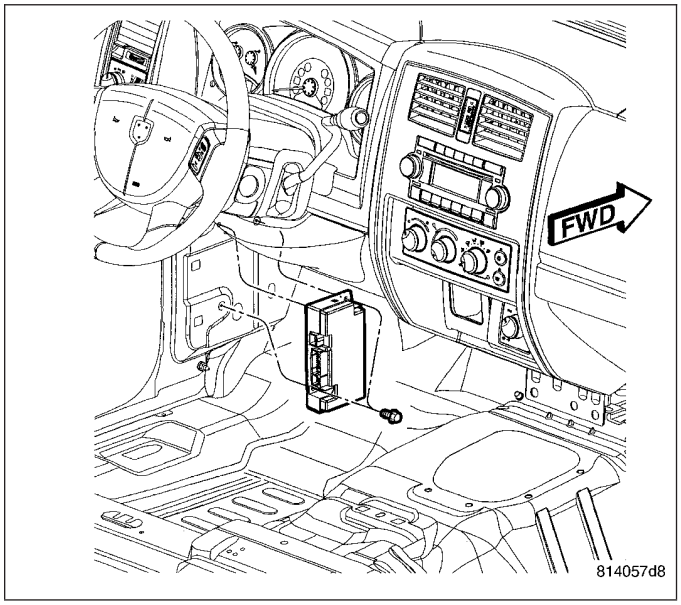
MODULE-HANDS FREE

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the left cowl side trim panel.
3. Disconnect electrical harness connector.

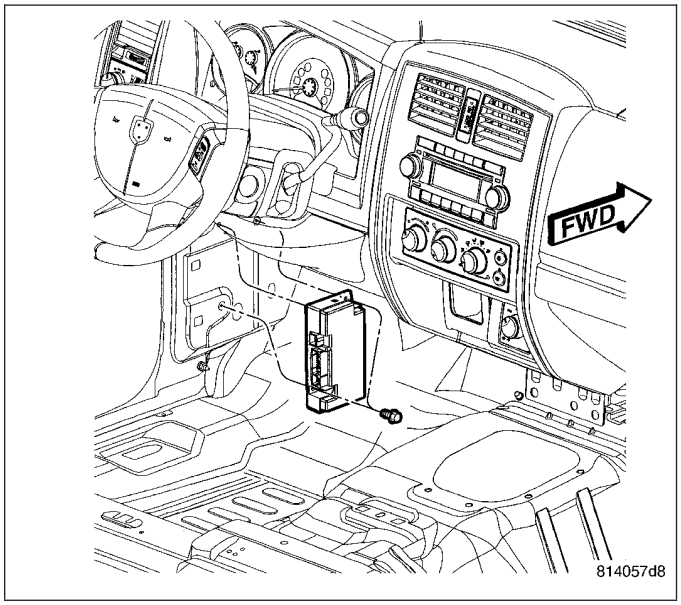


4. Remove the mounting fasteners and remove module.

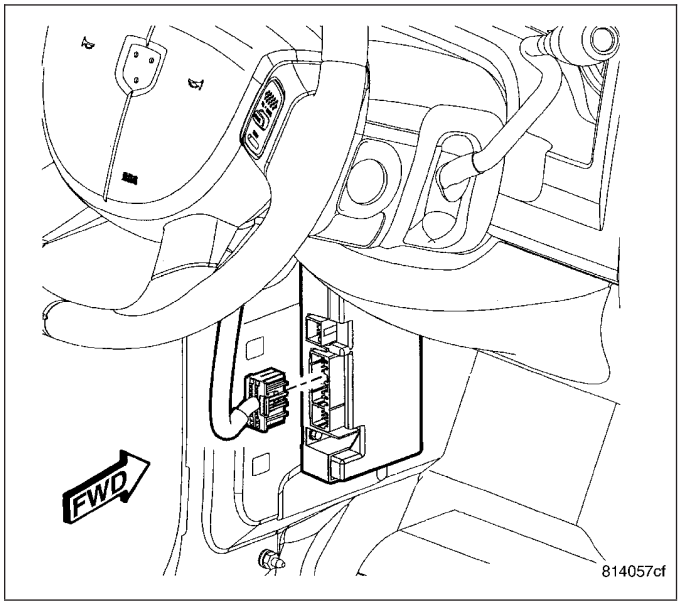


INSTALLATION

1. Position module. Install and tighten mounting fasteners.



2. Connect electrical harness connector.
3. Install cowl side trim panel.
4. Connect battery negative cable.



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8W-01 WIRING DIAGRAM INFORMATION

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WIRING DIAGRAM INFORMATION

DESCRIPTION

DESCRIPTION - HOW TO USE WIRING DIAGRAMS

DaimlerChrysler Corporation wiring diagrams are designed to provide information regarding the vehicles wiring content. In order to effectively use the wiring diagrams to diagnose and repair DaimlerChrysler Corporation vehicles, it is important to understand all of their features and characteristics.

Diagrams are arranged such that the power (B+) side of the circuit is placed near the top of the page, and the ground (B-) side of the circuit is placed near the bottom of the page.

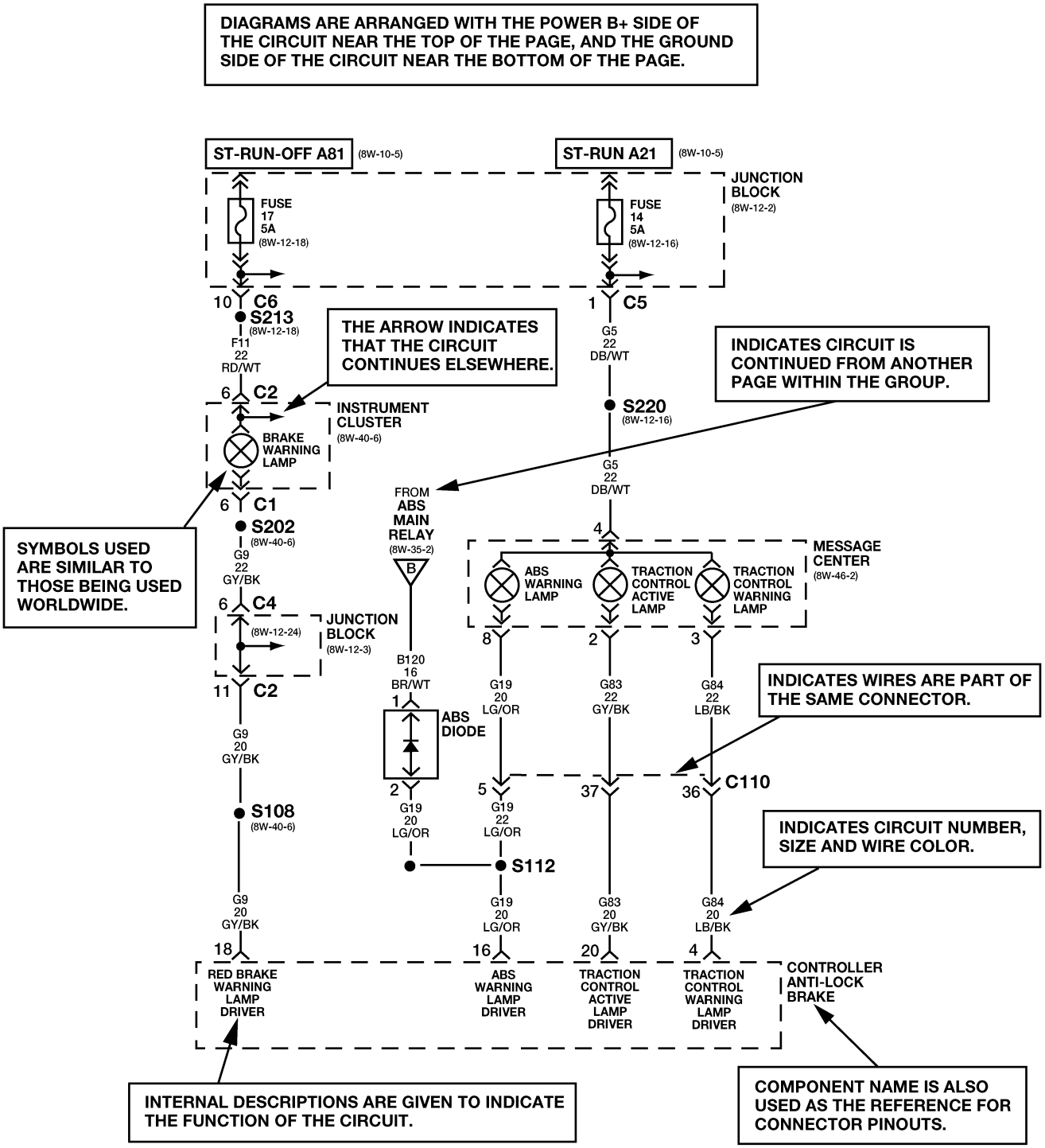
All switches, components, and modules are shown in the at rest position with the doors closed and the key removed from the ignition.

Components are shown two ways. A solid line around a component indicates that the component is complete. A dashed line around the component indicates that the component is being shown is not complete. Incomplete components have a reference number to indicate the page where the component is shown complete.

It is important to realize that no attempt is made on the diagrams to represent components and wiring as they appear on the vehicle. For example, a short piece of wire is treated the same as a long one. In addition, switches and other components are shown as simply as possible, with regard to function only.

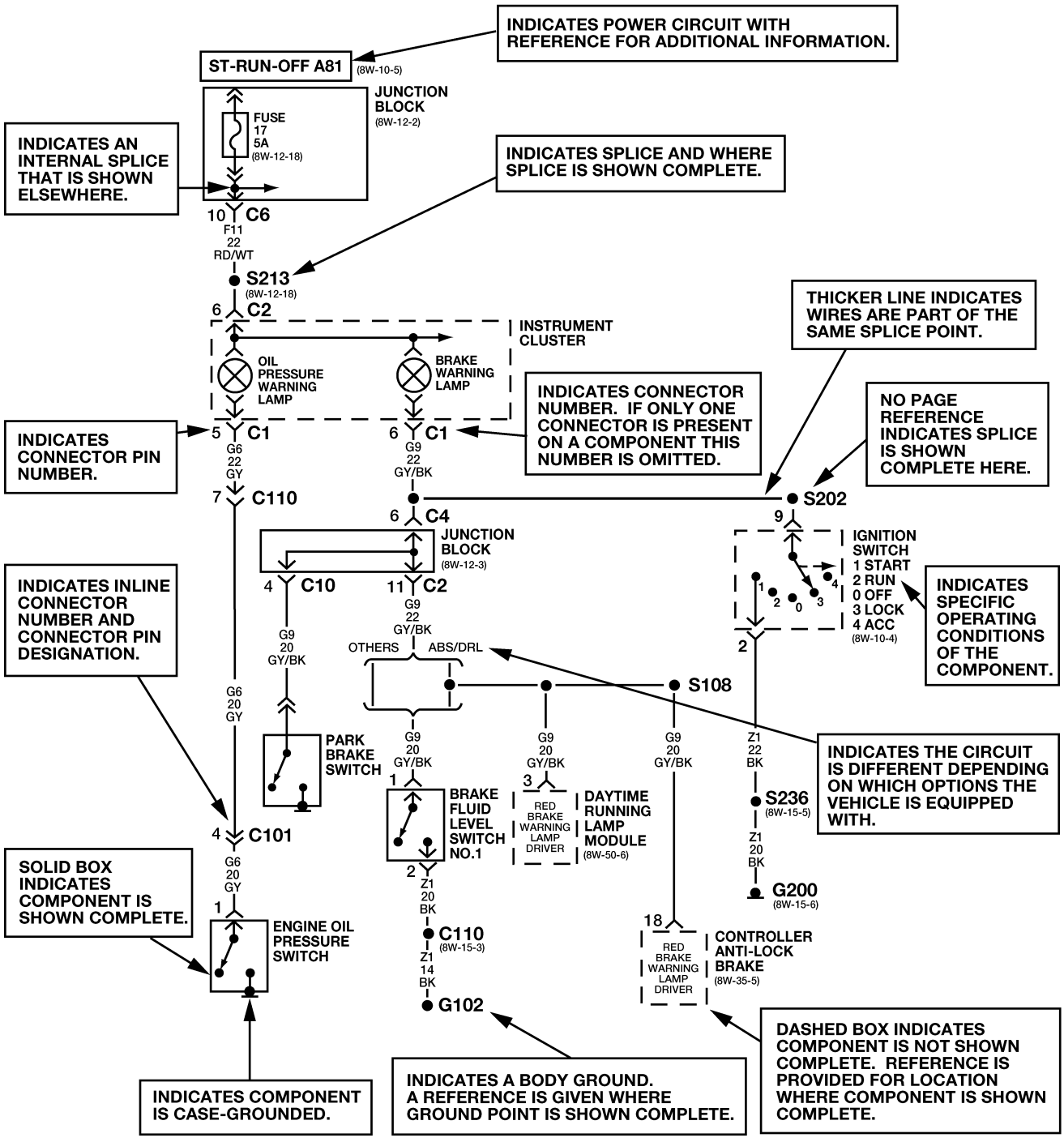
SYMBOLS

International symbols are used throughout the wiring diagrams. These symbols are consistent with those being used around the world.



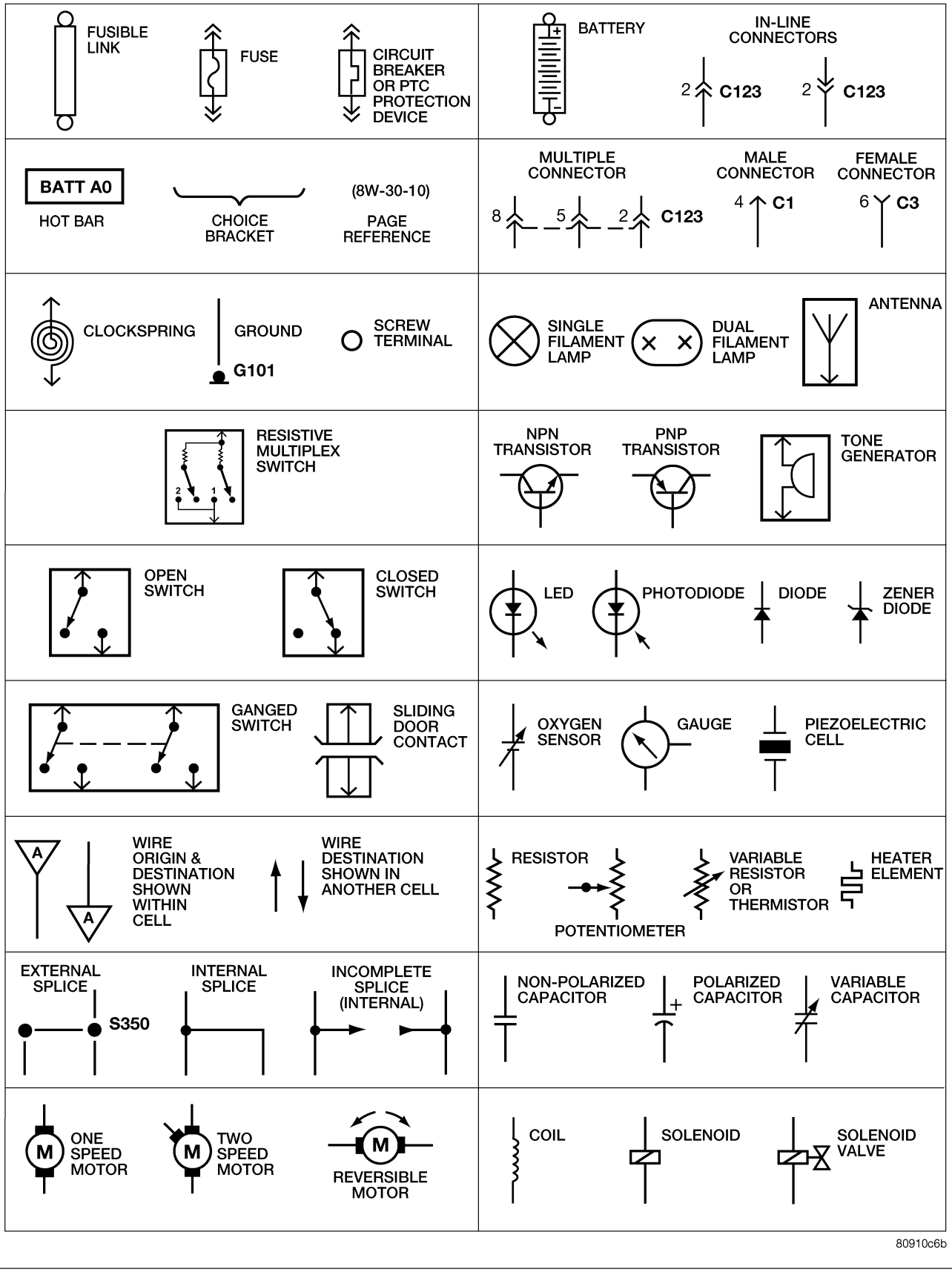
The System shown here is an EXAMPLE ONLY. It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.

80c06d01



The System shown here is an EXAMPLE ONLY. It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.

80c06d02


FUSIBLE LINK
FUSE
CIRCUIT BREAKER OR PTC PROTECTION DEVICE
BATTERY
IN-LINE CONNECTORS
2 C123
2 C123
BATT A0
HOT BAR
CHOICE BRACKET
(8W-30-10)
PAGE REFERENCE
MULTIPLE CONNECTOR
8 5 2 C123
MALE CONNECTOR
4 C1
FEMALE CONNECTOR
6 C3
CLOCKSPRING
GROUND
G101
SCREW TERMINAL
SINGLE FILAMENT LAMP
DUAL FILAMENT LAMP
ANTENNA
RESISTIVE MULTIPLEX SWITCH
2
1
NPN TRANSISTOR
PNP TRANSISTOR
TONE GENERATOR
OPEN SWITCH
CLOSED SWITCH
LED
PHOTODIODE
DIODE
ZENER DIODE
GANGED SWITCH
SLIDING DOOR CONTACT
OXYGEN SENSOR
GAUGE
PIEZOELECTRIC CELL
A
A
WIRE ORIGIN & DESTINATION SHOWN WITHIN CELL
WIRE DESTINATION SHOWN IN ANOTHER CELL
RESISTOR
POTENTIOMETER
VARIABLE RESISTOR OR THERMISTOR
HEATER ELEMENT
EXTERNAL SPLICE
S350
INTERNAL SPLICE
INCOMPLETE SPLICE (INTERNAL)
NON-POLARIZED CAPACITOR
POLARIZED CAPACITOR
VARIABLE CAPACITOR
M
ONE SPEED MOTOR
M
TWO SPEED MOTOR
M
REVERSIBLE MOTOR
COIL
SOLENOID
SOLENOID VALVE

80910c6b

TERMINOLOGY

This is a list of terms and definitions used in the wiring diagrams.

LHD . . . . . Left Hand Drive Vehicles
RHD . . . . . Right Hand Drive Vehicles
ATX . . . . . Automatic Transmissions-Front Wheel Drive
MTX . . . . . Manual Transmissions-Front Wheel Drive
AT . . . . . Automatic Transmissions-Rear Wheel Drive
MT . . . . . Manual Transmissions-Rear Wheel Drive
SOHC . . . . . Single Over Head Cam Engine
DOHC . . . . . Double Over Head Cam Engine
Export . . . . . Vehicles Built For Sale In Markets Other Than North America
Except Export . . . . . Vehicles Built For Sale In North America

DESCRIPTION - CIRCUIT INFORMATION

Each wire shown in the diagrams contains a code which identifies the main circuit, a specific part of the main circuit, gage of wire, and color. An example would be **A 2 18 LB/YL**. This is a Battery Feed circuit, level two, eighteen gauge, light blue with a yellow tracer.

WIRE COLOR CODE CHART

COLOR CODE	COLOR
BL	BLUE
BK	BLACK
BR	BROWN
DB	DARK BLUE
DG	DARK GREEN
GY	GRAY
LB	LIGHT BLUE
LG	LIGHT GREEN
OR	ORANGE
PK	PINK
RD	RED
TN	TAN
VT	VIOLET
WT	WHITE
YL	YELLOW
*	WITH TRACER

DESCRIPTION - CIRCUIT FUNCTIONS

All circuits in the diagrams use an alpha/numeric code to identify the wire and it's function. To identify which circuit code applies to a system, refer to the Circuit Identification Code Chart. This chart shows the main circuits only and does not show the secondary codes that may apply to some models.

CIRCUIT IDENTIFICATION CODE CHART

CIRCUIT	FUNCTION
A	BATTERY FEED
B	BRAKE CONTROLS
C	CLIMATE CONTROLS
D	DIAGNOSTIC CIRCUITS
E	DIMMING ILLUMINATION CIRCUITS
F	FUSED CIRCUITS
G	MONITORING CIRCUITS (GAUGES)
H	MULTIPLE
I	NOT USED
J	OPEN
K	POWERTRAIN CONTROL MODULE
L	EXTERIOR LIGHTING
M	INTERIOR LIGHTING
N	MULTIPLE
O	NOT USED
P	POWER OPTION (BATTERY FEED)
Q	POWER OPTIONS (IGNITION FEED)
R	PASSIVE RESTRAINT
S	SUSPENSION/STEERING
T	TRANSMISSION/TRANSAXLE/ TRANSFER CASE
U	OPEN
V	SPEED CONTROL, WIPER/ WASHER
W	WIPERS
X	AUDIO SYSTEMS
Y	TEMPORARY
Z	GROUNDS

DESCRIPTION - SECTION IDENTIFICATION AND INFORMATION

The wiring diagrams are grouped into individual sections. If a component is most likely found in a particular group, it will be shown complete (all wires, connectors, and pins) within that group. For example, the Auto Shutdown Relay is most likely to be found in Group 30, so it is shown there complete. It can, however, be shown partially in another group if it contains some associated wiring.

Splice diagrams in Section 8W-70 show the entire splice and provide references to other sections the splices serves. Section 8W-70 only contains splice diagrams that are not shown in their entirety somewhere else in the wiring diagrams.

Section 8W-80 shows each connector and the circuits involved with that connector. The connectors are identified using the name/number on the diagram pages.

DESCRIPTION - CONNECTOR, GROUND AND SPLICE INFORMATION

CAUTION: Not all connectors are serviced. Some connectors are serviced only with a harness. A typical example might be the Supplemental Restraint System connectors. Always check parts availability before attempting a repair.

IDENTIFICATION

In-line connectors are identified by a number, as follows:

- In-line connectors located in the engine compartment are C100 series numbers.
- In-line connectors located in the instrument panel area are C200 series numbers.
- In-line connectors located in the body are C300 series numbers.
- Jumper harness connectors are C400 series numbers.
- Grounds and ground connectors are identified with a “G” and follow the same series numbering as the in-line connectors.
- Splices are identified with an “S” and follow the same series numbering as the in-line connectors.
- Component connectors are identified by the component name instead of a number. Multiple connectors on a component use a C1, C2, etc. identifier.

LOCATIONS

Section 8W-91 contains connector/ground/splice location illustrations. The illustrations contain the connector name (or number)/ground number/splice number and component identification. Connector/ground/splice location charts in section 8W-91 reference the figure numbers of the illustrations.

The abbreviation T/O is used in the component location section to indicate a point in which the wiring harness branches out to a component. The abbreviation N/S means Not Shown in the illustrations

WARNING

WARNINGS - GENERAL

WARNINGS provide information to prevent personal injury and vehicle damage. Below is a list of general warnings that should be followed any time a vehicle is being serviced.

WARNING: Always wear safety glasses for eye protection.

WARNING: Use safety stands anytime a procedure requires being under a vehicle.

WARNING: Be sure that the ignition switch always is in the off position, unless the procedure requires it to be on.

WARNING: Set the parking brake when working on any vehicle. An automatic transmission should be in park. A manual transmission should be in neutral.

WARNING: Operate the engine only in a well-ventilated area.

WARNING: Keep away from moving parts when the engine is running, especially the fan and belts.

WARNING: To prevent serious burns, avoid contact with hot parts such as the radiator, exhaust manifold(s), tail pipe, catalytic converter and muffler.

WARNING: Do not allow flame or sparks near the battery. Gases are always present in and around the battery.

WARNING: Always remove rings, watches, loose hanging jewelry and avoid loose clothing.

DIAGNOSIS AND TESTING - WIRING HARNESS

TROUBLESHOOTING TOOLS

When diagnosing a problem in an electrical circuit there are several common tools necessary. These tools are listed and explained below.

- Jumper Wire - This is a test wire used to connect two points of a circuit. It can be used to bypass an open in a circuit.

WARNING: Never use a jumper wire across a load, such as a motor, connected between a battery feed and ground.

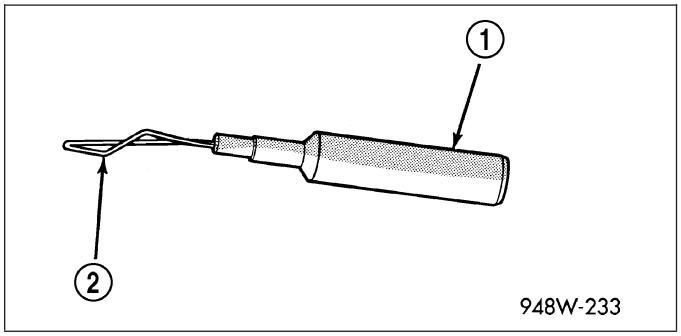
- Voltmeter - Used to check for voltage on a circuit. Always connect the black lead to a known good ground and the red lead to the positive side of the circuit.

CAUTION: Most of the electrical components used in today's vehicles are Solid State. When checking voltages in these circuits, use a meter with a 10 - megohm or greater impedance rating.

- Ohmmeter - Used to check the resistance between two points of a circuit. Low or no resistance in a circuit means good continuity.

CAUTION: Most of the electrical components used in today's vehicles are Solid State. When checking resistance in these circuits use a meter with a 10 - megohm or greater impedance rating. In addition, make sure the power is disconnected from the circuit. Circuits that are powered up by the vehicle's electrical system can cause damage to the equipment and provide false readings.

- Probing Tools - These tools are used for probing terminals in connectors. Select the proper size tool from Special Tool Package 6807, and insert the probing end (2) into the terminal being tested. Use the other end of the tool (1) to insert the meter probe.



INTERMITTENT AND POOR CONNECTIONS

Most intermittent electrical problems are caused by faulty electrical connections or wiring. It is also possible for a sticking component or relay to cause a problem. Before condemning a component or wiring assembly, check the following items.

- Connectors are fully seated
- Spread terminals, or terminal push out
- Terminals in the wiring assembly are fully seated into the connector/component and locked into position
- Dirt or corrosion on the terminals. Any amount of corrosion or dirt could cause an intermittent problem
- Damaged connector/component casing exposing the item to dirt or moisture
- Wire insulation that has rubbed through causing a short to ground
- Some or all of the wiring strands broken inside of the insulation
- Wiring broken inside of the insulation

TROUBLESHOOTING WIRING PROBLEMS

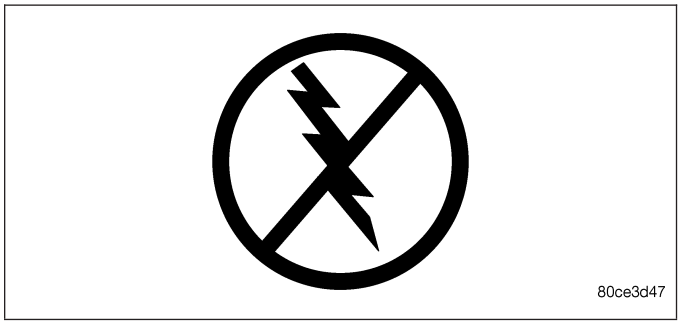
When troubleshooting wiring problems there are six steps which can aid in the procedure. The steps are listed and explained below. Always check for non-factory items added to the vehicle before doing any diagnosis. If the vehicle is equipped with these items, disconnect them to verify these add-on items are not the cause of the problem.

1. Verify the problem.
2. Verify any related symptoms. Do this by performing operational checks on components that are in the same circuit. Refer to the wiring diagrams.
3. Analyze the symptoms. Use the wiring diagrams to determine what the circuit is doing, where the problem most likely is occurring and where the diagnosis will continue.
4. Isolate the problem area.
5. Repair the problem area.
6. Verify the proper operation. For this step, check for proper operation of all items on the repaired circuit. Refer to the wiring diagrams.

STANDARD PROCEDURE

STANDARD PROCEDURE - ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

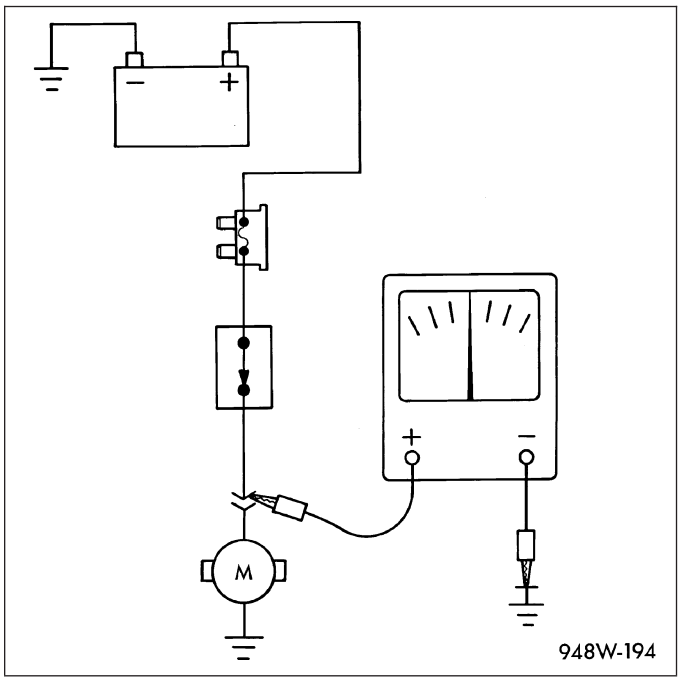
All ESD sensitive components are solid state and a symbol is used to indicate this. When handling any component with this symbol, comply with the following procedures to reduce the possibility of electrostatic charge build up on the body and inadvertent discharge into the component. If it is not known whether the part is ESD sensitive, assume that it is.



1. Always touch a known good ground before handling the part. This should be repeated while handling the part and more frequently after sliding across a seat, sitting down from a standing position, or walking a distance.
2. Avoid touching electrical terminals of the part, unless instructed to do so by a written procedure.
3. When using a voltmeter, be sure to connect the ground lead first.
4. Do not remove the part form it’s protective packing until it is time to install the part.
5. Before removing the part from it’s pakage, ground the pakage to a known good ground on the vehicle.

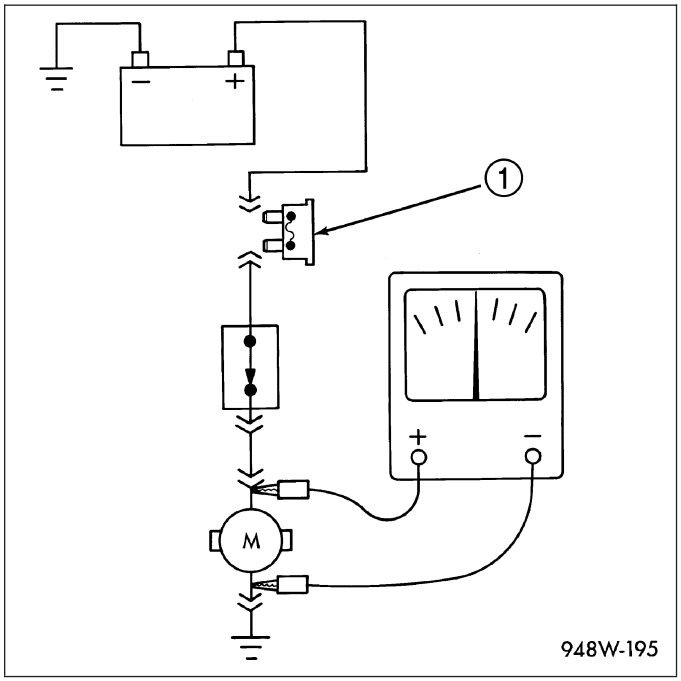
STANDARD PROCEDURE - TESTING OF VOLTAGE POTENTIAL

1. Connect the ground lead of a voltmeter to a known good ground.
2. Connect the other lead of the voltmeter to the selected test point. The vehicle ignition may need to be turned ON to check voltage. Refer to the appropriate test procedure.



STANDARD PROCEDURE - TESTING FOR CONTINUITY

1. Remove the fuse (1) for the circuit being checked or, disconnect the battery.
2. Connect one lead of the ohmmeter to one side of the circuit being tested
3. Connect the other lead to the other end of the circuit being tested. Low or no resistance means good continuity.



STANDARD PROCEDURE - TESTING FOR A SHORT TO GROUND

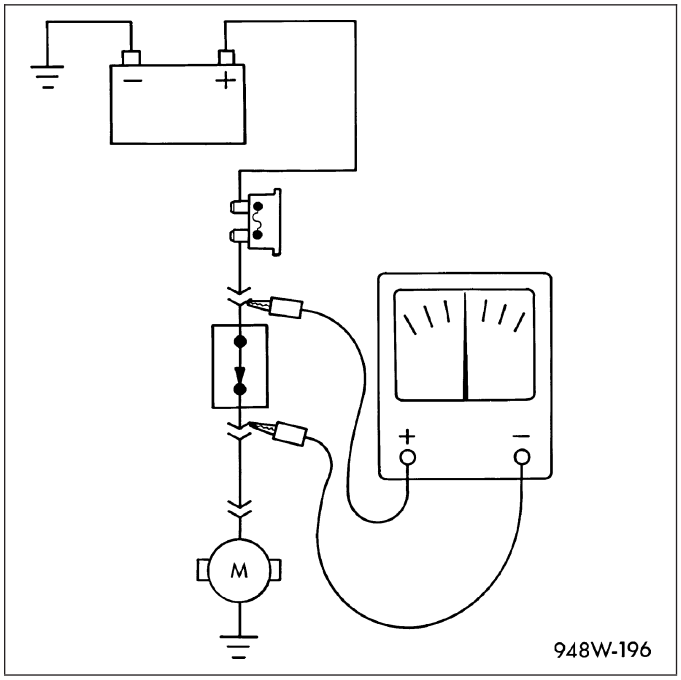
1. Remove the fuse and disconnect all items involved with the fuse.
2. Connect a test light or a voltmeter across the terminals of the fuse.
3. Starting at the fuse block, wiggle the wiring harness about six to eight inches apart and watch the voltmeter/test lamp.
4. If the voltmeter registers voltage or the test lamp glows, there is a short to ground in that general area of the wiring harness.

STANDARD PROCEDURE - TESTING FOR A SHORT TO GROUND ON FUSES POWERING SEVERAL LOADS

1. Refer to the wiring diagrams and disconnect or isolate all items on the suspected fused circuits.
2. Replace the blown fuse.
3. Supply power to the fuse by turning ON the ignition switch or re-connecting the battery.
4. Start connecting or energizing the items in the fuse circuit one at a time. When the fuse blows the circuit with the short to ground has been isolated.

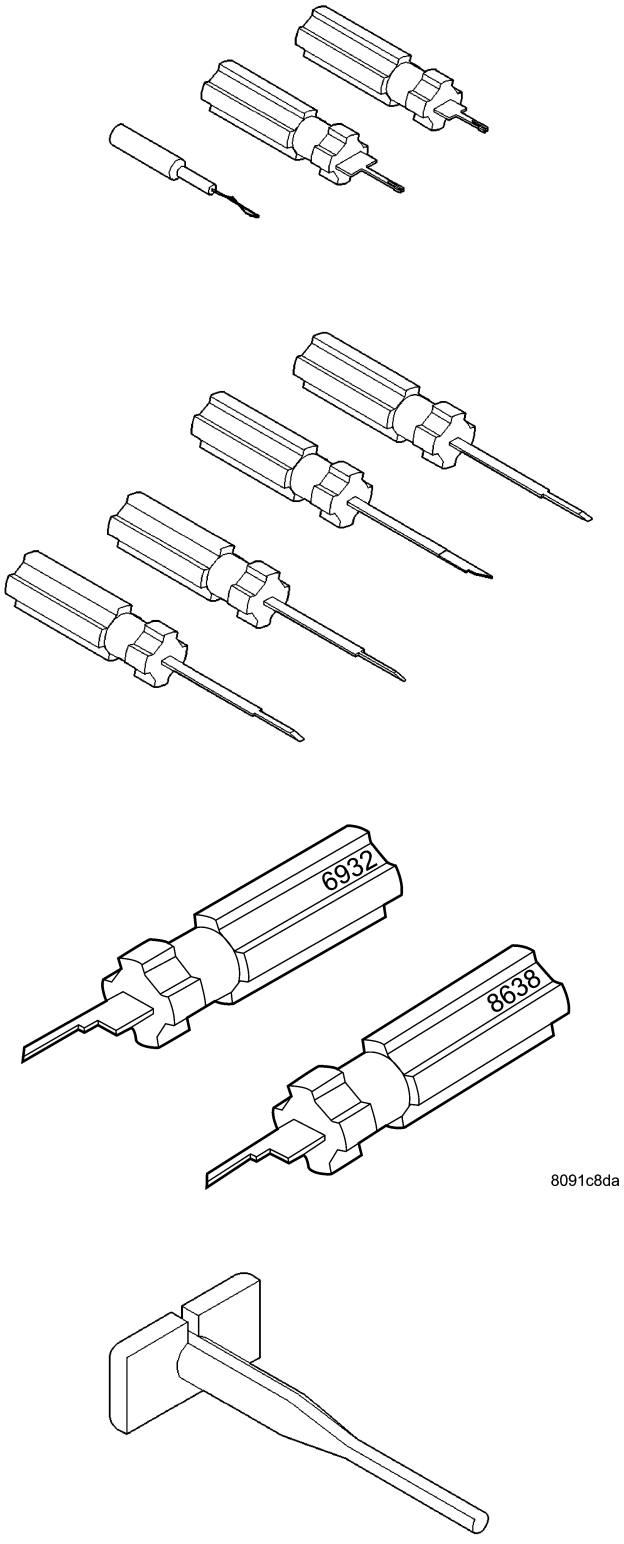
STANDARD PROCEDURE - TESTING FOR A VOLTAGE DROP

1. Connect the positive lead of the voltmeter to the side of the circuit closest to the battery.
2. Connect the other lead of the voltmeter to the other side of the switch, component or circuit.
3. Operate the item.
4. The voltmeter will show the difference in voltage between the two points.



SPECIAL TOOLS

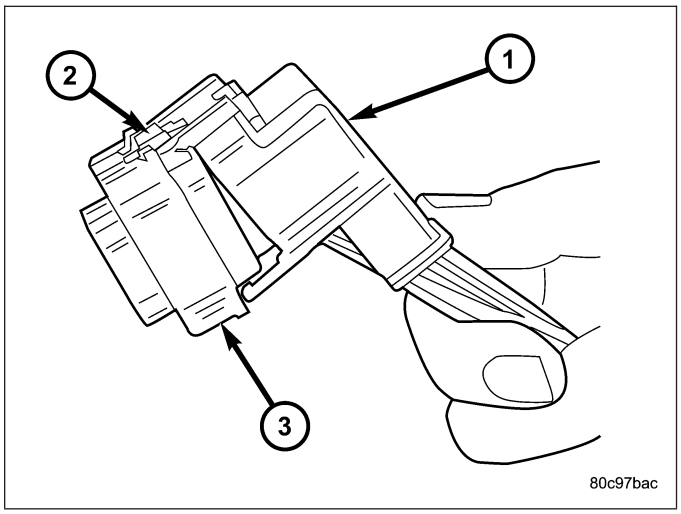
WIRING/TERMINAL

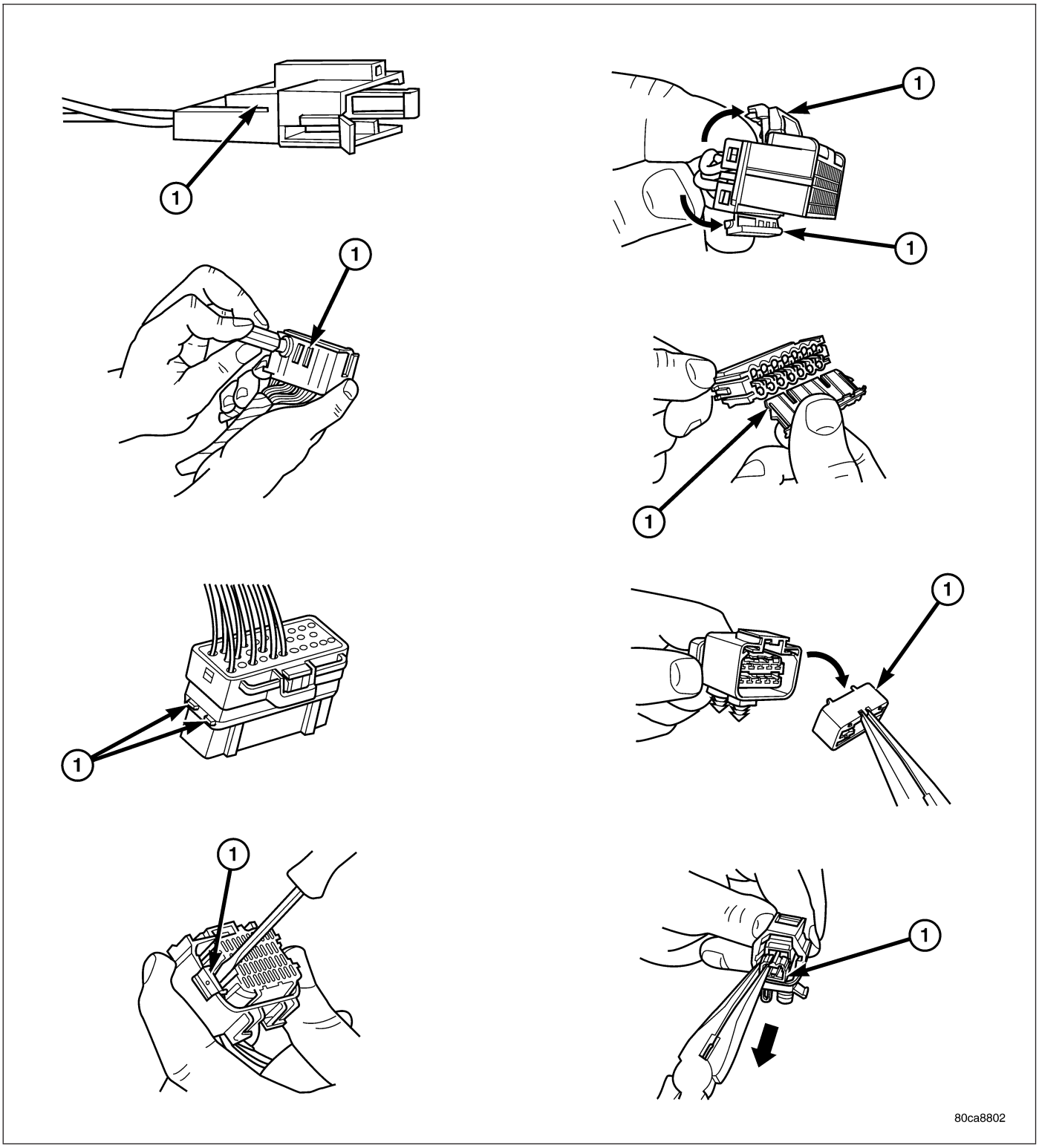


CONNECTOR

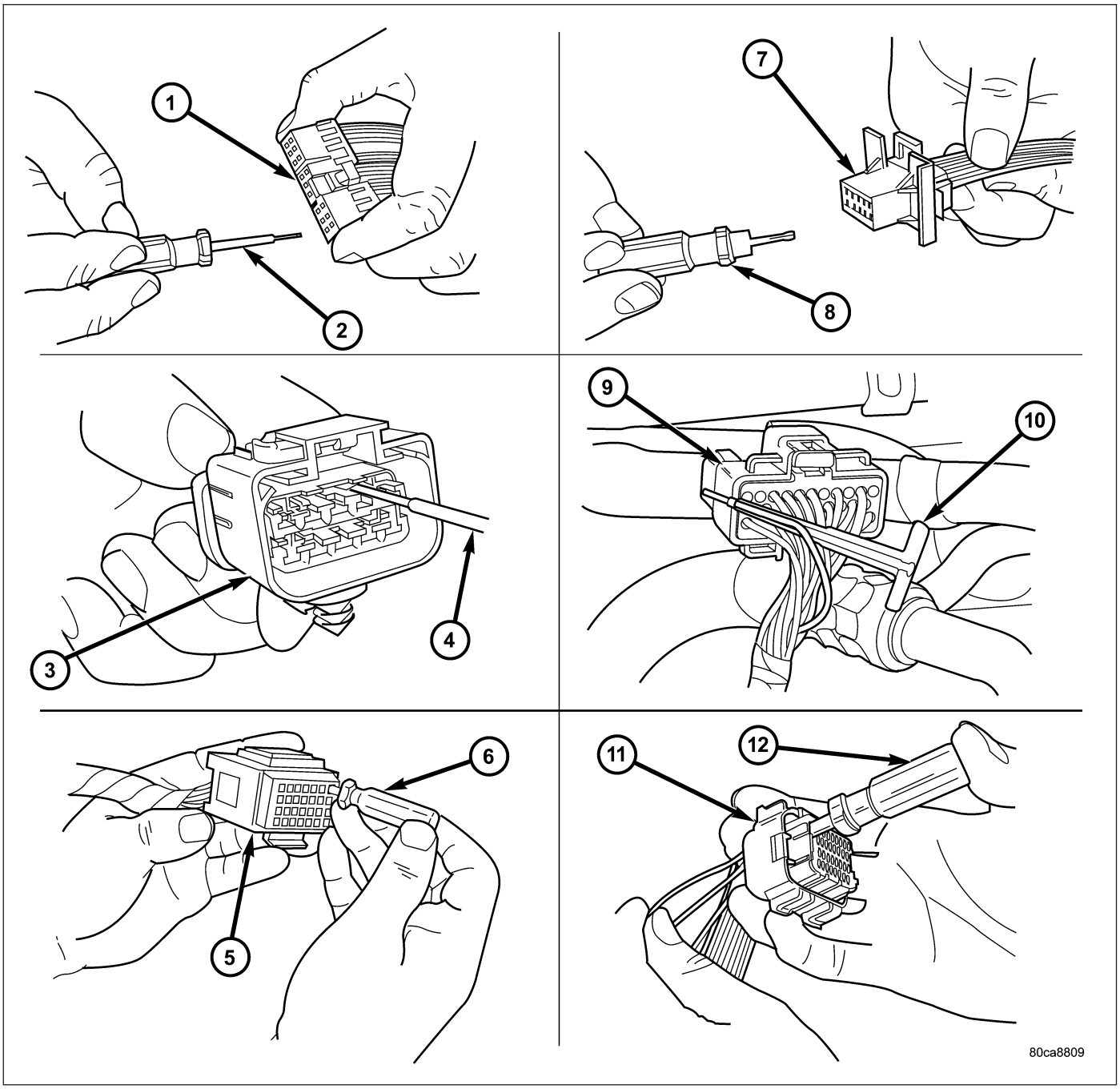
REMOVAL

1. Disconnect battery.
2. Release Connector Lock (2).
3. Disconnect the connector (3) being repaired from its mating half/component.
4. Remove the dress cover (if applicable) (1).





5. Release the Secondary Terminal Lock, if required (1).



1 - TYPICAL CONNECTOR
2 - PICK FROM SPECIAL TOOL KIT 6680
3 - APEX CONNECTOR
4 - PICK FROM SPECIAL TOOL KIT 6680
5 - AUGAT CONNECTOR
6 - SPECIAL TOOL 6932
7 - MOLEX CONNECTOR
8 - SPECIAL TOOL 6742
9 - THOMAS AND BETTS CONNECTOR
10 - SPECIAL TOOL 6934
11 - TYCO CONNECTOR
12 - SPECIAL TOOL 8638

6. Position the connector locking finger away from the terminal using the proper special tool. Pull on the wire to remove the terminal from the connector.

INSTALLATION

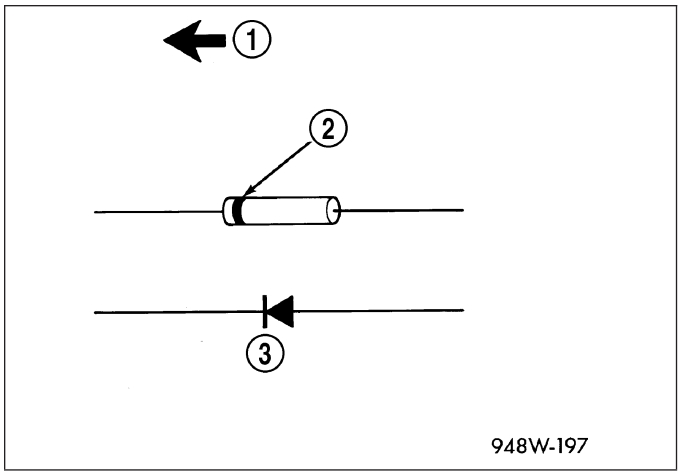
1. Insert the removed terminal in the same cavity on the repair connector.

2. Repeat steps for each terminal in the connector, being sure that all wires are inserted into the proper cavities. For additional connector pin-out identification, refer to the wiring diagrams.
3. When the connector is re-assembled, the secondary terminal lock must be placed in the locked position to prevent terminal push out.
4. Replace dress cover (if applicable).
5. Connect connector to its mating half/component.
6. Connect battery and test all affected systems.

DIODE

REMOVAL

1. Disconnect the battery.
2. Locate the diode in the harness, and remove the protective covering.
3. Remove the diode from the harness, pay attention to the current flow direction (1) (2) (3).



INSTALLATION

1. Remove the insulation from the wires in the harness. Only remove enough insulation to solder in the new diode.
2. Install the new diode in the harness, making sure current flow is correct. If necessary, refer to the appropriate wiring diagram for current flow.
3. Solder the connection together using rosin core type solder only. **Do not use acid core solder.**
4. Tape the diode to the harness using electrical tape. Make sure the diode is completely sealed from the elements.
5. Re-connect the battery and test affected systems.

TERMINAL

REMOVAL

1. Follow steps for removing terminals described in the connector removal section.
2. Cut the wire 6 inches from the back of the connector.

INSTALLATION

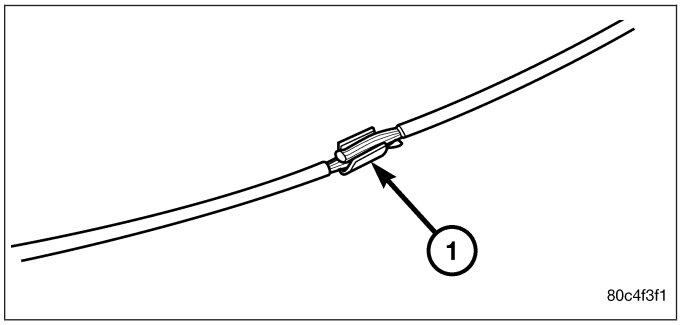
1. Select a wire from the terminal repair kit that best matches the color and gage of the wire being repaired.
2. Cut the repair wire to the proper length and remove one–half (1/2) inch of insulation.
3. Splice the repair wire to the wire harness (see wire splicing procedure) .
4. Insert the repaired wire into the connector.
5. Install the connector locking wedge, if required, and reconnect the connector to its mating half/component.
6. Re-tape the wire harness starting at 1–1/2 inches behind the connector and 2 inches past the repair.
7. Connect battery and test all affected systems.

WIRE

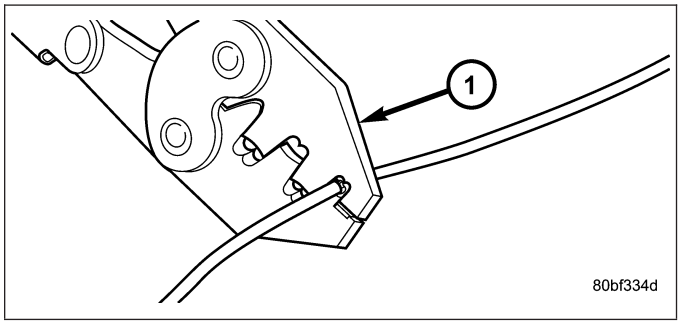
STANDARD PROCEDURE - WIRE SPLICING

When splicing a wire, it is important that the correct gage be used as shown in the wiring diagrams.

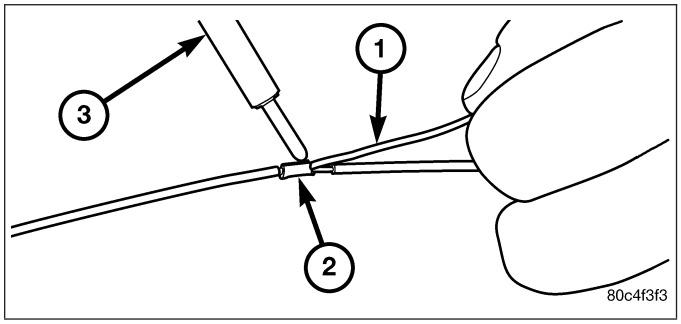
1. Remove one-half (1/2) inch of insulation from each wire that needs to be spliced.
2. Place a piece of adhesive lined heat shrink tubing on one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.
3. Place the strands of wire overlapping each other inside of the splice clip (1).



4. Using crimping tool (1), Mopar p/n 05019912AA, crimp the splice clip and wires together.

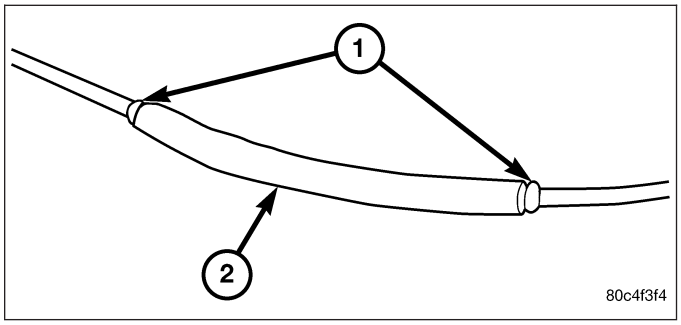


5. Solder (3) the connection (2) together using rosin core type solder (1) only.



CAUTION: DO NOT USE ACID CORE SOLDER.

6. Center the heat shrink tubing (2) over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant (1) comes out of both ends of the tubing.



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Fuse 17	8W-13-18
Fuse 18	8W-13-15
Fuse 19	8W-13-18
Fuse 20	8W-13-18
Fuse 21	8W-13-18
Fuse 22	8W-13-18
Fuse 23	8W-13-19
Fuse 24	8W-13-19
Fuse 25	8W-13-19
Fuse 27	8W-13-19
Fuse 28	8W-13-19
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Fuse 32	8W-13-20
Fuse 33	8W-13-20
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Fuse 38	8W-13-22
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Fuse 50	8W-13-25
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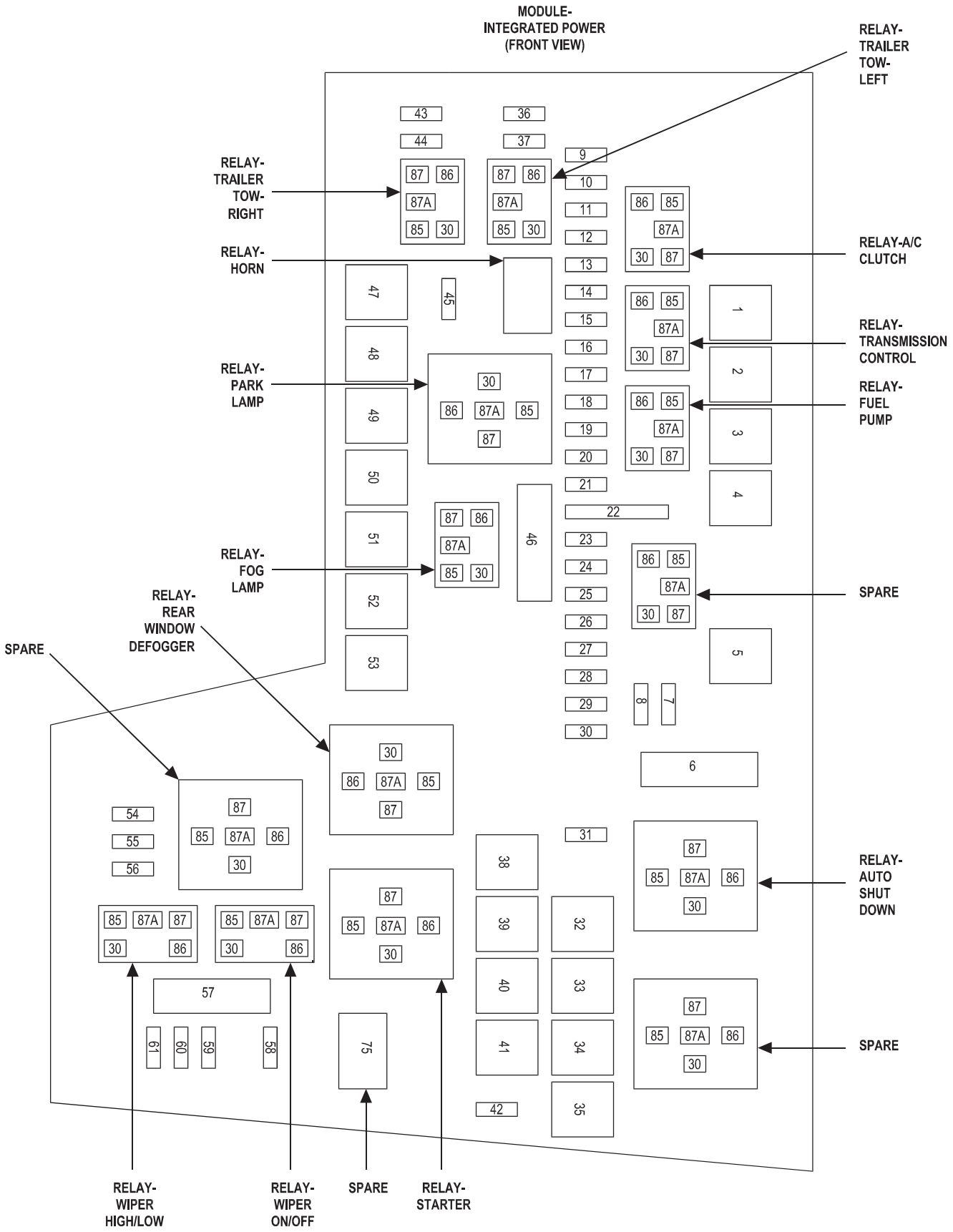

MODULE-
INTEGRATED POWER
(FRONT VIEW)
RELAY-
TRAILER
TOW-
LEFT
RELAY-
TRAILER
TOW-
RIGHT
RELAY-
HORN
RELAY-
PARK
LAMP
RELAY-
FOG
LAMP
RELAY-
REAR
WINDOW
DEFOGGER
SPARE
RELAY-A/C
CLUTCH
RELAY-
TRANSMISSION
CONTROL
RELAY-
FUEL
PUMP
SPARE
RELAY-
AUTO
SHUT
DOWN
SPARE
RELAY-
WIPER
HIGH/LOW
RELAY-
WIPER
ON/OFF
SPARE
RELAY-
STARTER

FUSES
(IPM)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	A927 12RD/OR	FUSED B(+)
2	40A	A904 12RD/LB	FUSED B(+)
3	30A	A400 14TN/RD ◆◆◆◆	FUSED B(+)
4	50A	A915 10RD	FUSED B(+)
5	40A	A917 12RD	FUSED B(+)
6	20A	A920 18RD/BK	FUSED B(+)
7	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
8	10A	F21 20PK/DG	FUSED IGNITION SWITCH OUTPUT (RUN-START)
9	10A	A956 20RD	FUSED B(+)
10	-	-	-
11	10A	INTERNAL	FUSED B(+)
12	15A	INTERNAL ◆◆◆◆	FUSED B(+)
13	15A	INTERNAL ◆◆◆◆	FUSED B(+)
14	20A	A918 18RD	FUSED B(+)
15	25A	INTERNAL ■■	FUSED B(+)
16	20A	INTERNAL	FUSED B(+)
17	20A	A111 18DG/RD ▼▼	FUSED B(+)
18	20A	INTERNAL	FUSED B(+)
19	15A	A103 20GY/RD	FUSED B(+)
20	20A	A924 18RD	FUSED B(+)
21	25A	A116 16YL/RD	FUSED B(+)
22	20A	F306 18DB/PK △△	FUSED B(+)
22	20A	F984 12PK/YL △	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
23	20A	INTERNAL ○○○	FUSED B(+)
24	20A	A919 18RD	FUSED B(+)
25	15A	A117 20RD/DG	FUSED B(+) (I.O.D.)
26	-	-	FUSED B(+)
27	20A	A940 18RD	FUSED B(+) -
28	20A	A901 18RD	FUSED B(+)
29	20A	A908	FUSED B(+)
30	-	-	-

△ I.O.D. ▼▼ AWAL
△△ EXCEPT I.O.D. ○○○ FOG LAMPS
■■ A/T ◆◆◆◆ TRAILER TOW

FUSES
(CONTINUED)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
31	-	-	-
32	30A	A905	FUSED B(+)
33	30A	INTERNAL	FUSED B(+)
34	30A	A906	FUSED B(+)
35	-	-	-
36	10A	F1 20PK/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
37	10A	F961 16PK/LB	IGNITION SWITCH OUTPUT (START)
38	20A	A923 18RD	FUSED B(+)
39	30A	INTERNAL	FUSED B(+)
40	-	-	-
41	30A	INTERNAL	FUSED B(+)
42	25A	A909	FUSED B(+)
43	10A	L77 20PK/RD	FUSED PARK LAMP RELAY OUTPUT
44	10A	L78 20WT/OR	FUSED PARK LAMP RELAY OUTPUT
45	20A	L76 20PK/RD ◆◆◆◆	FUSED PARK LAMP RELAY OUTPUT
46	10A	F201 20PK/OR	FUSED IGNITION SWITCH OUTPUT (RUN-START)
47	40A	A953 12RD	FUSED B(+)
48	-	-	-
49	30A	A100 12RD/VT ◆◆◆◆	FUSED B(+)
50	40A	A107 12TN/RD	FUSED B(+)
51	40A	INTERNAL	FUSED B(+)
52	-	-	-
53	40A	INTERNAL △△△	FUSED B(+)
54	-	-	-
55	10A	F983 20PK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
56	10A	C16 20DB/GY △△△	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
57	20A	F100 20PK/VT	FUSED IGNITION SWITCH OUTPUT (RUN)
58	20A	F525 18TN/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
59	10A	F504 20GY/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
60	10A	F500 20GY/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
61	20A	A907	FUSED IGNITION SWITCH OUTPUT (RUN)

△△△ EBL

◆◆◆◆ TRAILER TOW

RELAYS

RELAY-A/C CLUTCH

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	C13 20LB/OR	A/C CLUTCH RELAY CONTROL
86	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
87	C3 20DB/YL	A/C CLUTCH RELAY OUTPUT
87A	-	-

RELAY-AUTO SHUT DOWN

CAVITY	CIRCUIT	FUNCTION
A	A955	ASD RELAY OUTPUT
B	INTERNAL	FUSED B(+)
C	-	-
D	K51 20BR/GY	ASD RELAY CONTROL
E	INTERNAL	FUSED B(+)

RELAY-FOG LAMP

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	L139	FOG LAMP RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	L89 18WT/YL	FOG LAMP RELAY OUTPUT
87A	-	-

RELAY-FUEL PUMP

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	K31 20BR	FUEL PUMP RELAY CONTROL
86	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
87	N1 18DB/OR	FUEL PUMP RELAY OUTPUT
87A	-	-

RELAYS
(CONTINUED)

RELAY-HORN

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	X4	HORN RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	X2 18DG/OR	HORN RELAY OUTPUT
87A	-	-

RELAY-PARK LAMP

CAVITY	CIRCUIT	FUNCTION
A	INTERNAL	FUSED B(+)
B	INTERNAL	FUSED B(+)
C	Z385	GROUND
D	L779	PARK LAMP RELAY CONTROL
E	INTERNAL	PARK LAMP RELAY OUTPUT

RELAY-REAR WINDOW DEFOGGER

CAVITY	CIRCUIT	FUNCTION
A	C15 12DB/WT	REAR WINDOW DEFOGGER RELAY OUTPUT
B	F504 20GY/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
C	-	-
D	C115	REAR WINDOW DEFOGGER RELAY CONTROL
E	INTERNAL	FUSED B(+)

RELAYS
(CONTINUED)

RELAY-STARTER

CAVITY	CIRCUIT	FUNCTION
A	T750 14YL/GY	STARTER RELAY OUTPUT
B	INTERNAL	FUSED IGNITION SWITCH OUTPUT (START)
C	-	-
D	T752 20DG/OR	STARTER RELAY CONTROL
E	INTERNAL	FUSED B(+)

RELAY-TRAILER TOW-LEFT

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	LEFT TRAILER TOW BRAKE LAMP RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	L673 20YL	LEFT TRAILER TOW BRAKE LAMP RELAY OUTPUT
87A	-	-

RELAY-TRAILER TOW-RIGHT

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	RIGHT TRAILER TOW BRAKE LAMP RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	L674 20LG	RIGHT TRAILER TOW BRAKE LAMP RELAY OUTPUT
87A	-	-

RELAYS
(CONTINUED)

RELAY-TRANSMISSION CONTROL

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	Z915 20BK	GROUND
86	T15 20YL/BK	TRANSMISSION CONTROL RELAY CONTROL
87	T16 20YL/OR	TRANSMISSION CONTROL RELAY OUTPUT
87A	-	-

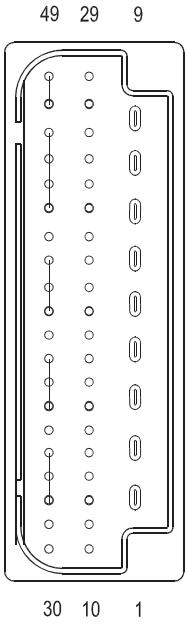
RELAY-WIPER HIGH/LOW

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	WIPER ON/OFF RELAY OUTPUT
85	INTERNAL	WIPER HIGH/LOW RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	W4 14BR/OR	WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT
87A	W3 14BR/WT	WIPER HIGH/LOW RELAY LOW SPEED OUTPUT

RELAY-WIPER ON/OFF

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	WIPER ON/OFF RELAY OUTPUT
85	INTERNAL	WIPER ON/OFF RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	INTERNAL	FUSED B(+)
87A	Z904 14BK	GROUND

MODULE- FRONT CONTROL IPM



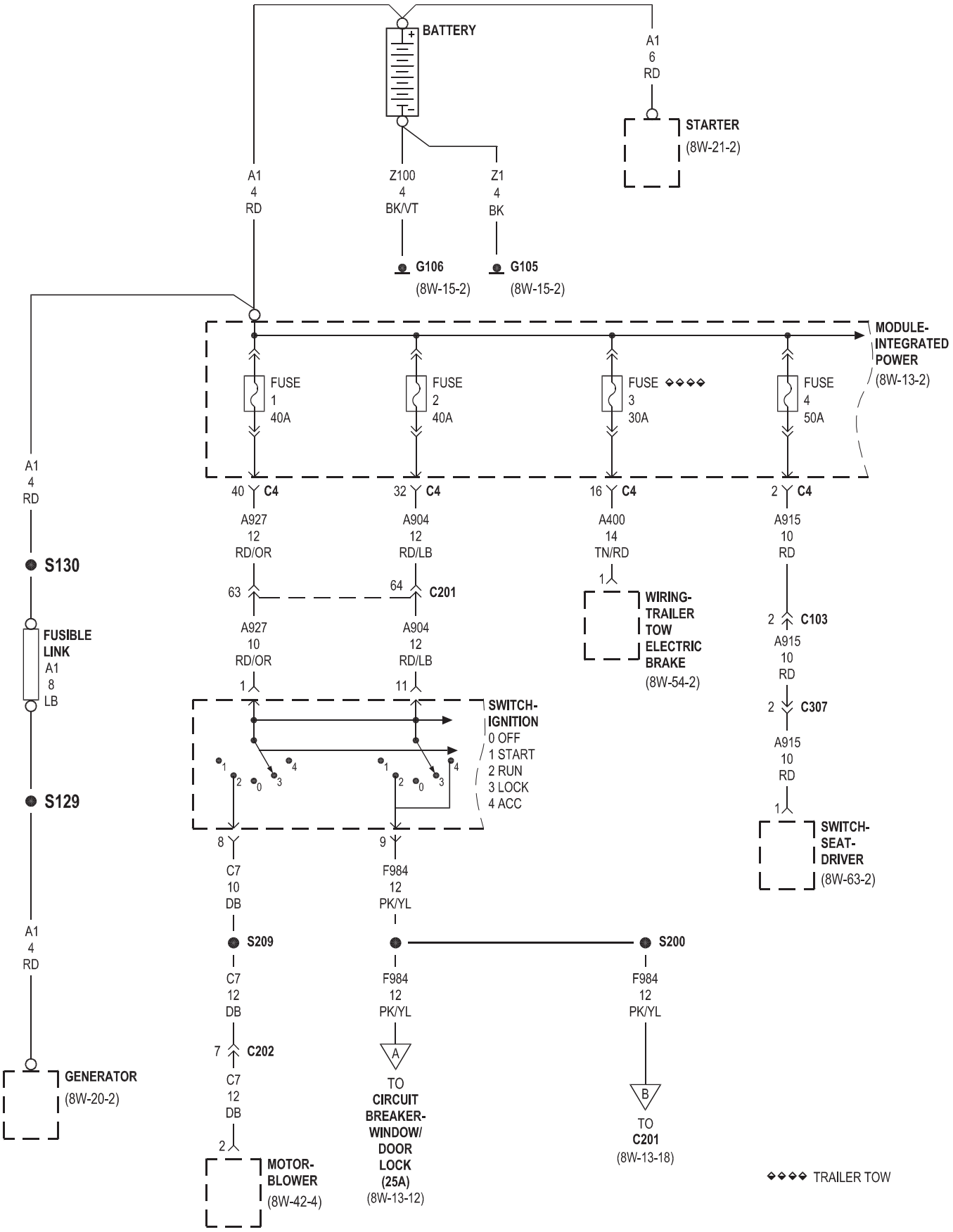
CAVITY	CIRCUIT	FUNCTION
1	Z921	GROUND
2	A908	FUSED B(+)
3	A906	FUSED B(+)
4	A905	FUSED B(+)
5	A907	FUSED B(+)
6	A909	FUSED B(+)
7	L1	BACK-UP LAMP FEED
8	T315	SHIFT MOTOR CONTROL A
9	T316	SHIFT MOTOR CONTROL B
10	C115	REAR WINDOW DEFOGGER RELAY CONTROL
11	-	-
12	W10 △△△	FRONT WASHER PUMP MOTOR CONTROL
13	-	-
14	-	-
15	A920	FUSED B(+)
16	-	-
17	F202	FUSED IGNITION SWITCH OUTPUT (RUN-START)
18	Z118	GROUND
19	Z909	GROUND
20	-	-
21	L656 ◆◆◆◆	RIGHT TRAILER TOW BRAKE LAMP RELAY CONTROL
22	L655 ◆◆◆◆	LEFT TRAILER TOW BRAKE LAMP RELAY CONTROL
23	-	-
24	Z909	GROUND
25	Z118	GROUND
26	L139	FOG LAMP RELAY CONTROL

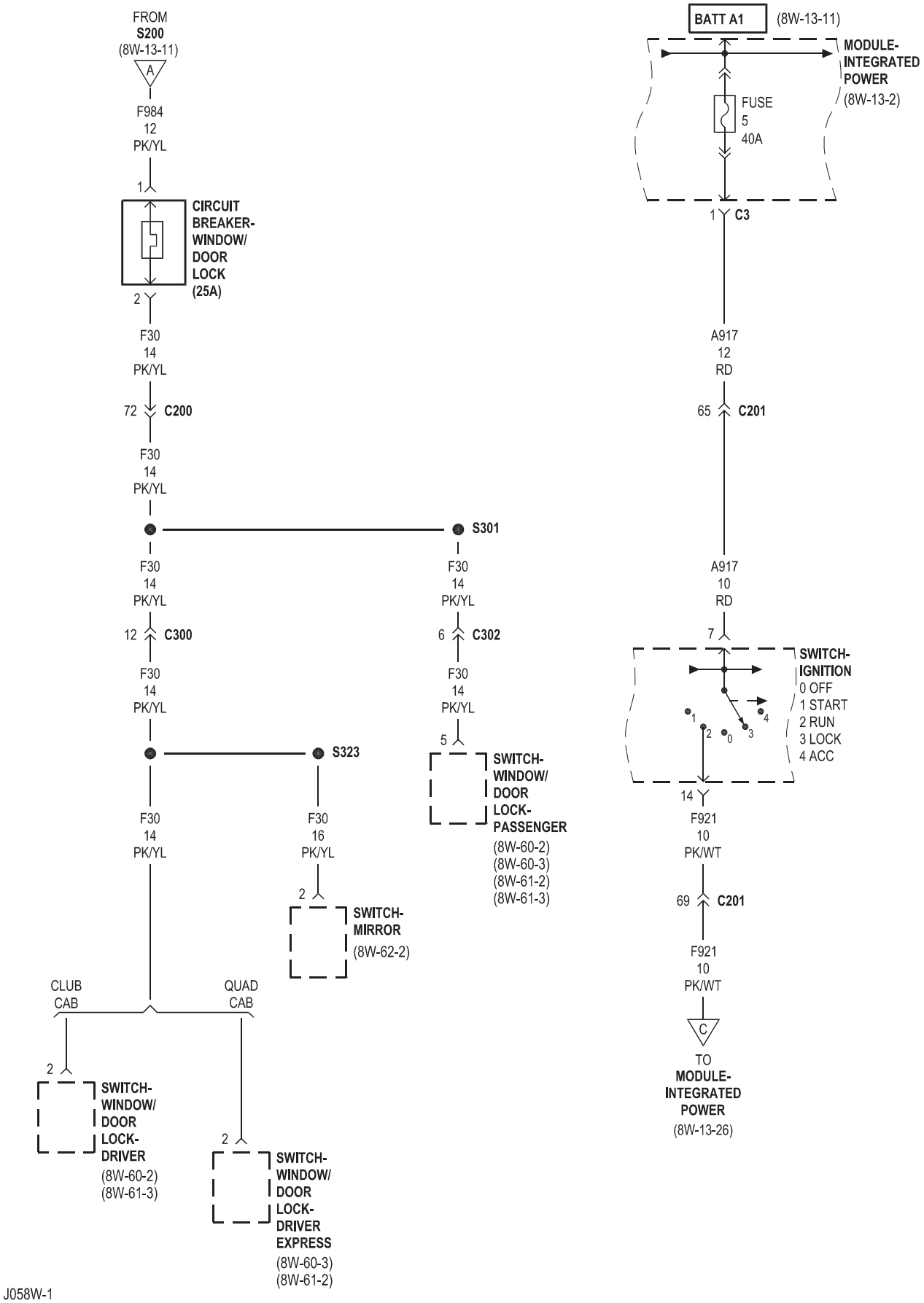
△△△ EBL

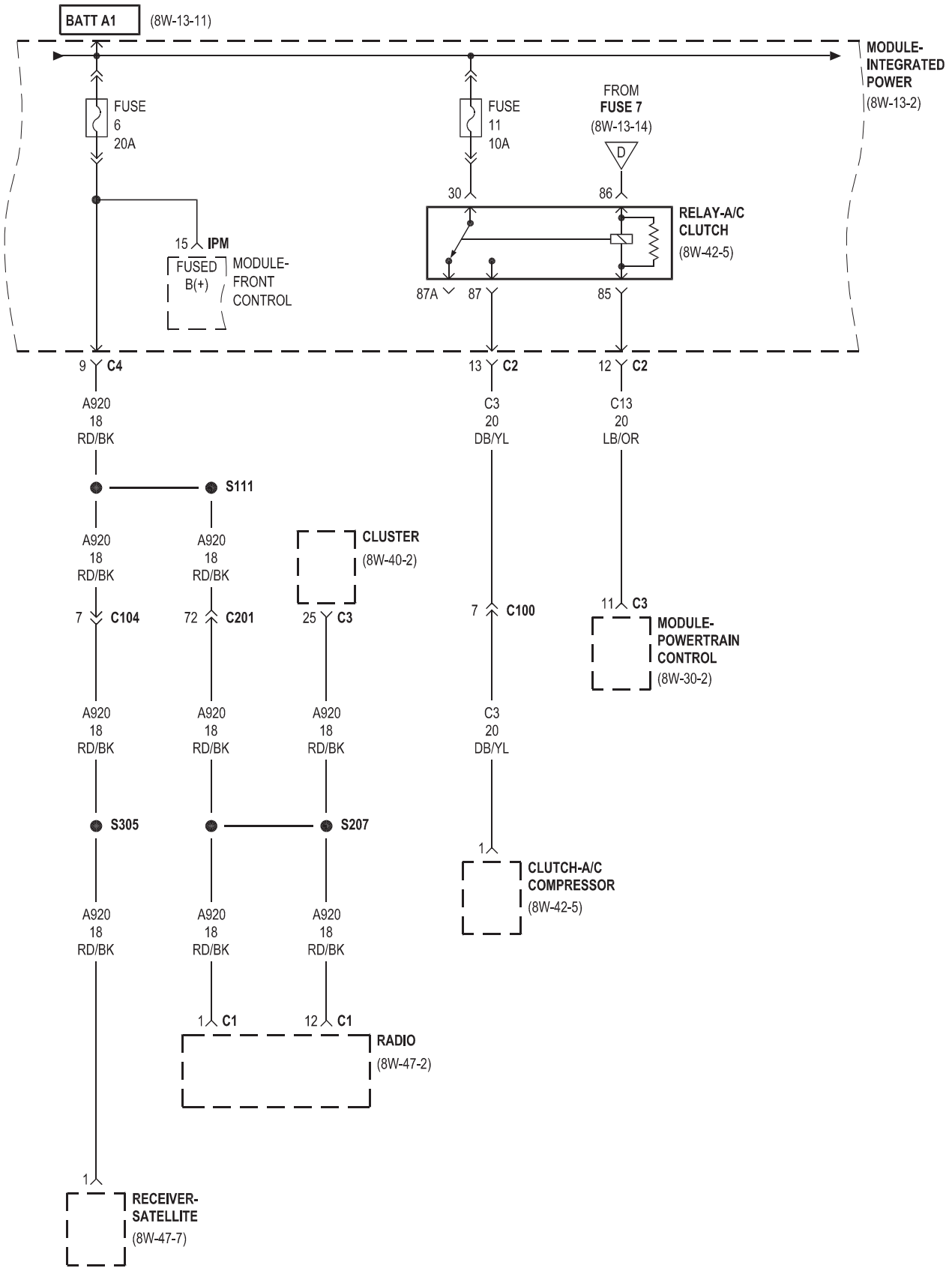
◆◆◆◆ TRAILER TOW

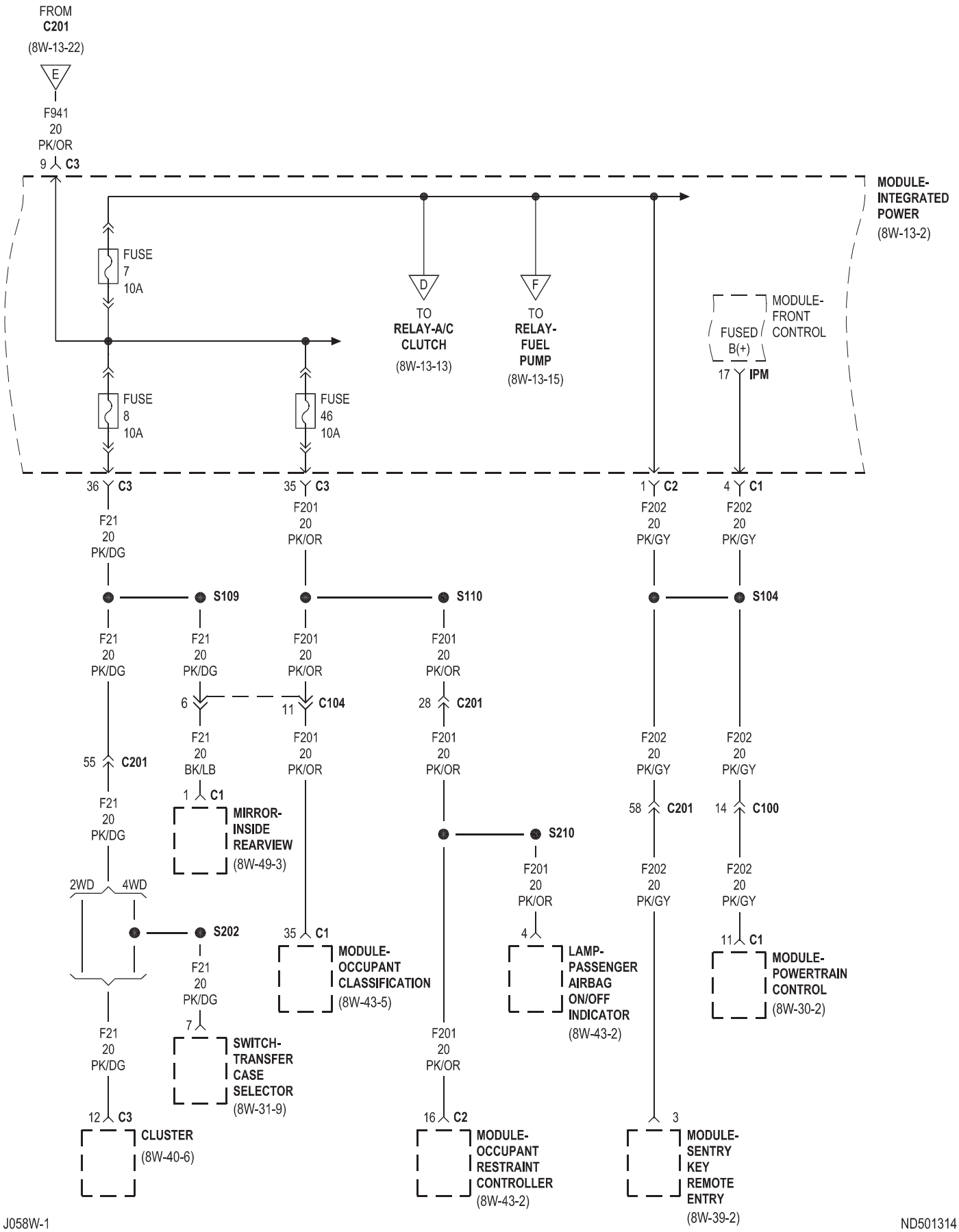
MODULE-FRONT CONTROL IPM
(CONTINUED)

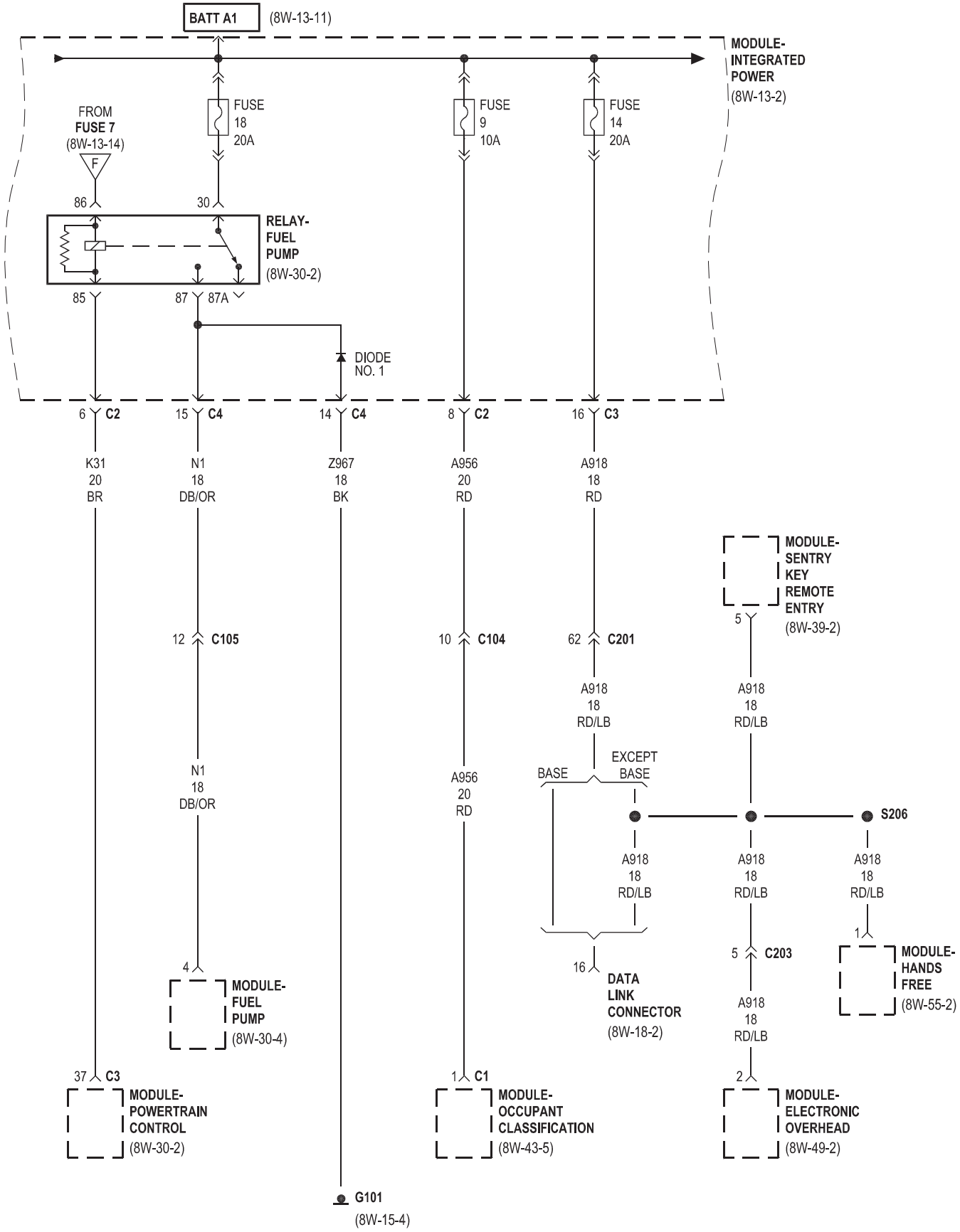
CAVITY	CIRCUIT	FUNCTION
27	W5	WIPER ON/OFF RELAY CONTROL
28	-	-
29	W2	WIPER HIGH/LOW RELAY CONTROL
30	A955	ASD RELAY OUTPUT
31	W7	WIPER PARK SWITCH SENSE
32	Z909	GROUND
33	Z118	GROUND
34	L62	RIGHT REAR TURN SIGNAL CONTROL
35	G180	FCM SENSOR RETURN
36	-	-
37	-	-
38	-	-
39	-	-
40	T2	LOW/REVERSE SOLENOID CONTROL
41	Z118	GROUND
42	-	-
43	L63	LEFT REAR TURN SIGNAL CONTROL
44	-	-
45	T313	5 VOLT MODE SENSOR SUPPLY
46	-	-
47	X4	HORN RELAY CONTROL
48	L179	PARK LAMP RELAY CONTROL
49	-	-

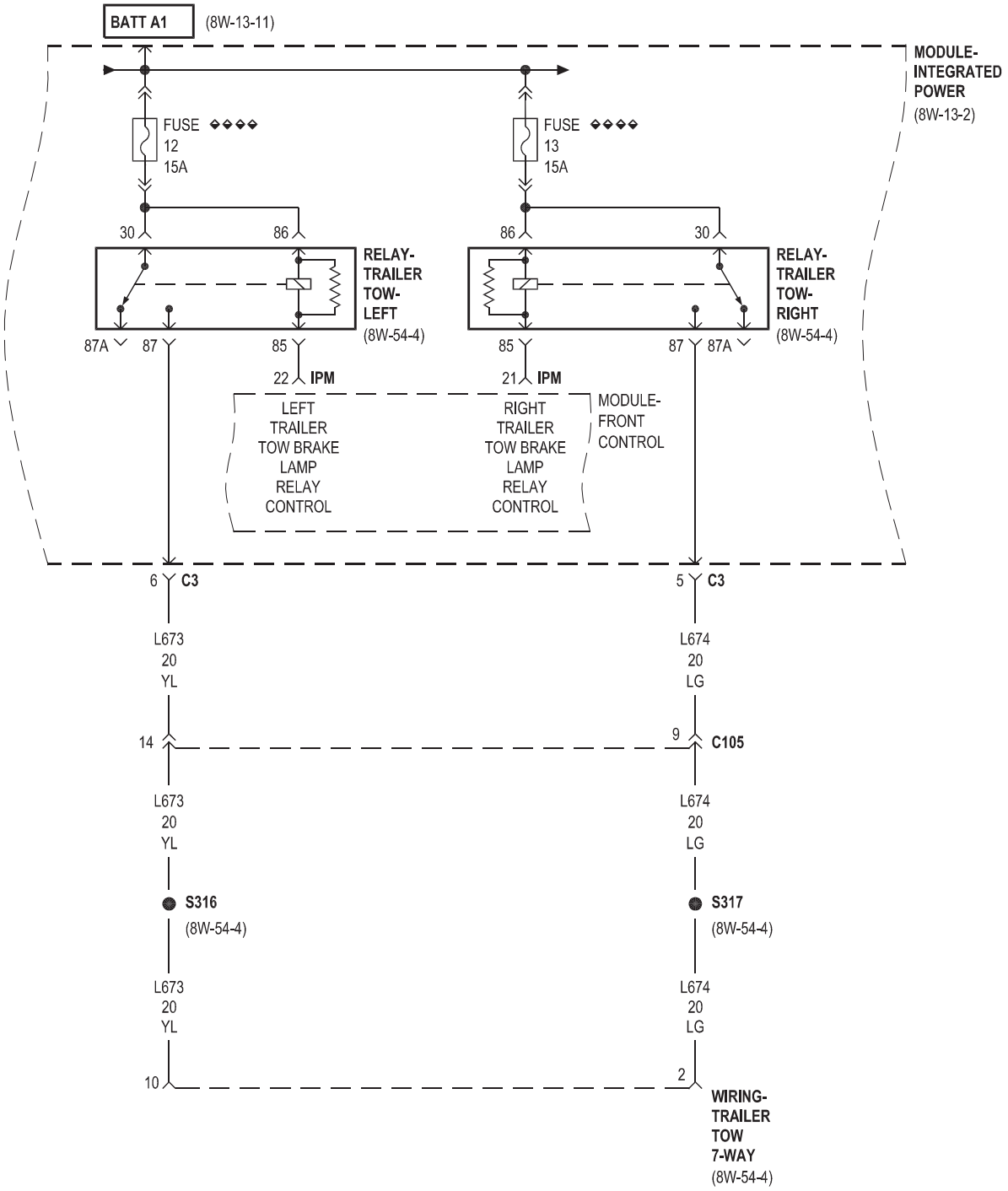

BATTERY
A1
6
RD
STARTER
(8W-21-2)
A1
4
RD
Z100
4
BK/VT
Z1
4
BK
G106
(8W-15-2)
G105
(8W-15-2)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
1
40A
FUSE
2
40A
FUSE
3
30A
FUSE
4
50A
A1
4
RD
40
C4
32
C4
16
C4
2
C4
A927
12
RD/OR
A904
12
RD/LB
A400
14
TN/RD
A915
10
RD
S130
63
64
C201
1
WIRING-
TRAILER
TOW
ELECTRIC
BRAKE
(8W-54-2)
2
C103
A915
10
RD
FUSIBLE
LINK
A1
8
LB
A927
10
RD/OR
A904
12
RD/LB
2
C307
A915
10
RD
1
11
SWITCH-
IGNITION
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
1
SWITCH-
SEAT-
DRIVER
(8W-63-2)
S129
8
9
C7
10
DB
F984
12
PK/YL
A1
4
RD
S209
S200
C7
12
DB
F984
12
PK/YL
F984
12
PK/YL
7
C202
A
B
C7
12
DB
TO
CIRCUIT
BREAKER-
WINDOW/
DOOR
LOCK
(25A)
(8W-13-12)
TO
C201
(8W-13-18)
GENERATOR
(8W-20-2)
2
MOTOR-
BLOWER
(8W-42-4)
TRAILER TOW


FROM
S200
(8W-13-11)
A
F984
12
PK/YL
1
CIRCUIT
BREAKER-
WINDOW/
DOOR
LOCK
(25A)
2
F30
14
PK/YL
72
C200
F30
14
PK/YL
S301
F30
14
PK/YL
12
C300
F30
14
PK/YL
S323
F30
14
PK/YL
F30
14
PK/YL
6
C302
F30
14
PK/YL
5
SWITCH-
WINDOW/
DOOR
LOCK-
PASSENGER
(8W-60-2)
(8W-60-3)
(8W-61-2)
(8W-61-3)
F30
16
PK/YL
2
SWITCH-
MIRROR
(8W-62-2)
CLUB
CAB
QUAD
CAB
2
SWITCH-
WINDOW/
DOOR
LOCK-
DRIVER
(8W-60-2)
(8W-61-3)
2
SWITCH-
WINDOW/
DOOR
LOCK-
DRIVER
EXPRESS
(8W-60-3)
(8W-61-2)
BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
5
40A
1
C3
A917
12
RD
65
C201
A917
10
RD
7
SWITCH-
IGNITION
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
14
F921
10
PK/WT
69
C201
F921
10
PK/WT
C
TO
MODULE-
INTEGRATED
POWER
(8W-13-26)

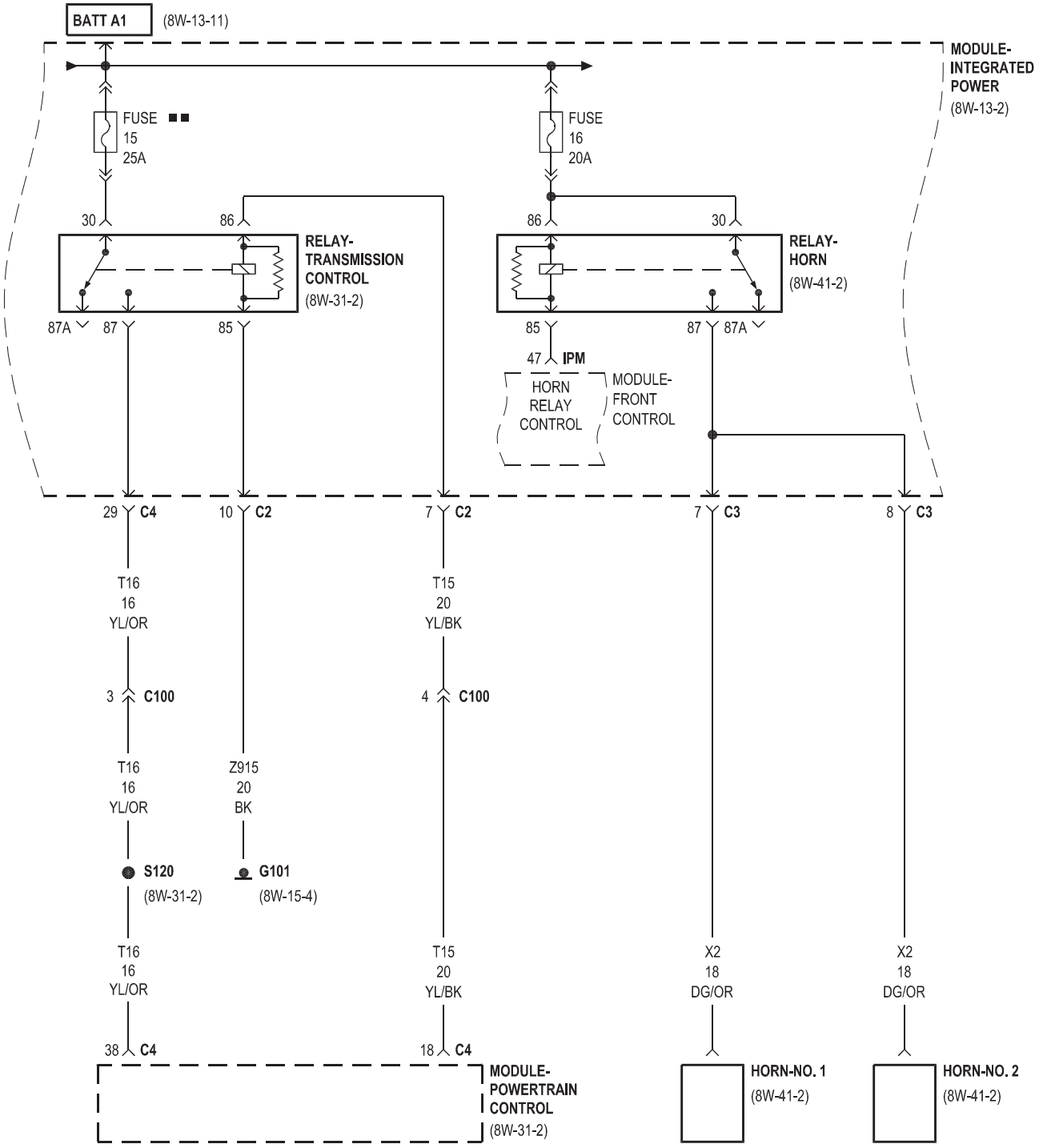

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
6
20A
FUSE
11
10A
FROM
FUSE 7
(8W-13-14)
D
30
86
RELAY-A/C
CLUTCH
(8W-42-5)
15
IPM
FUSED
B(+)
MODULE-
FRONT
CONTROL
87A
87
85
9
C4
13
C2
12
C2
A920
18
RD/BK
C3
20
DB/YL
C13
20
LB/OR
S111
CLUSTER
(8W-40-2)
7
C104
72
C201
25
C3
7
C100
11
C3
MODULE-
POWERTRAIN
CONTROL
(8W-30-2)
S305
S207
1
CLUTCH-A/C
COMPRESSOR
(8W-42-5)
1
C1
12
C1
RADIO
(8W-47-2)
1
RECEIVER-
SATELLITE
(8W-47-7)


FROM C201 (8W-13-22)
E
F941 20 PK/OR
9 C3
MODULE-INTEGRATED POWER (8W-13-2)
FUSE 7 10A
FUSE 8 10A
FUSE 46 10A
D
TO RELAY-A/C CLUTCH (8W-13-13)
F
TO RELAY-FUEL PUMP (8W-13-15)
MODULE-FRONT CONTROL
FUSED B(+)
17 IPM
36 C3
35 C3
1 C2
4 C1
F21 20 PK/DG
F201 20 PK/OR
F202 20 PK/GY
S109
S110
S104
F21 20 BK/LB
6
11 C104
28 C201
55 C201
58 C201
14 C100
1 C1
MIRROR-INSIDE REARVIEW (8W-49-3)
2WD
4WD
S202
S210
35 C1
MODULE-OCCUPANT CLASSIFICATION (8W-43-5)
4
LAMP-PASSENGER AIRBAG ON/OFF INDICATOR (8W-43-2)
11 C1
MODULE-POWERTRAIN CONTROL (8W-30-2)
7
SWITCH-TRANSFER CASE SELECTOR (8W-31-9)
12 C3
CLUSTER (8W-40-6)
16 C2
MODULE-OCCUPANT RESTRAINT CONTROLLER (8W-43-2)
3
MODULE-SENTRY KEY REMOTE ENTRY (8W-39-2)

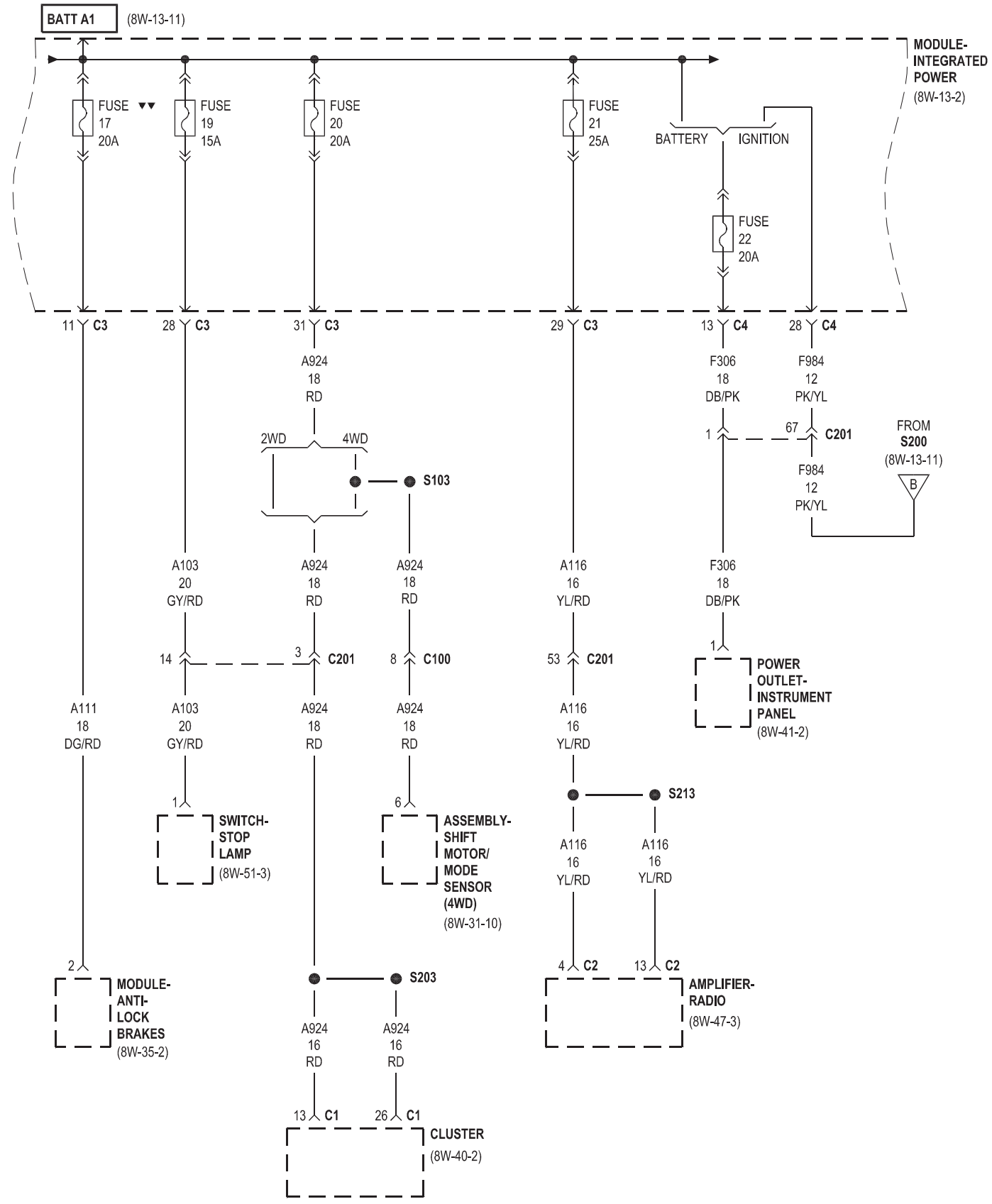

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FROM
FUSE 7
(8W-13-14)
F
FUSE
18
20A
FUSE
9
10A
FUSE
14
20A
86
30
RELAY-
FUEL
PUMP
(8W-30-2)
85
87
87A
DIODE
NO. 1
6 C2
15 C4
14 C4
8 C2
16 C3
K31
20
BR
N1
18
DB/OR
Z967
18
BK
A956
20
RD
A918
18
RD
MODULE-
SENTRY
KEY
REMOTE
ENTRY
(8W-39-2)
5
12 C105
10 C104
62 C201
A918
18
RD/LB
A918
18
RD/LB
EXCEPT
BASE
BASE
N1
18
DB/OR
A956
20
RD
S206
A918
18
RD/LB
A918
18
RD/LB
A918
18
RD/LB
1
4
16
5 C203
MODULE-
HANDS
FREE
(8W-55-2)
DATA
LINK
CONNECTOR
(8W-18-2)
MODULE-
FUEL
PUMP
(8W-30-4)
A918
18
RD/LB
37 C3
1 C1
2
MODULE-
POWERTRAIN
CONTROL
(8W-30-2)
MODULE-
OCCUPANT
CLASSIFICATION
(8W-43-5)
MODULE-
ELECTRONIC
OVERHEAD
(8W-49-2)
G101
(8W-15-4)


BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
12
15A
FUSE
13
15A
30
86
86
30
RELAY-
TRAILER
TOW-
LEFT
(8W-54-4)
RELAY-
TRAILER
TOW-
RIGHT
(8W-54-4)
87A
87
85
85
87
87A
22
IPM
21
IPM
LEFT
TRAILER
TOW BRAKE
LAMP
RELAY
CONTROL
RIGHT
TRAILER
TOW BRAKE
LAMP
RELAY
CONTROL
MODULE-
FRONT
CONTROL
6
C3
5
C3
L673
20
YL
L674
20
LG
14
9
C105
L673
20
YL
L674
20
LG
S316
(8W-54-4)
S317
(8W-54-4)
L673
20
YL
L674
20
LG
10
2
WIRING-
TRAILER
TOW
7-WAY
(8W-54-4)

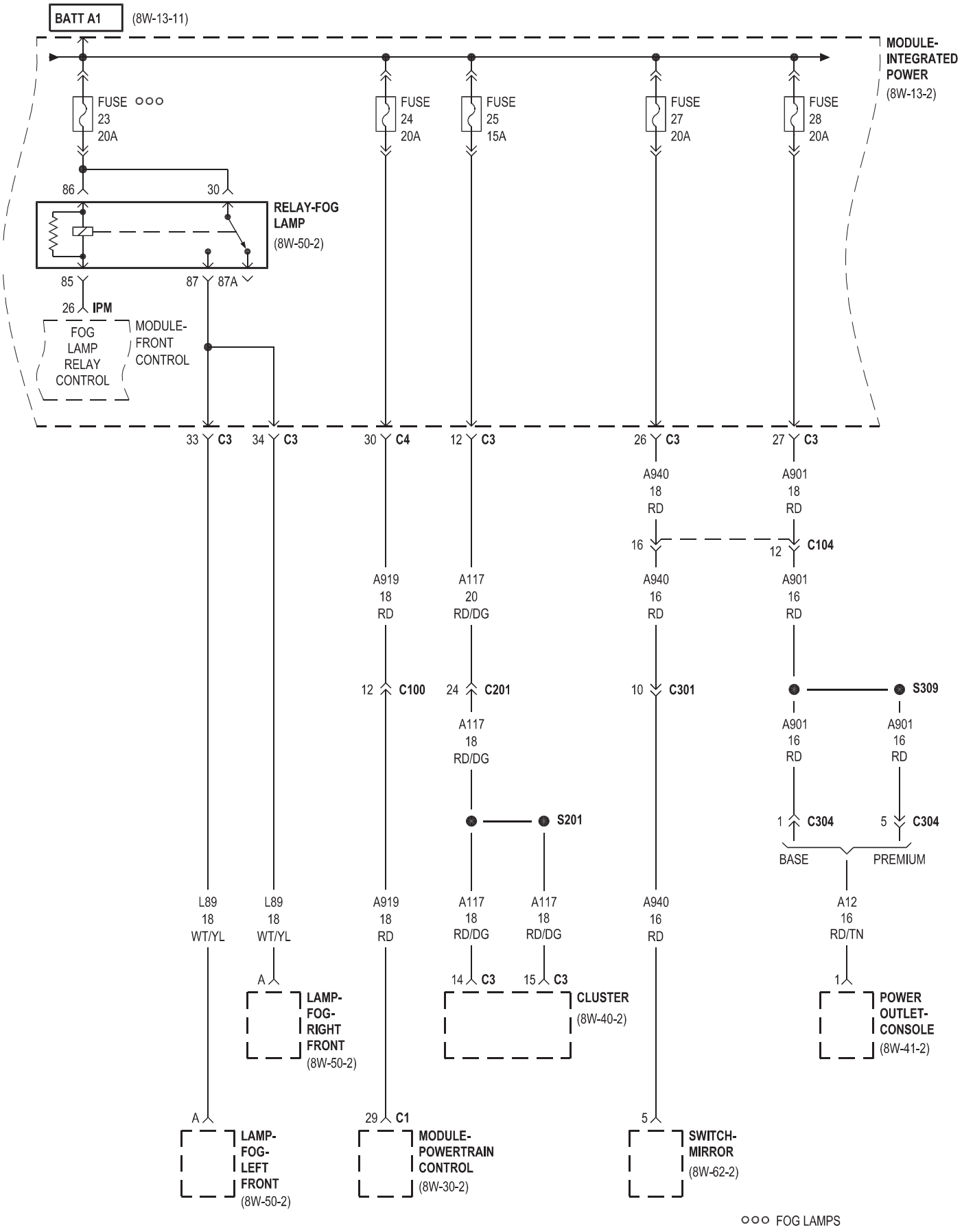
◆◆◆◆ TRAILER TOW

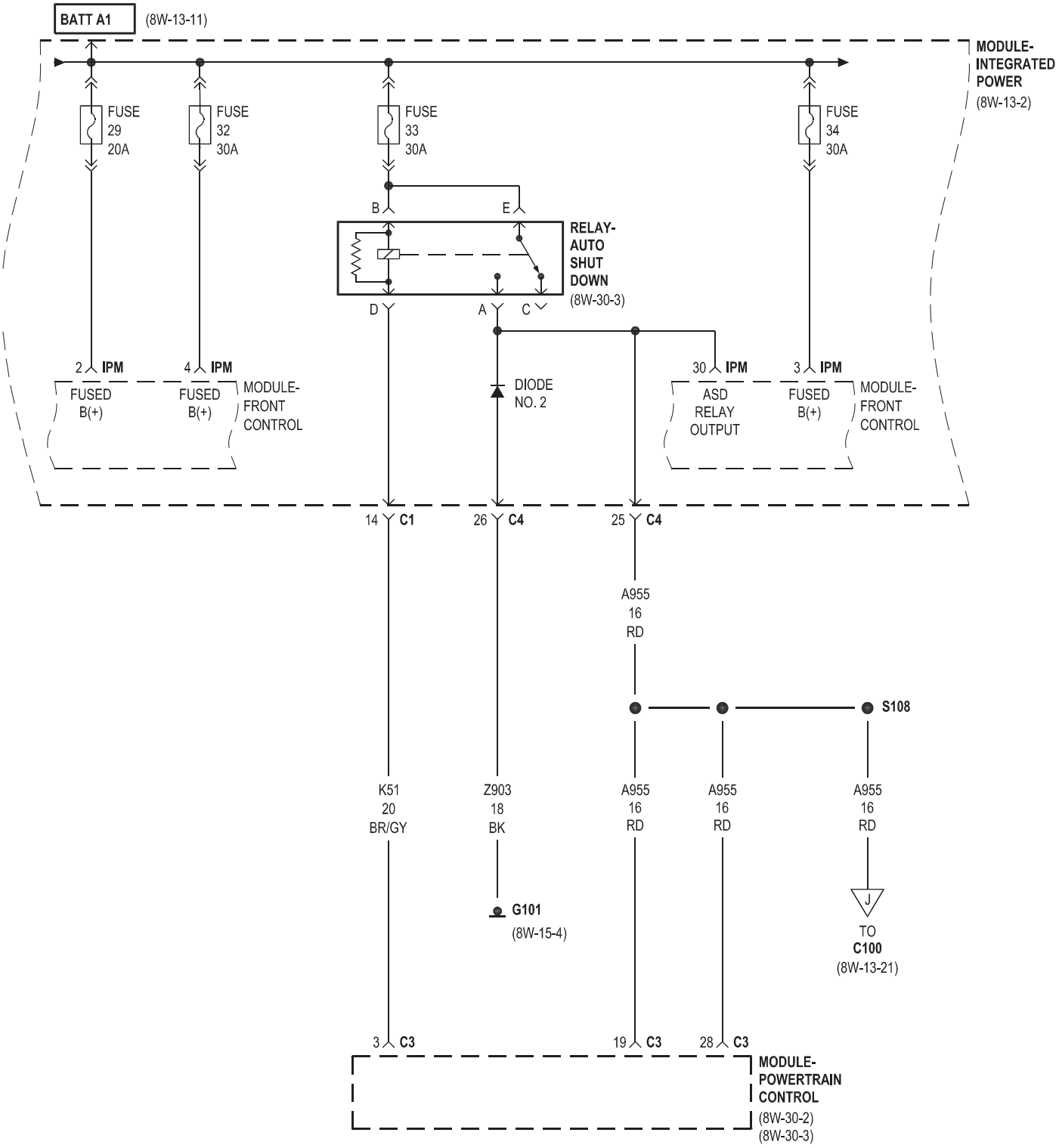

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
15
25A
FUSE
16
20A
30
86
86
30
RELAY-
TRANSMISSION
CONTROL
(8W-31-2)
RELAY-
HORN
(8W-41-2)
87A
87
85
85
87
87A
47
IPM
HORN
RELAY
CONTROL
MODULE-
FRONT
CONTROL
29
C4
10
C2
7
C2
7
C3
8
C3
T16
16
YL/OR
T15
20
YL/BK
3
C100
4
C100
T16
16
YL/OR
Z915
20
BK
S120
(8W-31-2)
G101
(8W-15-4)
T16
16
YL/OR
T15
20
YL/BK
X2
18
DG/OR
X2
18
DG/OR
38
C4
18
C4
MODULE-
POWERTRAIN
CONTROL
(8W-31-2)
HORN-NO. 1
(8W-41-2)
HORN-NO. 2
(8W-41-2)

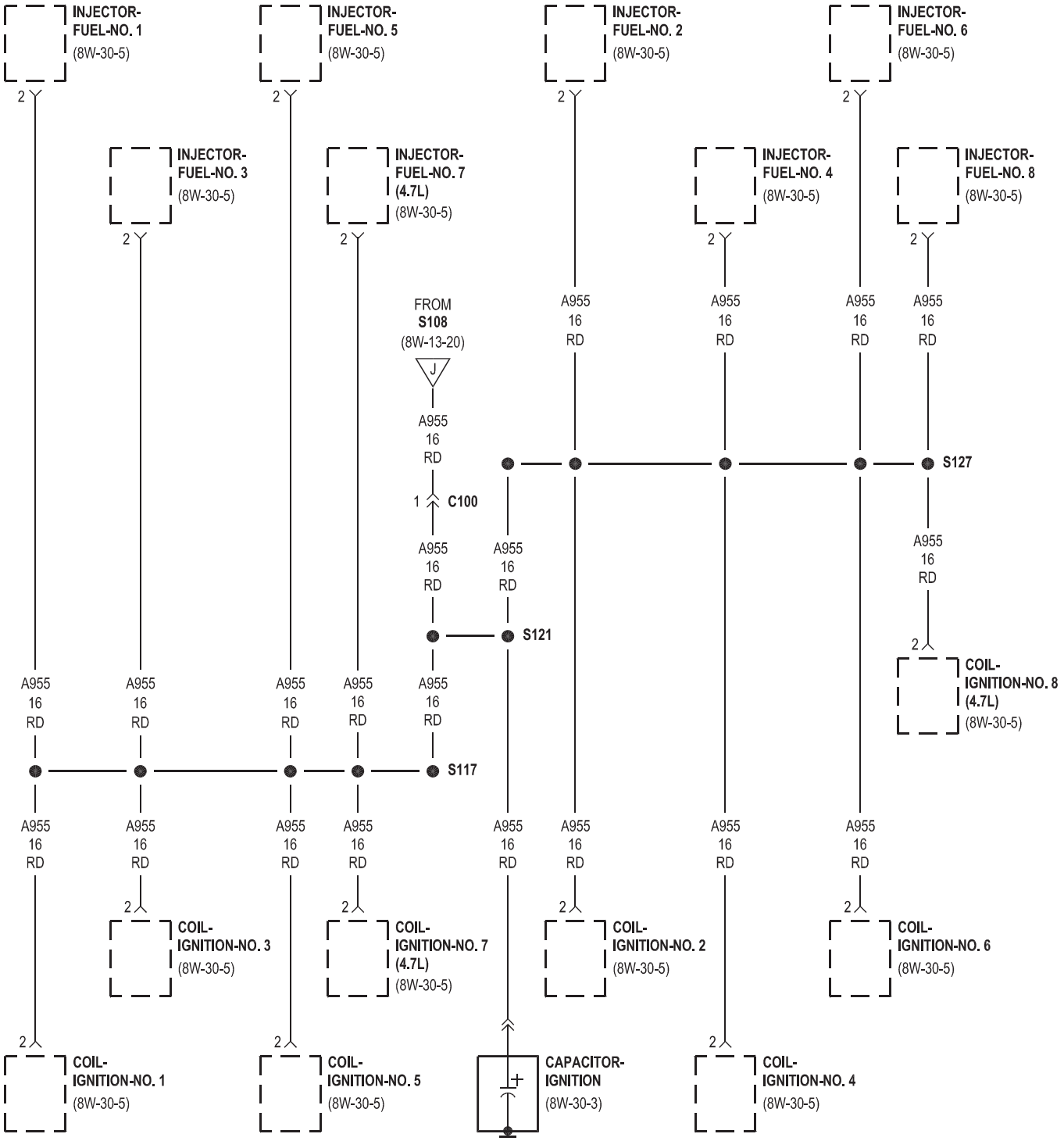
■■ A/T

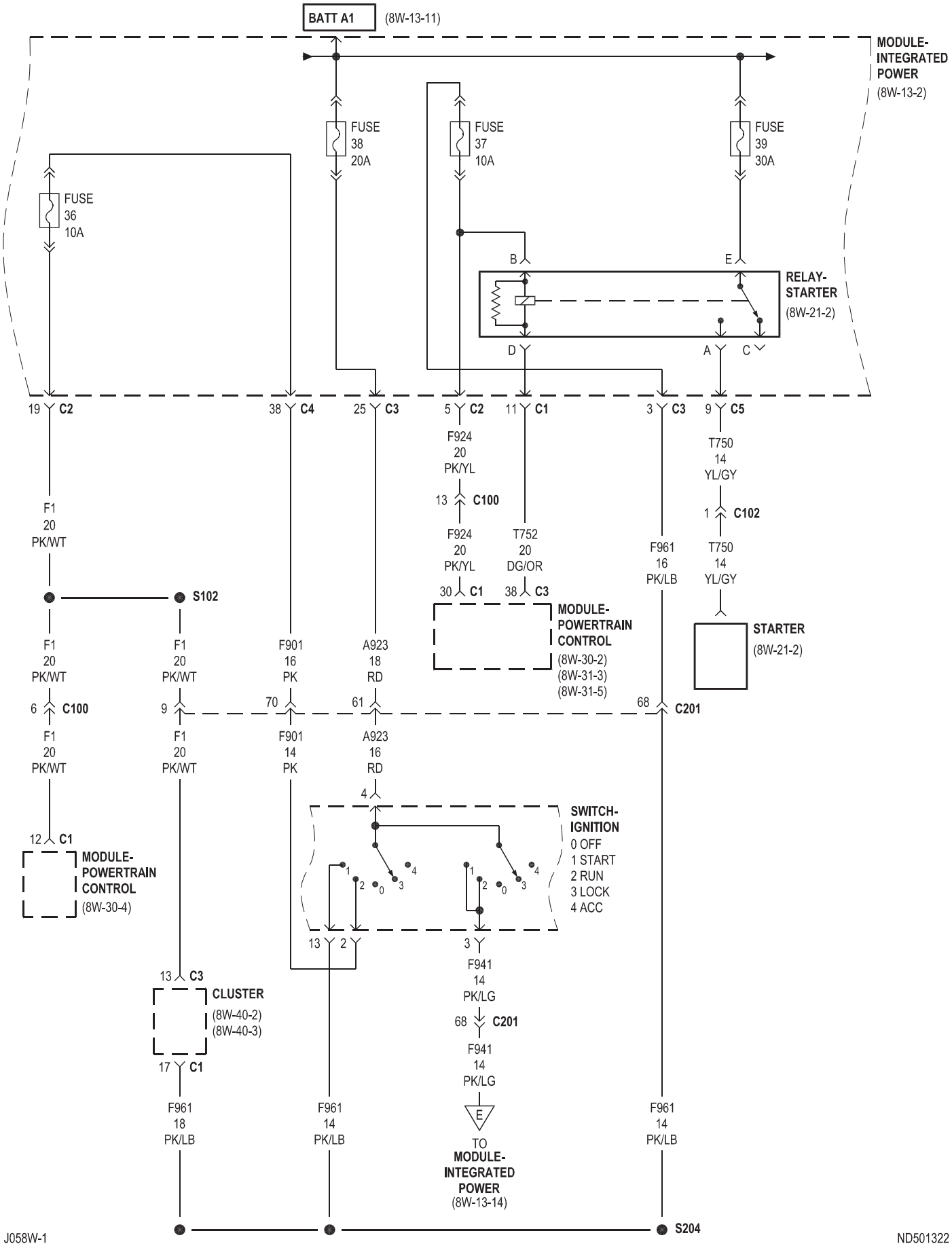

BATT A1
(8W-13-11)
MODULE-INTEGRATED POWER
(8W-13-2)
FUSE ▾▾ 17 20A
FUSE 19 15A
FUSE 20 20A
FUSE 21 25A
BATTERY
IGNITION
FUSE 22 20A
11 C3
28 C3
31 C3
29 C3
13 C4
28 C4
A924 18 RD
F306 18 DB/PK
F984 12 PK/YL
2WD
4WD
S103
1
67 C201
FROM S200 (8W-13-11)
B
F984 12 PK/YL
A103 20 GY/RD
A924 18 RD
A924 18 RD
A116 16 YL/RD
F306 18 DB/PK
14
3 C201
8 C100
53 C201
1
POWER OUTLET-INSTRUMENT PANEL
(8W-41-2)
A111 18 DG/RD
A103 20 GY/RD
A924 18 RD
A924 18 RD
A116 16 YL/RD
1
6
S213
SWITCH-STOP LAMP
(8W-51-3)
ASSEMBLY-SHIFT MOTOR/MODE SENSOR (4WD)
(8W-31-10)
A116 16 YL/RD
A116 16 YL/RD
2
S203
4 C2
13 C2
MODULE-ANTI-LOCK BRAKES
(8W-35-2)
AMPLIFIER-RADIO
(8W-47-3)
A924 16 RD
A924 16 RD
13 C1
26 C1
CLUSTER
(8W-40-2)

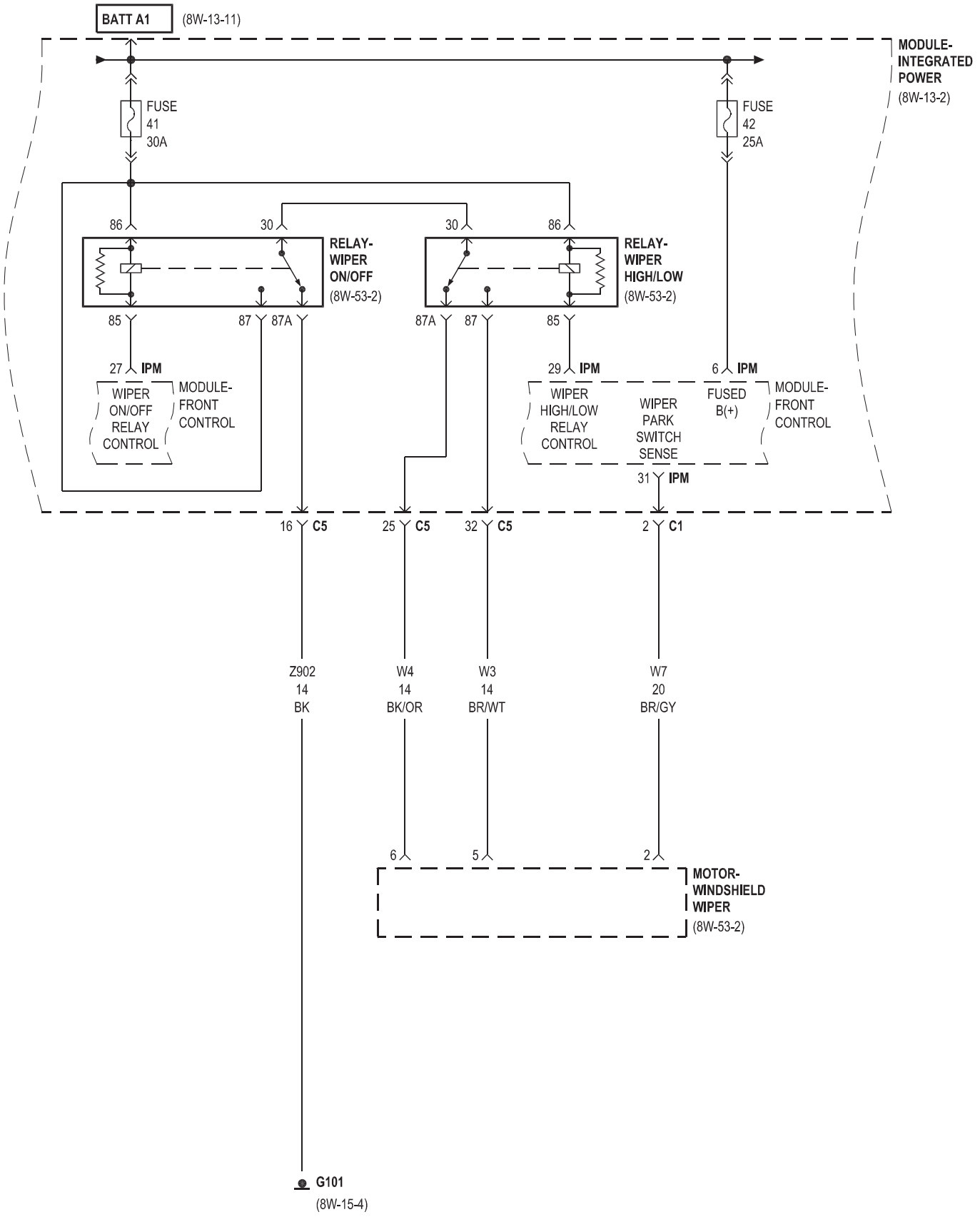
▾▾ AWAL

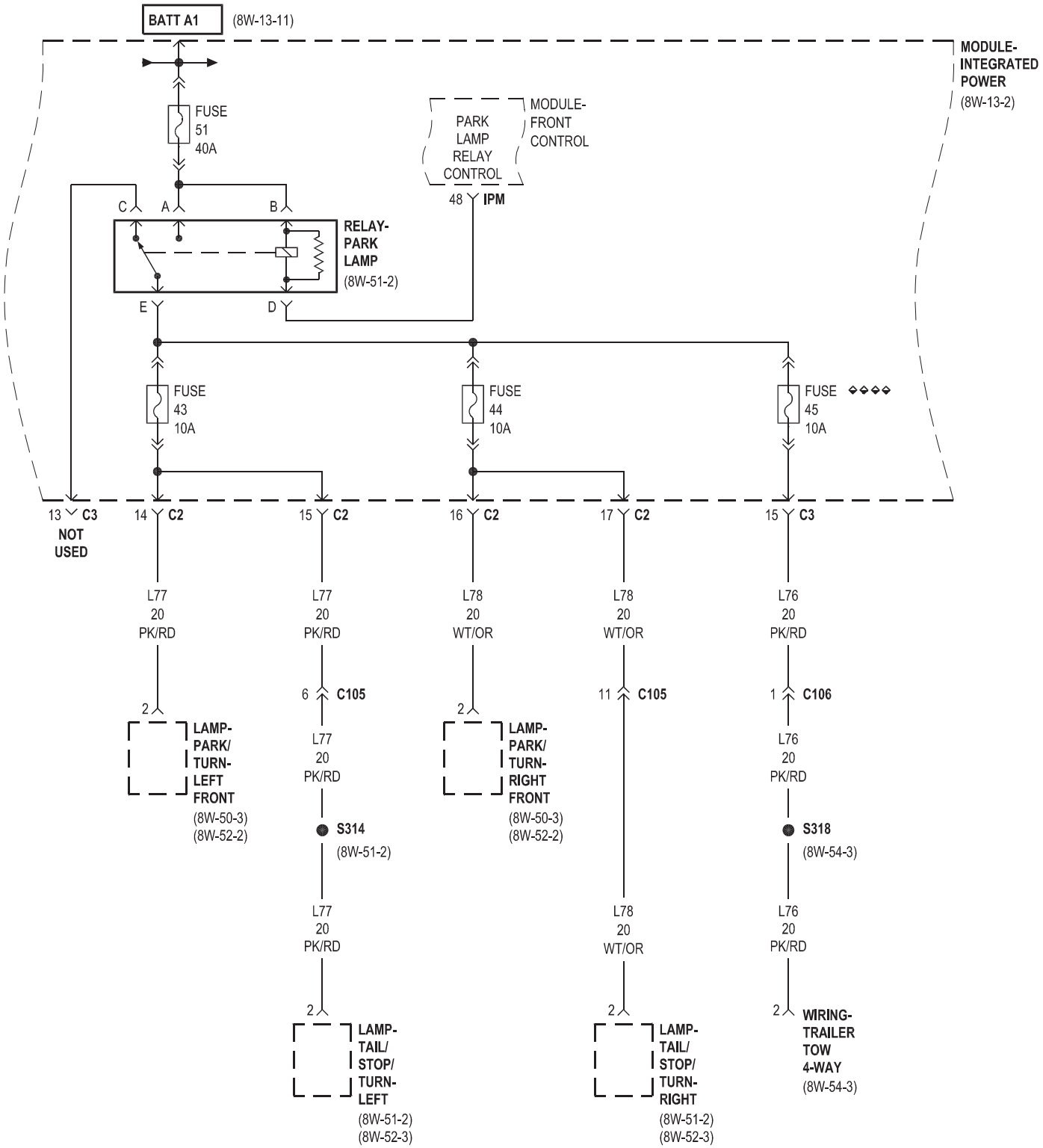

BATT A1
(8W-13-11)
MODULE-INTEGRATED POWER
(8W-13-2)
FUSE 23 20A
FUSE 24 20A
FUSE 25 15A
FUSE 27 20A
FUSE 28 20A
86
30
RELAY-FOG LAMP
(8W-50-2)
85
87
87A
26 IPM
FOG LAMP RELAY CONTROL
MODULE-FRONT CONTROL
33 C3
34 C3
30 C4
12 C3
26 C3
27 C3
A940 18 RD
A901 18 RD
16
12 C104
A919 18 RD
A117 20 RD/DG
A940 16 RD
A901 16 RD
12 C100
24 C201
10 C301
S309
A117 18 RD/DG
A901 16 RD
A901 16 RD
S201
1 C304
5 C304
BASE
PREMIUM
L89 18 WT/YL
L89 18 WT/YL
A919 18 RD
A117 18 RD/DG
A117 18 RD/DG
A940 16 RD
A12 16 RD/TN
A
14 C3
15 C3
1
LAMP-FOG-RIGHT FRONT
(8W-50-2)
CLUSTER
(8W-40-2)
POWER OUTLET-CONSOLE
(8W-41-2)
A
29 C1
5
LAMP-FOG-LEFT FRONT
(8W-50-2)
MODULE-POWERTRAIN CONTROL
(8W-30-2)
SWITCH-MIRROR
(8W-62-2)
FOG LAMPS


BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
29
20A
FUSE
32
30A
FUSE
33
30A
FUSE
34
30A
B
E
RELAY-
AUTO
SHUT
DOWN
(8W-30-3)
D
A
C
2 IPM
FUSED
B(+)
4 IPM
FUSED
B(+)
MODULE-
FRONT
CONTROL
DIODE
NO. 2
30 IPM
ASD
RELAY
OUTPUT
3 IPM
FUSED
B(+)
MODULE-
FRONT
CONTROL
14 C1
26 C4
25 C4
A955
16
RD
S108
K51
20
BR/GY
Z903
18
BK
A955
16
RD
A955
16
RD
A955
16
RD
G101
(8W-15-4)
J
TO
C100
(8W-13-21)
3 C3
19 C3
28 C3
MODULE-
POWERTRAIN
CONTROL
(8W-30-2)
(8W-30-3)

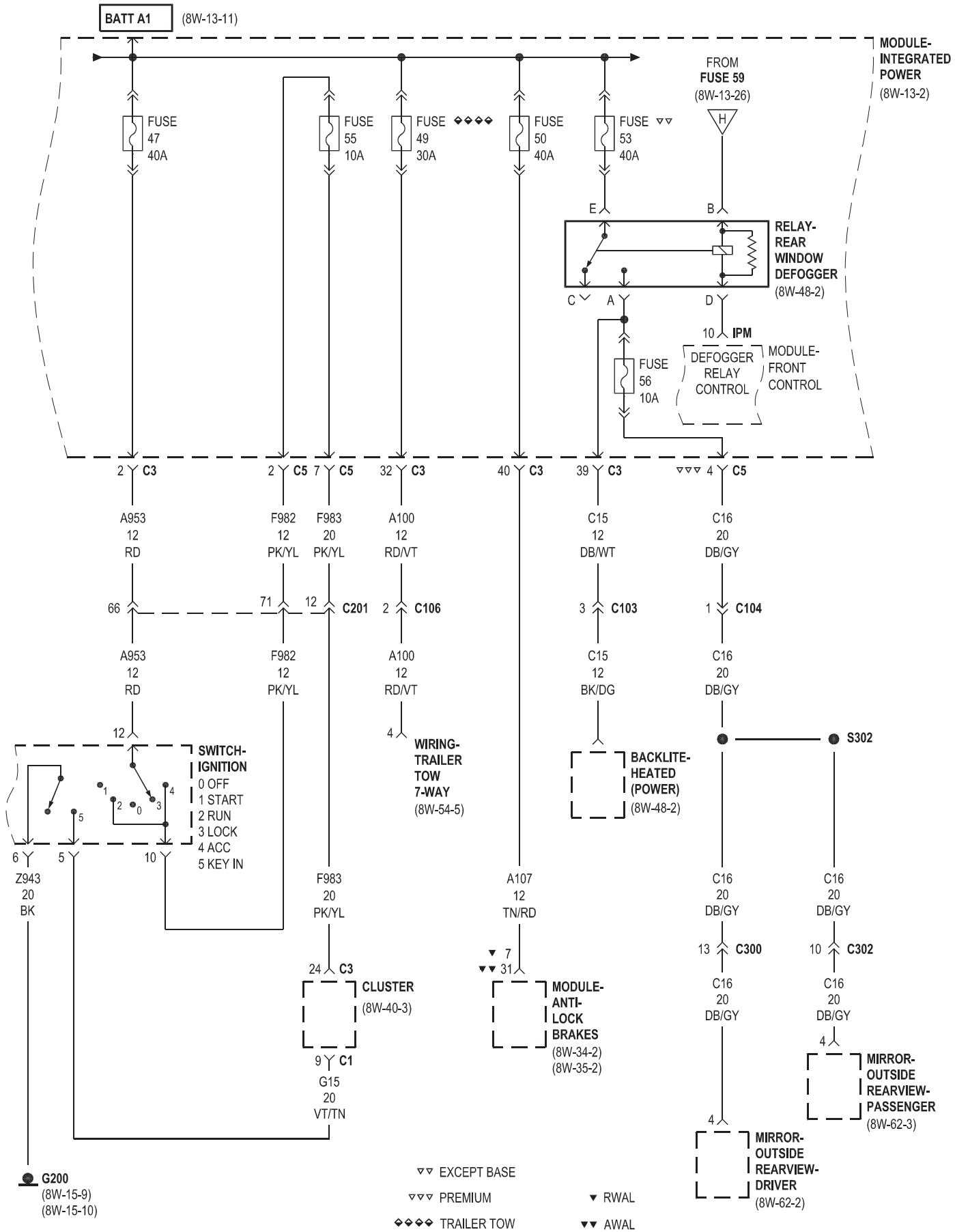

INJECTOR-
FUEL-NO. 1
(8W-30-5)
INJECTOR-
FUEL-NO. 5
(8W-30-5)
INJECTOR-
FUEL-NO. 2
(8W-30-5)
INJECTOR-
FUEL-NO. 6
(8W-30-5)
INJECTOR-
FUEL-NO. 3
(8W-30-5)
INJECTOR-
FUEL-NO. 7
(4.7L)
(8W-30-5)
INJECTOR-
FUEL-NO. 4
(8W-30-5)
INJECTOR-
FUEL-NO. 8
(8W-30-5)
FROM
S108
(8W-13-20)
J
C100
S127
S121
S117
A955
16
RD
COIL-
IGNITION-NO. 1
(8W-30-5)
COIL-
IGNITION-NO. 3
(8W-30-5)
COIL-
IGNITION-NO. 5
(8W-30-5)
COIL-
IGNITION-NO. 7
(4.7L)
(8W-30-5)
COIL-
IGNITION-NO. 2
(8W-30-5)
COIL-
IGNITION-NO. 4
(8W-30-5)
COIL-
IGNITION-NO. 6
(8W-30-5)
COIL-
IGNITION-NO. 8
(4.7L)
(8W-30-5)
CAPACITOR-
IGNITION
(8W-30-3)

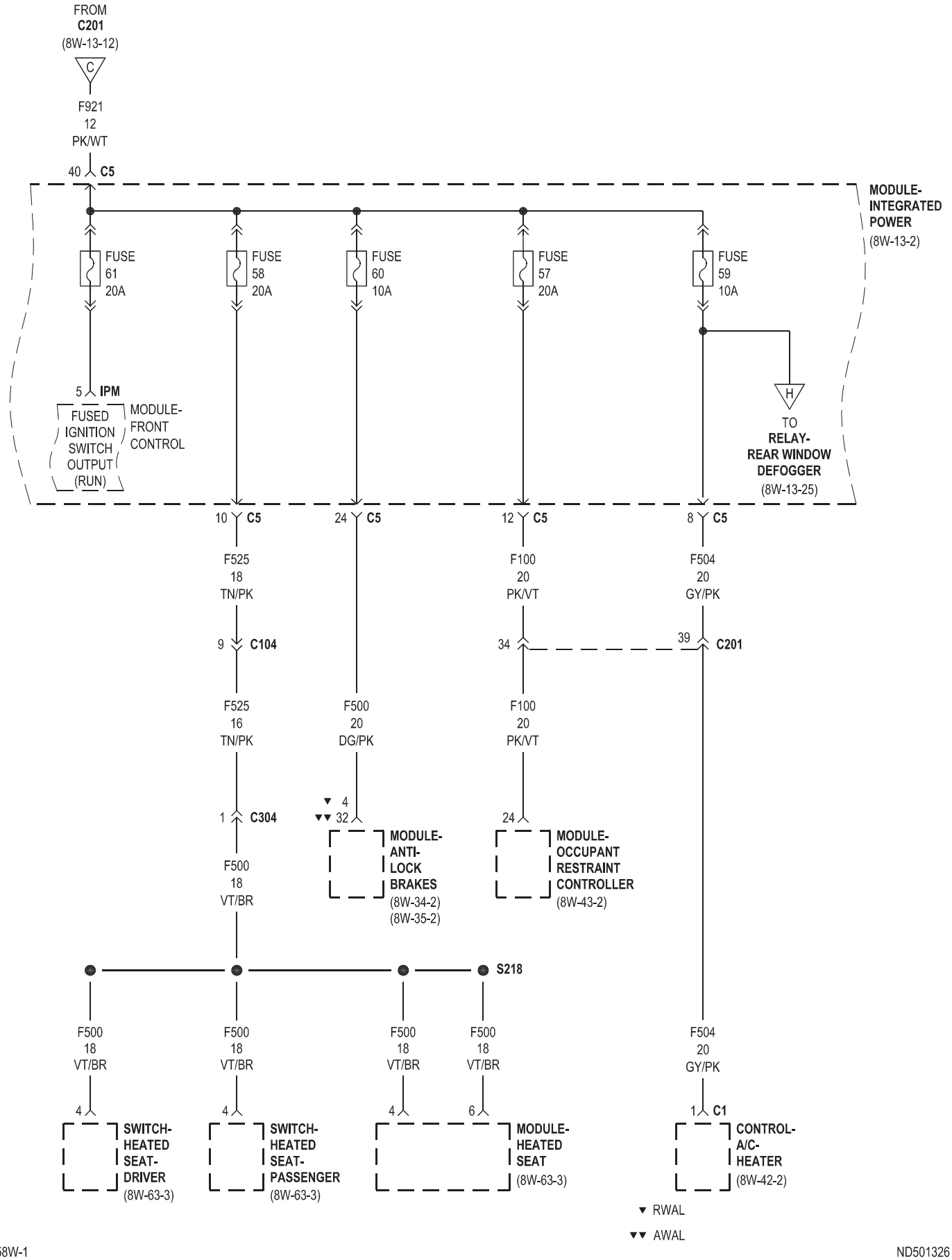

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
38
20A
FUSE
37
10A
FUSE
39
30A
FUSE
36
10A
B
E
RELAY-
STARTER
(8W-21-2)
D
A
C
19 C2
38 C4
25 C3
5 C2
11 C1
3 C3
9 C5
F924
20
PK/YL
T750
14
YL/GY
13 C100
1 C102
F1
20
PK/WT
F924
20
PK/YL
T752
20
DG/OR
F961
16
PK/LB
T750
14
YL/GY
S102
30 C1
38 C3
MODULE-
POWERTRAIN
CONTROL
(8W-30-2)
(8W-31-3)
(8W-31-5)
STARTER
(8W-21-2)
F1
20
PK/WT
F1
20
PK/WT
F901
16
PK
A923
18
RD
6 C100
9
70
61
68 C201
F1
20
PK/WT
F1
20
PK/WT
F901
14
PK
A923
16
RD
4
SWITCH-
IGNITION
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
12 C1
MODULE-
POWERTRAIN
CONTROL
(8W-30-4)
13 2
3
F941
14
PK/LG
13 C3
CLUSTER
(8W-40-2)
(8W-40-3)
68 C201
F941
14
PK/LG
17 C1
F961
18
PK/LB
F961
14
PK/LB
E
TO
MODULE-
INTEGRATED
POWER
(8W-13-14)
F961
14
PK/LB
S204

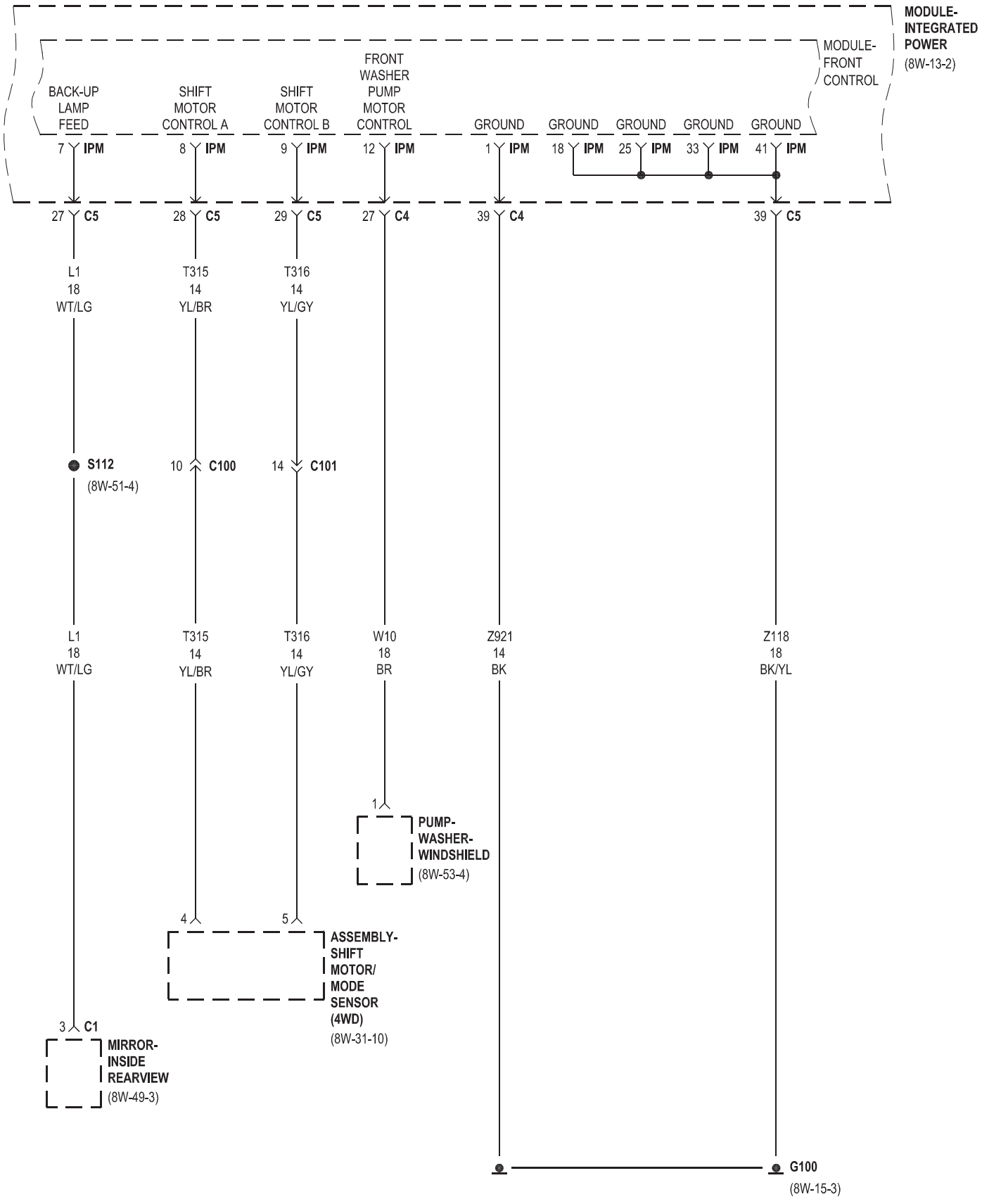

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
41
30A
FUSE
42
25A
86
30
30
86
RELAY-
WIPER
ON/OFF
(8W-53-2)
RELAY-
WIPER
HIGH/LOW
(8W-53-2)
85
87
87A
87A
87
85
27 IPM
WIPER
ON/OFF
RELAY
CONTROL
MODULE-
FRONT
CONTROL
29 IPM
WIPER
HIGH/LOW
RELAY
CONTROL
WIPER
PARK
SWITCH
SENSE
31 IPM
6 IPM
FUSED
B(+)
MODULE-
FRONT
CONTROL
16 C5
25 C5
32 C5
2 C1
Z902
14
BK
W4
14
BK/OR
W3
14
BR/WT
W7
20
BR/GY
6
5
2
MOTOR-
WINDSHIELD
WIPER
(8W-53-2)
G101
(8W-15-4)

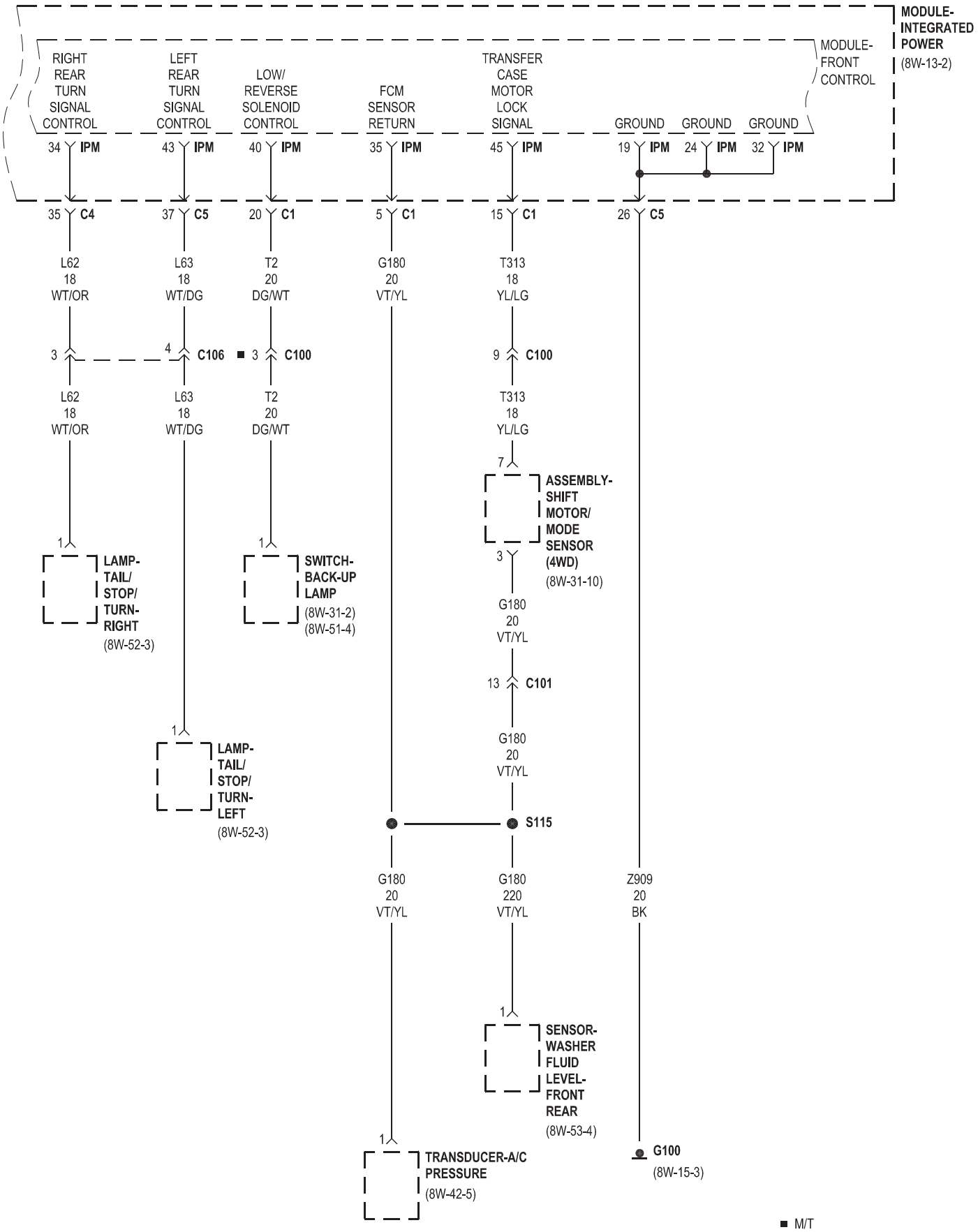

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
51
40A
PARK
LAMP
RELAY
CONTROL
MODULE-
FRONT
CONTROL
48 IPM
C
A
B
RELAY-
PARK
LAMP
(8W-51-2)
E
D
FUSE
43
10A
FUSE
44
10A
FUSE ◆◆◆◆
45
10A
13 C3
NOT
USED
14 C2
15 C2
16 C2
17 C2
15 C3
L77
20
PK/RD
L77
20
PK/RD
L78
20
WT/OR
L78
20
WT/OR
L76
20
PK/RD
2
LAMP-
PARK/
TURN-
LEFT
FRONT
(8W-50-3)
(8W-52-2)
6 C105
L77
20
PK/RD
S314
(8W-51-2)
L77
20
PK/RD
2
LAMP-
TAIL/
STOP/
TURN-
LEFT
(8W-51-2)
(8W-52-3)
2
LAMP-
PARK/
TURN-
RIGHT
FRONT
(8W-50-3)
(8W-52-2)
11 C105
L78
20
WT/OR
2
LAMP-
TAIL/
STOP/
TURN-
RIGHT
(8W-51-2)
(8W-52-3)
1 C106
L76
20
PK/RD
S318
(8W-54-3)
L76
20
PK/RD
2
WIRING-
TRAILER
TOW
4-WAY
(8W-54-3)

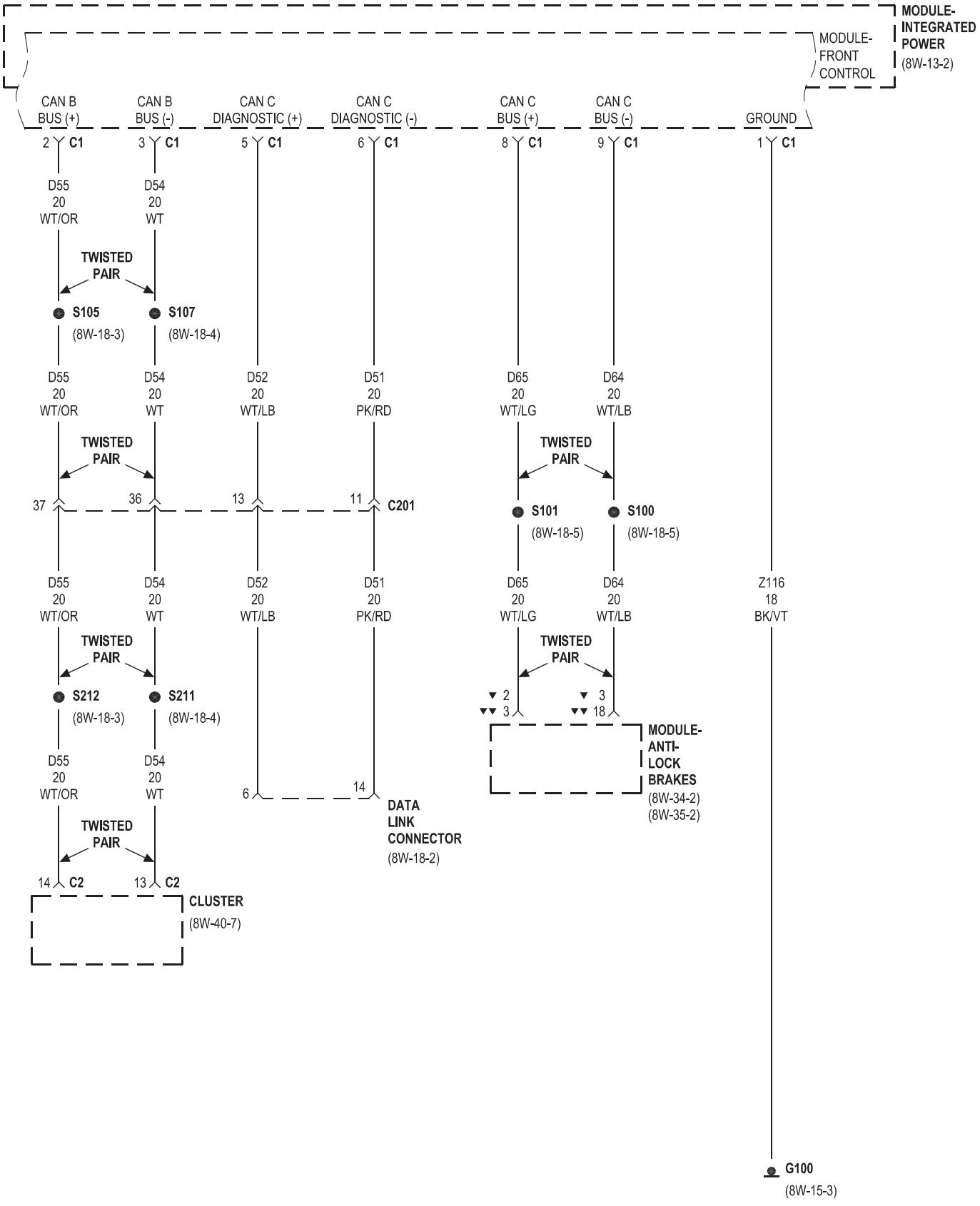
◆◆◆◆ TRAILER TOW


BATT A1
(8W-13-11)
MODULE-INTEGRATED POWER
(8W-13-2)
FUSE 47 40A
FUSE 55 10A
FUSE 49 30A
FUSE 50 40A
FUSE 53 40A
FROM FUSE 59
(8W-13-26)
H
E
B
RELAY-REAR WINDOW DEFOGGER
(8W-48-2)
C
A
D
10 IPM
DEFOGGER RELAY CONTROL
MODULE-FRONT CONTROL
FUSE 56 10A
2 C3
2 C5
7 C5
32 C3
40 C3
39 C3
4 C5
A953 12 RD
F982 12 PK/YL
F983 20 PK/YL
A100 12 RD/VT
C15 12 DB/WT
C16 20 DB/GY
66
71
12 C201
2 C106
3 C103
1 C104
A953 12 RD
F982 12 PK/YL
A100 12 RD/VT
C15 12 BK/DG
C16 20 DB/GY
12
4
WIRING-TRAILER TOW 7-WAY
(8W-54-5)
BACKLITE-HEATED (POWER)
(8W-48-2)
S302
SWITCH-IGNITION
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
5 KEY IN
6
5
10
Z943 20 BK
F983 20 PK/YL
A107 12 TN/RD
C16 20 DB/GY
C16 20 DB/GY
24 C3
7
31
13 C300
10 C302
CLUSTER
(8W-40-3)
MODULE-ANTI-LOCK BRAKES
(8W-34-2)
(8W-35-2)
C16 20 DB/GY
C16 20 DB/GY
9 C1
4
4
G15 20 VT/TN
MIRROR-OUTSIDE REARVIEW-PASSENGER
(8W-62-3)
MIRROR-OUTSIDE REARVIEW-DRIVER
(8W-62-2)
G200
(8W-15-9)
(8W-15-10)
EXCEPT BASE
PREMIUM
TRAILER TOW
RWAL
AWAL


FROM
C201
(8W-13-12)
C
F921
12
PK/WT
40 C5
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
61
20A
FUSE
58
20A
FUSE
60
10A
FUSE
57
20A
FUSE
59
10A
5 IPM
FUSED
IGNITION
SWITCH
OUTPUT
(RUN)
MODULE-
FRONT
CONTROL
H
TO
RELAY-
REAR WINDOW
DEFOGGER
(8W-13-25)
10 C5
24 C5
12 C5
8 C5
F525
18
TN/PK
F100
20
PK/VT
F504
20
GY/PK
9 C104
34
39 C201
F525
16
TN/PK
F500
20
DG/PK
F100
20
PK/VT
▼ 4
▼▼ 32
1 C304
24
F500
18
VT/BR
MODULE-
ANTI-
LOCK
BRAKES
(8W-34-2)
(8W-35-2)
MODULE-
OCCUPANT
RESTRAINT
CONTROLLER
(8W-43-2)
S218
F500
18
VT/BR
F500
18
VT/BR
F500
18
VT/BR
F500
18
VT/BR
F504
20
GY/PK
4
4
4
6
1 C1
SWITCH-
HEATED
SEAT-
DRIVER
(8W-63-3)
SWITCH-
HEATED
SEAT-
PASSENGER
(8W-63-3)
MODULE-
HEATED
SEAT
(8W-63-3)
CONTROL-
A/C-
HEATER
(8W-42-2)
▼ RWAL
▼▼ AWAL

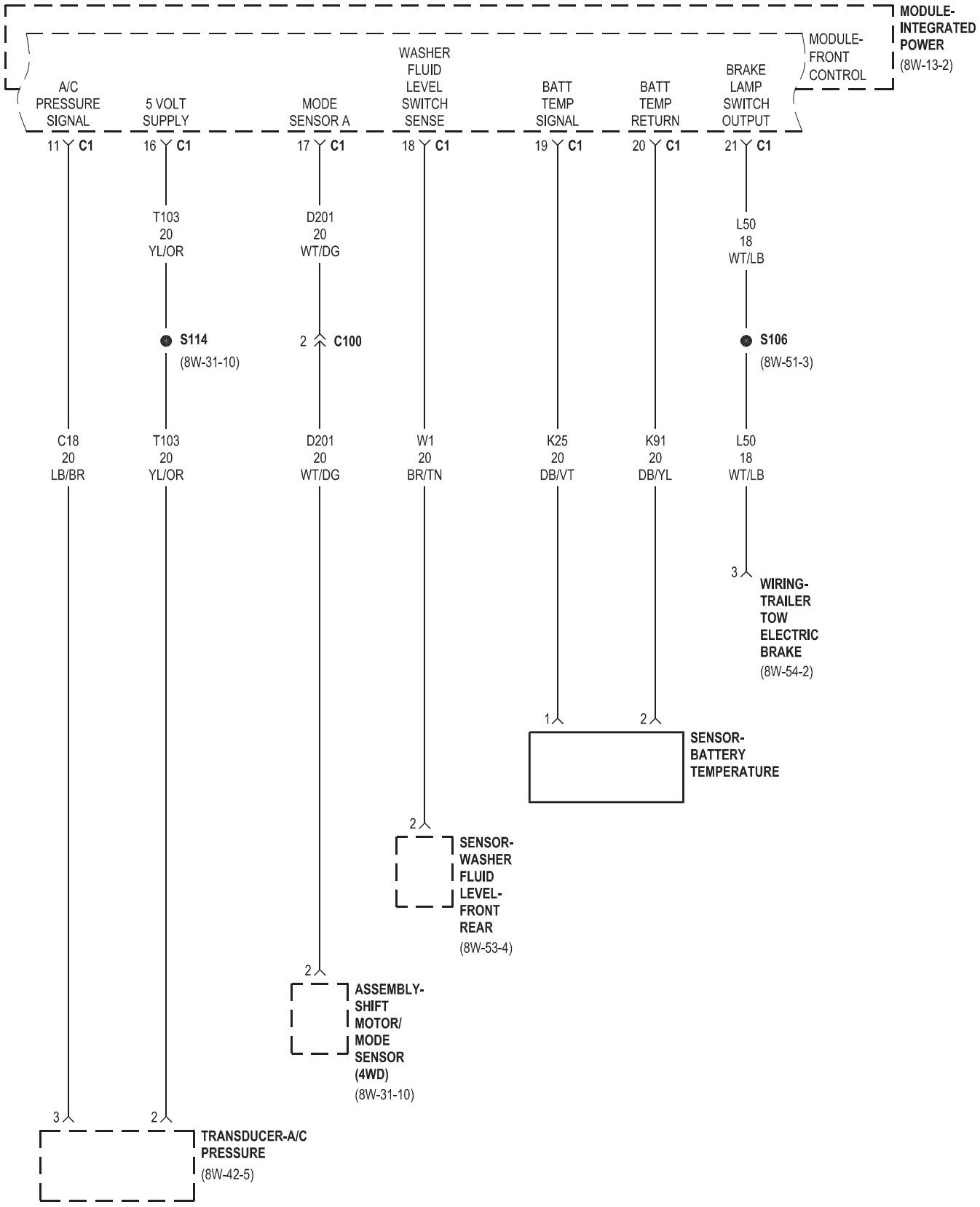

MODULE-INTEGRATED POWER
(8W-13-2)
MODULE-FRONT CONTROL
BACK-UP LAMP FEED
SHIFT MOTOR CONTROL A
SHIFT MOTOR CONTROL B
FRONT WASHER PUMP MOTOR CONTROL
GROUND
GROUND
GROUND
GROUND
GROUND
7 IPM
8 IPM
9 IPM
12 IPM
1 IPM
18 IPM
25 IPM
33 IPM
41 IPM
27 C5
28 C5
29 C5
27 C4
39 C4
39 C5
L1 18 WT/LG
T315 14 YL/BR
T316 14 YL/GY
S112
(8W-51-4)
10 C100
14 C101
L1 18 WT/LG
T315 14 YL/BR
T316 14 YL/GY
W10 18 BR
Z921 14 BK
Z118 18 BK/YL
1
PUMP-WASHER-WINDSHIELD
(8W-53-4)
4
5
ASSEMBLY-SHIFT MOTOR/MODE SENSOR (4WD)
(8W-31-10)
3 C1
MIRROR-INSIDE REARVIEW
(8W-49-3)
G100
(8W-15-3)

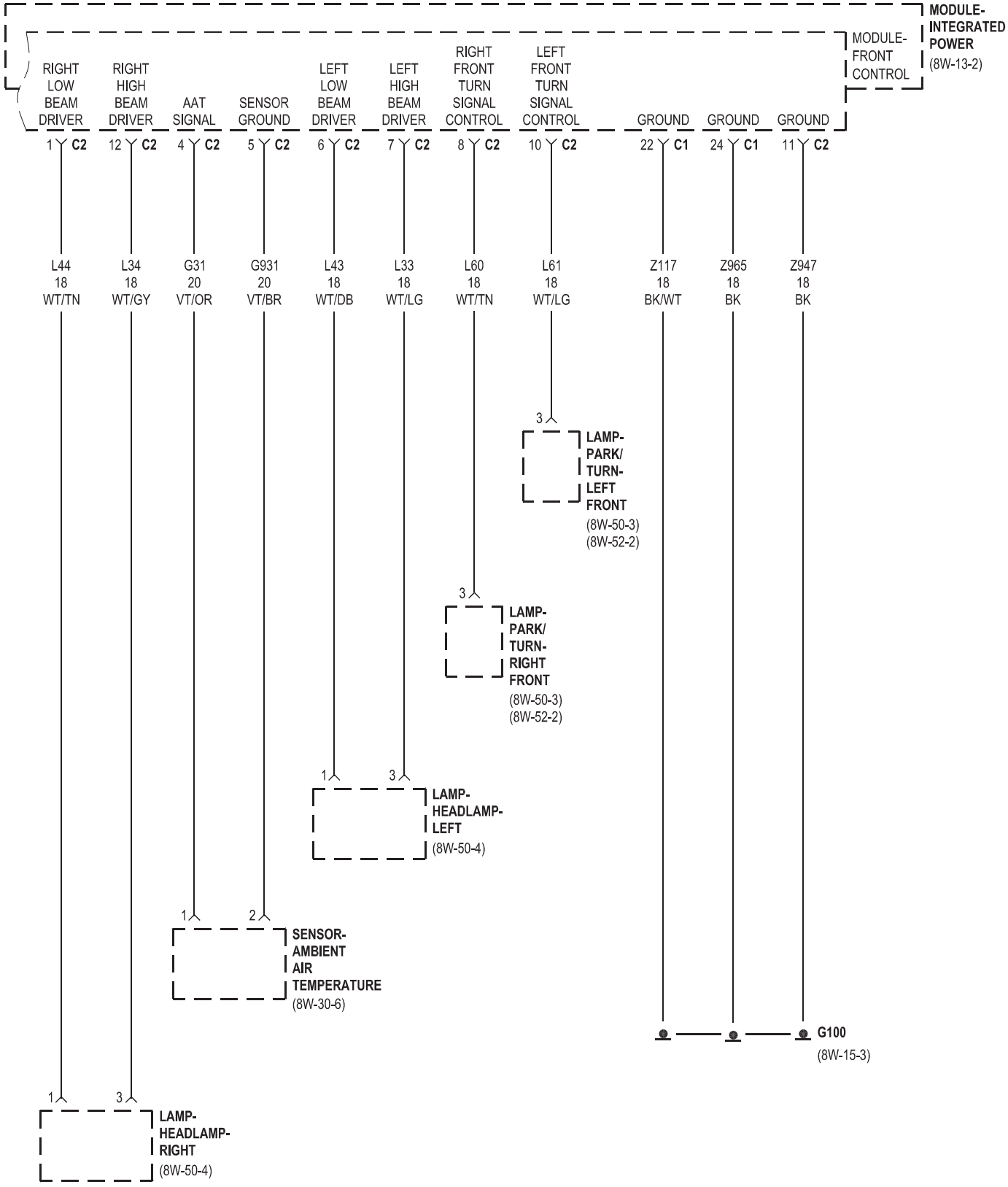

MODULE-INTEGRATED POWER (8W-13-2)
MODULE-FRONT CONTROL
RIGHT REAR TURN SIGNAL CONTROL
LEFT REAR TURN SIGNAL CONTROL
LOW/ REVERSE SOLENOID CONTROL
FCM SENSOR RETURN
TRANSFER CASE MOTOR LOCK SIGNAL
GROUND
GROUND
GROUND
34 IPM
43 IPM
40 IPM
35 IPM
45 IPM
19 IPM
24 IPM
32 IPM
35 C4
37 C5
20 C1
5 C1
15 C1
26 C5
L62 18 WT/OR
L63 18 WT/DG
T2 20 DG/WT
G180 20 VT/YL
T313 18 YL/LG
3
4 C106
3 C100
9 C100
L62 18 WT/OR
L63 18 WT/DG
T2 20 DG/WT
T313 18 YL/LG
7
1
1
ASSEMBLY-SHIFT MOTOR/ MODE SENSOR (4WD) (8W-31-10)
LAMP-TAIL/ STOP/ TURN-RIGHT (8W-52-3)
SWITCH-BACK-UP LAMP (8W-31-2) (8W-51-4)
3
G180 20 VT/YL
13 C101
G180 20 VT/YL
1
LAMP-TAIL/ STOP/ TURN-LEFT (8W-52-3)
S115
G180 20 VT/YL
G180 220 VT/YL
Z909 20 BK
1
SENSOR-WASHER FLUID LEVEL-FRONT REAR (8W-53-4)
1
TRANSDUCER-A/C PRESSURE (8W-42-5)
G100 (8W-15-3)
■ M/T


MODULE-INTEGRATED POWER
(8W-13-2)
MODULE-FRONT CONTROL
CAN B BUS (+)
CAN B BUS (-)
CAN C DIAGNOSTIC (+)
CAN C DIAGNOSTIC (-)
CAN C BUS (+)
CAN C BUS (-)
GROUND
2 C1
3 C1
5 C1
6 C1
8 C1
9 C1
1 C1
D55 20 WT/OR
D54 20 WT
TWISTED PAIR
S105
(8W-18-3)
S107
(8W-18-4)
D52 20 WT/LB
D51 20 PK/RD
D65 20 WT/LG
D64 20 WT/LB
37
36
13
11
C201
S101
(8W-18-5)
S100
(8W-18-5)
Z116 18 BK/VT
S212
(8W-18-3)
S211
(8W-18-4)
▼ 2
▼▼ 3
▼ 3
▼▼ 18
MODULE-ANTI-LOCK BRAKES
(8W-34-2)
(8W-35-2)
6
14
DATA LINK CONNECTOR
(8W-18-2)
14 C2
13 C2
CLUSTER
(8W-40-7)
G100
(8W-15-3)

▼ RWAL

▼▼ AWAL


MODULE-INTEGRATED POWER
(8W-13-2)
MODULE-FRONT CONTROL
A/C PRESSURE SIGNAL
5 VOLT SUPPLY
MODE SENSOR A
WASHER FLUID LEVEL SWITCH SENSE
BATT TEMP SIGNAL
BATT TEMP RETURN
BRAKE LAMP SWITCH OUTPUT
11 C1
16 C1
17 C1
18 C1
19 C1
20 C1
21 C1
T103 20 YL/OR
D201 20 WT/DG
L50 18 WT/LB
S114
(8W-31-10)
2 C100
S106
(8W-51-3)
C18 20 LB/BR
T103 20 YL/OR
D201 20 WT/DG
W1 20 BR/TN
K25 20 DB/VT
K91 20 DB/YL
L50 18 WT/LB
3
WIRING-TRAILER TOW ELECTRIC BRAKE
(8W-54-2)
1
2
SENSOR-BATTERY TEMPERATURE
2
SENSOR-WASHER FLUID LEVEL-FRONT REAR
(8W-53-4)
2
ASSEMBLY-SHIFT MOTOR/MODE SENSOR (4WD)
(8W-31-10)
3
2
TRANSDUCER-A/C PRESSURE
(8W-42-5)


MODULE-INTEGRATED POWER
(8W-13-2)
MODULE-FRONT CONTROL
RIGHT LOW BEAM DRIVER
RIGHT HIGH BEAM DRIVER
AAT SIGNAL
SENSOR GROUND
LEFT LOW BEAM DRIVER
LEFT HIGH BEAM DRIVER
RIGHT FRONT TURN SIGNAL CONTROL
LEFT FRONT TURN SIGNAL CONTROL
GROUND
GROUND
GROUND
1 C2
12 C2
4 C2
5 C2
6 C2
7 C2
8 C2
10 C2
22 C1
24 C1
11 C2
L44 18 WT/TN
L34 18 WT/GY
G31 20 VT/OR
G931 20 VT/BR
L43 18 WT/DB
L33 18 WT/LG
L60 18 WT/TN
L61 18 WT/LG
Z117 18 BK/WT
Z965 18 BK
Z947 18 BK
3
LAMP-PARK/TURN-LEFT FRONT
(8W-50-3)
(8W-52-2)
3
LAMP-PARK/TURN-RIGHT FRONT
(8W-50-3)
(8W-52-2)
1
3
LAMP-HEADLAMP-LEFT
(8W-50-4)
1
2
SENSOR-AMBIENT AIR TEMPERATURE
(8W-30-6)
G100
(8W-15-3)
1
3
LAMP-HEADLAMP-RIGHT
(8W-50-4)

8W-15 GROUND DISTRIBUTION

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Battery	8W-15-2
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G102	8W-15-3
G103	8W-15-6
G105	8W-15-2
G106	8W-15-2
G107	8W-15-7
G108	8W-15-8
G200	8W-15-9, 10
G201	8W-15-11
G202	8W-15-12
G300	8W-15-12, 13, 14
G301	8W-15-15, 16
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Generator	8W-15-8
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Lamp-Fog-Right Front	8W-15-6
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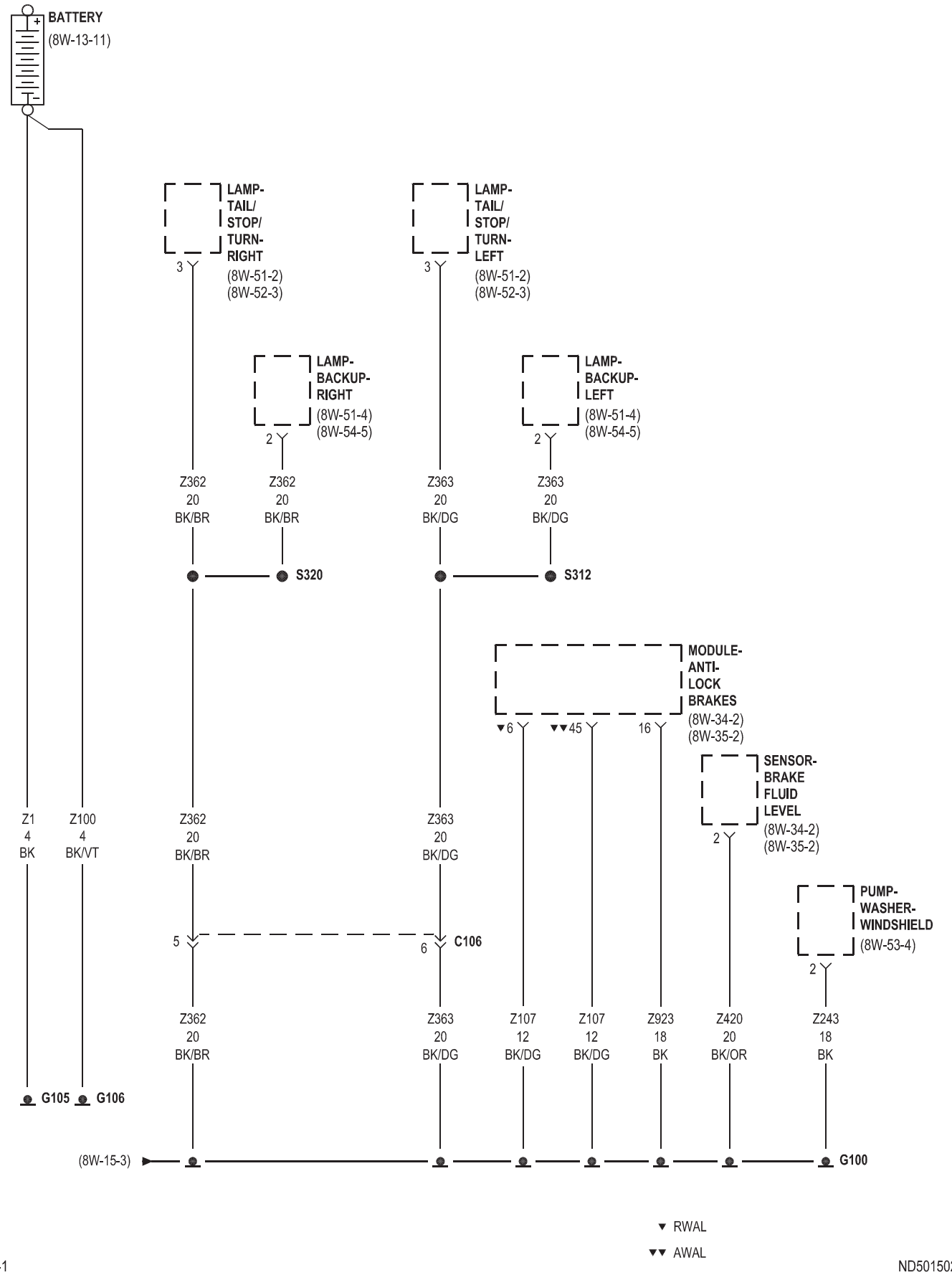
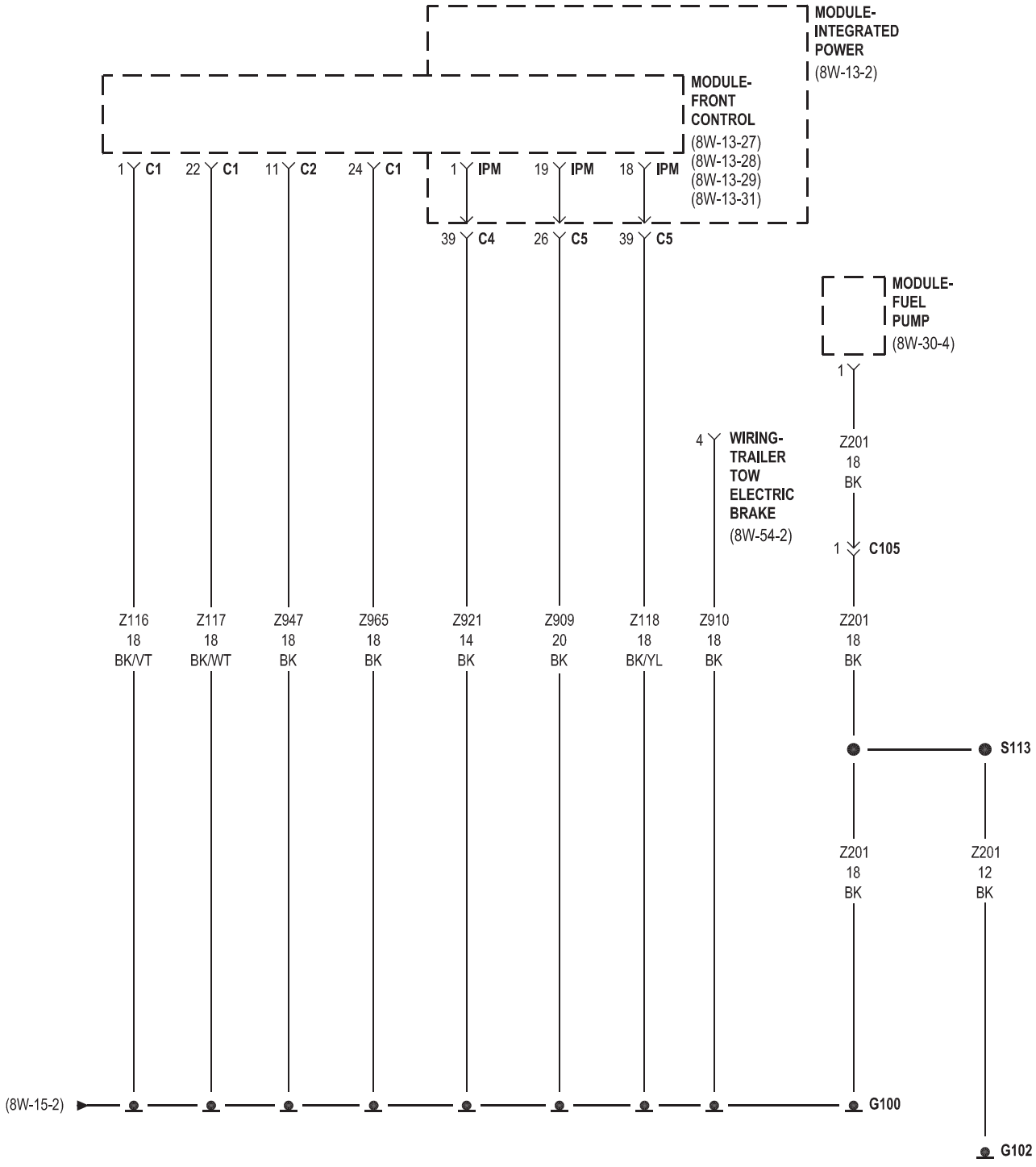
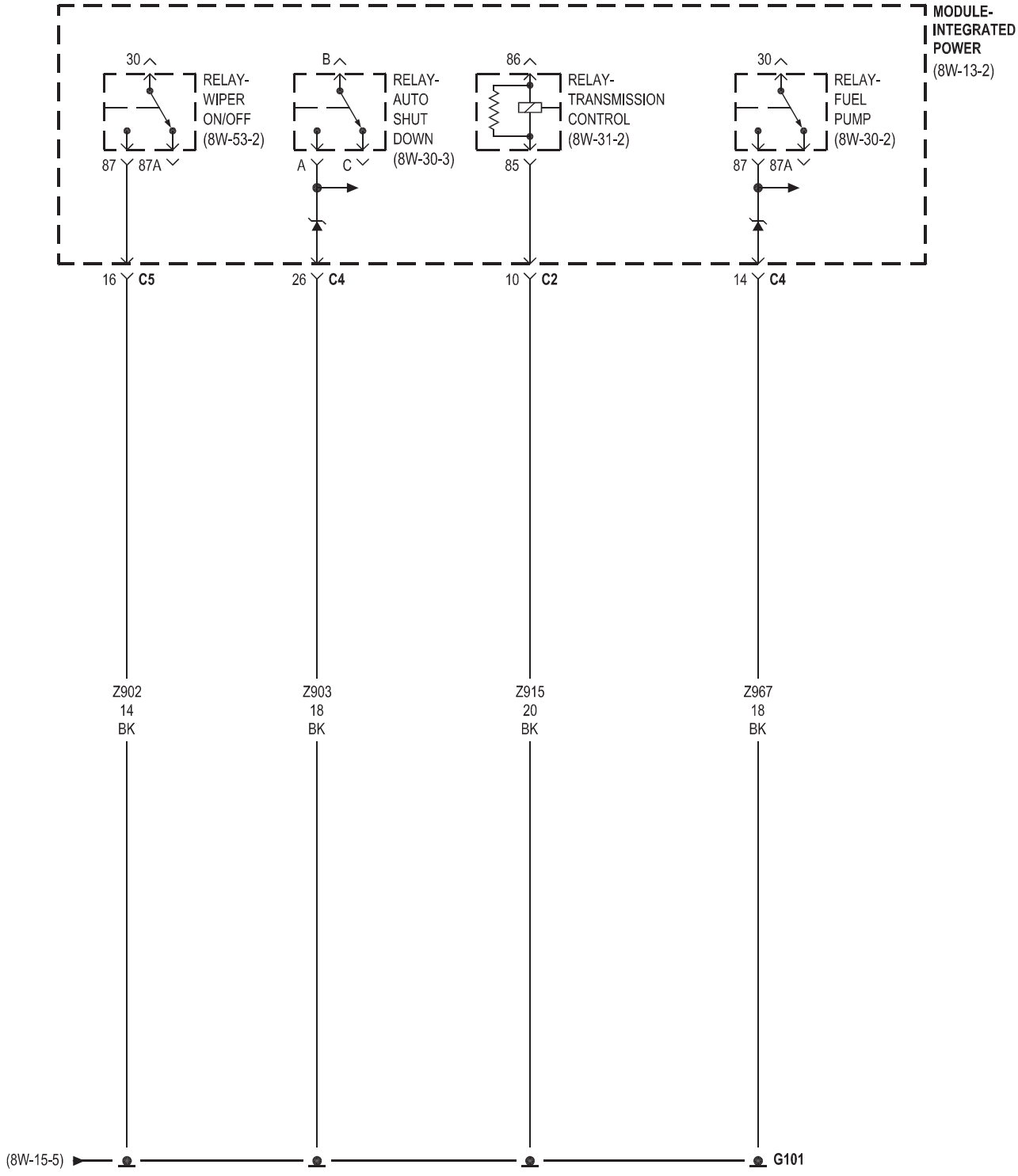
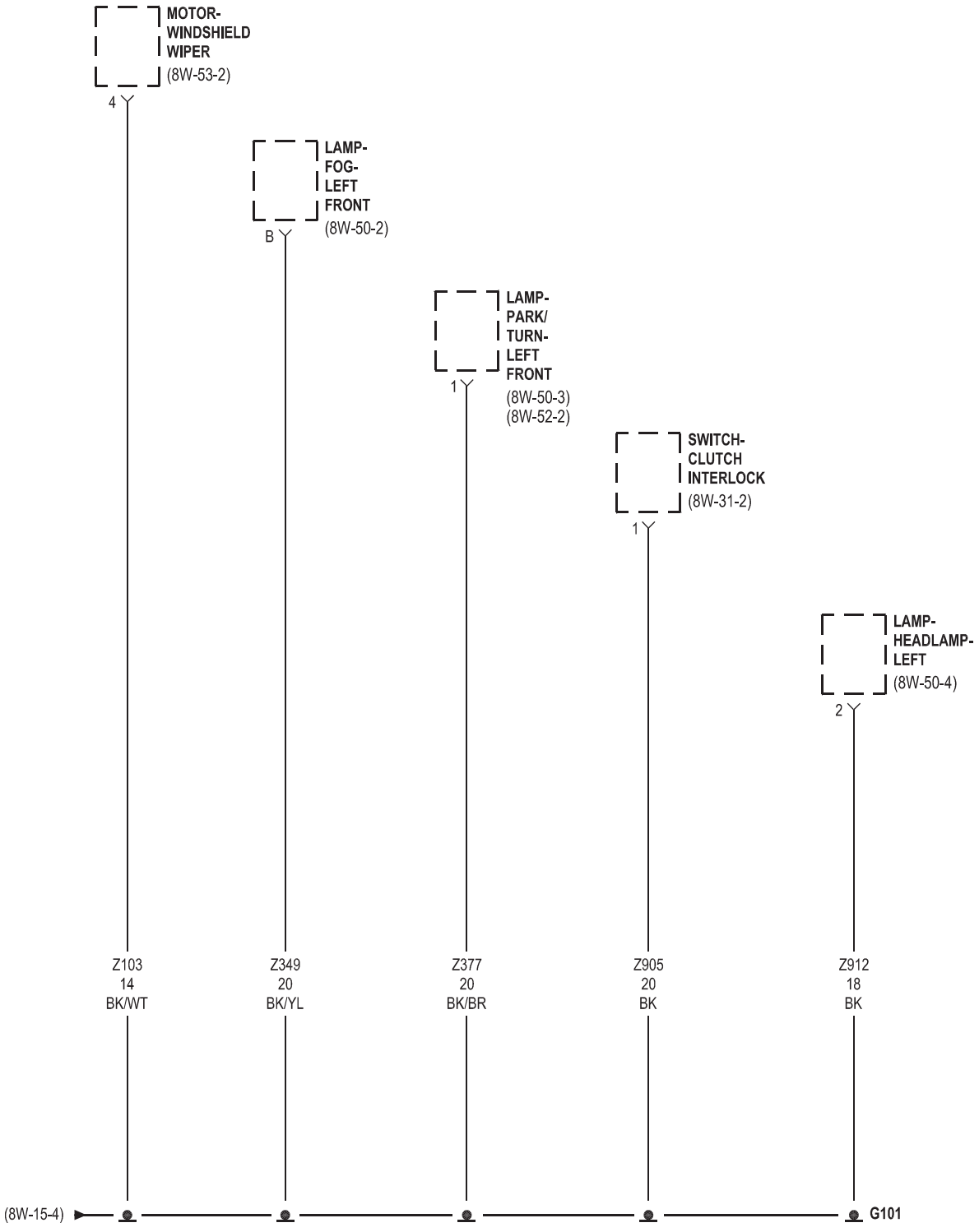
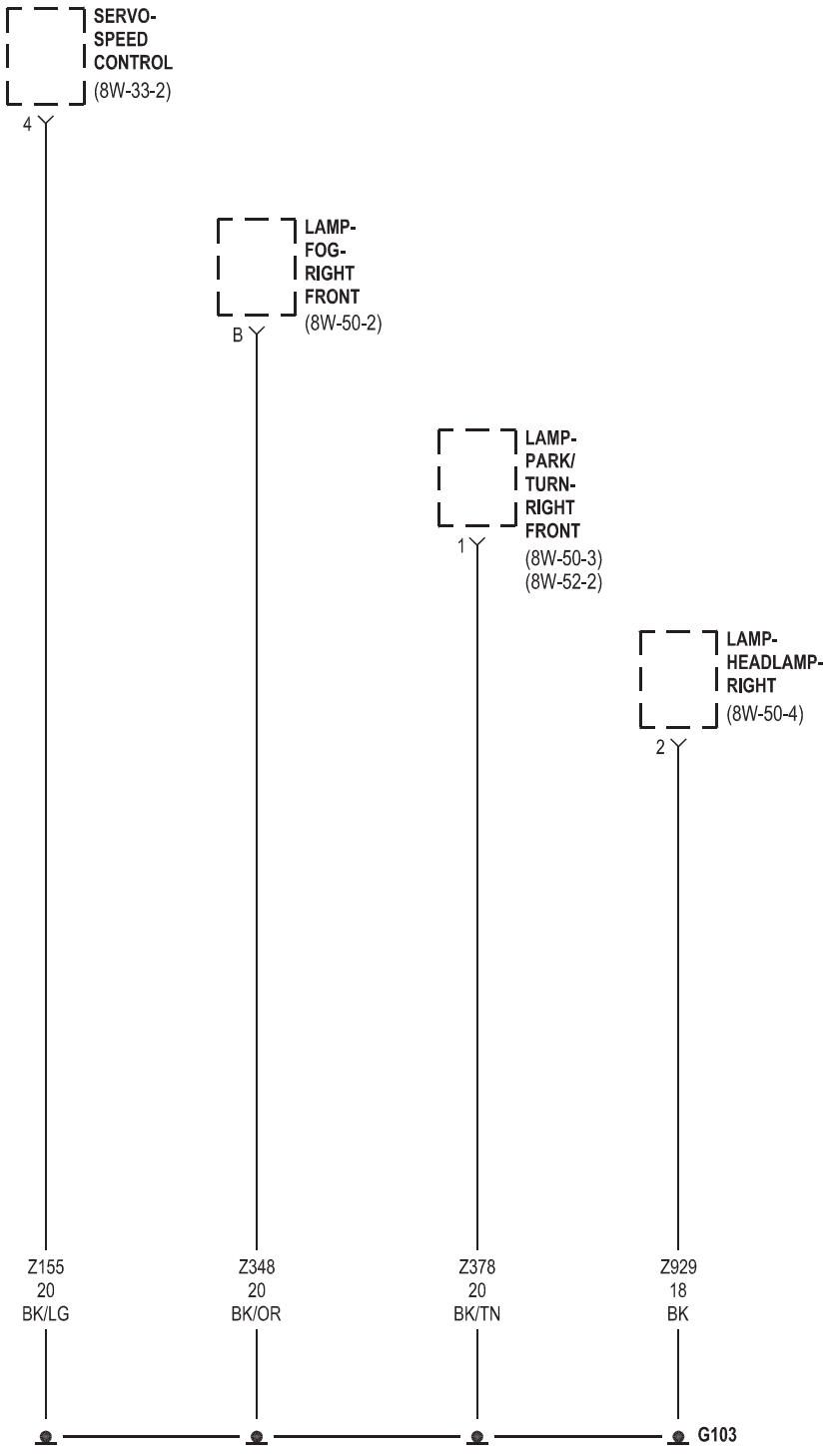
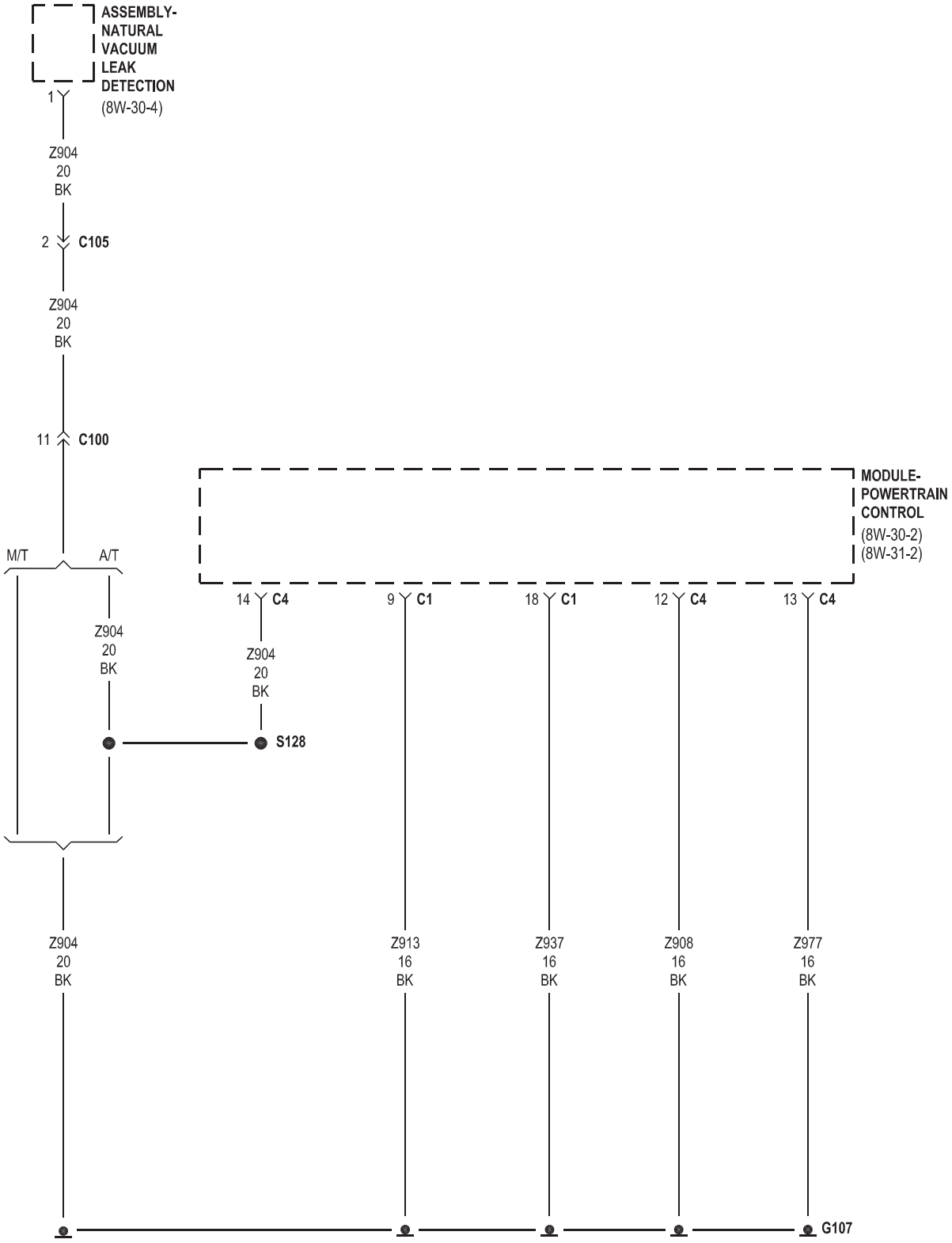

BATTERY
(8W-13-11)
LAMP-TAIL/STOP/TURN-RIGHT
(8W-51-2)
(8W-52-3)
LAMP-TAIL/STOP/TURN-LEFT
(8W-51-2)
(8W-52-3)
LAMP-BACKUP-RIGHT
(8W-51-4)
(8W-54-5)
LAMP-BACKUP-LEFT
(8W-51-4)
(8W-54-5)
Z362 20 BK/BR
Z362 20 BK/BR
Z363 20 BK/DG
Z363 20 BK/DG
S320
S312
MODULE-ANTI-LOCK BRAKES
(8W-34-2)
(8W-35-2)
SENSOR-BRAKE FLUID LEVEL
(8W-34-2)
(8W-35-2)
PUMP-WASHER-WINDSHIELD
(8W-53-4)
Z1 4 BK
Z100 4 BK/VT
Z362 20 BK/BR
Z363 20 BK/DG
C106
Z362 20 BK/BR
Z363 20 BK/DG
Z107 12 BK/DG
Z107 12 BK/DG
Z923 18 BK
Z420 20 BK/OR
Z243 18 BK
G105
G106
(8W-15-3)
G100
▼ RWAL
▼▼ AWAL

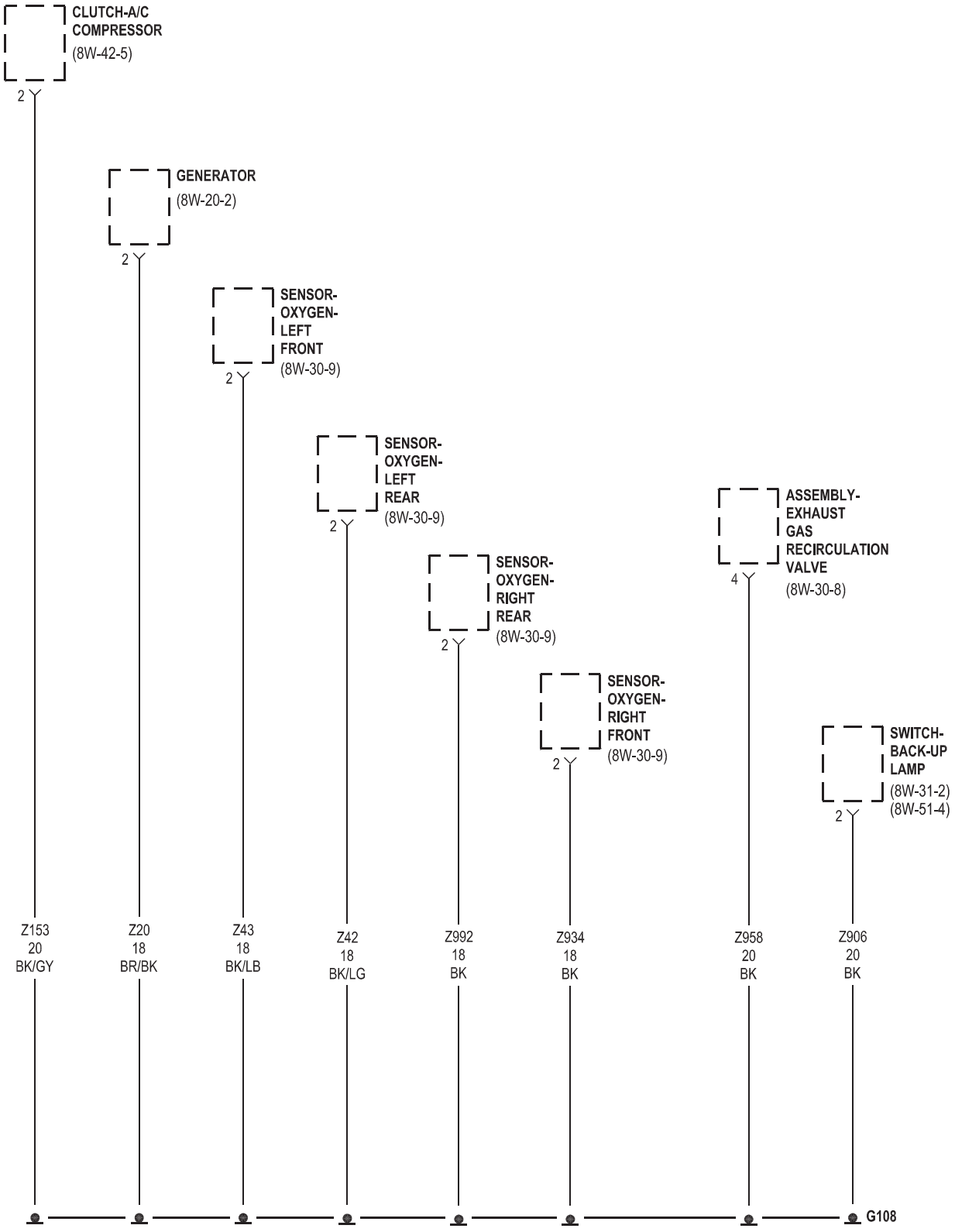

MODULE-
INTEGRATED
POWER
(8W-13-2)
MODULE-
FRONT
CONTROL
(8W-13-27)
(8W-13-28)
(8W-13-29)
(8W-13-31)
1 C1
22 C1
11 C2
24 C1
1 IPM
19 IPM
18 IPM
39 C4
26 C5
39 C5
MODULE-
FUEL
PUMP
(8W-30-4)
1
Z201
18
BK
1 C105
4 WIRING-
TRAILER
TOW
ELECTRIC
BRAKE
(8W-54-2)
Z116
18
BK/VT
Z117
18
BK/WT
Z947
18
BK
Z965
18
BK
Z921
14
BK
Z909
20
BK
Z118
18
BK/YL
Z910
18
BK
Z201
18
BK
S113
Z201
18
BK
Z201
12
BK
(8W-15-2)
G100
G102

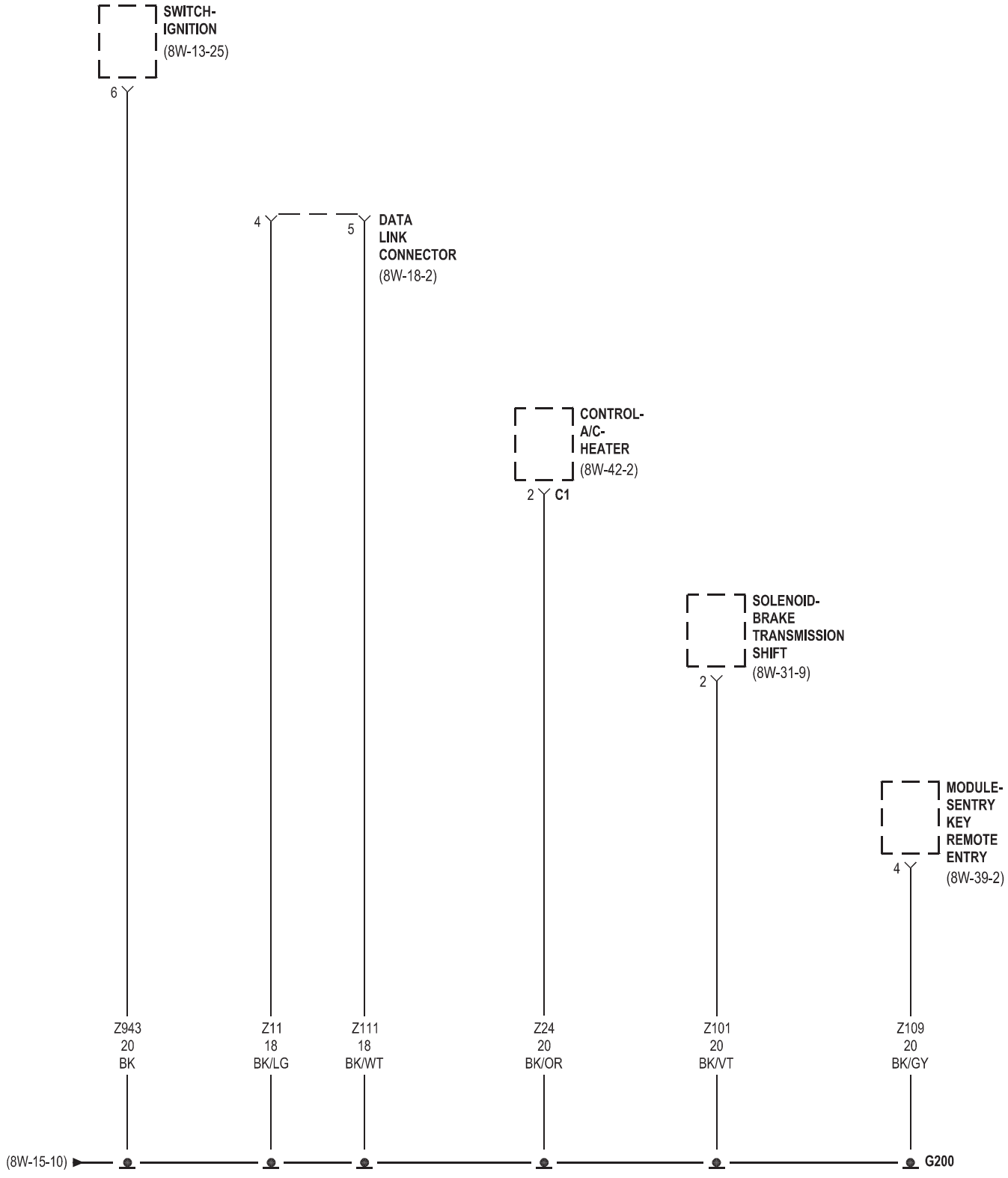

MODULE-
INTEGRATED
POWER
(8W-13-2)
30
RELAY-
WIPER
ON/OFF
(8W-53-2)
87
87A
B
RELAY-
AUTO
SHUT
DOWN
(8W-30-3)
A
C
86
RELAY-
TRANSMISSION
CONTROL
(8W-31-2)
85
30
RELAY-
FUEL
PUMP
(8W-30-2)
87
87A
16
C5
26
C4
10
C2
14
C4
Z902
14
BK
Z903
18
BK
Z915
20
BK
Z967
18
BK
(8W-15-5)
G101

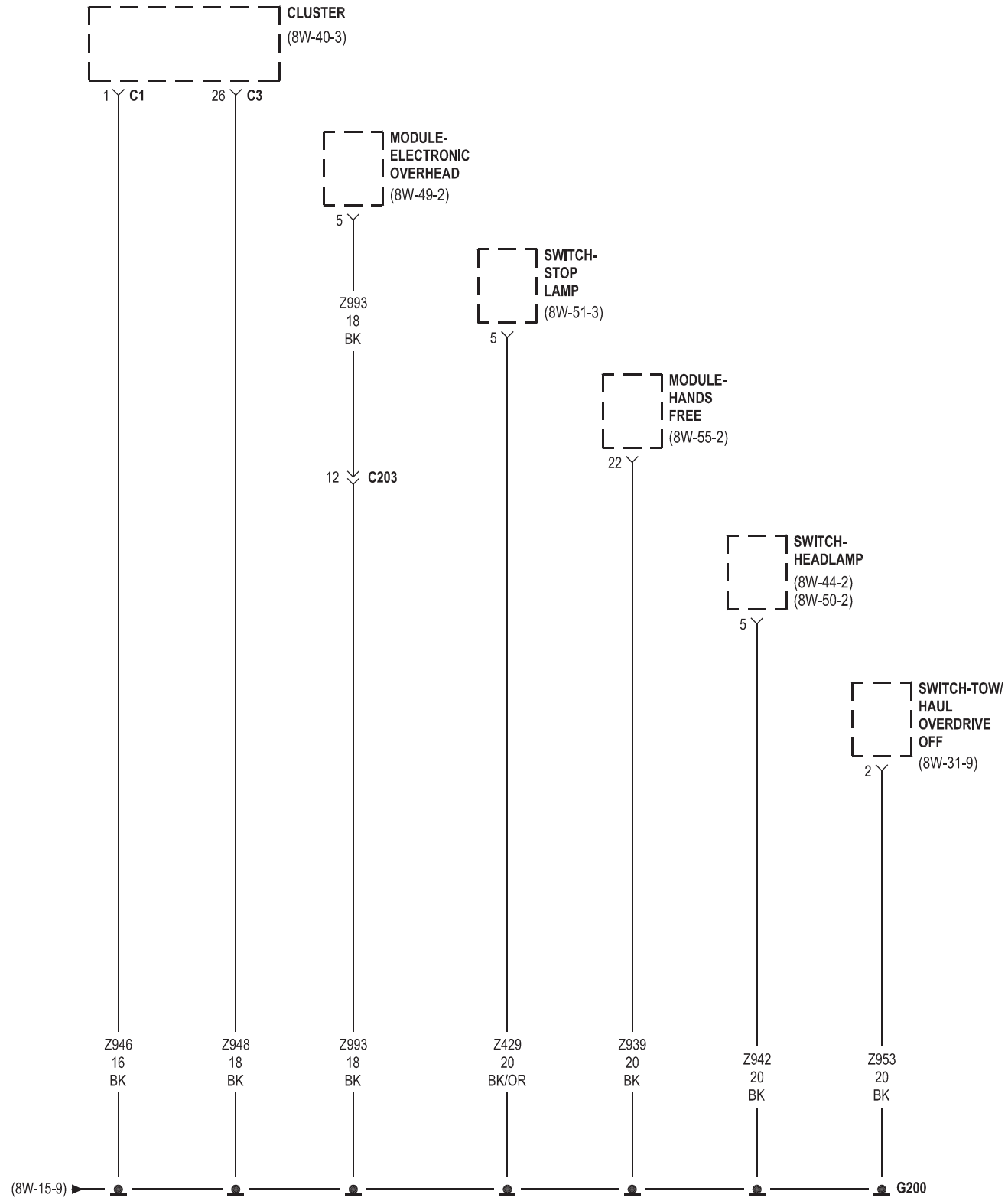

MOTOR-
WINDSHIELD
WIPER
(8W-53-2)
4
LAMP-
FOG-
LEFT
FRONT
(8W-50-2)
B
LAMP-
PARK/
TURN-
LEFT
FRONT
(8W-50-3)
(8W-52-2)
1
SWITCH-
CLUTCH
INTERLOCK
(8W-31-2)
1
LAMP-
HEADLAMP-
LEFT
(8W-50-4)
2
Z103
14
BK/WT
Z349
20
BK/YL
Z377
20
BK/BR
Z905
20
BK
Z912
18
BK
(8W-15-4)
G101

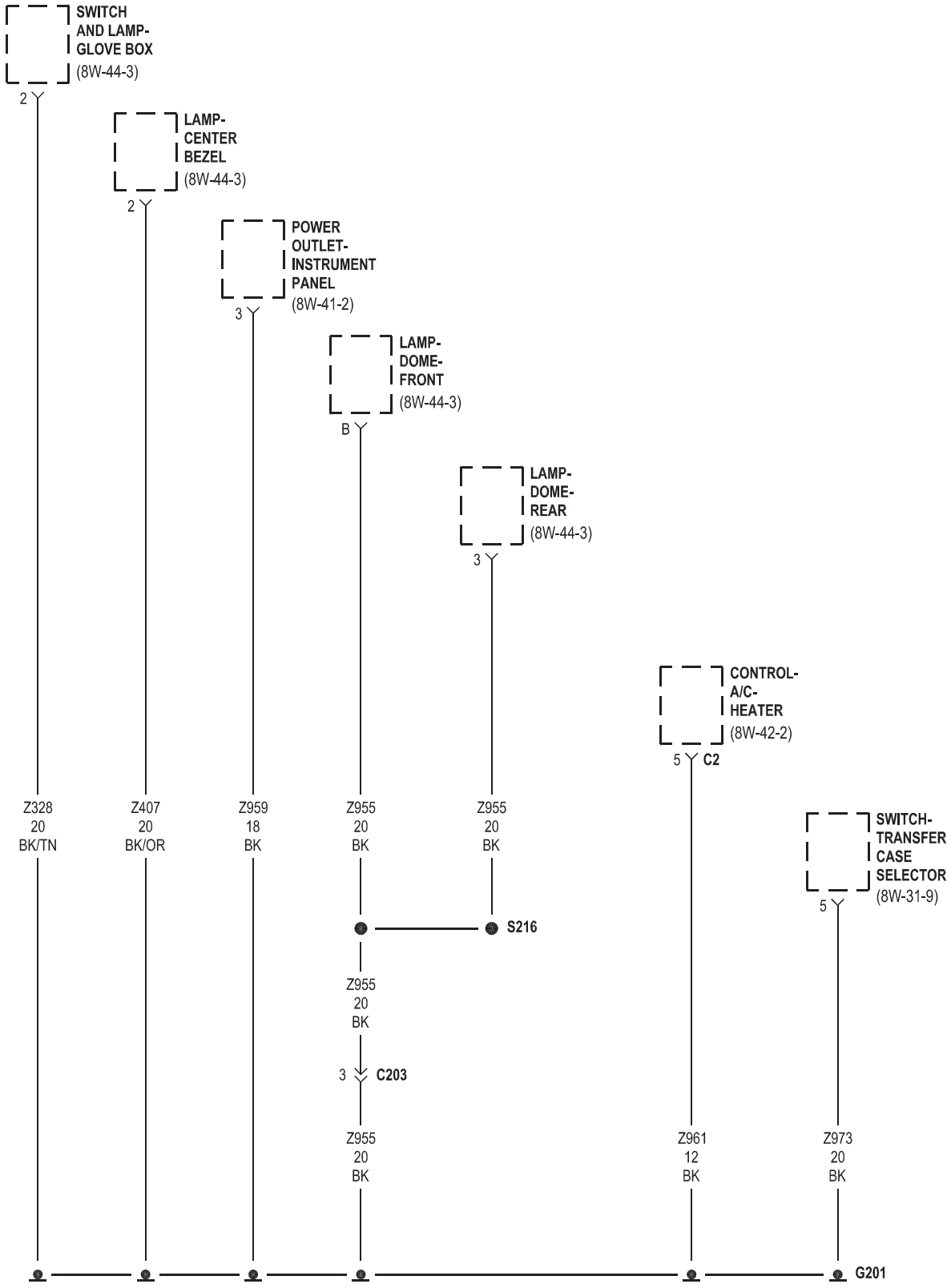

SERVO-
SPEED
CONTROL
(8W-33-2)
4
LAMP-
FOG-
RIGHT
FRONT
(8W-50-2)
B
LAMP-
PARK/
TURN-
RIGHT
FRONT
(8W-50-3)
(8W-52-2)
1
LAMP-
HEADLAMP-
RIGHT
(8W-50-4)
2
Z155
20
BK/LG
Z348
20
BK/OR
Z378
20
BK/TN
Z929
18
BK
G103

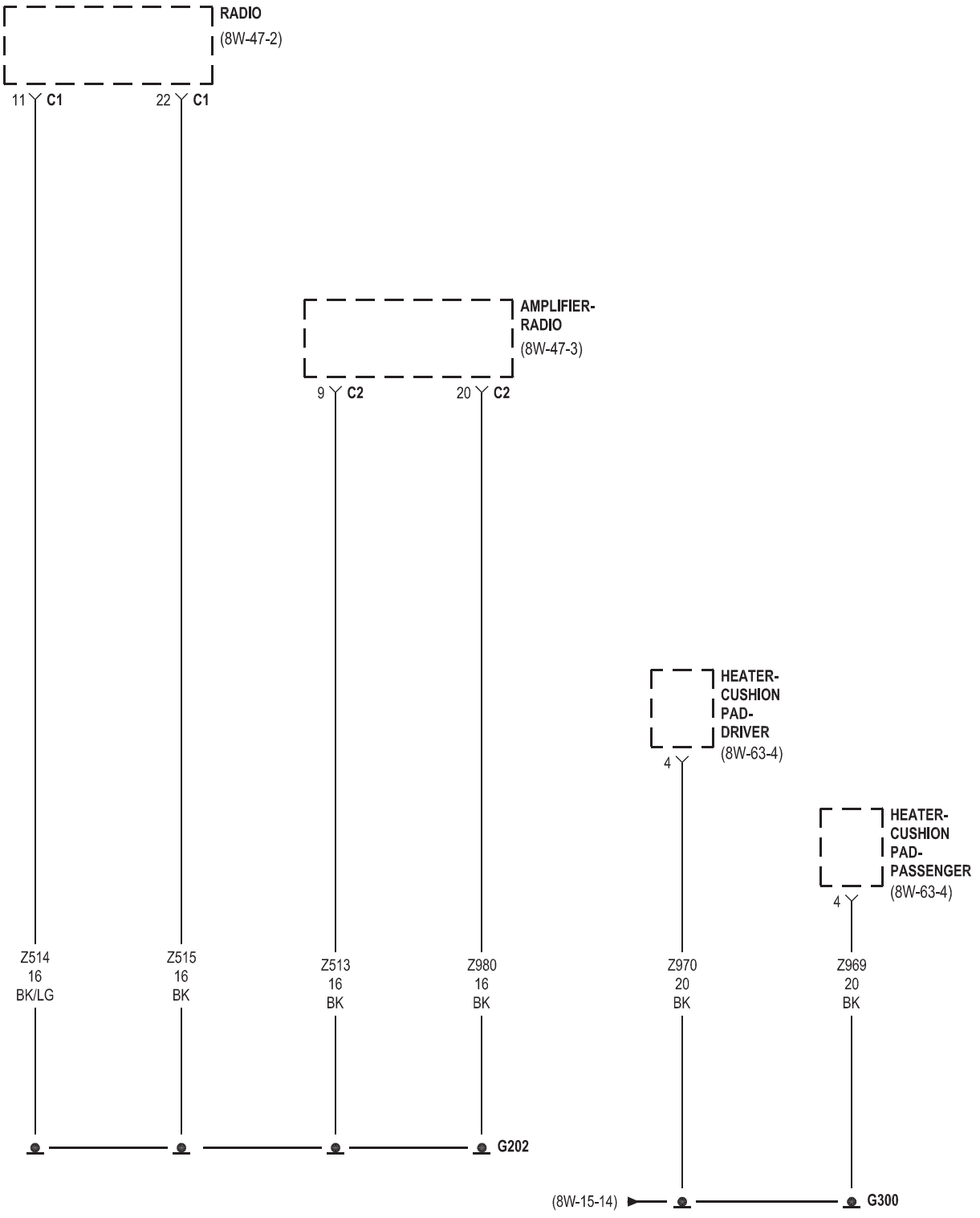

ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION
(8W-30-4)
1
Z904
20
BK
2 C105
Z904
20
BK
11 C100
M/T
A/T
Z904
20
BK
MODULE-
POWERTRAIN
CONTROL
(8W-30-2)
(8W-31-2)
14 C4
9 C1
18 C1
12 C4
13 C4
Z904
20
BK
S128
Z904
20
BK
Z913
16
BK
Z937
16
BK
Z908
16
BK
Z977
16
BK
G107

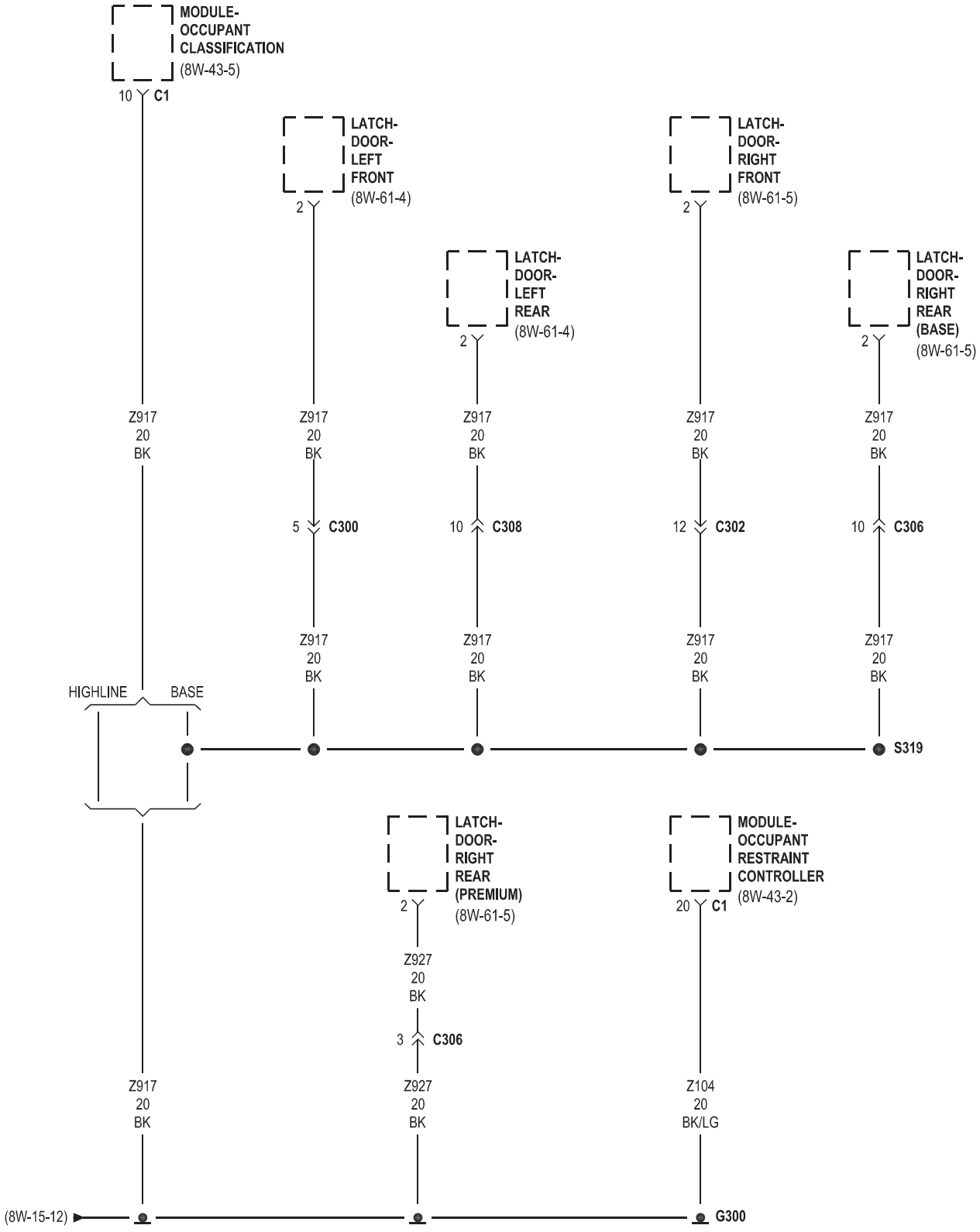

CLUTCH-A/C COMPRESSOR
(8W-42-5)
2
GENERATOR
(8W-20-2)
2
SENSOR-OXYGEN-LEFT FRONT
(8W-30-9)
2
SENSOR-OXYGEN-LEFT REAR
(8W-30-9)
2
SENSOR-OXYGEN-RIGHT REAR
(8W-30-9)
2
SENSOR-OXYGEN-RIGHT FRONT
(8W-30-9)
2
ASSEMBLY-EXHAUST GAS RECIRCULATION VALVE
(8W-30-8)
4
SWITCH-BACK-UP LAMP
(8W-31-2)
(8W-51-4)
2
Z153 20 BK/GY
Z20 18 BR/BK
Z43 18 BK/LB
Z42 18 BK/LG
Z992 18 BK
Z934 18 BK
Z958 20 BK
Z906 20 BK
G108

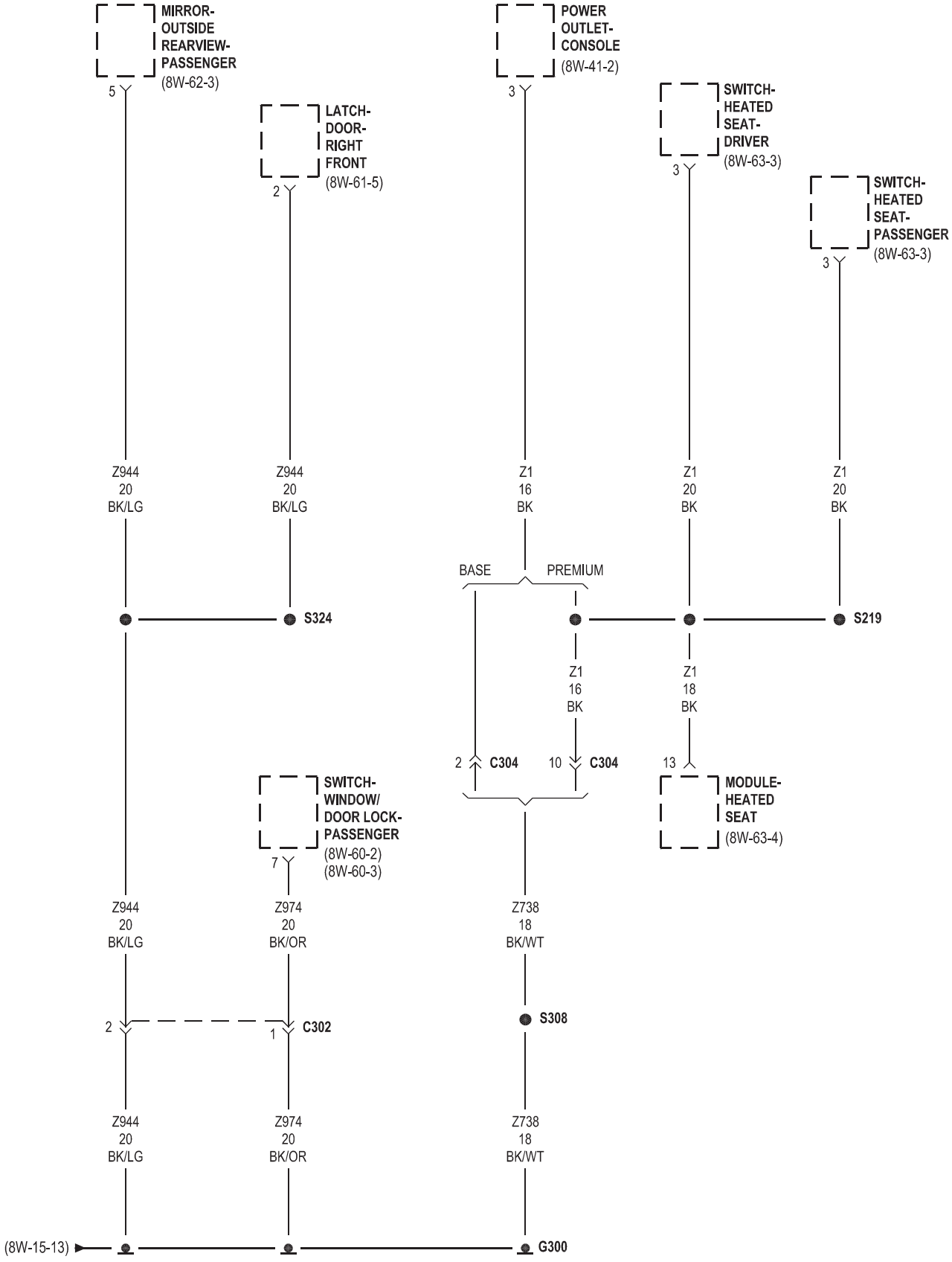

SWITCH-
IGNITION
(8W-13-25)
6
4
5
DATA
LINK
CONNECTOR
(8W-18-2)
CONTROL-
A/C-
HEATER
(8W-42-2)
2
C1
SOLENOID-
BRAKE
TRANSMISSION
SHIFT
(8W-31-9)
2
MODULE-
SENTRY
KEY
REMOTE
ENTRY
(8W-39-2)
4
Z943
20
BK
Z11
18
BK/LG
Z111
18
BK/WT
Z24
20
BK/OR
Z101
20
BK/VT
Z109
20
BK/GY
(8W-15-10)
G200

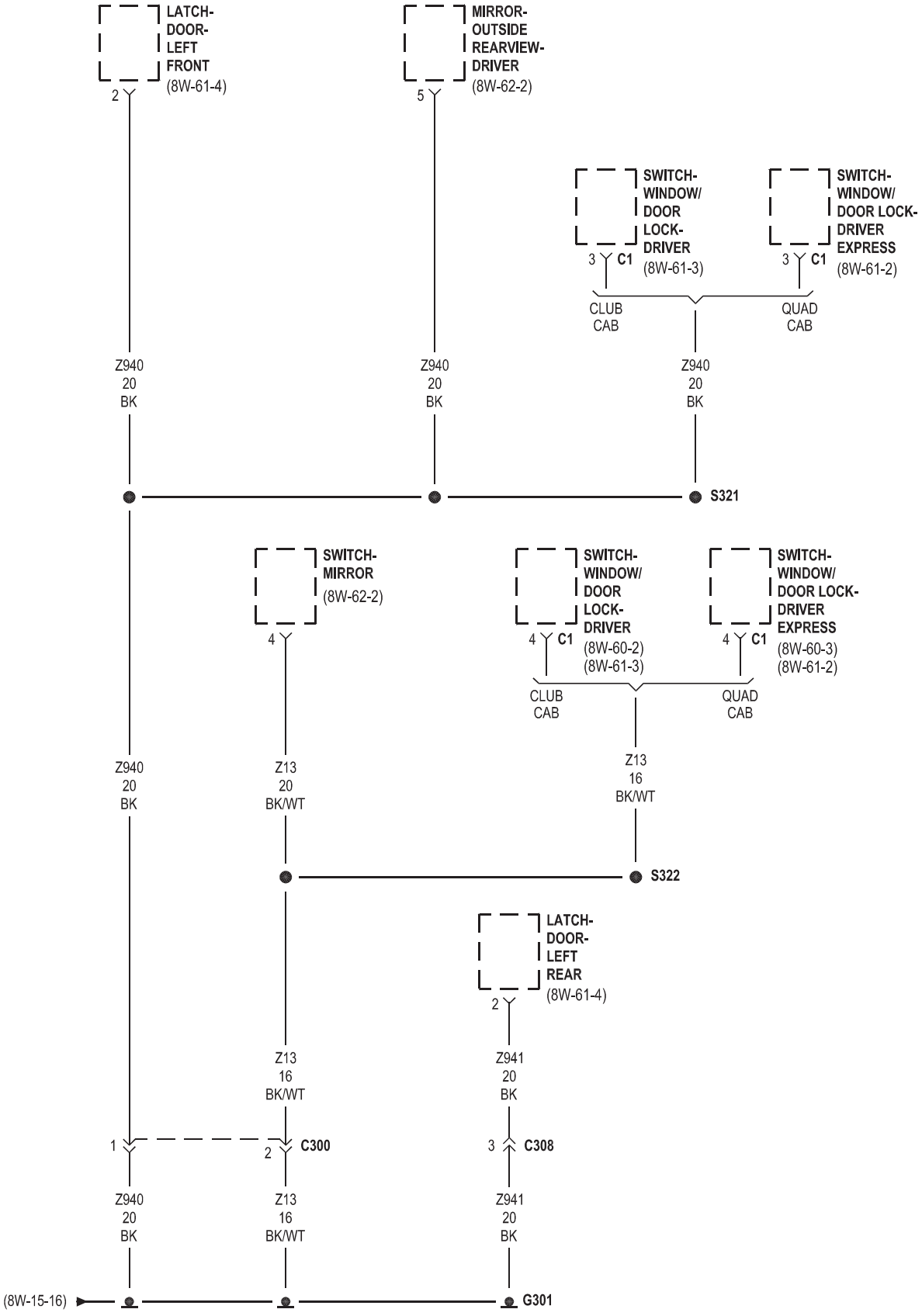

CLUSTER
(8W-40-3)
1 C1
26 C3
MODULE-
ELECTRONIC
OVERHEAD
(8W-49-2)
5
Z993
18
BK
12 C203
SWITCH-
STOP
LAMP
(8W-51-3)
5
MODULE-
HANDS
FREE
(8W-55-2)
22
SWITCH-
HEADLAMP
(8W-44-2)
(8W-50-2)
5
SWITCH-TOW/
HAUL
OVERDRIVE
OFF
(8W-31-9)
2
Z946
16
BK
Z948
18
BK
Z993
18
BK
Z429
20
BK/OR
Z939
20
BK
Z942
20
BK
Z953
20
BK
(8W-15-9)
G200

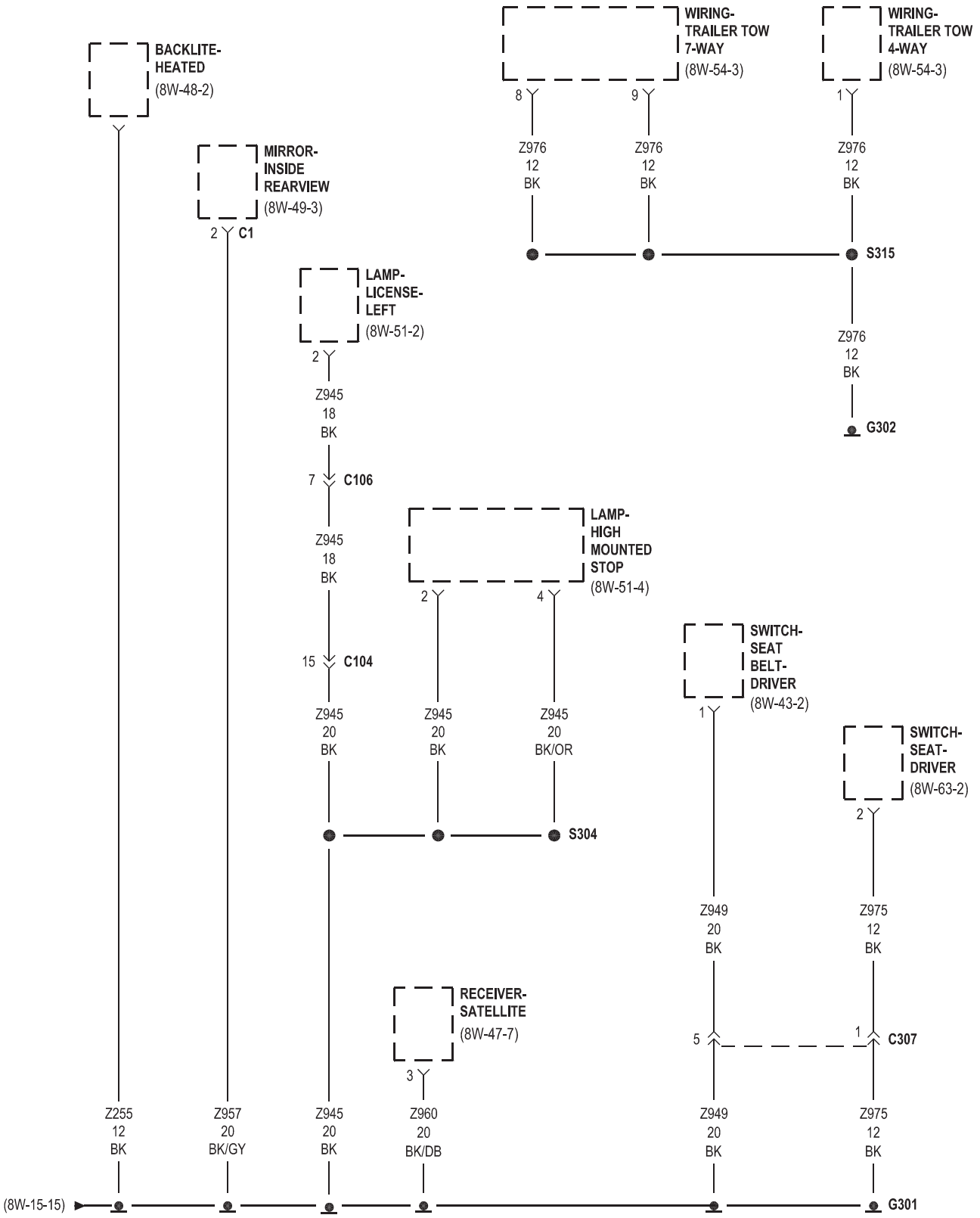

SWITCH AND LAMP-GLOVE BOX
(8W-44-3)
2
LAMP-CENTER BEZEL
(8W-44-3)
2
POWER OUTLET-INSTRUMENT PANEL
(8W-41-2)
3
LAMP-DOME-FRONT
(8W-44-3)
B
LAMP-DOME-REAR
(8W-44-3)
3
CONTROL-A/C-HEATER
(8W-42-2)
5
C2
SWITCH-TRANSFER CASE SELECTOR
(8W-31-9)
5
Z328
20
BK/TN
Z407
20
BK/OR
Z959
18
BK
Z955
20
BK
Z955
20
BK
S216
Z955
20
BK
3
C203
Z955
20
BK
Z961
12
BK
Z973
20
BK
G201


RADIO
(8W-47-2)
11 C1
22 C1
AMPLIFIER-
RADIO
(8W-47-3)
9 C2
20 C2
HEATER-
CUSHION
PAD-
DRIVER
(8W-63-4)
4
HEATER-
CUSHION
PAD-
PASSENGER
(8W-63-4)
4
Z514
16
BK/LG
Z515
16
BK
Z513
16
BK
Z980
16
BK
Z970
20
BK
Z969
20
BK
G202
(8W-15-14)
G300


MODULE-
OCCUPANT
CLASSIFICATION
(8W-43-5)
10 C1
LATCH-
DOOR-
LEFT
FRONT
(8W-61-4)
2
LATCH-
DOOR-
RIGHT
FRONT
(8W-61-5)
2
LATCH-
DOOR-
LEFT
REAR
(8W-61-4)
2
LATCH-
DOOR-
RIGHT
REAR
(BASE)
(8W-61-5)
2
Z917
20
BK
5 C300
10 C308
12 C302
10 C306
HIGHLINE
BASE
S319
LATCH-
DOOR-
RIGHT
REAR
(PREMIUM)
(8W-61-5)
2
Z927
20
BK
3 C306
MODULE-
OCCUPANT
RESTRAINT
CONTROLLER
(8W-43-2)
20 C1
Z104
20
BK/LG
(8W-15-12)
G300

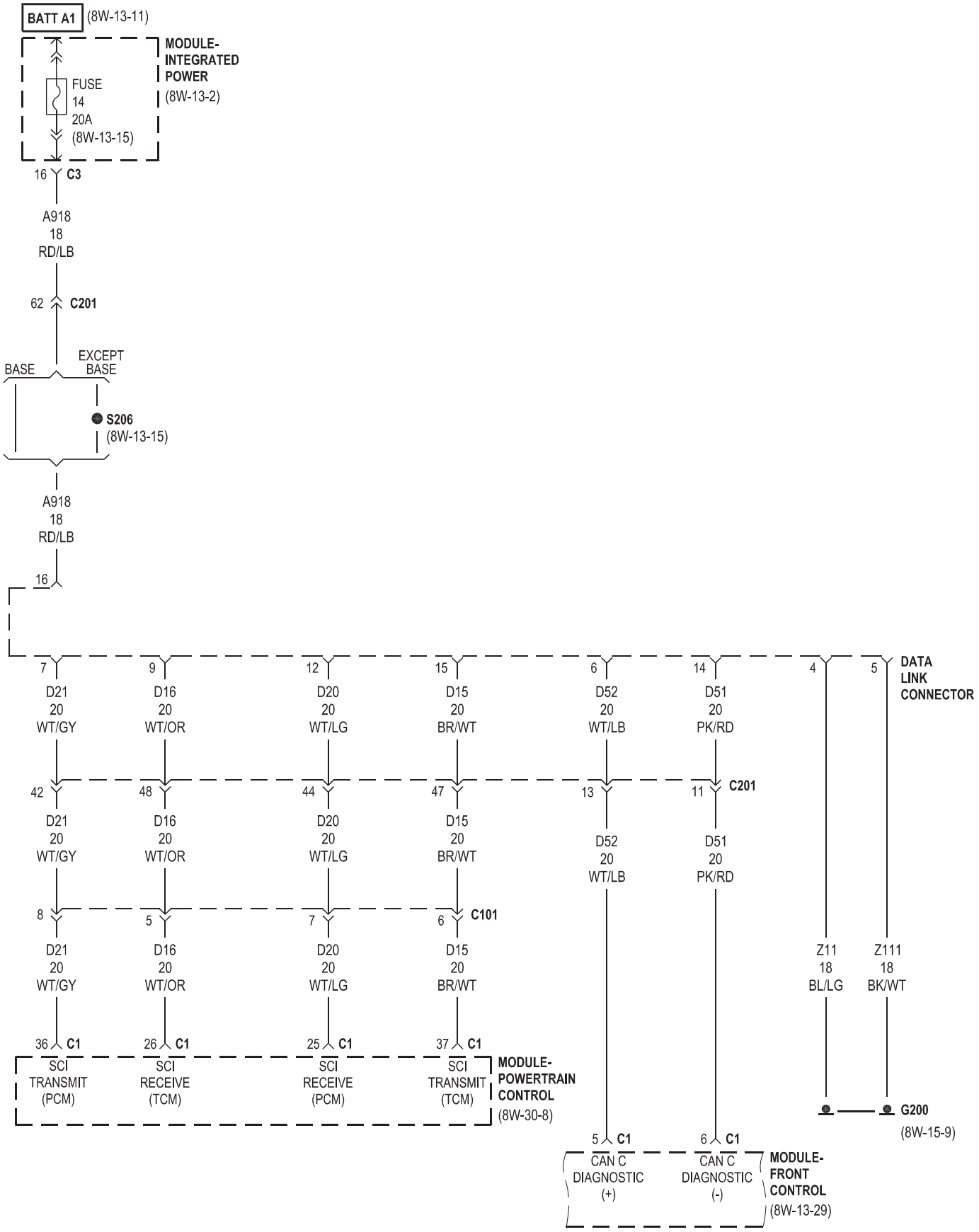

MIRROR-
OUTSIDE
REARVIEW-
PASSENGER
(8W-62-3)
5
LATCH-
DOOR-
RIGHT
FRONT
(8W-61-5)
2
POWER
OUTLET-
CONSOLE
(8W-41-2)
3
SWITCH-
HEATED
SEAT-
DRIVER
(8W-63-3)
3
SWITCH-
HEATED
SEAT-
PASSENGER
(8W-63-3)
3
Z944
20
BK/LG
Z944
20
BK/LG
Z1
16
BK
Z1
20
BK
Z1
20
BK
BASE
PREMIUM
S324
S219
Z1
16
BK
Z1
18
BK
2
C304
10
C304
13
SWITCH-
WINDOW/
DOOR LOCK-
PASSENGER
(8W-60-2)
(8W-60-3)
7
MODULE-
HEATED
SEAT
(8W-63-4)
Z944
20
BK/LG
Z974
20
BK/OR
Z738
18
BK/WT
2
C302
1
S308
Z944
20
BK/LG
Z974
20
BK/OR
Z738
18
BK/WT
(8W-15-13)
G300

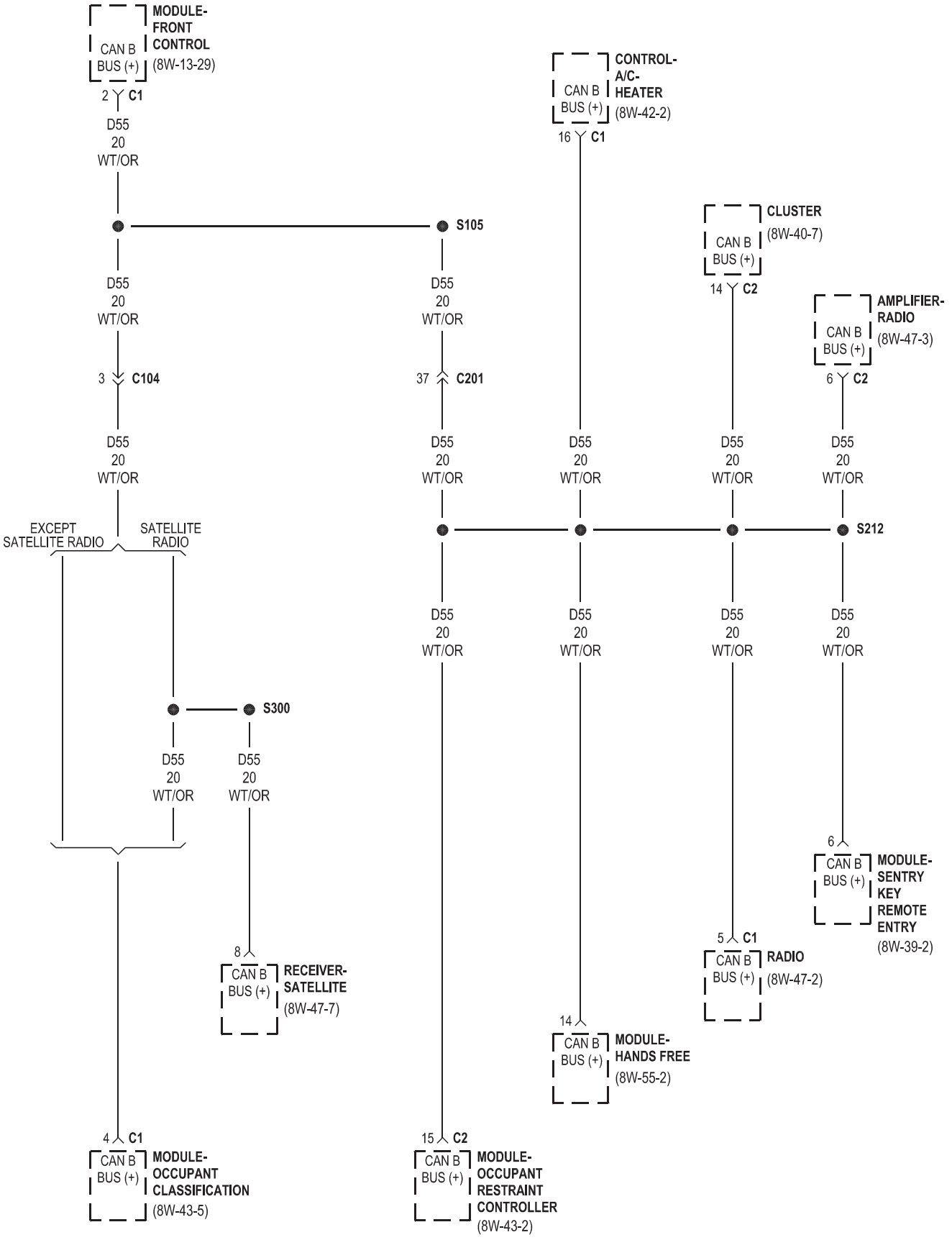

LATCH-
DOOR-
LEFT
FRONT
(8W-61-4)
2
MIRROR-
OUTSIDE
REARVIEW-
DRIVER
(8W-62-2)
5
SWITCH-
WINDOW/
DOOR
LOCK-
DRIVER
(8W-61-3)
3
C1
SWITCH-
WINDOW/
DOOR LOCK-
DRIVER
EXPRESS
(8W-61-2)
3
C1
CLUB
CAB
QUAD
CAB
Z940
20
BK
Z940
20
BK
Z940
20
BK
S321
SWITCH-
MIRROR
(8W-62-2)
4
SWITCH-
WINDOW/
DOOR
LOCK-
DRIVER
(8W-60-2)
(8W-61-3)
4
C1
SWITCH-
WINDOW/
DOOR LOCK-
DRIVER
EXPRESS
(8W-60-3)
(8W-61-2)
4
C1
CLUB
CAB
QUAD
CAB
Z940
20
BK
Z13
20
BK/WT
Z13
16
BK/WT
S322
LATCH-
DOOR-
LEFT
REAR
(8W-61-4)
2
Z13
16
BK/WT
Z941
20
BK
1
2
C300
3
C308
Z940
20
BK
Z13
16
BK/WT
Z941
20
BK
(8W-15-16)
G301

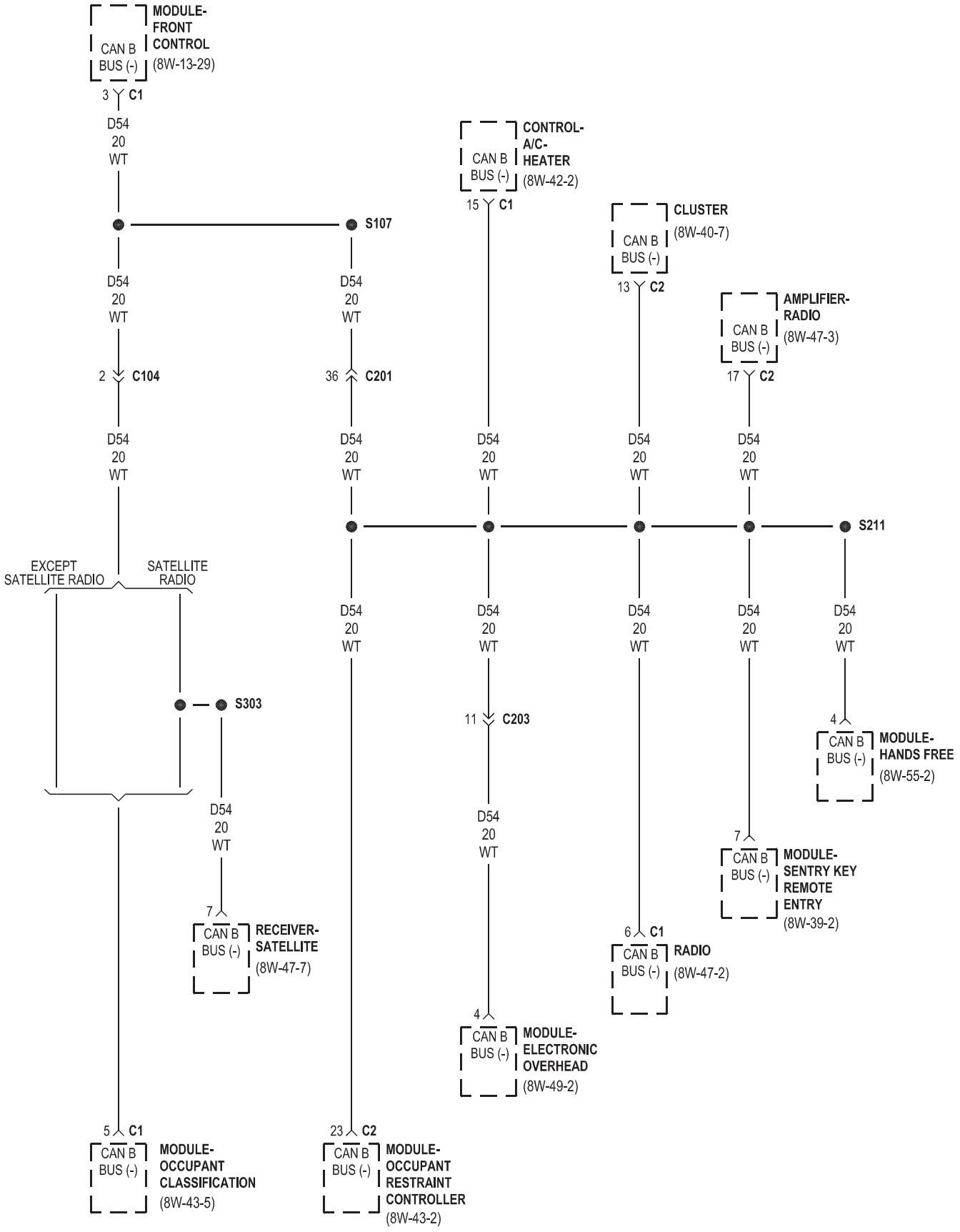

BACKLITE-HEATED
(8W-48-2)
MIRROR-INSIDE REARVIEW
(8W-49-3)
2 C1
LAMP-LICENSE-LEFT
(8W-51-2)
2
Z945
18
BK
7 C106
Z945
18
BK
15 C104
Z945
20
BK
WIRING-TRAILER TOW 7-WAY
(8W-54-3)
8
9
Z976
12
BK
Z976
12
BK
WIRING-TRAILER TOW 4-WAY
(8W-54-3)
1
Z976
12
BK
S315
Z976
12
BK
G302
LAMP-HIGH MOUNTED STOP
(8W-51-4)
2
4
Z945
20
BK
Z945
20
BK/OR
S304
SWITCH-SEAT BELT-DRIVER
(8W-43-2)
1
SWITCH-SEAT-DRIVER
(8W-63-2)
2
Z949
20
BK
Z975
12
BK
5
1
C307
RECEIVER-SATELLITE
(8W-47-7)
3
Z255
12
BK
Z957
20
BK/GY
Z945
20
BK
Z960
20
BK/DB
Z949
20
BK
Z975
12
BK
(8W-15-15)
G301

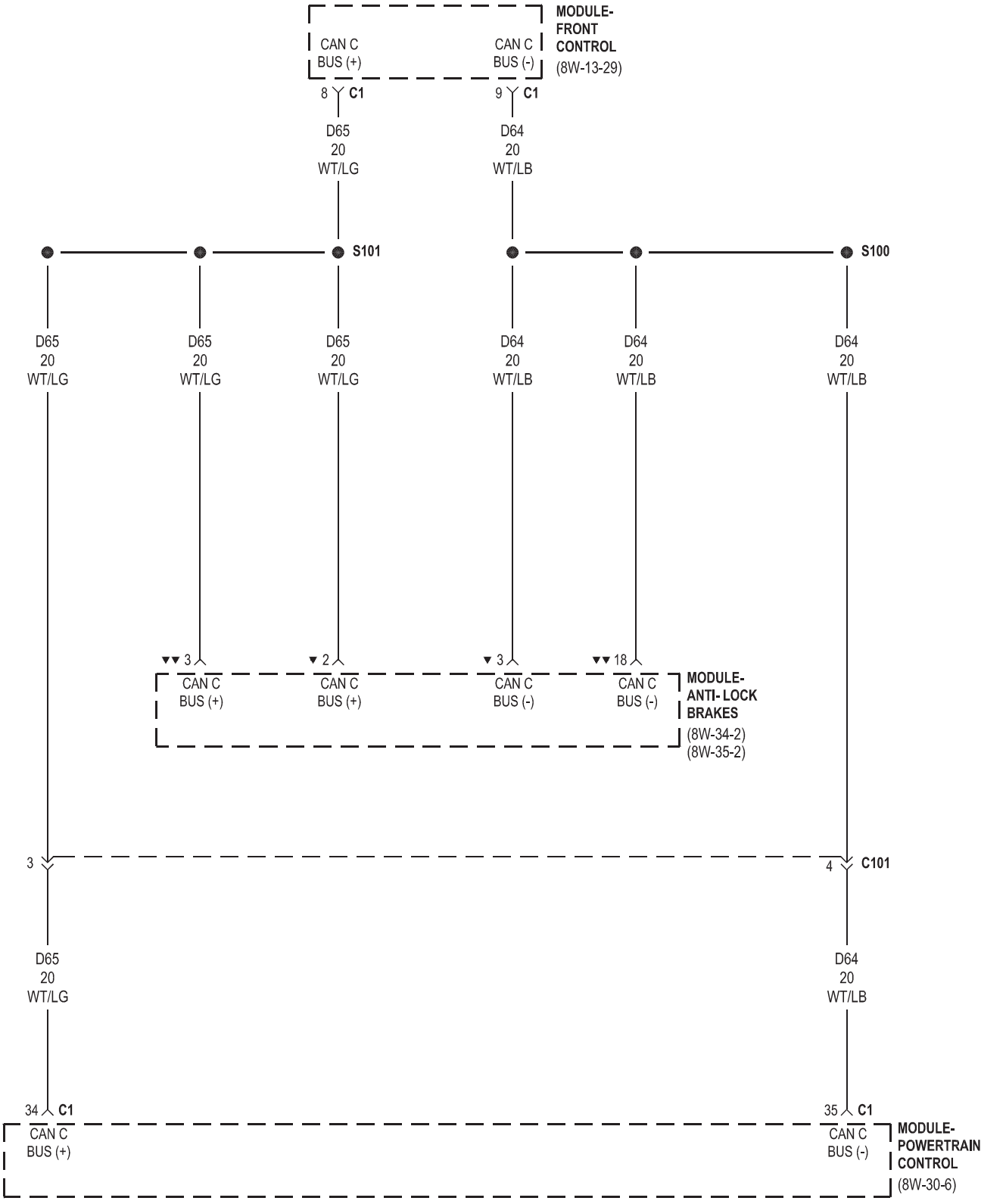
8W-18 BUS C0MMUNICATIONS

Component	Page
Amplifier-Radio	8W-18-3, 4
Cluster	8W-18-3, 4
Control-A/C-Heater	8W-18-3, 4
Data Link Connector	8W-18-2
Fuse 14	8W-18-2
G200	8W-18-2
Module-Anti-Lock Brakes	8W-18-5
Module-Electronic Overhead	8W-18-4
Module-Front Control	8W-18-2, 3, 4, 5
Module-Hands Free	8W-18-3, 4
Module-Integrated Power	8W-18-2
Module-Occupant Classification	8W-18-3, 4
Module-Occupant Restraint Controller	8W-18-3, 4
Module-Powertrain Control	8W-18-2, 5
Module-Sentry Key Remote Entry	8W-18-3, 4
Radio	8W-18-3, 4
Receiver-Satellite	8W-18-3, 4


BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
14
20A
(8W-13-15)
16
C3
A918
18
RD/LB
62
C201
BASE
EXCEPT
BASE
S206
(8W-13-15)
A918
18
RD/LB
16
7
D21
20
WT/GY
9
D16
20
WT/OR
12
D20
20
WT/LG
15
D15
20
BR/WT
6
D52
20
WT/LB
14
D51
20
PK/RD
4
5
DATA
LINK
CONNECTOR
42
48
44
47
13
11
C201
D21
20
WT/GY
D16
20
WT/OR
D20
20
WT/LG
D15
20
BR/WT
D52
20
WT/LB
D51
20
PK/RD
8
5
7
6
C101
D21
20
WT/GY
D16
20
WT/OR
D20
20
WT/LG
D15
20
BR/WT
Z11
18
BL/LG
Z111
18
BK/WT
36
C1
26
C1
25
C1
37
C1
SCI
TRANSMIT
(PCM)
SCI
RECEIVE
(TCM)
SCI
RECEIVE
(PCM)
SCI
TRANSMIT
(TCM)
MODULE-
POWERTRAIN
CONTROL
(8W-30-8)
G200
(8W-15-9)
5
C1
6
C1
CAN C
DIAGNOSTIC
(+)
CAN C
DIAGNOSTIC
(-)
MODULE-
FRONT
CONTROL
(8W-13-29)

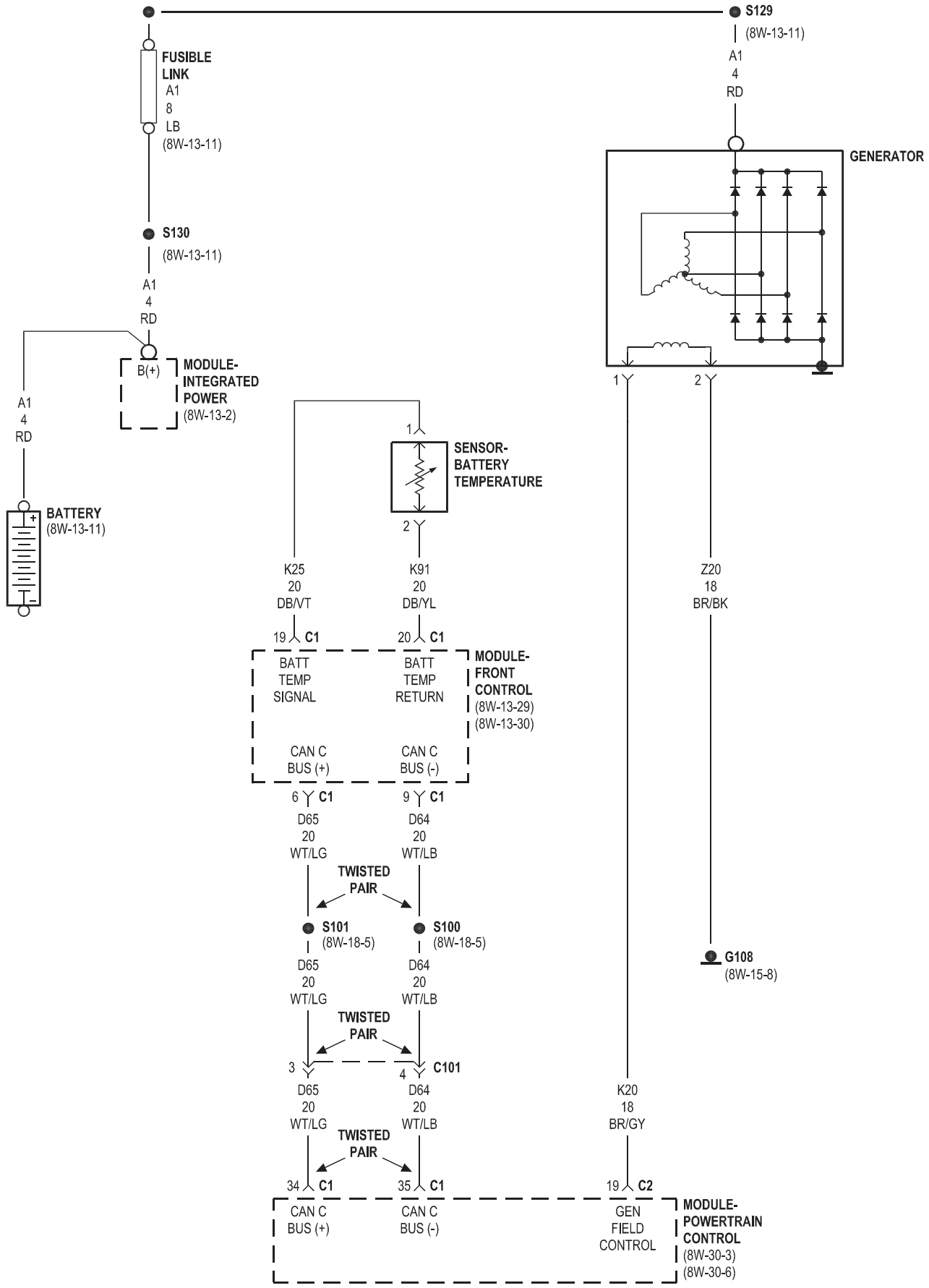

MODULE-FRONT CONTROL
CAN B BUS (+)
(8W-13-29)
2 C1
D55 20 WT/OR
S105
3 C104
37 C201
CONTROL-A/C-HEATER
16 C1
CLUSTER
14 C2
AMPLIFIER-RADIO
6 C2
EXCEPT SATELLITE RADIO
SATELLITE RADIO
S212
S300
8
RECEIVER-SATELLITE
(8W-47-7)
6
MODULE-SENTRY KEY REMOTE ENTRY
(8W-39-2)
5 C1
RADIO
(8W-47-2)
14
MODULE-HANDS FREE
(8W-55-2)
4 C1
MODULE-OCCUPANT CLASSIFICATION
(8W-43-5)
15 C2
MODULE-OCCUPANT RESTRAINT CONTROLLER
(8W-43-2)


MODULE-
FRONT
CONTROL
CAN B
BUS (-)
(8W-13-29)
3 C1
D54
20
WT
S107
2 C104
36 C201
CONTROL-
A/C-
HEATER
(8W-42-2)
15 C1
CLUSTER
(8W-40-7)
13 C2
AMPLIFIER-
RADIO
(8W-47-3)
17 C2
S211
EXCEPT
SATELLITE RADIO
SATELLITE
RADIO
S303
11 C203
4
MODULE-
HANDS FREE
(8W-55-2)
7
RECEIVER-
SATELLITE
(8W-47-7)
7
MODULE-
SENTRY KEY
REMOTE
ENTRY
(8W-39-2)
6 C1
RADIO
(8W-47-2)
4
MODULE-
ELECTRONIC
OVERHEAD
(8W-49-2)
5 C1
MODULE-
OCCUPANT
CLASSIFICATION
(8W-43-5)
23 C2
MODULE-
OCCUPANT
RESTRAINT
CONTROLLER
(8W-43-2)


MODULE-
FRONT
CONTROL
(8W-13-29)
CAN C
BUS (+)
CAN C
BUS (-)
8 C1
9 C1
D65
20
WT/LG
D64
20
WT/LB
S101
S100
D65
20
WT/LG
D65
20
WT/LG
D65
20
WT/LG
D64
20
WT/LB
D64
20
WT/LB
D64
20
WT/LB
▼▼ 3
▼ 2
▼ 3
▼▼ 18
CAN C
BUS (+)
CAN C
BUS (+)
CAN C
BUS (-)
CAN C
BUS (-)
MODULE-
ANTI- LOCK
BRAKES
(8W-34-2)
(8W-35-2)
3
4 C101
D65
20
WT/LG
D64
20
WT/LB
34 C1
35 C1
CAN C
BUS (+)
CAN C
BUS (-)
MODULE-
POWERTRAIN
CONTROL
(8W-30-6)
▼ RWAL
▼▼ AWAL

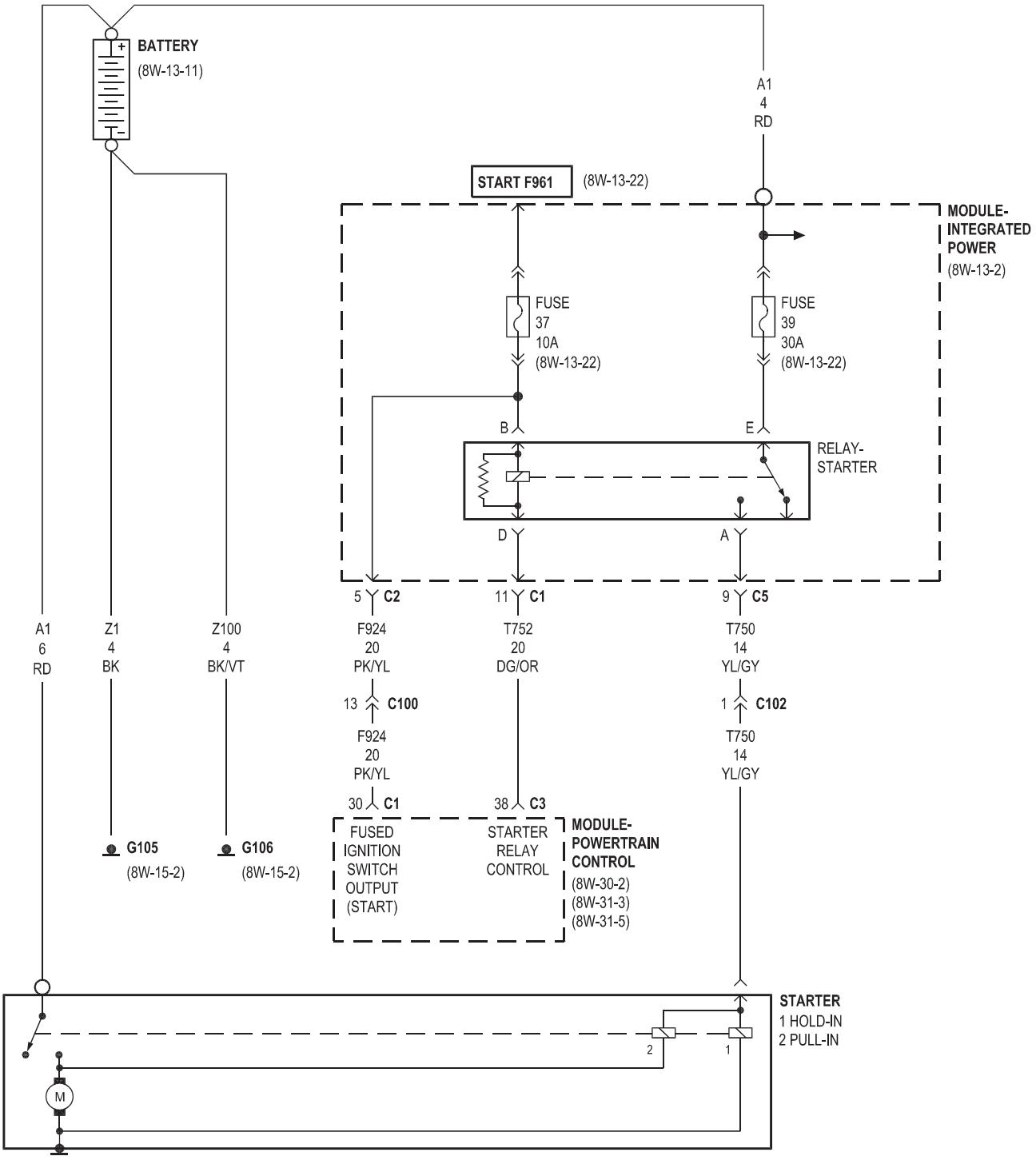
8W-20 CHARGING SYSTEM

Component	Page	Component	Page
Battery	8W-20-2	Module-Front Control	8W-20-2
Fusible Link	8W-20-2	Module-Integrated Power	8W-20-2
G108	8W-20-2	Module-Powertrain Control	8W-20-2
Generator	8W-20-2	Sensor-Battery Temperature	8W-20-2


S129
(8W-13-11)
A1
4
RD
GENERATOR
1
2
FUSIBLE
LINK
A1
8
LB
(8W-13-11)
S130
(8W-13-11)
A1
4
RD
B(+)
MODULE-
INTEGRATED
POWER
(8W-13-2)
A1
4
RD
BATTERY
(8W-13-11)
1
SENSOR-
BATTERY
TEMPERATURE
2
K25
20
DB/VT
K91
20
DB/YL
Z20
18
BR/BK
19 C1
20 C1
BATT
TEMP
SIGNAL
BATT
TEMP
RETURN
MODULE-
FRONT
CONTROL
(8W-13-29)
(8W-13-30)
CAN C
BUS (+)
CAN C
BUS (-)
6 C1
9 C1
D65
20
WT/LG
D64
20
WT/LB
TWISTED
PAIR
S101
(8W-18-5)
S100
(8W-18-5)
G108
(8W-15-8)
D65
20
WT/LG
D64
20
WT/LB
TWISTED
PAIR
3
4 C101
D65
20
WT/LG
D64
20
WT/LB
TWISTED
PAIR
K20
18
BR/GY
34 C1
35 C1
19 C2
CAN C
BUS (+)
CAN C
BUS (-)
GEN
FIELD
CONTROL
MODULE-
POWERTRAIN
CONTROL
(8W-30-3)
(8W-30-6)

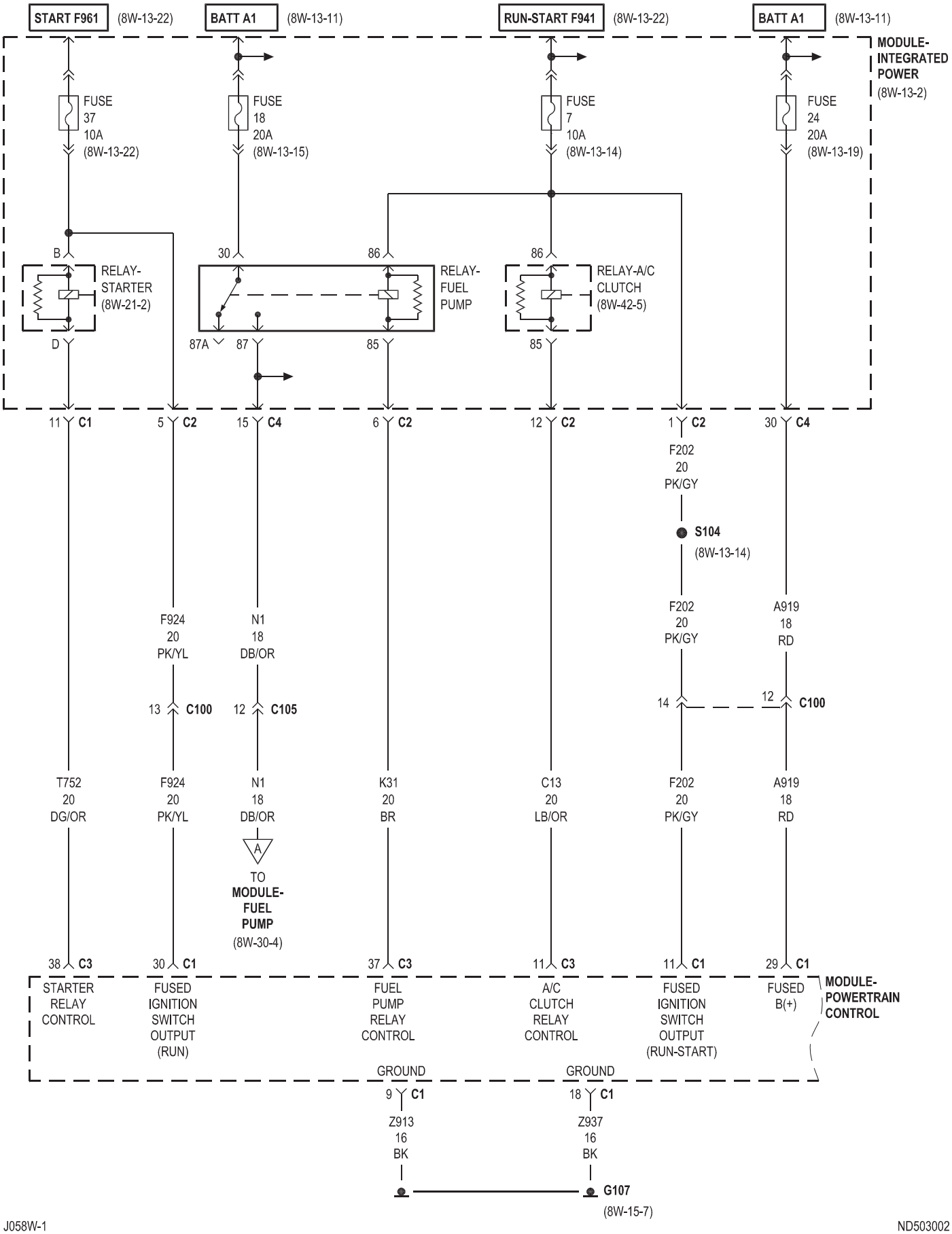
8W-21 STARTING SYSTEM

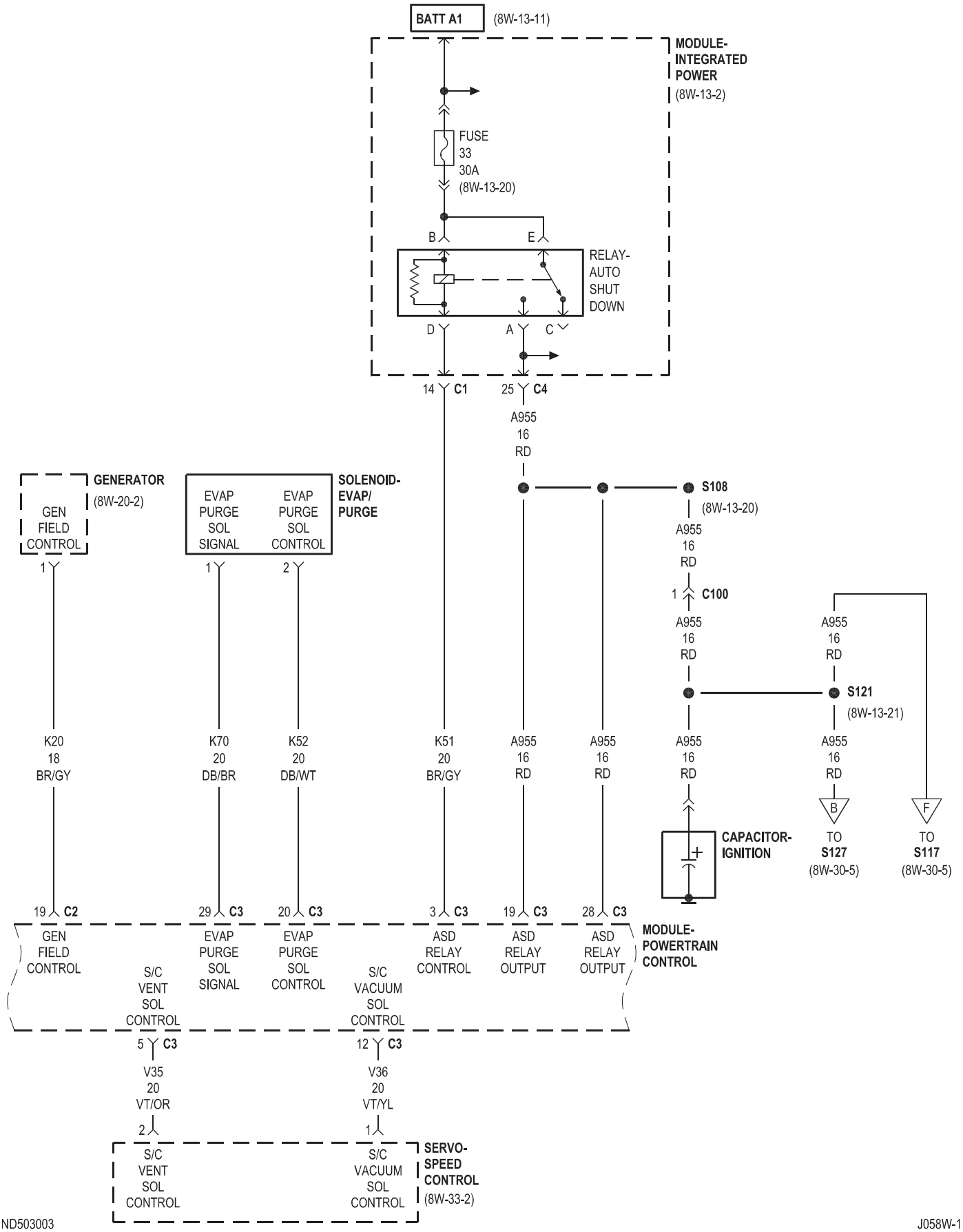
Component	Page
Battery	8W-21-2
Fuse 37	8W-21-2
Fuse 39	8W-21-2
G105	8W-21-2
G106	8W-21-2
Module-Integrated Power	8W-21-2
Module-Powertrain Control	8W-21-2
Relay-Starter	8W-21-2
Starter	8W-21-2

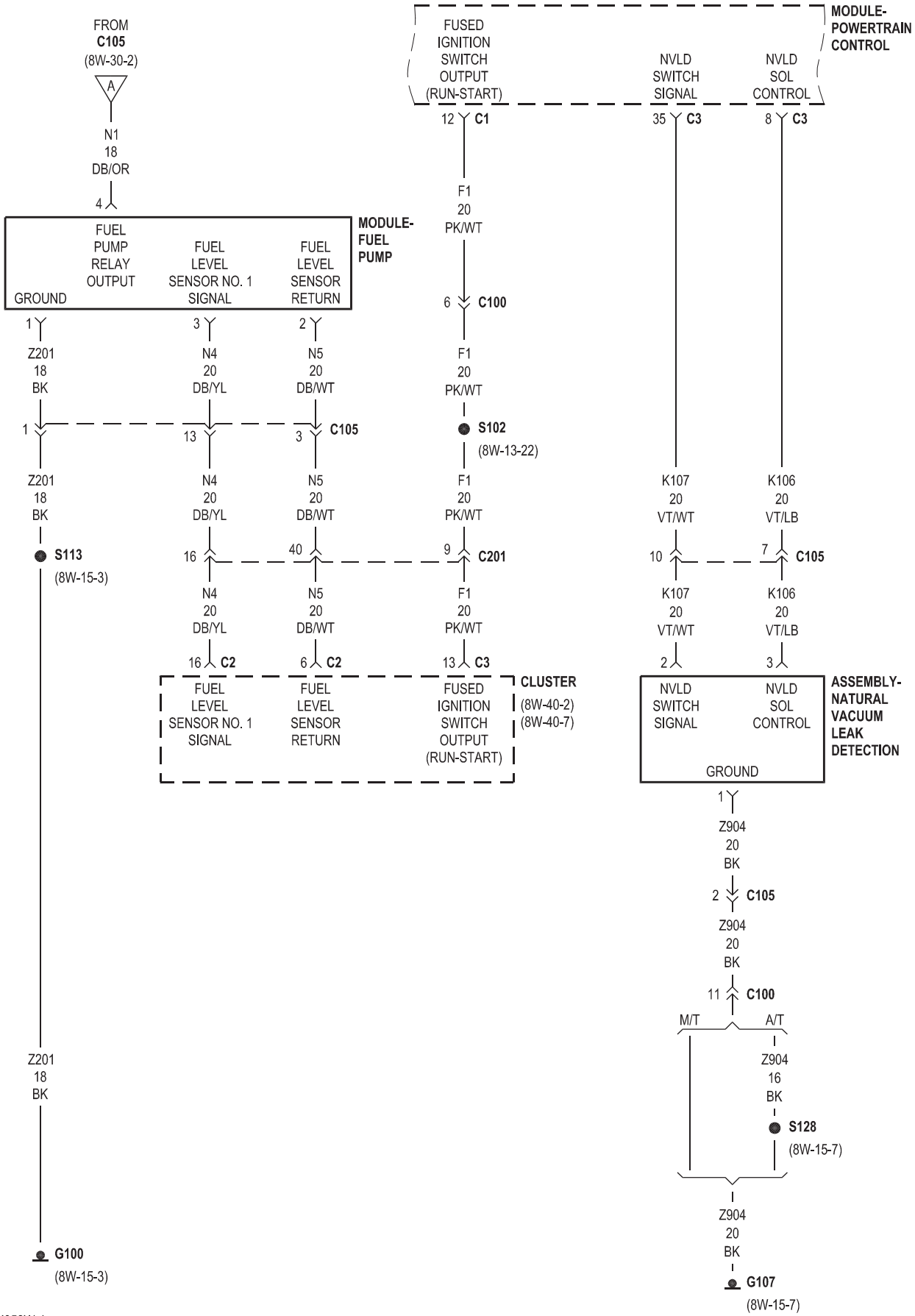

BATTERY
(8W-13-11)
A1
4
RD
START F961
(8W-13-22)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
37
10A
(8W-13-22)
FUSE
39
30A
(8W-13-22)
B
E
RELAY-
STARTER
D
A
5 C2
11 C1
9 C5
A1
6
RD
Z1
4
BK
Z100
4
BK/VT
F924
20
PK/YL
T752
20
DG/OR
T750
14
YL/GY
13 C100
1 C102
F924
20
PK/YL
T750
14
YL/GY
30 C1
38 C3
FUSED
IGNITION
SWITCH
OUTPUT
(START)
STARTER
RELAY
CONTROL
MODULE-
POWERTRAIN
CONTROL
(8W-30-2)
(8W-31-3)
(8W-31-5)
G105
(8W-15-2)
G106
(8W-15-2)
STARTER
1 HOLD-IN
2 PULL-IN
2
1
M

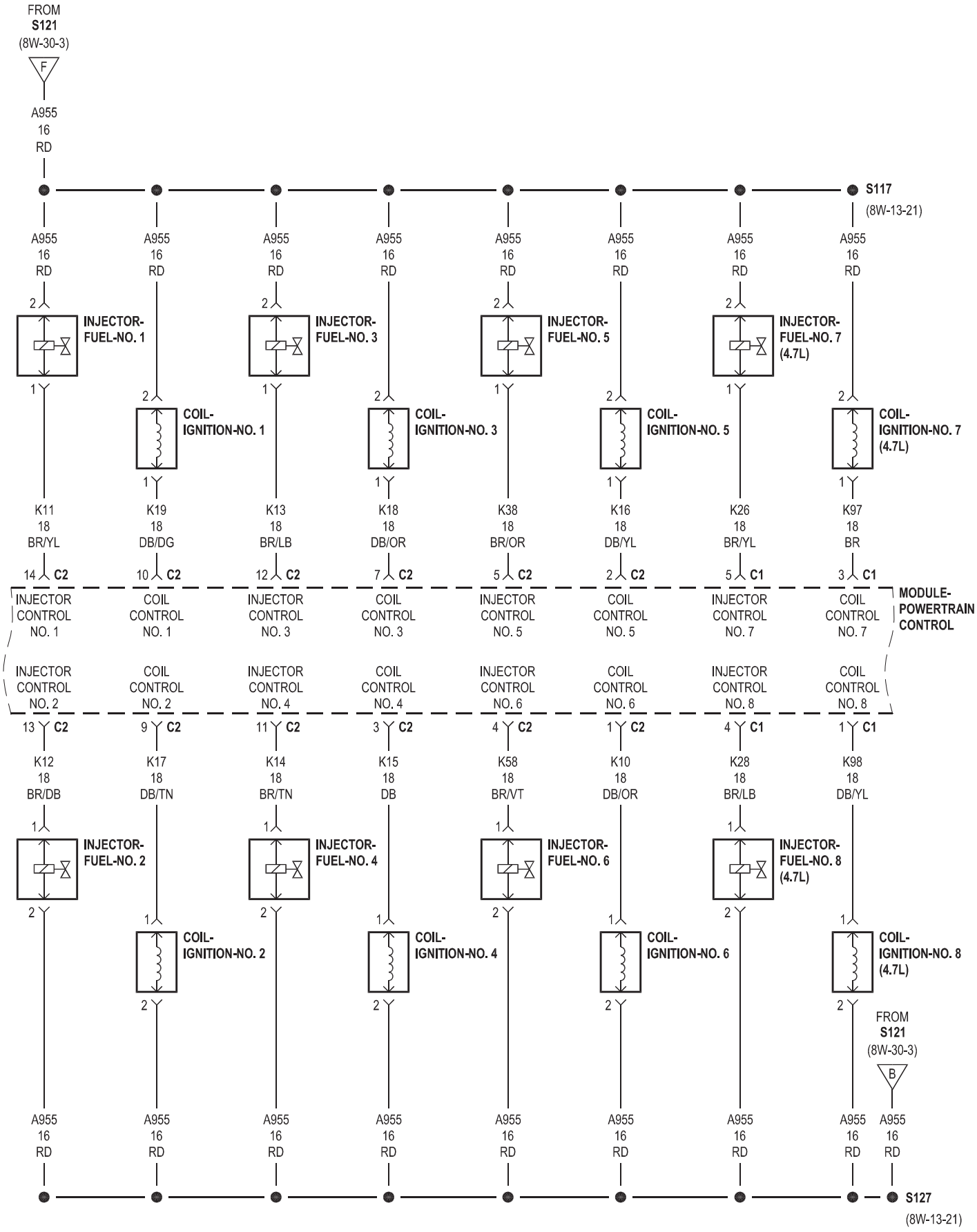
8W-30 FUEL/IGNITION SYSTEM

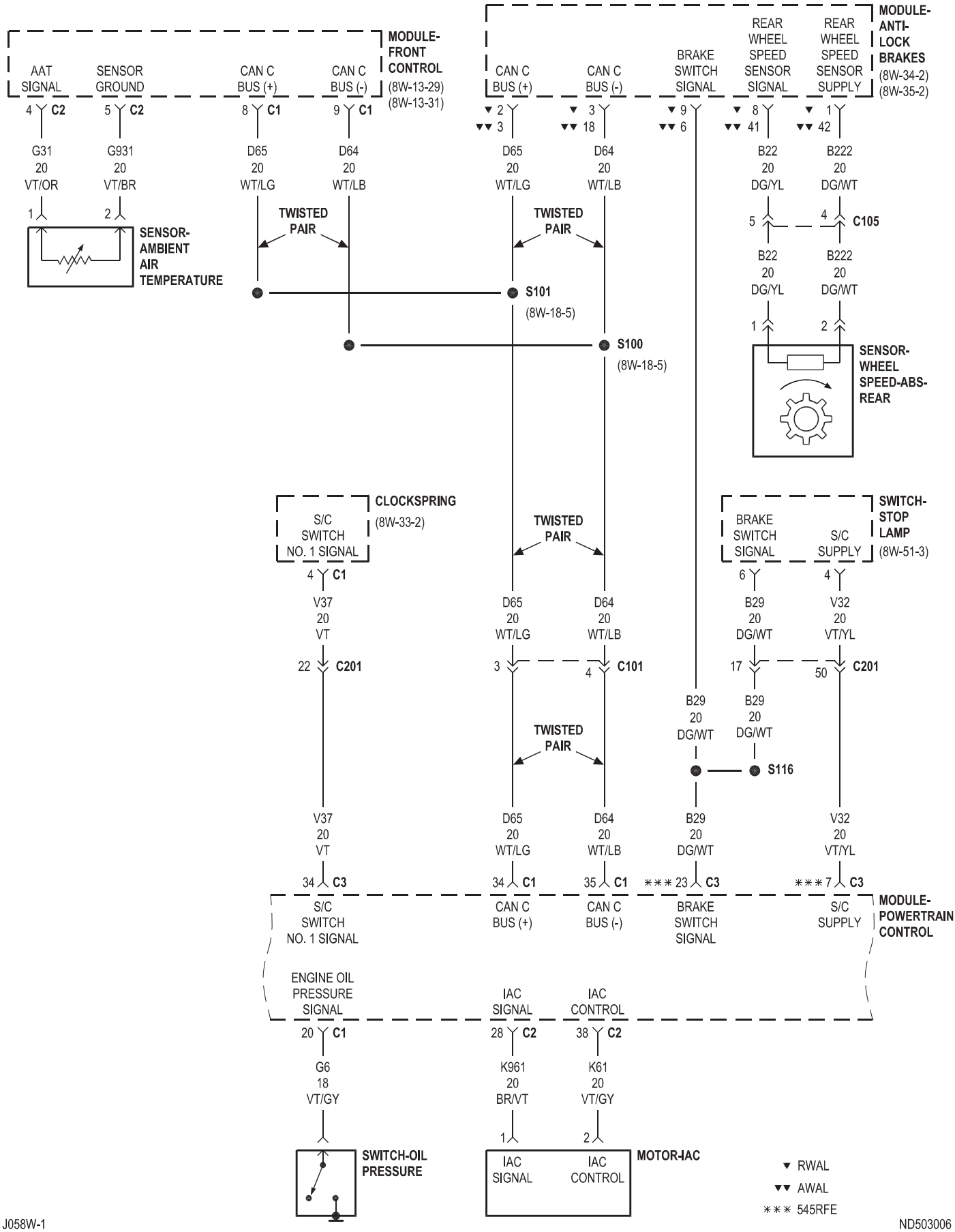
Component	Page
Assembly-Exhaust Gas Recirculation Valve	8W-30-7, 8
Assembly-Natural Vacuum Leak Detection	8W-30-4
Assembly-Transmission Solenoid/TRS	8W-30-8
Capacitor-Ignition	8W-30-3
Clockspring	8W-30-6
Cluster	8W-30-4
Coil-Ignition-No. 1	8W-30-5
Coil-Ignition-No. 2	8W-30-5
Coil-Ignition-No. 3	8W-30-5
Coil-Ignition-No. 4	8W-30-5
Coil-Ignition-No. 5	8W-30-5
Coil-Ignition-No. 6	8W-30-5
Coil-Ignition-No. 7	8W-30-5
Coil-Ignition-No. 8	8W-30-5
Data Link Connector	8W-30-8
Fuse 7	8W-30-2
Fuse 18	8W-30-2
Fuse 24	8W-30-2
Fuse 33	8W-30-3
Fuse 37	8W-30-2
G100	8W-30-4
G107	8W-30-2, 4
G108	8W-30-8, 9
Generator	8W-30-3
Injector-Fuel-No. 1	8W-30-5
Injector-Fuel-No. 2	8W-30-5
Injector-Fuel-No. 3	8W-30-5
Injector-Fuel-No. 4	8W-30-5
Injector-Fuel-No. 5	8W-30-5
Injector-Fuel-No. 6	8W-30-5
Injector-Fuel-No. 7	8W-30-5
Injector-Fuel-No. 8	8W-30-5
Module-Anti-Lock Brakes	8W-30-6
Module-Front Control	8W-30-6
Module-Fuel Pump	8W-30-2, 4
Module-Integrated Power	8W-30-2, 3
Module-Powertrain Control	8W-30-2, 3, 4, 5, 6, 7, 8, 9
Motor-Iac	8W-30-6
Relay-A/C Clutch	8W-30-2
Relay-Auto Shut Down	8W-30-3
Relay-Fuel Pump	8W-30-2
Relay-Starter	8W-30-2
Sensor-Ambient Air Temperature	8W-30-6
Sensor-Camshaft Position	8W-30-7
Sensor-Crankshaft Position	8W-30-7
Sensor-Engine Coolant Temperature	8W-30-8
Sensor-Intake Air Temperature	8W-30-7
Sensor-Knock	8W-30-7
Sensor-Map	8W-30-7
Sensor-Oxygen-Left Front	8W-30-9
Sensor-Oxygen-Left Rear	8W-30-9
Sensor-Oxygen-Right Front	8W-30-9
Sensor-Oxygen-Right Rear	8W-30-9
Sensor-Throttle Position	8W-30-7
Sensor-Transmission Range	8W-30-8
Sensor-Wheel Speed-Abs-Rear	8W-30-6
Servo-Speed Control	8W-30-3
Solenoid-EVAP/Purge	8W-30-3
Switch-Clutch Interlock	8W-30-8
Switch-Oil Pressure	8W-30-6
Switch-Stop Lamp	8W-30-6

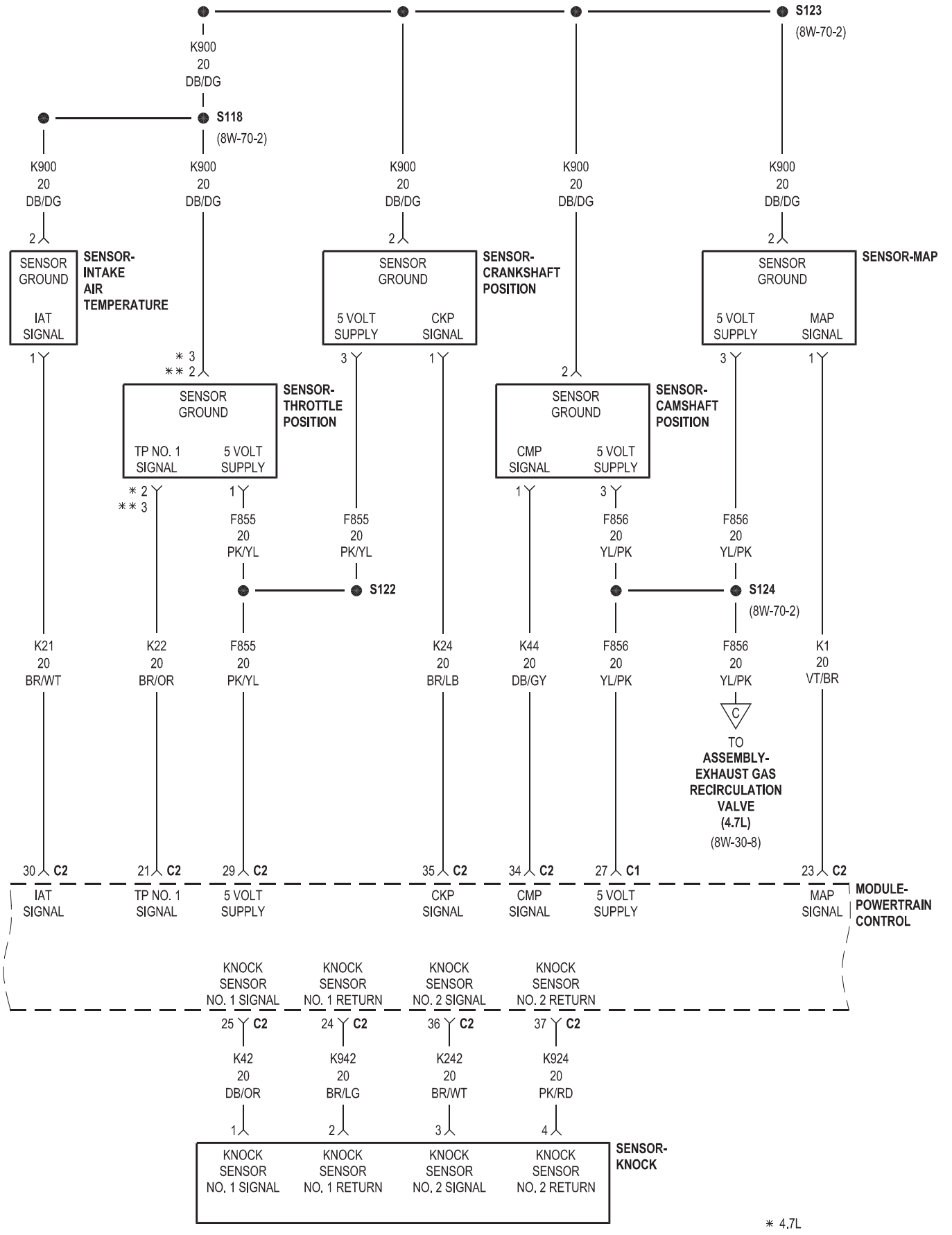

START F961
(8W-13-22)
BATT A1
(8W-13-11)
RUN-START F941
(8W-13-22)
BATT A1
(8W-13-11)
MODULE-INTEGRATED POWER
(8W-13-2)
FUSE 37 10A (8W-13-22)
FUSE 18 20A (8W-13-15)
FUSE 7 10A (8W-13-14)
FUSE 24 20A (8W-13-19)
RELAY-STARTER (8W-21-2)
RELAY-FUEL PUMP
RELAY-A/C CLUTCH (8W-42-5)
B
D
30
87A
87
86
85
86
85
11 C1
5 C2
15 C4
6 C2
12 C2
1 C2
30 C4
F202 20 PK/GY
S104
(8W-13-14)
F924 20 PK/YL
N1 18 DB/OR
F202 20 PK/GY
A919 18 RD
13 C100
12 C105
14
12 C100
T752 20 DG/OR
F924 20 PK/YL
N1 18 DB/OR
K31 20 BR
C13 20 LB/OR
F202 20 PK/GY
A919 18 RD
A
TO MODULE-FUEL PUMP
(8W-30-4)
38 C3
30 C1
37 C3
11 C3
11 C1
29 C1
MODULE-POWERTRAIN CONTROL
STARTER RELAY CONTROL
FUSED IGNITION SWITCH OUTPUT (RUN)
FUEL PUMP RELAY CONTROL
A/C CLUTCH RELAY CONTROL
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUSED B(+)
GROUND
GROUND
9 C1
18 C1
Z913 16 BK
Z937 16 BK
G107
(8W-15-7)

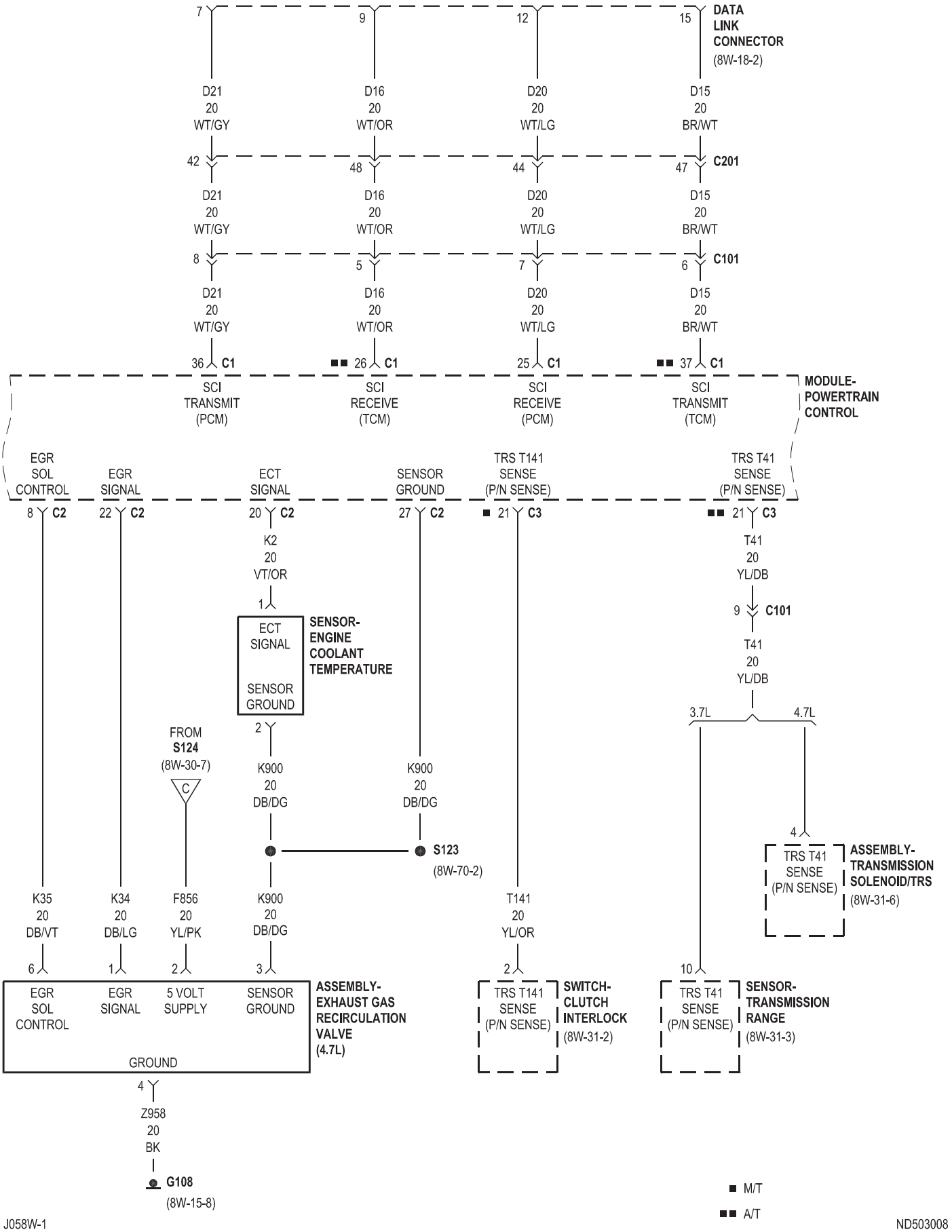

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
33
30A
(8W-13-20)
B
E
RELAY-
AUTO
SHUT
DOWN
D
A
C
14 C1
25 C4
A955
16
RD
S108
(8W-13-20)
A955
16
RD
1 C100
A955
16
RD
S121
(8W-13-21)
A955
16
RD
GENERATOR
(8W-20-2)
GEN
FIELD
CONTROL
1
EVAP
PURGE
SOL
SIGNAL
EVAP
PURGE
SOL
CONTROL
SOLENOID-
EVAP/
PURGE
1
2
K20
18
BR/GY
K70
20
DB/BR
K52
20
DB/WT
K51
20
BR/GY
A955
16
RD
A955
16
RD
A955
16
RD
A955
16
RD
CAPACITOR-
IGNITION
B
TO
S127
(8W-30-5)
F
TO
S117
(8W-30-5)
19 C2
29 C3
20 C3
3 C3
19 C3
28 C3
GEN
FIELD
CONTROL
S/C
VENT
SOL
CONTROL
EVAP
PURGE
SOL
SIGNAL
EVAP
PURGE
SOL
CONTROL
S/C
VACUUM
SOL
CONTROL
ASD
RELAY
CONTROL
ASD
RELAY
OUTPUT
ASD
RELAY
OUTPUT
MODULE-
POWERTRAIN
CONTROL
5 C3
12 C3
V35
20
VT/OR
V36
20
VT/YL
2
1
S/C
VENT
SOL
CONTROL
S/C
VACUUM
SOL
CONTROL
SERVO-
SPEED
CONTROL
(8W-33-2)

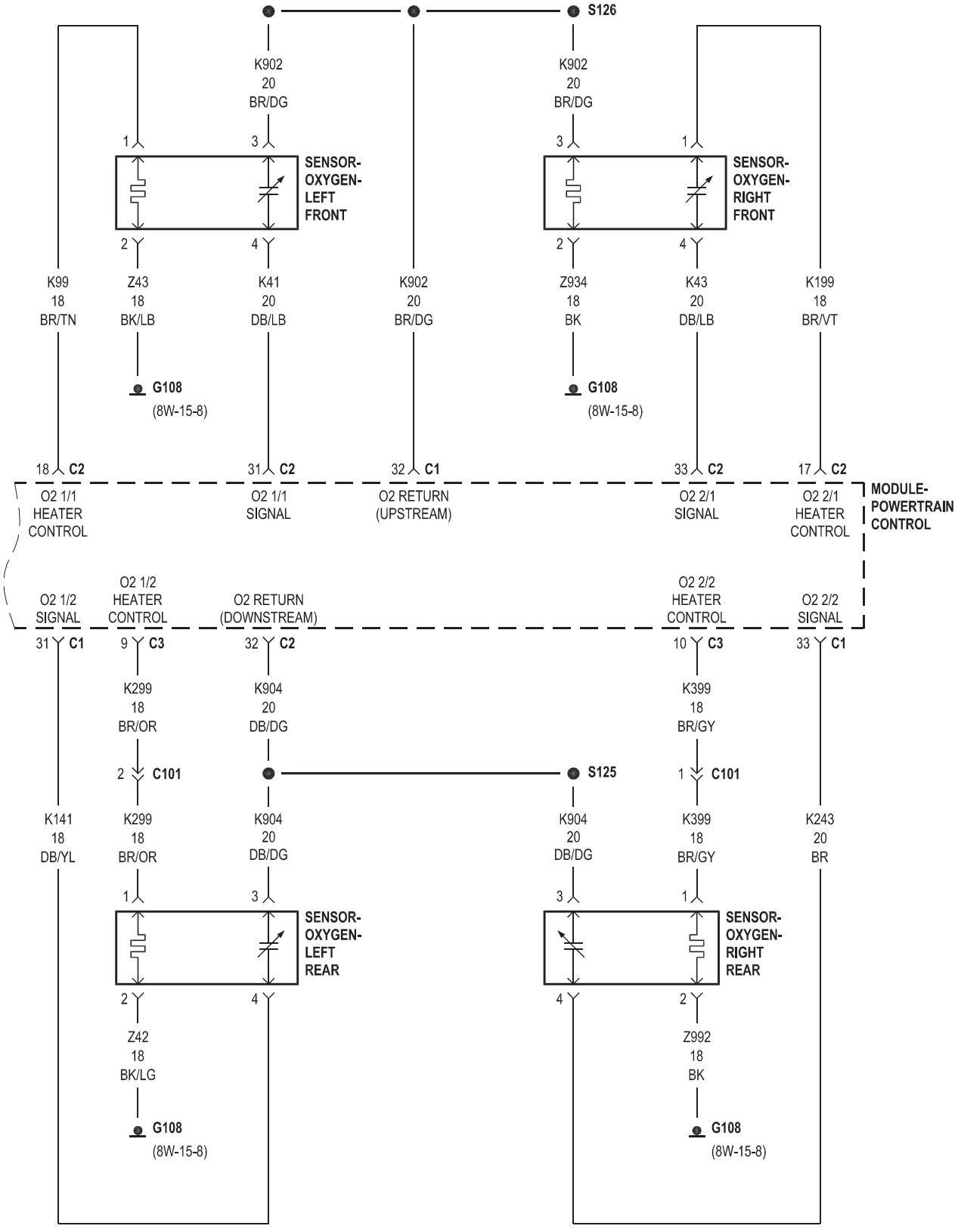

FROM C105 (8W-30-2)
A
N1 18 DB/OR
4
MODULE-FUEL PUMP
FUEL PUMP RELAY OUTPUT
FUEL LEVEL SENSOR NO. 1 SIGNAL
FUEL LEVEL SENSOR RETURN
GROUND
1
3
2
Z201 18 BK
N4 20 DB/YL
N5 20 DB/WT
1
13
3
C105
Z201 18 BK
N4 20 DB/YL
N5 20 DB/WT
S113
(8W-15-3)
16
40
N4 20 DB/YL
N5 20 DB/WT
16 C2
6 C2
CLUSTER
FUEL LEVEL SENSOR NO. 1 SIGNAL
FUEL LEVEL SENSOR RETURN
FUSED IGNITION SWITCH OUTPUT (RUN-START)
(8W-40-2)
(8W-40-7)
Z201 18 BK
G100
(8W-15-3)
MODULE-POWERTRAIN CONTROL
FUSED IGNITION SWITCH OUTPUT (RUN-START)
NVLD SWITCH SIGNAL
NVLD SOL CONTROL
12 C1
35 C3
8 C3
F1 20 PK/WT
6 C100
F1 20 PK/WT
S102
(8W-13-22)
F1 20 PK/WT
9 C201
F1 20 PK/WT
13 C3
K107 20 VT/WT
K106 20 VT/LB
10
7
C105
K107 20 VT/WT
K106 20 VT/LB
2
3
ASSEMBLY-NATURAL VACUUM LEAK DETECTION
NVLD SWITCH SIGNAL
NVLD SOL CONTROL
GROUND
1
Z904 20 BK
2 C105
Z904 20 BK
11 C100
M/T
A/T
Z904 16 BK
S128
(8W-15-7)
Z904 20 BK
G107
(8W-15-7)


FROM S121 (8W-30-3)
F
A955 16 RD
S117 (8W-13-21)
INJECTOR-FUEL-NO. 1
INJECTOR-FUEL-NO. 3
INJECTOR-FUEL-NO. 5
INJECTOR-FUEL-NO. 7 (4.7L)
COIL-IGNITION-NO. 1
COIL-IGNITION-NO. 3
COIL-IGNITION-NO. 5
COIL-IGNITION-NO. 7 (4.7L)
K11 18 BR/YL
K19 18 DB/DG
K13 18 BR/LB
K18 18 DB/OR
K38 18 BR/OR
K16 18 DB/YL
K26 18 BR/YL
K97 18 BR
14 C2
10 C2
12 C2
7 C2
5 C2
2 C2
5 C1
3 C1
INJECTOR CONTROL NO. 1
COIL CONTROL NO. 1
INJECTOR CONTROL NO. 3
COIL CONTROL NO. 3
INJECTOR CONTROL NO. 5
COIL CONTROL NO. 5
INJECTOR CONTROL NO. 7
COIL CONTROL NO. 7
MODULE-POWERTRAIN CONTROL
INJECTOR CONTROL NO. 2
COIL CONTROL NO. 2
INJECTOR CONTROL NO. 4
COIL CONTROL NO. 4
INJECTOR CONTROL NO. 6
COIL CONTROL NO. 6
INJECTOR CONTROL NO. 8
COIL CONTROL NO. 8
13 C2
9 C2
11 C2
3 C2
4 C2
1 C2
4 C1
1 C1
K12 18 BR/DB
K17 18 DB/TN
K14 18 BR/TN
K15 18 DB
K58 18 BR/VT
K10 18 DB/OR
K28 18 BR/LB
K98 18 DB/YL
INJECTOR-FUEL-NO. 2
INJECTOR-FUEL-NO. 4
INJECTOR-FUEL-NO. 6
INJECTOR-FUEL-NO. 8 (4.7L)
COIL-IGNITION-NO. 2
COIL-IGNITION-NO. 4
COIL-IGNITION-NO. 6
COIL-IGNITION-NO. 8 (4.7L)
FROM S121 (8W-30-3)
B
S127 (8W-13-21)


MODULE-FRONT CONTROL
(8W-13-29)
(8W-13-31)
AAT SIGNAL
SENSOR GROUND
CAN C BUS (+)
CAN C BUS (-)
4 C2
5 C2
8 C1
9 C1
G31 20 VT/OR
G931 20 VT/BR
D65 20 WT/LG
D64 20 WT/LB
1
2
SENSOR-AMBIENT AIR TEMPERATURE
TWISTED PAIR
TWISTED PAIR
S101
(8W-18-5)
S100
(8W-18-5)
MODULE-ANTI-LOCK BRAKES
(8W-34-2)
(8W-35-2)
CAN C BUS (+)
CAN C BUS (-)
BRAKE SWITCH SIGNAL
REAR WHEEL SPEED SENSOR SIGNAL
REAR WHEEL SPEED SENSOR SUPPLY
▼ 2 ▼▼ 3
▼ 3 ▼▼ 18
▼ 9 ▼▼ 6
▼ 8 ▼▼ 41
▼ 1 ▼▼ 42
D65 20 WT/LG
D64 20 WT/LB
B22 20 DG/YL
B222 20 DG/WT
5
4 C105
B22 20 DG/YL
B222 20 DG/WT
1
2
SENSOR-WHEEL SPEED-ABS-REAR
CLOCKSPRING
(8W-33-2)
S/C SWITCH NO. 1 SIGNAL
4 C1
V37 20 VT
22 C201
TWISTED PAIR
TWISTED PAIR
D65 20 WT/LG
D64 20 WT/LB
3 C101
4 C101
SWITCH-STOP LAMP
(8W-51-3)
BRAKE SWITCH SIGNAL
S/C SUPPLY
6
4
B29 20 DG/WT
V32 20 VT/YL
17 C201
50 C201
B29 20 DG/WT
B29 20 DG/WT
S116
V37 20 VT
D65 20 WT/LG
D64 20 WT/LB
B29 20 DG/WT
V32 20 VT/YL
34 C3
34 C1
35 C1
*** 23 C3
*** 7 C3
MODULE-POWERTRAIN CONTROL
S/C SWITCH NO. 1 SIGNAL
CAN C BUS (+)
CAN C BUS (-)
BRAKE SWITCH SIGNAL
S/C SUPPLY
ENGINE OIL PRESSURE SIGNAL
IAC SIGNAL
IAC CONTROL
20 C1
28 C2
38 C2
G6 18 VT/GY
K961 20 BR/VT
K61 20 VT/GY
1
2
SWITCH-OIL PRESSURE
MOTOR-IAC
IAC SIGNAL
IAC CONTROL
▼ RWAL
▼▼ AWAL
*** 545RFE

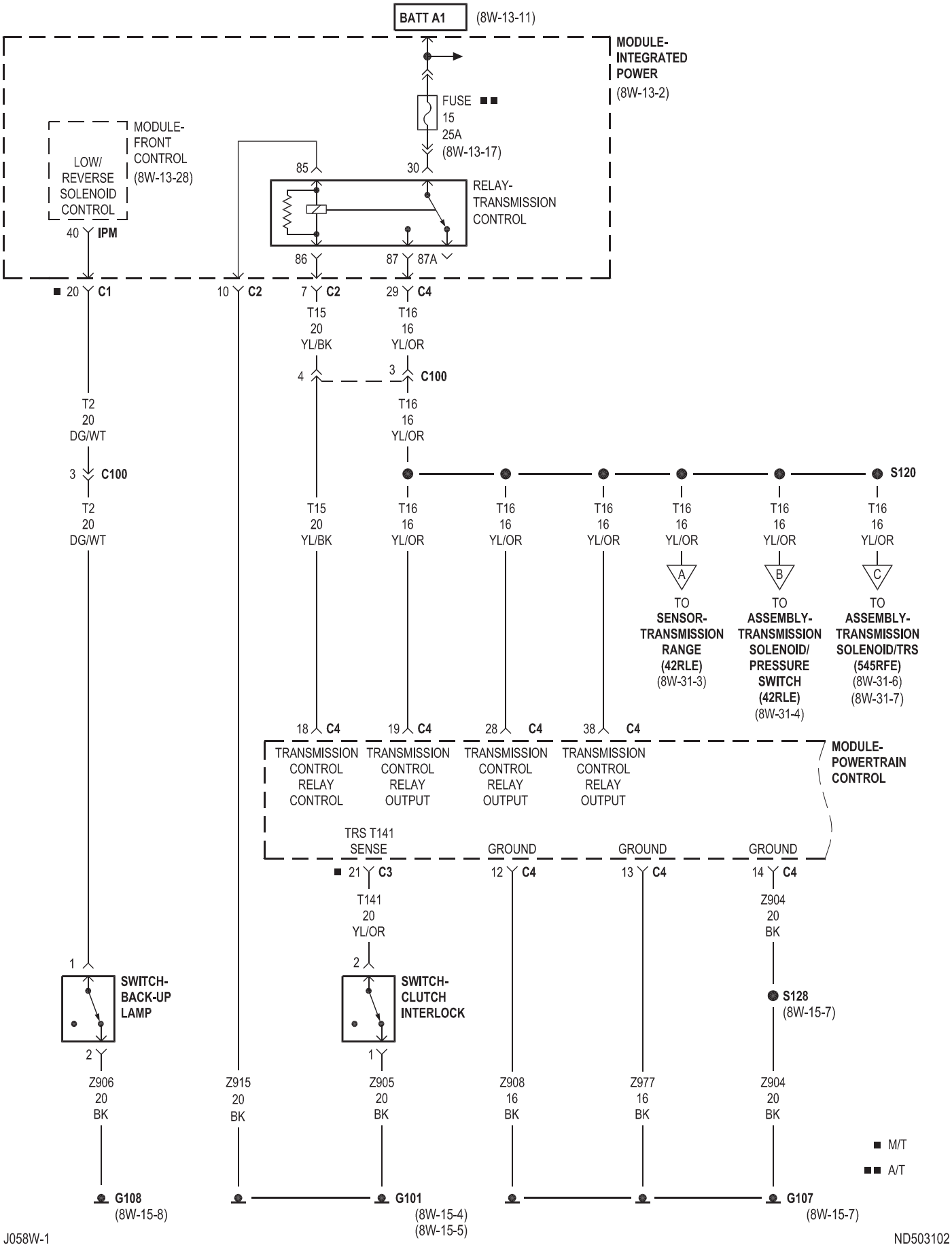

S123
(8W-70-2)
K900
20
DB/DG
S118
(8W-70-2)
K900
20
DB/DG
2
SENSOR
GROUND
IAT
SIGNAL
SENSOR-
INTAKE
AIR
TEMPERATURE
1
K21
20
BR/WT
30 C2
IAT
SIGNAL
* 3
** 2
SENSOR
GROUND
TP NO. 1
SIGNAL
5 VOLT
SUPPLY
SENSOR-
THROTTLE
POSITION
* 2
** 3
K22
20
BR/OR
21 C2
TP NO. 1
SIGNAL
1
F855
20
PK/YL
S122
F855
20
PK/YL
F855
20
PK/YL
29 C2
5 VOLT
SUPPLY
3
SENSOR
GROUND
5 VOLT
SUPPLY
CKP
SIGNAL
SENSOR-
CRANKSHAFT
POSITION
1
K24
20
BR/LB
35 C2
CKP
SIGNAL
2
SENSOR
GROUND
CMP
SIGNAL
5 VOLT
SUPPLY
SENSOR-
CAMSHAFT
POSITION
1
K44
20
DB/GY
34 C2
CMP
SIGNAL
3
F856
20
YL/PK
S124
(8W-70-2)
F856
20
YL/PK
27 C1
5 VOLT
SUPPLY
3
SENSOR
GROUND
5 VOLT
SUPPLY
MAP
SIGNAL
SENSOR-MAP
F856
20
YL/PK
C
TO
ASSEMBLY-
EXHAUST GAS
RECIRCULATION
VALVE
(4.7L)
(8W-30-8)
1
K1
20
VT/BR
23 C2
MAP
SIGNAL
MODULE-
POWERTRAIN
CONTROL
KNOCK
SENSOR
NO. 1 SIGNAL
KNOCK
SENSOR
NO. 1 RETURN
KNOCK
SENSOR
NO. 2 SIGNAL
KNOCK
SENSOR
NO. 2 RETURN
25 C2
24 C2
36 C2
37 C2
K42
20
DB/OR
K942
20
BR/LG
K242
20
BR/WT
K924
20
PK/RD
1
2
3
4
KNOCK
SENSOR
NO. 1 SIGNAL
KNOCK
SENSOR
NO. 1 RETURN
KNOCK
SENSOR
NO. 2 SIGNAL
KNOCK
SENSOR
NO. 2 RETURN
SENSOR-
KNOCK
* 4.7L
** 3.7L

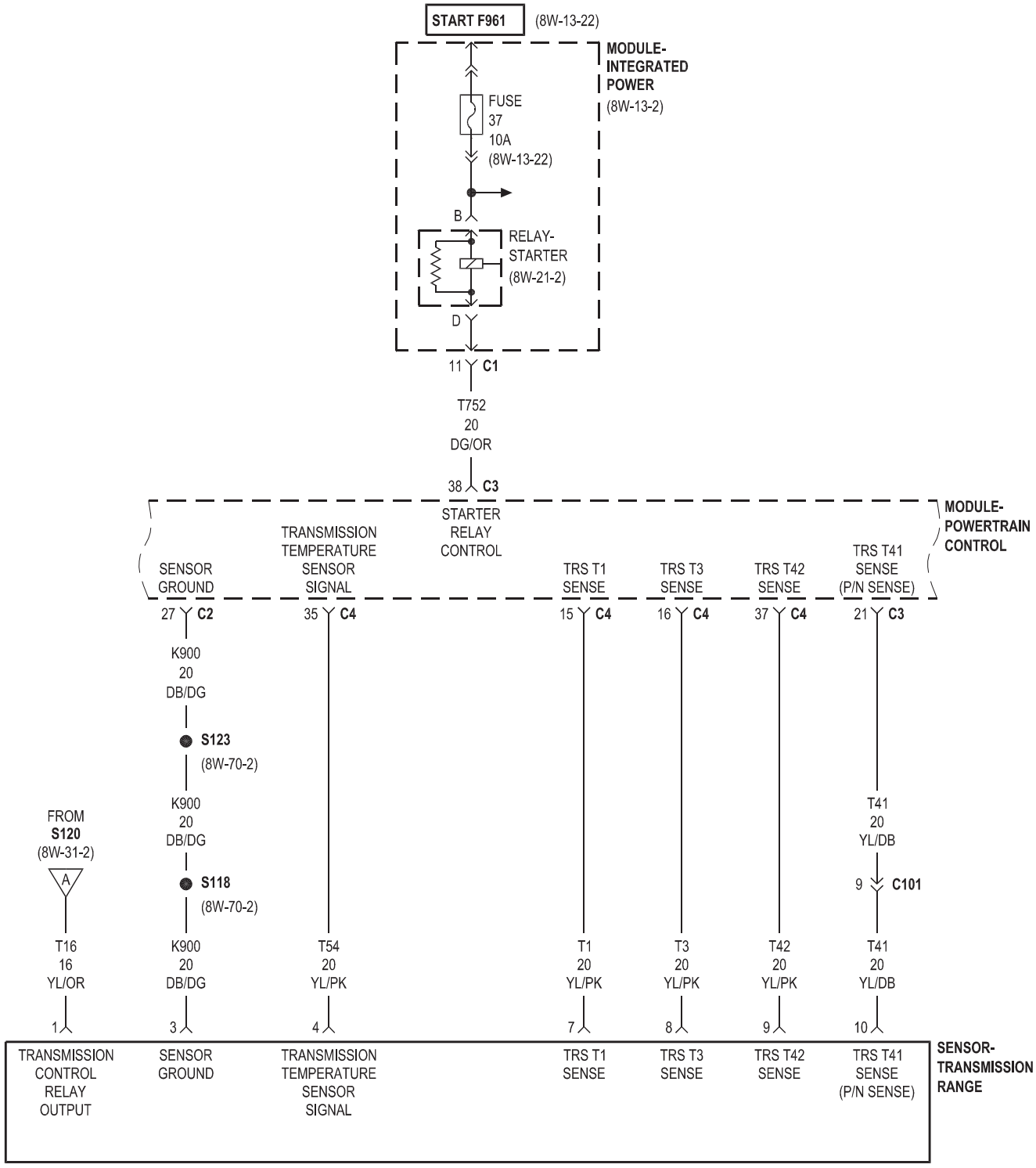

7
9
12
15
DATA LINK CONNECTOR
(8W-18-2)
D21 20 WT/GY
D16 20 WT/OR
D20 20 WT/LG
D15 20 BR/WT
42
48
44
47
C201
D21 20 WT/GY
D16 20 WT/OR
D20 20 WT/LG
D15 20 BR/WT
8
5
7
6
C101
D21 20 WT/GY
D16 20 WT/OR
D20 20 WT/LG
D15 20 BR/WT
36 C1
26 C1
25 C1
37 C1
SCI TRANSMIT (PCM)
SCI RECEIVE (TCM)
SCI RECEIVE (PCM)
SCI TRANSMIT (TCM)
MODULE-POWERTRAIN CONTROL
EGR SOL CONTROL
EGR SIGNAL
ECT SIGNAL
SENSOR GROUND
TRS T141 SENSE (P/N SENSE)
TRS T41 SENSE (P/N SENSE)
8 C2
22 C2
20 C2
27 C2
21 C3
21 C3
K2 20 VT/OR
T41 20 YL/DB
1
9 C101
ECT SIGNAL
SENSOR GROUND
SENSOR-ENGINE COOLANT TEMPERATURE
T41 20 YL/DB
2
3.7L
4.7L
FROM S124 (8W-30-7)
C
K900 20 DB/DG
K900 20 DB/DG
S123
(8W-70-2)
4
TRS T41 SENSE (P/N SENSE)
ASSEMBLY-TRANSMISSION SOLENOID/TRS
(8W-31-6)
K35 20 DB/VT
K34 20 DB/LG
F856 20 YL/PK
K900 20 DB/DG
T141 20 YL/OR
6
1
2
3
2
10
EGR SOL CONTROL
EGR SIGNAL
5 VOLT SUPPLY
SENSOR GROUND
GROUND
ASSEMBLY-EXHAUST GAS RECIRCULATION VALVE (4.7L)
TRS T141 SENSE (P/N SENSE)
SWITCH-CLUTCH INTERLOCK
(8W-31-2)
TRS T41 SENSE (P/N SENSE)
SENSOR-TRANSMISSION RANGE
(8W-31-3)
4
Z958 20 BK
G108
(8W-15-8)
■ M/T
■■ A/T

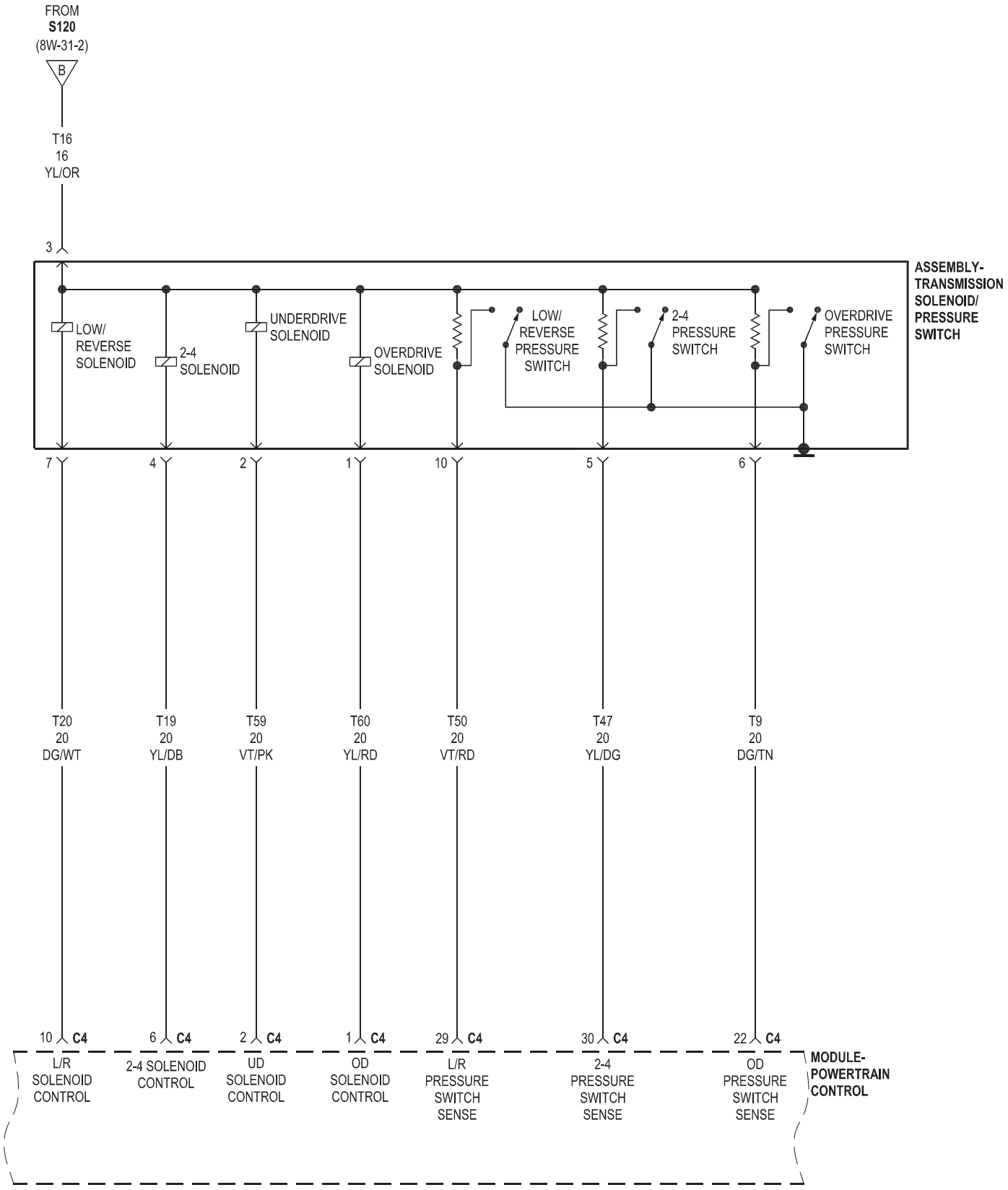

S126
K902
20
BR/DG
K902
20
BR/DG
1
3
SENSOR-
OXYGEN-
LEFT
FRONT
3
1
SENSOR-
OXYGEN-
RIGHT
FRONT
2
4
2
4
K99
18
BR/TN
Z43
18
BK/LB
K41
20
DB/LB
K902
20
BR/DG
Z934
18
BK
K43
20
DB/LB
K199
18
BR/VT
G108
(8W-15-8)
G108
(8W-15-8)
18 C2
31 C2
32 C1
33 C2
17 C2
O2 1/1
HEATER
CONTROL
O2 1/1
SIGNAL
O2 RETURN
(UPSTREAM)
O2 2/1
SIGNAL
O2 2/1
HEATER
CONTROL
MODULE-
POWERTRAIN
CONTROL
O2 1/2
SIGNAL
O2 1/2
HEATER
CONTROL
O2 RETURN
(DOWNSTREAM)
O2 2/2
HEATER
CONTROL
O2 2/2
SIGNAL
31 C1
9 C3
32 C2
10 C3
33 C1
K299
18
BR/OR
K904
20
DB/DG
K399
18
BR/GY
2 C101
S125
1 C101
K141
18
DB/YL
K299
18
BR/OR
K904
20
DB/DG
K904
20
DB/DG
K399
18
BR/GY
K243
20
BR
1
3
SENSOR-
OXYGEN-
LEFT
REAR
3
1
SENSOR-
OXYGEN-
RIGHT
REAR
2
4
4
2
Z42
18
BK/LG
Z992
18
BK
G108
(8W-15-8)
G108
(8W-15-8)

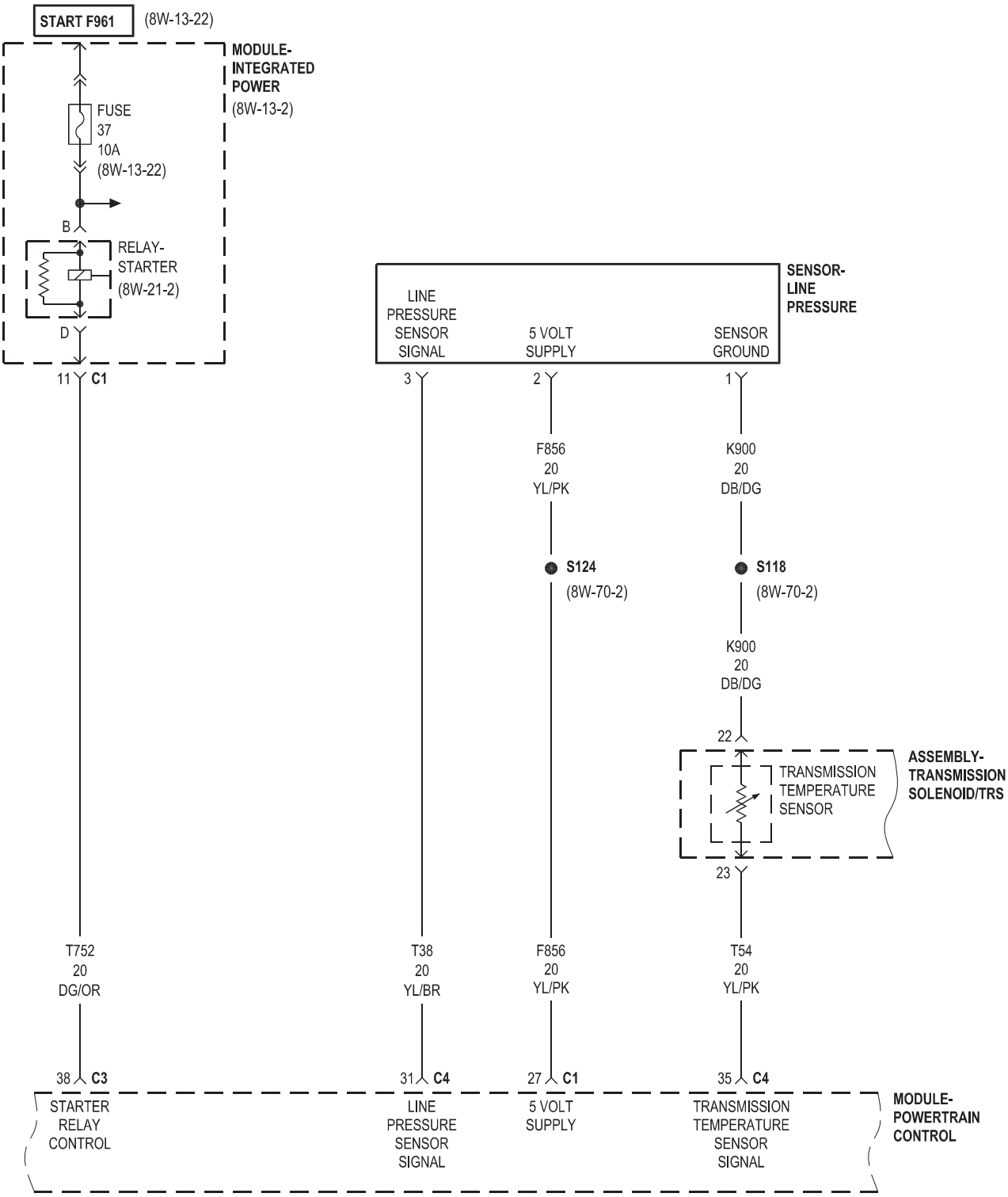
8W-31 TRANSMISSION CONTROL SYSTEM

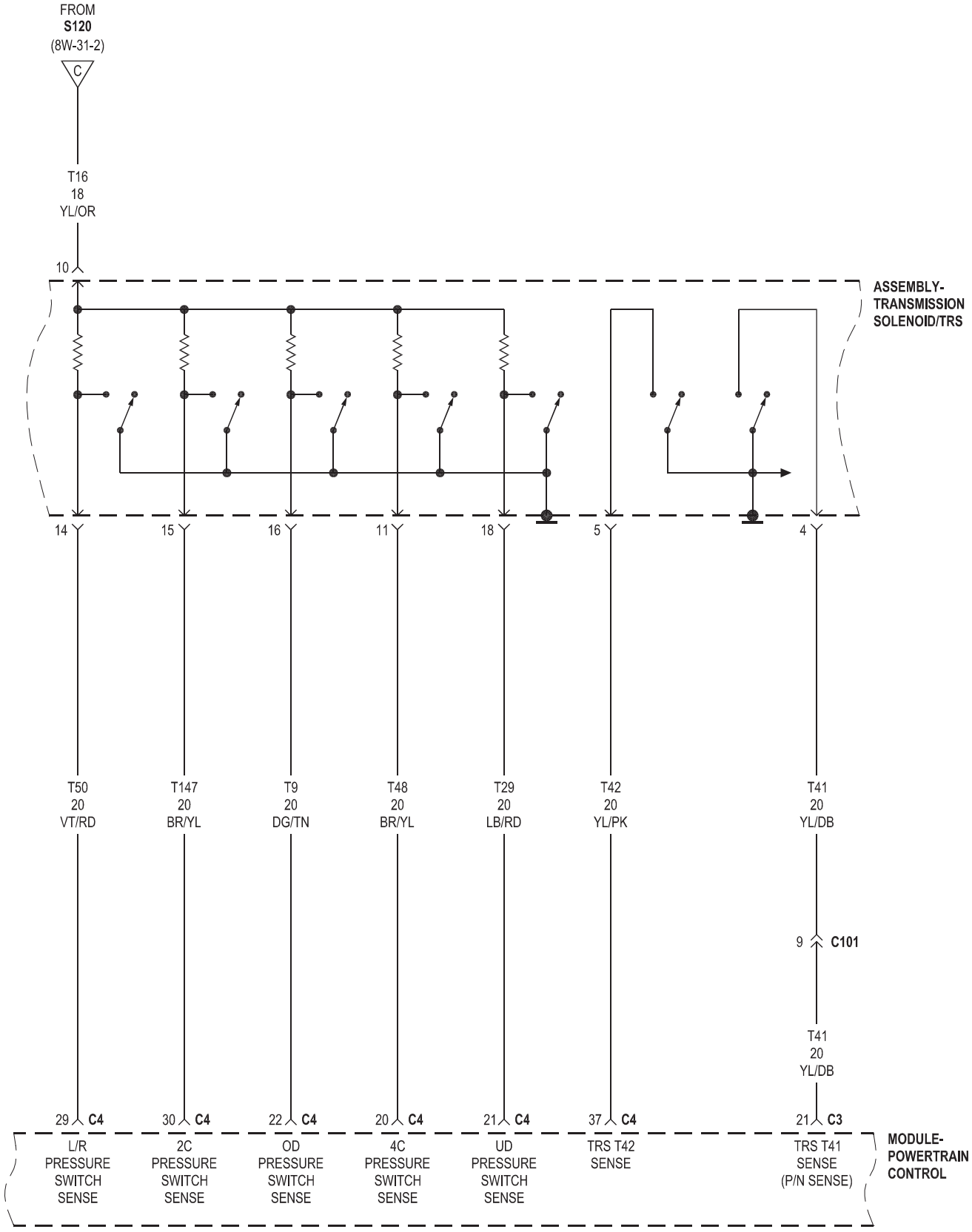
Component	Page
Assembly-Shift Motor/Mode Sensor	8W-31-10
Assembly-Transmission Solenoid/Pressure Switch	8W-31-2, 4
Assembly-Transmission Solenoid/TRS	8W-31-2, 5, 6, 7
Cluster	8W-31-9
Fuse 8	8W-31-9
Fuse 15	8W-31-2
Fuse 20	8W-31-10
Fuse 37	8W-31-3, 5
G101	8W-31-2
G107	8W-31-2
G108	8W-31-2
G200	8W-31-9
G201	8W-31-9
Module-Front Control	8W-31-2, 10
Module-Integrated Power	8W-31-2, 3, 5, 9, 10
Module-Powertrain Control	8W-31-2, 3, 4, 5, 6, 7, 8, 9
Relay-Starter	8W-31-3, 5
Relay-Transmission Control	8W-31-2
Sensor-Input Speed	8W-31-8
Sensor-Line Pressure	8W-31-5
Sensor-Output Speed	8W-31-8
Sensor-Transmission Range	8W-31-2, 3
Solenoid-Brake Transmission Shift	8W-31-9
Switch-Back-Up Lamp	8W-31-2
Switch-Clutch Interlock	8W-31-2
Switch-Tow/Haul Overdrive Off	8W-31-9
Switch-Transfer Case Selector	8W-31-9
Transducer-A/C Pressure	8W-31-10

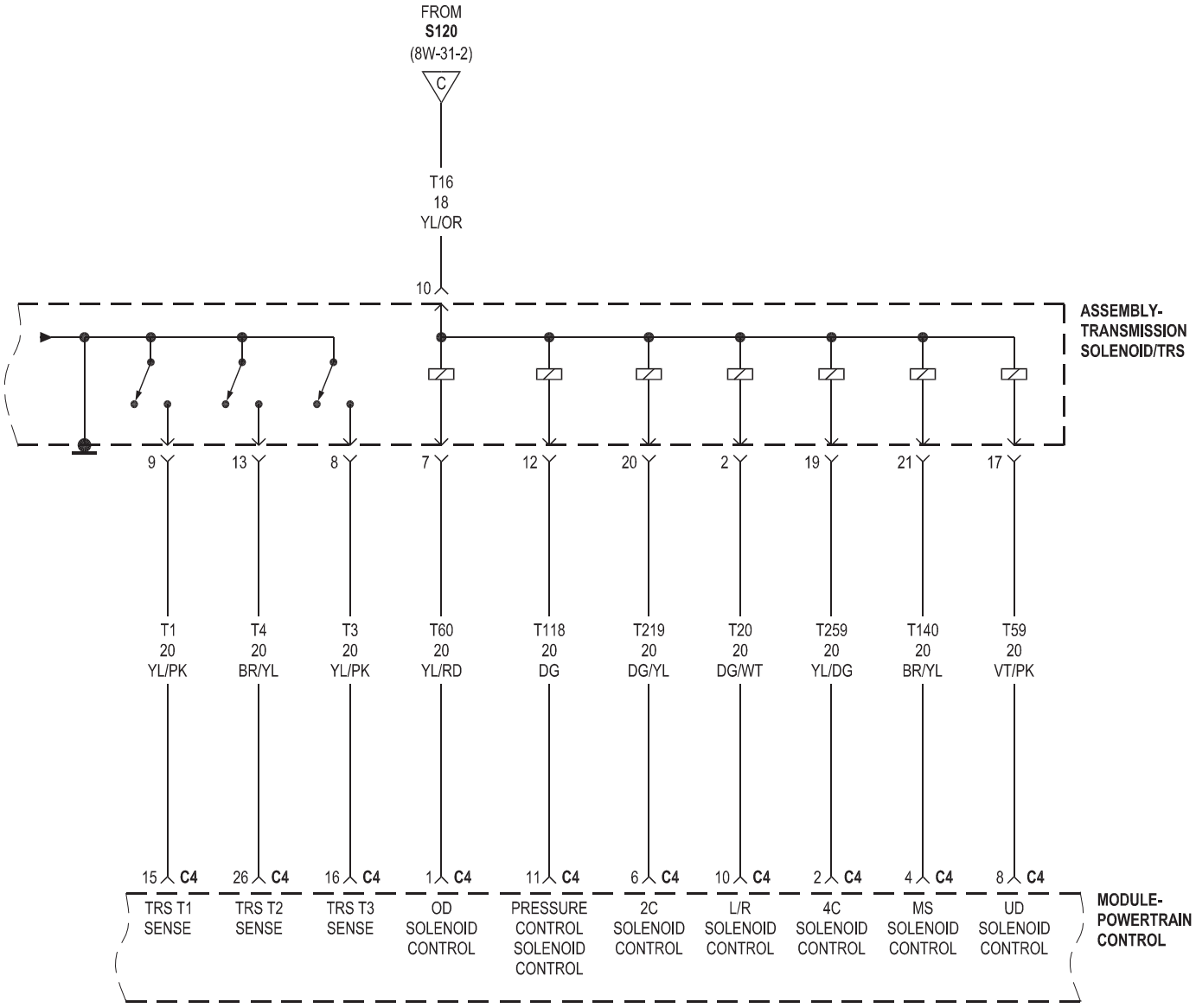

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
15
25A
(8W-13-17)
MODULE-
FRONT
CONTROL
(8W-13-28)
LOW/
REVERSE
SOLENOID
CONTROL
40 IPM
85
30
RELAY-
TRANSMISSION
CONTROL
86
87
87A
20 C1
10 C2
7 C2
29 C4
T15
20
YL/BK
T16
16
YL/OR
4
3 C100
T16
16
YL/OR
T2
20
DG/WT
3 C100
T2
20
DG/WT
T15
20
YL/BK
T16
16
YL/OR
T16
16
YL/OR
T16
16
YL/OR
T16
16
YL/OR
T16
16
YL/OR
T16
16
YL/OR
S120
A
B
C
TO
SENSOR-
TRANSMISSION
RANGE
(42RLE)
(8W-31-3)
TO
ASSEMBLY-
TRANSMISSION
SOLENOID/
PRESSURE
SWITCH
(42RLE)
(8W-31-4)
TO
ASSEMBLY-
TRANSMISSION
SOLENOID/TRS
(545RFE)
(8W-31-6)
(8W-31-7)
18 C4
19 C4
28 C4
38 C4
TRANSMISSION
CONTROL
RELAY
CONTROL
TRANSMISSION
CONTROL
RELAY
OUTPUT
TRANSMISSION
CONTROL
RELAY
OUTPUT
TRANSMISSION
CONTROL
RELAY
OUTPUT
MODULE-
POWERTRAIN
CONTROL
TRS T141
SENSE
GROUND
GROUND
GROUND
21 C3
12 C4
13 C4
14 C4
T141
20
YL/OR
Z904
20
BK
1
2
SWITCH-
BACK-UP
LAMP
SWITCH-
CLUTCH
INTERLOCK
S128
(8W-15-7)
2
1
Z906
20
BK
Z915
20
BK
Z905
20
BK
Z908
16
BK
Z977
16
BK
Z904
20
BK
M/T
A/T
G108
(8W-15-8)
G101
(8W-15-4)
(8W-15-5)
G107
(8W-15-7)

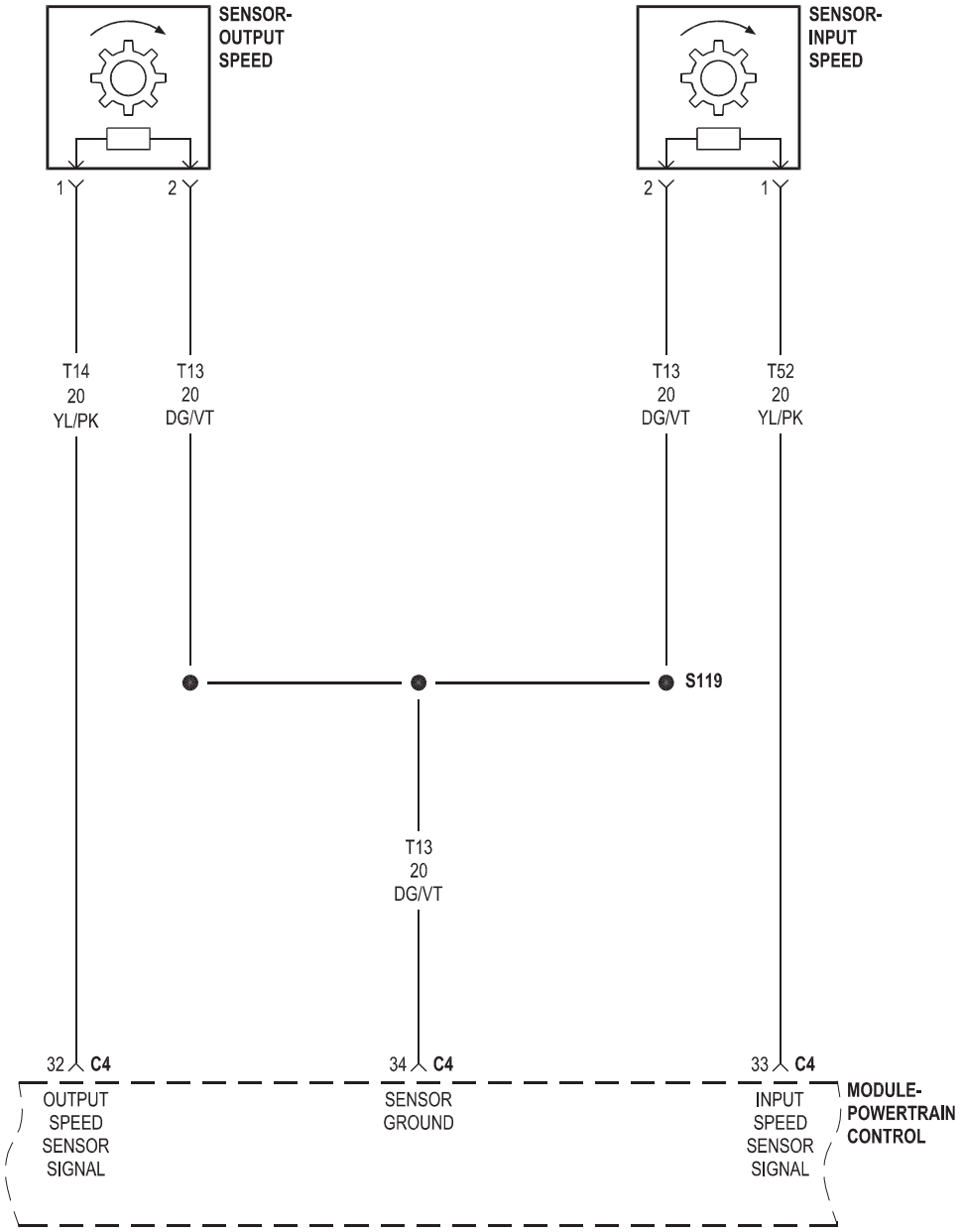

START F961
(8W-13-22)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
37
10A
(8W-13-22)
B
RELAY-
STARTER
(8W-21-2)
D
11 C1
T752
20
DG/OR
38 C3
STARTER
RELAY
CONTROL
MODULE-
POWERTRAIN
CONTROL
SENSOR
GROUND
TRANSMISSION
TEMPERATURE
SENSOR
SIGNAL
TRS T1
SENSE
TRS T3
SENSE
TRS T42
SENSE
TRS T41
SENSE
(P/N SENSE)
27 C2
35 C4
15 C4
16 C4
37 C4
21 C3
K900
20
DB/DG
S123
(8W-70-2)
K900
20
DB/DG
S118
(8W-70-2)
FROM
S120
(8W-31-2)
A
T41
20
YL/DB
9 C101
T16
16
YL/OR
K900
20
DB/DG
T54
20
YL/PK
T1
20
YL/PK
T3
20
YL/PK
T42
20
YL/PK
T41
20
YL/DB
1
3
4
7
8
9
10
TRANSMISSION
CONTROL
RELAY
OUTPUT
SENSOR
GROUND
TRANSMISSION
TEMPERATURE
SENSOR
SIGNAL
TRS T1
SENSE
TRS T3
SENSE
TRS T42
SENSE
TRS T41
SENSE
(P/N SENSE)
SENSOR-
TRANSMISSION
RANGE

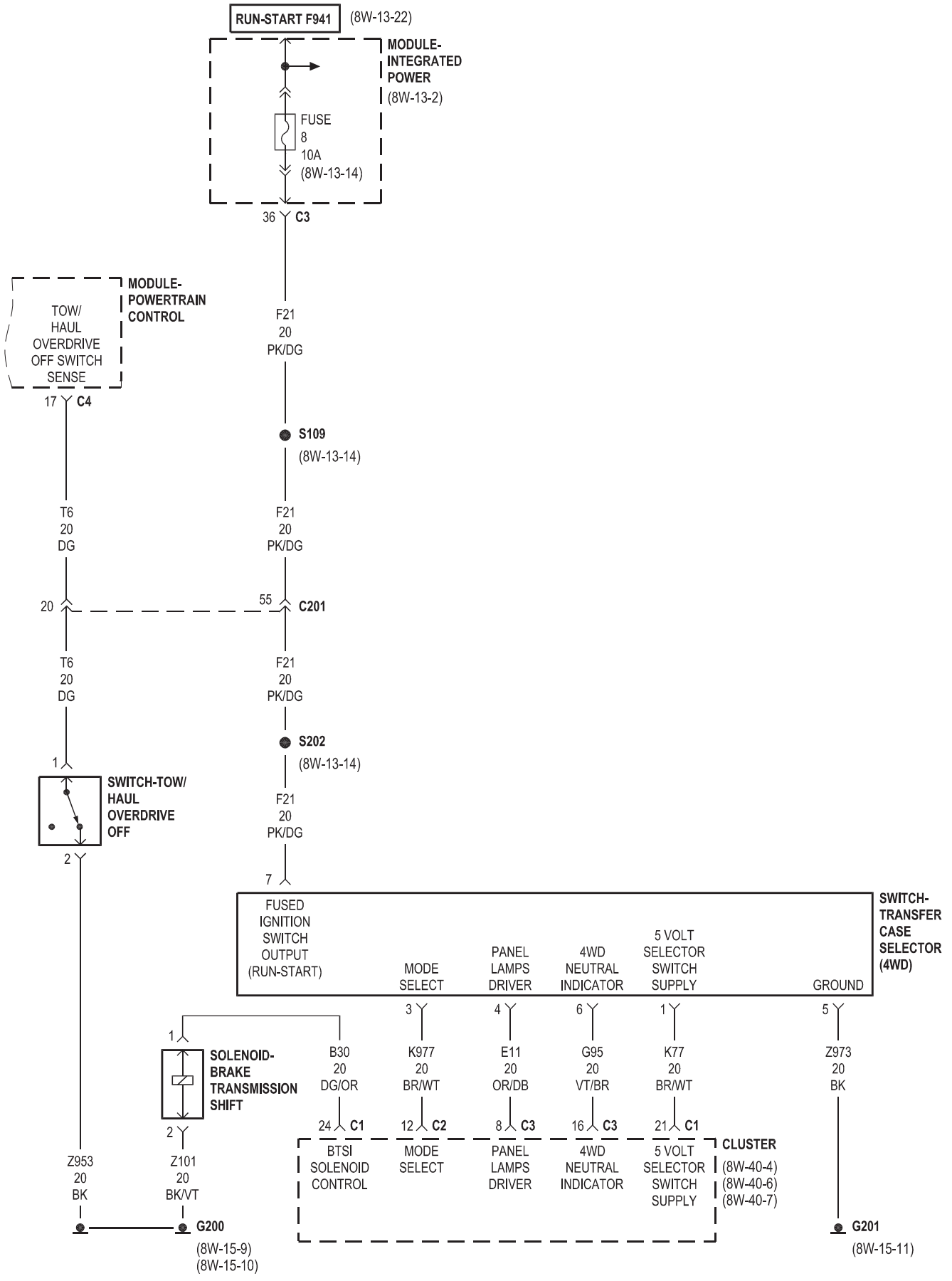

FROM
S120
(8W-31-2)
B
T16
16
YL/OR
3
ASSEMBLY-
TRANSMISSION
SOLENOID/
PRESSURE
SWITCH
LOW/
REVERSE
SOLENOID
2-4
SOLENOID
UNDERDRIVE
SOLENOID
OVERDRIVE
SOLENOID
LOW/
REVERSE
PRESSURE
SWITCH
2-4
PRESSURE
SWITCH
OVERDRIVE
PRESSURE
SWITCH
7
4
2
1
10
5
6
T20
20
DG/WT
T19
20
YL/DB
T59
20
VT/PK
T60
20
YL/RD
T50
20
VT/RD
T47
20
YL/DG
T9
20
DG/TN
10 C4
6 C4
2 C4
1 C4
29 C4
30 C4
22 C4
L/R
SOLENOID
CONTROL
2-4 SOLENOID
CONTROL
UD
SOLENOID
CONTROL
OD
SOLENOID
CONTROL
L/R
PRESSURE
SWITCH
SENSE
2-4
PRESSURE
SWITCH
SENSE
OD
PRESSURE
SWITCH
SENSE
MODULE-
POWERTRAIN
CONTROL

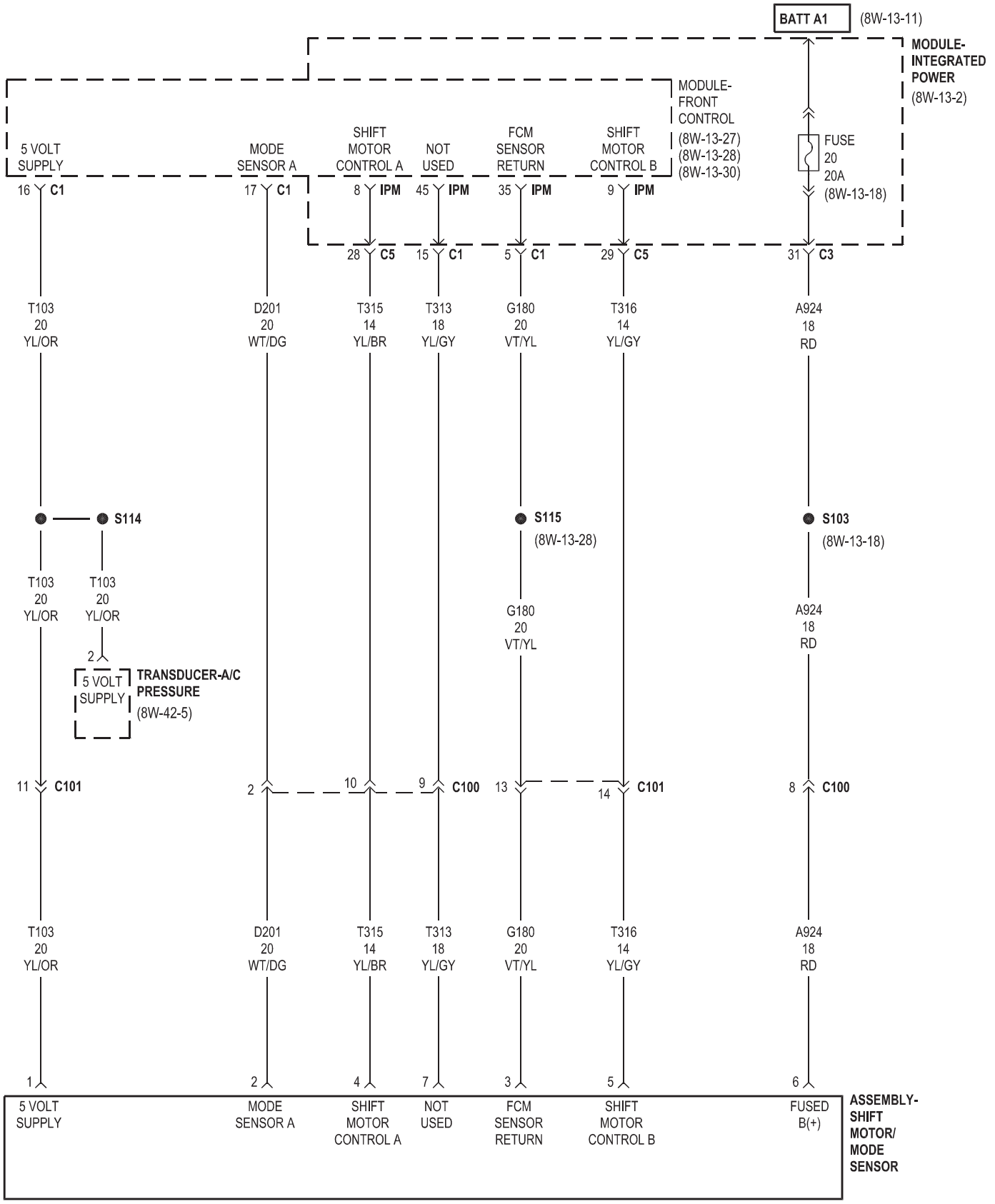

START F961
(8W-13-22)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
37
10A
(8W-13-22)
B
RELAY-
STARTER
(8W-21-2)
D
11
C1
SENSOR-
LINE
PRESSURE
LINE
PRESSURE
SENSOR
SIGNAL
5 VOLT
SUPPLY
SENSOR
GROUND
3
2
1
F856
20
YL/PK
K900
20
DB/DG
S124
(8W-70-2)
S118
(8W-70-2)
K900
20
DB/DG
22
TRANSMISSION
TEMPERATURE
SENSOR
ASSEMBLY-
TRANSMISSION
SOLENOID/TRS
23
T752
20
DG/OR
T38
20
YL/BR
F856
20
YL/PK
T54
20
YL/PK
38
C3
31
C4
27
C1
35
C4
STARTER
RELAY
CONTROL
LINE
PRESSURE
SENSOR
SIGNAL
5 VOLT
SUPPLY
TRANSMISSION
TEMPERATURE
SENSOR
SIGNAL
MODULE-
POWERTRAIN
CONTROL


FROM
S120
(8W-31-2)
C
T16
18
YL/OR
10
ASSEMBLY-
TRANSMISSION
SOLENOID/TRS
14
15
16
11
18
5
4
T50
20
VT/RD
T147
20
BR/YL
T9
20
DG/TN
T48
20
BR/YL
T29
20
LB/RD
T42
20
YL/PK
T41
20
YL/DB
9
C101
T41
20
YL/DB
29
C4
30
C4
22
C4
20
C4
21
C4
37
C4
21
C3
L/R
PRESSURE
SWITCH
SENSE
2C
PRESSURE
SWITCH
SENSE
OD
PRESSURE
SWITCH
SENSE
4C
PRESSURE
SWITCH
SENSE
UD
PRESSURE
SWITCH
SENSE
TRS T42
SENSE
TRS T41
SENSE
(P/N SENSE)
MODULE-
POWERTRAIN
CONTROL


FROM
S120
(8W-31-2)
C
T16
18
YL/OR
10
ASSEMBLY-
TRANSMISSION
SOLENOID/TRS
9
13
8
7
12
20
2
19
21
17
T1
20
YL/PK
T4
20
BR/YL
T3
20
YL/PK
T60
20
YL/RD
T118
20
DG
T219
20
DG/YL
T20
20
DG/WT
T259
20
YL/DG
T140
20
BR/YL
T59
20
VT/PK
15 C4
26 C4
16 C4
1 C4
11 C4
6 C4
10 C4
2 C4
4 C4
8 C4
TRS T1
SENSE
TRS T2
SENSE
TRS T3
SENSE
OD
SOLENOID
CONTROL
PRESSURE
CONTROL
SOLENOID
CONTROL
2C
SOLENOID
CONTROL
L/R
SOLENOID
CONTROL
4C
SOLENOID
CONTROL
MS
SOLENOID
CONTROL
UD
SOLENOID
CONTROL
MODULE-
POWERTRAIN
CONTROL

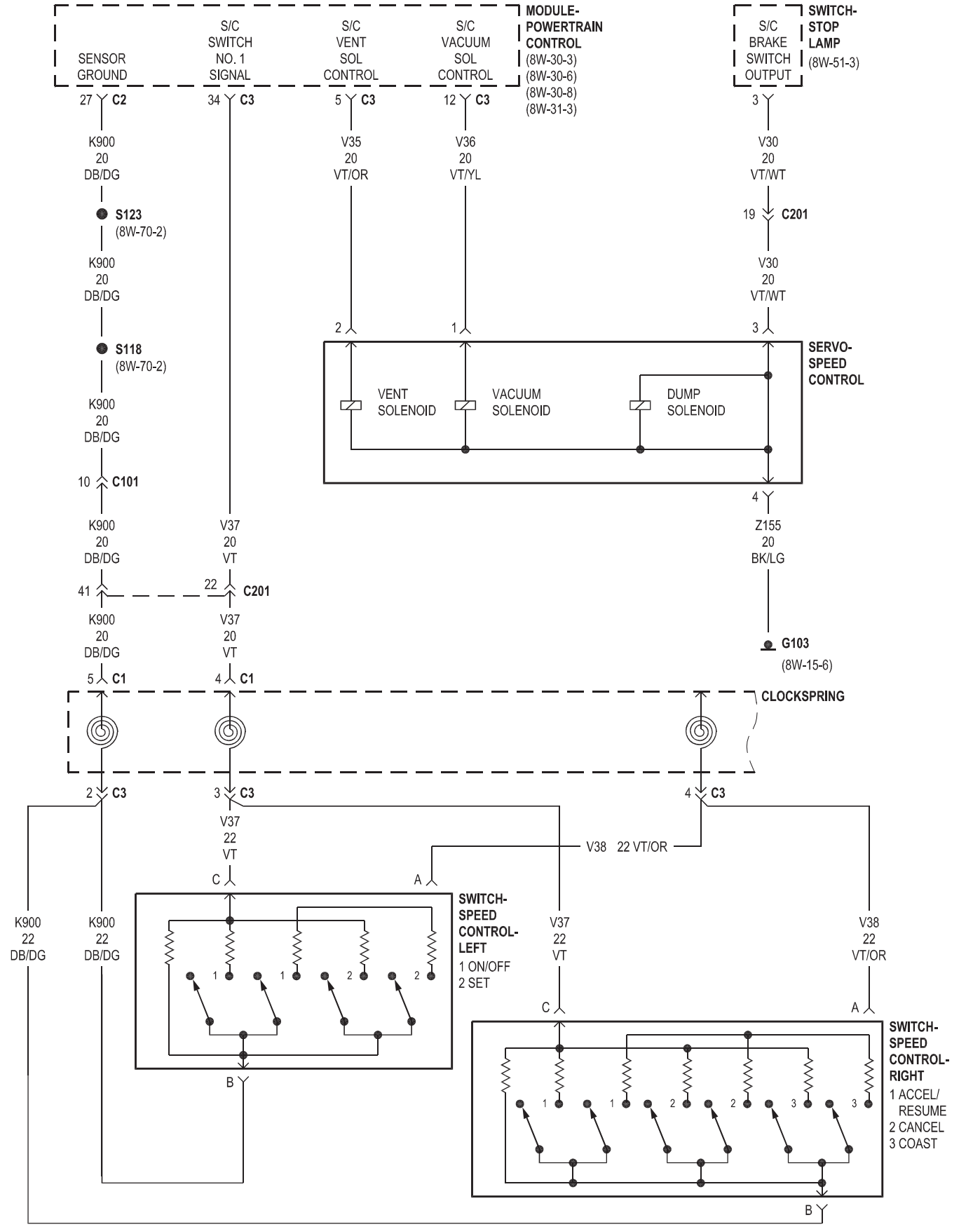

SENSOR-
OUTPUT
SPEED
SENSOR-
INPUT
SPEED
1
2
2
1
T14
20
YL/PK
T13
20
DG/VT
T13
20
DG/VT
T52
20
YL/PK
S119
T13
20
DG/VT
32 C4
34 C4
33 C4
OUTPUT
SPEED
SENSOR
SIGNAL
SENSOR
GROUND
INPUT
SPEED
SENSOR
SIGNAL
MODULE-
POWERTRAIN
CONTROL


RUN-START F941
(8W-13-22)
MODULE-INTEGRATED POWER
(8W-13-2)
FUSE
8
10A
(8W-13-14)
36 C3
MODULE-POWERTRAIN CONTROL
TOW/ HAUL OVERDRIVE OFF SWITCH SENSE
17 C4
F21
20
PK/DG
S109
(8W-13-14)
T6
20
DG
20
55 C201
F21
20
PK/DG
S202
(8W-13-14)
1
SWITCH-TOW/ HAUL OVERDRIVE OFF
2
7
SWITCH-TRANSFER CASE SELECTOR (4WD)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
MODE SELECT
PANEL LAMPS DRIVER
4WD NEUTRAL INDICATOR
5 VOLT SELECTOR SWITCH SUPPLY
GROUND
3
4
6
1
5
SOLENOID-BRAKE TRANSMISSION SHIFT
B30
20
DG/OR
K977
20
BR/WT
E11
20
OR/DB
G95
20
VT/BR
K77
20
BR/WT
Z973
20
BK
24 C1
12 C2
8 C3
16 C3
21 C1
CLUSTER
(8W-40-4)
(8W-40-6)
(8W-40-7)
BTSI SOLENOID CONTROL
MODE SELECT
PANEL LAMPS DRIVER
4WD NEUTRAL INDICATOR
5 VOLT SELECTOR SWITCH SUPPLY
Z953
20
BK
Z101
20
BK/VT
G200
(8W-15-9)
(8W-15-10)
G201
(8W-15-11)


BATT A1
(8W-13-11)
MODULE-INTEGRATED POWER
(8W-13-2)
MODULE-FRONT CONTROL
(8W-13-27)
(8W-13-28)
(8W-13-30)
FUSE 20 20A
(8W-13-18)
5 VOLT SUPPLY
MODE SENSOR A
SHIFT MOTOR CONTROL A
NOT USED
FCM SENSOR RETURN
SHIFT MOTOR CONTROL B
16 C1
17 C1
8 IPM
45 IPM
35 IPM
9 IPM
28 C5
15 C1
5 C1
29 C5
31 C3
T103 20 YL/OR
D201 20 WT/DG
T315 14 YL/BR
T313 18 YL/GY
G180 20 VT/YL
T316 14 YL/GY
A924 18 RD
S114
S115
(8W-13-28)
S103
(8W-13-18)
T103 20 YL/OR
T103 20 YL/OR
G180 20 VT/YL
A924 18 RD
2
5 VOLT SUPPLY
TRANSDUCER-A/C PRESSURE
(8W-42-5)
11 C101
2
10
9 C100
13
14 C101
8 C100
T103 20 YL/OR
D201 20 WT/DG
T315 14 YL/BR
T313 18 YL/GY
G180 20 VT/YL
T316 14 YL/GY
A924 18 RD
1
2
4
7
3
5
6
5 VOLT SUPPLY
MODE SENSOR A
SHIFT MOTOR CONTROL A
NOT USED
FCM SENSOR RETURN
SHIFT MOTOR CONTROL B
FUSED B(+)
ASSEMBLY-SHIFT MOTOR/ MODE SENSOR

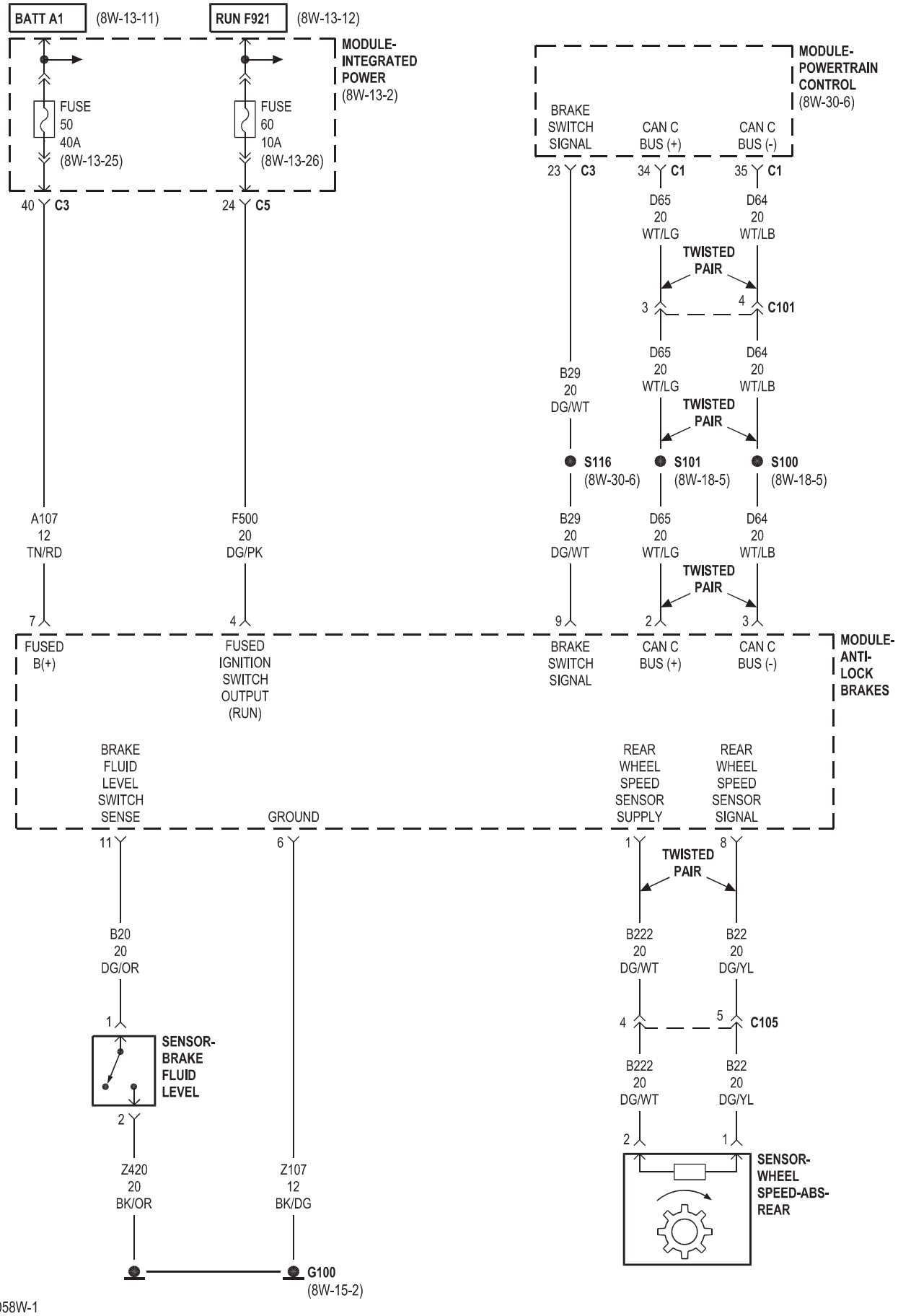
8W-33 VEHICLE SPEED CONTROL

Component	Page
Clockspring	8W-33-2
G103	8W-33-2
Module-Powertrain Control	8W-33-2
Servo-Speed Control	8W-33-2
Switch-Speed Control-Left	8W-33-2
Switch-Speed Control-Right	8W-33-2
Switch-Stop Lamp	8W-33-2


MODULE-POWERTRAIN CONTROL
(8W-30-3)
(8W-30-6)
(8W-30-8)
(8W-31-3)
SENSOR GROUND
S/C SWITCH NO. 1 SIGNAL
S/C VENT SOL CONTROL
S/C VACUUM SOL CONTROL
SWITCH-STOP LAMP
(8W-51-3)
S/C BRAKE SWITCH OUTPUT
27 C2
34 C3
5 C3
12 C3
3
K900 20 DB/DG
V35 20 VT/OR
V36 20 VT/YL
V30 20 VT/WT
S123
(8W-70-2)
19 C201
S118
(8W-70-2)
2
1
3
SERVO-SPEED CONTROL
VENT SOLENOID
VACUUM SOLENOID
DUMP SOLENOID
10 C101
4
Z155 20 BK/LG
V37 20 VT
41
22 C201
G103
(8W-15-6)
5 C1
4 C1
CLOCKSPRING
2 C3
3 C3
4 C3
V37 22 VT
V38 22 VT/OR
C
A
SWITCH-SPEED CONTROL-LEFT
1 ON/OFF
2 SET
K900 22 DB/DG
V37 22 VT
V38 22 VT/OR
SWITCH-SPEED CONTROL-RIGHT
1 ACCEL/ RESUME
2 CANCEL
3 COAST
B

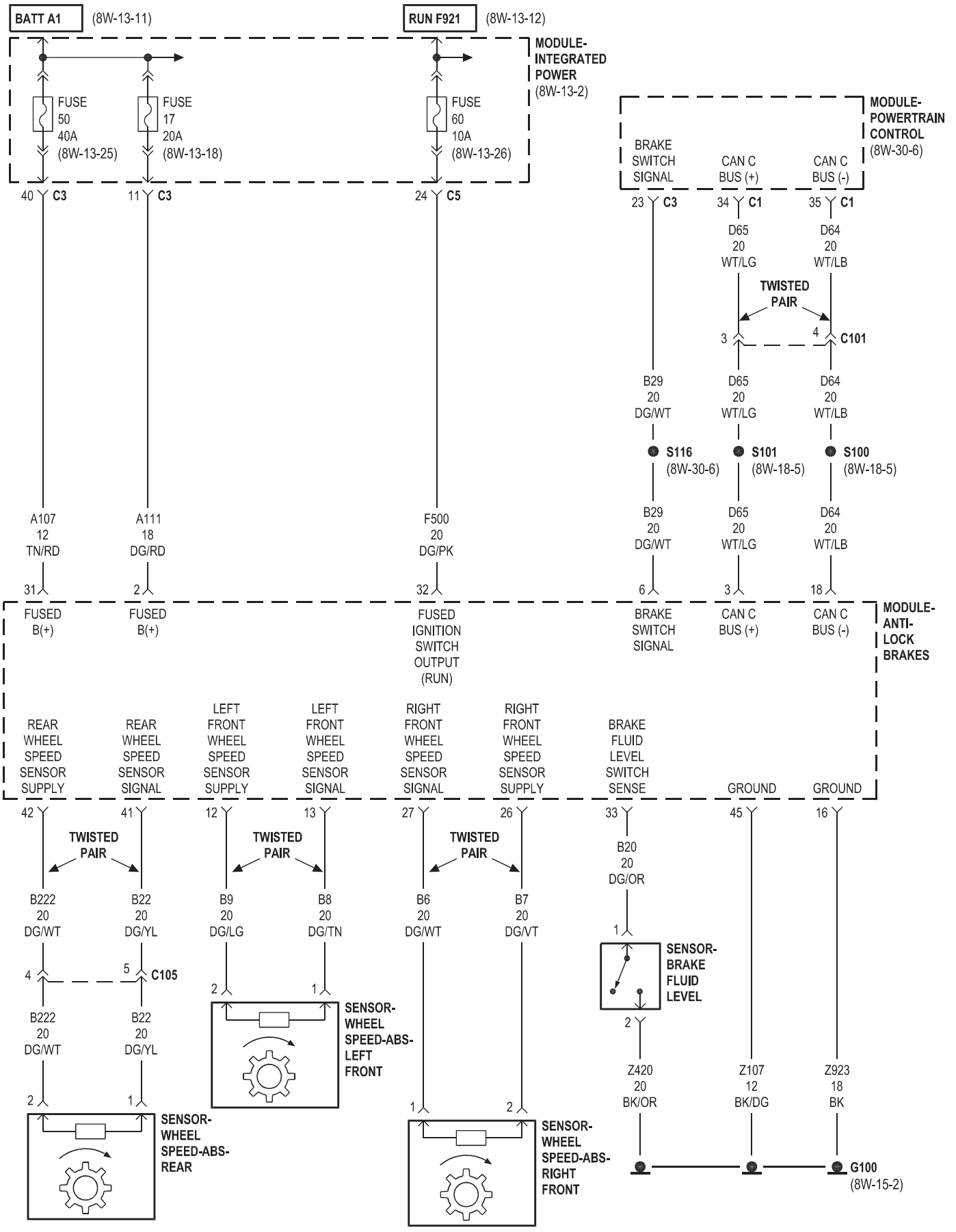
8W-34 REAR WHEEL ANTILOCK BRAKES

Component	Page	Component	Page
Fuse 50	8W-34-2	Module-Integrated Power	8W-34-2
Fuse 60	8W-34-2	Module-Powertrain Control	8W-34-2
G100	8W-34-2	Sensor-Brake Fluid Level	8W-34-2
Module-Anti-Lock Brakes	8W-34-2	Sensor-Wheel Speed-Abs-Rear	8W-34-2


BATT A1
(8W-13-11)
RUN F921
(8W-13-12)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
50
40A
(8W-13-25)
FUSE
60
10A
(8W-13-26)
40 C3
24 C5
MODULE-
POWERTRAIN
CONTROL
(8W-30-6)
BRAKE
SWITCH
SIGNAL
CAN C
BUS (+)
CAN C
BUS (-)
23 C3
34 C1
35 C1
D65
20
WT/LG
D64
20
WT/LB
TWISTED
PAIR
3
4
C101
B29
20
DG/WT
S116
(8W-30-6)
S101
(8W-18-5)
S100
(8W-18-5)
A107
12
TN/RD
F500
20
DG/PK
7
4
9
2
3
FUSED
B(+)
FUSED
IGNITION
SWITCH
OUTPUT
(RUN)
MODULE-
ANTI-
LOCK
BRAKES
BRAKE
FLUID
LEVEL
SWITCH
SENSE
GROUND
REAR
WHEEL
SPEED
SENSOR
SUPPLY
REAR
WHEEL
SPEED
SENSOR
SIGNAL
11
6
1
8
B20
20
DG/OR
B222
20
DG/WT
B22
20
DG/YL
4
5
C105
1
2
SENSOR-
BRAKE
FLUID
LEVEL
Z420
20
BK/OR
Z107
12
BK/DG
G100
(8W-15-2)
SENSOR-
WHEEL
SPEED-ABS-
REAR

8W-35 ANTILOCK BRAKES

Component	Page
Fuse 17	8W-35-2
Fuse 50	8W-35-2
Fuse 60	8W-35-2
G100	8W-35-2
Module-Anti-Lock Brakes	8W-35-2
Module-Integrated Power	8W-35-2
Module-Powertrain Control	8W-35-2
Sensor-Brake Fluid Level	8W-35-2
Sensor-Wheel Speed-Abs-Left Front	8W-35-2
Sensor-Wheel Speed-Abs-Rear	8W-35-2
Sensor-Wheel Speed-Abs-Right Front	8W-35-2

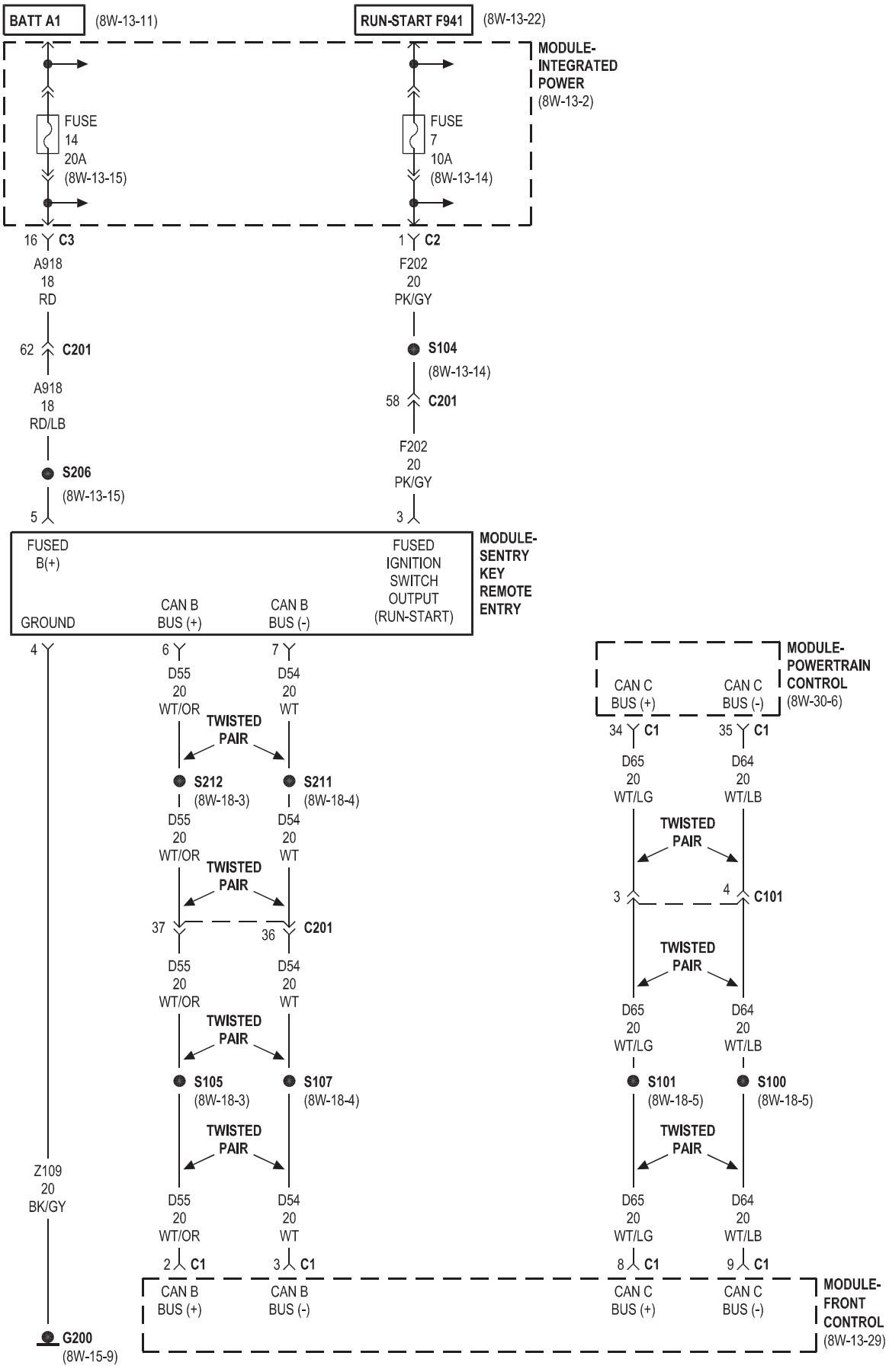


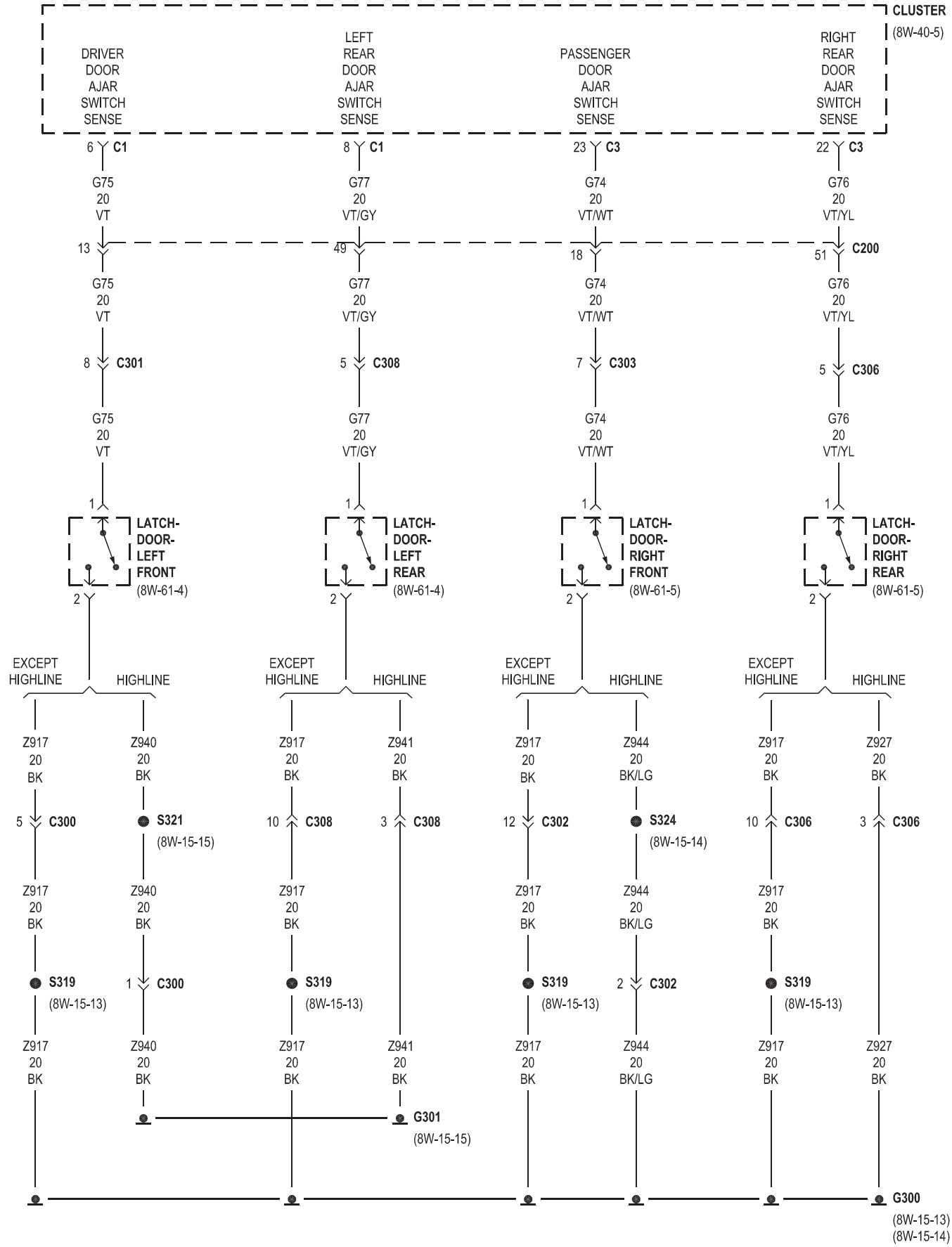
J058W-1

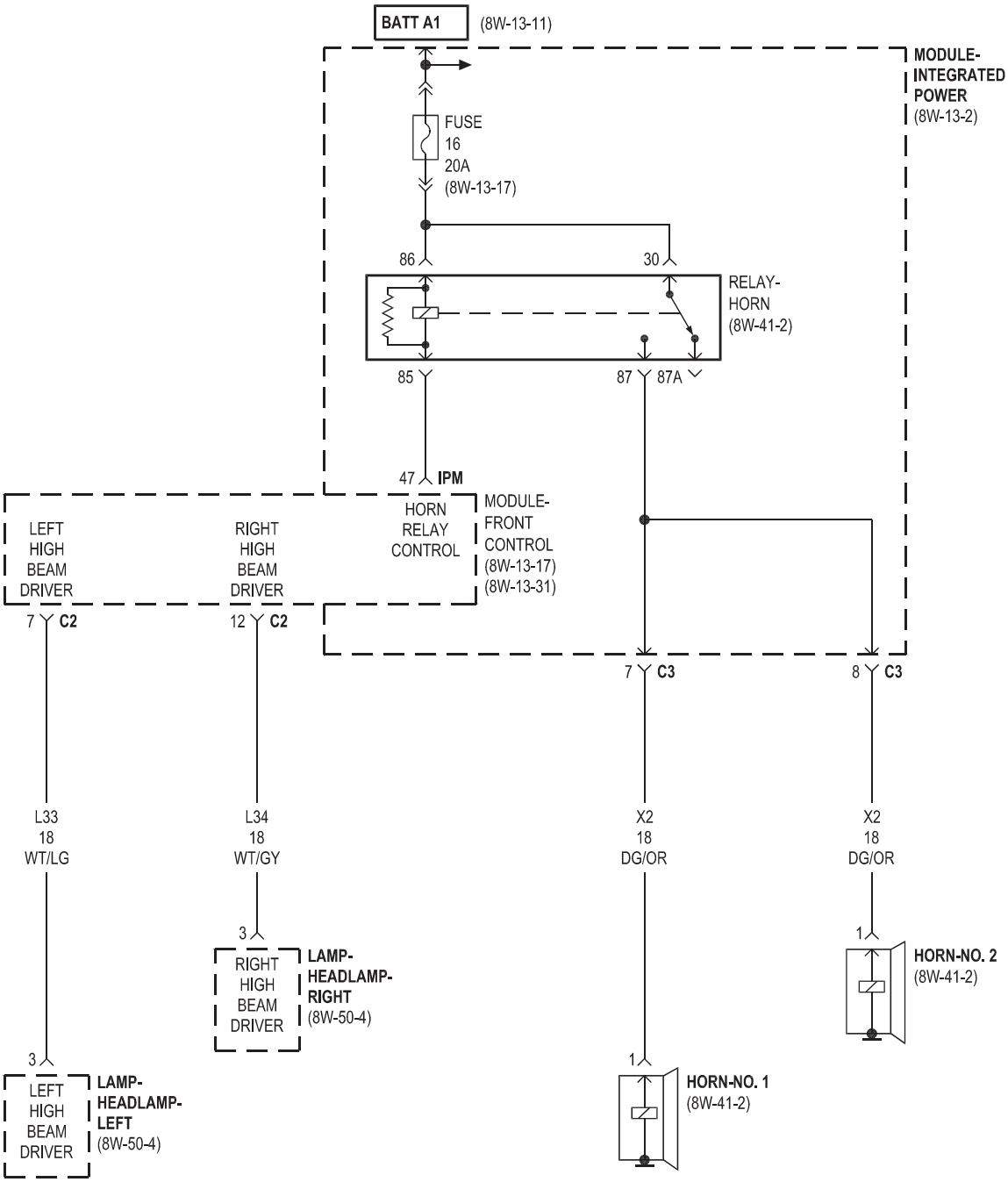
ND503502

8W-39 VEHICLE THEFT SECURITY SYSTEM

Component	Page
Cluster	8W-39-3
Fuse 7	8W-39-2
Fuse 14	8W-39-2
Fuse 16	8W-39-4
G200	8W-39-2
G300	8W-39-3
G301	8W-39-3
Horn-No. 1	8W-39-4
Horn-No. 2	8W-39-4
Lamp-Headlamp-Left	8W-39-4
Lamp-Headlamp-Right	8W-39-4
Latch-Door-Left Front	8W-39-3
Latch-Door-Left Rear	8W-39-3
Latch-Door-Right Front	8W-39-3
Latch-Door-Right Rear	8W-39-3
Module-Front Control	8W-39-2, 4
Module-Integrated Power	8W-39-2, 4
Module-Powertrain Control	8W-39-2
Module-Sentry Key Remote Entry	8W-39-2
Relay-Horn	8W-39-4

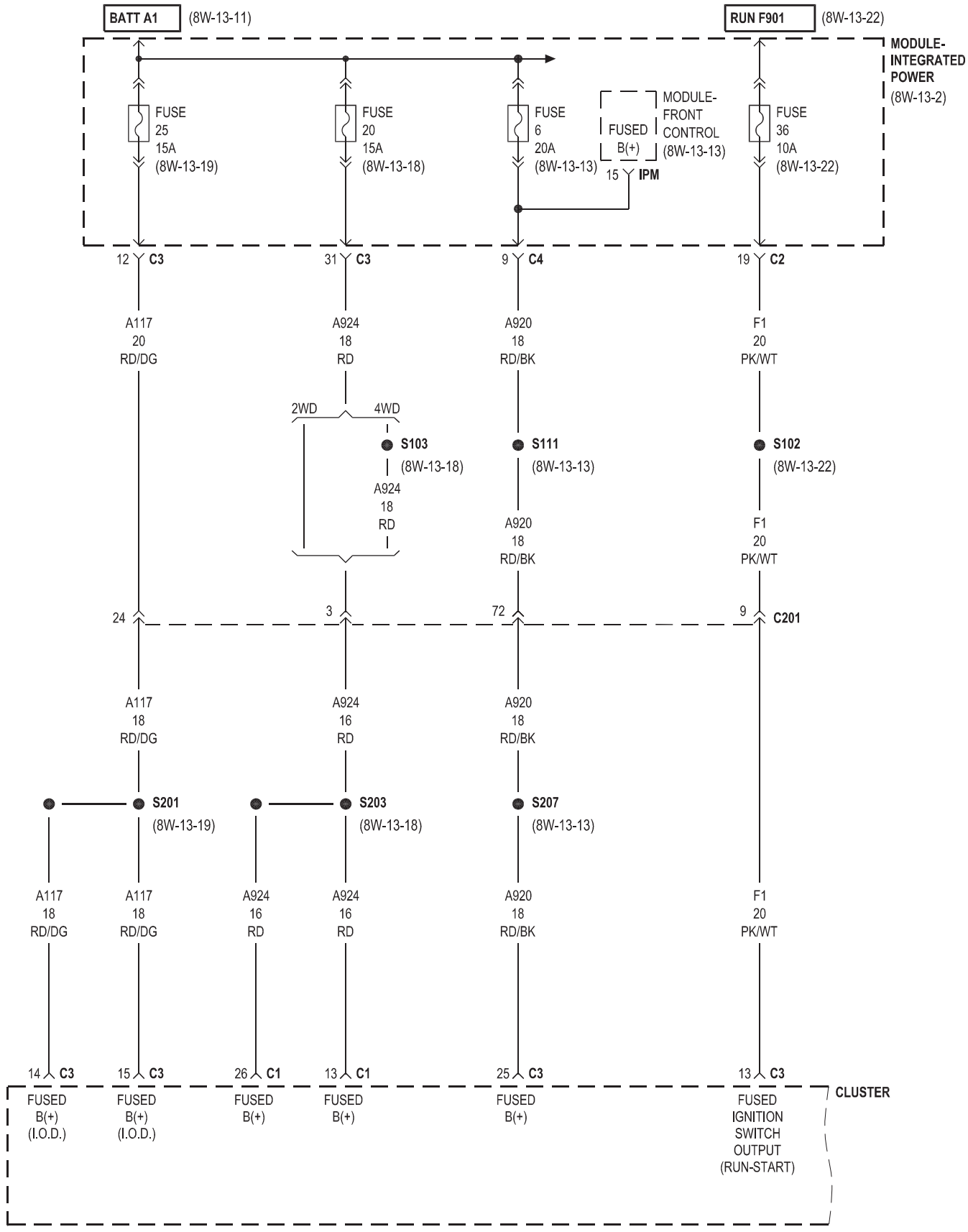

BATT A1
(8W-13-11)
RUN-START F941
(8W-13-22)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
14
20A
(8W-13-15)
FUSE
7
10A
(8W-13-14)
16 C3
A918
18
RD
1 C2
F202
20
PK/GY
62 C201
A918
18
RD/LB
S104
(8W-13-14)
58 C201
F202
20
PK/GY
S206
(8W-13-15)
5
3
FUSED
B(+)
FUSED
IGNITION
SWITCH
OUTPUT
(RUN-START)
MODULE-
SENTRY
KEY
REMOTE
ENTRY
GROUND
CAN B
BUS (+)
CAN B
BUS (-)
4
6
7
D55
20
WT/OR
D54
20
WT
TWISTED
PAIR
S212
(8W-18-3)
S211
(8W-18-4)
37
36
C201
S105
(8W-18-3)
S107
(8W-18-4)
Z109
20
BK/GY
2 C1
3 C1
G200
(8W-15-9)
CAN C
BUS (+)
CAN C
BUS (-)
MODULE-
POWERTRAIN
CONTROL
(8W-30-6)
34 C1
35 C1
D65
20
WT/LG
D64
20
WT/LB
3
4
C101
S101
(8W-18-5)
S100
(8W-18-5)
8 C1
9 C1
MODULE-
FRONT
CONTROL
(8W-13-29)

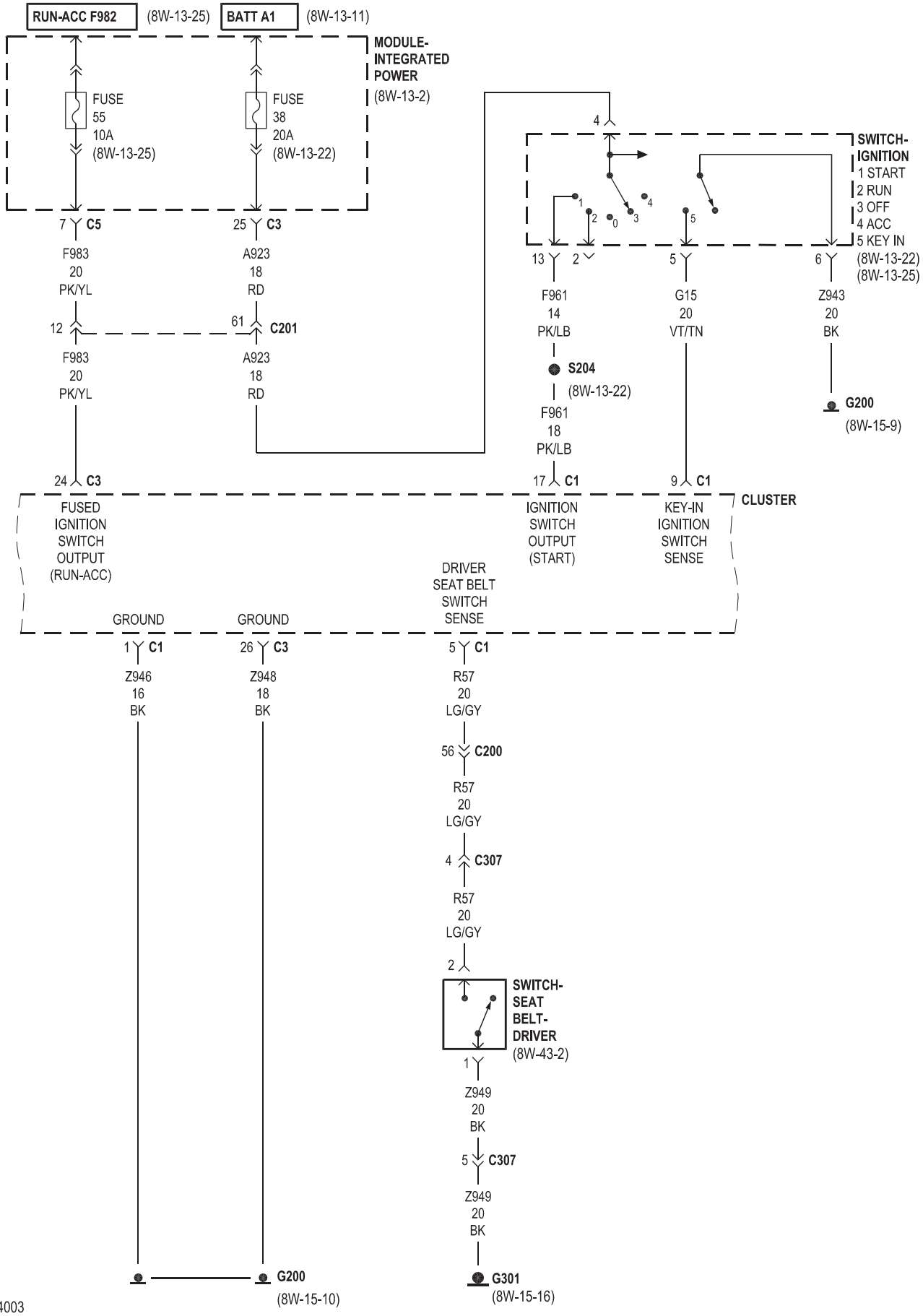

CLUSTER
(8W-40-5)
DRIVER DOOR AJAR SWITCH SENSE
LEFT REAR DOOR AJAR SWITCH SENSE
PASSENGER DOOR AJAR SWITCH SENSE
RIGHT REAR DOOR AJAR SWITCH SENSE
6 C1
8 C1
23 C3
22 C3
G75 20 VT
G77 20 VT/GY
G74 20 VT/WT
G76 20 VT/YL
13
49
18
51 C200
8 C301
5 C308
7 C303
5 C306
1
LATCH-DOOR-LEFT FRONT
(8W-61-4)
LATCH-DOOR-LEFT REAR
(8W-61-4)
LATCH-DOOR-RIGHT FRONT
(8W-61-5)
LATCH-DOOR-RIGHT REAR
(8W-61-5)
2
EXCEPT HIGHLINE
HIGHLINE
Z917 20 BK
Z940 20 BK
Z941 20 BK
Z944 20 BK/LG
Z927 20 BK
5 C300
S321
(8W-15-15)
10 C308
3 C308
12 C302
S324
(8W-15-14)
10 C306
3 C306
S319
(8W-15-13)
1 C300
2 C302
G301
(8W-15-15)
G300
(8W-15-13)
(8W-15-14)

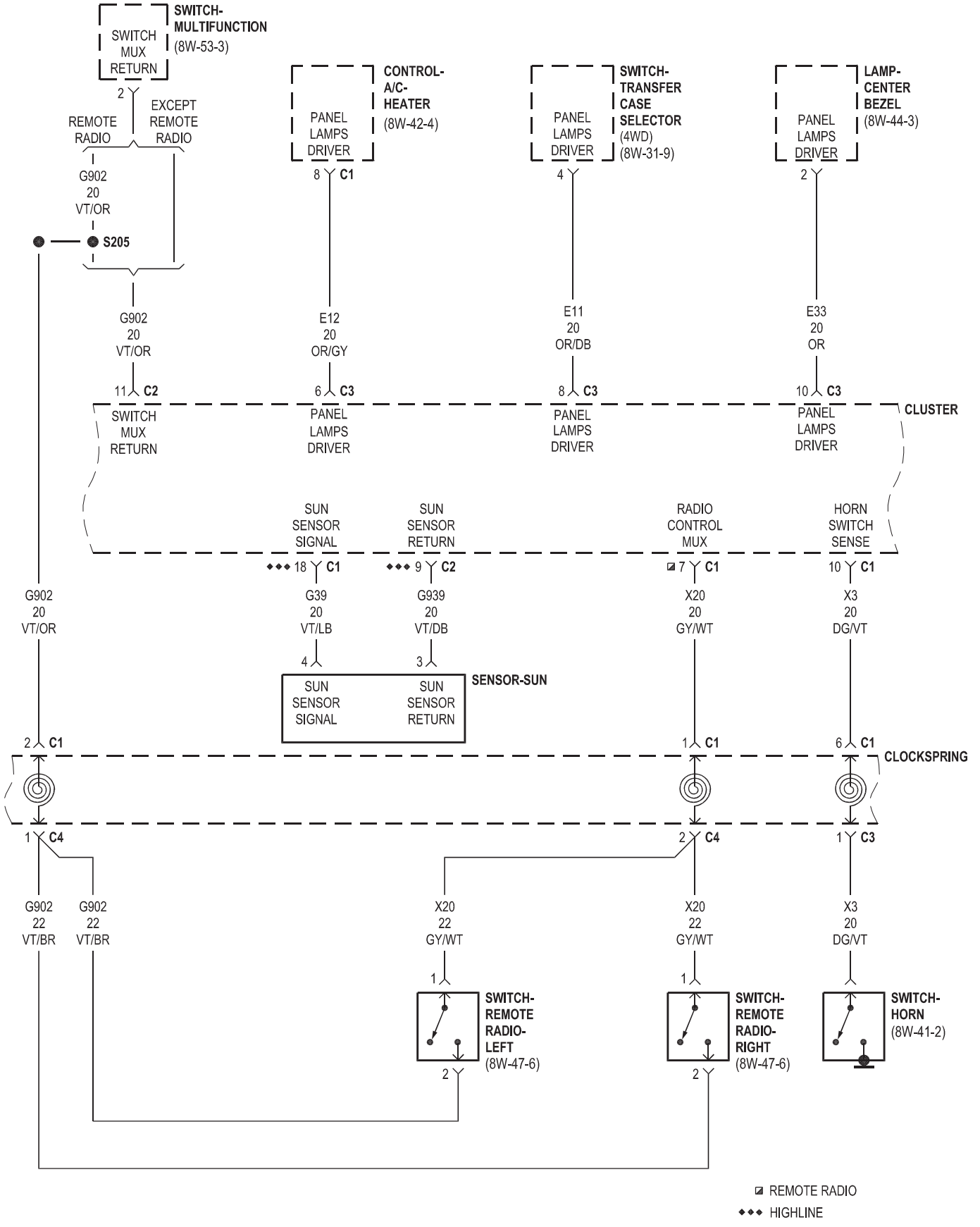

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
16
20A
(8W-13-17)
86
30
RELAY-
HORN
(8W-41-2)
85
87
87A
47
IPM
MODULE-
FRONT
CONTROL
(8W-13-17)
(8W-13-31)
LEFT
HIGH
BEAM
DRIVER
RIGHT
HIGH
BEAM
DRIVER
HORN
RELAY
CONTROL
7
C2
12
C2
7
C3
8
C3
L33
18
WT/LG
L34
18
WT/GY
X2
18
DG/OR
X2
18
DG/OR
3
3
1
1
RIGHT
HIGH
BEAM
DRIVER
LAMP-
HEADLAMP-
RIGHT
(8W-50-4)
LEFT
HIGH
BEAM
DRIVER
LAMP-
HEADLAMP-
LEFT
(8W-50-4)
HORN-NO. 2
(8W-41-2)
HORN-NO. 1
(8W-41-2)

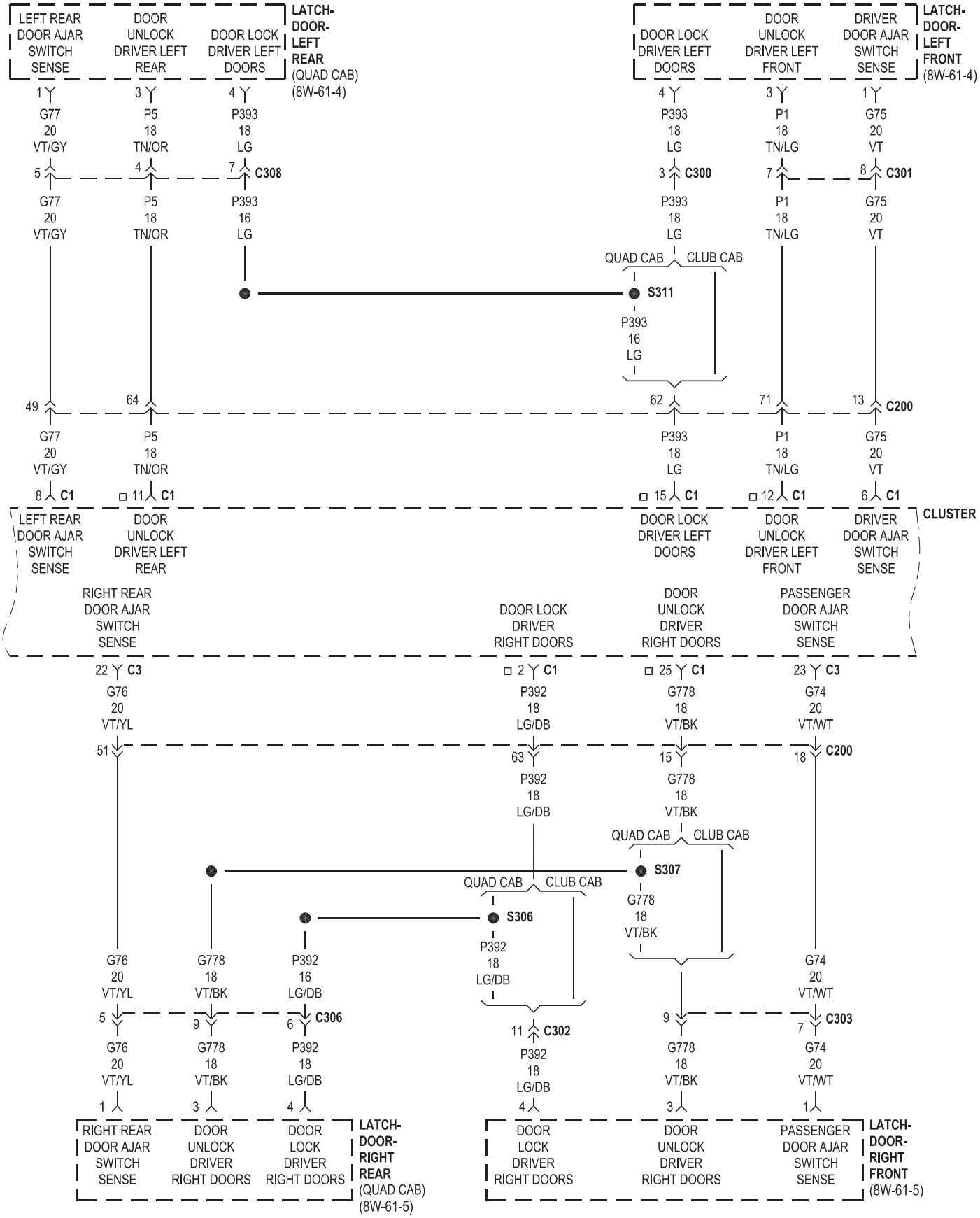
8W-40 INSTRUMENT CLUSTER

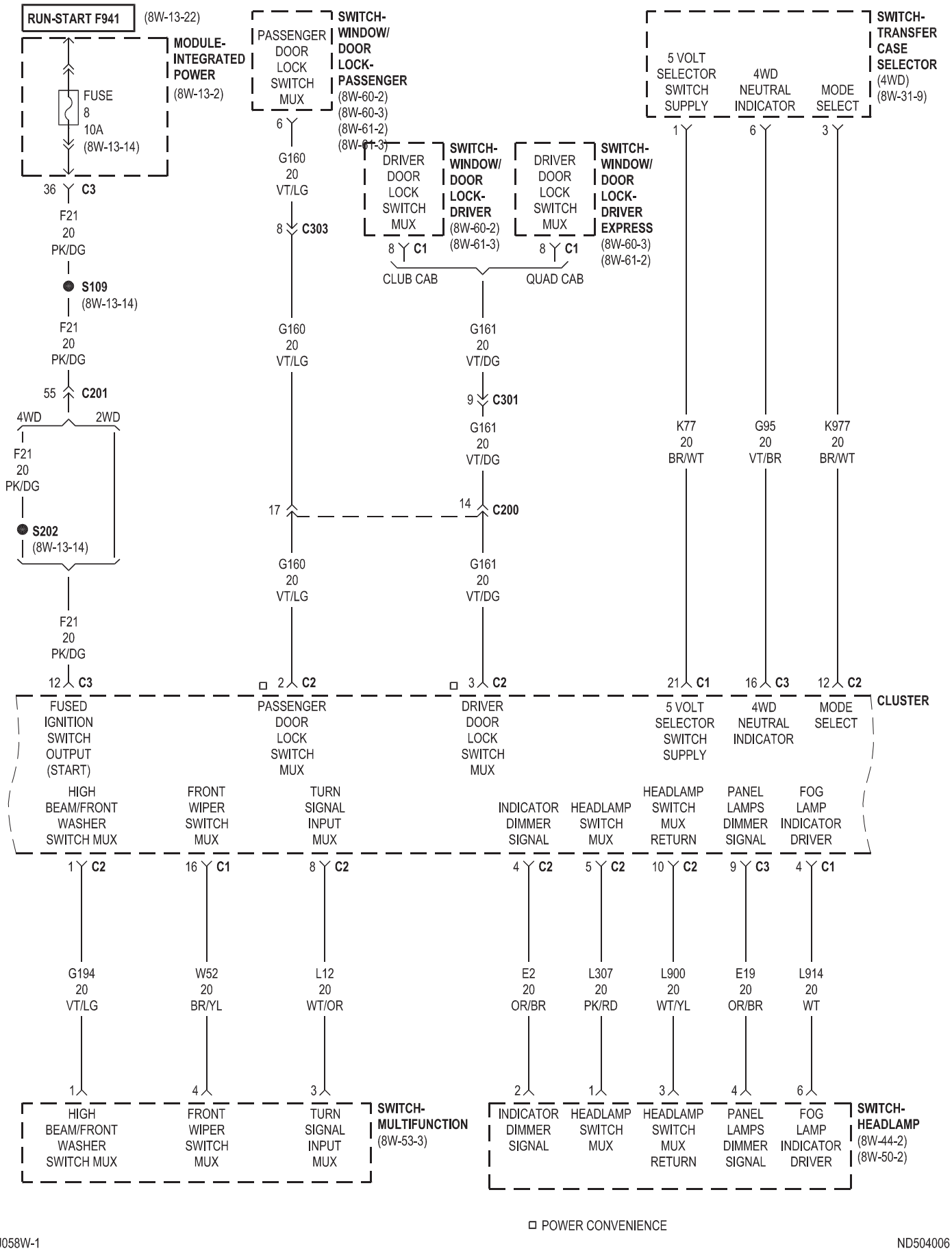
Component	Page
Clockspring	8W-40-4
Cluster	8W-40-2, 3, 4, 5, 6, 7
Control-A/C-Heater	8W-40-4
Fuse 6	8W-40-2
Fuse 8	8W-40-6
Fuse 20	8W-40-2
Fuse 25	8W-40-2
Fuse 36	8W-40-2
Fuse 38	8W-40-3
Fuse 55	8W-40-3
G200	8W-40-3
G301	8W-40-3
Lamp-Center Bezel	8W-40-4
Lamp-Dome-Front	8W-40-7
Lamp-High Mounted Stop	8W-40-7
Latch-Door-Left Front	8W-40-5
Latch-Door-Left Rear	8W-40-5
Latch-Door-Right Front	8W-40-5
Latch-Door-Right Rear	8W-40-5
Module-Front Control	8W-40-2, 7
Module-Fuel Pump	8W-40-7
Module-Integrated Power	8W-40-2, 3, 6
Sensor-Sun	8W-40-4
Solenoid-Brake Transmission Shift	8W-40-7
Switch-Headlamp	8W-40-6
Switch-Horn	8W-40-4
Switch-Ignition	8W-40-3
Switch-Multifunction	8W-40-4, 6
Switch-Parking Brake	8W-40-7
Switch-Remote Radio-Left	8W-40-4
Switch-Remote Radio-Right	8W-40-4
Switch-Seat Belt-Driver	8W-40-3
Switch-Transfer Case Selector	8W-40-4, 6
Switch-Window/Door Lock-Driver	8W-40-6
Switch-Window/Door Lock-Driver Express	8W-40-6
Switch-Window/Door Lock-Passenger	8W-40-6

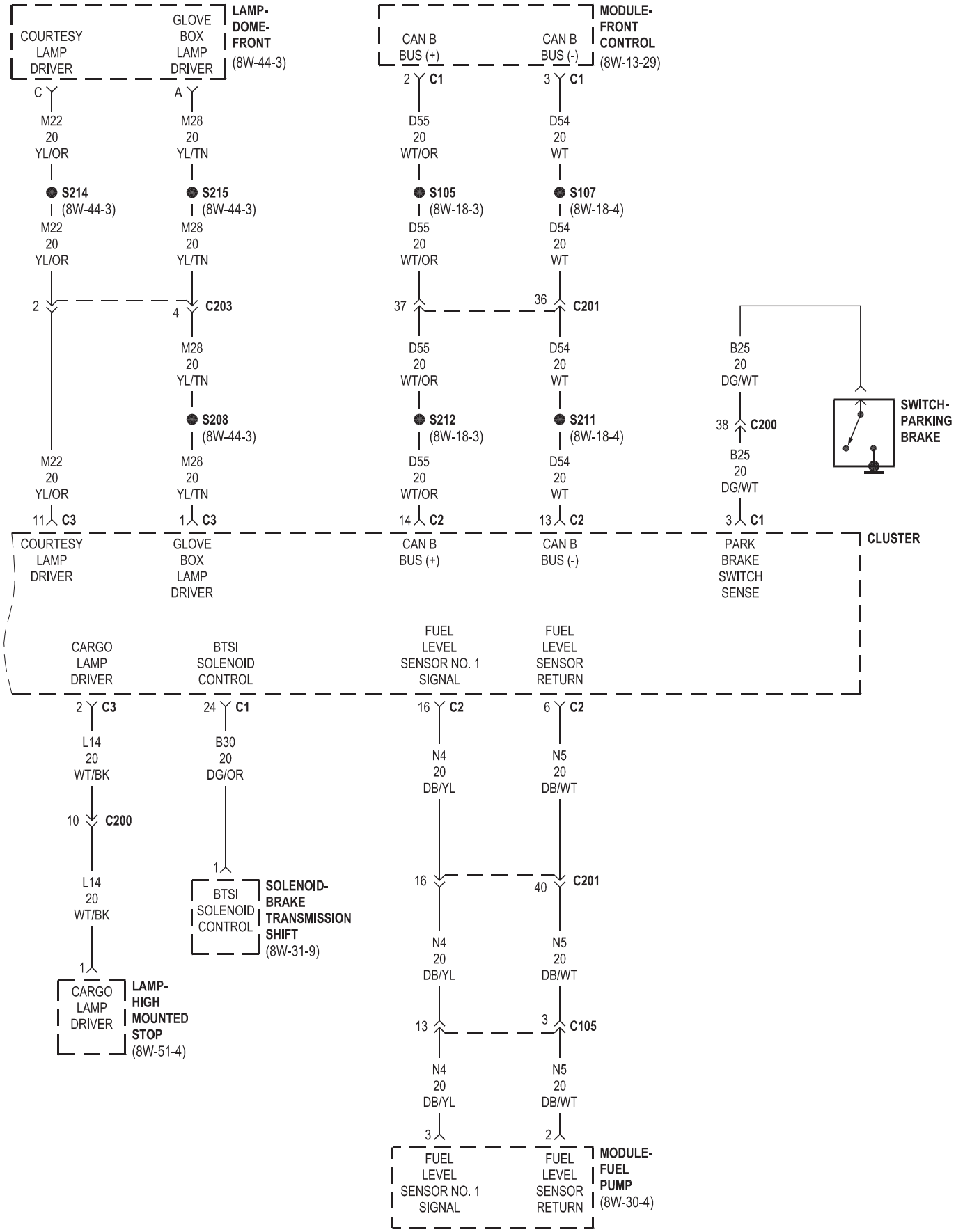

BATT A1
(8W-13-11)
RUN F901
(8W-13-22)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
25
15A
(8W-13-19)
FUSE
20
15A
(8W-13-18)
FUSE
6
20A
(8W-13-13)
FUSED
B(+)
MODULE-
FRONT
CONTROL
(8W-13-13)
15 IPM
FUSE
36
10A
(8W-13-22)
12 C3
31 C3
9 C4
19 C2
A117
20
RD/DG
A924
18
RD
A920
18
RD/BK
F1
20
PK/WT
2WD
4WD
S103
(8W-13-18)
A924
18
RD
S111
(8W-13-13)
S102
(8W-13-22)
A920
18
RD/BK
F1
20
PK/WT
24
3
72
9 C201
A117
18
RD/DG
A924
16
RD
A920
18
RD/BK
S201
(8W-13-19)
S203
(8W-13-18)
S207
(8W-13-13)
A117
18
RD/DG
A117
18
RD/DG
A924
16
RD
A924
16
RD
A920
18
RD/BK
F1
20
PK/WT
14 C3
15 C3
26 C1
13 C1
25 C3
13 C3
CLUSTER
FUSED
B(+)
(I.O.D.)
FUSED
B(+)
(I.O.D.)
FUSED
B(+)
FUSED
B(+)
FUSED
B(+)
FUSED
IGNITION
SWITCH
OUTPUT
(RUN-START)


RUN-ACC F982
(8W-13-25)
BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
55
10A
(8W-13-25)
FUSE
38
20A
(8W-13-22)
7 C5
F983
20
PK/YL
12
F983
20
PK/YL
24 C3
25 C3
A923
18
RD
61 C201
A923
18
RD
4
SWITCH-
IGNITION
1 START
2 RUN
3 OFF
4 ACC
5 KEY IN
(8W-13-22)
(8W-13-25)
13
F961
14
PK/LB
S204
(8W-13-22)
F961
18
PK/LB
17 C1
2
5
G15
20
VT/TN
9 C1
6
Z943
20
BK
G200
(8W-15-9)
CLUSTER
FUSED
IGNITION
SWITCH
OUTPUT
(RUN-ACC)
IGNITION
SWITCH
OUTPUT
(START)
KEY-IN
IGNITION
SWITCH
SENSE
DRIVER
SEAT BELT
SWITCH
SENSE
GROUND
GROUND
1 C1
Z946
16
BK
26 C3
Z948
18
BK
5 C1
R57
20
LG/GY
56 C200
R57
20
LG/GY
4 C307
R57
20
LG/GY
2
SWITCH-
SEAT
BELT-
DRIVER
(8W-43-2)
1
Z949
20
BK
5 C307
Z949
20
BK
G200
(8W-15-10)
G301
(8W-15-16)


SWITCH-MULTIFUNCTION
SWITCH MUX RETURN
(8W-53-3)
2
REMOTE RADIO
EXCEPT REMOTE RADIO
G902 20 VT/OR
S205
CONTROL-A/C-HEATER
PANEL LAMPS DRIVER
(8W-42-4)
8 C1
SWITCH-TRANSFER CASE SELECTOR
PANEL LAMPS DRIVER
(4WD)
(8W-31-9)
4
LAMP-CENTER BEZEL
PANEL LAMPS DRIVER
(8W-44-3)
2
G902 20 VT/OR
E12 20 OR/GY
E11 20 OR/DB
E33 20 OR
11 C2
6 C3
8 C3
10 C3
SWITCH MUX RETURN
PANEL LAMPS DRIVER
PANEL LAMPS DRIVER
PANEL LAMPS DRIVER
CLUSTER
SUN SENSOR SIGNAL
SUN SENSOR RETURN
RADIO CONTROL MUX
HORN SWITCH SENSE
18 C1
9 C2
7 C1
10 C1
G902 20 VT/OR
G39 20 VT/LB
G939 20 VT/DB
X20 20 GY/WT
X3 20 DG/VT
4
3
SUN SENSOR SIGNAL
SUN SENSOR RETURN
SENSOR-SUN
2 C1
1 C1
6 C1
CLOCKSPRING
1 C4
2 C4
1 C3
G902 22 VT/BR
G902 22 VT/BR
X20 22 GY/WT
X20 22 GY/WT
X3 20 DG/VT
1
1
1
SWITCH-REMOTE RADIO-LEFT
(8W-47-6)
SWITCH-REMOTE RADIO-RIGHT
(8W-47-6)
SWITCH-HORN
(8W-41-2)
2
2
REMOTE RADIO
HIGHLINE

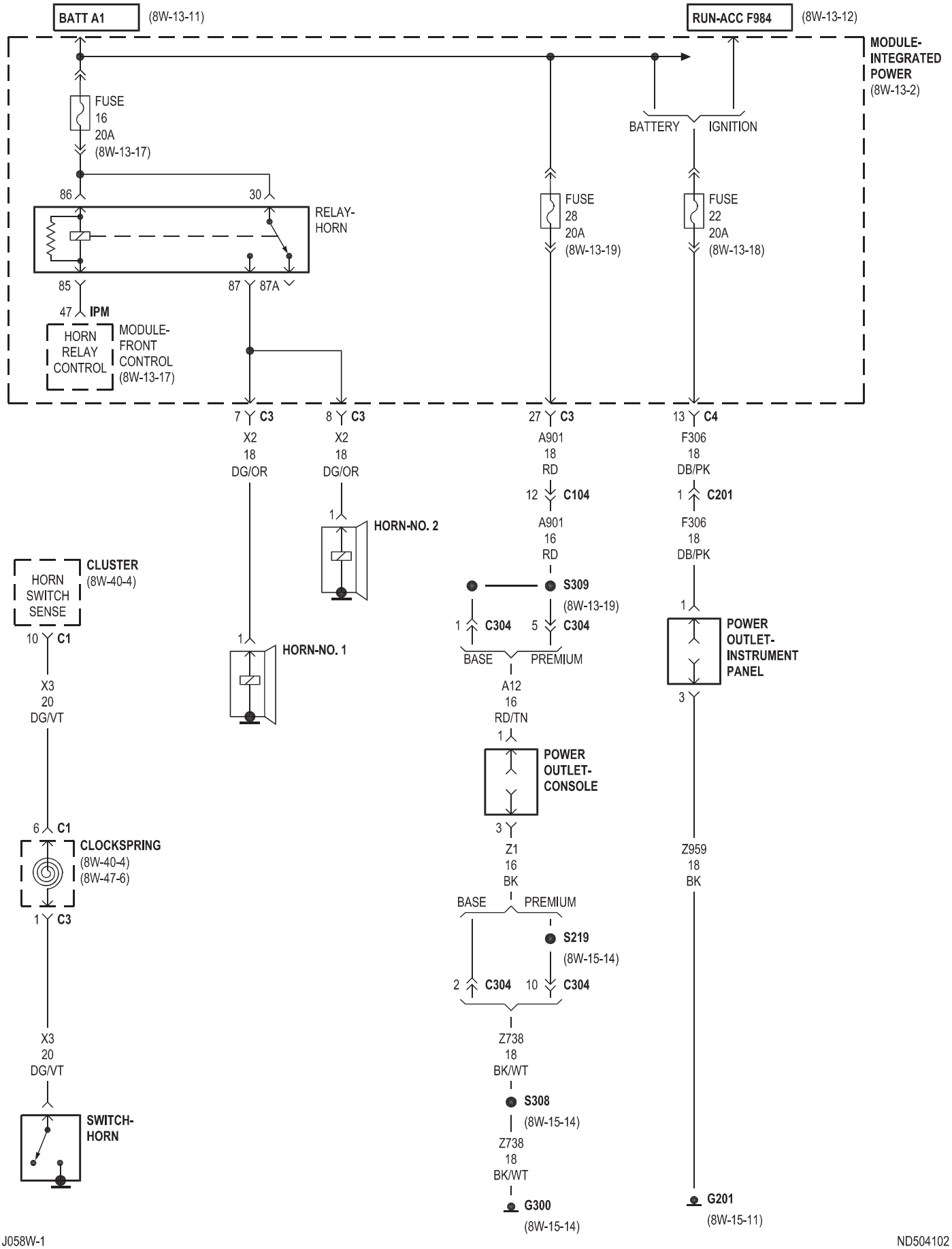

LATCH-DOOR-LEFT REAR (QUAD CAB) (8W-61-4)
LEFT REAR DOOR AJAR SWITCH SENSE
DOOR UNLOCK DRIVER LEFT REAR
DOOR LOCK DRIVER LEFT DOORS
LATCH-DOOR-LEFT FRONT (8W-61-4)
DOOR LOCK DRIVER LEFT DOORS
DOOR UNLOCK DRIVER LEFT FRONT
DRIVER DOOR AJAR SWITCH SENSE
C308
C300
C301
S311
QUAD CAB
CLUB CAB
C200
C1
CLUSTER
RIGHT REAR DOOR AJAR SWITCH SENSE
DOOR LOCK DRIVER RIGHT DOORS
DOOR UNLOCK DRIVER RIGHT DOORS
PASSENGER DOOR AJAR SWITCH SENSE
C3
S307
S306
C306
C302
C303
LATCH-DOOR-RIGHT REAR (QUAD CAB) (8W-61-5)
LATCH-DOOR-RIGHT FRONT (8W-61-5)
POWER CONVENIENCE


RUN-START F941
(8W-13-22)
MODULE-INTEGRATED POWER
(8W-13-2)
FUSE 8 10A
(8W-13-14)
36 C3
F21 20 PK/DG
S109
(8W-13-14)
F21 20 PK/DG
55 C201
4WD
2WD
F21 20 PK/DG
S202
(8W-13-14)
F21 20 PK/DG
12 C3
FUSED IGNITION SWITCH OUTPUT (START)
PASSENGER DOOR LOCK SWITCH MUX
SWITCH-WINDOW/ DOOR LOCK-PASSENGER
(8W-60-2)
(8W-60-3)
(8W-61-2)
(8W-61-3)
6
G160 20 VT/LG
8 C303
G160 20 VT/LG
17
G160 20 VT/LG
2 C2
DRIVER DOOR LOCK SWITCH MUX
SWITCH-WINDOW/ DOOR LOCK-DRIVER
(8W-60-2)
(8W-61-3)
8 C1
CLUB CAB
DRIVER DOOR LOCK SWITCH MUX
SWITCH-WINDOW/ DOOR LOCK-DRIVER EXPRESS
(8W-60-3)
(8W-61-2)
8 C1
QUAD CAB
G161 20 VT/DG
9 C301
G161 20 VT/DG
14 C200
G161 20 VT/DG
3 C2
5 VOLT SELECTOR SWITCH SUPPLY
4WD NEUTRAL INDICATOR
MODE SELECT
SWITCH-TRANSFER CASE SELECTOR
(4WD)
(8W-31-9)
1
6
3
K77 20 BR/WT
G95 20 VT/BR
K977 20 BR/WT
21 C1
16 C3
12 C2
CLUSTER
5 VOLT SELECTOR SWITCH SUPPLY
4WD NEUTRAL INDICATOR
MODE SELECT
HIGH BEAM/FRONT WASHER SWITCH MUX
FRONT WIPER SWITCH MUX
TURN SIGNAL INPUT MUX
INDICATOR DIMMER SIGNAL
HEADLAMP SWITCH MUX
HEADLAMP SWITCH MUX RETURN
PANEL LAMPS DIMMER SIGNAL
FOG LAMP INDICATOR DRIVER
1 C2
16 C1
8 C2
4 C2
5 C2
10 C2
9 C3
4 C1
G194 20 VT/LG
W52 20 BR/YL
L12 20 WT/OR
E2 20 OR/BR
L307 20 PK/RD
L900 20 WT/YL
E19 20 OR/BR
L914 20 WT
1
4
3
2
1
3
4
6
HIGH BEAM/FRONT WASHER SWITCH MUX
FRONT WIPER SWITCH MUX
TURN SIGNAL INPUT MUX
SWITCH-MULTIFUNCTION
(8W-53-3)
INDICATOR DIMMER SIGNAL
HEADLAMP SWITCH MUX
HEADLAMP SWITCH MUX RETURN
PANEL LAMPS DIMMER SIGNAL
FOG LAMP INDICATOR DRIVER
SWITCH-HEADLAMP
(8W-44-2)
(8W-50-2)
POWER CONVENIENCE


LAMP-DOME-FRONT (8W-44-3)
COURTESY LAMP DRIVER
GLOVE BOX LAMP DRIVER
C
A
M22 20 YL/OR
M28 20 YL/TN
S214 (8W-44-3)
S215 (8W-44-3)
2
4
C203
M28 20 YL/TN
S208 (8W-44-3)
M22 20 YL/OR
M28 20 YL/TN
11
1
C3
MODULE-FRONT CONTROL (8W-13-29)
CAN B BUS (+)
CAN B BUS (-)
2
3
C1
D55 20 WT/OR
D54 20 WT
S105 (8W-18-3)
S107 (8W-18-4)
37
36
C201
S212 (8W-18-3)
S211 (8W-18-4)
14
13
C2
B25 20 DG/WT
38
C200
3
SWITCH-PARKING BRAKE
CLUSTER
PARK BRAKE SWITCH SENSE
CARGO LAMP DRIVER
BTSI SOLENOID CONTROL
FUEL LEVEL SENSOR NO. 1 SIGNAL
FUEL LEVEL SENSOR RETURN
24
16
6
L14 20 WT/BK
B30 20 DG/OR
N4 20 DB/YL
N5 20 DB/WT
10
40
13
SOLENOID-BRAKE TRANSMISSION SHIFT (8W-31-9)
LAMP-HIGH MOUNTED STOP (8W-51-4)
MODULE-FUEL PUMP (8W-30-4)

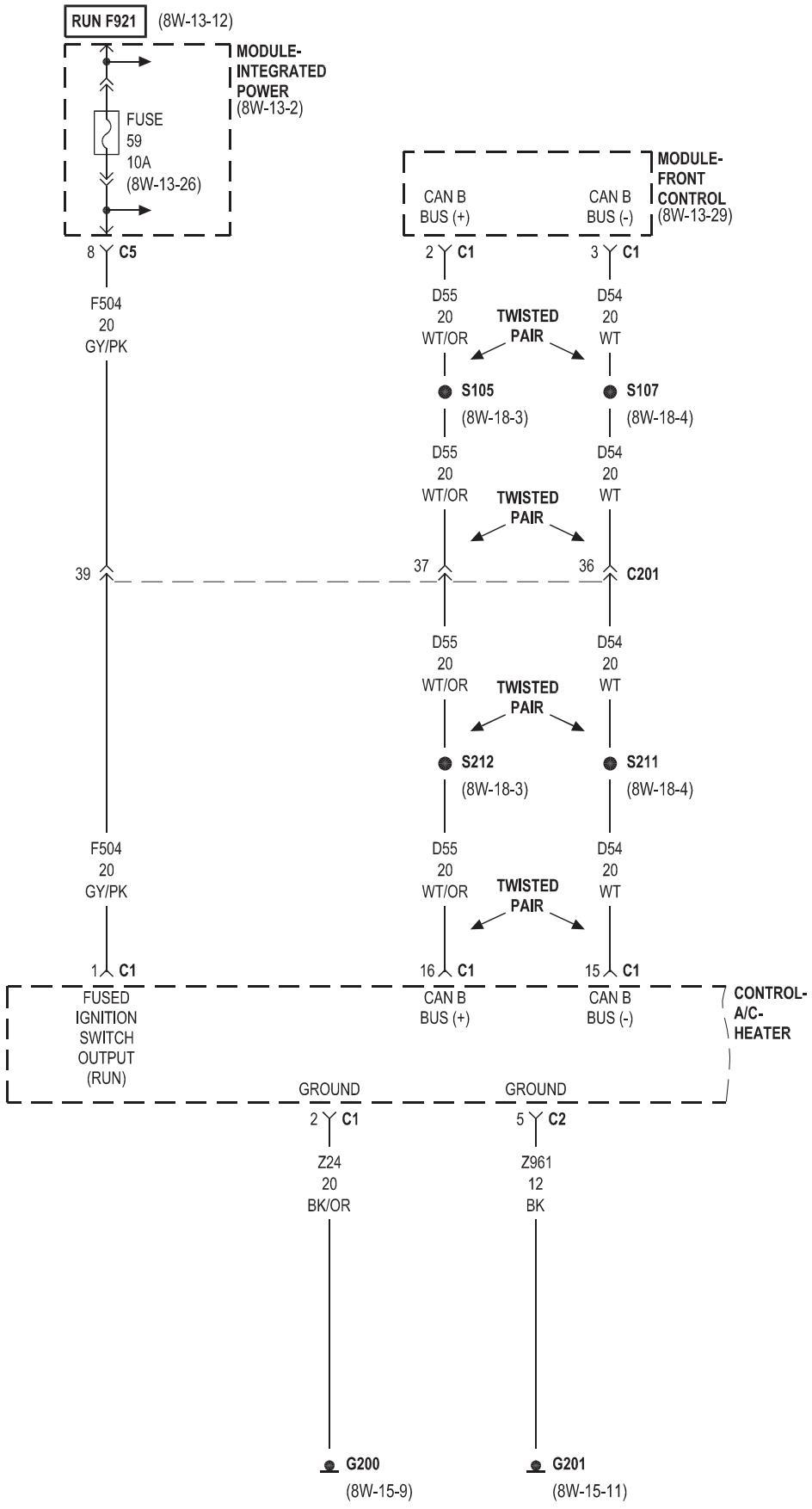
8W-41 HORN/CIGAR LIGHTER/POWER OUTLET

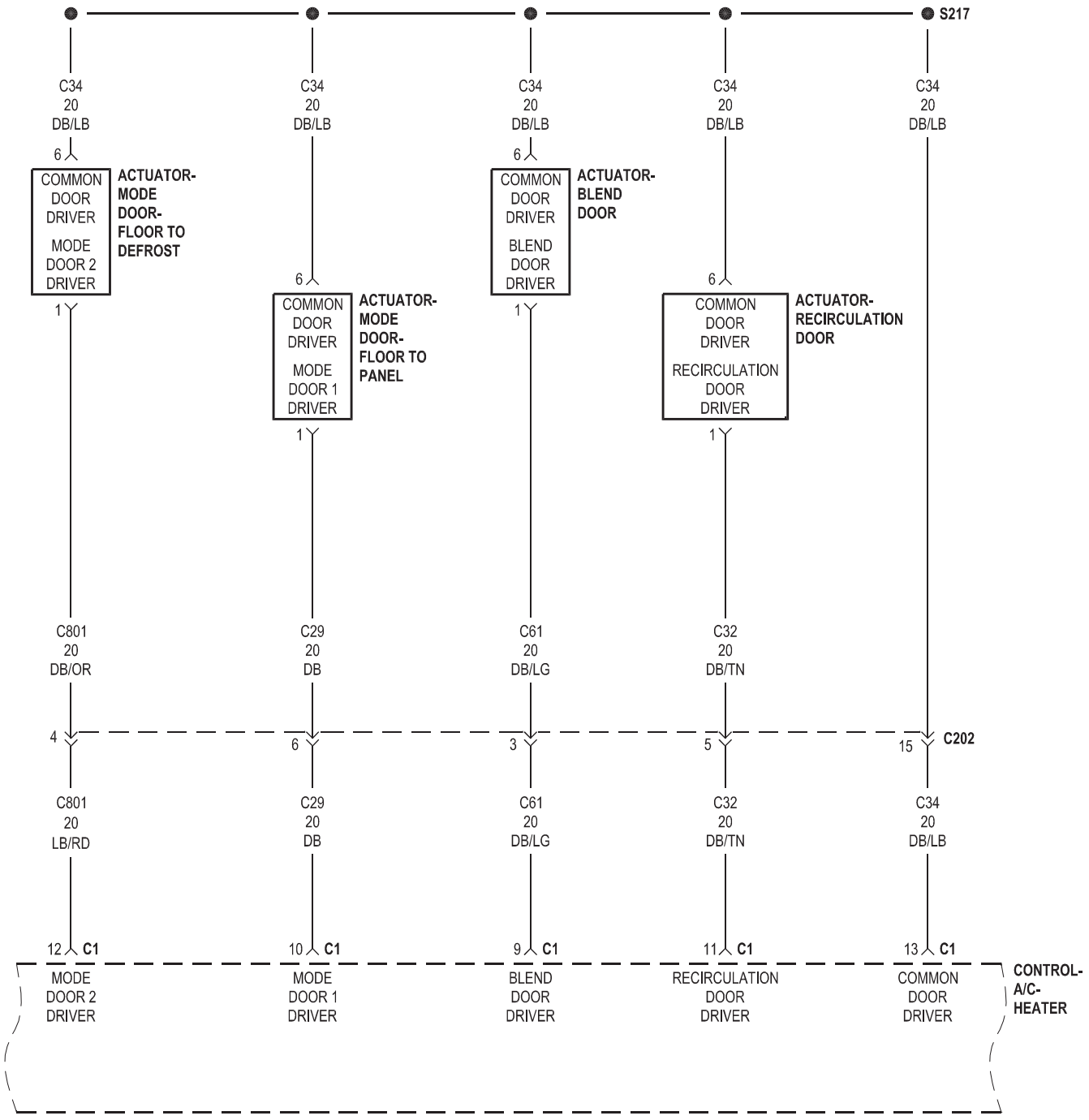
Component	Page
Clockspring	8W-41-2
Cluster	8W-41-2
Fuse 16	8W-41-2
Fuse 22	8W-41-2
Fuse 28	8W-41-2
G201	8W-41-2
G300	8W-41-2
Horn-No. 1	8W-41-2
Horn-No. 2	8W-41-2
Module-Front Control	8W-41-2
Module-Integrated Power	8W-41-2
Power Outlet-Console	8W-41-2
Power Outlet-Instrument Panel	8W-41-2
Relay-Horn	8W-41-2
Switch-Horn	8W-41-2

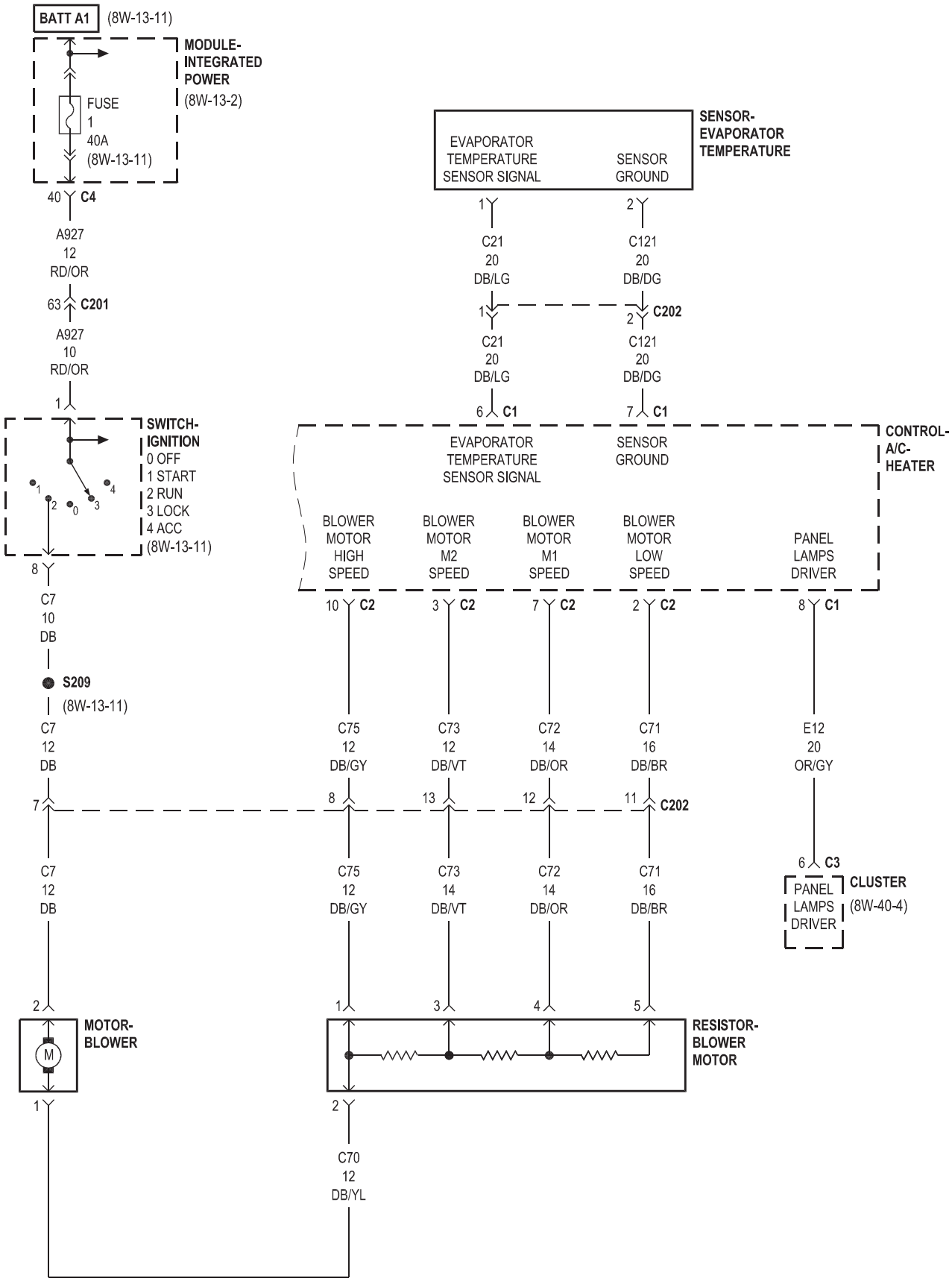

BATT A1
(8W-13-11)
RUN-ACC F984
(8W-13-12)
MODULE-INTEGRATED POWER
(8W-13-2)
FUSE 16 20A
(8W-13-17)
BATTERY
IGNITION
FUSE 28 20A
(8W-13-19)
FUSE 22 20A
(8W-13-18)
86
30
RELAY-HORN
85
87
87A
47 IPM
HORN RELAY CONTROL
MODULE-FRONT CONTROL
(8W-13-17)
7 C3
X2 18 DG/OR
8 C3
X2 18 DG/OR
27 C3
A901 18 RD
13 C4
F306 18 DB/PK
12 C104
A901 16 RD
1 C201
F306 18 DB/PK
HORN-NO. 2
HORN-NO. 1
S309
(8W-13-19)
1 C304
5 C304
BASE
PREMIUM
A12 16 RD/TN
POWER OUTLET-CONSOLE
POWER OUTLET-INSTRUMENT PANEL
Z1 16 BK
Z959 18 BK
BASE
PREMIUM
S219
(8W-15-14)
2 C304
10 C304
Z738 18 BK/WT
S308
(8W-15-14)
Z738 18 BK/WT
G300
(8W-15-14)
G201
(8W-15-11)
CLUSTER
(8W-40-4)
HORN SWITCH SENSE
10 C1
X3 20 DG/VT
6 C1
CLOCKSPRING
(8W-40-4)
(8W-47-6)
1 C3
X3 20 DG/VT
SWITCH-HORN

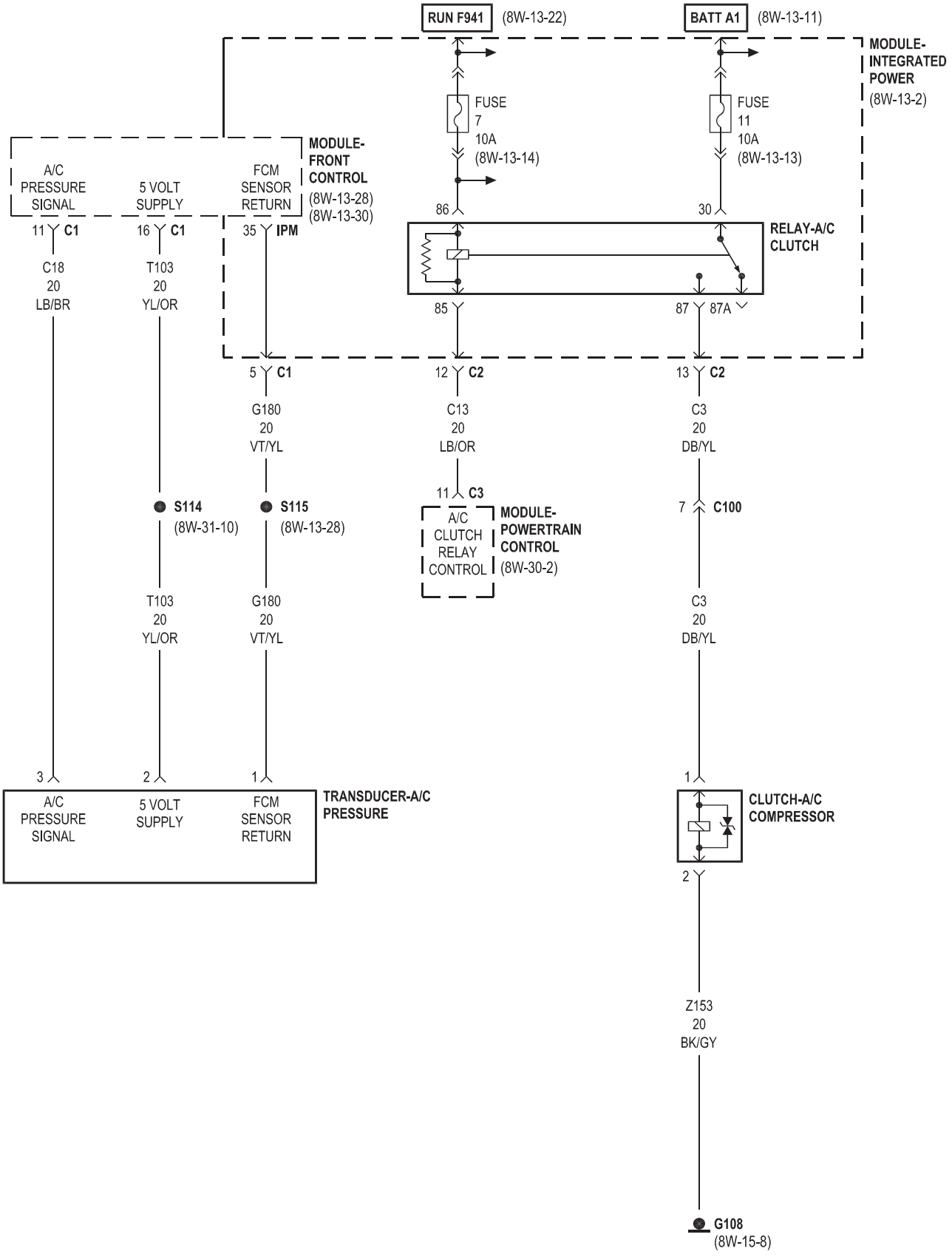
8W-42 AIR CONDITIONING/HEATER

Component	Page
Actuator-Blend Door	8W-42-3
Actuator-Mode Door-Floor To Defrost	8W-42-3
Actuator-Mode Door-Floor To Panel	8W-42-3
Actuator-Recirculation Door	8W-42-3
Cluster	8W-42-4
Clutch-A/C Compressor	8W-42-5
Control-A/C-Heater	8W-42-2, 3, 4
Fuse 1	8W-42-4
Fuse 7	8W-42-5
Fuse 11	8W-42-5
Fuse 59	8W-42-2
G108	8W-42-5
G200	8W-42-2
G201	8W-42-2
Module-Front Control	8W-42-2, 5
Module-Integrated Power	8W-42-2, 4, 5
Module-Powertrain Control	8W-42-5
Motor-Blower	8W-42-4
Relay-A/C Clutch	8W-42-5
Resistor-Blower Motor	8W-42-4
Sensor-EVAPOrator Temperature	8W-42-4
Switch-Ignition	8W-42-4
Transducer-A/C Pressure	8W-42-5


RUN F921
(8W-13-12)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
59
10A
(8W-13-26)
MODULE-
FRONT
CONTROL
(8W-13-29)
CAN B
BUS (+)
CAN B
BUS (-)
8 C5
2 C1
3 C1
F504
20
GY/PK
D55
20
WT/OR
TWISTED
PAIR
D54
20
WT
S105
(8W-18-3)
S107
(8W-18-4)
39
37
36 C201
S212
(8W-18-3)
S211
(8W-18-4)
1 C1
16 C1
15 C1
FUSED
IGNITION
SWITCH
OUTPUT
(RUN)
CONTROL-
A/C-
HEATER
GROUND
2 C1
5 C2
Z24
20
BK/OR
Z961
12
BK
G200
(8W-15-9)
G201
(8W-15-11)

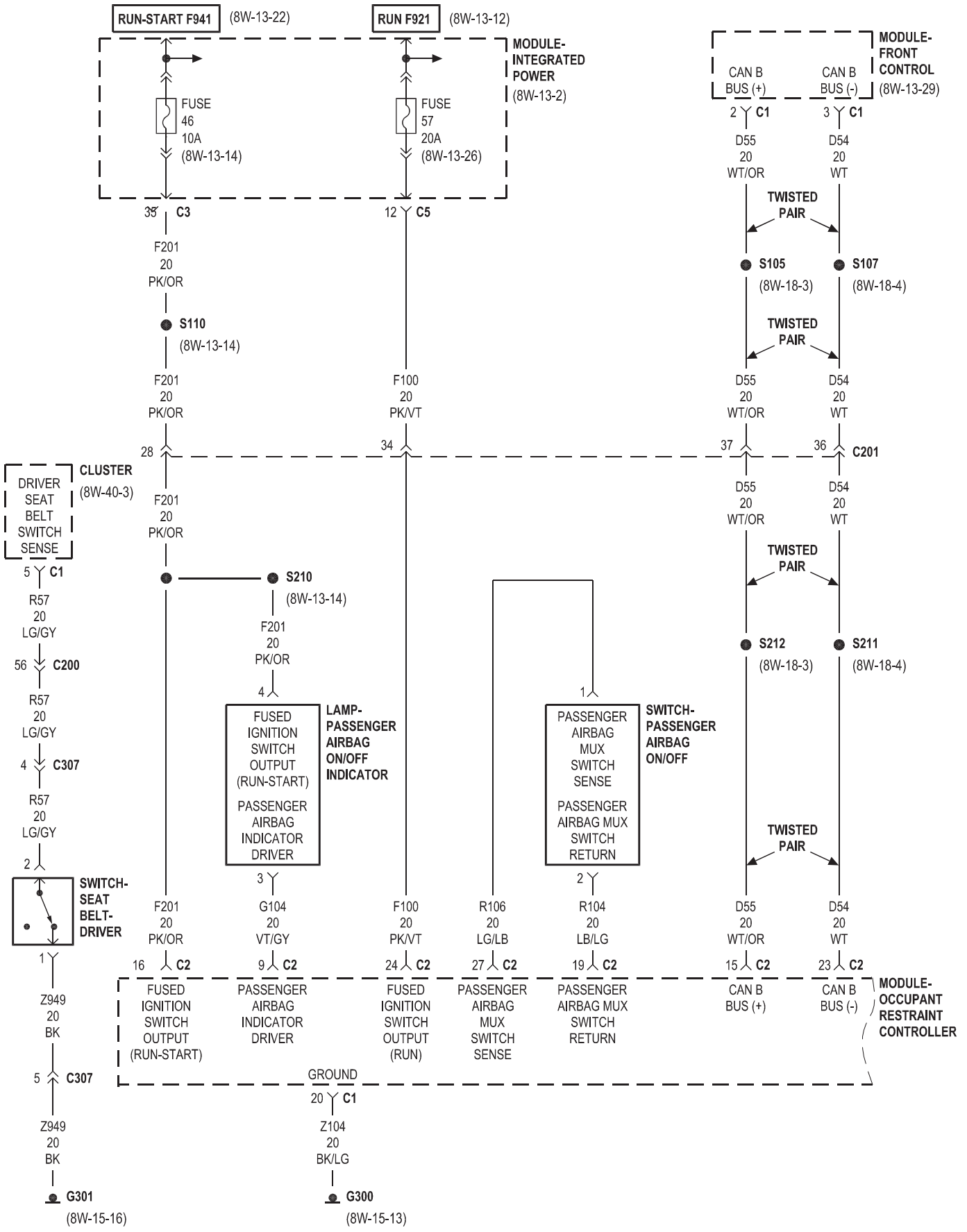

S217
C34
20
DB/LB
6
COMMON DOOR DRIVER
MODE DOOR 2 DRIVER
ACTUATOR-MODE DOOR-FLOOR TO DEFROST
1
C801
20
DB/OR
4
C801
20
LB/RD
12 C1
MODE DOOR 2 DRIVER
C34
20
DB/LB
6
COMMON DOOR DRIVER
MODE DOOR 1 DRIVER
ACTUATOR-MODE DOOR-FLOOR TO PANEL
1
C29
20
DB
6
C29
20
DB
10 C1
MODE DOOR 1 DRIVER
C34
20
DB/LB
6
COMMON DOOR DRIVER
BLEND DOOR DRIVER
ACTUATOR-BLEND DOOR
1
C61
20
DB/LG
3
C61
20
DB/LG
9 C1
BLEND DOOR DRIVER
C34
20
DB/LB
6
COMMON DOOR DRIVER
RECIRCULATION DOOR DRIVER
ACTUATOR-RECIRCULATION DOOR
1
C32
20
DB/TN
5
C32
20
DB/TN
11 C1
RECIRCULATION DOOR DRIVER
C34
20
DB/LB
C202
15
C34
20
DB/LB
13 C1
COMMON DOOR DRIVER
CONTROL-A/C-HEATER

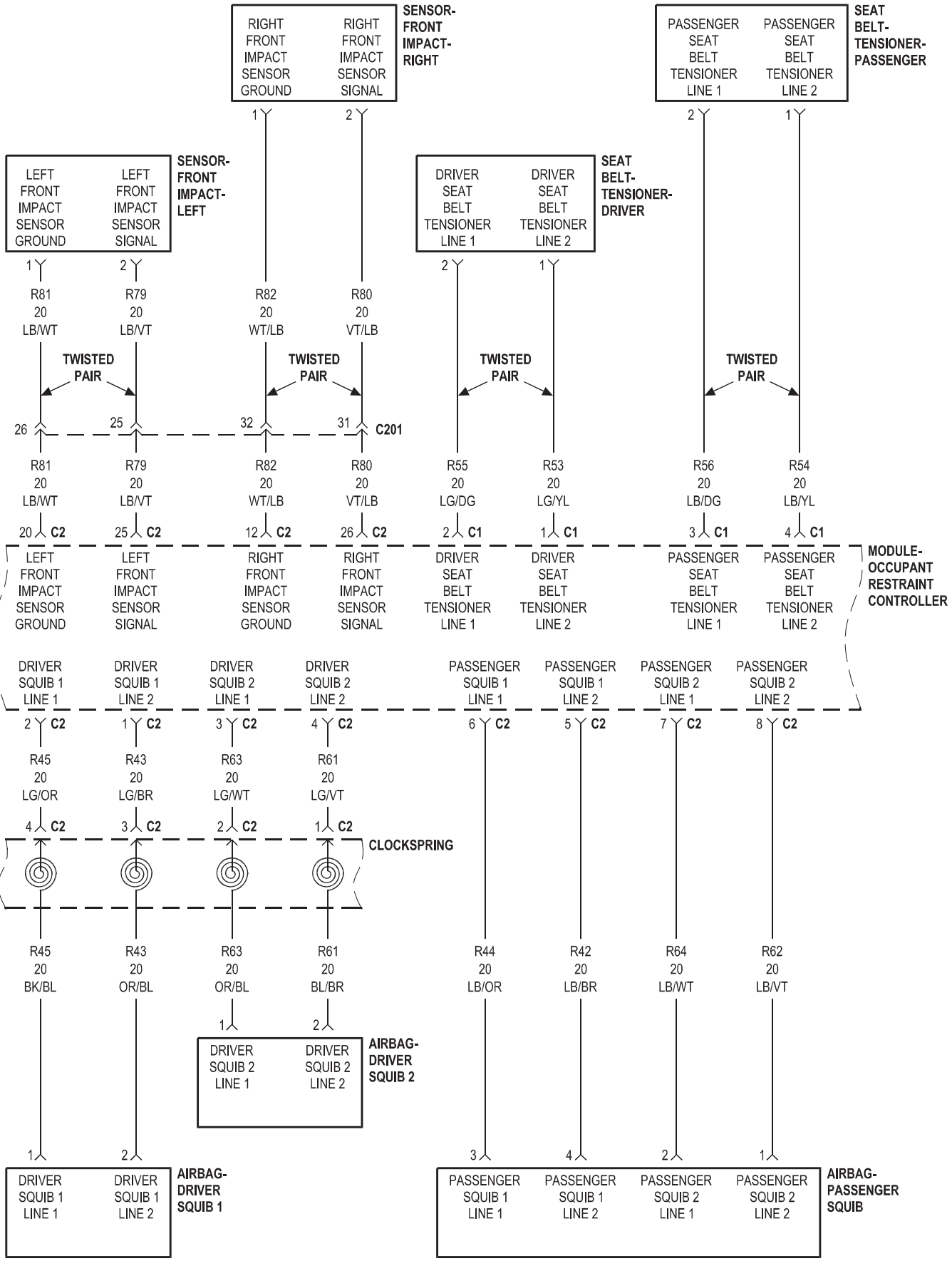

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
1
40A
(8W-13-11)
40 C4
A927
12
RD/OR
63 C201
A927
10
RD/OR
1
SWITCH-
IGNITION
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
(8W-13-11)
8
C7
10
DB
S209
(8W-13-11)
C7
12
DB
7
C7
12
DB
2
MOTOR-
BLOWER
M
1
SENSOR-
EVAPORATOR
TEMPERATURE
EVAPORATOR
TEMPERATURE
SENSOR SIGNAL
SENSOR
GROUND
1
2
C21
20
DB/LG
C121
20
DB/DG
1
2 C202
C21
20
DB/LG
C121
20
DB/DG
6 C1
7 C1
CONTROL-
A/C-
HEATER
EVAPORATOR
TEMPERATURE
SENSOR SIGNAL
SENSOR
GROUND
BLOWER
MOTOR
HIGH
SPEED
BLOWER
MOTOR
M2
SPEED
BLOWER
MOTOR
M1
SPEED
BLOWER
MOTOR
LOW
SPEED
PANEL
LAMPS
DRIVER
10 C2
3 C2
7 C2
2 C2
8 C1
C75
12
DB/GY
C73
12
DB/VT
C72
14
DB/OR
C71
16
DB/BR
E12
20
OR/GY
8
13
12
11 C202
C75
12
DB/GY
C73
14
DB/VT
C72
14
DB/OR
C71
16
DB/BR
6 C3
CLUSTER
PANEL
LAMPS
DRIVER
(8W-40-4)
1
3
4
5
RESISTOR-
BLOWER
MOTOR
2
C70
12
DB/YL

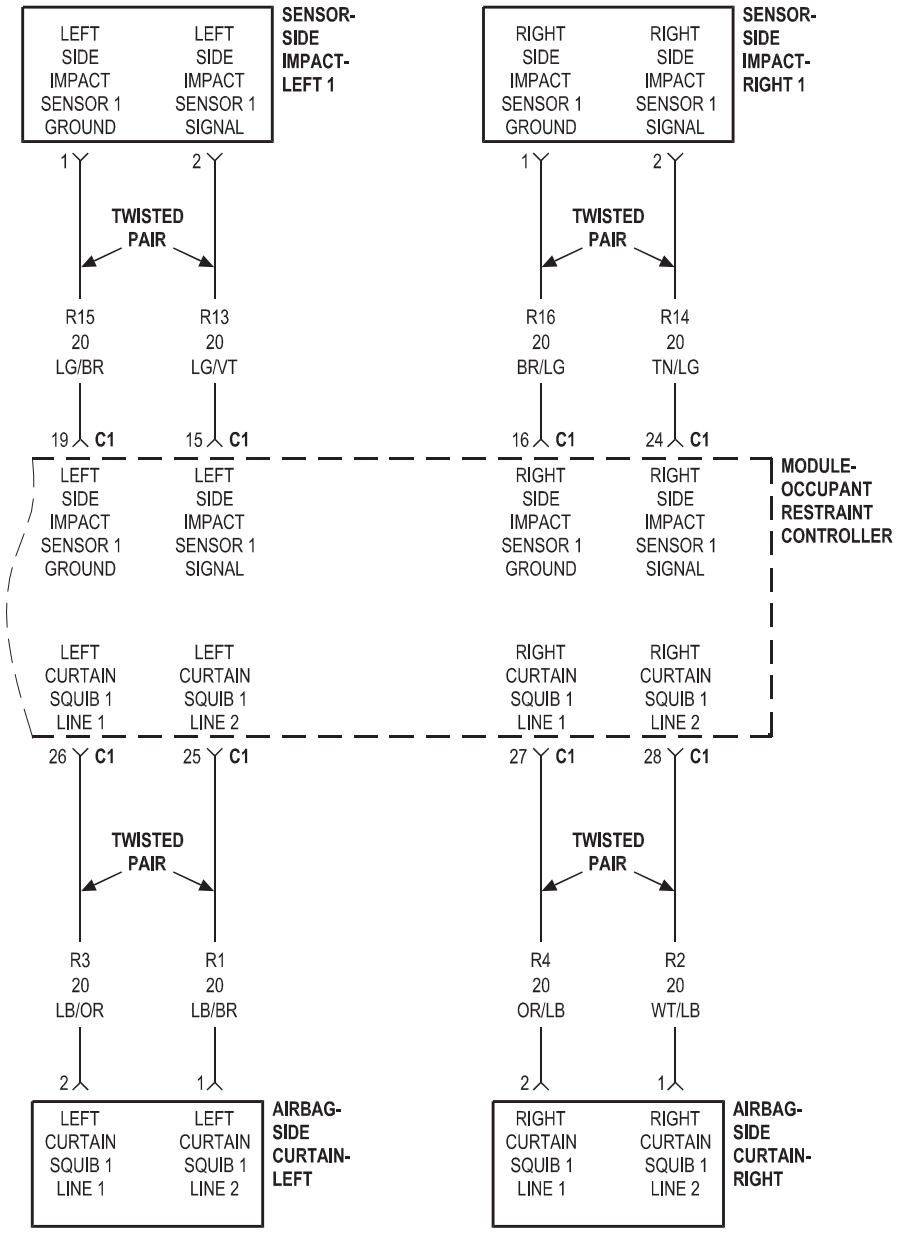

RUN F941
(8W-13-22)
BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
7
10A
(8W-13-14)
FUSE
11
10A
(8W-13-13)
MODULE-
FRONT
CONTROL
(8W-13-28)
(8W-13-30)
A/C
PRESSURE
SIGNAL
5 VOLT
SUPPLY
FCM
SENSOR
RETURN
11 C1
16 C1
35 IPM
86
30
RELAY-A/C
CLUTCH
85
87
87A
C18
20
LB/BR
T103
20
YL/OR
5 C1
12 C2
13 C2
G180
20
VT/YL
C13
20
LB/OR
C3
20
DB/YL
S114
(8W-31-10)
S115
(8W-13-28)
11 C3
7 C100
A/C
CLUTCH
RELAY
CONTROL
MODULE-
POWERTRAIN
CONTROL
(8W-30-2)
T103
20
YL/OR
G180
20
VT/YL
C3
20
DB/YL
3
2
1
1
A/C
PRESSURE
SIGNAL
5 VOLT
SUPPLY
FCM
SENSOR
RETURN
TRANSDUCER-A/C
PRESSURE
CLUTCH-A/C
COMPRESSOR
2
Z153
20
BK/GY
G108
(8W-15-8)

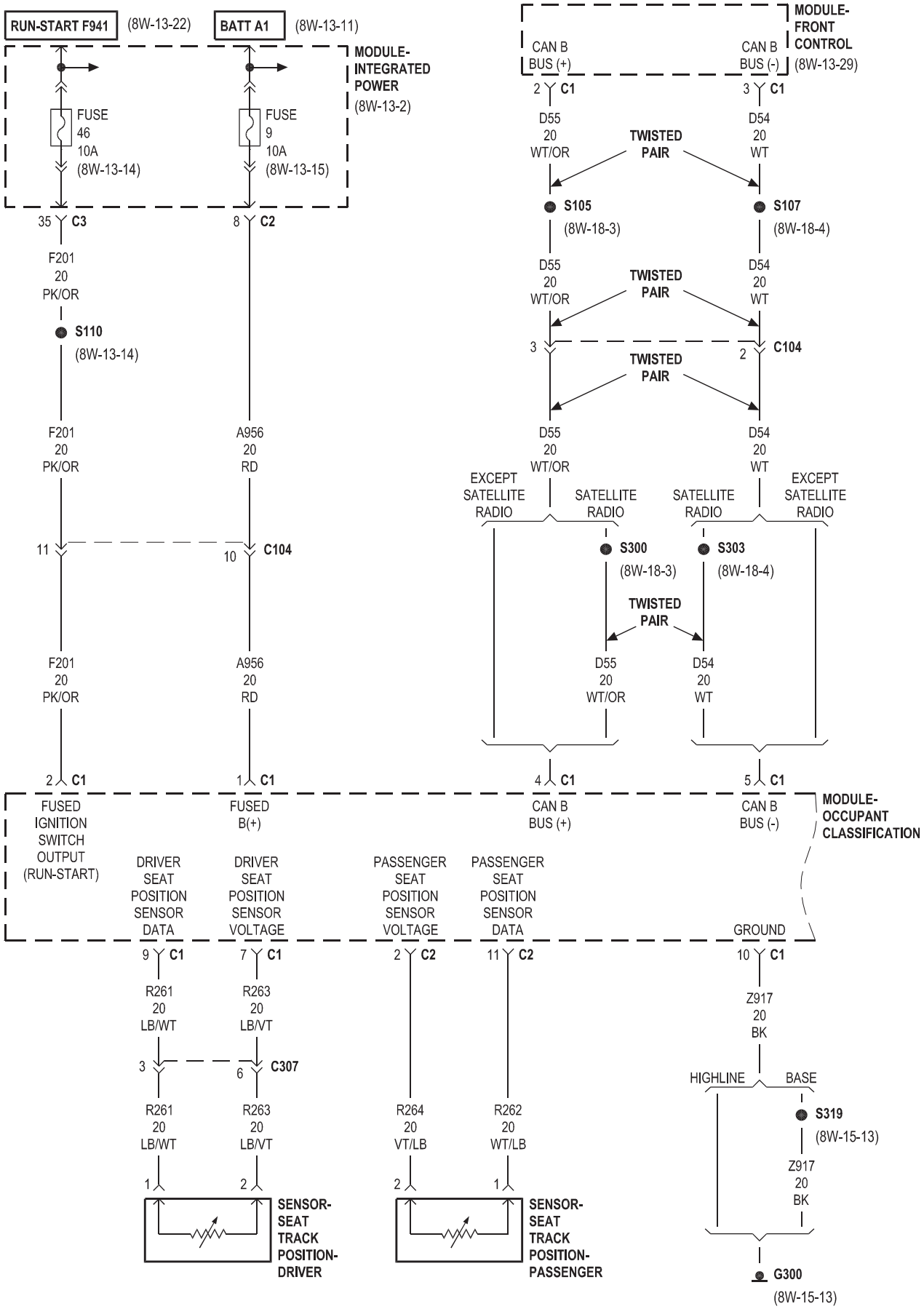
8W-43 OCCUPANT RESTRAINT SYSTEM

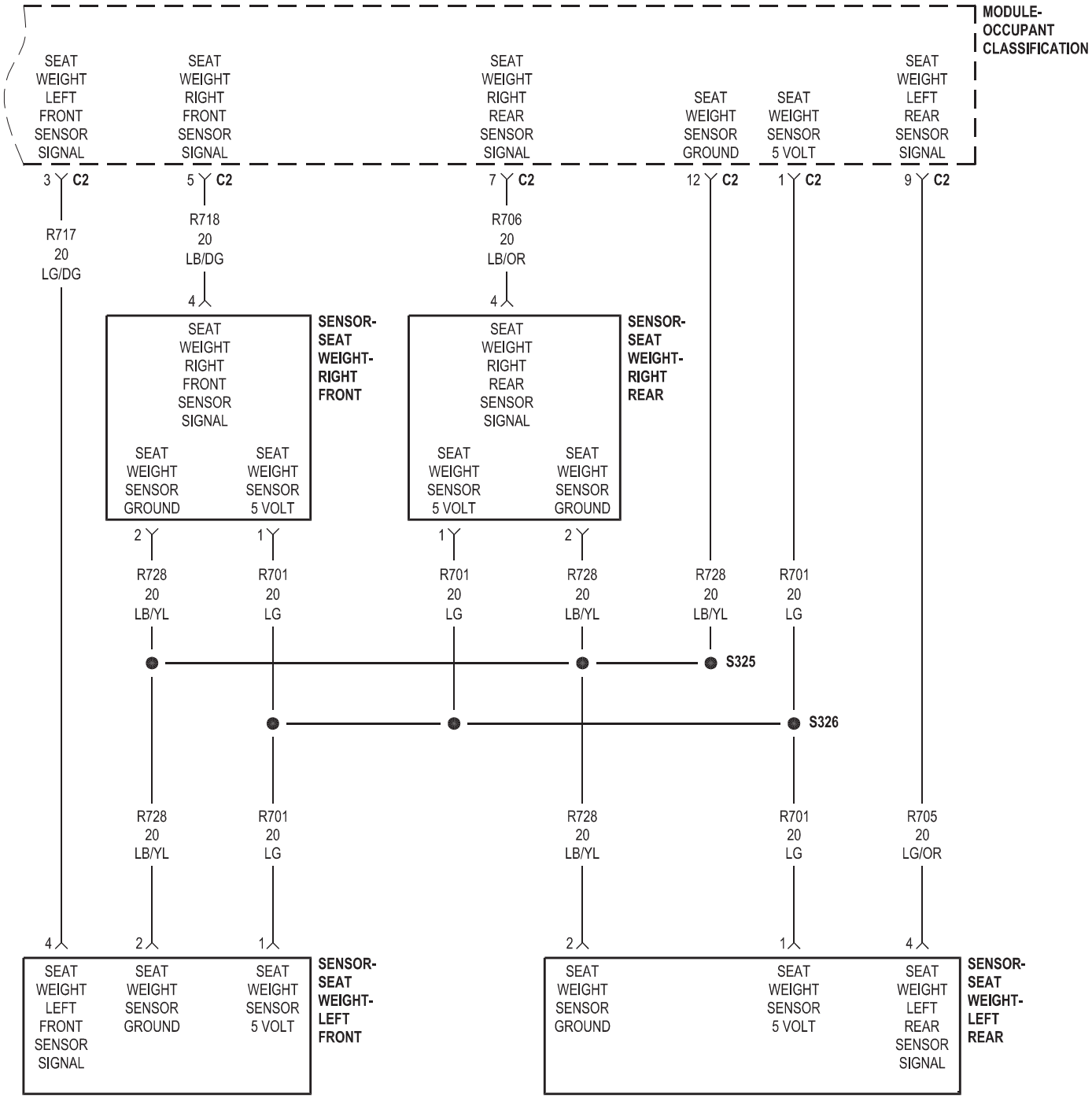
Component	Page
Airbag-Driver Squib 1	8W-43-3
Airbag-Driver Squib 2	8W-43-3
Airbag-Passenger Squib	8W-43-3
Airbag-Side Curtain-Left	8W-43-4
Airbag-Side Curtain-Right	8W-43-4
Clockspring	8W-43-3
Cluster	8W-43-2
Fuse 9	8W-43-5
Fuse 46	8W-43-2, 5
Fuse 57	8W-43-2
G300	8W-43-2, 5
G301	8W-43-2
Lamp-Passenger Airbag On/Off Indicator	8W-43-2
Module-Front Control	8W-43-2, 5
Module-Integrated Power	8W-43-2, 5
Module-Occupant Classification	8W-43-5, 6
Module-Occupant Restraint Controller	8W-43-2, 3, 4
Seat Belt-Tensioner-Driver	8W-43-3
Seat Belt-Tensioner-Passenger	8W-43-3
Sensor-Front Impact-Left	8W-43-3
Sensor-Front Impact-Right	8W-43-3
Sensor-Seat Track Position-Driver	8W-43-5
Sensor-Seat Track Position-Passenger	8W-43-5
Sensor-Seat Weight-Left Front	8W-43-6
Sensor-Seat Weight-Left Rear	8W-43-6
Sensor-Seat Weight-Right Front	8W-43-6
Sensor-Seat Weight-Right Rear	8W-43-6
Sensor-Side Impact-Left 1	8W-43-4
Sensor-Side Impact-Right 1	8W-43-4
Switch-Passenger Airbag On/Off	8W-43-2
Switch-Seat Belt-Driver	8W-43-2


RUN-START F941
(8W-13-22)
RUN F921
(8W-13-12)
MODULE-INTEGRATED POWER
(8W-13-2)
FUSE 46 10A (8W-13-14)
FUSE 57 20A (8W-13-26)
MODULE-FRONT CONTROL
(8W-13-29)
CAN B BUS (+)
CAN B BUS (-)
2 C1
3 C1
D55 20 WT/OR
D54 20 WT
TWISTED PAIR
S105
S107
(8W-18-3)
(8W-18-4)
35 C3
12 C5
F201 20 PK/OR
S110
(8W-13-14)
F100 20 PK/VT
28
34
37
36 C201
CLUSTER
(8W-40-3)
DRIVER SEAT BELT SWITCH SENSE
5 C1
R57 20 LG/GY
56 C200
4 C307
2
S210
(8W-13-14)
S212
S211
4
1
3
2
FUSED IGNITION SWITCH OUTPUT (RUN-START)
PASSENGER AIRBAG INDICATOR DRIVER
LAMP-PASSENGER AIRBAG ON/OFF INDICATOR
PASSENGER AIRBAG MUX SWITCH SENSE
PASSENGER AIRBAG MUX SWITCH RETURN
SWITCH-PASSENGER AIRBAG ON/OFF
SWITCH-SEAT BELT-DRIVER
1
Z949 20 BK
5 C307
Z949 20 BK
G301
(8W-15-16)
R106 20 LG/LB
R104 20 LB/LG
G104 20 VT/GY
16 C2
9 C2
24 C2
27 C2
19 C2
15 C2
23 C2
FUSED IGNITION SWITCH OUTPUT (RUN)
MODULE-OCCUPANT RESTRAINT CONTROLLER
GROUND
20 C1
Z104 20 BK/LG
G300
(8W-15-13)


RIGHT FRONT IMPACT SENSOR GROUND
RIGHT FRONT IMPACT SENSOR SIGNAL
SENSOR- FRONT IMPACT- RIGHT
PASSENGER SEAT BELT TENSIONER LINE 1
PASSENGER SEAT BELT TENSIONER LINE 2
SEAT BELT- TENSIONER- PASSENGER
LEFT FRONT IMPACT SENSOR GROUND
LEFT FRONT IMPACT SENSOR SIGNAL
SENSOR- FRONT IMPACT- LEFT
DRIVER SEAT BELT TENSIONER LINE 1
DRIVER SEAT BELT TENSIONER LINE 2
SEAT BELT- TENSIONER- DRIVER
R81 20 LB/WT
R79 20 LB/VT
R82 20 WT/LB
R80 20 VT/LB
TWISTED PAIR
C201
R55 20 LG/DG
R53 20 LG/YL
R56 20 LB/DG
R54 20 LB/YL
MODULE- OCCUPANT RESTRAINT CONTROLLER
DRIVER SQUIB 1 LINE 1
DRIVER SQUIB 1 LINE 2
DRIVER SQUIB 2 LINE 1
DRIVER SQUIB 2 LINE 2
PASSENGER SQUIB 1 LINE 1
PASSENGER SQUIB 1 LINE 2
PASSENGER SQUIB 2 LINE 1
PASSENGER SQUIB 2 LINE 2
R45 20 LG/OR
R43 20 LG/BR
R63 20 LG/WT
R61 20 LG/VT
CLOCKSPRING
R45 20 BK/BL
R43 20 OR/BL
R63 20 OR/BL
R61 20 BL/BR
R44 20 LB/OR
R42 20 LB/BR
R64 20 LB/WT
R62 20 LB/VT
AIRBAG- DRIVER SQUIB 2
AIRBAG- DRIVER SQUIB 1
AIRBAG- PASSENGER SQUIB

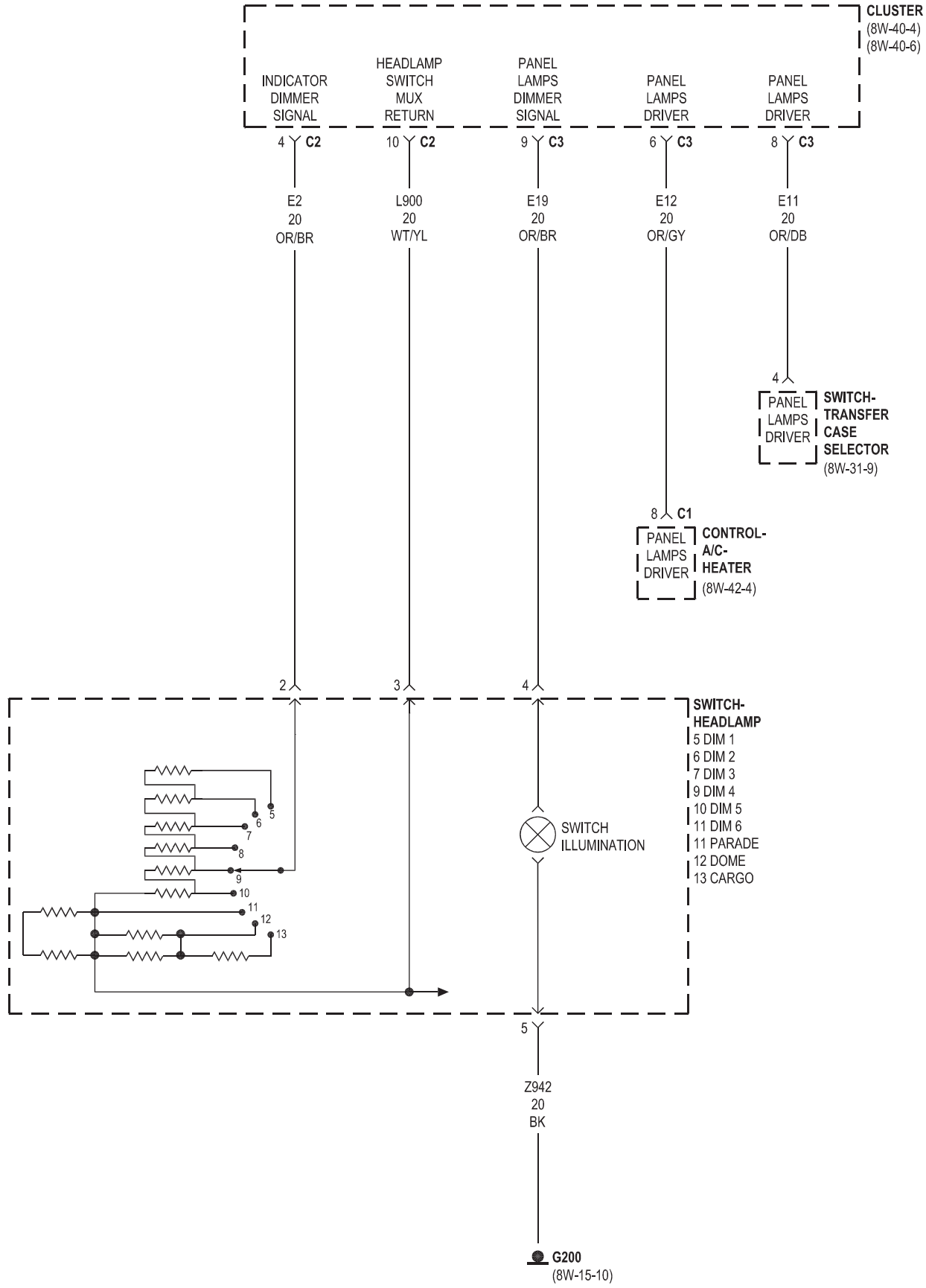

LEFT SIDE IMPACT SENSOR 1 GROUND
LEFT SIDE IMPACT SENSOR 1 SIGNAL
SENSOR-SIDE IMPACT-LEFT 1
RIGHT SIDE IMPACT SENSOR 1 GROUND
RIGHT SIDE IMPACT SENSOR 1 SIGNAL
SENSOR-SIDE IMPACT-RIGHT 1
1
2
TWISTED PAIR
R15 20 LG/BR
R13 20 LG/VT
R16 20 BR/LG
R14 20 TN/LG
19 C1
15 C1
16 C1
24 C1
MODULE-OCCUPANT RESTRAINT CONTROLLER
LEFT CURTAIN SQUIB 1 LINE 1
LEFT CURTAIN SQUIB 1 LINE 2
RIGHT CURTAIN SQUIB 1 LINE 1
RIGHT CURTAIN SQUIB 1 LINE 2
26 C1
25 C1
27 C1
28 C1
R3 20 LB/OR
R1 20 LB/BR
R4 20 OR/LB
R2 20 WT/LB
AIRBAG-SIDE CURTAIN-LEFT
AIRBAG-SIDE CURTAIN-RIGHT

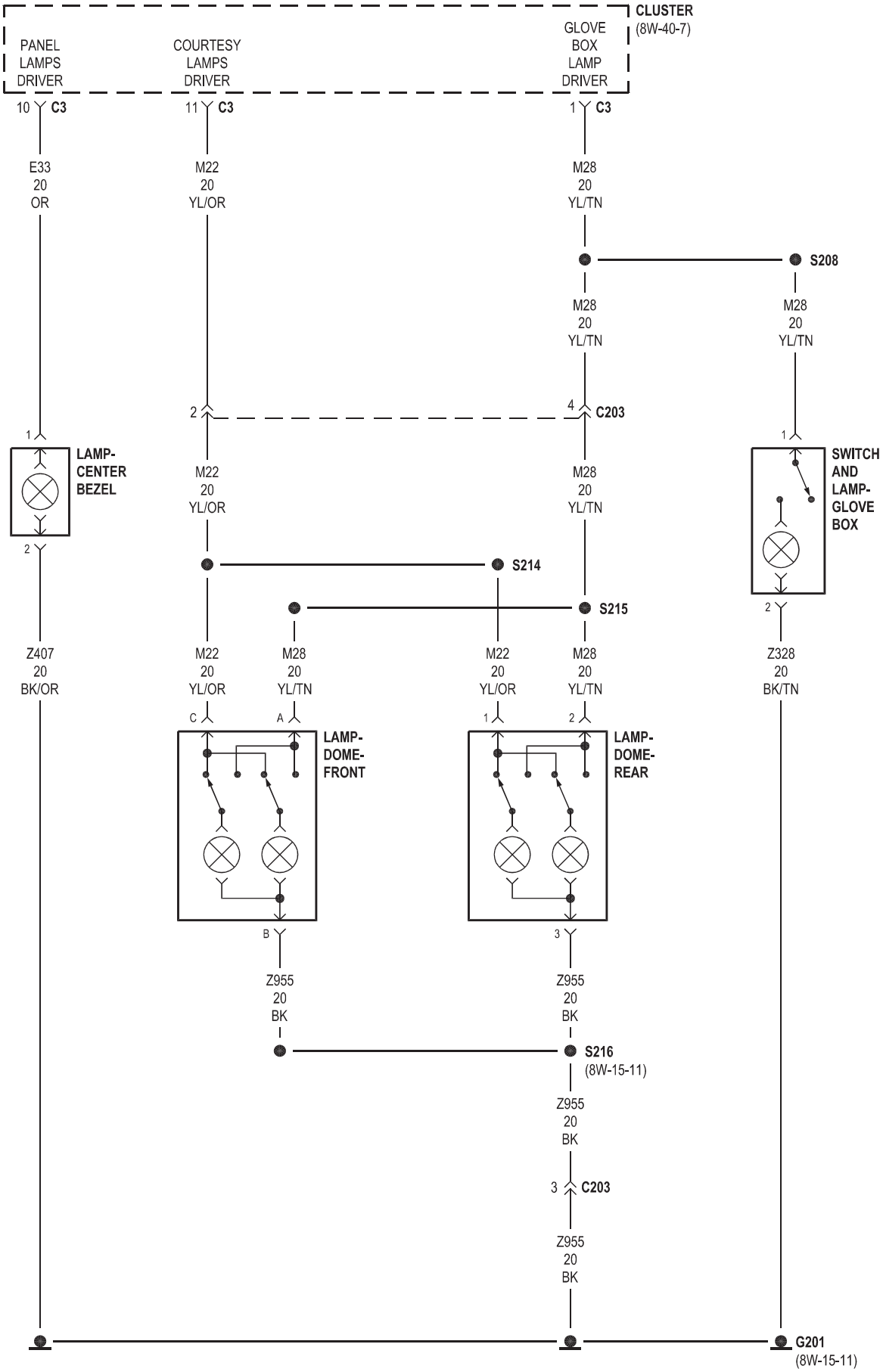

RUN-START F941
(8W-13-22)
BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
46
10A
(8W-13-14)
FUSE
9
10A
(8W-13-15)
35 C3
8 C2
F201
20
PK/OR
S110
(8W-13-14)
F201
20
PK/OR
A956
20
RD
11
10 C104
F201
20
PK/OR
A956
20
RD
2 C1
1 C1
FUSED
IGNITION
SWITCH
OUTPUT
(RUN-START)
FUSED
B(+)
MODULE-
FRONT
CONTROL
(8W-13-29)
CAN B
BUS (+)
CAN B
BUS (-)
2 C1
3 C1
D55
20
WT/OR
TWISTED
PAIR
D54
20
WT
S105
(8W-18-3)
S107
(8W-18-4)
D55
20
WT/OR
TWISTED
PAIR
D54
20
WT
3
2 C104
TWISTED
PAIR
D55
20
WT/OR
D54
20
WT
EXCEPT
SATELLITE
RADIO
SATELLITE
RADIO
SATELLITE
RADIO
EXCEPT
SATELLITE
RADIO
S300
(8W-18-3)
S303
(8W-18-4)
TWISTED
PAIR
D55
20
WT/OR
D54
20
WT
4 C1
5 C1
CAN B
BUS (+)
CAN B
BUS (-)
MODULE-
OCCUPANT
CLASSIFICATION
DRIVER
SEAT
POSITION
SENSOR
DATA
DRIVER
SEAT
POSITION
SENSOR
VOLTAGE
PASSENGER
SEAT
POSITION
SENSOR
VOLTAGE
PASSENGER
SEAT
POSITION
SENSOR
DATA
GROUND
9 C1
7 C1
2 C2
11 C2
10 C1
R261
20
LB/WT
R263
20
LB/VT
Z917
20
BK
3
6 C307
HIGHLINE
BASE
R261
20
LB/WT
R263
20
LB/VT
R264
20
VT/LB
R262
20
WT/LB
S319
(8W-15-13)
Z917
20
BK
1
2
2
1
SENSOR-
SEAT
TRACK
POSITION-
DRIVER
SENSOR-
SEAT
TRACK
POSITION-
PASSENGER
G300
(8W-15-13)


MODULE-
OCCUPANT
CLASSIFICATION
SEAT WEIGHT LEFT FRONT SENSOR SIGNAL
SEAT WEIGHT RIGHT FRONT SENSOR SIGNAL
SEAT WEIGHT RIGHT REAR SENSOR SIGNAL
SEAT WEIGHT SENSOR GROUND
SEAT WEIGHT SENSOR 5 VOLT
SEAT WEIGHT LEFT REAR SENSOR SIGNAL
3 C2
5 C2
7 C2
12 C2
1 C2
9 C2
R717 20 LG/DG
R718 20 LB/DG
R706 20 LB/OR
4
4
SENSOR-SEAT WEIGHT-RIGHT FRONT
SENSOR-SEAT WEIGHT-RIGHT REAR
SEAT WEIGHT RIGHT FRONT SENSOR SIGNAL
SEAT WEIGHT SENSOR GROUND
SEAT WEIGHT SENSOR 5 VOLT
SEAT WEIGHT RIGHT REAR SENSOR SIGNAL
SEAT WEIGHT SENSOR 5 VOLT
SEAT WEIGHT SENSOR GROUND
2
1
1
2
R728 20 LB/YL
R701 20 LG
R701 20 LG
R728 20 LB/YL
R728 20 LB/YL
R701 20 LG
S325
S326
R728 20 LB/YL
R701 20 LG
R728 20 LB/YL
R701 20 LG
R705 20 LG/OR
4
2
1
2
1
4
SENSOR-SEAT WEIGHT-LEFT FRONT
SENSOR-SEAT WEIGHT-LEFT REAR
SEAT WEIGHT LEFT FRONT SENSOR SIGNAL
SEAT WEIGHT SENSOR GROUND
SEAT WEIGHT SENSOR 5 VOLT
SEAT WEIGHT SENSOR GROUND
SEAT WEIGHT SENSOR 5 VOLT
SEAT WEIGHT LEFT REAR SENSOR SIGNAL

8W-44 INTERIOR LIGHTING

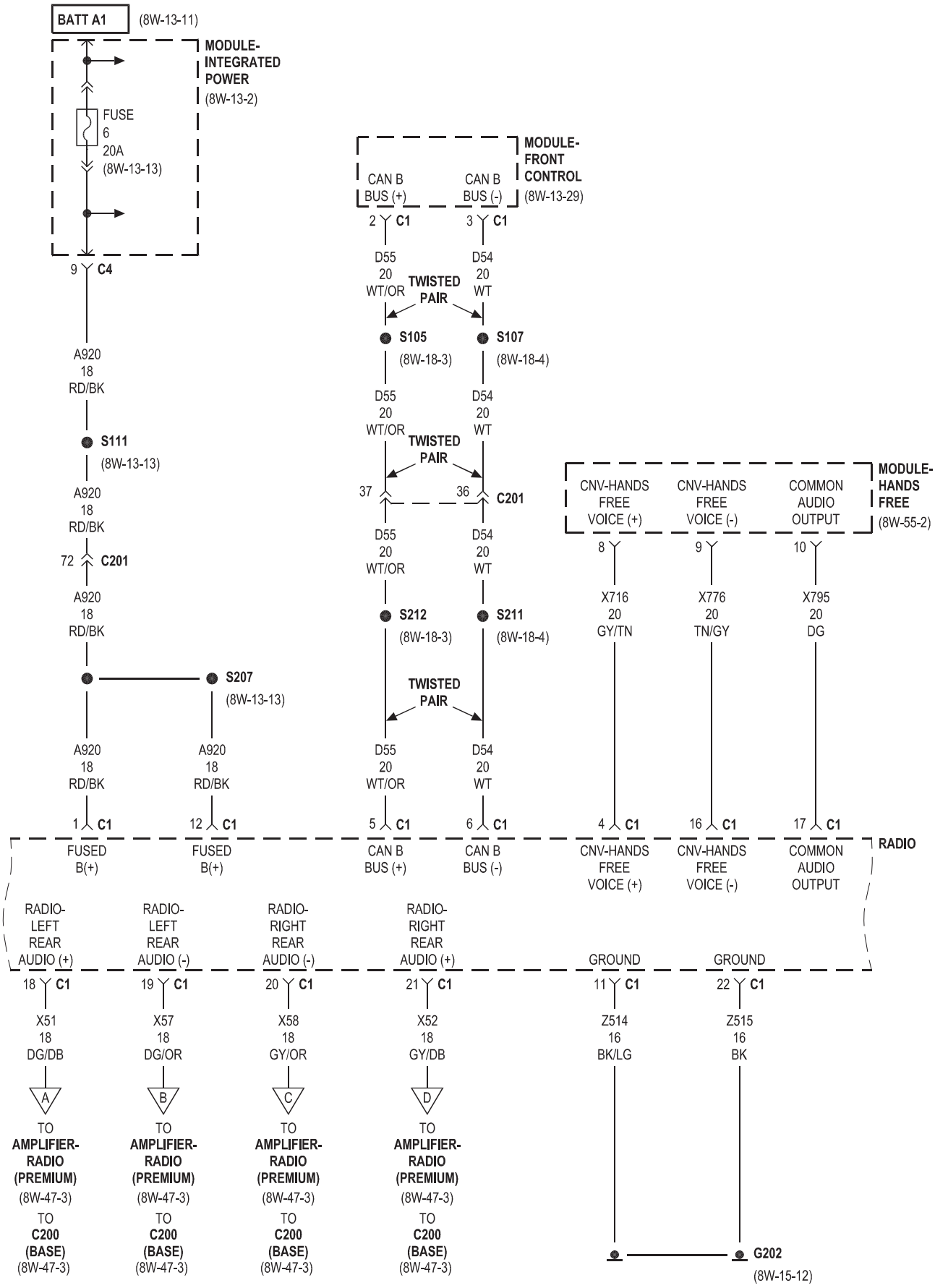
Component	Page
Cluster	8W-44-2, 3
Control-A/C-Heater	8W-44-2
G200	8W-44-2
G201	8W-44-3
Lamp-Center Bezel	8W-44-3
Lamp-Dome-Front	8W-44-3
Lamp-Dome-Rear	8W-44-3
Switch And Lamp-Glove Box	8W-44-3
Switch-Headlamp	8W-44-2
Switch-Transfer Case Selector	8W-44-2

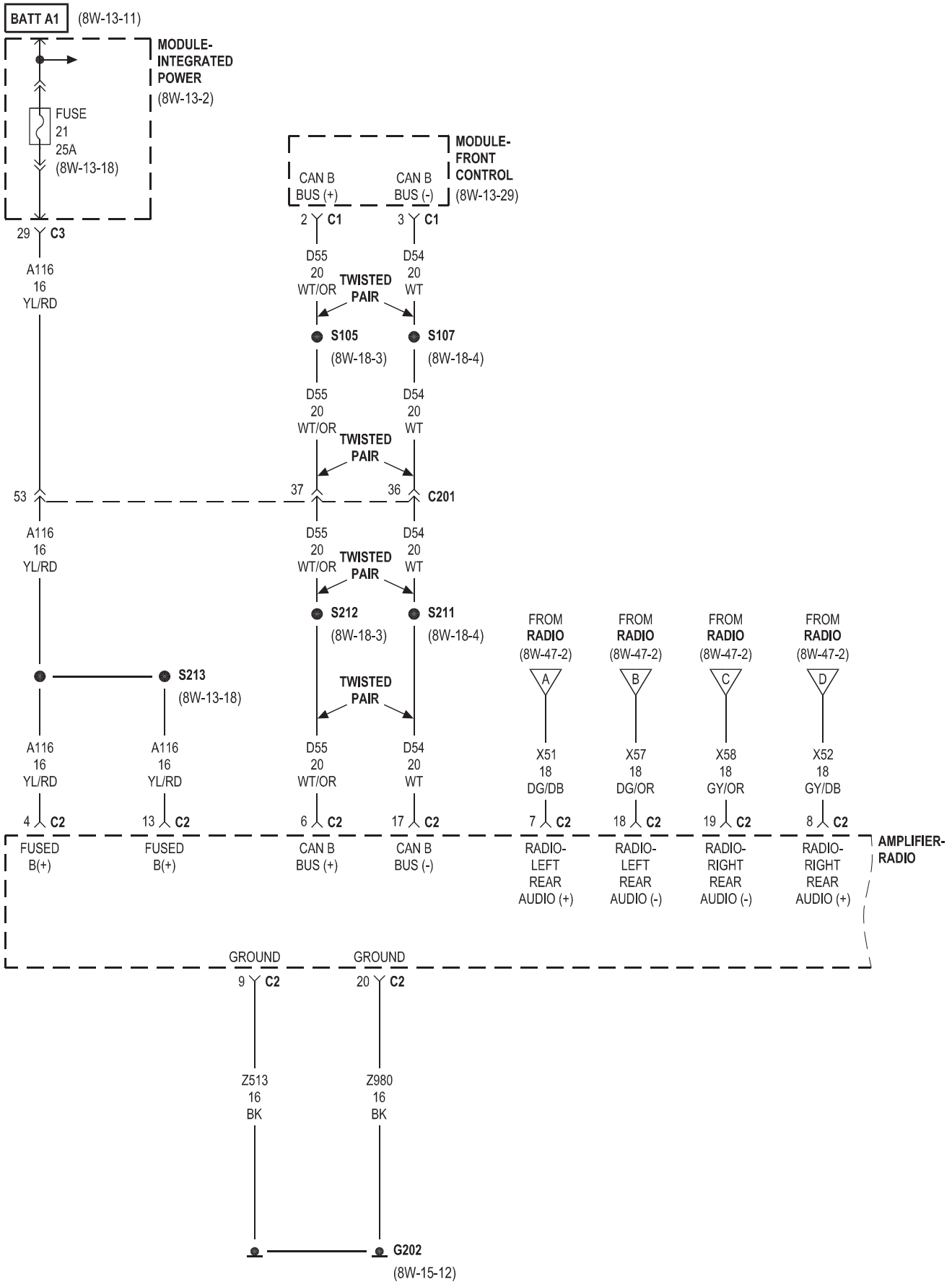

CLUSTER
(8W-40-4)
(8W-40-6)
INDICATOR DIMMER SIGNAL
HEADLAMP SWITCH MUX RETURN
PANEL LAMPS DIMMER SIGNAL
PANEL LAMPS DRIVER
PANEL LAMPS DRIVER
4 C2
10 C2
9 C3
6 C3
8 C3
E2 20 OR/BR
L900 20 WT/YL
E19 20 OR/BR
E12 20 OR/GY
E11 20 OR/DB
4
PANEL LAMPS DRIVER
SWITCH-TRANSFER CASE SELECTOR
(8W-31-9)
8 C1
PANEL LAMPS DRIVER
CONTROL-A/C-HEATER
(8W-42-4)
2
3
4
SWITCH-HEADLAMP
5 DIM 1
6 DIM 2
7 DIM 3
9 DIM 4
10 DIM 5
11 DIM 6
11 PARADE
12 DOME
13 CARGO
5
6
7
8
9
10
11
12
13
SWITCH ILLUMINATION
5
Z942 20 BK
G200
(8W-15-10)

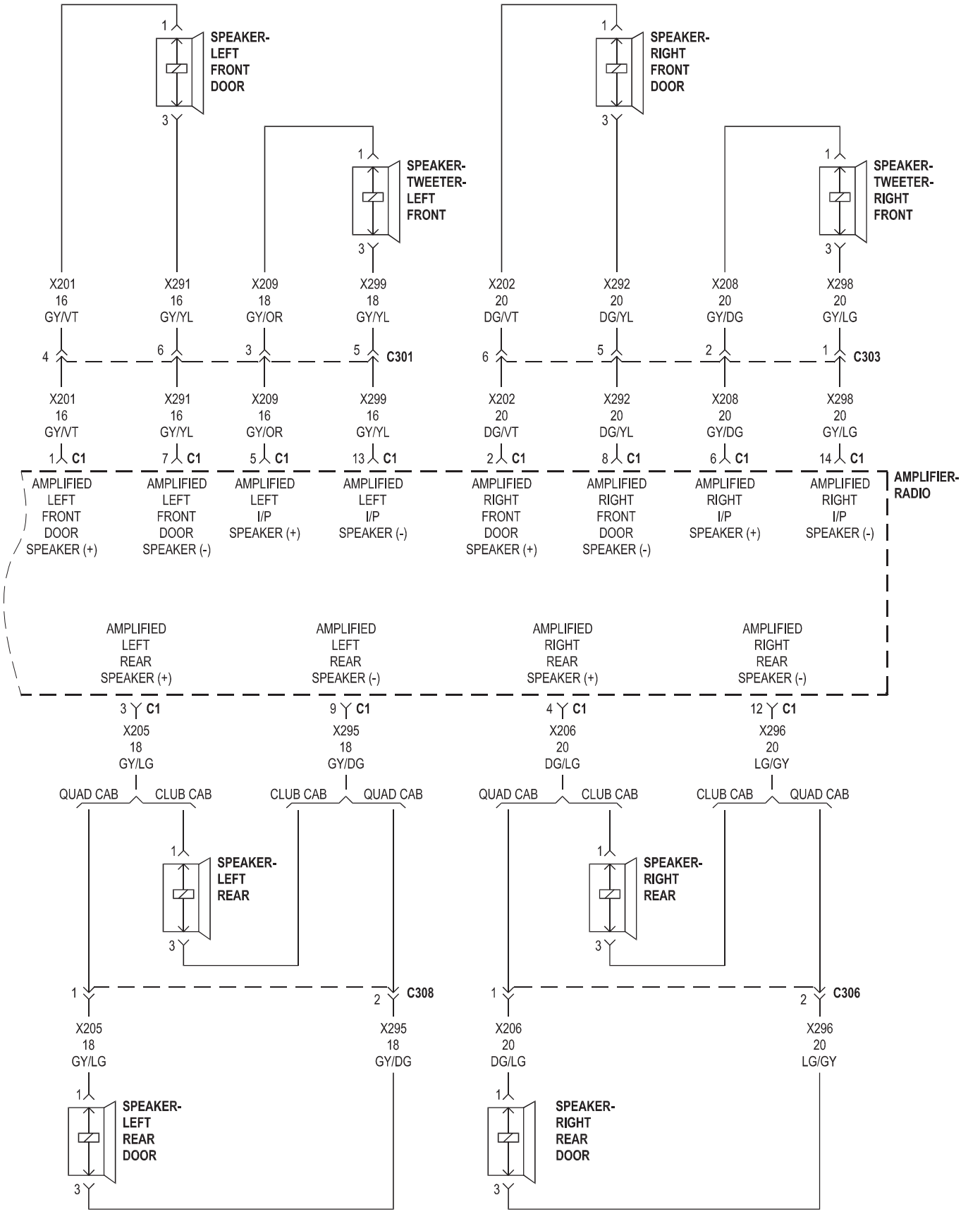

CLUSTER
(8W-40-7)
PANEL LAMPS DRIVER
COURTESY LAMPS DRIVER
GLOVE BOX LAMP DRIVER
10 C3
11 C3
1 C3
E33 20 OR
M22 20 YL/OR
M28 20 YL/TN
S208
M28 20 YL/TN
M28 20 YL/TN
2
4 C203
1
LAMP-CENTER BEZEL
M22 20 YL/OR
M28 20 YL/TN
1
SWITCH AND LAMP-GLOVE BOX
2
S214
S215
2
Z407 20 BK/OR
M22 20 YL/OR
M28 20 YL/TN
M22 20 YL/OR
M28 20 YL/TN
Z328 20 BK/TN
C
A
1
2
LAMP-DOME-FRONT
LAMP-DOME-REAR
B
3
Z955 20 BK
Z955 20 BK
S216
(8W-15-11)
Z955 20 BK
3 C203
Z955 20 BK
G201
(8W-15-11)

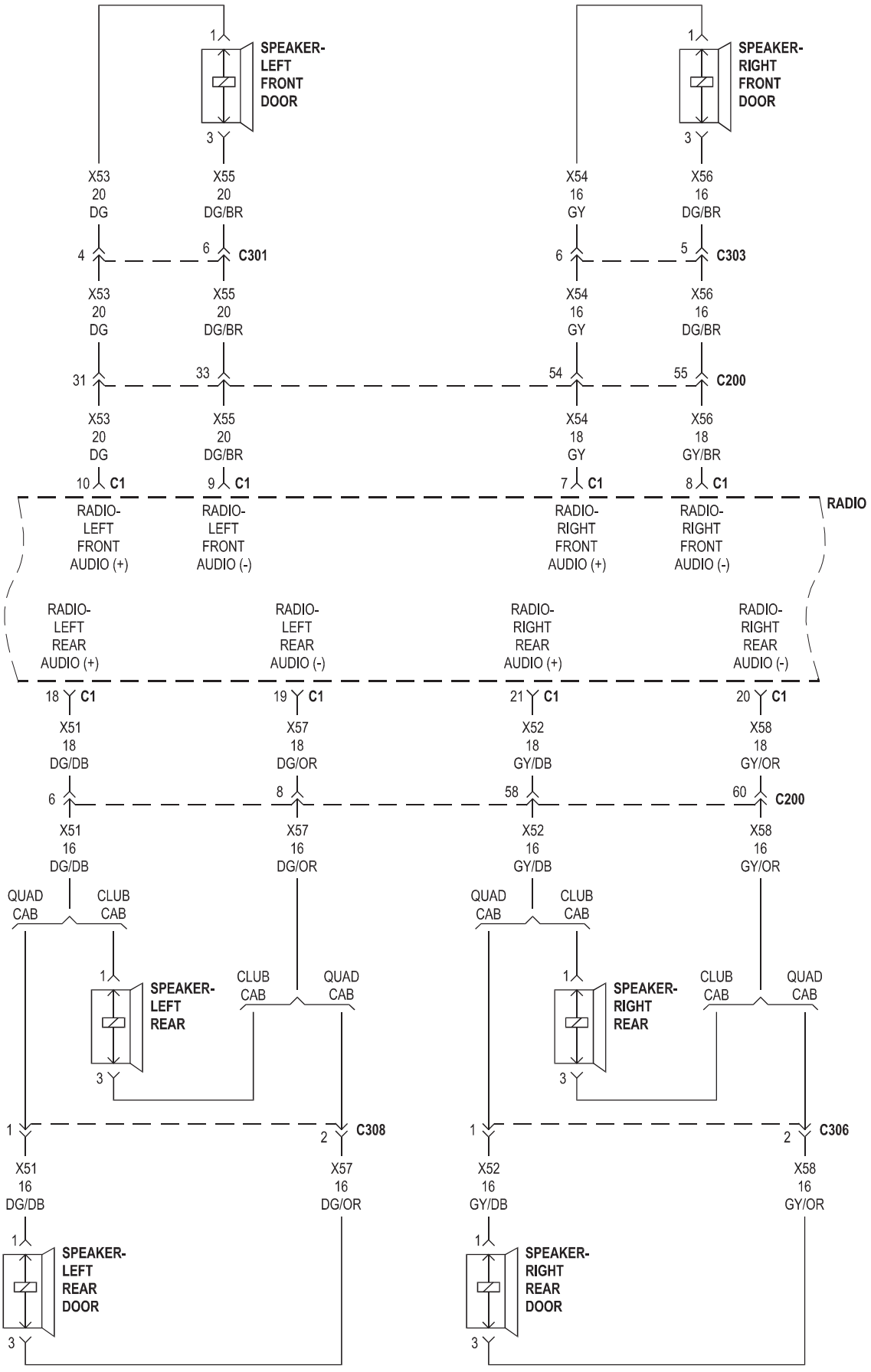
8W-47 AUDIO SYSTEM

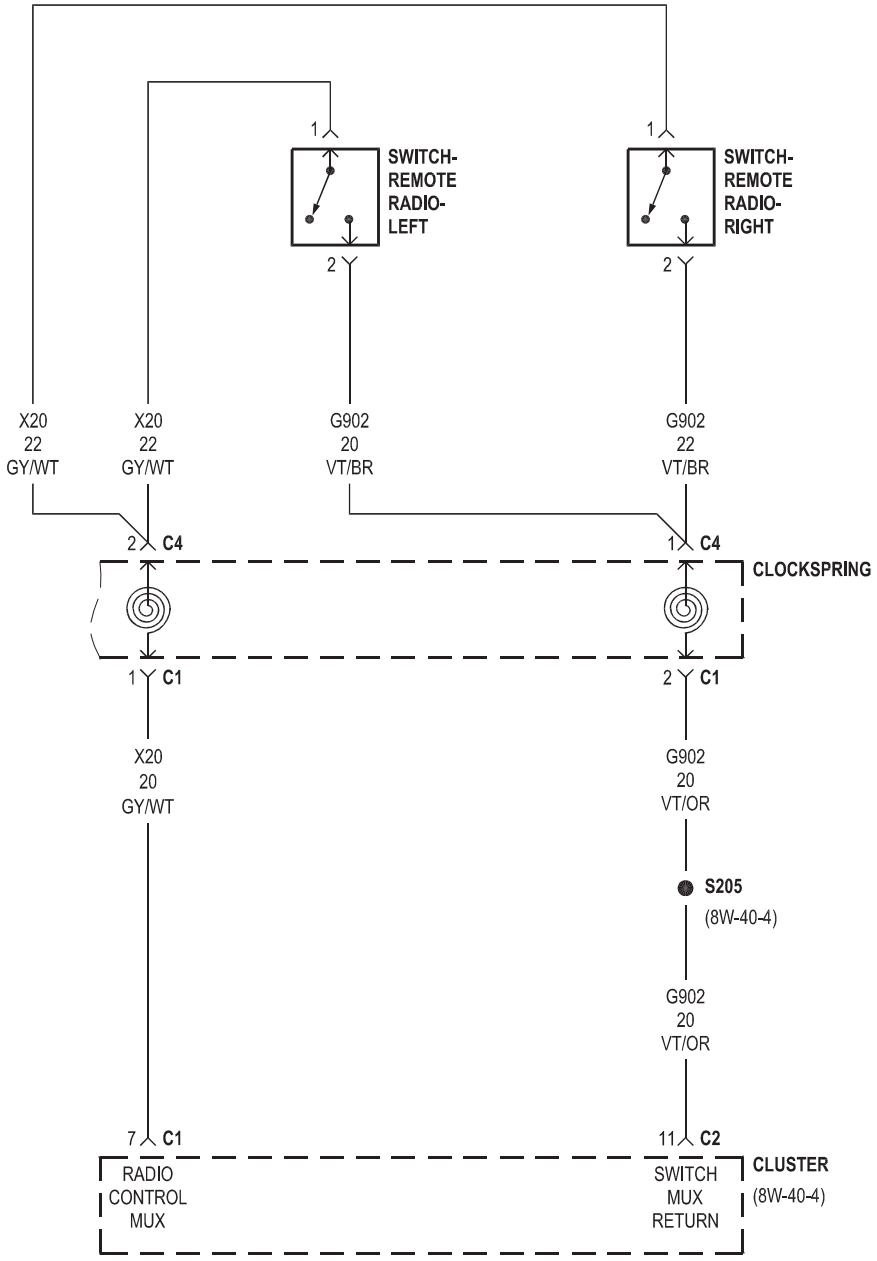
Component	Page
Amplifier-Radio	8W-47-2, 3, 4
Antenna-Satellite	8W-47-7
Clockspring	8W-47-6
Cluster	8W-47-6
Fuse 6	8W-47-2, 7
Fuse 21	8W-47-3
G202	8W-47-2, 3
G301	8W-47-7
Module-Front Control	8W-47-2, 3, 7
Module-Hands Free	8W-47-2
Module-Integrated Power	8W-47-2, 3, 7
Radio	8W-47-2, 3, 5, 7
Receiver-Satellite	8W-47-7
Speaker-Left Front Door	8W-47-4, 5
Speaker-Left Rear	8W-47-4, 5
Speaker-Left Rear Door	8W-47-4, 5
Speaker-Right Front Door	8W-47-4, 5
Speaker-Right Rear	8W-47-4, 5
Speaker-Right Rear Door	8W-47-4, 5
Speaker-Tweeter-Left Front	8W-47-4
Speaker-Tweeter-Right Front	8W-47-4
Switch-Remote Radio-Left	8W-47-6
Switch-Remote Radio-Right	8W-47-6


BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
6
20A
(8W-13-13)
9 C4
A920
18
RD/BK
S111
(8W-13-13)
A920
18
RD/BK
72 C201
A920
18
RD/BK
S207
(8W-13-13)
A920
18
RD/BK
A920
18
RD/BK
1 C1
12 C1
FUSED
B(+)
FUSED
B(+)
MODULE-
FRONT
CONTROL
(8W-13-29)
CAN B
BUS (+)
CAN B
BUS (-)
2 C1
3 C1
D55
20
WT/OR
D54
20
WT
TWISTED
PAIR
S105
(8W-18-3)
S107
(8W-18-4)
D55
20
WT/OR
D54
20
WT
TWISTED
PAIR
37
36
C201
D55
20
WT/OR
D54
20
WT
S212
(8W-18-3)
S211
(8W-18-4)
TWISTED
PAIR
D55
20
WT/OR
D54
20
WT
5 C1
6 C1
CAN B
BUS (+)
CAN B
BUS (-)
MODULE-
HANDS
FREE
(8W-55-2)
CNV-HANDS
FREE
VOICE (+)
CNV-HANDS
FREE
VOICE (-)
COMMON
AUDIO
OUTPUT
8
9
10
X716
20
GY/TN
X776
20
TN/GY
X795
20
DG
4 C1
16 C1
17 C1
CNV-HANDS
FREE
VOICE (+)
CNV-HANDS
FREE
VOICE (-)
COMMON
AUDIO
OUTPUT
RADIO
RADIO-
LEFT
REAR
AUDIO (+)
RADIO-
LEFT
REAR
AUDIO (-)
RADIO-
RIGHT
REAR
AUDIO (-)
RADIO-
RIGHT
REAR
AUDIO (+)
GROUND
GROUND
18 C1
19 C1
20 C1
21 C1
11 C1
22 C1
X51
18
DG/DB
X57
18
DG/OR
X58
18
GY/OR
X52
18
GY/DB
Z514
16
BK/LG
Z515
16
BK
A
B
C
D
TO
AMPLIFIER-
RADIO
(PREMIUM)
(8W-47-3)
TO
C200
(BASE)
(8W-47-3)
G202
(8W-15-12)

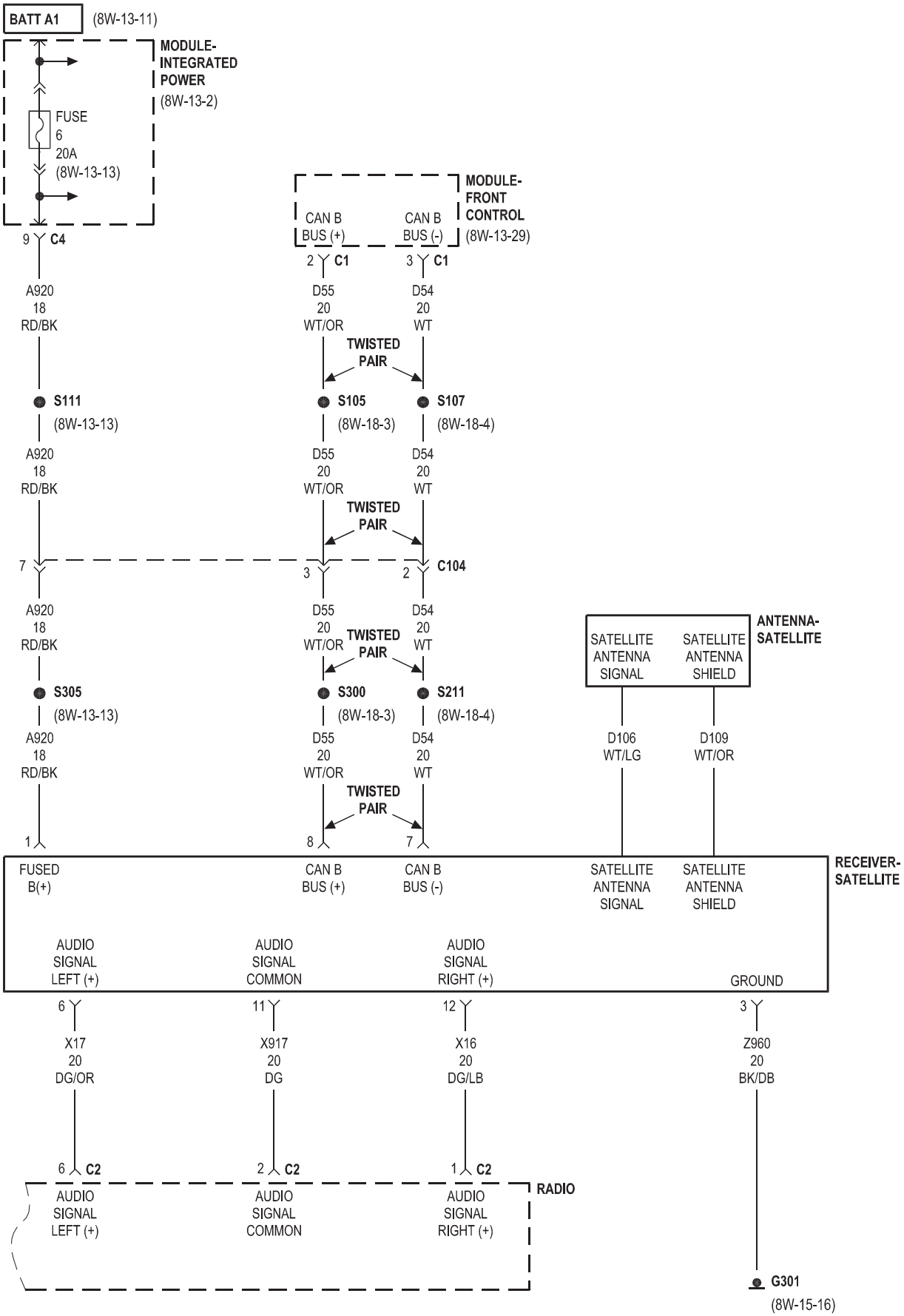

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
21
25A
(8W-13-18)
MODULE-
FRONT
CONTROL
(8W-13-29)
CAN B
BUS (+)
CAN B
BUS (-)
2 C1
3 C1
29 C3
A116
16
YL/RD
D55
20
WT/OR
D54
20
WT
TWISTED
PAIR
S105
(8W-18-3)
S107
(8W-18-4)
53
37
36
C201
S212
(8W-18-3)
S211
(8W-18-4)
S213
(8W-13-18)
FROM
RADIO
(8W-47-2)
A
B
C
D
X51
18
DG/DB
X57
18
DG/OR
X58
18
GY/OR
X52
18
GY/DB
4 C2
13 C2
6 C2
17 C2
7 C2
18 C2
19 C2
8 C2
FUSED
B(+)
CAN B
BUS (+)
CAN B
BUS (-)
RADIO-
LEFT
REAR
AUDIO (+)
RADIO-
LEFT
REAR
AUDIO (-)
RADIO-
RIGHT
REAR
AUDIO (-)
RADIO-
RIGHT
REAR
AUDIO (+)
AMPLIFIER-
RADIO
GROUND
9 C2
20 C2
Z513
16
BK
Z980
16
BK
G202
(8W-15-12)


SPEAKER- LEFT FRONT DOOR
SPEAKER- TWEETER- LEFT FRONT
SPEAKER- RIGHT FRONT DOOR
SPEAKER- TWEETER- RIGHT FRONT
X201 16 GY/VT
X291 16 GY/YL
X209 18 GY/OR
X299 18 GY/YL
X202 20 DG/VT
X292 20 DG/YL
X208 20 GY/DG
X298 20 GY/LG
C301
C303
AMPLIFIED LEFT FRONT DOOR SPEAKER (+)
AMPLIFIED LEFT FRONT DOOR SPEAKER (-)
AMPLIFIED LEFT I/P SPEAKER (+)
AMPLIFIED LEFT I/P SPEAKER (-)
AMPLIFIED RIGHT FRONT DOOR SPEAKER (+)
AMPLIFIED RIGHT FRONT DOOR SPEAKER (-)
AMPLIFIED RIGHT I/P SPEAKER (+)
AMPLIFIED RIGHT I/P SPEAKER (-)
AMPLIFIER- RADIO
AMPLIFIED LEFT REAR SPEAKER (+)
AMPLIFIED LEFT REAR SPEAKER (-)
AMPLIFIED RIGHT REAR SPEAKER (+)
AMPLIFIED RIGHT REAR SPEAKER (-)
X205 18 GY/LG
X295 18 GY/DG
X206 20 DG/LG
X296 20 LG/GY
QUAD CAB
CLUB CAB
SPEAKER- LEFT REAR
SPEAKER- RIGHT REAR
C308
C306
SPEAKER- LEFT REAR DOOR
SPEAKER- RIGHT REAR DOOR


SPEAKER-
LEFT
FRONT
DOOR
SPEAKER-
RIGHT
FRONT
DOOR
X53
20
DG
X55
20
DG/BR
X54
16
GY
X56
16
DG/BR
C301
C303
C200
X53
20
DG
X55
20
DG/BR
X54
16
GY
X56
16
DG/BR
X53
20
DG
X55
20
DG/BR
X54
18
GY
X56
18
GY/BR
C1
RADIO
RADIO-
LEFT
FRONT
AUDIO (+)
RADIO-
LEFT
FRONT
AUDIO (-)
RADIO-
RIGHT
FRONT
AUDIO (+)
RADIO-
RIGHT
FRONT
AUDIO (-)
RADIO-
LEFT
REAR
AUDIO (+)
RADIO-
LEFT
REAR
AUDIO (-)
RADIO-
RIGHT
REAR
AUDIO (+)
RADIO-
RIGHT
REAR
AUDIO (-)
X51
18
DG/DB
X57
18
DG/OR
X52
18
GY/DB
X58
18
GY/OR
C200
X51
16
DG/DB
X57
16
DG/OR
X52
16
GY/DB
X58
16
GY/OR
QUAD
CAB
CLUB
CAB
SPEAKER-
LEFT
REAR
SPEAKER-
RIGHT
REAR
C308
C306
X51
16
DG/DB
X57
16
DG/OR
X52
16
GY/DB
X58
16
GY/OR
SPEAKER-
LEFT
REAR
DOOR
SPEAKER-
RIGHT
REAR
DOOR

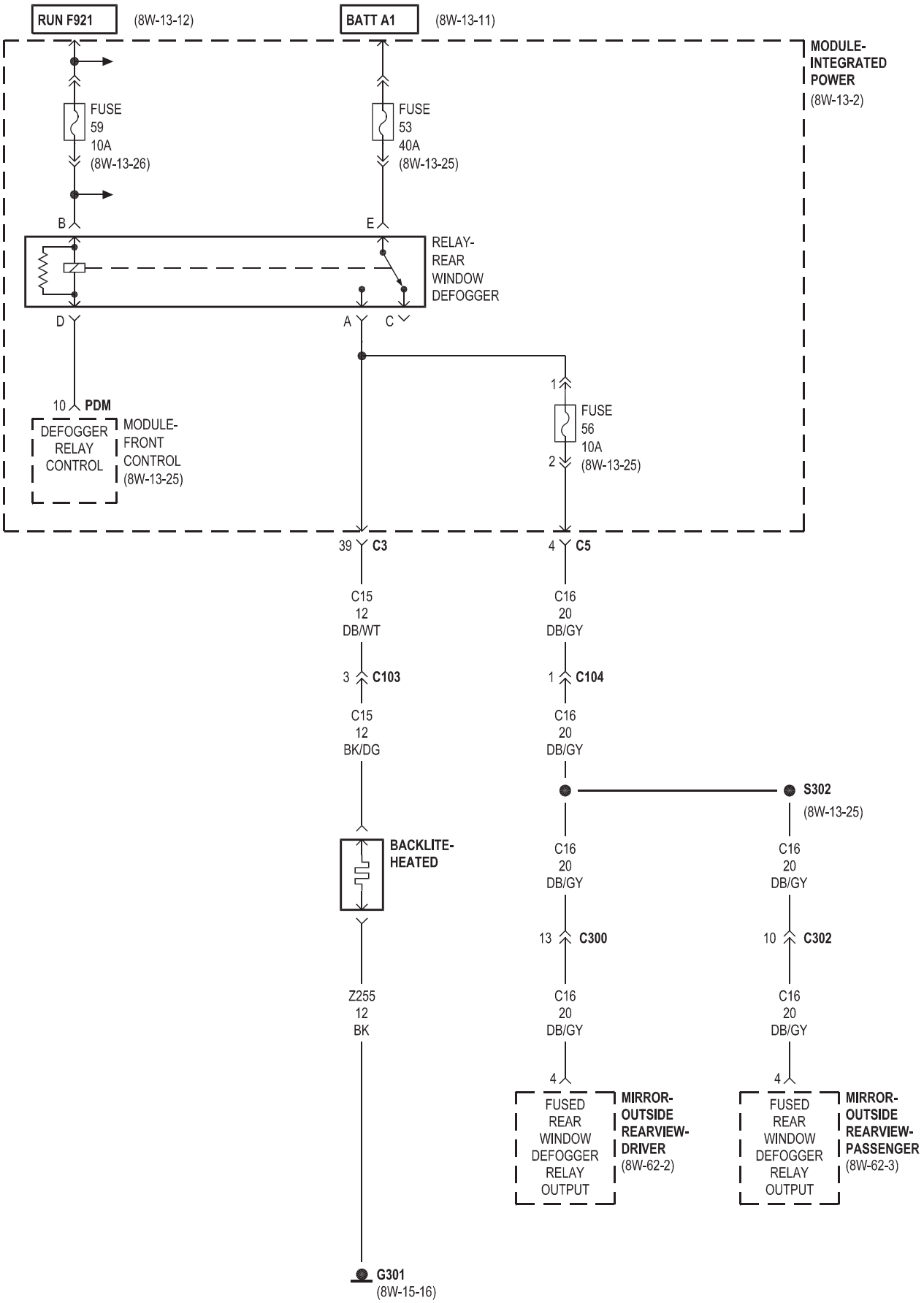

1
SWITCH-
REMOTE
RADIO-
LEFT
2
1
SWITCH-
REMOTE
RADIO-
RIGHT
2
X20
22
GY/WT
X20
22
GY/WT
G902
20
VT/BR
G902
22
VT/BR
2 C4
1 C4
CLOCKSPRING
1 C1
2 C1
X20
20
GY/WT
G902
20
VT/OR
S205
(8W-40-4)
G902
20
VT/OR
7 C1
11 C2
CLUSTER
(8W-40-4)
RADIO
CONTROL
MUX
SWITCH
MUX
RETURN

SATELLITE RADIO



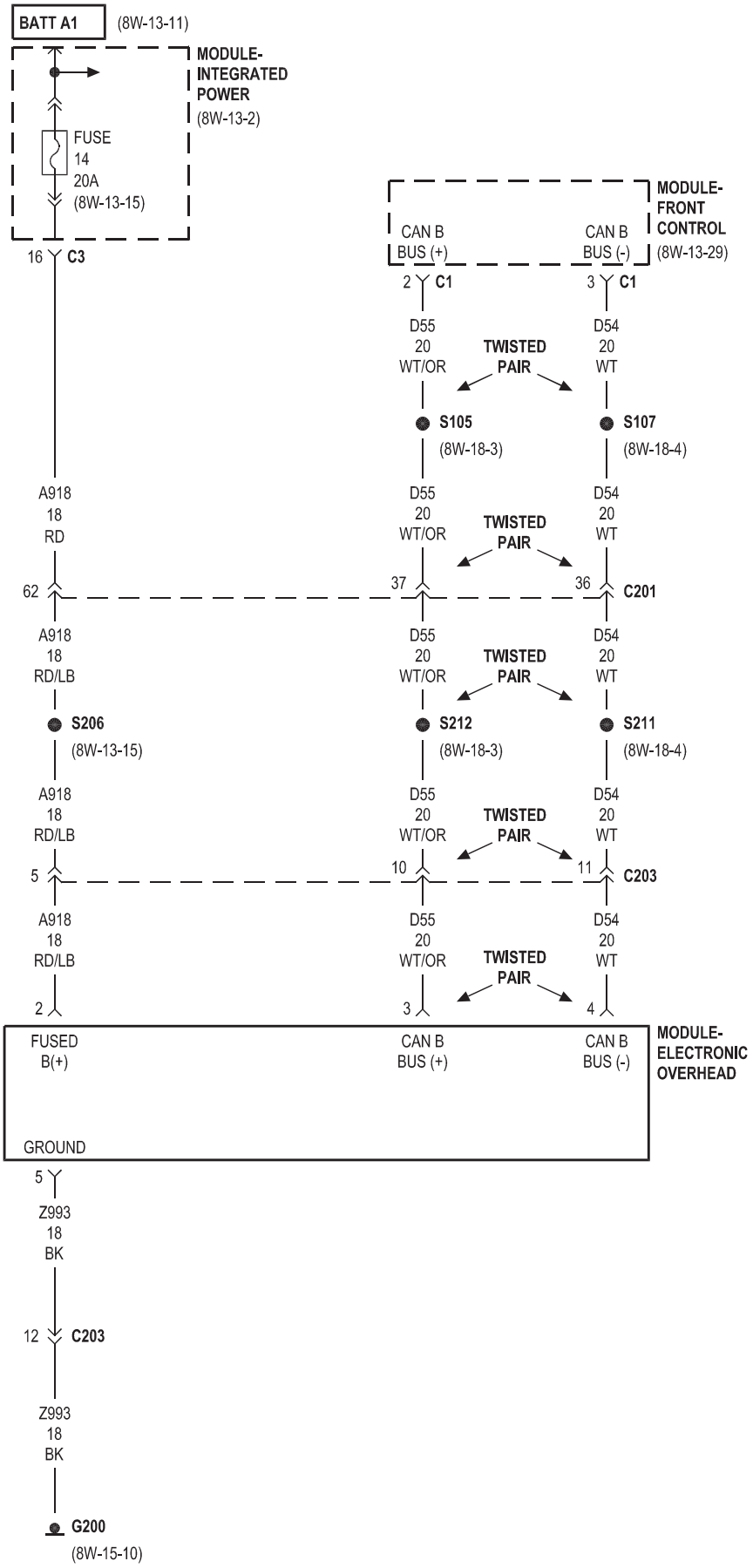
8W-48 REAR WINDOW DEFOGGER

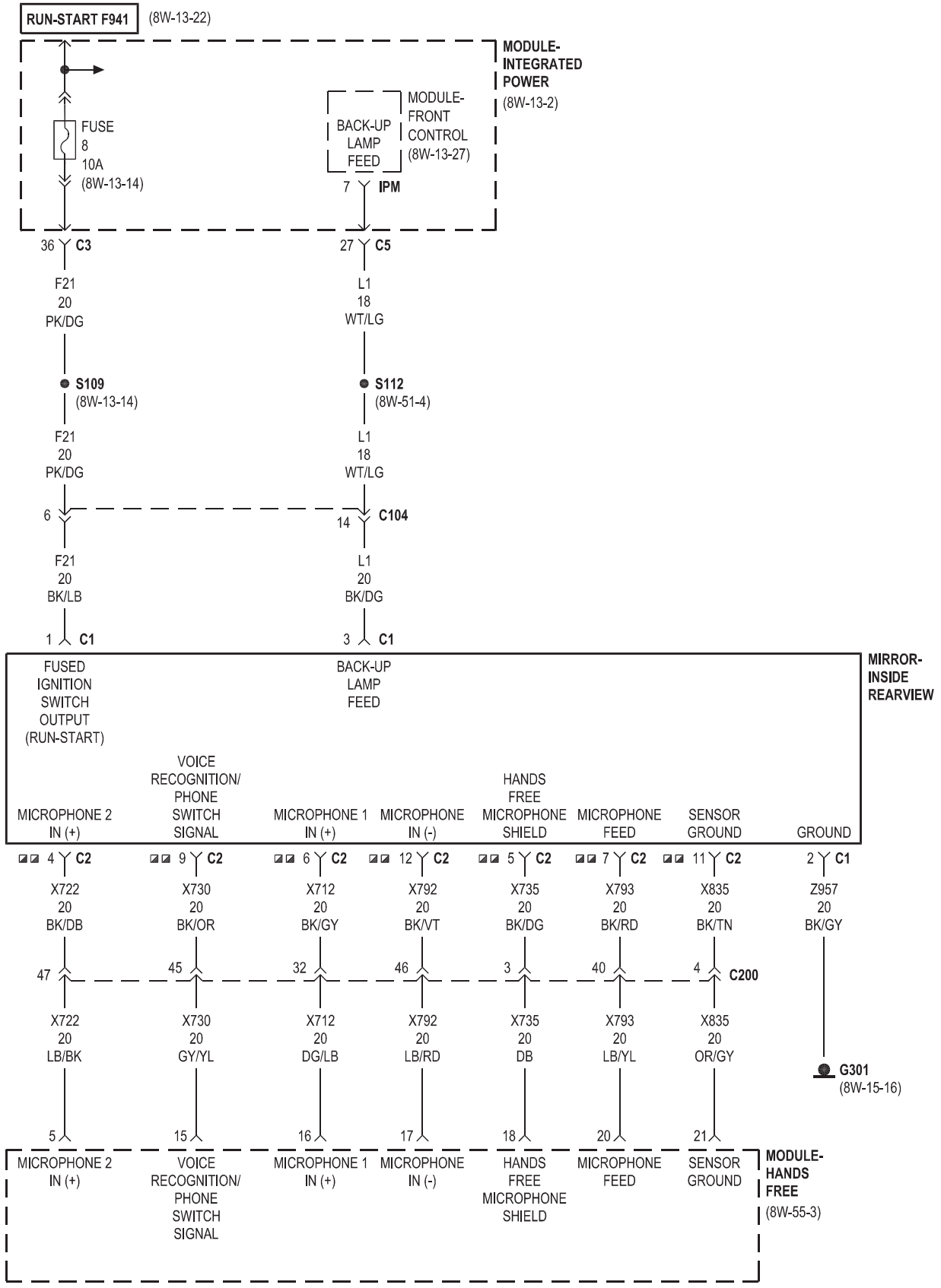
Component	Page
Backlite-Heated	8W-48-2
Fuse 53	8W-48-2
Fuse 56	8W-48-2
Fuse 59	8W-48-2
G301	8W-48-2
Mirror-Outside Rearview-Driver	8W-48-2
Mirror-Outside Rearview-Passenger	8W-48-2
Module-Front Control	8W-48-2
Module-Integrated Power	8W-48-2
Relay-Rear Window Defogger	8W-48-2


RUN F921
(8W-13-12)
BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
59
10A
(8W-13-26)
FUSE
53
40A
(8W-13-25)
B
E
RELAY-
REAR
WINDOW
DEFOGGER
D
A
C
1
FUSE
56
10A
2
(8W-13-25)
10
PDM
DEFOGGER
RELAY
CONTROL
MODULE-
FRONT
CONTROL
(8W-13-25)
39
C3
4
C5
C15
12
DB/WT
C16
20
DB/GY
3
C103
1
C104
C15
12
BK/DG
C16
20
DB/GY
S302
(8W-13-25)
BACKLITE-
HEATED
C16
20
DB/GY
C16
20
DB/GY
13
C300
10
C302
Z255
12
BK
C16
20
DB/GY
C16
20
DB/GY
4
4
FUSED
REAR
WINDOW
DEFOGGER
RELAY
OUTPUT
MIRROR-
OUTSIDE
REARVIEW-
DRIVER
(8W-62-2)
FUSED
REAR
WINDOW
DEFOGGER
RELAY
OUTPUT
MIRROR-
OUTSIDE
REARVIEW-
PASSENGER
(8W-62-3)
G301
(8W-15-16)

8W-49 OVERHEAD CONSOLE

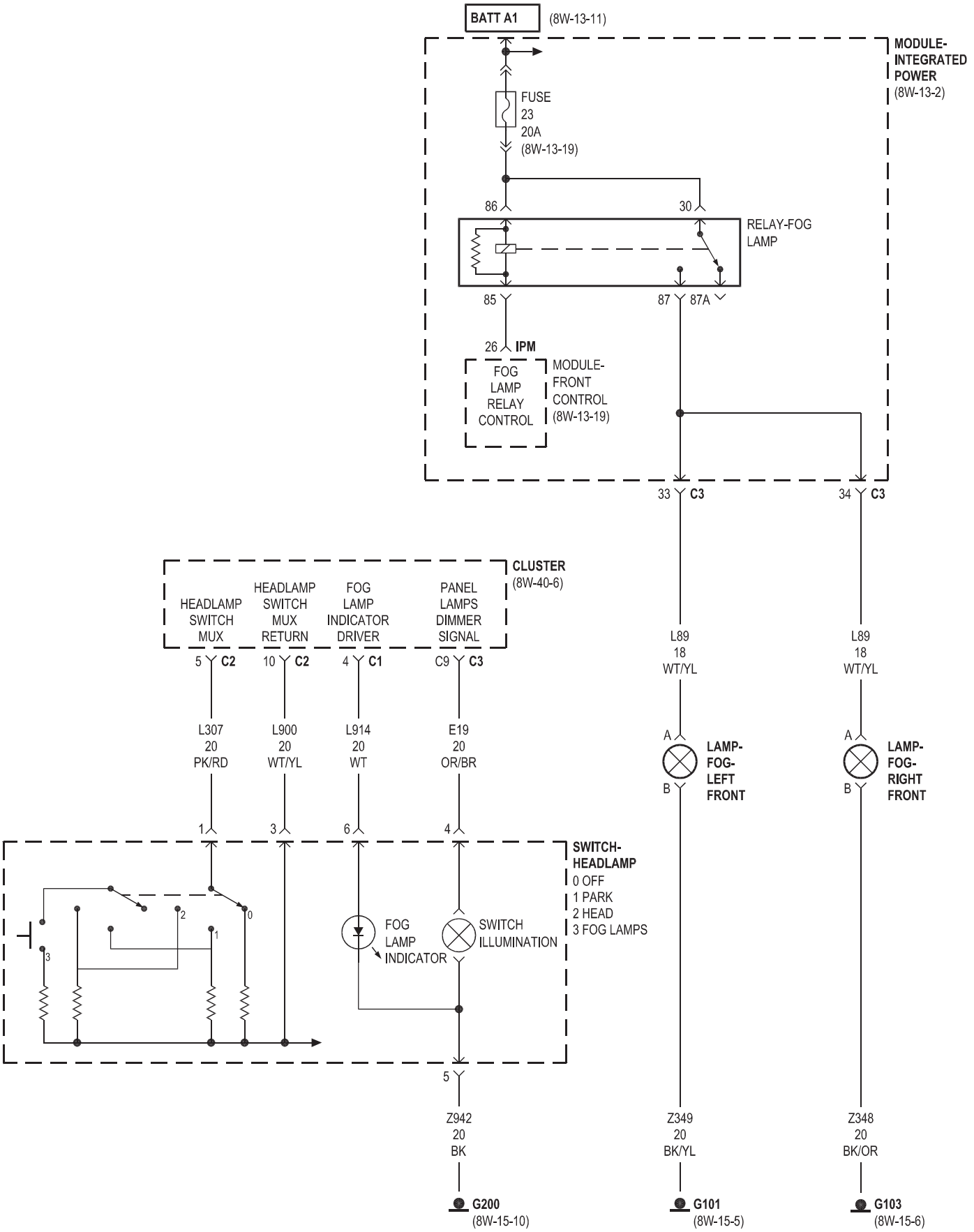
Component	Page
Fuse 8	8W-49-3
Fuse 14	8W-49-2
G200	8W-49-2
G301	8W-49-3
Mirror-Inside Rearview	8W-49-3
Module-Electronic Overhead	8W-49-2
Module-Front Control	8W-49-2, 3
Module-Hands Free	8W-49-3
Module-Integrated Power	8W-49-2, 3

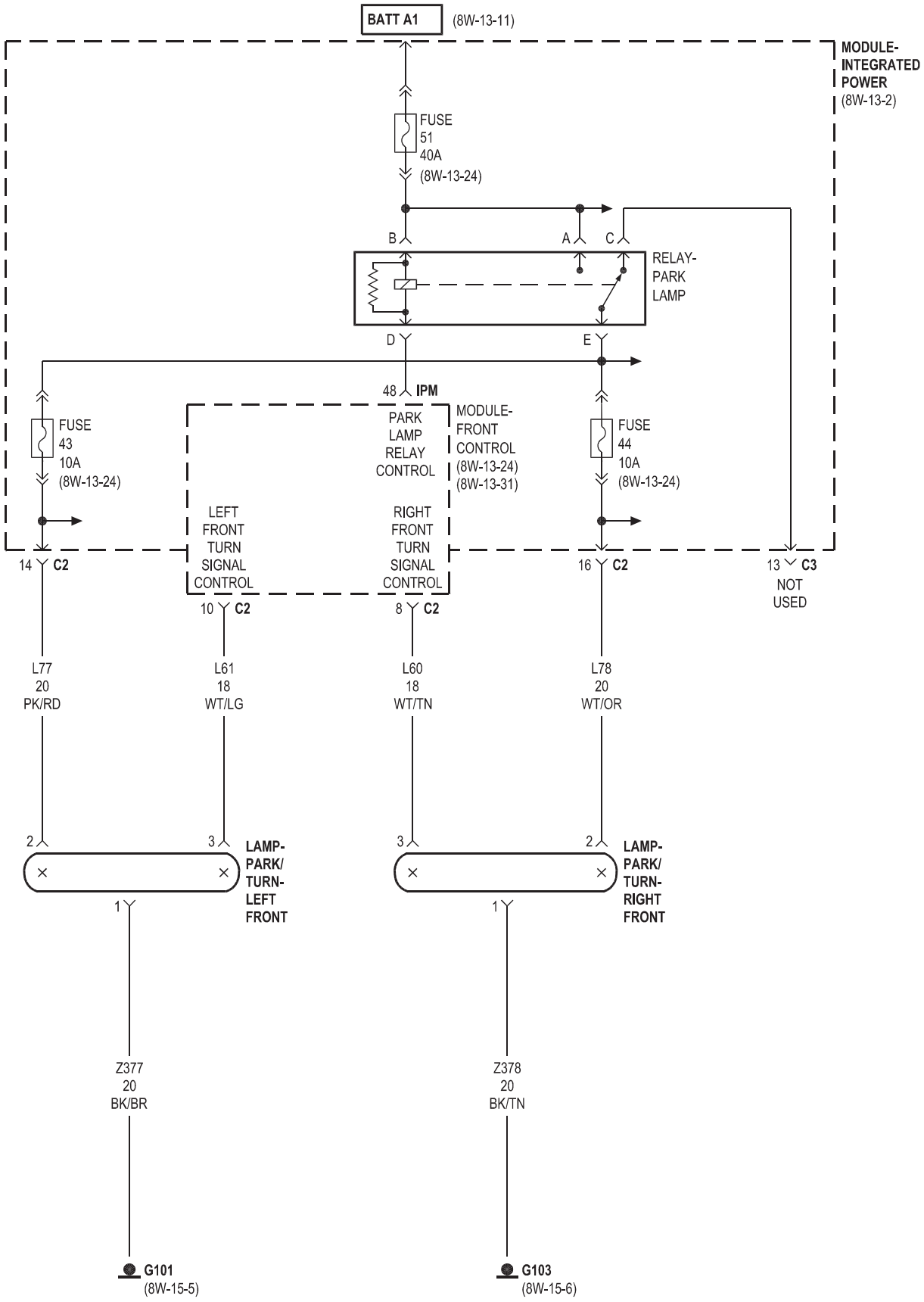

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
14
20A
(8W-13-15)
16 C3
MODULE-
FRONT
CONTROL
(8W-13-29)
CAN B
BUS (+)
CAN B
BUS (-)
2 C1
3 C1
D55
20
WT/OR
TWISTED
PAIR
D54
20
WT
S105
(8W-18-3)
S107
(8W-18-4)
A918
18
RD
62
37
36
C201
A918
18
RD/LB
S206
(8W-13-15)
S212
(8W-18-3)
S211
(8W-18-4)
5
10
11
C203
2
3
4
MODULE-
ELECTRONIC
OVERHEAD
FUSED
B(+)
GROUND
Z993
18
BK
12 C203
G200
(8W-15-10)

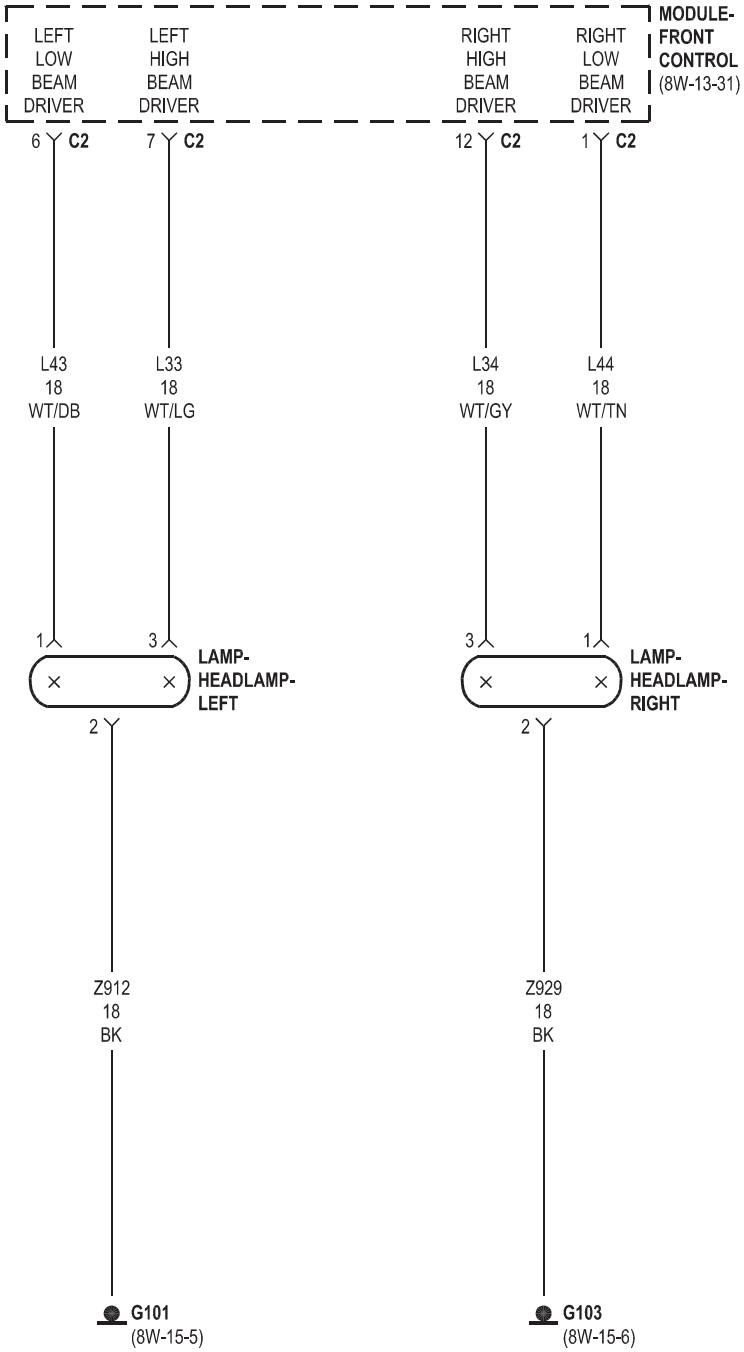

RUN-START F941
(8W-13-22)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
8
10A
(8W-13-14)
BACK-UP
LAMP
FEED
MODULE-
FRONT
CONTROL
(8W-13-27)
7 IPM
36 C3
27 C5
F21
20
PK/DG
L1
18
WT/LG
S109
(8W-13-14)
S112
(8W-51-4)
F21
20
PK/DG
L1
18
WT/LG
6
14 C104
F21
20
BK/LB
L1
20
BK/DG
1 C1
3 C1
FUSED
IGNITION
SWITCH
OUTPUT
(RUN-START)
BACK-UP
LAMP
FEED
MIRROR-
INSIDE
REARVIEW
MICROPHONE 2
IN (+)
VOICE
RECOGNITION/
PHONE
SWITCH
SIGNAL
MICROPHONE 1
IN (+)
MICROPHONE
IN (-)
HANDS
FREE
MICROPHONE
SHIELD
MICROPHONE
FEED
SENSOR
GROUND
GROUND
4 C2
9 C2
6 C2
12 C2
5 C2
7 C2
11 C2
2 C1
X722
20
BK/DB
X730
20
BK/OR
X712
20
BK/GY
X792
20
BK/VT
X735
20
BK/DG
X793
20
BK/RD
X835
20
BK/TN
Z957
20
BK/GY
47
45
32
46
3
40
4 C200
X722
20
LB/BK
X730
20
GY/YL
X712
20
DG/LB
X792
20
LB/RD
X735
20
DB
X793
20
LB/YL
X835
20
OR/GY
G301
(8W-15-16)
5
15
16
17
18
20
21
MICROPHONE 2
IN (+)
VOICE
RECOGNITION/
PHONE
SWITCH
SIGNAL
MICROPHONE 1
IN (+)
MICROPHONE
IN (-)
HANDS
FREE
MICROPHONE
SHIELD
MICROPHONE
FEED
SENSOR
GROUND
MODULE-
HANDS
FREE
(8W-55-3)
HANDS FREE

8W-50 FRONT LIGHTING

Component	Page
Cluster	8W-50-2
Fuse 23	8W-50-2
Fuse 43	8W-50-3
Fuse 44	8W-50-3
Fuse 51	8W-50-3
G101	8W-50-2, 3, 4
G103	8W-50-2, 3, 4
G200	8W-50-2
Lamp-Fog-Left Front	8W-50-2
Lamp-Fog-Right Front	8W-50-2
Lamp-Headlamp-Left	8W-50-4
Lamp-Headlamp-Right	8W-50-4
Lamp-Park/Turn-Left Front	8W-50-3
Lamp-Park/Turn-Right Front	8W-50-3
Module-Front Control	8W-50-2, 3, 4
Module-Integrated Power	8W-50-2, 3
Relay-Fog Lamp	8W-50-2
Relay-Park Lamp	8W-50-3
Switch-Headlamp	8W-50-2

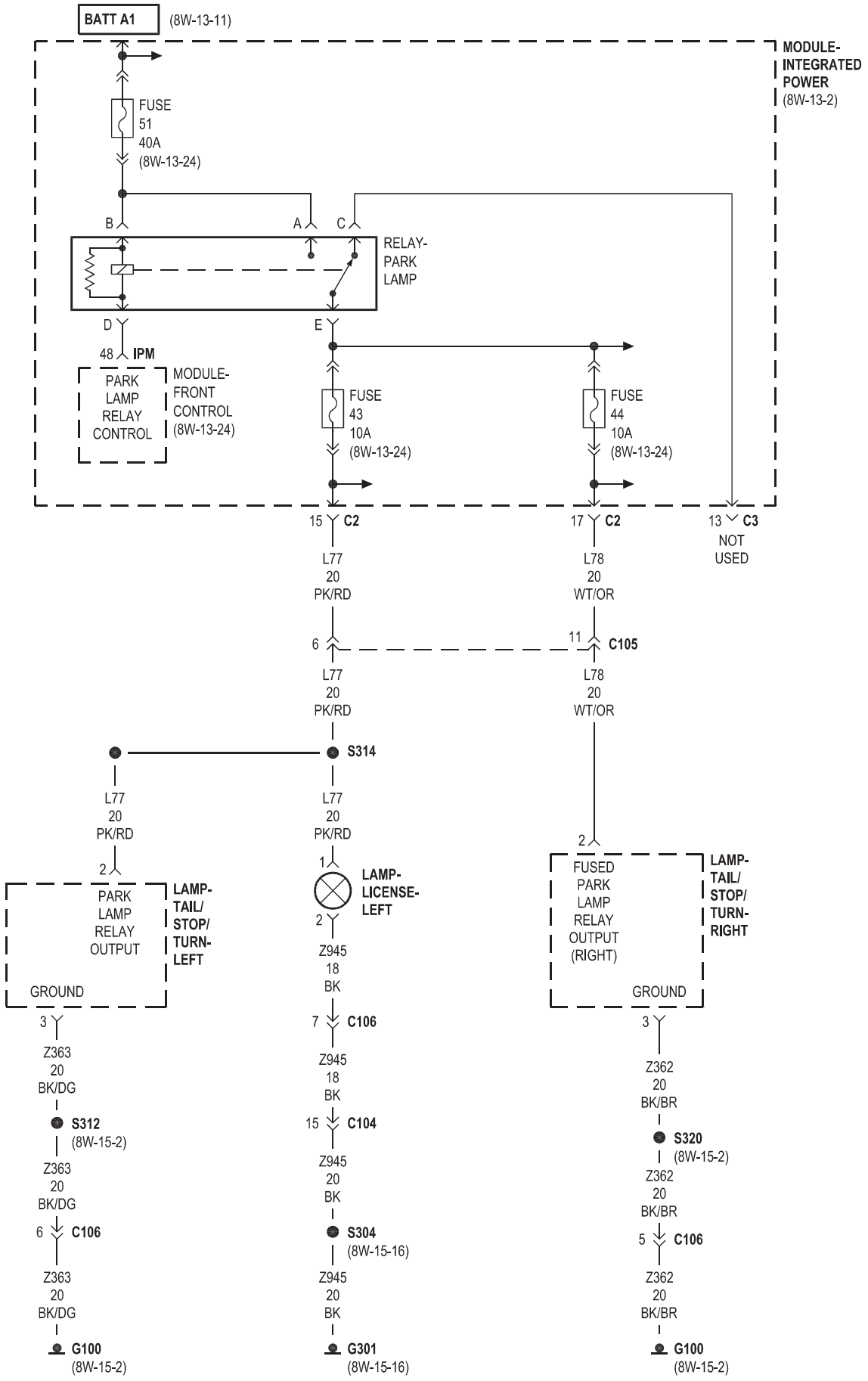

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
23
20A
(8W-13-19)
86
30
RELAY-FOG
LAMP
85
87
87A
26
IPM
FOG
LAMP
RELAY
CONTROL
MODULE-
FRONT
CONTROL
(8W-13-19)
33
C3
34
C3
CLUSTER
(8W-40-6)
HEADLAMP
SWITCH
MUX
HEADLAMP
SWITCH
MUX
RETURN
FOG
LAMP
INDICATOR
DRIVER
PANEL
LAMPS
DIMMER
SIGNAL
5
C2
10
C2
4
C1
C9
C3
L307
20
PK/RD
L900
20
WT/YL
L914
20
WT
E19
20
OR/BR
L89
18
WT/YL
L89
18
WT/YL
A
B
LAMP-
FOG-
LEFT
FRONT
A
B
LAMP-
FOG-
RIGHT
FRONT
1
3
6
4
SWITCH-
HEADLAMP
0 OFF
1 PARK
2 HEAD
3 FOG LAMPS
FOG
LAMP
INDICATOR
SWITCH
ILLUMINATION
5
Z942
20
BK
Z349
20
BK/YL
Z348
20
BK/OR
G200
(8W-15-10)
G101
(8W-15-5)
G103
(8W-15-6)

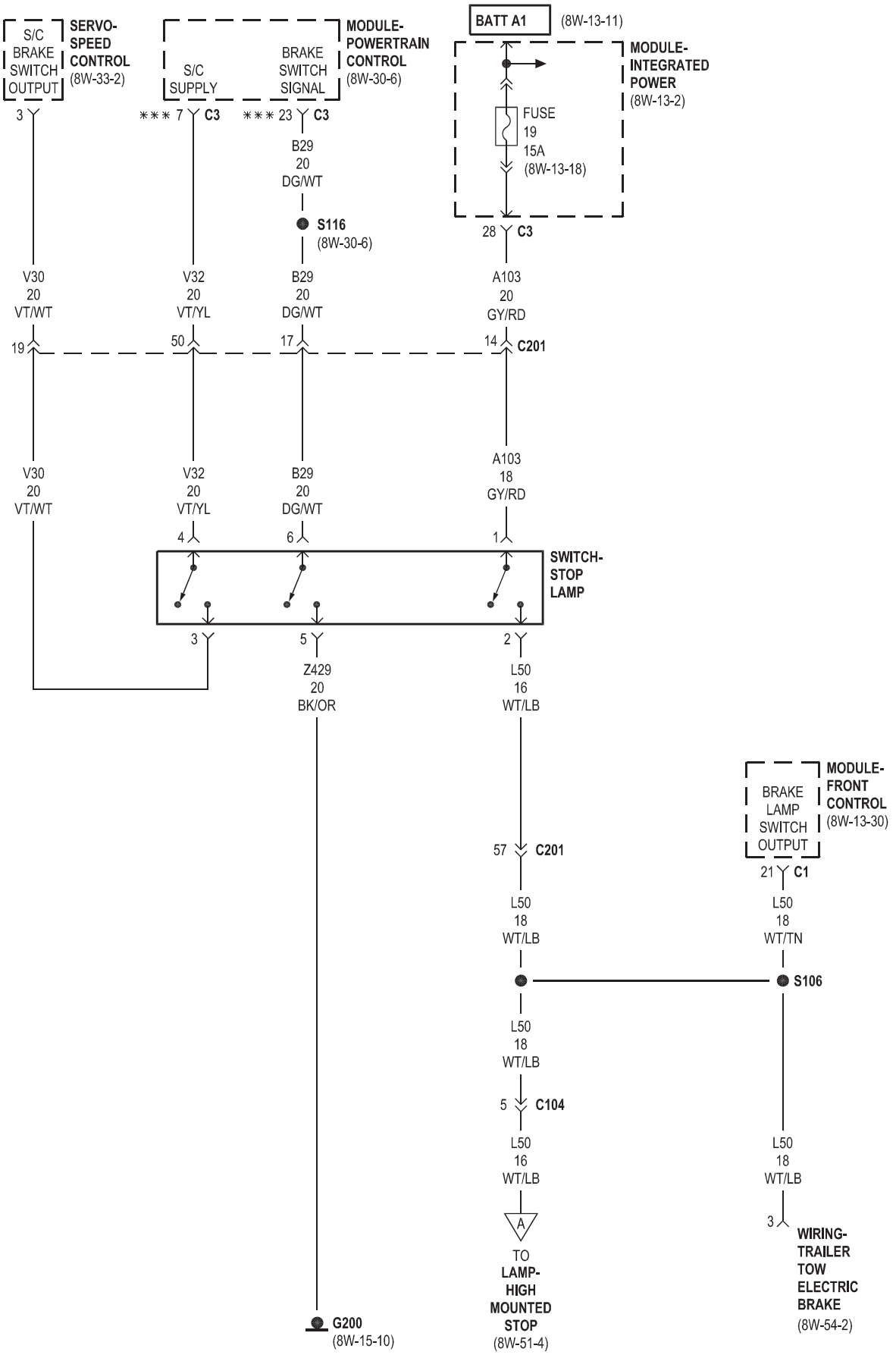

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
51
40A
(8W-13-24)
B
A
C
RELAY-
PARK
LAMP
D
E
48
IPM
FUSE
43
10A
(8W-13-24)
PARK
LAMP
RELAY
CONTROL
MODULE-
FRONT
CONTROL
(8W-13-24)
(8W-13-31)
FUSE
44
10A
(8W-13-24)
LEFT
FRONT
TURN
SIGNAL
CONTROL
RIGHT
FRONT
TURN
SIGNAL
CONTROL
14
C2
10
C2
8
C2
16
C2
13
C3
NOT
USED
L77
20
PK/RD
L61
18
WT/LG
L60
18
WT/TN
L78
20
WT/OR
2
3
3
2
LAMP-
PARK/
TURN-
LEFT
FRONT
LAMP-
PARK/
TURN-
RIGHT
FRONT
1
1
Z377
20
BK/BR
Z378
20
BK/TN
G101
(8W-15-5)
G103
(8W-15-6)


MODULE-
FRONT
CONTROL
(8W-13-31)
LEFT
LOW
BEAM
DRIVER
LEFT
HIGH
BEAM
DRIVER
RIGHT
HIGH
BEAM
DRIVER
RIGHT
LOW
BEAM
DRIVER
6 C2
7 C2
12 C2
1 C2
L43
18
WT/DB
L33
18
WT/LG
L34
18
WT/GY
L44
18
WT/TN
1
3
3
1
LAMP-
HEADLAMP-
LEFT
LAMP-
HEADLAMP-
RIGHT
2
2
Z912
18
BK
Z929
18
BK
G101
(8W-15-5)
G103
(8W-15-6)

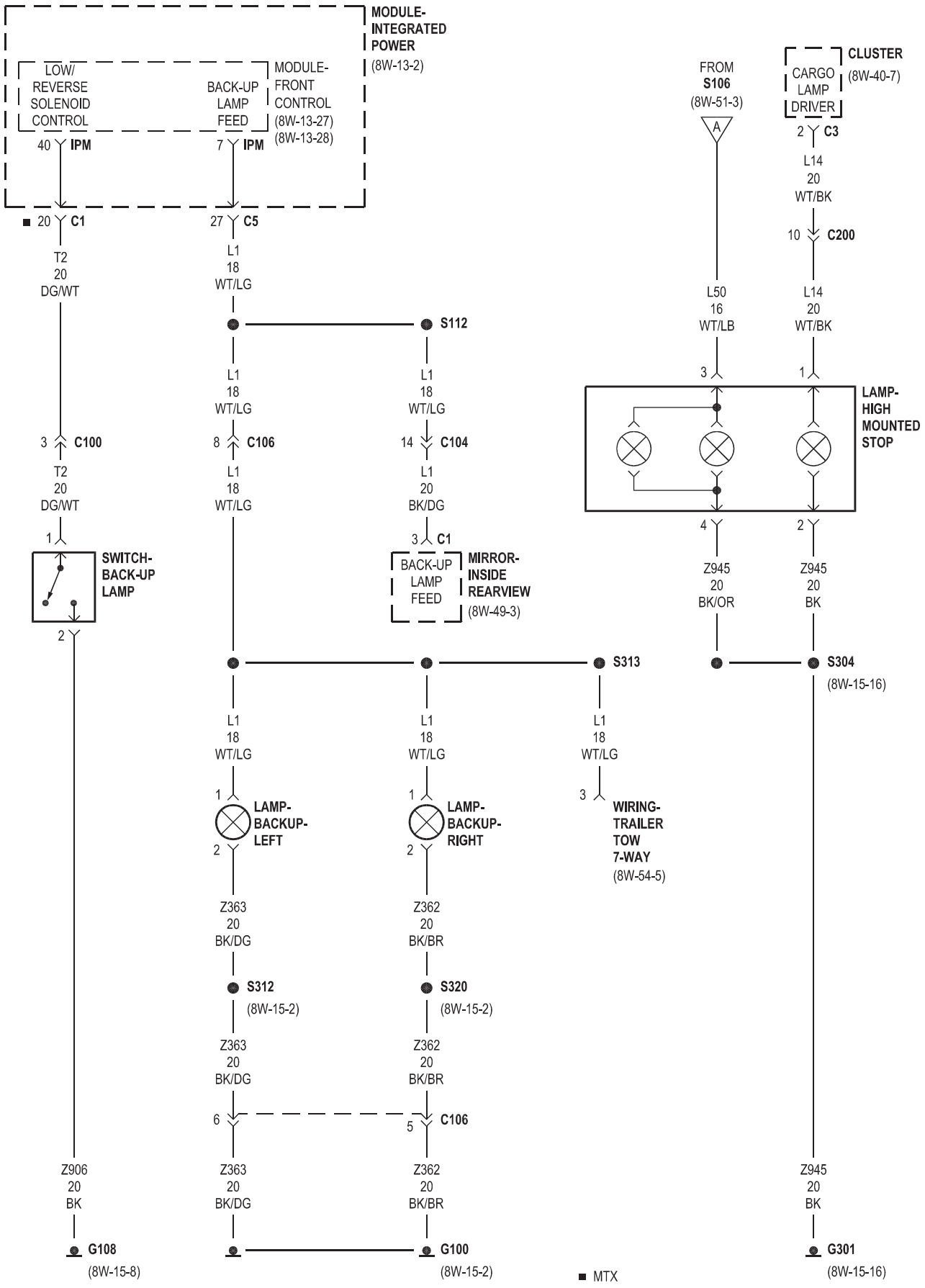
8W-51 REAR LIGHTING

Component	Page
Cluster	8W-51-4
Fuse 19	8W-51-3
Fuse 43	8W-51-2
Fuse 44	8W-51-2
Fuse 51	8W-51-2
G100	8W-51-2, 4
G108	8W-51-4
G200	8W-51-3
G301	8W-51-2, 4
Lamp-Backup-Left	8W-51-4
Lamp-Backup-Right	8W-51-4
Lamp-High Mounted Stop	8W-51-3, 4
Lamp-License-Left	8W-51-2
Lamp-Tail/Stop/Turn-Left	8W-51-2
Lamp-Tail/Stop/Turn-Right	8W-51-2
Mirror-Inside Rearview	8W-51-4
Module-Front Control	8W-51-2, 3, 4
Module-Integrated Power	8W-51-2, 3, 4
Module-Powertrain Control	8W-51-3
Relay-Park Lamp	8W-51-2
Servo-Speed Control	8W-51-3
Switch-Back-Up Lamp	8W-51-4
Switch-Stop Lamp	8W-51-3
Wiring-Trailer Tow 7-Way	8W-51-4
Wiring-Trailer Tow Electric Brake	8W-51-3


BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
51
40A
(8W-13-24)
B
A
C
RELAY-
PARK
LAMP
D
E
48 IPM
PARK
LAMP
RELAY
CONTROL
MODULE-
FRONT
CONTROL
(8W-13-24)
FUSE
43
10A
(8W-13-24)
FUSE
44
10A
(8W-13-24)
15 C2
17 C2
13 C3
NOT
USED
L77
20
PK/RD
L78
20
WT/OR
6
11 C105
L77
20
PK/RD
L78
20
WT/OR
S314
L77
20
PK/RD
L77
20
PK/RD
2
1
LAMP-
LICENSE-
LEFT
2
PARK
LAMP
RELAY
OUTPUT
LAMP-
TAIL/
STOP/
TURN-
LEFT
GROUND
FUSED
PARK
LAMP
RELAY
OUTPUT
(RIGHT)
LAMP-
TAIL/
STOP/
TURN-
RIGHT
GROUND
3
Z363
20
BK/DG
S312
(8W-15-2)
Z363
20
BK/DG
6 C106
Z363
20
BK/DG
G100
(8W-15-2)
Z945
18
BK
7 C106
Z945
18
BK
15 C104
Z945
20
BK
S304
(8W-15-16)
Z945
20
BK
G301
(8W-15-16)
3
Z362
20
BK/BR
S320
(8W-15-2)
Z362
20
BK/BR
5 C106
Z362
20
BK/BR
G100
(8W-15-2)

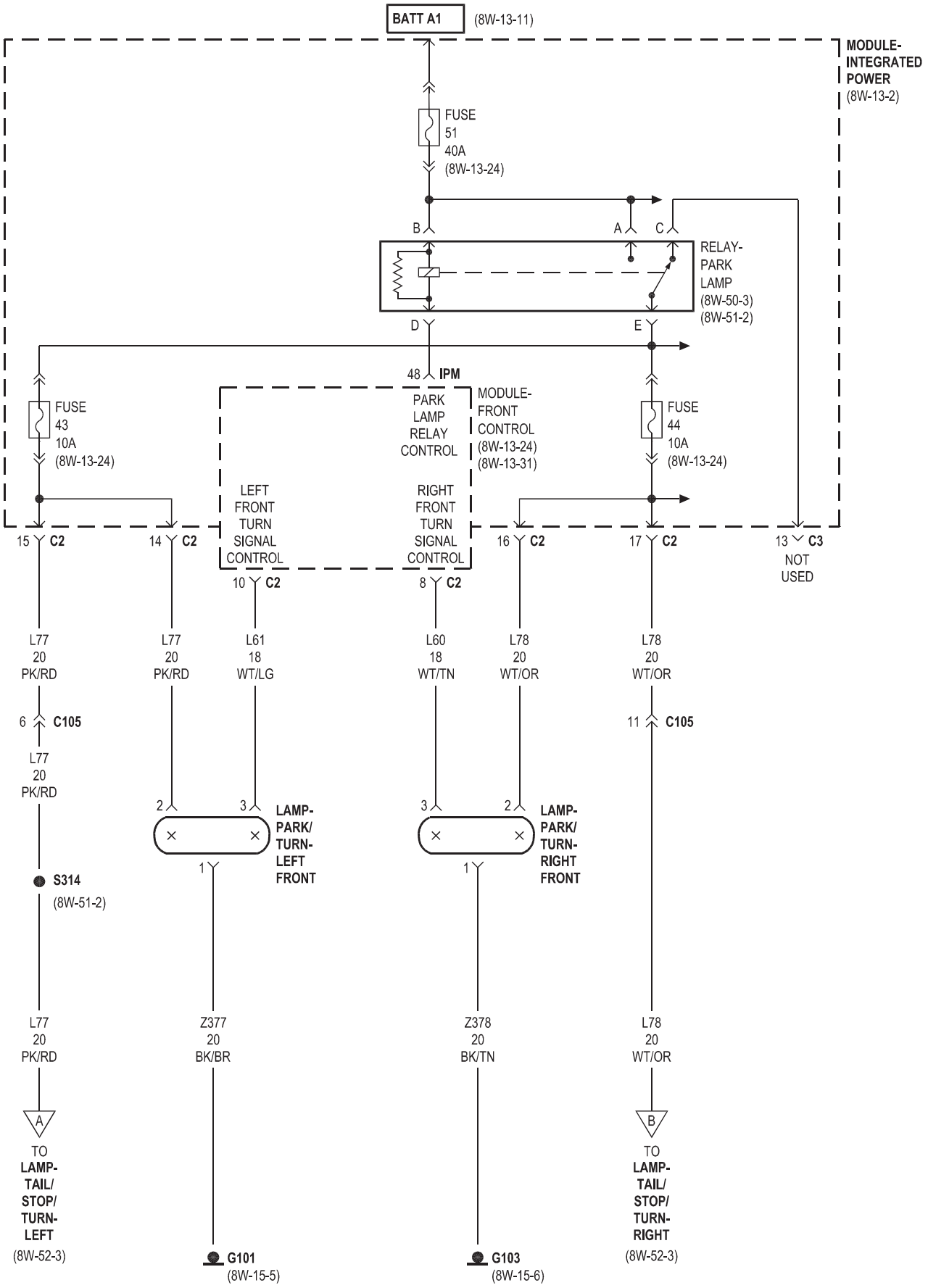

S/C BRAKE SWITCH OUTPUT
SERVO-SPEED CONTROL (8W-33-2)
S/C SUPPLY
BRAKE SWITCH SIGNAL
MODULE-POWERTRAIN CONTROL (8W-30-6)
BATT A1 (8W-13-11)
MODULE-INTEGRATED POWER (8W-13-2)
FUSE 19 15A (8W-13-18)
3
*** 7 C3
*** 23 C3
B29 20 DG/WT
S116 (8W-30-6)
28 C3
V30 20 VT/WT
V32 20 VT/YL
B29 20 DG/WT
A103 20 GY/RD
19
50
17
14 C201
A103 18 GY/RD
4
6
1
SWITCH-STOP LAMP
3
5
2
Z429 20 BK/OR
L50 16 WT/LB
G200 (8W-15-10)
57 C201
L50 18 WT/LB
5 C104
L50 16 WT/LB
A
TO LAMP-HIGH MOUNTED STOP (8W-51-4)
BRAKE LAMP SWITCH OUTPUT
MODULE-FRONT CONTROL (8W-13-30)
21 C1
L50 18 WT/TN
S106
L50 18 WT/LB
3
WIRING-TRAILER TOW ELECTRIC BRAKE (8W-54-2)

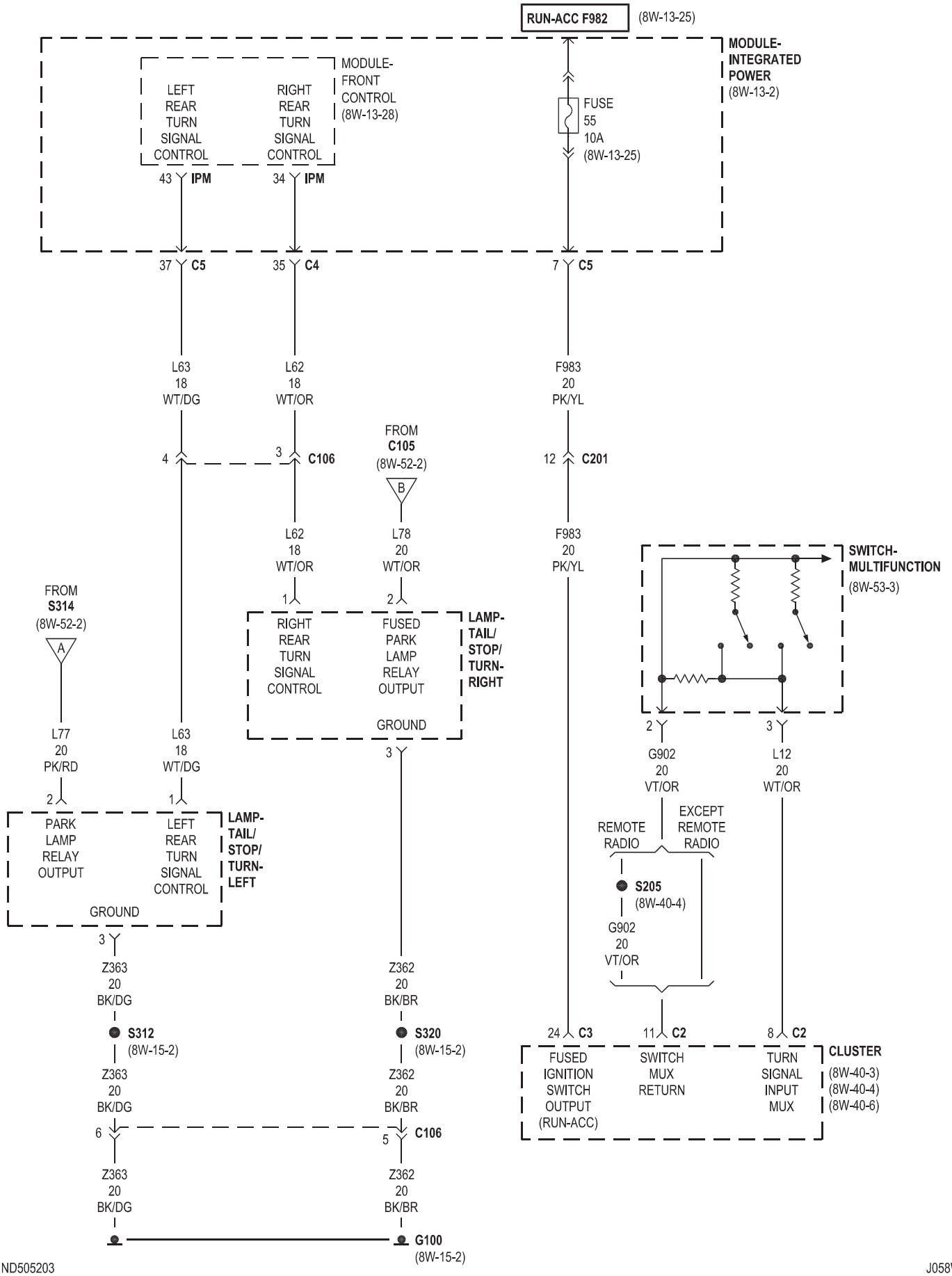
*** 545RFE


MODULE-INTEGRATED POWER (8W-13-2)
LOW/ REVERSE SOLENOID CONTROL
BACK-UP LAMP FEED
MODULE-FRONT CONTROL (8W-13-27) (8W-13-28)
40 IPM
7 IPM
20 C1
27 C5
T2 20 DG/WT
L1 18 WT/LG
S112
L1 18 WT/LG
L1 18 WT/LG
3 C100
8 C106
14 C104
T2 20 DG/WT
L1 18 WT/LG
L1 20 BK/DG
1
SWITCH-BACK-UP LAMP
2
3 C1
BACK-UP LAMP FEED
MIRROR-INSIDE REARVIEW (8W-49-3)
S313
L1 18 WT/LG
L1 18 WT/LG
L1 18 WT/LG
1
LAMP-BACKUP-LEFT
2
1
LAMP-BACKUP-RIGHT
2
3
WIRING-TRAILER TOW 7-WAY (8W-54-5)
Z363 20 BK/DG
Z362 20 BK/BR
S312 (8W-15-2)
S320 (8W-15-2)
Z363 20 BK/DG
Z362 20 BK/BR
6
5 C106
Z906 20 BK
Z363 20 BK/DG
Z362 20 BK/BR
G108 (8W-15-8)
G100 (8W-15-2)
MTX
FROM S106 (8W-51-3)
A
L50 16 WT/LB
3
4
Z945 20 BK/OR
CLUSTER
CARGO LAMP DRIVER (8W-40-7)
2 C3
L14 20 WT/BK
10 C200
L14 20 WT/BK
1
2
Z945 20 BK
LAMP-HIGH MOUNTED STOP
S304 (8W-15-16)
Z945 20 BK
G301 (8W-15-16)

8W-52 TURN SIGNALS

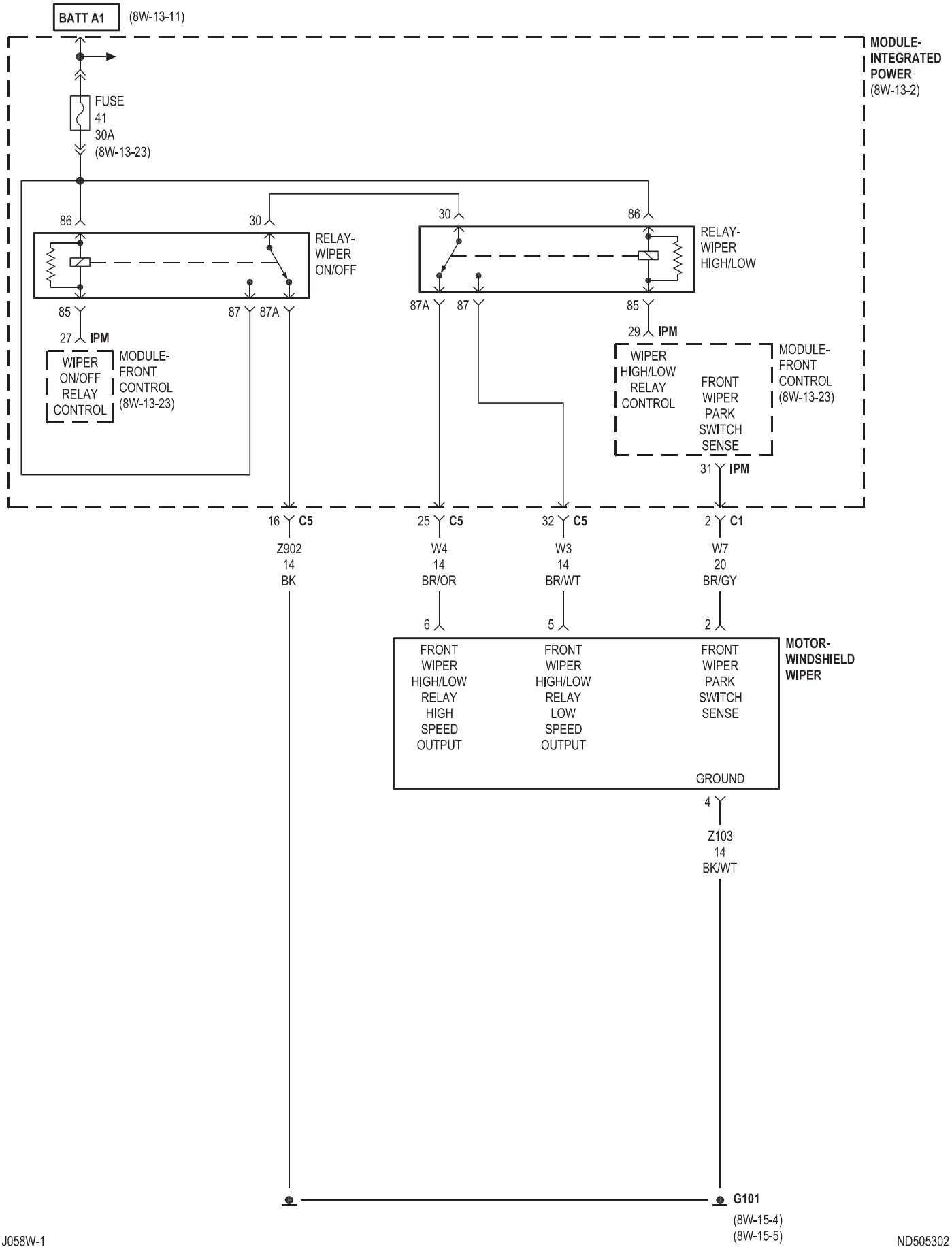
Component	Page
Cluster	8W-52-3
Fuse 43	8W-52-2
Fuse 44	8W-52-2
Fuse 51	8W-52-2
Fuse 55	8W-52-3
G100	8W-52-3
G101	8W-52-2
G103	8W-52-2
Lamp-Park/Turn-Left Front	8W-52-2
Lamp-Park/Turn-Right Front	8W-52-2
Lamp-Tail/Stop/Turn-Left	8W-52-2, 3
Lamp-Tail/Stop/Turn-Right	8W-52-2, 3
Module-Front Control	8W-52-2, 3
Module-Integrated Power	8W-52-2, 3
Relay-Park Lamp	8W-52-2
Switch-Multifunction	8W-52-3

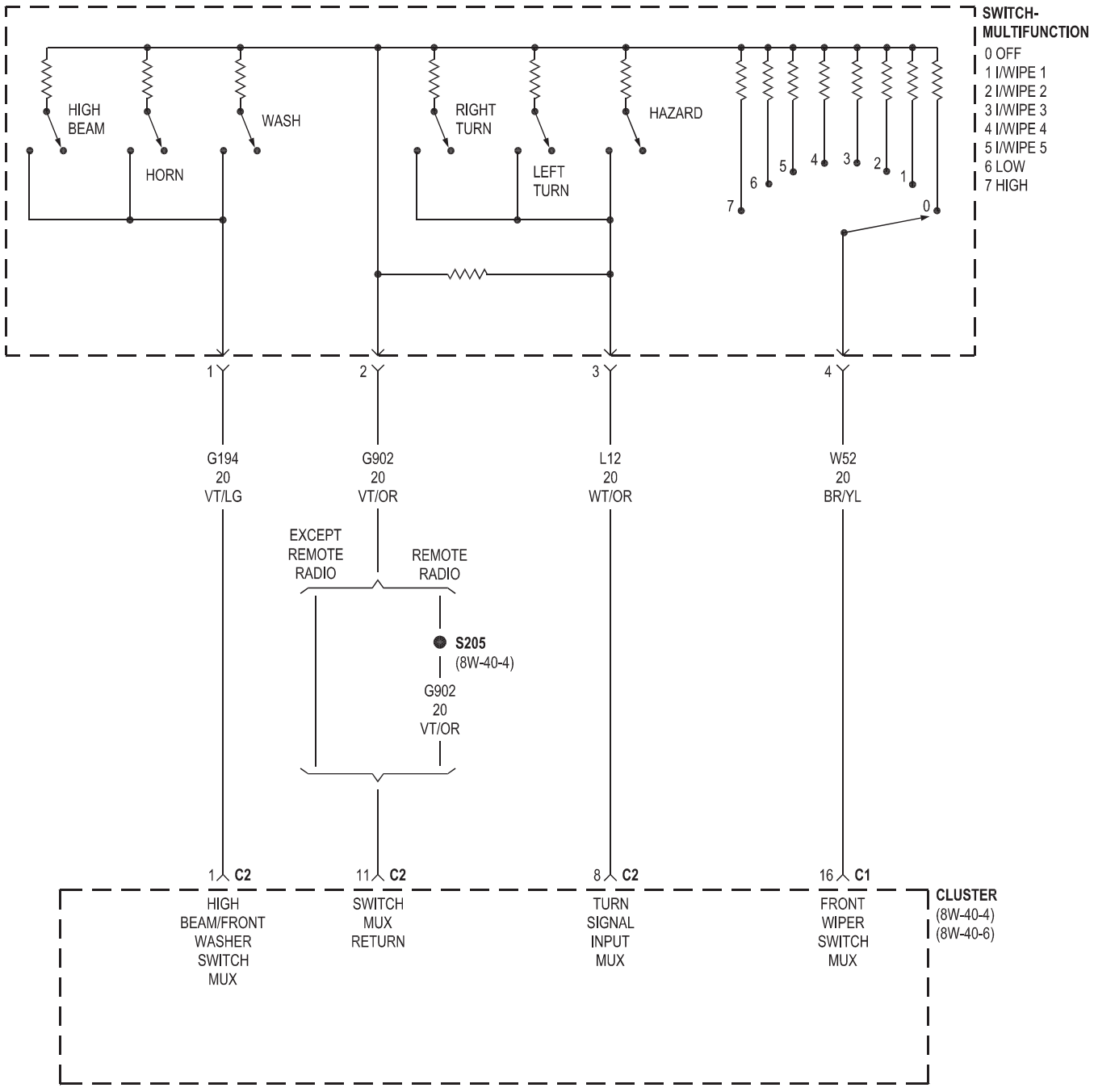

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
51
40A
(8W-13-24)
B
A
C
RELAY-
PARK
LAMP
(8W-50-3)
(8W-51-2)
D
E
48 IPM
PARK
LAMP
RELAY
CONTROL
MODULE-
FRONT
CONTROL
(8W-13-24)
(8W-13-31)
FUSE
43
10A
(8W-13-24)
FUSE
44
10A
(8W-13-24)
LEFT
FRONT
TURN
SIGNAL
CONTROL
RIGHT
FRONT
TURN
SIGNAL
CONTROL
15 C2
14 C2
10 C2
8 C2
16 C2
17 C2
13 C3
NOT
USED
L77
20
PK/RD
L77
20
PK/RD
L61
18
WT/LG
L60
18
WT/TN
L78
20
WT/OR
L78
20
WT/OR
6 C105
11 C105
L77
20
PK/RD
2
3
LAMP-
PARK/
TURN-
LEFT
FRONT
3
2
LAMP-
PARK/
TURN-
RIGHT
FRONT
1
1
S314
(8W-51-2)
L77
20
PK/RD
Z377
20
BK/BR
Z378
20
BK/TN
L78
20
WT/OR
A
B
TO
LAMP-
TAIL/
STOP/
TURN-
LEFT
(8W-52-3)
TO
LAMP-
TAIL/
STOP/
TURN-
RIGHT
(8W-52-3)
G101
(8W-15-5)
G103
(8W-15-6)

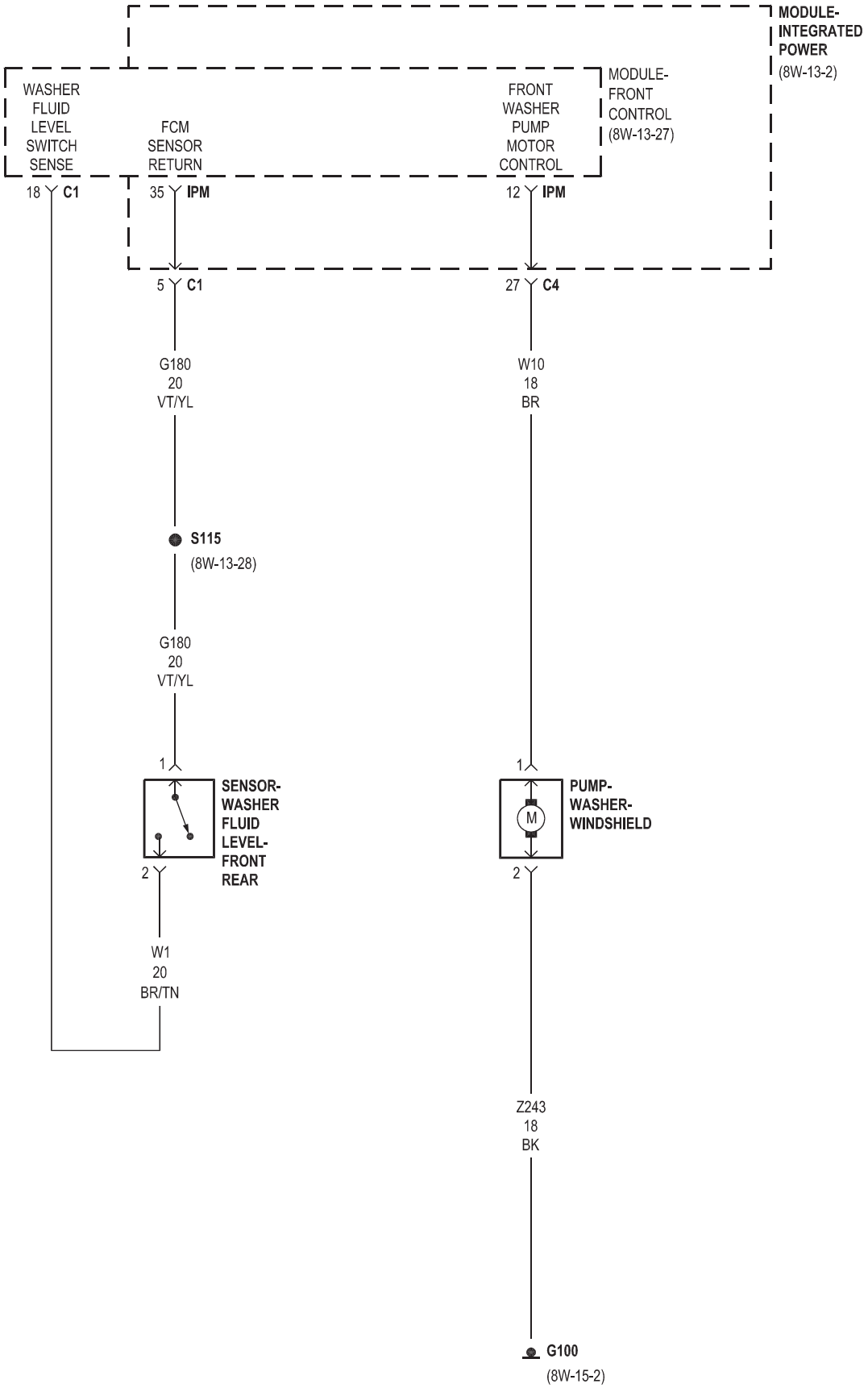

RUN-ACC F982
(8W-13-25)
MODULE-INTEGRATED POWER
(8W-13-2)
MODULE-FRONT CONTROL
(8W-13-28)
LEFT REAR TURN SIGNAL CONTROL
RIGHT REAR TURN SIGNAL CONTROL
FUSE 55 10A
(8W-13-25)
43 IPM
34 IPM
37 C5
35 C4
7 C5
L63 18 WT/DG
L62 18 WT/OR
F983 20 PK/YL
4
3 C106
FROM C105
(8W-52-2)
B
12 C201
L62 18 WT/OR
L78 20 WT/OR
F983 20 PK/YL
1
2
RIGHT REAR TURN SIGNAL CONTROL
FUSED PARK LAMP RELAY OUTPUT
LAMP-TAIL/STOP/TURN-RIGHT
GROUND
3
SWITCH-MULTIFUNCTION
(8W-53-3)
FROM S314
(8W-52-2)
A
L77 20 PK/RD
L63 18 WT/DG
2
1
PARK LAMP RELAY OUTPUT
LEFT REAR TURN SIGNAL CONTROL
LAMP-TAIL/STOP/TURN-LEFT
GROUND
3
2
3
G902 20 VT/OR
L12 20 WT/OR
REMOTE RADIO
EXCEPT REMOTE RADIO
S205
(8W-40-4)
G902 20 VT/OR
Z363 20 BK/DG
Z362 20 BK/BR
S312
(8W-15-2)
S320
(8W-15-2)
24 C3
11 C2
8 C2
Z363 20 BK/DG
Z362 20 BK/BR
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
SWITCH MUX RETURN
TURN SIGNAL INPUT MUX
CLUSTER
(8W-40-3)
(8W-40-4)
(8W-40-6)
6
5 C106
Z363 20 BK/DG
Z362 20 BK/BR
G100
(8W-15-2)

8W-53 WIPERS

Component	Page
Cluster	8W-53-3
Fuse 41	8W-53-2
G100	8W-53-4
G101	8W-53-2
Module-Front Control	8W-53-2, 4
Module-Integrated Power	8W-53-2, 4
Motor-Windshield Wiper	8W-53-2
Pump-Washer-Windshield	8W-53-4
Relay-Wiper High/Low	8W-53-2
Relay-Wiper On/Off	8W-53-2
Sensor-Washer Fluid Level-Front Rear	8W-53-4
Switch-Multifunction	8W-53-3

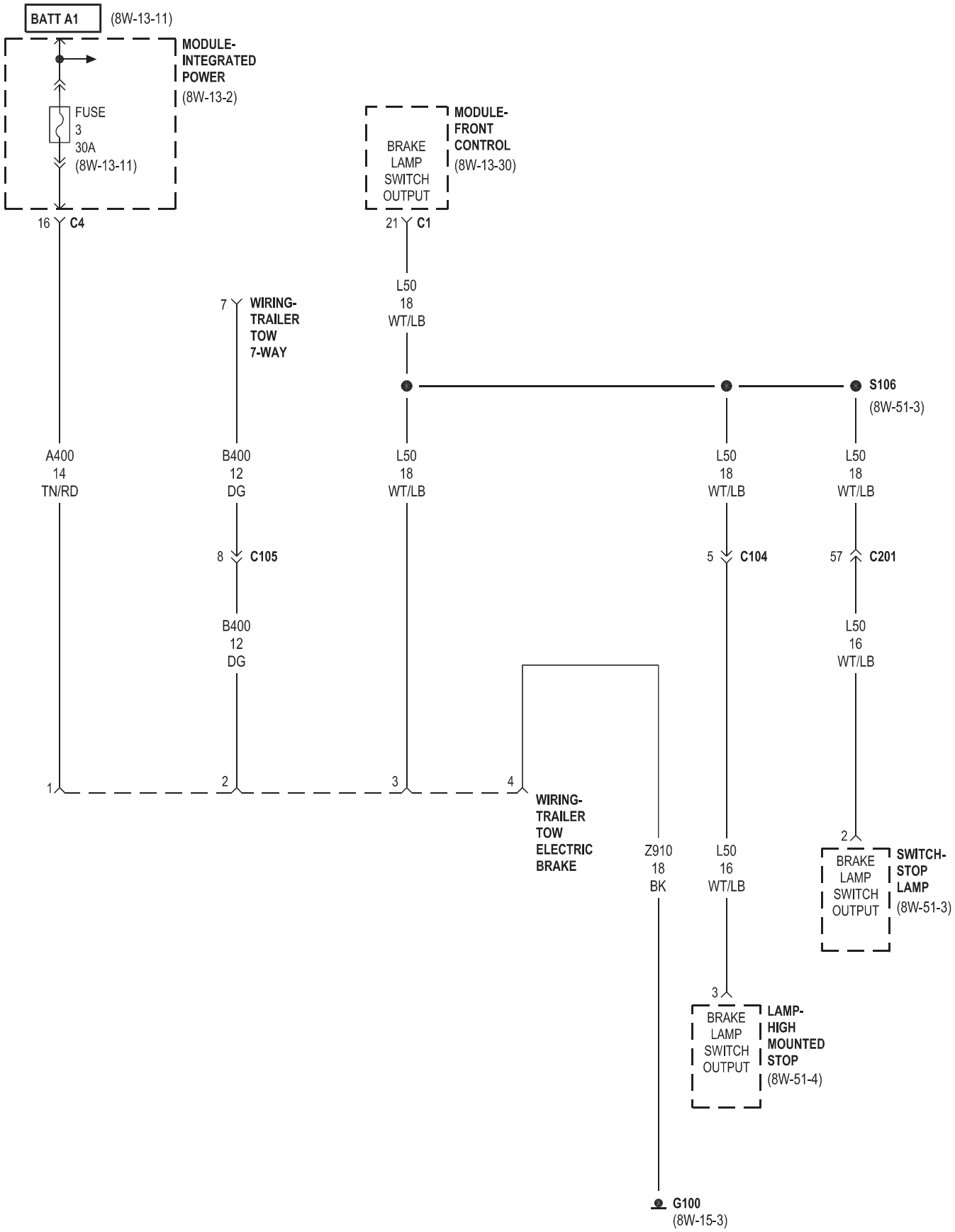

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
41
30A
(8W-13-23)
86
30
RELAY-
WIPER
ON/OFF
85
87
87A
27
IPM
WIPER
ON/OFF
RELAY
CONTROL
MODULE-
FRONT
CONTROL
(8W-13-23)
30
86
RELAY-
WIPER
HIGH/LOW
87A
87
85
29
IPM
WIPER
HIGH/LOW
RELAY
CONTROL
FRONT
WIPER
PARK
SWITCH
SENSE
MODULE-
FRONT
CONTROL
(8W-13-23)
31
IPM
16
C5
Z902
14
BK
25
C5
W4
14
BR/OR
32
C5
W3
14
BR/WT
2
C1
W7
20
BR/GY
6
5
2
FRONT
WIPER
HIGH/LOW
RELAY
HIGH
SPEED
OUTPUT
FRONT
WIPER
HIGH/LOW
RELAY
LOW
SPEED
OUTPUT
FRONT
WIPER
PARK
SWITCH
SENSE
GROUND
MOTOR-
WINDSHIELD
WIPER
4
Z103
14
BK/WT
G101
(8W-15-4)
(8W-15-5)

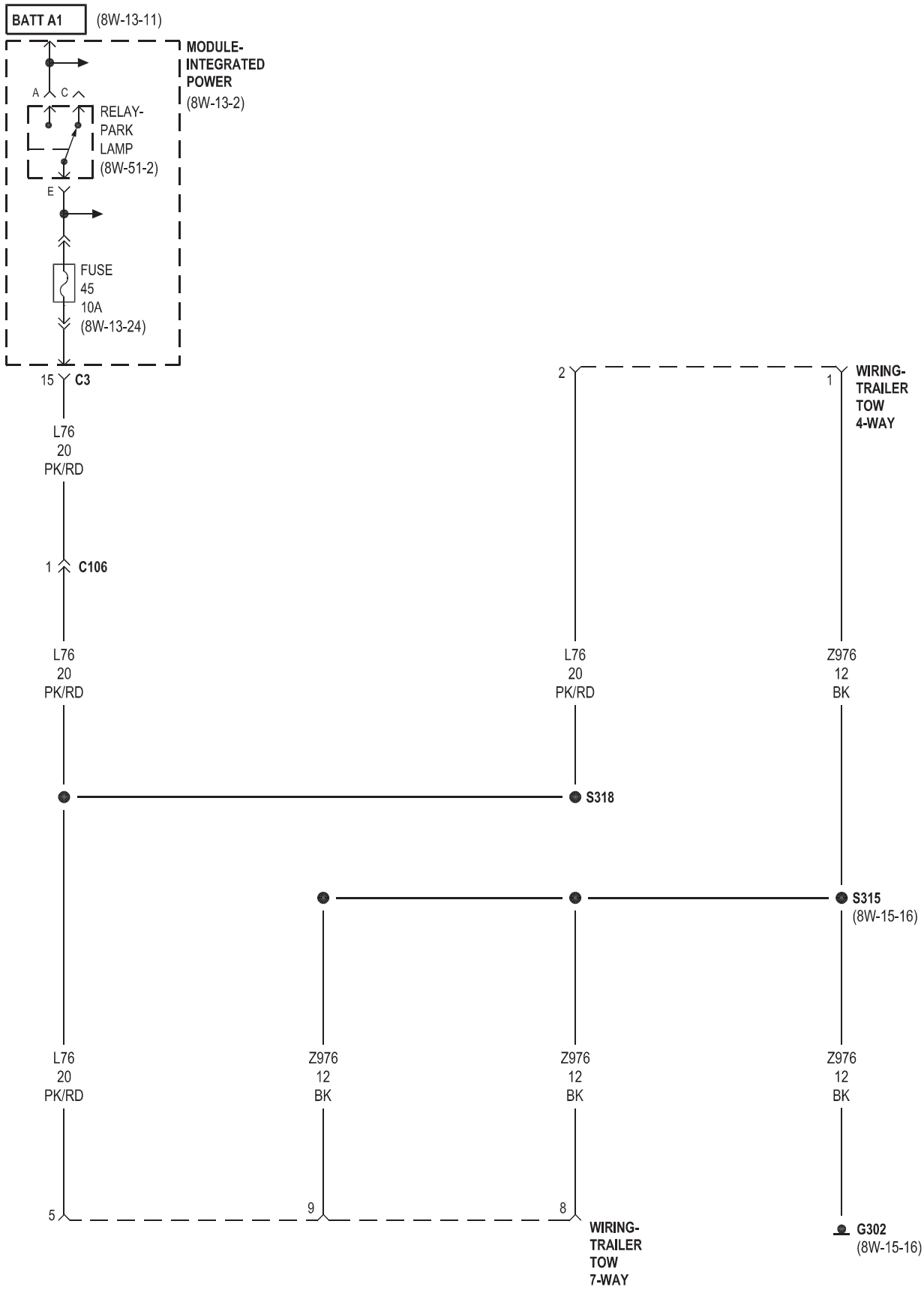

SWITCH-
MULTIFUNCTION
0 OFF
1 I/WIPE 1
2 I/WIPE 2
3 I/WIPE 3
4 I/WIPE 4
5 I/WIPE 5
6 LOW
7 HIGH
HIGH BEAM
HORN
WASH
RIGHT TURN
LEFT TURN
HAZARD
1
2
3
4
G194
20
VT/LG
G902
20
VT/OR
L12
20
WT/OR
W52
20
BR/YL
EXCEPT REMOTE RADIO
REMOTE RADIO
S205
(8W-40-4)
G902
20
VT/OR
1 C2
11 C2
8 C2
16 C1
HIGH BEAM/FRONT WASHER SWITCH MUX
SWITCH MUX RETURN
TURN SIGNAL INPUT MUX
FRONT WIPER SWITCH MUX
CLUSTER
(8W-40-4)
(8W-40-6)

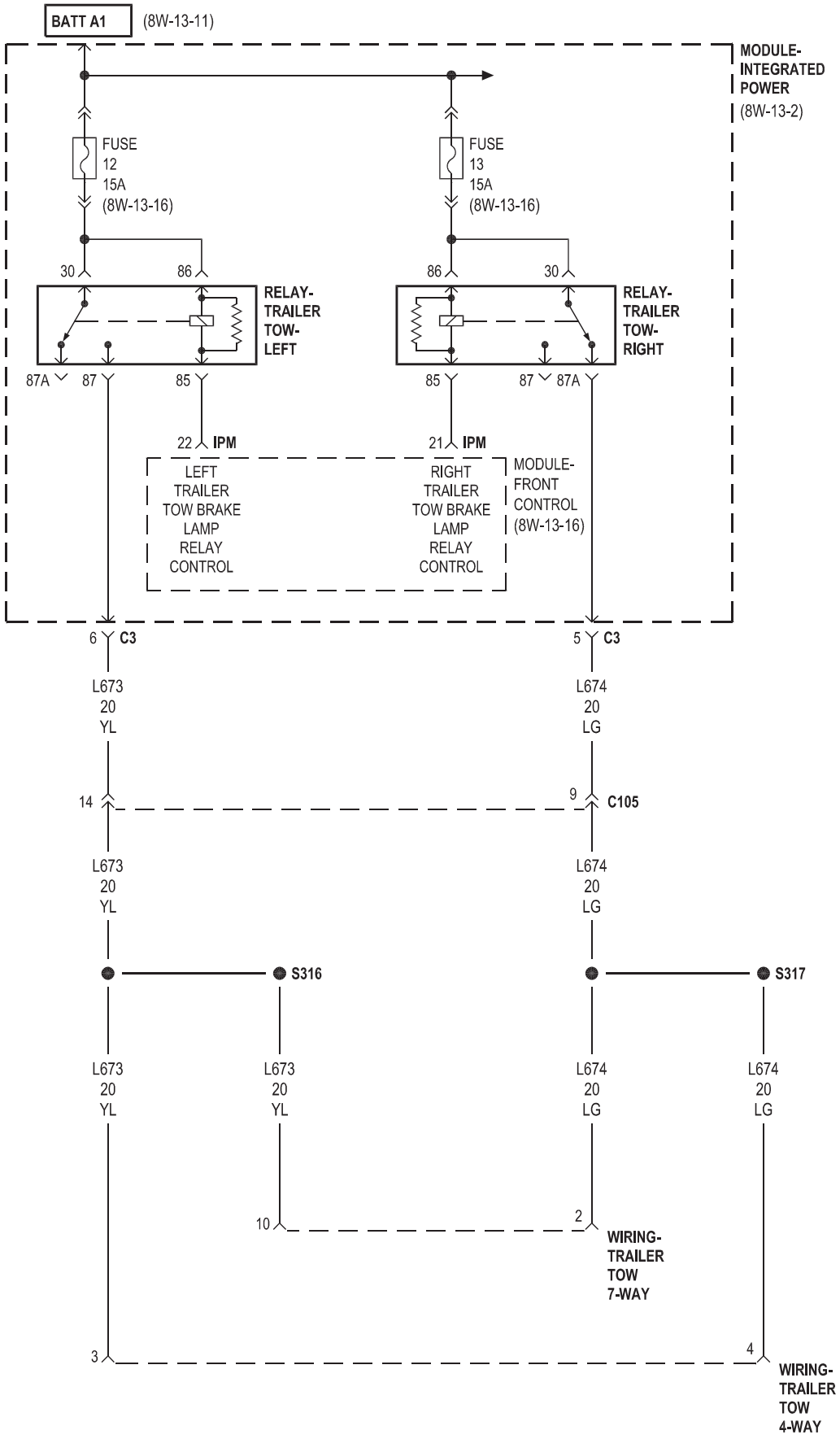

MODULE-
INTEGRATED
POWER
(8W-13-2)
MODULE-
FRONT
CONTROL
(8W-13-27)
WASHER
FLUID
LEVEL
SWITCH
SENSE
18 C1
FCM
SENSOR
RETURN
35 IPM
FRONT
WASHER
PUMP
MOTOR
CONTROL
12 IPM
5 C1
27 C4
G180
20
VT/YL
W10
18
BR
S115
(8W-13-28)
G180
20
VT/YL
1
1
SENSOR-
WASHER
FLUID
LEVEL-
FRONT
REAR
PUMP-
WASHER-
WINDSHIELD
M
2
2
W1
20
BR/TN
Z243
18
BK
G100
(8W-15-2)

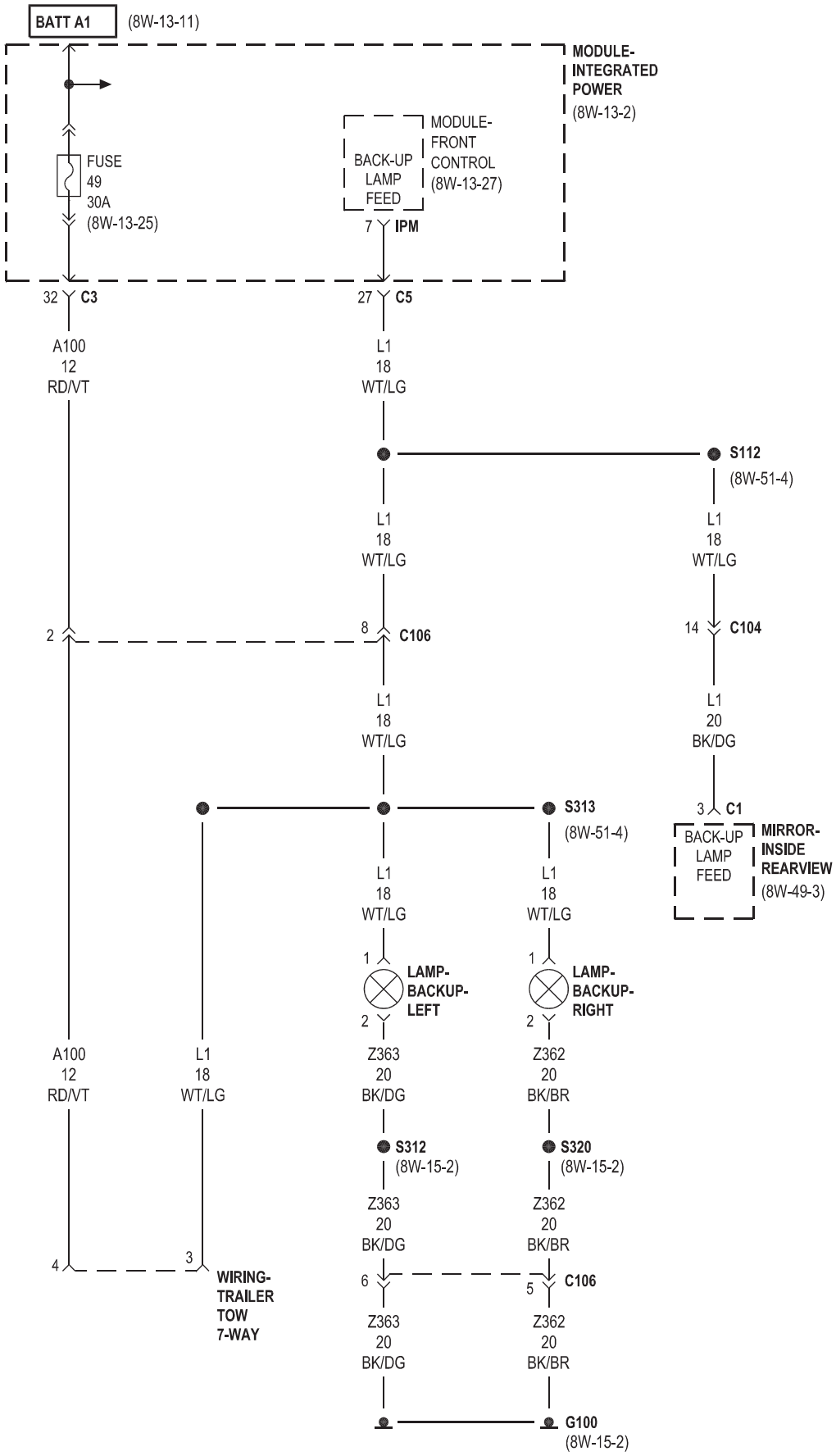
8W-54 TRAILER TOW

Component	Page
Fuse 3	8W-54-2
Fuse 12	8W-54-4
Fuse 13	8W-54-4
Fuse 45	8W-54-3
Fuse 49	8W-54-5
G100	8W-54-2, 5
G302	8W-54-3
Lamp-Backup-Left	8W-54-5
Lamp-Backup-Right	8W-54-5
Lamp-High Mounted Stop	8W-54-2
Mirror-Inside Rearview	8W-54-5
Module-Front Control	8W-54-2, 4, 5
Module-Integrated Power	8W-54-2, 3, 4, 5
Relay-Park Lamp	8W-54-3
Relay-Trailer Tow-Left	8W-54-4
Relay-Trailer Tow-Right	8W-54-4
Switch-Stop Lamp	8W-54-2
Wiring-Trailer Tow 4-Way	8W-54-3, 4
Wiring-Trailer Tow 7-Way	8W-54-2, 3, 4, 5
Wiring-Trailer Tow Electric Brake	8W-54-2


BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
3
30A
(8W-13-11)
16 C4
BRAKE
LAMP
SWITCH
OUTPUT
MODULE-
FRONT
CONTROL
(8W-13-30)
21 C1
L50
18
WT/LB
7 WIRING-
TRAILER
TOW
7-WAY
S106
(8W-51-3)
A400
14
TN/RD
B400
12
DG
L50
18
WT/LB
L50
18
WT/LB
L50
18
WT/LB
8 C105
5 C104
57 C201
B400
12
DG
L50
16
WT/LB
1
2
3
4
WIRING-
TRAILER
TOW
ELECTRIC
BRAKE
Z910
18
BK
L50
16
WT/LB
2
BRAKE
LAMP
SWITCH
OUTPUT
SWITCH-
STOP
LAMP
(8W-51-3)
3
BRAKE
LAMP
SWITCH
OUTPUT
LAMP-
HIGH
MOUNTED
STOP
(8W-51-4)
G100
(8W-15-3)

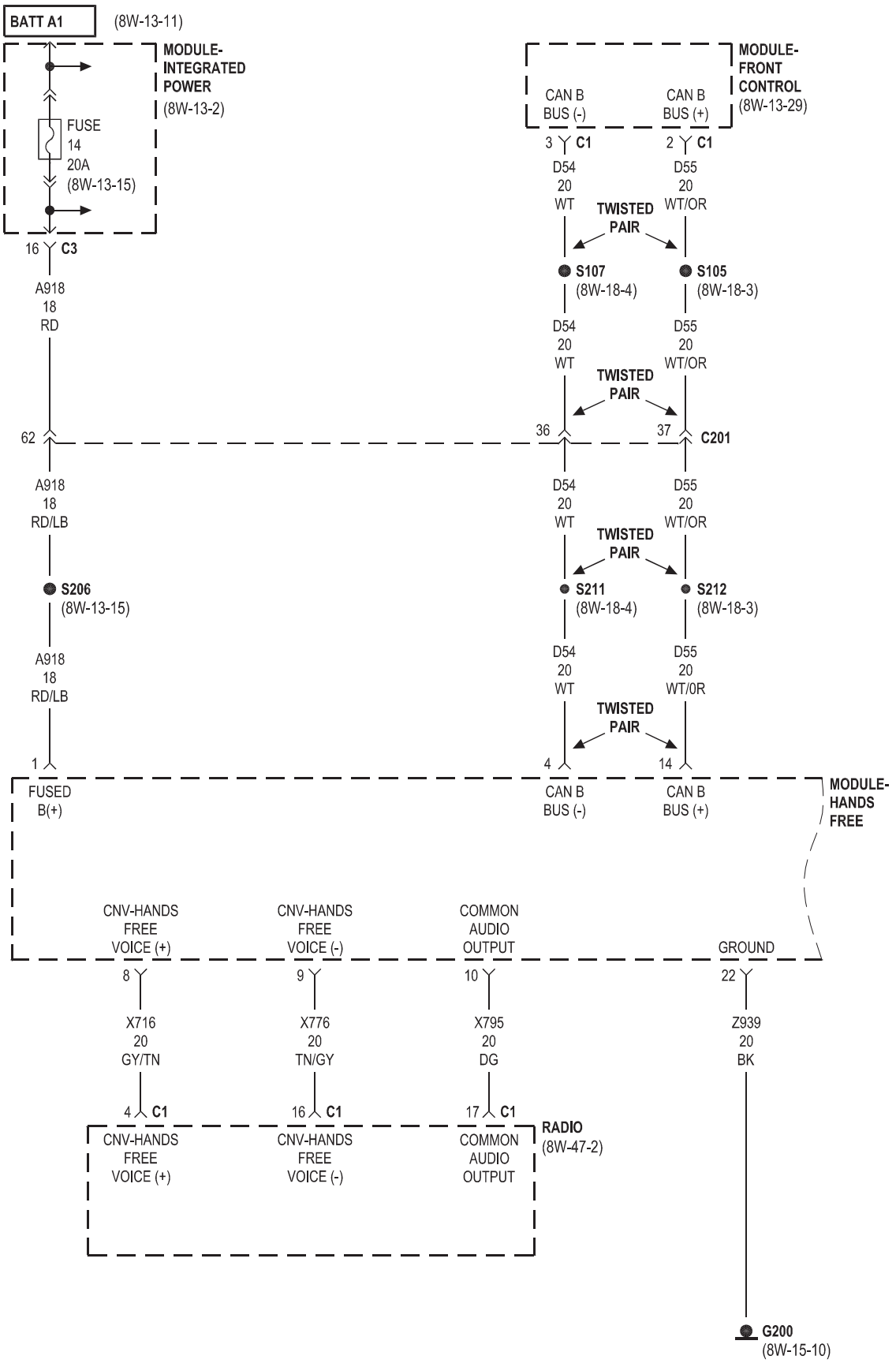

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
A
C
RELAY-
PARK
LAMP
(8W-51-2)
E
FUSE
45
10A
(8W-13-24)
15
C3
L76
20
PK/RD
1
C106
L76
20
PK/RD
2
1
WIRING-
TRAILER
TOW
4-WAY
L76
20
PK/RD
Z976
12
BK
S318
S315
(8W-15-16)
L76
20
PK/RD
Z976
12
BK
Z976
12
BK
Z976
12
BK
5
9
8
WIRING-
TRAILER
TOW
7-WAY
G302
(8W-15-16)

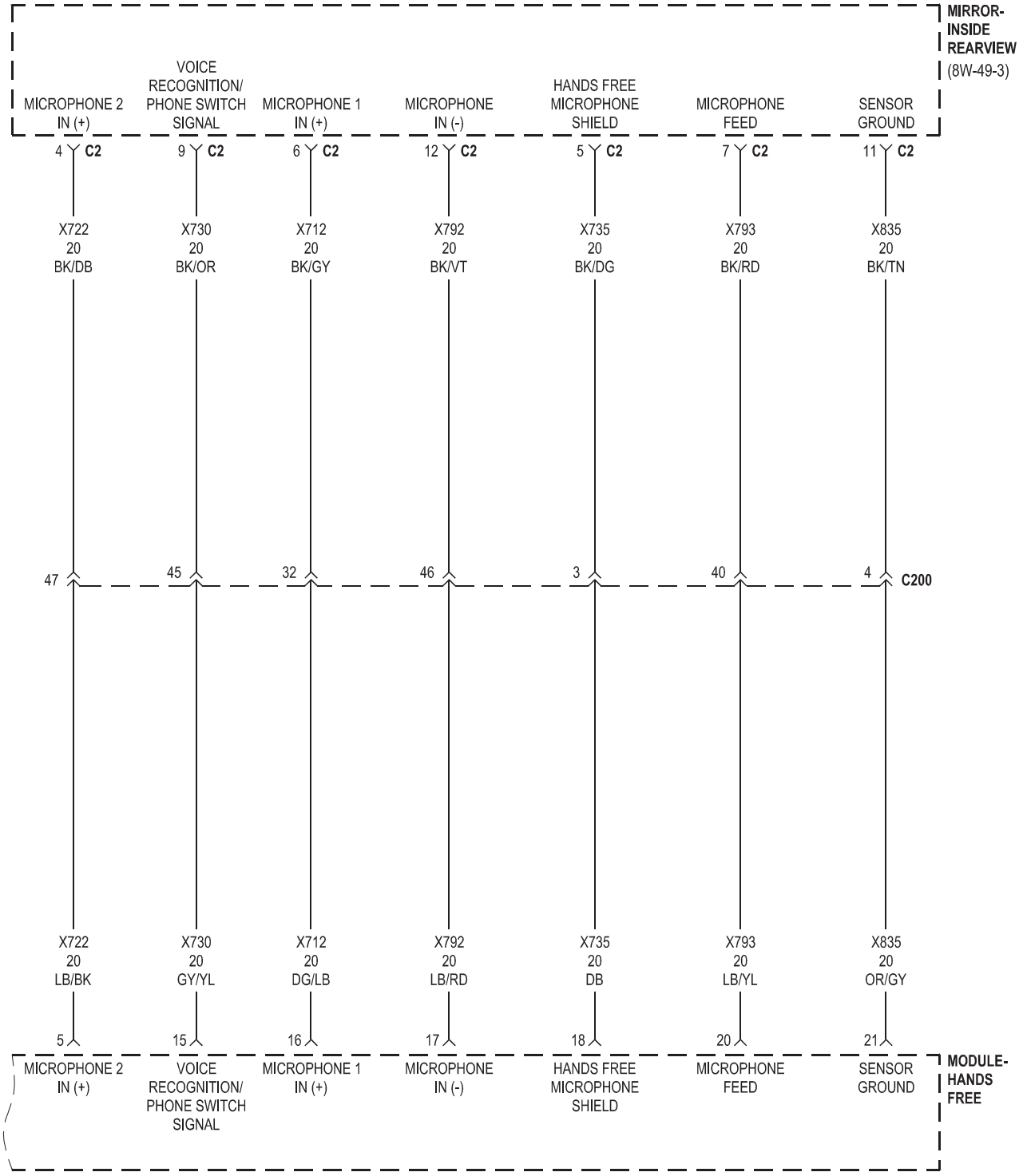

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
12
15A
(8W-13-16)
FUSE
13
15A
(8W-13-16)
30
86
86
30
RELAY-
TRAILER
TOW-
LEFT
RELAY-
TRAILER
TOW-
RIGHT
87A
87
85
85
87
87A
22
IPM
21
IPM
LEFT
TRAILER
TOW BRAKE
LAMP
RELAY
CONTROL
RIGHT
TRAILER
TOW BRAKE
LAMP
RELAY
CONTROL
MODULE-
FRONT
CONTROL
(8W-13-16)
6
C3
5
C3
L673
20
YL
L674
20
LG
14
9
C105
L673
20
YL
L674
20
LG
S316
S317
L673
20
YL
L673
20
YL
L674
20
LG
L674
20
LG
10
2
WIRING-
TRAILER
TOW
7-WAY
3
4
WIRING-
TRAILER
TOW
4-WAY


BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
49
30A
(8W-13-25)
MODULE-
FRONT
CONTROL
(8W-13-27)
BACK-UP
LAMP
FEED
7 IPM
32 C3
27 C5
A100
12
RD/VT
L1
18
WT/LG
S112
(8W-51-4)
L1
18
WT/LG
2
8 C106
14 C104
L1
20
BK/DG
3 C1
BACK-UP
LAMP
FEED
MIRROR-
INSIDE
REARVIEW
(8W-49-3)
S313
(8W-51-4)
1
LAMP-
BACKUP-
LEFT
2
LAMP-
BACKUP-
RIGHT
Z363
20
BK/DG
Z362
20
BK/BR
S312
(8W-15-2)
S320
(8W-15-2)
4
3
WIRING-
TRAILER
TOW
7-WAY
6
5 C106
G100
(8W-15-2)

8W-55 NAVIGATION/TELECOMMUNICATIONS

Component	Page
Fuse 14	8W-55-2
G200	8W-55-2
Mirror-Inside Rearview	8W-55-3
Module-Front Control	8W-55-2
Module-Hands Free	8W-55-2, 3
Module-Integrated Power	8W-55-2
Radio	8W-55-2

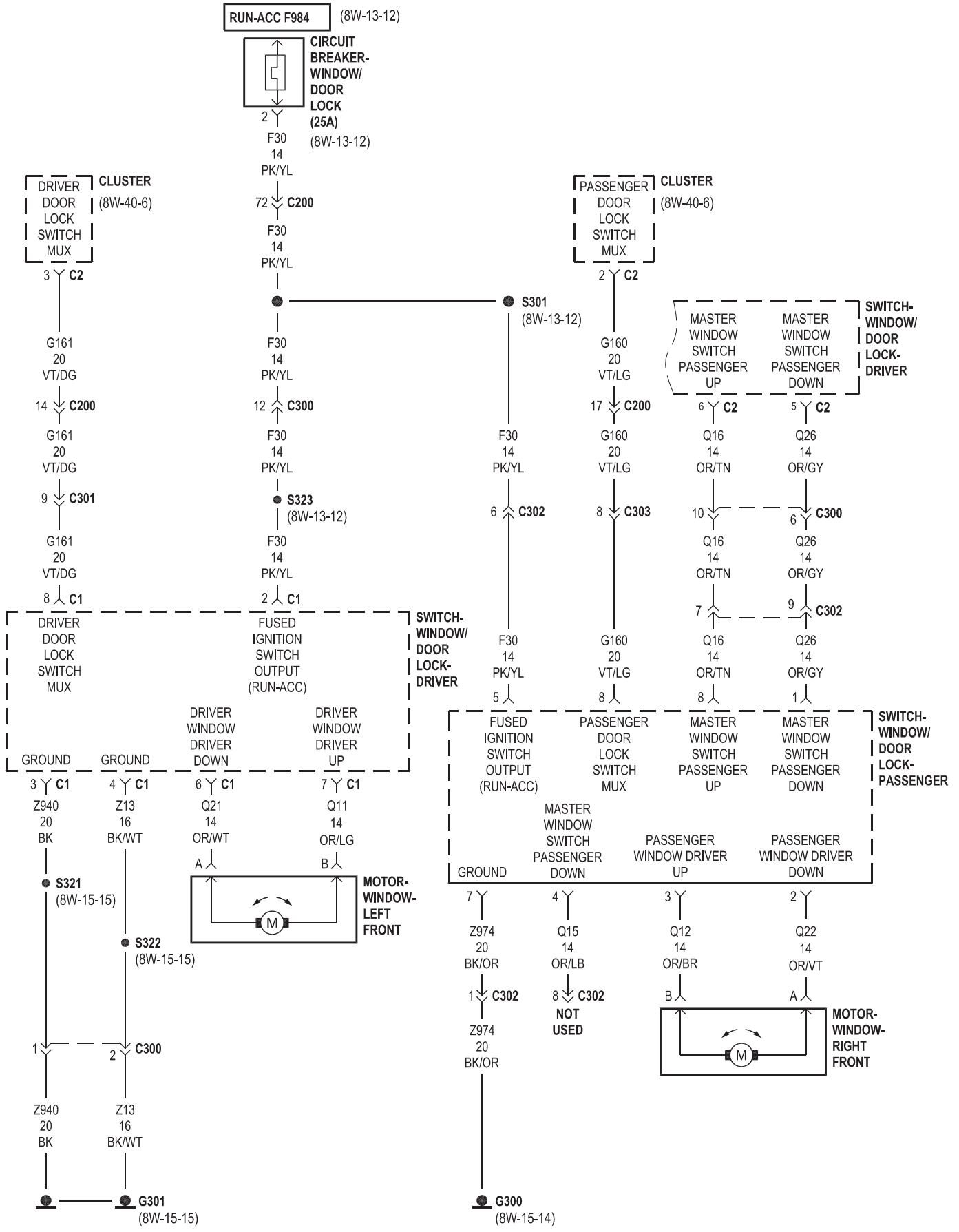

BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
14
20A
(8W-13-15)
16 C3
A918
18
RD
62
A918
18
RD/LB
S206
(8W-13-15)
A918
18
RD/LB
1
FUSED
B(+)
MODULE-
FRONT
CONTROL
(8W-13-29)
CAN B
BUS (-)
CAN B
BUS (+)
3 C1
2 C1
D54
20
WT
D55
20
WT/OR
TWISTED
PAIR
S107
(8W-18-4)
S105
(8W-18-3)
D54
20
WT
D55
20
WT/OR
TWISTED
PAIR
36
37
C201
D54
20
WT
D55
20
WT/OR
TWISTED
PAIR
S211
(8W-18-4)
S212
(8W-18-3)
D54
20
WT
D55
20
WT/0R
TWISTED
PAIR
4
14
CAN B
BUS (-)
CAN B
BUS (+)
MODULE-
HANDS
FREE
CNV-HANDS
FREE
VOICE (+)
CNV-HANDS
FREE
VOICE (-)
COMMON
AUDIO
OUTPUT
GROUND
8
9
10
22
X716
20
GY/TN
X776
20
TN/GY
X795
20
DG
Z939
20
BK
4 C1
16 C1
17 C1
CNV-HANDS
FREE
VOICE (+)
CNV-HANDS
FREE
VOICE (-)
COMMON
AUDIO
OUTPUT
RADIO
(8W-47-2)
G200
(8W-15-10)

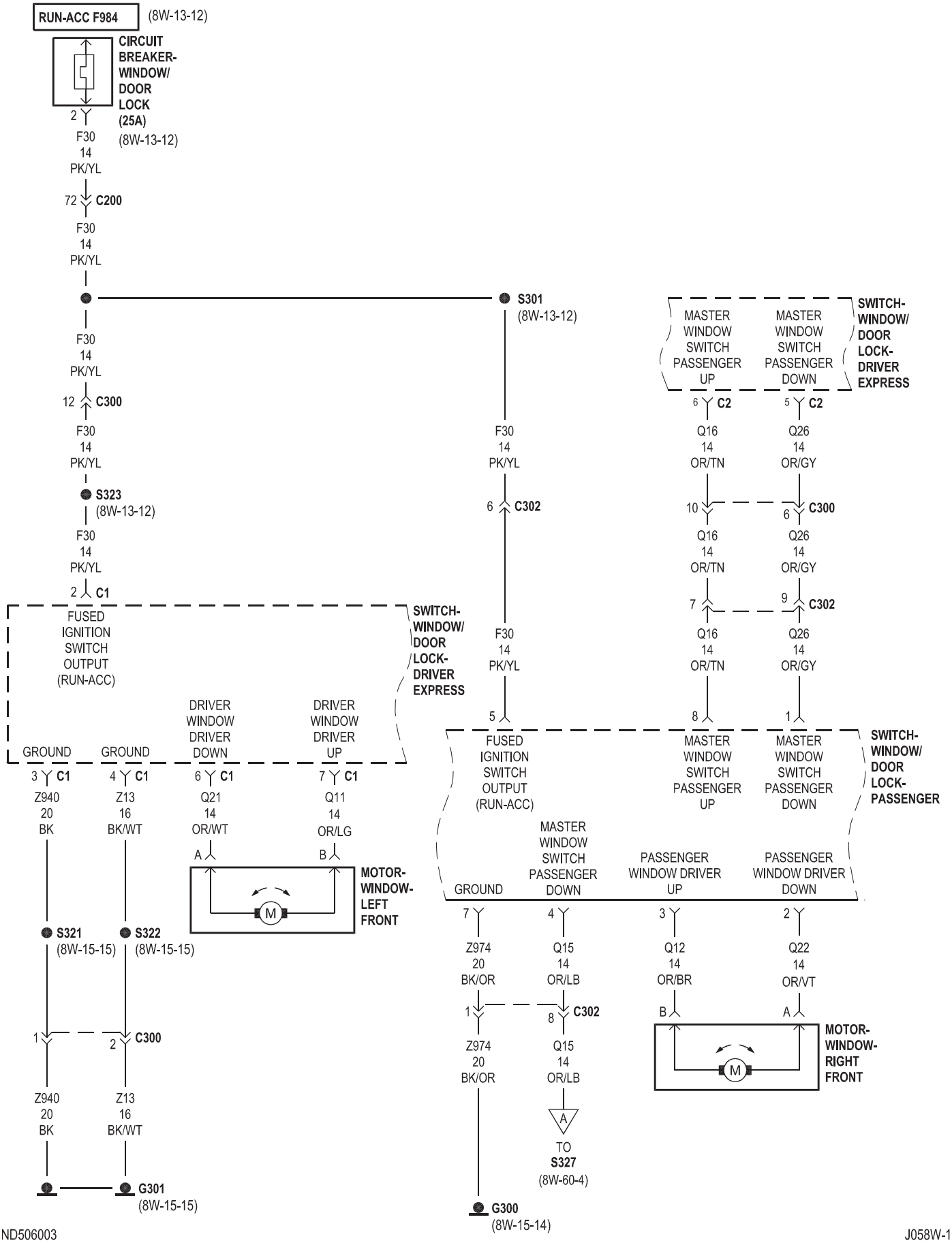

MIRROR-
INSIDE
REARVIEW
(8W-49-3)
MICROPHONE 2 IN (+)
VOICE RECOGNITION/ PHONE SWITCH SIGNAL
MICROPHONE 1 IN (+)
MICROPHONE IN (-)
HANDS FREE MICROPHONE SHIELD
MICROPHONE FEED
SENSOR GROUND
4 C2
9 C2
6 C2
12 C2
5 C2
7 C2
11 C2
X722 20 BK/DB
X730 20 BK/OR
X712 20 BK/GY
X792 20 BK/VT
X735 20 BK/DG
X793 20 BK/RD
X835 20 BK/TN
47
45
32
46
3
40
4
C200
X722 20 LB/BK
X730 20 GY/YL
X712 20 DG/LB
X792 20 LB/RD
X735 20 DB
X793 20 LB/YL
X835 20 OR/GY
5
15
16
17
18
20
21
MICROPHONE 2 IN (+)
VOICE RECOGNITION/ PHONE SWITCH SIGNAL
MICROPHONE 1 IN (+)
MICROPHONE IN (-)
HANDS FREE MICROPHONE SHIELD
MICROPHONE FEED
SENSOR GROUND
MODULE-
HANDS
FREE

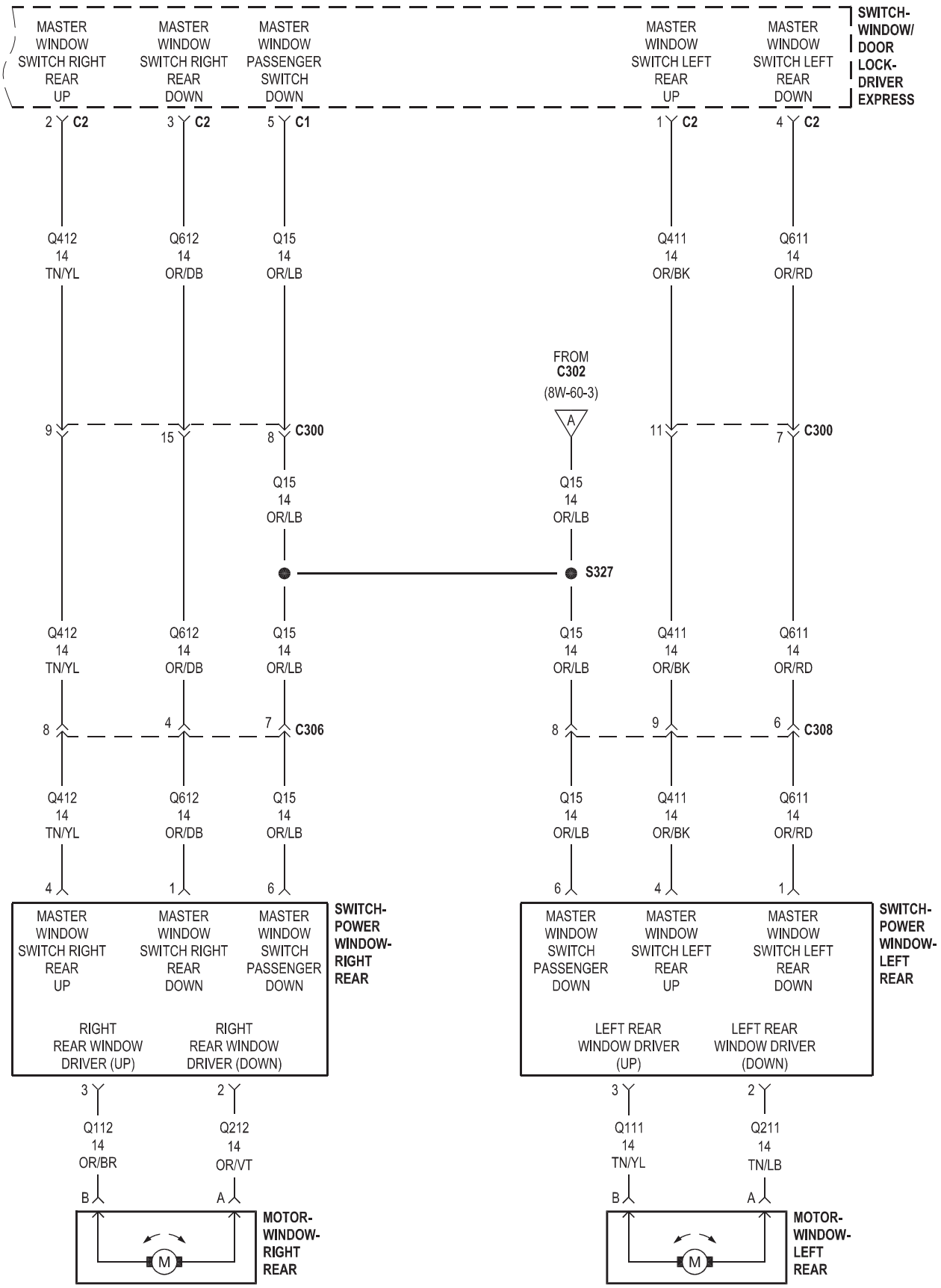
8W-60 POWER WINDOWS

Component	Page
Circuit Breaker-Window/Door Lock	8W-60-2, 3
Cluster	8W-60-2
G300	8W-60-2, 3
G301	8W-60-2, 3
Motor-Window-Left Front	8W-60-2, 3
Motor-Window-Left Rear	8W-60-4
Motor-Window-Right Front	8W-60-2, 3
Motor-Window-Right Rear	8W-60-4
Switch-Power Window-Left Rear	8W-60-4
Switch-Power Window-Right Rear	8W-60-4
Switch-Window/Door Lock-Driver	8W-60-2
Switch-Window/Door Lock-Driver Express	8W-60-3, 4
Switch-Window/Door Lock-Passenger	8W-60-2, 3

CLUB CAB

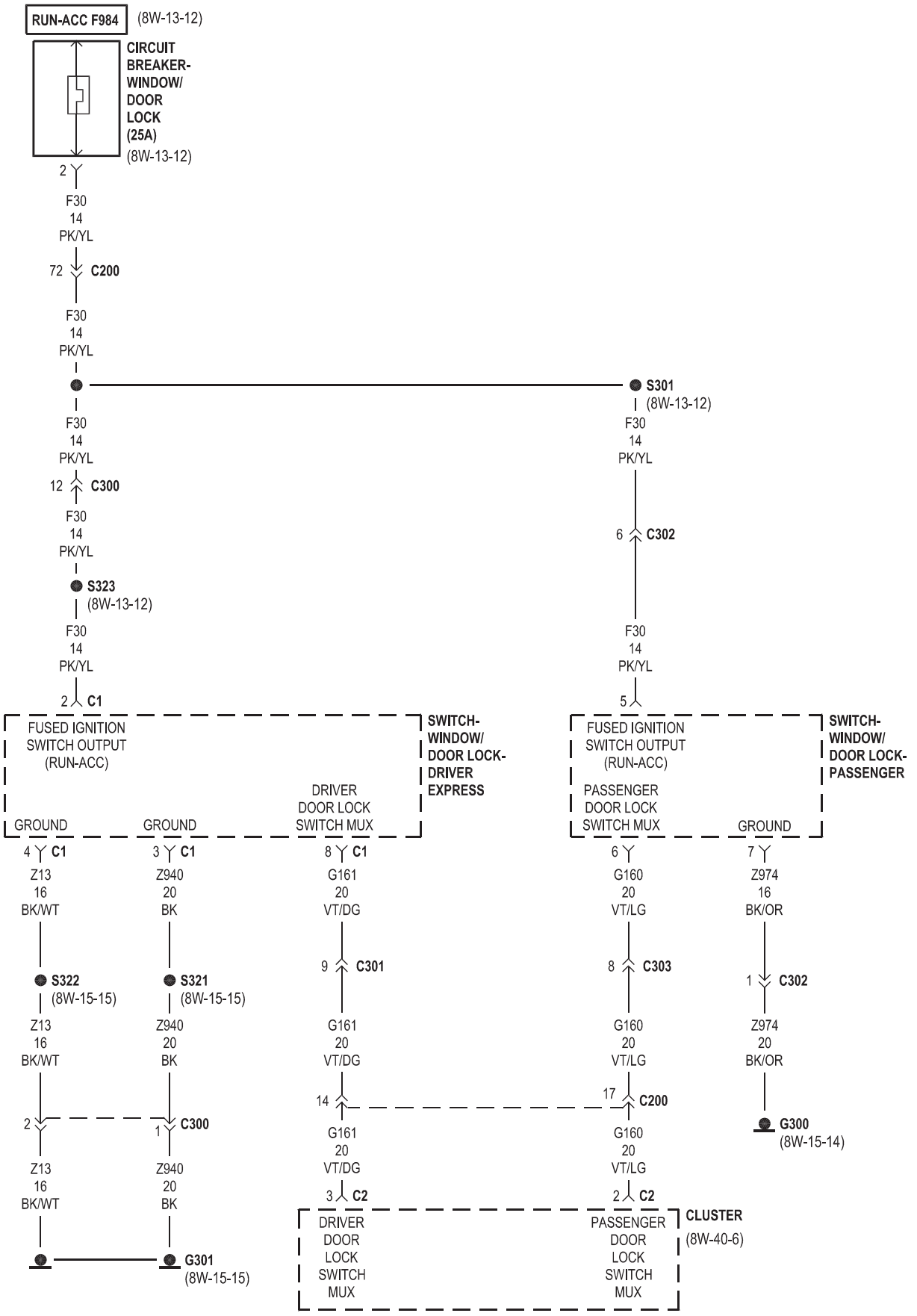

RUN-ACC F984
(8W-13-12)
CIRCUIT BREAKER-WINDOW/ DOOR LOCK (25A)
2
F30
14
PK/YL
(8W-13-12)
72 C200
F30
14
PK/YL
S301
(8W-13-12)
DRIVER DOOR LOCK SWITCH MUX
CLUSTER
(8W-40-6)
3 C2
G161
20
VT/DG
14 C200
G161
20
VT/DG
9 C301
G161
20
VT/DG
8 C1
F30
14
PK/YL
12 C300
F30
14
PK/YL
S323
(8W-13-12)
F30
14
PK/YL
2 C1
F30
14
PK/YL
6 C302
F30
14
PK/YL
5
PASSENGER DOOR LOCK SWITCH MUX
CLUSTER
(8W-40-6)
2 C2
G160
20
VT/LG
17 C200
G160
20
VT/LG
8 C303
G160
20
VT/LG
8
MASTER WINDOW SWITCH PASSENGER UP
MASTER WINDOW SWITCH PASSENGER DOWN
SWITCH-WINDOW/ DOOR LOCK-DRIVER
6 C2
Q16
14
OR/TN
10
Q16
14
OR/TN
7
Q16
14
OR/TN
8
5 C2
Q26
14
OR/GY
6 C300
Q26
14
OR/GY
9 C302
Q26
14
OR/GY
1
DRIVER DOOR LOCK SWITCH MUX
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
SWITCH-WINDOW/ DOOR LOCK-DRIVER
GROUND
GROUND
DRIVER WINDOW DRIVER DOWN
DRIVER WINDOW DRIVER UP
3 C1
Z940
20
BK
4 C1
Z13
16
BK/WT
6 C1
Q21
14
OR/WT
A
7 C1
Q11
14
OR/LG
B
S321
(8W-15-15)
S322
(8W-15-15)
M
MOTOR-WINDOW-LEFT FRONT
1
2 C300
Z940
20
BK
Z13
16
BK/WT
G301
(8W-15-15)
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
PASSENGER DOOR LOCK SWITCH MUX
MASTER WINDOW SWITCH PASSENGER UP
MASTER WINDOW SWITCH PASSENGER DOWN
SWITCH-WINDOW/ DOOR LOCK-PASSENGER
GROUND
MASTER WINDOW SWITCH PASSENGER DOWN
PASSENGER WINDOW DRIVER UP
PASSENGER WINDOW DRIVER DOWN
7
Z974
20
BK/OR
1 C302
Z974
20
BK/OR
4
Q15
14
OR/LB
8 C302
NOT USED
3
Q12
14
OR/BR
B
2
Q22
14
OR/VT
A
M
MOTOR-WINDOW-RIGHT FRONT
G300
(8W-15-14)

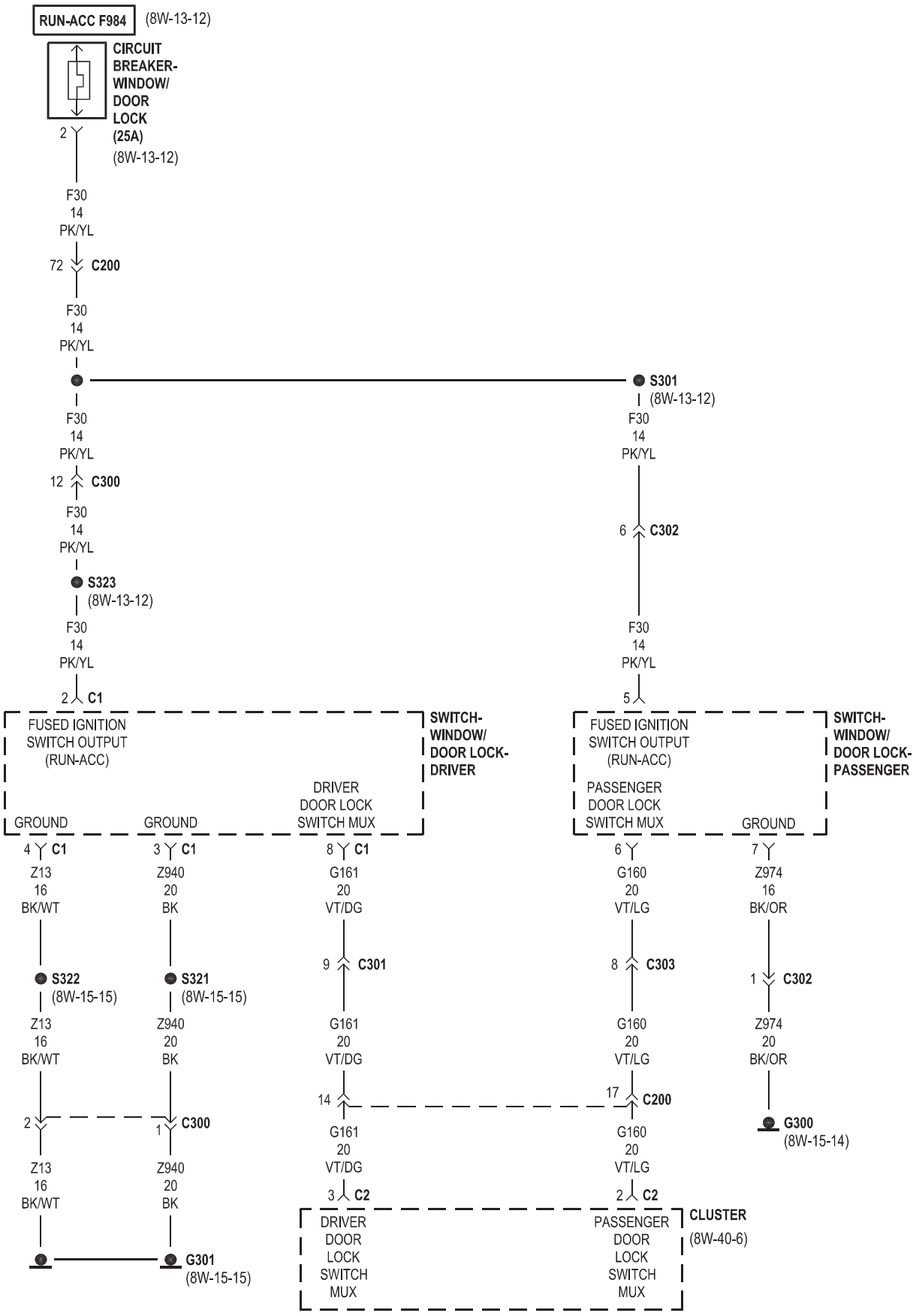

RUN-ACC F984
(8W-13-12)
CIRCUIT BREAKER-WINDOW/ DOOR LOCK (25A)
2
F30
14
PK/YL
(8W-13-12)
72 C200
F30
14
PK/YL
S301
(8W-13-12)
F30
14
PK/YL
12 C300
F30
14
PK/YL
S323
(8W-13-12)
F30
14
PK/YL
2 C1
SWITCH-WINDOW/ DOOR LOCK-DRIVER EXPRESS
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
GROUND
GROUND
DRIVER WINDOW DRIVER DOWN
DRIVER WINDOW DRIVER UP
3 C1
4 C1
6 C1
7 C1
Z940
20
BK
Z13
16
BK/WT
Q21
14
OR/WT
Q11
14
OR/LG
A
B
M
MOTOR-WINDOW-LEFT FRONT
S321
(8W-15-15)
S322
(8W-15-15)
1
2 C300
Z940
20
BK
Z13
16
BK/WT
G301
(8W-15-15)
F30
14
PK/YL
6 C302
F30
14
PK/YL
5
MASTER WINDOW SWITCH PASSENGER UP
MASTER WINDOW SWITCH PASSENGER DOWN
SWITCH-WINDOW/ DOOR LOCK-DRIVER EXPRESS
6 C2
5 C2
Q16
14
OR/TN
Q26
14
OR/GY
10
6 C300
Q16
14
OR/TN
Q26
14
OR/GY
7
9 C302
Q16
14
OR/TN
Q26
14
OR/GY
8
1
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
MASTER WINDOW SWITCH PASSENGER UP
MASTER WINDOW SWITCH PASSENGER DOWN
SWITCH-WINDOW/ DOOR LOCK-PASSENGER
GROUND
MASTER WINDOW SWITCH PASSENGER DOWN
PASSENGER WINDOW DRIVER UP
PASSENGER WINDOW DRIVER DOWN
7
4
3
2
Z974
20
BK/OR
Q15
14
OR/LB
Q12
14
OR/BR
Q22
14
OR/VT
1
8 C302
B
A
Z974
20
BK/OR
Q15
14
OR/LB
A
TO S327
(8W-60-4)
M
MOTOR-WINDOW-RIGHT FRONT
G300
(8W-15-14)

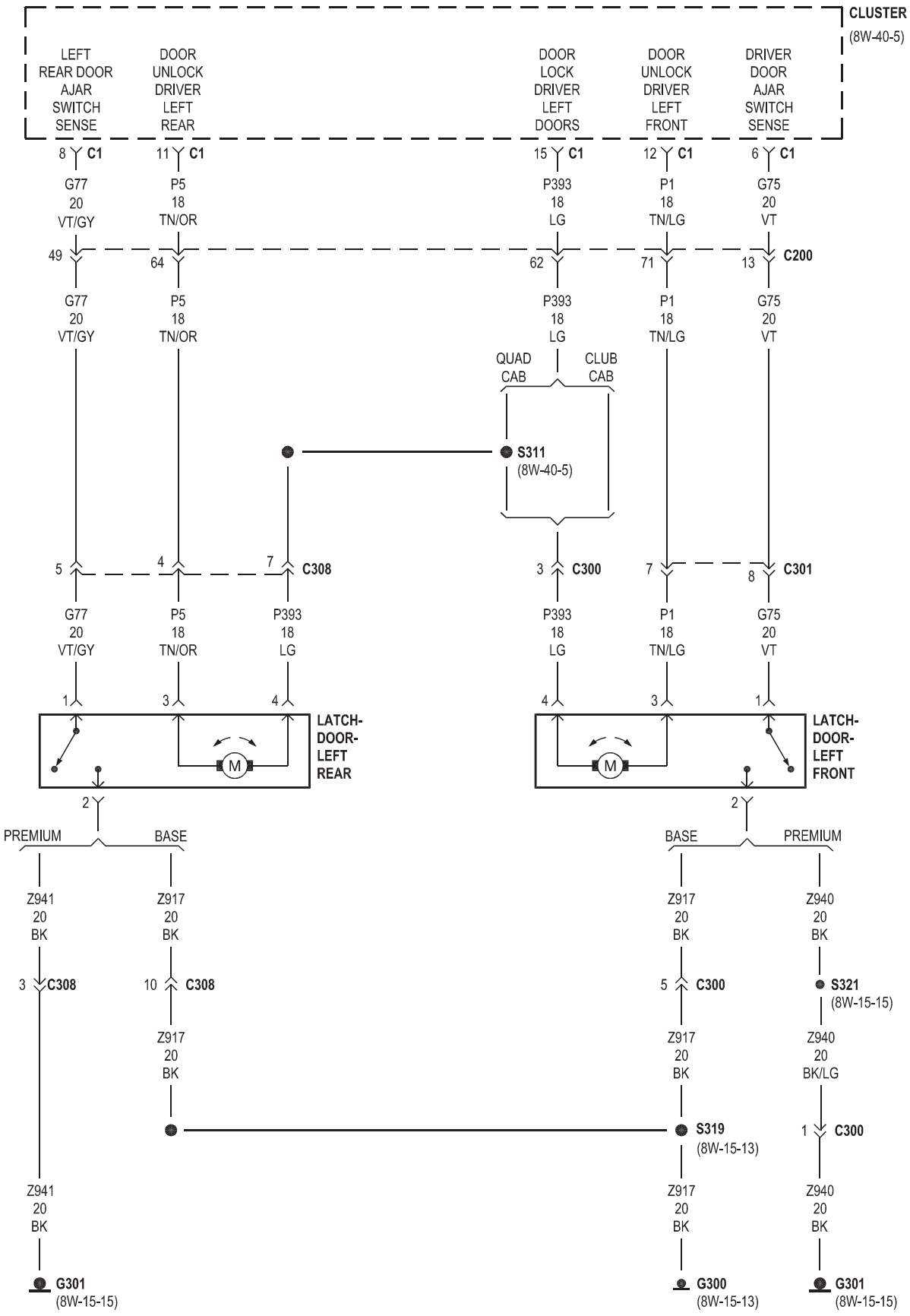

SWITCH-WINDOW/DOOR LOCK-DRIVER EXPRESS
MASTER WINDOW SWITCH RIGHT REAR UP
MASTER WINDOW SWITCH RIGHT REAR DOWN
MASTER WINDOW PASSENGER SWITCH DOWN
MASTER WINDOW SWITCH LEFT REAR UP
MASTER WINDOW SWITCH LEFT REAR DOWN
2 C2
3 C2
5 C1
1 C2
4 C2
Q412 14 TN/YL
Q612 14 OR/DB
Q15 14 OR/LB
Q411 14 OR/BK
Q611 14 OR/RD
FROM C302 (8W-60-3)
A
9
15
8 C300
11
7 C300
Q15 14 OR/LB
Q15 14 OR/LB
S327
Q412 14 TN/YL
Q612 14 OR/DB
Q15 14 OR/LB
Q15 14 OR/LB
Q411 14 OR/BK
Q611 14 OR/RD
8
4
7 C306
8
9
6 C308
Q412 14 TN/YL
Q612 14 OR/DB
Q15 14 OR/LB
Q15 14 OR/LB
Q411 14 OR/BK
Q611 14 OR/RD
4
1
6
6
4
1
SWITCH-POWER WINDOW-RIGHT REAR
MASTER WINDOW SWITCH RIGHT REAR UP
MASTER WINDOW SWITCH RIGHT REAR DOWN
MASTER WINDOW SWITCH PASSENGER DOWN
RIGHT REAR WINDOW DRIVER (UP)
RIGHT REAR WINDOW DRIVER (DOWN)
SWITCH-POWER WINDOW-LEFT REAR
MASTER WINDOW SWITCH PASSENGER DOWN
MASTER WINDOW SWITCH LEFT REAR UP
MASTER WINDOW SWITCH LEFT REAR DOWN
LEFT REAR WINDOW DRIVER (UP)
LEFT REAR WINDOW DRIVER (DOWN)
3
2
3
2
Q112 14 OR/BR
Q212 14 OR/VT
Q111 14 TN/YL
Q211 14 TN/LB
B
A
B
A
M
M
MOTOR-WINDOW-RIGHT REAR
MOTOR-WINDOW-LEFT REAR

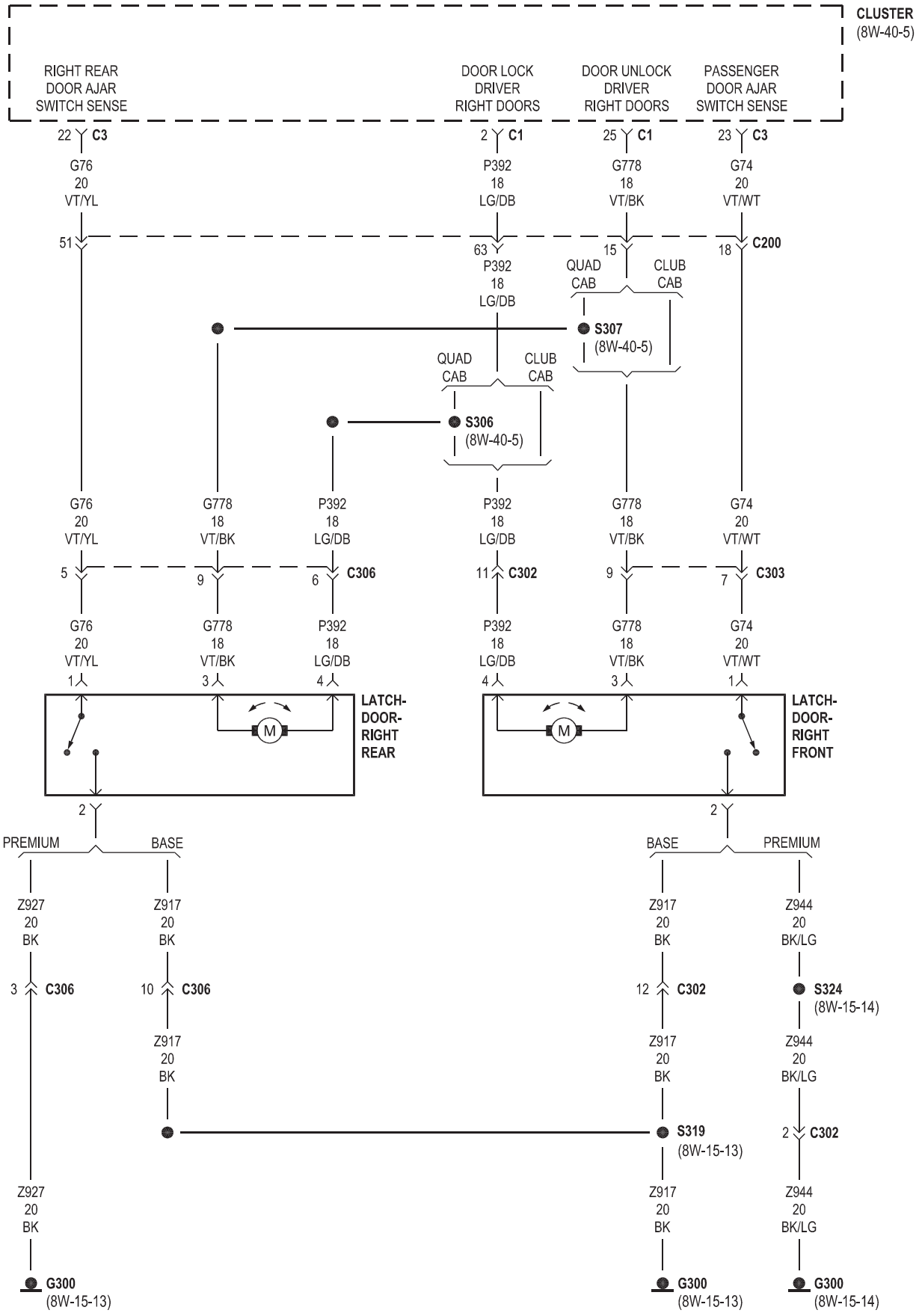
8W-61 POWER DOOR LOCKS

Component	Page
Circuit Breaker-Window/Door Lock	8W-61-2, 3
Cluster	8W-61-2, 3, 4, 5
G300	8W-61-2, 3, 4, 5
G301	8W-61-2, 3, 4
Latch-Door-Left Front	8W-61-4
Latch-Door-Left Rear	8W-61-4
Latch-Door-Right Front	8W-61-5
Latch-Door-Right Rear	8W-61-5
Switch-Window/Door Lock-Driver	8W-61-3
Switch-Window/Door Lock-Driver Express	8W-61-2
Switch-Window/Door Lock-Passenger	8W-61-2, 3


RUN-ACC F984
(8W-13-12)
CIRCUIT BREAKER-WINDOW/ DOOR LOCK (25A)
(8W-13-12)
2
F30
14
PK/YL
72 C200
F30
14
PK/YL
S301
(8W-13-12)
F30
14
PK/YL
12 C300
F30
14
PK/YL
S323
(8W-13-12)
F30
14
PK/YL
2 C1
F30
14
PK/YL
6 C302
F30
14
PK/YL
5
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
GROUND
GROUND
DRIVER DOOR LOCK SWITCH MUX
SWITCH-WINDOW/ DOOR LOCK-DRIVER EXPRESS
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
PASSENGER DOOR LOCK SWITCH MUX
GROUND
SWITCH-WINDOW/ DOOR LOCK-PASSENGER
4 C1
Z13
16
BK/WT
3 C1
Z940
20
BK
8 C1
G161
20
VT/DG
6 C1
G160
20
VT/LG
7
Z974
16
BK/OR
S322
(8W-15-15)
S321
(8W-15-15)
9 C301
8 C303
1 C302
Z13
16
BK/WT
Z940
20
BK
G161
20
VT/DG
G160
20
VT/LG
Z974
20
BK/OR
2
1 C300
14
17 C200
G300
(8W-15-14)
Z13
16
BK/WT
Z940
20
BK
G161
20
VT/DG
G160
20
VT/LG
3 C2
2 C2
G301
(8W-15-15)
DRIVER DOOR LOCK SWITCH MUX
PASSENGER DOOR LOCK SWITCH MUX
CLUSTER
(8W-40-6)

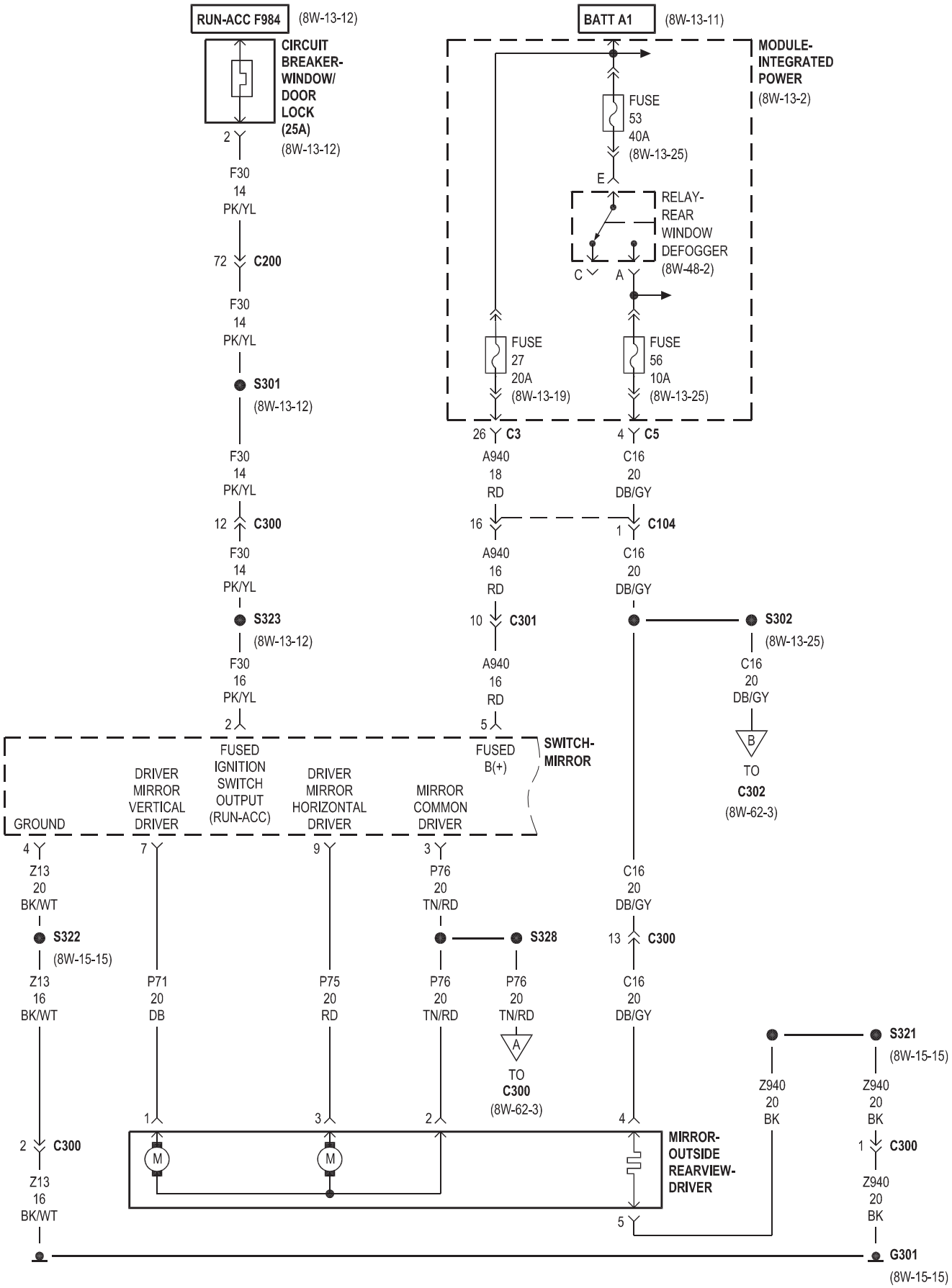

RUN-ACC F984
(8W-13-12)
CIRCUIT BREAKER-WINDOW/ DOOR LOCK (25A)
(8W-13-12)
F30 14 PK/YL
C200
S301
(8W-13-12)
C300
S323
(8W-13-12)
C302
C1
SWITCH-WINDOW/ DOOR LOCK-DRIVER
SWITCH-WINDOW/ DOOR LOCK-PASSENGER
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
GROUND
DRIVER DOOR LOCK SWITCH MUX
PASSENGER DOOR LOCK SWITCH MUX
Z13 16 BK/WT
Z940 20 BK
G161 20 VT/DG
G160 20 VT/LG
Z974 16 BK/OR
S322
(8W-15-15)
S321
(8W-15-15)
C301
C303
G300
(8W-15-14)
G301
(8W-15-15)
C2
CLUSTER
(8W-40-6)
DRIVER DOOR LOCK SWITCH MUX
PASSENGER DOOR LOCK SWITCH MUX

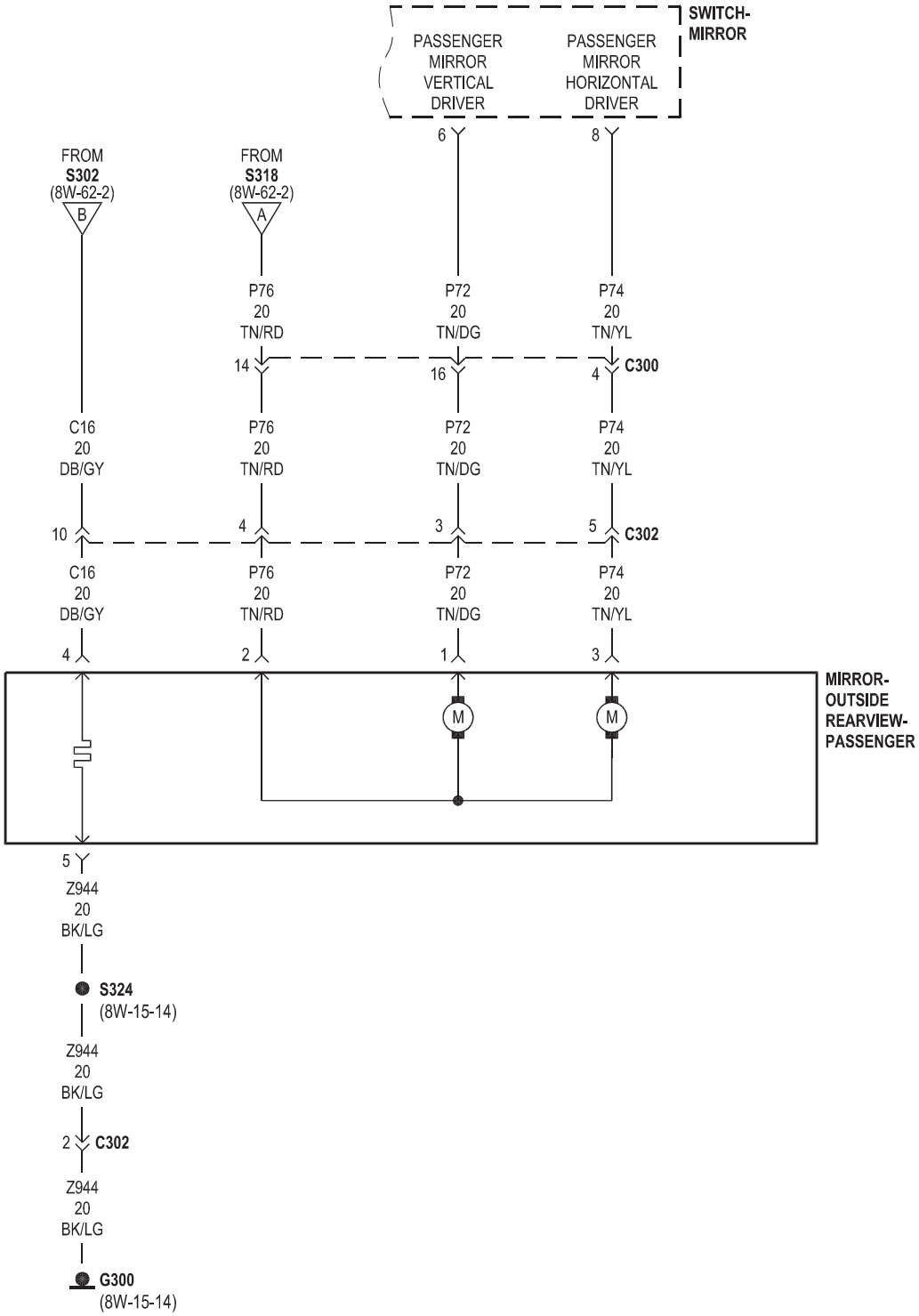

CLUSTER
(8W-40-5)
LEFT REAR DOOR AJAR SWITCH SENSE
DOOR UNLOCK DRIVER LEFT REAR
DOOR LOCK DRIVER LEFT DOORS
DOOR UNLOCK DRIVER LEFT FRONT
DRIVER DOOR AJAR SWITCH SENSE
8 C1
11 C1
15 C1
12 C1
6 C1
G77 20 VT/GY
P5 18 TN/OR
P393 18 LG
P1 18 TN/LG
G75 20 VT
49
64
62
71
13 C200
QUAD CAB
CLUB CAB
S311
(8W-40-5)
5
4
7 C308
3 C300
7
8 C301
P393 18 LG
1
3
4
LATCH-DOOR-LEFT REAR
LATCH-DOOR-LEFT FRONT
M
2
PREMIUM
BASE
Z941 20 BK
Z917 20 BK
Z940 20 BK
3 C308
10 C308
5 C300
S321
(8W-15-15)
Z940 20 BK/LG
S319
(8W-15-13)
1 C300
G301
(8W-15-15)
G300
(8W-15-13)


CLUSTER
(8W-40-5)
RIGHT REAR DOOR AJAR SWITCH SENSE
DOOR LOCK DRIVER RIGHT DOORS
DOOR UNLOCK DRIVER RIGHT DOORS
PASSENGER DOOR AJAR SWITCH SENSE
22 C3
2 C1
25 C1
23 C3
G76 20 VT/YL
P392 18 LG/DB
G778 18 VT/BK
G74 20 VT/WT
51
63
15
18 C200
QUAD CAB
CLUB CAB
S307
(8W-40-5)
S306
(8W-40-5)
5
9
6 C306
11 C302
9
7 C303
1
3
4
4
3
1
LATCH-DOOR-RIGHT REAR
LATCH-DOOR-RIGHT FRONT
M
2
2
PREMIUM
BASE
Z927 20 BK
Z917 20 BK
Z944 20 BK/LG
3 C306
10 C306
12 C302
S324
(8W-15-14)
S319
(8W-15-13)
2 C302
G300
(8W-15-13)
G300
(8W-15-14)

8W-62 POWER MIRRORS

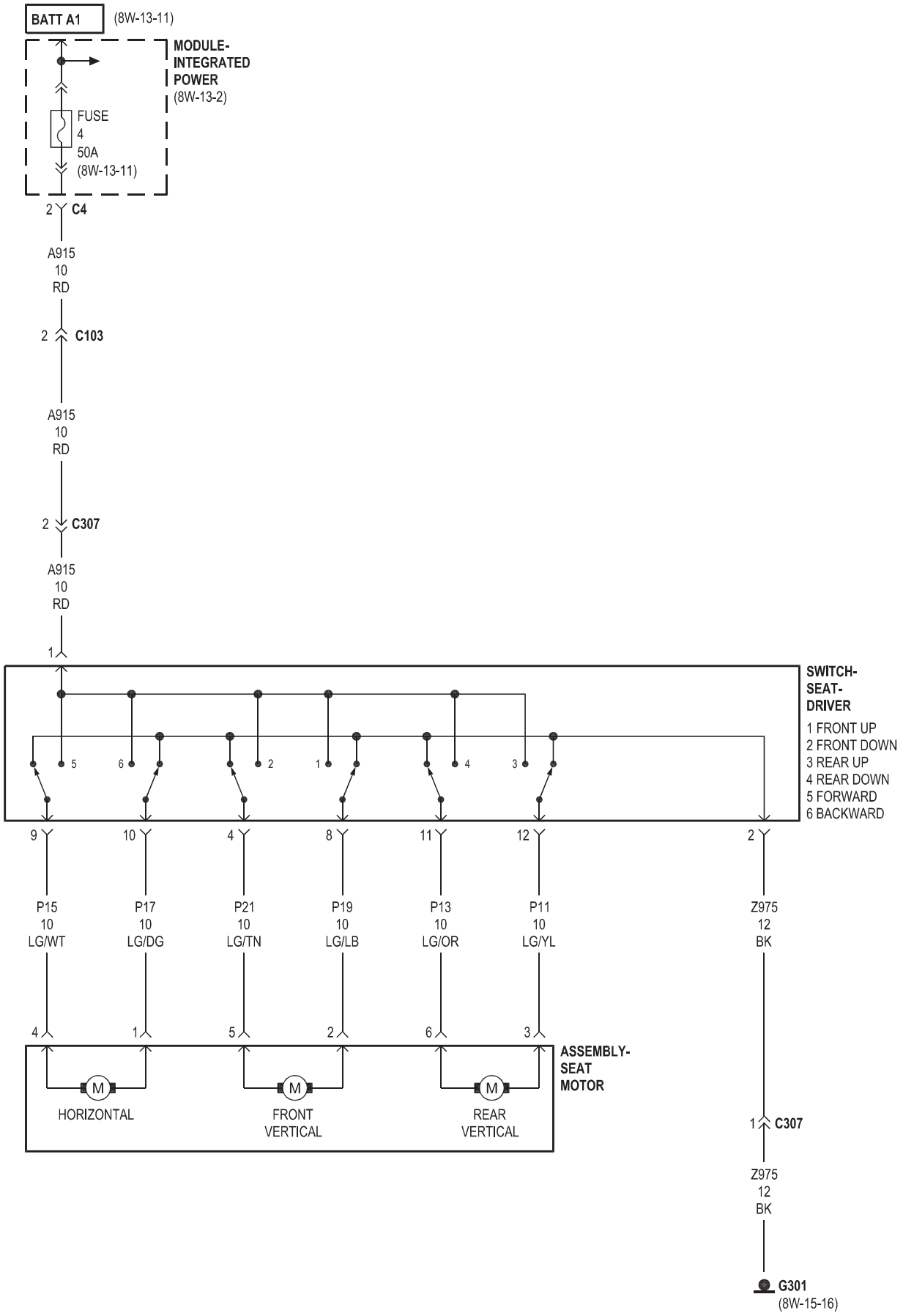
Component	Page
Circuit Breaker-Window/Door Lock	8W-62-2
Fuse 27	8W-62-2
Fuse 53	8W-62-2
Fuse 56	8W-62-2
G300	8W-62-3
G301	8W-62-2
Mirror-Outside Rearview-Driver	8W-62-2
Mirror-Outside Rearview-Passenger	8W-62-3
Module-Integrated Power	8W-62-2
Relay-Rear Window Defogger	8W-62-2
Switch-Mirror	8W-62-2, 3

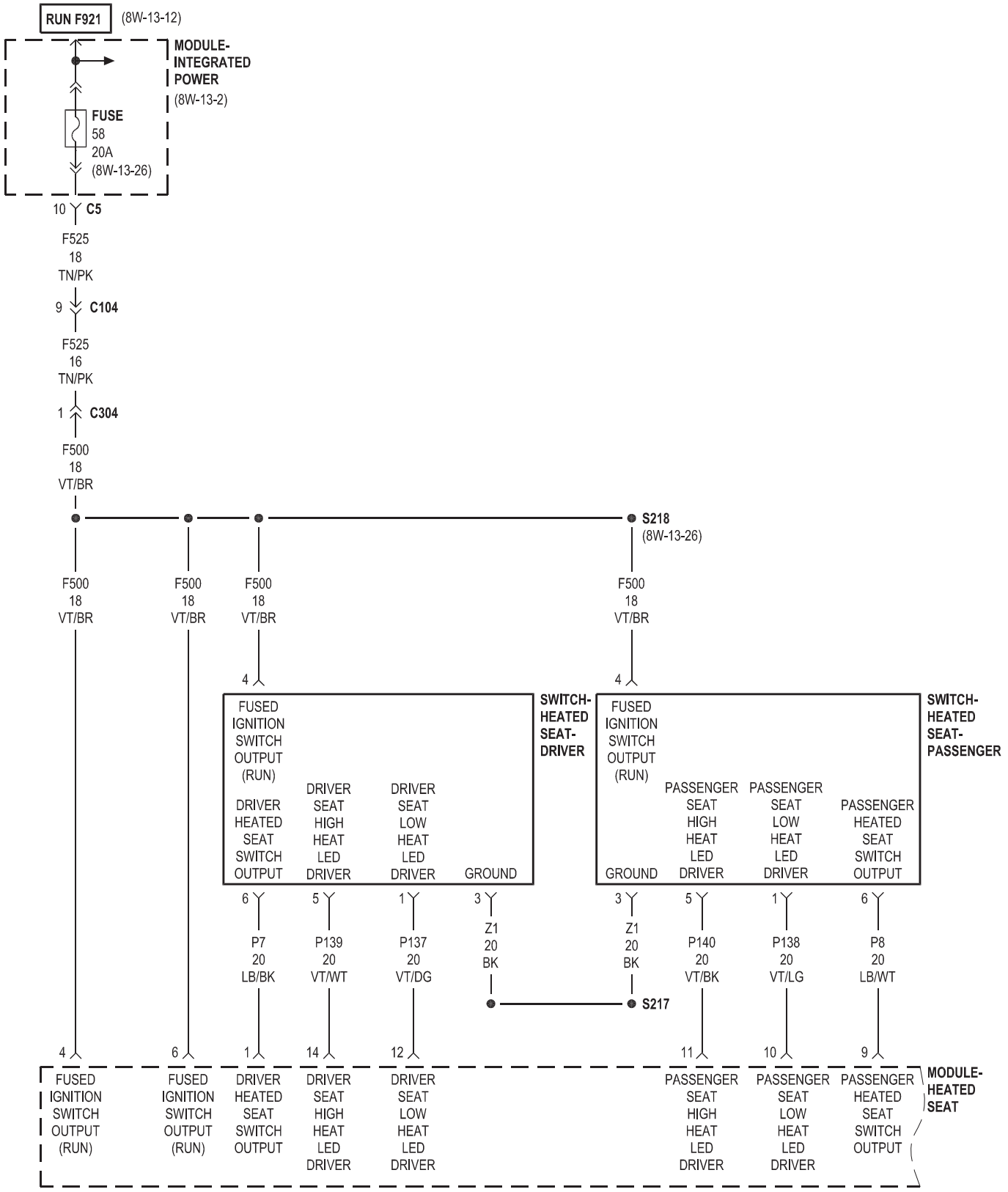

RUN-ACC F984
(8W-13-12)
CIRCUIT BREAKER-WINDOW/ DOOR LOCK (25A)
(8W-13-12)
2
F30
14
PK/YL
72 C200
F30
14
PK/YL
S301
(8W-13-12)
F30
14
PK/YL
12 C300
F30
14
PK/YL
S323
(8W-13-12)
F30
16
PK/YL
2
BATT A1
(8W-13-11)
MODULE-INTEGRATED POWER
(8W-13-2)
FUSE 53 40A
(8W-13-25)
E
RELAY-REAR WINDOW DEFOGGER
(8W-48-2)
C
A
FUSE 27 20A
(8W-13-19)
FUSE 56 10A
(8W-13-25)
26 C3
A940
18
RD
4 C5
C16
20
DB/GY
16 C104
A940
16
RD
1 C104
C16
20
DB/GY
10 C301
A940
16
RD
5
S302
(8W-13-25)
C16
20
DB/GY
B
TO C302
(8W-62-3)
SWITCH-MIRROR
GROUND
DRIVER MIRROR VERTICAL DRIVER
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
DRIVER MIRROR HORIZONTAL DRIVER
MIRROR COMMON DRIVER
FUSED B(+)
4
Z13
20
BK/WT
S322
(8W-15-15)
Z13
16
BK/WT
7
P71
20
DB
9
P75
20
RD
3
P76
20
TN/RD
S328
P76
20
TN/RD
A
TO C300
(8W-62-3)
C16
20
DB/GY
13 C300
C16
20
DB/GY
S321
(8W-15-15)
Z940
20
BK
Z940
20
BK
1 C300
Z940
20
BK
2 C300
Z13
16
BK/WT
1
3
2
4
M
M
MIRROR-OUTSIDE REARVIEW-DRIVER
5
G301
(8W-15-15)

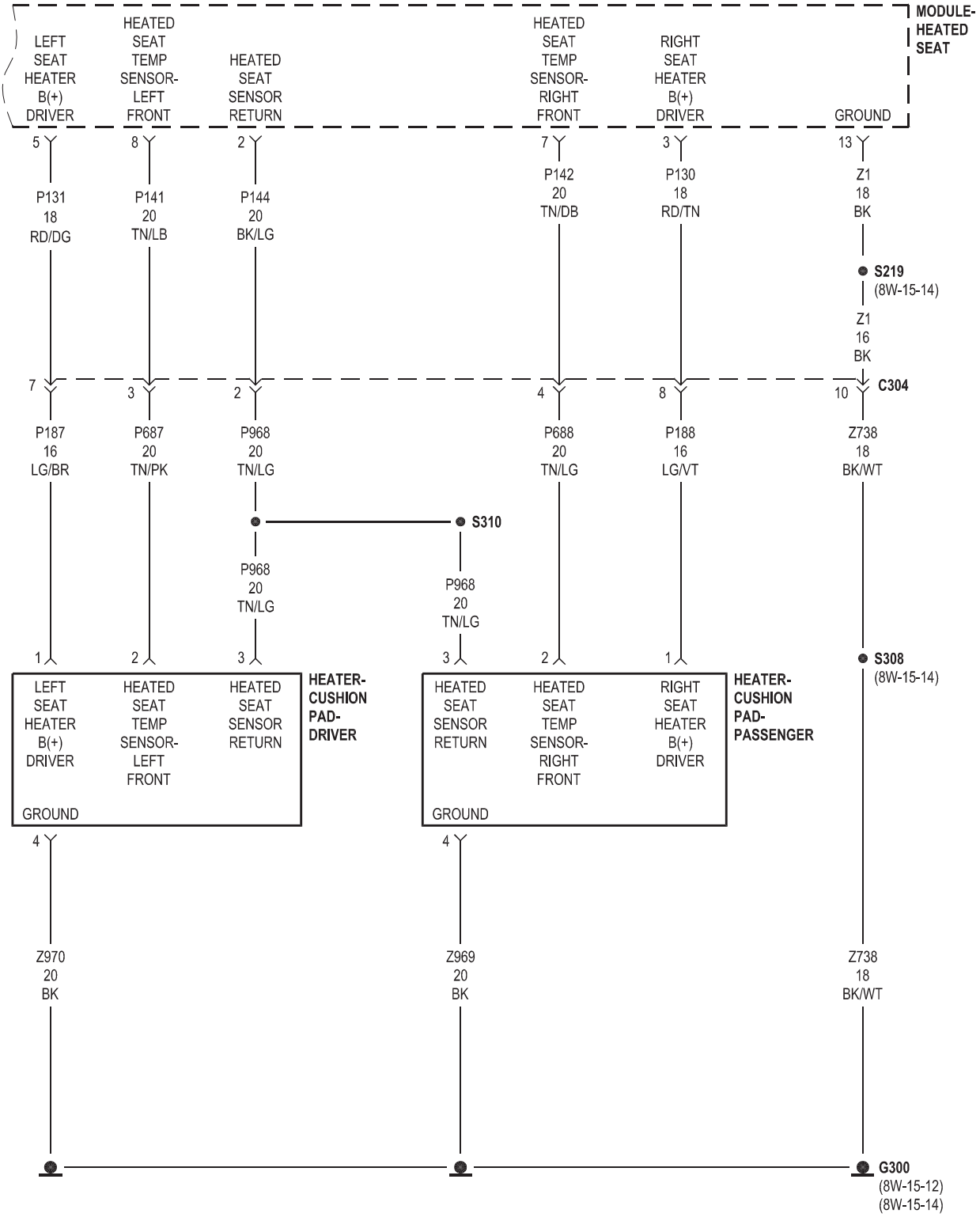

SWITCH-
MIRROR
PASSENGER
MIRROR
VERTICAL
DRIVER
PASSENGER
MIRROR
HORIZONTAL
DRIVER
6
8
FROM
S302
(8W-62-2)
B
FROM
S318
(8W-62-2)
A
P76
20
TN/RD
P72
20
TN/DG
P74
20
TN/YL
14
16
4
C300
C16
20
DB/GY
P76
20
TN/RD
P72
20
TN/DG
P74
20
TN/YL
10
4
3
5
C302
C16
20
DB/GY
P76
20
TN/RD
P72
20
TN/DG
P74
20
TN/YL
4
2
1
3
M
M
MIRROR-
OUTSIDE
REARVIEW-
PASSENGER
5
Z944
20
BK/LG
S324
(8W-15-14)
Z944
20
BK/LG
2
C302
Z944
20
BK/LG
G300
(8W-15-14)

8W-63 POWER SEAT

Component	Page
Assembly-Seat Motor	8W-63-2
Fuse 4	8W-63-2
Fuse 58	8W-63-3
G300	8W-63-4
G301	8W-63-2
Heater-Cushion Pad-Driver	8W-63-4
Heater-Cushion Pad-Passenger	8W-63-4
Module-Heated Seat	8W-63-3, 4
Module-Integrated Power	8W-63-2, 3
Switch-Heated Seat-Driver	8W-63-3
Switch-Heated Seat-Passenger	8W-63-3
Switch-Seat-Driver	8W-63-2


BATT A1
(8W-13-11)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
4
50A
(8W-13-11)
2 C4
A915
10
RD
2 C103
A915
10
RD
2 C307
A915
10
RD
1
SWITCH-
SEAT-
DRIVER
1 FRONT UP
2 FRONT DOWN
3 REAR UP
4 REAR DOWN
5 FORWARD
6 BACKWARD
9
10
4
8
11
12
2
P15
10
LG/WT
P17
10
LG/DG
P21
10
LG/TN
P19
10
LG/LB
P13
10
LG/OR
P11
10
LG/YL
Z975
12
BK
4
1
5
2
6
3
M
M
M
HORIZONTAL
FRONT
VERTICAL
REAR
VERTICAL
ASSEMBLY-
SEAT
MOTOR
1 C307
Z975
12
BK
G301
(8W-15-16)


RUN F921
(8W-13-12)
MODULE-
INTEGRATED
POWER
(8W-13-2)
FUSE
58
20A
(8W-13-26)
10 C5
F525
18
TN/PK
9 C104
F525
16
TN/PK
1 C304
F500
18
VT/BR
S218
(8W-13-26)
F500
18
VT/BR
4
FUSED
IGNITION
SWITCH
OUTPUT
(RUN)
DRIVER
HEATED
SEAT
SWITCH
OUTPUT
DRIVER
SEAT
HIGH
HEAT
LED
DRIVER
DRIVER
SEAT
LOW
HEAT
LED
DRIVER
GROUND
SWITCH-
HEATED
SEAT-
DRIVER
PASSENGER
SEAT
HIGH
HEAT
LED
DRIVER
PASSENGER
SEAT
LOW
HEAT
LED
DRIVER
PASSENGER
HEATED
SEAT
SWITCH
OUTPUT
SWITCH-
HEATED
SEAT-
PASSENGER
6
5
1
3
P7
20
LB/BK
P139
20
VT/WT
P137
20
VT/DG
Z1
20
BK
S217
P140
20
VT/BK
P138
20
VT/LG
P8
20
LB/WT
11
10
9
MODULE-
HEATED
SEAT


MODULE-
HEATED
SEAT
LEFT SEAT HEATER B(+) DRIVER
HEATED SEAT TEMP SENSOR- LEFT FRONT
HEATED SEAT SENSOR RETURN
HEATED SEAT TEMP SENSOR- RIGHT FRONT
RIGHT SEAT HEATER B(+) DRIVER
GROUND
5
8
2
7
3
13
P131 18 RD/DG
P141 20 TN/LB
P144 20 BK/LG
P142 20 TN/DB
P130 18 RD/TN
Z1 18 BK
S219
(8W-15-14)
Z1 16 BK
C304
7
3
2
4
8
10
P187 16 LG/BR
P687 20 TN/PK
P968 20 TN/LG
P688 20 TN/LG
P188 16 LG/VT
Z738 18 BK/WT
S310
P968 20 TN/LG
P968 20 TN/LG
S308
(8W-15-14)
1
2
3
3
2
1
LEFT SEAT HEATER B(+) DRIVER
HEATED SEAT TEMP SENSOR- LEFT FRONT
HEATED SEAT SENSOR RETURN
GROUND
HEATER-CUSHION PAD-DRIVER
HEATED SEAT SENSOR RETURN
HEATED SEAT TEMP SENSOR- RIGHT FRONT
RIGHT SEAT HEATER B(+) DRIVER
GROUND
HEATER-CUSHION PAD-PASSENGER
4
4
Z970 20 BK
Z969 20 BK
Z738 18 BK/WT
G300
(8W-15-12)
(8W-15-14)

8W-70 SPLICE INFORMATION

Component	Page
S100	8W-18-5
S101	8W-18-5
S102	8W-13-22
S103	8W-13-18
S104	8W-13-14
S105	8W-18-3
S106	8W-51-3
S107	8W-18-4
S108	8W-13-20
S109	8W-13-14
S110	8W-13-14
S111	8W-13-13
S112	8W-51-4
S113	8W-15-3
S114	8W-31-10
S115	8W-13-28
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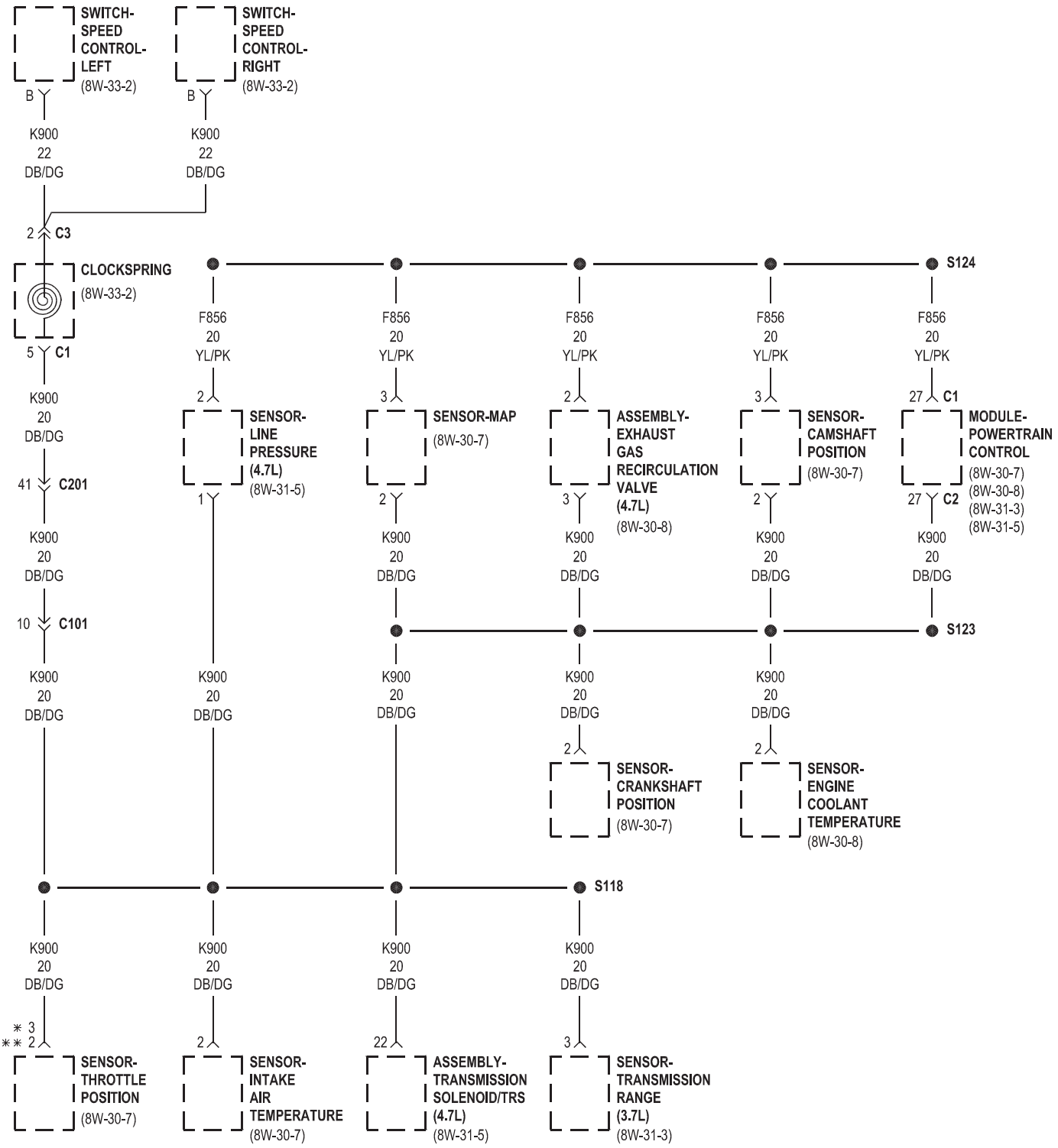
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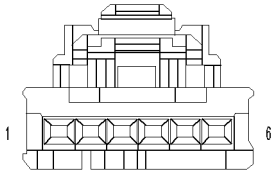
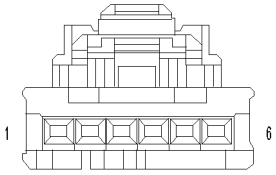


**ACTUATOR-
BLEND
DOOR**

ACTUATOR-BLEND DOOR - 6 WAY

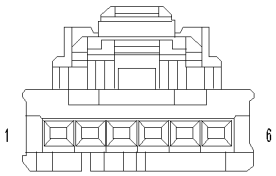
CAV	CIRCUIT	FUNCTION
1	C61 DB/LG	BLEND DOOR DRIVER
2	-	-
3	-	-
4	-	-
5	-	-
6	C34 20DB/LB	COMMON DOOR DRIVER



**ACTUATOR-
MODE DOOR-
FLOOR TO
DEFROST**

ACTUATOR-MODE DOOR-FLOOR TO DEFROST - 6 WAY

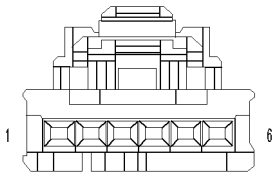
CAV	CIRCUIT	FUNCTION
1	C801 20DB/OR	MODE DOOR 2 DRIVER
2	-	-
3	-	-
4	-	-
5	-	-
6	C34 20DB/LB	COMMON DOOR DRIVER



**ACTUATOR-
MODE DOOR-
FLOOR TO
PANEL**

ACTUATOR-MODE DOOR-FLOOR TO PANEL - 6 WAY

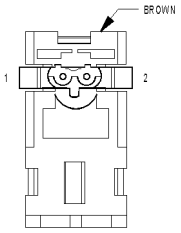
CAV	CIRCUIT	FUNCTION
1	C29 20DB	MODE DOOR 1 DRIVER
2	-	-
3	-	-
4	-	-
5	-	-
6	C34 20DB/LB	COMMON DOOR DRIVER



**ACTUATOR-
RECIRCULATION
DOOR**

ACTUATOR-RECIRCULATION DOOR - 6 WAY

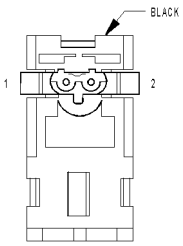
CAV	CIRCUIT	FUNCTION
1	C32 20DB/TN	RECIRCULATION DOOR DRIVER
2	-	-
3	-	-
4	-	-
5	-	-
6	C34 20DB/LB	COMMON DOOR DRIVER



**AIRBAG-
DRIVER SQUIB 1**

AIRBAG-DRIVER SQUIB 1 - BROWN 2 WAY

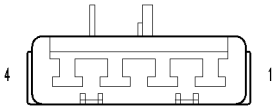
CAV	CIRCUIT	FUNCTION
1	R45 20BK/BL	DRIVER SQUIB 1 LINE 1
2	R43 20OR/BL	DRIVER SQUIB 1 LINE 2



**AIRBAG-
DRIVER SQUIB 2**

AIRBAG-DRIVER SQUIB 2 - BLACK 2 WAY

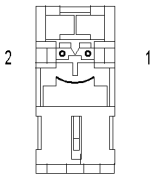
CAV	CIRCUIT	FUNCTION
1	R63 20OR/BL	DRIVER SQUIB 2 LINE 1
2	R61 20BR/BL	DRIVER SQUIB 2 LINE 2



**AIRBAG-
PASSENGER
SQUIB**

AIRBAG-PASSENGER SQUIB - 4 WAY

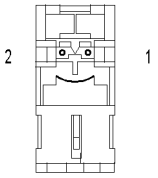
CAV	CIRCUIT	FUNCTION
1	R62 20LB/VT	PASSENGER SQUIB 2 LINE 2
2	R64 20LB/WT	PASSENGER SQUIB 2 LINE 1
3	R44 20LB/OR	PASSENGER SQUIB 1 LINE 1
4	R42 20LB/BR	PASSENGER SQUIB 1 LINE 2



**AIRBAG-
SIDE
CURTAIN-
LEFT**

AIRBAG-SIDE CURTAIN-LEFT - 2 WAY

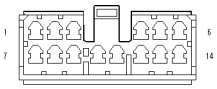
CAV	CIRCUIT	FUNCTION
1	R1 20LB/BR	LEFT CURTAIN SQUIB 1 LINE 2
2	R3 20LB/OR	LEFT CURTAIN SQUIB 1 LINE 1



**AIRBAG-
SIDE
CURTAIN-
RIGHT**

AIRBAG-SIDE CURTAIN-RIGHT - 2 WAY

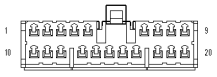
CAV	CIRCUIT	FUNCTION
1	R2 20WT/LB	RIGHT CURTAIN SQUIB 1 LINE 2
2	R4 20OR/LB	RIGHT CURTAIN SQUIB 1 LINE 1



**AMPLIFIER-
RADIO C1
(PREMIUM)**

AMPLIFIER-RADIO C1 (PREMIUM) - 14 WAY

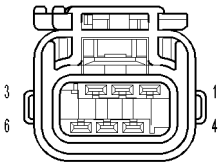
CAV	CIRCUIT	FUNCTION
1	X201 16GY/VT	AMPLIFIED LEFT FRONT SPEAKER (+)
2	X202 20DG/VT	AMPLIFIED RIGHT FRONT SPEAKER (+)
3	X205 18GY/LG	AMPLIFIED LEFT REAR SPEAKER (+)
4	X206 20DG/LG	AMPLIFIED RIGHT REAR SPEAKER (+)
5	X209 16GY/OR	AMPLIFIED LEFT I/P SPEAKER (+)
6	X208 20GY/DG	AMPLIFIED RIGHT I/P SPEAKER (+)
7	X291 16GY/YL	AMPLIFIED LEFT FRONT SPEAKER (-)
8	X292 20DG/YL	AMPLIFIED RIGHT FRONT SPEAKER (-)
9	X295 18GY/DG	AMPLIFIED LEFT REAR SPEAKER(-)
10	-	-
11	-	-
12	X296 20LG/GY	AMPLIFIED RIGHT REAR SPEAKER(-)
13	X299 16GY/YL	AMPLIFIED LEFT I/P SPEAKER (-)
14	X298 20GY/LG	AMPLIFIED RIGHT I/P SPEAKER (-)



**AMPLIFIER-
RADIO C2
(PREMIUM)**

AMPLIFIER-RADIO C2 (PREMIUM) - 20 WAY

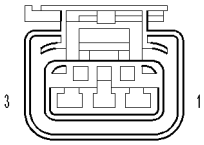
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	A116 16YL/RD	FUSED B(+)
5	-	-
6	D55 20WT/OR	CAN B BUS(+)
7	X51 18DG/DB	RADIO-LEFT REAR AUDIO (+)
8	X52 18GY/DB	RADIO-RIGHT REAR AUDIO (+)
9	Z513 16BK	GROUND
10	-	-
11	-	-
12	-	-
13	A116 16YL/RD	FUSED B(+)
14	-	-
15	-	-
17	D54 20WT	CAN B BUS(-)
18	X57 18DG/OR	RADIO-LEFT REAR AUDIO (-)
19	X58 18GY/OR	RADIO-RIGHT REAR AUDIO (-)
20	Z980 16BK	GROUND



ASSEMBLY-EXHAUST GAS RECIRCULATION VALVE (4.7L)

ASSEMBLY-EXHAUST GAS RECIRCULATION VALVE (4.7L) - 6 WAY

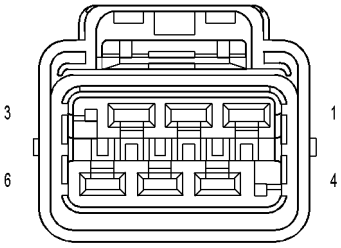
CAV	CIRCUIT	FUNCTION
1	K34 20DB/LG	EGR SIGNAL
2	F856 20YL/PK	5 VOLT SUPPLY
3	K900 20DB/DG	SENSOR GROUND
4	Z958 20BK	GROUND
5	-	-
6	K35 20DB/VT	EGR SOL CONTROL



ASSEMBLY-NATURAL VACUUM LEAK DETECTION

ASSEMBLY-NATURAL VACUUM LEAK DETECTION - 3 WAY

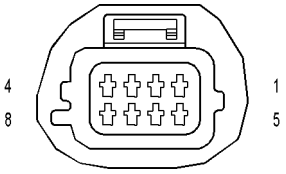
CAV	CIRCUIT	FUNCTION
1	Z904 20BK	GROUND
2	K107 20VT/WT	NVLD SWITCH SIGNAL
3	K106 20VT/LB	NVLD SOL CONTROL



ASSEMBLY-SEAT MOTOR

ASSEMBLY-SEAT MOTOR - 6 WAY

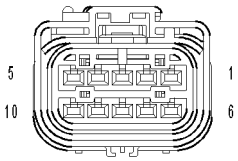
CAV	CIRCUIT	FUNCTION
1	P17 10LG/DG	DRIVER SEAT HORIZONTAL REARWARD DRIVER
2	P19 10LG/LB	DRIVER SEAT FRONT RISER UP DRIVER
3	P11 10LG/YL	DRIVER SEAT REAR RISER UP DRIVER
4	P15 10LG/WT	DRIVER SEAT HORIZONTAL FORWARD DRIVER
5	P21 10LG/TN	DRIVER SEAT FRONT RISER DOWN DRIVER
6	P13 10LG/OR	DRIVER SEAT REAR RISER DOWN DRIVER



ASSEMBLY-SHIFT MOTOR/MODE SENSOR (4WD)

ASSEMBLY-SHIFT MOTOR/MODE SENSOR (4WD) - 8 WAY

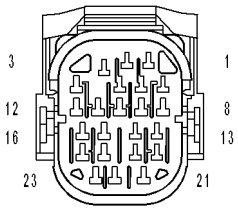
CAV	CIRCUIT	FUNCTION
1	T103 20YL/OR	5 VOLT SUPPLY
2	D201 20WT/DG	MODE SENSOR A
3	G180 20VT/YL	FCM SENSOR RETURN
4	T315 14YL/BR	SHIFT MOTOR CONTROL A
5	T316 14YL/GY	SHIFT MOTOR CONTROL B
6	A924 18RD	FUSED B(+)
7	T313 18YL/LG	NOT USED
8	-	-



ASSEMBLY-TRANSMISSION SOLENOID/PRESSURE SWITCH (42 RLE)

ASSEMBLY-TRANSMISSION SOLENOID/PRESSURE SWITCH (42RLE) - 10 WAY

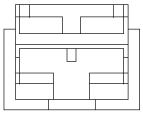
CAV	CIRCUIT	FUNCTION
1	T60 20YL/RD	OD SOLENOID CONTROL
2	T59 20VT/PK	UD SOLENOID CONTROL
3	T16 16YL/OR	TRANSMISSION CONTROL RELAY OUTPUT
4	T19 20YL/DB	2-4 SOLENOID CONTROL
5	T47 20YL/DG	2-4 PRESSURE SWITCH SENSE
6	T9 20DG/TN	OD PRESSURE SWITCH SENSE
7	T20 20DG/WT	L/R SOLENOID CONTROL
8	-	-
9	-	-
10	T50 20VT/RD	L/R PRESSURE SWITCH SENSE



ASSEMBLY-TRANSMISSION SOLENOID/TRS (4.7L)

ASSEMBLY-TRANSMISSION SOLENOID/TRS (4.7L) - 23 WAY

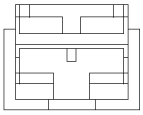
CAV	CIRCUIT	FUNCTION
1	-	-
2	T20 20DG/WT	L/R SOLENOID CONTROL
3	-	-
4	T41 20YL/DB	TRS T41 SENSE (P/N SENSE)
5	T42 20YL/PK	TRS T42 SENSE
6	-	-
7	T60 20YL/RD	OD SOLENOID CONTROL
8	T3 20YL/PK	TRS T3 SENSE
9	T1 20YL/PK	TRS T1 SENSE
10	T16 16YL/OR	TRANSMISSION CONTROL RELAY OUTPUT
11	T48 20BR/YL	4C PRESSURE SWITCH SENSE
12	T118 20DG	PRESSURE CONTROL SOLENOID CONTROL
13	T4 20BR/YL	TRS T2 SENSE
14	T50 20VT/RD	L/R PRESSURE SWITCH SENSE
15	T147 20BR/YL	2C PRESSURE SWITCH SENSE
16	T9 20DG/TN	OD PRESSURE SWITCH SENSE
17	T59 20VT/PK	UD SOLENOID CONTROL
18	T29 20LB/RD	UD PRESSURE SWITCH SENSE
19	T259 20YL/DG	4C SOLENOID CONTROL
20	T219 20DG/YL	2C SOLENOID CONTROL
21	T140 20BR/YL	MS SOLENOID CONTROL
22	K900 20DB/DG	SENSOR GROUND
23	T54 20YL/PK	TRANSMISSION TEMPERATURE SENSOR SIGNAL



BACKLITE-HEATED (POWER)

BACKLITE-HEATED (POWER) - 1 WAY

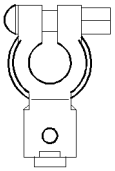
CAV	CIRCUIT	FUNCTION
1	C15 12BK/DG	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT



BACKLITE-HEATED (GROUND)

BACKLITE-HEATED (GROUND) - 1 WAY

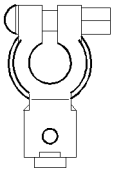
CAV	CIRCUIT	FUNCTION
1	Z255 12BK	GROUND



BATTERY (POSITIVE)

BATTERY (POSITIVE) - 1 WAY

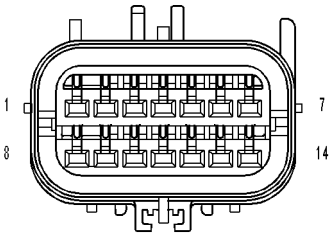
CAV	CIRCUIT	FUNCTION
A1	A1 04RD	B(+)



BATTERY (NEGATIVE)

BATTERY (NEGATIVE) - 2 WAY

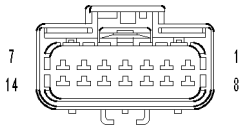
CAV	CIRCUIT	FUNCTION
B1	Z100 04BK/VT	GROUND
B2	Z1 04BK	GROUND



C100

C100 - (ENGINE SIDE)

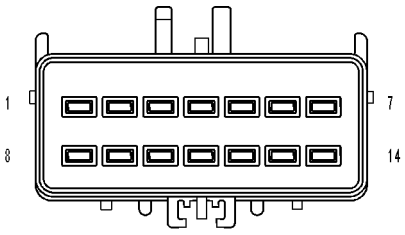
CAV	CIRCUIT
1	A955 16RD
2	D201 20WT/DG
3	T16 16YL/OR (A/T)
3	T2 20DG/WT (M/T)
4	T15 20YL/BK (A/T)
5	-
6	F1 20PK/WT
7	C3 20DB/YL
8	A924 18RD
9	T313 18YL/LG
10	T315 14YL/BR
11	Z904 20BK
12	A919 18RD
13	F924 20PK/YL
14	F202 20PK/GY



C100

C100 - (HEADLAMP AND DASH SIDE)

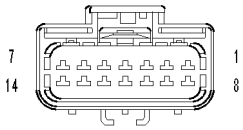
CAV	CIRCUIT
1	A955 16RD
2	D201 20WT/DG (4X4)
3	T16 16YL/OR (A/T)
3	T2 20DG/WT (M/T)
4	T15 20YL/BK (A/T)
5	-
6	F1 20PK/WT
7	C3 20DB/YL
8	A924 18RD (4X4)
9	T313 18YL/LG (4X4)
10	T315 14YL/BR (4X4)
11	Z904 16BK (A/T)
11	Z904 20BK (M/T)
12	A919 18RD
13	F924 20PK/YL
14	F202 20PK/GY



C101

C101 - (HEADLAMP AND DASH SIDE)

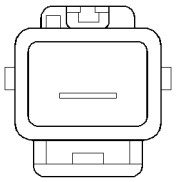
CAV	CIRCUIT
1	K399 18BR/GY
2	K299 18BR/OR
3	D65 20WT/LG.
4	D64 20WT/LB
5	D16 20WT/OR (A/T)
6	D15 20BR/WT (A/T)
7	D20 20WT/LG
8	D21 20WT/GY
9	T41 20YL/DB (A/T)
10	K900 20DB/DG
11	T103 20YL/OR
12	T6 20DG (A/T)
13	G180 20VT/YL
14	T316 14YL/GY



C101

C101 - (ENGINE SIDE)

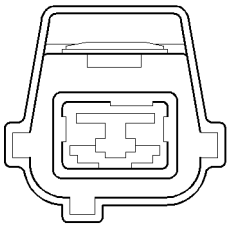
CAV	CIRCUIT
1	K399 18BR/GY
2	K299 18BR/OR
3	D65 20WT/LG
4	D64 20WT/LB
5	D16 20WT/OR (A/T)
6	D15 20BR/WT (A/T)
7	D20 20WT/LG
8	D21 20WT/GY
9	T41 20YL/DB (A/T)
10	K900 20DB/DG
11	T103 20YL/OR (4X4)
12	T6 20DG (A/T)
13	G180 20VT/YL (4X4)
14	T316 14YL/GY (4X4)



C102

C102 - (BATTERY SIDE)

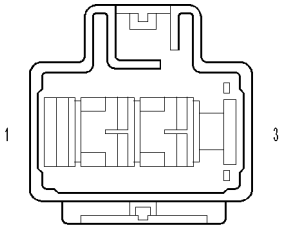
CAV	CIRCUIT
1	T750 14YL/GY



C102

C102 - (HEADLAMP AND DASH SIDE)

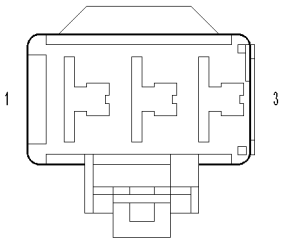
CAV	CIRCUIT
1	T750 14YL/GY



C103

C103 - (HEADLAMP AND DASH SIDE)

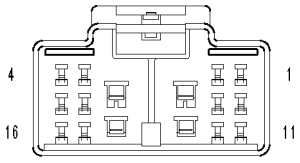
CAV	CIRCUIT
1	-
2	A915 10RD
3	C15 12DB/WT (EXCEPT BASE)



C103

C103 - (BODY SIDE)

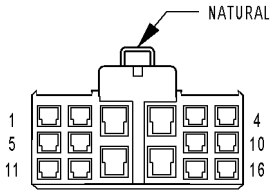
CAV	CIRCUIT
1	-
2	A915 10RD
3	C15 12BK/DG (EXCEPT BASE)



C104

C104 - (HEADLAMP AND DASH SIDE)

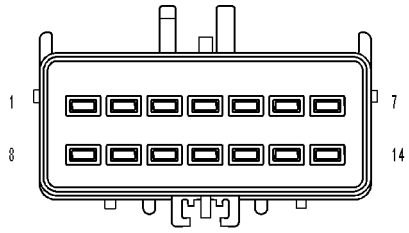
CAV	CIRCUIT
1	C16 20DB/GY (EXCEPT BASE)
2	D54 20WT
3	D55 20WT/OR
4	-
5	L50 18WT/LB
6	F21 20PK/DG
7	A920 18RD/BK
8	-
9	F525 18TN/PK
10	A956 20RD.
11	F201 20PK/OR
12	A901 18RD
13	-
14	L1 18WT/LG
15	Z945 18BK
16	A940 18RD



C104

C104 - NATURAL (BODY SIDE)

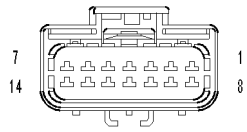
CAV	CIRCUIT
1	C16 DB/GY
2	D54 20WT
2	D54 20WT (SATELLITE RADIO)
3	D55 20WT/OR
3	D55 20WT/OR (SATELLITE RADIO)
4	-
5	L50 16WT/LB
6	F21 20BK/LB
6	F21 20BK/LB
7	A920 18RD/BK
8	-
9	F525 16TN/PK
10	A956 20RD
11	F201 20PK/OR
12	A901 16RD
13	-
14	L1 20BK/DG
14	L1 20BK/DG
15	Z945 20BK
16	A940 16RD



C105

C105 - (CHASSIS SIDE)

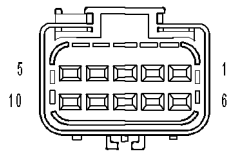
CAV	CIRCUIT
1	Z201 18BK
2	Z904 20BK
3	N5 20DB/WT
4	B222 20DG/WT
5	B22 20DG/YL
6	L77 20PK/RD
7	K106 20VT/LB
8	B400 12DG (TRAILER TOW)
9	L674 20LG (TRAILER TOW)
10	K107 20VT/WT
11	L78 20WT/OR
12	N1 18DB/OR
13	N4 20DB/YL
14	L673 20YL (TRAILER TOW)



C105

C105 - (HEADLAMP AND DASH SIDE)

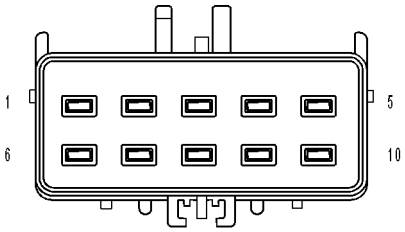
CAV	CIRCUIT
1	Z201 18BK
2	Z904 20BK
3	N5 20DB/WT
4	B222 20DG/WT.
5	B22 20DG/YL
6	L77 20PK/RD
7	K106 20VT/LB
8	B400 12DG (TRAILER TOW)
9	L674 20LG (TRAILER TOW)
10	K107 20VT/WT
11	L78 20WT/OR
12	N1 18DB/OR
13	N4 20DB/YL
14	L673 20YL (TRAILER TOW)



C106

C106 - (HEADLAMP AND DASH SIDE)

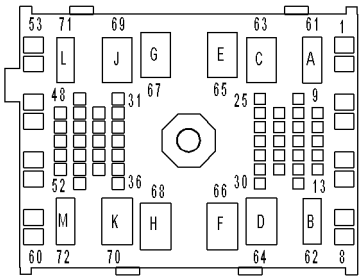
CAV	CIRCUIT
1	L76 20PK/RD PREMIUM
2	A100 12RD/VT PREMIUM
3	L62 18WT/OR
4	L63 18WT/DG
5	Z362 20BK/BR
6	Z363 20BK/DG
7	Z945 18BK
8	L1 18WT/LG
9	-
10	-



C106

C106 - (CHASSIS SIDE)

CAV	CIRCUIT
1	L76 20PK/RD (TRAILER TOW)
2	A100 12RD/VT (TRAILER TOW)
3	L62 18WT/OR
4	L63 18WT/DG
5	Z362 20BK/BR
6	Z363 20BK/DG
7	Z945 18BK
8	L1 18WT/LG
9	-
10	-



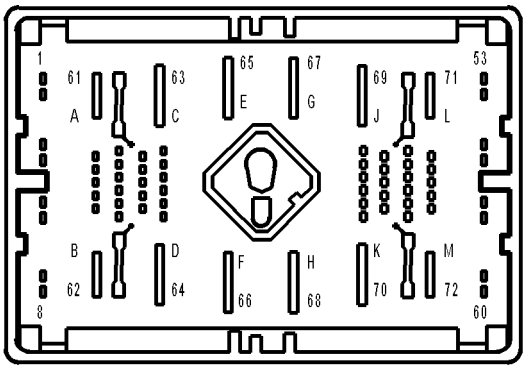
C200

C200 - (BODY SIDE)

CAV	CIRCUIT
1	-
2	-
3	X735 20B/DG
4	X835 20BK/TN
5	-
6	X51 16DG/DB
7	-
8	X57 16DG/OR
9	-
10	L14 20WT/BK
11	-
12	-
13	G75 20VT
14	G161 20VT/DG
15	G778 18VT/BK
16	-
17	G160 20VT/LG
18	G74 20VT/WT
19	-
20	-
21	-
22	-
23	-
24	-
25	-
26	-
27	-
28	-
29	-
30	-
31	X53 20DG
32	X712 20BK/GY
33	X55 20DG/BR
34	-
35	X917 20DG
36	-
37	X17 20DG/OR
38	B25 20DG/WT
39	X16 20DG/LB

C200 - (BODY SIDE)

CAV	CIRCUIT
40	X793 20BK/RD
41	-
42	-
43	-
44	-
45	X730 20BK/OR
46	X792 20BK/VT
47	X722 20BK/DB
48	-
49	G77 20VT/GY
50	-
51	G76 20VT/YL
52	-
53	-
54	X54 16GY
55	X56 16DG/BR
56	R57 20LG/GY
57	-
58	X52 16GY/DB
59	-
60	X58 16GY/OR
61	-
62	P393 18LG
63	P392 18LG/DB
64	P5 18TN/OR
65	-
66	-
67	-
68	-
69	-
70	-
71	P1 18TN/LG
72	F30 14PK/YL



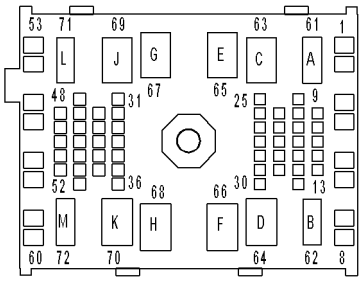
C200

C200 - (I/P SIDE)

CAV	CIRCUIT
1	-
2	-
3	X735 20DB
4	X835 20OR/GY
5	-
6	X51 18DG/DB
7	-
8	X57 18DG/OR
9	-
10	L14 20WT/BK
11	-
12	-
13	G75 20VT
14	G161 20VT/DG
15	G778 18VT/BK
16	-
17	G160 20VT/LG
18	G74 20VT/WT
19	-
20	-
21	-
22	-
23	-
24	-
25	-
26	-
27	-
28	-
29	-
30	-
31	X53 20DG
32	X712 20DG/LB
33	X55 20DG/BR
34	-
35	X917 20DG
36	-
37	X17 20DG/OR
38	B25 20DG/WT
39	X16 20DG/LB
40	X793 20LB/YL
41	-
42	-
43	-
44	-
45	X730 20GY/YL
46	X792 20LB/RD
47	X722 20LB/BK
48	-
49	G77 20VT/GY
50	-
51	G76 20VT/YL
52	-
53	-
54	X54 18GY

C200 - (I/P SIDE)

CAV	CIRCUIT
55	X56 18GY/BR
56	R57 20LG/GY
57	-
58	X52 18GY/DB
59	-
60	-
61	-
62	P393 18LG
63	P392 18LG/DB
64	P5 18TN/OR
65	-
66	-
67	-
68	-
69	-
70	-
71	P1 18TN/LG
72	F30 14PK/YL



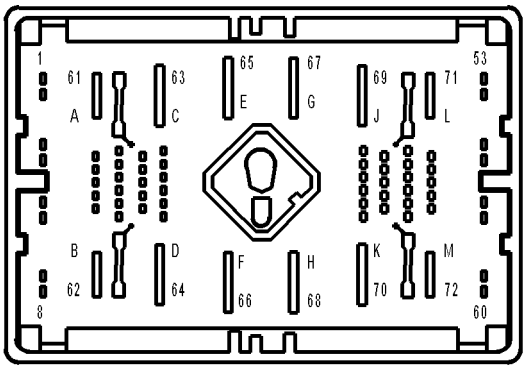
C201

C201 - (HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
1	F306 18DB/PK
2	-
3	A924 18RD
4	-
5	F961 16PK/LB
6	-
7	-
8	-
9	F1 20PK/WT
10	-
11	D51 20PK/RD
12	F983 20PK/YL
13	D52 20WT/LB
14	A103 20GY/RD
15	-
16	N4 20DB/YL
17	B29 20DG/WT
18	-
19	V30 20VT/WT
20	T6 20DG
21	-
22	V37 20VT
23	-
24	A117 20RD/DG
25	R79 20LB/VT
26	R81 20LB/WT
27	-
28	F201 20PK/OR
29	-
30	-
31	R80 20VT/LB
32	R82 20WT/LB

C201 - (HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
33	-
34	F100 20PK/VT
35	-
36	D54 20WT
37	D55 20WT/OR
38	-
39	F504 20GY/PK
40	N5 20DB/WT
41	K900 20DB/DG
42	D21 20WT/GY
43	-
44	D20 20WT/LG
45	-
46	-
47	D15 20BR/WT
48	D16 20WT/OR
49	-
50	V32 20VT/YL
51	-
52	-
53	A116 16YL/RD
54	-
55	F21 20PK/DG
56	-
57	L50 18WT/LB
58	F202 20PK/GY
59	-
60	-
61	A923 18RD
62	A918 18RD
63	A927 12RD/OR
64	A904 12RD/LB
65	A917 12RD
66	A953 12RD
67	F984 12PK/LG
68	F941 14PK/LG
69	F921 12PK/WT
70	F901 16PK
71	F982 12PK/YL
72	A920 18RD/BK



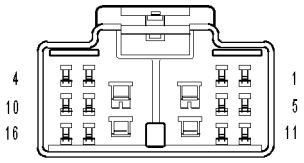
C201

C201 - (IP SIDE)

CAV	CIRCUIT
1	F306 18DB/PK
2	-
3	A924 16RD
4	-
5	F961 14PK/LB
6	-
7	-
8	-
9	F1 20PK/WT
10	-
11	D51 20PK/RD
12	F983 20PK/YL
13	D52 20WT/LB
14	A103 18GY/RD
15	-
16	N4 20DB/YL
17	B29 20DG/WT
18	-
19	V30 20VT/WT
20	T6 20DG
21	-
22	V37 20VT
23	-
24	A117 18RD/DG
25	R79 20LB/VT
26	R81 20LB/WT
27	-
28	F201 20PK/OR
29	-
30	-
31	R80 20VT/LB
32	R82 20WT/LB
33	-
34	F100 20PK/VT
35	-
36	D54 20WT
37	D55 20WT/OR
38	-
39	F504 20GY/PK
40	N5 20DB/WT
41	K900 20DB/DG
42	D21 20WT/GY
43	-
44	D20 20WT/LG
45	-
46	-
47	D15 20BR/WT
48	D16 20WT/OR
49	-
50	V32 20VT/YL
51	-
52	-
53	A116 16YL/RD
54	-

C201 - (IP SIDE)

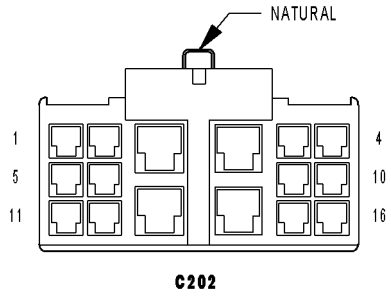
CAV	CIRCUIT
55	F21 20PK/DG (2X4)
55	F21 20PK/DG (4X4)
56	-
57	L50 16WT/LB
58	F202 20PK/GY
59	-
60	-
61	A923 16RD
62	A918 18RD/LB
63	A927 10RD/OR
64	A904 12RD/LB
65	A917 10RD
66	A953 12RD
67	F984 12PK/YL (BASE)
67	F984 12PK/YL (EXCEPT BASE)
68	F941 14PK/LG
69	F921 10PK/WT
70	F901 14PK
71	F982 12PK/YL
72	A920 18RD/BK



C202

C202 - (HVAC SIDE)

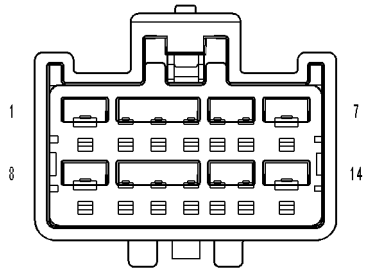
CAV	CIRCUIT
1	C21 20DB/LG
2	C121 20DB/DG
3	C61 20DB/LG
4	C801 20DB/OR
5	C32 20DB/TN
6	C29 20DB
7	C7 12DB
8	C75 12DB/GY
9	-
10	-
11	C71 16DB/BR
12	C72 14DB/OR
13	C73 14DB/VT
14	-
15	C34 20DB/LB
16	-



C202

C202 - NATURAL (I/P SIDE)

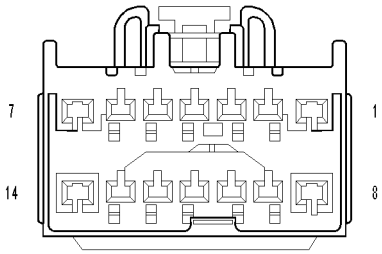
CAV	CIRCUIT
1	C21 20DB/LG
2	C121 20DB/DG
3	C61 20DB/LG
4	C801 20LB/RD
5	C32 20DB/TN
6	C29 20DB
7	C7 12DB
8	C75 12DB/GY
9	-
10	-
11	C71 16DB/BR
12	C72 14DB/OR
13	C73 12DB/VT
14	-
15	C34 20DB/LB
16	-



C203

C203 - (I/P SIDE)

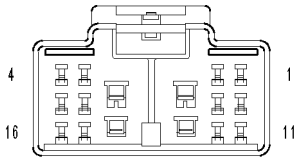
CAV	CIRCUIT
1	-
2	M22 20YL/OR
3	Z955 20BK
4	M28 20YL/TN
5	A918 18RD/LB (EXCEPT BASE)
5	A918 18RD/LB (HIGHLINE)
7	-
8	-
9	-
10	D55 20WT/OR (EXCEPT BASE)
11	D54 20WT (EXCEPT BASE)
12	Z993 18BK (EXCEPT BASE)
13	-
14	-



C203

C203 - (HEADLINER SIDE)

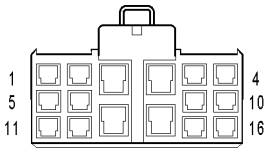
CAV	CIRCUIT
1	-
2	M22 20YL/OR
3	Z955 20BK
4	M28 20YL/TN
5	A918 18RD/LB (OVERHEAD CONSOLE)
6	-
7	-
8	-
9	-
10	D55 20WT/OR
10	D55 20WT/OR (OVERHEAD CONSOLE)
11	D54 20WT
11	D54 20WT (OVERHEAD CONSOLE)
12	Z993 18BK
12	Z993 18BK (OVERHEAD CONSOLE)
13	-
14	-



C300

C300 - (LEFT FRONT DOOR SIDE)

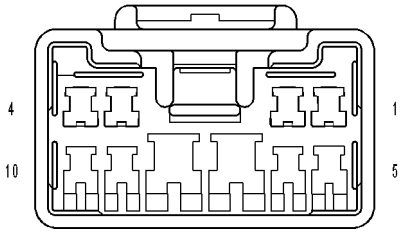
CAV	CIRCUIT
1	Z940 20BK (EXCEPT BASE)
2	Z13 16BK/WT (EXCEPT BASE)
3	P393 18LG (EXCEPT BASE)
4	P74 20TN/YL (EXCEPT BASE)
5	Z917 20BK (BASE)
6	Q26 14OR/GY (EXCEPT BASE)
7	Q611 14OR/RD (QUAD CAB)
8	Q15 14OR/LB (QUAD CAB)
9	Q412 14TN/YL (QUAD CAB)
10	Q16 14OR/TN (EXCEPT BASE)
11	Q411 14OR/BK (QUAD CAB)
12	F30 14PK/YL (EXCEPT BASE)
13	C16 20DB/GY (EXCEPT BASE)
14	P76 20TN/RD (EXCEPT BASE)
15	Q612 14OR/DB (QUAD CAB)
16	P72 20TN/DG (EXCEPT BASE)



C300

C300 - (BODY SIDE)

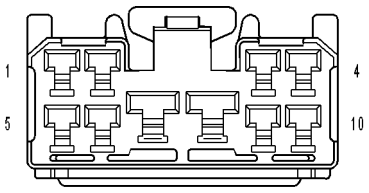
CAV	CIRCUIT
1	Z940 20BK (EXCEPT BASE)
2	Z13 16BK/WT (EXCEPT BASE)
3	P393 18LG (EXCEPT BASE)
4	P74 20TN/YL (EXCEPT BASE)
5	-
6	Q26 14OR/GY (EXCEPT BASE)
7	Q611 14OR/RD (QUAD CAB)
8	Q15 14OR/LB (QUAD CAB)
9	Q412 14TN/YL (QUAD CAB)
10	Q16 14OR/TN (QUAD CAB)
11	Q411 14OR/BK (QUAD CAB)
12	F30 14PK/YL (EXCEPT BASE)
13	C16 20DB/GY (EXCEPT BASE)
14	P76 20TN/RD (EXCEPT BASE)
15	Q612 14OR/DB (QUAD CAB)
16	P72 20TN/DG (EXCEPT BASE)



C301

C301 - (LEFT FRONT DOOR SIDE)

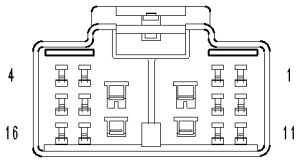
CAV	CIRCUIT
1	-
2	-
3	X209 18GY/OR (PREMIUM AUDIO)
4	X53 20DG (BASE AUDIO)
4	X201 16GY/VT (PREMIUM AUDIO)
5	X299 18GY/YL (PREMIUM AUDIO)
6	X55 20DG/BR (BASE AUDIO)
6	X291 16GY/YL (PREMIUM AUDIO)
7	P1 18TN/LG (EXCEPT BASE)
8	G75 20VT
9	G161 20VT/DG (EXCEPT BASE)
10	A940 16RD (EXCEPT BASE)



C301

C301 - (BODY SIDE)

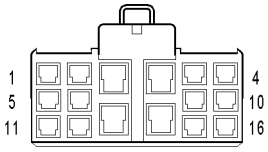
CAV	CIRCUIT
1	-
2	-
3	X209 16GY/OR (PREMIUM AUDIO)
4	X53 20DG (BASE AUDIO)
4	X201 16GY/VT (PREMIUM AUDIO)
5	X299 16GY/YL (PREMIUM AUDIO)
6	X55 20DG/BR (BASE AUDIO)
6	X291 16GY/YL (PREMIUM AUDIO)
7	P1 18TN/LG (EXCEPT BASE)
8	G75 20VT
9	G161 20VT/DG (EXCEPT BASE)
10	A940 16RD (EXCEPT BASE)



C302

C302 - (BODY SIDE)

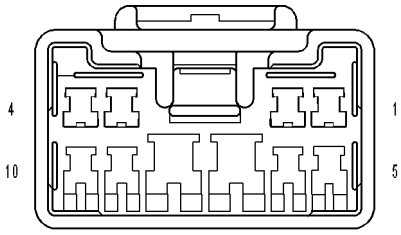
CAV	CIRCUIT
1	Z974 20BK/OR (EXCEPT BASE)
2	Z944 20BK/LG
3	P72 20TN/DG (EXCEPT BASE)
4	P76 20TN/RD (EXCEPT BASE)
5	P74 20TN/YL (EXCEPT BASE)
6	F30 14PK/YL (EXCEPT BASE)
7	Q16 14OR/TN (EXCEPT BASE)
8	Q15 14OR/LB (EXCEPT BASE)
9	Q26 14OR/GY (EXCEPT BASE)
10	C16 20DB/GY (EXCEPT BASE)
11	P392 18LG/DB
12	Z917 20BK (BASE)
13	-
14	-
15	-
16	-



C302

C302 - (RIGHT FRONT DOOR SIDE)

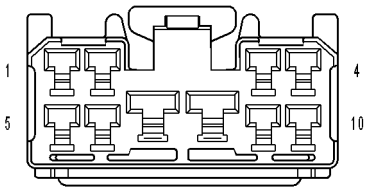
CAV	CIRCUIT
1	Z974 20BK/OR (EXCEPT BASE)
2	Z944 20BK/LG
3	P72 20TN/DG (EXCEPT BASE)
4	P76 20TN/RD (EXCEPT BASE)
5	P74 20TN/YL (EXCEPT BASE)
6	F30 14PK/YL (EXCEPT BASE)
7	Q16 14OR/TN (EXCEPT BASE)
8	Q15 14OR/LB (EXCEPT BASE)
9	Q26 14OR/GY (EXCEPT BASE)
10	C16 20DB/GY (EXCEPT BASE)
11	P392 18LG/DB
12	-
13	-
14	-
15	-
16	-



C303

C303 - (RIGHT FRONT DOOR SIDE)

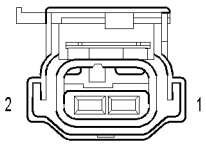
CAV	CIRCUIT
1	X298 20GY/LG (PREMIUM AUDIO)
2	X208 20GY/DG (PREMIUM AUDIO)
3	-
4	-
5	X56 16DG/BR (BASE AUDIO)
5	X292 20DG/YL (PREMIUM AUDIO)
6	X54 16GY (BASE AUDIO)
6	X202 20DG/VT (PREMIUM AUDIO)
7	G74 20VT/WT
8	G160 20VT/LG (EXCEPT BASE)
9	G778 18VT/BK
10	-



C303

C303 - (BODY SIDE)

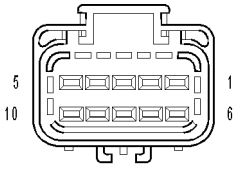
CAV	CIRCUIT
1	X298 20GY/LG (PREMIUM AUDIO)
2	X208 20GY/DG (PREMIUM AUDIO)
3	-
4	-
5	X56 16DG/BR (BASE AUDIO)
5	X292 20DG/YL (PREMIUM AUDIO)
6	X54 16GY (BASE AUDIO)
6	X202 20DG/VT (PREMIUM AUDIO)
7	G74 20VT/WT
8	G160 20VT/LG (EXCEPT BASE)
9	G778 18VT/BK (EXCEPT BASE)
10	-



C304
(BASE)

C304 (BASE) - (CONSOLE SIDE)

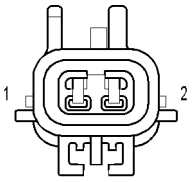
CAV	CIRCUIT
1	A12 16RD/TN
2	Z1 16BK



C304
(PREMIUM)

C304 (PREMIUM) - (BODY SIDE)

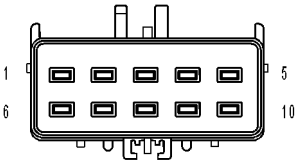
CAV	CIRCUIT
1	F525 16TN/PK
2	P968 20TN/LG
3	P687 20TN/PK
4	P688 20TN/LG
5	A901 16RD
6	-
7	P187 16LG/BR
8	P188 16LG/VT
9	-
10	Z738 18BK/WT



C304
(BASE)

C304 (BASE) - (BODY SIDE)

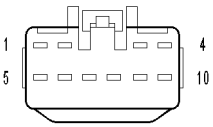
CAV	CIRCUIT
1	A901 16RD
2	Z738 18BK/WT



C304
(PREMIUM)

C304 (PREMIUM) - (CONSOLE SIDE)

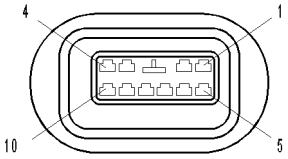
CAV	CIRCUIT
1	F500 18VT/BR
2	P144 20BK/LG
3	P141 20TN/LB
4	P142 20TN/DB
5	A12 16RD/TN
6	-
7	P131 18RD/DG
8	P130 18RD/TN
9	-
10	Z1 16BK



C306
(QUAD CAB)

C306 (QUAD CAB) - (BODY SIDE)

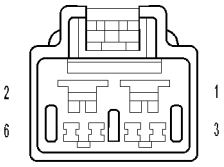
CAV	CIRCUIT
1	X52 16GY/DB (BASE AUDIO)
1	X206 20DG/LG (PREMIUM AUDIO)
2	X58 16GY/OR (BASE AUDIO)
2	X296 20LG/GY (PREMIUM AUDIO)
3	Z927 20BK (EXCEPT BASE)
4	Q612 14OR/DB (EXCEPT BASE)
5	G76 20VT/YL
6	P392 18LG/DB (EXCEPT BASE)
7	Q15 14OR/LB (EXCEPT BASE)
8	Q412 14TN/YL (EXCEPT BASE)
9	G778 18VT/BK (EXCEPT BASE)
10	Z917 20BK (BASE AUDIO)



C306
(QUAD CAB)

C306 (QUAD CAB) - (RIGHT REAR DOOR SIDE)

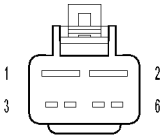
CAV	CIRCUIT
1	X52 16GY/DB (BASE)
1	X206 20DG/LG (EXCEPT BASE)
2	X58 16GY/OR (BASE)
2	X296 20LG/GY (EXCEPT BASE)
3	Z927 20BK (EXCEPT BASE)
4	Q612 14OR/DB (EXCEPT BASE)
5	G76 20VT/YL
6	P392 18LG/DB (EXCEPT BASE)
7	Q15 14OR/LB (EXCEPT BASE)
8	Q412 14TN/YL (EXCEPT BASE)
9	G778 18VT/BK (EXCEPT BASE)
10	Z917 20BK (BASE)



C307
(LEFT SEAT SIDE)

C307 - (LEFT SEAT SIDE)

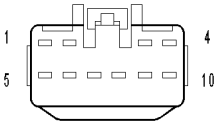
CAV	CIRCUIT
1	Z975 12BK (EXCEPT BASE)
2	A915 10RD (EXCEPT BASE)
3	R261 20LB/WT
4	R57 20LG/GY
5	Z949 20BK
6	R263 20LB/VT



C307

C307 - (BODY SIDE)

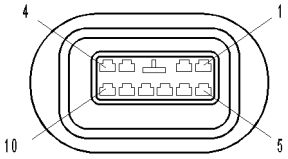
CAV	CIRCUIT
1	Z975 12BK (EXCEPT BASE)
2	A915 10RD (EXCEPT BASE)
3	R261 20LB/WT
4	R57 20LG/GY
5	Z949 20BK
6	R263 20LB/VT



C308
(QUAD CAB)

C308 (QUAD CAB) - (BODY SIDE)

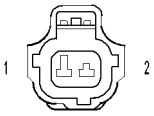
CAV	CIRCUIT
1	X51 16DG/DB (BASE AUDIO)
1	X205 18GY/LG (PREMIUM AUDIO)
2	X57 16DG/OR (BASE AUDIO)
3	Z941 20BK (EXCEPT BASE)
4	P5 18TN/OR (EXCEPT BASE)
5	G77 20VT/GY
6	Q611 14OR/RD (EXCEPT BASE)
7	P393 18LG (EXCEPT BASE)
8	Q15 14OR/LB (EXCEPT BASE)
9	Q411 14OR/BK (EXCEPT BASE)
10	Z917 20BK (BASE AUDIO)



C308
(QUAD CAB)

C308 (QUAD CAB) - (LEFT REAR DOOR SIDE)

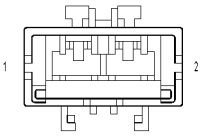
CAV	CIRCUIT
1	X51 18DG/DB (BASE AUDIO)
1	X205 18GY/LG (PREMIUM AUDIO)
2	X57 18DG/OR (BASE AUDIO)
2	X295 18GY/DG (PREMIUM AUDIO)
3	Z941 20BK
4	P5 18TN/OR
5	G77 20VT/GY
6	Q611 14OR/RD (EXCEPT BASE)
7	P393 18LG
8	Q15 14OR/LB (PWR CONV.)
9	Q411 14OR/BK (PWR CONV.)
10	Z917 20BK (BASE)



CAPACITOR-
IGNITION

CAPACITOR-IGNITION - 2 WAY

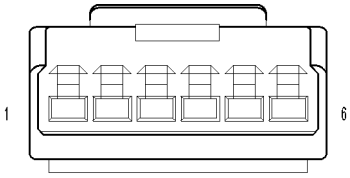
CAV	CIRCUIT	FUNCTION
1	A955 16RD	ASD RELAY OUTPUT
2	-	-



CIRCUIT BREAKER-
WINDOW/
DOOR LOCK

CIRCUIT BREAKER-WINDOW/DOOR LOCK - 2 WAY

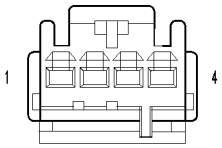
CAV	CIRCUIT	FUNCTION
1	F984 12PK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	F30 14PK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)



CLOCKSPRING C1

CLOCKSPRING C1 - 6 WAY

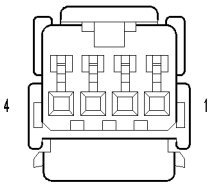
CAV	CIRCUIT	FUNCTION
1	X20 20GY/WT (REMOTE AUDIO)	RADIO CONTROL MUX
2	G902 20VT/OR (REMOTE AUDIO)	SWITCH MUX RETURN
3	-	-
4	V37 20VT	S/C SWITCH NO. 1 SIGNAL
5	K900 20DB/DG	SENSOR GROUND
6	X3 20DG/VT	HORN SWITCH SENSE



CLOCKSPRING C2

CLOCKSPRING C2 - 4 WAY

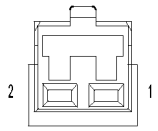
CAV	CIRCUIT	FUNCTION
1	R61 20LG/VT	DRIVER SQUIB 2 LINE 2
2	R63 20LG/WT	DRIVER SQUIB 2 LINE 1
3	R43 20LG/BR	DRIVER SQUIB 1 LINE 2
4	R45 20LG/OR	DRIVER SQUIB 1 LINE 1



CLOCKSPRING C3

CLOCKSPRING C3 - 4 WAY

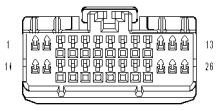
CAV	CIRCUIT	FUNCTION
1	X3 20DG/VT	HORN SWITCH SENSE
2	K900 22DB/DG	SENSOR GROUND
2	K900 22DB/DG	SENSOR GROUND
3	V37 22VT	S/C SWITCH NO. 1 SIGNAL
3	V37 22VT	S/C SWITCH NO. 1 SIGNAL
4	V38 22VT/OR	NOT USED
4	V38 22VT/OR	NOT USED



CLOCKSPRING C4

CLOCKSPRING C4 - 2 WAY

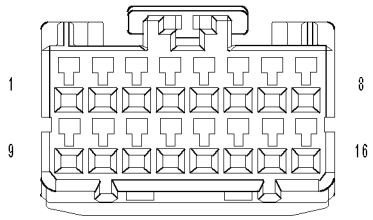
CAV	CIRCUIT	FUNCTION
1	G902 22VT/BR	SWITCH MUX RETURN
1	G902 22VT/BR	SWITCH MUX RETURN
2	X20 22GY/WT	RADIO CONTROL MUX
2	X20 22GY/WT	RADIO CONTROL MUX



CLUSTER C1

CLUSTER C1 - 26 WAY

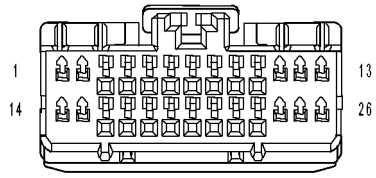
CAV	CIRCUIT	FUNCTION
1	Z946 16BK	GROUND
2	P392 18LG/DB (EXCEPT BASE)	DOOR LOCK DRIVER RIGHT DOORS
3	B25 20DG/WT	PARK BRAKE SWITCH SENSE
4	L914 20WT	FOG LAMP INDICATOR DRIVER
5	R57 20LG/GY	DRIVER SEAT BELT SWITCH SENSE
6	G75 20VT	DRIVER DOOR AJAR SWITCH SENSE
7	X20 20GY/WT (REMOTE AUDIO)	RADIO CONTROL MUX
8	G77 20VT/GY	LEFT REAR DOOR AJAR SWITCH SENSE
9	G15 20VT/TN	KEY-IN IGNITION SWITCH SENSE
10	X3 20DG/VT	HORN SWITCH SENSE
11	P5 18TN/OR (EXCEPT BASE)	DOOR UNLOCK DRIVER LEFT REAR
12	P1 18TN/LG (EXCEPT BASE)	DOOR UNLOCK DRIVER LEFT FRONT
13	A924 16RD	FUSED B(+)
14	-	-
15	P393 18LG (EXCEPT BASE)	DOOR LOCK DRIVER LEFT DOORS
16	W52 20BR/YL	FRONT WIPER SWITCH MUX
17	F961 18PK/LB	IGNITION SWITCH OUTPUT (START)
18	G39 20VT/LB (HIGHLINE)	SUN SENSOR SIGNAL
19	-	-
20	-	-
21	K77 20BR/WT (4X4)	5 VOLT SELECTOR SWITCH SUPPLY
22	-	-
23	-	-
24	B30 20DG/OR	BTSI SOLENOID CONTROL
25	G778 18VT/BK (EXCEPT BASE)	DOOR UNLOCK DRIVER RIGHT DOORS
26	A924 16RD	FUSED B(+)



CLUSTER C2

CLUSTER C2 - 16 WAY

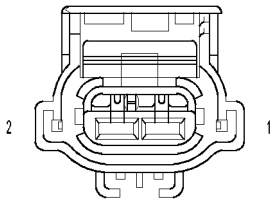
CAV	CIRCUIT	FUNCTION
1	G194 20VT/LG	HIGH BEAM/FRONT WASHER SWITCH MUX
2	G160 20VT/LG (EXCEPT BASE)	PASSENGER DOOR LOCK SWITCH MUX
3	G161 20VT/DG (EXCEPT BASE)	DRIVER DOOR LOCK SWITCH MUX
4	E2 20OR/BR	INDICATOR DIMMER SIGNAL
5	L307 20PK/RD	HEADLAMP SWITCH MUX
6	N5 20DB/WT	FUEL LEVEL SENSOR RETURN
7	-	-
8	L12 20WT/OR	TURN SIGNAL INPUT MUX
9	G939 20VT/DB (HIGHLINE)	SUN SENSOR RETURN
10	L900 20WT/YL	HEADLAMP SWITCH MUX RETURN
11	G902 20VT/OR	SWITCH MUX RETURN
12	K977 20BR/WT (4WD)	MODE SELECT
13	D54 20WT	CAN B BUS(-)
14	D55 20WT/OR	CAN B BUS(+)
15	-	-
16	N4 20DB/YL	FUEL LEVEL SENSOR NO. 1 SIGNAL



CLUSTER C3

CLUSTER C3 - 26 WAY

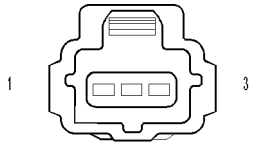
CAV	CIRCUIT	FUNCTION
1	M28 20YL/TN	GLOVE BOX LAMP DRIVER
2	L14 20WT/BK	CARGO LAMP DRIVER
3	-	-
4	-	-
5	-	-
6	E12 20OR/GY	PANEL LAMPS DRIVER
7	-	-
8	E11 20OR/DB (4WD)	PANEL LAMPS DRIVER
9	E19 20OR/BR	PANEL LAMPS DIMMER SIGNAL
10	E33 20OR	PANEL LAMPS DRIVER
11	M22 20YL/OR	COURTESY LAMPS DRIVER
12	F21 20PK/DG	FUSED IGNITION SWITCH OUTPUT (START)
13	F1 20PK/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
14	A117 18RD/DG	FUSED B(+) (I.O.D.)
15	A117 18RD/DG	FUSED B(+) (I.O.D.)
16	G95 20VT/BR (4WD)	4WD NEUTRAL INDICATOR
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	G76 20VT/YL	RIGHT REAR DOOR AJAR SWITCH SENSE
23	G74 20VT/WT	PASSENGER DOOR AJAR SWITCH SENSE
24	F983 20PK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
25	A920 18RD/BK	FUSED B(+)
26	Z948 18BK	GROUND



CLUTCH-A/C COMPRESSOR

CLUTCH-A/C COMPRESSOR - 2 WAY

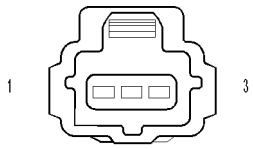
CAV	CIRCUIT	FUNCTION
1	C3 20DB/YL	A/C CLUTCH RELAY OUTPUT
2	Z153 20BK/GY	GROUND



COIL-IGNITION-NO. 1

COIL-IGNITION-NO. 1 - 3 WAY

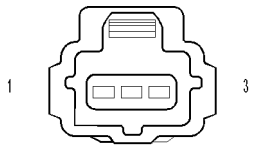
CAV	CIRCUIT	FUNCTION
1	K19 18DB/DG	COIL CONTROL NO. 1
2	A955 16RD	ASD RELAY OUTPUT
3	-	-



COIL-IGNITION-NO. 2

COIL-IGNITION-NO. 2 - 3 WAY

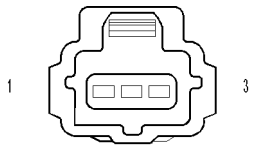
CAV	CIRCUIT	FUNCTION
1	K17 18DB/TN	COIL CONTROL NO. 2
2	A955 16RD	ASD RELAY OUTPUT
3	-	-



COIL-IGNITION-NO. 3

COIL-IGNITION-NO. 3 - 3 WAY

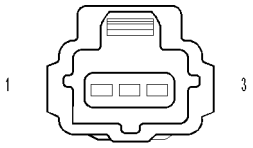
CAV	CIRCUIT	FUNCTION
1	K18 18DB/OR	COIL CONTROL NO. 3
2	A955 16RD	ASD RELAY OUTPUT
3	-	-



COIL-IGNITION-NO. 4

COIL-IGNITION-NO. 4 - 3 WAY

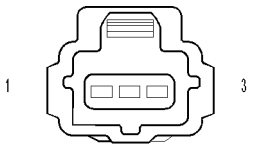
CAV	CIRCUIT	FUNCTION
1	K15 18DB	COIL CONTROL NO. 4
2	A955 16RD	ASD RELAY OUTPUT
3	-	-



COIL-IGNITION-NO. 5

COIL-IGNITION-NO. 5 - 3 WAY

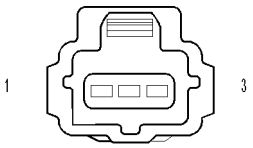
CAV	CIRCUIT	FUNCTION
1	K16 18DB/YL	COIL CONTROL NO. 5
2	A955 16RD	ASD RELAY OUTPUT
3	-	-



COIL-IGNITION-NO. 6

COIL-IGNITION-NO. 6 - 3 WAY

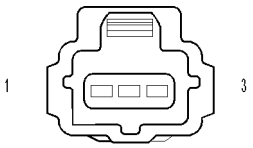
CAV	CIRCUIT	FUNCTION
1	K10 18DB/OR	COIL CONTROL NO. 6
2	A955 16RD	ASD RELAY OUTPUT
3	-	-



COIL-IGNITION-NO. 7 (4.7L)

COIL-IGNITION-NO. 7 (4.7L) - 3 WAY

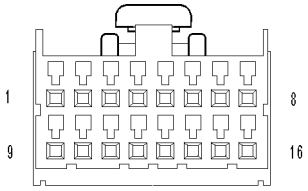
CAV	CIRCUIT	FUNCTION
1	K97 18BR	COIL CONTROL NO. 7
2	A955 16RD	ASD RELAY OUTPUT
3	-	-



COIL-IGNITION-NO. 8 (4.7L)

COIL-IGNITION-NO. 8 (4.7L) - 3 WAY

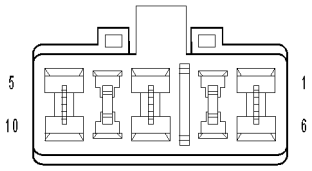
CAV	CIRCUIT	FUNCTION
1	K98 18DB/YL	COIL CONTROL NO. 8
2	A955 16RD	ASD RELAY OUTPUT
3	-	-



CONTROL-A/C-HEATER C1

CONTROL-A/C-HEATER C1 - 16 WAY

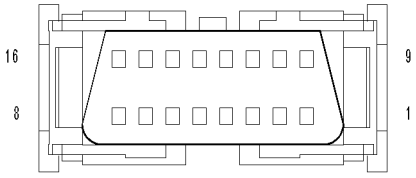
CAV	CIRCUIT	FUNCTION
1	F504 20GY/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
2	Z24 20BK/OR	GROUND
3	-	-
4	-	-
5	-	-
6	C21 20DB/LG	EVAPORATOR TEMPERATURE SENSOR SIGNAL
7	C121 DB/DG	SENSOR GROUND
8	E12 20OR/GY	PANEL LAMPS DRIVER
9	C61 20DB/LG	BLEND DOOR DRIVER
10	C29 20DB	MODE DOOR 1 DRIVER
11	C32 20DB/TN	RECIRCULATION DOOR DRIVER
12	C801 20LB/RD	MODE DOOR 2 DRIVER
13	C34 20DB/LB	COMMON DOOR DRIVER
14	-	-
15	D54 20WT	CAN B BUS(-)
16	D55 20WT/OR	CAN B BUS(+)



CONTROL-A/C-HEATER C2

CONTROL-A/C-HEATER C2 - 10 WAY

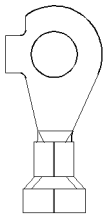
CAV	CIRCUIT	FUNCTION
1	-	-
2	C71 16DB/BR	BLOWER MOTOR LOW SPEED
3	C73 12DB/VT	BLOWER MOTOR M2 SPEED
4	-	-
5	Z961 12BK	GROUND
6	-	-
7	C72 14DB/OR	BLOWER MOTOR M1 SPEED
8	-	-
9	-	-
10	C75 12DB/GY	BLOWER MOTOR HIGH SPEED



DATA LINK CONNECTOR

DATA LINK CONNECTOR - 16 WAY

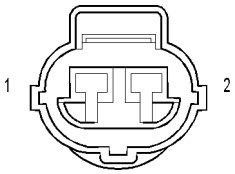
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	Z11 18BK/LG	GROUND
5	Z111 18BK/WT	GROUND
6	D52 20WT/LB	CAN C DIAGNOSTIC (+)
7	D21 20WT/GY	SCI TRANSMIT (PCM)
8	-	-
9	D16 20WT/OR	SCI RECEIVE (TCM)
10	-	-
11	-	-
12	D20 20WT/LG	SCI RECEIVE (PCM)
13	-	-
14	D51 20PK/RD	CAN C DIAGNOSTIC (-)
15	D15 20BR/WT	SCI TRANSMIT (TCM)
16	A918 18RD/LB	FUSED B(+)



GENERATOR (B+)

GENERATOR (B+) - 1 WAY

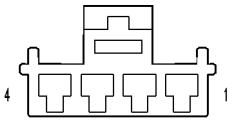
CAV	CIRCUIT	FUNCTION
1	A1 04RD	B(+)



GENERATOR

GENERATOR - 2 WAY

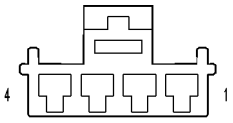
CAV	CIRCUIT	FUNCTION
1	K20 18BR/GY	GEN FIELD CONTROL
2	Z20 18BR/BK	GROUND



HEATER-CUSHION PAD-DRIVER (HEATED SEATS)

HEATER-CUSHION PAD-DRIVER (HEATED SEATS) - 4 WAY

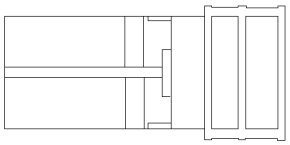
CAV	CIRCUIT	FUNCTION
1	P187 16LG/BR	LEFT SEAT HEATER B(+) DRIVER
2	P687 20TN/PK	HEATED SEAT TEMP SENSOR - LEFT FRONT
3	P968 20TN/LG	HEATED SEAT SENSOR RETURN
4	Z970 20BK	GROUND



HEATER-CUSHION PAD-PASSENGER (HEATED SEATS)

HEATER-CUSHION PAD-PASSENGER (HEATED SEATS) - 4 WAY

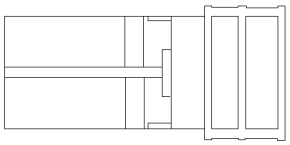
CAV	CIRCUIT	FUNCTION
1	P188 16LG/VT	RIGHT SEAT HEATER B(+) DRIVER
2	P688 20TN/LG	HEATED SEAT TEMP SENSOR - RIGHT FRONT
3	P968 20TN/LG	HEATED SEAT SENSOR RETURN
4	Z969 20BK	GROUND



HORN-NO. 1

HORN-NO. 1 - 1 WAY

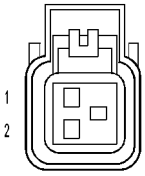
CAV	CIRCUIT	FUNCTION
1	X2 18DG/OR	HORN RELAY OUTPUT



HORN NO. 2

HORN-NO. 2 - 1 WAY

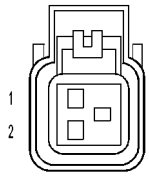
CAV	CIRCUIT	FUNCTION
1	X2 18DG/OR	HORN RELAY OUTPUT



INJECTOR-FUEL-NO. 1

INJECTOR-FUEL-NO. 1 - 2 WAY

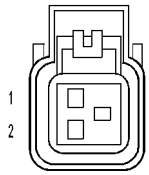
CAV	CIRCUIT	FUNCTION
1	K11 18BR/YL	INJECTOR CONTROL NO. 1
2	A955 16RD	ASD RELAY OUTPUT



INJECTOR-FUEL-NO. 2

INJECTOR-FUEL-NO. 2 - 2 WAY

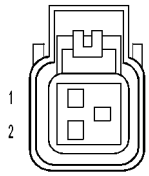
CAV	CIRCUIT	FUNCTION
1	K12 18BR/DB	INJECTOR CONTROL NO. 2
2	A955 16RD	ASD RELAY OUTPUT



INJECTOR-FUEL-NO. 3

INJECTOR-FUEL-NO. 3 - 2 WAY

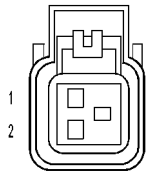
CAV	CIRCUIT	FUNCTION
1	K13 18BR/LB	INJECTOR CONTROL NO. 3
2	A955 16RD	ASD RELAY OUTPUT



INJECTOR-FUEL-NO. 4

INJECTOR-FUEL-NO. 4 - 2 WAY

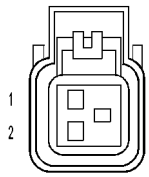
CAV	CIRCUIT	FUNCTION
1	K14 18BR/TN	INJECTOR CONTROL NO. 4
2	A955 16RD	ASD RELAY OUTPUT



INJECTOR-FUEL-NO. 5

INJECTOR-FUEL-NO. 5 - 2 WAY

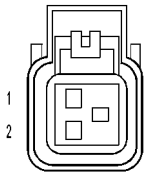
CAV	CIRCUIT	FUNCTION
1	K38 18BR/OR	INJECTOR CONTROL NO. 5
2	A955 16RD	ASD RELAY OUTPUT



INJECTOR-FUEL-NO. 6

INJECTOR-FUEL-NO. 6 - 2 WAY

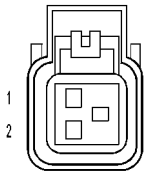
CAV	CIRCUIT	FUNCTION
1	K58 18BR/VT	INJECTOR CONTROL NO. 6
2	A955 16RD	ASD RELAY OUTPUT



INJECTOR-FUEL-NO. 7 (4.7L)

INJECTOR-FUEL-NO. 7 (4.7L) - 2 WAY

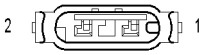
CAV	CIRCUIT	FUNCTION
1	K26 18BR/YL	INJECTOR CONTROL NO. 7
2	A955 16RD	ASD RELAY OUTPUT



INJECTOR-FUEL-NO. 8 (4.7L)

INJECTOR-FUEL-NO. 8 (4.7L) - 2 WAY

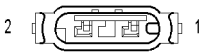
CAV	CIRCUIT	FUNCTION
1	K28 18BR/LB	INJECTOR CONTROL NO. 8
2	A955 16RD	ASD RELAY OUTPUT



LAMP-BACKUP-LEFT

LAMP-BACKUP-LEFT - 2 WAY

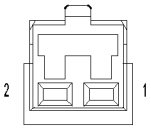
CAV	CIRCUIT	FUNCTION
1	L1 18WT/LG	BACK-UP LAMP FEED
2	Z363 20BK/DG	GROUND



LAMP-BACKUP-RIGHT

LAMP-BACKUP-RIGHT - 2 WAY

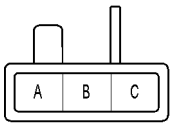
CAV	CIRCUIT	FUNCTION
1	L1 18WT/LG	BACK-UP LAMP FEED
2	Z362 20BK/BR	GROUND



LAMP-CENTER BEZEL

LAMP-CENTER BEZEL - 2 WAY

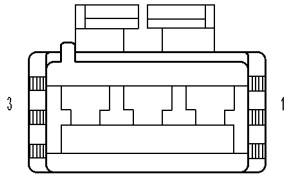
CAV	CIRCUIT	FUNCTION
1	E33 20OR	PANEL LAMPS DRIVER
2	Z407 20BK/OR	GROUND



LAMP-DOME-FRONT

LAMP-DOME-FRONT - 3 WAY

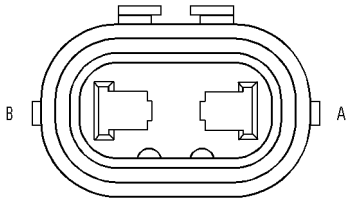
CAV	CIRCUIT	FUNCTION
A	M28 20YL/TN	GLOVE BOX LAMP DRIVER
B	Z955 20BK	GROUND
C	M22 20YL/OR	COURTESY LAMPS DRIVER



**LAMP-
DOME-
REAR**

LAMP-DOME-REAR - 3 WAY

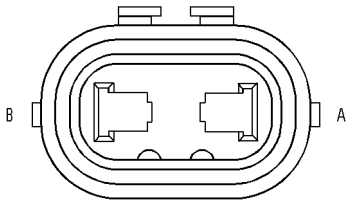
CAV	CIRCUIT	FUNCTION
1	M22 20YL/OR	COURTESY LAMPS DRIVER
2	M28 20YL/TN	GLOVE BOX LAMP DRIVER
3	Z955 20BK	GROUND



**LAMP-FOG-
LEFT
FRONT**

LAMP-FOG-LEFT FRONT - 2 WAY

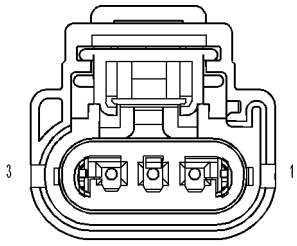
CAV	CIRCUIT	FUNCTION
A	L89 18WT/YL	FRONT FOG LAMP RELAY OUTPUT
B	Z349 20BK/YL	GROUND



**LAMP-FOG-
RIGHT
FRONT**

LAMP-FOG-RIGHT FRONT - 2 WAY

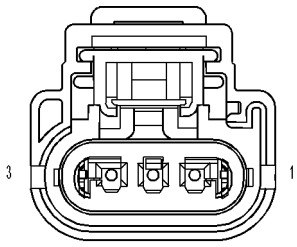
CAV	CIRCUIT	FUNCTION
A	L89 18WT/YL	FRONT FOG LAMP RELAY OUTPUT
B	Z348 20BK/OR	GROUND



**LAMP-
HEADLAMP-
LEFT**

LAMP-HEADLAMP-LEFT - 3 WAY

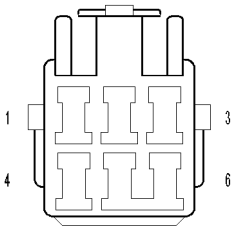
CAV	CIRCUIT	FUNCTION
1	L43 18WT/DB	LEFT LOW BEAM DRIVER
2	Z912 18BK	GROUND
3	L33 18WT/LG	LEFT HIGH BEAM DRIVER



**LAMP-
HEADLAMP-
RIGHT**

LAMP-HEADLAMP-RIGHT - 3 WAY

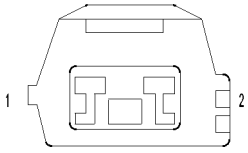
CAV	CIRCUIT	FUNCTION
1	L44 18WT/TN	RIGHT LOW BEAM DRIVER
2	Z929 18BK	GROUND
3	L34 18WT/GY	RIGHT HIGH BEAM DRIVER



LAMP-
HIGH
MOUNTED
STOP

LAMP-HIGH MOUNTED STOP - 6 WAY

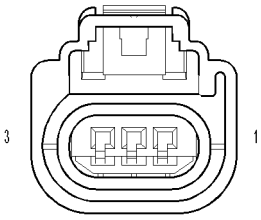
CAV	CIRCUIT	FUNCTION
1	L14 20WT/BK	CARGO LAMP DRIVER
2	Z945 20BK	GROUND
3	L50 16WT/LB	BRAKE LAMP SWITCH OUTPUT
4	Z945 20BK/OR	GROUND
5	-	-
6	-	-



LAMP-
LICENSE-
LEFT

LAMP-LICENSE-LEFT - 2 WAY

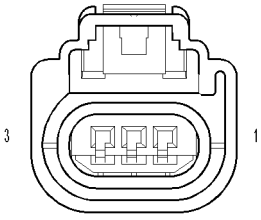
CAV	CIRCUIT	FUNCTION
1	L77 20PK/RD	PARK LAMP RELAY OUTPUT
2	Z945 18BK	GROUND



LAMP-
PARK/
TURN-
LEFT
FRONT

LAMP-PARK/TURN-LEFT FRONT - 3 WAY

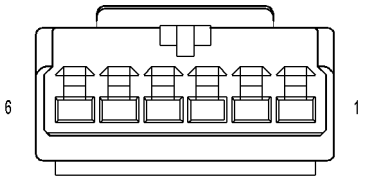
CAV	CIRCUIT	FUNCTION
1	Z377 20BK/BR	GROUND
2	L77 20PK/RD	FUSED PARK LAMP RELAY OUTPUT
3	L61 18WT/LG	LEFT FRONT TURN SIGNAL CONTROL



LAMP-
PARK/
TURN-
RIGHT
FRONT

LAMP-PARK/TURN-RIGHT FRONT - 3 WAY

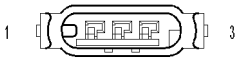
CAV	CIRCUIT	FUNCTION
1	Z378 20BK/TN	GROUND
2	L78 20WT/OR	FUSED PARK LAMP RELAY OUTPUT (RIGHT)
3	L60 18WT/TN	RIGHT FRONT TURN SIGNAL CONTROL



**LAMP-
PASSENGER
AIRBAG
ON/OFF
INDICATOR**

LAMP-PASSENGER AIRBAG ON/OFF INDICATOR - 6 WAY

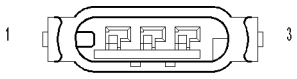
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	G104 20VT/GY	PASSENGER AIRBAG INDICATOR DRIVER
4	F201 20PK/OR	FUSED IGNITION SWITCH OUTPUT (RUN-START)
5	-	-
6	-	-



**LAMP-
TAIL/STOP/TURN-
LEFT**

LAMP-TAIL/STOP/TURN-LEFT - 3 WAY

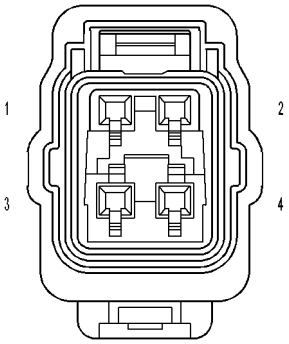
CAV	CIRCUIT	FUNCTION
1	L63 18WT/DG	LEFT REAR TURN SIGNAL CONTROL
2	L77 20PK/RD	PARK LAMP RELAY OUTPUT
3	Z363 20BK/DG	GROUND



**LAMP-
TAIL/STOP/TURN-
RIGHT**

LAMP-TAIL/STOP/TURN-RIGHT - 3 WAY

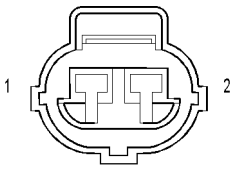
CAV	CIRCUIT	FUNCTION
1	L62 18WT/OR	RIGHT REAR TURN SIGNAL CONTROL
2	L78 20WT/OR	FUSED PARK LAMP RELAY OUTPUT (RIGHT)
3	Z362 20BK/BR	GROUND



**LATCH-
DOOR-
LEFT FRONT
(POWER
CONVENIENCE)**

LATCH-DOOR-LEFT FRONT (POWER CONVENIENCE) - 4 WAY

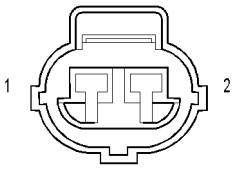
CAV	CIRCUIT	FUNCTION
1	G75 20VT	DRIVER DOOR AJAR SWITCH SENSE
2	Z940 20BK	GROUND
3	P1 18TN/LG	DOOR UNLOCK DRIVER LEFT FRONT
4	P393 18LG	DOOR LOCK DRIVER LEFT DOORS



**LATCH-
DOOR-
LEFT FRONT
(BASE)**

LATCH-DOOR-LEFT FRONT (BASE) - 2 WAY

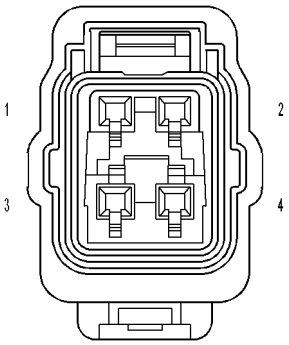
CAV	CIRCUIT	FUNCTION
1	G75 20VT	DRIVER DOOR AJAR SWITCH SENSE
2	Z917 20BK	GROUND



**LATCH-
DOOR-
LEFT REAR
(QUAD CAB
BASE)**

LATCH-DOOR-LEFT REAR (QUAD CAB BASE) - 2 WAY

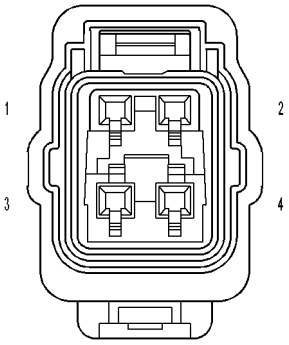
CAV	CIRCUIT	FUNCTION
1	G77 20VT/GY	LEFT REAR DOOR AJAR SWITCH SENSE
2	Z917 20BK	GROUND



**LATCH-
DOOR-
LEFT REAR
(QUAD CAB
POWER CONVENIENCE)**

LATCH-DOOR-LEFT REAR (QUAD CAB POWER CONVENIENCE) - 4 WAY

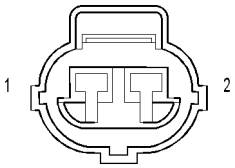
CAV	CIRCUIT	FUNCTION
1	G77 20VT/GY	LEFT REAR DOOR AJAR SWITCH SENSE
2	Z941 20BK	GROUND
3	P5 18TN/OR	DOOR UNLOCK DRIVER LEFT REAR
4	P393 18LG	DOOR LOCK DRIVER LEFT DOORS



**LATCH-
DOOR-
RIGHT FRONT
(POWER
CONVENIENCE)**

LATCH-DOOR-RIGHT FRONT (POWER CONVENIENCE) - 4 WAY

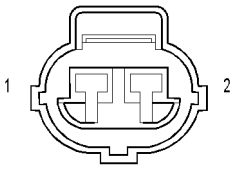
CAV	CIRCUIT	FUNCTION
1	G74 20VT/WT	PASSENGER DOOR AJAR SWITCH SENSE
2	Z944 20BK/LG	GROUND
3	G778 18VT/BK	DOOR UNLOCK DRIVER RIGHT DOORS
4	P392 18LG/DB	DOOR LOCK DRIVER RIGHT DOORS



**LATCH-
DOOR-
RIGHT FRONT
(BASE)**

LATCH-DOOR-RIGHT FRONT (BASE) - 2 WAY

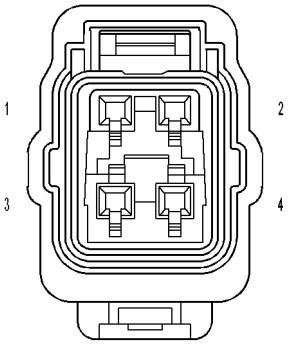
CAV	CIRCUIT	FUNCTION
1	G74 20VT/WT	PASSENGER DOOR AJAR SWITCH SENSE
2	Z917 20BK	GROUND



**LATCH-
DOOR-
RIGHT REAR
(QUAD CAB
BASE)**

LATCH-DOOR-RIGHT REAR (QUAD CAB BASE) - 2 WAY

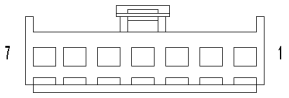
CAV	CIRCUIT	FUNCTION
1	G76 20VT/YL	RIGHT REAR DOOR AJAR SWITCH SENSE
2	Z917 20BK	GROUND



**LATCH-
DOOR-
RIGHT REAR
(QUAD CAB
POWER CONVENIENCE)**

LATCH-DOOR-RIGHT REAR (QUAD CAB POWER CONVENIENCE) - 4 WAY

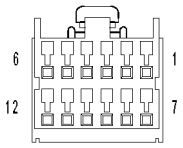
CAV	CIRCUIT	FUNCTION
1	G76 20VT/YL	RIGHT REAR DOOR AJAR SWITCH SENSE
2	Z927 20BK	GROUND
3	G778 18VT/BK	DOOR UNLOCK DRIVER RIGHT DOORS
4	P392 18LG/DB	DOOR LOCK DRIVER RIGHT DOORS



**MIRROR-
INSIDE
REARVIEW C1**

MIRROR-INSIDE REARVIEW C1 - 7 WAY

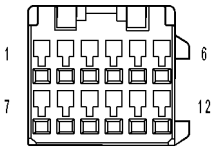
CAV	CIRCUIT	FUNCTION
1	F21 20BK/LB	FUSED IGNITION SWITCH OUTPUT (START)
2	Z957 20BK/GY	GROUND
3	L1 20BK/DG	BACK-UP LAMP FEED
4	-	-
5	-	-
6	-	-
7	-	-



MIRROR-INSIDE REARVIEW C2 (HANDS FREE)

MIRROR-INSIDE REARVIEW C2 (HANDS FREE) - 12 WAY

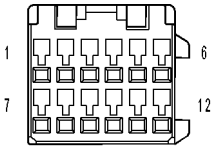
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	X722 20BK/DB	MICROPHONE 2 IN (+)
5	X735 20BK/DG	HANDS FREE MICROPHONE SHIELD
6	X712 20BK/GY	MICROPHONE 1 IN (+)
7	X793 20BK/RD	MICROPHONE FEED
8	-	-
9	X730 20BK/OR	VOICE RECOGNITION/PHONE SWITCH SIGNAL
10	-	-
11	X835 20BK/TN	SENSOR GROUND
12	X792 20BK/VT	MICROPHONE IN (-)



MIRROR-OUTSIDE REARVIEW-DRIVER (POWER CONVENIENCE)

MIRROR-OUTSIDE REARVIEW-DRIVER (POWER CONVENIENCE) - 12 WAY

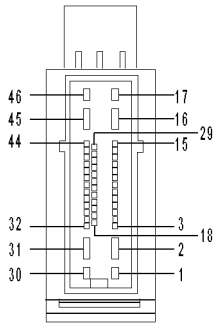
CAV	CIRCUIT	FUNCTION
1	P71 20DB	DRIVER MIRROR VERTICAL DRIVER
2	P76 20TN/RD	MIRROR COMMON DRIVER
3	P75 20RD	DRIVER MIRROR HORIZONTAL DRIVER
4	C16 20DB/GY	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
5	Z940 20BK	GROUND
6	-	-
7	-	-
8	-	-
9	-	-
10	-	-
11	-	-
12	-	-



MIRROR-OUTSIDE REARVIEW-PASSENGER (POWER CONVENIENCE)

MIRROR-OUTSIDE REARVIEW-PASSENGER (POWER CONVENIENCE) - 12 WAY

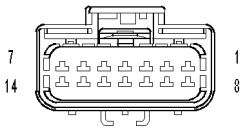
CAV	CIRCUIT	FUNCTION
1	P72 20TN/DG	PASSENGER MIRROR VERTICAL DRIVER
2	P76 20TN/RD	MIRROR COMMON DRIVER
3	P74 20TN/YL	PASSENGER MIRROR HORIZONTAL DRIVER
4	C16 20DB/GY	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
5	Z944 20BK/LG	GROUND
6	-	-
7	-	-
8	-	-
9	-	-
10	-	-
11	-	-
12	-	-



MODULE-ANTI-LOCK BRAKES (AWAL)

MODULE-ANTI-LOCK BRAKES (AWAL) - 46 WAY

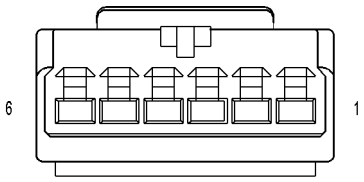
CAV	CIRCUIT	FUNCTION
1	-	-
2	A111 18DG/RD	FUSED B(+)
3	D65 20WT/LG	CAN C BUS(+)
4	-	-
5	-	-
6	B29 20DG/WT	BRAKE SWITCH SIGNAL
7	-	-
8	-	-
9	-	-
10	-	-
11	-	-
12	B9 20DG/LG	LEFT FRONT WHEEL SPEED SENSOR SUPPLY
13	B8 20DG/TN	LEFT FRONT WHEEL SPEED SENSOR SIGNAL
14	-	-
15	-	-
16	Z923 18BK	GROUND
17	-	-
18	D64 20WT/LB	CAN C BUS(-)
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	B7 20DG/VT	RIGHT FRONT WHEEL SPEED SENSOR SUPPLY
27	B6 20DG/WT	RIGHT FRONT WHEEL SPEED SENSOR SIGNAL
28	-	-
29	-	-
30	-	-
31	A107 12TN/RD	FUSED B(+)
32	F500 20DG/PK	FUSED RUN RELAY OUTPUT
33	B20 20DG/OR	BRAKE FLUID LEVEL SWITCH SENSE
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	B22 20DG/YL	REAR WHEEL SPEED SENSOR SIGNAL
42	B222 20DG/WT	REAR WHEEL SPEED SENSOR SUPPLY
43	-	-
44	-	-
45	Z107 12BK/DG	GROUND
46	-	-



MODULE-ANTI-LOCK BRAKES (RWAL)

MODULE-ANTI-LOCK BRAKES (RWAL) - 14 WAY

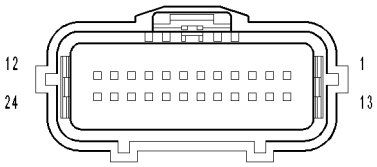
CAV	CIRCUIT	FUNCTION
1	B222 20DG/WT	REAR WHEEL SPEED SENSOR SUPPLY
2	D65 20WT/LG	CAN C BUS(+)
3	D64 20WT/LB	CAN C BUS(-)
4	F500 20DG/PK	FUSED RUN RELAY OUTPUT
5	-	-
6	Z107 12BK/DG	GROUND
7	A107 12TN/RD	FUSED B(+)
8	B22 20DG/YL	REAR WHEEL SPEED SENSOR SIGNAL
9	B29 20DG/WT	BRAKE SWITCH SIGNAL
10	-	-
11	B20 20DG/OR	BRAKE FLUID LEVEL SWITCH SENSE
12	-	-
13	-	-
14	-	-



MODULE-ELECTRONIC OVERHEAD

MODULE-ELECTRONIC OVERHEAD - 6 WAY

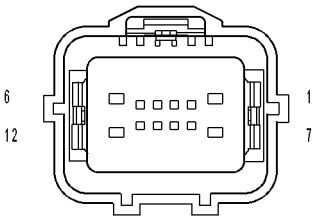
CAV	CIRCUIT	FUNCTION
1	-	-
2	A918 18RD/LB	FUSED B(+)
3	D55 20WT/OR	CAN B BUS(+)
4	D54 20WT	CAN B BUS(-)
5	Z993 18BK	GROUND
6	-	-



MODULE-
FRONT
CONTROL C1

MODULE-FRONT CONTROL C1 - 24 WAY

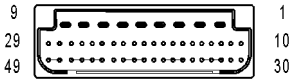
CAV	CIRCUIT	FUNCTION
1	Z116 18BK/VT	GROUND
2	D55 20WT/OR	CAN B BUS(+)
3	D54 20WT	CAN B BUS(-)
4	-	-
5	D52 20WT/LB	CAN C DIAGNOSTIC (+)
6	D51 20PK/RD	CAN C DIAGNOSTIC (-)
7	-	-
8	D65 20WT/LG	CAN C BUS(+)
9	D64 20WT/LB	CAN C BUS(-)
10	-	-
11	C18 20LB/BR	A/C PRESSURE SIGNAL
12	-	-
13	-	-
14	-	-
15	-	-
16	T103 20YL/OR	5 VOLT SUPPLY
17	D201 20WT/DG	MODE SENSOR A
18	W1 20BR/TN	WASHER FLUID LEVEL SWITCH SENSE
19	K25 20DB/VT	BATT TEMP SIGNAL
20	K91 20DB/YL	BATT TEMP RETURN
21	L50 18WT/LB	BRAKE LAMP SWITCH OUTPUT
22	Z117 18BK/WT	GROUND
23	-	-
24	Z965 18BK	GROUND



MODULE-
FRONT
CONTROL C2

MODULE-FRONT CONTROL C2 - 12 WAY

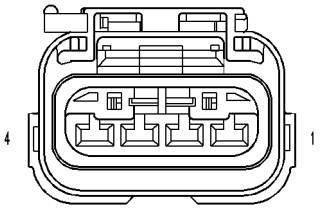
CAV	CIRCUIT	FUNCTION
1	L44 18WT/TN	RIGHT LOW BEAM DRIVER
2	-	-
3	-	-
4	G31 20VT/OR	AAT SIGNAL
5	G931 20VT/BR	SENSOR GROUND
6	L43 18WT/DB	LEFT LOW BEAM DRIVER
7	L33 18WT/LG	LEFT HIGH BEAM DRIVER
8	L60 18WT/TN	RIGHT FRONT TURN SIGNAL CONTROL
9	-	-
10	L61 18WT/LG	LEFT FRONT TURN SIGNAL CONTROL
11	Z947 18BK	GROUND
12	L34 18WT/GY	RIGHT HIGH BEAM DRIVER



MODULE-
FRONT
CONTROL
(IPM)

MODULE-FRONT CONTROL IPM - 49 WAY

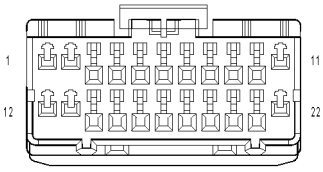
CAV	CIRCUIT	FUNCTION
1	Z921	GROUND
2	A908	FUSED B(+)
3	A906	FUSED B(+)
4	A905	FUSED B(+)
5	A907	FUSED B(+)
6	A909	FUSED B(+)
7	L1	BACK-UP LAMP FEED
8	T315	SHIFT MOTOR CONTROL A
9	T316	SHIFT MOTOR CONTROL B
10	C115	DEFOGGER RELAY CONTROL
11	-	-
12	W10	FRONT WASHER PUMP MOTOR CONTROL
13	-	-
14	-	-
15	A920	FUSED B(+)
16	-	-
17	F202	FUSED IGNITION SWITCH OUTPUT (RUN-START)
18	Z118	GROUND
19	Z909	GROUND
20	-	-
21	L656	RIGHT TRAILER TOW BRAKE LAMP RELAY CONTROL
22	L655	LEFT TRAILER TOW BRAKE LAMP RELAY CONTROL
23	-	-
24	Z909	GROUND
25	Z118	GROUND
26	L139	FOG LAMP RELAY CONTROL
27	W5	WIPER ON/OFF RELAY CONTROL
28	-	-
29	W2	WIPER HIGH/LOW RELAY CONTROL
30	A955	ASD RELAY OUTPUT
31	W7	WIPER PARK SWITCH SENSE
32	Z909	GROUND
33	Z118	GROUND
34	L62	RIGHT REAR TURN SIGNAL CONTROL
35	G180	FCM SENSOR RETURN
36	-	-
37	-	-
38	-	-
39	-	-
40	T2	LOW/REVERSE SOLENOID CONTROL
41	Z118	GROUND
42	-	-
43	L63	LEFT REAR TURN SIGNAL CONTROL
44	-	-
45	T313	NOT USED
46	-	-
47	X4	HORN RELAY CONTROL
48	L779	PARK LAMP RELAY CONTROL
49	-	-



**MODULE-
FUEL
PUMP**

MODULE-FUEL PUMP - 4 WAY

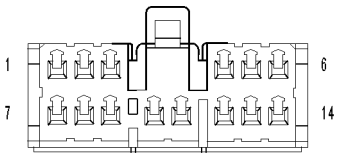
CAV	CIRCUIT	FUNCTION
1	Z201 18BK	GROUND
2	N5 20DB/WT	FUEL LEVEL SENSOR RETURN
3	N4 20DB/YL	FUEL LEVEL SENSOR NO. 1 SIGNAL
4	N1 18DB/OR	FUEL PUMP RELAY OUTPUT



**MODULE-
HANDS FREE**

MODULE-HANDS FREE - 22 WAY

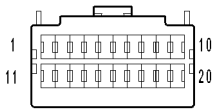
CAV	CIRCUIT	FUNCTION
1	A918 18RD/LB	FUSED B(+)
2	-	-
3	-	-
4	D54 20WT	CAN B BUS(-)
5	X722 20LB/BK	MICROPHONE 2 IN (+)
6	-	-
7	-	-
8	X716 20GY/TN	CNV-HANDS FREE VOICE (+)
9	X776 20TN/GY	CNV-HANDS FREE VOICE (-)
10	X795 20DG	COMMON AUDIO OUTPUT
11	-	-
12	-	-
13	-	-
14	D55 20WT/OR	CAN B BUS(+)
15	X730 20GY/YL	VOICE RECOGNITION/PHONE SWITCH SIGNAL
16	X712 20DG/LB	MICROPHONE 1 IN (+)
17	X792 20LB/RD	MICROPHONE IN (-)
18	X735 20DB	HANDS FREE MICROPHONE SHIELD
19	-	-
20	X793 20LB/YL	MICROPHONE FEED
21	X835 20OR/GY	SENSOR GROUND
22	Z939 20BK	GROUND



**MODULE-
HEATED
SEAT**

MODULE-HEATED SEAT - 14 WAY

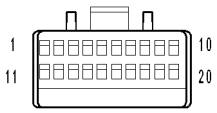
CAV	CIRCUIT	FUNCTION
1	P7 20LB/BK	DRIVER HEATED SEAT SWITCH OUTPUT
2	P144 20BK/LG	HEATED SEAT SENSOR RETURN
3	P130 18RD/TN	RIGHT SEAT HEATER B(+) DRIVER
4	F500 18VT/BR	FUSED IGNITION SWITCH OUTPUT (RUN)
5	P131 18RD/DG	LEFT SEAT HEATER B(+) DRIVER
6	F500 18VT/BR	FUSED IGNITION SWITCH OUTPUT (RUN)
7	P142 20TN/DB	HEATED SEAT TEMP SENSOR - RIGHT FRONT
8	P141 20TN/LB	HEATED SEAT TEMP SENSOR - LEFT FRONT
9	P8 20LB/WT	PASSENGER HEATED SEAT SWITCH OUTPUT
10	P138 20VT/LG	PASSENGER SEAT LOW HEAT LED DRIVER
11	P140 20VT/BK	PASSENGER SEAT HIGH HEAT LED DRIVER
12	P137 20VT/DG	DRIVER SEAT LOW HEAT LED DRIVER
13	Z1 18BK	GROUND
14	P139 20VT/WT	DRIVER SEAT HIGH HEAT LED DRIVER



MODULE-INTEGRATED POWER C1

MODULE-INTEGRATED POWER C1 - 20 WAY

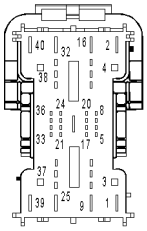
CAV	CIRCUIT	FUNCTION
1	-	-
2	W7 20BR/GY	FRONT WIPER PARK SWITCH SENSE
3	-	-
4	F202 20PK/GY	FUSED IGNITION SWITCH OUTPUT (RUN-START)
5	G180 20VT/YL	FCM SENSOR RETURN
6	-	-
7	-	-
8	-	-
9	-	-
10	-	-
11	T752 20DG/OR	STARTER RELAY CONTROL
12	-	-
13	-	-
14	K51 20BR/GY	ASD RELAY CONTROL
15	T313 18YL/LG	NOT USED
16	-	-
17	-	-
18	-	-
19	-	-
20	T2 20DG/WT (M/T)	LOW/REVERSE SOLENOID CONTROL



MODULE-INTEGRATED POWER C2

MODULE-INTEGRATED POWER C2 - 20 WAY

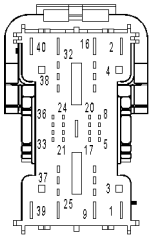
CAV	CIRCUIT	FUNCTION
1	F202 20PK/GY	FUSED IGNITION SWITCH OUTPUT (RUN-START)
2	-	-
3	-	-
4	-	-
5	F924 20PK/YL	FUSED IGNITION SWITCH OUTPUT (START)
6	K31 20BR	FUEL PUMP RELAY CONTROL
7	T15 20YL/BK (A/T)	TRANSMISSION CONTROL RELAY CONTROL
8	A956 20RD	FUSED B(+)
9	-	-
10	Z915 20BK	GROUND
11	-	-
12	C13 20LB/OR	A/C CLUTCH RELAY CONTROL
13	C3 20DB/YL	A/C CLUTCH RELAY OUTPUT
14	L77 20PK/RD	PARK LAMP RELAY OUTPUT
15	L77 20PK/RD	PARK LAMP RELAY OUTPUT
16	L78 20WT/OR	FUSED PARK LAMP RELAY OUTPUT (RIGHT)
17	L78 20WT/OR	FUSED PARK LAMP RELAY OUTPUT (RIGHT)
18	-	-
19	F1 20PK/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
20	-	-



MODULE-INTEGRATED POWER C3

MODULE-INTEGRATED POWER C3 - 40 WAY

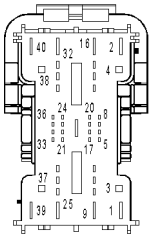
CAV	CIRCUIT	FUNCTION
1	A917 12RD	FUSED B(+)
2	A953 12RD	FUSED B(+)
3	F961 16PK/LB	IGNITION SWITCH OUTPUT (START)
4	-	-
5	L674 20LG (TRAILER TOW)	RIGHT TRAILER TOW BRAKE LAMP RELAY OUTPUT
6	L673 20YL (TRAILER TOW)	LEFT TRAILER TOW BRAKE LAMP RELAY OUTPUT
7	X2 18DG/OR	HORN RELAY OUTPUT
8	X2 18DG/OR	HORN RELAY OUTPUT
9	F941 14PK/LG	IGNITION SWITCH OUTPUT (RUN-START)
10	-	-
11	A111 18DG/RD (AWAL)	FUSED B(+)
12	A117 20RD/DG	FUSED B(+) (I.O.D.)
13	-	-
14	-	-
15	L76 20PK/RD (TRAILER TOW)	TRAILER TOW RELAY OUTPUT
16	A918 18RD	FUSED B(+)
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	A923 18RD	FUSED B(+)
26	A940 18RD	FUSED B(+)
27	A901 18RD	FUSED B(+)
28	A103 20GY/RD	FUSED B(+)
29	A116 16YL/RD	FUSED B(+)
30	-	-
31	A924 18RD	FUSED B(+)
32	A100 12RD/VT (TRAILER TOW)	FUSED B(+)
33	L89 18WT/YL (FOG LAMPS)	FRONT FOG LAMP RELAY OUTPUT
34	L89 18WT/YL (FOG LAMPS)	FRONT FOG LAMP RELAY OUTPUT
35	F201 20PK/OR	FUSED IGNITION SWITCH OUTPUT (RUN-START)
36	F21 20PK/DG	FUSED IGNITION SWITCH OUTPUT (START)
37	-	-
38	-	-
39	C15 12DB/WT (EBL)	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
40	A107 12TN/RD	FUSED B(+)



MODULE-INTEGRATED POWER C4

MODULE-INTEGRATED POWER C4 - 40 WAY

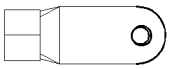
CAV	CIRCUIT	FUNCTION
1	-	-
2	A915 10RD	FUSED B(+)
3	-	-
4	-	-
5	-	-
6	-	-
7	-	-
8	-	-
9	A920 18RD/BK	FUSED B(+)
10	-	-
11	-	-
12	-	-
13	F306 18DB/PK	FUSED B(+)
14	Z967 18BK	GROUND
15	N1 18DB/OR	FUEL PUMP RELAY OUTPUT
16	A400 14TN/RD (TRAILER TOW)	FUSED B(+)
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	A955 16RD	ASD RELAY OUTPUT
26	Z903 18BK	GROUND
27	W10 18BR	FRONT WASHER PUMP MOTOR CONTROL
28	F984 12PK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
29	T16 16YL/OR (A/T)	TRANSMISSION CONTROL RELAY OUTPUT
30	A919 18RD	FUSED B(+)
31	-	-
32	A904 12RD/LB	FUSED B(+)
33	-	-
34	-	-
35	L62 18WT/OR	RIGHT REAR TURN SIGNAL CONTROL
36	-	-
37	-	-
38	F901 16PK	IGNITION SWITCH OUTPUT (RUN)
39	Z921 14BK	GROUND
40	A927 12RD/OR	FUSED B(+)



MODULE-INTEGRATED POWER C5

MODULE-INTEGRATED POWER C5 - 40 WAY

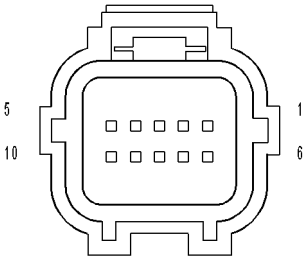
CAV	CIRCUIT	FUNCTION
1	-	-
2	F982 12PK/YL	IGNITION SWITCH OUTPUT (RUN-ACC)
3	-	-
4	C16 20DB/GY (EBL)	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
5	-	-
6	-	-
7	F983 20PK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
8	F504 20GY/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
9	T750 14YL/GY	STARTER RELAY OUTPUT
10	F525 18TN/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
11	-	-
12	F100 20PK/VT	FUSED IGNITION SWITCH OUTPUT (RUN)
13	-	-
14	-	-
15	-	-
16	Z902 14BK	GROUND
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	F500 20DG/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
25	W4 14BR/OR	FRONT WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT
26	Z909 20BK	GROUND
27	L1 18WT/LG	BACK-UP LAMP FEED
28	T315 14YL/BR	SHIFT MOTOR CONTROL A
29	T316 14YL/GY	SHIFT MOTOR CONTROL B
30	-	-
31	-	-
32	W3 14BR/WT	FRONT WIPER HIGH/LOW RELAY LOW SPEED OUTPUT
33	-	-
34	-	-
35	-	-
36	-	-
37	L63 18WT/DG	LEFT REAR TURN SIGNAL CONTROL
38	-	-
39	Z118 18BK/YL	GROUND
40	F921 12PK/WT	FUSED IGNITION SWITCH OUTPUT (RUN)



**MODULE-
INTEGRATED
POWER
EYELET**

MODULE-INTEGRATED POWER EYELET - 1 WAY

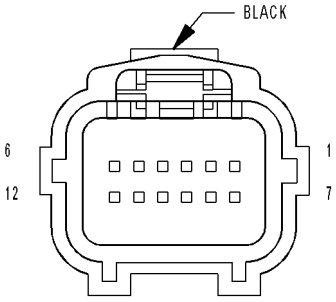
CAV	CIRCUIT	FUNCTION
L1	A1 04RD	B(+)



**MODULE-
OCCUPANT
CLASSIFICATION C1**

MODULE-OCCUPANT CLASSIFICATION C1 - 10 WAY

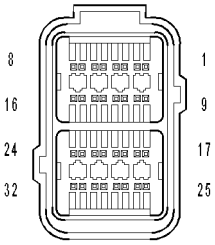
CAV	CIRCUIT	FUNCTION
1	A956 20RD	FUSED B(+)
2	F201 20PK/OR	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	-	-
4	D55 20WT/OR	CAN B BUS(+)
5	D54 20WT	CAN B BUS(-)
6	-	-
7	R263 20LB/VT	DRIVER SEAT POSITION SENSOR VOLTAGE
8	-	-
9	R261 20LB/WT	DRIVER SEAT POSITION SENSOR DATA
10	Z917 20BK	GROUND



**MODULE-
OCCUPANT
CLASSIFICATION C2**

MODULE-OCCUPANT CLASSIFICATION C2 - BLACK 12 WAY

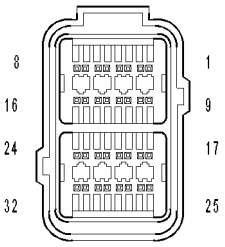
CAV	CIRCUIT	FUNCTION
1	R701 20LG	SEAT WEIGHT SENSOR 5 VOLT
2	R264 20VT/LB	PASSENGER SEAT POSITION SENSOR VOLTAGE
3	R717 20LG/DG	SEAT WEIGHT LEFT FRONT SENSOR SIGNAL
4	-	-
5	R718 20LB/DG	SEAT WEIGHT RIGHT FRONT SENSOR SIGNAL
6	-	-
7	R706 20LB/OR	SEAT WEIGHT RIGHT REAR SENSOR SIGNAL
8	-	-
9	R705 20LG/OR	SEAT WEIGHT LEFT REAR SENSOR SIGNAL
10	-	-
11	R262 20WT/LB	PASSENGER SEAT POSITION SENSOR DATA
12	R728 20LB/YL	SEAT WEIGHT SENSOR GROUND



MODULE-OCCUPANT RESTRAINT CONTROLLER C1

MODULE-OCCUPANT RESTRAINT CONTROLLER C1 - 32 WAY

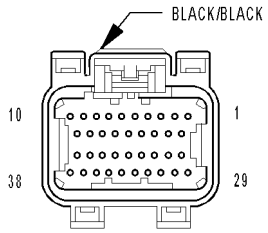
CAV	CIRCUIT	FUNCTION
1	R53 20LG/YL	DRIVER SEAT BELT TENSIONER LINE 2
2	R55 20LG/DG	DRIVER SEAT BELT TENSIONER LINE 1
3	R56 20LB/DG	PASSENGER SEAT BELT TENSIONER LINE 1
4	R54 20LB/YL	PASSENGER SEAT BELT TENSIONER LINE 2
5	-	-
6	-	-
7	-	-
8	-	-
9	-	-
10	-	-
11	-	-
12	-	-
13	-	-
14	-	-
15	R13 20LG/VT (SIDE AIRBAG)	LEFT SIDE IMPACT SENSOR 1 SIGNAL
16	R16 20BR/LG (SIDE AIRBAG)	RIGHT SIDE IMPACT SENSOR 1 GROUND
17	-	-
18	-	-
19	R15 20LG/BR (SIDE AIRBAG)	LEFT SIDE IMPACT SENSOR 1 GROUND
20	Z104 20BK/LG	GROUND
21	-	-
22	-	-
23	-	-
24	R14 20TN/LG (SIDE AIRBAG)	RIGHT SIDE IMPACT SENSOR 1 SIGNAL
25	R1 20LB/BR (SIDE AIRBAG)	LEFT CURTAIN SQUIB 1 LINE 2
26	R3 20LB/OR (SIDE AIRBAG)	LEFT CURTAIN SQUIB 1 LINE 1
27	R4 20OR/LB (SIDE AIRBAG)	RIGHT CURTAIN SQUIB 1 LINE 1
28	R2 20WT/LB (SIDE AIRBAG)	RIGHT CURTAIN SQUIB 1 LINE 2
29	-	-
30	-	-
31	-	-
32	-	-



MODULE-OCCUPANT RESTRAINT CONTROLLER C2

MODULE-OCCUPANT RESTRAINT CONTROLLER C2 - 32 WAY

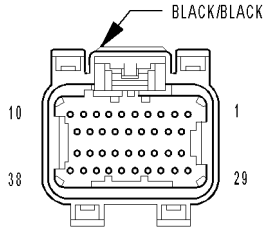
CAV	CIRCUIT	FUNCTION
1	R43 20LG/BR	DRIVER SQUIB 1 LINE 2
2	R45 20LG/OR	DRIVER SQUIB 1 LINE 1
3	R63 20LG/WT	DRIVER SQUIB 2 LINE 1
4	R61 20LG/VT	DRIVER SQUIB 2 LINE 2
5	R42 20LB/BR	PASSENGER SQUIB 1 LINE 2
6	R44 20LB/OR	PASSENGER SQUIB 1 LINE 1
7	R64 20LB/WT	PASSENGER SQUIB 2 LINE 1
8	R62 20LB/VT	PASSENGER SQUIB 2 LINE 2
9	G104 20VT/GY	PASSENGER AIRBAG INDICATOR DRIVER
10	-	-
11	-	-
12	R82 20WT/LB	RIGHT FRONT IMPACT SENSOR GROUND
13	-	-
14	-	-
15	D55 20WT/OR	CAN B BUS(+)
16	F201 20PK/OR	FUSED IGNITION SWITCH OUTPUT (RUN-START)
17	-	-
18	-	-
19	R104 20LB/LG	PASSENGER AIRBAG MUX SWITCH RETURN
20	R81 20LB/WT	LEFT FRONT IMPACT SENSOR GROUND
21	-	-
22	-	-
23	D54 20WT	CAN B BUS(-)
24	F100 20PK/VT	FUSED IGNITION SWITCH OUTPUT (RUN)
25	R79 20LB/VT	LEFT FRONT IMPACT SENSOR SIGNAL
26	R80 20VT/LB	RIGHT FRONT IMPACT SENSOR SIGNAL
27	R106 20LG/LB	PASSENGER AIRBAG MUX SWITCH SENSE
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-



MODULE-POWERTRAIN CONTROL C1 (3.7L)

MODULE-POWERTRAIN CONTROL C1 (3.7L) - BLACK/BLACK 38 WAY

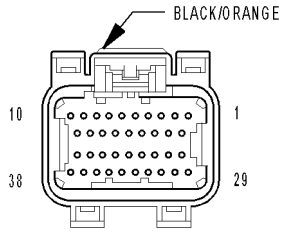
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	-	-
5	-	-
6	-	-
7	-	-
8	-	-
9	Z913 16BK	GROUND
10	-	-
11	F202 20PK/GY	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	F1 20PK/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	Z937 16BK	GROUND
19	-	-
20	G6 18VT/GY	ENGINE OIL PRESSURE SIGNAL
21	-	-
22	-	-
23	-	-
24	-	-
25	D20 20WT/LG	SCI RECEIVE (PCM)
26	D16 20WT/OR	SCI RECEIVE (TCM)
27	F856 20YL/PK	5 VOLT SUPPLY
28	-	-
29	A919 18RD	FUSED B(+)
30	F924 20PK/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
31	K141 18DB/YL	O2 1/2 SIGNAL
32	K902 20BR/DG	O2 RETURN (UPSTREAM)
33	K243 20BR	O2 2/2 SIGNAL
34	D65 20WT/LG	CAN C BUS(+)
35	D64 20WT/LB	CAN C BUS(-)
36	D21 20WT/GY	SCI TRANSMIT (PCM)
37	D15 20BR/WT (A/T)	SCI TRANSMIT (TCM)
38	-	-



MODULE-POWERTRAIN CONTROL C1 (4.7L)

MODULE-POWERTRAIN CONTROL C1 (4.7L) - BLACK/BLACK 38 WAY

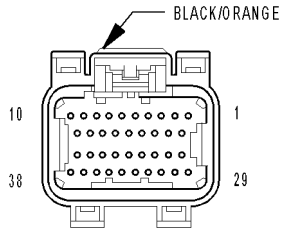
CAV	CIRCUIT	FUNCTION
1	K98 18DB/YL	COIL CONTROL NO. 8
2	-	-
3	K97 18BR	COIL CONTROL NO. 7
4	K28 18BR/LB	INJECTOR CONTROL NO. 8
5	K26 18BR/YL	INJECTOR CONTROL NO. 7
6	-	-
7	-	-
8	-	-
9	Z913 16BK	GROUND
10	-	-
11	F202 20PK/GY	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	F1 20PK/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	Z937 16BK	GROUND
19	-	-
20	G6 18VT/GY	ENGINE OIL PRESSURE SIGNAL
21	-	-
22	-	-
23	-	-
24	-	-
25	D20 20WT/LG	SCI RECEIVE (PCM)
26	D16 20WT/OR	SCI RECEIVE (TCM)
27	F856 20YL/PK	5 VOLT SUPPLY
28	-	-
29	A919 18RD	FUSED B(+)
30	F924 20PK/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
31	K141 18DB/YL	O2 1/2 SIGNAL
32	K902 20BR/DG	O2 RETURN (UPSTREAM)
33	K243 20BR	O2 2/2 SIGNAL
34	D65 20WT/LG	CAN C BUS(+)
35	D64 20WT/LB	CAN C BUS(-)
36	D21 20WT/GY	SCI TRANSMIT (PCM)
37	D15 20BR/WT (A/T)	SCI TRANSMIT (TCM)
38	-	-



MODULE-POWERTRAIN CONTROL C2 (4.7L)

MODULE-POWERTRAIN CONTROL C2 (4.7L) - BLACK/ORANGE 38 WAY

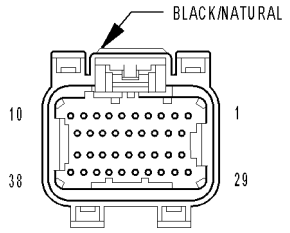
CAV	CIRCUIT	FUNCTION
1	K10 18DB/OR	COIL CONTROL NO. 6
2	K16 18DB/YL	COIL CONTROL NO. 5
3	K15 18DB	COIL CONTROL NO. 4
4	K58 18BR/VT	INJECTOR CONTROL NO. 6
5	K38 18BR/OR	INJECTOR CONTROL NO. 5
6	-	-
7	K18 18DB/OR	COIL CONTROL NO. 3
8	K35 20DB/VT	EGR SOL CONTROL
9	K17 18DB/TN	COIL CONTROL NO. 2
10	K19 18DB/DG	COIL CONTROL NO. 1
11	K14 18BR/TN	INJECTOR CONTROL NO. 4
12	K13 18BR/LB	INJECTOR CONTROL NO. 3
13	K12 18BR/DB	INJECTOR CONTROL NO. 2
14	K11 18BR/YL	INJECTOR CONTROL NO. 1
15	-	-
16	-	-
17	K199 18BR/VT	O2 2/1 HEATER CONTROL
18	K99 18BR/TN	O2 1/1 HEATER CONTROL
19	K20 18BR/GY	GEN FIELD CONTROL
20	K2 20VT/OR	ECT SIGNAL
21	K22 20BR/OR	TP NO. 1 SIGNAL
22	K34 20DB/LG	EGR SIGNAL
23	K1 20VT/BR	MAP SIGNAL
24	K942 20BR/LG	KNOCK SENSOR NO. 1 RETURN
25	K42 20DB/OR	KNOCK SENSOR NO. 1 SIGNAL
26	-	-
27	K900 20DB/DG	SENSOR GROUND
28	K961 20BR/VT	IAC SIGNAL
29	F855 20PK/YL	5 VOLT SUPPLY
30	K21 20BR/WT	IAT SIGNAL
31	K41 20DB/LB	O2 1/1 SIGNAL
32	K904 20DB/DG	O2 RETURN (DOWNSTREAM)
33	K43 20DB/LG	O2 2/1 SIGNAL
34	K44 20DB/GY	CMP SIGNAL
35	K24 20BR/LB	CKP SIGNAL
36	K242 20BR/WT	KNOCK SENSOR NO. 2 SIGNAL
37	K924 20PK/RD	KNOCK SENSOR NO. 2 RETURN
38	K61 20VT/GY	IAC CONTROL



MODULE-POWERTRAIN CONTROL C2 (3.7L)

MODULE-POWERTRAIN CONTROL C2 (3.7L) - BLACK/ORANGE 38 WAY

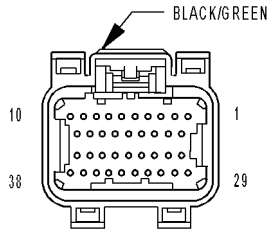
CAV	CIRCUIT	FUNCTION
1	K10 18DB/OR	COIL CONTROL NO. 6
2	K16 18DB/YL	COIL CONTROL NO. 5
3	K15 18DB	COIL CONTROL NO. 4
4	K58 18BR/VT	INJECTOR CONTROL NO. 6
5	K38 18BR/OR	INJECTOR CONTROL NO. 5
6	-	-
7	K18 18DB/OR	COIL CONTROL NO. 3
8	-	-
9	K17 18DB/TN	COIL CONTROL NO. 2
10	K19 18DB/DG	COIL CONTROL NO. 1
11	K14 18BR/TN	INJECTOR CONTROL NO. 4
12	K13 18BR/LB	INJECTOR CONTROL NO. 3
13	K12 18BR/DB	INJECTOR CONTROL NO. 2
14	K11 18BR/YL	INJECTOR CONTROL NO. 1
15	-	-
16	-	-
17	K199 18BR/VT	O2 2/1 HEATER CONTROL
18	K99 18BR/TN	O2 1/1 HEATER CONTROL
19	K20 18BR/GY	GEN FIELD CONTROL
20	K2 20VT/OR	ECT SIGNAL
21	K22 20BR/OR	TP NO. 1 SIGNAL
22	-	-
23	K1 20VT/BR	MAP SIGNAL
24	K942 20BR/LG	KNOCK SENSOR NO. 1 RETURN
25	K42 20DB/OR	KNOCK SENSOR NO. 1 SIGNAL
26	-	-
27	K900 20DB/DG	SENSOR GROUND
28	K961 20BR/VT	IAC SIGNAL
29	F855 20PK/YL	5 VOLT SUPPLY
30	K21 20BR/WT	IAT SIGNAL
31	K41 20DB/LB	O2 1/1 SIGNAL
32	K904 20DB/DG	O2 RETURN (DOWNSTREAM)
33	K43 20DB/LG	O2 2/1 SIGNAL
34	K44 20DB/GY	CMP SIGNAL
35	K24 20BR/LB	CKP SIGNAL
36	K242 20BR/WT	KNOCK SENSOR NO. 2 SIGNAL
37	K924 20PK/RD	KNOCK SENSOR NO. 2 RETURN
38	K61 20VT/GY	IAC CONTROL



MODULE-POWERTRAIN CONTROL C3

MODULE-POWERTRAIN CONTROL C3 - BLACK/NATURAL 38 WAY

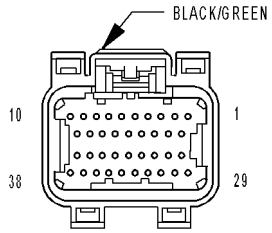
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	K51 20BR/GY	ASD RELAY CONTROL
4	-	-
5	V35 20VT/OR	S/C VENT SOL CONTROL
6	-	-
7	V32 20VT/YL	S/C SUPPLY
8	K106 20VT/LB	NVLD SOL CONTROL
9	K299 18BR/OR	O2 1/2 HEATER CONTROL
10	K399 18BR/GY	O2 2/2 HEATER CONTROL
11	C13 20LB/OR	A/C CLUTCH RELAY CONTROL
12	V36 20VT/YL	S/C VACUUM SOL CONTROL
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	A955 16RD	ASD RELAY OUTPUT
20	K52 20DB/WT	EVAP PURGE SOL CONTROL
21	T41 20YL/DB (A/T)	TRS T41 SENSE (P/N SENSE)
21	T141 20YL/OR (M/T)	TRS T141 SENSE (P/N SENSE)
22	-	-
23	B29 20DG/WT	BRAKE SWITCH SIGNAL
24	-	-
25	-	-
26	-	-
27	-	-
28	A955 16RD	ASD RELAY OUTPUT
29	K70 20DB/BR	EVAP PURGE SOL SIGNAL
30	-	-
31	-	-
32	-	-
33	-	-
34	V37 20VT	S/C SWITCH NO. 1 SIGNAL
35	K107 20VT/WT	NVLD SWITCH SIGNAL
36	-	-
37	K31 20BR	FUEL PUMP RELAY CONTROL
38	T752 20DG/OR	STARTER RELAY CONTROL



MODULE-POWERTRAIN CONTROL C4 (545RFE)

MODULE-POWERTRAIN CONTROL C4 (545RFE) - BLACK/GREEN 38 WAY

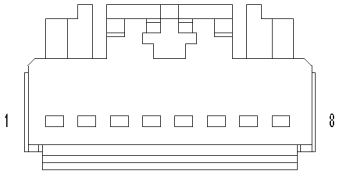
CAV	CIRCUIT	FUNCTION
1	T60 20YL/RD	OD SOLENOID CONTROL
2	T259 20YL/DG	4C SOLENOID CONTROL
3	-	-
4	T140 20BR/YL	MS SOLENOID CONTROL
5	-	-
6	T219 20DG/YL	2C SOLENOID CONTROL
7	-	-
8	T59 20VT/PK	UD SOLENOID CONTROL
9	-	-
10	T20 20DG/WT	L/R SOLENOID CONTROL
11	T118 20DG	PRESSURE CONTROL SOLENOID CONTROL
12	Z908 16BK	GROUND
13	Z977 16BK	GROUND
14	Z904 20BK	GROUND
15	T1 20YL/PK	TRS T1 SENSE
16	T3 20YL/PK	TRS T3 SENSE
17	T6 20DG	TOW/HAUL OVERDRIVE OFF SWITCH SENSE
18	T15 20YL/BK	TRANSMISSION CONTROL RELAY CONTROL
19	T16 16YL/OR	TRANSMISSION CONTROL RELAY OUTPUT
20	T48 20BR/YL	4C PRESSURE SWITCH SENSE
21	T29 20LB/RD	UD PRESSURE SWITCH SENSE
22	T9 20DG/TN	OD PRESSURE SWITCH SENSE
23	-	-
24	-	-
25	-	-
26	T4 20BR/YL	TRS T2 SENSE
27	-	-
28	T16 16YL/OR	TRANSMISSION CONTROL RELAY OUTPUT
29	T50 20VT/RD	L/R PRESSURE SWITCH SENSE
30	T147 20BR/YL	2C PRESSURE SWITCH SENSE
31	T38 20YL/BR	LINE PRESSURE SENSOR SIGNAL
32	T14 20YL/PK	OUTPUT SPEED SENSOR SIGNAL
33	T52 20YL/PK	INPUT SPEED SENSOR SIGNAL
34	T13 20DG/VT	SENSOR GROUND
35	T54 20YL/PK	TRANSMISSION TEMPERATURE SENSOR SIGNAL
36	-	-
37	T42 20YL/PK	TRS T42 SENSE
38	T16 16YL/OR	TRANSMISSION CONTROL RELAY OUTPUT



MODULE-POWERTRAIN CONTROL C4 (42RLE)

MODULE-POWERTRAIN CONTROL C4 (42RLE) - BLACK/GREEN 38 WAY

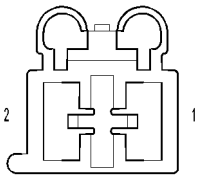
CAV	CIRCUIT	FUNCTION
1	T60 20YL/RD	OD SOLENOID CONTROL
2	T59 20VT/PK	UD SOLENOID CONTROL
3	-	-
4	-	-
5	-	-
6	T19 20YL/DB	2-4 SOLENOID CONTROL
7	-	-
8	-	-
9	-	-
10	T20 20DG/WT	L/R SOLENOID CONTROL
11	-	-
12	Z908 16BK	GROUND
13	Z977 16BK	GROUND
14	Z904 20BK	GROUND
15	T1 20YL/PK	TRS T1 SENSE
16	T3 20YL/PK	TRS T3 SENSE
17	T6 20DG	TOW/HAUL OVERDRIVE OFF SWITCH SENSE
18	T15 20YL/BK	TRANSMISSION CONTROL RELAY CONTROL
19	T16 16YL/OR	TRANSMISSION CONTROL RELAY OUTPUT
20	-	-
21	-	-
22	T9 20DG/TN	OD PRESSURE SWITCH SENSE
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	T16 16YL/OR	TRANSMISSION CONTROL RELAY OUTPUT
29	T50 20VT/RD	L/R PRESSURE SWITCH SENSE
30	T47 20YL/DG	2-4 PRESSURE SWITCH SENSE
31	-	-
32	T14 20YL/PK	OUTPUT SPEED SENSOR SIGNAL
33	T52 20YL/PK	INPUT SPEED SENSOR SIGNAL
34	T13 20DG/VT	SENSOR GROUND
35	T54 20YL/PK	TRANSMISSION TEMPERATURE SENSOR SIGNAL
36	-	-
37	T42 20YL/PK	TRS T42 SENSE
38	T16 16YL/OR	TRANSMISSION CONTROL RELAY OUTPUT



**MODULE-
SENTRY KEY
REMOTE ENTRY**

MODULE-SENTRY KEY REMOTE ENTRY - 8 WAY

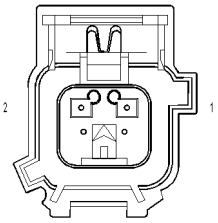
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	F202 20PK/GY	FUSED IGNITION SWITCH OUTPUT (RUN-START)
4	Z109 20BK/GY	GROUND
5	A918 18RD/LB	FUSED B(+)
6	D55 20WT/OR	CAN B BUS(+)
7	D54 20WT	CAN B BUS(-)
8	-	-



**MOTOR-
BLOWER**

MOTOR-BLOWER - 2 WAY

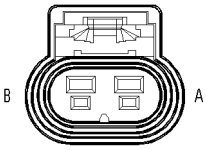
CAV	CIRCUIT	FUNCTION
1	C70 12DB/YL	BLOWER MOTOR DRIVER
2	C7 12DB	BLOWER MOTOR SUPPLY



**MOTOR-
IAC**

MOTOR-IAC - 2 WAY

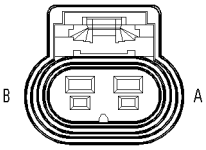
CAV	CIRCUIT	FUNCTION
1	K961 20BR/VT	IAC SIGNAL
2	K61 20VT/GY	IAC CONTROL



**MOTOR-
WINDOW-
LEFT
FRONT**

MOTOR-WINDOW-LEFT FRONT - 2 WAY

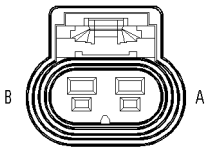
CAV	CIRCUIT	FUNCTION
A	Q21 14OR/WT	DRIVER WINDOW DRIVER DOWN
B	Q11 14OR/LG	DRIVER WINDOW DRIVER UP



**MOTOR-
WINDOW-
LEFT
REAR
(QUAD CAB/
POWER CONVENIENCE)**

MOTOR-WINDOW-LEFT REAR (QUAD CAB/POWER CONVENIENCE) - 2 WAY

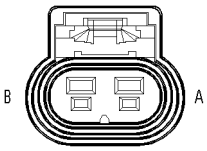
CAV	CIRCUIT	FUNCTION
A	Q211 14TN/LB	LEFT REAR WINDOW DRIVER (DOWN)
B	Q111 14TN/YL	LEFT REAR WINDOW DRIVER (UP)



MOTOR-WINDOW-RIGHT FRONT

MOTOR-WINDOW-RIGHT FRONT - 2 WAY

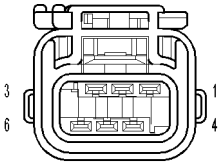
CAV	CIRCUIT	FUNCTION
A	Q22 14OR/VT	PASSENGER WINDOW DRIVER DOWN
B	Q12 14OR/BR	PASSENGER WINDOW DRIVER UP



MOTOR-WINDOW-RIGHT REAR (QUAD CAB/ POWER CONVENIENCE)

MOTOR-WINDOW-RIGHT REAR (QUAD CAB/POWER CONVENIENCE) - 2 WAY

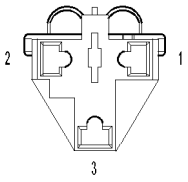
CAV	CIRCUIT	FUNCTION
A	Q212 14OR/VT	RIGHT REAR WINDOW DRIVER (DOWN)
B	Q112 14OR/BR	RIGHT REAR WINDOW DRIVER (UP)



MOTOR-WINDSHIELD WIPER

MOTOR-WINDSHIELD WIPER - 6 WAY

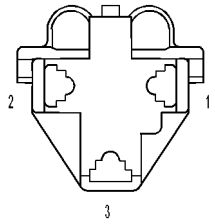
CAV	CIRCUIT	FUNCTION
1	-	-
2	W7 20BR/GY	FRONT WIPER PARK SWITCH SENSE
3	-	-
4	Z103 14BK/WT	GROUND
5	W3 14BR/WT	FRONT WIPER HIGH/LOW RELAY LOW SPEED OUTPUT
6	W4 14BR/OR	FRONT WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT



POWER OUTLET-CONSOLE

POWER OUTLET-CONSOLE - 3 WAY

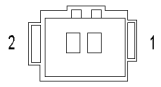
CAV	CIRCUIT	FUNCTION
1	A12 16RD/TN	FUSED B(+)
2	-	-
3	Z1 16BK	GROUND



POWER OUTLET- INSTRUMENT PANEL

POWER OUTLET-INSTRUMENT PANEL - 3 WAY

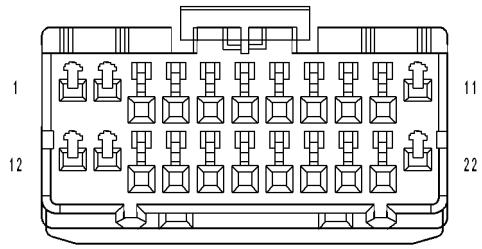
CAV	CIRCUIT	FUNCTION
1	F306 18DB/PK	FUSED B(+)
2	-	-
3	Z959 18BK	GROUND



PUMP- WASHER- WINDSHIELD

PUMP-WASHER-WINDSHIELD - 2 WAY

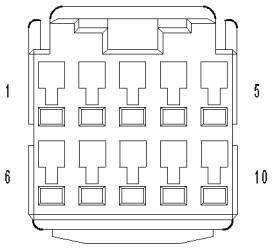
CAV	CIRCUIT	FUNCTION
1	W10 18BR	FRONT WASHER PUMP MOTOR CONTROL
2	Z243 18BK	GROUND



RADIO C1

RADIO C1 - 22 WAY

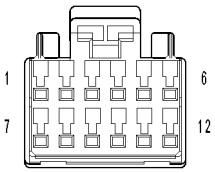
CAV	CIRCUIT	FUNCTION
1	A920 18RD/BK	FUSED B(+)
2	-	-
3	-	-
4	X716 20GY/TN (HANDS FREE)	CNV-HANDS FREE VOICE (+)
5	D55 20WT/OR	CAN B BUS(+)
6	D54 20WT	CAN B BUS(-)
7	X54 18GY (BASE)	RADIO-RIGHT FRONT AUDIO (+)
8	X56 18GY/BR (BASE)	RADIO-RIGHT FRONT AUDIO (-)
9	X55 20DG/BR (BASE)	RADIO-LEFT FRONT AUDIO (-)
10	X53 20DG (BASE)	RADIO-LEFT FRONT AUDIO (+)
11	Z514 16BK/LG	GROUND
12	A920 18RD/BK	FUSED B(+)
13	-	-
14	-	-
15	-	-
16	X776 20TN/GY (HANDS FREE)	CNV-HANDS FREE VOICE (-)
17	X795 20DG (HANDS FREE)	COMMON AUDIO OUTPUT
18	X51 18DG/DB	RADIO-LEFT REAR AUDIO (+)
19	X57 18DG/OR	RADIO-LEFT REAR AUDIO (-)
20	X58 18GY/OR	RADIO-RIGHT REAR AUDIO (-)
21	X52 18GY/DB	RADIO-RIGHT REAR AUDIO (+)
22	Z515 16BK	GROUND



RADIO C2
(SATELLITE RADIO)

RADIO C2 (SATELLITE RADIO) - 10 WAY

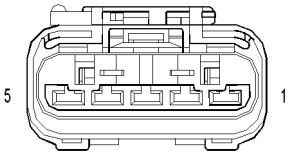
CAV	CIRCUIT	FUNCTION
1	X16 20DG/LB	AUDIO SIGNAL RIGHT (+)
2	X917 20DG	AUDIO SIGNAL COMMON
3	-	-
4	-	-
5	-	-
6	X17 20DG/OR	AUDIO SIGNAL LEFT (+)
7	-	-
8	-	-
9	-	-
10	-	-



RECEIVER-
SATELLITE

RECEIVER-SATELLITE - 12 WAY

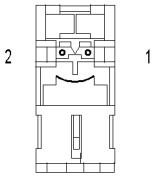
CAV	CIRCUIT	FUNCTION
1	A920 18RD/BK	FUSED B(+)
2	-	-
3	Z960 20BK/DB	GROUND
4	-	-
5	-	-
6	X17 20DG/OR	AUDIO SIGNAL LEFT (+)
7	D54 20WT	CAN B BUS(-)
8	D55 20WT/OR	CAN B BUS(+)
9	-	-
10	-	-
11	X917 20DG	AUDIO SIGNAL COMMON
12	X16 20DG/LB	AUDIO SIGNAL RIGHT (+)



RESISTOR-
BLOWER
MOTOR

RESISTOR-BLOWER MOTOR - 5 WAY

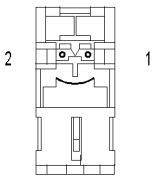
CAV	CIRCUIT	FUNCTION
1	C75 12DB/GY	BLOWER MOTOR HIGH SPEED
2	C70 12DB/YL	BLOWER MOTOR DRIVER
3	C73 14DB/VT	BLOWER MOTOR M2 SPEED
4	C72 14DB/OR	BLOWER MOTOR M1 SPEED
5	C71 16DB/BR	BLOWER MOTOR LOW SPEED



SEAT BELT-TENSIONER-DRIVER

SEAT BELT-TENSIONER-DRIVER - 2 WAY

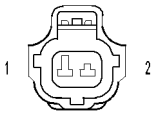
CAV	CIRCUIT	FUNCTION
1	R53 20LG/YL	DRIVER SEAT BELT TENSIONER LINE 2
2	R55 20LG/DG	DRIVER SEAT BELT TENSIONER LINE 1



SEAT BELT-TENSIONER-PASSENGER

SEAT BELT-TENSIONER-PASSENGER - 2 WAY

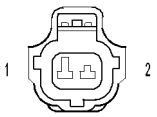
CAV	CIRCUIT	FUNCTION
1	R54 20LB/YL	PASSENGER SEAT BELT TENSIONER LINE 2
2	R56 20LB/DG	PASSENGER SEAT BELT TENSIONER LINE 1



SENSOR-AMBIENT AIR TEMPERATURE

SENSOR-AMBIENT AIR TEMPERATURE - 2 WAY

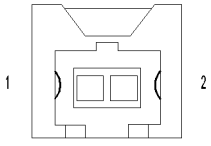
CAV	CIRCUIT	FUNCTION
1	G31 20VT/OR	AAT SIGNAL
2	G931 20VT/BR	SENSOR GROUND



SENSOR-BATTERY TEMPERATURE

SENSOR-BATTERY TEMPERATURE - 2 WAY

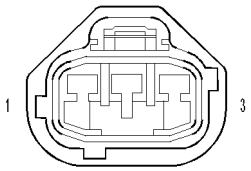
CAV	CIRCUIT	FUNCTION
1	K25 20DB/VT	BATT TEMP SIGNAL
2	K91 20DB/YL	BATT TEMP RETURN



SENSOR-BRAKE FLUID LEVEL

SENSOR-BRAKE FLUID LEVEL - 2 WAY

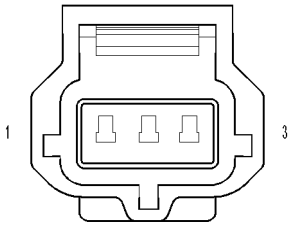
CAV	CIRCUIT	FUNCTION
1	B20 20DG/OR	BRAKE FLUID LEVEL SWITCH SENSE
2	Z420 20BK/OR	GROUND



**SENSOR-
CAMSHAFT
POSITION**

SENSOR-CAMSHAFT POSITION - 3 WAY

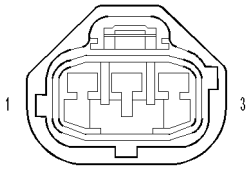
CAV	CIRCUIT	FUNCTION
1	K44 20DB/GY	CMP SIGNAL
2	K900 20DB/DG	SENSOR GROUND
3	F856 20YL/PK	5 VOLT SUPPLY



**SENSOR-
CRANKSHAFT
POSITION
(3.7L)**

SENSOR-CRANKSHAFT POSITION (3.7L) - 3 WAY

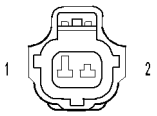
CAV	CIRCUIT	FUNCTION
1	K24 20BR/LB	CKP SIGNAL
2	K900 20DB/DG	SENSOR GROUND
3	F855 20PK/YL	5 VOLT SUPPLY



**SENSOR-
CRANKSHAFT
POSITION
(4.7L)**

SENSOR-CRANKSHAFT POSITION (4.7L) - 3 WAY

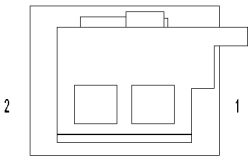
CAV	CIRCUIT	FUNCTION
1	K24 20BR/LB	CKP SIGNAL
2	K900 20DB/DG	SENSOR GROUND
3	F855 20PK/YL	5 VOLT SUPPLY



**SENSOR-
ENGINE
COOLANT
TEMPERATURE**

SENSOR-ENGINE COOLANT TEMPERATURE - 2 WAY

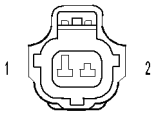
CAV	CIRCUIT	FUNCTION
1	K2 20VT/OR	ECT SIGNAL
2	K900 20DB/DG	SENSOR GROUND



**SENSOR-
EVAPORATOR
TEMPERATURE**

SENSOR-EVAPORATOR TEMPERATURE - 2 WAY

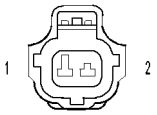
CAV	CIRCUIT	FUNCTION
1	C21 20DB/LG	EVAPORATOR TEMPERATURE SENSOR SIGNAL
2	C121 20DB/DG	SENSOR GROUND



SENSOR-FRONT IMPACT-LEFT

SENSOR-FRONT IMPACT-LEFT - 2 WAY

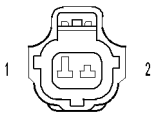
CAV	CIRCUIT	FUNCTION
1	R81 20LB/WT	LEFT FRONT IMPACT SENSOR GROUND
2	R79 20LB/VT	LEFT FRONT IMPACT SENSOR SIGNAL



SENSOR-FRONT IMPACT-RIGHT

SENSOR-FRONT IMPACT-RIGHT - 2 WAY

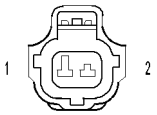
CAV	CIRCUIT	FUNCTION
1	R82 20WT/LB	RIGHT FRONT IMPACT SENSOR GROUND
2	R80 20VT/LB	RIGHT FRONT IMPACT SENSOR SIGNAL



SENSOR-INPUT SPEED (A/T)

SENSOR-INPUT SPEED (A/T) - 2 WAY

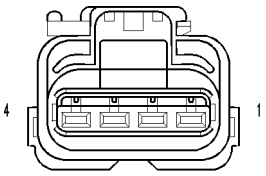
CAV	CIRCUIT	FUNCTION
1	T52 20YL/PK	INPUT SPEED SENSOR SIGNAL
2	T13 20DG/VT	SENSOR GROUND



SENSOR-INTAKE AIR TEMPERATURE

SENSOR-INTAKE AIR TEMPERATURE - 2 WAY

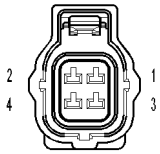
CAV	CIRCUIT	FUNCTION
1	K21 20BR/WT	IAT SIGNAL
2	K900 20DB/DG	SENSOR GROUND



SENSOR-KNOCK

SENSOR-KNOCK - 4 WAY

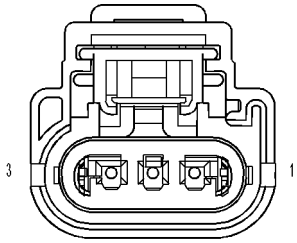
CAV	CIRCUIT	FUNCTION
1	K42 20DB/OR	KNOCK SENSOR NO. 1 SIGNAL
2	K942 20BR/LG	KNOCK SENSOR NO. 1 RETURN
3	K242 20BR/WT	KNOCK SENSOR NO. 2 SIGNAL
4	K924 20PK/RD	KNOCK SENSOR NO. 2 RETURN



**SENSOR-
LINE
PRESSURE
(4.7L A/T)**

SENSOR-LINE PRESSURE (4.7L A/T) - 4 WAY

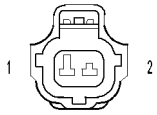
CAV	CIRCUIT	FUNCTION
1	K900 20DB/DG	SENSOR GROUND
2	F856 20YL/PK	5 VOLT SUPPLY
3	T38 20YL/BR	LINE PRESSURE SENSOR SIGNAL
4	-	-



**SENSOR-
MAP**

SENSOR-MAP - 3 WAY

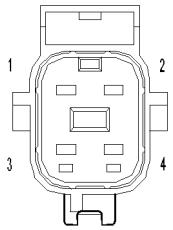
CAV	CIRCUIT	FUNCTION
1	K1 20VT/BR	MAP SIGNAL
2	K900 20DB/DG	SENSOR GROUND
3	F856 20YL/PK	5 VOLT SUPPLY



**SENSOR-
OUTPUT
SPEED
(A/T)**

SENSOR-OUTPUT SPEED (A/T) - 2 WAY

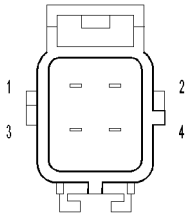
CAV	CIRCUIT	FUNCTION
1	T14 20YL/PK	OUTPUT SPEED SENSOR SIGNAL
2	T13 20DG/VT	SENSOR GROUND



**SENSOR-
OXYGEN-
LEFT FRONT
(3.7L)**

SENSOR-OXYGEN-LEFT FRONT (3.7L) - 4 WAY

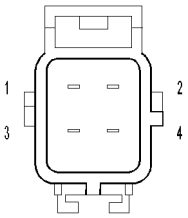
CAV	CIRCUIT	FUNCTION
1	K99 18BR/TN	O2 1/1 HEATER CONTROL
2	Z43 18BK/LB	GROUND
3	K902 20BR/DG	O2 RETURN (UPSTREAM)
4	K41 20DB/LB	O2 1/1 SIGNAL



**SENSOR-
OXYGEN-
LEFT
FRONT
(4.7L)**

SENSOR-OXYGEN-LEFT FRONT (4.7L) - 4 WAY

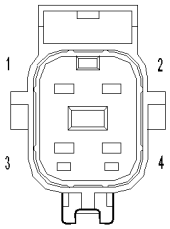
CAV	CIRCUIT	FUNCTION
1	K99 18BR/TN	O2 1/1 HEATER CONTROL
2	Z43 18BK/LB	GROUND
3	K902 20BR/DG	O2 RETURN (UPSTREAM)
4	K41 20DB/LB	O2 1/1 SIGNAL



SENSOR-OXYGEN-LEFT REAR (3.7L)

SENSOR-OXYGEN-LEFT REAR (3.7L) - 4 WAY

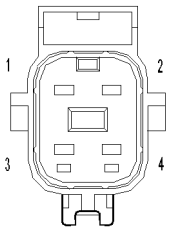
CAV	CIRCUIT	FUNCTION
1	K299 18BR/OR	O2 1/2 HEATER CONTROL
2	Z42 18BK/LG	GROUND
3	K904 20DB/DG	O2 RETURN (DOWNSTREAM)
4	K141 18DB/YL	O2 1/2 SIGNAL



SENSOR-OXYGEN-LEFT REAR (4.7L)

SENSOR-OXYGEN-LEFT REAR (4.7L) - 4 WAY

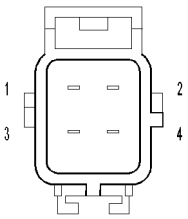
CAV	CIRCUIT	FUNCTION
1	K299 18BR/OR	O2 1/2 HEATER CONTROL
2	Z42 18BK/LG	GROUND
3	K904 20DB/DG	O2 RETURN (DOWNSTREAM)
4	K141 18DB/YL	O2 1/2 SIGNAL



SENSOR-OXYGEN-RIGHT FRONT (3.7L)

SENSOR-OXYGEN-RIGHT FRONT (3.7L) - 4 WAY

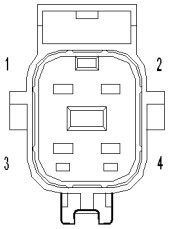
CAV	CIRCUIT	FUNCTION
1	K199 18BR/VT	O2 2/1 HEATER CONTROL
2	Z934 18BK	GROUND
3	K902 20BR/DG	O2 RETURN (UPSTREAM)
4	K43 20DB/LG	O2 2/1 SIGNAL



SENSOR-OXYGEN-RIGHT FRONT (4.7L)

SENSOR-OXYGEN-RIGHT FRONT (4.7L) - 4 WAY

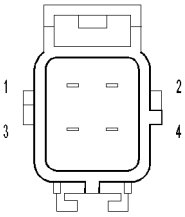
CAV	CIRCUIT	FUNCTION
1	K199 18BR/VT	O2 2/1 HEATER CONTROL
2	Z934 18BK	GROUND
3	K902 20BR/DG	O2 RETURN (UPSTREAM)
4	K43 20DB/LG	O2 2/1 SIGNAL



SENSOR-OXYGEN-RIGHT REAR (3.7L)

SENSOR-OXYGEN-RIGHT REAR (3.7L) - 4 WAY

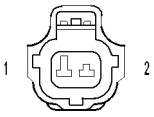
CAV	CIRCUIT	FUNCTION
1	K399 18BR/GY	O2 2/2 HEATER CONTROL
2	Z992 18BK	GROUND
3	K904 20DB/DG	O2 RETURN (DOWNSTREAM)
4	K243 20BR	O2 2/2 SIGNAL



SENSOR-OXYGEN-RIGHT REAR (4.7L)

SENSOR-OXYGEN-RIGHT REAR (4.7L) - 4 WAY

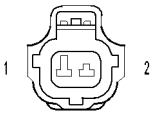
CAV	CIRCUIT	FUNCTION
1	K399 18BR/GY	O2 2/2 HEATER CONTROL
2	Z992 18BK	GROUND
3	K904 20DB/DG	O2 RETURN (DOWNSTREAM)
4	K243 20BR	O2 2/2 SIGNAL



SENSOR-SEAT TRACK POSITION-DRIVER

SENSOR-SEAT TRACK POSITION-DRIVER - 2 WAY

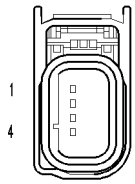
CAV	CIRCUIT	FUNCTION
1	R261 20LB/WT	DRIVER SEAT POSITION SENSOR DATA
2	R263 20LB/VT	DRIVER SEAT POSITION SENSOR VOLTAGE



SENSOR-SEAT TRACK POSITION-PASSENGER

SENSOR-SEAT TRACK POSITION-PASSENGER - 2 WAY

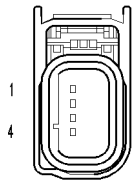
CAV	CIRCUIT	FUNCTION
1	R262 20WT/LB	PASSENGER SEAT POSITION SENSOR DATA
2	R264 20VT/LB	PASSENGER SEAT POSITION SENSOR VOLTAGE



SENSOR-SEAT WEIGHT-LEFT FRONT

SENSOR-SEAT WEIGHT-LEFT FRONT - 4 WAY

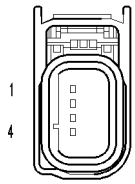
CAV	CIRCUIT	FUNCTION
1	R701 20LG	SEAT WEIGHT SENSOR 5 VOLT
2	R728 20LB/YL	SEAT WEIGHT SENSOR GROUND
3	-	-
4	R717 20LG/DG	SEAT WEIGHT LEFT FRONT SENSOR SIGNAL



SENSOR-SEAT WEIGHT-LEFT REAR

SENSOR-SEAT WEIGHT-LEFT REAR - 4 WAY

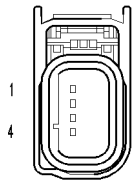
CAV	CIRCUIT	FUNCTION
1	R701 20LG	SEAT WEIGHT SENSOR 5 VOLT
2	R728 20LB/YL	SEAT WEIGHT SENSOR GROUND
3	-	-
4	R705 20LG/OR	SEAT WEIGHT LEFT REAR SENSOR SIGNAL



SENSOR-SEAT WEIGHT-RIGHT FRONT

SENSOR-SEAT WEIGHT-RIGHT FRONT - 4 WAY

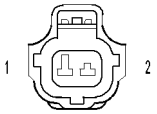
CAV	CIRCUIT	FUNCTION
1	R701 20LG	SEAT WEIGHT SENSOR 5 VOLT
2	R728 20LB/YL	SEAT WEIGHT SENSOR GROUND
3	-	-
4	R718 20LB/DG	SEAT WEIGHT RIGHT FRONT SENSOR SIGNAL



SENSOR-SEAT WEIGHT-RIGHT REAR

SENSOR-SEAT WEIGHT-RIGHT REAR - 4 WAY

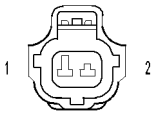
CAV	CIRCUIT	FUNCTION
1	R701 20LG	SEAT WEIGHT SENSOR 5 VOLT
2	R728 20LB/YL	SEAT WEIGHT SENSOR GROUND
3	-	-
4	R706 20LB/OR	SEAT WEIGHT RIGHT REAR SENSOR SIGNAL



SENSOR-SIDE IMPACT-LEFT 1

SENSOR-SIDE IMPACT-LEFT 1 - 2 WAY

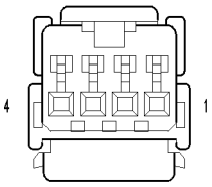
CAV	CIRCUIT	FUNCTION
1	R15 20LG/BR	LEFT SIDE IMPACT SENSOR 1 GROUND
2	R13 20LG/VT	LEFT SIDE IMPACT SENSOR 1 SIGNAL



SENSOR-SIDE IMPACT-RIGHT 1

SENSOR-SIDE IMPACT-RIGHT 1 - 2 WAY

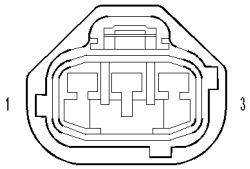
CAV	CIRCUIT	FUNCTION
1	R16 20BR/LG	RIGHT SIDE IMPACT SENSOR 1 GROUND
2	R14 20TN/LG	RIGHT SIDE IMPACT SENSOR 1 SIGNAL



SENSOR-SUN (HIGHLINE)

SENSOR-SUN (HIGHLINE) - 4 WAY

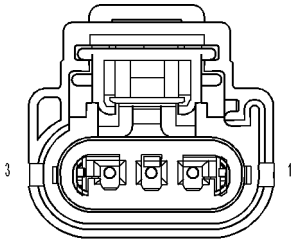
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	G939 20VT/DB	SUN SENSOR RETURN
4	G39 20VT/LB	SUN SENSOR SIGNAL



SENSOR-THROTTLE POSITION (4.7L)

SENSOR-THROTTLE POSITION (4.7L) - 3 WAY

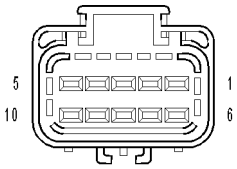
CAV	CIRCUIT	FUNCTION
1	F855 20PK/YL	5 VOLT SUPPLY
2	K22 20BR/OR	TP NO. 1 SIGNAL
3	K900 20DB/DG	SENSOR GROUND



SENSOR-THROTTLE POSITION (3.7L)

SENSOR-THROTTLE POSITION (3.7L) - 3 WAY

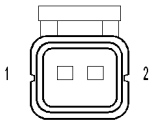
CAV	CIRCUIT	FUNCTION
1	F855 20PK/YL	5 VOLT SUPPLY
2	K900 20DB/DG	SENSOR GROUND
3	K22 20BR/OR	TP NO. 1 SIGNAL



SENSOR-TRANSMISSION RANGE (3.7L A/T)

SENSOR-TRANSMISSION RANGE (3.7L A/T) - 10 WAY

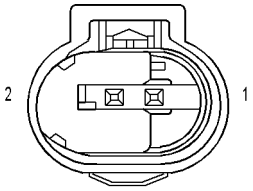
CAV	CIRCUIT	FUNCTION
1	T16 16YL/OR	TRANSMISSION CONTROL RELAY OUTPUT
2	-	-
3	K900 20DB/DG	SENSOR GROUND
4	T54 20YL/PK	TRANSMISSION TEMPERATURE SENSOR SIGNAL
5	-	-
6	-	-
7	T1 20YL/PK	TRS T1 SENSE
8	T3 20YL/PK	TRS T3 SENSE
9	T42 20YL/PK	TRS T42 SENSE
10	T41 20YL/DB	TRS T41 SENSE (P/N SENSE)



SENSOR-WASHER FLUID LEVEL-FRONT REAR

SENSOR-WASHER FLUID LEVEL-FRONT REAR - 2 WAY

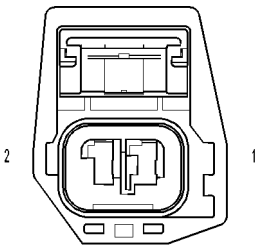
CAV	CIRCUIT	FUNCTION
1	G180 20VT/YL	FCM SENSOR RETURN
2	W1 20BR/TN	WASHER FLUID LEVEL SWITCH SENSE



SENSOR-WHEEL SPEED-ABS-LEFT FRONT (AWAL)

SENSOR-WHEEL SPEED-ABS-LEFT FRONT (AWAL) - 2 WAY

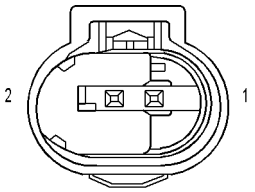
CAV	CIRCUIT	FUNCTION
1	B8 20DG/TN	LEFT FRONT WHEEL SPEED SENSOR SIGNAL
2	B9 20DG/LG	LEFT FRONT WHEEL SPEED SENSOR SUPPLY



SENSOR-WHEEL SPEED ABS-REAR

SENSOR-WHEEL SPEED-ABS-REAR - 2 WAY

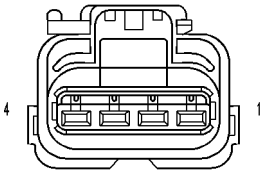
CAV	CIRCUIT	FUNCTION
1	B22 20DG/YL	REAR WHEEL SPEED SENSOR SIGNAL
2	B222 20DG/WT	REAR WHEEL SPEED SENSOR SUPPLY



SENSOR-
WHEEL SPEED-
ABS-
RIGHT FRONT
(AWAL)

SENSOR-WHEEL SPEED-ABS-RIGHT FRONT (AWAL) - 2 WAY

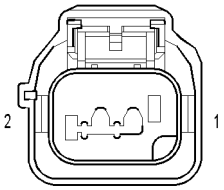
CAV	CIRCUIT	FUNCTION
1	B6 20DG/WT	RIGHT FRONT WHEEL SPEED SENSOR SIGNAL
2	B7 20DG/VT	RIGHT FRONT WHEEL SPEED SENSOR SUPPLY



SERVO-
SPEED
CONTROL

SERVO-SPEED CONTROL - 4 WAY

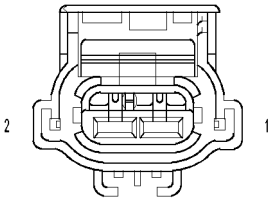
CAV	CIRCUIT	FUNCTION
1	V36 20VT/YL	S/C VACUUM SOL CONTROL
2	V35 20VT/OR	S/C VENT SOL CONTROL
3	V30 20VT/WT	S/C BRAKE SWITCH OUTPUT
4	Z155 20BK/LG	GROUND



SOLENOID-
BRAKE
TRANSMISSION
SHIFT

SOLENOID-BRAKE TRANSMISSION SHIFT - 2 WAY

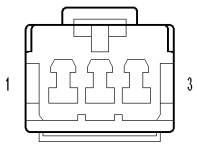
CAV	CIRCUIT	FUNCTION
1	B30 20DG/OR	BTSI SOLENOID CONTROL
2	Z101 20BK/VT	GROUND



SOLENOID-
EVAP/PURGE

SOLENOID-EVAP/PURGE - 2 WAY

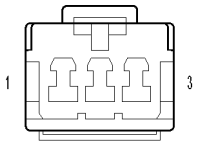
CAV	CIRCUIT	FUNCTION
1	K70 20DB/BR	EVAP PURGE SOL SIGNAL
2	K52 20DB/WT	EVAP PURGE SOL CONTROL



SPEAKER-
LEFT
FRONT
DOOR

SPEAKER-LEFT FRONT DOOR - 3 WAY

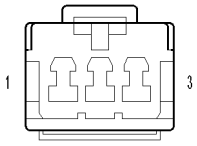
CAV	CIRCUIT	FUNCTION
1	X53 20DG (BASE)	RADIO-LEFT FRONT AUDIO (+)
1	X201 16GY/VT (PREMIUM)	AMPLIFIED LEFT FRONT DOOR SPEAKER (+)
2	-	-
3	X55 20DG/BR (BASE)	RADIO-LEFT FRONT AUDIO (-)
3	X291 16GY/YL (PREMIUM)	AMPLIFIED LEFT FRONT DOOR SPEAKER (-)



**SPEAKER-
LEFT
REAR
(CLUB CAB)**

SPEAKER-LEFT REAR (CLUB CAB)

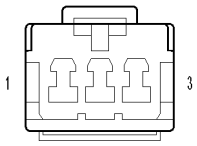
CAV	CIRCUIT	FUNCTION
1	X51 16DG/DB (BASE)	RADIO-LEFT REAR AUDIO (+)
1	X205 18GY/LG (PREMIUM)	AMPLIFIED LEFT REAR SPEAKER (+)
2	-	-
3	X57 16DG/OR (BASE)	RADIO-LEFT REAR AUDIO (-)
3	X295 18GY/DG (PREMIUM)	AMPLIFIED LEFT REAR SPEAKER (-)



**SPEAKER-
LEFT
REAR
DOOR
(QUAD CAB)**

SPEAKER-LEFT REAR DOOR (QUAD CAB) - 3 WAY

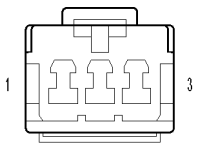
CAV	CIRCUIT	FUNCTION
1	X51 16DG/DB (BASE)	RADIO-LEFT REAR AUDIO (+)
1	X205 18GY/LG (PREMIUM)	AMPLIFIED LEFT REAR DOOR SPEAKER (+)
2	-	-
3	X57 16DG/OR (BASE)	RADIO-LEFT REAR AUDIO (-)
3	X295 18GY/DG (PREMIUM)	AMPLIFIED LEFT REAR DOOR SPEAKER (-)



**SPEAKER-
RIGHT
FRONT
DOOR**

SPEAKER-RIGHT FRONT DOOR - 3 WAY

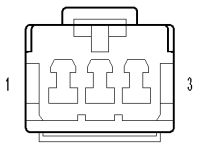
CAV	CIRCUIT	FUNCTION
1	X54 16GY (BASE)	RADIO-RIGHT FRONT AUDIO (+)
1	X202 20DG/VT (PREMIUM)	AMPLIFIED RIGHT FRONT DOOR SPEAKER (+)
2	-	-
3	X56 16DG/BR (BASE)	RADIO-RIGHT FRONT AUDIO (-)
3	X292 20DG/YL (PREMIUM)	AMPLIFIED RIGHT FRONT DOOR SPEAKER (-)



**SPEAKER-
RIGHT
REAR
(CLUB CAB)**

SPEAKER-RIGHT REAR (CLUB CAB) - 3 WAY

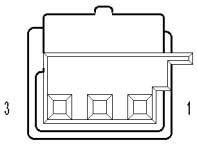
CAV	CIRCUIT	FUNCTION
1	X52 16GY/DB (BASE)	RADIO-RIGHT REAR AUDIO (+)
1	X206 20DG/LG (PREMIUM)	AMPLIFIED RIGHT REAR SPEAKER (+)
2	-	-
3	X58 16GY/OR (BASE)	RADIO-RIGHT REAR AUDIO (-)
3	X296 20LG/GY (PREMIUM)	AMPLIFIED RIGHT REAR SPEAKER (-)



**SPEAKER-
RIGHT
REAR
DOOR
(QUAD CAB)**

SPEAKER-RIGHT REAR DOOR (QUAD CAB) - 3 WAY

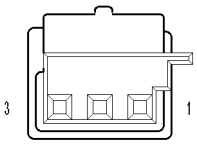
CAV	CIRCUIT	FUNCTION
1	X52 16GY/DB (BASE)	RADIO-RIGHT REAR AUDIO (+)
1	X206 20DG/LG (PREMIUM)	AMPLIFIED RIGHT REAR DOOR SPEAKER (+)
2	-	-
3	X58 16GY/OR (BASE)	RADIO-RIGHT REAR AUDIO (-)
3	X296 20LG/GY (PREMIUM)	AMPLIFIED RIGHT REAR DOOR SPEAKER(-)



SPEAKER-TWEETER-LEFT FRONT (PREMIUM)

SPEAKER-TWEETER-LEFT FRONT (PREMIUM) - 3 WAY

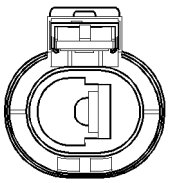
CAV	CIRCUIT	FUNCTION
1	X209 18GY/OR	AMPLIFIED LEFT I/P SPEAKER (+)
2	-	-
3	X299 18GY/YL	AMPLIFIED LEFT I/P SPEAKER (-)



SPEAKER-TWEETER-RIGHT FRONT (PREMIUM)

SPEAKER-TWEETER-RIGHT FRONT (PREMIUM) - 3 WAY

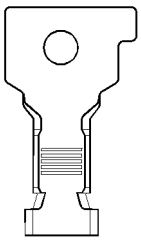
CAV	CIRCUIT	FUNCTION
1	X208 20GY/DG	AMPLIFIED RIGHT I/P SPEAKER (+)
2	-	-
3	X298 20GY/LG	AMPLIFIED RIGHT I/P SPEAKER (-)



STARTER

STARTER - 1 WAY

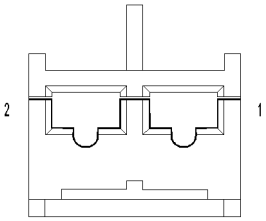
CAV	CIRCUIT	FUNCTION
1	T750 14YL/GY	STARTER RELAY OUTPUT



STARTER (B+)

STARTER (B+) - 1 WAY

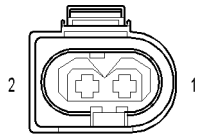
CAV	CIRCUIT	FUNCTION
1	A1 06RD	B(+)



SWITCH AND LAMP-GLOVE BOX

SWITCH AND LAMP-GLOVE BOX - 2 WAY

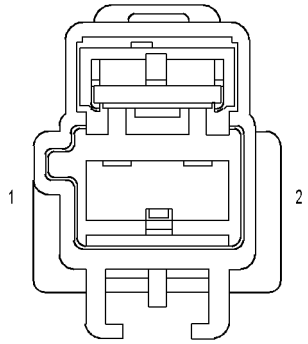
CAV	CIRCUIT	FUNCTION
1	M28 20YL/TN	GLOVE BOX LAMP DRIVER
2	Z328 20BK/TN	GROUND



SWITCH-
BACK UP
LAMP

SWITCH-BACK UP LAMP - 2 WAY

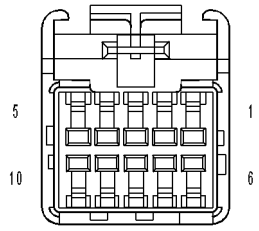
CAV	CIRCUIT	FUNCTION
1	T2 20DG/WT	LOW/REVERSE SOLENOID CONTROL
2	Z906 20BK	GROUND



SWITCH-
CLUTCH
INTERLOCK

SWITCH-CLUTCH INTERLOCK - 2 WAY

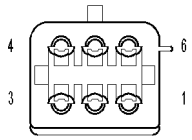
CAV	CIRCUIT	FUNCTION
1	Z905 20BK	GROUND
2	T141 20YL/OR	TRS T141 SENSE (P/N SENSE)



SWITCH-
HEADLAMP

SWITCH-HEADLAMP - 10 WAY

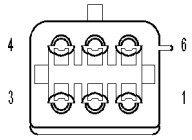
CAV	CIRCUIT	FUNCTION
1	L307 20PK/RD	HEADLAMP SWITCH MUX
2	E2 20OR/BR	INDICATOR DIMMER SIGNAL
3	L900 20WT/YL	HEADLAMP SWITCH MUX RETURN
4	E19 20OR/BR	PANEL LAMPS DIMMER SIGNAL
5	Z942 20BK	GROUND
6	L914 20WT	FOG LAMP INDICATOR DRIVER
7	-	-
8	-	-
9	-	-
10	-	-



SWITCH-
HEATED
SEAT-
DRIVER

SWITCH-HEATED SEAT-DRIVER - 6 WAY

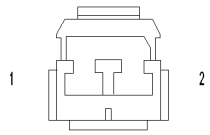
CAV	CIRCUIT	FUNCTION
1	P137 20VT/DG	DRIVER SEAT LOW HEAT LED DRIVER
2	-	-
3	Z1 20BK	GROUND
4	F500 18VT/BR	FUSED IGNITION SWITCH OUTPUT (RUN)
5	P139 20VT/WT	DRIVER SEAT HIGH HEAT LED DRIVER
6	P7 20LB/BK	DRIVER HEATED SEAT SWITCH OUTPUT



SWITCH-HEATED SEAT-PASSENGER

SWITCH-HEATED SEAT-PASSENGER - 6 WAY

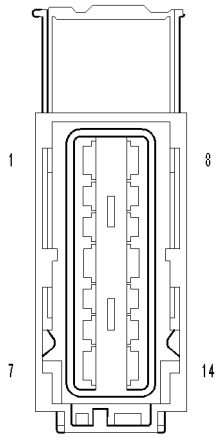
CAV	CIRCUIT	FUNCTION
1	P138 20VT/LG	PASSENGER SEAT LOW HEAT LED DRIVER
2	-	-
3	Z1 20BK	GROUND
4	F500 18VT/BR	FUSED IGNITION SWITCH OUTPUT (RUN)
5	P140 20VT/BK	PASSENGER SEAT HIGH HEAT LED DRIVER
6	P8 20LB/WT	PASSENGER HEATED SEAT SWITCH OUTPUT



SWITCH-HORN

SWITCH-HORN - 1 WAY

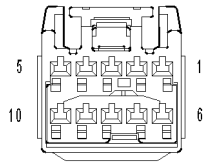
CAV	CIRCUIT	FUNCTION
1	X3 20DG/VT	HORN SWITCH SENSE



SWITCH-IGNITION

SWITCH-IGNITION - 14 WAY

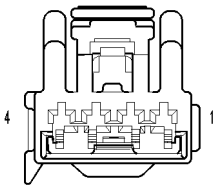
CAV	CIRCUIT	FUNCTION
1	A927 10RD/OR	FUSED B(+)
2	F901 14PK	IGNITION SWITCH OUTPUT (RUN)
3	F941 14PK/LG	IGNITION SWITCH OUTPUT (RUN-START)
4	A923 16RD	FUSED B(+)
5	G15 20VT/TN	KEY-IN IGNITION SWITCH SENSE
6	Z943 20BK	GROUND
7	A917 10RD	FUSED B(+)
8	C7 10DB	BLOWER MOTOR SUPPLY
9	F984 12PK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
10	F982 12PK/YL	IGNITION SWITCH OUTPUT (RUN-ACC)
11	A904 12RD/LB	FUSED B(+)
12	A953 12RD	FUSED B(+)
13	F961 14PK/LB	IGNITION SWITCH OUTPUT (START)
14	F921 10PK/WT	FUSED IGNITION SWITCH OUTPUT (RUN)



SWITCH-MIRROR (POWER CONVENIENCE)

SWITCH-MIRROR (POWER CONVENIENCE) - 10 WAY

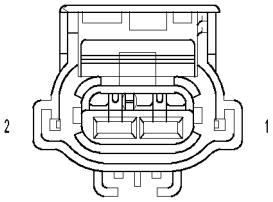
CAV	CIRCUIT	FUNCTION
1	-	-
2	F30 16PK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
3	P76 20TN/RD	MIRROR COMMON DRIVER
4	Z13 20BK/WT	GROUND
5	A940 16RD	FUSED B(+)
6	P72 20TN/DG	PASSENGER MIRROR VERTICAL DRIVER
7	P71 20DB	DRIVER MIRROR VERTICAL DRIVER
8	P74 20TN/YL	PASSENGER MIRROR HORIZONTAL DRIVER
9	P75 20RD	DRIVER MIRROR HORIZONTAL DRIVER
10	-	-



**SWITCH-
MULTIFUNCTION**

SWITCH-MULTIFUNCTION - 4 WAY

CAV	CIRCUIT	FUNCTION
1	G194 20VT/LG	HIGH BEAM/FRONT WASHER SWITCH MUX
2	G902 20VT/OR	SWITCH MUX RETURN
3	L12 20WT/OR	TURN SIGNAL INPUT MUX
4	W52 20BR/YL	FRONT WIPER SWITCH MUX



**SWITCH-
OIL PRESSURE**

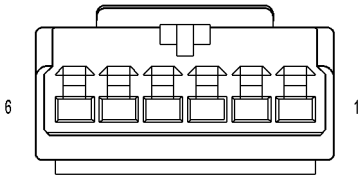
SWITCH-OIL PRESSURE - 2 WAY

CAV	CIRCUIT	FUNCTION
1	G6 18VT/GY	ENGINE OIL PRESSURE SIGNAL
2	-	-

**SWITCH-
PARKING
BRAKE**

SWITCH-PARKING BRAKE - 1 WAY

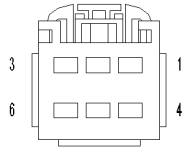
CAV	CIRCUIT	FUNCTION
1	B25 20DG/WT	PARK BRAKE SWITCH SENSE



**SWITCH-
PASSENGER
AIRBAG
ON/OFF**

SWITCH-PASSENGER AIRBAG ON/OFF - 6 WAY

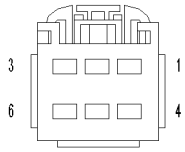
CAV	CIRCUIT	FUNCTION
1	R106 20LG/LB	PASSENGER AIRBAG MUX SWITCH SENSE
2	R104 20LB/LG	PASSENGER AIRBAG MUX SWITCH RETURN
3	-	-
4	-	-
5	-	-
6	-	-



**SWITCH-
POWER
WINDOW
LEFT
REAR
(QUAD CAB/
POWER CONVENIENCE)**

SWITCH-POWER WINDOW-LEFT REAR (QUAD CAB/POWER CONVENIENCE) - 6 WAY

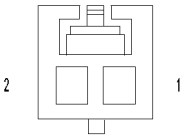
CAV	CIRCUIT	FUNCTION
1	Q611 14OR/RD	MASTER WINDOW SWITCH LEFT REAR (DOWN)
2	Q211 14TN/LB	LEFT REAR WINDOW DRIVER (DOWN)
3	Q111 14TN/YL	LEFT REAR WINDOW DRIVER (UP)
4	Q411 14OR/BK	MASTER WINDOW SWITCH LEFT REAR (UP)
5	-	-
6	Q15 14OR/LB	MASTER WINDOW SWITCH PASSENGER DOWN



SWITCH-POWER WINDOW-RIGHT REAR (QUAD CAB/ POWER CONVENIENCE)

SWITCH-POWER WINDOW-RIGHT REAR (QUAD CAB/POWER CONVENIENCE) - 6 WAY

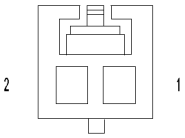
CAV	CIRCUIT	FUNCTION
1	Q612 14OR/DB	MASTER WINDOW SWITCH RIGHT REAR (DOWN)
2	Q212 14OR/VT	RIGHT REAR WINDOW DRIVER (DOWN)
3	Q112 14OR/BR	RIGHT REAR WINDOW DRIVER (UP)
4	Q412 14TN/YL	MASTER WINDOW SWITCH RIGHT REAR (UP)
5	-	-
6	Q15 14OR/LB	MASTER WINDOW SWITCH PASSENGER DOWN



SWITCH-REMOTE RADIO-LEFT

SWITCH-REMOTE RADIO-LEFT - 2 WAY

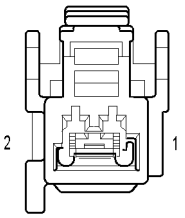
CAV	CIRCUIT	FUNCTION
1	X20 22GY/WT	RADIO CONTROL MUX
2	G902 22VT/BR	MULTI-FUNCTION SWITCH MUX RETURN



SWITCH-REMOTE RADIO-RIGHT

SWITCH-REMOTE RADIO-RIGHT - 2 WAY

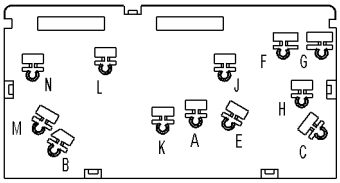
CAV	CIRCUIT	FUNCTION
1	X20 22GY/WT	RADIO CONTROL MUX
2	G902 22VT/BR	MULTI-FUNCTION SWITCH MUX RETURN



SWITCH-SEAT BELT-DRIVER

SWITCH-SEAT BELT-DRIVER - 2 WAY

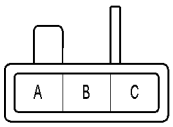
CAV	CIRCUIT	FUNCTION
1	Z949 20BK	GROUND
2	R57 20LG/GY	DRIVER SEAT BELT SWITCH SENSE



SWITCH-SEAT-DRIVER (POWER CONVENIENCE)

SWITCH-SEAT-DRIVER (POWER CONVENIENCE) - 12 WAY

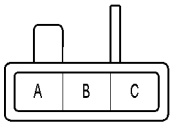
CAV	CIRCUIT	FUNCTION
1	A915 10RD	FUSED B(+)
2	Z975 12BK	GROUND
3	-	-
4	P21 10LG/TN	DRIVER SEAT FRONT RISER DOWN DRIVER
5	-	-
6	-	-
7	-	-
8	P19 10LG/LB	DRIVER SEAT FRONT RISER UP DRIVER
9	P15 10LG/WT	DRIVER SEAT HORIZONTAL FORWARD DRIVER
10	P17 10LG/DG	DRIVER SEAT HORIZONTAL REARWARD DRIVER
11	P13 10LG/OR	DRIVER SEAT REAR RISER DOWN DRIVER
12	P11 10LG/YL	DRIVER SEAT REAR RISER UP DRIVER



SWITCH-SPEED CONTROL-LEFT

SWITCH-SPEED CONTROL-LEFT - 3 WAY

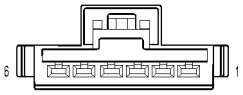
CAV	CIRCUIT	FUNCTION
A	V38 22VT/OR	NOT USED
B	K900 22DB/DG	SENSOR GROUND
C	V37 22VT	S/C SWITCH NO. 1 SIGNAL



SWITCH-SPEED CONTROL-RIGHT

SWITCH-SPEED CONTROL-RIGHT - 3 WAY

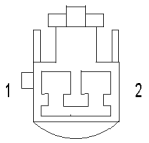
CAV	CIRCUIT	FUNCTION
A	V38 22VT/OR	NOT USED
B	K900 22DB/DG	SENSOR GROUND
C	V37 22VT	S/C SWITCH NO. 1 SIGNAL



SWITCH-STOP LAMP

SWITCH-STOP LAMP - 6 WAY

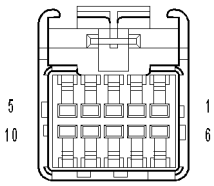
CAV	CIRCUIT	FUNCTION
1	A103 18GY/RD	FUSED B(+)
2	L50 16WT/LB	BRAKE LAMP SWITCH OUTPUT
3	V30 20VT/WT	S/C BRAKE SWITCH OUTPUT
4	V32 20VT/YL	S/C SUPPLY
5	Z429 20BK/OR	GROUND
6	B29 20DG/WT	BRAKE SWITCH SIGNAL



SWITCH-TOW/HAUL OVERDRIVE OFF

SWITCH-TOW/HAUL OVERDRIVE OFF - 2 WAY

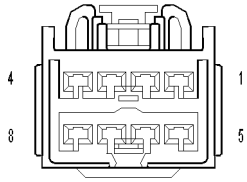
CAV	CIRCUIT	FUNCTION
1	T6 20DG	TOW/HAUL OVERDRIVE OFF SWITCH SENSE
2	Z953 20BK	GROUND



SWITCH-TRANSFER CASE SELECTOR (4WD)

SWITCH-TRANSFER CASE SELECTOR (4WD) - 10 WAY

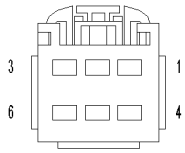
CAV	CIRCUIT	FUNCTION
1	K77 20BR/WT	5 VOLT SELECTOR SWITCH SUPPLY
2	-	-
3	K977 20BR/WT	MODE SELECT
4	E11 20OR/DB	PANEL LAMPS DRIVER
5	Z973 20BK	GROUND
6	G95 20VT/BR	4WD NEUTRAL INDICATOR
7	F21 20PK/DG	FUSED IGNITION SWITCH OUTPUT (START)
8	-	-
9	-	-
10	-	-



SWITCH-WINDOW/DOOR LOCK-DRIVER C1 (CLUB CAB)

SWITCH-WINDOW/DOOR LOCK-DRIVER C1 (CLUB CAB) - 8 WAY

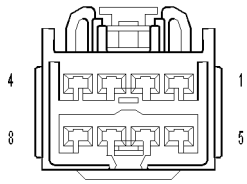
CAV	CIRCUIT	FUNCTION
1	-	-
2	F30 14PK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
3	Z940 20BK	GROUND
4	Z13 16BK/WT	GROUND
5	-	-
6	Q21 14OR/WT	DRIVER WINDOW DRIVER DOWN
7	Q11 14OR/LG	DRIVER WINDOW DRIVER UP
8	G161 20VT/DG	DRIVER DOOR LOCK SWITCH MUX



SWITCH-WINDOW/DOOR LOCK-DRIVER C2 (CLUB CAB)

SWITCH-WINDOW/DOOR LOCK-DRIVER C2 (CLUB CAB) - 6 WAY

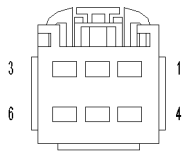
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	-	-
5	Q26 14OR/GY	MASTER WINDOW SWITCH PASSENGER DOWN
6	Q16 14OR/TN	MASTER WINDOW SWITCH PASSENGER UP



SWITCH-WINDOW/DOOR LOCK-DRIVER EXPRESS C1 (QUAD CAB)

SWITCH-WINDOW/DOOR LOCK-DRIVER EXPRESS C1 (QUAD CAB) - 8 WAY

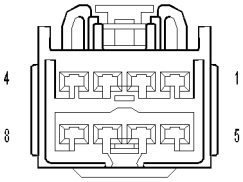
CAV	CIRCUIT	FUNCTION
1	-	-
2	F30 14PK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
3	Z940 20BK	GROUND
4	Z13 16BK/WT	GROUND
5	Q15 14OR/LB	MASTER WINDOW SWITCH PASSENGER DOWN
6	Q21 14OR/WT	DRIVER WINDOW DRIVER DOWN
7	Q11 14OR/LG	DRIVER WINDOW DRIVER UP
8	G161 20VT/DG	DRIVER DOOR LOCK SWITCH MUX



SWITCH-WINDOW/DOOR LOCK-DRIVER EXPRESS C2 (QUAD CAB)

SWITCH-WINDOW/DOOR LOCK-DRIVER EXPRESS C2 (QUAD CAB) - 6 WAY

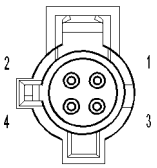
CAV	CIRCUIT	FUNCTION
1	Q411 14OR/BK	MASTER WINDOW SWITCH LEFT REAR (UP)
2	Q412 14TN/YL	MASTER WINDOW SWITCH RIGHT REAR (UP)
3	Q612 14OR/DB	MASTER WINDOW SWITCH RIGHT REAR (DOWN)
4	Q611 14OR/RD	MASTER WINDOW SWITCH LEFT REAR (DOWN)
5	Q26 14OR/GY	MASTER WINDOW SWITCH PASSENGER DOWN
6	Q16 14OR/TN	MASTER WINDOW SWITCH PASSENGER UP



SWITCH-WINDOW/DOOR LOCK-PASSENGER - 8 WAY

CAV	CIRCUIT	FUNCTION
1	Q26 14OR/GY	MASTER WINDOW SWITCH PASSENGER DOWN
2	Q22 14OR/VT	PASSENGER WINDOW DRIVER DOWN
3	Q12 14OR/BR	PASSENGER WINDOW DRIVER UP
4	Q15 14OR/LB	MASTER WINDOW SWITCH PASSENGER DOWN
5	F30 14PK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
6	G160 20VT/LG	PASSENGER DOOR LOCK SWITCH MUX
7	Z974 20BK/OR	GROUND
8	Q16 14OR/TN	MASTER WINDOW SWITCH PASSENGER UP

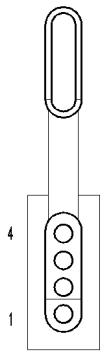
SWITCH-WINDOW/DOOR LOCK-PASSENGER



TRANSDUCER-A/C PRESSURE - 4 WAY

CAV	CIRCUIT	FUNCTION
1	G180 20VT/YL	FCM SENSOR RETURN
2	T103 20YL/OR	5 VOLT SUPPLY
3	C18 20LB/BR	A/C PRESSURE SIGNAL
4	-	-

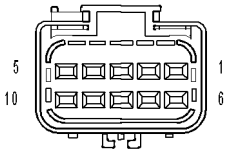
TRANSDUCER-A/C PRESSURE



WIRING-TRAILER TOW 4 WAY - 4 WAY

CAV	CIRCUIT	FUNCTION
1	Z976 12BK	GROUND
2	L76 20PK/RD	TRAILER TOW RELAY OUTPUT
3	L673 20YL	LEFT TRAILER TOW BRAKE LAMP RELAY OUTPUT
4	L674 20LG	RIGHT TRAILER TOW BRAKE LAMP RELAY OUTPUT

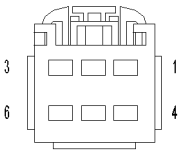
WIRING-TRAILER TOW 4 WAY



WIRING-TRAILER TOW 7 WAY - 10 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	L674 20LG	RIGHT TRAILER TOW BRAKE LAMP RELAY OUTPUT
3	L1 18WT/LG	BACK-UP LAMP FEED
4	A100 12RD/VT	FUSED B(+)
5	L76 20PK/RD	TRAILER TOW RELAY OUTPUT
6	-	-
7	B400 12DG	TRAILER TOW ELECTRIC BRAKE OUTPUT
8	Z976 12BK	GROUND
9	Z976 12BK	GROUND
10	L673 20YL	LEFT TRAILER TOW BRAKE LAMP RELAY OUTPUT

WIRING-TRAILER TOW 7 WAY



WIRING-
TRAILER TOW
ELECTRIC BRAKE

WIRING-TRAILER TOW ELECTRIC BRAKE - 4 WAY

CAV	CIRCUIT	FUNCTION
1	A400 14TN/RD	FUSED B(+)
2	B400 12DG	TRAILER TOW ELECTRIC BRAKE OUTPUT
3	L50 18WT/LB	BRAKE LAMP SWITCH OUTPUT
4	Z910 18BK	GROUND
5		
6		

8W-91 CONNECTOR/GROUND/SPLICE LOCATION

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CONNECTOR/GROUND/SPLICE LOCATION
DESCRIPTION 1

CONNECTOR/GROUND/SPLICE LOCATION

DESCRIPTION

This section provides illustrations identifying connector, ground and splice locations in the vehicle. Connector, ground and splice indexes are provided. Use the wiring diagrams in each section for connector, ground and splice identification. Refer to the appropriate index for the proper figure number. For items that are not shown in this section N/S is placed in the Fig. column.

CONNECTORS

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Actuator-Blend Door	BK	Right HVAC Unit	19
Actuator-Mode Door 1 (Panel to Floor)	BK	Top HVAC Unit	19
Actuator-Mode Door 2 (Defrost to Floor)	BK	Top HVAC Unit	19
Actuator-Recirculation Door	BK	Right HVAC Unit	19
Air Bag-Driver Squib 1	TAN	Steering Wheel Pad	28
Air Bag-Driver Squib 2	BK	Steering Wheel Pad	28
Airbag-Passenger Squib	YL	Right Instrument Panel	21
Airbag-Side Curtain-Left	YL	Top of Left A-Pillar	41
Airbag-Side Curtain-Right	YL	Top of Right A-Pillar	41
Amplifier-Radio C1	NAT	Right Lower Kick Panel	30, 31
Amplifier-Radio C2	WT	Right Lower Kick Panel	21, 24
Antenna-Radio	-	Right Lower Kick Panel	21, 33
Antenna-Satellite No. 1	BL	Center Rear Roof	34, 35
Antenna-Satellite No. 2	WT	Center Rear Roof	34, 35
Assembly-EGR Valve	BK	Left Side Engine	11
Assembly-Natural Vacuum Leak Detection	BK	Top of Fuel Tank	36
Assembly-Seat Motor	BK	Under Driver Seat	N/S
Assembly-Shift Motor/Mode Sensor	DK GY	Front of Transfer Case	14, 15, 18
Assembly-Transmission Solenoid/Pressure Switch	BK	Right Side Transmission	18

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Assembly-Transmission Solenoid/TRS		Left Side of Transmission	14
Backlite-Heated (Power)	-	Left Backlite	42
Backlite-Heated (Ground)	-	Right Backlite	42
Battery (+)	-	Left Front Engine Compartment	10
Battery (-)	-	Left Front Engine Comartment	9, 10
C100		Left Side Engine Compartment	5, 9
C101		Left Side Engine Compartment	5, 9
C102		Left Side Engine Compartment	6, 10
C103	WT	Lower Left Instrument Panel	4, 32
C104	WT	Lower Left Instrument Panel	4, 32
C105		Lower Right Rear Engine Compartment	8, 36
C106		Lower Right Rear Engine Compartment	8, 36
C200	BK	Lower Left Instrument Panel	22, 23, 32
C201	GY	Lower Left Instrument Panel	4, 23
C202	WT	Left HVAC Unit	19, 22, 23
C203	WT	Right Side Instrument Panel	21, 23, 41
C300	BK	Lower Left Instrument Panel	32, 38
C301	WT	Lower Left Instrument Panel	32, 38
C302	BK	Front of Right Door	30, 31, 37
C303		Front of Right Door	30, 31, 37
C304	BK	Center Body	30, 31
C305	BK	Below Driver Seat	30, 31
C306	NAT	Right B-Pillar	31, 39
C307	WT	Left Side Body	30, 31
C308	NAT	Left B-Pillar	31
Capacitor-Ignition	BK	Right Side Engine Compartment	9
Circuit Breaker	GY	At Junction Block	22
Clockspring C1	WT	At Steering Column	22, 29
Clockspring C2	BK	Steering Wheel	28
Clockspring C3	BK	Steering Wheel	28
Clockspring C4	YL	At Steering Column	22, 29
Cluster C1	DK GY	Left Side of Instrument Panel	22
Cluster C2	DK GY	Left Side of Instrument Panel	22
Cluster C3	WT	Left Side of Instrument Panel	22
Clutch-A/C Compressor	BK	Right Front Engine	13
Coil-Ignition-No. 1 (3.7L)	BK	Left Top Engine	16
Coil-Ignition-No. 1 (4.7L)	BK	Left Top Engine	11
Coil-Ignition-No. 2 (3.7L)	BK	Right Top Engine	17
Coil-Ignition-No. 2 (4.7L)	BK	Right Top Engine	12
Coil-Ignition-No. 3 (3.7L)	BK	Left Top Engine	16
Coil-Ignition-No. 3 (4.7L)	BK	Left Top Engine	11

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Coil-Ignition-No. 4 (3.7L)	BK	Right Top Engine	17
Coil-Ignition-No. 4 (4.7L)	BK	Right Top Engine	12
Coil-Ignition-No. 5 (3.7L)	BK	Left Top Engine	16
Coil-Ignition-No. 5 (4.7L)	BK	Left Top Engine	11
Coil-Ignition-No. 6 (3.7L)	BK	Right Top Engine	17
Coil-Ignition-No. 6 (4.7L)	BK	Right Top Engine	12
Coil-Ignition-No. 7 (4.7L)	BK	Left Top Engine	11
Coil-Ignition-No. 8 (4.7L)	BK	Right Top Engine	12
Control-A/C-Heater C1	BK	Center of Instrument Panel	22, 26
Control-A/C-Heater C2	BK	Center of Instrument Panel	22, 26
Data Link Connector	BK	Lower Left Instrument Panel	22
Diode-Zener-No. 1	-	Located in Integrated Power Module	N/S
Diode-Zener-No. 2	-	Located in Integrated Power Module	N/S
Generator	GY	Left Front Top Engine	10, 11, 16
Heater-Cushion Pad-Driver	GN	Under Driver Seat	30, 31
Heater-Cushion Pad-Passenger	GN	Under Passenger Seat	30, 31
Horn No. 1	BK	In front of Left Radiator	7
Horn No. 2	BK	In Front of Left Radiator	7
Injector-Fuel-No. 1 (3.7L)	BK	Left Top Engine	16
Injector-Fuel-No. 1 (4.7L)	BK	Left Top Engine	11
Injector-Fuel-No. 2 (3.7L)	BK	Right Top Engine	17
Injector-Fuel-No. 2 (4.7L)	BK	Right Top Engine	12
Injector-Fuel-No. 3 (3.7L)	BK	Left Top Engine	16
Injector-Fuel-No. 3 (4.7L)	BK	Left Top Engine	11
Injector-Fuel-No. 4 (3.7L)	BK	Right Top Engine	17
Injector-Fuel-No. 4 (4.7L)	BK	Right Top Engine	12
Injector-Fuel-No. 5 (3.7L)	BK	Left Top Engine	16
Injector-Fuel-No. 5 (4.7L)	BK	Left Top Engine	11
Injector-Fuel-No. 6 (3.7L)	BK	Right Top Engine	17
Injector-Fuel-No. 6 (4.7L)	BK	Right Top Engine	12
Injector-Fuel-No. 7 (4.7L)	BK	Left Top Engine	11
Injector-Fuel-No. 8 (4.7L)	BK	Right Top Engine	12
Lamp-Backup-Left	GY	Left Rear Lamp Assembly	43
Lamp-Backup-Right	GY	Right Rear Lamp Assembly	43
Lamp-Center Bezel	BK	At Center Stack	22, 26
Lamp-Dome-Front	WT	Headliner Front	N/S
Lamp-Dome-Rear	BK	Headliner Rear	N/S
Lamp-Fog-Left Front	BK	Left Front Fender	7
Lamp-Fog-Right Front	BK	Right Front Fender	2
Lamp-Headlamp-Left	DK GN	Left Front Headlamp Assembly	1, 7
Lamp-Headlamp-Right	DK GN	Right Front Headlamp Assembly	2

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Lamp-High Mounted Stop	WT	Top of Liftgate	42
Lamp-License		At License Plate	N/S
Lamp-Park/Turn-Left Front	BK	At Left Headlamp Assembly	1, 7
Lamp-Park/Turn-Right Front	BK	At Right Headlamp Assembly	2
Lamp-Passenger Airbag On/Off Indicator	BK	Top of Center Stack	22, 26
Lamp-Tail/Stop/Turn-Left	BK	At Left Tail Lamp Assembly	43
Lamp-Tail/Stop/Turn-Right	BK	At Right Tail Lamp Assembly	43
Latch-Door-Left Front	BK	At Latch	38
Latch-Door-Left Rear	BK	Left Rear Door	39
Latch-Door-Right Front	BK	Right Front Door	37
Latch-Door-Right Rear	BK	Right Rear Door	39
Mirror-Inside Rearview C1	BK	Top Center Windshield	41
Mirror-Inside Rearview C2	BK	Top Center Windshield	41
Mirror-Outside Rearview-Driver	BK	Left Front Door	38
Mirror-Outside Rearview-Passenger	BK	Right Door	37
Module-Anti-lock Brakes	BK	Left Side Engine Compartment	6
Module-Brake Provision	BL	Lower Left Instrument Panel	4
Module-Electronic Overhead	BK	Front Headliner	N/S
Module-Front Control C1		Left Side Engine Compartment	5, 6
Module-Front Control C2	BK	Left Side Engine Compartment	5, 6
Module-Front Control IPM	BK	At Side of Power Distribution Module	N/S
Module-Fuel Pump	LT GY	Top of Fuel Tank	36
Module-Hands Free	LT GY	Left Side Instrument Panel	22, 32
Module-Heated Seat		Under Center Console	N/S
Module-Integrated Power C1		Left Side Engine Compartment	5
Module-Integrated Power C2		Left Side Engine Compartment	5
Module-Integrated Power C3		Left Side Engine Compartment	5
Module-Integrated Power C4		Left Side Engine Compartment	5
Module-Integrated Power C5		Left Side Engine Compartment	5
Module-Integrated Power Eyelet		Left Side Engine Compartment	10
Module-Occupant Classification C1	BK	Under Passenger Seat	30, 31
Module-Occupant Classification C2	BK	Under Passenger Seat	N/S
Module-Occupant Restraint Controller C1	YL	Below Center Console	30, 31
Module-Occupant Restraint Controller C2	YL	Below Center Console	22, 30, 31
Module-Powertrain Control C1	BK/BK	Right Engine Compartment	9

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Module-Powertrain Control C2	BK/OR	Right Engine Compartment	9
Module-Powertrain Control C3	BK/NAT	Right Engine Compartment	3
Module-Powertrain Control C4	BK/GN	Right Engine Compartment	9
Module-Sentry Key Remote Entry	BK	At Steering Column	22, 29
Motor-Blower	BK	Front HVAC Unit	N/S
Motor-IAC (3.7L)	BK	At Throttle Body	16
Motor-IAC (4.7L)	BK	At Throttle Body	11
Motor-Window-Left Front	BK	Left Front Door	38
Motor-window-Left Rear	BK	Left Rear Door	39
Motor-Window-Right Front	BK	Right Front Door	37
Motor-Window-Right Rear	BK	Right Rear Door	39
Motor-Windshield Wiper		Left Rear Engine Compartment	4
Power Outlet-Console	GY	At Console	N/S
Power Outlet-Instrument Panel	GY	Center Stack	22, 26
Pump Washer-Windshield		Lower Right Front Engine Compartment	2
Radio Antenna	-	Rear of Radio	25
Radio C1	DK GY	Rear of Radio	22, 25
Radio C2	BK	Rear of Radio	22, 25
Receiver-Satellite	BK	Left Rear Floor	34, 35, 40
Receiver-Satellite Antenna No. 1	BL	Left Rear Floor	34, 35
Receiver-Satellite Antenna No. 2	WT	Left Rear Floor	34, 35
Resistor Block-Blower Motor	BK	Right Side HVAC Unit	19
Seat Belt-Tensioner-Driver	BK	Base of Left B-Pillar	30, 31
Seat Belt-Tensioner-Passenger	BK	Base of Right B-Pillar	30, 31
Sensor-Ambient Air Temperature	BK	Front Left of Engine Compartment	7
Sensor-Battery Temperature	BK	Battery Tray	7
Sensor-Brake Fluid Level	BK	Left Rear Engine Compartment	6
Sensor-Camshaft Position	GY	Right Front Side of Engine	13
Sensor-Crankshaft Position (3.7L)	BK	Right Front Rear Engine	15, 18
Sensor-Crankshaft Position (4.7L)	BK	Right Rear Engine	14, 15
Sensor-Engine Coolant Temperature	BK	Right Front Side of Engine	13
Sensor-Evaporator Temperature	WT	On HVAC Unit	N/S

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Sensor-Front Impact-Left	DK GY	Left Front of Engine Compartment	7
Sensor-Front Impact-Right	DK GY	Right Front of Engine Compartment	2
Sensor-Input Speed	BK	Left Front of Transmission	14, 18
Sensor-Intake Air Temperature	DK GY	Top of Engine	11, 16
Sensor-Knock	BK	Left Rear of Engine	16
Sensor-Line Pressure	BK	Right Rear Transmission	14
Sensor-MAP	GY	Right Front Side of Engine	13
Sensor-Output Speed	BK	Left Rear of Transmission	14, 18
Sensor-Oxygen-Left Front (3.7L)	GY	Left Front of Transmission	15
Sensor-Oxygen-Left Front (4.7L)		Left Front of Transmission	14, 15, 18
Sensor-Oxygen-Left Rear		Left Rear of Transmission	14, 15, 18
Sensor-Oxygen-Right Front		Right Front of Transmission	14,15, 18
Sensor-Oxygen-Right Rear		Right Rear of Transmission	14, 15, 18
Sensor-Seat Track Position-Dirver	DK GY	Under Driver Seat	N/S
Sensor-Seat Track Position-Passenger	DK GY	Right Side Under Passenger Seat	N/S
Sensor-Seat Weight-Left Front	BK	Left Front Under Passenger Seat	N/S
Sensor-Seat Weight-Left Rear	BK	Left Rear Under Passenger Seat	N/S
Sensor-Seat Weight-Right Front	BK	Right Front Under Passenger Seat	N/S
Sensor-Seat Weight-Right Rear	BK	Right Rear Under Passenger Seat	N/S
Sensor-Side Impact-Left 1		Left Side Near B-Pillar	30, 31
Sensor-Side Impact-Right 1		Right Side Near B-Pilar	30, 31
Sensor-Sun	BK	Top of Instrument Panel	27
Sensor-Throttle Position (3.7L)	NAT	At Throttle Body	16
Sensor-Throttle Position (4.7L)	NAT	At Throttle Body	11
Sensor-Transmission Range	LT GN	Left Side of Transmission	18
Sensor-Washer Fluid Level	GY	Lower Right Front Engine Compartment	2
Sensor-Wheel Speed-ABS-Left Front		Left Front Wheel	6
Sensor-Wheel Speed-ABS-Rear		Near Right Rear Wheel by Crossmember	36
Sensor-Wheel Speed-ABS-Right Front		Right Front Wheel	3
Servo-Speed Control	BK	Right Front Engine Compartment	2
Solenoid-Brake Transmission Shift Interlock		Near Steering Column	22, 29

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Solenoid-EVAP/Purge		Left Rear Engine Compartment	3
Speaker-Left Front Door		Lower Left Front Door	38
Speaker-Left Rear		Lower Left Rear Cab	40
Speaker-Left Rear Door		Left Rear Door	39
Speaker-Right Front Door		Lower Right Front Door	37
Speaker-Right Rear		At Right Rear Door	30
Speaker-Right Rear Door		At Right Rear Door	39
Speaker-Tweeter-Left Front (Premium)		Left Front Door	38
Speaker-Tweeter-Right Front (Premium)		Right Front Door	37
Starter		Left Rear Engine	10
Switch and Lamp-Glove Box			21
Switch-Back Up Lamp		Right Rear Transmission	15
Switch-Clutch Interlock		Lower Left Instrument Panel	4
Switch-Headlamp	BK	Left Side of Instrument Panel	22
Switch-Heated Seat-Driver		Center Console	N/S
Switch-Heated Seat-Passenger		Center Console	N/S
Switch-Horn		In Steering Wheel	28
Switch-Ignition		At Steering Column	22, 29
Switch-Mirror		Left Front Door	38
Switch-Multifunction		At Steering Column	22, 29
Switch-Oil Pressure		Left Front of Engine	12, 17
Switch Parking Brake		Left Side Instrument Panel	32
Switch-Passenger Airbag On/Off		Center Stack	22, 26
Switch-Power Window-Left Rear		Left Rear Door	39
Switch-Power Window-Right Rear		Right Rear Door	39
Switch-Remote Radio-Left		Steering Wheel	N/S
Switch-Remote Radio-Right		Steering Wheel	N/S
Switch-Seat Belt-Driver		Under Driver Seat	N/S
Switch-Seat-Driver		Side of Driver Seat	N/S
Switch-Speed Control-Left	BK	Left Steering Wheel	28
Switch-Speed Control-Right	BK	Right Steering Wheel	28
Switch-Stop Lamp		Left Lower Instrument Panel	22, 29
Switch-Tow/Haul Overdrive		Lower Left Instrument Panel	22
Switch-Transfer Case Selector	BK	Center of Instrument Panel	22, 26
Switch-Window/Door Lock-Driver C1		Left Front Door	38

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Switch-Window/Door Lock-Driver C2		Left Front Door	38
Switch-Window/Door Lock-Driver Express C1		Left Front Door	38
Switch-Window/Door Lock-Driver Express C2		Left Front Door	38
Switch-Window/Door Lock-Passenger		Right Front Door	37
Transducer-A/C Pressure	GY	Right Front Engine Compartment	2
Wiring-Trailer Tow 4-Way	BK	Near Rear Bumper	N/S
Wiring-Trailer Tow 7-Way	BK	Center Rear Bumper	36

GROUNDS

GROUND	LOCATION	FIG.
G100	Left Front Engine Compartment	7
G101	Left Front Engine Compartment	N/S
G102	Left Front Engine Compartment	7
G103	Right Frong Engine Compartment	2
G105	Left Front of Engine	12, 17
G106	Left Side Engine Compartment	9
G107	Right Side Engine Compartment	9
G108	Lower Right Front Engine	13
G200	Left Side Instrument Panel	22
G201	Right Side Instrument Panel	21, 24
G202	Right Side Instrument Panel	21, 24
G300	Front Center Body	30, 31
G301	Left Front Body	30, 31, 32
G302	Lower Right Rear Engine Compartment	8, 36

SPLICES

SPLICE	LOCATION	FIG.
S100	Left Side Engine Compartment	6
S101	Left Side Engine Compartment	6
S102	Left Side Engine Compartment	6
S103	Left Side Engine Compartment	6
S104	Left Side Engine Compartment	6
S105	Left Side Engine Compartment	6
S106	Left Rear Engine Compartment	4
S107	Left Rear Engine Compartment	4
S108	Left Rear Engine Compartment	4
S109	Left Side Engine Compartment	5
S110	Left Side Engine Compartment	5
S111	Left Rear Engine Compartment	4
S112	Engine Compartment	N/S
S113	Engine Compartment	N/S
S114	Right Side Engine Compartment	3
S115	Right Side Engine Compartment	3
S116	Right Side Engine Compartment	3
S117	Left Side Engine	11, 16
S118	Rear of Engine	14, 15, 16
S119	Top of Transmission	14, 15
S120	Top of Transmission	14 15
S121	Top of Transmission	14, 15, 18
S122	Top of Transmission	14, 15, 18
S123	Right Top Engine	12, 17
S124	Right Top Engine	12, 17
S125	Right Rear Engine Compartment	9, 17
S126	Right Rear Engine Compartment	9, 17
S127	Right Top Engine	12, 17
S128	Right Side Engine Compartment	9
S129	Left Top Engine	10
S130	Left Top Engine	10
S200	Lower Left Instrument Panel	22
S201	Left Instrument Panel	20
S202	Left Instrument Panel	20
S203	Left Instrument Panel	20
S204	Left Instrument Panel	20
S205	Left Instrument Panel	20
S206	Left Instrument Panel	20
S207	Left Instrument Panel	20
S208	Left Instrument Panel	20
S209	Left Instrument Panel	20

SPLICE	LOCATION	FIG.
S210	Left Instrument Panel	20
S211	Center Instrument Panel	20
S212	Center Instrument Panel	20
S213	Right Instrument Panel	20
S214	Headliner	N/S
S215	Headliner	N/S
S216	Headliner	N/S
S300	Left Front Body	30, 31, 32
S301	Left Front Body	30, 31, 32
S302	Left Front Body	30, 31, 32
S303	Left Front Body	30, 31, 32
S304	Left Front Body	30, 31, 32
S305	Left Front Body	30, 31, 32
S306	Center Body	30, 31
S307	Center Body	30, 31
S308	Left Front Body Under Driver Seat	30, 31
S309	Left Front Body Under Driver Seat	30, 31
S310	Left Front Body Under Driver Seat	30, 31
S311	Left Front Body	30
S312	In T/O for Left Rear Lamps	43
S313	Left Rear Chassis	36
S314	Left Rear Chassis	36
S315	Left Rear Chassis	36
S316	Left Rear Chassis	36
S317	Left Rear Chassis	36
S318	Left Rear Chassis	36
S320	Chassis	N/S
S321	Left Front Door	38
S322	Left Front Door	38
S323	Left Front Door	38
S324	Right Front Door	37

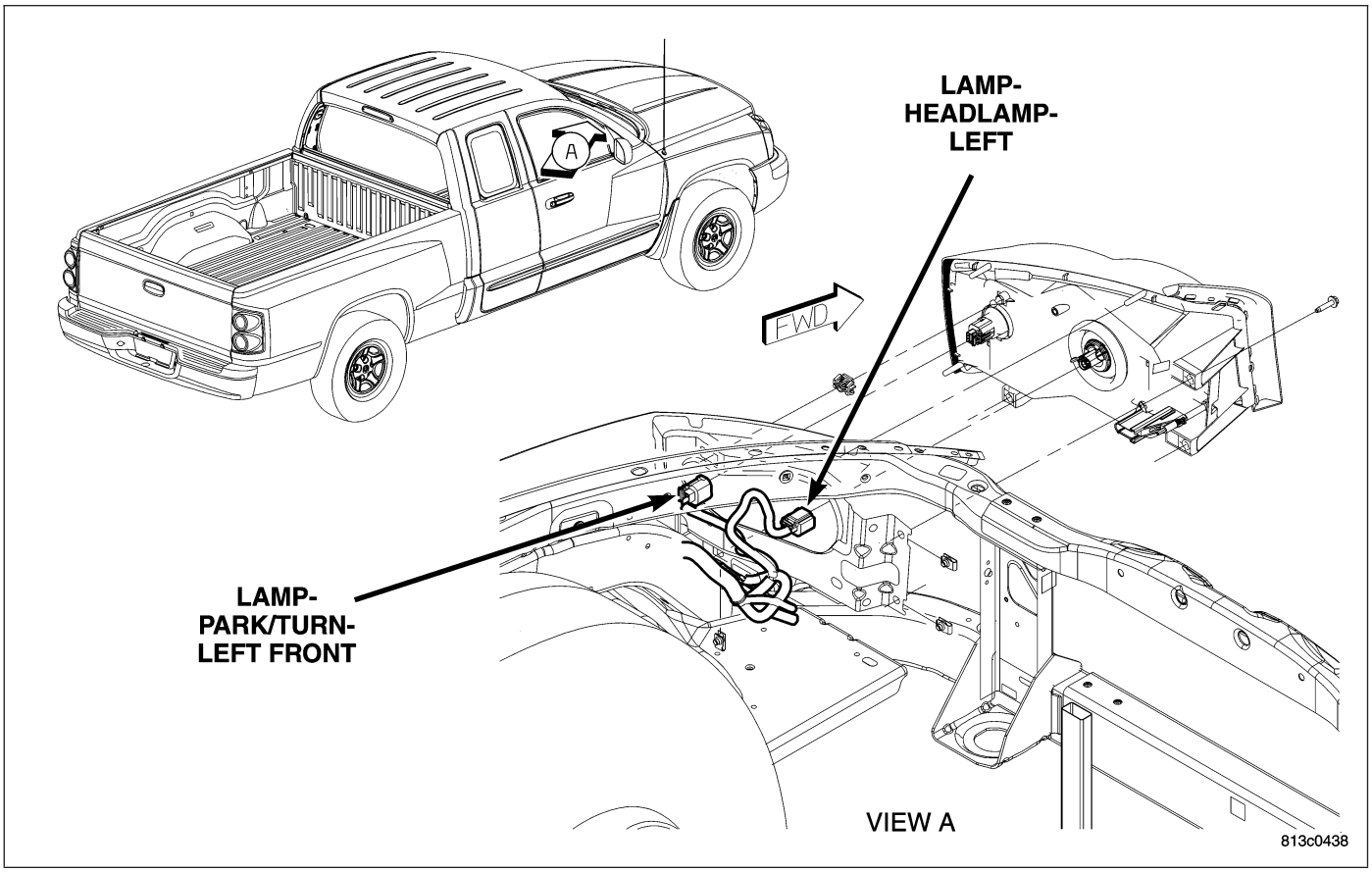

Fig. 1 LEFT FRONT LAMP ASSEMBLY

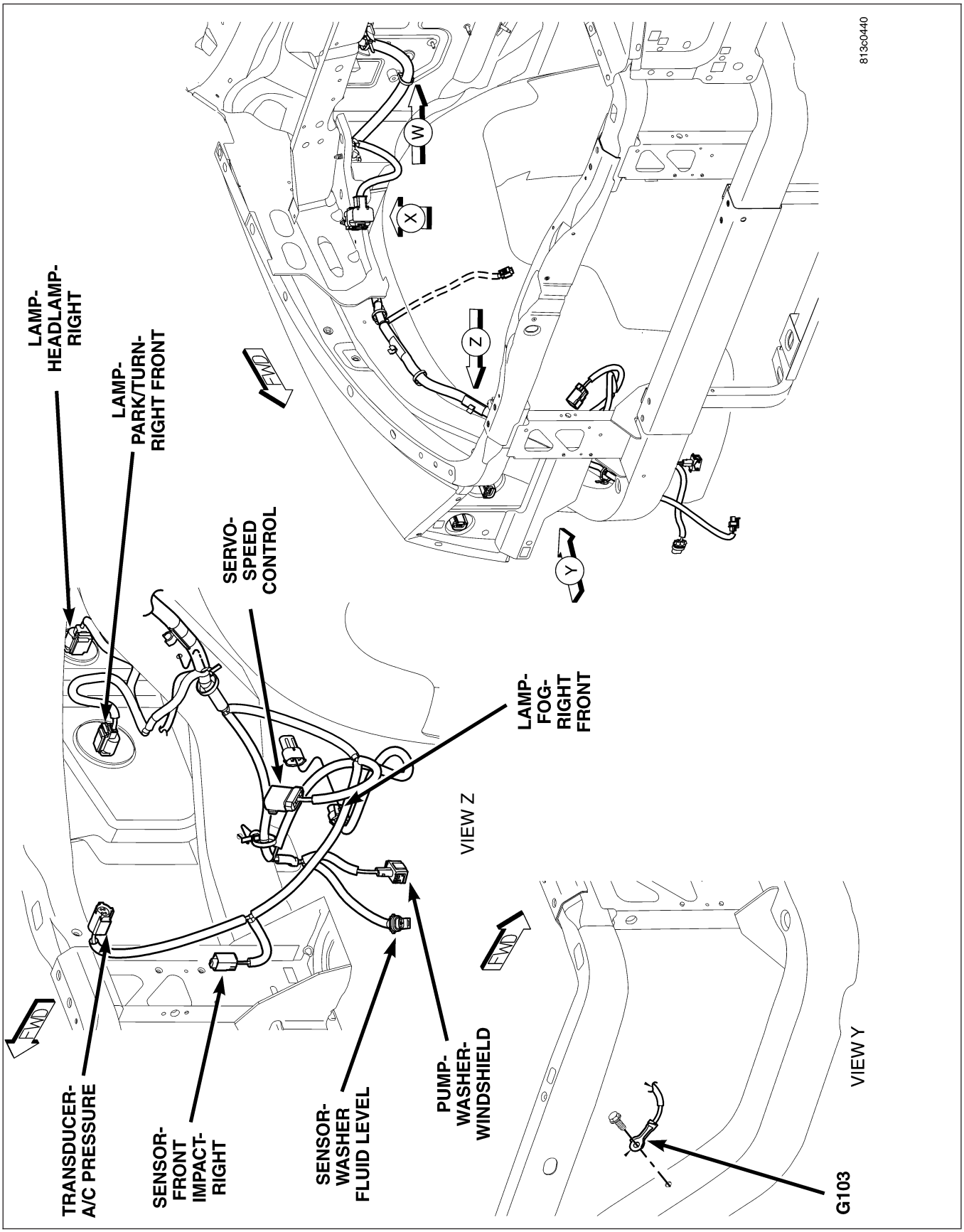

Fig. 2 RIGHT FRONT ENGINE COMPARTMENT

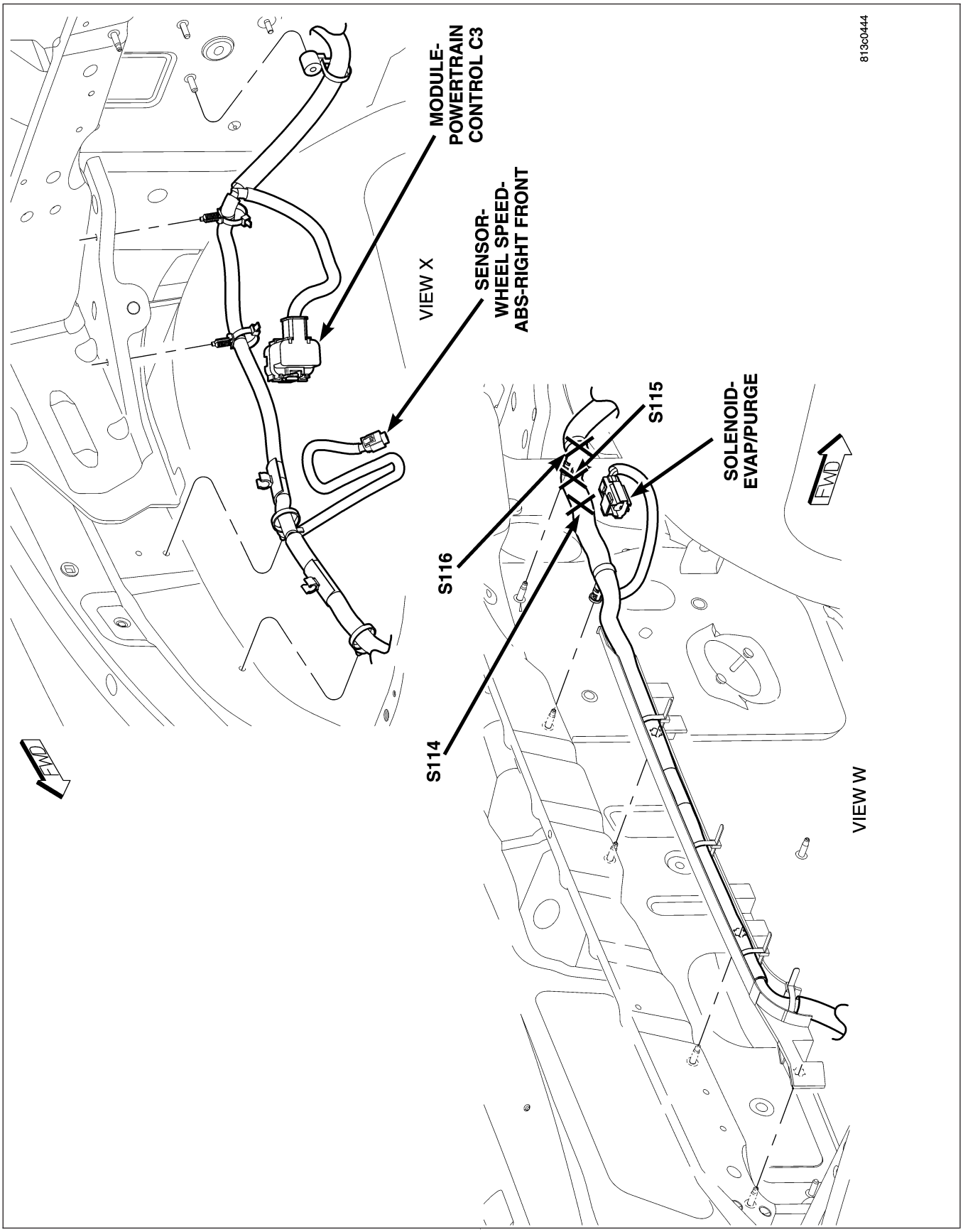

Fig. 3 REAR ENGINE COMPARTMENT

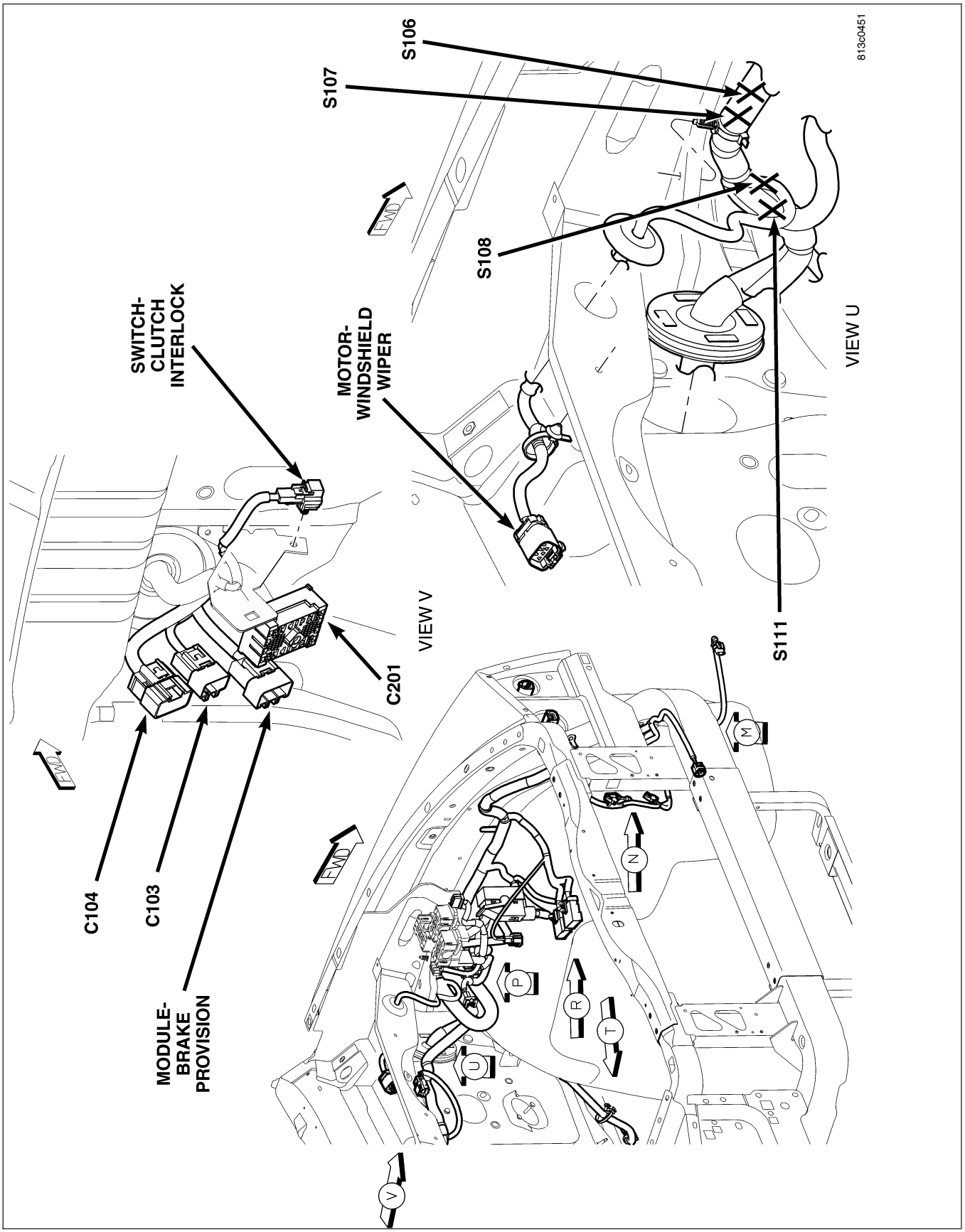

Fig. 4 LEFT REAR ENGINE COMPARTMENT

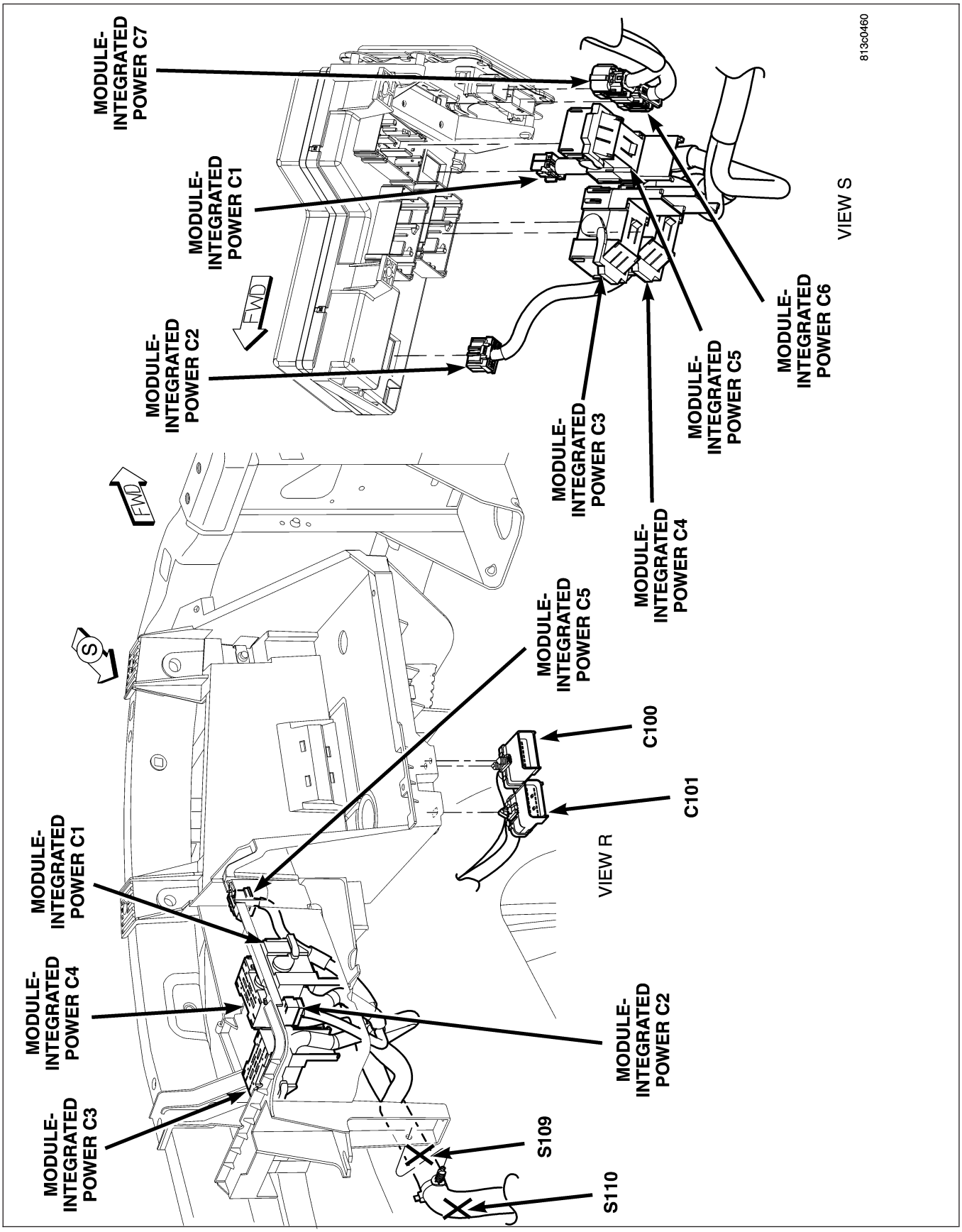

Fig. 5 LEFT SIDE ENGINE COMPARTMENT

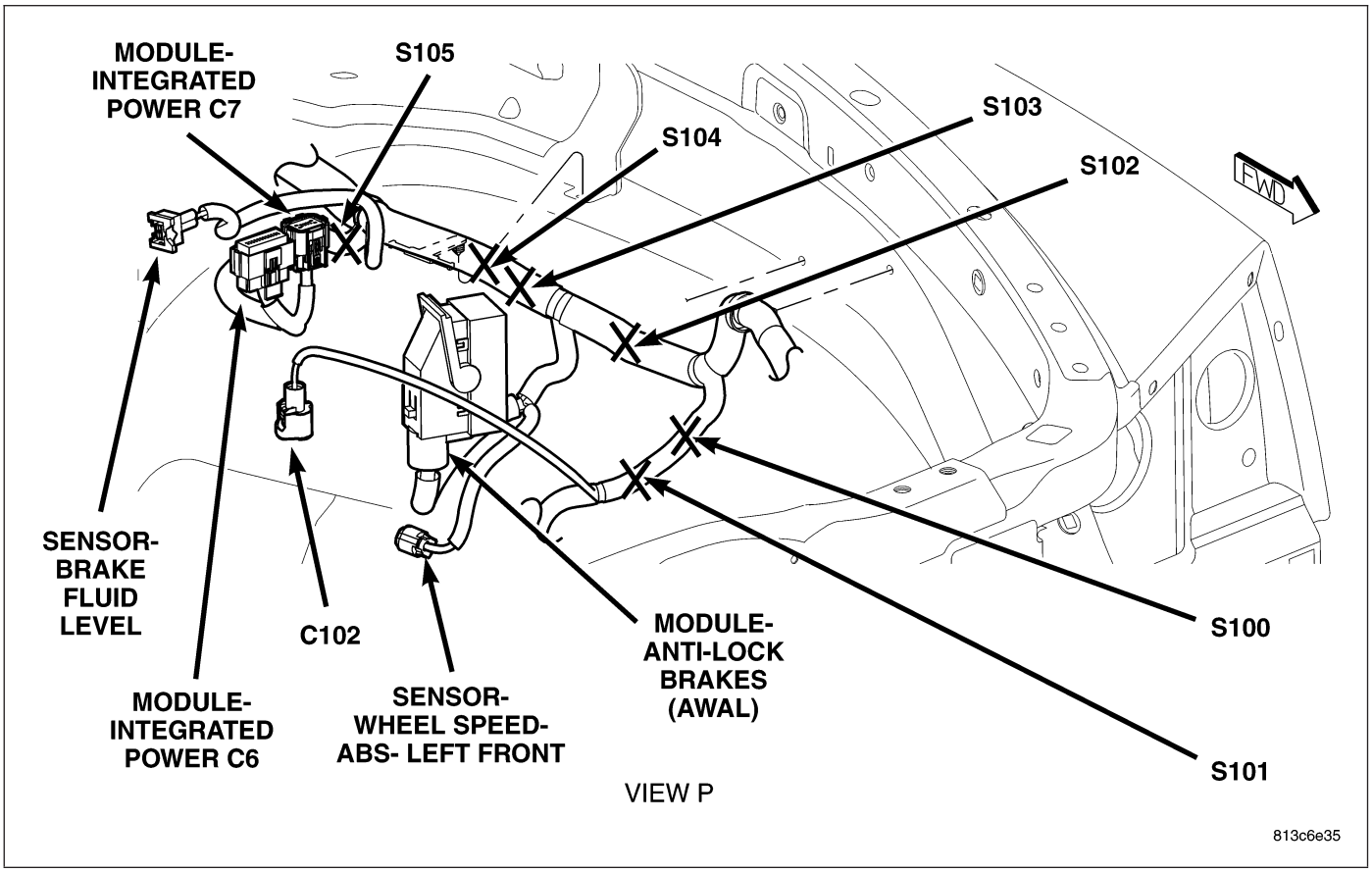

Fig. 6 LEFT ENGINE COMPARTMENT

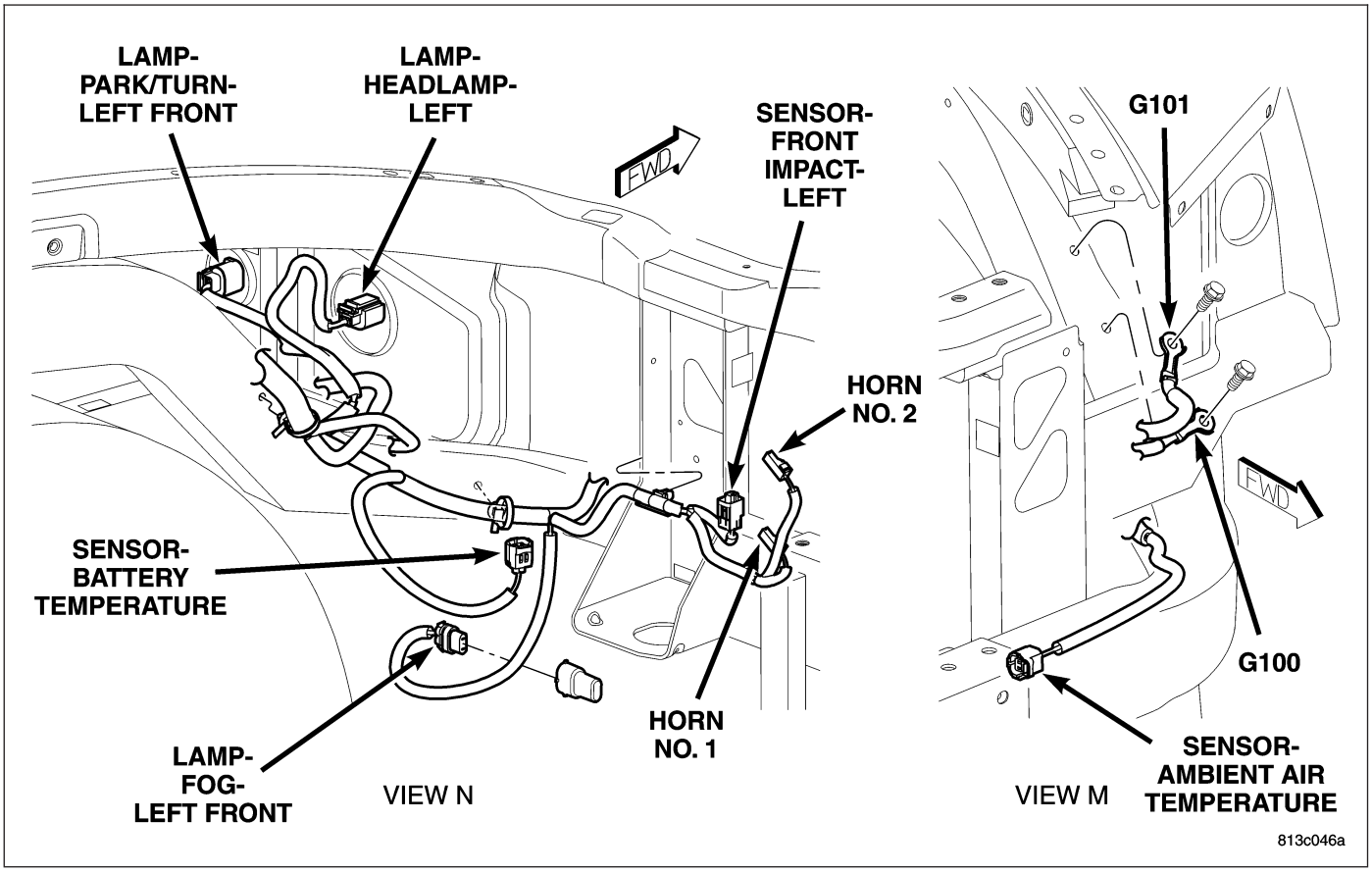

Fig. 7 LEFT FRONT ENGINE COMPARTMENT

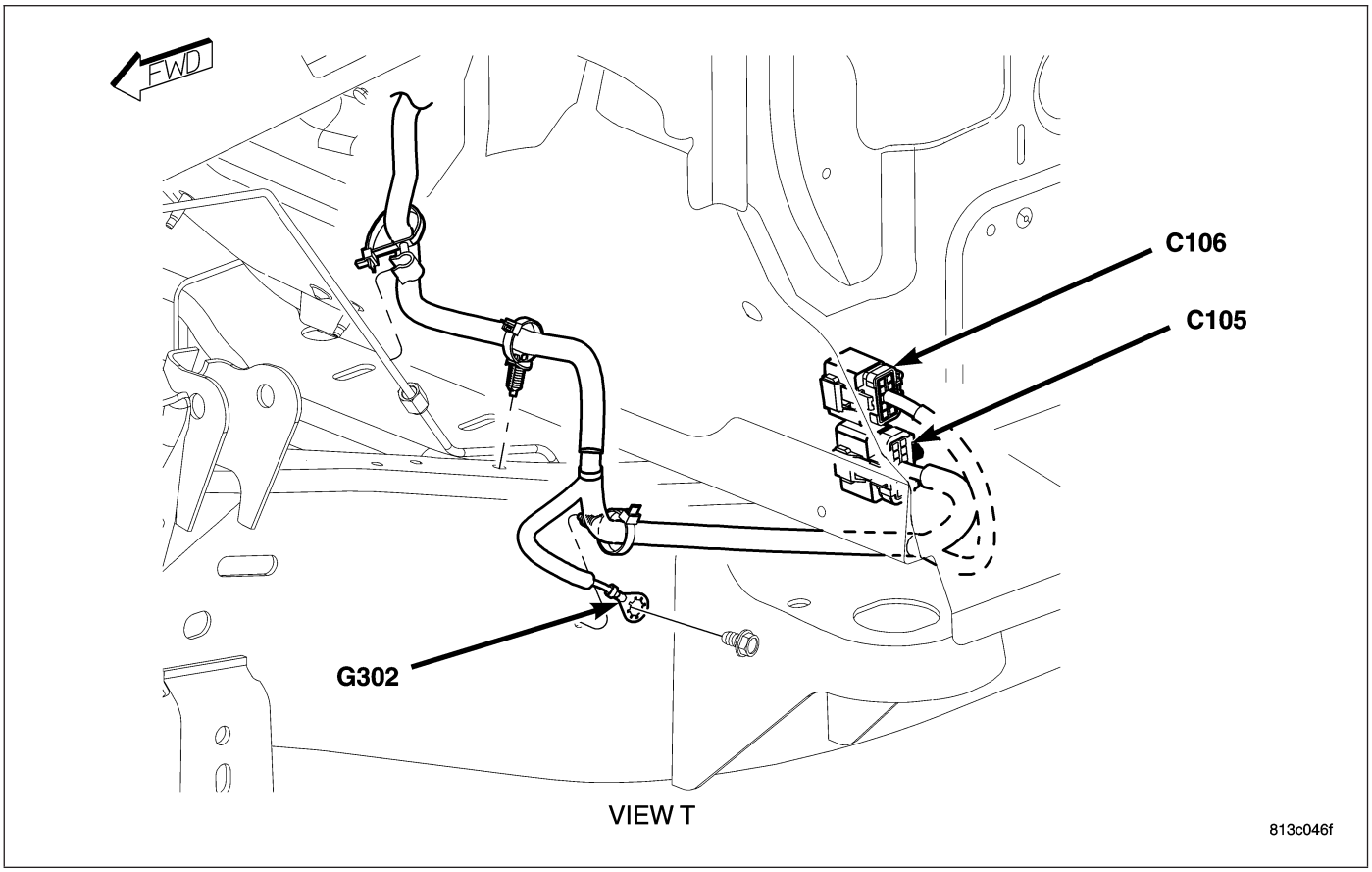

Fig. 8 LOWER RIGHT REAR ENGINE COMPARTMENT

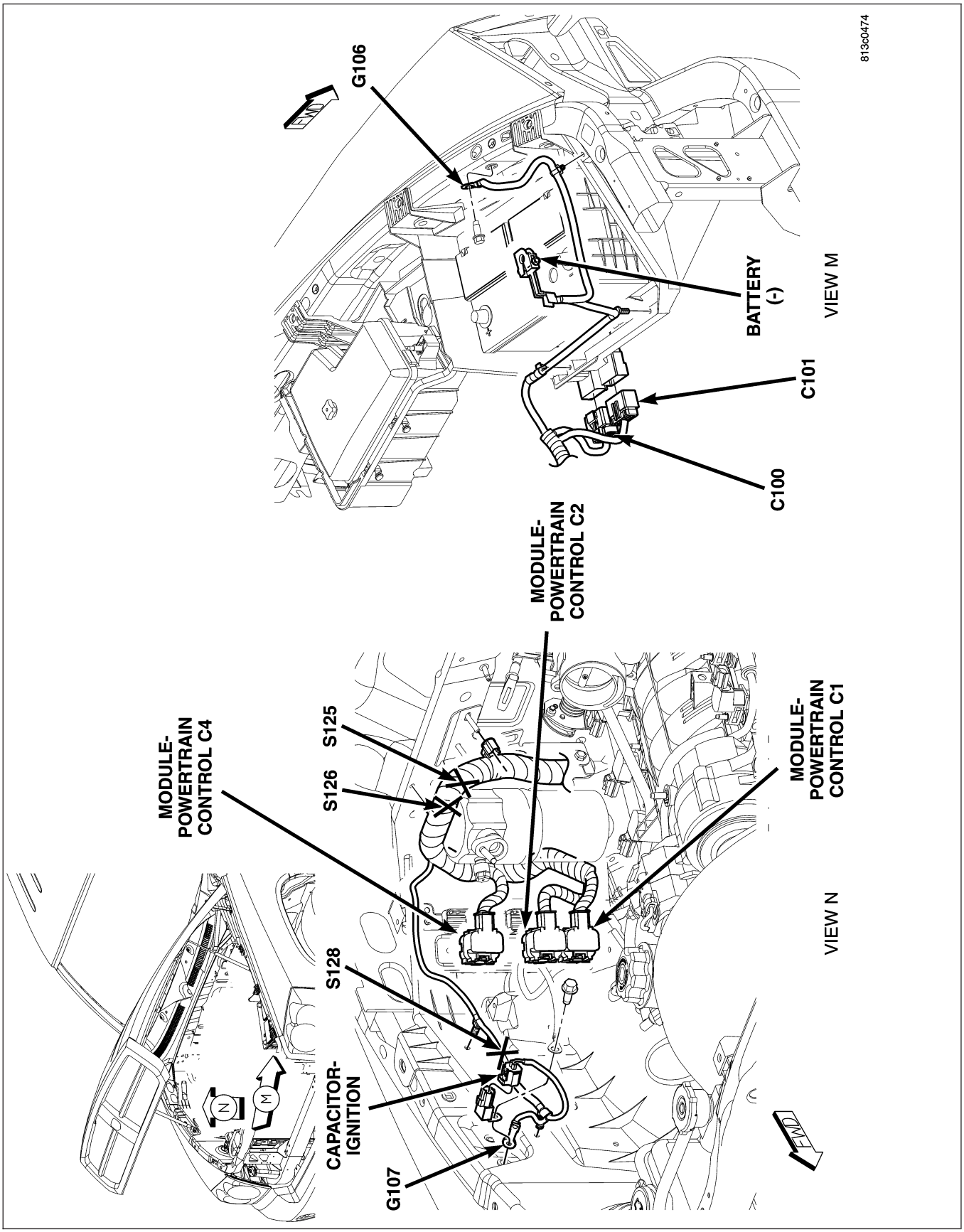

Fig. 9 ENGINE COMPARTMENT

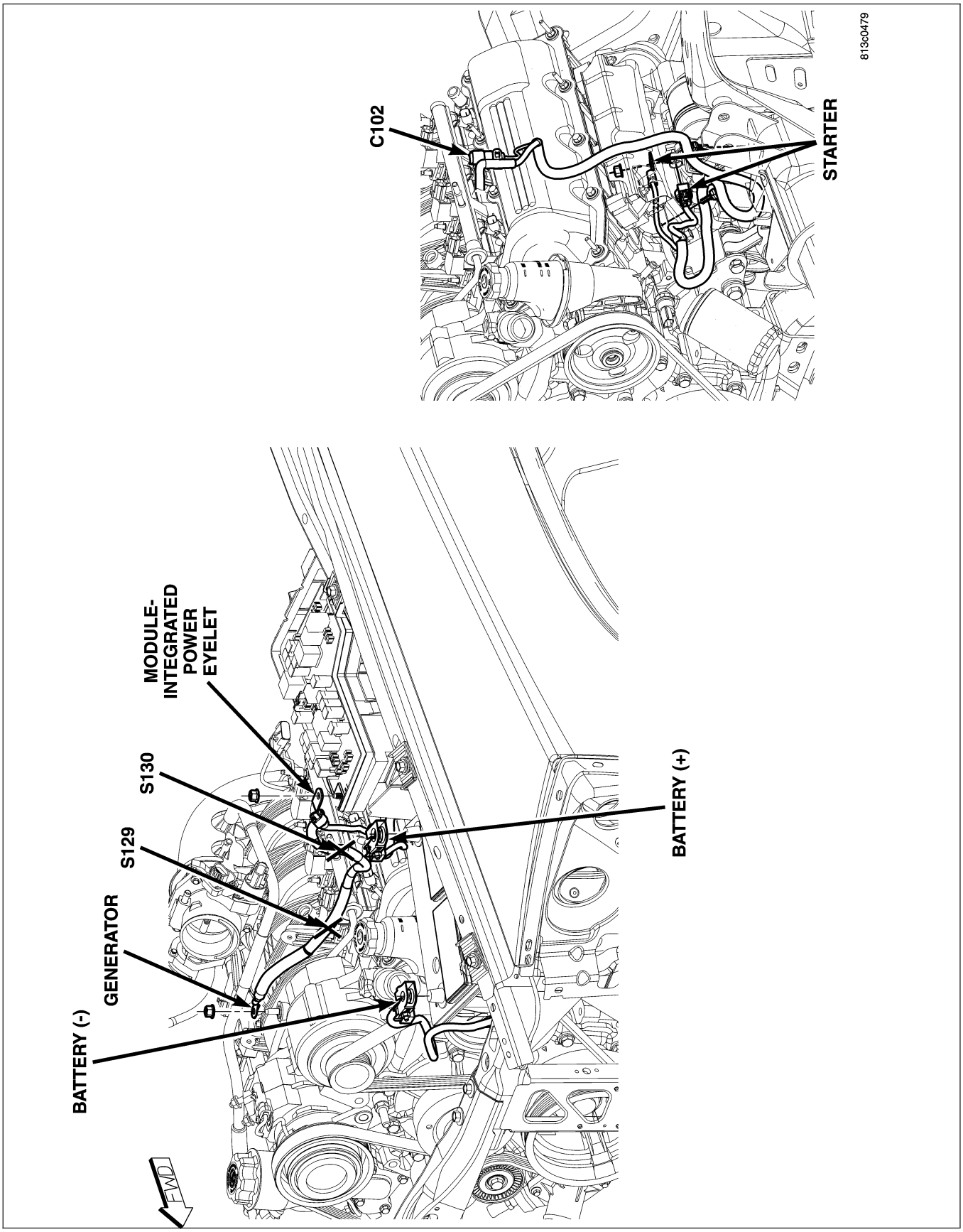

Fig. 10 LEFT FRONT ENGINE

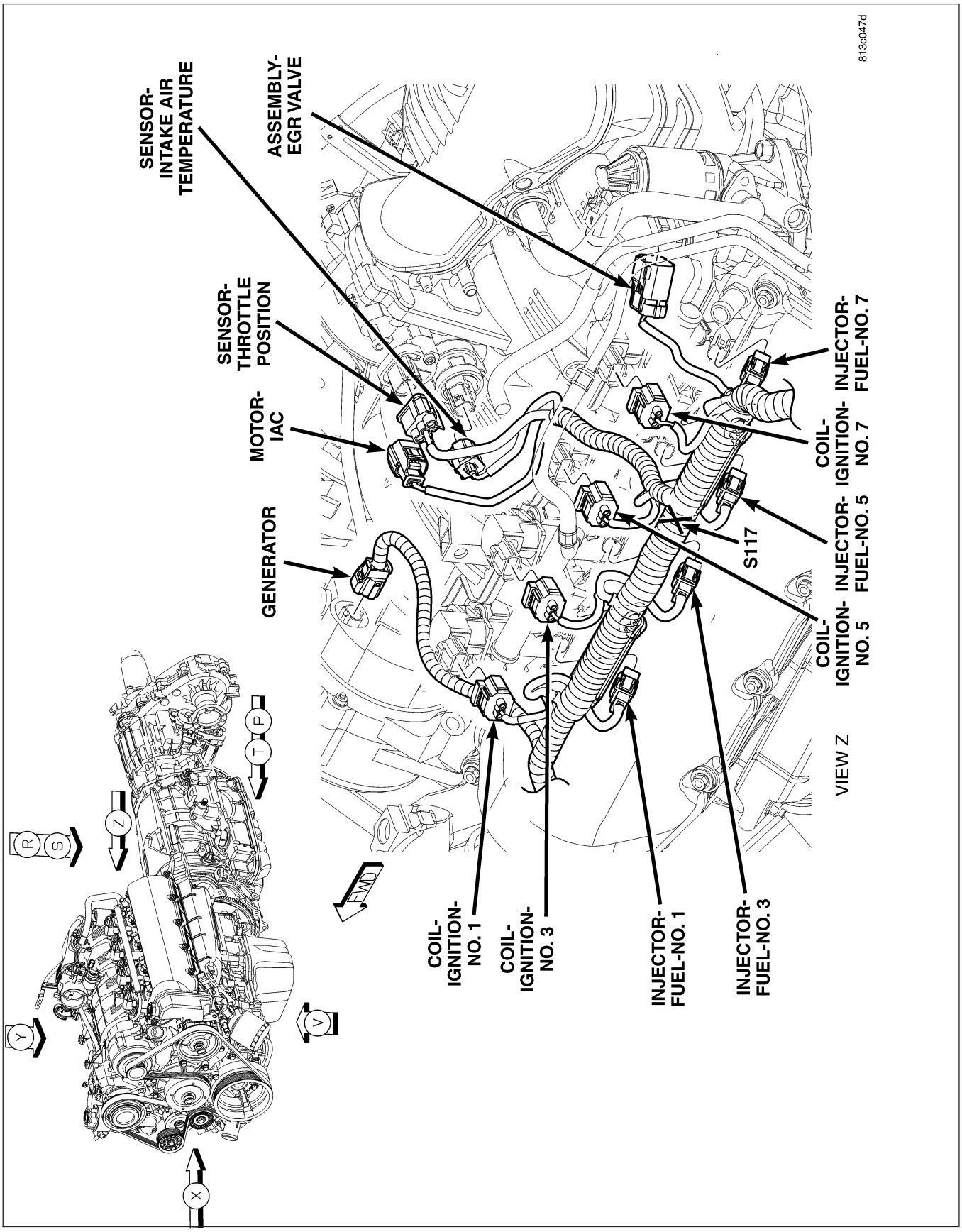

Fig. 11 UPPER LEFT ENGINE (4.7L)

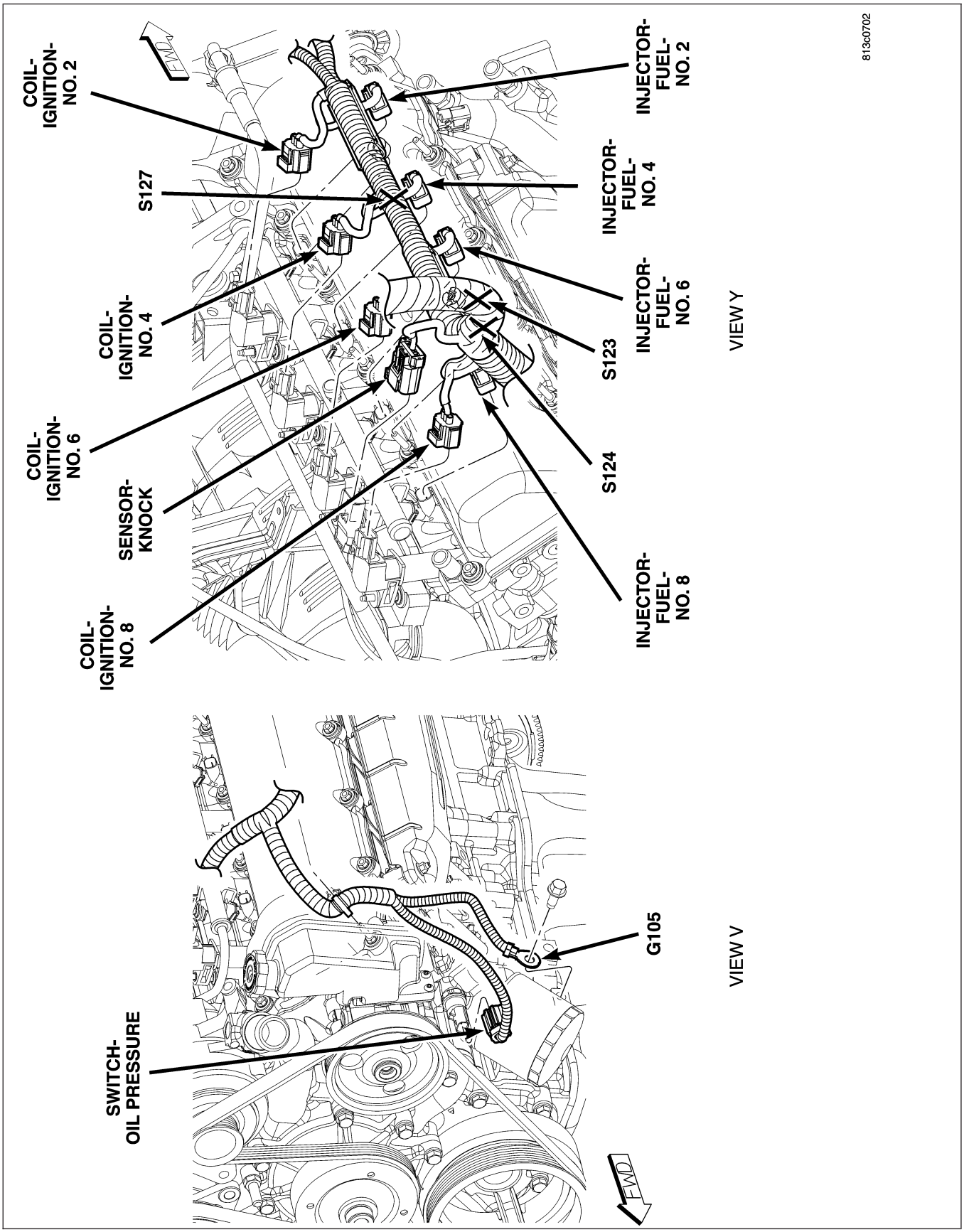

Fig. 12 LEFT FRONT AND RIGHT TOP ENGINE (4.7L)

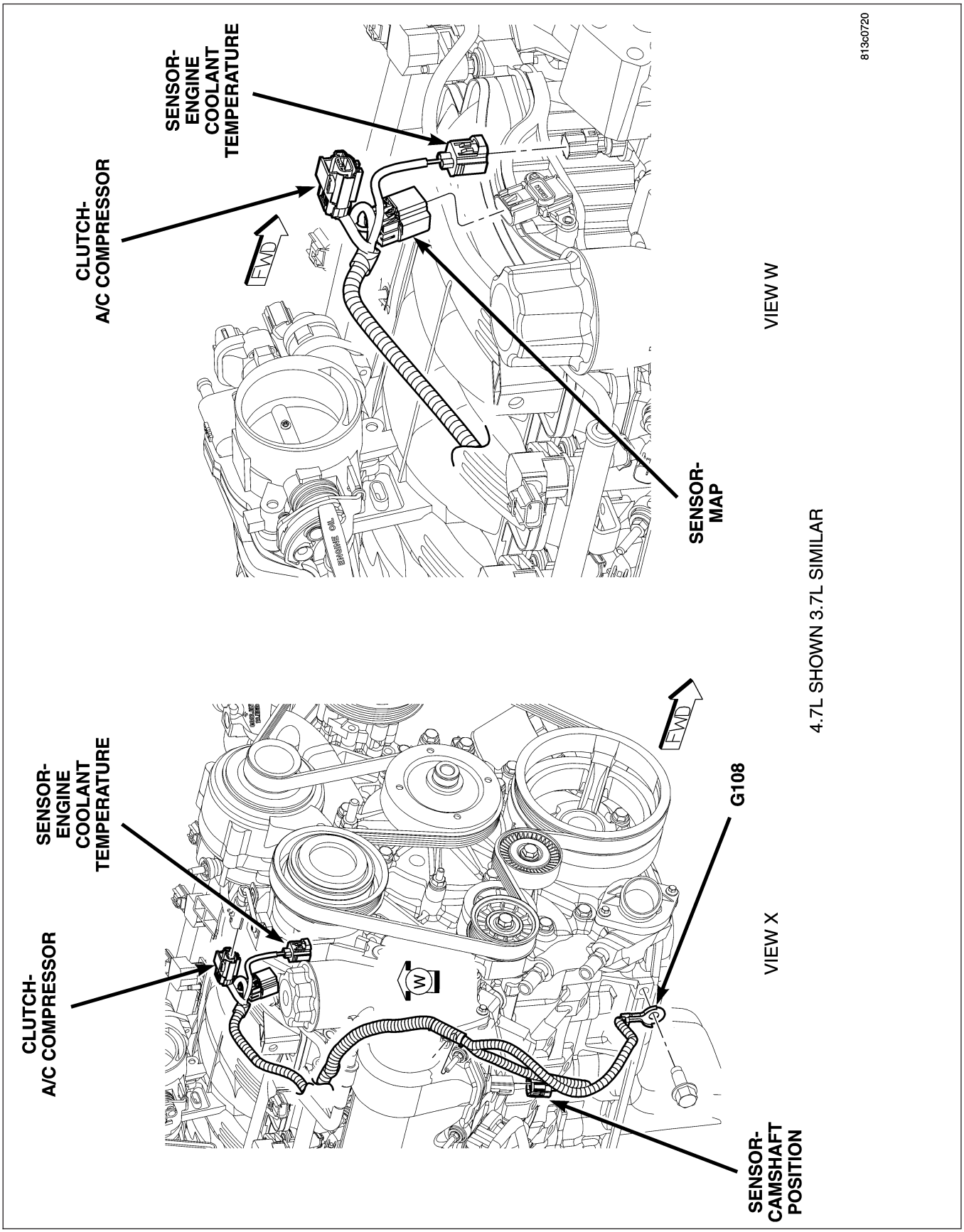

Fig. 13 RIGHT FRONT ENGINE

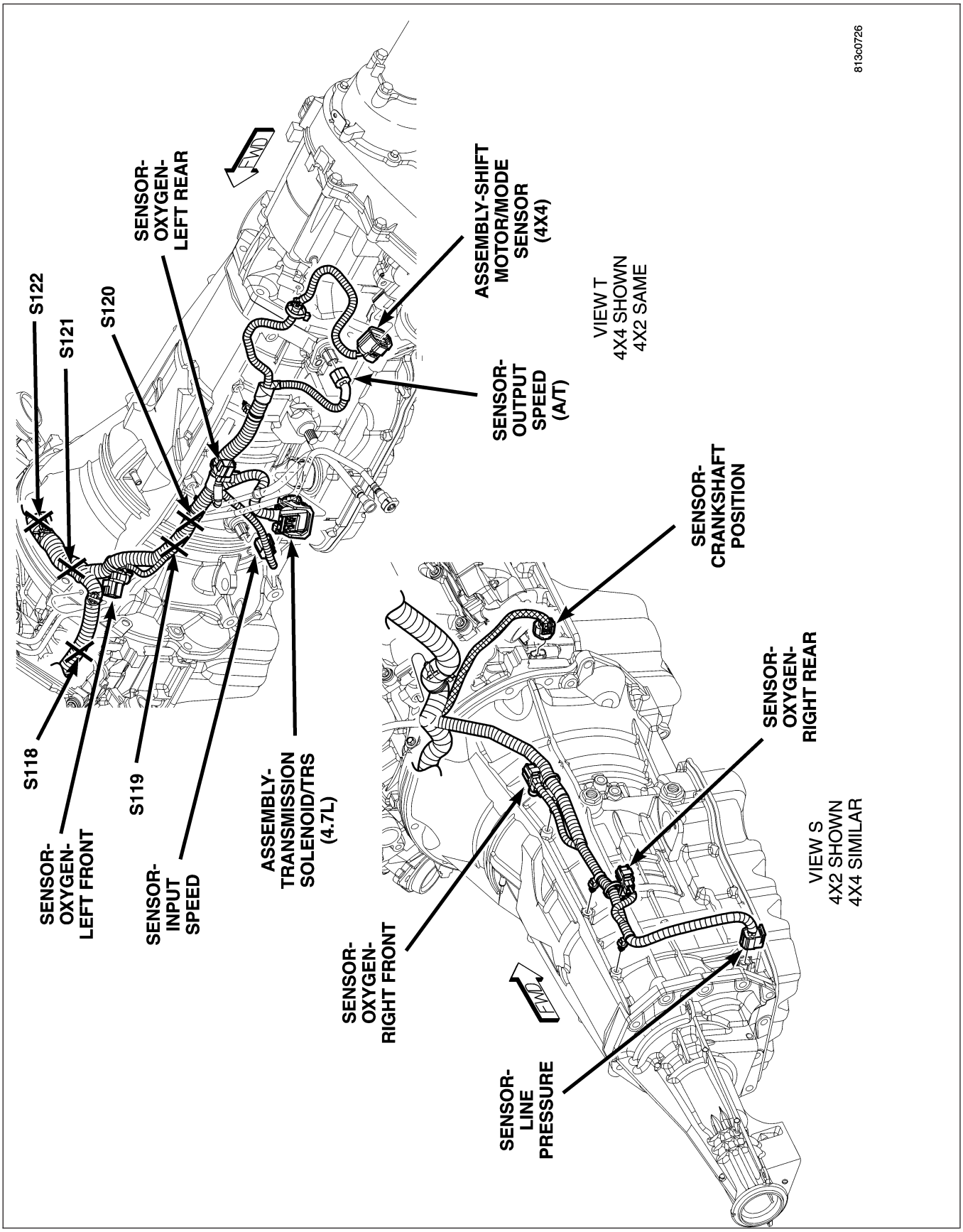

Fig. 14 AUTOMATIC TRANSMISSION (4.7L)

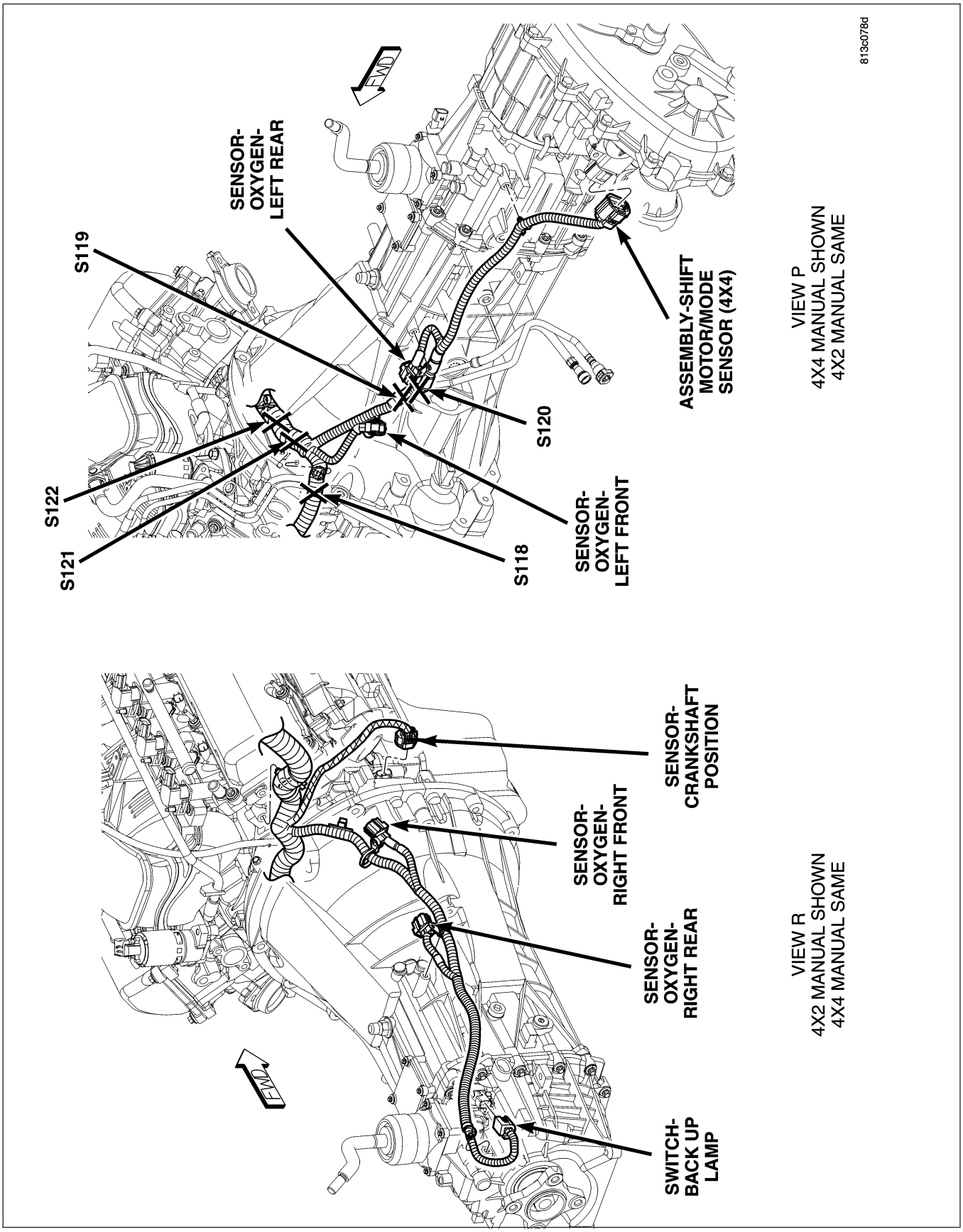

Fig. 15 MANUAL TRANSMISSION

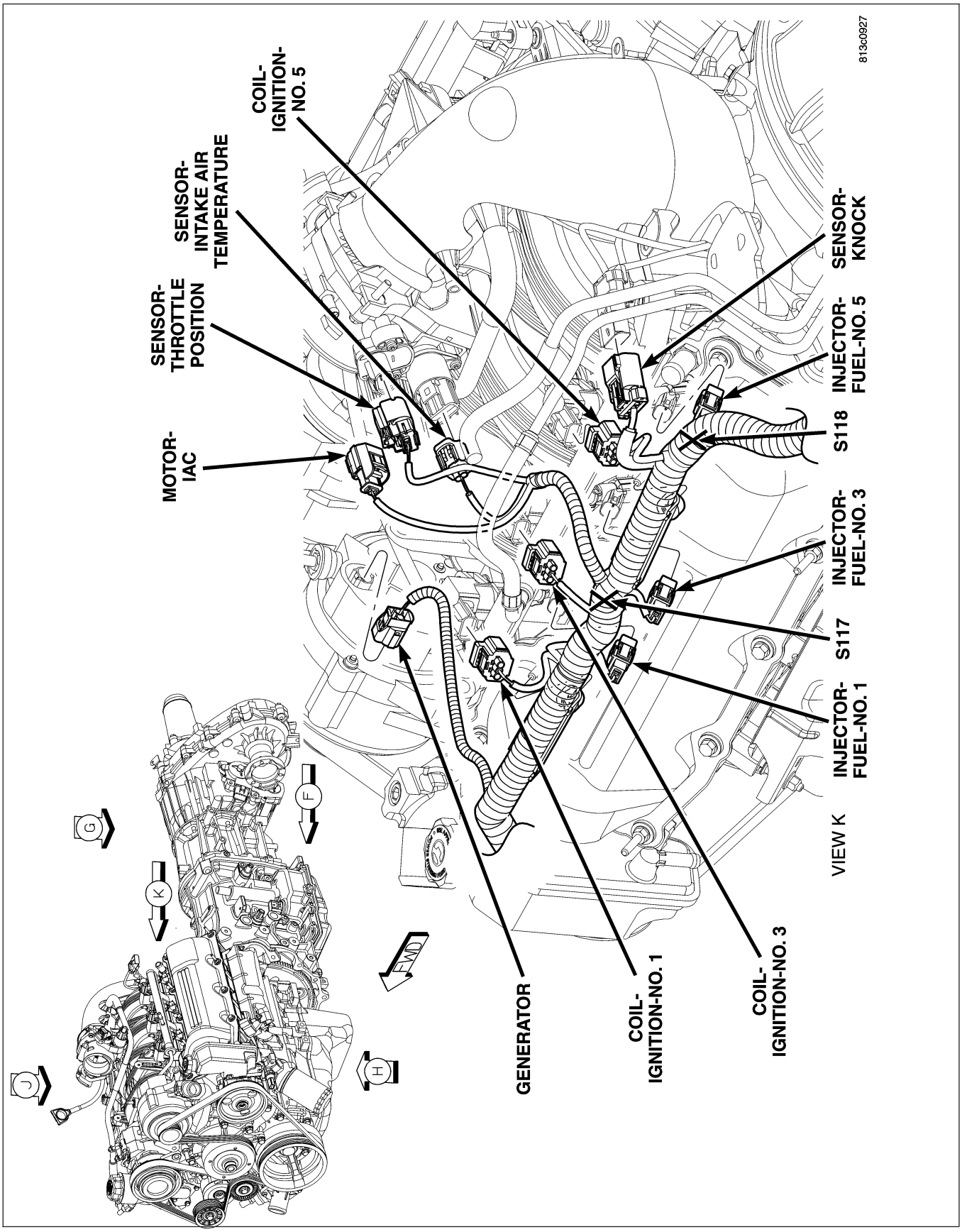

Fig. 16 LEFT REAR ENGINE (3.7L)

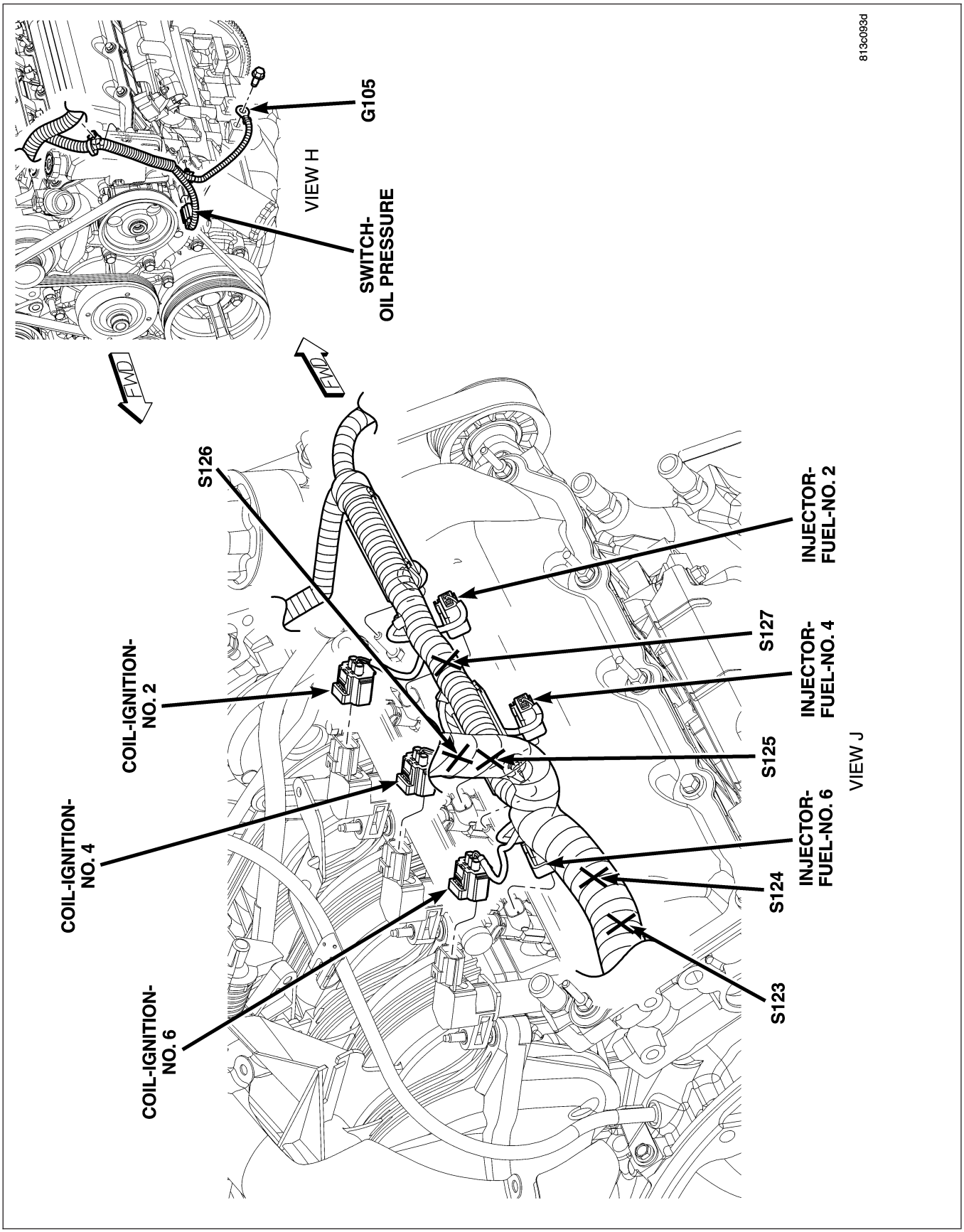

Fig. 17 LEFT FRONT AND RIGHT TOP ENGINE (3.7L)

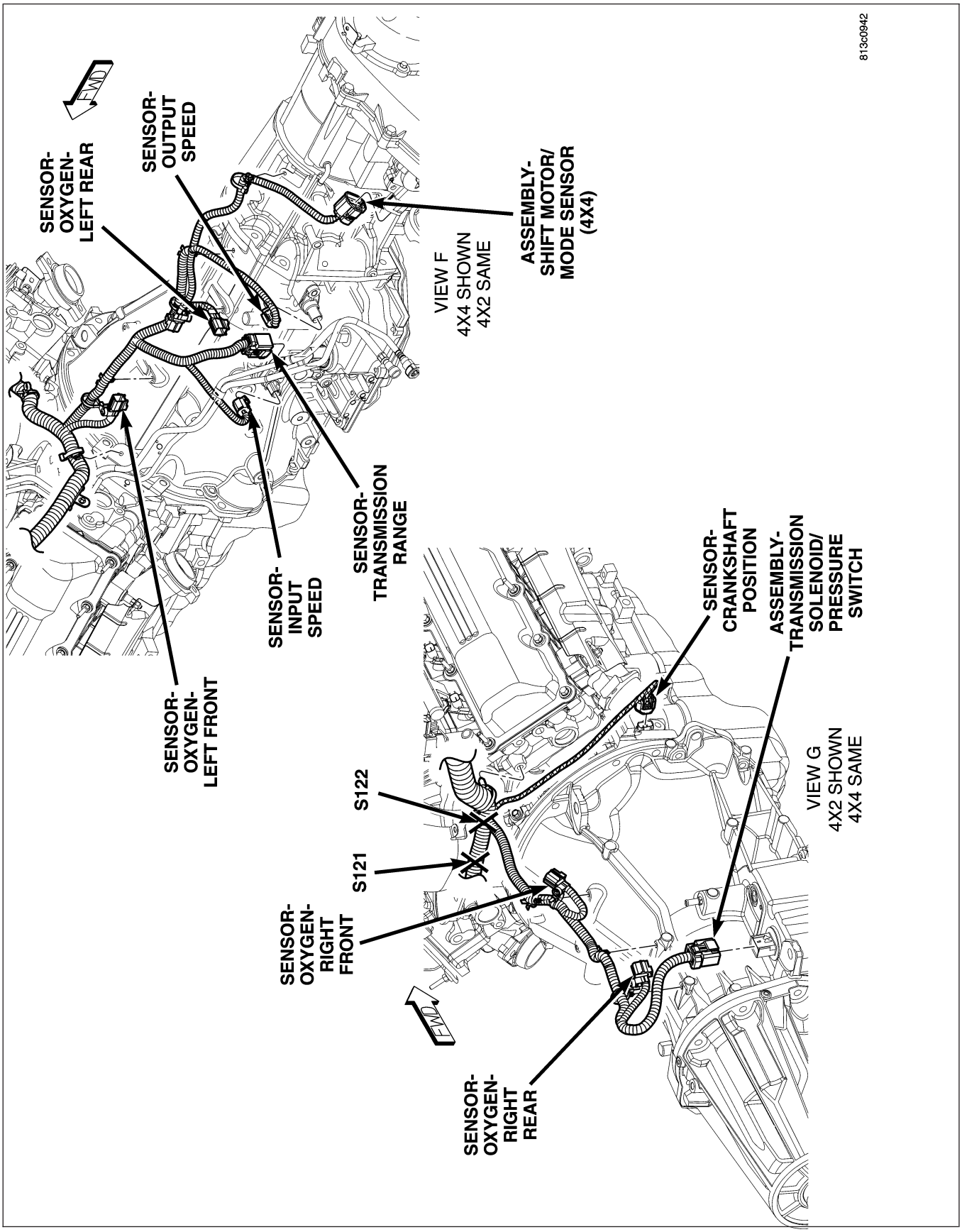

Fig. 18 AUTOMATIC TRANSMISSION (3.7L)

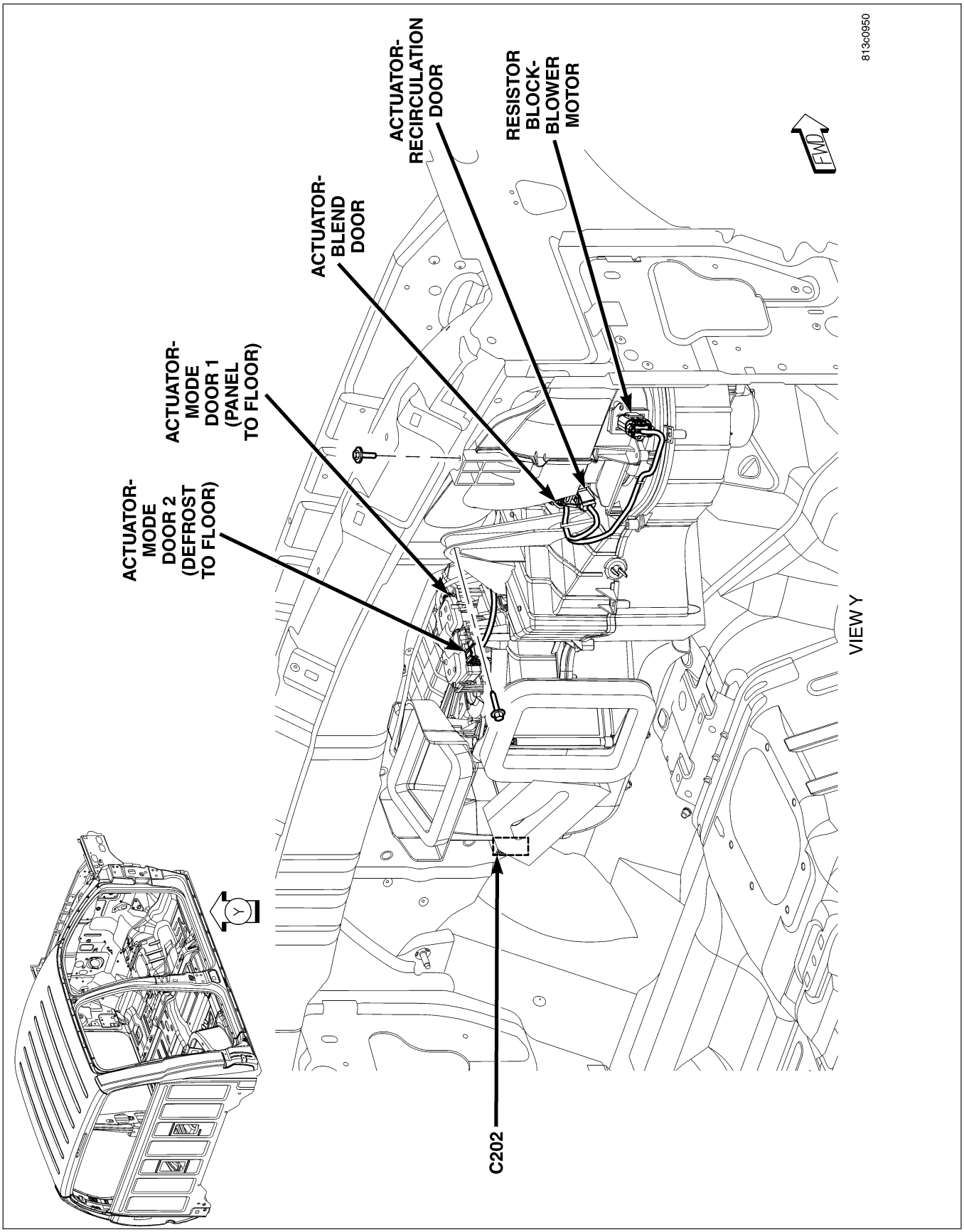

Fig. 19 HVAC UNIT

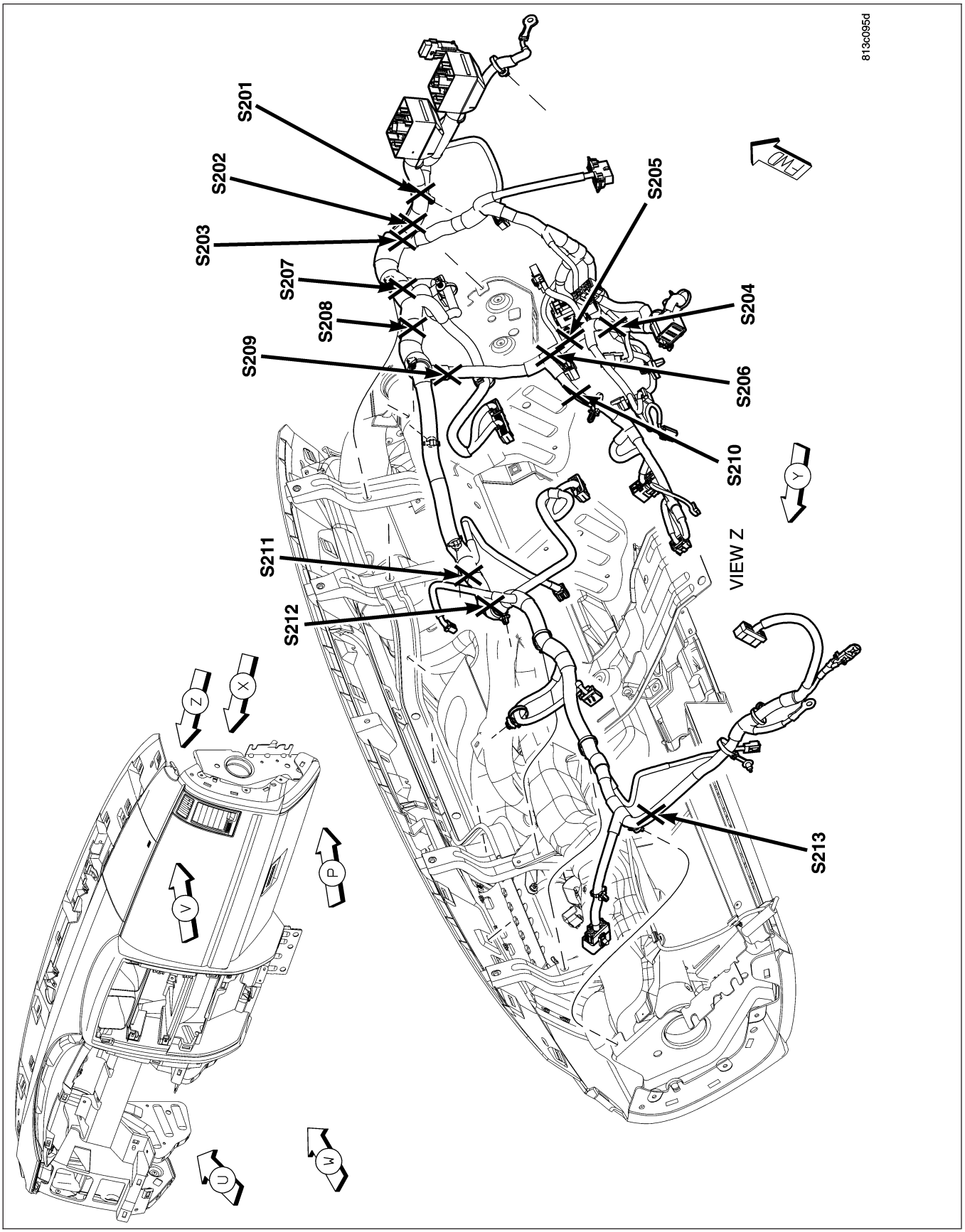

Fig. 20 INSTRUMENT PANEL

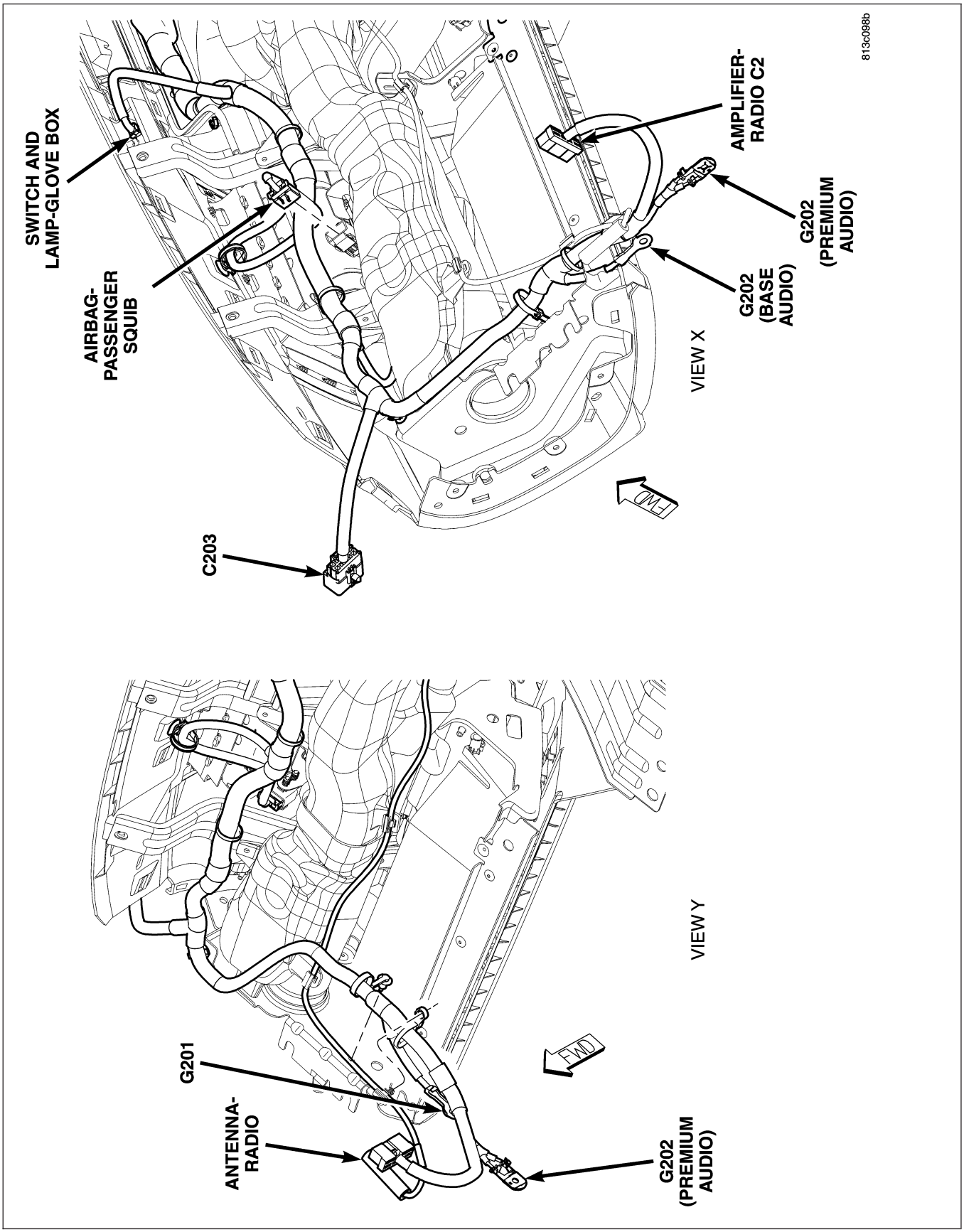

Fig. 21 RIGHT SIDE INSTRUMENT PANEL

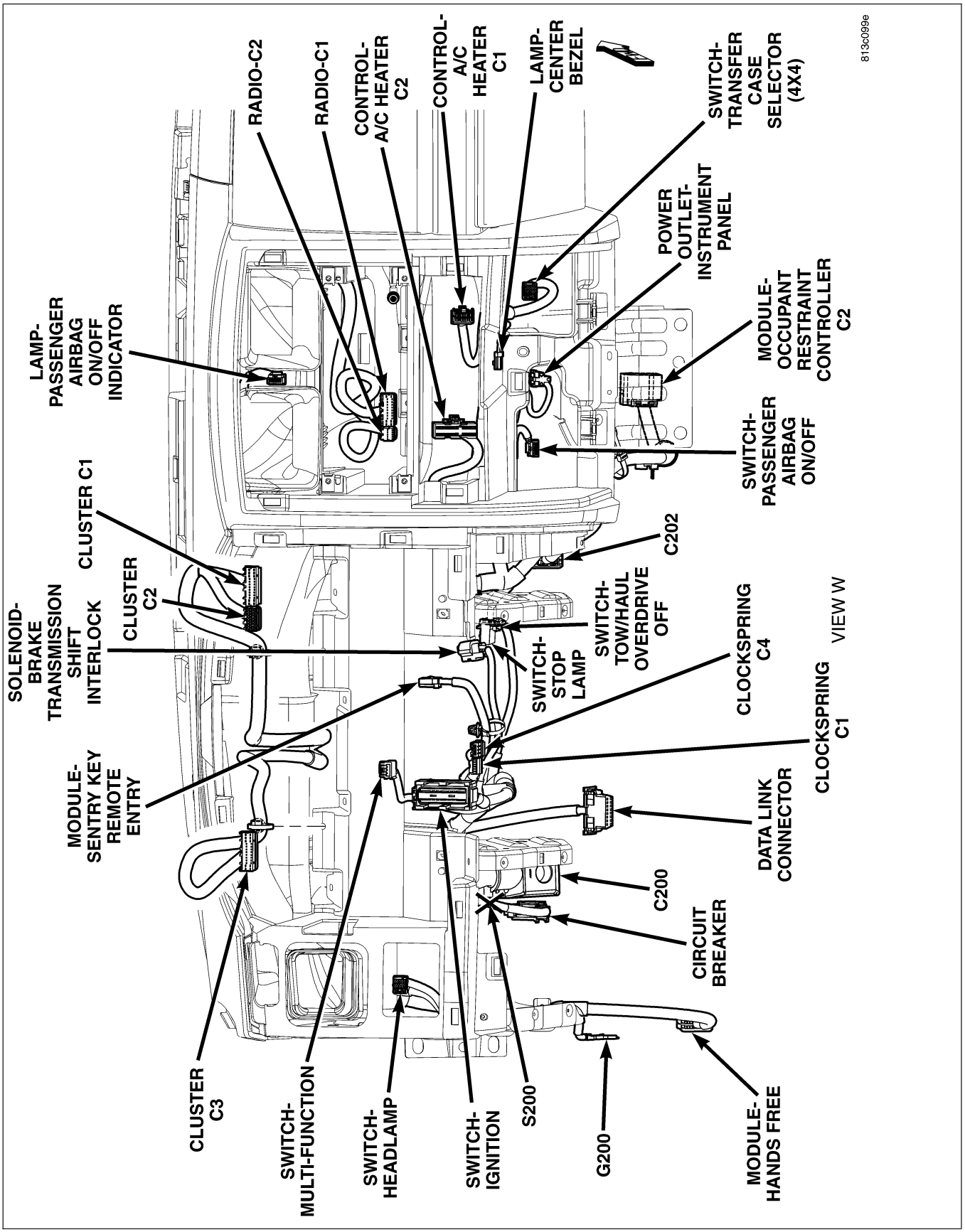

Fig. 22 LEFT FRONT INSTRUMENT PANEL

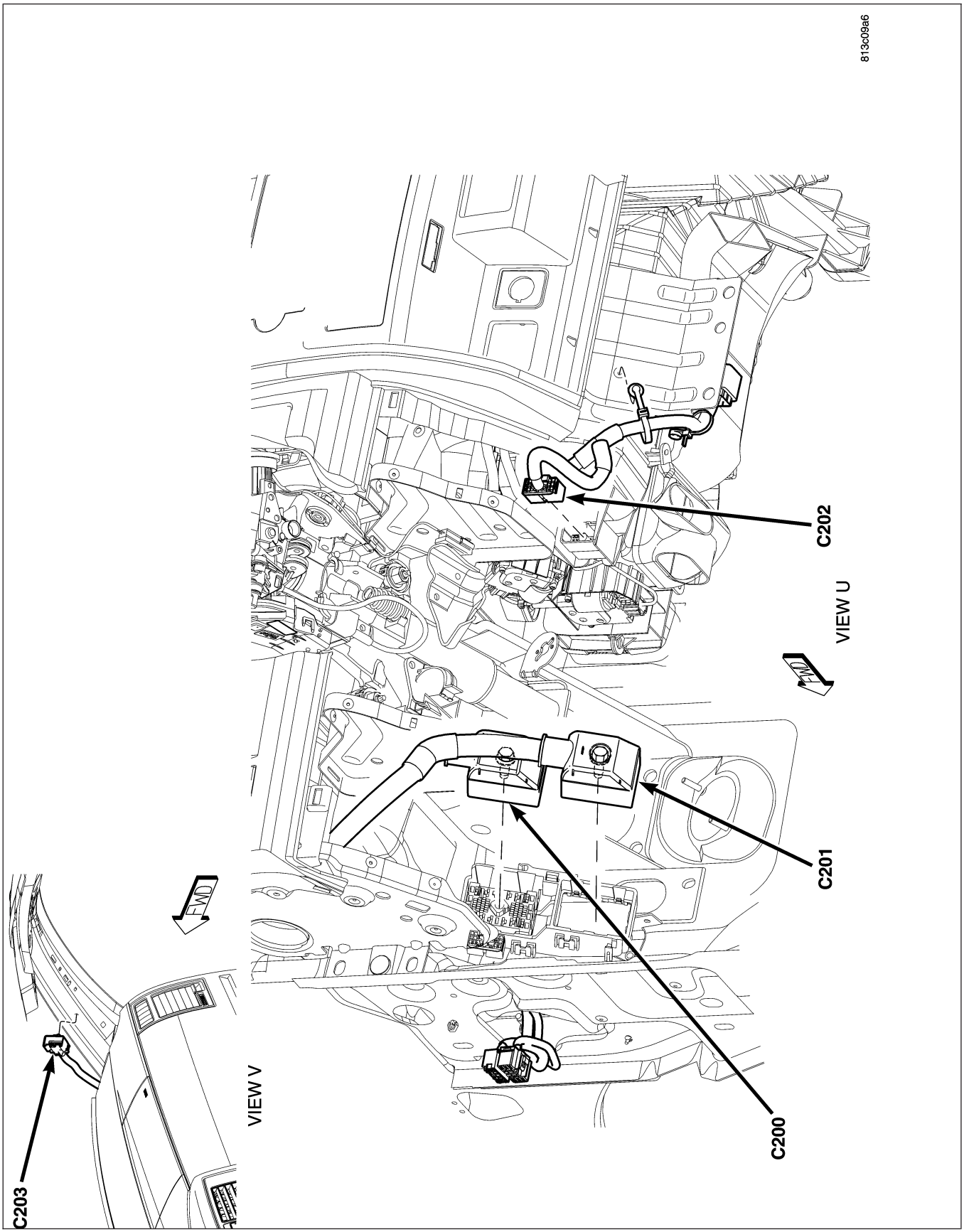

Fig. 23 LOWER LEFT INSTRUMENT PANEL

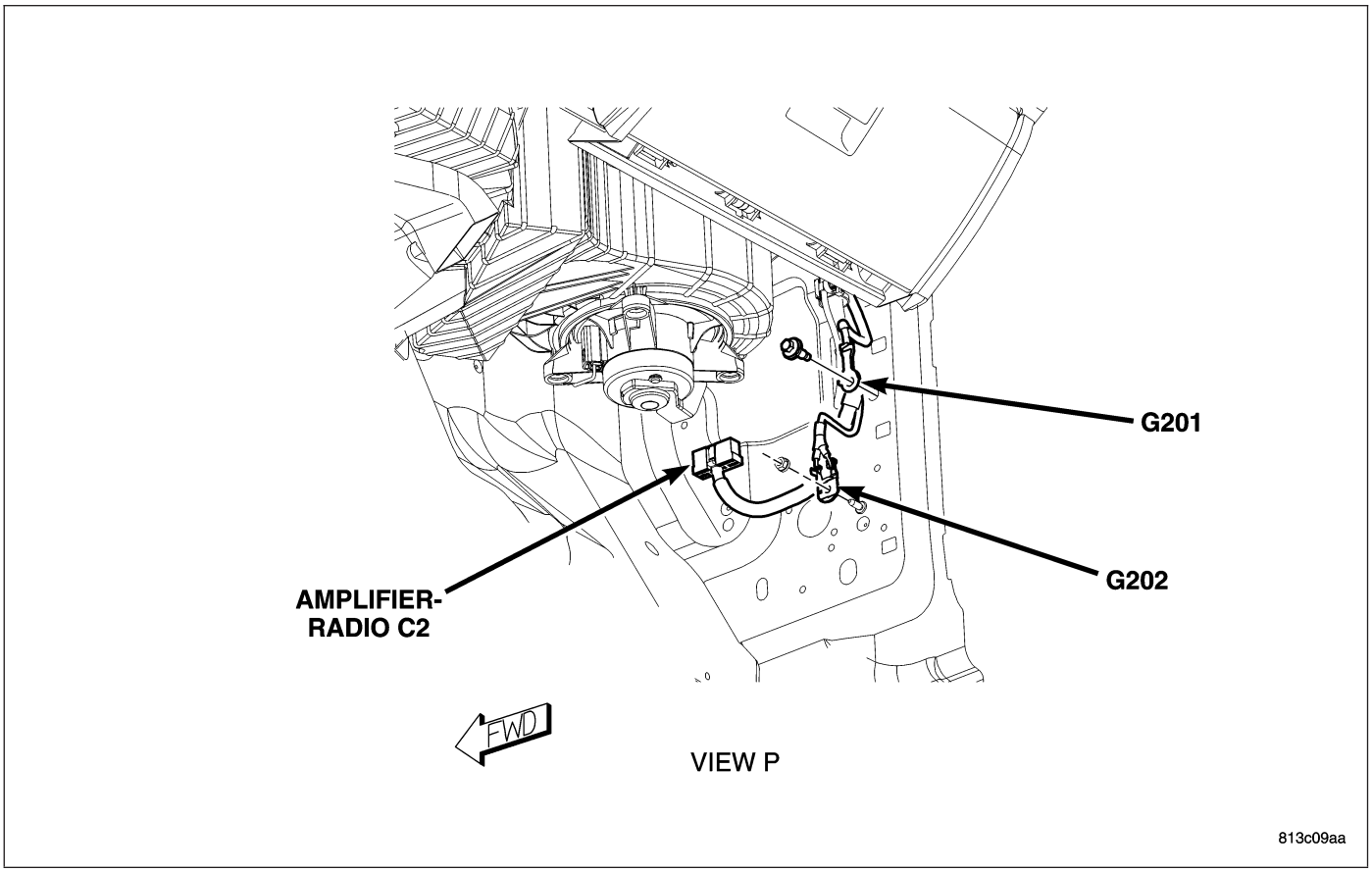

Fig. 24 LOWER RIGHT INSTRUMENT PANEL

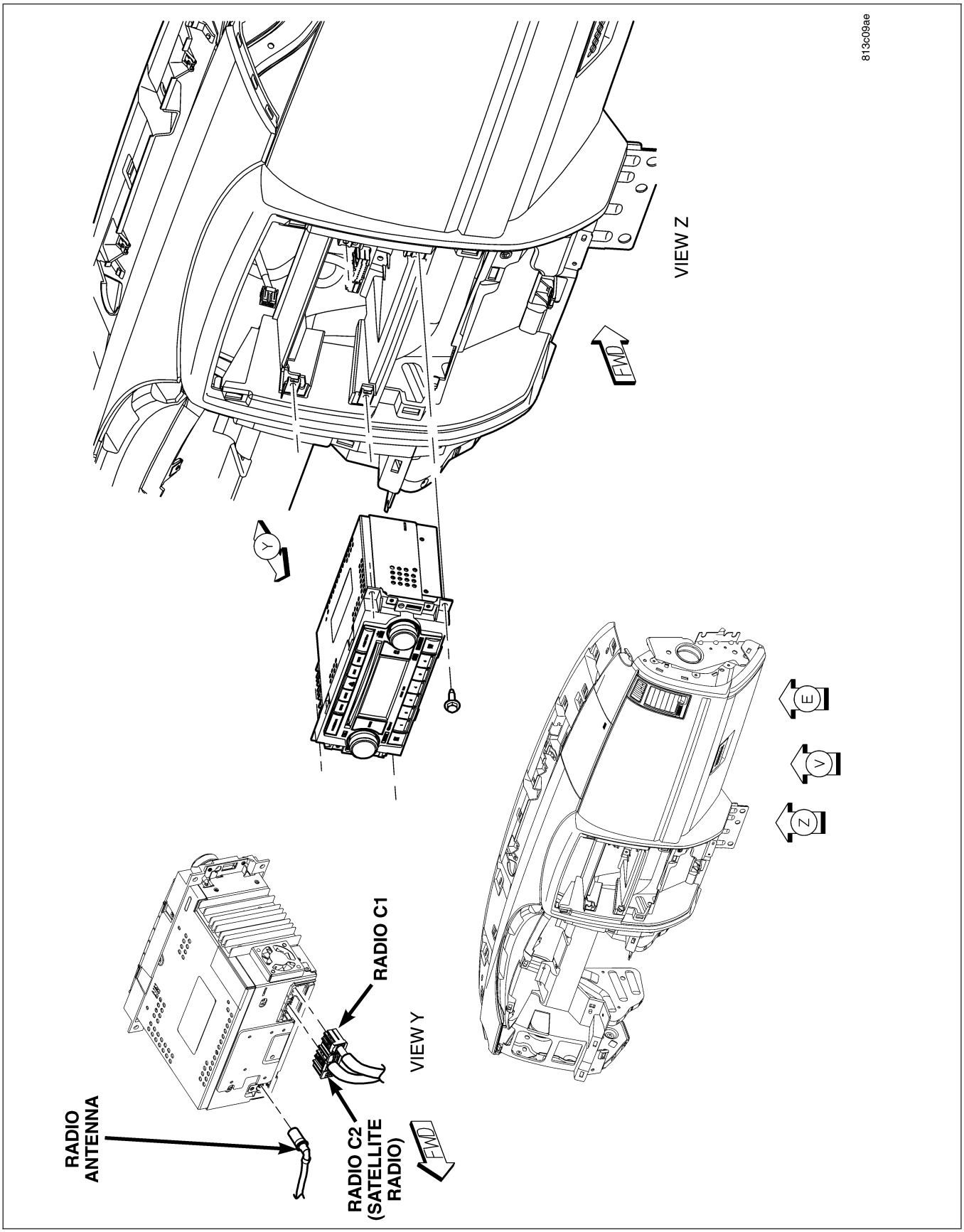
813c09ae
VIEW Z
FWD
Y
E
V
Z
RADIO C1
VIEW Y
RADIO ANTENNA
RADIO C2 (SATELLITE RADIO)
FWD

Fig. 25 RADIO

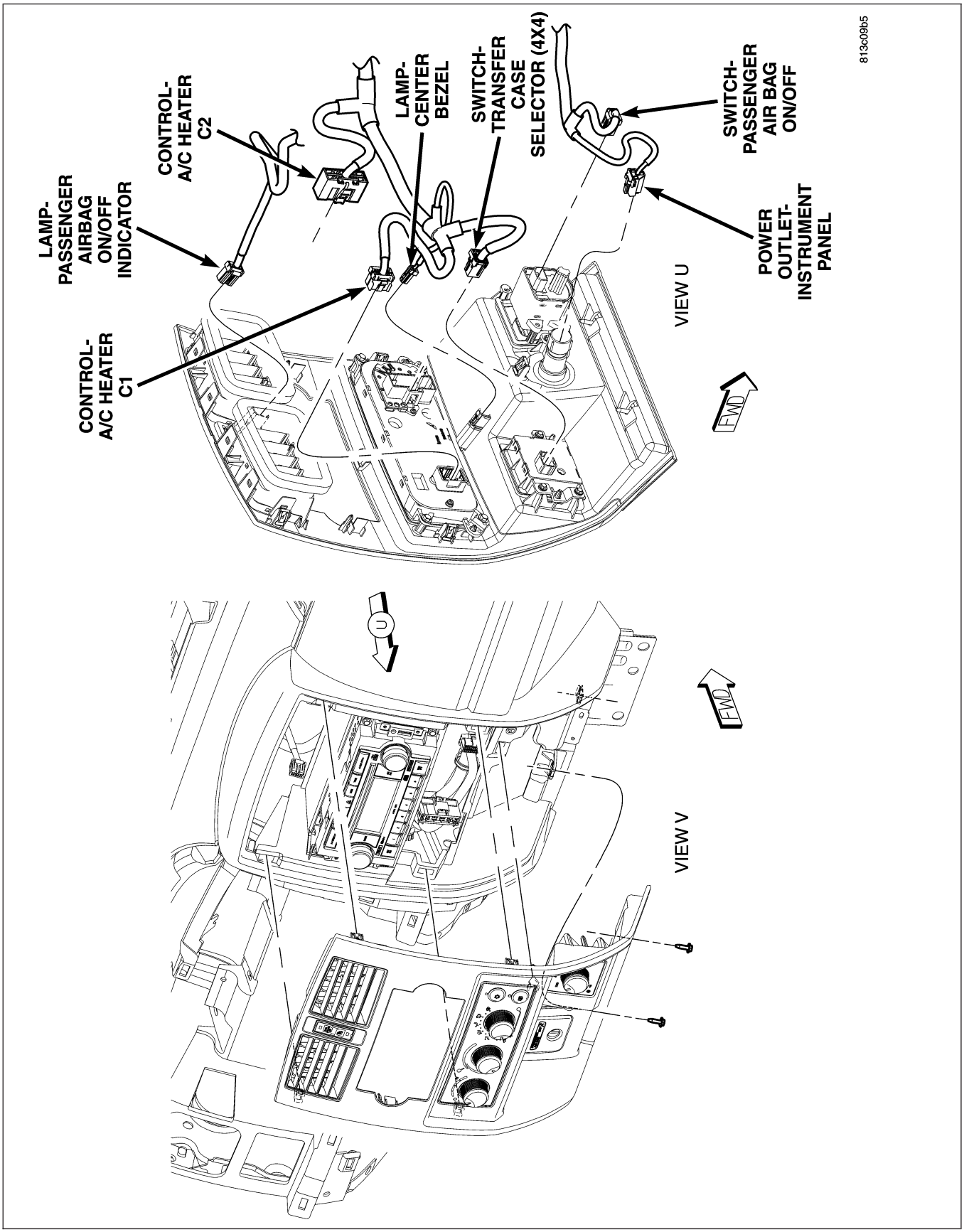

Fig. 26 CENTER STACK

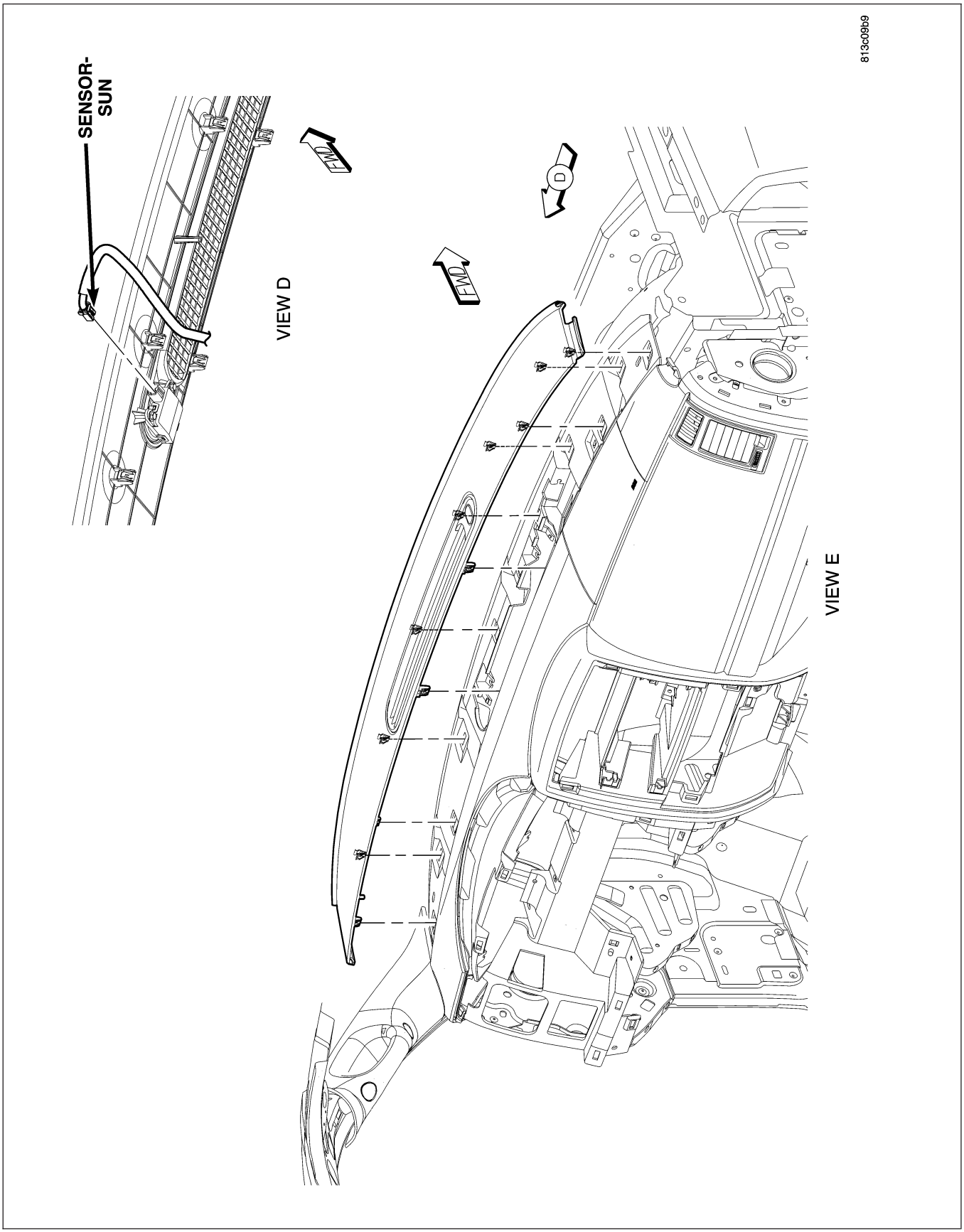

Fig. 27 TOP INSTRUMENT PANEL

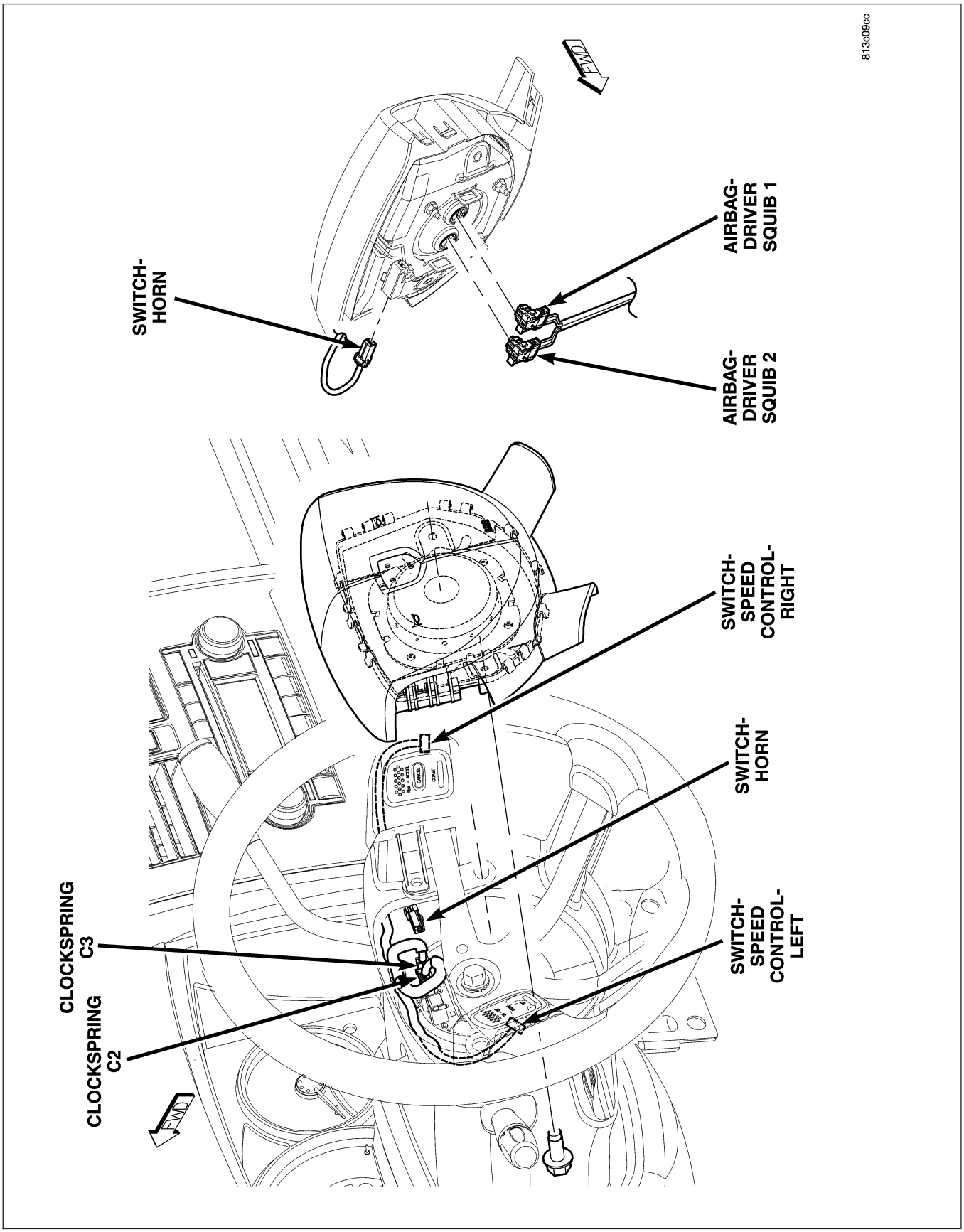

Fig. 28 STEERING WHEEL

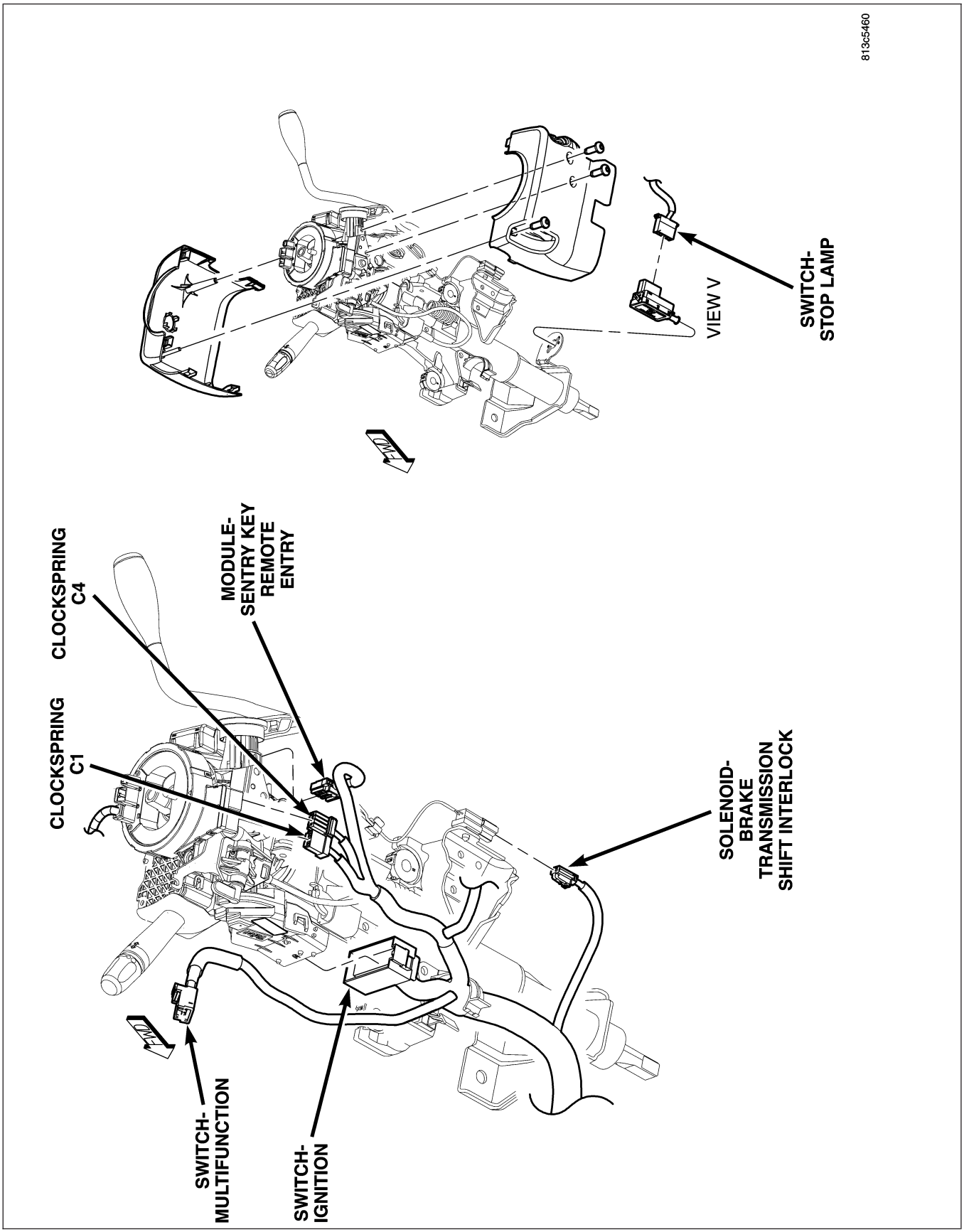

Fig. 29 STEERING COLUMN

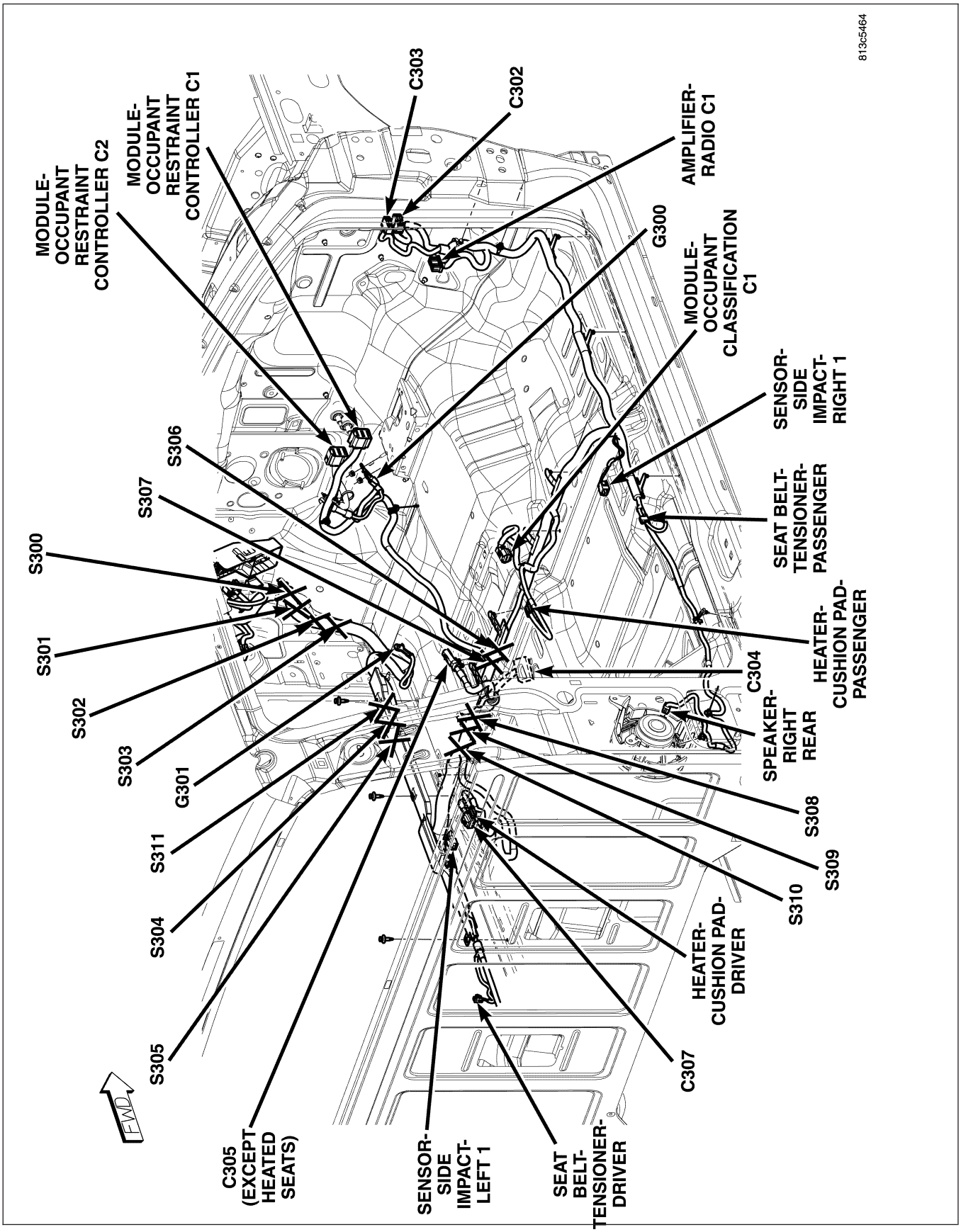

Fig. 30 BODY (CLUB CAB)

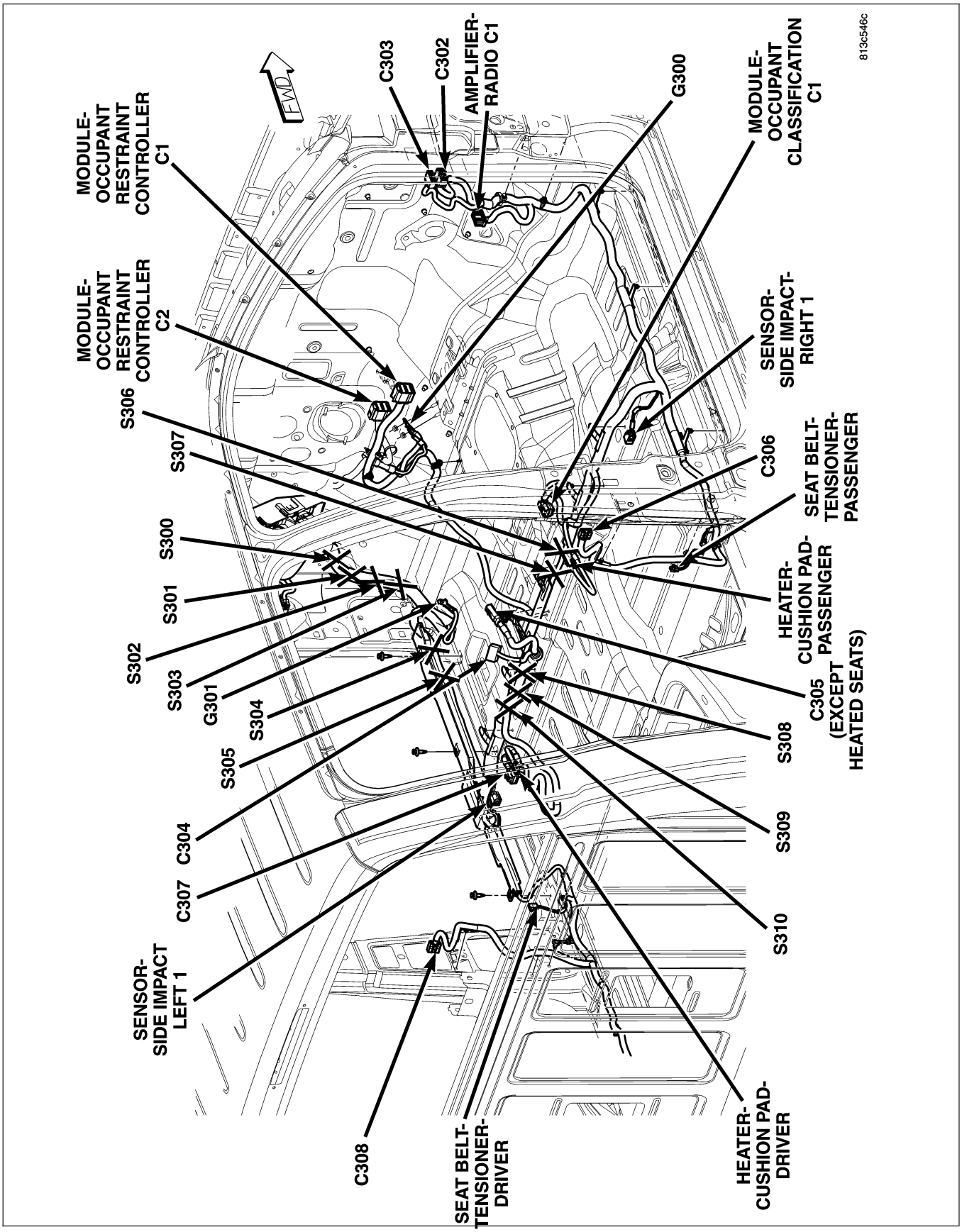

Fig. 31 BODY (QUAD CAB)

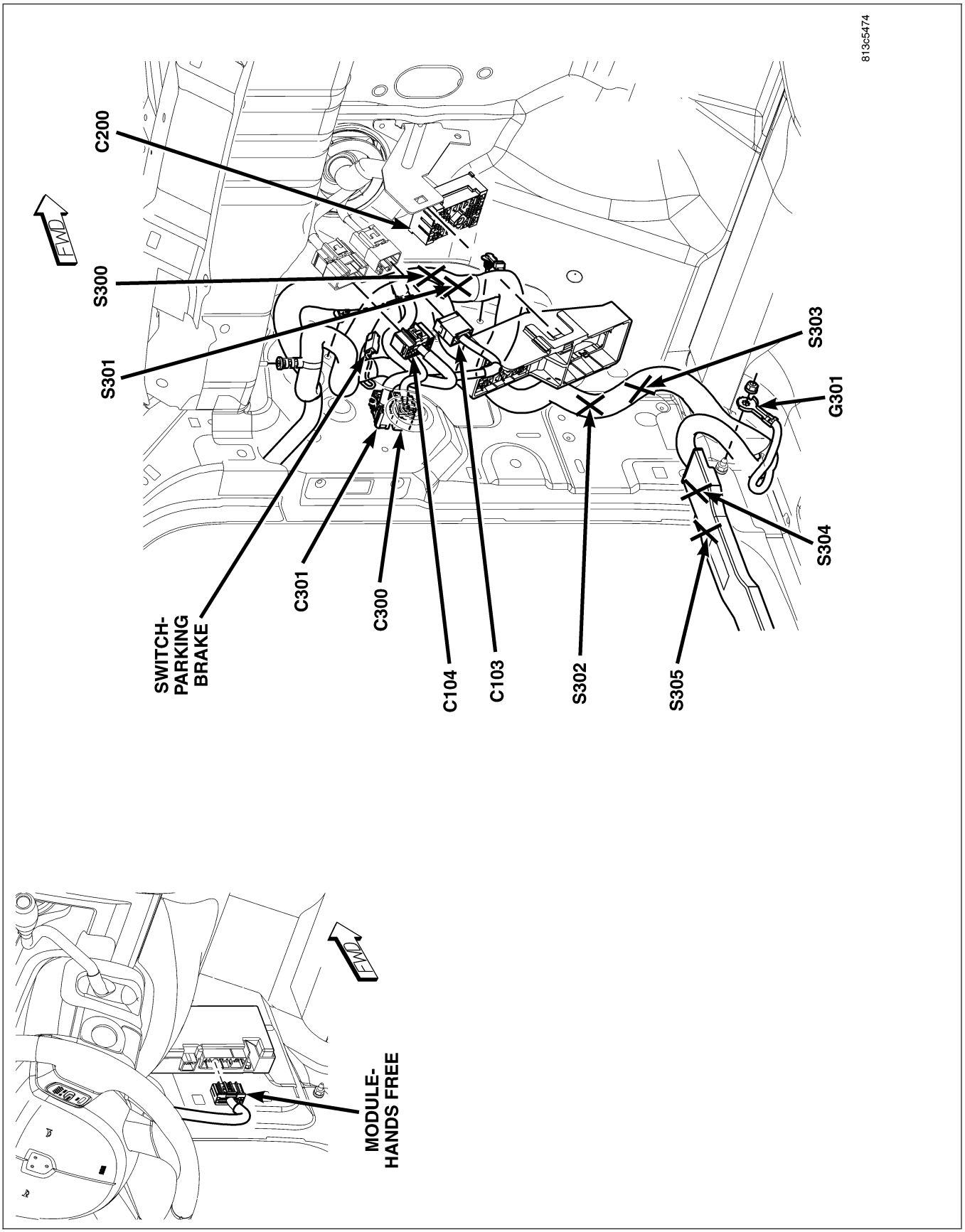

Fig. 32 LEFT KICK PANEL

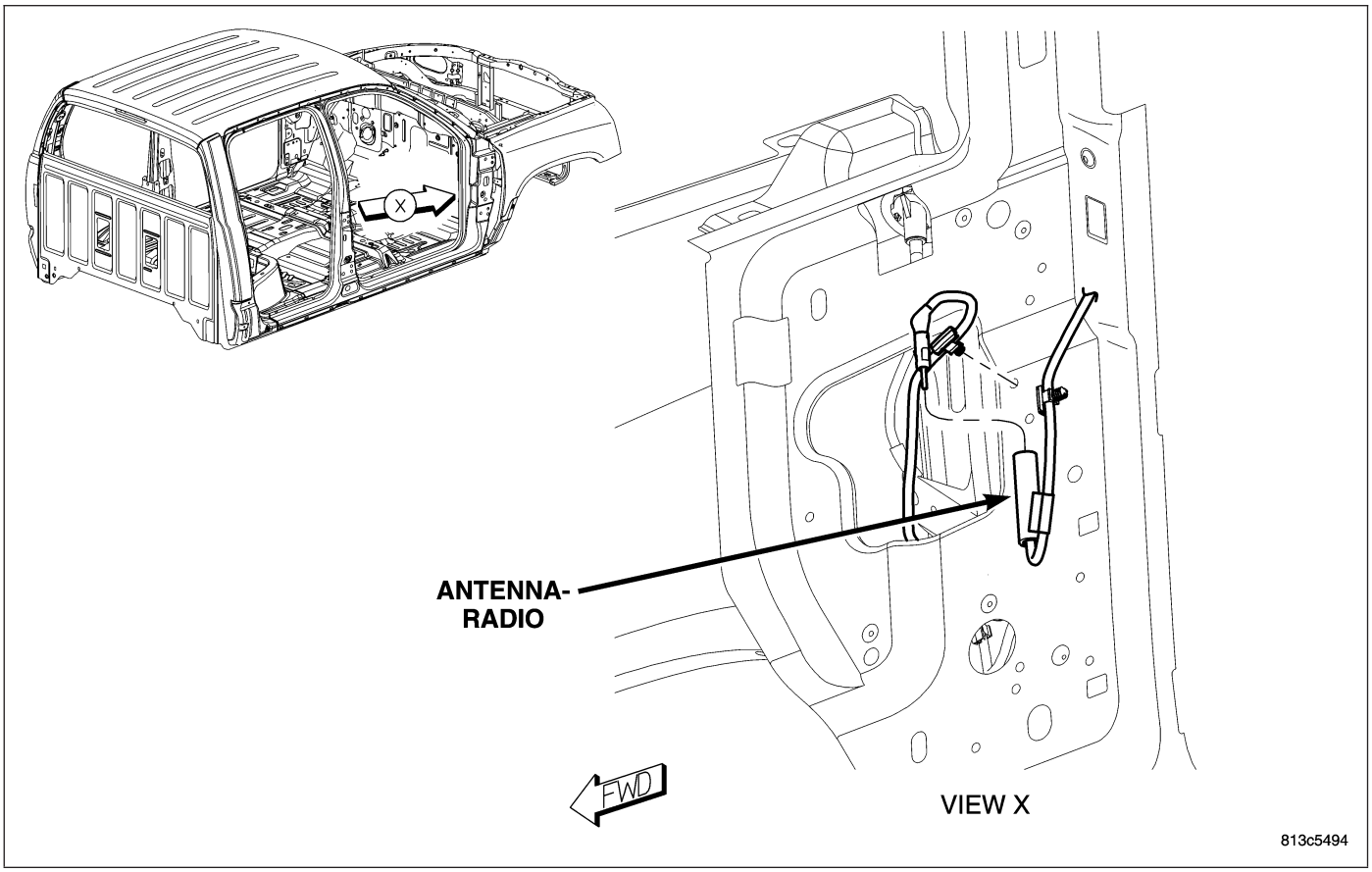

Fig. 33 RIGHT KICK PANEL

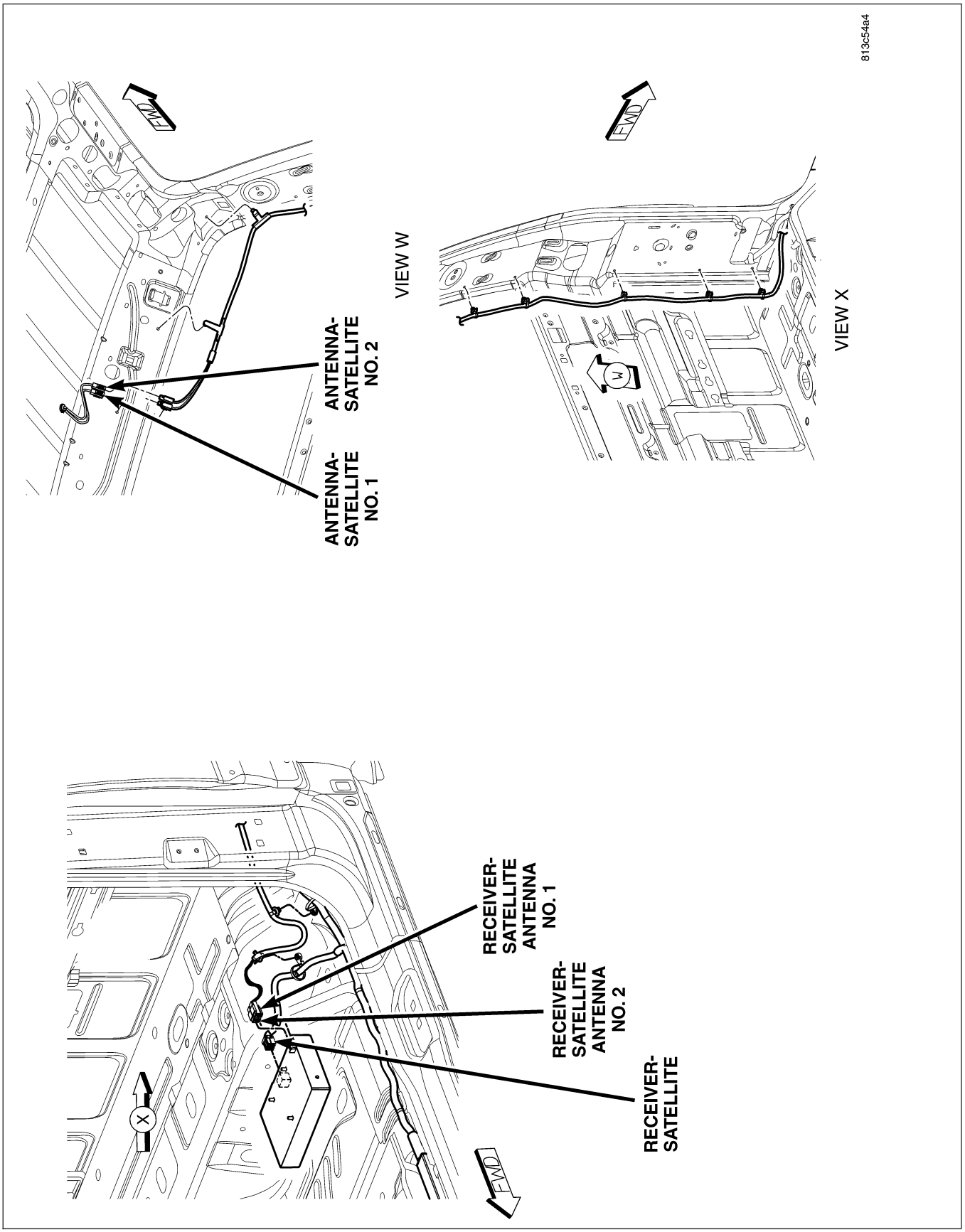

Fig. 34 REAR BODY (CLUB CAB)

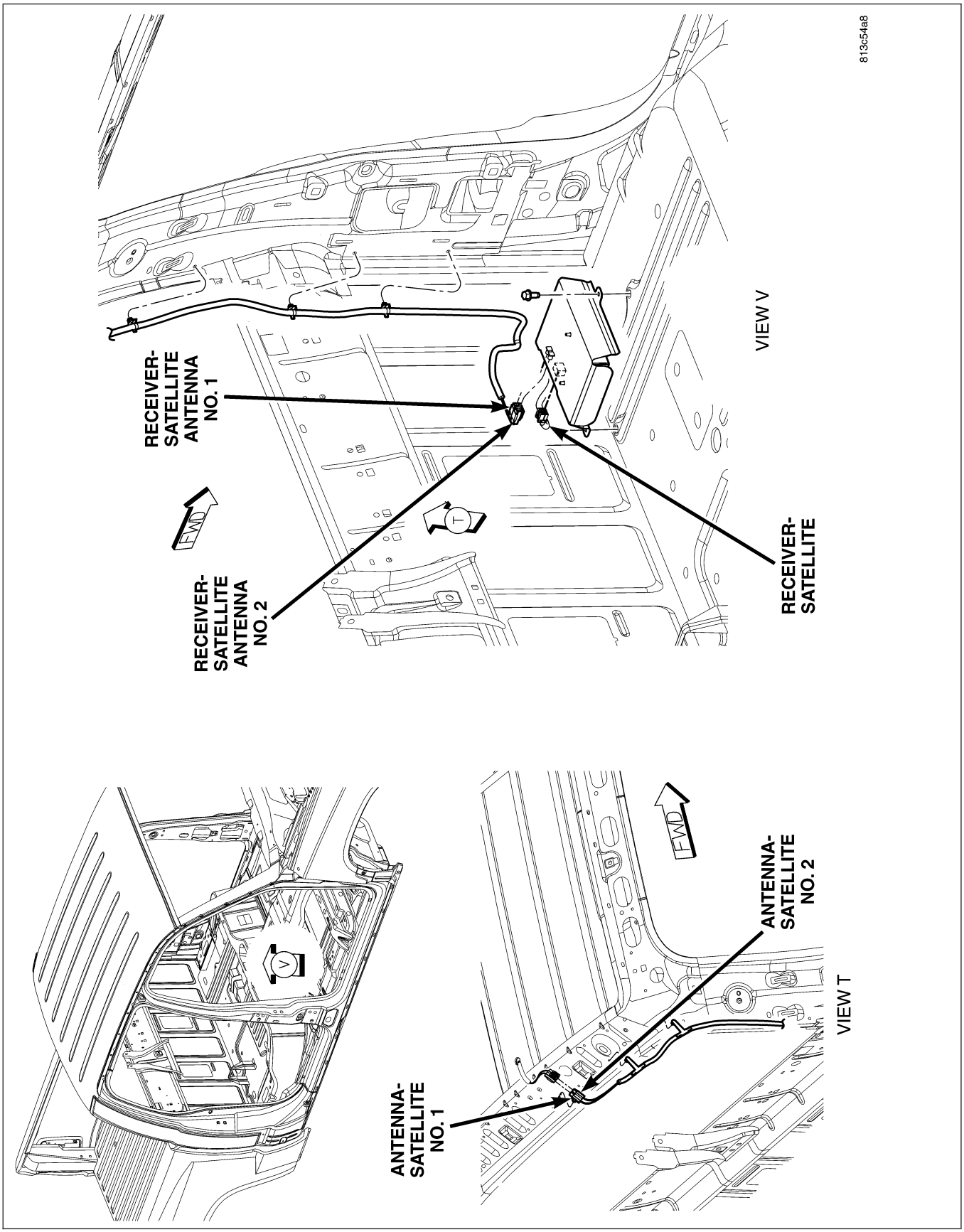

Fig. 35 LEFT REAR BODY (QUAD CAB)

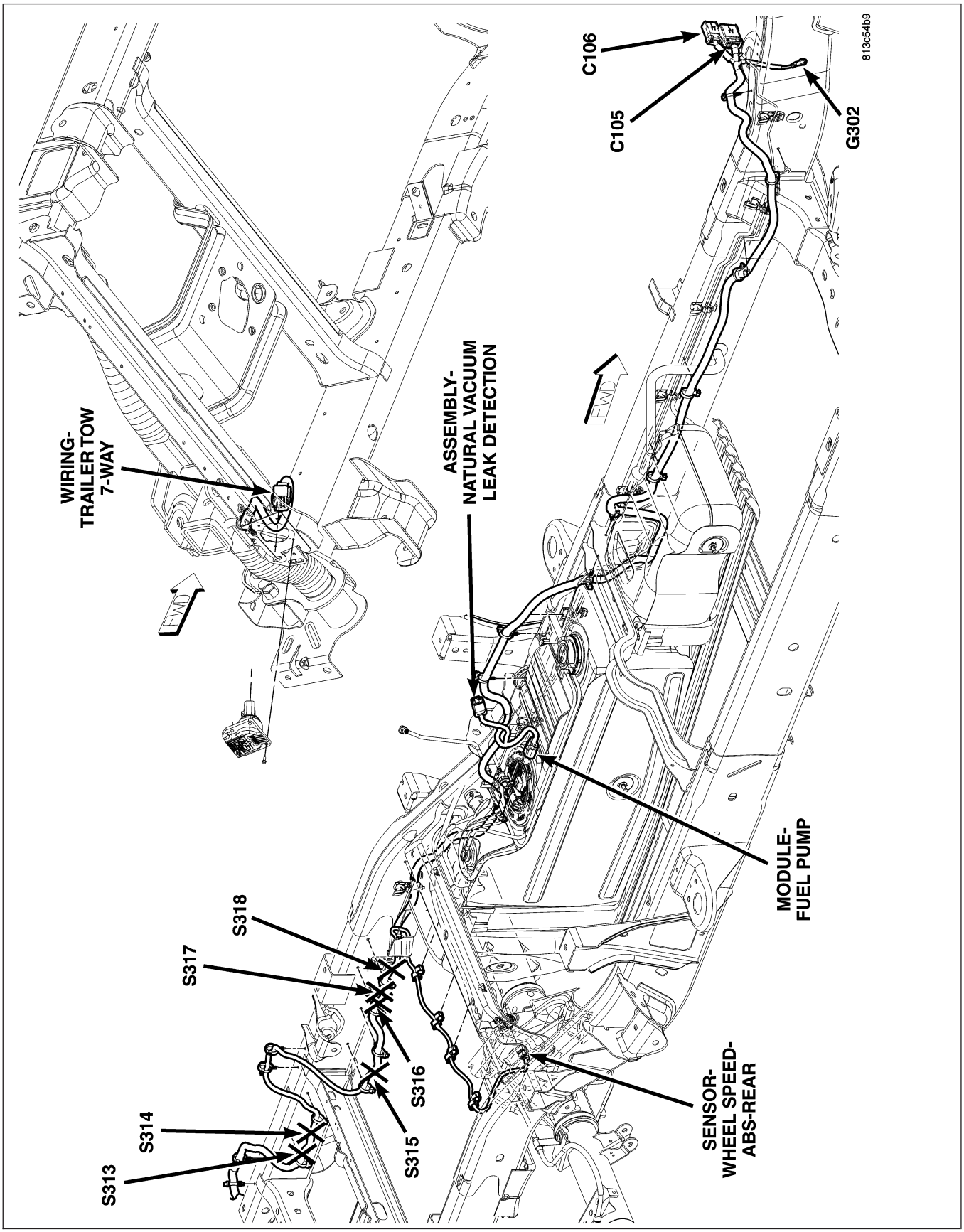

Fig. 36 CHASSIS

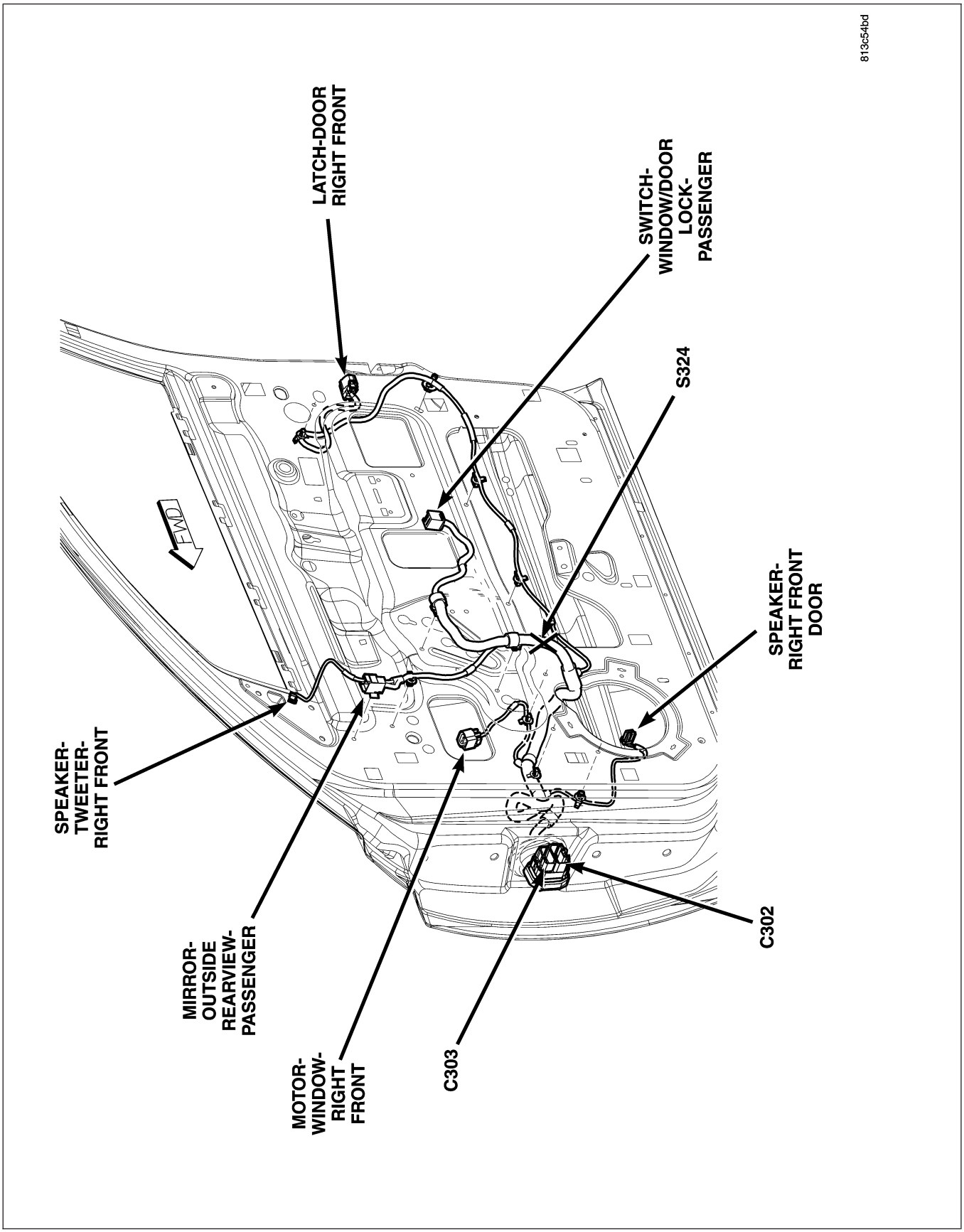

Fig. 37 RIGHT FRONT DOOR

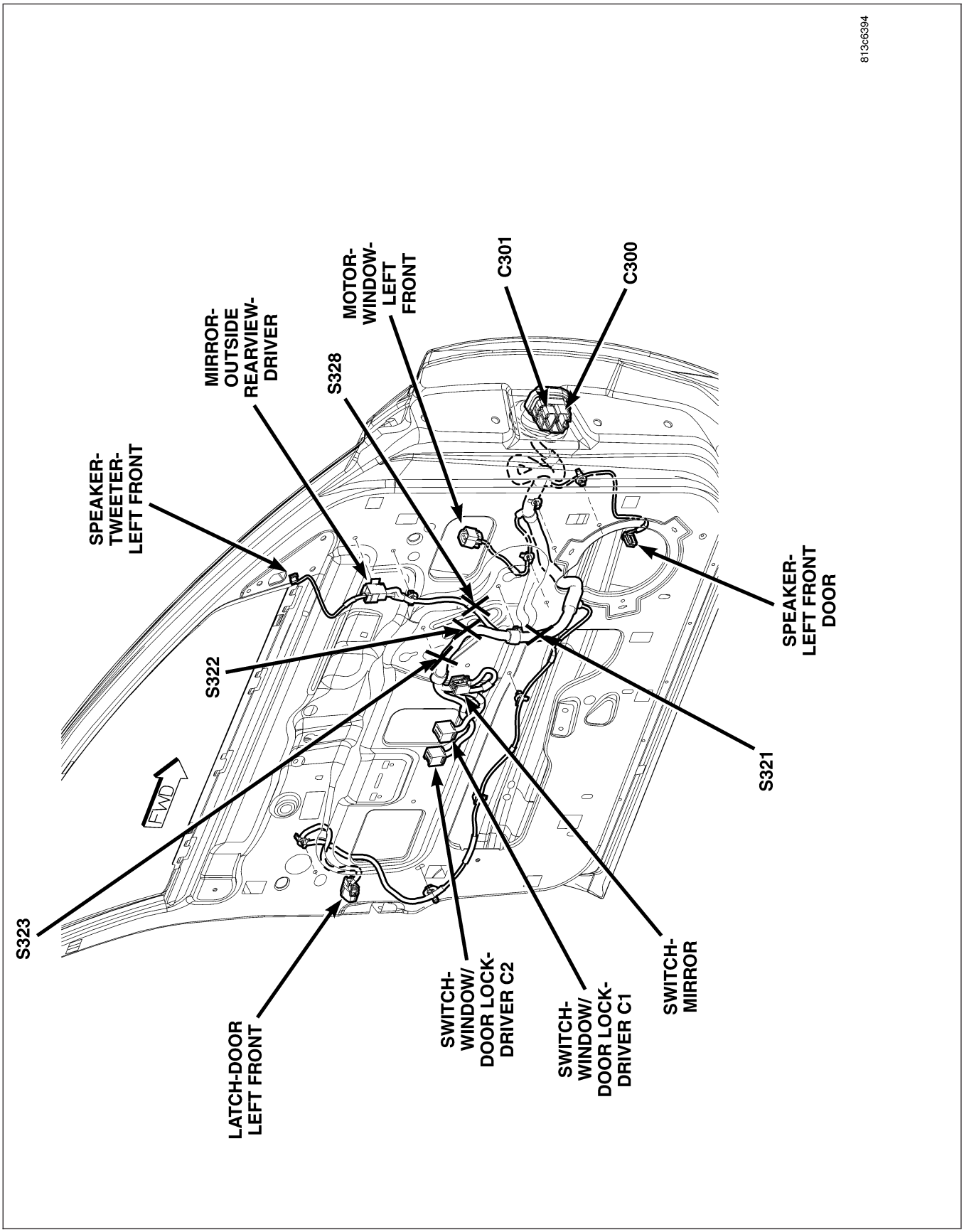

Fig. 38 LEFT FRONT DOOR

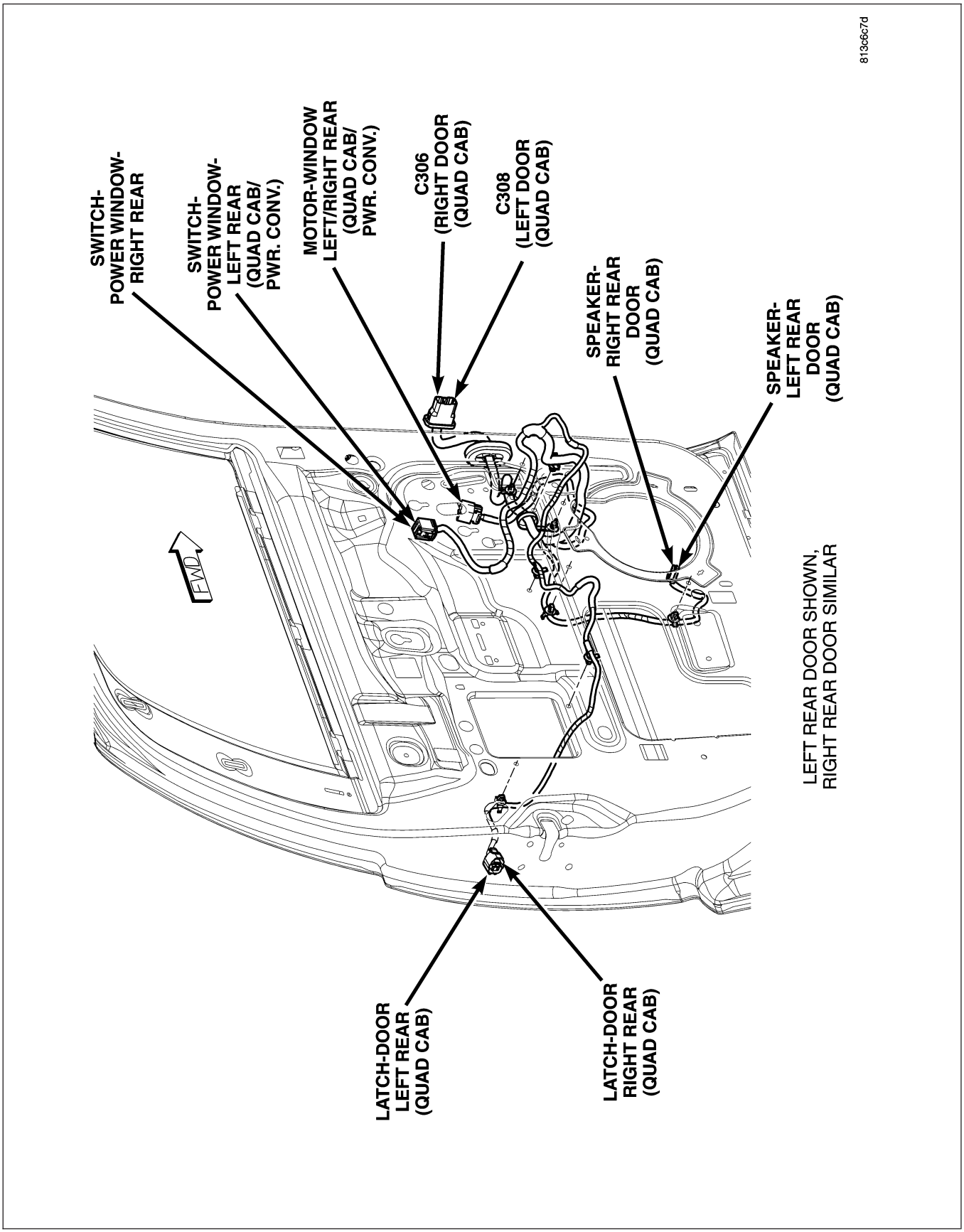

Fig. 39 LEFT REAR DOOR (RIGHT SIMILAR)

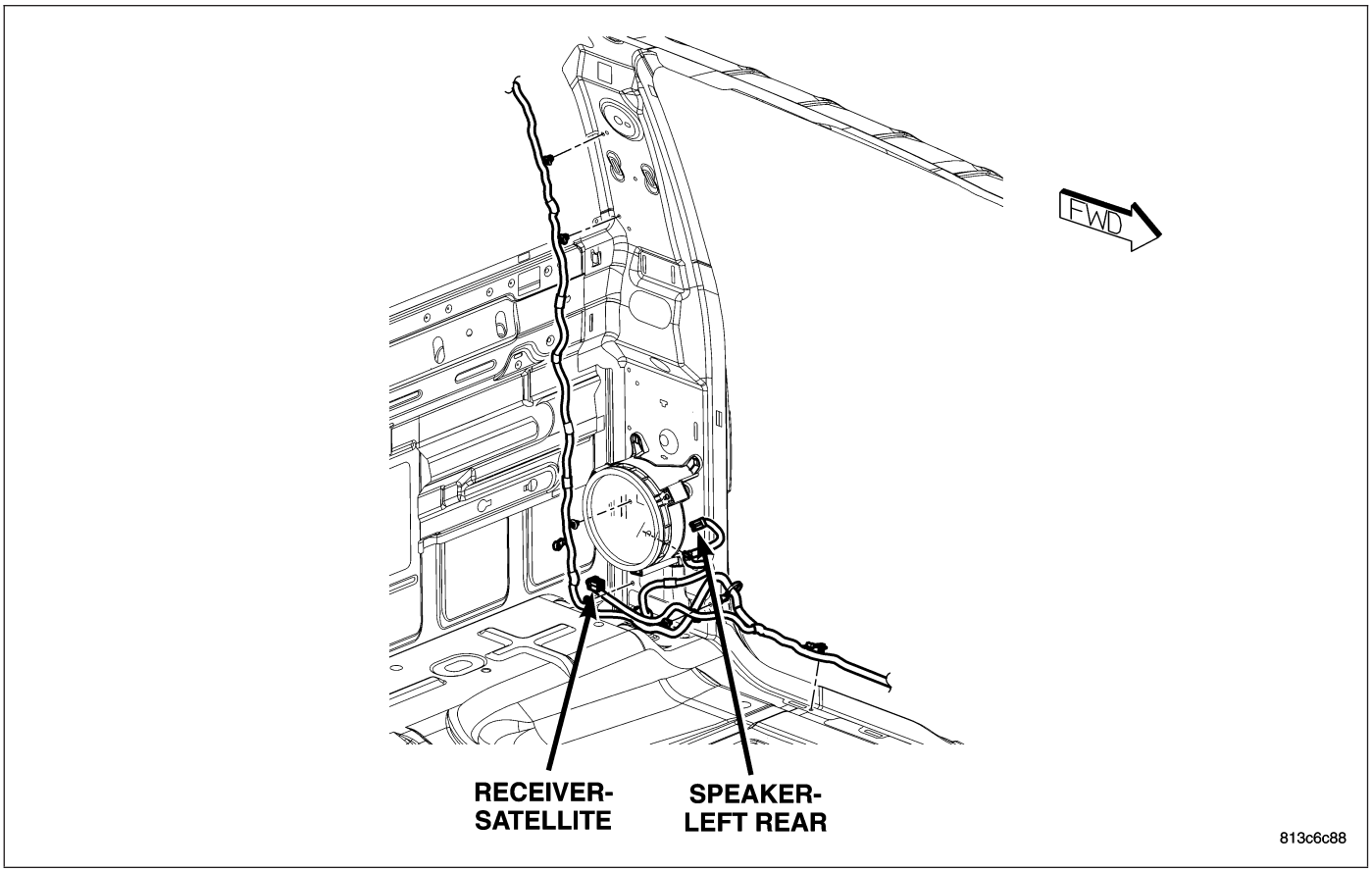

Fig. 40 LEFT REAR BODY (CLUB CAB)

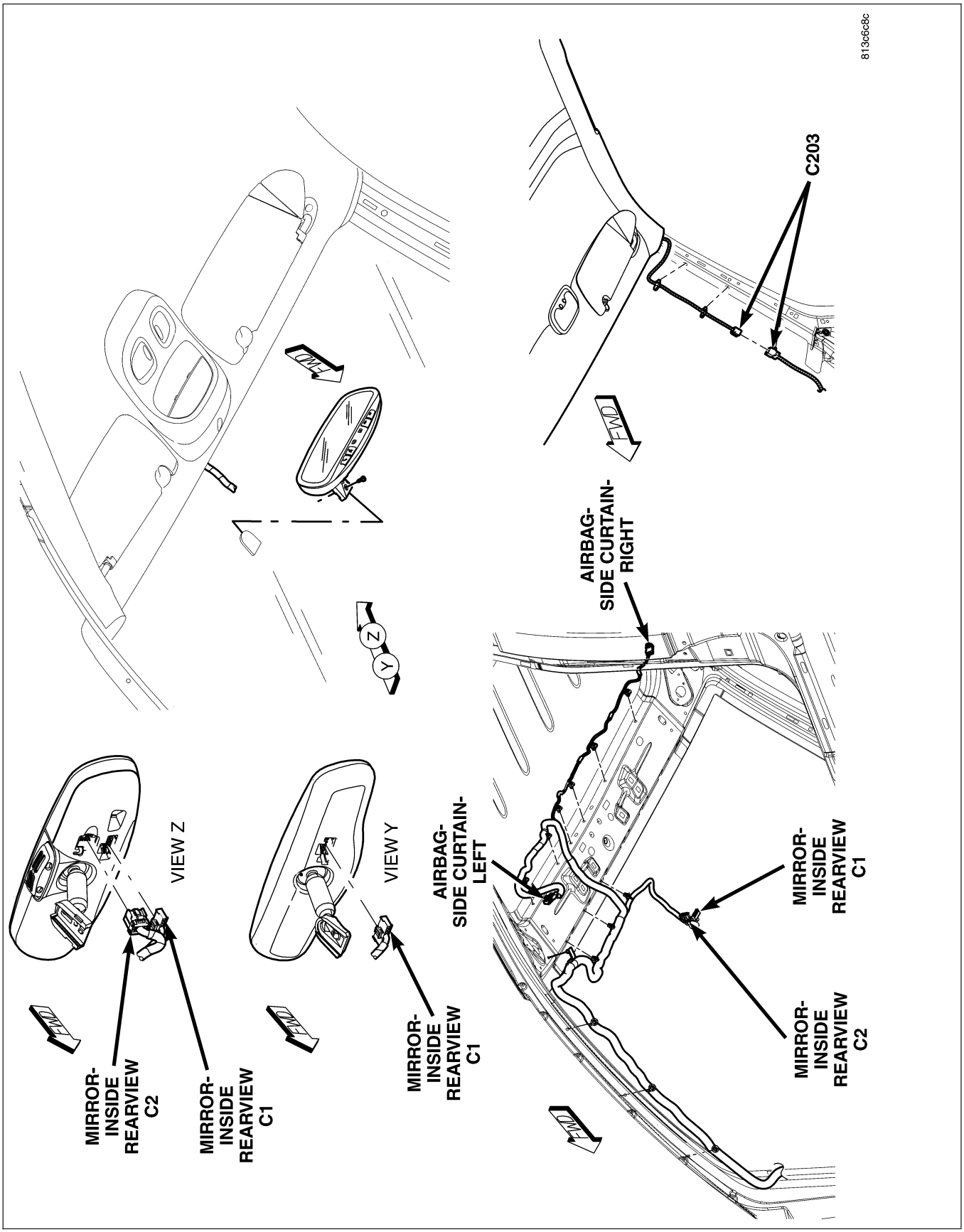

Fig. 41 A-PILLARS AND FRONT HEADLINER

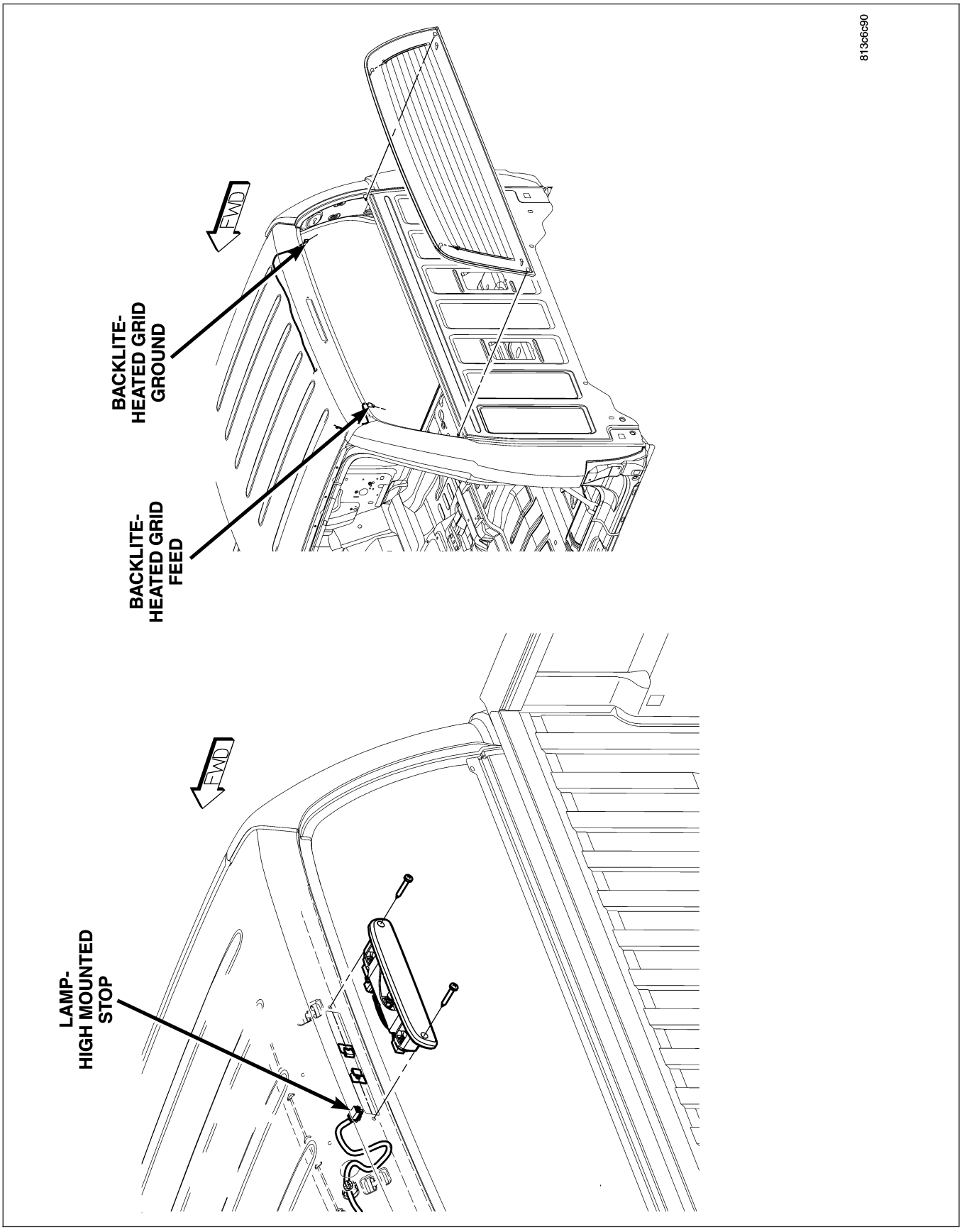

Fig. 42 REAR CAB

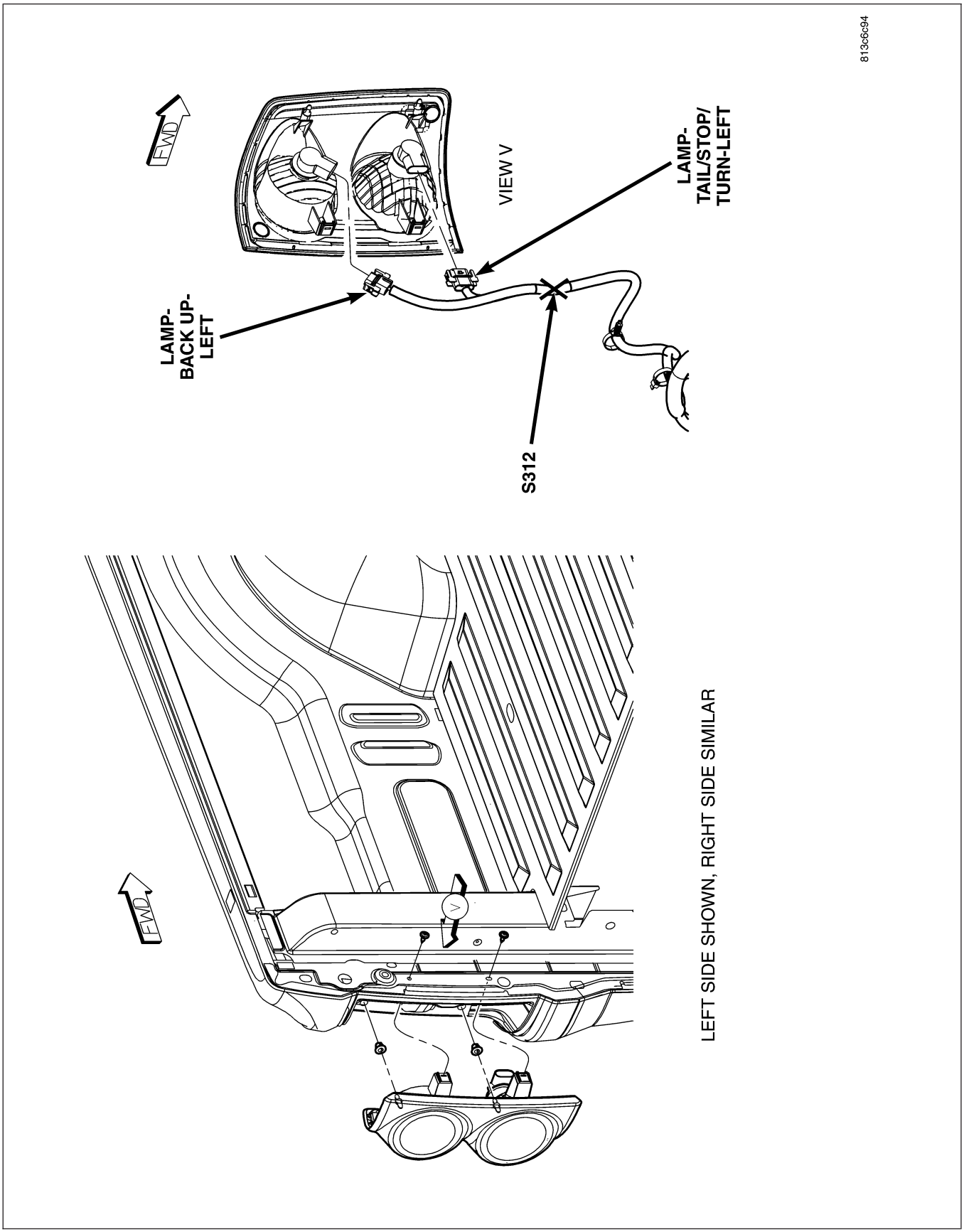

Fig. 43 REAR LIGHTING

8W-97 POWER DISTRIBUTION - SERVICE INFORMATION

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POWER DISTRIBUTION - SERVICE INFORMATION

DESCRIPTION

The power distribution system for this vehicle consists of the following components:

- Cigar Lighter Outlet
- Front Control Module (FCM)
- Integrated Power Module (IPM)
- Power Distribution Center (PDC)
- Power Outlets

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

The power distribution system also incorporates various types of circuit control and protection features, including:

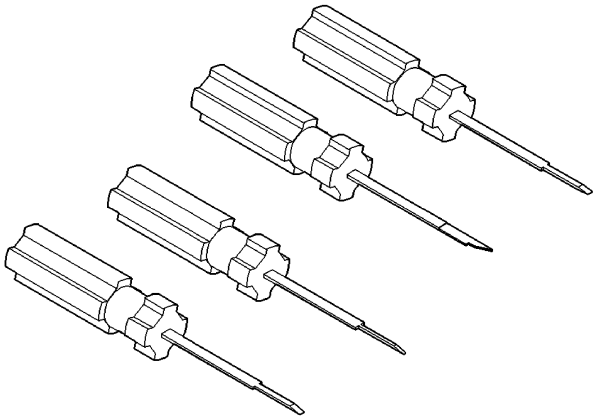
- Automatic resetting circuit breakers
- Blade-type fuses
- Cartridge fuses
- Relays

OPERATION

The power distribution system for this vehicle is designed to provide safe, reliable, and centralized distribution points for the electrical current required to operate all of the many standard and optional factory-installed electrical and electronic powertrain, chassis, safety, security, comfort and convenience systems. At the same time, the power distribution system was designed to provide ready access to these electrical distribution points for the technician to use when conducting diagnosis and repair of inoperative circuits. The power distribution system can also prove useful for the sourcing of additional electrical circuits that may be required to provide the electrical current needed to operate many accessories that the vehicle owner may choose to have installed.

SPECIAL TOOLS

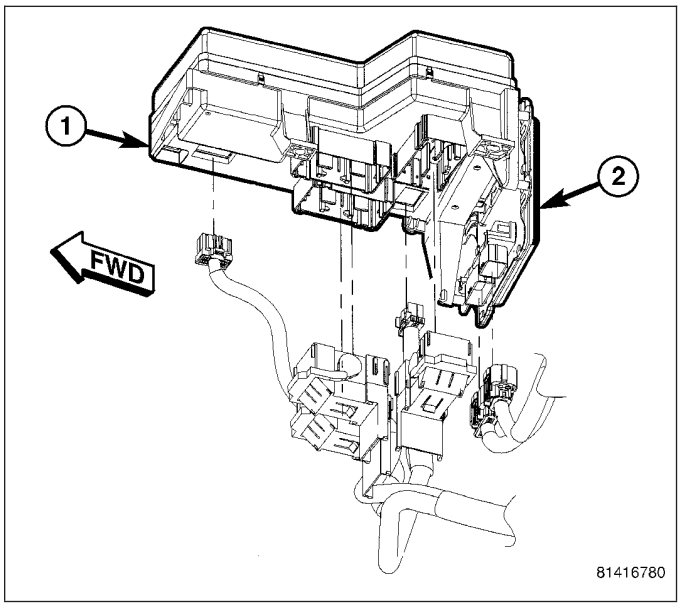
POWER DISTRIBUTION SYSTEMS



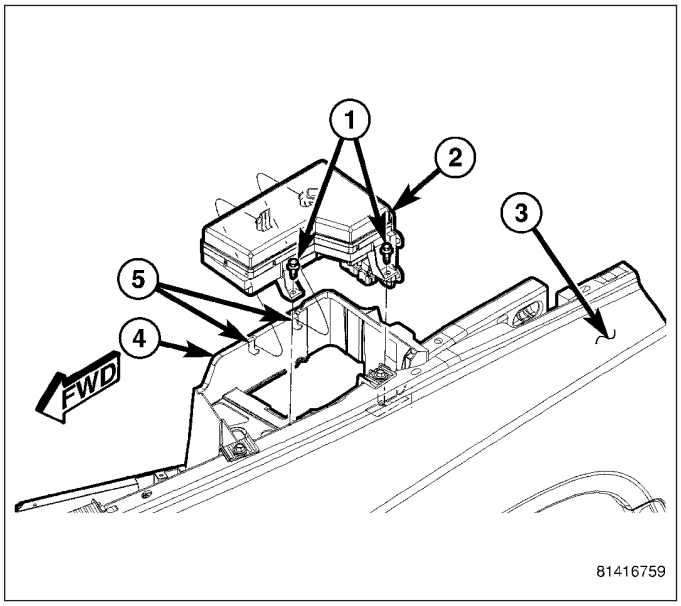
INTEGRATED POWER MODULE

DESCRIPTION

The Integrated Power Module (IPM) is a combination of the Power Distribution Center (PDC) (1) and the Front Control Module (FCM) (2). The PDC mates directly with the FCM to form the IPM. The PDC is a printed circuit board based module that contains fuses and relays, while the FCM contains the electronics controlling the IPM and other functions. The IPM connects directly to the battery positive via a stud located on top of the unit. The ground connection is via electrical connectors. The IPM provides the primary means of voltage distribution and protection for the entire vehicle.



The IPM (2) is located in the engine compartment, next to the battery. It is secured to the battery tray (4) with two locating slots (5) and two pushpin style fasteners (1). The PDC portion of the IPM cannot be repaired and must be replaced if inoperative or damaged, (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/POWER DISTRIBUTION CENTER - REMOVAL).

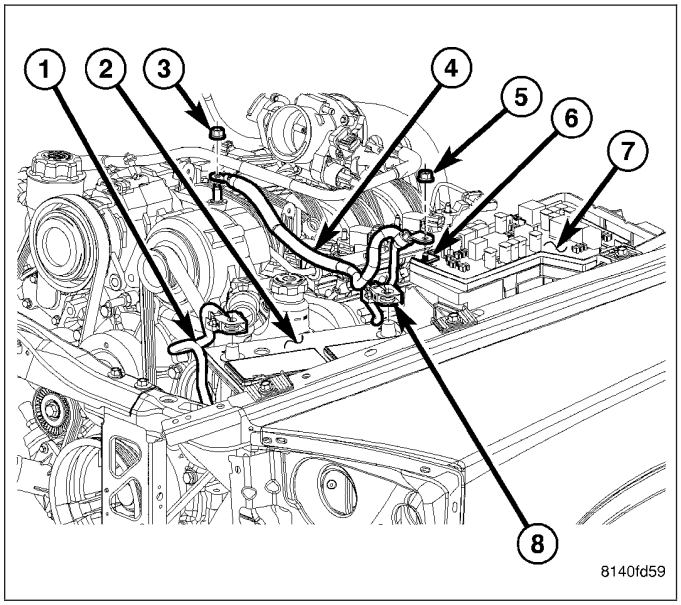


OPERATION

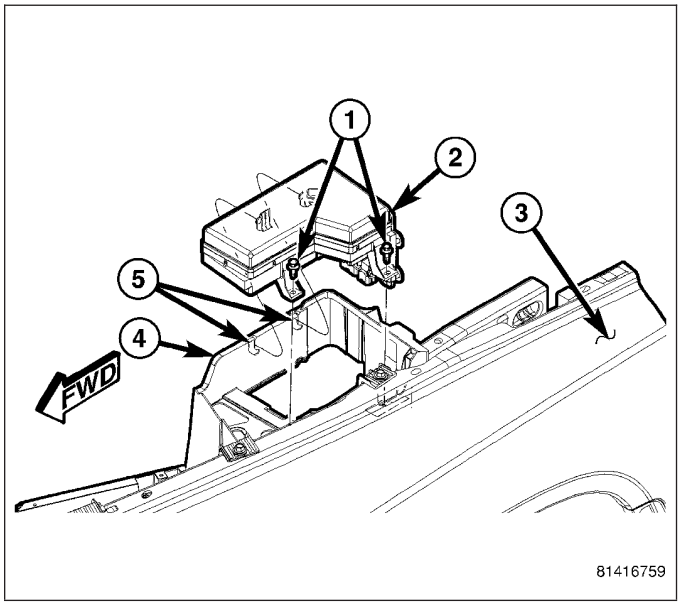
All of the current from the battery and the generator output enters the integrated power module via a stud on the top of the module. Internal connections of all of the power distribution center circuits is accomplished by a combination of bus bars and a printed circuit board.

REMOVAL

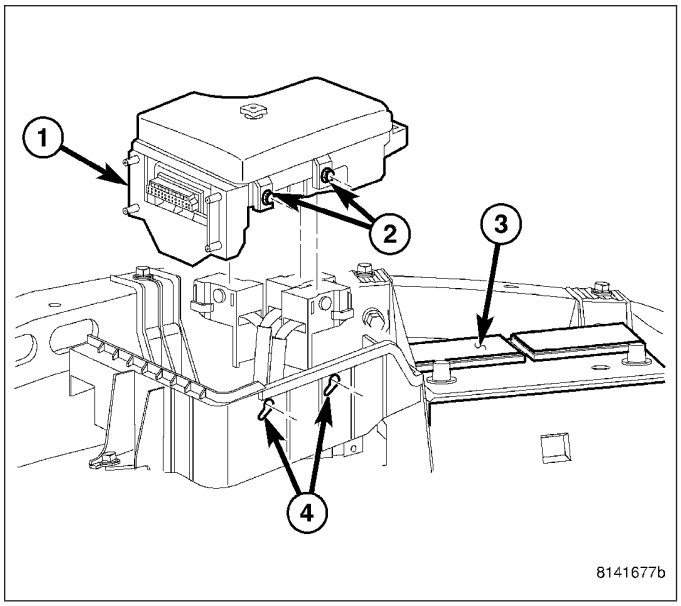
1. Disconnect the battery negative cable.
2. Remove the Integrated Power Module (IPM) cover and remove the nut (5) from the IPM B+ terminal stud (6).
3. Remove the battery positive cable (4).



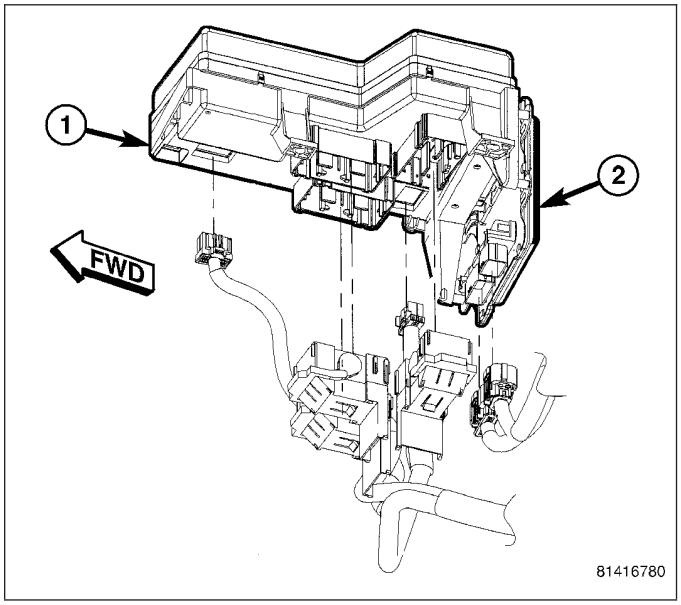
4. Remove the IPM (2) pushpin fasteners (1) from the battery tray (4).



5. Move the IPM (1) forward and up to disengage the locking tabs (2) from the battery tray locating slots (4).

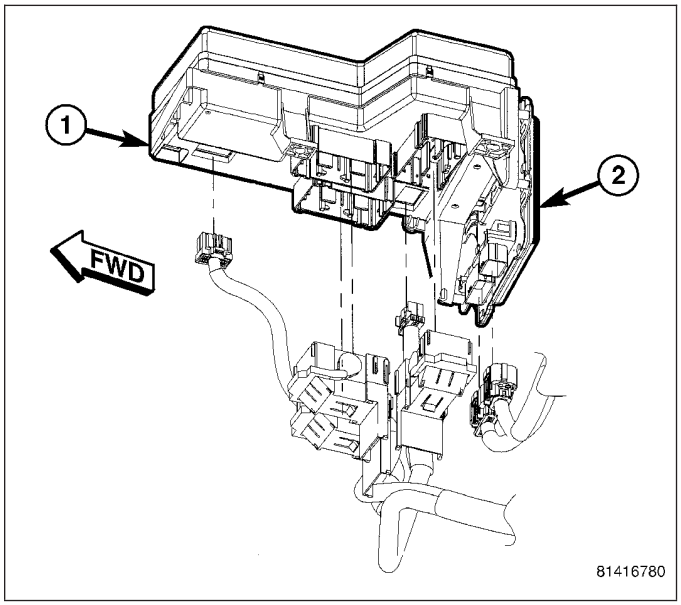


6. Lift the IPM up to access and disconnect the wiring harness connectors from the Power Distribution Center (1) and Front Control Module (2).
7. Remove the IPM assembly from the vehicle.

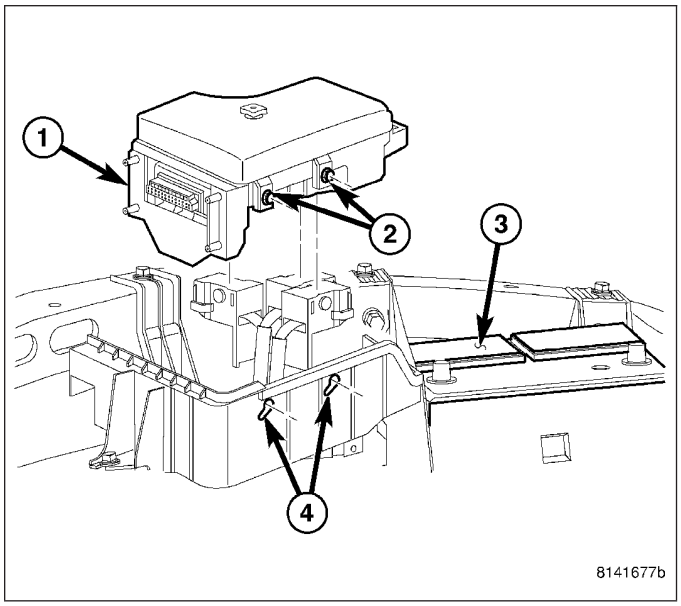


INSTALLATION

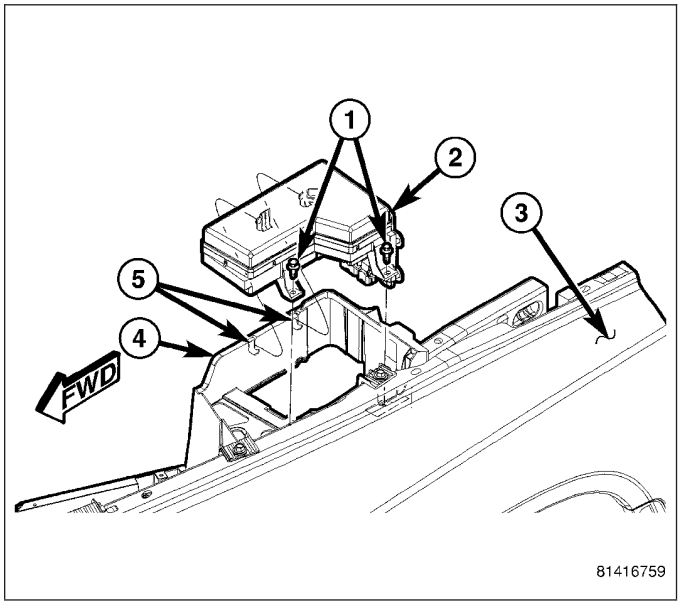
1. Connect the wiring harness connectors to the Power Distribution Center (1) and the Front Control Module (2).



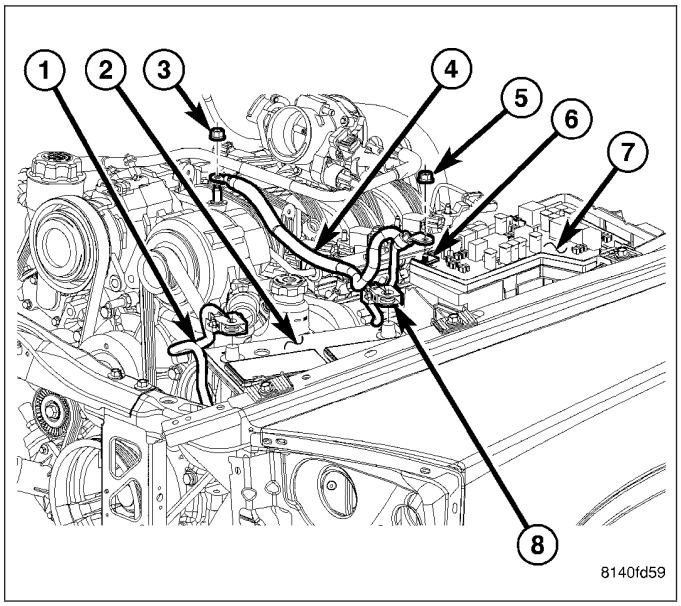
2. Position the Integrated Power Module (IPM) (1) into the battery tray. Move the IPM down and rearward to engage the locking tabs (2) into the battery tray locating slots (4).



3. Install the IPM (2) pushpin fasteners (1) into the battery tray (4).



4. Position the battery positive cable (4) and install the nut (5) onto the IPM B+ terminal stud (6). Install the IPM cover.
5. Connect the battery negative cable.
6. Confirm proper vehicle operation.



IOD FUSE

DESCRIPTION

All vehicles are equipped with an Ignition-Off Draw (IOD) fuse that is disconnected within the Integrated Power Module when the vehicle is shipped from the factory. Dealer personnel are to reconnect the IOD fuse in the Integrated Power Module as part of the preparation procedures performed just prior to new vehicle delivery. The IOD fuse can be removed to avoid discharging the battery by disconnecting non-essential, low-current memory functions that are normally on at all times. A detent on the IOD fuse holder allows it to be stored in its normal cavity but out of contact. The holder is pushed into place to restore power to the systems it supplies. The following circuits are protected by the IOD fuse:

- Cluster (CCN)
- Diagnostic Connector
- Map Lamps
- Glove Box Lamp
- Courtesy Lamps
- Radio
- Underhood Lamp

OPERATION

The term ignition-off draw identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. The IOD fuse feeds the memory and sleep mode functions for some of the electronic modules in the vehicle as well as various other accessories that require battery current when the ignition switch is in the Off position. The only reason the IOD fuse is disconnected is to reduce the normal IOD of the vehicle electrical system during new vehicle transportation and pre-delivery storage to reduce battery depletion, while still allowing vehicle operation so that the vehicle can be loaded, unloaded and moved as needed.

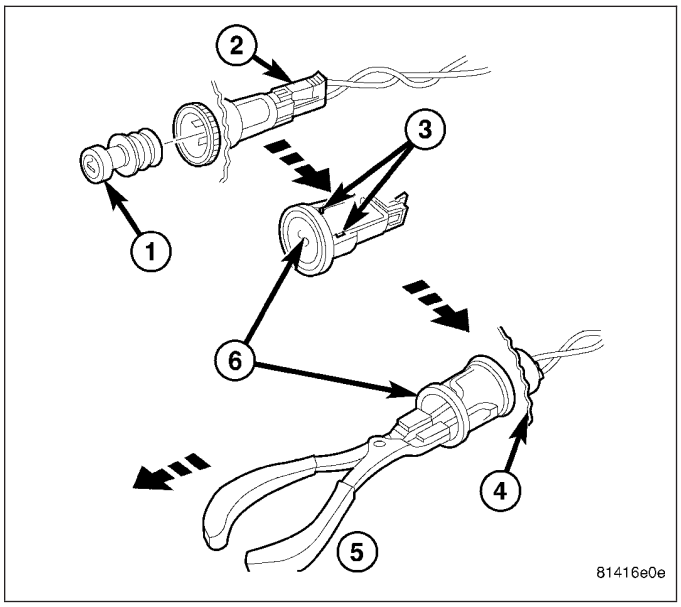
The IOD fuse is disconnected from Integrated Power Module when the vehicle is shipped from the assembly plant. Dealer personnel must reconnect the IOD fuse when the vehicle is being prepared for delivery in order to restore full electrical system operation. Once the vehicle is prepared for delivery, the IOD function of this fuse becomes transparent and the fuse that has been assigned the IOD designation becomes another Fused B(+) circuit fuse.

The IOD fuse can be used by the vehicle owner as a convenient means of reducing battery depletion when a vehicle is to be stored for periods not to exceed about thirty days. However, it must be remembered that disconnecting the IOD fuse will not eliminate IOD, but only reduce this normal condition. If a vehicle will be stored for more than about thirty days, the battery negative cable should be disconnected to eliminate normal IOD; and, the battery should be tested and recharged at regular intervals during the vehicle storage period to prevent the battery from becoming discharged or damaged.

POWER OUTLET

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Pull the cigar lighter knob and element (1) out of the cigar lighter receptacle base (6), or unsnap the protective cap from the power outlet receptacle base (6).
3. Look inside the cigar lighter or power outlet receptacle base and note the position of the rectangular retaining bosses (3) of the mount that secures the receptacle base to the panel (4).
4. Insert a pair of external snap ring pliers (5) into the cigar lighter or power outlet receptacle base and engage the tips of the pliers with the retaining bosses of the mount.
5. Squeeze the pliers to disengage the mount retaining bosses from the receptacle base and, using a gentle rocking motion, pull the pliers and the receptacle base out of the mount.
6. Pull the receptacle base away from the instrument panel far enough to access the instrument panel wire harness connector (2).



7. Disconnect the instrument panel wire harness connector (2) from the cigar lighter or power outlet receptacle base (6).
8. Remove the cigar lighter or power outlet mount from the instrument panel.

INSTALLATION

1. Connect the instrument panel wire harness connector to the cigar lighter or power outlet receptacle base connector receptacle.
2. Install the cigar lighter or power outlet mount into the instrument panel.
3. Align the splines on the outside of the cigar lighter or power outlet receptacle base connector receptacle with the grooves on the inside of the mount.
4. Press firmly on the cigar lighter or power outlet receptacle base until the retaining bosses of the mount are fully engaged in their receptacles.
5. Install the cigar lighter knob and element into the cigar lighter receptacle base, or the protective cap into the power outlet receptacle base.
6. Connect the battery negative cable.

ENGINE

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ENGINE ELECTRICAL DIAGNOSTICS

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ENGINE ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. NO RESPONSE

Make sure the scan tool will communicate with the appropriate modules.

Are you currently experiencing a NO RESPONSE condition?

Yes >> The NO RESPONSE condition must be properly diagnosed before continuing.
Refer to the appropriate BUS Communication test in Section 8 ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTICS.

No >> Go To 2

---

2. NO START

Is the customer complaint a NO START condition?

Yes >> Check the vehicle for any NO START related PCM DTC(s) or Vehicle Theft Security related DTC(s).
If no Theft related DTC(s) are present, refer to the Non DTC Diagnostic Procedures that relate to Fuel and Starting.

No >> Go To 3

---

3. VEHICLE HISTORY AND TSB(s)

Continue by reading PCM DTC(s) and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are present you will want to check the following items which may assist in repairing the customers complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inpect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any TSB(s) related to the customer's complaint or DTC(s).

If a TSB applies, follow the instructions per the TSB.

Choose the following scenario that best applies.

The TSB repaired the customers complaint.
Testing complete.

A DTC is present, no TSB applies, or the TSB didn't repair the customers complaint.
Go To 4

No DTC(s) are present.
Refer to the INTERMITTENT CONDITION Diagnostic Procedure.

PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE (CONTINUED)

4. WIRE HARNESS INSPECTION

Clear the DTC(s).

Attempt to duplicate the customer complaint.

Whether the customer complaint can be duplicated or not, make a quick wire harness inspection related to the DTC(s) that were previously cleared.

Check the Powertrain Control Module connectors, the suspected component connection, in-line connectors, wire harness splices, PCM power and ground circuits, and any related fuses.

If the DTC(s) are fuel or air related, check the fuel level and quality.

Were any repairs made that fixed the customer's complaint?

Yes >> Testing complete.

No >> Refer to the diagnostic test procedure related to the DTC.

INTERMITTENT CONDITION

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

POSSIBLE CAUSES
INTERMITTENT CONDITION

Diagnostic Test

1. INTERMITTENT CONDITION

NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Refer to any Technical Service Bulletins (TSBs) that may apply.

Review the scan tool Freeze Frame information. If possible, try to duplicate the conditions under which the DTC set.

With the engine running at normal operating temperature, monitor the scan tool parameters related to the DTC while wiggling the wire harness. Look for parameter values to change and/or a DTC to set.

Turn the ignition off.

Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

Perform a voltage drop test on the related circuits between the suspected faulty component and the PCM.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Inspect and clean all PCM, engine, and chassis grounds that are related to the most current DTC.

If numerous trouble codes were set, use a wire schematic and look for any common ground or supply circuits.

For any Relay DTCs, actuate the Relay with the scan tool and wiggle the related wire harness to try to interrupt the actuation.

For intermittent Evaporative Emission trouble codes perform a visual and physical inspection of the related parts including hoses and the Fuel Filler cap.

For intermittent Misfire DTC's check for restrictions in the Intake and Exhaust system, proper installation of Sensors, vacuum leaks, and binding components that are run by the accessory drive belt.

Use the scan tool to perform a System Test if one applies to failing component.

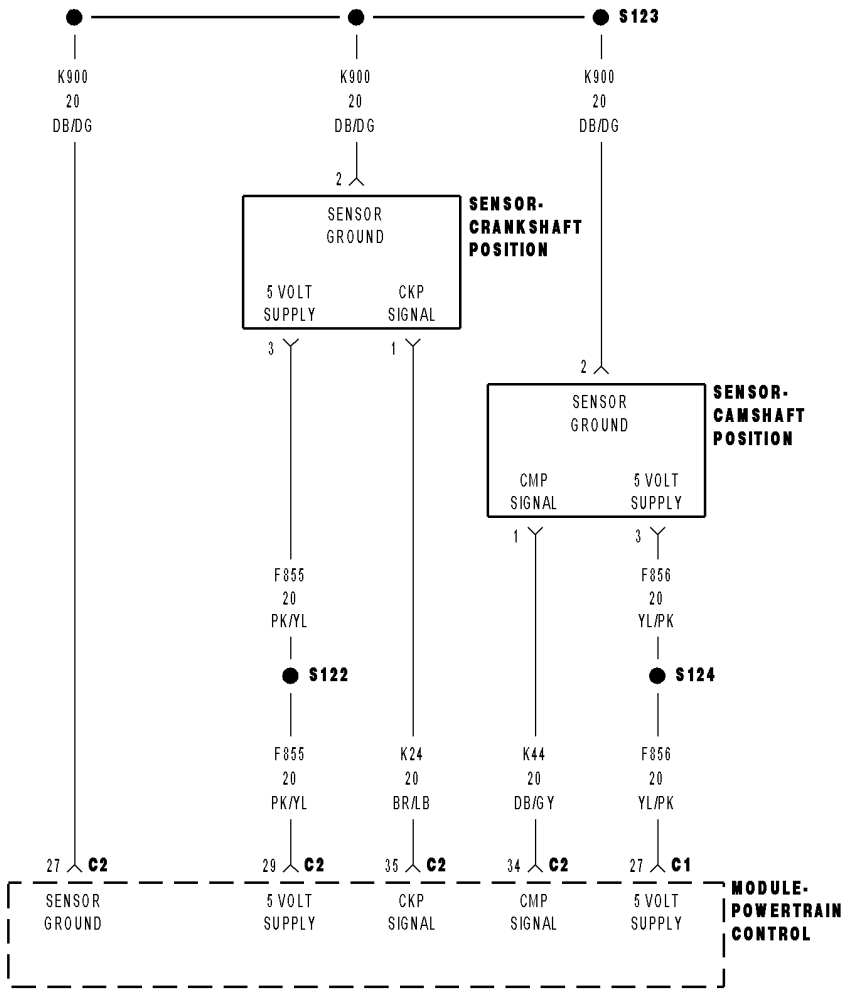
A co-pilot, data recorder, and/or lab scope should be used to help diagnose intermittent conditions.

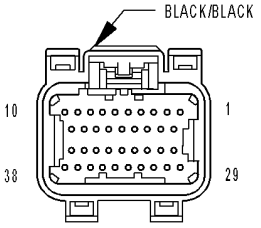
Were any problems found during the above inspections?

Yes >> Perform the necessary repairs.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

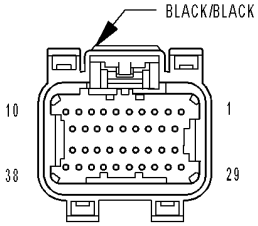
No >> Test Complete.

P0016–CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT

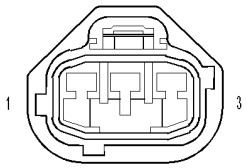




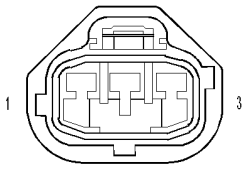
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



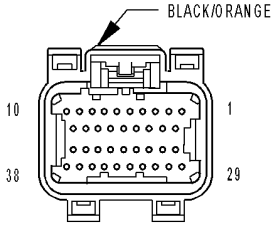
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



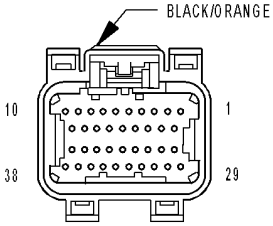
SENSOR-
CAMSHAFT
POSITION



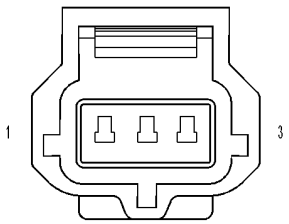
SENSOR-
CRANKSHAFT
POSITION
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



SENSOR-
CRANKSHAFT
POSITION
(3.7L)

8132af00

P0016–CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine cranking and Engine running
- **Set Condition:**
  Powertrain Control Module detects an error when the camshaft position is out of phase with the crankshaft position. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
ERRATIC CAM POSITION SENSOR SIGNAL
CAMSHAFT POSITION SENSOR TONE WHEEL/PULSE RING
ERRATIC CRANKSHAFT POSITION SENSOR SIGNAL
CRANKSHAFT POSITION SENSOR TONE WHEEL/PULSE RING
CAMSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With the scan tool clear the DTC(s).

Start the engine and run until operating temp is reached. (Closed Loop)

If the DTC does not reset it may be necessary to test drive the vehicle.

Does the P0016 return?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. CHECKING THE CMP SIGNAL WITH A LAB SCOPE

With a lab scope, backprobe the (K44) CMP Signal circuit at the CMP Sensor harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Go To 3

No >> Go To 6

P0016–CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT (CONTINUED)

3. CMP WIRE HARNESS INSPECTION

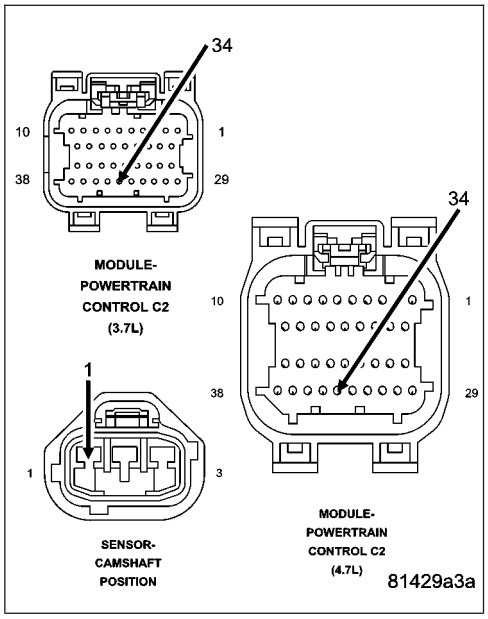
Turn the ignition off.

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to their proper specification.

Refer to any TSBs that may apply.



Were any of the above conditions present?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. TONE WHEEL/PULSE RING INSPECTION

Remove the Camshaft Position Sensor.

Inspect the Tone Wheel/Pulse Ring for damage, foreign material, or excessive movement.

Were any problems found?

Yes >> Repair or replace the Tone Wheel/Pulse Ring as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. CAMSHAFT POSITION SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the Camshaft Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0016–CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT (CONTINUED)

6. ERRATIC CMP SIGNAL

Turn the ignition off.

Remove the lab scope probe.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

With scan tool, erase DTCs.

Start the engine.

Gently tap on and wiggle the Cam Position Sensor.

Ignition on, engine not running.

Inspect the Sensor connector and harness connector, and inspect the PCM connector and harness connector for loose, bent, corroded, or pushed out pins/terminals.

Inspect the related wire harness and the splices in the CMP circuit.

Does the P0016 return?

Yes >> Repair the wiring/connector concerns as needed or replace the Camshaft Position Sensor. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

---

7. CHECKING THE CKP SIGNAL WITH A LAB SCOPE

Turn the ignition off.

With a lab scope, backprobe the (K24) CKP Signal circuit at the CKP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Go To 8

No >> Go To 10

P0016–CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT (CONTINUED)

8. CKP WIRE HARNESS INSPECTION

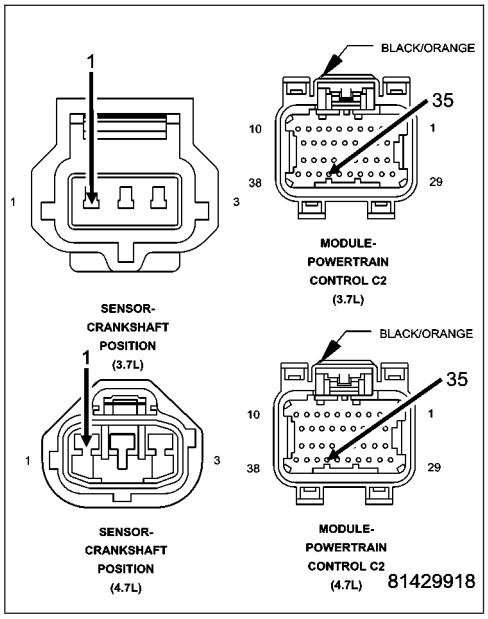
Turn the ignition off.

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to their proper specification.

Refer to any TSBs that may apply.



Were any of the above conditions present?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

9. TONE WHEEL/FLEX PLATE INSPECTION

Remove the Crankshaft Position Sensor.

Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement.

Were any problems found?

Yes >> Repair or replace the Tone Wheel/Flex Plate as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the Crankshaft Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

10. ERRATIC CKP SIGNAL

NOTE: The conditions that set this DTC are not present at this time. The following test may help in identifying the intermittent condition.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

Gently tap on and wiggle the Crank Position Sensor.

Turn the ignition off.

Inspect the Sensor connector and harness connector, and inspect the PCM connector and harness connector for loose, bent, corroded, or pushed out pins/terminals.

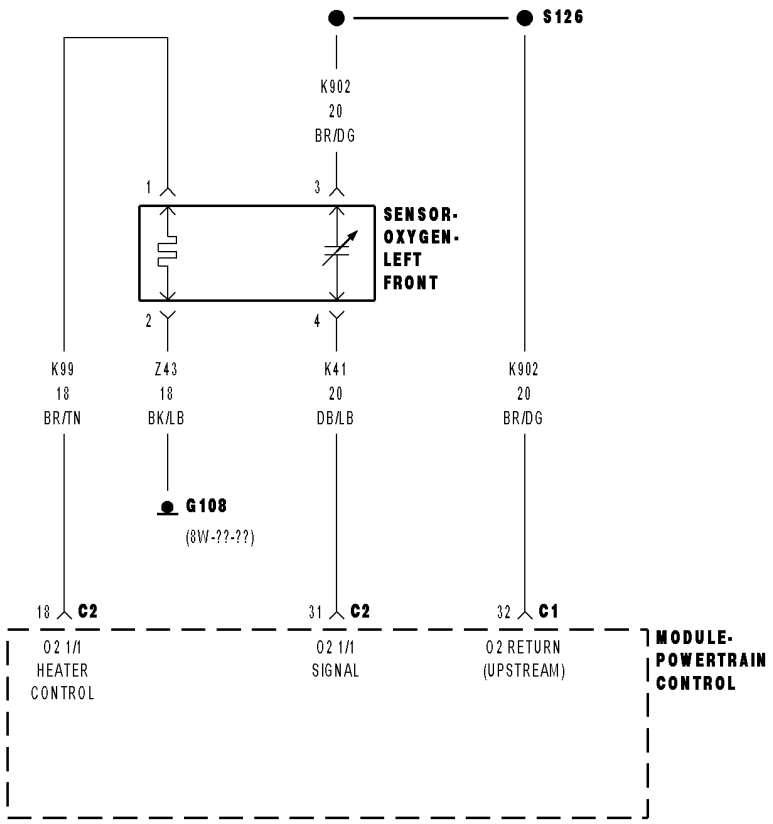
Inspect the related wire harness and the splices in the CKP circuits.

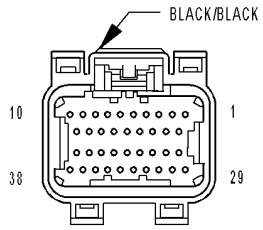
Were any problems found?

Yes >> Repair the wiring/connector concerns as needed or replace the Crankshaft Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

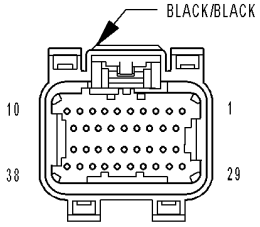
No >> Test Complete.

P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW

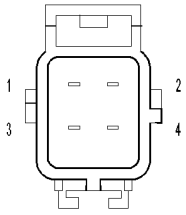




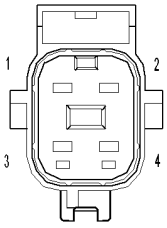
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



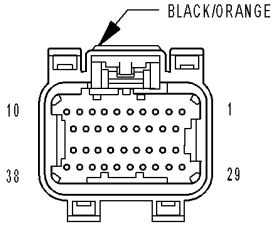
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



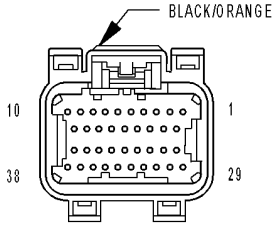
SENSOR-
OXYGEN-
LEFT
FRONT
(4.7L)



SENSOR-
OXYGEN-
LEFT FRONT
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

8132af33

P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is powered.
- **Set Condition:**
  Desired state does not match Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K99) O2 SENSOR 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

Does the O2 Sensor voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 1/1 O2 Sensor harness connector.

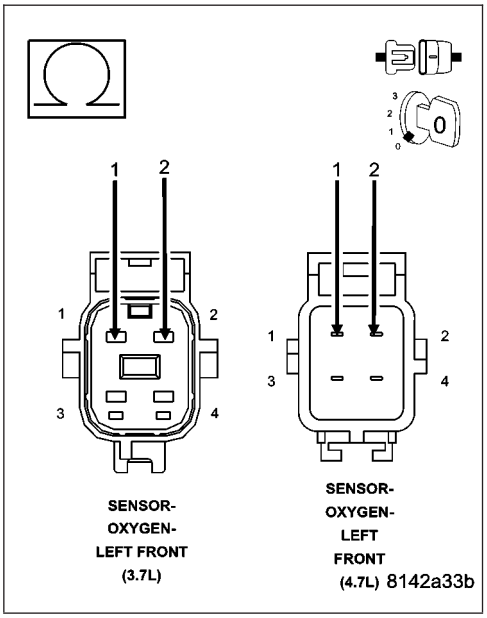
Measure the resistance across the O2 Sensor Heater element, between the Heater Control terminal and the Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Ignition on, engine not running.

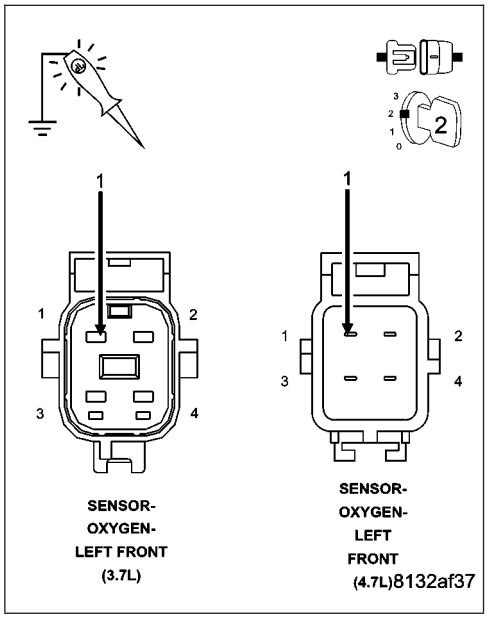
With a scan tool, actuate the O2 1/1Heater Test with the O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K99) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

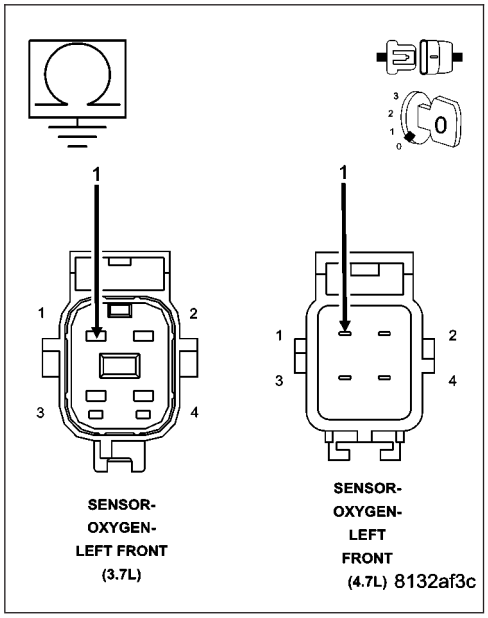
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K99) O2 1/1 Heater Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW (CONTINUED)

5. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

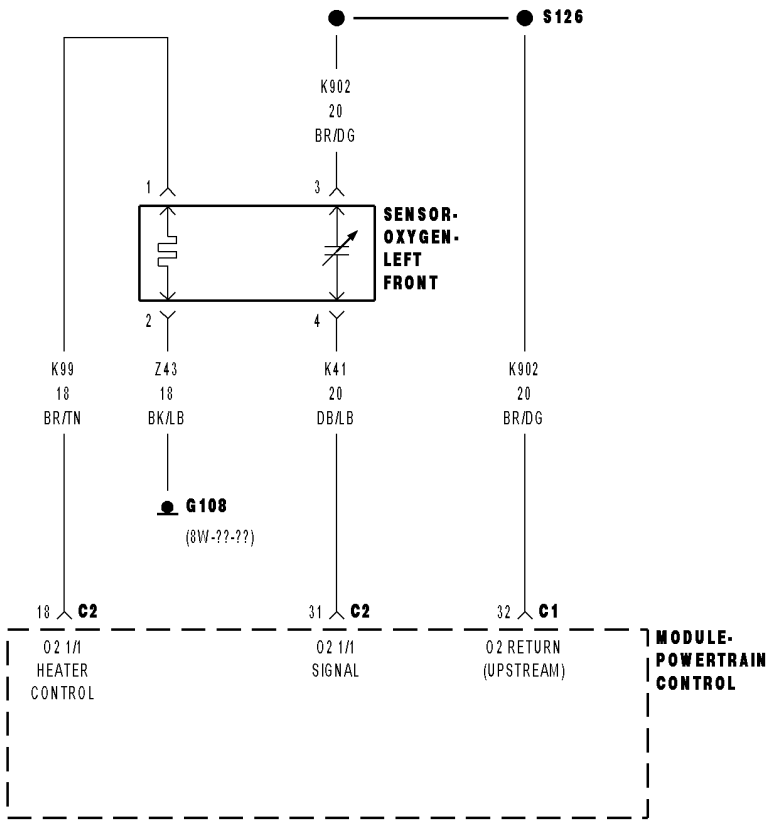
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

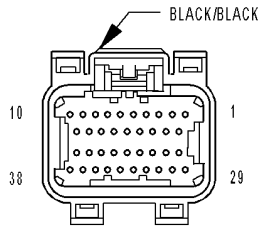
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

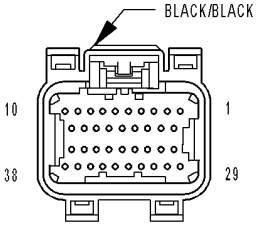
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH

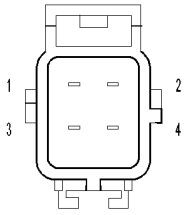




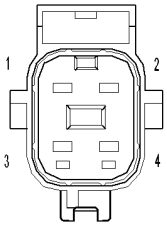
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



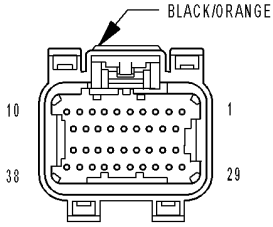
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



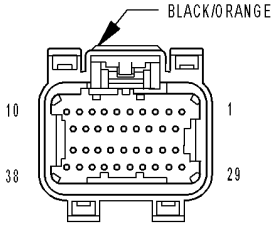
SENSOR-
OXYGEN-
LEFT
FRONT
(4.7L)



SENSOR-
OXYGEN-
LEFT FRONT
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

8132af33

P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.
- **Set Condition:**
  Desired state does not equal Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN
(Z43) O2 1/1 HEATER GROUND CIRCUIT OPEN
(K99) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC's.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.
Disconnect the 1/1 O2 Sensor harness connector.

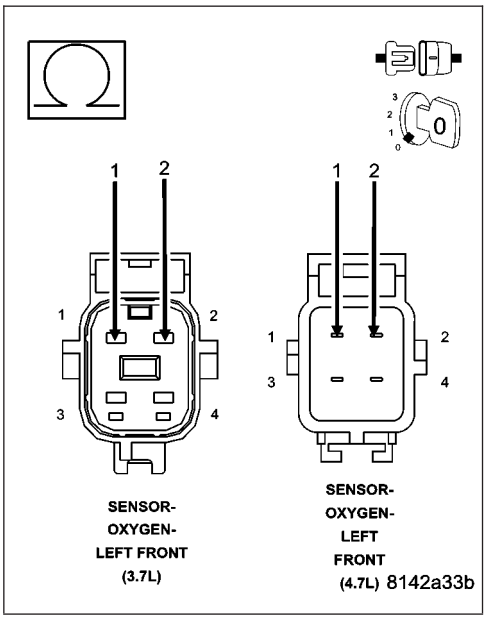
Measure the resistance across the O2 Sensor Heater element between the O2 Heater Control terminal and the O2 Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH (CONTINUED)

3. (K99) O2 1/1 HEATER CONTROL CIRCUIT

Ignition on, engine not running.

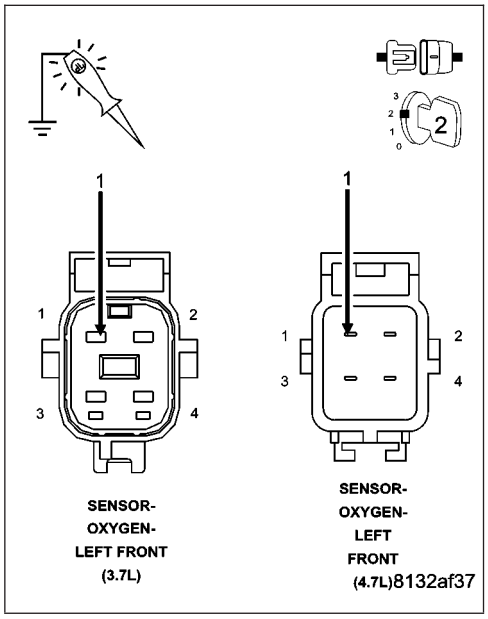
With a scan tool, actuate the O2 1/1 Heater Test with the Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Go To 4

No >> Go To 5



4. (Z43) O2 HEATER GROUND CIRCUIT OPEN

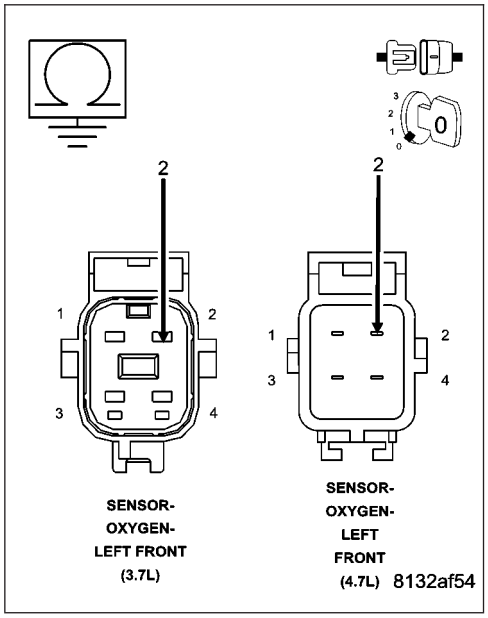
Turn the ignition off.

Measure the resistance between an engine ground and the (Z43) O2 1/1 Heater ground circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (Z43) O2 1/1Heater ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH (CONTINUED)

5. (K99) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

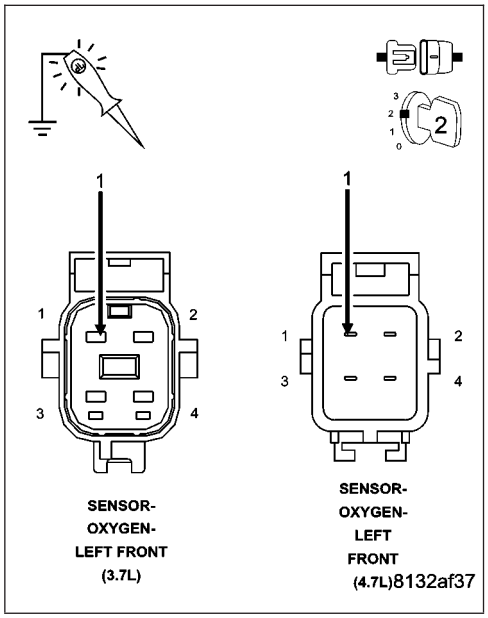
Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly?

Yes >> Repair the short to battery voltage in the (K99) O2 1/1 Heater Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

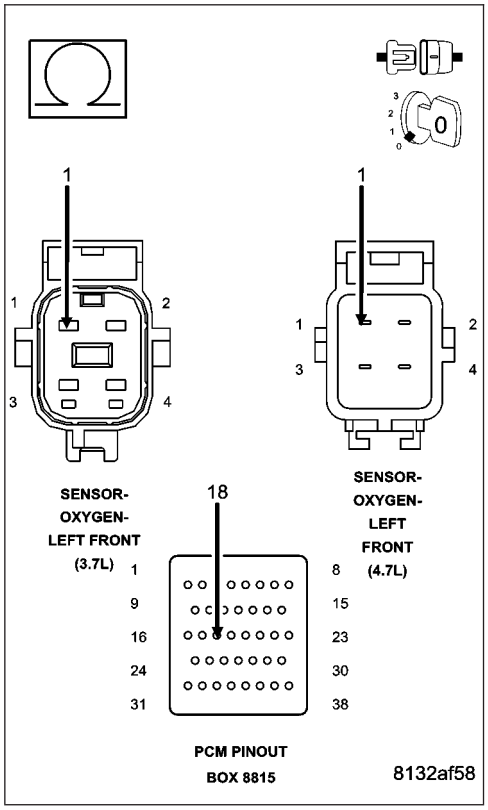
CAUTION: Do not probe the PCM harness connectors. Probing the PCM hanrness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K99) O2 1/1 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K99) O2 1/1 Heater Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

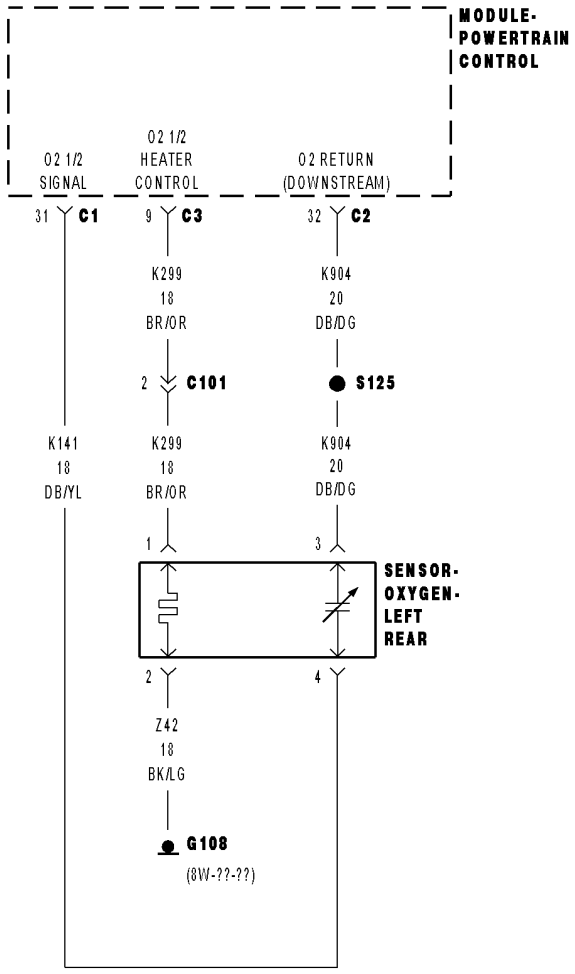
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

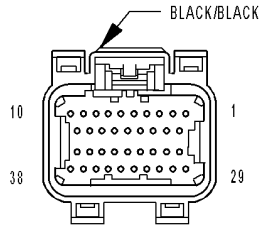
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

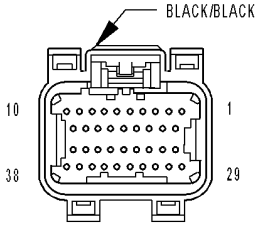
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0037-O2 SENSOR 1/2 HEATER CIRCUIT LOW

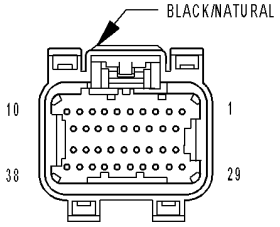




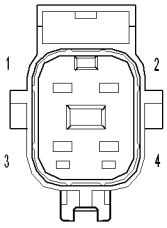
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



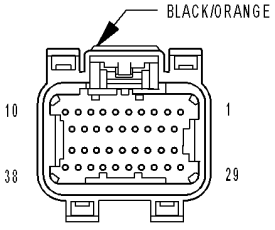
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



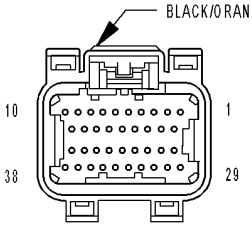
MODULE-
POWERTRAIN
CONTROL C3



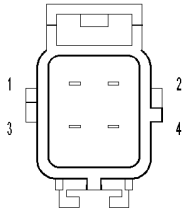
SENSOR-
OXYGEN-
LEFT REAR
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



SENSOR-
OXYGEN-
LEFT
REAR
(3.7L)

8132af63

P0037-O2 SENSOR 1/2 HEATER CIRCUIT LOW (CONTINUED)

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.
- **Set Condition:**
  Desired state does not match Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K299) O2 1/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 1/2 Heater Test.

With the scan tool, monitor 1/2 O2 Sensor voltage for at least 2 minutes.

Does the O2 Sensor voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 1/2 O2 Sensor harness connector.

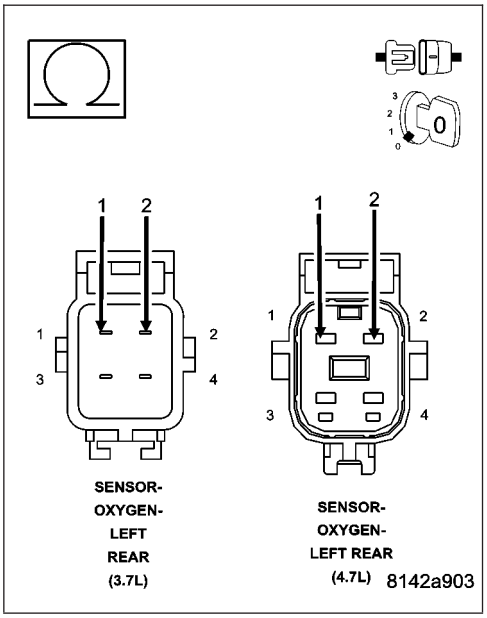
Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the O2 Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0037-O2 SENSOR 1/2 HEATER CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Ignition on, engine not running.

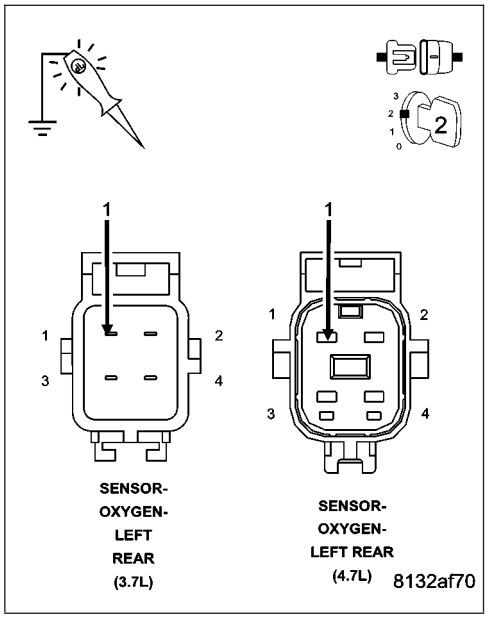
With a scan tool, actuate the O2 Heater Test with the 1/2 O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K299) O2 1/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

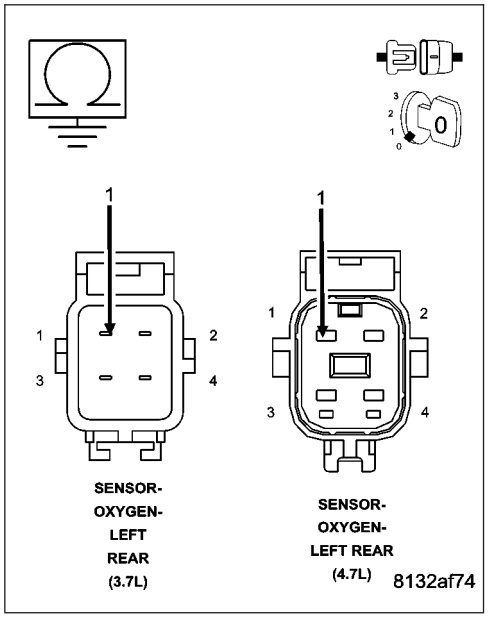
Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K299) O2 1/2 Heater Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0037-O2 SENSOR 1/2 HEATER CIRCUIT LOW (CONTINUED)

5. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

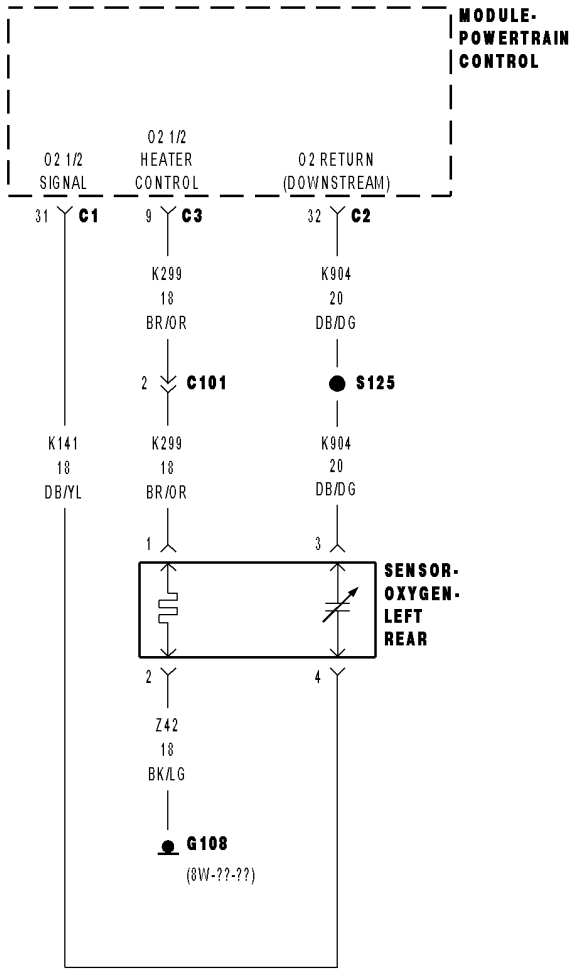
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

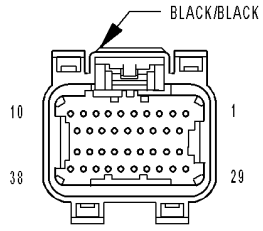
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

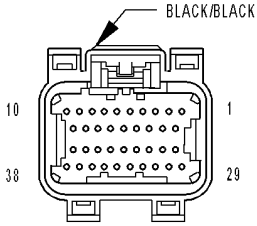
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH

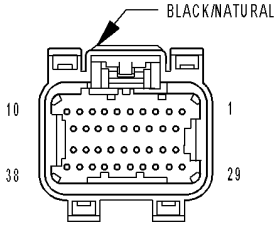




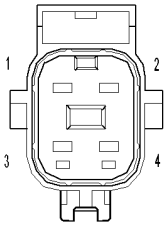
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



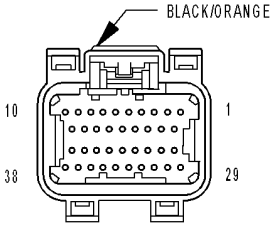
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



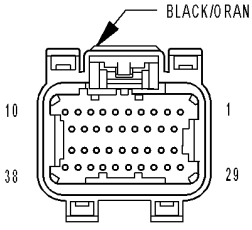
MODULE-
POWERTRAIN
CONTROL C3



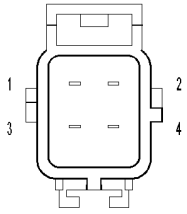
SENSOR-
OXYGEN-
LEFT REAR
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



SENSOR-
OXYGEN-
LEFT
REAR
(3.7L)

8132af63

P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.
- **Set Condition:**
  Desired state does not equal Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN
(Z42) O2 1/2 HEATER GROUND CIRCUIT OPEN
(K299) O2 SENSOR 1/2 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC's.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.
Disconnect the 1/2 O2 Sensor harness connector.

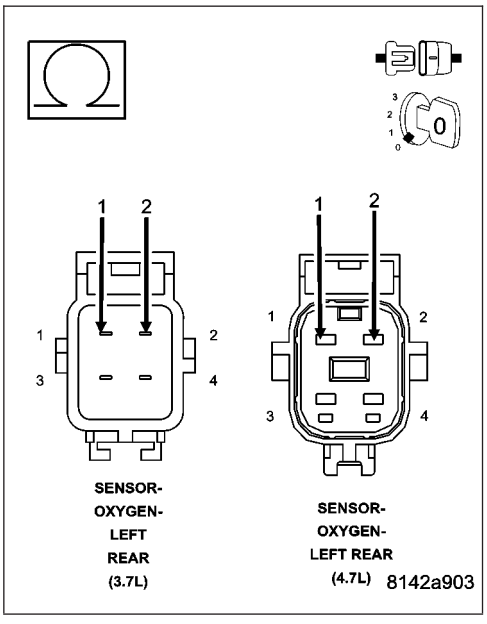
Measure the resistance across the O2 Sensor Heater element, between the Heater Control terminal and the Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH (CONTINUED)

3. (K299) O2 1/2 HEATER CONTROL CIRCUIT

Ignition on, engine not running.

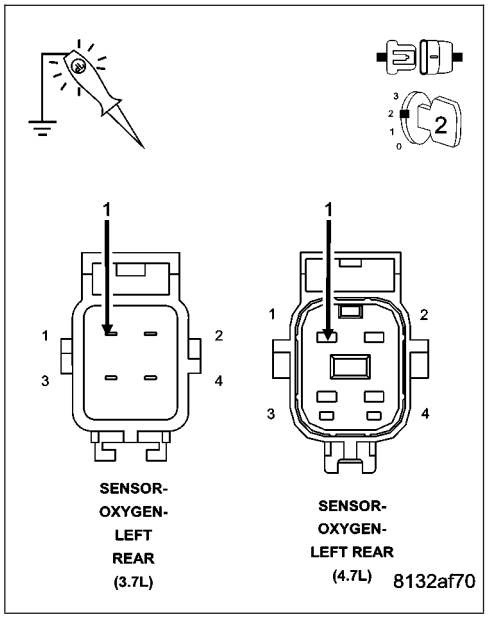
With a scan tool, actuate the O2 1/2 Heater Test with the O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Go To 4

No >> Go To 5



4. (Z42) O2 HEATER GROUND CIRCUIT OPEN

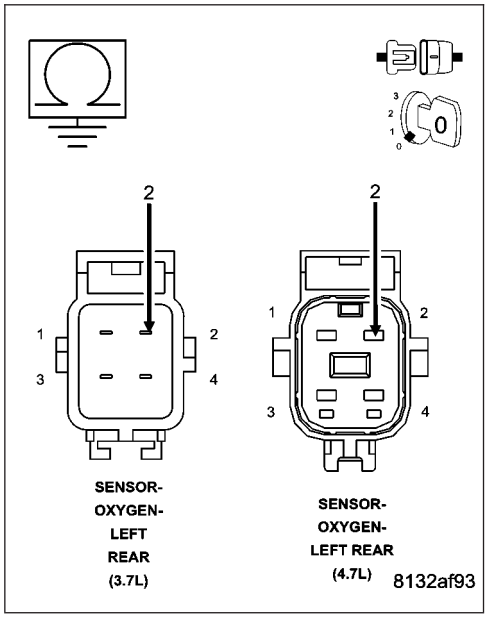
Turn the ignition off.

Measure the resistance between an engine ground and the (Z42) O2 1/2 Heater ground circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (Z42) O2 1/2 Heater ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH (CONTINUED)

5. (K299) O2 1/2 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

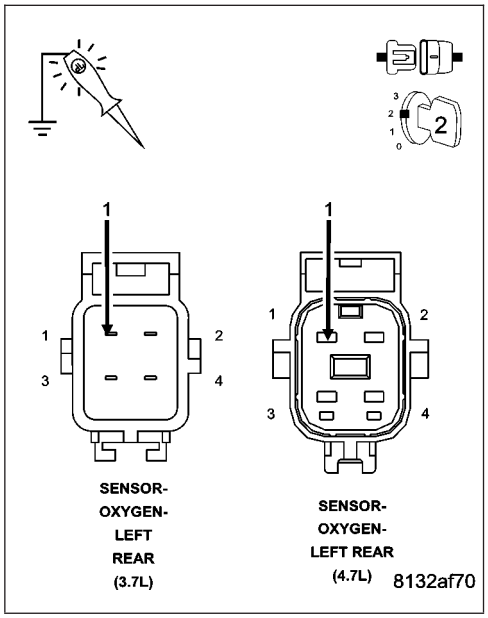
Ignition on, engine not running.

Using a 12-volt test light connect to ground, probe the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly?

Yes >> Repair the short to battery voltage in the (K299) O2 1/2 Heater Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

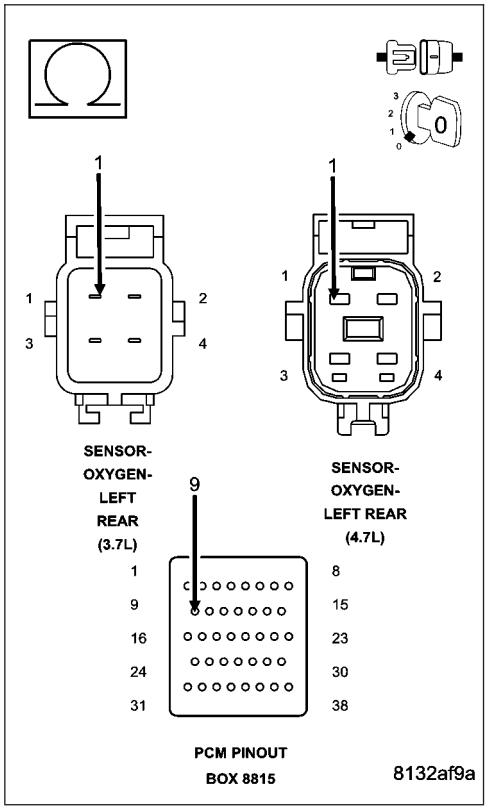
CAUTION: Do not probe the PCM harness connectors. Probing the PCM hanrness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K299) O2 1/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K299) O2 1/2 Heater Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

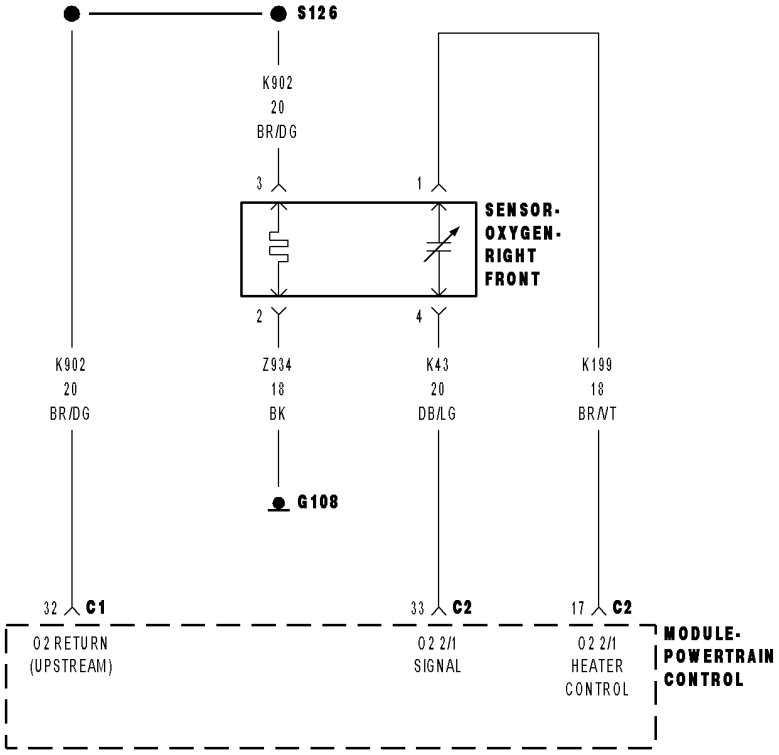
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

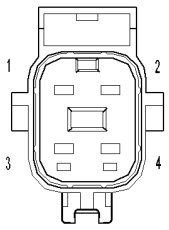
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

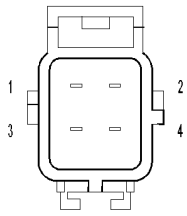
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW

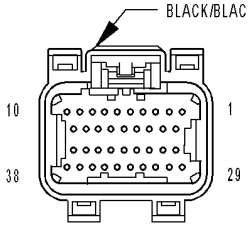




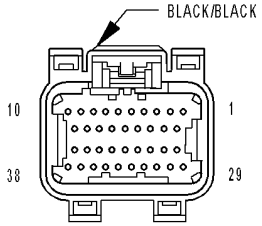
SENSOR-
OXYGEN-
RIGHT FRONT
(3.7L)



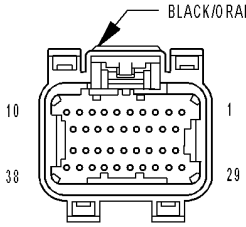
SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



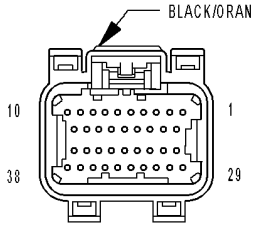
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

8132b019

P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.
- **Set Condition:**
  Desired state does not match Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With a scan tool, monitor 2/1 O2 Sensor voltage for at least 2 minutes.

Does the O2 Sensor voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 2/1 O2 Sensor harness connector.

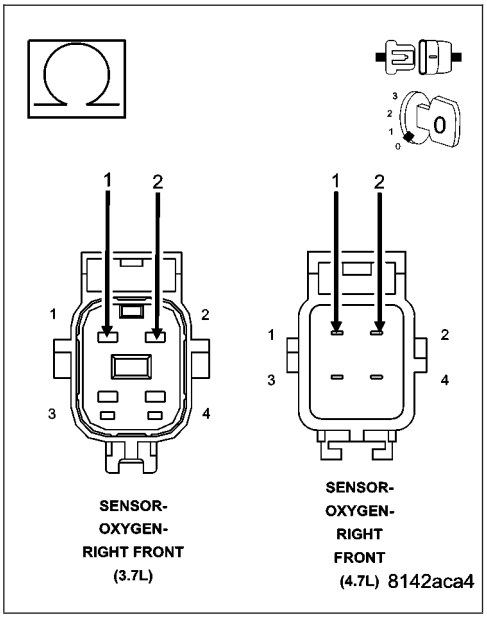
Measure the resistance across the O2 Sensor Heater element, between the Heater Control terminal and the Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Ignition on, engine not running.

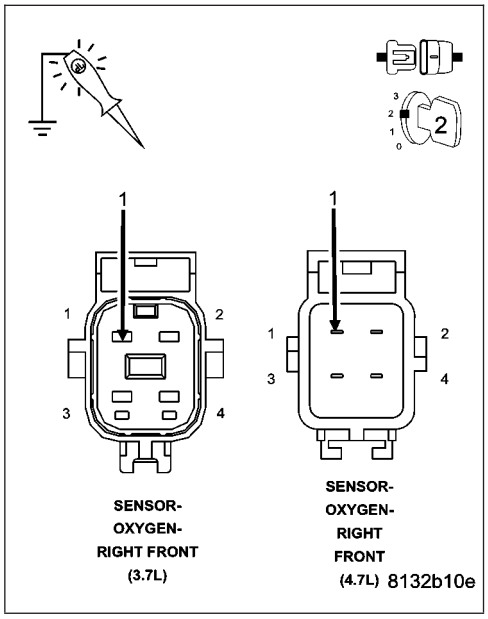
With a scan tool, actuate the O2 Heater Test with the O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

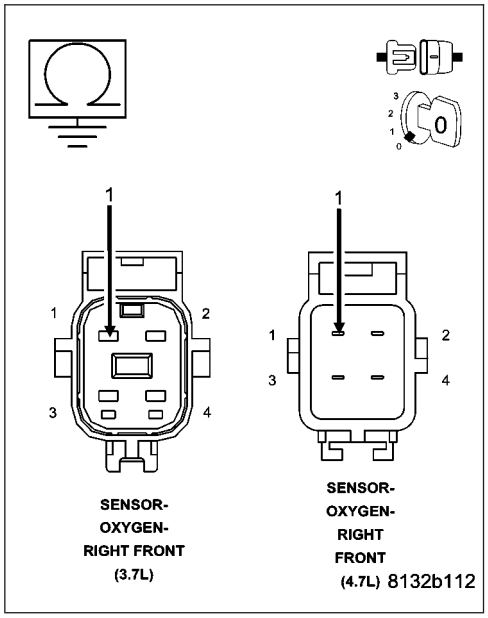
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K199) O2 2/1 Sensor Heater Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW (CONTINUED)

5. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

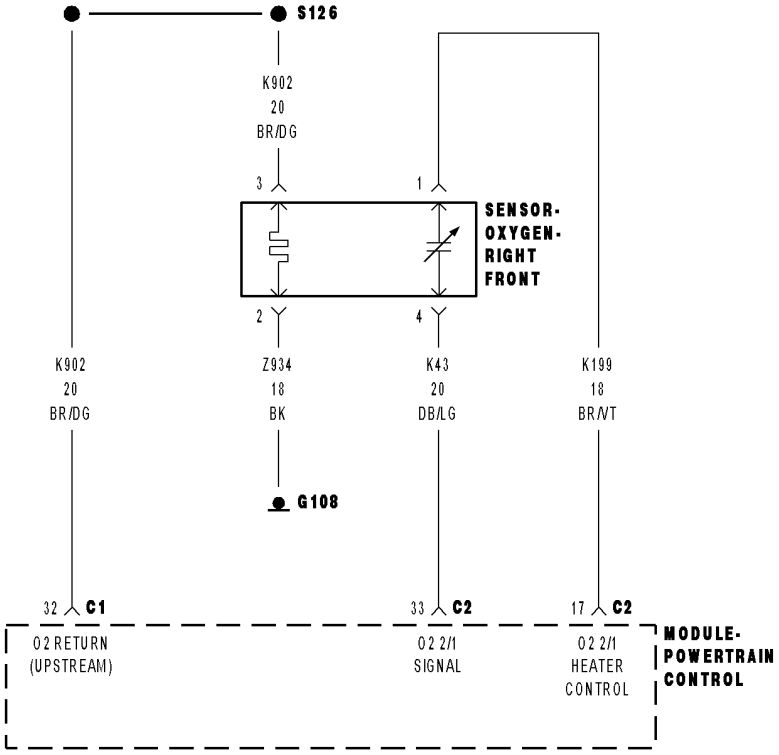
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

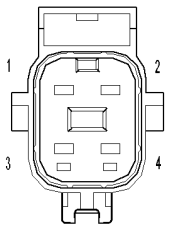
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

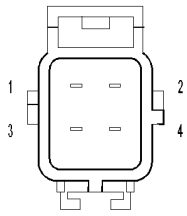
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH

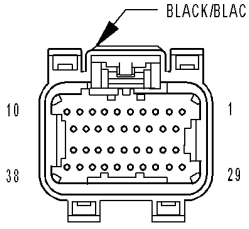




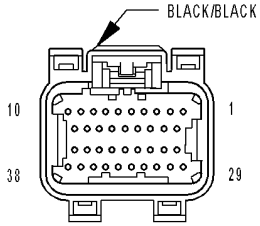
SENSOR-
OXYGEN-
RIGHT FRONT
(3.7L)



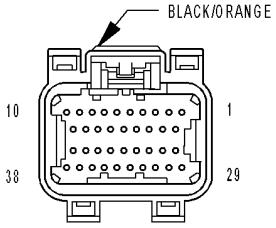
SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



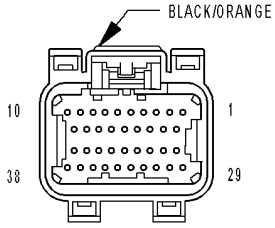
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

8132b019

P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.
- **Set Condition:**
  Desired state does not equal Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN
(Z934) O2 2/1 HEATER GROUND CIRCUIT OPEN
(K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC's.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.
Disconnect the 2/1 O2 Sensor harness connector.

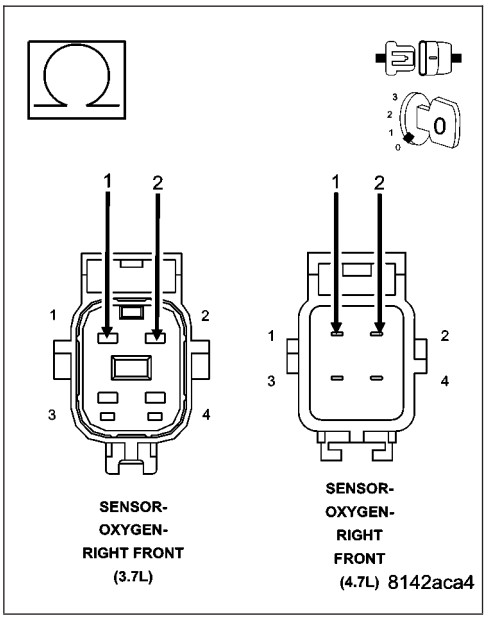
Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control teriminal and the Heater ground terminal at the component connector.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH (CONTINUED)

3. (K199) O2 2/1 HEATER CONTROL CIRCUIT

Ignition on, engine not running.

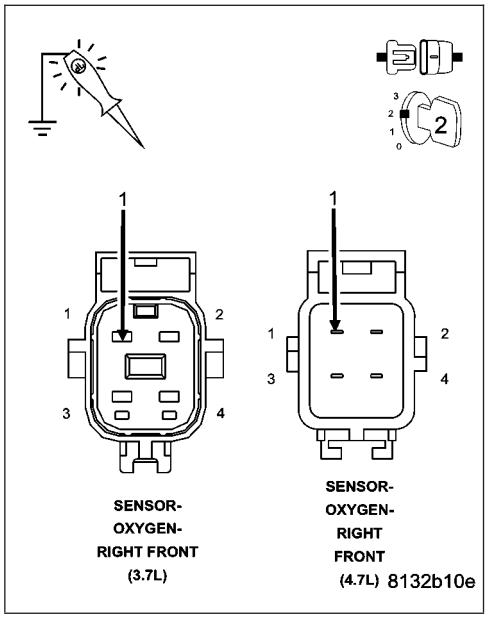
With the scan tool, actuate the O2 Heater Test with the Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Go To 4

No >> Go To 5



4. (Z934) O2 2/1 HEATER GROUND CIRCUIT OPEN

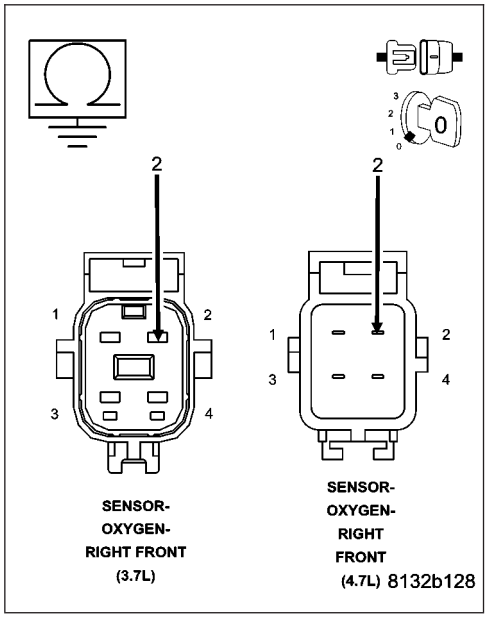
Turn the ignition off.

Measure the resistance between an engine ground and the (Z934) O2 2/1 Heater ground circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (Z934) O2 2/1 Heater ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH (CONTINUED)

5. (K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

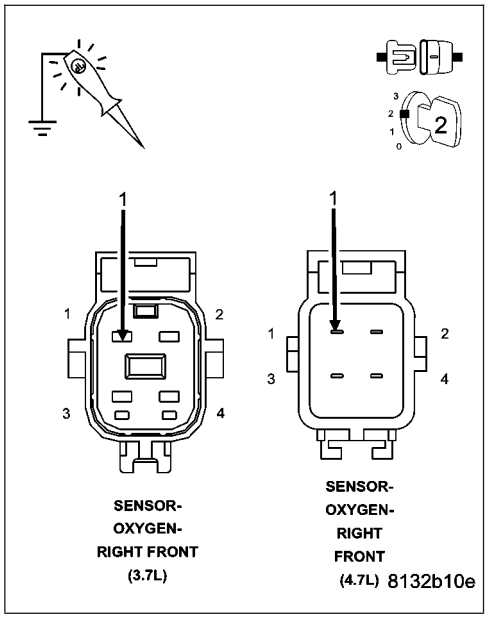
Using a 12-volt test light connected to ground, probe the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate?

Yes >> Repair the short to battery voltage in the (K199) O2 2/1 Heater Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM hanrness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

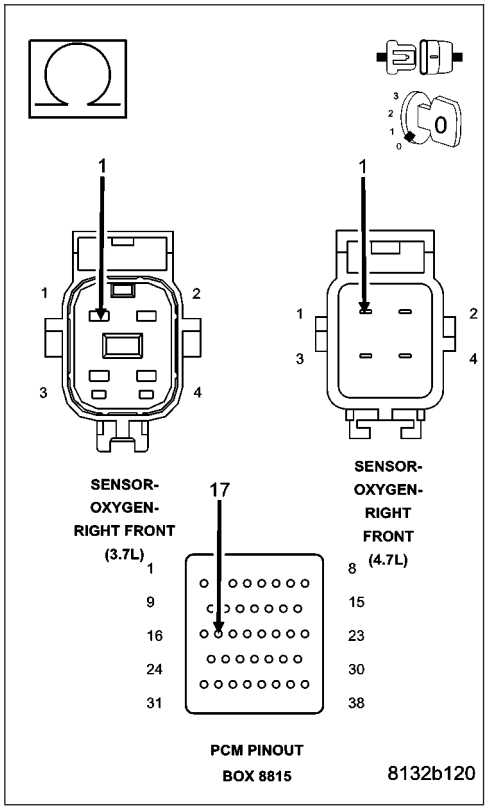
Measure the resistance of the (K199) O2 2/1 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K199) O2 2/1 Heater Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

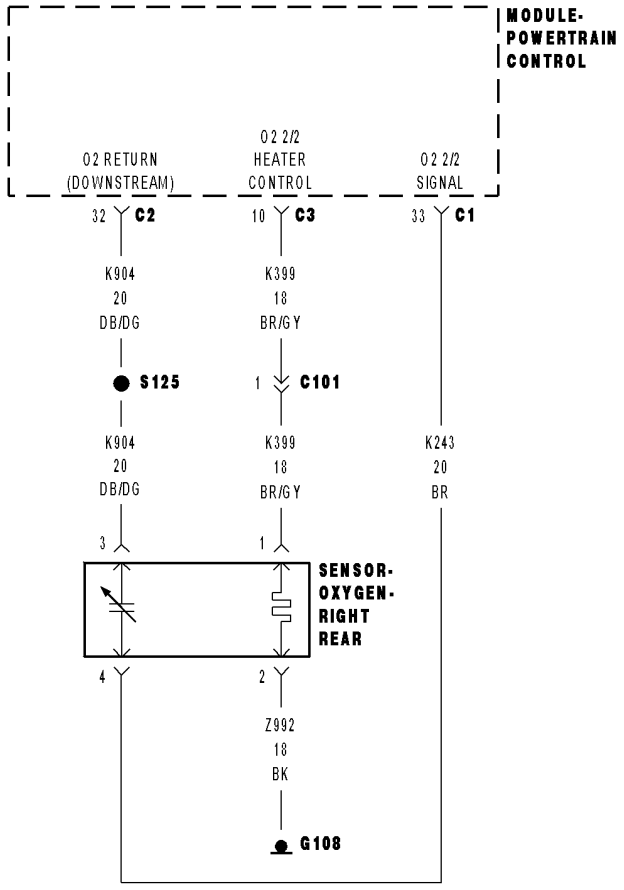
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

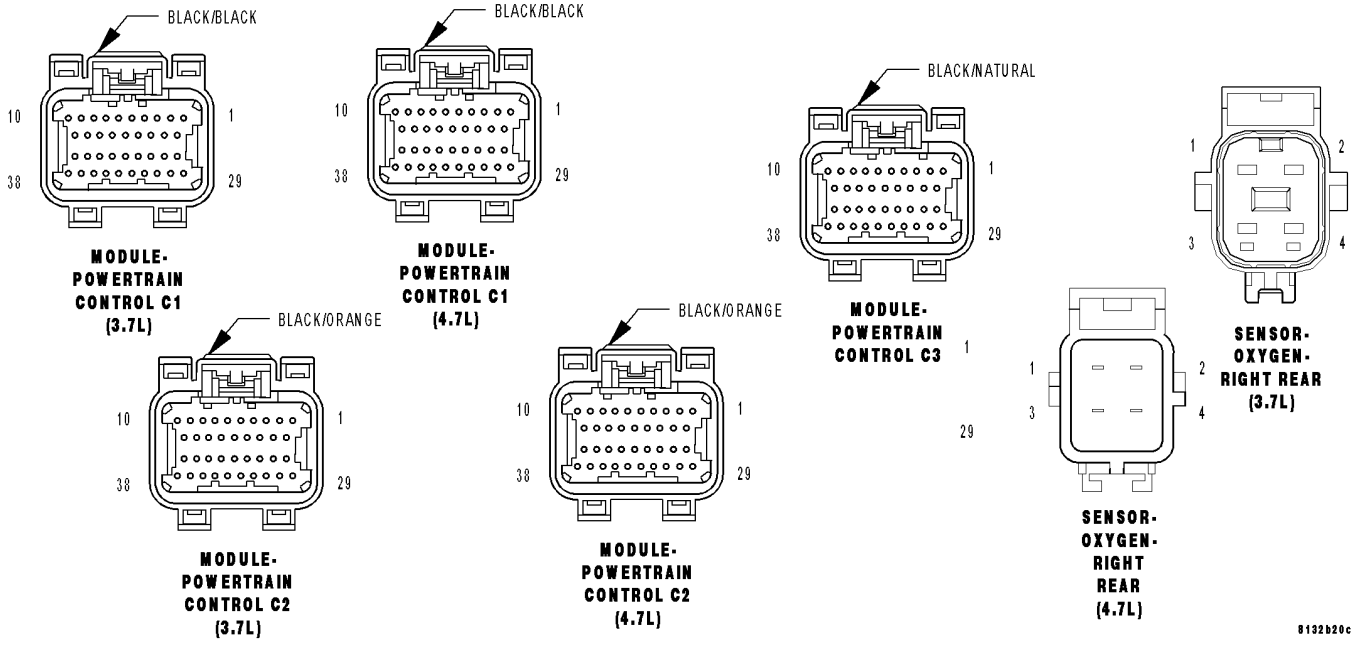
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0057-O2 SENSOR 2/2 HEATER CIRCUIT LOW





P0057-O2 SENSOR 2/2 HEATER CIRCUIT LOW (CONTINUED)

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.
- **Set Condition:**
  Desired state does not match Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 2/2 O2 Sensor voltage for at least 2 minutes.

Does the O2 Sensor voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 2/2 O2 Sensor harness connector.

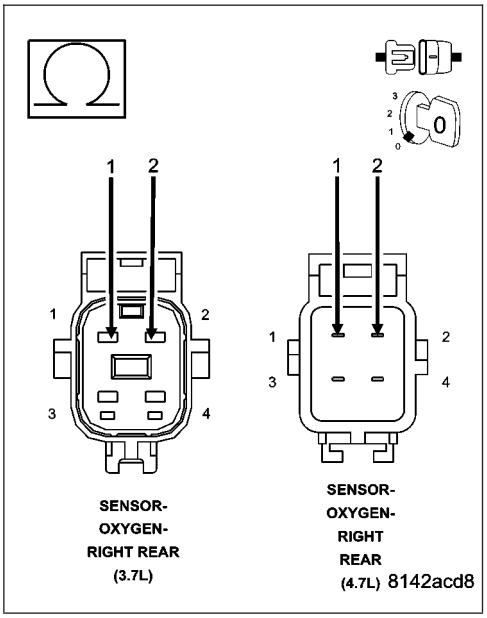
Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the O2 Heater ground terminal in the component connector.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0057-O2 SENSOR 2/2 HEATER CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Ignition on, engine not running.

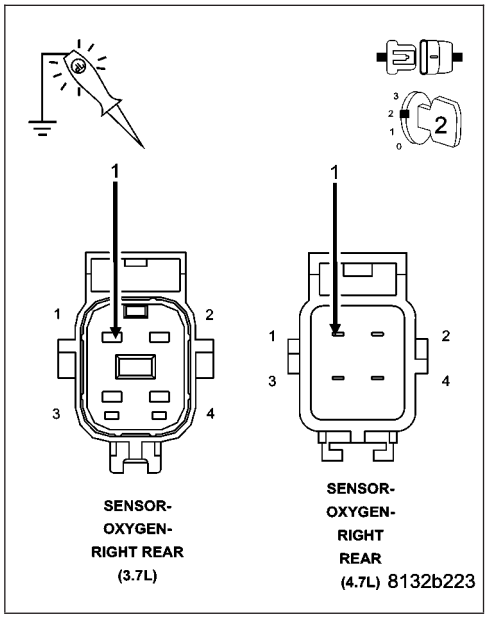
With a scan tool, actuate the O2 Heater Test with the O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K399) O2 2/2 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K399) O2 2/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

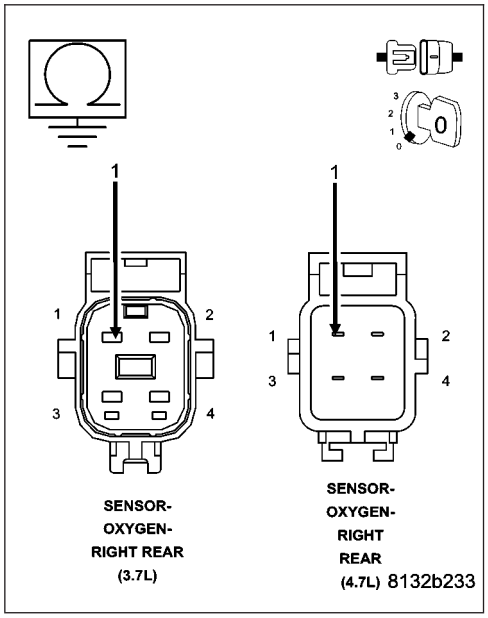
Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K399) O2 2/2 Heater Control circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K399) O2 2/2 Sensor Heater Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0057-O2 SENSOR 2/2 HEATER CIRCUIT LOW (CONTINUED)

5. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

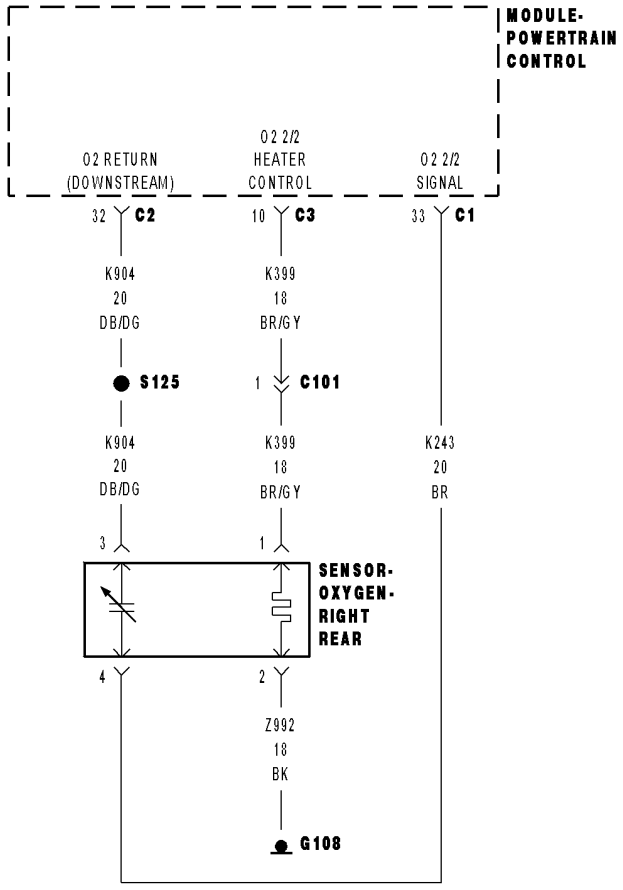
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

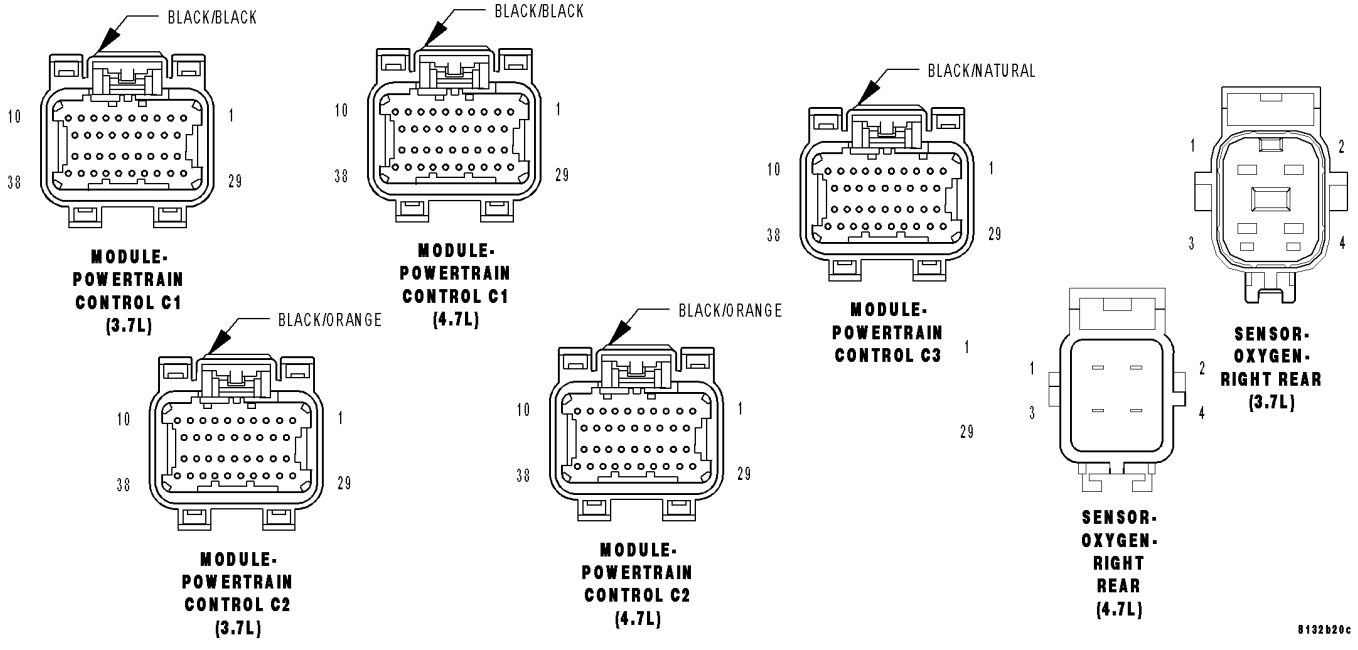
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0058-O2 SENSOR 2/2 HEATER CIRCUIT HIGH





P0058-O2 SENSOR 2/2 HEATER CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.
- **Set Condition:**
  Desired state does not equal Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN
(Z992) O2 2/2 HEATER GROUND CIRCUIT OPEN
(K399) O2 2/2 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC's.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 2/2 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the O2 Heater ground terminal in the component connector.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0058-O2 SENSOR 2/2 HEATER CIRCUIT HIGH (CONTINUED)

3. (K399) O2 2/2 HEATER CONTROL CIRCUIT

Ignition on, engine not running.

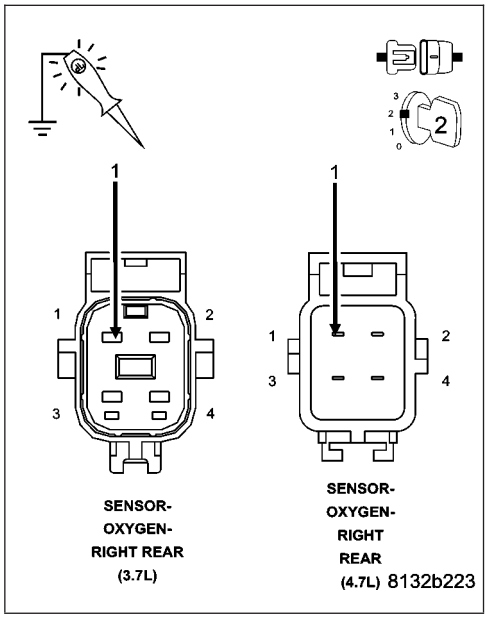
With a scan tool, actuate the O2 2/2 Heater Test with the Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K399) O2 2/2 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Go To 4

No >> Go To 5



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4. (Z992) O2 HEATER GROUND CIRCUIT OPEN

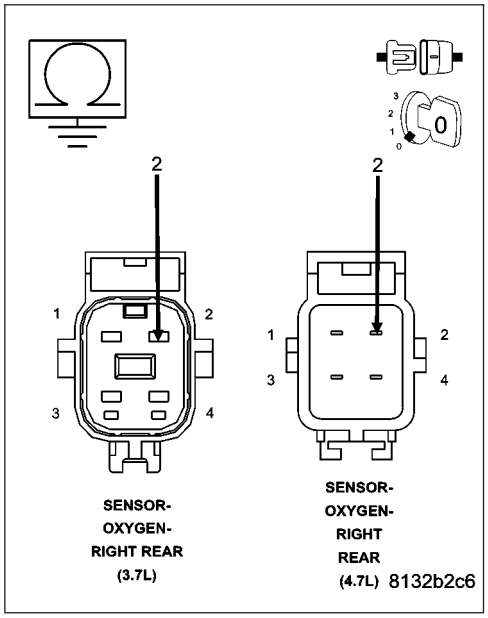
Turn the ignition off.

Measure the resistance between an engine ground and the (Z992) O2 2/2 Heater ground circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (Z992) O2 2/2 Heater ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0058-O2 SENSOR 2/2 HEATER CIRCUIT HIGH (CONTINUED)

5. (K399) O2 2/2 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

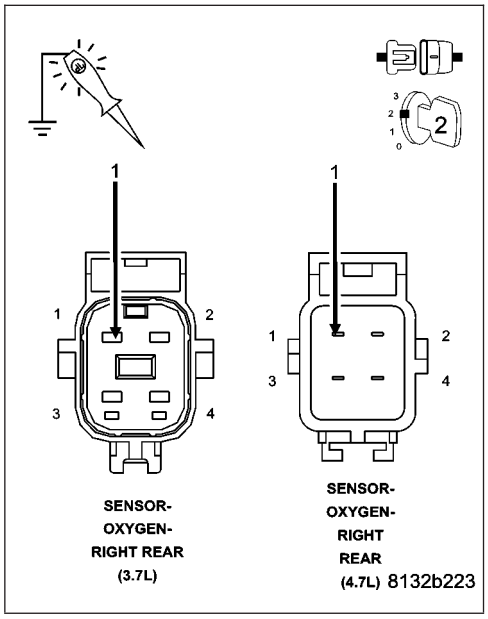
Using a 12-volt test light connected to ground, probe the (K399) O2 Heater 2/2 Control circuit in the O2 Sensor harness connector.

Does the test light illuminate?

Yes >> Repair the short to battery voltage in the (K399) O2 2/2 Heater Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM hanrness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

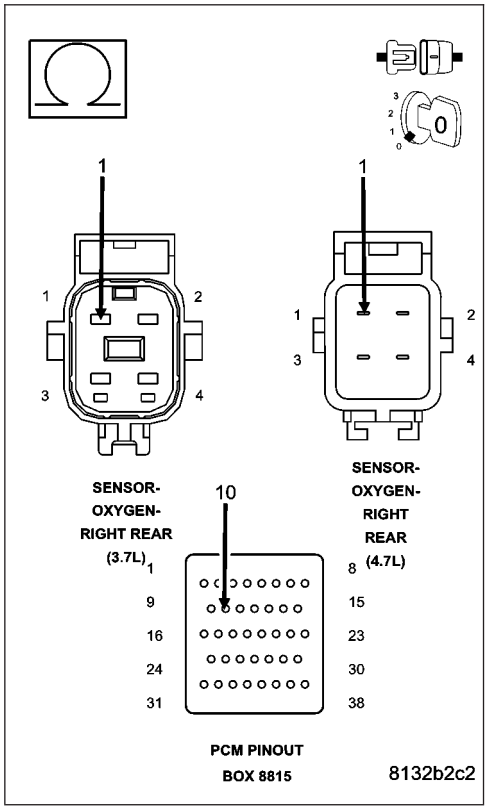
Measure the resistance of the (K399) O2 2/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K399) O2 2/2 Heater Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0058-O2 SENSOR 2/2 HEATER CIRCUIT HIGH (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

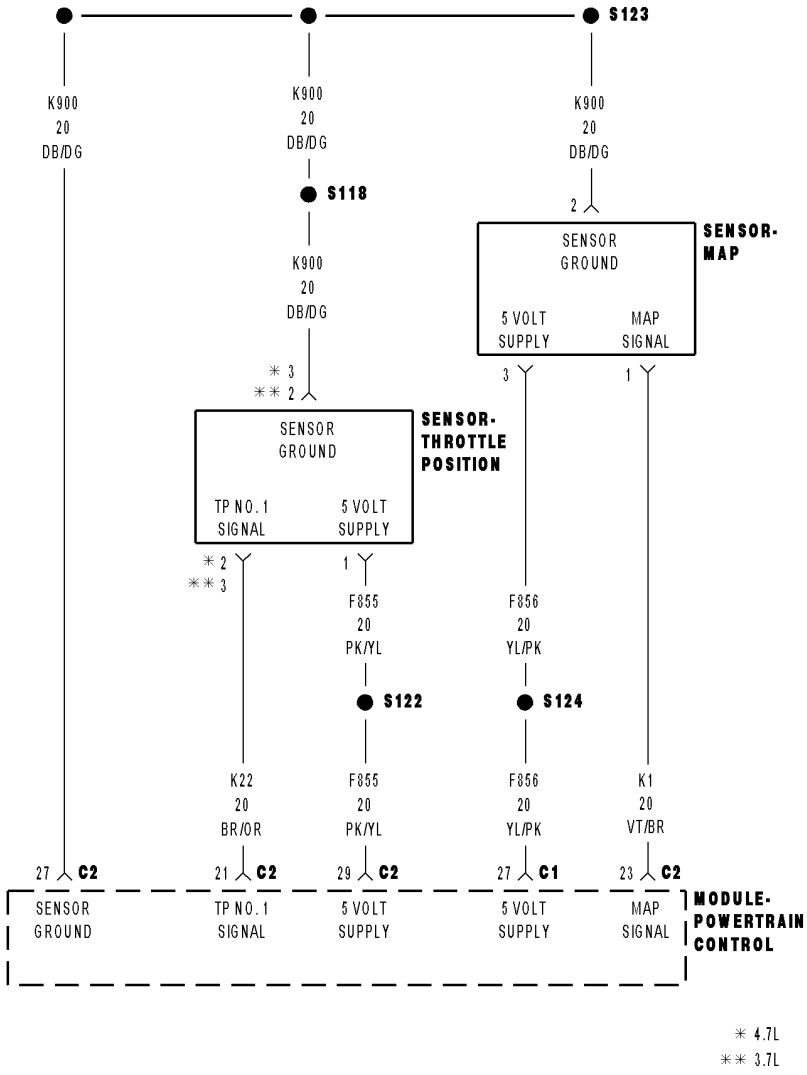
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

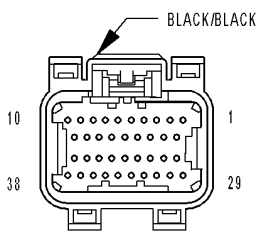
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

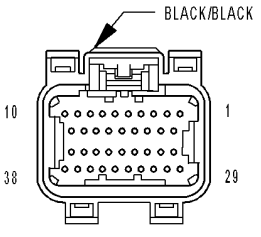
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION

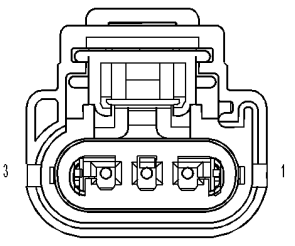




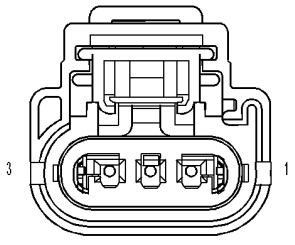
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



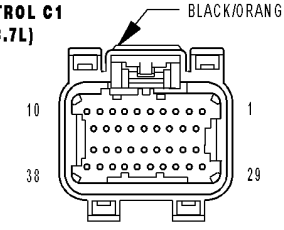
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



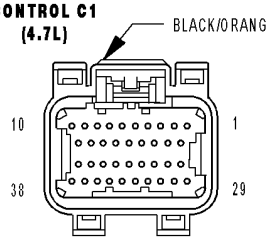
SENSOR-
THROTTLE
POSITION
(3.7L)



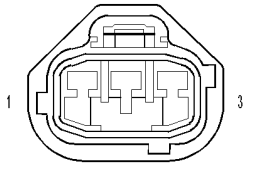
SENSOR-
MAP



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



SENSOR-
THROTTLE
POSITION
(4.7L)

8132b2ea

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

This DTC sets when an unexpected high intake manifold air flow condition exists that can lead to increased engine speed and puts the NGC into a High Air flow Protection limiting mode. The High Air flow Protection feature includes RPM limits for when a Throttle and/or MAP sensor limp-in fault is present.

- **When Monitored:**
  During all drive modes.
- **Set Condition:**
  If vacuum drops below 1.5″Hg with engine RPM greater than 2000 RPM and closed throttle. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
VACUUM LEAK
RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K22) TP SENSOR NO.1 SIGNAL CIRCUIT
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
MAP SENSOR
THROTTLE POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any TP Sensor or MAP Sensor component DTCs before continuing.

NOTE: If the P0501 - No Vehicle Speed Signal is set long with this DTC, refer to the P0501 diagnostics before continuing.

NOTE: The throttle plate and linkage should be free from binding and carbon build up.

NOTE: Make sure the throttle plate is at the idle position.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

2. VACUUM LEAK

NOTE: This code is enabled on engines with a plastic intake manifold and is intended to shut down the engine if a large crack occurs.

NOTE: A large vacuum leak is most likely the cause of this DTC.

Inspect the Intake Manifold for leaks and cracks.

Inspect the Power Brake Booster for any vacuum leaks.

Inspect the PCV system for proper operation and vacuum leaks.

Inspect the throttle plate to see if it is bent and will close entirely, if it is bent it may need to be replaced.

Inspect the MAP Sensor for proper installation.

Verify the engine is free from any mechanical failures.

Were any vacuum leaks found?

Yes >> Repair the vacuum leak as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. MAP SENSOR OPERATION

Start the engine.

With a scan tool, monitor the MAP Sensor voltage.

Snap the throttle.

Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at wide open throttle?

Yes >> Go To 4

No >> Go To 11

---

4. TP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor voltage while slowly pressing the throttle pedal from closed to wide open throttle.

Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

5. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

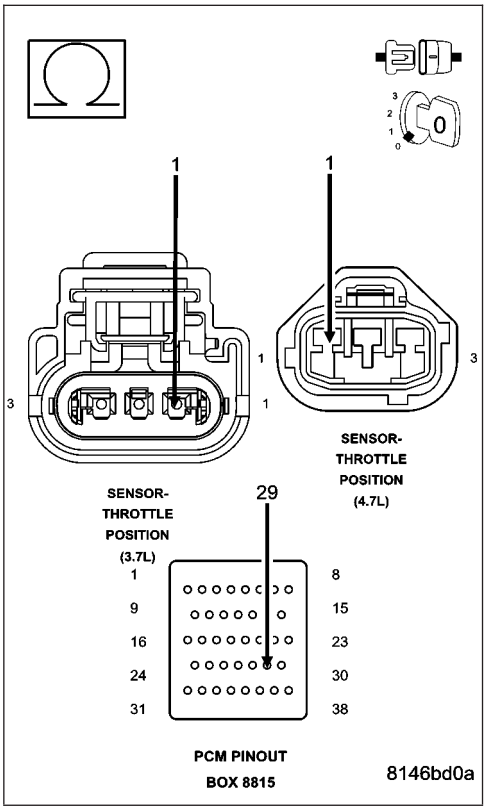
Turn the ignition off.

Disconnect the TP Sensor harness connector.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

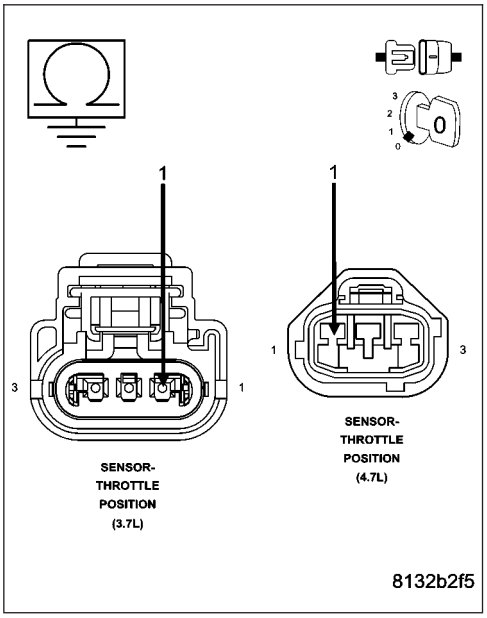
Yes >> Go To 6

No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and (F855) 5-volt Supply circuit in the TP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

7. THROTTLE POSITION SENSOR

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor voltage.

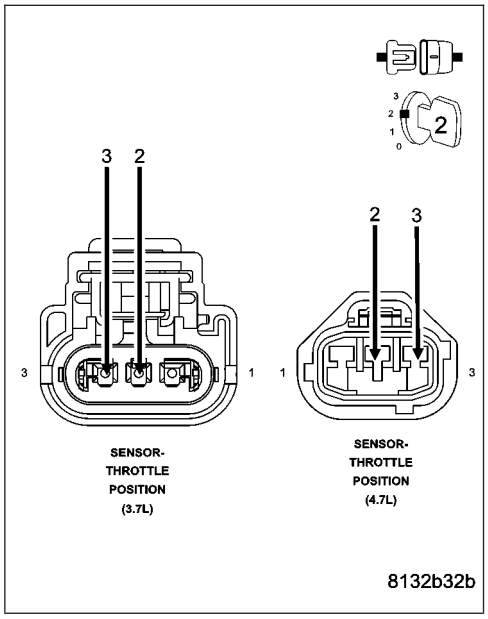
Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

Does the TP Sensor voltage change from approximately 4.9 volts to below 0.5 of a volt with the jumper wire installed?

Yes >> Replace the Throttle Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

NOTE: Remove the jumper wire before continuing.



8. EXCESSIVE RESISTANCE IN THE (K22) TP NO.1 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

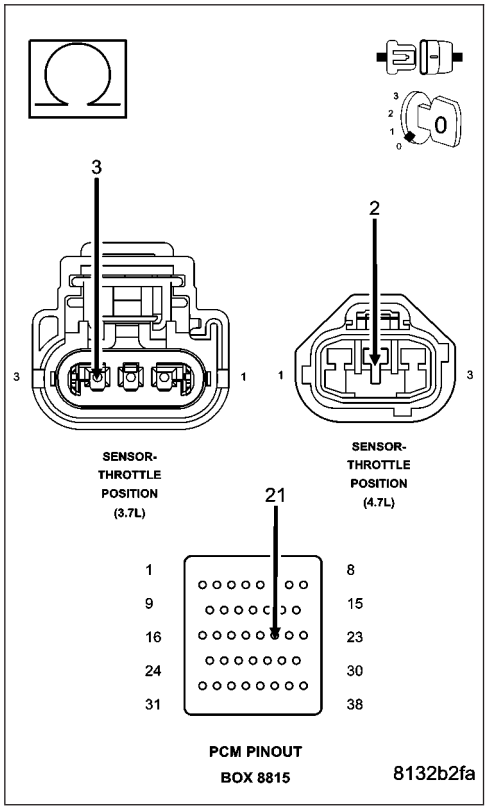
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the excessive resistance in the (K22) TP Sensor No.1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

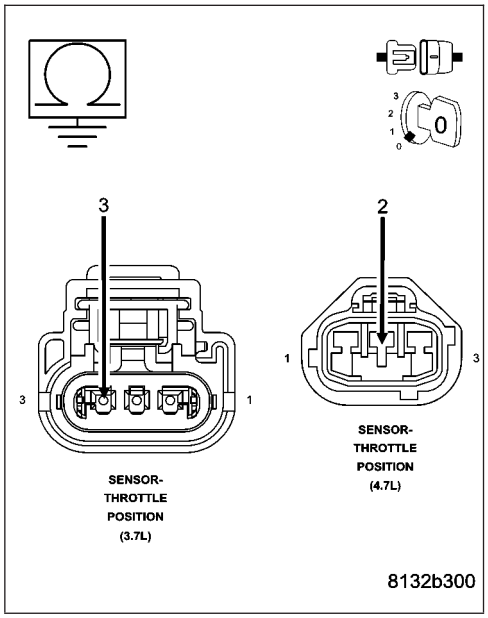
9. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit in the TP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10



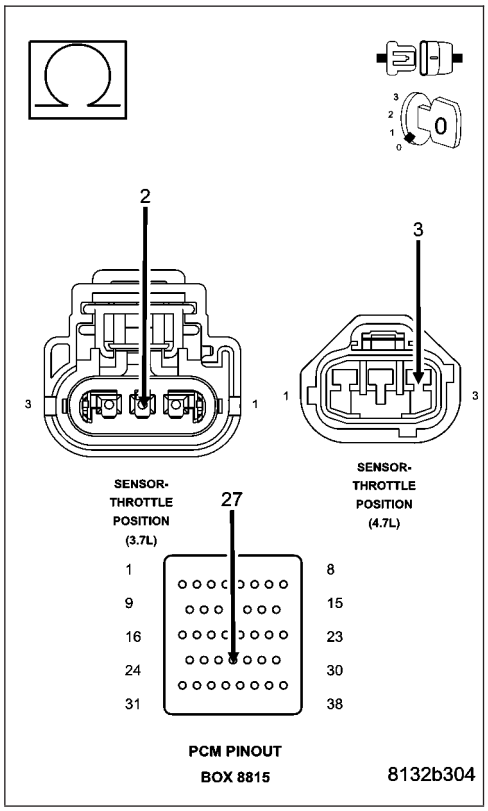
10. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (K900) Sensor ground circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

11. EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

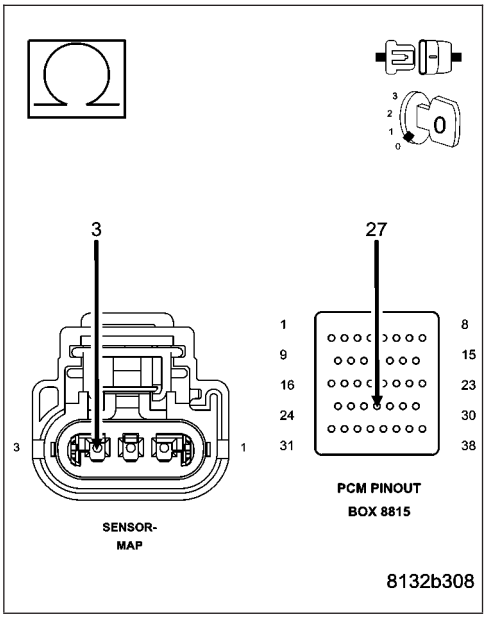
Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

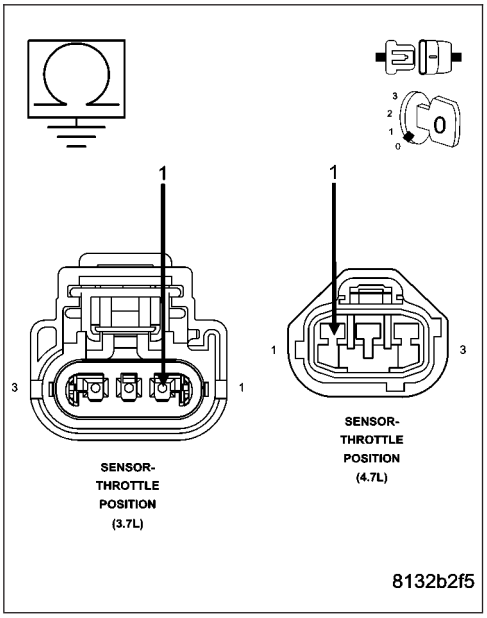
Yes >> Go To 12

No >> Repair the excessive resistance in the (F856) 5-volt Supply circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the resistance above 100k ohms?

Yes >> Go To 13

No >> Repair the short to ground in the (F856) 5-volt Supply circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

13. MAP SENSOR

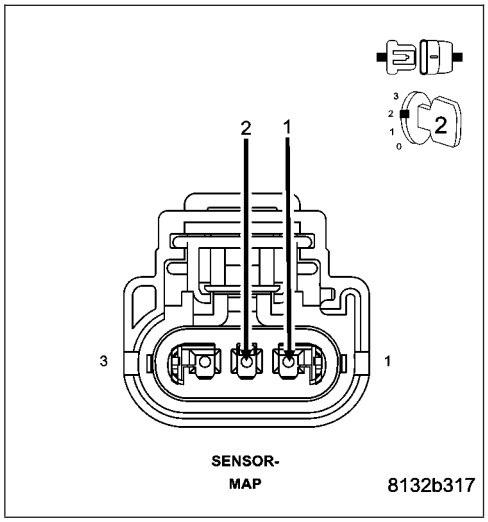
Turn the ignition off.

Connect the C1 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the MAP Sensor voltage.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit.



Does the scan tool display MAP voltage from approximately 4.9 volts to below 0.5 of a volt with the jumper wire installed?

Yes >> Replace the MAP Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

NOTE: Remove the jumper wire before continuing.

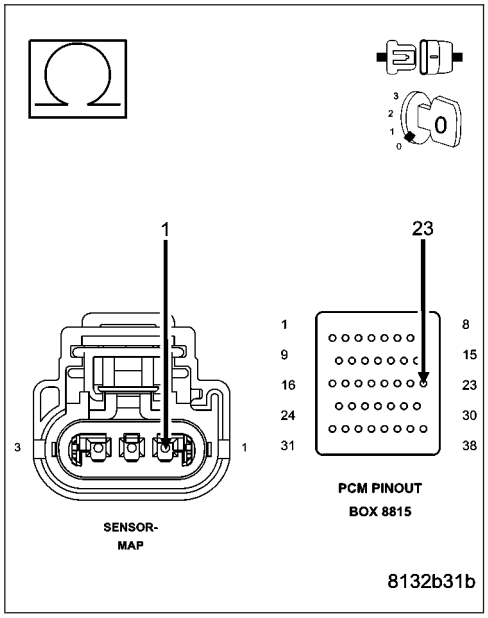
14. EXCESSIVE RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

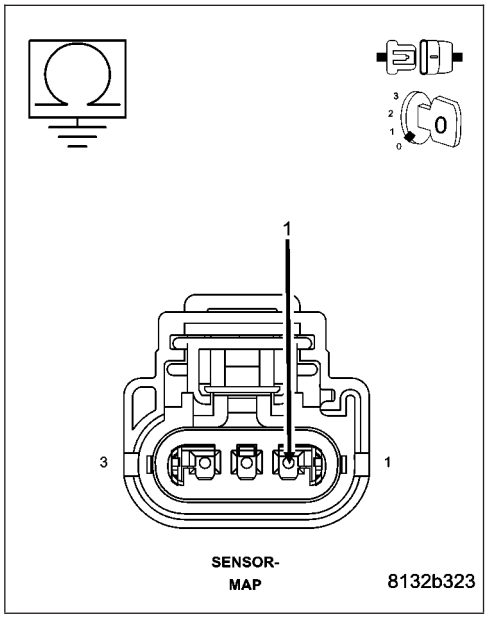
Yes >> Go To 15

No >> Repair the excessive resistance in the (K1) MAP Signal circuit
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

15. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.



Is the resistance below 100 ohms?

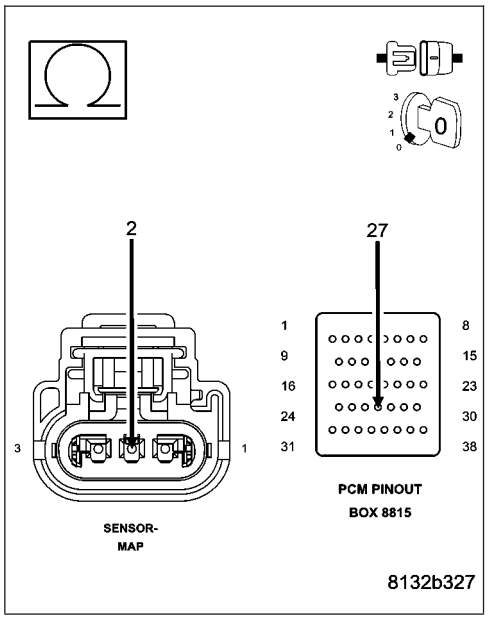
Yes >> Repair the short to ground in the (K1) MAP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

16. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

17. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

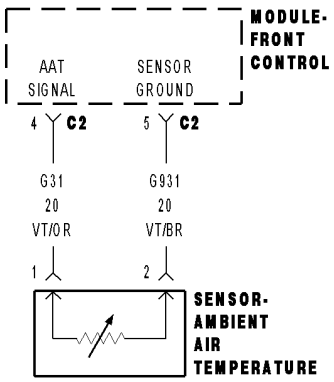
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

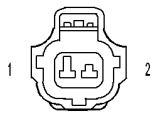
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

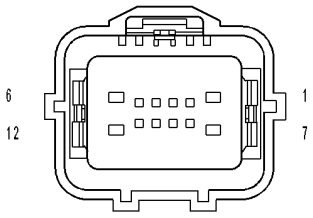
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE





SENSOR-
AMBIENT
AIR
TEMPERATURE



MODULE-
FRONT
CONTROL C2

8132b426

P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

Ambient Air Temperature Sensor performance looks at the outputs of three temperature sensors and compare them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If the engine coolant and intake air temperature sensors agree and the ambient air temperature does not agree, the ambient air temperature sensor is declared as irrational.

- **When Monitored:**
  Engine off time is greater than 480 minutes. Ambient temperature is greater than 4 deg C (38 deg F).
- **Set Condition:**
  After a calibrated amount of cool down time the PCM compares the ECT Sensor, IAT Sensor, and the Ambient Air Temp Sensor values. If the IAT Sensor value is not within –10 deg C (18 deg F) of the other two temperature sensors. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(G31) AAT SIGNAL CIRCUIT OPEN
(G931) SENSOR GROUND CIRCUIT OPEN
(G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND
(G31) AAT SIGNAL CIRCUIT SHORTED TO THE (G931) SENSOR GROUND CIRCUIT
AMBIENT AIR TEMPERATURE SENSOR
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any CAN - C Communication DTCs before continuing.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

2. (G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 FCM harness connector.

Disconnect the AAT Sensor harness connector.

NOTE: Visually inspect both the component and the IPM connectors. Look for damaged, partially broken wires, and backed out or corroded terminals.

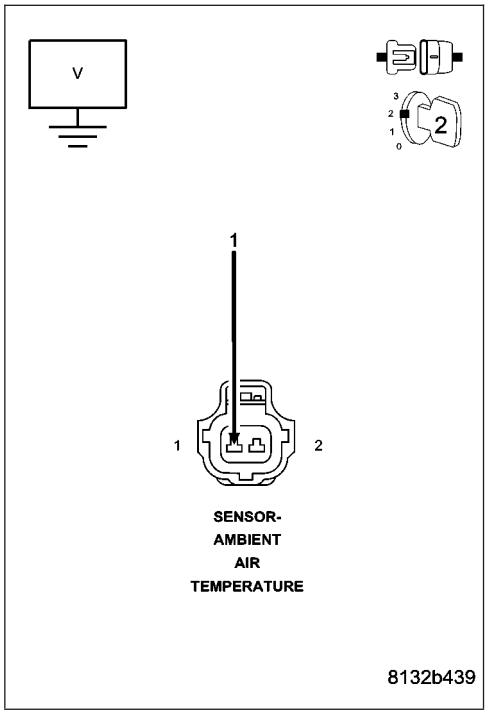
Ignition on, engine not running.

Measure the voltage on the (G31) AAT Signal circuit in the AAT Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to voltage in the (G31) AAT Signal circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. AAT SENSOR VOLTAGE ABOVE 4.6 VOLTS

Turn the ignition off.

Connect the C2 FCM harness connector.

Ignition on, engine not running.

With a scan tool, read the AAT voltage.

Is the voltage above 4.6 volts?

Yes >> Go To 4

No >> Go To 7

P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

4. AAT SENSOR

Connect a jumper wire between the (G31) AAT Signal circuit and the (G931) Sensor ground circuit in the AAT Sensor harness connector.

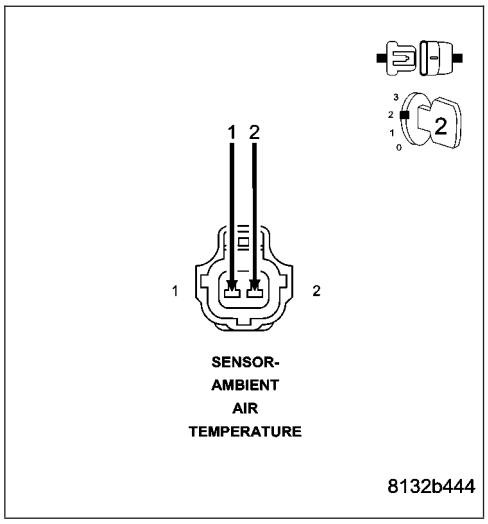
With a scan tool, read the AAT voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the AAT Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.



5. (G31) AAT SIGNAL CIRCUIT OPEN

Turn the ignition off.

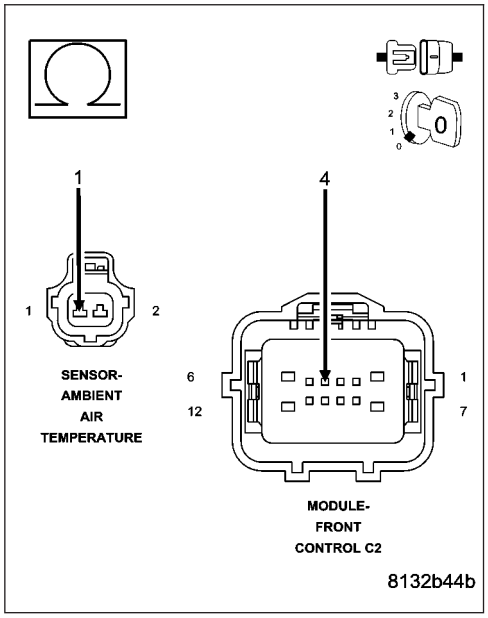
Disconnect the C2 FCM harness connector.

Measure the resistance of the (G31) AAT Signal circuit from the AAT Sensor harness connector to the C2 FCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (G31) AAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

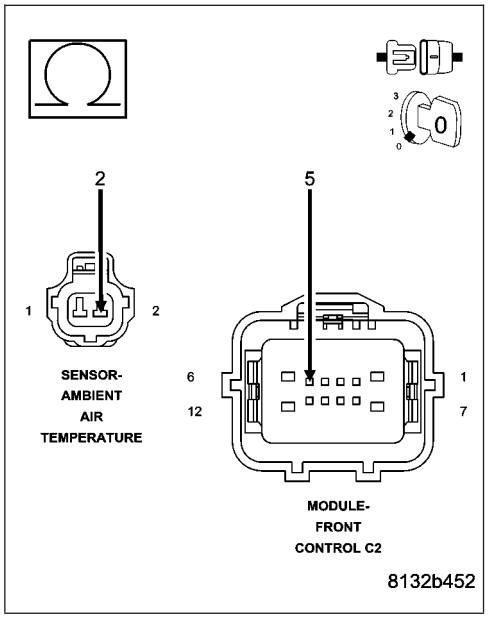
6. (G931) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (G931) Sensor ground circuit from the AAT Sensor harness connector to the C2 FCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the (G931) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

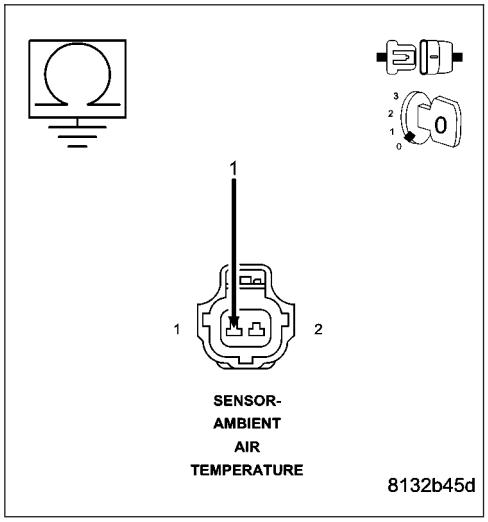
Disconnect the C2 FCM harness connector.

Measure the resistance between ground and the (G31) AAT Signal circuit in the AAT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (G31) AAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

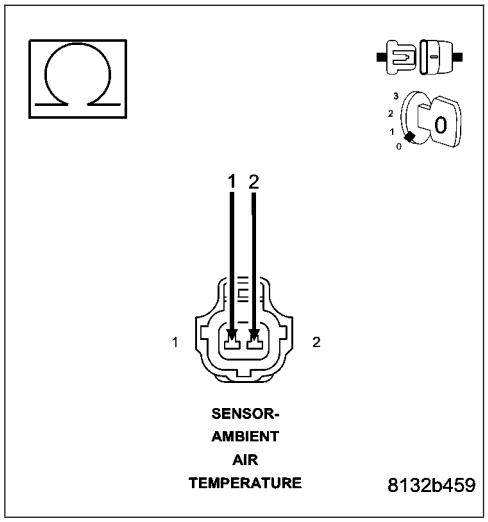
No >> Go To 8



P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

8. (G31) AAT SIGNAL CIRCUIT SHORTED TO THE (G931) SENSOR GROUND CIRCUIT

Measure the resistance between the (G31) AAT Signal circuit and the (G931) Sensor ground circuit in the AAT Sensor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (G931) Sensor ground circuit and the (G31) AAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

---

9. FRONT CONTROL MODULE

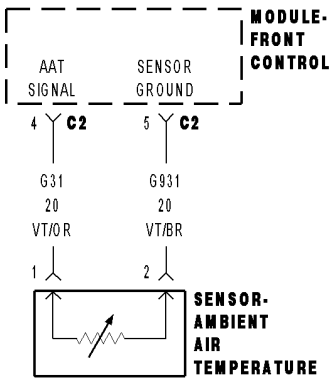
NOTE: Before continuing, check the FCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

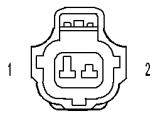
Were there any problems found?

Yes >> Repair as necessary.
Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

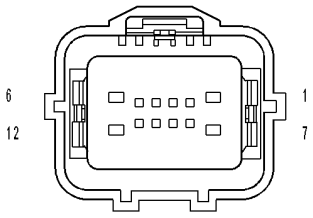
No >> Replace the Front Control Module per Service Information.
Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

P0072-AMBIENT AIR TEMPERATURE SENSOR CIRCUIT LOW





SENSOR-
AMBIENT
AIR
TEMPERATURE



MODULE-
FRONT
CONTROL C2

8132b426

P0072-AMBIENT AIR TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The ignition key on.
- **Set Condition:**
  Ambient Temperture Sensor is less than 0.078 of a volt at the PCM for 2.8 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND
(G31) AAT SIGNAL CIRCUIT SHORTED TO THE (G931) SENSOR GROUND CIRCUIT
AMBIENT AIR TEMPERATURE SENSOR
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. AAT SENSOR VOLTAGE BELOW 0.078 OF A VOLT

NOTE: Diagnose any CAN - C Communication DTCs before continuing.
Ignition on, engine not running.
With a scan tool, read the Ambient Air Temperature Sensor voltage.

Is the voltage below 0.078 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. CHECKING AAT SENSOR

Turn the ignition off.
Disconnect the Ambient Air Temperature Sensor harness connector.
Ignition on, engine not running.
With a scan tool, read the AAT Sensor voltage.

Is the voltage above 4.6 volts?

Yes >> Replace the Ambient Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0072-AMBIENT AIR TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

3. (G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

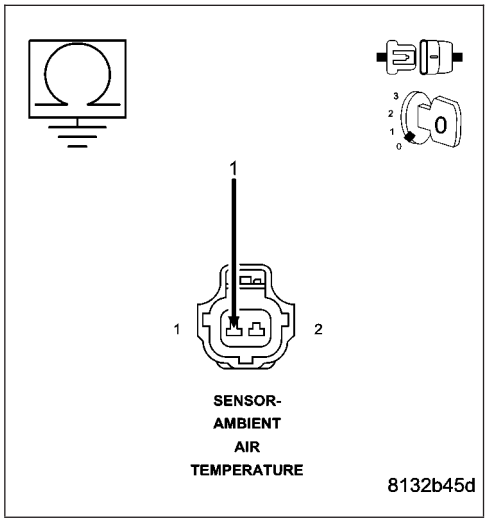
Disconnect the C2 FCM harness connector.

Measure the resistance between ground and the (G31) AAT Signal circuit in the AAT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (G31) AAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



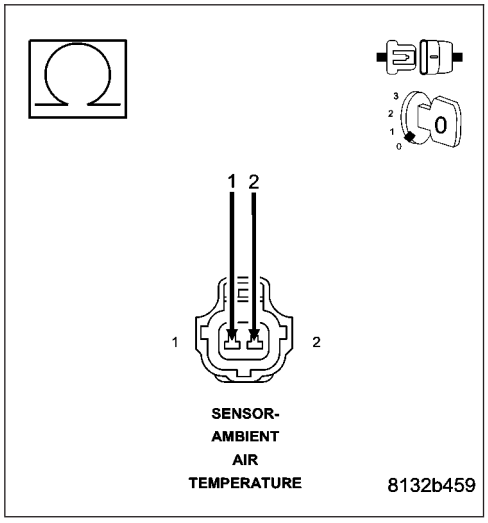
4. (G31) AAT SIGNAL CIRCUIT SHORTED TO THE (G931) SENSOR GROUND CIRCUIT

Measure the resistance between the (G931) Sensor ground circuit and the (G31) AAT Signal circuit in the AAT Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (G931) Sensor ground circuit and the (G31) AAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. FRONT CONTROL MODULE

NOTE: Before continuing, check the FCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

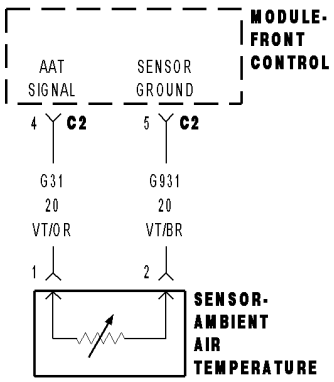
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

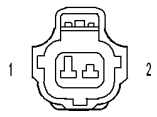
Were there any problems found?

Yes >> Repair as necessary.
Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

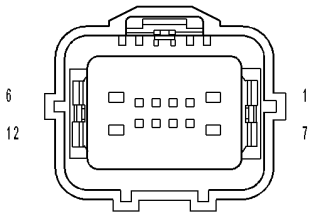
No >> Replace and program the Front Control Module per Service Information.
Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

P0073–AMBIENT AIR TEMPERATURE SENSOR CIRCUIT HIGH





SENSOR-
AMBIENT
AIR
TEMPERATURE



MODULE-
FRONT
CONTROL C2

8132b426

P0073–AMBIENT AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts.
- **Set Condition:**
  The Ambient Temperature Sensor voltage is greater than 4.98 volts at the PCM for 2.8 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(G31) AAT SIGNAL CIRCUIT OPEN
(G931) SENSOR GROUND CIRCUIT OPEN
AMBIENT AIR TEMPERATURE SENSOR
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. AAT SENSOR VOLTAGE ABOVE 4.98 VOLTS

Ignition on, engine not running.

With a scan tool, read the Ambient Air Temperature Sensor voltage.

Is the voltage above 4.98 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. AAT SENSOR

Turn the ignition off.

Disconnect the Ambient Air Temperature Sensor harness connector.

Connect a jumper wire between the (G31) AAT Signal circuit and the (G931) Sensor ground circuit in the AAT Sensor harness connector.

Ignition on, engine not running.

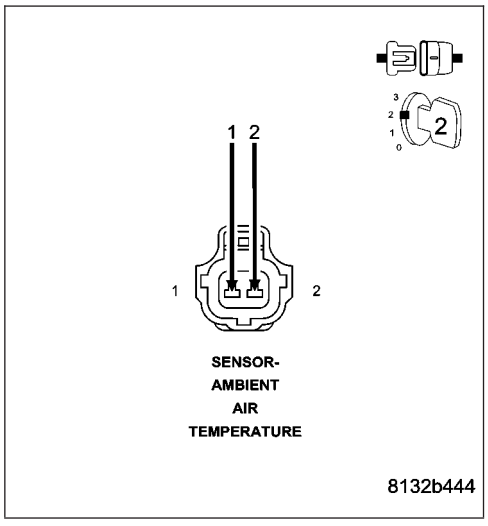
With a scan tool, read AAT Sensor voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the Ambient Air Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



P0073–AMBIENT AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

3. (G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 FCM harness connector.

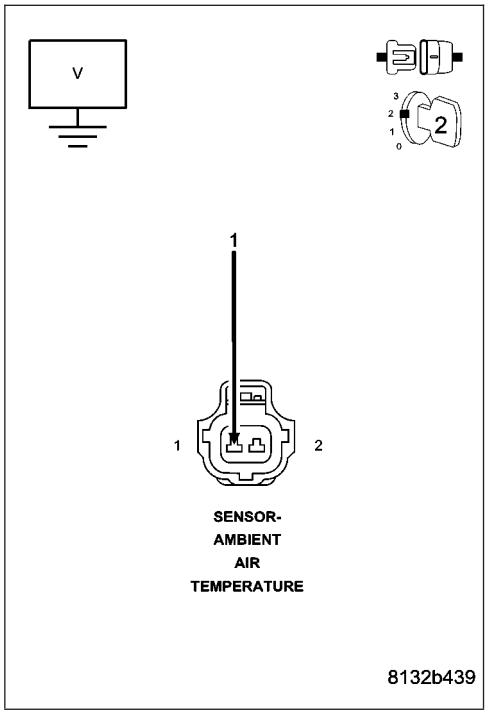
Ignition on, engine not running.

Measure the voltage on the (G31) AAT Signal circuit in the AAT Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (G31) AAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (G31) AAT SIGNAL CIRCUIT OPEN

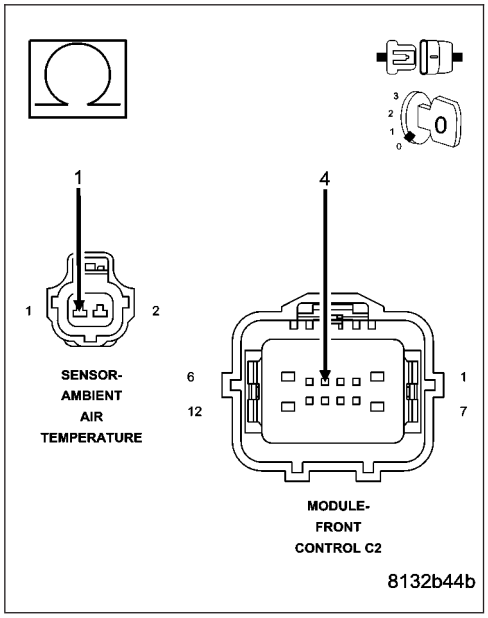
Turn the ignition off.

Measure the resistance of the (G31) AAT Signal circuit from the AAT Sensor harness connector to the C2 FCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

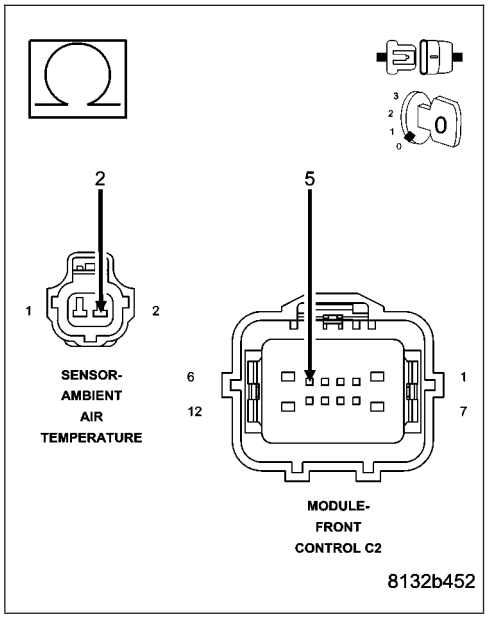
No >> Repair the open in the (G31) AAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0073–AMBIENT AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

5. (G931) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (G931) Sensor ground circuit from the AAT Sensor harness connector to the C2 FCM hanress connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (G931) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. FRONT CONTROL MODULE

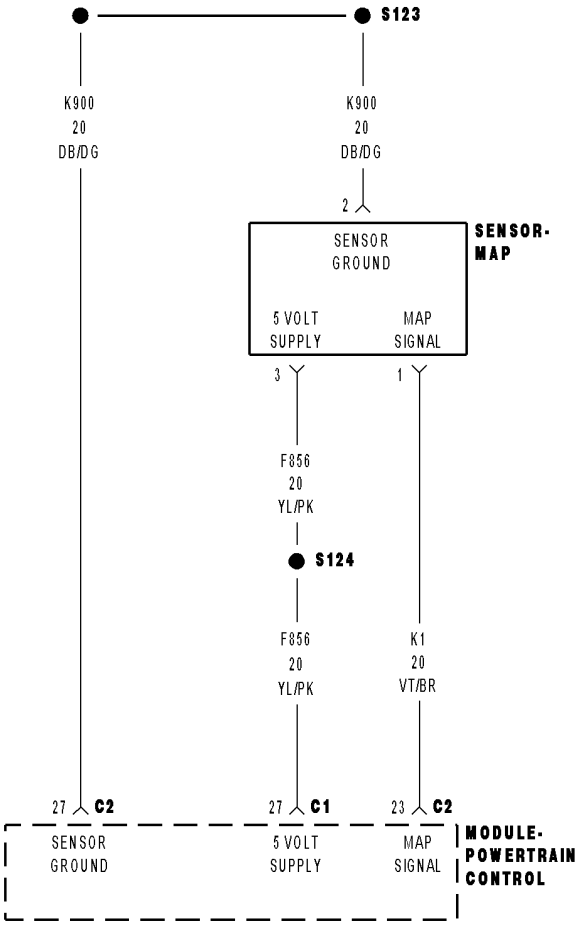
NOTE: Before continuing, check the FCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

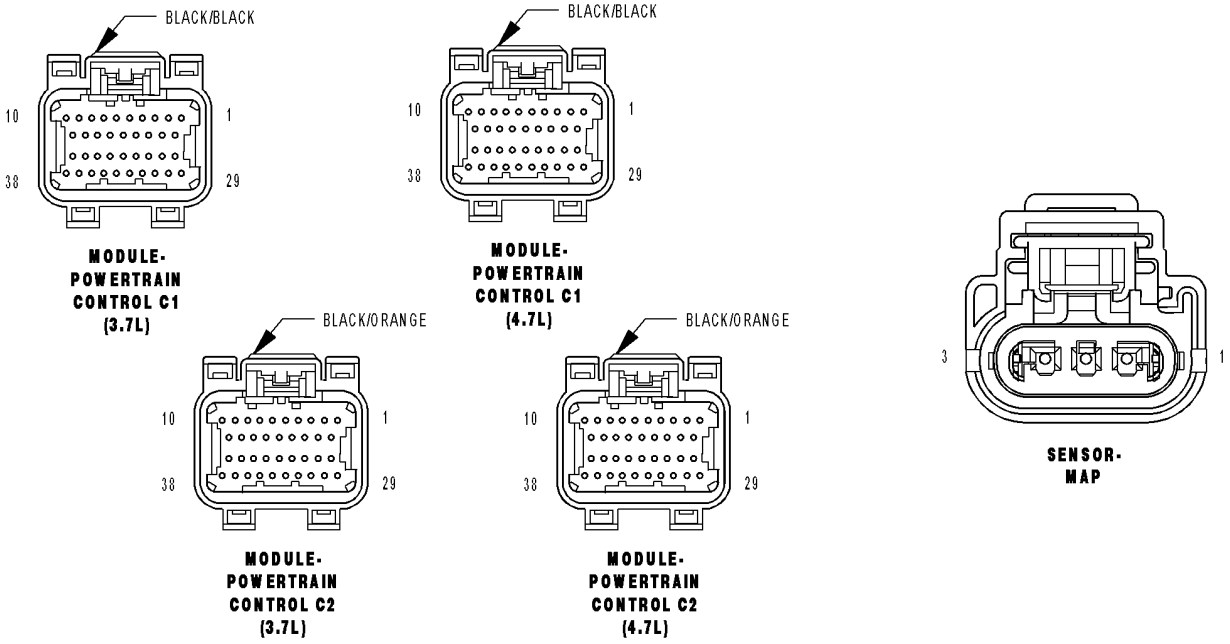
Were there any problems found?

Yes >> Repair as necessary.
Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the Front Control Module per Service Information.
Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

P0107-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW





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P0107-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine speed between 600 to 3500 RPM. Battery voltage greater than 10 volts.
- **Set Condition:**
  The MAP sensor signal voltage is below 0.08 of a volt for 3.0 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
MAP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. MAP SENSOR VOLTAGE BELOW 0.08 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the MAP Sensor voltage.

Is the voltage below 0.08 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

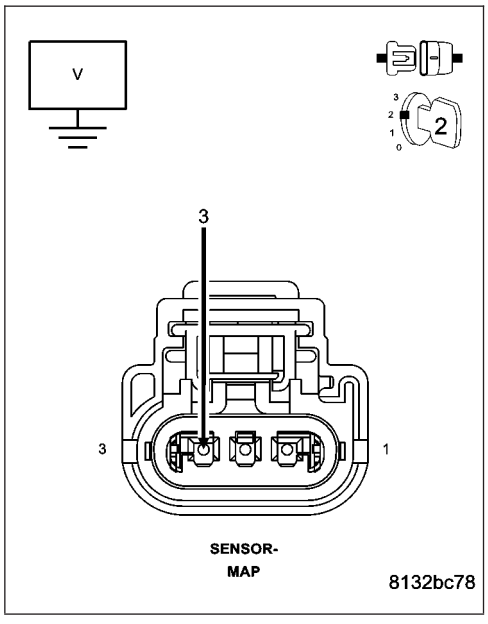
2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 6

P0107-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

3. MAP SENSOR

With a scan tool, monitor the MAP Sensor voltage with the Sensor harness connector disconnected.

Is the voltage above 4.5 volts?

Yes >> Replace the MAP Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

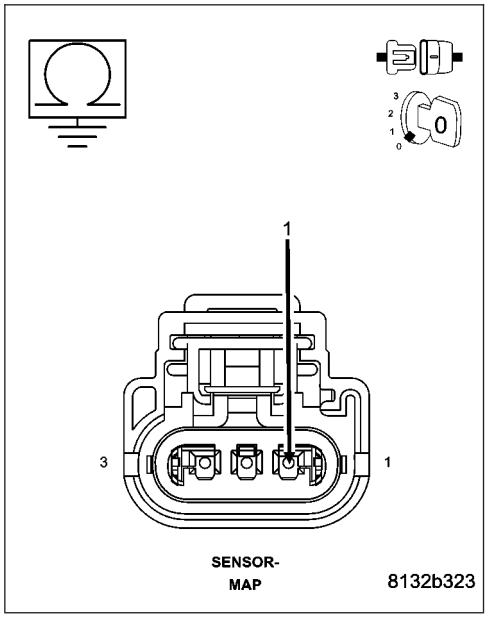
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K1) MAP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



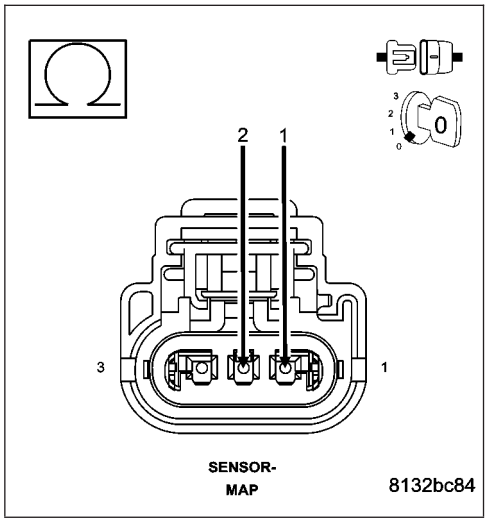
5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the MAP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground and the (K1) MAP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0107-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

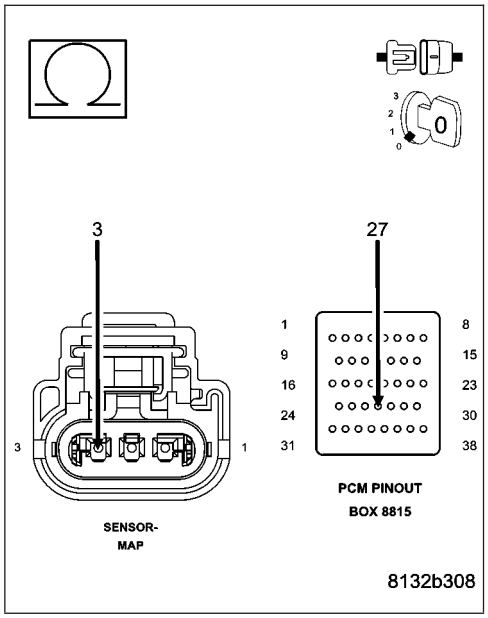
6. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



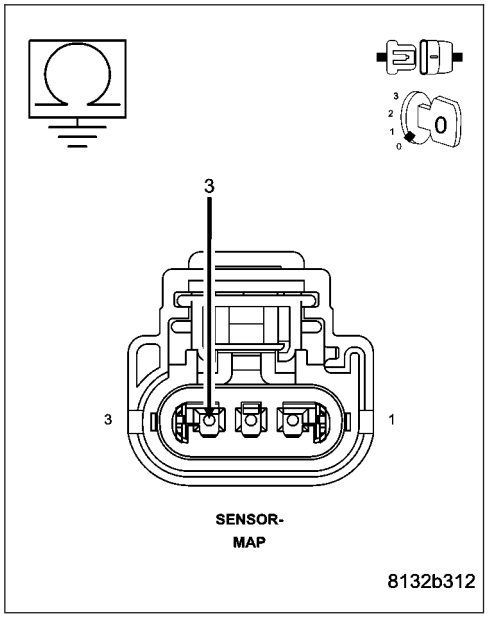
Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (F856) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0107-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

8. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

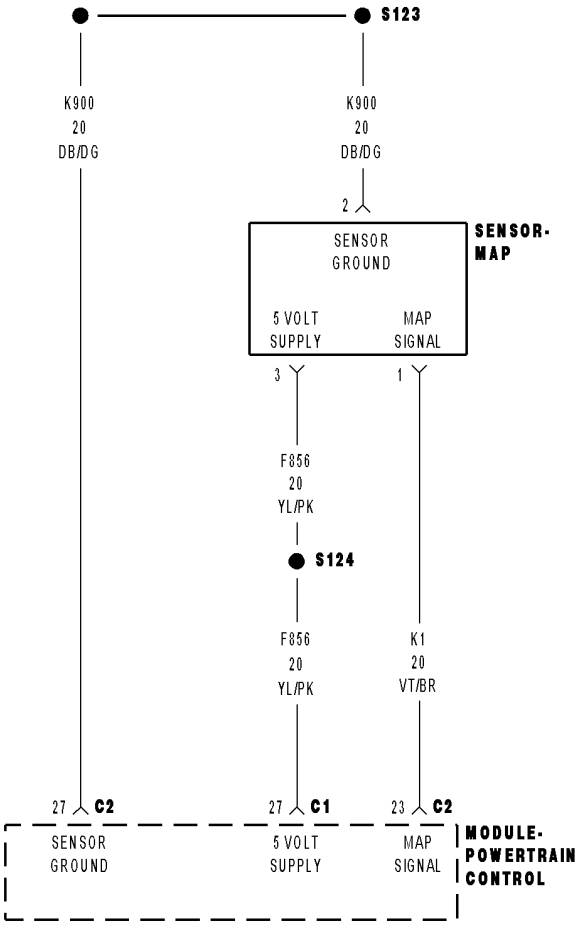
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

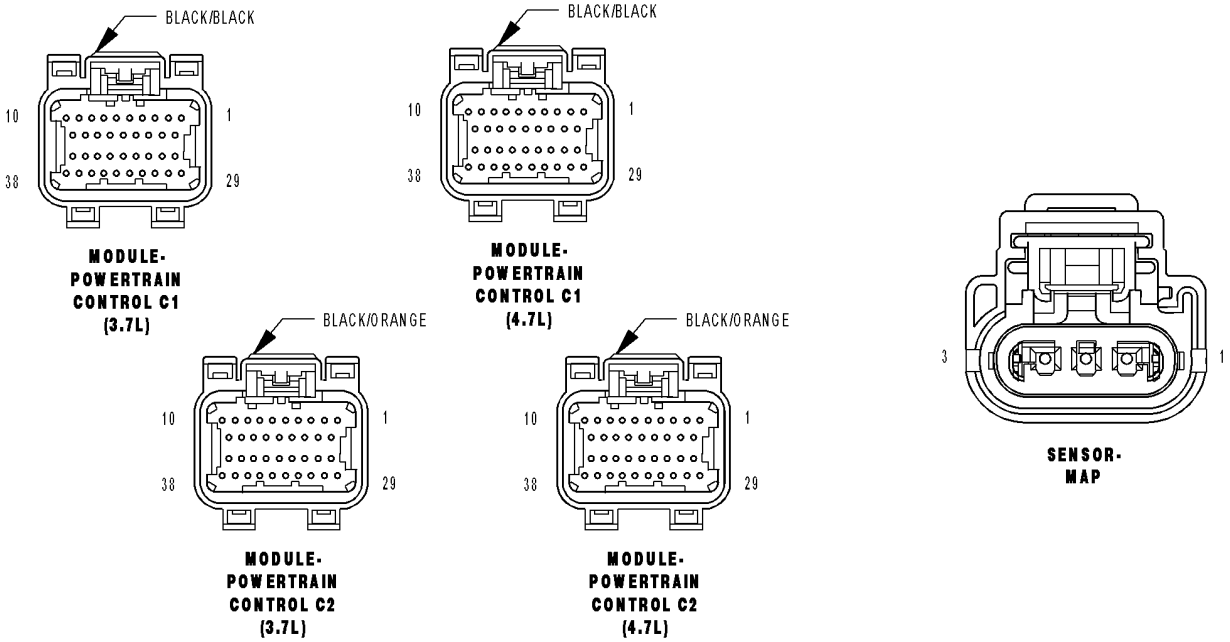
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0108-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH





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P0108-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine speed between 600 to 3500 RPM. Battery voltage greater than 10.37 volts.
- **Set Condition:**
  The MAP sensor signal voltage is greater than 4.92 volts for 3.0 seconds. One trip fault. Three good trips to turn off the MIL.

Possible Causes
(K1) MAP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K1) MAP SIGNAL CIRCUIT OPEN
(K1) MAP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
MAP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. MAP SENSOR VOLTAGE ABOVE 4.92 VOLTS

Start the engine.

With a scan tool, read the MAP Sensor voltage.

Is the voltage above 4.92 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. MAP SENSOR

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

Ignition on, engine not running.

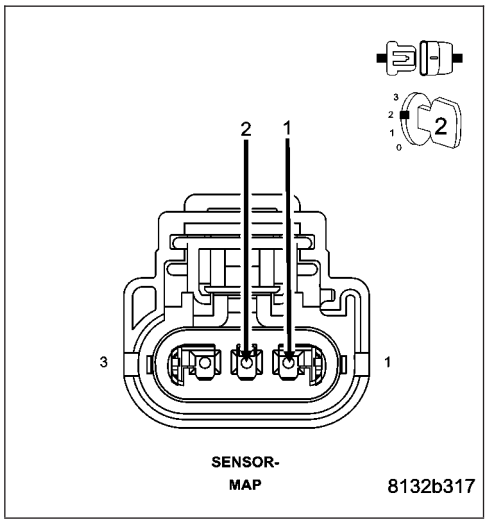
With a scan tool, monitor the MAP Sensor voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the MAP Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



P0108-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

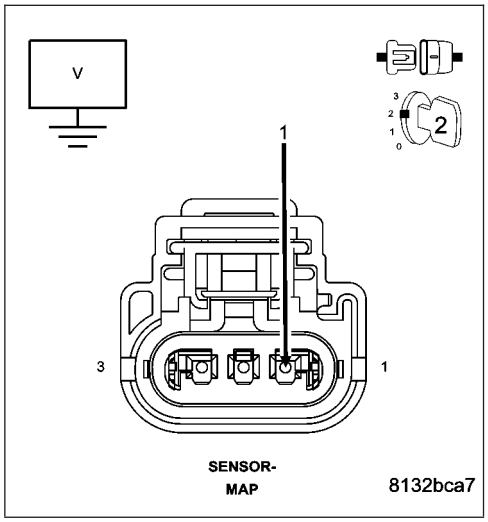
3. (K1) MAP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

Ignition on, engine not running.

Measure the voltage on the (K1) MAP Signal circuit in the MAP Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K1) MAP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

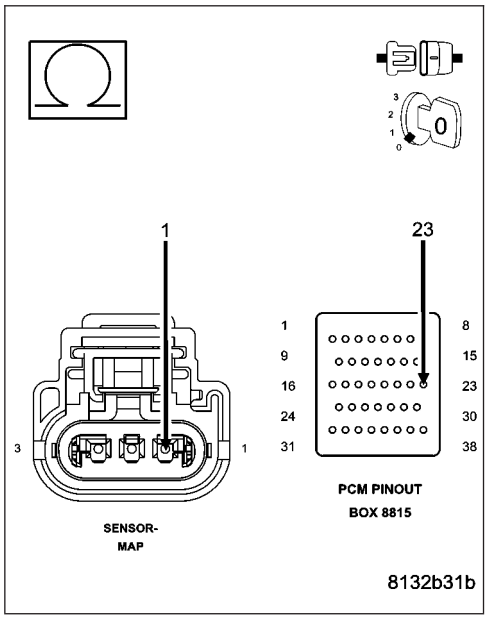
No >> Go To 4

4. (K1) MAP SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

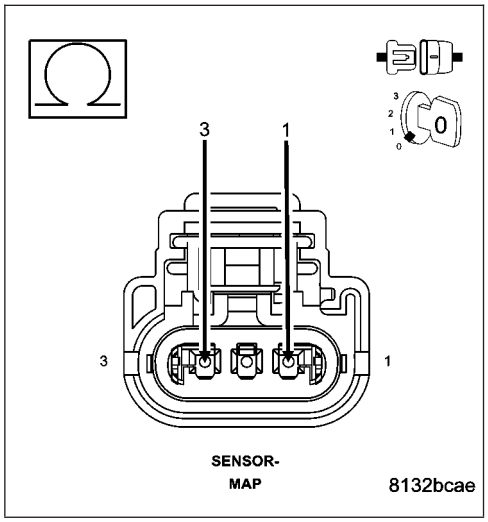
Yes >> Go To 5

No >> Repair the open in the (K1) MAP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0108-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K1) MAP Signal circuit and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



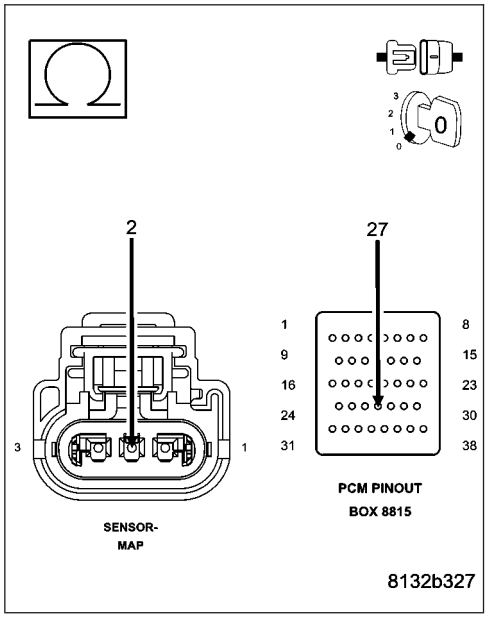
Is the resistance below 100 ohms?

Yes >> Repair the short between the (F856) 5-volt Supply circuit and the (K1) MAP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0108-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

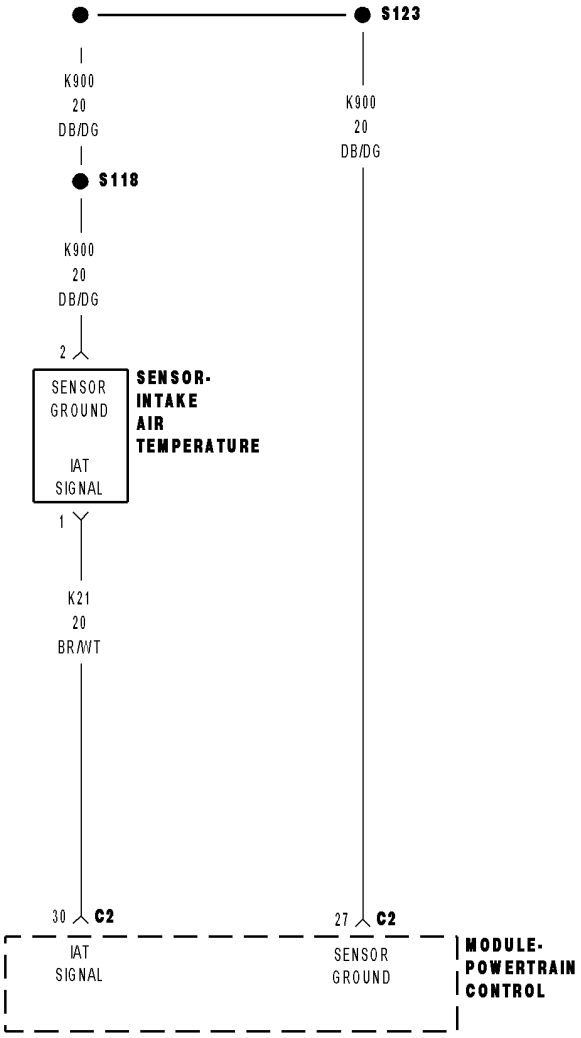
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

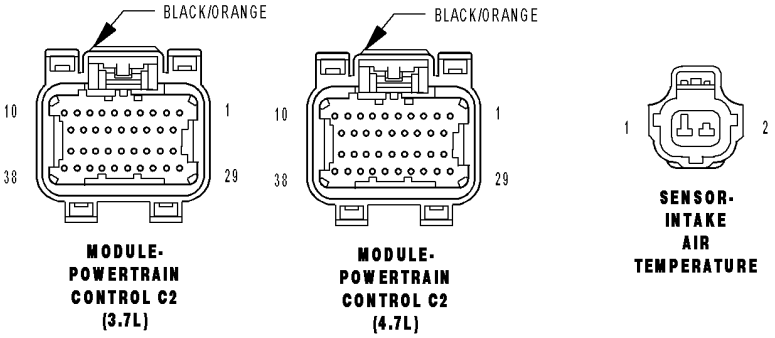
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0111-INTAKE AIR TEMPERATURE SENSOR RATIONALITY





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P0111-INTAKE AIR TEMPERATURE SENSOR RATIONALITY (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

Intake Air Temperature Sensor performance looks at the outputs of three temperature sensors and compare them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If the engine coolant and ambient air temperature sensors agree and the intake air temperature does not agree, the intake air temperature sensor is declared as irrational.

- **When Monitored:**
  The engine off time is greater than 480 minutes. Ambient Temperature if greater than 4 deg C (38 deg F).
- **Set Condition:**
  After a calibrated amount of cool down time the PCM compares the ECT Sensor, IAT Sensor, and the Ambient Air Temp Sensor values. If the IAT Sensor value is not within 10 deg C of the other two temperature sensors. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K21) IAT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND
(K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
INTAKE AIR TEMPERATURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0111-INTAKE AIR TEMPERATURE SENSOR RATIONALITY (CONTINUED)

2. (K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect the IAT Sensor harness connector.

NOTE: Visually inspect both the component and the PCM connectors. Look for damaged, partially broken wires, and backed out or corroded terminals.

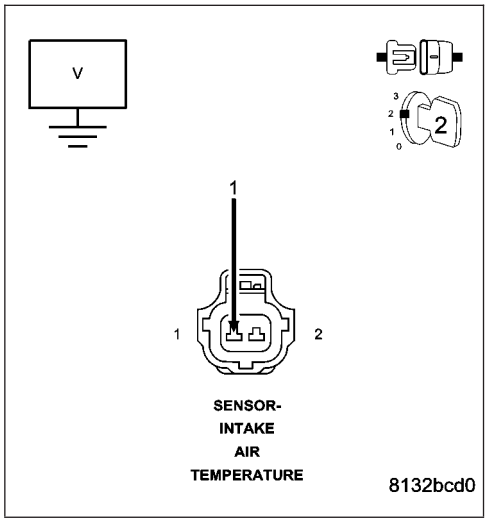
Ignition on, engine not running.

Measure the voltage on the (K21) IAT Signal circuit in the IAT Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K21) IAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. IAT SENSOR VOLTAGE ABOVE 4.6 VOLTS

Turn the ignition off.

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, read the IAT voltage.

Is the voltage above 4.6 volts?

Yes >> Go To 4

No >> Go To 7

4. IAT SENSOR

Connect a jumper wire between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.

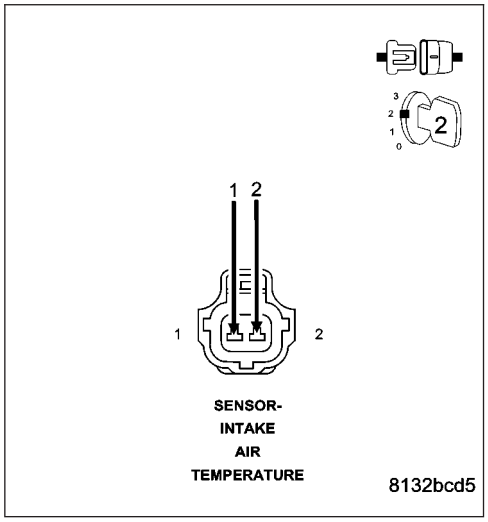
With a scan tool, read the IAT voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the IAT Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.



P0111-INTAKE AIR TEMPERATURE SENSOR RATIONALITY (CONTINUED)

5. (K21) IAT SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

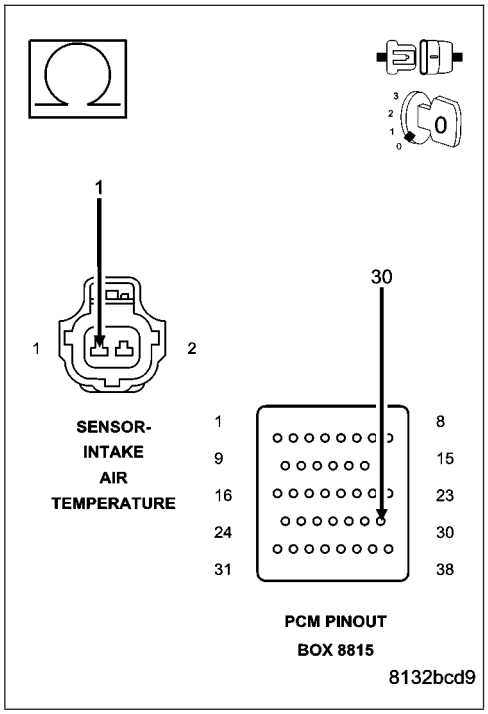
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K21) IAT Signal circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K21) IAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



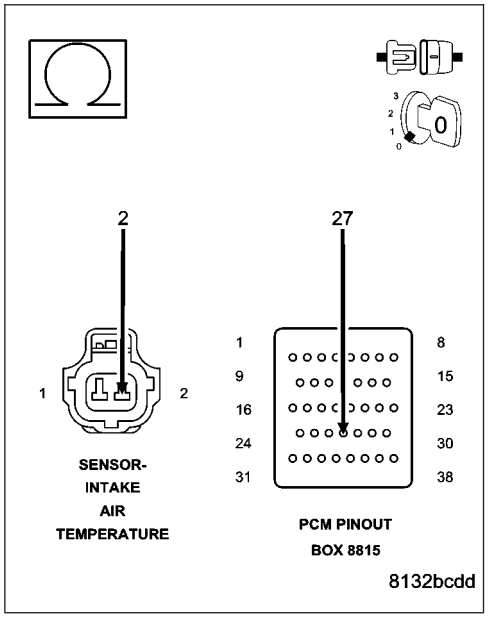
6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



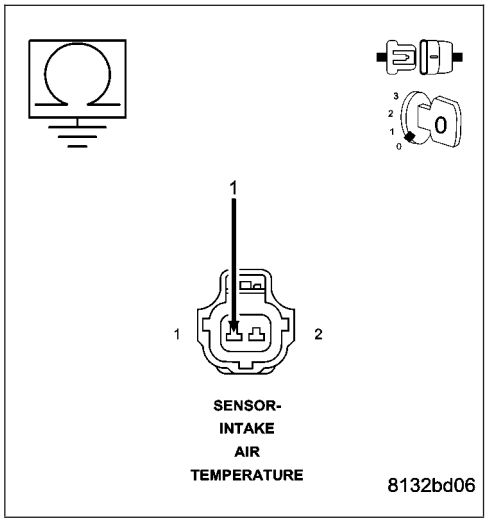
P0111-INTAKE AIR TEMPERATURE SENSOR RATIONALITY (CONTINUED)

7. (K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K21) IAT Signal circuit in the IAT Sensor harness connector.



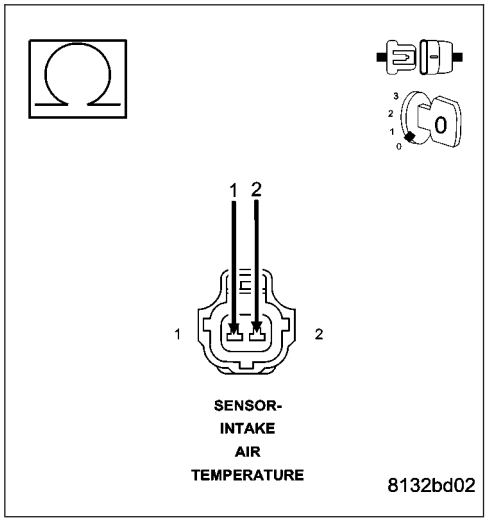
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K21) IAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. (K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K21) IAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

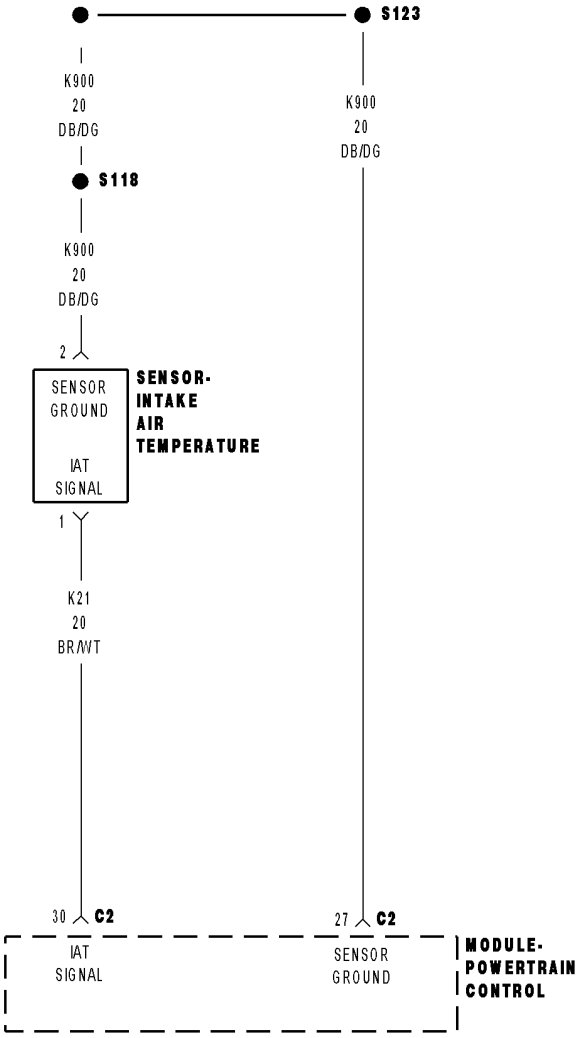
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

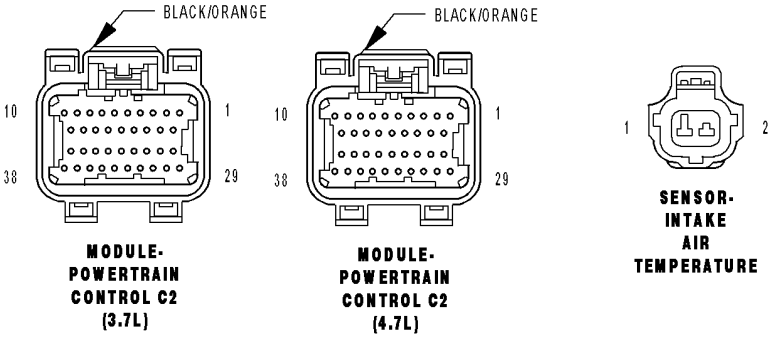
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0112-INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW





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P0112-INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  When the Inlet Air Temp Sensor Signal circuit voltage is less than .078 volt for more than 2.8 seconds. One trip failure. Three good trips to clear the MIL.

Possible Causes
(K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND
(K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
INTAKE AIR TEMPERATURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IAT SENSOR VOLTAGE BELOW 0.078 OF A VOLT

Ignition on, engine not running.
With a scan tool, read the IAT voltage.

Is the voltage below 0.078 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. IAT SENSOR

Turn the ignition off.
Disconnect the IAT Sensor harness connector.
Ignition on, engine not running.
With a scan tool, read IAT voltage.

Is the voltage above 0.05 of a volt?

Yes >> Replace the Intake Air Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0112-INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

3. (K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

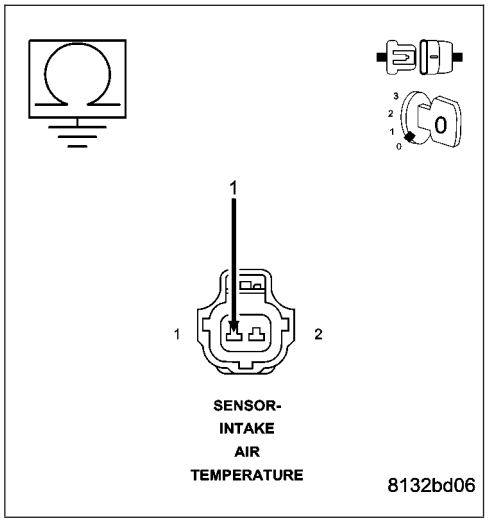
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K21) IAT Signal circuit in the IAT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K21) IAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



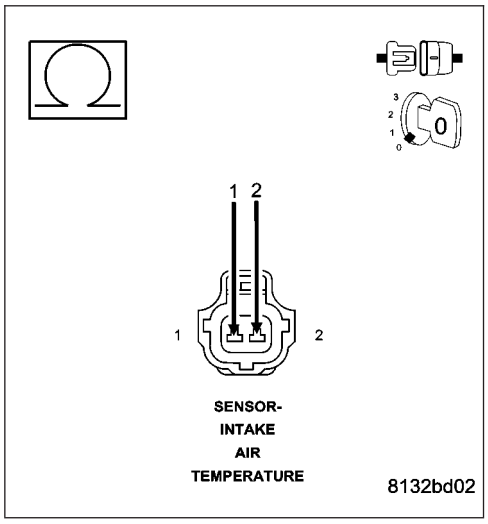
4. (K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K21) IAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

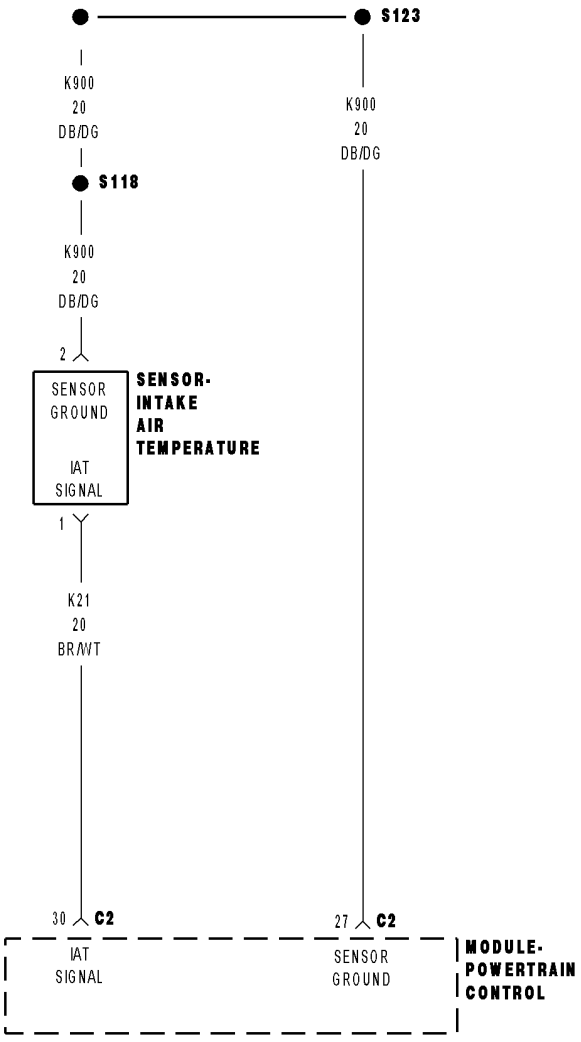
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

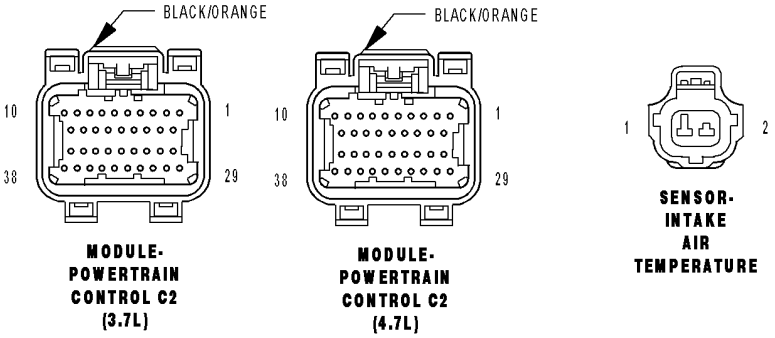
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH





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P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine System Schematic circuit diagram. (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Intake Air Temperature (IAT) sensor circuit voltage at the PCM goes above 4.98 volts for 2.8 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K21) IAT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
IAT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IAT SENSOR VOLTAGE ABOVE 4.98 VOLTS

Ignition on, engine not running.

With a scan tool, read the Intake Air Temperature Sensor voltage.

Is the voltage above 4.98 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. IAT SENSOR

Turn the ignition off.

Disconnect the Intake Air Temperature Sensor harness connector.

Connect a jumper wire between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.

Ignition on, engine not running.

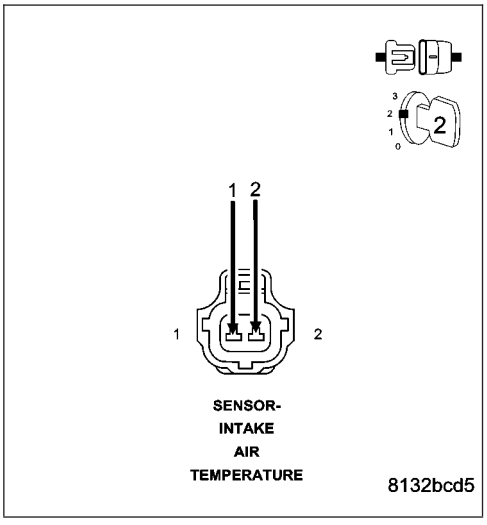
With a scan tool, read the IAT Sensor voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the IAT Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

3. (K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Ignition on, engine not running.

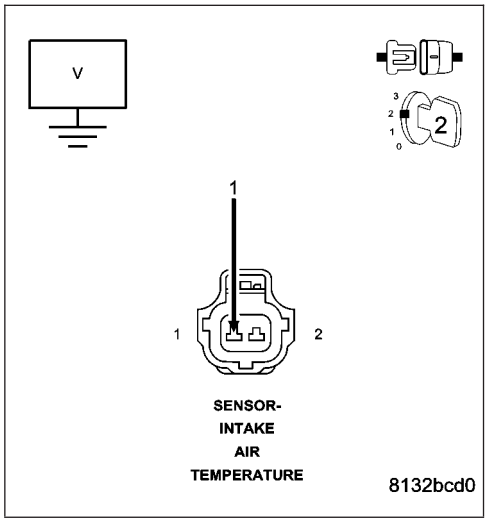
Disconnect the C2 PCM harness connector.

Measure the voltage on the (K21) IAT Signal circuit in the IAT Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K21) IAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K21) IAT SIGNAL CIRCUIT OPEN

Turn the ignition off.

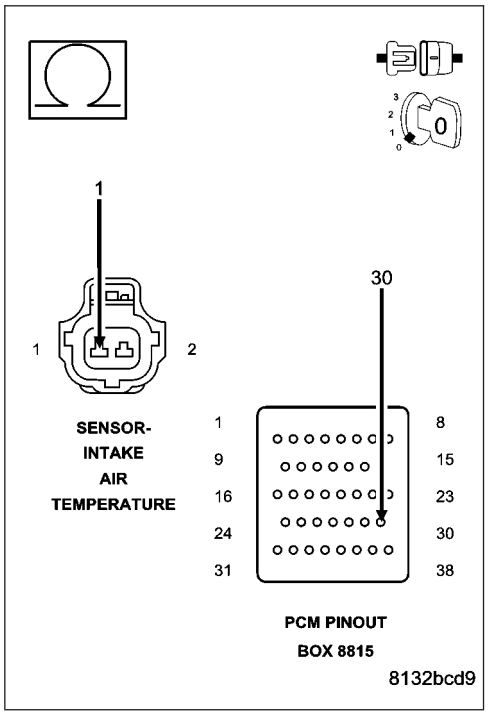
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K21) IAT Signal circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

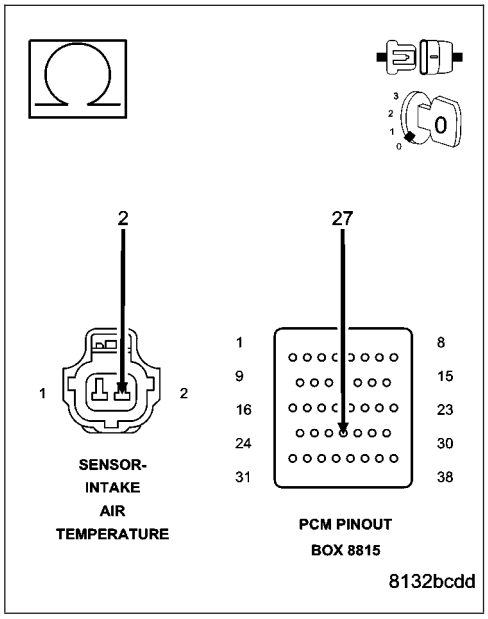
No >> Repair the open in the (K21) IAT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

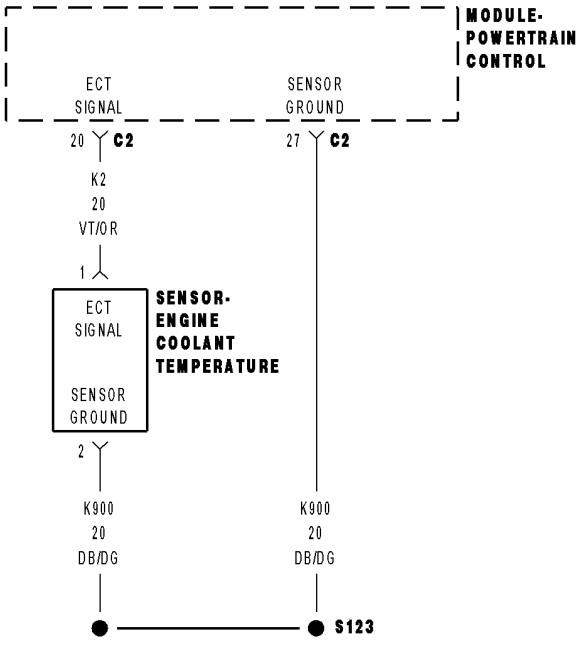
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

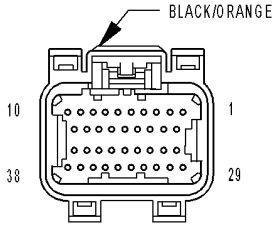
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

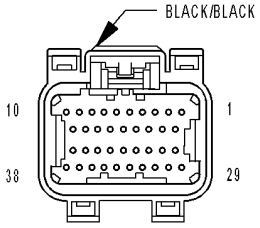
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0116–ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE

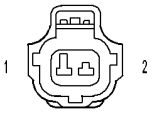




MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



SENSOR-
ENGINE
COOLANT
TEMPERATURE

8132bec8

P0116–ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE (CONTINUED)

For the Engine System Schematic circuit diagram. (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

Engine Coolant Temperature Sensor performance looks at the outputs of three temperature sensors and compare them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If the intake air and ambient air temperature sensors agree and the engine coolant temperature does not agree, the engine coolant temperature sensor is declared as irrational.

- **When Monitored:**
  Engine off time is greater than 480 minutes. Ambient temperature is greater than 4 deg C (38 deg F).
- **Set Condition:**
  After a calibrated amount of cool down time the PCM compares the ECT Sensor, IAT Sensor, and the Ambient Air Temp Sensor values. If the ECT Sensor value is not within 10 deg C of the other two temperature sensors. Two Trip Fault. Three good trips to turn off the MIL. (5.7L ETC lamp will illuminate with the MIL.)

Possible Causes
(K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K2) ECT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
ECT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0116–ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE (CONTINUED)

2. (K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

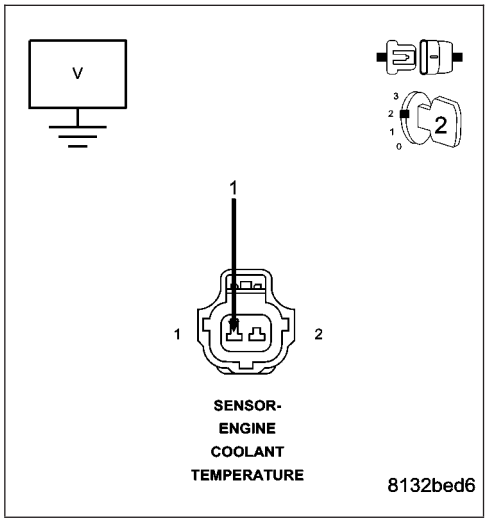
Disconnect the C2 PCM harness connector.

Disconnect the ECT Sensor harness connector.

NOTE: Visually inspect both the component and the PCM connectors. Look for damaged, partially broken wires, and backed out or corroded terminals.

Ignition on, engine not running.

Measure the voltage on the (K2) ECT Signal circuit in the ECT Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K2) ECT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. ECT SENSOR VOLTAGE ABOVE 4.6 VOLTS

Turn the ignition off.

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, read the ECT voltage.

Is the voltage above 4.6 volts?

Yes >> Go To 4

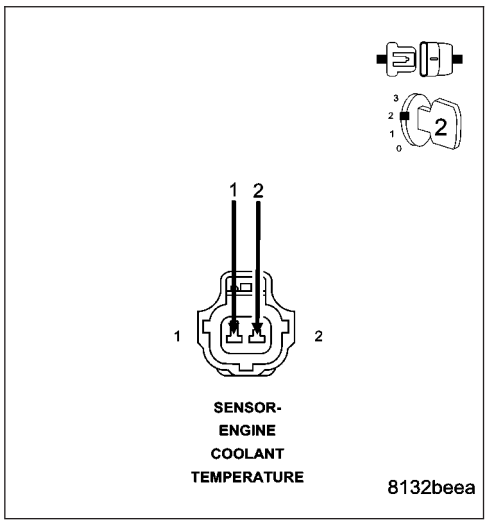
No >> Go To 7

---

4. ECT SENSOR

Connect a jumper wire between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.

With a scan tool, read the ECT voltage.



Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the ECT Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.

P0116–ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE (CONTINUED)

5. (K2) ECT SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

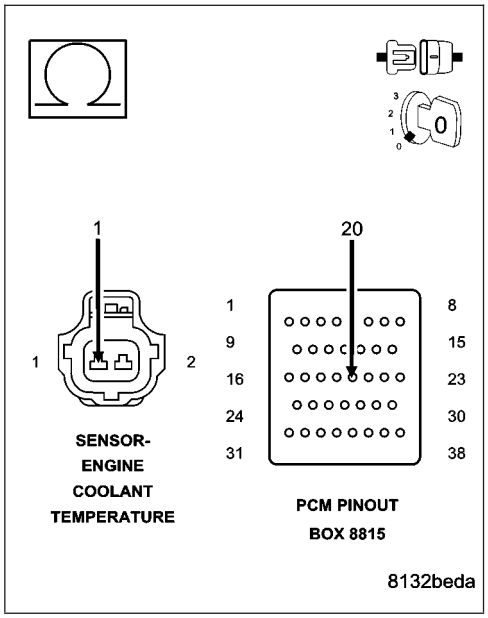
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K2) ECT Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K2) ECT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



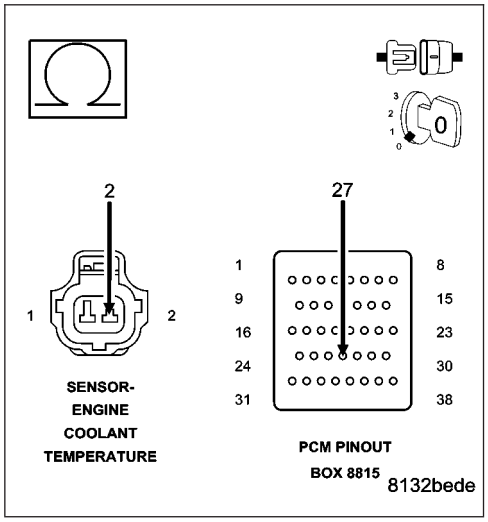
6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0116–ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE (CONTINUED)

7. (K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

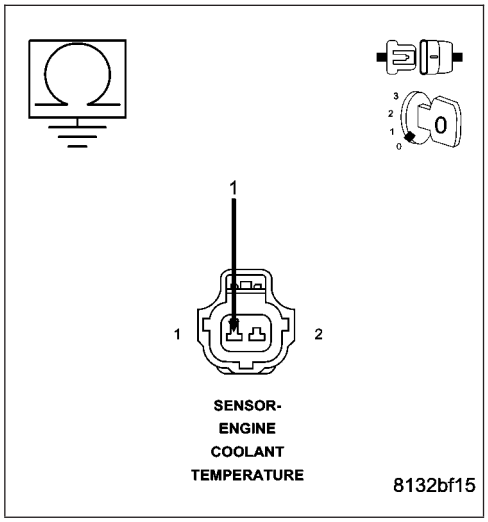
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K2) ECT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



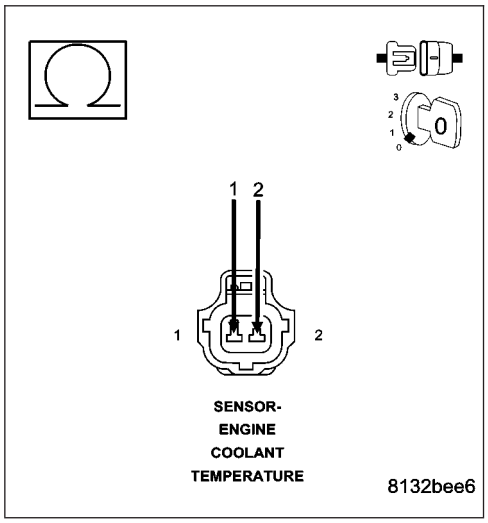
8. (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9



9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

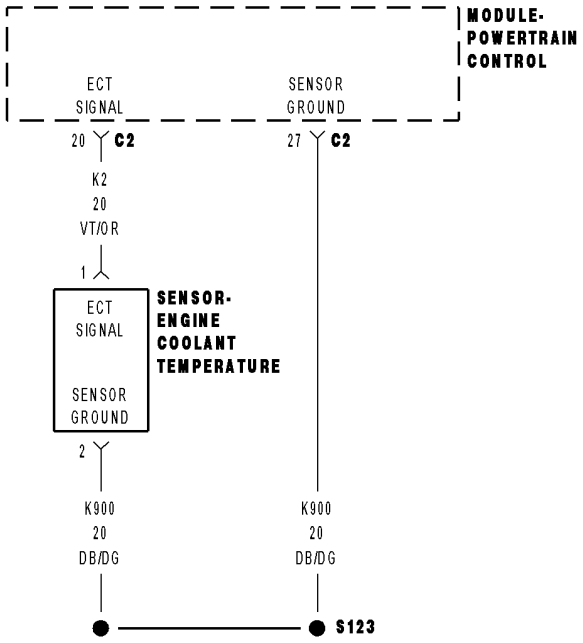
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

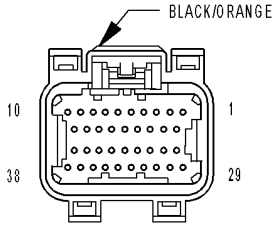
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

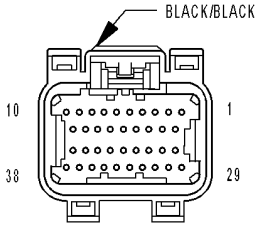
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW

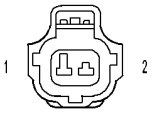




MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



SENSOR-
ENGINE
COOLANT
TEMPERATURE

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P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The engine coolant temperature sensor is a negative temperature coefficient thermistor-type sensor whose resistance varies inversely with temperature. At cold temperatures the sensor resistance is high so the voltage is high. As the coolant temperature increases the resistance decreases and the voltage becomes low.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Engine Coolant Temperature (ECT) sensor circuit voltage at the PCM is less than 0.078 of a volt for more than 2.8 seconds. One Trip Fault. Three good trips to clear the MIL.

Possible Causes
(K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
ECT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ECT SENSOR VOLTAGE BELOW 0.078 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the ECT voltage.

Is the voltage below 0.078 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. ECT SENSOR

Turn the ignition off.

Disconnect the ECT harness connector.

Ignition on, engine not running.

With a scan tool, read ECT voltage.

Is the voltage above 1.0 volt?

Yes >> Replace the ECT Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

3. (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Turn the ignition off.

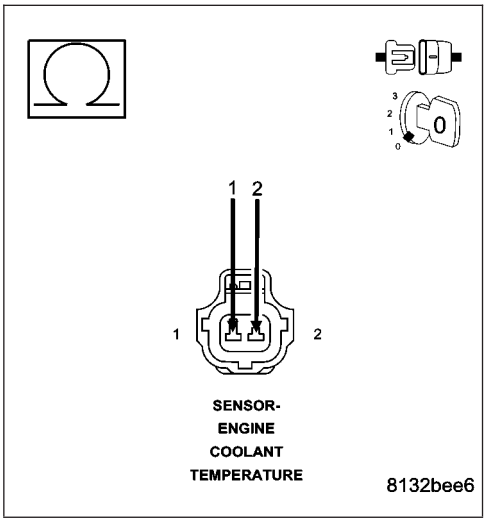
Disconnect the C2 PCM harness connector.

Measure the resistance between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



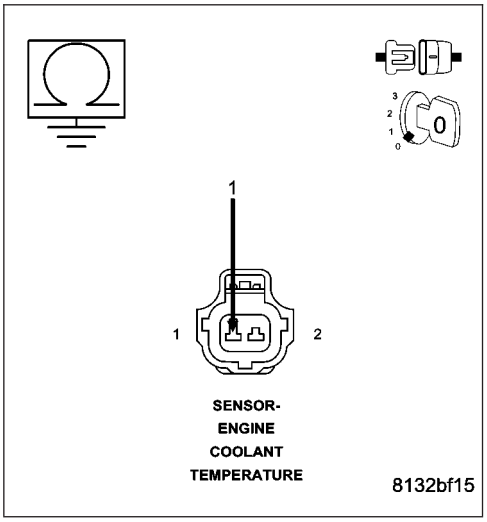
4. (K2) ECT SIGNAL CIRCUIT SHORTED GROUND

Measure the resistance between ground and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K2) ECT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

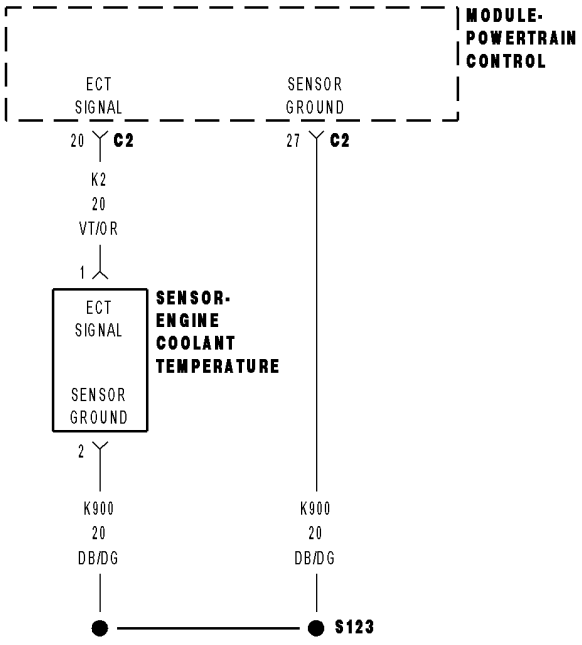
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

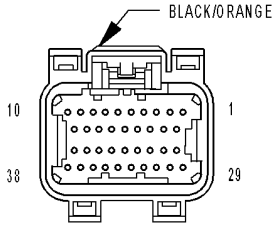
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

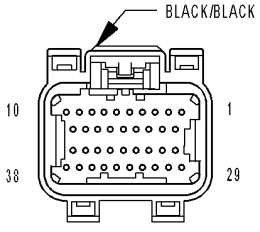
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH

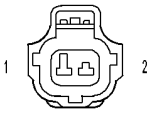




MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



SENSOR-
ENGINE
COOLANT
TEMPERATURE

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P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The engine coolant temperature sensor is a negative temperature coefficient thermistor-type sensor whose resistance varies inversely with temperature. At cold temperatures the sensor resistance is high so the voltage is high. As the coolant temperature increases the resistance decreases and the voltage becomes low.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Engine Coolant Temperature (ECT) sensor circuit voltage at the PCM is greater than 4.98 volts for more than 2.8 seconds. One Trip Fault. Three good trips to turn off the MIL. (5.7L ETC lamp will illuminate with the MIL.)

Possible Causes
(K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K2) ECT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
ECT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ECT SENSOR VOLTAGE ABOVE 4.98 VOLTS

Ignition on, engine not running.
With a scan tool, read the ECT voltage.

Is the voltage above 4.98 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

2. ECT SENSOR

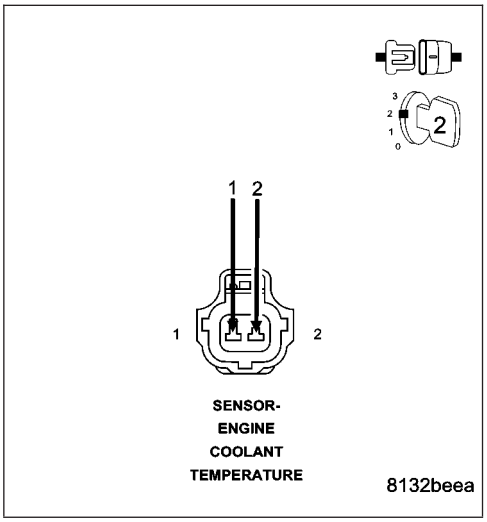
Turn the ignition off.

Disconnect the ECT harness connector.

Connect a jumper wire between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT harness connector.

Ignition on, engine not running.

With a scan tool, read ECT voltage.



Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the ECT Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.

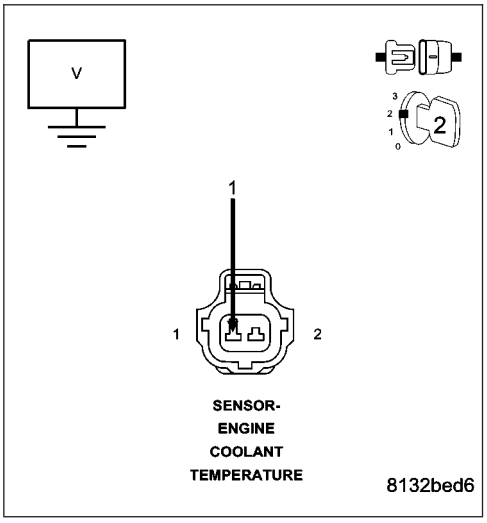
3. (K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K2) ECT Signal circuit in the ECT Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K2) ECT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

4. (K2) ECT SIGNAL CIRCUIT OPEN

Turn the ignition off.

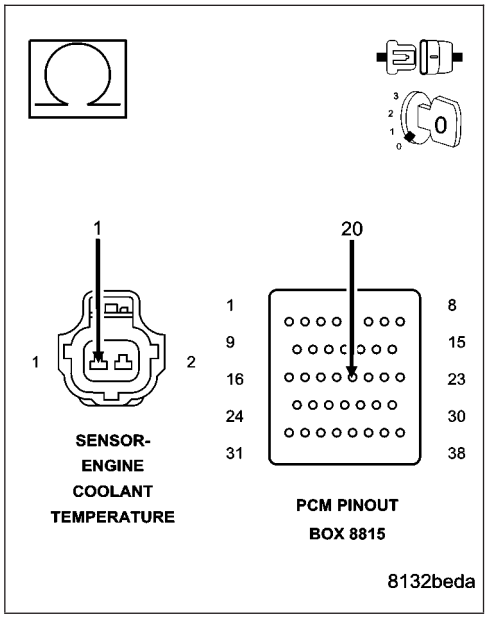
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K2) ECT Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K2) ECT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



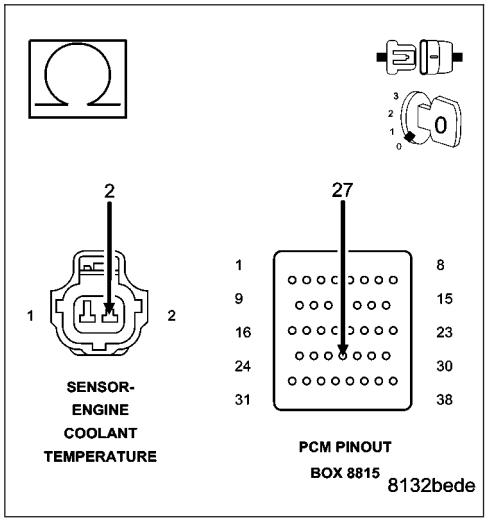
5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor ground circuit.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

6. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

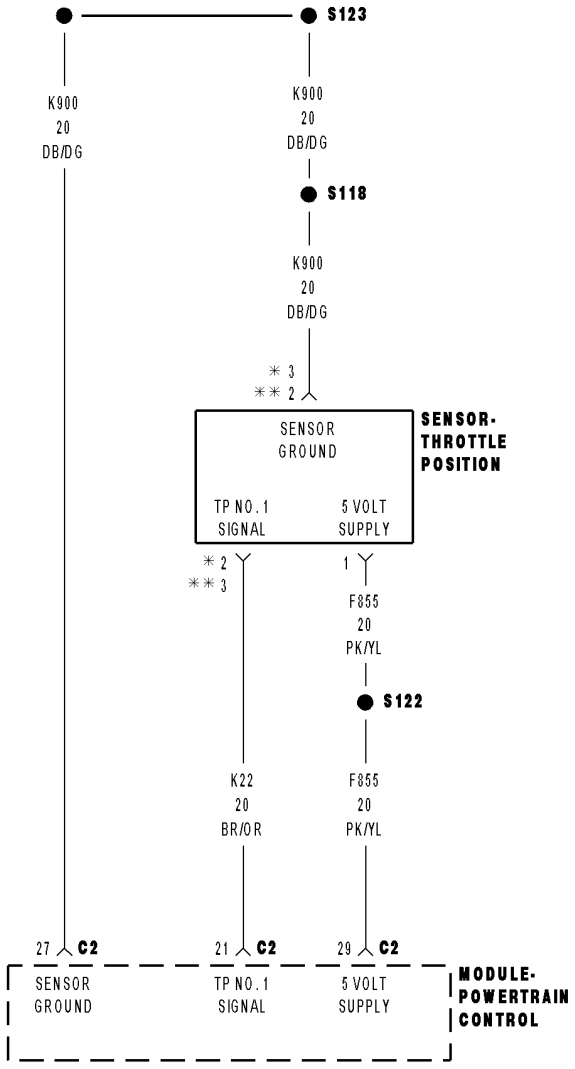
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

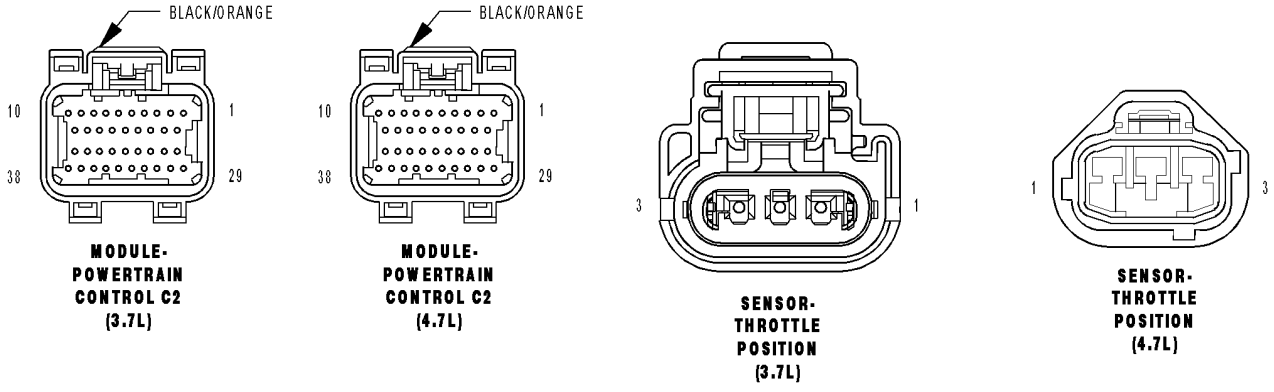
Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW



* 4.7L
** 3.7L



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P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  Throttle Position Sensor voltage at the PCM is less than 0.0978 of a volt for 1.3 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
THROTTLE POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. THROTTLE POSITION SENSOR VOLTAGE BELOW 0.098 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the TP Sensor voltage.

Is the voltage below 0.098 of a volt?

Yes >> Go To 2

No >> Go To 9

---

2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the TP Sensor harness connector.

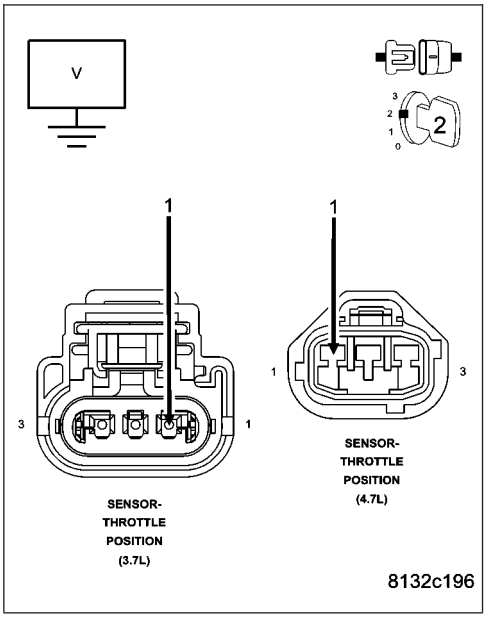
Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the TP Sensor harness connector.

Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 6



P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (CONTINUED)

3. THROTTLE POSITION SENSOR

With the a scan tool, monitor the TP Sensor voltage with the Sensor harness connector disconnected.

Is the voltage above 4.5 volts?

Yes >> Replace the Throttle Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

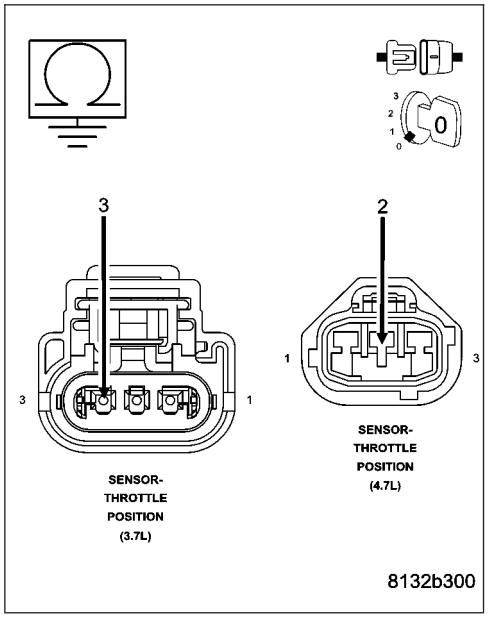
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit in the TP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



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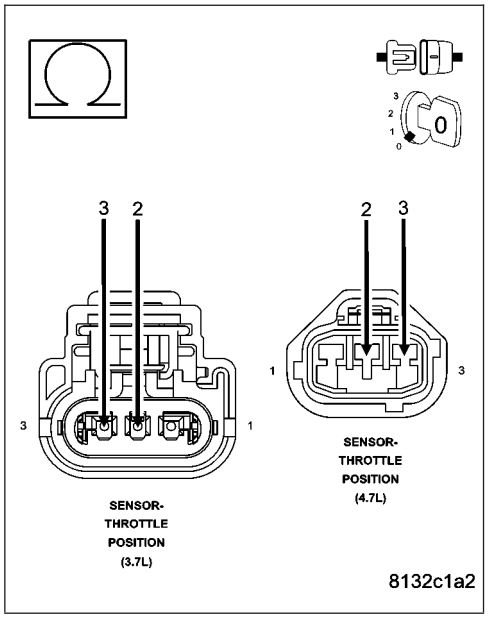
5. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K22) TP Sensor No.1 Signal circuit and the (K900) Sensor ground circuit in the TP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground and the (K22) TP Sensor No.1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (CONTINUED)

6. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

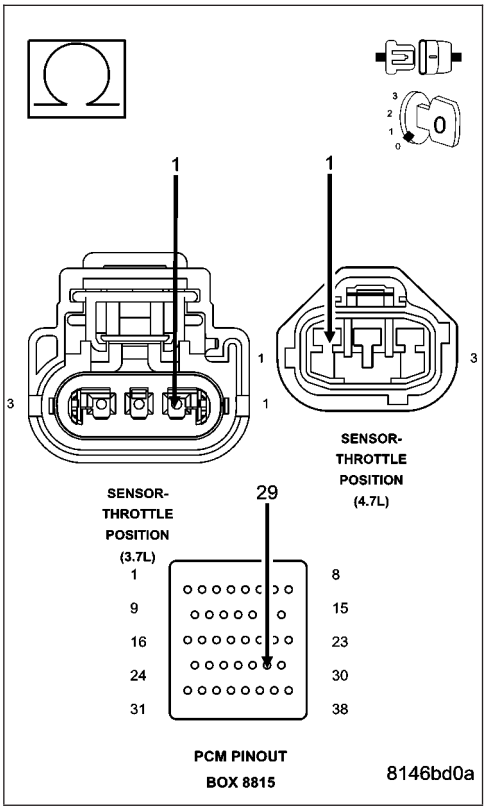
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



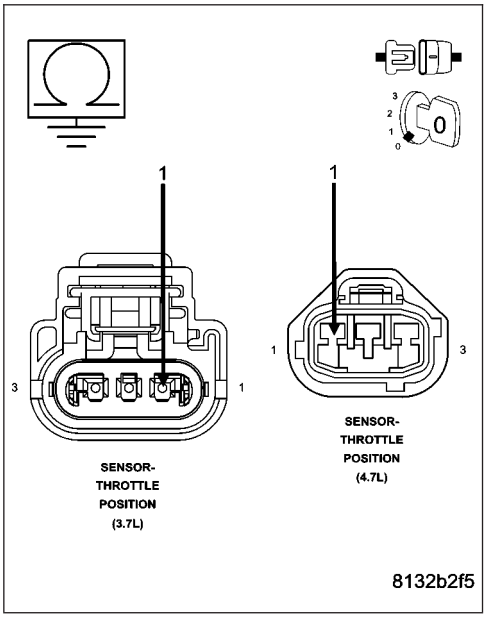
7. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the TP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (CONTINUED)

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

9. THROTTLE POSITION SENSOR SWEEP

With a scan tool, monitor the Throttle Position Sensor voltage.

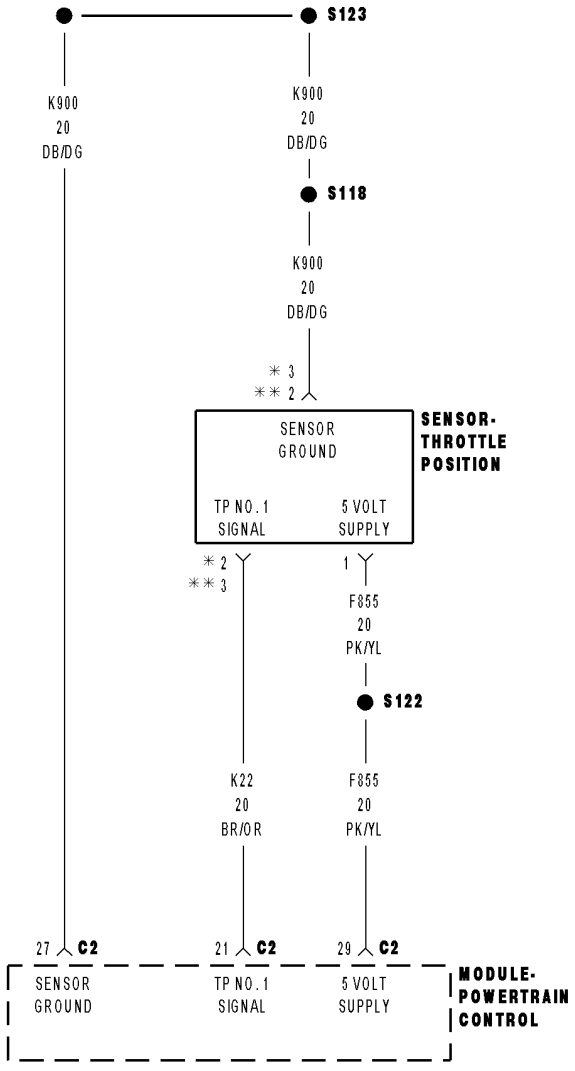
Slowly open the throttle from the idle position to the wide open throttle position.

Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?

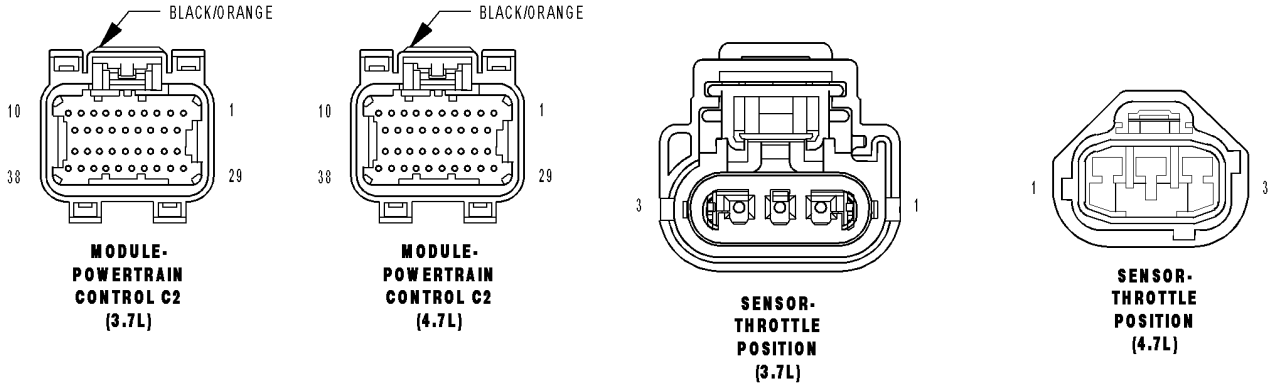
Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the Throttle Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH



* 4.7L
** 3.7L



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P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  Throttle Position Sensor voltage at the PCM is greater than 4.47 volts for 1.3 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT OPEN
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
THROTTLE POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. TP SENSOR VOLTAGE ABOVE 4.5 VOLTS

NOTE: Make sure the throttle is fully closed and free from binding or carbon build up.
Start the engine.
With a scan tool, read the TP Sensor voltage.

Is the voltage above 4.5 volts?

Yes >> Go To 2
No >> Go To 8

P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (CONTINUED)

2. THROTTLE POSITION SENSOR

Turn the ignition off.

Disconnect the TP Sensor harness connector.

Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

With a scan tool, monitor the TP Sensor voltage.

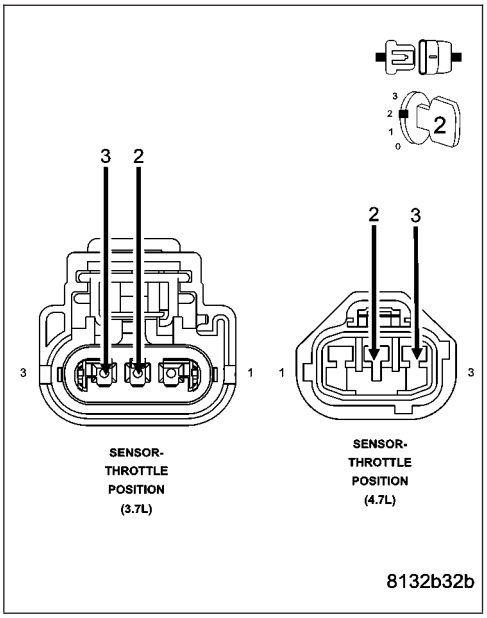
Ignition on, engine not running.

Is the voltage below 0.5 of a volt with the jumper wire installed?

Yes >> Replace the Throttle Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



3. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

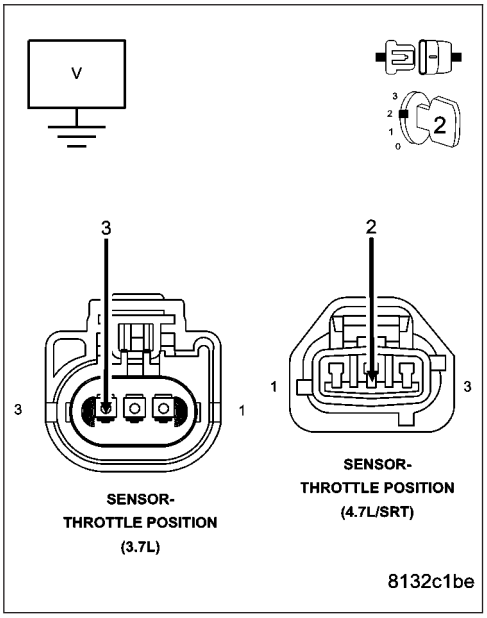
Ignition on, engine not running.

Measure the voltage on the (K22) TP Sensor No.1 Signal circuit in the TP Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K22) TP Sensor No.1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



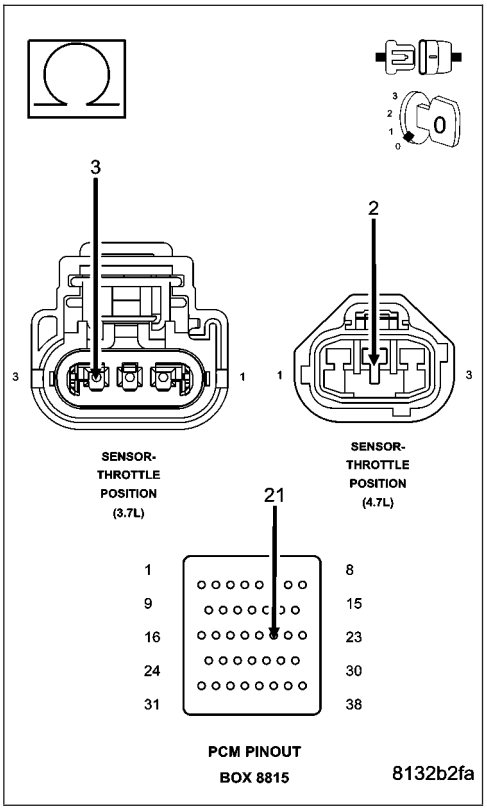
P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (CONTINUED)

4. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

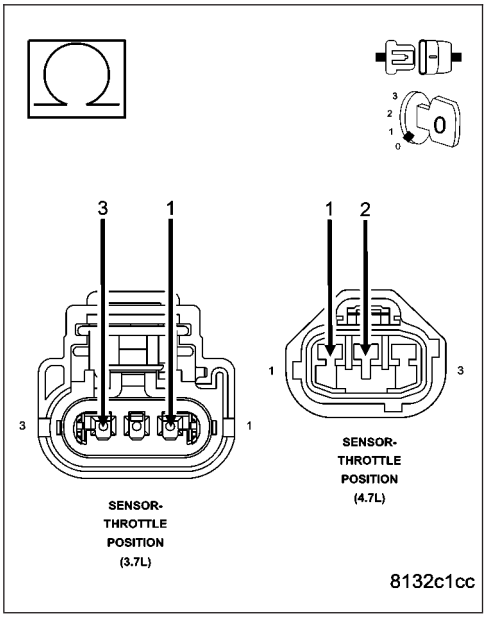
Yes >> Go To 5

No >> Repair the open in the (K22) TP Sensor No.1 Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K22) TP Sensor No.1 Signal circuit and the (F855) 5-volt Supply circuit in the TP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (F855) 5-volt Supply circuit and the (K22) TP Sensor No.1 Signal circuit.

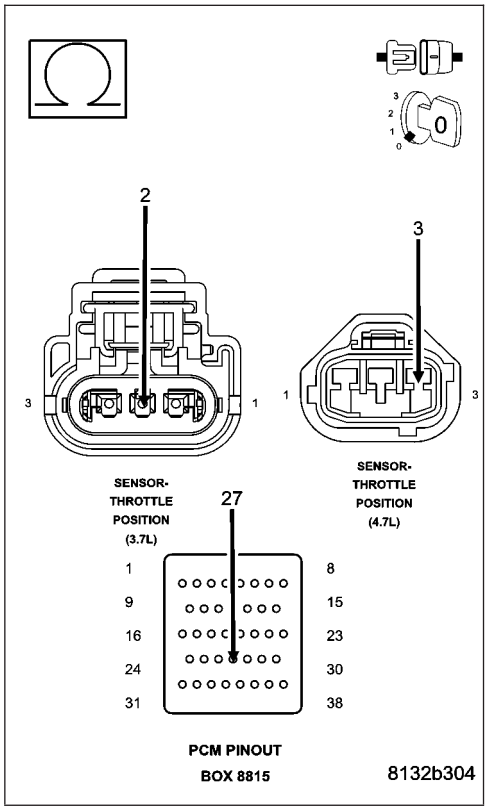
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (CONTINUED)

6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. THROTTEL POSITION SENSOR SWEEP

With a scan tool, monitor the Throttle Position Sensor voltage.

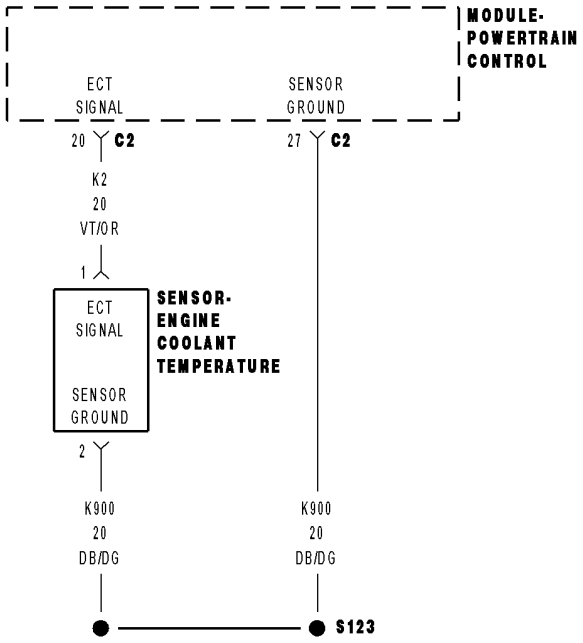
Slowly open the throttle from the idle position to the wide open throttle position.

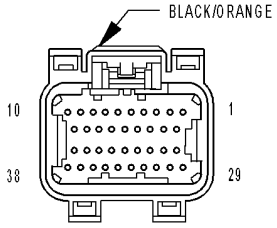
Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

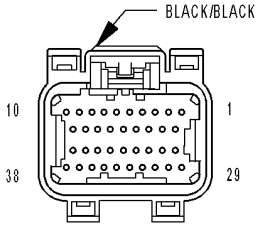
No >> Replace the Throttle Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0125-INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL

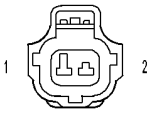




MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



SENSOR-
ENGINE
COOLANT
TEMPERATURE

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P0125-INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL (CONTINUED)

For the Engine System circuit diagrams Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The engine coolant temperature sensor is a negative temperature coefficient thermistor-type sensor whose resistance varies inversely with temperature. At cold temperatures the sensor resistance is high so the voltage is high. As the coolant temperature increases the resistance decreases and the voltage becomes low. The INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL determines if the engine coolant temperature will reach the closed loop fueling control temperature limit in a regulated time after start.

- **When Monitored:**
  With battery voltage greater than 10.4 volts and after engine is started.
- **Set Condition:**
  The engine temperature does not go above -10°C (15°F). Failure time depends on start-up coolant temperature and ambient temperature. (i.e. 2 minutes for a start temp of -10°C (15°F) or up to 10 mintues for a vehicle with a start-up temp of -28°C (5°F). Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
LOW COOLANT LEVEL
THERMOSTAT
ECT SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CHECKING COOLANT LEVEL AND CONDITION

Ignition on, engine not running.

With a scan tool, read DTCs.

NOTE: If an Engine Coolant Temperature (ECT) DTC is set along with this code, diagnose the ECT DTC first.

NOTE: Inspect the ECT terminals and related PCM terminals. Make sure the terminals are free from corrosion and damage.

NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.

NOTE: Extremely cold outside ambient temperatures may have caused this DTC to set.

WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Extreme burns or scalding may result. Failure to follow these instructions can result in persoanl injury or death. Allow the engine to cool before opening the cooling system.

Inspect the coolant system for proper level and condition.

Is the coolant level and condition OK?

Yes >> Go To 2

No >> Inspect the vehicle for a coolant leak, make the appropriate repairs, and add the correct amount of coolant.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0125-INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL (CONTINUED)

2. THERMOSTAT OPERATION

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tool Eng Coolant Tmp Deg values should stay relatively close to each other.

Using the appropriate service information, determine the proper opening temperature of the thermostat.

Did the thermostat open at the proper temperature?

Yes >> Go To 3

No >> Replace the thermostat.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. ECT SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

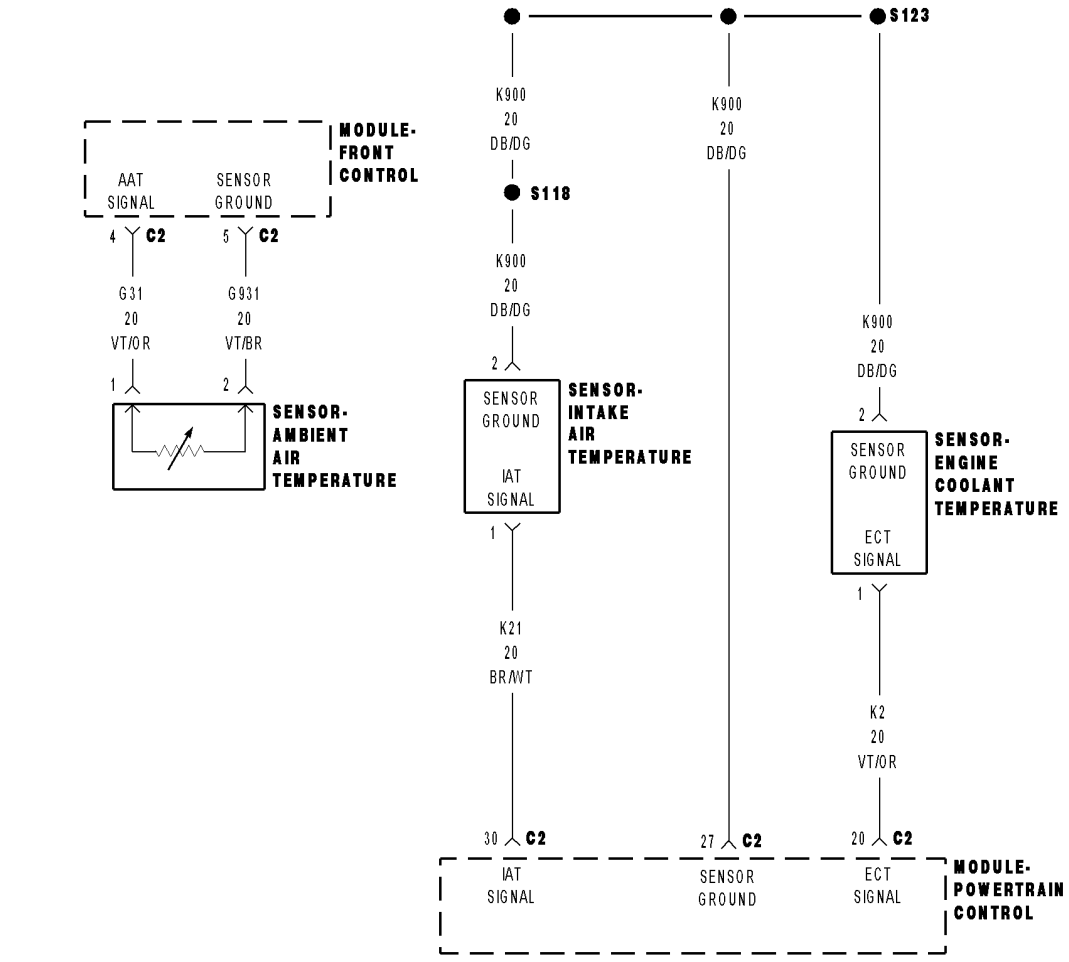
NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tools Eng Coolant Tmp Deg value should stay relatively close to each other.

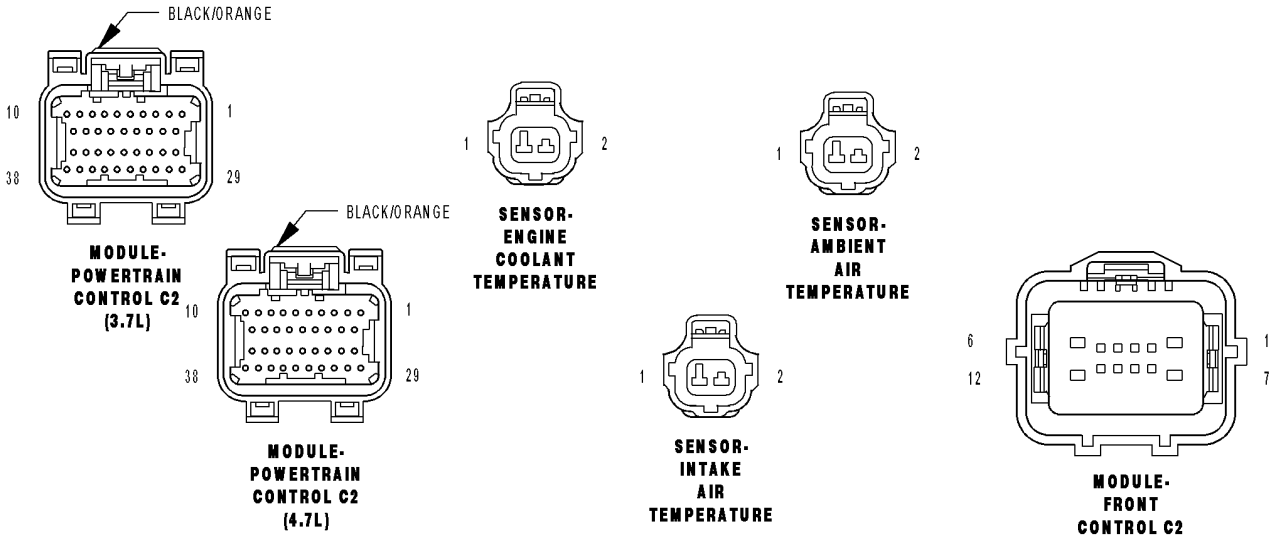
Is the thermometer reading relatively close to the scan tool ECT reading?

Yes >> Test Complete.

No >> Replace the Engine Coolant Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0128-THERMOSTAT RATIONALITY





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P0128-THERMOSTAT RATIONALITY (CONTINUED)

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The PCM predicts what the engine coolant temperature should be, based on the engine coolant temperature at start-up, ambient temperature and how the vehicle is subsequently driven. The predicted engine coolant temperature is compared to the Engine Coolant Temperature Sensor reading. The error between the two is calculated and integrated with respect to time. When the Thermostat diagnostic runs, the integrated error is compared to a calibrated threshold and pass/fail is determined. Separate pass and fail thresholds are used in order to improve accuracy of the diagnostic.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The PCM predicts a coolant temperature value that it will compare to the actual coolant temperature. A significant difference results in an error. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
LOW COOLANT LEVEL
THERMOSTAT OPERATION
SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
TEMPERATURE SENSOR
SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
SIGNAL CIRCUIT SHORTED TO GROUND
SIGNAL CIRCUIT SHORTED TO (K900), (G931) SENSOR GROUND
OTHER POSSIBLE CAUSES
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If any ECT, AAT, CMP or CKP sensor DTCs have set along with P0128, diagnose them before continuing.

NOTE: Make sure that the Pinion Factor has been programmed correctly into the PCM.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0128-THERMOSTAT RATIONALITY (CONTINUED)

2. LOW COOLANT LEVEL

NOTE: If a Engine Coolant Temperature (ECT) DTC is set along with this code, diagnose the ECT DTC first.

NOTE: Inspect the ECT terminals and related PCM terminals. Make sure the terminals are free from corrosion and damage.

NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.

NOTE: Extremely cold outside ambient temperatures may have caused this DTC to set.

WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Failure to follow these instructions can result in personal injury including extreme burns, scalding, or death. Allow the engine to cool before opening the cooling system.

Check the coolant system to make sure that the coolant is in good condition and at the proper level.

Is the coolant level and condition OK?

Yes >> Go To 3

No >> Inspect the vehicle for a coolant leak and add the necessary amount of coolant.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. THERMOSTAT OPERATION

NOTE: This test works best if performed on a cold engine (cold soak).

Ignition on, engine not running.

With a scan tool, read the ECT Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the ECT Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tool, ECT Temperature value should stay relatively close to each other.

Using the appropriate service information, determine the proper opening temperature of the thermostat.

Did the thermostat open at the proper temperature?

Yes >> Go To 4

No >> Replace the thermostat.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. AMBIENT AIR TEMP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, read and record the AAT Sensor Temperature value.

Using the DRB Temperature Probe #CH7050, or an equivalent temperature measuring tool, measure the ambient air temperature near the AAT Sensor.

Is the AAT Sensor value with -15°C (5°F) of the temperature probe reading?

Yes >> Go To 5

No >> Go To 7

P0128-THERMOSTAT RATIONALITY (CONTINUED)

5. ECT SENSOR OPERATION

WARNING: Make sure the engine cooling system is cool before removing the pressure cap or any hose. The cooling system is pressurized when hot. Failure to follow these instructions can result in personal injury including extreme burns ,scalding, or death.

With a scan tool, read and record the ECT Sensor Temperature value.

Use the DRB Temperature Probe #CH7050, or an equivalent temperature measuring tool, measure the engine coolant temperature.

Is the ECT Sensor value with -15°C (5°F) of the temperature probe reading?

Yes >> Go To 6

No >> Go To 7

---

6. OTHER POSSIBLE CAUSES

Inspect the Temperature Sensors for any physical damage.

Inspect the engine coolant. Make sure the coolant is at the proper level. Refer to the Service Information COOLING.

Make sure the Temperature Sensors are properly installed.

Make sure the CMP and CKP sensors are installed properly. Check the connectors for any signs of damage.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Refer to any Technical Service Bulletins (TSBs) that may apply.

With the engine running at normal operating temperature, monitor the Temperature sensor parameters while wiggling the wire harness. Look for parameter values to change.

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Inspect and clean all PCM, engine, and chassis grounds.

Were any problems found during the above inspections?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete, the condition that set this DTC is not present at this time.

P0128-THERMOSTAT RATIONALITY (CONTINUED)

7. SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

NOTE: Visually inspect both the component and the PCM connectors. Look for damage, partially broken wires and backed out or corroded terminals

Turn the ignition off.

Disconnect the applicable Temperature Sensor harness connector.

Disconnect the C2 FCM harness connector and the C2 PCM harness connector.

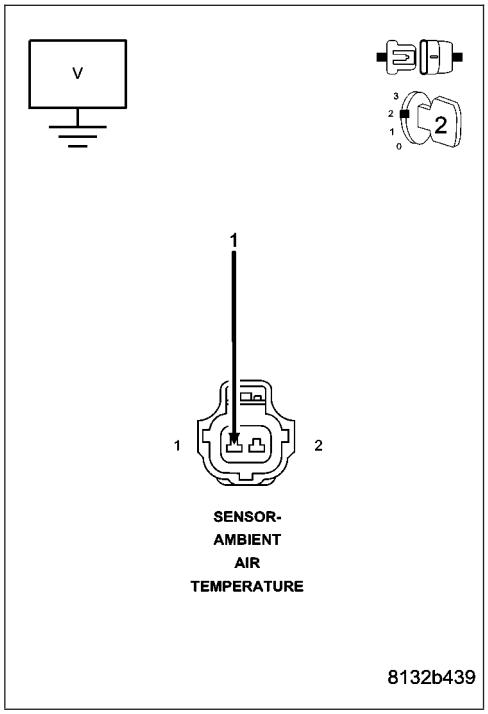
Ignition on, engine not running.

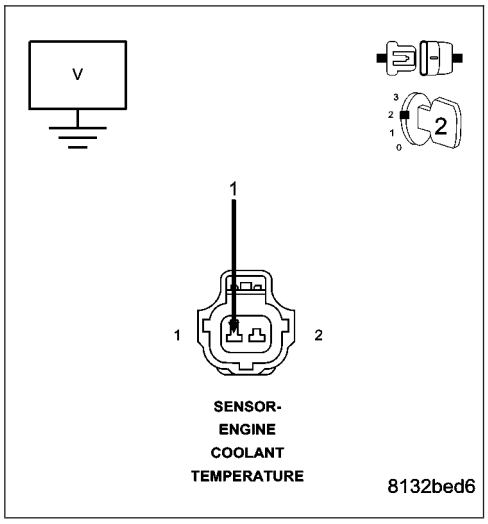
Measure the voltage on the (K2) ECT Signal circuit and the (G31) AAT Signal circuit at the appropriate Temperature Sensor harness connector.

Is the voltage above 5.2 volts?

Yes >> Repair the short to battery voltage in the Signal circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8





P0128-THERMOSTAT RATIONALITY (CONTINUED)

8. TEMPERATURE SENSOR

Turn the ignition off.

Connect the C2 FCM harness connector and the C2 PCM harness connector.

Connect a jumper wire across the ECT and AAT Sensor harness connectors.

Ignition on, engine not running.

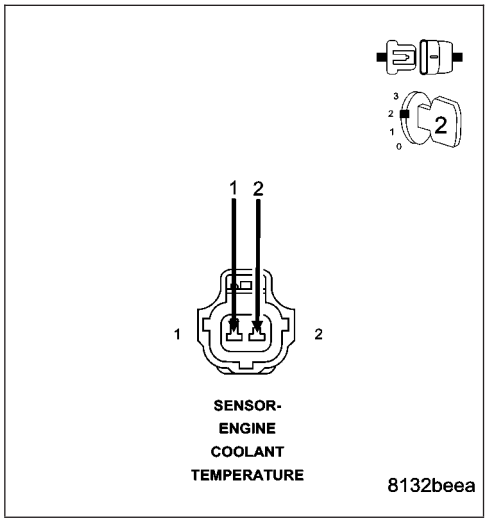
With a scan tool, read the Temperature Sensor voltage.

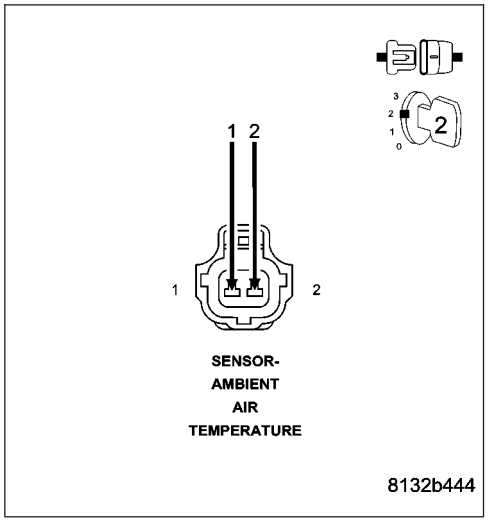
Does the voltage start at 5.0 volts and drop below 1.0 volt when the jumper wire is installed?

Yes >> Replace the appropriate Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

NOTE: Disconnect the jumper wire before continuing.





P0128-THERMOSTAT RATIONALITY (CONTINUED)

9. SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

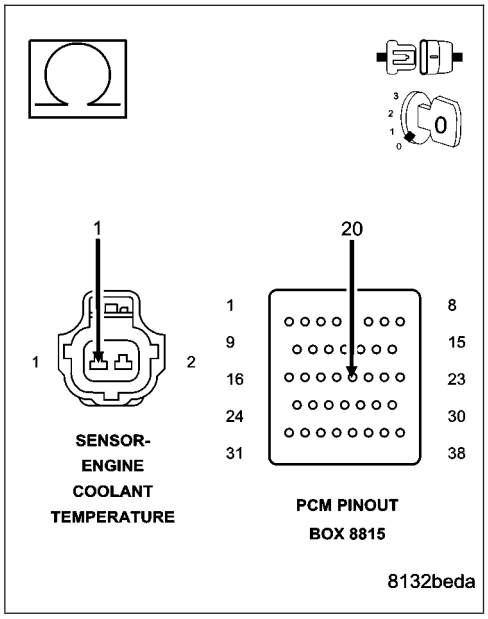
Measure the resistance of the (K2) ECT Sensor Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

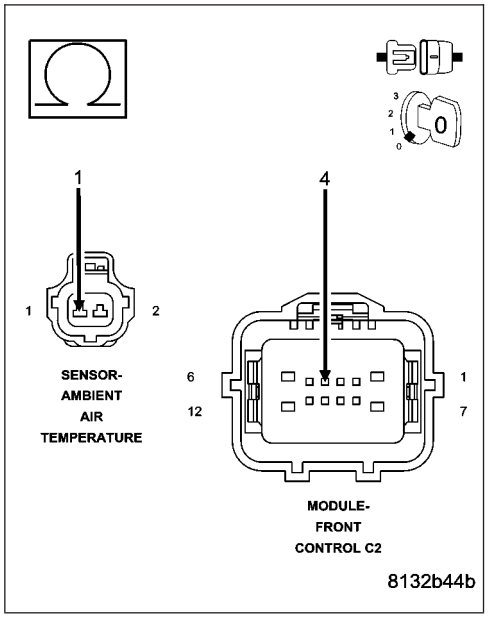
Measure the resistance of the (G31) AAT Sensor Signal circuit from the AAT Sensor harness connector to the C2 FCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 10

No >> Repair the open in the Sensor Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P0128-THERMOSTAT RATIONALITY (CONTINUED)

10. SENSOR GROUND CIRCUIT OPEN

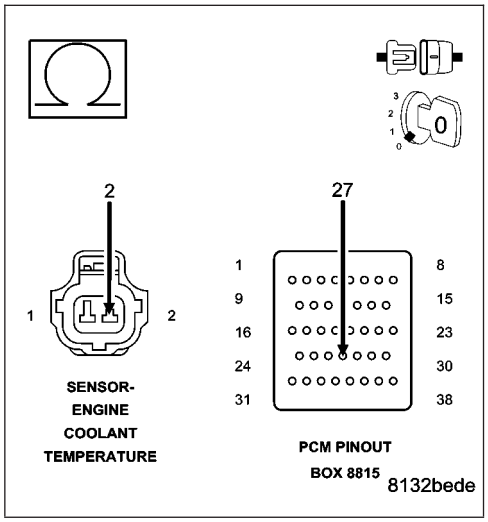
Measure the resistance of the (K900) Sensor ground circuit from the appropriate Temperature Sensor harness connector to the appropriate terminal of special tool #8815.

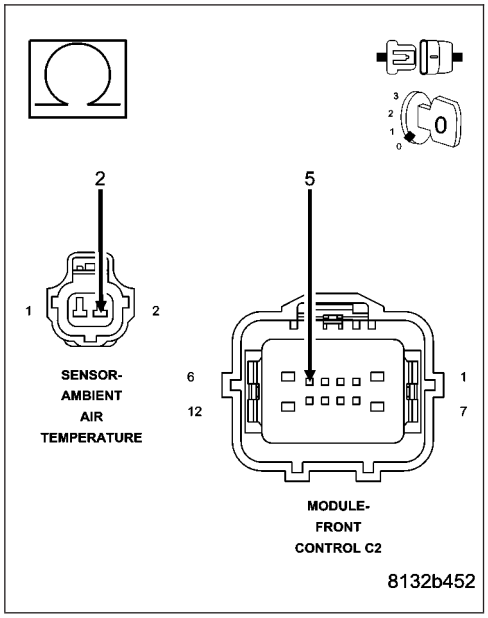
Measure the resistance of the (G931) Sensor ground circuit from the AAT Sensor harness connector to the C2 FCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 11

No >> Repair the open in the Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P0128-THERMOSTAT RATIONALITY (CONTINUED)

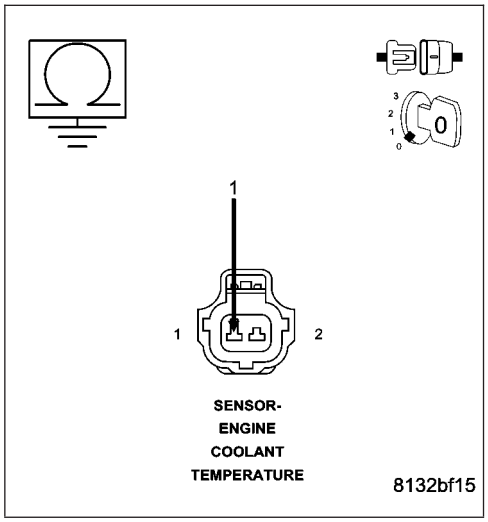
11. SIGNAL CIRCUIT SHORTED TO GROUND

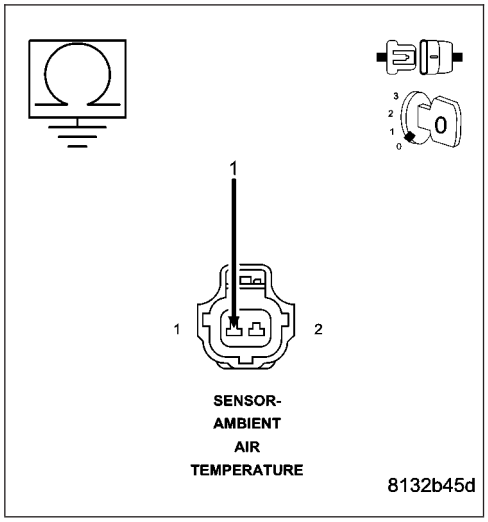
Measure the resistance between ground and the Sensor Signal circuit in the Temperature Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the Signal circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12





P0128-THERMOSTAT RATIONALITY (CONTINUED)

12. SIGNAL CIRCUIT SHORTED TO (K900) SENSOR GROUND CIRCUIT OR (G931) SENSOR GROUND CIRCUIT

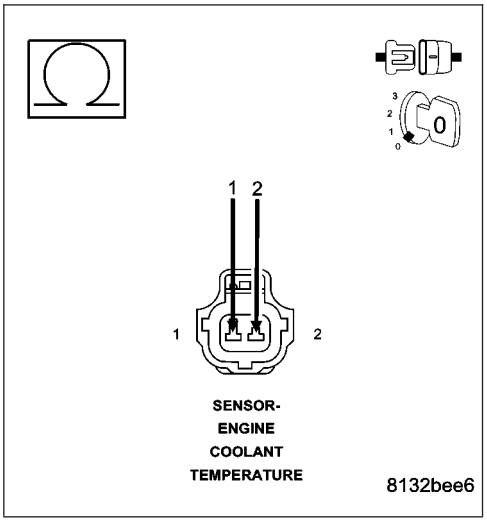
Measure the resistance between the Signal circuit and the (K900) Sensor ground circuit in the (K2) ECT Sensor harness connector.

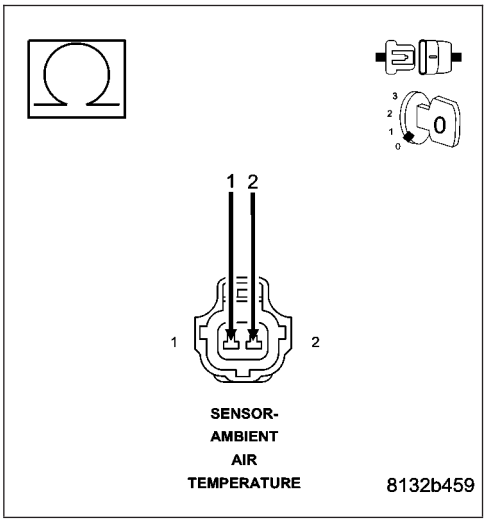
Measure the resistance between the Signal circuit and the (G931) Sensor ground circuit in the (G31) AAT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the Sensor ground circuit and the Sensor Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13





13. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

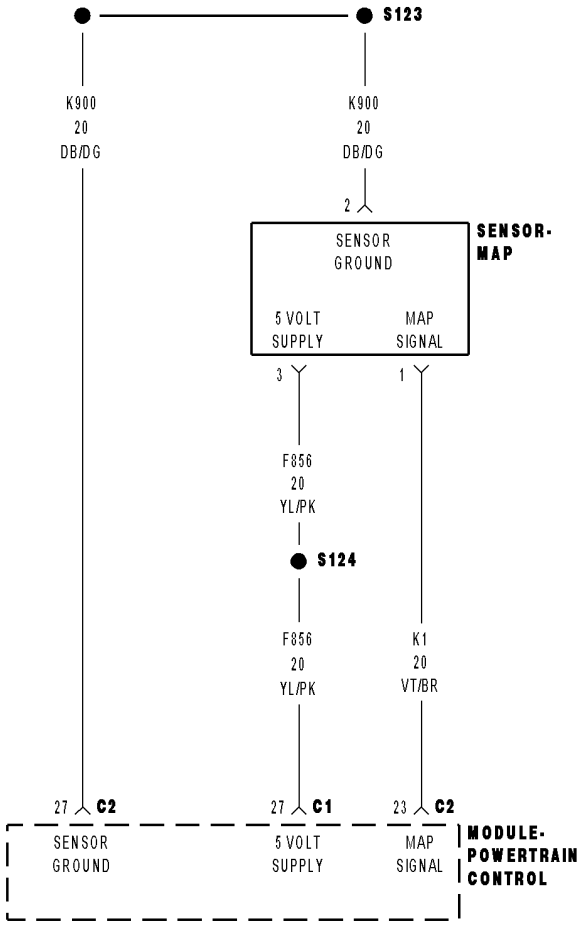
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

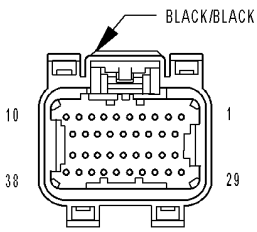
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

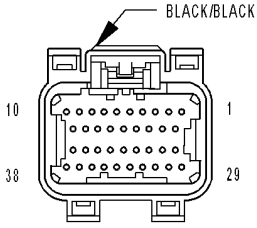
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW

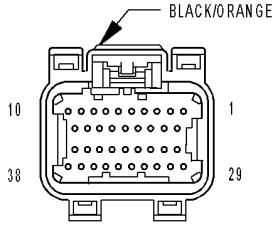




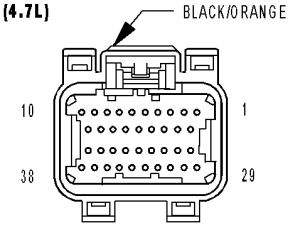
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



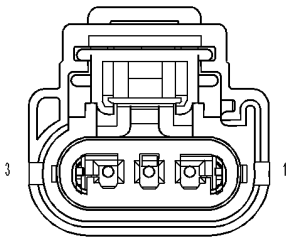
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



SENSOR-
MAP

8132bc68

P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on. No Cam or Crank signal within 75 ms. Engine speed less than 250 RPM.
- **Set Condition:**
  The PCM senses the voltage from the MAP sensor to be less than 2.2 volts but above 0.04 of a volt for 300 milliseconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT OPEN
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
MAP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time.

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW (CONTINUED)

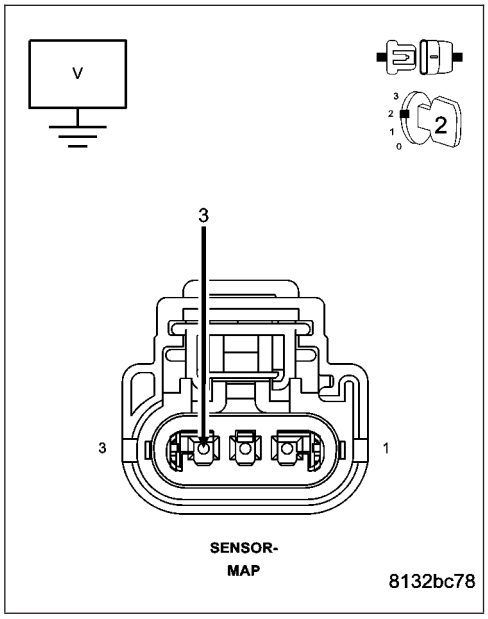
2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 7

3. MAP SENSOR

With a scan tool, monitor the MAP Sensor voltage with the Sensor harness connector disconnected.

Is the voltage above 2.2 volts?

Yes >> Replace the MAP Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

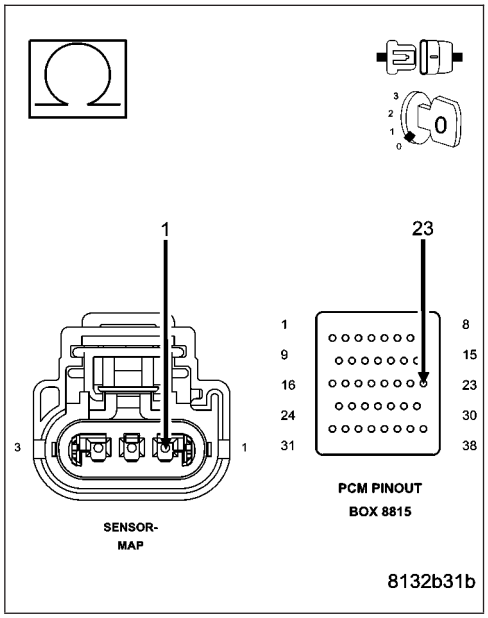
4. (K1) MAP SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

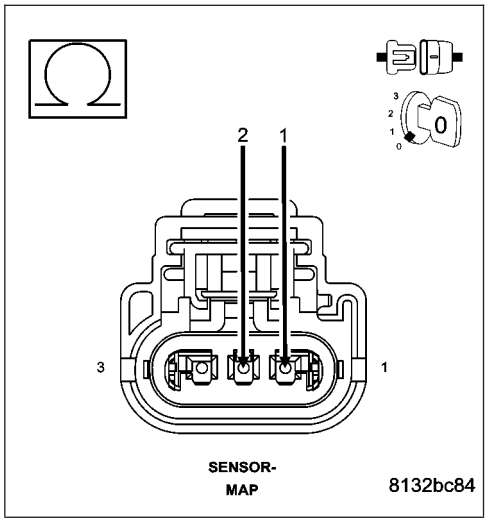
Yes >> Go To 5

No >> Repair the open in the (K1) MAP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW (CONTINUED)

5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K900) Sensor ground circuit and the (K1) MAP Signal circuit in the MAP Sensor harness connector.



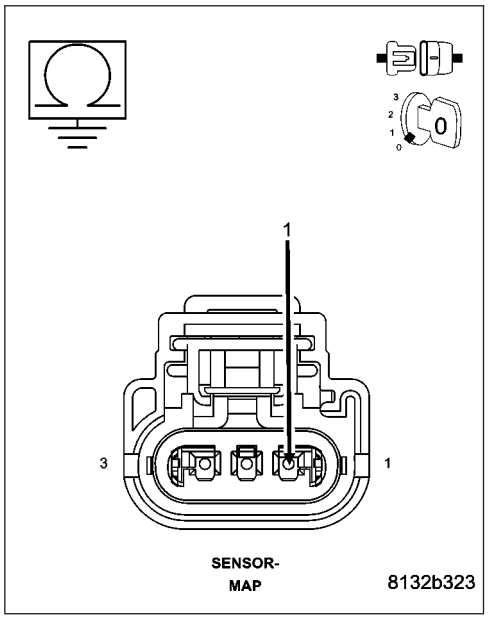
Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K1) MAP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K1) MAP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW (CONTINUED)

7. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

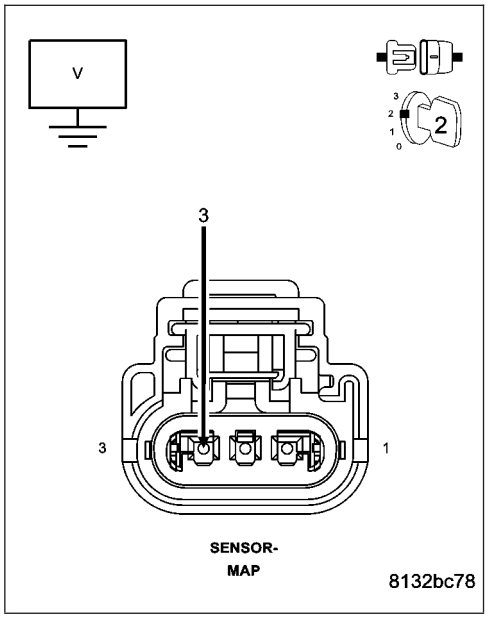
Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

Is the voltage above 5.2 volts?

Yes >> Repair the short to battery voltage in the (F856) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



8. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

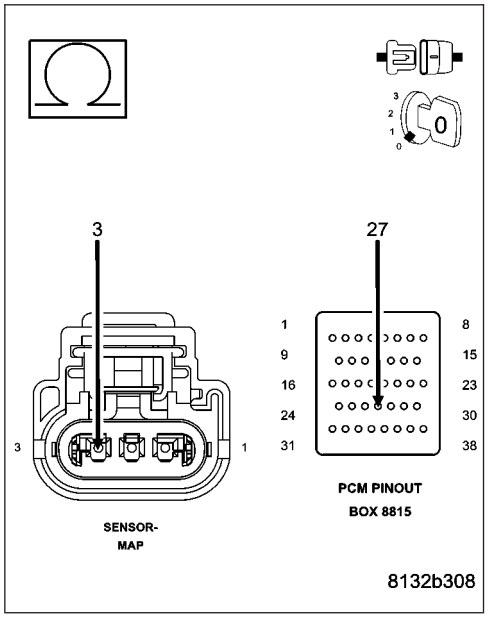
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

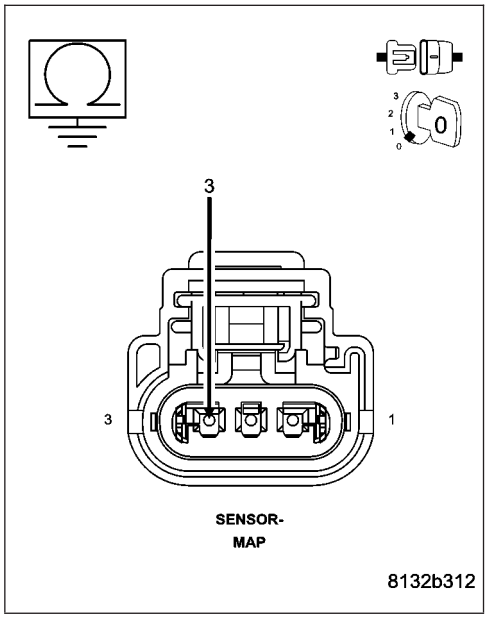
No >> Repair the open in the (F856) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW (CONTINUED)

9. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

10. PCM

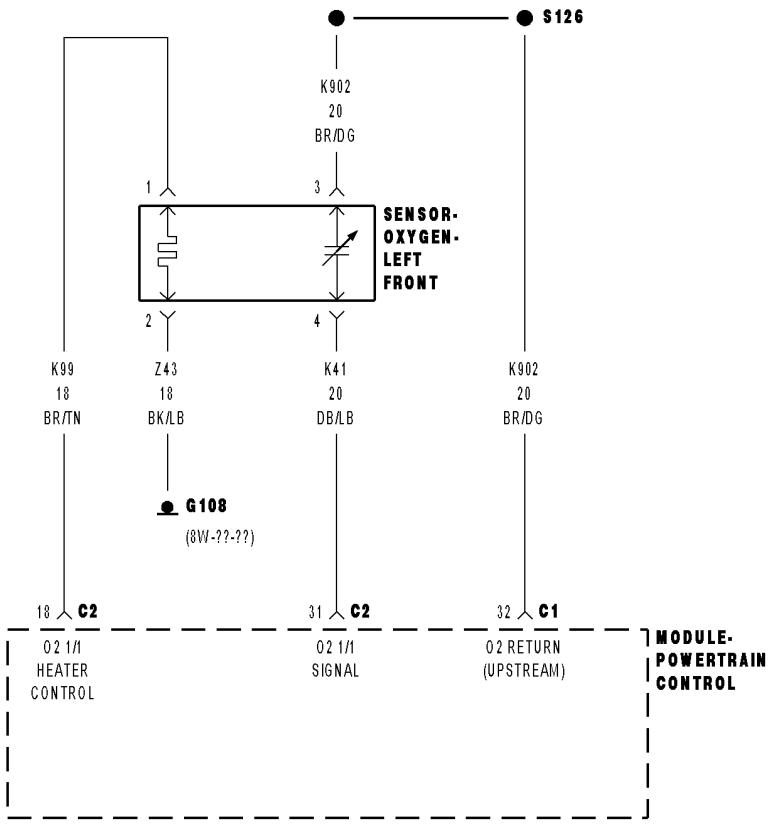
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

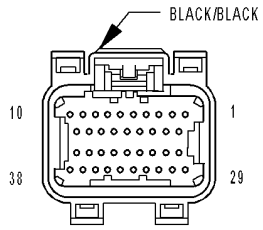
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

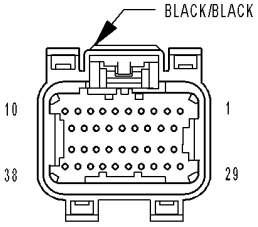
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0131-O2 SENSOR 1/1 CIRCUIT LOW

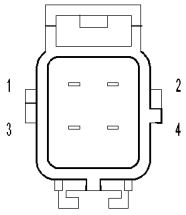




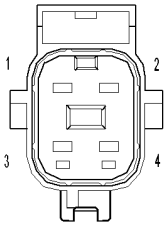
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



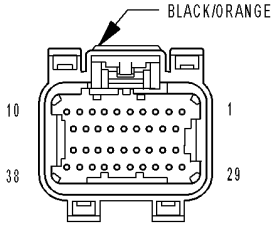
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



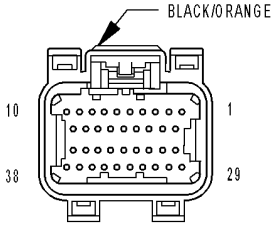
SENSOR-
OXYGEN-
LEFT
FRONT
(4.7L)



SENSOR-
OXYGEN-
LEFT FRONT
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

8132af33

P0131-O2 SENSOR 1/1 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251°C (484°F) with battery voltage greater 10.4 volts.
- **Set Condition:**
  The oxygen sensor signal voltage is below 2.5196 volts for 6 seconds after starting engine. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO GROUND
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 RETURN UPSTREAM CIRCUIT
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO THE (Z43) O2 1/1 HEATER GROUND CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR BELOW 2.52 VOLTS

Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, read the 1/1 O2 Sensor voltage.

Is the voltage below 2.52 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT

Turn the ignition off.
Disconnect the 1/1 O2 Sensor harness connector.
Ignition on, engine not running.
With a scan tool, monitor the O2 Sensor voltage.

Is the 1/1 O2 Sensor voltage above 4.8 volts?

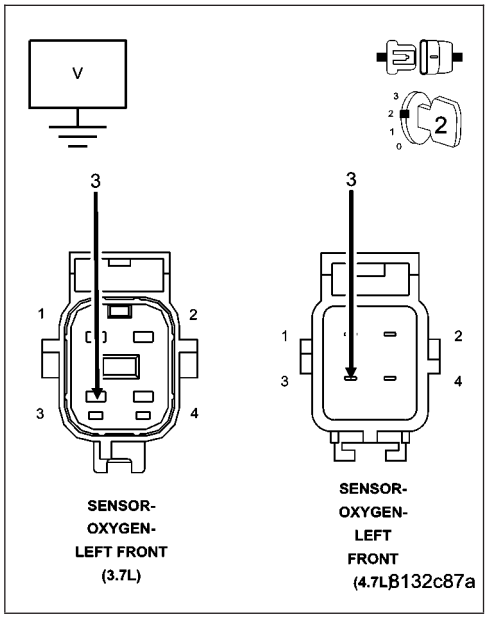
Yes >> Go To 3

No >> Go To 5

P0131-O2 SENSOR 1/1 CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

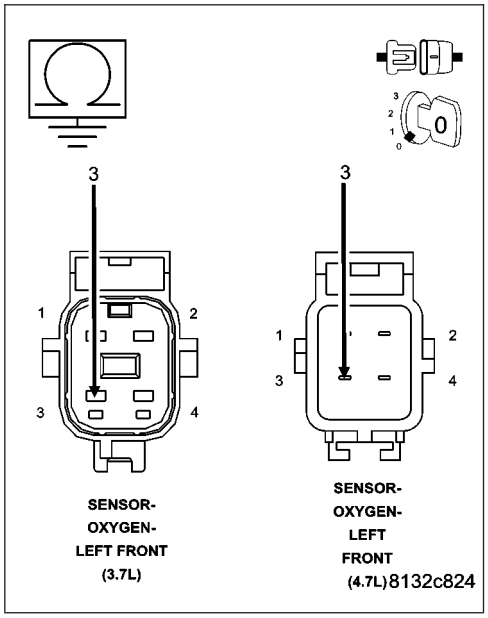
No >> Go To 4

4. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K902) O2 Return Upstream circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0131-O2 SENSOR 1/1 CIRCUIT LOW (CONTINUED)

5. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

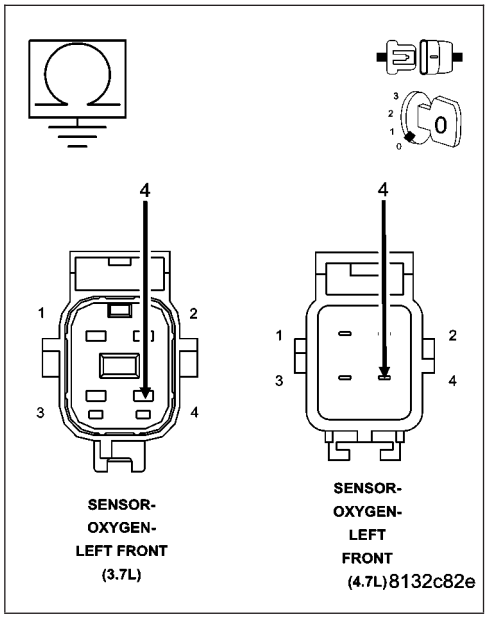
Disconnect the C1 and C2 PCM harness connectors.

Measure the resistance between ground and the (K41) O2 Sensor 1/1 Signal circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K41) O2 Sensor 1/1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



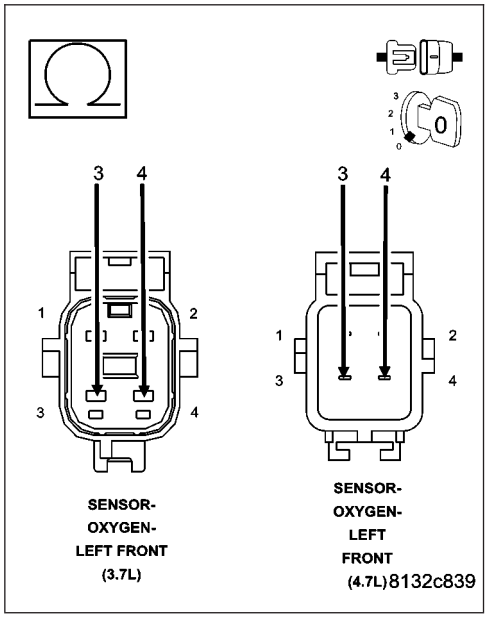
6. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 RETURN UPSTREAM CIRCUIT

Measure the resistance between the (K41) O2 Sensor 1/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K902) O2 Return Upstream circuit and the (K41) O2 Sensor 1/1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

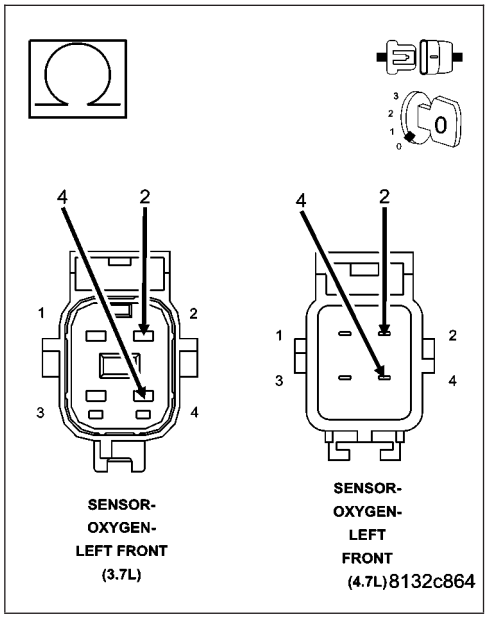
No >> Go To 7



P0131-O2 SENSOR 1/1 CIRCUIT LOW (CONTINUED)

7. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO THE (Z43) O2 1/1 HEATER GROUND CIRCUIT

Measure the resistance between the (K41) O2 Sensor 1/1 Signal circuit and the (Z43) O2 1/1Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (Z43) O2 1/1 Heater ground circuit and the (K41) O2 Sensor 1/1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

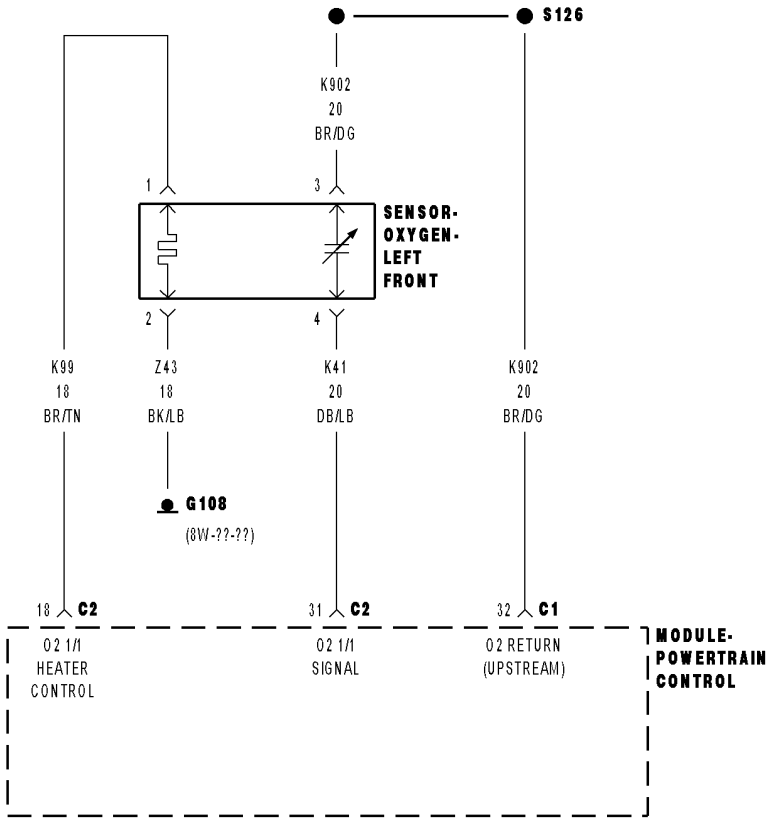
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

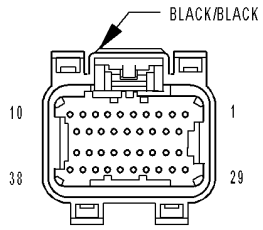
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

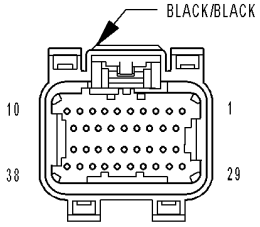
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0132-O2 SENSOR 1/1 CIRCUIT HIGH

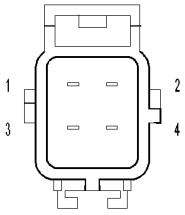




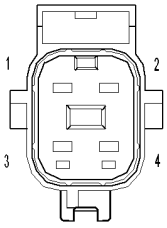
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



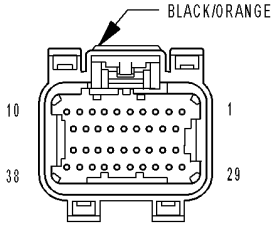
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



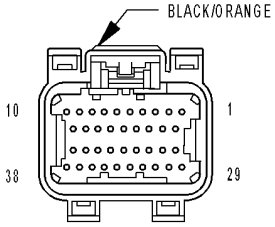
SENSOR-
OXYGEN-
LEFT
FRONT
(4.7L)



SENSOR-
OXYGEN-
LEFT FRONT
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

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P0132-O2 SENSOR 1/1 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  O2 Sensor Heater Temperature is greater than 496°C (925°F) and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Oxygen Sensor voltage is above 3.99 volts for 40 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE
(K41) O2 1/1 SIGNAL CIRCUIT OPEN
(K902) O2 RETURN UPSTREAM CIRCUIT OPEN
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR ABOVE 3.99 VOLTS

NOTE: When only one O2 Sensor is shorted to voltage, the scan tool will display all O2 Sensor voltage readings at approximately 5.0 volts. When diagnosing this DTC, only diagnose the O2 Sensor that set the DTC.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 1/1 O2 Sensor voltage.

Is the voltage above 3.9 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0132-O2 SENSOR 1/1 CIRCUIT HIGH (CONTINUED)

2. (K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Start the engine and allow the engine to idle.

Disconnect the 1/1 O2 Sensor harness connector.

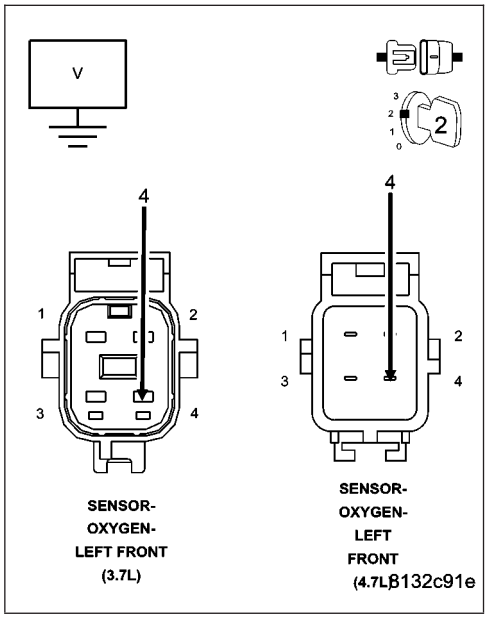
Measure the voltage on the (K41) O2 Sensor 1/1 Signal circuit in the 1/1 O2 Sensor harness connector.

NOTE: Measure the voltage in reference to ground, not the (K902) O2 Return Upstream circuit.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K41) O2 Sensor 1/1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

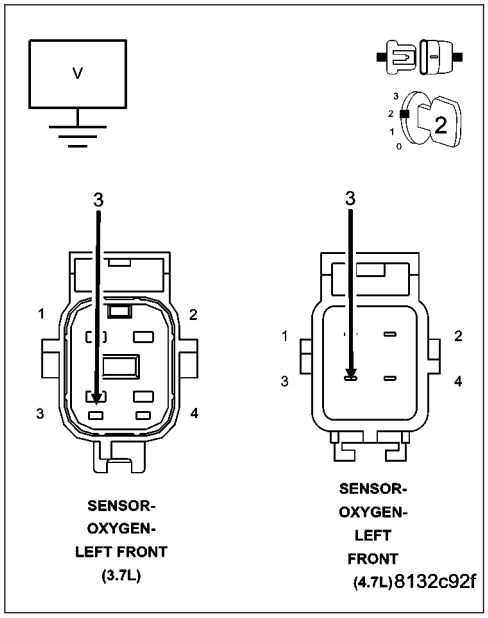
Ignition on, engine not running.

Measure the voltage on the (K902) O2 Return Upstream circuit in the 1/1 O2 Sensor harness connector.

Is there any voltage present?

Yes >> Repair the short to battery voltage in the (K902) O2 Return Upstream circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE) S

No >> Go To 4



P0132-O2 SENSOR 1/1 CIRCUIT HIGH (CONTINUED)

4. 1/1 O2 SENSOR

Turn the ignition off.

Connect the C1 PCM harness connector.

Connect a jumper wire between the (K41) O2 1/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Ignition on, engine not running.

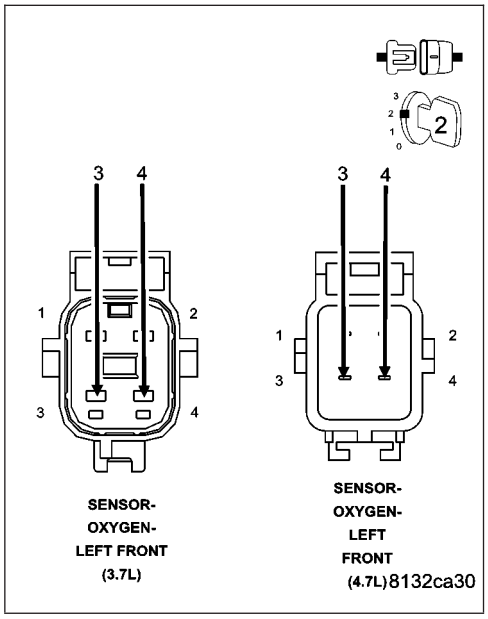
With a scan tool, monitor the 1/1 O2 Sensor voltage.

Is the voltage between 2.3 and 2.7 volts with the jumper wire installed?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.



5. (K41) O2 1/1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

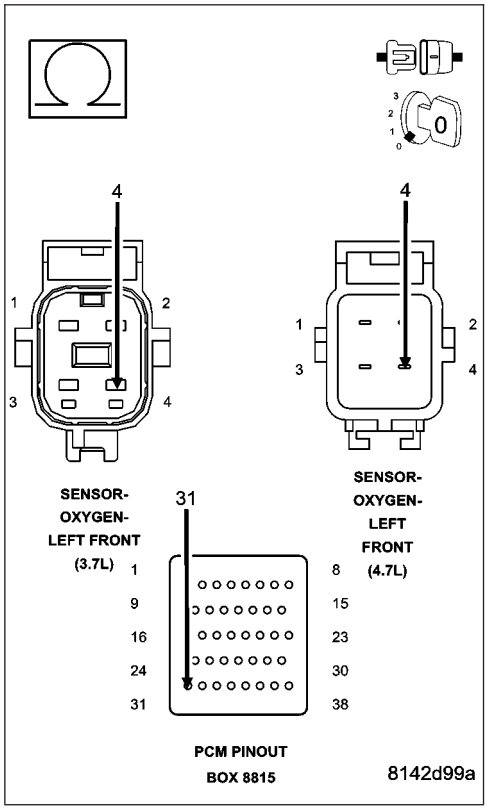
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K41) O2 1/1 Signal circuit from the 1/1 O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

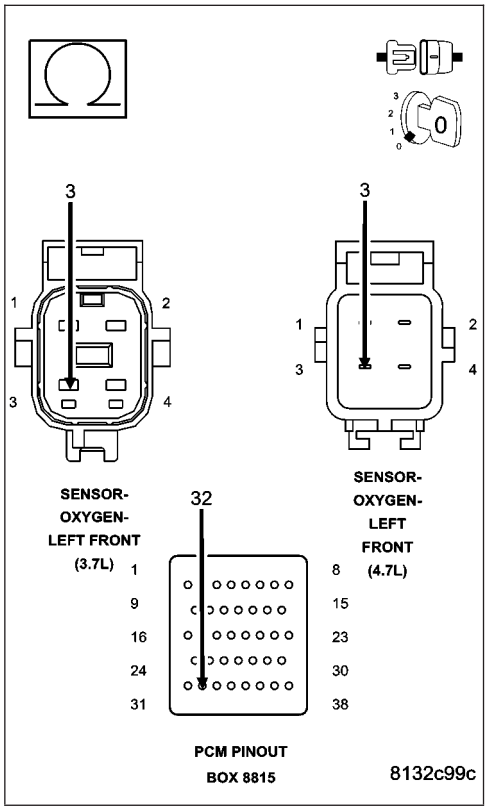
No >> Repair the open in the (K41) O2 1/1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0132-O2 SENSOR 1/1 CIRCUIT HIGH (CONTINUED)

6. (K902) O2 RETURN UPSTREAM CIRCUIT OPEN

Measure the resistance of the (K902) O2 Return Upstream circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K902) O2 Return Upstream circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

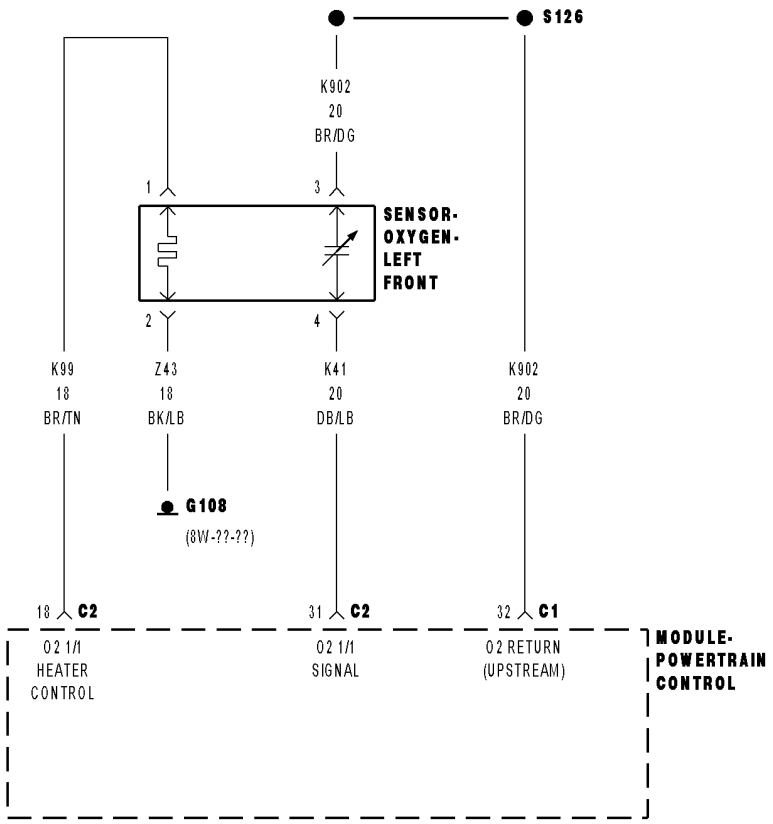
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

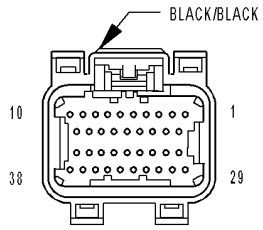
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

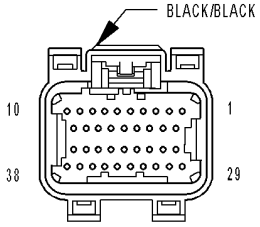
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0133-O2 SENSOR 1/1 SLOW RESPONSE

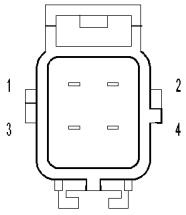




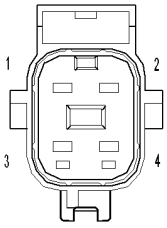
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



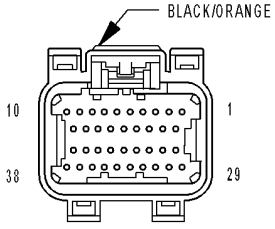
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



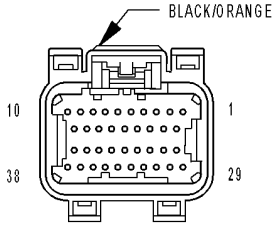
SENSOR-
OXYGEN-
LEFT
FRONT
(4.7L)



SENSOR-
OXYGEN-
LEFT FRONT
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

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P0133-O2 SENSOR 1/1 SLOW RESPONSE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Vehicle is started and driven between 20 and 55 MPH with the Throttle open for a minimum of 120 seconds. Coolant greater than 70°C (158°F). Catalytic Converter Temp greater than 600°C (1112°F) and EVAP Purge is active.
- **Set Condition:**
  The oxygen sensor signal voltage switches less than 16 times from lean to rich within 20 seconds during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K41) O2 1/1 SIGNAL CIRCUIT
(K902) O2 RETURN UPSTREAM CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.
Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EXHAUST LEAK

Start the engine.
Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0133-O2 SENSOR 1/1 SLOW RESPONSE (CONTINUED)

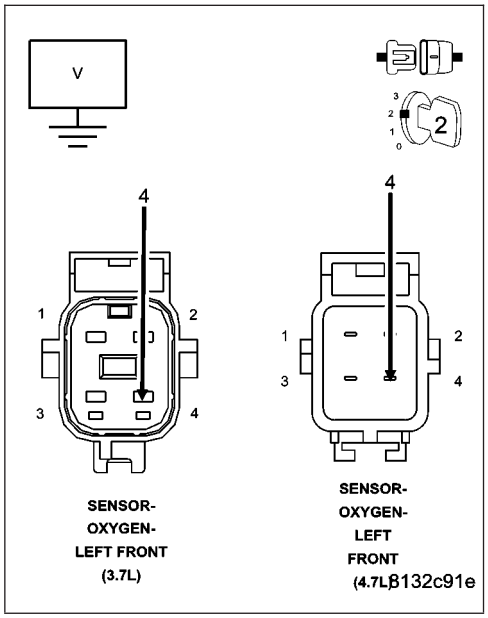
3. (K41) O2 1/1 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 1/1 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K41) O2 1/1 Signal circuit in the O2 Sensor harness connector.



Is the voltage approximately 5.0 volts?

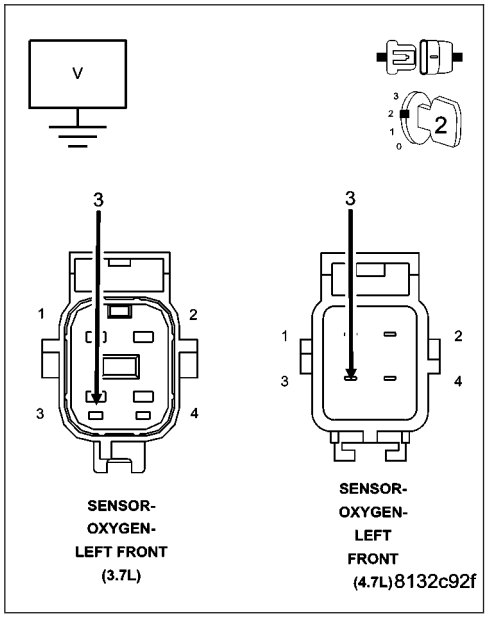
Yes >> Go To 4

No >> Check the (K41) O2 1/1 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K902) O2 RETURN UPSTREAM CIRCUIT

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Go To 5

No >> Check the (K902) O2 Return Upstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. O2 SENSOR

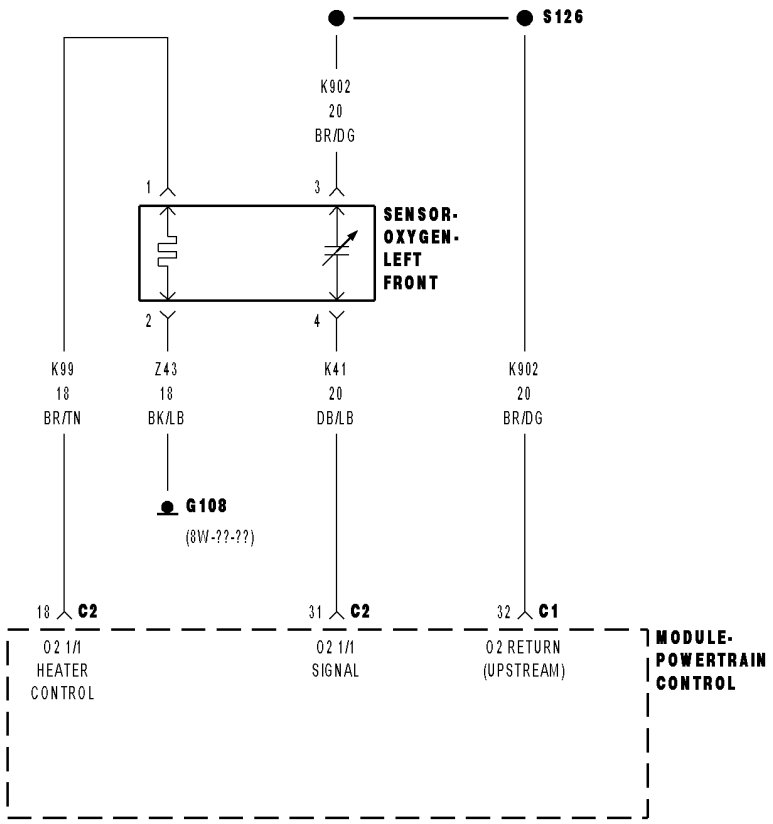
If there are no possible causes remaining, view repair.

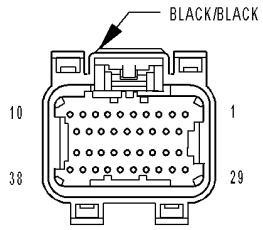
Repair

Replace the O2 Sensor

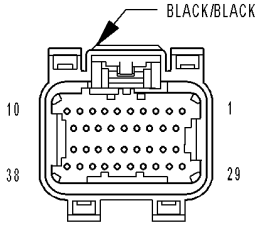
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0135-O2 SENSOR 1/1 HEATER PERFORMANCE

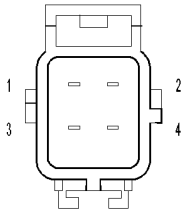




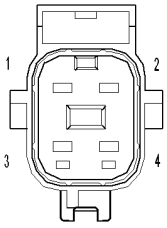
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



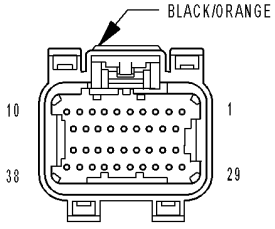
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



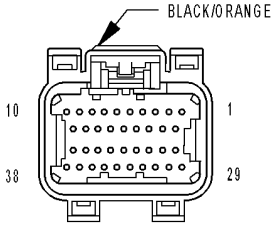
SENSOR-
OXYGEN-
LEFT
FRONT
(4.7L)



SENSOR-
OXYGEN-
LEFT FRONT
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

8132af33

P0135-O2 SENSOR 1/1 HEATER PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**
  Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.
- **Set Condition:**
  No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN
(Z43) O2 1/1 HEATER GROUND CIRCUIT OPEN
O2 SENSOR HEATER ELEMENT
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0135-O2 SENSOR 1/1 HEATER PERFORMANCE (CONTINUED)

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the 1/1 O2 Sensor connector between the O2 Heater Control terminal and the Heater ground terminal.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

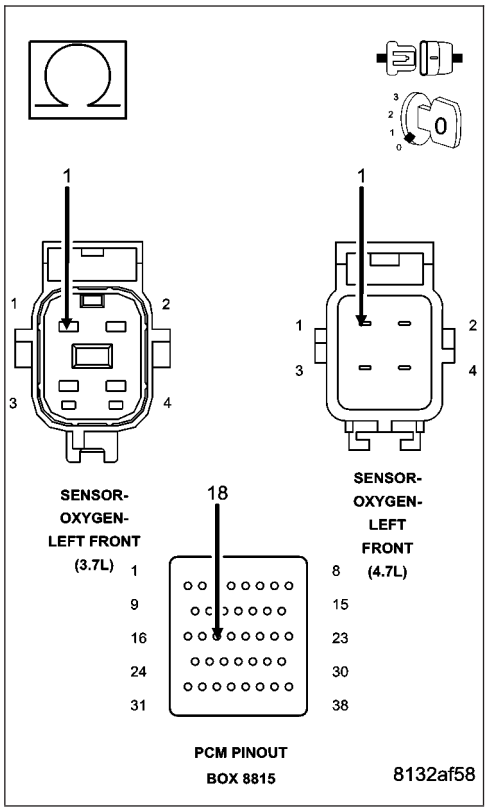
---

3. (K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K99) O2 1/1 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 0.5 of an ohm?

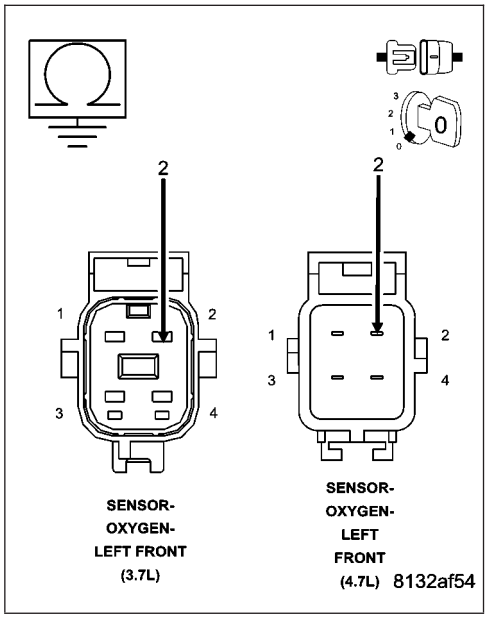
Yes >> Go To 4

No >> Repair the excessive resistance in the (K99) O2 1/1 Heater Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0135-O2 SENSOR 1/1 HEATER PERFORMANCE (CONTINUED)

4. (Z43) O2 1/1 HEATER GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z43) O2 1/1Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 0.5 of an ohm?

Yes >> Go To 5

No >> Repair the excessive resistance in the (Z43) O2 1/1 Heater ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

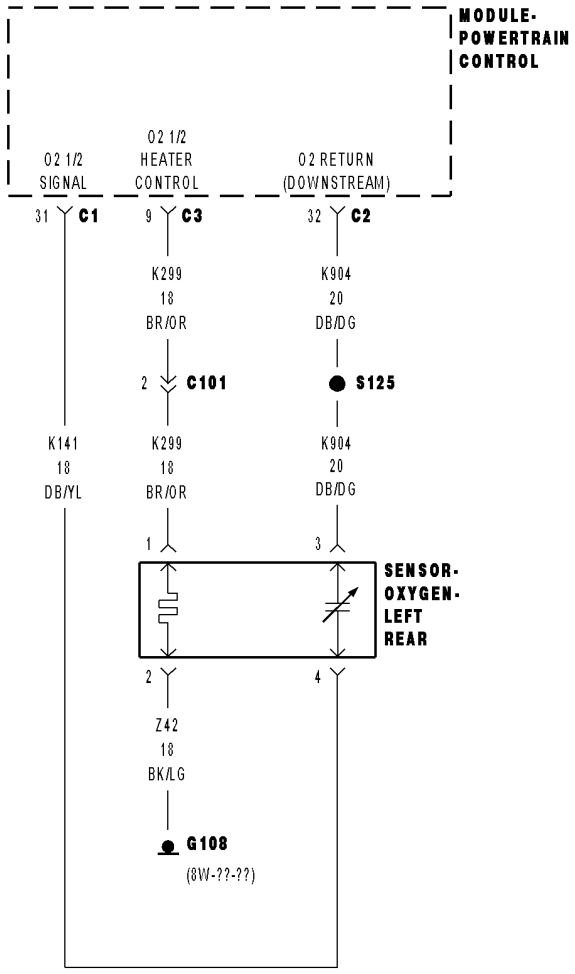
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

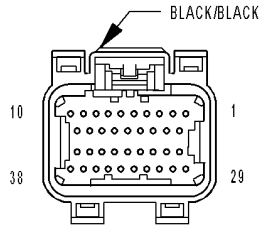
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

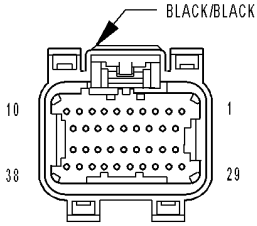
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0137-O2 SENSOR 1/2 CIRCUIT LOW

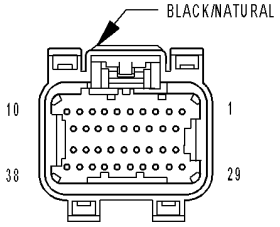




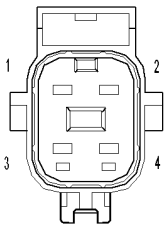
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



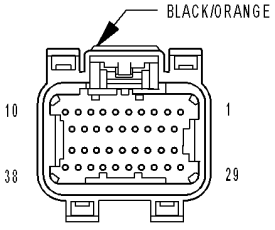
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



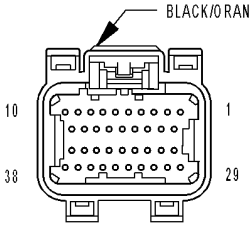
MODULE-
POWERTRAIN
CONTROL C3



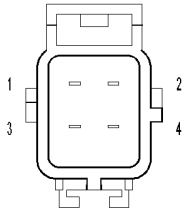
SENSOR-
OXYGEN-
LEFT REAR
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



SENSOR-
OXYGEN-
LEFT
REAR
(3.7L)

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P0137-O2 SENSOR 1/2 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251°C (484°F) with battery voltage greater 10.99 volts.
- **Set Condition:**
  The oxygen sensor signal voltage is below 2.5196 volts for 3 seconds after starting engine. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND
(K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO GROUND
(K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 RETURN DOWNSTREAM CIRCUIT
(K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (Z42) O2 1/2 HEATER GROUND CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR BELOW 2.52 VOLTS

Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, read the 1/2 O2 Sensor voltage.

Is the voltage below 2.52 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K141) O2 1/2 SIGNAL CIRCUIT

Turn the ignition off.
Disconnect the 1/2 O2 Sensor harness connector.
Ignition on, engine not running.
With a scan tool, monitor the 1/2 O2 Sensor voltage.

Is the O2 Sensor voltage above 4.8 volts?

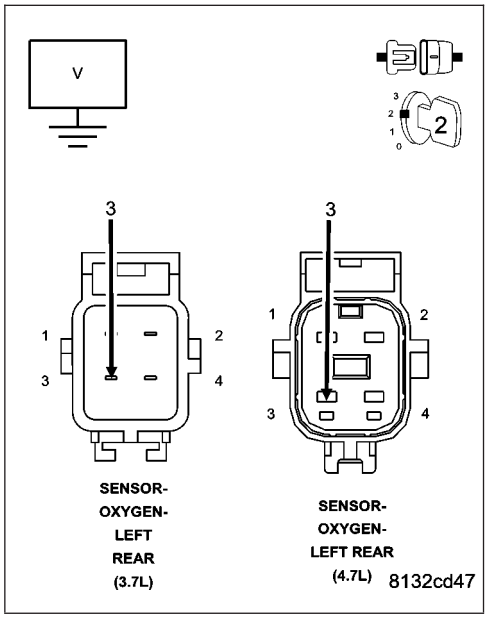
Yes >> Go To 3

No >> Go To 5

P0137-O2 SENSOR 1/2 CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

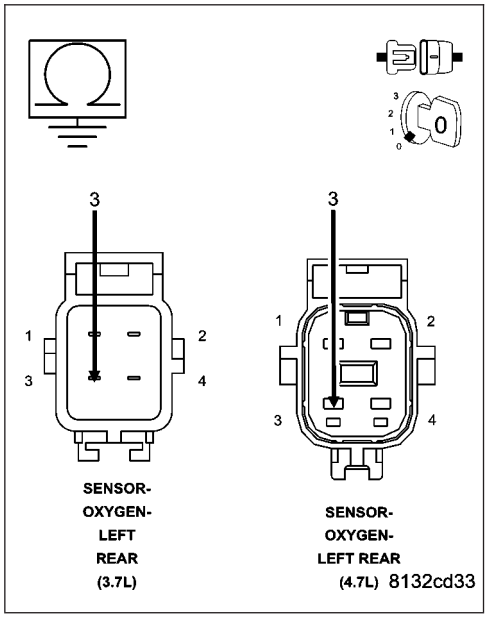
No >> Go To 4

4. (K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K904) O2 Return Downstream circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0137-O2 SENSOR 1/2 CIRCUIT LOW (CONTINUED)

5. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

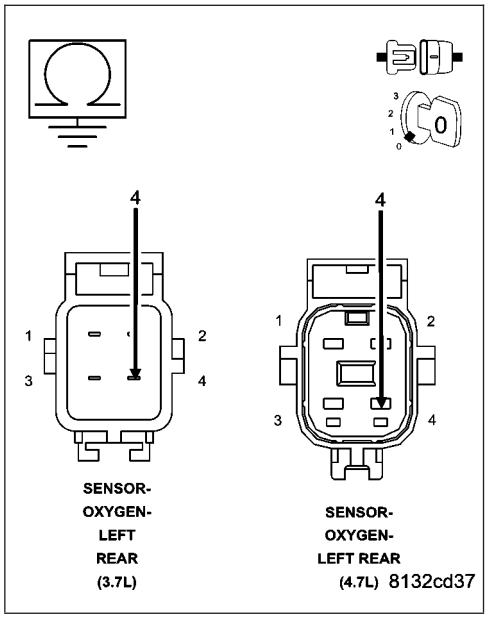
Disconnect the C1 and C2 PCM harness connectors.

Measure the resistance between ground and the (K141) O2 1/2 Signal circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K141) O2 1/2 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



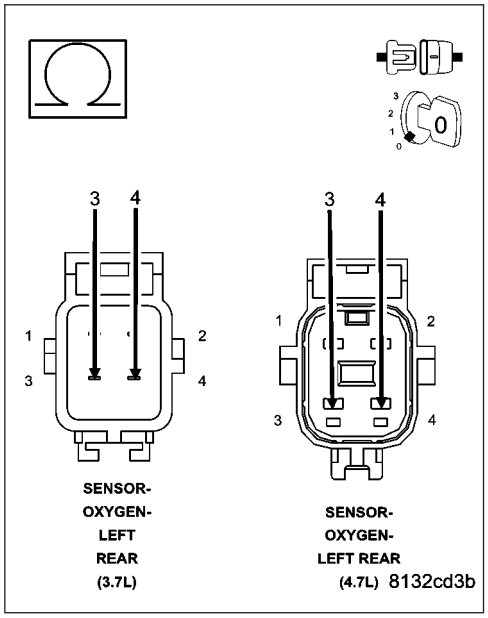
6. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 RETURN DOWNSTREAM CIRCUIT

Measure the resistance between the (K141) O2 1/2 Signal circuit and the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K904) O2 Return Downstream circuit and the (K141) O2 1/2 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

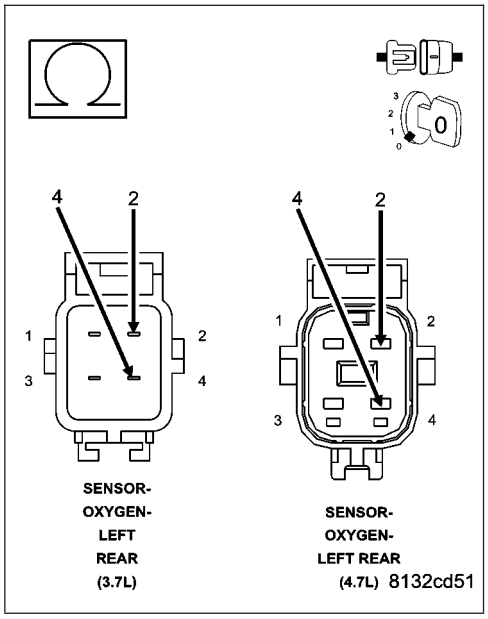
No >> Go To 7



P0137-O2 SENSOR 1/2 CIRCUIT LOW (CONTINUED)

7. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (Z42) O2 1/2 HEATER GROUND CIRCUIT

Measure the resistance between the (K141) O2 1/2 Signal circuit and the (Z42) O2 1/2 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (Z42) O2 1/2 Heater ground circuit and the (K141) O2 1/2 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

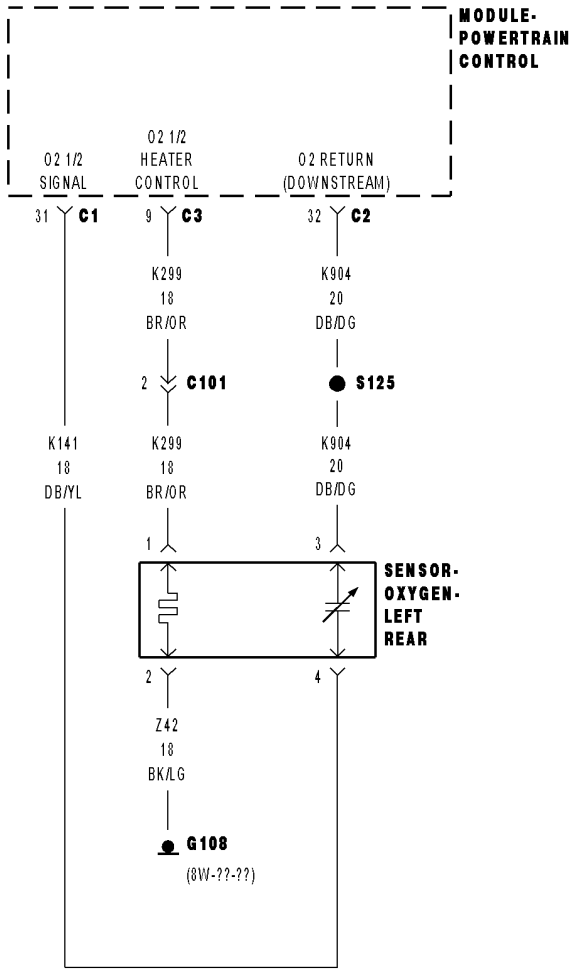
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

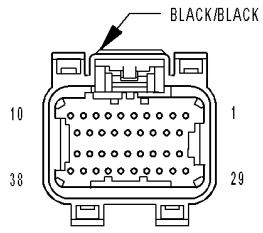
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

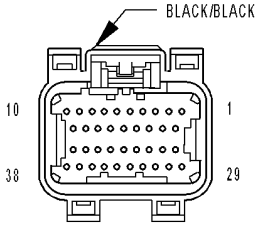
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0138-O2 SENSOR 1/2 CIRCUIT HIGH

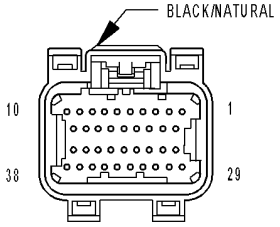




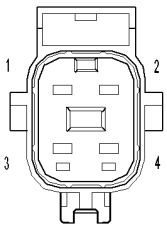
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



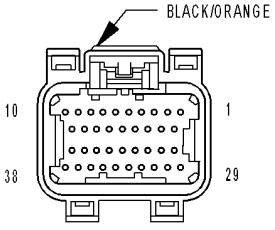
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



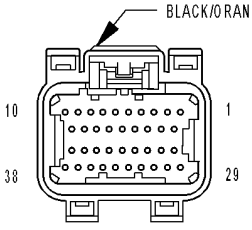
MODULE-
POWERTRAIN
CONTROL C3



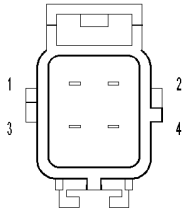
SENSOR-
OXYGEN-
LEFT REAR
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



SENSOR-
OXYGEN-
LEFT
REAR
(3.7L)

8132af63

P0138-O2 SENSOR 1/2 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  O2 Sensor Heater Temperature is greater than 496°C (925°F) and battery voltage greater than 10.99 volts.
- **Set Condition:**
  The Oxygen Sensor voltage is above 3.99 volts for 30 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE
(K141) O2 1/2 SENSOR SIGNAL CIRCUIT OPEN
(K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR ABOVE 3.9 VOLTS

NOTE: When only one O2 Sensor is shorted to voltage, the scan tool will display all O2 Sensor voltage readings at approximately 5.0 volts. When diagnosing this DTC, only diagnose the O2 Sensor that set the DTC.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 1/2 O2 Sensor voltage.

Is the voltage above 3.9 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0138-O2 SENSOR 1/2 CIRCUIT HIGH (CONTINUED)

2. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Start the engine and allow the engine to idle.

Disconnect the 1/2 O2 Sensor harness connector.

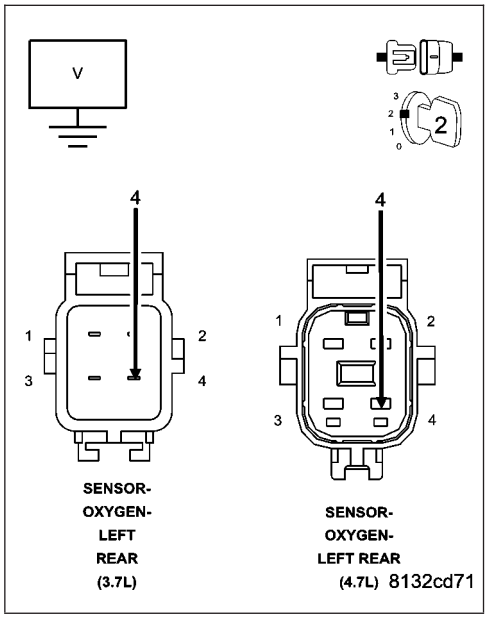
Measure the voltage on the (K141) O2 Sensor 1/2 Signal circuit in the O2 Sensor harness connector.

NOTE: Measure the voltage in reference to ground, not the (K904) O2 Return Downstream circuit.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K141) O2 Sensor 1/2 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

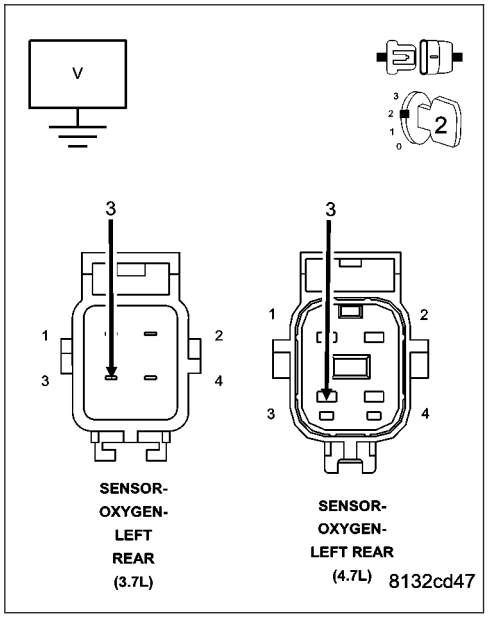
Ignition on, engine not running.

Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is there any voltage present?

Yes >> Repair the short to battery voltage in the (K904) O2 Return Downstream circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0138-O2 SENSOR 1/2 CIRCUIT HIGH (CONTINUED)

4. O2 SENSOR

Turn the ignition off.

Connect the C2 PCM harness connector.

Connect a jumper wire between the (K141) O2 1/2 Signal circuit and the (K904) O2 Return Downstream circuit in the 1/2 O2 Sensor harness connector.

Ignition on, engine not running.

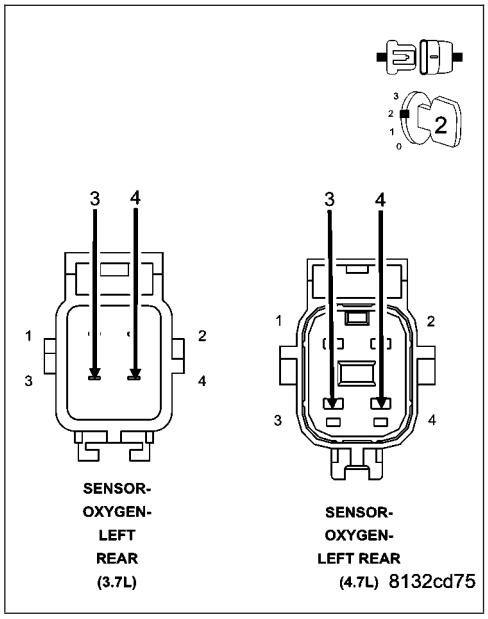
With a scan tool, monitor the 1/2 O2 Sensor voltage.

Is the voltage between 2.3 and 2.7 volts with the jumper wire installed?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.



5. (K141) O2 1/2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

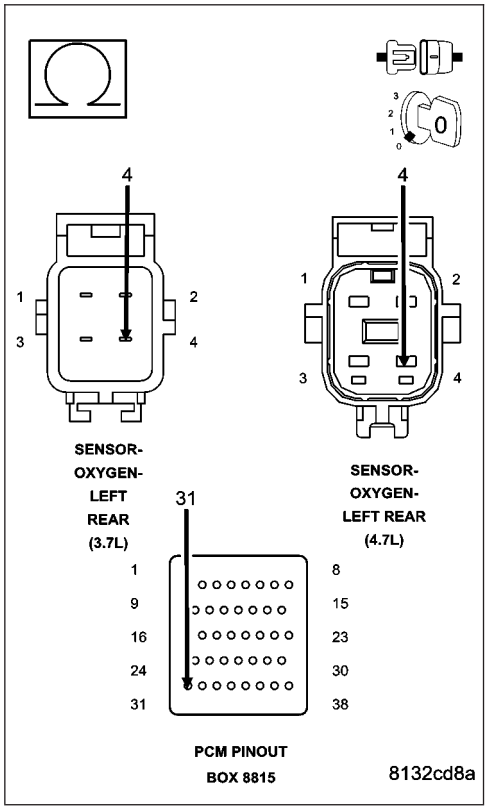
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K141) O2 1/2 Signal circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

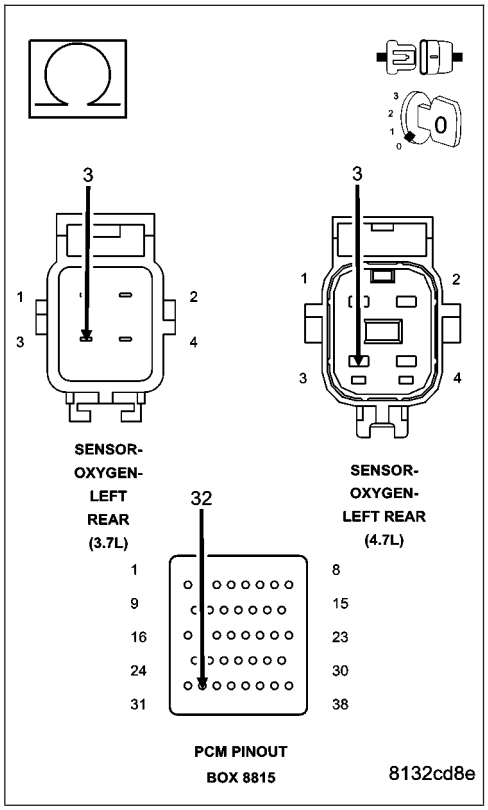
No >> Repair the open in the (K141) O2 1/2 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE) Z



P0138-O2 SENSOR 1/2 CIRCUIT HIGH (CONTINUED)

6. (K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN

Measure the resistance of the (K904) O2 Return Downstream circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K904) O2 Return Downstream circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

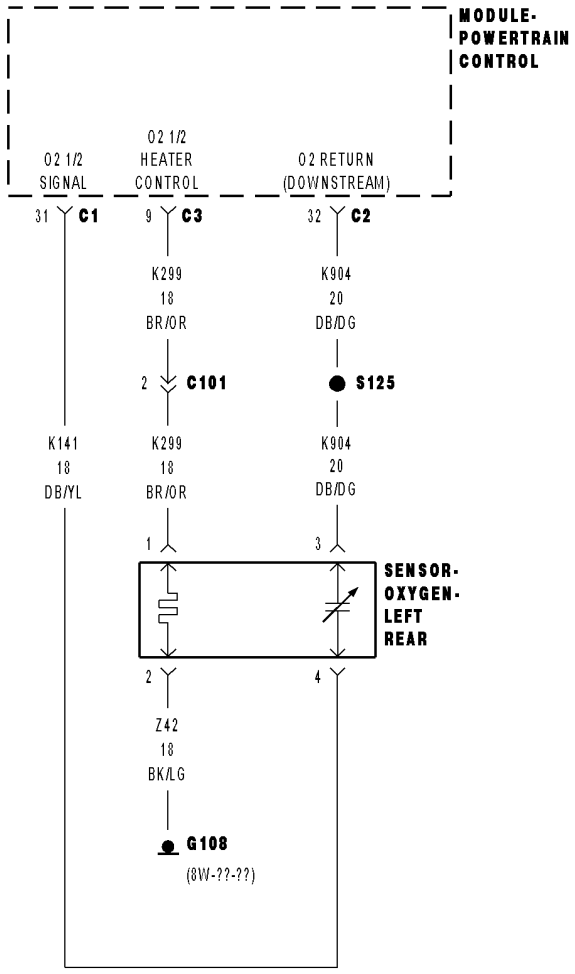
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

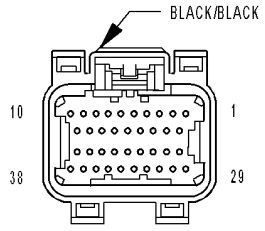
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

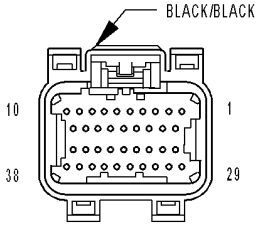
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0139-O2 SENSOR 1/2 SLOW RESPONSE

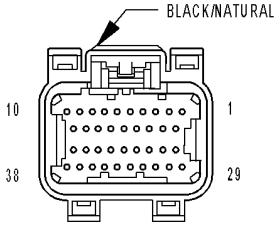




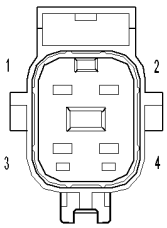
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



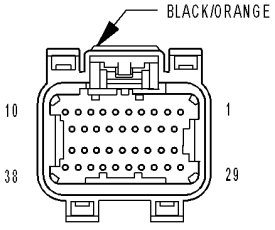
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



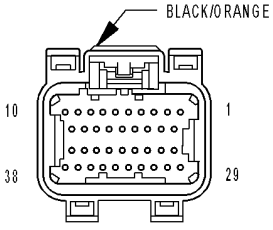
MODULE-
POWERTRAIN
CONTROL C3



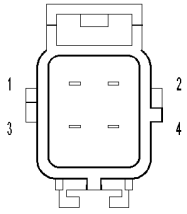
SENSOR-
OXYGEN-
LEFT REAR
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



SENSOR-
OXYGEN-
LEFT
REAR
(3.7L)

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P0139-O2 SENSOR 1/2 SLOW RESPONSE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The downstream O2 Sensor is located in the exhaust path behind the catalytic converter, is monitored for proper response to assure optimum catalytic converter efficiency. The downstream O2 response monitor is intended to diagnose a downstream O2 sensor that is not moving or stuck in a voltage window and to insure accurate information for catalyst monitor diagnosis.

- **When Monitored:**
  Vehicle is started and driven between 20 and 55 MPH with the Throttle open for a minimum of 120 seconds. Coolant greater than 70°C (158°F). Catalytic Converter Temp greater than 600°C (1112°F) and EVAP Purge is active.
- **Set Condition:**
  The oxygen sensor signal voltage switches less than 16 times from lean to rich within 20 seconds during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K141) O2 1/2 SIGNAL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.
Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EXHAUST LEAK

Start the engine.
Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0139-O2 SENSOR 1/2 SLOW RESPONSE (CONTINUED)

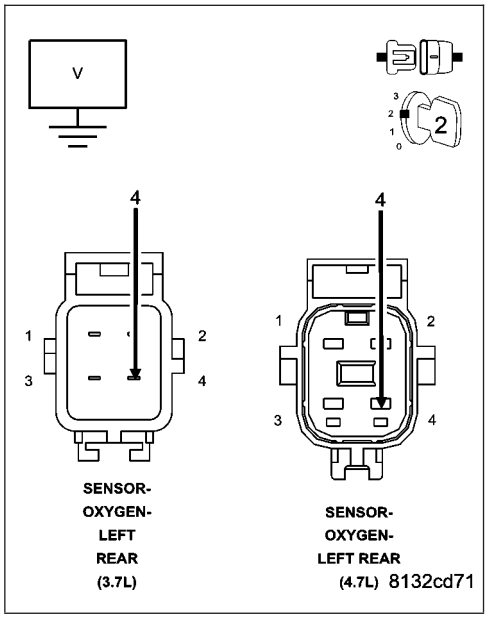
3. (K141) O2 1/2 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 1/2 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K141) O2 1/2 Signal circuit in the O2 Sensor harness connector.



Is the voltage approximately 5.0 volts?

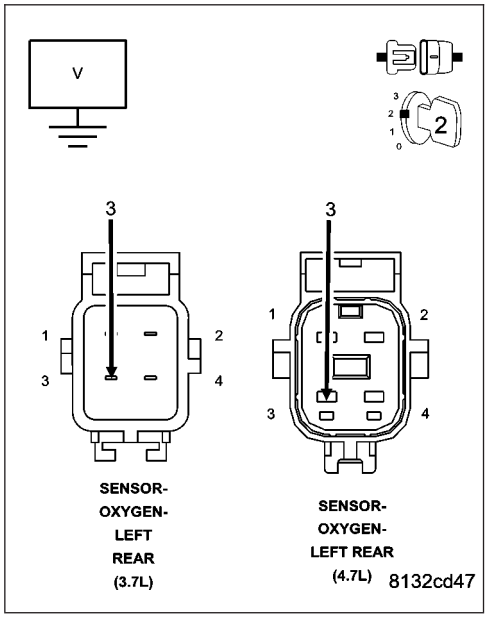
Yes >> Go To 4

No >> Check the (K141) O2 1/2 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K904) O2 RETURN DOWNSTREAM CIRCUIT

Measure the voltage on the (K904) O2 Return Downstream circuit in the 1/2 O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Go To 5

No >> Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. O2 SENSOR

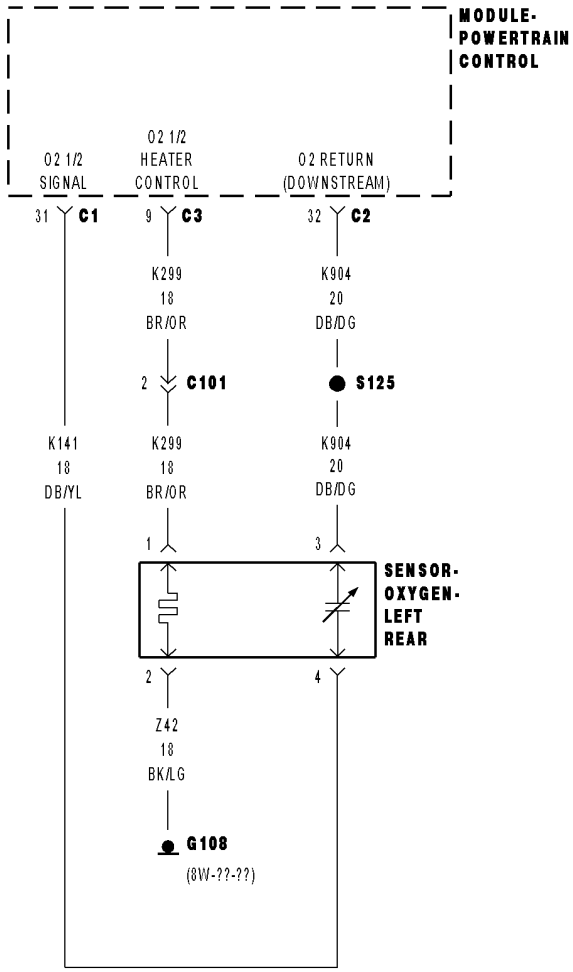
If there are no possible causes remaining, view repair.

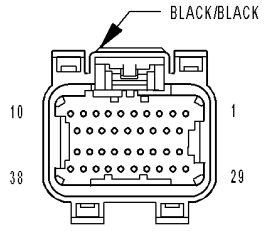
Repair

Replace the O2 Sensor

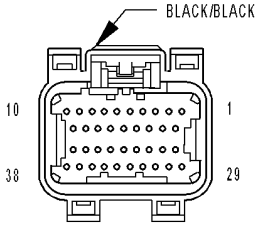
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0141-O2 SENSOR 1/2 HEATER PERFORMANCE

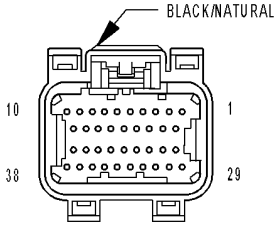




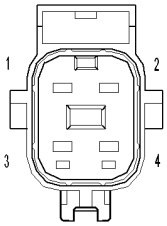
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



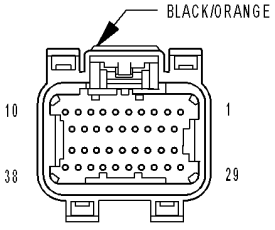
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



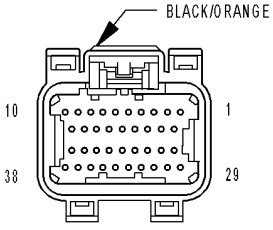
MODULE-
POWERTRAIN
CONTROL C3



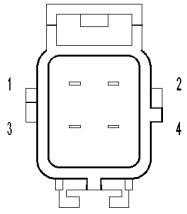
SENSOR-
OXYGEN-
LEFT REAR
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



SENSOR-
OXYGEN-
LEFT
REAR
(3.7L)

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P0141-O2 SENSOR 1/2 HEATER PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**
  Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.
- **Set Condition:**
  No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN
(Z42) O2 HEATER GROUND CIRCUIT OPEN
O2 SENSOR HEATER ELEMENT
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 1/2 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0141-O2 SENSOR 1/2 HEATER PERFORMANCE (CONTINUED)

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the O2 Sensor connector between the O2 Heater Control terminal and the Heater ground terminal.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

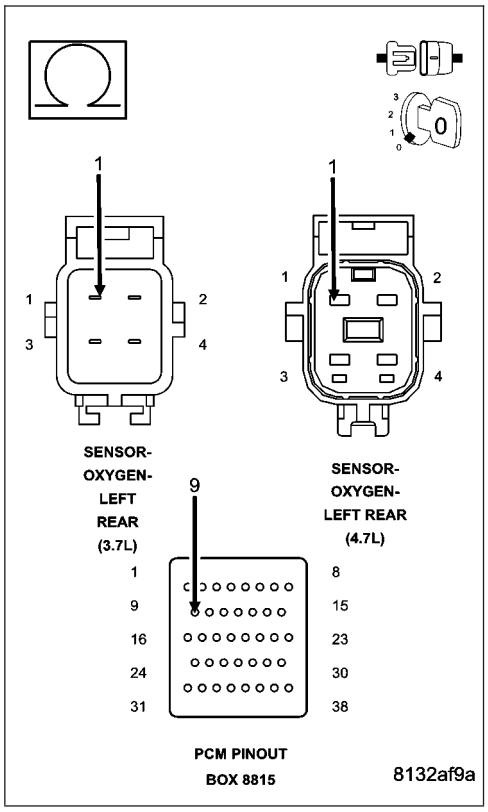
---

3. (K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K299) O2 1/2 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 0.5 of an ohm?

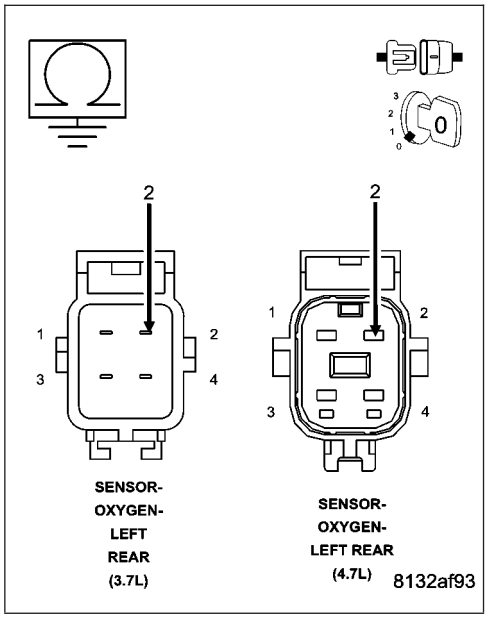
Yes >> Go To 4

No >> Repair the excessive resistance in the (K299) O2 1/2 Heater Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0141-O2 SENSOR 1/2 HEATER PERFORMANCE (CONTINUED)

4. (Z42) O2 1/2 HEATER GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z42) O2 1/2 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 0.5 of an ohm?

Yes >> Go To 5

No >> Repair the excessive resistance in the (Z42) O2 1/2 Heater ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

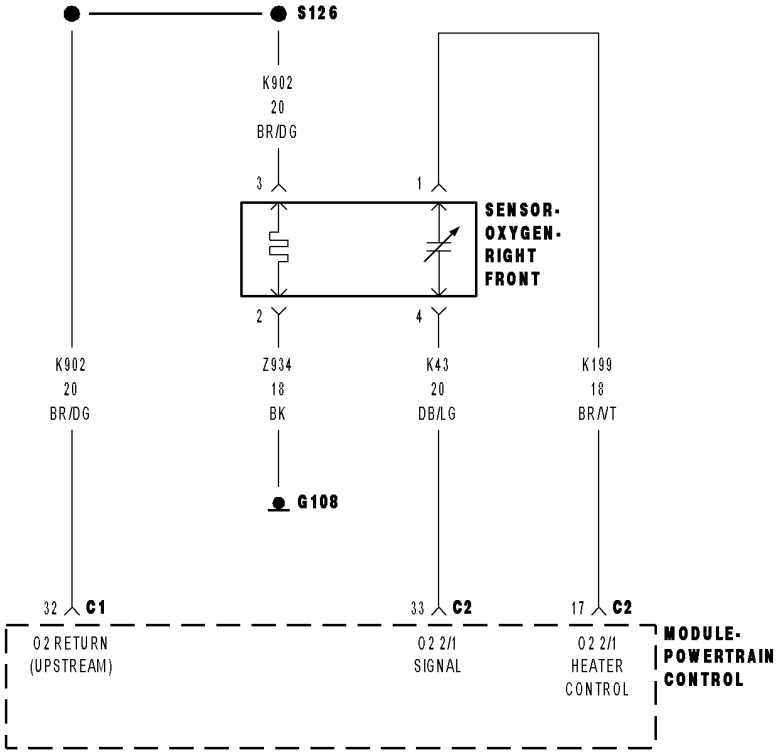
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

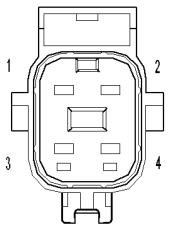
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

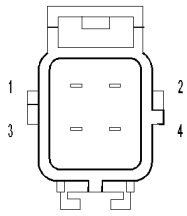
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0151-O2 SENSOR 2/1 CIRCUIT LOW

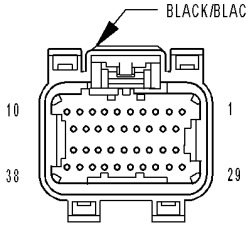




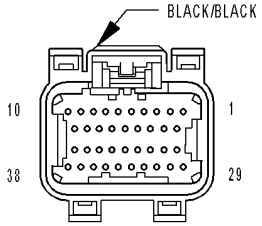
SENSOR-
OXYGEN-
RIGHT FRONT
(3.7L)



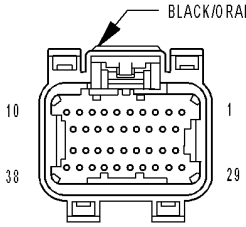
SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



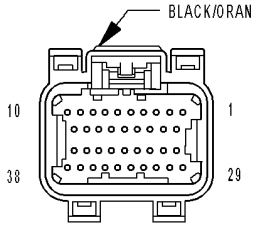
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

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P0151-O2 SENSOR 2/1 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251°C (484°F) with battery voltage greater 10.99 volts.
- **Set Condition:**
  The oxygen sensor signal voltage is below 2.5196 volts for 3 seconds after starting engine. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO GROUND
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 RETURN UPSTREAM CIRCUIT
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (Z934) HEATER GROUND CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR BELOW 2.52 VOLTS

Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, read the 2/1 O2 Sensor voltage.

Is the voltage below 2.52 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K43) O2 2/1 SIGNAL CIRCUIT

Turn the ignition off.
Disconnect the 2/1 O2 Sensor harness connector.
Ignition on, engine not running.
With a scan tool, monitor the 2/1 O2 Sensor voltage.

Is the O2 Sensor voltage above 4.8 volts?

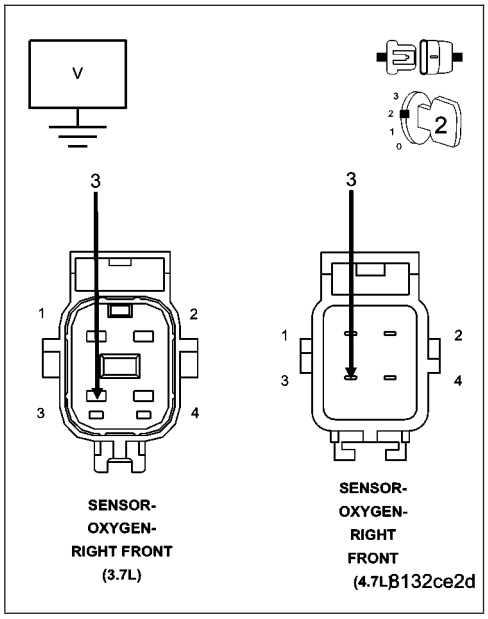
Yes >> Go To 3

No >> Go To 5

P0151-O2 SENSOR 2/1 CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Replace the 2/1 O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

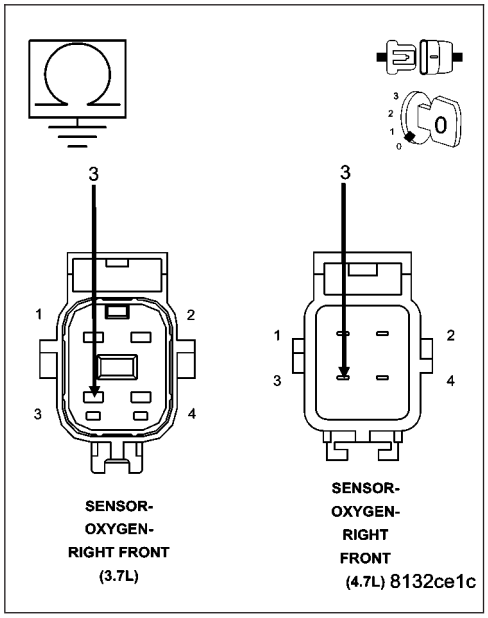
No >> Go To 4

4. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K902) O2 Return Upstream circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0151-O2 SENSOR 2/1 CIRCUIT LOW (CONTINUED)

5. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

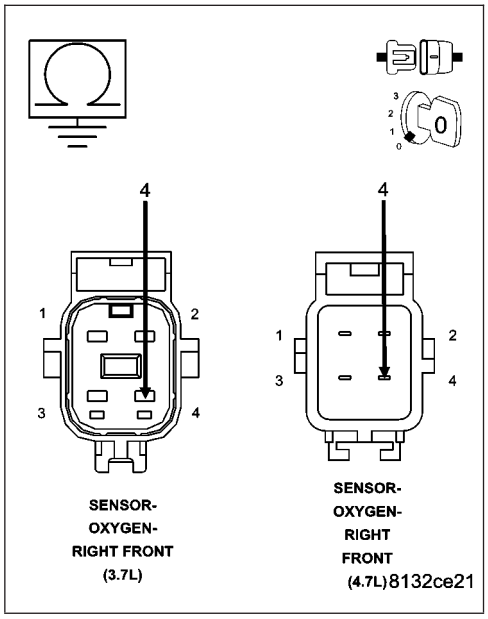
Measure the resistance between ground and the (K43) O2 2/1 Signal circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K43) O2 2/1 Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO (K902) O2 RETURN UPSTREAM CIRCUIT

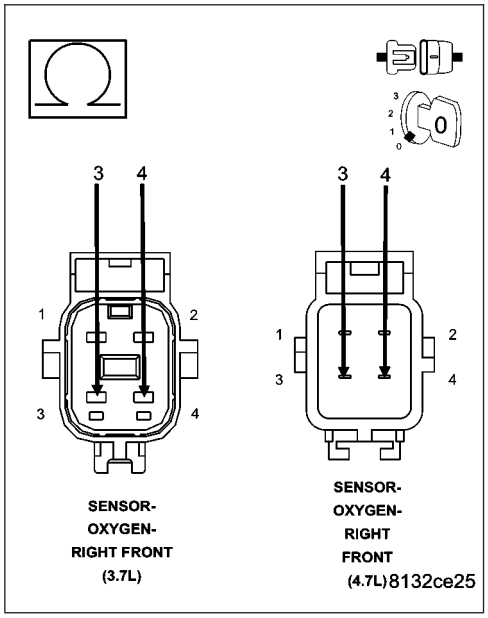
Measure the resistance between the (K43) O2 2/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K902) O2 Return Upstream circuit and the (K43) O2 2/1 Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

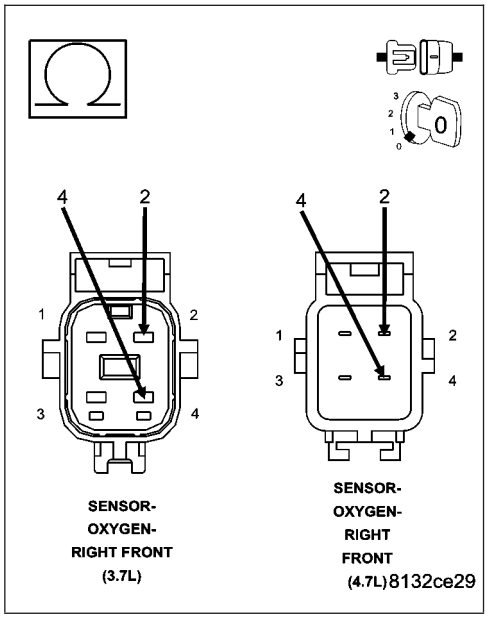
No >> Go To 7



P0151-O2 SENSOR 2/1 CIRCUIT LOW (CONTINUED)

7. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (Z934) HEATER GROUND CIRCUIT

Measure the resistance between the (K43) O2 2/1 Signal circuit and the (Z934) O2 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (Z934) O2 Heater ground circuit and the (K43) O2 2/1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

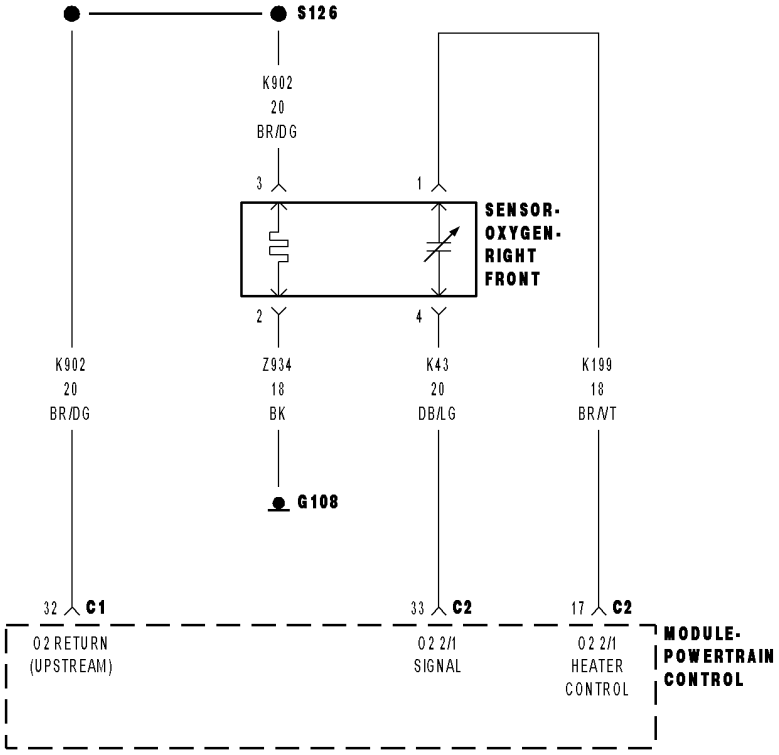
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

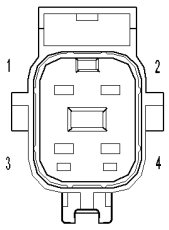
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

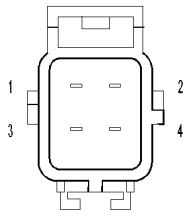
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0152-O2 SENSOR 2/1 CIRCUIT HIGH

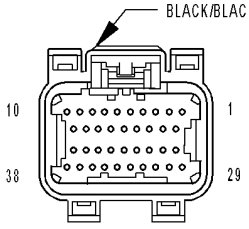




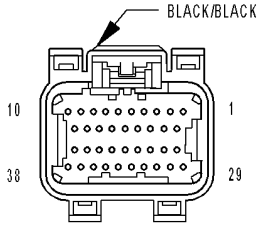
SENSOR-
OXYGEN-
RIGHT FRONT
(3.7L)



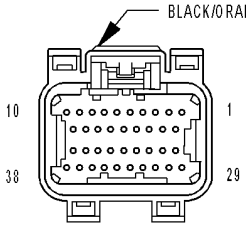
SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



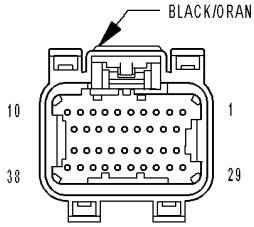
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

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P0152-O2 SENSOR 2/1 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  O2 Sensor Heater Temperature is greater than 496°C (925°F) and battery voltage greater than 10.99 volts.
- **Set Condition:**
  The Oxygen Sensor voltage is above 3.99 volts for 30 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE
(K43) O2 2/1 SIGNAL CIRCUIT OPEN
(K902) O2 RETURN UPSTREAM CIRCUIT OPEN
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR ABOVE 3.99 VOLTS

NOTE: When only one O2 Sensor is shorted to voltage, the scan tool will display all O2 Sensor voltage readings at approximately 5.0 volts. When diagnosing this DTC, only diagnose the O2 Sensor that set the DTC.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 2/1 O2 Sensor voltage.

Is the voltage above 3.99 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0152-O2 SENSOR 2/1 CIRCUIT HIGH (CONTINUED)

2. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Start the engine and allow the engine to idle.

Disconnect the 2/1 O2 Sensor harness connector.

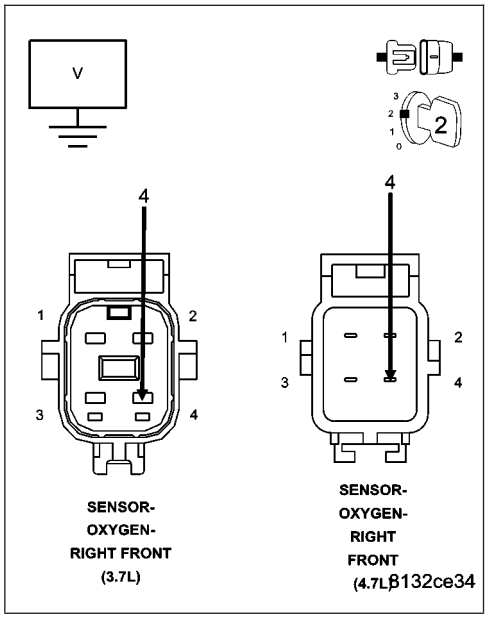
Measure the voltage on the (K43) O2 Sensor 2/1 Signal circuit in the 2/1 O2 Sensor harness connector.

NOTE: Measure the voltage in reference to ground, not the (K902) O2 Return Upstream circuit.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K43) O2 Sensor 2/1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

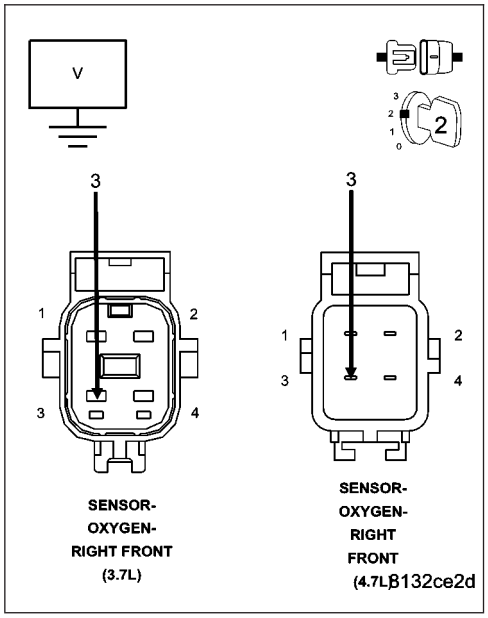
Ignition on, engine not running.

Measure the voltage on the (K902) O2 Return Upstream circuit in the 2/1 O2 Sensor harness connector.

Is there any voltage present?

Yes >> Repair the short to battery voltage in the (K902) O2 Return Upstream circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0152-O2 SENSOR 2/1 CIRCUIT HIGH (CONTINUED)

4. O2 SENSOR

Turn the ignition off.

Connect the C1 PCM harness connector.

Connect a jumper wire between the (K43) O2 2/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Ignition on, engine not running.

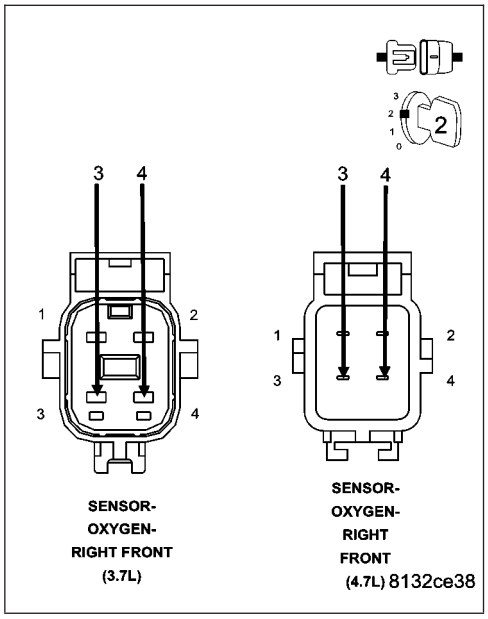
With a scan tool, monitor the 2/1 O2 Sensor voltage.

Is the voltage between 2.3 and 2.7 volts with the jumper wire in place?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.



5. (K43) O2 2/1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

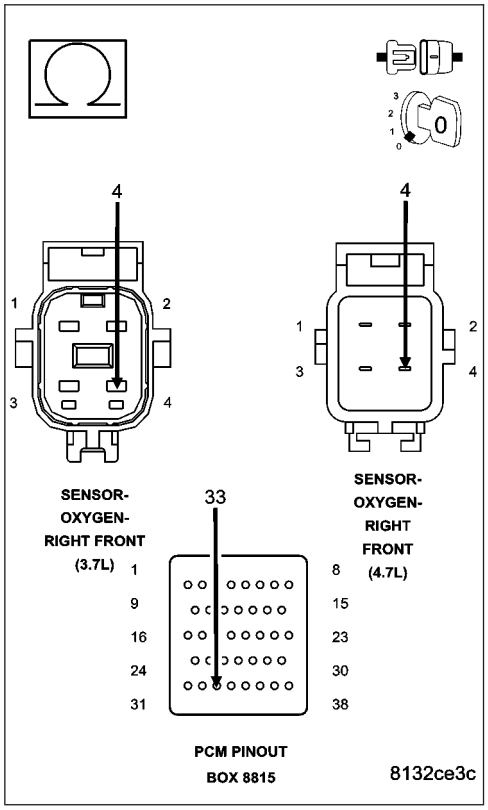
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K43) O2 2/1 Signal circuit from the 2/1 O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

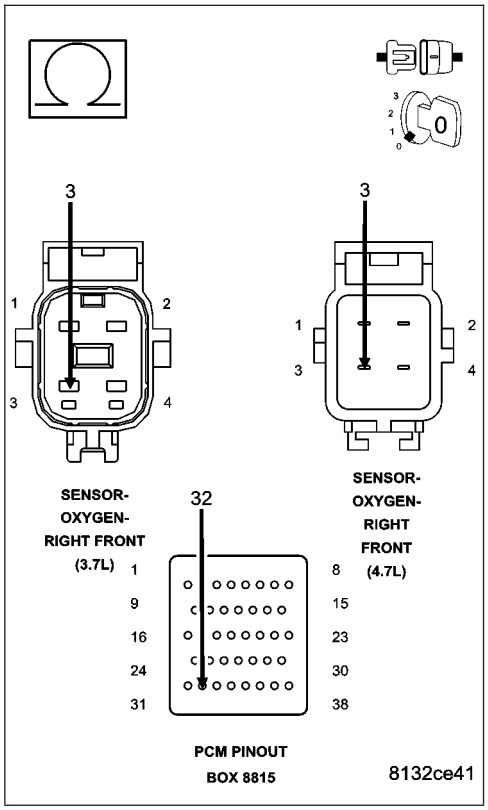
No >> Repair the open in the (K43) O2 2/1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0152-O2 SENSOR 2/1 CIRCUIT HIGH (CONTINUED)

6. (K902) O2 RETURN UPSTREAM CIRCUIT OPEN

Measure the resistance of the (K902) O2 Return Upstream circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K902) O2 Return Upstream circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

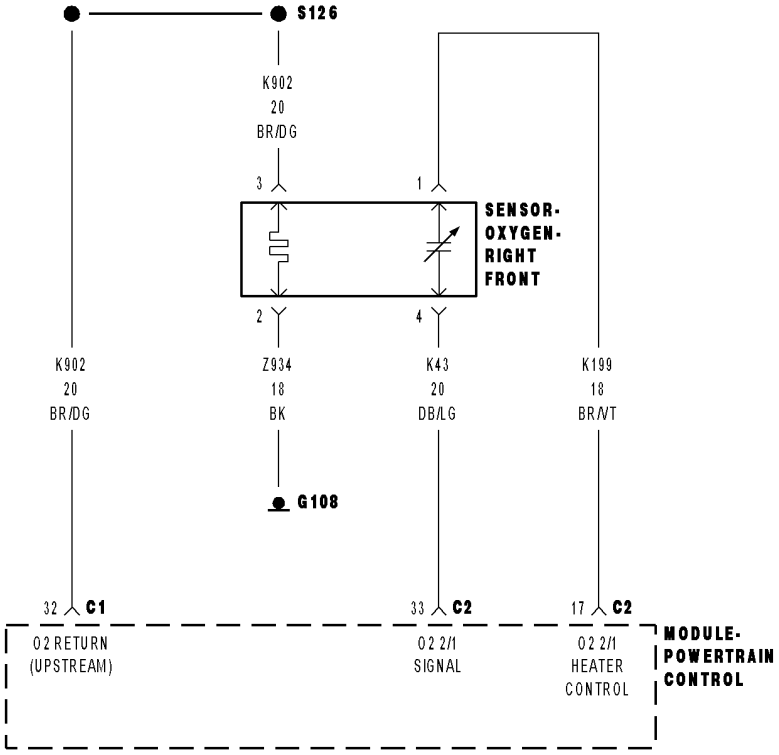
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

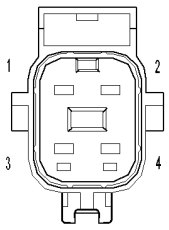
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

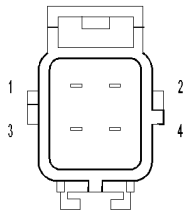
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0153-O2 SENSOR 2/1 SLOW RESPONSE

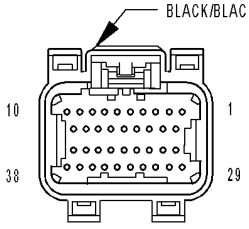




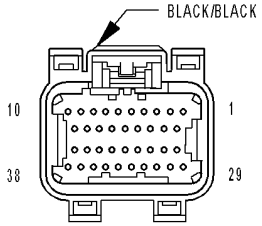
SENSOR-
OXYGEN-
RIGHT FRONT
(3.7L)



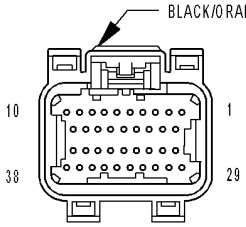
SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



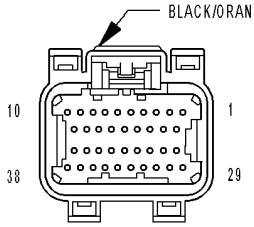
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

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P0153-O2 SENSOR 2/1 SLOW RESPONSE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Vehicle is started and driven between 20 and 55 MPH with the Throttle open for a minimum of 120 seconds. Coolant greater than 70°C (158°F). Catalytic Converter Temp greater than 600°C (1112°F) and EVAP Purge is active.
- **Set Condition:**
  The oxygen sensor signal voltage switches less than 16 times from lean to rich within 20 seconds during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K43) O2 2/1 SIGNAL CIRCUIT
(K902) O2 RETURN UPSTREAM CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.
Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.
With a scan tool, read DTCs and record the related Freeze Frame data.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EXHAUST LEAK

Start the engine.
Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0153-O2 SENSOR 2/1 SLOW RESPONSE (CONTINUED)

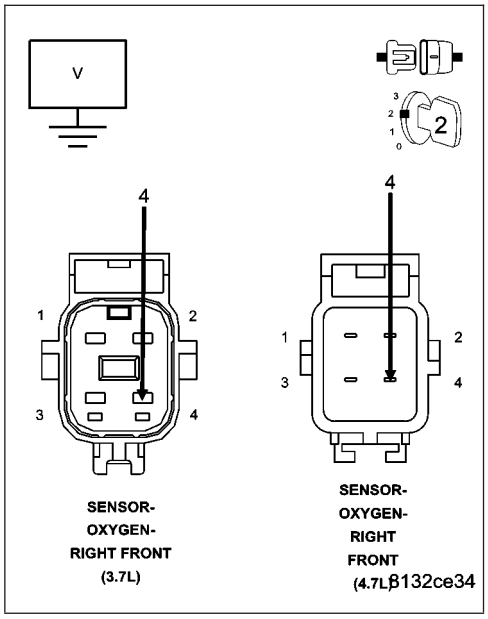
3. (K43) O2 2/1 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K43) O2 2/1 Signal circuit in the O2 Sensor harness connector.



Is the voltage between 4.5 and 5.0 volts?

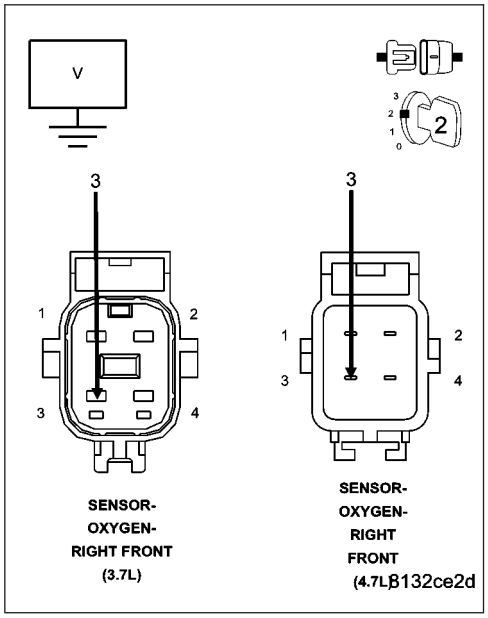
Yes >> Go To 4

No >> Check the (K43) O2 2/1 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K902) O2 RETURN UPSTREAM CIRCUIT

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Go To 5

No >> Check the (K902) O2 Return Upstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. O2 SENSOR

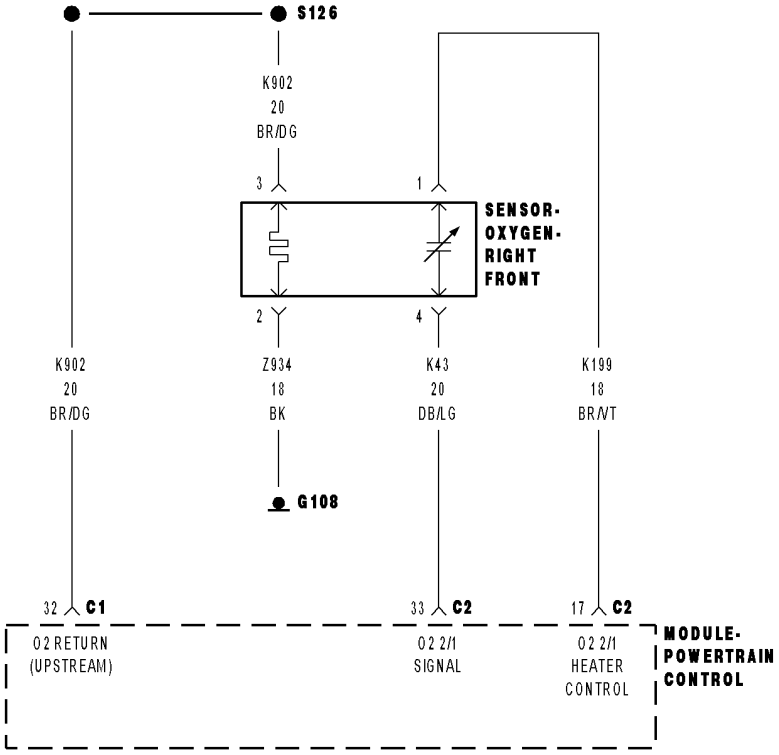
If there are no possible causes remaining, view repair.

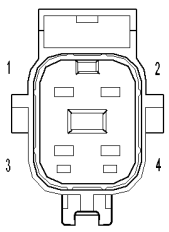
Repair

Replace the O2 Sensor.

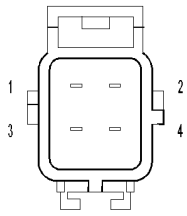
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0155-O2 SENSOR 2/1 HEATER PERFORMANCE

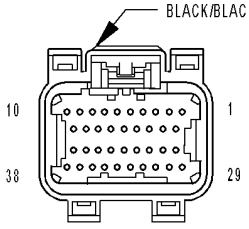




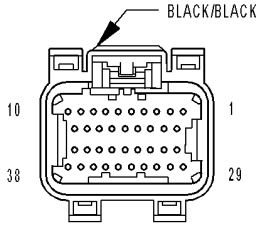
SENSOR-
OXYGEN-
RIGHT FRONT
(3.7L)



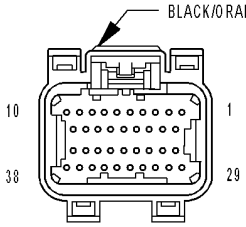
SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



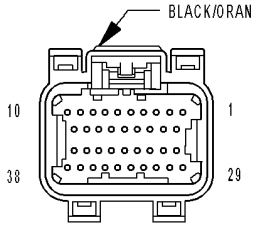
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

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P0155-O2 SENSOR 2/1 HEATER PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**
  Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.
- **Set Condition:**
  No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN
(Z934) O2 HEATER GROUND CIRCUIT OPEN
O2 SENSOR HEATER ELEMENT
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 2/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0155-O2 SENSOR 2/1 HEATER PERFORMANCE (CONTINUED)

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the 2/1 O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the O2 Sensor connector between the O2 Heater Control terminal and the O2 Heater ground terminal.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

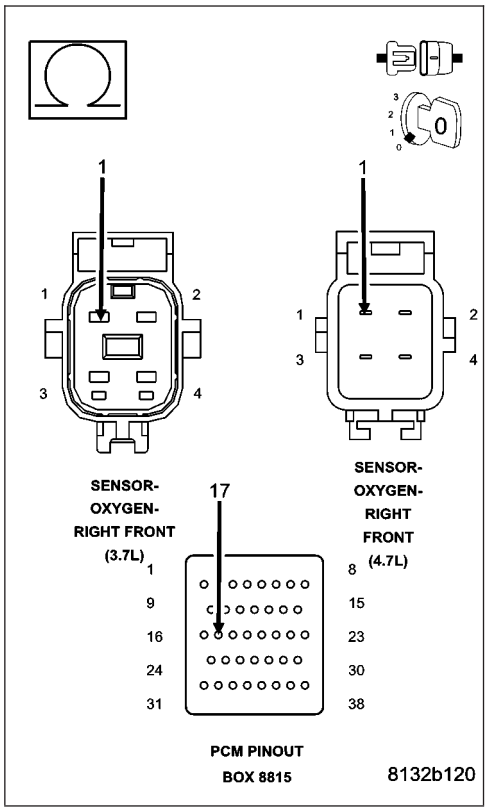
---

3. (K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K199) O2 2/1 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 0.5 of an ohm?

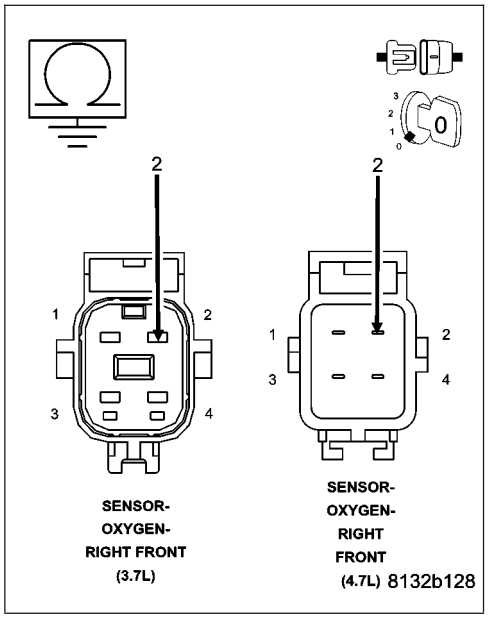
Yes >> Go To 4

No >> Repair the excessive resistance in the (K199) O2 2/1 Heater Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0155-O2 SENSOR 2/1 HEATER PERFORMANCE (CONTINUED)

4. (Z934) O2 SENSOR HEATER GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z934) O2 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 0.5 of an ohm?

Yes >> Go To 5

No >> Repair the excessive resistance in the (Z934) O2 Heater ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

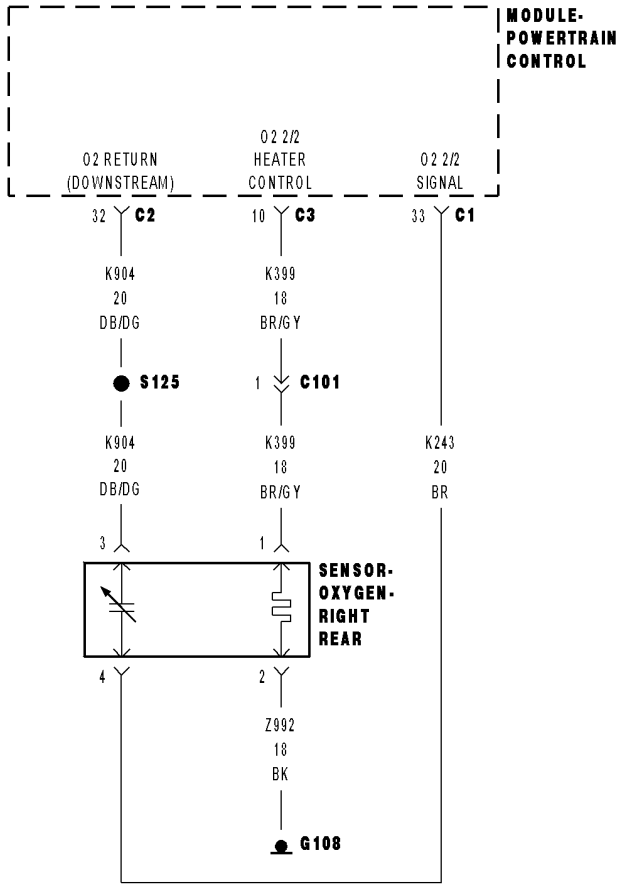
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

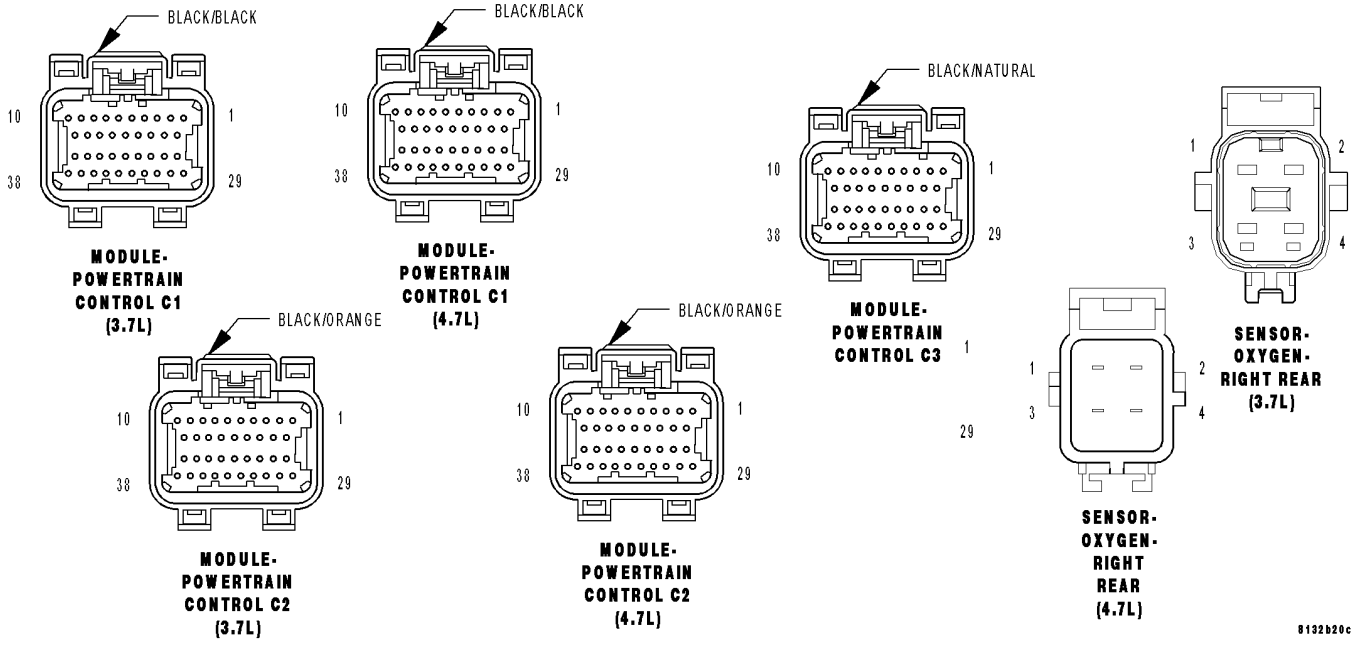
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0157-O2 SENSOR 2/2 CIRCUIT LOW





P0157-O2 SENSOR 2/2 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251°C (484°F) with battery voltage greater 10.99 volts.
- **Set Condition:**
  The oxygen sensor signal voltage is below 2.5196 volts for 3 seconds after starting engine. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND
(K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO GROUND
(K243) O2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 RETURN DOWNSTREAM CIRCUIT
(K243) O2 SIGNAL CIRCUIT SHORTED TO THE (Z992) O2 2/2 HEATER GROUND CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR BELOW 2.52 VOLTS

Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, read the 2/2 O2 Sensor voltage.

Is the voltage below 2.52 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K243) O2 2/2 SIGNAL CIRCUIT

Turn the ignition off.
Disconnect the 2/2 O2 Sensor harness connector.
Ignition on, engine not running.
With a scan tool, monitor the 2/2 O2 Sensor voltage.

Is the O2 Sensor voltage above 4.8 volts?

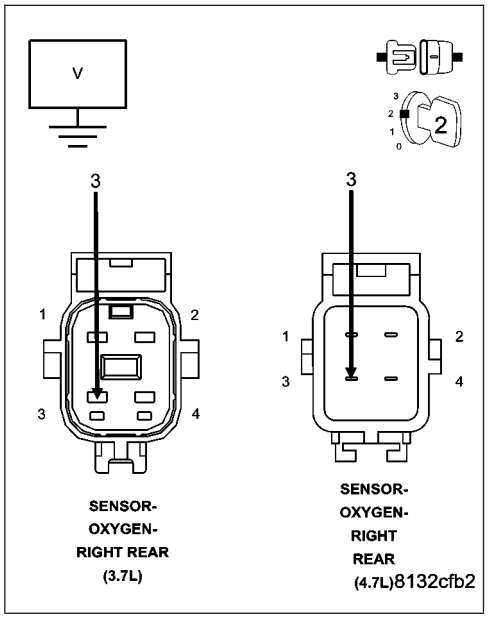
Yes >> Go To 3

No >> Go To 5

P0157-O2 SENSOR 2/2 CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Measure the voltage on the (K904) O2 Return Donwstream circuit in the O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

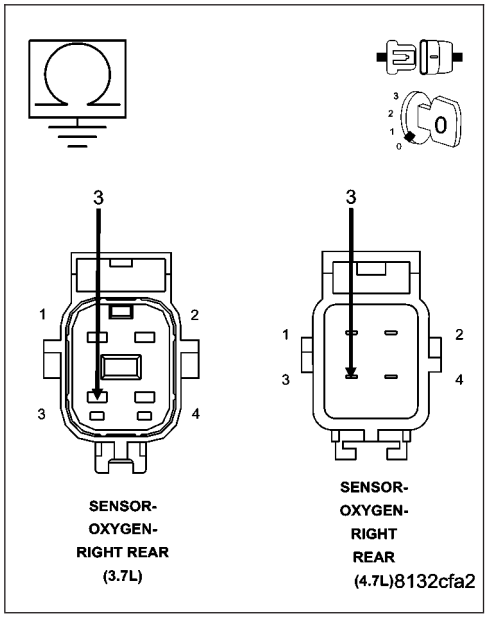
No >> Go To 4

4. (K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K904) O2 Return Downstream circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0157-O2 SENSOR 2/2 CIRCUIT LOW (CONTINUED)

5. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1and C2 PCM harness connectors.

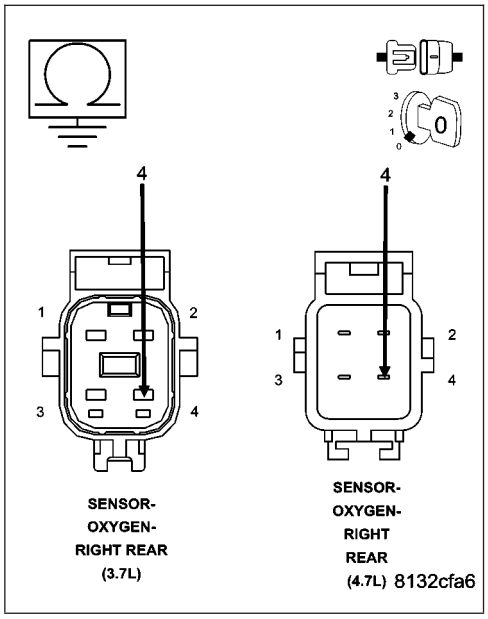
Measure the resistance between ground and the (K243) O2 2/2 Signal circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K243) O2 2/2 Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 RETURN DOWNSTREAM CIRCUIT

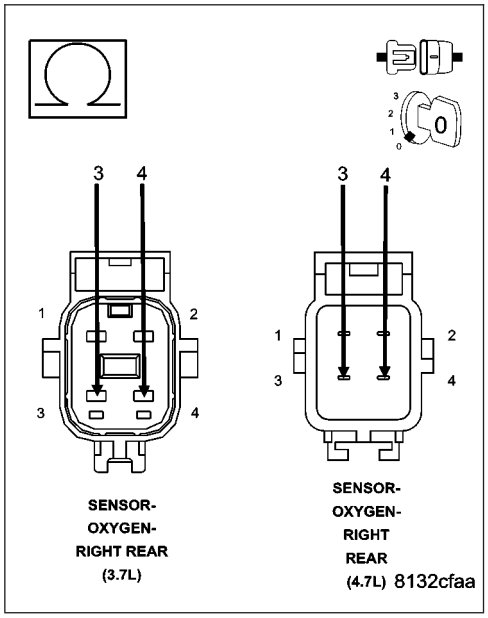
Measure the resistance between the (K243) O2 2/2 Signal circuit and the (K904) O2 Return Dowstream circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K904) O2 Return Downstream circuit and the (K243) O2 2/2 Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

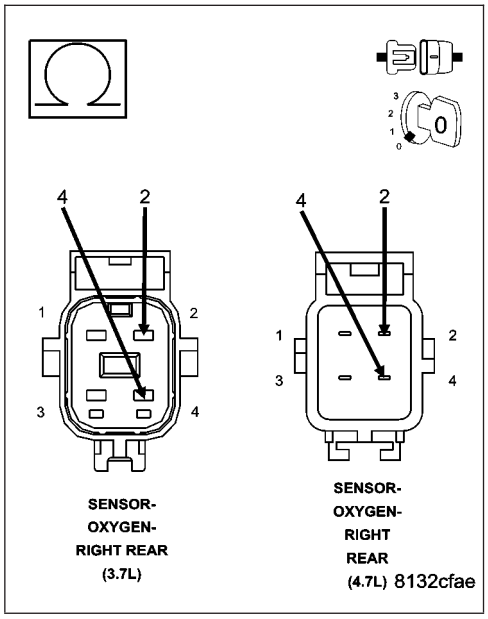
No >> Go To 7



P0157-O2 SENSOR 2/2 CIRCUIT LOW (CONTINUED)

7. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO THE (Z992) O2 2/2 HEATER GROUND CIRCUIT

Measure the resistance between the (K243) O2 2/2 Signal circuit and the (Z992) O2 2/2 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (Z992) O2 2/2 Heater ground circuit and the (K243) O2 2/2 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

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8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

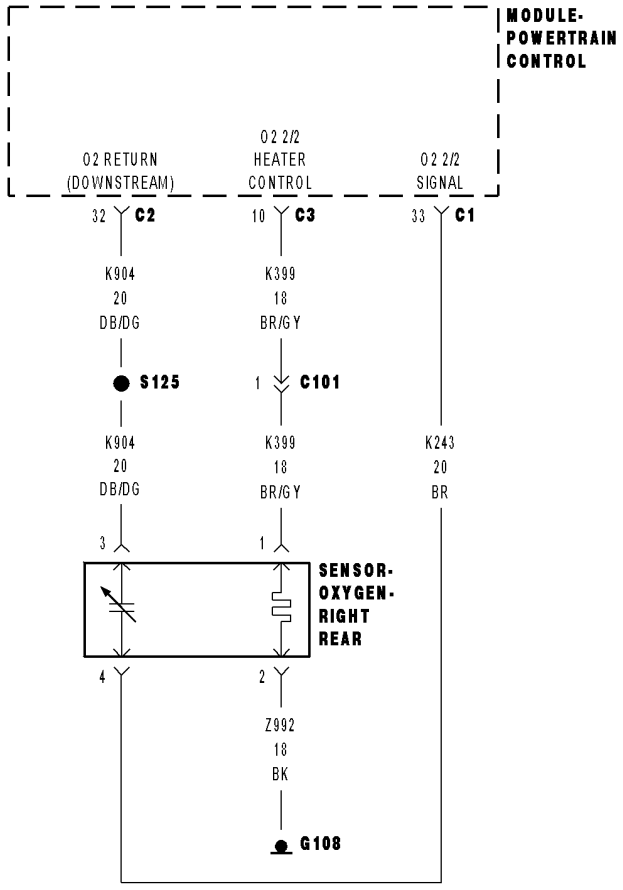
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

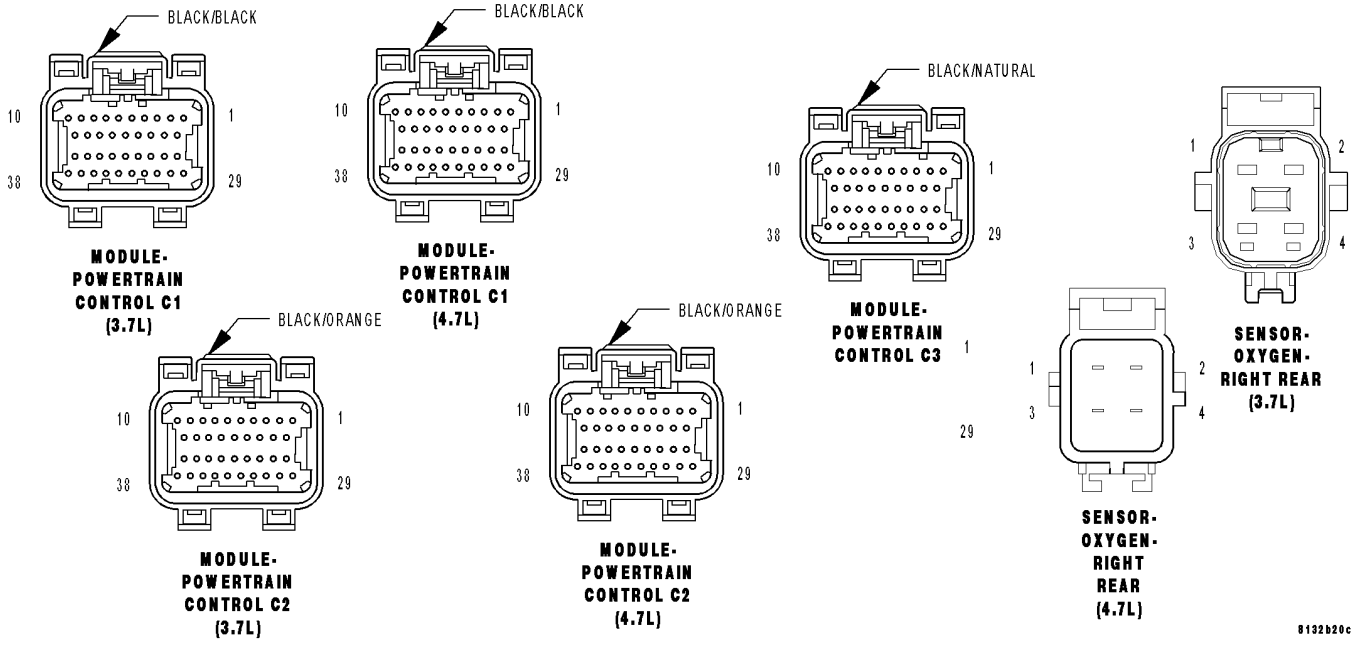
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0158-O2 SENSOR 2/2 CIRCUIT HIGH





P0158-O2 SENSOR 2/2 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  O2 Sensor Heater Temperature is greater than 496°C (925°F) and battery voltage greater than 10.99 volts.
- **Set Condition:**
  The Oxygen Sensor voltage is above 3.99 volts for 30 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE
(K243) O2 2/2 SIGNAL CIRCUIT OPEN
(K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR ABOVE 3.99 VOLTS

NOTE: When only one O2 Sensor is shorted to voltage, the scan tool will display all O2 Sensor voltage readings at approximately 5.0 volts. When diagnosing this DTC, only diagnose the O2 Sensor that set the DTC.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 2/2 O2 Sensor voltage.

Is the voltage above 3.99 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0158-O2 SENSOR 2/2 CIRCUIT HIGH (CONTINUED)

2. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Start the engine and allow the engine to idle.

Disconnect the 2/2 O2 Sensor harness connector.

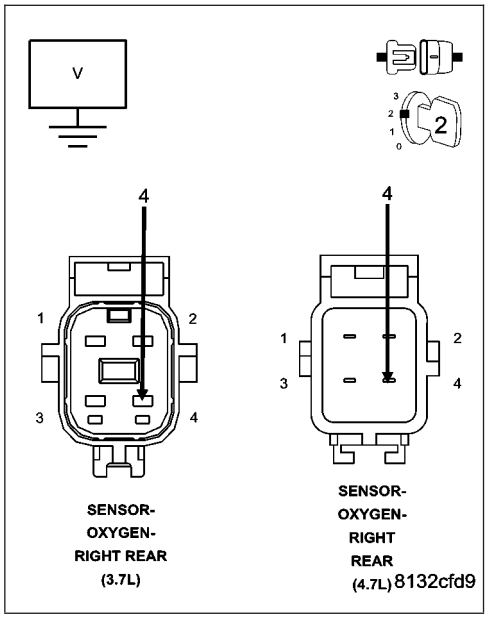
Measure the voltage on the (K243) O2 Sensor 2/2 Signal circuit in the O2 Sensor harness connector.

NOTE: Measure the voltage in reference to ground, not the (K904) O2 Return Downstream circuit.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K243) O2 Sensor 2/2 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

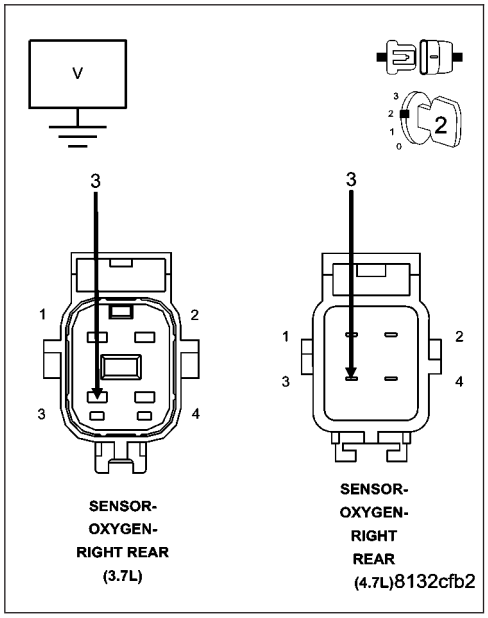
Ignition on, engine not running.

Measure the voltage on the (K904) O2 Return Downstream circuit in the 2/2 O2 Sensor harness connector.

Is there any voltage present?

Yes >> Repair the short to battery voltage in the (K904) O2 Return Downstream circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0158-O2 SENSOR 2/2 CIRCUIT HIGH (CONTINUED)

4. O2 SENSOR

Turn the ignition off.

Connect the C2 PCM harness connector.

Connect a jumper wire between the (K243) O2 2/2 Signal circuit and the (K904) O2 Return Downstream circuit in the 2/2 O2 Sensor harness connector.

Ignition on, engine not running.

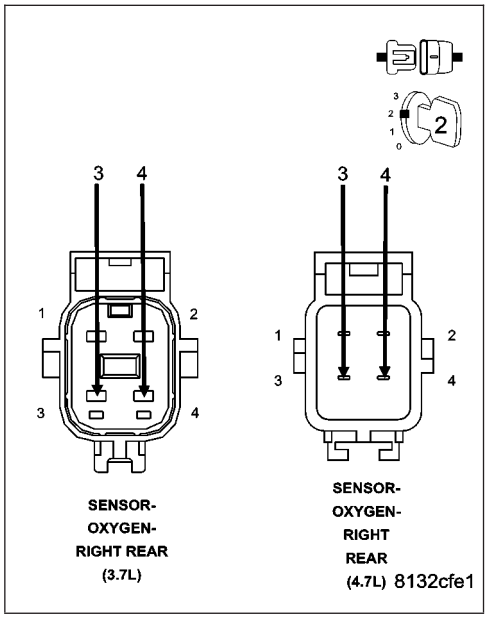
With a scan tool, monitor the 2/2 O2 Sensor voltage.

Is the voltage between 2.3 and 2.7 volts with the jumper wire installed?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.



5. (K243) O2 2/2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

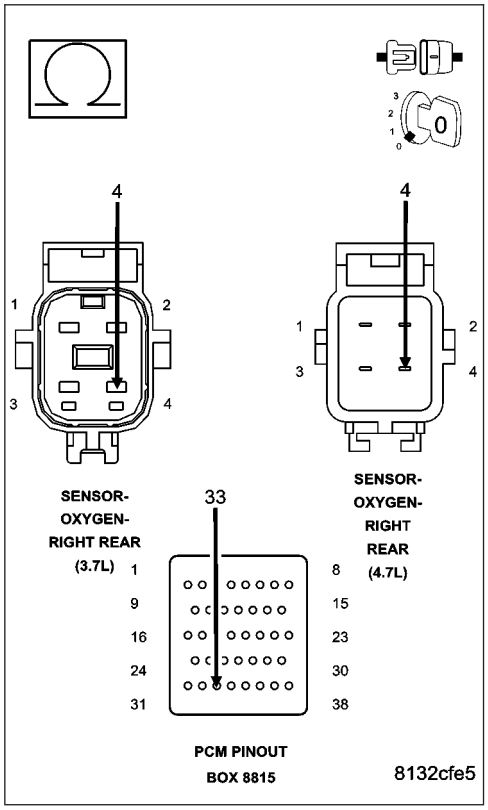
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K243) O2 2/2 Signal circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

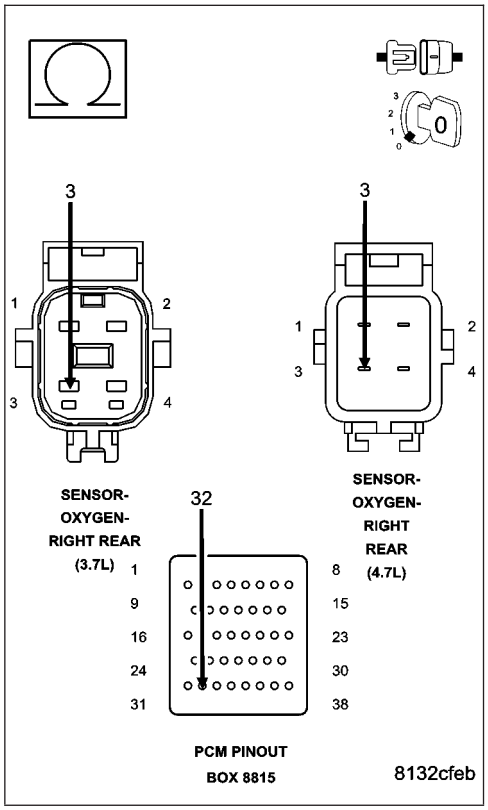
No >> Repair the open in the (K243) O2 2/2 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0158-O2 SENSOR 2/2 CIRCUIT HIGH (CONTINUED)

6. (K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN

Measure the resistance of the (K904) O2 Return Downstream circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K904) O2 Return Downstream circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

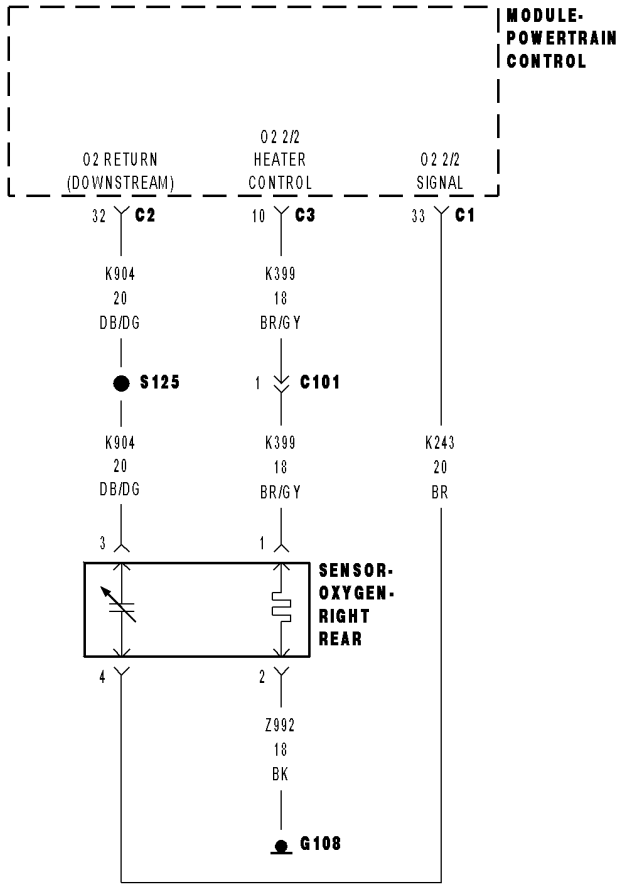
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

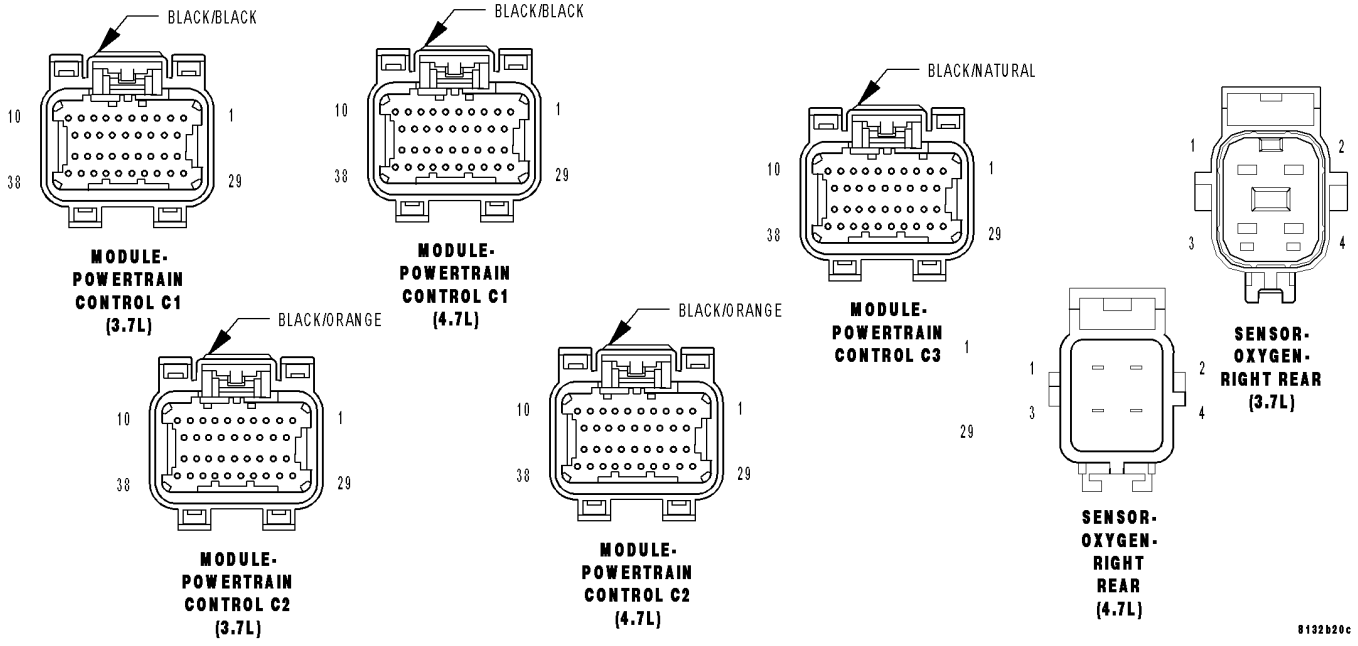
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0159-O2 SENSOR 2/2 SLOW RESPONSE





P0159-O2 SENSOR 2/2 SLOW RESPONSE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The downstream O2 Sensor is located in the exhaust path behind the catalytic converter, is monitored for proper response to assure optimum catalytic converter efficiency. The downstream O2 response monitor is intended to diagnose a downstream O2 sensor that is not moving or stuck in a voltage window and to insure accurate information for catalyst monitor diagnosis.

- **When Monitored:**
  Vehicle is started and driven between 20 and 55 MPH with the Throttle open for a minimum of 120 seconds. Coolant greater than 70°C (158°F). Catalytic Converter Temp greater than 600°C (1112°F) and EVAP Purge is active.
- **Set Condition:**
  The oxygen sensor signal voltage switches less than 16 times from lean to rich within 20 seconds during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K243) O2 2/2 SIGNAL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.
Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EXHAUST LEAK

Start the engine.
Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0159-O2 SENSOR 2/2 SLOW RESPONSE (CONTINUED)

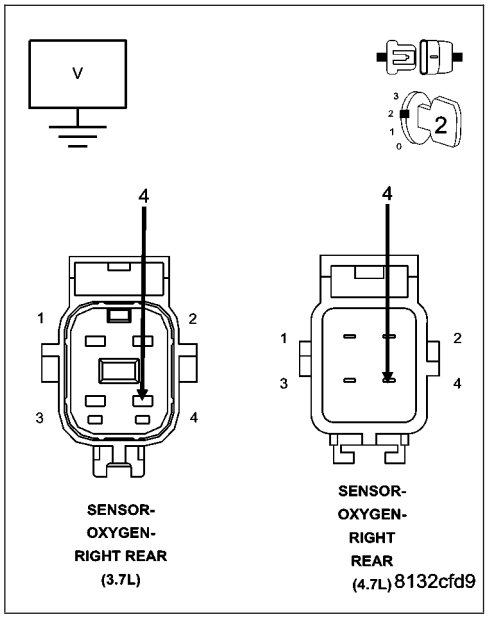
3. (K243) O2 2/2 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 2/2 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K243) O2 2/2 Signal circuit in the O2 Sensor harness connector.



Is the voltage approximately 5.0 volts?

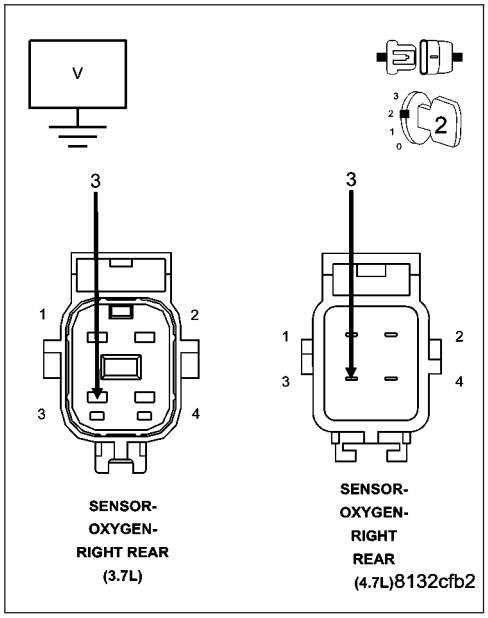
Yes >> Go To 4

No >> Check the (K243) O2 2/2 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K904) O2 RETURN DOWNSTREAM CIRCUIT

Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Go To 5

No >> Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. O2 SENSOR

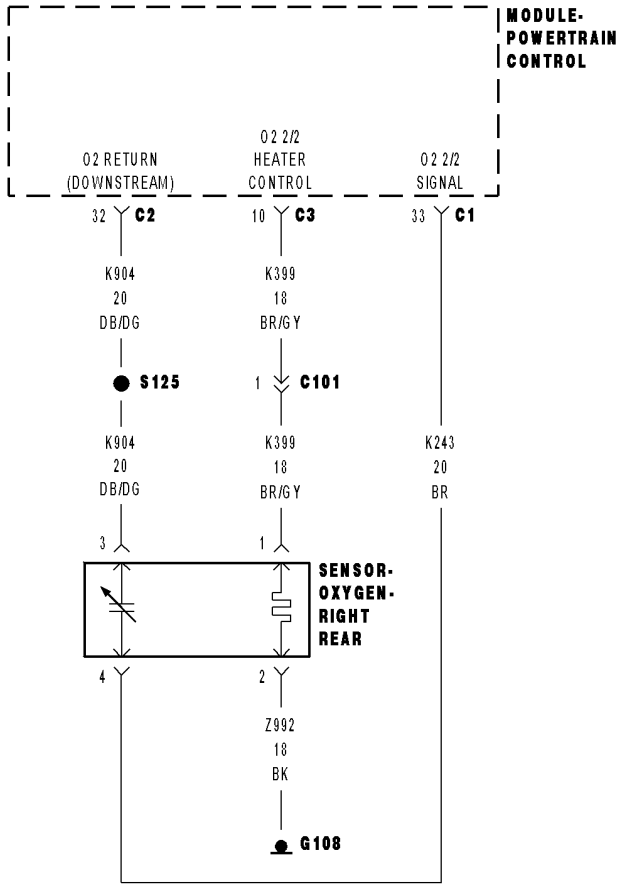
If there are no possible causes remaining, view repair.

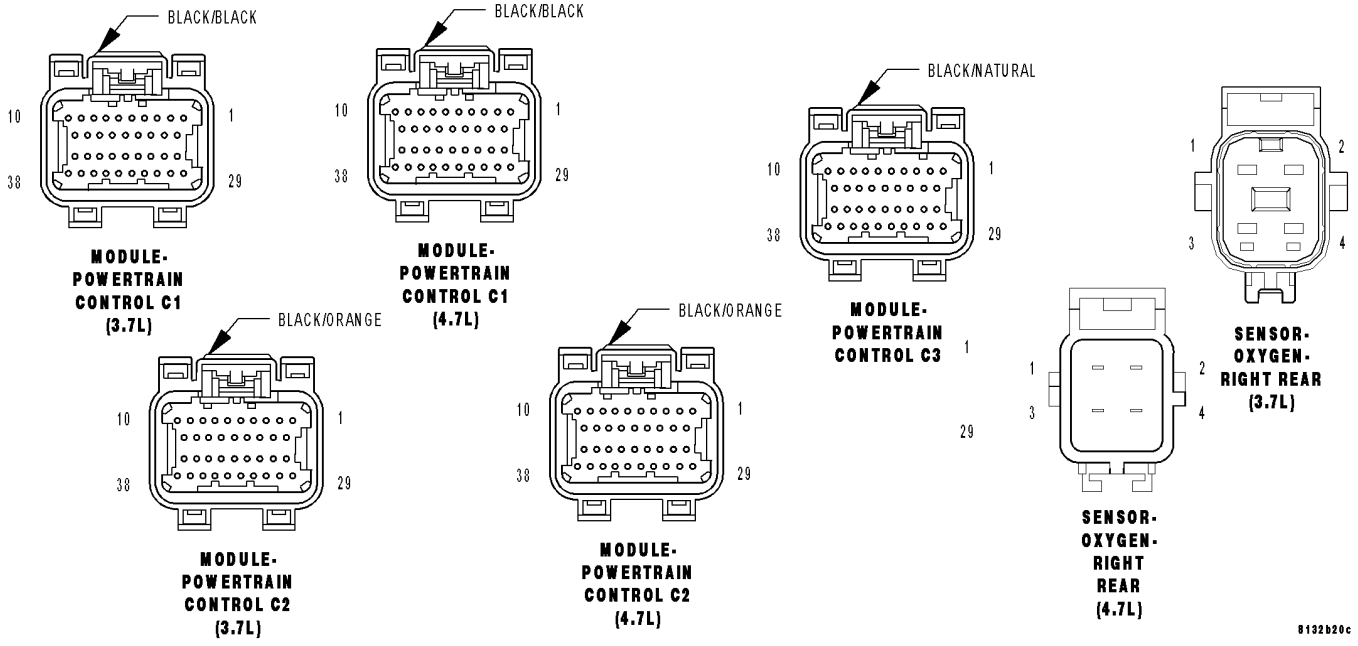
Repair

Replace the O2 Sensor

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0161-O2 SENSOR 2/2 HEATER PERFORMANCE





P0161-O2 SENSOR 2/2 HEATER PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**
  Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.
- **Set Condition:**
  No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN
(Z922) O2 2/2 HEATER GROUND CIRCUIT OPEN
O2 SENSOR HEATER ELEMENT
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With a scan tool, monitor 2/2 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0161-O2 SENSOR 2/2 HEATER PERFORMANCE (CONTINUED)

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the 2/2 O2 Heater Element, between the O2 Heater Control terminal and the O2 Heater ground terminal in the O2 Sensor connector.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

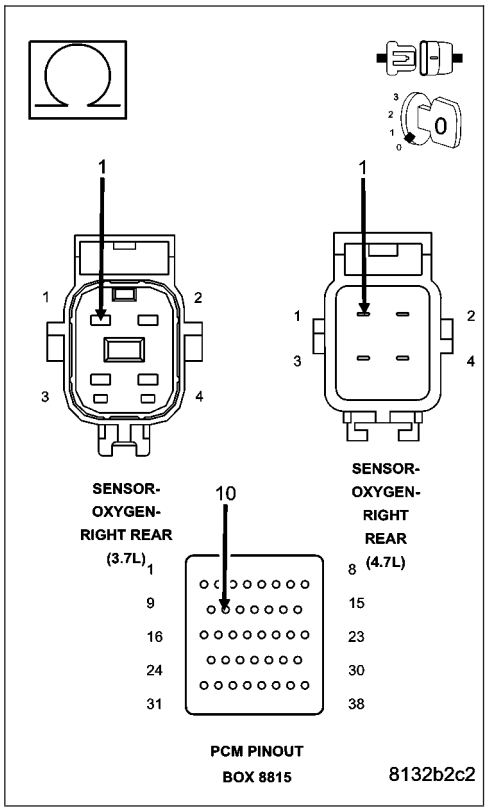
---

3. (K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN

Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K399) O2 2/2 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 0.5 of an ohm?

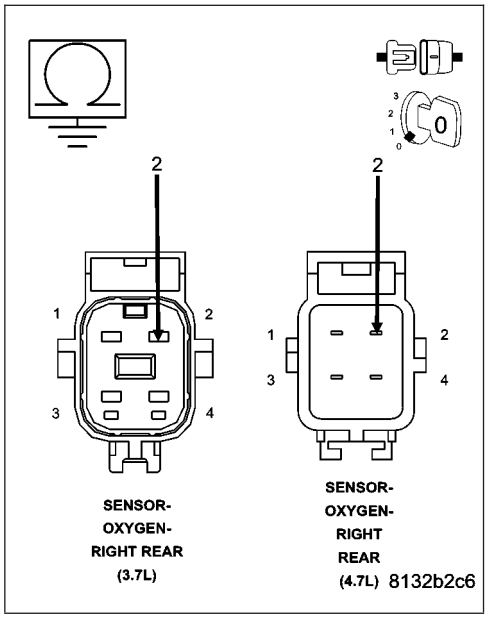
Yes >> Go To 4

No >> Repair the excessive resistance in the (K399) O2 2/2 Heater Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0161-O2 SENSOR 2/2 HEATER PERFORMANCE (CONTINUED)

4. (Z992) O2 2/2 HEATER GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z992) O2 2/2 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 0.5 of an ohm?

Yes >> Go To 5

No >> Repair the excessive resistance in the (Z992) O2 2/2 Heater ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

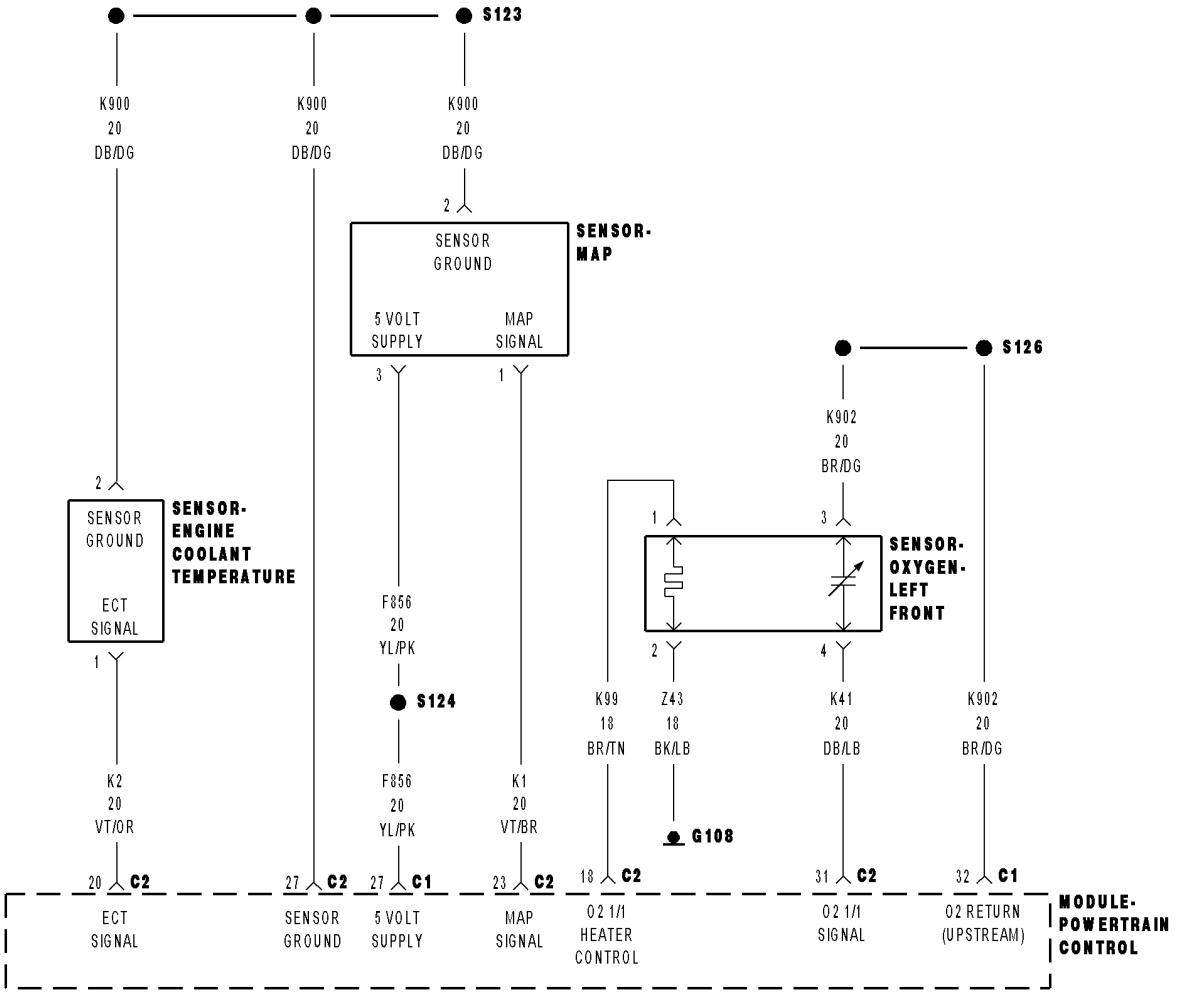
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

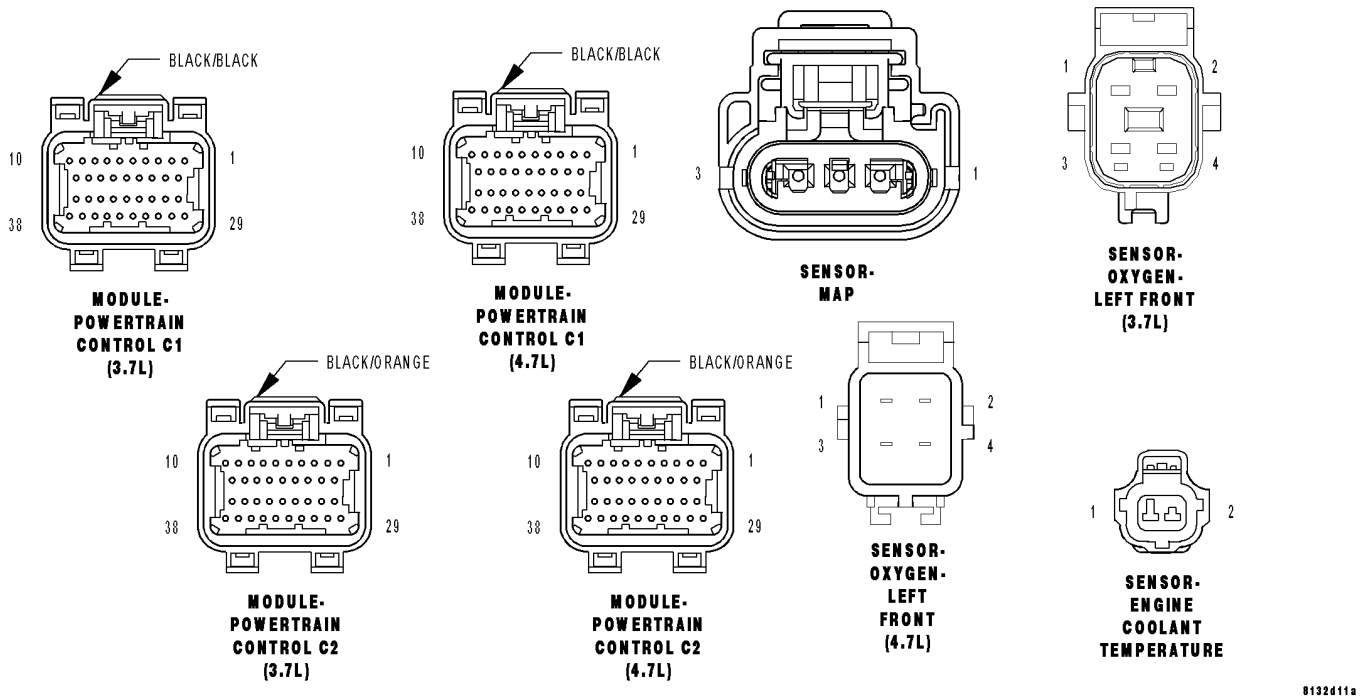
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0171-FUEL SYSTEM 1/1 LEAN





P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL

Possible Causes
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
O2 SIGNAL CIRCUIT
O2 RETURN CIRCUIT
O2 SENSOR HEATER OPERATION
O2 SENSOR
MAP SENSOR OPERATION
ECT SENSOR OPERATION
ENGINE MECHANICAL
FUEL FILTER/PRESSURE REGULATOR (HIGH)
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose all other trouble codes before continuing.

NOTE: Check for contaminants that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Turn the ignition off.

CAUTION: Stop All Actuations.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

Go To 3

Above Specification

Replace the fuel filter/pressure regulator.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

Below Specification

Go To 12

---

3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensor's Signal or Return circuit is shorted to ground the scan tool will display all O2 Sensor voltage readings low. The O2 Sensor that is shorted to ground will display a voltage reading near or at 0 volts.

NOTE: If one of the O2 Sensor Signal or Return circuits are shorted to voltage, the scan tool will display all O2 Sensor voltage readings high.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With a scan tool, monitor all of the O2 Sensor voltage readings.

Is the voltage switching between 2.5 and 3.4 volts for all the O2 Sensors?

Yes >> Go To 4

No >> Go To 8

P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

4. 1/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the 1/1 O2 Heater Test.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Replace the 1/1 O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading within 1″ of the Vacuum Gauge reading?

Yes >> Go To 6

No >> Replace the MAP Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With a scan tool, read the Engine Coolant Temperature (ECT) Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the ECT Sensor value. The temperature value change should be a smooth transition from start up to normal operating temperature 82°C (180°F). The value should reach at least 82°C (180°F).

Did the ECT value increase smoothly and did it reach at least 180°F (82°C)?

Yes >> Go To 7

No >> Replace the Engine Coolant Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

7. ENGINE MECHANICAL

Turn the ignition off.

Check for any of the following conditions/mechanical concerns.

AIR INDUCTION SYSTEM - must be free from leaks.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

---

8. 1/1 O2 SENSOR

Ignition on, engine not running.

Disconnect the 1/1 O2 Sensor harness connector.

With a scan tool, monitor the 1/1 O2 Sensor voltage.

O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

Connect a jumper wire between the (K41) Signal circuit and the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.

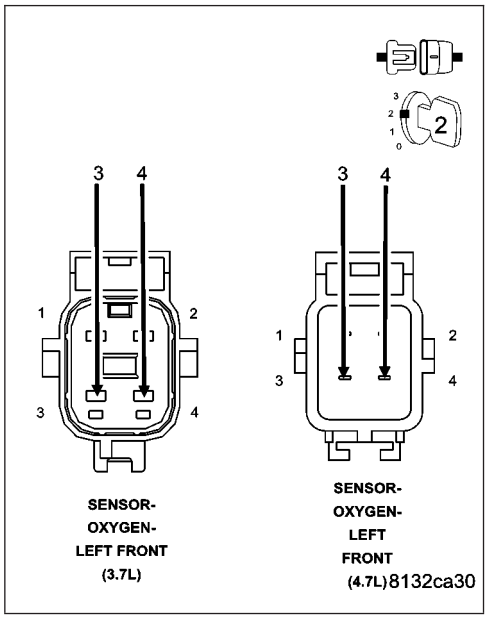
NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor voltage change from 5.0 volts to 2.5 volts with the jumper wire installed?

Yes >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

NOTE: Remove the jumper wire before continuing.



P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

9. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT

With a scan tool, monitor the 1/1 O2 Sensor voltage reading with the jumper wire removed.

NOTE: The scan tool will display all O2 Sensor voltage readings approximately 5.0 volts when only one O2 Sensor's Signal circuit is shorted to voltage.

NOTE: The scan tool will display one O2 Sensor voltage close to zero and the others will read lower than normal when one O2 Sensor Signal circuit contains excessive resistance.

Is the voltage above 4.8 volts?

Yes >> Go To 10

No >> Check the (K41) O2 Sensor 1/1 Signal circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

10. (K902) O2 UPSTREAM RETURN CIRCUIT

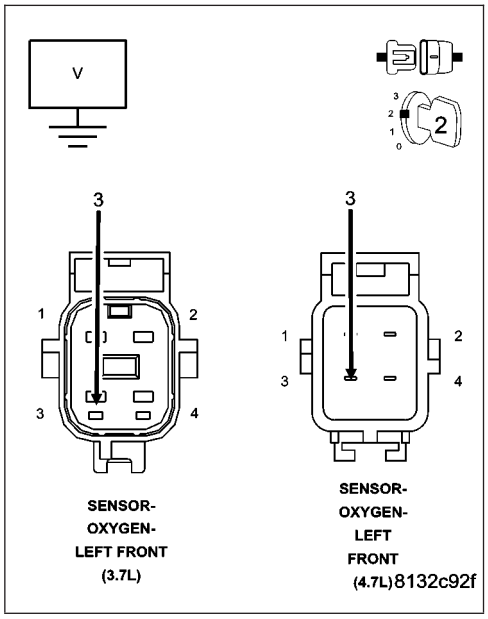
Disconnect the 1/1 O2 Sensor harness connector.

Measure the voltage on the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

Yes >> Go To 11

No >> Check the O2 Return circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertriain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



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11. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

12. RESTRICTED FUEL SUPPLY LINE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special 5/16 fuel line adapter tool #6539 between disconnected fuel line and the fuel pump module.

Attach a fuel pressure test gauge to the T fitting on tool #6539.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

CAUTION: Stop All Actuations.

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

---

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

---

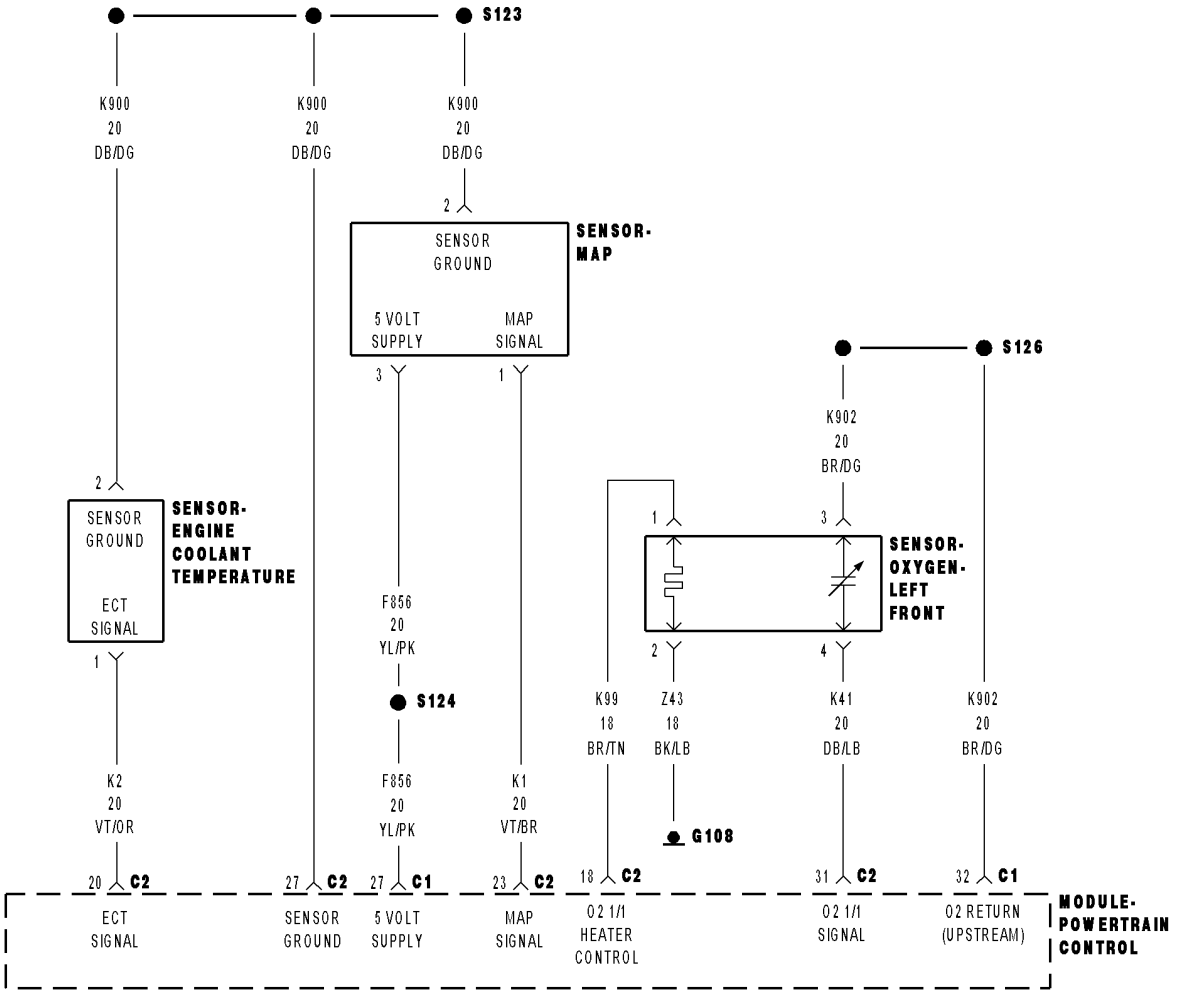
14. FUEL PUMP MODULE

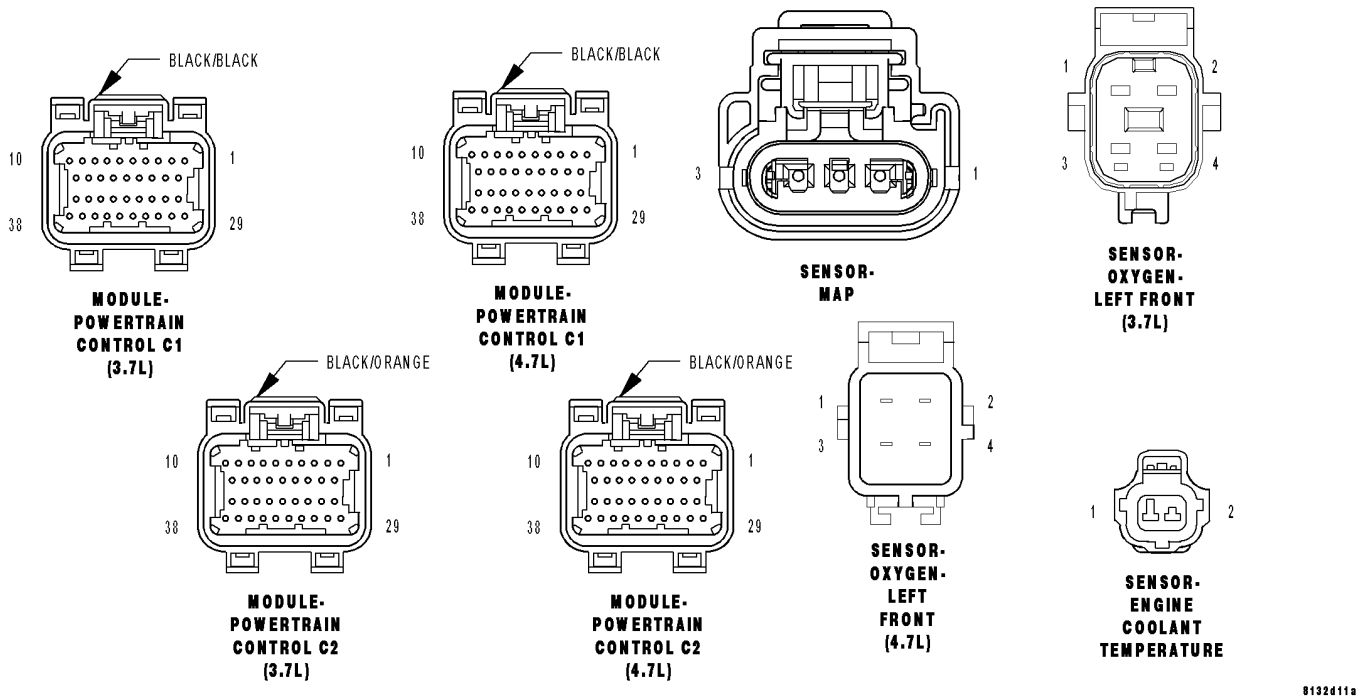
If there are no possible causes remaining, view repair.

Repair

Replace the Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0172-FUEL SYSTEM 1/1 RICH





P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
O2 SENSOR HEATER OPERATION
EVAP PURGE SOLENOID OPERATION
O2 SIGNAL CIRCUIT
O2 RETURN CIRCUIT
O2 SENSOR
MAP SENSOR
ECT SENSOR
ENGINE MECHANICAL
FUEL FILTER/PRESSURE REGULATOR (HIGH)
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminates that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Turn the ignition off.

CAUTION: Stop All Actuations.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

Go To 3

Above Specification

Replace the fuel filter/pressure regulator.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensors Signal or Return circuit is shorted to ground or voltage, all the other O2 Sensor voltage readings will be affected.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With the scan tool, monitor the 1/1 O2 Sensor voltage reading.

Is the voltage switching between 2.5 and 3.4 volts?

Yes >> Go To 4

No >> Go To 9

---

4. 1/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With the scan tool, perform the 1/1 O2 Heater Test.

With the scan tool, monitor the O2 Sensor voltage while performing the Heater test for at least 2 minutes.

Does the voltage stay above 4.5 volts during the Heater test?

Yes >> Replace the O2 Sensor.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With a scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading within 1″ of the Vacuum Gauge reading?

Yes >> Go To 6

No >> Replace the MAP Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Remove the vacuum gauge before continuing.

---

6. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With a scan tool, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F).

Did the ECT value increase smoothly and reach at least 180°F (82°C)?

Yes >> Go To 7

No >> Replace the Engine Coolant Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. EVAP PURGE SOLENOID OPERATION

Turn the ignition off.

Disconnect the hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port on the component side.

Did the Evap Purge Solenoid hold vacuum?

Yes >> Go To 8

No >> Replace the EVAP Purge Solenoid.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Connect the vacuum hoses before continuing.

P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

8. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from restrictions.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12

---

9. 1/1 O2 SENSOR

NOTE: Perform the following test on the O2 Sensors whose voltage was not switching properly in the previous step.
Ignition on, engine not running.
Disconnect the 1/1 O2 Sensor harness connector.
With a scan tool, monitor the 1/1 O2 Sensor voltage.
O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.
Connect a jumper wire between the (K41) O2 Sensor 1/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

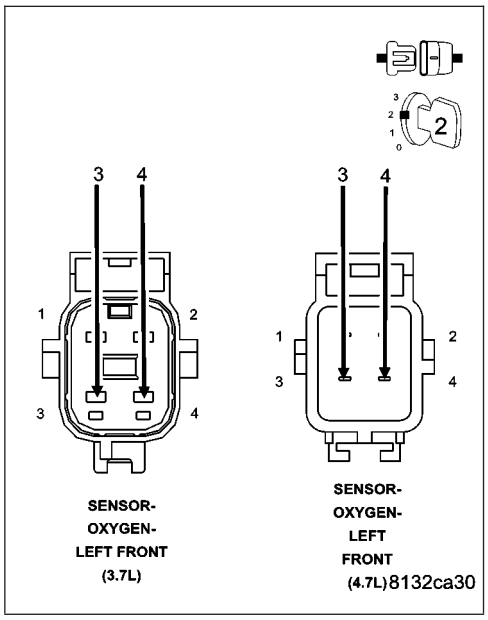
NOTE: The voltage should drop from 5.0 volts down to 2.5 volts with the jumper wire connected.

Did the O2 Sensor voltage drop from 5 volts to 2.5 volts when the jumper wire was installed?

Yes >> Replace the 1/1 O2 Sensor
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

NOTE: Remove the jumper wire before continuing.



P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

10. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

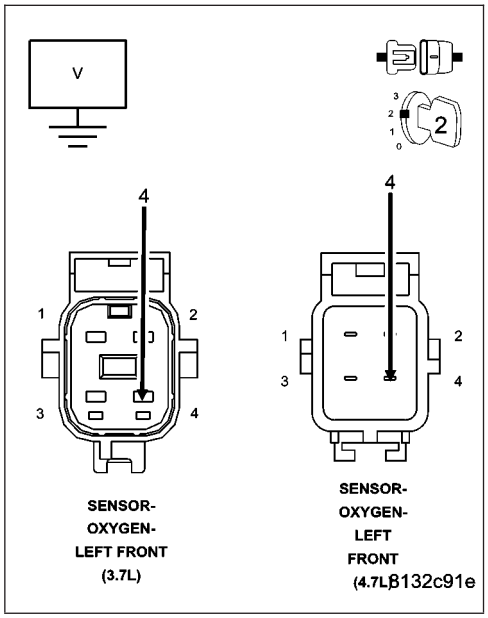
Measure the voltage on the (K41) O2 Sensor 1/1 Signal circuit in the O2 Sensor harness connector.

Is the voltage above 4.8 volts?

Yes >> Check the (K41) O2 Sensor 1/1 Signal circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



11. (K902) O2 SENSOR RETURN UPSTREAM CIRCUIT

Engine still running.

Measure the voltage on the (K902) O2 Return Upstream circuit in the 1/1 O2 Sensor harness connector.

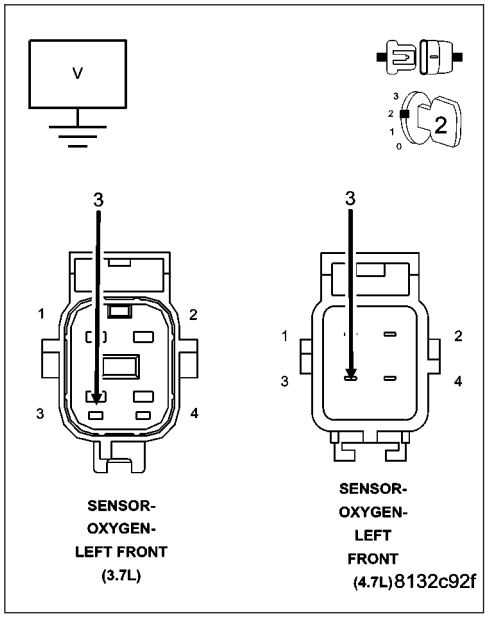
Is the voltage at 2.5 volts?

Yes >> Go To 12

No >> Check the (K902) O2 Return Upstream circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Turn the ignition off before continuing.



P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

12. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

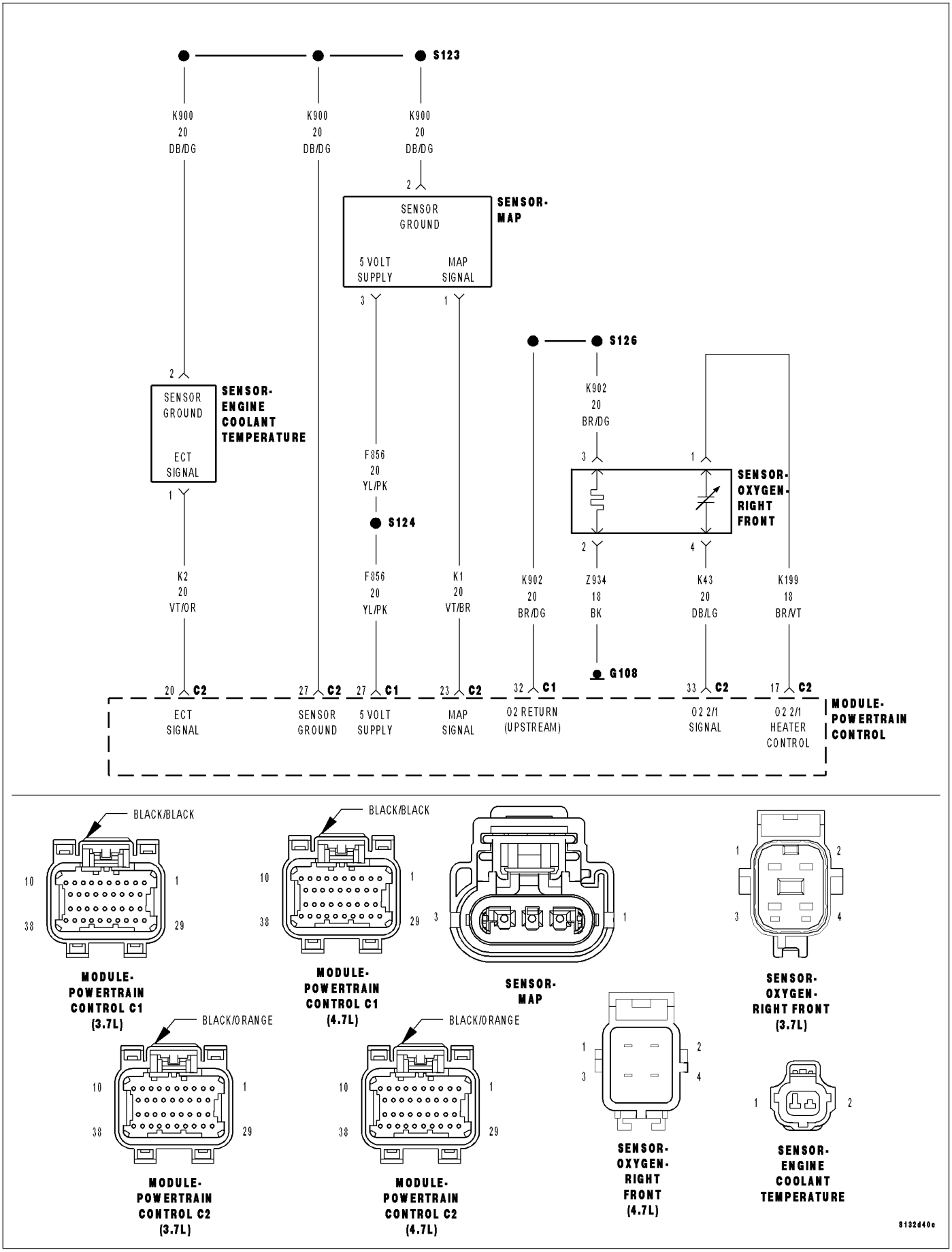
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0174-FUEL SYSTEM 2/1 LEAN



P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
O2 SIGNAL CIRCUIT
O2 RETURN CIRCUIT
O2 SENSOR HEATER OPERATION
O2 SENSOR
MAP SENSOR OPERATION
ECT SENSOR OPERATION
ENGINE MECHANICAL
FUEL FILTER/PRESSURE REGULATOR (HIGH)
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose all other trouble codes before continuing.

NOTE: Check for contaminants that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Turn the ignition off.

CAUTION: Stop All Actuations.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

Go To 3

Above Specification

Replace the fuel filter/pressure regulator.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

Below Specification

Go To 12

---

3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensor's Signal or Return circuit is shorted to ground the scan tool will display all O2 Sensor voltage readings low. The O2 Sensor that is shorted to ground will display a voltage reading near or at 0 volts.

NOTE: If one of the O2 Sensor Signal or Return circuits are shorted to voltage, the scan tool will display all O2 Sensor voltage readings high.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With the scan tool, monitor the 2/1 O2 Sensor voltage reading.

Is the voltage switching between 2.5 and 3.4 volts?

Yes >> Go To 4

No >> Go To 8

P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

4. 2/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

NOTE: Perform the following test on all O2 Sensors.

Ignition on, engine not running.

With a scan tool, actuate the 2/1 O2 Heater Test.

With the scan tool, monitor 2/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Replace the 2/1 O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading within 1″ of the Vacuum Gauge reading?

Yes >> Go To 6

No >> Replace the MAP Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak).

Ignition on, engine not running.

With the scan tool, read the Engine Coolant Temperature (ECT) Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the ECT Sensor value. The temperature value change should be a smooth transition from start up to normal operating temperature 82°C (180°F). The value should reach at least 82°C (180°F).

Did the ECT value increase smoothly and did it reach at least 180°F (82°C)?

Yes >> Go To 7

No >> Replace the Engine Coolant Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

7. ENGINE MECHANICAL

Turn the ignition off.

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

---

8. O2 SENSOR

Ignition on, engine not running.

Disconnect the 2/1 O2 Sensor harness connector.

With the scan tool, monitor the 2/1 O2 Sensor voltage.

O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

Connect a jumper wire between the (K43) O2 Sensor 2/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

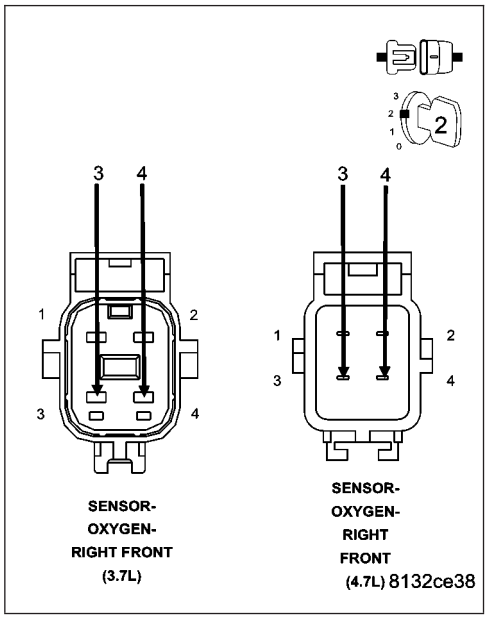
NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor voltage change from 5.0 volts to 2.5 volts when the jumper wire was installed?

Yes >> Replace the 2/1 O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

NOTE: Remove the jumper wire before continuing.



P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

9. O2 SENSOR SIGNAL CIRCUIT

With the scan tool, monitor all the O2 Sensor voltage reading with the jumper wire removed.

NOTE: The scan tool will display all O2 Sensor voltage readings approximately 5.0 volts when only one O2 Sensor's Signal circuit is shorted to voltage.

NOTE: The scan tool will display one O2 Sensor voltage close to zero and the others will read lower than normal when one O2 Sensor Signal circuit contains excessive resistance.

Is the voltage above 4.8 volts?

Yes >> Go To 10

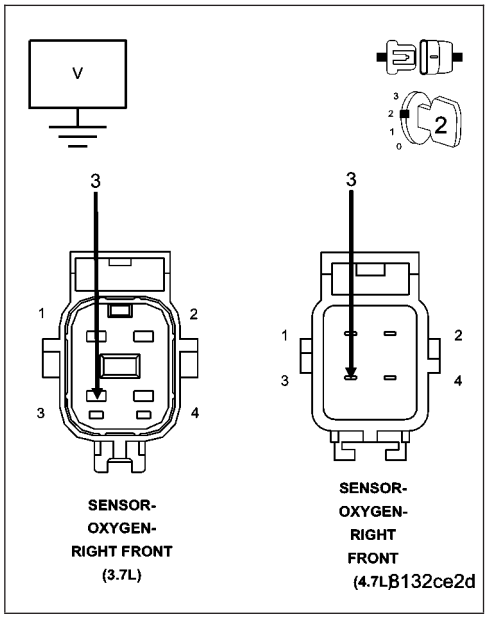
No >> Check all the O2 Signal circuits for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

10. (K902) O2 RETURN UPSTREAM CIRCUIT

Disconnect the 2/1 O2 Sensor harness connector.

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Go To 11

No >> Check the (K902) O2 Return Upstream circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertriain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

11. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

12. RESTRICTED FUEL SUPPLY LINE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special 5/16 fuel line adapter tool #6539 between disconnected fuel line and the fuel pump module.

Attach a fuel pressure test gauge to the T fitting on tool #6539.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

CAUTION: Stop All Actuations.

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

---

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

---

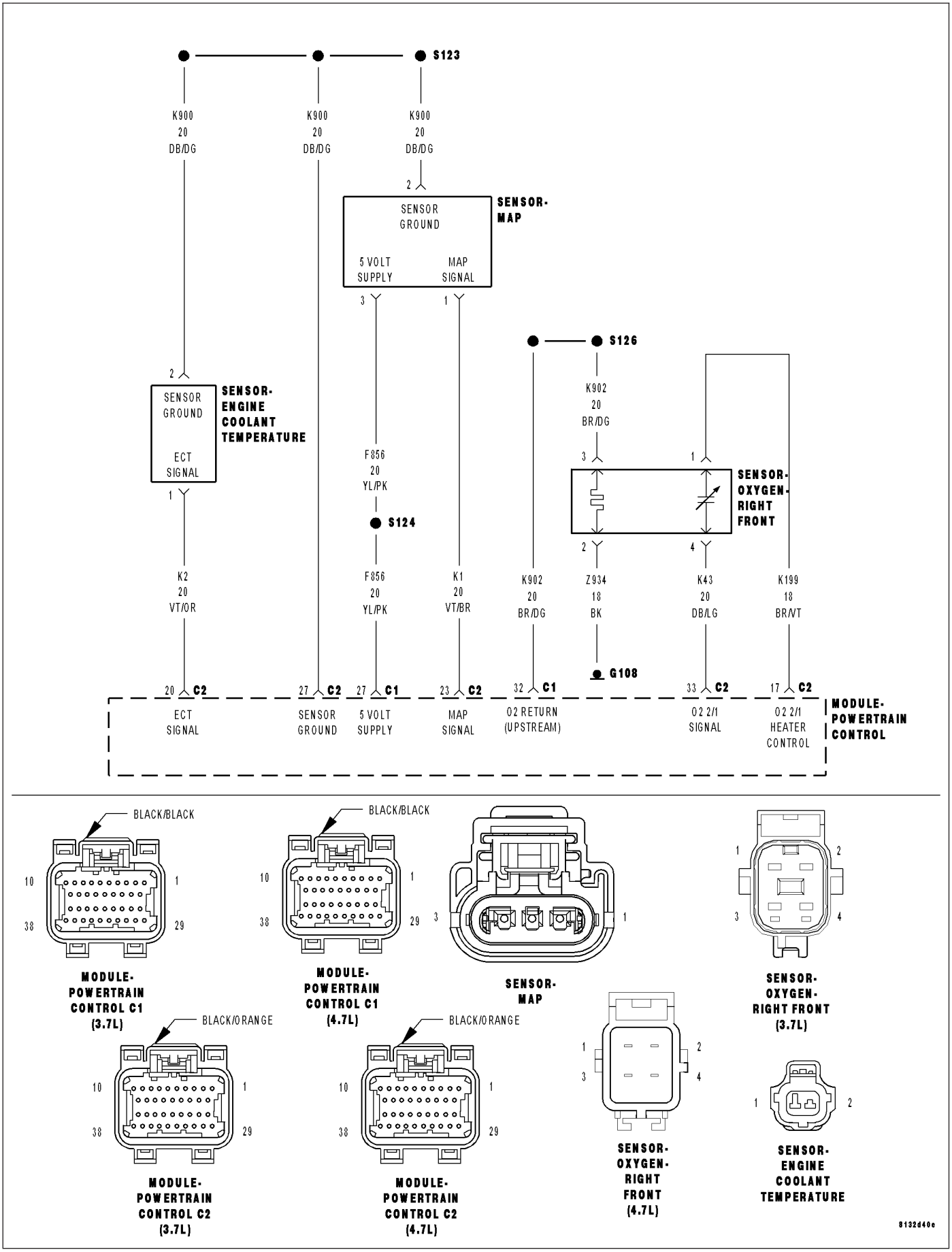
14. FUEL PUMP MODULE

If there are no possible causes remaining, view repair.

Repair

Replace the Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0175-FUEL SYSTEM 2/1 RICH



P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
O2 SENSOR HEATER OPERATION
EVAP PURGE SOLENOID OPERATION
O2 SIGNAL CIRCUIT
O2 RETURN CIRCUIT
O2 SENSOR
MAP SENSOR
ECT SENSOR
ENGINE MECHANICAL
FUEL FILTER/PRESSURE REGULATOR (HIGH)
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminates that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Turn the ignition off.

CAUTION: Stop All Actuations.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

Go To 3

Above Specification

Replace the fuel filter/pressure regulator.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensors Signal or Return circuit is shorted to ground or voltage, all the other O2 Sensor voltage readings will be affected.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With the scan tool, monitor the 2/1 O2 Sensor voltage reading.

Is the voltage switching between 2.5 and 3.4 volts?

Yes >> Go To 4

No >> Go To 9

---

4. 2/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With the scan tool, perform the 2/1 O2 Heater Test for each O2 Sensor.

With the scan tool, monitor the 2/1 O2 Sensor voltage while performing the Heater test for at least 2 minutes.

Does the voltage stay above 4.5 volts for each Sensor?

Yes >> Replace the 2/1 O2 Sensor.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading within 1″ of the Vacuum Gauge reading?

Yes >> Go To 6

No >> Replace the MAP Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Remove the vacuum gauge before continuing.

---

6. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak).

Ignition on, engine not running.

With the scan tool, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F).

Did the ECT value increase smoothly and reach at least 180°F (82°C)?

Yes >> Go To 7

No >> Replace the Engine Coolant Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. EVAP PURGE SOLENOID OPERATION

Turn the ignition off.

Disconnect the hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port on the component side.

Did the Evap Purge Solenoid hold vacuum?

Yes >> Go To 8

No >> Replace the EVAP Purge Solenoid.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Connect the vacuum hoses before continuing.

P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

8. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from restrictions.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12

---

9. 2/1 O2 SENSOR

Ignition on, engine not running.
Disconnect the 2/1 O2 Sensor harness connector.
With the scan tool, monitor the 2/1 O2 Sensor voltage.
O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.
Connect a jumper wire between the (K43) O2 Sensor 2/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

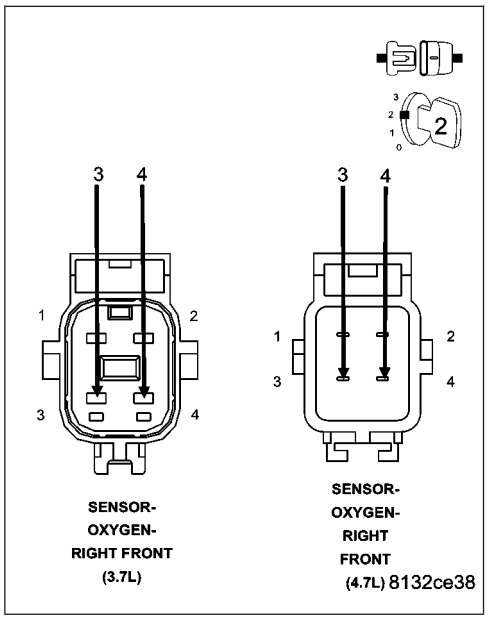
NOTE: The voltage should drop from 5.0 volts down to 2.5 volts with the jumper wire connected.

Did the O2 Sensor voltage drop from 5 volts to 2.5 volts when the jumper wire was installed?

Yes >> Replace the O2 Sensor
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

NOTE: Remove the jumper wire before continuing.



P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

10. O2 SENSOR SIGNAL CIRCUIT

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

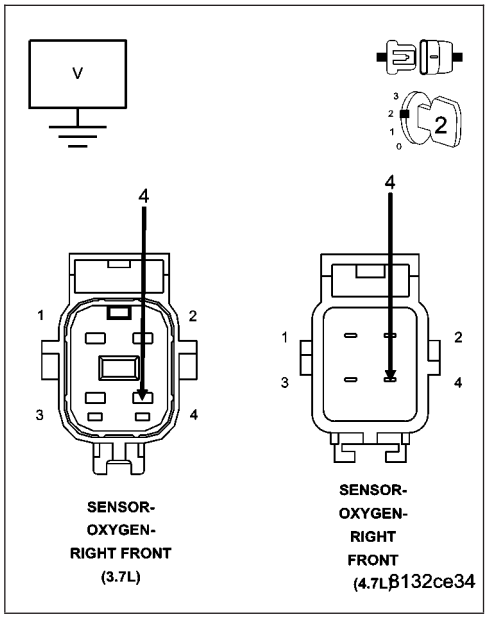
Measure the voltage on the (K43) O2 Sensor 2/1 Signal circuit in the O2 Sensor harness connector.

Is the voltage above 4.8 volts?

Yes >> Check the (K43) O2 Sensor 2/1 Signal circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



11. (K902) O2 SENSOR RETURN UPSTREAM CIRCUIT

Engine still running.

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

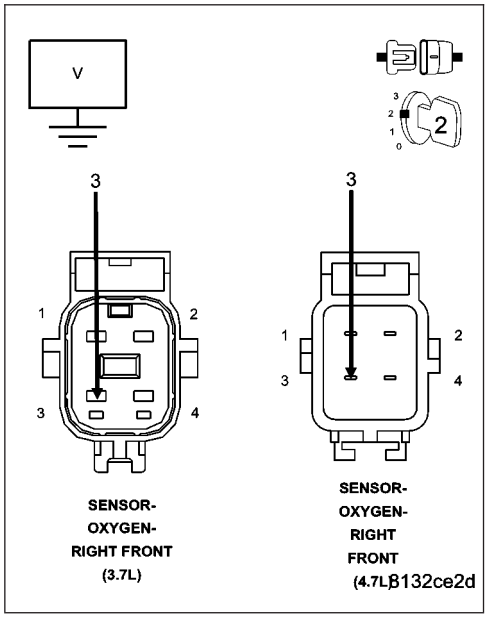
Is the voltage at 2.5 volts?

Yes >> Go To 12

No >> Check the (K902) O2 Return Upstream circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Turn the ignition off before continuing.



P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

12. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

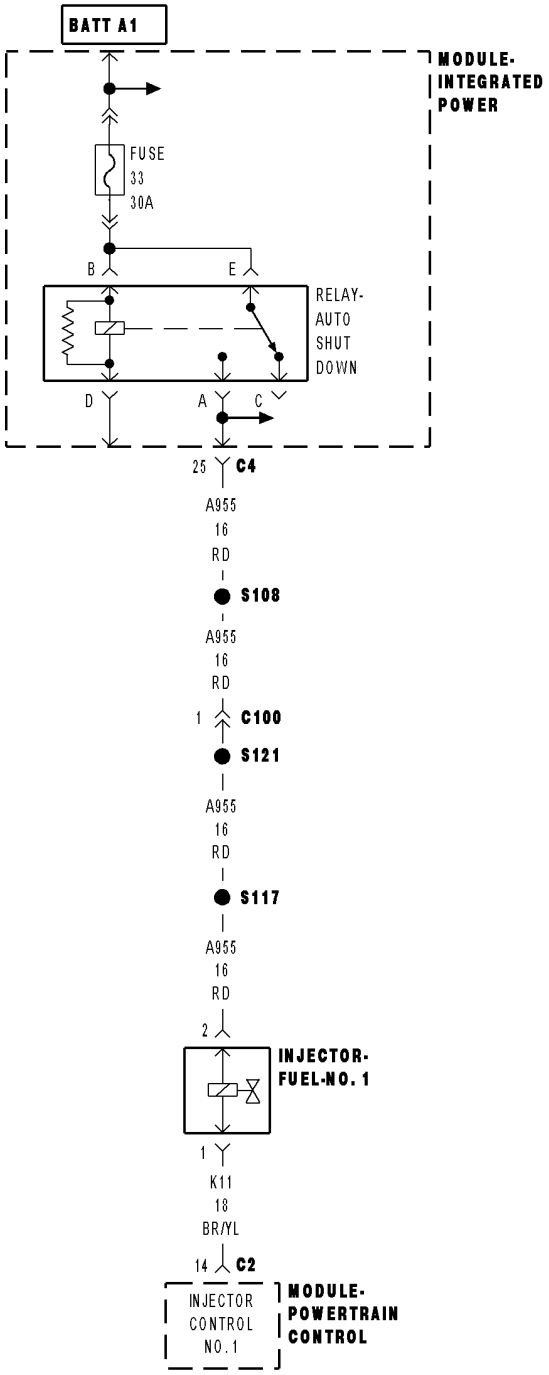
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

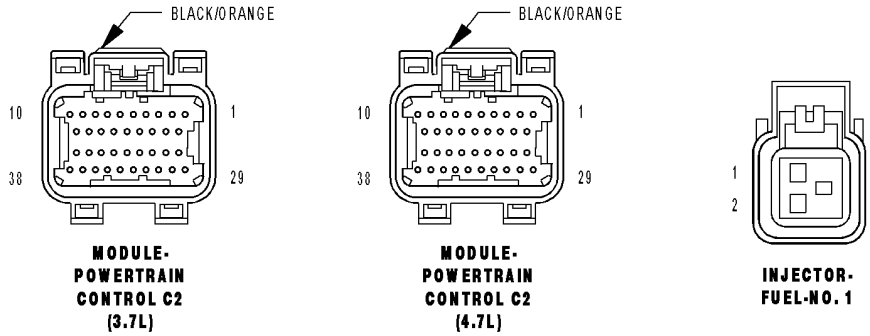
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0201-FUEL INJECTOR 1 CIRCUIT





8132d53c

P0201-FUEL INJECTOR 1 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K11) INJECTOR CONTROL NO.1 CIRCUIT OPEN
(K11) INJECTOR CONTROL NO.1 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

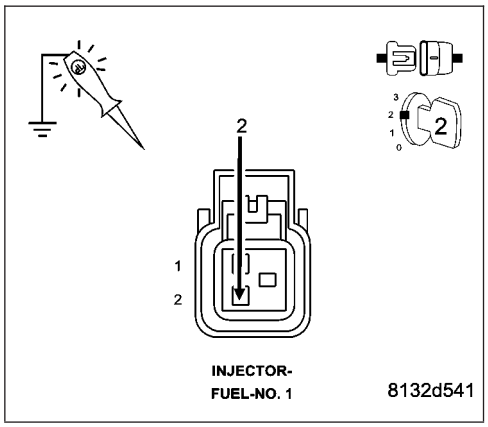
Turn the ignition off.

Disconnect the No.1 Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Fuel Injector harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0201-FUEL INJECTOR 1 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K11) Injector Control No.1 circuit.

With the scan tool, actuate the Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

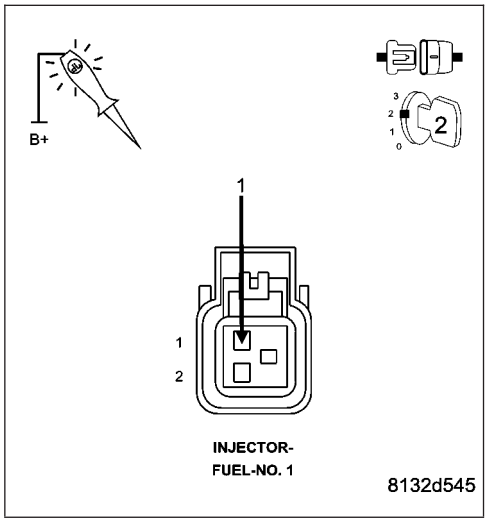
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K11) INJECTOR CONTROL NO.1 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

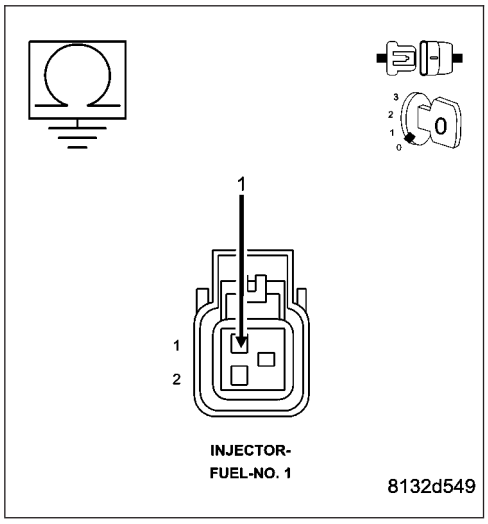
Measure the resistance between ground and the (K11) Injector Control No.1 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K11) Injector Control No.1 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0201-FUEL INJECTOR 1 CIRCUIT (CONTINUED)

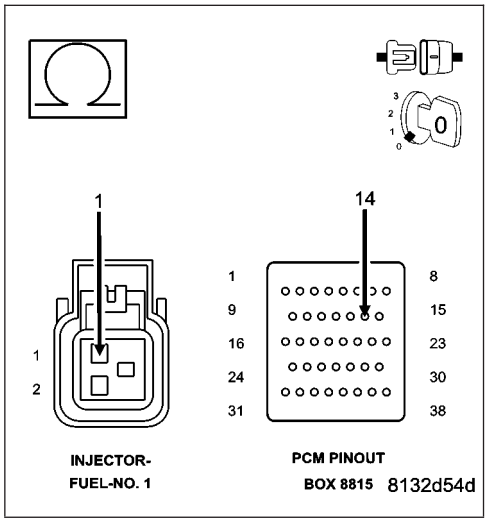
5. (K11) INJECTOR CONTROL NO.1 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K11) Injector Control No.1 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K11) Injector Control No.1 circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

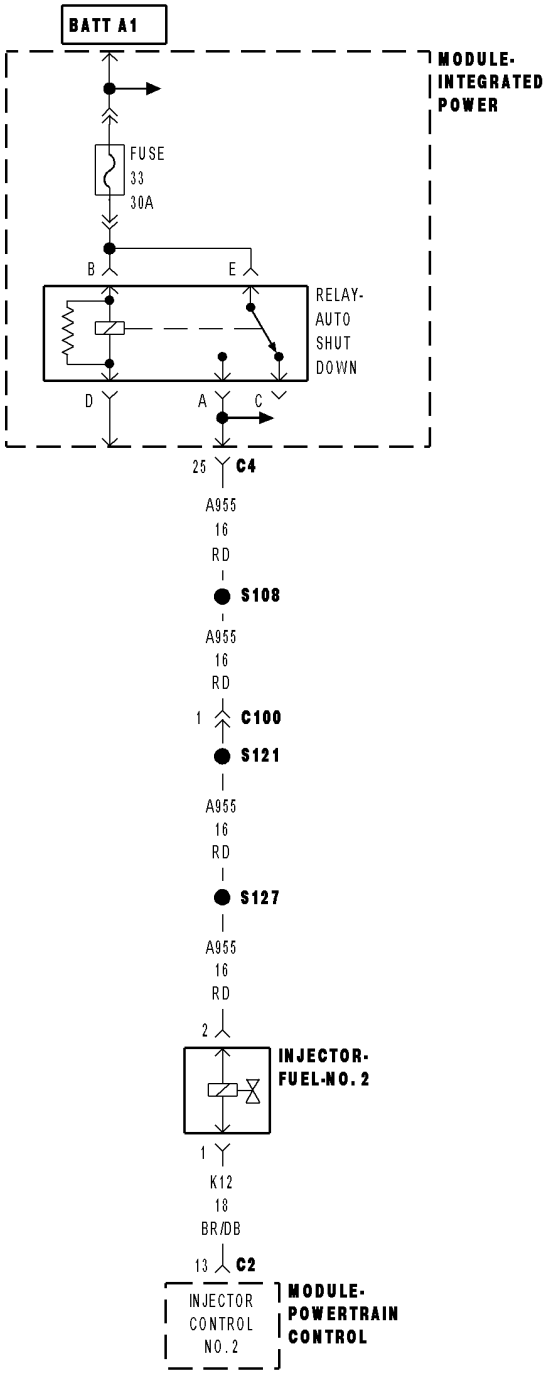
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

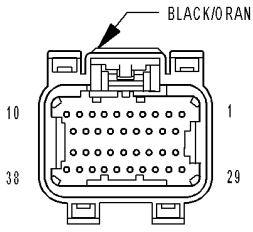
Were there any problems found?

Yes >> Repair as necessary.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

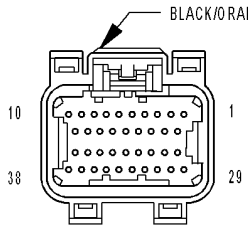
No >> Replace and program the Powertrain Control Module per Service Information.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0202-FUEL INJECTOR 2 CIRCUIT

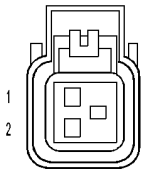




MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



INJECTOR-
FUEL-NO. 2

8132d567

P0202-FUEL INJECTOR 2 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K12) INJECTOR CONTROL NO.2 CIRCUIT OPEN
(K12) INJECTOR CONTROL NO.2 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.2 Fuel Injector harness connector.

Ignition on, engine not running.

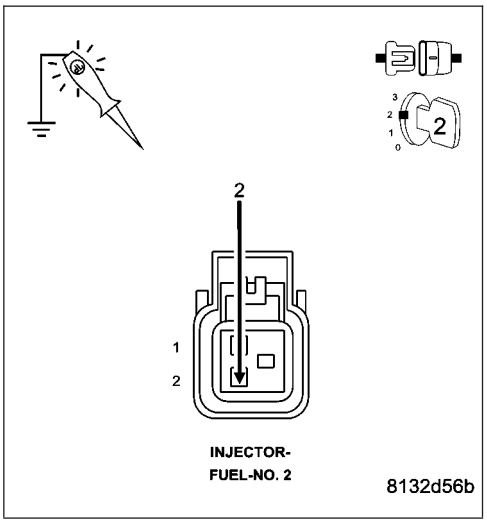
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the No.2 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0202-FUEL INJECTOR 2 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K12) Injector Control No.2 circuit.

With the scan tool, actuate the No.2 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

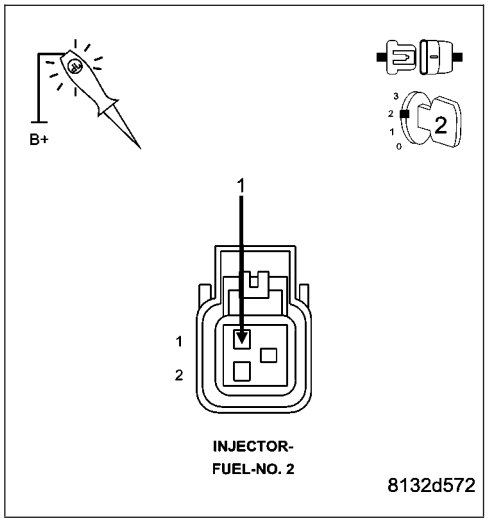
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K12) INJECTOR CONTROL NO.2 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

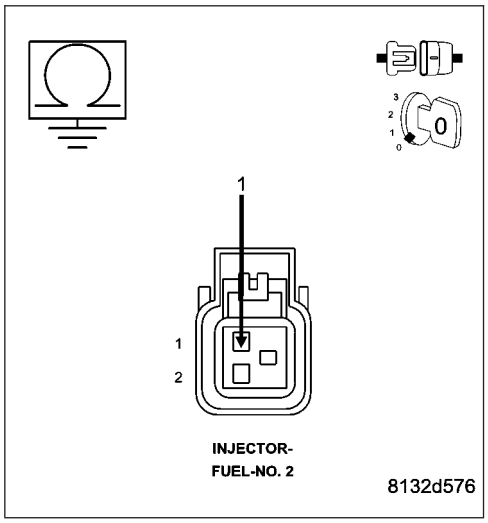
Measure the resistance between ground and the (K12) Injector Control No.2 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K12) Injector Control No.2 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0202-FUEL INJECTOR 2 CIRCUIT (CONTINUED)

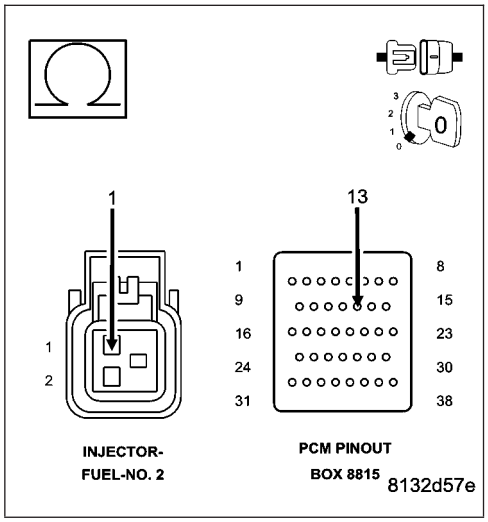
5. (K12) INJECTOR CONTROL NO.2 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K12) Injector Control No.2 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K12) Injector Control No.2 circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

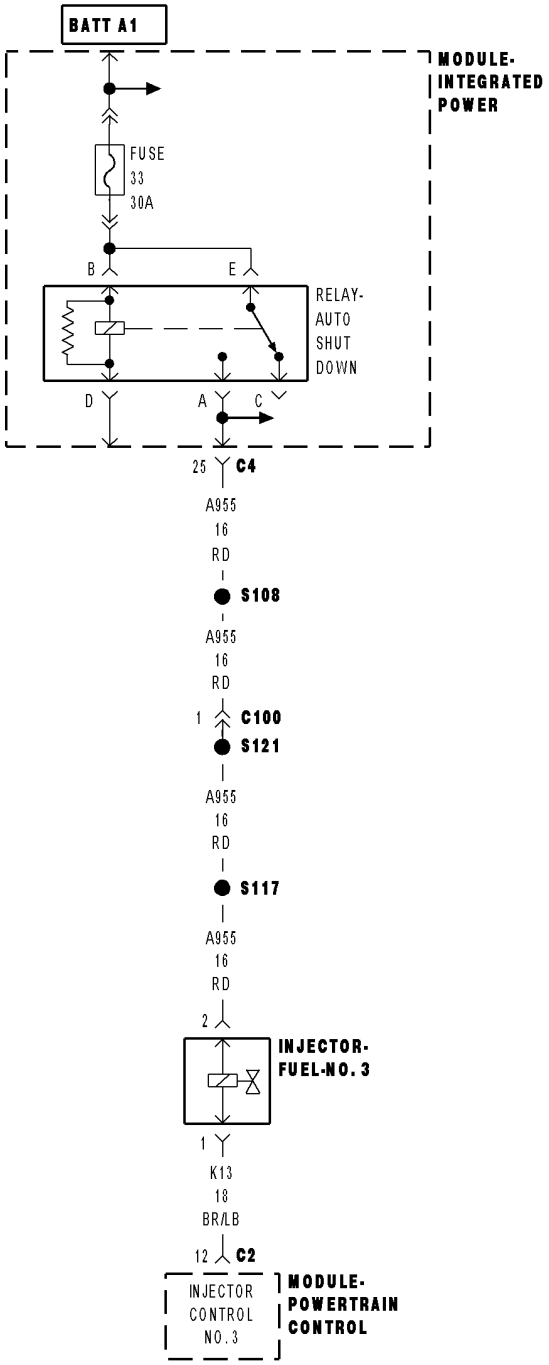
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

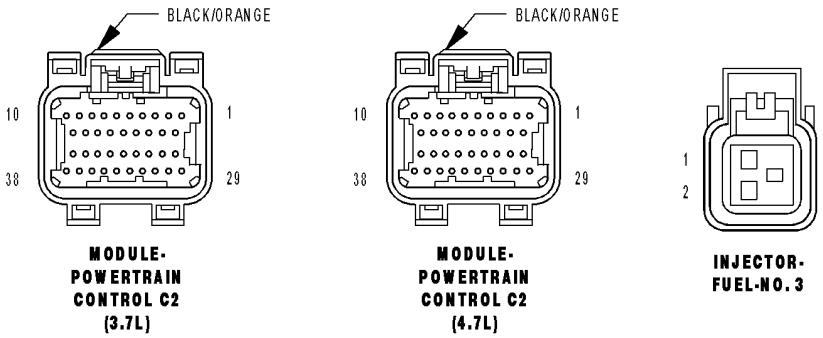
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0203-FUEL INJECTOR 3 CIRCUIT





8132d67e

P0203-FUEL INJECTOR 3 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K13) INJECTOR CONTROL NO.3 CIRCUIT OPEN
(K13) INJECTOR CONTROL NO.3 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.3 Fuel Injector harness connector.

Ignition on, engine not running.

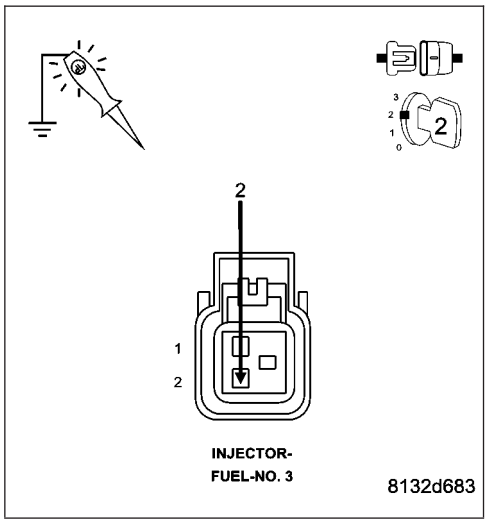
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the No.3 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0203-FUEL INJECTOR 3 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K13) Injector Control No.3 circuit.

With the scan tool, actuate the No.3 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

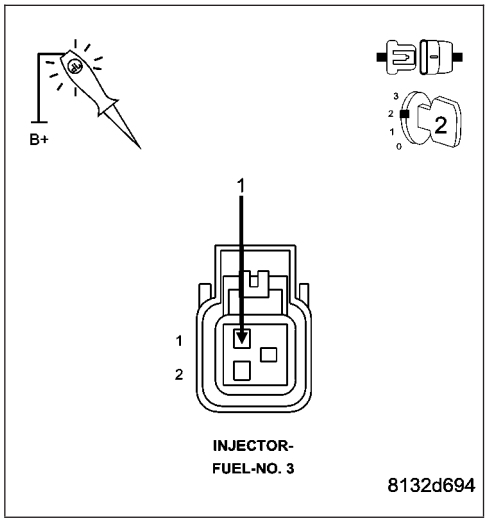
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K13) INJECTOR CONTROL NO.3 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

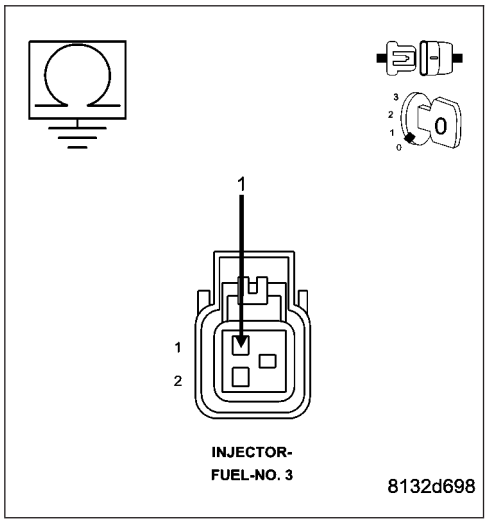
Measure the resistance between ground and the (K13) Injector Control No.3 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K13) Injector Control No.3 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0203-FUEL INJECTOR 3 CIRCUIT (CONTINUED)

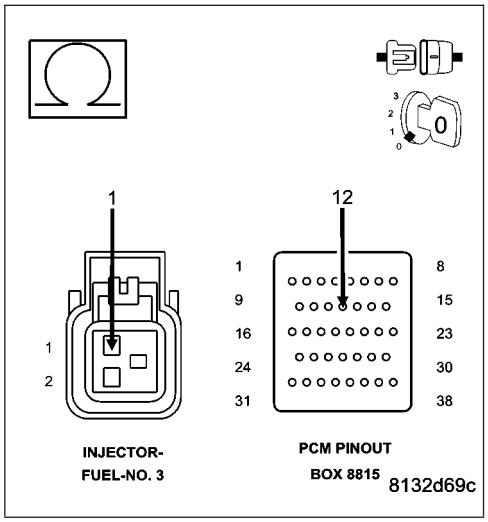
5. (K13) INJECTOR CONTROL NO.3 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K13) Injector Control No.3 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K13) Injector Control No.3 circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

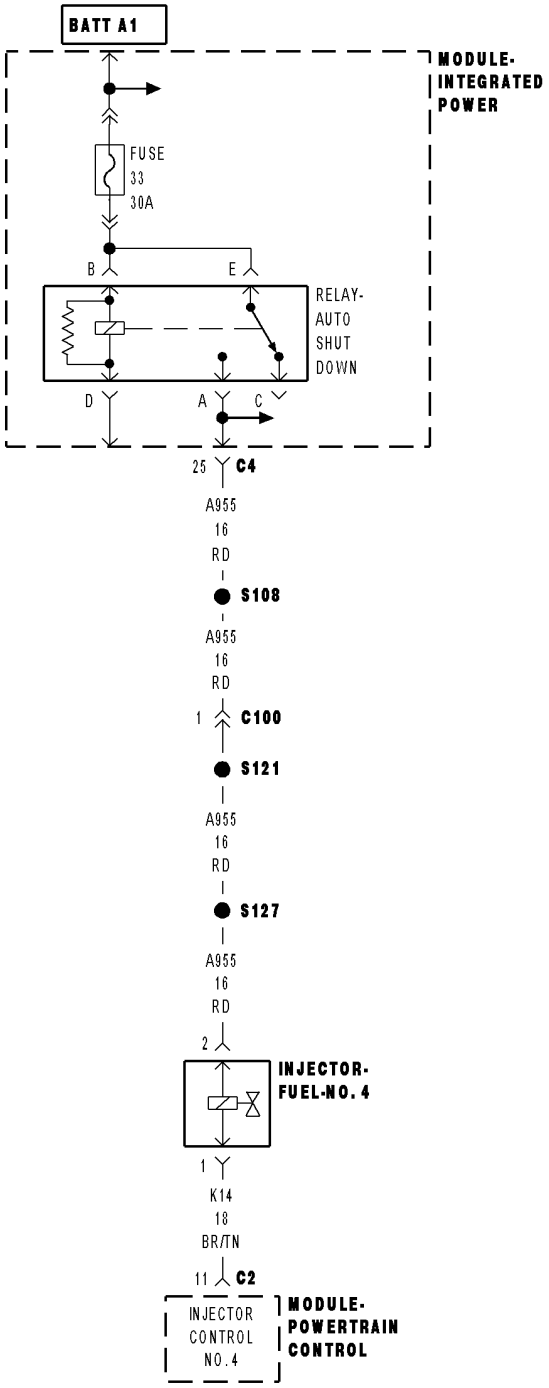
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

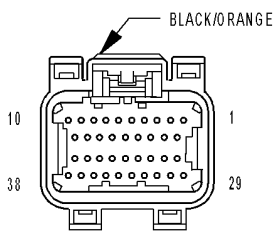
Were there any problems found?

Yes >> Repair as necessary.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

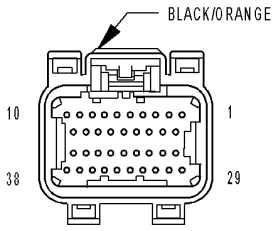
No >> Replace and program the Powertrain Control Module per Service Information.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0204-FUEL INJECTOR 4 CIRCUIT

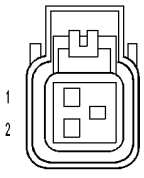




MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



INJECTOR-
FUEL-NO. 4

8132d76f

P0204-FUEL INJECTOR 4 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K14) INJECTOR CONTROL NO.4 CIRCUIT OPEN
(K14) INJECTOR CONTROL NO.4 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.4 Fuel Injector harness connector.

Ignition on, engine not running.

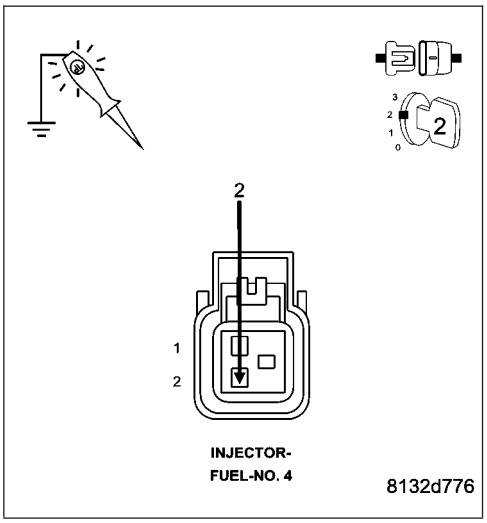
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the No.4 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0204-FUEL INJECTOR 4 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K14) Injector Control No.4 circuit.

With the scan tool, actuate the No.4 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

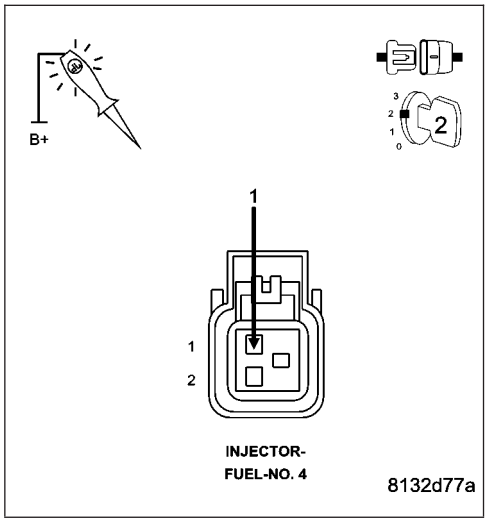
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K14) INJECTOR CONTROL NO.4 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

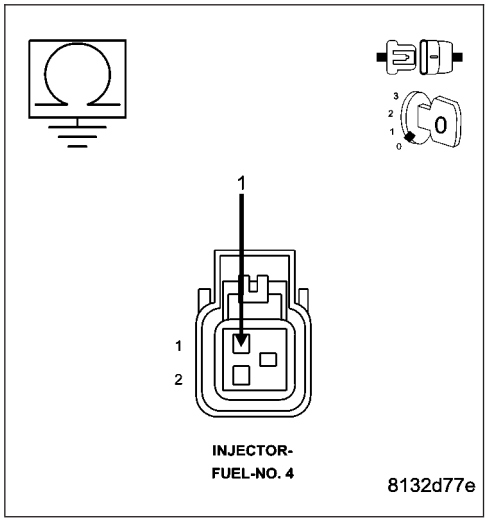
Measure the resistance between ground and the (K14) Injector Control No.4 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K14) Injector Control No.4 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0204-FUEL INJECTOR 4 CIRCUIT (CONTINUED)

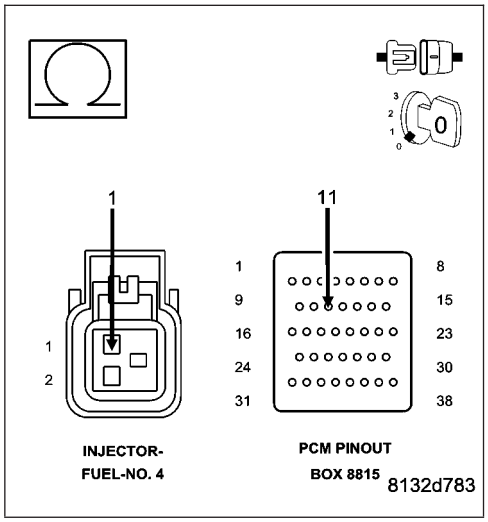
5. (K14) INJECTOR CONTROL NO.4 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K14) Injector Control No.4 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K14) Injector Control No.4 circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

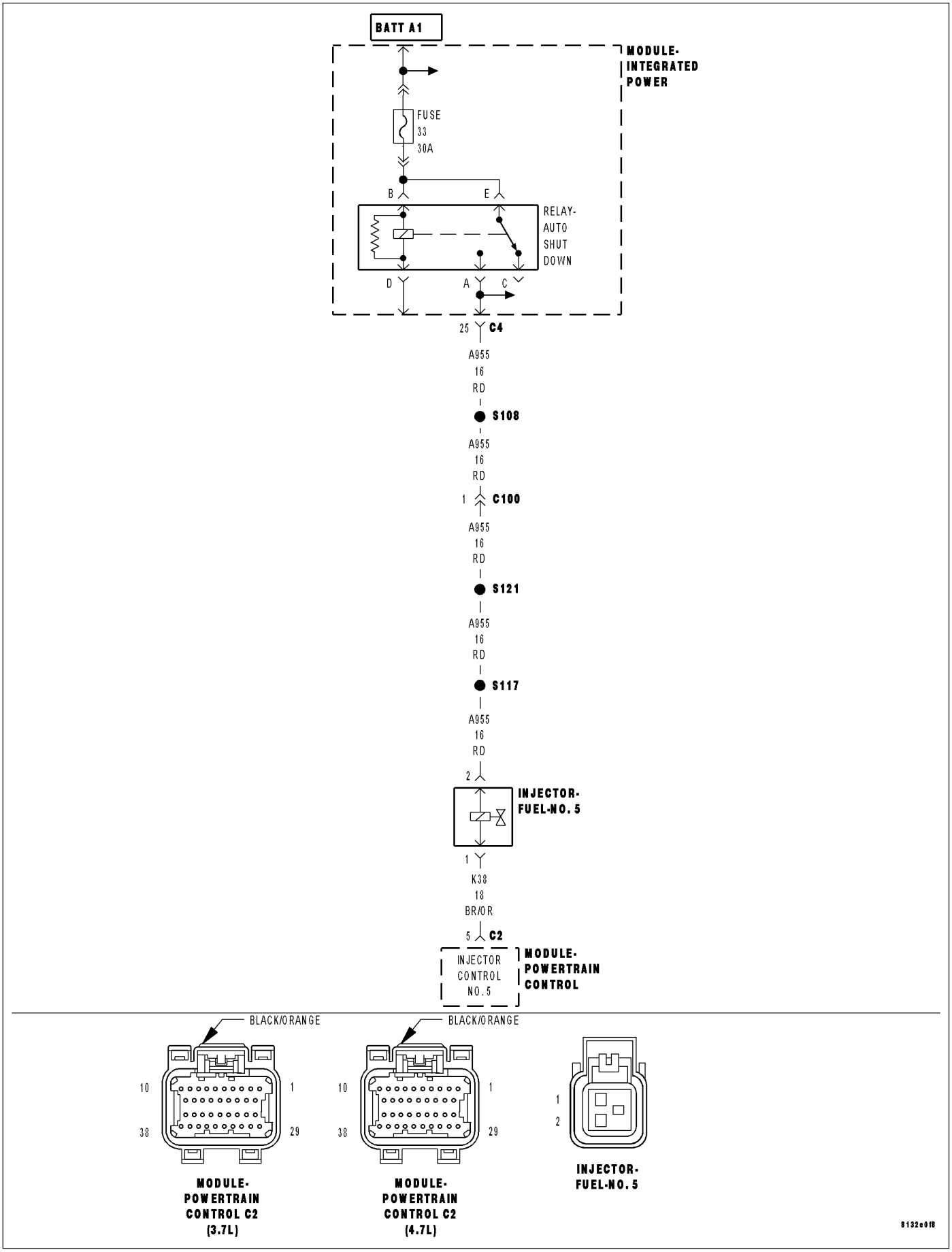
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0205-FUEL INJECTOR 5 CIRCUIT



P0205-FUEL INJECTOR 5 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K38) INJECTOR CONTROL NO.5 CIRCUIT OPEN
(K38) INJECTOR CONTROL NO.5 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.5 Fuel Injector harness connector.

Ignition on, engine not running.

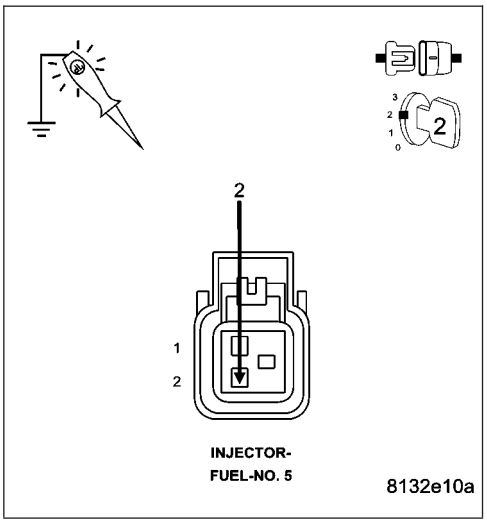
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the No.5 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0205-FUEL INJECTOR 5 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K38) Injector Control No.5 circuit.

With the scan tool, actuate the No.5 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

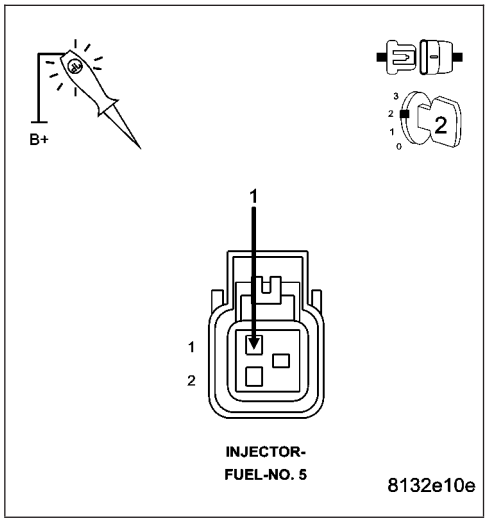
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K38) INJECTOR CONTROL NO.5 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

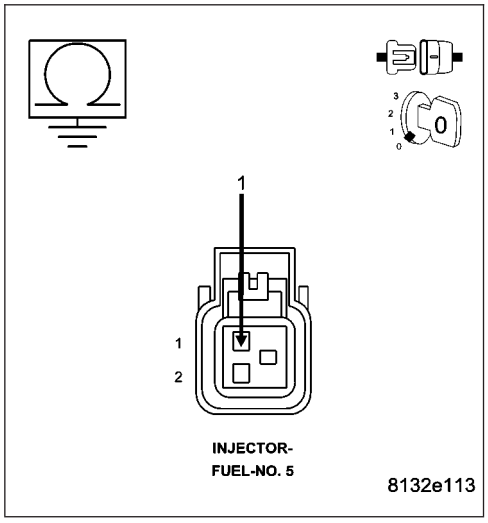
Measure the resistance between ground and the (K38) Injector Control No.5 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K38) Injector Control No.5 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0205-FUEL INJECTOR 5 CIRCUIT (CONTINUED)

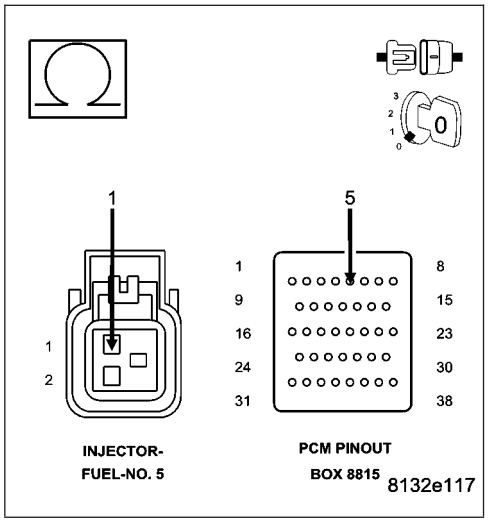
5. (K38) INJECTOR CONTROL NO.5 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K38) Injector Control No.5 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K38) Injector Control No.5 circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

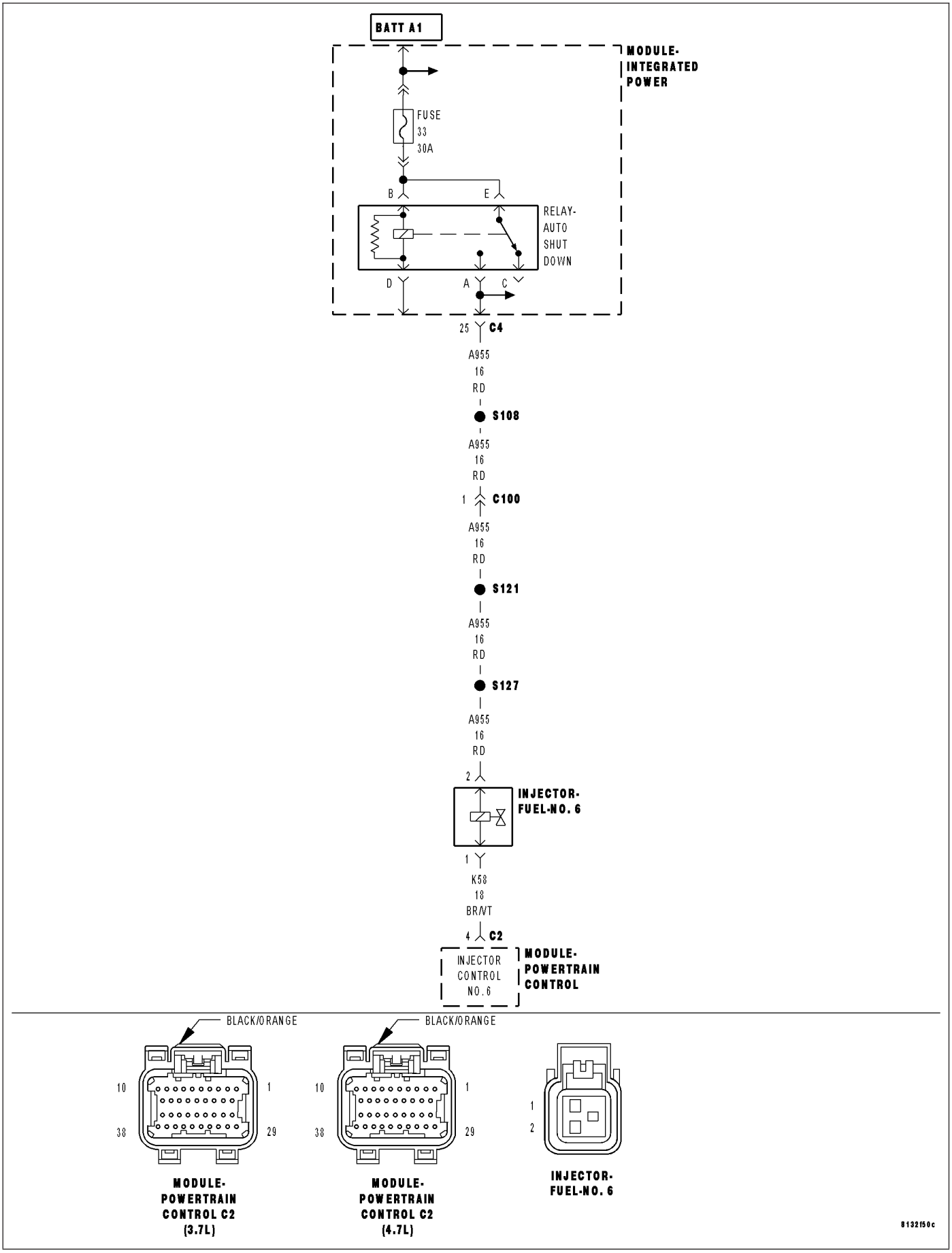
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0206-FUEL INJECTOR 6 CIRCUIT



P0206-FUEL INJECTOR 6 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K58) INJECTOR CONTROL NO.6 CIRCUIT OPEN
(K58) INJECTOR CONTROL NO.6 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.6 Fuel Injector harness connector.

Ignition on, engine not running.

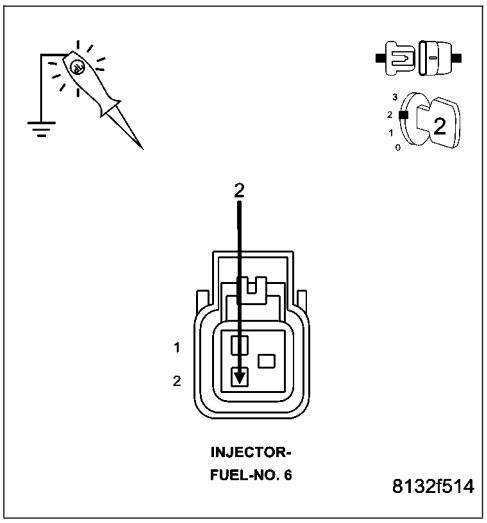
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the No.6 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0206-FUEL INJECTOR 6 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K58) Injector Control No.6 circuit.

With the scan tool, actuate the No.6 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

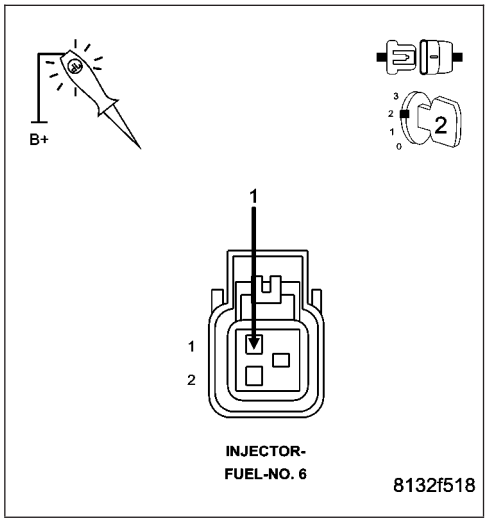
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K58) INJECTOR CONTROL NO.6 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

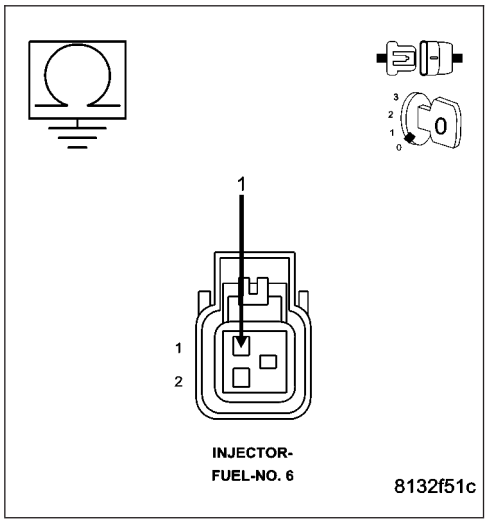
Measure the resistance between ground and the (K58) Injector Control No.6 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K58) Injector Control No.6 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0206-FUEL INJECTOR 6 CIRCUIT (CONTINUED)

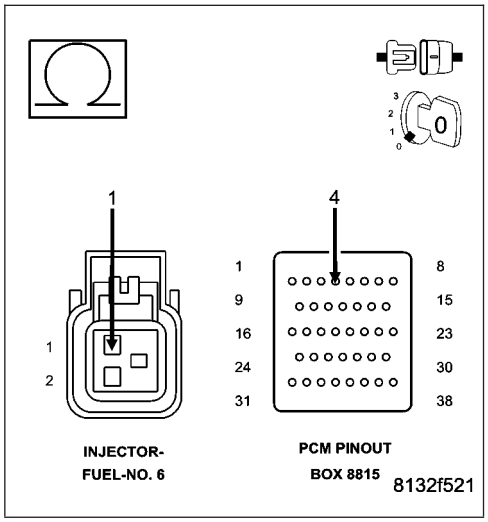
5. (K58) INJECTOR CONTROL NO.6 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K58) Injector Control No.6 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K58) Injector Control No.6 circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

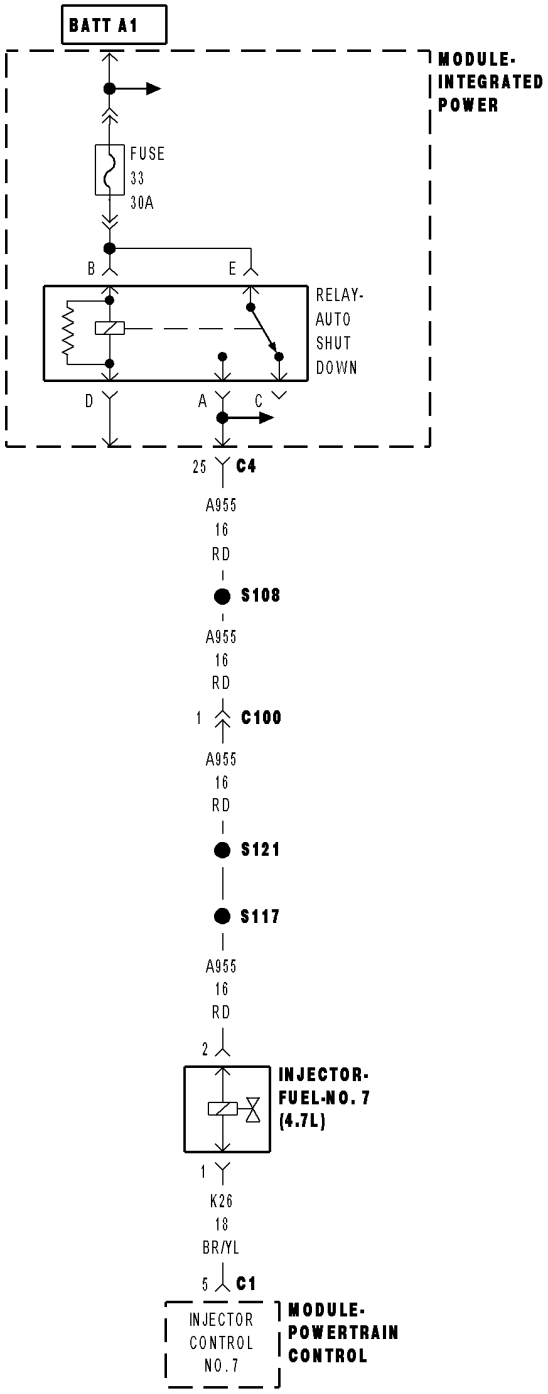
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

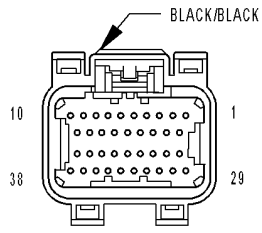
Were there any problems found?

Yes >> Repair as necessary.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

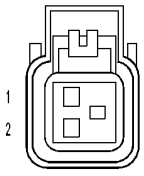
No >> Replace and program the Powertrain Control Module per Service Information.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0207-FUEL INJECTOR 7 CIRCUIT





MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



INJECTOR-
FUEL-NO. 7
(4.7L)

8132f561

P0207-FUEL INJECTOR 7 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K26) INJECTOR CONTROL NO.7 CIRCUIT OPEN
(K26) INJECTOR CONTROL NO.7 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.7 Fuel Injector harness connector.

Ignition on, engine not running.

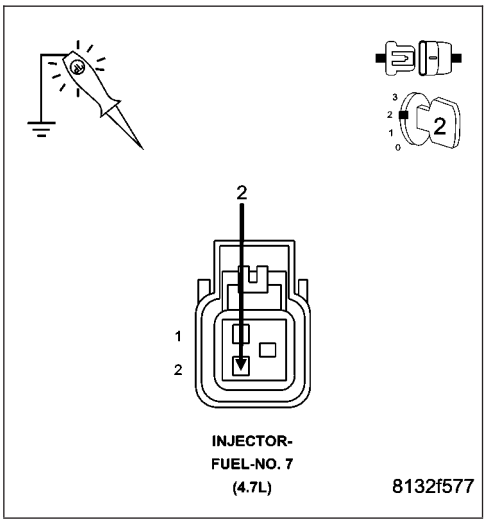
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the No.7 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0207-FUEL INJECTOR 7 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K26) Injector Control No.7 circuit.

With the scan tool, actuate the No.7 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

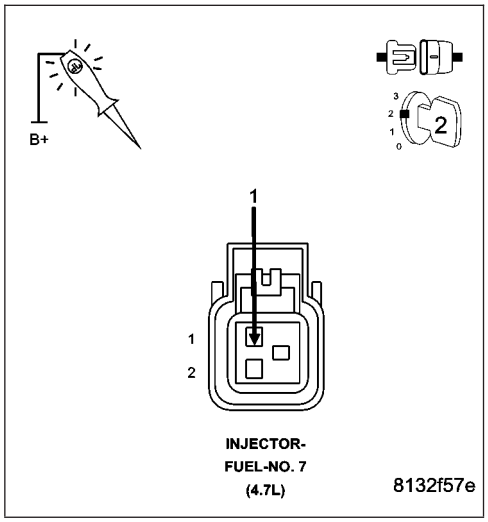
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K26) INJECTOR CONTROL NO.7 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

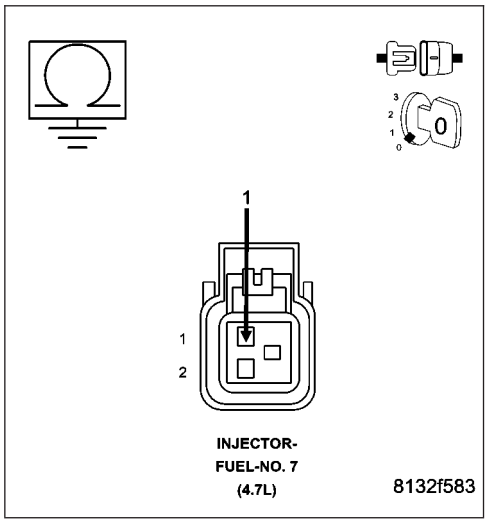
Measure the resistance between ground and the (K26) Injector Control No.7 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K26) Injector Control No.7 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0207-FUEL INJECTOR 7 CIRCUIT (CONTINUED)

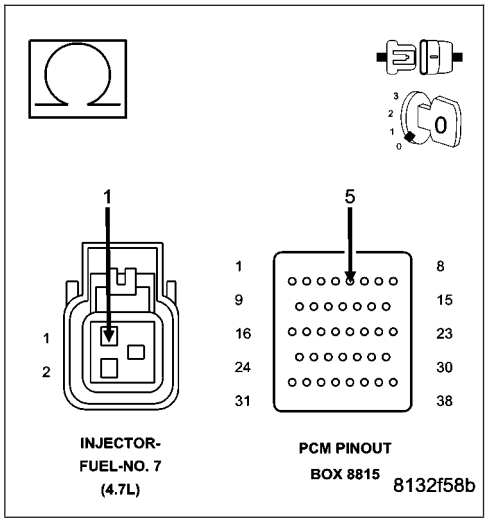
5. (K26) INJECTOR CONTROL NO.7 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K26) Injector Control No.7 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K26) Injector Control No.7 circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

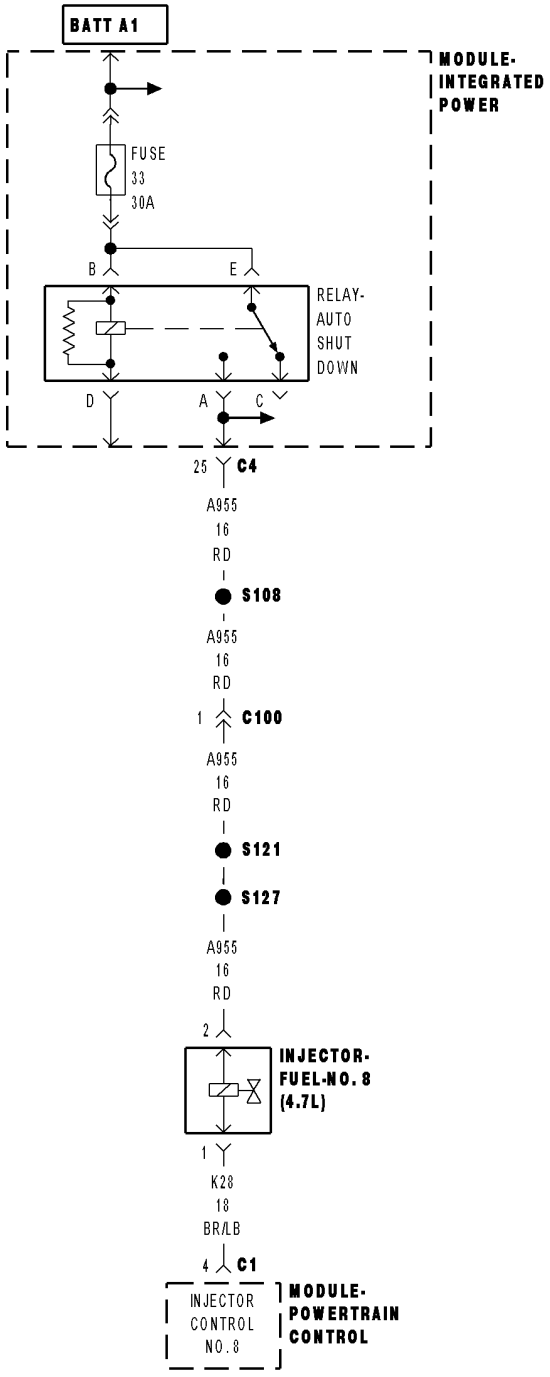
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

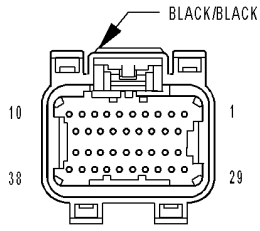
Were there any problems found?

Yes >> Repair as necessary.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

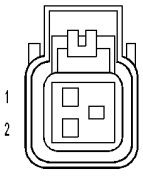
No >> Replace and program the Powertrain Control Module per Service Information.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0208-FUEL INJECTOR 8 CIRCUIT





MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



INJECTOR-
FUEL-NO. 8
(4.7L)

8132f5b5

P0208-FUEL INJECTOR 8 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K28) INJECTOR CONTROL NO.8 CIRCUIT OPEN
(K28) INJECTOR CONTROL NO.8 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.8 Fuel Injector harness connector.

Ignition on, engine not running.

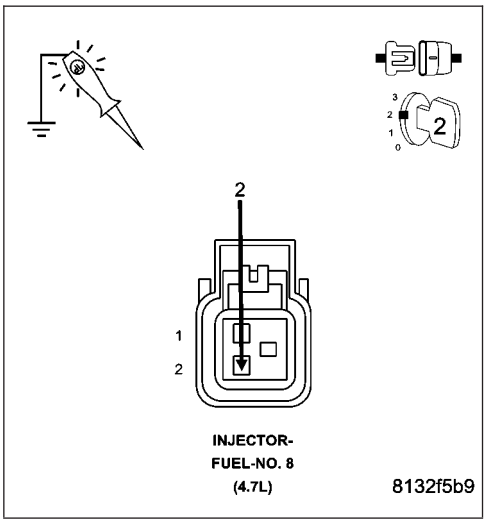
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the No.8 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0208-FUEL INJECTOR 8 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K28) Injector Control No.8 circuit.

With the scan tool, actuate the No.8 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

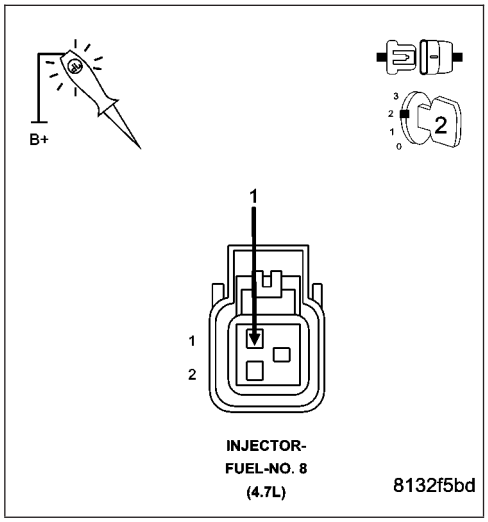
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K28) INJECTOR CONTROL NO.8 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

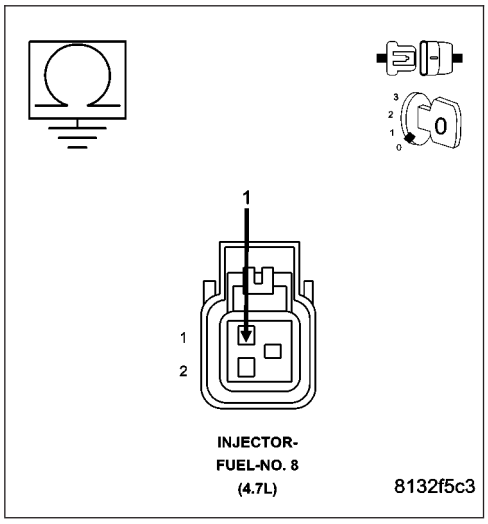
Measure the resistance between ground and the (K28) Injector Control No.8 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K28) Injector Control No.8 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0208-FUEL INJECTOR 8 CIRCUIT (CONTINUED)

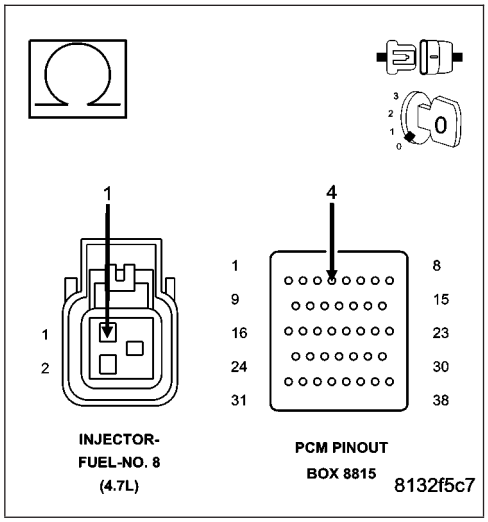
5. (K28) INJECTOR CONTROL NO.8 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K28) Injector Control No.8 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K28) Injector Control No.8 circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than a 2% (2.5% LEV) misfire rate is measured during two trips. Above 3000 RPM 1 trip less than 3000 RPM 2 trip. Three good trips to turn off the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
INJECTOR CONTROL CIRCUIT
COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL PROBLEM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

NOTE: Check for any TSB's that apply to a Misfire condition. Review the vehicle repair history for any misfire condition repairs that have been performed.

Star the engine.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

Yes >> Repair as necessary.
Perform 'POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. (A955) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Ignition Coil harness connector of the misfiring cylinders.

Disconnect the Fuel Injector harness connector of the misfiring cylinders.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connectors.
Remove the Ignition Coils.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

---

5. SPARK PLUG

Turn the ignition off.
Remove the Spark Plug.
Inspect the Spark Plug for the following conditions.
- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Does the Spark Plug have any problems?

Yes >> Replace the Spark Plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.
Install a fuel pressure gauge to the fuel rail.
Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi)

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform POWERTRAIN VERIFICATION TEST VER - 5.

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector for the cylinder that indicated the misfire.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the Fuel Injector harness connector of the misfiring cylinder.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the Injector Control circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

---

11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.
Disconnect the Fuel Injector harness connector.
Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Check the Injector Control circuit for an open, short to ground, and short to voltage.

Was a problem found with the Injector Control circuit?

Yes >> Repair the excessive resistance or short in the Injector Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

---

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay or ASD Relay.

Using a 12-volt test light connected to 12-volts, probe the Ignition Coil Control circuit.

Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

15. COIL CONTROL CIRCUIT

Turn the ignition off.

Disconnect the Ignition Coil harness connector.

Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the Coil Control circuit for an open, short to ground, and short to voltage.

Was a problem found with the Coil Control circuit?

Yes >> Repair the Coil Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

---

16. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

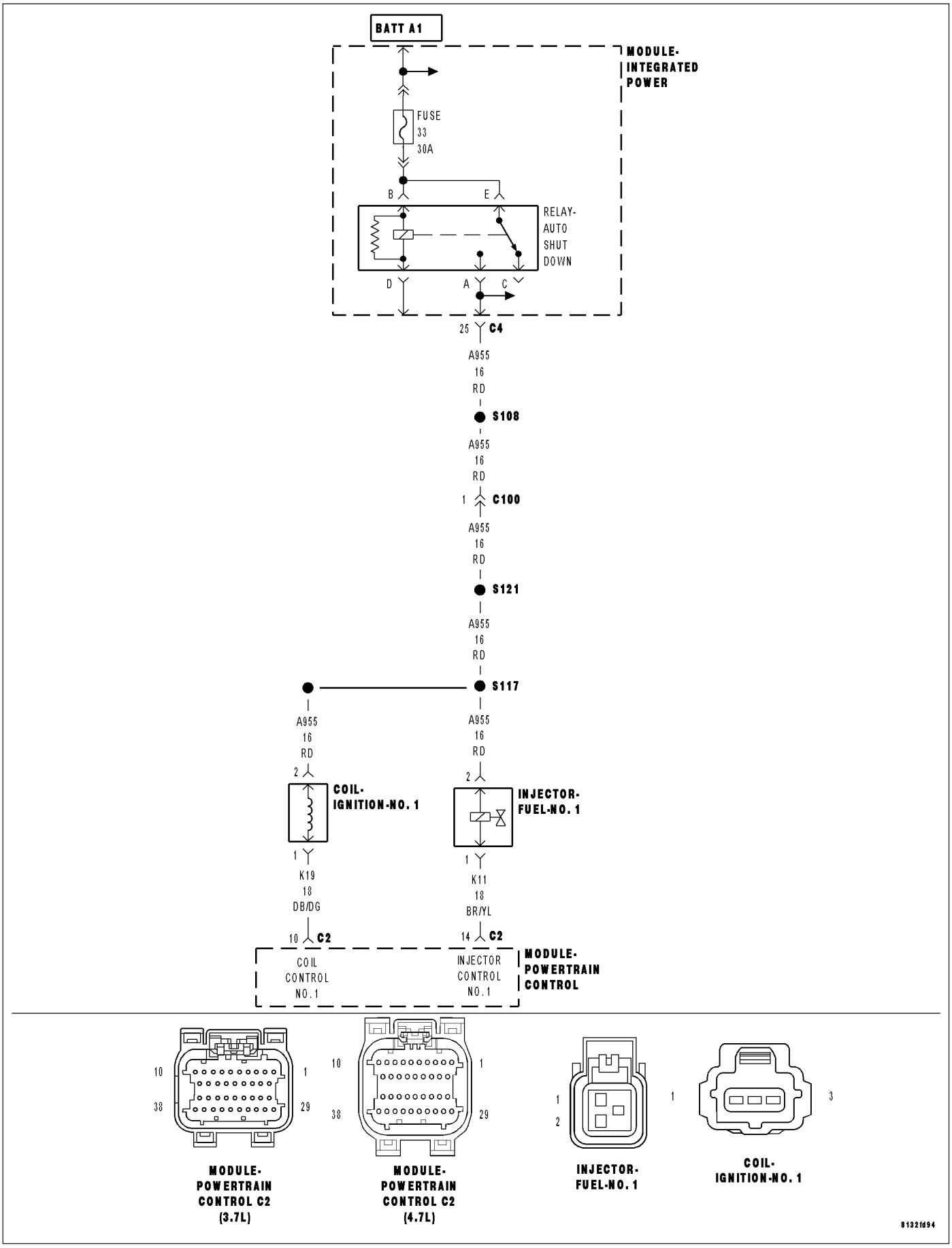
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0301-CYLINDER 1 MISFIRE



P0301-CYLINDER 1 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5%LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K11) INJECTOR CONTROL NO.1 CIRCUIT
(K19) COIL CONTROL NO.1 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL PROBLEM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0301-CYLINDER 1 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

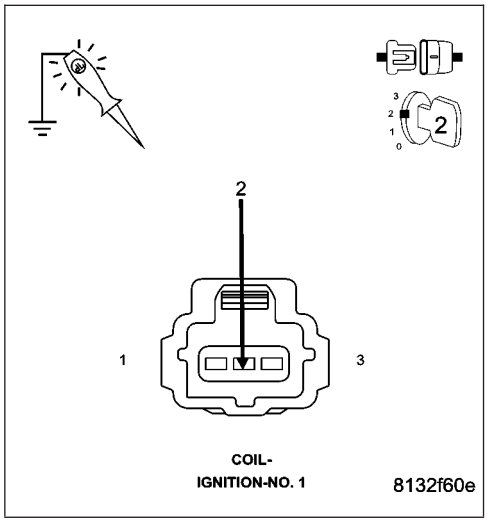
Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

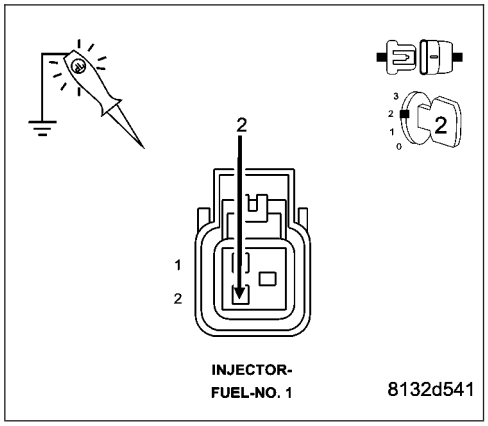
No >> Go To 3

P0301-CYLINDER 1 MISFIRE (CONTINUED)

3. (A955) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.
Disconnect the Ignition Coil No.1 harness connector.
Disconnect the Fuel Injector No.1 harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.





Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.1 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0301-CYLINDER 1 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0301-CYLINDER 1 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair /replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.1 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0301-CYLINDER 1 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

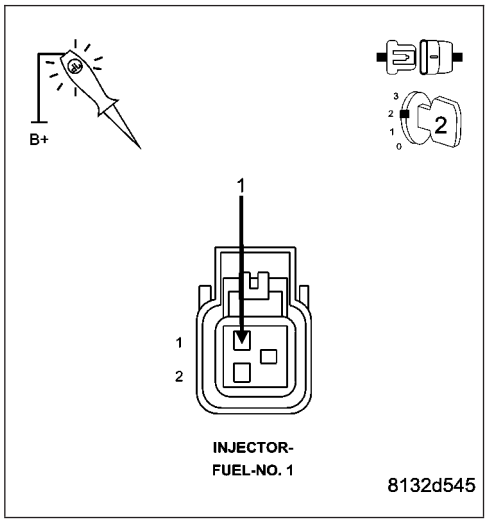
No >> Go To 16

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the No.1 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K11) Injector Control No.1 circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0301-CYLINDER 1 MISFIRE (CONTINUED)

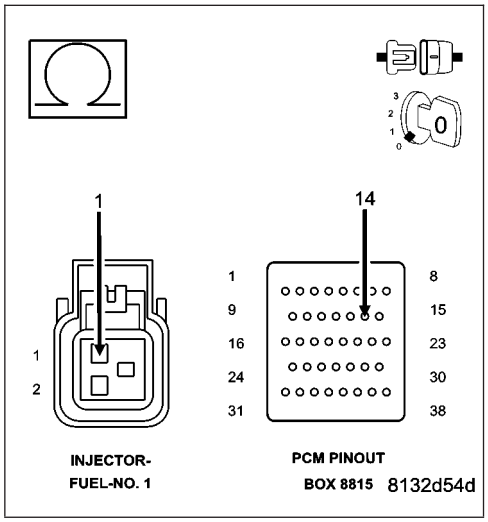
11. (K11) INJECTOR CONTROL NO.1 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K11) Injector Control No.1 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K11) Injector Control No.1 circuit?

Yes >> Repair the excessive resistance or short in the (K11) Injector Control No.1 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0301-CYLINDER 1 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

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14. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K19) Coil Control No.1 circuit.

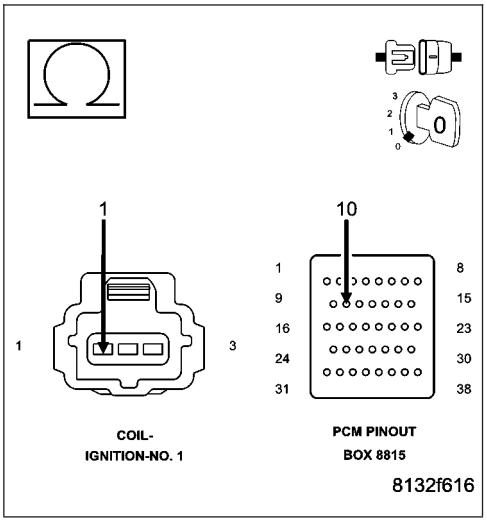
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15



P0301-CYLINDER 1 MISFIRE (CONTINUED)

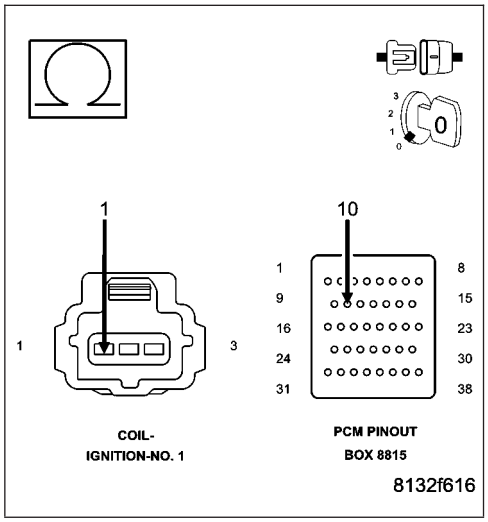
15. (K19) COIL CONTROL NO.1 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K19) Coil Control No.1 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K19) Coil Control No.1 circuit?

Yes >> Repair the (K19) Coil Control No.1 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

16. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

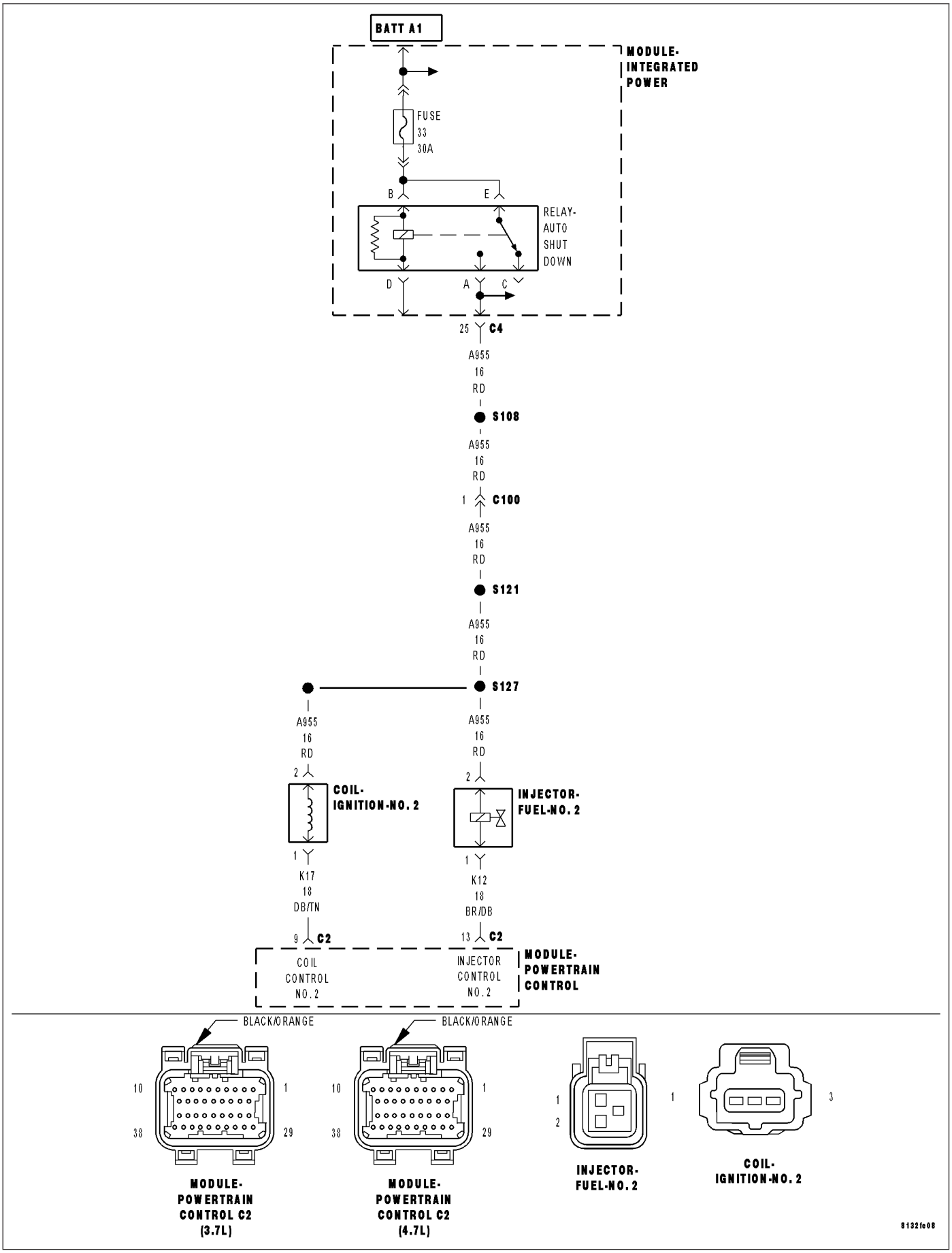
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
PerformPOWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0302-CYLINDER 2 MISFIRE



P0302-CYLINDER 2 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5% LEV) misfire rate is measured during two trips, or with 10 % to 30 % misfire rate during one trip. Three good trips to clear the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K12) INJECTOR CONTROL NO.2 CIRCUIT
(K17) COIL CONTROL NO.2 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL PROBLEM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with the scan tool.

Is there a misfire present?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0302-CYLINDER 2 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

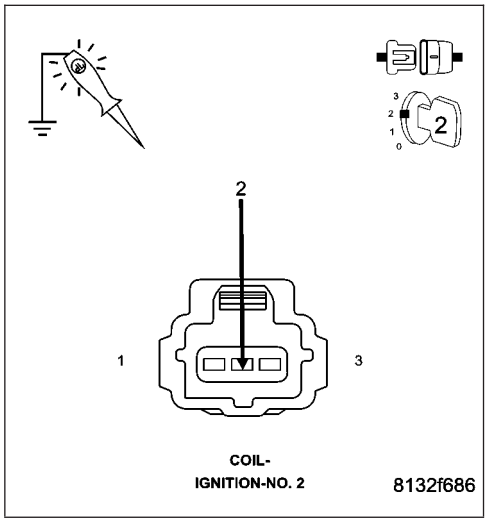
Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0302-CYLINDER 2 MISFIRE (CONTINUED)

3. (A955) ASD RELAY OUTPUT CIRCUIT

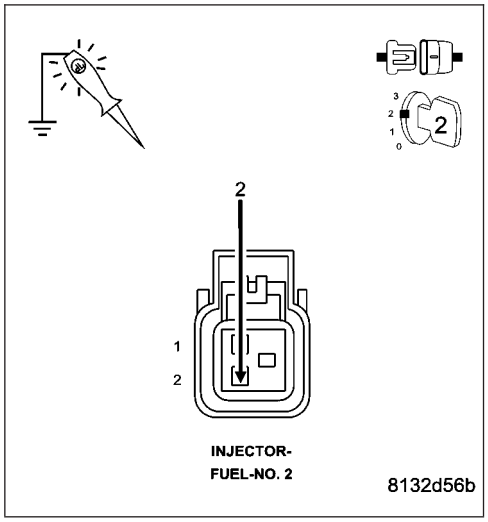
Turn the ignition off.
Disconnect the Ignition Coil No.2 harness connector.
Disconnect the Fuel Injector No.2 harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.2 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0302-CYLINDER 2 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0302-CYLINDER 2 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair /replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi)

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using scan tool, actuate the No.2 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0302-CYLINDER 2 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

---

10. FUEL INJECTOR

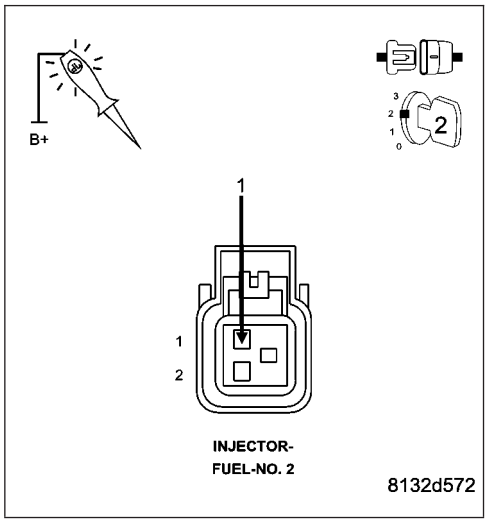
Turn the ignition off.
Disconnect the No.2 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K12) Injector Control No.2 circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



P0302-CYLINDER 2 MISFIRE (CONTINUED)

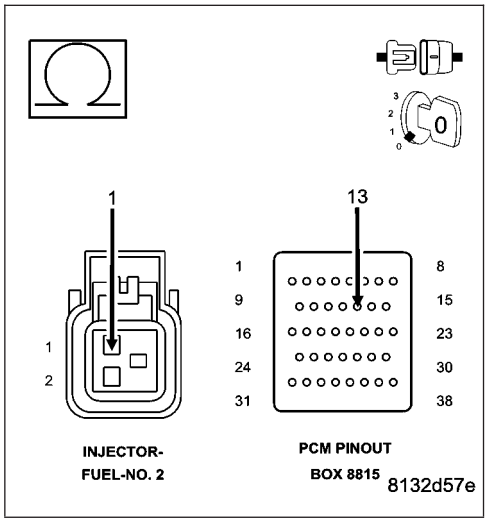
11. (K12) INJECTOR CONTROL NO.2 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K12) Injector Control No.2 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K12) Injector Control No.2 circuit?

Yes >> Repair the excessive resistance or short in the (K12) Injector Control No.2 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0302-CYLINDER 2 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

14. IGNITION COIL

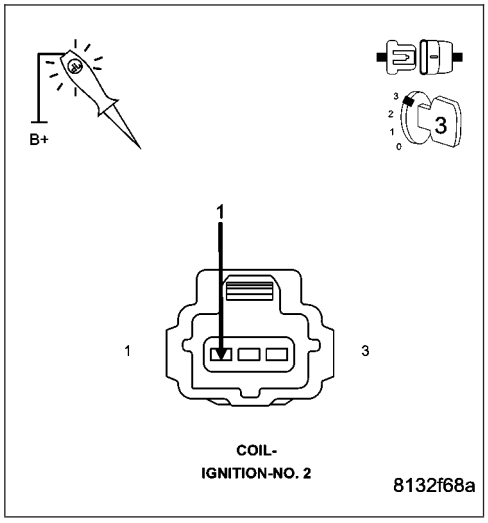
Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K17) Coil Control No.2 circuit.

Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).



Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

P0302-CYLINDER 2 MISFIRE (CONTINUED)

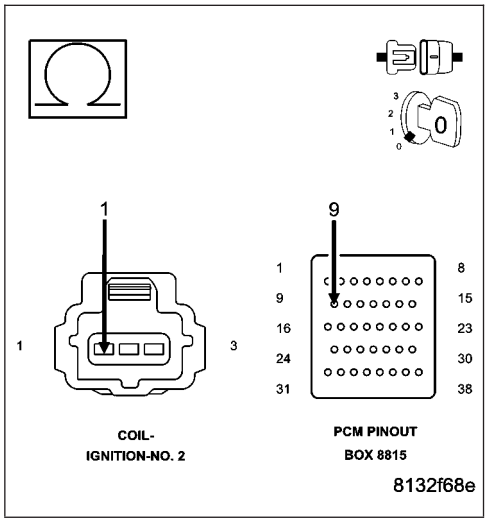
15. (K17) COIL CONTROL NO.2 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K17) Coil Control No.2 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K17) Coil Control No.2 circuit?

Yes >> Repair the (K17) Coil Control No.2 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

16. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

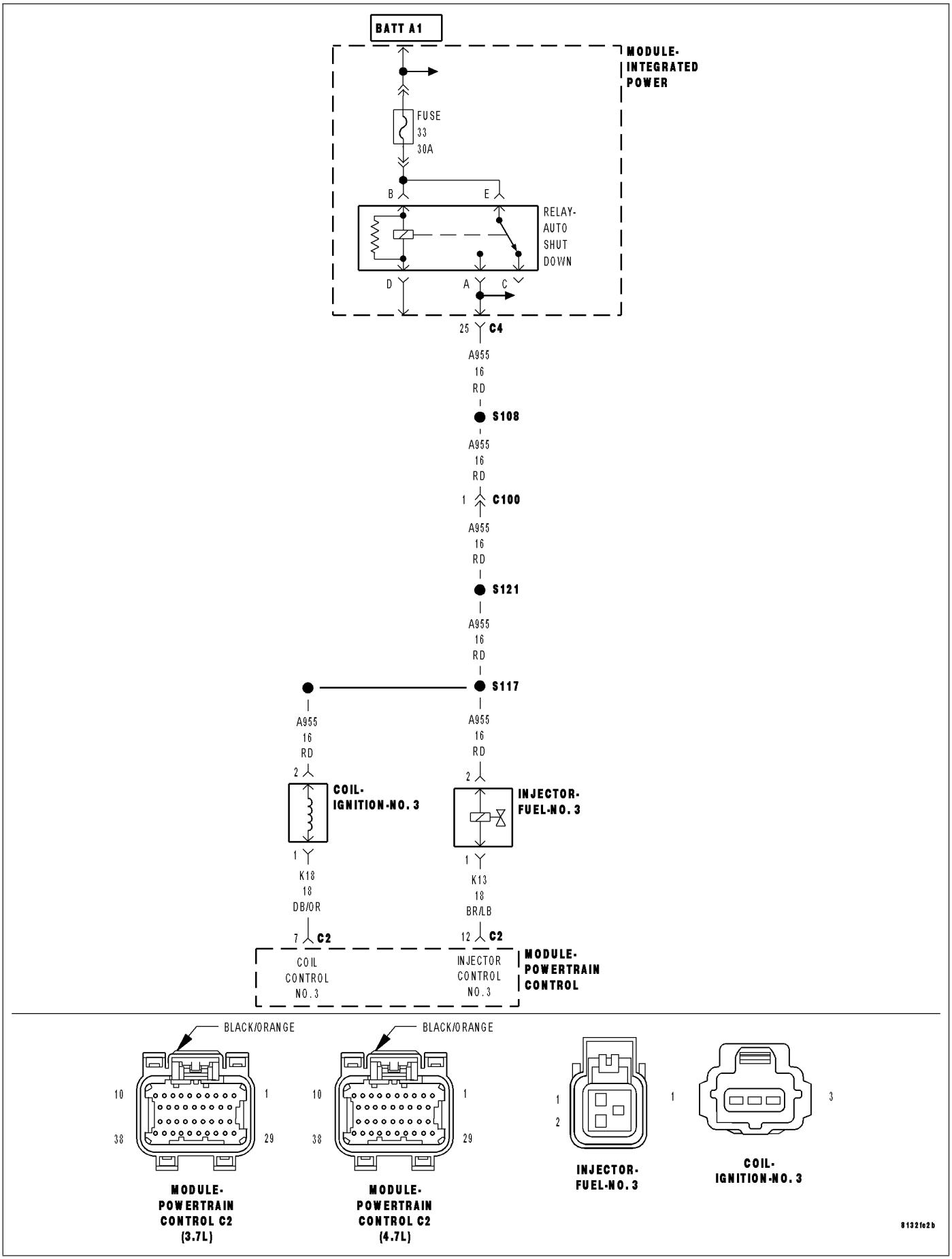
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
PerformPOWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0303-CYLINDER 3 MISFIRE



P0303-CYLINDER 3 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5%LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K13) INJECTOR CONTROL NO.3 CIRCUIT
(K18) COIL CONTROL NO.3 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL PROBLEM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0303-CYLINDER 3 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

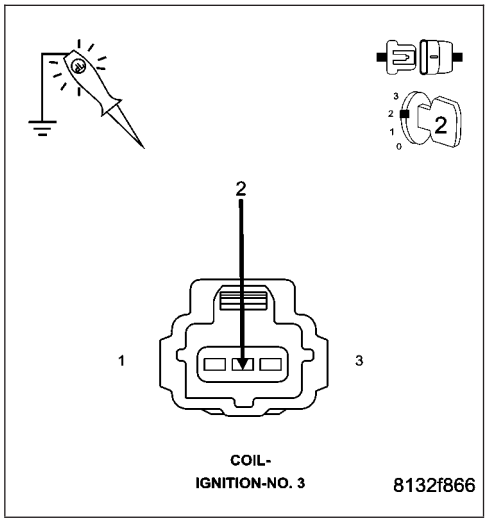
Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0303-CYLINDER 3 MISFIRE (CONTINUED)

3. (A955) ASD RELAY OUTPUT CIRCUIT

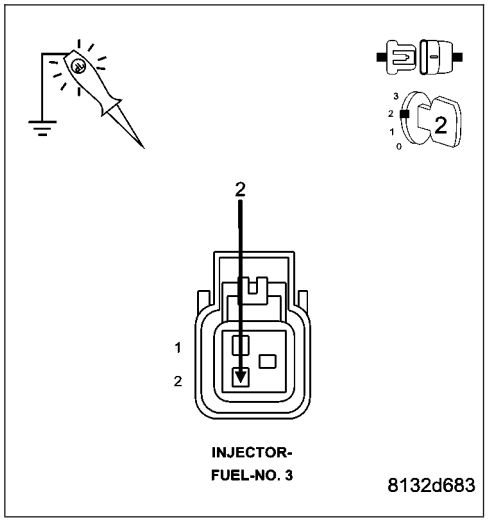
Turn the ignition off.
Disconnect the No.3 Ignition Coil harness connector.
Disconnect the No.3 Fuel Injector harness connector.
Ignition on, engine not running.
With a scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.3 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0303-CYLINDER 3 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0303-CYLINDER 3 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair /replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the fuel pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using a scan tool, actuate the No.3 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0303-CYLINDER 3 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

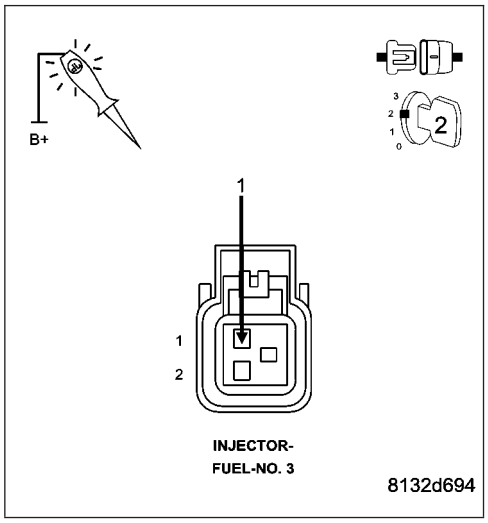
No >> Go To 16

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the No.3 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K13) Injector Control No.3 circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0303-CYLINDER 3 MISFIRE (CONTINUED)

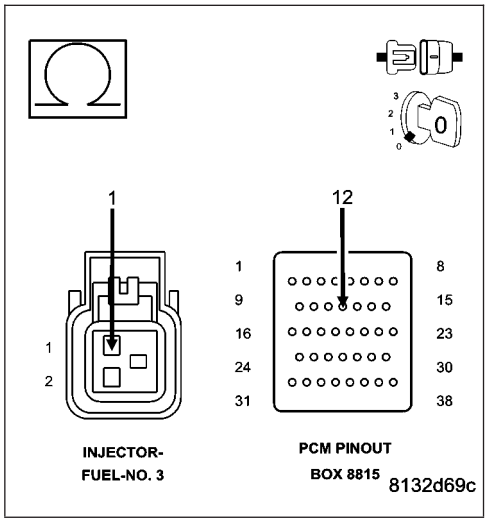
11. (K13) INJECTOR CONTROL NO.3 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K13) Injector Control No.3 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K13) Injector Control No.3 circuit?

Yes >> Repair the excessive resistance or short in the (K13) Injector Control No.3 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0303-CYLINDER 3 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
PerformPOWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION COIL

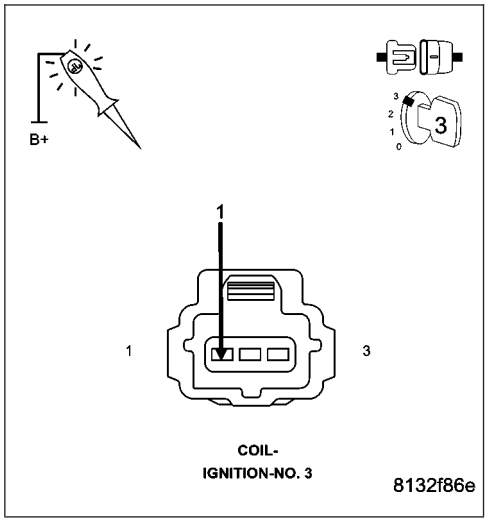
Disconnect the No.3 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K18) Coil Control No.3 circuit.

Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).



Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

P0303-CYLINDER 3 MISFIRE (CONTINUED)

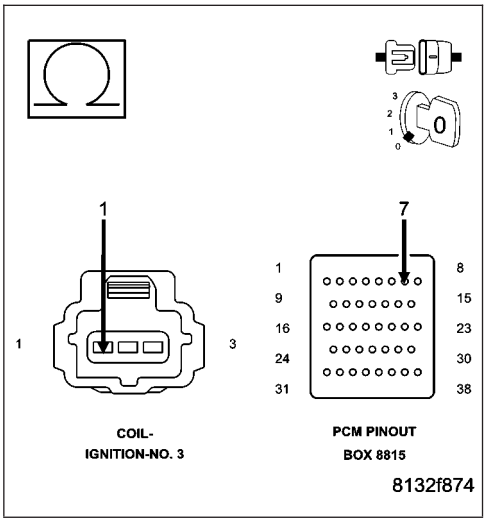
15. (K18) COIL CONTROL NO.3 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K18) Coil Control No.3 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K18) Coil Control No.3 circuit?

Yes >> Repair the (K18) Coil Control No.3 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

16. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

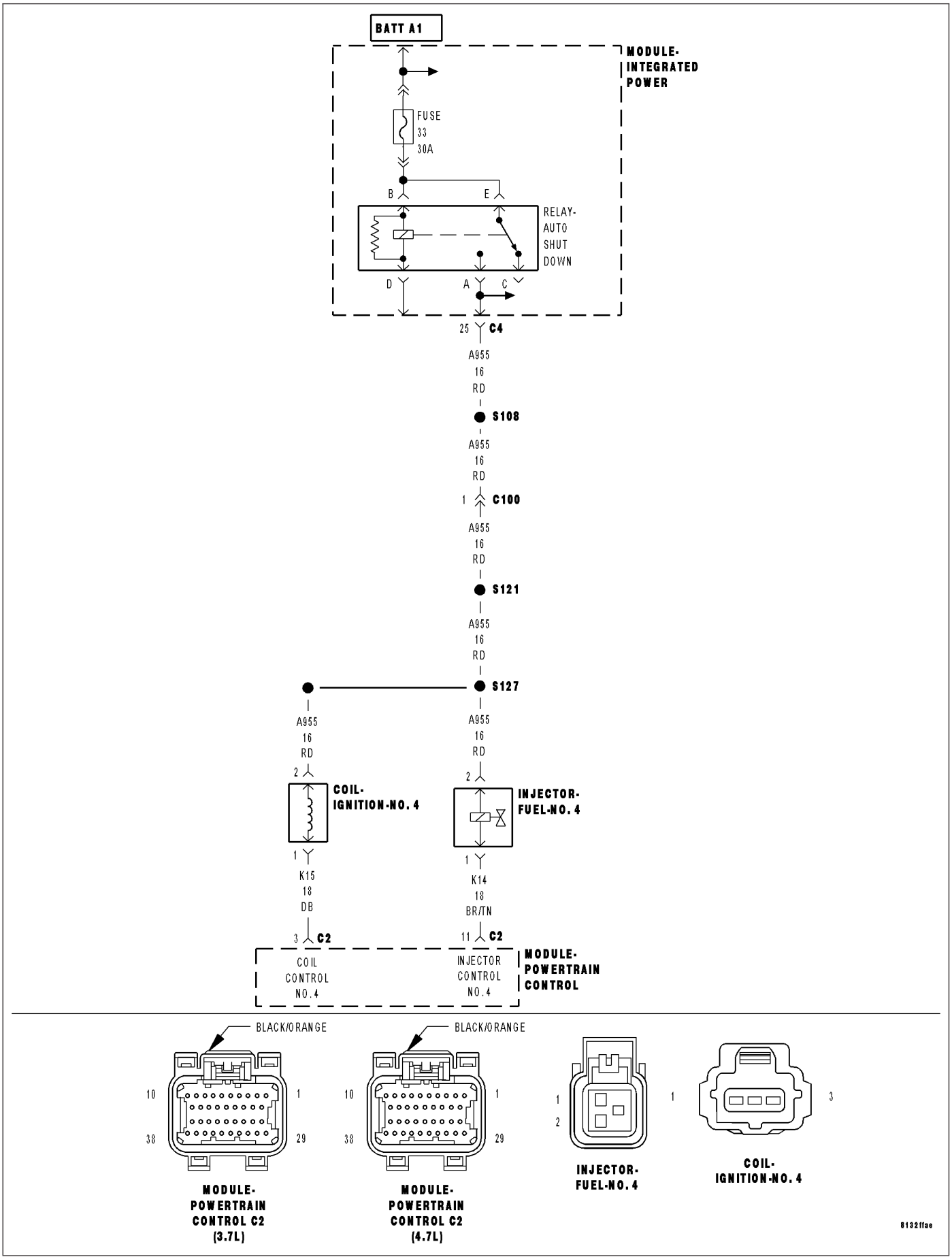
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0304-CYLINDER 4 MISFIRE



P0304-CYLINDER 4 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5%LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K14) INJECTOR CONTROL NO.4 CIRCUIT
(K15) COIL CONTROL NO.4 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL PROBLEM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0304-CYLINDER 4 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

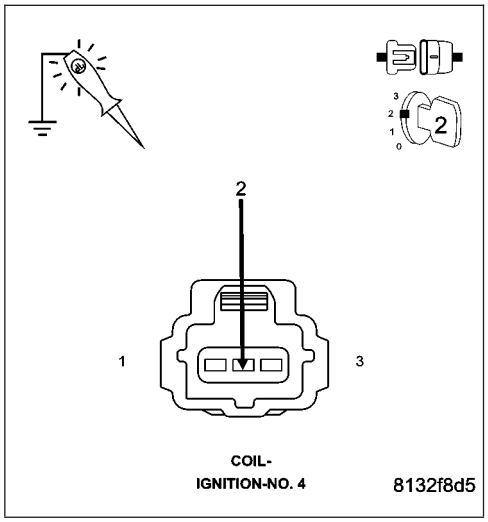
Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

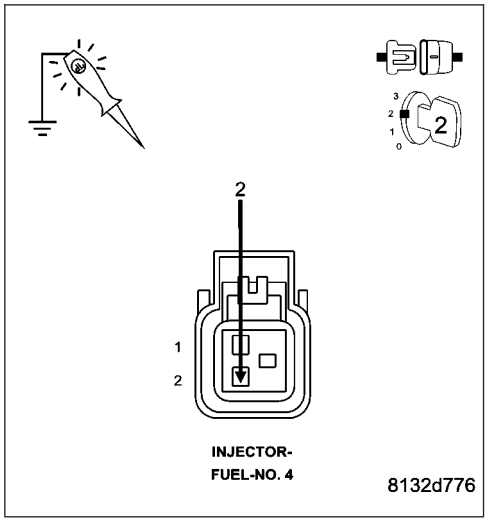
No >> Go To 3

P0304-CYLINDER 4 MISFIRE (CONTINUED)

3. (A955) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.
Disconnect the No.4 Ignition Coil harness connector.
Disconnect the No.4 Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.





Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the No.4 Ignition Coil harness connector.
Remove the No.4 Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0304-CYLINDER 4 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

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6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0304-CYLINDER 4 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair /replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi)

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.4 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0304-CYLINDER 4 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

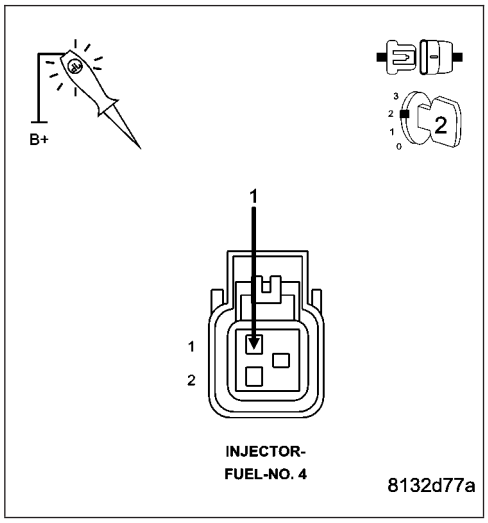
No >> Go To 16

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the No.4 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K14) Injector Control No.4 circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0304-CYLINDER 4 MISFIRE (CONTINUED)

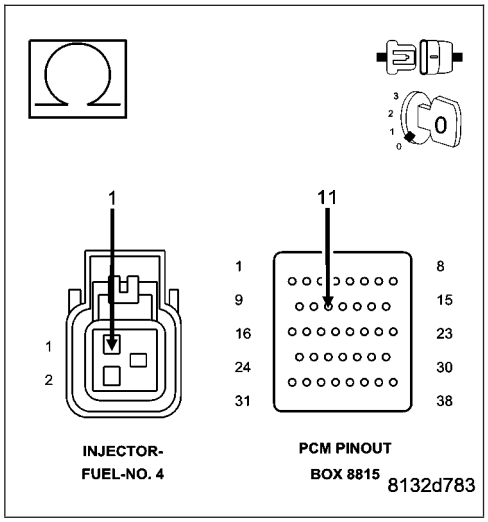
11. (K14) INJECTOR CONTROL NO.4 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K14) Injector Control No.4 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K14) Injector Control No.4 circuit?

Yes >> Repair the excessive resistance or short in the (K14) Injector Control No.4 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0304-CYLINDER 4 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

14. IGNITION COIL

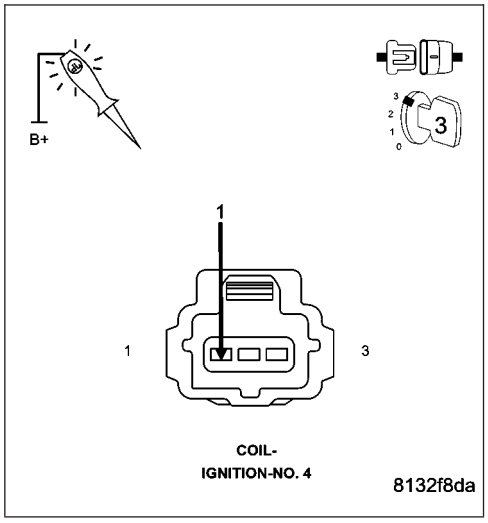
Disconnect the No.4 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K15) Coil Control No.4 circuit.

Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).



Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

P0304-CYLINDER 4 MISFIRE (CONTINUED)

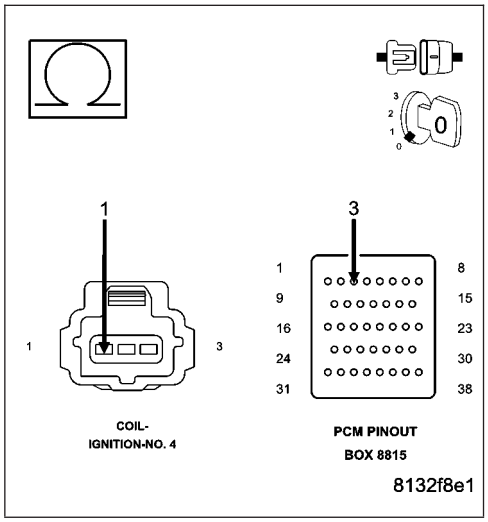
15. (K15) COIL CONTROL NO.4 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K15) Coil Control No.4 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K15) Coil Control No.4 circuit?

Yes >> Repair the (K15) Coil Control No.4 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

16. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

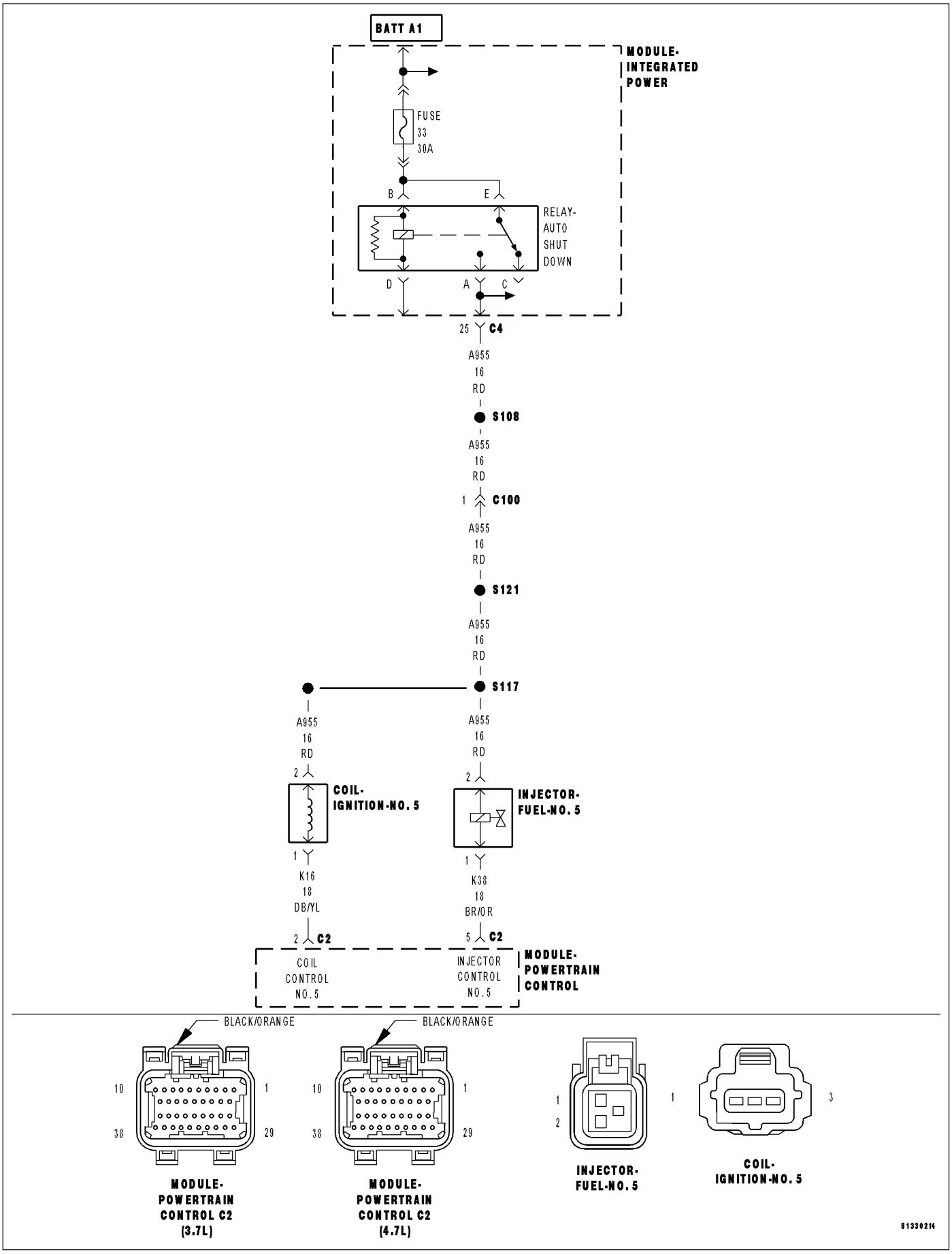
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0305-CYLINDER 5 MISFIRE



P0305-CYLINDER 5 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5%LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K38) INJECTOR CONTROL NO.5 CIRCUIT
(K16) COIL CONTROL NO.5 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL PROBLEM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with a scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0305-CYLINDER 5 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

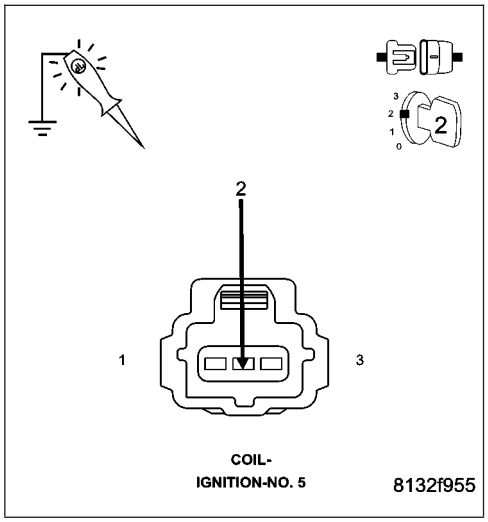
Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0305-CYLINDER 5 MISFIRE (CONTINUED)

3. (A955) ASD RELAY OUTPUT CIRCUIT

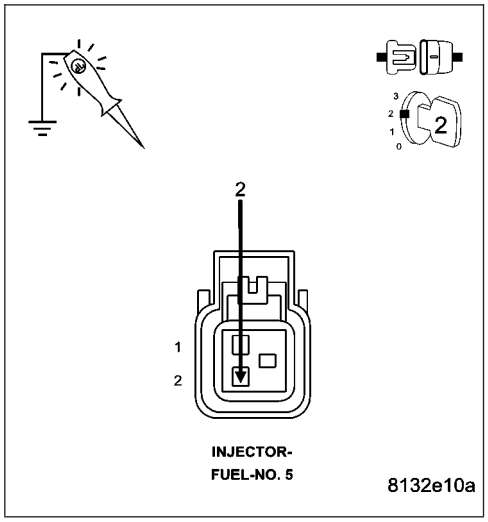
Turn the ignition off.
Disconnect the No.5 Ignition Coil harness connector.
Disconnect the No.5 Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.5 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0305-CYLINDER 5 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0305-CYLINDER 5 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair /replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.5 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0305-CYLINDER 5 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

---

10. FUEL INJECTOR

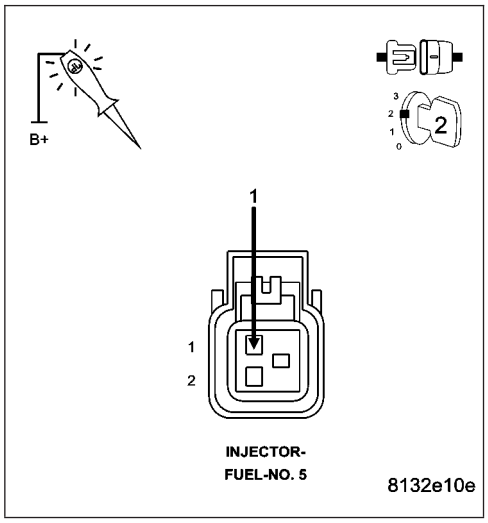
Turn the ignition off.
Disconnect the No.5 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K38) Injector Control No.5 circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



P0305-CYLINDER 5 MISFIRE (CONTINUED)

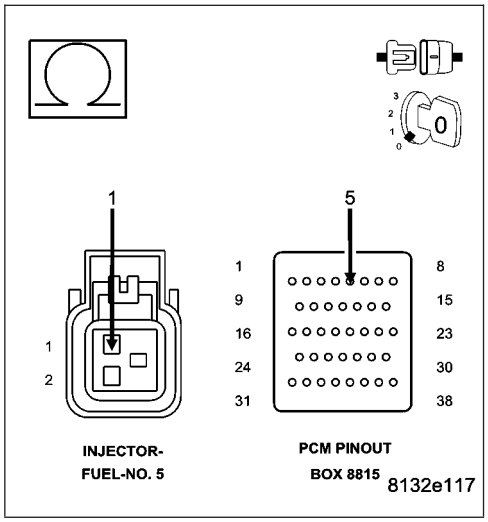
11. (K38) INJECTOR CONTROL NO.5 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K38) Injector Control No.5 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K38) Injector Control No.5 circuit?

Yes >> Repair the excessive resistance or short in the (K38) Injector Control No.5 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

---

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0305-CYLINDER 5 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

14. IGNITION COIL

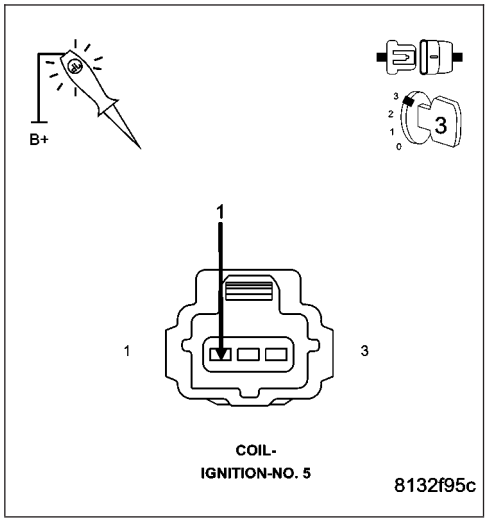
Disconnect the No.5 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K16) Coil Control No.5 circuit.

Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).



Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

P0305-CYLINDER 5 MISFIRE (CONTINUED)

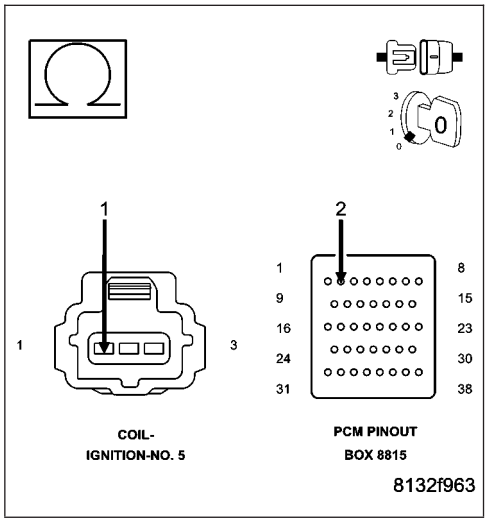
15. (K16) COIL CONTROL NO.5 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K16) Coil Control No.5 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K16) Coil Control No.5 circuit?

Yes >> Repair the (K16) Coil Control No.5 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

16. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

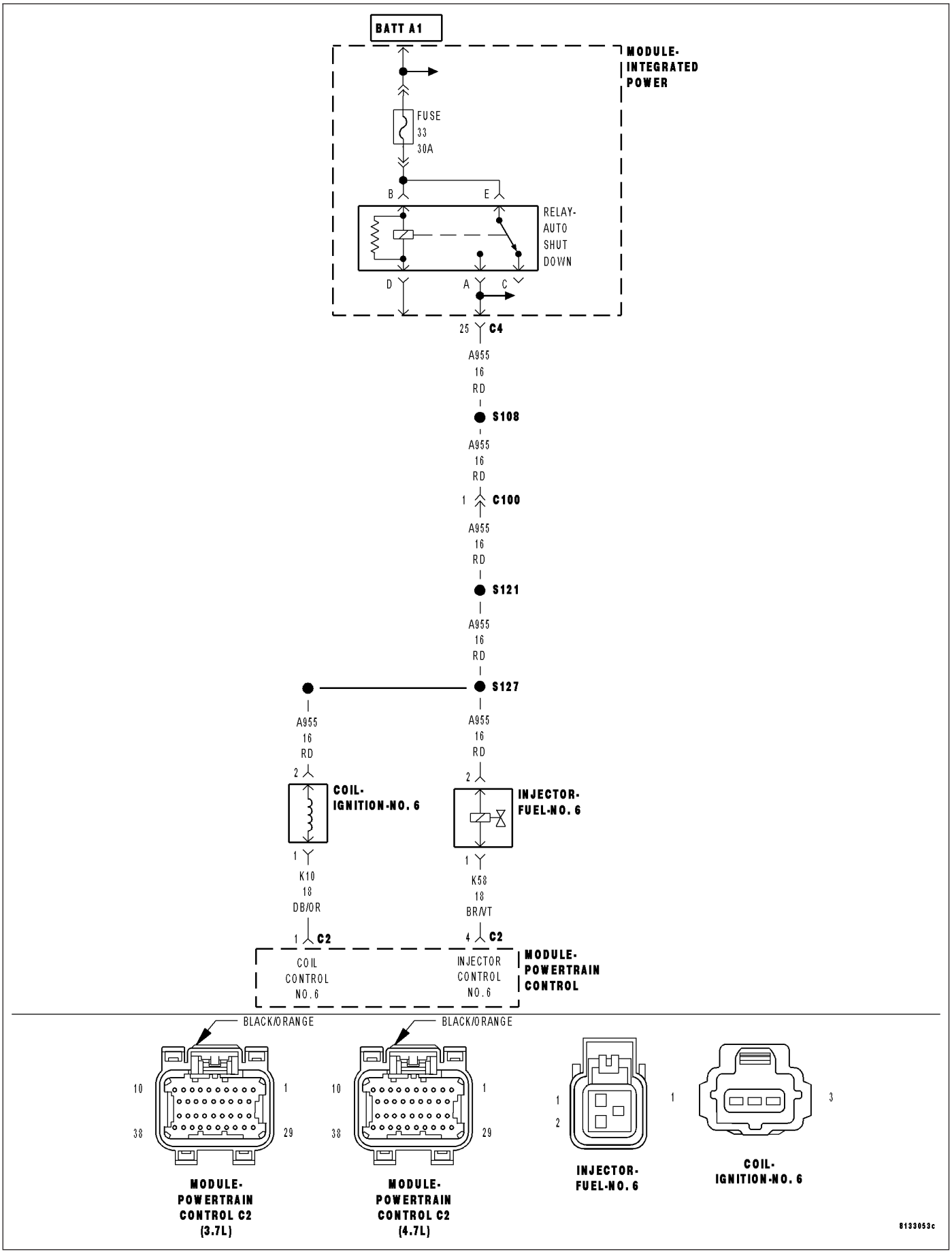
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0306-CYLINDER 6 MISFIRE



P0306-CYLINDER 6 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5%LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K58) INJECTOR CONTROL NO.6 CIRCUIT
(K10) COIL CONTROL NO.6 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL PROBLEM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with a scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0306-CYLINDER 6 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

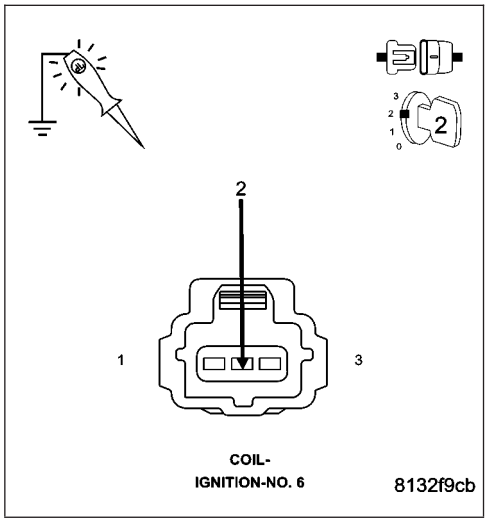
Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

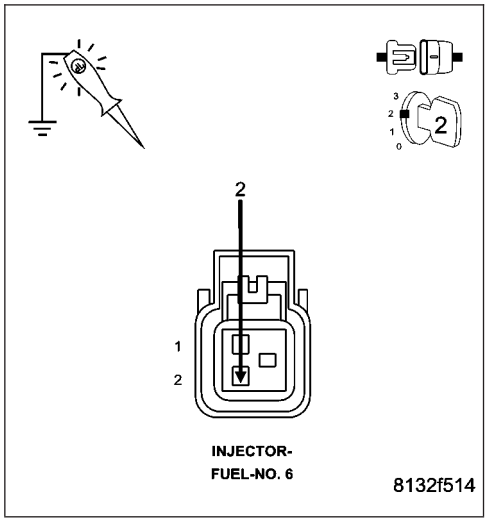
No >> Go To 3

P0306-CYLINDER 6 MISFIRE (CONTINUED)

3. (A955) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.
Disconnect the No.6 Ignition Coil harness connector.
Disconnect the No.6 Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.





Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.6 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0306-CYLINDER 6 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

P0306-CYLINDER 6 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair /replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.6 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0306-CYLINDER 6 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

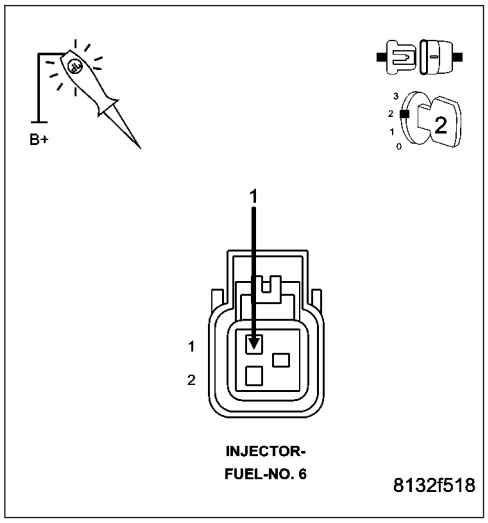
No >> Go To 16

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the No.6 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K58) Injector Control No.6 circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0306-CYLINDER 6 MISFIRE (CONTINUED)

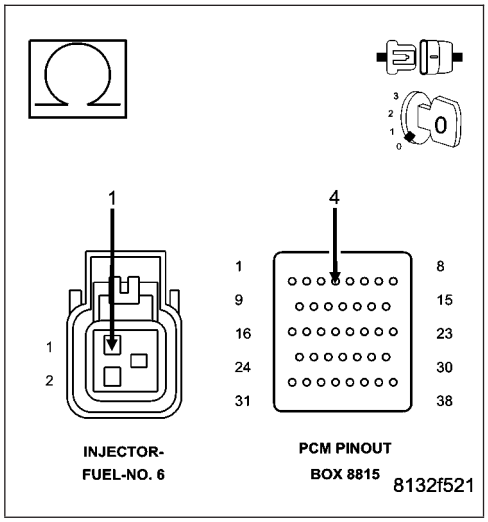
11. (K58) INJECTOR CONTROL NO.6 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K58) Injector Control No.6 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K58) Injector Control No.6 circuit?

Yes >> Repair the excessive resistance or short in the (K58) Injector Control No.6 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0306-CYLINDER 6 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

14. IGNITION COIL

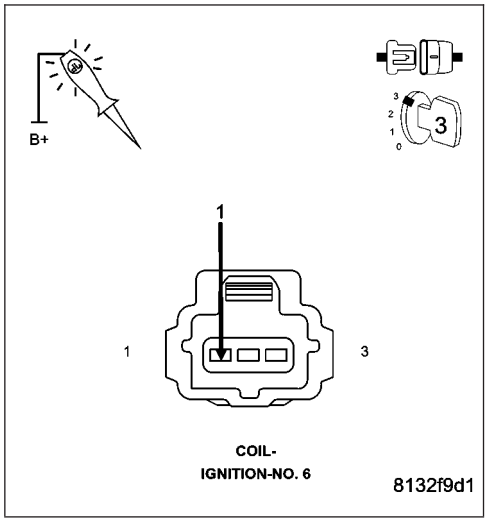
Disconnect the No.6 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K10) Coil Control No.6 circuit.

Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).



Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

P0306-CYLINDER 6 MISFIRE (CONTINUED)

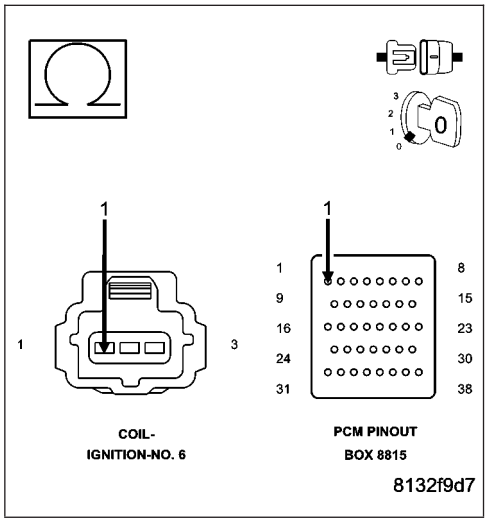
15. (K10) COIL CONTROL NO.6 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K10) Coil Control No.6 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K10) Coil Control No.6 circuit?

Yes >> Repair the (K10) Coil Control No.6 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

16. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

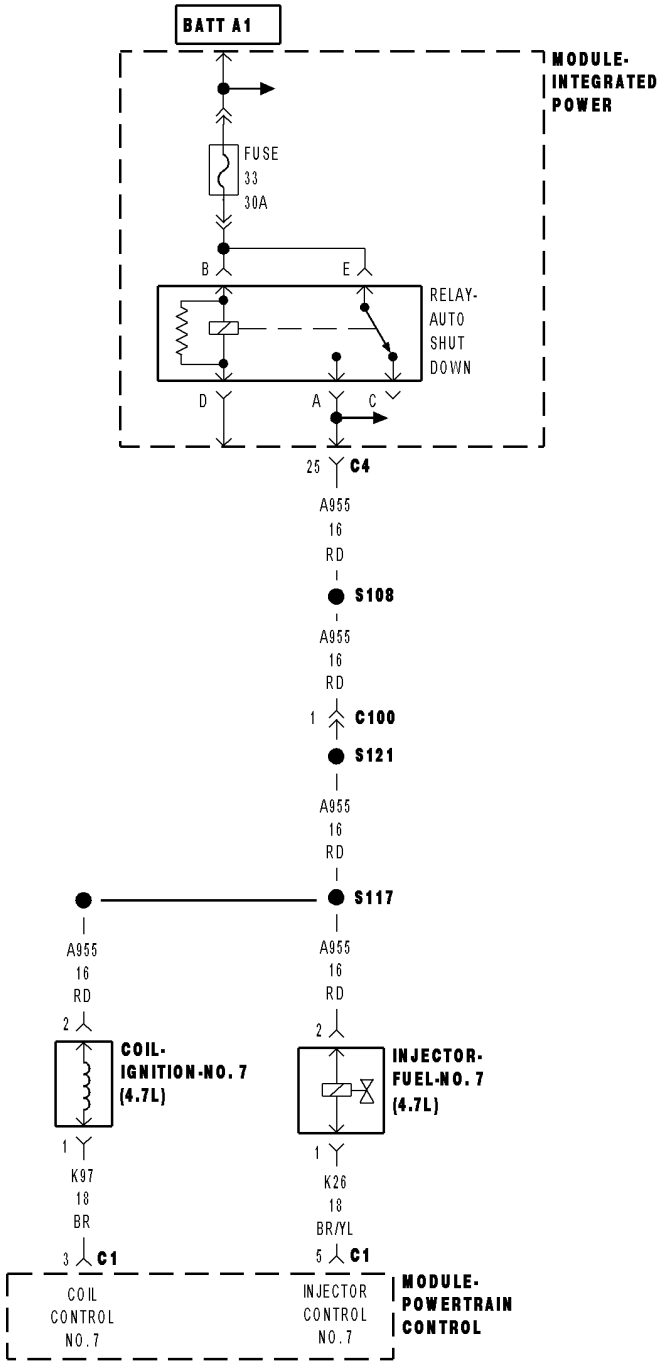
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

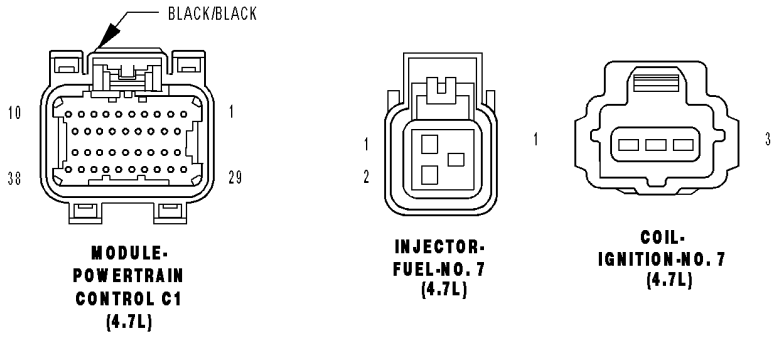
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0307-CYLINDER 7 MISFIRE





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P0307-CYLINDER 7 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5%LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K26) INJECTOR CONTROL NO.7 CIRCUIT
(K97) COIL CONTROL NO.7 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL PROBLEM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with a scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0307-CYLINDER 7 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

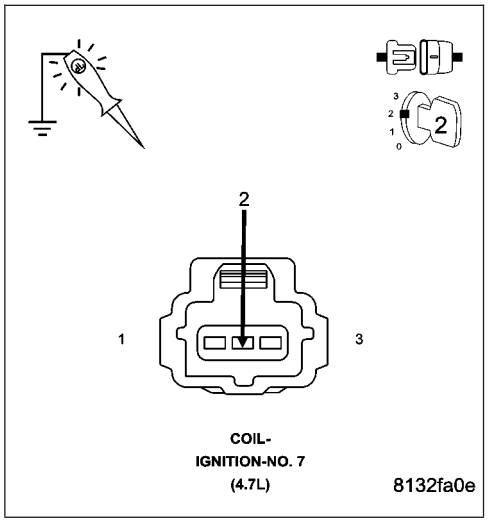
Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

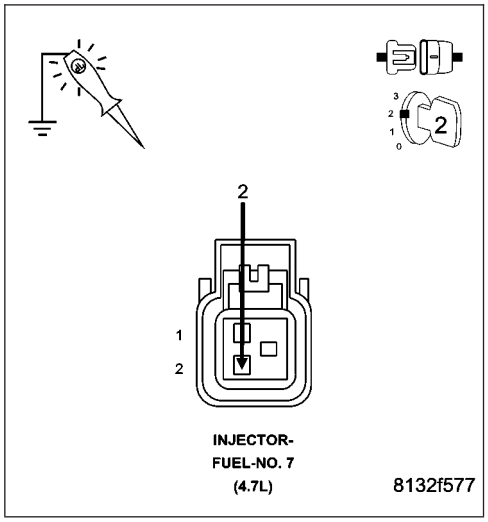
No >> Go To 3

P0307-CYLINDER 7 MISFIRE (CONTINUED)

3. (A955) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.
Disconnect the No.7 Ignition Coil harness connector.
Disconnect the No.7 Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.





Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.7 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0307-CYLINDER 7 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0307-CYLINDER 7 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair /replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.7 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0307-CYLINDER 7 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

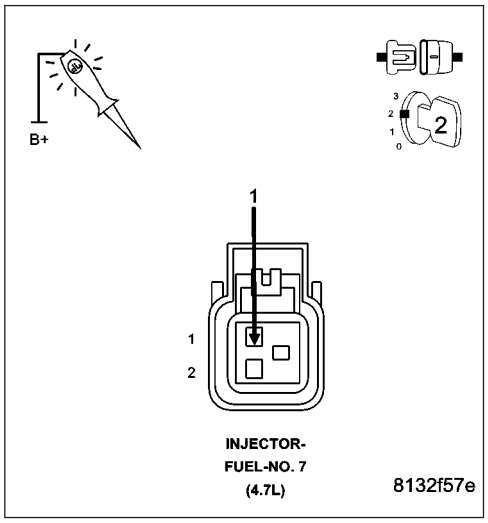
No >> Go To 16

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the No.7 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K26) Injector Control No.7 circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0307-CYLINDER 7 MISFIRE (CONTINUED)

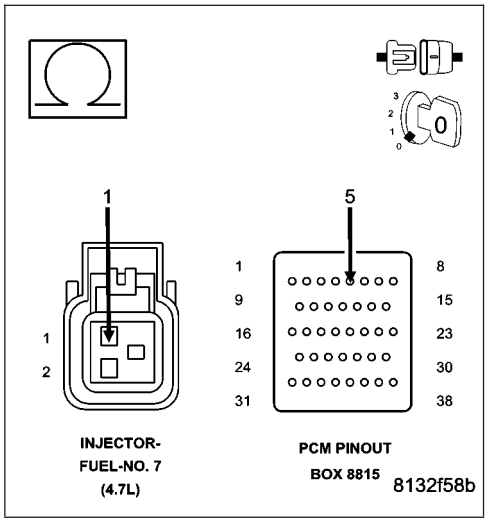
11. (K26) INJECTOR CONTROL NO.7 CIRCUIT

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K26) Injector Control No.7 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K26) Injector Control No.7 circuit?

Yes >> Repair the excessive resistance or short in the (K26) Injector Control No.7 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0307-CYLINDER 7 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION COIL

Disconnect the No.7 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K97) Coil Control No.7 circuit.

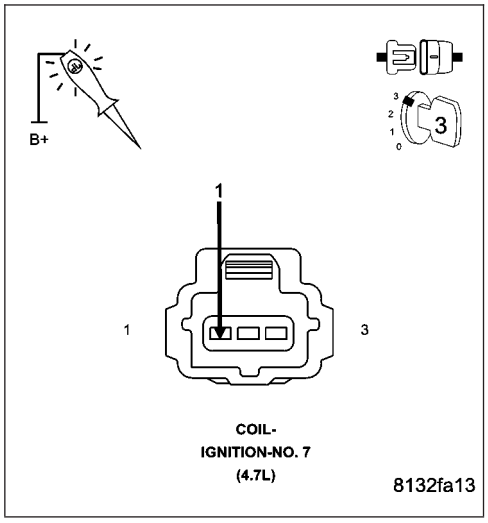
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15



P0307-CYLINDER 7 MISFIRE (CONTINUED)

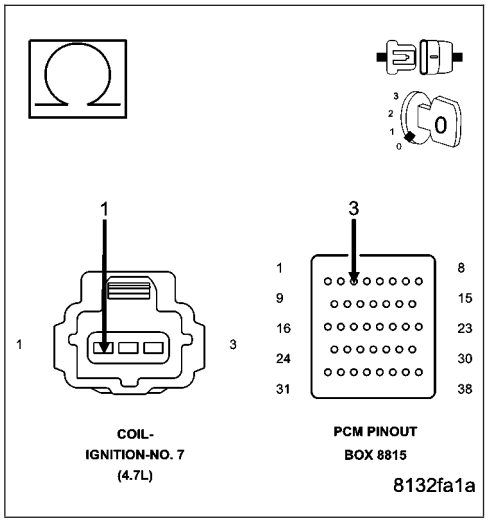
15. (K97) COIL CONTROL NO.7 CIRCUIT

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K97) Coil Control No.7 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K97) Coil Control No.7 circuit?

Yes >> Repair the (K97) Coil Control No.7 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

16. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

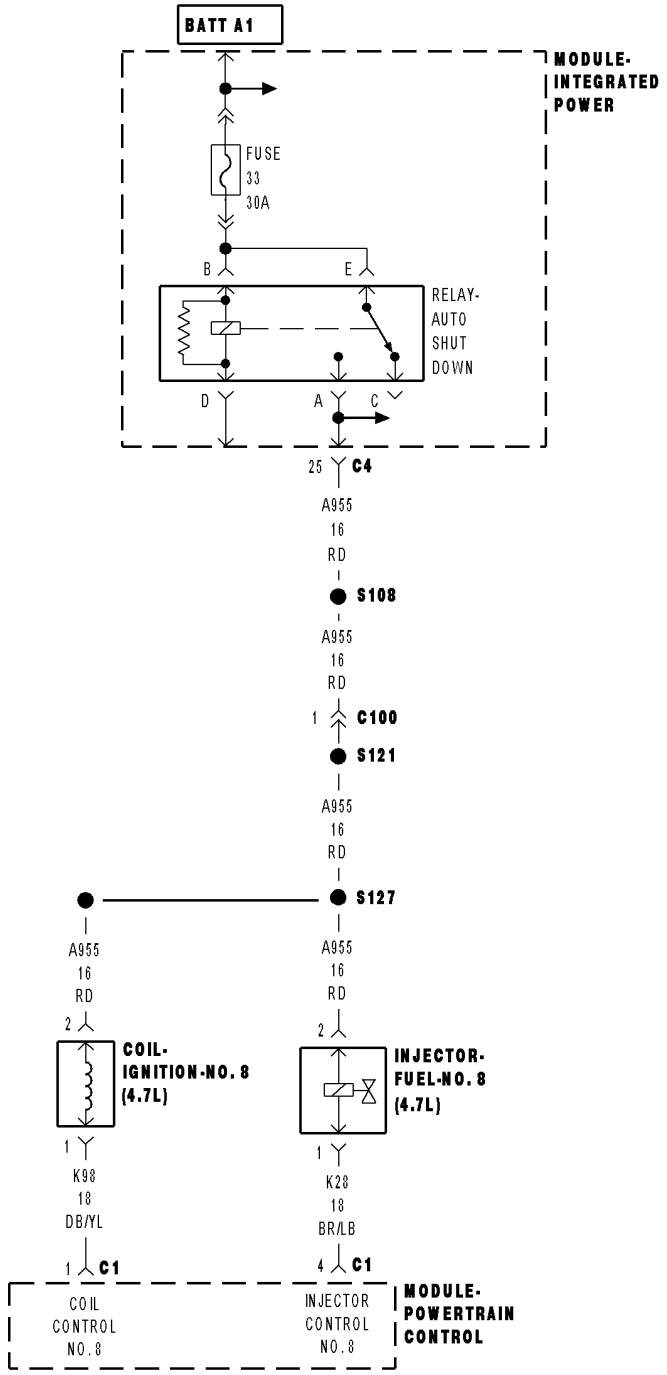
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

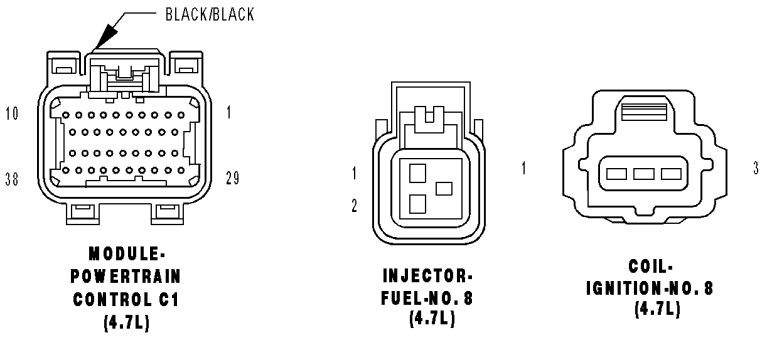
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0308-CYLINDER 8 MISFIRE





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P0308-CYLINDER 8 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5%LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K28) INJECTOR CONTROL NO.8 CIRCUIT
(K98) COIL CONTROL NO.8 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL PROBLEM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with a scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0308-CYLINDER 8 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

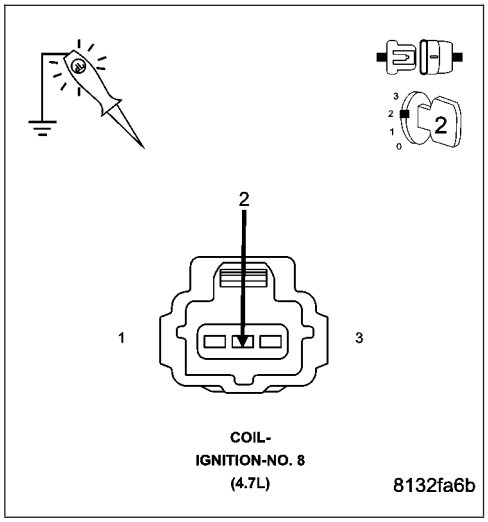
Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0308-CYLINDER 8 MISFIRE (CONTINUED)

3. (A955) ASD RELAY OUTPUT CIRCUIT

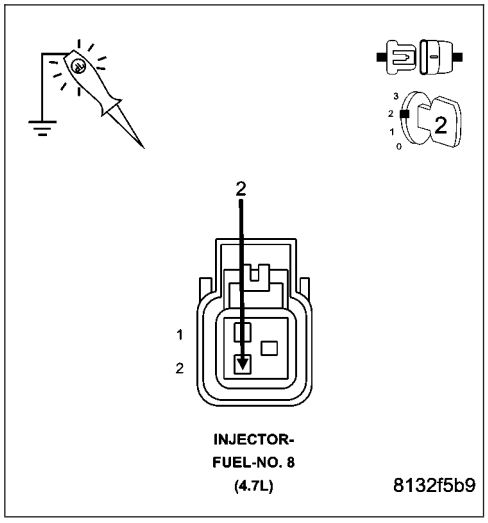
Turn the ignition off.
Disconnect the No.8 Ignition Coil harness connector.
Disconnect the No.8 Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.8 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0308-CYLINDER 8 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0308-CYLINDER 8 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair /replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.8 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0308-CYLINDER 8 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

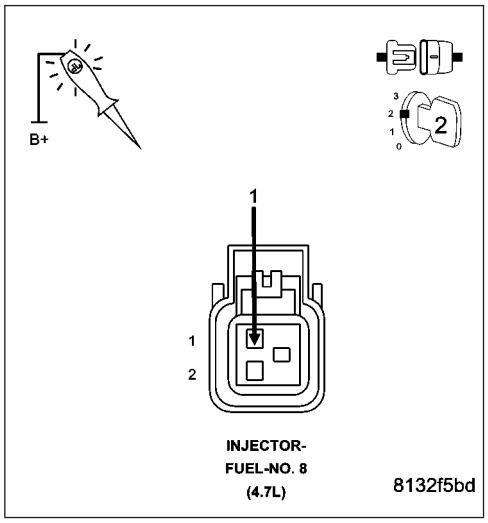
No >> Go To 16

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the No.8 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K28) Injector Control No.8 circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0308-CYLINDER 8 MISFIRE (CONTINUED)

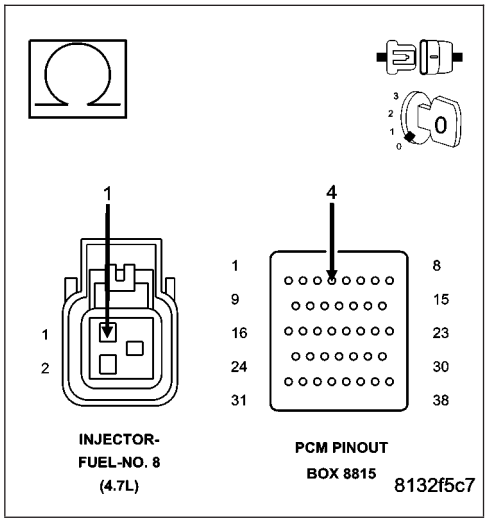
11. (K28) INJECTOR CONTROL NO.8 CIRCUIT

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K28) Injector Control No.8 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K28) Injector Control No.8 circuit?

Yes >> Repair the excessive resistance or short in the (K28) Injector Control No.8 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

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12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0308-CYLINDER 8 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION COIL

Disconnect the No.8 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K98) Coil Control No.8 circuit.

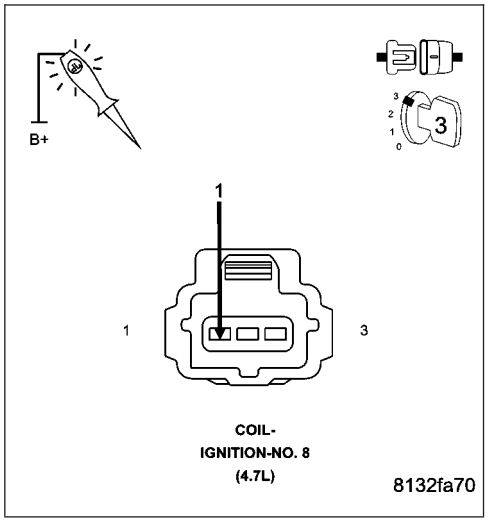
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15



P0308-CYLINDER 8 MISFIRE (CONTINUED)

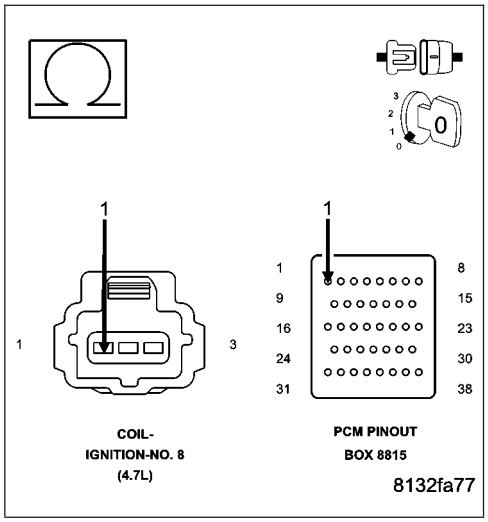
15. (K98) COIL CONTROL NO.8 CIRCUIT

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K98) Coil Control No.8 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K98) Coil Control No.8 circuit?

Yes >> Repair the (K98) Coil Control No.8 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

16. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

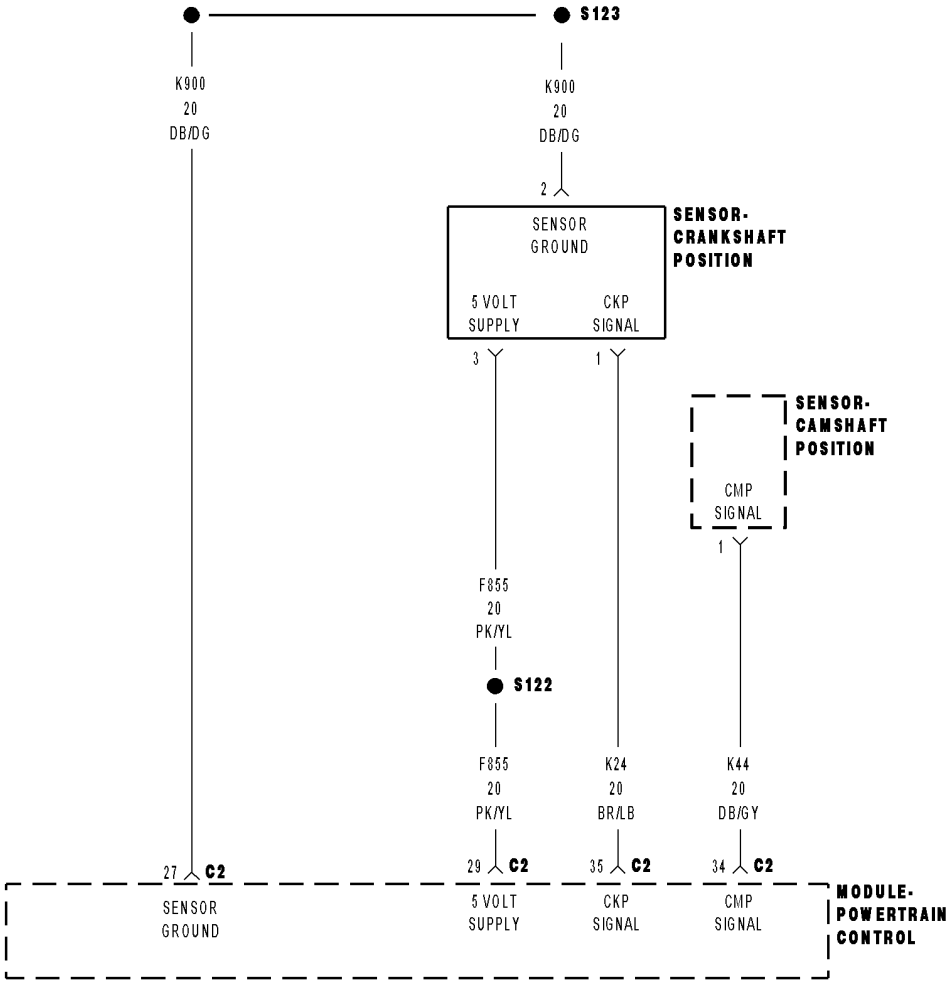
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

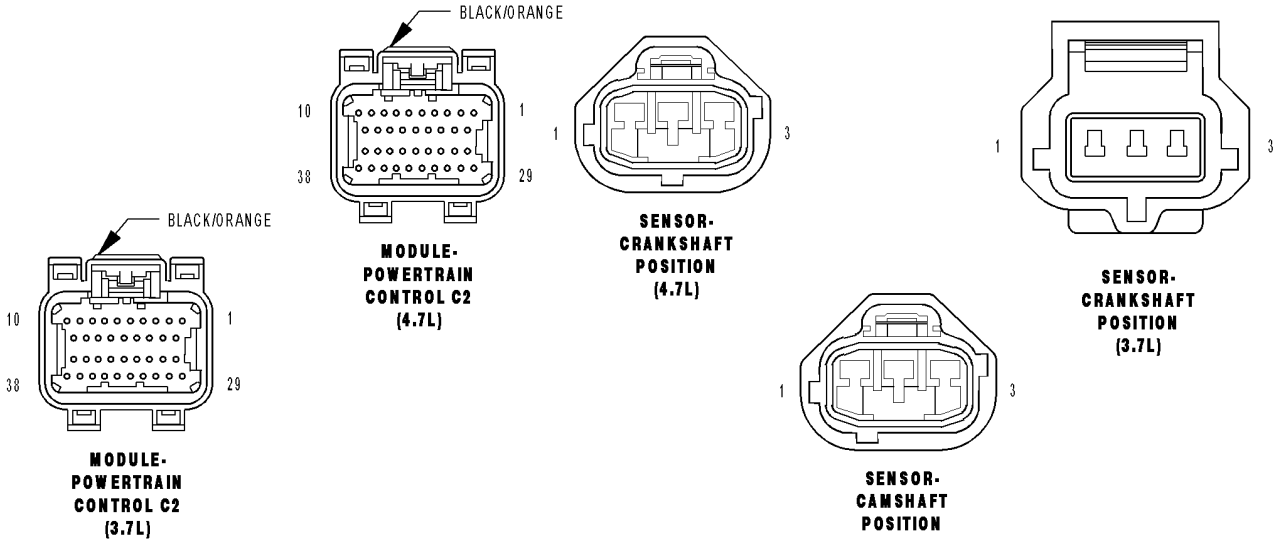
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0315-NO CRANK SENSOR LEARNED





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P0315-NO CRANK SENSOR LEARNED (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Under closed throttle decel and A/C off. ECT above 75°C (167°F). Engine start time is greater than 50 seconds.
- **Set Condition:**
  One of the CKP sensor target windows has more than 2.86% variance from the reference. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
TONE WHEEL/PULSE RING
WIRE HARNESS
CRANKSHAFT POSITION SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, clear DTCs, PCM battery disconnect to reset the PCM.

Start the engine.

If the MIL has not yet illuminated, test drive the vehicle to try to get the code to reset.

Does the code reset while cranking or during the test drive?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0315-NO CRANK SENSOR LEARNED (CONTINUED)

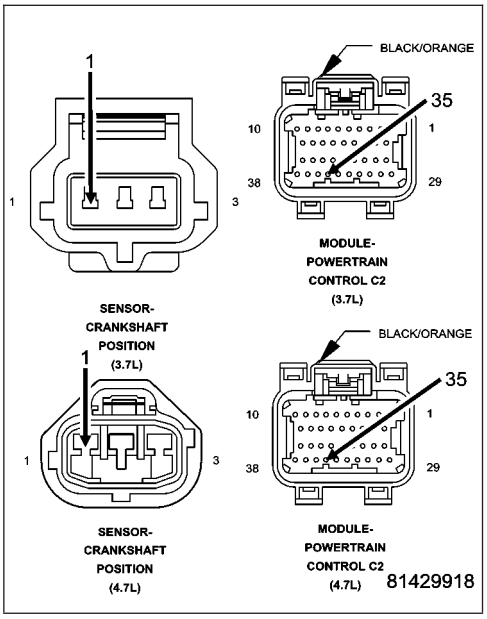
2. WIRE HARNESS INSPECTION

Turn the ignition off.

Visually inspect the CKP wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the CKP wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor is properly installed and the mounting bolt(s) are torqued to the proper specification.



Were any of the above conditions present?

Yes >> Repair as necessary
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

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3. TONE WHEEL/FLEX PLATE INSPECTION

Remove the Crankshaft Position Sensor.

Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement.

Were any problems found?

Yes >> Repair or replace the Tone Wheel/Flex Plate as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

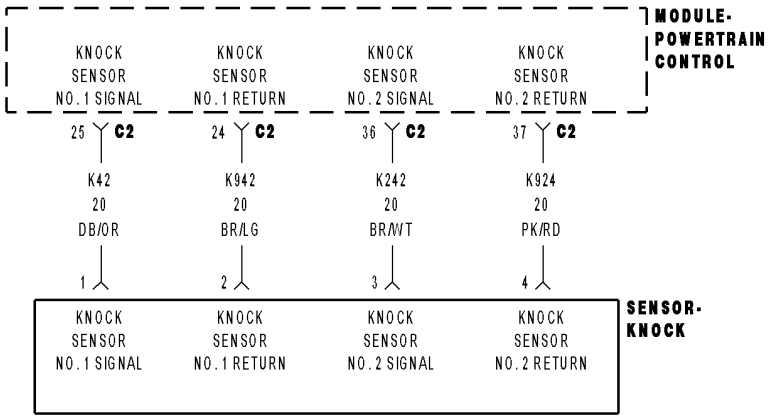
4. CRANKSHAFT POSITION SENSOR

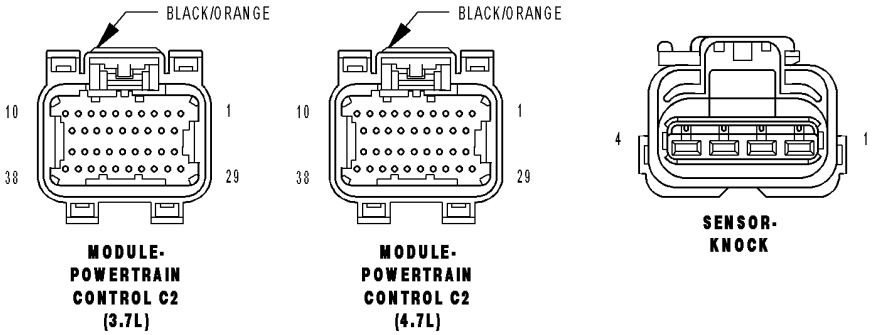
If there are no possible causes remaining, view repair.

Repair

Replace the Crankshaft Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0325-KNOCK SENSOR 1 CIRCUIT





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P0325-KNOCK SENSOR 1 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The Knock Sensor circuit voltage falls below a minimum value at idle or deceleration. The minimum value is from a look-up table internal to the PCM and is based on engine RPM. DTC will also set if the sensor voltage goes above 5.0 volts. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT OPEN
(K942) KNOCK SENSOR NO.1 RETURN CIRCUIT OPEN
(K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K942) KNOCK SENSOR NO.1 RETURN CIRCUIT
(K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
KNOCK SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0325-KNOCK SENSOR 1 CIRCUIT (CONTINUED)

2. (K42) KNOCK SENSOR NO.1 SIGNAL SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the Knock Sensor harness connector.

Disconnect the C2 PCM harness connector.

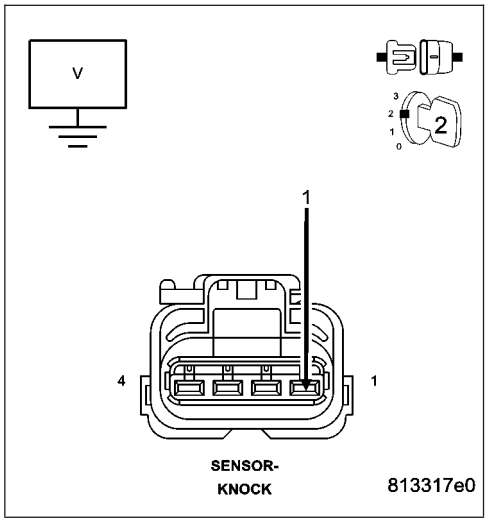
Ignition on, engine not running.

Measure the voltage on the (K42) Knock Sensor No.1 Signal circuit in the Knock Sensor harness connector.

Is the voltage above 2.0 volts?

Yes >> Repair the short to battery voltage in the (K42) Knock Sensor No.1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

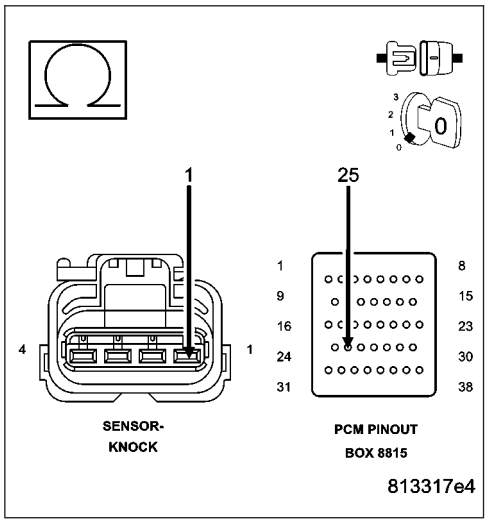
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K42) Knock Sensor No.1 Signal circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the open in the (K42) Knock Sensor No.1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0325-KNOCK SENSOR 1 CIRCUIT (CONTINUED)

4. (K942) KNOCK SENSOR NO.1 RETURN CIRCUIT OPEN

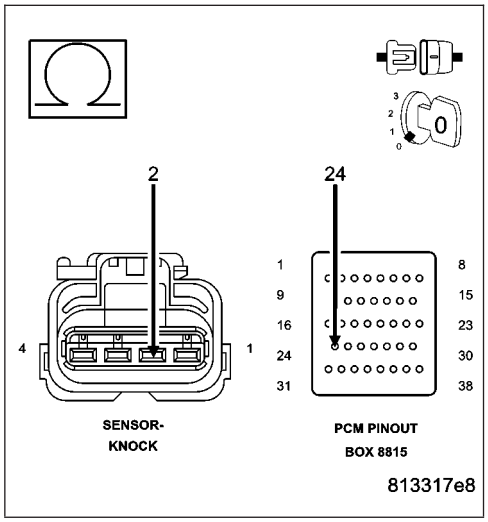
Measure the resistance of the (K942) Knock Sensor No.1 Return circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K942) Knock Sensor No.1 Return circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K42) KNOCK SENSOR NO.1 SIGNAL SHORTED TO THE (K942) KNOCK SENSOR NO.1 RETURN CIRCUIT

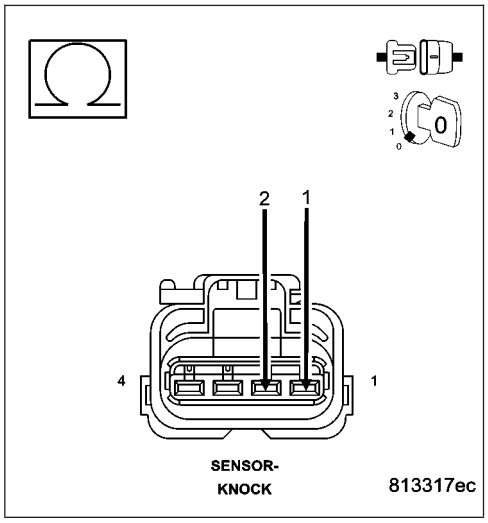
Measure the resistance between the (K42) Knock Sensor No.1 Signal circuit and the (K942) Knock Sensor No.1 Return circuit in the Knock Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K42) Knock Sensor No.1 Signal circuit and the (K942) Knock Sensor No.1 Return circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

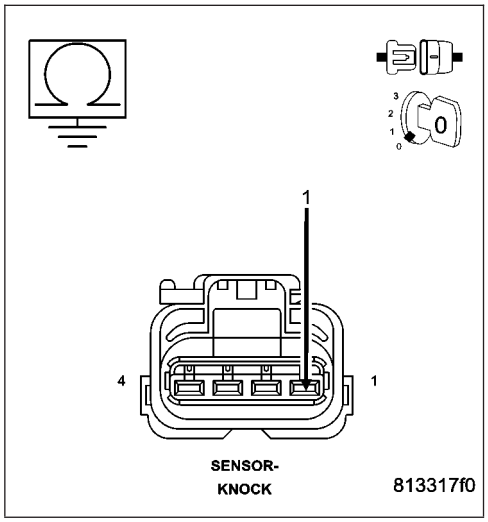
No >> Go To 6



P0325-KNOCK SENSOR 1 CIRCUIT (CONTINUED)

6. (K42) KNOCK SENSOR NO.1 SIGNAL SHORTED TO GROUND

Measure the resistance between ground and the (K42) Knock Sensor No.1 Signal circuit in the Knock Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K42) Knock Sensor No.1 Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

7. KNOCK SENSOR

Replace the Knock Sensor.

Ignition on, engine not running.

With the scan tool, erase DTC.

Attempt to operate the vehicle using the information noted in the Freeze Frame.

With the scan tool, read DTCs.

Does the scan tool display the DTC that was previously erased?

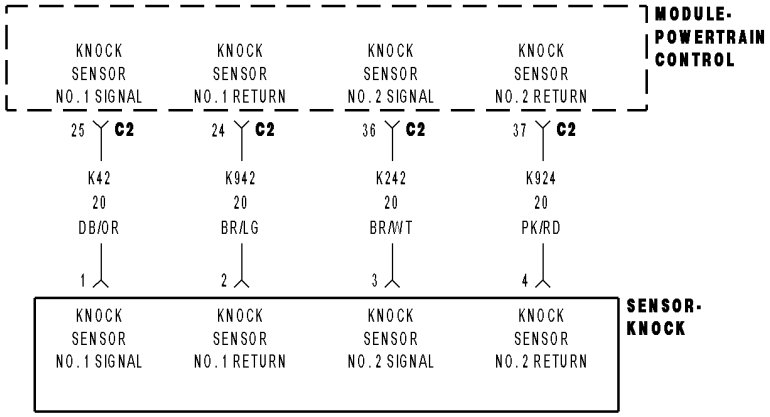
Yes >>

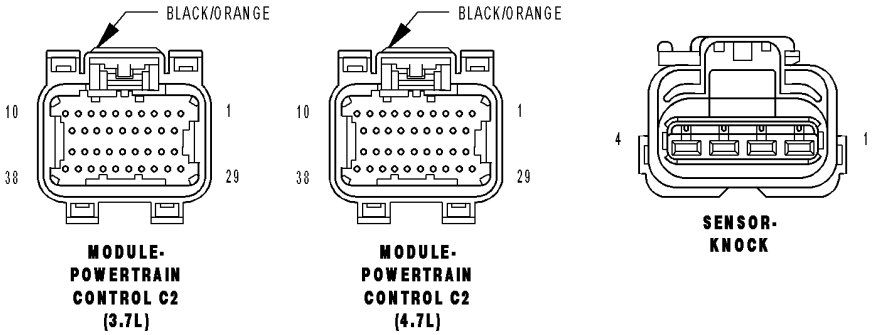
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary. Replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P0330-KNOCK SENSOR 2 CIRCUIT





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P0330-KNOCK SENSOR 2 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running
- **Set Condition:**
  The Knock Sensor circuit voltage falls below a minimum value at idle or deceleration. The minimum value is from a look-up table internal to the PCM and is based on engine RPM. DTC well also set if the sensor voltage goes above 5.0 volts. One Trip Fault. Three good trips to turn off the MIL. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT OPEN
(K924) KNOCK SENSOR NO.2 RETURN CIRCUIT OPEN
(K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO THE (K924) KNOCK SENSOR NO.2 RETURN CIRCUIT
(K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO GROUND
KNOCK SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0330-KNOCK SENSOR 2 CIRCUIT (CONTINUED)

2. (K242) KNOCK SENSOR NO.2 SIGNAL SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the No.2 Knock Sensor harness connector.

Disconnect the C2 PCM harness connector.

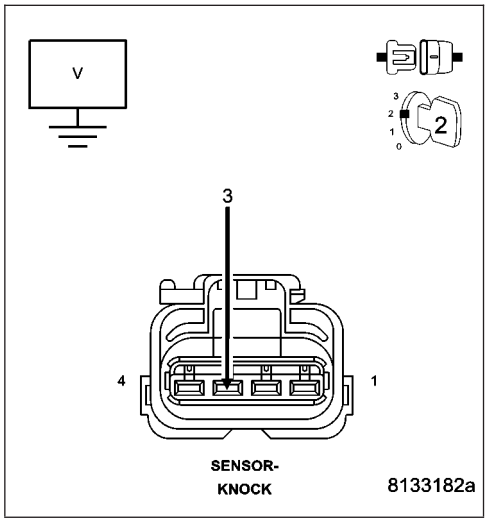
Ignition on, engine not running.

Measure the voltage on the (K242) Knock Sensor No.2 Signal circuit in the Knock Sensor harness connector.

Is the voltage above 2.0 volts?

Yes >> Repair the short to battery voltage in the (K242) Knock Sensor No.2 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

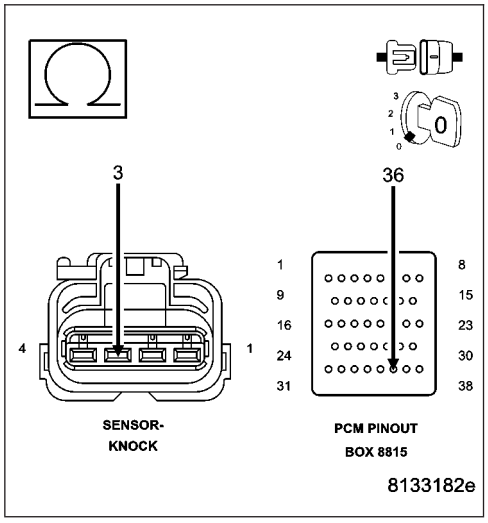
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K242) Knock Sensor No.2 Signal circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the open in the (K242) Knock Sensor No.2 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0330-KNOCK SENSOR 2 CIRCUIT (CONTINUED)

4. (K924) KNOCK SENSOR NO.2 RETURN CIRCUIT OPEN

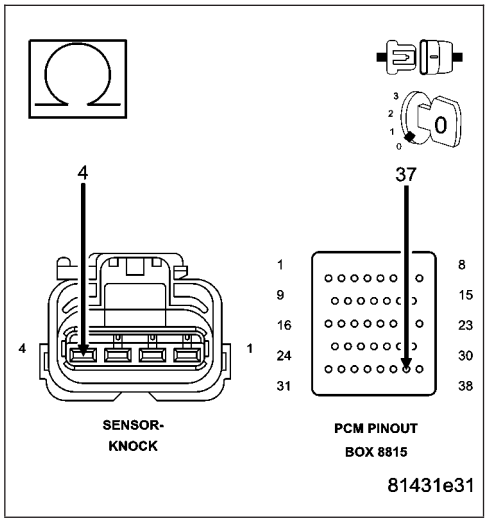
Measure the resistance of the (K924) Knock Sensor No.2 Return circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K924) Knock Sensor No.2 Return circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K242) KNOCK SENSOR NO.2 SIGNAL SHORTED TO THE (K924) KNOCK SENSOR NO.2 RETURN CIRCUIT

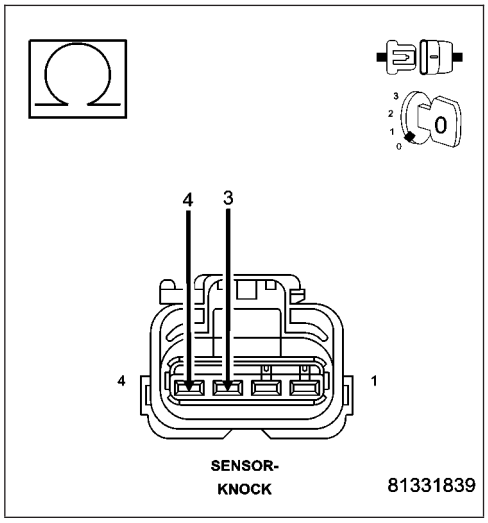
Measure the resistance between the (K242) Knock Sensor No.2 Signal circuit and the (K924) Knock Sensor No.2 Return circuit in the Knock Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K242) Knock Sensor No.2 Signal circuit and the (K924) Knock Sensor No.2 Return circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

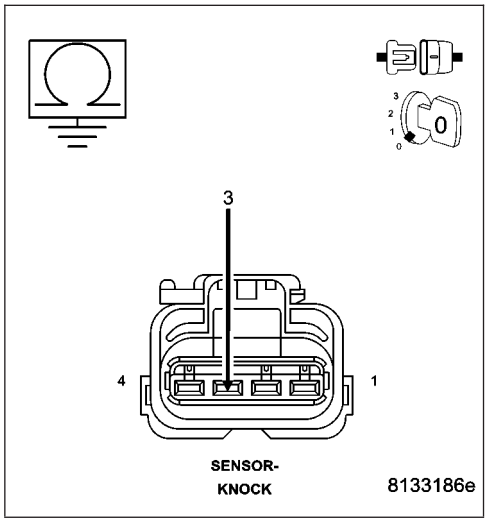
No >> Go To 6



P0330-KNOCK SENSOR 2 CIRCUIT (CONTINUED)

6. (K242) KNOCK SENSOR NO.2 SIGNAL SHORTED TO GROUND

Measure the resistance between ground and the (K242) Knock Sensor No.2 Signal circuit in the Knock Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K242) Knock Sensor No.2 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

---

7. KNOCK SENSOR

Replace the Knock Sensor.
Ignition on, engine not running.
With the scan tool, erase DTC.
Attempt to operate the vehicle using the information noted in the Freeze Frame.
With the scan tool, read DTCs.

Does the scan tool display the DTC that was previously erased?

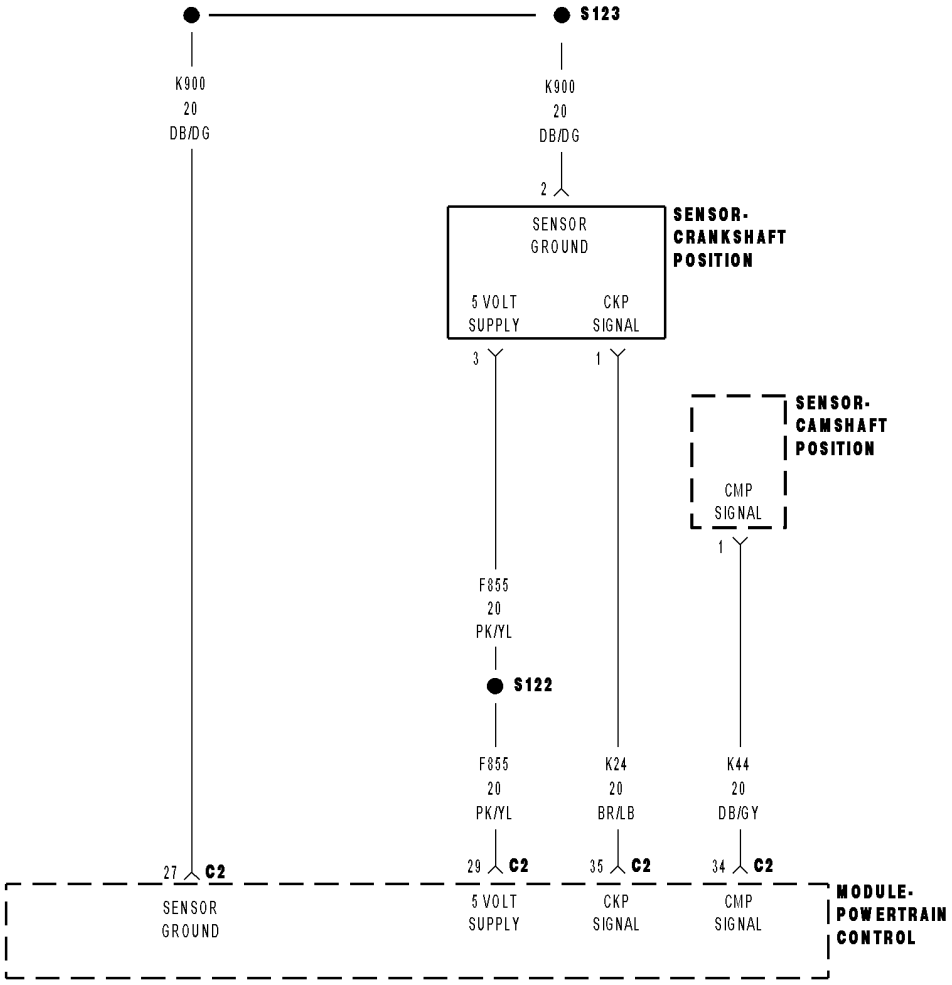
Yes >>

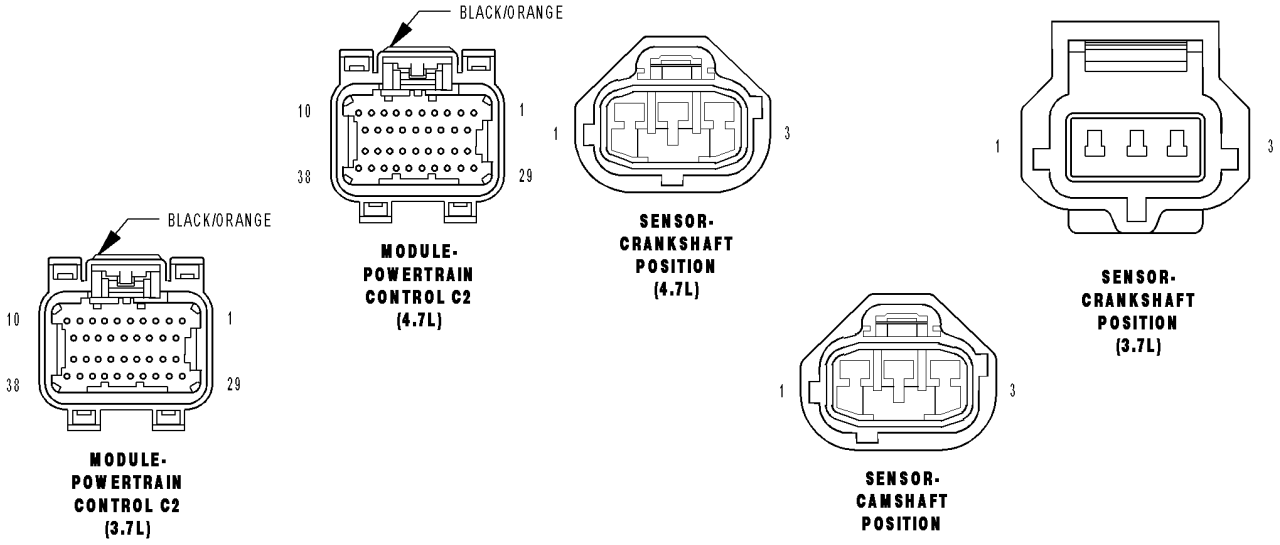
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary. Replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P0335-CRANKSHAFT POSITION SENSOR CIRCUIT





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P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine cranking.
- **Set Condition:**
  No CKP signal is present during engine cranking, and at least 8 camshaft position sensor signals have occurred. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K24) CKP SIGNAL CIRCUIT OPEN
(K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K24) CKP SIGNAL CIRCUIT SHORTED GROUND
(K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
CRANKSHAFT POSITION SENSOR
CAMSHAFT POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Crank the engine.
Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Go To 14

P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the CKP Sensor harness connector.

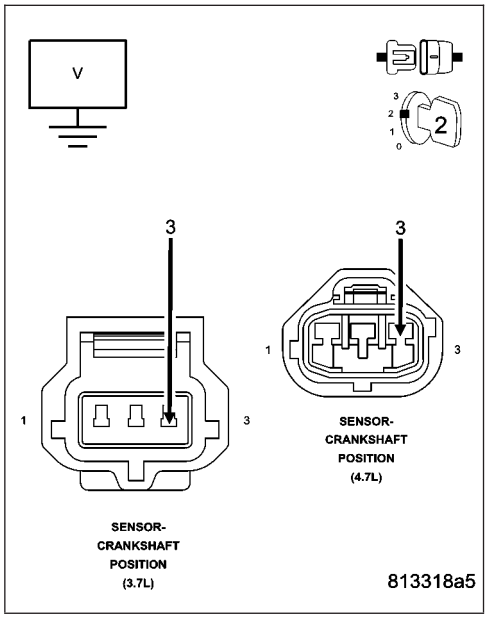
Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.

Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 3

No >> Go To 10



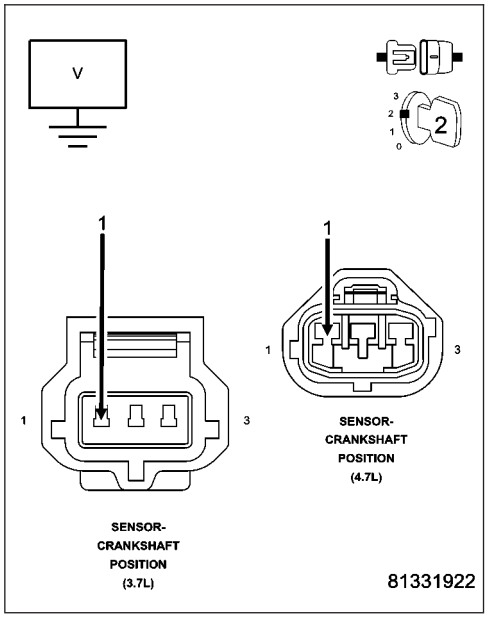
3. (K24) CKP SIGNAL CIRCUIT

Measure the voltage on the (K24) CKP Signal circuit in the CKP Sensor harness connector.

Is the voltage between 4.5 and 5.0 volts?

Yes >> Go To 4

No >> Go To 7



P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

4. (K900) SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

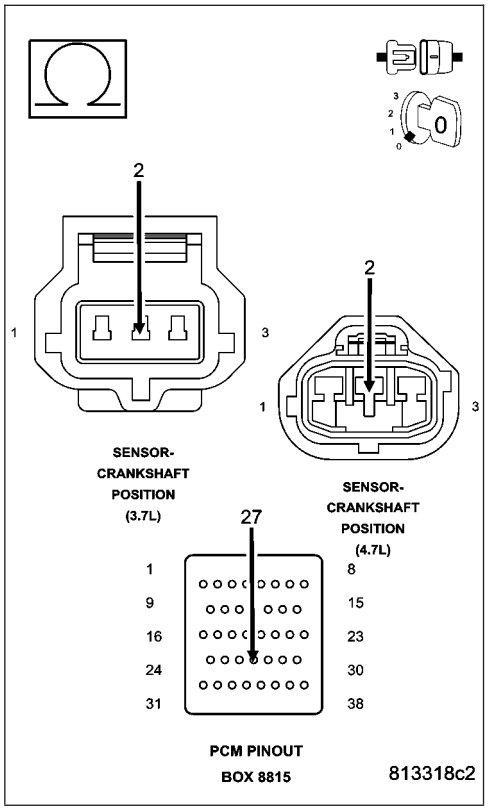
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor ground circuit from the CKP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



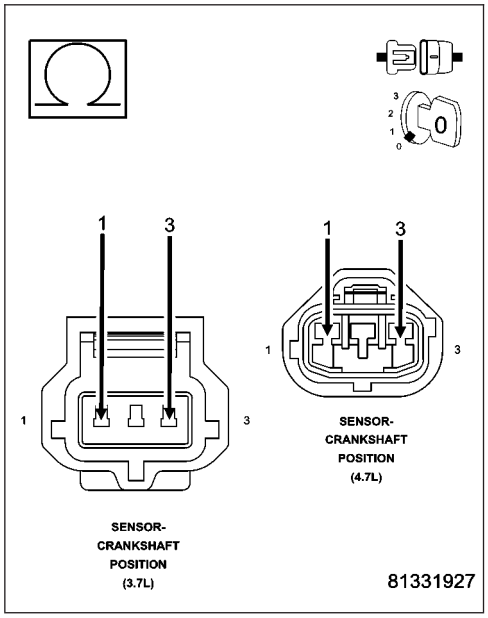
5. (K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K24) CKP Signal circuit and the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K24) CKP Signal circuit and the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

6. CRANKSHAFT POSITION SENSOR

NOTE: Inspect the slots on the flywheel for damage. If a problem is found repair as necessary.

If there are no possible causes remaining, view repair.

Repair

Replace the Crankshaft Position Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

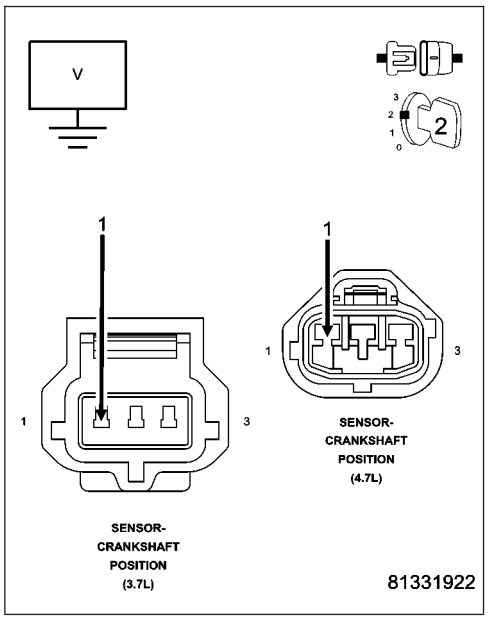
7. (K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K24) CKP Signal circuit in the CKP Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K24) CKP Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

8. (K24) CKP SIGNAL CIRCUIT OPEN

Turn the ignition off.

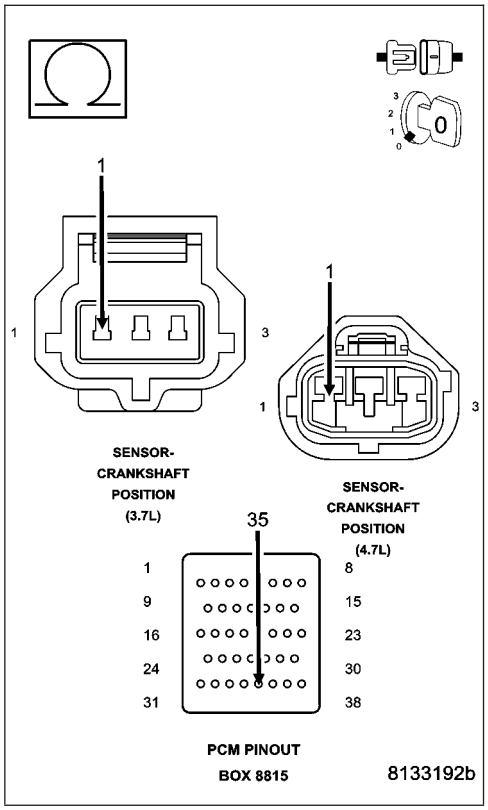
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K24) CKP Signal circuit from the CKP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the (K24) CKP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



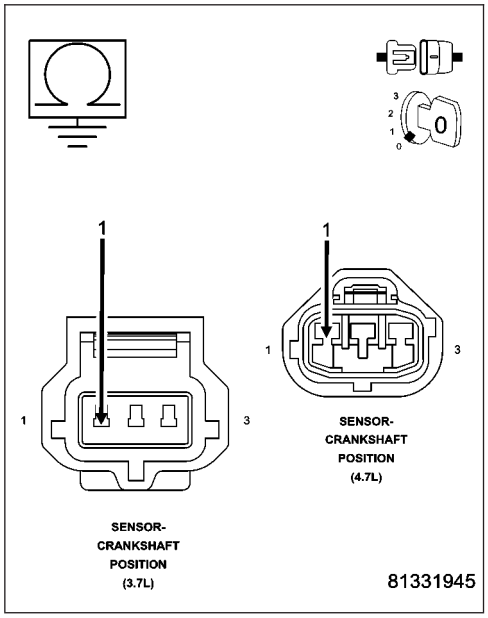
9. (K24) CKP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K24) CKP Signal circuit in the CKP Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K24) CKP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13



P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

10. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

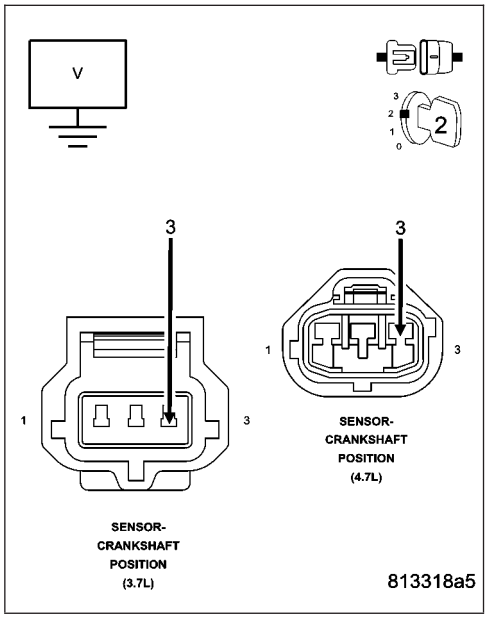
Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



11. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

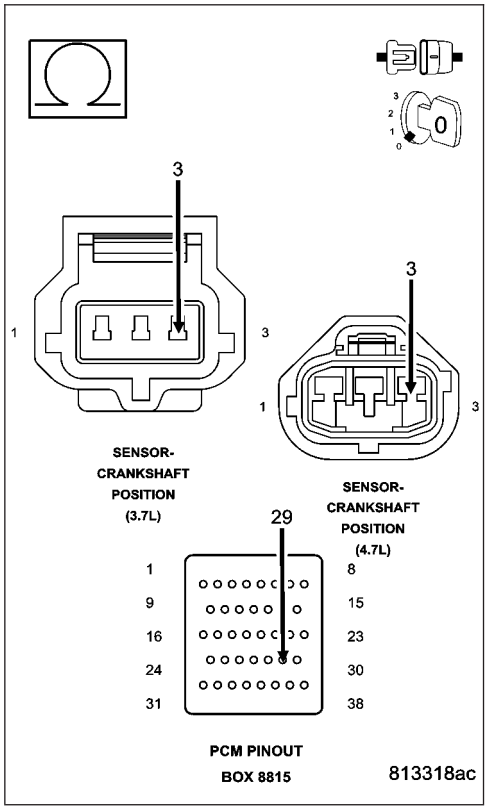
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the CKP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 12

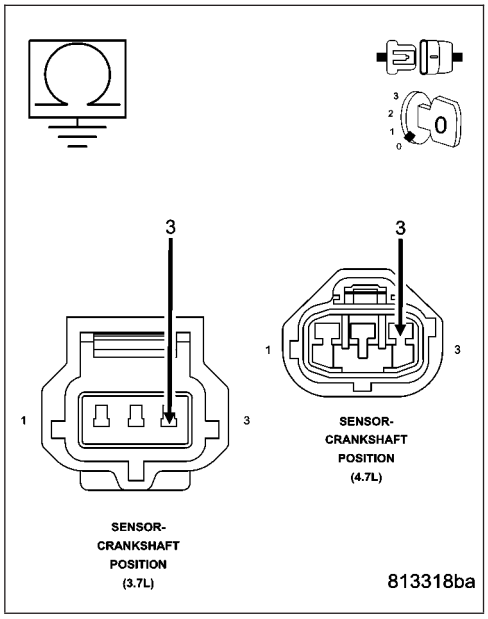
No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

12. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

13. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

14. ERRATIC CKP SENSOR SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harnessconnector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crank Position Sensor.

Observe the lab scope screen.

Look for any pulses generated by the CKP Sensor.

Allow the engine to idle.

Observe the lab scope screen.

Did the CKP Sensor generate any erratic pulses?

Yes >> Inspect the related wire harness and replace the Crankshaft Position Sensor if no wiring problems were found.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

---

15. ERRATIC CMP SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the CMP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Cam Position Sensor.

Observe the lab scope screen.

Look for any pulses generated by the CMP Sensor.

Allow the engine to idle.

Observe the lab scope screen.

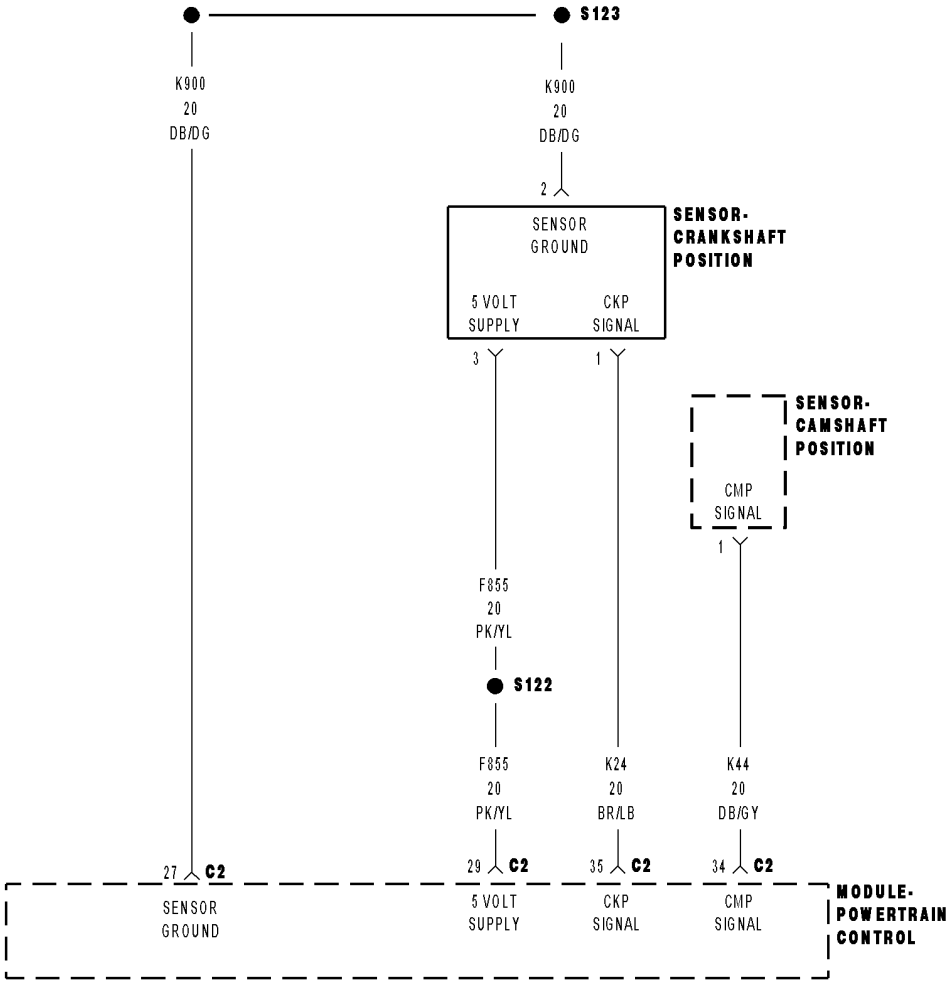
Did the CMP Sensor generate any pulses?

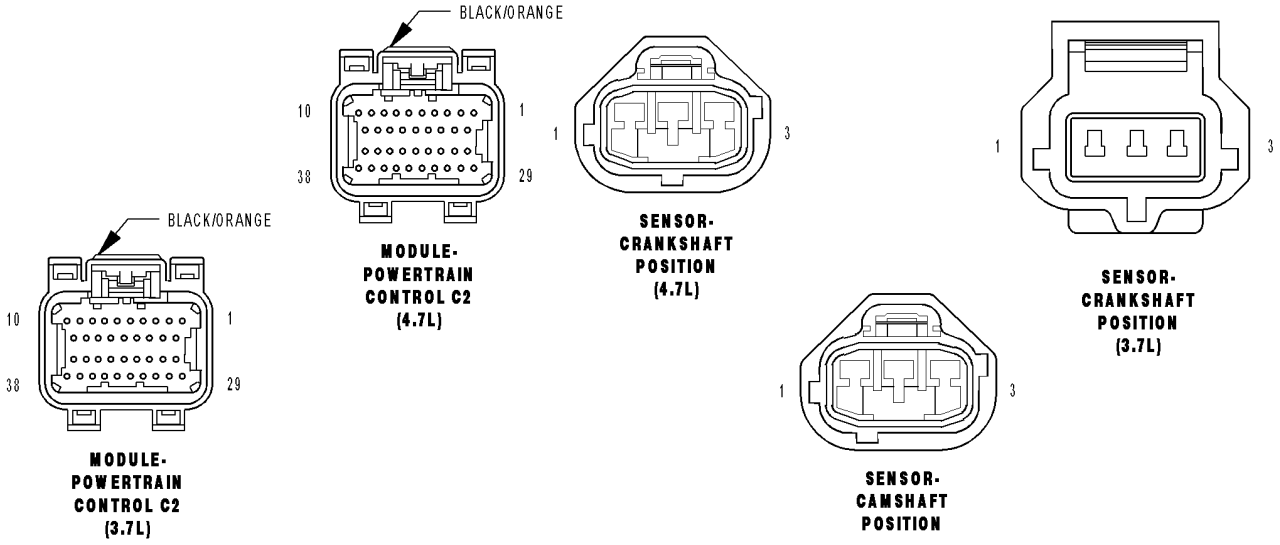
Yes >> Inspect the related wire harness and replace the Camshaft Position Sensor if no wiring problems were found.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete, the conditions that set this DTC are not present at this time.

P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT





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P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While cranking the engine and with the engine running.
- **Set Condition:**
  When the CKP Sensor failure counter reaches 20. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K24) CKP SIGNAL CIRCUIT OPEN
(K24) CKP SIGNAL CIRCUIT SHORTED TO GROUND
(K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
CRANKSHAFT POSITION SENSOR
TONE WHEEL/PULSE RING
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. CHECKING CRANKSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the Sensor harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Go To 3

No >> Go To 8

P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

3. WIRE HARNESS INSPECTION

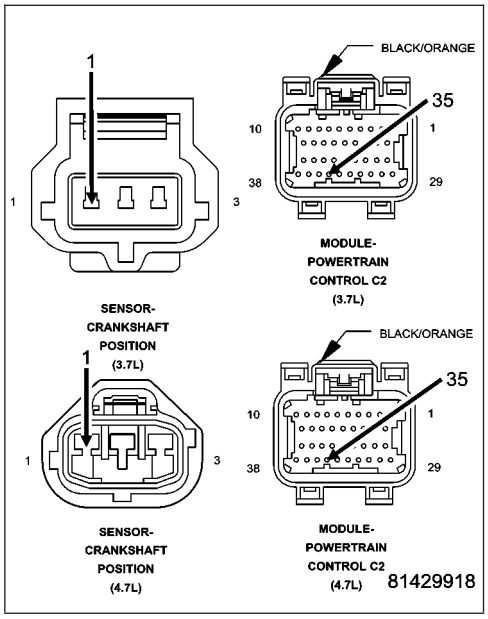
Turn the ignition off.

Visually inspect the related wire harness including the ground circuit. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to the proper specification.

Refer to any TSBs that may apply.



Were any of the above conditions present?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

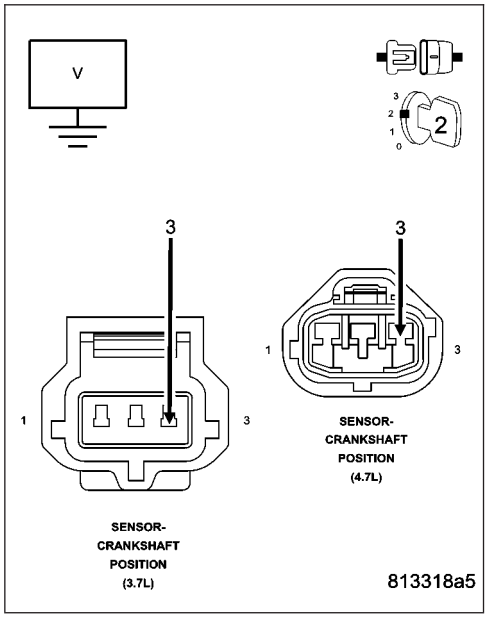
No >> Go To 4

4. (F855) 5-VOLT SUPPLY CIRCUIT OPEN OR SHORTED TO GROUND

Disconnect the CKP Sensor connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the Sensor harness connector.



Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 5

No >> Repair the open or short to ground in the (F855) 5-volt Supply circuit. Use Miller special tool #8815 when checking for an open circuit to prevent PCM harness connector terminal damage.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

5. TONE WHEEL/FLEX PLATE INSPECTION

Turn the ignition off.

Carefully disconnect the Negative Battery (Ground) cable.

Remove the Crankshaft Position Sensor.

Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement.

Were any problems found?

Yes >> Repair or replace the Tone Wheel/Flex Plate as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. CHECKING CAMSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

Install the CKP Sensor and connect the battery cable.

NOTE: An intermittent condition in the Cam Position Sensor can cause the P0339 to set.
With the a lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the Sensor harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Cam Position Sensor.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Replace the Cam Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

---

7. CRANKSHAFT POSITION SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the Crankshaft Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

8. (K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect the CKP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K24) CKP Signal circuit in the Sensor harness connector.

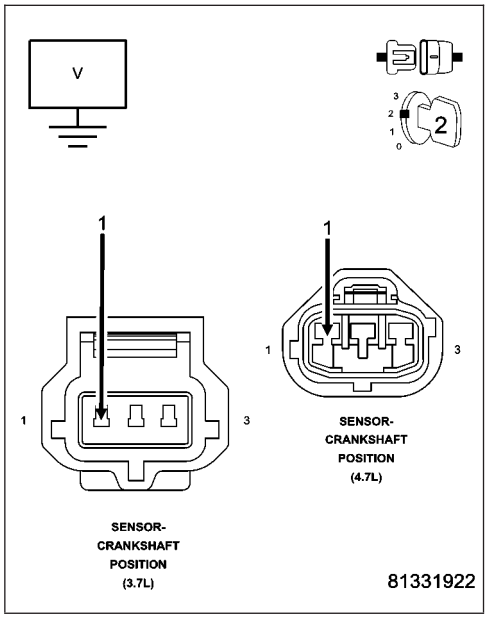
Wiggle the related wire harness while taking this measurement.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K24) CKP Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9



9. (K24) CKP SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance in the (K24) CKP Signal circuit from the CKP harness connector to the appropriate terminal of special tool #8815.

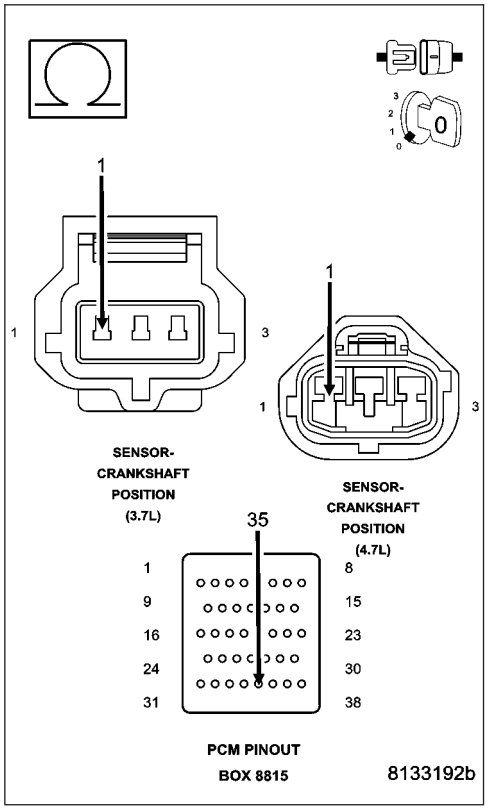
Wiggle the wire harness while taking this measurement.

Is the resistance below 1.0 ohm?

Yes >> Go To 10

No >> Repair the excessive resistance in the (K24) CKP Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

10. (K24) CKP SIGNAL CIRCUIT SHORTED TO GROUND

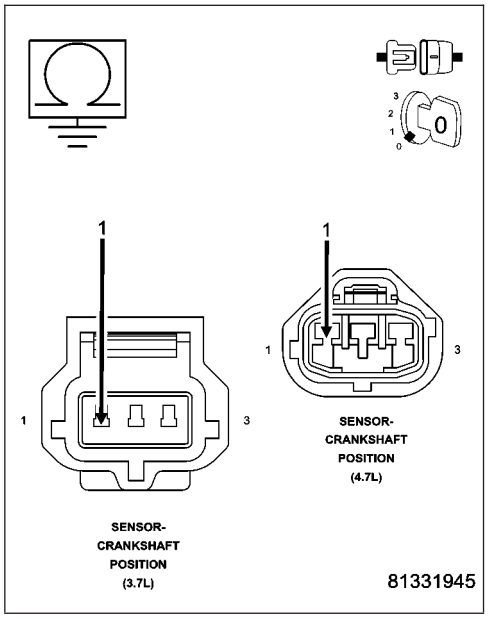
Measure the resistance between ground and the (K24) CKP Signal circuit in the CKP Sensor harness connector.

Wiggle the related wire harness while monitoring the resistance value.

Does the resistance ever go below 100 ohms?

Yes >> Repair the short to ground in the (K24) Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



11. (K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

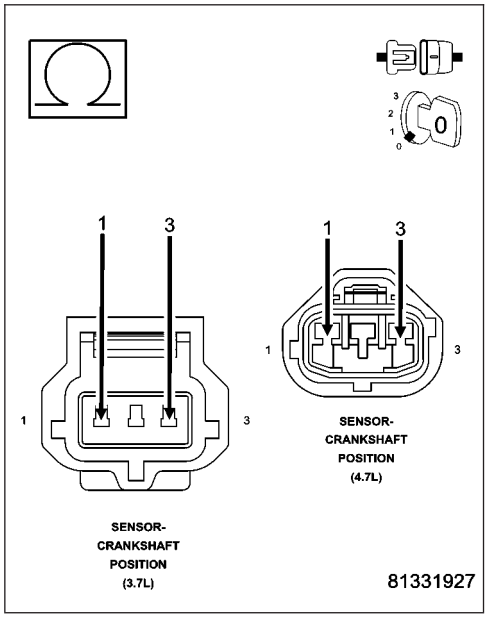
Measure the resistance between the (F855) 5-volt Supply circuit and the (K24) CKP Signal circuit in the CKP harness connector.

Wiggle the related wire harness while taking this measurement.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (F855) 5-volt Supply circuit and the (K24) CKP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12



P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

12. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

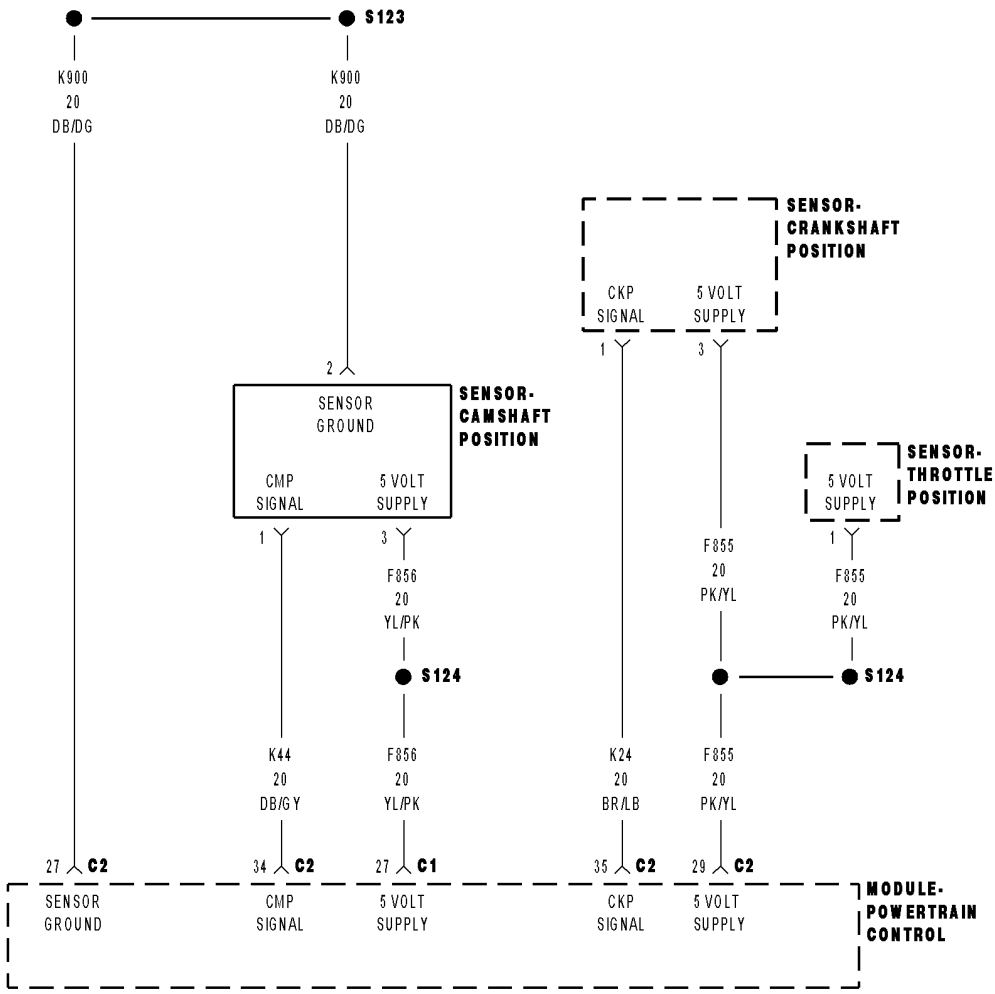
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

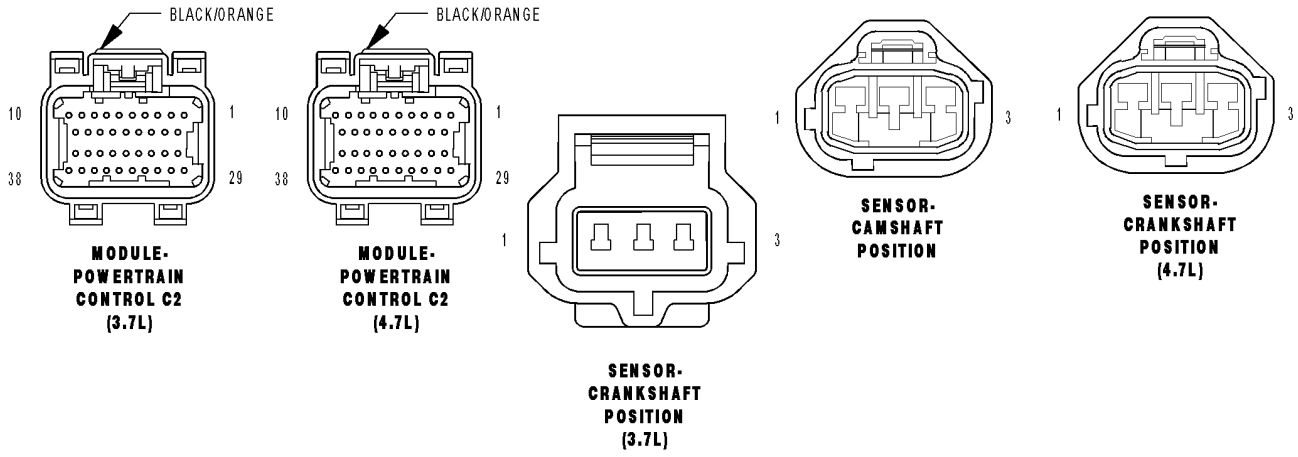
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0340-CAMSHAFT POSITION SENSOR CIRCUIT





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P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During engine cranking and with the engine running. Battery voltage greater than 10 volts.
- **Set Condition:**
  At least 5 seconds or 2.5 engine revolutions have elapsed with crankshaft position sensor signals present but no camshaft position sensor signal. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K44) CMP SIGNAL CIRCUIT OPEN
(K44) CMP SIGNAL CIRCUIT SHORTED GROUND
(K44) CMP SIGNAL SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
CAMSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Crank the engine.
Ignition on, engine not running.
With a scan tool read the DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Go To 14

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

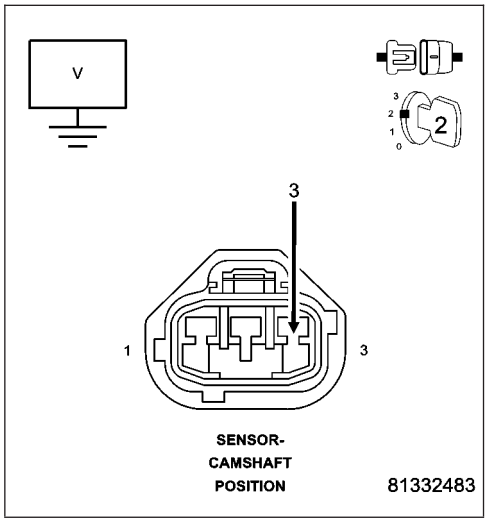
2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.



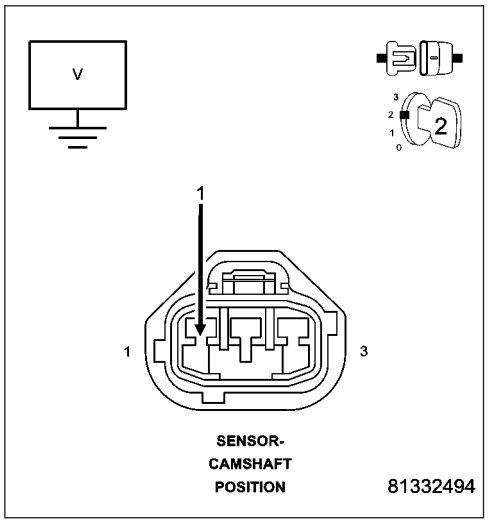
Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 3

No >> Go To 10

3. (K44) CMP SIGNAL CIRCUIT

Measure the voltage on the (K44) CMP Signal circuit in the CMP Sensor harness connector.



Is the voltage between 4.5 and 5.0 volts?

Yes >> Go To 4

No >> Go To 7

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

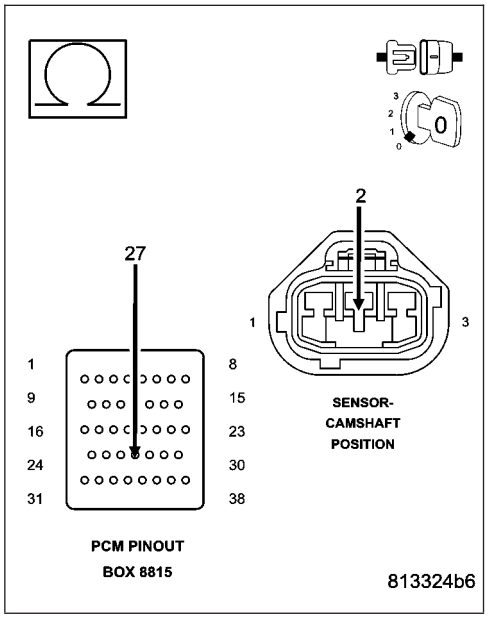
4. (K900) SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor ground circuit from the CMP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

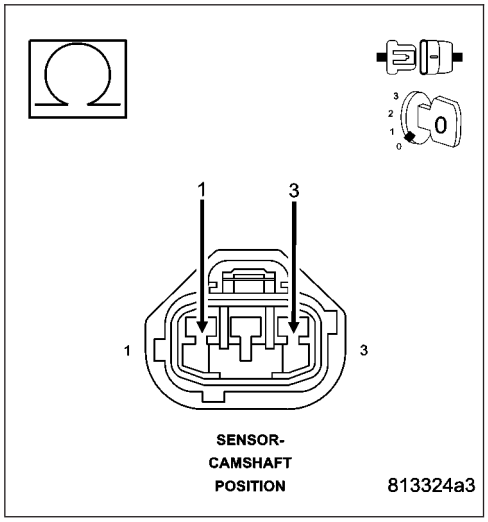
Yes >> Go To 5

No >> Repair the open in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. (K44) CMP SIGNAL SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Disconnect the C1 PCM harness connector.

Measure the resistance between the (K44) CMP Signal circuit and the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K44) CMP Signal circuit and the (F856) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. CAMSHAFT POSITION SENSOR

NOTE: Inspect the Camshaft sprocket for damage per the Service Information. If a problem is found repair as necessary.

If there are no possible causes remaining, view repair.

Repair

Replace the Camshaft Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

7. (K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

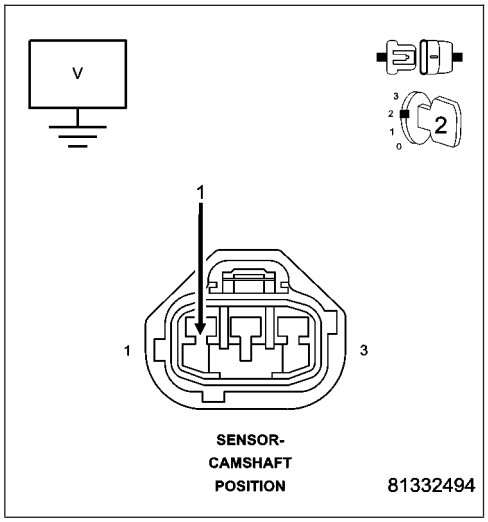
Ignition on, engine not running.

Measure the voltage on the (K44) CMP Signal circuit in the CMP Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K44) CMP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



8. (K44) CMP SIGNAL CIRCUIT OPEN

Turn the ignition off.

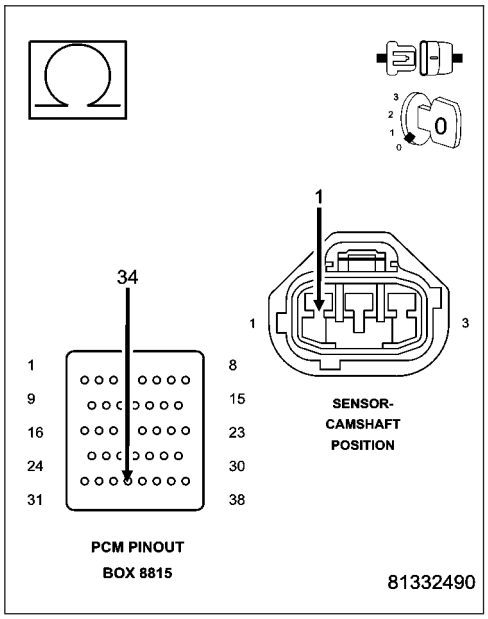
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K44) CMP Signal circuit from the CMP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

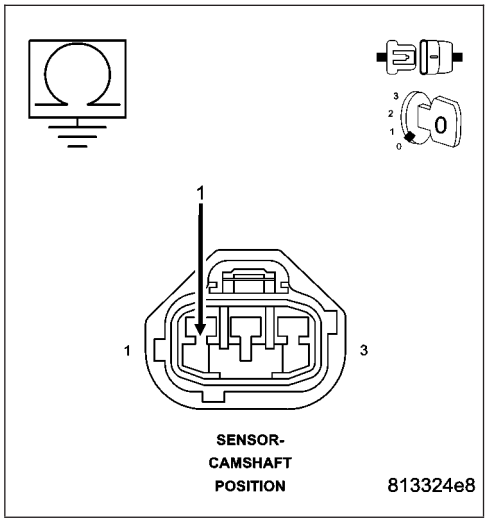
No >> Repair the open in the (K44) CMP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

9. (K44) CMP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K44) CMP Signal circuit in the CMP Sensor harness connector.



Is the resistance below 100 ohms?

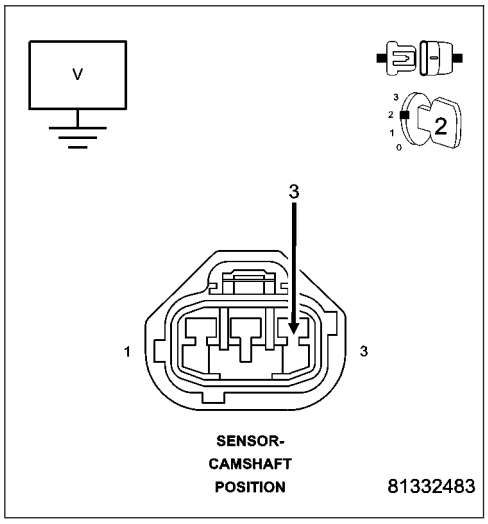
Yes >> Repair the short to ground in the (K44) CMP Signal circuit
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

10. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (F856) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

11. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

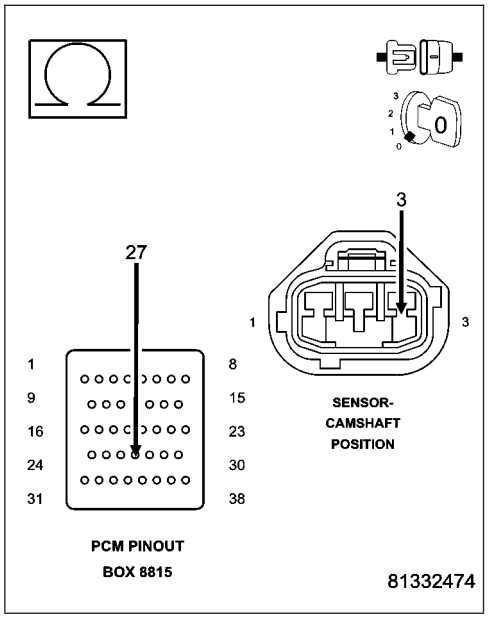
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit between the CMP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 12

No >> Repair the open in the (F856) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



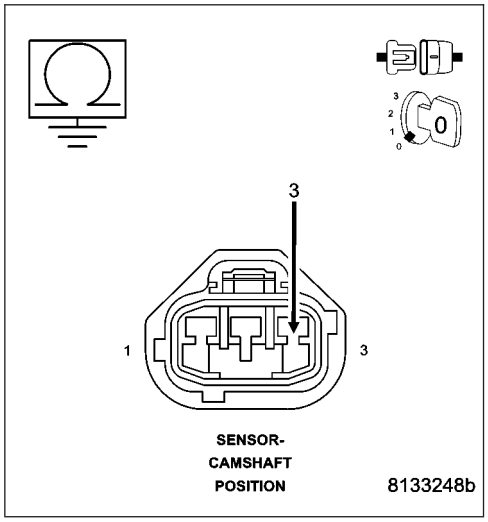
12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13



P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

13. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. ERRATIC CMP SIGNAL

With a lab scope probe and the Miller special tool #6801, back probe the (K44) CMP Signal circuit in the CMP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap the Camshaft Position Sensor.

Observe the lab scope screen.

Allow the engine to idle.

Observe the lab scope screen.

Did the CMP Sensor generate any erratic pulses?

Yes >> Replace the Camshaft Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

---

15. ERRATIC CKP SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crankshaft Position Sensor.

Observe the lab scope screen.

Allow the engine to idle.

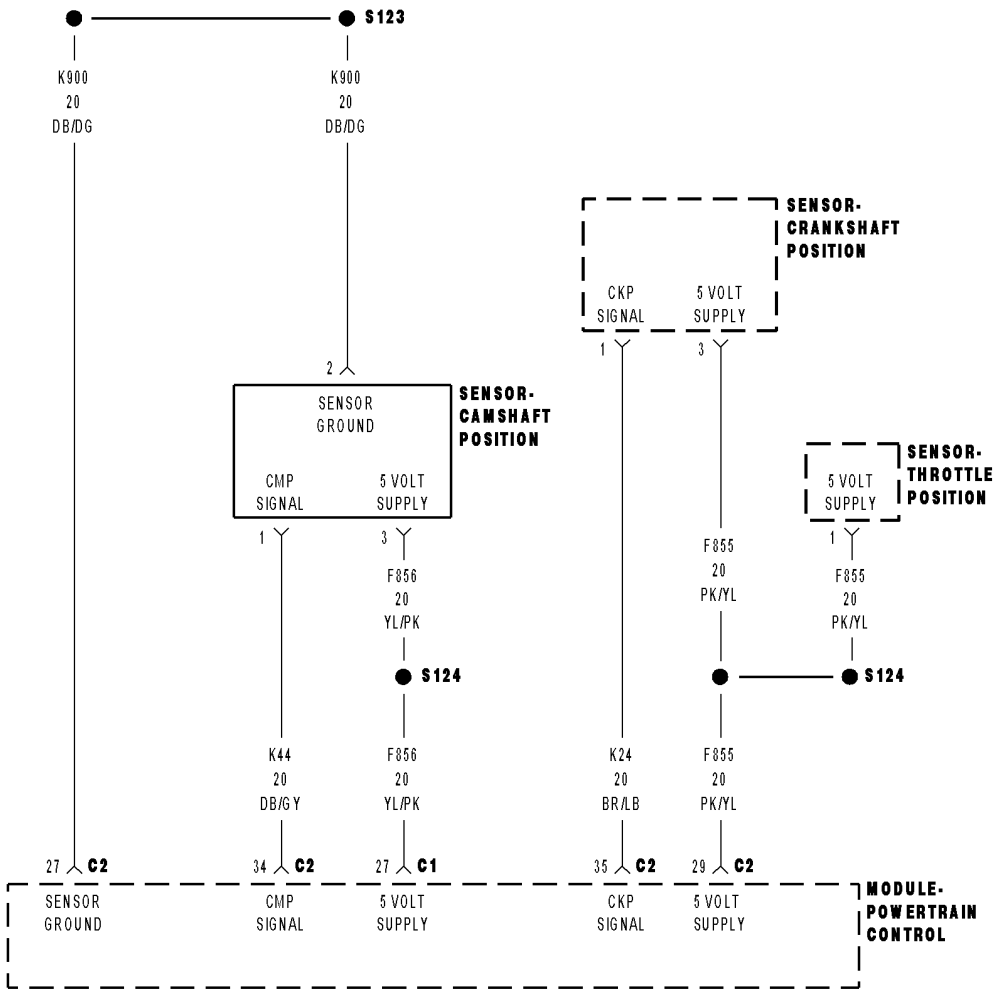
Observe the lab scope screen.

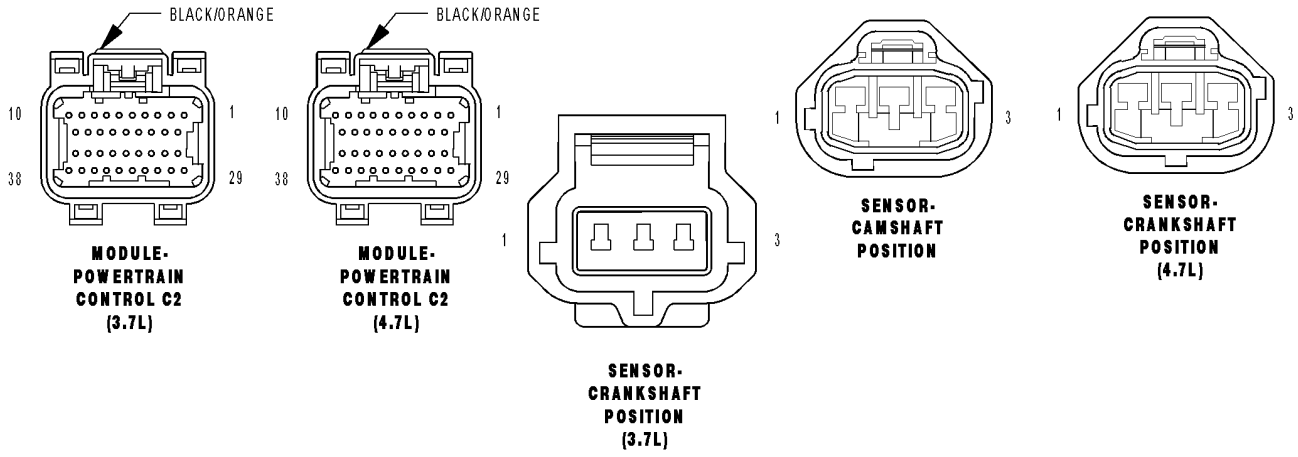
Did the CKP Sensor generate any erratic pulses?

Yes >> Replace the Crankshaft Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete, the conditions that set this DTC are not present at this time.

P0344-CAMSHAFT POSITION SENSOR INTERMITTENT





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P0344-CAMSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While cranking the engine and engine running.
- **Set Condition:**
  When the failure counter reaches 20. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K44) CMP SIGNAL CIRCUIT OPEN
(K44) CMP SIGNAL CIRCUIT SHORTED TO GROUND
(K44) CMP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
TONE WHEEL/PULSE RING
CAMSHAFT POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. CHECKING CAMSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the CMP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Go To 3

No >> Go To 8

P0344-CAMSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

3. WIRE HARNESS INSPECTION

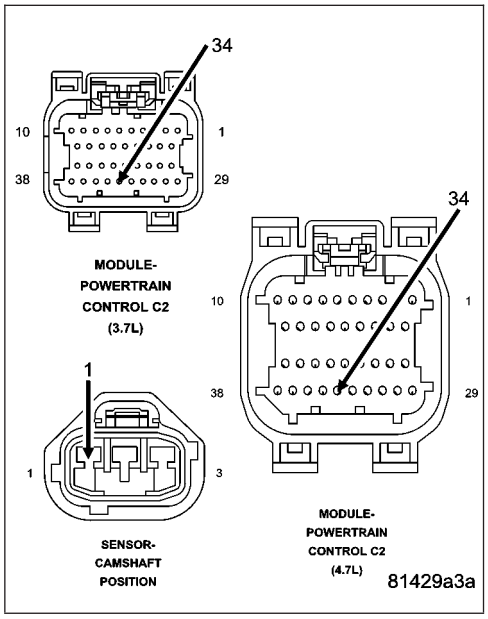
Turn the ignition off.

Visually inspect the related wire harness including the ground circuit. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to the proper specification.

Refer to any TSBs that may apply.



Were any of the above conditions present?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

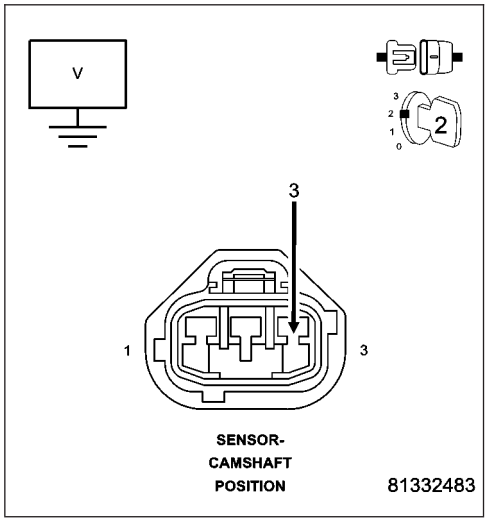
No >> Go To 4

4. (F856) 5-VOLT SUPPLY CIRCUIT OPEN OR SHORTED TO GROUND

Disconnect the CMP Sensor connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the CMP harness connector.



Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 5

No >> Repair the open or short to ground in the (F856) 5-volt Supply circuit. Use Miller special tool #8815 when checking for an open circuit to prevent PCM harness connector terminal damage.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. TONE WHEEL/PULSE RING INSPECTION

Turn the ignition off.

Carefully disconnect the Battery Ground cable.

Remove the Camshaft Position Sensor.

Inspect the Tone Wheel/Pulse Ring for damage, foreign material, or excessive movement.

Were any problems found?

Yes >> Repair or replace the Tone Wheel/Pulse Ring as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0344-CAMSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

6. CHECKING CRANKSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

NOTE: An intermittent condition in the Crank Position Sensor can cause the P0344 to set.

Install the CMP Sensor and connect the Battery cable.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crank Position Sensor.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Replace the Crank Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

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7. CAMSHAFT POSITION SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the Camshaft Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. (K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the CMP Sensor connector.

Disconnect the C1 and C2 PCM harness connectors.

Ignition on, engine not running.

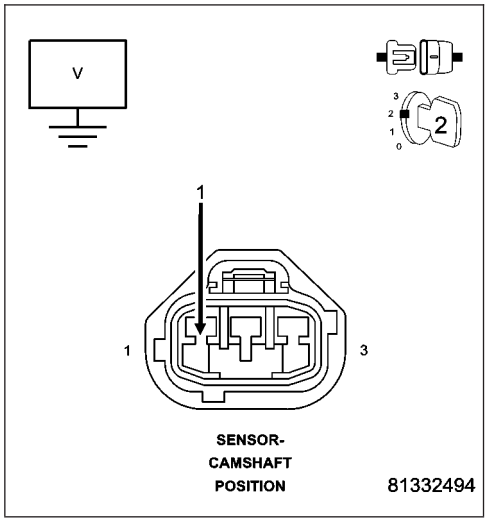
Measure the voltage on the (K44) CMP Signal circuit.

Wiggle the related wire harness while taking this measurement.

Does the voltage ever increase above 0 volts?

Yes >> Repair the short to battery voltage in the (K44) CMP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9



P0344-CAMSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

9. (K44) CMP SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance in the (K44) CMP Signal circuit from the CMP harness connector to the appropriate terminal of special tool #8815.

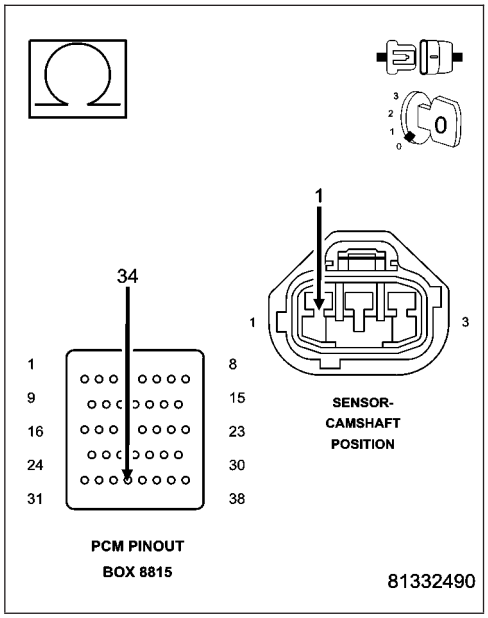
Wiggle the related wire harness while taking this measurement.

Is the resistance below 5.0 ohms?

Yes >> Go To 10

No >> Repair the excessive resistance in the (K44) CMP Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



10. (K44) CMP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K44) CMP Signal circuit in the CMP Sensor harness connector.

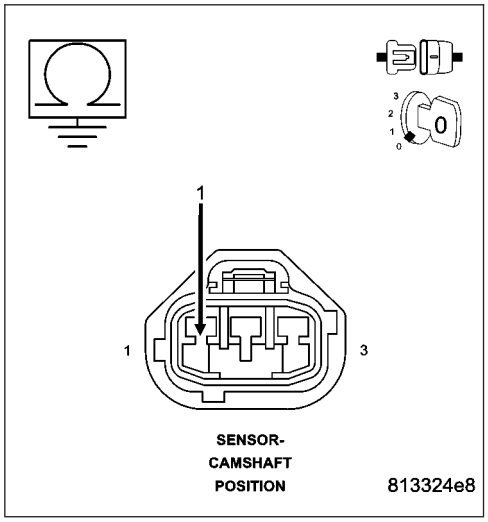
Wiggle the related wire harness while monitoring the resistance value.

Does the resistance ever go below 100 ohms?

Yes >> Repair the short to ground in the (K44) CMP Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



P0344-CAMSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

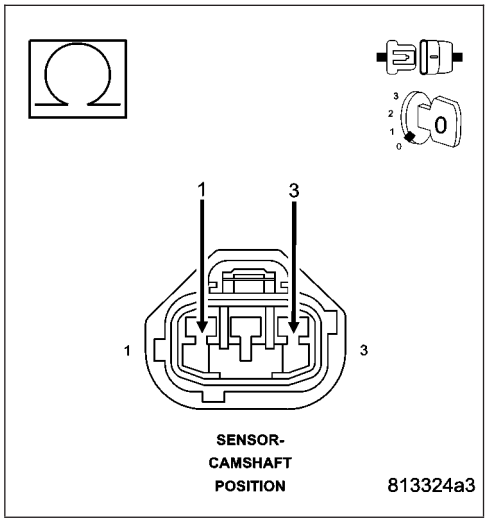
11. (K44) CMP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (F856) 5-volt Supply circuit and the (K44) CMP Signal circuit in the CMP harness connector.
Wiggle the related wire harness while taking this measurement.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (F856) 5-volt Supply circuit and the (K44) CMP Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12



12. PCM

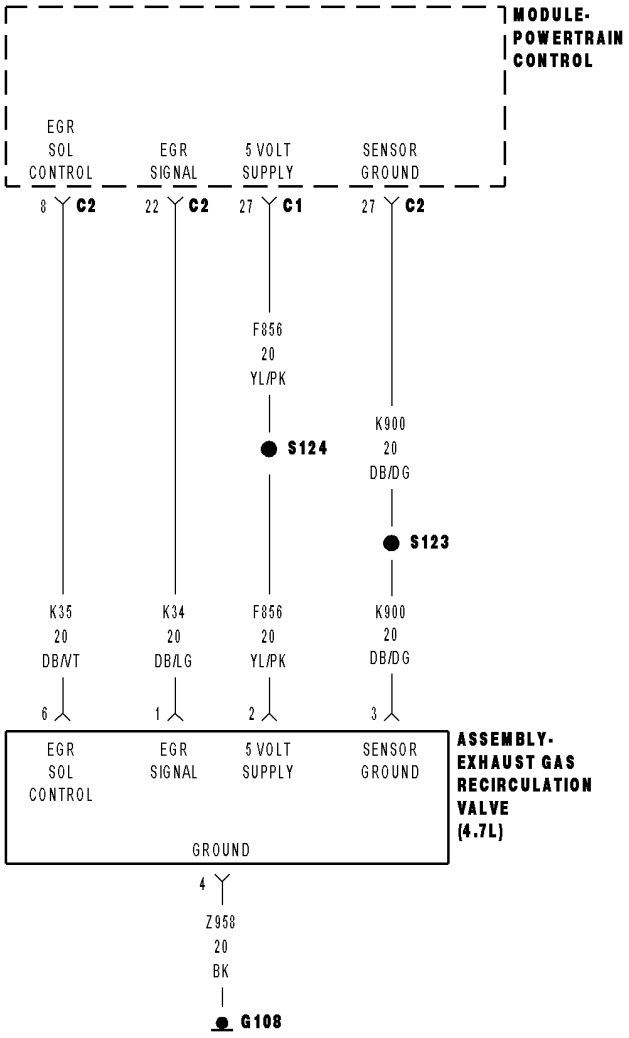
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

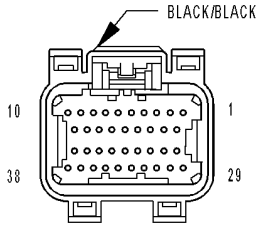
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

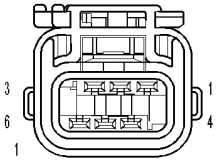
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0401-EGR SYSTEM PERFORMANCE

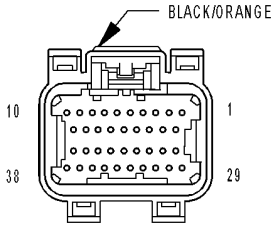




MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



ASSEMBLY-
EXHAUST GAS
RECIRCULATION
VALVE
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

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P0401-EGR SYSTEM PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

Exhaust gas recirculation is a method of reducing emissions of oxides of nitrogen. As the inert exhaust gas is recirculated, the mixture absorbs heat in the combustion chamber without interacting with the fuel/air mixture and reduces the formation of NOx emissions. After the EGR monitor conditions are met, the EGR valve is turned on and off momentarily. The EGR monitor calculated the difference in engine roughness from the EGR off condition to the EGR condition. This engine combustion stability difference as measured by engine roughness is the measure of a functional EGR system.

- **When Monitored:**
  Engine running for greater than two minutes with the Engine Coolant Temp greater than 70°C (158°F). EGR active. Less than 8500 feet. Ambient temperature greater than -6°C (20°F).
- **Set Condition:**
  The PCM closes the EGR valve while monitoring the O2 Sensor signal. Once a closed EGR fueling sample has been established the PCM then ramps in EGR and additional fueling while monitoring the O2 sensor signal in the open state. A fueling sample is again established. The PCM then compares the different O2 Sensor signal readings (fueling samples). If a larger than expected variation is detected, a soft failure is recorded. Three soft failures set a one trip failure. After two failed trips, a DTC is set and the MIL is illuminated.

Possible Causes
(Z958) EGR SOLENOID GROUND CIRCUIT OPEN
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K35) EGR SOLENOID CONTROL CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0401-EGR SYSTEM PERFORMANCE (CONTINUED)

2. EGR OPERATION

NOTE: If the vehicle is running rough at idle (scan tool not actuating) follow the yes path to continue.
Turn all accessories off.
Start the engine.
Allow the engine to reach normal operating temperature.
With the scan tool, enter Engine System Test, then EGR System Test.
Actuate the FLOW function in the EGR System Test.

Did the engine run rough or stall?

Yes >> Go To 3

No >> Go To 6

---

3. EGR VALVE OPEN AT IDLE

Turn the ignition off.
Disconnect the EGR Solenoid Assembly harness connector.
Start engine. Attempt to allow the engine to idle.

Does the engine run rough or stall?

Yes >> Inspect the EGR tube assembly. If OK, replace the EGR valve.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. EGR VALVE ASSEMBLY INSPECTION

Inspect the EGR Assembly for the following.
Gasket(s) for leaking
Damage and/or holes in the EGR tube(s)
Carbon build up on or near the EGR pintle and passage ways.
Obstruction in the EGR tubes.

Were any problem found?

Yes >> Repair or replace the EGR Assembly as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0401-EGR SYSTEM PERFORMANCE (CONTINUED)

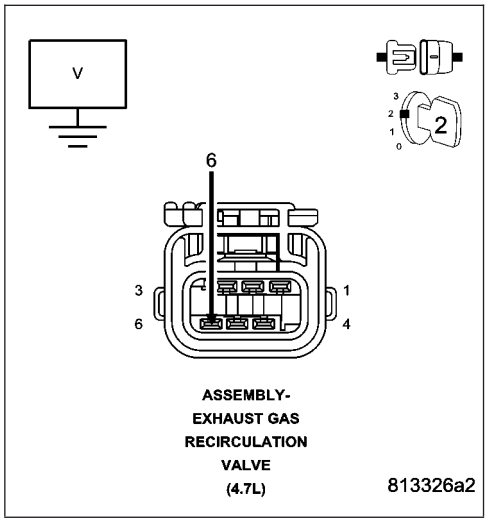
5. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Ignition on, engine not running.

Measure the voltage on the (K35) EGR Solenoid Control circuit in the EGR Solenoid connector.



Is the voltage above 1.0 volt?

Yes >> Repair the short to battery voltage in the (K35) EGR Solenoid Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

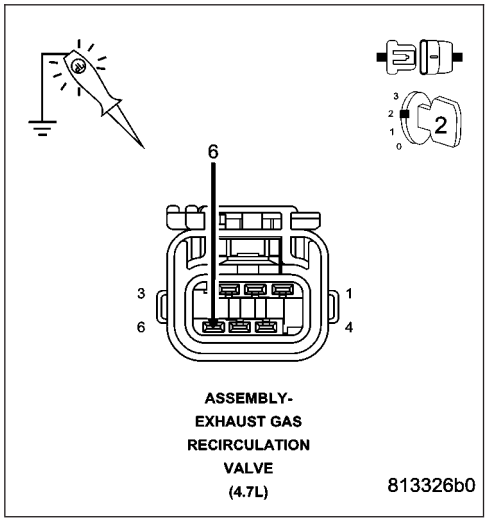
No >> Go To 10

6. EGR SOLENOID ASSEMBLY

Disconnect the EGR Solenoid harness connector.

Using a 12-volt test light, jump across the (K35) EGR Solenoid Control terminal and the (Z958) Ground terminal in the EGR Solenoid harness connector.

With the scan tool, actuate the EGR solenoid.



Does the 12-volt test light flash on and off?

Yes >> Inspect the tube(s) for obstructions and damage, repair as necessary. Replace the EGR Solenoid Assembly.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P0401-EGR SYSTEM PERFORMANCE (CONTINUED)

7. (Z958) EGR SOLENOID GROUND CIRCUIT OPEN

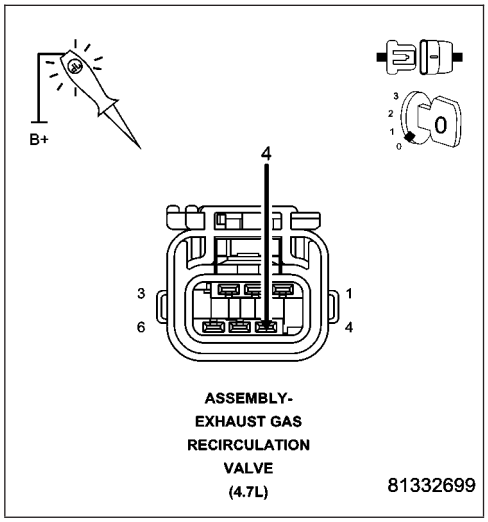
Turn the ignition off.

Using a 12-volt test light connected to battery voltage, probe the (Z958) EGR Solenoid ground circuit in the EGR Solenoid harness connector.

Does the 12-volt test light illuminate brightly?

Yes >> Go To 8

No >> Repair the open in the (Z958) EGR Solenoid ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

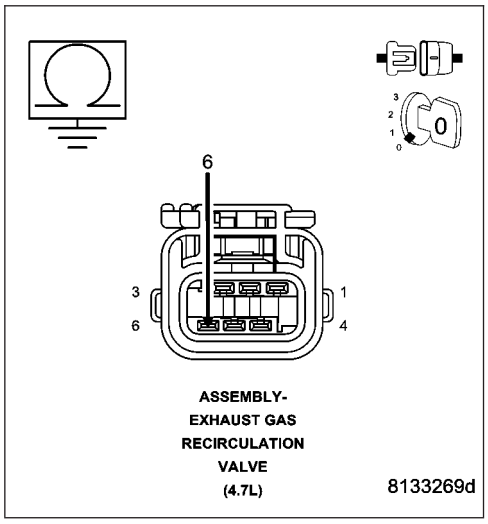
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K35) EGR Solenoid Control circuit in the EGR Solenoid harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K35) EGR Solenoid Control circuirt.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

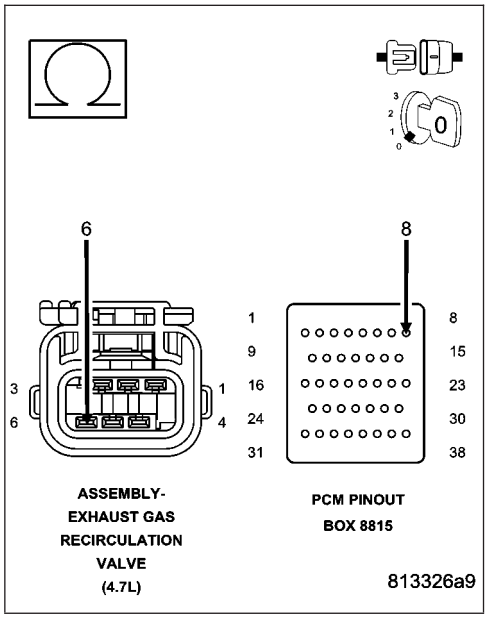


P0401-EGR SYSTEM PERFORMANCE (CONTINUED)

9. (K35) EGR SOLENOID CONTROL CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K35) EGR Solenoid Control circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 10

No >> Repair the open in the (K35) EGR Solenoid Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

10. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

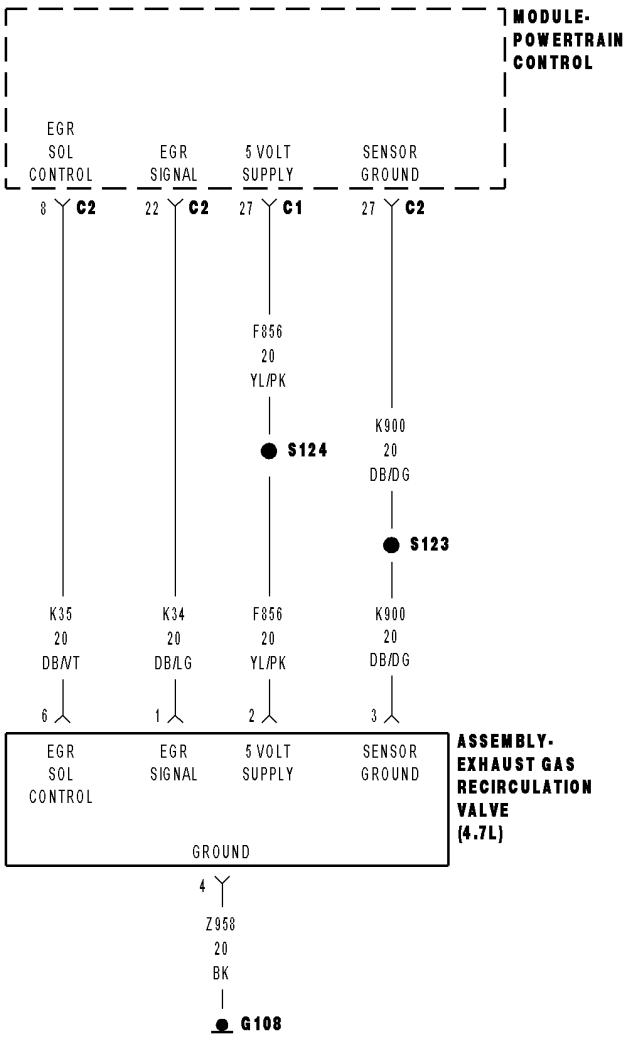
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

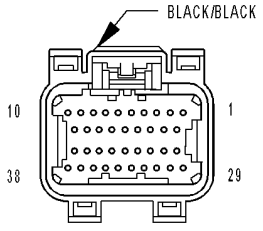
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

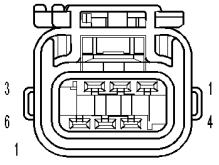
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0403-EGR SOLENOID CIRCUIT

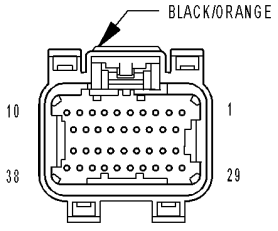




MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



ASSEMBLY-
EXHAUST GAS
RECIRCULATION
VALVE
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

81332692

P0403-EGR SOLENOID CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running. Battery voltage greater than 10 volts.
- **Set Condition:**
  The EGR solenoid control circuit is not in the expected state when requested to operate by the PCM. One Trip Fault.

Possible Causes
(Z958) EGR SOLENOID GROUND CIRCUIT OPEN
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
(K35) EGR SOLENOID CONTROL CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

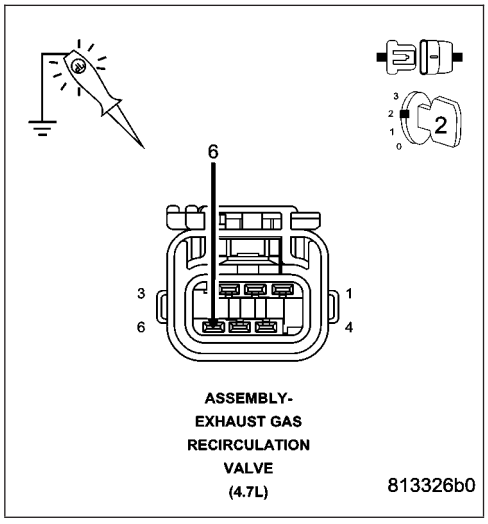
Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EGR SOLENOID ASSEMBLY

Turn the ignition off.
Disconnect the EGR Solenoid harness connector.
Ignition on, engine not running.
Turn off all accessories.
Using a 12-volt test light connected to the (Z958) EGR Solenoid ground circuit, probe the (K34) EGR Solenoid Control circuit.
With a scan tool, actuate the EGR solenoid.



Does the 12-volt test light flash on and off?

Yes >> Replace the EGR Solenoid Assembly.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0403-EGR SOLENOID CIRCUIT (CONTINUED)

3. (Z958) EGR SOLENOID GROUND CIRCUIT OPEN

Turn the ignition off.

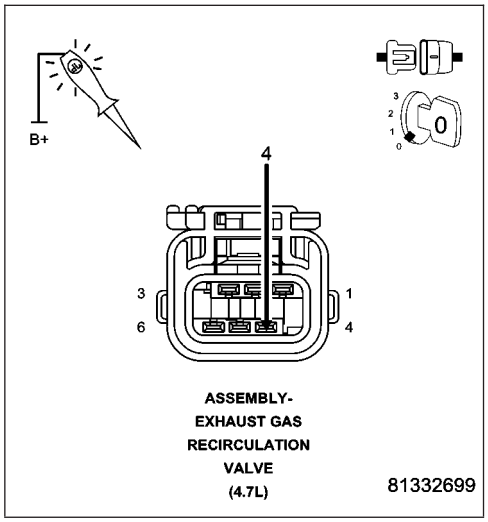
Using a 12-volt test light connected to the 12-volts, probe the (Z958) EGR Solenoid ground circuit in the EGR Solenoid harness connector.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the open in the (Z958) EGR Solenoid ground circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Ignition on, engine not running.

Disconnect the C2 PCM harness connector.

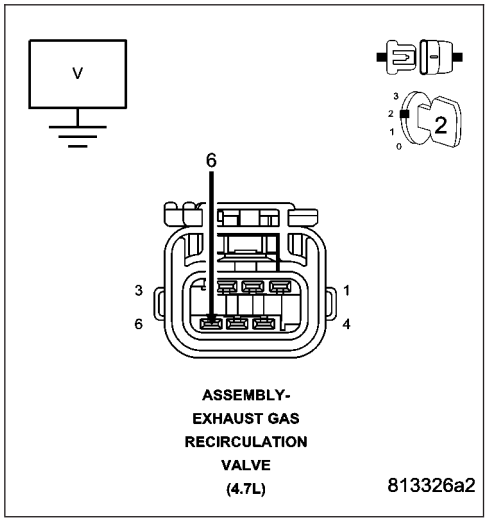
Measure the voltage on the (K35) EGR Solenoid Control circuit in the EGR Solenoid connector.

Is the voltage above 1.0 volt?

Yes >> Repair the short to battery voltage in the (K35) EGR Solenoid Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0403-EGR SOLENOID CIRCUIT (CONTINUED)

5. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

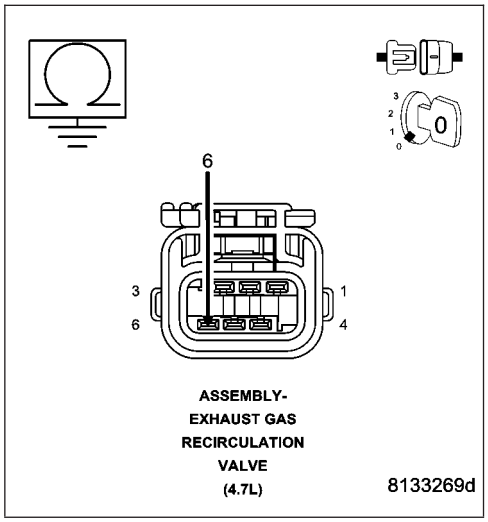
Turn the ignition off.

Measure the resistance between ground and the (K35) EGR Solenoid Control circuit in the EGR Solenoid harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K35) EGR Solenoid Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



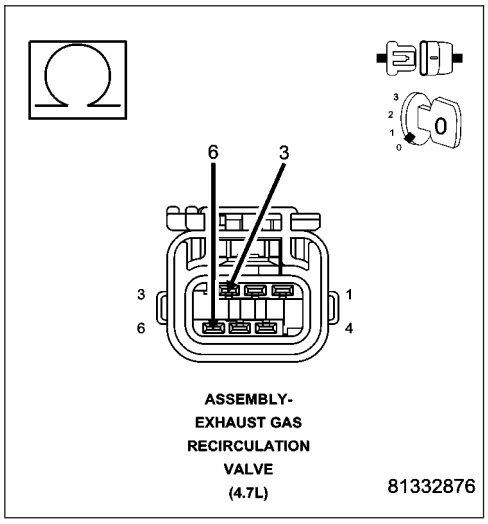
6. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K35) EGR Solenoid Control circuit and the (K900) Sensor ground circuit in the EGR Solenoid connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K35) EGR Solenoid Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

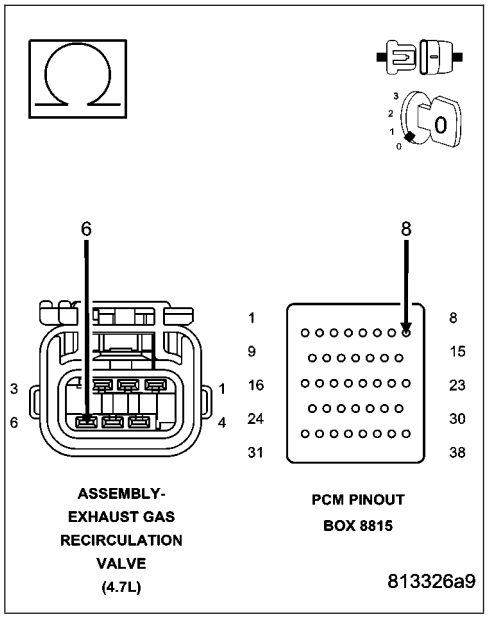
No >> Go To 7



P0403-EGR SOLENOID CIRCUIT (CONTINUED)

7. (K35) EGR SOLENOID CONTROL CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (K35) EGR Solenoid Control circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 8

No >> Repair the open in the (K35) EGR Solenoid Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. PCM

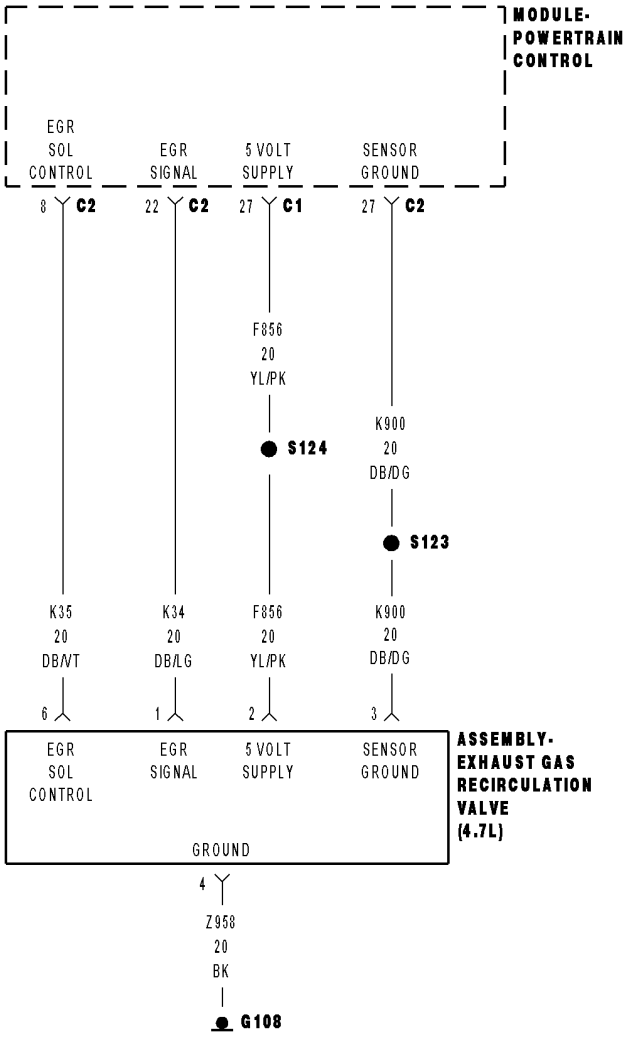
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

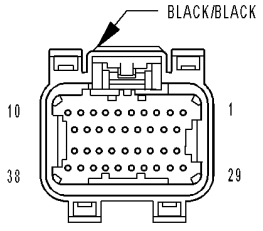
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

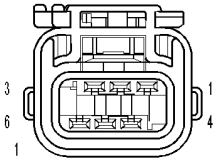
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0404-EGR POSITION SENSOR PERFORMANCE

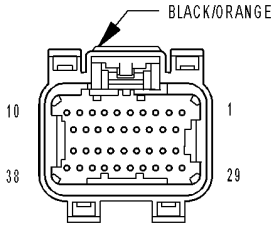




MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



ASSEMBLY-
EXHAUST GAS
RECIRCULATION
VALVE
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

81332692

P0404-EGR POSITION SENSOR PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The EGR valve has a position sensor and the EGR position rationality is designed to make sure that the valve moves freely within its operating range. Closed valve position reference check verifies that the valve is within its allowable upper and lower limits. The EGR position rationality test looks for a sustained error relative to commanded valve position.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The EGR flow or valve movement is not what is expected.

Possible Causes
EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(K35) EGR SOLENOID CONTROL CIRCUIT
(K34) EGR SENSOR SIGNAL CIRCUIT OPEN
(K34) EGR SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K900) SENSOR GROUND CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EGR POSITION VOLTAGE

NOTE: Diagnose all other EGR DTC(s) before continuing.
Start the engine.
With a scan tool, read the EGR Position Sensor voltage.

Choose a conclusion that best matches the EGR voltage reading.

Below 3.5 volts
Go To 3

Between 3.5 volts to 4.3 volts
Go To 5

Above 4.3 volts
Go To 6

P0404-EGR POSITION SENSOR PERFORMANCE (CONTINUED)

3. EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

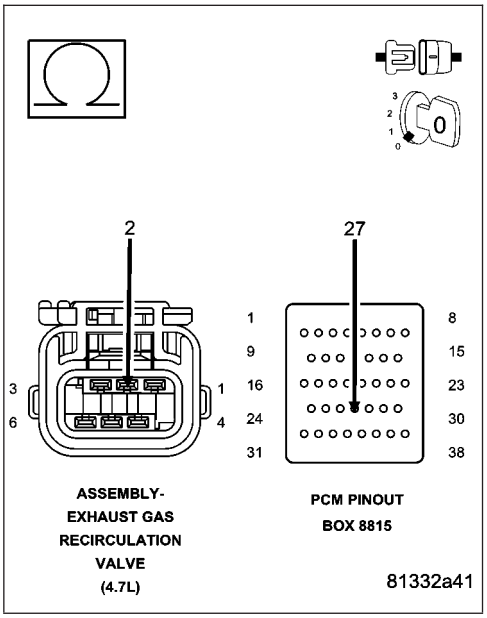
Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Disconnect the C1 and C2 PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

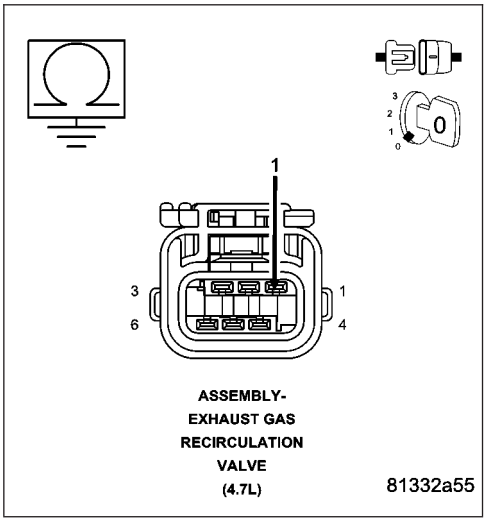
Yes >> Go To 4

No >> Repair the excessive resistance in the (F856) 5-volt Supply circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K34) EGR SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K34) EGR Sensor Signal circuit in the EGR Solenoid harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K34) EGR Sensor Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the EGR Assembly.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0404-EGR POSITION SENSOR PERFORMANCE (CONTINUED)

5. (K35) EGR SOLENOID CONTROL CIRCUIT

Ignition on, engine not running.
With the scan tool, actuate the EGR Solenoid.
Allow the EGR Solenoid to actuate for at least 15 seconds.
Feel the EGR Solenoid for operation.
Stop actuation.

Does EGR Solenoid operate while actuating and then turn off when actuation test is stopped?

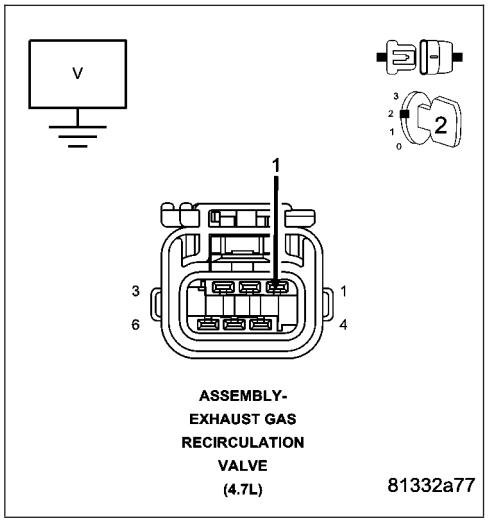
a. Yes
Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Refer to the P0403-EGR Control Circuit diagnostic procedure and continue.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. (K34) EGR SENSOR SIGNAL CIRCUIT

Turn the ignition off.
Disconnect the EGR Solenoid harness connector.
Ignition on, engine not running.
Measure the voltage of the (K34) EGR Sensor Signal circuit in the EGR Solenoid harness connector.



Is the voltage above 4.30 volts?

Yes >> Go To 7

No >> Go To 8

P0404-EGR POSITION SENSOR PERFORMANCE (CONTINUED)

7. (K900) SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

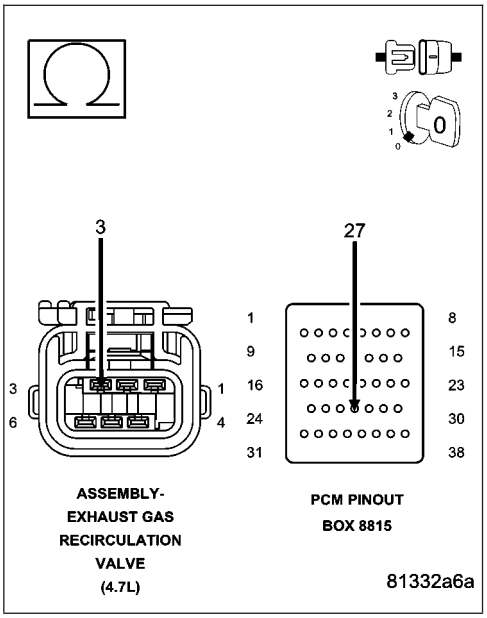
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor ground circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Replace the EGR Assembly.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K34) EGR SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

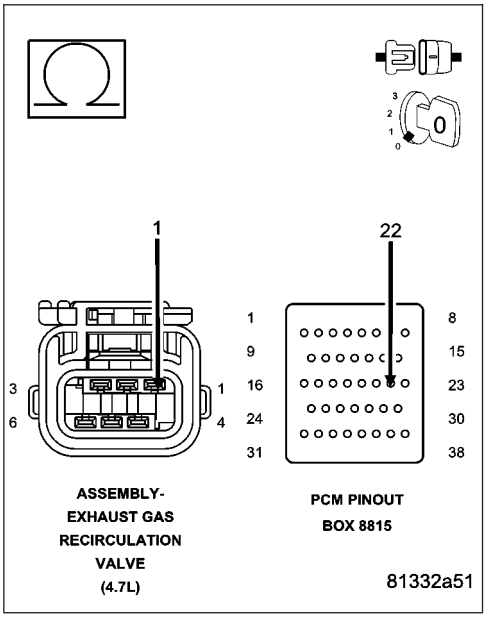
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K34) EGR Sensor Signal circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

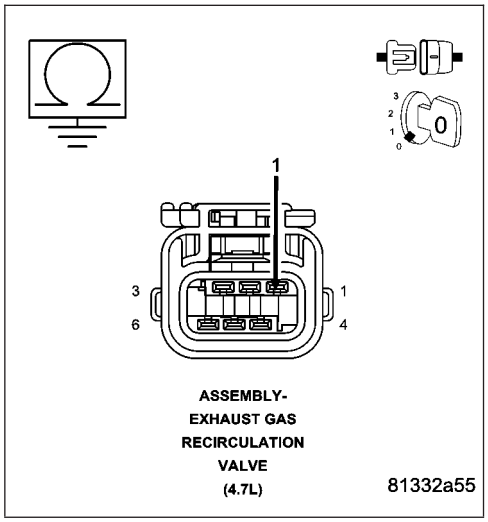
No >> Repair the open in the (K34) EGR Sensor Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0404-EGR POSITION SENSOR PERFORMANCE (CONTINUED)

9. (K34) EGR SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K34) EGR Sensor Signal circuit in the EGR Solenoid harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K34) EGR Sensor Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

---

10. PCM

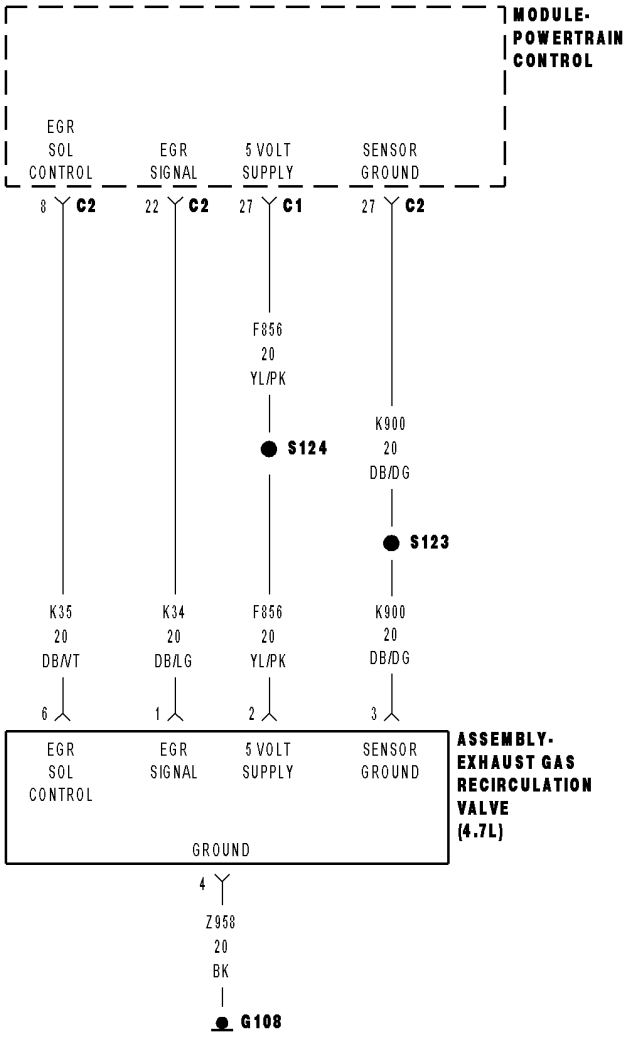
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

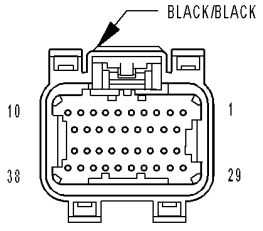
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

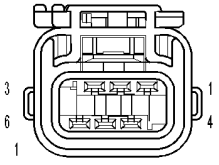
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0405-EGR POSITION SENSOR CIRCUIT LOW

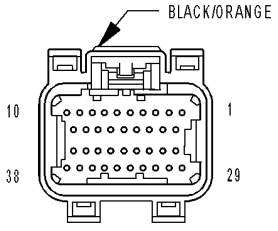




MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



ASSEMBLY-
EXHAUST GAS
RECIRCULATION
VALVE
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

81332692

P0405-EGR POSITION SENSOR CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage above 10.0 volts.
- **Set Condition:**
  EGR Position Sensor Signal is less than 0.1 of a volt. One trip Fault.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
EGR POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. EGR POSITION SENSOR BELOW 0.2 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the EGR Position Sensor voltage.

Is the voltage below 0.2 of a volt?

Yes >> Go To 2

No >> Go To 9

---

2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

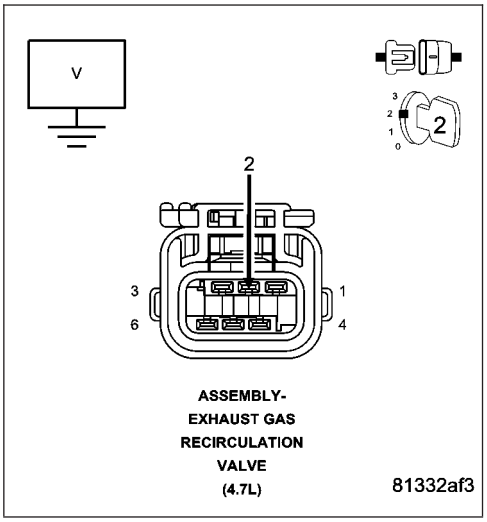
Ignition on, engine not running.

Measure the voltage of the (F856) 5-volt Supply circuit in the EGR Solenoid harness connector.

Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 6



P0405-EGR POSITION SENSOR CIRCUIT LOW (CONTINUED)

3. EGR POSITION

With the scan tool, monitor the EGR Position Sensor voltage.

Is the voltage above 4.5 volts?

Yes >> Replace the EGR Solenoid Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

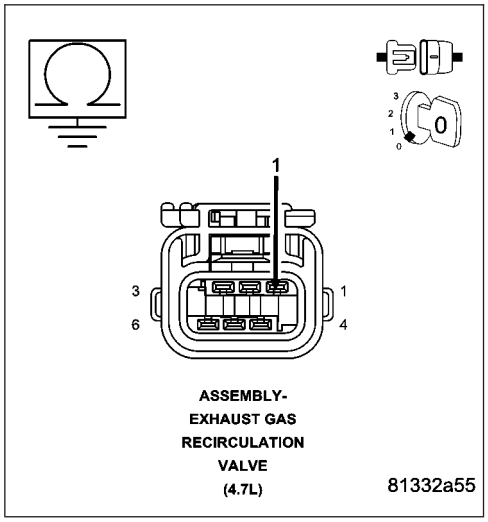
---

4. (K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K34) EGR Position Sensor Signal circuit in the EGR Solenoid harness connector.



Is the resistance below 100 ohms?

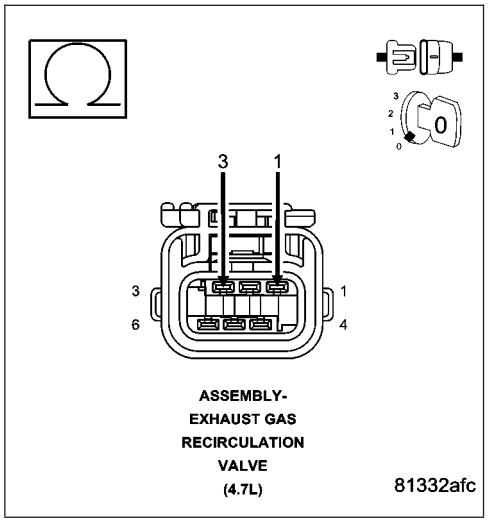
Yes >> Repair the short to ground circuit in the (K34) EGR Position Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. (K34) EGR SENSOR SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K34) EGR Position Sensor Signal circuit and (K900) Sensor ground circuit in the EGR Solenoid harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground and the (K34) EGR Position Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0405-EGR POSITION SENSOR CIRCUIT LOW (CONTINUED)

6. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

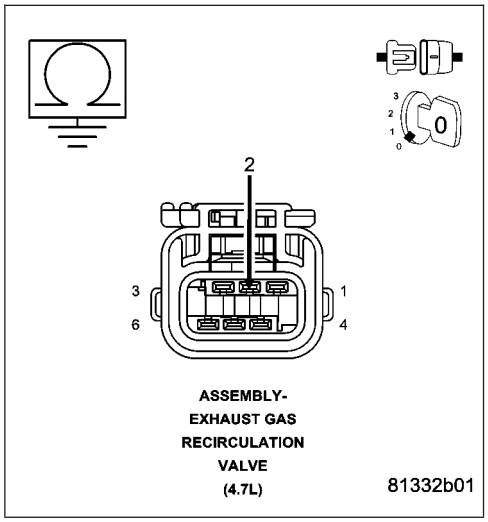
Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the EGR Solenoid harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



7. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

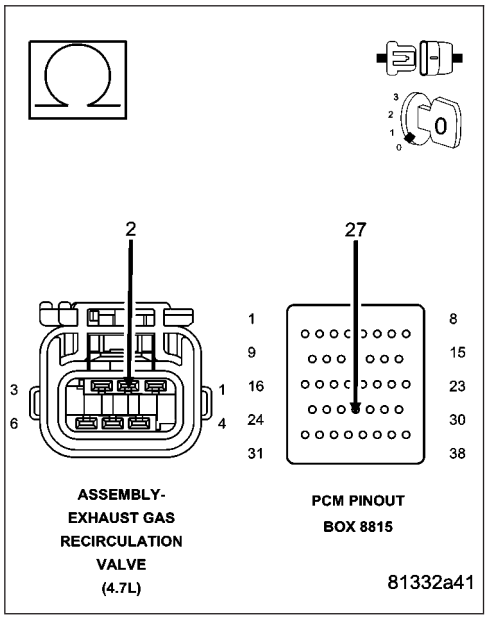
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 8

No >> Repair the open in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0405-EGR POSITION SENSOR CIRCUIT LOW (CONTINUED)

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

9. EGR POSITION SENSOR SWEEP

NOTE: The engine will run rough and possibly stall in the following test. Feather the accelerator pedal to keep the engine from stalling.

Start the engine.

With the scan tool, enter System Test and then EGR System Test. Push the 4=VARIABLE function.

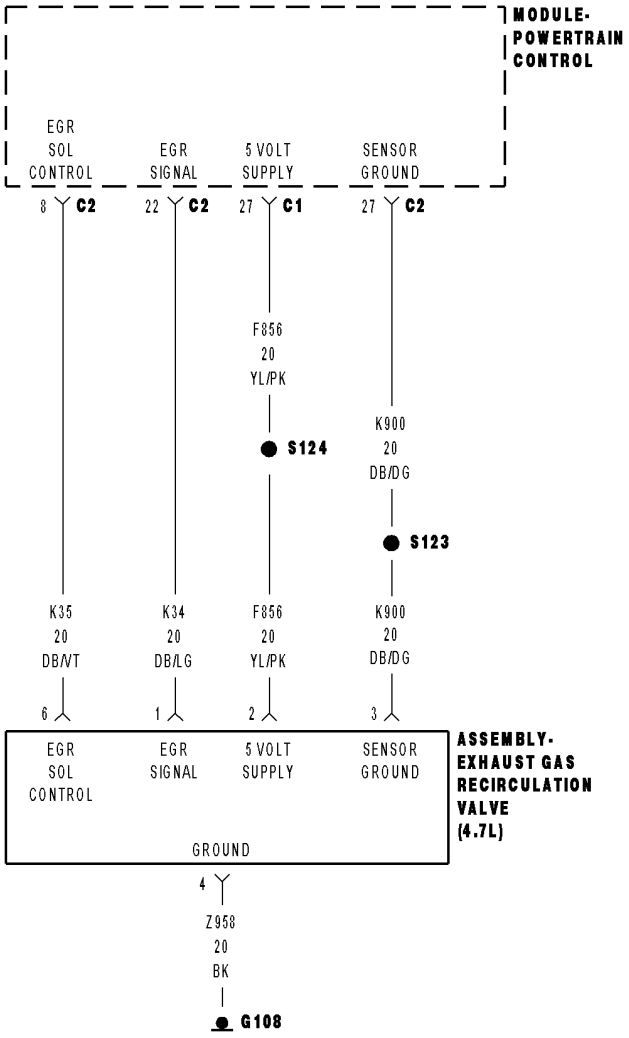
Monitor the EGR voltage while slowly pushing the up arrow.

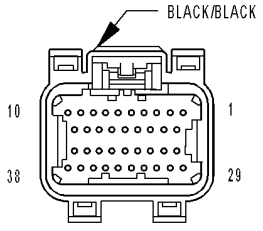
Is the voltage change smooth?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

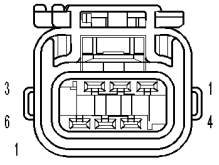
No >> Replace the EGR Solenoid Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0406-EGR POSITION SENSOR CIRCUIT HIGH

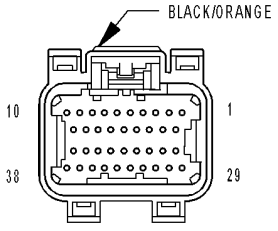




MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



ASSEMBLY-
EXHAUST GAS
RECIRCULATION
VALVE
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

81332692

P0406-EGR POSITION SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts.
- **Set Condition:**
  EGR position sensor signal is greater than 4.89. One trip Fault.

Possible Causes
(K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K34) EGR POSITION SENSOR SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. EGR POSITION SENSOR VOLTAGE ABOVE 4.5 VOLTS

Start the engine.

With the scan tool, read the EGR Position Sensor voltage.

Is the voltage above 4.5 volts?

Yes >> Go To 2

No >> Go To 8

---

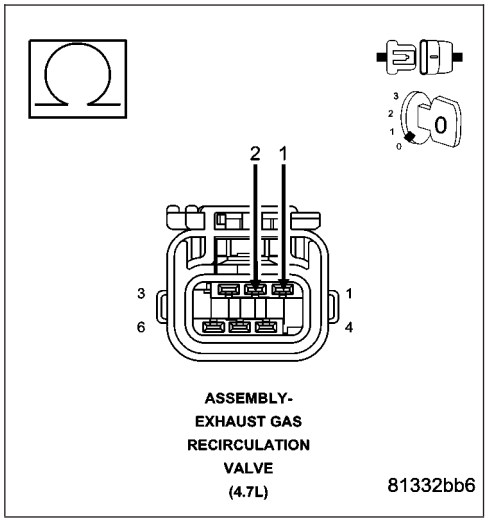
2. (K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Disconnect the C1 and C2 PCM harness connectors.

Measure the resistance between the (K34) EGR Position Sensor Signal circuit and the (F856) 5-volt Supply circuit in the EGR Solenoid harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K34) EGR Position Sensor Signal circuit and the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0406-EGR POSITION SENSOR CIRCUIT HIGH (CONTINUED)

3. (K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

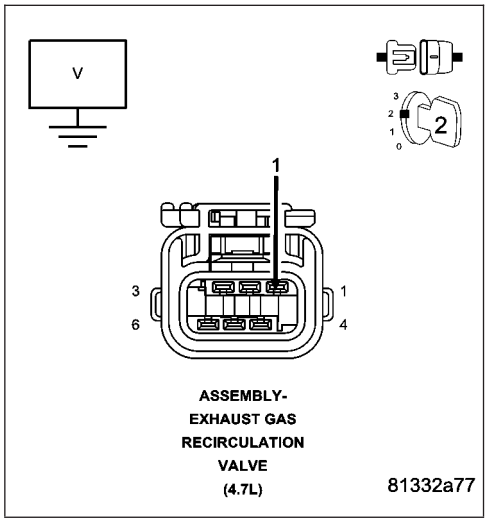
Ignition on, engine not running.

Measure the voltage on the (K34) EGR Sensor Signal circuit in the EGR Solenoid harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K34) EGR Position Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. EGR SOLENOID ASSEMBLY

Turn the ignition off.

Connect the C1 and C2 PCM harness connectors.

Connect a jumper wire between the (K34) EGR Position Sensor Signal circuit and the (K900) Sensor ground circuit.

With the scan tool, monitor the EGR Position Sensor voltage.

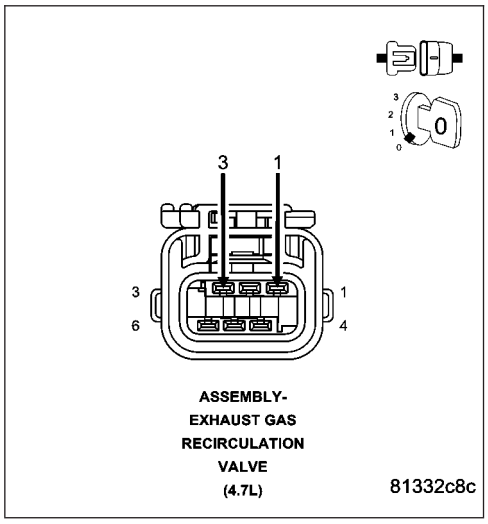
Ignition on, engine not running.

Is the voltage below 0.5 of a volt?

Yes >> Replace the EGR Solenoid Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.



P0406-EGR POSITION SENSOR CIRCUIT HIGH (CONTINUED)

5. (K34) EGR POSITION SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

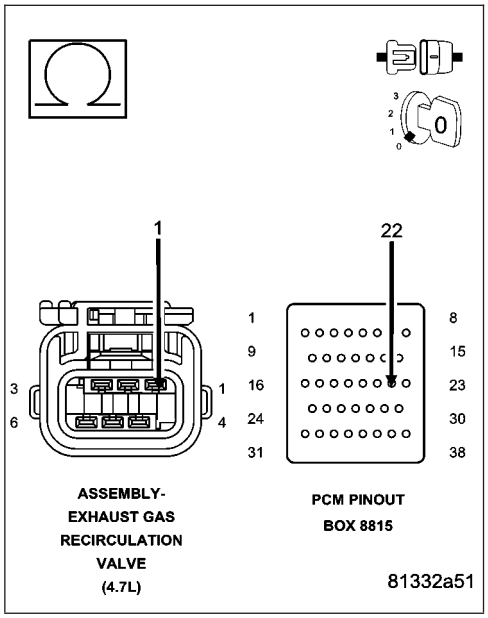
Measure the resistance of the (K34) EGR Position Sensor Signal circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K34) EGR Position Sensor Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K900) SENSOR GROUND CIRCUIT OPEN

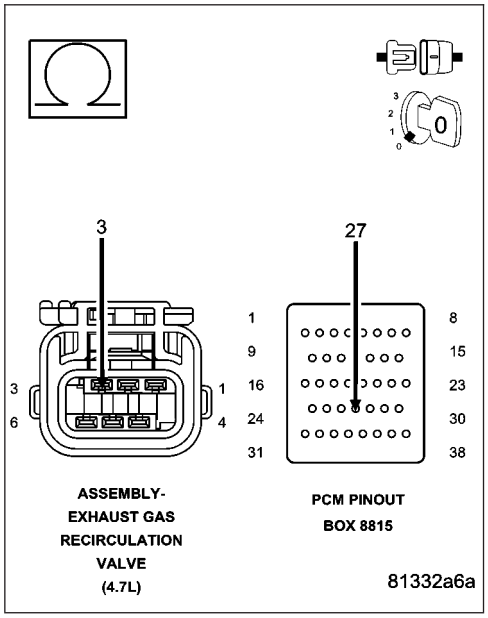
Measure the resistance of the (K900) Sensor ground circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 30 ohms?

Yes >> Go To 7

No >> Repair the open in the (K900) Sensor ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0406-EGR POSITION SENSOR CIRCUIT HIGH (CONTINUED)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. EGR POSITION SENSOR SWEEP

NOTE: The engine will run rough and possibly stall in the following test. Feather the accelerator pedal to keep the engine from stalling.

Start the engine.

With the scan tool, enter System Test and then EGR System Test. Push the 4=VARIABLE function.

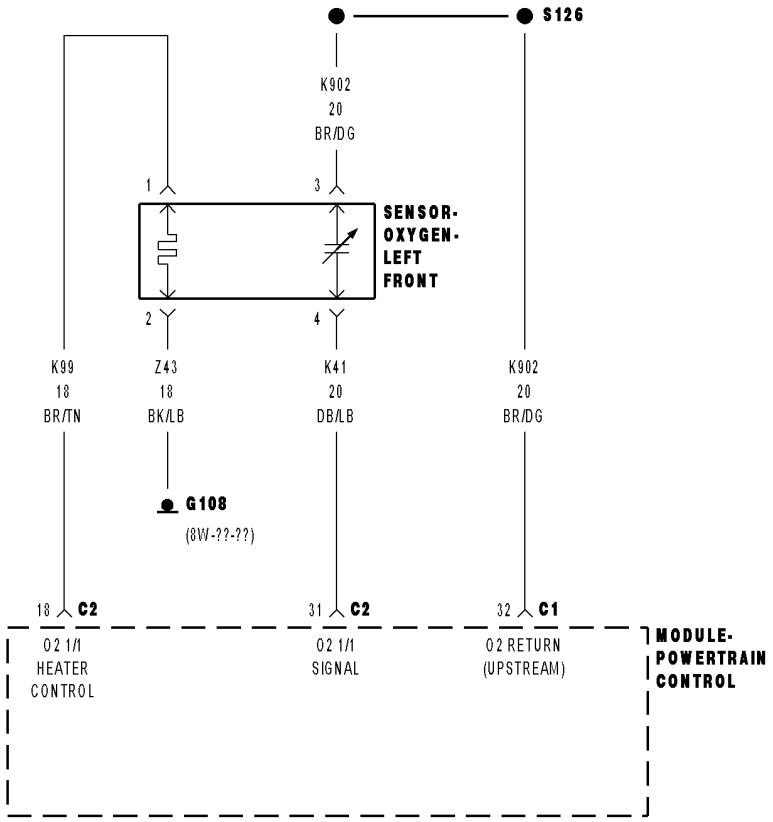
Monitor the EGR voltage while slowly pushing the up arrow.

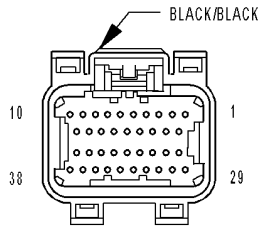
Is the voltage change smooth?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

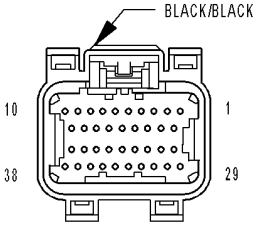
No >> Replace the EGR Solenoid Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0420-CATALYST 1/1 EFFICIENCY

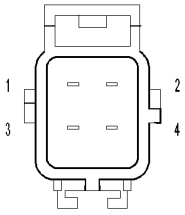




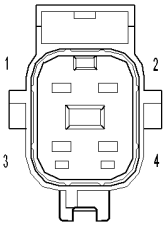
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



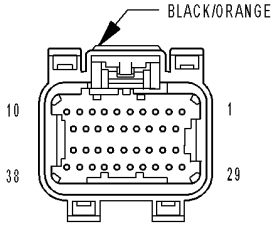
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



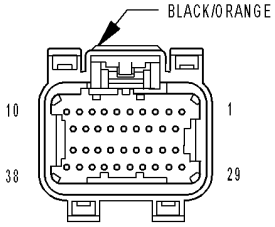
SENSOR-
OXYGEN-
LEFT
FRONT
(4.7L)



SENSOR-
OXYGEN-
LEFT FRONT
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

8132af33

P0420-CATALYST 1/1 EFFICIENCY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The upstream O2 sensor is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. During the catalyst/O2 monitor test, the response rate (cycles/second) of the upstream O2 sensor determines the sensor's ability to achieve the tailpipe emissions limits. The response rate of the downstream O2 sensor relative to the upstream O2 sensor response rate measures the catalyst's ability to store oxygen and is used to infer the catalyst's ability to achieve the tailpipe emissions limits.

- **When Monitored:**
  After engine warm up to 70°C (158°F), 180 seconds of open throttle operation, at a speed greater than 18 mph and less than 55 mph, with the engine at 1200-1700 rpm and MAP vacuum between 15.0 and 21.0 inches of mercury (Hg).
- **Set Condition:**
  As catalyst efficiency deteriorates, the switch rate of the downstream O2 sensor approaches that of the upstream O2 sensor. If at any point during the test the switch ratio reaches a predetermined value a counter is incremented by one. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL CONDITION
AGING O2 SENSOR
CATALYTIC CONVERTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set. Review the repair history of the vehicle before continuing.

NOTE: If an O2 Sensor DTC set along with the Catalytic Converter Efficiency DTC diagnose the O2 Sensor DTC(s) before continuing.

NOTE: Check for contaminants that may have damaged the O2 Sensor and Catalytic Converter: contaminated fuel, unapproved silicone, oil and coolant, repair necessary.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0420-CATALYST 1/1 EFFICIENCY (CONTINUED)

2. VISUALLY INSPECT CATALYTIC CONVERTER

Inspect the Catalytic Converter for the following damage.
Damaged Catalytic Converter, dents or holes.
Severe discoloration caused by overheating the Catalytic Converter.
Catalytic Converter broken internally.
Leaking Catalytic Converter.

Were any problems found?

Yes >> Replace the Catalytic Converter. Repair the condition that may have caused the failure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. EXHAUST LEAK

Start the engine.
Inspect the exhaust for leaks between the engine and the 1/1 O2 Sensor.
Inspect the exhaust for leaks between the engine and the 1/2 O2 Sensor.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. ENGINE MECHANICAL CONDITION

Check the exhaust for excessive smoke caused by an internal problem in the engine.

Is an engine mechanical condition present?

Yes >> Repair the engine mechanical condition as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. AGING O2 SENSOR

A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set.
Review the vehicles repair history.

Has the rear O2 Sensor been replaced without replacing the front O2 Sensor?

Yes >> Replace the Front O2 Sensor as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

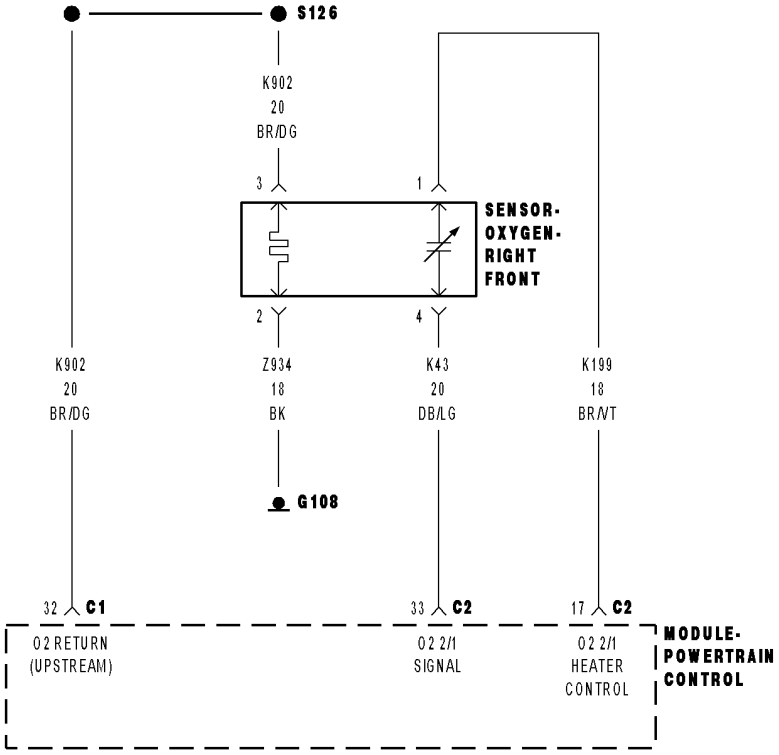
6. CATALYTIC CONVERTER

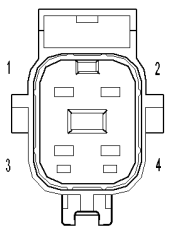
If there are no possible cause remaining, view repair.

Repair

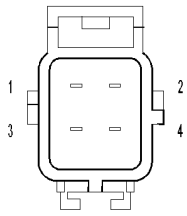
Replace the Catalytic Converter.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0430-CATALYST 2/1 EFFICIENCY

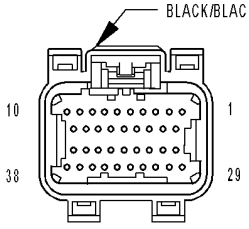




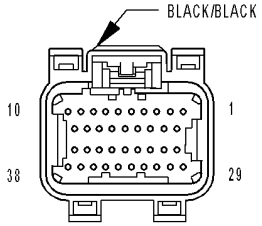
SENSOR-
OXYGEN-
RIGHT FRONT
(3.7L)



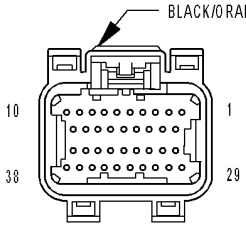
SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



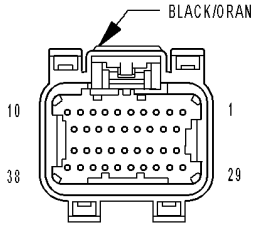
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)

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P0430-CATALYST 2/1 EFFICIENCY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The upstream O2 sensor is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. During the catalyst/O2 monitor test, the response rate (cycles/second) of the upstream O2 sensor determines the sensor's ability to achieve the tailpipe emissions limits. The response rate of the downstream O2 sensor relative to the upstream O2 sensor response rate measures the catalyst's ability to store oxygen and is used to infer the catalyst's ability to achieve the tailpipe emissions limits.

- **When Monitored:**
  After engine warm up to 147 deg. F, 180 seconds of open throttle operation, at a speed greater than 20 mph, with the engine at 1200-1700 rpm and MAP vacuum between 15.0 and 21.0 inches of mercury (Hg).
- **Set Condition:**
  As catalyst efficiency deteriorates, the switch rate of the downstream O2 sensor approaches that of the upstream O2 sensor. If at any point during the test the switch ratio reaches a predetermined value a counter is incremented by one. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL CONDITION
AGING O2 SENSOR
CATALYTIC CONVERTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set. Review the repair history of the vehicle before continuing.

NOTE: If an O2 Sensor DTC set along with the Catalytic Converter Efficiency DTC diagnose the O2 Sensor DTC(s) before continuing.

NOTE: Check for contaminants that may have damaged the O2 Sensor and Catalytic Converter: contaminated fuel, unapproved silicone, oil and coolant, repair necessary.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0430-CATALYST 2/1 EFFICIENCY (CONTINUED)

2. VISUALLY INSPECT CATALYTIC CONVERTER

Inspect the Catalytic Converter for the following damage.
Damaged Catalytic Converter, dents or holes.
Severe discoloration caused by overheating the Catalytic Converter.
Catalytic Converter broken internally.
Leaking Catalytic Converter.

Were any problems found?

Yes >> Replace the Catalytic Converter. Repair the condition that may have caused the failure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. EXHAUST LEAK

Start the engine.
Inspect the exhaust for leaks between the engine and the 2/1 O2 Sensor.
Inspect the exhaust for leaks between the engine and the 2/2 O2 Sensor.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. ENGINE MECHANICAL CONDITION

Check the exhaust for excessive smoke caused by an internal problem in the engine.

Is an engine mechanical condition present?

Yes >> Repair the engine mechanical condition as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. AGING O2 SENSOR

A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set.
Review the vehicles repair history.

Has the rear O2 Sensor been replaced without replacing the front O2 Sensor?

Yes >> Replace the 2/1 O2 Sensor as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

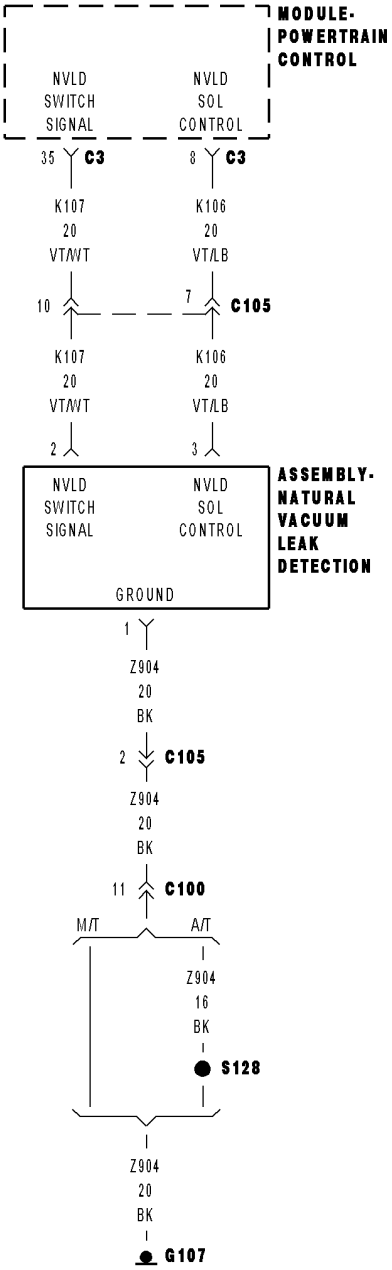
6. CATALYTIC CONVERTER

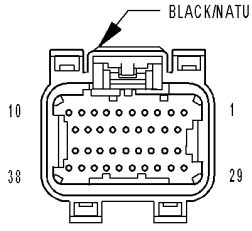
If there are no possible cause remaining, view repair.

Repair

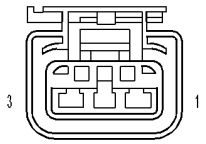
Replace the Catalytic Converter.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0440-GENERAL EVAP SYSTEM FAILURE





MODULE-
POWERTRAIN
CONTROL C3



ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION

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P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The theory behind the Natural Vacuum Leak Detection (NVLD) is adherence to the Ideal Gas Law. Pressure in a sealed vessel will change linearly as a function of the temperature of the gas in the vessel. Even small leaks will allow the pressure in the vessel to come to equilibrium with the atmospheric pressure. After key-off and a calibrated amount of time, cool down from operating temperatures or diurnal ambient temperature the system pressure will force the system to go negative or draw a vacuum if there is no leak. When the vacuum level reaches 1" H2O (0.25 KPA) the NVLD vacuum switch closes. This sends a signal to the NGC freezing a timer and registering a pass. If a switch closure is not detected an assessment of leak size will be made.

- **When Monitored:**
  Engine Running. Fuel Level greater than 12%. Ambient Temperature between 4°C and 32°C (39°F and 89°F).
- **Set Condition:**
  The PCM does not see the NVLD switch close during the medium/large leak test. The PCM then will increase the vacuum supply to the EVAP system by increasing flow through the EVAP Purge valve. If the switch does not close with an increase in vacuum an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SOLENOID VACUUM SUPPLY
(Z904) GROUND CIRCUIT OPEN
(K107) NVLD SWITCH SIGNAL CIRCUIT OPEN
EVAPORATIVE EMISSION LEAK DETECTION
NVLD ASSEMBLY
EVAP PURGE SOLENOID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If any of the following DTCs are set (P0443, P0452, P0453, P0498 or P0499) diagnose them first before continuing with P0440.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

2. VISUAL AND PHYSICAL INSPECTION

Turn the ignition off.
Perform a visual and physical inspection of the entire Evaporative Emission system.
Check for the following conditions:
- Hoses disconnected or left off
- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Fuel Cap left off or bad gasket seal

Were any of the above conditions found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. EVAP VACUUM SUPPLY HOSE INSPECTION

Carefully inspect the Evap Purge Solenoid vacuum supply hose for proper routing.
Check for a pinched or plugged hose from the throttle body to the Purge Solenoid.
Make sure the vacuum port at the throttle body is free from any blockage.

Were any problems found?

Yes >> Repair the vacuum supply, hose/tube as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. CHECKING EVAP PURGE SOLENOID FUNCTIONALITY

Disconnect the vacuum supply hoses form the EVAP Purge Solenoid.
Using a hand vacuum pump, apply 10 in Hg to the ″CAN″ side of the EVAP Purge Solenoid.
Ignition on, engine not running.
Observe the vacuum gauge.
With the scan tool, actuate the EVAP Purge Solenoid.

Does the vacuum drop when the solenoid is actuated?

Yes >> Go To 5

No >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

5. NVLD SWITCH OPERATION

Connect the previously disconnected vacuum hose.

Start the engine.

Allow the engine to idle.

Using the scan tool, perform the NVLD FORCED MONITOR TEST.

Monitor the NVLD Switch state.

NOTE: As the test runs, the NVLD Switch should go from an OPEN state to a CLOSED state and then return to OPEN when the test is complete.

Did the NVLD Switch operate as described above?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404 Evaporative Emission Leak Detector (EELD).

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.

Connect the red power lead of EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the EVAP Canister.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the .040 orifice on the tester's control panel.

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute.

Install the service port adapter #8404-14 on the vehicle's service port (if equipped) or install the #8404-ADP into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes >> Go To 7

No >> Go To 8

P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

7. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may aid diagnosis also.

To continue testing, you will need Miller Tool #8404 Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port or the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move at this point.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that are left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke or dye may or may not be visible. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Was a leak found?

Yes >> Repair or replace the leaking component as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

8. NVLD ASSEMBLY

Turn the ignition off.

Disconnect the NVLD electrical harness connector.

Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

Connect a jumper wire between the (K107) NVLD Switch Signal circuit and the (Z904) Ground circuit in the NVLD electrical harness connector.

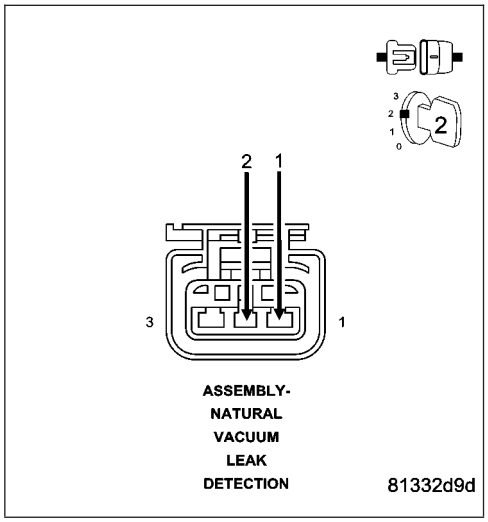
Monitor the NVLD Switch state on the scan tool.

Does the Switch change from OPEN to CLOSED when the jumper wire is installed?

Yes >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

NOTE: Remove the jumper wire before continuing.



9. (Z904) GROUND CIRCUIT OPEN

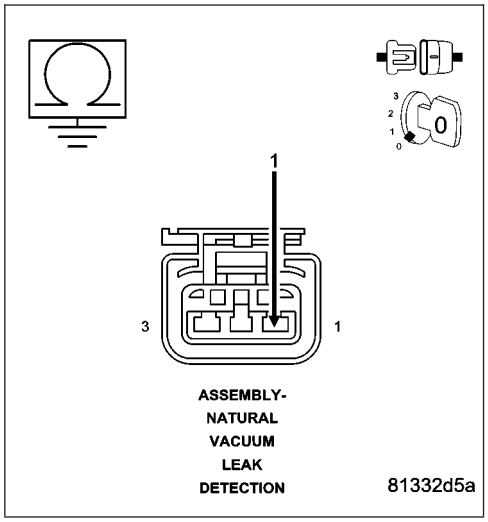
Turn the ignition off.

Measure the resistance between the (Z904) Ground circuit and ground at the NVLD Assembly.

Is the resistance below 5.0 ohms?

Yes >> Go To 10

No >> Repair the open in the (Z904) Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

10. (K107) NVLD SWITCH SIGNAL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

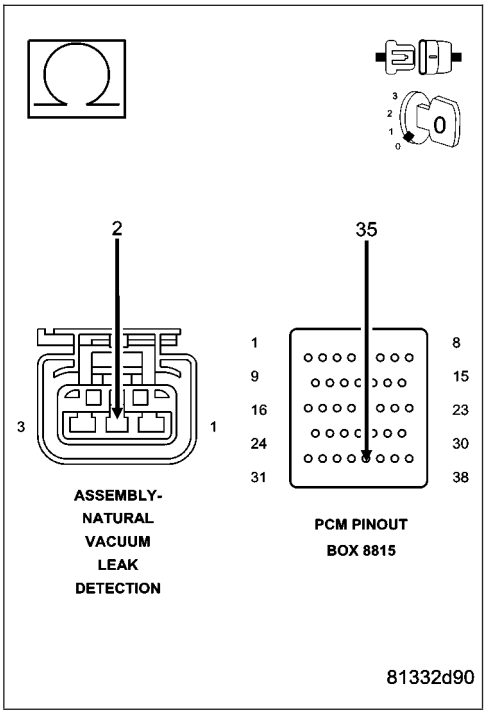
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K107) NVLD Switch Signal circuit from the NVLD electrical harness connector to the appropriate terminal of the special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 11

No >> Repair the open in the (K107) Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



11. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

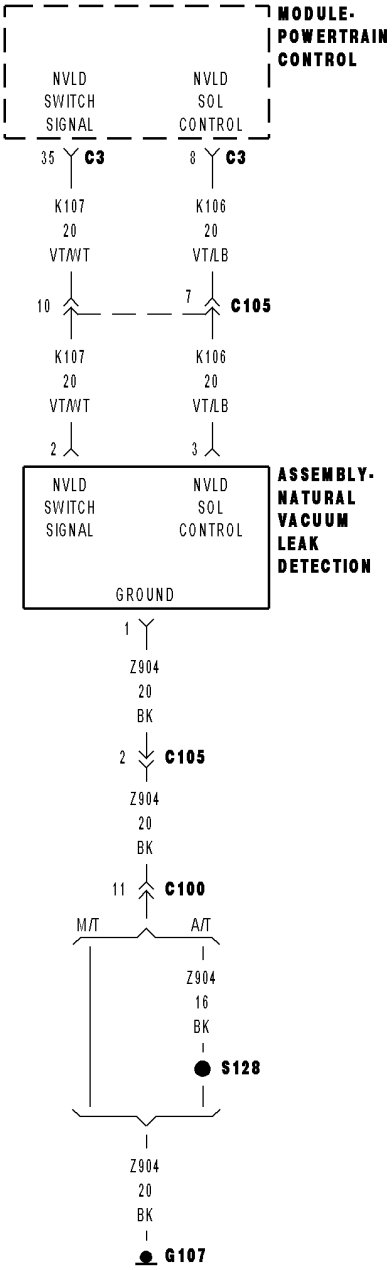
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

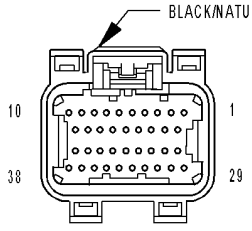
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

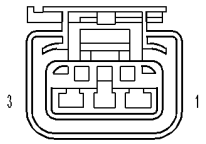
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0441-EVAP PURGE SYSTEM PERFORMANCE





MODULE-
POWERTRAIN
CONTROL C3



ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION

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P0441-EVAP PURGE SYSTEM PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Cold start test. Engine Running. Small Leak Test Passed.
- **Set Condition:**
  The PCM activates the EVAP Purge solenoid gradually increases to maximum flow. During flow, the PCM looks for the NVLD switch to close. If the PCM does not see the NVLD switch close at maximum flow an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SOLENOID VACUUM SUPPLY
EVAP PURGE SOLENOID

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If any of the following DTCs are set (P0443, P0452, P0453, P0498 or P0499) diagnose them first before continuing with P0441.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. CHECKING EVAP PURGE SOLENOID FUNCTIONALITY

NOTE: After disconnecting the Evap Purge vacuum connections, inspect the lines and solenoid for any signs of contamination or foreign materials.

Using a hand vacuum pump, apply 10 in Hg to ″CAN″ side of the EVAP Purge Solenoid.

Ignition on, engine not running.

Observe the vacuum gauge.

With the scan tool, actuate the EVAP Purge Solenoid.

Does the vacuum drop when the solenoid is actuated?

Yes >> Go To 3

No >> Replace the Evap Purge Solenoid.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Remove the vacuum pump before continuing.

P0441-EVAP PURGE SYSTEM PERFORMANCE (CONTINUED)

3. EVAP VACUUM SUPPLY HOSE INSPECTION

Turn the ignition off.

Carefully inspect the Evap Purge Solenoid vacuum supply hose for proper routing.

Check for a pinched or plugged hose from the throttle body to the Purge Solenoid.

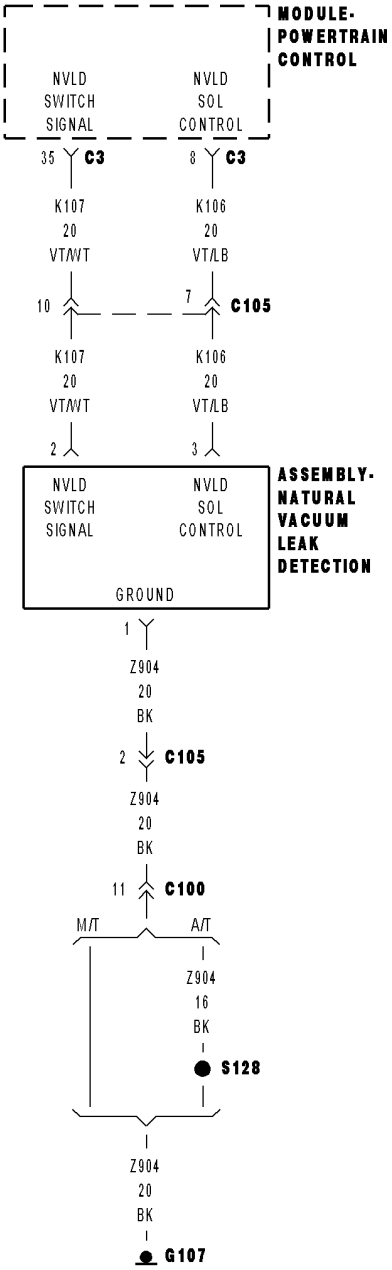
Inspect the vacuum port at the throttle body for any damage or plugging.

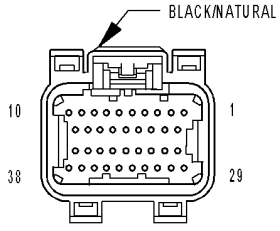
Were any problems found?

Yes >> Repair the vacuum supply hose/tube as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

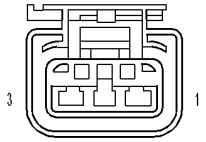
No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0442-EVAP PURGE SYSTEM MEDIUM LEAK





MODULE-
POWERTRAIN
CONTROL C3



ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION

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P0442-EVAP PURGE SYSTEM MEDIUM LEAK (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The theory behind the Natural Vacuum Leak Detection (NVLD) is adherence to the Ideal Gas Law. Pressure in a sealed vessel will change linearly as a function of the temperature of the gas in the vessel. Even small leaks will allow the pressure in the vessel to come to equilibrium with the atmospheric pressure. After key-off and a calibrated amount of time, cool down from operating temperatures or diurnal ambient temperature the system pressure will force the system to go negative or draw a vacuum if there is no leak. When the vacuum level reaches 1" H2O (0.25 KPA) the NVLD vacuum switch closes. This sends a signal to the NGC freezing a timer and registering a pass. If a switch closure is not detected an assessment of leak size will be made.

- **When Monitored:**
  Engine Running. Cold start test. Fuel Level greater than 12%. Ambient Temperature between 4°C and 32°C (39°F and 89°F) Close Loop fuel system. Test runs when small leak test is maturing.
- **Set Condition:**
  The PCM activates the EVAP Purge Solenoid to pull the EVAP system into a vacuum to close the NVLD switch. Once the NVLD switch is closed, the PCM turns the EVAP Purge solenoid off to seal the EVAP system. If the NVLD switch reopens before the calibrated amount of time for a Medium leak an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SYSTEM LEAK
EVAP PURGE SOLENOID
NVLD SWITCH

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Since a hot vehicle can conceal a leak, it is best to perform this test at room temperature.

NOTE: A loose gas cap could have caused this DTC to set. Make sure gas cap is tight and in good condition. Make sure the gas cap meets OEM specifications.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0442-EVAP PURGE SYSTEM MEDIUM LEAK (CONTINUED)

2. VISUAL AND PHYSICAL INSPECTION

Perform a visual and physical inspection of the entire Evaporative Emission system.

Check for the follow conditions:

- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Fuel Cap gasket seal

Were any of the above conditions found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes >> Go To 4

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0442-EVAP PURGE SYSTEM MEDIUM LEAK (CONTINUED)

4. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may also aid diagnosis.

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move in the smoke mode.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Was a leak found?

Yes >> Repair or replace the leaking component as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. EVAP PURGE SOLENOID OPERATION

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in Hg to the ″CAN″ of the EVAP Purge Solenoid.

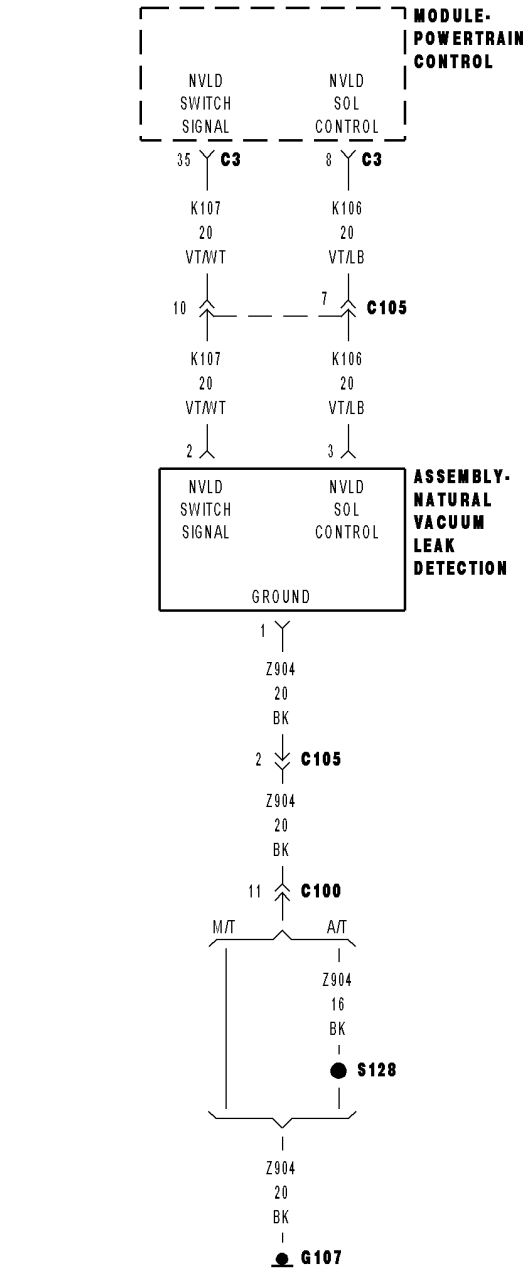
NOTE: Monitor the vacuum gauge for at least 15 seconds.

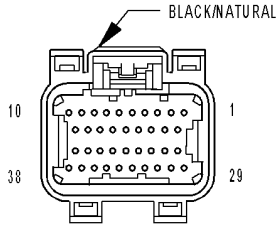
Does the EVAP Purge Solenoid hold vacuum?

Yes >> Test Complete.

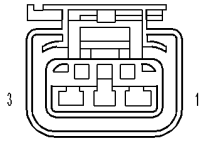
No >> Replace the Evap Purge Solenoid.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0443-EVAP PURGE SOLENOID CIRCUIT





MODULE-
POWERTRAIN
CONTROL C3



ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION

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P0443-EVAP PURGE SOLENOID CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The ignition on or engine running. Battery voltage greater than 10 volts.
- **Set Condition:**
  The PCM will set a trouble code if the actual state of the solenoid does not match the intended state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K52) EVAP PURGE CONTROL CIRCUIT OPEN
(K52) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K70) EVAP PURGE SOLENOID SIGNAL CIRCUIT OPEN
(K70) EVAP PURGE SOLENOID SIGNAL CIRCUIT SHORTED TO GROUND
EVAP PURGE SOLENOID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With the scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. EVAP PURGE SOLENOID OPERATION

Turn the ignition off.

Disconnect the EVAP Purge Solenoid harness connector.

Ignition on, engine not running.

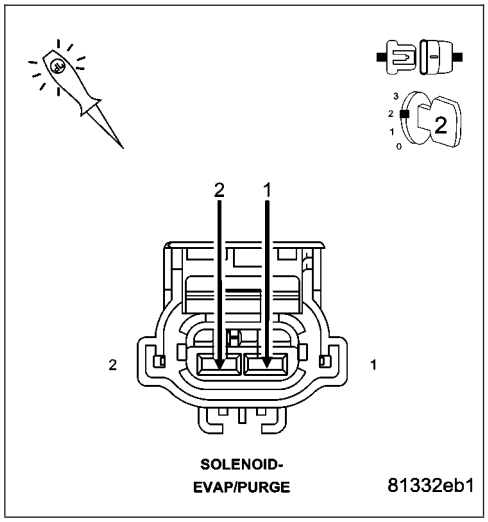
Using a 12-volt test light, jump across the (K52) Evap Purge Solenoid Control circuit and (K70) Evap Purge Solenoid Signal circuit in the EVAP Purge Solenoid harness connector.

With a scan tool, actuate the EVAP Purge Solenoid.

Does the test light flash on and off?

Yes >> Replace the EVAP Purge Solenoid.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



P0443-EVAP PURGE SOLENOID CIRCUIT (CONTINUED)

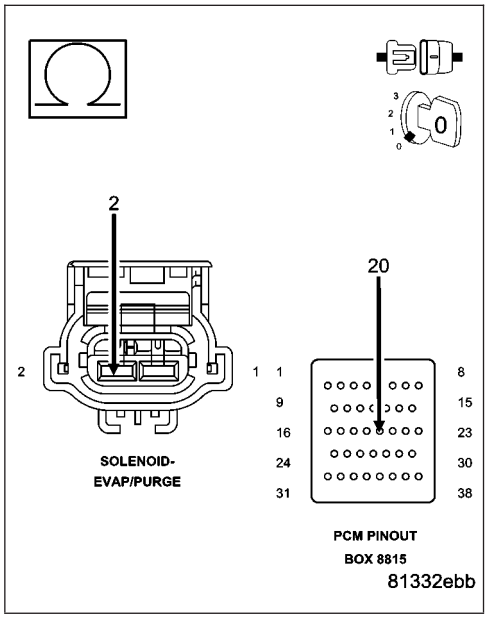
3. (K52) EVAP PURGE SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K52) Evap Purge Solenoid Control circuit from the Evap Purge Solenoid harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

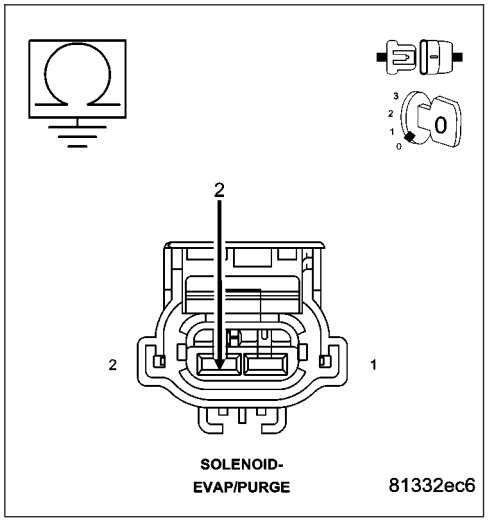
Yes >> Go To 4

No >> Repair the open in the (K52) EVAP Purge Solenoid Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K52) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K52) Evap Purge Solenoid Control circuit in the Evap Purge Solenoid harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K52) EVAP Purge Solenoid Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

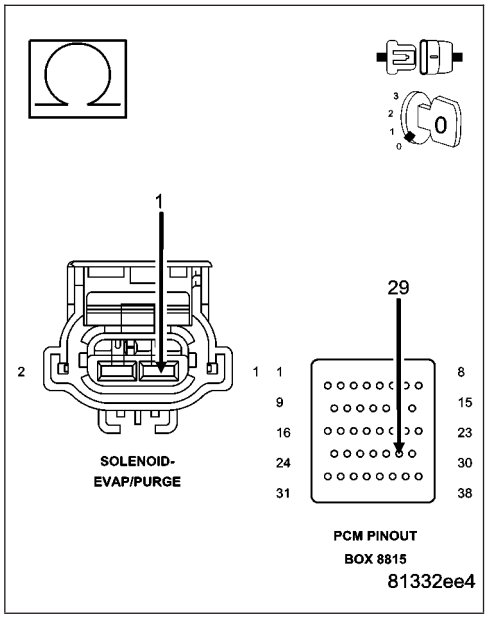
No >> Go To 5

P0443-EVAP PURGE SOLENOID CIRCUIT (CONTINUED)

5. (K70) EVAP PURGE SOLENOID SIGNAL CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K70) Evap Purge Solenoid Signal circuit from the EVAP Purge Solenoid harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

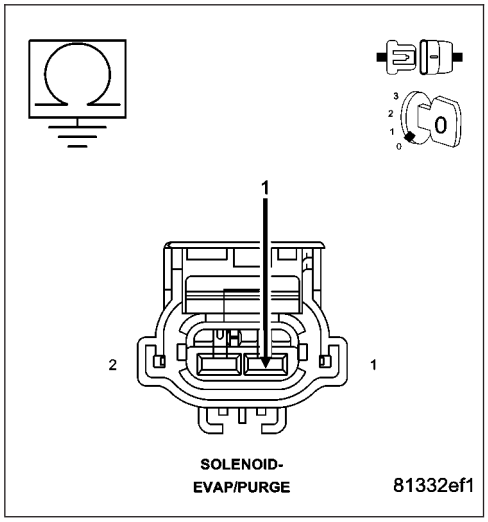
Yes >> Go To 6

No >> Repair the open in the (K70) Evap Purge Solenoid Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. (K70) EVAP PURGE SOLENOID SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K70) Evap Purge Solenoid Signal circuit in the Evap Purge Solenoid harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K70) Evap Purge Solenoid Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P0443-EVAP PURGE SOLENOID CIRCUIT (CONTINUED)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

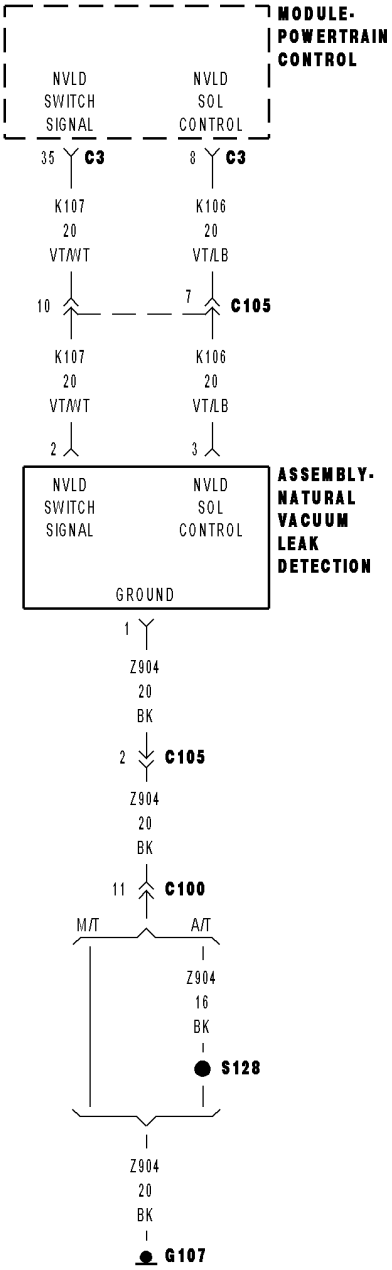
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

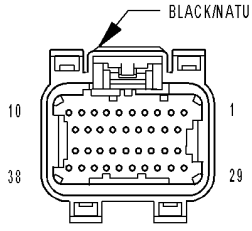
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

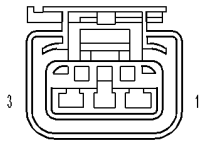
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0452-NVLD PRESSURE SWITCH STUCK CLOSED





MODULE-
POWERTRAIN
CONTROL C3



ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION

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P0452-NVLD PRESSURE SWITCH STUCK CLOSED (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Immediately after the engine has been started.
- **Set Condition:**
  The PCM activates the NLVD Solenoid. If PCM does not see NVLD switch open an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K52) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
NVLD ASSEMBLY
EVAP PURGE SOLENOID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EVAP PURGE SOLENOID OPERATION

Turn the ignition off.

Disconnect the EVAP Purge Solenoid harness connector.

Ignition on, engine not running.

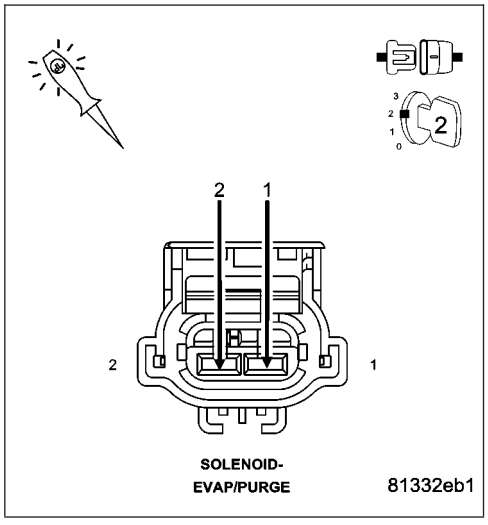
Using a 12-volt test light, jump across the Evap Purge Solenoid harness connector.

With the scan tool, actuate the EVAP Purge Solenoid.

Does the test light flash on and off?

Yes >> Go To 3

No >> Go To 7



P0452-NVLD PRESSURE SWITCH STUCK CLOSED (CONTINUED)

3. EVAP PURGE SOLENOID LEAKS/STUCK OPEN

Turn the ignition off.

Connect the Evap Purge Solenoid harness connector.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.

Using a hand vacuum pump, apply 10 in Hg to the ″CAN″ of the EVAP Purge Solenoid.

NOTE: Monitor the vacuum gauge for at least 15 seconds.

Does the EVAP Purge Solenoid hold vacuum?

Yes >> Go To 4

No >> Replace the Evap Purge Solenoid.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. NVLD SWITCH OPERATION

Ignition on, engine not running.

Using the scan tool, monitor the NVLD Switch State with the vacuum pump still installed and holding vacuum.

Does the scan tool display the NVLD state OPEN?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the vacuum pump and connect the vacuum hose before continuing.

---

5. NVLD ASSEMBLY

Disconnect the NVLD electrical connector.

Does the Switch change from CLOSED to OPEN?

Yes >> Replace the NVLD Assembly.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

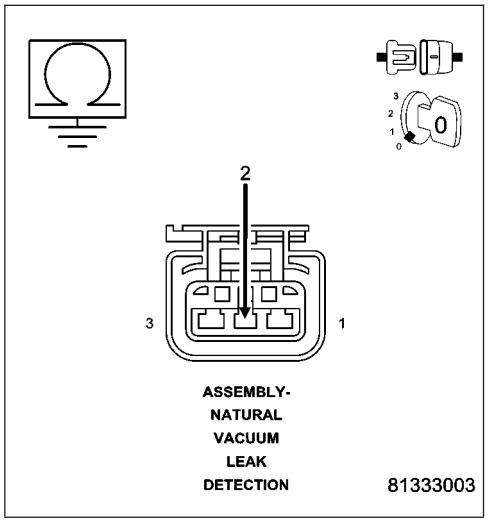
P0452-NVLD PRESSURE SWITCH STUCK CLOSED (CONTINUED)

6. (K107) SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K107) NVLD Switch Signal circuit in the NVLD Assembly harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K107) NVLD Switch Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

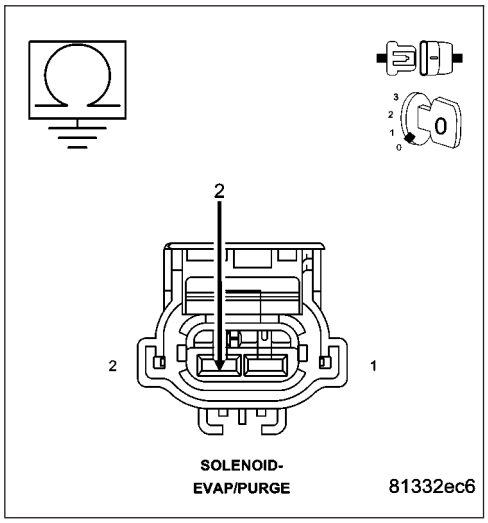
No >> Go To 8

7. (K52) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K52) Evap Purge Solenoid Control circuit in the EVAP Purge Solenoid harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K52) Evap Purge Sol Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

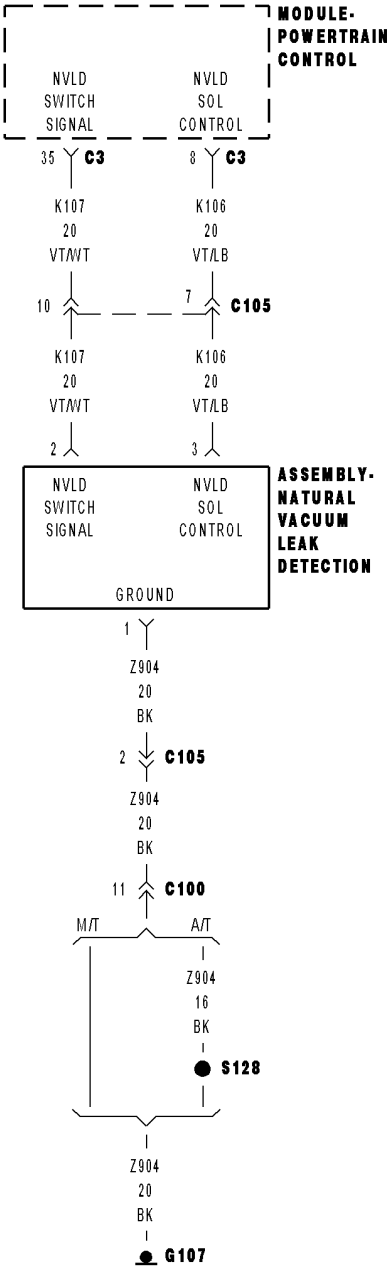
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

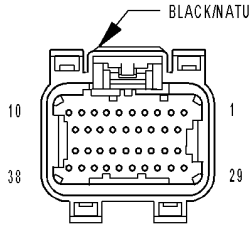
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

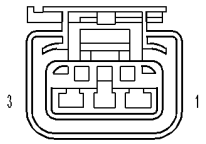
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0453-NVLD PRESSURE SWITCH STUCK OPEN





MODULE-
POWERTRAIN
CONTROL C3



ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION

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P0453-NVLD PRESSURE SWITCH STUCK OPEN (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  If the PCM does not see the NVLD switch close during test an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K107) NVLD SWITCH SIGNAL CIRCUIT OPEN
(K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO THE (K106) NVLD SOLENOID CONTROL CIRCUIT
(Z904) GROUND CIRCUIT OPEN
NVLD ASSEMBLY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. NVLD SWITCH OPERATION

Start the engine.

Allow the engine to idle.

Using a scan tool, perform the NVLD FORCED MONITOR TEST.

Monitor the NVLD Switch state.

NOTE: As the test runs, the NVLD Switch should go from an OPEN state to a CLOSED state and then return to OPEN when the test is complete.

Did the NVLD Switch operate as described above?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

P0453-NVLD PRESSURE SWITCH STUCK OPEN (CONTINUED)

2. NVLD ASSEMBLY

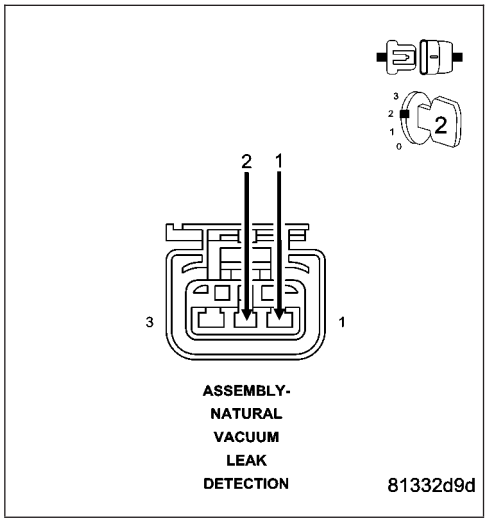
Turn the ignition off.

Disconnect the NVLD electrical harness connector.

Ignition on, engine not running.

Monitor the NVLD Switch state on the scan tool.

Connect a jumper wire between the (K107) NVLD Switch Signal circuit and the (Z904) Ground circuit in the NVLD harness connector.



Does the Switch change from OPEN to CLOSED with the jumper wire installed?

Yes >> Replace the NVLD Assembly.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.

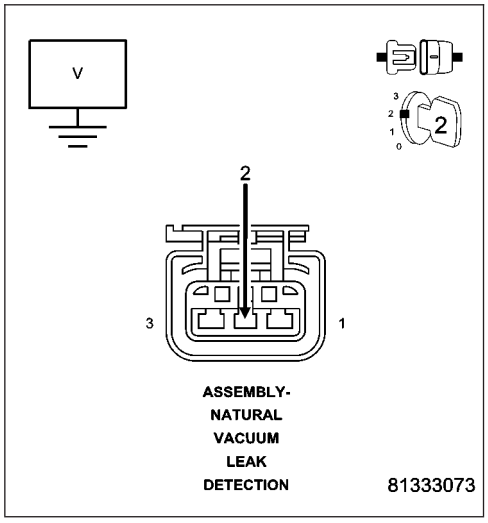
3. (K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K107) NVLD Switch Signal circuit in the NVLD electrical harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K107) NVLD Switch Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P0453-NVLD PRESSURE SWITCH STUCK OPEN (CONTINUED)

4. (K107) NVLD SWITCH SIGNAL CIRCUIT OPEN

Turn the ignition off.

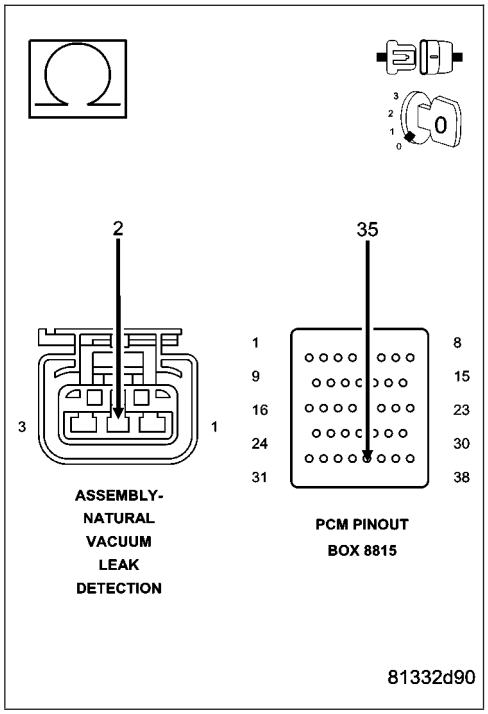
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K107) NVLD Switch Signal circuit from the NVLD electrical harness connector to the appropriate terminal of special tool # 8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K107) NVLD Switch Signal circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



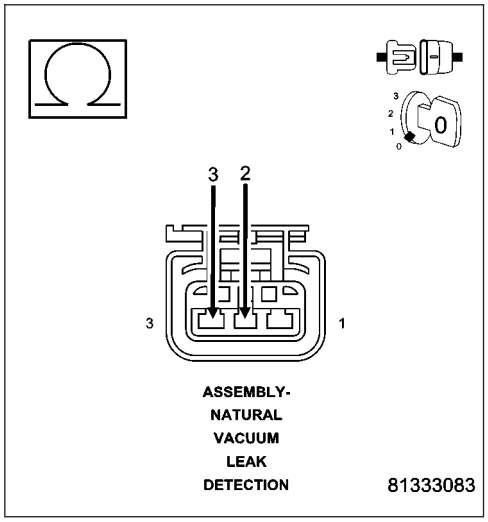
5. (K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO THE (K106) NVLD SOLENOID CONTROL CIRCUIT

Measure the resistance between the (K107) NVLD Switch Signal circuit and the (K106) NVLD Solenoid Control circuit in the NVLD electrical harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K107) NVLD Switch Signal circuit and the (K106) NVLD Solenoid Control circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

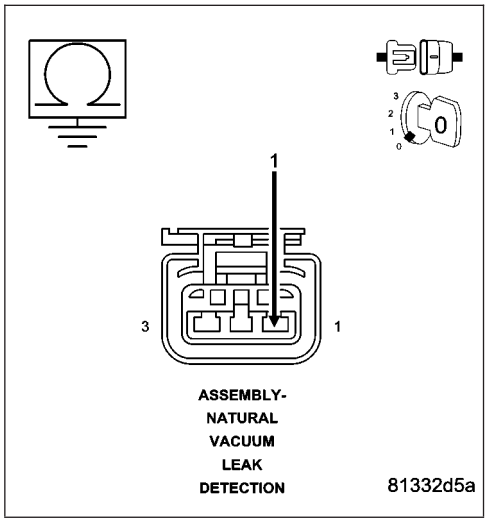
No >> Go To 6



P0453-NVLD PRESSURE SWITCH STUCK OPEN (CONTINUED)

6. (Z904) GROUND CIRCUIT OPEN

Measure the resistance between the (Z904) Ground circuit and ground.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (Z904) Ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

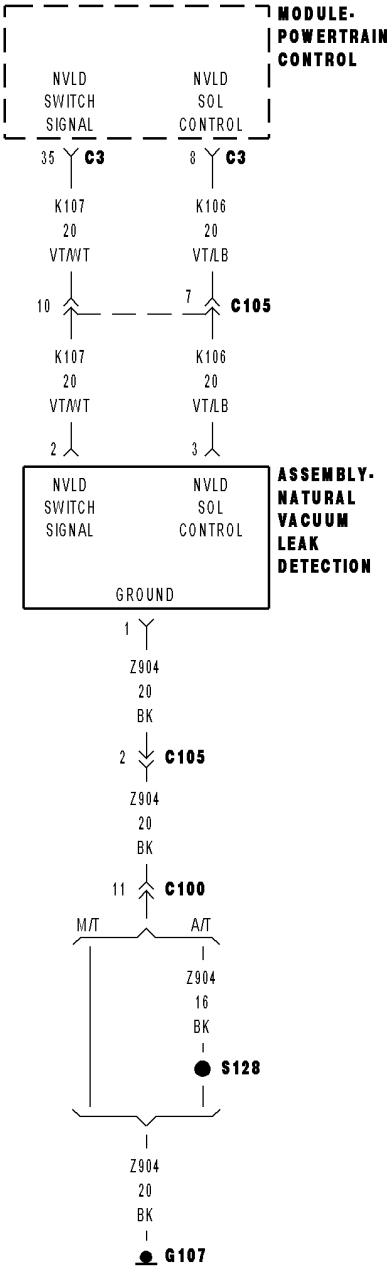
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

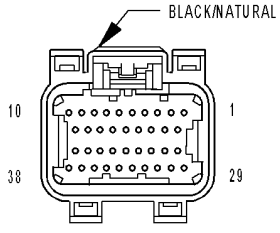
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

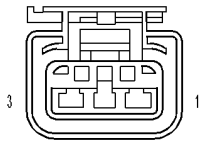
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0455-EVAP PURGE SYSTEM LARGE LEAK





MODULE-
POWERTRAIN
CONTROL C3



ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION

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P0455-EVAP PURGE SYSTEM LARGE LEAK (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The theory behind the Natural Vacuum Leak Detection (NVLD) is adherence to the Ideal Gas Law. Pressure in a sealed vessel will change linearly as a function of the temperature of the gas in the vessel. Even small leaks will allow the pressure in the vessel to come to equilibrium with the atmospheric pressure. After key-off and a calibrated amount of time, cool down from operating temperatures or diurnal ambient temperature the system pressure will force the system to go negative or draw a vacuum if there is no leak. When the vacuum level reaches 1" H2O (0.25 KPA) the NVLD vacuum switch closes. This sends a signal to the NGC freezing a timer and registering a pass. If a switch closure is not detected an assessment of leak size will be made.

- **When Monitored:**
  Engine Running. Cold start test. Fuel Level greater than 12%. Ambient Temperature between 4°C and 32°C (39°F and 89°F) Close Loop fuel system. Test runs when small leak test is maturing.
- **Set Condition:**
  The PCM activates the EVAP Purge Solenoid to pull the EVAP system into a vacuum to close the NVLD switch. Once the NVLD switch is closed, the PCM turns the EVAP Purge solenoid off to seal the EVAP system. If the NVLD switch reopens before the calibrated amount of time for a Large leak an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SYSTEM LEAK
EVAP PURGE SOLENOID
NVLD SWITCH

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Check for any related TSBs before continuing.

NOTE: Since a hot vehicle can conceal a leak, it is best to perform this test at room temperature.

NOTE: A loose gas cap could have caused this DTC to set. Make sure gas cap is tight and in good condition. Make sure the gas cap meets OEM specifications.

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0455-EVAP PURGE SYSTEM LARGE LEAK (CONTINUED)

2. VISUAL AND PHYSICAL INSPECTION

Perform a visual and physical inspection of the entire Evaporative Emission system.

Check for the follow conditions:

- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Fuel Cap gasket seal

Were any of the above conditions found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes >> Go To 4

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0455-EVAP PURGE SYSTEM LARGE LEAK (CONTINUED)

4. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may aid diagnosis also.

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move in the smoke mode.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Was a leak found?

Yes >> Repair or replace the leaking component as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. EVAP PURGE SOLENOID OPERATION

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in Hg to the ″CAN″ of the EVAP Purge Solenoid.

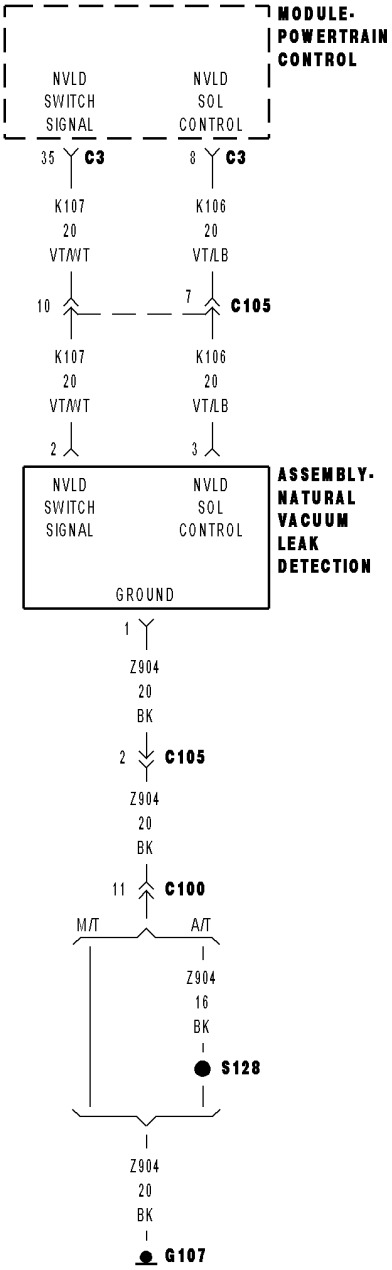
NOTE: Monitor the vacuum gauge for at least 15 seconds.

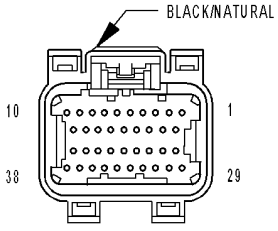
Does the EVAP Purge Solenoid hold vacuum?

Yes >> Test Complete.

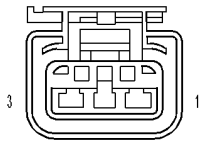
No >> Replace the Evap Purge Solenoid.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0456-EVAP PURGE SYSTEM SMALL LEAK





MODULE-
POWERTRAIN
CONTROL C3



ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION

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P0456-EVAP PURGE SYSTEM SMALL LEAK (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The theory behind the Natural Vacuum Leak Detection (NVLD) is adherence to the Ideal Gas Law. Pressure in a sealed vessel will change linearly as a function of the temperature of the gas in the vessel. Even small leaks will allow the pressure in the vessel to come to equilibrium with the atmospheric pressure. After key-off and a calibrated amount of time, cool down from operating temperatures or diurnal ambient temperature the system pressure will force the system to go negative or draw a vacuum if there is no leak. When the vacuum level reaches 1" H2O (0.25 KPA) the NVLD vacuum switch closes. This sends a signal to the NGC freezing a timer and registering a pass. If a switch closure is not detected an assessment of leak size will be made.

- **When Monitored:**
  Ignition off. Fuel Level less than 88%. Ambient Temperature between 4°C and 43°C (39°F and 109°F) Close Loop fuel system.
- **Set Condition:**
  Due to termperature changes, a vacuum is created in the fuel tank and EVAP system. With the EVAP system sealed, the PCM monitors the NVLD switch. If the NVLD switch does not close within a calibrated time allowance, an error is detectd by the PCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SYSTEM LEAK
EVAP PURGE SOLENOID

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Since a hot vehicle can conceal a leak, it is best to perform this test at room temperature.

NOTE: A loose gas cap could have caused this DTC to set. Make sure gas cap is tight and in good condition. Make sure the gas cap meets OEM specifications.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0456-EVAP PURGE SYSTEM SMALL LEAK (CONTINUED)

2. VISUAL AND PHYSICAL INSPECTION

Perform a visual and physical inspection of the entire Evaporative Emission system.

Check for the follow conditions:

- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Fuel Cap gasket seal

Were any of the above conditions found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes >> Go To 4

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0456-EVAP PURGE SYSTEM SMALL LEAK (CONTINUED)

4. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may also aid diagnosis.

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move in the smoke mode.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Was a leak found?

Yes >> Repair or replace the leaking component as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

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5. EVAP PURGE SOLENOID OPERATION

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in Hg to the ″CAN″ of the EVAP Purge Solenoid.

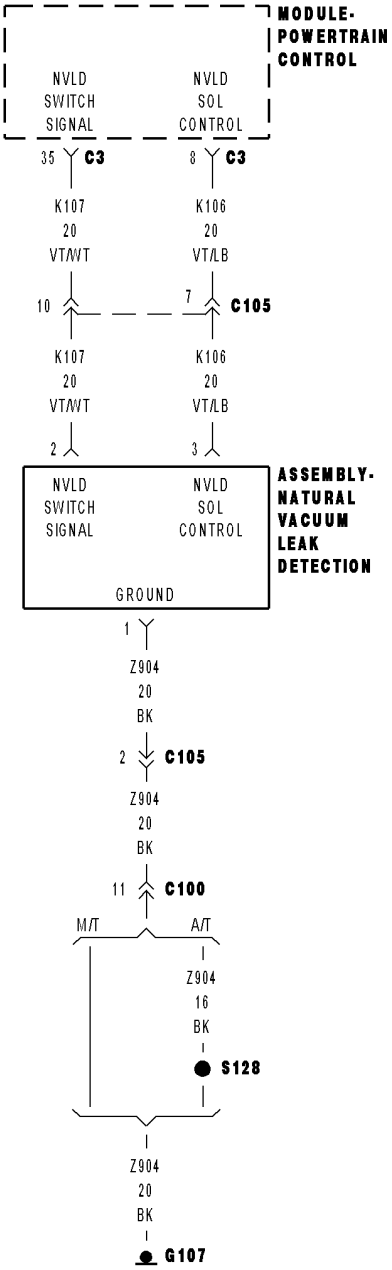
NOTE: Monitor the vacuum gauge for at least 15 seconds.

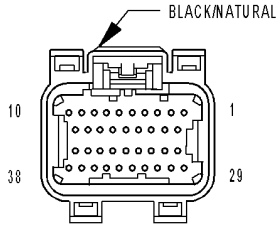
Does the EVAP Purge Solenoid hold vacuum?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

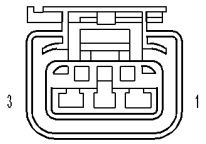
No >> Replace the Evap Purge Solenoid.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0457-LOOSE FUEL CAP





MODULE-
POWERTRAIN
CONTROL C3



ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION

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P0457-LOOSE FUEL CAP (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

Fuel level is recorded when the ignition key is turned off and is compared to the fuel level when the ignition key is turned back on. The PCM recognizes an increase in fuel level and will fail the Medium leak test because the fuel cap is broken or not installed properly. GAS CAP will be displayed in odometer to inform the owner that the cap is off of loose.

- **When Monitored:**
  Ignition on. Ambient Temperature between 4°C and 32°C (39°F and 89°F) Close Loop fuel system. Test runs after the medium leak test is inconclusive and the PCM has senses a fuel increase.
- **Set Condition:**
  The PCM activates the EVAP Purge Solenoid to pull the EVAP system into a vacuum to close the NVLD switch. Once the NVLD switch is closed, the PCM turns the EVAP Purge Solenoid off to seal the EVAP system. If the NVLD switch reopens before the calibrated amount of time after a fuel tank fill, an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
LOOSE OR MISSING FUEL CAP
FUEL FILL CAP
EVAP PURGE SYSTEM MEDIUM LEAK

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. LOOSE OR MISSING FUEL FILL CAP

Inspect the fuel fill cap.
Inspect the cap for any abnormal defects.

Was the cap off, missing, or broken?

Yes >> Properly install the fuel fill cap and proceed to step 3.

No >> Go To 4

P0457-LOOSE FUEL CAP (CONTINUED)

3. NVLD SERVICE TEST

With the scan tool perform the NVLD Service Test.

Does the NVLD Service Test pass?

Yes >> Test complete.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes >> Go To 5

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0457-LOOSE FUEL CAP (CONTINUED)

5. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may also aid diagnosis.

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move in the smoke mode.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Was a leak found?

Yes >> Repair or replace the leaking component as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. EVAP PURGE SOLENOID OPERATION

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in Hg to the ″CAN″ of the EVAP Purge Solenoid.

NOTE: Monitor the vacuum gauge for at least 15 seconds.

Does the EVAP Purge Solenoid hold vacuum?

Yes >> Go To 7.

No >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0457-LOOSE FUEL CAP (CONTINUED)

7. NVLD SWITCH OPERATION

Reconnect all vacuum hoses.

Start the engine.

Allow the engine to idle.

Using the scan tool, perform the NVLD FORCED MONITOR TEST.

Monitor the NVLD Switch.

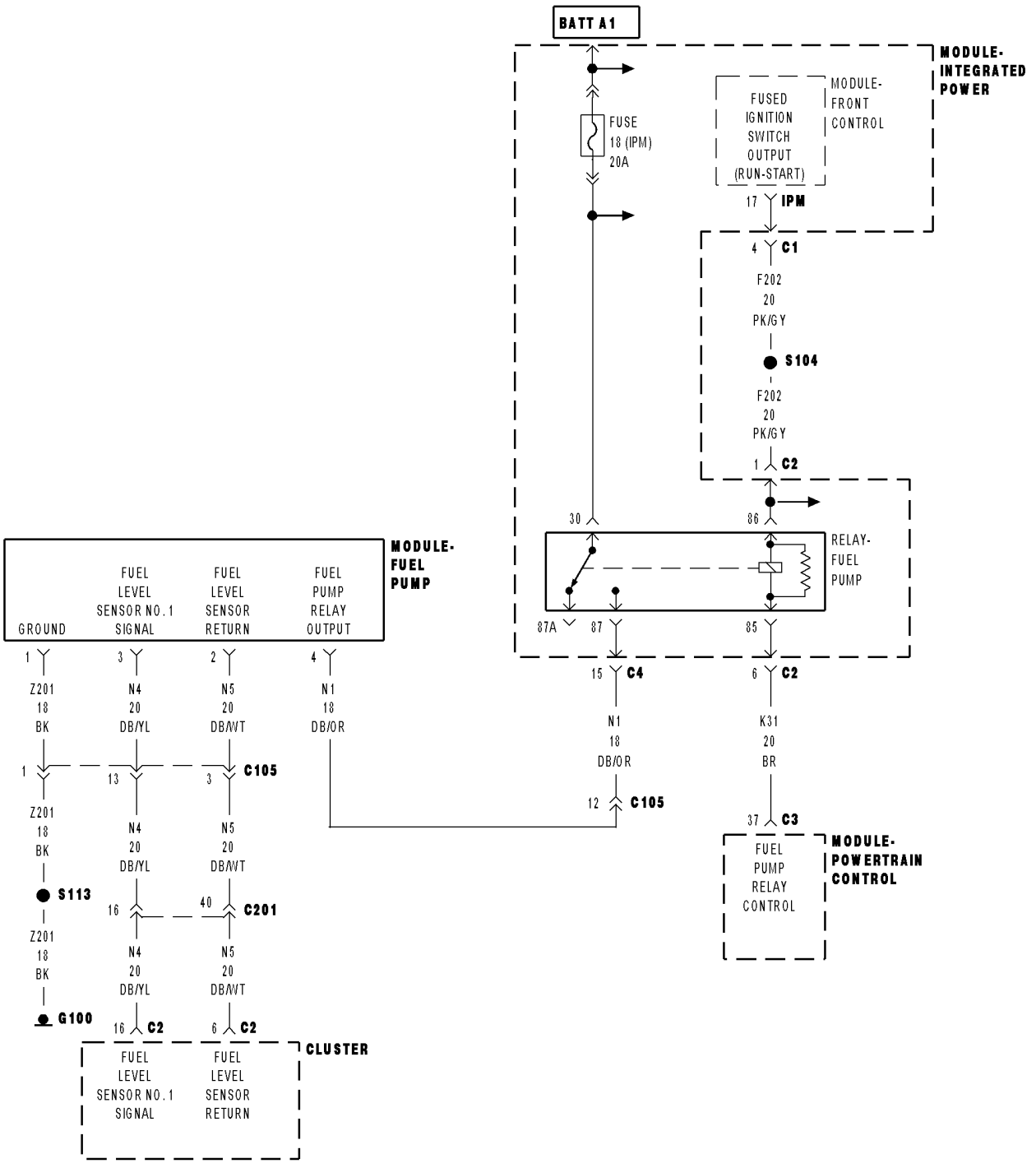
NOTE: As the test runs, the NVLD Switch should go from an OPEN state to CLOSED. After the vacuum is released form the EVAP system the Switch state will return to OPEN.

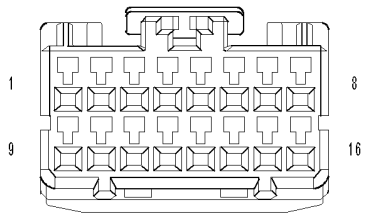
Did the NVLD Switch operate as described above?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

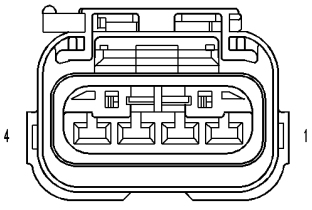
No >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0461-FUEL LEVEL SENSOR 1 PERFORMANCE





CLUSTER C2



MODULE-
FUEL
PUMP

81335acc

P0461-FUEL LEVEL SENSOR 1 PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel level rationality will set a fault for a fuel level reading that does not change over an accumulated mileage threshold to keep stuck high or stuck low fuel levels from disabling OBD monitors. If the vehicle is fitted with a saddle tank fuel system this feature includes diagnostics for both of the sending units and diagnostics for a siphon tube that has become disconnected or plugged. The power up test looks to see a large enough fuel level voltage change from the last key-off to the following engine run. The engine run test looks to see a fuel level voltage change over an accumulated mileage.

- **When Monitored:**
  TEST No.1: With the ignition on, the fuel level is compared to the previous key down after a 20 second delay.
  TEST No.2: The PCM monitors the fuel level at ignition on.
- **Set Condition:**
  TEST No.1: If the PCM does not see a difference in fuel level of greater than 0.1 volt the test will fail. TEST No.2: If the PCM does not see a change in the fuel level of .1765 over a set amount of miles the test will fail. Three good trips to turn off the MIL.

Possible Causes
(N4) FUEL LEVEL SIGNAL CIRCUIT OPEN
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND
(N5) FUEL LEVEL SENSOR RETURN CIRCUIT OPEN
FUEL TANK
FUEL LEVEL SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any CAN - C or CAN - B Communication DTCs before continuing.

NOTE: Diagnose P0462 or P0463 first, if set along with P0461.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. VISUALLY INSPECT FUEL TANK

Visually inspect the Fuel Tank for damage that may restrict the Fuel Sending Unit float from moving.

Is the Fuel Tank OK?

Yes >> Go To 3

No >> Replace the Fuel Tank as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0461-FUEL LEVEL SENSOR 1 PERFORMANCE (CONTINUED)

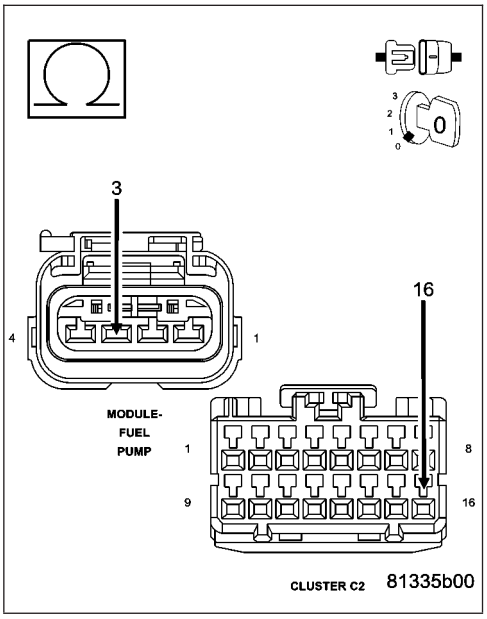
3. (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Fuel Pump Module harness connector.

Disconnect the C2 Cluster harness connector.

Measure the resistance of the (N4) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the C2 Cluster harness connector.



Is the resistance below 5.0 ohms?

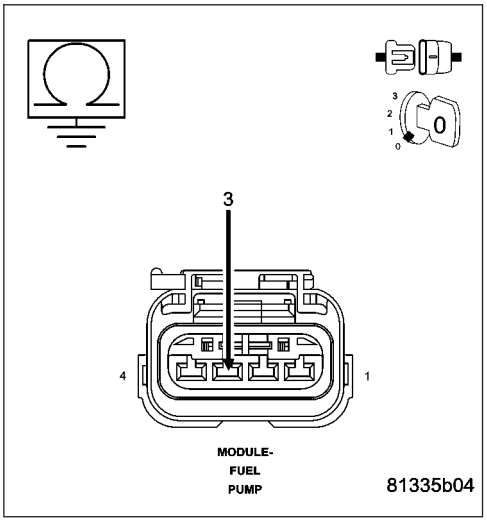
Yes >> Go To 4

No >> Repair the open in the (N4) Fuel Level Signal circuit.

Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

4. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (N4) Fuel Level Signal circuit.

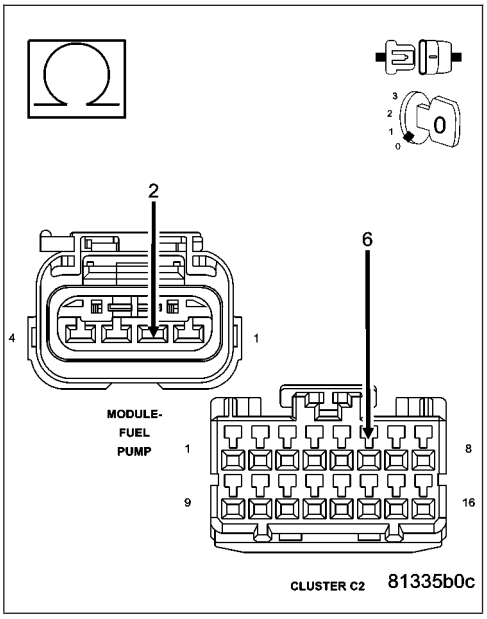
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 5

P0461-FUEL LEVEL SENSOR 1 PERFORMANCE (CONTINUED)

5. (N5) FUEL LEVEL SENSOR RETURN CIRCUIT OPEN

Measure the resistance of the (N5) Fuel Level Sensor Return circuit from the Fuel Pump Module harness connector to the C2 Cluster harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (N5) Fuel Level Sensor Return circuit.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

6. INTERNAL INSPECTION OF THE FUEL TANK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Tank per Service Information.

Remove the Fuel Pump Module.

Visually inspect the inside of the Fuel Tank for any obstructions or deformities.

Inspect the Fuel Pump Module Float arm for damage.

Were any problems found?

Yes >> Repair or replace as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

7. FUEL LEVEL SENSOR

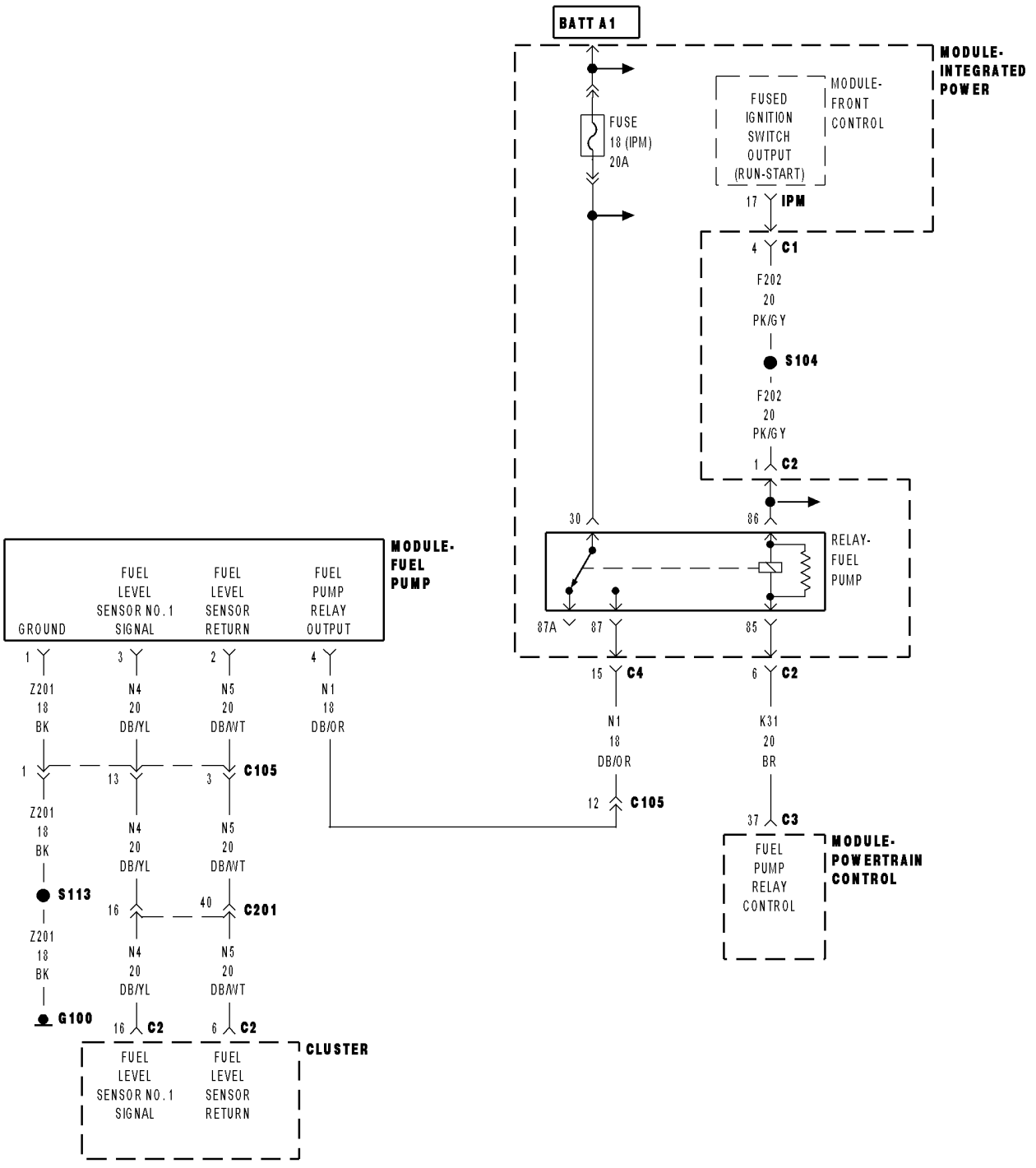
If there are no possible causes remaining, view repair.

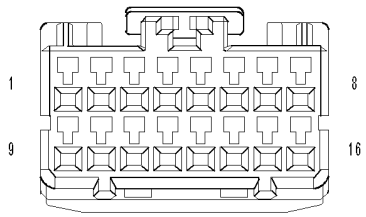
Repair

Replace the Fuel Level Sensor.

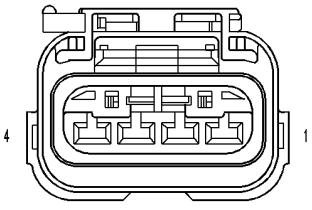
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

P0462-FUEL LEVEL SENSOR 1 CIRCUIT LOW





CLUSTER C2



MODULE-
FUEL
PUMP

81335acc

P0462-FUEL LEVEL SENSOR 1 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  The fuel level sensor signal voltage goes below 0.4 of a volt for more than 90 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (N5) FUEL LEVEL SENSOR RETURN CIRCUIT
FUEL LEVEL SENSOR
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

Diagnostic Test

1. FUEL LEVEL SENSOR VOLTAGE BELOW 0.4 OF A VOLT

NOTE: Diagnose any CAN - B or CAN -C Communication DTCs before continuing.
Ignition on, engine not running.
With the scan tool, read the Fuel Level Sensor voltage.

Is the Fuel Level Sensor voltage below 0.4 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. FUEL LEVEL SENSOR

Turn the ignition off.
Disconnect the Fuel Pump Module harness connector.
Ignition on, engine not running.
With the scan tool, read the Fuel Level Sensor voltage.

Did the Fuel Level Sensor voltage change from below 0.4 of a volt to above 4.0 volts?

Yes >> Replace the Fuel Level Sensor.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

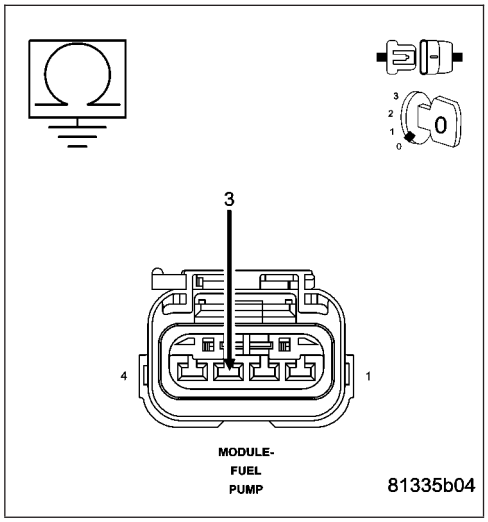
P0462-FUEL LEVEL SENSOR 1 CIRCUIT LOW (CONTINUED)

3. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 Cluster harness connector.

Measure the resistance between ground and the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.



Is the resistance below 100 ohms?

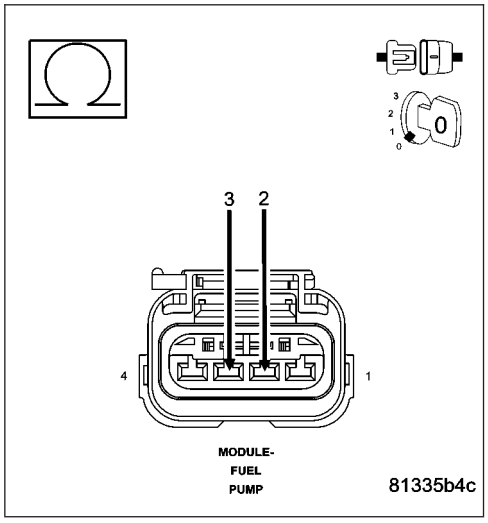
Yes >> Repair the short to ground in the (N4) Fuel Level Signal circuit.

Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

4. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (N5) FUEL LEVEL SENSOR RETURN CIRCUIT

Measure the resistance between the (N4) Fuel Level Signal circuit and the (N5) Fuel Level Sensor Return circuit in the Fuel Pump Module harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (N5) Fuel Level Sensor Return circuit and the (N4) Fuel Level Signal circuit.

Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 5

5. INSTRUMENT CLUSTER

NOTE: Before continuing, check the Instrument Cluster harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

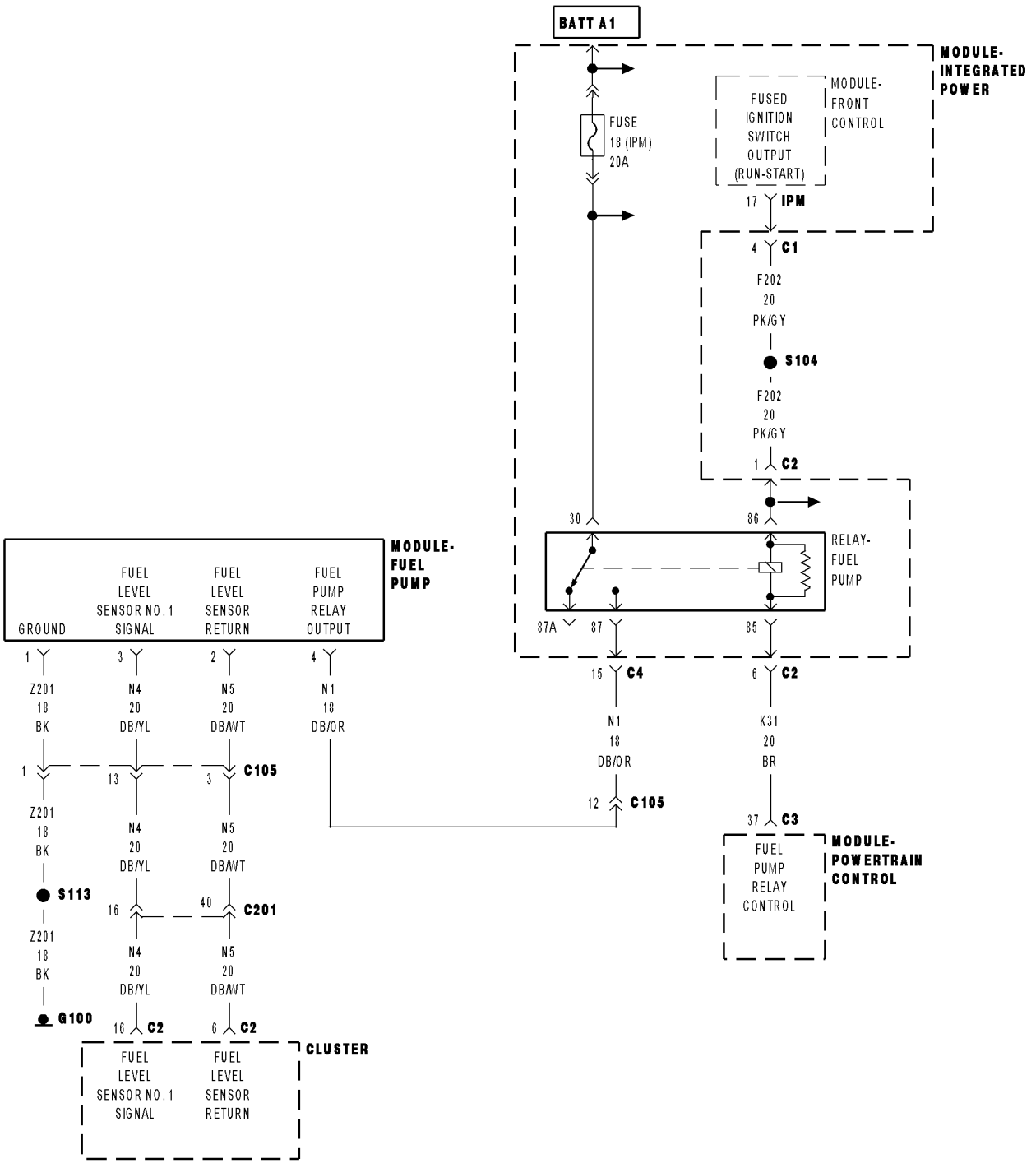
Yes >> Repair as necessary.

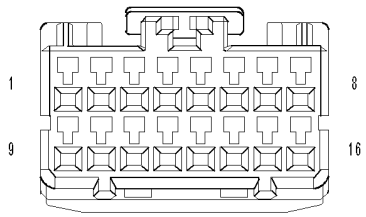
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace and program the Instrument Cluster per Service Information.

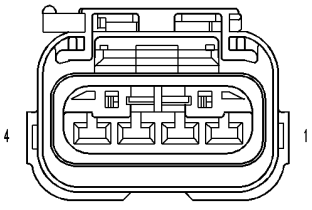
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH





CLUSTER C2



MODULE-
FUEL
PUMP

81335acc

P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  The fuel level sensor signal voltage at the PCM goes above 4.9 volts for more than 90 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(N4) FUEL LEVEL SIGNAL CIRCUIT OPEN
(N5) FUEL LEVEL SENSOR RETURN CIRCUIT OPEN
FUEL LEVEL SENSOR
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. FUEL LEVEL SENSOR VOLTS ABOVE 4.9 VOLTS

NOTE: Diagnose any CAN - B and CAN - C Communication DTCs before continuing.
Ignition on, engine not running.

With a scan tool, read the Fuel Level Sensor voltage.

Is the Fuel Level Sensor voltage above 4.9 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH (CONTINUED)

2. FUEL LEVEL SENSOR

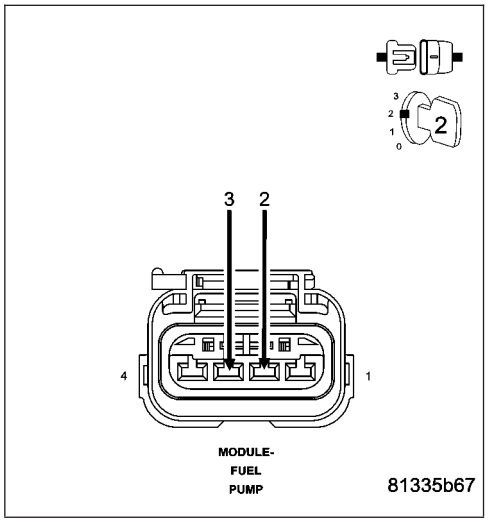
Turn the ignition off.

Disconnect the Fuel Pump Module electrical harness connector.

Ignition on, engine not running.

Connect a jumper wire between the (N4) Fuel Level Signal circuit and the (N5) Fuel Level Sensor Return circuit in the Fuel Pump Module harness connector.

With the scan tool, read the Fuel Level Sensor voltage.



Did the Fuel Level Sensor voltage change from above 4.8 volts to below 0.4 of a volt with the jumper wire installed?

Yes >> Replace the Fuel Level Sensor.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.

---

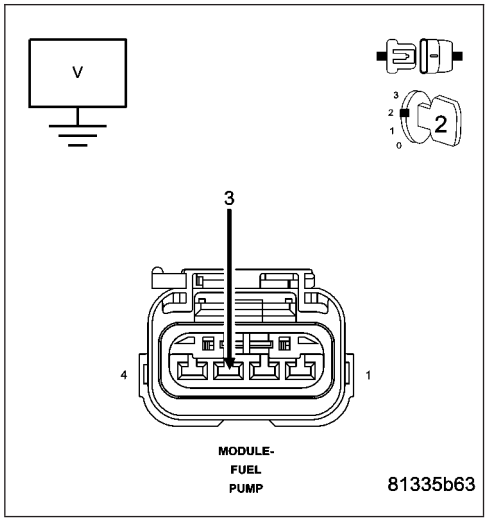
3. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 Cluster harness connector.

Ignition on, engine not running.

Measure the voltage on the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (N4) Fuel Level Signal circuit.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

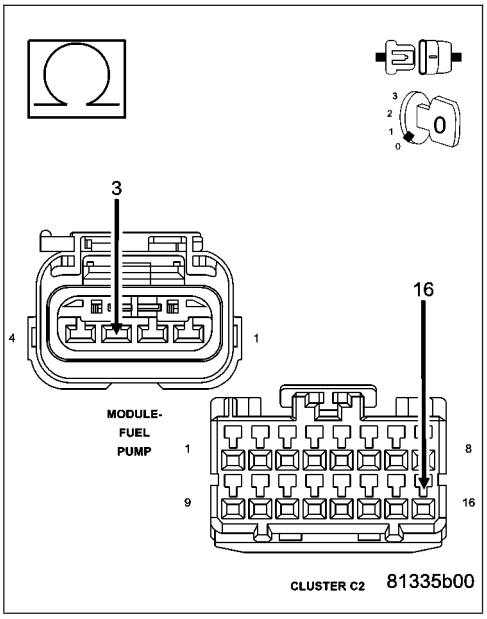
No >> Go To 4

P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH (CONTINUED)

4. (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (N4) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the C2 Cluster harness connector.



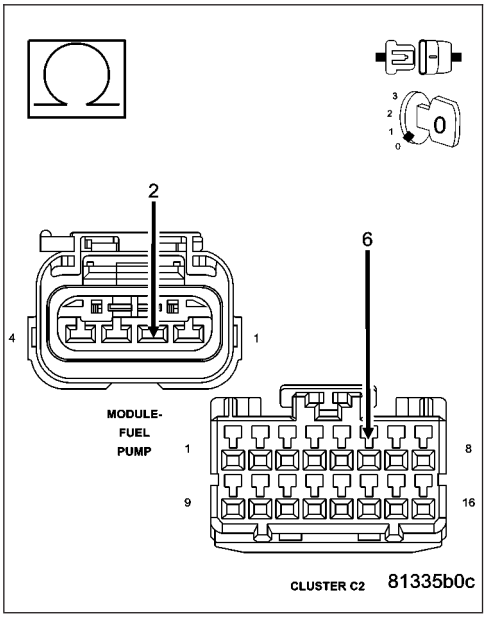
Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (N4) Fuel Level Signal circuit.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

5. (N5) FUEL LEVEL SENSOR RETURN CIRCUIT OPEN

Measure the resistance of the (N5) Fuel Level Sensor Return circuit from the Fuel Pump Module harness connector to the C2 Cluster harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (N5) Fuel Level Sensor Return circuit.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH (CONTINUED)

6. INSTRUMENT CLUSTER

NOTE: Before continuing, check the Instrument Cluster harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

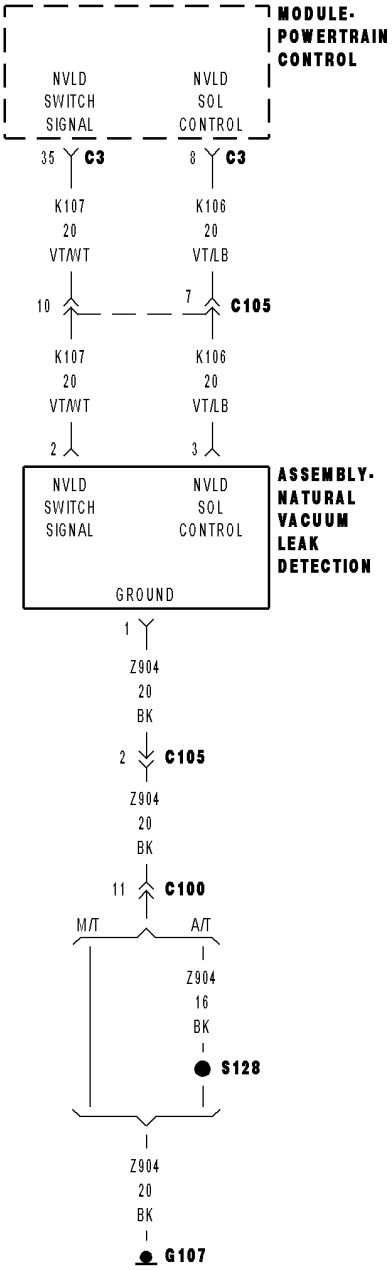
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

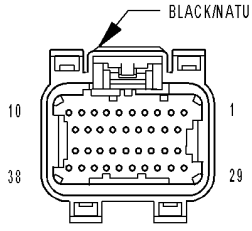
Were there any problems found?

Yes >> Repair as necessary.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

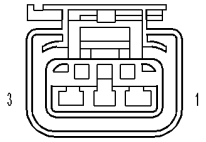
No >> Replace and program the Instrument Cluster per Service Information.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

P0498-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT LOW





MODULE-
POWERTRAIN
CONTROL C3



ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION

81332d55

P0498-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The PCM detects a short in the NVLD Canister vent solenoid circuits. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K106) NVLD SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
NVLD ASSEMBLY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

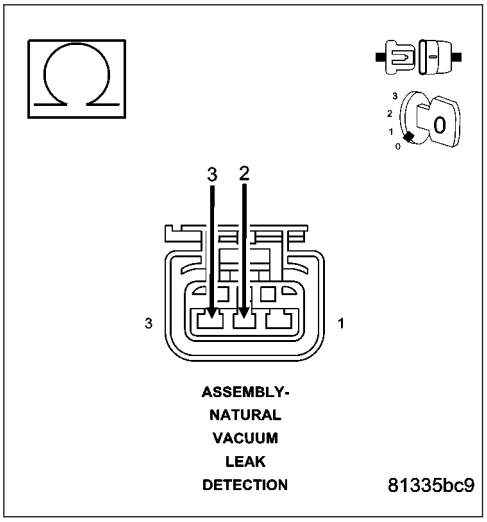
2. NVLD SOLENOID

Turn the ignition off.
Disconnect the NVLD electrical harness connector.
Measure the resistance of the NVLD Solenoid Coil.

Is the resistance between 7.5 to 8.5 ohms?

Yes >> Go To 3

No >> Replace the NVLD Assembly.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

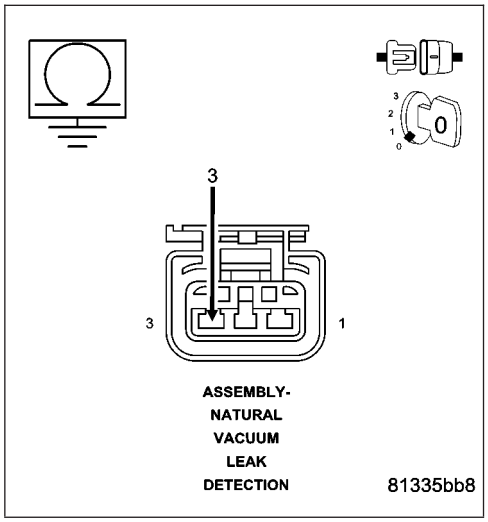


P0498-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT LOW (CONTINUED)

3. (K106) NVLD SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K106) NVLD Solenoid Control circuit in the NVLD electrical harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K106) NVLD Solenoid Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

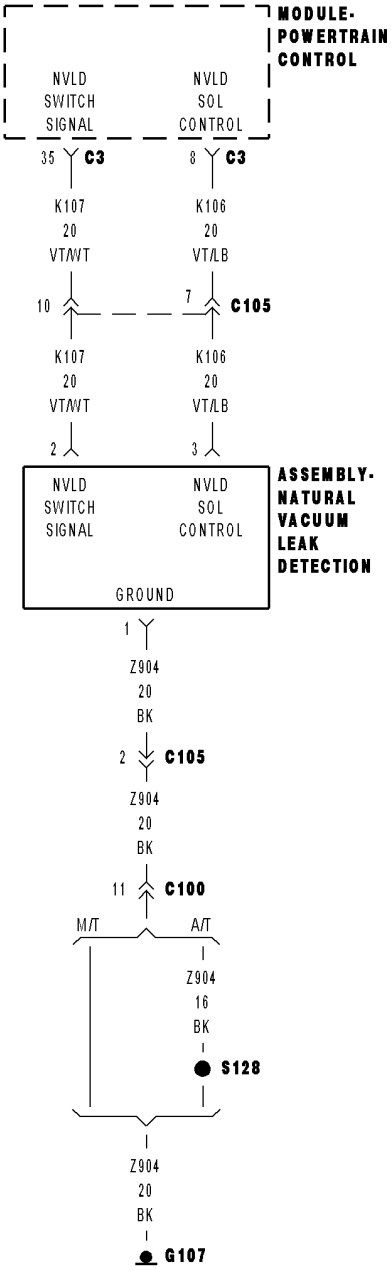
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

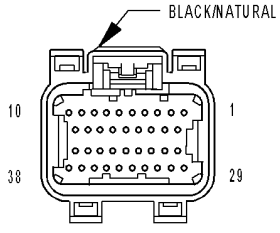
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

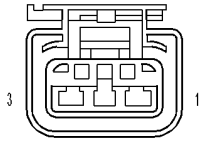
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0499-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT HIGH





MODULE-
POWERTRAIN
CONTROL C3



ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION

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P0499-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The PCM detects an open in the NVLD Canister vent solenoid circuits. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K106) NVLD SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K106) NVLD SOLENOID CONTROL CIRCUIT OPEN
(Z904) GROUND CIRCUIT OPEN
NVLD SOLENOID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. NVLD SOLENOID

Turn the ignition off.

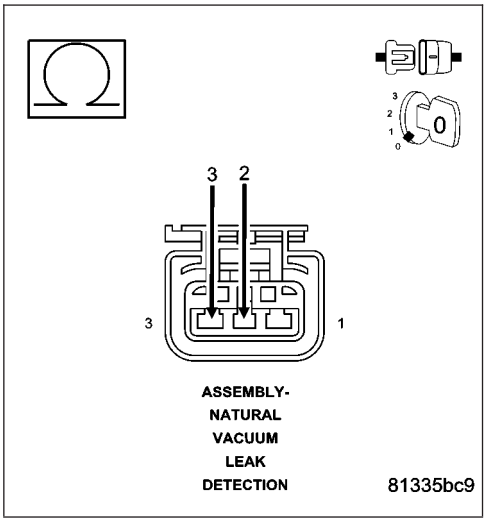
Disconnect the NVLD Assembly harness connector.

Measure the resistance of the NVLD Solenoid coil.

Is the resistance between 7.5 to 8.5 ohms?

Yes >> Go To 3

No >> Replace the NVLD Assembly.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0499-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT HIGH (CONTINUED)

3. (K106) NVLD SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Disconnect the C3 PCM harness connector.

Take this measurement with the Ignition in the off (lock) position and in the Ignition on, engine off position.

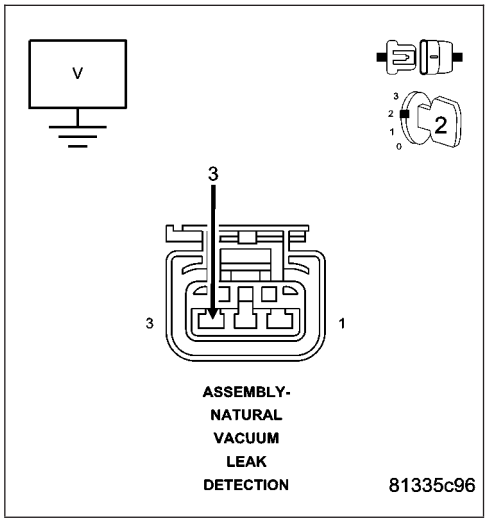
Measure the voltage on the (K106) NVLD Solenoid Control circuit in the NVLD Assembly harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K106) NVLD Solenoid Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K106) NVLD SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

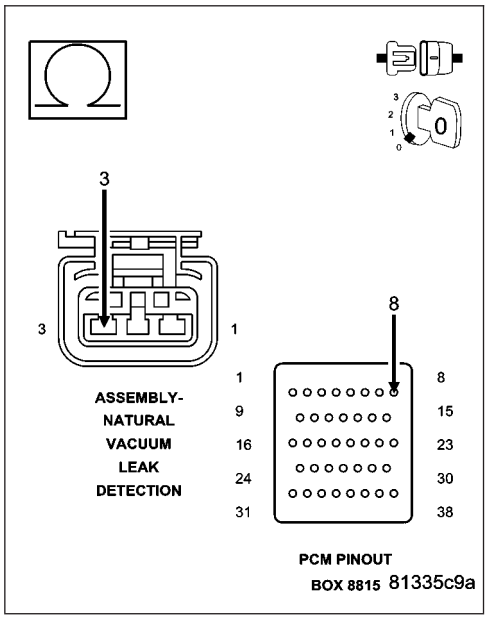
Measure the resistance of the (K106) NVLD Solenoid Control circuit from the NVLD Assembly harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K106) NVLD Solenoid Control circuit.

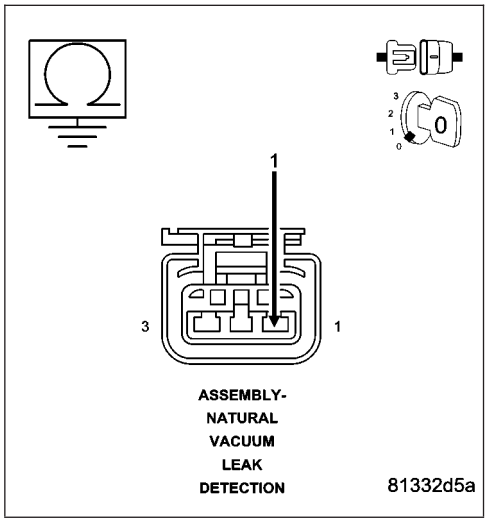
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0499-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT HIGH (CONTINUED)

5. (Z904) GROUND CIRCUIT OPEN

Measure the resistance between the (Z904) Ground circuit and ground.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (Z904) Ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

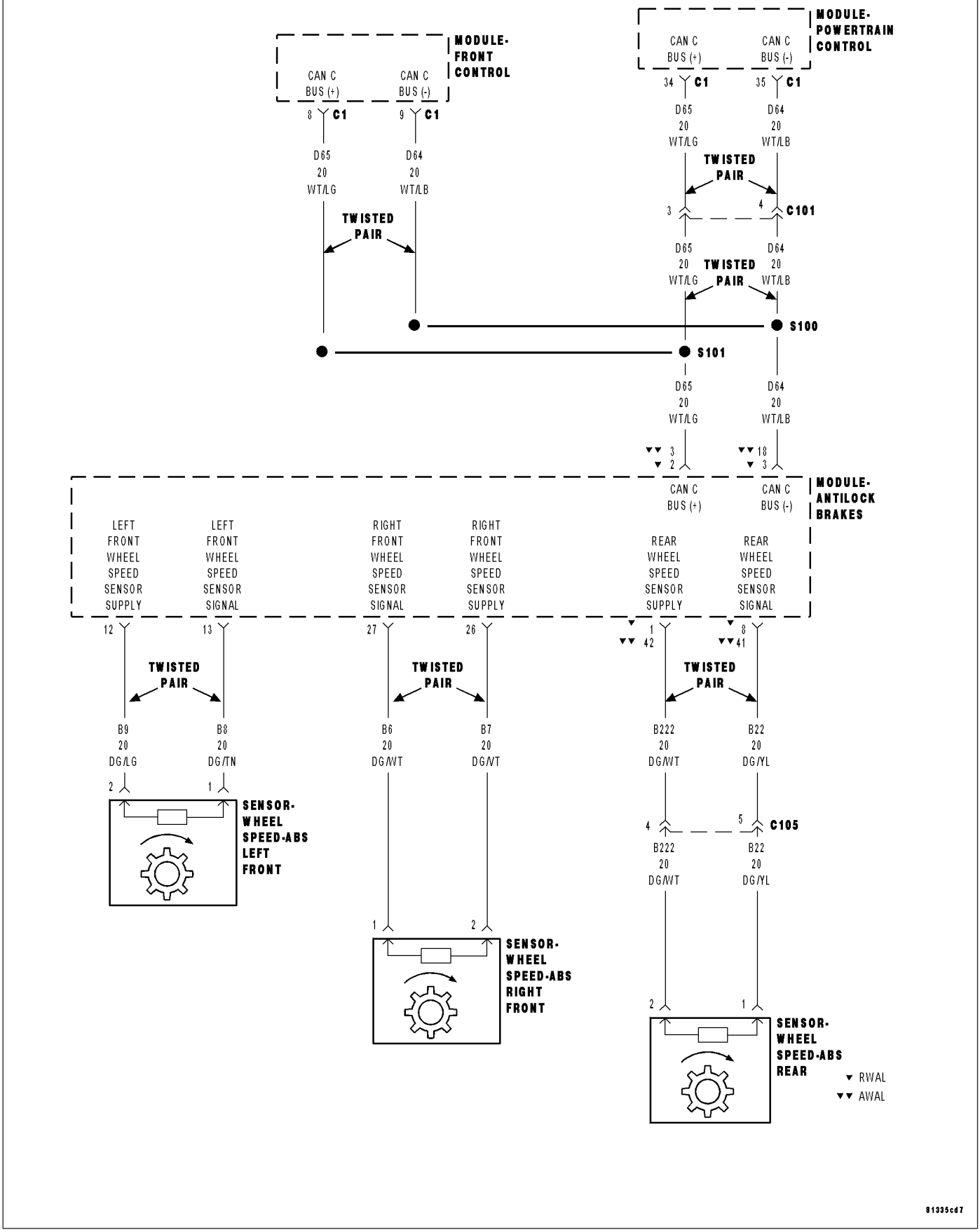
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0501-VEHICLE SPEED SENSOR 1 PERFORMANCE



P0501-VEHICLE SPEED SENSOR 1 PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The vehicle speed sensor rationality is a continuous test that monitors the vehicle speed sensor for lack of activity. The rationality will not run if a limp-in exists for MAP, Throttle Position, and Engine Coolant Temperature. If vehicle speed sensor is below a minimum threshold for a period of time after the vehicle is operated at a sufficient load, a failure will be indicated.

- **When Monitored:**
  With the engine running, transmission not in park or neutral, brakes not applied, and engine rpm greater than 1500.
- **Set Condition:**
  This code will set if no vehicle speed signal is received from the ABS Module for more than 11 seconds for 2 consecutive trips. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
ACTIVE BUS OR COMMUNICATION DTCS
TIRE CIRCUMFERENCE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: Check for any Bus Communication DTCs. If no Bus or Communication DTCs are set, check for active DTCs stored in the Anti-Lock Brake Module. Any bus or communication DTCs or VSS DTCs in the Anti-Lock Brake Module must be properly diagnosed before continuing.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. VISUAL INSPECTION

NOTE: This code can set due to tire circumference differences and from the front or rear wheels being on a slippery surface while the opposite tires are not.

This code may also set on a hard acceleration on loose gravel or during other off road driving conditions.

Check tire pressure of all the tires.

Check tire wear on all the tires.

Ask the customer what the road and driving conditions were like when the fault set.

Were any problems found?

Yes >> Repair as necessary. If the code set during a front OR rear wheel spin condition, no repair is necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0501-VEHICLE SPEED SENSOR 1 PERFORMANCE (CONTINUED)

3. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0506-IDLE SPEED PERFORMANCE LOWER THAN EXCEPTED

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The objective of the Idle “Speed Rationality is to monitor the ability to achieve and maintain a steady idle condition. The monitor will judge the functionality of the idle speed control system by monitoring RPM during idle. If RPM does not come within a calibrated deadband of target idle speed, a timer is started. If the timer reaches its maximum threshold without any sign of the RPM trending towards control, a soft failure is generated.

- **When Monitored:**
  With the engine running at idle, MAF <250 mg/tdc, air temp >-17.8°C (0°F) and <-7°C (19.4°F) enable after coolant temp >70°C (158°F) or air temp >-7°C (19.4°F), coolant temp >-7°C (19.4°F) <130°C (266°F), canister purge <100% duty cycle, and no VSS, MAF/MAP, ECT, TPS, ETC, CRK Sensor DTCs nor any fuel system or injector DTCs.
- **Set Condition:**
  Engine speed is 100 RPM or more below idle speed for 7 seconds. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
AIR INDUCTION SYSTEM
THROTTLE BODY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If any other DTCs are present, they must be diagnosed and repaired before continuing this test.
Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. AIR INDUCTION SYSTEM

Inspect the Air Induction System for the following problems.
Restrictions: Dirty Air Cleaner, Foreign material trap in the air intake tube, etc.
Leaks: Air Intake tube connection, Air Cleaner housing, etc.

Were any problems found?

Yes >> Repair or replace as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0506-IDLE SPEED PERFORMANCE LOWER THAN EXCEPTED (CONTINUED)

3. THROTTLE BODY OPERATION

Inspect the throttle body for carbon build up, other restrictions, and a bent throttle plate using a straight edge.

If the throttle plate does not close entirely it may be bent and needs to be replaced.

Verify that the throttle cable between the Accelerator Pedal and APPS is not binding.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

While the vehicle is running, lightly tap on ETC Motor, with your hand, and listen for idle to raise.

Were any problems found?

Yes >> Repair or replace as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0507-IDLE SPEED PERFORMANCE HIGHER THAN EXCEPTED

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The objective of the Idle “Speed Rationality is to monitor the ability to achieve and maintain a steady idle condition. The monitor will judge the functionality of the idle speed control system by monitoring RPM during idle. If RPM does not come within a calibrated deadband of target idle speed, a timer is started. If the timer reaches its maximum threshold without any sign of the RPM trending towards control, a soft failure is generated.

- **When Monitored:**
  With the engine running at idle, MAF <250 mg/tdc, air temp >-17.8°C (0°F) and <-7°C (19.4°F) enable after coolant temp >70°C (158°F) or air temp >-7°C (19.4°F), coolant temp >-7°C (19.4°F) <130°C (266°F), canister purge <100% duty cycle, and no VSS, MAF/MAP, ECT, TPS, ETC, CRK Sensor DTCs nor any fuel system or injector DTCs.
- **Set Condition:**
  Engine speed is 200 RPM or more above idle speed for 7 seconds. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
AIR INDUCTION SYSTEM
VACUUM LEAKS
THROTTLE BODY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If any other DTCs are present, they must be diagnosed and repaired before continuing this test.
Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. AIR INDUCTION SYSTEM

Inspect the Air Induction System for the following problems.
Restrictions: Dirty Air Cleaner, Foreign material trap in the air intake tube, etc.
Leaks: Air Intake tube connection, Air Cleaner housing, etc.

Were any problems found?

Yes >> Repair or replace as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0507-IDLE SPEED PERFORMANCE HIGHER THAN EXCEPTED (CONTINUED)

3. VACUUM LEAKS

Start the engine.
Inspect the vehicle for external vacuum leaks.
Inspect the engine for internal leaks.

Were any vacuum leaks found?

Yes >> Repair the vacuum leak as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. THROTTLE BODY OPERATION

Inspect the throttle body for carbon build up, other restrictions, and a bent throttle plate using a straight edge.
If the throttle plate does not close entirely it may be bent and needs to be replaced.
Verify that the throttle cable between the Accelerator Pedal and APPS is not binding.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.
While the vehicle is running, lightly tap on ETC Motor, with your hand, and listen for idle to fluctuate.

Were any problems found?

Yes >> Repair or replace as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. PCM

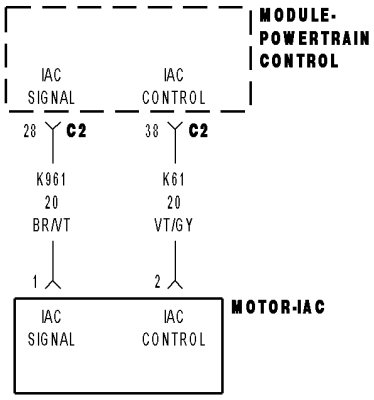
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

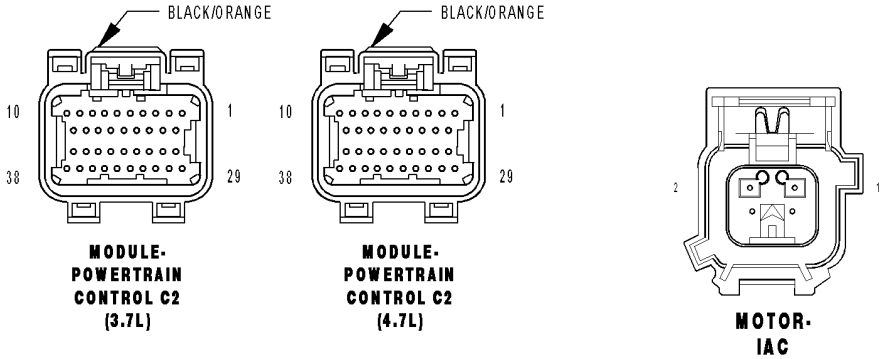
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0508-IDLE AIR CONTROL VALVE SENSE CIRCUIT LOW





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P0508-IDLE AIR CONTROL VALVE SENSE CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running. Battery voltage greater than 10 volts. IAC motor operating.
- **Set Condition:**
  The PCM senses a short to ground or battery voltage on any of the Linear Idle Air Control (LIAC) control circuits for 2.75 seconds while the IAC motor is active. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K61) IAC CONTROL CIRCUIT SHORTED TO GROUND
(K961) IAC SIGNAL CIRCUIT OPEN
(K961) IAC SIGNAL CIRCUIT SHORTED TO GROUND
(K61) IAC CONTROL CIRCUIT OPEN
IAC MOTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IAC MOTOR OPERATION

NOTE: If the engine will not idle, maintain an engine speed between 800 and 1500 RPM.

Start the engine.

Allow the engine to idle.

With a scan tool, read the IAC Current.

Is the IAC Current below 146 mA?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0508-IDLE AIR CONTROL VALVE SENSE CIRCUIT LOW (CONTINUED)

2. IAC MOTOR

Turn the ignition off.

Disconnect the IAC Motor harness connector.

Remove the IAC Motor.

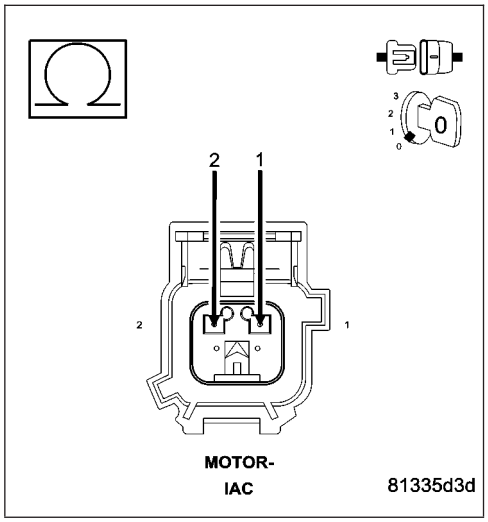
NOTE: Inspect the IAC air passages for restrictions and damage to the IAC valve.

Measure the resistance across the IAC Motor pin terminals (component).

Is the resistance 9.7 +/- 1.0 ohms?

Yes >> Go To 3

No >> Replace the IAC Motor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K961) IAC SIGNAL CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

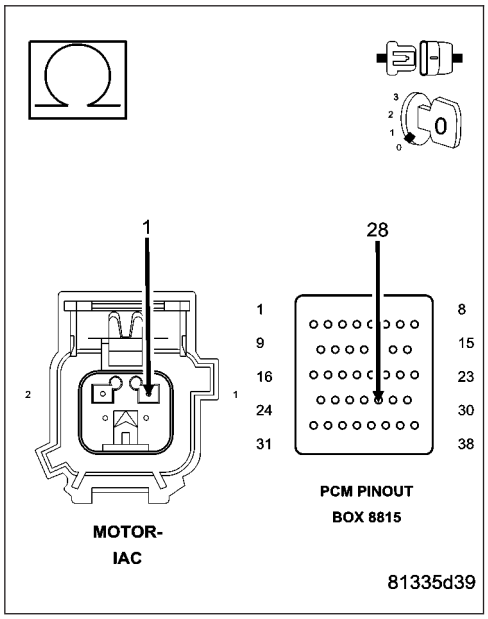
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K961) IAC Signal circuit from the IAC Motor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

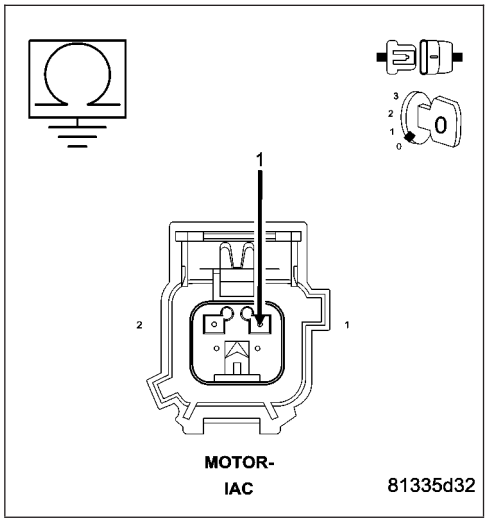
No >> Repair the open in the (K961) IAC Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0508-IDLE AIR CONTROL VALVE SENSE CIRCUIT LOW (CONTINUED)

4. (K961) IAC SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K961) IAC Signal circuit in the IAC Motor harness connector.



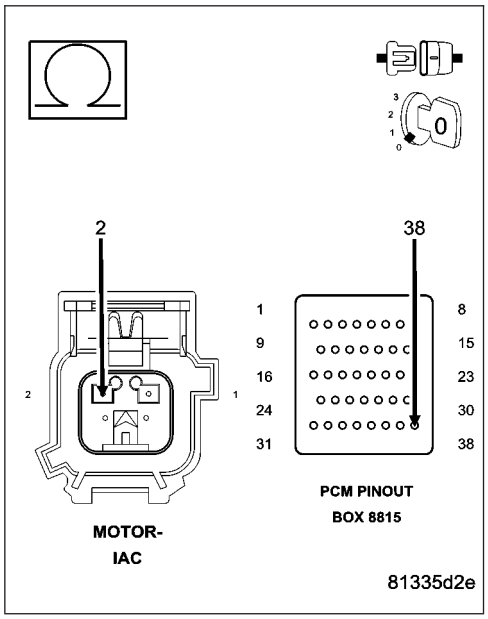
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K961) IAC Signal circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. (K61) IAC CONTROL CIRCUIT OPEN

Measure the resistance of the (K61) IAC Control circuit from the IAC Motor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

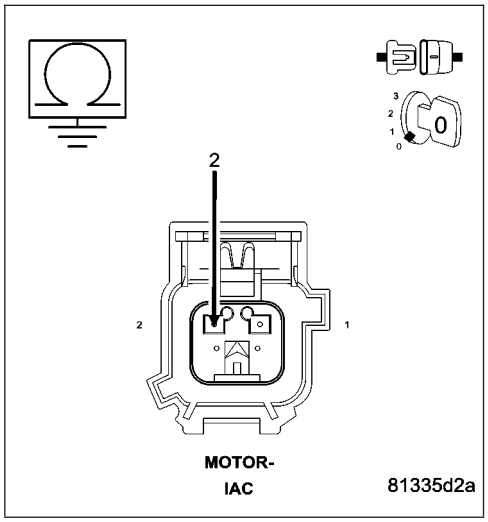
Yes >> Go To 6

No >> Repair the open in the (K61) IAC Control circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0508-IDLE AIR CONTROL VALVE SENSE CIRCUIT LOW (CONTINUED)

6. (K61) IAC CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K61) IAC Control circuit in the IAC Motor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K61) IAC Control circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

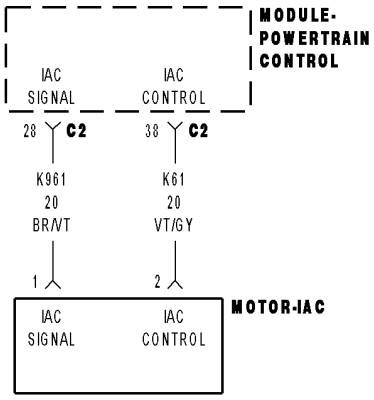
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

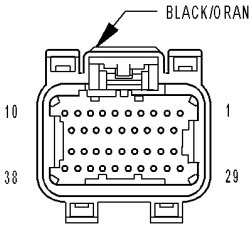
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

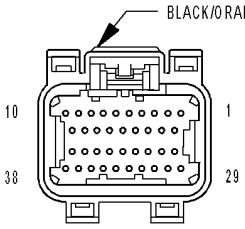
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0509-IDLE AIR CONTROL VALVE SENSE CIRCUIT HIGH

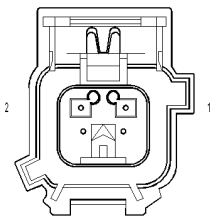




MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



MOTOR-
IAC

81335d26

P0509-IDLE AIR CONTROL VALVE SENSE CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running. Battery voltage greater than 10 volts. IAC motor operating.
- **Set Condition:**
  The PCM senses a short to ground or battery voltage on any of the Linear Idle Air Control (LIAC) control circuits for 2.75 seconds while the IAC motor is active. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K961) IAC RETURN CIRCUIT SHORTED TO BATTERY VOLTAGE
(K61) IAC CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K61) IAC CONTROL CIRCUIT SHORTED TO THE (K961) IAC RETURN CIRCUIT
IAC MOTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IAC MOTOR OPERATION

NOTE: If the engine will not idle, maintain an engine speed between 800 and 1500 RPM.
Start the engine.
Allow the engine to idle.
With a scan tool, read the IAC Current.

Is the IAC Current above 999 mA?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITON Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. IAC MOTOR

Turn the ignition off.
Disconnect the IAC Motor harness connector.
With the scan tool, monitor the IAC Current.
Ignition on, engine not running.

Does the scan tool display IAC Current at 0mA?

Yes >> Replace the IAC Motor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0509-IDLE AIR CONTROL VALVE SENSE CIRCUIT HIGH (CONTINUED)

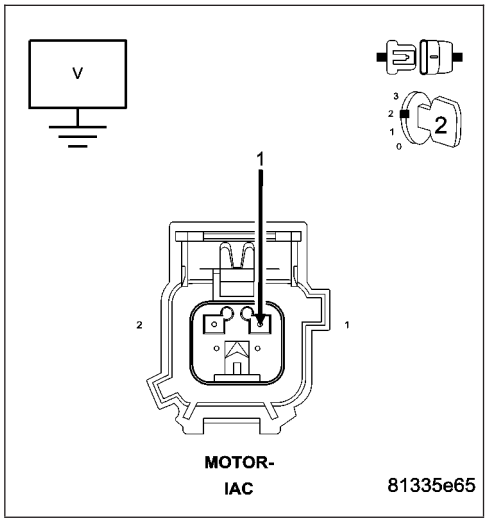
3. (K961) IAC SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K961) IAC Signal circuit in the IAC Motor harness connector.



Is the voltage above 0.5 of a volt?

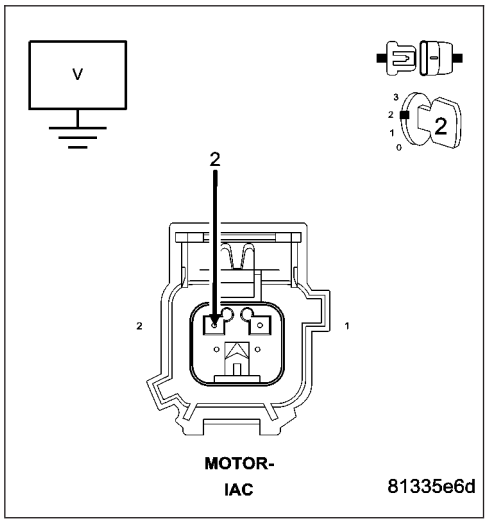
Yes >> Repair the short to battery voltage in the (K961) IAC Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. (K61) IAC CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Measure the voltage on the (K61) IAC Control circuit in the IAC Motor harness connector.



Is the voltage above 0.5 of a volt?

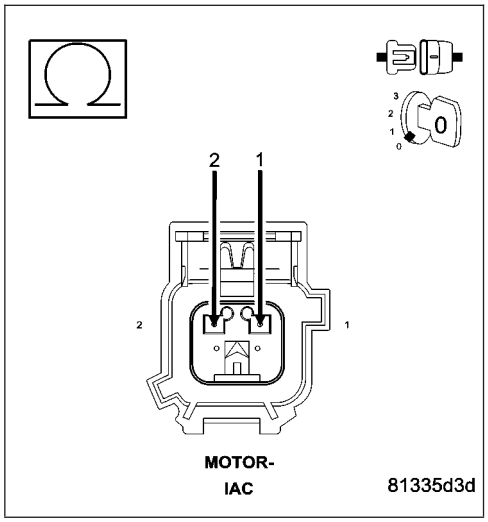
Yes >> Repair the short to battery voltage in the (K61) IAC Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0509-IDLE AIR CONTROL VALVE SENSE CIRCUIT HIGH (CONTINUED)

5. (K61) IAC CONTROL CIRCUIT SHORTED TO THE (K961) IAC RETURN CIRCUIT

Measure the resistance across the (K961) IAC Signal circuit and the (K61) IAC Control circuit in the IAC Motor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K961) IAC Signal circuit and the (K61) IAC Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0513-INVALID SKIM KEY

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM detects an invalid SKREEM key. One Trip Fault.

Possible Causes
INCORRECT VIN PROGRAMMED IN THE PCM
NO COMMUNICATION WITH SKREEM
NO VIN PROGRAMMED IN THE PCM
IGNITION KEY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With the scan tool, read the PCM DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Go To 6

---

2. NO COMMUNICATION WITH SKREEM

With the scan tool, attempt to communicate with the SKREEM.

Can the scan tool communicate with the SKREEM?

Yes >> Go To 3

No >> Refer to Section 8 - Electrical VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS and perform the appropriate Diagnostic Procedure.
Perform SKREEM VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

3. SKREEM TROUBLE CODES SET

With the scan tool, check for SKREEM DTCs.

Are any DTCs present in the SKREEM?

Yes >> Refer to Section 8 - Electrical VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS and perform the appropriate Diagnostic Procedure.
Perform SKREEM VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Go To 4

P0513-INVALID SKIM KEY (CONTINUED)

4. VIN PROGRAMMED INTO PCM

With the scan tool, display the VIN that is programmed in the PCM.

Has a VIN been programmed into the PCM?

Yes >> Go To 5

No >> Program the correct VIN into the PCM and retest.
Perform SKREEM VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

5. PCM

Turn the ignition off.
Replace and program the SKREEM per Service Information.
Ignition on, engine not running.
With the scan tool, erase all SKREEM and PCM DTCs.
Attempt to start and idle the engine.
With the scan tool, read the PCM DTCs.

Does the scan tool display this code?

Yes >> NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary. Replace and program the Powertrain Control Module per Service Information.
Perform SKREEM VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

---

6. IGNITION KEY

NOTE: You must obtain the SKREEM pin number.

NOTE: This DTC could have been set if the SKREEM harness connector was disconnected, or if the SKREEM was replaced recently.

NOTE: All keys that the customer uses for this vehicle must be tested to verify they are operating properly.
Ignition on, engine not running.
Verify the correct VIN is programmed into the PCM and SKREEM.
Turn the ignition off.
With each customer key turn the ignition key on and crank the engine to start.
With the scan tool, read the PCM DTCs. Look for P0513.

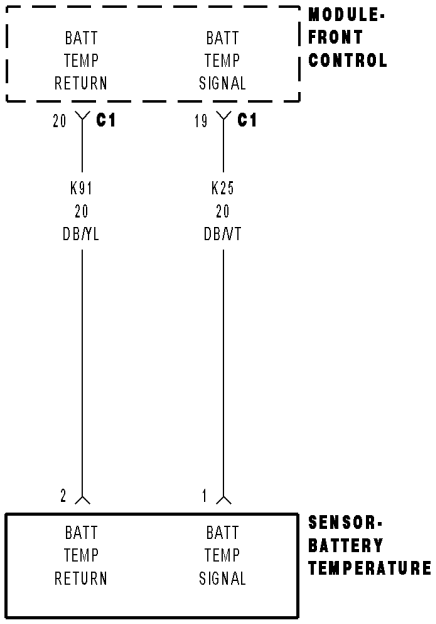
Is the DTC P0513 still active?

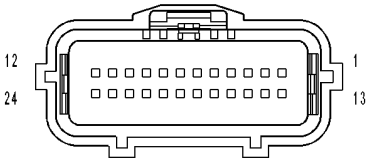
Yes >> Replace the Ignition Key.
Perform SKREEM VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

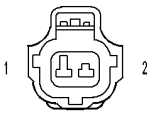
NOTE: If this DTC cannot be reset, it could have been an actual theft attempt.

P0516-BATTERY TEMPERATURE SENSOR CIRCUIT LOW





MODULE-
FRONT
CONTROL C1



SENSOR-
BATTERY
TEMPERATURE

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P0516-BATTERY TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts
- **Set Condition:**
  Battery temperature sensor voltage below 0.039 of a volt. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K25) BATT TEMP SIGNAL CIRCUIT SHORTED TO GROUND
(K25) BATT TEMP SIGNAL CIRCUIT SHORTED TO THE (K91) BATT TEMP RETURN CIRCUIT
BATTERY TEMPERATURE SENSOR
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. BATTERY TEMP SENSOR VOLTAGE BELOW 0.5 OF A VOLT

Ignition on, engine not running.

With the scan tool, monitor Battery Temperature Sensor volts.

Is the voltage below 0.5 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. BATTERY TEMPERATURE SENSOR

Ignition on, engine not running.

With the scan tool, read the Battery Temp Sensor Voltage value.

Disconnect the Battery Temperature Sensor harness connector.

Did the Battery Temperature Voltage value change from below 1.0 volt to above 4.5 volts?

Yes >> Replace the Battery Temperature Sensor.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0516-BATTERY TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

3. (K25) BATT TEMP SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

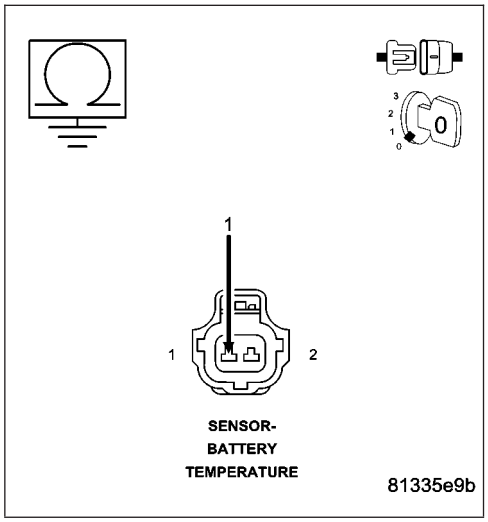
Disconnect the C1 FCM harness connector.

Measure the resistance between ground and the (K25) Batt Temp Signal circuit in the Battery Temp Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K25) Batt Temp Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



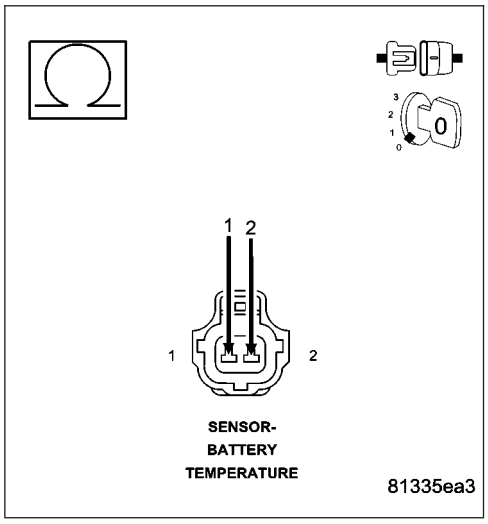
4. (K25) BATT TEMP SIGNAL CIRCUIT SHORTED TO THE (K91) BATT TEMP RETURN CIRCUIT

Measure the resistance between the (K25) Batt Temp Signal circuit and the (K91) Batt Temp Return circuit in the Battery Temp Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K91) Batt Temp Return circuit and the (K25) Batt Temp Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. FRONT CONTROL MODULE

NOTE: Before continuing, check the FCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

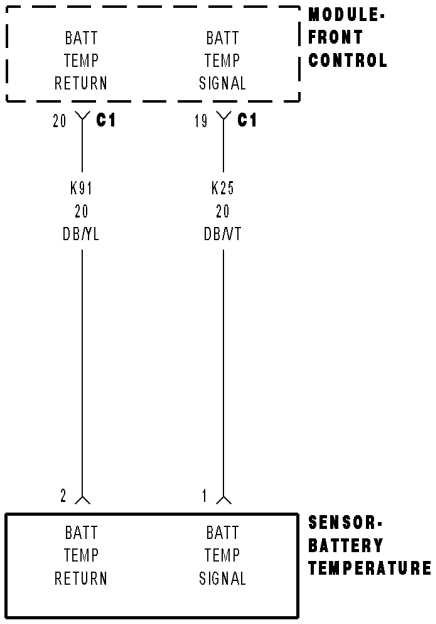
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

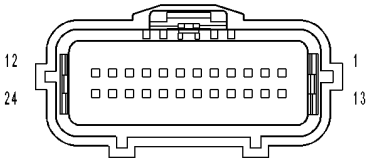
Were there any problems found?

Yes >> Repair as necessary.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

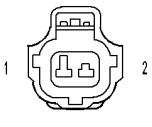
No >> Replace and program the Front Control Module per Service Information.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

P0517-BATTERY TEMPERATURE SENSOR CIRCUIT HIGH





MODULE-
FRONT
CONTROL C1



SENSOR-
BATTERY
TEMPERATURE

81335e97

P0517-BATTERY TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Battery temperature voltage above 4.94 volts. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K25) BATT TEMP SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K25) BATT TEMP SIGNAL CIRCUIT OPEN
(K91) BATT TEMP RETURN CIRCUIT OPEN
BATTERY TEMPERATURE SENSOR
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. BATTERY TEMPERATURE SENSOR VOLTAGE ABOVE 4.8 VOLTS

NOTE: Diagnose any CAN - C Communication DTCs before continuing.

Ignition on, engine not running.

With a scan tool, monitor the Battery Temperature Sensor voltage.

Is the voltage above 4.9 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. BATTERY TEMPERATURE SENSOR

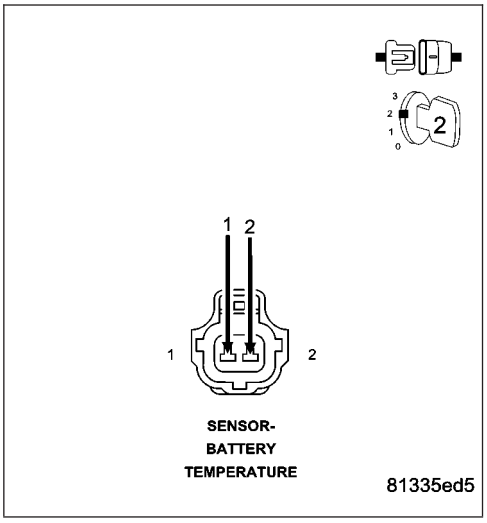
Turn the ignition off.

Disconnect the Battery Temperature Sensor harness connector.

Ignition on, engine not running.

With the scan tool, read the Battery Temp Voltage value.

Connect a jumper wire between the (K25) Batt Temp Signal circuit and the (K91) Batt Temp Return circuit in the Battery Temp Sensor harness connector.



Did the Battery Temp voltage value change from greater than 4.5 volts to less than 1.0 volt with the jumper wire installed?

Yes >> Replace the Battery Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.

P0517-BATTERY TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

3. (K25) BATT TEMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

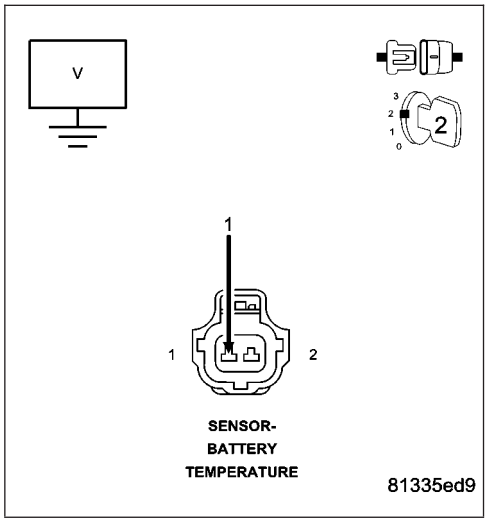
Disconnect the C1 FCM harness connector.

Measure the voltage on the (K25) Batt Temp Signal circuit in the Battery Temp Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K25) Batt Temp Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K25) BATT TEMP SIGNAL CIRCUIT OPEN

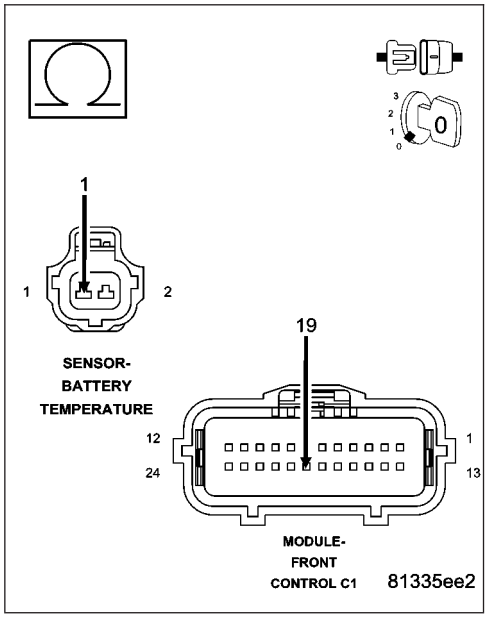
Turn the ignition off.

Measure the resistance of the (K25) Batt Temp Signal circuit from the Battery Temp Sensor harness connector to the C6 IPM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

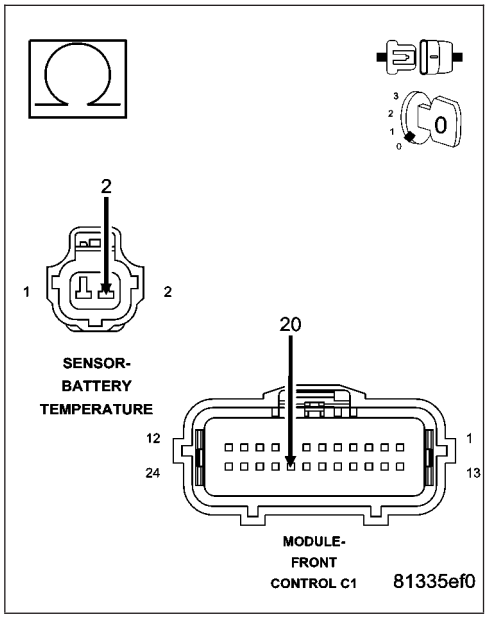
No >> Repair the open in the (K25) Batt Temp Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0517-BATTERY TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

5. (K91) BATT TEMP RETURN CIRCUIT OPEN

Measure the resistance in the (K91) Batt Temp Return circuit from the Sensor connector to the C1 FCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K91) Batt Temp Return circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. FRONT CONTROL MODULE

NOTE: Before continuing, check the FCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

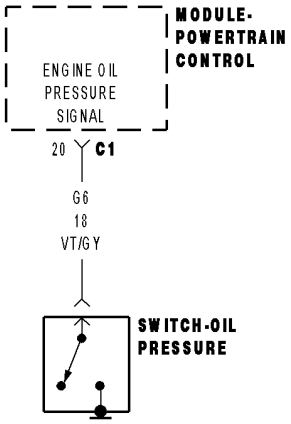
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

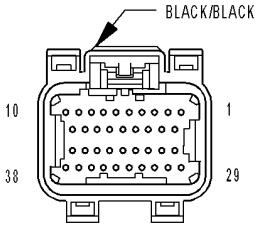
Were there any problems found?

Yes >> Repair as necessary.
Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

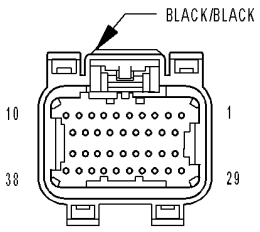
No >> Replace and program the Front Control Module per Service Information.
Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

P0522-OIL PRESSURE TOO LOW

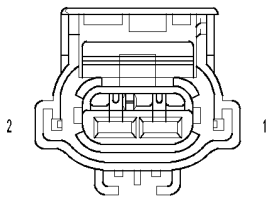




MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



SWITCH-
OIL PRESSURE

81336a00

P0522-OIL PRESSURE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on and battery voltage above 10.4 volts.
- **Set Condition:**
  The oil pressure sensor voltage at PCM goes below 0.1 of a volt for 0.5 of a second. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(G6) OIL PRESSURE SIGNAL CIRCUIT OPEN
(G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND
OIL PRESSURE SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0522-OIL PRESSURE TOO LOW (CONTINUED)

2. OIL PRESSURE SWITCH

Turn the ignition off.

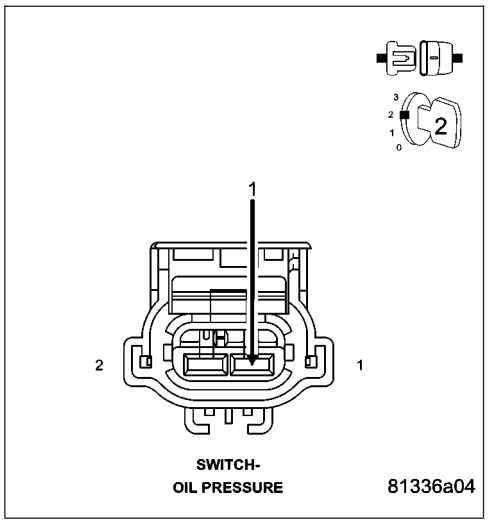
Disconnect the Oil Pressure Switch harness connector.

Ignition on, engine not running.

Connect a jumper wire to the (G6) Oil Pressure Signal circuit in the Sensor harness connector.

With the scan tool monitor the Oil Pressure Switch state.

Touch the other end of the jumper wire to a known good Ground several times.



Did the Oil Pressure Switch state change from High to Low when connecting and disconnecting the jumper wire to ground?

Yes >> Replace the Oil Pressure Switch.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.

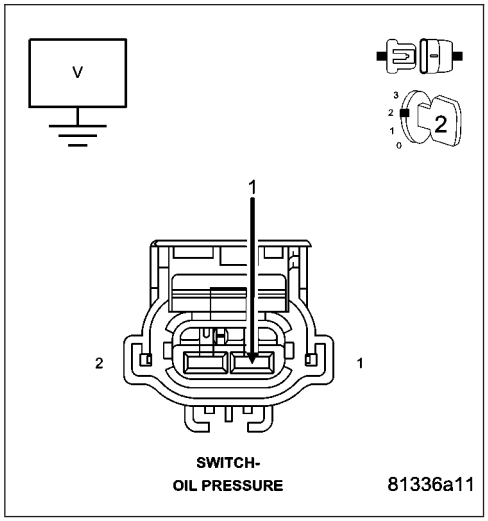
3. (G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (G6) Oil Pressure Signal circuit in the Switch harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage on the (G6) Oil Pressure Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

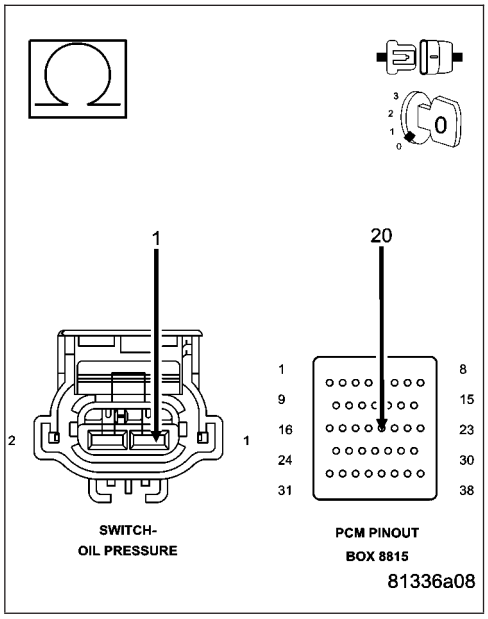
No >> Go To 4

P0522-OIL PRESSURE TOO LOW (CONTINUED)

4. (G6) OIL PRESSURE SWITCH SIGNAL CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (G6) Oil Pressure Signal circuit from the Oil Pressure Switch harness connector to the appropriate terminal of special tool #8815.



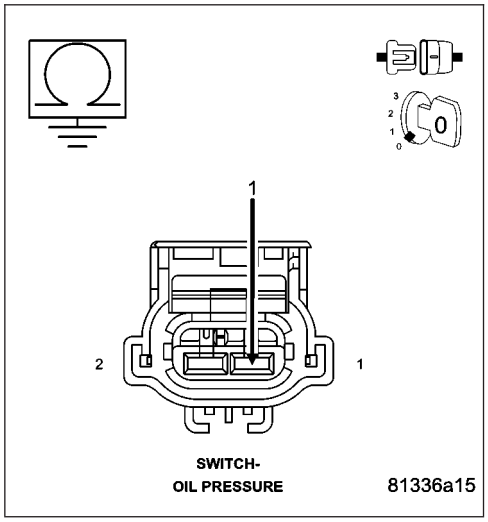
Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (G6) Oil Pressure Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. (G6) SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (G6) Oil Pressure Signal circuit in the Switch connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (G6) Oil Pressure Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0522-OIL PRESSURE TOO LOW (CONTINUED)

6. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

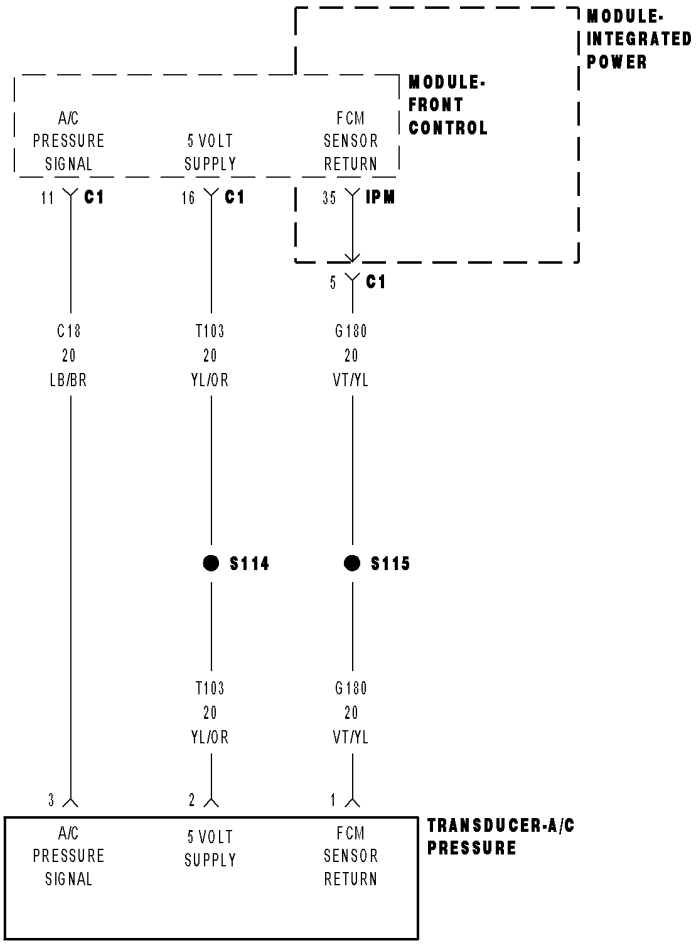
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

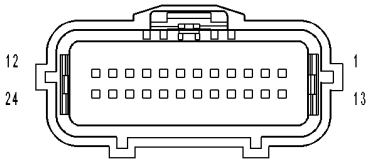
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

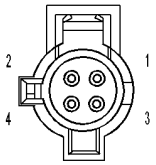
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0532-A/C PRESSURE SENSOR CIRCUIT LOW

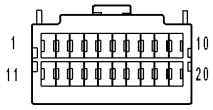




MODULE-
FRONT
CONTROL C1



TRANSDUCER-A/C
PRESSURE



MODULE-
INTEGRATED
POWER C1

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P0532-A/C PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running, AC is learned, and AC Clutch Relay energized.
- **Set Condition:**
  The A/C pressure sensor signal voltage at the PCM goes below 0.58 of a volt for 2.6 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(T103) 5-VOLT SUPPLY CIRCUIT OPEN
(T103) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
A/C PRESSURE TRANSDUCER
(C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND
(C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (G180) SENSOR RETURN CIRCUIT
FRONT CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. A/C PRESSURE TRANSDUCER VOLTAGE BELOW 0.6 OF A VOLT

NOTE: Make sure the A/C refrigerant System is properly charged per Service Information.

Start the engine.

With a scan tool, read the A/C Pressure Sensor voltage.

Is the voltage below 0.6 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

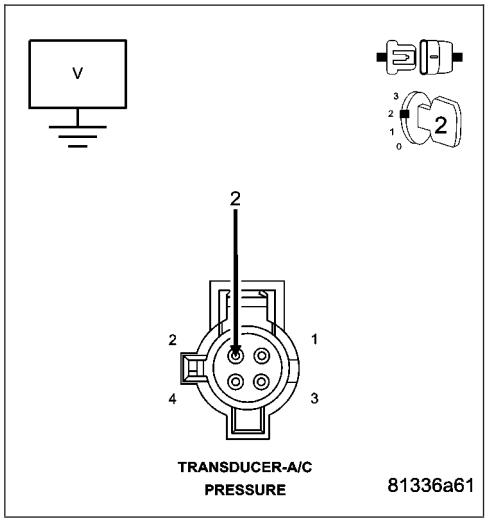
2. (T103) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the A/C Pressure Transducer harness connector.

Ignition on, engine not running.

Measure the voltage on the (T103) 5-volt Supply circuit in the A/C Pressure Transducer harness connector.



Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 6

P0532-A/C PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

3. A/C PRESSURE TRANSDUCER

With the scan tool, monitor the A/C Pressure Transducer voltage.

Is the voltage above 0.6 of a volt?

Yes >> Replace the A/C Pressure Transducer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

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4. (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

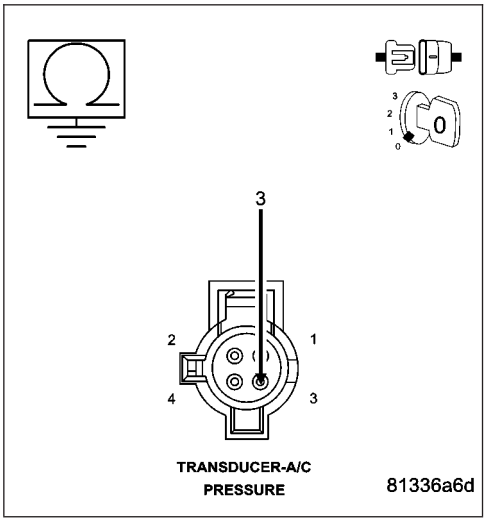
Disconnect the C1 FCM harness connector.

Measure the resistance between ground and the (C18) A/C Pressure Signal circuit in the A/C Pressure Transducer harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (C18) A/C Pressure Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



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5. (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (G180) SENSOR RETURN CIRCUIT

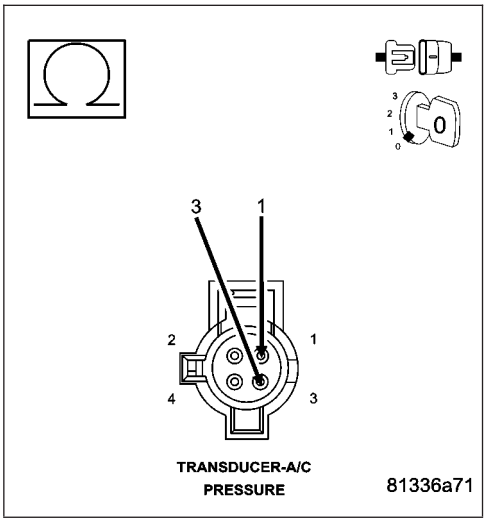
Disconnect the C3 FCM harness connector.

Measure the resistance between the (C18) A/C Pressure Signal circuit and the (G180) Sensor Return circuit in the A/C Pressure Transducer harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (G180) Sensor Return circuit and the (C18) A/C Pressure Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0532-A/C PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

6. (T103) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

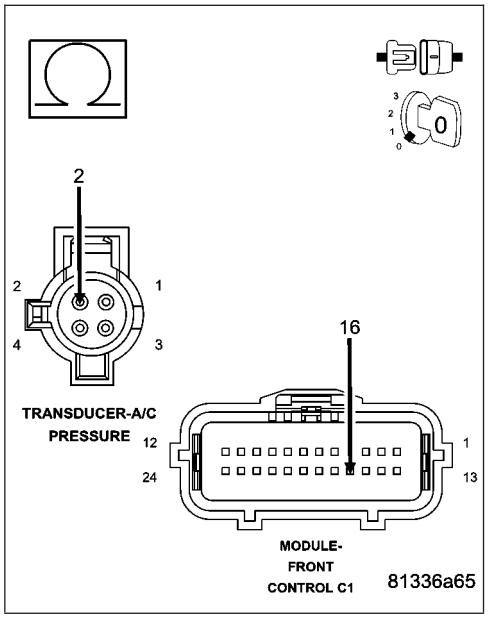
Disconnect the C1 FCM harness connector.

Measure the resistance of the (T103) 5-volt Supply circuit from the A/C Pressure Transducer harness connector to the C1 FCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (T103) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



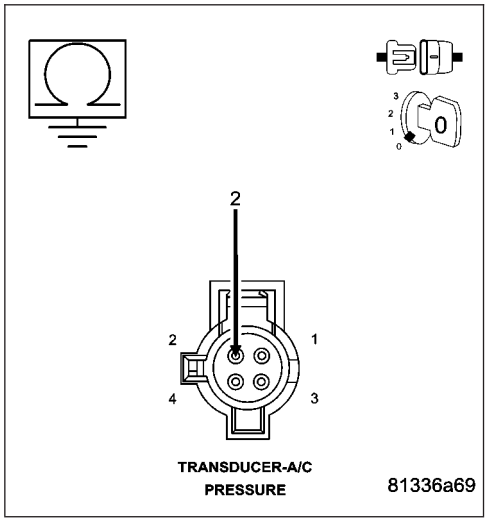
7. (T103) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (T103) 5-volt Supply circuit in the A/C Pressure Transducer harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (T103) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0532-A/C PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

8. FRONT CONTROL MODULE

NOTE: Before continuing, check the FCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

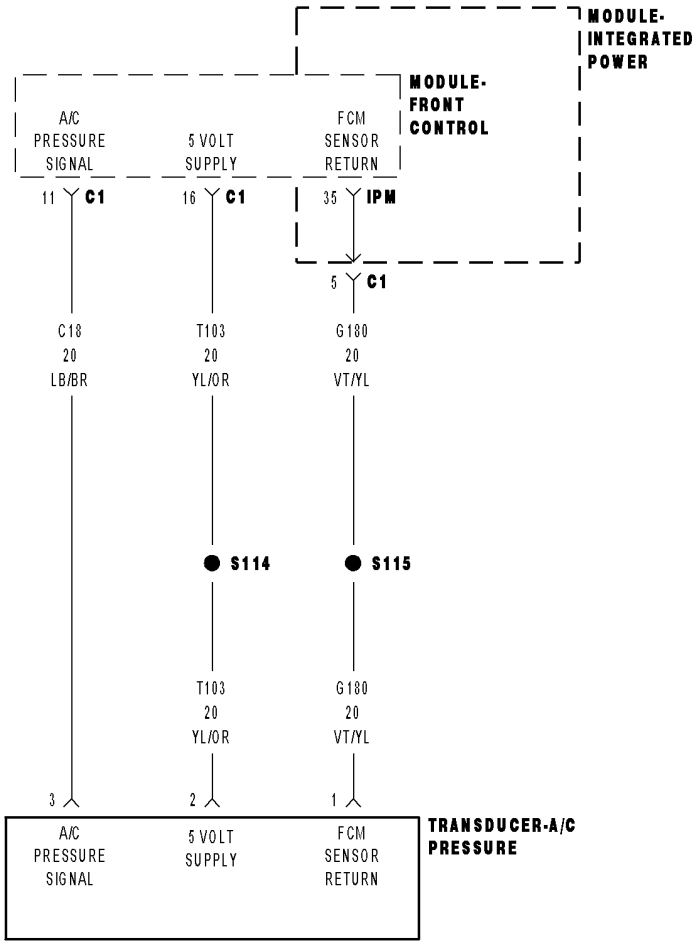
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

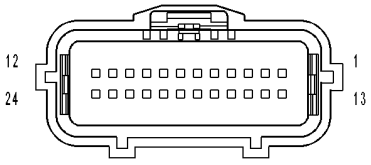
Were there any problems found?

Yes >> Repair as necessary.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

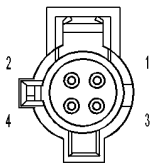
No >> Replace and program the Front Control Module per Service Information.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

P0533-A/C PRESSURE SENSOR CIRCUIT HIGH

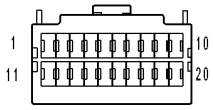




MODULE-
FRONT
CONTROL C1



TRANSDUCER-A/C
PRESSURE



MODULE-
INTEGRATED
POWER C1

81336a2c

P0533-A/C PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and the AC Clutch Relay energized.
- **Set Condition:**
  The A/C pressure transducer signal at the PCM goes above 4.92 volts. One trip Fault. Three good trips to turn off the MIL.

Possible Causes
(C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(C18) A/C PRESSURE SIGNAL CIRCUIT OPEN
(C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (T103) 5-VOLT SUPPLY CIRCUIT
(G180) SENSOR RETURN CIRCUIT OPEN
A/C PRESSURE TRANSDUCER
FCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. A/C PRESSURE TRANSDUCER VOLTAGE ABOVE 4.9 VOLTS

NOTE: Make sure the A/C refrigerant System is properly charged per Service Information.
Start the engine.
With a scan tool, read the A/C Pressure Sensor voltage.

Is the voltage above 4.9 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0533-A/C PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

2. A/C PRESSURE TRANSDUCER

Turn the ignition off.

Disconnect the A/C Pressure Transducer harness connector.

Connect a jumper wire between the (C18) A/C Pressure Signal circuit and the (G180) Sensor Return circuit in the Transducer harness connector.

Ignition on, engine not running.

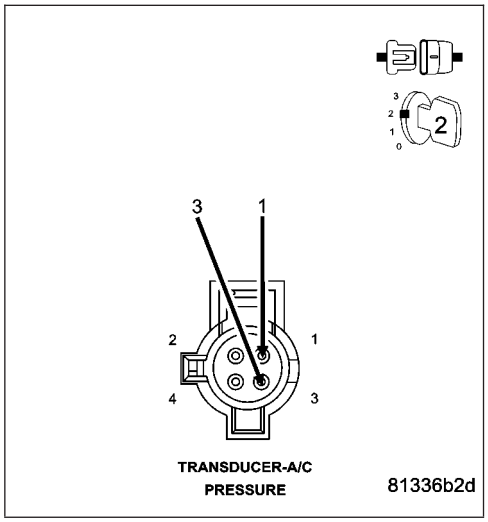
With the scan tool, monitor the A/C Pressure Transducer voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the A/C Pressure Transducer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



3. (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 FCM harness connector.

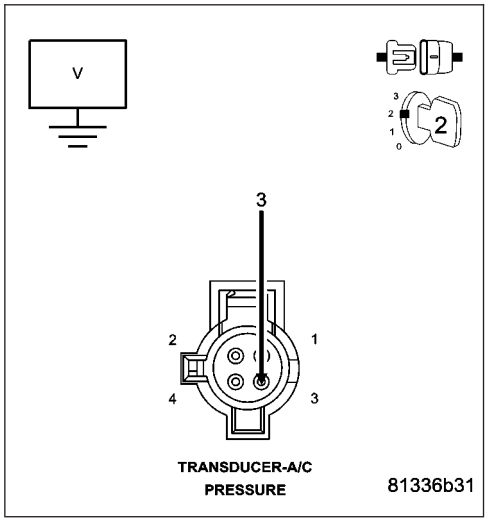
Ignition on, engine not running.

Measure the voltage on the (C18) A/C Pressure Signal circuit in the A/C Pressure Transducer harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (C18) A/C Pressure Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0533-A/C PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

4. (C18) A/C PRESSURE SIGNAL CIRCUIT OPEN

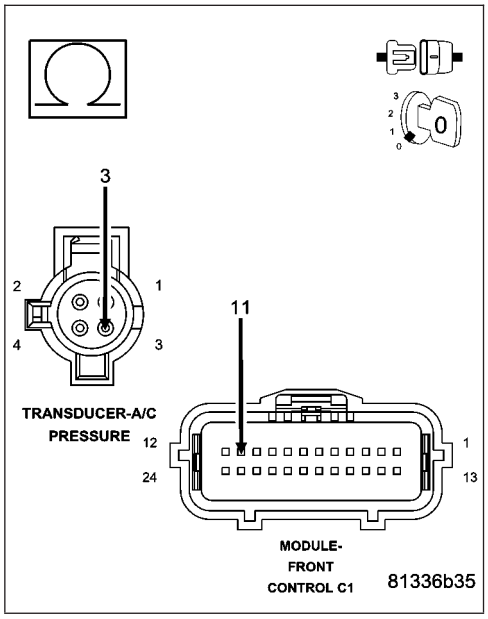
Turn the ignition off.

Measure the resistance of the (C18) A/C Pressure Signal circuit from the A/C Pressure Transducer harness connector to the C1 FCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (C18) A/C Pressure Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



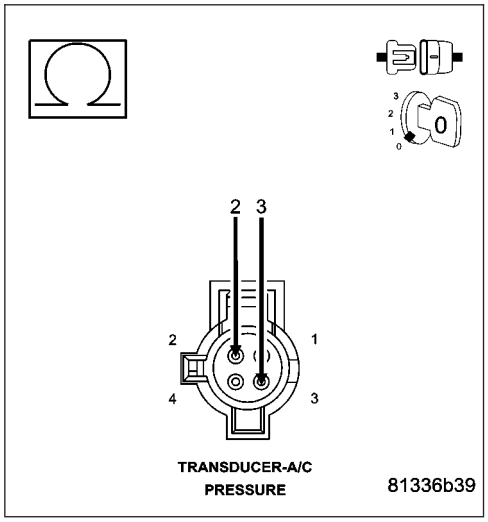
5. (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (T103) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (C18) A/C Pressure Signal circuit and the (T103) 5-volt Supply circuit in the A/C Pressure Transducer harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (T103) 5-volt Supply circuit and the (C18) A/C Pressure Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

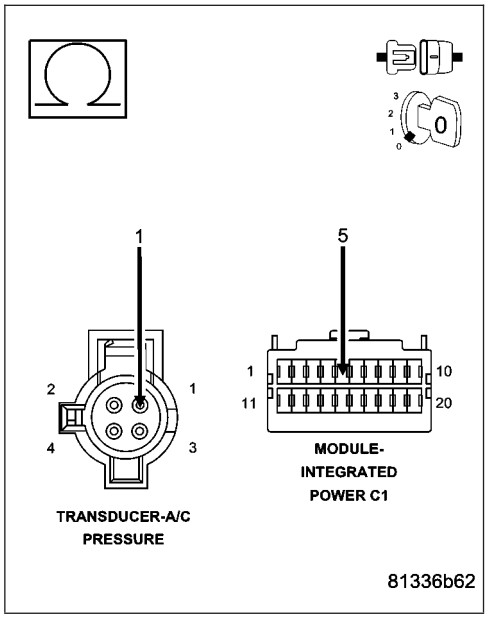


P0533-A/C PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

6. (G180) SENSOR RETURN CIRCUIT OPEN

Disconnect the C3 FCM harness connector.

Measure the resistance of the (G180) Sensor Return circuit from the A/C Pressure Sensor harness connector to the C3 FCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (G180) Sensor Return circuit
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. FRONT CONTROL MODULE

NOTE: Before continuing, check the FCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

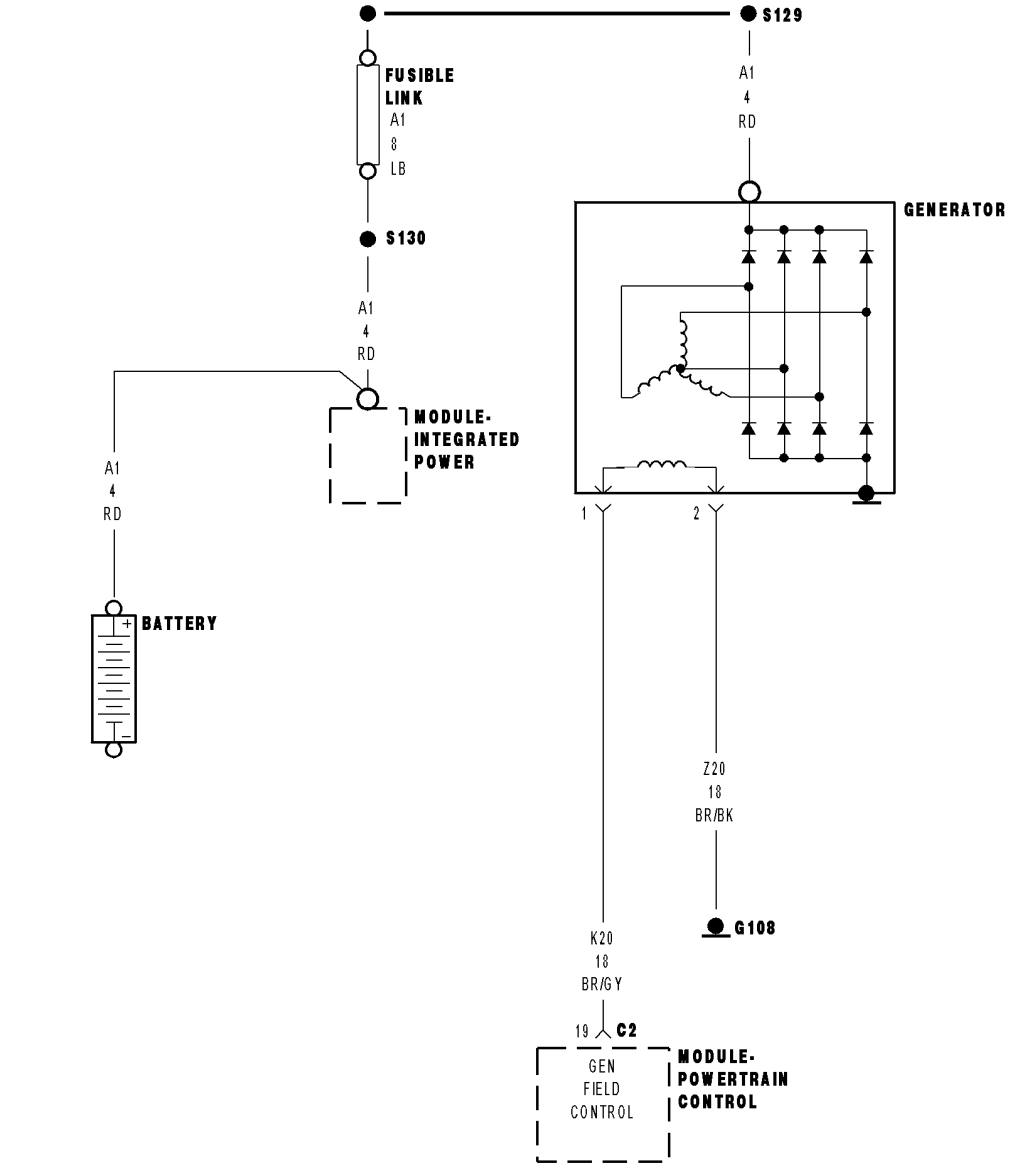
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

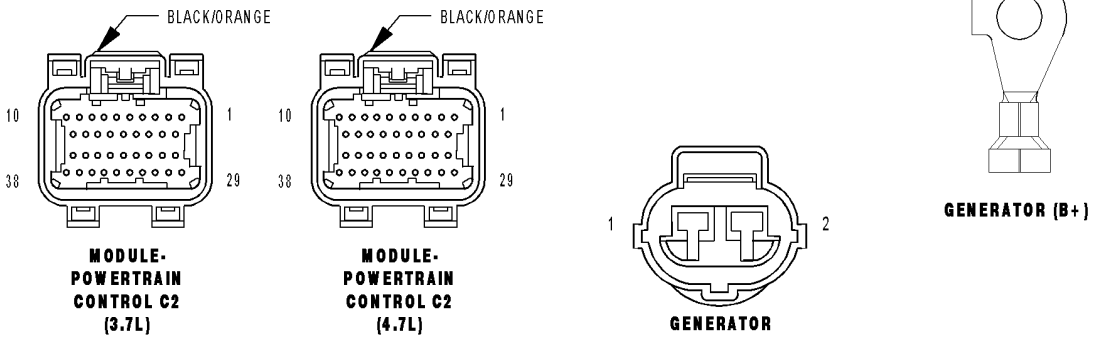
Were there any problems found?

Yes >> Repair as necessary.
Perform BODY VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace and program the Front Control Module per Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

P0562-BATTERY VOLTAGE LOW





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P0562-BATTERY VOLTAGE LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The engine running. The engine speed greater than 1000 RPM.
- **Set Condition:**
  Battery voltage is 1 volt less than desired voltage for a set period of time. One Trip Fault. ETC light is flashing.

Possible Causes
RESISTANCE IN THE (A1) BATTERY POSITIVE CIRCUIT
RESISTANCE IN THE GENERATOR CASE GROUND
GENERATOR OPERATION
(K20) GENERATOR FIELD CONTROL CIRCUIT OPEN
(K20) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO GROUND
(Z20) GROUND CIRCUIT OPEN
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Battery is in good condition. Using the Midtronics Battery Tester, test the Battery before continuing.

NOTE: Inspect the vehicle for after market accessories that may exceed the Generator System output.
Turn the ignition off.

NOTE: Make sure the generator drive belt is in good operating condition.

NOTE: Inspect the fuses in the IPM. If an open fuse is found, use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.
Ignition on, engine not running.

With the scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0562-BATTERY VOLTAGE LOW (CONTINUED)

2. (A1) B+ CIRCUIT HIGH RESISTANCE

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

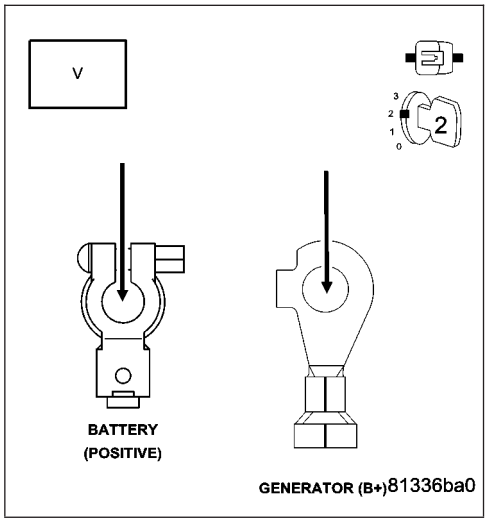
NOTE: Make sure all wires are clear of the engine's moving parts.
Measure the voltage between the (A1) B+ Terminal at the Generator and the Battery + Post.

Start the engine.

Is the voltage above 0.4 of a volt?

Yes >> Repair the excessive resistance in the (A1) B+ circuit between the Generator and Battery.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. GENERATOR CASE GROUND HIGH RESISTANCE

Ignition on, engine not running.

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: Make sure all wires are clear of the engine's moving parts.
Measure the voltage between the Generator case and Battery ground post.

Is the voltage above 0.1 of a volt?

Yes >> Repair excessive resistance in the Generator Ground between the Generator Case and Battery ground side.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. GENERATOR OPERATION

Turn the ignition off.

Disconnect the Generator Field harness connector.

Using a 12-volt test light, jump it across the Generator Field harness connector.

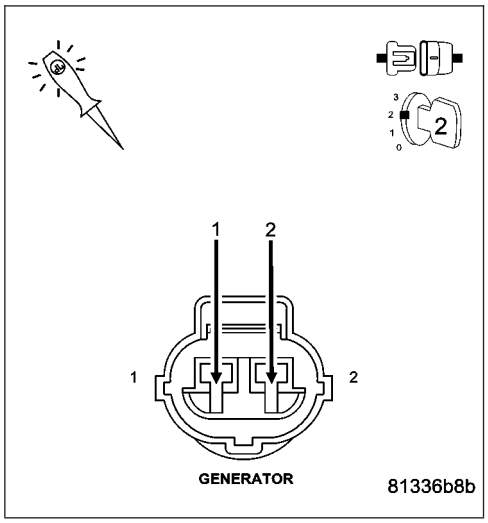
Ignition on, engine not running.

With the scan tool, actuate the Gen Field Control circuit.

Does the test light illuminate brightly and flash on and off?

Yes >> Replace the Generator.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0562-BATTERY VOLTAGE LOW (CONTINUED)

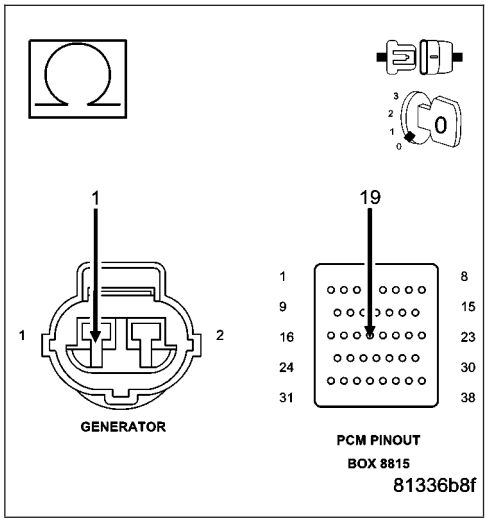
5. (K20) GENERATOR FIELD CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K20) Gen Field Control circuit from the Generator harness connector to the appropriate terminal of the special tool #8815.



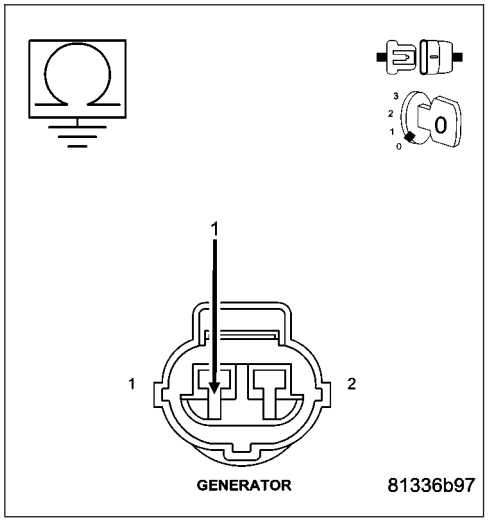
Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K20) Gen Field Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. (K20) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K20) Gen Field Control circuit in the Generator Field harness connector.



Is the resistance below 100 ohms?

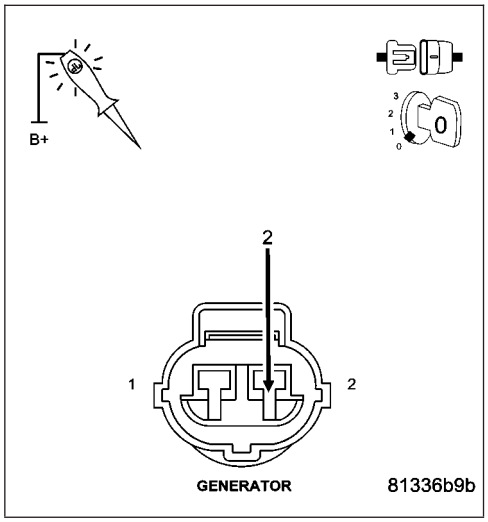
Yes >> Repair the short to ground in the (K20) Gen Field Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P0562-BATTERY VOLTAGE LOW (CONTINUED)

7. (Z20) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, probe the (Z20) Ground circuit in the Generator Field harness connector.



Does the test light illuminate brightly?

Yes >> Go To 8

No >> Repair the open in the (Z20) Ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. PCM

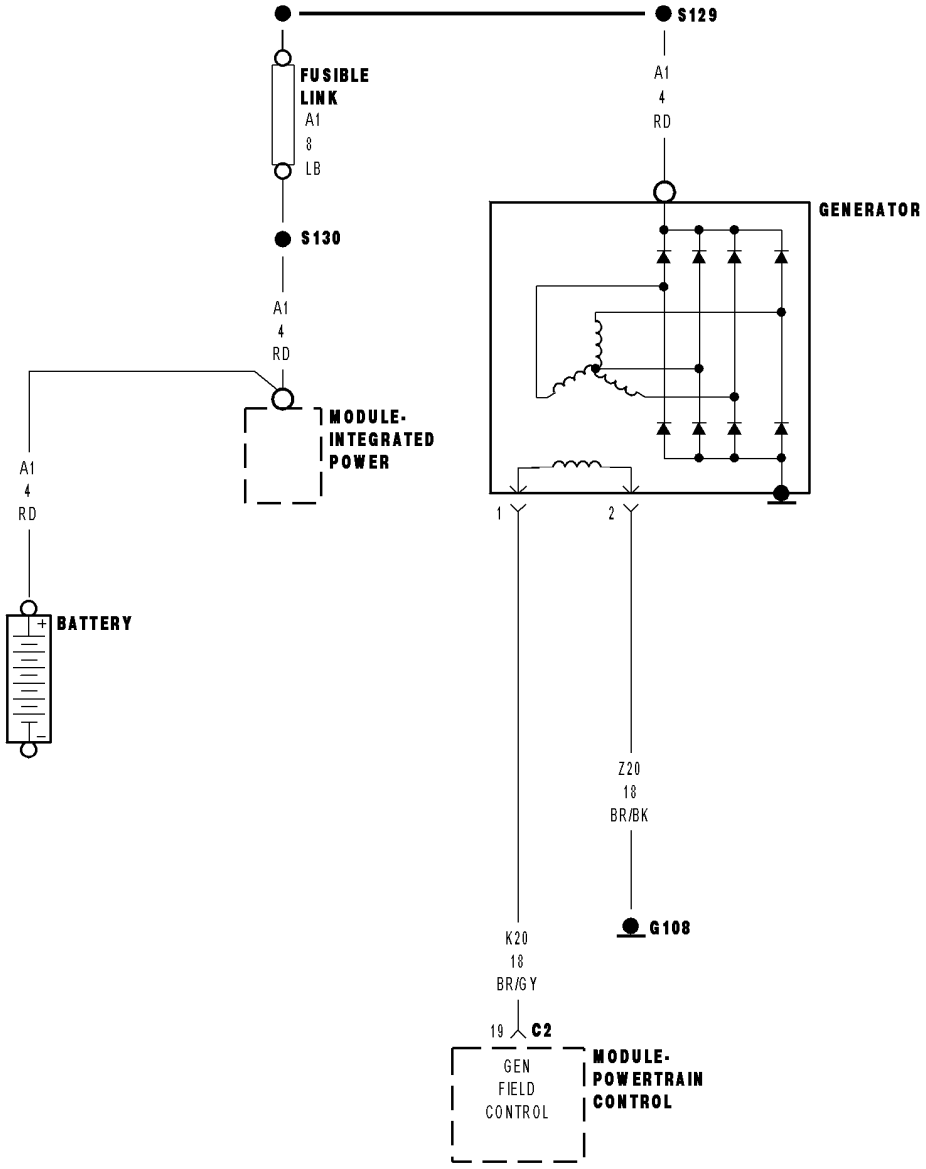
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

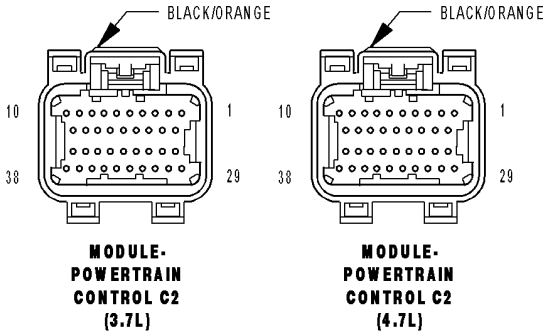
Were there any problems found?

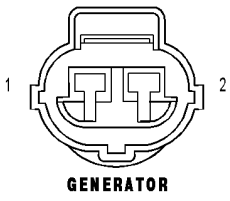
Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

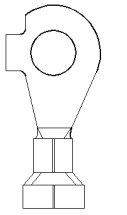
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0563-BATTERY VOLTAGE HIGH









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P0563-BATTERY VOLTAGE HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Engine RPM greater than 1000 RPM. With no other charging system codes set.
- **Set Condition:**
  Battery voltage is 1 volt greater than desired voltage. Battery voltage greater than 15.75 volts. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K20) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
GENERATOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Battery is in good condition. Using the Midtronics Battery Tester, test the Battery before continuing.

NOTE: Inspect the vehicle for after market accessories that may exceed the Generator System output.
Turn the ignition off.

NOTE: Make sure the generator drive belt is in good operating condition.

NOTE: Inspect the fuses in the IPM. If a fuse is open use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.
Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0563-BATTERY VOLTAGE HIGH (CONTINUED)

2. GENERATOR OPERATION

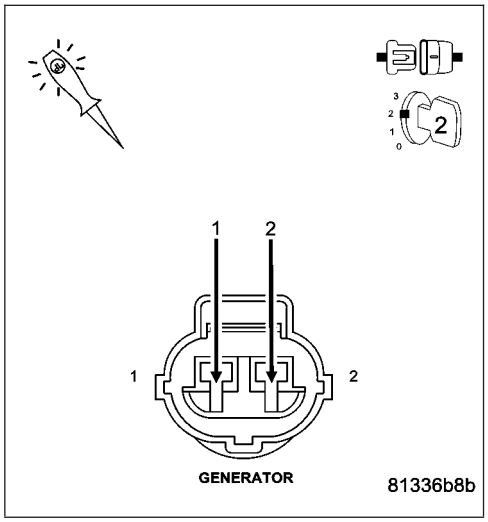
Turn the ignition off.

Disconnect the Generator Field harness connector.

Using a 12-volt test light, jump across the Generator Field harness connector.

Ignition on, engine not running.

With the scan tool, actuate the Generator Field Driver.



Does the test light illuminate brightly and flash on and off?

Yes >> Replace the Generator.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

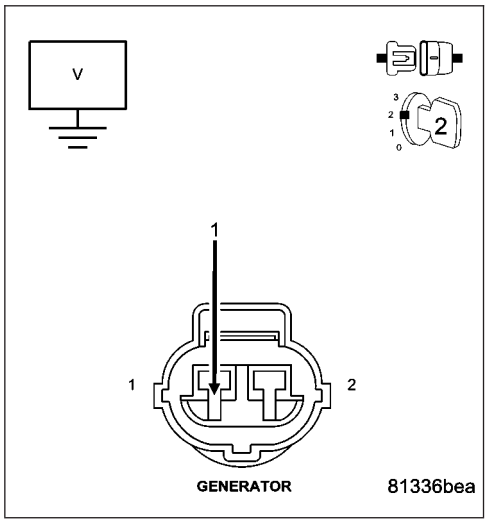
3. (K20) FIELD CIRCUIT SHORTED BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K20) Gen Field Control circuit at the Generator Field harness connector.



Is the voltage above 1.0 volt?

Yes >> Repair the short to battery voltage in the (K20) Gen Field Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

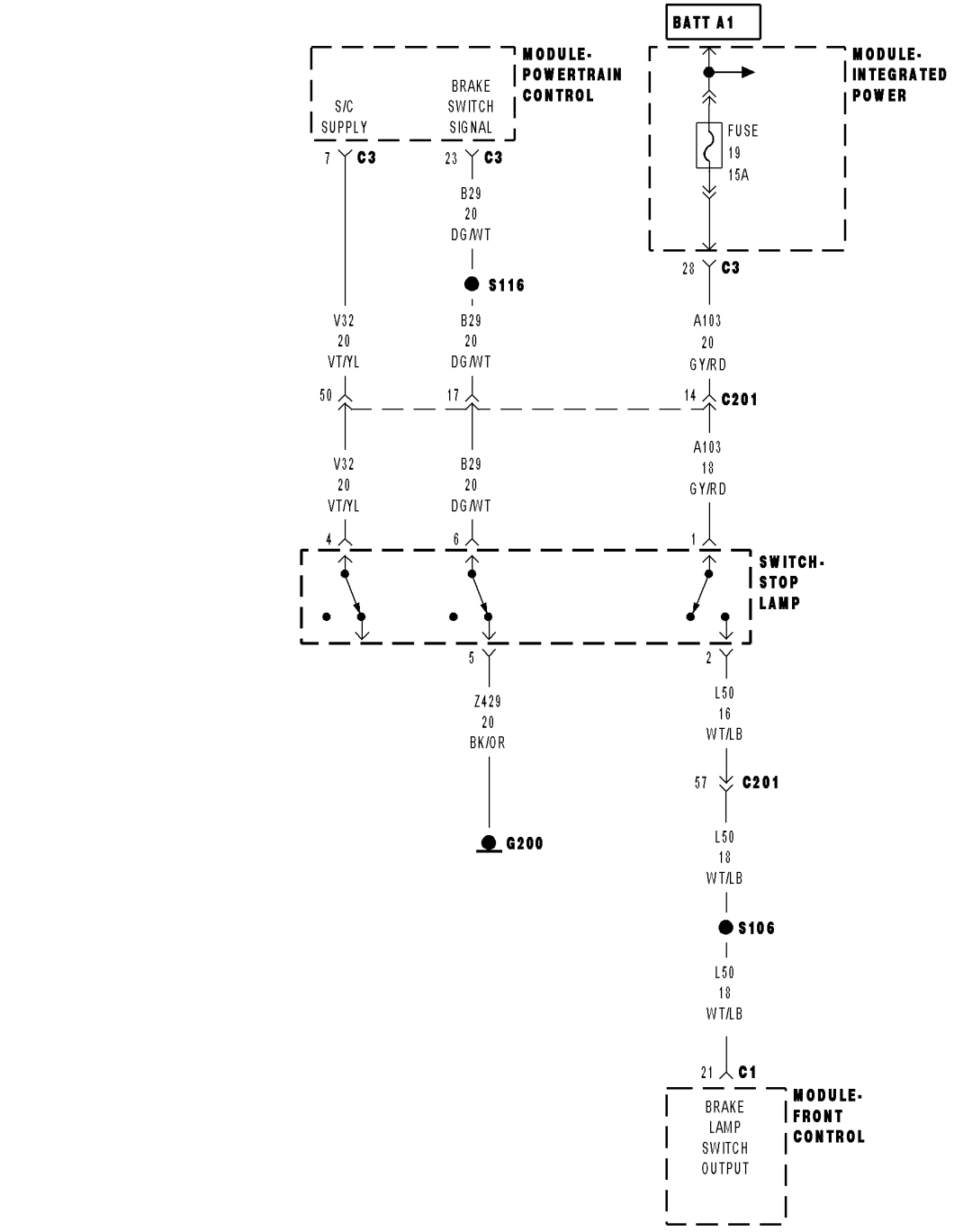
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

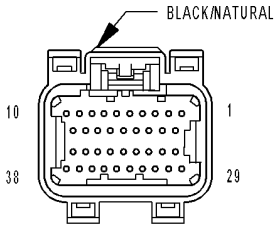
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

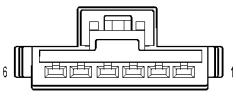
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0572-BRAKE SWITCH 1 STUCK ON

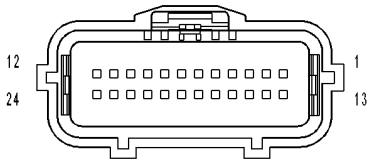




MODULE-
POWERTRAIN
CONTROL C3



SWITCH-
STOP
LAMP



MODULE-
FRONT
CONTROL C1

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P0572-BRAKE SWITCH 1 STUCK ON (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes Brake Switch No.1 is mechanically stuck in the low/on position. One Trip Fault. Three Global Good Trips to Clear.

Possible Causes
(B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
(L50) BRAKE LAMP SWITCH OUTPUT CIRCUIT OPEN
STOP LAMP SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Verify battery voltage is greater than 10 volts.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0572-BRAKE SWITCH 1 STUCK ON (CONTINUED)

2. STOP LAMP SWITCH

Turn the ignition off.

Remove the Stop Lamp Switch and disconnect the harness connector.

Measure the resistance between the (Z429) Ground circuit terminal and the (B29) Brake Switch No.1 Signal terminal in the Stop Lamp Switch.

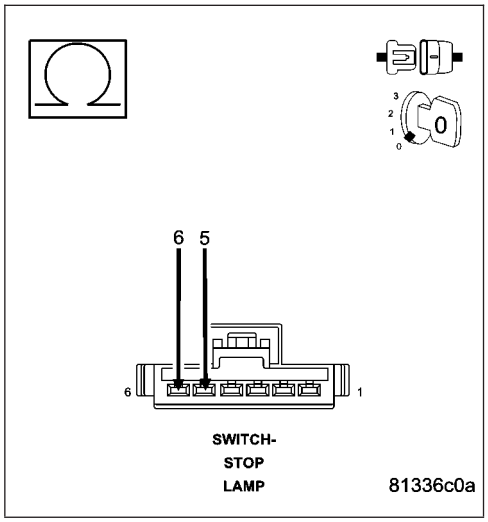
Measure the resistance between the (A103) Fused B+ circuit terminal and the (L50) Brake Lamp Switch Output terminal in the Stop Lamp Switch.

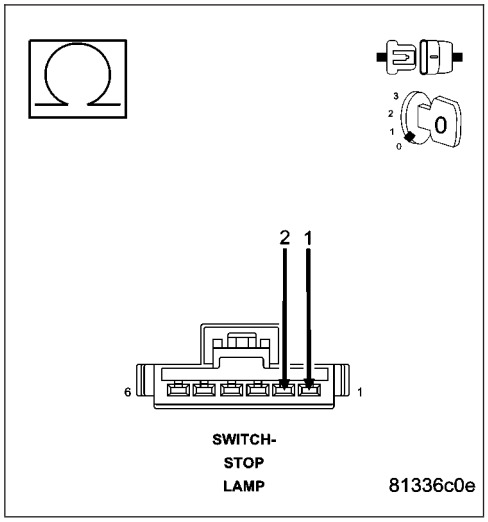
Apply and release the Stop Lamp Switch while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to an open circuit?

Yes >> Go To 3

No >> Replace the Stop Lamp Switch.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





3. (B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

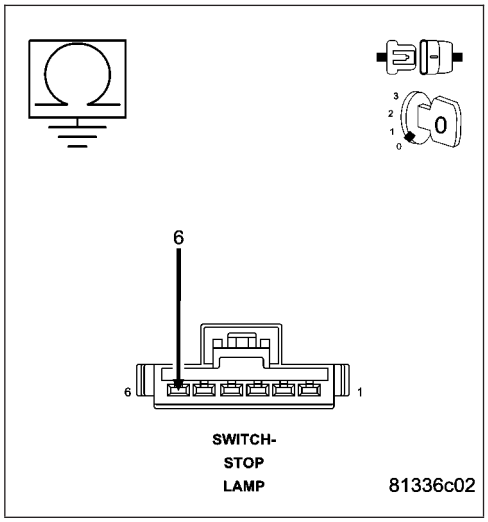
Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (B29) Brake Switch No.1 Signal circuit in the Stop Lamp Switch harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (B29) Brake Switch No.1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE))

No >> Go To 4

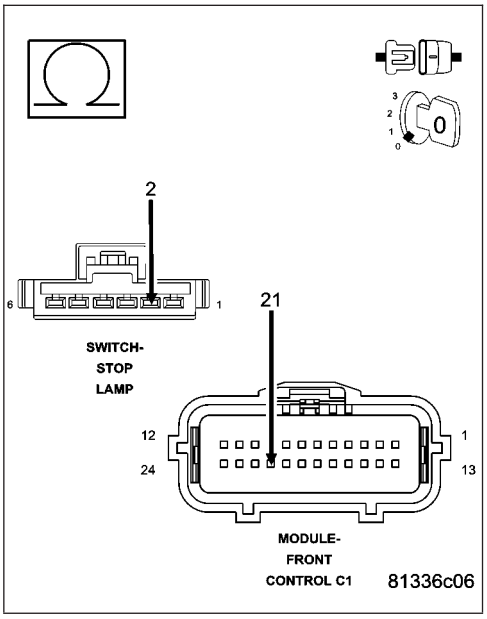


P0572-BRAKE SWITCH 1 STUCK ON (CONTINUED)

4. (L50) BRAKE LAMP SWITCH OUTPUT CIRCUIT OPEN

Disconnect the C1 FCM harness connector.

Measure the resistance of the (L50) Brake Lamp Switch Output circuit from the Stop Lamp Switch harness connector to the C1 FCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (L50) Brake Lamp Switch Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

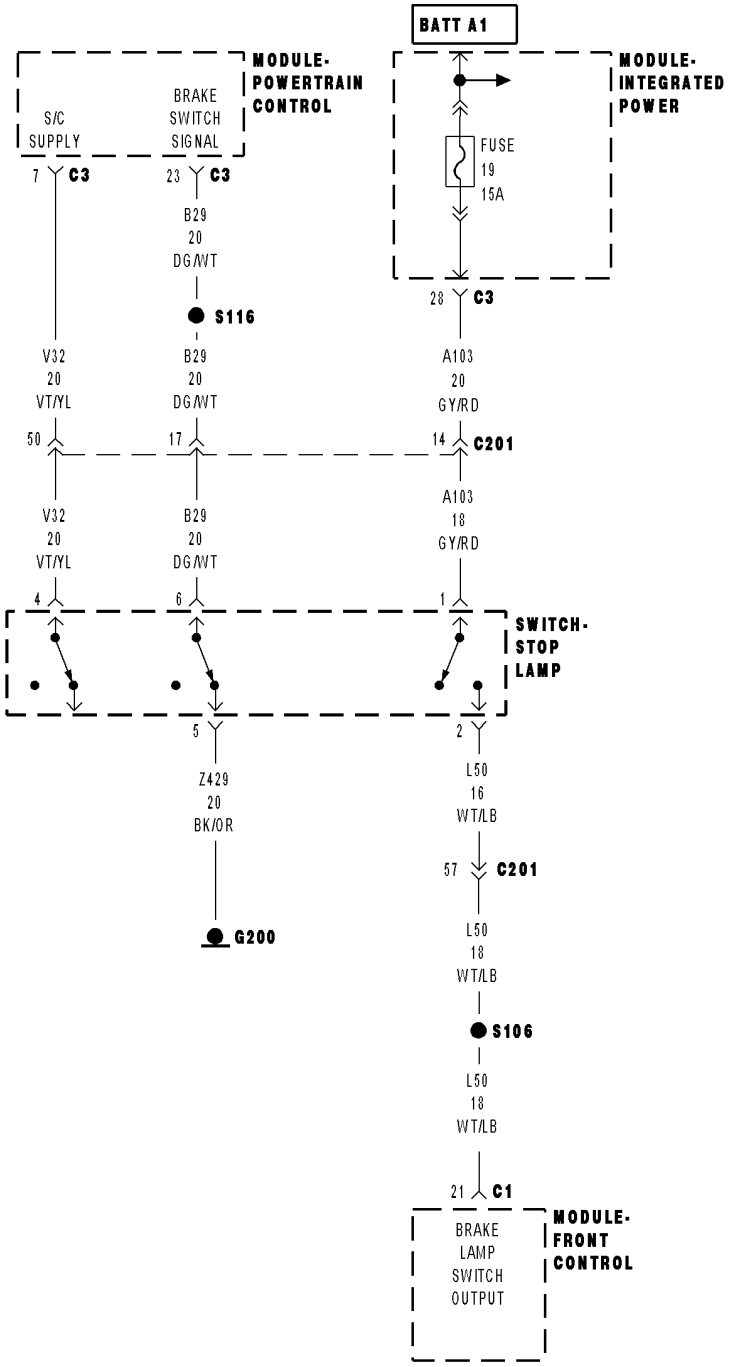
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

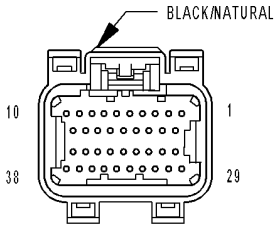
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

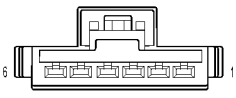
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0573-BRAKE SWITCH 1 STUCK OFF

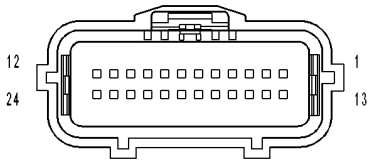




MODULE-
POWERTRAIN
CONTROL C3



SWITCH-
STOP
LAMP



MODULE-
FRONT
CONTROL C1

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P0573-BRAKE SWITCH 1 STUCK OFF (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes Brake Switch No.1 is stuck in the high/off position. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT OPEN
(L50) BRAKE LAMP SWITCH OUTPUT CIRCUIT SHORTED TO GROUND
(Z429) GROUND CIRCUIT OPEN
STOP LAMP SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. STOP LAMP SWITCH

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

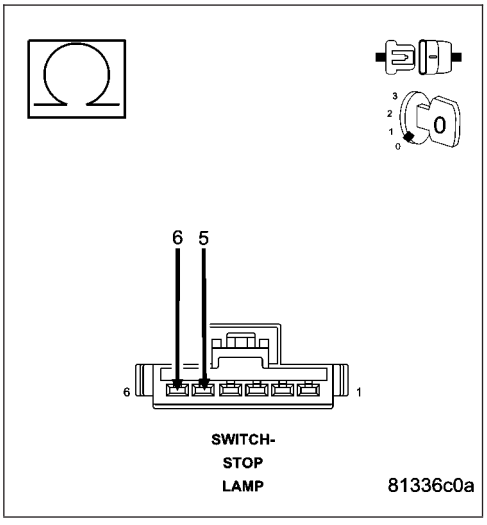
Measure the resistance between the (Z429) Ground circuit terminal and the (B29) Brake Switch No.1 Signal circuit terminal in the Stop Lamp Switch.

Apply and release the Stop Lamp Switch while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to an open circuit?

Yes >> Go To 3

No >> Replace the Stop Lamp Switch.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0573-BRAKE SWITCH 1 STUCK OFF (CONTINUED)

3. (B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

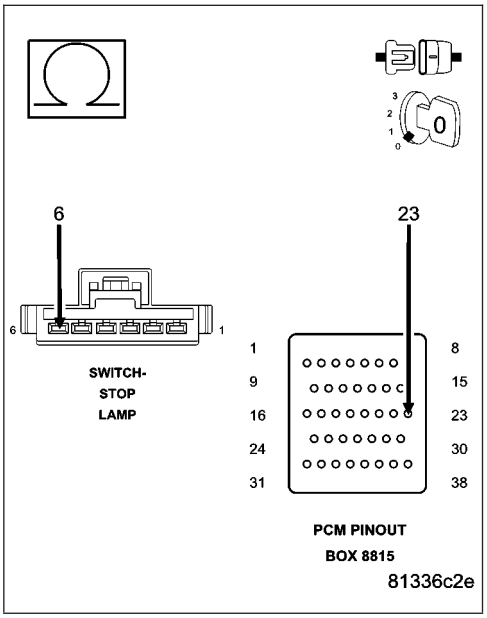
Measure the resistance of the (B29) Brake Switch No.1 Signal circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the open in the (B29) Brake Switch No.1 Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (L50) BRAKE LAMP SWITCH OUTPUT CIRCUIT SHORTED TO GROUND

Disconnect the C1 FCM harness connector.

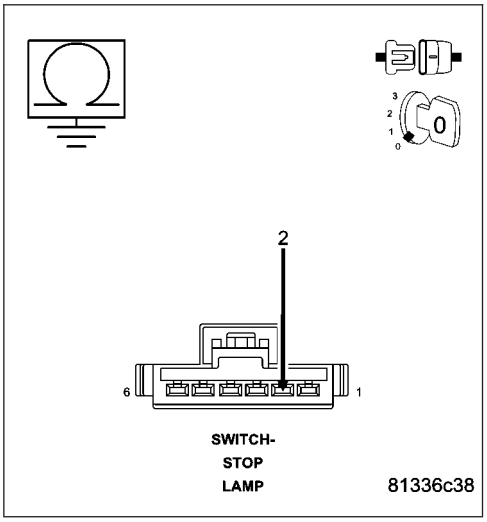
Measure the resistance between ground and the (L50) Brake Lamp Switch Output circuit in the Stop Lamp Switch harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (L50) Brake Lamp Switch Output circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE))

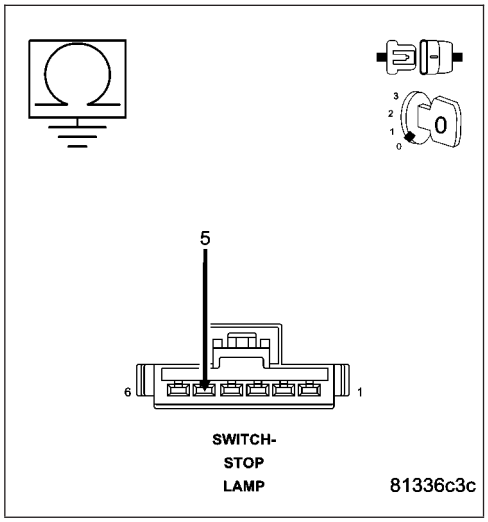
No >> Go To 5



P0573-BRAKE SWITCH 1 STUCK OFF (CONTINUED)

5. (Z429) GROUND CIRCUIT OPEN

Measure the resistance between the (Z429) Ground circuit and ground in the Stop Lamp Switch harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (Z429) Ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

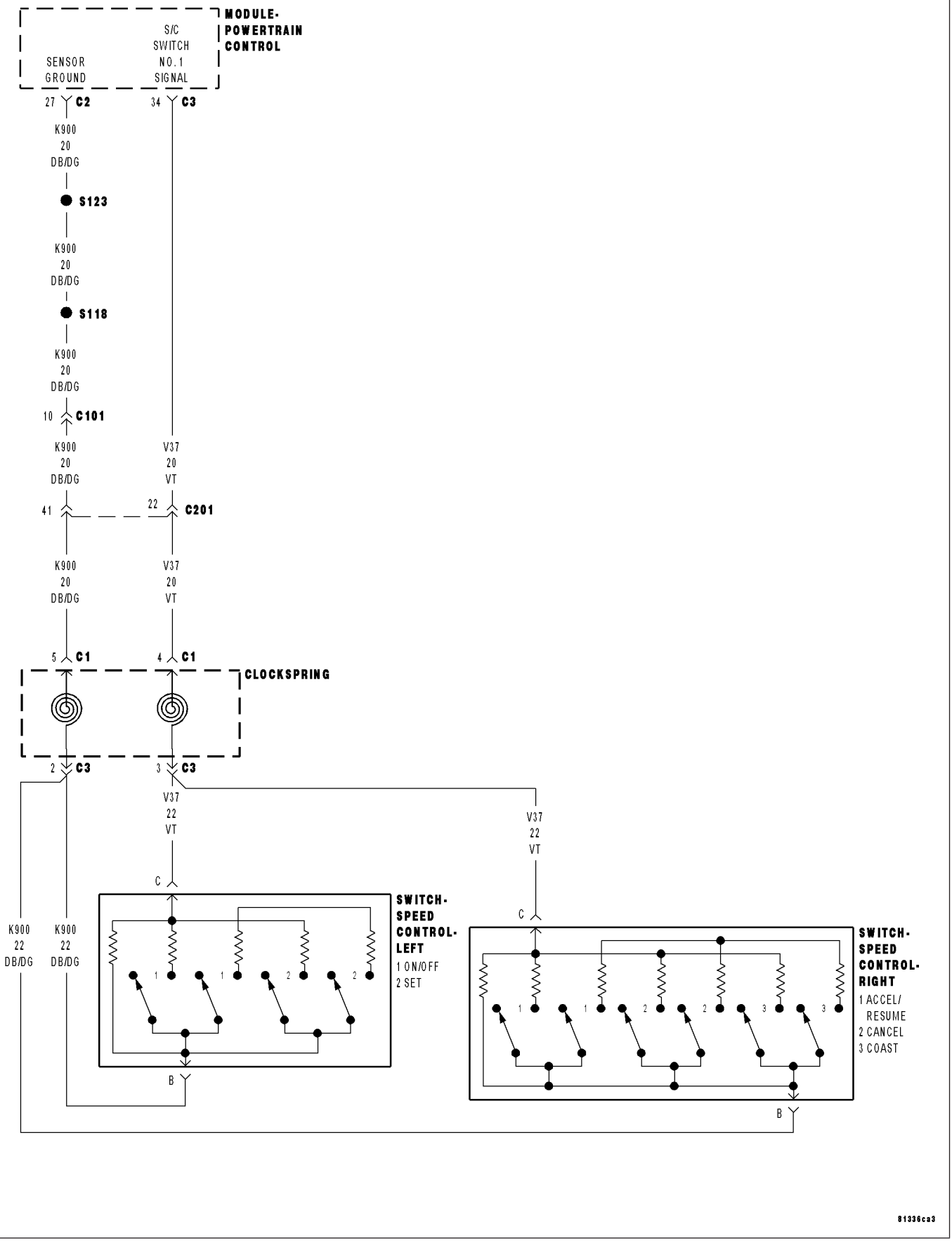
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE))

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW



P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on. Battery voltage above 10 volts.
- **Set Condition:**
  When switch voltage is less than 0.43 of a volt for 2 minutes. One trip fault. Three good trips to turn off the MIL.

Possible Causes
(V37) S/C SIGNAL NO.1 CIRCUIT SHORTED TO GROUND
(V37) S/C SIGNAL NO.1 CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
CLOCKSPRING
SPEED CONTROL ON/OFF SWITCH
SPEED CONTROL RESUME/ACCEL SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL SWITCH VOLTAGE LOW

NOTE: Do not press any of the Speed Control Switch buttons.
Ignition on, engine not running.
With a scan tool, read the Speed Control voltage.

Is the Speed Control voltage below 1.0 volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. SPEED CONTROL ON/OFF SWITCH

Ignition on, engine not running.
With the scan tool, monitor the Speed Control Switch voltage.
Disconnect the Speed Control On/Off Switch harness connector per Service Information.

Did the voltage change to above 4.7 volts?

Yes >> Replace the Speed Control On/Off Switch.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (CONTINUED)

3. SPEED CONTROL RESUME/ACCEL SWITCH

With the scan tool, monitor the Speed Control Switch voltage.

Disconnect the Speed Control Resume/Accel Switch harness connectors per Service Information.

Did the voltage change to above 4.7 volts?

Yes >> Replace the Speed Control Resume/Accel Switch.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. CLOCKSPRING

Turn the ignition off.

Disconnect the C1 Clockspring 6-way harness connector (instrument panel wiring side) per Service Information.

Ignition on, engine not running.

With the scan tool, read the S/C Switch voltage.

Did the S/C Switch volts change to 5.0 volts?

Yes >> Replace the Clockspring.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. (V37) S/C NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Connect the C1 Clockspring harness connector per Service Information.

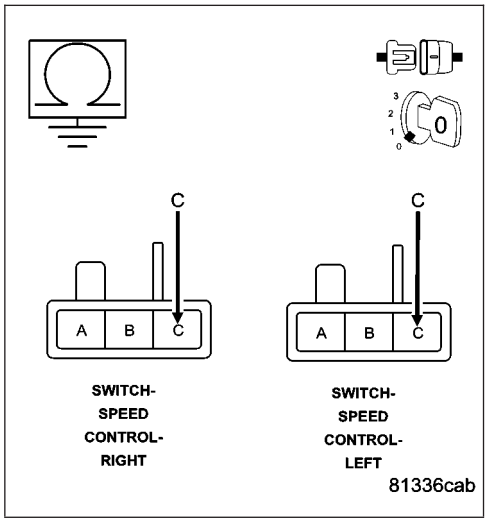
Disconnect the C2 and C3 PCM harness connectors.

Measure the resistance between ground and the (V37) S/C Signal circuit in one of the S/C Switch harness connectors.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V37) S/C Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE))

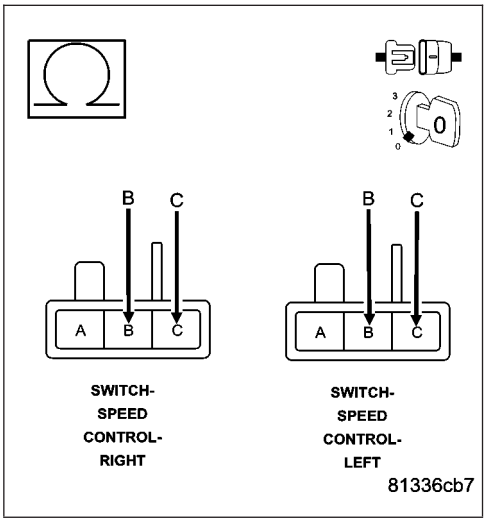
No >> Go To 6



P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (CONTINUED)

6. (V37) S/C SIGNAL NO.1 CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K900) Sensor ground circuit and the (V37) S/C Signal No.1 circuit in the Speed Control Switch.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (V37) S/C Signal No.1 circuit and the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

7. PCM

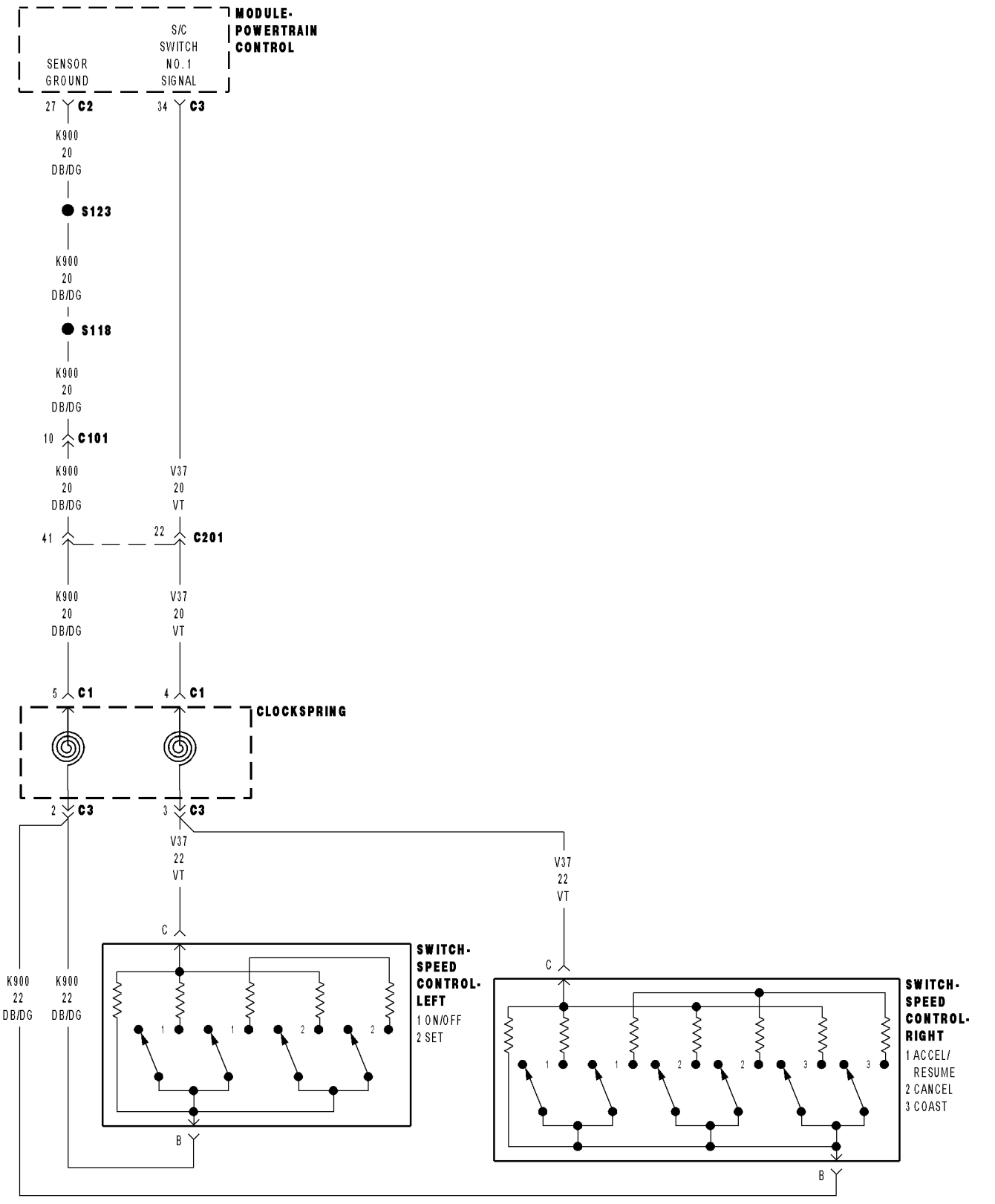
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH



P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on. Battery voltage above 10 volts.
- **Set Condition:**
  The PCM detects an open or short to voltage in the Speed Control Switch Signal circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING
(K900) SENSOR GROUND CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING
(K900) SENSOR GROUND CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH
CLOCKSPRING
SPEED CONTROL SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL SWITCH VOLTAGE HIGH

NOTE: Do not press any of the Speed Control Switch buttons.
Ignition on, engine not running.
With a scan tool, read the Speed Control voltage.

Is the Speed Control voltage above 4.8 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (CONTINUED)

2. SPEED CONTROL SWITCHES

Turn the ignition off.

Remove the Speed Control Switches from the steering wheel.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

Resume/Accel - 15.4 kohms

Cancel - 1.24 kohms

Coast - 2.94 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes >> Go To 3

No >> Replace the Speed Control Switch that had the incorrect resistance value.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. CLOCKSPRING

Disconnect the C1 and C2 Clockspring harness connectors per Service Information.

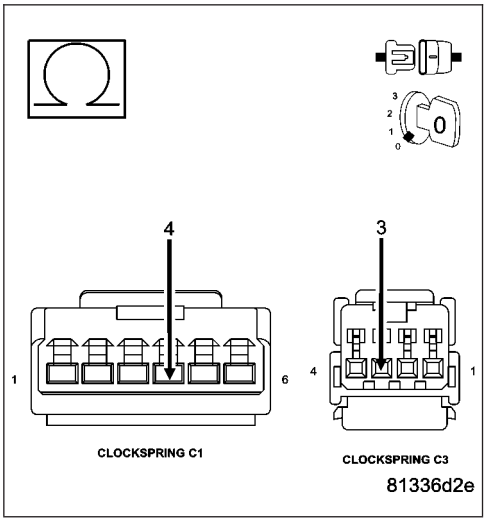
Measure the resistance of the (K900) Sensor ground circuit between the upper and lower 6-way clockspring harness connectors.

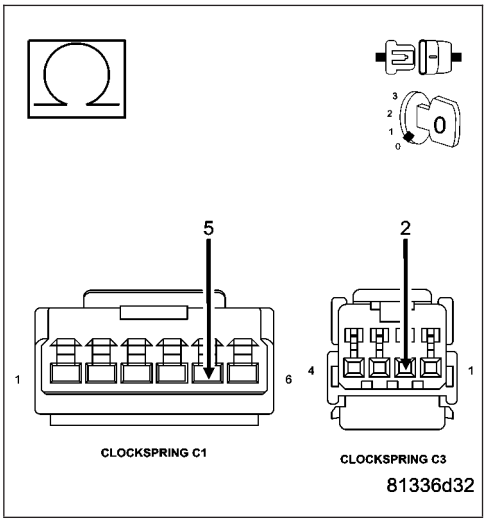
Measure the resistance of the (V37) S/C Switch No.1 Signal circuit between the upper and lower 6-way clockspring harness connectors.

Was the resistance above 5.0 ohms for either circuit?

Yes >> Replace the clockspring.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4





P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (CONTINUED)

4. (V37) S/C SWITH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Connect the Clockspring harness connectors per Service Information.

Disconnect the C2 and C3 PCM harness connectors.

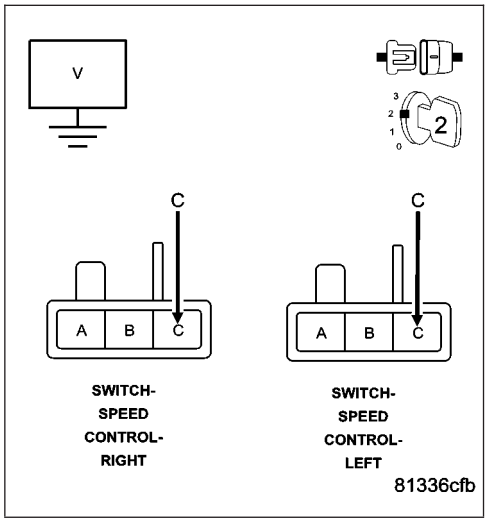
Ignition on, engine not running.

Measure the voltage on the (V37) S/C Switch No.1 Signal circuit in the Speed Control harness connector.

Is the voltage above 5.3 volts?

Yes >> Repair the short to battery voltage in the (V37) S/C Switch No.1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING

Turn the ignition off.

Disconnect the C1 and C2 Clockspring harness connectors per Service Information.

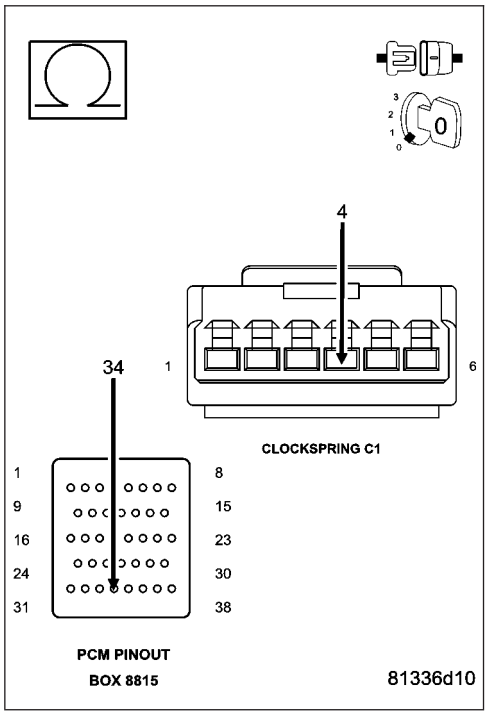
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V37) S/C Switch No.1 Signal circuit from the lower Clockspring harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

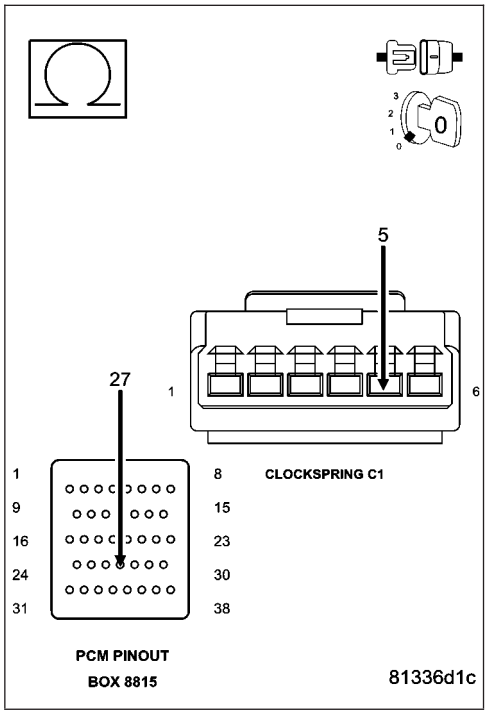
No >> Repair the open in the (V37) S/C Switch No.1 Signal circuit between the PCM and Clockspring.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (CONTINUED)

6. (K900) SENSOR GROUND CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING

Measure the resistance of the (K900) Sensor ground circuit from the C1 Clockspring harness connector to the appropriate terminal of special tool #8815.



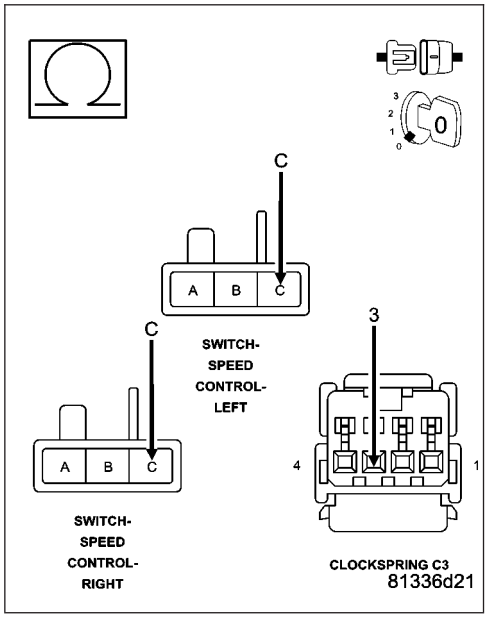
Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open (K900) Sensor ground circuit between the PCM and Clockspring.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH

Measure the resistance of the (V37) S/C Switch No.1 Signal circuit from the C3 Clockspring harness connector to the On/Off switch harness connector.



Is the resistance below 5.0 ohms?

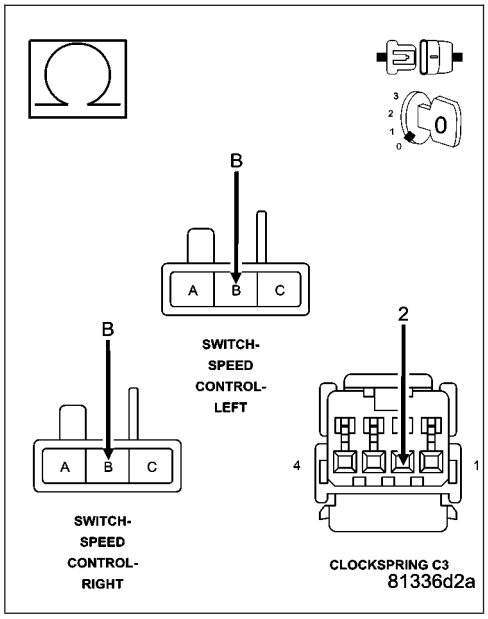
Yes >> Go To 8

No >> Repair the open in the (V37) S/C Switch No.1 Signal circuit, Clockspring to S/C Switch.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (CONTINUED)

8. (K900) SENSOR GROUND CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH

Measure the resistance of the (K900) Sensor ground circuit from the On/Off Switch 2-way harness connector to the C3 Clockspring harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the (K900) Sensor ground circuit between the Clockspring and S/C Switch.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

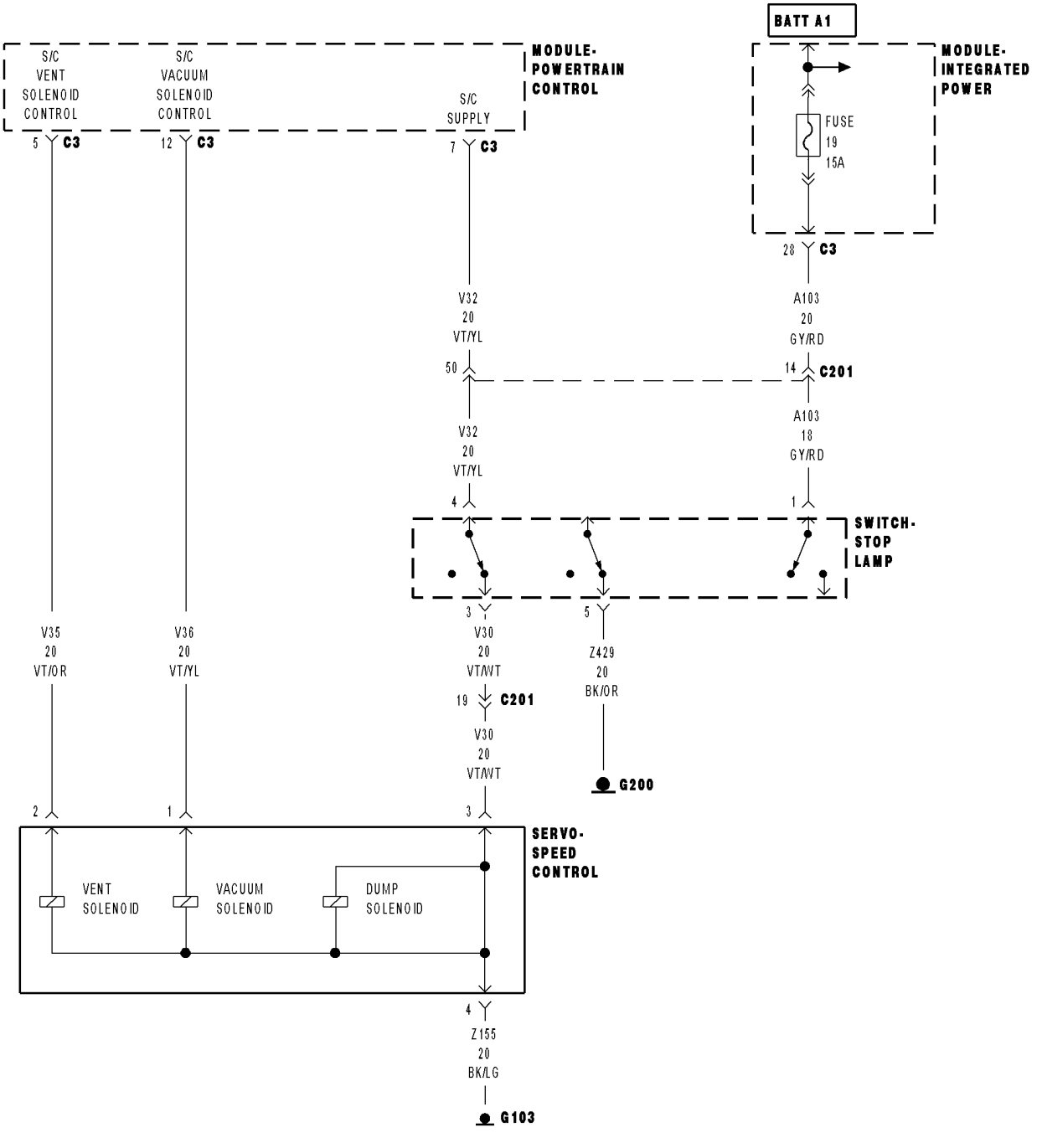
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

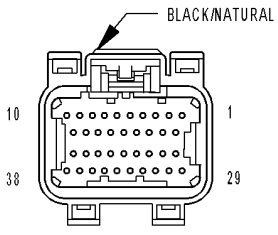
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

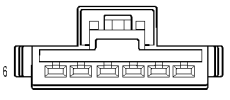
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT

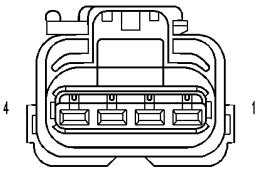




MODULE-
POWERTRAIN
CONTROL C3



SWITCH-
STOP
LAMP



SERVO-
SPEED
CONTROL

81336d6e

P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  An open or shorted condition detected in the Speed control vacuum solenoid control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(V32) S/C SUPPLY CIRCUIT OPEN
(V32) S/C SUPPLY SHORT TO GROUND
(V36) S/C VACUUM SOL CONTROL CIRCUIT SHORTED TO GROUND
(V36) S/C VACUUM SOL CONTROL CIRCUIT OPEN
(Z155) GROUND CIRCUIT OPEN
SPEED CONTROL VACUUM SOLENOID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL VACUUM CONTROL

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

With the scan tool, actuate the Speed Control Vacuum Solenoid and note operation.

Does the Speed Control Vacuum Solenoid actuate properly?

Yes >> Refer to the INTERMITTENT CONDITION symptom in the Driveability category.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

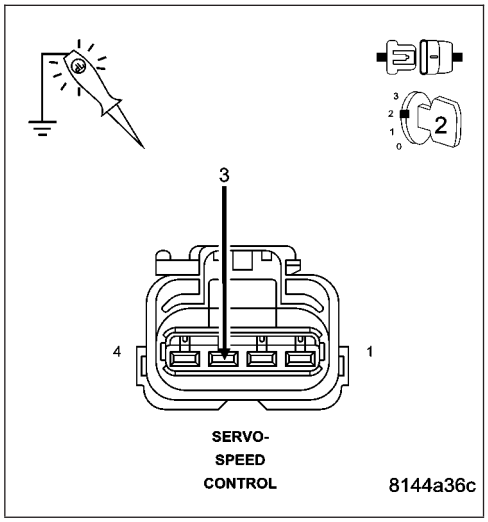
P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT (CONTINUED)

2. (V30) S/C BRAKE SWITCH OUTPUT CIRCUIT

Turn the ignition off.
Disconnect the S/C Servo harness connector.
Ignition on, engine not running.
Using the scan tool, actuate the S/C Vacuum Solenoid.
Using a test light connected to ground, probe the (V30) S/C Brake Switch Output circuit in the S/C Servo harness connector.

Does the test light illuminate brightly and flash on and off?

Yes >> Go To 5
No >> Go To 3

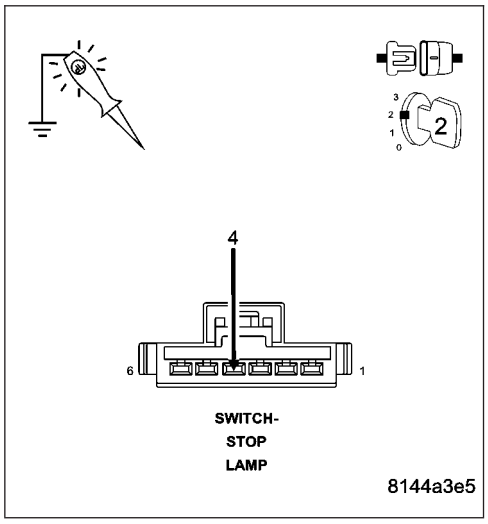


3. (V32) S/C SUPPLY CIRCUIT

Turn the ignition off.
Connect the S/C Servo harness connector.
Disconnect the Stop Lamp Switch harness connector.
Ignition on, engine not running.
Using the scan tool, actuate the S/C Vacuum Solenoid.
Using a test light connected to ground, probe the (V32) S/C Supply circuit in the Stop Lamp Switch harness connector.

Does the test light illuminate brightly?

Yes >> Go To 4
No >> Go To 8



P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT (CONTINUED)

4. (Z155) S/C GROUND CIRCUIT OPEN

Turn the ignition off.

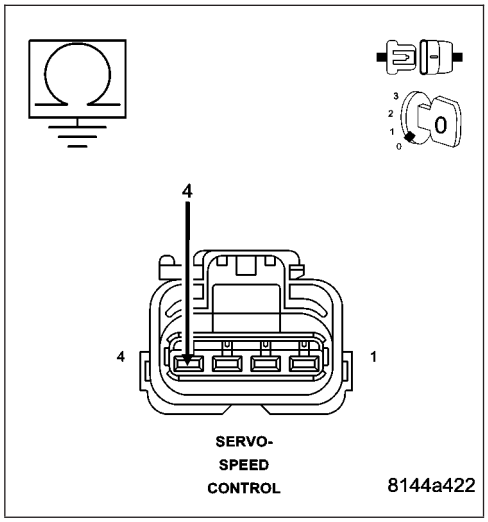
Disconnect the S/C Servo harness connector.

Measure the resistance between ground and the (Z155) S/C Ground circuit at the S/C Servo harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (Z155) S/C Ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. SPEED CONTROL VACUUM SOLENOID

Ignition on, engine not running.

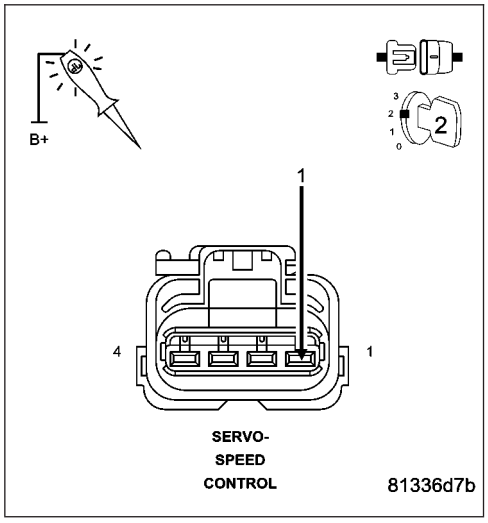
With the scan tool, actuate the Speed Control Vacuum Solenoid.

Using a 12-volt test light connected to battery voltage, probe the (V36) S/C Vacuum Control circuit.

Does the test light illuminate brightly and flash on and off?

Yes >> Replace the Speed Control Servo.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT (CONTINUED)

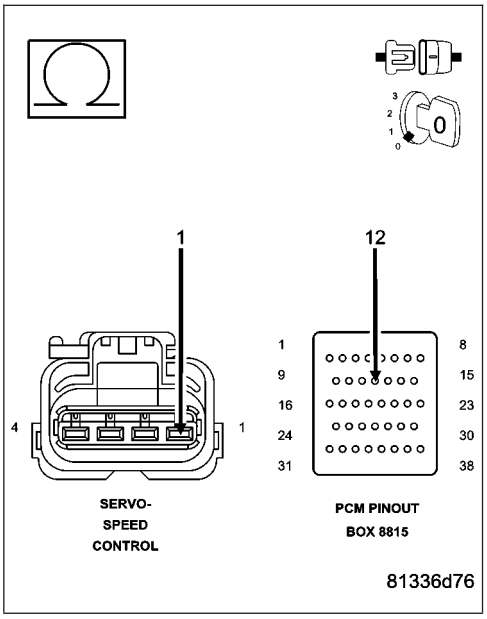
6. (V36) S/C VACUUM SOL CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V36) S/C Vacuum Sol Control circuit from the Speed Control Servo harness connector to the appropriate terminal of special tool # 8815.



Is the resistance below 5.0 ohms?

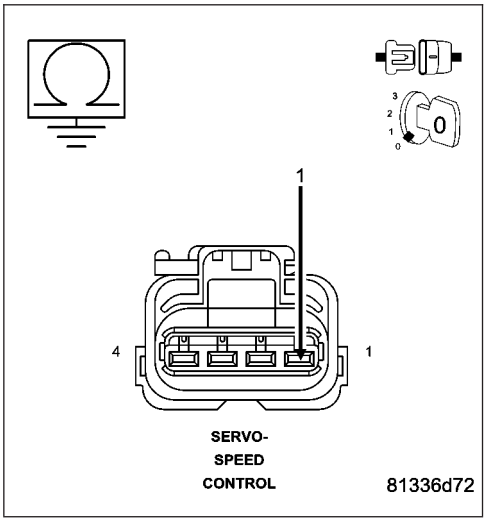
Yes >> Go To 7

No >> Repair the open/high resistance in the (V36) S/C Vacuum Sol Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. (V36) SPEED CONTROL VACUUM SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V36) S/C Vacuum Solenoid Control circuit at the Speed Control Servo harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V36) S/C Vacuum Sol Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT (CONTINUED)

8. (V32) S/C SUPPLY OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

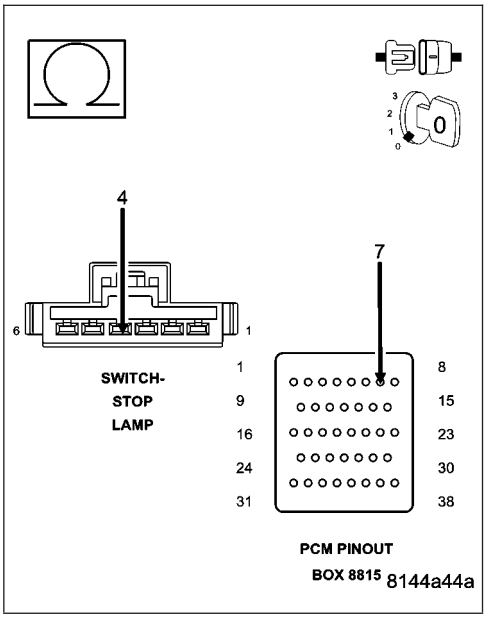
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V32) S/C Supply circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open/high resistance in the (V32) S/C Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



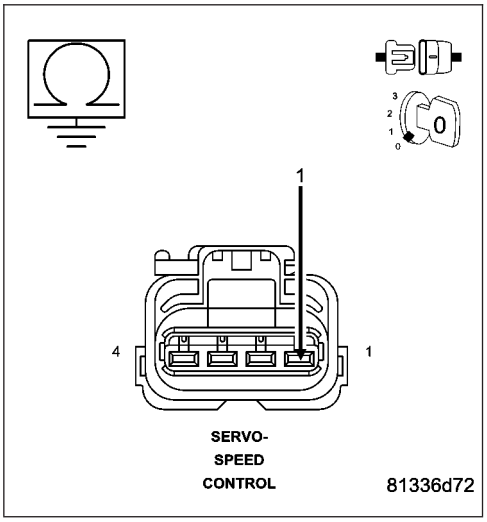
9. (V32) S/C SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V32) S/C Supply circuit at the Speed Control Servo harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V32) S/C Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10



10. PCM

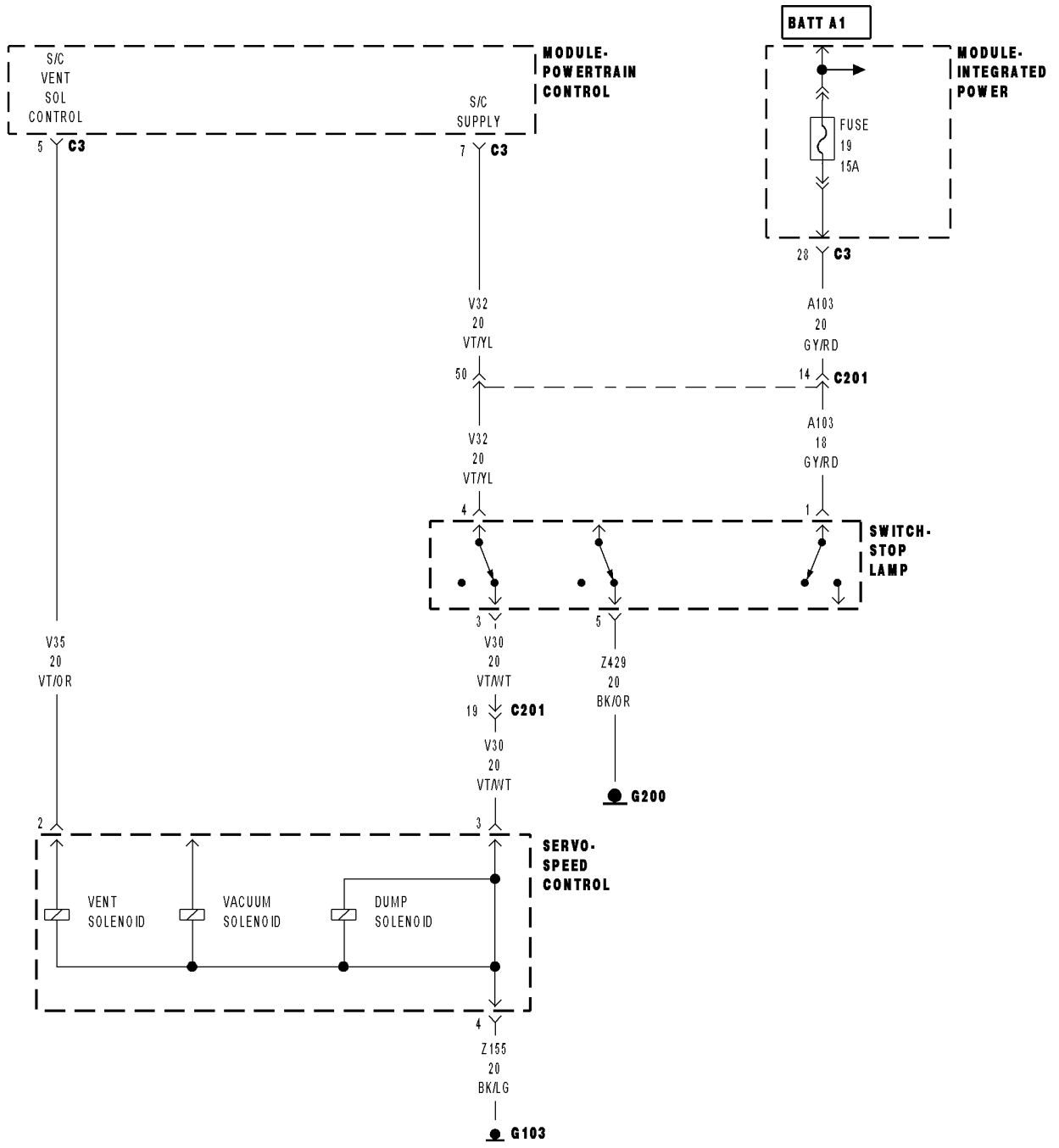
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

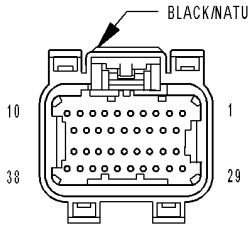
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

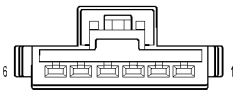
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0586-SPEED CONTROL VENT CONTROL CIRCUIT

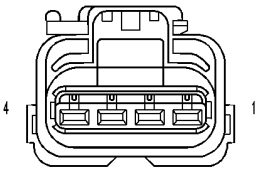




MODULE-
POWERTRAIN
CONTROL C3



SWITCH-
STOP
LAMP



SERVO-
SPEED
CONTROL

81336e25

P0586-SPEED CONTROL VENT CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  An open or shorted condition detected in the Speed control vent solenoid control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(V32) S/C SUPPLY CIRCUIT OPEN
(V32) S/C SUPPLY SHORT TO GROUND
(V35) S/C VENT SOL CONTROL CIRCUIT SHORTED TO GROUND
(V35) S/C VENT SOL CONTROL CIRCUIT OPEN
(Z155) GROUND CIRCUIT OPEN
SPEED CONTROL VENT SOLENOID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL VENT CONTROL

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
With the scan tool, actuate the Speed Control Vent Solenoid and note operation.

Does the Speed Control Vacuum Solenoid actuate properly?

Yes >> Refer to the INTERMITTENT CONDITION symptom in the Driveability category.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

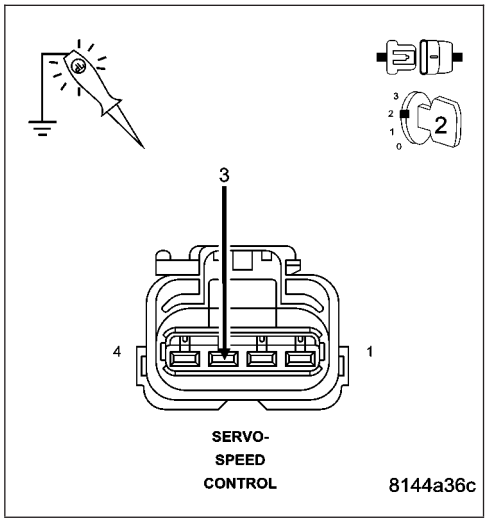
P0586-SPEED CONTROL VENT CONTROL CIRCUIT (CONTINUED)

2. (V30) S/C BRAKE SWITCH OUTPUT CIRCUIT

Turn the ignition off.
Disconnect the S/C Servo harness connector.
Ignition on, engine not running.
Using the scan tool, actuate the S/C Vent Solenoid.
Using a test light connected to ground, probe the (V30) S/C Brake Switch Output circuit in the S/C Servo harness connector.

Does the test light illuminate brightly and flash on and off?

Yes >> Go To 5
No >> Go To 3

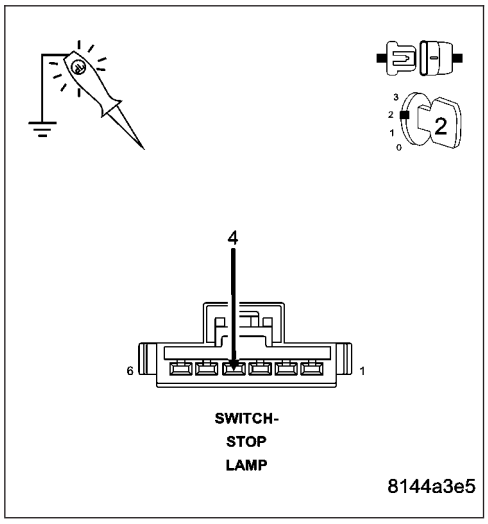


3. (V32) S/C SUPPLY CIRCUIT

Turn the ignition off.
Connect the S/C Servo harness connector.
Disconnect the Stop Lamp Switch harness connector.
Ignition on, engine not running.
Using the scan tool, actuate the S/C Vent Solenoid.
Using a test light connected to ground, probe the (V32) S/C Supply circuit in the Stop Lamp Switch harness connector.

Does the test light illuminate brightly?

Yes >> Go To 4
No >> Go To 8



P0586-SPEED CONTROL VENT CONTROL CIRCUIT (CONTINUED)

4. (Z155) S/C GROUND CIRCUIT OPEN

Turn the ignition off.

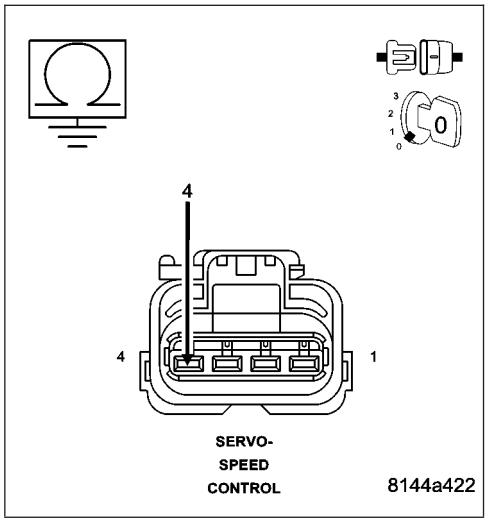
Disconnect the S/C Servo harness connector.

Measure the resistance between ground and the (Z155) S/C Ground circuit at the S/C Servo harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (Z155) S/C Ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. SPEED CONTROL VENT SOLENOID

Ignition on, engine not running.

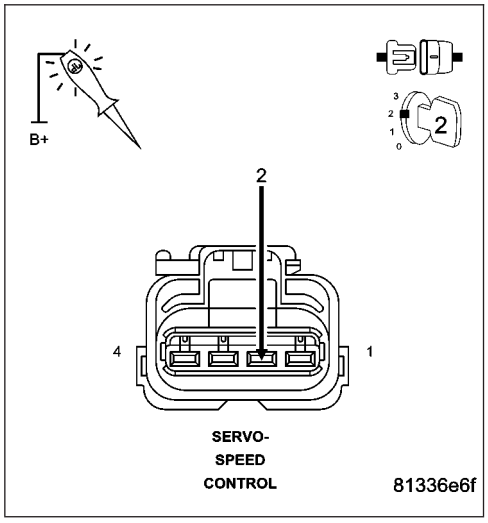
With the scan tool, actuate the Speed Control Vent Solenoid.

Using a 12-volt test light connected to battery voltage, probe the (V36) S/C Vent Control circuit.

Does the test light illuminate brightly and flash on and off?

Yes >> Replace the Speed Control Servo.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0586-SPEED CONTROL VENT CONTROL CIRCUIT (CONTINUED)

6. (V35) S/C VENT CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

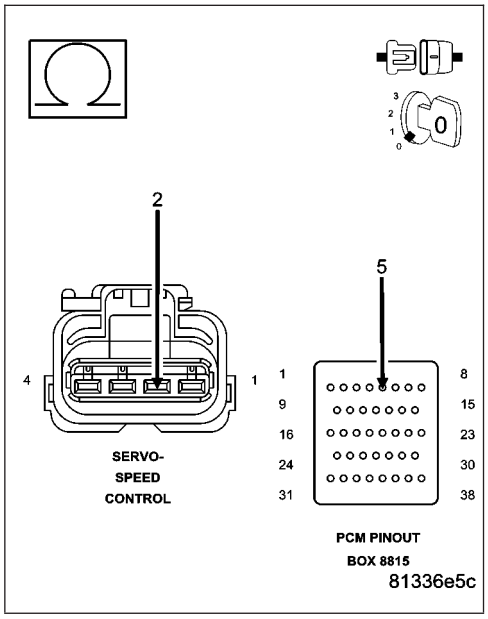
Measure the resistance of the (V35) S/C Vent Sol Control circuit from the Speed Control Servo harness connector to the appropriate terminal of special tool # 8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open/high resistance in the (V35) S/C Vent Sol Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (V35) SPEED CONTROL VENT SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

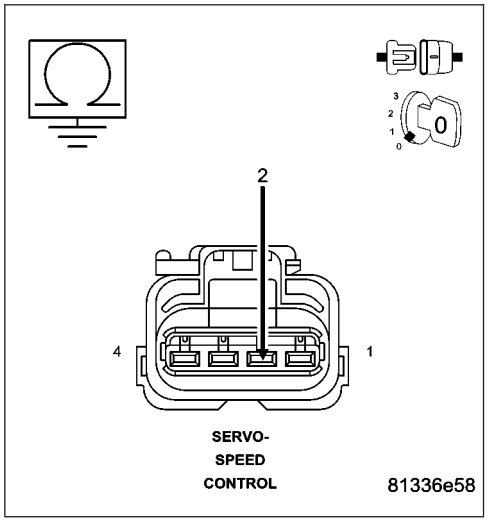
Measure the resistance between ground and the (V35) S/C Vent Sol Control circuit at the Speed Control Servo harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V35) S/C Vent Sol Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10



P0586-SPEED CONTROL VENT CONTROL CIRCUIT (CONTINUED)

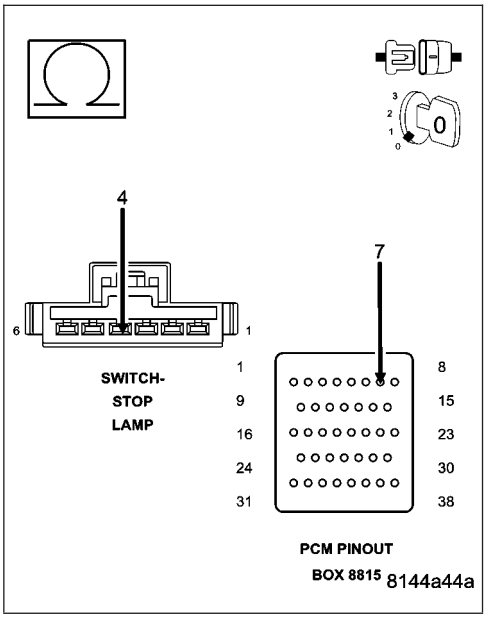
8. (V32) S/C SUPPLY OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V32) S/C Supply circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.



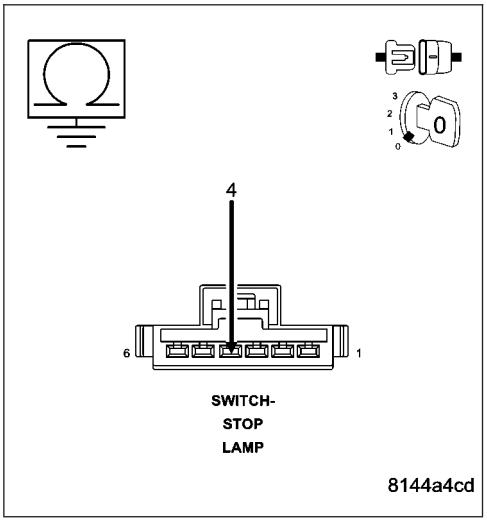
Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open/high resistance in the (V32) S/C Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. (V32) S/C SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V32) S/C Supply circuit at the Speed Control Servo harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V32) S/C Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

10. PCM

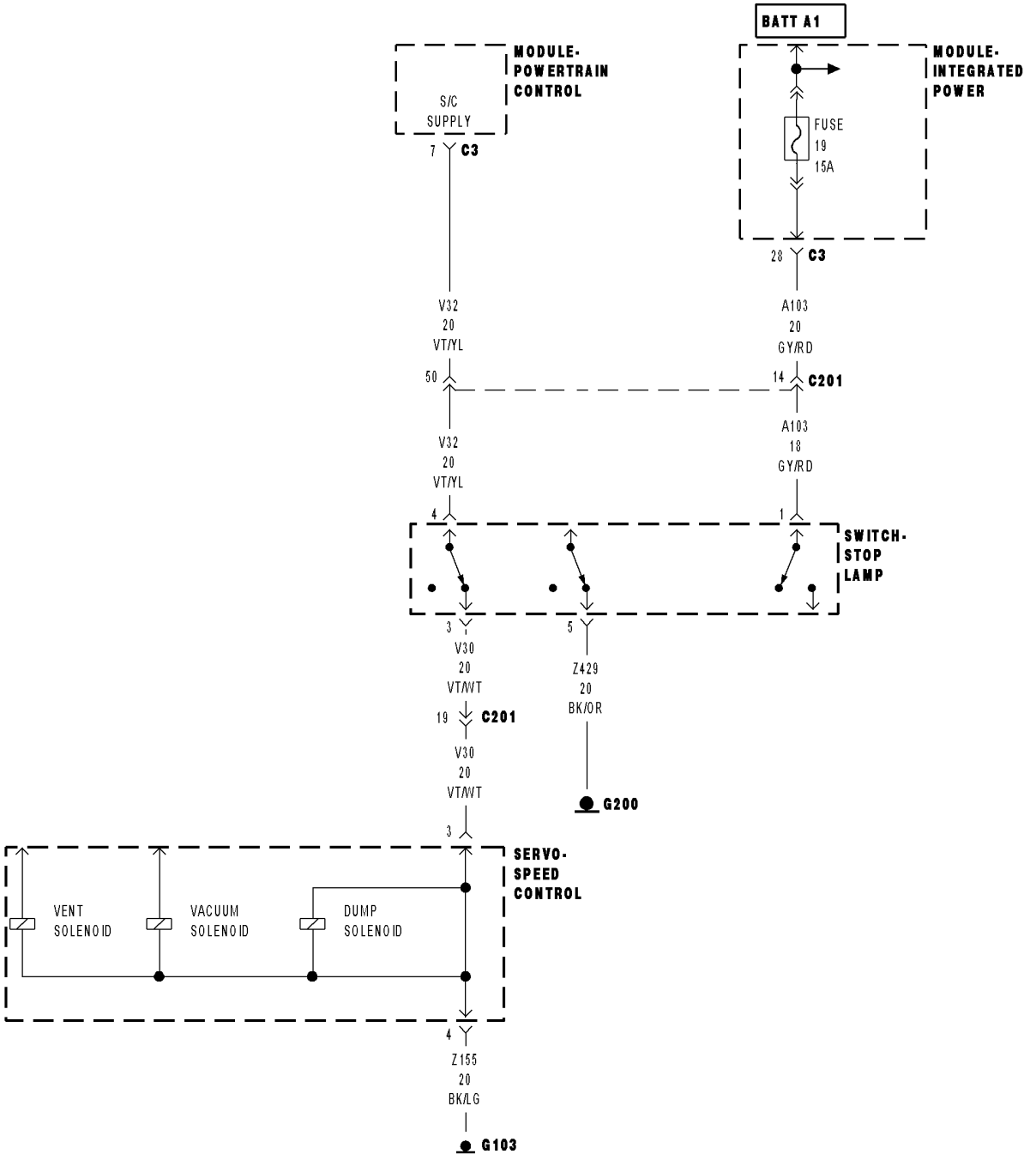
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

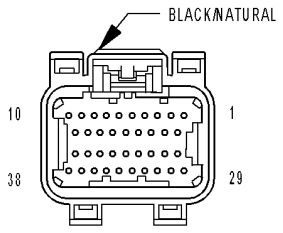
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

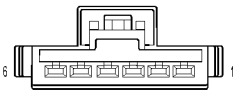
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT

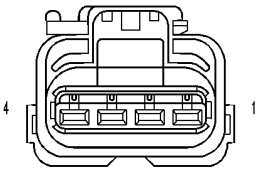




MODULE-
POWERTRAIN
CONTROL C3



SWITCH-
STOP
LAMP



SERVO-
SPEED
CONTROL

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P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on. The speed control switched on.
- **Set Condition:**
  The speed control power supply circuit is either open or shorted to ground. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(V32) S/C SUPPLY CIRCUIT OPEN
(V32) S/C SUPPLY CIRCUIT SHORTED TO GROUND
(V30) S/C BRAKE SWITCH OUTPUT CIRCUIT OPEN
(V30) S/C BRAKE SWITCH OUTPUT CIRCUIT SHORTED TO GROUND
STOP LAMP SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If this code is setting on a vehicle that doesn't have a S/C Servo, flash the correct code into the PCM or the wrong PCM may have previously been installed.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

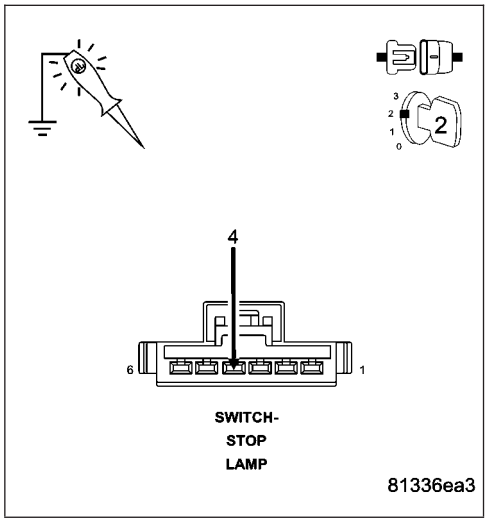
P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT (CONTINUED)

2. (V32) S/C SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

Using a 12-volt test light connected to ground, probe the (V32) S/C Supply circuit in the Switch harness connector while holding the Cruise Switch in the ON position.



Does the test light illuminate brightly?

Yes >> Go To 3

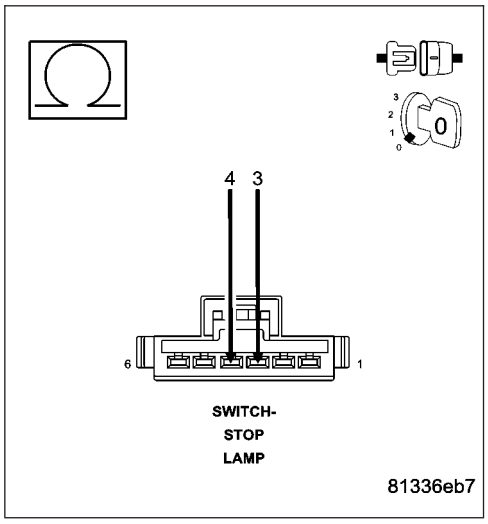
No >> Go To 7

3. STOP LAMP SWITCH

Disconnect and remove the Stop Lamp Switch.

Measure the resistance across the (V32) S/C Supply circuit terminal and the (V30) S/C Brake Switch Output circuit terminal in the Stop Lamp Switch.

Push the Plunger of the Switch in and let it out.



Does the resistance change from below 5.0 ohms to an open circuit?

Yes >> Go To 4

No >> Replace the Stop Lamp Switch.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT (CONTINUED)

4. (V30) S/C BRAKE SWITCH OUTPUT

Turn the ignition off.

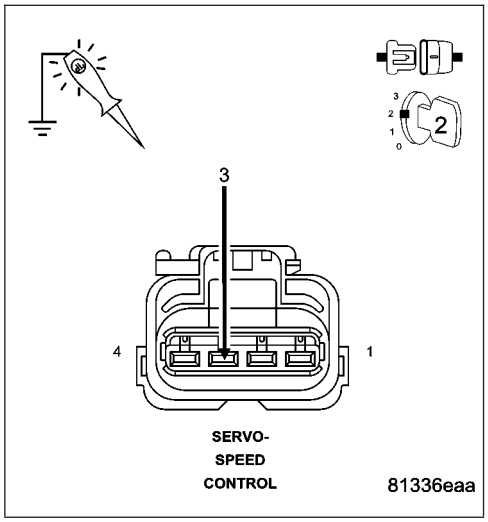
Connect the Stop Lamp Switch harness connecter and install the Switch.

Disconnect the Speed Control Servo harness connector.

Ignition on, engine not running.

NOTE: It is necessary to PRESS and HOLD the Speed Control Switch in the ON position while checking for voltage.

Using a 12-volt test light connected to ground, probe the (V30) S/C Brake Switch Output circuit in the Servo Harness connector.



Does the test light illuminate brightly?

Yes >> Replace the S/C Servo.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

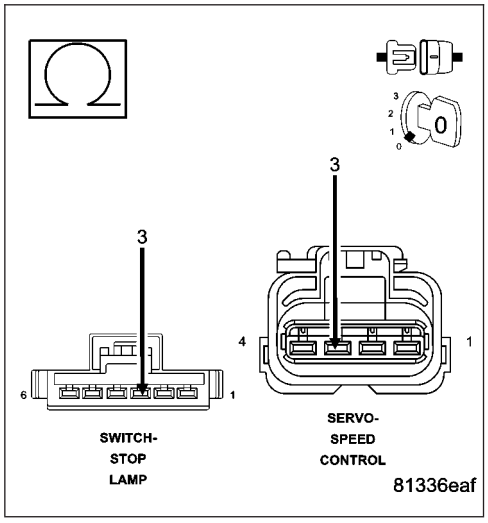
No >> Go To 5

5. (V30) S/C BRAKE SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Brake Lamp Switch harness connector.

Measure the resistance of the (V30) S/C Brake Switch Output circuit from the Stop Lamp Switch harness connector to the S/C Servo harness connector.



Is the resistance below 5.0 ohms?

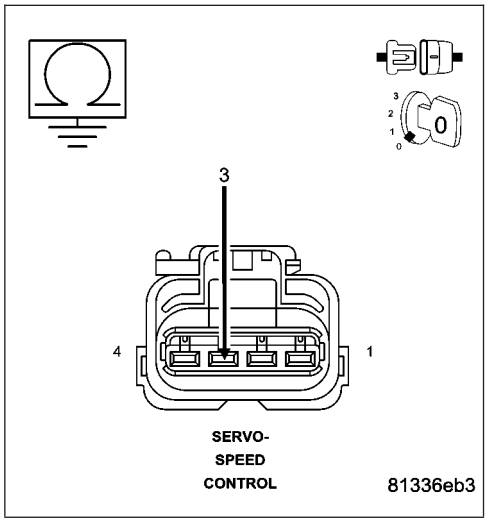
Yes >> Repair the excessive resistance in the (V30) S/C Brake Switch Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT (CONTINUED)

6. (V30) S/C BRAKE SWITCH OUTPUT CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V30) S/C Brake Switch Output circuit in the Speed Control Servo harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V30) S/C Brake Switch Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

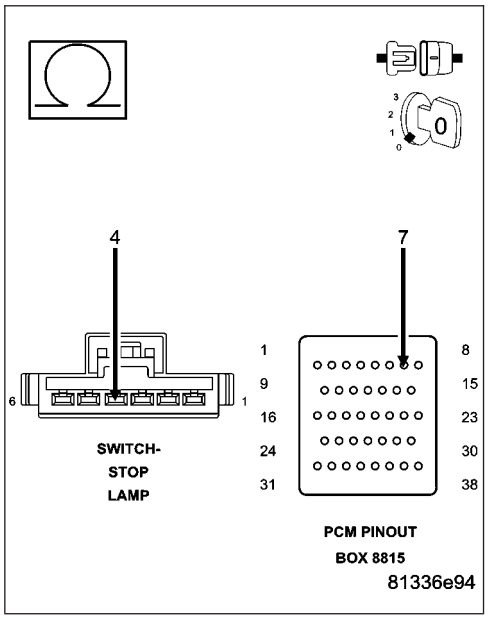
7. (V32) S/C SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V32) S/C Supply circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.



Is the resistance above 5.0 ohms?

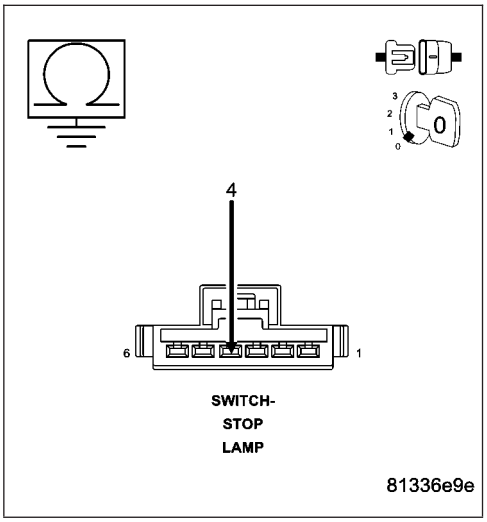
Yes >> Repair the open in the (V32) S/C Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT (CONTINUED)

8. (V32) S/C SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V32) S/C Supply circuit in the Stop Lamp Switch harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V32) S/C Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0600-SERIAL COMMUNICATION LINK

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Internal Bus communication failure between processors. One Trip Fault. Three Global Good Trips to Clear.

Possible Causes
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM

NOTE: Diagnose any CMP or CKP Sensor faults before continuing. Check for intermittent loose CMP or CKP connections.

The Powertrain Control Module is reporting internal errors, view repair to continue.

Repair

Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0601-INTERNAL MEMORY CHECKSUM INVALID

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Internal checksum for software failed, does not match calculated value. One Trip Fault, Three Good Trips to clear.

Possible Causes
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM

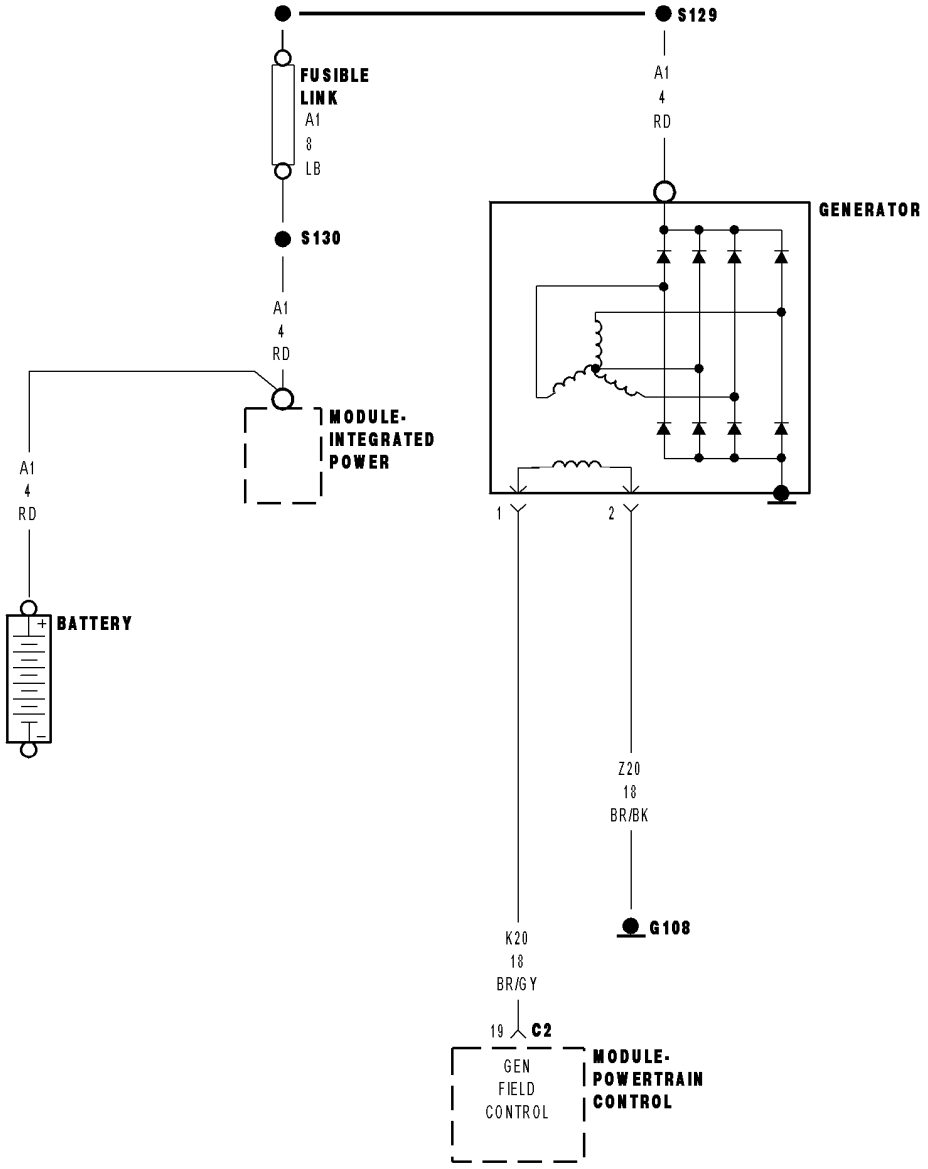
NOTE: Diagnose any CMP or CKP Sensor faults before continuing. Check for intermittent loose CMP or CKP connections.

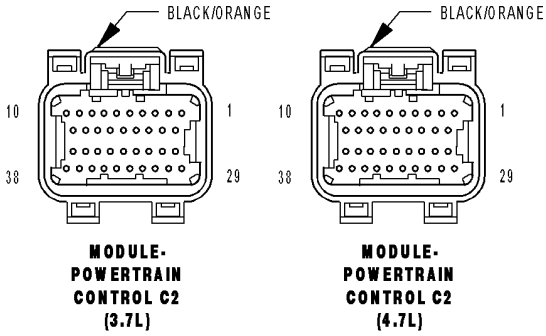
The Powertrain Control Module is reporting internal errors, view repair to continue.

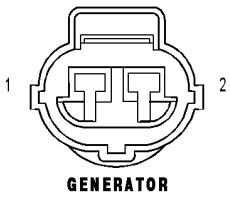
Repair

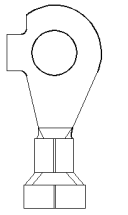
Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0622-GENERATOR FIELD CONTROL CIRCUIT









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P0622-GENERATOR FIELD CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Engine running.
- **Set Condition:**
  When the PCM tries to regulate the generator field with no result during monitoring. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K20) GEN FIELD CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K20) GEN FIELD CONTROL CIRCUIT OPEN
(K20) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND
(Z20) GROUND CIRCUIT OPEN
GENERATOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. GENERATOR OPERATION

Turn the ignition off.

Disconnect the Generator Field harness connector.

Using a 12-volt test light, jump it across the Generator Field harness connector.

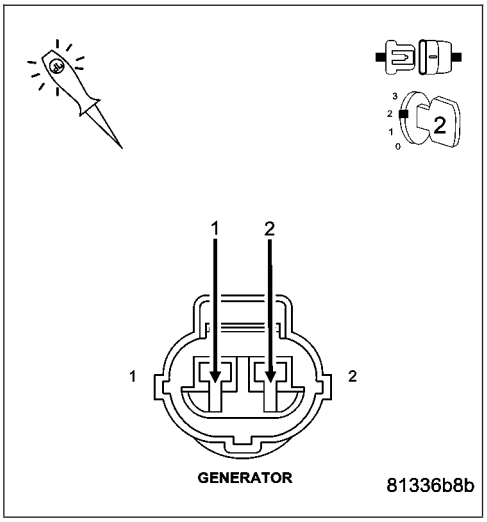
Ignition on, engine not running.

With the scan tool, actuate the Generator Field Control circuit.

Does the test light illuminate brightly and flash on and off?

Yes >> Replace the Generator.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



P0622-GENERATOR FIELD CONTROL CIRCUIT (CONTINUED)

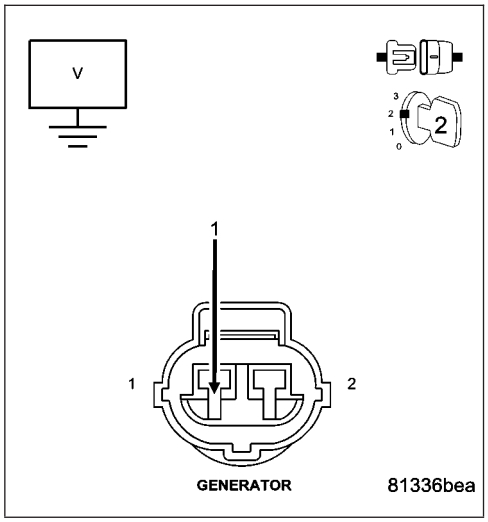
3. (K20) GEN FIELD CIRCUIT SHORTED BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K20) Gen Field Control circuit in the Generator Field harness connector.



Is the voltage above 1.0 volt?

Yes >> Repair the short to battery voltage in the (K20) Gen Field Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

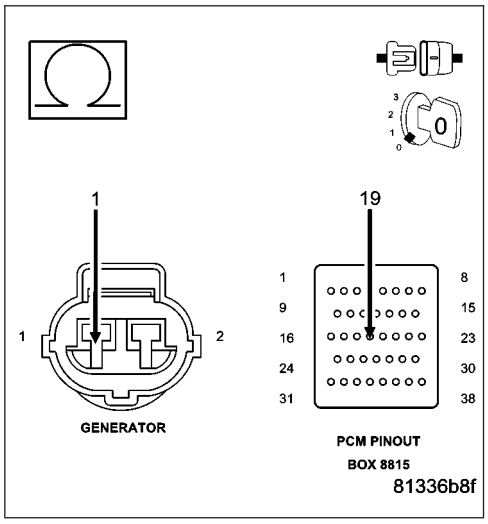
No >> Go To 4

4. (K20) GEN FIELD CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K20) Gen Field Control circuit from the Generator Field harness connector to appropriate terminal of the special tool #8815.



Is the resistance below 5.0 ohms?

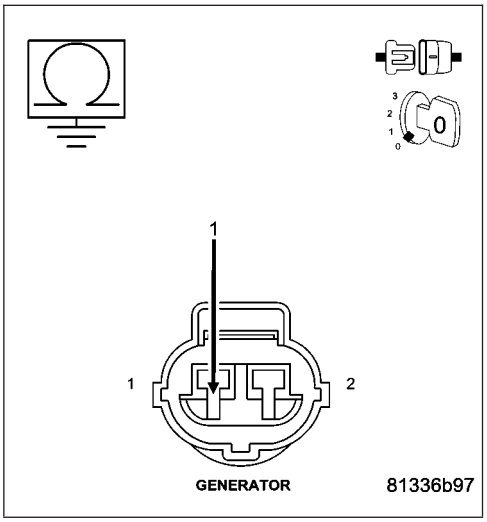
Yes >> Go To 5

No >> Repair the open in the (K20) Gen Field Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0622-GENERATOR FIELD CONTROL CIRCUIT (CONTINUED)

5. (K20) GEN FIELD CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K20) Gen Field Control circuit in the Generator Field harness connector.



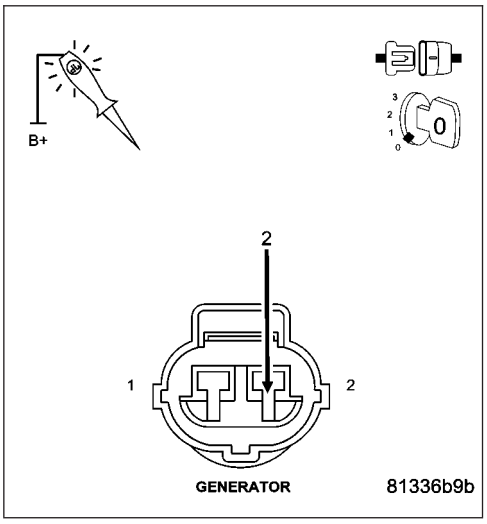
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K20) Gen Field Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (Z20) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to battery voltage, probe the (Z20) Ground circuit in the Gen Field harness connector.



Does the test light illuminate brightly?

Yes >> Go To 7

No >> Repair the open in the (Z20) Ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

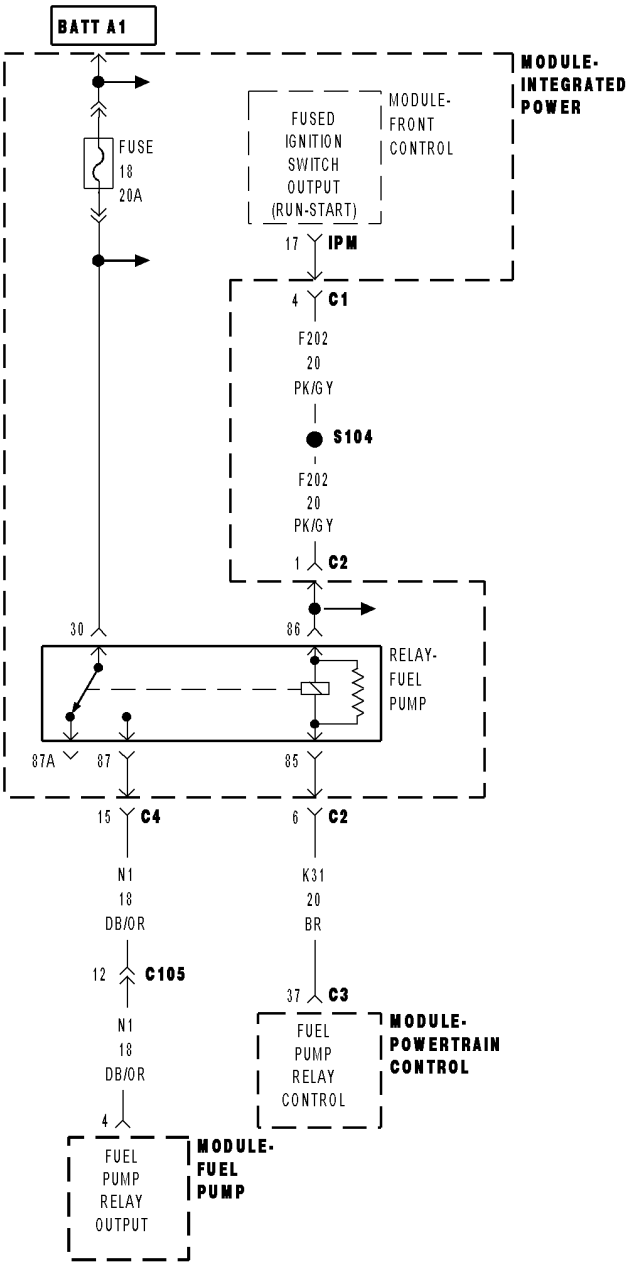
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

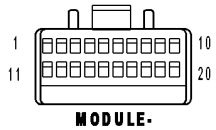
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

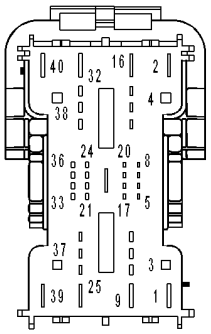
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0627-FUEL PUMP RELAY CIRCUIT

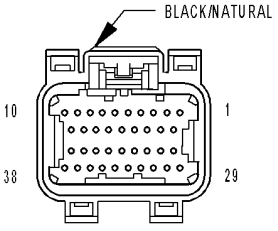




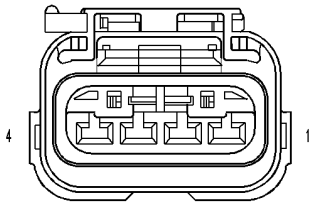
MODULE-
INTEGRATED
POWER C2



MODULE-
INTEGRATED
POWER C4



MODULE-
POWERTRAIN
CONTROL C3



MODULE-
FUEL
PUMP

81336f50

P0627-FUEL PUMP RELAY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  An open or shorted condition is detected in the fuel pump relay control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
INTERNAL FUSED B+ CIRCUITS
(K31) FUEL PUMP RELAY CONTROL CIRCUIT OPEN
(K31) FUEL PUMP RELAY CONTROL CIRCUIT SHORTED TO GROUND
FUEL PUMP RELAY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. FUEL PUMP RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the Fuel Pump Relay.

Is the Fuel Pump Relay operating?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. FUEL PUMP RELAY

Turn the ignition off.

Remove the Fuel Pump Relay from the IPM.

Measure the resistance of the Fuel Pump Relay Coil.

Is the resistance between 70 to 90 ohms?

Yes >> Go To 3

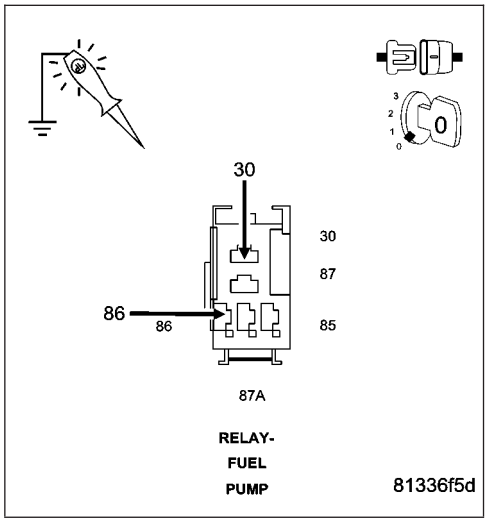
No >> Replace the Fuel Pump Relay.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0627-FUEL PUMP RELAY CIRCUIT (CONTINUED)

3. INTERNAL FUSED B+ CIRCUITS

Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the Internal Fused B+ circuits.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the open or short to ground in the Internal Fused B+ circuits. Inspect the related fuse and repair as necessary.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

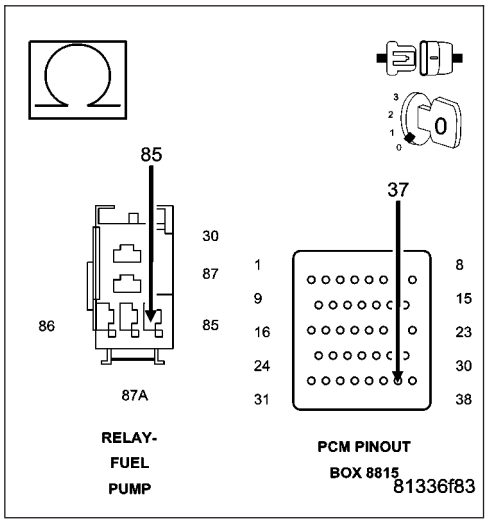
4. (K31) FUEL PUMP RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K31) Fuel Pump Relay Control circuit from the IPM to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 5

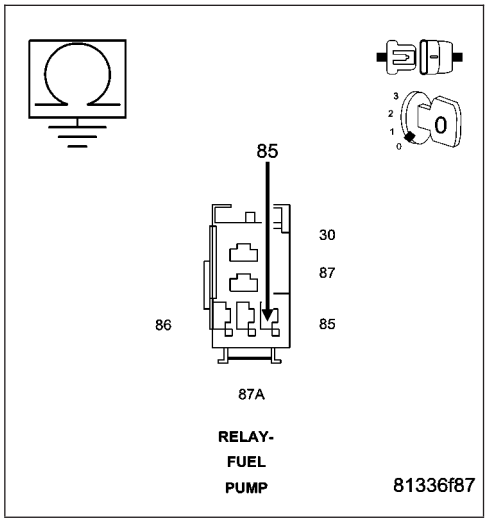
No >> Repair the open in the (K31) Fuel Pump Relay Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0627-FUEL PUMP RELAY CIRCUIT (CONTINUED)

5. (K31) FUEL PUMP RELAY CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K31) Fuel Pump Relay Control circuit in the IPM.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K31) Fuel Pump Relay Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0630-VIN NOT PROGRAMMED IN PCM

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At initialization.
- **Set Condition:**
  The VIN has not been programmed into the PCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PROGRAMMING VIN INTO PCM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAMMING VIN INTO THE PCM

Ignition on, engine not running.

Using the scan tool, program VIN into the PCM.

Start the engine.

NOTE: If the engine will not start, crank the engine over for 15 seconds. Crank at least 2 times with the ignition switch returning to the off position each time.

Allow the engine to reach normal operating temperature.

With the scan tool, read DTCs.

Does the DTC reset?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> The VIN has been successfully programmed into the PCM. Test is complete.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0632-ODOMETER NOT PROGRAMMED IN PCM

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  Odometer is not programed into the PCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PROGRAMMING MILEAGE INTO THE PCM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAMMING MILEAGE INTO THE PCM

Ignition on, engine not running.
With the scan tool, erase DTCs.
Using a scan tool, program the mileage into the PCM.
Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, read DTCs.

Does the DTC reset?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> The mileage has been successfully programmed into the PCM. Test is complete.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0633-SKIM SECRET KEY NOT STORED IN PCM

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The SKIM Key information has not been programmed into the PCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PROGRAMMING SKIM KEY INTO THE PCM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAMMING SKIM KEY INTO THE PCM

Ignition on, engine not running.

With a scan tool, erase DTCs.

Using the scan tool, program the SKIM Key information into the PCM.

Start the engine.

NOTE: If the engine will not start, crank the engine over for 15 seconds. Crank at least 2 times with the ignition switch returning to the off position each time.

Allow the engine to reach normal operating temperature.

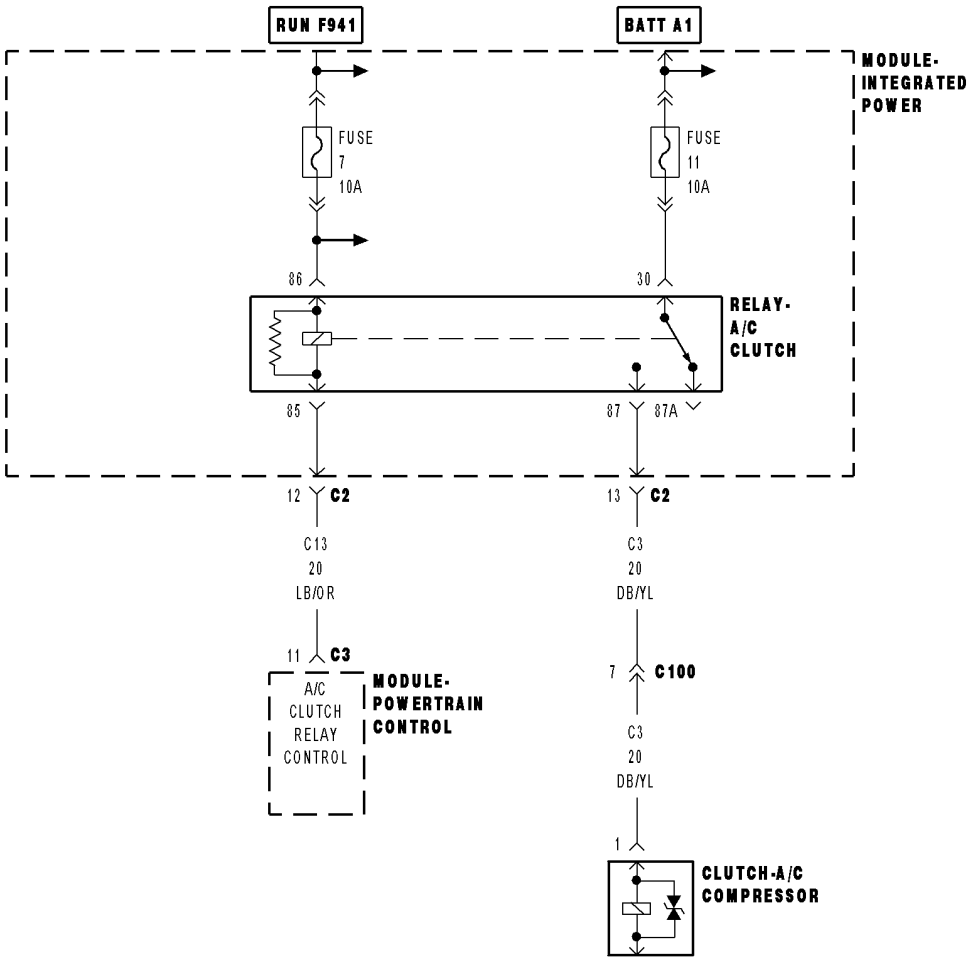
With the scan tool, read DTCs.

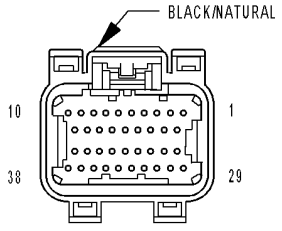
Does the DTC reset?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

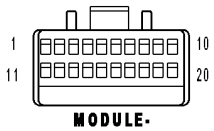
No >> The SKIM KEY information has been successfully programmed into the PCM. Test is complete.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0645-A/C CLUTCH RELAY CIRCUIT





MODULE-
POWERTRAIN
CONTROL C3



MODULE-
INTEGRATED
POWER C2

8133707c

P0645-A/C CLUTCH RELAY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts. A/C Switch on.
- **Set Condition:**
  An open or shorted condition is detected in the A/C clutch relay control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
INTERNAL FUSED B+ CIRCUIT
(C13) A/C CLUTCH RELAY CONTROL CIRCUIT OPEN
(C13) A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO GROUND
A/C CLUTCH RELAY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. A/C CLUTCH RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the A/C Clutch Relay.

Is the A/C Clutch Relay operating?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. A/C CLUTCH RELAY RESISTANCE

Turn the ignition off.

Remove the A/C Clutch Relay from the IPM.

Measure the resistance of the A/C Clutch Relay Coil.

Is the resistance between 60 to 80 ohms?

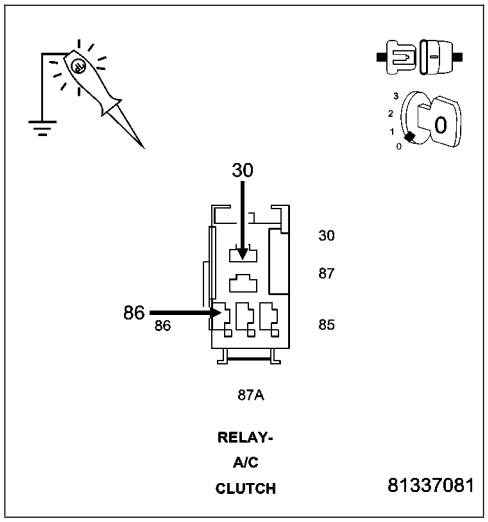
Yes >> Go To 3

No >> Replace the A/C Clutch Relay.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0645-A/C CLUTCH RELAY CIRCUIT (CONTINUED)

3. INTERNAL FUSED B+ CIRCUIT

Using a 12-volt test light connected to ground, probe the Internal Fused B+ circuit at the connection.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the open or short to ground in the (F202) Fused Ignition Switch Output circuit. Check and replace any open fuses.

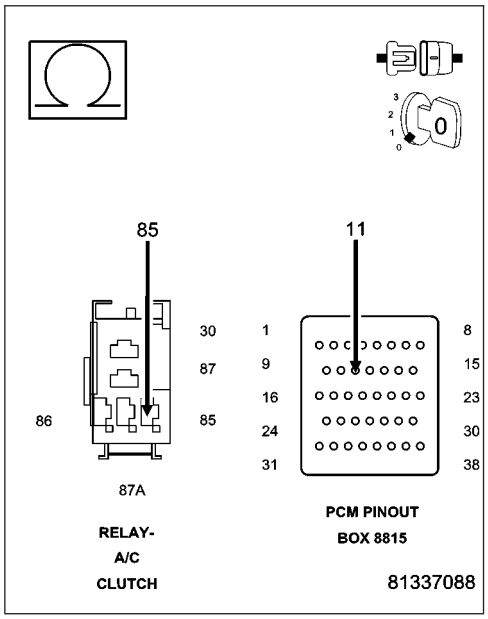
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (C13) A/C CLUTCH RELAY CONTROL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (C13) A/C Clutch Relay Control circuit from the relay connection to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 5

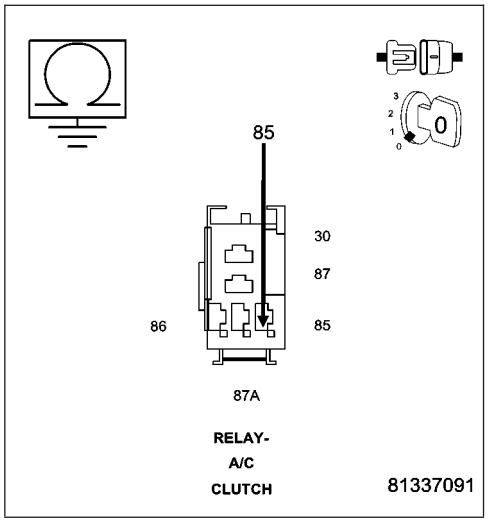
No >> Repair the open in the (C13) A/C Clutch Relay Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0645-A/C CLUTCH RELAY CIRCUIT (CONTINUED)

5. (C13) A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (C13) A/C Clutch Relay Control circuit at the IPM.



Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (C13) A/C Relay Clutch Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. PCM

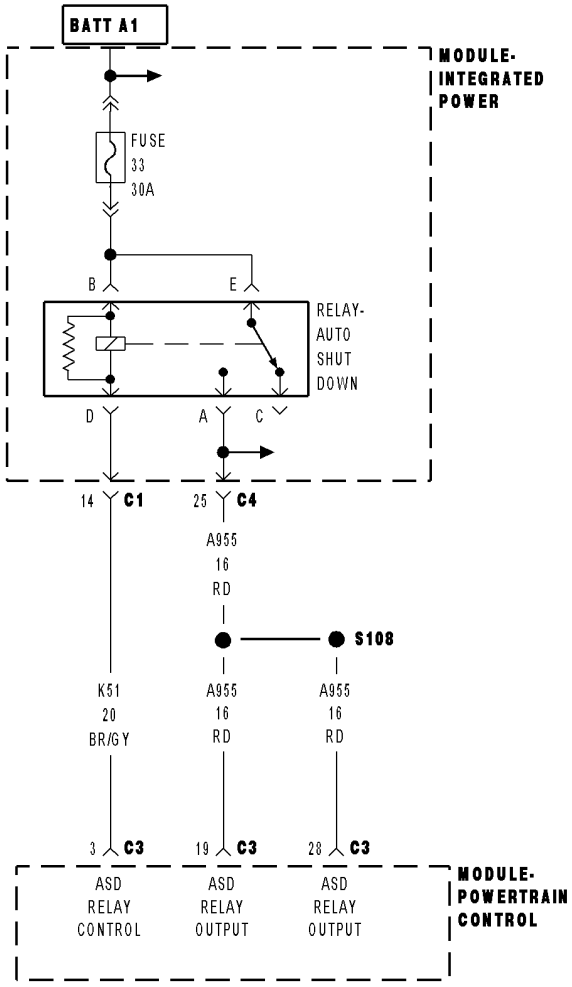
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

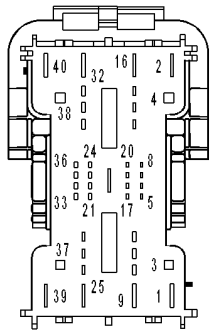
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

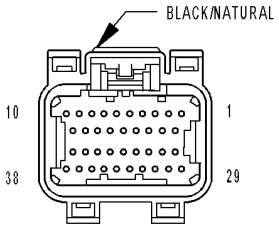
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0685-AUTO SHUTDOWN RELAY CONTROL CIRCUIT

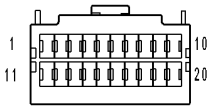




MODULE-
INTEGRATED
POWER C4



MODULE-
POWERTRAIN
CONTROL C3



MODULE-
INTEGRATED
POWER C1

81337381

P0685-AUTO SHUTDOWN RELAY CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on. Battery voltage above 10 volts.
- **Set Condition:**
  An open or shorted condition is detected in the ASD relay control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
INTERNAL FUSED B+ CIRCUITS
(K51) ASD RELAY CONTROL CIRCUIT OPEN
(K51) ASD RELAY CONTROL CIRCUIT SHORTED TO GROUND
ASD RELAY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ASD RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Is the ASD Relay operating?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. INTERNAL FUSED B+ CIRCUITS

Turn the ignition off.

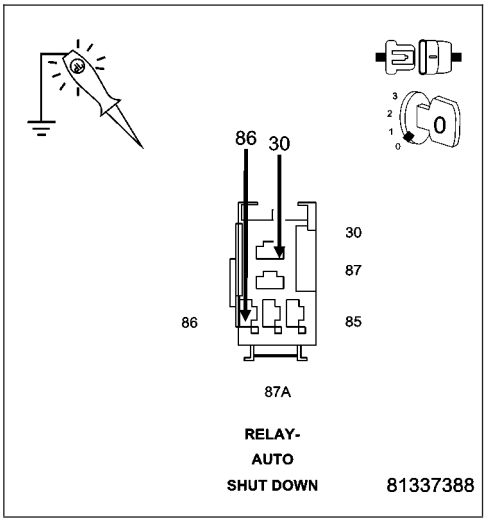
Remove the ASD Relay from the IPM.

Using a 12-volt test light connected to ground, probe the Internal Fused B+ circuits in the IPM.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the Internal Fused B+ circuits. Inspect and replace any open fuses.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0685-AUTO SHUTDOWN RELAY CONTROL CIRCUIT (CONTINUED)

3. ASD RELAY

Measure the resistance of the ASD Relay Coil.

Is the resistance between 60 to 80 ohms?

Yes >> Go To 4

No >> Replace the ASD Relay.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K51) ASD RELAY CONTROL CIRCUIT OPEN

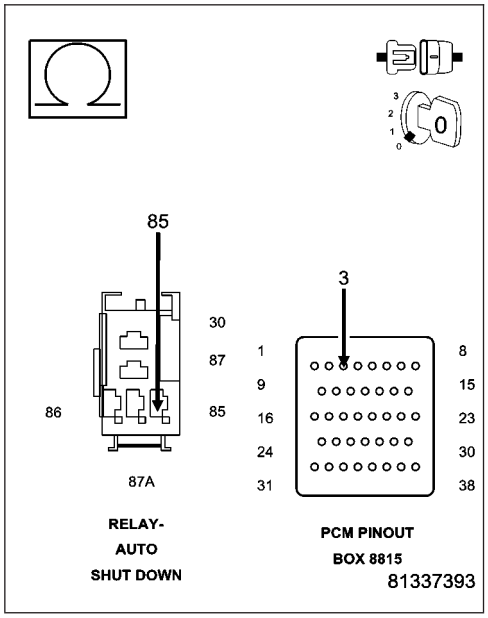
Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (K51) ASD Relay Control circuit from the IPM to the appropriate terminals of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K51) ASD Relay Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



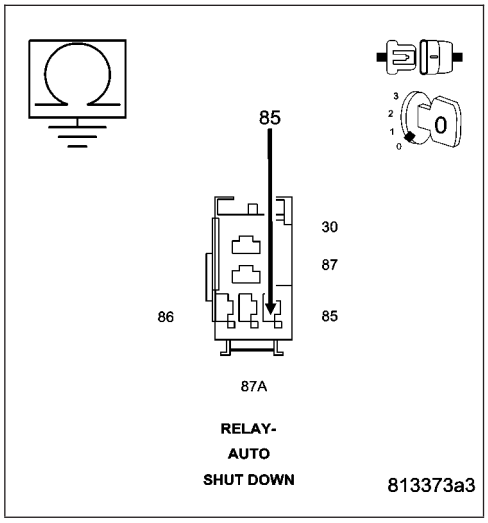
5. (K51) ASD RELAY CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K51) ASD Relay Control circuit in the IPM.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K51) ASD Relay Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0685-AUTO SHUTDOWN RELAY CONTROL CIRCUIT (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

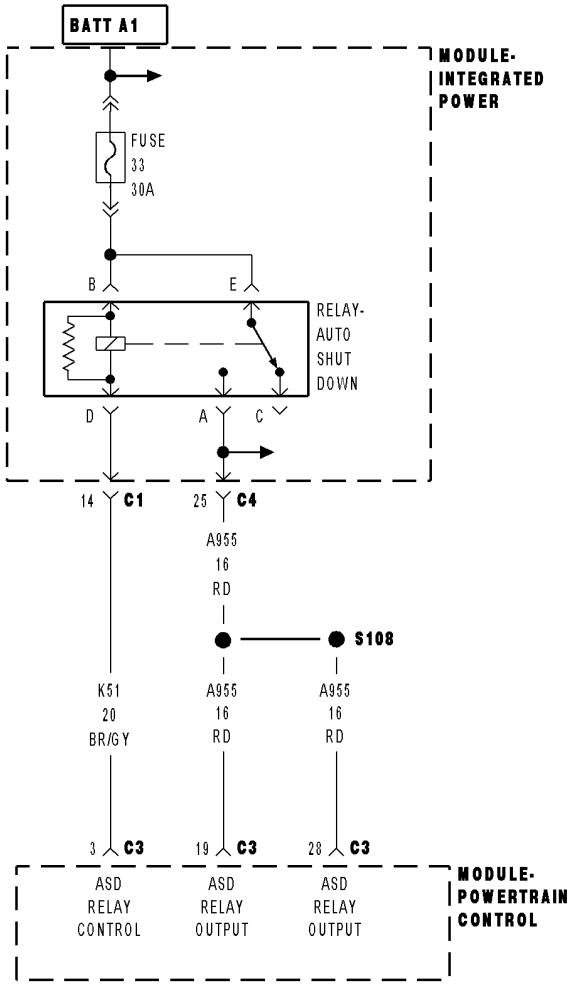
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

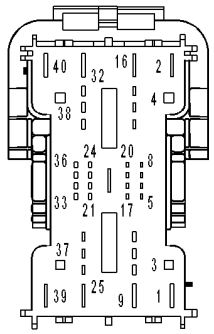
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

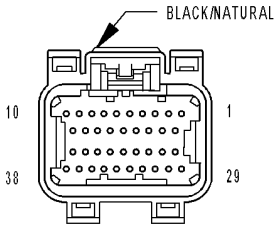
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW

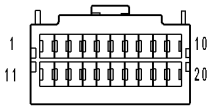




MODULE-
INTEGRATED
POWER C4



MODULE-
POWERTRAIN
CONTROL C3



MODULE-
INTEGRATED
POWER C1

81337381

P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition key on. Battery voltage greater than 10 volts.
- **Set Condition:**
  No voltage sensed at the PCM when the ASD relay is energized. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
INTERNAL FUSED B+ CIRCUITS
(A955) ASD RELAY OUTPUT CIRCUIT OPEN
ASD RELAY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VERIFY ASD DTC

NOTE: Diagnose P0685 - Auto Shutdown Relay Control Circuit first if it set along with this DTC.
With a scan tool, erase the DTC.

Attempt to start the engine. If the engine will not start, crank the engine for at least 15 seconds. It may be necessary to repeat several times.

Does the DTC reset?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. ENGINE OPERATION

Attempt to start the engine.

Does the engine start?

Yes >> Go To 3

No >> Go To 4

P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW (CONTINUED)

3. (A955) ASD RELAY OUTPUT CIRCUIT OPEN

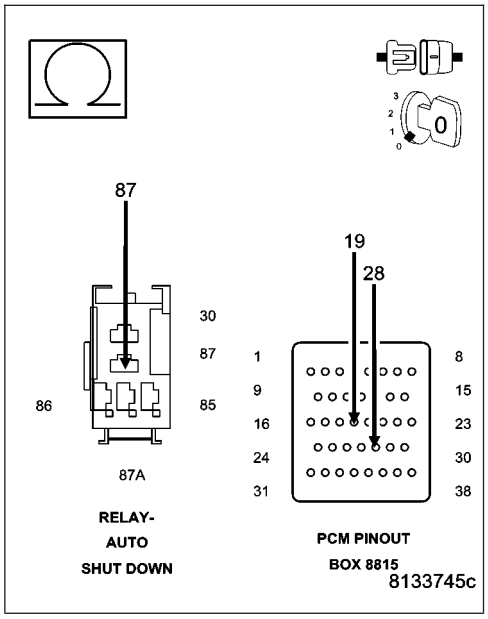
Turn the ignition off.

Remove the ASD Relay.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (A955) ASD Relay Output circuit from the Relay connection to the appropriate terminals of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. ASD RELAY

Turn the ignition off.

Install a substitute relay in place of the ASD Relay.

Ignition on, engine not running.

With a scan tool, erase DTCs.

Attempt to start the engine.

With a scan tool, read DTCs.

Does the DTC reset?

Yes >> Go To 5

No >> Replace the ASD Relay.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW (CONTINUED)

5. INTERNAL FUSED B+ CIRCUITS

Turn the ignition off.

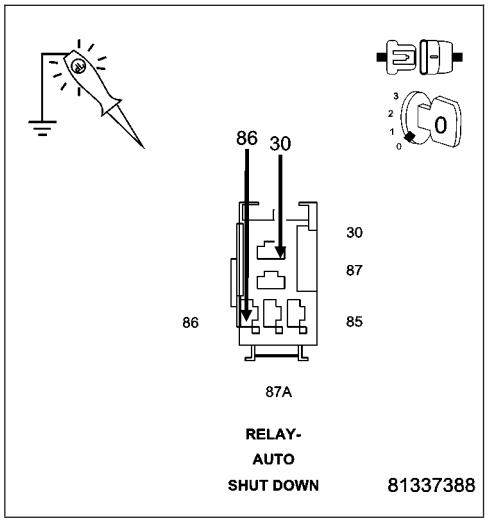
Using a 12-volt test light connected to ground, probe the Internal Fused B+ circuits at the Relay connection.

Does the test light illuminate brightly?

Yes >> Go To 6

No >> Repair the open or short to ground in the Internal Fused B+ circuits. Inspect the related fuse and repair as necessary.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (A955) ASD RELAY OUTPUT CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

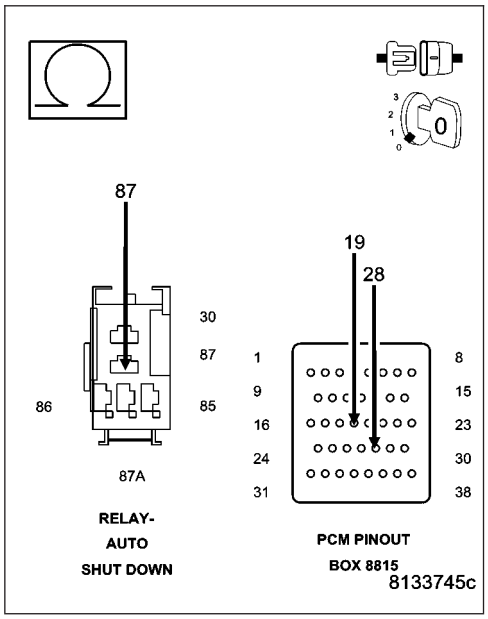
Measure the resistance of the (A955) ASD Relay Output circuit from the Relay connection to the appropriate terminals of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (A955) ASD Relay Output circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

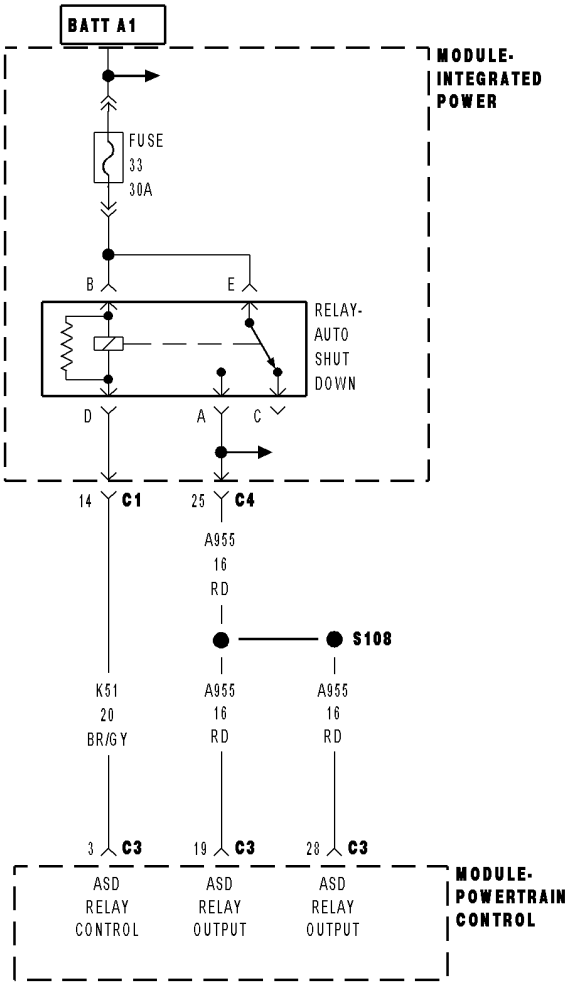
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

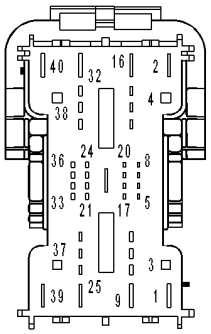
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

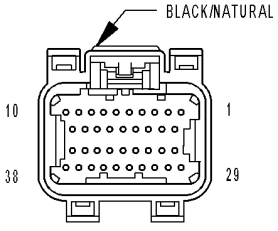
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0689-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW

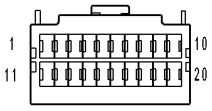




MODULE-
INTEGRATED
POWER C4



MODULE-
POWERTRAIN
CONTROL C3



MODULE-
INTEGRATED
POWER C1

8133748f

P0689-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on. Battery voltage between 9 and 16 volts and the ASD Relay is powered on.
- **Set Condition:**
  The ASD Output circuit voltage drops below an acceptable value at the FCM. The circuit is continuously monitored.

Possible Causes
INTERNAL FUSED B+ CIRCUITS
(A955) ASD RELAY OUTPUT CIRCUIT OPEN
(A955) ASD RELAY OUTPUT CIRCUIT SHORTED TO GROUND
ASD RELAY
FCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: P0685 and P0688 ASD Relay Control circuit DTCs must be diagnosed before continuing.
Ignition on, engine not running.
With a scan tool read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

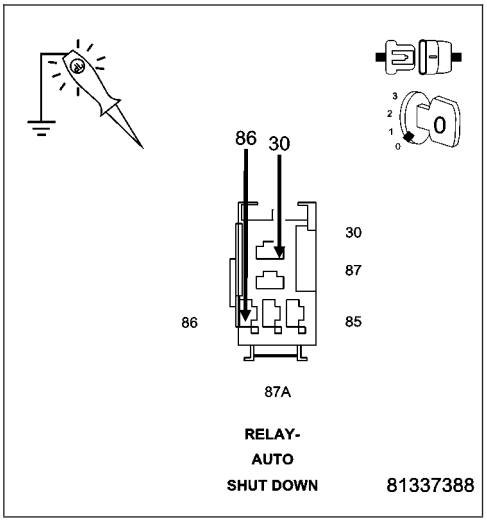
2. INTERNAL FUSED B+ CIRCUITS

Turn the ignition off.
Remove the ASD Relay from the IPM.
Using a 12-volt test light connected to ground, probe the Internal Fused B+ circuits in the IPM.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the Internal Fused B+ circuits. Inspect the related fuse and repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

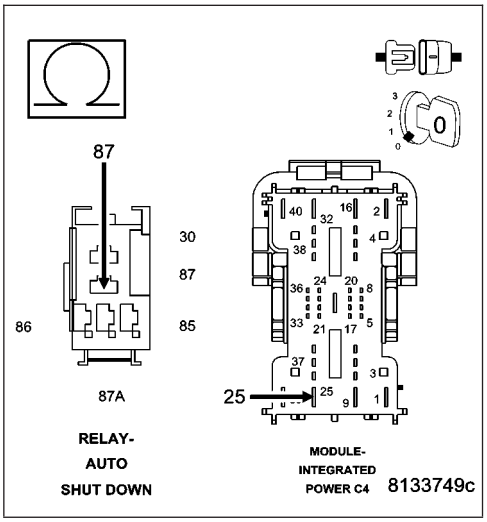


P0689-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW (CONTINUED)

3. (A955) ASD RELAY OUTPUT CIRCUIT OPEN

Disconnect the C4 IPM harness connector.

Measure the resistance of the (A955) ASD Relay Output circuit from the Relay terminal to the C4 IPM harness connector.



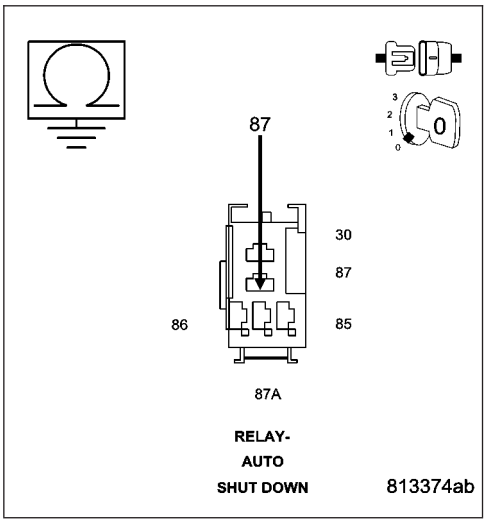
Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the open in the (A955) ASD Relay Output circuit, replace the IPM per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (A955) ASD RELAY OUTPUT CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (A955) ASD Relay Output circuit at the Relay terminals.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (A955) ASD Relay Control circuit, replace the IPM per Service Information..
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. ASD RELAY

Measure the resistance of the ASD Relay Coil between terminals 86 and 85.

Is the resistance between 60 and 80 ohms?

Yes >> Go To 6

No >> Replace the ASD Relay.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0689-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW (CONTINUED)

6. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

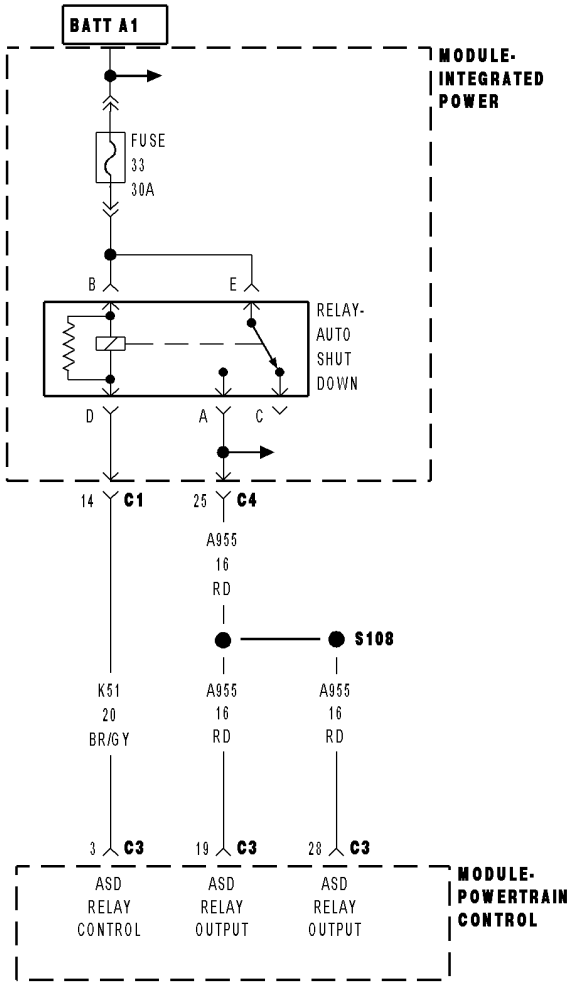
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

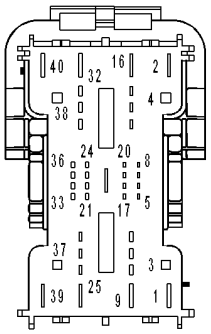
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

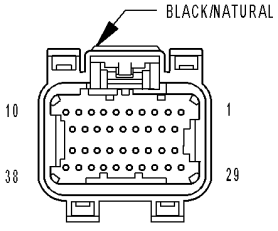
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0690-AUTO SHUTDOWN RELAY SENSE CIRCUIT HIGH

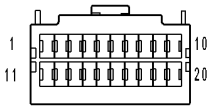




MODULE-
INTEGRATED
POWER C4



MODULE-
POWERTRAIN
CONTROL C3



MODULE-
INTEGRATED
POWER C1

8133748f

P0690-AUTO SHUTDOWN RELAY SENSE CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  If the FCM detects high voltage on the ASD Relay Sense circuit for more than 3.5 seconds.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT SHORTED TO VOLTAGE
ASD RELAY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: P0685 and P0688 ASD Relay Control circuit DTCs must be diagnosed before continuing.
Ignition on, engine not running.
With a scan tool read DTCs.

Is the DTC active at this time?

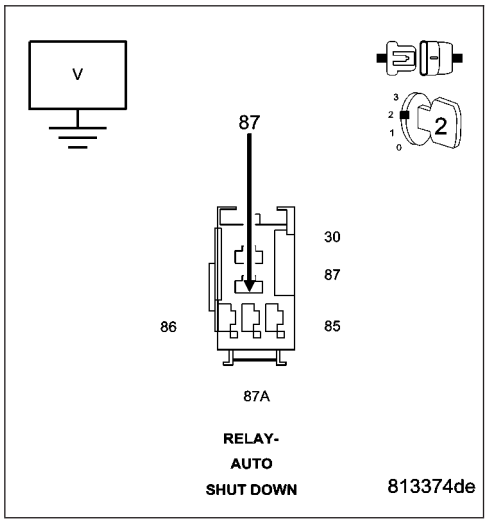
Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT CHECK

Turn the ignition off.
Remove the ASD Relay.
Ignition on, engine not running.
Measure the voltage on the (A955) ASD Relay Output circuit at the Relay connection.



Is the voltage above 1.0 volt?

Yes >> Go To 3

No >> Go To 4

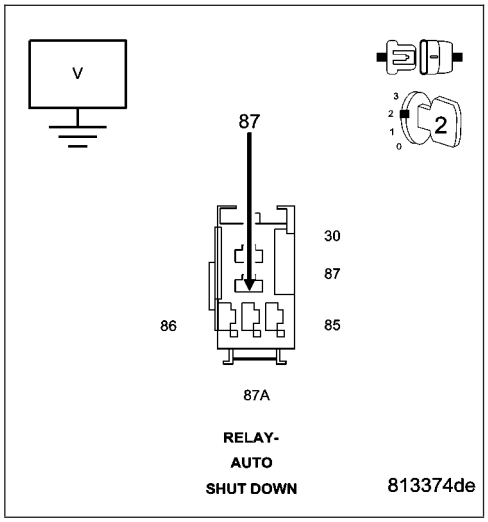
P0690-AUTO SHUTDOWN RELAY SENSE CIRCUIT HIGH (CONTINUED)

3. (A955) ASD RELAY OUTPUT CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C4 IPM harness connector.

Measure the voltage of the (A955) ASD Relay Output Circuit at the Relay connection.



Is the voltage above 1.0 volts?

Yes >> Repair the short to voltage in the (A955) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the Front Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

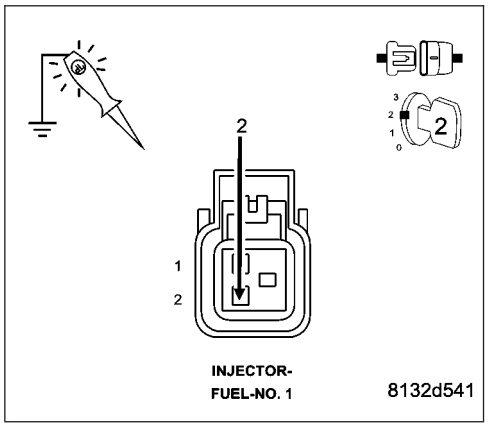
4. ASD RELAY

Install the ASD Relay.

Ignition on, engine not running.

Disconnect the No.1 Fuel Injector harness connector.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit at the No.1 Fuel Injector harness connector.



Does the test light illuminate brightly?

Yes >> Replace the ASD Relay.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace Front Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0700-TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  An active DTC is stored in the TCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
DTC PRESENT IN THE TRANSMISSION CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. DTC PRESENT IN EATX CONTROLLER

This is an informational DTC letting you know that a DTC(s) is stored in the Transmission Control Module.

Erase this DTC from the PCM after all Transmission DTC(s) have been repaired.

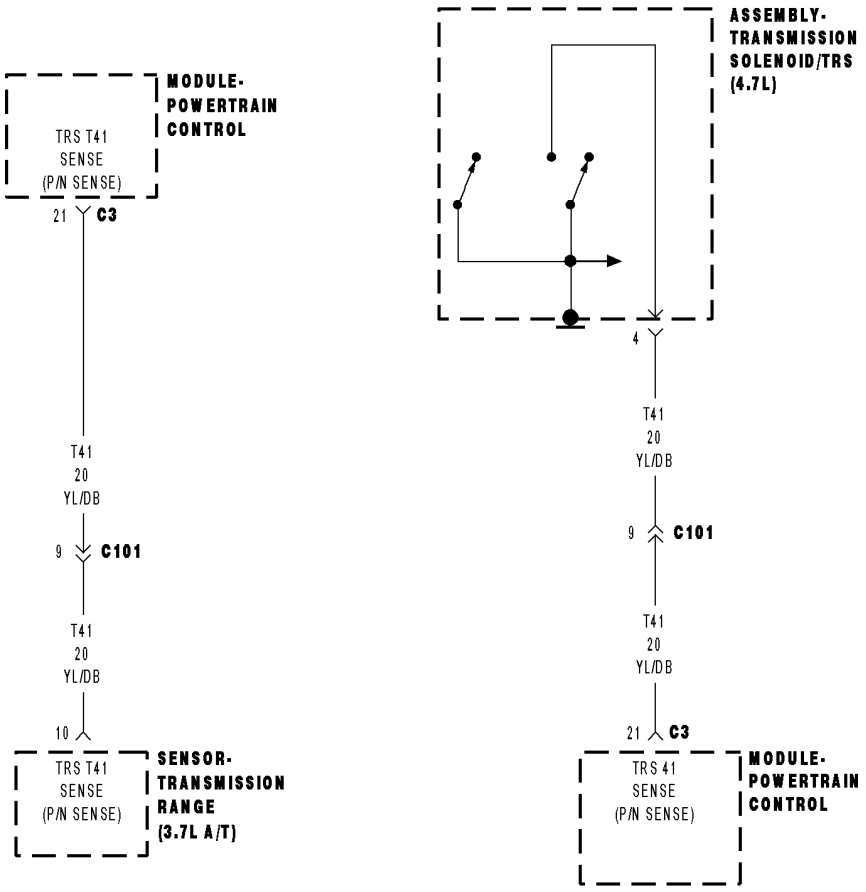
Using a scan tool, read the Transmission Controller DTC and refer to the Transmission Category and perform the appropriate symptom.

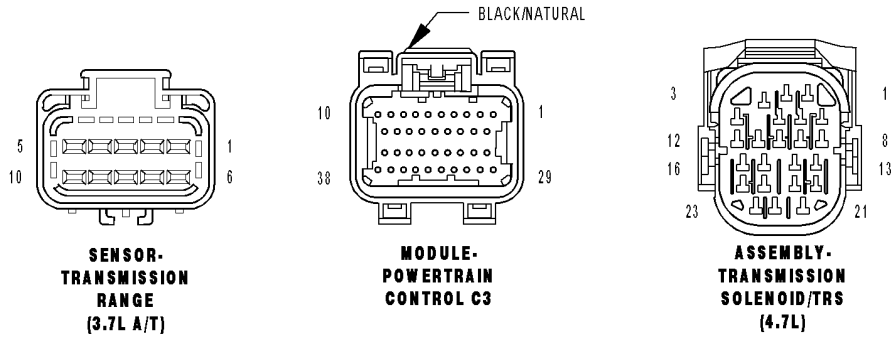
PCM Diagnostic Information complete.

Continue

Test Complete.

P0850-PARK/NEUTRAL SWITCH PERFORMANCE





813376c8

P0850-PARK/NEUTRAL SWITCH PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The Park Neutral switch rationality test is enabled only for vehicles equipped with a 4/5 speed automatic transmission. This diagnostic checks if the park/neutral switch is incorrectly stuck in the neutral position during driving conditions by comparing Vehicle Speed, Engine Speed, Throttle Position, and Pressure Ratio to the fail thresholds and by looking at the state of the Park/Neutral Switch. The stuck in drive condition is not explicitly checked as the starter relay does not energize and therefore render the vehicle inoperable.

- **When Monitored:**
  Continuously with the transmission in Park, Neutral, or Drive and NOT in Limp-in mode.
- **Set Condition:**
  This code will set if the PCM detects an incorrect Park/Neutral switch state for a given mode of vehicle operation. One trip fault. Three good trips to turn off the MIL.

Possible Causes
TRS (T41) SENSE (P/N SENSE) CIRCUIT OPEN
TRS (T41) SENSE (P/N SENSE) CIRCUIT SHORTED TO GROUND
TRANSMISSION RANGE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. P/N & D/R NOT IN CORRECT POSITION

NOTE: Check the TCM for DTCs, if P0706 is set in the TCM diagnose the TCM code before continuing.
Ignition on, engine not running.

With the scan tool, read the Park/Neutral Position Switch input state.

While moving the gear selector through all gear positions (Park to 1 and back to Park), monitor the scan tool display.

Did the scan tool display show P/N and D/R in the correct gear positions?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

P0850-PARK/NEUTRAL SWITCH PERFORMANCE (CONTINUED)

2. TRS (T41) SENSE (P/N SENSE) CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Disconnect the Transmission Range Sensor harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

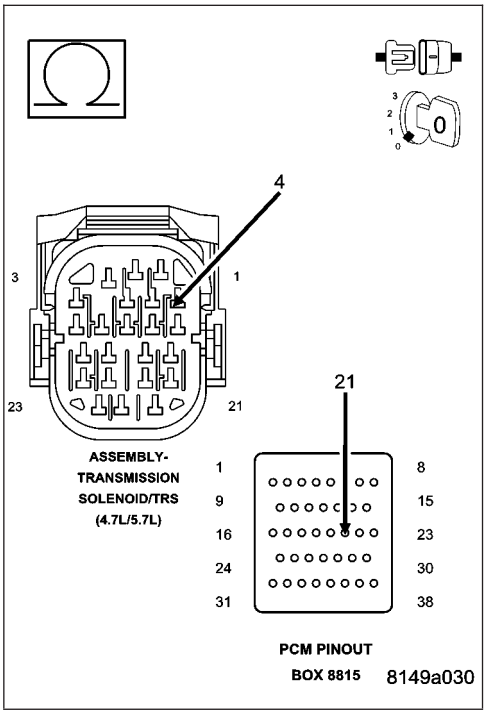
Measure the resistance of the TRS (T41) Sense (P/N Sense) circuit from the TRS harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the open in the TRS (T41) Sense (P/N Sense) circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. TRS (T41) SIGNAL CIRCUIT SHORTED TO GROUND

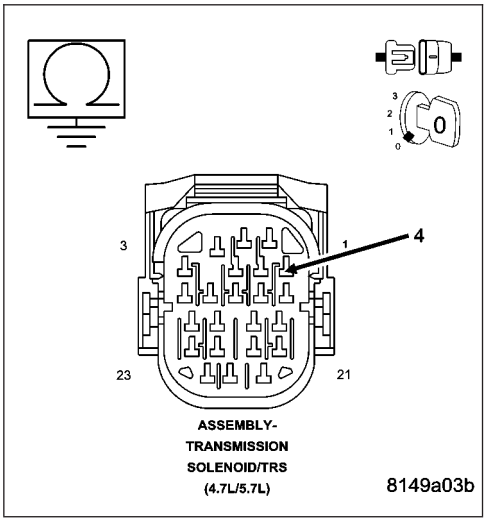
Measure the resistance between ground and the TRS (T41) Sense (P/N Sense) circuit at the TRS harness connector.

Is the resistance above 100k ohms?

Yes >> Go To 4

No >> Repair the short to ground in the TRS (T41) Sense (P/N Sense) circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0850-PARK/NEUTRAL SWITCH PERFORMANCE (CONTINUED)

4. TRANSMISSION RANGE SENSOR

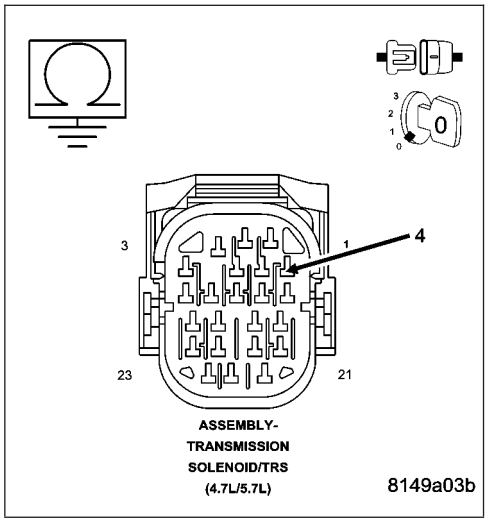
Measure the resistance between ground and the (T41) TRS Sense (P/N Sense) circuit while moving the gear selector through each gear in the TRS connector.

NOTE: The circuit is grounded in Park and Neutral and open in the other positions.

Did the resistance change from above 100 kohms (open) to below 10.0 ohms (grounded)?

Yes >> Go To 5

No >> Replace the Transmission Range Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. PCM

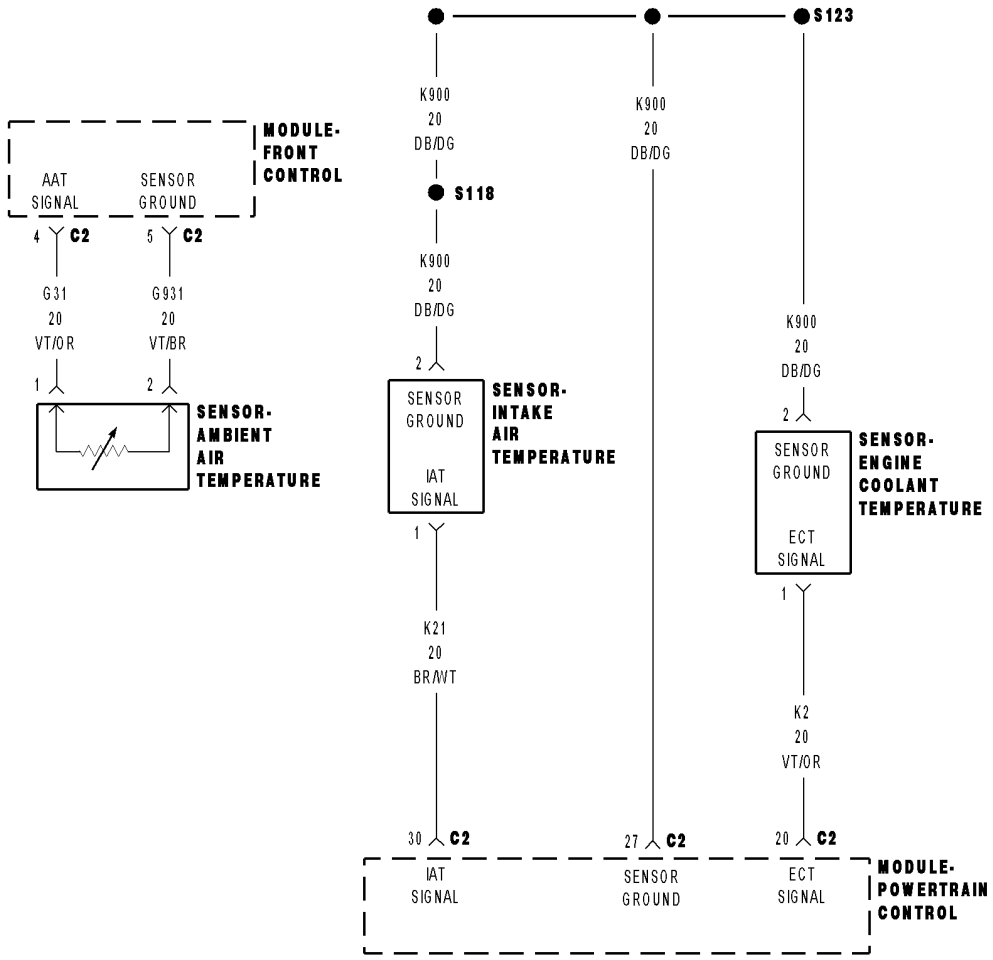
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

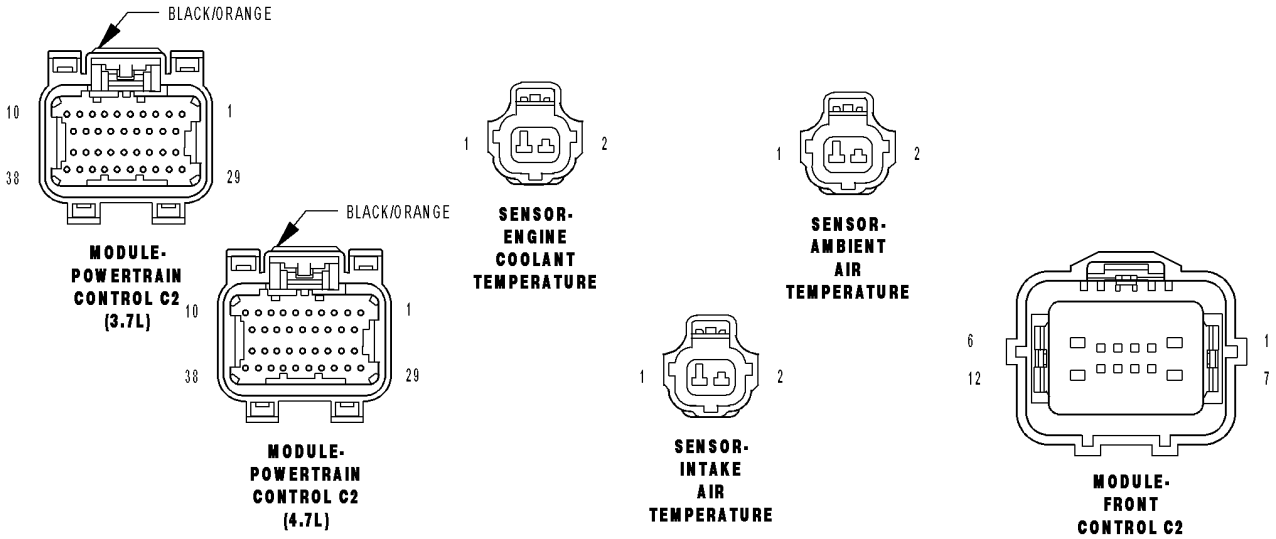
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1115-GENERAL TEMPERATURE RATIONALITY





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P1115-GENERAL TEMPERATURE RATIONALITY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Ambient Air, Engine Coolant, and Intake Air Temp sensor inputs are compared under cold start conditions. After start up the temp readings are monitored. If two of the three readings agree and the third doesn't, a DTC is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXCESSIVE RESISTANCE IN THE SENSOR SIGNAL CIRCUIT
EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
TEMPERATURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read the DTCs.

NOTE: All ECT, Intake Air, and Ambient Air Temperature Sensor codes must be diagnosed and repaired before continuing.

NOTE: In cold weather, this DTC could be set by a high powered block heater and no repair would be required.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. TEMPERATURE SENSOR CIRCUIT

With a scan tool, read the ECT, Ambient AirTemp, and Intake Air Temp Sensor temp values.

Start the engine.

Allow the engine to reach normal operating temperature while monitoring the three Sensor temperature values.

Is the temperature for each of the Sensors increasing properly?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P1115-GENERAL TEMPERATURE RATIONALITY (CONTINUED)

3. TEMPERATURE SENSOR

Ignition on, engine not running.

Disconnect the suspected sensor.

Connect a jumper wire between the Sensor Signal circuit and the (K900) Sensor ground circuit.

With the scan tool, read the voltage of the suspected Sensor.

Did the voltage reading start at 4.8 to 5.0 volts and decrease to 0 volts when the jumper wire was installed?

Yes >> Replace the Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE))

No >> Go To 4

NOTE: Remove the jumper wire before continuing.

---

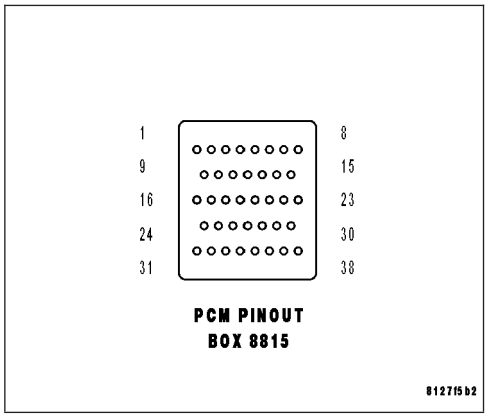
4. EXCESSIVE RESISTANCE IN THE TEMPERATURE SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the Sensor Signal circuit from the Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance above 5.0 ohms.

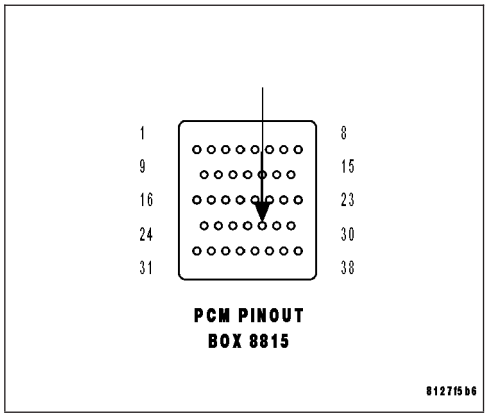
Yes >> Repair the excessive resistance in the Temperature Sensor Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance of the (K900) Sensor ground circuit from the Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance above 5.0 ohms.

Yes >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P1115-GENERAL TEMPERATURE RATIONALITY (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

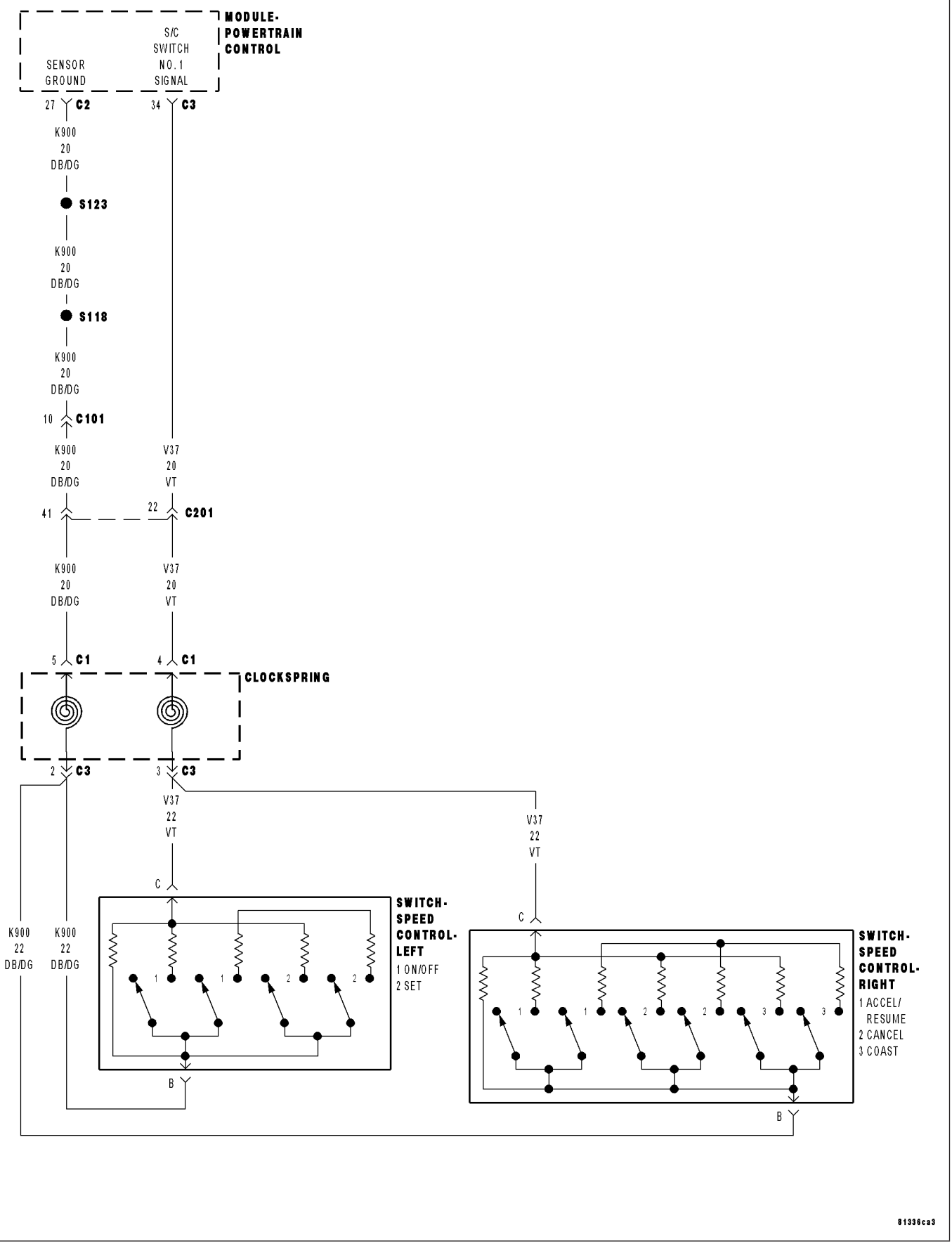
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE))

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1593-SPEED CONTROL SWITCH 1 STUCK



P1593-SPEED CONTROL SWITCH 1 STUCK (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  S/C Switch No.1 is mechanically stuck in the On/Off, Resume/Accel, or Set position for too long. One trip fault.

Possible Causes
(V37) S/C SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(V37) S/C SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND OPEN
(V37) S/C SIGNAL CIRCUIT SHORTED TO GROUND
(V37) S/C SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
SPEED CONTROL SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL SWITCH STATUS

Start the engine.
With a scan tool, monitor each which function for the Speed Control Switches.
Press and release each Speed Control Button.
- Resume/Accel
- Cancel
- Decel (Coast)
- On/Off
- Set

Does each switch function change status when pressing each switch?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

P1593-SPEED CONTROL SWITCH 1 STUCK (CONTINUED)

2. SPEED CONTROL SWITCHES

Turn the ignition off.

Disconnect and remove the Speed Control Switches from the steering wheel per Service Information.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

Resume/Accel - 15.4 kohms

Cancel - 1.24 kohms

Coast - 2.94 kohms

On/Off -0.47 kohms

Set - 5.49 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes >> Go To 3

No >> Replace the Speed Control Switch that had the incorrect resistance value.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

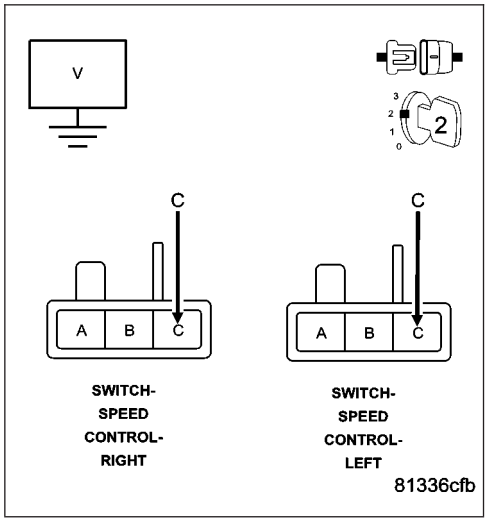
---

3. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 and C3 PCM harness connectors.

Measure the voltage of the (V37) S/C Switch No.1 Signal circuit in the Speed Control harness connector.



Is the voltage above 5.0 volts?

Yes >> Repair the short to battery voltage in the (V37) S/C Signal No.1 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P1593-SPEED CONTROL SWITCH 1 STUCK (CONTINUED)

4. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN

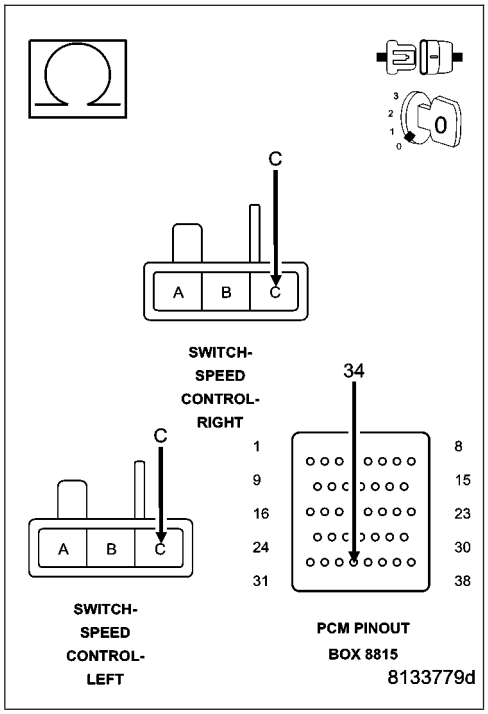
NOTE: The measurement must be taken from both Speed Control Switch harness connectors.
Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (V37) S/C Switch No.1 Signal circuit from the Speed Control harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms for both measurements?

Yes >> Go To 5

No >> Repair the open in the (V37) S/C Switch No.1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



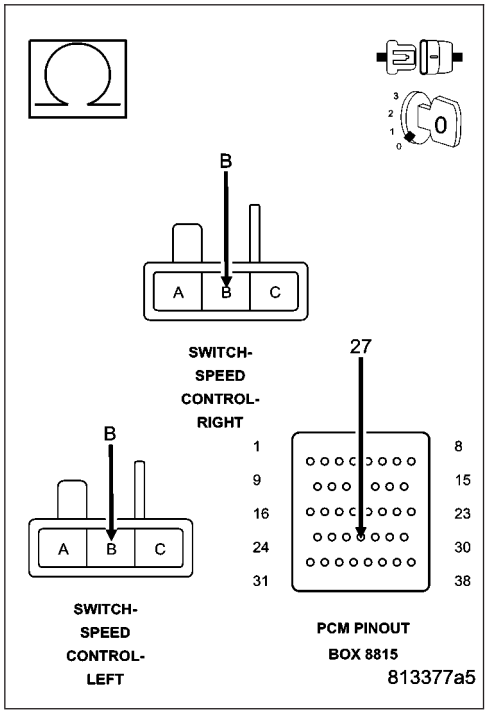
5. (K900) SENSOR GROUND CIRCUIT OPEN

NOTE: The measurement must be taken from both Speed Control Switch harness connectors.
Measure the resistance of the (K900) Sensor ground circuit from the Speed Control harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms for both measurements?

Yes >> Go To 6

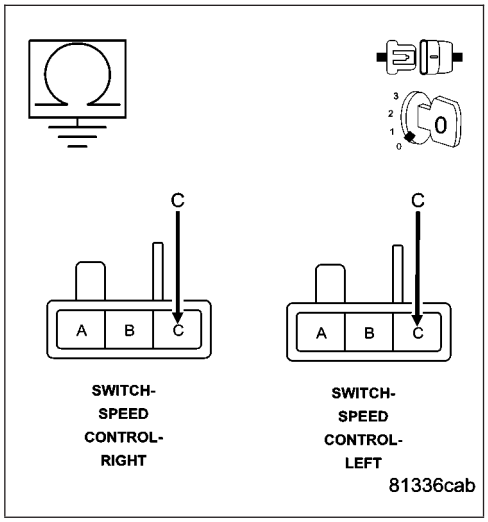
No >> Repair the open in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P1593-SPEED CONTROL SWITCH 1 STUCK (CONTINUED)

6. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V37) S/C Switch No.1 Signal circuit in the Speed Control harness connector.



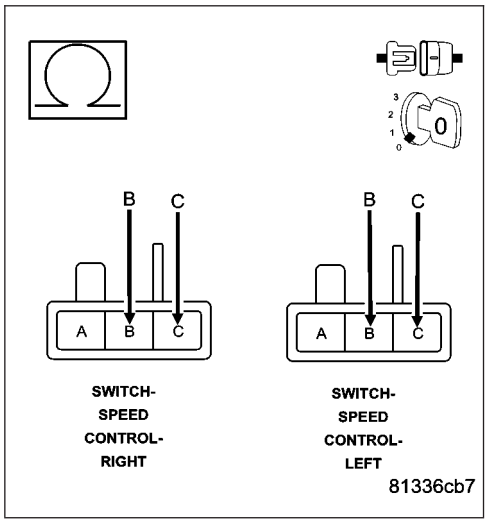
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V37) S/C Switch No.1 Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

7. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (V37) S/C Switch No.1 Signal circuit and the (K900) Sensor ground circuit in the Speed Control harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (V37) S/C Switch No.1 Signal circuit and the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE))

P1603-PCM INTERNAL DUAL-PORT RAM COMMUNICATION FAILURE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Internal PCM failure detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PCM FUSED IGNITION SWITCH CIRCUIT
PCM INTERNAL

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM IGNITION CIRCUITS

Turn the ignition off.

Disconnect the C1 PCM harness connector.

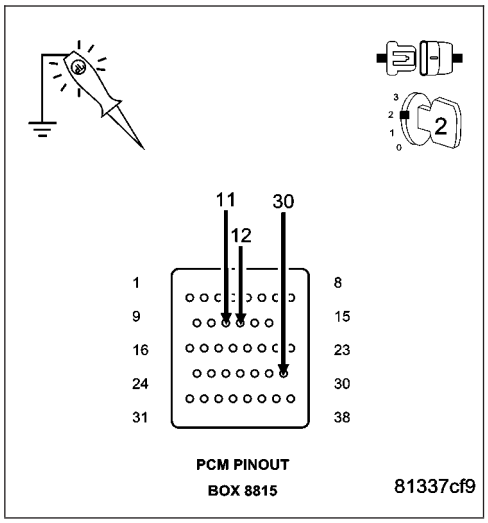
Ignition on, engine not running.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

With a 12-volt test light connected to ground and with special tool #8815 installed, probe the (F202) and (F924) Fused Ignition Switch circuits.

Perform the above check with the Ignition key in the off lock position, Ignition on, engine not running position, and during cranking.

Wiggle the related wire harness while probing the special tool with the test light to try to interrupt the circuit.



Does the test light illuminate brightly?

Yes >> Go To 2

No >> Repair the open or excessive resistance in the (F202) and (F924) Fused Ignition Switch (Offf, Run, Start) circuits. Inspect the related fuse, if the fuse is open check the circuits for a short to ground.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1603-PCM INTERNAL DUAL-PORT RAM COMMUNICATION FAILURE (CONTINUED)

2. PCM

The Powertrain Control Module is reporting internal errors.

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1604-PCM INTERNAL DUAL-PORT RAM READ/WRITE INTEGRITY FAILURE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Internal PCM failure detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PCM FUSED IGNITION SWITCH CIRCUIT
PCM INTERNAL

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM IGNITION CIRCUITS

Turn the ignition off.

Disconnect the C1 PCM harness connector.

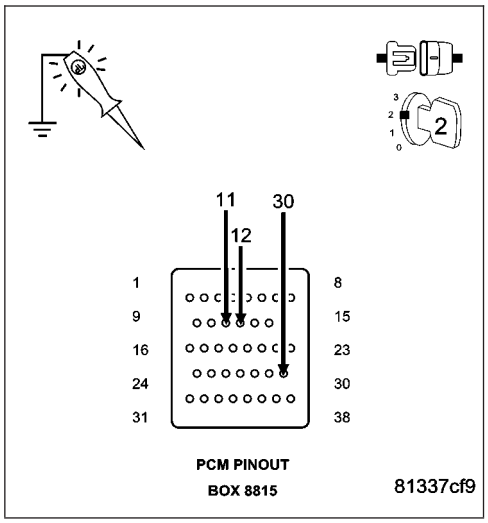
Ignition on, engine not running.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

With a 12-volt test light connected to ground and with special tool #8815 installed, probe the (F202) and (F924) Fused Ignition Switch circuits.

Perform the above check with the Ignition key in the off lock position, Ignition on, engine not running position, and during cranking.

Wiggle the related wire harness while probing the special tool with the test light to try to interrupt the circuit.



Does the test light illuminate brightly?

Yes >> Go To 2

No >> Repair the open or excessive resistance in the (F202) and (F924) Fused Ignition Switch (Offf, Run, Start) circuits. Inspect the related fuse, if the fuse is open check the circuits for a short to ground.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1604-PCM INTERNAL DUAL-PORT RAM READ/WRITE INTEGRITY FAILURE (CONTINUED)

2. PCM

The Powertrain Control Module is reporting internal errors.

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1607-PCM INTERNAL SHUTDOWN TIMER RATIONALITY

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Internal PCM failure detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PCM FUSED IGNITION SWITCH CIRCUIT
PCM INTERNAL

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM IGNITION CIRCUITS

Turn the ignition off.

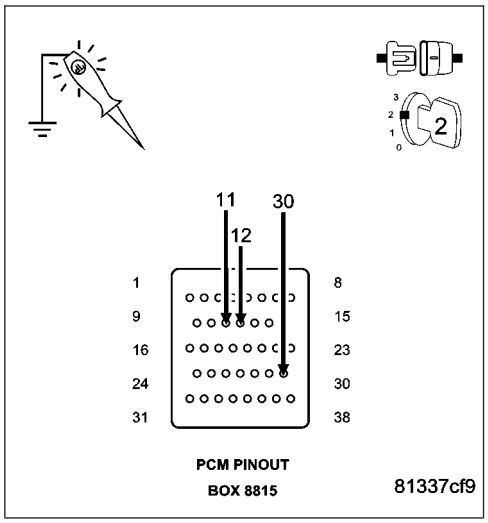
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

With a 12-volt test light connected to ground and with special tool #8815 installed, probe the (F202) and (F924) Fused Ignition Switch circuits.

Perform the above check with the Ignition key in the off lock position, Ignition on, engine not running position, and during cranking.

Wiggle the related wire harness while probing the special tool with the test light to try to interrupt the circuit.



Does the test light illuminate brightly?

Yes >> Go To 2

No >> Repair the open or excessive resistance in the (F202) and (F924) Fused Ignition Switch (Offf, Run, Start) circuits. Inspect the related fuse, if the fuse is open check the circuits for a short to ground.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. PCM

The Powertrain Control Module is reporting internal errors.

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1696-EEPROM MEMORY WRITE DENIED/INVALID

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on.
- **Set Condition:**
  An attempt to program/write to the internal EEPROM failed, Also checks at power down. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SCAN TOOL DISPLAYS A WRITE FAILURE

With a scan tool, perform the SRI Memory Test.

Does scan tool display Write Failure?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. SCAN TOOL DISPLAYS A WRITE REFUSED

With the a scan tool, perform the SRI Memory Test.

Does the scan tool display Write Refused?

Yes >> Go To 3

No >> Go To 4

---

3. PCM REFUSED 2ND TEST

With a scan tool, perform the SRI Memory Test a third time.

NOTE: Retest the SRI Memory two more times.

Does the scan tool display Write Refused again?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE) z

No >> Test Complete.

---

4. SCAN TOOL DISPLAYS SRI MILEAGE INVALID

With a scan tool, perform the SRI Memory Test.

Does the scan tool display SRI Mileage Invalid?

Yes >> Update the mileage and retest the SRI Memory.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P1696-EEPROM MEMORY WRITE DENIED/INVALID (CONTINUED)

5. COMPARE SRI MILEAGE WITH ODOMETER

Compare the SRI Mileage stored with the Instrument Panel Odometer.

Is the mileage within the specified range displayed on the scan tool?

Yes >> Test Complete.

No >> Update the mileage and retest the SRI Memory.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1697-EMR (SRI) MILEAGE NOT STORED

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on.
- **Set Condition:**
  An attempt to program/write to the internal EEPROM failed, Also checks at powerdown. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SCAN TOOL DISPLAYS A WRITE FAILURE

With a scan tool, perform the SRI Memory Test.

Does scan tool display Write Failure?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. SCAN TOOL DISPLAYS A WRITE REFUSED

With the a scan tool, perform the SRI Memory Test.

Does the scan tool display Write Refused?

Yes >> Go To 3

No >> Go To 4

---

3. PCM REFUSED 2ND TEST

With a scan tool, perform the SRI Memory Test a third time.

NOTE: Retest the SRI Memory two more times.

Does the scan tool display Write Refused again?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

---

4. SCAN TOOL DISPLAYS SRI MILEAGE INVALID

With a scan tool, perform the SRI Memory Test.

Does the scan tool display SRI Mileage Invalid?

Yes >> Update the mileage and retest the SRI Memory.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P1697-EMR (SRI) MILEAGE NOT STORED (CONTINUED)

5. COMPARE SRI MILEAGE WITH ODOMETER

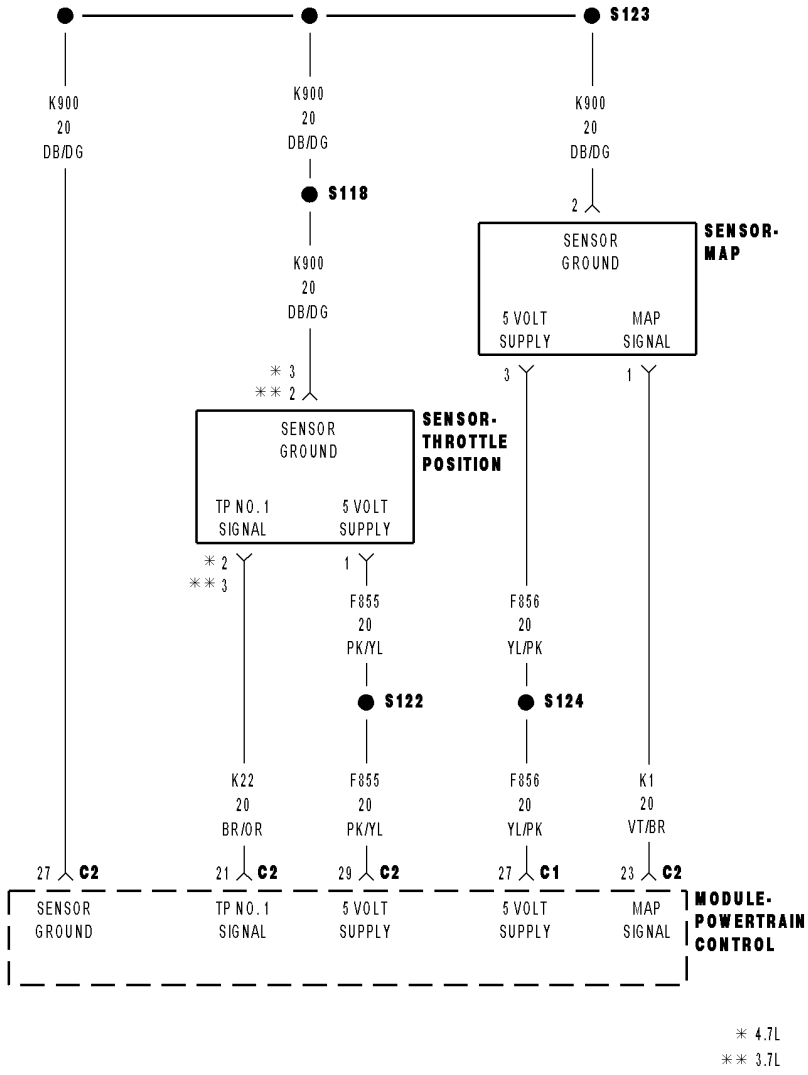
Compare the SRI Mileage stored with the Instrument Panel Odometer.

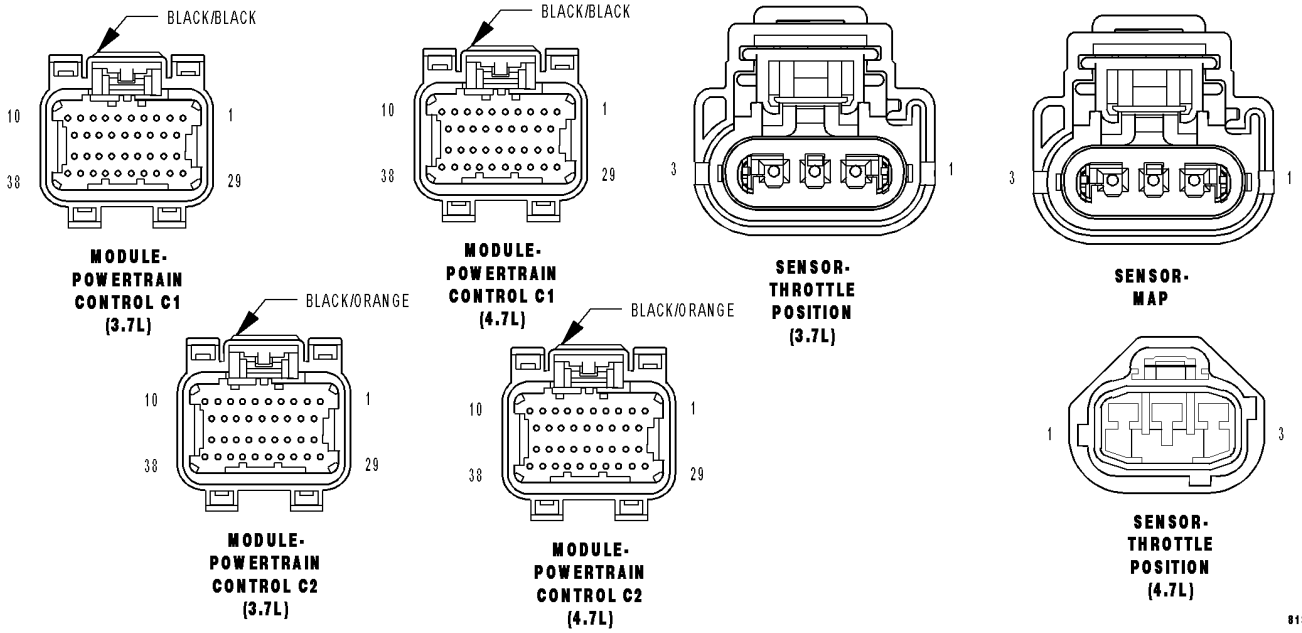
Is the mileage within the specified range displayed on the scan tool?

Yes >> Test Complete.

No >> Update the mileage and retest the SRI Memory.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED





P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

This DTC sets when an unexpected high intake manifold air flow condition exists that can lead to increased engine speed and puts the NGC into a High Air flow Protection limiting mode. The High Air flow Protection feature includes RPM limits for when a Throttle and/or MAP sensor limp-in fault is present.

- **When Monitored:**
  During all drive modes
- **Set Condition:**
  If vacuum drops below 1.5″Hg with engine RPM greater than 2000 RPM and closed throttle. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
VACUUM LEAK
RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K22) TP SENSOR NO.1 SIGNAL CIRCUIT
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
MAP SENSOR
THROTTLE POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any TP Sensor or MAP Sensor component DTCs before continuing.

NOTE: If the P0501 - No Vehicle Speed Signal is set long with this DTC, refer to the P0501 diagnostics before continuing.

NOTE: The throttle plate and linkage should be free from binding and carbon build up.

NOTE: Make sure the throttle plate is at the idle position.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

2. VACUUM LEAK

NOTE: This code is enabled on engines with a plastic intake manifold and is intended to shut down the engine if a large crack occurs.

NOTE: A large vacuum leak is most likely the cause of this DTC.

Inspect the Intake Manifold for leaks and cracks.

Inspect the Power Brake Booster for any vacuum leaks.

Inspect the PCV system for proper operation and vacuum leaks.

Inspect the throttle plate to see if it is bent and will close entirely, if it is bent it may need to be replaced.

Inspect the MAP Sensor for proper installation.

Verify the engine is free from any mechanical failures.

Were any vacuum leaks found?

Yes >> Repair the vacuum leak as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. MAP SENSOR OPERATION

Start the engine.

With a scan tool, monitor the MAP Sensor voltage.

Snap the throttle.

Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at wide open throttle?

Yes >> Go To 4

No >> Go To 11

---

4. TP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor voltage while slowly pressing the throttle pedal from closed to wide open throttle.

Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

5. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

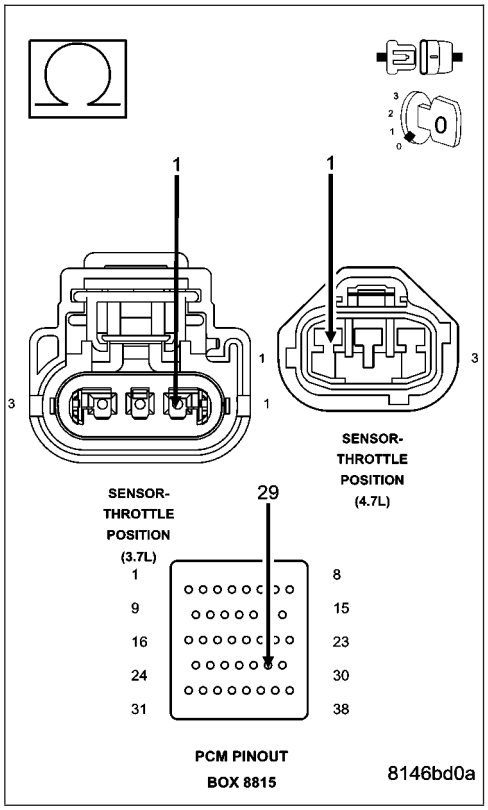
Turn the ignition off.

Disconnect the TP Sensor harness connector.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

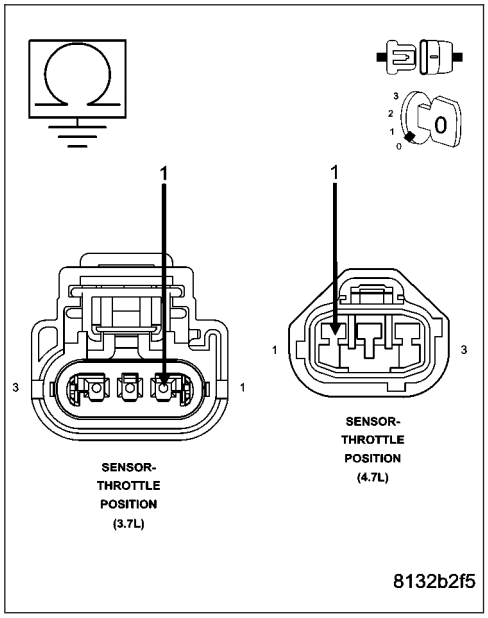
Yes >> Go To 6

No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and (F855) 5-volt Supply circuit in the TP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

7. THROTTLE POSITION SENSOR

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor voltage.

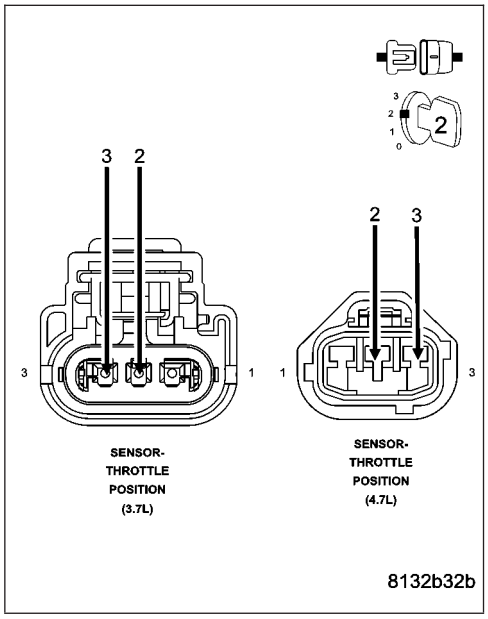
Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

Does the TP Sensor voltage change from approximately 4.9 volts to below 0.5 of a volt with the jumper wire installed?

Yes >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

NOTE: Remove the jumper wire before continuing.



8. EXCESSIVE RESISTANCE IN THE (K22) TP NO.1 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

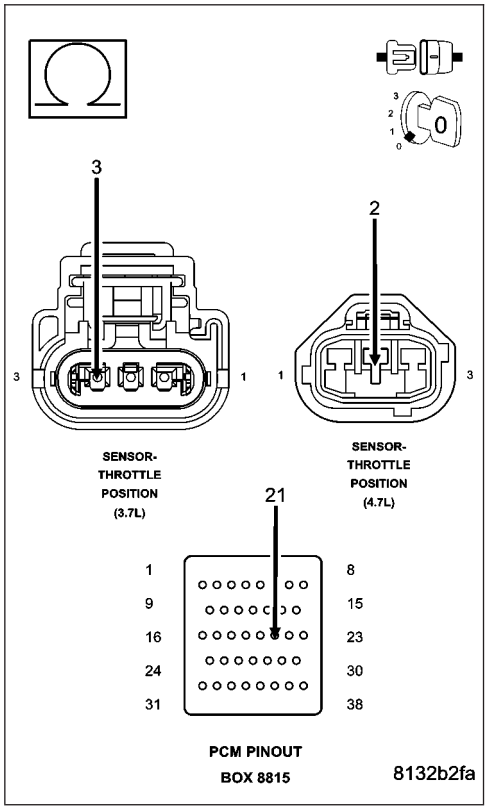
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the excessive resistance in the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

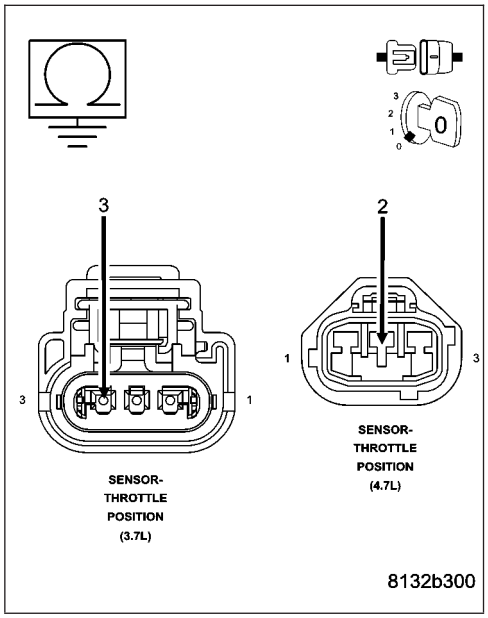
9. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit in the TP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE

No >> Go To 10



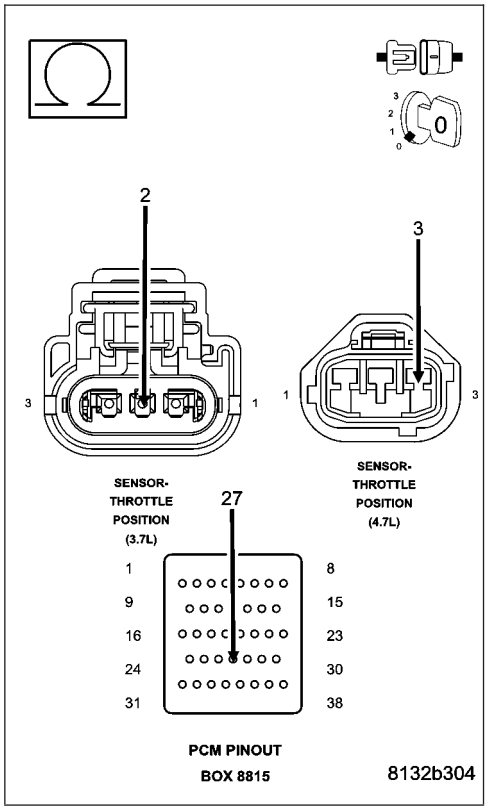
10. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (K900) Sensor ground circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

11. EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

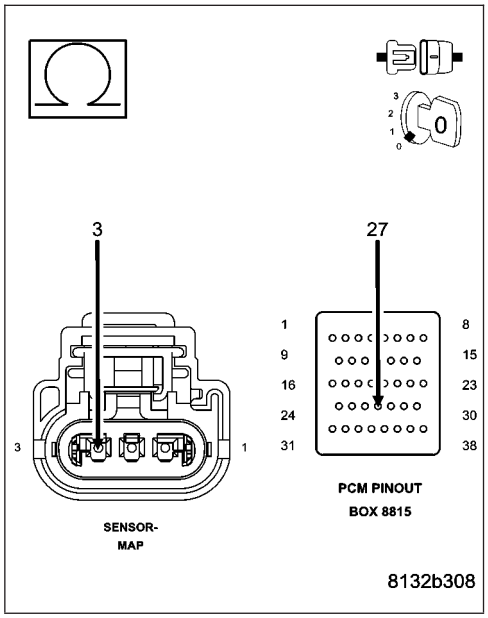
Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

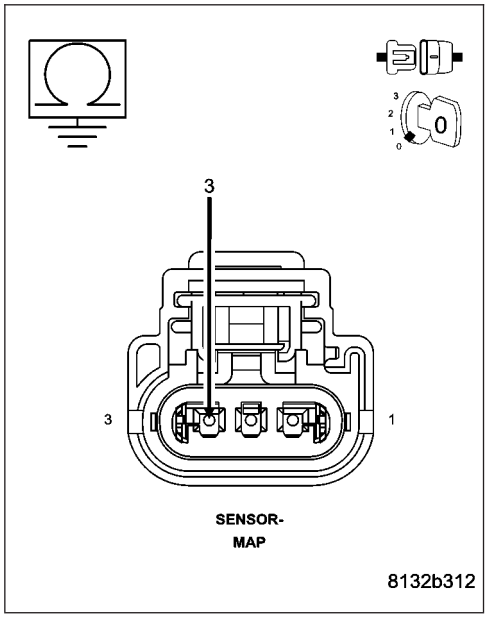
Yes >> Go To 12

No >> Repair the excessive resistance in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the resistance above 100k ohms?

Yes >> Go To 13

No >> Repair the short to ground in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

13. MAP SENSOR

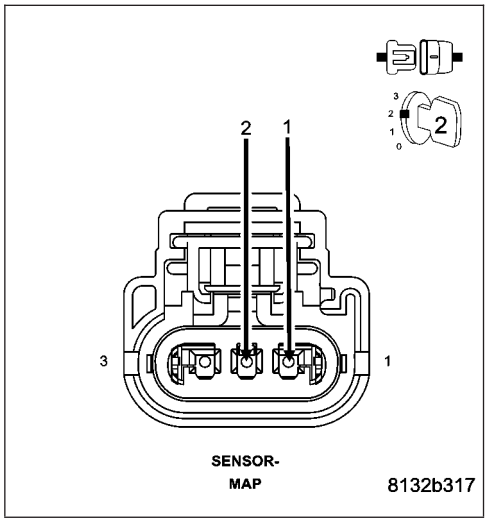
Turn the ignition off.

Connect the C1 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the MAP Sensor voltage.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit.



Does the scan tool display MAP voltage from approximately 4.9 volts to below 0.5 of a volt with the jumper wire installed?

Yes >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

NOTE: Remove the jumper wire before continuing.

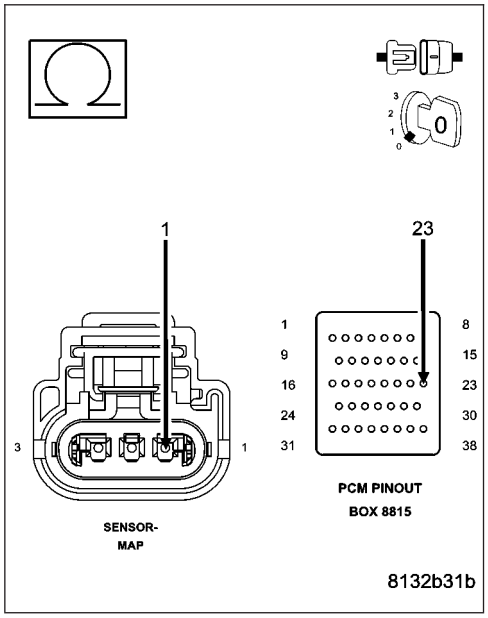
14. EXCESSIVE RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 15

No >> Repair the excessive resistance in the (K1) MAP Signal circuit
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

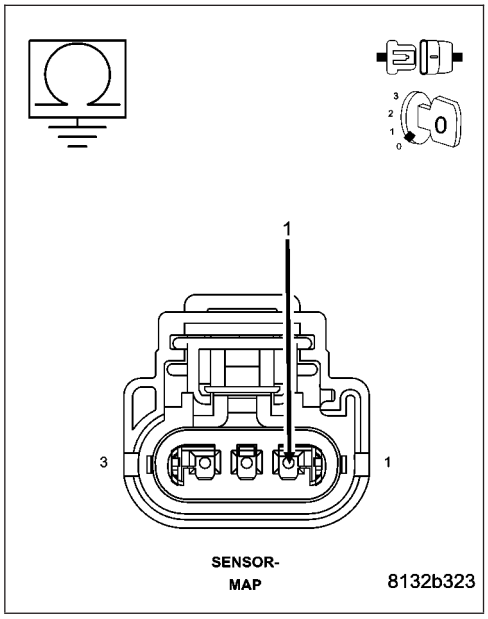
15. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K1) MAP Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



16. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

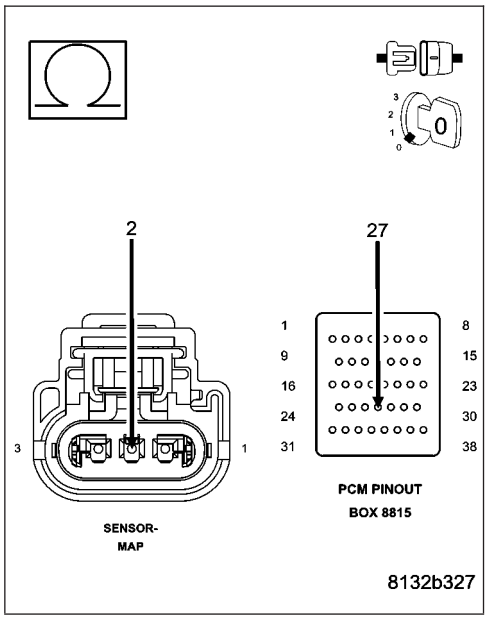
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

17. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

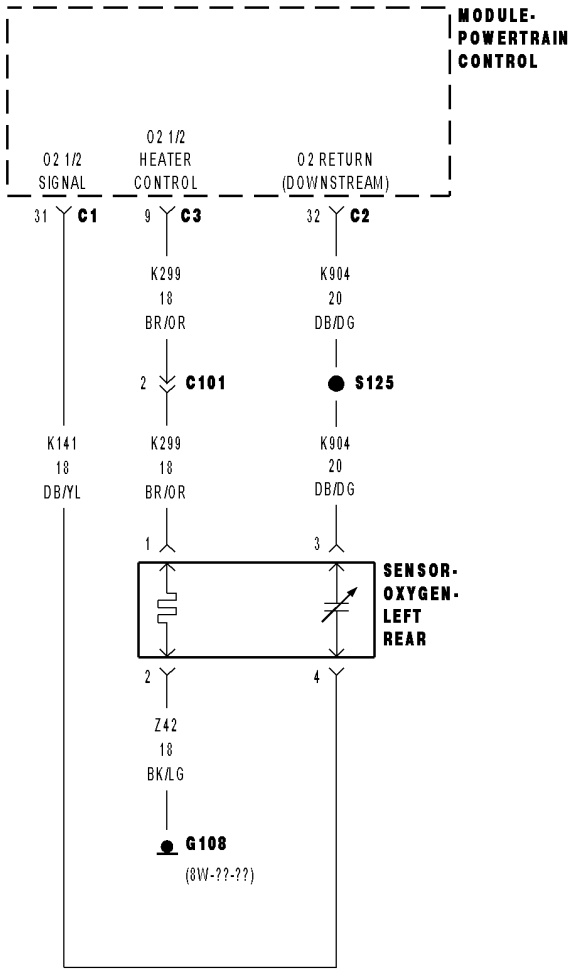
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

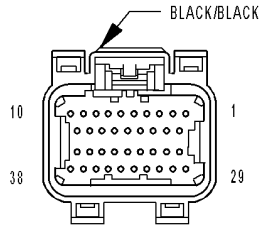
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

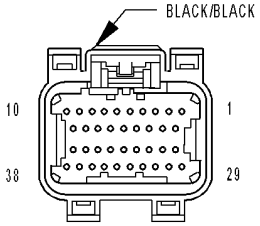
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN

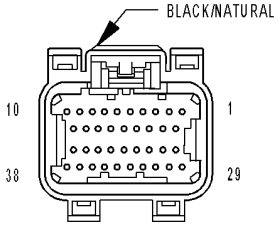




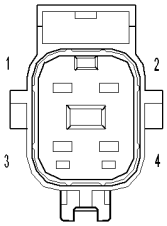
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



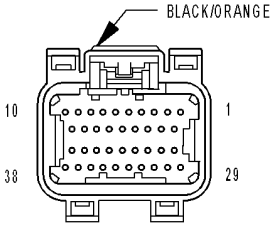
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



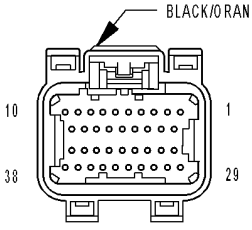
MODULE-
POWERTRAIN
CONTROL C3



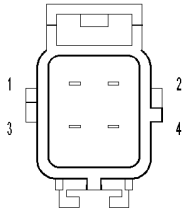
SENSOR-
OXYGEN-
LEFT REAR
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



SENSOR-
OXYGEN-
LEFT
REAR
(3.7L)

8132af63

P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above (-7°C) 20°F, altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive as well as a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL
1/2 O2 SENSOR
(K141) O2 SENSOR 1/2 SIGNAL CIRCUIT
(K299) O2 1/2 HEATER CONTROL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
FUEL CONTAMINATION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check the vehicle repair history. If the 1/2 O2 has been replaced make sure that the O2 sensor was properly installed and meets OEM specification.

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE))

P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN (CONTINUED)

2. EXHAUST LEAK

Turn the ignition off.

WARNING: To avoid personal injury from the exhaust system being hot, allow the exhaust to cool down to a safe temperature before performing a physical inspection. Failure to follow these instructions can result in personal injury or death.

Visually and Physically inspect the exhaust system for holes, cracks, and blockage in the exhaust system.

Is the exhaust system is good condition?

Yes >> Go To 3

No >> Repair or Replace as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from leaks
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN (CONTINUED)

4. O2 SENSOR

Ignition on, engine not running.

Disconnect the 1/2 O2 Sensor harness connector.

With the scan tool, monitor the 1/2 O2 Sensor voltage.

The O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

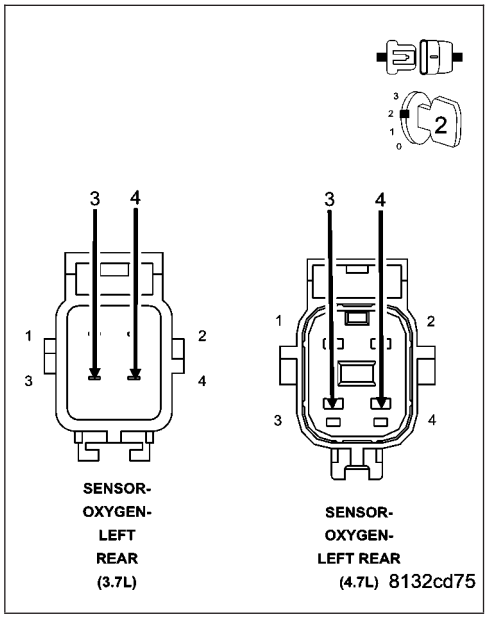
Using a jumper wire, jump the (K141) O2 Sensor 1/2 Signal circuit to the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor volts change from 5.0 volts to 2.5 volts?

Yes >> Replace the O2 Sensor
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN (CONTINUED)

5. (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT

Remove the jump wire.

Ignition on, engine not running.

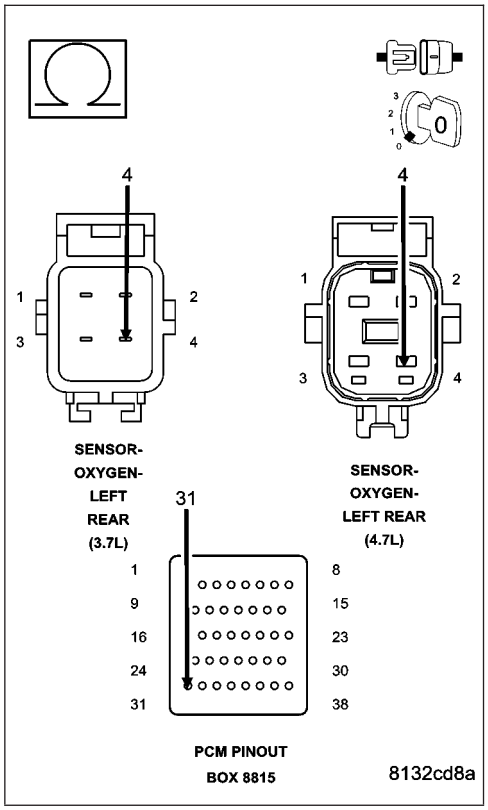
With the scan tool, monitor the 1/2 O2 Sensor voltage.

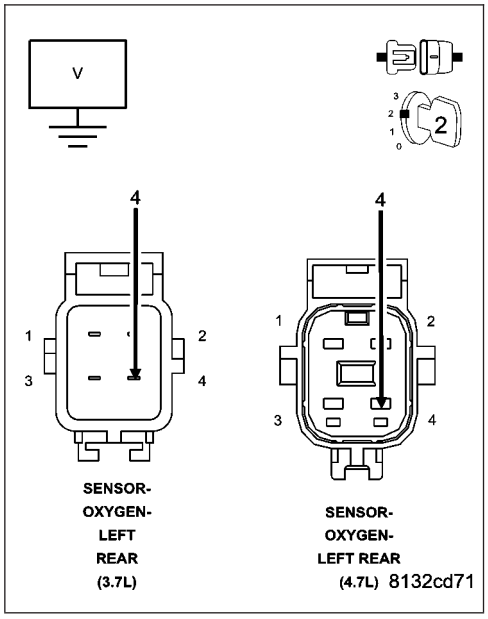
Is the voltage above 4.8 volts?

Yes >> Go To 6

No >> Check the (K141) O2 Sensor 1/2 Signal circuit for an open or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN (CONTINUED)

6. (K299) O2 SENSOR 1/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

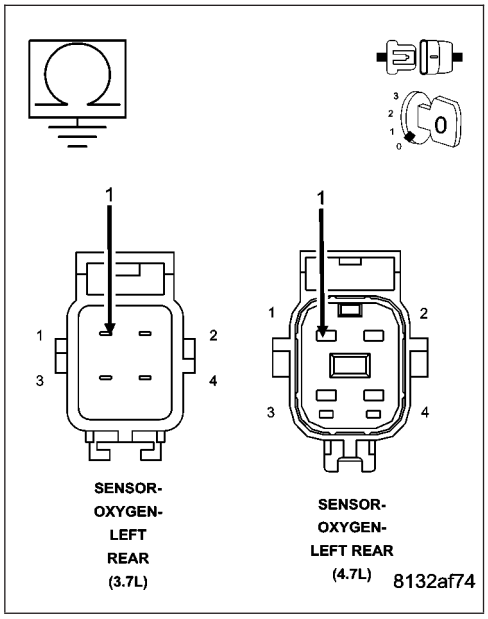
Measure the resistance between ground and the (K299) O2 Sensor 1/2 Heater Control circuit from the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K299) O2 Sensor 1/2 Heater Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN (CONTINUED)

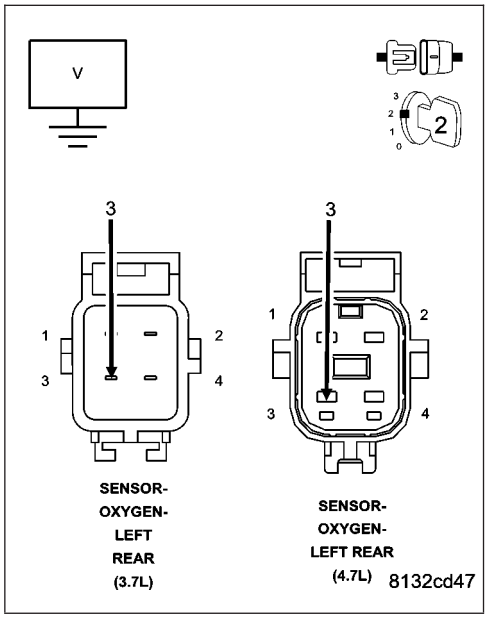
7. (K904) O2 RETURN DOWNSTREAM CIRCUIT

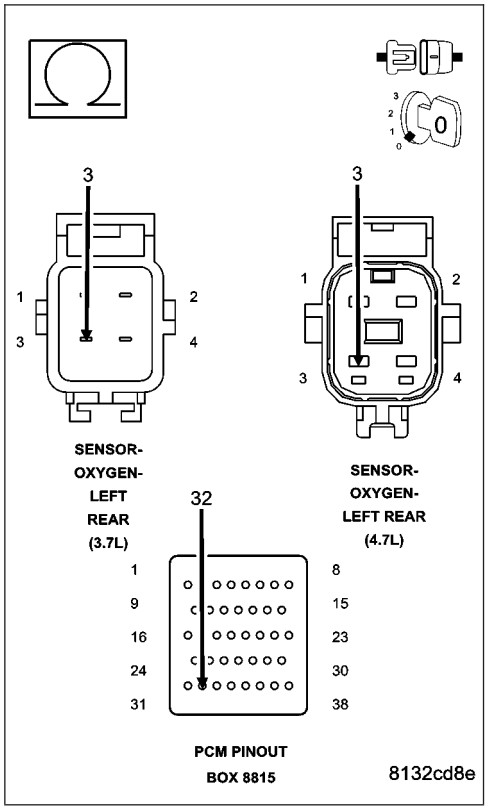
Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

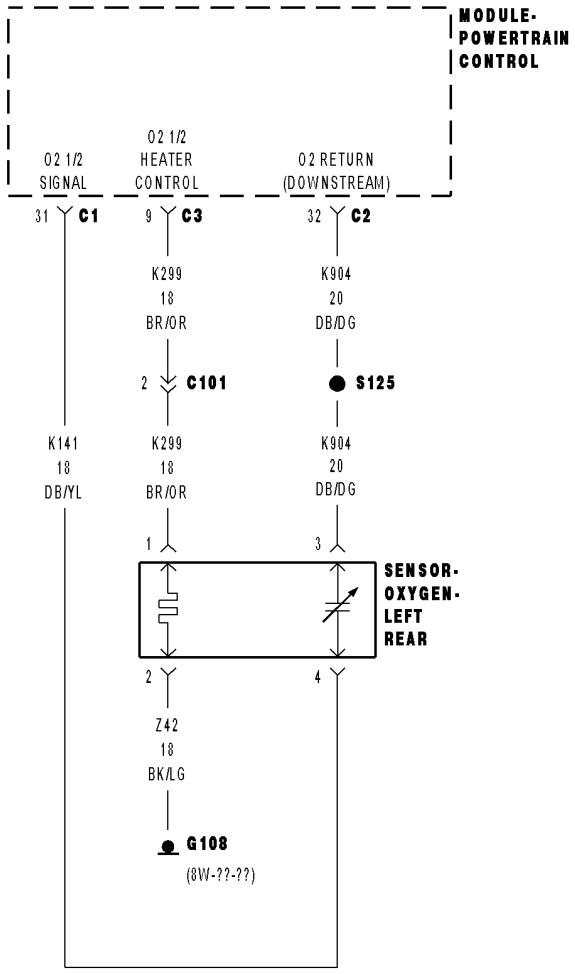
Yes >> Check the fuel system for contaminants.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

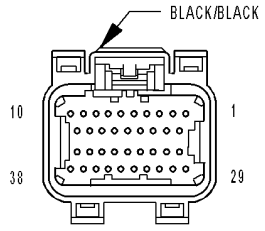
No >> Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



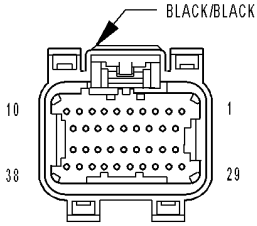


P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH

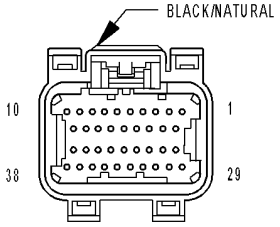




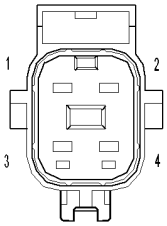
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



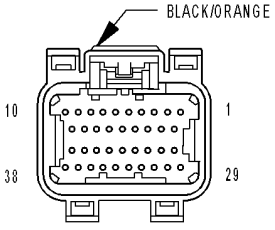
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



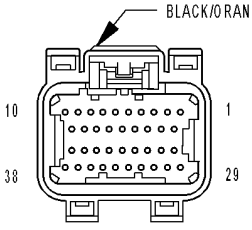
MODULE-
POWERTRAIN
CONTROL C3



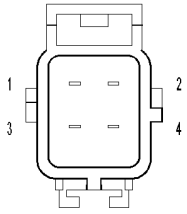
SENSOR-
OXYGEN-
LEFT REAR
(4.7L)



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



SENSOR-
OXYGEN-
LEFT
REAR
(3.7L)

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P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above (-7°C)20°F, altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive as well as a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL
1/2 O2 SENSOR
(K141) O2 SENSOR 1/2 SIGNAL CIRCUIT
(K299) O2 HEATER 1/2 CONTROL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
FUEL CONTAMINATION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check the vehicle repair history. If the 1/2 O2 has been replaced make sure that the O2 sensor was properly installed and meets OEM specification.

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH (CONTINUED)

2. EXHAUST LEAK

Turn the ignition off.

WARNING: To avoid personal injury from the exhaust system being hot, allow the exhaust to cool down to a safe temperature before performing a physical inspection. Failure to follow these instructions can result in personal injury or death.

Visually and Physically inspect the exhause system for holes, cracks, and blockage in the exhaust system.

Is the exhaust system is good condition?

Yes >> Go To 3

No >> Repair or Replace as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems
AIR INDUCTION SYSTEM - must be free from leaks.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH (CONTINUED)

4. O2 SENSOR

Ignition on, engine not running.

Disconnect the 1/2 O2 Sensor harness connector.

With the scan tool, monitor the 1/2 O2 Sensor voltage.

The O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

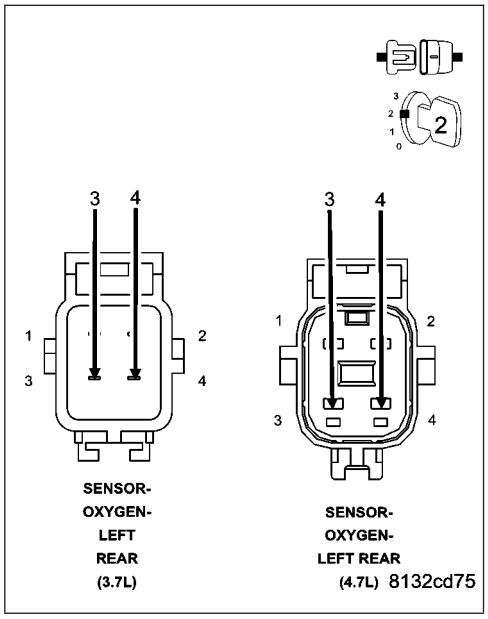
Using a jumper wire, jump the (K141) O2 Sensor 1/2 Signal circuit to the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor volts change from 5.0 volts to 2.5 volts?

Yes >> Replace the O2 Sensor
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH (CONTINUED)

5. (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT

Remove the jump wire.

Ignition on, engine not running.

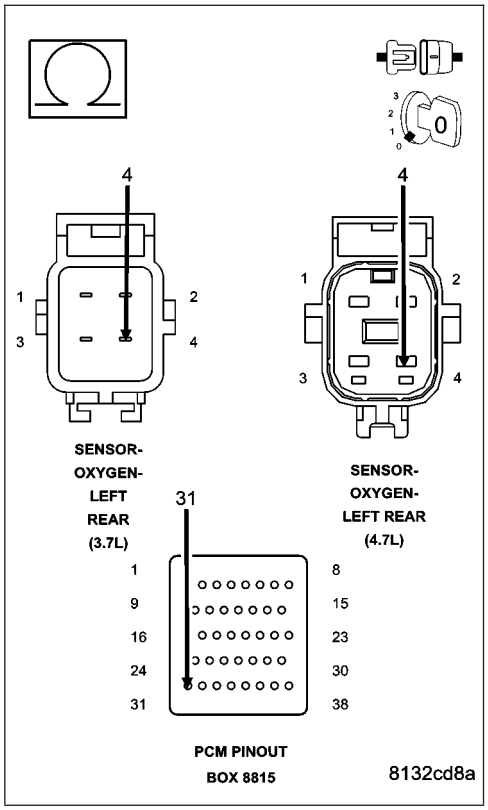
With the scan tool, monitor the 1/2 O2 Sensor voltage.

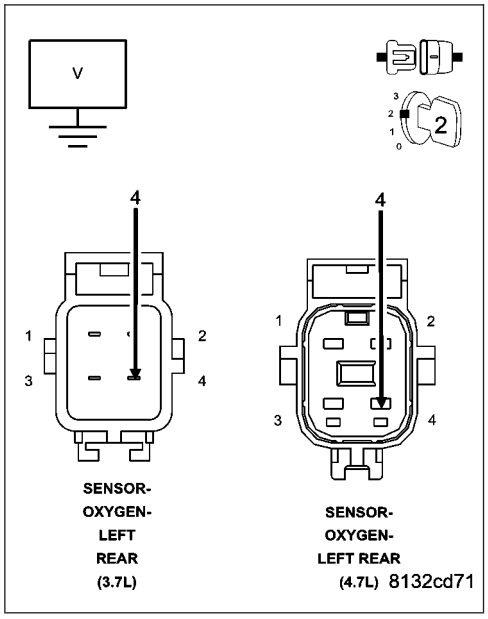
Is the voltage above 4.8 volts?

Yes >> Go To 6

No >> Check the (K141) O2 Sensor 1/2 Signal circuit for an open or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH (CONTINUED)

6. (K299) O2 SENSOR 1/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

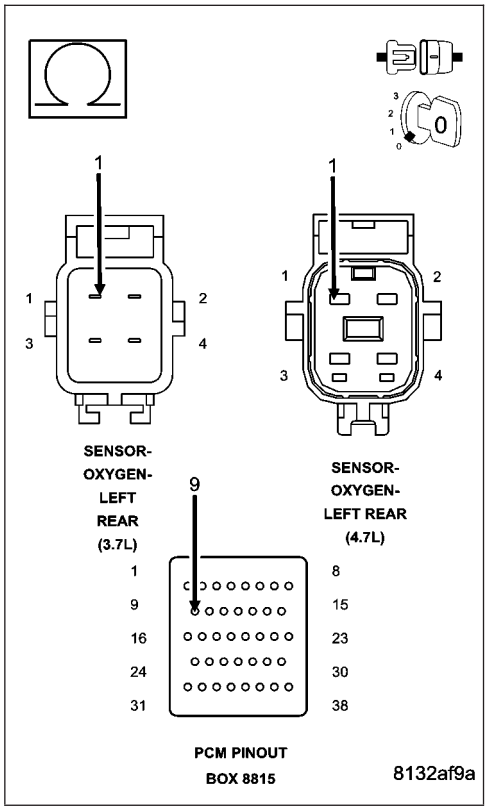
Measure the resistance of the (K299) O2 Sensor 1/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K299) O2 Sensor 1/2 Heater Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH (CONTINUED)

7. (K904) O2 RETURN DOWNSTREAM CIRCUIT

Connect the C3 PCM harness connector.

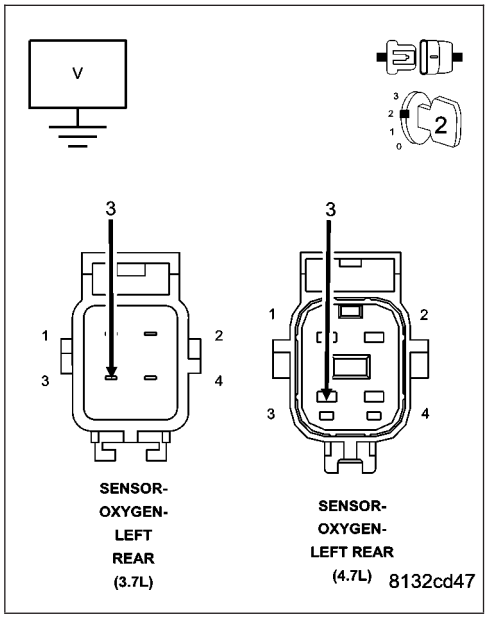
Ignition on, engine not running.

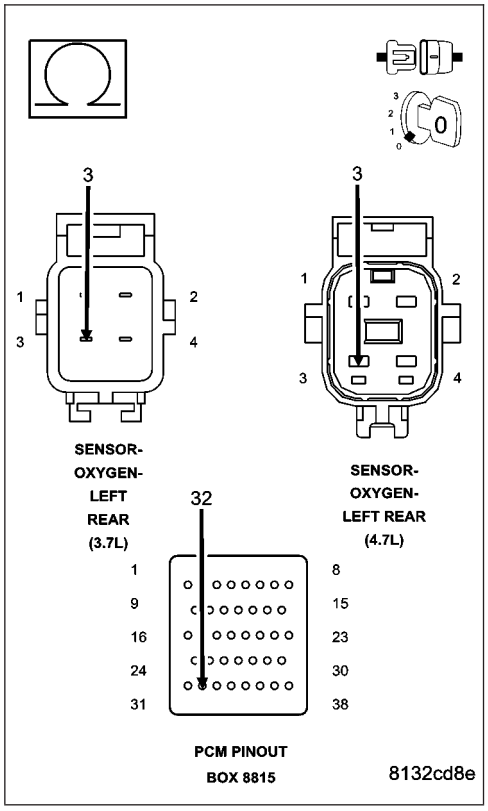
Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

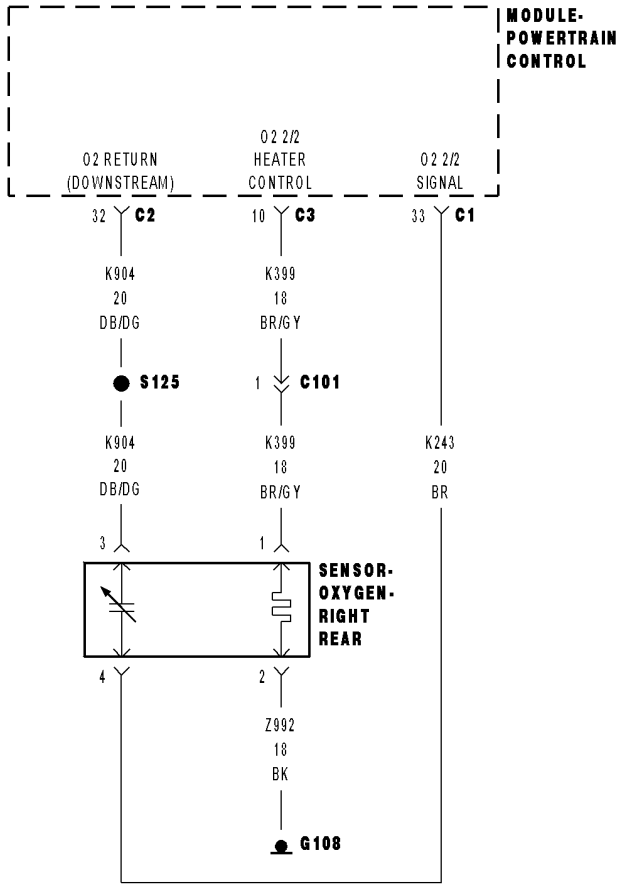
Yes >> Check the fuel system for contaminants.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE))

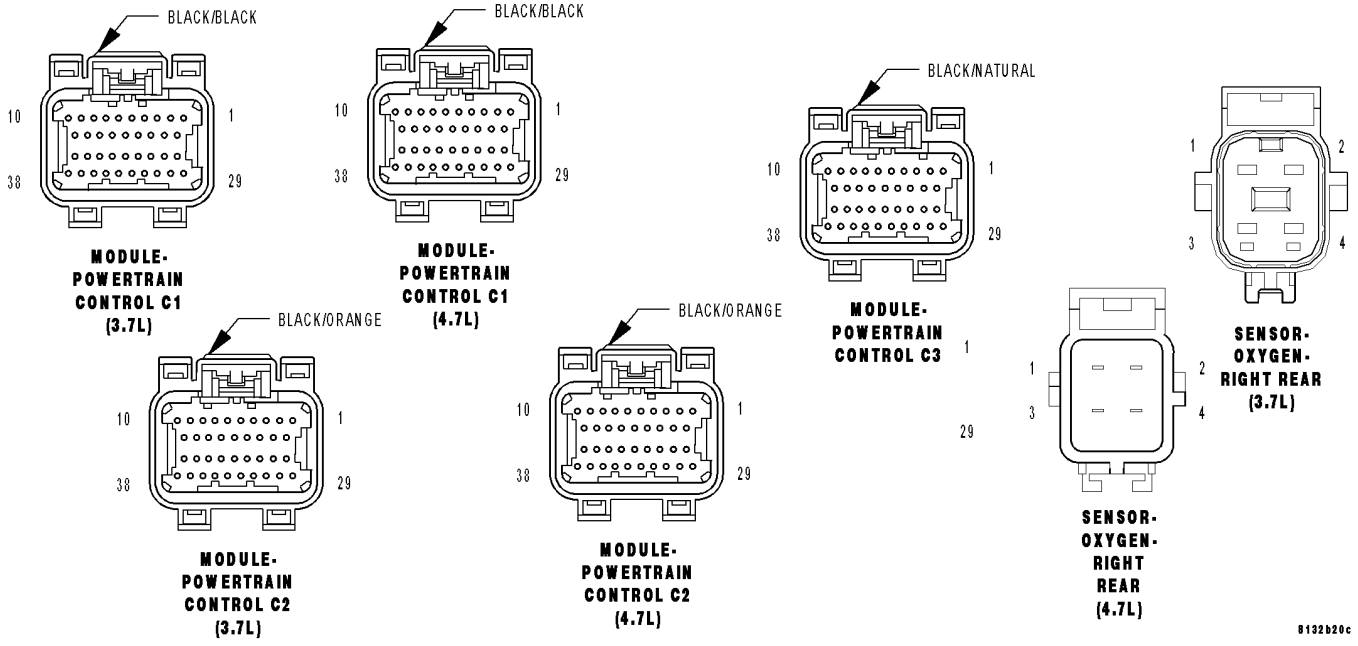
No >> Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN





P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above (-7°C) 20°F, altitude below 8500 ft and fuel level greater than 15%.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL
2/2 O2 SENSOR
(K243) O2 2/2 SIGNAL CIRCUIT
(K399) O2 HEATER 2/2 CONTROL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
FUEL CONTAMINATION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check the vehicle repair history. If the 2/2 O2 has been replaced make sure that the O2 sensor was properly installed and meets OEM specification.

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN (CONTINUED)

2. EXHAUST LEAK

Turn the ignition off.

WARNING: To avoid personal injury from the exhaust system being hot, allow the exhaust to cool down to a safe temperature before performing a physical inspection. Failure to follow these instructions can result in personal injury or death.

Visually and Physically inspect the exhaust system for holes, cracks, and blockage in the exhaust system.

Is the exhaust system is good condition?

Yes >> Go To 3

No >> Repair or Replace as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from leaks
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN (CONTINUED)

4. O2 SENSOR

Ignition on, engine not running.

Disconnect the 2/2 O2 Sensor harness connector.

With the scan tool, monitor the 2/2 O2 Sensor voltage.

The O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

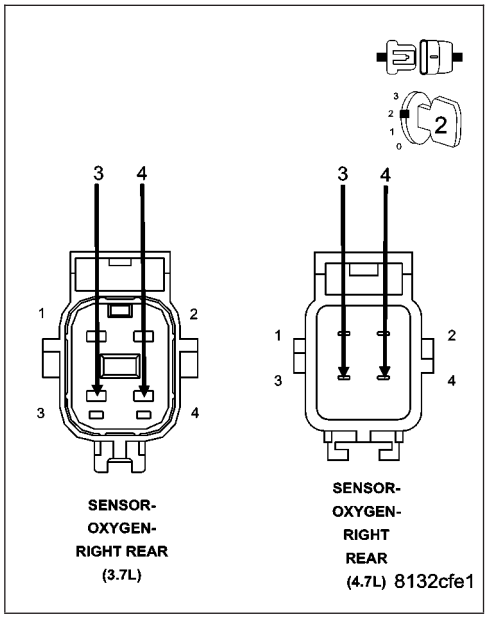
Using a jumper wire, jump the (K243) O2 Sensor 2/2 Signal circuit to the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor volts change from 5.0 volts to 2.5 volts?

Yes >> Replace the O2 Sensor
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN (CONTINUED)

5. (K243) O2 SENSOR 2/2 SIGNAL CIRCUIT

Remove the jump wire.

Ignition on, engine not running.

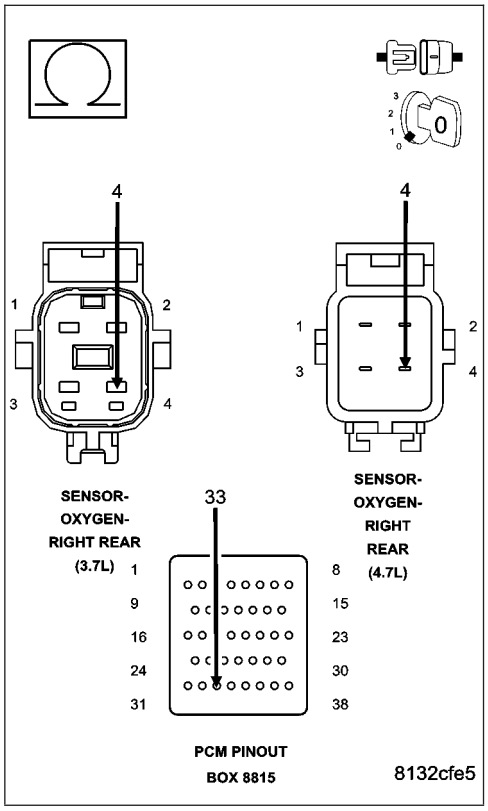
With the scan tool, monitor the O2 Sensor voltage.

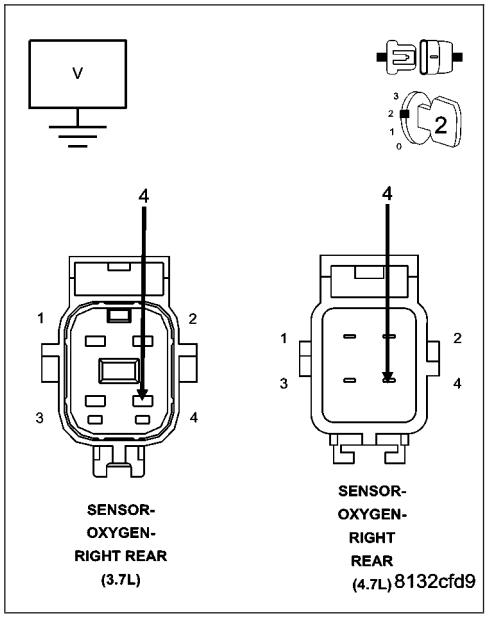
Is the voltage above 4.8 volts?

Yes >> Go To 6

No >> Check the (K243) O2 Sensor 2/2 Signal circuit for a open or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN (CONTINUED)

6. (K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (K399) O2 Sensor 2/2 Heater Control circuit in the O2 Sensor harness connector.

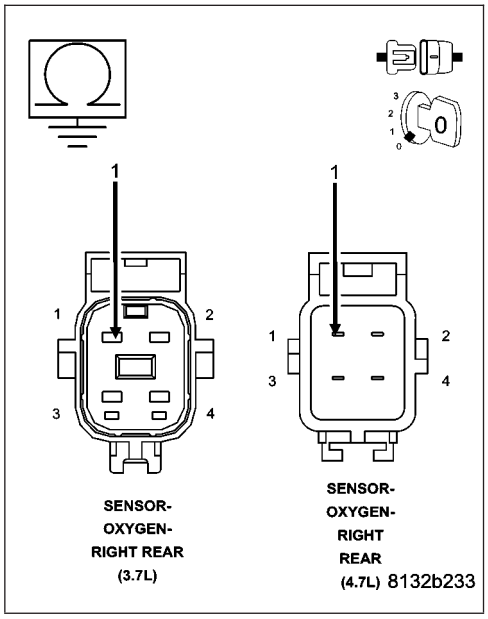
Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K399) O2 Sensor 2/2 Heater Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN (CONTINUED)

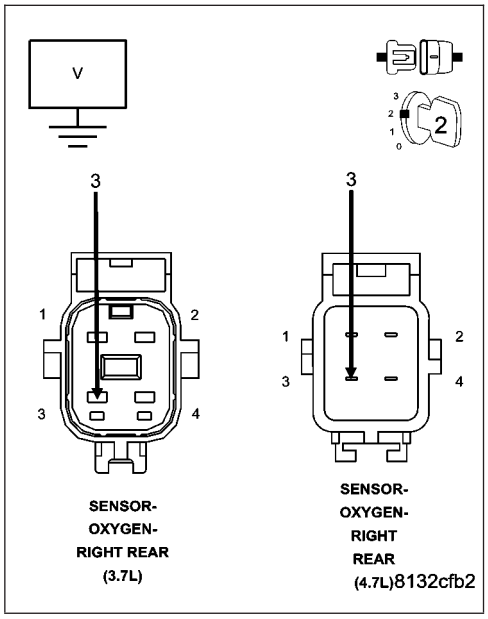
7. (K904) O2 RETURN DOWNSTREAM CIRCUIT

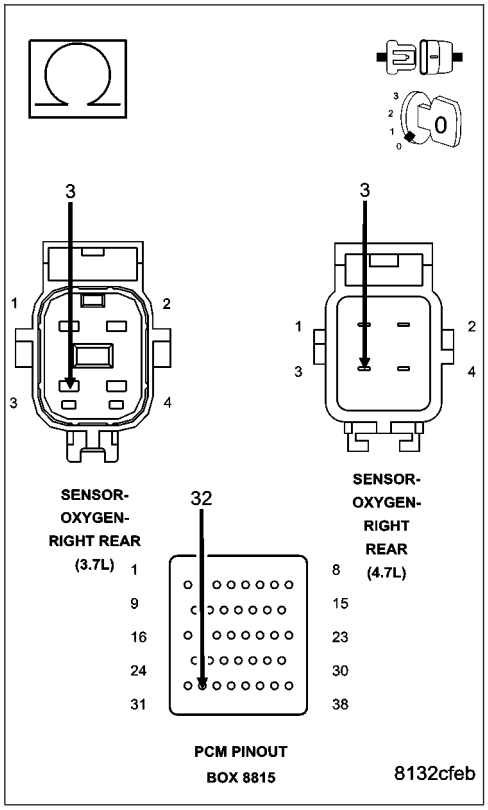
Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

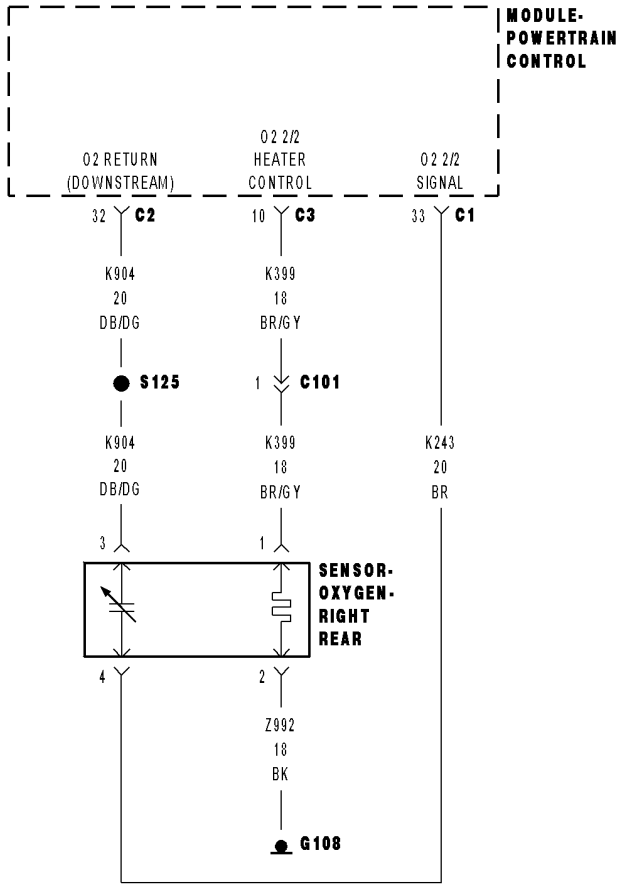
Yes >> Check the fuel system for contaminants.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

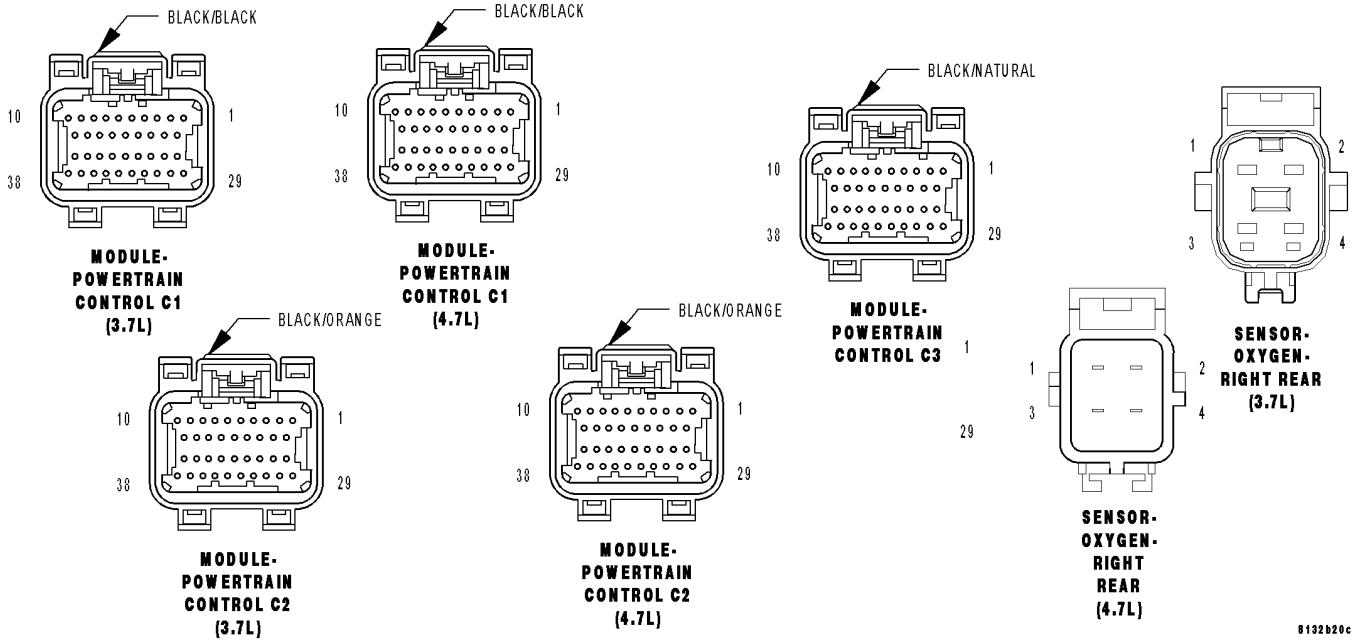
No >> Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH





P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above (-7°C) 20°F, altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive as well as a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL
2/2 O2 SENSOR
(K342) O2 SENSOR 2/2 SIGNAL CIRCUIT
(K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
FUEL CONTAMINATION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check the vehicle repair history. If the 2/2 O2 has been replaced make sure that the O2 sensor was properly installed and meets OEM specification.

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH (CONTINUED)

2. EXHAUST LEAK

Turn the ignition off.

WARNING: To avoid personal injury from the exhaust system being hot, allow the exhaust to cool down to a safe temperature before performing a physical inspection. Failure to follow these instructions can result in personal injury or death.

Visually and Physically inspect the exhaust system for holes, cracks, and blockage in the exhaust system.

Is the exhaust system is good condition?

Yes >> Go To 3

No >> Repair or Replace as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from leaks
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH (CONTINUED)

4. O2 SENSOR

Ignition on, engine not running.

Disconnect the 2/2 O2 Sensor harness connector.

With the scan tool, monitor the 2/2 O2 Sensor voltage.

The O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

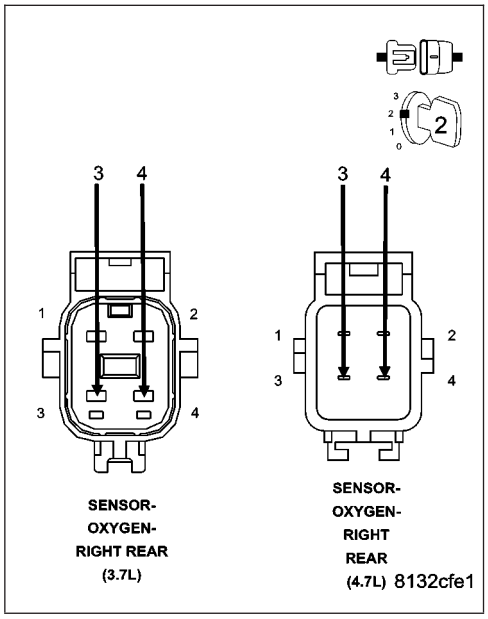
Using a jumper wire, jump the (K243) O2 Signal 2/2 circuit to the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor volts change from 5.0 volts to 2.5 volts?

Yes >> Replace the O2 Sensor
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH (CONTINUED)

5. (K243) O2 SENSOR 2/2 SIGNAL CIRCUIT

Remove the jump wire.

Ignition on, engine not running.

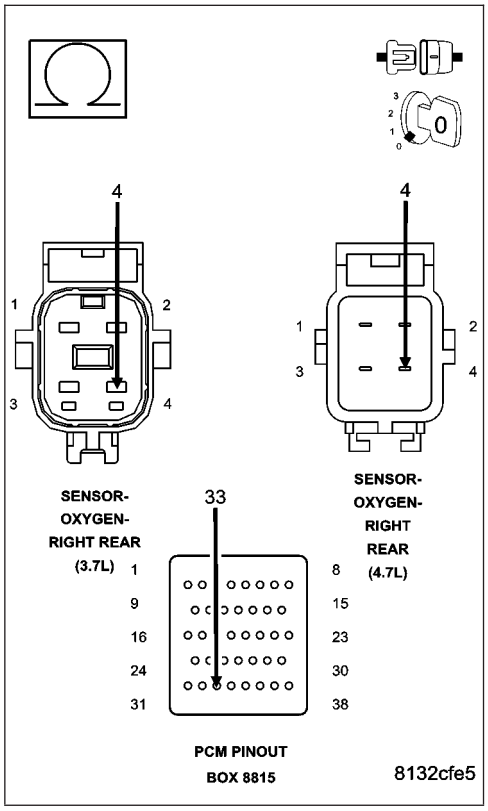
With the scan tool, monitor the 2/2 O2 Sensor voltage.

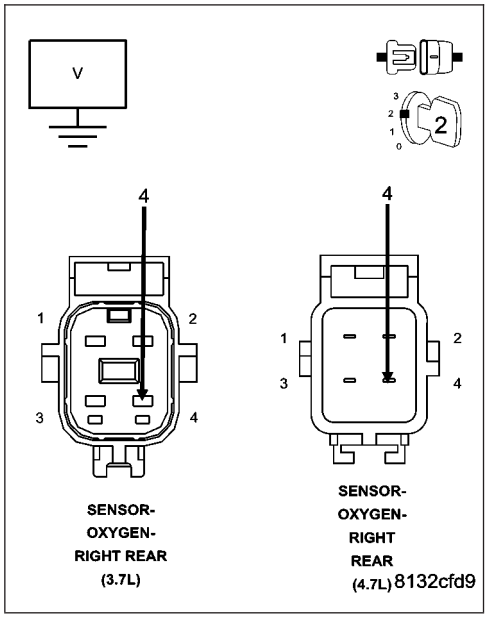
Is the voltage above 4.8 volts?

Yes >> Check the (K243) O2 Sensor 2/2 Signal circuit for an open or short to battery voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

No >> Go To 6

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH (CONTINUED)

6. (K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

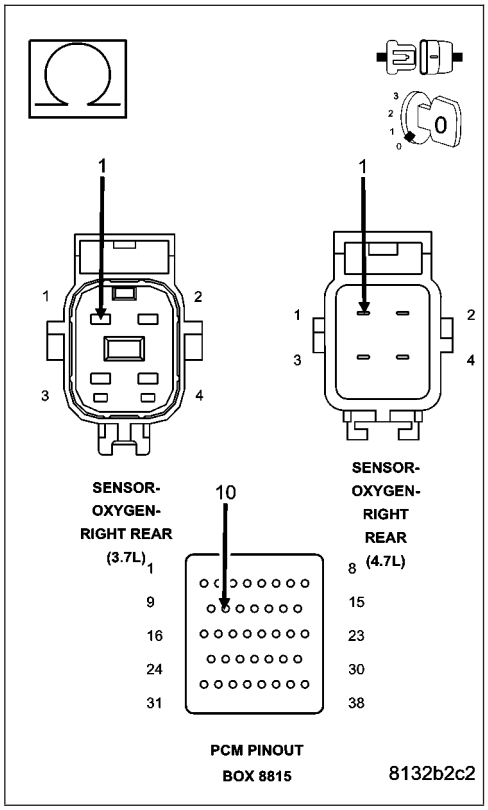
Measure the resistance of the (K399) O2 Sensor 2/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K399) O2 Sensor 2/2 Heater Control circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH (CONTINUED)

7. (K904) O2 RETURN DOWNSTREAM CIRCUIT

Connect the C3 PCM harness connector.

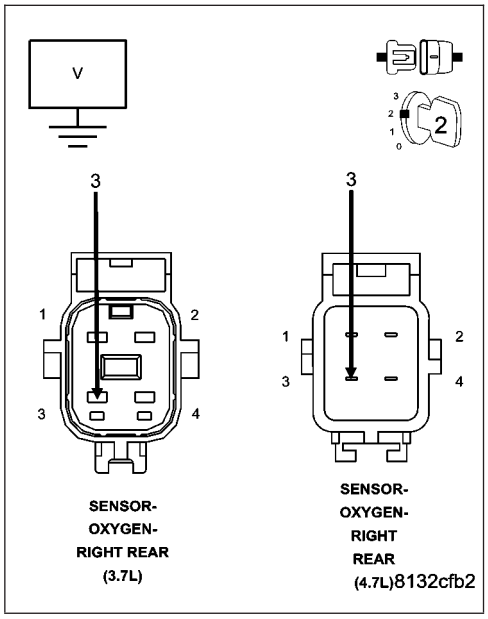
Ignition on, engine not running.

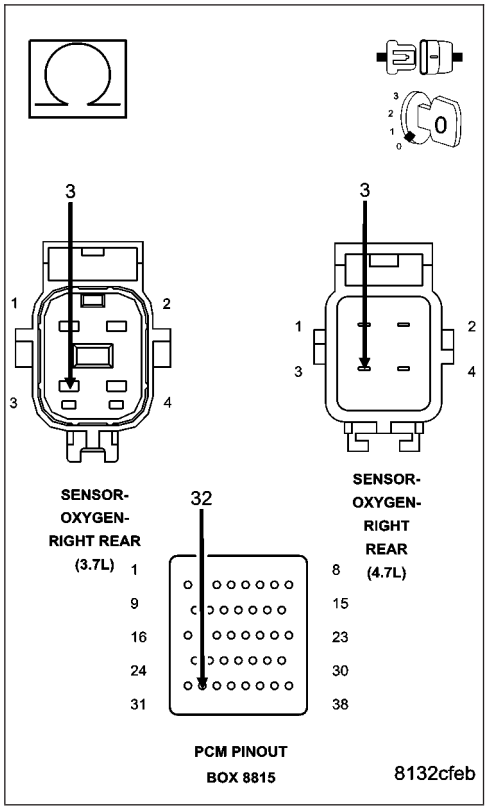
Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

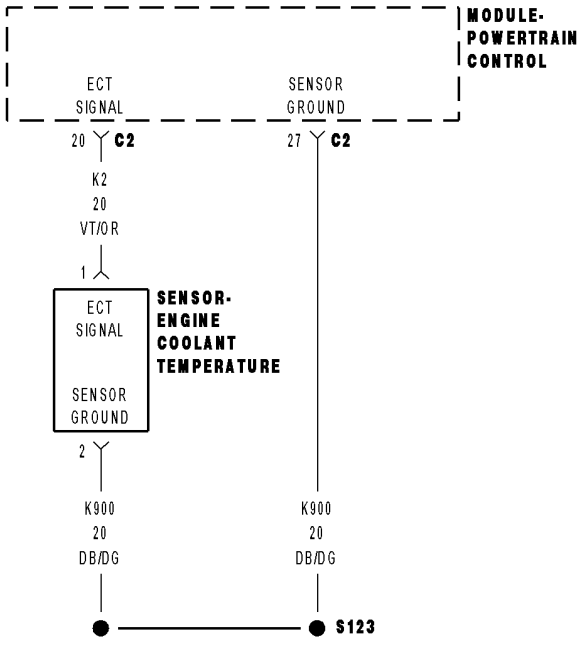
Yes >> Check the fuel system for contaminants.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

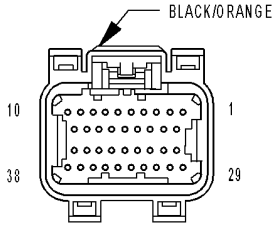
No >> Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



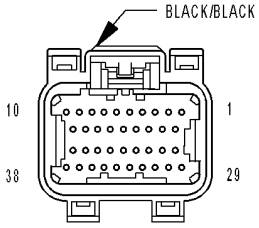


P2181-COOLING SYSTEM PERFORMANCE

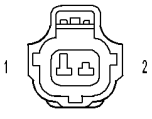




MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



SENSOR-
ENGINE
COOLANT
TEMPERATURE

8132bec8

P2181-COOLING SYSTEM PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on, Engine running, and no ECT DTCs present.
- **Set Condition:**
  PCM recognizes that the ECT has failed its self coherence test. The coolant temp should only change at a certain rate, if this rate is too slow or too fast this fault will set. Two trip fault. Three good trips to clear MIL. ETC light will illuminate on first trip failure.

Possible Causes
LOW COOLANT LEVEL
(K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K2) ECT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND
THERMOSTAT
ECT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: If this code sets during extreme ambient temperatures, improper installation of a block heater could be the cause of this DTC.

With a scan tool, read DTCs.

Diagnose all other ECT and Cooling System codes before continuing.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE))

P2181-COOLING SYSTEM PERFORMANCE (CONTINUED)

2. LOW COOLANT LEVEL

NOTE: If a Engine Coolant Temperature (ECT) DTC is set along with this code, diagnose the ECT DTC first.

NOTE: Inspect the ECT terminals and related PCM terminals. Ensure the terminals are free from corrosion and damage.

NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.

NOTE: Extremely cold outside ambient temperatures may have caused this DTC to set.

NOTE: Need to make sure that that no Cooling System DTCs are set or changes that would make the warm up much slower or much faster: broken water pump can set this, addition of aftermarket auxiliary cooler can set this DTC.

WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Failure to follow these instructions can result in personal injury or death. Allow the engine to cool before opening the cooling system.

Inspect the coolant system for proper level and condition.

Is the coolant level and condition OK?

Yes >> Go To 3

No >> Inspect the vehicle for a coolant leak and add the necessary amount of coolant.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. THERMOSTAT

NOTE: This test works best if performed on a cold engine (cold soak).

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the Eng Coolant Tmp Deg on the scan tool should stay relatively close to each other.

Using the appropriate service information, determine the proper opening temperature of the thermostat.

Did the thermostat open at the proper temperature?

Yes >> Go To 4

No >> Replace the thermostat.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2181-COOLING SYSTEM PERFORMANCE (CONTINUED)

4. ECT SENSOR

Connect a jumper between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.

Turn the ignition off.

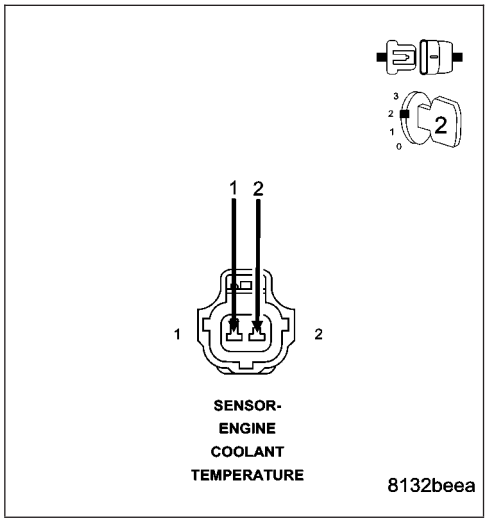
Disconnect the ECT Sensor harness connector.

With a scan tool, read the ECT voltage.

Is the voltage below 1.0 volt?

Yes >> Replace the ECT Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. (K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

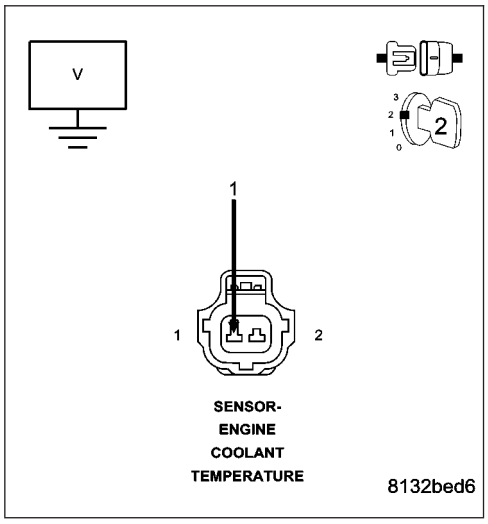
Ignition on, engine not running.

Measure the voltage on the (K2) ECT Signal circuit in the ECT Sensor harness connector.

Is the voltage above 5.2 volts?

Yes >> Repair the short to battery voltage in the (K2) ECT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P2181-COOLING SYSTEM PERFORMANCE (CONTINUED)

6. (K2) ECT SIGNAL CIRCUIT OPEN

Turn the ignition off.

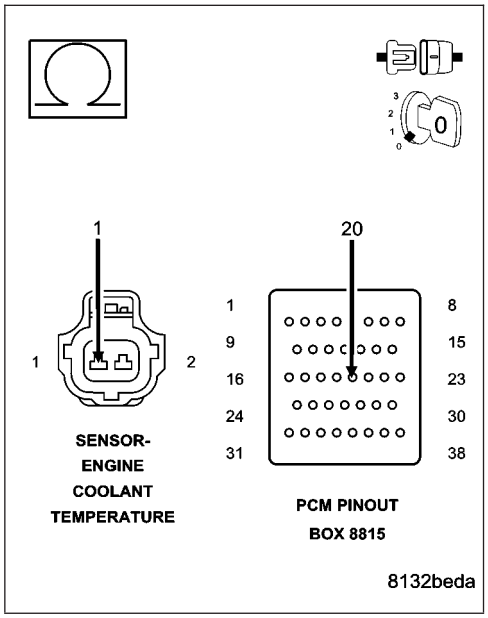
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K2) ECT Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K2) ECT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



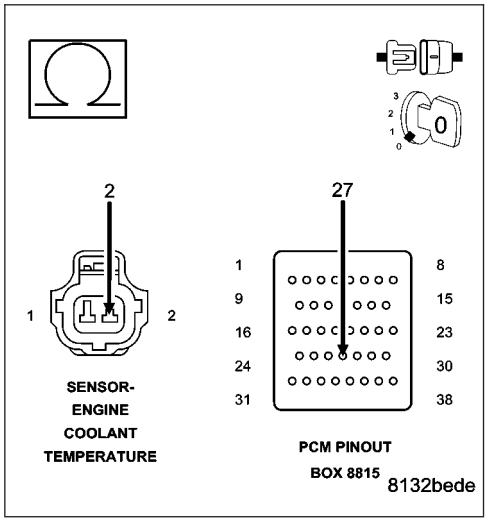
7. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 8

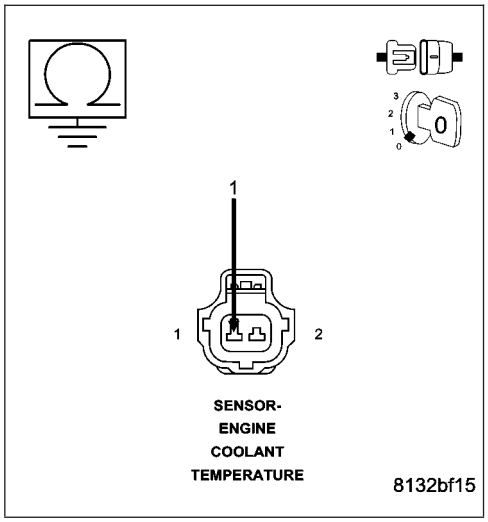
No >> Repair the open in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2181-COOLING SYSTEM PERFORMANCE (CONTINUED)

8. (K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K2) ECT Signal circuit in the ECT Sensor harness connector.



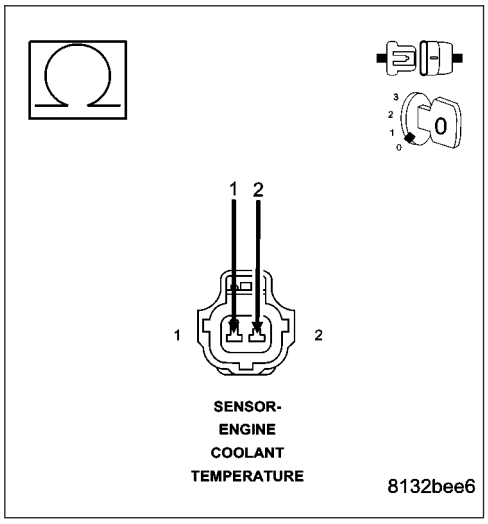
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K2) ECT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

9. (K2) ECT SIGNAL CIRCIUT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor ground and the (K2) ECT Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

10. PCM

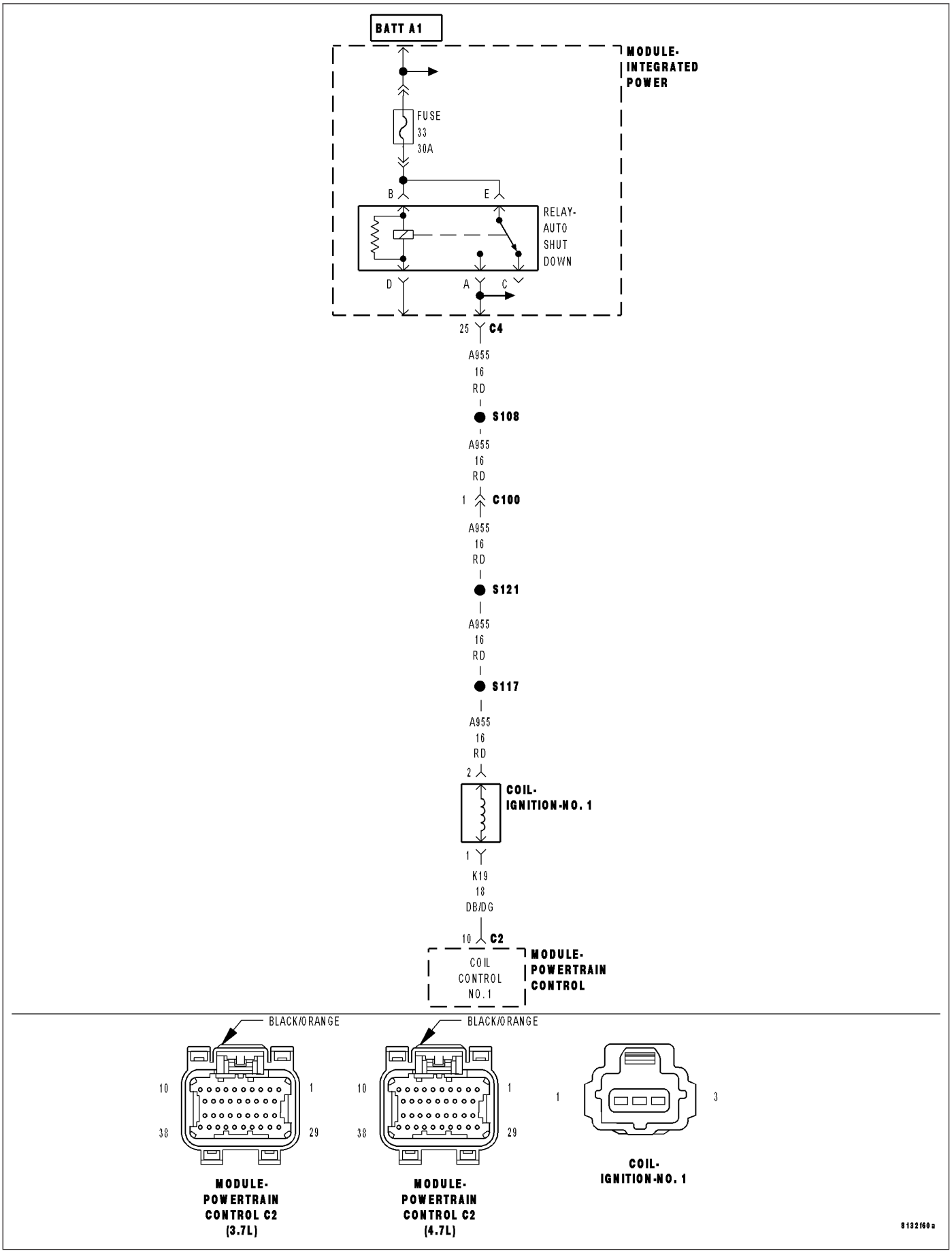
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2302-IGNITION COIL 1 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2302-IGNITION COIL 1 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, too short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K19) COIL CONTROL NO.1 CIRCUIT OPEN
(K19) COIL CONTROL NO.1 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

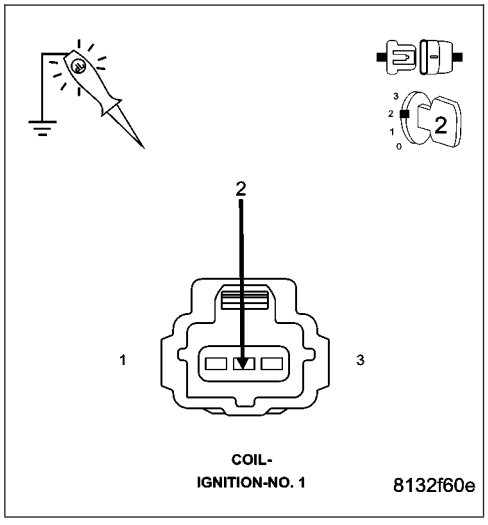
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Coil on Plug harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (A955) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.

P2302-IGNITION COIL 1 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L and 3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

No >> Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K19) Coil Control No.1 circuit.

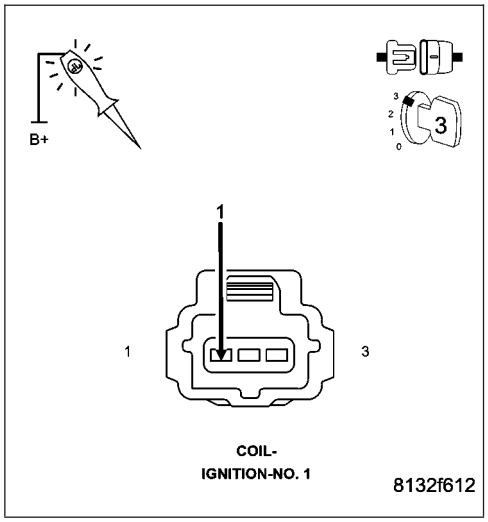
Crank the engine for 5 seconds while observing the test light.

What is the condition of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



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5. (K19) COIL CONTROL NO.1 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

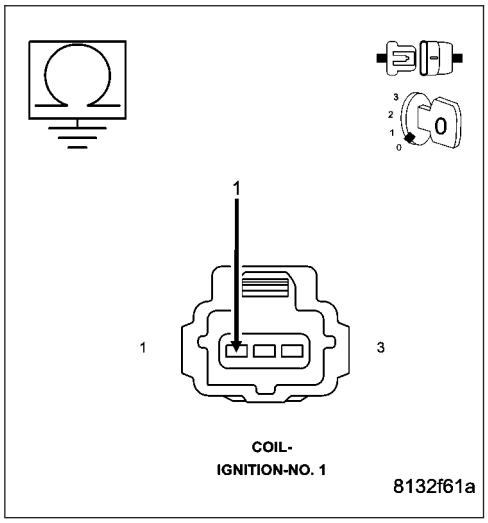
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K19) Coil Control No.1 circuit in the Coil on Plug harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K19) Coil Control No.1 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P2302-IGNITION COIL 1 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

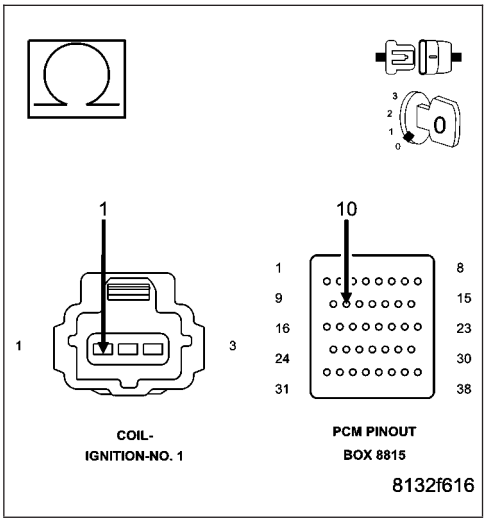
6. (K19) COIL CONTROL NO.1 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K19) Coil Control No.1 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K19) Coil Control No.1 circuit.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

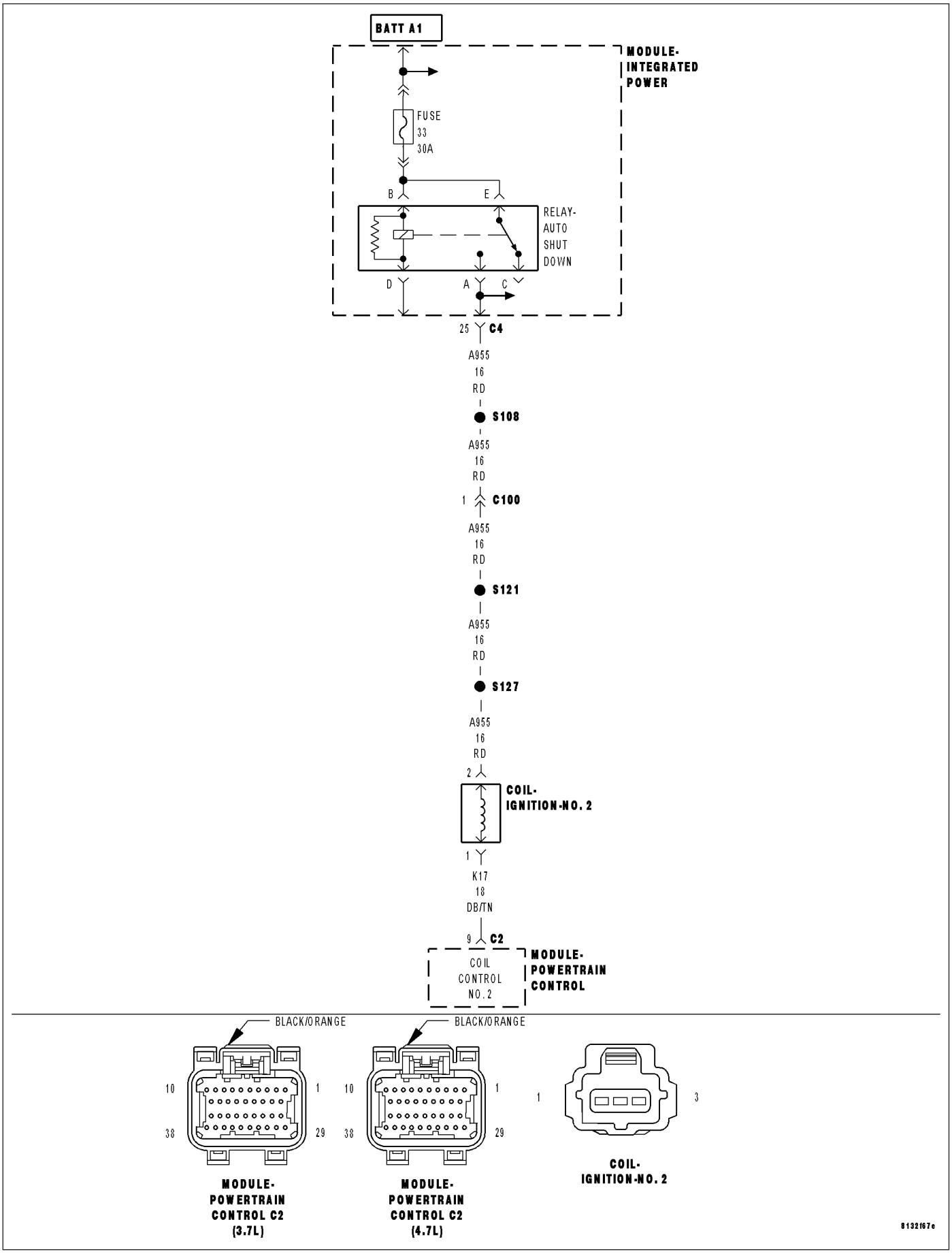
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2305-IGNITION COIL 2 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2305-IGNITION COIL 2 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K17) COIL CONTROL NO.2 CIRCUIT OPEN
(K17) COIL CONTROL NO.2 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

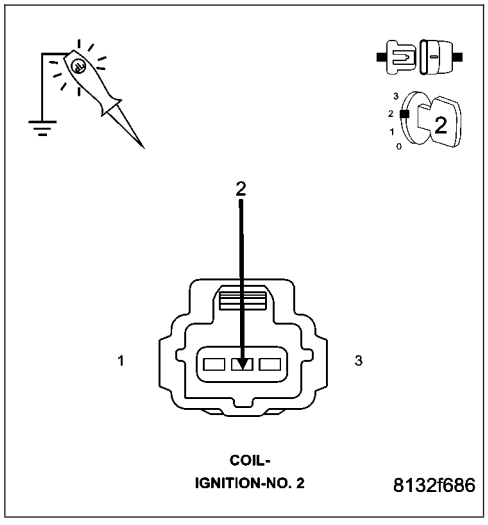
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Coil on Plug harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (A955) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.

P2305-IGNITION COIL 2 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L and 3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

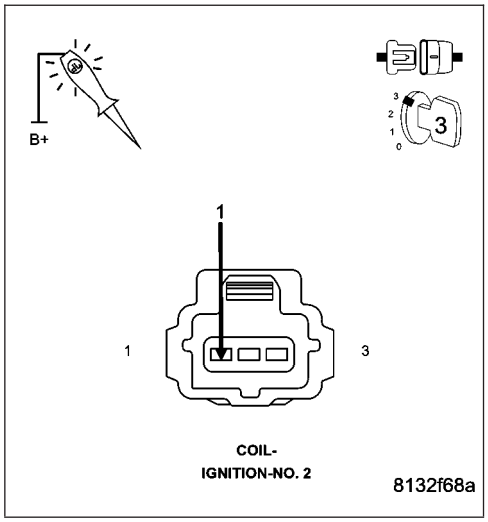
No >> Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K17) Coil Control No.2 circuit.

Crank the engine for 5 seconds while observing the test light.



What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6

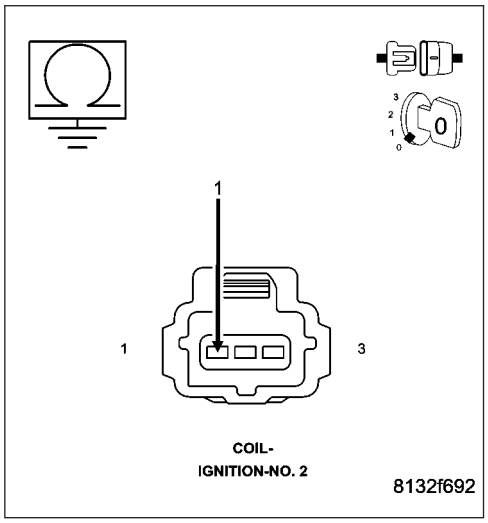
---

5. (K17) COIL CONTROL NO.2 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K17) Coil Control No.2 circuit in the Coil on Plug harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K17) Coil Control No.2 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P2305-IGNITION COIL 2 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

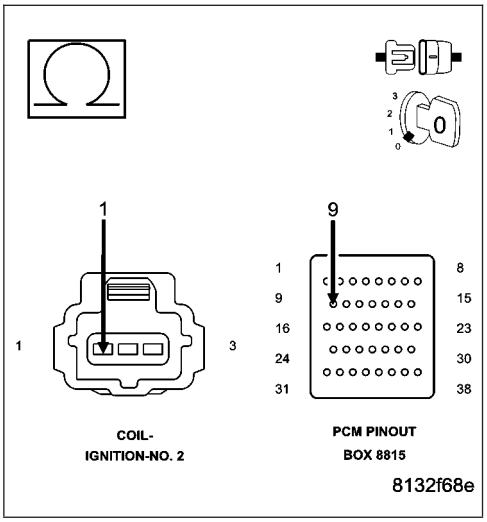
6. (K17) COIL CONTROL NO.2 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K17) Coil Control No.2 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K17) Coil Control No.2 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

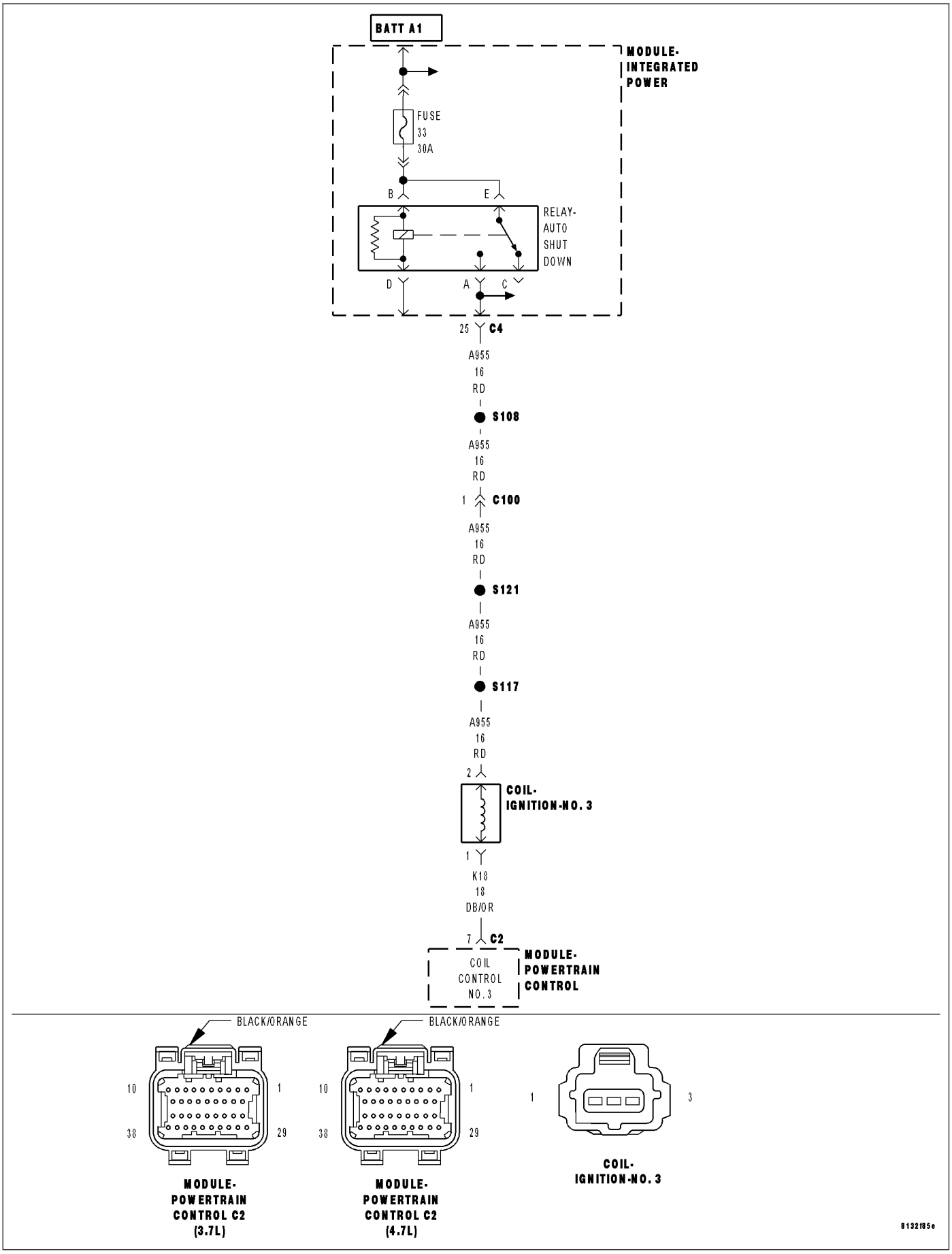
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2308-IGNITION COIL 3 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2308-IGNITION COIL 3 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K18) COIL CONTROL NO.3 CIRCUIT OPEN
(K18) COIL CONTROL NO.3 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

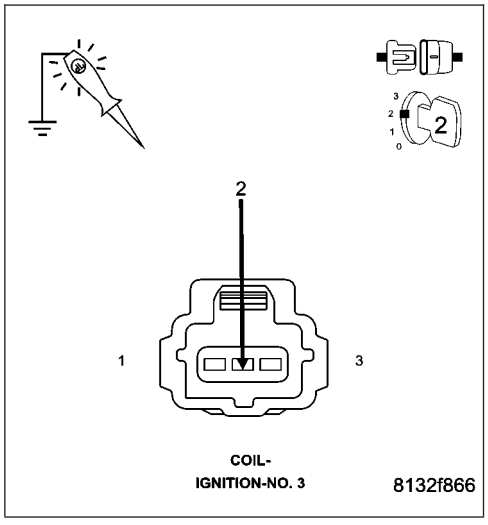
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Coil on Plug harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (A955) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.

P2308-IGNITION COIL 3 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L and 3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

No >> Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K18) Coil Control No.3 circuit.

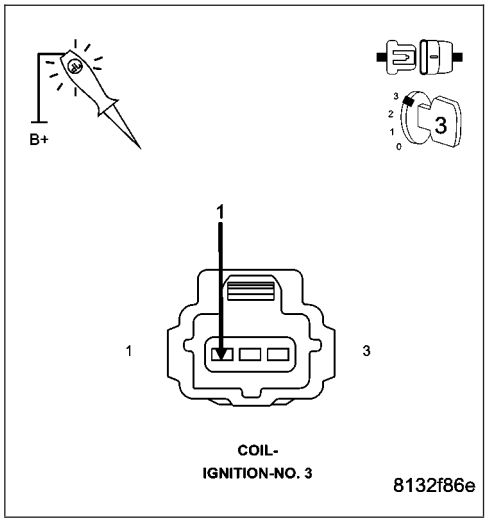
Crank the engine for 5 seconds while observing the test light.

What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



---

5. (K18) COIL CONTROL NO.3 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

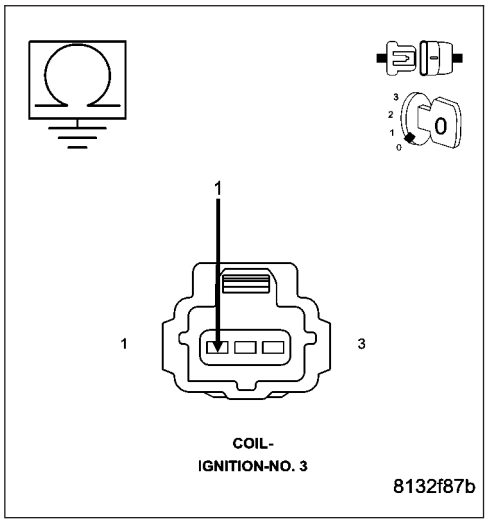
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K18) Coil Control No.3 circuit in the Coil on Plug harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K18) Coil Control No.3 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P2308-IGNITION COIL 3 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

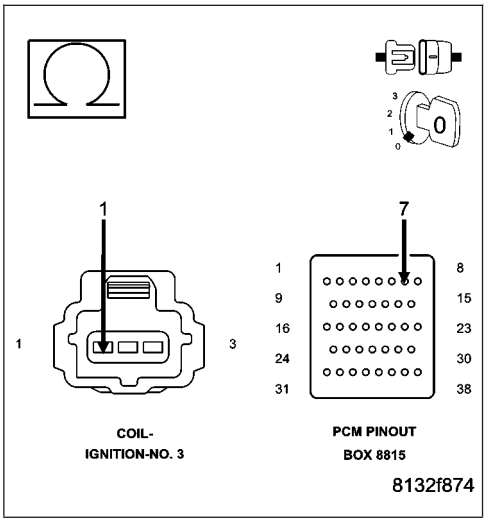
6. (K18) COIL CONTROL NO.3 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K18) Coil Control No.3 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K18) Coil Control No.3 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

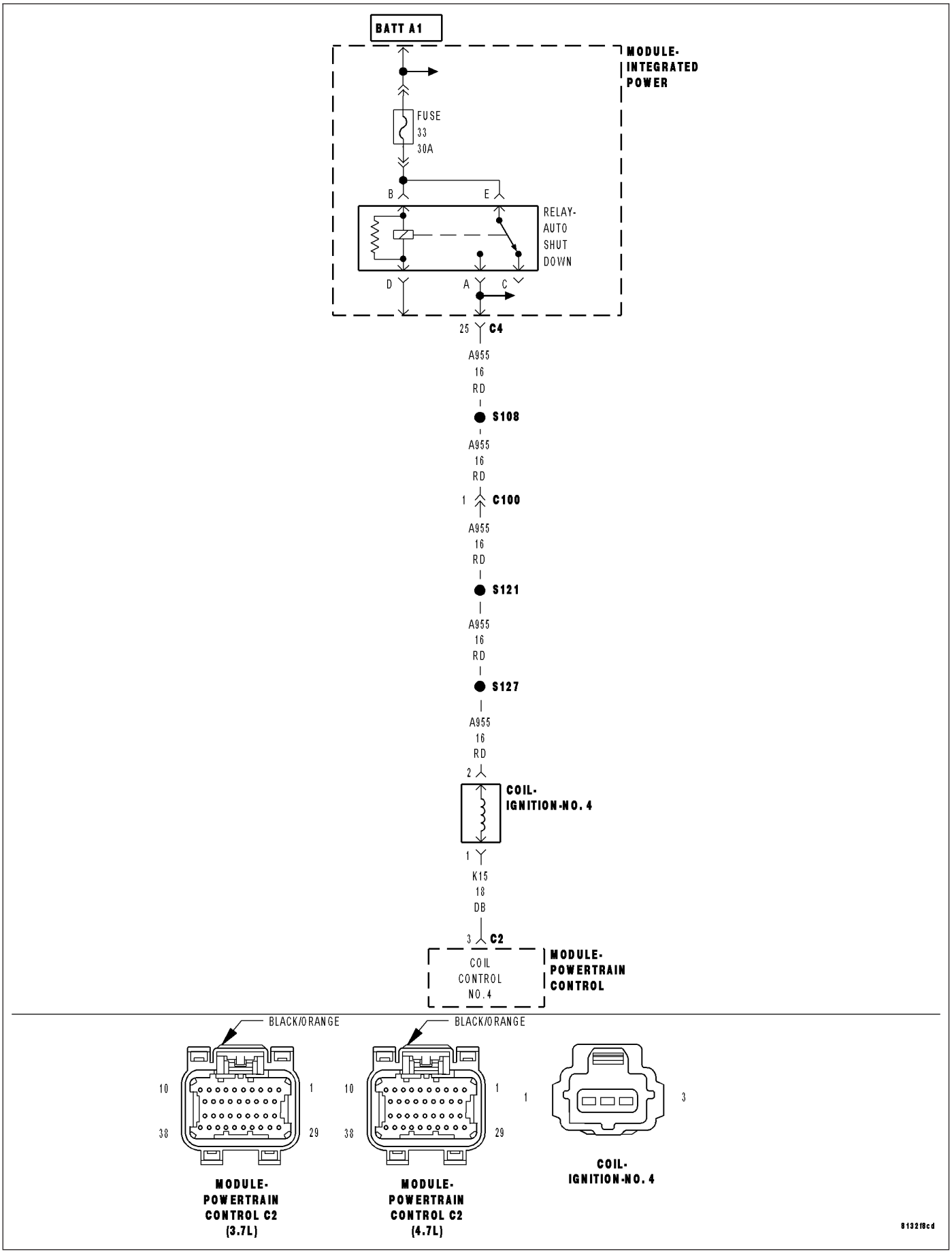
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2311-IGNITION COIL 4 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2311-IGNITION COIL 4 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K15) COIL CONTROL NO.4 CIRCUIT OPEN
(K15) COIL CONTROL NO.4 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

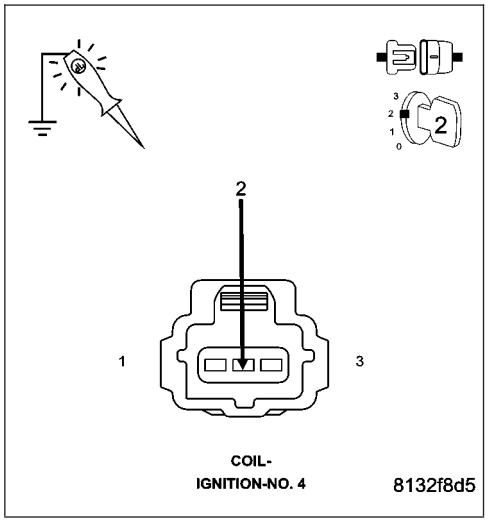
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Coil on Plug harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (A955) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.

P2311-IGNITION COIL 4 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L and 3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

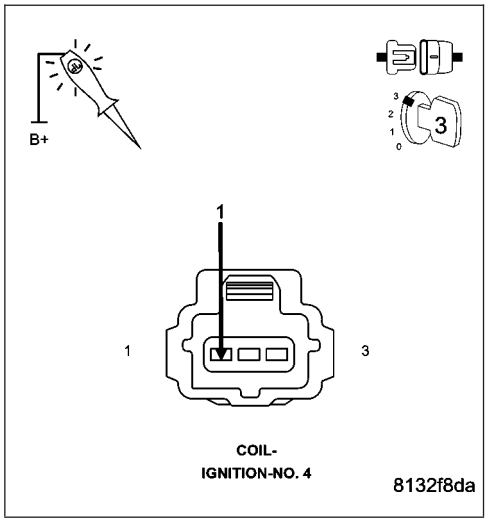
No >> Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K15) Coil Control No.4 circuit.

Crank the engine for 5 seconds while observing the test light.



What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6

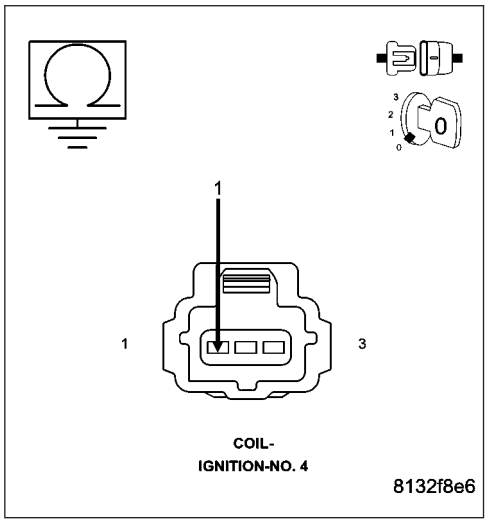
---

5. (K15) COIL CONTROL NO.4 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K15) Coil Control No.4 circuit in the Coil on Plug harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K15) Coil Control No.4 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P2311-IGNITION COIL 4 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

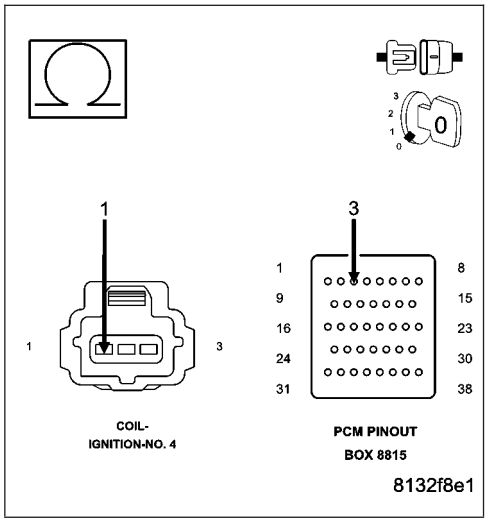
6. (K15) COIL CONTROL NO.4 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K15) Coil Control No.4 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K15) Coil Control No.4 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

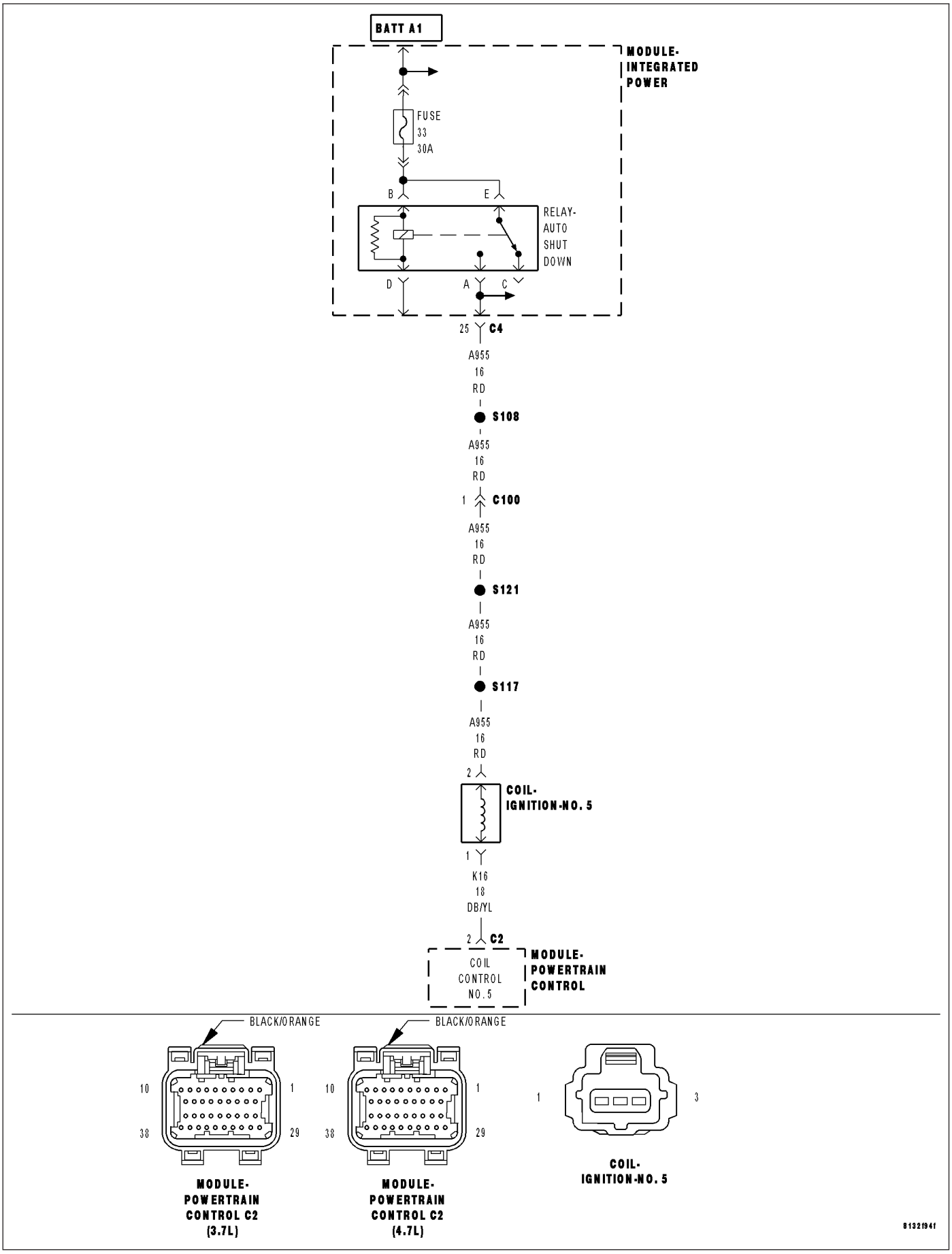
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2314-IGNITION COIL 5 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2314-IGNITION COIL 5 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K16) COIL CONTROL NO.5 CIRCUIT OPEN
(K16) COIL CONTROL NO.5 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

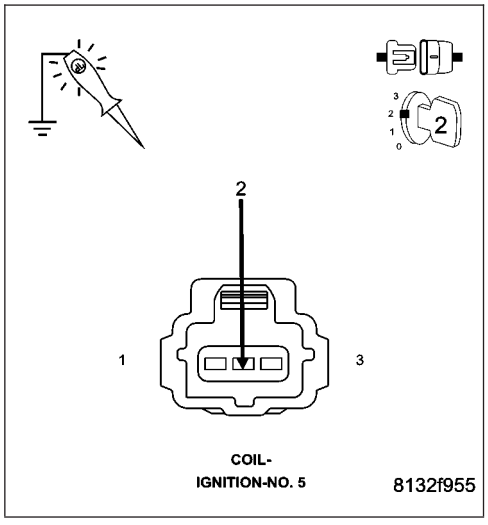
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Coil on Plug harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (A955) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.

P2314-IGNITION COIL 5 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L and 3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

No >> Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K16) Coil Control No.5 circuit.

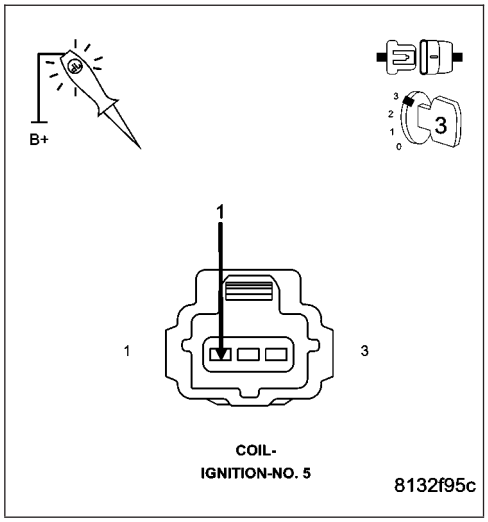
Crank the engine for 5 seconds while observing the test light.

What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



---

5. (K16) COIL CONTROL NO.5 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

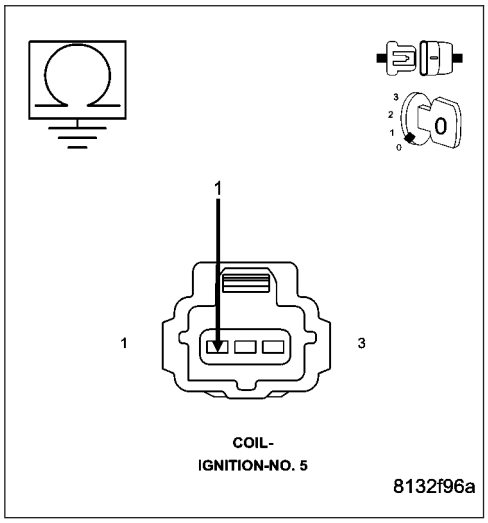
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K16) Coil Control No.5 circuit in the Coil on Plug harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K16) Coil Control No.5 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P2314-IGNITION COIL 5 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

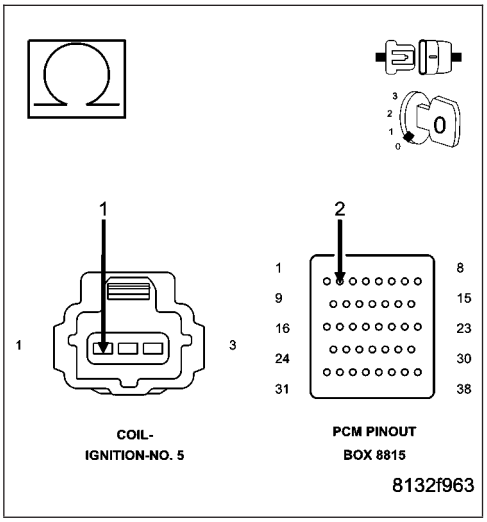
6. (K16) COIL CONTROL NO.5 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K16) Coil Control No.5 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K16) Coil Control No.5 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

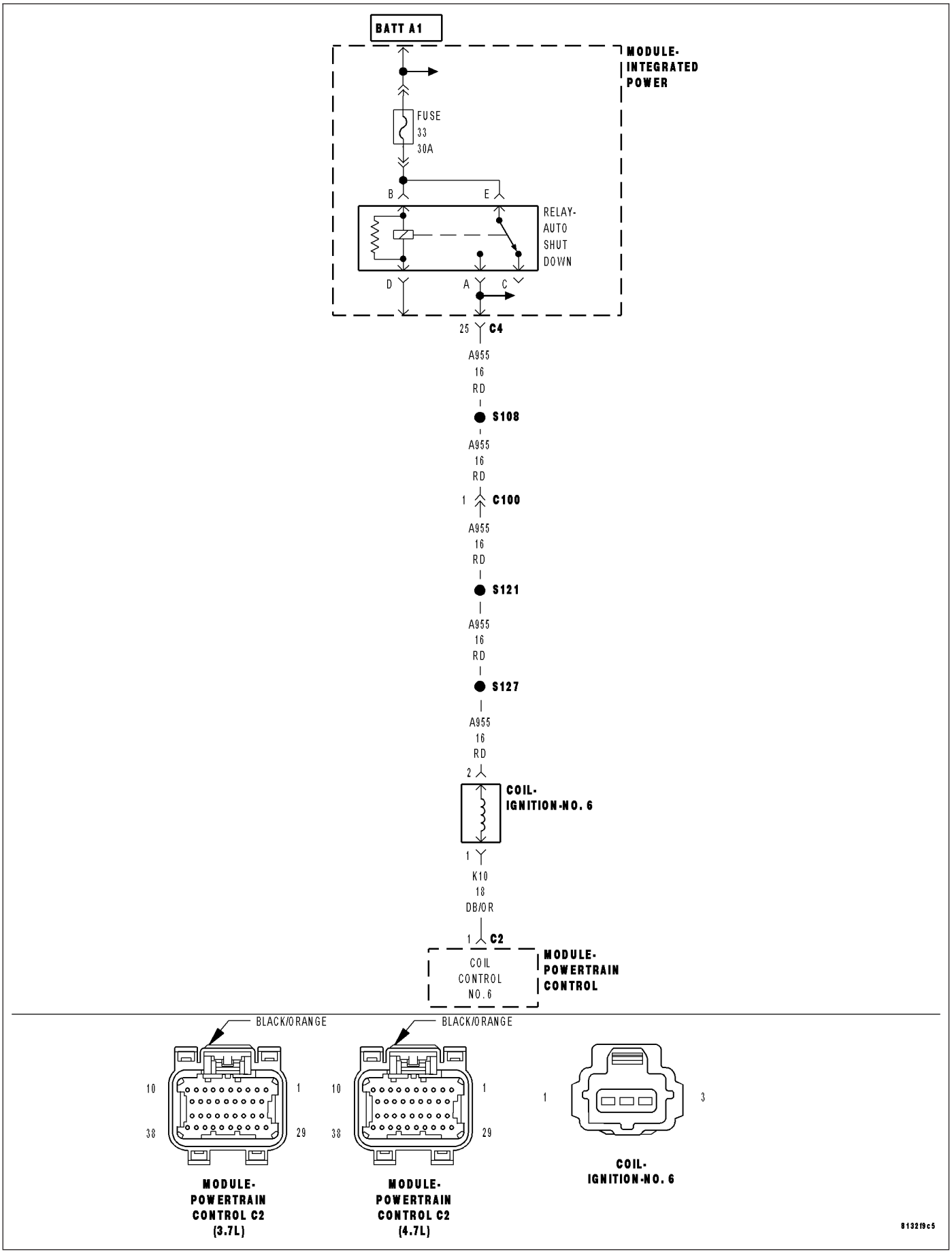
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2317-IGNITION COIL 6 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2317-IGNITION COIL 6 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K10) COIL CONTROL NO.6 CIRCUIT OPEN
(K10) COIL CONTROL NO.6 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

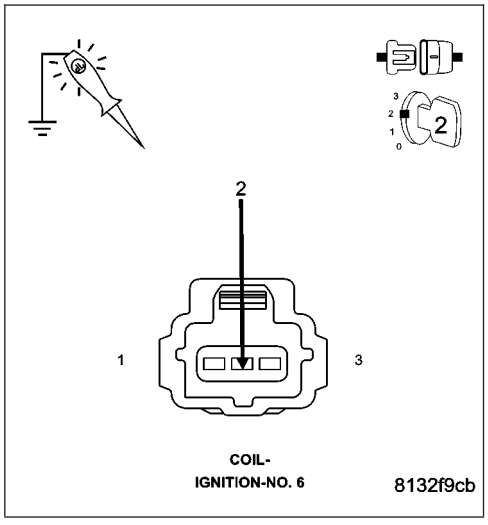
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Coil on Plug harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (A955) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.

P2317-IGNITION COIL 6 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L and 3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

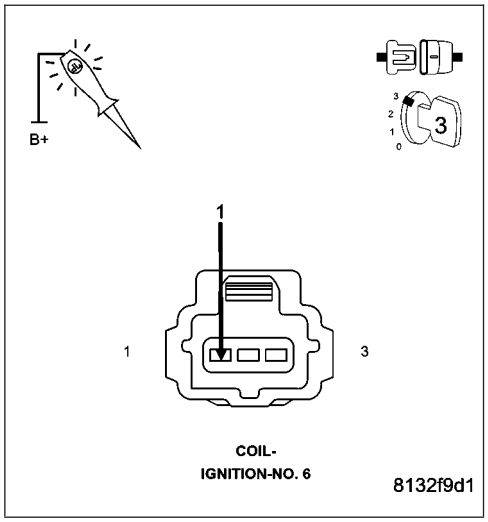
No >> Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K10) Coil Control No.6 circuit.

Crank the engine for 5 seconds while observing the test light.



What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6

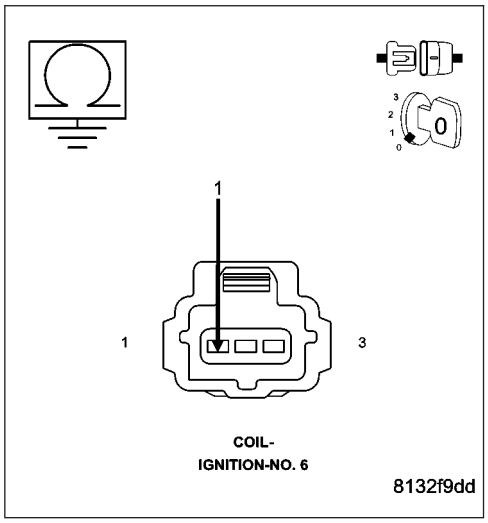
---

5. (K10) COIL CONTROL NO.6 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K10) Coil Control No.6 circuit in the Coil on Plug harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K10) Coil Control No.6 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P2317-IGNITION COIL 6 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

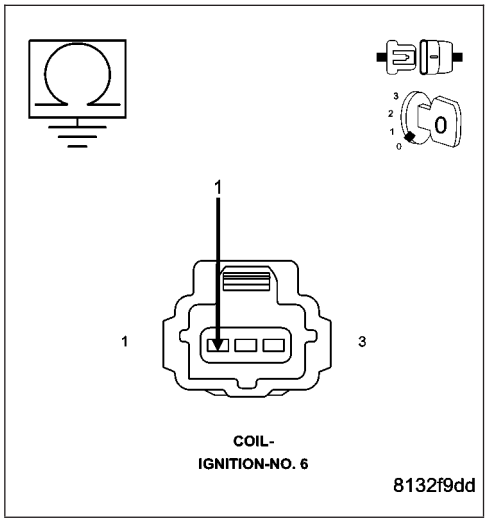
6. (K10) COIL CONTROL NO.6 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K10) Coil Control No.6 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K10) Coil Control No.6 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

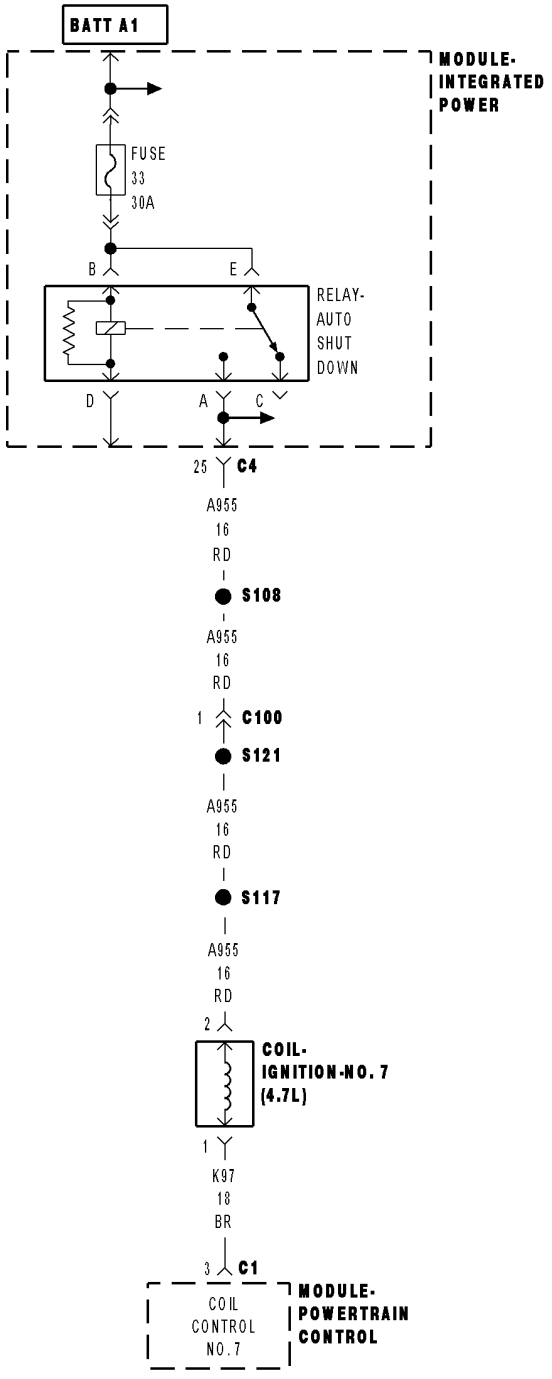
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

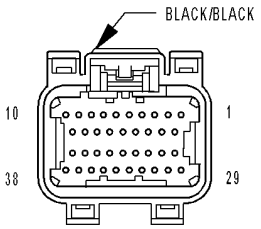
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

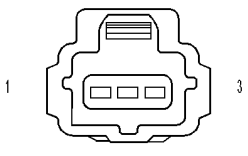
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2320-IGNITION COIL 7 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION





MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



COIL-
IGNITION-NO. 7
(4.7L)

8132fa08

P2320-IGNITION COIL 7 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K97) COIL CONTROL NO.7 CIRCUIT OPEN
(K97) COIL CONTROL NO.7 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

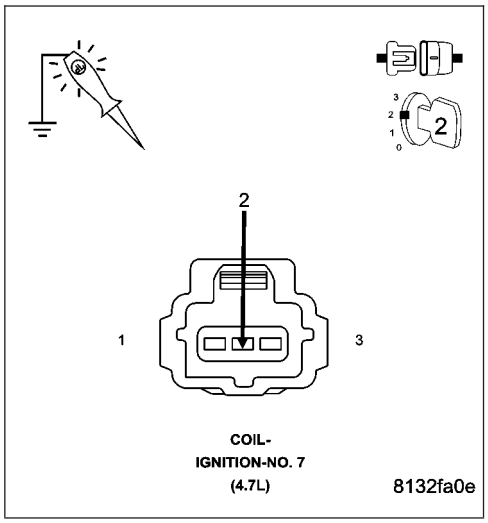
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Coil on Plug harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (A955) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.

P2320-IGNITION COIL 7 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

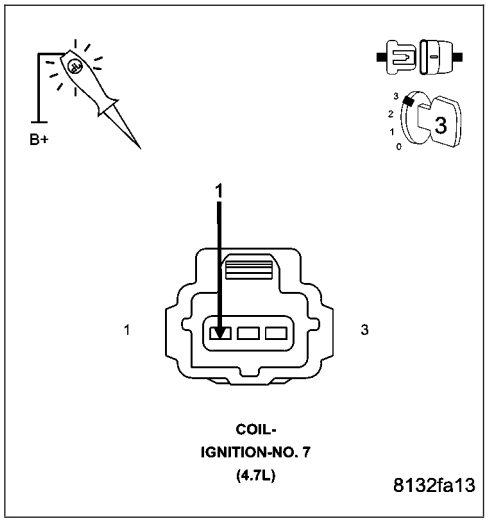
No >> Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K97) Coil Control No.7 circuit.

Crank the engine for 5 seconds while observing the test light.



What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform (POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6

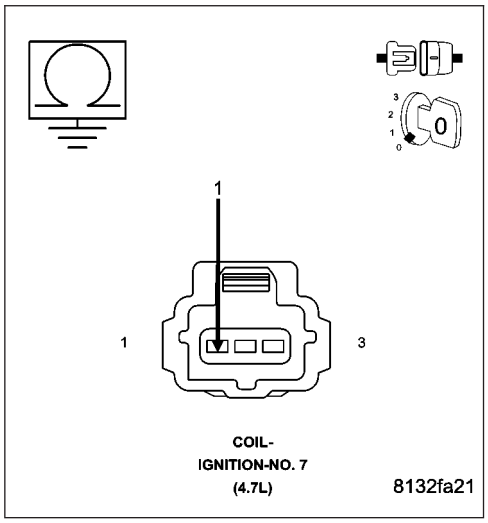
---

5. (K97) COIL CONTROL NO.7 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (K97) Coil Control No.7 circuit in the Coil on Plug harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K97) Coil Control No.7 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P2320-IGNITION COIL 7 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

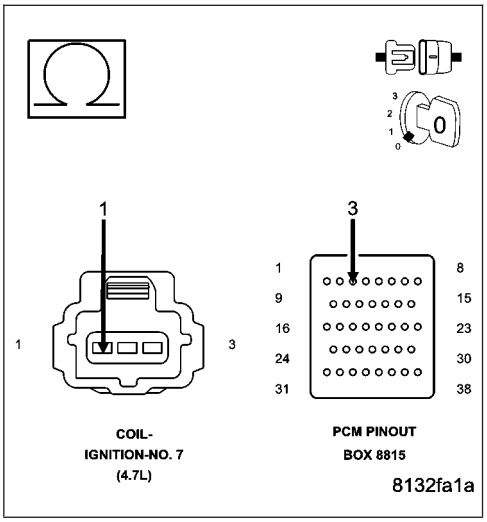
6. (K97) COIL CONTROL NO.7 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K97) Coil Control No.7 circuit from the Coil on Plug connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K97) Coil Control No.7 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

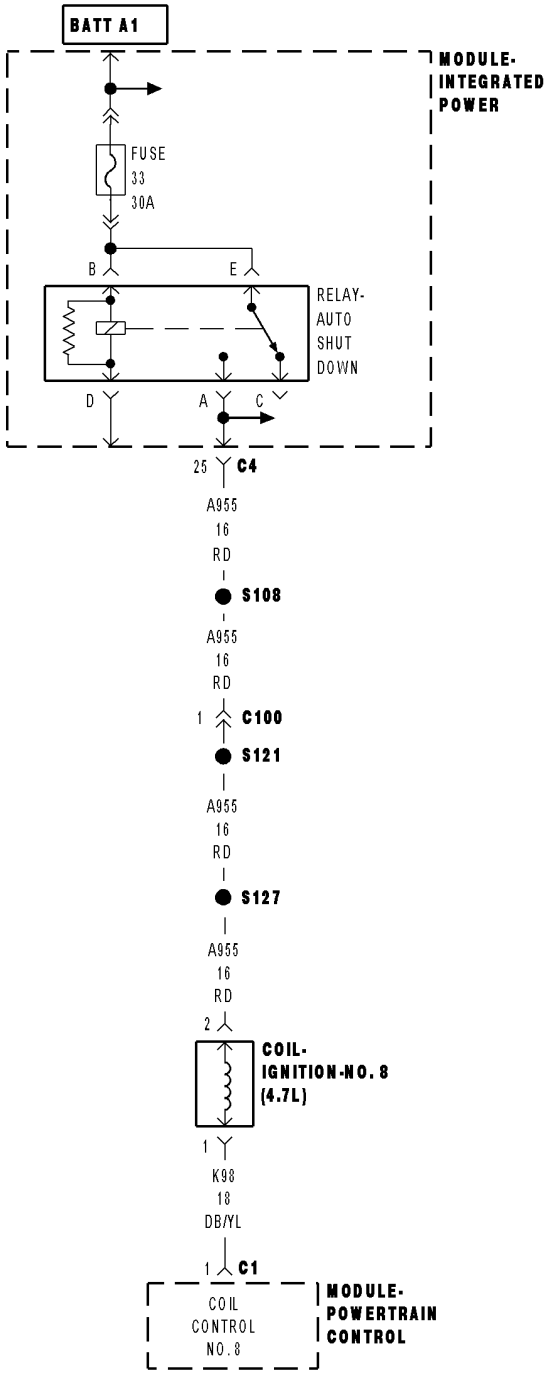
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

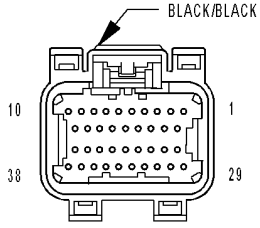
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

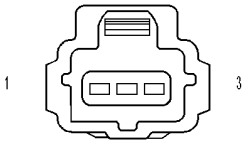
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2323-IGNITION COIL 8 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION





MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



COIL-
IGNITION-NO. 8
(4.7L)

8132fa64.

P2323-IGNITION COIL 8 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(A955) ASD RELAY OUTPUT CIRCUIT
(K98) COIL CONTROL NO.8 CIRCUIT OPEN
(K98) COIL CONTROL NO.8 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A955) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

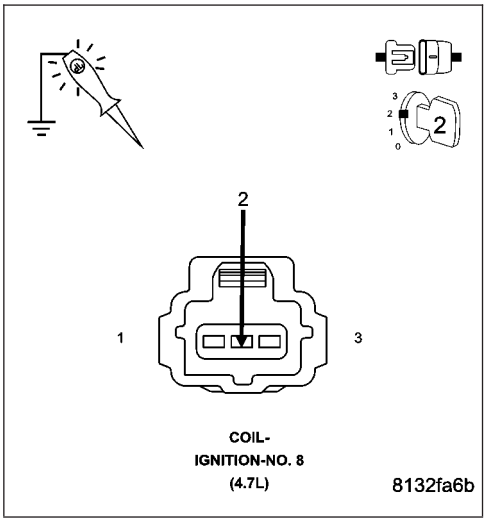
Using a 12-volt test light connected to ground, probe the (A955) ASD Relay Output circuit in the Coil on Plug harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (A955) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.



P2323-IGNITION COIL 8 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

No >> Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K98) Coil Control No.8 circuit.

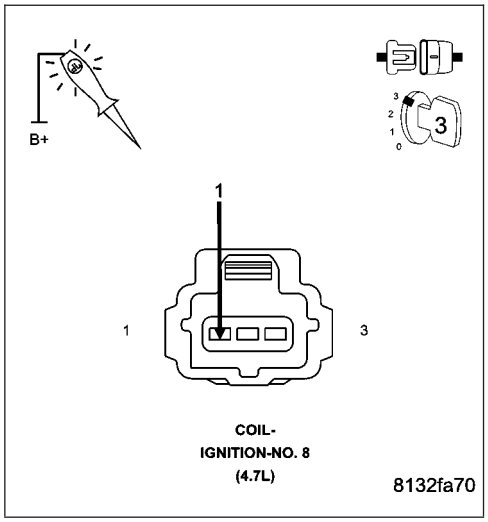
Crank the engine for 5 seconds while observing the test light.

What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



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5. (K98) COIL CONTROL NO.8 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

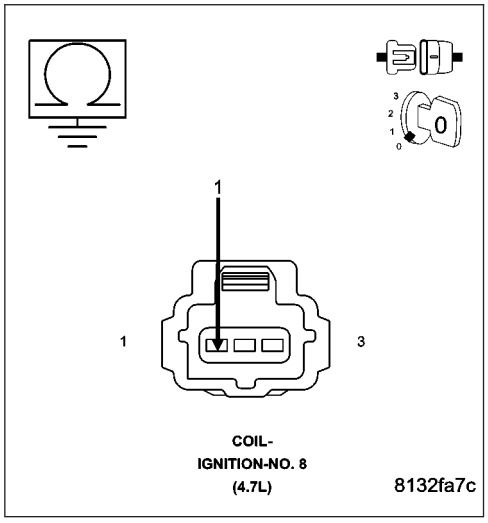
Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (K98) Coil Control No.8 circuit in the Coil on Plug harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K98) Coil Control No.8 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P2323-IGNITION COIL 8 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

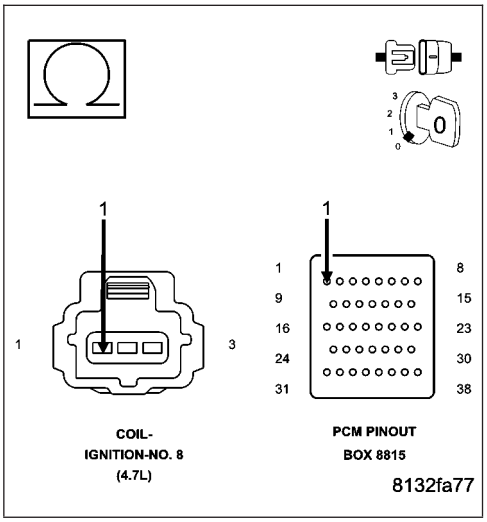
6. (K98) COIL CONTROL NO.8 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K98) Coil Control No.8 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K98) Coil Control No.8 circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

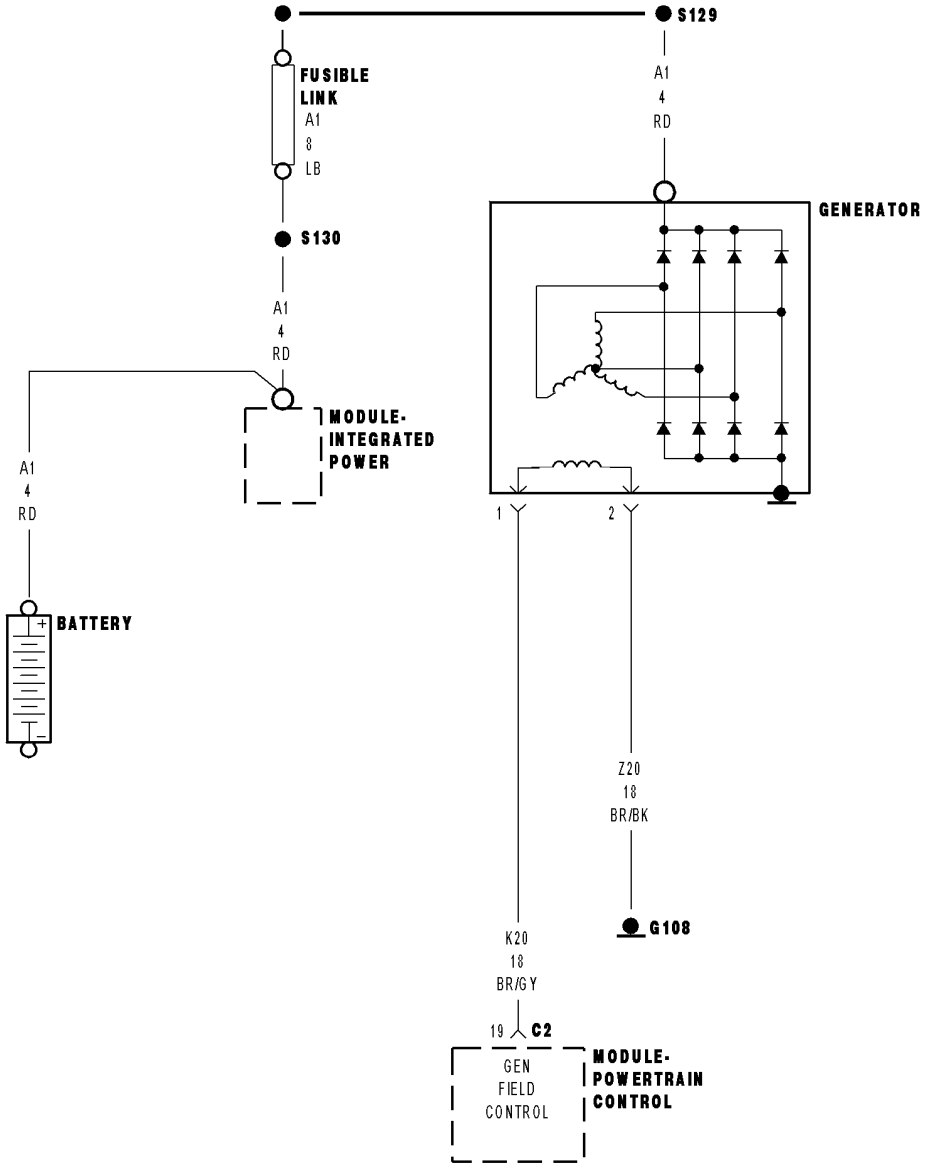
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

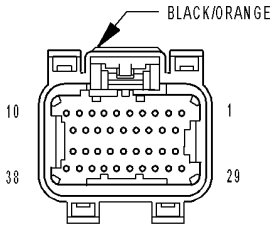
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

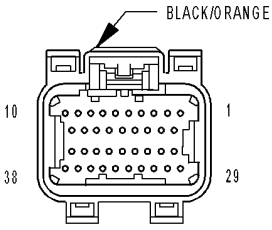
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2503-CHARGING SYSTEM OUTPUT LOW

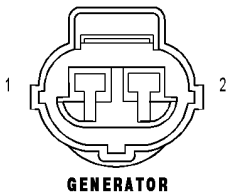




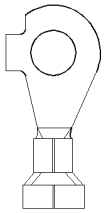
MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



MODULE-
POWERTRAIN
CONTROL C2
(4.7L)



GENERATOR



GENERATOR (B+)

81336b87

P2503-CHARGING SYSTEM OUTPUT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The engine running. The engine speed greater than 1157 RPM.
- **Set Condition:**
  The battery sensed voltage is 1 volt below the charging goal for 13.47 seconds. The PCM senses the battery voltage turns off the field driver and senses the battery voltage again. If the voltages are the same, the code is set. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXCESSIVE RESISTANCE IN THE (A1) BATTERY POSITIVE CIRCUIT
EXCESSIVE RESISTANCE IN THE CASE GROUND
(K20) GEN FIELD CONTROL CIRCUIT SHORTED TO VOLTAGE
(K20) GEN FIELD CONTROL CIRCUIT OPEN
(K20) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND
(Z20) GEN GROUND CIRCUIT OPEN
GENERATOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Inspect the vehicle for aftermarket accessories that may exceed the Generator System output.
Ignition on, engine not running.

NOTE: The battery must be fully charged.

NOTE: The Generator belt tension and condition must be checked before continuing.
With a scan tool, read DTCs.
With a scan tool, erase DTCs.
Start the engine.
Allow the idle to stabilize.
With the scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2503-CHARGING SYSTEM OUTPUT LOW (CONTINUED)

2. (A1) FUSED B+ CIRCUIT HIGH RESISTANCE

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.
Ignition on, engine not running.

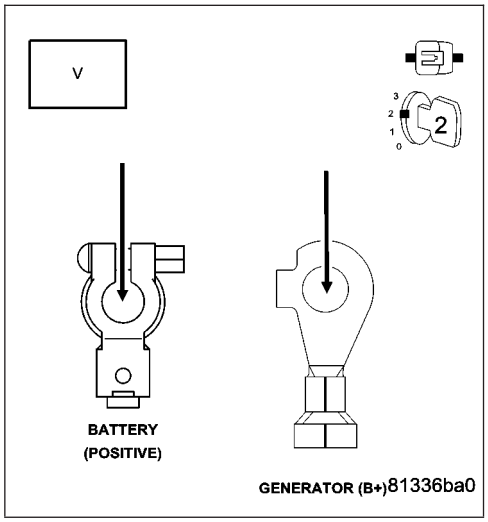
NOTE: Make sure all wires are clear of the engine's moving parts.
Measure the voltage between the Generator B+ Output Terminal and the Battery+ Post.

Start the engine.

Is the voltage above 0.4 of a volt?

Yes >> Repair the excessive resistance in the (A1) Battery positive circuit between the Generator and Battery.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. EXCESSIVE RESISTANCE IN THE CASE GROUND

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.
Start the engine.

Warm the engine to operating temperature.

NOTE: Make sure all wires are clear of the engine's moving parts.
Measure the voltage between the Generator Case and Battery ground post.

Is the voltage above 0.1 of a volt?

Yes >> Repair the excessive resistance in the Generator Case Ground.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P2503-CHARGING SYSTEM OUTPUT LOW (CONTINUED)

4. GENERATOR OPERATION

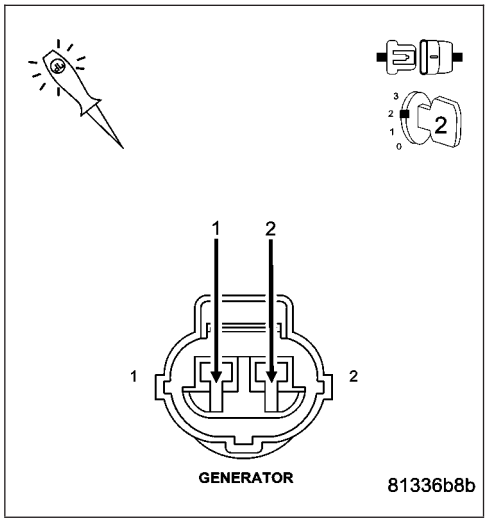
Turn the ignition off.

Disconnect the Generator Field harness connector.

Using a 12-volt test light, jump across the Generator Field harness connector.

Ignition on, engine not running.

With a scan tool, actuate the Generator Field Driver.



Does the test light illuminate brightly and flash on and off?

Yes >> Replace the Generator.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

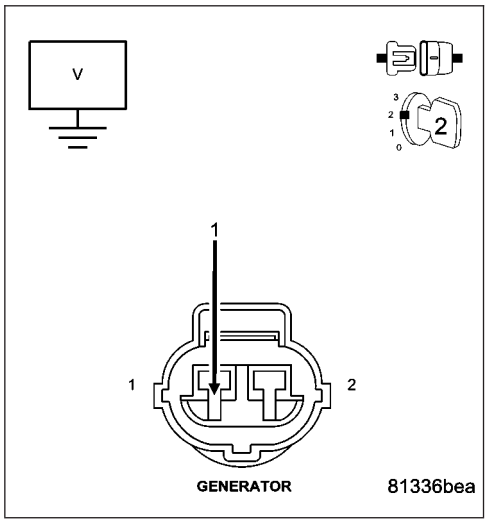
5. (K20) GEN FIELD CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K20) Gen Field Control circuit in the Generator Field harness connector.



Is the voltage above 1.0 volt?

Yes >> Repair the short to battery voltage in the (K20) Gen Field Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

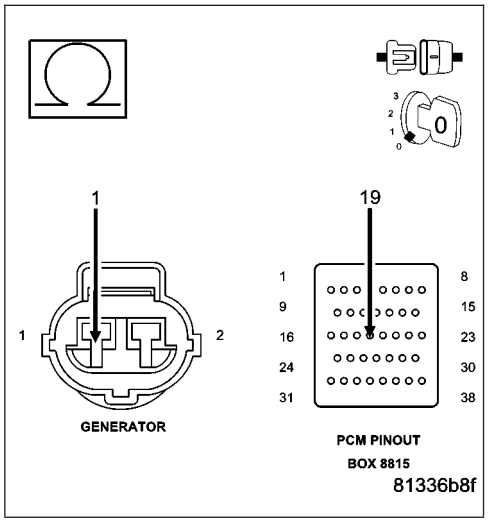
P2503-CHARGING SYSTEM OUTPUT LOW (CONTINUED)

6. (K20) FIELD CONTROL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K20) Gen Field Control circuit from the Generator Field harness connector to the appropriate terminal of special tool #8815.



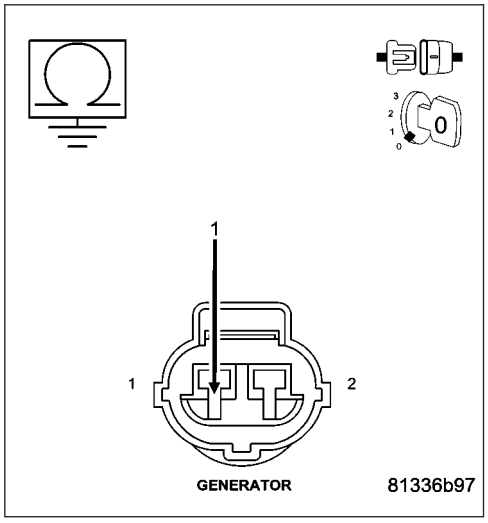
Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K20) Gen Field Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. (K20) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K20) Gen Field Control circuit in the Generator Field harness connector.



Is the resistance below 100 ohms?

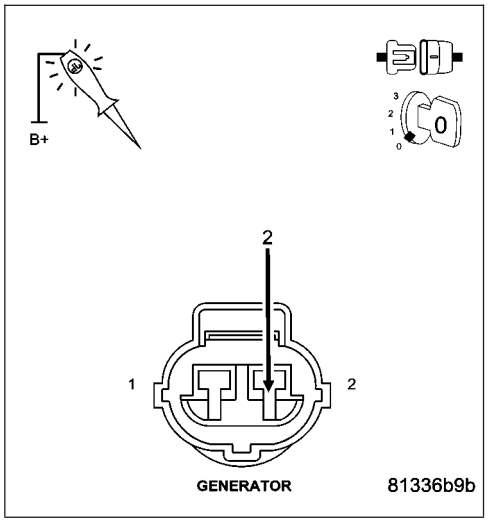
Yes >> Repair the short to ground in the (K20) Gen Field Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P2503-CHARGING SYSTEM OUTPUT LOW (CONTINUED)

8. (Z20) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to battery voltage, probe the (Z20) Ground circuit in the Generator Field harness connector.



Does the test light illuminate brightly?

Yes >> Go To 9

No >> Repair the open in the (Z20) Generator Ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

9. PCM

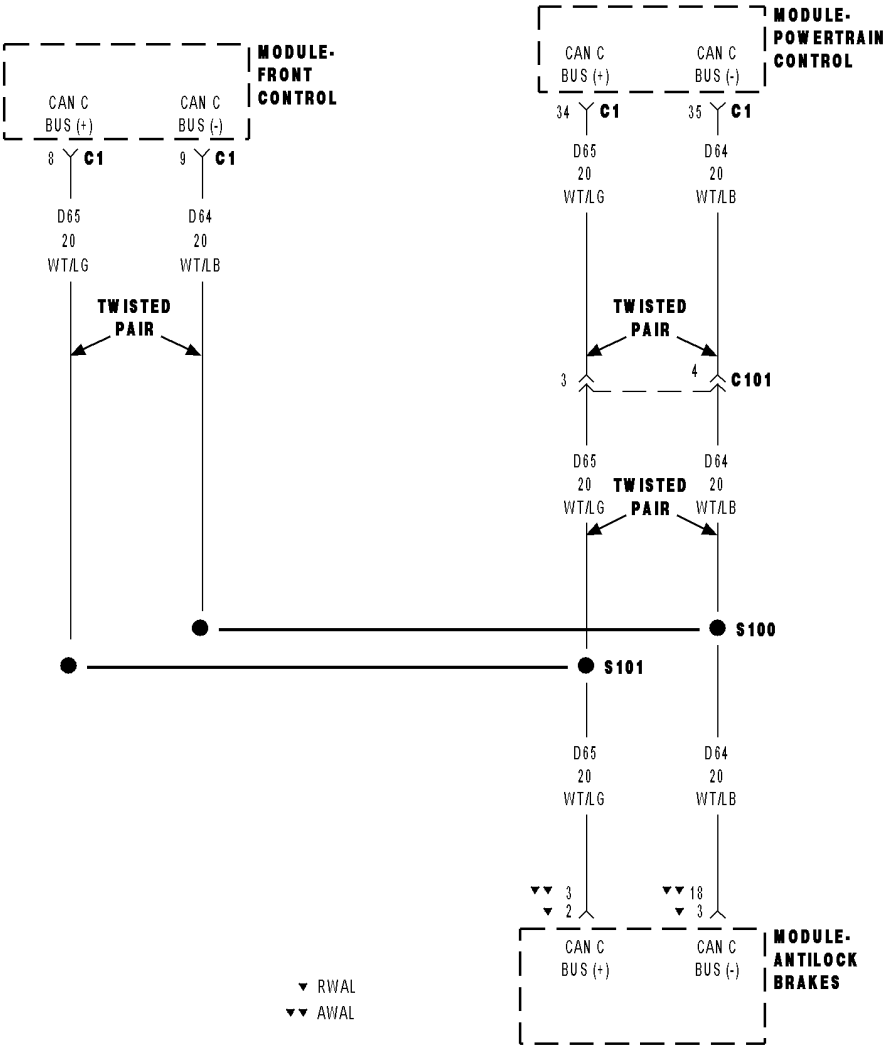
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

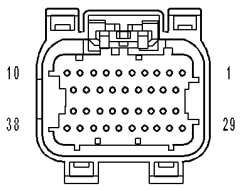
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

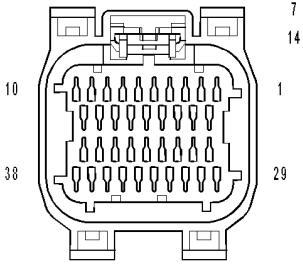
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0001-CAN C BUS

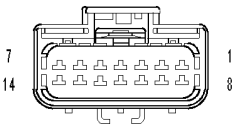




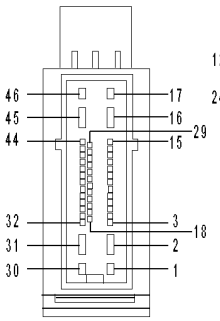
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



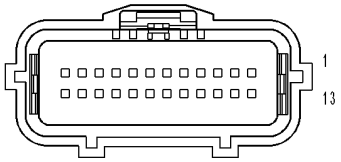
MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
ANTI-
LOCK
BRAKES
(RWAL)



MODULE-
ANTI-LOCK
BRAKES
(AWAL)



MODULE-
FRONT
CONTROL C1

8132fb20

U0001-CAN C BUS (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition run time is greater than 1 second. Battey voltage between 9 and 16 volts. Engine run time greater than 3 seconds.
- **Set Condition:**
  The PCM loses communication over the CAN C Bus circuit. The circuit is continuously monitored.

Possible Causes
CAN C BUS FAILURE OPEN OR SHORTED CONDITION
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read FCM DTCs.

Is the DTC active at this time?

Yes >> Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0101-LOST COMMUNICATION WITH TCM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition run time is greater than 1 second. Battery voltage between 9 and 16 volts. Engine run time greater than 3 seconds.
- **Set Condition:**
  The PCM doesn't receive a Bus Message from the Transmission Control Module for 7 consecutive seconds. The circuit is continuously monitored.

Possible Causes
CAN C BUS OPEN OR SHORTED CONDITION
PCM

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

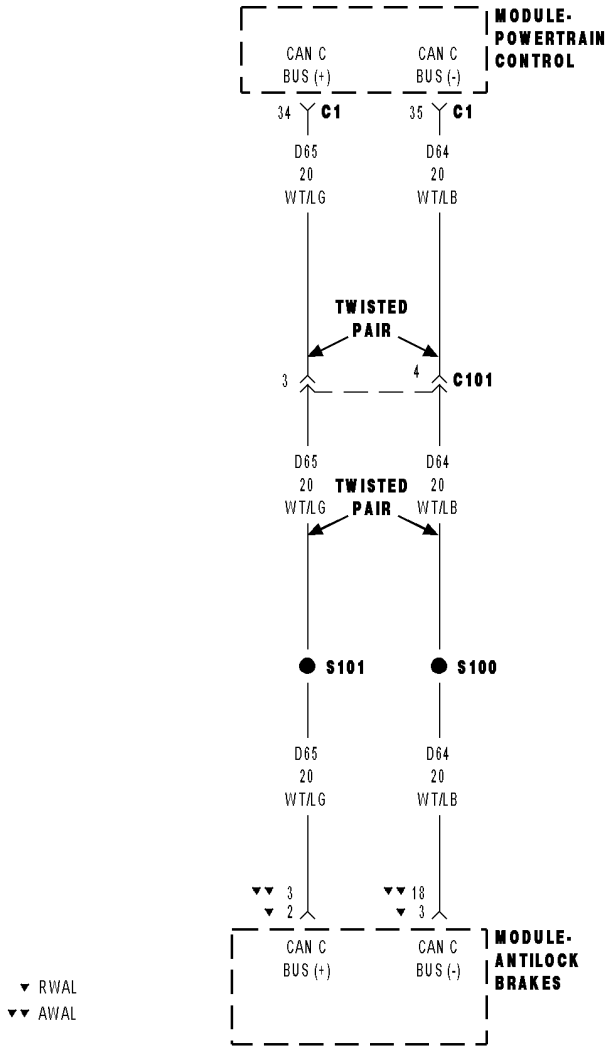
With a scan tool, read PCM DTCs.

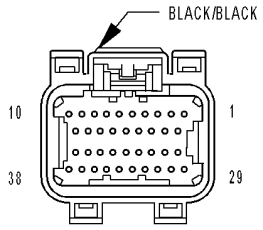
Is the DTC active at this time?

Yes >> Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

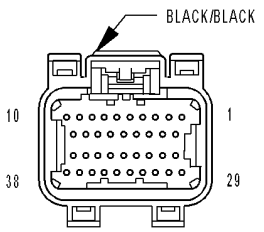
No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE MODULE

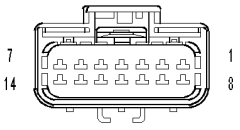




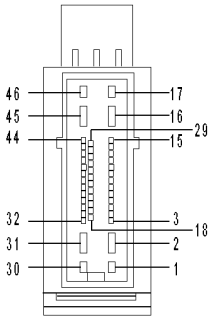
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
ANTI-
LOCK
BRAKES
(RWAL)



MODULE-
ANTI-LOCK
BRAKES
(AWAL)

8132fb59

U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE MODULE (CONTINUED)
For a complete wiring diagram**Refer to Section 8W**.

- **When Monitored:**
  Ignition run time is greater than 1 second. Battey voltage between 9 and 16 volts. Engine run time greater than 3 seconds.
- **Set Condition:**
  The PCM doesn't receive an ABS message over the CAN C circuit for 7 consecutive seconds. The circuit is continuously monitored.

Possible Causes
CAN C BUS OPEN OR SHORTED CONDITION
ABS MODULE
PCM

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Diagnostic Test

1. ACTIVE DTC

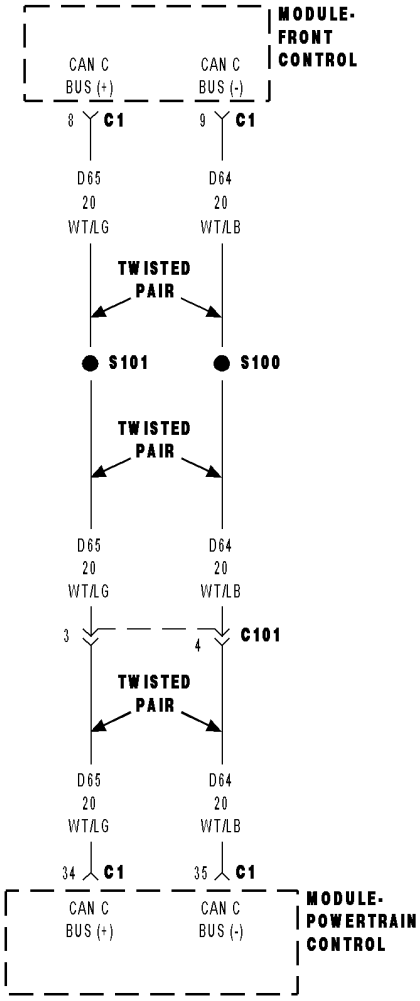
Ignition on, engine not running.
With a scan tool, read PCM DTCs.

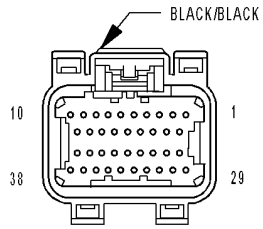
Is the DTC active at this time?

Yes >> Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

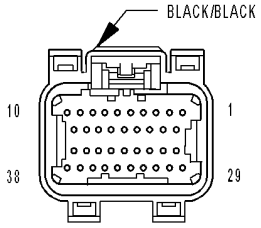
No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE

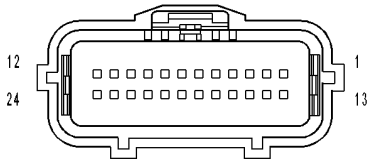




MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
FRONT
CONTROL C1

8132fb6c

U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition run time is greater than 1 second. Battey voltage between 9 and 16 volts.
- **Set Condition:**
  The PCM doesn't receive a FCM message over the CAN C circuit for 7 consecutive seconds. The circuit is continuously monitored.

Possible Causes
CAN C BUS OPEN OR SHORTED CONDITION
FRONT CONTROL MODULE
PCM

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

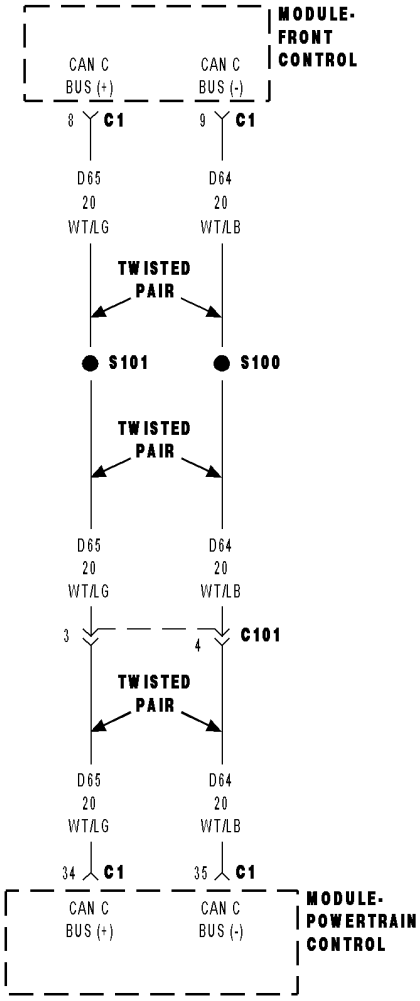
With a scan tool, read PCM DTCs.

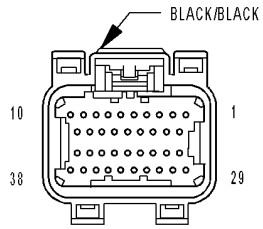
Is the DTC active at this time?

Yes >> Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

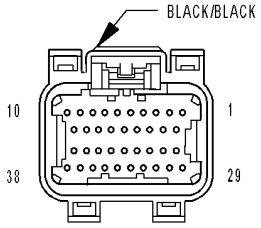
No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U110E-LOST AMBIENT TEMPERATURE MESSAGE

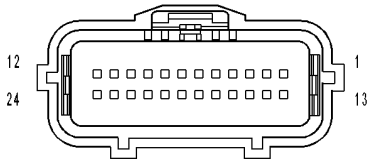




MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
FRONT
CONTROL C1

8132fb6c

U110E-LOST AMBIENT TEMPERATURE MESSAGE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM doesn't receive the ambient temperature signal over the CAN C bus from the FCM. The circuit is continuously monitored.

Possible Causes
CAN C BUS CIRCUIT OPEN OR SHORTED
FRONT CONTROL MODULE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The ambient temperature sensor signal is a direct input to the FCM. The FCM sends the PCM the ambient temperature signal over the CAN C bus.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With the scan tool read Powertrain DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE ALSO ACTIVE

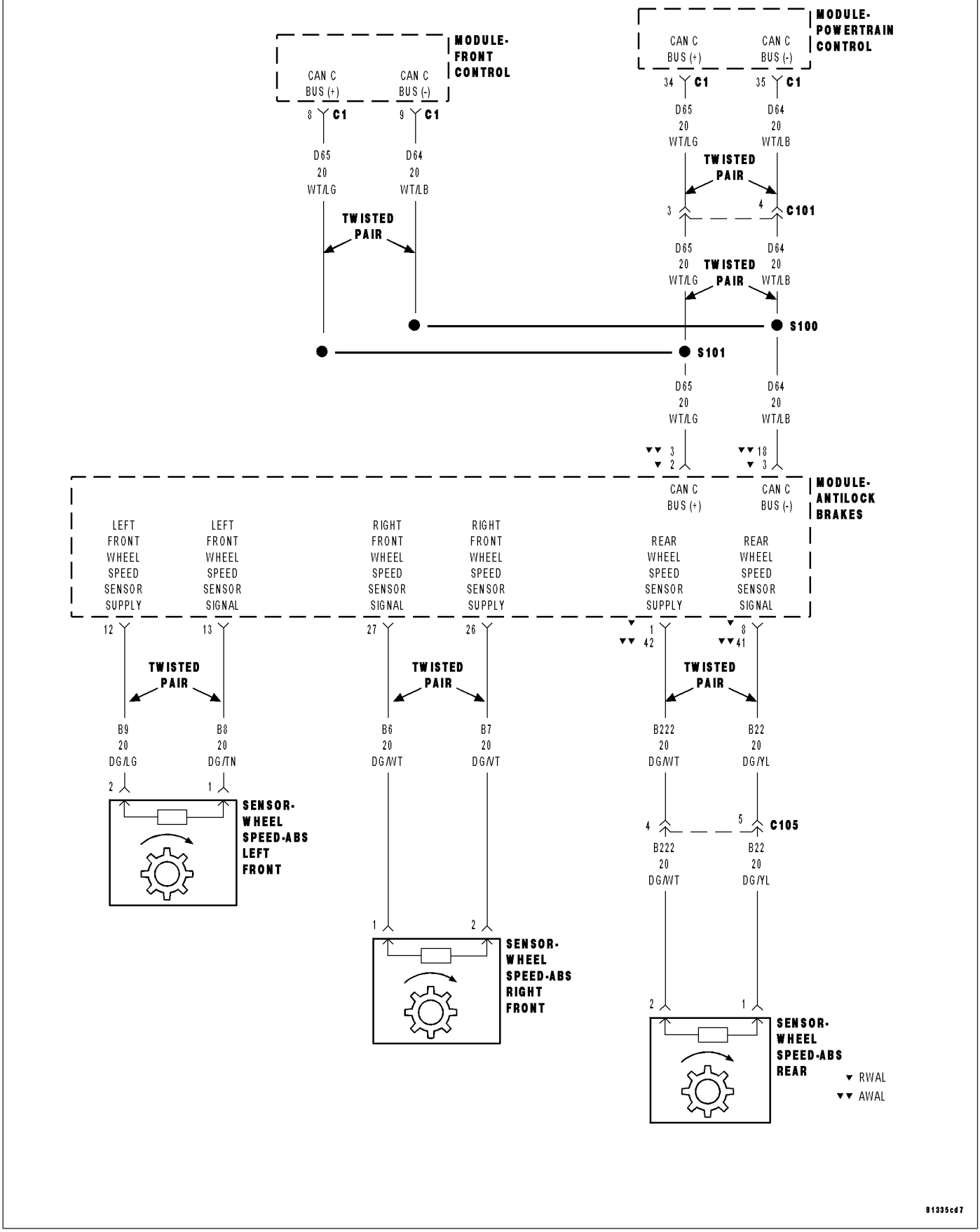
With the scan tool read DTCs.

Is the U0141-NO BUS MESSAGE RECEIVED FROM THE FCM also set?

Yes >> Follow the daignostics for U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U1110-LOST VEHICLE SPEED MESSAGE



U1110-LOST VEHICLE SPEED MESSAGE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM doesn't receive a vehicle speed signal from the Anti-lock brake Module over the CAN C bus.

Possible Causes
CAN C BUS CIRCUIT OPEN OR SHORTED
ANTI-LOCK BRAKE MODULE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .

Theory of Operation

The PCM receives the vehicle speed signal over the CAN C bus from the Anit-lock Brake Module.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool read Powertrain DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. U0121-LOST COMMUNICATION WITH ABS MODULE ALSO SET

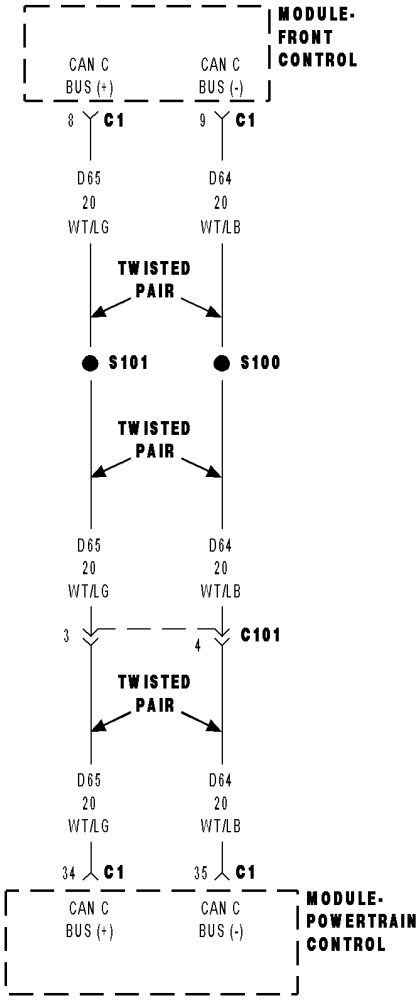
With the scan tool continue reading DTCs.

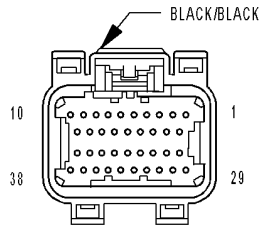
Is the U0121-LOST COMMUNICATION WITH ABS MODULE also set?

Yes >> Follow the daignostics for U0121-LOST COMMUNICATION WITH ABS MODULE
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

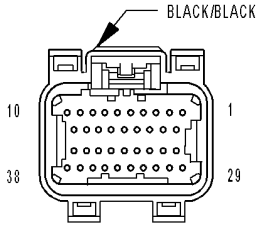
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U1113-LOST A/C PRESSURE MESSAGE

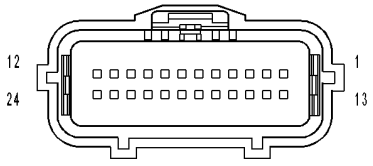




MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



MODULE-
FRONT
CONTROL C1

8132fb6c

U1113-LOST A/C PRESSURE MESSAGE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM doesn't receive the a/c pressure signal over the CAN C bus from the FCM. The circuit is continuously monitored.

Possible Causes
CAN C BUS CIRCUIT OPEN OR SHORTED
FRONT CONTROL MODULE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The A/C Pressure Transducer signal is a direct input to the FCM. The FCM sends the PCM the aA/C Pressure Transducer signal over the CAN C bus.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With the scan tool read Powertrain DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE ALSO ACTIVE

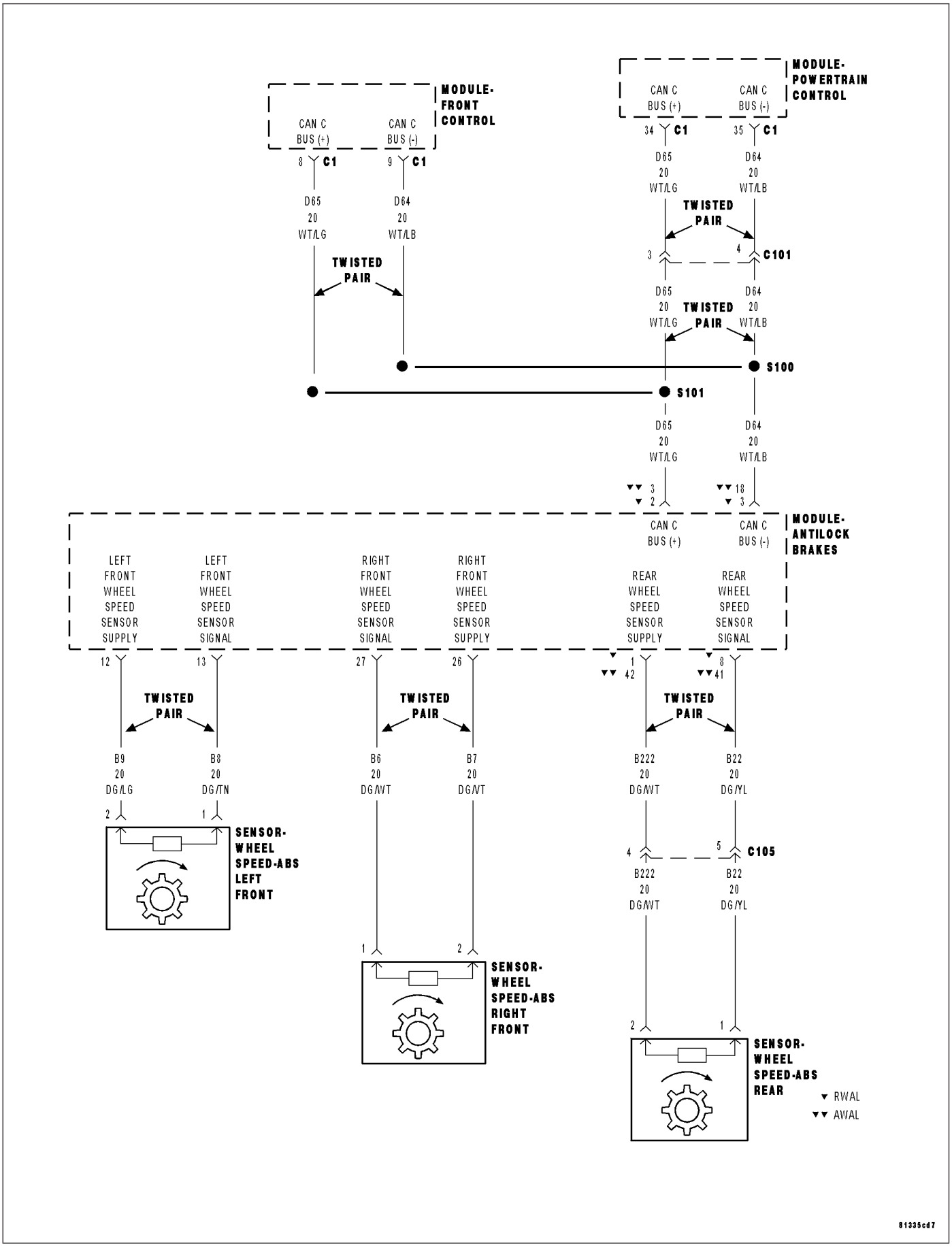
With the scan tool read DTCs.

Is the U0141-NO BUS MESSAGE RECEIVED FROM THE FCM also set?

Yes >> Follow the daignostics for U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U1120-LOST WHEEL DISTANCE MESSAGE



U1120-LOST WHEEL DISTANCE MESSAGE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM doesn't receive a wheel distance message from the Anti-lock brake Module or FCM (NON-ABS) over the CAN C bus.

Possible Causes
CAN C BUS CIRCUIT OPEN OR SHORTED
ANTI-LOCK BRAKE MODULE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The PCM receives the vehicle speed signal over the CAN C bus from the Anti-lock Brake Module or FCM (NON-ABS).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With the scan tool read Powertrain DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. U0121-LOST COMMUNICATION WITH ABS MODULE/P0141–LOST COMMUNICATION WITH FCM ALSO SET

NOTE: If the vehicle is not equipped with ABS the VSS signal will come from the FCM.

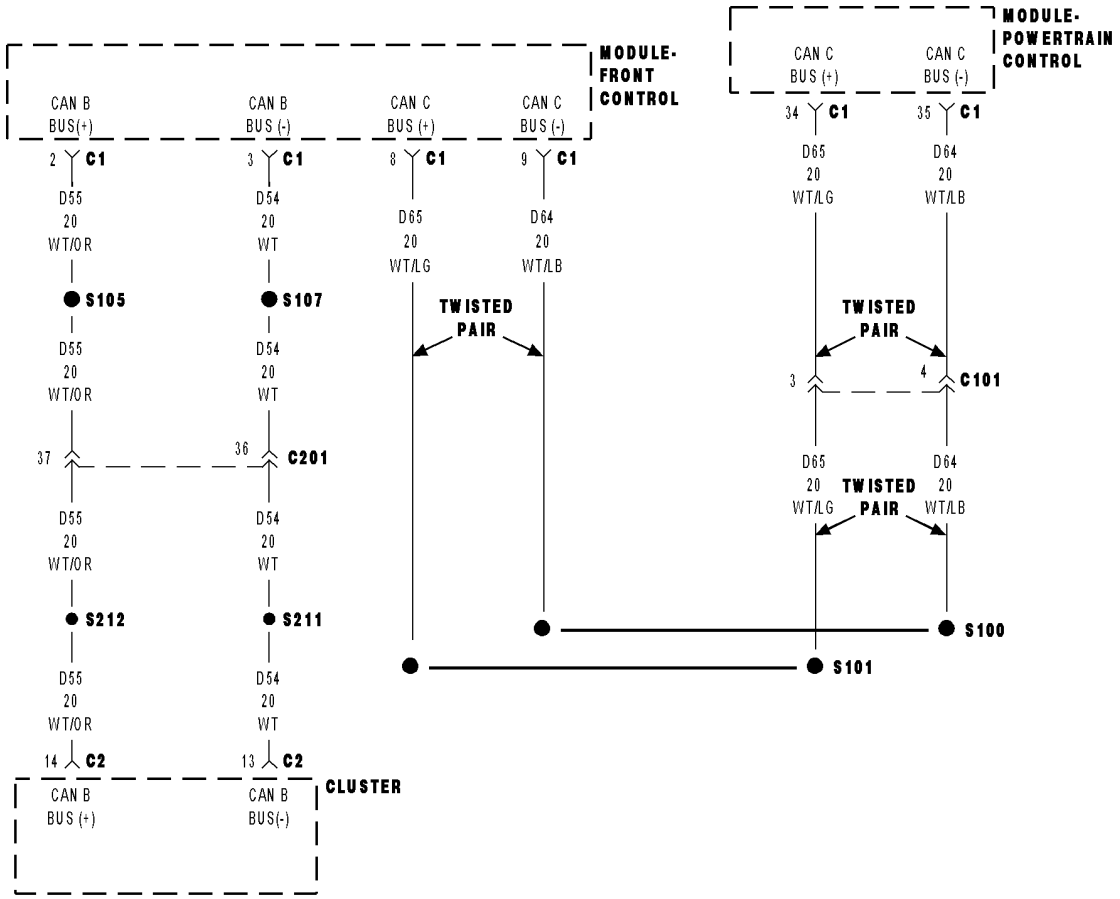
With the scan tool, read the appropriate module for DTCs.

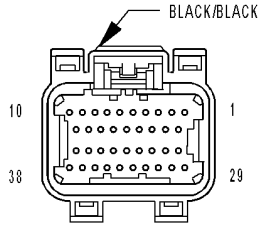
Is the U0121-LOST COMMUNICATION WITH ABS MODULE/P0141–Lost Communicate With FCM also set?

Yes >> Perform the appropriate diagnostic test. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

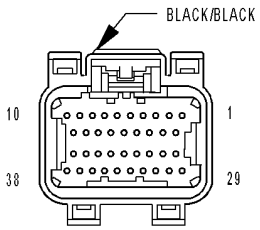
No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U1411-IMPLAUSIBLE FUEL VOLUME SIGNAL RECEIVED

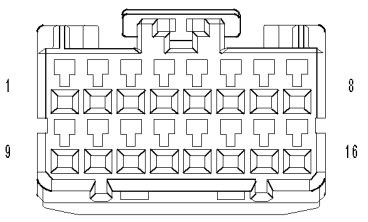




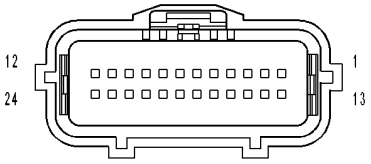
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



CLUSTER C2



MODULE-
FRONT
CONTROL C1

8132fc06

U1411-IMPLAUSIBLE FUEL VOLUME SIGNAL RECEIVED (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The fuel volumel message the PCM is receiving is implausible. The circuit is continuously monitored.

Possible Causes
CAN B OPEN OR SHORTED
CLUSTER MODULE
FRONT CONTROL MODULE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The Front Control Module isn't receiveing a fuel volume signal over CAN B from the Cluster Module. The FCM has to send the PCM a fuel volume signal over CAN C. The signal the FCM sends over CAN C is implausible.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. CAN B BUS HARWARE DTCS ALSO ACTIVE

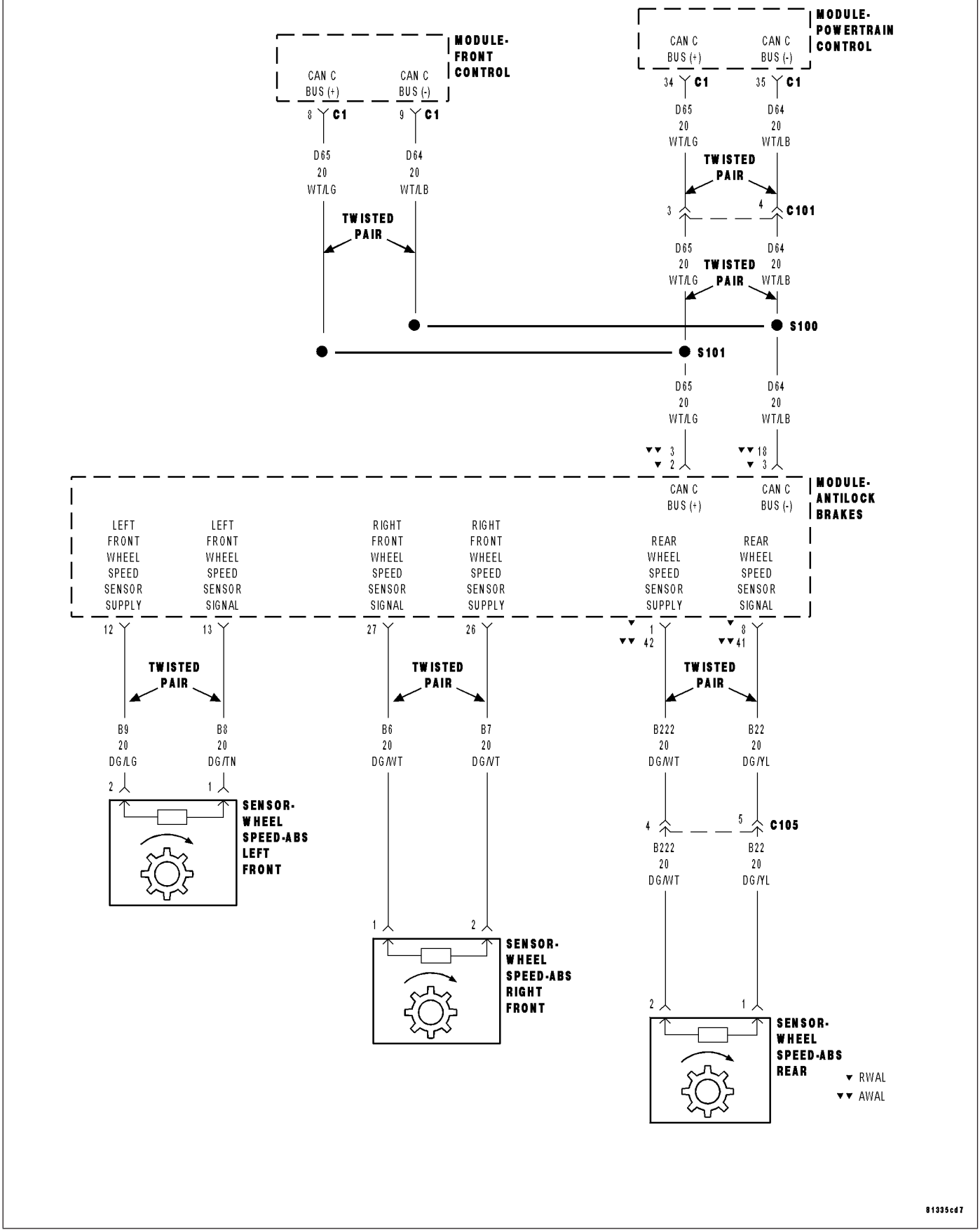
With a scan tool check for DTCs in the FCM.

Are any CAN B Hardware related DTCs active at this time?

Yes >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the appropriate diagnostic procedures.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U1412-IMPLAUSIBLE VEHICLE SPEED SIGNAL RECEIVED



U1412-IMPLAUSIBLE VEHICLE SPEED SIGNAL RECEIVED (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM gets an implausible signal over the CAN C circuit from the ABS Module. The circuit is continuously monitored.

Possible Causes
CAN C BUS CIRCUIT SHORTED
CAN C BUS CIRCUIT OPEN
ABS MODULE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The ABS Module sends vehicle speed information over the CAN C Bus circuit to the PCM.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the U1412-IMPLAUSIBLE VEHICLE SPEED SIGNAL RECEIVED active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. U0001-NO COMMUNICATION ON THE CAN C BUS CIRCUIT IS ACTIVE

Continue reading DTCs.

Is the U0001-NO COMMUNICATION ON THE CAN C BUS CIRCUIT ACTIVE at this time?

Yes >> Refer to the Diagnostic Procedure for the U0001-NO COMMUNICATION ON THE CAN C BUS CIRCUIT.

No >> Go To 3

U1412-IMPLAUSIBLE VEHICLE SPEED SIGNAL RECEIVED (CONTINUED)

3. ABS MODULE IS ACTIVE ON THE CAN C BUS

With the scan tool, select ECU View.

Verify that the ABS Module active on the bus.

Is the ABS Module active on the bus?

Yes >> Go To 4

No >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response diagnostic procedures.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. ACTIVE DTCS IN THE FCM

With the scan tool, select ECU View and select FCM.

Withe the scan tool, read active DTCs.

Is the U0001-NO COMMUNICATION ON THE CAN C BUS CIRCUIT ACTIVE in the FCM at this time?

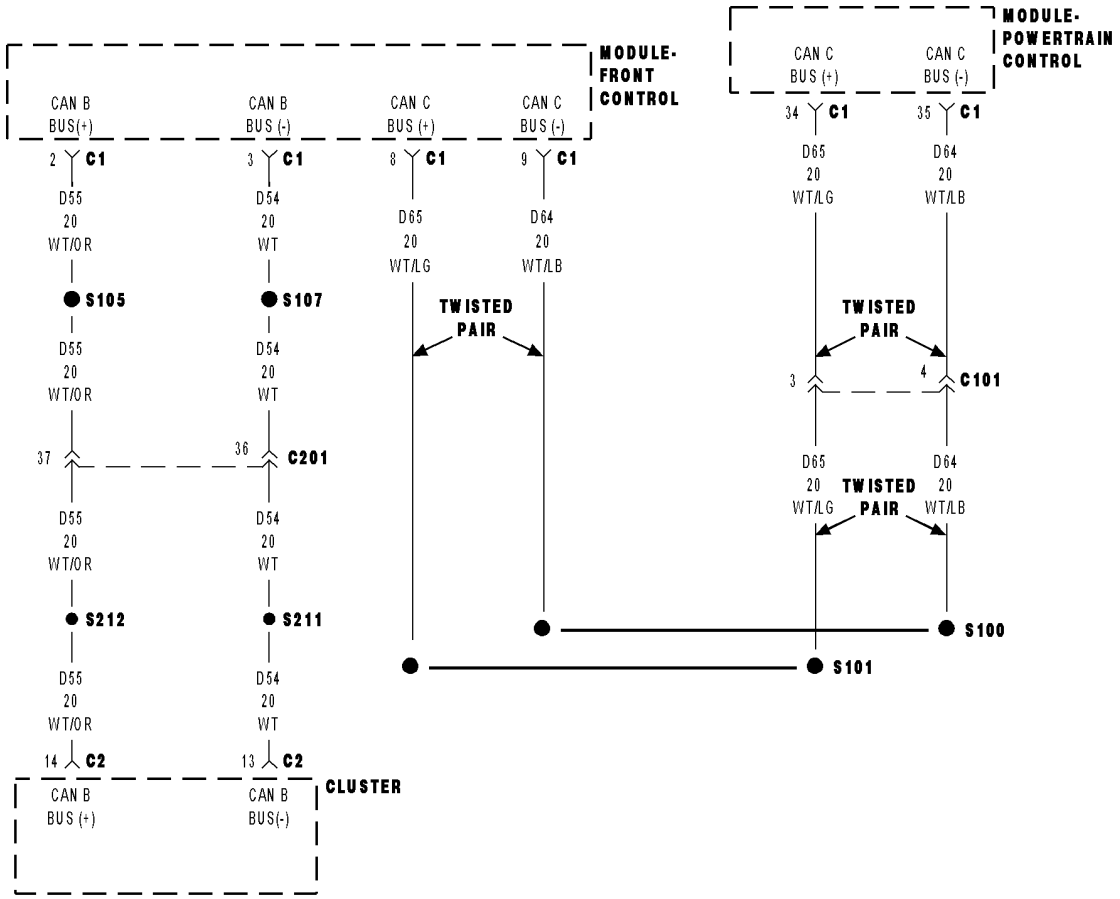
Yes >> Replace the ABS Module per Service Information.

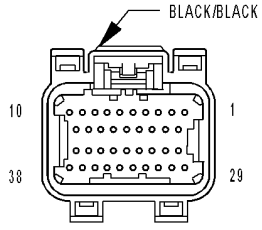
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace and program the Powertrain Control Module per Service Information.

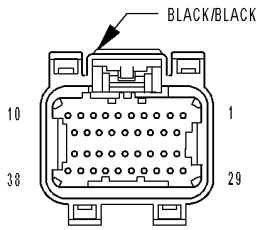
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

U1413-IMPLAUSIBLE ODOMETER SIGNAL RECEIVED

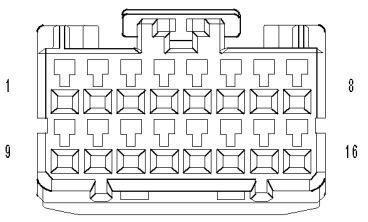




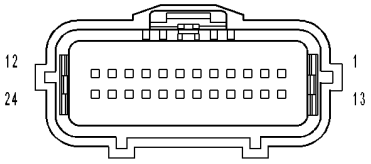
MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)



CLUSTER C2



MODULE-
FRONT
CONTROL C1

8132fc06

U1413-IMPLAUSIBLE ODOMETER SIGNAL RECEIVED (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The odometer message the PCM is receiving is implausible. The circuit is continuously monitored.

Possible Causes
CAN B OPEN OR SHORTED
CLUSTER MODULE
FRONT CONTROL MODULE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The Front Control Module isn't receiveing an odometer signal over CAN B from the Cluster Module. The FCM has to send the PCM an odometerl signal over CAN C. The signal the FCM is sending over CAN C is implausible.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. CAN B BUS HARWARE DTCS ALSO ACTIVE

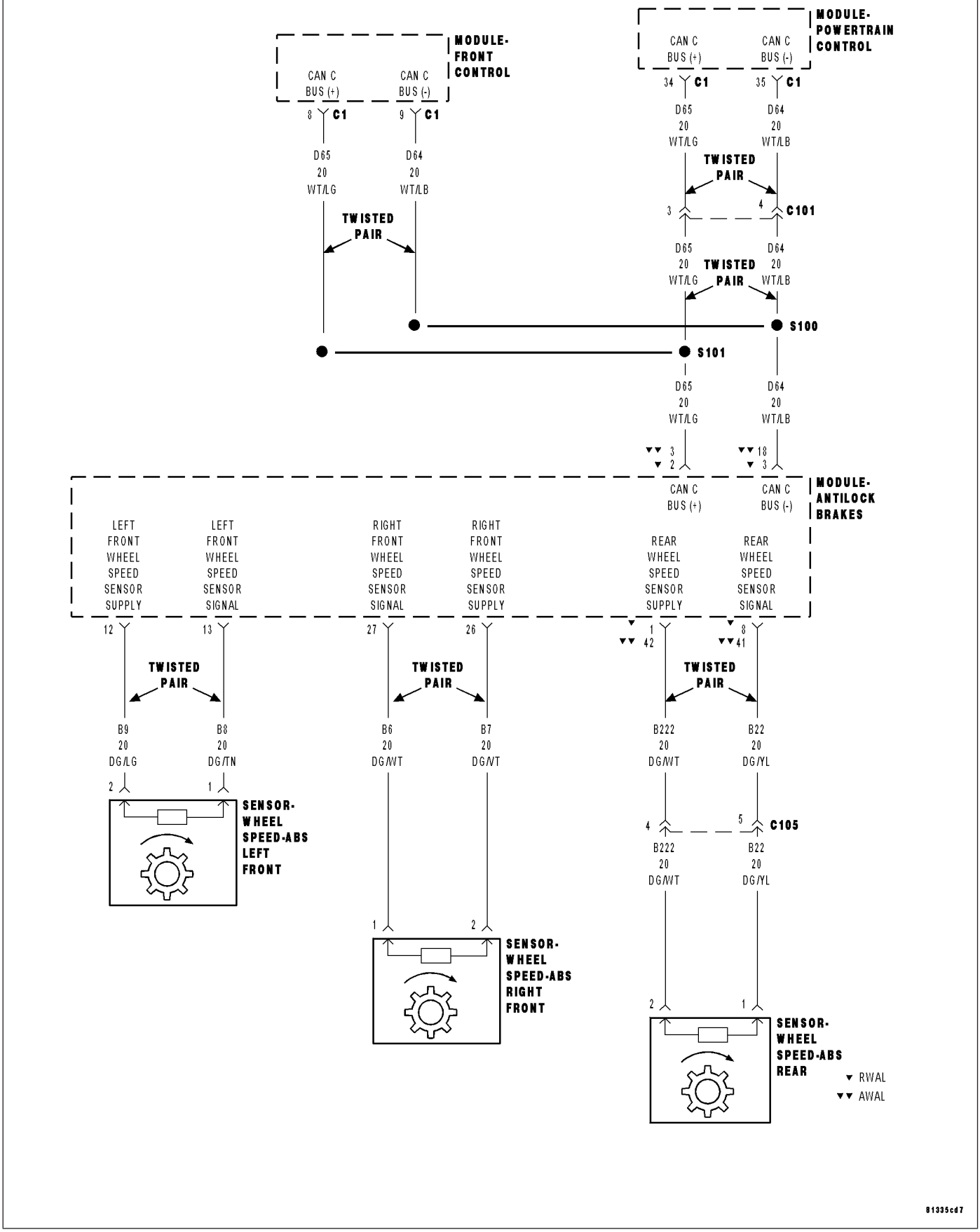
With a scan tool check for DTCs in the FCM.

Are any CAN B Hardware related DTCs active at this time?

Yes >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the appropriate diagnostic procedures.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U1417-IMPLAUSIBLE LEFT WHEEL DISTANCE SIGNAL RECEIVED



U1417-IMPLAUSIBLE LEFT WHEEL DISTANCE SIGNAL RECEIVED (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM gets an implausible signal over the CAN C circuit from the ABS Module. The circuit is continuously monitored.

Possible Causes
VEHICLE SPEED SENSOR FAULT ACTIVE IN ANTI-LOCK BRAKE MODULE
CAN C BUS CIRCUIT SHORTED
CAN C BUS CIRCUIT OPEN
ABS MODULE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The ABS Module sends an implausible distance signal over the CAN C Bus circuit to the PCM.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the U1417-IMPLAUSIBLE LEFT WHEEL DISTANCE SIGNAL RECEIVED active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. ABS MODULE IS ACTIVE ON THE CAN C BUS

With the scan tool, select ECU View.
Verify that the ABS Module active on the bus.

Is the ABS Module active on the bus?

Yes >> Go To 3

No >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response diagnostic procedures.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

U1417-IMPLAUSIBLE LEFT WHEEL DISTANCE SIGNAL RECEIVED (CONTINUED)

3. DTCS STORED OR ACTIVE IN THE ABS MODULE

Check for DTCs in the ABS Module.

Are any DTCs active or stored in the ABS Module?

Yes >> Refer to section 5 - BRAKES - ABS ELECTRICAL DIAGNOSTICS and perform the diagnostics for the DTCs in the ABS Module.
Perform ABS VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 4

---

4. ACTIVE DTCS IN THE FCM

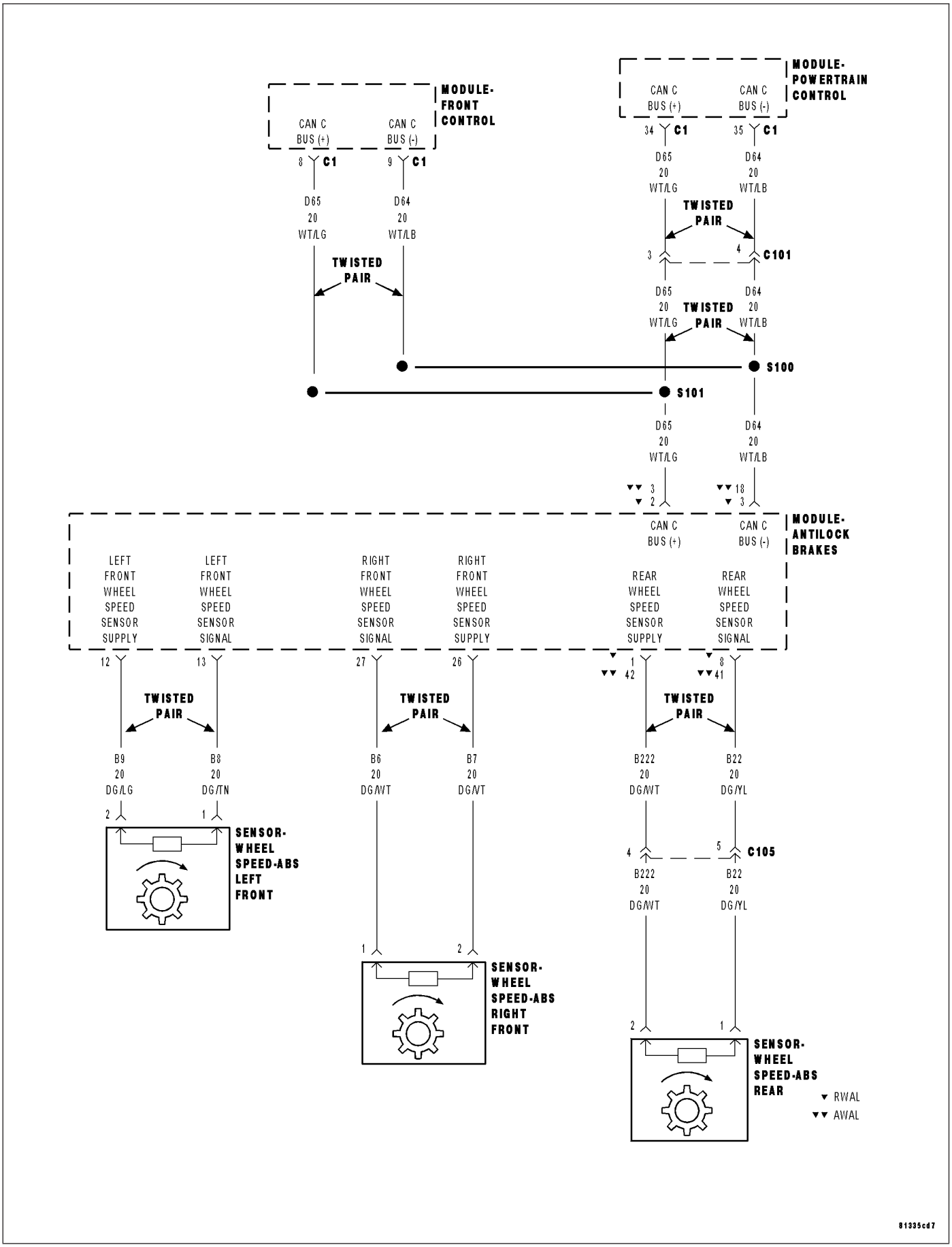
With the scan tool, select ECU View and select FCM.
Withe the scan tool, read active DTCs.

Are any Communication DTCs active in the FCM relating to the ABS System?

Yes >> Replace the ABS Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U1418-IMPLAUSIBLE RIGHT WHEEL DISTANCE SIGNAL RECEIVED



U1418-IMPLAUSIBLE RIGHT WHEEL DISTANCE SIGNAL RECEIVED (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM gets an implausible signal over the CAN C circuit from the ABS Module. The circuit is continuously monitored.

Possible Causes
VEHICLE SPEED SENSOR FAULT ACTIVE IN ANTI-LOCK BRAKE MODULE
CAN C BUS CIRCUIT SHORTED
CAN C BUS CIRCUIT OPEN
ABS MODULE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The ABS Module sends an implausible distance signal over the CAN C Bus circuit to the PCM.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the U1418-IMPLAUSIBLE RIGHT WHEEL DISTANCE SIGNAL RECEIVED active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. ABS MODULE IS ACTIVE ON THE CAN C BUS

With the scan tool, select ECU View.
Verify that the ABS Module active on the bus.

Is the ABS Module active on the bus?

Yes >> Go To 3

No >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response diagnostic procedures.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

U1418-IMPLAUSIBLE RIGHT WHEEL DISTANCE SIGNAL RECEIVED (CONTINUED)

3. DTCS STORED OR ACTIVE IN THE ABS MODULE

Check for DTCs in the ABS Module.

Are any DTCs active or stored in the ABS Module?

Yes >> Refer to section 5 - BRAKES - ABS ELECTRICAL DIAGNOSTICS and perform the diagnostics for the DTCs in the ABS Module.
Perform ABS VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 4

---

4. ACTIVE DTCS IN THE FCM

With the scan tool, select ECU View and select FCM.
Withe the scan tool, read active DTCs.

Are any Communication DTCs active in the FCM relating to the ABS System?

Yes >> Replace the ABS Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

*CHECKING THE FUEL DELIVERY SYSTEM

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
(N1) FUEL PUMP RELAY OUTPUT CIRCUIT OPEN
FUEL PUMP RELAY
FUEL PUMP

Diagnostic Test

1. FUEL PUMP OPERATION

Ignition on, engine not running.

With a scan tool, actuate the Fuel System test.

NOTE: It may be necessary to use a mechanics stethoscope in the next step.

Listen for fuel pump operation at the fuel tank.

CAUTION: Stop All Actuations.

Does the Fuel Pump operate?

Yes >> Go To 2

No >> Go To 5

---

2. FUEL PRESSURE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge at the engine.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

CAUTION: Stop All Actuations.

Choose a conclusion that best matches your fuel pressure reading.

Below Specification

Go To 3

Within Specification

Test Complete.

Above Specification

Replace the fuel filter/fuel pressure regulator.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE))

***CHECKING THE FUEL DELIVERY SYSTEM (CONTINUED)**

3. RESTRICTED FUEL SUPPLY LINE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) or #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

CAUTION: Stop All Actuations.

Is the fuel pressure within specification now?

Yes >> Repair/replace fuel supply line as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. CHECKING FUEL INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

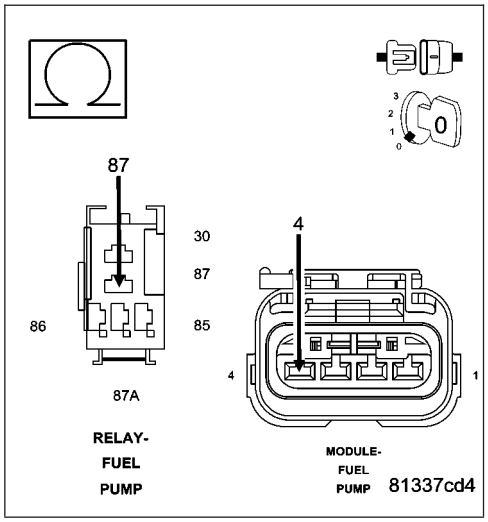
5. (N1) FUEL PUMP RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Remove the Fuel Pump Relay from the IPM.

Disconnect the Fuel Pump Module harness connector.

Measure the resistance of the (N1) Fuel Pump Relay Output circuit from the relay connector to the fuel pump module connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the Fuel Pump Relay.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (N1) Fuel Pump Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

*HARD START FUEL SYSTEM

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
FUEL CONTAMINATION
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
FAULTY FUEL PUMP MODULE
FUEL INJECTOR(S)

Diagnostic Test

1. CHECKING FUEL PRESSURE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge at the engine.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Below Specification
Go To 2

Within Specification
Go To 4

---

2. RESTRICTED FUEL SUPPLY LINE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel supply line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Visually and physically inspect the fuel supply lines between the fuel tank and the fuel rail. Repair/replace as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

***HARD START FUEL SYSTEM (CONTINUED)**

3. CHECKING THE FUEL INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. FUEL PUMP MODULE

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi)

Does the fuel pressure drop?

Yes >> Replace Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

***HARD START FUEL SYSTEM (CONTINUED)**

5. FUEL INJECTOR(S)

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove special tool #C4390.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Move special tool #C4390, Hose Clamp Pliers, from between the fuel pressure gauge and the engine to between the fuel pressure gauge and fuel pump module.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

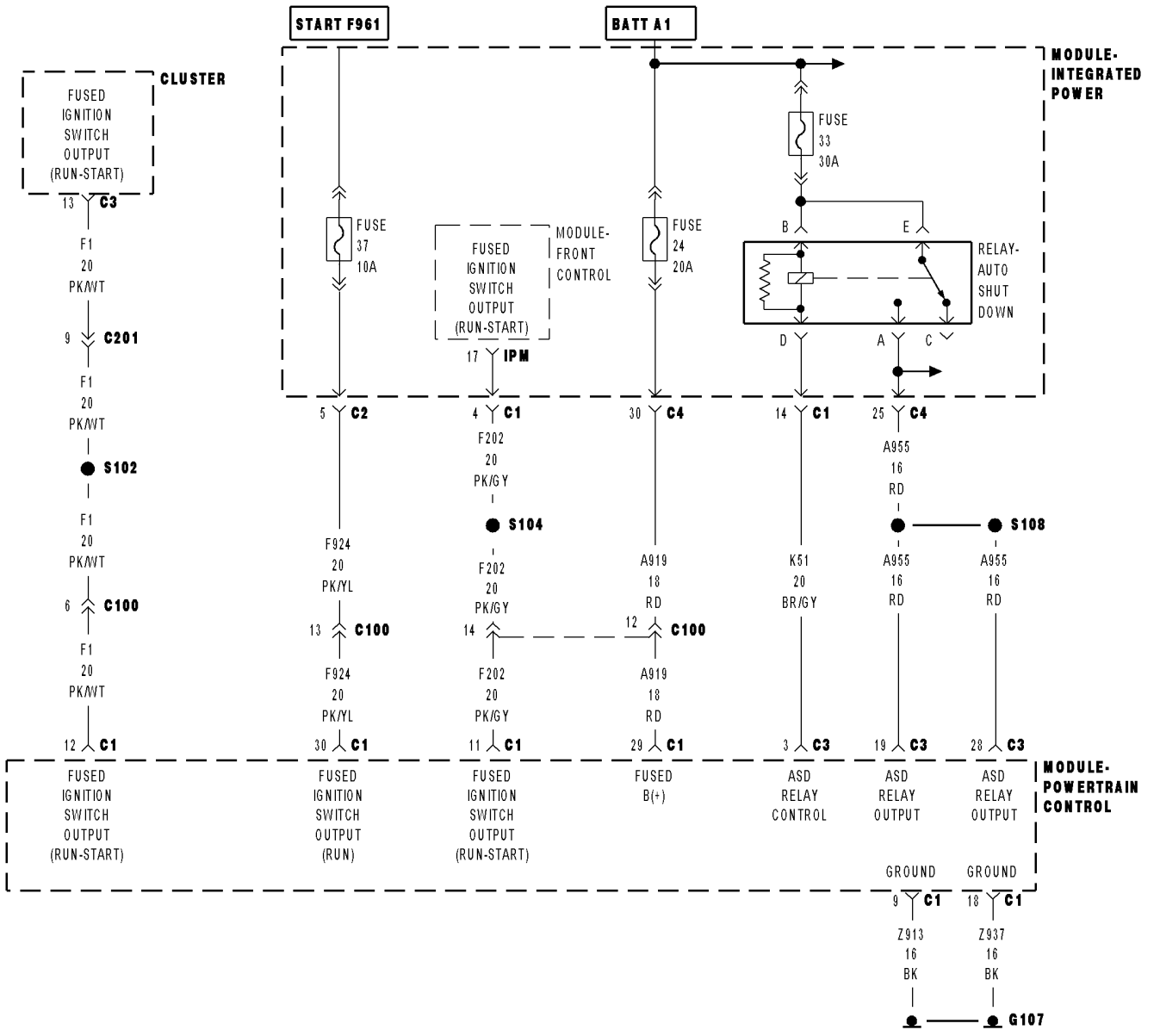
NOTE: The pressure should not fall below 241 KPa (35 psi)

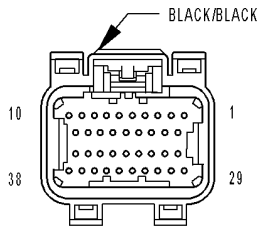
Does the fuel pressure drop?

Yes >> Replace the leaking fuel injectors.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

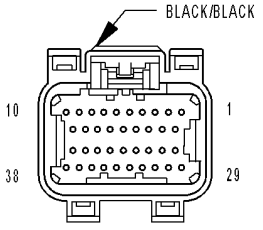
No >> Check the fuel for contaminants.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

*ENGINE CRANKS BUT DOES NOT START

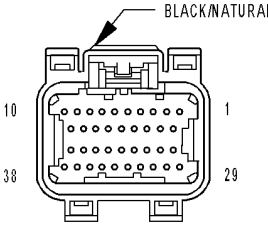




MODULE-POWERTRAIN CONTROL C1 (3.7L)



MODULE-POWERTRAIN CONTROL C1 (4.7L)



MODULE-POWERTRAIN CONTROL C3

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***ENGINE CRANKS BUT DOES NOT START (CONTINUED)**

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
NO START PRE-TEST
POWERTRAIN FUSES OPEN
SECONDARY INDICATORS PRESENT
ENGINE MECHANICAL PROBLEM
(A955) ASD RELAY OUTPUT CIRCUIT OPEN
FUEL CONTAMINATION

Diagnostic Test

1. NO START PRE-TEST

NOTE: The following list of items must be checked before continuing with any no start tests.

The battery must be fully charged and in good condition. A low charged battery may produce invalid test results. If the battery is low, charge the battery and then attempt to start the vehicle by cranking the engine for 15 seconds, 3 consecutive times.

This will allow any DTCs to set that may have been erased due to a dead battery.

Try to communicate with PCM if not able to communicate check fuses.

Make sure the Powers and Ground to the PCM are ok.

Make sure the PCM communicates with the scan tool and that there are no DTCs stored in the PCM memory. If the PCM reports a No Response condition, refer to section 8 Electrical Electronic Control Module Electrical Diagnostics for the proper tests.

Read the PCM DTCs with the scan tool. If any DTCs are present, they must be repaired before continuing with any other No Start diagnostic tests. Refer to the Table of Contents for the related P-code that is reported by the PCM.

Make sure that the Bus is functional. Attempt to communicate with the Instrument Cluster and VTSS, If you are unable to establish communications refer to 8 Electrical Electronic Control Module Electrical Diagnostics for the proper Diagnostic procedures.

The Sentry Key Immobilizer System must be operating properly. Check for proper communication with the scan tool and check for DTCs that may be stored in the Sentry Key Immobilizer Module (SKREM). Repair the DTC(s) before continuing.

If no DTCs are found, using the scan tool, select Clear PCM (BATT Disconnect).

Crank the engine several times. Using the scan tool, read DTCs. If a DTC is present perform the DTC diagnostics before continuing.

Were any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

***ENGINE CRANKS BUT DOES NOT START (CONTINUED)**

2. OPEN FUSE

Check for any open fuses in the IPM or Junction Block that may be related to the No Start condition.

Are any of the fuses open?

Yes >> Replace the open fuse and check the related circuit(s) for a short to ground.
PerformPOWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. SECONDARY INDICATORS PRESENT

Ignition on, engine not running.
With the scan tool, under DTCs & Related Functions, read the Secondary Indicators while cranking the engine.

Are there any Secondary Indicators present while cranking the engine?

Yes >> Refer to the Engine Electrical Diagnostics group and perform the tests related to the secondary indicator that is reported by the scan tool.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. POSSIBLE MECHANICAL PROBLEMS

Check for any of the following conditions/mechanical problems.
ENGINE VALVE TIMING - must be within specifications, check for broken timing components
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

***ENGINE CRANKS BUT DOES NOT START (CONTINUED)**

5. (A955) ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

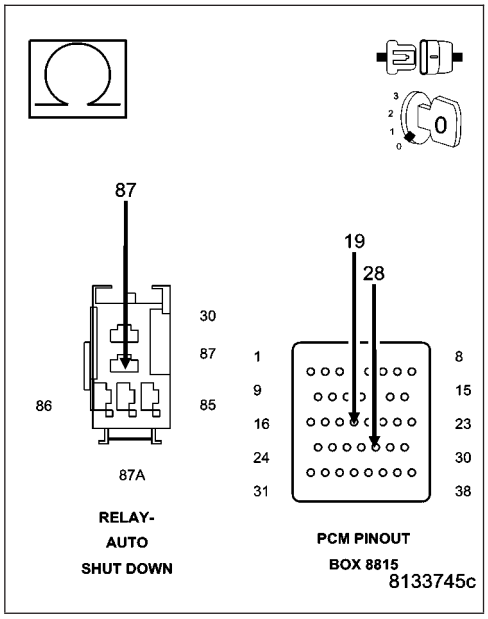
Remove the ASD relay from the IPM.

Disconnect the C3 PCM harness connector.

Verify the ASD Relay is getting voltage on the Fused B+ circuits before continuing.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the ASD Relay Output circuit from the ASD Relay connector to the appropriate terminals of special tool #8815, Ignition coil, and the fuel injectors.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (A955)) ASD Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. FUEL PUMP DELIVERY

Verify that the Fuel tank is not empty before continuing.

Follow the diagnostics for Checking Fuel Delivery in the Driveability section of this manual.

Was the No Start condition solved after following the above diagnostic test?

Yes >> Test Complete.

No >> Check for contamination/water in the fuel. Make sure the fuel being used in this vehicle meets manufactures Fuel Requirement, refer to the service manual.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

*FUEL PRESSURE LEAK DOWN

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
FAULTY FUEL PUMP MODULE
FUEL INJECTOR(S)

Diagnostic Test

1. FUEL PUMP MODULE

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi)

Does the fuel pressure drop?

Yes >> Replace Fuel Pump Module.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

***FUEL PRESSURE LEAK DOWN (CONTINUED)**

2. FUEL INJECTOR(S)

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove special tool #C4390.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Move special tool #C4390, Hose Clamp Pliers, from between the fuel pressure gauge and the engine to between the fuel pressure gauge and fuel pump module.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

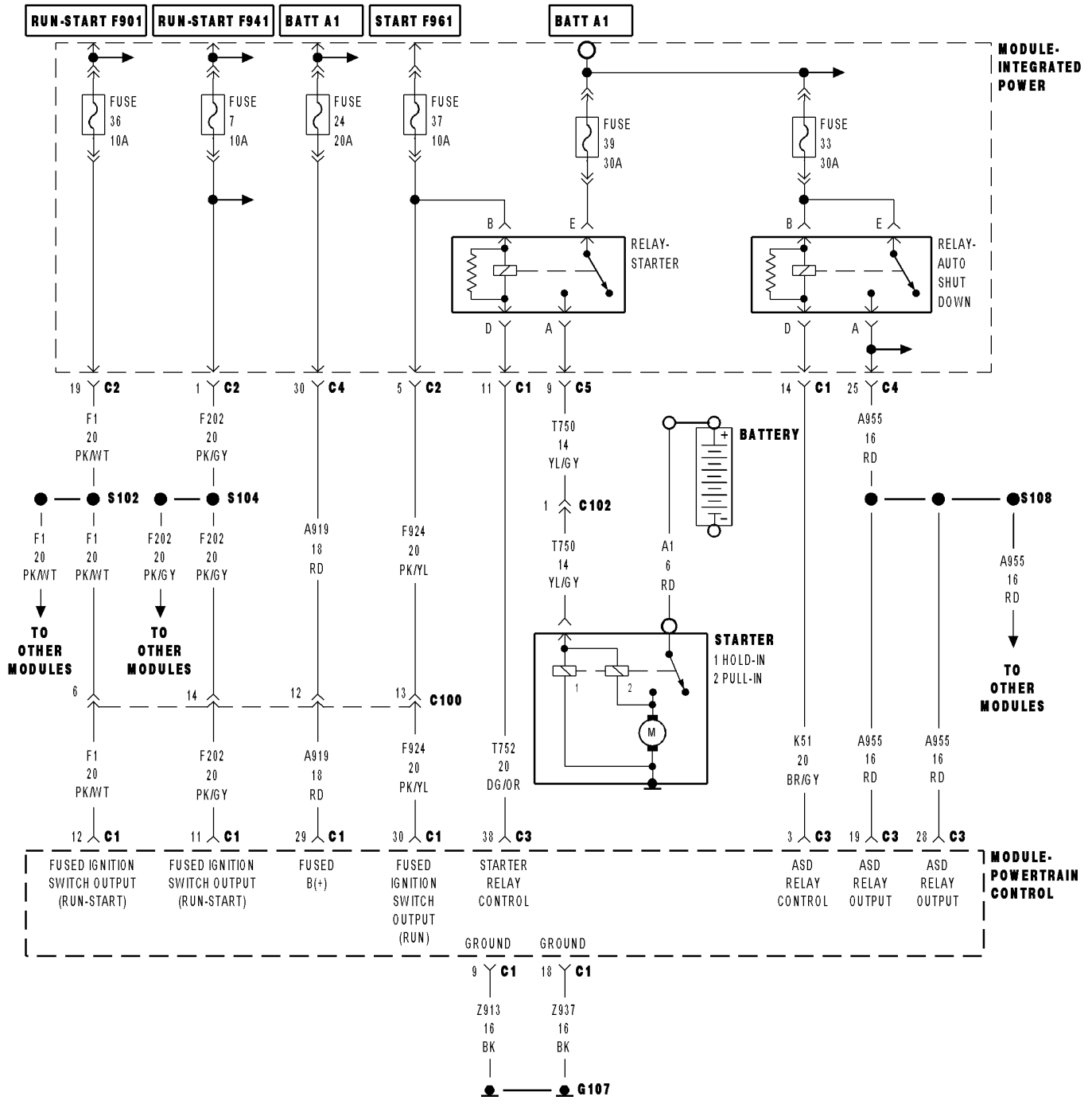
NOTE: The pressure should not fall below 241 KPa (35 psi)

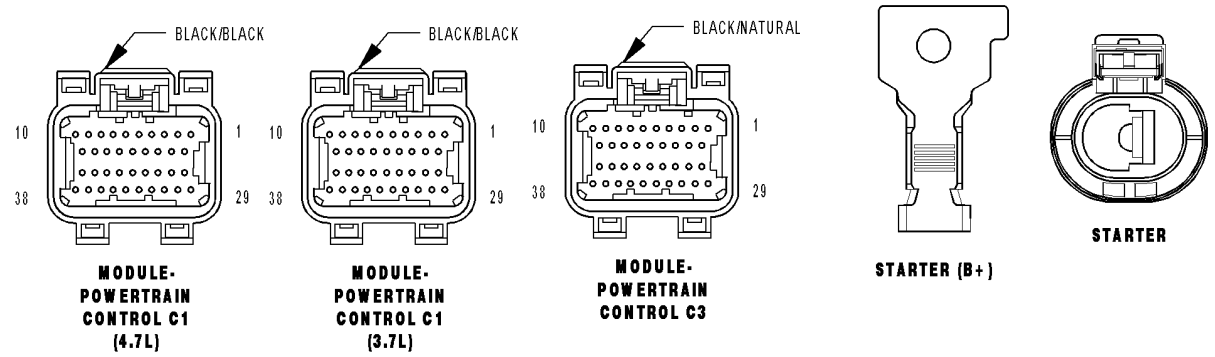
Does the fuel pressure drop?

Yes >> Replace the leaking fuel injectors.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

*NO CRANK CONDITION





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***NO CRANK CONDITION (CONTINUED)**

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
MECHANICAL CONDITION
BATTERY CIRCUIT RESISTANCE TOO HIGH
FUSED IGNITION SWITCH OUTPUT CIRCUITS
FUSED B+ CIRCUIT OPEN
(T752) STARTER RELAY CONTROL CIRCUIT OPEN
(T750) STARTER RELAY OUTPUT CIRCUIT OPEN
TRANSMISSION RANGE SENSOR
STARTER RELAY
STARTER

Diagnostic Test

1. MECHANICAL CONDITION

NOTE: Verify the battery is fully charged and capable of passing a load test before continuing.

WARNING: Make sure the battery is disconnected, then wait two minutaes before proceeding. Failur to do so may result in personal injury or possible death.

Turn the engine over by hand to make sure the engine is not seized.

Is the engine able to turn over?

Yes >> Go To 2

No >> Repair the mechanical condition preventing the starter motor from cranking.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. TRANSMISSION RANGE SENSOR

Turn the ignition off.

Disconnect the TRS harness connector.

Move the Gear selector through all gear positions, from Park to 1st and back.

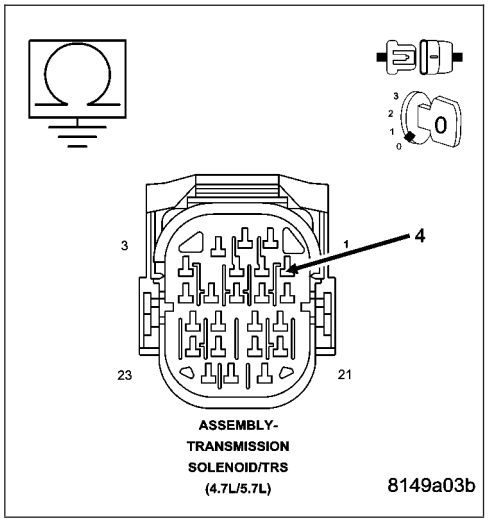
While moving the gear selector through each gear, measure the resistance between ground and the TRS (T41) Sense (P/NSense) circuit at the TRS connector.

NOTE: The circuit is grounded in Park and Neutral and open in the other positions.

Did the resistance change from above 100 kohms (open) to below 10.0 ohms (grounded)?

Yes >> Go To 3

No >> Replace the Transmission Range Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



***NO CRANK CONDITION (CONTINUED)**

3. EXCESSIVE RESISTANCE IN THE BATTERY CIRCUIT

Turn the ignition off.

Check the Battery Cables for excessive resistance using the service information procedure.

Did either Battery Cable have a voltage drop greater than 0.2 of a volt?

Yes >> Repair the excessive resistance in the Battery circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. STARTER RELAY

Turn ignition off.

Remove the Starter Relay from IPM.

CAUTION: The Parking Brake must be on and the Transmission must be in park for a vehicle equipped with an automatic transmission.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Briefly connect a jumper wire between Internal Fused B+ circuit and the (T750) Starter Relay Output circuit.

Did the Starter Motor crank the engine?

Yes >> Go To 5

No >> Go To 7

---

5. INTERNAL FUSED IGNITION SWITCH OUTPUT CIRCUIT

Ignition on, engine not running.

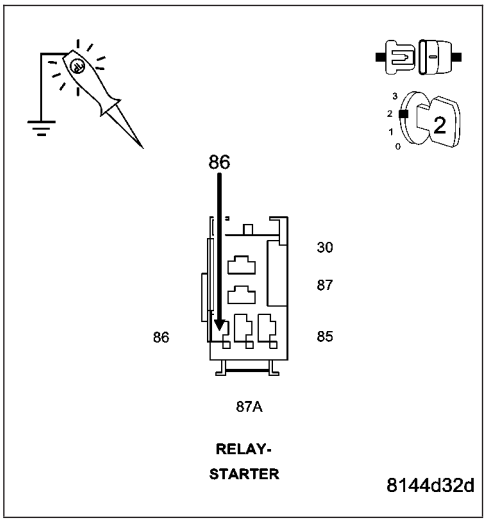
Using a 12-volt test light, probe the Internal Fused Ignition Switch Output circuit in the Starter Relay connector.

While observing 12-volt test light, hold ignition key in the start position.

Does the test light illuminate brightly?

Yes >> Go To 6

No >> Repair the excessive resistance in the InternalFused Ignition Switch Output circuit. Inspect related fuses and repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



***NO CRANK CONDITION (CONTINUED)**

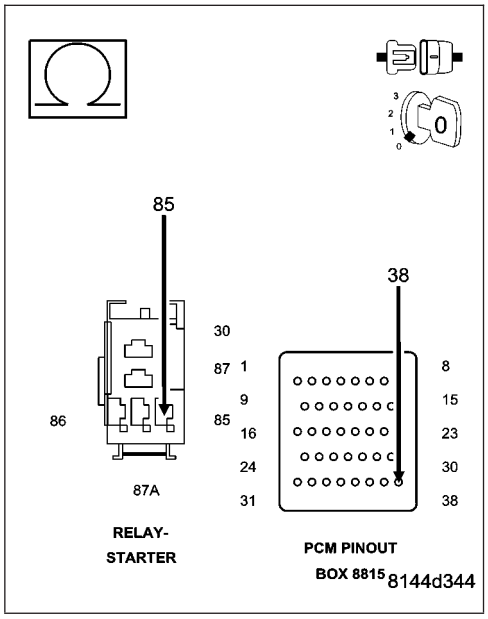
6. (T752) STARTER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Remove the Starter Relay from the IPM.

Disconnect the C3 PCM harness connector.

Measure the resistance in the (T752) Starter Relay Control circuit from the Relay terminal to the appropriate terminals of special tool #8815.



Is the resistance below 5.0 ohms?

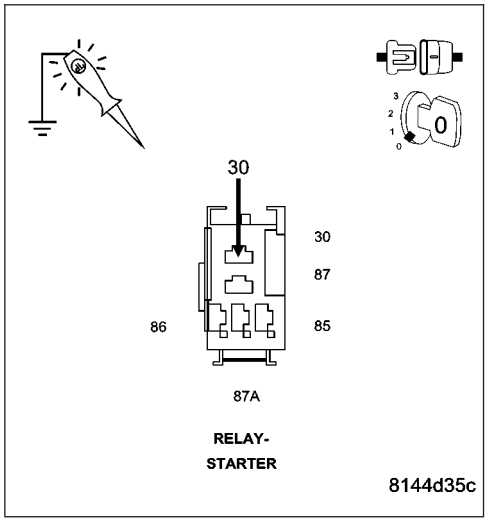
Yes >> Replace the Starter Motor Relay.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (T752) Starter Relay Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. INTERNAL FUSED B+ CIRCUIT OPEN

Turn the ignition off.

Using a 12-volt test light connected to ground, probe the Internal Fused B+ circuit at the Starter Relay terminal.



Does the test light illuminate brightly?

Yes >> Go To 8

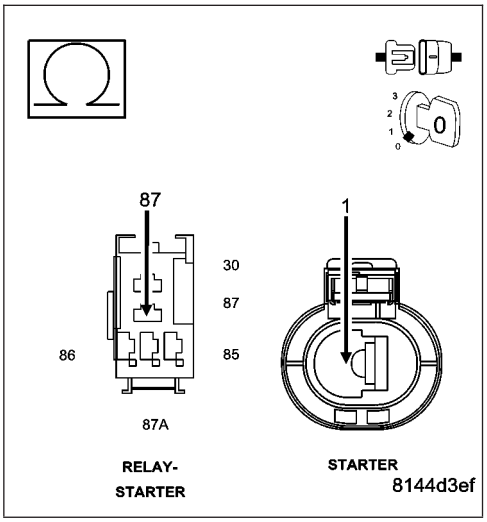
No >> Repair the excessive resistance in the Internal Fused B+ circuit. Inspect related fuses and repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***NO CRANK CONDITION (CONTINUED)**

8. (T750) STARTER RELAY OUTPUT CIRCUIT OPEN

Disconnect the Starter Solenoid harness connector from the Starter Solenoid.

Measure the resistance of the (T750) Starter Relay Output circuit between the Relay and the Solenoid harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the Starter Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. STARTER

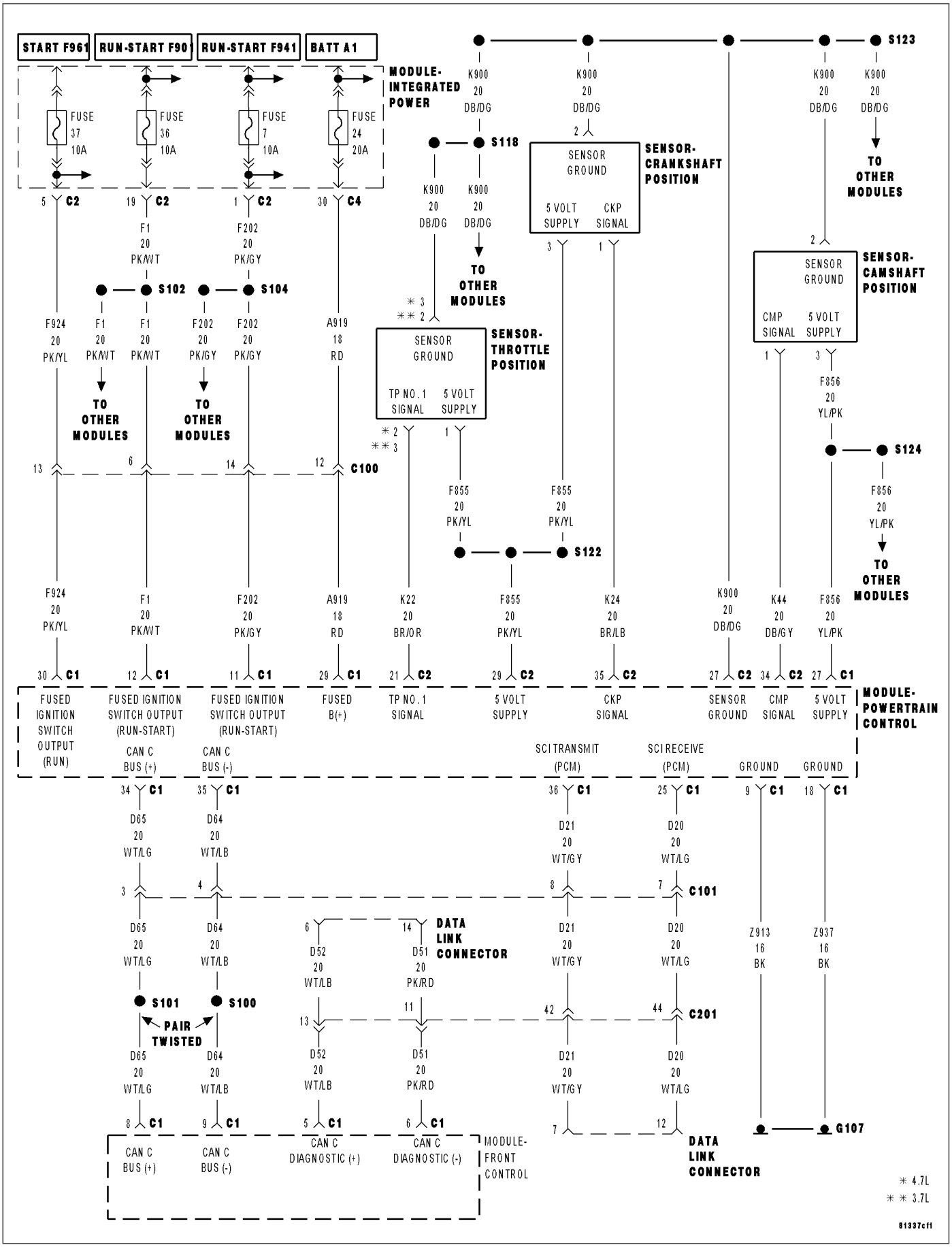
If there are no other possible causes remaining, review repair.

Repair

Replace the Starter.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

*NO RESPONSE WITH A NO START CONDITION



***NO RESPONSE WITH A NO START CONDITION (CONTINUED)**

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A919) PCM FUSED B+ CIRCUIT
PCM NO RESPONSE
(F202) (F924) PCM FUSED IGNITION SWITCH OUTPUT CIRCUITS
(Z913) (Z937) PCM GROUND CIRCUITS
CRANKSHAFT POSITION SENSOR
(F855) 5-VOLT SENSOR OPEN/SHORTED
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
PCM

Diagnostic Test

1. (A919) PCM FUSED B+ CIRCUIT

NOTE: The scan tool and cable must be operating properly for the results of this test to be valid.

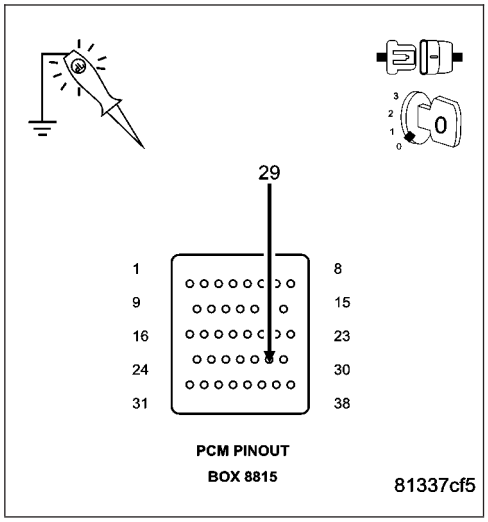
NOTE: Make sure the ignition switch was on while trying to communicate with the PCM.

Turn the ignition off.

Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to ground probe the appropriate terminal of special tool #8815.



Does the test light illuminate brightly?

Yes >> Go To 2

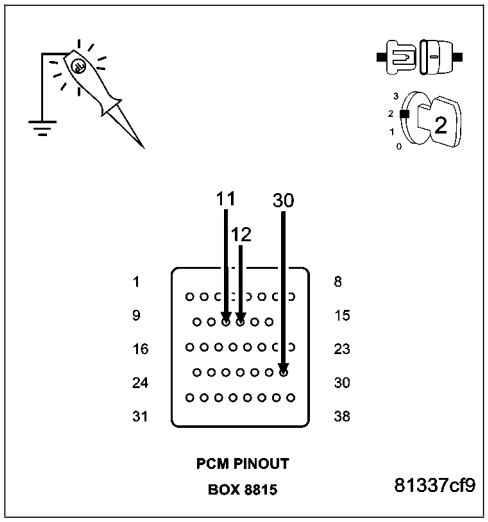
No >> Repair the open or short to ground in the (A919) Fused B+ circuit. Inspect and replace fuses as necessary.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***NO RESPONSE WITH A NO START CONDITION (CONTINUED)**

2. (F202) (F924) PCM FUSED IGNITION SWITCH CIRCUITS

Using a 12-volt test light connected to ground, probe the PCM Fused Ignition Switch Output circuit in the the appropriate terminals of special tool #8815.



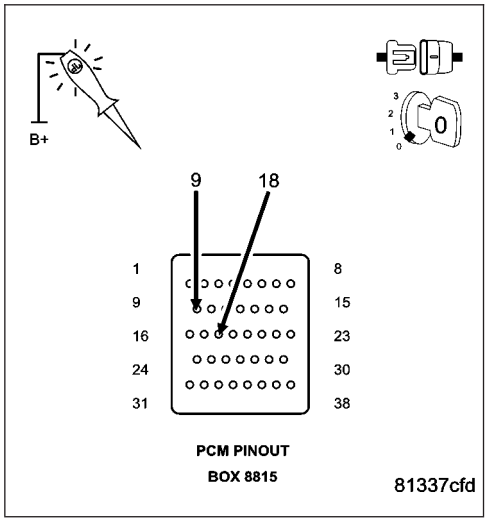
Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the (F202) (F924) Ignition Switch Output circuit. Inspect and replace fuses as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. (Z913) (Z937) PCM GROUND CIRCUITS

Using a 12-volt test light connected to battery voltage, probe the (Z913) (Z937) PCM ground circuits in the appropriate terminals of special tool #8815.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the PCM ground circuits.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***NO RESPONSE WITH A NO START CONDITION (CONTINUED)**

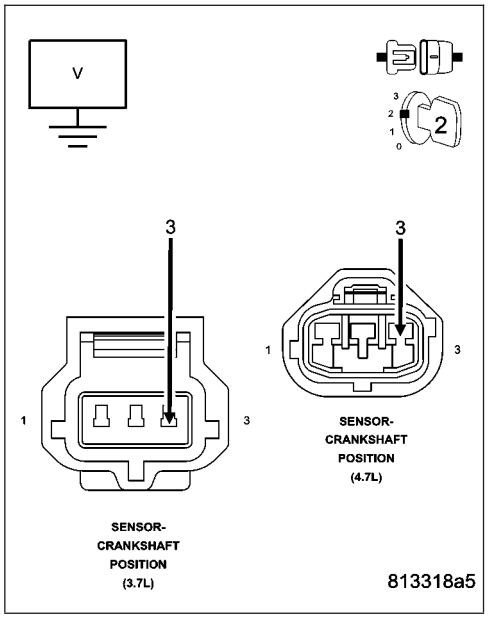
4. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.
Connect the C2 PCM harness connector.
Disconnect the Crankshaft Position Sensor harness connector.
Ignition on, engine not running.
Measure the voltage on the (F855) 5-volt Supply circuit.

Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 5

No >> Go To 6



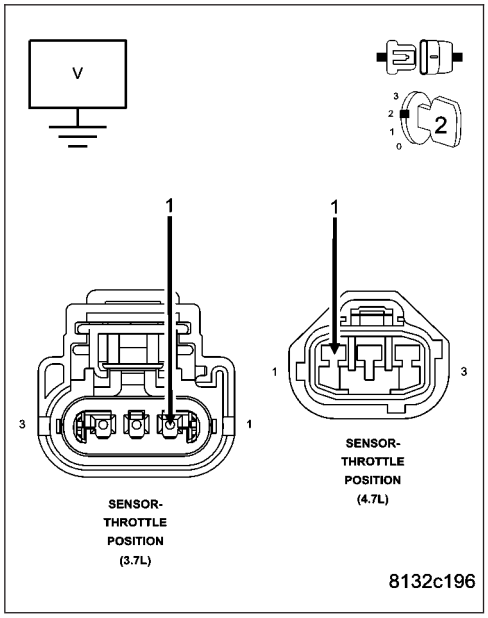
5. CKP SENSOR

Turn the ignition off.
Disconnect the TP Sensor harness connector.
Ignition on, engine not running.
Measure the voltage on the (F855) 5-volt Supply circuit in the TP Sensor harness connector.

Is the voltage between 4.5 and 5.2 volts?

Yes >> If communication is available with a PCM on a like vehicle, replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the Crankshaft Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



***NO RESPONSE WITH A NO START CONDITION (CONTINUED)**

6. (F855) 5-VOLT SENSOR OPEN/SHORTED

Turn the ignition off.

Disconnect the TP Sensor/Throttle Body harness connector.

Ignition on, engine not running.

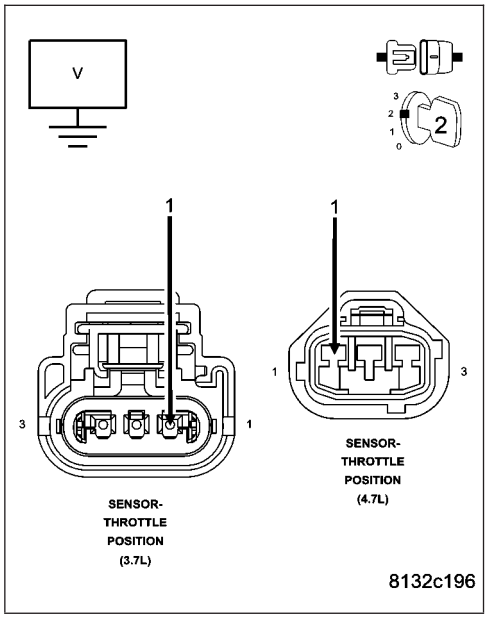
Measure the voltage on the (F855) 5-volt Supply circuit.

Disconnect all the sensors that use the (F855) 5-volt Supply circuit.

Did the voltage return to 4.5 to 5.2 volts when disconnecting any of the sensors.

Yes >> Replace the sensor that is pulling down the (F855) 5-volt supply.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



7. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect C1 and C2 PCM harness connectors.

Disconnect all the sensors that share the (F855) 5-volt Supply circuit.

Measure the resistance between ground and the (F855) 5-volt Supply circuit at one of the sensor harness connectors.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Disconnect all the sensors that share the (F856) 5-volt Supply circuit.

Measure the resistance between ground and the (F856) 5-volt Supply circuit at one of the sensor harness connectors.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

***NO RESPONSE WITH A NO START CONDITION (CONTINUED)**

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform (NGC) POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

*START AND STALL CONDITION

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
CURRENT PCM DTCS
CURRENT SKIM DTCS
THROTTLE POSITION SENSOR SWEEP
TP SENSOR NO.1 VOLTAGE GREATER THAN 0.92 VOLTS WITH THROTTLE CLOSED
ECT SENSOR
OTHER POSSIBLE CAUSES FOR START AND STALL CONDITON
FUEL CONTAMINATION

Diagnostic Test

1. CHECKING DTCS

Ignition on, engine not running.
With a scan tool, read DTCs.

Are any DTCs present?

Yes >> Refer to the appropriate Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. CHECKING SKIM DTCS

NOTE: If you are unable to communicate with the SKREEM, refer to the VEHICLE THEFT AND SECURITY ELECTRICAL DIAGNOSTICS in Section 8 and perform the appropriate diagnostics.
With the scan tool, read the SKIM codes.

Are there any SKIM DTCs?

Yes >> Refer to the Sentry Key Vehicle Theft Security Electrical Diagnostics in Section 8.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. TP SENSOR SWEEP

Ignition on, engine not running.
With the scan tool read TP Sensor voltage.
While monitoring the scan tool, slowly open and close the Throttle.

Was the voltage change smooth?

Yes >> Go To 4

No >> Replace the Throttle Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***START AND STALL CONDITION (CONTINUED)**

4. TP SENSOR NO.1 VOLTAGE GREATER THAN 0.92 VOLTS WITH THROTTLE CLOSED

With the scan tool, read Throttle Position Sensor No.1 voltage.

Throttle must be against its stop.

Is the voltage 0.92 or less with the Throttle closed?

Yes >> Go To 5

No >> Check for a binding throttle condition. If OK, replace the Throttle Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

5. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soaked).

NOTE: If the vehicle was allowed to sit over night with no engine start, coolant temperature should be near ambient temperatures.

Ignition on, engine not running.

With the scan tool, read the ECT value.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temperature value change should be a smooth transition from start up to normal operating temp 82° C (180° F). The value should reach at least 82° C (180° F).

Did the Engine Temperature value increase smoothly and did it reach at least 82° C (180° F)?

Yes >> Go To 6

No >> Replace the Engine Coolant Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. OTHER POSSIBLE CAUSES OF START AND STALL CONDITION

The following additional items should be checked as a possible cause for a start and stall condition.

Refer to any Technical Service Bulletins (TSBs) that may apply to the symptom.

The exhaust system must be free of any restrictions.

The engine compression must be within specifications.

The engine valve timing must be within specifications.

The engine must be free from vacuum leaks.

The throttle body must be free of carbon buildup and dirt.

Do any of the above conditions exist?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

***START AND STALL CONDITION (CONTINUED)**

7. FUEL PUMP DELIVERY

Verify that the Fuel tank is not empty before continuing.

Follow the diagnostics for Checking Fuel Delivery in this manual.

Was the No Start condition solved after following the above diagnostic test?

Yes >> Test Complete.

No >> Check for contamination/water in the fuel. Ensure the fuel being used in this vehicle meets manufactures Fuel Requirement, refer to the service manual.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

STANDARD PROCEDURE

POWERTRAIN VERIFICATION TEST

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. SELECTING THE PROPER VERIFICATION TEST

The following verification test are for different repairs. Select the appropriate Verification test for the repair that has been completed.

Speed Control repair
Go To 2

Charging System repair
Go To 3

NVLD System repair
Go To 4

All other repairs
Go To 5

POWERTRAIN VERIFICATION TEST (CONTINUED)

2. POWERTRAIN VERIFICATION TEST 1

NOTE: If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.

NOTE: 2. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.

NOTE: 3. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.

NOTE: 4. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information.

5. Inspect the vehicle to make sure that all engine components are properly installed and connected.
6. Connect the scan tool to the data link connector and erase all codes.
7. Turn the speed control ON (if equipped, cruise light will be on).
8. Depress and release the SET Switch when the vehicle speed is greater than 35 MPH. The speed control should engage and hold the selected speed.
9. Press and hold the RESUME/ACCEL Switch. The vehicle speed should increase by at least 2 MPH.
10. Press and hold the COAST switch. The vehicle speed should decrease.
11. Using caution, press and release the brake pedal. The speed control should disengage.
12. Bring the vehicle speed back up to 35 MPH.
13. Press the RESUME/ACCEL switch. The speed control should resume the previously set speed.
14. Hold down the SET switch. The vehicle should decelerate.
15. Make sure vehicle speed is greater than 35 mph and release the SET Switch. The vehicle should adjust and set a new vehicle speed.
16. Press and release the CANCEL switch. The speed control should disengage.
17. Bring the vehicle speed back up above 35 mph and engage speed control.
18. Turn the Speed Control Off. (Cruise light will be off). The speed control should disengage.

NOTE: OVERSHOOT/UNDERSHOOT FOLLOWING SPEED CONTROL SET.

20. If the vehicle operator repeatedly presses and releases the SET button with their foot off of the accelerator (referred to as ″lift foot set″), the vehicle may accelerate and exceed the desired set speed by up to 5 mph (8 km/h).
21. It may also decelerate to less than the desired set speed, before finally achieving the desired set speed.
22. The Speed Control System has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths.
23. When the speed control is set with the vehicles operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts accordingly.
24. If the ″lift foot sets″ are continually used, a speed control overshoot/undershoot condition will develop.
25. To ″unlearn″ the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed using the accelerator pedal (not decelerating or accelerating).
26. Then turn the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds.
27. This procedure must be performed approximately 10-15 times to completely unlearn the overshoot/undershoot condition.

Did the Speed Control pass the above test?

Yes >> Repair is complete.

No >> Check for any related Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

POWERTRAIN VERIFICATION TEST (CONTINUED)

3. POWERTRAIN VERIFICATION TEST 2

1. If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly has been replaced use a scan tool to perform the ETC RELEARN function.

NOTE: 2. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.

NOTE: 3. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.

NOTE: 4. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information.

5. Inspect the vehicle to make sure that all components related to the repair are properly installed and connected.
6. With the scan tool, clear DTCs.
7. Perform generator output test. Refer to the appropriate service information as necessary.
8. Start the engine and set engine speed to 2000 RPM for at least thirty seconds.
9. Cycle the ignition key off and on.
10. With the scan tool, read the DTCs.

Are any DTCs or symptoms remaining?

Yes >> Check for any Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

No >> Repair is complete.

---

4. POWERTRAIN VERIFICATION TEST 3

1. Install the Miller Tool #8404 Evaporative Emission Leak Detector (EELD) according to the instructions in the previous DTC table.
2. Set the smoke/air control switch to AIR.
3. Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).
4. Press the remote smoke/air start button.
5. Position the red flag on the air flow meter so it is aligned with the indicator ball.
6. When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size of leak indicated by the DTC set in the PCM.
7. Install the service port adapter #8404-14 on the vehicle's service port.
8. Connect the Air supply hose from the EELD to the vehicle.
9. Press the remote button to activate AIR flow.

NOTE: 10. Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

11. Compare the flow meter indicator ball reading to the red flag.
12. ABOVE the red flag indicates a leak present.
13. BELOW the red flag indicates a sealed system.

NOTE: If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.

15. If the indicator ball shows a leak present, perform the smoke test indicated in the previous test and identify the leak and repair. Perform this verification test when the repair is complete.

Did the indicator ball indicate the a leak is present?

Yes >> Repeat the DTC test to identify the leak and repair.

No >> Repair is complete.

POWERTRAIN VERIFICATION TEST (CONTINUED)

5. POWERTRAIN VERIFICATION TEST 4

NOTE: 1. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.

NOTE: 2. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.

NOTE: 3. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information.

NOTE: 4. If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.

NOTE: 5. When replacing an O2 Sensor, the PCM RAM memory must be cleared, either by disconnecting the PCM C1 connector or momentarily disconnecting the Battery negative terminal.

6. The NGC learns the characteristics of each O2 heater element and these old values should be cleared when installing a new O2 sensor. The customer may experience driveability issues if this is not performed.

7. Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.

8. Connect the scan tool to the data link connector.

9. Make sure the fuel tank has at least a quarter tank of fuel. Turn off all accessories.

10. If the Catalyst was replaced, with the scan tool go to the Miscellaneous Menu Option ″Catalyst Replaced″ and press enter.

11. If a Comprehensive Component DTC was repaired, perform steps 12 - 14. If a Major OBDII Monitor DTC was repaired skip those steps and continue verification.

12. After the ignition has been off for at least 10 seconds, restart the vehicle and run 2 minutes.

13. With the scan tool, monitor the appropriate pre-test enabling conditions until all conditions have been met. Once the conditions have been met, switch screen to the appropriate OBDII monitor, (Audible beeps when the monitor is running).

14. If the repaired OBDII trouble code has reset or was seen in the monitor while on the road test, the repair is not complete. Check for any related technical service bulletins or flash updates and return to Engine Electrical Diagnostic List.

15. If the conditions cannot be duplicated, erase all DTCs with the Scan tool.

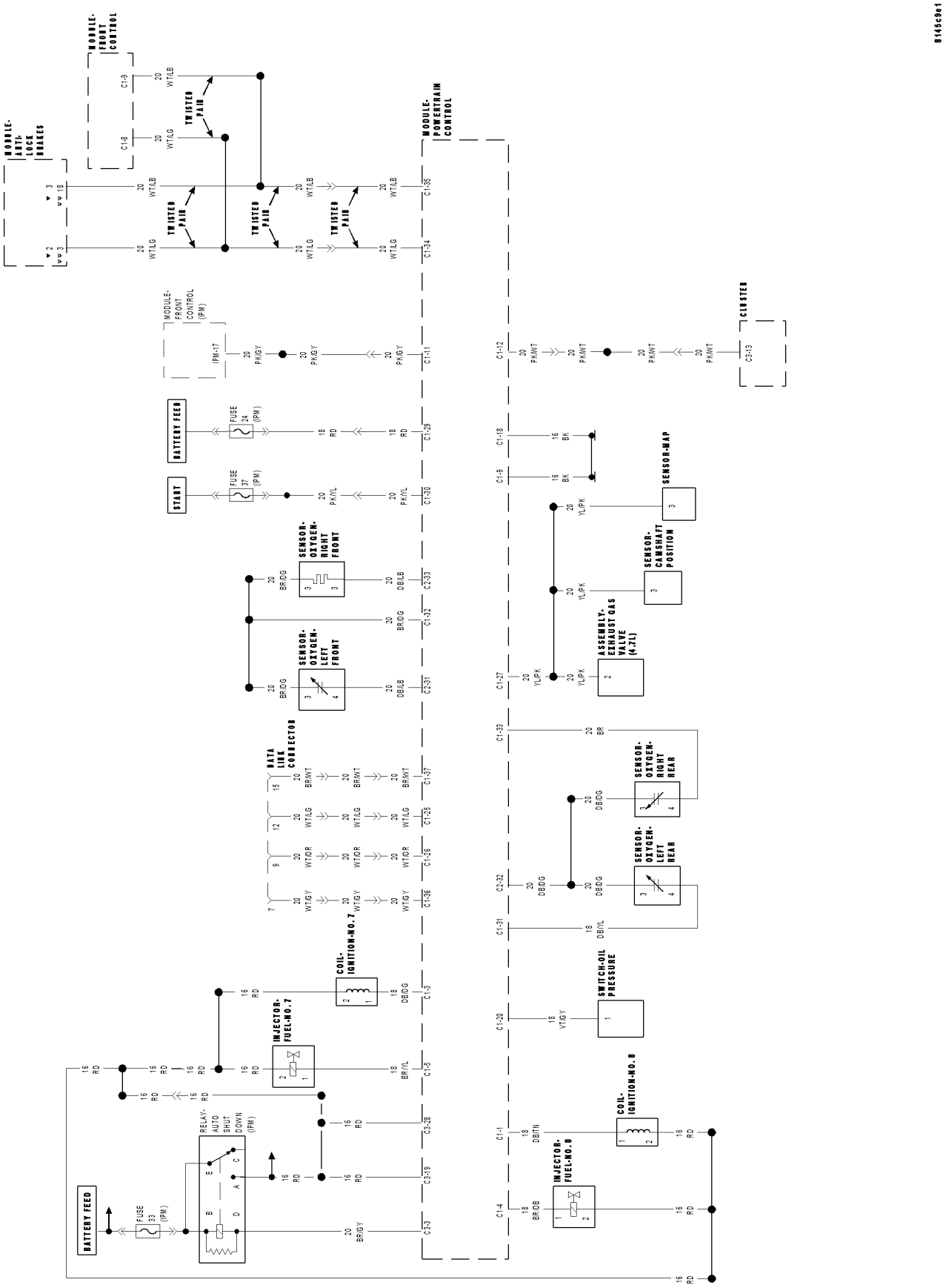
16. If another DTC has set, return to the Engine Electrical Diagnostic List and follow the path specified for that DTC.

Did the OBDII Monitor run successfully and has the Good Trip Counter changed to one or more?

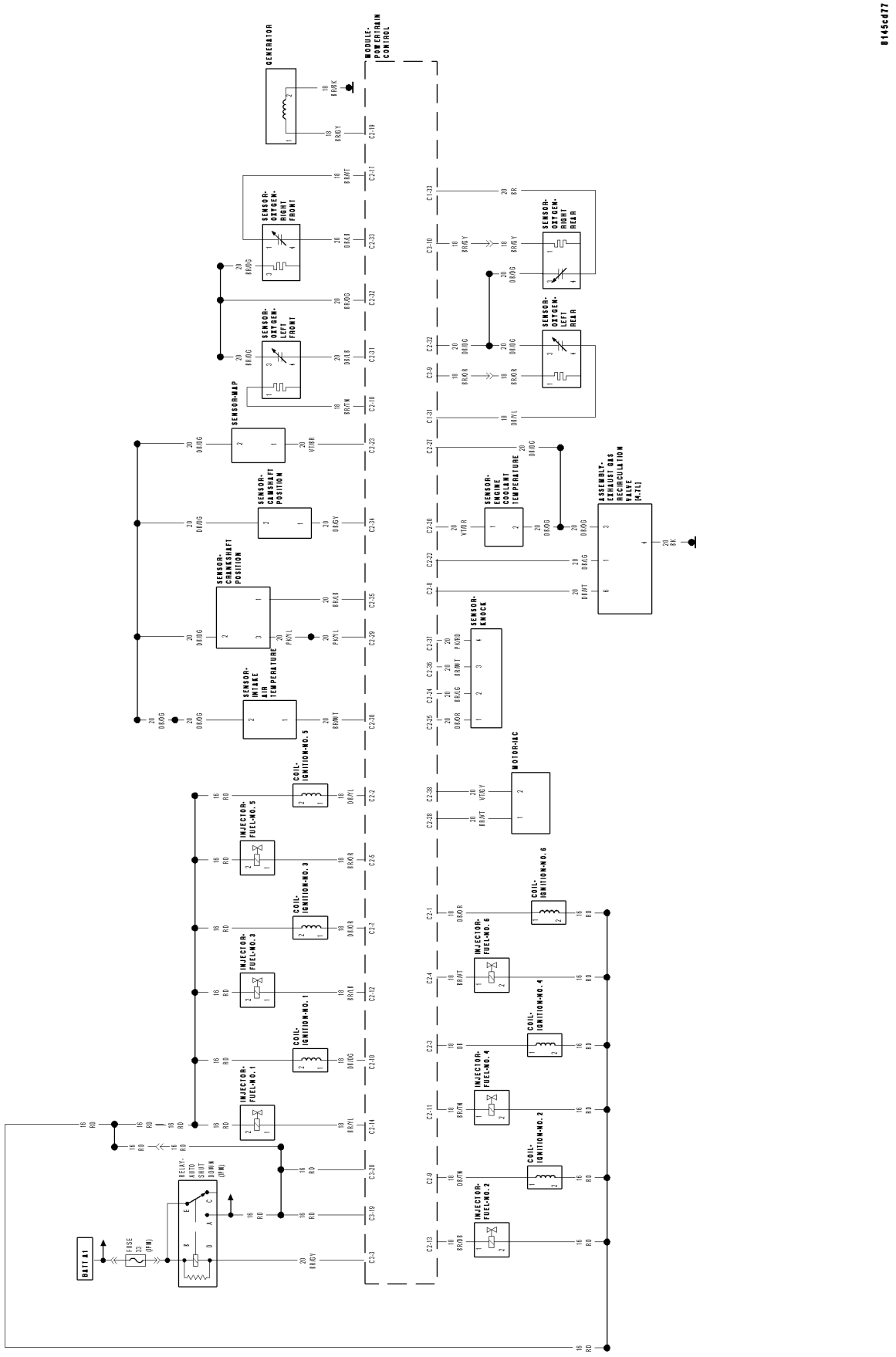
Yes >> Repair is complete.

No >> Check for any related Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

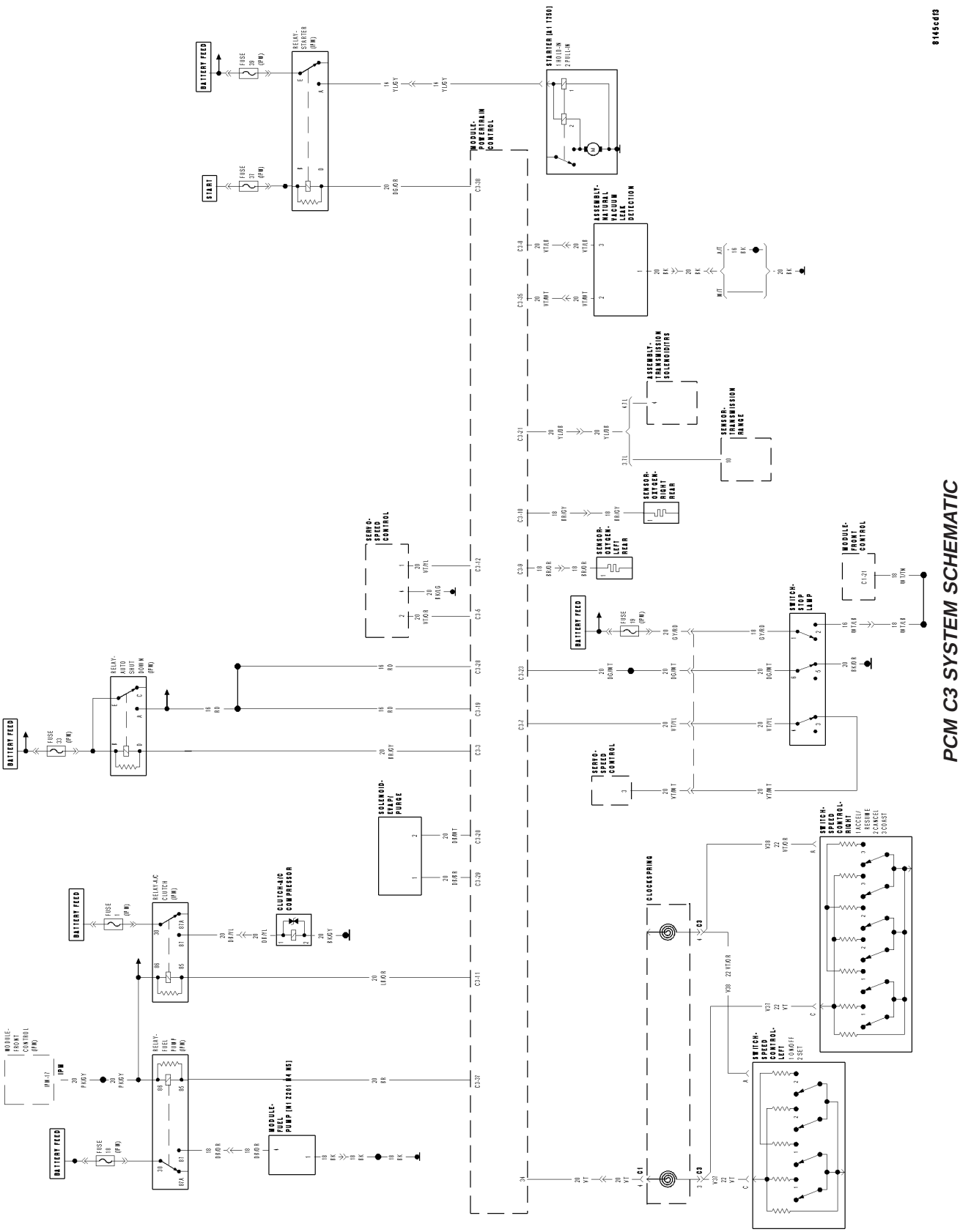
SCHEMATICS AND DIAGRAMS



PCM C1 SYSTEM SCHEMATIC



PCM C2 SYSTEM SCHEMATIC


PCM C3 SYSTEM SCHEMATIC
8145cd03
BATTERY FEED
START
MODULE-POWERTRAIN CONTROL
RELAY-STARTER (PDM)
STARTER (4.7 TBV)
ASSEMBLY-MANIFOLD VACUUM LEAK DETECTION
ASSEMBLY-TRANSMISSION SOLENOIDS
SENSOR-TRANSMISSION RANGE
SENSOR-DITCH-RIGHT REAR
SENSOR-DITCH-LEFT REAR
SERVO-SPEED CONTROL
MODULE-FRONT CONTROL
SWITCH-STOP LAMP
RELAY-AUTO SHUT DOWN (PDM)
SOLENOID-EVAP PURGE
RELAY-A/C CLUTCH (PDM)
CLUTCH-A/C COMPRESSOR
CLOCKSPRING
SWITCH-SPEED CONTROL-RIGHT
SWITCH-SPEED CONTROL-LEFT
RELAY-FUEL PUMP (PDM)
MODULE-FUEL PUMP (NV 2201 (4 MS))
MODULE-FRONT CONTROL (PDM)
IPM

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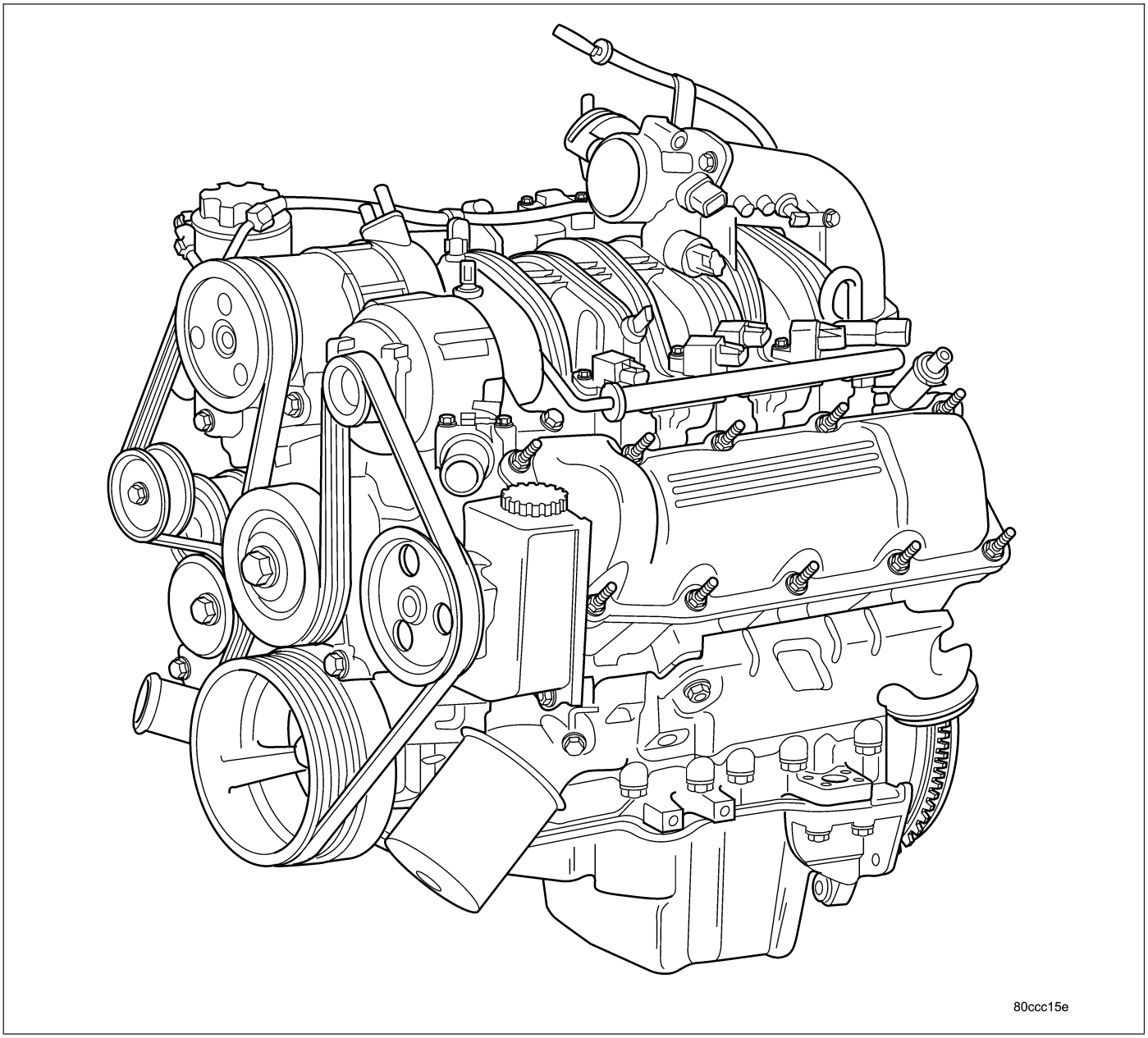
ENGINE - 3.7L SERVICE INFORMATION

DESCRIPTION



The 3.7 liter (226 CID) six-cylinder engine is an 90° single overhead camshaft engine. The cast iron cylinder block is made up of two different components; the first component is the cylinder bore and upper block, the second component is the bedplate that comprises the lower portion of the cylinder block and houses the lower half of the crankshaft main bearings. The cylinders are numbered from front to rear with the left bank being numbered 1,3, and 5 and the right bank being numbered 2,4, and 6. The firing order is 1–6–5–4–3–2. The engine serial number is located at the right front side of the engine block

DIAGNOSIS AND TESTING

ENGINE DIAGNOSIS - INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either performance (e.g., engine idles rough and stalls) or mechanical (e.g., a strange noise).

(Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) - PERFORMANCE and (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) - MECHANICAL for possible causes and corrections of malfunctions. Refer to 14 - FUEL SYSTEM for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following diagnosis:

- Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
- Cylinder Combustion Pressure Leakage Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
- Engine Cylinder Head Gasket Failure Diagnosis (Refer to 9 - ENGINE/CYLINDER HEAD - DIAGNOSIS AND TESTING).
- Intake Manifold Leakage Diagnosis (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - DIAGNOSIS AND TESTING).

ENGINE DIAGNOSIS - PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery	1. Charge or replace as necessary.
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals.
	3. Faulty starter.	3. (Refer to 8 - ELECTRICAL/ STARTING - DIAGNOSIS AND TESTING).
	4. Faulty coil or control unit.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	5. Incorrect spark plug gap.	5. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	6. Incorrect right bank cam timing.	6. Refer to engine timing in this section.
	7. Dirt or water in fuel system.	7. Clean system and replace fuel filter.
	8.Faulty fuel pump, relay or wiring.	8.Repair or replace as necessary.
	9. Faulty cam or crank sensor	9. Refer to Ignition system.
ENGINE STALLS OR ROUGH IDLE		
	1. Vacuum leak.	1. Inspect intake manifold and vacuum hoses, repair or replace as necessary.
	2. Faulty crank position sensor	Replace crank position sensor
	3. Faulty coil.	3. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL)
	4. Incorrect cam timing.	4. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

CONDITION	POSSIBLE CAUSE	CORRECTION
1. ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped spark plugs.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Dirt or water in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. (Refer to 14 - FUEL SYSTEM/ FUEL DELIVERY/FUEL PUMP - DIAGNOSIS AND TESTING).
	4. Blown cylinder head gasket.	4. Replace cylinder head gasket.
	5. Low compression.	5. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), repair as necessary.
	6. Burned, warped or pitted valves.	6. Replace as necessary.
	7. Plugged or restricted exhaust system.	7. Inspect and replace as necessary.
	8. Faulty coil.	8. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	9. Incorrect cam timing.	9. Refer to Engine Timing in this section.
1. ENGINE MISSES ON ACCELERATION	1. Spark plugs dirty or incorrectly gapped.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Dirt in fuel system.	2. Clean fuel system.
	3. Burned, warped or pitted valves.	3. Replace as necessary.
	4. Faulty coil.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
1. ENGINE MISSES AT HIGH SPEED	1. Spark plugs dirty or incorrectly gapped.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Faulty coil.	2. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	3. Dirt or water in fuel system.	3. Clean system and replace fuel filter.

ENGINE DIAGNOSIS - MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTIONS
NOISY VALVES	1. High or low oil level in crankcase.	1. (Refer to 9 - ENGINE/ LUBRICATION/OIL - STANDARD PROCEDURE)
	2. Thin or diluted oil.	2. Change oil and filter.
	3. Low oil pressure.	3. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	4. Dirt in lash adjusters.	4. Replace as necessary.
	5. Worn rocker arms.	5. Replace as necessary.
	6. Worn lash adjusters	6. Replace as necessary.
	7. Worn valve guides.	7. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE)
	8. Excessive runout of valve seats on valve faces.	8. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE)
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. (Refer to 9 - ENGINE/ LUBRICATION/OIL - STANDARD PROCEDURE)
	2. Low oil pressure.	2. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Connecting rod journal out-of-round.	5. Service or replace crankshaft.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. (Refer to 9 - ENGINE/ LUBRICATION/OIL - STANDARD PROCEDURE)
	2. Low oil pressure.	2. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Excessive end play.	5. Check thrust washers for wear.
	6. Crankshaft journal out-of round.	6. Service or replace crankshaft.
	7. Loose flywheel or torque converter.	7. Tighten to correct torque

ENGINE DIAGNOSIS - LUBRICATION

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS	1. Gaskets and O-Rings.	1.
	(a) Misaligned or damaged.	(a) Replace as necessary.
	(b) Loose fasteners, broken or porous metal parts.	(b) Tighten fasteners, Repair or replace metal parts.
	2. Crankshaft rear seal	2. Replace as necessary (Refer to 9 - ENGINE/ENGINE BLOCK/ CRANKSHAFT OIL SEAL - REAR - REMOVAL)
	3. Crankshaft seal flange. Scratched, nicked or grooved.	3. Polish or replace crankshaft.
	4. Oil pan flange cracked.	4. Replace oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)
	5. Timing chain cover seal, damaged or misaligned.	5. Replace seal (Refer to 9 - ENGINE/ENGINE BLOCK/ CRANKSHAFT OIL SEAL - FRONT - REMOVAL)
	6. Scratched or damaged vibration damper hub.	6. Polish or replace damper.
OIL PRESSURE DROP	1. Low oil level.	1. Check and correct oil level.
	2. Faulty oil pressure sending unit.	2. Replace sending unit (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE SENSOR/SWITCH - REMOVAL)
	3. Low oil pressure.	3. Check oil pump and bearing clearance.
	4. Clogged oil filter.	4. Replace oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL)
	5. Worn oil pump.	5. Replace oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL)
	6. Thin or diluted oil.	6. Change oil and filter.
	7. Excessive bearing clearance.	7. Replace as necessary.
	8. Oil pump relief valve stuck.	8. Replace oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL)
	9. Oil pick up tube loose, damaged or clogged.	9. Replace as necessary.

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL PUMPING AT RINGS; SPARK PLUGS FOULING	1. Worn or damaged rings.	1. Hone cylinder bores and replace rings.
	2. Carbon in oil ring slots.	2. Replace rings (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - STANDARD PROCEDURE)
	3. Incorrect ring size installed.	3. Replace rings (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - STANDARD PROCEDURE)
	4. Worn valve guides.	4. Ream guides and replace valves (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - REMOVAL)
	5. Leaking valve guide seals.	5. Replace valve guide seals.

CYLINDER COMPRESSION PRESSURE

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

1. Clean the spark plug recesses with compressed air.
2. Remove the spark plugs.
3. Secure the throttle in the wide-open position.
4. Disable the fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DESCRIPTION).
5. Remove the Automatic Shutdown (ASD) relay (Refer to 8 - ELECTRICAL/IGNITION CONTROL/AUTO SHUT DOWN RELAY - REMOVAL).
6. Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.
7. Record the compression pressure on the 3rd revolution. Continue the test for the remaining cylinders.
8. Refer (Refer to 9 - ENGINE - SPECIFICATIONS) for the correct engine compression pressures.

CYLINDER COMBUSTION PRESSURE LEAKAGE

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

1. Check the coolant level and fill as required. DO NOT install the radiator cap.
2. Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.
3. Remove the spark plugs.
4. Remove the oil filler cap.
5. Remove the air cleaner hose.
6. Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.
7. Perform the test procedures on each cylinder according to the tester manufacturer's instructions. Set piston of cylinder to be tested at TDC compression,While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART .

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

STANDARD PROCEDURE

REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

MOPAR® ENGINE RTV GEN II

Mopar® Engine RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® ATF RTV

Mopar® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER

Mopar® Gasket Maker is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® GASKET SEALANT

Mopar® Gasket Sealant is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

FORM-IN-PLACE GASKET AND SEALER APPLICATION

Assembling parts using a form-in-place gasket requires care but it's easier than using precut gaskets.

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

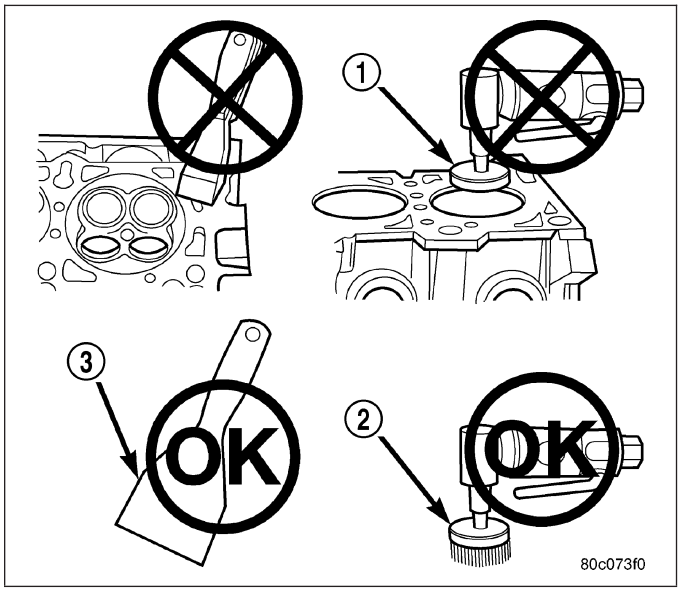
Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

ENGINE GASKET SURFACE PREPARATION

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

Never use the following to clean gasket surfaces:

- Metal scraper.
- Abrasive pad or paper to clean cylinder block and head.
- High speed power tool with an abrasive pad or a wire brush (1).



NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.

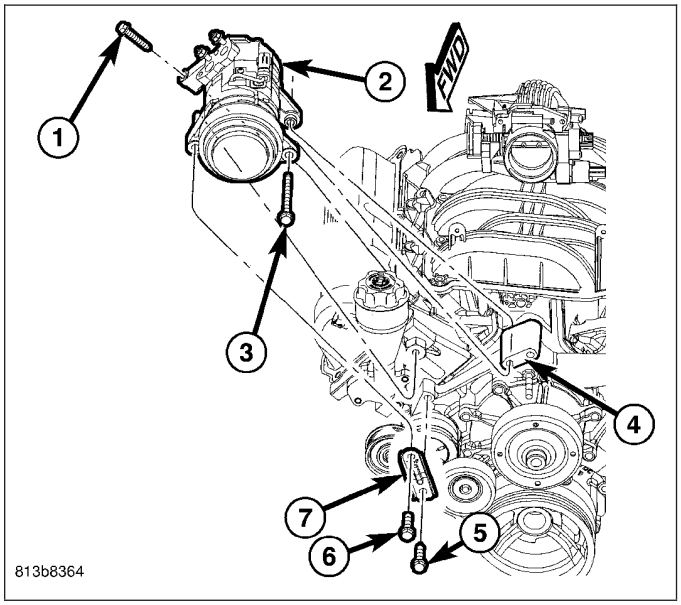
Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover
- Plastic or wood scraper (3).
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow) (2).

CAUTION: Excessive pressure or high RPM (beyond the recommended speed), can damage the sealing surfaces. The mild (white, 120 grit) bristle disc is recommended. If necessary, the medium (yellow, 80 grit) bristle disc may be used on cast iron surfaces with care.

REMOVAL - ENGINE

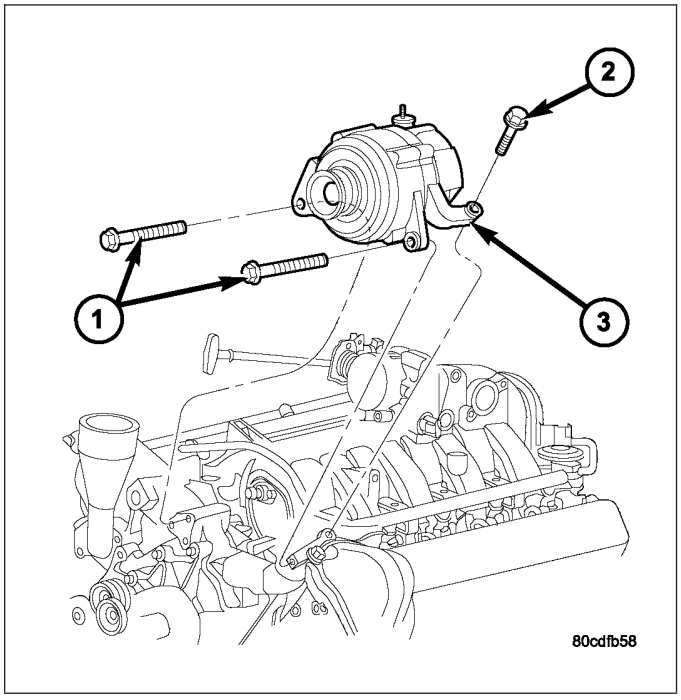
1. Release fuel rail pressure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE) then disconnect the fuel supply quick connect fitting at the fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).
2. Disconnect the battery negative cable.
3. Remove air cleaner assembly.
4. Remove fan shroud with viscous fan assembly.
5. Remove drive belt.
6. Remove A/C compressor (2) and secure away from engine.



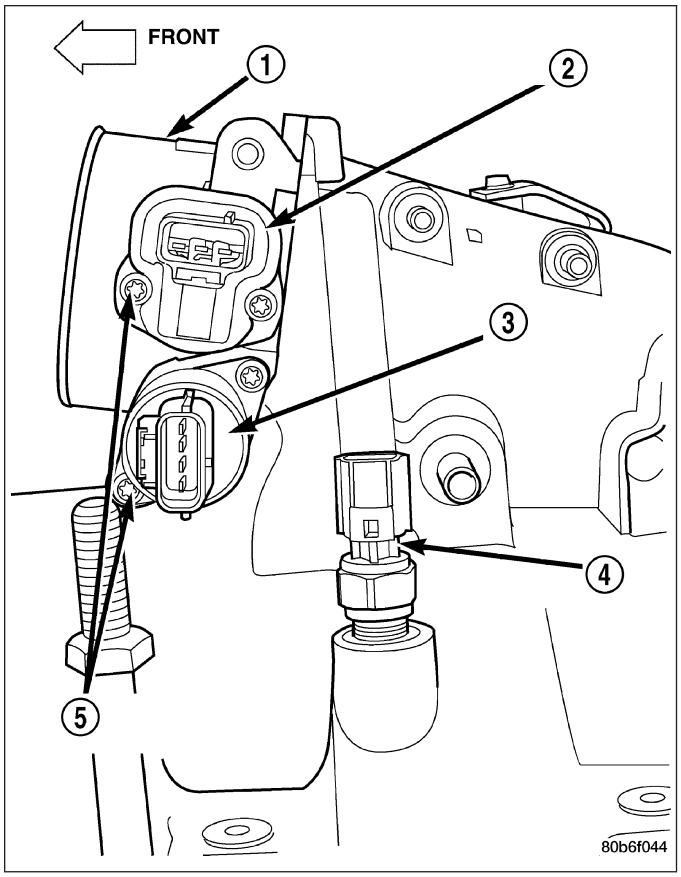
7. Remove generator (3) and secure away from engine.

NOTE: Do NOT remove the phenolic pulley from the P/S pump. It is not required for P/S pump removal.

8. Remove power steering pump with lines attached and secure away from engine.
9. Drain cooling system.
10. Disconnect the heater hoses from the engine.
11. Disconnect heater hoses from heater core and remove hose assembly.
12. Disconnect throttle and speed control cables.
13. Remove upper radiator hose from engine.
14. Remove lower radiator hose from engine.
15. Remove radiator/cooling module assembly.
16. Disconnect the engine to body ground straps at the left side of cowl.



17. Disconnect the engine wiring harness at the following points:
    - Intake air temperature (IAT) sensor (4)
    - Fuel Injectors
    - Throttle Position (TPS) Switch (2)
    - Idle Air Control (IAC) Motor (3)
    - Engine Oil Pressure Switch
    - Engine Coolant Temperature (ECT) Sensor
    - Manifold Absolute Pressure MAP) Sensor
    - Camshaft Position (CMP) Sensor
    - Coil Over Plugs
    - Crankshaft Position Sensor
18. Remove coil over plugs.

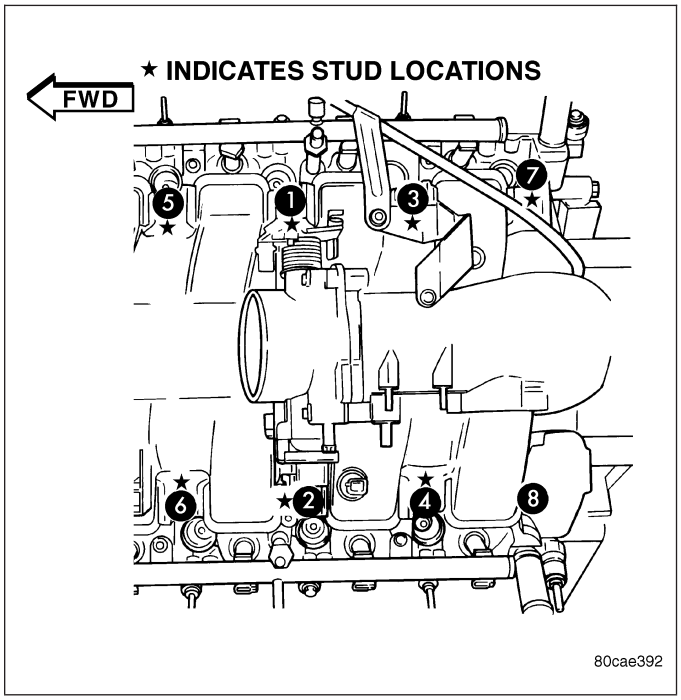


19. Remove fuel rail and secure away from engine.

NOTE: It is not necessary to release the quick connect fitting from the fuel supply line for engine removal.

20. Remove the PCV hose.
21. Remove the breather hoses.
22. Remove the vacuum hose for the power brake booster.
23. Disconnect knock sensors.
24. Remove engine oil dipstick tube.
25. Remove intake manifold.
26. Install engine lifting fixture,special tool # 8247, using original fasteners from the removed intake manifold, and fuel rail. Torque to factory specifications.

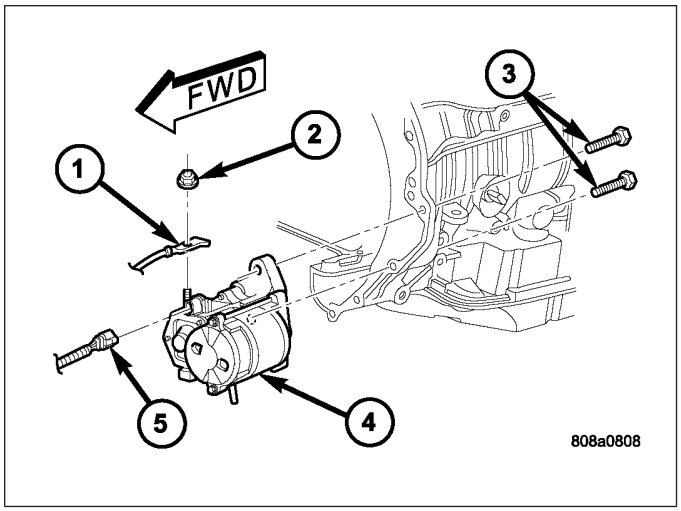
NOTE: Recheck bolt torque for engine lift plate before removing engine.

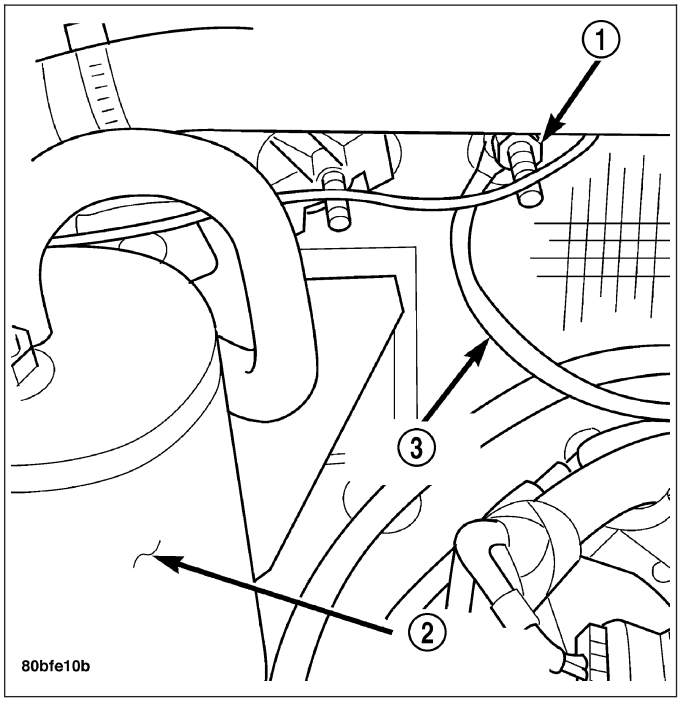


27. Disconnect oxygen sensor wiring.
28. Disconnect crankshaft postion sensor.
29. Disconnect the engine block heater power cable, if equipped.
30. Disconnect the front propshaft at the front differential and secure out of way.
31. Remove the pinion bracket.

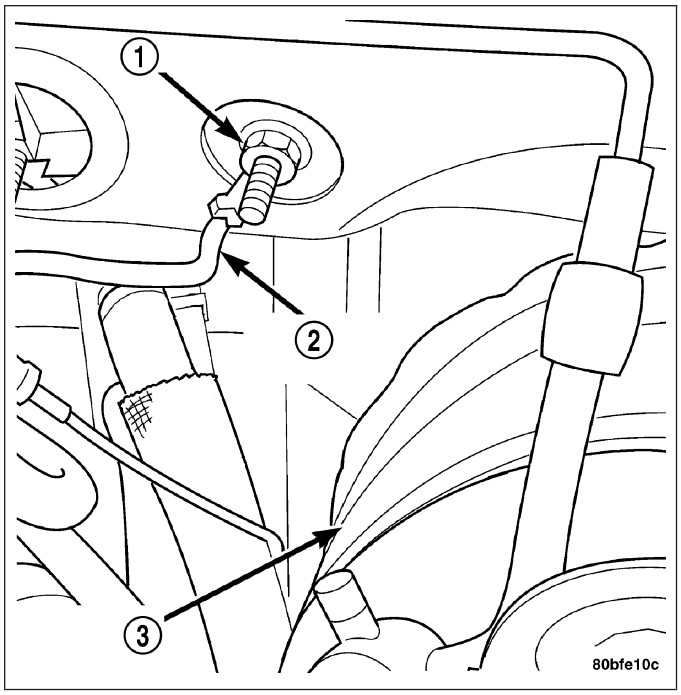
NOTE: It is necessary to disconnect the front propshaft for access to the starter and left side exhaust flange.

32. Remove the starter (4).

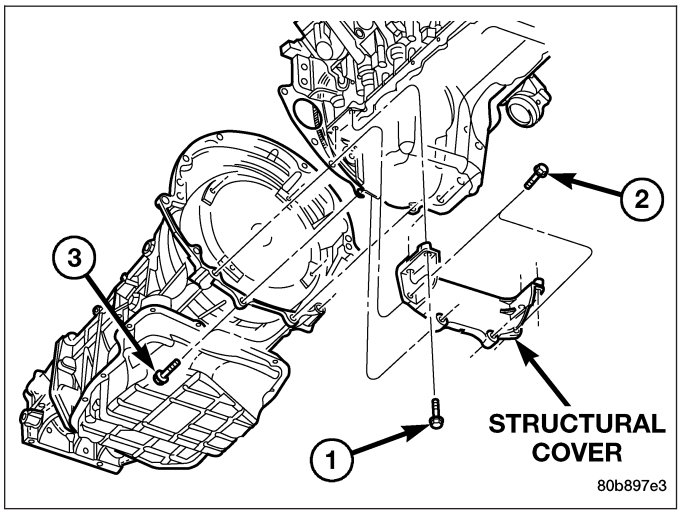




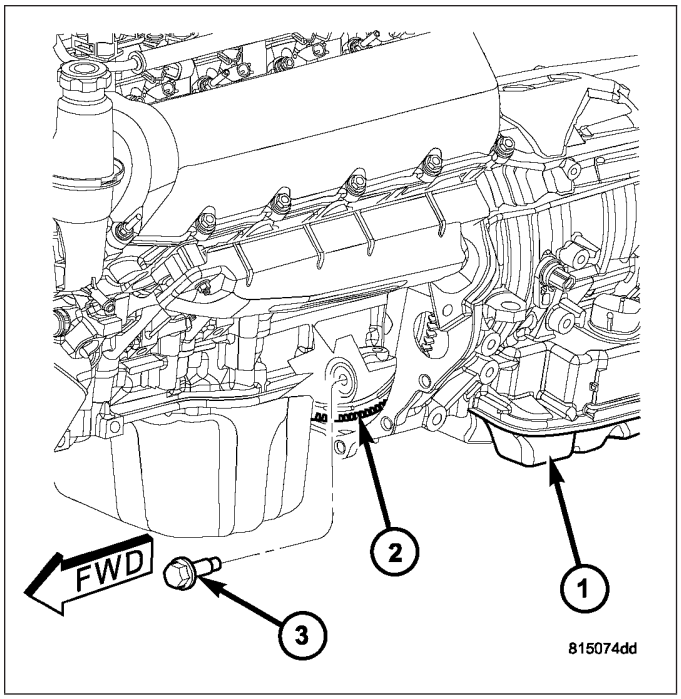
33. Remove the ground straps from the left (2) and right (3) side of the block.



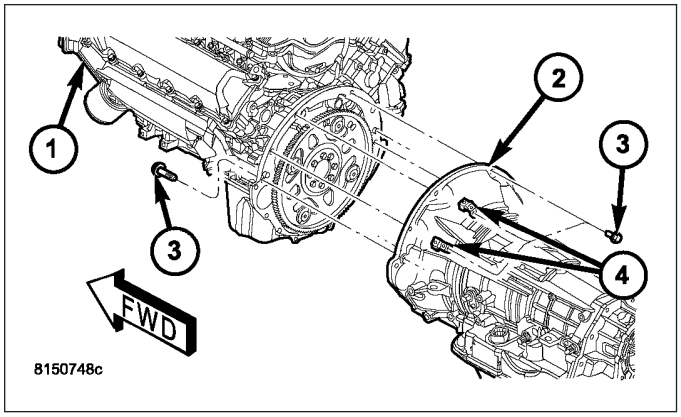
34. Remove the structural cover.
35. Disconnect the right and left exhaust pipes at the manifolds and from the crossover, and remove from the vehicle.



36. Remove torque convertor bolts (3), and mark location for reassembly.

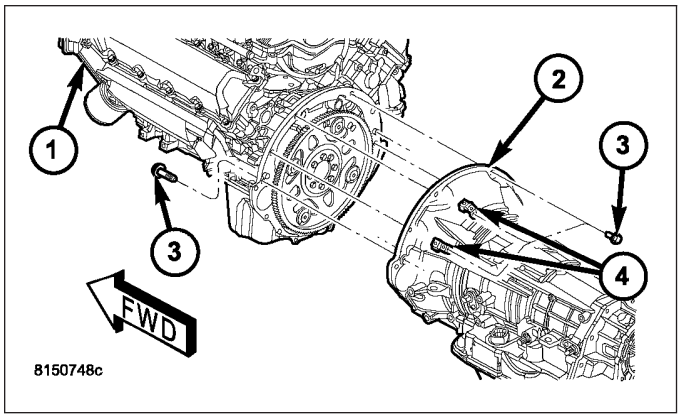


37. Remove transmission bellhousing to engine bolts (3).
38. Remove left and right engine mount thru bolts (3).
39. Lower the vehicle.
40. Support the transmission with a suitable jack.
41. Connect a suitable engine hoist to the engine lift plate.
42. Remove engine from vehicle.

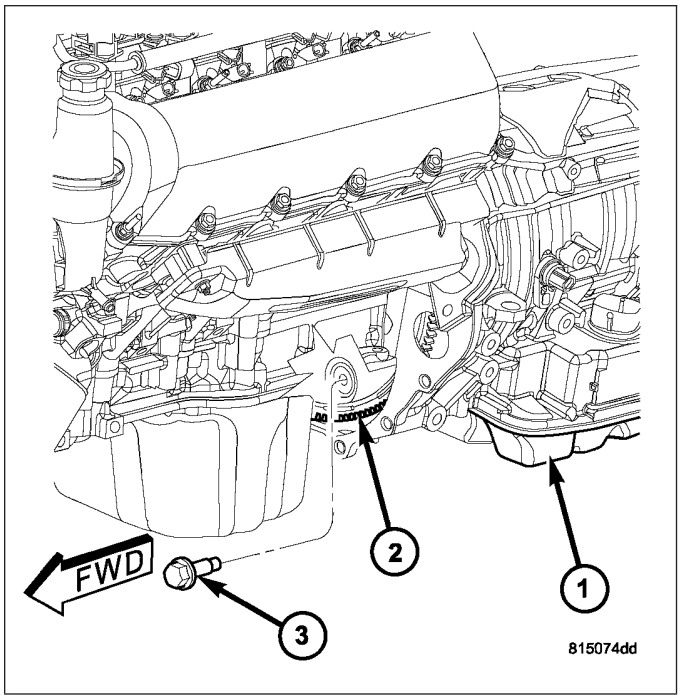


INSTALLATION - ENGINE

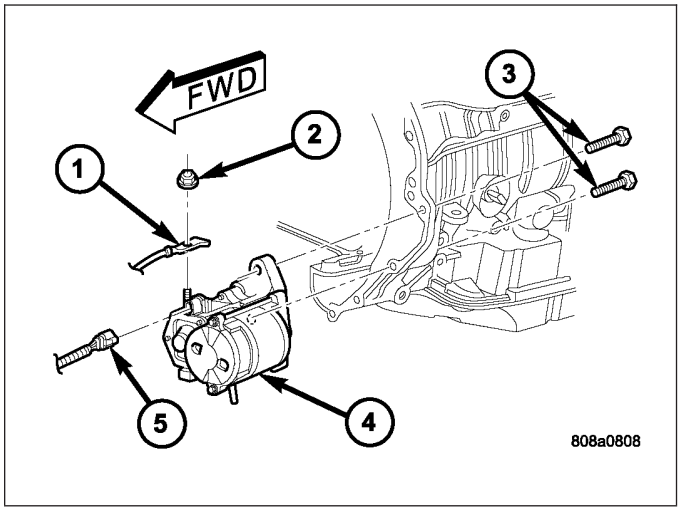
1. Position the engine in the vehicle.
2. Install the transmission bellhousing to engine mounting bolts (3). Tighten the bolts to 41 N·m (30ft. lbs.)
3. Install the engine mount thru bolts.



4. Install the torque convertor bolts (3).

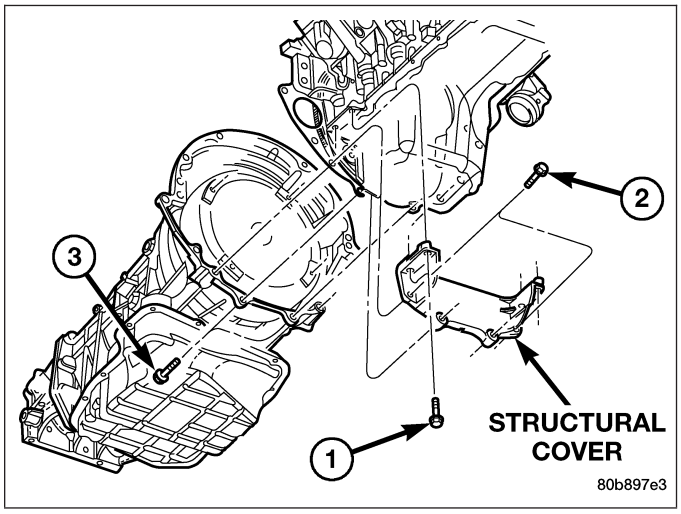


5. Install the starter(4).
6. Connect the crankshaft position sensor.
7. Install the engine block heater power cable, if equipped.



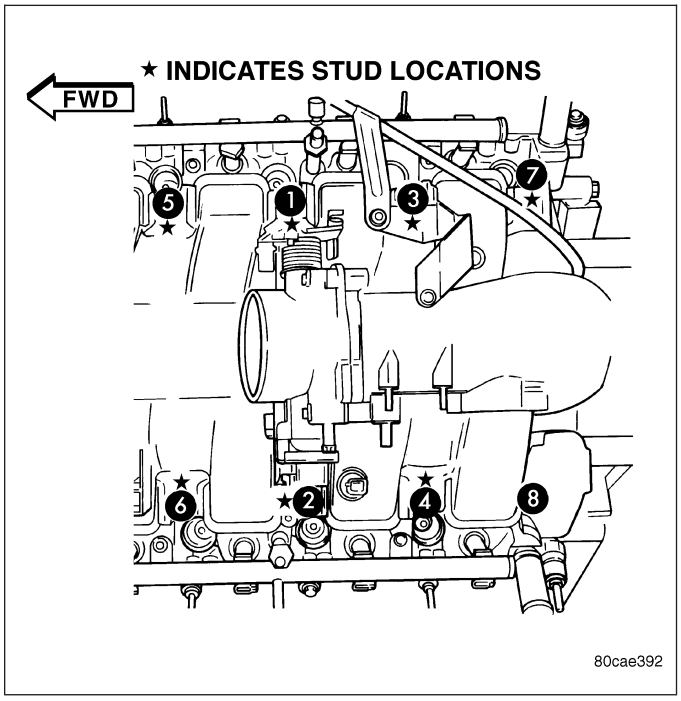
CAUTION: The structural cover requires a specific torque sequence. Failure to follow this sequence may cause severe damage to the cover.

8. Install the structural cover.
9. Install the pinion bracket.
10. Install the left and right exhaust pipes.
11. Connect the left and right oxygen sensors.
12. Remove the engine lift plate.
13. Connect the knock sensors.

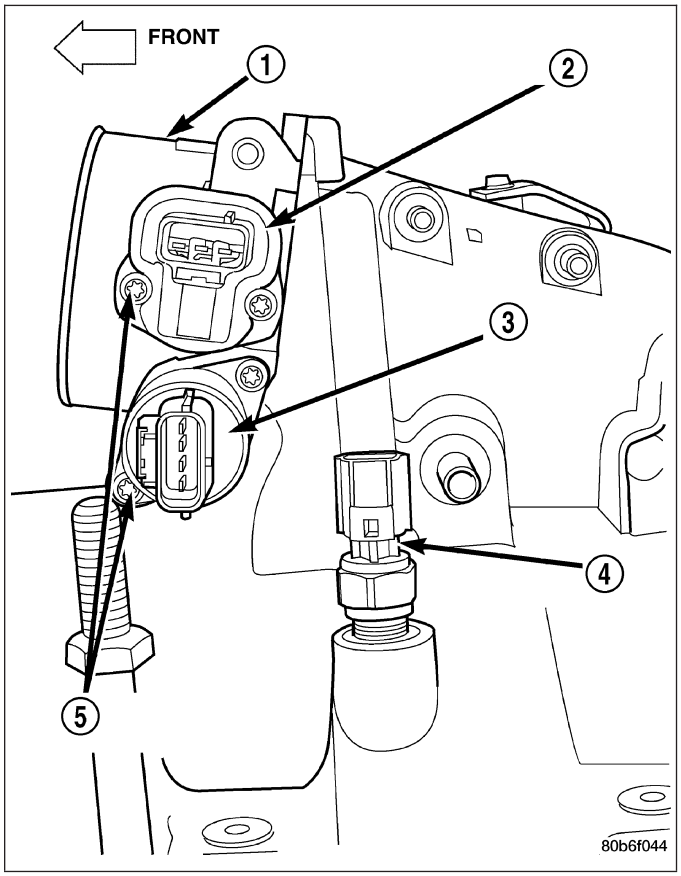


14. Connect the engine to body ground straps at the left side of the cowl.

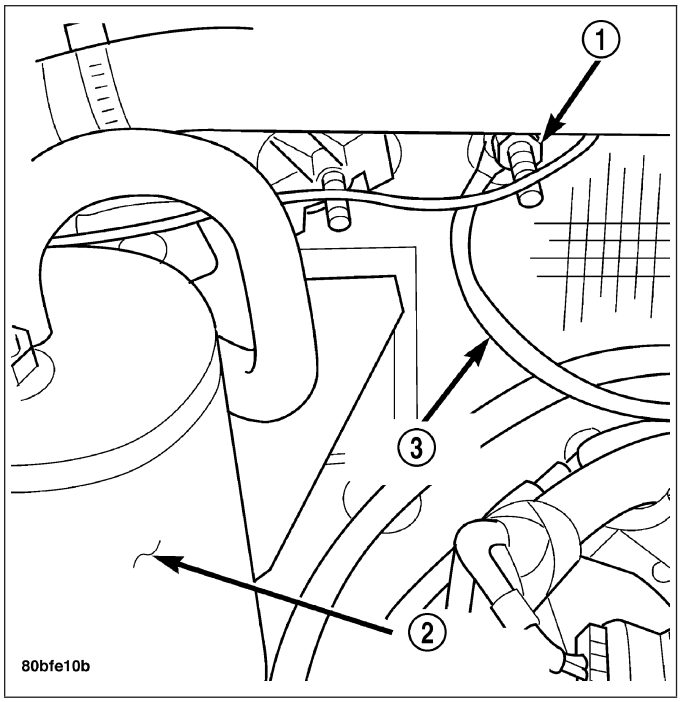
15. Install the intake manifold using the sequence provided.
16. Install the engine oil dipstick tube.
17. Install the power brake booster vacuum hose.
18. Install the breather hoses.
19. Install the PCV hose.
20. Install the fuel rail.
21. Install the coil over plugs.



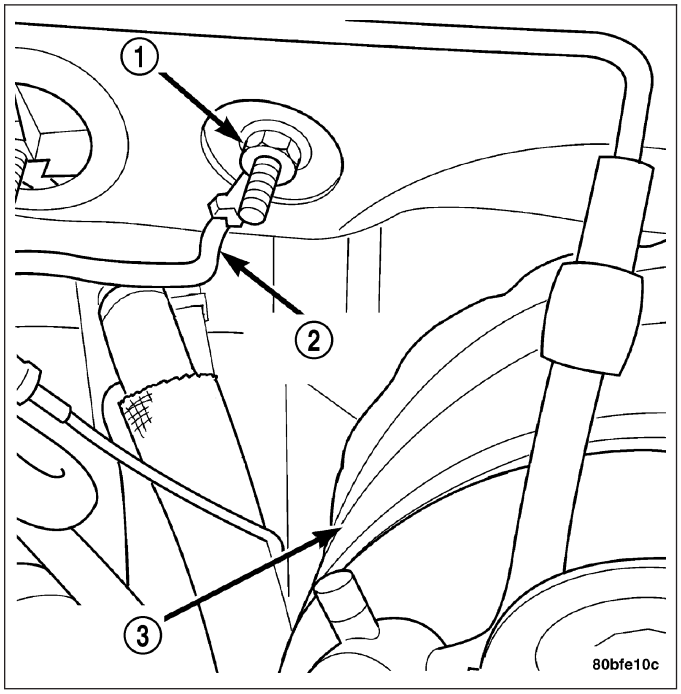
22. Connect the engine wiring harness at the following points:
    - Intake air temperature (IAT) sensor (4)
    - Fuel Injectors
    - Throttle Position (TPS) Switch (2)
    - Idle Air Control (IAC) Motor (3)
    - Engine Oil Pressure Switch
    - Engine Coolant Temperature (ECT) Sensor
    - Manifold Absolute Pressure MAP) Sensor
    - Camshaft Position (CMP) Sensor
    - Coil Over Plugs
    - Crankshaft Position Sensor



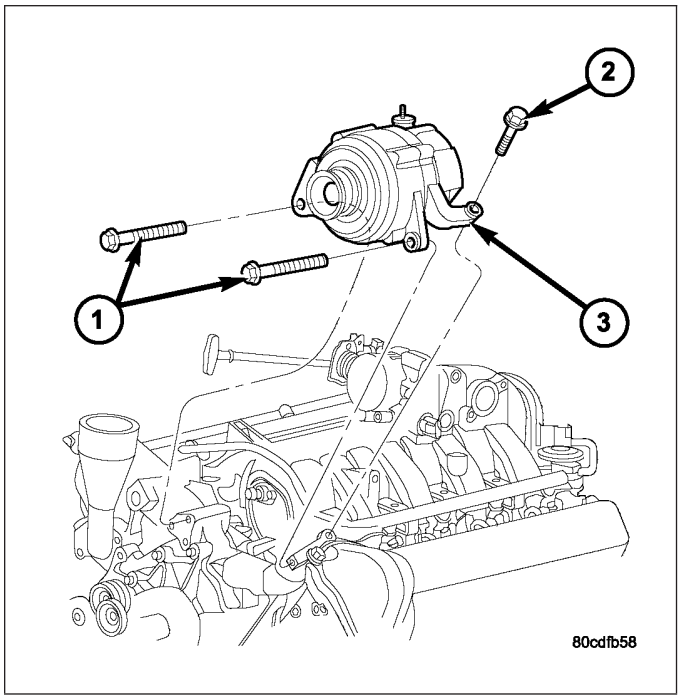
23. Connect the ground straps on the right (3)side of the engine.



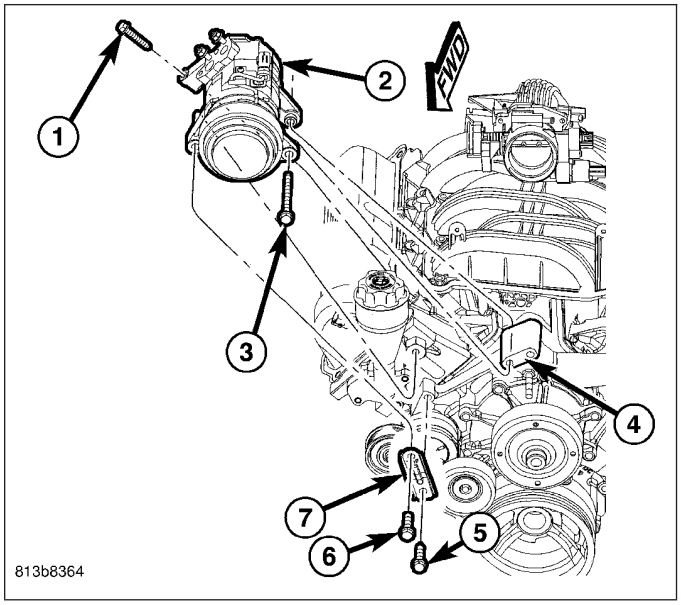
24. Connect the ground straps on the left (2) side of the engine.



25. Reinstall the radiator/cooling module assembly.
26. Connect lower radiator hose.
27. Connect upper radiator hose.
28. Connect throttle and speed control cables.
29. Install the heater hose assembly.
30. Install coolant recovery bottle.
31. Install the power steering pump.
32. Install the generator (3).



33. Install the A/C compressor (2).
34. Install the drive belt.
35. Install the fan shroud with the viscous fan assembly.
36. Install the radiator core support bracket.
37. Recharge the A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).
38. Install the air cleaner assembly.
39. Refill the engine cooling system.
40. Check and fill engine oil.
41. Connect the battery negative cable.
42. Start the engine and check for leaks.



SPECIFICATIONS

SPECIFICATIONS - 3.7L ENGINE

GENERAL SPECIFICATIONS

DESCRIPTION	SPECIFICATION	
Type	90° SOHC V6 12 Valve	
Number of Cylinders	6	
Firing Order	1-6-5-4-3-2	
Lead Cylinder	No. 1 Left Bank	
Compression Ratio	9.6:1	
Max. Variation Between Cylinders	25%	
	Metric	**Standard**
Displacement	3.7 Liters	226 Cubic Inches
Bore	93.0 mm	3.66 in.
Stroke	90.8 mm	3.40 in.
Horsepower	211 @ 5200 RPM	
Torque	236ft. lbs.@4000 PRM	
Compression Pressure	1172-1551 kPa	170-225 psi

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Bore Diameter	93.013 ± .0075 mm	3.6619 ± 0.0003 in.
Out of Round (MAX)	0.076 mm	0.003 in.
Taper (MAX)	0.051 mm	0.002 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Diameter	92.975 mm	3.6605 in.
Weight	365.0 grams	12.87 oz
Ring Groove Diameter		
No. 1	85.37 - 83.13 mm	3.282 - 3.273 in
No. 2	82.833 - 83.033 mm	3.261 - 3.310 in.
No. 3	83.88 - 84.08 mm	3.302 - 3.310 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Clearance In Piston	0.006 - 0.015 mm	0.0002 - 0.0005 in.
Diameter	24.017 - 24.020 mm	0.9455 - 0.9456 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring Gap		
Top Compression Ring	0.20 - 0.36 mm	0.0079 - 0.0142 in.
Second Compression Ring	0.37 - 0.63 mm	0.0146 - 0.0249 in.
Oil Control (Steel Rails)	0.25 - 0.76 mm	0.0099 - 0.30 in.
Side Clearance		
Top Compression Ring	.051 - .094 mm	0.0020 - 0.0037 in.
Second Compression Ring	0.040 - 0.080 mm	0.0016 - 0.0031 in.
Oil Ring (Steel Ring)	.019 - .229 mm	.0007 - .0091 in.
Ring Width		
Top Compression Ring	1.472 - 1.490 mm	0.057 - 0.058 in.
Second Compression Ring	1.472 - 1.490 mm	0.057 - 0.058 in.
Oil Ring (Steel Rails)	0.445 - 0.470 mm	0.017 - 0.018 in.

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.006 - 0.044 mm	0.0002 - 0.0017 in.
Side Clearance	0.10 - 0.35 mm	0.004 - 0.0138 in.
Piston Pin Clearance	.015 - .028 mm	0.0006 - 0.0011 in.
Bearing Bore Out of Round (MAX)	0.004 mm	0.0002 in.
Total Weight (Less Bearing)	612 grams	21.588 ounces

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Main Bearing Journal Diameter	63.488 - 63.512 mm	2.4996 - 2.5005 in.
Bearing Clearance	0.002 - 0.046 mm	0.00008 - 0.0018 in.
Out of Round (MAX)	0.005 mm	0.0002 in.
Taper (MAX)	0.006 mm	0.0004 in.
End Play	0.052 - 0.282 mm	0.0021 - 0.0112 in.
End Play (MAX)	0.282 mm	0.0112 in.
Connecting Rod Journal Diameter	57.908 - 57.892 mm	2.2798 - 2.2792 in.
Bearing Clearance	0.006 - 0.044	0.0002 - 0.0011 in.
Out of Round (MAX)	0.005 mm	0.0002 in.
Taper (MAX)	0.006 mm	0.0002 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bore Diameter	26.02 - 26.04 mm	1.0245 - 1.0252 in.
Bearing Journal Diameter	25.975 - 25.995 mm	1.0227 - 1.0235 in.
Bearing Clearance	0.025 - 0.065 mm	0.001 - 0.0026 in.
Bearing Clearance (MAX)	0.065 mm	0.0026 in.
End Play	.075 - .200 mm	0.003 - 0.0079 in.
End Play (MAX)	.200 mm	0.0079 in.

VALVE TIMING

DESCRIPTION	SPECIFICATION
Intake	
Opens (BTDC)	5.6°
Closes (ATDC)	240.1°
Duration	245.7°
Exhaust	
Opens (BTDC)	241.5°
Closes (ATDC)	20.1°
Duration	261.6°
Valve Overlap	25.7°

VALVES

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Face Angle	45° - 45.5°	
Head Diameter		
Intake	48.52 - 48.78 mm	1.9103 - 1.9205 in.
Exhaust	36.87 - 37.13 mm	1.4516 - 1.4618 in.
Length (Overall)		
Intake	113.45 - 114.21 mm	4.4666 - 4.4965 in.
Exhaust	114.92 - 115.68 mm	4.5244 - 4.5543 in.
Stem Diameter		
Intake	6.931 - 6.957 mm	0.2729 - 0.2739 in.
Exhaust	6.902 - 6.928 mm	0.2717 - 0.2728 in.
Stem-to-Guide Clearance		
Intake	0.018 - 0.069 mm	0.0008 - 0.0028 in.
Exhaust	0.047 - 0.098 mm	0.0019 - 0.0039 in.
Max. Allowable Stem-to-Guide Clearance (Rocking Method)		
Intake	0.069 mm	0.0028 in.
Exhaust	0.098 mm	0.0039 in.
Valve Lift (Zero Lash)		
Intake	12.00 mm	0.472 in.
Exhaust	12.00 mm	0.472 in.

VALVE SPRING

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Free Length (Approx)		
Intake	48.18 mm	1.896 in.
Exhaust - w/damper	48.2 mm	1.897 in.
Spring Force (Valve Closed)		
Intake	332.0 - 368.0 N @ 40.12 mm	74.63 - 82.72 lbs. @ 1.5795 in.
Exhaust - (without damper)	356 - 394 N @ 39.12 mm	80.031 - 88.57 lbs. @ 1.54 in.
Spring Force (Valve Open)		
Intake	948.0 - 1038.0 N @ 28.12 mm	213.2 - 233.8 lbs. @ 1.107 in.
Exhaust - without damper	974 - 956 N @ 27.12 mm	218.8 - 215.1 lbs. @ 1.067 in.
Number of Coils		
Intake	7.30	
Exhaust	7.15	
Wire Diameter		
Intake	4.77 × 3.80mm	0.1878 × 0.1496 in.
Exhaust	4.66 × 3.72mm	0.1843 × .1464 in.
Installed Height (Spring Seat to Bottom of Retainer) Nominal		
Intake	40.12 mm	1.579 in.
Exhaust - w/damper	40.12 mm	1.579 in.

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Gasket Thickness (Compressed)	0.7 mm	(0.0276 in.)
Valve Seat Angle	44.5° - 45.0°	
Valve Seat Runout (MAX)	0.051 mm	0.002 in.
Valve Seat Width		
Intake	1.75 - 2.36 mm	0.0698 - 0.0928 in.
Exhaust	1.71 - 2.32 mm	0.0673 - 0.0911 in.
Guide Bore Diameter (Std.)	6.975 - 7.00 mm	0.2747 - 0.2756 in.
Cylinder Head Warpage (Flatness)	0.0508 mm	0.002 in.

OIL PUMP

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance Over Rotors/End Face (MAX)	0.095 mm	0.0038 in.
Cover Out - of -Flat (MAX)	0.025 mm	0.001 in.
Inner and Outer Rotor Thickness	12.02 mm	0.4731 in.
Outer Rotor to pocket (Diametral) clearance (MAX)	.235 mm	.0093 in.
Outer Rotor Diameter (MIN)	85.925 mm	0.400 in.
Tip Clearance Between Rotors (MAX)	0.150 mm	0.006 in.

OIL PRESSURE

SPECIFICATION	SPECIFICATION	
	Metric	Standard
At Curb Idle Speed (MIN)*	25 kPa	4 psi
@ 3000 rpm	170 - 758 kPa	25 - 110 psi
*** CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 rpm.**		

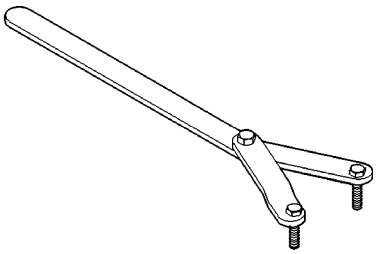
TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft			
Non - Oiled Sprocket Bolt	122	90	-
Bearing Cap Bolts	11	-	100
Counterbalance Shaft Retaining Bbolt	28	-	250
Timing Chain Cover Bolts	58	43	-
Connecting Rod Cap Bolts	27	20	-
	PLUS 90° TURN		
Bed Plate Bolts	Refer to Procedure		
Crankshaft Damper Bolt	175	130	-
Cylinder Head Bolts			
M11 Bolts	Refer To Procedure		
M8 Bolts	Refer To Procedure		
Cylinder Head Cover Bolts	12	-	105
Exhaust Manifold Bolts	25	18	-
Exhaust Manifold Heat Shield Nuts	8	-	72
	Then loosen 45°		
Flexplate Bolts	95	70	-
Engine Mount Bracket to Block Bolts	61	45	-
Rear Mount to Transmission Bolts	46	34	-
Generator Mounting Bolts			
M10 Bolts	54	40	-
M8 Bolts	28	-	250

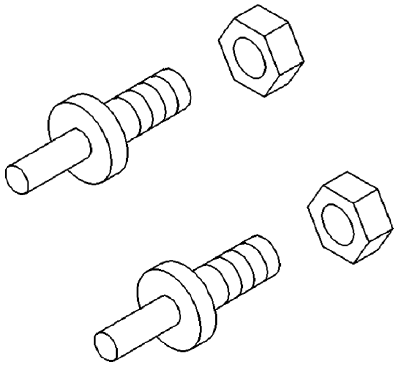
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Intake Manifold Bolts	12	-	105
	Refer to Procedure for Tightening Sequence		
Oil Pan Bolts	15	-	130
Oil Pan Drain Plug	34	25	-
Oil Pump Bolts	28	-	250
Oil Pump Cover Bolts	12	-	105
Oil Pickup Tube Bolt and Nut	28	-	250
Oil Dipstick Tube to Engine Block Bolt	15	-	130
Oil Fill Tube Bolts	12	-	105
Timing Chain Guide Bolts	28	-	250
Timing Chain Tensioner Arm	28	-	250
Hydraulic Tensioner Bolts	28	-	250
Timing Chain Primary Tensioner Bolts	28	-	250
Timing Drive Idler Sprocket Bolt	34	25	-
Thermostat Housing Bolts	12	-	105
Water Pump Bolts	58	43	-

SPECIAL TOOLS

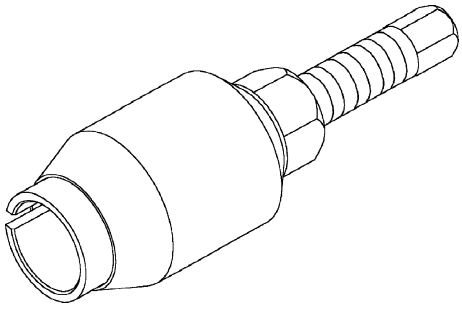
3.7L ENGINE



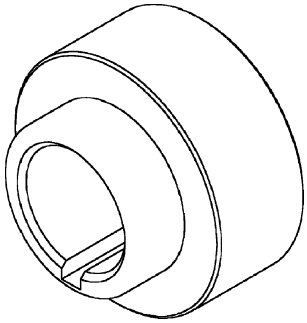
Spanner Wrench - 6958



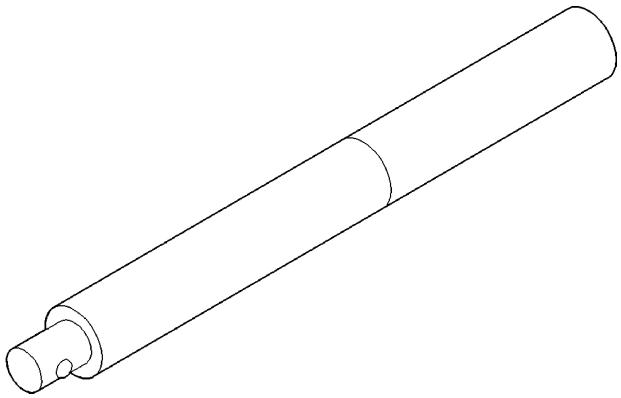
Adapter Pins 8346



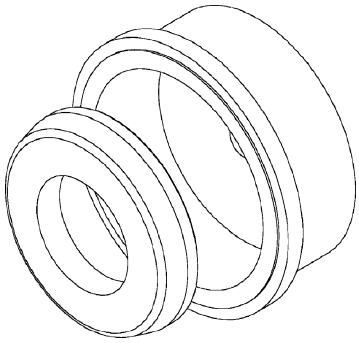
Front Crankshaft Seal Remover 8511



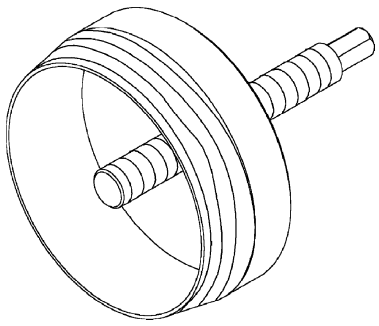
Front Crankshaft Seal Installer 8348



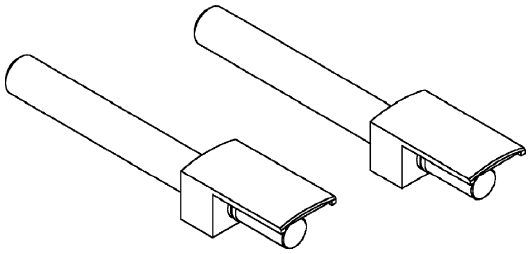
HANDLE C-4171



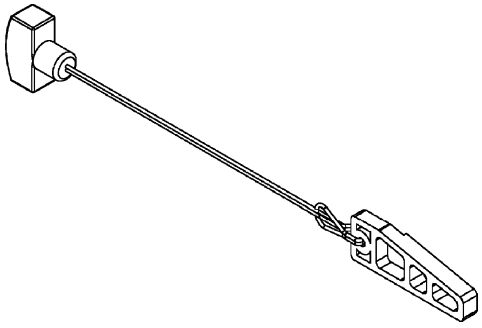
Rear Crankshaft Seal Installer 8349



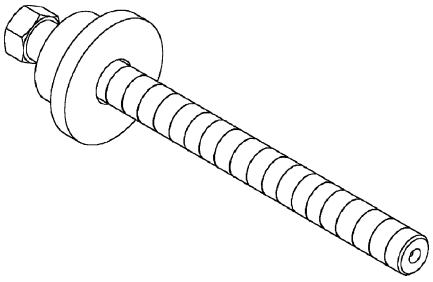
Rear Crankshaft Seal Remover 8506



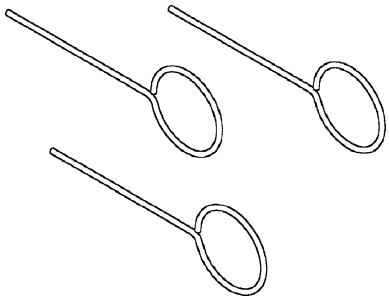
Connecting Rod Guides 8507



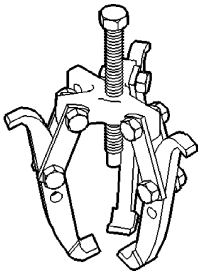
Chain Tensioner



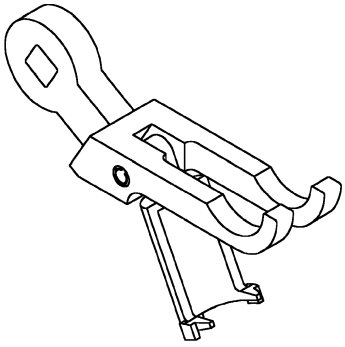
Crankshaft Damper Installer 8512



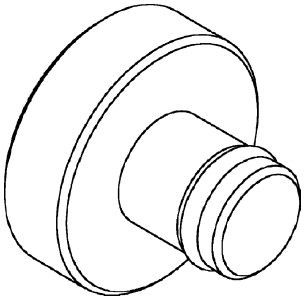
Chain Tensioner Pins 8514



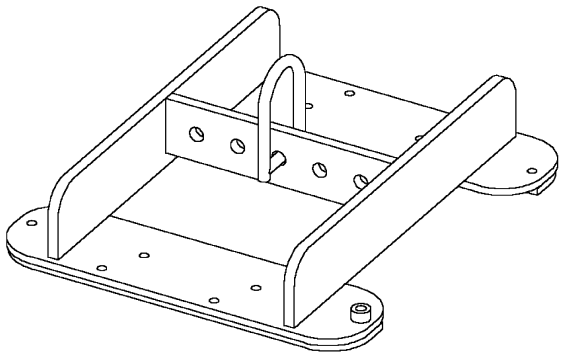
Puller 1026



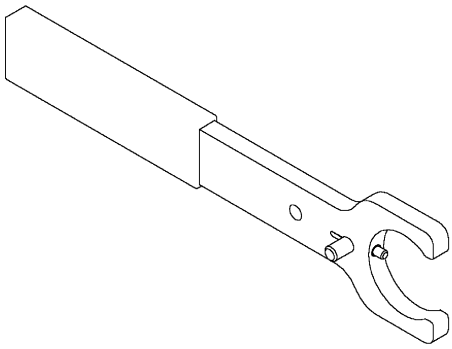
VALVE SPRING COMPRESSOR 8426



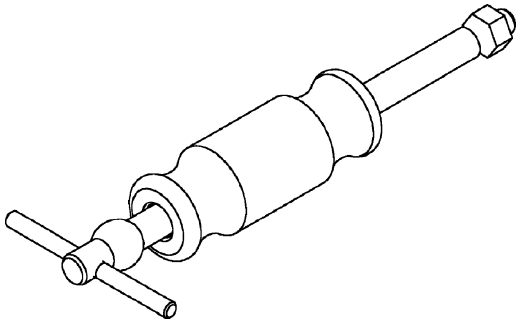
Crankshaft Damper Removal Insert 8513 - A



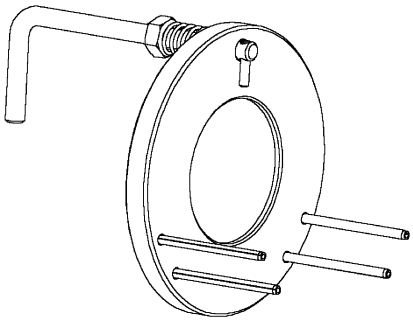
ENGINE LIFTING FIXTURE 8427



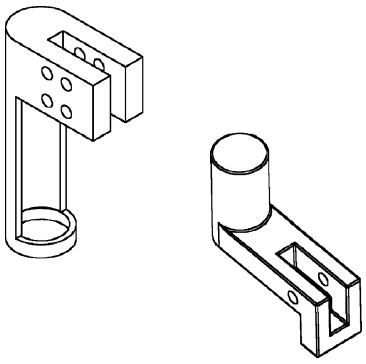
CAMSHAFT HOLDER 8428



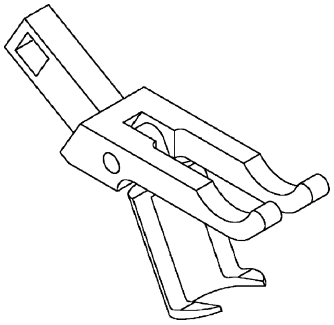
Idler Shaft Remover 8517



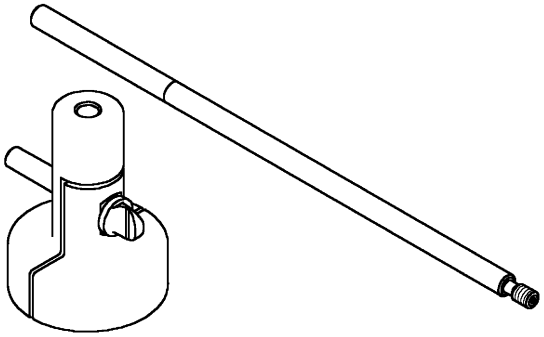
HOLDER SECONDARY CAMSHAFT CHAIN 8429



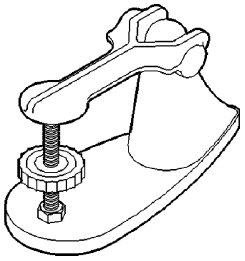
Valve Spring Compressor Adapters 8519



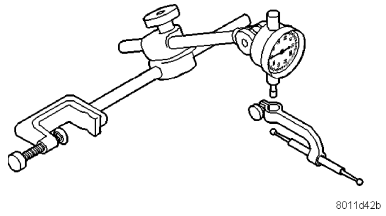
Remover, Rocker Arm 8516



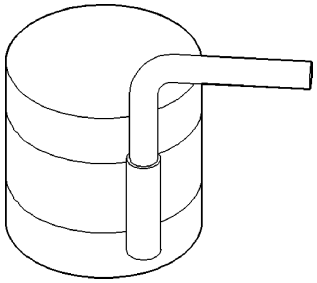
INSTALLER COUNTER BALANCE SHAFT 8641



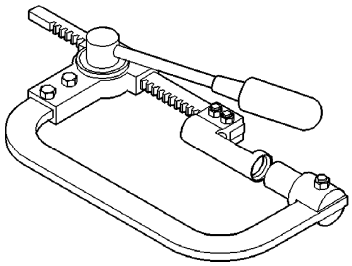
Valve Spring Tester C-647



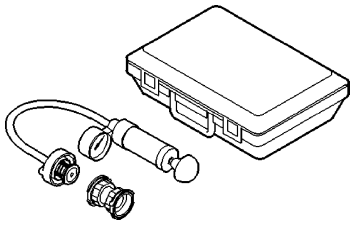
Dial Indicator C-3339



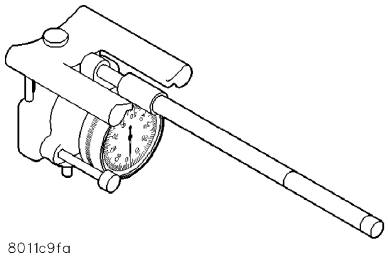
Piston Ring Compressor C-385



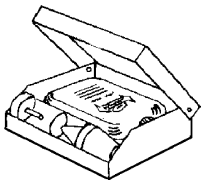
Valve Spring Compressor C-3422-B



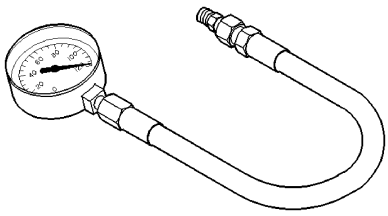
Pressure Tester Kit 7700



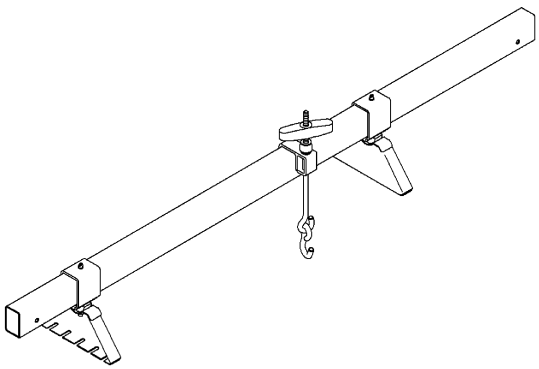
Indicator, Cylinder Bore C-119



Bloc–Chek–Kit C-3685–A



Oil Pressure Gauge C-3292



ENGINE SUPPORT FIXTURE 8534

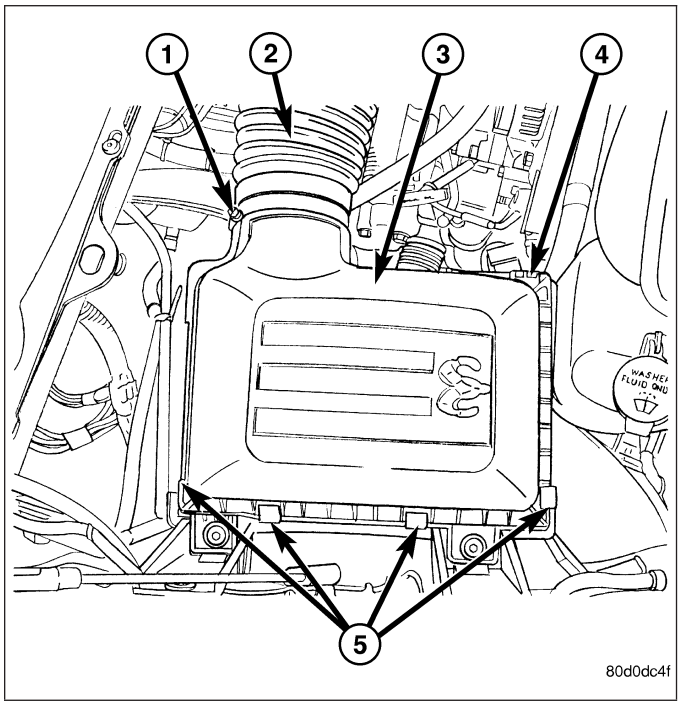
CLEANER-AIR ELEMENT

REMOVAL

Filter Element Only

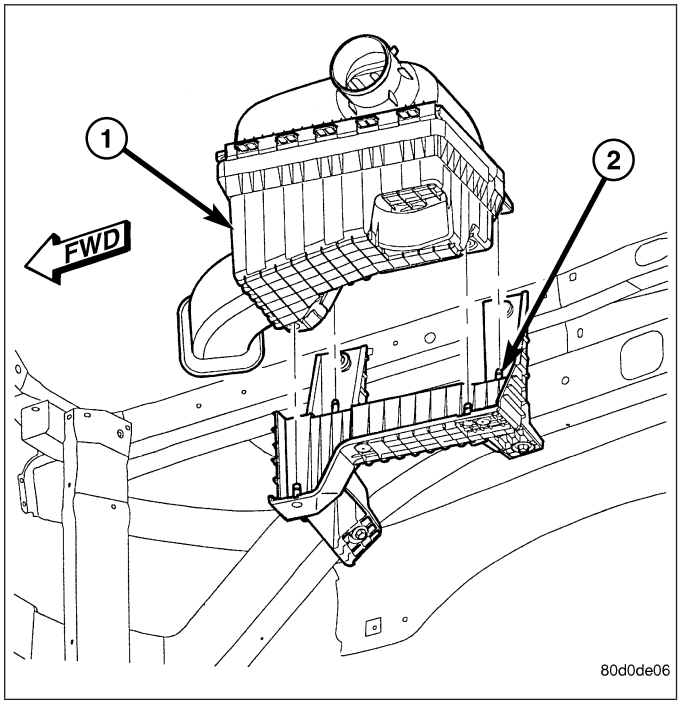
Housing removal is not necessary for element (filter) replacement.

1. Loosen clamp (1) and disconnect air duct at air cleaner cover (3).
2. Pry over 4 spring clips (5) from housing cover (spring clips retain cover to housing).
3. Release housing cover (3) from locating tabs on housing and remove cover (3).
4. Remove air cleaner element (filter) from housing.
5. Clean inside of housing before replacing element.



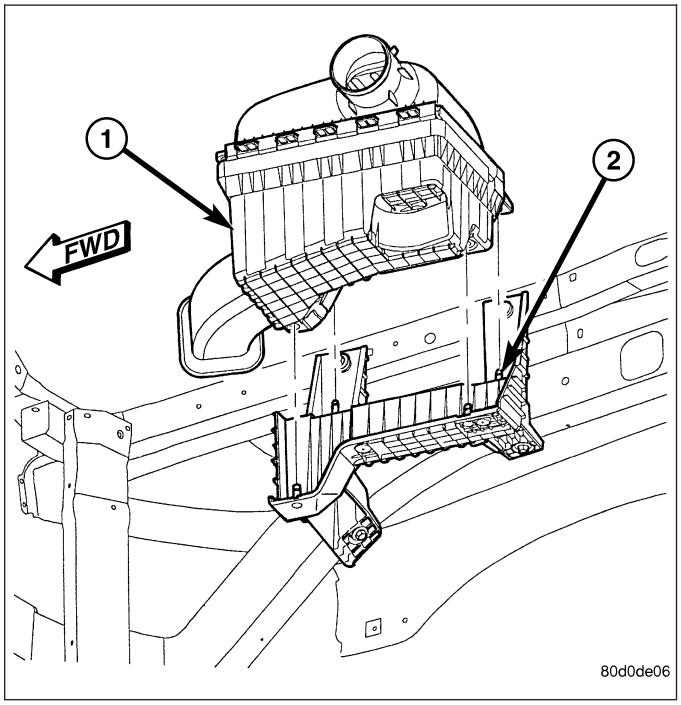
Housing Assembly

1. Loosen clamp and disconnect air duct at air cleaner cover.
2. Lift entire housing assembly (1) from 4 locating pins (2).



INSTALLATION

1. Install filter element into housing (1).
2. Position housing cover into housing locating tabs.
3. Pry up 4 spring clips and lock cover to housing.
4. Install air duct to air cleaner cover and tighten hose clamp to 3 N·m (30 in. lbs.) torque.
5. If any other hose clamps were removed from air intake system, tighten them to 3.4 N·m (30 in. lbs.) torque.
6. If any bolts were removed from air resonator housing or air intake tubing, tighten them to 4.5 N·m (40 in. lbs.) torque.



CYLINDER HEAD

DESCRIPTION

CYLINDER HEAD

The cylinder heads are made of an aluminum alloy. The cylinder head features two valves per cylinder with pressed in powdered metal valve guides. The cylinder heads also provide enclosures for the timing chain drain, necessitating unique left and right cylinder heads.

VALVE GUIDE SEALS

The valve guide seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

DIAGNOSIS AND TESTING

CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING). An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50 - 70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

DIAGNOSIS AND TESTING - HYDRAULIC LASH ADJUSTER

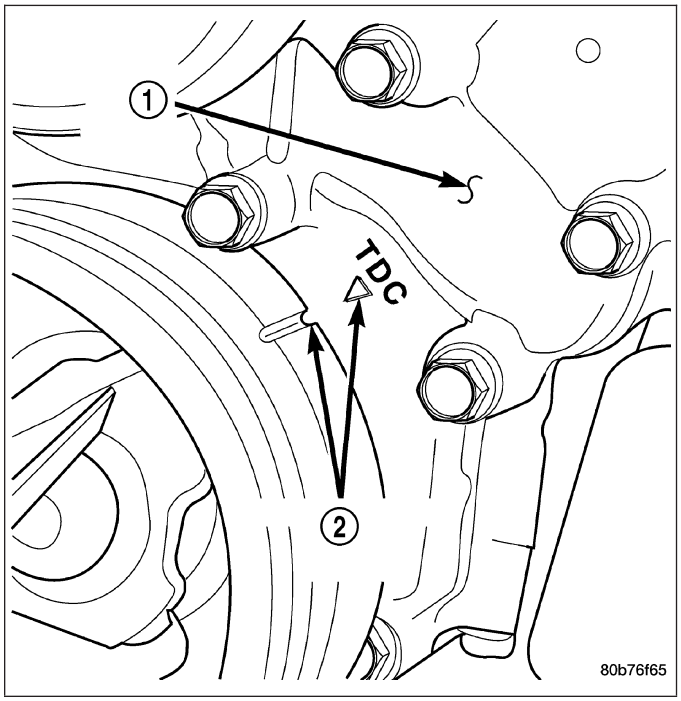
A tappet-like noise may be produced from several items. Check the following items.

1. Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.
2. Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.
3. Turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.
4. Low oil pressure.
5. The oil restrictor in cylinder head gasket or the oil passage to the cylinder head is plugged with debris.
6. Air ingested into oil due to broken or cracked oil pump pick up.
7. Worn valve guides.
8. Rocker arm ears contacting valve spring retainer.
9. Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.
10. Oil leak or excessive cam bore wear in cylinder head.
11. Faulty lash adjuster.
    a. Check lash adjusters for sponginess while installed in cylinder head and cam on camshaft at base circle. Depress part of rocker arm over adjuster. Normal adjusters should feel firm when pressed quickly. When pressed very slowly, lash adjusters should collapse.
    b. Remove suspected lash adjusters, and replace.
    c. Before installation, make sure adjusters are full of oil. This can be verified by little plunger travel when lash adjuster is depressed quickly.

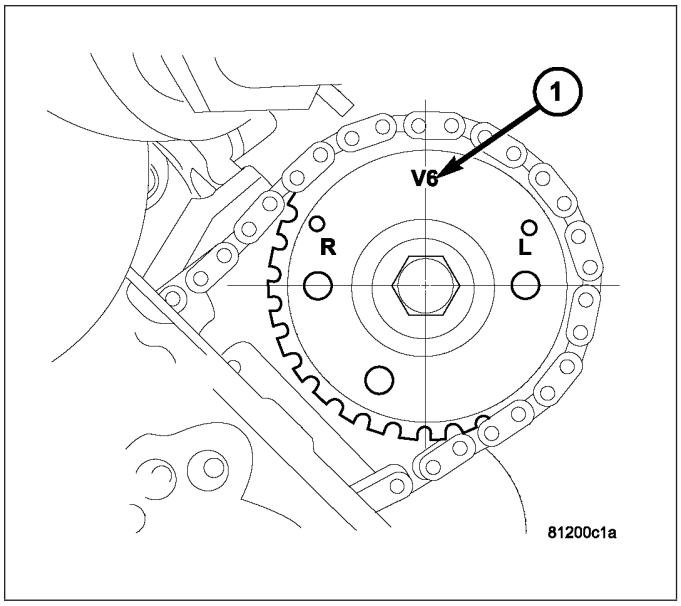
REMOVAL

CYLINDER HEAD - LEFT

1. Disconnect the negative cable from the battery.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the left side exhaust manifold.
4. Drain the engine coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Lower the vehicle.
6. Remove the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
7. Remove the master cylinder and booster assembly (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/POWER BRAKE BOOSTER - REMOVAL).
8. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
9. Remove the fan shroud and fan blade assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
10. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
11. Remove the power steering pump and set aside.
12. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (2).



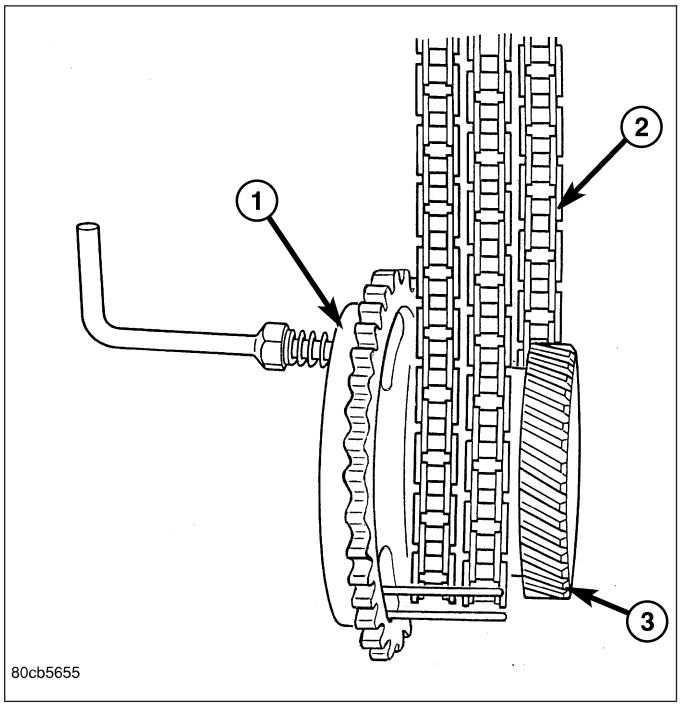
13. Verify the V6 mark (1) on the camshaft sprocket is at the 12 o'clock position, with the No. 1 cylinder at TDC on the exhaust stroke.. Rotate the crankshaft one turn if necessary.
14. Remove the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
15. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL)



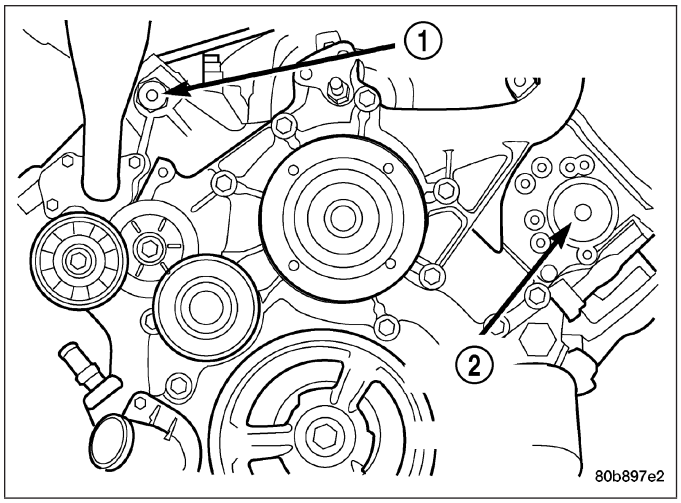
16. Lock the secondary timing chains (2) to the idler sprocket using Special Tool 8429 Timing Chain Holding Fixture (1).

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

17. Mark the secondary timing chain (2), one link on each side of the V6 mark on the camshaft drive gear.
18. Remove the left side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).



19. Remove the cylinder head access plug (1) and (2).
20. Remove the left side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).



21. Remove the retaining bolt and the camshaft drive gear.

CAUTION: Do not allow the engine to rotate. Severe damage to the valve train can occur.

CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

NOTE: The cylinder head is attached to the cylinder block with twelve bolts.

22. Remove the cylinder head retaining bolts.
23. Remove the cylinder head and gasket. Discard the gasket.

CAUTION: Do not lay the cylinder head on its gasket sealing surface, due to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

CYLINDER HEAD - RIGHT

1. Disconnect battery negative cable.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the right side exhaust manifold.
4. Drain the engine coolant (Refer to 7 - COOLING - STANDARD PROCEDURE)
5. Lower the vehicle.
6. Remove the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
7. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
8. Remove the radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
9. Remove oil fill housing from cylinder head.
10. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
11. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark.
12. Verify the V6 mark on the camshaft sprocket is at the 12 o'clock position. Rotate the crankshaft one turn if necessary.
13. Remove the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
14. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
15. Lock the secondary timing chains to the idler sprocket using Special Tool 8429 Timing Chain Holding Fixture.

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

16. Mark the secondary timing chain, one link on each side of the V6 mark on the camshaft drive gear.
17. Remove the right side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
18. Remove the cylinder head access plug.
19. Remove the right side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

CAUTION: The nut on the right side camshaft sprocket should not be removed for any reason, as the sprocket and camshaft sensor target wheel is serviced as an assembly. If the nut was removed retorque nut to 5 N·m (44 in. lbs.).

20. Remove the retaining bolt and the camshaft drive gear.

CAUTION: Do not allow the engine to rotate. severe damage to the valve train can occur.

CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason. A damaged target wheel can result in a vehicle no start condition.

NOTE: The cylinder head is attached to the cylinder block with twelve bolts.

21. Remove the cylinder head retaining bolts.
22. Remove the cylinder head and gasket. Discard the gasket.

CAUTION: Do not lay the cylinder head on its gasket sealing surface, do to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

INSPECTION

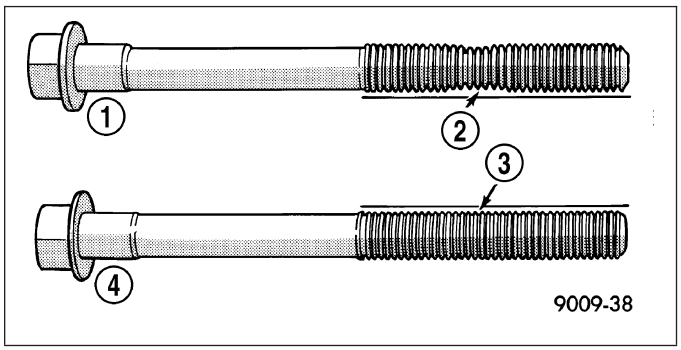
1. Inspect the cylinder head for out-of-flatness, using a straightedge and a feeler gauge. If tolerances exceed 0.0508 mm (0.002 in.) replace the cylinder head.
2. Inspect the valve seats for damage. Service the valve seats as necessary.
3. Inspect the valve guides for wear, cracks or looseness. If either condition exist, replace the cylinder head.

INSTALLATION

CYLINDER HEAD - LEFT

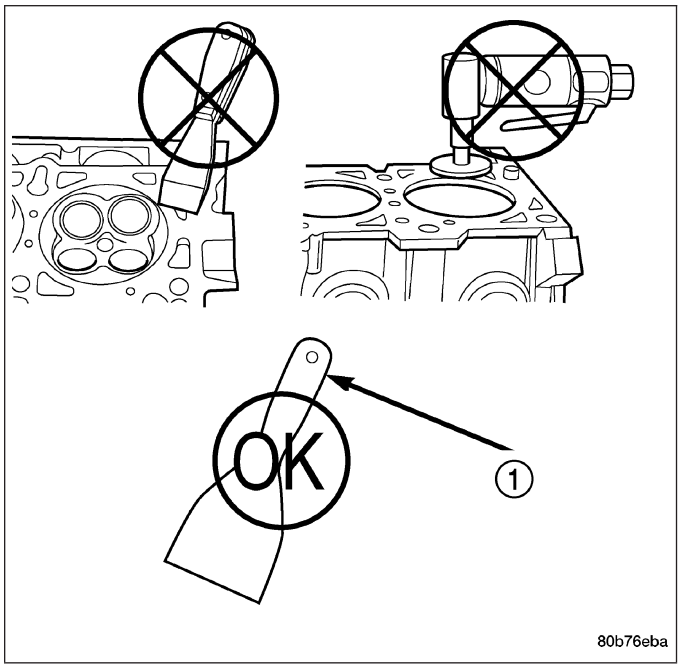
NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts should be replaced.

Necking can be checked by holding a straight edge against the threads (2). If all the threads do not contact the scale, the bolt should be replaced.



CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper (1).

1. Clean the cylinder head and cylinder block mating surfaces.



2. Position the new cylinder head gasket on the locating dowels.

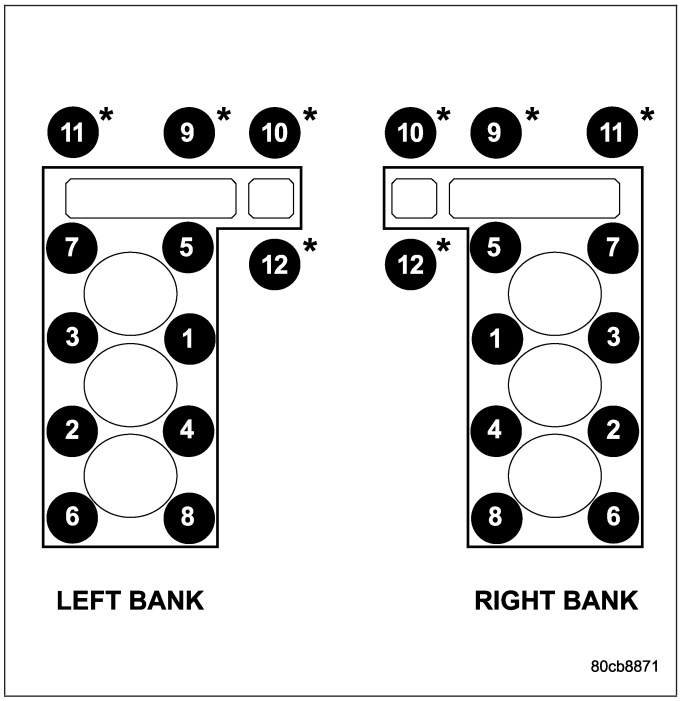
CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

NOTE: The four smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks. The locations are identified wit *.

4. Lubricate the cylinder head bolt threads with clean engine oil and install the eight M11 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar® Lock and Seal Adhesive** then install the bolts.

NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.



6. Tighten the bolts in sequence using the following steps and torque values:
   - Step 1: Tighten bolts 1-8, 27 N·m (20 ft. lbs.).
   - Step 2: Verify that bolts 1-8, all reached 27 N·m (20 ft. lbs.), by repeating step 1 without loosening the bolts. Tighten bolts 9 thru 12 to 14 N·m (10 ft. lbs.).
   - Step 3: Tighten bolts 1-8, 90 degrees.
   - Step 4: Tighten bolts 1-8, 90 degrees, again. Tighten bolts 9-12, 26 N·m (19 ft. lbs.)
7. Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V6 mark on the gear then using Special Tool 8428 Camshaft Wrench, position the gear onto the camshaft.

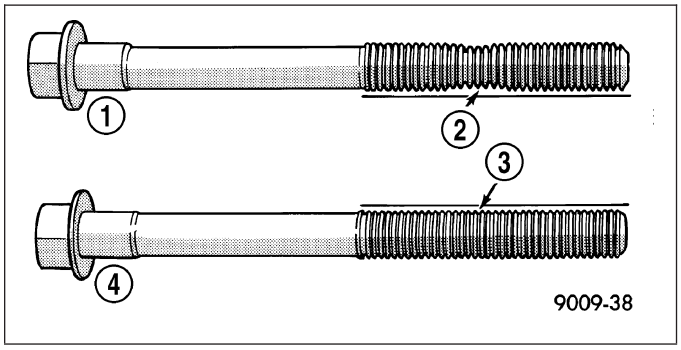
CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torqueing of bolt resulting in bolt failure.

8. Install the camshaft drive gear retaining bolt.
9. Install the left side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
10. Install the cylinder head access plug.
11. Re-set and install the left side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/ CHAIN AND SPROCKETS - INSTALLATION)
12. Remove Special Tool 8429.
13. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION)
14. Install the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION). Tighten damper bolt 175 N·m (130 Ft. Lbs.).
15. Install the power steering pump.
16. Install the fan blade assembly and fan shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
17. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
18. Install the master cylinder and booster assembly (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/POWER BRAKE BOOSTER - INSTALLATION).
19. Install the intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
20. Refill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
21. Raise the vehicle.
22. Install the exhaust pipe onto the left exhaust manifold (Refer to 11 - EXHAUST SYSTEM/EXHAUST PIPE - INSTALLATION).
23. Lower the vehicle.
24. Connect the negative cable to the battery.
25. Start the engine and check for leaks.

CYLINDER HEAD - RIGHT

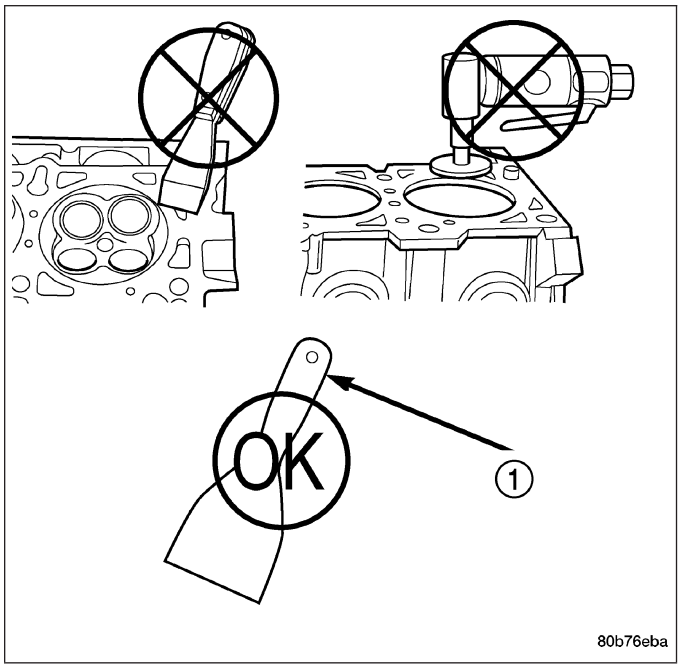
NOTE: The cylinder head bolts (4) are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts should be replaced.

Necking can be checked by holding a straight edge against the threads (2). If all the threads do not contact the scale, the bolt should be replaced.



CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper (1).

1. Clean the cylinder head and cylinder block mating surfaces.



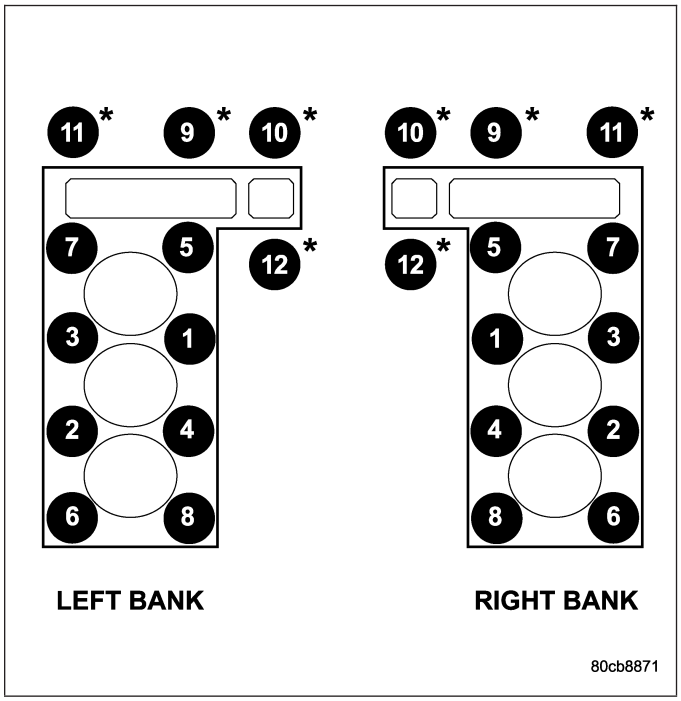
2. Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

NOTE: The four M8 cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks.

4. Lubricate the cylinder head bolt threads with clean engine oil and install the eight M10 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar Lock and Seal Adhesive** then install the bolts.



NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

6. Tighten the bolts in sequence using the following steps and torque values:
   - Step 1: Tighten bolts 1-8, 27 N·m (20 ft. lbs.).
   - Step 2: Verify that bolts 1-8, all reached 27 N·m (20 ft. lbs.), by repeating step 1 without loosening the bolts. Tighten bolts 9 thru 12 to 14 N·m (10 ft. lbs.).
   - Step 3: Tighten bolts 1-8, 90 °.
   - Step 4: Tighten bolts 1-8, 90 °, again. Tighten bolts 9-12, 26 N·m (19 ft. lbs.)

CAUTION: The nut on the right side camshaft sprocket should not be removed for any reason, as the sprocket and camshaft sensor target wheel is serviced as an assembly. If the nut was removed retorque nut to 5 N·m (60 in. lbs.).

7. Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V6 mark on the gear then using Tool 8428 Camshaft Wrench, position the gear onto the camshaft.

CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torquing of bolt resulting in bolt failure.

8. Install the camshaft drive gear retaining bolt.
9. Install the right side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
10. Install the cylinder head access plug.
11. Re-set and install the right side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
12. Remove Special Tool 8429.
13. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
14. Install the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION). Tighten damper bolt 175 N·m (130 Ft. Lbs.).
15. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
16. Install the radiator fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
17. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
18. Install the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
19. Install oil fill housing onto cylinder head.
20. Refill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
21. Raise the vehicle.
22. Install the exhaust pipe onto the right exhaust manifold.
23. Lower the vehicle.
24. Reconnect battery negative cable.
25. Start the engine and check for leaks.

CAMSHAFT(S)

DESCRIPTION

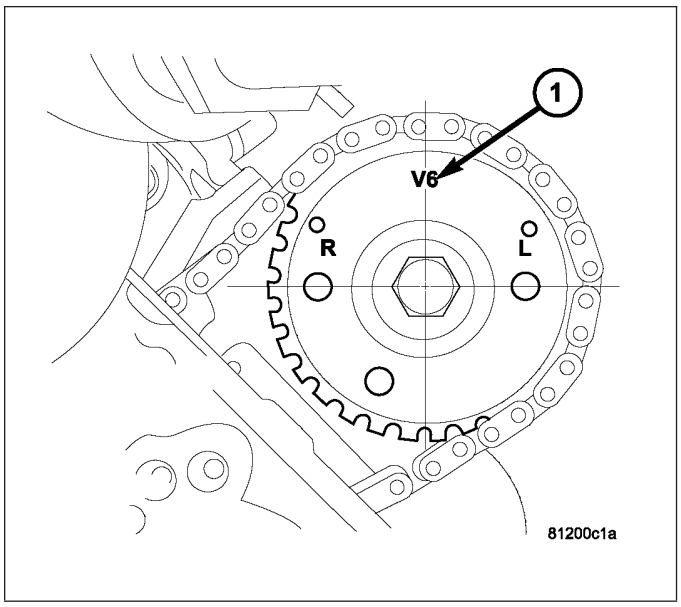
The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. Four bearing journals are machined into the camshaft. Camshaft end play is controlled by two thrust walls that border the nose piece journal.

REMOVAL

REMOVAL - LEFT

CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use Special Tool 8379 will result in hydraulic tensioner ratchet over extension, requiring timing chain cover removal to reset the tensioner ratchet.



1. Remove cylinder head cover (Refer to 9 - ENGINE/ CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Set engine to TDC cylinder No. 1, camshaft sprocket V6 marks (1) at the 12 o'clock position.
3. Mark one link on the secondary timing chain on both sides of the V6 mark on the camshaft sprocket to aid in installation.

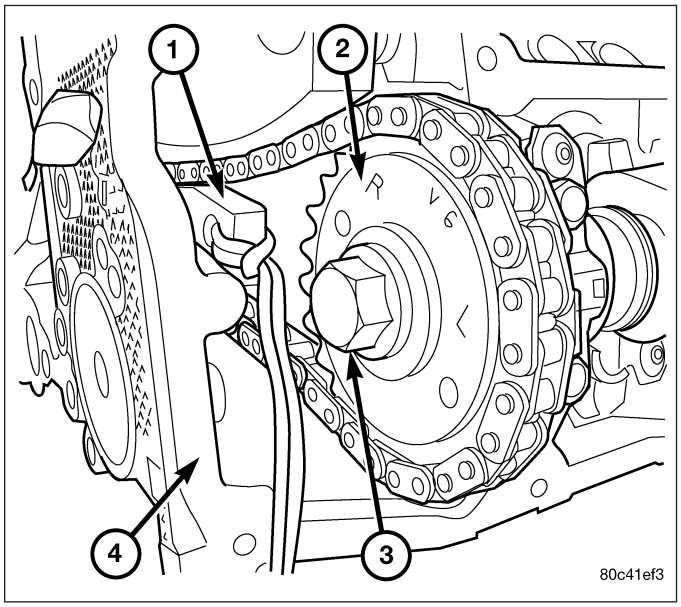
CAUTION: Do not hold or pry on the camshaft target wheel (Located on the right side camshaft sprocket) for any reason, Severe damage will occur to the target wheel resulting in a vehicle no start condition.

4. Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave the bolt snug against the sprocket.

NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.

5. Position Special Tool 8379 timing chain wedge (1) between the timing chain strands, tap the tool to securely wedge the timing chain against the tensioner arm and guide.

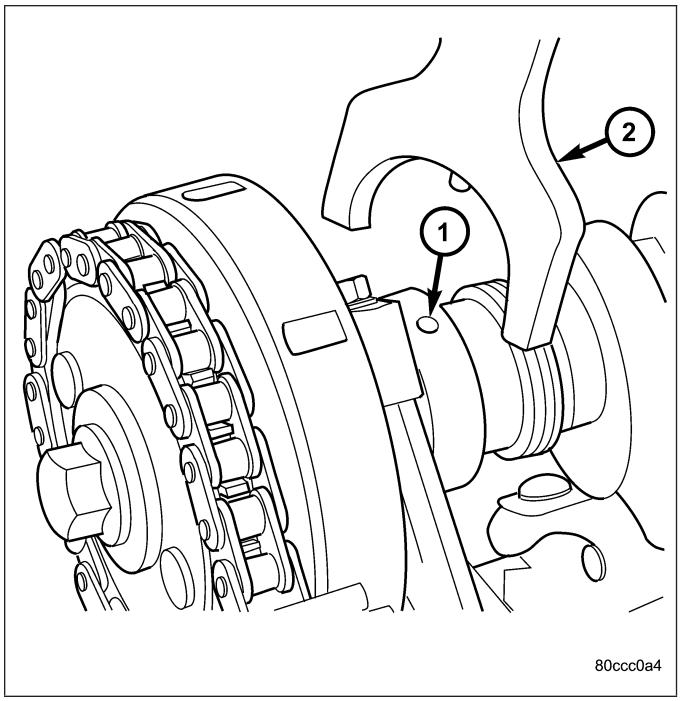


6. Hold the camshaft with Special Tool 8428 Camshaft Wrench (2), while removing the camshaft sprocket bolt and sprocket.
7. Using Special Tool 8428 Camshaft Wrench (2), gently allow the camshaft to rotate 5° clockwise until the camshaft is in the neutral position (no valve load).
8. Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

9. Remove the camshaft bearing caps and the camshaft.



CAMSHAFT-RIGHT

CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use special tool 8379 will result in hydraulic tensioner ratchet over extension, Requiring timing chain cover removal to re-set the tensioner ratchet.

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Set engine to TDC cylinder No. 1, camshaft sprocket V6 marks at the 12 o'clock position.
3. Mark one link on the secondary timing chain on both sides of the V6 mark on the camshaft sprocket to aid in installation.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason, Severe damage will occur to the target wheel. A damaged target wheel could cause a vehicle no start condition.

4. Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave bolt snug against sprocket.

NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.

5. Position Tool 8379 timing chain wedge between the timing chain strands. Tap the tool to securely wedge the timing chain against the tensioner arm and guide.
6. Remove the camshaft position sensor.

7. Hold the camshaft with Tool 8428 Camshaft Wrench, while removing the camshaft sprocket bolt and sprocket.
8. Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

9. Remove the camshaft bearing caps and the camshaft.

INSTALLATION

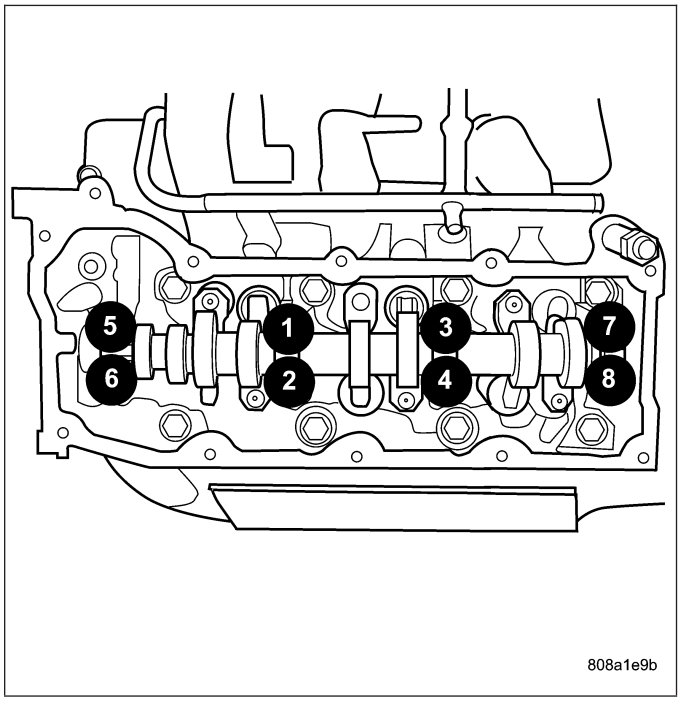
INSTALLATION - LEFT

1. Lubricate camshaft journals with clean engine oil.

NOTE: Position the left side camshaft so that the camshaft sprocket dowel is near the 1 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

2. Position the camshaft into the cylinder head.
3. Install the camshaft bearing caps, hand tighten the retaining bolts.

NOTE: Caps should be installed so that the stamped numbers on the caps are in numerical order, (1 thru 4) from the front to the rear of the engine. All caps should be installed so that the stamped arrows on the caps point toward the front of the engine.



4. Working in 1/2 turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward.
5. Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).
6. Position the camshaft drive gear into the timing chain aligning the V6 mark between the two marked chain links (Two links marked during removal).
7. Using Tool 8428 Camshaft Wrench, rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft.

CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt over-torque resulting in bolt failure.

8. Remove excess oil from bolt, then install the camshaft sprocket retaining bolt and hand tighten.
9. Remove Special Tool 8379 timing chain wedge.
10. Using Special Tool 6958 spanner wrench with adapter pins 8346, torque the camshaft sprocket retaining bolt to 122 N·m (90 ft. lbs.).
11. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

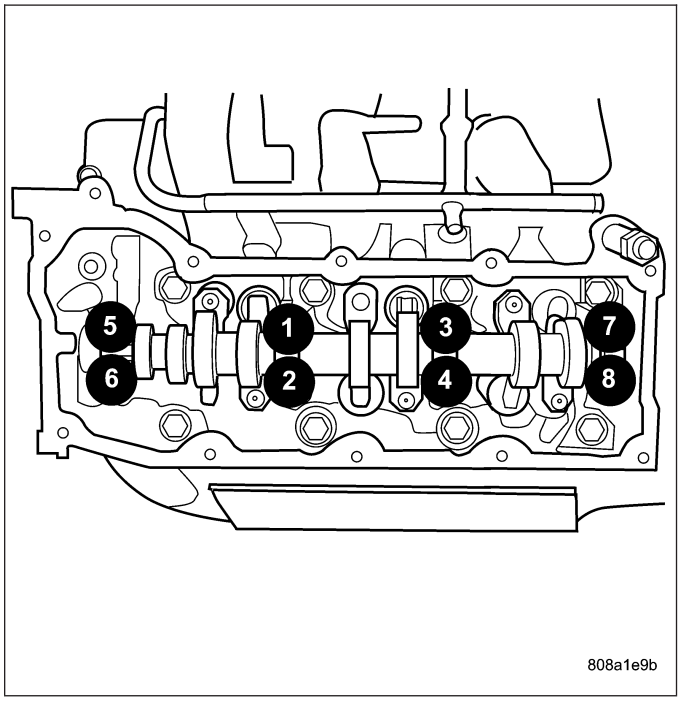
CAMSHAFT-RIGHT

1. Lubricate camshaft journals with clean engine oil.

NOTE: Position the right side camshaft so that the camshaft sprocket dowel is near the 10 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

2. Position the camshaft into the cylinder head.
3. Install the camshaft bearing caps, hand tighten the retaining bolts.

NOTE: Caps should be installed so that the stamped numbers on the caps are in numerical order, (1 thru 4) from the front to the rear of the engine. All caps should be installed so that the stamped arrows on the caps point toward the front of the engine.



4. Working in 1/2 turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward as shown.
5. Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).
6. Position the camshaft drive gear into the timing chain aligning the V6 mark between the two marked chain links (Two links marked during removal).
7. Using Special Tool 8428 Camshaft Wrench, rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft.

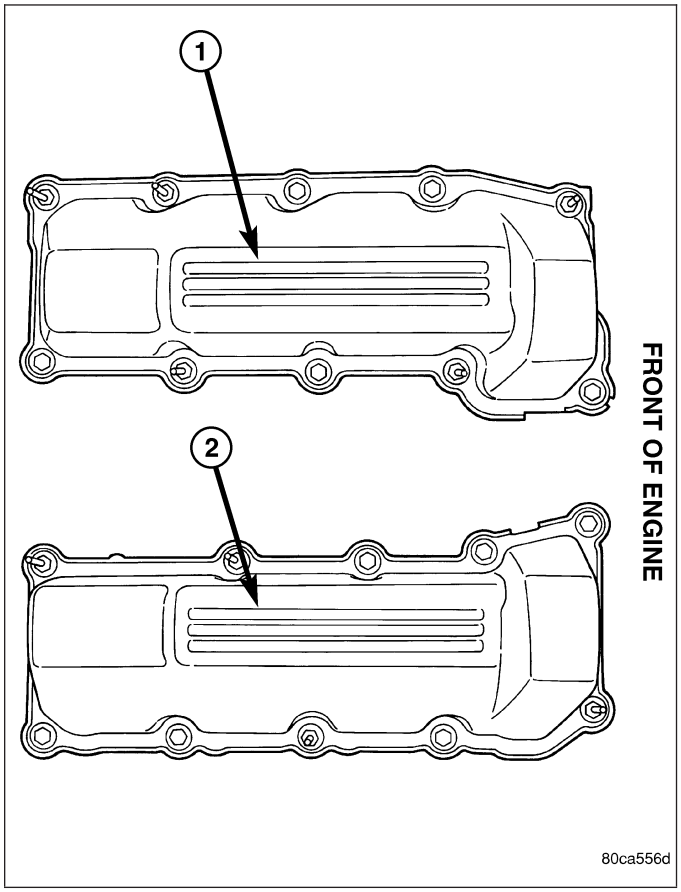
CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt over-torque resulting in bolt failure.

8. Remove excess oil from camshaft sprocket bolt, then install the camshaft sprocket retaining bolt and hand tighten.
9. Remove timing chain wedge Ttool 8379.
10. Using Tool 6958 spanner wrench with adapter pins 8346, torque the camshaft sprocket retaining bolt to 122 N·m (90 ft. lbs.).
11. Install the camshaft position sensor.
12. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

COVER(S)-CYLINDER HEAD

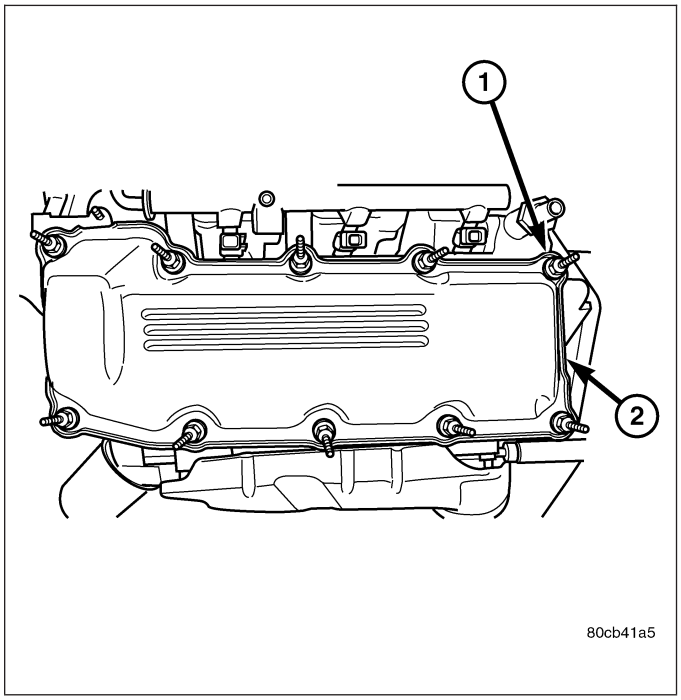
DESCRIPTION

The cylinder head covers (1,2) are made of glass re-enforced thermoset plastic, and are not interchangable from side-to-side.



REMOVAL

1. Disconnect negative cable from battery.
2. Remove the resonator assemble and air inlet hose.
3. Disconnect injector connectors and un-clip the injector harness.
4. Route injector harness in front of cylinder head cover (2).
5. Disconnect the left side breather tube and remove the breather tube.
6. Remove the cylinder head cover mounting bolts (1).
7. Remove cylinder head cover and gasket.



NOTE: The gasket may be used again, providing no cuts, tears, or deformation has occurred.

INSTALLATION

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

1. Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Tighten cylinder head cover bolts and double ended studs to 12 N·m (105 in. lbs.).
3. Install left side breather and connect breather tube.
4. Connect injector electrical connectors and injector harness retaining clips.
5. Install the resonator and air inlet hose.
6. Connect negative cable to battery.

VALVES & SEATS - INTAKE/EXHAUST

DESCRIPTION

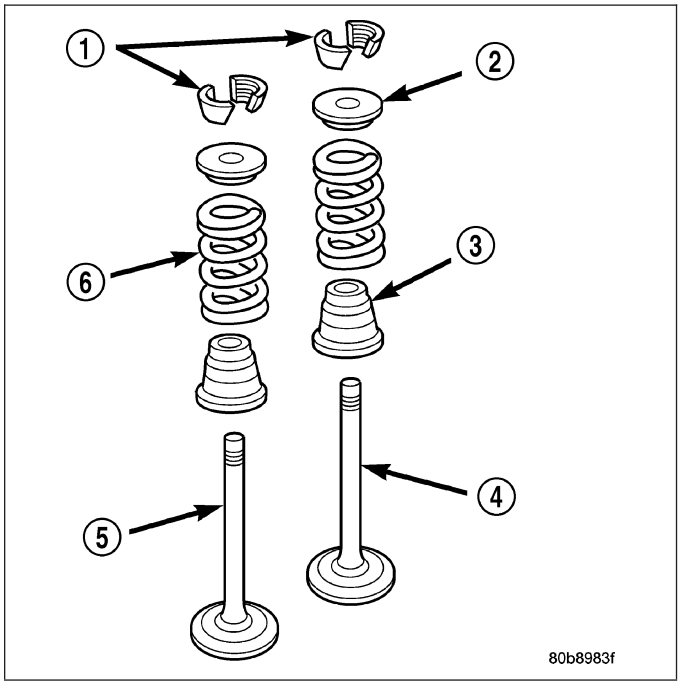
The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. Each valve is actuated by a roller rocker arm which pivots on a stationary lash adjuster. All valves use three bead lock keepers to retain the springs and promote valve rotation.

STANDARD PROCEDURE

REFACING

NOTE: Valve seats that are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise the cylinder head must be replaced.

NOTE: When refacing valves and valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.



1. Using a suitable dial indicator measure the center of the valve seat Total run out must not exceed 0.051 mm (0.002 in).
2. Apply a small amount of Prussian blue to the valve seat, insert the valve (4) or (5) into the cylinder head, while applying light pressure on the valve rotate the valve. Remove the valve and examine the valve face. If the blue is transferred below the top edge of the valve face, lower the valve seat using a 15 degree stone. If the blue is transferred to the bottom edge of the valve face, raise the valve seat using a 65 degree stone.
3. When the seat is properly positioned the width of the intake seat must be 1.75 - 2.36 mm (0.0689 - 0.0928 in.) and the exhaust seat must be 1.71 - 2.32 mm (0.0673 - 0.0911 in.).
4. Check the valve spring installed height after refacing the valve (4) and (5) and seat. The installed height for both intake and exhaust valve springs must not exceed 40.74 mm (1.6039 in.).

5. The valve seat and valve face must maintain a face angle of 44.5 - 45 ° angle.

REMOVAL

NOTE: The cylinder heads must be removed in order to perform this procedure.

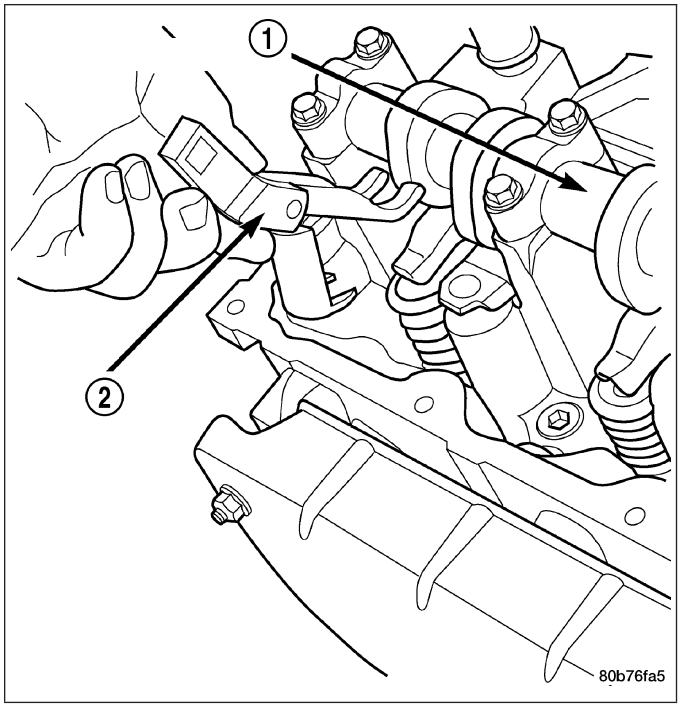
1. Remove rocker arms and lash adjusters (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL).
2. Remove the camshaft bearing caps and the camshaft.

NOTE: All six valve springs and valves are removed in the same manner; this procedure only covers one valve and valve spring.

3. Using Tool C-3422–B or C-3422–C Valve Spring Compressor and Tool 8519 Adapter (2), compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

4. Remove the two spring retainer lock halves.



NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

5. Remove the valve spring compressor (2).
6. Remove the spring retainer, and the spring.

NOTE: Check for sharp edges on the keeper grooves. Remove any burrs from the valve stem before removing the valve from the cylinder head.

7. Remove the valve from the cylinder head.

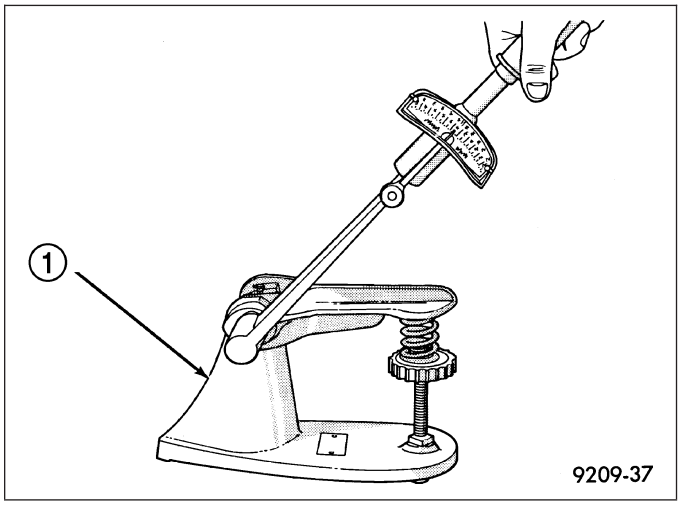
NOTE: The valve stem seals are common between intake and exhaust.

8. Remove the valve stem seal. Mark the valve for proper installation.

TESTING VALVE SPRINGS

NOTE: Whenever the valves are removed from the cylinder head it is recommended that the valve springs be inspected and tested for reuse.

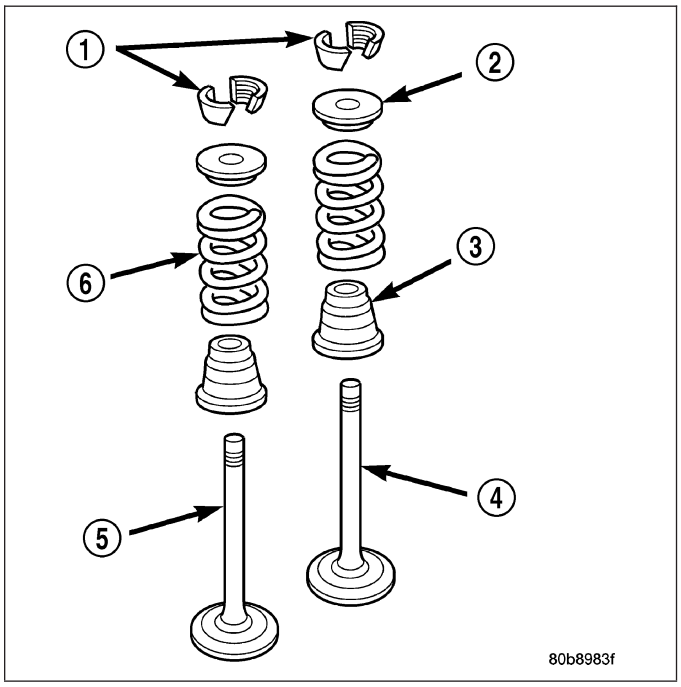
Inspect the valve springs for physical signs of wear or damage. Turn table of Tool C-647 (1) until surface is in line with the 40.12 mm (1.579 in.) mark on the threaded stud and the zero mark on the front. Place spring over the stud on the table and lift compressing lever to set tone device. Pull on torque wrench until a Ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer



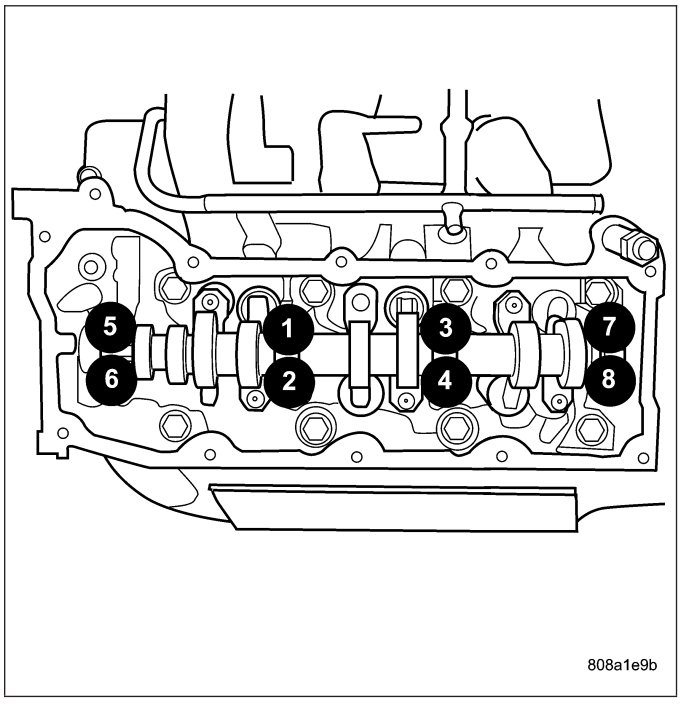
to Specifications Section to obtain specified height and allowable tensions. Replace any springs that do not meet specifications.

INSTALLATION

1. Coat the valve stem with clean engine oil and insert it into the cylinder head.
2. Install the valve stem seal (3). Make sure the seal is fully seated and that the garter spring at the top of the seal is intact.
3. Install the spring and the spring retainer (2).
4. Using the valve spring compressor, compress the spring (6) and install the two valve spring retainer halves (1).
5. Release the valve spring compressor and make sure the two spring retainer halves (1) and the spring retainer (2) are fully seated.
6. Lubricate the camshaft journal with clean engine oil then position the camshaft, with the sprocket dowel on the left camshaft at 11 o'clock and the right camshaft at 12 o'clock, then position the camshaft bearing caps.



7. Install the camshaft bearing cap retaining bolts. Tighten the bolts 9-13 N·m (100 in. lbs.) in 1/2 turn increments in the sequence shown.
8. Position the hydraulic lash adjusters and rocker arms (Refer to 9 - ENGINE/CYLINDER HEAD/ ROCKER ARM / ADJUSTER ASSY - INSTALLATION).



ARM-ROCKER

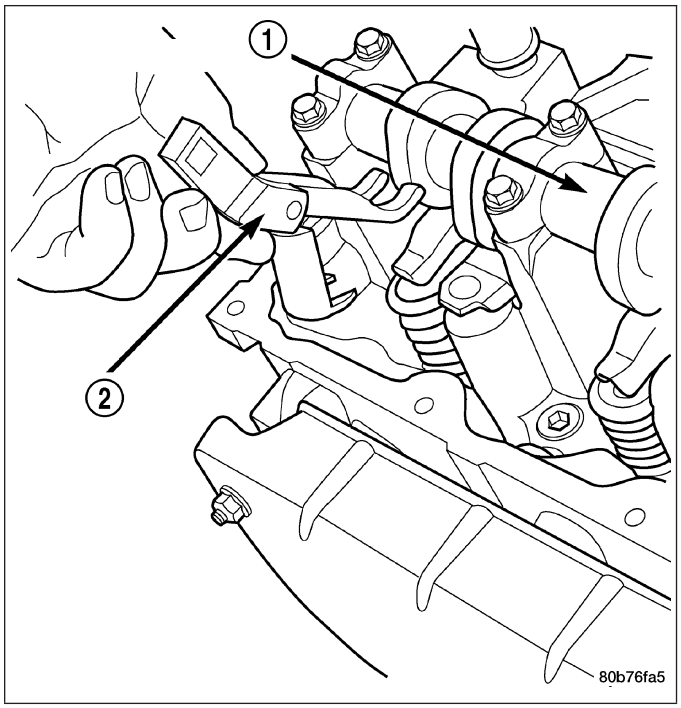
DESCRIPTION

The rocker arms are steel stampings with an integral roller bearing. The rocker arms incorporate a 0.5 mm oil hole in the lash adjuster socket for roller and camshaft lubrication.

REMOVAL

NOTE: Disconnect the battery negative cable to prevent accidental starter engagement.

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. For rocker arm removal on cylinder No. 4, Rotate the crankshaft until cylinder No. 1 is at BDC intake stroke.
3. For rocker arm removal on cylinder No. 1, Rotate the crankshaft until cylinder No. 1 is at BDC combustion stroke.
4. For rocker arm removal on cylinders No. 3 and No. 5, Rotate the crankshaft until cylinder No. 1 is at TDC exhaust stroke.
5. For rocker arm removal on cylinders No. 2 and No. 6, Rotate the crankshaft until cylinder No. 1 is at TDC ignition stroke.
6. Using special Tool 8516 Rocker Arm Remover (2), press downward on the valve spring, remove rocker arm.

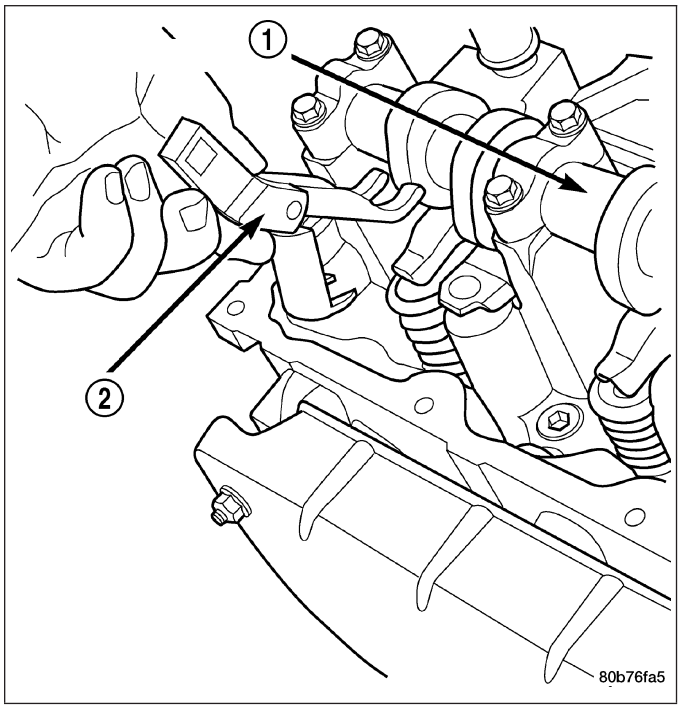


INSTALLATION

1. Using Tool 8516 (2) press downward on the valve spring, install rocker arm.

CAUTION: Make sure the rocker arms are installed with the concave pocket over the lash adjusters. Failure to do so may cause severe damage to the rocker arms and/or lash adjusters.

NOTE: Coat the rocker arms with clean engine oil prior to installation.



2. For rocker arm installation on cylinders No. 4, Rotate the crankshaft until cylinder No. 1 is at BDC intake stroke.
3. For rocker arm installation on cylinder No. 1, Rotate the crankshaft until cylinder No. 1 is at BDC combustion stroke.
4. For rocker arm installation on cylinders No. 3 and No. 5, Rotate the crankshaft until cylinder No. 1 is at TDC exhaust stroke.
5. For rocker arm installation on cylinders No. 2 and No. 6, Rotate the crankshaft until cylinder No. 1 is at TDC ignition stroke.
6. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

SEALS-VALVE GUIDE

DESCRIPTION

The valve guide seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

SPRINGS-VALVE

DESCRIPTION

The valve springs are made from high strength chrome silicon steel. The springs are NOT common for intake and exhaust applications. The valve spring seat is integral with the valve stem seal, which is a positive type seal to control lubrication.

REMOVAL

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Using Special Tool 8516 Valve Spring Compressor, remove the rocker arms and the hydraulic lash adjusters.
3. Remove the spark plug for the cylinder the valve spring and seal are to be removed from.
4. Apply shop air to the cylinder to hold the valves in place when the spring is removed.

NOTE: All six valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.

5. Using Special Tool 8387 Valve Spring Compressor, compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

6. Remove the two spring retainer lock halves.

NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

7. Remove the valve spring compressor.

NOTE: The valve springs are NOT common between intake and exhaust.

8. Remove the spring retainer, and the spring.
9. Remove the valve stem seal.

NOTE: The valve stem seals are common between intake and exhaust.

INSTALLATION

NOTE: All six valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.

1. Apply shop air to the cylinder to hold the valves in place while the spring is installed.

NOTE: The valve stem seals are common between intake and exhaust.

2. Install the valve stem seal.

NOTE: The valve springs are NOT common between intake and exhaust.

3. Install the spring retainer, and the spring.
4. Using Special Tool 8387 Valve Spring Compressor, compress the valve spring.
5. Install the two spring retainer lock halves.

NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

6. Remove the valve spring compressor.
7. Disconnect the shop air to the cylinder.
8. Install the spark plug for the cylinder the valve spring and seal was installed on.
9. Using Special Tool 8516 Valve Spring Compressor, install the rocker arms and the hydraulic lash adjusters.
10. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

ENGINE BLOCK

DESCRIPTION

The cylinder block is made of cast iron. The block is a closed deck design with the left bank forward. To provide high rigidity and improved NVH an enhanced compacted graphite bedplate is bolted to the block. The block design allows coolant flow between the cylinders bores, and an internal coolant bypass to a single poppet inlet thermostat is included in the cast aluminum front cover.

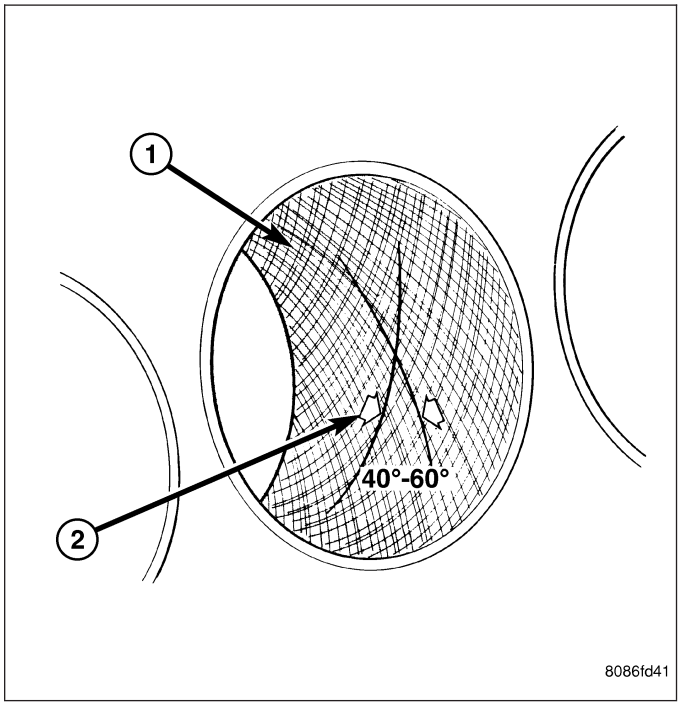
STANDARD PROCEDURE - CYLINDER BORE HONING

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

1. Used carefully, the Cylinder Bore Sizing Hone C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

2. Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil C-3501-3880, or a light honing oil, available from major oil distributors.



CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

3. Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern. The hone marks should INTERSECT at 50° to 60° for proper seating of rings.
4. A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle (1). The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle (2). Faster up and down strokes increase the crosshatch angle.
5. After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

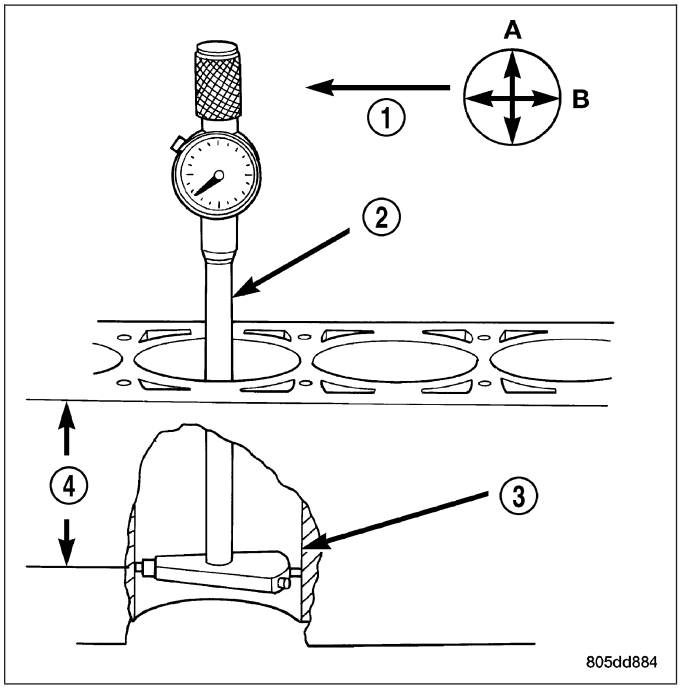
Use compressed air to clean out:

- The galley at the oil filter adaptor hole.
- The front and rear oil galley holes.
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Loctite PST pipe sealant with Teflon 592 to the threads of the front and rear oil galley plugs. Tighten the 1/4 inch NPT plugs to 20 N·m (177 in. lbs.) torque. Tighten the 3/8 inch NPT plugs to 27 N·m (240 in. lbs.) torque.

INSPECTION

1. It is mandatory to use a dial bore gauge (2) to measure each cylinder bore diameter. To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
2. Measure the inside diameter of the cylinder bore at three levels below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft and then take two additional reading.
3. Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement near the middle of the bore, then repeat the measurement near the bottom of the bore.
4. Determine taper by subtracting the smaller diameter from the larger diameter.
5. Rotate measuring device 90° and repeat steps above.
6. Determine out-of-roundness by comparing the difference between each measurement.

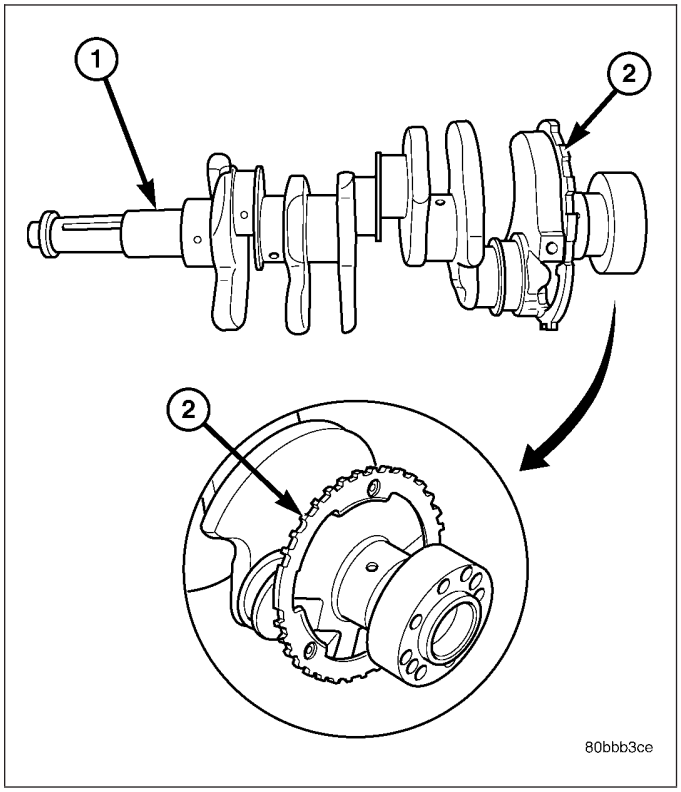


7. If cylinder bore taper does not exceed 0.025 mm (0.001 inch) and out-of-roundness does not exceed 0.025 mm (0.001 inch), the cylinder bore can be honed. If the cylinder bore taper or out- of-round condition exceeds these maximum limits, the cylinder block must be replaced. A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

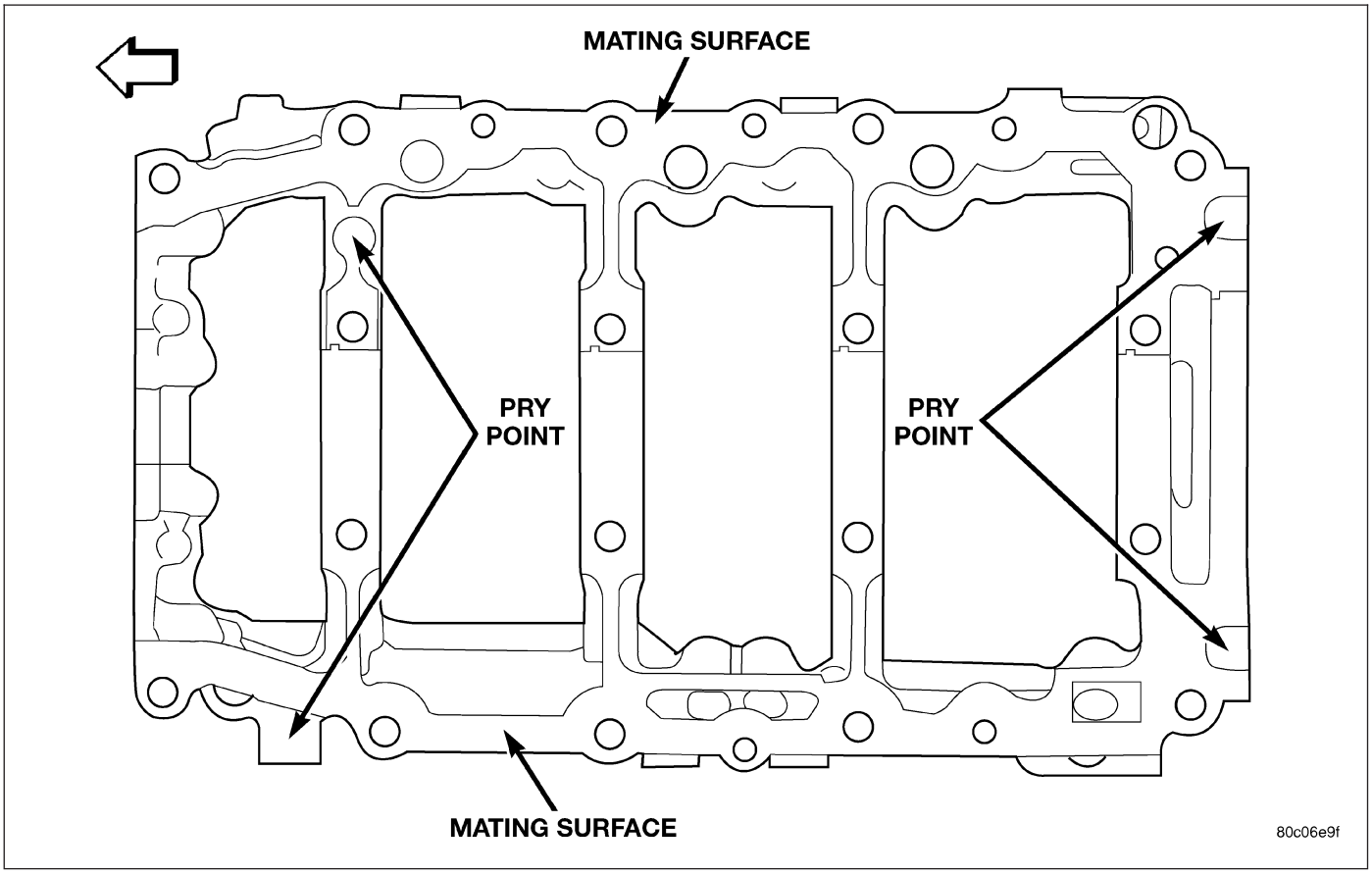
CRANKSHAFT

DESCRIPTION

The crankshaft (1) is constructed of nodular cast iron. The crankshaft is a three throw split pin design with six counterweights for balancing purposes. The crankshaft is supported by four select fit main bearings with the No. 2 serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The No. 6 counterweight has provisions for crankshaft position sensor target wheel mounting. The select fit main bearing markings are located on the rear side of the target wheel (2). The crankshaft oil seals are one piece design. The front oil seal is retained in the timing chain cover, and the rear seal is pressed in to a bore formed by the cylinder block and the bedplate assembly.



REMOVAL



NOTE: To remove the crankshaft from the engine, the engine must be removed from the vehicle.

1. Remove the engine (Refer to 9 - ENGINE - REMOVAL).
2. Remove the engine oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

CAUTION: DO NOT pry on the oil pan gasket when removing the oil pan, The oil pan gasket is mounted to the cylinder block in three locations and will remain attached to block when removing oil pan. Gasket can not be removed with oil pan.

3. Remove the bedplate mounting bolts. Note the location of the two stud bolts for installation.
4. Remove the connecting rods from the crankshaft.

CAUTION: The bedplate to cylinder block mating surface is a critical sealing surface. Do not pry on or damage this surface in anyway.

NOTE: The bedplate contains the lower main bearing halves. Use care when handling bedplate as not to drop or damage bearing halves. Installing main bearing halves in the wrong position will cause severe damage to the crankshaft.

NOTE: The bedplate has pry points (1) cast into it. Use these points only.

5. Carefully pry on the pry points (1) to loosen the bedplate then remove the bedplate.

CAUTION: When removing the crankshaft, use care not to damage bearing surfaces on the crankshaft.

6. Remove the crankshaft.

7. Remove the crankshaft tone wheel.

INSPECTION

NOTE: Thoroughly inspect the connecting rod bearing bores and main bearing bores for scoring, blueing or severe scratches. Further disassembly may be required.

If connecting rod bearing bores show damage, the cylinder heads must be removed to service the piston and rod assemblies. If the bedplate or the cylinder block main bearing bores show damage the engine must be replaced.

1. If required, remove the main bearing halves from the cylinder block and bedplate.
2. Thoroughly clean the bedplate to cylinder block sealing surfaces and main bearing bores. Remove all oil and sealant residue.
3. Inspect the bedplate main bearing bores for cracks, scoring or severe blueing. If either condition exists the engine must be replaced.
4. Inspect the crankshaft thrust washers for scoring, scratches, wear or blueing. If either condition exist replace the thrust washers.
5. Inspect the oil pan gasket/windage tray for splits, tears or cracks in the gasket sealing surfaces. Replace gasket as necessary.

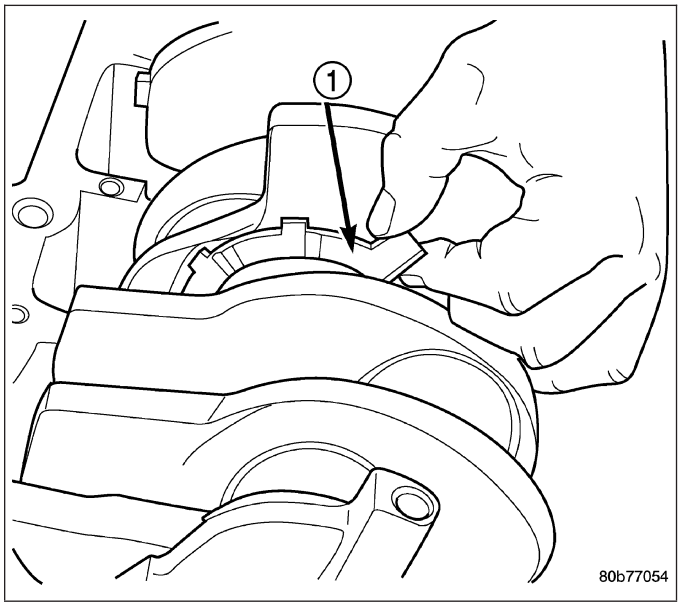
INSTALLATION

CAUTION: Main bearings are select fit. Refer to Crankshaft Main Bearings in this section for proper bearing selections.

CAUTION: When installing crankshaft, use care not to damage bearing surfaces on the crankshaft.

NOTE: Apply sealant to the tone wheel retaining screws prior to installation.

1. Lubricate upper main bearing halves with clean engine oil.
2. Install the crankshaft tone wheel. Torque the mounting screws to 15 N·m (11 ft. lbs.).
3. Position crankshaft in cylinder block.
4. Install the thrust washers (1).

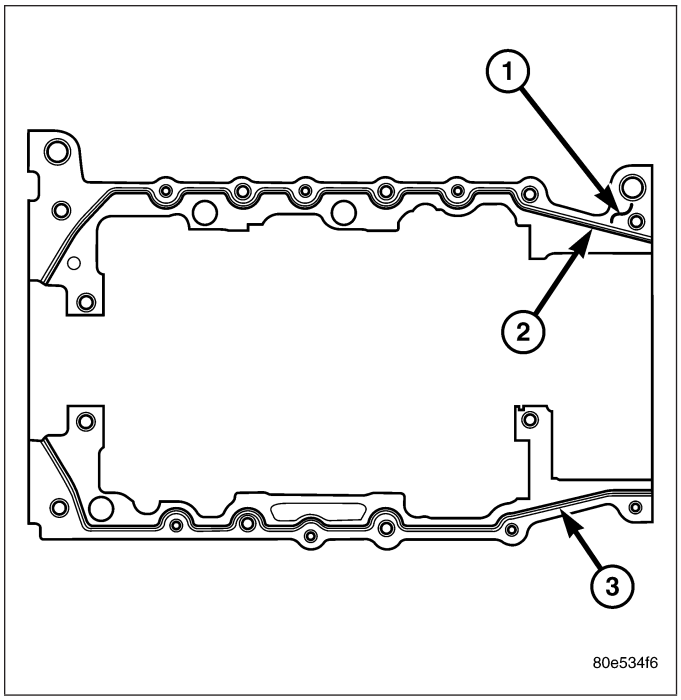


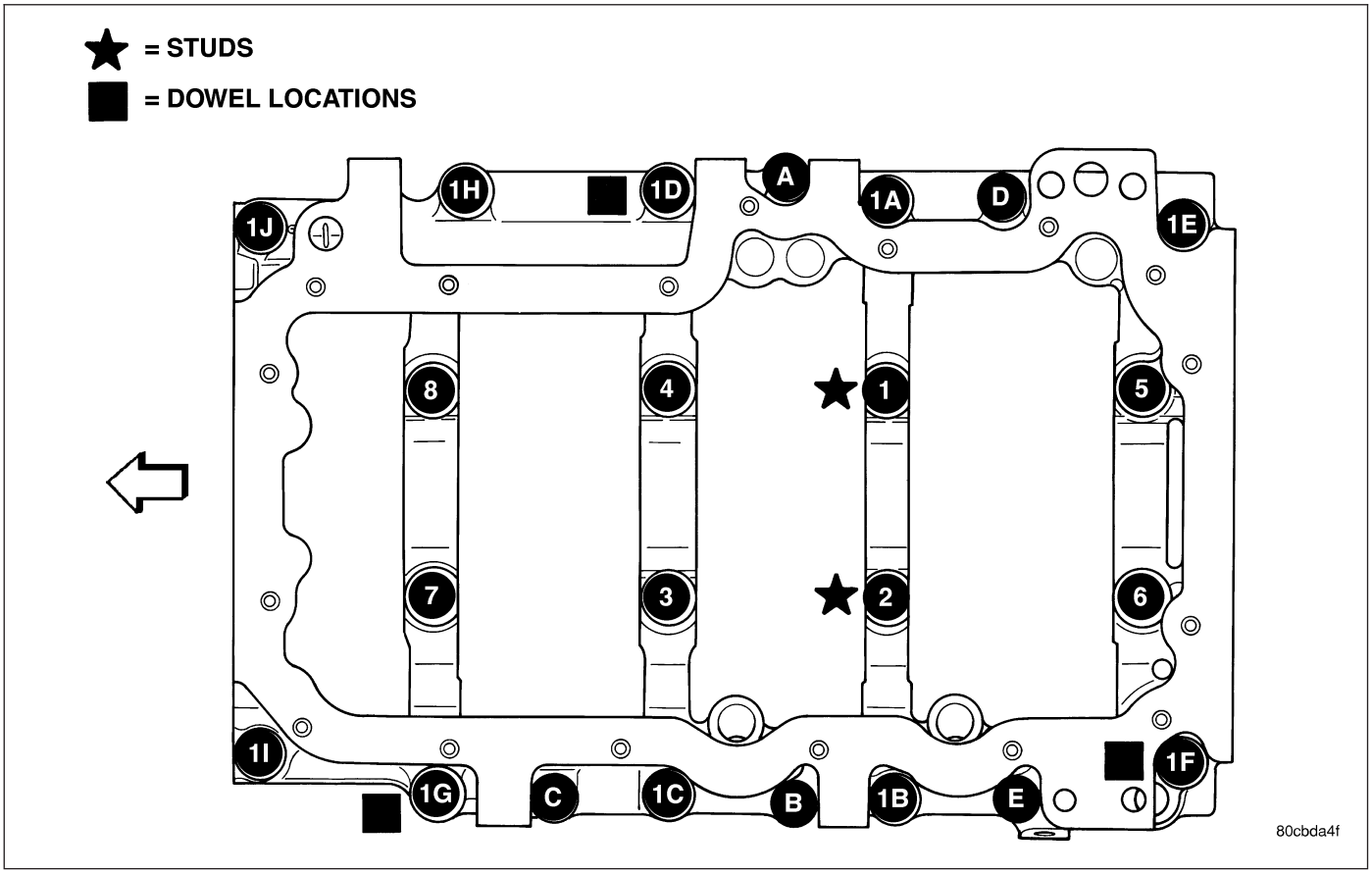
CAUTION: The bedplate to cylinder block mating surface must be coated with Mopar® Engine RTV sealant prior to installation. Failure to do so will cause severe oil leaks.

NOTE: Make sure that the bedplate and cylinder block sealing surfaces are clean and free of oil or other contaminants. Contaminants on the sealing surfaces may cause main bearing distortion and/or oil leaks.

5. Apply a 2.5mm (0.100 inch) bead of Mopar® Engine RTV sealant to the cylinder block-to-bedplate mating surface (1) and (2).
6. Coat the crankshaft main bearing journals with clean engine oil and position the bedplate onto the cylinder block.

NOTE: Lubricate the bedplate retaining bolts with clean engine oil prior to installation.





7. Install the bedplate retaining bolts, making sure to place the stud bolts in the correct location, Torque the bolts in the sequence shown.
   - Hand tighten bolts **1D,1G and 1F** until the bedplate contacts the block.
   - Tighten bolts **1A - 1J** to 54 N·m (40 ft. lbs.)
   - Tighten bolts **1 - 8** to 7 N·m (5 ft. lbs.)
   - Turn bolts **1 - 8** an additional 90°.

- Tighten bolts **A - E** 27 N·m (20 ft. lbs.).

8. Measure crankshaft end play.
9. Install the connecting rods and measure side clearance (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - STANDARD PROCEDURE).
10. Install oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).
11. Install the engine (Refer to 9 - ENGINE - INSTALLATION).

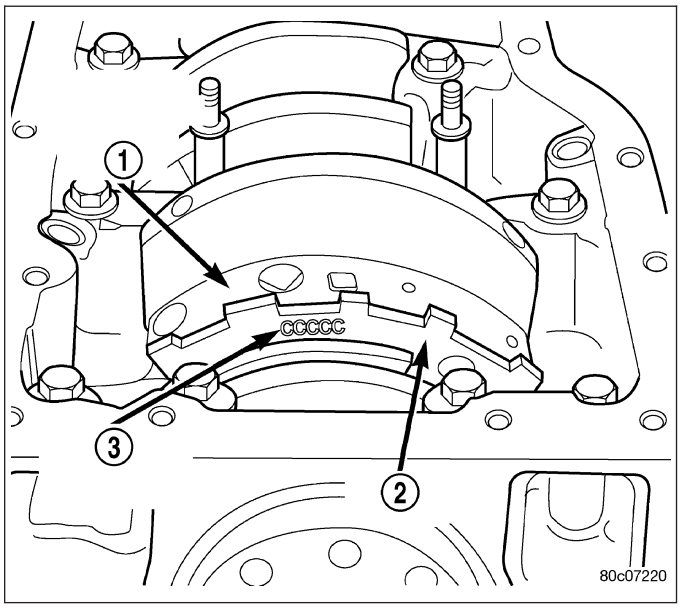
BEARINGS-CRANKSHAFT MAIN

STANDARD PROCEDURE

MAIN BEARING FITTING

SELECT FIT IDENTIFICATION

The main bearings are “select fit” to achieve proper oil clearances. For main bearing selection, the crankshaft position sensor target wheel (2) has grade identification marks (3) stamped into it. These marks are read from left to right, corresponding with journal number 1, 2, 3, 4. The crankshaft position sensor target wheel (2) is mounted to the number 6 counter weight (1) on the crankshaft.



INSPECTION

Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded in the lining. Normal main bearing insert wear patterns are illustrated.

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

Replace all damaged or worn bearing inserts.

MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Remove the crankshaft from the cylinder block (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - REMOVAL).

Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper is 0.008mm (0.0004 inch.) and maximum out of round is 0.005mm (0.002 inch). Compare the measured diameter with the journal diameter specification (Main Bearing Fitting Chart). Select inserts required to obtain the specified bearing-to-journal clearance.

Install the crankshaft into the cylinder block (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - INSTALLATION).

Check crankshaft end play.

CRANKSHAFT MAIN BEARING SELECTION

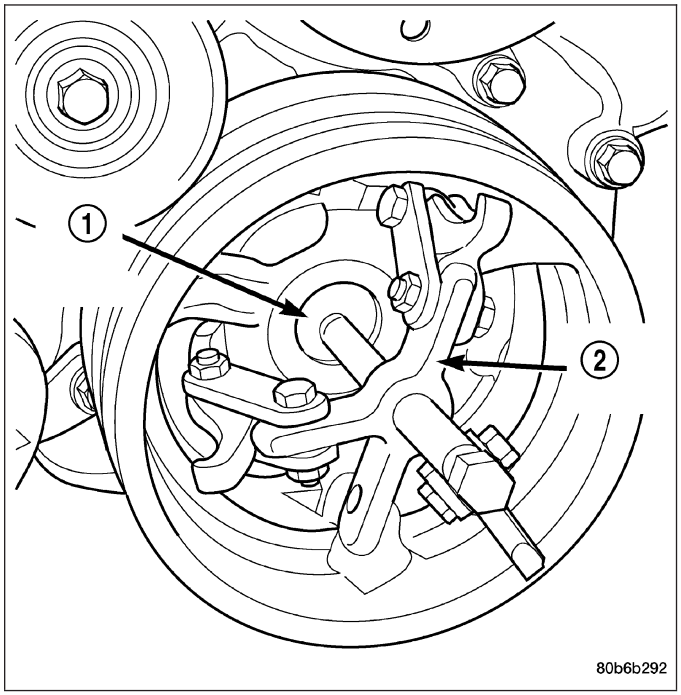
1. Service main bearings are available in four grades. The chart below identifies the four service grades available.

Crankshaft Marking	JOURNAL SIZE SIZE mm (in.)	
″R″ Size	63.488 - 63.496 mm (2.4995 - 2.4998 in.)	
″S″ Size	63.496 - 63.500 mm (2.4998 - 2.4999 in.)	
″T″ Size	63.500 - 63.504 mm (2.4999 - 2.501 in.)	
″U″ Size	63.504 - 63.512 mm (2.5001 - 2.5004 in.)	
Bearing size		
Bearing Code	Size	Application
Upper Bearing		
A	.2.443 - 2.447 mm (.0961 - .0963 in.)	Use with crankshaft size ″R″
B	2.439 - 2.443 mm (0.960 - .0961 in.)	Use with crankshaft ″S, T″
C	2.435 - 2.439 mm (.0958 - .0960 in.)	Use with crankshaft ″U″
Lower Bearing Main ″1″ and ″4″		
″1″	2.441 - 2.447 mm (.0961 -.0963 in.)	Use with crankshaft ″R, S″
″2″	2.435 - 2.441 mm (.0958 - .0962 in.)	Use with crankshaft ″T, U″
Lower Main Bearing ″2″ and ″3″		
″3″	2.429 - 2.435 mm (.0956 - .0958 in.)	Use with crankshaft ″R, S″
″4″	2.423 - 2.429 mm (.0953 - .0956 in.)	Use with crankshaft ″T, U″
Bearing Clearances		
Main ″1, 4″		
Crankshaft ″R″	.004 - .034 mm (.00015 - .0013 in.)	
Crankshaft ″S″	.004 - .030 mm (.00015 - .0011 in.)	
Crankshaft ″T″	.006 - .032 mm (.0002 - .0012 in.)	
Crankshaft ″U″	.002 - .032 mm (.00007 -. 0012 in.)	
Main ″2, 3″		
Crankshaft ″R″	.016 - .046 mm (.0006 - .0018 in.)	
Crankshaft ″S″	.016 - .042 mm (.00062 - .016 in.)	
Crankshaft ″T″	.018 - .044 mm (.0007 - .0017 in.)	
Crankshaft ″U″	.014 - .044 mm (.0005 - .0017 in.)	

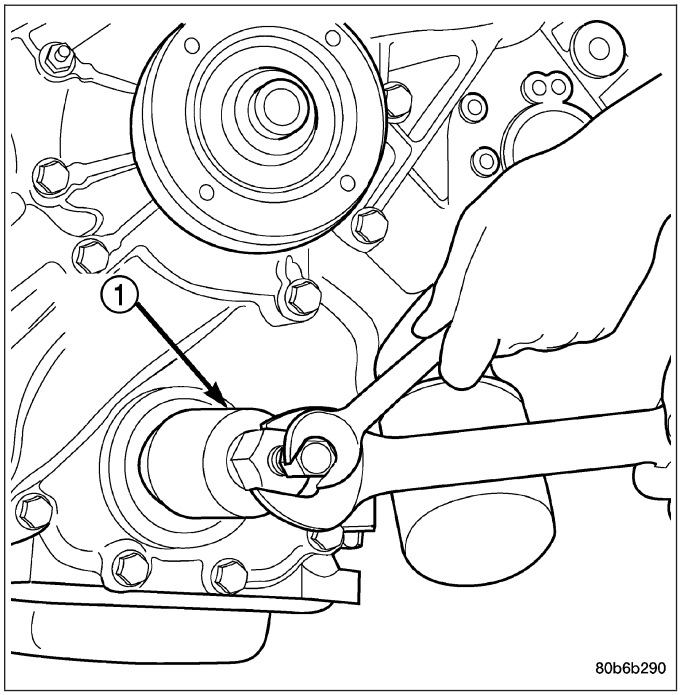
SEAL-CRANKSHAFT OIL - FRONT

REMOVAL

1. Disconnect negative cable from battery.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Remove A/C compressor mouning fasteners and set aside.
4. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Remove upper radiator hose.
6. Disconnect electrical connector for fan mounted inside radiator shroud.
7. Remove radiator cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
8. Remove crankshaft damper bolt.
9. Remove damper using Special Tools 8513 Insert (1) and Tool 1026 Three Jaw Puller (2).



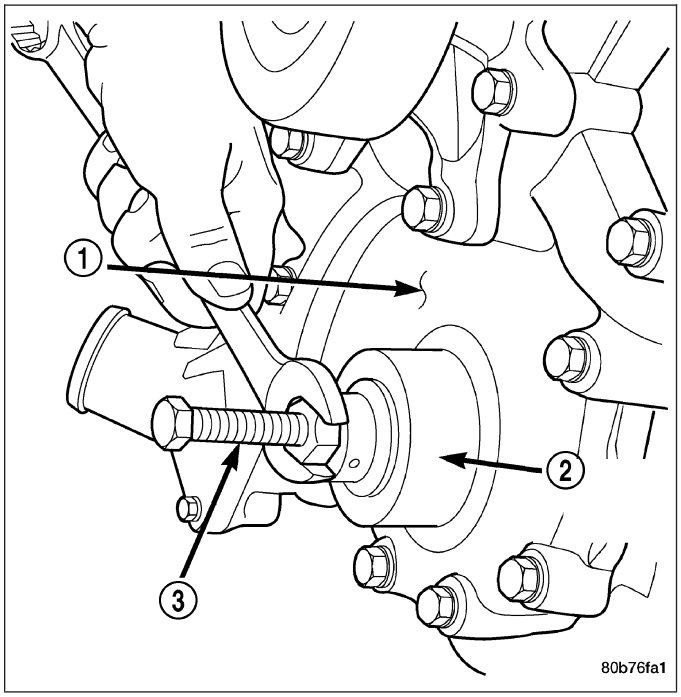
10. Using Special Tool 8511 (1), remove crankshaft front seal.



INSTALLATION

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

1. Using Special Tool 8348 (2) and 8512 (3) , install crankshaft front seal.
2. Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
3. Install radiator cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
4. Install upper radiator hose.
5. Install A/C compressor and tighten fasteners to 54 N·m (40 ft. lbs.).
6. Install accessory drive belt (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
7. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
8. Connect negative cable to battery.



CRANKSHAFT OIL SEAL - REAR

DIAGNOSIS AND TESTING - REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Engine, for proper repair procedures of these items.
4. If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), under the Oil Leak row, for components inspections on possible causes and corrections.
7. After the oil leak root cause and appropriate corrective action have been identified, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).

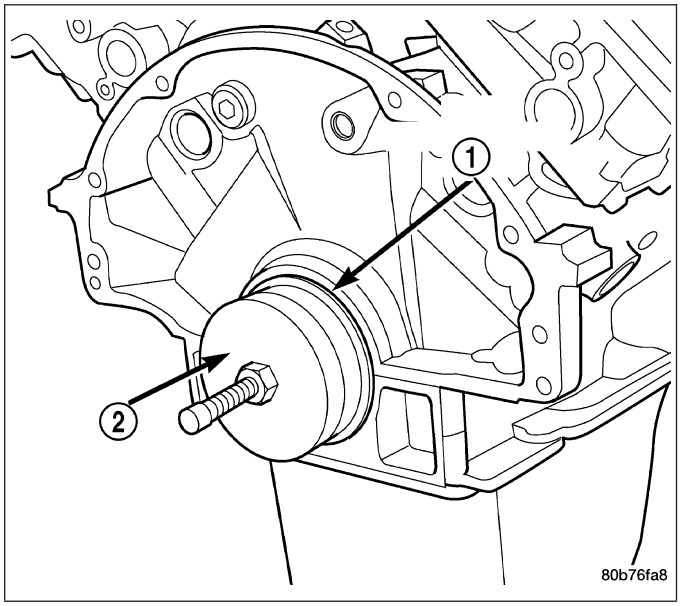
REMOVAL

NOTE: This procedure can be performed in vehicle.

1. If being preformed in vehicle, remove the transmission.
2. Remove the flexplate (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - REMOVAL).

NOTE: The crankshaft oil seal (1) CAN NOT be reused after removal.

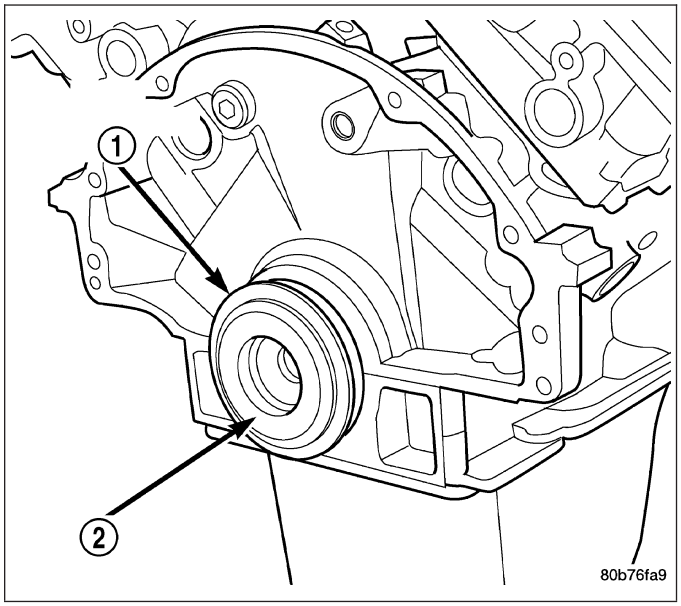
NOTE: The crankshaft rear oil seal remover Special Tool 8506 (2) must be installed deeply into the seal. Continue to tighten the removal tool into the seal until the tool can not be turned farther. Failure to install tool correctly the first time will cause tool to pull free of seal without removing seal from engine.



3. Using Special Tool 8506 (2) , remove the crankshaft rear oil seal (1).

INSTALLATION

1. Lubricate the crankshaft flange with engine oil.
2. Position the magnetic seal guide Special Tool 8349-2 (2) onto the crankshaft rear face. Then position the crankshaft rear oil seal (1) onto the guide.



3. Using Special Tools 8349 Crankshaft Rear Oil Seal Installer (2) and C-4171 Driver Handle (3), with a hammer, tap the seal (1) into place. Continue to tap on the driver handle until the seal installer seats against the cylinder block crankshaft bore.
4. Install the flexplate (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - INSTALLATION).
5. Install the transmission.

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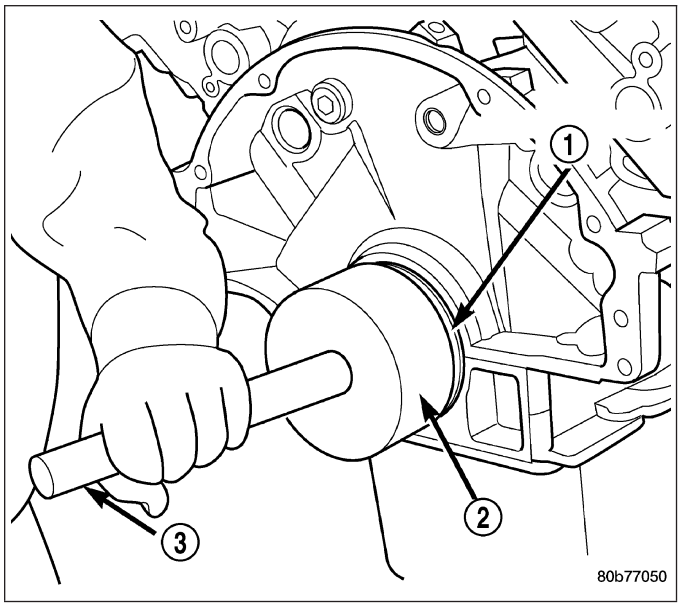
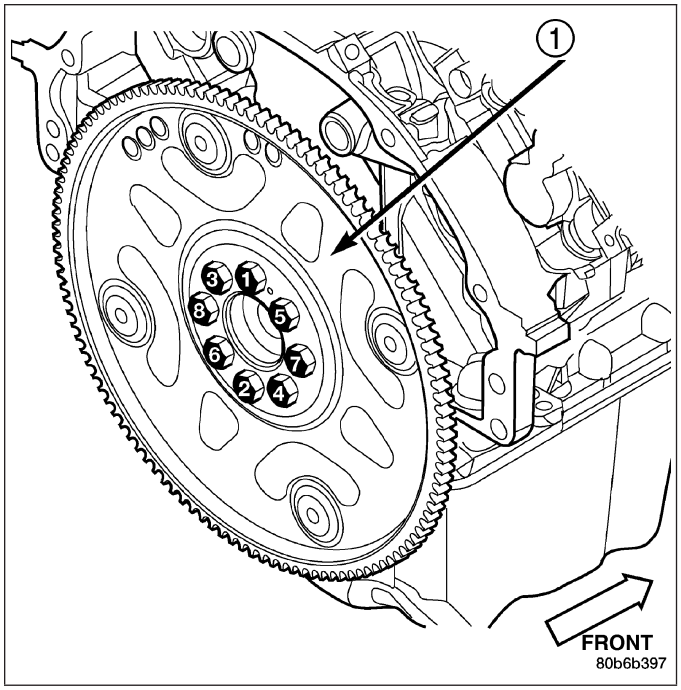


FLEX PLATE

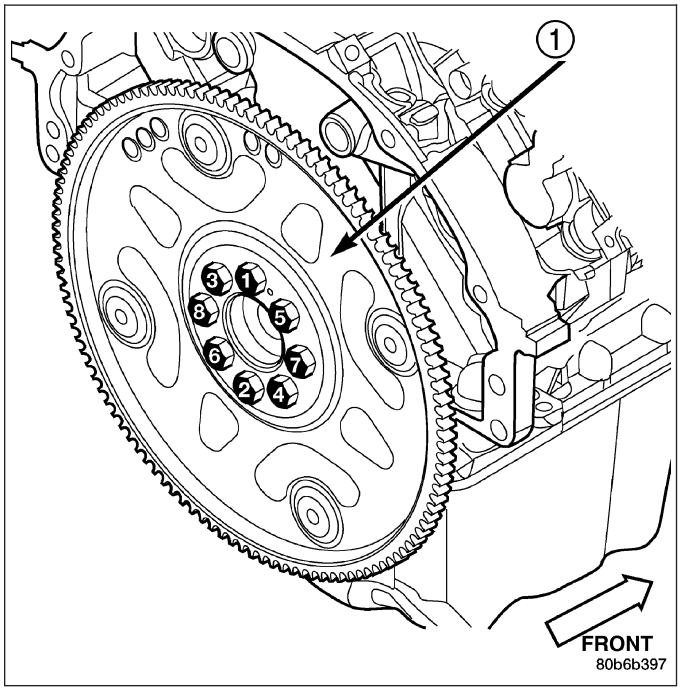
REMOVAL

1. Remove the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - REMOVAL).
2. Remove the bolts using the sequence provided.
3. Remove the flexplate.



INSTALLATION

1. Position the flexplate onto the crankshaft and install the bolts hand tight.
2. Tighten the flexplate retaining bolts to 95 N·m (70 ft. lbs.) in the sequence shown.
3. Install the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - INSTALLATION).

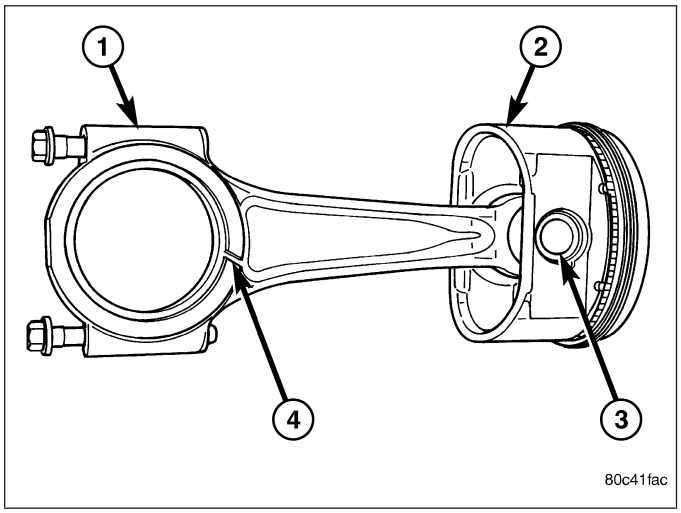


ROD-PISTON & CONNECTING

DESCRIPTION

CAUTION: Do not use a metal stamp to mark connecting rods as damage may result, instead use ink or a scratch awl.

The pistons (2) are made of a high strength aluminum alloy. The connecting rods are made of forged powdered metal, with a “fractured cap” design (1). A full floating piston pin (3) is used to attach the piston to the connecting rod.



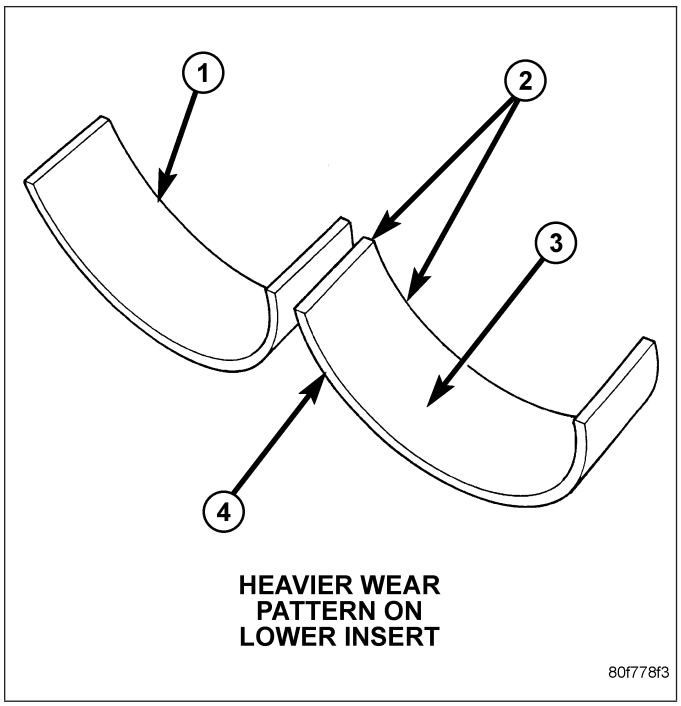
STANDARD PROCEDURE

CONNECTING ROD BEARING FITTING

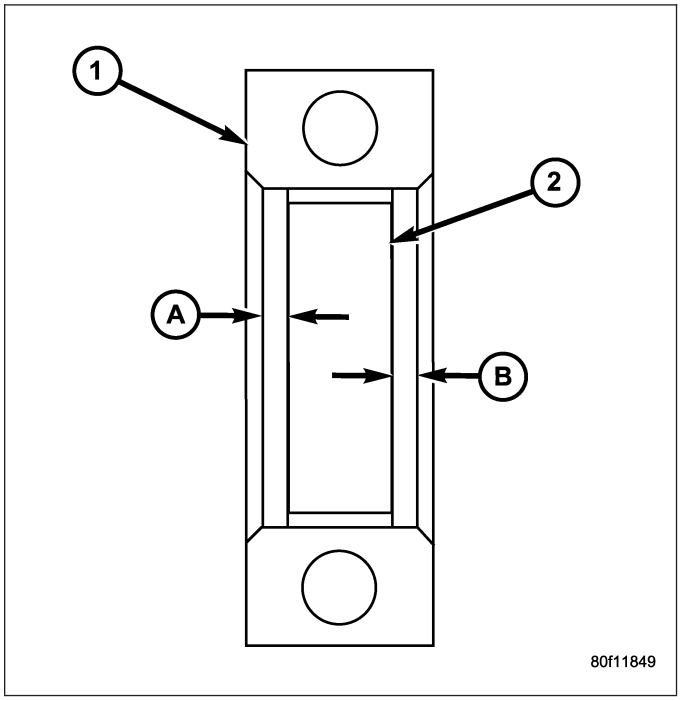
Inspect the connecting rod bearings for scoring (10 and (3). Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting. Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

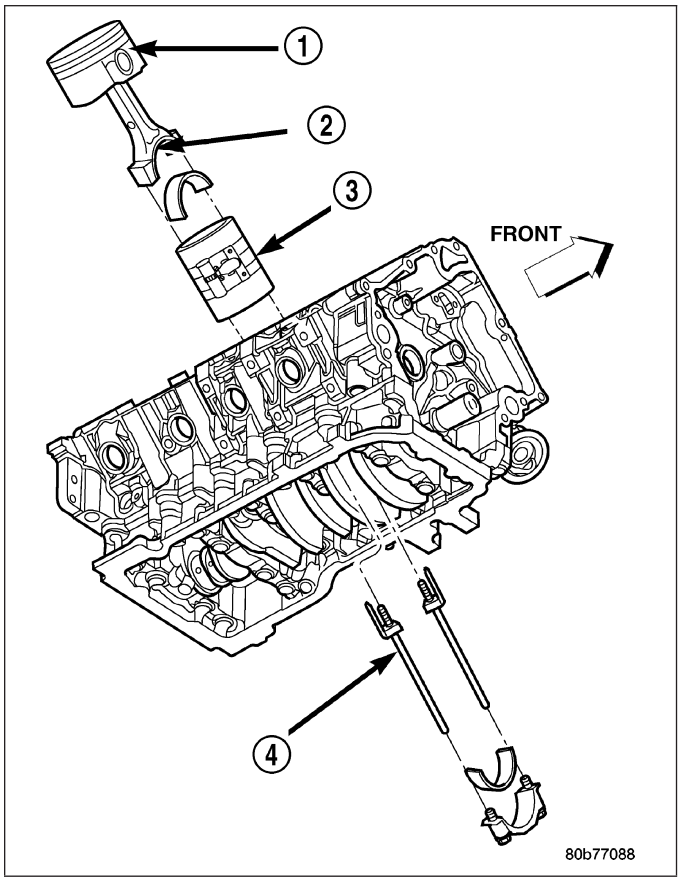
Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment. Replace misaligned, bent or twisted connecting rods.



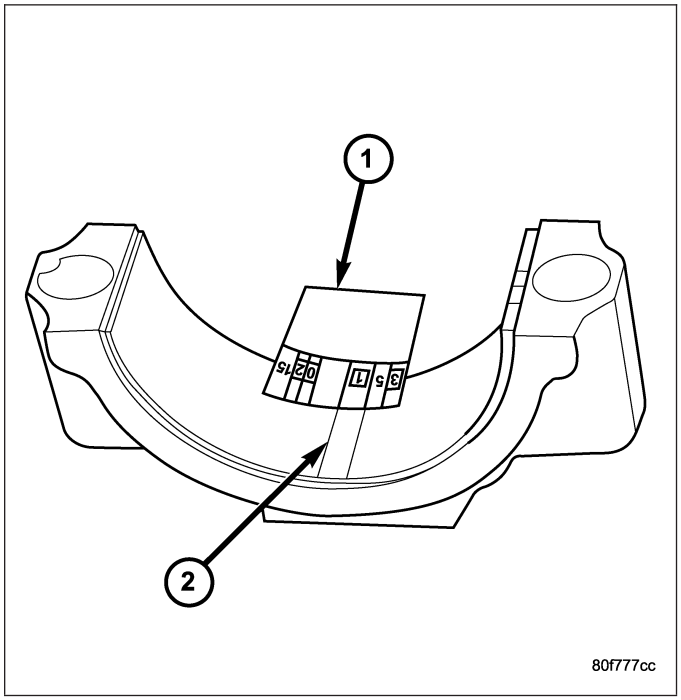
1. Wipe the oil from the connecting rod journal.
2. Lubricate the upper bearing insert (2) and position in connecting rod (1). Center bearing insert in connecting rod
3. Measure at point A and point B. Measurement should be less then .50mm (.0196 in.).



4. Use piston ring compressor (3) and Guide Pins Special Tool 8507 (4) to install the rod and piston assemblies. The oil slinger slots in the rods must face front of the engine. The “F”’s (1) near the piston wrist pin bore should point to the front of the engine.



5. Install the lower bearing insert in the bearing cap. Center bearing insert in connecting rod. The lower insert must be dry. Place strip of Plastigage (1) across full width of the lower insert at the center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.
6. Install bearing cap and connecting rod on the journal and tighten bolts to 27 N·m (20 ft. lbs.) plus a 90° turn. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.
7. Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage (2). Refer to Engine Specifications for the proper clearance. **Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod or foreign material trapped between the insert and cap or rod.**
8. If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage from crankshaft journal and bearing insert. Proceed with installation.



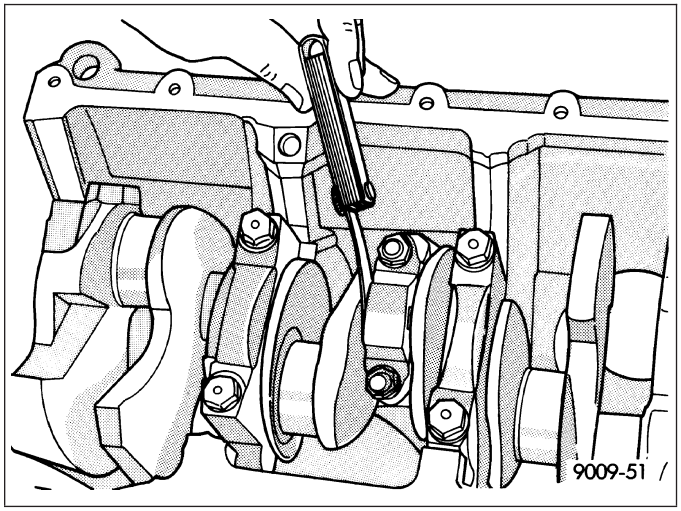
9. If bearing-to-journal clearance exceeds the specification, determin which services bearing set to use the bearing sizes are as follows:

Bearing Mark	SIZE	USED WITH JOURNAL SIZE
.025 US	.025 mm (.001 in.)	57.883-57.867 mm (2.2788-2.2783 in.)
Std.	STANDARD	57.908-57.892 mm (2.2798-2.2792 in.)
.250 US	.250 mm (.010 in.)	57.658-57.646 mm (2.2700-2.2695 in.)

CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

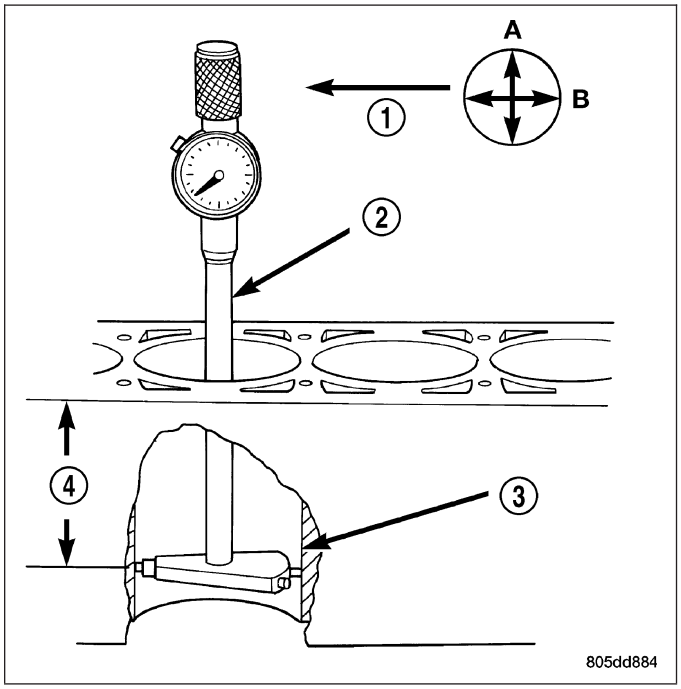
10. Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.
11. Once you have selected the proper insert, install the insert and cap. Tighten the connecting rod bolts to 27 N·m (20 ft. lbs.) plus a 90° turn.

Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange. Refer to Engine Specifications for the proper clearance. Replace the connecting rod if the side clearance is not within specification.

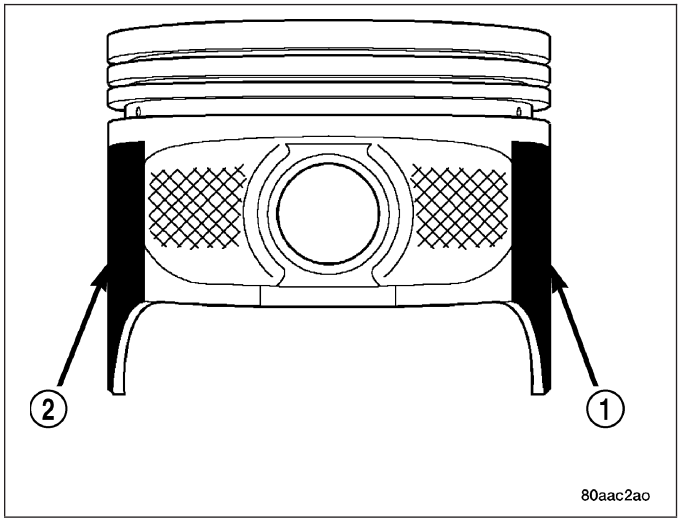


PISTON FITTING

1. To correctly select the proper size piston, a cylinder bore gauge (2), capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
2. Measure the inside diameter of the cylinder bore at a point 38.0 mm (1.5 inches) below top of bore (4). Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B.



3. The coated pistons will be serviced with the piston pin and connecting rod pre-assembled.
4. The coating material (1) and (2) is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston will not provide accurate results. Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY**. To correctly select the proper size piston, a cylinder bore gauge capable of reading in 0.003 mm (.0001 in.) increments is required.
5. Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.



REMOVAL

1. Disconnect negative cable from battery.
2. Remove the following components:
   - Oil pan and gasket/windage tray (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
   - Cylinder head(s) (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL) and (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
3. If necessary, remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation.** Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so the each connecting rod is centered in cylinder bore.

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur

NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.

4. Mark connecting rod and bearing cap positions using a permanent ink marker or scribe tool.

CAUTION: Care must be taken not to damage the fractured rod and cap joint face surfaces, as engine damage may occur.

5. Remove connecting rod cap. Install Special Tool 8507 Connecting Rod Guides into the connecting rod being removed. Remove piston from cylinder bore. Repeat this procedure for each piston being removed.

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur

6. Immediately after piston and connecting rod removal, install bearing cap on the mating connecting rod to prevent damage to the fractured cap and rod surfaces.

CLEANING

CAUTION: DO NOT use a wire wheel or other abrasive cleaning devise to clean the pistons or connecting rods. The pistons have a Moly coating, this coating must not be damaged.

1. Using a suitable cleaning solvent clean the pistons in warm water and towel dry.
2. Use a wood or plastic scraper to clean the ring land grooves.

CAUTION: DO NOT remove the piston pin from the piston and connecting rod assembly.

INSPECTION

Check the connecting rod journal for excessive wear, taper and scoring (Refer to 9 - ENGINE/ENGINE BLOCK/ PISTON & CONNECTING ROD - STANDARD PROCEDURE)

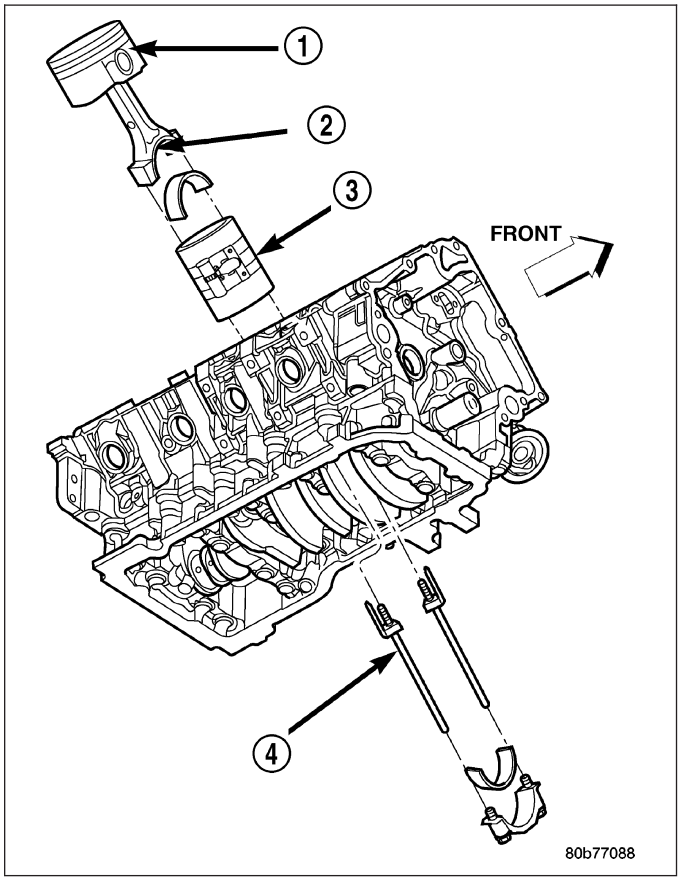
Check the connecting rod for signs of twist or bending.

Check the piston for taper and elliptical shape before it is fitted into the cylinder bore (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - STANDARD PROCEDURE).

Check the piston for scoring, or scraping marks in the piston skirts. Check the ring lands for cracks and/or deterioration.

INSTALLATION

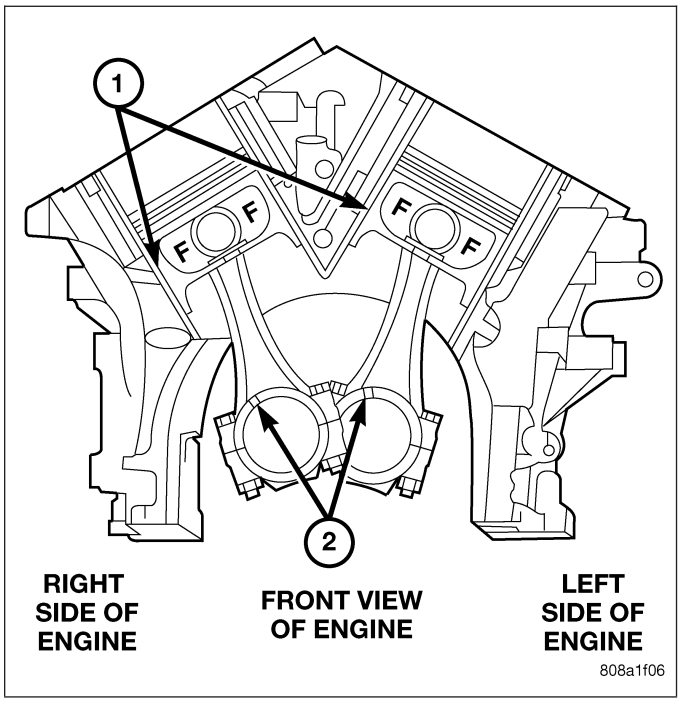
1. Before installing piston and connecting rod assemblies into the bore, install the piston rings.
2. Immerse the piston head and rings in clean engine oil. Position a ring compressor (3) over the piston and rings. Tighten ring compressor (3). **Ensure position of rings do not change during this operation.**
3. Position bearing onto connecting rod. Ensure that hole in bearing shell aligns with hole in connecting rod. Lubricate bearing surface with clean engine oil.
4. Install Special Tool 8507 Connecting Rod Guides (4) into connecting rod bolt threads.



5. The pistons are marked on the piston pin bore surface with an raised “F” (1) indicating installation position. This mark must be pointing toward the front of engine on both cylinder banks. The connecting rod oil slinger slot faces the front of the engine.
6. Wipe cylinder bore clean and lubricate with engine oil.
7. Rotate crankshaft until connecting rod journal is on the center of cylinder bore. Insert rod and piston into cylinder bore and carefully position connecting rod guides over crankshaft journal.
8. Tap piston down in cylinder bore using a hammer handle. While at the same time, guide connecting rod into position on rod journal.

CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

9. Lubricate rod bolts and bearing surfaces with engine oil. Install connecting rod cap and bearing. Tighten bolts to 27 N·m (20 ft. lbs.) plus 90°.
10. Install the following components:



- Cylinder head(s) (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
- Timing chain and cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
- Cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
- Oil pan and gasket/windage tray. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

11. Fill crankcase with proper engine oil to correct level.
12. Connect negative cable to battery.

RINGS-PISTON

STANDARD PROCEDURE

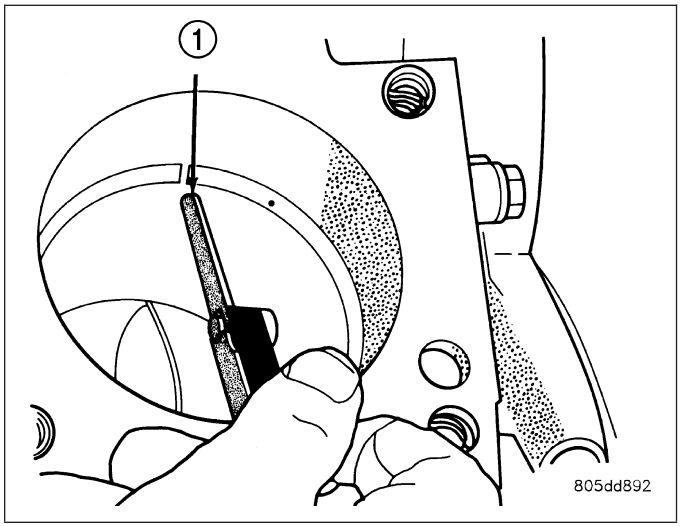
PISTON RING FITTING

Before reinstalling used rings or installing new rings, the ring clearances must be checked.

1. Wipe the cylinder bore clean.
2. Insert the ring in the cylinder bore.

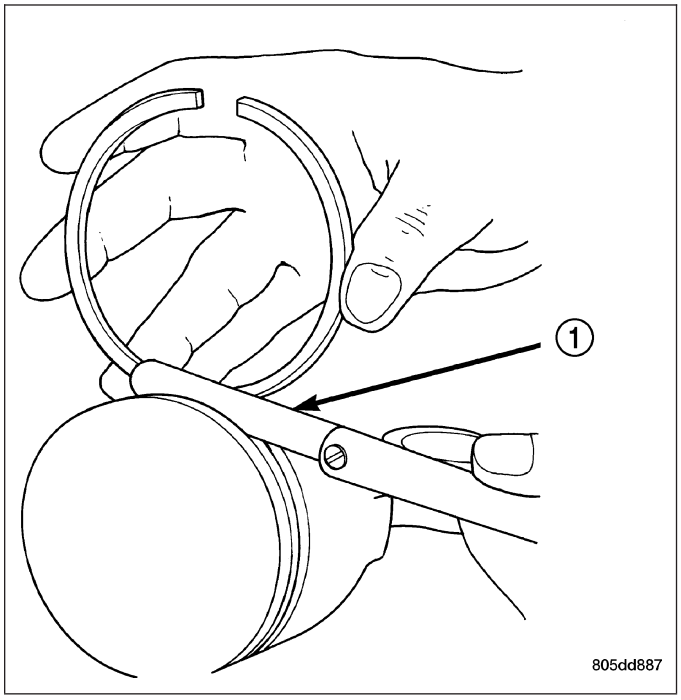
NOTE: The ring gap measurement must be made with the ring positioned at least 12mm (0.50 inch.) from bottom of cylinder bore.

3. Using a piston, to ensure that the ring is squared in the cylinder bore, slide the ring downward into the cylinder.
4. Using a feeler gauge (1), check the ring end gap. Replace any rings not within specification.



PISTON RING SIDE CLEARANCE

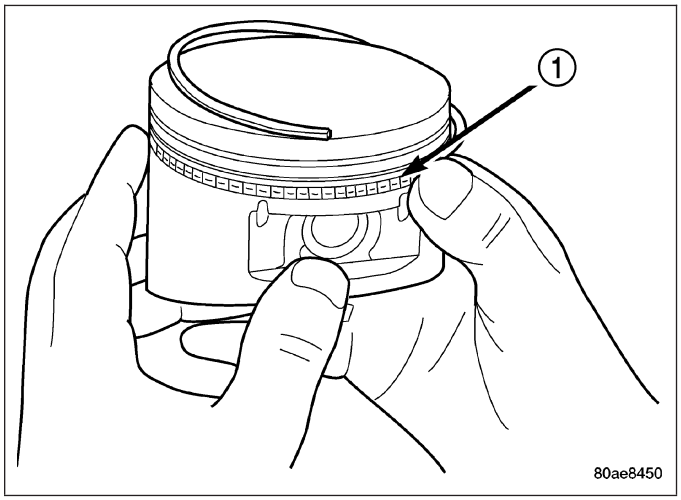
NOTE: Make sure the piston ring grooves are clean and free of nicks and burrs.



PISTON RING SPECIFICATION CHART

Ring Position	Groove Clearance	Maximum Clearance
Upper Ring	.051-.094 mm (0.0020-.0037 in.)	0.11 mm (0.004 in.)
Intermediate Ring	0.04-0.08 mm (0.0016-0.0031 in.)	0.10 mm (0.004 in.)
Oil Control Ring (Steel Rails)	.019-.229 mm (.0007-.0090 in.)	.25 mm (0.010 in.)
Ring Position	**Ring Gap**	**Wear Limit**
Upper Ring	0.20-0.36 mm (0.0079-0.0142 in.)	0.43 mm (0.0017 in.)
Intermediate Ring	0.37-0.63 mm (0.0146-0.0249 in.)	0.74 mm (0.029 in.)
Oil Control Ring (Steel Rail)	0.025-0.76 mm (0.0099- 0.03 in.)	1.55 mm (0.061 in.)

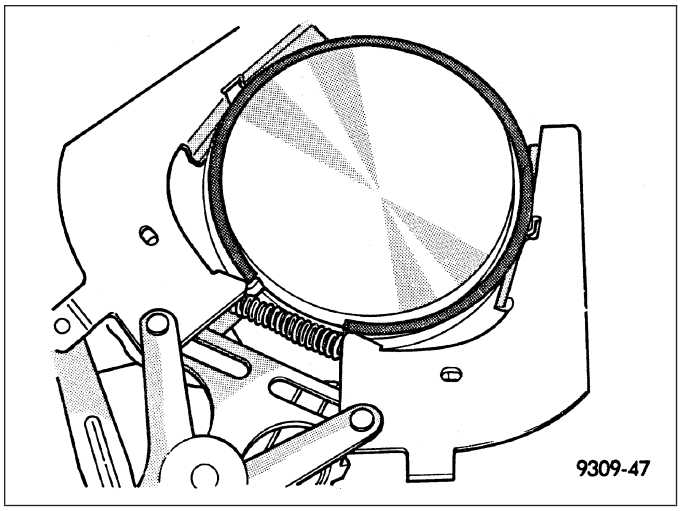
5. Measure the ring side clearance as shown make sure the feeler gauge (1) fits snugly between the ring land and the ring. Replace any ring not within specification.
6. Rotate the ring around the piston, the ring must rotate in the groove with out binding.
7. The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston.



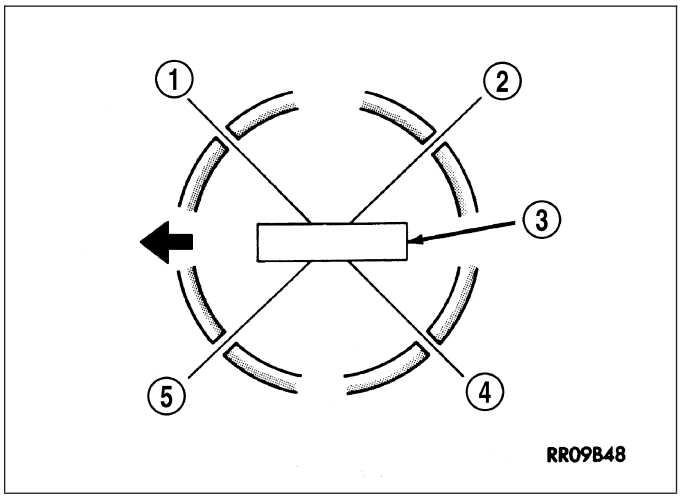
NOTE: Piston rings are installed in the following order:
- **Oil ring expander.**
- **Upper oil ring side rail (1).**
- **Lower oil ring side rail.**
- **No. 2 Intermediate piston ring.**
- **No. 1 Upper piston ring.**

8. Install the oil ring expander.
9. Install upper side rail by placing one end between the piston ring groove and the expander ring. Hold end firmly and press down the portion to be installed until side rail is in position. Repeat this step for the lower side rail.

10. Install No. 2 intermediate piston ring using a piston ring installer.
11. Install No. 1 upper piston ring using a piston ring installer.



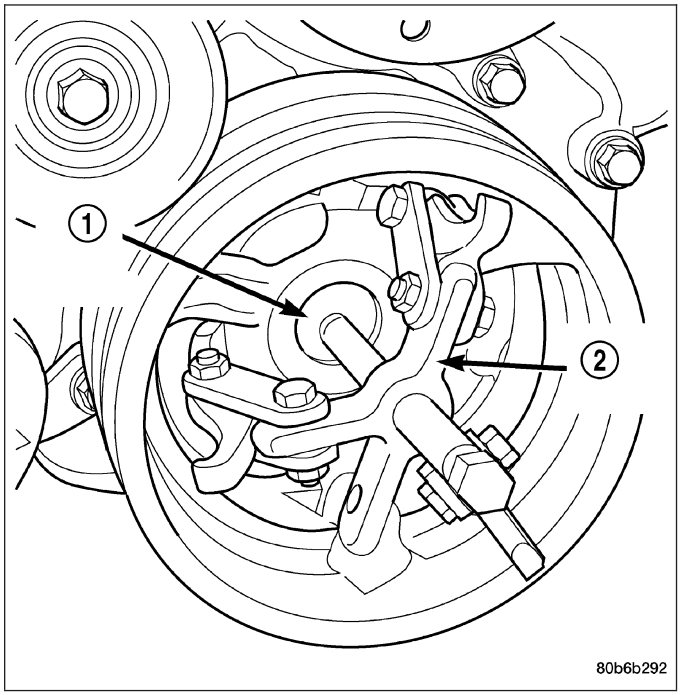
12. Position piston ring end gaps as shown in. It is important that expander ring gap is at least 45° from the side rail gaps, but not on the piston pin center or on the thrust direction.



DAMPER-CRANKSHAFT

REMOVAL

1. Disconnect negative cable from battery.
2. Remove radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
3. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
4. Remove crankshaft damper bolt.
5. Remove damper using Special Tools 8513 Insert (1) and 1026 Three Jaw Puller (2).

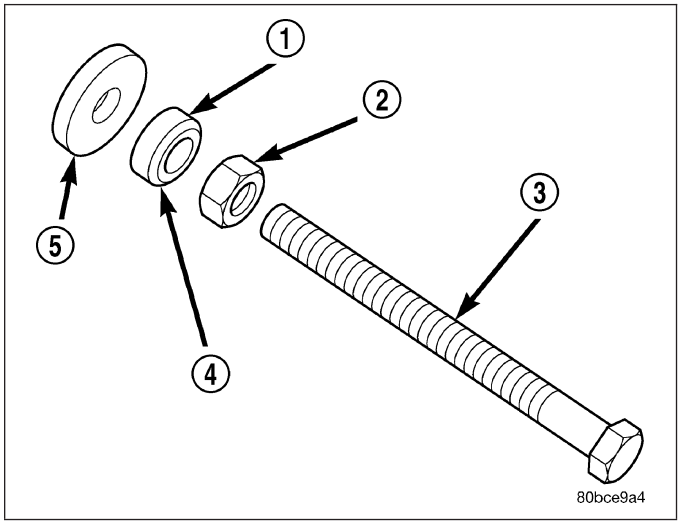


INSTALLATION

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512–A, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

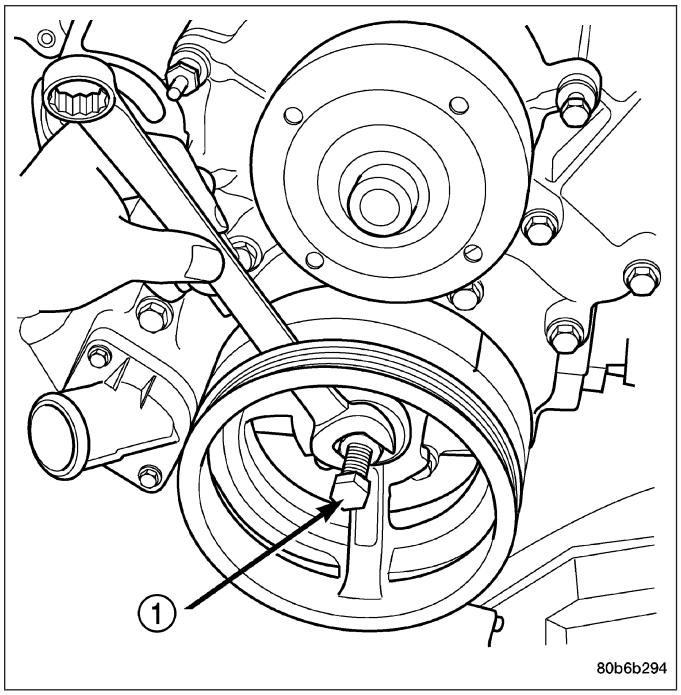
1. Align crankshaft damper slot with key in crankshaft. Slide damper onto crankshaft slightly.

CAUTION: Special Tool 8512–A, is assembled in a specific sequence. Failure to assemble this tool in this sequence can result in tool failure and severe damage to either the tool or the crankshaft.



2. Assemble Special Tool 8512–A as follows, The nut (2) is threaded onto the threaded rod (3) first. Then the roller bearing (1) is placed onto the threaded rod (The hardened bearing surface of the bearing **MUST**face the nut (4)). Then the hardened washer (5) slides onto the threaded rod. Once assembled coat the threaded rod's threads with Mopar® Nickel Anti-Seize or equivalent.

3. Using Special Tool 8512–A, press damper onto crankshaft.
4. Install then tighten crankshaft damper bolt to 175 N·m (130 ft. lbs.).
5. Install radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
6. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION)
7. Connect negative cable to battery.



COVER-STRUCTURAL

DESCRIPTION

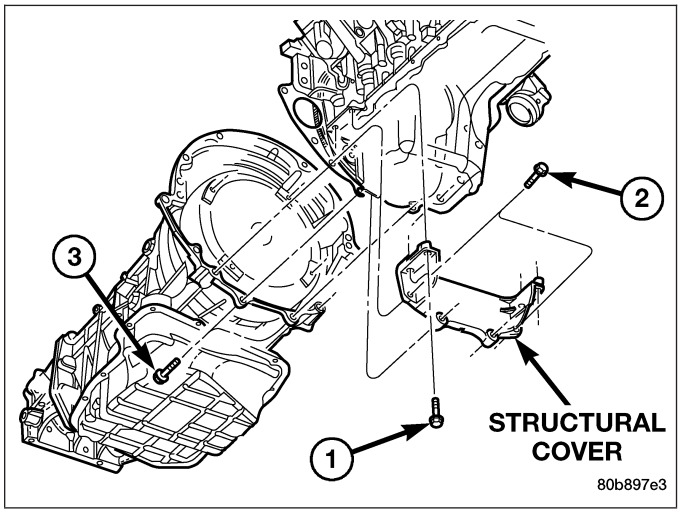
The structural dust cover is made of die cast aluminum and joins the lower half of the transmission bell housing to the engine bedplate.

OPERATION

The structural cover provides additional powertrain stiffness and reduces noise and vibration.

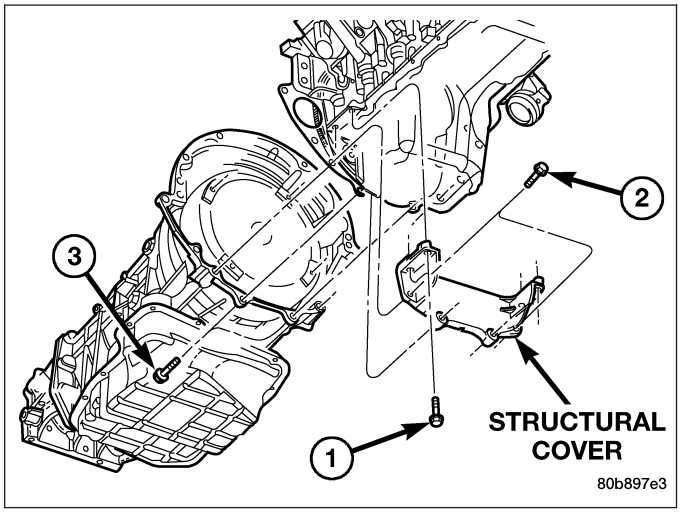
REMOVAL

1. Raise vehicle on hoist.
2. Remove the left hand exhaust pipe from exhaust manifold.
3. Loosen the right hand exhaust manifold-to-exhaust pipe retaining bolts.
4. Remove the eight bolts (1,2,3) retaining structural cover in the sequence shown.
5. Pivot the exhaust pipe downward and remove the structural cover.



INSTALLATION

CAUTION: The structural cover must be installed as described in the following steps. Failure to do so will cause severe damage to the cover.



1. Position the structural cover in the vehicle.
2. Install all bolts (1,2,3) retaining the cover-to-engine. DO NOT tighten the bolts at this time.
3. Install the four cover-to-transmission bolts. Do NOT tighten at this time.

CAUTION: The structural cover must be held tightly against both the engine and the transmission bell housing during tightening sequence. Failure to do so may cause damage to the cover.

4. Starting with the two rear cover-to-engine bolts, tighten bolts (1) to 54 N·m (40 ft. lbs.), then tighten bolts (2) and (3) to 54 N·m (40 ft. lbs.) in the sequence shown.
5. Install the exhaust pipe on left hand exhaust manifold.
6. Tighten exhaust manifold-to-exhaust pipe retaining bolts to 20 - 26 N·m (15-20 ft. lbs.).

MOUNT - FRONT

REMOVAL

2WD

1. Disconnect the negative cable from the battery.

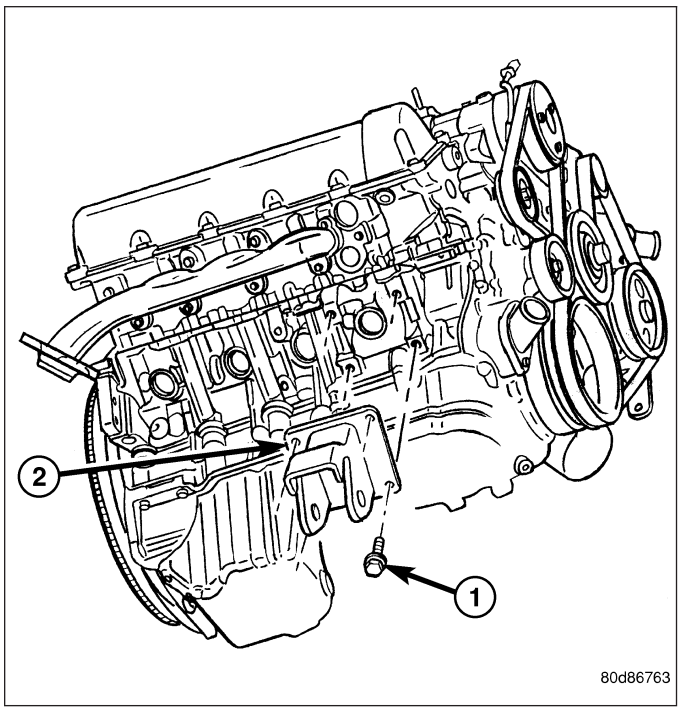
CAUTION: Remove the viscous fan before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.

2. Remove the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
3. Raise the vehicle.
4. Remove the engine oil filter.
5. Remove the oil drain trough.
6. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
7. Support the front axle with a suitable jack.
8. Remove the bolts that attach the engine mounts to the front axle.
9. Remove the bolts that attach the front axle to the left engine bracket.
10. Lower the front axle.
11. Remove the through bolts
12. Raise the engine far enough to be able to remove the left and right engine mounts.
13. Remove the mount to engine attaching bolts
14. Remove the engine mounts.

4WD

1. Disconnect the negative cable from the battery.
2. Remove the viscous fan.
3. Raise the vehicle.
4. Remove the skid plate.
5. Remove the front crossmember.
6. Remove the engine oil filter.
7. Remove the oil drain trough.
8. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
9. Support the front axle with a suitable jack.
10. Remove the bolts that attach the engine mounts to the front axle.
11. Remove the bolts that attach the front axle to the left engine bracket.
12. Lower the front axle.
13. Remove the through bolts

CAUTION: Remove the viscous fan before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.



14. Remove the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
15. Raise the engine far enough to be able to remove the left and right engine mounts (2).
16. Remove the engine mount bolts (1), and the mounts (2).

INSTALLATION

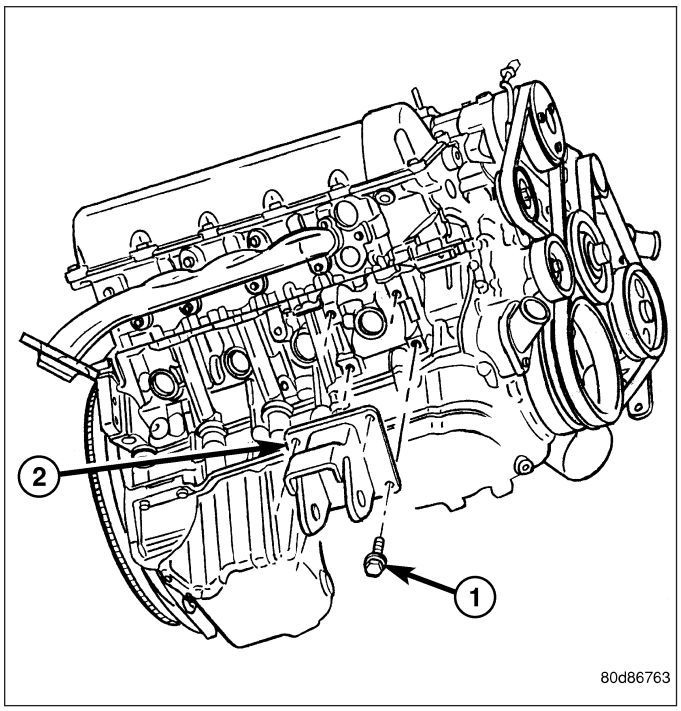
2WD

NOTE: For mount to engine block and left engine bracket to front axle bolts, apply Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.

1. Install the right and left side engine mounts to the engine block bolts. Torque bolts to 54 N·m (40 ft. lbs.).
2. Insert the through bolts into the right and left side engine mounts and loose assemble the two nuts onto the through bolts.
3. Lower the engine until the through bolts rest onto the slots in the frame brackets.
4. Tighten the through bolt nuts to 94 N·m (70 ft. lbs.).
5. Install the oil drain trough.
6. Install the engine oil filter.
7. Lower the vehicle.
8. Install the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
9. Reconnect the negative battery cable.

4WD

NOTE: For mount to engine block and left engine bracket to front axle bolts, apply Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.

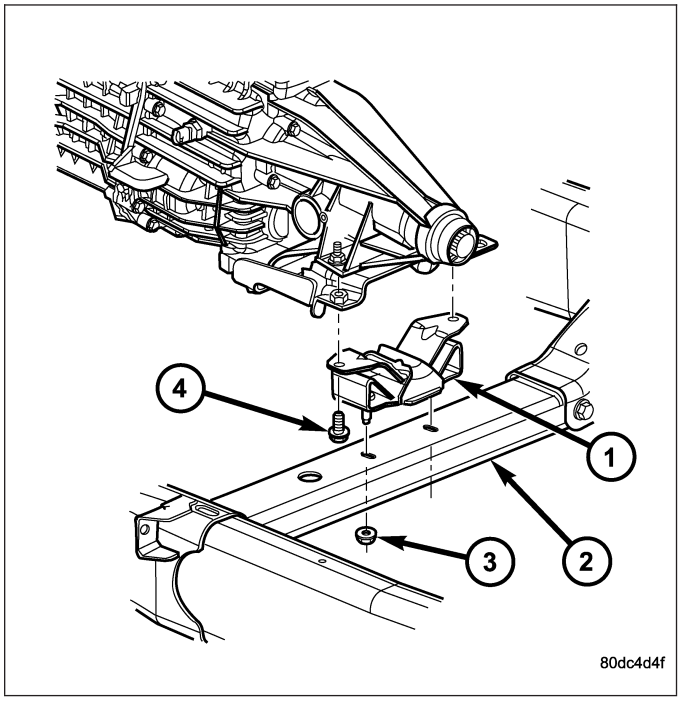


1. Install the right and left side engine mount brackets (2) to the engine.
2. Install the right and left side engine mounts to the front axle. Torque nuts to 94 N·m (70 ft. lbs.).
3. Raise the front axle into the frame and install the left and right side through bolts. Torque nuts to 94 N·m (70 ft. lbs.).
4. Insert the two upper through bolts into the right and left side engine mounts and loose assemble the two nuts onto the through bolts.
5. Lower the engine until the left and right side engine brackets rest on the through bolts, and the lower engine bracket through holes align with the engine mounts, and the left engine bracket holes align with the front axle slots.
6. Loose assemble the bolts that attach the front axle to the left engine bracket.
7. Loose assemble the lower through bolts.
8. Torque the nuts for the through bolts to 101 N·m (75 ft. lbs.).
9. Torque the bolts that attach the front axle to the left engine bracket to 101 N·m (75 ft. lbs.).
10. Install the oil drain trough.
11. Install the engine oil filter.
12. Lower the vehicle.
13. Install the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
14. Reconnect the negative battery cable.

MOUNT - REAR

REMOVAL

1. Raise the vehicle on a hoist.
2. Using a suitable jack, support transmission.
3. Remove the nuts from the transmission mount (1).
4. Remove the two bolts that attach the transmission mount to the engine bracket.
5. Raise the transmission enough to remove the mount from the crossmember (2).
6. Remove the mount (1).



INSTALLATION

NOTE: Threadlocking compound must be applied to the bolts before installation.

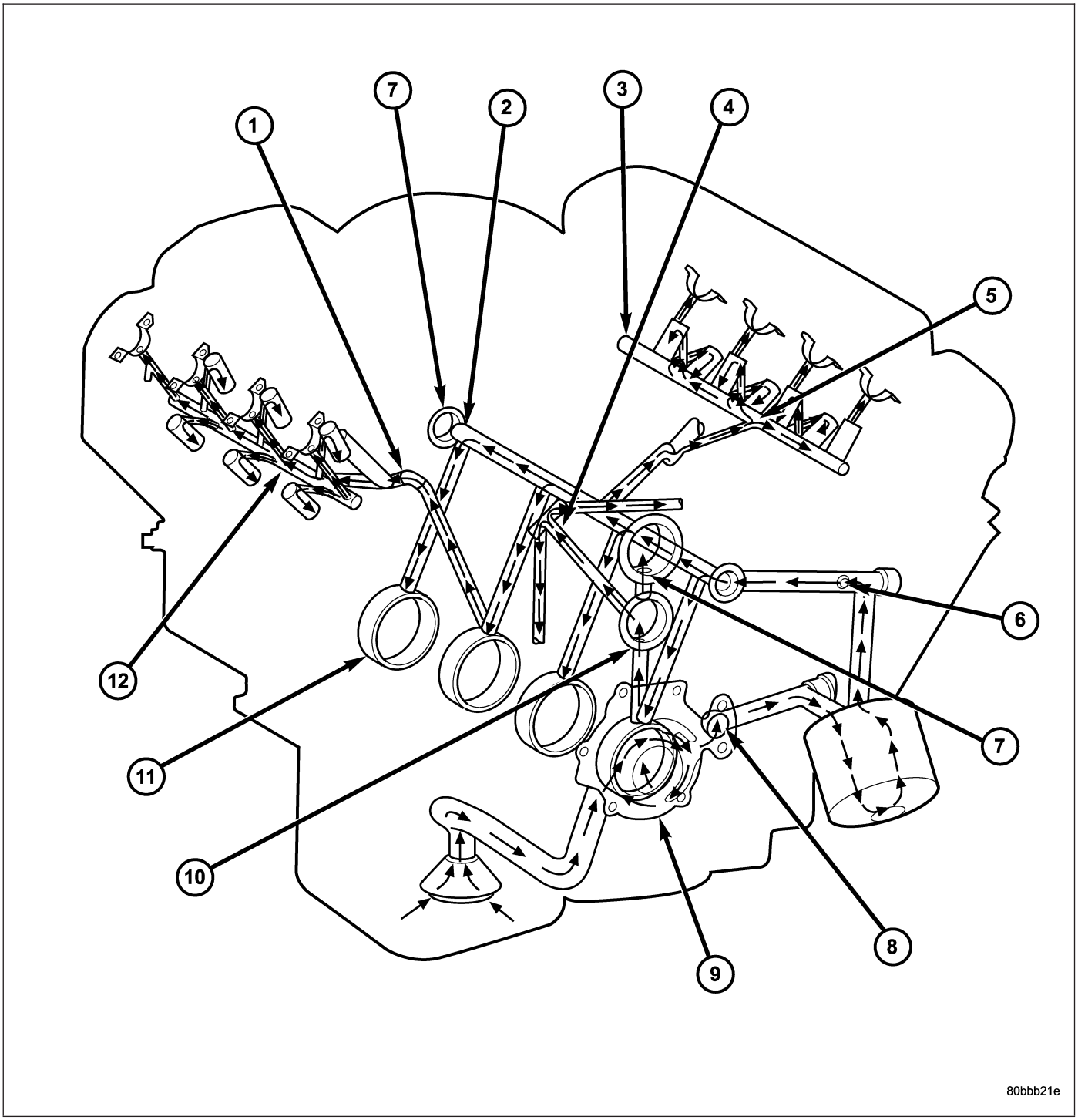
1. Install the two bolts that attach the transmission mount to the transmission bracket.
2. Torque the bolts to 61N·m (45 ft.lbs.) torque.
3. Lower the transmission so the transmission mount rests on the crossmember, and the studs of the transmission mount are aligned in the slots in the crossmember.
4. Install the nuts onto the transmission mount studs through the crossmember access slot.
5. Torque the nuts to 54N·m (40 ft. lbs.).

LUBRICATION

DESCRIPTION

The lubrication system is a full flow filtration pressure feed type.

OPERATION



1 - OIL FLOW TO RIGHT CYLINDER HEAD
2 - CYLINDER BLOCK MAIN OIL GALLERY
3 - LEFT CYLINDER HEAD OIL GALLERY
4 - OIL FLOW TO BOTH SECONDARY TENSIONERS
5 - OIL FLOW TO LEFT CYLINDER HEAD
6 - OIL PRESSURE SENSOR LOCATION
7 - OIL FLOW TO COUNTER BALANCE SHAFT
8 - OIL PUMP OUTLET TO CYLINDER BLOCK
9 - OIL PUMP
10 - OIL FLOW TO CRANKSHAFT MAIN JOURNALS
11 - CRANKSHAFT MAIN BEARING JOURNALS
12 - RIGHT CYLINDER HEAD OIL GALLERY

Oil from the oil pan is pumped by a gerotor type oil pump directly mounted to the crankshaft nose. Oil pressure is controlled by a relief valve mounted inside the oil pump housing.

The camshaft exhaust valve lobes and rocker arms are lubricated through a small hole in the rocker arm; oil flows through the lash adjuster then through the rocker arm and onto the camshaft lobe. Due to the orientation of the rocker arm, the camshaft intake lobes are not lubed in the same manner as the exhaust lobes. The intake lobes are lubed through internal passages in the camshaft. Oil flows through a bore in the No. 3 camshaft bearing bore, and as the camshaft turns, a hole in the camshaft aligns with the hole in the camshaft bore allowing engine oil to enter the camshaft tube. The oil then exits through 1.6mm (0.063 in.) holes drilled into the intake lobes, lubricating the lobes and the rocker arms.

Engine Lubrication Flow Chart - Block: Table 1

FROM	TO
Oil Pickup Tube	Oil Pump
Oil Pump	Oil Filter
Oil Filter	Block Main Oil Gallery
Block Main Oil Gallery	1. Crankshaft Main Journal 2. Left Cylinder Head* 3. Right Cylinder Head* 4. Counterbalance Shaft Rear Journal
Crankshaft Main Journals	Crankshaft Rod Journals
Crankshaft Number One Main Journal	1. Front Timing Chain Idler Shaft 2. Counterbalance Shaft - Front Journal 3. Both Secondary Chain Tensioners
Left Cylinder Head	Refer to Engine Lubrication Flow Chart - Cylinder Heads: Table 2
Right Cylinder Head	Refer to Engine Lubrication Flow Chart - Cylinder Heads: Table 2
* The cylinder head gaskets have an oil restricter to control oil flow to the cylinder heads	

Engine Lubrication Flow Chart - Cylinder Heads: Table 2

FROM	TO
Cylinder Head Oil Port (in bolt hole)	Diagonal Cross Drilling to Main Oil Gallery
Main Oil Gallery (drilled through head from rear to front)	1. Base of Camshaft Towers 2. Lash Adjuster Towers
Base of Camshaft Towers	Vertical Drilling Through Tower to Camshaft Bearings**
Lash Adjuster Towers	Diagonal Drillings to Hydraulic Lash Adjuster Pockets
** The number three camshaft bearing journal feeds oil into the hollow camshaft tubes. Oil is routed to the intake lobes, which have oil passages drilled into them to lubricate the rocker arms.	

DIAGNOSIS AND TESTING

ENGINE OIL LEAK

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

1. Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.
2. Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.

3. Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.If the oil leak source is not positively identified at this time, proceed with the air leak detection test method.

Air Leak Detection Test Method

1. Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.
2. Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.
3. Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kPa (3 PSI) of test pressure.

4. Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.
5. If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.
6. If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose.
7. Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.
4. If no leaks are detected, pressurize the crankcase as outlined in the, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

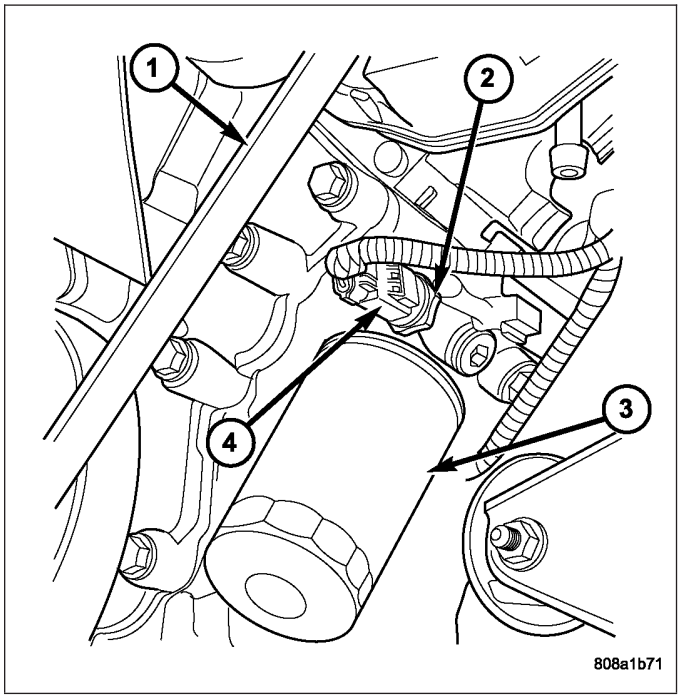
5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

CHECKING ENGINE OIL PRESSURE

1. Remove oil pressure sending unit (2) and install gauge assembly C-3292.
2. Run engine until thermostat opens.
3. Oil Pressure:
   - Curb Idle - 25 kPa (4 psi) minimum
   - 3000 rpm - 170 - 758 kPa (25 - 110 psi)
4. If oil pressure is 0 at idle, shut off engine. Check for a clogged oil pick-up screen or a pressure relief valve stuck open.



REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Engine, for proper repair procedures of these items.
4. If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

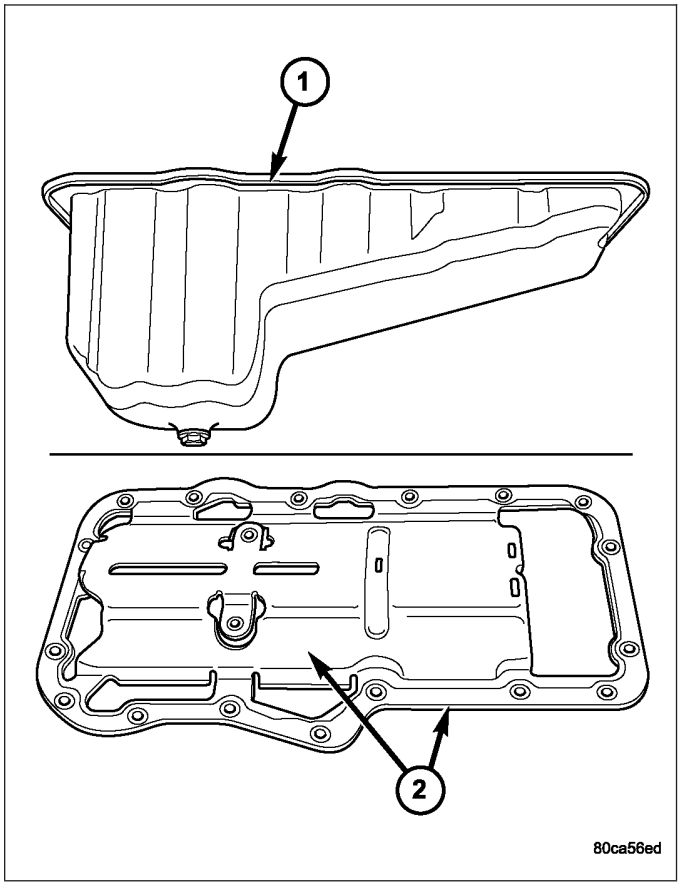
CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) , under the Oil Leak, for components inspections on possible causes and corrections.
7. After the oil leak root cause and appropriate corrective action have been identified, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).

PAN-ENGINE OIL

DESCRIPTION

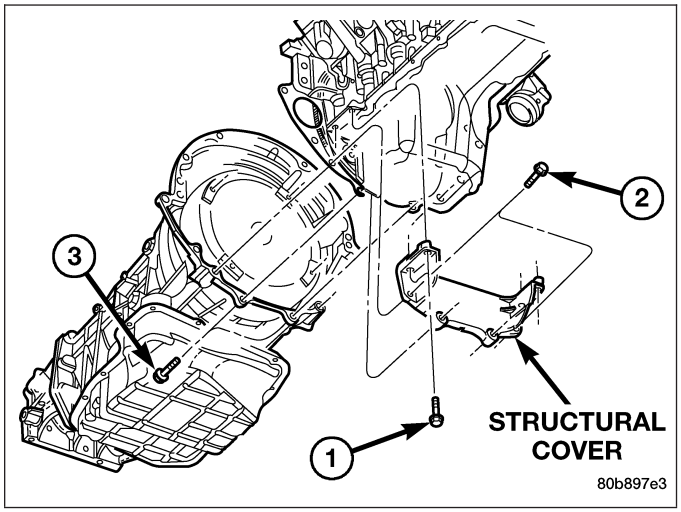
The engine oil pan (1) is made of laminated steel and has a single plane sealing surface. The sandwich style oil pan gasket has an integrated windage tray (2) and steel carrier. The sealing area of the gasket is molded with rubber and is designed to be reused as long as the gasket is not cut, torn or ripped.



REMOVAL

1. Disconnect the negative battery cable.
2. Install engine support fixture (1) special tool # 8534. **Do not raise engine at this time.**
3. Remove both left and right side engine mount through bolts.

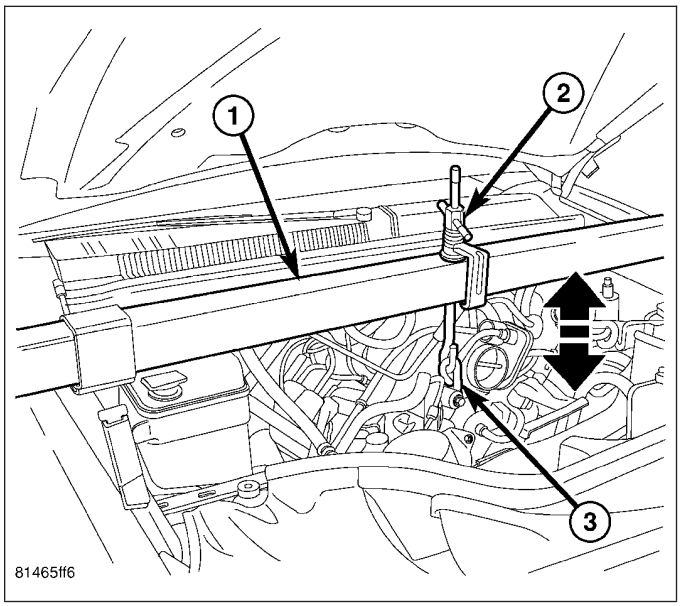
4. Remove the structural dust cover.



5. Drain engine oil.

CAUTION: Only raise the engine enough to provide clearance for oil pan removal. Check for proper clearance at fan shroud to fan and cowl to intake manifold.

6. Raise engine using special tool (1) # 8534 to provide clearance to remove oil pan.

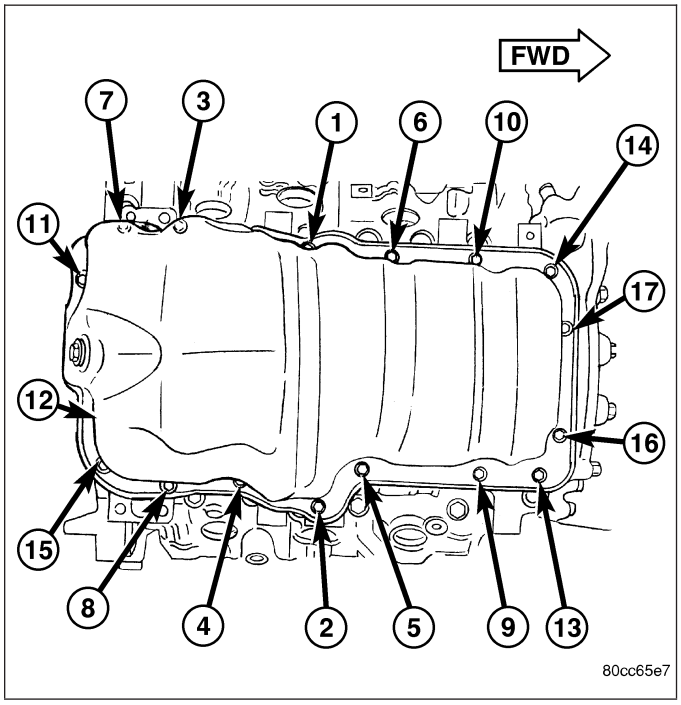


NOTE: On 4WD vehicles, the front axle must be lowered, to provide clearance for oil pan removal. It is not necessary to remove the front axle from the vehicle, or remove the axle shafts.

7. **For 4WD Vehicles** Remove the pinion bracket.
8. **For 4WD Vehicles** Disconnect the front driveshaft at the front axle.
9. **For 4WD Vehicles** Remove the front axle mounting bolts.
10. **For 4WD Vehicles** Lower axle using suitable jack enough to provide clearance to remove oil pan.

NOTE: Do not pry on oil pan or oil pan gasket. Gasket is integral to engine windage tray and does not come out with oil pan.

11. Remove the oil pan mounting bolts and oil pan.
12. Unbolt oil pump pickup tube and remove tube.
13. Inspect the integral windage tray and gasket and replace as needed.



CLEANING

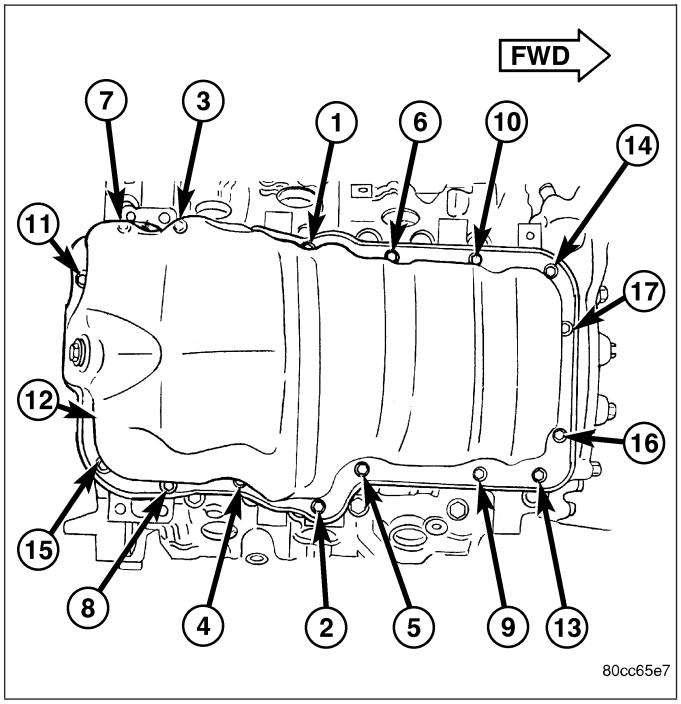
1. Clean oil pan in solvent and wipe dry with a clean cloth.
2. Clean the oil pan gasket surface. **DO NOT** use a grinder wheel or other abrasive tool to clean sealing surface.
3. Clean oil screen and tube thoroughly in clean solvent.

INSPECTION

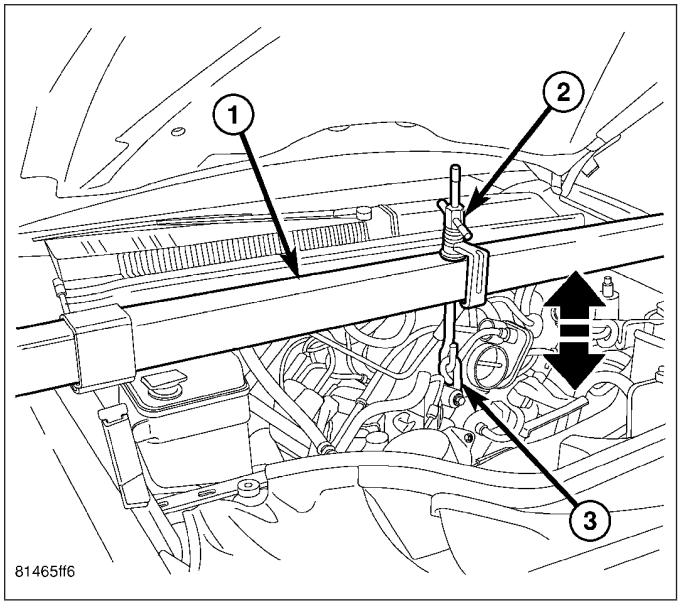
1. Inspect oil drain plug and plug hole for stripped or damaged threads. Repair as necessary.
2. Inspect the oil pan mounting flange for bends or distortion. Straighten flange, if necessary.

INSTALLATION

1. Clean the oil pan gasket mating surface of the bedplate and oil pan.
2. Position the oil pan gasket and pickup tube with new o-ring. Install the mounting bolt and nuts. Tighten bolt and nuts to 28 N·m (20 ft. lbs.).
3. Position the oil pan and install the mounting bolts. Tighten the mounting bolts to 15 N·m (11 ft. lbs.) in the sequence shown.



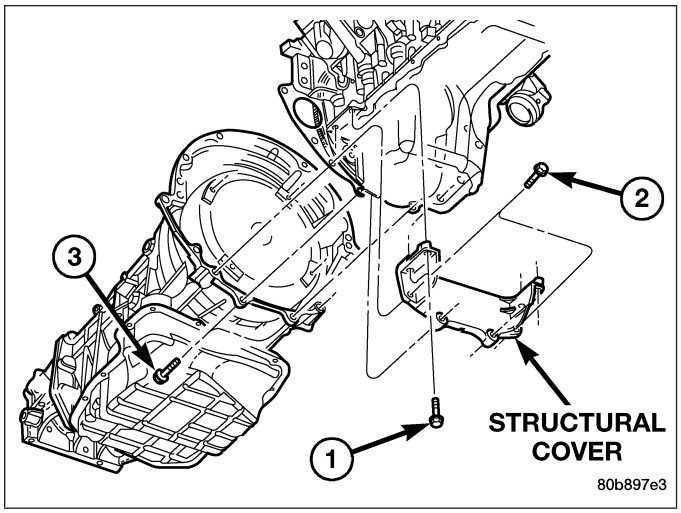
4. Lower the engine into mounts using special tool (1) # 8534.
5. Install both the left and right side engine mount through bolts. Tighten the bolts to 68 N·m (50 ft. lbs.).
6. Remove special tool # 8534.



7. Install structural dust cover.

NOTE: On 4WD vehicles, the front axle must be lowered, to provide clearance for oil pan removal. It is not necessary to remove the front axle from the vehicle, or remove the axle shafts.

8. **For 4WD Vehicles** Raise axle using suitable jack.
9. **For 4WD Vehicles** Install the front axle mounting bolts.
10. **For 4WD Vehicles** Install the pinion bracket.
11. **For 4WD Vehicles** Install the front driveshaft to the front axle.
12. Fill engine oil.
13. Reconnect the negative battery cable.
14. Start engine and check for leaks.



SENSOR/SWITCH-OIL PRESSURE

DESCRIPTION

The 3 wire, solid-state engine oil pressure sensor (sending unit) is located in an engine oil pressure gallery.

OPERATION

The oil pressure sensor uses three circuits. They are:

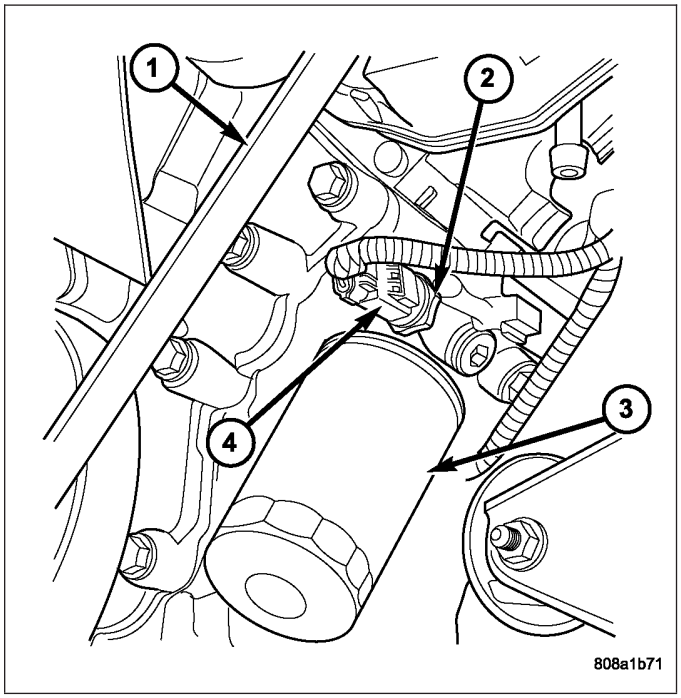
- A 5 volt power supply from the Powertrain Control Module (PCM)
- A sensor ground through the PCM's sensor return
- A signal to the PCM relating to engine oil pressure

The oil pressure sensor has a 3 wire electrical function very much like the Manifold Absolute Pressure (MAP) sensor. Meaning different pressures relate to different output voltages.

A 5 volt supply is sent to the sensor from the PCM to power up the sensor. The sensor returns a voltage signal back to the PCM relating to engine oil pressure. This signal is then transferred (bussed) to the instrument panel on either a CCD or PCI bus circuit (depending on vehicle line) to operate the oil pressure gauge and the check gauges lamp. Ground for the sensor is provided by the PCM through a low-noise sensor return.

REMOVAL

1. Disconnect the negative cable from the battery.
2. Raise vehicle on hoist.
3. Remove front splash shield.
4. Disconnect oil pressure sender connector (4).
5. Remove the pressure sender (2).



INSTALLATION

1. Install oil pressure sender.
2. Connect oil pressure sender wire.
3. Install front splash shield.
4. Lower vehicle.
5. Connect the negative battery cable.

PUMP-ENGINE OIL

REMOVAL

1. Remove the oil pan and pick-up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
2. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
3. Remove the timing chains and tensioners (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
4. Remove the four bolts, primary timing chain tensioner and the oil pump.

DISASSEMBLY

1. Remove oil pump cover screws and lift off cover plate.
2. Remove pump inner and outer rotors.

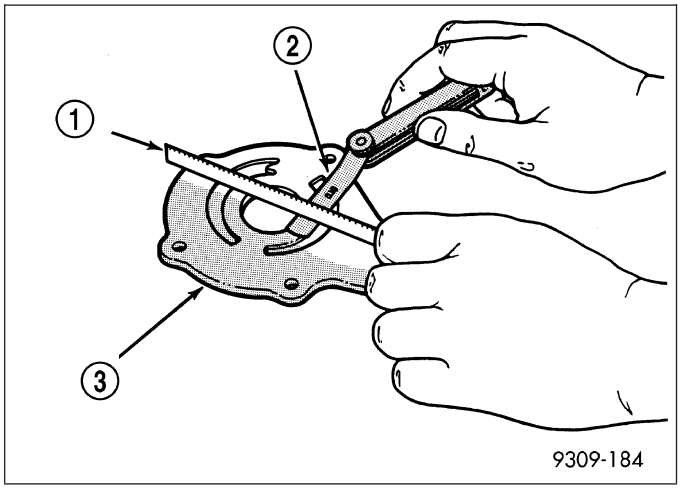
NOTE: Once the oil pressure relief valve, cup plug, and pin are removed, the pump assembly must be replaced.

3. If it is necessary to remove the pressure relief valve, drive the roll pin from pump housing and remove cup plug, spring and valve.

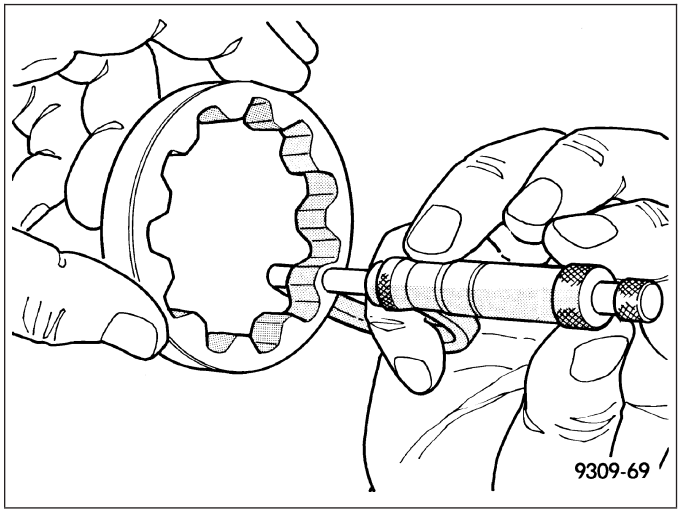
INSPECTION

CAUTION: Oil pump pressure relief valve and spring should not be removed from the oil pump. If these components are disassembled and or removed from the pump the entire oil pump assembly must be replaced.

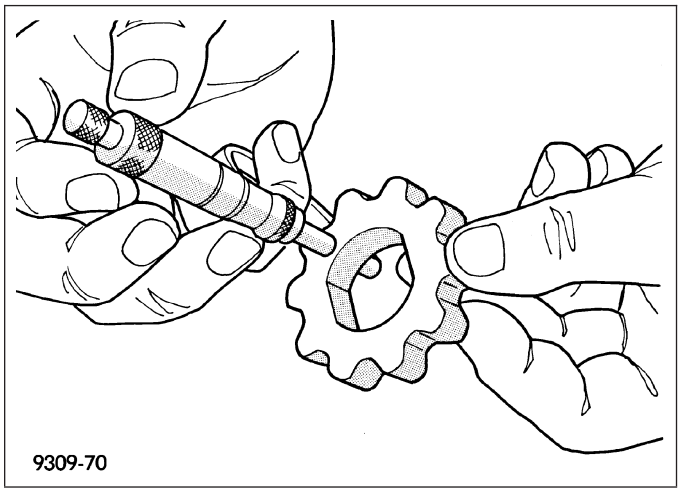
1. Clean all parts thoroughly. Mating surface of the oil pump housing should be smooth. If the pump cover is scratched or grooved the oil pump assembly should be replaced.
2. Lay a straight edge (1) across the pump cover surface. If a 0.025 mm (0.001 in.) feeler gauge (2) can be inserted between the cover and the straight edge the oil pump assembly should be replaced.



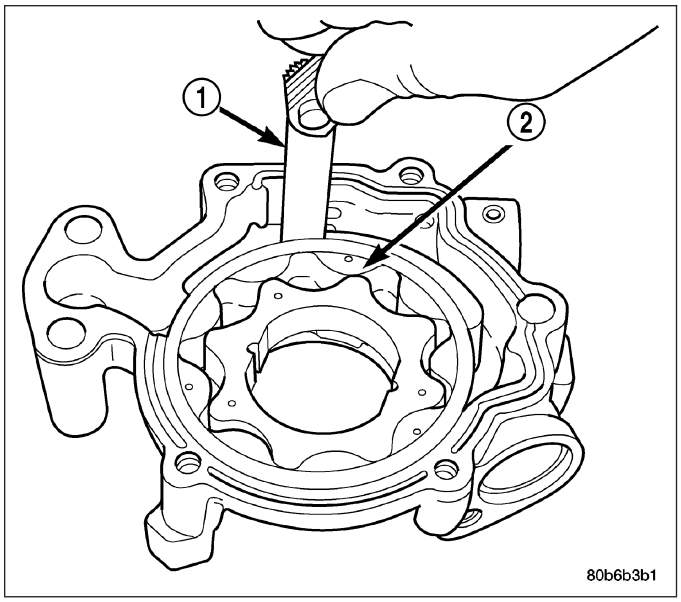
3. Measure the thickness of the outer rotor. If the outer rotor thickness measures at 12.005 mm (0.472 in.) or less the oil pump assembly must be replaced.



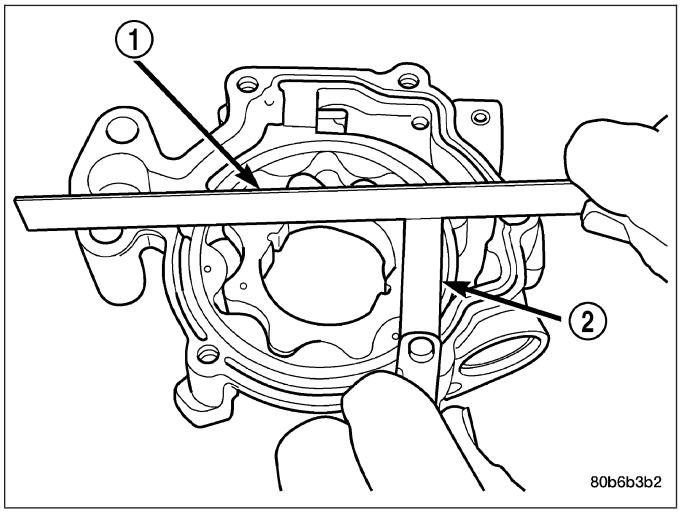
4. Measure the diameter of the outer rotor. If the outer rotor diameter measures at 85.925 mm (3.382 in.) or less the oil pump assembly must be replaced.
5. Measure the thickness of the inner rotor. If the inner rotor thickness measures at 12.005 mm (0.472 in.) or less then the oil pump assembly must be replaced.



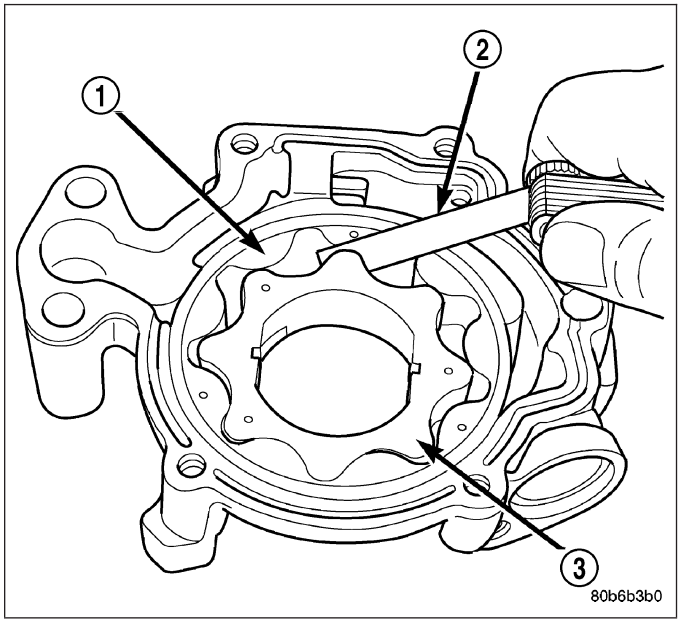
6. Slide outer rotor (1) into the body of the oil pump. Press the outer rotor to one side of the oil pump body and measure clearance between the outer rotor and the body. If the measurement is 0.235mm (0.009 in.) or more the oil pump assembly must be replaced.



7. Install the inner rotor in the into the oil pump body. Measure the clearance between the inner and outer rotors. If the clearance between the rotors is .150 mm (0.006 in.) or more the oil pump assembly must be replaced.



8. Place a straight edge (1) across the body of the oil pump (between the bolt holes), if a feeler gauge (2) of .095 mm (0.0038 in.) or greater can be inserted between the straightedge and the rotors, the pump must be replaced.



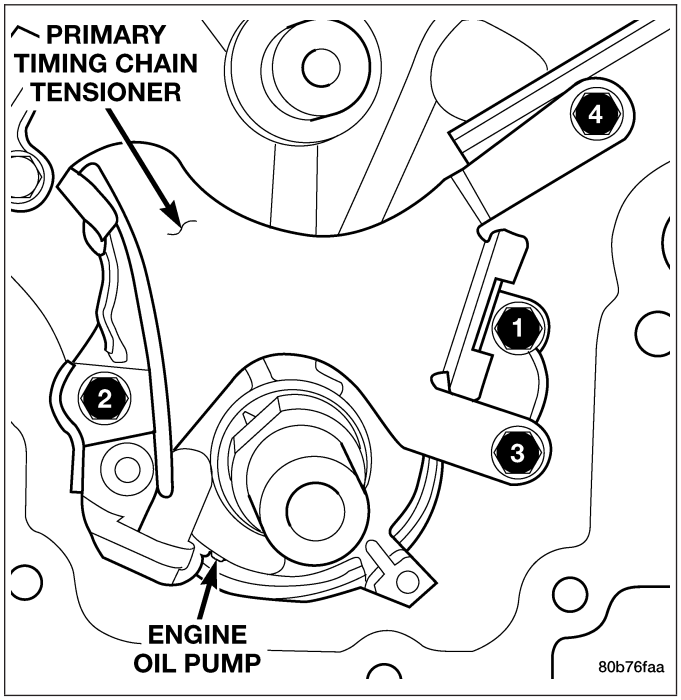
NOTE: The 3.7 Oil pump is released as an assembly. There are no DaimlerChrysler part numbers for Sub-Assembly components. In the event the oil pump is not functioning or out of specification it must be replaced as an assembly.

ASSEMBLY

1. Wash all parts in a suitable solvent and inspect carefully for damage or wear.
2. Install inner and outer rotors
3. Install oil pump cover plate and install cover bolts and tighten them to 12 N·m (105 in. lbs.).
4. Prime oil pump before installation by filling rotor cavity with engine oil.
5. If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other causes for oil pressure loss.

INSTALLATION

1. Position the oil pump onto the crankshaft and install one oil pump retaining bolts.
2. Position the primary timing chain tensioner and install three retaining bolts.
3. Tighten the oil pump and primary timing chain tensioner retaining bolts to 28 N·m (250 in. lbs.) in the sequence shown.
4. Install the secondary timing chain tensioners and timing chains (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
5. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
6. Install the pick-up tube and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).



FILTER-ENGINE OIL

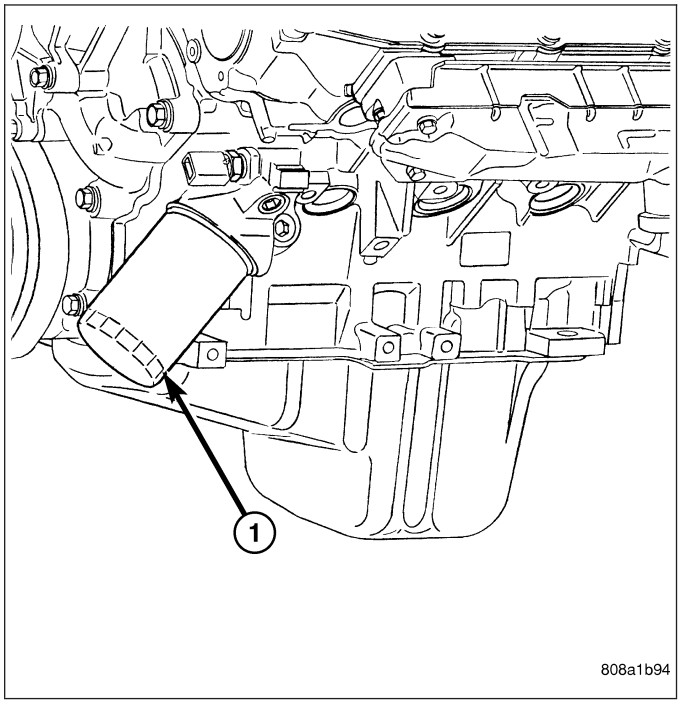
REMOVAL

All engines are equipped with a high quality full-flow, disposable type oil filter (1). DaimlerChrysler Corporation recommends a Mopar® or equivalent oil filter be used.

1. Position a drain pan under the oil filter.
2. Using a suitable oil filter wrench loosen filter.
3. Rotate the oil filter (1) counterclockwise to remove it from the cylinder block oil filter boss.
4. When filter separates from cylinder block oil filter boss, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

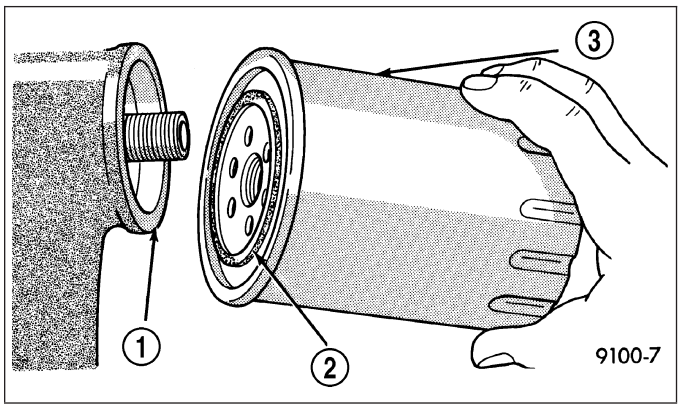
NOTE: Make sure filter gasket was removed with filter.

5. With a wiping cloth, clean the gasket sealing surface of oil and grime.



INSTALLATION

1. Lightly lubricate oil filter gasket (2) with engine oil.
2. Thread filter onto adapter nipple. When gasket makes contact with sealing surface (1), hand tighten filter (2) one full turn, do not over tighten.
3. Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.

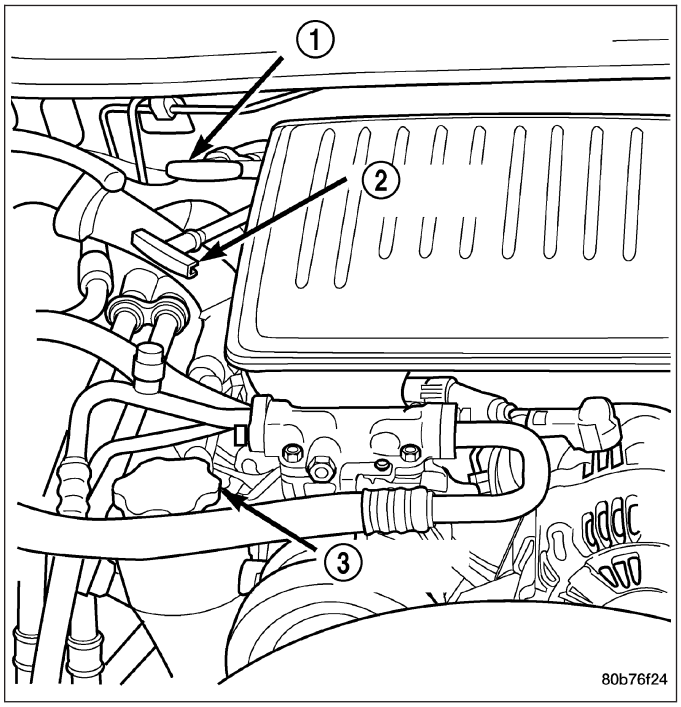


OIL

STANDARD PROCEDURE

ENGINE OIL SERVICE

The engine oil level indicator (2) is located at the right rear of the engine on the 3.7L engines..



CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, pressure loss or oil foaming can result.

Inspect engine oil level approximately every 800 kilometers (500 miles). Unless the engine has exhibited loss of oil pressure, run the engine for about five minutes before checking oil level. Checking engine oil level on a cold engine is not accurate.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

1. Position vehicle on level surface.
2. With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.
3. Wipe dipstick clean.
4. Install dipstick and verify it is seated in the tube.
5. Remove dipstick, with handle held above the tip, take oil level reading.
6. Add oil only if level is below the ADD mark on dipstick.

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in Maintenance Schedules.

Run engine until achieving normal operating temperature.

1. Position the vehicle on a level surface and turn engine off.
2. Hoist and support vehicle on safety stands.
3. Remove oil fill cap.
4. Place a suitable drain pan under crankcase drain.

5. Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.
6. Install drain plug in crankcase.
7. Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.
8. Install oil fill cap.
9. Start engine and inspect for leaks.
10. Stop engine and inspect oil level.

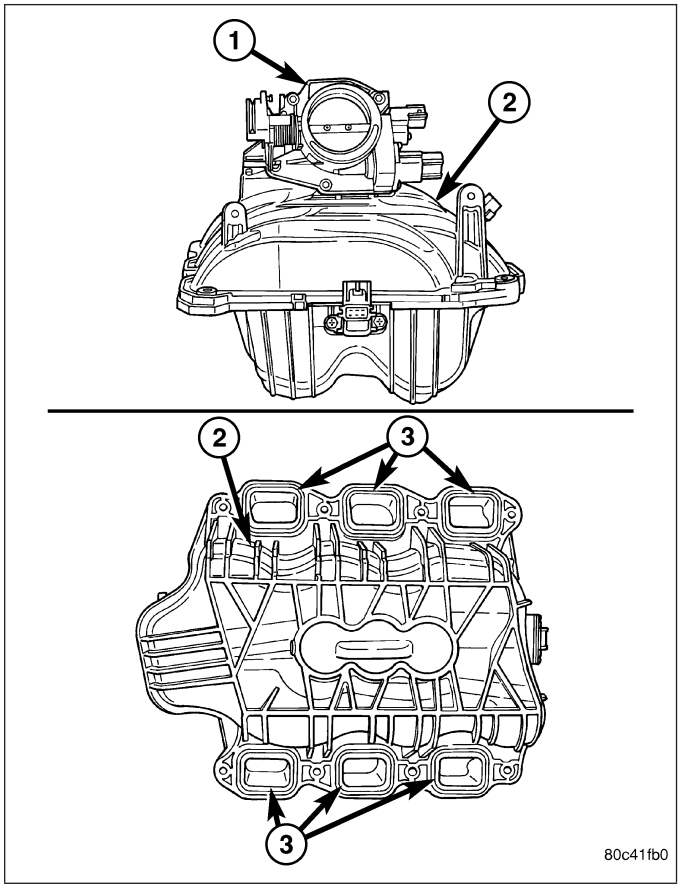
USED ENGINE OIL DISPOSAL

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING at beginning of this section.

MANIFOLD-INTAKE

DESCRIPTION

The intake manifold (2) is made of a composite material and features 300 mm (11.811 in.) long runners which maximizes low end torque. The intake manifold (2) uses single plane sealing which consist of six individual press in place port gaskets to prevent leaks. The throttle body (1) attaches directly to the intake manifold (2). Eight studs and two bolts are used to fasten the intake to the head.



DIAGNOSIS AND TESTING

INTAKE MANIFOLD LEAKS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

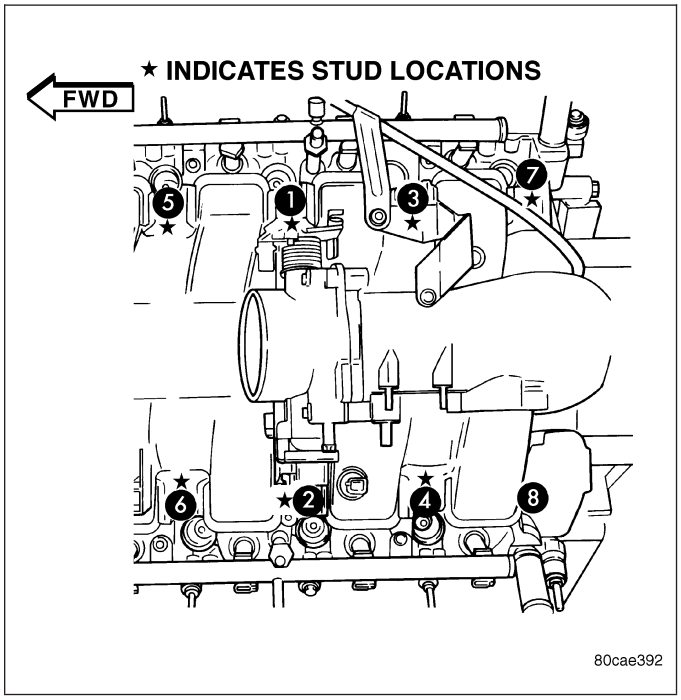
1. Start the engine.
2. Spray a small stream of water (spray bottle) at the suspected leak area.
3. If engine RPM'S change, the area of the suspected leak has been found.
4. Repair as required.

REMOVAL

1. Disconnect negative cable from battery.
2. Remove resonator assembly and air inlet hose.
3. Disconnect throttle and speed control cables.
4. Disconnect electrical connectors for the following components: Refer to FUEL SYSTEM for component locations.
   - Manifold Absolute Pressure (MAP) Sensor
   - Intake Air Temperature (IAT) Sensor
   - Throttle Position (TPS) Sensor
   - Coolant Temperature (CTS) Sensor
   - Idle Air Control (IAC) Motor
5. Disconnect vapor purge hose, brake booster hose, speed control servo hose, positive crankcase ventilation (PCV) hose.
6. Disconnect generator electrical connections.
7. Disconnect air conditioning compressor electrical connections.
8. Disconnect left and right radio suppressor straps.
9. Disconnect and remove ignition coil towers.
10. Remove top oil dipstick tube retaining bolt and ground strap.
11. Bleed fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).
12. Remove fuel rail.
13. Remove throttle body assembly and mounting bracket.
14. Drain cooling system below coolant temperature level (Refer to 7 - COOLING - STANDARD PROCEDURE).
15. Remove the heater hoses from the engine front cover and the heater core.
16. Unclip and remove heater hoses and tubes from intake manifold.
17. Remove coolant temperature sensor (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT TEMP SENSOR - REMOVAL) .
18. Remove intake manifold retaining fasteners in reverse order of tightening sequence.
19. Remove intake manifold.

INSTALLATION

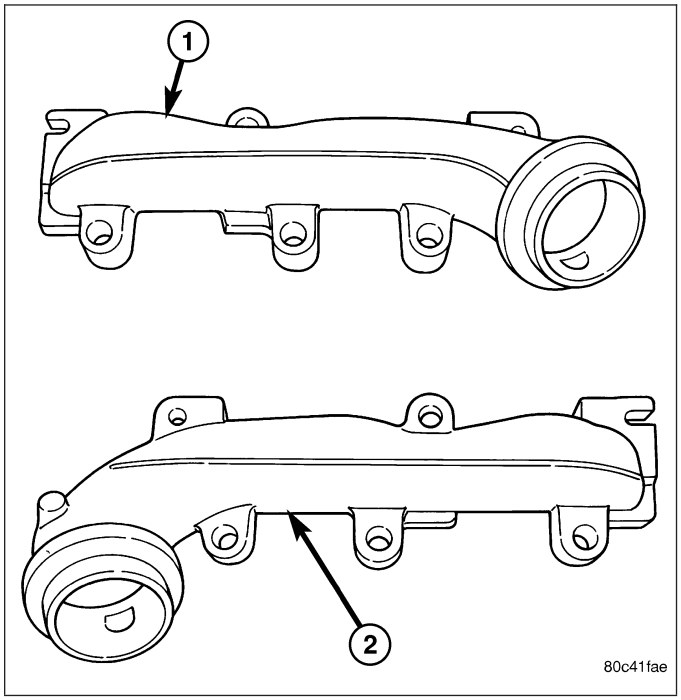
1. Install intake manifold gaskets.
2. Install intake manifold.
3. Install intake manifold retaining bolts and tighten in sequence shown in to 12 N·m (105 in. lbs.).
4. Install left and right radio suppressor straps.
5. Install throttle body assembly.
6. Connect throttle cable and speed control cable to throttle body.
7. Install fuel rail.
8. Install ignition coil towers.
9. Position and install heater hoses and tubes onto intake manifold.
10. Install the heater hoses to the heater core and engine front cover.
11. Connect electrical connectors for the following components:
    - Manifold Absolute Pressure (MAP) Sensor
    - Intake Air Temperature (IAT) Sensor
    - Throttle Position (TPS) Sensor
    - Coolant Temperature (CTS) Sensor
    - Idle Air Control (IAC) Motor
    - Ignition coil towers
    - Fuel injectors
12. Install top oil dipstick tube retaining bolt and ground strap.
13. Connect generator electrical connections.
14. Connect Vapor purge hose, Brake booster hose, Speed control servo hose, Positive crankcase ventilation (PCV) hose.
15. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
16. Install resonator assembly and air inlet hose.
17. Connect negative cable to battery.



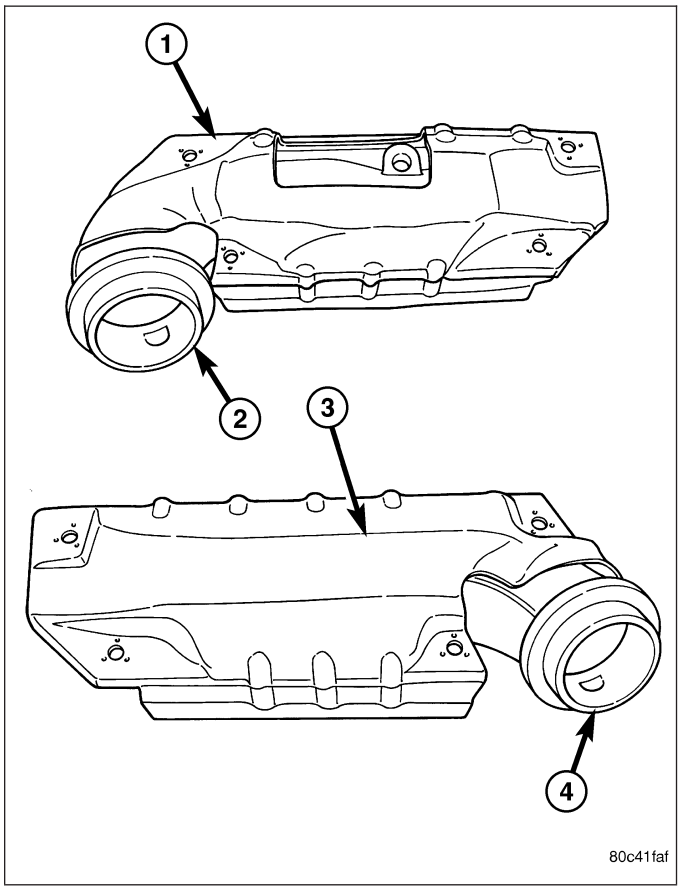
MANIFOLD-EXHAUST

DESCRIPTION

The exhaust manifolds(1 and 2) are log style with a patented flow enhancing design to maximize performance. The exhaust manifolds are made of high silicon molybdenum cast iron. A perforated core graphite exhaust manifold gasket is used to improve sealing to the cylinder head.



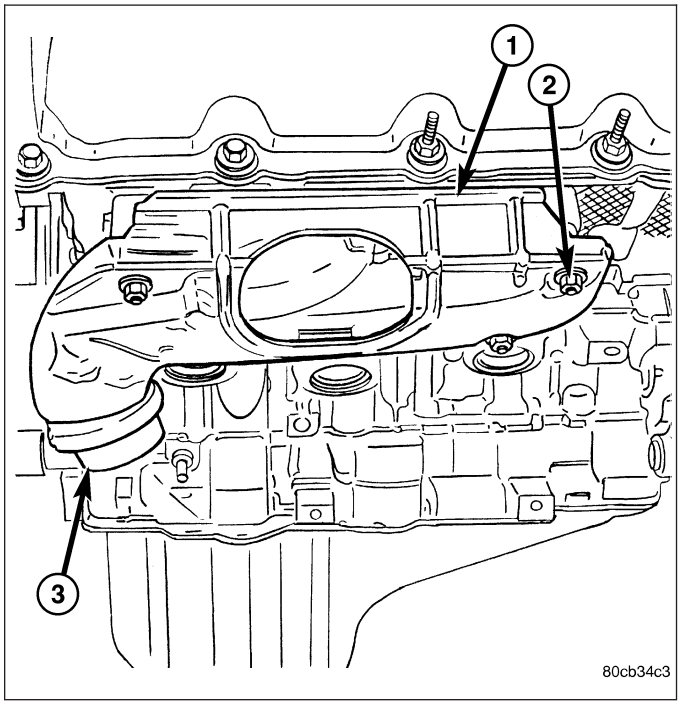
The exhaust manifolds are covered by a three layer laminated heat shield (1 and 3) for thermal protection and noise reduction. The heat shields(1 and 3) are fastened with a torque prevailing nut that is backed off slightly to allow for the thermal expansion of the exhaust manifold.



REMOVAL

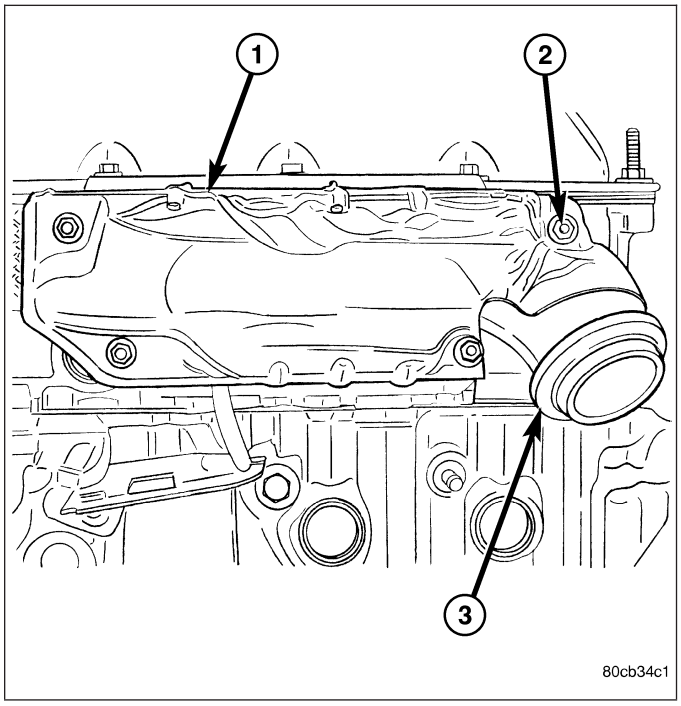
RIGHT EXHAUST MANIFOLD

1. Disconnect the negative cable from the battery.
2. Raise and support the vehicle.
3. Remove the bolts and nuts attaching the exhaust pipe to the engine exhaust manifold.
4. Lower the vehicle.
5. Remove the exhaust heat shield (1).
6. Remove bolts, nuts (2) and washers attaching manifold to cylinder head.
7. Remove manifold and gasket from the cylinder head.



LEFT EXHAUST MANIFOLD

1. Disconnect the negative cable from the battery.
2. Raise and support the vehicle.
3. Remove the bolts and nuts attaching the exhaust pipe to the engine exhaust manifold.
4. Lower the vehicle.
5. Remove the exhaust heat shields (1).
6. Remove bolts, nuts (2) and washers attaching manifold to cylinder head.
7. Remove manifold and gasket from the cylinder head.



INSTALLATION

RIGHT EXHAUST MANIFOLD

CAUTION: If the studs came out with the nuts when removing the engine exhaust manifold, install new studs. Apply sealer on the coarse thread ends. Water leaks may develop at the studs if this precaution is not taken.

1. Position the engine exhaust manifold and gasket on the two studs located on the cylinder head. Install conical washers and nuts on these studs.
2. Install remaining conical washers. Starting at the center arm and working outward, tighten the bolts and nuts to 25 N·m (18 ft. lbs.) torque.
3. Install the exhaust heat shields.
4. Raise and support the vehicle.

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

5. Assemble exhaust pipe to manifold and secure with bolts, nuts and retainers. Tighten the bolts and nuts to 34 N·m (25 ft. lbs.) torque.

LEFT EXHAUST MANIFOLD

CAUTION: If the studs came out with the nuts when removing the engine exhaust manifold, install new studs. Apply sealer on the coarse thread ends. Water leaks may develop at the studs if this precaution is not taken.

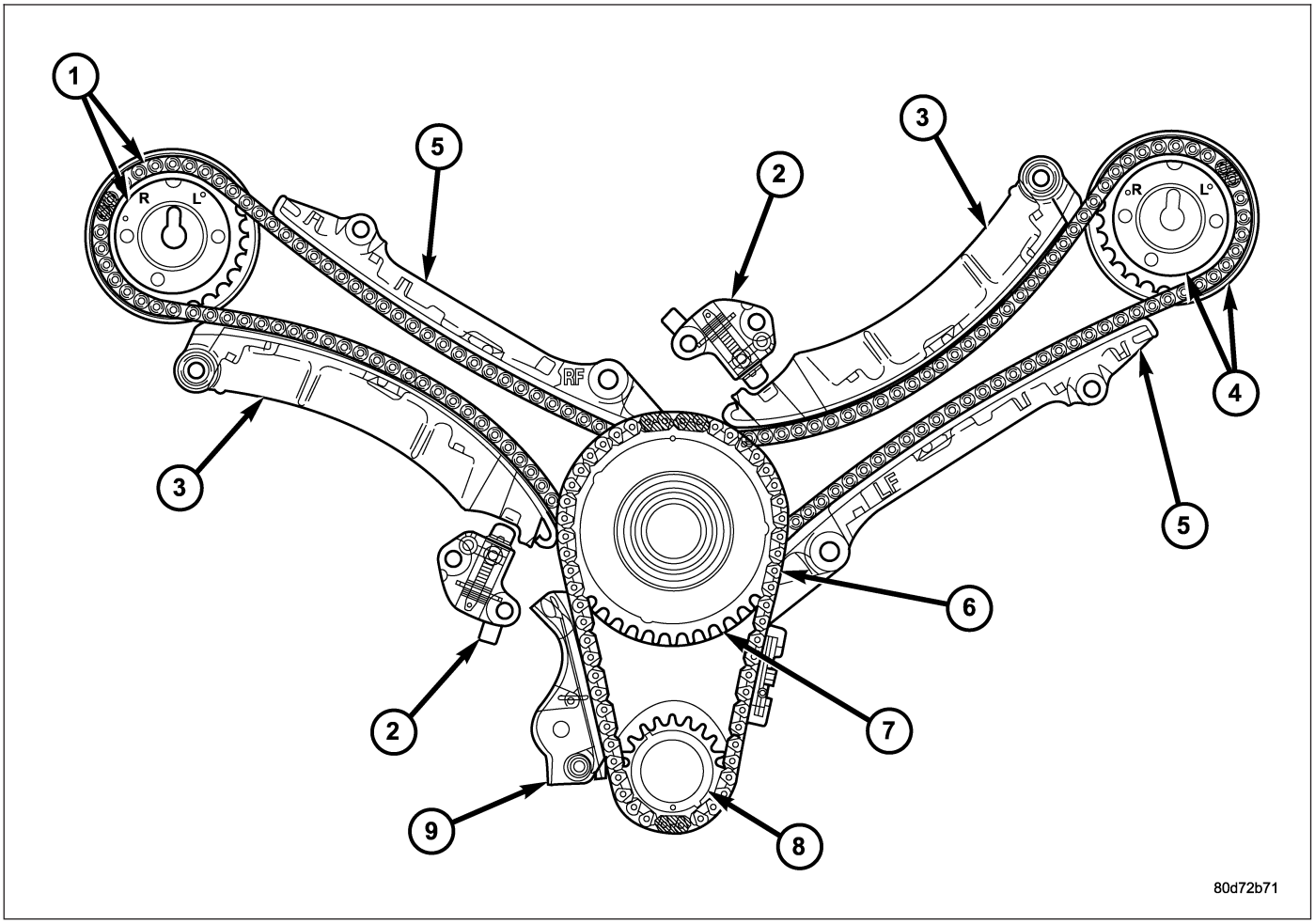
1. Position the engine exhaust manifold and gasket on the two studs located on the cylinder head. Install conical washers and nuts on these studs.
2. Install remaining conical washers. Starting at the center arm and working outward, tighten the bolts and nuts to 25 N·m (18 ft. lbs.) torque.
3. Install the exhaust heat shields.
4. Raise and support the vehicle.

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

5. Assemble exhaust pipe to manifold and secure with bolts, nuts and retainers. Tighten the bolts and nuts to 34 N·m (25 ft. lbs.) torque.

VALVE TIMING

DESCRIPTION



Timing Drive System

1 - RIGHT CAMSHAFT SPROCKET AND SECONDARY CHAIN
2 - SECONDARY TIMING CHAIN TENSIONER (LEFT AND RIGHT SIDE NOT INTERCHANGEABLE)
3 - SECONDARY TENSIONER ARM
4 - LEFT CAMSHAFT SPROCKET AND SECONDARY CHAIN
5 - CHAIN GUIDE (LEFT AND RIGHT SIDE ARE NOT INTERCHANGEABLE)
6 - PRIMARY CHAIN
7 - IDLER SPROCKET
8 - CRANKSHAFT SPROCKET
9 - PRIMARY CHAIN TENSIONER

The timing drive system has been designed to provide quiet performance and reliability to support a **non-free wheeling** engine. Specifically the intake valves are non-free wheeling and can be easily damaged with forceful engine rotation if camshaft-to-crankshaft timing is incorrect. The timing drive system consists of a primary chain, two secondary timing chain drives and a counterbalance shaft drive.

OPERATION

The primary timing chain is a single inverted tooth chain type. The primary chain drives the large 50 tooth idler sprocket directly from a 25 tooth crankshaft sprocket. Primary chain motion is controlled by a pivoting leaf spring tensioner arm and a fixed guide. The arm and the guide both use nylon plastic wear faces for low friction and long wear. The primary chain receives oil splash lubrication from the secondary chain drive and designed oil pump leakage. The idler sprocket assembly connects the primary chain drive, secondary chain drives, and the counterbalance shaft. The idler sprocket assembly consists of two integral 26 tooth sprockets a 50 tooth sprocket and a helical gear that is press-fit to the assembly. The spline joint for the 50 tooth sprocket is a non serviceable press fit anti rattle

type. A spiral ring is installed on the outboard side of the 50 tooth sprocket to prevent spline disengagement. The idler sprocket assembly spins on a stationary idler shaft. The idler shaft is a light press-fit into the cylinder block. A large washer on the idler shaft bolt and the rear flange of the idler shaft are used to control sprocket thrust movement. Pressurized oil is routed through the center of the idler shaft to provide lubrication for the two bushings used in the idler sprocket assembly.

There are two secondary drive chains, both are roller type, one to drive the camshaft in each SOHC cylinder head. There are no shaft speed changes in the secondary chain drive system. Each secondary chain drives a 26 tooth cam sprocket directly from the 26 tooth sprocket on the idler sprocket assembly. A fixed chain guide and a hydraulic oil damped tensioner are used to maintain tension in each secondary chain system. The hydraulic tensioners for the secondary chain systems are fed pressurized oil from oil reservoir pockets in the block. Each tensioner incorporates a controlled leak path through a device known as a vent disc located in the nose of the piston to manage chain loads. Each tensioner also has a mechanical ratchet system that limits chain slack if the tensioner piston bleeds down after engine shut down. The tensioner arms and guides also utilize nylon wear faces for low friction and long wear. The secondary timing chains receive lubrication from a small orifice in the tensioners. This orifice is protected from clogging by a fine mesh screen which is located on the back of the hydraulic tensioners.

STANDARD PROCEDURE

MEASURING TIMING CHAIN WEAR

NOTE: This procedure must be performed with the timing chain cover removed.

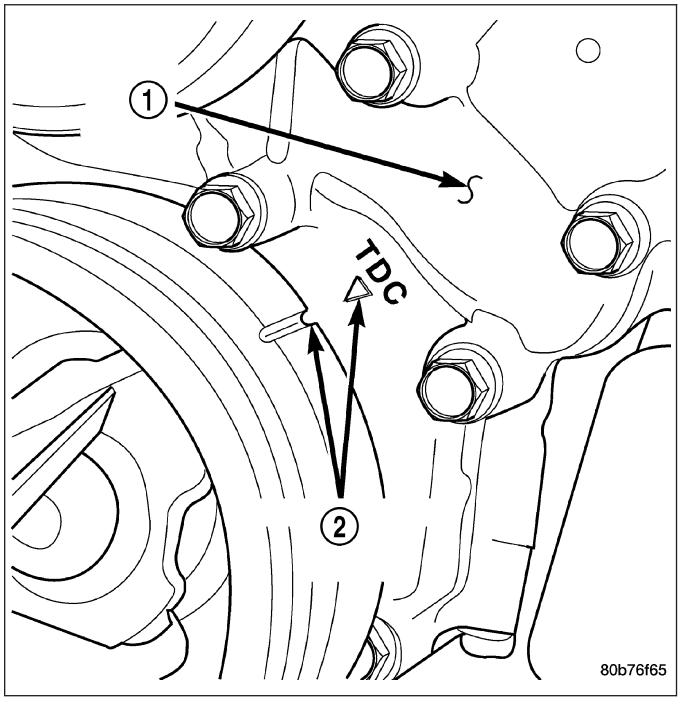
1. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
2. To determine if the secondary timing chains are worn, rotate the engine clockwise until maximum tensioner piston extension is obtained. Measure the distance between the secondary timing chain tensioner housing and the step ledge on the piston. The measurement at point (A) must be less than 15mm (.5906 inches).
3. If the measurement exceeds the specification the secondary timing chains are worn and require replacement (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

SERVICE PROCEDURE - TIMING VERIFICATION

CAUTION: The 3.7L is a non free-wheeling design engine. Therefore, correct engine timing is critical.

NOTE: Components referred to as left hand or right hand are as viewed from the drivers position inside the vehicle.

NOTE: The blue link plates on the chains and the dots on the camshaft drive sprockets may not line up during the timing verification procedure. The blue link plates are lined up with the sprocket dots only when re-timing the complete timing drive. Once the timing drive is rotated blue link-to-dot alignment is no longer valid.

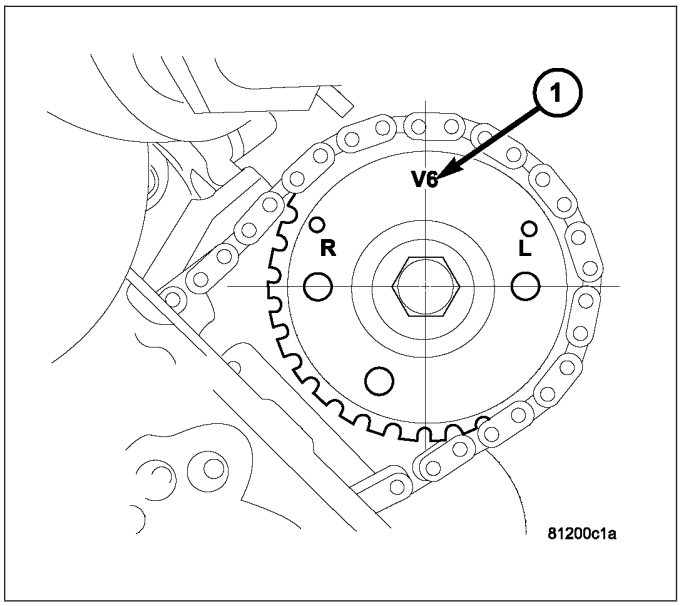


Engine base timing can be verified by the following procedure:

1. Remove the cylinder head covers. Refer to the procedure in this section.
2. Using a mirror, locate the TDC arrow (2) on the front cover (1). Rotate the crankshaft until the mark

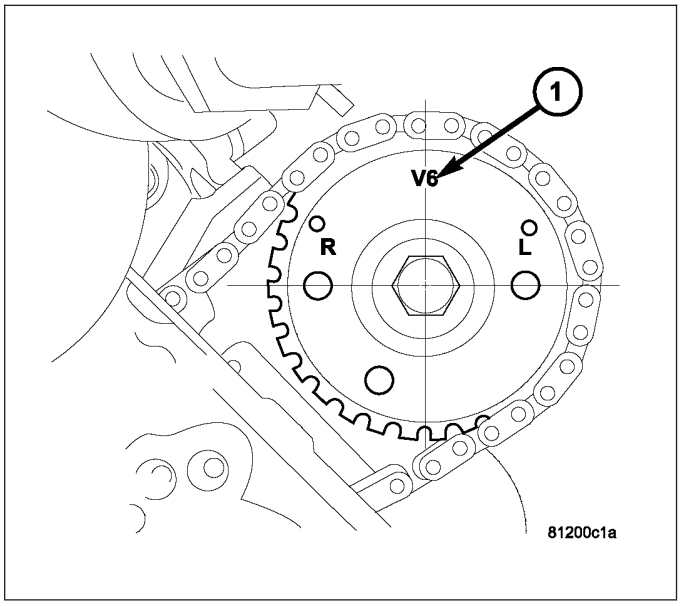
on the crankshaft damper is aligned with the TDC arrow on the front cover. The engine is now at TDC.

3. Note the location of the V6 mark (1) stamped into the camshaft drive gears. If the V6 mark on each camshaft drive gear is at the twelve o'clock position, the engine is at TDC on the exhaust stroke. If the V6 mark on each gear is at the six o'clock position, the engine is at TDC on the compression stroke.
4. If both of the camshaft drive gears are off in the same or opposite directions, the primary chain or both secondary chains are at fault. Refer to Timing Chain and Sprockets procedure in this section.
5. If only one of the camshaft drive gears is off and the other is correct, the problem is confined to one secondary chain. Refer to Single camshaft timing, in this procedure.
6. If both camshaft drive gear V6 marks are at the twelve o'clock or the six o'clock position the engine base timing is correct. Reinstall the cylinder head covers.

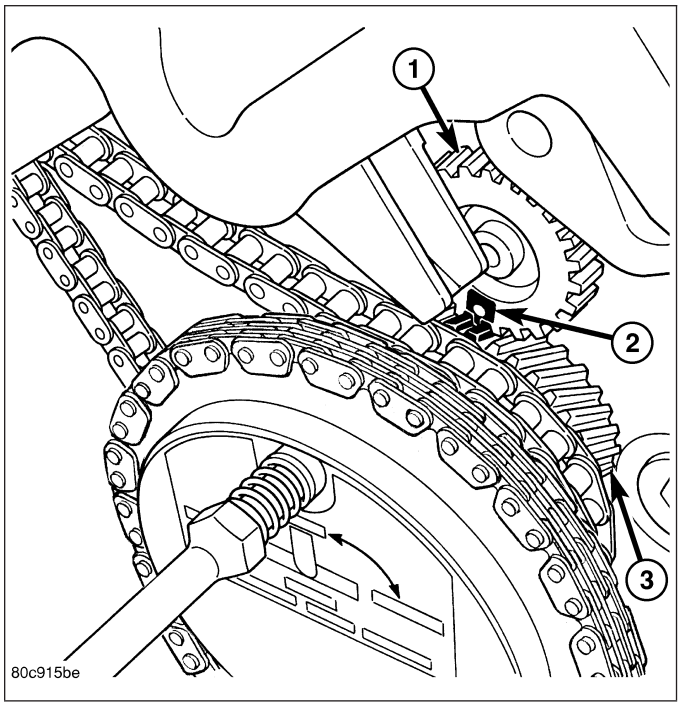


COUNTER BALANCE SHAFT TIMING

1. Ensure that the engine is at TDC with both camshaft sprocket V6 marks (1) in the 12 o'clock position.



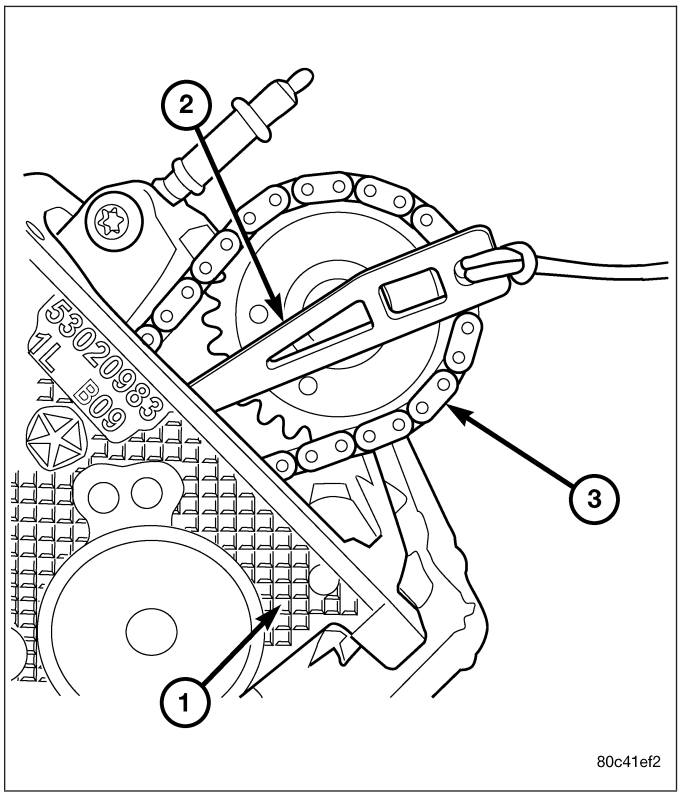
2. Look down the left cylinder head chain cavity. The timing dot on the counter balance shaft drive gear should be in the 6 o'clock position (2).



TIMING - SINGLE CAMSHAFT

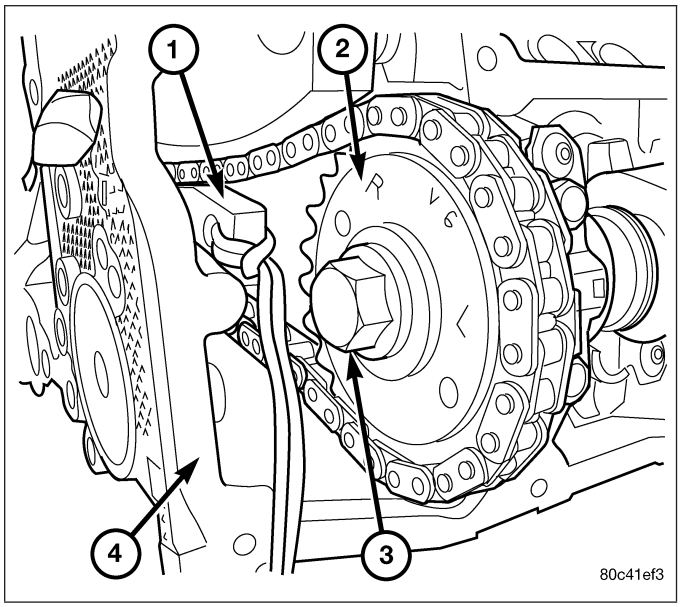
NOTE: to adjust the timing on one camshaft, preform the following procedure.

1. Using Chain Tensioner Wedge, Special Tool 8379 (2), stabilize the secondary chain drive (3). For reference purposes, mark the chain-to-sprocket position.



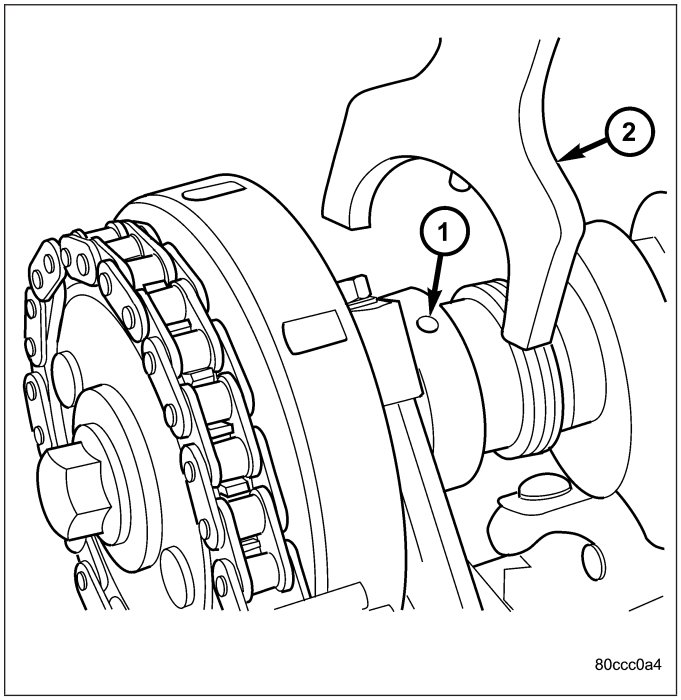
2. Remove the camshaft drive gear retaining bolt.

3. Carefully remove the camshaft drive gear (2) from the camshaft.
4. Re-index the camshaft drive gear in the chain until the V6 mark is at the same position as the V6 mark on the opposite camshaft drive gear.

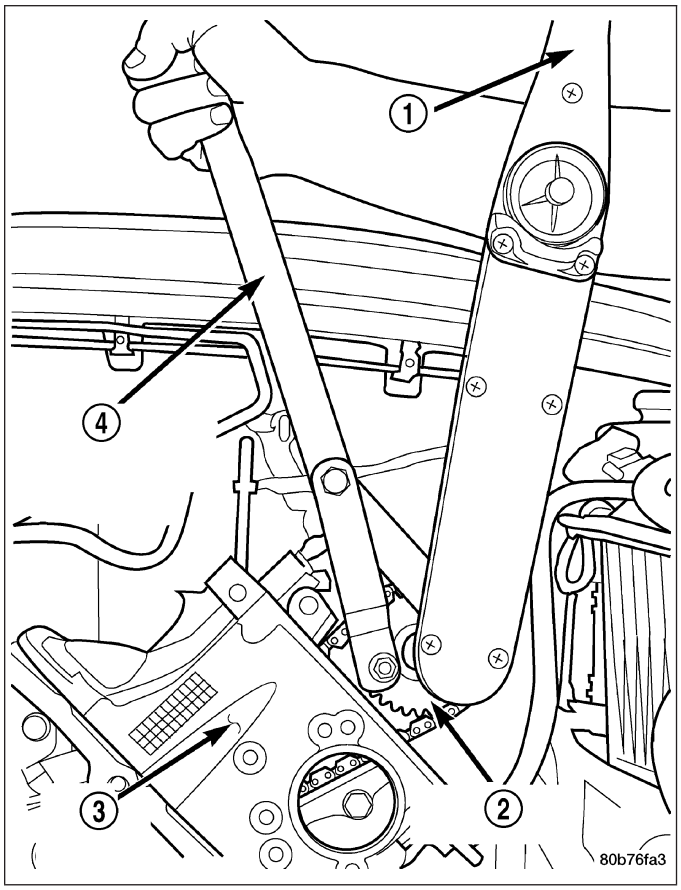


5. Using Special Tool 8428 Camshaft Wrench (2), rotate the camshaft until the alignment dowel on the camshaft is aligned with the slot in the camshaft drive gear.

CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torqueing of bolt resulting in bolt failure.



6. Position the camshaft drive gear onto the camshaft, remove oil from bolt then install the retaining bolt. Using Special Tools, Spanner Wrench 6958 with Adapter Pins 8346 (4) and a suitable torque wrench (1), tighten retaining bolt to 122 N·m (90 ft. Lbs.).
7. Remove Special Tool 8379.
8. Rotate the crankshaft two full revolutions, then verify that the camshaft drive gear V6 marks are in fact aligned.
9. Install the cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

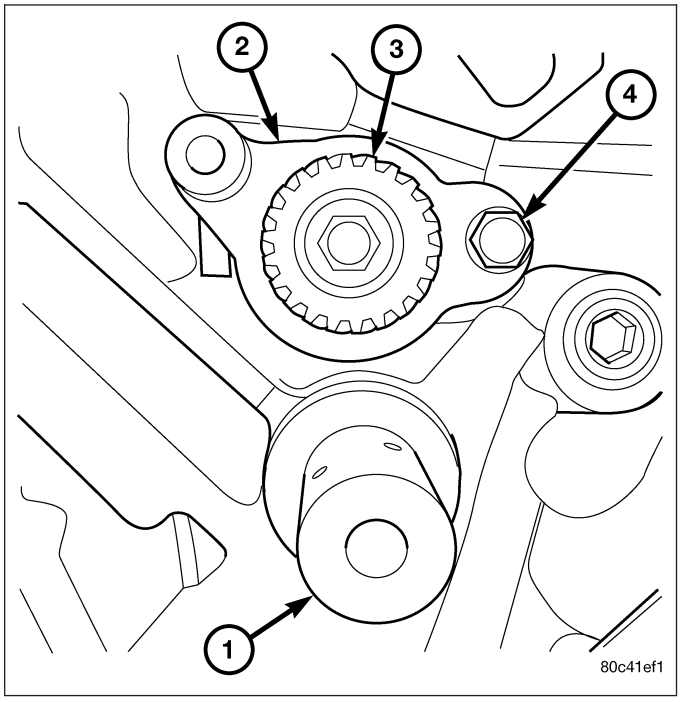


SHAFT-BALANCE

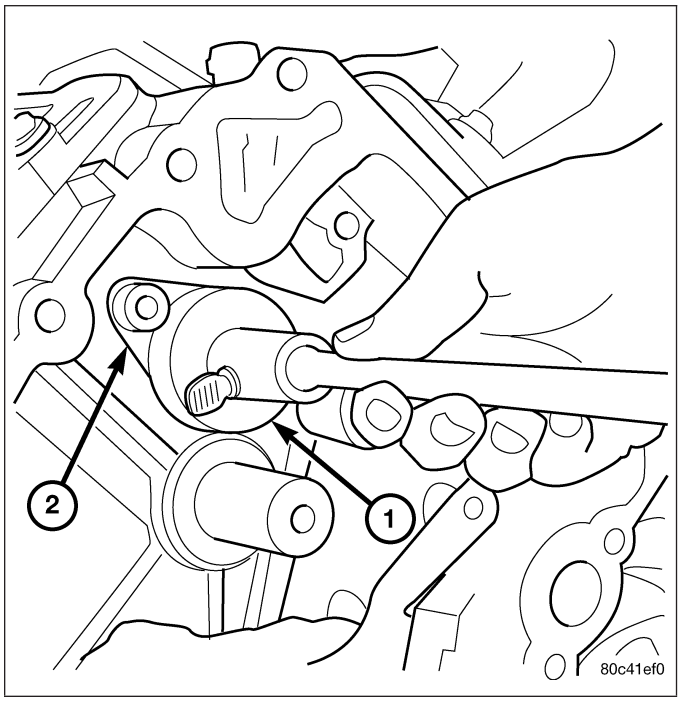
REMOVAL

1. Remove the primary and secondary timing chains. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

NOTE: The balance shaft and gear are serviced as an assembly. Do not attempt to remove the gear from the balance shaft.Remove the retaining bolt (4) from the counterbalance shaft thrust plate (2).



2. Using Special Tool 8641 Counterbalance shaft remover/installer tool (1), remove the counterbalance shaft from the engine.



INSTALLATION

NOTE: The balance shaft and gear are serviced as an assembly. Do not attempt to remove the gear from the balance shaft.

1. Coat counterbalance shaft bearing journals with clean engine oil.

NOTE: The balance shaft is heavy, and care should be used when installing shaft, so bearings are not damaged.

2. Using Special Tool 8641 Counterbalance shaft remover/installer tool, carefully install counterbalance shaft into engine.
3. Install Counterbalance shaft thrust plate retaining bolt finger tight.Do not tighten bolt at this time.
4. Position the right side of the thrust plate with the right chain guide bolt, install bolt finger tight.
5. Torque the thrust plate retaining bolt to 28 N·m (250 in. lbs.).
6. Remove the chain guide bolt so that guide can be installed.

IDLER SHAFT

REMOVAL

1. Remove the primary and secondary timing chains and sprockets. Refer to procedure in this section.

NOTE: To remove the idler shaft, it is necessary to tap threads into the shaft, to install the removal tool.

2. Using a 12 mm X 1.75 tap, cut threads in the idler shaft center bore.
3. Cover the radiator core with a suitable cover.

CAUTION: Use care when removing the idler shaft, Do not strike the radiator cooling fins with the slide hammer.

4. Using Special Tool 8517 Slide Hammer, remove the idler shaft.

INSTALLATION

1. Thoroughly clean the idler shaft bore.
2. Position the idler shaft in the bore.

NOTE: The two lubrication holes in the idler shaft do not require any special alignment.

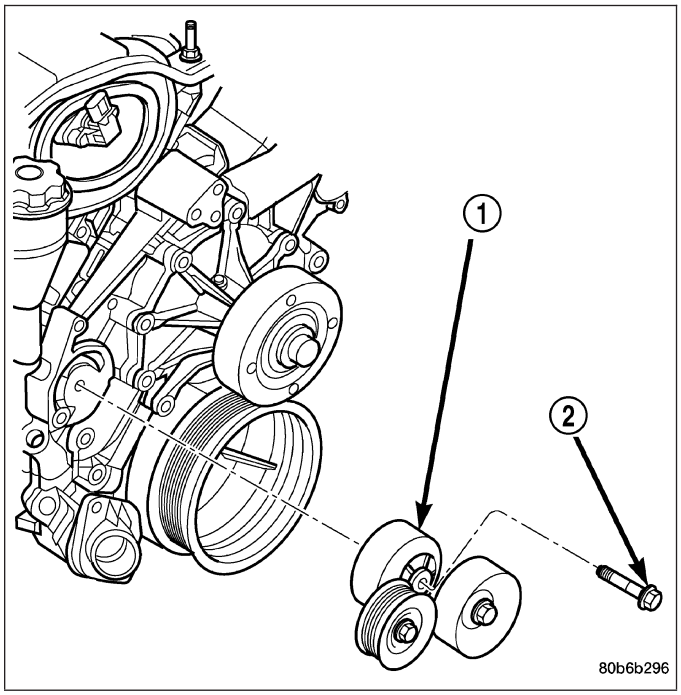
NOTE: Before using the retaining bolt to install the idler shaft, coat the threads and the pilot on the idler shaft, with clean engine oil.

3. Using the primary idler sprocket retaining bolt and washer, carefully draw the idler shaft into the bore until fully seated.
4. Coat the idler shaft with clean engine oil.
5. Install the timing chains and sprockets. Refer to procedure in this section.

COVER - TIMING

REMOVAL

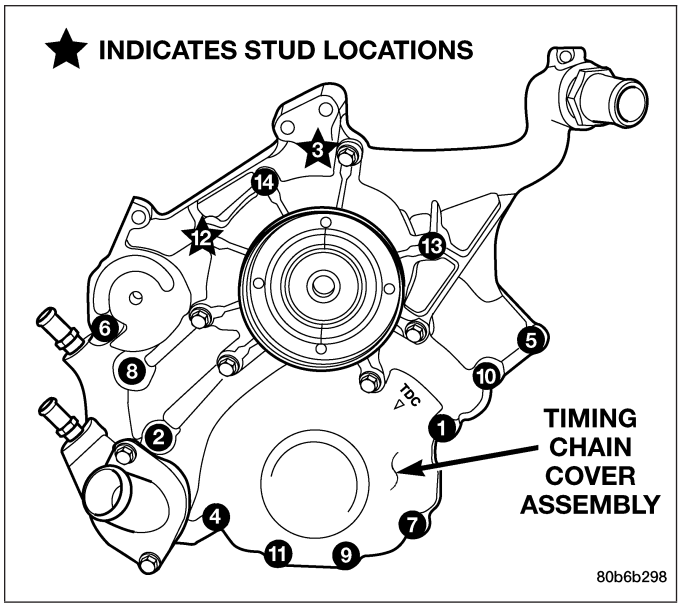
1. Disconnect the battery negative cable.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Remove electric cooling fan and fan shroud assembly.
4. Remove radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
5. Disconnect both heater hoses at timing cover.
6. Disconnect lower radiator hose at engine.
7. Remove accessory drive belt tensioner assembly (1).
8. Remove crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
9. Remove the generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).
10. Remove A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL).



CAUTION: The 3.7L engine uses an anerobic sealer instead of a gasket to seal the front cover to the engine block, from the factory. For service, Mopar® Grey Engine RTV sealant must be substituted.

NOTE: It is not necessary to remove the water pump for timing cover removal.

11. Remove the bolts holding the timing cover to engine block.
12. Remove the timing cover.



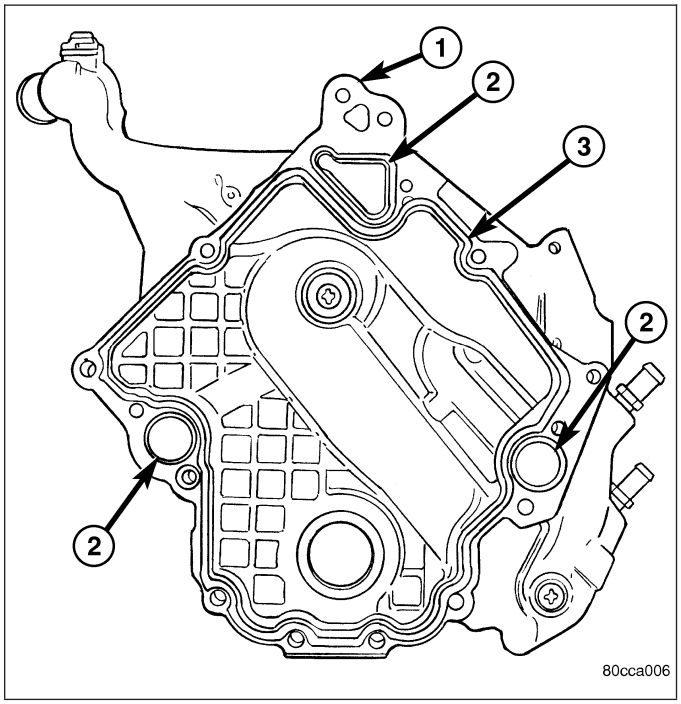
INSTALLATION

CAUTION: Do not use oil based liquids to clean timing cover or block surfaces. Use only rubbing alcohol, along with plastic or wooden scrapers. Use no wire brushes or abrasive wheels or metal scrapers, or damage to surfaces could result.

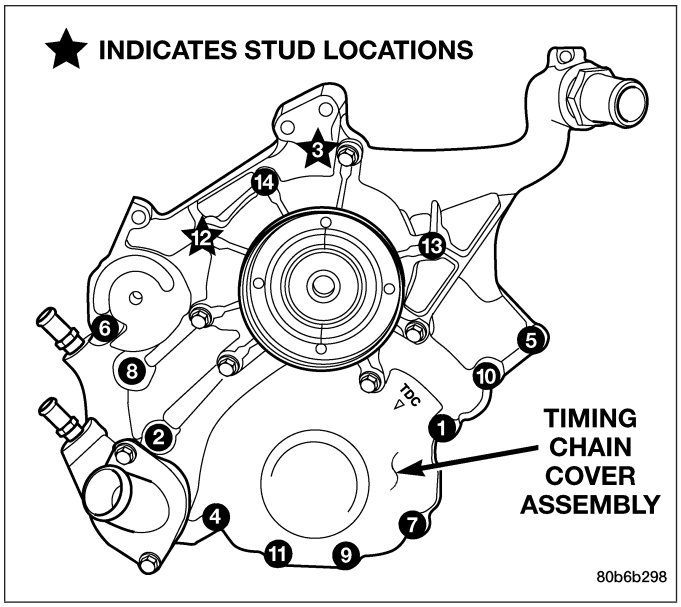
1. Clean timing chain cover and block surface using rubbing alcohol.

CAUTION: The 3.7L uses a special anerobic sealer instead of a gasket to seal the timing cover to the engine block, from the factory. For service repairs, Mopar® Engine RTV must be used as a substitute.

2. Inspect the water passage o-rings (2) for any damage, and replace as necessary.
3. Apply Mopar® Engine RTV sealer to front cover as shown (3) using a 3 to 4mm thick bead.



4. Install cover. Tighten fasteners in sequence as shown in to 58 N·m (43 ft. lbs.).
5. Install crankshaft damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
6. Install the A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION).
7. Install the generator (Refer to 8 - ELECTRICAL/ CHARGING/GENERATOR - INSTALLATION).
8. Install accessory drive belt tensioner (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - INSTALLATION).
9. Install radiator upper and lower hoses.
10. Install both heater hoses.
11. Install radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

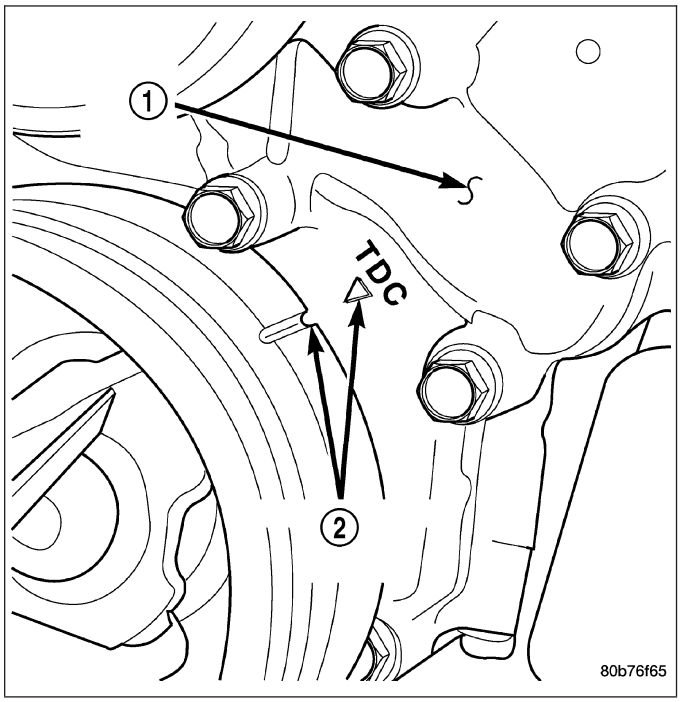


12. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
13. Connect the battery negative cable.

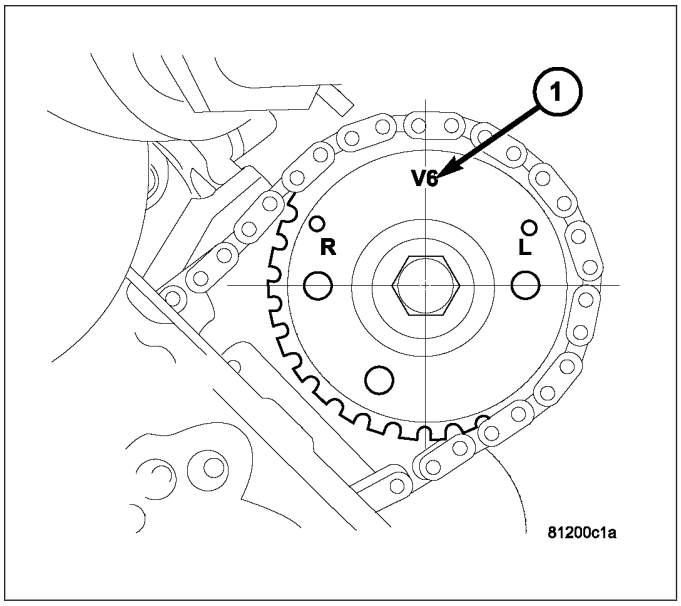
TIMING CHAIN & SPROCKETS

REMOVAL

1. Disconnect negative cable from battery.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Remove right and left cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
4. Remove radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
5. Rotate engine until timing mark (2) on crankshaft damper aligns with TDC mark on timing chain cover (1).



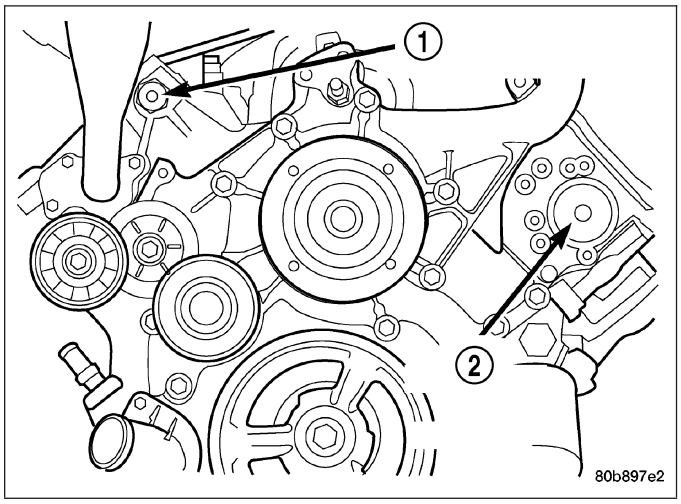
6. Make sure the camshaft sprocket “V6” marks (1) are at the 12 o’clock position (No. 1 TDC exhaust stroke).
7. Remove power steering pump (Refer to 19 - STEERING/PUMP - REMOVAL).



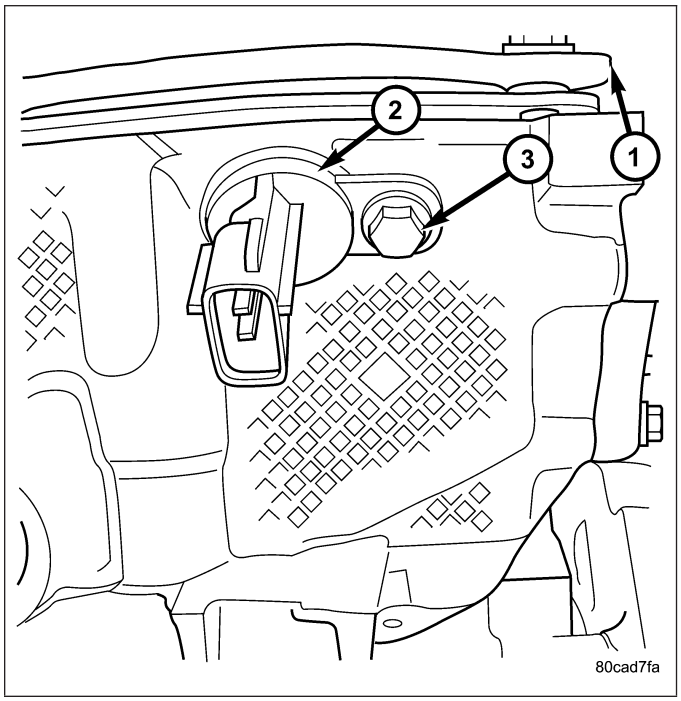
8. Remove access plugs (1 and 2) from left and right cylinder heads for access to chain guide fasteners.
9. Remove the oil fill housing to gain access to the right side tensioner arm fastener.
10. Remove crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL) and timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
11. Collapse and pin primary chain tensioner.

CAUTION: Plate behind left secondary chain tensioner could fall into oil pan. Therefore, cover pan opening.

12. Remove secondary chain tensioners.

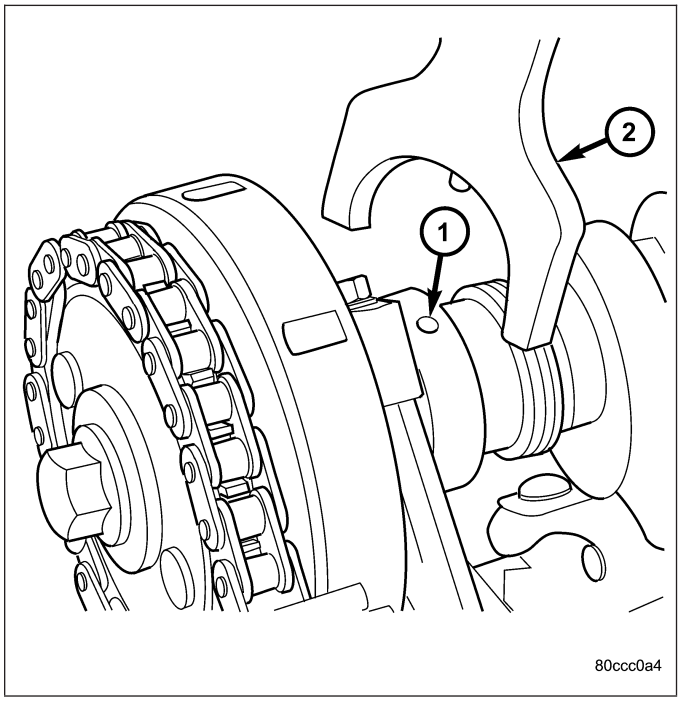


13. Remove camshaft position sensor (2).



CAUTION: Care should be taken not to damage camshaft target wheel. Do not hold target wheel while loosening or tightening camshaft sprocket. Do not place the target wheel near a magnetic source of any kind. A damaged or magnetized target wheel could cause a vehicle no start condition.

CAUTION: Do not forcefully rotate the camshafts or crankshaft independently of each other. Damaging intake valve to piston contact will occur. Ensure negative battery cable is disconnected to guard against accidental starter engagement.



14. Remove left and right camshaft sprocket bolts.
15. While holding the left camshaft steel tube with Special Tool 8428 Camshaft Wrench (2) , remove the left camshaft sprocket. Slowly rotate the camshaft approximately 5 degrees clockwise to a neutral position.
16. While holding the right camshaft steel tube with Special Tool 8428 Camshaft Wrench (2), remove the right camshaft sprocket.
17. Remove idler sprocket assembly bolt.
18. Slide the idler sprocket assembly and crank sprocket forward simultaneously to remove the primary and secondary chains.
19. Remove both pivoting tensioner arms and chain guides.
20. Remove primary chain tensioner.

INSPECTION

Inspect the following components:

- Sprockets for excessive tooth wear. Some tooth markings are normal and not a cause for sprocket replacement.

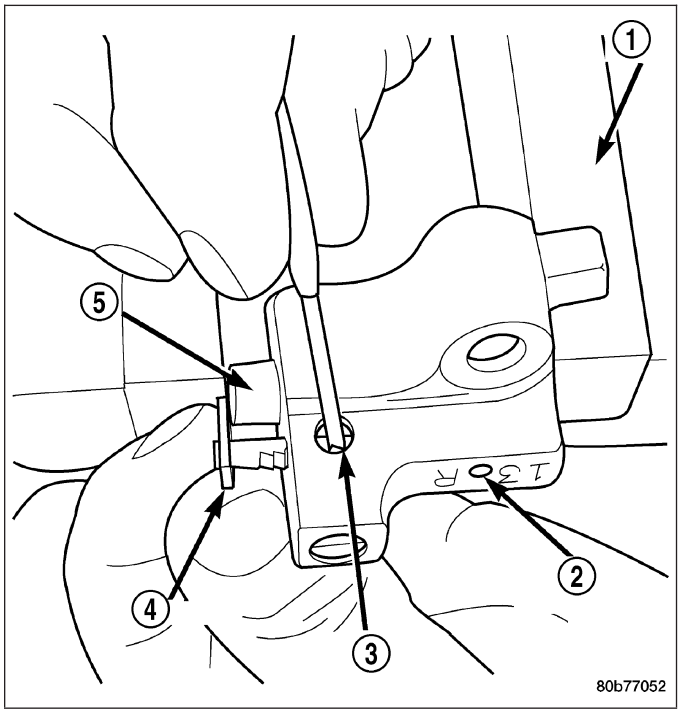
- Idler sprocket assembly bushing and shaft for excessive wear.
- Idler sprocket assembly spline joint. The joint should be tight with no backlash or axial movement.
- Chain guides and tensioner arms. Replace these parts if grooving in plastic face is more than 1 mm (0.039 in.) deep. If plastic face is severely grooved or melted, the tensioner lube jet may be clogged. The tensioner should be replaced.
- Secondary chain tensioner piston and ratcheting device. Inspect for evidence of heavy contact between tensioner piston and tensioner arm. If this condition exist the tensioner tensioner arm and chain should be replaced.
- Primary chain tensioner plastic faces. Replace as required.

INSTALLATION

1. Using a vise, lightly compress the secondary chain tensioner piston until the piston step (5) is flush with the tensioner body. Using a pin or suitable tool, release ratchet pawl (4) by pulling pawl back against spring force through access hole on side of tensioner. While continuing to hold pawl back, Push ratchet device to approximately 2 mm from the tensioner body. Install Special Tool 8514 lock pin (2) into hole on front of tensioner. Slowly open vise to transfer piston spring force to lock pin.
2. Position primary chain tensioner over oil pump and insert bolts into lower two holes on tensioner bracket. Tighten bolts to 28 N·m (250 in. lbs.).
3. Install right side chain tensioner arm. Install Torx® bolt. Tighten Torx® bolt to 28 N·m (250 in. lbs.).

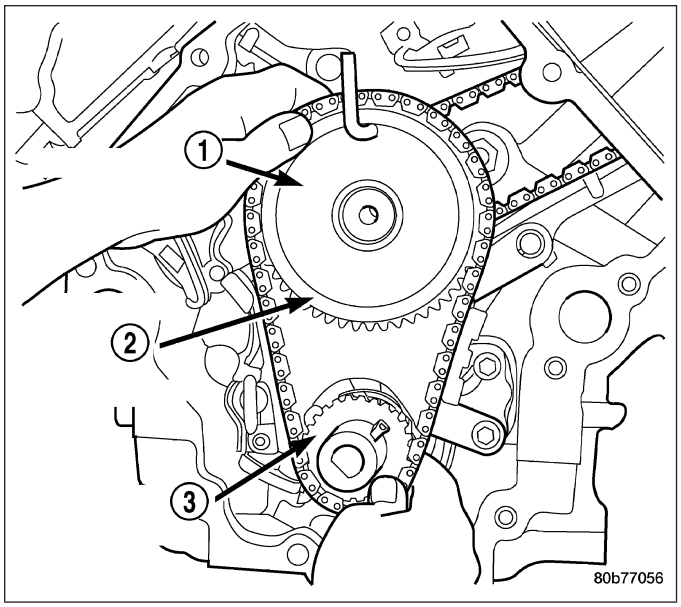
CAUTION: The silver bolts retain the guides to the cylinder heads and the black bolts retain the guides to the engine block.

4. Install the left side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).
5. Install left side chain tensioner arm, and Torx® bolt. Tighten Torx® bolt to 28 N·m (250 in. lbs.).
6. Install the right side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).



7. Install both secondary chains onto the idler sprocket (2). Align two plated links on the secondary chains to be visible through the two lower openings on the idler sprocket (4 o'clock and 8 o'clock). Once the secondary timing chains are installed, position special tool 8429 (1) to hold chains in place for installation.
8. Align primary chain double plated links with the timing mark at 12 o'clock on the idler sprocket. Align the primary chain single plated link with the timing mark at 6 o'clock on the crankshaft sprocket.
9. Lubricate idler shaft and bushings with clean engine oil.

NOTE: The idler sprocket must be timed to the counterbalance shaft drive gear before the idler sprocket is fully seated.

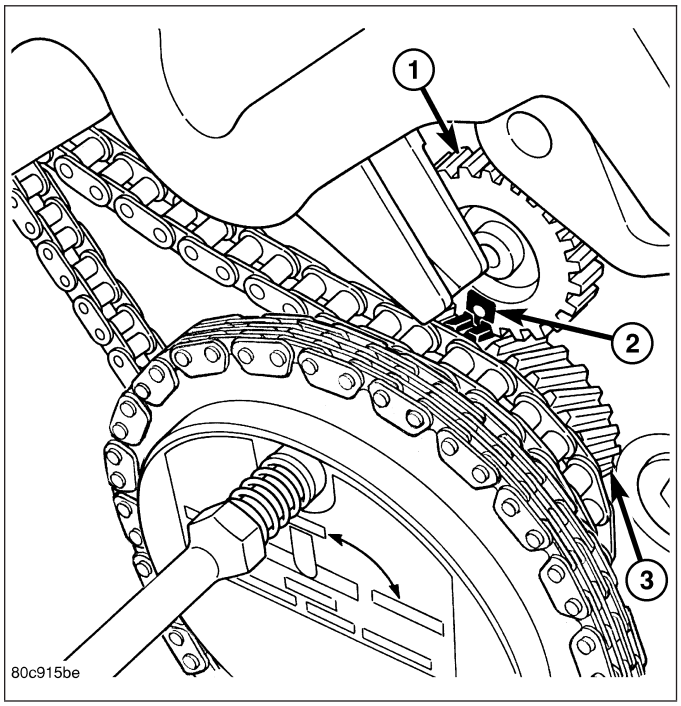


10. Install all chains, crankshaft sprocket, and idler sprocket as an assembly. After guiding both secondary chains through the block and cylinder head openings, affix chains with a elastic strap or equivalent. This will maintain tension on chains to aid in installation. Align the timing mark (2) on the idler sprocket gear (3) to the timing mark on the counterbalance shaft drive gear (1), then seat idler sprocket fully. Before installing idler sprocket bolt, lubricate washer with oil, and tighten idler sprocket assembly retaining bolt to 34 N·m (25 ft. lbs.).

NOTE: It will be necessary to slightly rotate camshafts for sprocket installation.

11. Align left camshaft sprocket "L" dot to plated link on chain.
12. Align right camshaft sprocket "R" dot to plated link on chain.

CAUTION: Remove excess oil from the camshaft sprocket bolt. Failure to do so can result in overtorque of bolt resulting in bolt failure.



13. Remove Special Tool 8429, then attach both sprockets to camshafts. Remove excess oil from bolts, then Install sprocket bolts, but do not tighten at this time.
14. Verify that all plated links are aligned with the marks on all sprockets and the "V6" marks on camshaft sprockets are at the 12 o'clock position.

CAUTION: Ensure the plate between the left secondary chain tensioner and block is correctly installed.

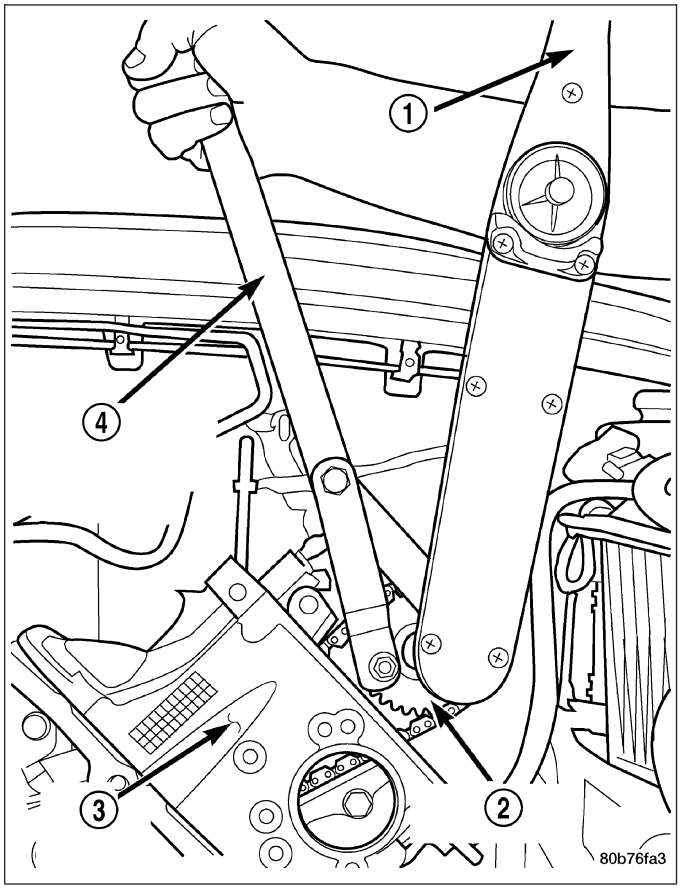
15. Install both secondary chain tensioners. Tighten bolts to 28 N·m (250 in. lbs.).

NOTE: Left and right secondary chain tensioners are not common.

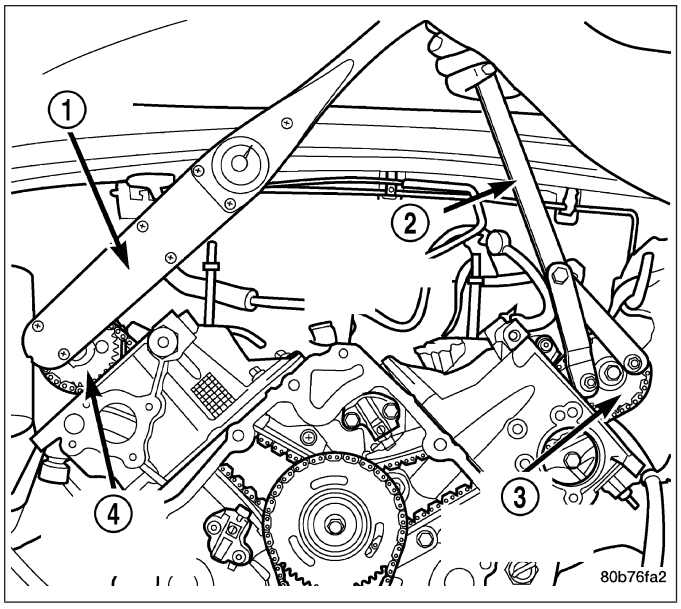
16. Remove all locking pins (3) from tensioners.

CAUTION: After pulling locking pins out of each tensioner, DO NOT manually extend the tensioner(s) ratchet. Doing so will over tension the chains, resulting in noise and/or high timing chain loads.

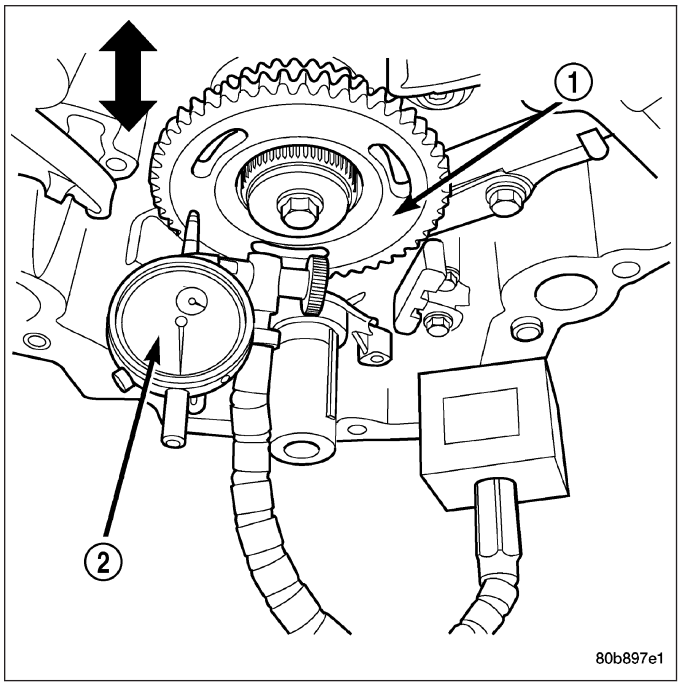
17. Using Special Tool 6958, Spanner with Adaptor Pins 8346 (4) , tighten left. camshaft sprocket bolts to 122 N·m (90 ft. lbs.).



18. Using Special Tool 6958, Spanner with Adaptor Pins 8346 (2) , tighten right camshaft sprocket bolts to 122 N·m (90 ft. lbs.).
19. Rotate engine two full revolutions. Verify timing marks are at the follow locations:
    - primary chain idler sprocket dot is at 12 o'clock
    - primary chain crankshaft sprocket dot is at 6 o'clock
    - secondary chain camshaft sprockets "V6" marks are at 12 o'clock
    - counterbalancer shaft drive gear dot is aligned to the idler sprocket gear dot
20. Lubricate all three chains with engine oil.

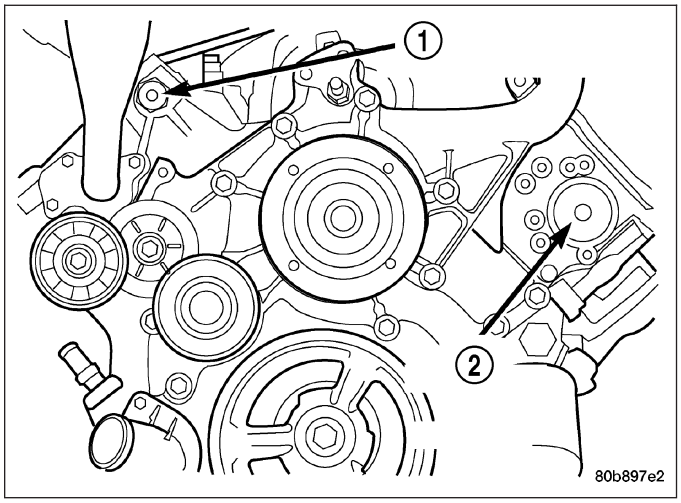


21. After installing all chains, it is recommended that the idler gear end play be checked. The end play must be within 0.10 -0.25 mm (0.004 - 0.010 in.). If not within specification, the idler gear (1) must be replaced.
22. Install timing chain cover and crankshaft damper (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION) and (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
23. Install cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).



NOTE: Before installing threaded plug in right cylinder head, the plug must be coated with sealant to prevent leaks.

24. Coat the large threaded access plug (2) with **Mopar® Thread Sealant with Teflon**, then install into the right cylinder head and tighten to 81 N·m (60 ft. lbs.).
25. Install the oil fill housing.
26. Install access plug (1) in left cylinder head.
27. Install power steering pump (Refer to 19 - STEERING/PUMP - INSTALLATION).
28. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
29. Connect negative cable to battery.



ENGINE - 4.7L SERVICE INFORMATION

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ENGINE - 4.7L SERVICE INFORMATION

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either performance (e.g., engine idles rough and stalls) or mechanical (e.g., a strange noise).

(Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) - PERFORMANCE and (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)—MECHANICAL for possible causes and corrections of malfunctions. (Refer to 14 - FUEL SYSTEM/

FUEL DELIVERY - DIAGNOSIS AND TESTING) and (Refer to 14 - FUEL SYSTEM/FUEL INJECTION - DIAGNOSIS AND TESTING) for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following diagnosis:

- Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
- Cylinder Combustion Pressure Leakage Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
- Engine Cylinder Head Gasket Failure Diagnosis (Refer to 9 - ENGINE/CYLINDER HEAD - DIAGNOSIS AND TESTING).
- Intake Manifold Leakage Diagnosis (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - DIAGNOSIS AND TESTING).

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery	1. Charge or replace as necessary.
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals.
	3. Faulty starter.	3. (Refer to 8 - ELECTRICAL/ STARTING - DIAGNOSIS AND TESTING).
	4. Faulty coil or control unit.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	5. Incorrect spark plug gap.	5. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	6. Dirt or water in fuel system.	6. Clean system and replace fuel filter.
	7. Faulty fuel pump, relay or wiring.	7. Repair or replace as necessary.
ENGINE STALLS OR ROUGH IDLE	1. Idle speed set to low.	1. (Refer to 14 - FUEL SYSTEM/ FUEL INJECTION/IDLE AIR CONTROL MOTOR - REMOVAL).
	2. Idle mixture too lean or too rich.	2. Refer to Powertrain Diagnosis Information.
	3. Vacuum leak.	3. Inspect intake manifold and vacuum hoses, repair or replace as necessary.
	4. Faulty coil.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	5. Incorrect engine timing.	5. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped spark plugs.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Dirt or water in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. Refer to the Appropriate Diagnostic Information
	4. Blown cylinder head gasket.	4. Replace cylinder head gasket.
	5. Low compression.	5. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
	6. Burned, warped or pitted valves.	6. Replace as necessary.
	7. Plugged or restricted exhaust system.	7. Inspect and replace as necessary.
	8. Faulty coil.	8. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
ENGINE MISSES ON ACCELERATION	1. Spark plugs dirty or incorrectly gapped.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Dirt in fuel system.	2. Clean fuel system.
	3. Burned, warped or pitted valves.	3. Replcae as necessary.
	4. Faulty coil.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
ENGINE MISSES AT HIGH SPEED	1. Spark plugs dirty or incorrectly gapped.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Faulty coil.	2. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	3. Dirt or water in fuel system.	3. Clean system and replace fuel filter.

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTIONS
NOISY VALVES	1. High or low oil level in crankcase.	1. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS)
	2. Thin or diluted oil.	2. Change oil and filter.
	3. Low oil pressure.	3. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	4. Dirt in lash adjusters.	4. Replace as necessary.
	5. Worn rocker arms.	5. Replace as necessary.
	6. Worn lash adjusters	6. Replace as necessary.
	7. Worn valve guides.	7. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE)
	8. Excessive runout of valve seats on valve faces.	8. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE)
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS)
	2. Low oil pressure.	2. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Connecting rod journal out-of-round.	5. Service or replace crankshaft.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS)
	2. Low oil pressure.	2. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Excessive end play.	5. Check thrust washers for wear.
	6. Crankshaft journal out-of round.	6. Service or replace crankshaft.
	7. Loose flywheel or torque converter.	7. Tighten to correct torque

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - LUBRICATION

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS	1. Gaskets and O-Rings.	1.
	(a) Misaligned or damaged.	(a) Replace as necessary.
	(b) Loose fasteners, broken or porous metal parts.	(b) Tighten fasteners, Repair or replace metal parts.
	2. Crankshaft rear seal	2. Replace as necessary (Refer to 9 - ENGINE/ENGINE BLOCK/ CRANKSHAFT OIL SEAL - REAR - REMOVAL).
	3. Crankshaft seal flange. Scratched, nicked or grooved.	3. Polish or replace crankshaft.
	4. Oil pan flange cracked.	4. Replace oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
	5. Timing chain cover seal, damaged or misaligned.	5. Replace seal (Refer to 9 - ENGINE/ENGINE BLOCK/ CRANKSHAFT OIL SEAL - FRONT - REMOVAL).
	6. Scratched or damaged vibration damper hub.	6. Polish or replace damper.
OIL PRESSURE DROP	1. Low oil level.	1. Check and correct oil level.
	2. Faulty oil pressure sending unit.	2. Replace sending unit (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE SENSOR/SWITCH - REMOVAL).
	3. Low oil pressure.	3. Check oil pump and bearing clearance.
	4. Clogged oil filter.	4. Replace oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).
	5. Worn oil pump.	5. Replace oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).
	6. Thin or diluted oil.	6. Change oil and filter.
	7. Excessive bearing clearance.	7. Replace as necessary.
	8. Oil pump relief valve stuck.	8. Replace oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).
	9. Oil pick up tube loose, damaged or clogged.	9. Replace as necessary.

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL PUMPING AT RINGS; SPARK PLUGS FOULING	1. Worn or damaged rings.	1. Hone cylinder bores and replace rings.
	2. Carbon in oil ring slots.	2. Replace rings (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - STANDARD PROCEDURE).
	3. Incorrect ring size installed.	3. Replace rings (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - STANDARD PROCEDURE).
	4. Worn valve guides.	4. Ream guides and replace valves (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE).
	5. Leaking valve guide seals.	5. Replace valve guide seals.

DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

1. Clean the spark plug recesses with compressed air.
2. Remove the spark plugs.
3. Disable the fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DESCRIPTION).
4. Remove the ASD relay (Refer to 8 - ELECTRICAL/IGNITION CONTROL/AUTO SHUT DOWN RELAY - REMOVAL).
5. Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.
6. Record the compression pressure on the 3rd revolution. Continue the test for the remaining cylinders.
7. (Refer to 9 - ENGINE - SPECIFICATIONS) for the correct engine compression pressures.

DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

1. Check the coolant level and fill as required. DO NOT install the radiator cap.
2. Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.
3. Remove the spark plugs.
4. Remove the oil filler cap.
5. Remove the air cleaner hose.
6. Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.
7. Perform the test procedures on each cylinder according to the tester manufacturer's instructions. Set piston of cylinder to be tested at TDC compression,While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART .

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

STANDARD PROCEDURE

STANDARD PROCEDURE - REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

STANDARD PROCEDURE - FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

MOPAR® ENGINE RTV GEN II

Mopar® Engine RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® ATF RTV

Mopar® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER

Mopar® Gasket Maker is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® GASKET SEALANT

Mopar® Gasket Sealant is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

FORM-IN-PLACE GASKET AND SEALER APPLICATION

Assembling parts using a form-in-place gasket requires care but it's easier than using precut gaskets.

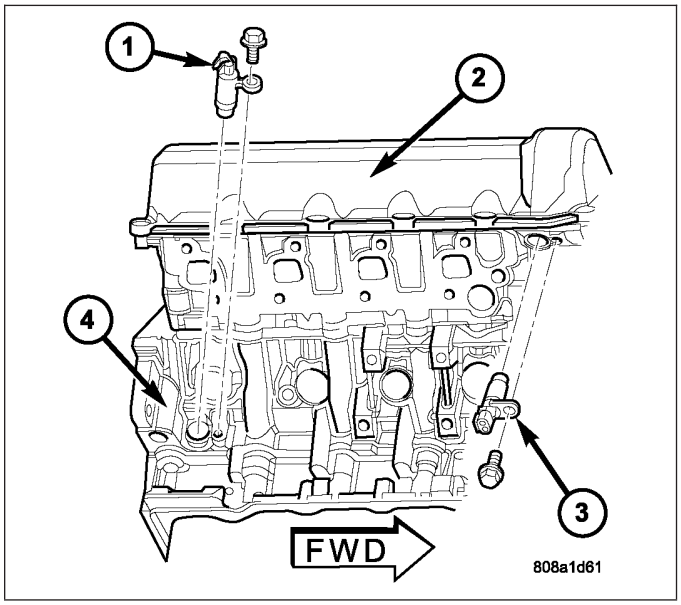
Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

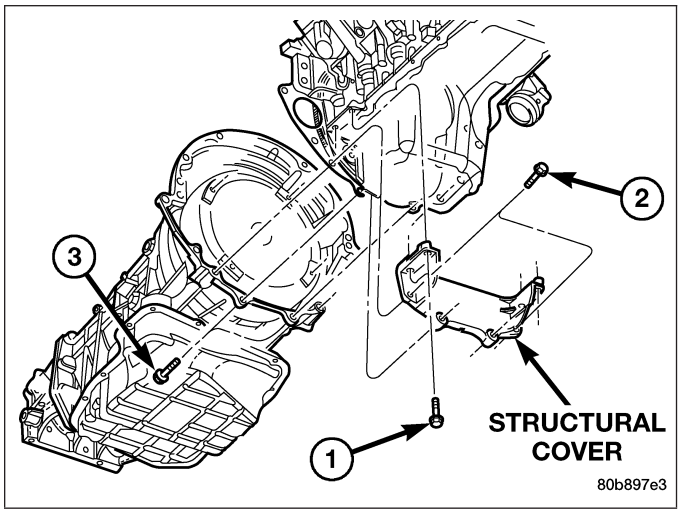
Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

REMOVAL - ENGINE

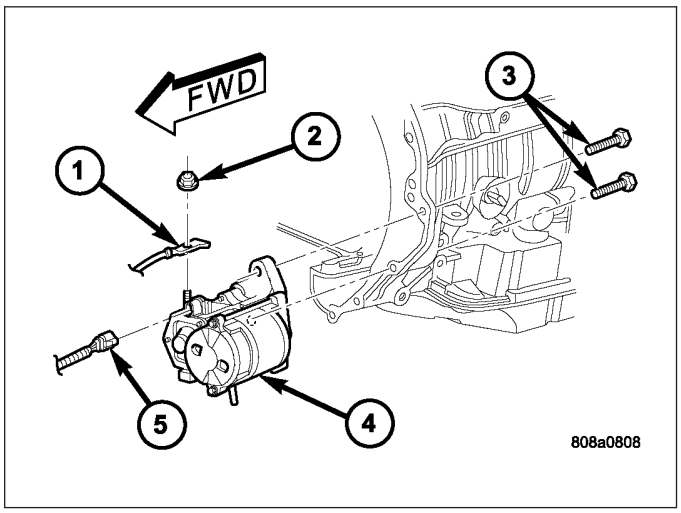
1. Release fuel rail pressure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE) then disconnect the fuel supply quick connect fitting at the fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).
2. Disconnect the battery negative and positive cables.
3. Disconnect two ground straps from the lower left hand side and one ground strap from the lower right hand side of the engine.
4. Remove the through bolt retaining nut and bolt (3) from both the left and right side engine mounts.
5. Disconnect crankshaft position sensor (1).



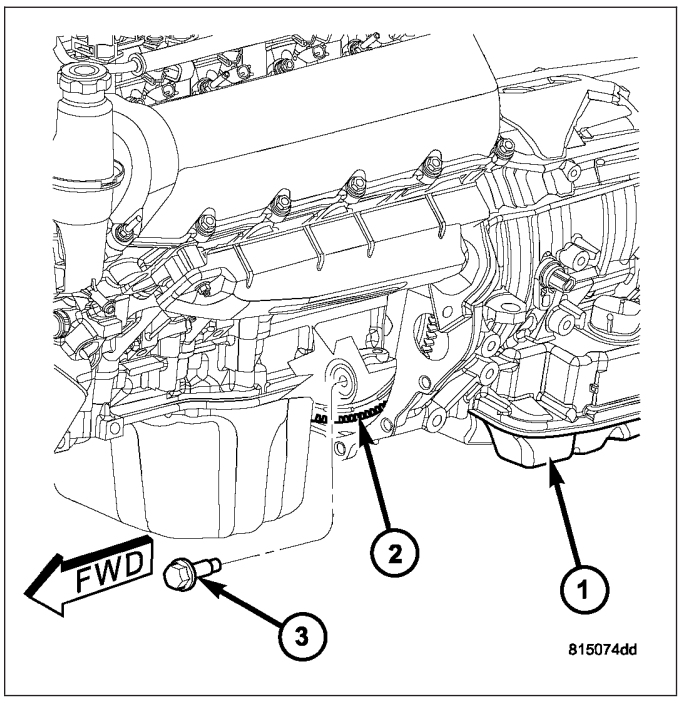
6. Remove exhaust crossover pipe from exhaust manifolds.
7. Remove the pinion bracket.
8. Remove structural cover (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - REMOVAL).



9. Remove starter (4) (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL).

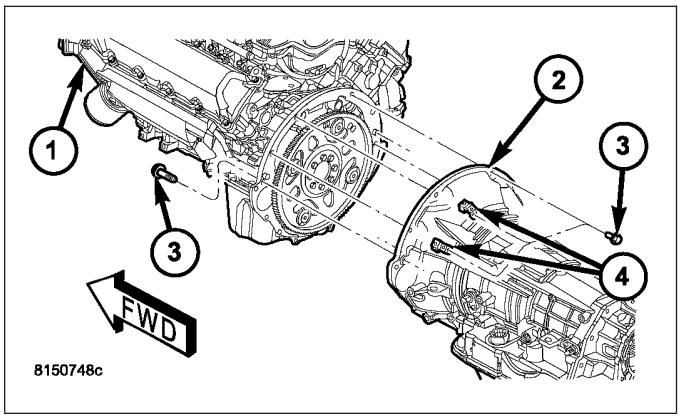


10. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

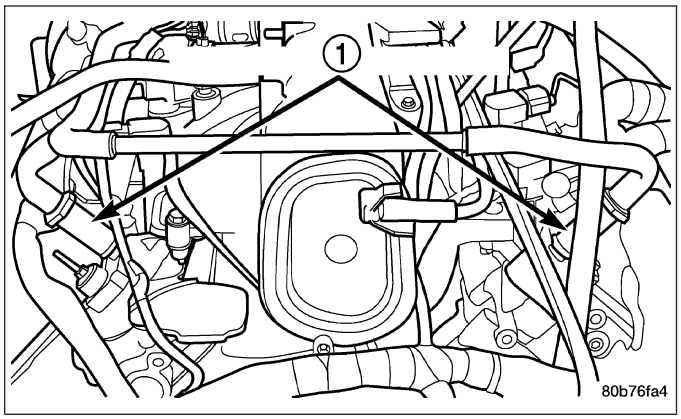


11. Remove torque converter bolts (3) (Automatic Transmission Only).

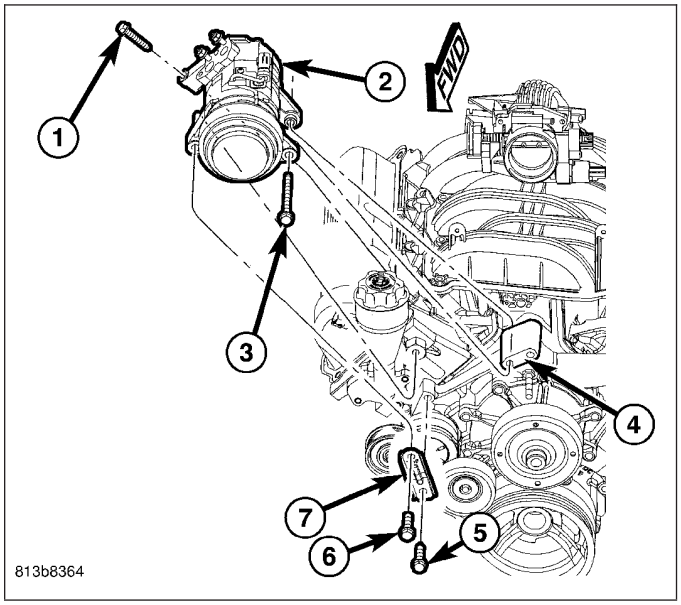
12. Remove transmission to engine mounting bolts (3).
13. Disconnect the engine block heater power cable from the block heater, if equipped.
14. Lower vehicle.
15. Remove throttle body resonator assembly and air inlet hose.
16. Disconnect throttle and speed control cables.



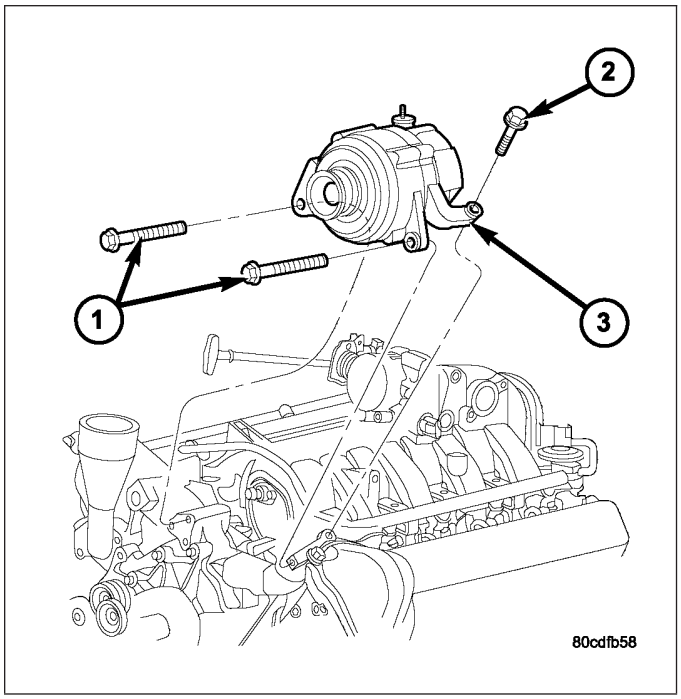
17. Disconnect tube from both the left and right side crankcase breathers (1). Remove breathers.



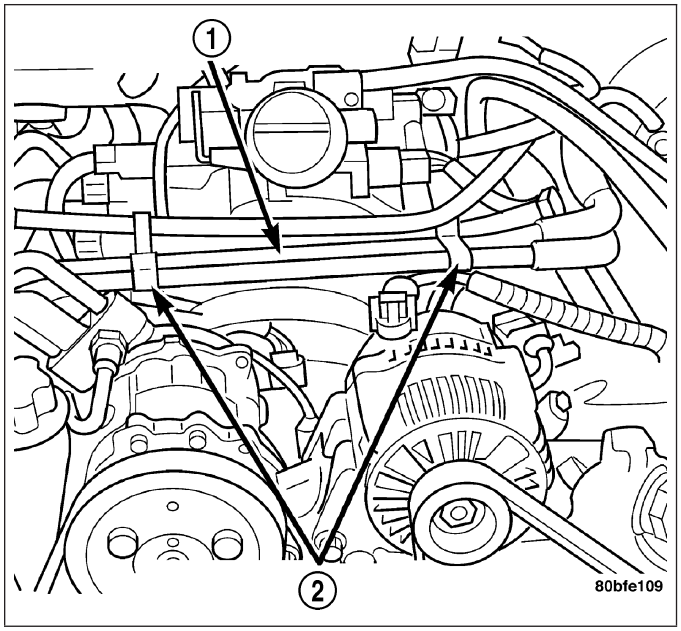
18. Discharge A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).
19. Remove A/C compressor (2) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL).



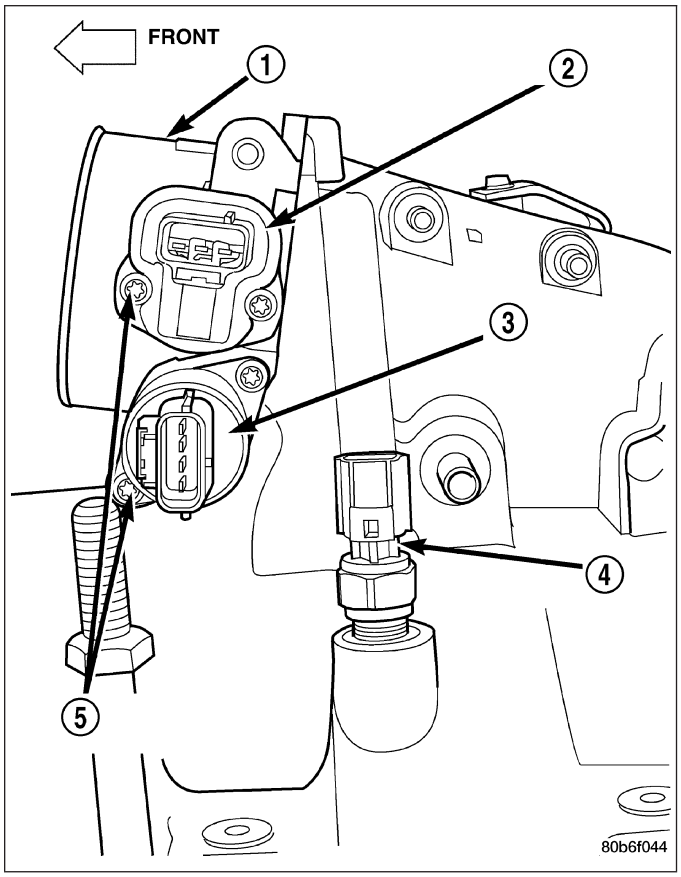
20. Remove shroud, fan assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL) and accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/ DRIVE BELTS - REMOVAL).
21. Disconnect transmission oil cooler lines at the radiator.
22. Disconnect radiator upper and lower hoses.
23. Remove radiator (Refer to 7 - COOLING/ENGINE/ RADIATOR - REMOVAL), A/C condenser (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C CONDENSER - REMOVAL) and transmission oil cooler.
24. Remove generator (3) (Refer to 8 - ELECTRICAL/ CHARGING/GENERATOR - REMOVAL).



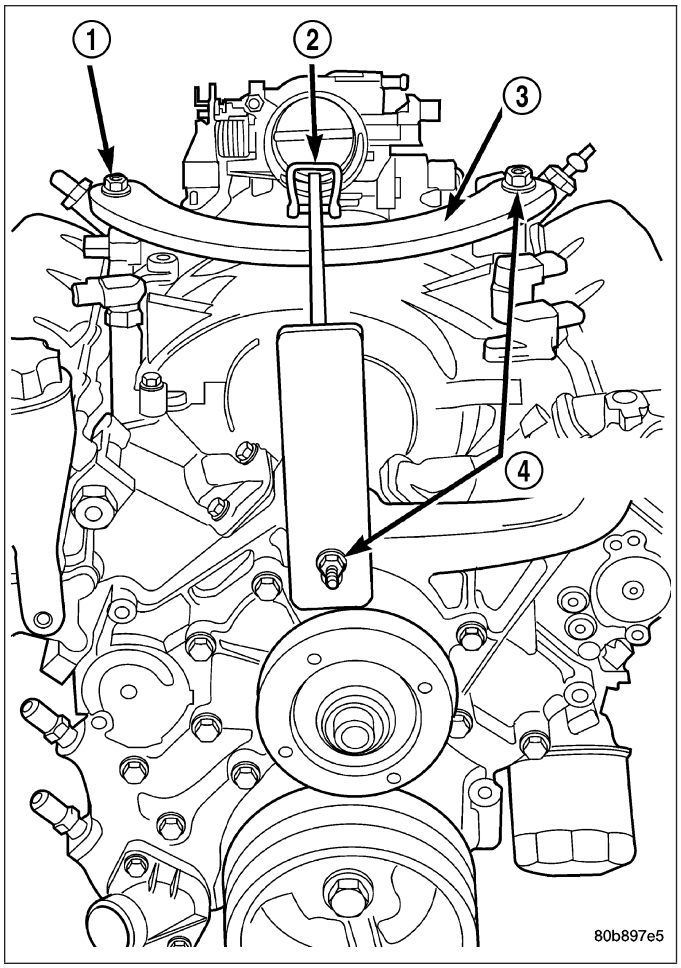
25. Disconnect the two heater hoses from the timing chain cover and heater core.
26. Unclip (2) and remove heater hoses (1) and tubes from the intake manifold.



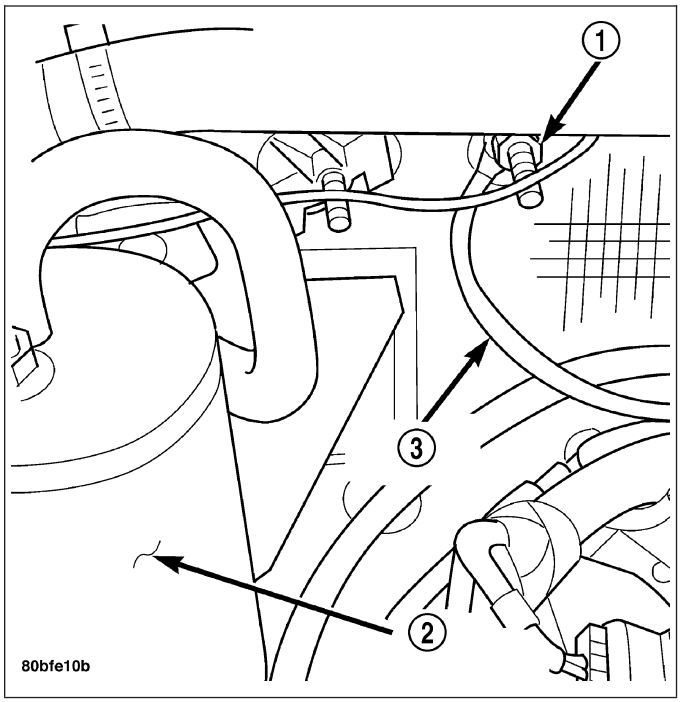
27. Disconnect engine harness at the following points :
    - Intake air temperature (IAT) sensor (4)
    - Fuel Injectors
    - Throttle Position (TPS) Switch (2)
    - Idle Air Control (IAC) Motor (3)
    - Engine Oil Pressure Switch
    - Engine Coolant Temperature (ECT) Sensor
    - Manifold absolute pressure (MAP) Sensor
    - Camshaft Position (CMP) Sensor
    - Coil Over Plugs
28. Disconnect the vacuum lines at the throttle body and intake manifold.
29. Remove power steering pump and position out of the way.



30. Install Special Tools 8400 Lifting Studs, into the cylinder heads.
31. Install Engine Lifting Fixture Special Tool 8347 (3) following these steps.
    - Holding the lifting fixture at a slight angle, slide the large bore in the front plate over the hex portion of the lifting stud.
    - Position the two remaining fixture arms onto the two Special Tools 8400 Lifting Studs, in the cylinder heads.
    - Pull foward and upward on the lifting fixture so that the lifting stud rest in the slotted area below the large bore.
    - Secure the lifting fixture to the three studs using three 7/16 – 14 N/C locknuts.
    - Make sure the lifting loop in the lifting fixture is in the last hole (closest to the throttle body) to minimize the angle of engine during removal.



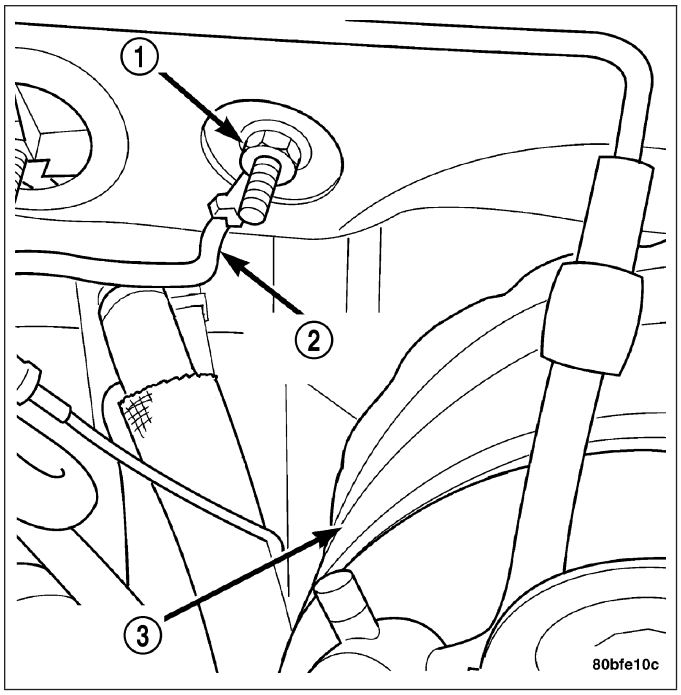
32. Disconnect body ground strap (3) at the right side cowl.



33. Disconnect body ground strap (2) at the left side cowl.

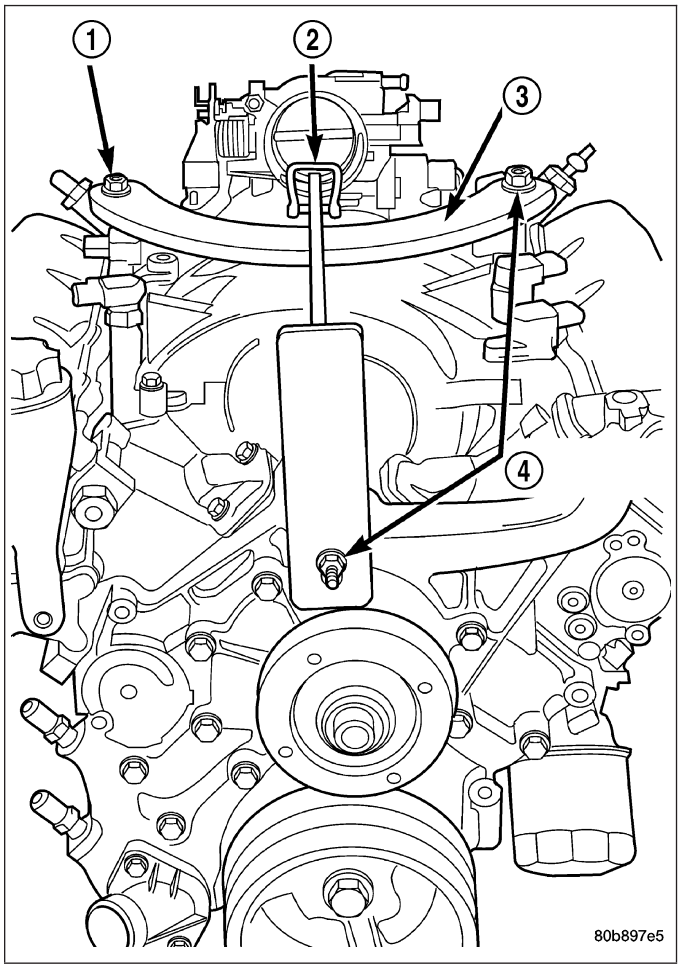
NOTE: It will be necessary to support the transmission in order to remove the engine.

34. Position a suitable jack under the transmission.
35. Remove engine from the vehicle.

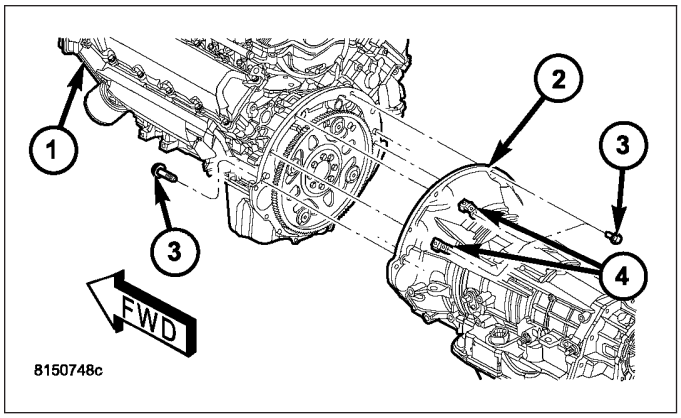


INSTALLATION - ENGINE

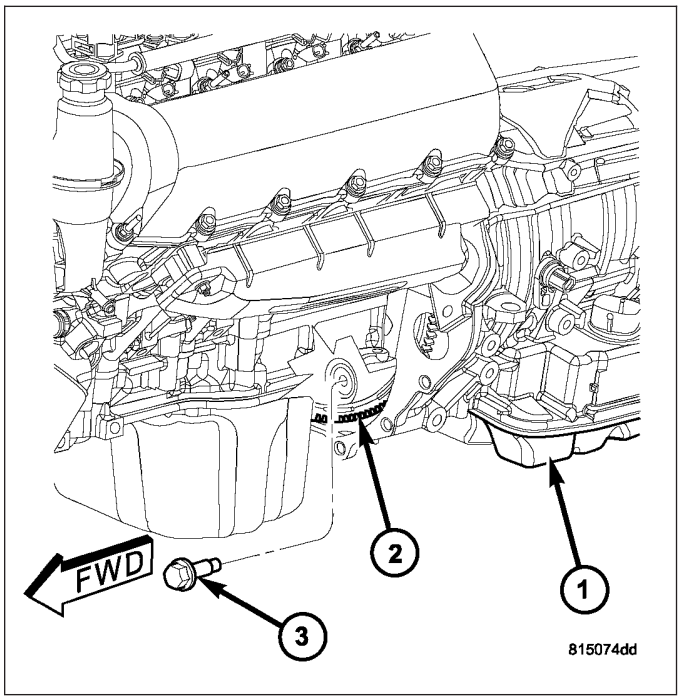
1. Position engine in the vehicle.
2. Remove jack from under the transmission.
3. Remove Engine Lifting Fixture Special Tool 8347 (3).
4. Remove Special Tools 8400 Lifting Studs.
5. Position both the left and right side engine mount brackets and install the through bolts (3) and nuts. Tighten to 95 N·m (70 ft. lbs.)



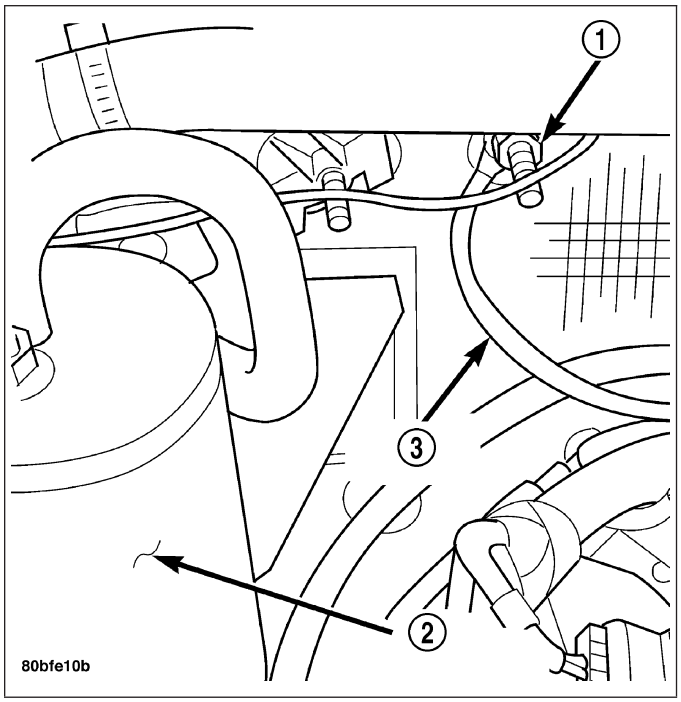
6. Install transmission to engine mounting bolts (3). Tighten the bolts to 41 N·m (30 ft. lbs.).

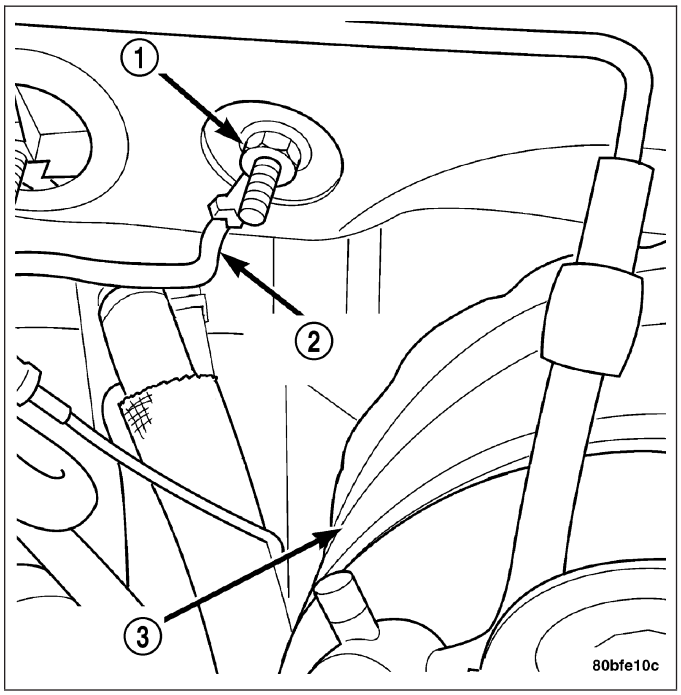


7. Install torque converter bolts (3).

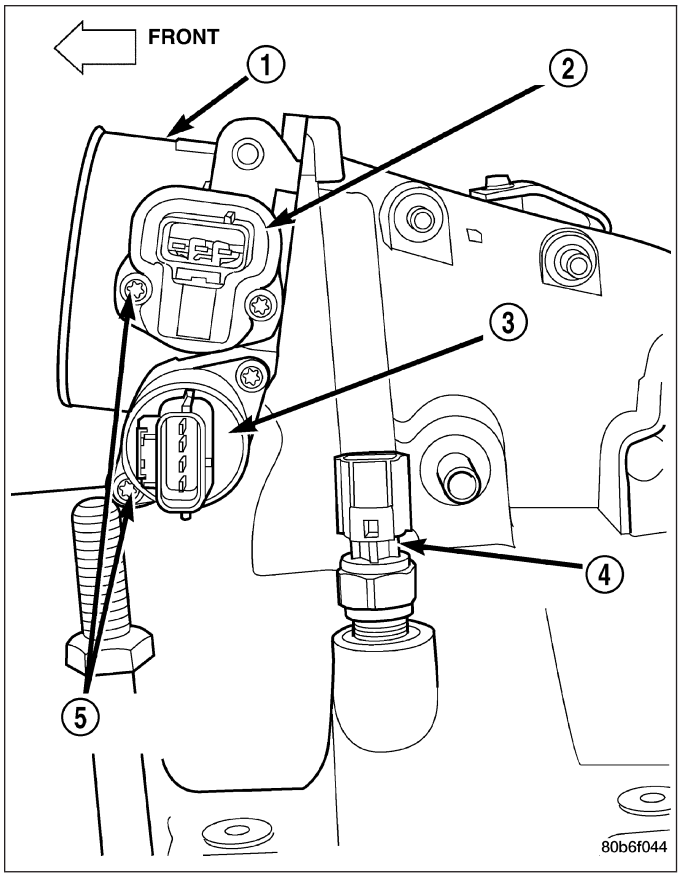


8. Connect both left (2) and right (3) side body ground straps.
9. Position generator wiring behind the oil dipstick tube, then install the oil dipstick tube upper mounting bolt.
10. Install power steering pump.
11. Connect fuel supply line quick connect fitting (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/ QUICK CONNECT FITTING - STANDARD PROCEDURE).
12. Connect the vacuum lines at the throttle body and intake manifold.

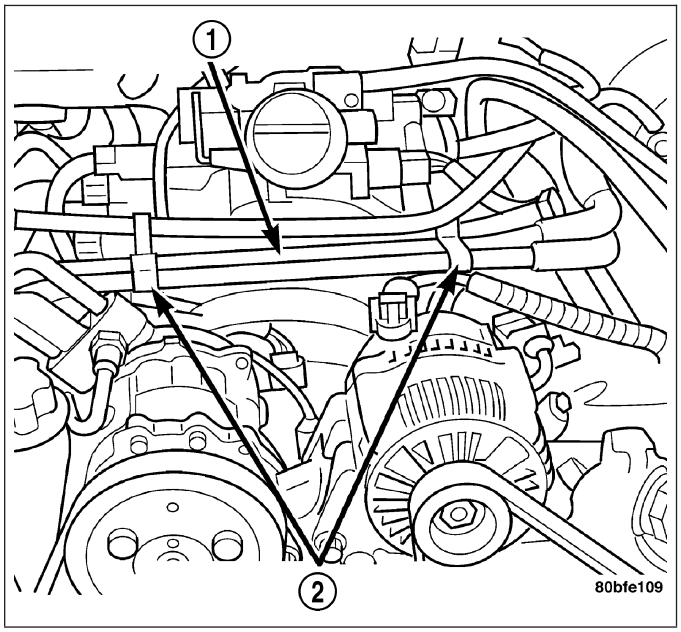




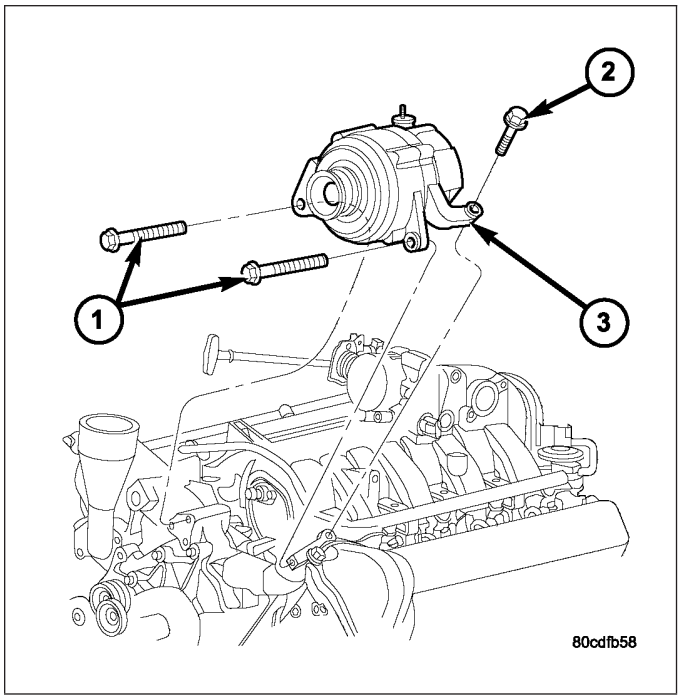
13. Connect engine harness at the following points:
    - Intake Air Temperature (IAT) Sensor (4)
    - Idle Air Control (IAC) Motor (3)
    - Fuel Injectors
    - Throttle Position (TPS) Switch (2)
    - Engine Oil Pressure Switch
    - Engine Coolant Temperature (ECT) Sensor
    - Manifold Absolute Pressure (MAP) Sensor
    - Camshaft Position (CMP) Sensor
    - Coil Over Plugs



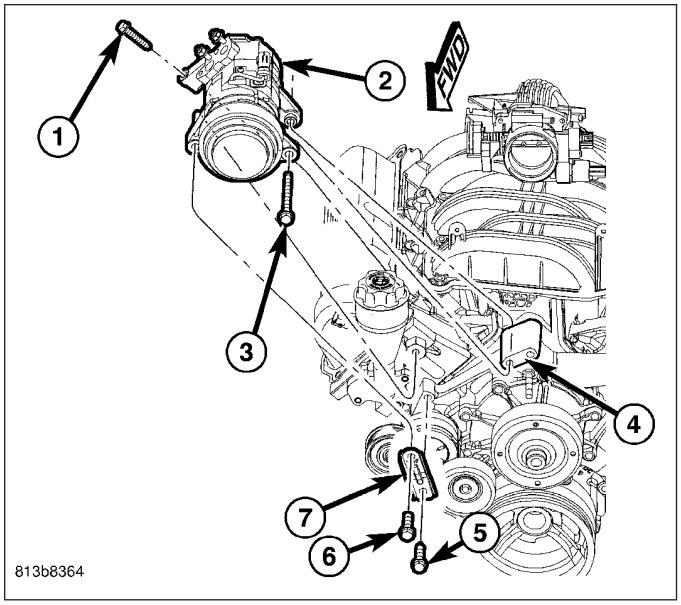
14. Position and install heater hoses (1) and tubes onto intake manifold.
15. Install the heater hoses onto the heater core and the engine front cover, and install clips (2).



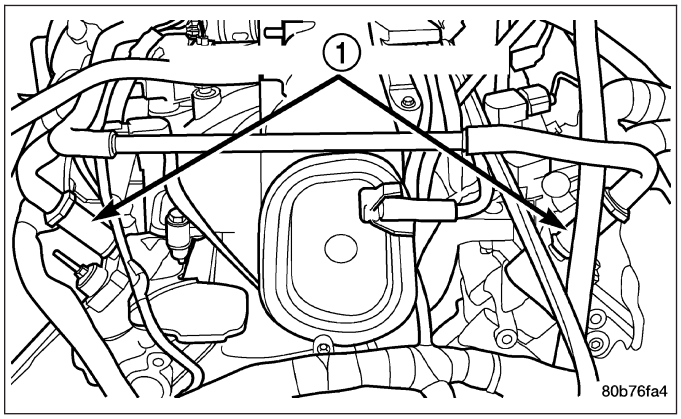
16. Install generator (3) (Refer to 8 - ELECTRICAL/ CHARGING/GENERATOR - INSTALLATION).
17. Install A/C condenser (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C CONDENSER - INSTALLATION), radiator (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION) and transmission oil cooler.
18. Connect radiator upper and lower hoses.
19. Connect the transmission oil cooler lines to the radiator.
20. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION), fan assembly and shroud (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).



21. Install A/C compressor (2) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION).

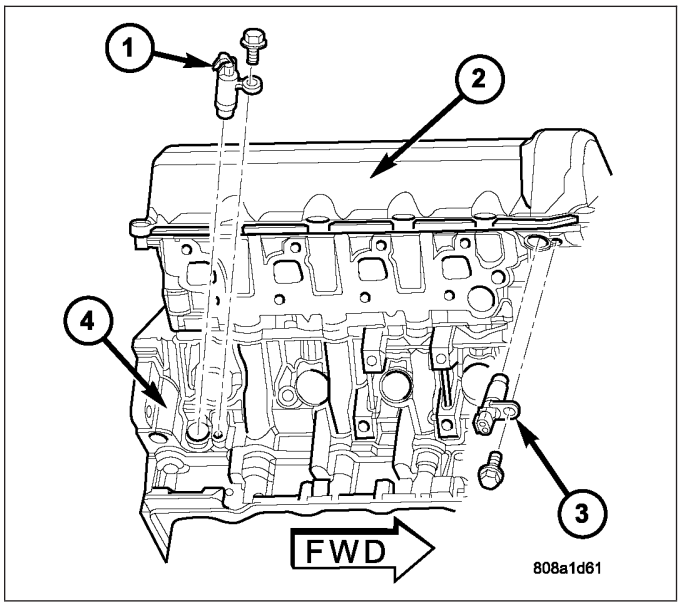


22. Install both breathers (1). Connect tube to both crankcase breathers.
23. Connect throttle and speed control cables.
24. Install throttle body resonator assembly and air inlet hose. Tighten clamps 4 N·m (35 in. lbs.).

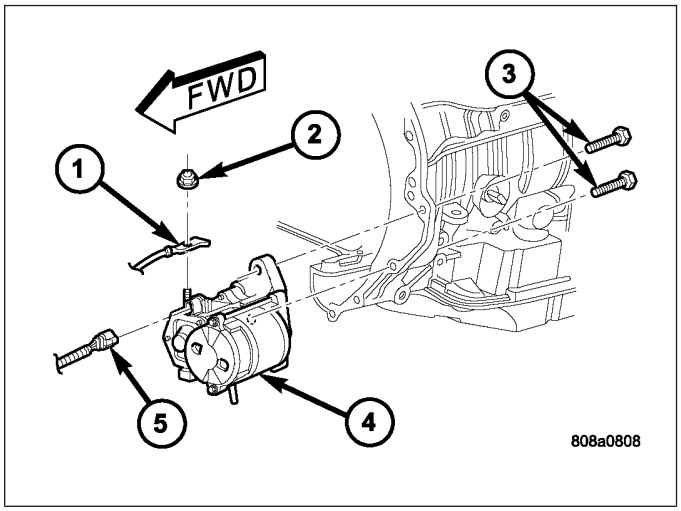


25. Raise vehicle.

26. Connect crankshaft position sensor (1).

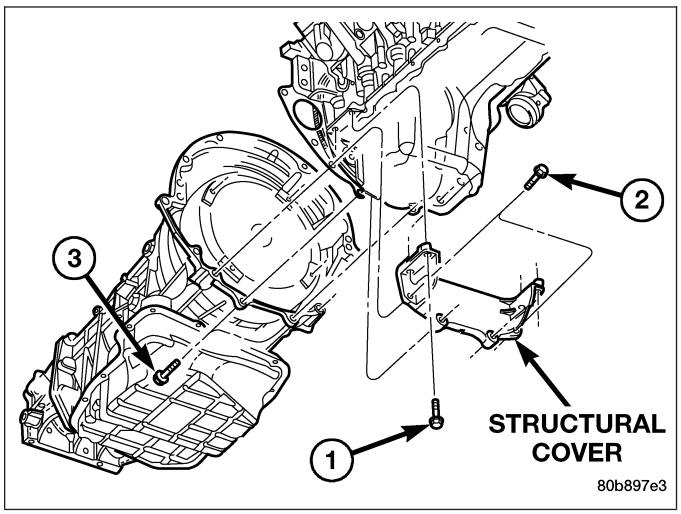


27. Install starter (4) (Refer to 8 - ELECTRICAL/ STARTING/STARTER MOTOR - INSTALLATION).



CAUTION: The structural cover requires a specific torque sequence. Failure to follow this sequence may cause severe damage to the cover.

28. Install structural cover (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - INSTALLATION).
29. Install the pinion bracket.
30. Install exhaust crossover pipe.
31. Install engine block heater power cable, If equipped.
32. Check and fill engine oil.



33. Recharge the A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).
34. Refill the engine cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
35. Connect the battery positive and negative cables.
36. Start the engine and check for leaks.

SPECIFICATIONS

SPECIFICATIONS - 4.7L ENGINE

GENERAL DESCRIPTION

DESCRIPTION	SPECIFICATION
Engine Type	90° SOHC V-8 16-Valve
Displacement	4.7 Liters / 4701 cc 287 (Cubic Inches)
Bore	93.0 mm (3.66 in.)
Stroke	86.5 mm (3.40 in.)
Compression Ratio	9.0:1
Horsepower	235 BHP @ 4800 RPM
Torque	295 LB-FT @ 3200 RPM
Lead Cylinder	#1 Left Bank
Firing Order	1-8-4-3-6-5-7-2

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bore Diameter	93.010 ± .0075 mm	3.6619 ± 0.0003 in.
Out of Round (MAX)	0.076 mm	0.003 in.
Taper (MAX)	0.051 mm	0.002 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Diameter	92.975 mm	3.6605 in.
Weight	366 grams	12.9 oz
Ring Groove Diameter		
No. 1	83.37 - 83.13 mm	3.282 - 3.273 in
No. 2	82.833 - 83.033 mm	3.261 - 3.310 in.
No. 3	83.88 - 84.08 mm	3.302 - 3.310 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance In Piston	0.010 - 0.019 mm	0.0004 - 0.0008 in.
Diameter	24.013 - 24.016 mm	0.9454 - 0.9455 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring Gap		
Top Compression Ring	0.20 - 0.36 mm	0.0079 - 0.0142 in.
Second Compression Ring	0.37 - 0.63 mm	0.0146 - 0.0249 in.
Oil Control (Steel Rails)	0.25 - 0.76 mm	0.0099 - 0.30 in.
Side Clearance		
Top Compression Ring	.051 - .094 mm	0.0020 - 0.0037 in.
Second Compression Ring	0.040 - 0.080 mm	0.0016 - 0.0031 in.
Oil Ring (Steel Ring)	.019 - .229 mm	.0007 - .0091 in.
Ring Width		
Top Compression Ring	1.472 - 1.490 mm	0.057 - 0.058 in.
Second Compression Ring	1.472 - 1.490 mm	0.057 - 0.058 in.
Oil Ring (Steel Rails)	0.445 - 0.470 mm	0.017 - 0.018 in.

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.015 - 0.055 mm	0.0006 - 0.0022 in.
Side Clearance	0.10 - 0.35 mm	0.004 - 0.0138 in.
Piston Pin Bore Diameter (Interference Fit)	.025 - .048 mm	0.001 - 0.0019 in.
Bearing Bore Out of Round (MAX)	0.004 mm	0.0002 in.
Total Weight (Less Bearing)	555 grams	19.5771 ounces

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Main Bearing Journal Diameter	63.488 - 63.512 mm	2.4996 - 2.5005 in.
Bearing Clearance	0.004 - 0.034 mm	0.0002 - 0.0013 in.
Out of Round (MAX)	0.005 mm	0.0004 in.
Taper (MAX)	0.008 mm	0.0004 in.
End Play	0.052 - 0.282 mm	0.0021 - 0.0112 in.
End Play (MAX)	0.282 mm	0.0112 in.
Connecting Rod Journal Diameter	50.992 - 51.008 mm	2.0076 - 2.0082 in.
Bearing Clearance	0.010 - 0.048	0.0004 - 0.0019 in.
Out of Round (MAX)	0.005 mm	0.0002 in.
Taper (MAX)	0.008 mm	0.0004 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bore Diameter	26.02 - 26.04 mm	1.0245 - 1.0252 in.
Bearing Journal Diameter	25.975 - 25.995 mm	1.0227 - 1.0235 in.
Bearing Clearance	0.025 - 0.065 mm	0.001 - 0.0026 in.
Bearing Clearance (MAX)	0.065 mm	0.0026 in.
End Play	.075 - .200 mm	0.003 - 0.0079 in.
End Play (MAX)	.200 mm	0.0079 in.

VALVE TIMING

DESCRIPTION	SPECIFICATION
Intake	
Opens (BTDC)	4.4°
Closes (ATDC)	239.1°
Duration	243.5°
Exhaust	
Opens (BTDC)	240.5°
Closes (ATDC)	13.2°
Duration	253.70°
Valve Overlap	17.6°

VALVES

DESCRIPTION	SPECIFICATION
Face Angle	45° - 45.5°
Head Diameter	
Intake	48.52 - 48.78 mm (1.9103 - 1.9205 in.)
Exhaust	36.87 - 37.13 mm (1.4516 - 1.4618 in.)
Length (Overall)	
Intake	113.45 - 114.21 mm (4.4666 - 4.4965)
Exhaust	114.92 - 115.68 mm (4.5244 - 4.5543 in.)
Stem Diameter	
Intake	6.931 - 6.957 mm (0.2729 - 0.2739 in.)
Exhaust	6.902 - 6.928 mm (0.2717 - 0.2728 in.)
Stem - to - Guide Clearance	
Intake	0.018 - 0.069 mm (0.0008 - 0.0028 in.)
Exhaust	0.047 - 0.098 mm (0.0019 - 0.0039 in.)
Max. Allowable Stem - to - Guide Clearance (Rocking Method)	
Intake	0.069 mm (0.0028 in.)
Exhaust	0.098 mm (0.0039 in.)
Valve Lift (Zero Lash)	
Intake	11.25 mm (0.443 in.)
Exhaust	10.90 mm (0.4292 in.)

VALVE SPRING

DESCRIPTION	SPECIFICATION
Free Length (Approx)	
Intake	49.0 mm (1.9291 in.)
Exhaust	49.0 mm (1.9291 in.)
Spring Force (Valve Closed)	
Intake and Exhaust	313.0 - 354.0 N @ 40.12 mm (70.365 - 79.582 lbs. @ 1.5795 in.)
Spring Force (Valve Open)	
Intake and Exhaust	776.0 - 870.0 N @ 28.88 mm (174.451 - 195.583 lbs. @ 1.137 in.)
Number of Coils	
Intake	7.3
Exhaust	7.3
Wire Diameter	
Intake and Exhaust	4.6 × 3.67mm (0.1811 - 0.1445 in.)
Installed Height (Spring Seat to Bottom of Retainer) Nominal	
Intake	40.12 mm (1.579 in.)
Exhaust	40.12 mm (1.579 in.)

CYLINDER HEAD

DESCRIPTION	SPECIFICATION
Gasket Thickness (Compressed)	0.7 mm (0.0276 in.)
Valve Seat Angle	44.5° - 45.0°
Valve Seat Runout (MAX)	0.051 mm (0.002 in.)
Valve Seat Width	
Intake	1.75 - 2.36 mm (0.0698 - 0.0928 in.)
Exhaust	1.71 - 2.32 mm (0.0673 - 0.0911 in.)
Guide Bore Diameter (Std.)	6.975 - 7.00 mm (0.2747 - 0.2756 in.)
Cylinder Head Warpage (Flatness)	0.0508 mm (0.002 in.)

OIL PUMP

DESCRIPTION	SPECIFICATION
Clearance Over Rotors/End Face (MAX)	0.095 mm (0.0038 in.)
Cover Out - of -Flat (MAX)	0.025 mm (0.001 in.)
Inner and Outer Rotor Thickness	12.02 mm (0.4731 in.)
Outer Rotor to pocket (Diametral) clearance (MAX)	.235 mm (.0093 in.)
Outer Rotor Diameter (MIN)	85.925 mm (0.400 in.)
Tip Clearance Between Rotors (MAX)	0.150 mm (0.006 in.)

OIL PRESSURE

SPECIFICATION	SPECIFICATION
At Curb Idle Speed (MIN)*	48 kPa (7 psi)
@ 3000 rpm	240 - 725 kPa (35 - 105 psi)
*** CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 rpm.**	

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft			
Non - Oiled Sprocket Bolt	122	90	—
Bearing Cap Bolts	11	—	100
Timing Chain Cover—Bolts	58	43	—
Connecting Rod Cap—Bolts	27	20	—
	PLUS 90° TURN		
Bed Plate—Bolts	Refer to Procedure		
Cylinder Head—Bolts	Refer to Procedure		
Crankshaft Damper—Bolt	175	130	—
Cylinder Head Cover—Bolts	12	—	105
Exhaust Manifold—Bolts	25	18	—
Exhaust Manifold Heat Shield—Nuts	8	—	72
	Then loosen 45°		
Flexplate—Bolts	60	45	—
Engine Mount Bracket to Block—Bolts	61	45	—
Rear Mount to Transmission—Bolts	46	34	—
Generator Mounting—Bolts			
M10 Bolts	54	40	—
M8 Bolts	28	—	250
Intake Manifold—Bolts	12	—	105
	Refer to Procedure for Tightening Sequence		
Oil Pan—Bolts	15	—	130
Oil Pan—Drain Plug	34	25	—
Oil Pump—Bolts	28	—	250

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Oil Pump Cover—Bolts	12	—	105
Oil Pickup Tube—Bolt and Nut	28	—	250
Oil Dipstick Tube to Engine Block—Bolt	15	—	130
Oil Fill Tube—Bolts	12	—	105
Timing Chain Guide—Bolts	28	—	250
Timing Chain Tensioner Arm—Special Pin Bolt	17	—	150
Hydraulic Tensioner—Bolts	28	—	250
Timing Chain Primary Tensioner—Bolts	28	—	250
Timing Drive Idler Sprocket—Bolt	34	25	—
Thermostat Housing—Bolts	13	—	115
Water Pump—Bolts	58	43	—

SPECIFICATIONS - 4.7L H.O. ENGINE

DESCRIPTION	SPECIFICATION
GENERAL SPECIFICATIONS	
Engine Type	90° SOHC V-8 16-Valve
Displacement	4.7 Liters / 4701cc (287 Cubic Inches)
Bore	93.0 mm (3.66 in.)
Stroke	86.5 mm (3.40 in.)
Compression Ratio	9.7:1
Horsepower	270 BHP @ 5100 RPM
Torque	330 LB-FT @ 3600 RPM
Lead Cylinder	#1 Left Bank
Firing Order	1-8-4-3-6-5-7-2
CYLINDER BLOCK	
Cylinder Block	Cast Iron
Bore Diameter	93.010 ± .0075 mm (3.6619 ± 0.0003 in.)
Out of Round (MAX)	0.076 mm (0.003 in.)
Taper (MAX)	0.051 mm (0.002 in.)
PISTONS	
Material	Aluminum Alloy
Diameter	92.975 mm (3.6605 in.)

DESCRIPTION	SPECIFICATION
Weight	383.5 grams (13.52 oz)
Ring Groove Diameter	
No. 1	83.37 - 83.13 mm (3.296 - 3.269 in.)
No. 2	82.833 - 83.033 mm (3.261 - 3.310 in.)
No. 3	83.88 - 84.08 mm (3.302 - 3.310 in.)
PISTON PINS	
Type	Full Floating
Clearance In Piston	0.010 - 0.019 mm (0.0004 - 0.0008 in.)
Clearance in Rod	0.015 - 0.028 mm (0.0006 - 0.0011 in.)
Diameter	24.017 - 24.020 mm (0.9456 - 0.9457 in.)
PISTON RINGS	
Ring Gap	
Top Compression Ring	0.20 - 0.36 mm (0.0079 - 0.0142 in.)
Second Compression Ring	0.37 - 0.63 mm (0.0146 - 0.0249 in.)
Oil Control (Steel Rails)	0.25 - 0.76 mm (0.0099 - 0.30 in.)
Side Clearance	
Top Compression Ring	.051 - .094 mm (0.0020 - 0.0037 in.)
Second Compression Ring	0.040 - 0.080 mm (0.0016 - 0.0031 in.)
Oil Ring (Steel Ring)	.019 - .229 mm (.0007 - .0091 in.)
Ring Width	
Top Compression Ring	1.472 - 1.490 mm (0.057 - 0.058 in.)
Second Compression Ring	1.472 - 1.490 mm (0.057 - 0.058 in.)
Oil Ring (Steel Rails)	0.445 - 0.470 mm (0.017 - 0.018 in.)

DESCRIPTION	SPECIFICATION
CONNECTING RODS	
Bearing Clearance	0.015 - 0.055 mm (0.0006 - 0.0022 in.)
Side Clearance	0.10 - 0.35 mm (0.004 - 0.0138 in.)
Piston Pin Bore Diameter	24.045 - 24.035 mm (0.94665 - 0.94626 in.)
Bearing Bore Out of Round (MAX)	0.004 mm (0.0002 in.)
Total Weight (Less Bearing)	555 grams (19.5771 ounces)
CRANKSHAFT	
Main BearingJournal Diameter	63.488 - 63.512 mm (2.4996 - 2.5005 in.)
Bearing Clearance	0.018 - 0.052 mm (0.0008 - 0.0021 in.)
Out of Round (MAX)	0.005 mm (0.0002 in.)
Taper (MAX)	0.008 mm (0.0004 in.)
End Play	0.052 - 0.282 mm (0.0021 - 0.0112 in.)
End Play (MAX)	0.282 mm (0.0112 in)
Connecting Rod Journal Diameter	50.992 - 51.008 mm (2.0076 - 2.0082 in.)
Bearing Clearance	0.015 - 0.055 mm (0.0006 -0.0022 in.)
Out of Round (MAX)	0.005 mm (0.0002 in.)
Taper (MAX)	0.008 mm (0.0004 in.)
CAMSHAFT	
Bore Diameter	26.02 - 26.04 mm
	(1.0245 - 1.0252 in.)
Bearing Journal Diameter	25.975 - 25.995 mm (1.0227 - 1.0235 in.)
Bearing Clearance	0.025 - 0.065 mm (0.001 - 0.0026 in.)
Bearing Clearance (MAX)	0.065 mm (0.0026 in.)

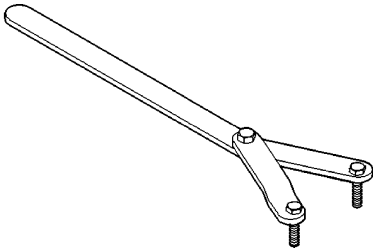
DESCRIPTION	SPECIFICATION
End Play	.075 - .200 mm (0.003 - 0.0079 in.)
End Play (MAX)	.200 mm (0.0079 in.)
VALVE TIMING	
Intake	
Opens (BTDC)	3.0°
Closes (ATDC)	233.0°
Duration	236.0°
Exhaust	
Opens (BTDC)	235.0°
Closes (ATDC)	15.0°
Duration	250.0°
Valve Overlap	18.0°
VALVES	
Face Angle	45° - 45.5°
Head Diameter	
Intake	48.52 - 48.78 mm (1.9103 - 1.9205 in.)
Exhaust	36.87 - 37.13 mm 1.4516 - 1.4618 in.)
Length (Overall)	
Intake	113.45 - 114.21 mm (4.4666 - 4.4965)
Exhaust	114.92 - 115.68 mm (4.5244 - 4.5543 in.)
Stem Diameter	
Intake	6.931 - 6.957 mm (0.2729 - 0.2739 in.)
Exhaust	6.902 - 6.928 mm (0.2717 - 0.2728 in.)
Stem - to - Guide Clearance	
Intake	.018 - .069 mm (0.0008 - 0.0028 in.)
Exhaust	.047 - .098 mm (0.0019 - 0.0039 in.)

DESCRIPTION	SPECIFICATION
Max. Allowable Stem - to - Guide Clearance (Rocking Method)	
Intake	0.069 mm (0.0028 in.)
Exhaust	0.098 mm (0.0039 in.)
Valve Lift (Zero Lash)	
Intake	12.00 mm (0.4724 in.)
Exhaust	10.90 mm (0.4292 in.)
VALVE SPRING	
Free Length (Approx)	
Intake and Exhaust	48.92 mm (1.9259 in.)
Spring Force (Valve Closed)	
Intake	361.0 - 390.0 N @40.12 mm (81.1560 - 87.6755 lbs. @1.5795 in.)
Exhaust	390.0 - 430.0 N @40.12 mm (87.6755 - 96.6678 lbs. @ 1.5795 in.)
Spring Force (Valve Open)	
Intake	984.0 - 1040.0 N @ 28.12 mm (221.212 - 233.801 lbs. @ 1.107 in.)
Exhaust	965.0 - 1055 N@ 29.12 mm (216.940 - 237.173 lbs. @ 1.146 in.)
Number of Coils	
Intake	7.30
Exhaust	7.45
Wire Diameter	
Intake and Exhaust	4.77 +/- 0.03 mm x 3.80+/- .03mm
Installed Height (Spring Seat to Bottom of Retainer) Nominal	
Intake	40.12 mm (1.579 in.)
Exhaust	40.12 mm (1.579 in.)
CYLINDER HEAD	
Gasket Thickness (Compressed)	.7 mm (0.0276 in.)
Valve Seat Angle	44.5° - 45.0°
Valve Seat Runout (MAX)	0.051 mm (0.002 in.)
Valve Seat Width	
Intake	1.75 - 2.36 mm (0.0698 - 0.0928 in.)
Exhaust	1.71 - 2.32 mm

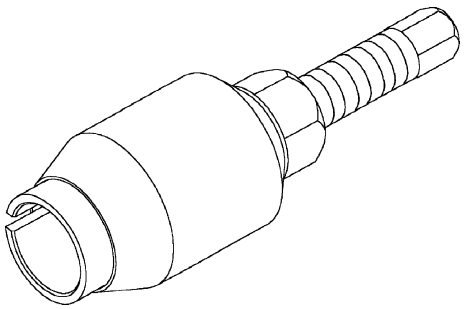
DESCRIPTION	SPECIFICATION
	(0.0673 - 0.0911 in.)
Guide Bore Diameter (Std.)	6.975 - 7.00 mm (0.2747 - 0.2756 in.)
Cylinder Head Warpage (Flatness)	0.0508 mm (0.002 in.)
OIL PUMP	
Clearance Over Rotors / End Face (MAX)	.095 mm (0.0038 in.)
Cover Out - of -Flat (MAX)	.025 mm (0.001 in.)
Inner and Outer Rotor Thickness	12.02 mm (0.4731 in.)
Outer Rotor to Pocket (Diametral) Clearance (MAX)	.235 mm (.0093 in.)
Outer Rotor Diameter (MIN)	85.925 mm (0.400 in.)
Tip Clearance Between Rotors (MAX)	.150 mm (0.006 in.)
OIL PRESSURE	
At Curb Idle Speed (MIN)*	25 kPa (4 psi)
@ 3000 rpm	170 - 758 kPa (25 - 110 psi)
*** CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 rpm.**	

SPECIAL TOOLS

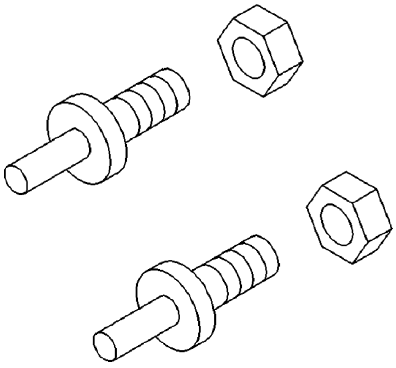
4.7L ENGINE



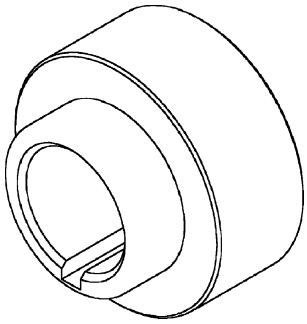
Spanner Wrench 6958



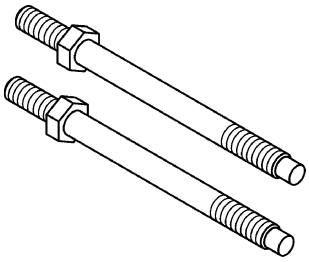
Front Crankshaft Seal Remover 8511



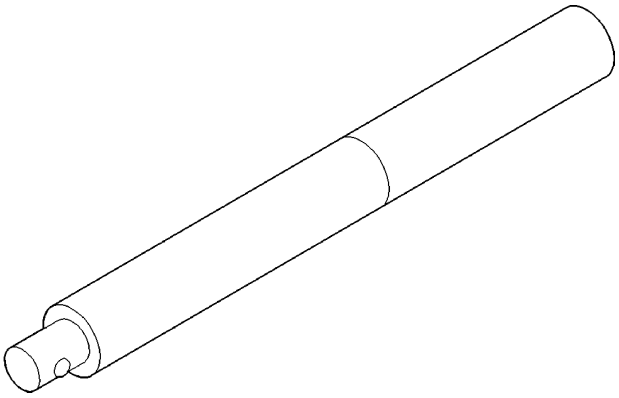
Adapter Pins 8346



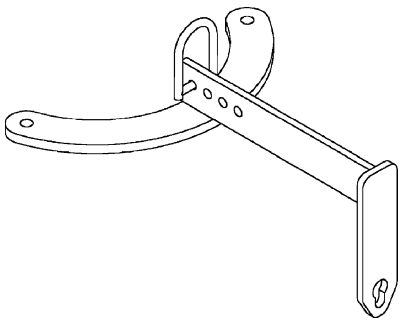
Front Crankshaft Seal Installer 8348



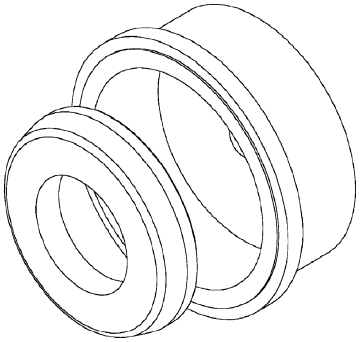
Engine Lifting Studs 8400



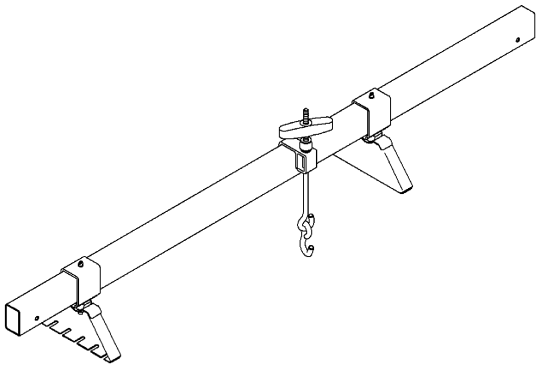
HANDLE C-4171



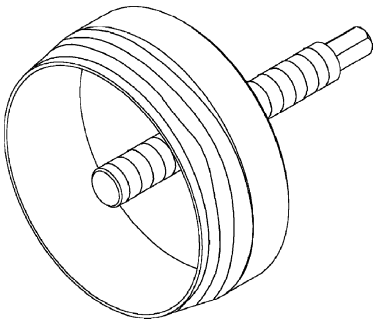
Engine Lift Fixture 8347



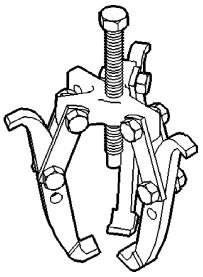
Rear Crankshaft Seal Installer 8349



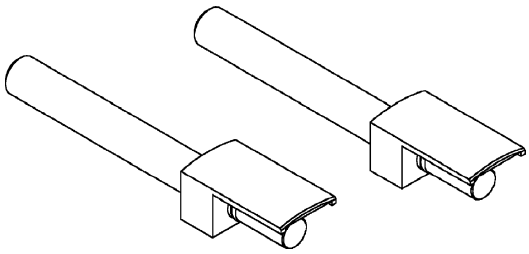
ENGINE SUPPORT FIXTURE 8534



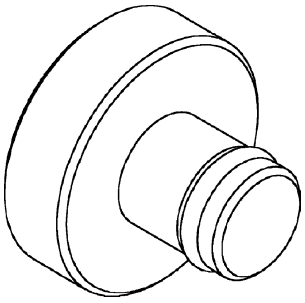
Rear Crankshaft Seal Remover 8506



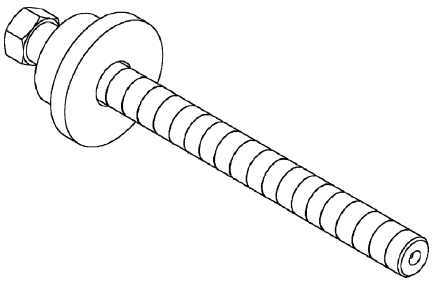
Puller 1026



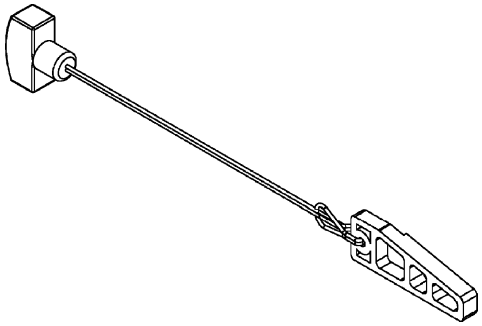
Connecting Rod Guides 8507



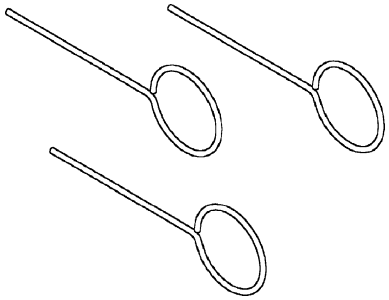
Crankshaft Damper Removal Insert 8513



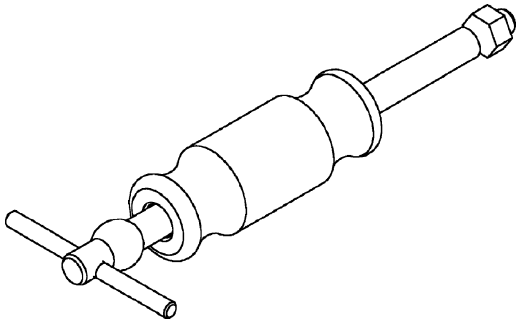
Crankshaft Damper Installer 8512



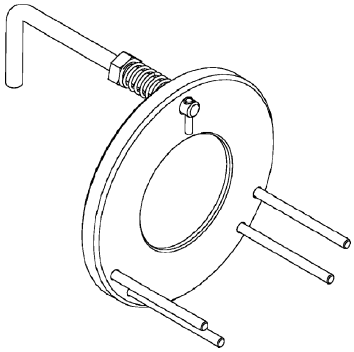
Chain Tensioner Wedge 8379



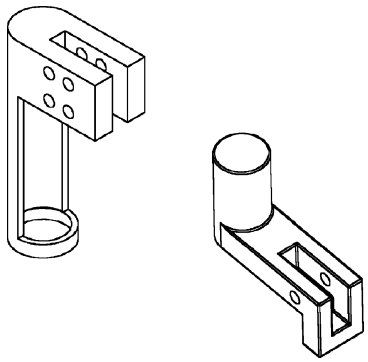
Chain Tensioner Pins 8514



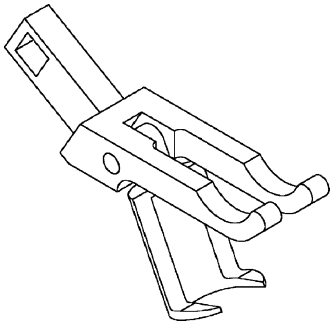
Idler Shaft Remover 8517



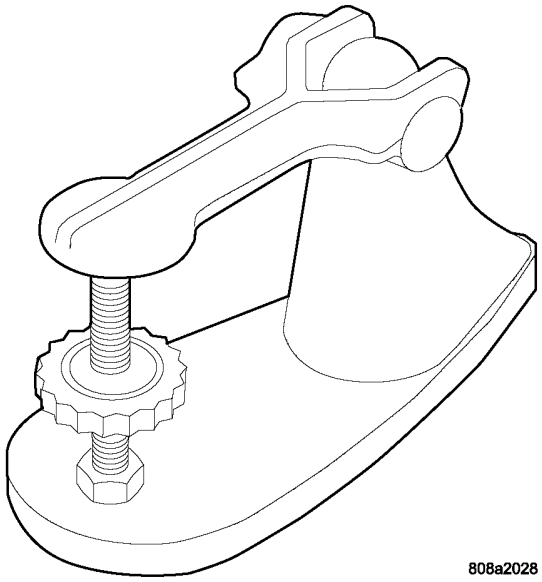
Secondary Chain Holder 8515



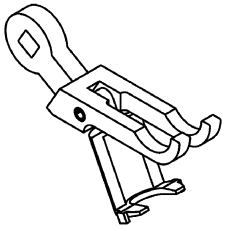
Valve Spring Compressor Adapters 8519



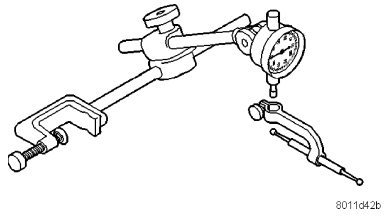
Remover, Rocker Arm 8516



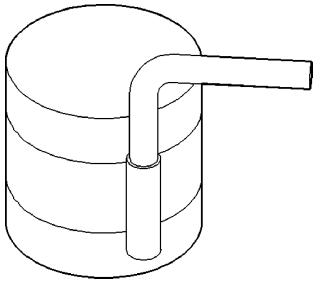
Valve Spring Tester C-647



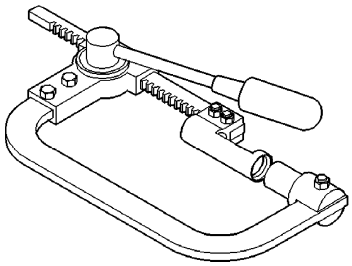
Valve Spring Compressor 8387



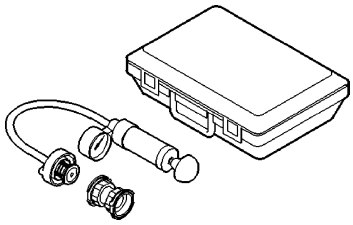
DIAL INDICATOR C-3339



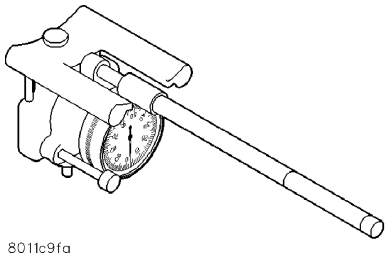
Piston Ring Compressor C-385



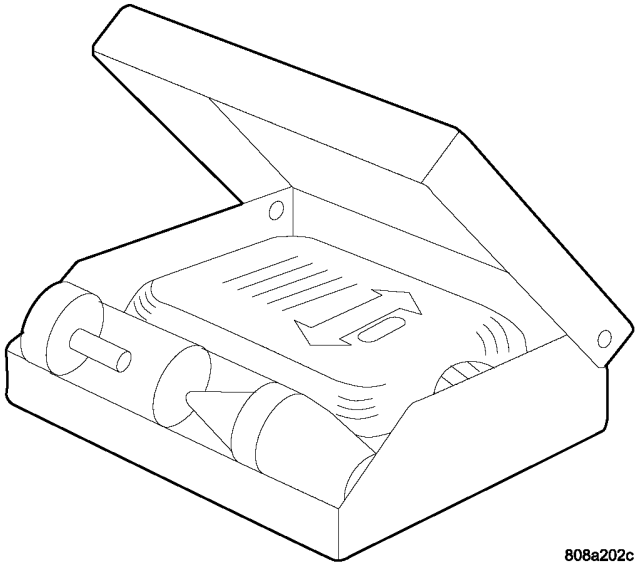
COMPRESSOR VALVE SPRING C-3422-C

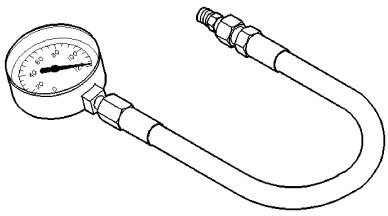


Pressure Tester Kit 7700



INDICATOR CYLINDER BORE C-119





GAUGE OIL PRESSURE - C-3292

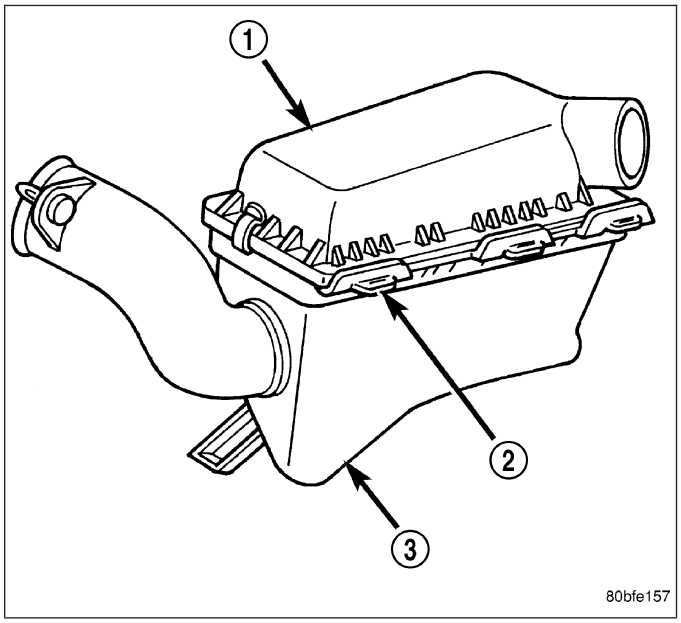
BLOC-CHEK KIT C-3685

CLEANER-AIR ELEMENT

REMOVAL

Housing removal is not necessary for element (filter) replacement.

1. Pry up spring clips from housing cover (spring clips retain cover to housing).
2. Release housing cover from locating tabs on housing and remove cover.
3. Remove air cleaner element (filter) from housing.
4. Clean inside of housing before replacing element.



INSTALLATION

1. Install element into housing.
2. Position housing cover into housing locating tabs.
3. Pry up spring clips and lock cover to housing.

CYLINDER HEAD

DESCRIPTION

DESCRIPTION - CYLINDER HEAD

The cylinder heads are made of an aluminum alloy. The cylinder head features two valves per cylinder with pressed in powdered metal valve guides. The cylinder heads also provide enclosures for the timing chain drain, necessitating unique left and right cylinder heads.

DESCRIPTION - VALVE GUIDES

The valve guides are made of powered metal and are pressed into the cylinder head. The guides are not replaceable or serviceable, and valve guide reaming is not recommended. If the guides are worn beyond acceptable limits, replace the cylinder heads.

DIAGNOSIS AND TESTING

CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring

- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING). An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50 - 70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

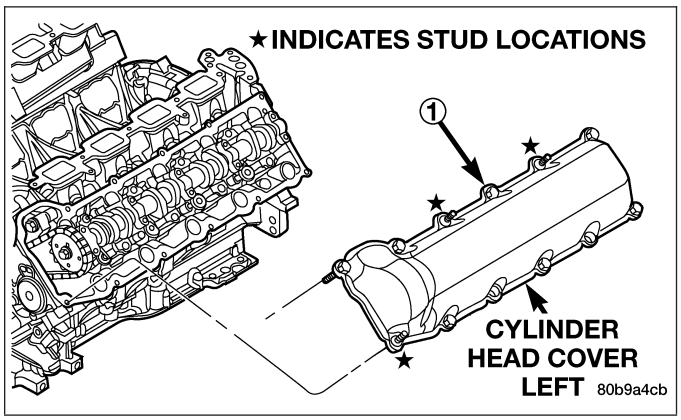
CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

REMOVAL

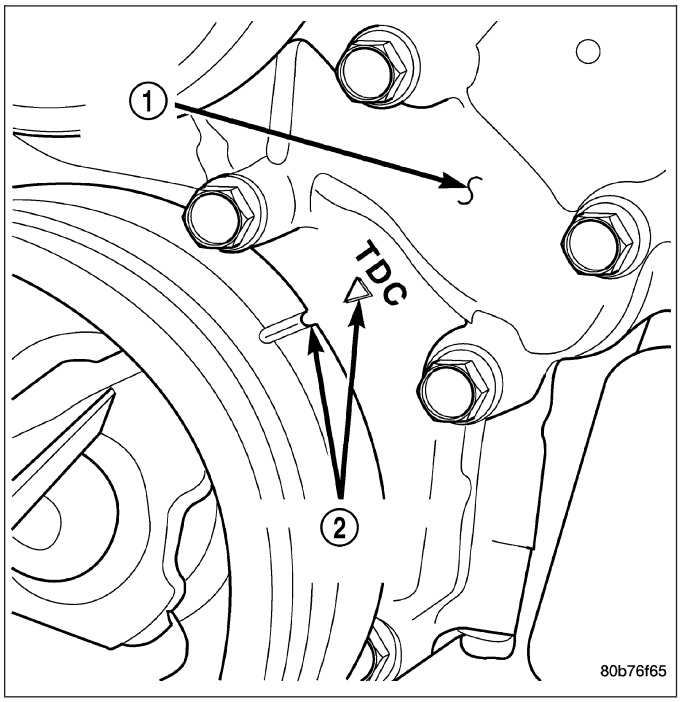
REMOVAL - LEFT CYLINDER HEAD

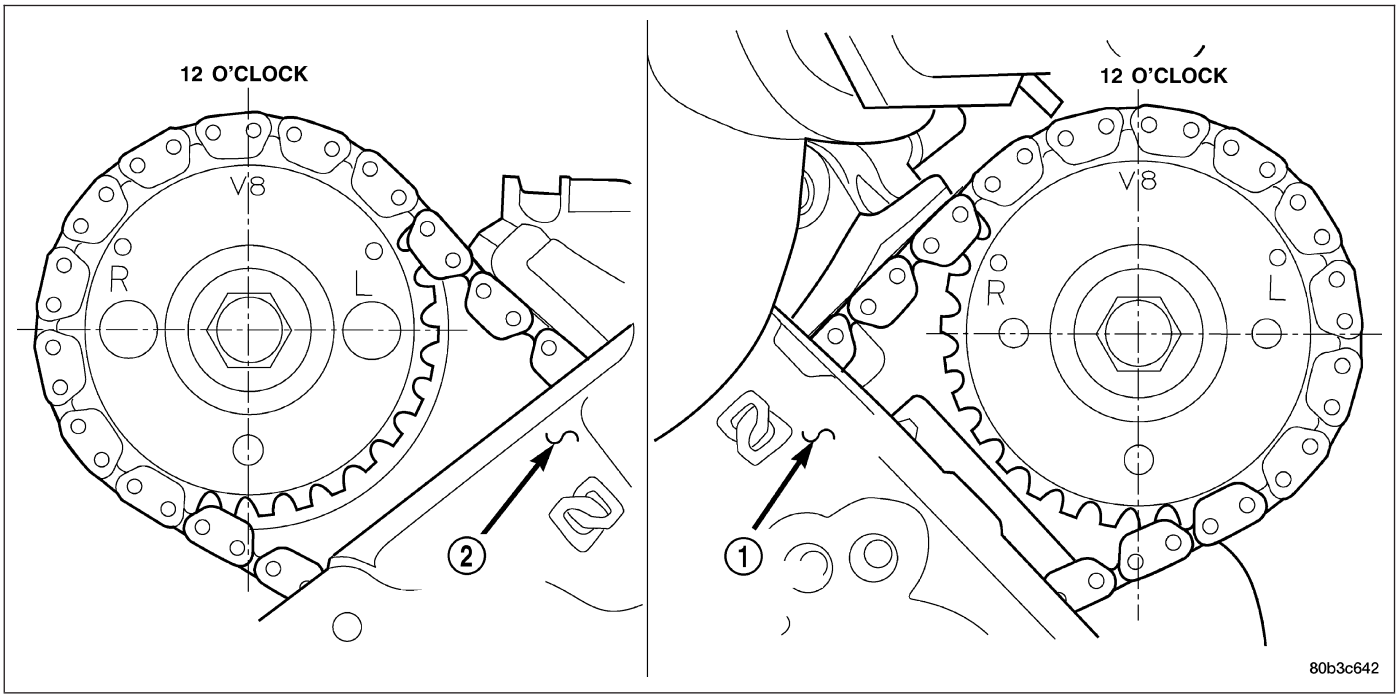
1. Disconnect the negative cable from the battery.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the left side exhaust manifold.
4. Drain the engine coolant. Refer to COOLING SYSTEM.
5. Lower the vehicle.
6. Remove the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
7. Remove the master cylinder and booster assembly. Refer to section 5 brakes.



8. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

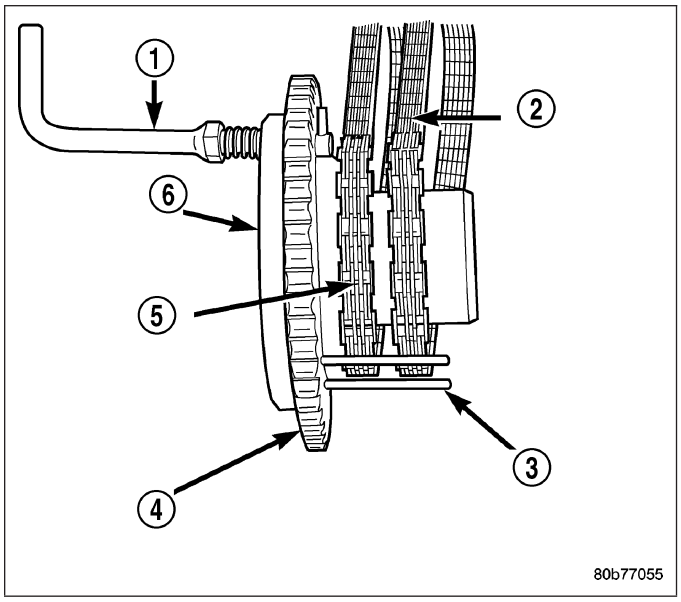
9. Remove the fan shroud and fan blade assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
10. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
11. Remove the power steering pump and set aside.
12. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark.

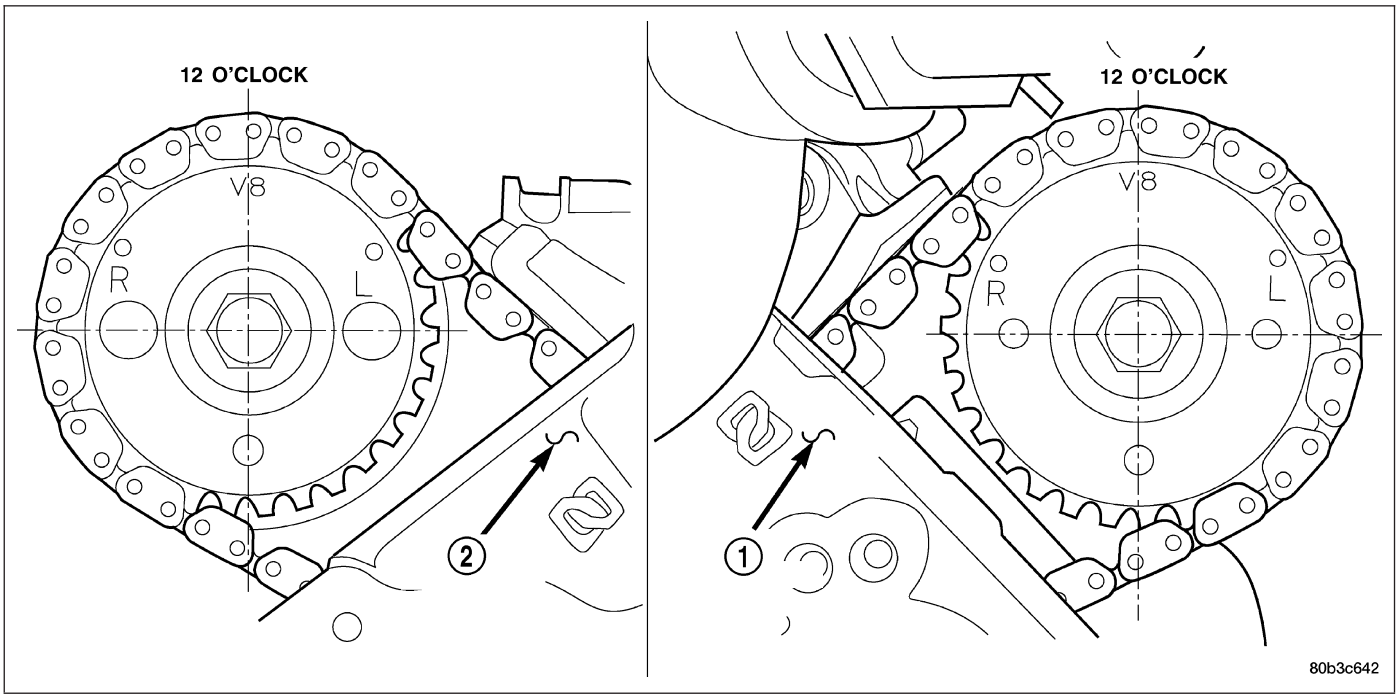




13. Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position. Rotate the crankshaft one turn if necessary.
14. Remove the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
15. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

16. Lock the secondary timing chains to the idler sprocket using Special Tool 8515.



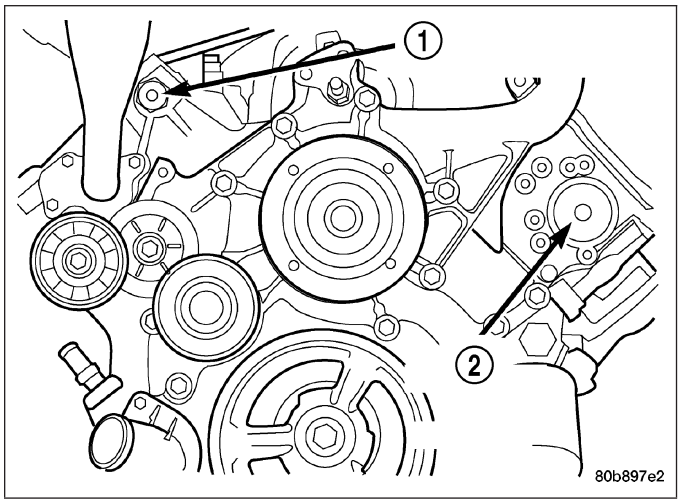


NOTE: Mark the secondary timing chain prior to removal to aid in installation.

17. Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear.
18. Remove the left side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

19. Remove the cylinder head access plug (2).
20. Remove the left side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
21. Remove the retaining bolt and the camshaft drive gear.

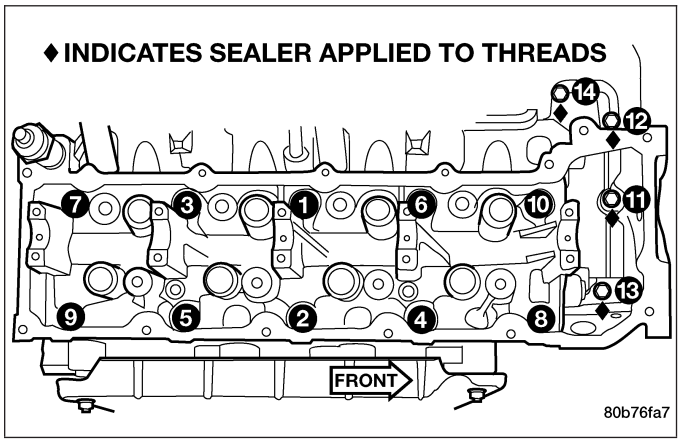
CAUTION: Do not allow the engine to rotate. Severe damage to the valve train can occur.



CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.

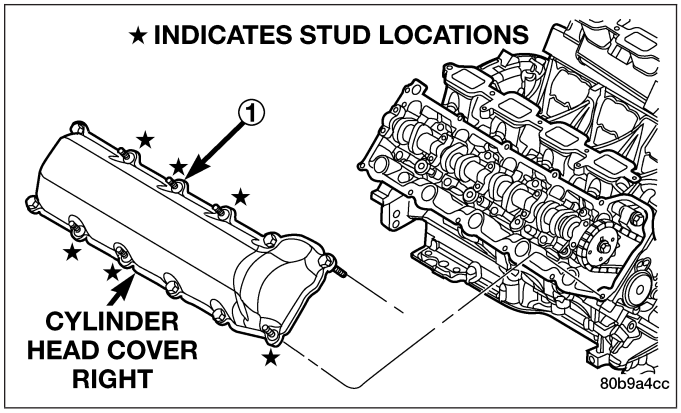
22. Remove the cylinder head retaining bolts using the sequence provided.
23. Remove the cylinder head and gasket. Discard the gasket.



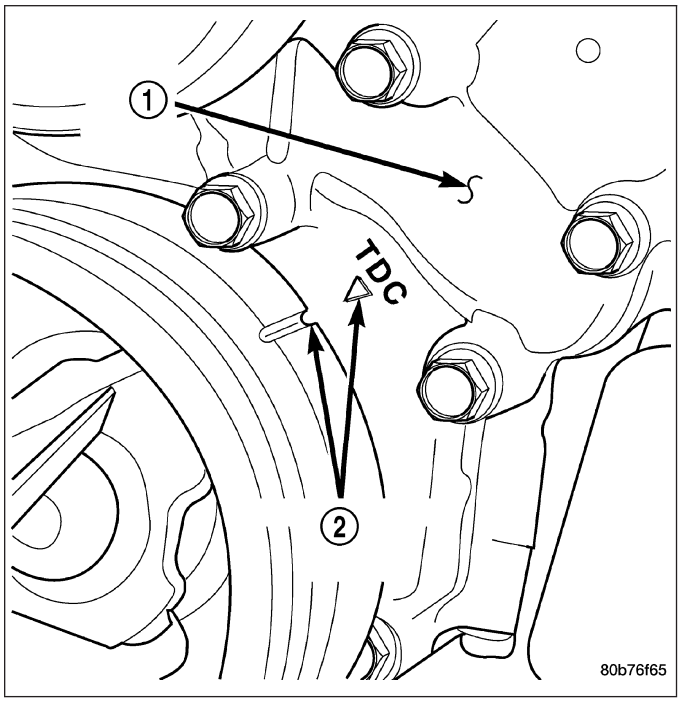
CAUTION: Do not lay the cylinder head on its gasket sealing surface, due to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

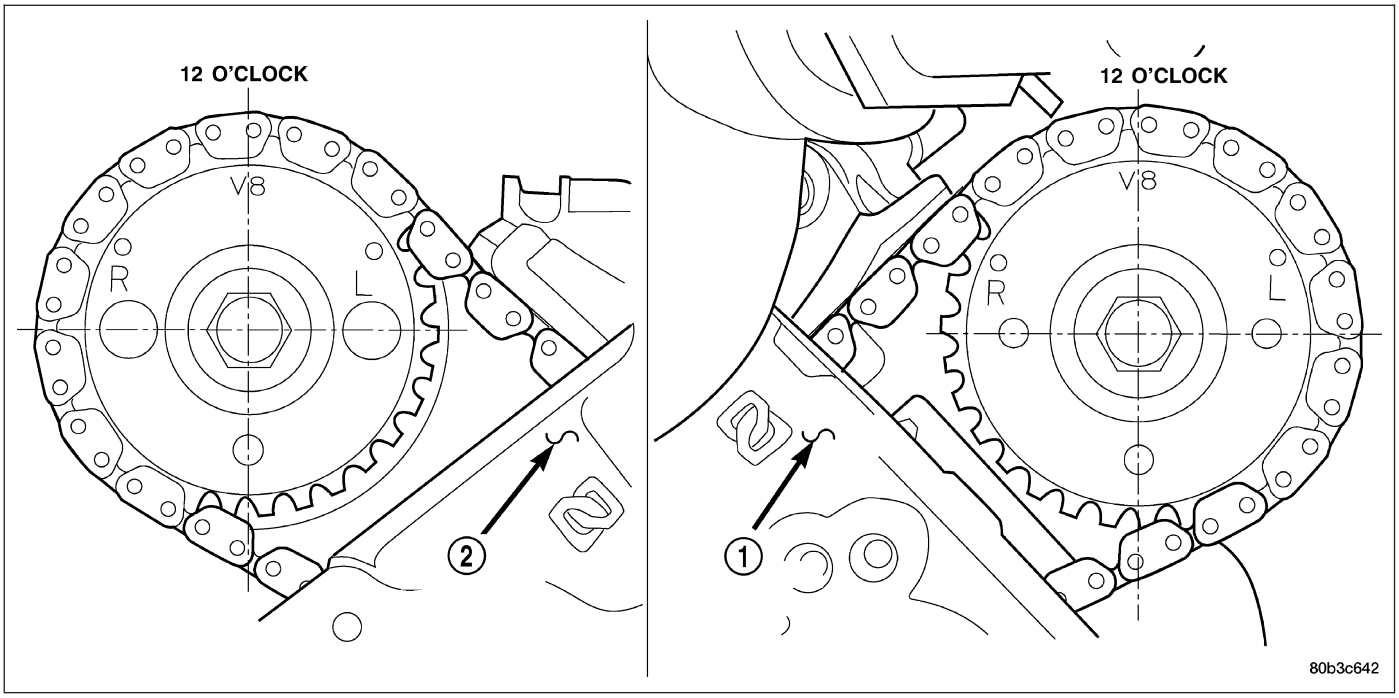
REMOVAL - RIGHT CYLINDER HEAD

1. Disconnect battery negitive cable.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the right side exhaust manifold.
4. Drain the engine coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Lower the vehicle.
6. Remove the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
7. Remove the cylinder head cover (1) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).



8. Remove the fan shroud (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
9. Remove oil fill housing from cylinder head.
10. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
11. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (2).



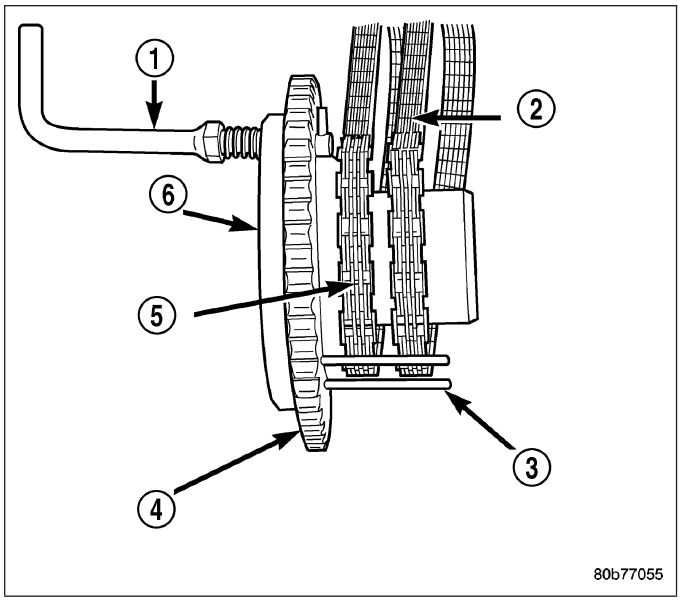


12. Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position (2). Rotate the crankshaft one turn if necessary.
13. Remove the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
14. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

15. Lock the secondary timing chains to the idler sprocket using Special Tool 8515 (6).

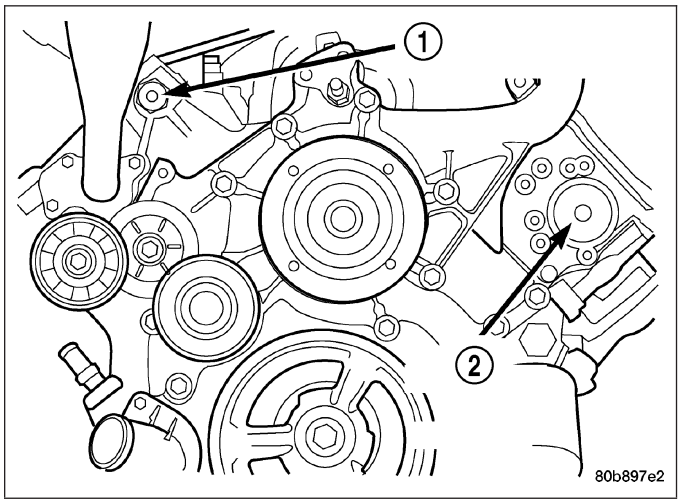
NOTE: Mark the secondary timing chain prior to removal to aid in installation.

16. Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear.
17. Remove the right side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).



18. Remove the cylinder head access plug (1).
19. Remove the right side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
20. Remove the retaining bolt and the camshaft drive gear.

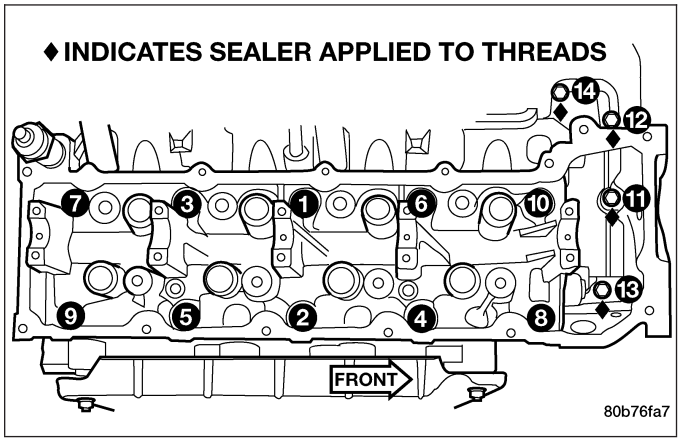
CAUTION: Do not allow the engine to rotate. severe damage to the valve train can occur.



CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason. A damaged target wheel can result in a vehicle no start condition.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.



21. Remove the cylinder head retaining bolts using the sequence provided.
22. Remove the cylinder head and gasket. Discard the gasket.

CAUTION: Do not lay the cylinder head on its gasket sealing surface, do to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

CLEANING

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

INSPECTION

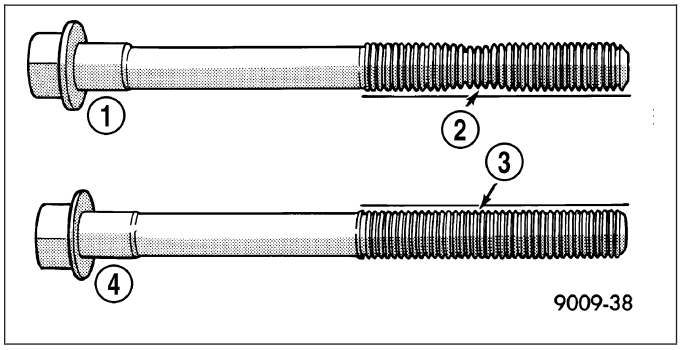
1. Inspect the cylinder head for out-of-flatness, using a straightedge and a feeler gauge. If tolerances exceed 0.0508 mm (0.002 in.) replace the cylinder head.
2. Inspect the valve seats for damage. Service the valve seats as necessary.
3. Inspect the valve guides for wear, cracks or looseness. If either condition exist, replace the cylinder head.

INSTALLATION

INSTALLATION - LEFT CYLINDER HEAD

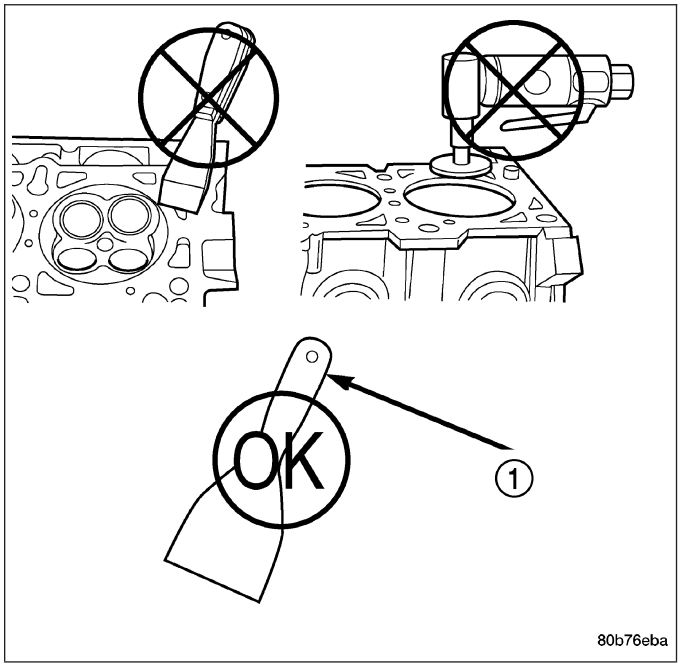
NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down (2) the bolts should be replaced.

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced.



CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper (1).

1. Clean the cylinder head and cylinder block mating surfaces.

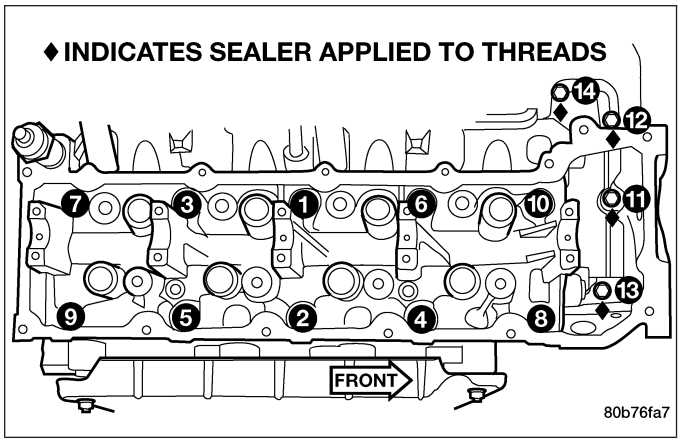


2. Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

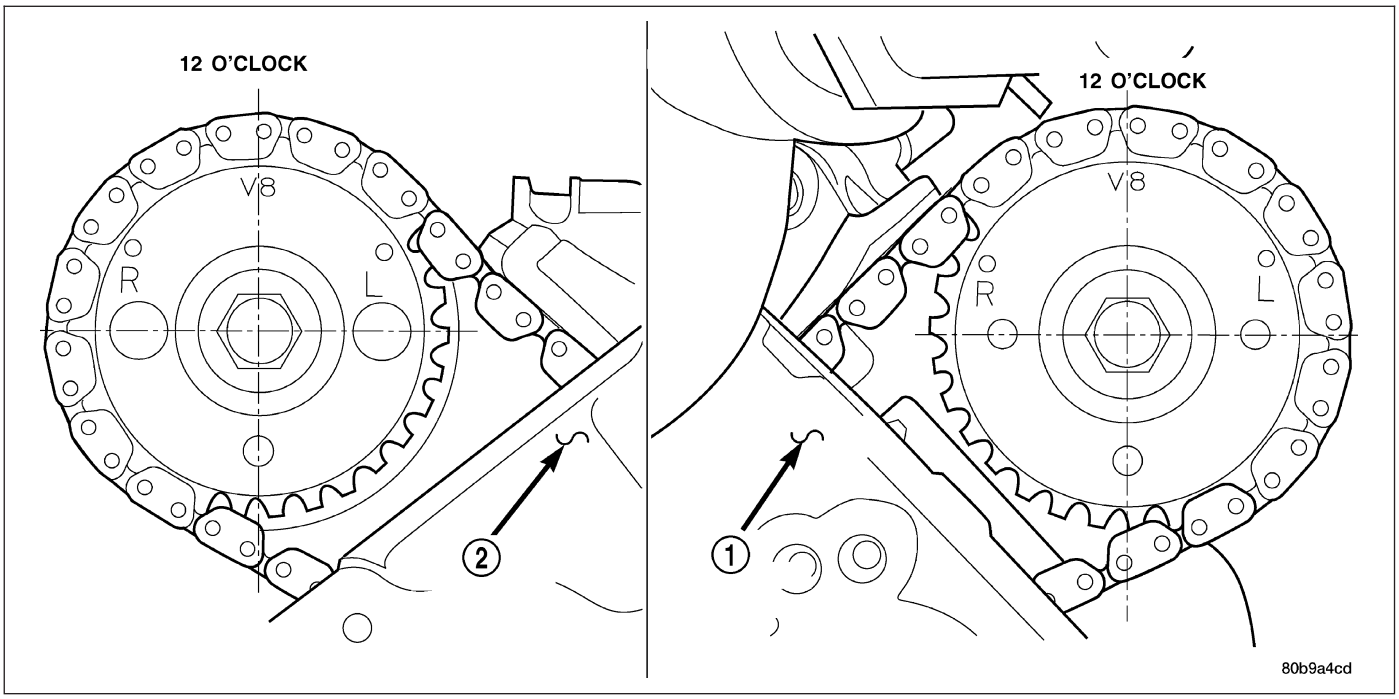
NOTE: The four smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks.



4. Lubricate the cylinder head bolt threads with clean engine oil and install the ten M11 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar® Lock and Seal Adhesive** then install the bolts.

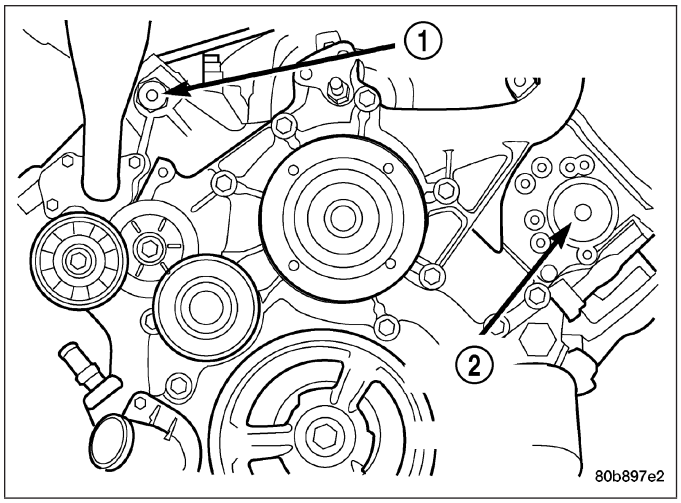
NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

6. Tighten the bolts in sequence using the following steps and torque values:
   - Step 1: Tighten bolts 1–10, 20 N·m (15 ft. lbs.).
   - Step 2: Tighten bolts 1–10, 47 N·m (35 ft. lbs.). Tighten bolts 11–14, 25 N·m (18 ft. lbs.).
   - Step 3: Tighten bolts 1–10, 90 degrees. Tighten bolts 11–14, 30 N·m (22 ft. lbs.).

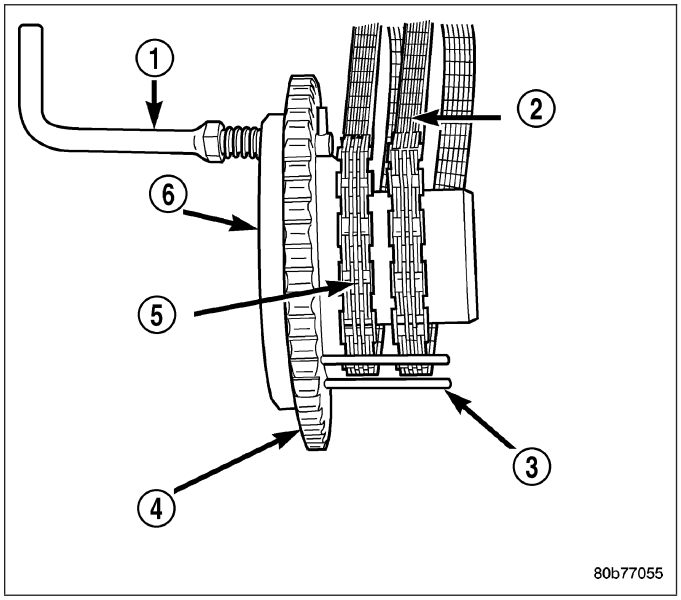


7. Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V8 mark on the gear and position the gear onto the camshaft.
8. Install the camshaft drive gear retaining bolt.
9. Install the left side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

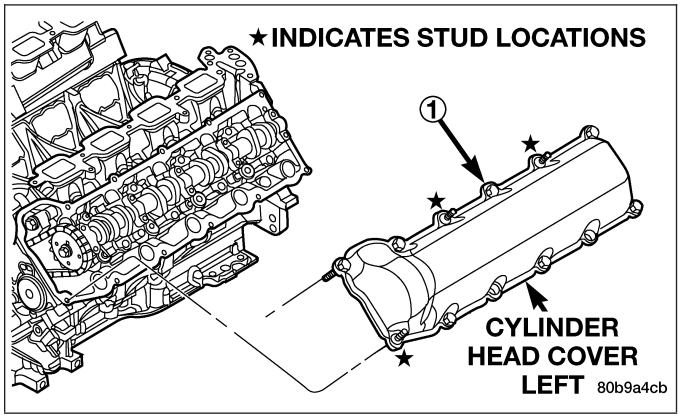
10. Install the cylinder head access plug (2).
11. Re-set and Install the left side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/ TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).



12. Remove Special Tool 8515 (6).
13. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
14. Install the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
15. Install the power steering pump.
16. Install the fan blade assembly and fan shroud (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).



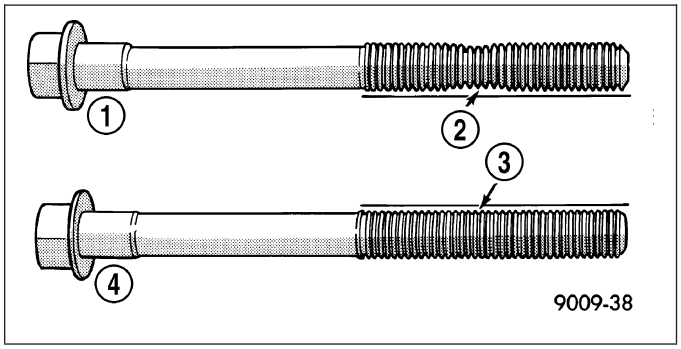
17. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
18. Reinstall the master cylinder and booster assembly. Refer to section 5 brakes.
19. Install the intake manifold (Refer to 9 - ENGINE/ MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
20. Refill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
21. Raise the vehicle.
22. Install the exhaust pipe onto the left exhaust manifold.
23. Lower the vehicle.
24. Connect the negative cable to the battery.
25. Start the engine and check for leaks.



INSTALLATION - RIGHT CYLINDER HEAD

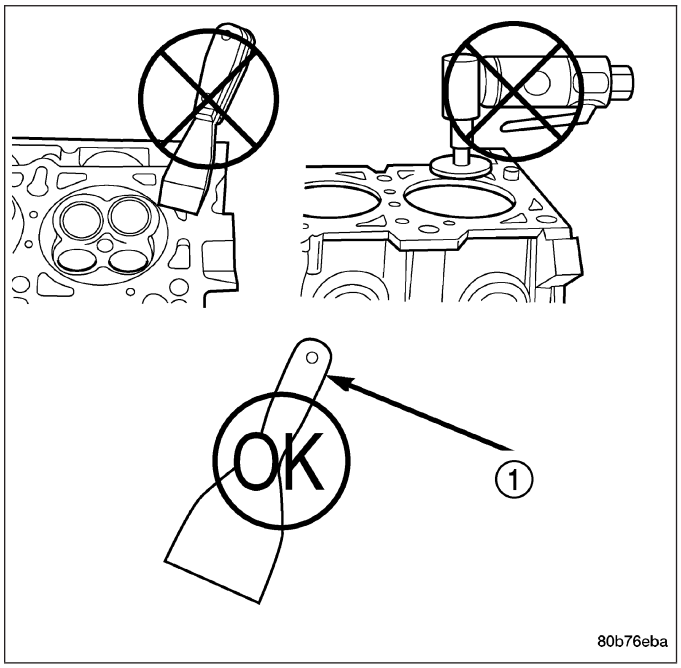
NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down (2) the bolts should be replaced.

Necking (2) can be checked by holding a straight edge against the threads. If all the threads do not contact the scale (2), the bolt should be replaced.



CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper (1).

1. Clean the cylinder head and cylinder block mating surfaces.

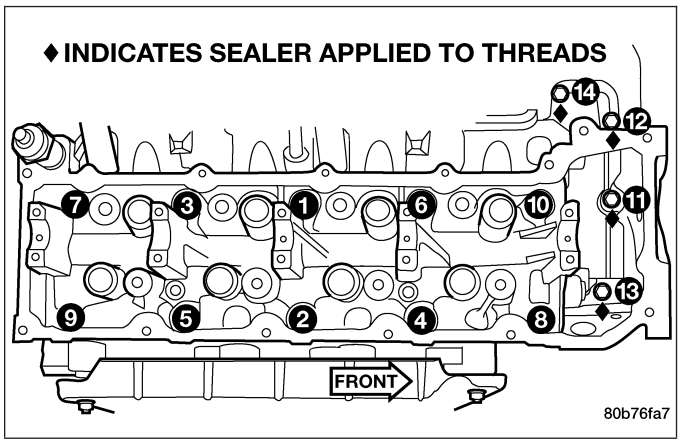


2. Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

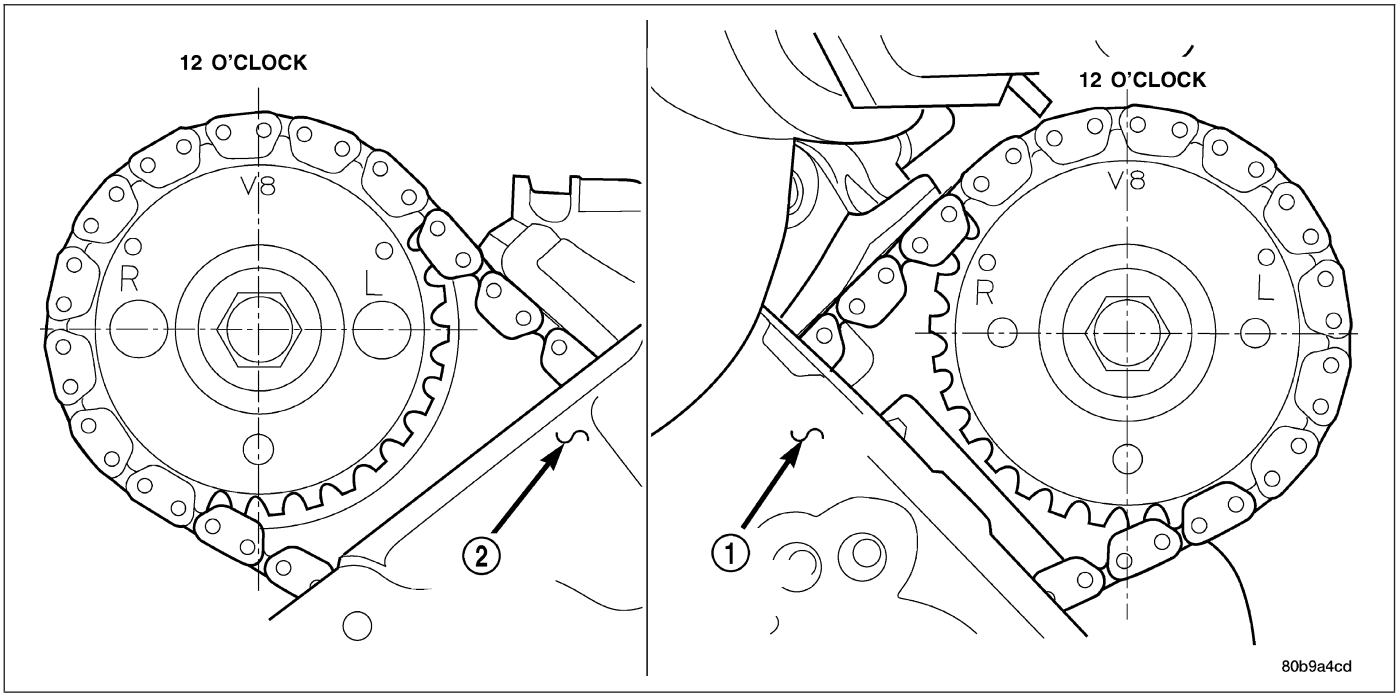
NOTE: The four smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks.



4. Lubricate the cylinder head bolt threads with clean engine oil and install the ten M10 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar® Lock and Seal Adhesive** then install the bolts.

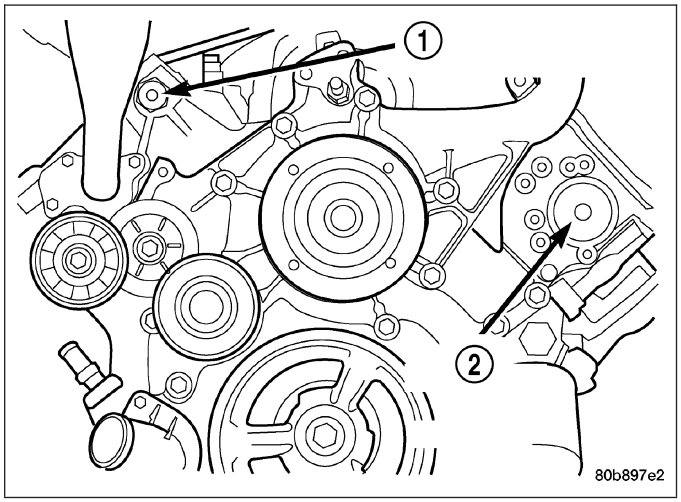
NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

6. Tighten the bolts in sequence using the following steps and torque values:
   - Step 1: Tighten bolts 1–10, 20 N·m (15 ft. lbs.).
   - Step 2: Tighten bolts 1–10, 47 N·m (35 ft. lbs.). Tighten bolts 11–14, 25 N·m (18 ft. lbs.).
   - Step 3: Tighten bolts 1–10, 90 degrees. Tighten bolts 11–14, 30 N·m (22 ft. lbs.).

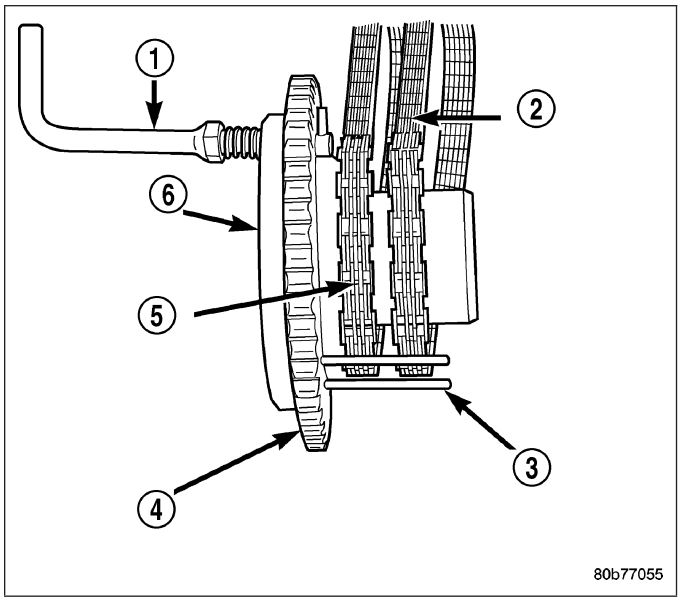


7. Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V8 mark on the gear (2) and position the gear onto the camshaft.
8. Install the camshaft drive gear retaining bolt.
9. Install the right side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

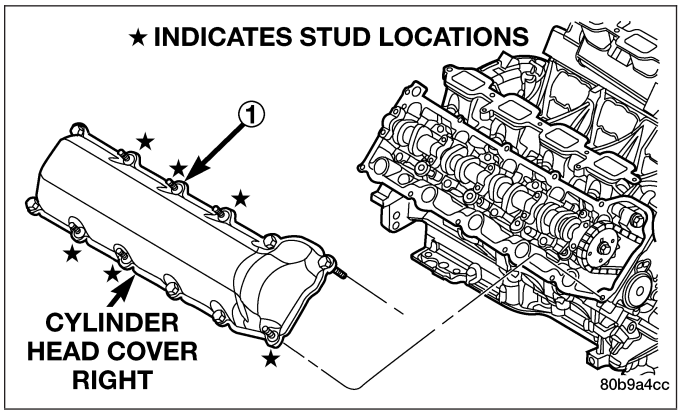
10. Install the right side cylinder head access plug (1).
11. Re-set and install the right side secondary chain tensioner.



12. Remove Special Tool 8515 (6).
13. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
14. Install the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
15. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
16. Install the fan shroud.



17. Install the cylinder head cover (1) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
18. Install the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
19. Install oil fill housing onto cylinder head.
20. Refill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
21. Raise the vehicle.
22. Install the exhaust pipe onto the right exhaust manifold.
23. Lower the vehicle.
24. Reconnect battery negitive cable.
25. Start the engine and check for leaks.



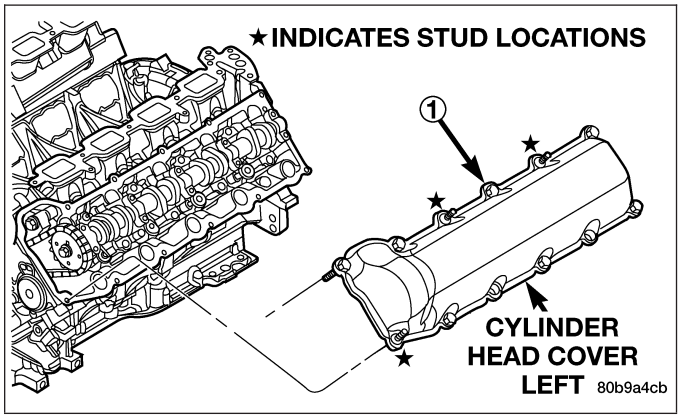
CAMSHAFT - LEFT

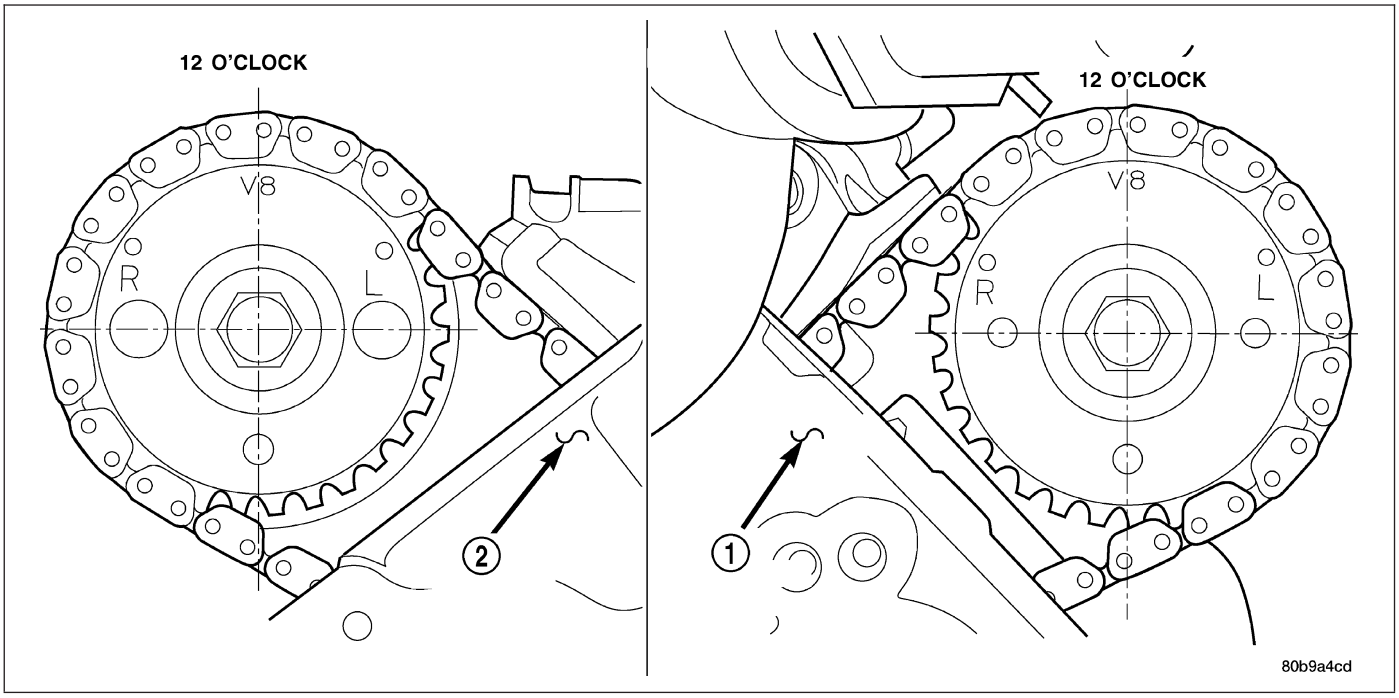
DESCRIPTION

The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. A steel post or nose piece is friction-welded to the steel camshaft tube. Five bearing journals are machined into the camshaft, four on the steel tube and one on the steel nose piece. Camshaft end play is controlled by two thrust walls that border the nose piece journal. Engine oil enters the hollow camshafts at the third journal and lubricates every intake lobe rocker through a drilled passage in the intake lobe.

REMOVAL

1. Remove cylinder head cover (1) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).





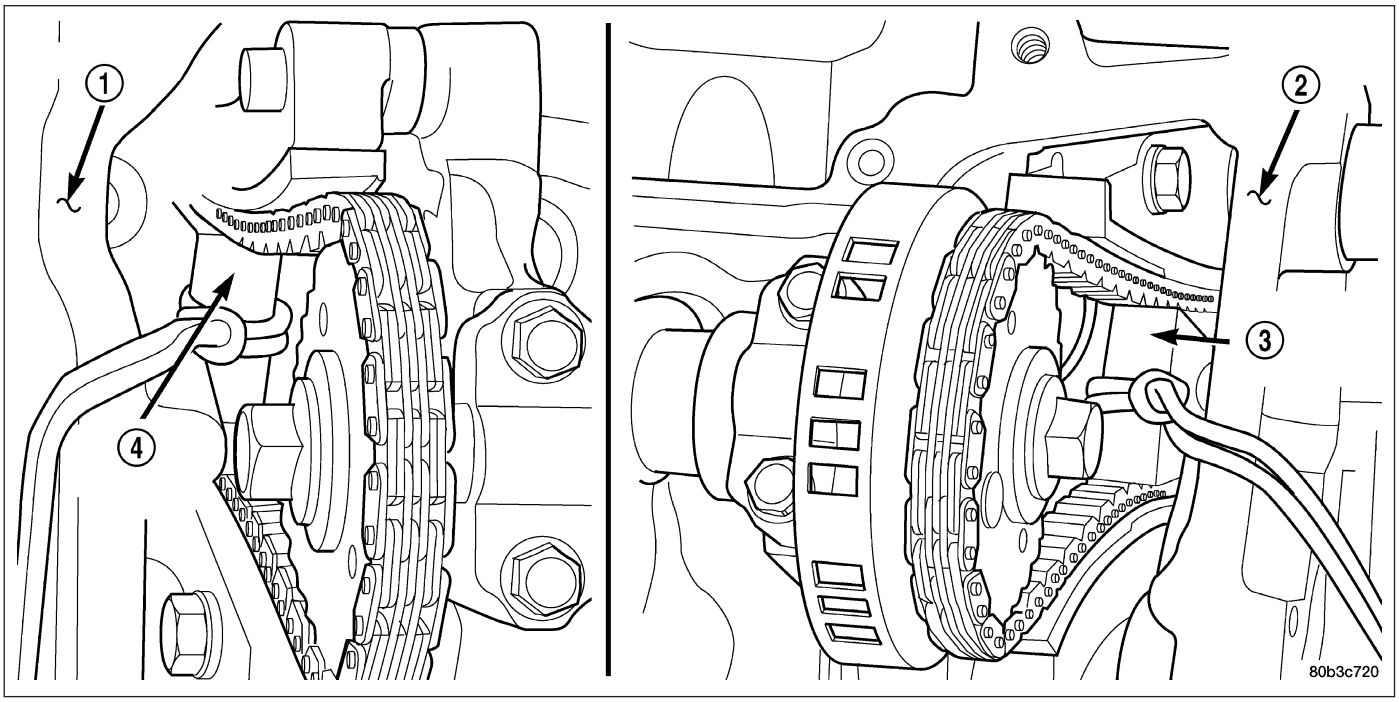
CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use Special Tool 8350 will result in hydraulic tensioner ratchet over extension, requiring timing chain cover removal to reset the tensioner ratchet.

2. Set engine to TDC cylinder #1, camshaft sprocket V8 marks at the 12 o'clock position (1).
3. Mark one link on the secondary timing chain on both sides of the V8 mark on the camshaft sprocket to aid in installation.

CAUTION: Do not hold or pry on the camshaft target wheel (Located on the right side camshaft sprocket) for any reason, Severe damage will occur to the target wheel resulting in a vehicle no start condition.

4. Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave the bolt snug against the sprocket.



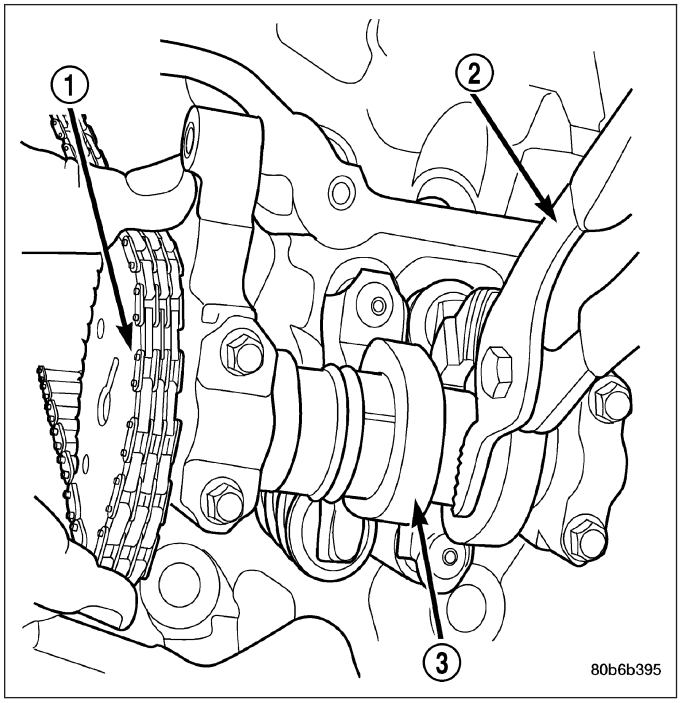
NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.

5. Position Special Tool 8350 (4) timing chain wedge between the timing chain strands, tap the tool to securely wedge the timing chain against the tensioner arm and guide.

NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

6. Hold the camshaft (3) with adjustable pliers (2) while removing the camshaft sprocket bolt and sprocket (1).
7. Using the pliers, gently allow the camshaft to rotate 15° clockwise until the camshaft is in the neutral position (no valve load).

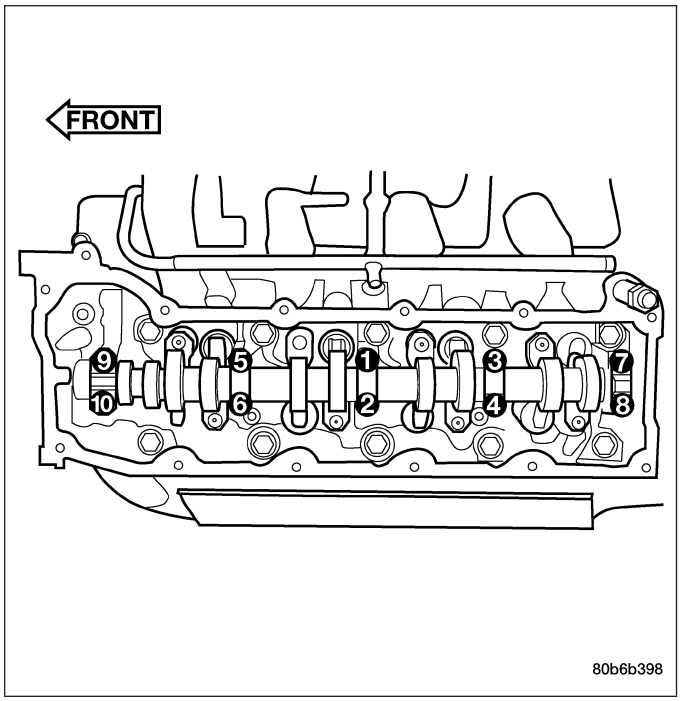


8. Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

9. Remove the camshaft bearing caps and the camshaft.

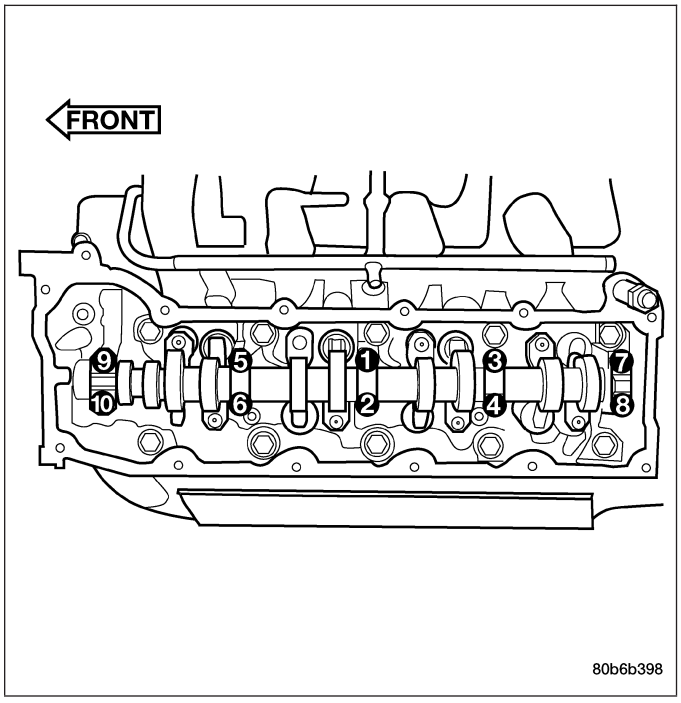


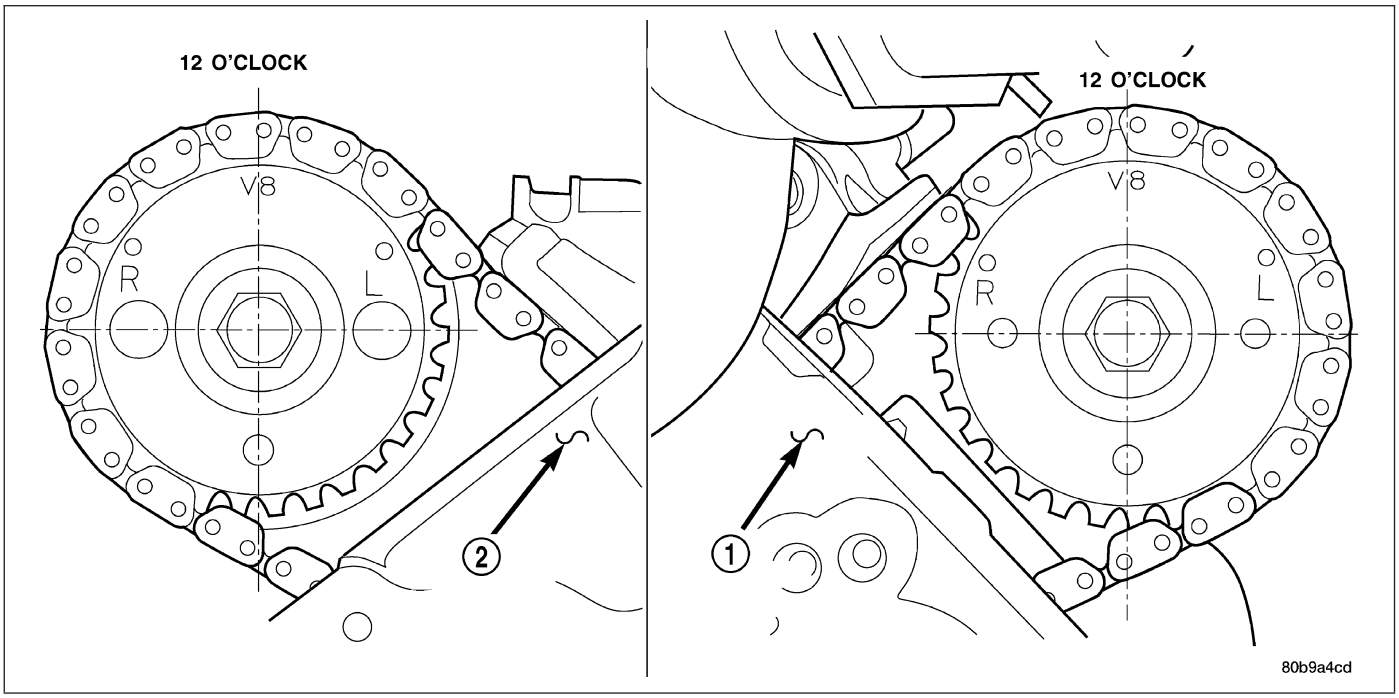
INSTALLATION

1. Lubricate camshaft journals with clean engine oil.

NOTE: Position the left side camshaft so that the camshaft sprocket dowel is near the 1 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

2. Position the camshaft into the cylinder head.
3. Install the camshaft bearing caps, hand tighten the retaining bolts.
4. Working in ½ turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward.
5. Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).





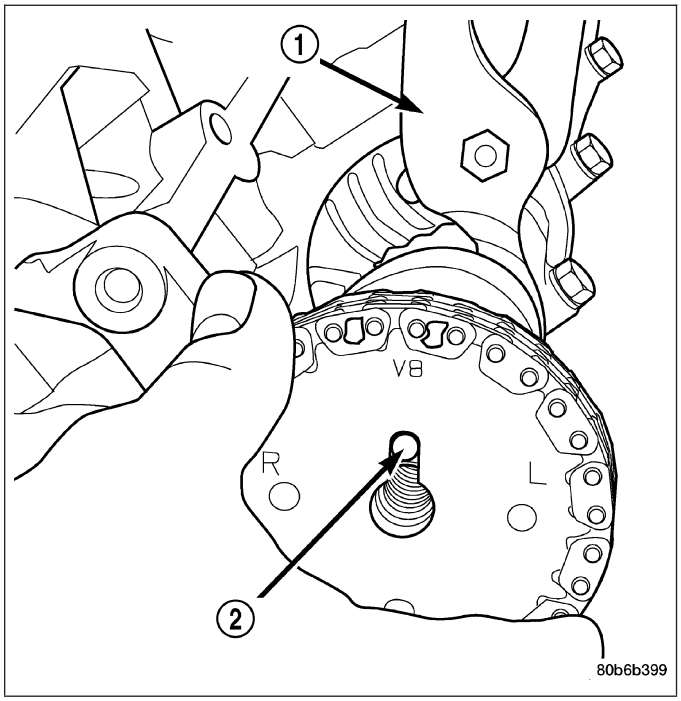
6. Position the camshaft drive gear into the timing chain aligning the V8 mark between the two marked chain links (Two links marked during removal) (1).

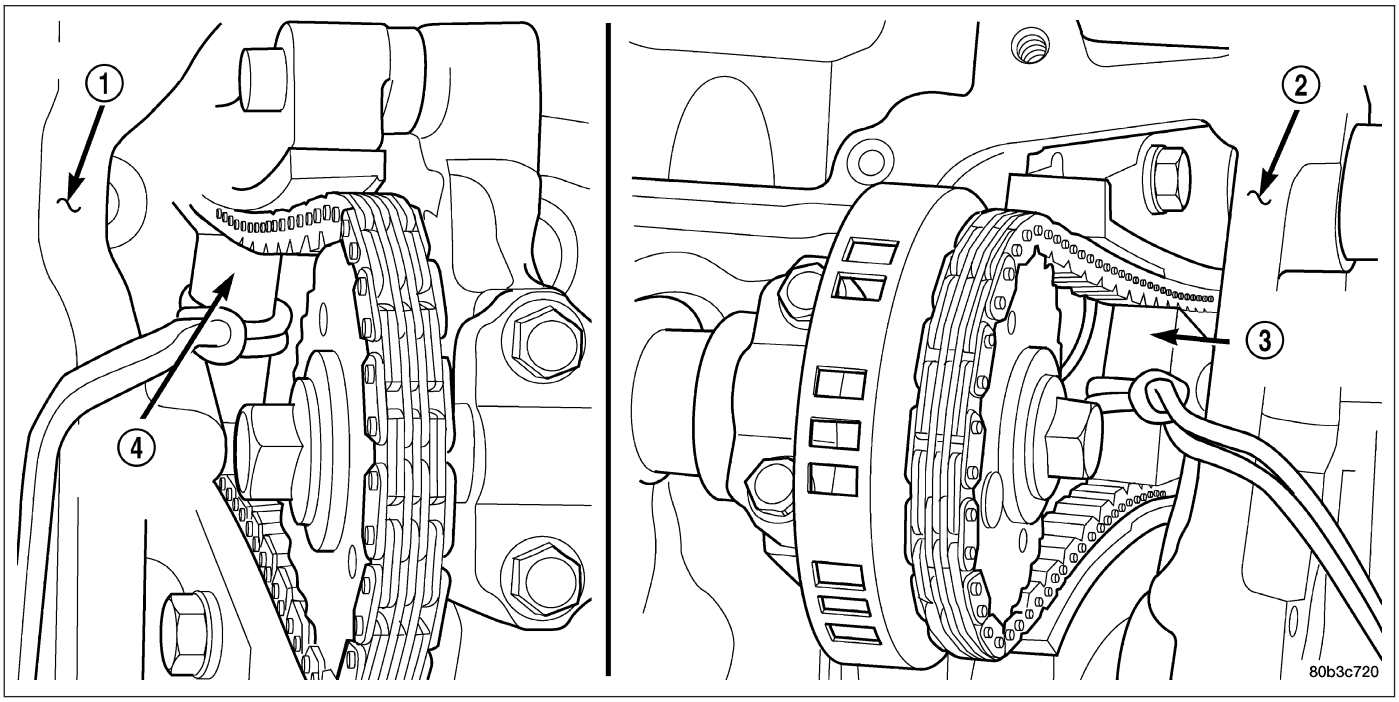
NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

7. Using the adjustable pliers (1), rotate the camshaft until the camshaft sprocket dowel (2) is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft.

CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt over-torque resulting in bolt failure.

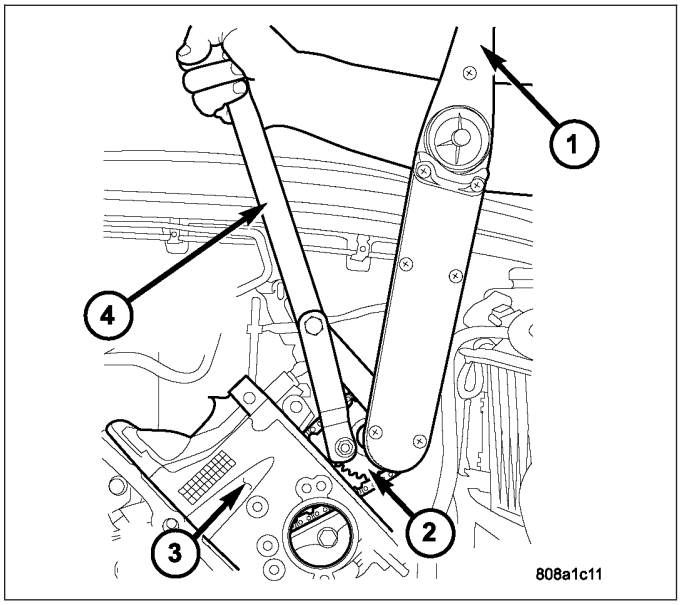
8. Remove excess oil from bolt, then install the camshaft sprocket retaining bolt and hand tighten.



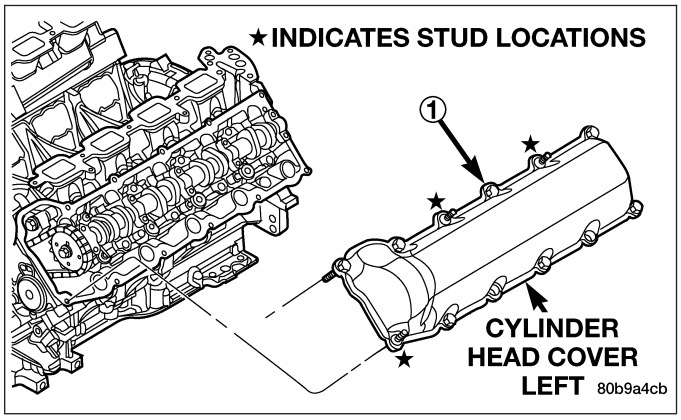


9. Remove Special Tool 8350 timing chain wedge (4).

10. Using Special Tool 6958 spanner wrench (4)with adapter pins 8346, torque the camshaft sprocket retaining bolt (2) to 122 N·m (90 ft. lbs.).



11. Install the cylinder head cover (1).



CAMSHAFT - RIGHT

DESCRIPTION

The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. A steel post or nose piece is friction-welded to the steel camshaft tube. Five bearing journals are machined into the camshaft, four on the steel tube and one on the steel nose piece. Camshaft end play is controlled by two thrust walls that border the nose piece journal. Engine oil enters the hollow camshafts at the third journal and lubricates every intake lobe rocker through a drilled passage in the intake lobe.

REMOVAL

CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use special tool 8350 will result in hydraulic tensioner ratchet over extension, Requiring timing chain cover removal to re-set the tensioner ratchet.

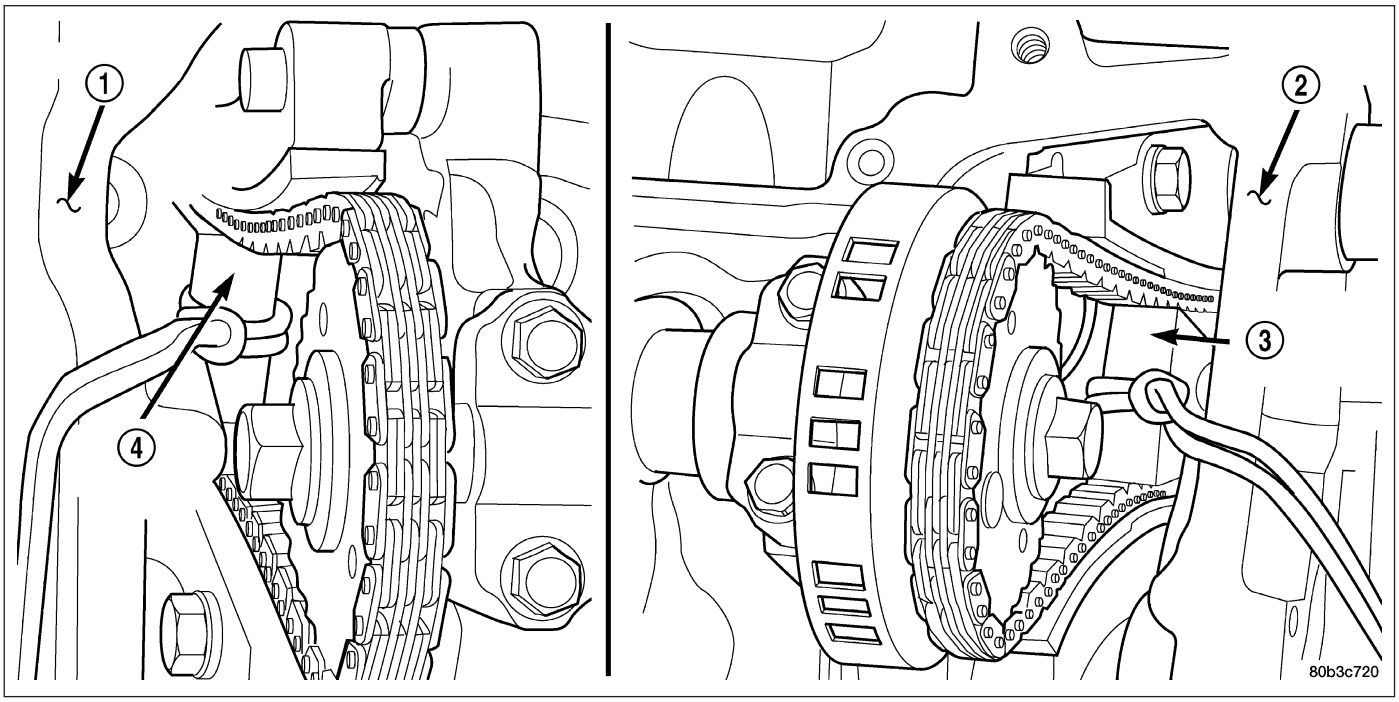
1. Remove the cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Set engine to TDC cylinder #1, camshaft sprocket V8 marks at the 12 o'clock position.
3. Mark one link on the secondary timing chain on both sides of the V8 mark on the camshaft sprocket to aid in installation.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason, Severe damage will occur to the target wheel. A damaged target wheel could cause a vehicle no start condition.

4. Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave bolt snug against sprocket.

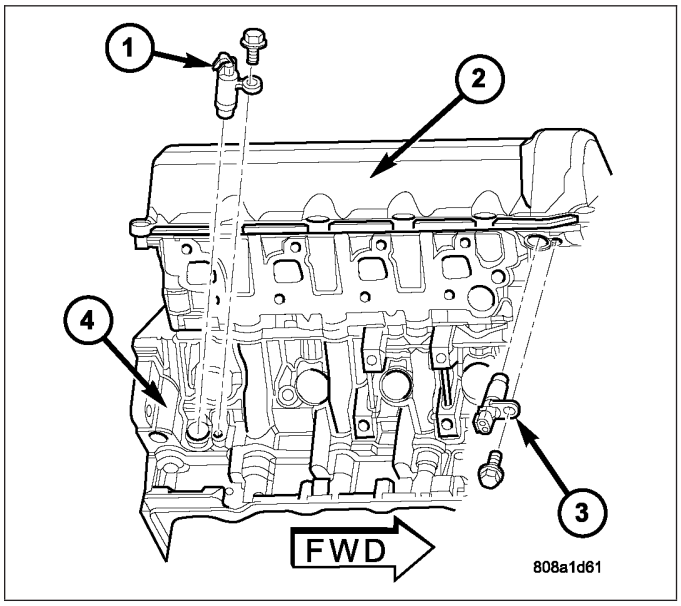
NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.



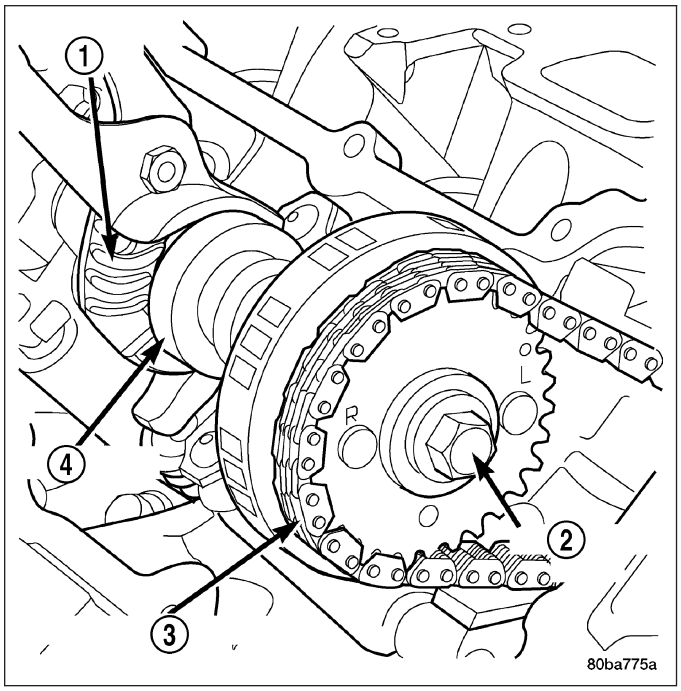
5. Position Special Tool 8350 timing chain wedge between the timing chain strands. Tap the tool to securely wedge the timing chain against the tensioner arm and guide.

6. Remove the camshaft position sensor.



NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

7. Hold the camshaft with adjustable pliers while removing the camshaft sprocket bolt and sprocket.
8. Using the pliers, gently allow the camshaft to rotate 45° counter-clockwise until the camshaft is in the neutral position (no valve load).



9. Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

10. Remove the camshaft bearing caps and the camshaft.

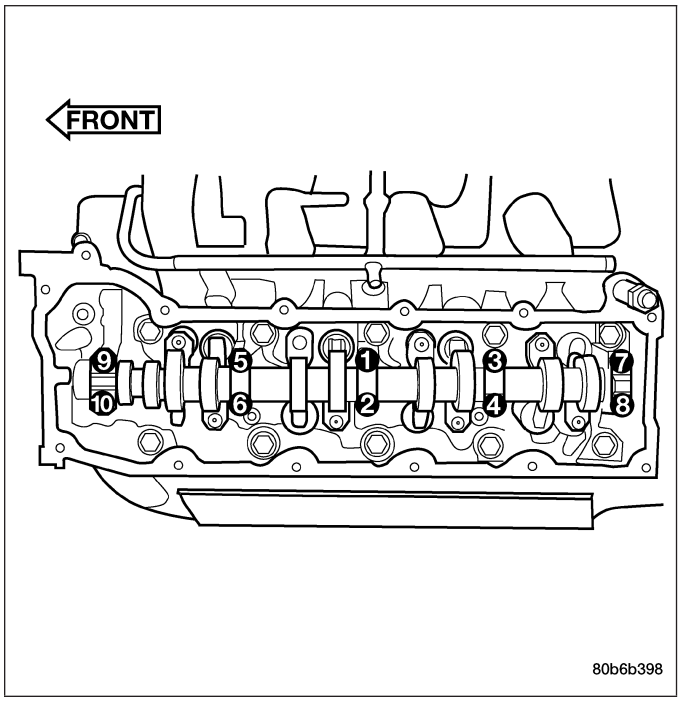
INSTALLATION

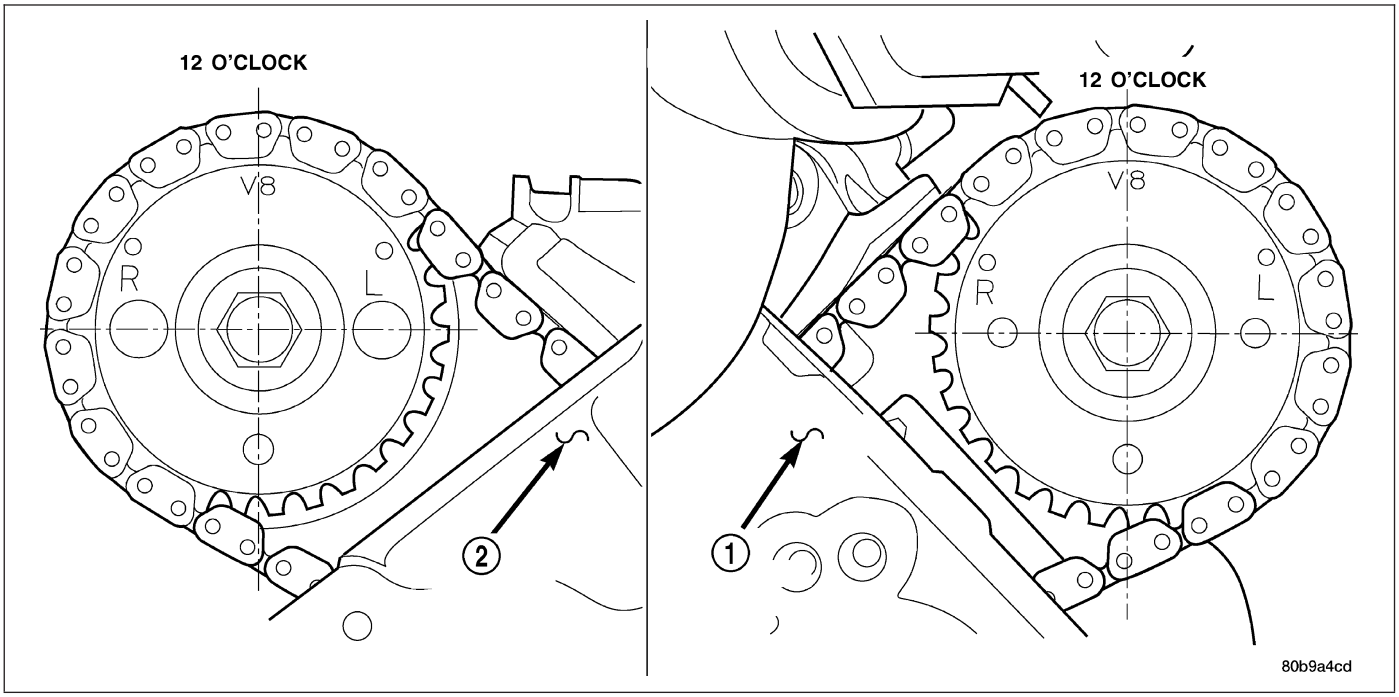
1. Lubricate camshaft journals with clean engine oil.

NOTE: Position the right side camshaft so that the camshaft sprocket dowel is near the 10 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

2. Position the camshaft into the cylinder head.

3. Install the camshaft bearing caps, hand tighten the retaining bolts.
4. Working in 1/2 turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward.
5. Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).

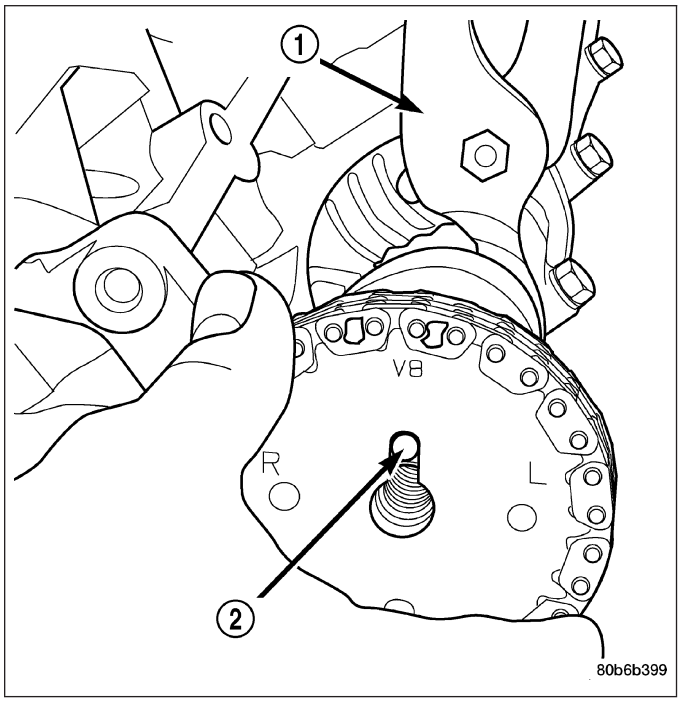




6. Position the camshaft drive gear into the timing chain aligning the V8 mark between the two marked chain links (Two links marked during removal).

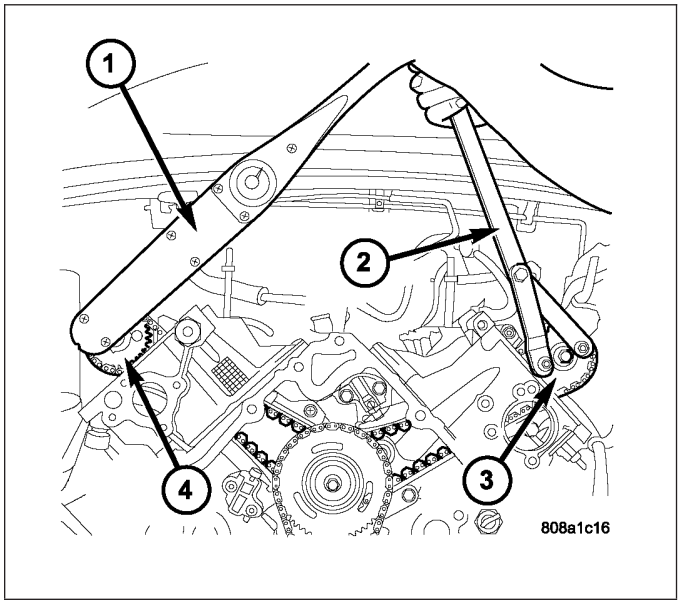
NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

7. Using the adjustable pliers, rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft.



CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt over-torque resulting in bolt failure.

8. Remove excess oil from camshaft sprocket bolt, then install the camshaft sprocket retaining bolt and hand tighten.
9. Remove timing chain wedge special tool 8350.
10. Using Special Tool 6958 spanner wrench with adapter pins 8346 , torque the camshaft sprocket retaining bolt to 122 N·m (90 ft. lbs.).



11. Install the camshaft position sensor.
12. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

COVER - CYLINDER HEAD

DESCRIPTION

The cylinder head covers are made of injection molded thermo-set plastic, and are not interchangeable from side-to-side. It is imperative that nothing rest on the cylinder head covers. Prolonged contact with other items may wear a hole in the cylinder head cover.

REMOVAL

REMOVAL - RIGHT SIDE

1. Disconnect battery negative cable.
2. Remove air cleaner assembly, resonator assembly and air inlet hose.
3. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
5. Remove air conditioning compressor retaining bolts and move compressor to the left.
6. Remove heater hoses.
7. Disconnect injector and ignition coil connectors.
8. Disconnect and remove positive crankcase ventilation (PCV) hose.
9. Remove oil fill tube.
10. Un-clip injector and ignition coil harness and move away from cylinder head cover.
11. Remove right rear breather tube and filter assembly.
12. Remove cylinder head cover retaining bolts.
13. Remove cylinder head cover.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

REMOVAL - LEFT SIDE

1. Disconnect negative cable from battery.
2. Remove the resonator assemble and air inlet hose.
3. Disconnect injector connectors and un-clip the injector harness.
4. Route injector harness in front of cylinder head cover.
5. Disconnect the left side breather tube and remove the breather tube.
6. Remove the cylinder head cover mounting bolts.
7. Remove cylinder head cover and gasket.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

CLEANING

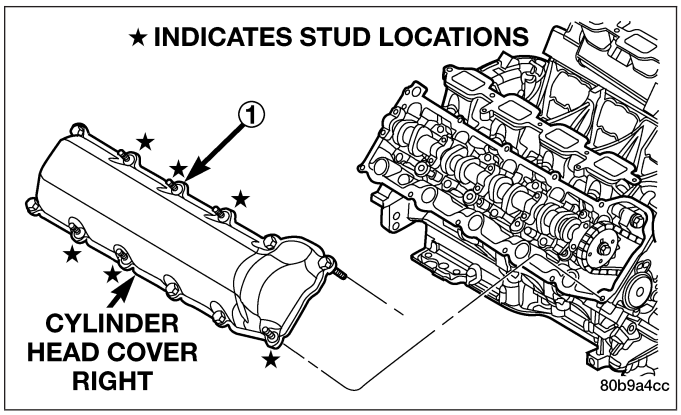
Clean cylinder head cover gasket surface.

Clean head rail, if necessary.

INSTALLATION

INSTALLATION - RIGHT SIDE

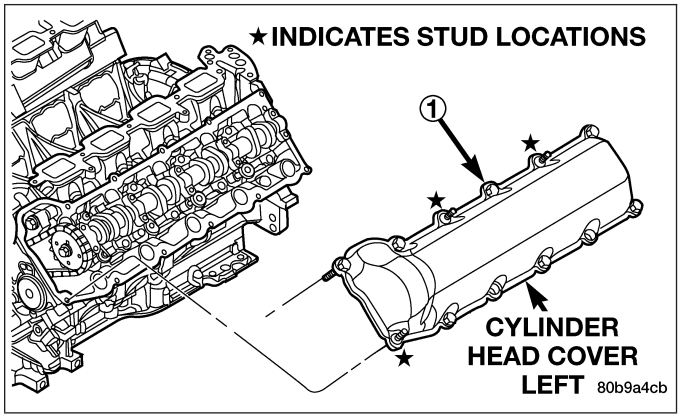
CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.



1. Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Install cylinder head cover and hand start all fasteners (1). Verify that all double ended studs are in the correct location shown in.
3. Tighten cylinder head cover bolts and double ended studs to 12 N·m (105 in. lbs).
4. Install right rear breather tube and filter assembly.
5. Connect injector, ignition coil electrical connectors and harness retaining clips.
6. Install the oil fill tube.
7. Install PCV hose.
8. Install heater hoses.
9. Install air conditioning compressor retaining bolts.
10. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
11. Fill Cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
12. Install air cleaner assembly, resonator assembly and air inlet hose.
13. Connect battery negative cable.

INSTALLATION - LEFT SIDE

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.



1. Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Install cylinder head cover and hand start all fasteners. Verify that all studs are in the correct location shown in.
3. Tighten cylinder head cover bolts (1) and double ended studs to 12 N·m (105 in. lbs.).
4. Install left side breather and connect breather tube.
5. Connect injector electrical connectors and injector harness retaining clips.
6. Install the resonator and air inlet hose.
7. Connect negative cable to battery.

VALVES & SEATS - INTAKE/EXHAUST

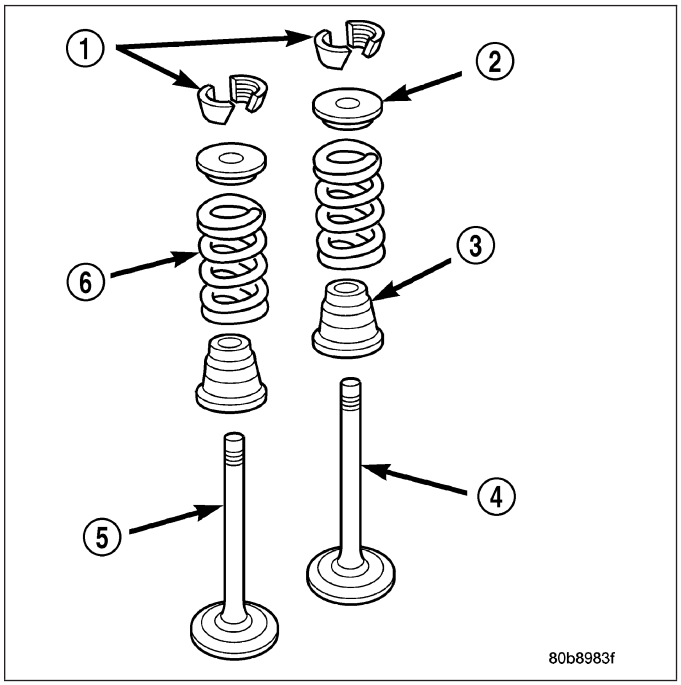
DESCRIPTION

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. Each valve is actuated by a roller rocker arm which pivots on a stationary lash adjuster. All valves use three bead lock keepers to retain the springs and promote valve rotation.

STANDARD PROCEDURE - REFACING

NOTE: Valve seats that are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise the cylinder head must be replaced.

NOTE: When refacing valves (4) and valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.



1. Using a suitable dial indicator measure the center of the valve seat Total run out must not exceed 0.051 mm (0.002 in).
2. Apply a small amount of Prussian blue to the valve seat, insert the valve into the cylinder head, while applying light pressure on the valve rotate the valve. Remove the valve and examine the valve face. If the blue is transferred below the top edge of the valve face, lower the valve seat using a 15 degree stone. If the blue is transferred to the bottom edge of the valve face, raise the valve seat using a 65 degree stone.
3. When the seat is properly positioned the width of the intake seat must be 1.75 - 2.36 mm (0.0689 - 0.0928 in.) and the exhaust seat must be 1.71 - 2.32 mm (0.0673 - 0.0911 in.).
4. Check the valve spring (6) installed height after refacing the valve and seat. The installed height for both intake and exhaust valve springs must not exceed 40.74 mm (1.6039 in.).
5. The valve seat and valve face must maintain a face angle of 44.5 - 45 ° angle .

ROCKER ARM-VALVE

DESCRIPTION

The rocker arms are steel stampings with an integral roller bearing. The rocker arms incorporate a 2.8 mm (0.11 inch) oil hole in the lash adjuster socket for roller and camshaft lubrication.

DIAGNOSIS AND TESTING - HYDRAULIC LASH ADJUSTER

A tappet-like noise may be produced from several items. Check the following items.

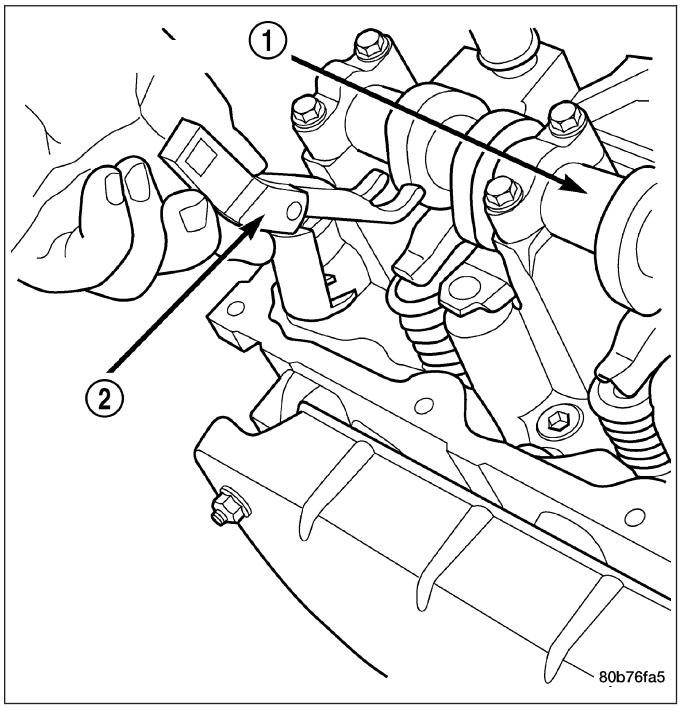
1. Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.
2. Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.
3. Turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.
4. Low oil pressure.
5. The oil restrictor in cylinder head gasket or the oil passage to the cylinder head is plugged with debris.

6. Air ingested into oil due to broken or cracked oil pump pick up.
7. Worn valve guides.
8. Rocker arm ears contacting valve spring retainer.
9. Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.
10. Oil leak or excessive cam bore wear in cylinder head.
11. Faulty lash adjuster.
    a. Check lash adjusters for sponginess while installed in cylinder head and cam on camshaft at base circle. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.
    b. Remove suspected lash adjusters, and replace.
    c. Before installation, make sure adjusters are at least partially full of oil. This can be verified by little or no plunger travel when lash adjuster is depressed.

REMOVAL

NOTE: Disconnect the battery negative cable to prevent accidental starter engagement.

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. For rocker arm removal on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.
3. For rocker arm removal on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.
4. For rocker arm removal on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.
5. For rocker arm removal on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.
6. Using special tool 8516 Rocker Arm Remover (2), press downward on the valve spring, remove rocker arm.



INSTALLATION

CAUTION: Make sure the rocker arms are installed with the concave pocket over the lash adjusters. Failure to do so may cause severe damage to the rocker arms and/or lash adjusters.

NOTE: Coat the rocker arms with clean engine oil prior to installation.

1. For rocker arm installation on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.
2. For rocker arm installation on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.
3. For rocker arm installation on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.
4. For rocker arm installation on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.
5. Using special tool 8516 press downward on the valve spring, install rocker arm.

6. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

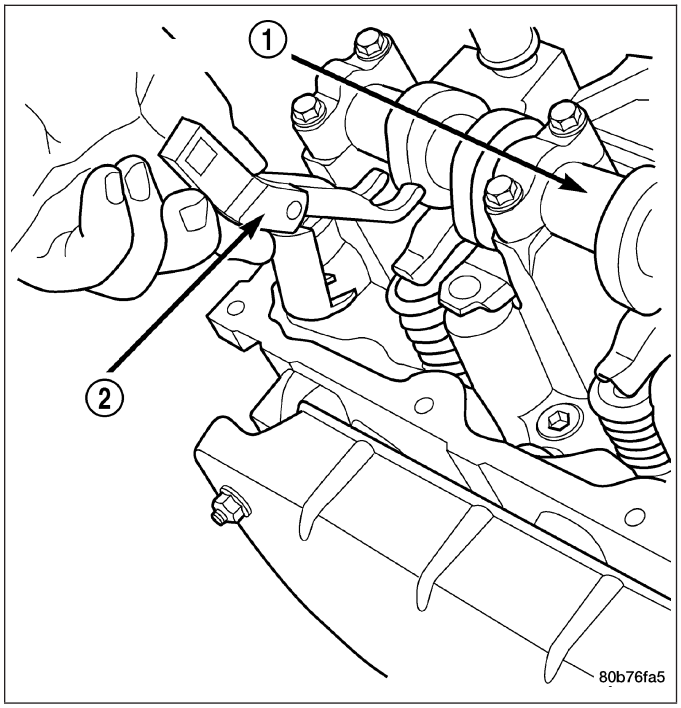
SPRINGS-VALVE

DESCRIPTION

The valve springs are made from high strength chrome silicon steel. The springs are common for intake and exhaust applications. The valve spring seat is integral with the valve stem seal, which is a positive type seal to control lubrication.

REMOVAL

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Using Special Tool 8516 Rocker Arm Remover (2), remove the rocker arms and the hydraulic lash adjusters.
3. Remove the spark plug for the cylinder the valve spring and seal are to be removed from.
4. Apply shop air to the cylinder to hold the valves in place when the spring is removed



NOTE: All eight valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.

5. Using Special Tool 8387 Valve Spring Compressor, compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

6. Remove the two spring retainer lock halves.

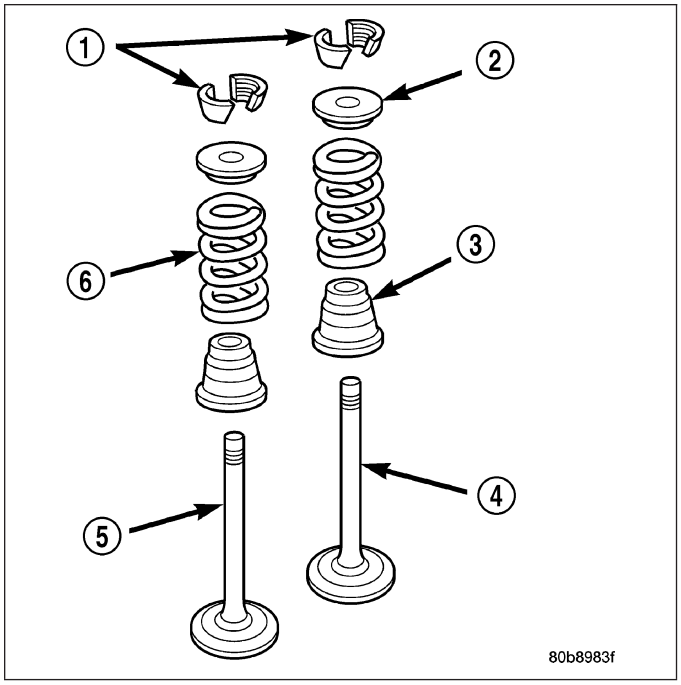
NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

7. Remove the valve spring compressor.
8. Remove the spring retainer, and the spring.
9. Remove the valve stem seal.

NOTE: The valve stem seals are common between intake and exhaust.

INSTALLATION

1. Coat the valve stem with clean engine oil and install the valve stem seal. Make sure the seal is fully seated and that the garter spring at the top of the seal is intact.
2. Install the spring (6) and the spring retainer (2).
3. Using Special Tool 8387 Valve Spring Compressor, compress the spring and install the two valve spring retainer halves.
4. Release the valve spring compressor and make sure the two spring retainer halves and the spring retainer are fully seated.
5. Position the hydraulic lash adjusters and rocker arms.
6. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).



SEALS-VALVE GUIDE

DESCRIPTION

The valve stem seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

ENGINE BLOCK

DESCRIPTION

The cylinder block is made of cast iron. The block is a closed deck design with the left bank forward. To provide high rigidity and improved NVH an enhanced compacted graphite bedplate is bolted to the block. The block design allows coolant flow between the cylinders bores, and an internal coolant bypass to a single poppet inlet thermostat is included in the cast aluminum front cover.

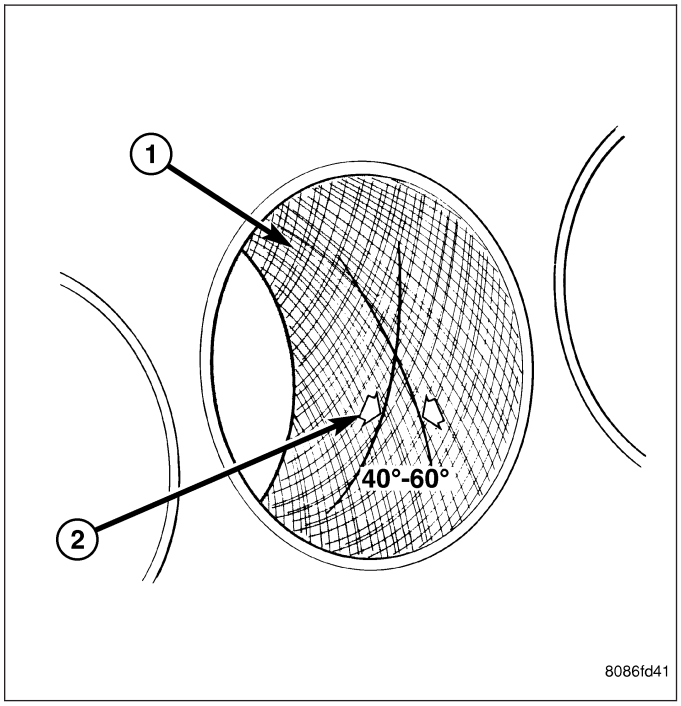
STANDARD PROCEDURE - CYLINDER BORE HONING

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

1. Used carefully, the Cylinder Bore Sizing Hone C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

2. Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil C-3501-3880, or a light honing oil, available from major oil distributors.



CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

3. Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern (1). The hone marks should INTERSECT at 50° to 60° for proper seating of rings (2).
4. A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle. Faster up and down strokes increase the crosshatch angle.
5. After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

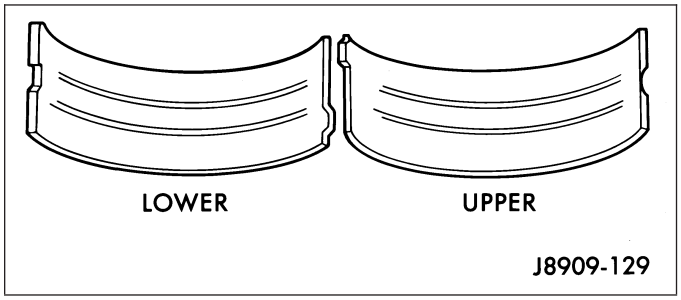
Use compressed air to clean out:

- The galley at the oil filter adaptor hole.
- The front and rear oil galley holes.
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Loctite PST pipe sealant with Teflon 592 to the threads of the front and rear oil galley plugs. Tighten the plugs to 34 N·m (25 ft. lbs.) torque.

BEARINGS-CONNECTING ROD

STANDARD PROCEDURE - CONNECTING ROD BEARING FITTING



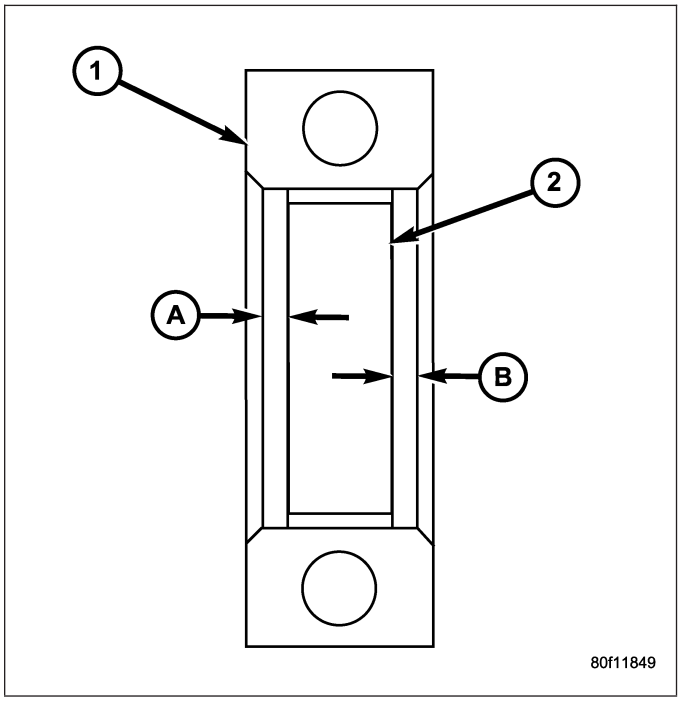
Inspect the connecting rod bearings for scoring. Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting. Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

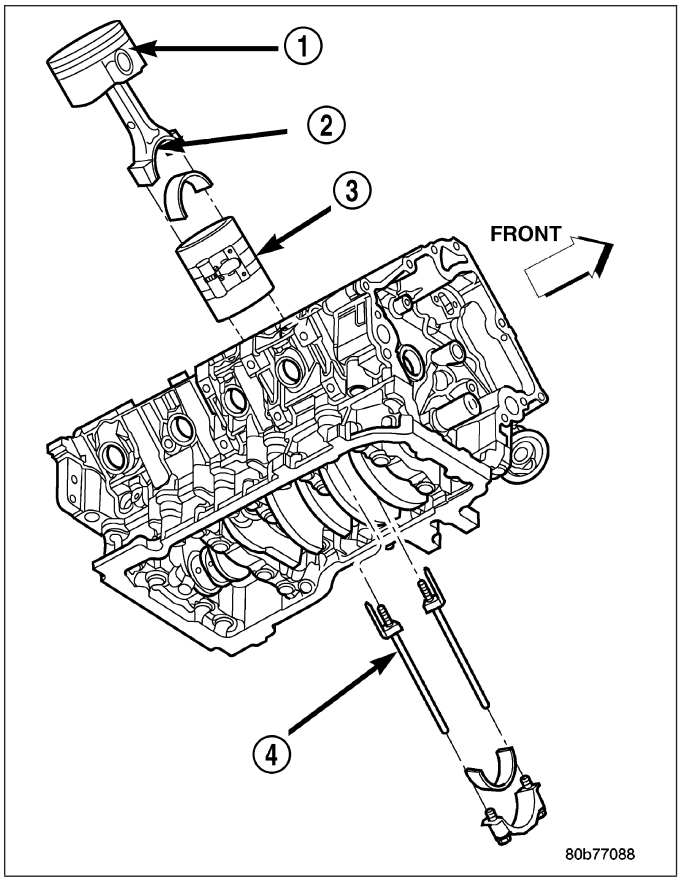
Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment. Replace misaligned, bent or twisted connecting rods.

1. Wipe the oil from the connecting rod journal.

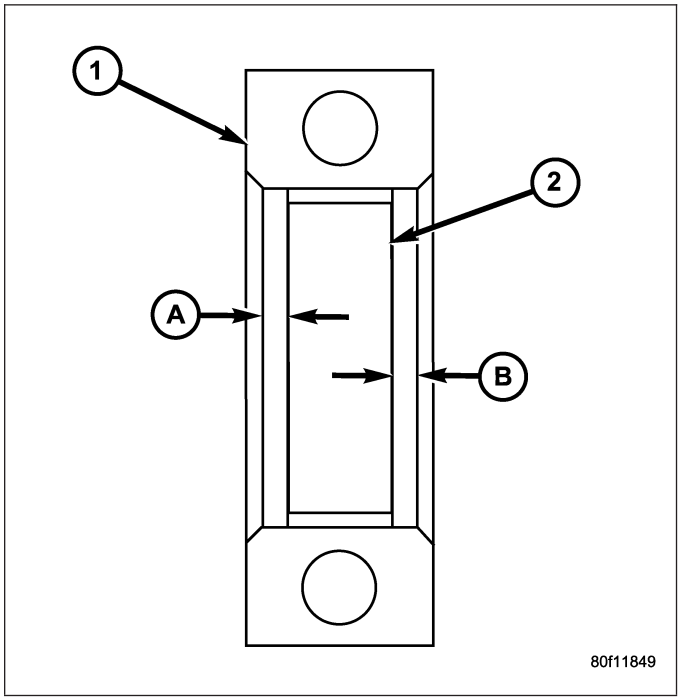
2. Lubricate the upper bearing insert (2) and install in connecting rod (1). **Center bearing insert (2) in connecting rod.**



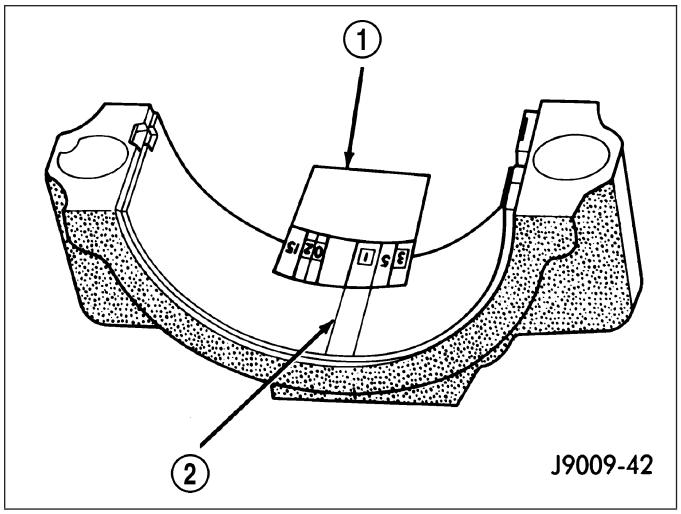
3. Use piston ring compressor (3) and Guide Pins Special Tool 8507 (4) to install the rod and piston assemblies. The oil slinger slots in the rods must face front of the engine. The “F”’s near the piston wrist pin bore should point to the front of the engine.



4. Install the lower bearing insert in the bearing cap **Center bearing insert (2) in connecting rod (1).**. The lower insert must be dry. Place strip of Plastigage across full width of the lower insert at the center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.



5. Install bearing cap and connecting rod on the journal and tighten bolts to 27 N·m (20 ft. lbs.) plus a 90° turn. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.
6. Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage (2). Refer to Engine Specifications for the proper clearance. **Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod or foreign material trapped between the insert and cap or rod.**
7. If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage (2) from crankshaft journal and bearing insert. Proceed with installation.



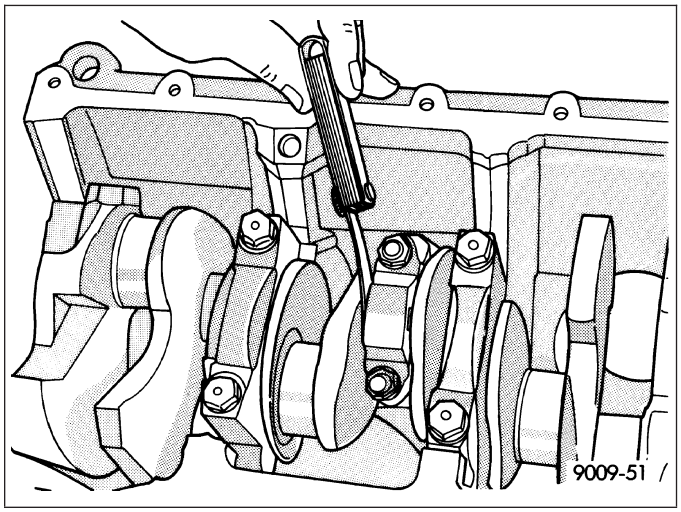
Bearing Mark	SIZE	USED WITH JOURNAL SIZE
.025 US	.025 mm (.001 in.)	50.983-50.967 mm (2.0073-2.0066 in.)
Std.	STANDARD	50.992-51.008 mm (2.0076-2.0082 in.)
.250 US	.250 mm (.010 in.)	50.758-50.742 mm (1.9984-1.9978 in.)

8. If bearing-to-journal clearance exceeds the specification, determine which service bearing set to use, using the following bearing sizes:

CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

9. Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.
10. Once you have selected the proper insert, install the insert and cap. Tighten the connecting rod bolts to 27 N·m (20 ft. lbs.) plus a 90° turn.

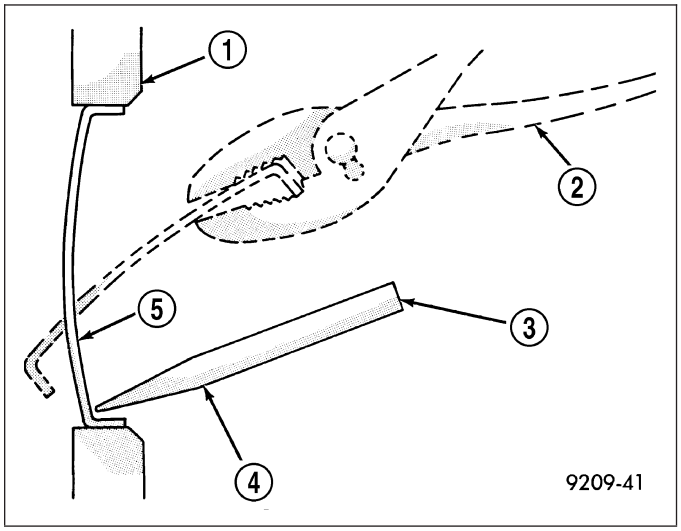
Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange. Refer to Engine Specifications for the proper clearance. Replace the connecting rod if the side clearance is not within specification.



PLUGS - CORE

REMOVAL

1. Drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
2. Using a blunt tool such as a drift or a screw driver and a hammer, strike the bottom edge of the cup plug (5).
3. Using a suitable pair of pliers, grasp the core plug (2) and remove.



INSTALLATION

NOTE: Thoroughly clean core plug bore, remove all of the old sealer.

1. Coat the edges of the engine core plug and the core plug bore with Mopar Gasket Maker, or equivalent.

NOTE: It is not necessary to wait for the sealant to cure on the core plugs. The cooling system can be filled and the vehicle returned to service immediately.

2. Using proper plug driver, drive core plug into the core plug bore. The sharp edge of the core plug should be at least 0.50 mm (0.020 in.) inside the lead in chamfer.
3. Refill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

CRANKSHAFT

DESCRIPTION

The crankshaft is constructed of nodular cast iron. The crankshaft is a crosshaped four throw design with eight counterweights for balancing purposes. The crankshaft is supported by five select fit main bearings with the number three serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The number eight counterweight has provisions for crankshaft position sensor target wheel mounting. The select fit main bearing markings are located on the rear side of the target wheel. The crankshaft oil seals are one piece design. The front oil seal is retained in the timing chain cover, and the rear seal is pressed in to a bore formed by the cylinder block and the bedplate assembly.

REMOVAL

NOTE: To remove the crankshaft from the engine, the engine must be removed from the vehicle.

1. Remove the engine. (Refer to 9 - ENGINE - REMOVAL).
2. Remove the engine oil pump. (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

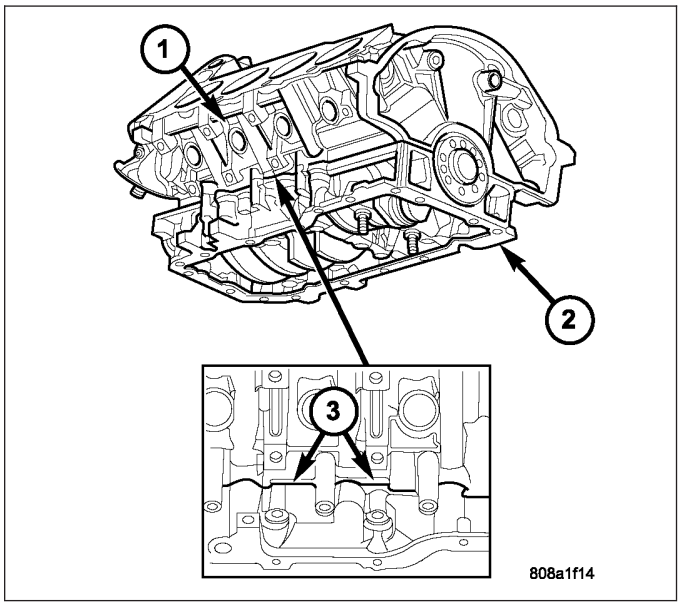
CAUTION: DO NOT pry on the oil pan gasket when removing the oil pan, The oil pan gasket is mounted to the cylinder block in three locations and will remain attached to block when removing oil pan. Gasket can not be removed with oil pan.

3. Remove oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
4. Remove the oil pump pickup tube and oil pan gasket /windage tray.
5. Remove the bedplate mounting bolts. Note the location of the three stud bolts for installation.
6. Remove the connecting rods from the crankshaft.

CAUTION: The bedplate to cylinder block mating surface is a critical sealing surface. Do not pry on or damage this surface in anyway.

NOTE: The bedplate contains the lower main bearing halves. Use care when handling bedplate as not to drop or damage bearing halves. Installing main bearing halves in the wrong position will cause sever damage to the crankshaft.

NOTE: The bedplate has pry points cast into it. Use these points only. The pry points are on both the left and right sides, only the left side is shown.



7. Carefully pry on the pry points to loosen the bedplate then remove the bedplate.

CAUTION: When removing the crankshaft, use care not to damage bearing surfaces on the crankshaft.

8. Remove the crankshaft.
9. Remove the crankshaft target wheel.

INSPECTION

NOTE: Thoroughly inspect the connecting rod bearing bores and main bearing bores for scoring, blueing or severe scratches. Further disassembly may be required.

If connecting rod bearing bores show damage, the cylinder heads must be removed to service the piston and rod assemblies. If the bedplate or the cylinder block main bearing bores show damage the engine must be replaced.

1. If required, remove the main bearing halves from the cylinder block and bedplate.
2. Thoroughly clean the bedplate to cylinder block sealing surfaces and main bearing bores. Remove all oil and sealant residue.
3. Inspect the bedplate main bearing bores for cracks, scoring or severe blueing. If either condition exists the engine must be replaced.
4. Inspect the crankshaft thrust washers for scoring, scratches, wear or blueing. If either condition exist replace the thrust washer.
5. Inspect the oil pan gasket/windage tray for splits, tears or cracks in the gasket sealing surfaces. Replace gasket as necessary.

INSTALLATION

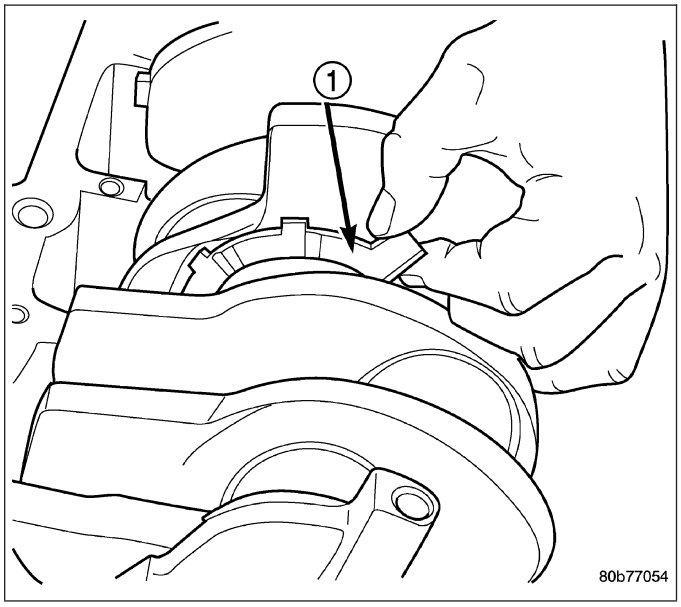
CAUTION: Main bearings are select fit. (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - STANDARD PROCEDURE) for proper bearing selections.

1. Lubricate upper main bearing halves with clean engine oil.

CAUTION: When installing crankshaft, use care not to damage bearing surfaces on the crankshaft.

NOTE: Apply sealant to the target wheel retaining screws prior to installation.

2. Install the crankshaft target wheel. Torque the mounting screws to 15 N·m (12 ft. lbs.).
3. Position crankshaft in cylinder block.
4. Install the thrust washers (1).

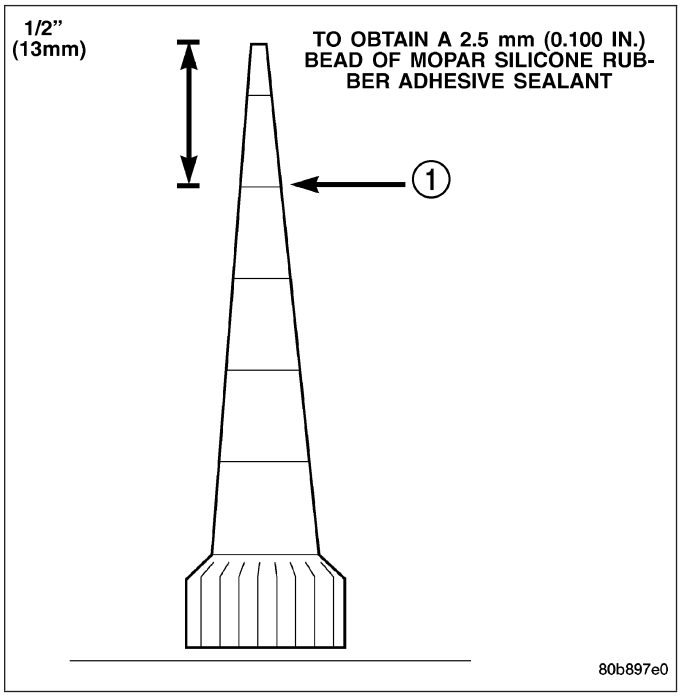


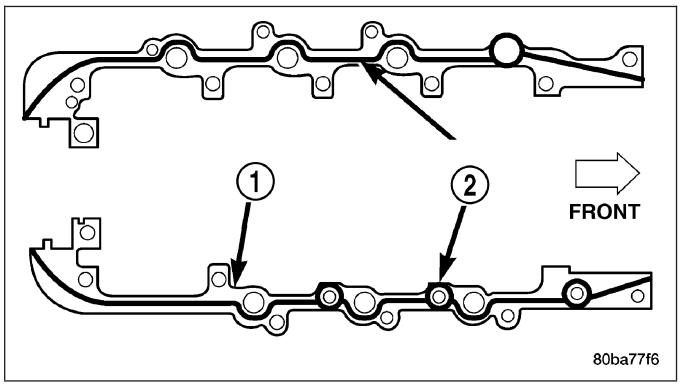
CAUTION: The bedplate to cylinder block mateing surface must be coated with sealant prior to installation. Failure to do so will cause severe oil leaks.

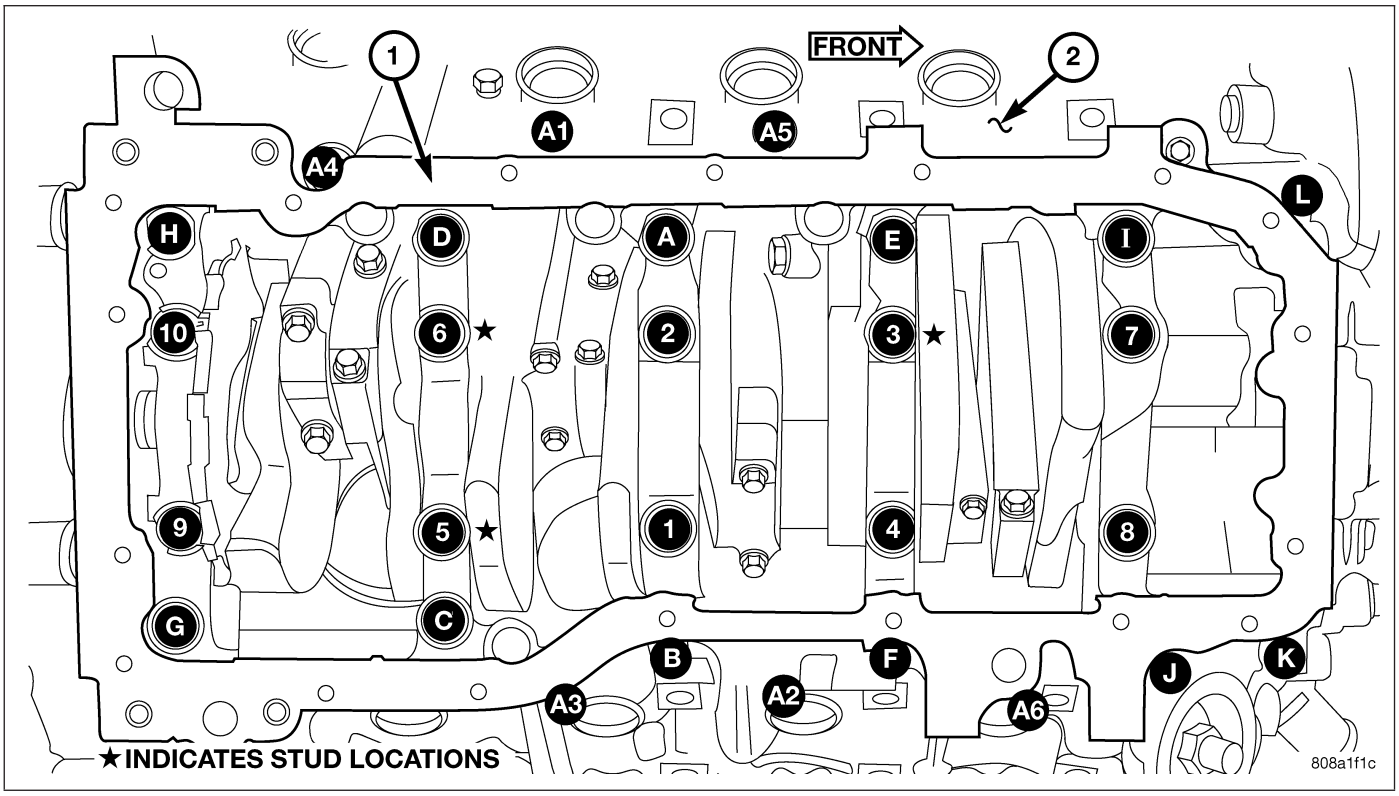
NOTE: The installation time to install the bedplate after the sealant has been applied is critical.

NOTE: Make sure that the bedplate and cylinder block sealing surfaces are clean and free of oil or other contaminants. Contaminants on the sealing surfaces may cause main bearing distortion and/or oil leaks.

5. Apply a 2.5mm (0.100 inch) bead of Mopar® Gen II Silicone Rubber Adhesive sealant (2) to the cylinder block-to-bedplate mating surface (1) as shown.
6. Coat the crankshaft main bearing journals with clean engine oil and position the bedplate onto the cylinder block.

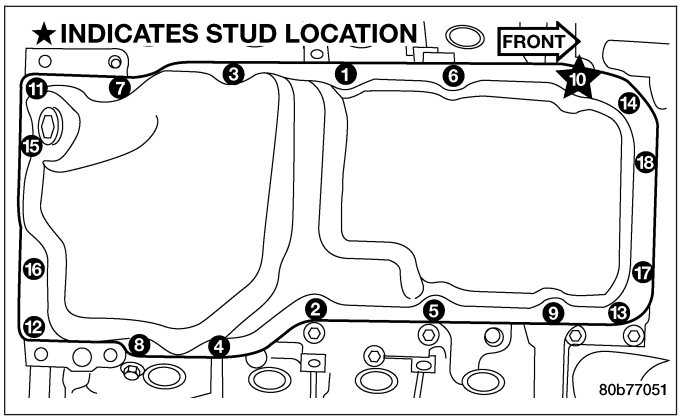






NOTE: Lubricate the bedplate retaining bolts with clean engine oil prior to installation.

7. Install the bedplate retaining bolts, making sure to place the stud bolts in the correct location, Torque the bolts in the sequence shown.
   - Tighten bolts **A – L** to 54 N·m (40 ft. lbs.)
   - Tighten bolts **1–10** to 2.8 N·m (25 in. lbs.)
   - Turn bolts **1–10** an additional 90°.
   - Tighten bolts **A1– A6** to 27 N·m (20 ft. lbs.)
8. Measure crankshaft end play. (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - STANDARD PROCEDURE).
9. Install the connecting rods and measure side clearance. (Refer to 9 - ENGINE/ENGINE BLOCK/CONNECTING ROD BEARINGS - STANDARD PROCEDURE).
10. Position the oil pan gasket/windage tray, using a new o-ring, install the oil pickup tube. Torque the bolt to 28N·n (20 ft. lbs.) torque the nuts to 28N·m (20 ft. lbs.).
11. Install the oil pan. Torque the retaining bolts to 15 N·m (11 ft. lbs.) in the sequence shown.
12. Install the engine (Refer to 9 - ENGINE - INSTALLATION).



BEARINGS - CRANKSHAFT MAIN

STANDARD PROCEDURE - CRANKSHAFT MAIN BEARING - FITTING

MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Crankshaft removed from the cylinder block.

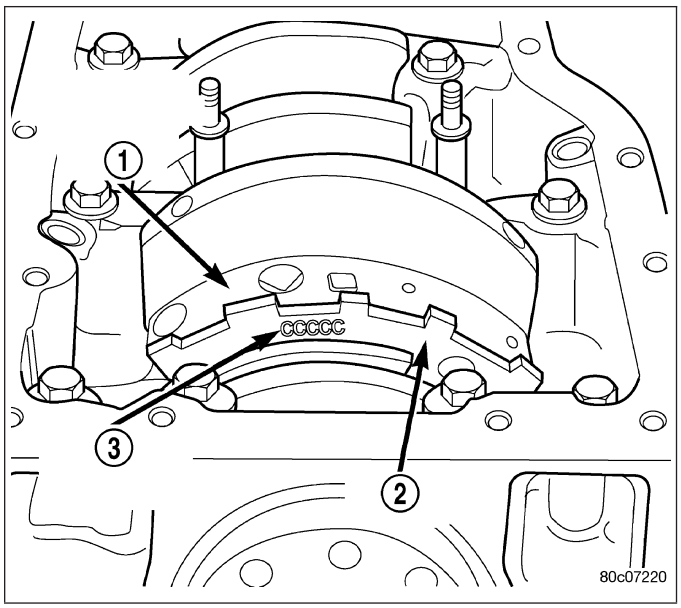
Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper is 0.008mm (0.0004 inch.) and maximum out of round is 0.005mm (0.002 inch). Compare the measured diameter with the journal diameter specification (Main Bearing Fitting Chart). Select inserts required to obtain the specified bearing-to-journal clearance.

CRANKSHAFT MAIN BEARING SELECTION

The main bearings are “select fit” to achieve proper oil clearances. For main bearing selection, the crankshaft position sensor target wheel has grade identification marks stamped into it (2). These marks are read from left to right, corresponding with journal number 1, 2, 3, 4 and 5. The crankshaft position sensor target wheel (2) is mounted to the number 8 counter weight (1) on the crankshaft.



NOTE: Service main bearings are coded. These codes identify what size (grade) the bearing is.

MAIN BEARING SELECTION CHART - 4.7L

GRADE MARKING	SIZE mm (in.)	FOR USE WITH JOURNAL SIZE
A	0.008 mm U/S (0.0004 in.) U/S	63.488–63.496 mm (2.4996–2.4999 in.)
B	NOMINAL	63.496–63.504 mm (2.4999–2.5002 in.)
C	0.008 mm O/S (0.0004 in.) O/S	63.504–63.512 mm (2.5002–2.5005 in.)

INSPECTION

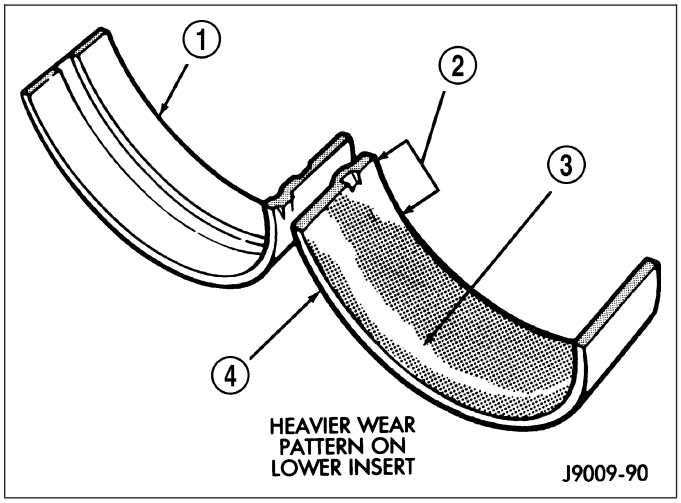
Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded in the lining. Normal main bearing insert wear patterns are illustrated.

NOTE: If any of the crankshaft journals are scored, the crankshaft must be repaired or replaced.

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

Replace all damaged or worn bearing inserts.



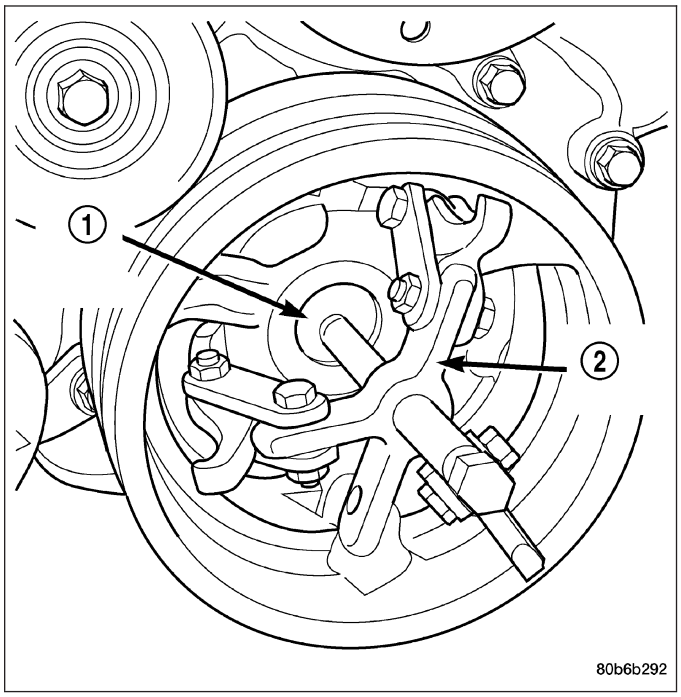
SEAL - CRANKSHAFT OIL - FRONT

REMOVAL

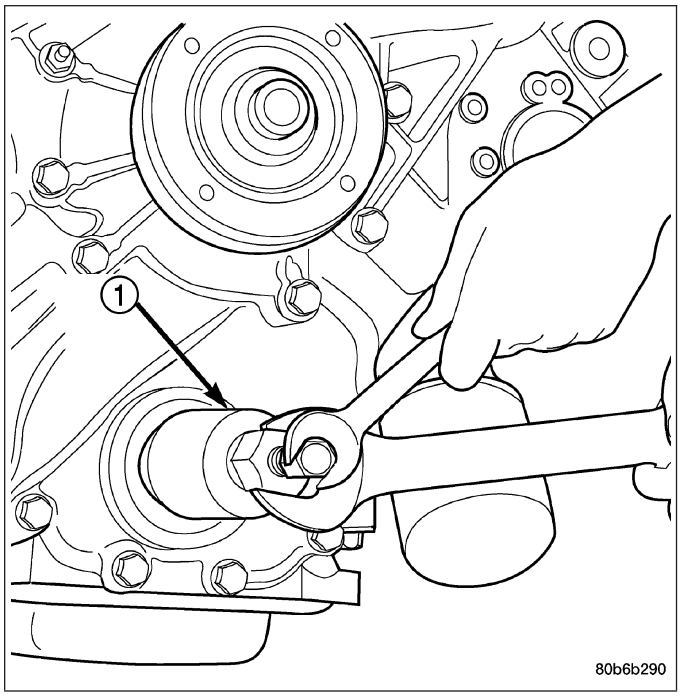
1. Disconnect negative cable from battery.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Remove A/C compressor mouning fasteners and set aside.
4. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Remove upper radiator hose.
6. Disconnect electrical connector for fan mounted inside radiator shroud.
7. Remove radiator shroud attaching fasteners.

NOTE: Transmission cooler line snaps into shroud lower right hand corner.

8. Remove radiator cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
9. Remove crankshaft damper bolt.
10. Remove damper using Special Tools 8513 Insert and 1026 Three Jaw Puller (2).



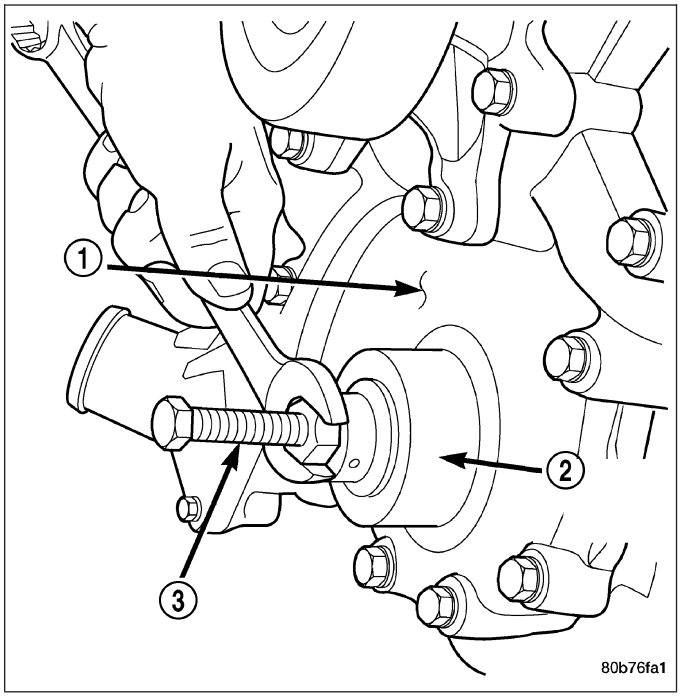
11. Using Special Tool 8511 (1), remove crankshaft front seal.



INSTALLATION

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

1. Using Special Tool 8348 and 8512 (2,3), install crankshaft front seal.
2. Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
3. Install radiator cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
4. Install upper radiator hose.
5. Install A/C compressor and tighten fasteners to 54 N·m (40 ft. lbs.).
6. Install accessory drive belt refer (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
7. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
8. Connect negative cable to battery.



SEAL - CRANKSHAFT OIL - REAR

DIAGNOSIS AND TESTING - REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Engine, for proper repair procedures of these items.
4. If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), under the Oil Leak row, for components inspections on possible causes and corrections.
7. After the oil leak root cause and appropriate corrective action have been identified, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).

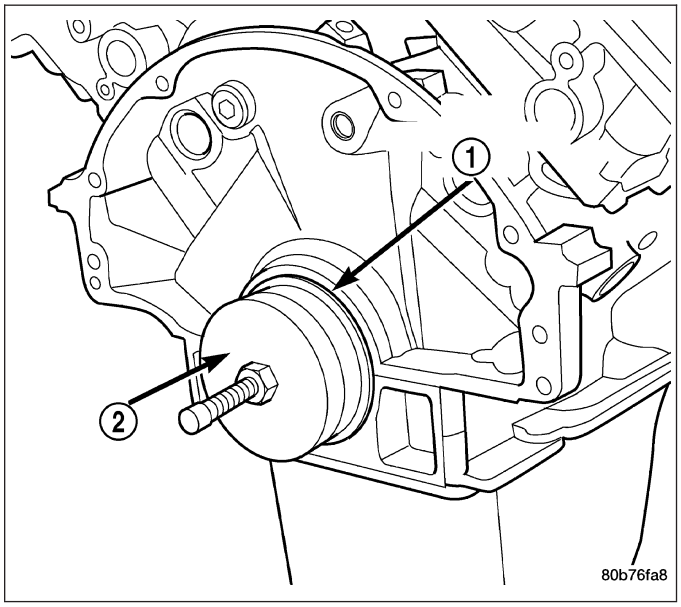
REMOVAL

NOTE: This procedure can be performed in vehicle.

1. If being performed in vehicle, remove the transmission.
2. Remove the flexplate (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - REMOVAL).

NOTE: The crankshaft oil seal CAN NOT be reused after removal.

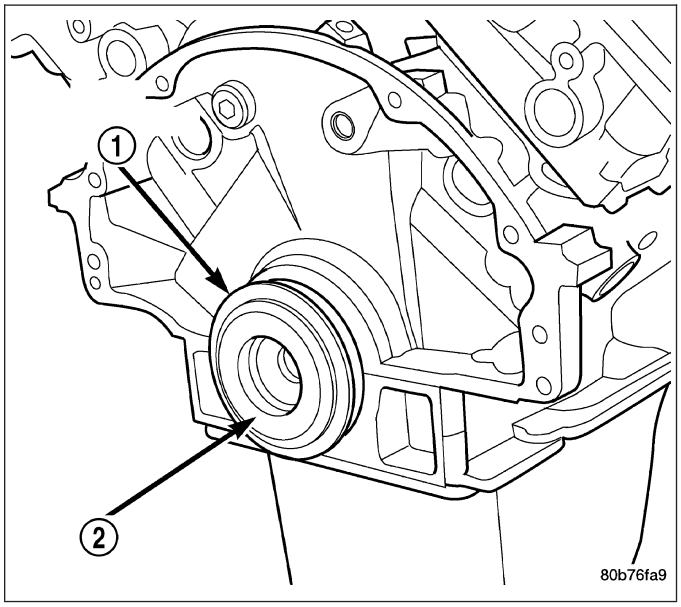
NOTE: The crankshaft rear oil seal remover Special Tool 8506 must be installed deeply into the seal. Continue to tighten the removal tool into the seal until the tool can not be turned farther. Failure to install tool correctly the first time will cause tool to pull free of seal without removing seal from engine.



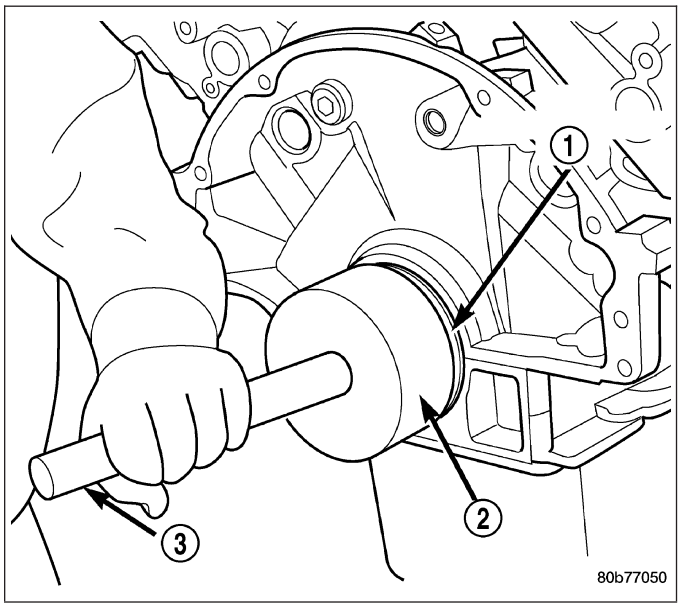
3. Using Special Tool 8506 (2), remove the crankshaft rear oil seal (1)

INSTALLATION

1. Lubricate the crankshaft flange with engine oil.
2. Position the magnetic seal guide Special Tool 8349-2 onto the crankshaft rear face. Then position the crankshaft rear oil seal (1) onto the guide (2).



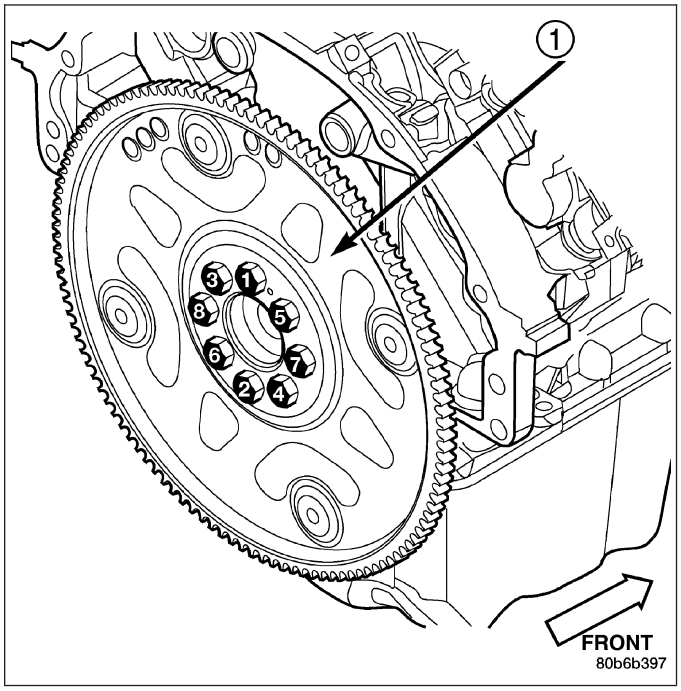
3. Using Special Tools 8349 Crankshaft Rear Oil Seal Installer (2) and C-4171 Driver Handle (3), with a hammer, tap the seal (1) into place. Continue to tap on the driver handle until the seal installer seats against the cylinder block crankshaft bore.
4. Install the flexplate.
5. Install the transmission.



FLEX PLATE

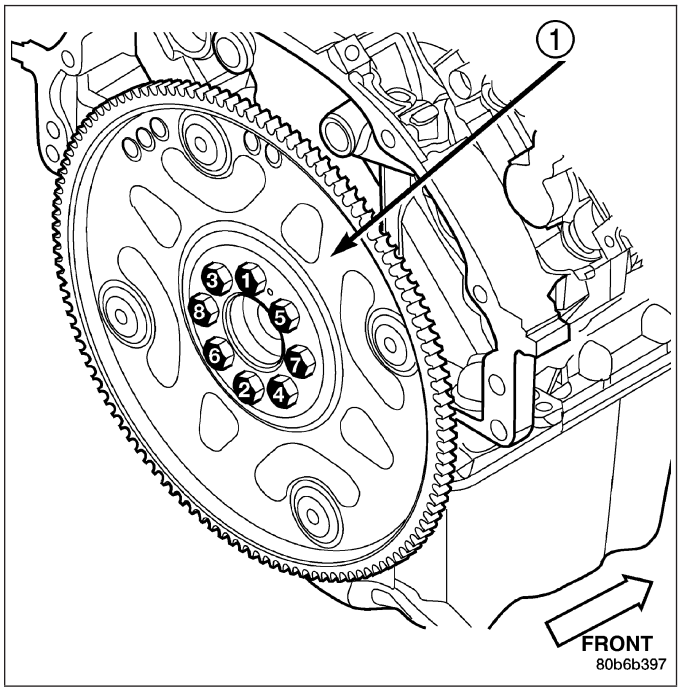
REMOVAL

1. Remove the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - REMOVAL).
2. Remove the bolts and flexplate (1).



INSTALLATION

1. Position the flexplate onto the crankshaft and install the bolts hand tight.
2. Tighten the flexplate retaining bolts to 60 N·m (45 ft. lbs.) in the sequence shown.
3. Install the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - INSTALLATION).



ROD - PISTON & CONNECTING

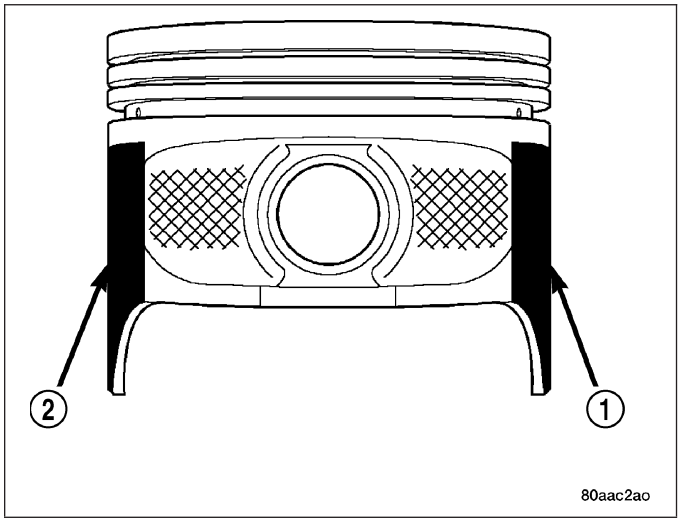
DESCRIPTION

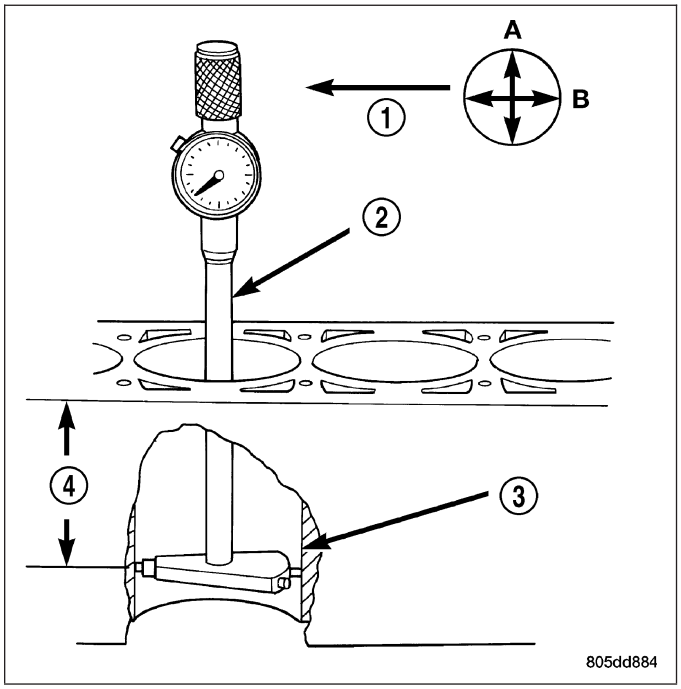
CAUTION: Do not use a metal stamp to mark connecting rods as damage may result, instead use ink or a scratch awl.

The pistons are made of a high strength aluminum alloy. The anodized top ring groove and crown has been replaced with a coated top ring that is blue in color on the bottom surface. Piston skirts are coated with a solid lubricant (Molykote) to reduce friction and provide scuff resistance. The connecting rods are made of forged powdered metal, with a “fractured cap” design. A pressed fit piston pin is used to attach the piston and connecting rod.

STANDARD PROCEDURE - PISTON FITTING

1. To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
2. Measure the inside diameter of the cylinder bore at a point 38.0 mm (1.5 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B.
3. The coated pistons will be serviced with the piston pin and connecting rod pre-assembled.
4. The coating material is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston will not provide accurate results. Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY**. To correctly select the proper size piston, a cylinder bore gauge capable of reading in 0.003 mm (.0001 in.) increments is required.
5. Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.





REMOVAL

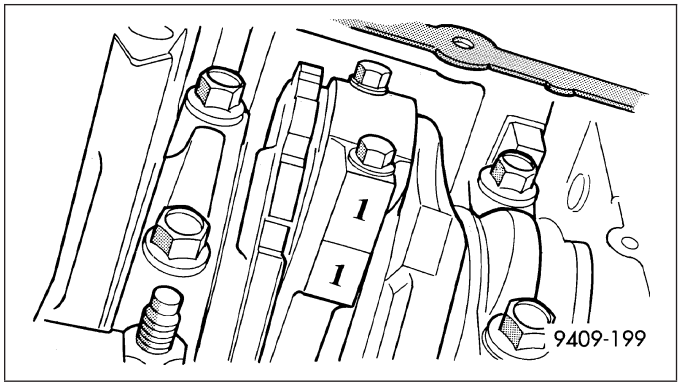
1. Disconnect negative cable from battery.
2. Remove the following components:
   - Oil pan and gasket/windage tray (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
   - Cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL) and (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
   - Timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
   - Cylinder head(s) (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL) and (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
3. If necessary, remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation.** Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so the each connecting rod is centered in cylinder bore.

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur

NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.

4. Mark connecting rod and bearing cap positions using a permanent ink marker or scribe tool.

CAUTION: Care must be taken not to damage the fractured rod and cap joint face surfaces, as engine damage may occur.



5. Remove connecting rod cap. Install Special Tool 8507 Connecting Rod Guides into the connecting rod being removed. Remove piston from cylinder bore. Repeat this procedure for each piston being removed.

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur

6. Immediately after piston and connecting rod removal, install bearing cap on the mating connecting rod to prevent damage to the fractured cap and rod surfaces.
7. Carefully remove piston rings from piston(s), starting from the top ring down.

CLEANING

CAUTION: DO NOT use a wire wheel or other abrasive cleaning devise to clean the pistons or connecting rods. The pistons have a Moly coating, this coating must not be damaged.

1. Using a suitable cleaning solvent clean the pistons in warm water and towel dry.
2. Use a wood or plastic scraper to clean the ring land grooves.

CAUTION: DO NOT remove the piston pin from the piston and connecting rod assembly.

INSPECTION

Check the connecting rod journal for excessive wear, taper and scoring (Refer to 9 - ENGINE/ENGINE BLOCK/ CONNECTING ROD BEARINGS - STANDARD PROCEDURE).

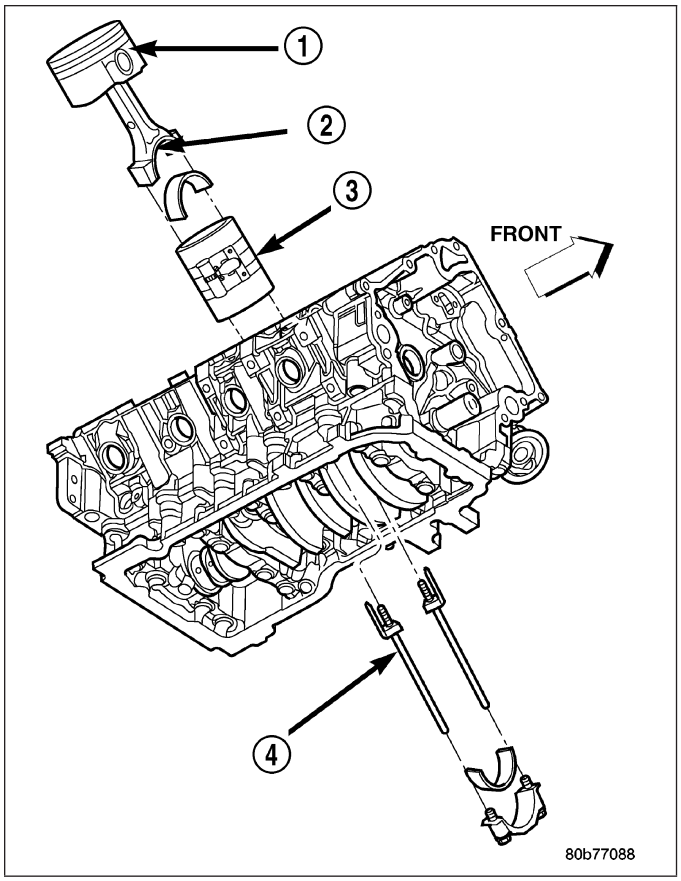
Check the connecting rod for signs of twist or bending.

Check the piston for taper and elliptical shape before it is fitted into the cylinder bore (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - STANDARD PROCEDURE).

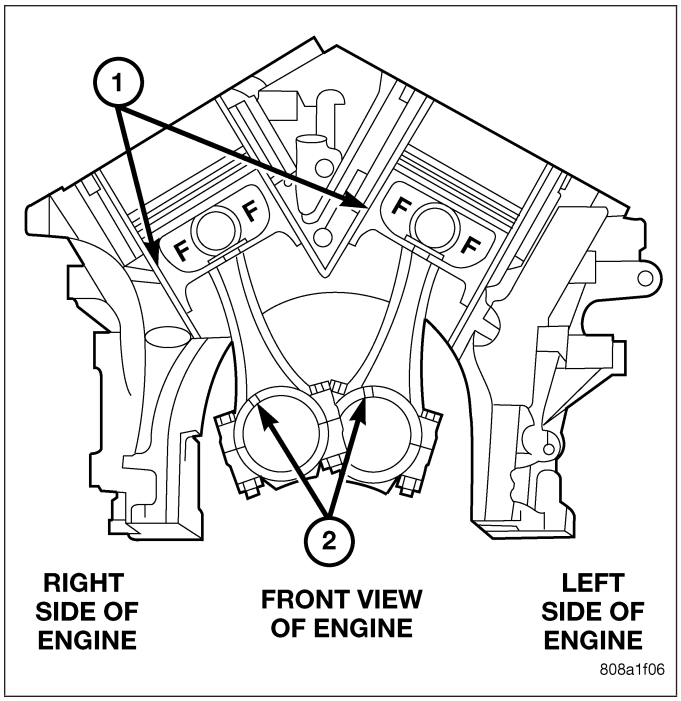
Check the piston for scoring, or scraping marks in the piston skirts. Check the ring lands for cracks and/or deterioration.

INSTALLATION

1. Before installing piston and connecting rod assemblies into the bore, install the piston rings.
2. Immerse the piston head and rings in clean engine oil. Position a ring compressor (3) over the piston and rings. Tighten ring compressor. **Ensure position of rings do not change during this operation.**
3. Position bearing onto connecting rod. Ensure that hole in bearing shell aligns with hole in connecting rod. Lubricate bearing surface with clean engine oil.
4. Install Special Tool 8507 Connecting Rod Guides (4) into connecting rod bolt threads.



5. The pistons are marked on the piston pin bore surface with an raised “F” indicating installation position (1). This mark must be pointing toward the front of engine on both cylinder banks. The connecting rod oil slinger slot faces the front of the engine.
6. Wipe cylinder bore clean and lubricate with engine oil.
7. Rotate crankshaft until connecting rod journal is on the center of cylinder bore. Insert rod and piston into cylinder bore and carefully position connecting rod guides over crankshaft journal.
8. Tap piston down in cylinder bore using a hammer handle. While at the same time, guide connecting rod into position on rod journal.



CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

9. Lubricate rod bolts and bearing surfaces with engine oil. Install connecting rod cap and bearing. Tighten bolts to 27 N·m (20 ft. lbs.) plus 90°.
10. Install the following components:
    - Cylinder head(s). (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
    - Timing chain and cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
    - Cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
    - Oil pan and gasket/windage tray. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
11. Fill crankcase with proper engine oil to correct level.
12. Connect negative cable to battery.

RINGS - PISTON

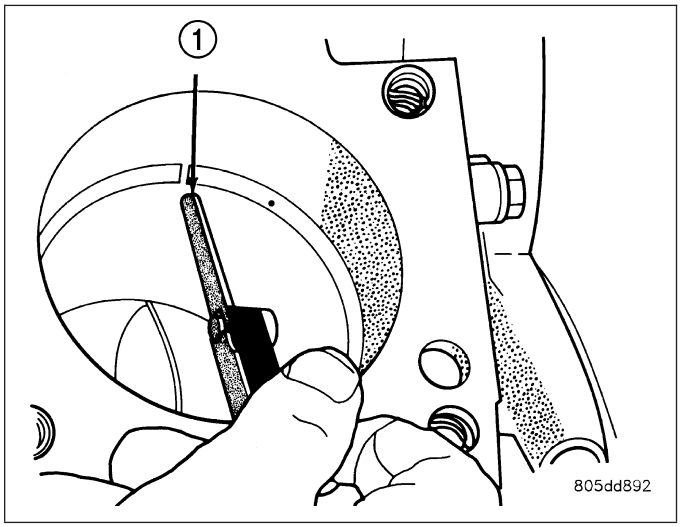
STANDARD PROCEDURE - PISTON RING FITTING

Before reinstalling used rings or installing new rings, the ring clearances must be checked.

1. Wipe the cylinder bore clean.
2. Insert the ring in the cylinder bore.

NOTE: The ring gap measurement must be made with the ring positioned at least 12mm (0.50 inch.) from bottom of cylinder bore.

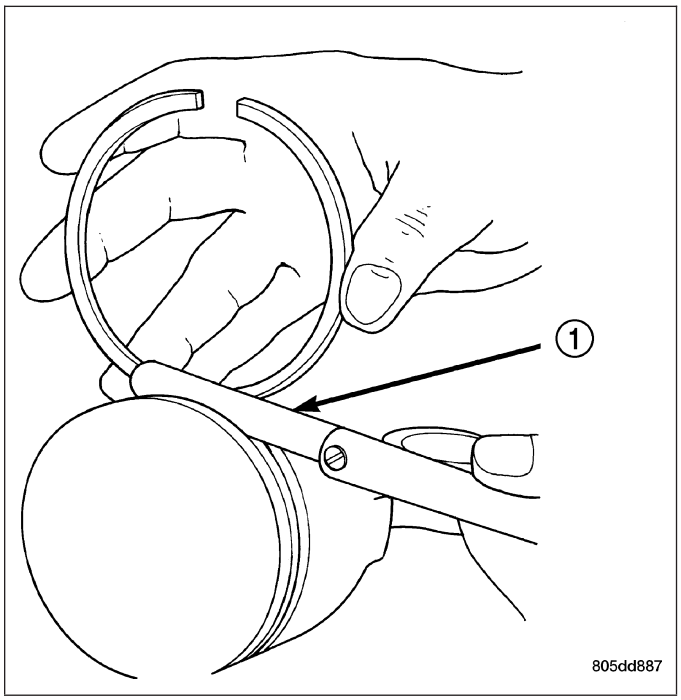
3. Using a piston, to ensure that the ring is squared in the cylinder bore, slide the ring downward into the cylinder.



4. Using a feeler gauge (1) check the ring end gap. Replace any rings not within specification.

PISTON RING SIDE CLEARANCE

NOTE: Make sure the piston ring grooves are clean and free of nicks and burrs.

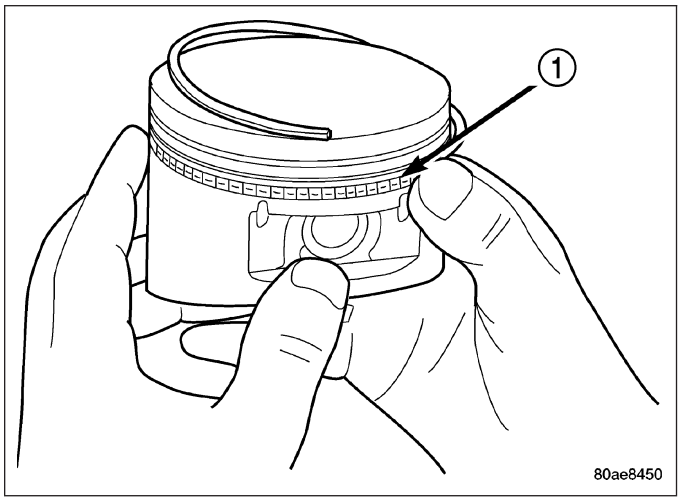


5. Measure the ring side clearance as shown make sure the feeler gauge (1) fits snugly between the ring land and the ring. Replace any ring not within specification.
6. Rotate the ring around the piston, the ring must rotate in the groove with out binding.

PISTON RING SPECIFICATION CHART

Ring Position	Groove Clearance	Maximum Clearance
Upper Ring	.051-.094 mm (0.0020-.0037 in.)	0.11 mm (0.004 in.)
Intermediate Ring	0.04-0.08 mm (0.0016-0.0031 in.)	0.10 mm (0.004 in.)
Oil Control Ring (Steel Rails)	.019-.229 mm (.0007-.0090 in.)	.25 mm (0.010 in.)
Ring Position	**Ring Gap**	**Wear Limit**
Upper Ring	0.20-0.36 mm (0.0079-0.0142 in.)	0.43 mm (0.0017 in.)
Intermediate Ring	0.37-0.63 mm (0.0146-0.0249 in.)	0.74 mm (0.029 in.)
Oil Control Ring (Steel Rail)	0.025-0.76 mm (0.0099- 0.03 in.)	1.55 mm (0.061 in.)

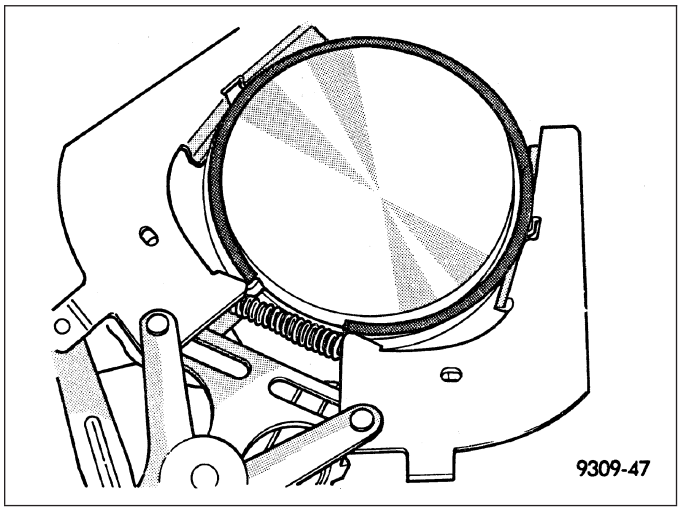
7. The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston.



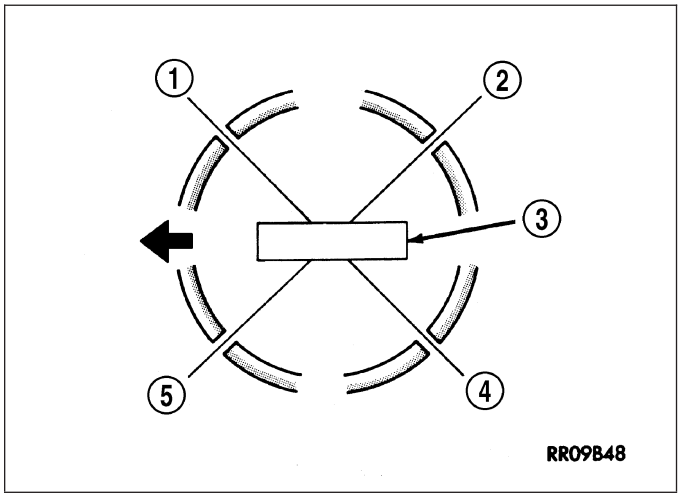
NOTE: Piston rings are installed in the following order:
- **Oil ring expander.**
- **Upper oil ring side rail.**
- **Lower oil ring side rail.**
- **No. 2 Intermediate piston ring.**
- **No. 1 Upper piston ring.**

8. Install the oil ring expander.
9. Install upper side rail (1) by placing one end between the piston ring groove and the expander ring. Hold end firmly and press down the portion to be installed until side rail is in position. Repeat this step for the lower side rail.

10. Install No. 2 intermediate piston ring using a piston ring installer.
11. Install No. 1 upper piston ring using a piston ring installer.



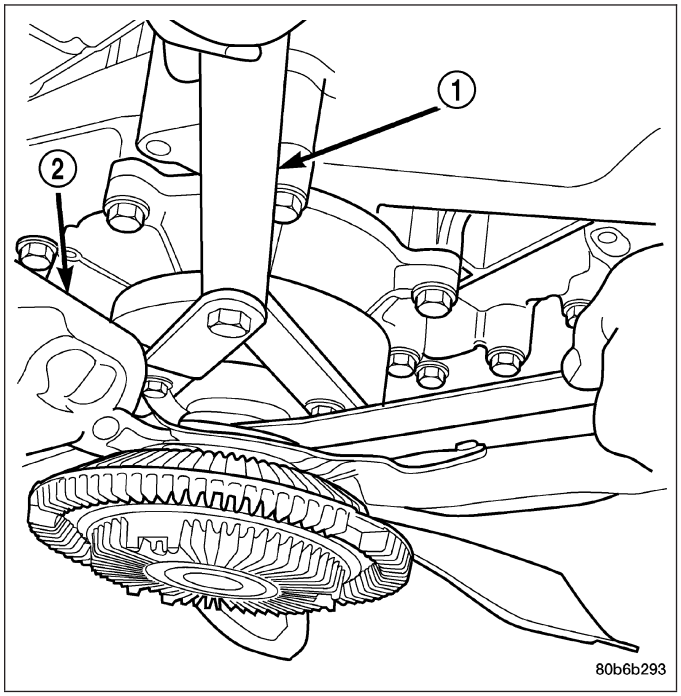
12. Position piston ring end gaps as shown in. It is important that expander ring gap (5) is at least 45° from the side rail gaps, but not on the piston pin center or on the thrust direction.



DAMPER - CRANKSHAFT

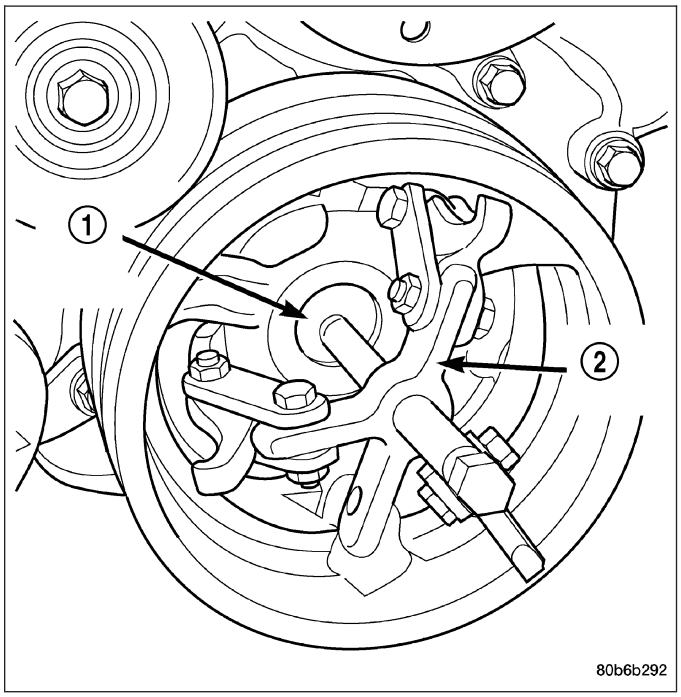
REMOVAL

1. Disconnect negative cable from battery.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Remove radiator upper hose.
5. Remove upper fan shroud.
6. Using Special Tools 6958 Spanner with Adapter Pins 8346 (1), loosen fan and viscous assembly from water pump.
7. Remove fan and viscous assembly.
8. Disconnect electrical connector for fan mounted inside radiator shroud.



NOTE: Transmission cooler line snaps into shroud lower right hand corner.

9. Remove crankshaft damper bolt.
10. Remove damper using Special Tools 8513 Insert and 1026 Three Jaw Puller (2).

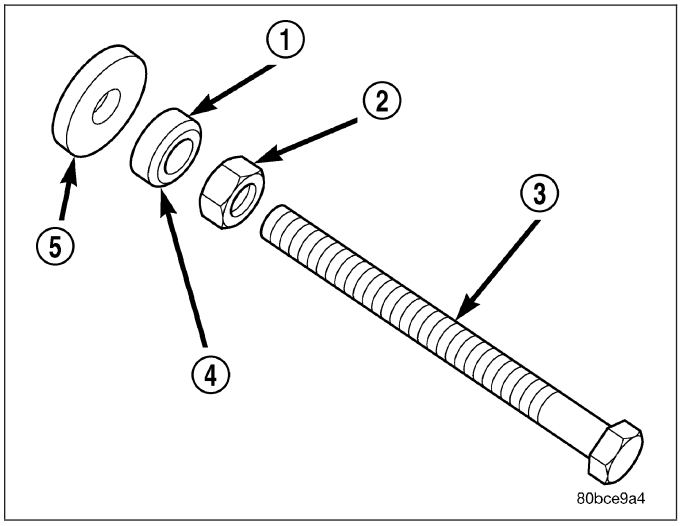


INSTALLATION

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512–A, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

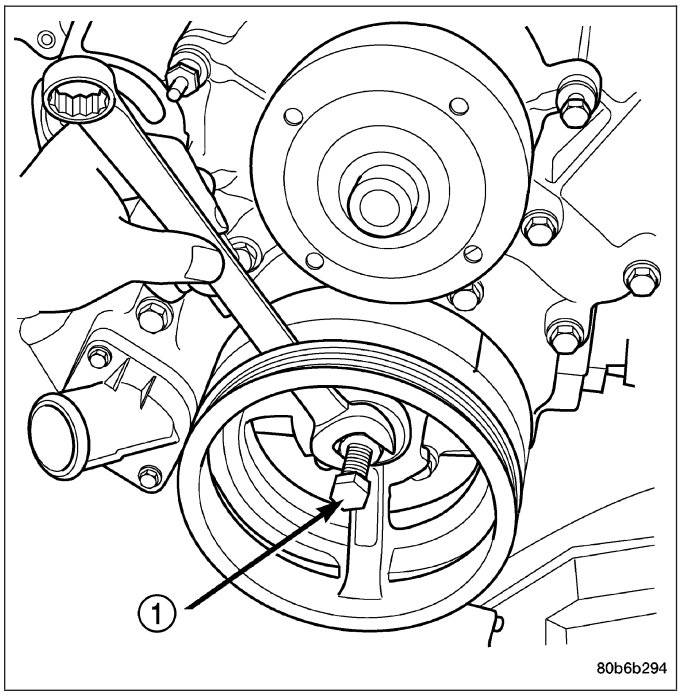
1. Align crankshaft damper slot with key in crankshaft. Slide damper onto crankshaft slightly.

CAUTION: Special Tool 8512–A, is assembled in a specific sequence. Failure to assemble this tool in this sequence can result in tool failure and severe damage to either the tool or the crankshaft.



2. Assemble Special Tool 8512–A as follows, The nut (2) is threaded onto the shaft first. Then the roller bearing (1) is placed onto the threaded rod (3) (The hardened bearing surface of the bearing (1) **MUST**face the nut (2). Then the hardened washer (5)slides onto the threaded rod. Once assembled coat the threaded rod's threads with Mopar® Nickel Anti-Seize or equivalent.

3. Using Special Tool 8512–A, press damper onto crankshaft (1).
4. Install then tighten crankshaft damper bolt to 175 N·m (130 ft. lbs.).
5. Install fan blade assembly (Refer to 7 - COOLING/ ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
6. Install radiator upper shroud and tighten fasteners to 11 N·m (95 in. lbs.).
7. Connect electrical connector for shroud fan.
8. Install radiator upper hose.
9. Install accessory drive belt (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
10. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
11. Connect negative cable to battery.



COVER - STRUCTURAL

DESCRIPTION

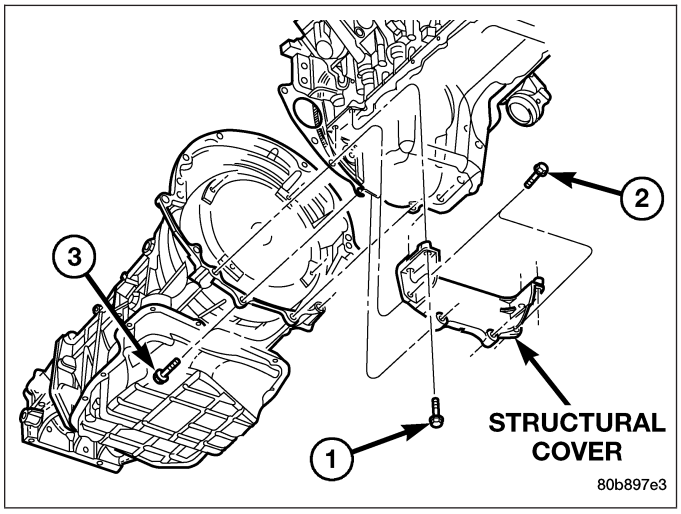
The structural dust cover is made of die cast aluminum and joins the lower half of the transmission bell housing to the engine bedplate.

OPERATION

The structural cover provides additional powertrain stiffness and reduces noise and vibration.

REMOVAL

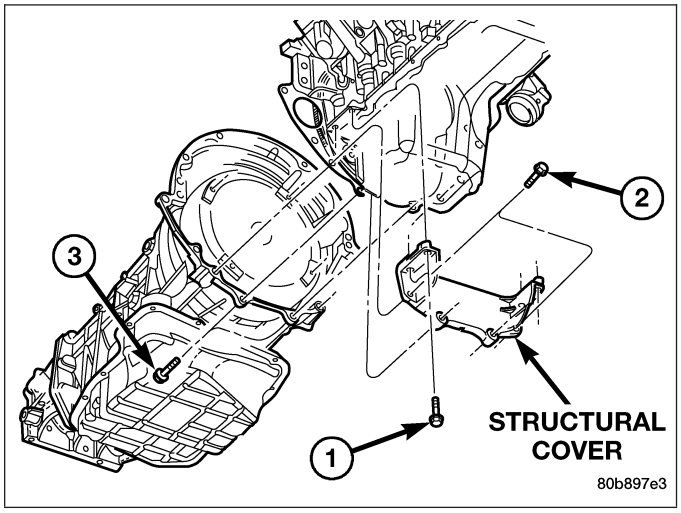
1. Raise vehicle on hoist.
2. Remove the left hand exhaust pipe from exhaust manifold.
3. Loosen the right hand exhaust manifold-to-exhaust pipe retaining bolts.
4. Remove the eight bolts (1,2,3) retaining structural cover in the sequence shown.
5. Pivot the exhaust pipe downward and remove the structural cover.



INSTALLATION

CAUTION: The structural cover must be installed as described in the following steps. Failure to do so will cause severe damage to the cover.

1. Position the structural cover in the vehicle.
2. Install all four bolts retaining the cover-to-engine. DO NOT tighten the bolts at this time.
3. Install the four cover-to-transmission bolts. Do NOT tighten at this time.



CAUTION: The structural cover must be held tightly against both the engine and the transmission bell housing during tightening sequence. Failure to do so may cause damage to the cover.

4. Starting with the two rear cover-to-engine bolts, tighten bolts (1) to 54 N·m (40 ft. lbs.), then tighten bolts (2) and (3) to 54 N·m (40 ft. lbs.) in the sequence shown.
5. Install the exhaust pipe on left hand exhaust manifold.
6. Tighten exhaust manifold-to-exhaust pipe retaining bolts to 20–26 N·m (15–20 ft. lbs.).

MOUNT - FRONT

REMOVAL

2WD

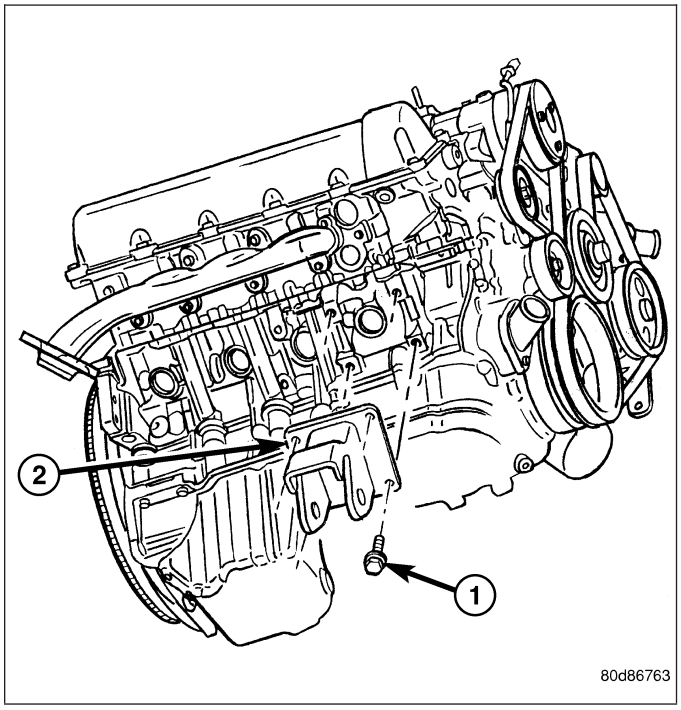
1. Disconnect the negative cable from the battery.

CAUTION: Remove the viscous fan before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.

2. Remove the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
3. Raise the vehicle.
4. Remove the engine oil filter.
5. Remove the oil drain trough.
6. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
7. Support the front axle with a suitable jack.
8. Remove the bolts that attach the engine mounts to the front axle.
9. Remove the bolts that attach the front axle to the left engine bracket.
10. Lower the front axle.
11. Remove the through bolts
12. Raise the engine far enough to be able to remove the left and right engine mounts.
13. Remove the mount to engine attaching bolts
14. Remove the engine mounts.

4WD

1. Disconnect the negative cable from the battery.
2. Remove the viscous fan.
3. Raise the vehicle.
4. Remove the skid plate.
5. Remove the front crossmember.
6. Remove the engine oil filter.
7. Remove the oil drain trough.
8. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
9. Support the front axle with a suitable jack.
10. Remove the bolts that attach the engine mounts to the front axle.
11. Remove the bolts that attach the front axle to the left engine bracket.
12. Lower the front axle.
13. Remove the through bolts



CAUTION: Remove the viscous fan before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.

14. Remove the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
15. Raise the engine far enough to be able to remove the left and right engine mounts (2).
16. Remove the engine mount bolts (1), and the mounts (2).

INSTALLATION

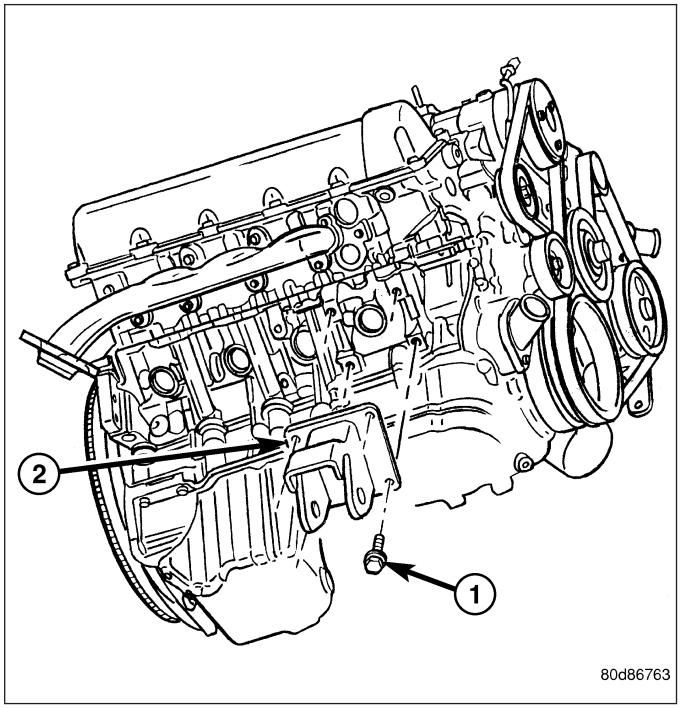
2WD

NOTE: For mount to engine block and left engine bracket to front axle bolts, apply Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.

1. Install the right and left side engine mounts to the engine block bolts. Torque bolts to 54 N·m (40 ft. lbs.).
2. Insert the through bolts into the right and left side engine mounts and loose assemble the two nuts onto the through bolts.
3. Lower the engine until the through bolts rest onto the slots in the frame brackets.
4. Tighten the through bolt nuts to 94 N·m (70 ft. lbs.).
5. Install the oil drain trough.
6. Install the engine oil filter.
7. Lower the vehicle.
8. Install the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
9. Reconnect the negative battery cable.

4WD

NOTE: For mount to engine block and left engine bracket to front axle bolts, apply Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.

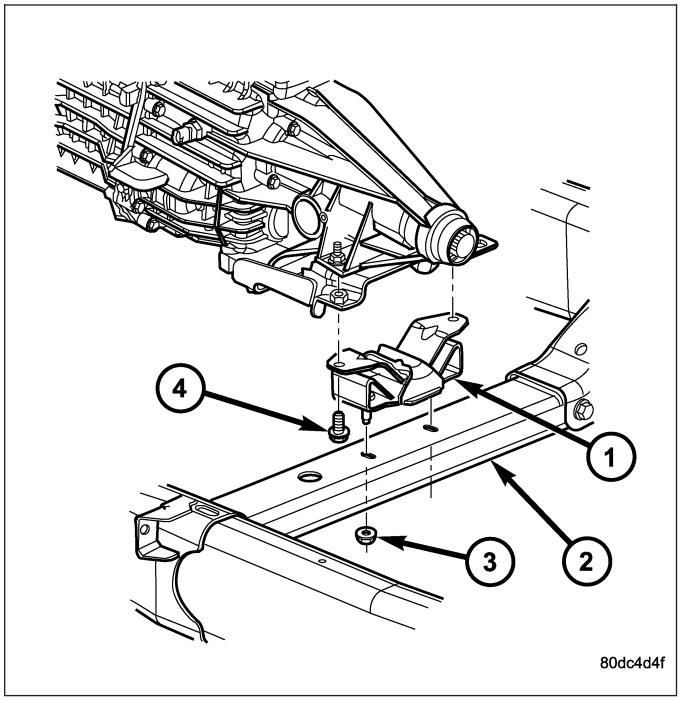


1. Install the right and left side engine mount brackets (2) to the engine.
2. Install the right and left side engine mounts to the front axle. Torque nuts to 94 N·m (70 ft. lbs.).
3. Raise the front axle into the frame and install the left and right side through bolts. Torque nuts to 94 N·m (70 ft. lbs.).
4. Insert the two upper through bolts into the right and left side engine mounts and loose assemble the two nuts onto the through bolts.
5. Lower the engine until the left and right side engine brackets rest on the through bolts, and the lower engine bracket through holes align with the engine mounts, and the left engine bracket holes align with the front axle slots.
6. Loose assemble the bolts that attach the front axle to the left engine bracket.
7. Loose assemble the lower through bolts.
8. Torque the nuts for the through bolts to 101 N·m (75 ft. lbs.).
9. Torque the bolts that attach the front axle to the left engine bracket to 101 N·m (75 ft. lbs.).
10. Install the oil drain trough.
11. Install the engine oil filter.
12. Lower the vehicle.
13. Install the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
14. Reconnect the negative battery cable.

MOUNT - REAR

REMOVAL

1. Raise the vehicle on a hoist.
2. Using a suitable jack, support transmission.
3. Remove the nuts from the transmission mount (1).
4. Remove the two bolts that attach the transmission mount to the engine bracket.
5. Raise the transmission enough to remove the mount from the crossmember (2).
6. Remove the mount (1).



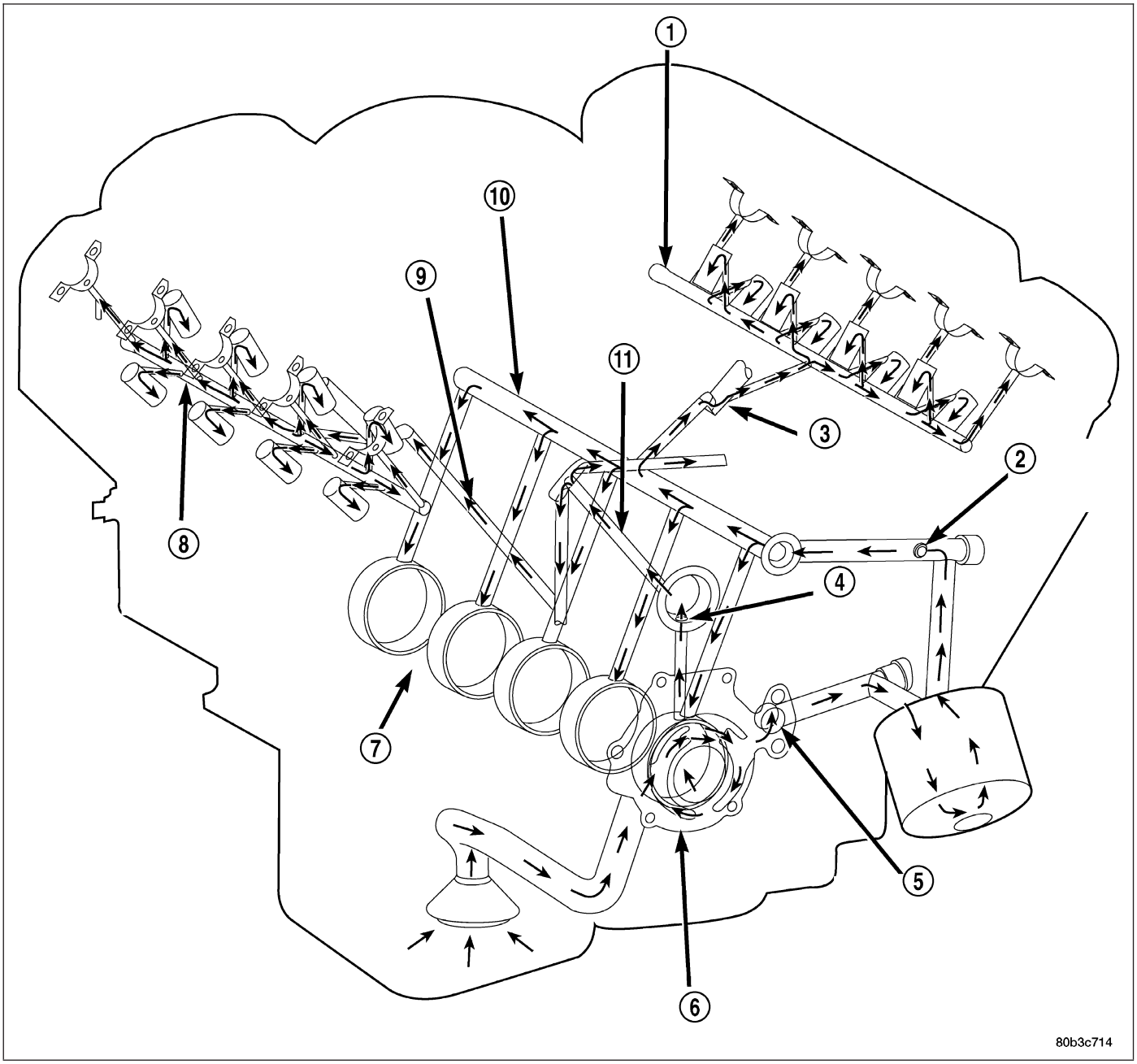
INSTALLATION

NOTE: Threadlocking compound must be applied to the bolts before installation.

1. Install the two bolts that attach the transmission mount to the transmission bracket.
2. Torque the bolts to 61N·m (45 ft.lbs.) torque.
3. Lower the transmission so the transmission mount rests on the crossmember, and the studs of the transmission mount are aligned in the slots in the crossmember.
4. Install the nuts onto the transmission mount studs through the crossmember access slot.
5. Torque the nuts to 54N·m (40 ft. lbs.).

LUBRICATION

DESCRIPTION



The lubrication system is a full flow filtration pressure feed type.

OPERATION

Oil from the oil pan is pumped by a gerotor type oil pump directly mounted to the crankshaft nose. Oil pressure is controlled by a relief valve mounted inside the oil pump housing.

The camshaft exhaust valve lobes and rocker arms are lubricated through a small hole in the rocker arm; oil flows through the lash adjuster then through the rocker arm and onto the camshaft lobe. Due to the orentation of the rocker arm, the camshaft intake lobes are not lubed in the same manner as the exhaust lobes. The intake lobes are lubed through internal passages in the camshaft. Oil flows through a bore in the number 3 camshaft bearing bore, and as the camshaft turns, a hole in the camshaft aligns with the hole in the camshaft bore allowing engine oil to

enter the camshaft tube. The oil then exits through 1.6mm (0.063 in.) holes drilled into the intake lobes, lubricating the lobes and the rocker arms.

Engine Lubrication Flow Chart—Block: Table 1

FROM	TO
Oil Pickup Tube	Oil Pump
Oil Pump	Oil Filter
Oil Filter	Block Main Oil Gallery
Block Main Oil Gallery	1. Crankshaft Main Journal 2. Left Cylinder Head* 3. Right Cylinder Head*
Crankshaft Main Journals	Crankshaft Rod Journals
Crankshaft Number One Main Journal	1.Front Timing Chain Idler Shaft 2.Both Secondary Chain Tensioners
Left Cylinder Head	See Table 2
Right Cylinder Head	See Table 2
* The cylinder head gaskets have an oil restricter to control oil flow to the cylinder heads.	

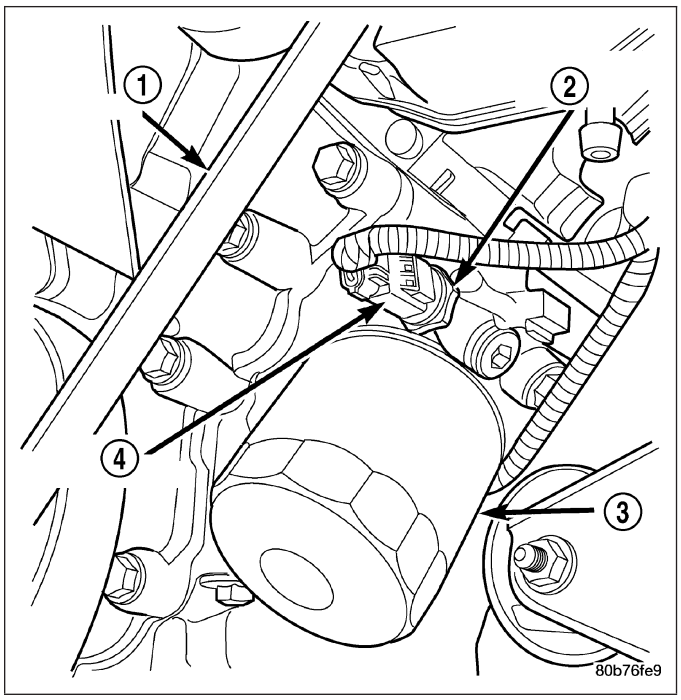
Engine Lubrication Flow Chart—Cylinder Heads: Table 2

FROM	TO
Cylinder Head Oil Port (in bolt hole)	Diagonal Cross Drilling to Main Oil Gallery
Main Oil Gallery (drilled through head from rear to front)	1. Base of Camshaft Towers 2. Lash Adjuster Towers
Base of Camshaft Towers	Vertical Drilling Through Tower to Camshaft Bearings**
Lash Adjuster Towers	Diagonal Drillings to Hydraulic Lash Adjuster Pockets
** The number three camshaft bearing journal feeds oil into the hollow camshaft tubes. Oil is routed to the intake lobes, which have oil passages drilled into them to lubricate the rocker arms.	

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE OIL PRESSURE

1. Remove oil pressure sending unit and install gauge assembly C-3292.
2. Run engine until thermostat opens.
3. Oil Pressure:
   - Curb Idle—25 Kpa (4 psi) minimum
   - 3000 rpm—170 - 550 KPa (25 - 80 psi)
4. If oil pressure is 0 at idle, shut off engine. Check for a clogged oil pick-up screen or a pressure relief valve stuck open.



DIAGNOSIS AND TESTING - ENGINE OIL LEAK

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

1. Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.
2. Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.
3. Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.If the oil leak source is not positively identified at this time, proceed with the air leak detection test method.

Air Leak Detection Test Method

1. Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.
2. Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.
3. Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kPa (3 PSI) of test pressure.

4. Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.
5. If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.
6. If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose.

7. Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.
4. If no leaks are detected, pressurize the crankcase as outlined in the, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

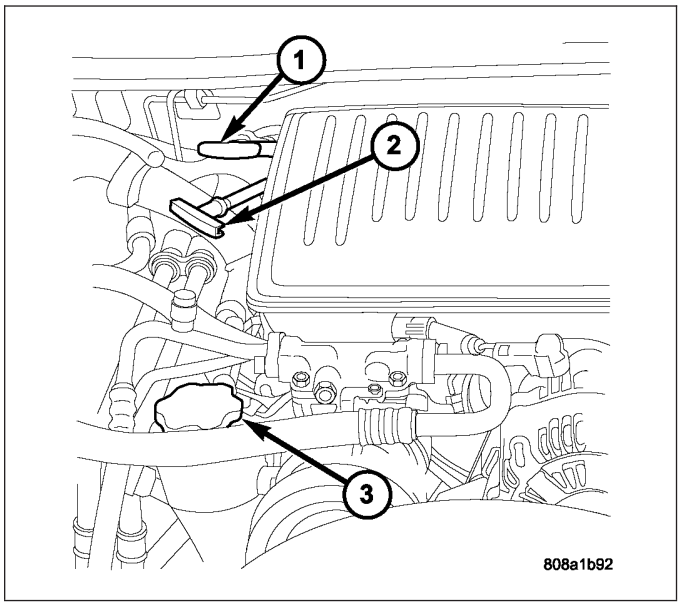
6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

OIL

STANDARD PROCEDURE

ENGINE OIL SERVICE

The engine oil level indicator is located at the right rear of the engine on the 4.7L engines..



CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, pressure loss or oil foaming can result.

Inspect engine oil level approximately every 800 kilometers (500 miles). Unless the engine has exhibited loss of oil pressure, run the engine for about five minutes before checking oil level. Checking engine oil level on a cold engine is not accurate.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

1. Position vehicle on level surface.
2. With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.
3. Wipe dipstick clean.
4. Install dipstick and verify it is seated in the tube.
5. Remove dipstick, with handle held above the tip, take oil level reading.
6. Add oil only if level is below the ADD mark on dipstick.

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in Maintenance Schedules.

Run engine until achieving normal operating temperature.

1. Position the vehicle on a level surface and turn engine off.
2. Hoist and support vehicle on safety stands.
3. Remove oil fill cap.
4. Place a suitable drain pan under crankcase drain.
5. Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.
6. Install drain plug in crankcase.
7. Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.
8. Install oil fill cap.
9. Start engine and inspect for leaks.
10. Stop engine and inspect oil level.

NOTE: Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING at beginning of this section.

FILTER - ENGINE OIL

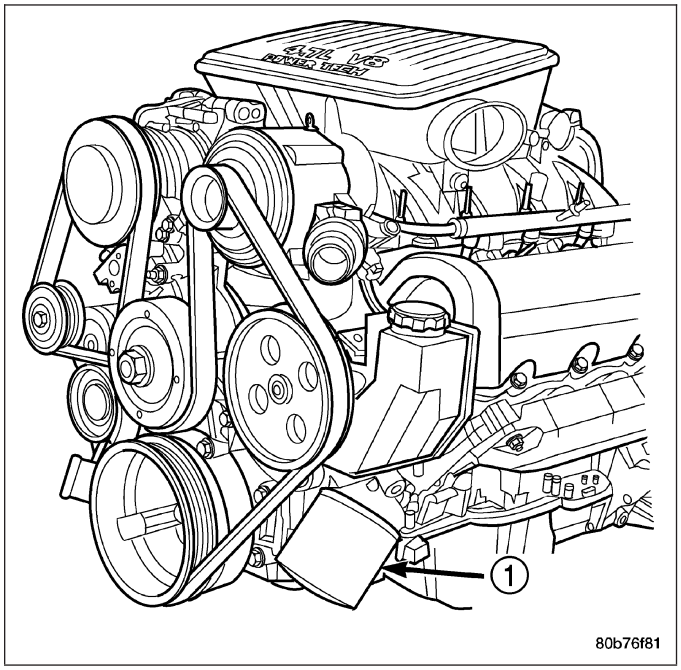
REMOVAL

All engines are equipped with a high quality full-flow, disposable type oil filter. DaimlerChrysler Corporation recommends a Mopar® or equivalent oil filter be used.

1. Position a drain pan under the oil filter.
2. Using a suitable oil filter wrench loosen filter.
3. Rotate the oil filter counterclockwise to remove it from the cylinder block oil filter boss.
4. When filter separates from cylinder block oil filter boss, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

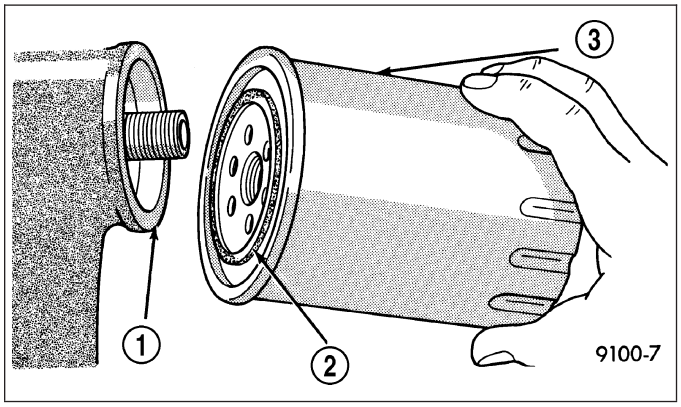
NOTE: Make sure filter gasket was removed with filter.

5. With a wiping cloth, clean the gasket sealing surface of oil and grime.



INSTALLATION

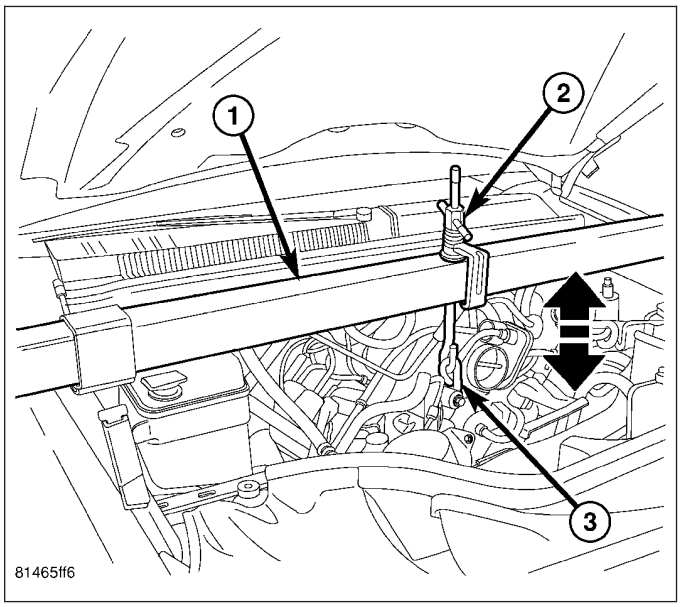
1. Lightly lubricate oil filter gasket (2) with engine oil.
2. Thread filter (3) onto adapter nipple. When gasket makes contact with sealing surface, hand tighten filter one full turn, do not over tighten.
3. Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.



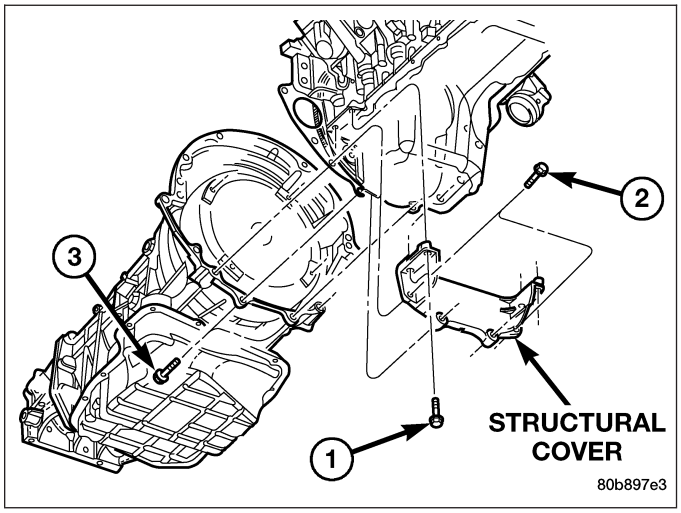
PAN-ENGINE OIL

REMOVAL

1. Disconnect the negative battery cable.
2. Install engine support fixture (1) special tool # 8534. **Do not raise engine at this time.**
3. Remove both left and right side engine mount through bolts.

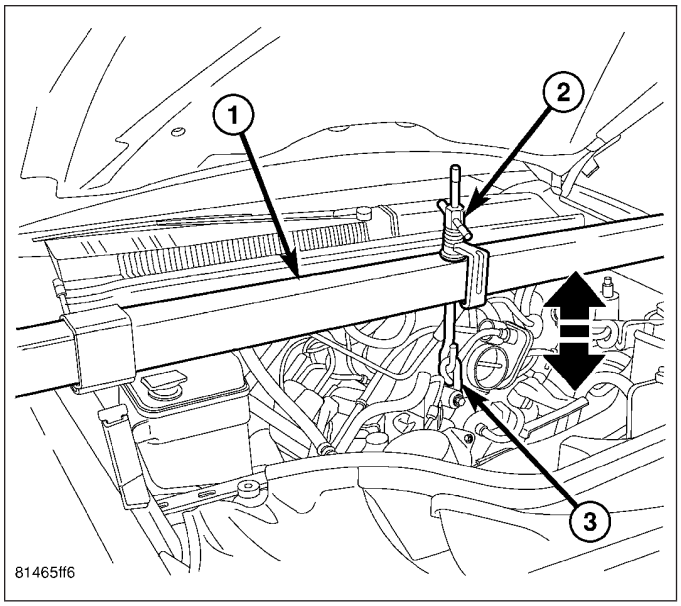


4. Remove the structural dust cover.
5. Drain engine oil.



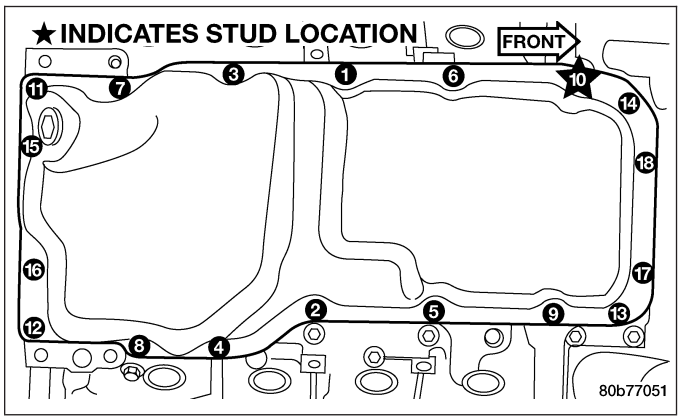
CAUTION: Only raise the engine enough to provide clearance for oil pan removal. Check for proper clearance at fan shroud to fan and cowl to intake manifold.

6. Raise engine using special tool (1) # 8534 to provide clearance to remove oil pan.



NOTE: On 4WD vehicles, the front axle must be lowered, to provide clearance for oil pan removal. It is not necessary to remove the front axle from the vehicle, or remove the axle shafts.

7. **For 4WD Vehicles** Remove the pinion bracket.
8. **For 4WD Vehicles** Disconnect the front driveshaft at the front axle.
9. **For 4WD Vehicles** Remove the front axle mounting bolts.
10. **For 4WD Vehicles** Lower axle using suitable jack enough to provide clearance to remove oil pan.

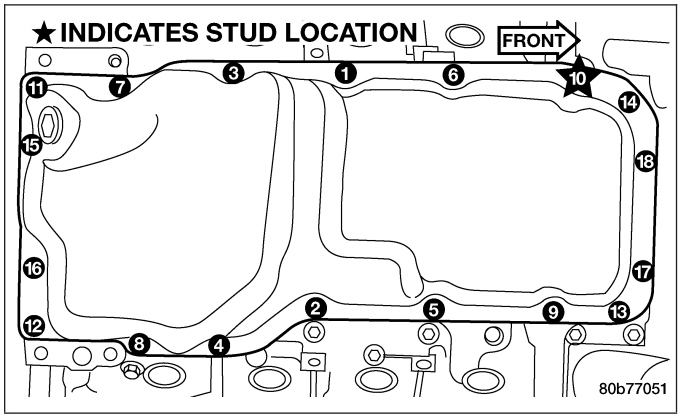


NOTE: Do not pry on oil pan or oil pan gasket. Gasket is integral to engine windage tray and does not come out with oil pan.

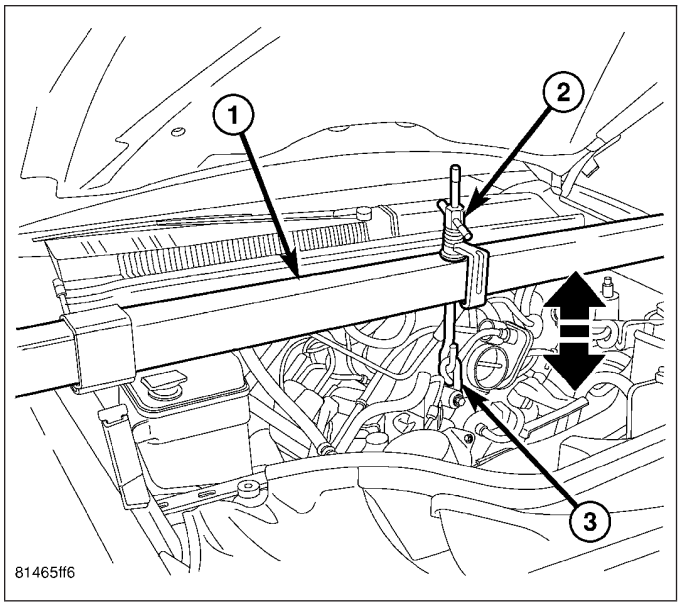
11. Remove the oil pan mounting bolts and oil pan.
12. Unbolt oil pump pickup tube and remove tube.
13. Inspect the integral windage tray and gasket and replace as needed.

INSTALLATION

1. Clean the oil pan gasket mating surface of the bedplate and oil pan.
2. Position the oil pan gasket and pickup tube with new o-ring. Install the mounting bolt and nuts. Tighten bolt and nuts to 28 N·m (20 ft. lbs.).
3. Position the oil pan and install the mounting bolts. Tighten the mounting bolts to 15 N·m (11 ft. lbs.) in the sequence shown.



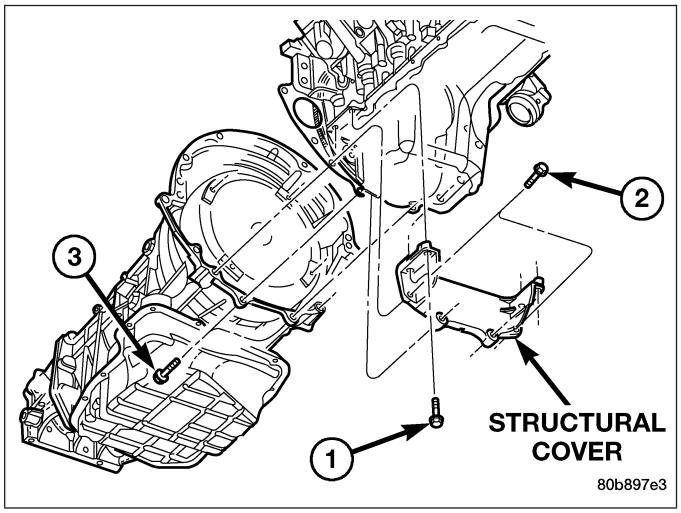
4. Lower the engine into mounts using special tool (1) # 8534.
5. Install both the left and right side engine mount through bolts. Tighten the bolts to 68 N·m (50 ft. lbs.).
6. Remove special tool # 8534.



7. Install structural dust cover.

NOTE: On 4WD vehicles, the front axle must be lowered, to provide clearance for oil pan removal. It is not necessary to remove the front axle from the vehicle, or remove the axle shafts.

8. **For 4WD Vehicles** Raise axle using suitable jack.
9. **For 4WD Vehicles** Install the front axle mounting bolts.
10. **For 4WD Vehicles** Install the pinion bracket.
11. **For 4WD Vehicles** Install the front driveshaft to the front axle.
12. Fill engine oil.
13. Reconnect the negative battery cable.
14. Start engine and check for leaks.



SWITCH - OIL PRESSURE

DESCRIPTION

The 3–wire, electrical/mechanical engine oil pressure sensor (sending unit) is located in an engine oil pressure gallery.

OPERATION

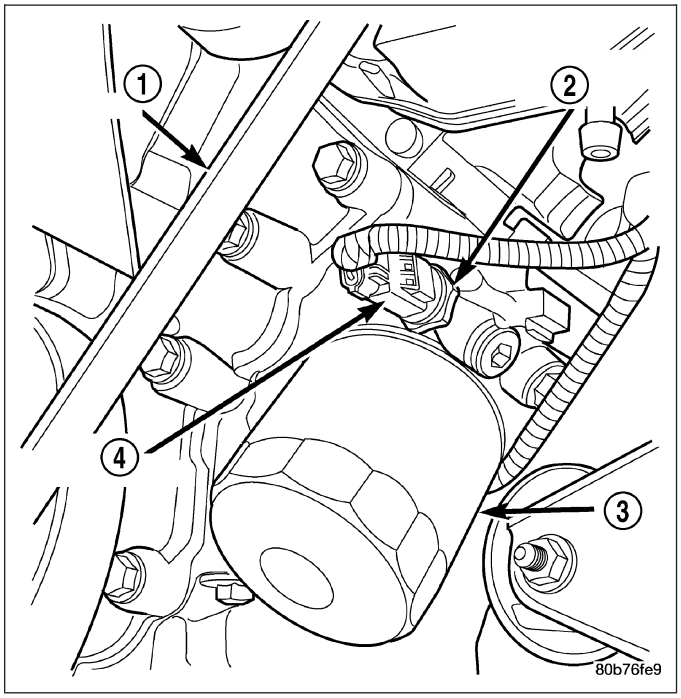
The oil pressure sensor uses two circuits. They are:

- A signal to the PCM relating to engine oil pressure
- A sensor ground through the PCM's sensor return

The oil pressure sensor returns a voltage signal back to the PCM relating to engine oil pressure. This signal is then transferred (bussed) to the instrument panel on a CCD bus circuit to operate the oil pressure gauge and the check gauges lamp. Ground for the sensor is provided by the PCM through a low-noise sensor return.

REMOVAL

1. Disconnect the negative cable from the battery.
2. Raise vehicle on hoist.
3. Remove front splash shield.
4. Disconnect oil pressure sender wire (4).
5. Remove the pressure sender (2).



INSTALLATION

1. Install oil pressure sender.
2. Connect oil pressure sender wire.
3. Install front splash shield.
4. Lower vehicle.
5. Connect the negative battery cable.

PUMP - ENGINE OIL

REMOVAL

1. Remove the oil pan and pick-up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
2. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
3. Remove the timing chains and tensioners (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
4. Remove the four bolts, primary timing chain tensioner and the oil pump.

DISASSEMBLY

1. Remove oil pump cover screws and lift off cover plate.
2. Remove pump inner and outer rotors.

NOTE: Once the oil pressure relief valve, cup plug, and pin are removed, the pump assembly must be replaced.

3. If it is necessary to remove the pressure relief valve, drive the roll pin from pump housing and remove cup plug, spring and valve.

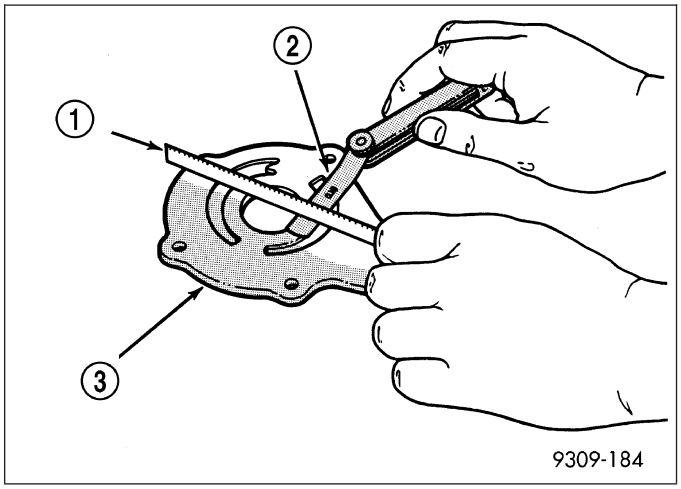
CLEANING

1. Wash all parts in a suitable solvent.

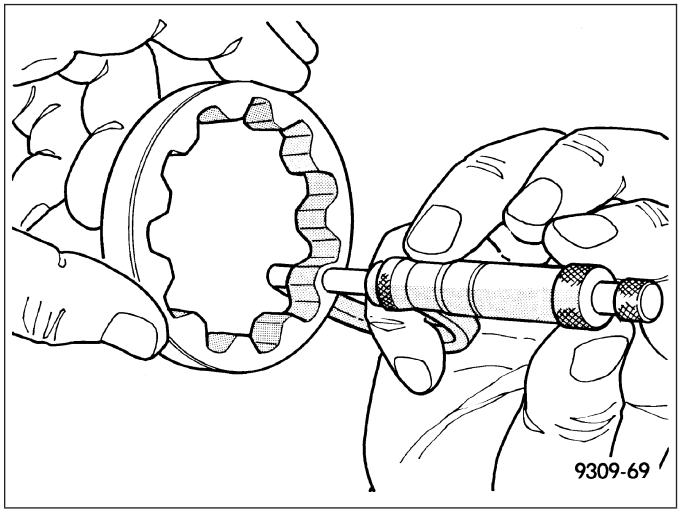
INSPECTION

CAUTION: Oil pump pressure relief valve and spring should not be removed from the oil pump. If these components are disassembled and or removed from the pump the entire oil pump assembly must be replaced.

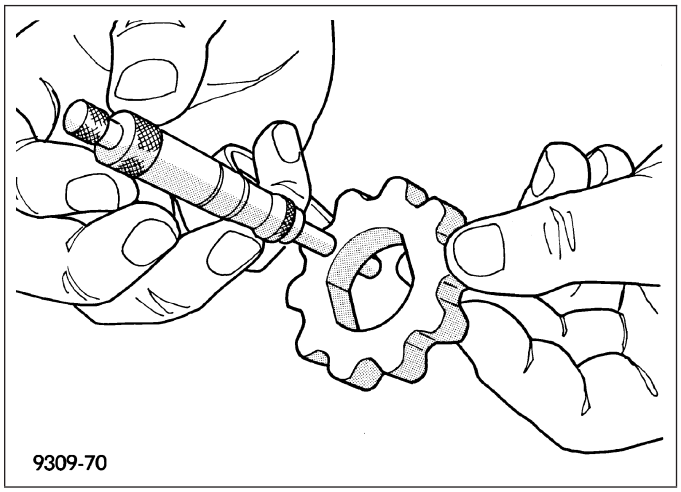
1. Clean all parts thoroughly. Mating surface of the oil pump housing should be smooth. If the pump cover is scratched or grooved the oil pump assembly should be replaced.
2. Lay a straight edge across the pump cover surface (3). If a 0.025 mm (0.001 in.) feeler gauge (2) can be inserted between the cover and the straight edge the oil pump assembly should be replaced.



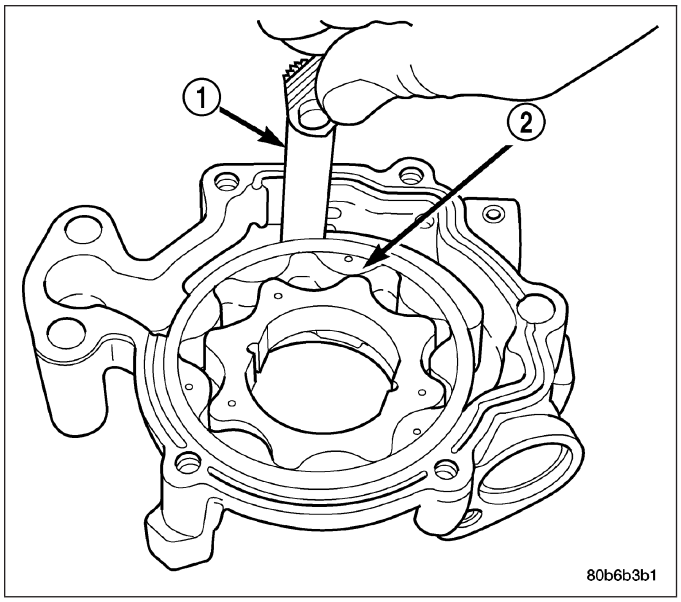
3. Measure the thickness of the outer rotor. If the outer rotor thickness measures at 12.005 mm (0.472 in.) or less the oil pump assembly must be replaced.
4. Measure the diameter of the outer rotor. If the outer rotor diameter measures at 85.925 mm (3.382 in.) or less the oil pump assembly must be replaced.



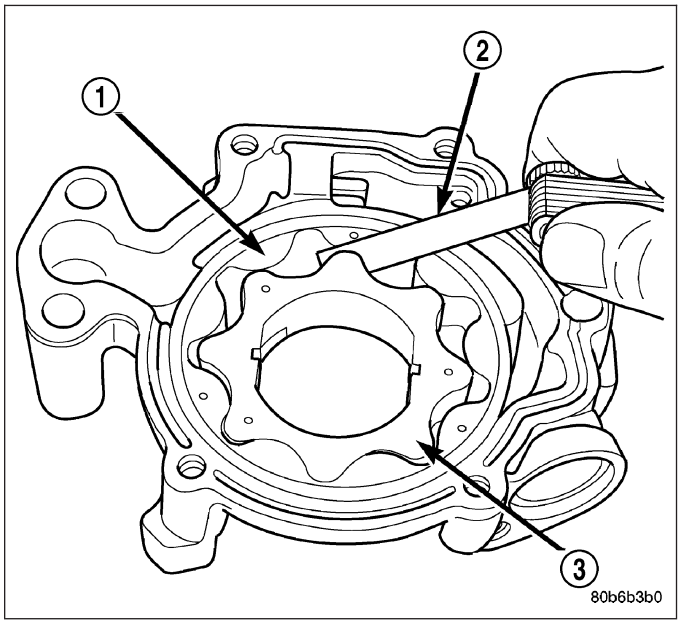
5. Measure the thickness of the inner rotor. If the inner rotor thickness measures at 12.005 mm (0.472 in.) or less then the oil pump assembly must be replaced.



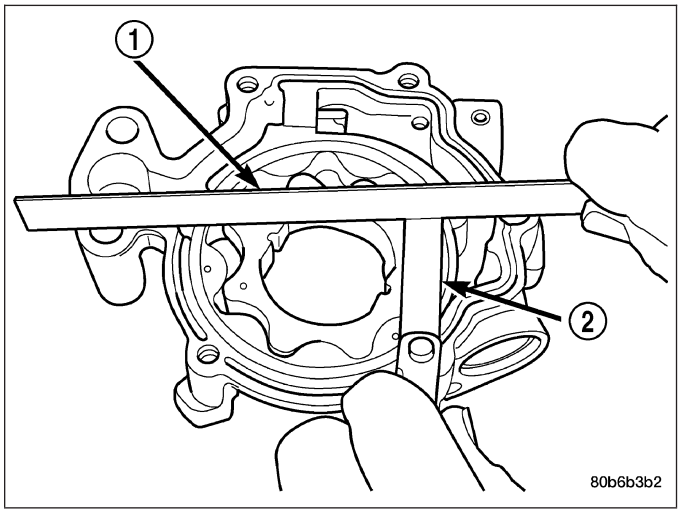
6. Slide outer rotor (2) into the body of the oil pump. Press the outer rotor to one side of the oil pump body and measure clearance between the outer rotor and the body. If the measurement is 0.235mm (0.009 in.) or more the oil pump assembly must be replaced.



7. Install the inner rotor in the into the oil pump body. Measure the clearance between the inner (3) and outer (1) rotors. If the clearance between the rotors is .150 mm (0.006 in.) or more the oil pump assembly must be replaced.



8. Place a straight edge (1) across the body of the oil pump (between the bolt holes), if a feeler gauge (2) of .095 mm (0.0038 in.) or greater can be inserted between the straightedge and the rotors, the pump must be replaced.



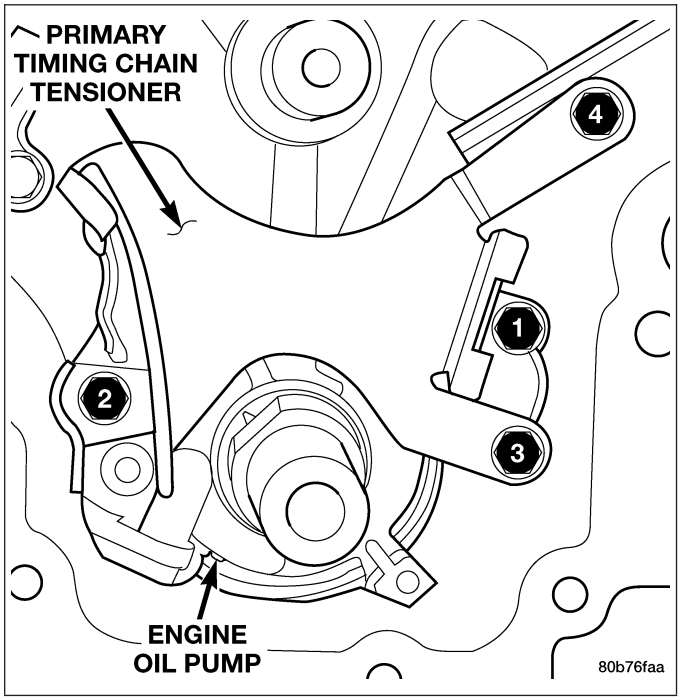
NOTE: The 3.7L/4.7L Oil pump is released as an assembly. There are no DaimlerChrysler part numbers for Sub-Assembly components. In the event the oil pump is not functioning or out of specification it must be replaced as an assembly.

ASSEMBLY

1. Wash all parts in a suitable solvent and inspect carefully for damage or wear.
2. Install inner and outer rotors
3. Install oil pump cover plate and install cover bolts and tighten them to 12 N·m (105 in. lbs.).
4. Prime oil pump before installation by filling rotor cavity with engine oil.
5. If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other causes for oil pressure loss.

INSTALLATION

1. Position the oil pump onto the crankshaft and install one oil pump retaining bolts.
2. Position the primary timing chain tensioner and install three retaining bolts.
3. Tighten the oil pump and primary timing chain tensioner retaining bolts to 28 N·m (250 in. lbs.) in the sequence shown.
4. Install the secondary timing chain tensioners and timing chains (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
5. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
6. Install the pick-up tube and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).



MANIFOLD - INTAKE

DESCRIPTION

The intake manifold is made of a composite material and features long runners which maximizes low end torque. The intake manifold uses single plane sealing which consist of eight individual press in place port gaskets to prevent leaks. Eight studs and two bolts are used to fasten the intake to the head.

DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKAGE

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

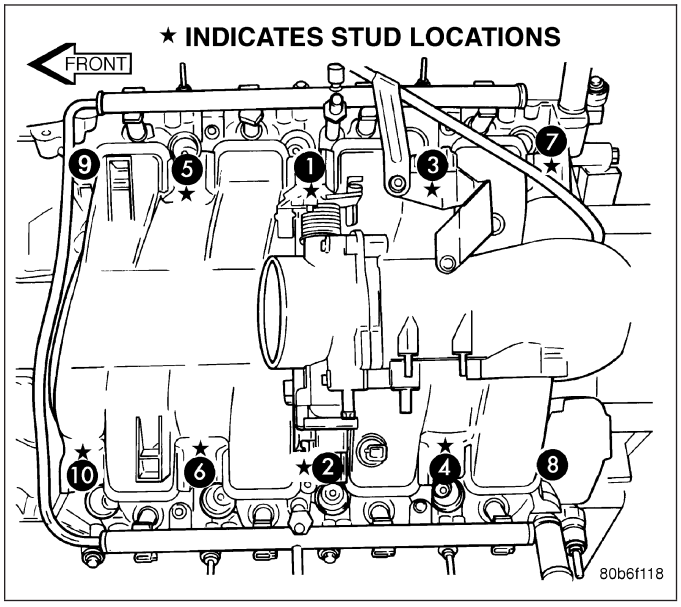
WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

1. Start the engine.
2. Spray a small stream of water at the suspected leak area.

3. If a change in RPM is observed the area of the suspected leak has been found.
4. Repair as required.

REMOVAL

1. Disconnect negative cable from battery.
2. Remove the wiper module (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).
3. Remove resonator assembly and air inlet hose.
4. Disconnect throttle and speed control cables.
5. Disconnect electrical connectors for the following components:
   - Manifold Absolute Pressure (MAP) Sensor
   - Intake Air Temperature (IAT) Sensor
   - Throttle Position (TPS) Sensor
   - Coolant Temperature (CTS) Sensor
   - Idle Air Control (IAC) Motor
6. Disconnect brake booster hose and positive crankcase ventilation (PCV) hose.
7. Disconnect generator electrical connections.
8. Disconnect air conditioning compressor electrical connections.
9. Disconnect left and right radio suppressor straps.
10. Disconnect and remove ignition coil towers (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - REMOVAL).
11. Remove top oil dipstick tube retaining bolt and ground strap.
12. Bleed fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).
13. Remove fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - REMOVAL).
14. Remove throttle body assembly and mounting bracket.
15. Drain cooling system below coolant temperature level (Refer to 7 - COOLING - STANDARD PROCEDURE).
16. Remove the heater hoses from the engine front cover and the heater core.
17. Unclip and remove heater hoses and tubes from intake manifold.
18. Remove coolant temperature sensor (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT TEMPERATURE SENSO - REMOVAL).
19. Remove intake manifold retaining fasteners in reverse order of tightening sequence.
20. Remove intake manifold.



CLEANING

NOTE: There is NO approved repair procedure for the intake manifold. If severe damage is found during inspection, the intake manifold must be replaced.

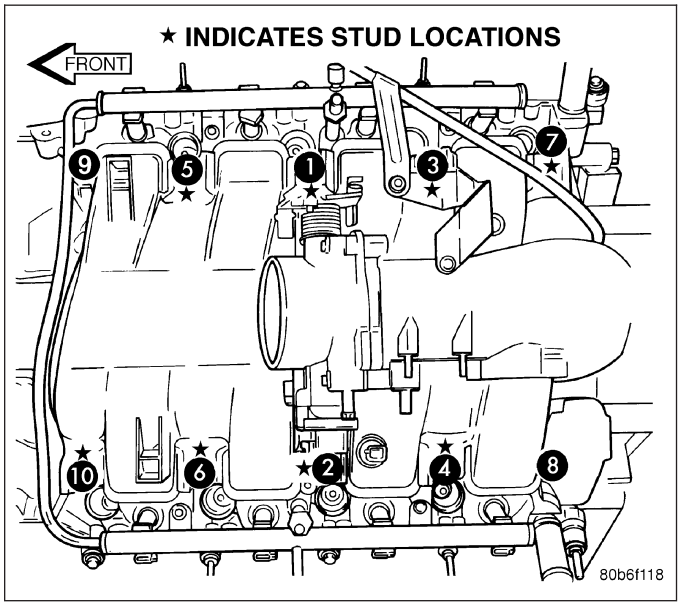
Before installing the intake manifold thoroughly clean the mating surfaces. Use a suitable cleaning solvent, then air dry.

INSPECTION

1. Inspect the intake sealing surface for cracks, nicks and distortion.
2. Inspect the intake manifold vacuum hose fittings for looseness or blockage.
3. Inspect the manifold to throttle body mating surface for cracks, nicks and distortion.

INSTALLATION

1. Install intake manifold gaskets.
2. Position intake manifold.
3. Install intake manifold retaining bolts and tighten in sequence shown in to 12 N·m (105 in. lbs.).



4. Install left and right radio suppressor straps.
5. Install throttle body assembly.
6. Install throttle cable bracket.
7. Connect throttle cable and speed control cable to throttle body.
8. Install fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - INSTALLATION).
9. Install ignition coil towers (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - INSTALLATION).
10. Position and install heater hoses and tubes onto intake manifold.
11. Install the heater hoses to the heater core and engine front cover.
12. Connect electrical connectors for the following components:
    - Manifold Absolute Pressure (MAP) Sensor
    - Intake Air Temperature (IAT) Sensor
    - Throttle Position (TPS) Sensor
    - Coolant Temperature (CTS) Sensor
    - Idle Air Control (IAC) Motor
    - Ignition coil towers
    - Fuel injectors

13. Install top oil dipstick tube retaining bolt and ground strap.
14. Connect generator electrical connections.
15. Connect Brake booster hose and Positive crankcase ventilation (PCV) hose.
16. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
17. Install the wiper module (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).
18. Install resonator assembly and air inlet hose.
19. Connect negative cable to battery.

MANIFOLD - EXHAUST

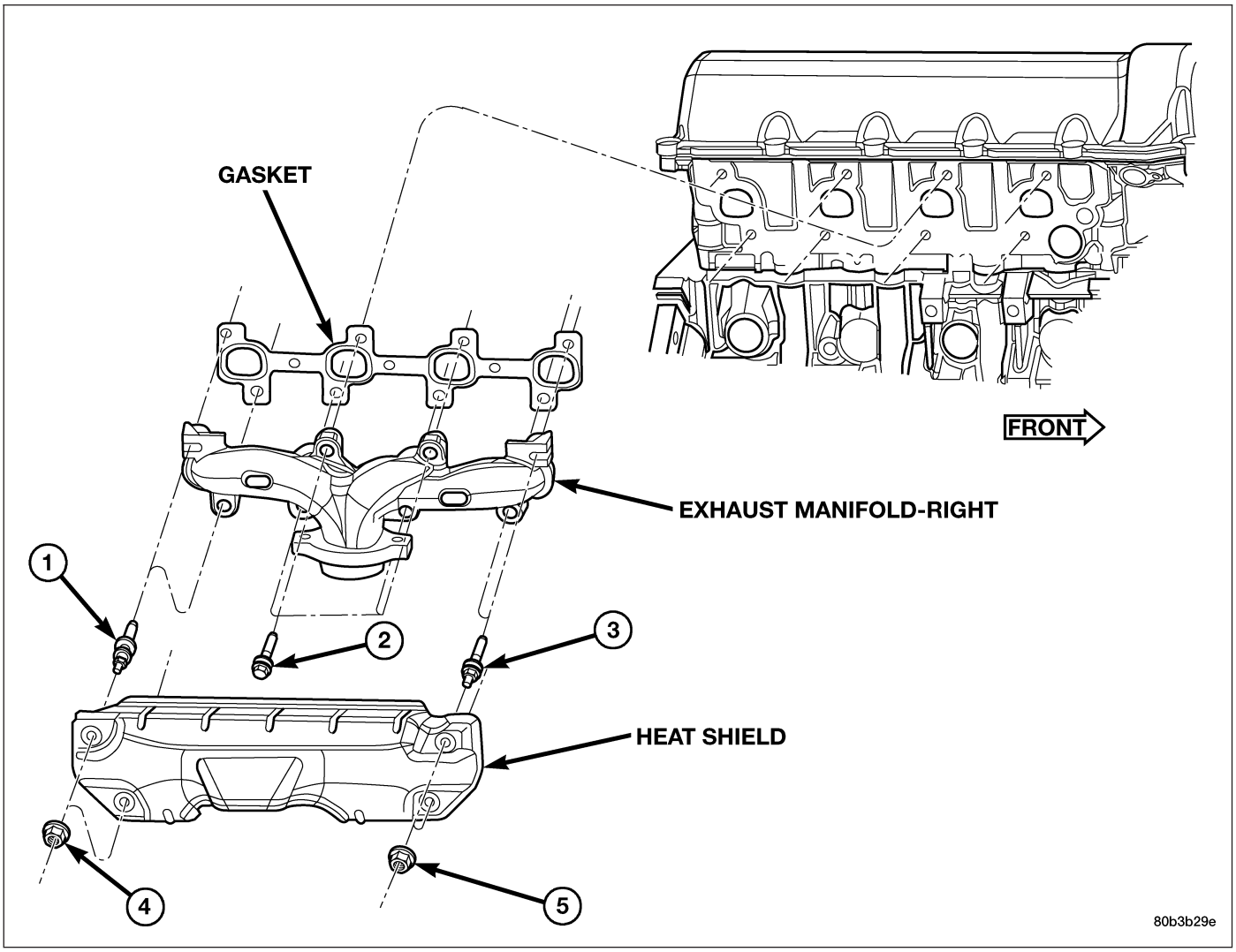
DESCRIPTION

The exhaust manifolds are log style with a patented flow enhancing design to maximize performance. The exhaust manifolds are made of high silicon molybdenum cast iron. A perforated core graphite exhaust manifold gasket is used to improve sealing to the cylinder head. The exhaust manifolds are covered by a three layer laminated heat shield for thermal protection and noise reduction. The heat shields are fastened with a torque prevailing nut that is backed off slightly to allow for the thermal expansion of the exhaust manifold.

REMOVAL

RIGHT EXHAUST MANIFOLD

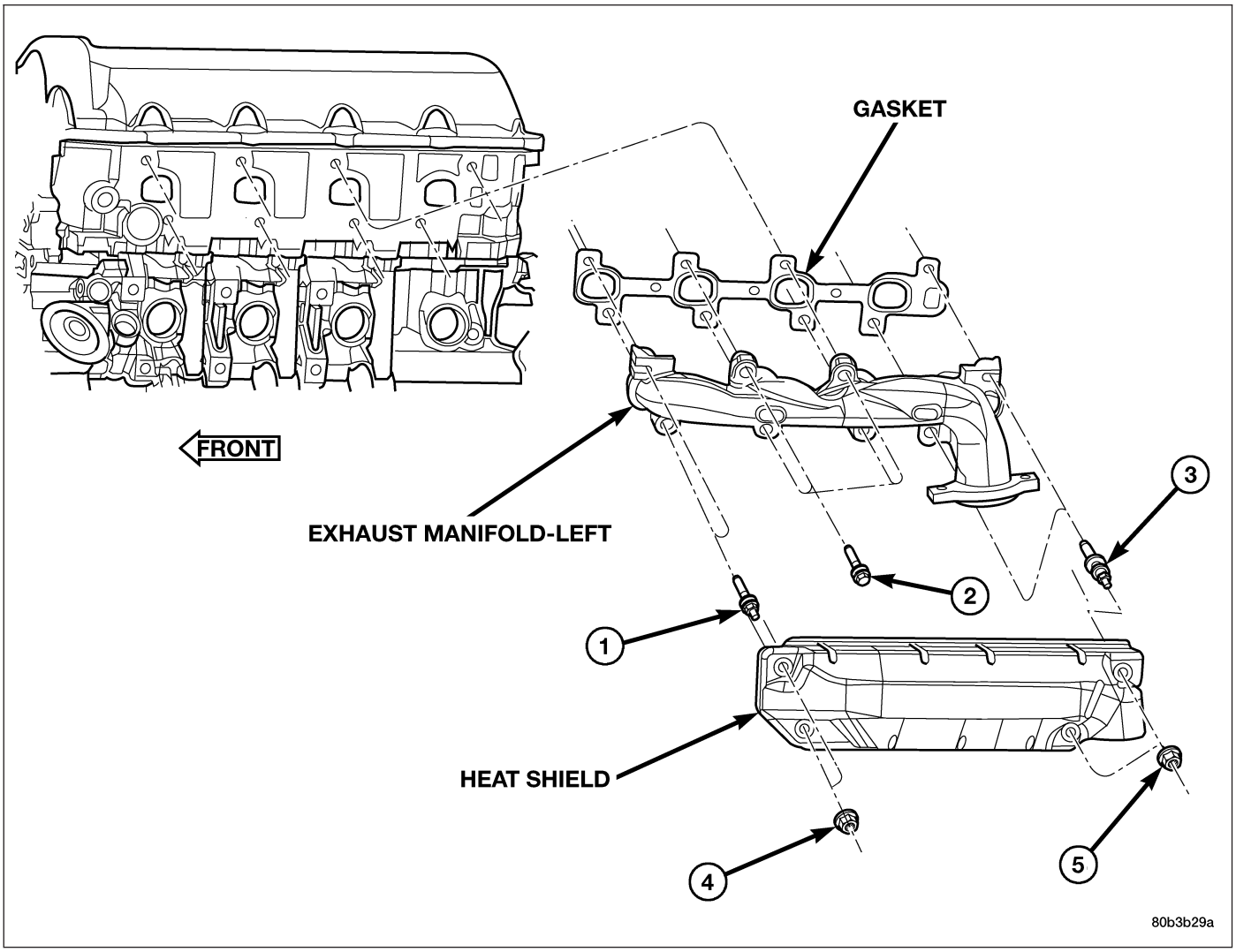
1. Disconnect negative cable for battery.
2. Remove air cleaner assembly, resonator assembly and air inlet hose.
3. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
4. Remove A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL).
5. Remove A/C accumulator support bracket fastener.
6. Drain coolant below heater hose level (Refer to 7 - COOLING - STANDARD PROCEDURE).
7. Remove heater hoses at engine.
8. Remove fasteners attaching exhaust manifold heat shield.
9. Remove heat shield.
10. Remove upper exhaust manifold attaching fasteners.
11. Raise vehicle on hoist.
12. Disconnect exhaust pipe from manifold.
13. Remove fasteners attaching starter. Move starter aside.
14. Remove lower exhaust manifold attaching fasteners.



15. Remove exhaust manifold and gasket. Manifold is removed from below the engine compartment.

LEFT EXHAUST MANIFOLD

1. Disconnect negative cable for battery.
2. Hoist vehicle.
3. Disconnect exhaust pipe at manifold.
4. Lower vehicle.
5. Remove the front two exhaust heat shield retaining fasteners. Raise vehicle and remove the fasteners at rear of heat shield.



6. Remove heat shield.
7. Lower vehicle and remove the upper exhaust manifold retaining bolts.
8. Raise vehicle and remove the lower exhaust manifold retaining bolts.
9. Remove exhaust manifold and gasket. Manifold is removed from below the engine compartment.

CLEANING

1. Clean the exhaust manifold using a suitable cleaning solvent, then allow to air dry.
2. Clean all gasket residue from the manifold mating surface.

INSPECTION

1. Inspect the exhaust manifold for cracks in the mating surface and at every mounting bolt hole.
2. Using a straight edge and a feeler gauge, check the mating surface for warp and twist.
3. Inspect the manifold to exhaust pipe mating surface for cracks, gouges, or other damage that would prevent sealing.

INSTALLATION

RIGHT EXHAUST MANIFOLD

1. Install exhaust manifold and gasket from below engine compartment.
2. Install lower exhaust manifold fasteners. DO NOT tighten until all fasteners are in place.

3. Lower vehicle and install upper exhaust manifold fasteners. Tighten all manifold bolts starting at center and working outward to 25 N·m (18 ft. lbs.).

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

4. Install exhaust manifold heat shield. Tighten fasteners to 8 N·m (72 in. lbs.), then loosen 45 degrees.
5. Install starter and fasteners.
6. Connect exhaust pipe to manifold.
7. Connect heater hoses at engine.
8. Install fastener attaching A/C accumulator.
9. Install A/C compressor and fasteners.
10. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
11. Install air cleaner assembly, resonator assembly and air inlet hose.
12. Install battery and connect cables.
13. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

LEFT EXHAUST MANIFOLD

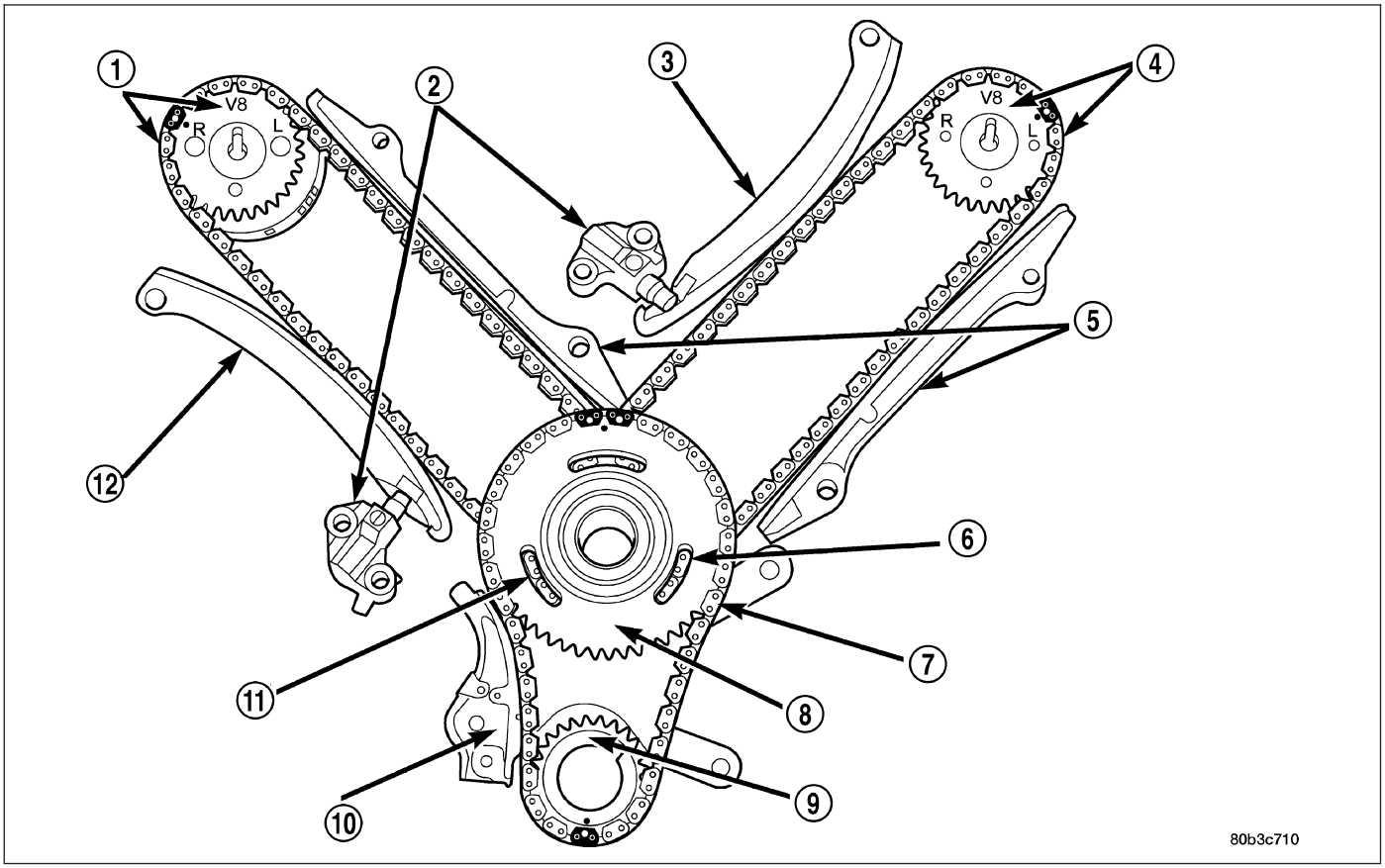
1. Install exhaust manifold and gasket from below engine compartment.
2. Install lower exhaust manifold fasteners. DO NOT tighten until all fasteners are in place.
3. Lower vehicle and install upper exhaust manifold fasteners. Tighten all manifold bolts starting at center and working outward to 25 N·m (18 ft. lbs.).

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

4. Install exhaust manifold heat shield. Tighten fasteners to 8 N·m (72 in. lbs.), then loosen 45 degrees.
5. Connect exhaust pipe to manifold.
6. Connect negative cable to battery.

VALVE TIMING

DESCRIPTION - TIMING DRIVE SYSTEM



The timing drive system has been designed to provide quiet performance and reliability to support a **non-free wheeling** engine. Specifically the intake valves are non-free wheeling and can be easily damaged with forceful engine rotation if camshaft-to-crankshaft timing is incorrect. The timing drive system consists of a primary chain and two secondary timing chain drives.

OPERATION - TIMING DRIVE SYSTEM

The primary timing chain is a single inverted tooth type. The primary chain drives the large fifty tooth idler sprocket directly from a 25 tooth crankshaft sprocket. Primary chain motion is controlled by a pivoting leaf spring tensioner arm and a fixed guide. The arm and the guide both use nylon plastic wear faces for low friction and long wear. The primary chain receives oil splash lubrication from the secondary chain drive and oil pump leakage. The idler sprocket assembly connects the primary and secondary chain drives. The idler sprocket assembly consists of two integral thirty tooth sprockets and a fifty tooth sprocket that is splined to the assembly. The spline joint is a non – serviceable press fit anti rattle type. The idler sprocket assembly spins on a stationary idler shaft. The idler shaft is press-fit into the cylinder block. A large washer on the idler shaft bolt and the rear flange of the idler shaft are used to control sprocket thrust movement. Pressurized oil is routed through the center of the idler shaft to provide lubrication for the two bushings used in the idler sprocket assembly.

There are two secondary drive chains, both are inverted tooth type, one to drive the camshaft in each SOHC cylinder head. There are no shaft speed changes in the secondary chain drive system. Each secondary chain drives a thirty tooth cam sprocket directly from the thirty tooth sprocket on the idler sprocket assembly. A fixed chain guide and a hydraulic oil damped tensioner are used to maintain tension in each secondary chain system. The hydraulic tensioners for the secondary chain systems are fed pressurized oil from oil reservoir pockets in the block. Each tensioner also has a mechanical ratchet system that limits chain slack if the tensioner piston bleeds down after engine shut down. The tensioner arms and guides also utilize nylon wear faces for low friction and long wear. The secondary timing chains receive lubrication from a small orifice in the tensioners. This orifice is protected from clogging by a fine mesh screen which is located on the back of the hydraulic tensioners.

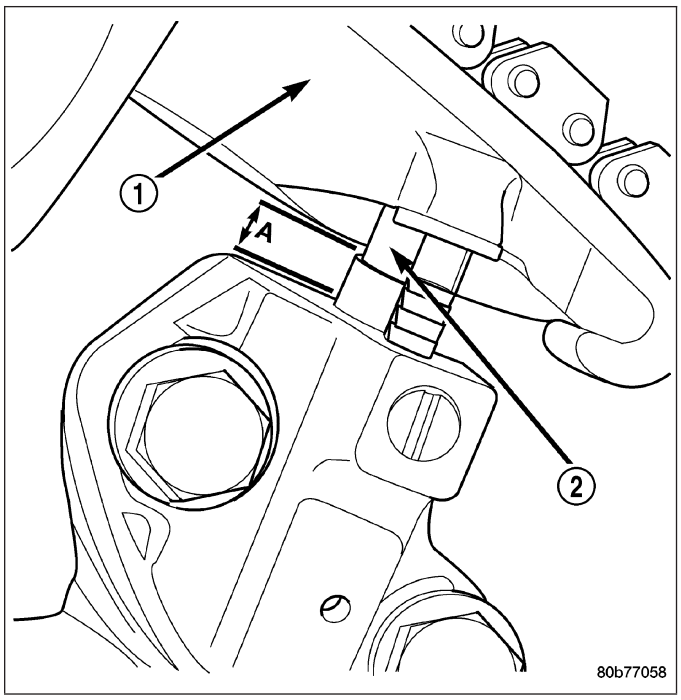
STANDARD PROCEDURE

STANDARD PROCEDURE - MEASURING TIMING CHAIN WEAR

NOTE: This procedure must be performed with the timing chain cover removed.

1. Remove the timing chain cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
2. To determine if the secondary timing chains are worn, rotate the engine clockwise until maximum tensioner piston (2) extension is obtained. Measure the distance between the secondary timing chain tensioner housing and the step ledge on the piston. The measurement at point (A) must be less than 15mm (0.5906 inches).
3. If the measurement exceeds the specification the secondary timing chains are worn and require replacement. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

NOTE: If the secondary chains are to be replaced the primary chain must also be replaced.



STANDARD PROCEDURE - ENGINE TIMING - VERIFICATION

CAUTION: The 4.7L is a non free-wheeling design engine. Therefore, correct engine timing is critical.

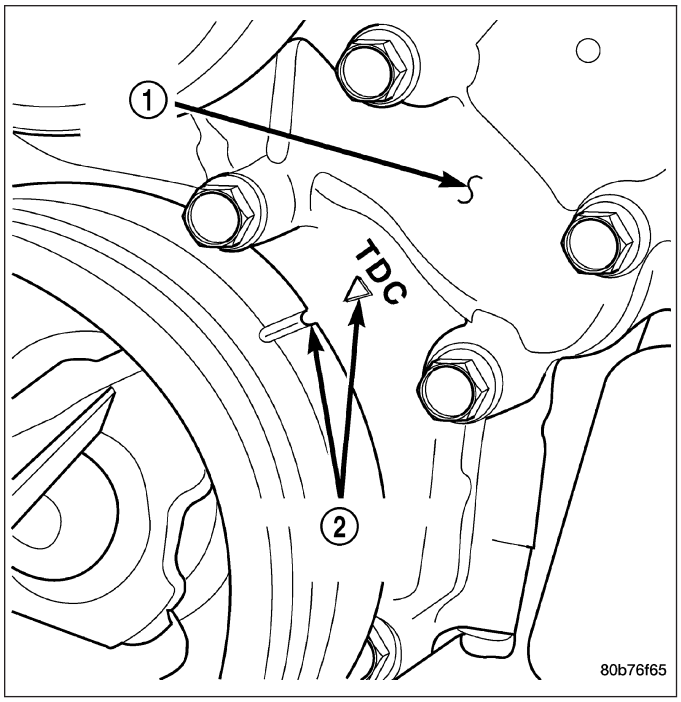
NOTE: Components referred to as left hand or right hand are as viewed from the drivers position inside the vehicle.

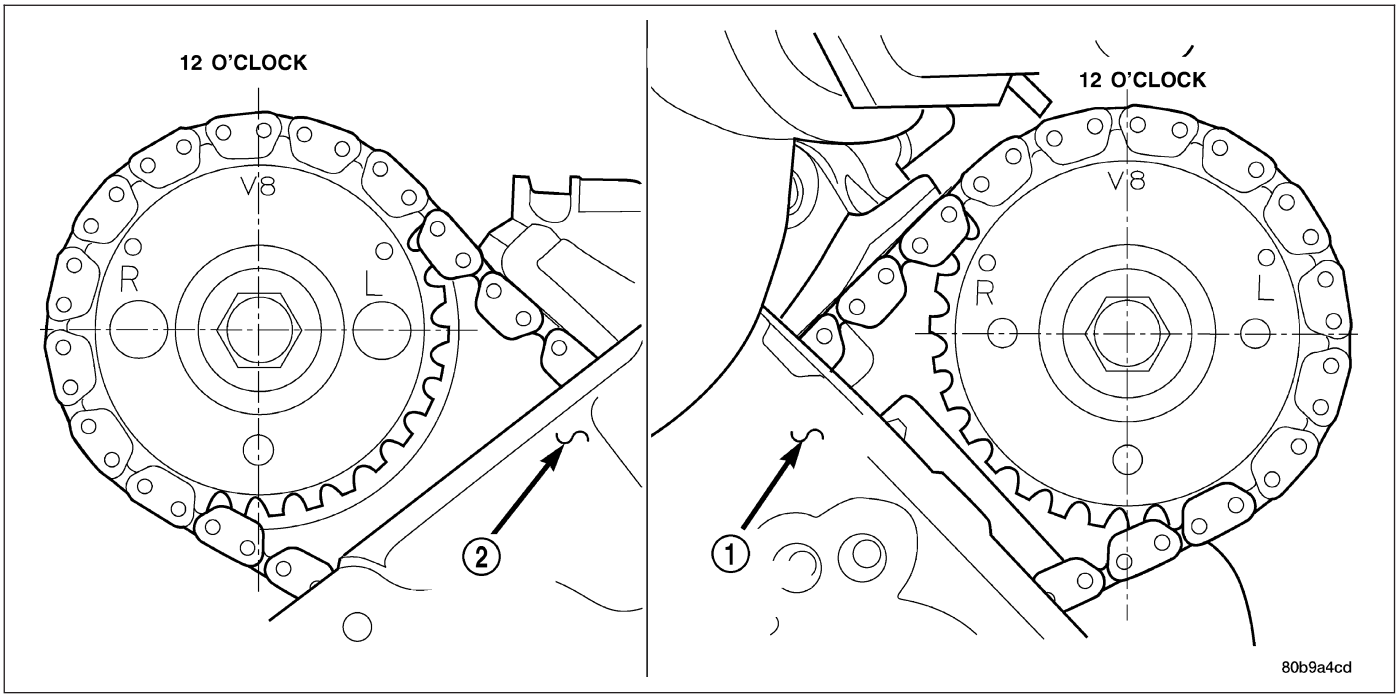
NOTE: The blue link plates on the chains and the dots on the camshaft drive sprockets may not line up during the timing verification procedure. The blue link plates are lined up with the sprocket dots only when re-timing the complete timing drive. Once the timing drive is rotated blue link-to-dot alignment is no longer valid.

Engine base timing can be verified by the following procedure:

1. Remove the cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

2. Using a mirror, locate the TDC arrow on the front cover. Rotate the crankshaft until the mark on the crankshaft damper is aligned with the TDC arrow on the front cover. The engine is now at TDC.

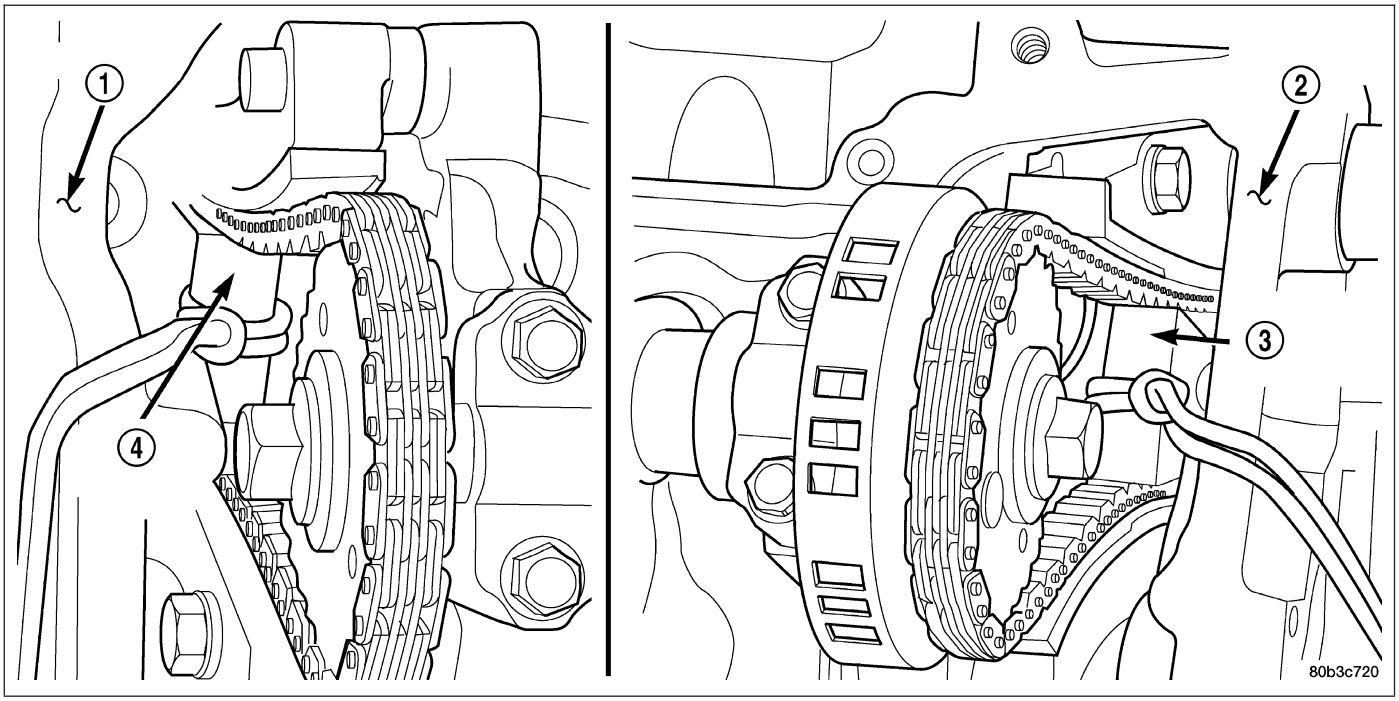




3. Note the location of the V8 mark stamped into the camshaft drive gears. If the V8 mark on each camshaft drive gear is at the twelve o'clock position, the engine is at TDC (cylinder #1) on the exhaust stroke. If the V8 mark on each gear is at the six o'clock position, the engine is at TDC (cylinder #1) on the compression stroke.
4. If both of the camshaft drive gears are off in the same or opposite directions, the primary chain or both secondary chains are at fault. Refer to Timing Chain and Sprockets procedure in this section.
5. If only one of the camshaft drive gears is off and the other is correct, the problem is confined to one secondary chain. Refer to Single camshaft timing, in this procedure.
6. If both camshaft drive gear V8 marks are at the twelve o'clock or the six o' clock position the engine base timing is correct. Reinstall the cylinder head covers.

SINGLE CAMSHAFT TIMING

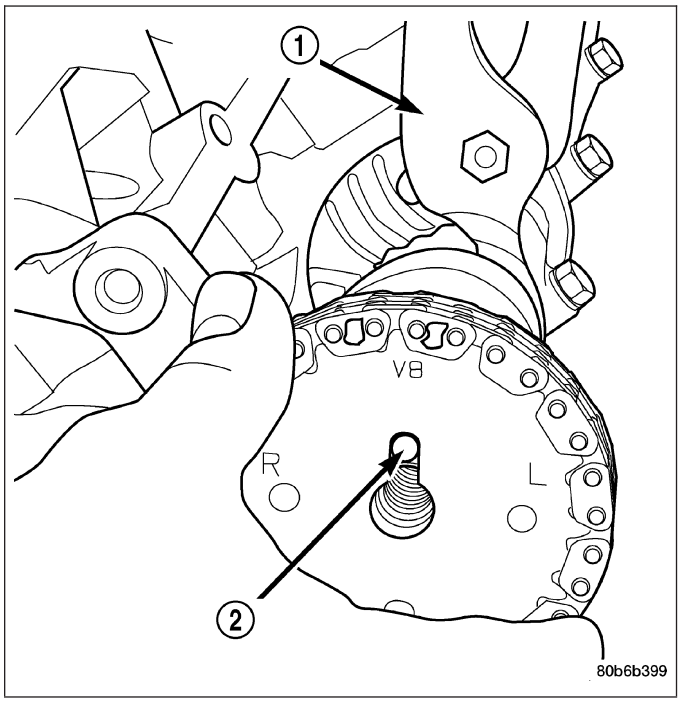
NOTE: to adjust the timing on one camshaft, peform the following procedure.



1. Using Chain Tensioner Wedge, special tool 8350 (3), stabilize the secondary chain drive. For reference purposes, mark the chain-to-sprocket position.
2. Remove the camshaft drive gear retaining bolt.
3. Carefully remove the camshaft drive gear from the camshaft.
4. Re-index the camshaft drive gear in the chain until the V8 mark is at the same position as the V8 mark on the opposite camshaft drive gear.

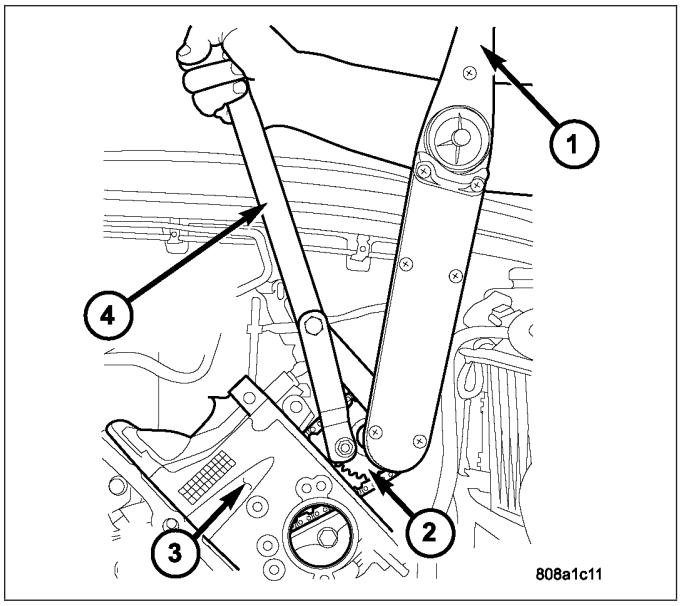
NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

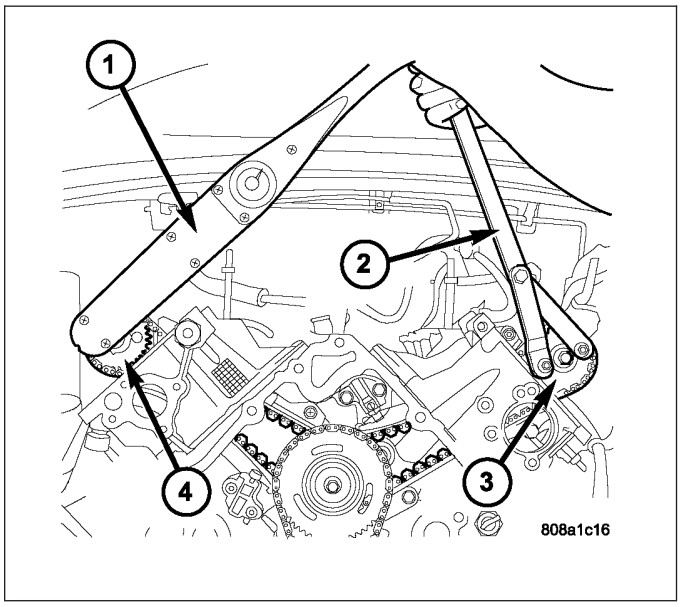
5. Using a suitable pair of adjustable pliers (1), rotate the camshaft until the alignment dowel (2) on the camshaft is aligned with the slot in the camshaft drive gear.

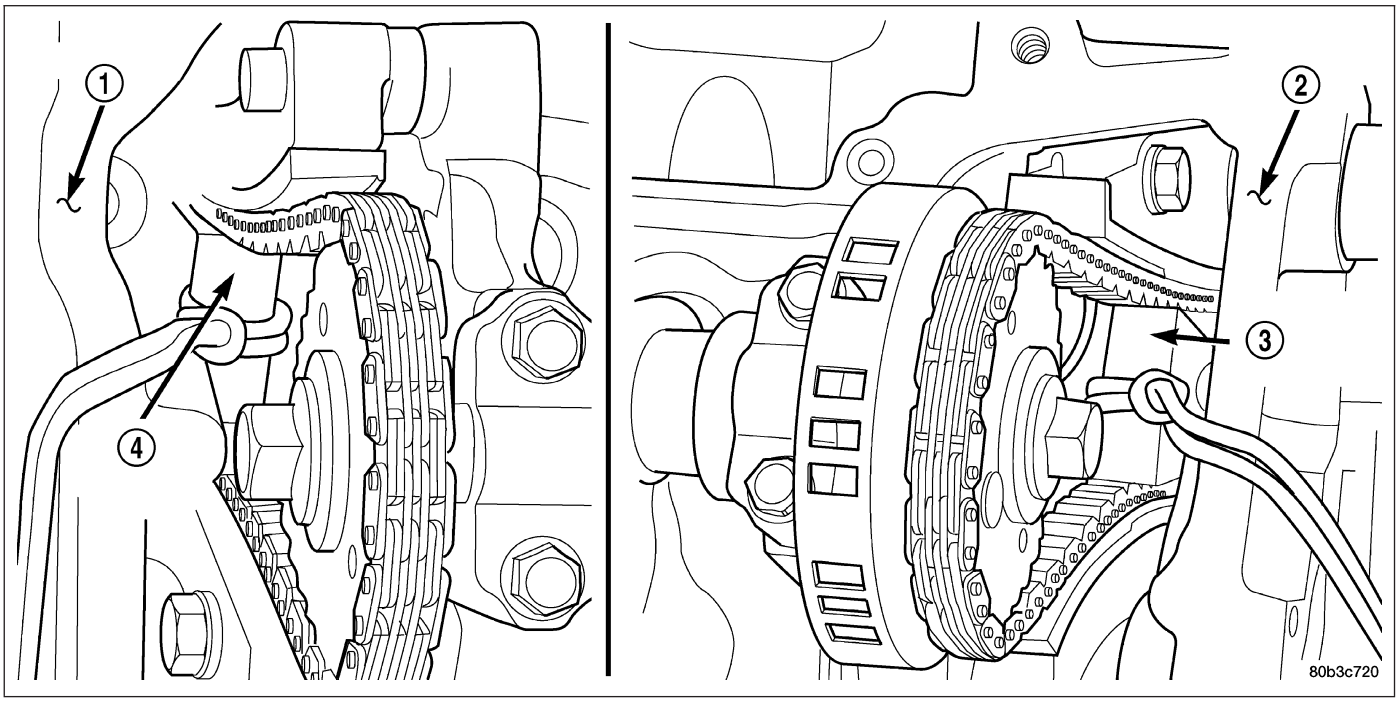


CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torqueing of bolt resulting in bolt failure.

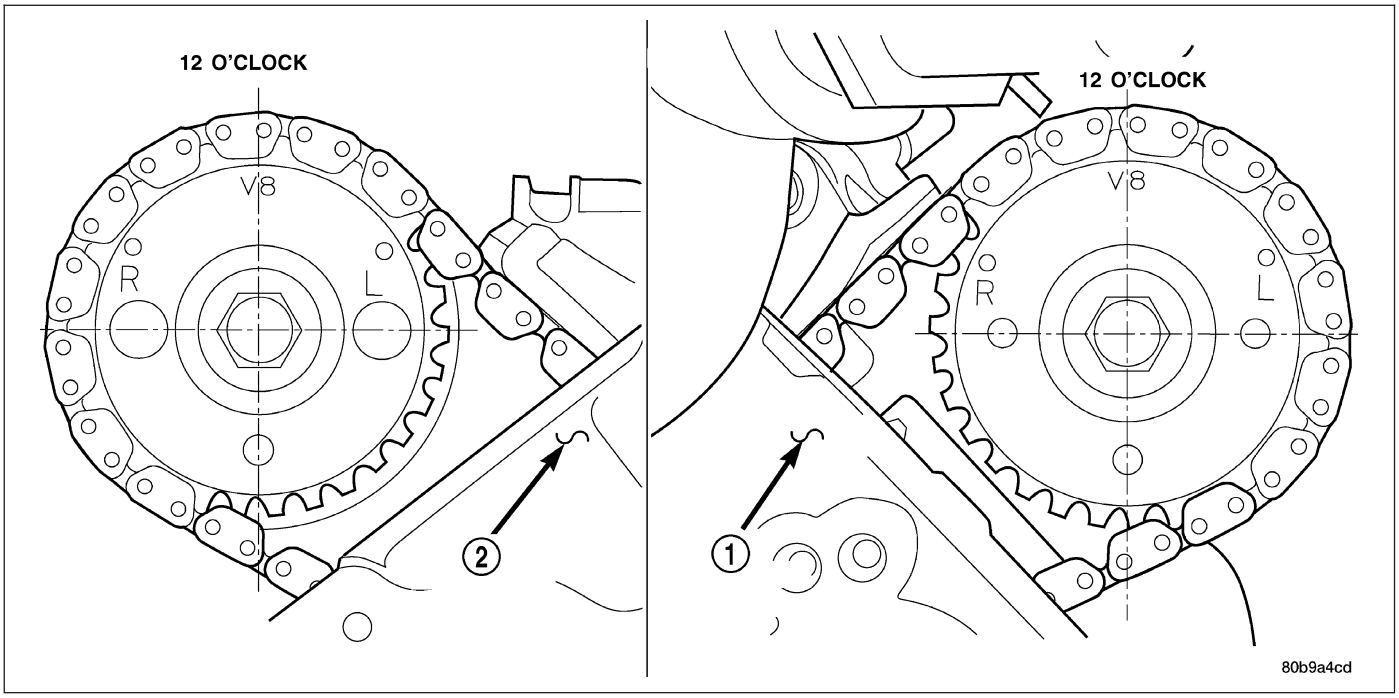
6. Position the camshaft drive gear onto the camshaft, remove oil from bolt then install the retaining bolt. Using Special Tools, Spanner Wrench 6958 with Adapter Pins 8346 and a suitable torque wrench (1), Tighten retaining bolt to 122N·m (90 ft. Lbs.).







7. Remove special tool 8350 (3,4).

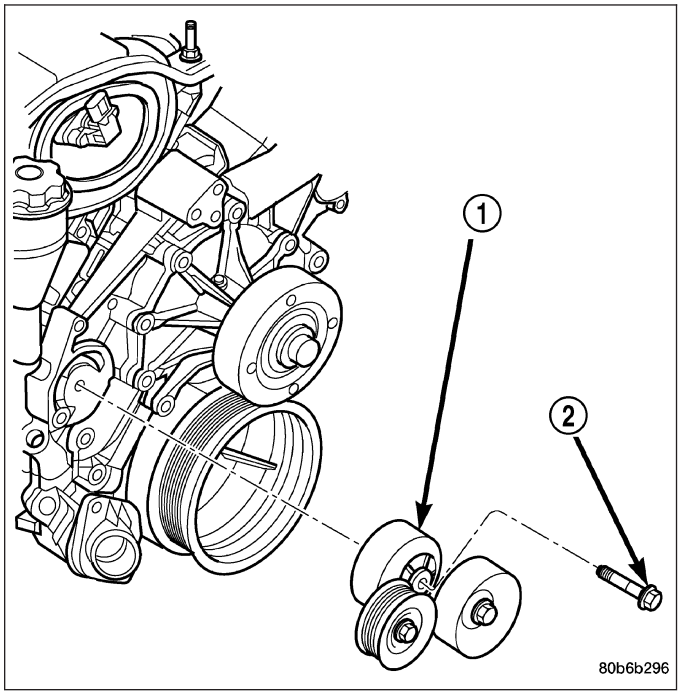


8. Rotate the crankshaft two full revolutions, then reverify that the camshaft drive gear V8 marks are in fact aligned.
9. Install the cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

COVER(S)-TIMING BELT / CHAIN

REMOVAL

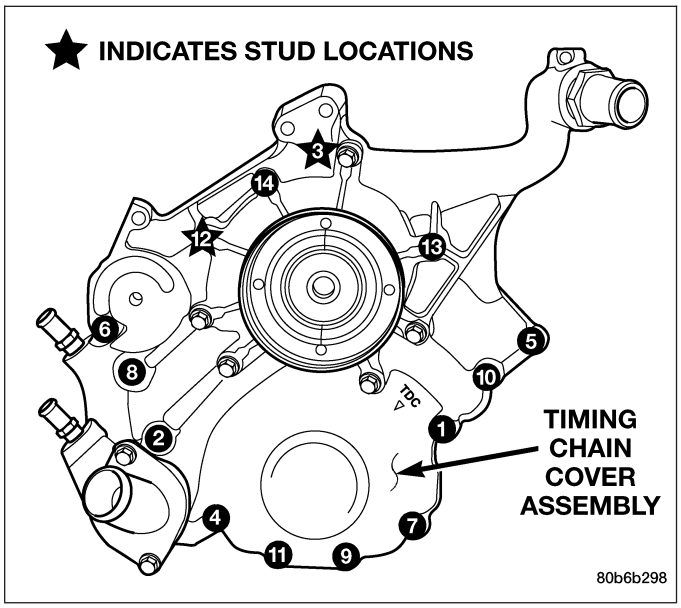
1. Disconnect the battery negative cable.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Disconnect both heater hoses at timing cover.
4. Disconnect lower radiator hose at engine.
5. Remove crankshaft damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
6. Remove accessory drive belt tensioner assembly (1).
7. Remove the generator and A/C compressor.



CAUTION: The 4.7L engine uses an RTV sealer instead of a gasket to seal the front cover to the engine block, from the factory. For service, Mopar® Grey Engine RTV sealant must be substituted.

NOTE: It is not necessary to remove the water pump for timing cover removal.

8. Remove the bolts holding the timing cover to engine block.
9. Remove cover.



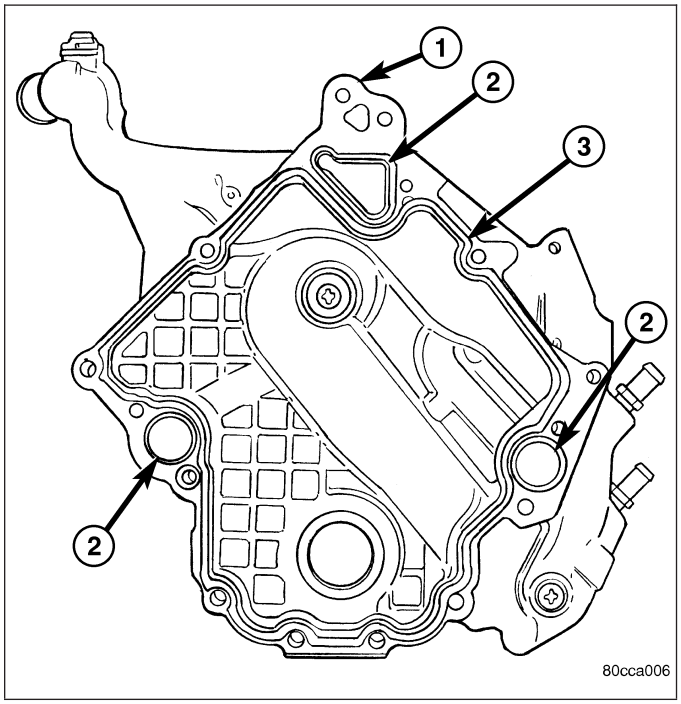
INSTALLATION

CAUTION: Do not use oil based liquids to clean timing cover or block surfaces. Use only rubbing alcohol, along with plastic or wooden scrapers. Use no wire brushes or abrasive wheels or metal scrapers, or damage to surfaces could result.

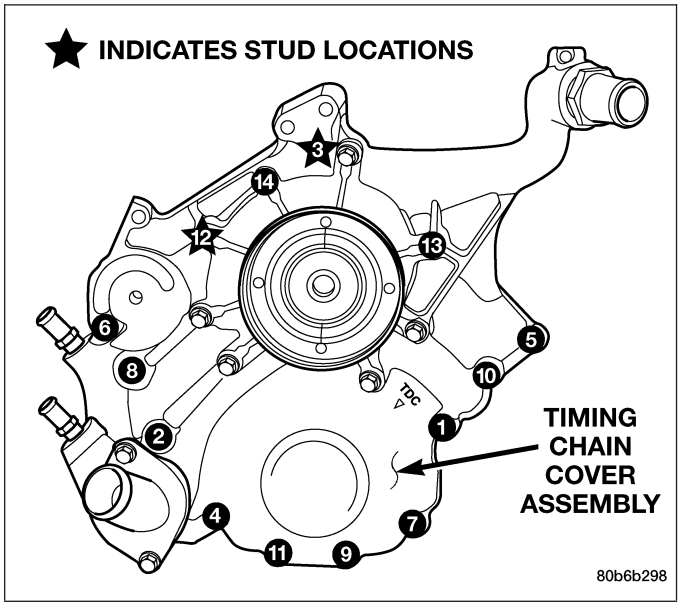
1. Clean timing chain cover and block surface using rubbing alcohol.

CAUTION: The 4.7L can use a special RTV sealer instead of a carrier gasket to seal the timing cover to the engine block, from the factory. For service repairs, Mopar® Grey Engine RTV must be used as a substitute, if RTV is present. If the front cover being used has no provisions for the water passage o-rings, then Mopar® Grey Engine RTV must be applied around the water passages.

2. Inspect the water passage o-rings, if equipped for any damage, and replace as necessary.
3. Apply Mopar® Grey Engine RTV sealer to the front cover following the path above, using a 3 to 4mm thick bead.



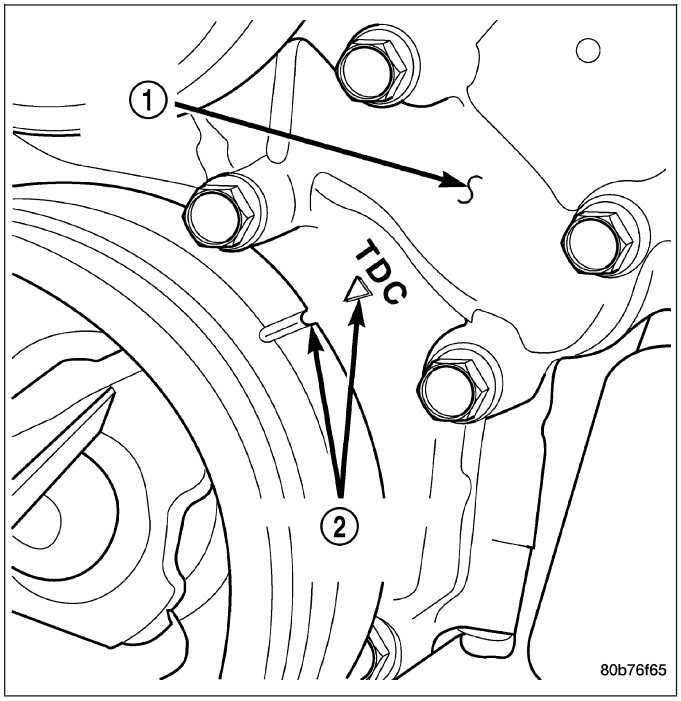
4. Install cover. Tighten flange head fasteners in sequence as shown in to 58 N·m (43 ft. lbs.).
5. Install the A/C compressor and generator.
6. Install crankshaft damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
7. Install accessory drive belt tensioner assembly. Tighten fastener to 54 N·m (40 ft. lbs.).
8. Install lower radiator hose.
9. Install both heater hoses.
10. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
11. Connect the battery negative cable.

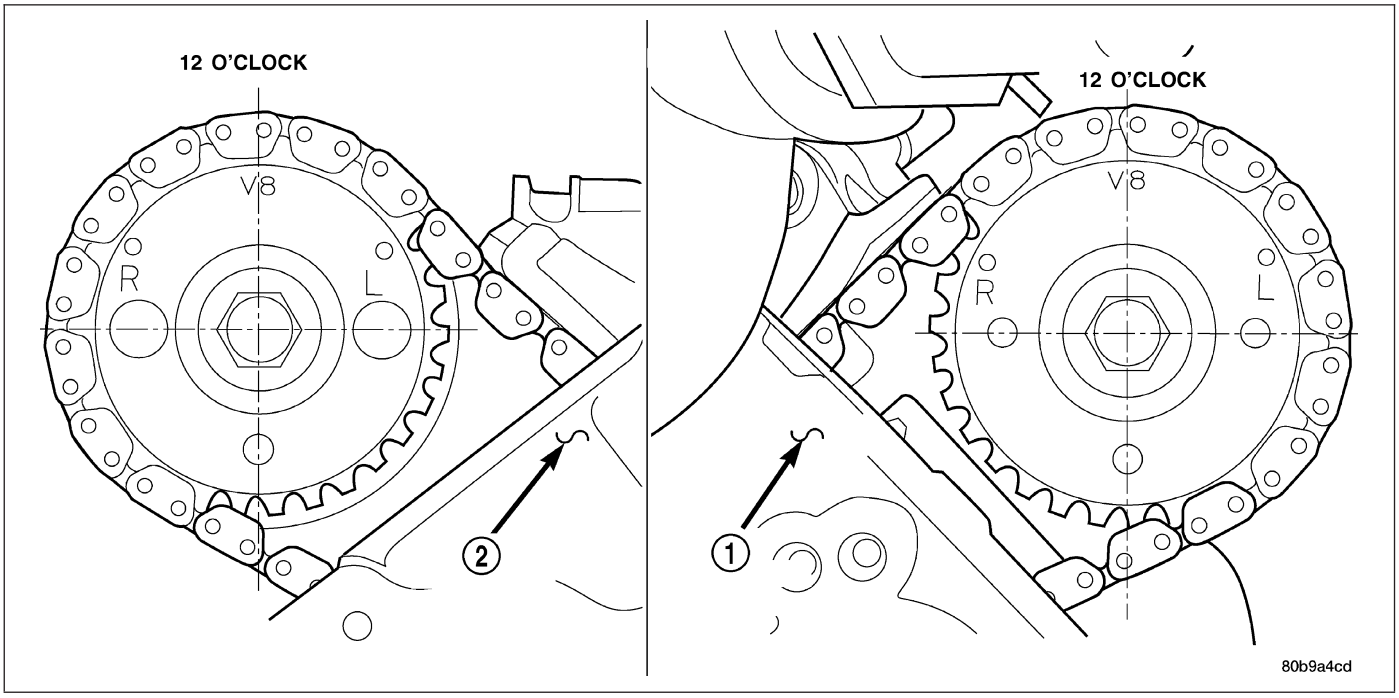


TIMING CHAIN & SPROCKETS

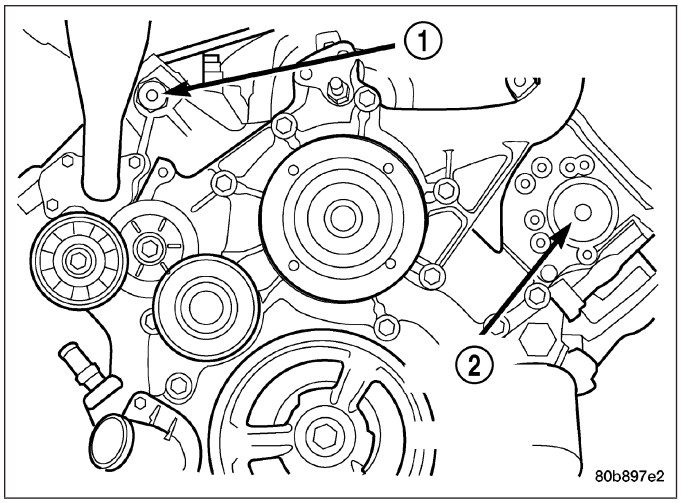
REMOVAL

1. Disconnect negative cable from battery.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Remove right and left cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
4. Remove radiator fan shroud.
5. Rotate engine until timing mark (2) on crankshaft damper aligns with TDC mark on timing chain cover (2) (#1 cylinder exhaust stroke) and the camshaft sprocket “V8” marks are at the 12 o’clock position (1,2).





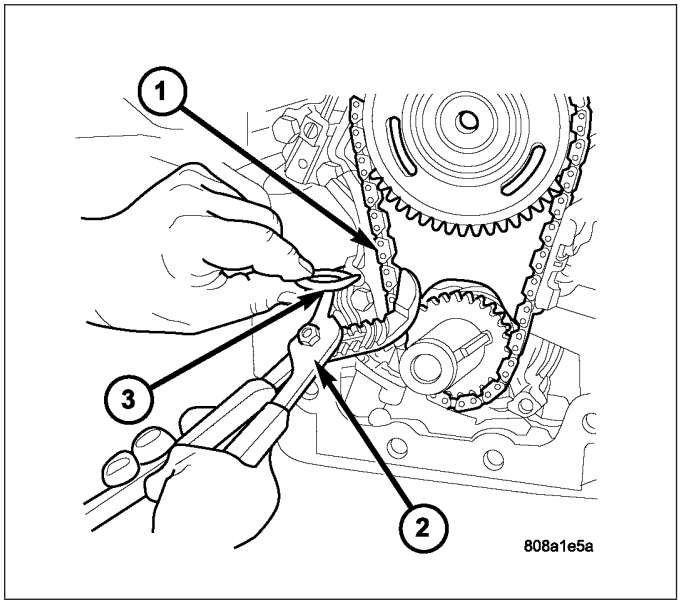
6. Remove power steering pump (Refer to 19 - STEERING/PUMP - REMOVAL).
7. Remove access plugs (1,2) from left and right cylinder heads for access to chain guide fasteners.
8. Remove the oil fill housing to gain access to the right side tensioner arm fastener.
9. Remove crankshaft damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - REMOVAL) and timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).



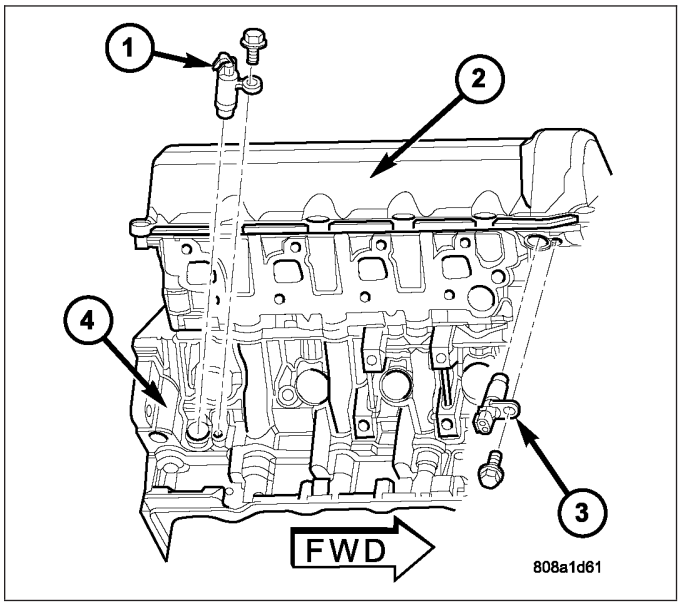
10. Collapse and pin primary chain tensioner (1).

CAUTION: Plate behind left secondary chain tensioner could fall into oil pan. Therefore, cover pan opening.

11. Remove secondary chain tensioners.



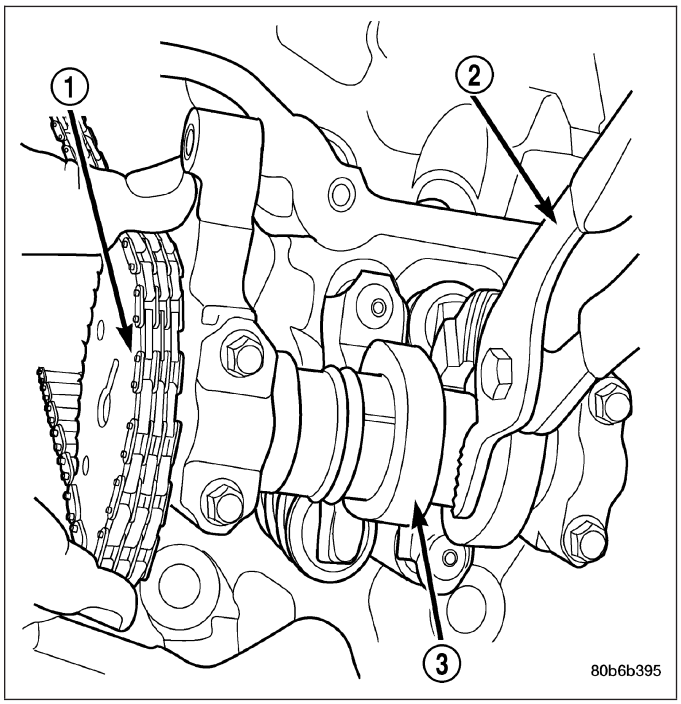
12. Remove camshaft position sensor (1) from right cylinder head.

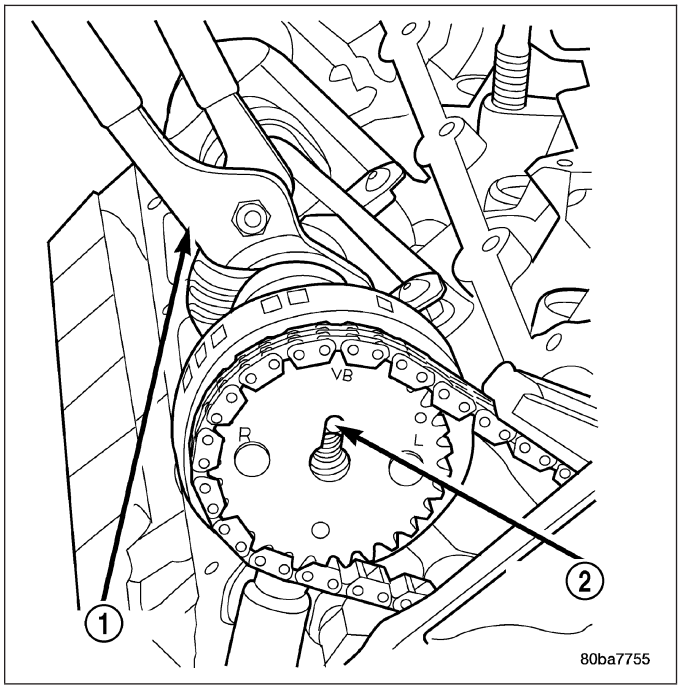


CAUTION: Care should be taken not to damage camshaft target wheel. Do not hold target wheel while loosening or tightening camshaft sprocket. Do not place the target wheel near a magnetic source of any kind. A damaged or magnetized target wheel could cause a vehicle no start condition.

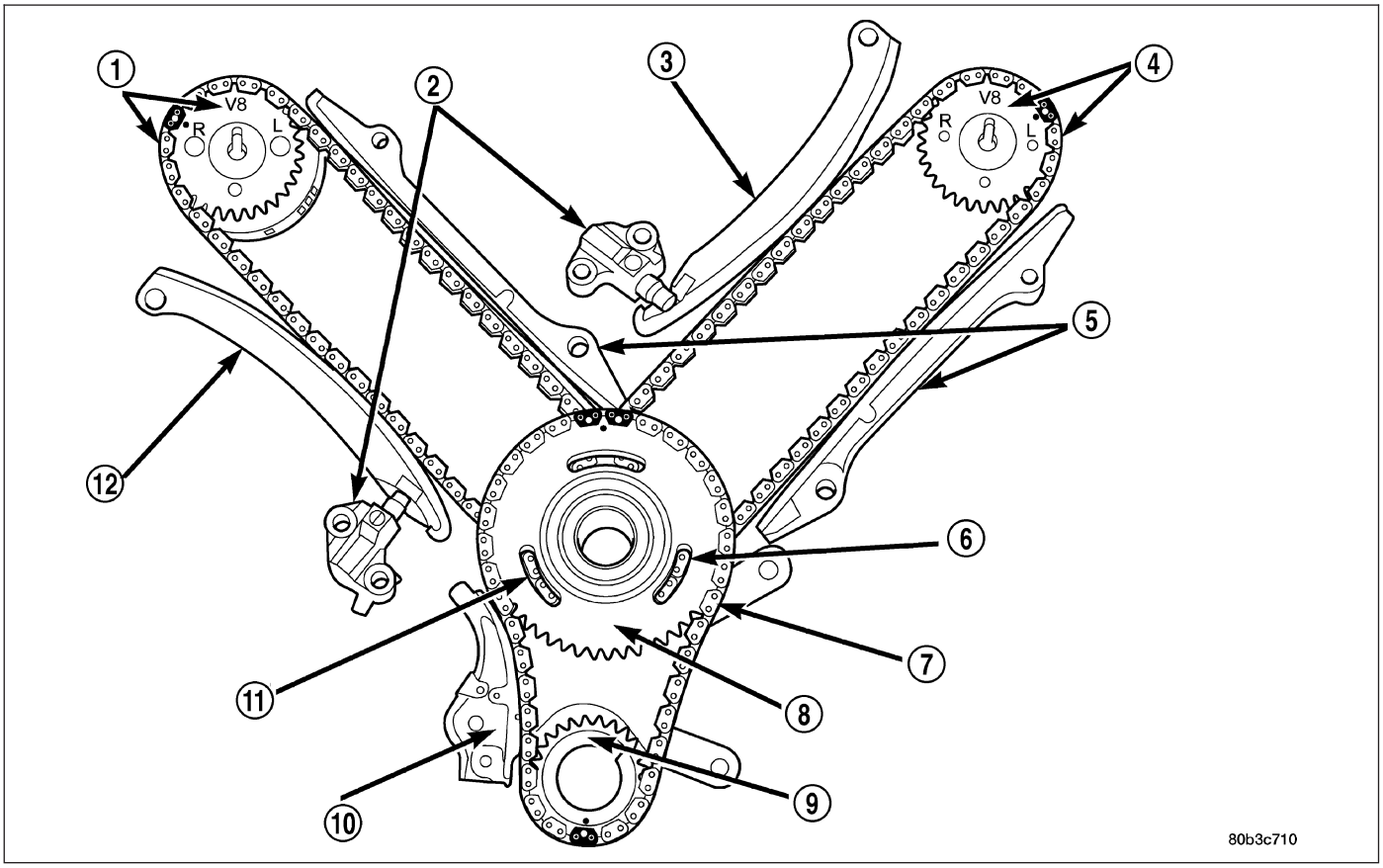
CAUTION: Do not forcefully rotate the camshafts or crankshaft independently of each other. Damaging intake valve to piston contact will occur. Ensure negative battery cable is disconnected to guard against accidental starter engagement.

13. Remove left and right camshaft sprocket bolts.
14. While holding the left camshaft steel tube with adjustable pliers (1), remove the left camshaft sprocket. Slowly rotate the camshaft approximately 15 degrees clockwise to a neutral position.
15. While holding the right camshaft steel tube with adjustable pliers (1), remove the right camshaft sprocket. Slowly rotate the camshaft approximately 45 degrees counterclockwise to a neutral position.
16. Remove idler sprocket assembly bolt.
17. Slide the idler sprocket assembly and crank sprocket forward simultaneously to remove the primary and secondary chains.
18. Remove both pivoting tensioner arms and chain guides.
19. Remove chain tensioner.





INSPECTION

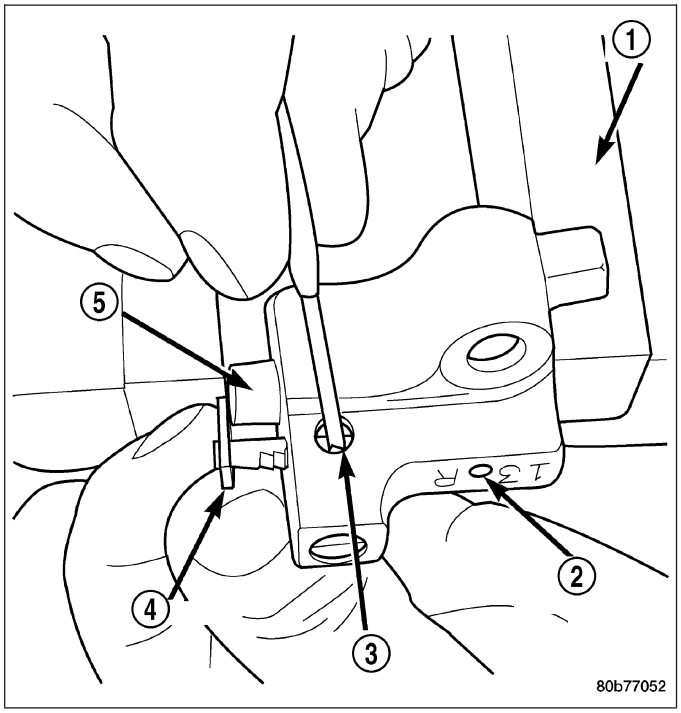


Inspect the following components:

- Sprockets for excessive tooth wear. Some tooth markings are normal and not a cause for sprocket replacement.
- Idler sprocket assembly bushing and shaft for excessive wear.
- Idler sprocket assembly spline joint. The joint should be tight with no backlash or axial movement.
- Chain guides and tensioner arms. Replace these parts if grooving in plastic face is more than 1 mm (0.039 in.) deep. If plastic face is severely grooved or melted, the tensioner lube jet may be clogged. The tensioner should be replaced.
- Secondary chain tensioner piston and ratcheting device. Inspect for evidence of heavy contact between tensioner piston and tensioner arm. If this condition exist the tensioner and tensioner arm should be replaced.
- Primary chain tensioner plastic faces. Replace as required.

INSTALLATION

1. Using a vise, lightly compress the secondary chain tensioner piston until the piston step is flush with the tensioner body. Using a pin or suitable tool, release ratchet pawl by pulling pawl back against spring force through access hole on side of tensioner. While continuing to hold pawl back, Push ratchet device to approximately 2 mm from the tensioner body. Install Special Tool 8514 lock pin (3) into hole on front of tensioner (2). Slowly open vise to transfer piston spring force to lock pin.



2. Position primary chain tensioner over oil pump and insert bolts into lower two holes on tensioner bracket. Tighten bolts to 28 N·m (250 in. lbs.).

CAUTION: Overtightening the tensioner arm torx® bolt can cause severe damage to the cylinder head. Tighten torx® bolt to specified torque only.

3. Install right side chain tensioner arm. Apply Mopar® Lock N, Seal to torx® bolt, tighten bolt to 17 N·m (150 in. lbs.).

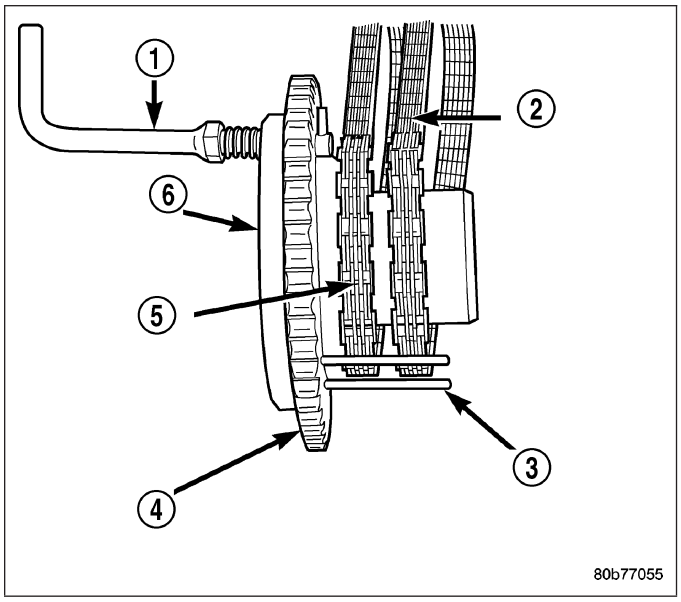
NOTE: The silver bolts retain the guides to the cylinder heads and the black bolts retain the guides to the engine block.

4. Install the left side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).

CAUTION: Overtightening the tensioner arm torx® bolt can cause severe damage to the cylinder head. Tighten torx® bolt to specified torque only.

5. Install left side chain tensioner arm. Apply Mopar® Lock N, Seal to torx® bolt, tighten bolt to 17 N·m (150 in. lbs.).
6. Install the right side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).

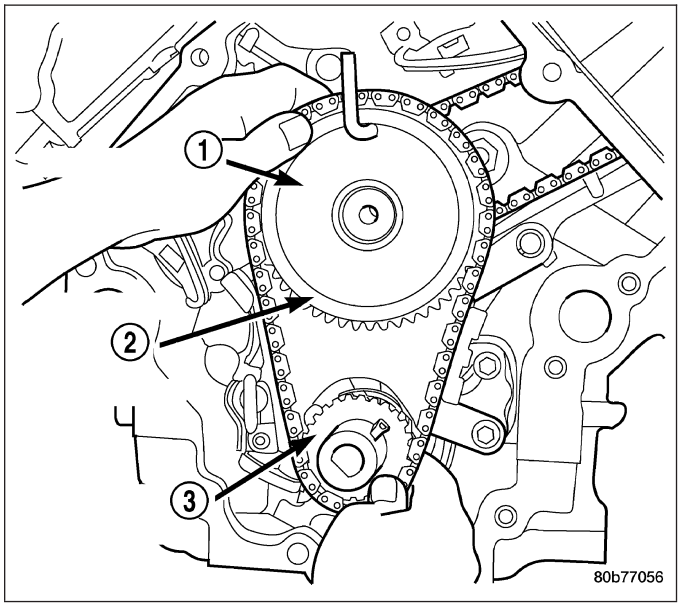
7. Install both secondary chains onto the idler sprocket. Align two plated links on the secondary chains to be visible through the two lower openings on the idler sprocket (4 o'clock and 8 o'clock). Once the secondary timing chains are installed, position special tool 8515 (6) to hold chains in place for installation.
8. Align primary chain double plated links with the timing mark at 12 o'clock (1) on the idler sprocket. Align the primary chain single plated link with the timing mark at 6 o'clock on the crankshaft sprocket (3).



9. Lubricate idler shaft and bushings with clean engine oil.
10. Install all chains, crankshaft sprocket, and idler sprocket as an assembly. After guiding both secondary chains through the block and cylinder head openings, affix chains with a elastic strap or the equivalent, This will maintain tension on chains to aid in installation.

NOTE: It will be necessary to slightly rotate camshafts for sprocket installation.

11. Align left camshaft sprocket "L" dot to plated link on chain.
12. Align right camshaft sprocket "R" dot to plated link on chain.



CAUTION: Remove excess oil from the camshaft sprocket bolt. Failure to do so can result in over-torque of bolt resulting in bolt failure.

13. Remove Special Tool 8515, then attach both sprockets to camshafts. Remove excess oil from bolts, then Install sprocket bolts, but do not tighten at this time.
14. Verify that all plated links are aligned with the marks on all sprockets and the "V8" marks on camshaft sprockets are at the 12 o'clock position.

CAUTION: Ensure the plate between the left secondary chain tensioner and block is correctly installed.

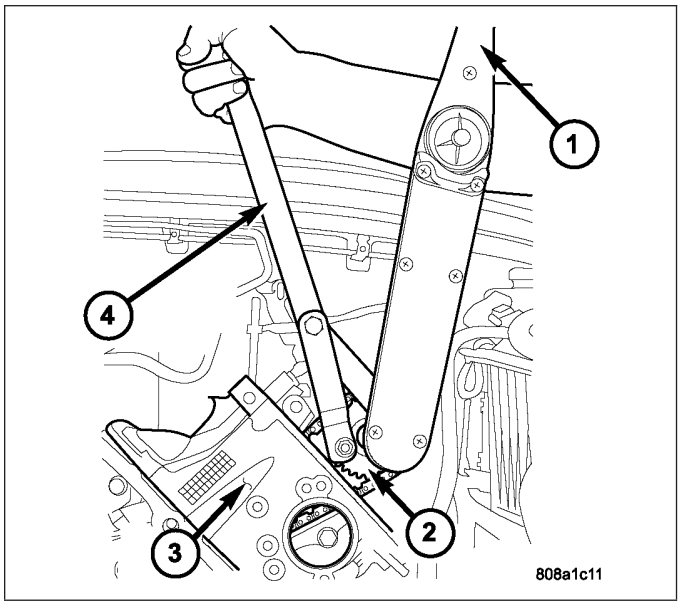
15. Install both secondary chain tensioners. Tighten bolts to 28 N·m (250 in. lbs.).

NOTE: Left and right secondary chain tensioners are not common.

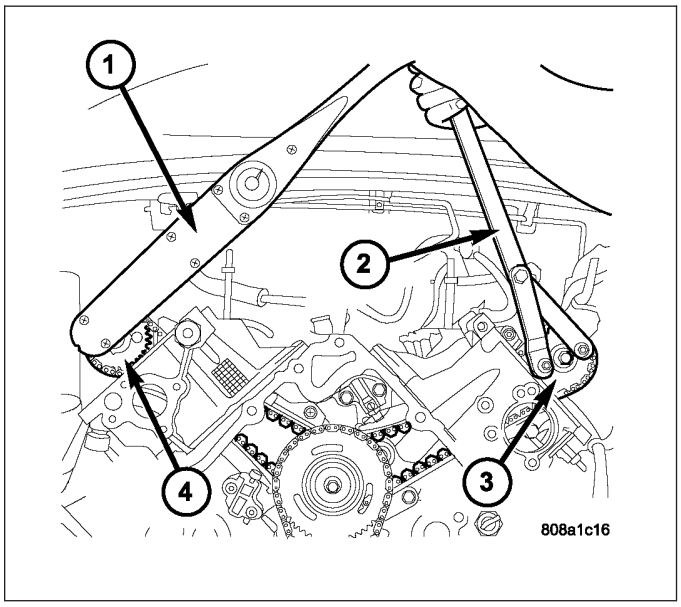
16. Before installing idler sprocket bolt, lubricate washer with oil, and tighten idler sprocket assembly retaining bolt to 34 N·m (25 ft. lbs.).
17. Remove all locking pins (3) from tensioners.

CAUTION: After pulling locking pins out of each tensioner, DO NOT manually extend the tensioner(s) ratchet. Doing so will over tension the chains, resulting in noise and/or high timing chain loads.

18. Using Special Tool 6958, Spanner with Adaptor Pins 8346, tighten left (3) and right (4), camshaft sprocket bolts to 122 N·m (90 ft. lbs.).
19. Rotate engine two full revolutions. Verify timing marks are at the follow locations:
    - primary chain idler sprocket dot is at 12 o'clock
    - primary chain crankshaft sprocket dot is at 6 o'clock
    - secondary chain camshaft sprockets "V8" marks are at 12 o'clock
20. Lubricate all three chains with engine oil.



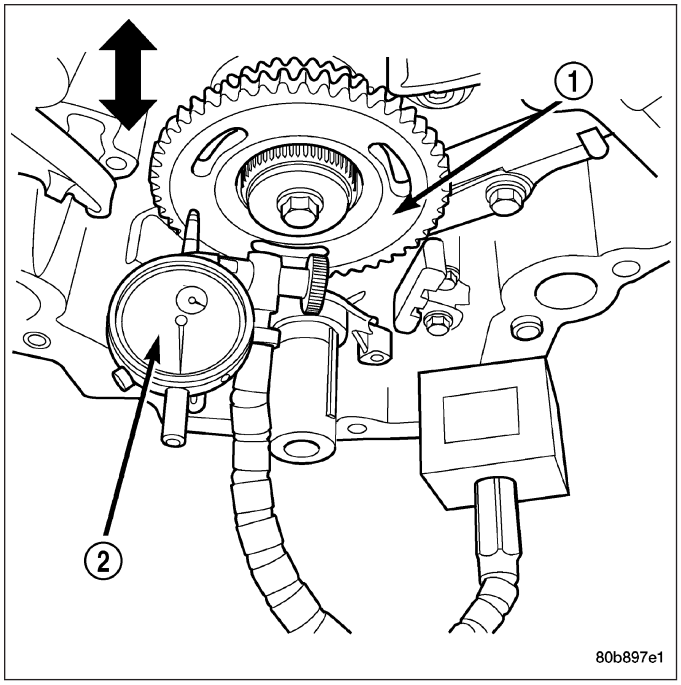
21. After installing all chains, it is recommended that the idler gear (1) end play be checked. The end play must be within 0.10–0.25 mm (0.004–0.010 in.). If not within specification, the idler gear must be replaced.



22. Install timing chain cover (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION) and crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
23. Install cylinder head covers (Refer to 9 - ENGINE/ CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

NOTE: Before installing threaded plug in right cylinder head, the plug must be coated with sealant to prevent leaks.

24. Coat the large threaded access plug with **Mopar® Thread Sealant with Teflon**, then install into the right cylinder head and tighten to 81 N·m (60 ft. lbs.).
25. Install the oil fill housing.
26. Install access plug in left cylinder head.



27. Install power steering pump (Refer to 19 - STEERING/PUMP - INSTALLATION).
28. Install radiator fan shroud.
29. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
30. Connect negative cable to battery.

SHAFT-IDLER

REMOVAL

1. Remove the primary and secondary timing chains and sprockets (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL) .

NOTE: To remove the idler shaft, it is necessary to tap threads into the shaft, to install the removal tool.

2. Using a 12 mm X 1.75 tap, cut threads in the idler shaft center bore.
3. Cover the radiator core with a suitable cover.

CAUTION: Use care when removing the idler shaft, Do not strike the radiator cooling fins with the slide hammer.

4. Using Special Tool 8517 Slide Hammer, remove the idler shaft.

INSTALLATION

1. Thoroughly clean the idler shaft bore.
2. Position the idler shaft in the bore.

NOTE: The two lubrication holes in the idler shaft do not require any special alignment.

NOTE: Before using the retaining bolt to install the idler shaft, coat the threads and the pilot on the idler shaft, with clean engine oil.

3. Using the primary idler sprocket retaining bolt and washer, carefully draw the idler shaft into the bore until fully seated.
4. Coat the idler shaft with clean engine oil.
5. Install the timing chains and sprockets (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION) .

EXHAUST SYSTEM

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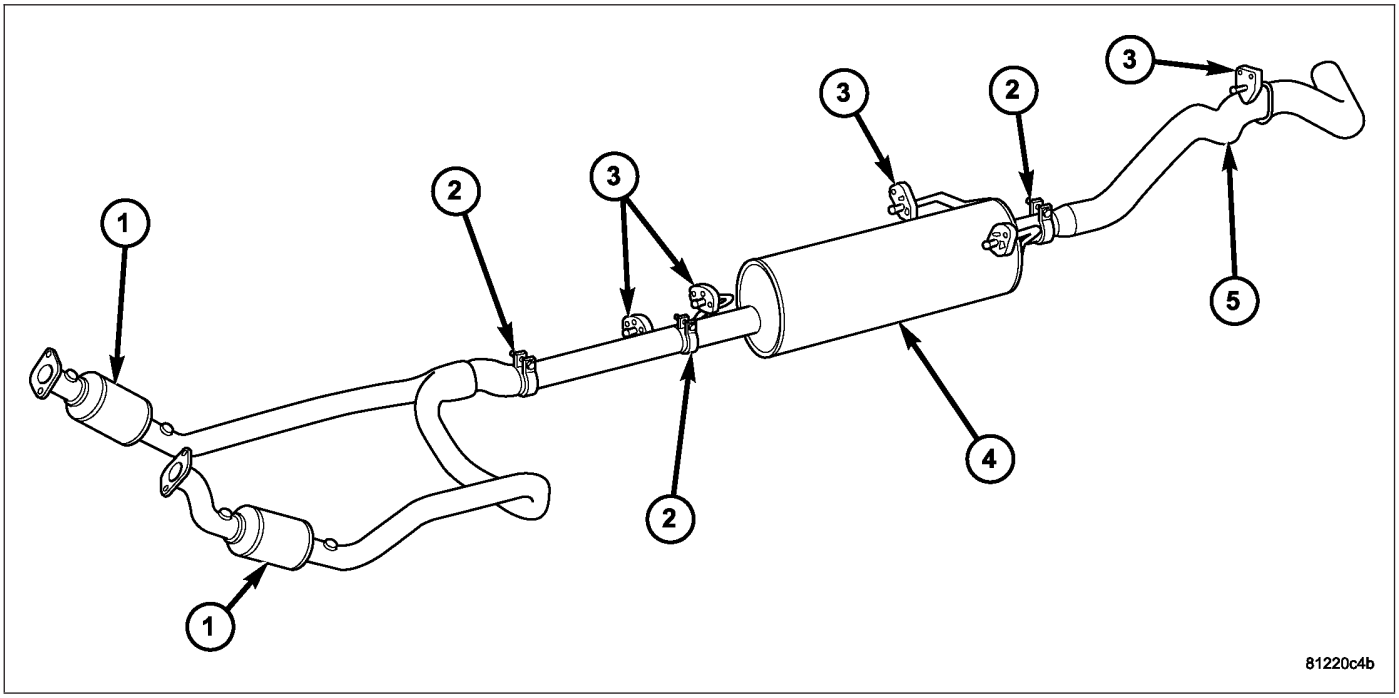
EXHAUST SYSTEM

DESCRIPTION



Exhaust System - 3.7L Engine - Typical

CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan exhaust heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.

The gasoline engine exhaust system consists of engine exhaust manifolds, exhaust pipes , catalytic converter(s) (1), extension pipe (if needed), exhaust heat shields, muffler (4) and exhaust tailpipe (5).

The exhaust system must be properly aligned to prevent stress, leakage and body contact. Minimum clearance between any exhaust component and the body or frame is 25.4 mm (1.0 in.). If the system contacts any body panel, it may amplify objectionable noises from the engine or body.

OPERATION

The exhaust system channels exhaust gases from the engine and away from the vehicle.

DIAGNOSIS AND TESTING

EXHAUST SYSTEM

EXHAUST SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE EXHAUST NOISE	1. Leaks at pipe joints.	1. Tighten clamps to specified torque at leaking joints (Refer to 11 - EXHAUST SYSTEM - SPECIFICATIONS).
	2. Burned or blown out muffler.	2. Replace muffler assembly (Refer to 11 - EXHAUST SYSTEM/ MUFFLER - REMOVAL). Check exhaust system.
	3. Burned or rusted-out exhaust pipe.	3. Replace exhaust pipe (Refer to 11 - EXHAUST SYSTEM/EXHAUST PIPE - REMOVAL).
	4. Exhaust pipe leaking at manifold flange.	4. Tighten connection attaching nuts (Refer to 11 - EXHAUST SYSTEM - SPECIFICATIONS).
	5. Exhaust manifold cracked or broken.	5. Replace exhaust manifold (Refer to 9 - ENGINE/MANIFOLDS/ EXHAUST MANIFOLD - REMOVAL).
	6. Leak between exhaust manifold and cylinder head.	6. Tighten exhaust manifold to cylinder head stud nuts or bolts (Refer to 9 - ENGINE - SPECIFICATIONS).
	7. Restriction in muffler or tailpipe.	7. Remove restriction, if possible. Replace muffler or tailpipe, as necessary.
	8. Exhaust system contacting body or chassis.	8. Re-align exhaust system to clear surrounding components.
LEAKING EXHAUST GASES	1. Leaks at pipe joints.	1. Tighten/replace clamps at leaking joints (Refer to 11 - EXHAUST SYSTEM - SPECIFICATIONS).

SPECIFICATIONS

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Exhaust Clamp Nuts (All)	61	45	-
Exhaust Pipe to Manifold Nuts	34	25	-
Heat Shield Nuts	7	-	60
Muffler Hanger Bolts	23	-	200
Tailpipe Hanger Bolt	23	-	200

CONVERTER-CATALYTIC

DESCRIPTION

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.

The exhaust system uses a single muffler with a welded tailpipe.

The 50 State Emissions vehicles use two mini catalytic converters inline with the exhaust pipe below the exhaust manifolds.

The exhaust manifolds are equipped with ball flange outlets to assure a tight seal and strain free connections.

The exhaust system must be properly aligned to prevent stress, leakage and body contact. If the system contacts any body panel, it may amplify objectionable noises originating from the engine or body.

When inspecting an exhaust system, critically inspect for cracked or loose joints, stripped screw or bolt threads, corrosion damage and worn, cracked or broken hangers. Replace all components that are badly corroded or damaged. DO NOT attempt to repair.

When replacement is required, use original equipment parts (or their equivalent). This will assure proper alignment and provide acceptable exhaust noise levels.

The basic exhaust system consists of exhaust manifold(s), exhaust pipe with oxygen sensors, catalytic converter(s), heat shield(s), muffler and tailpipe.

OPERATION

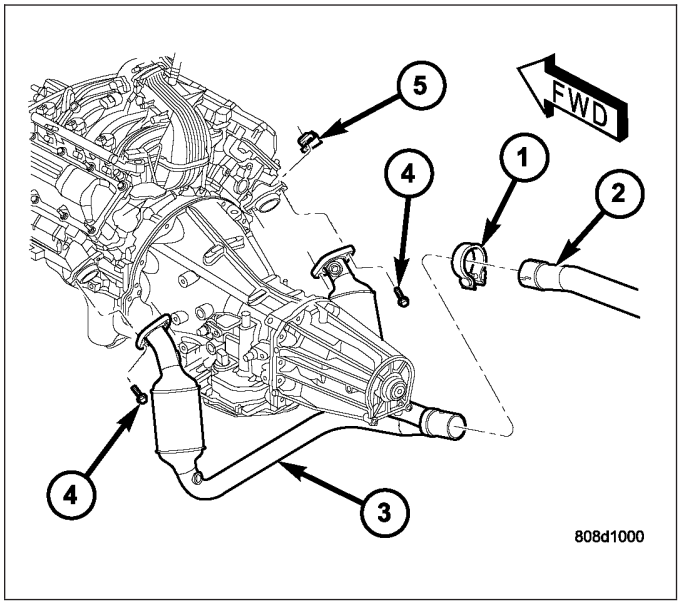
The catalytic converter captures and burns any unburned fuel mixture exiting the combustion chambers during the exhaust stroke of the engine. This process aids in reducing emissions output.

REMOVAL

3.7L/4.7L ENGINE

CAUTION: When servicing or replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor.

1. Raise and support the vehicle.
2. Saturate all exhaust bolts and nuts with Mopar® Rust Penetrant. Allow 5 minutes for penetration.
3. Disconnect the oxygen senor electrical connectors.
4. Remove the catalytic converter-to-manifold bolts (5).
5. Remove the catalytic converter to the exhaust pipe clamp (1).
6. If present, grind tack weld.
7. Remove the catalytic converter. You may have to loosen up other sections of the exhaust system.



INSPECTION

Look at the stainless steel body of the converter, inspect for bulging or other distortion that could be a result of overheating. If the converter has a heat shield attached make sure it is not bent or loose.

If you suspect internal damage to the catalyst, tapping the bottom of the catalyst with a rubber mallet may indicate a damaged core.

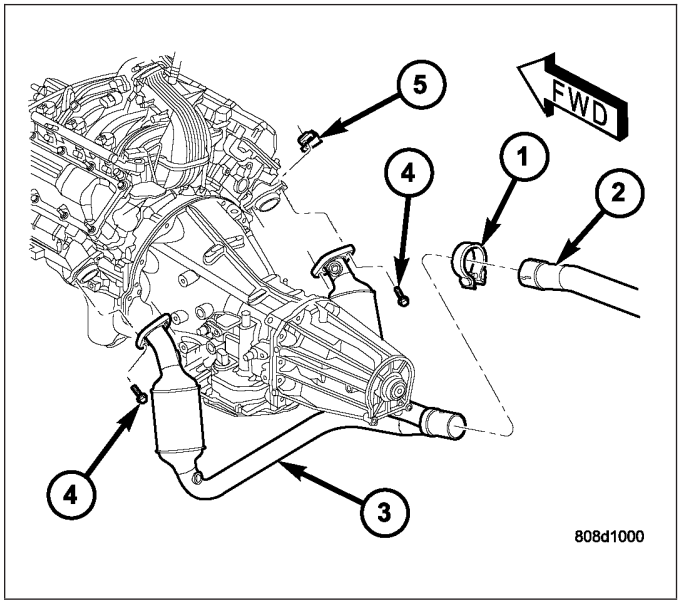
INSTALLATION

3.7L/4.7L ENGINE

CAUTION: When servicing or replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor.

NOTE: The band clamps are not reusable. After removal, they must be replaced with new one.

1. Make sure the catalytic converter pipe is free of burrs.
2. Insert the catalytic converter into the exhaust pipe.
3. Make sure the alignment tang is fully seated in the alignment slot.
4. If other sections of the exhaust system where loosened in removal, refer to that information for the tightening procedures.
5. At the catalytic converter-to-extension pipe connection, install new clamp and nuts. Tighten the clamp nuts to 61 N·m (45 ft. lbs.) torque.
6. Lower the vehicle.
7. Start the engine, inspect for exhaust leaks. Repair exhaust leaks as necessary.

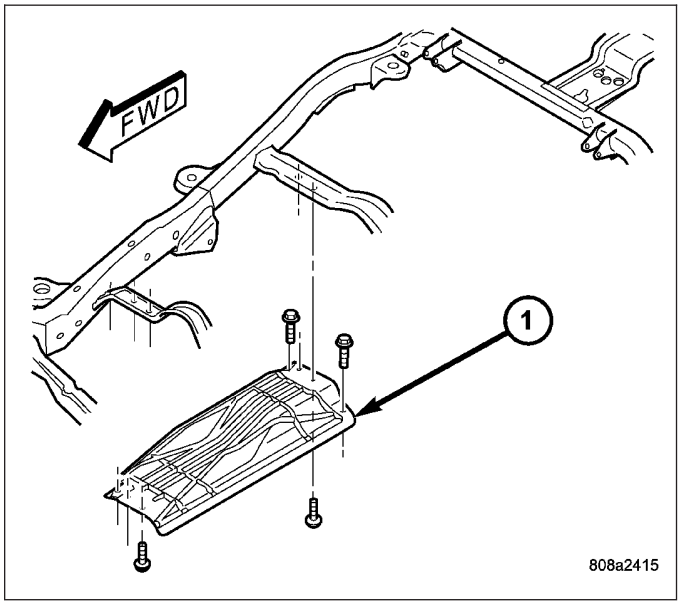


8. Check the exhaust system for contact with the body panels. Make the necessary adjustments, if necessary.

SHIELDS-HEAT

DESCRIPTION

There are two types of heat shields (1) used. One is stamped steel the other is molded foil sheets. The shields attach to the vehicle around the exhaust system.

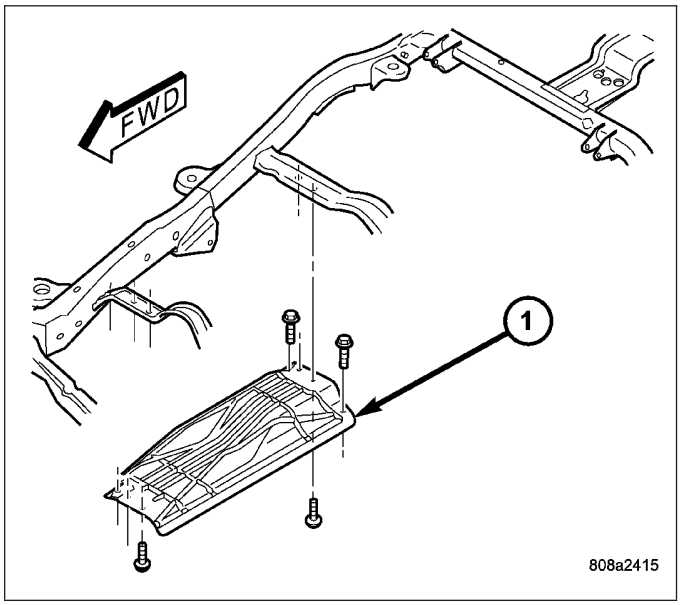


OPERATION

The heat shields prevent heat from the exhaust system from entering the passenger area and other areas where the heat can cause damage to other components.

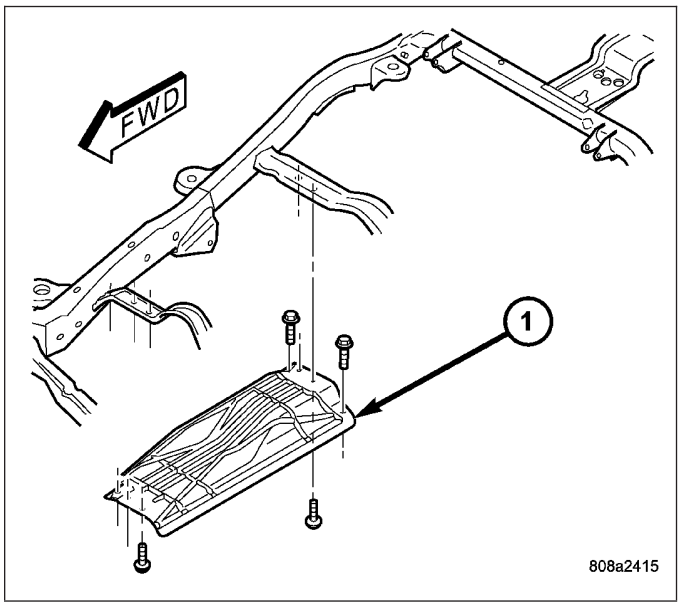
REMOVAL

1. Raise and support the vehicle.
2. Remove the screws and nuts holding the heat shields (1) to the frame and floor pan. **Be sure to disconnect both oxygen sensor connectors.**
3. Slide the heat shield (1) out around the exhaust system.



INSTALLATION

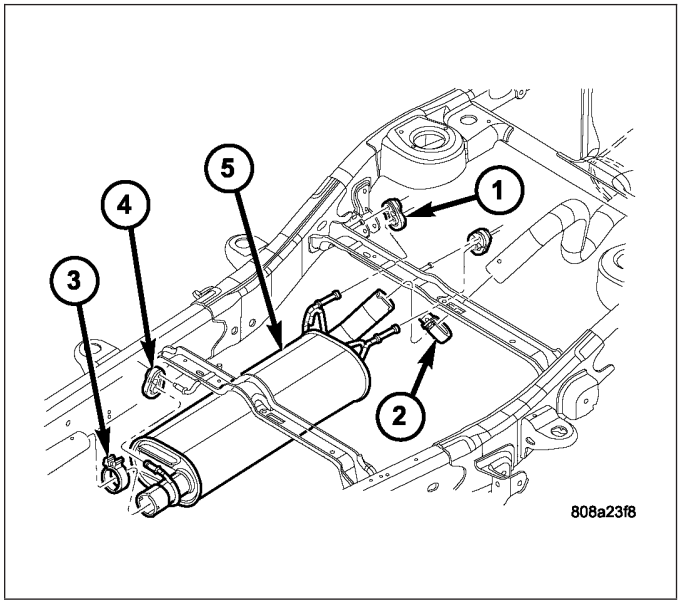
1. Position the heat shields (1) to the floor pan or the frame and install the screws and nuts.
2. Tighten the screws/nuts to 7 N·m (60 in. lbs.) torque. Tighten the muffler hangers (2) to 23 N·m (200 in. lbs.)
3. Lower the vehicle.



MUFFLER

DESCRIPTION

All engines use a stainless steel muffler (1) to control exhaust noise levels and exhaust back pressure.

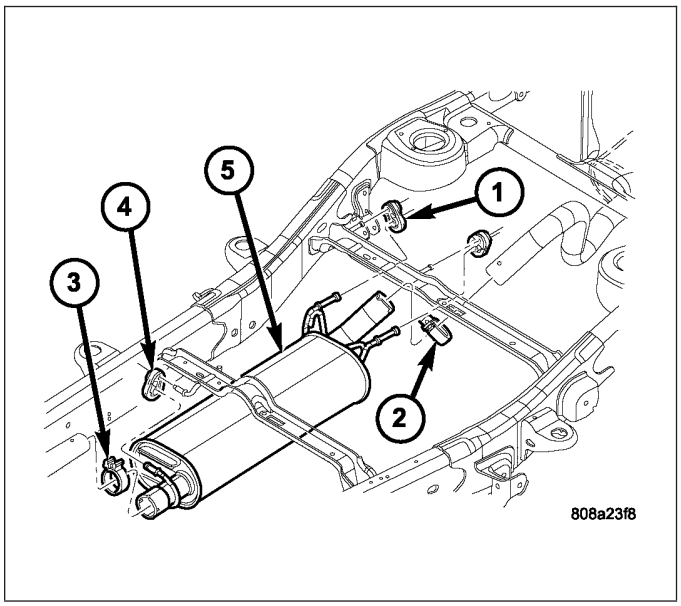


OPERATION

The muffler is designed to muffle the sound of the exhaust as it leaves the engine.

REMOVAL

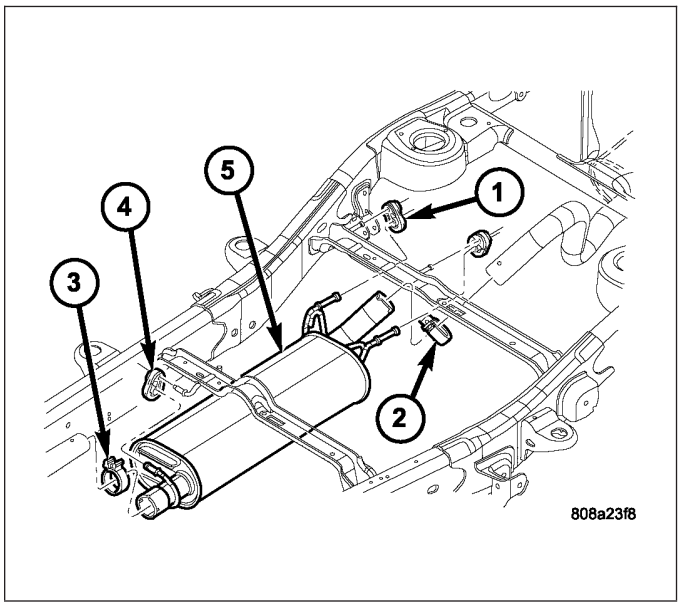
1. Raise vehicle on hoist.
2. Remove the exhaust pipe (Refer to 11 - EXHAUST SYSTEM/EXHAUST PIPE - REMOVAL).
3. Remove the muffler-to-catalytic converter clamp (3).
4. Remove the muffler isolators (1 and 4).
5. Remove the muffler (5) from the catalytic converter.



INSTALLATION

NOTE: The band clamps are not reusable. After removal, they must be replaced.

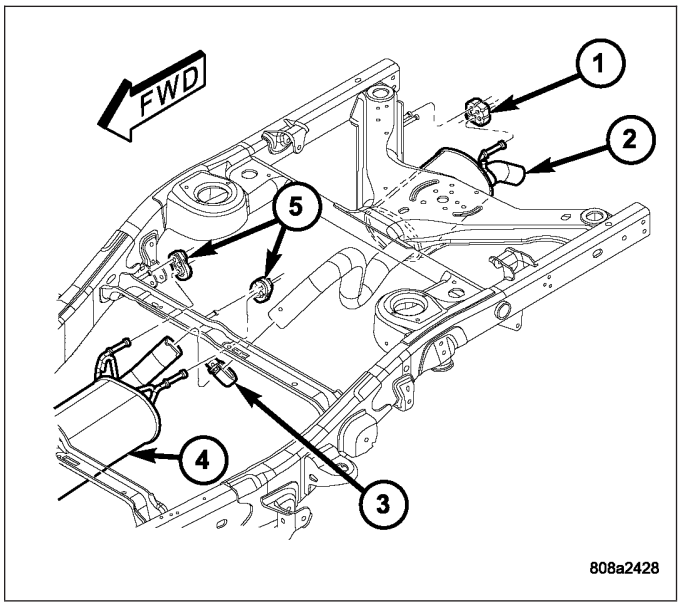
1. Install muffler to the catalytic converter (1).
2. Make sure the alignment tang seats in the alignment slot.
3. Install new exhaust clamp (4). Do not tighten at this time.
4. Install muffler isolators.
5. Install exhaust pipe (Refer to 11 - EXHAUST SYSTEM/EXHAUST PIPE - INSPECTION).
6. Align muffler and exhaust pipe. Tighten exhaust clamp nuts to 61 N·m (45 ft. lbs.).
7. Check the exhaust system for contact with the body panels. A minimum of 25.4 mm (1.0 in.) is required between the exhaust system components and body/frame parts. Make the necessary adjustments, if needed.
8. Lower vehicle.
9. Start engine and check for exhaust leaks. Repair exhaust leaks as necessary.



TAILPIPE

DESCRIPTION

The tailpipe is made of stainless steel and attaches to the muffler.



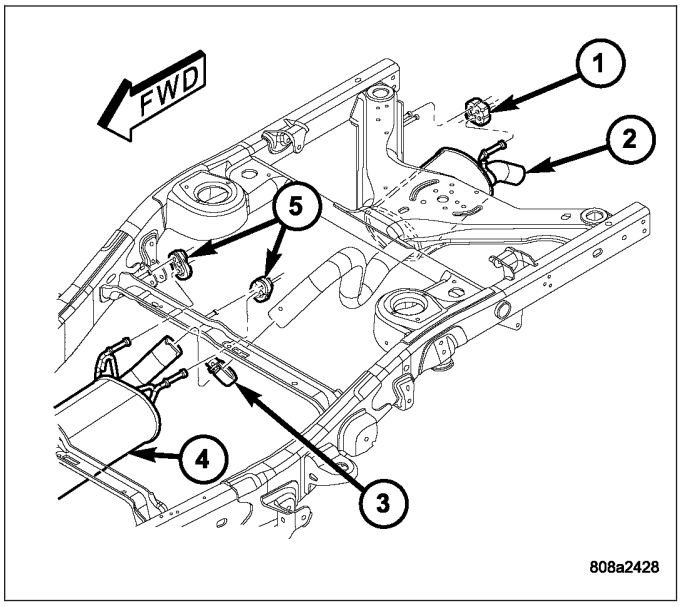
OPERATION

The tailpipe channels the exhaust out of the muffler and out from under the vehicle to control noise and prevent exhaust gas fumes from entering the passenger compartment.

REMOVAL

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, WEAR PROTECTIVE EYE COVERING AND DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

CAUTION: When servicing or replacing exhaust system components, be sure to disconnect all oxygen sensor connectors. Allowing the exhaust system to hang by the harness will damage the wiring and/or sensor.



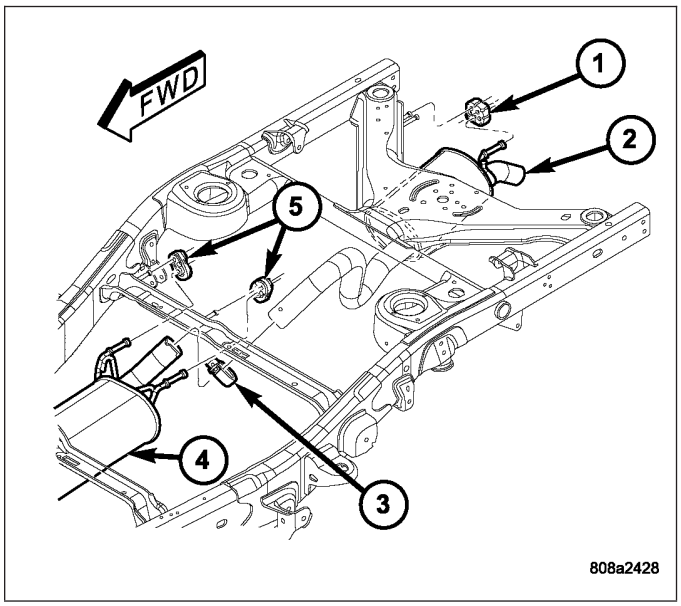
1. Raise and support the vehicle.
2. Saturate the bolts and nuts with Mopar® Rust Penetrant. Allow 5 minutes for penetration.
3. Remove the exhaust pipe-to-muffler clamp (3).
4. Grind any tack weld, if present.
5. Remove the exhaust pipe insulators (1).
6. Remove the rear muffler insulators (5) if necessary.
7. If necessary, heat connection with an oxygen/acetylene torch and twist tailpipe out of muffler.
8. Remove the exhaust pipe (2) from the muffler (4).

INSPECTION

Discard rusted clamps, broken or worn supports and attaching parts. Replace a component with original equipment parts, or equivalent. This will assure proper alignment with other parts in the system and provide acceptable exhaust noise levels.

INSTALLATION

NOTE: The band clamps are not reusable. After removal, they must be replaced.



1. Remove any burrs from the exhaust pipe (2).
2. Connect the exhaust pipe (2) to the muffler (4).
3. Make sure that the alignment tang is seated in the alignment slot.
4. Install the muffler-to-exhaust pipe clamp. Do not tighten at this time.
5. Install the rear muffler insulators (5), if removed.
6. Install the tail pipe insulators (1)
7. Check the exhaust system for contact with the body panels. Make the necessary adjustments, if necessary.
8. Tighten muffler-to-exhaust pipe clamp to 61 N·m (45 ft. lbs.).
9. Lower the vehicle.
10. Start the engine, inspect for exhaust leaks. Repair exhaust leaks as necessary.

FRAME & BUMPERS

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FRAME & BUMPERS

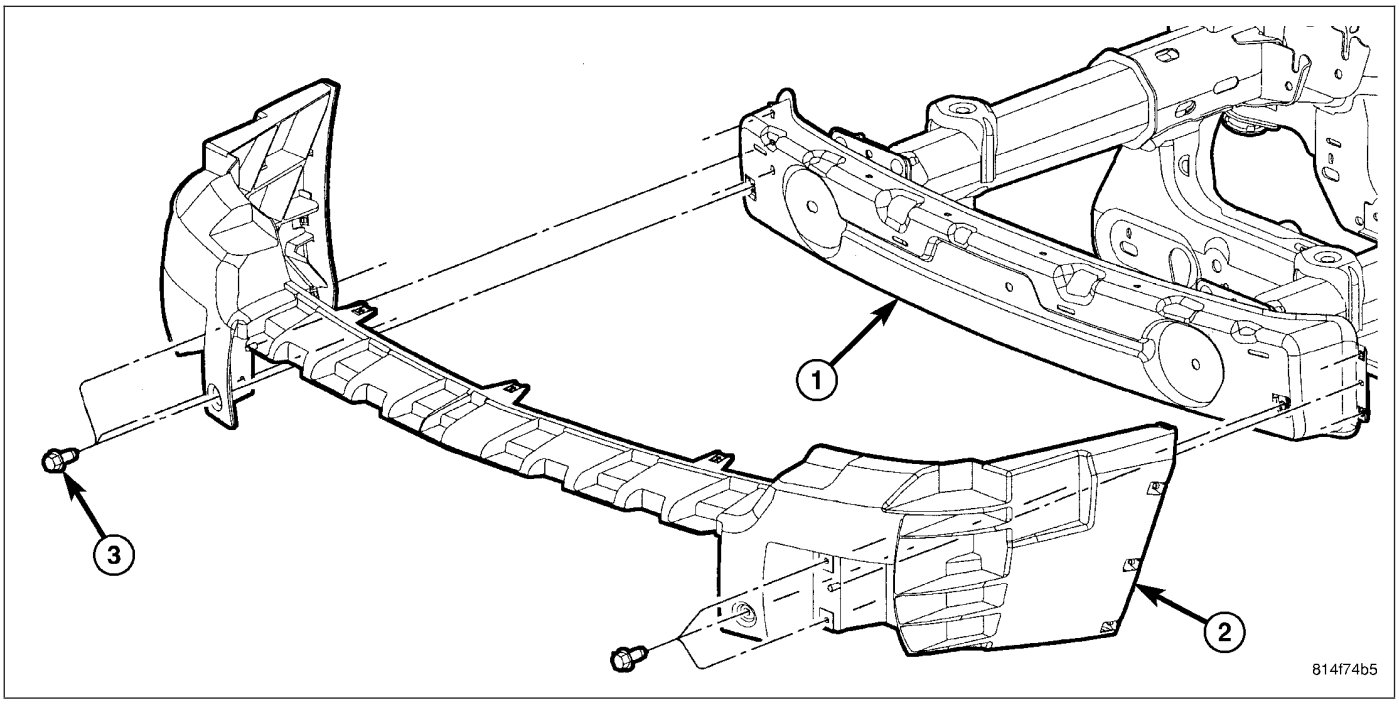
SPECIFICATIONS

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Crossmember bolts/nuts	102	75	—
Front end sheet metal mounting bolt - tow hook	75	55	—
Front fascia supprt nuts	95	70	—
Front tow hook bracket nuts	95	70	—
Rear bumper nuts	54	40	—
Trailer hitch bolts	170	125	—

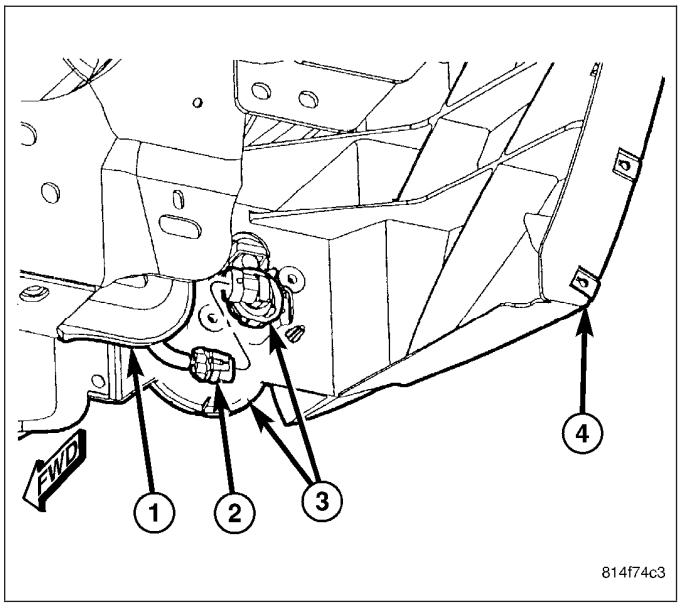
BRACKET-FASCIA SUPPORT

REMOVAL



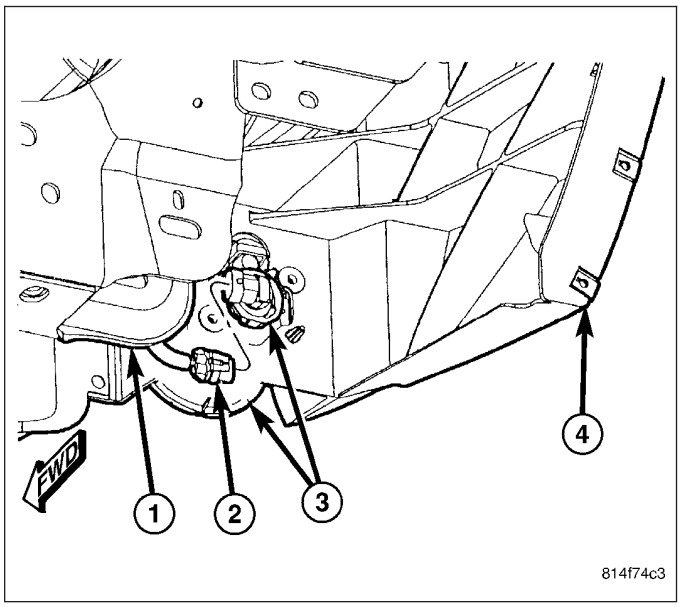
1. Remove the fascia. (Refer to 13 - FRAME & BUMPERS/BUMPERS/FASCIA-FRONT - REMOVAL)
2. Remove the three screws on the top of the bracket (2).
3. Remove the six screws (3) and separate the bracket (2) from the fascia support (1).

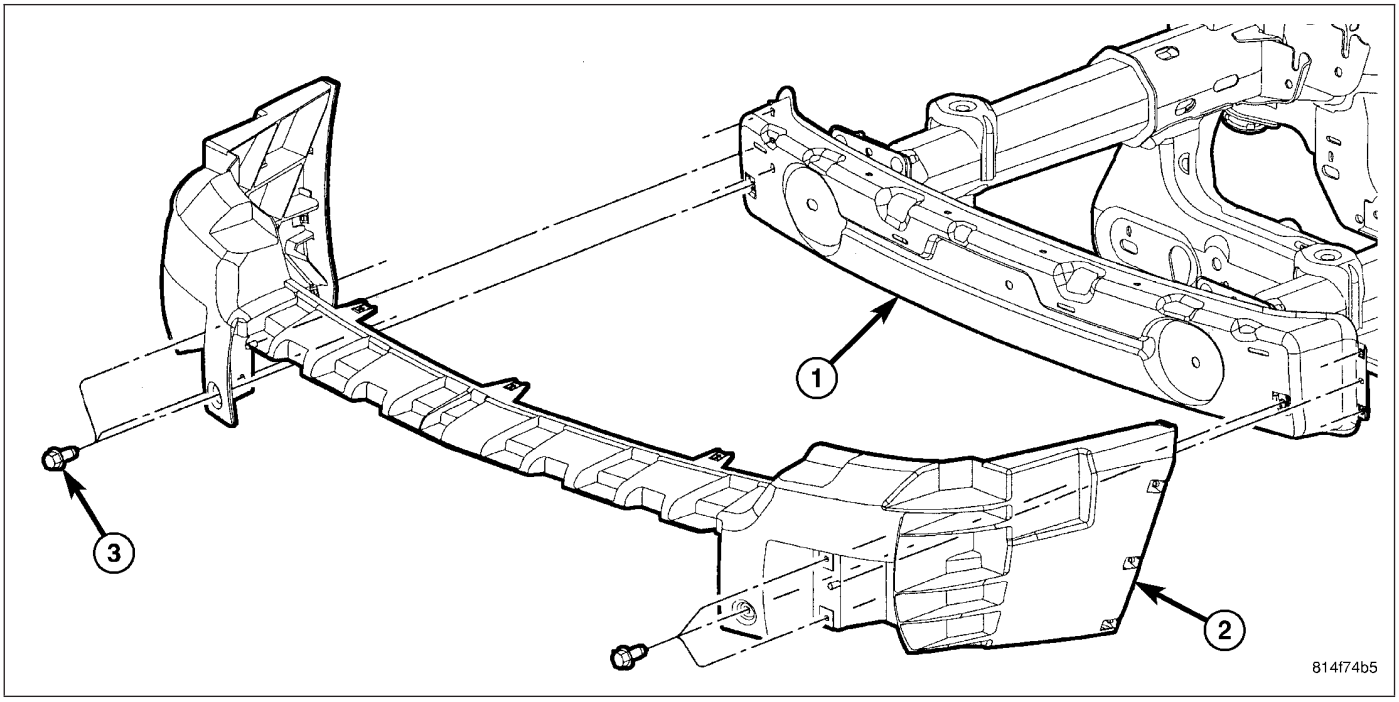
4. Disconnect the fog lamp electrical connector (2).
5. Remove the fog lamp (3) from the bracket (4).



INSTALLATION

1. Install the fog lamps (3) onto the bracket (4) and position the bracket onto the vehicle (1).
2. Connect the fog lamp electrical connector (2).

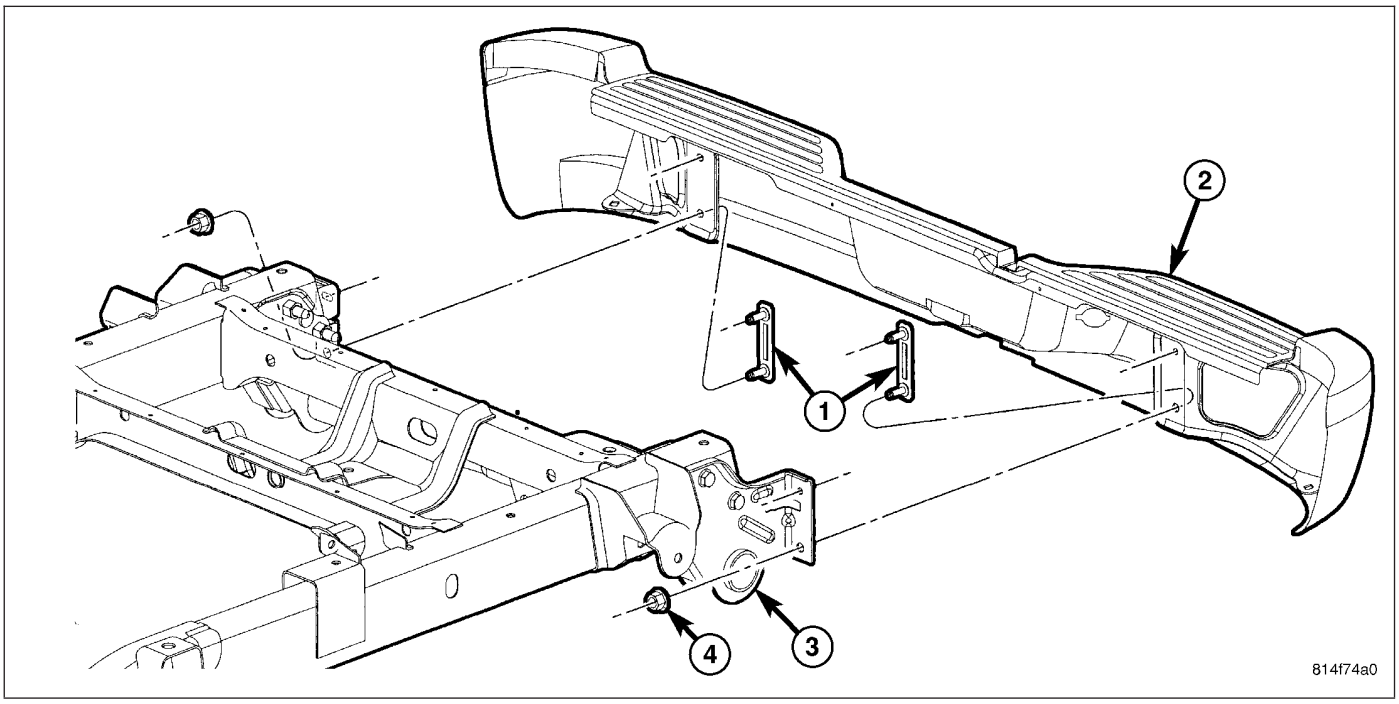




3. Install the three screws on the top of the bracket (2).
4. Install the three screws (3) on each side of the bracket (2).
5. Install the fascia. (Refer to 13 - FRAME & BUMPERS/BUMPERS/FASCIA-FRONT - INSTALLATION)

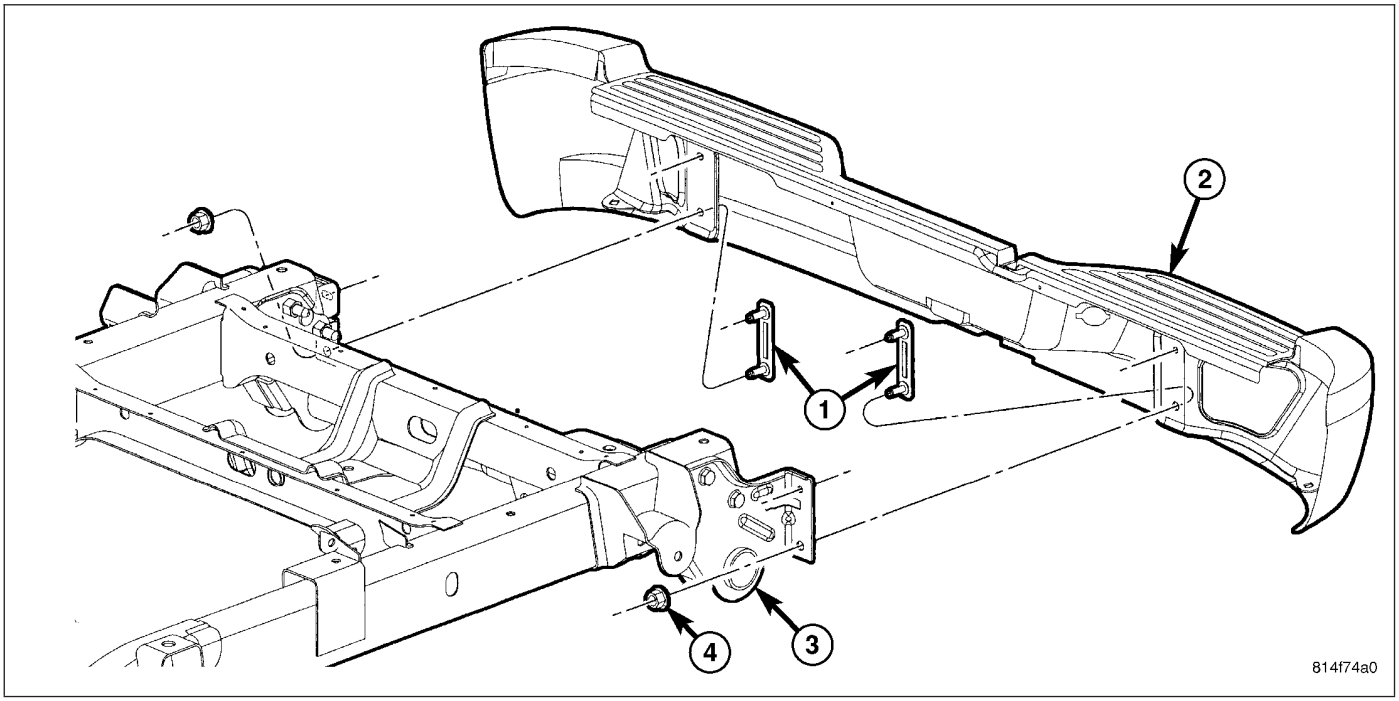
BUMPER-STEP

REMOVAL



1. Disconnect the license plate lamp electrical connectors and separate the wire harness from the bumper (2).
2. Support the bumper (2).
3. Remove the four nuts (4) attaching the bumper (2) to the hitch (3).
4. Remove the bumper.

INSTALLATION



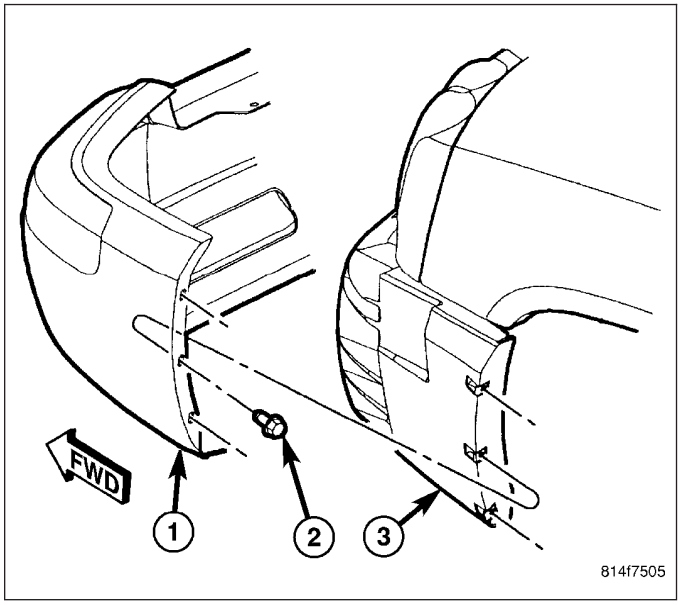
1. Verify that the stud plates (1) are in place and install the bumper (2) onto the trailer hitch (3) brackets.

2. Install the nuts (4) and adjust the bumper gap to specifications. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
3. Tighten the nuts to 54 N·m (40 ft. lbs.).
4. Position the license plate light wire harness back onto the bumper and connect the electrical connectors.

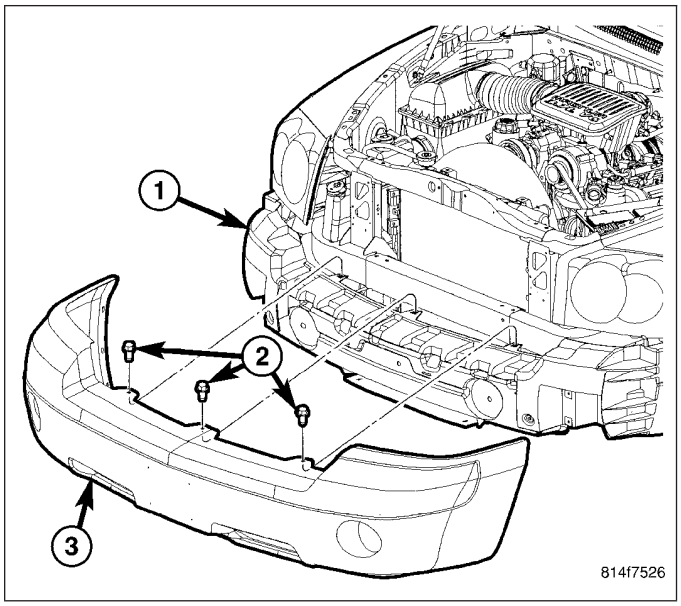
FASCIA-FRONT

REMOVAL

1. Remove the wheel well screws (2) on each side of the vehicle.

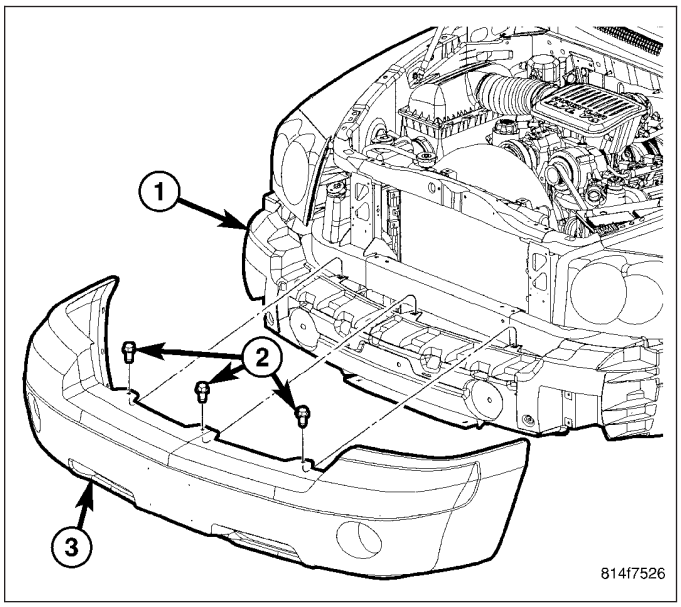


2. Remove the upper three screws (2).
3. Remove the two push pins on the lower edge and remove the fascia (3).

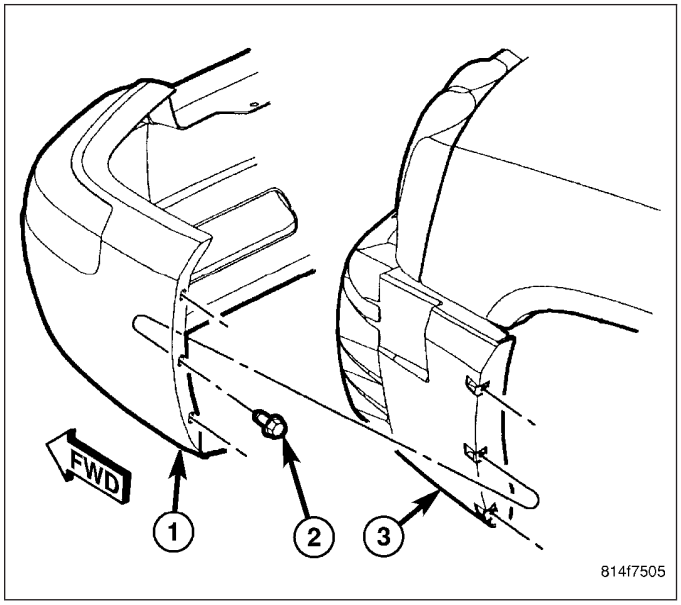


INSTALLATION

1. Position the fascia (3) onto the support bracket (1).
2. Install the three upper screws (2).
3. Install the two lower edge push pin fasteners.

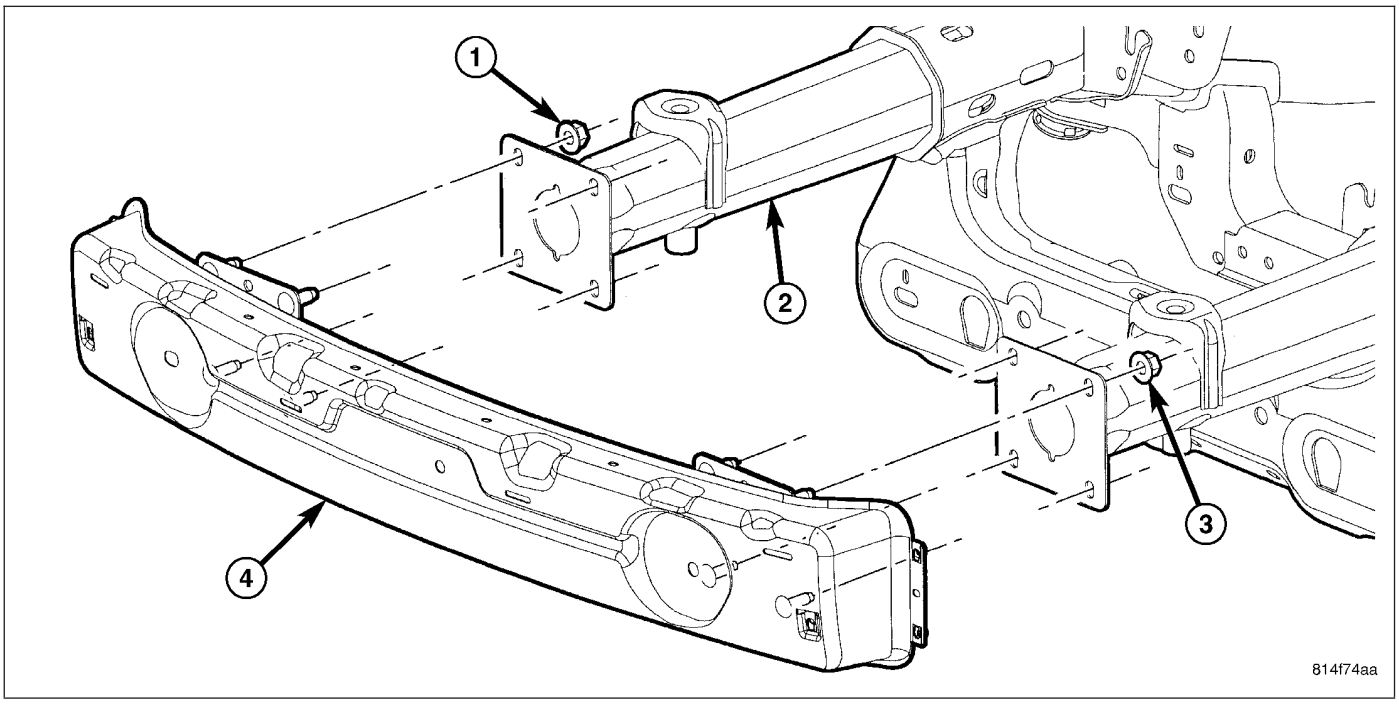


4. Install the three screws (2) at each wheel well.



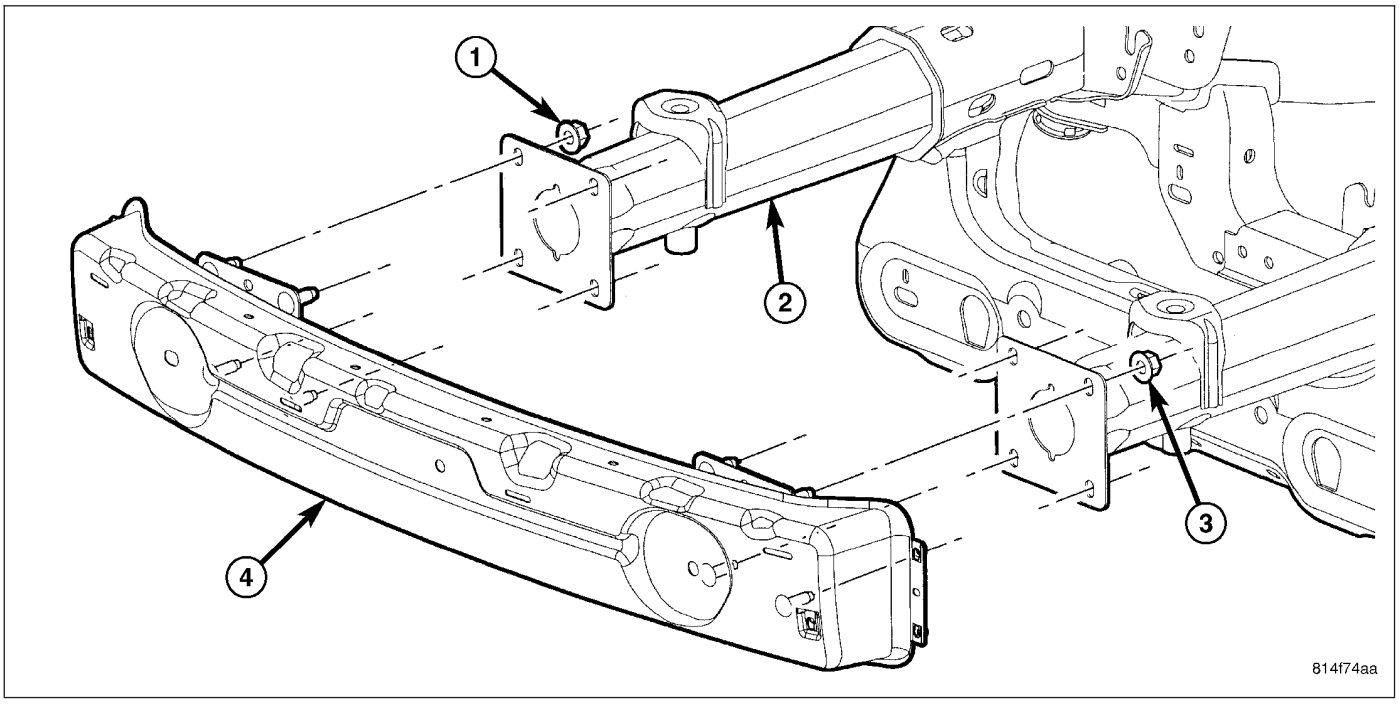
SUPPORT-FRONT FASCIA

REMOVAL



1. Remove the support bracket. (Refer to 13 - FRAME & BUMPERS/BUMPERS/BRACKET-FASCIA SUPPORT - REMOVAL)
2. Remove the four nuts (1 and 3) securing the fascia support (4) to the frame tips (2).
3. Remove the support (4).

INSTALLATION



1. Install the fascia support (4) and install the right (1) and left (3) nuts.
2. Tighten the nuts to 94 N·m (70 ft. lbs.).

3. Install the fascia support bracket. (Refer to 13 - FRAME & BUMPERS/BUMPERS/BRACKET-FASCIA SUPPORT - INSTALLATION)
4. Check front fascia gap and flush positioning. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. loosen the nuts (1 and 3) and adjust the front fascia to specifications.
6. Tighten the nuts to 94 N·m (70 ft. lbs.).

FRAME

WARNING

SAFETY PRECAUTIONS AND WARNINGS

WARNING: BEFORE PERFORMING ANY WELDING OPERATIONS DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE AND DISCONNECT ALL WIRE HARNESS CONNECTORS FROM THE AIRBAG CONTROL MODULE (ACM). FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND OTHER POSSIBLE DAMAGE TO THE SUPPLEMENTAL RESTRAINT SYSTEM CIRCUITS AND COMPONENTS.

- **USE EYE PROTECTION WHEN GRINDING OR WELDING METAL, SERIOUS EYE INJURY CAN RESULT.**
- **BEFORE PROCEEDING WITH FRAME REPAIR INVOLVING GRINDING OR WELDING, VERIFY THAT VEHICLE FUEL SYSTEM IS NOT LEAKING OR IN CONTACT WITH REPAIR AREA, PERSONAL INJURY CAN RESULT.**
- **DO NOT ALLOW OPEN FLAME OR HEAT AND METAL SPATTER FROM ARC WELDING, TO CONTACT PLASTIC BODY PANELS. FIRE OR EXPLOSION CAN RESULT.**
- **WHEN WELDED FRAME COMPONENTS ARE REPLACED, ENSURE COMPLETE PENETRATION WELD IS ACHIEVED DURING INSTALLATION. IF NOT, DANGEROUS OPERATING CONDITIONS CAN RESULT.**
- **STAND CLEAR OF CABLES OR CHAINS ON PULLING EQUIPMENT DURING FRAME STRAIGHTENING OPERATIONS, PERSONAL INJURY CAN RESULT.**
- **DO NOT VENTURE UNDER A HOISTED VEHICLE THAT IS NOT SUPPORTED ON SAFETY STANDS, PERSONAL INJURY CAN RESULT.**
- **NO HEAT MAY BE USED IF FRAME STRAIGHTENING IS REQUIRED. THE USE OF HEAT IS ACCEPTABLE IN THOSE SITUATIONS WHERE THE PART BEING HEATED WILL BE REPLACED. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

CAUTION: Do not reuse damaged fasteners, quality of repair would be suspect. Failure to use only production fasteners or fasteners of equivalent hardness can result in loosening or failure. Do not drill any holes in the frame that are not specifically outlined in this or other, DaimlerChrysler procedure as frame rail failure can result.

SPECIFICATIONS

WELD PROCESS

CAUTION: All welds should conform to DaimlerChrysler vehicle engineering process standard "ps 9472".

WELDING PARAMETERS

WELDING PROCESS	FLUX CORED ARC	GAS METAL ARC (MIG)*	SHIELDED METAL ARC (STICK)
Material Thickness	3.7 mm to 4.2 mm	3.7 mm to 4.2 mm	3.7 mm to 4.2 mm
Electrode Type	Lincoln Electrical Co. Product #: NR-211 MP **(Do Not Substitute)**	AWS ER70S-3 **(Do Not Substitute)**	** AWS E 7018
Electrodes Size Inches	.045 Tubular	.035 Solid	3/32″
Electrode Stick Out	3/8″ - 1/2″	1/2″ - 5/8″	N/A
Polarity	Electrode ″-″ Work Piece ″+″	Electrode ″+″ Work Piece ″-″	Electrode ″+″ Work Piece ″-″
Shielding Gas	Self Shielded	75% Ar 25% CO2	Self Shielded
Gas Flow Rate	N/A	25 - 35 CFM	N/A
Wire Feed Speed (inches per minute)	110 - 130 Vertical Down 70 - 90 Flat & Overhead	245 - 250 Vertical Down 210 - 225 Flat & Overhead	N/A
Approximate Amperage			
Vertical	110 - 130	175	85 (3/32″ Diameter)
Flat & Overhead	70 - 90	155	90 (3/32″ Diameter)
Voltage	15 - 18	19 - 20	N/A
Direction of Welding			
Vertical	Vertical Down Hill (only)	Vertical Down Hill (only)	Vertical - Up Hill (only)
Flat & Overhead	Flat - Push or Drag	Flat - Push or Drag	Flat - Drag

***First choice - Gas Metal Arc Welding Process:** Butt joints - apply two layers (passes) of weld metal. First pass should only fill approximately ½ the thickness. Vertical position welds - maintain electrode wire at leading edge of weld puddle while traveling down hill to produce maximum penetration into the sleeve. These techniques work for FCAW as well.

****E7018** new electrodes may be exposed to the atmosphere for up to ten hours with no harmful effect. Reconditioning schedules should come from the manufacturer.

FRAME DIMENSIONS

Frame dimensions are listed in metric scale. All dimensions are from center to center of Principal Locating Point (PLP), or from center to center of PLP and fastener location.

VEHICLE PREPARATION

Position the vehicle on a frame alignment rack, refer to instructions provided with equipment being used. Adjust the vehicle PLP heights to the specified dimension above the work surface (datum line). Vertical dimensions can be taken from the datum line to the locations indicated were applicable.

DESCRIPTION	FIGURE
ND 33 TOP VIEW - (4 X 2)	1
ND 33 LEFT SIDE VIEW - (4 X 2)	2
ND 33 TOP VIEW - (4 X 4)	3
ND 33 LEFT SIDE VIEW - (4 X 4)	4
ND 84 TOP VIEW - (4 X 2)	5
ND 84 LEFT SIDE VIEW - (4 X 2)	6
ND 84 TOP VIEW - (4 X 4)	7
ND 84 LEFT SIDE VIEW - (4 X 4)	8

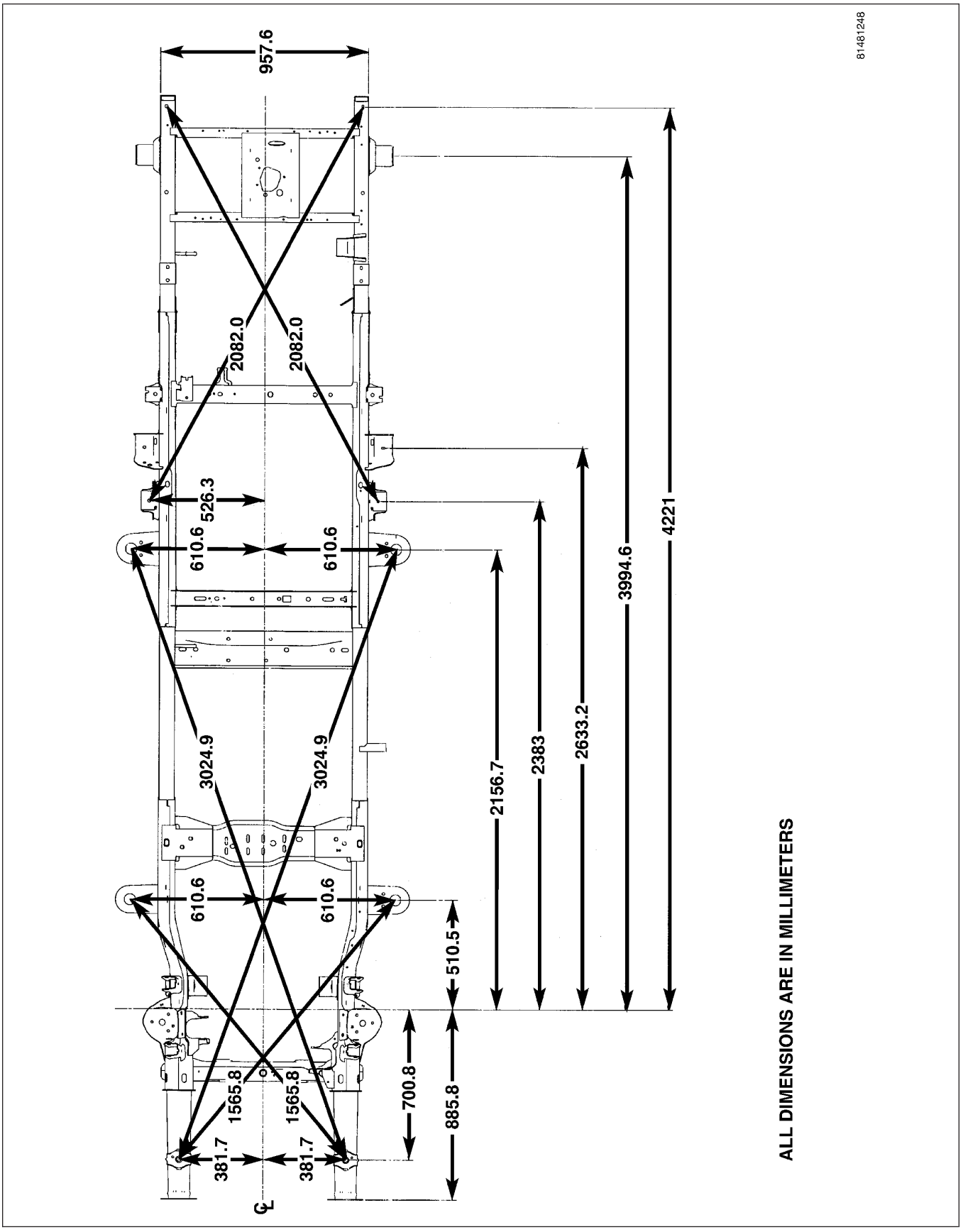


Fig. 1 ND 33 TOP VIEW - (4 X 2)

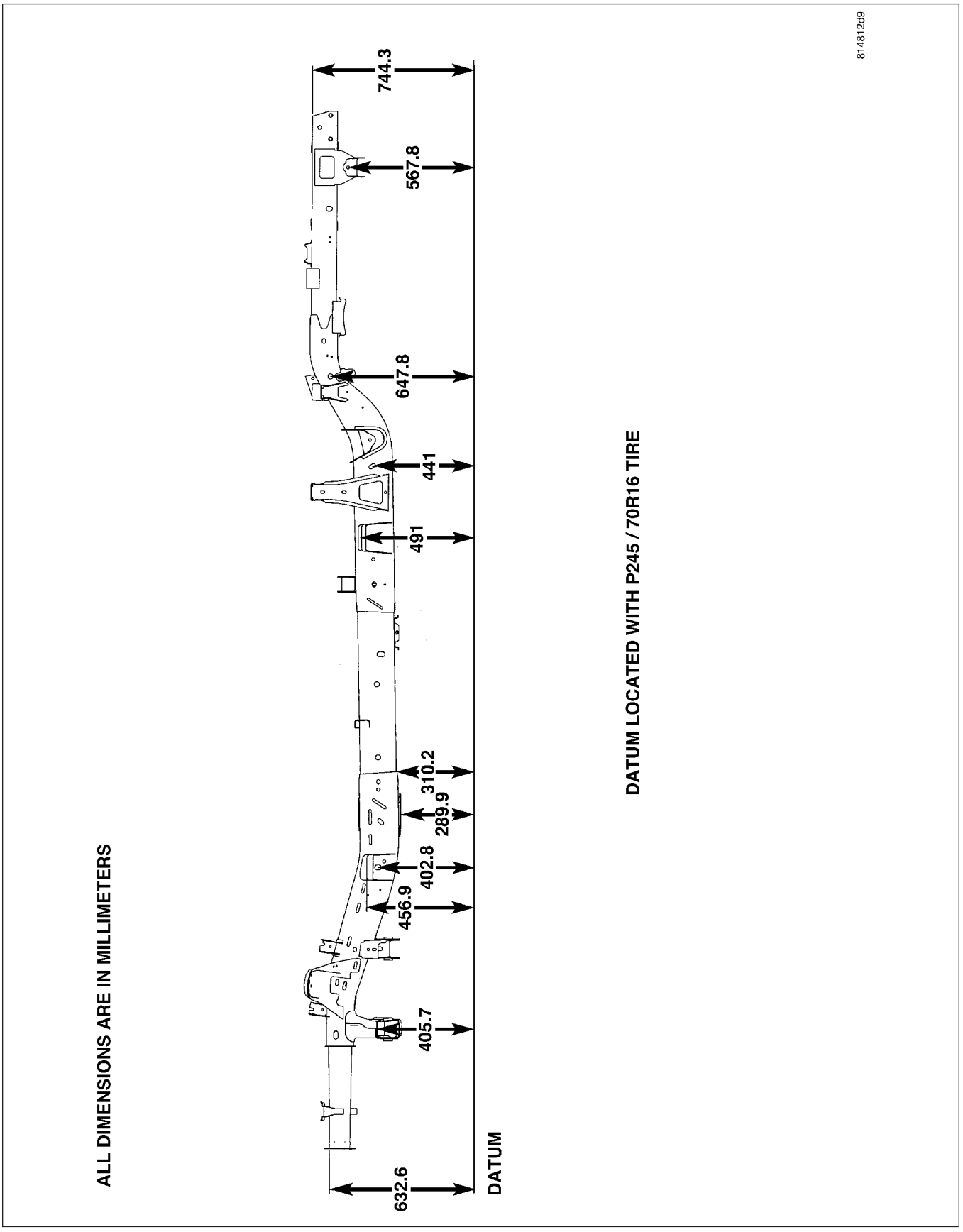


Fig. 2 ND 33 LEFT SIDE VIEW - (4 X 2)

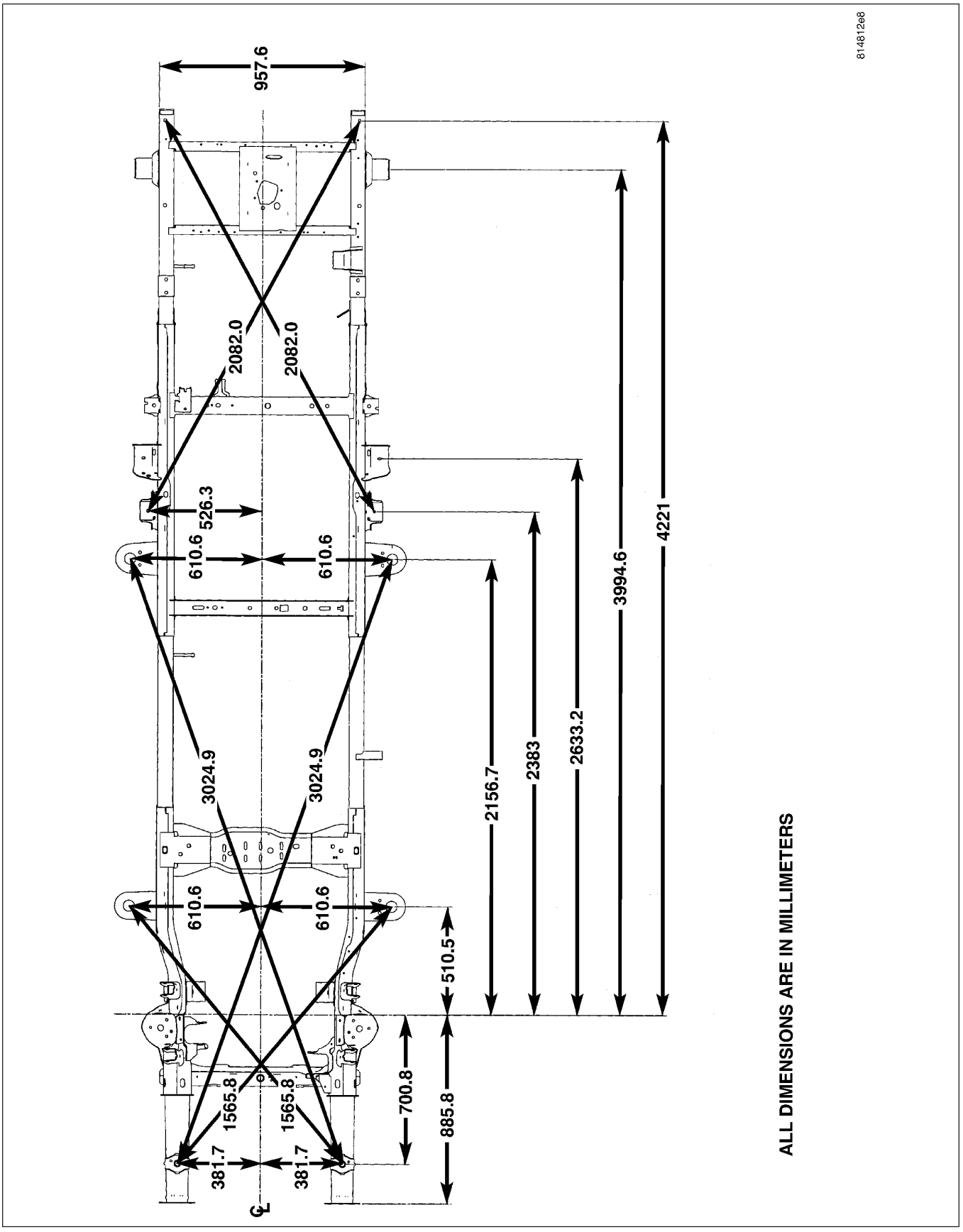


Fig. 3 ND 33 TOP VIEW - (4 X 4)

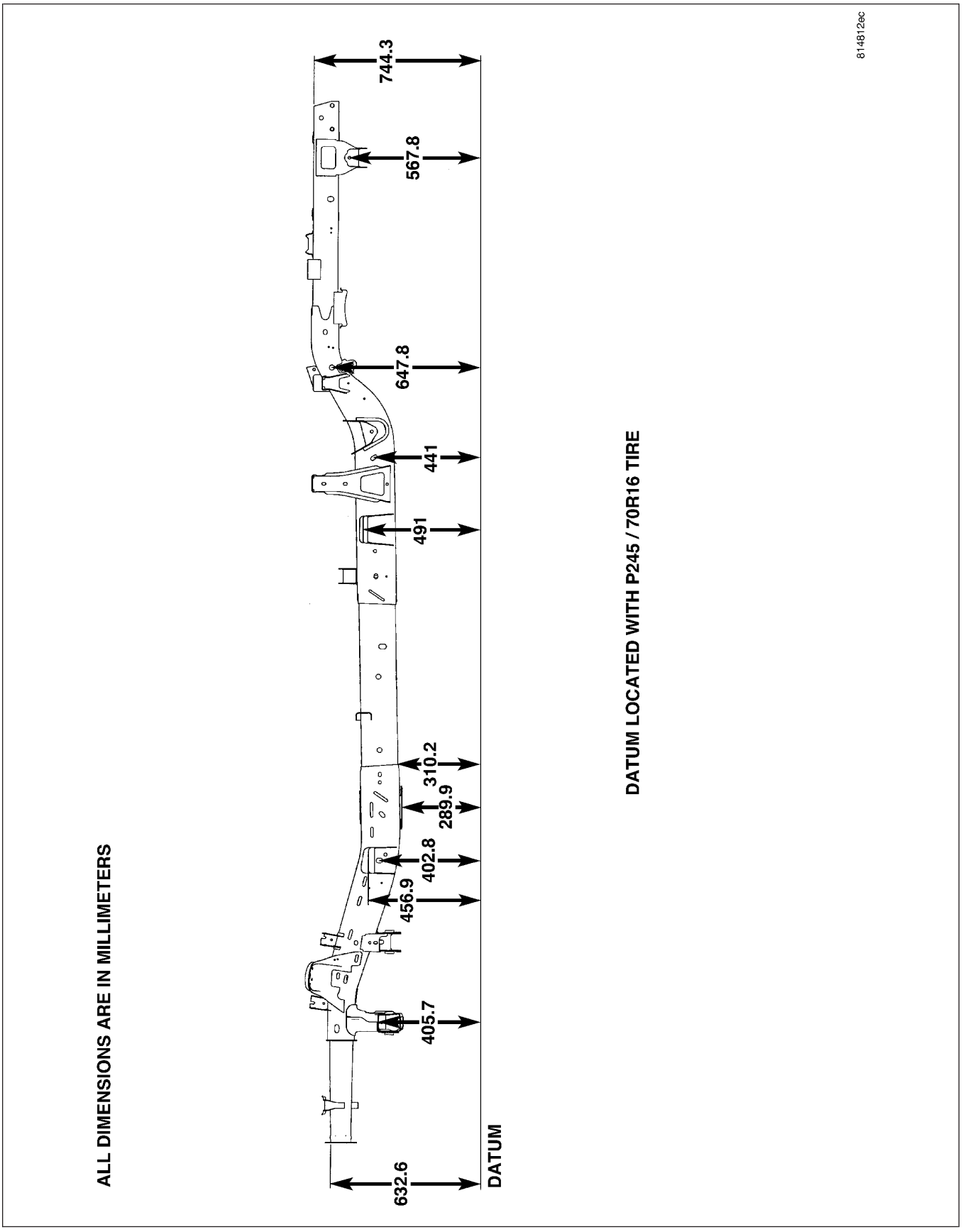


Fig. 4 ND 33 LEFT SIDE VIEW - (4 X 4)

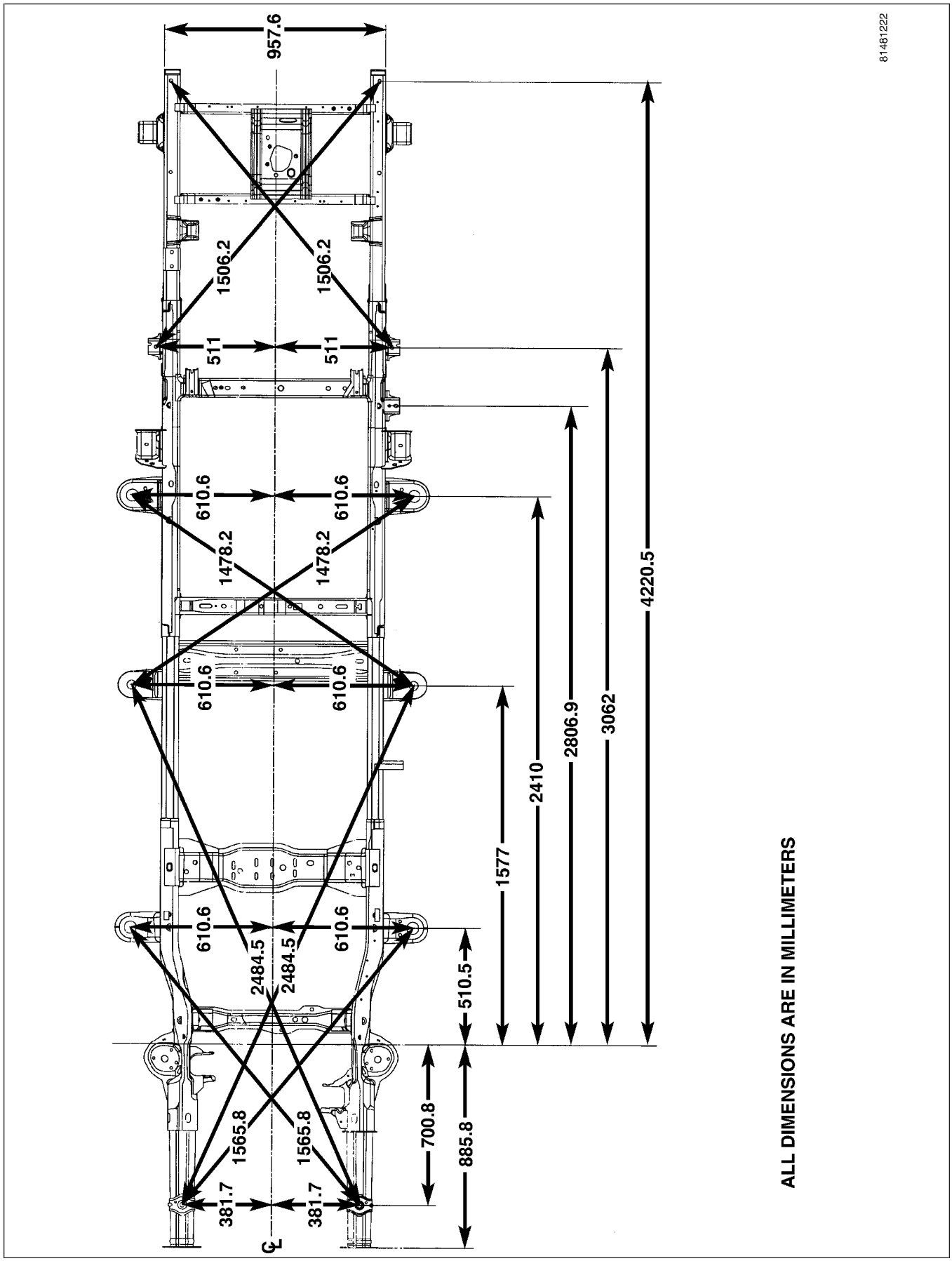


Fig. 5 ND 84 TOP VIEW - (4 X 2)

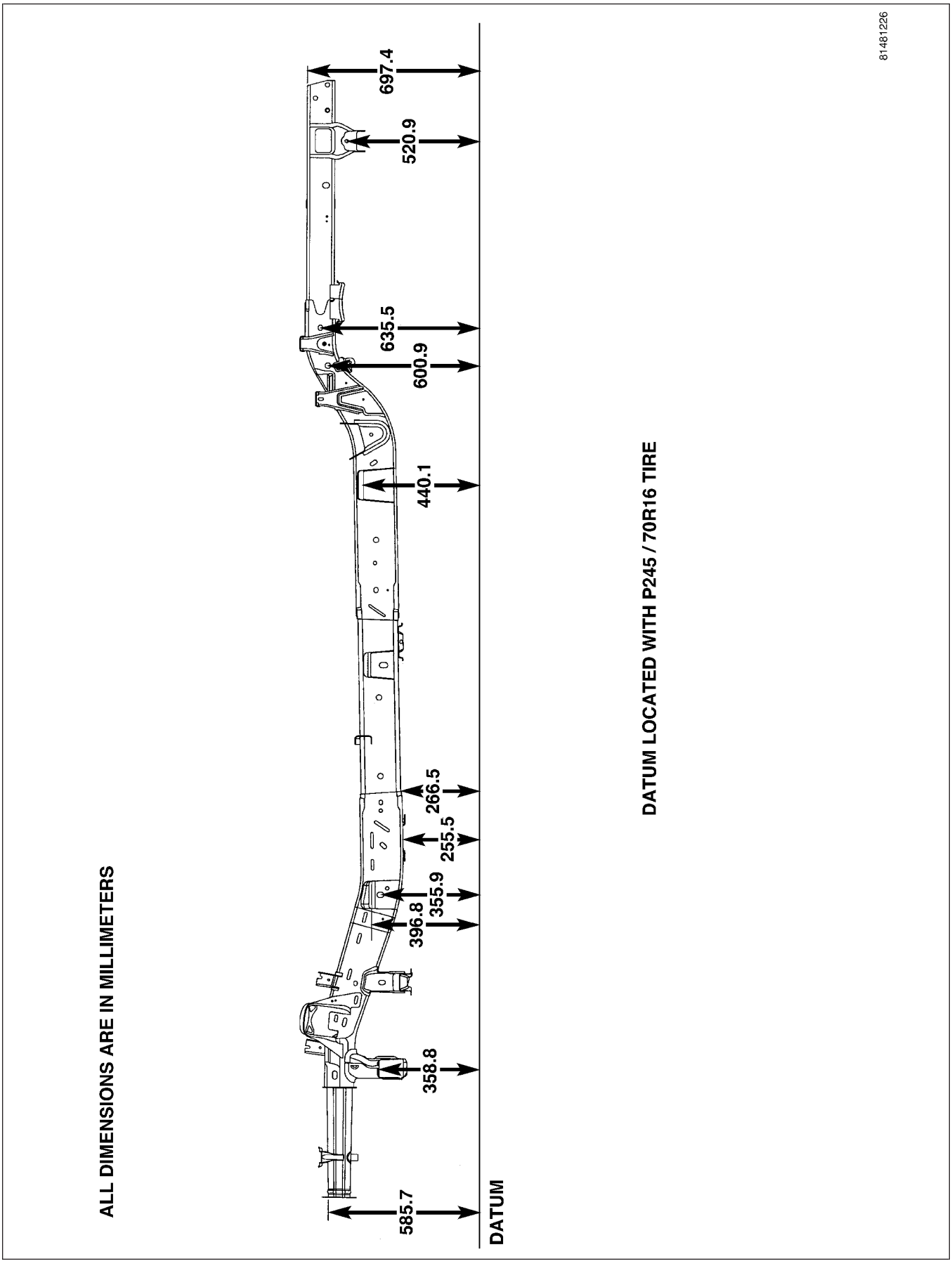


Fig. 6 ND 84 LEFT SIDE VIEW - (4 X 2)

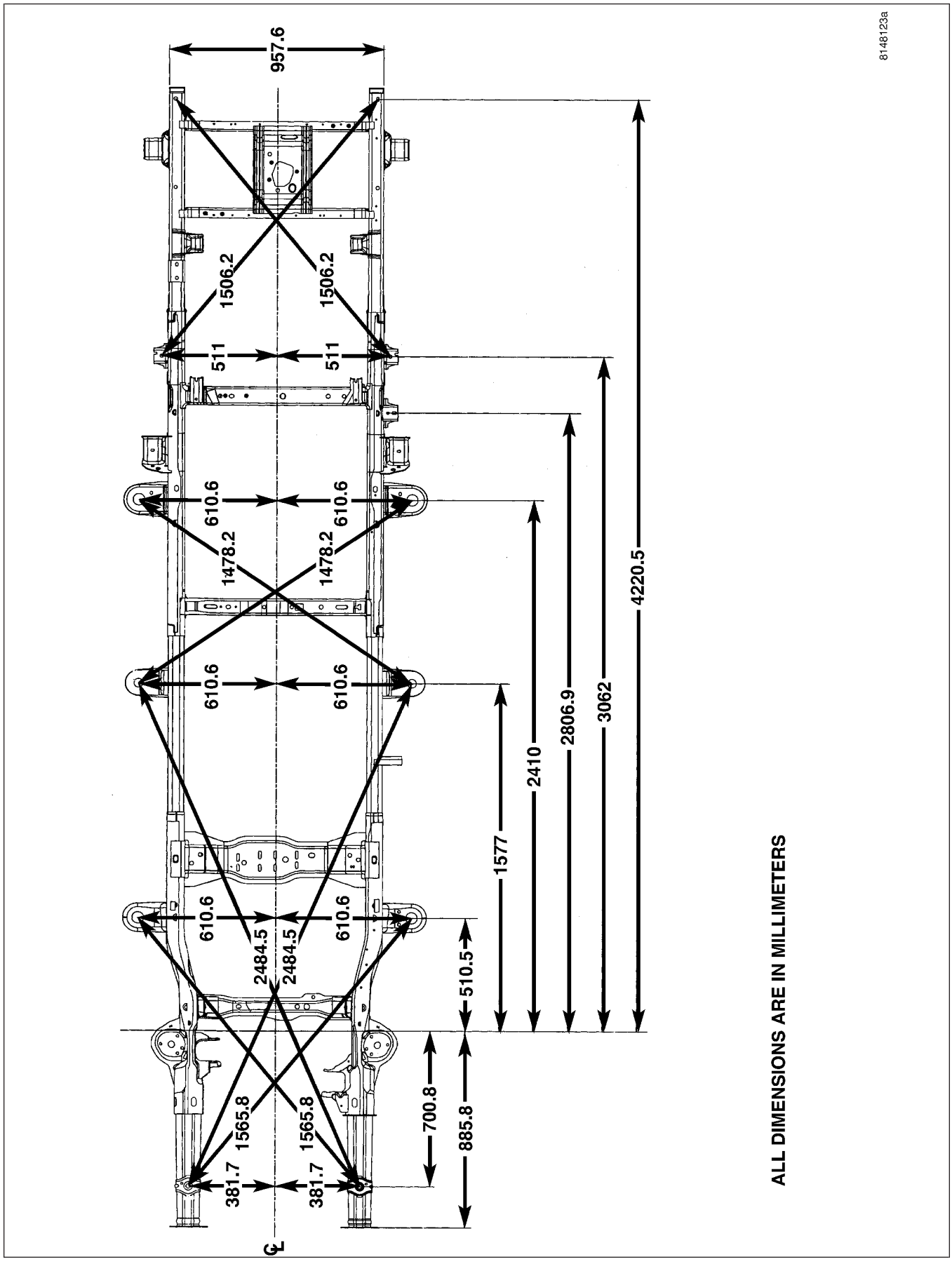


Fig. 7 ND 84 TOP VIEW - (4 X 4)

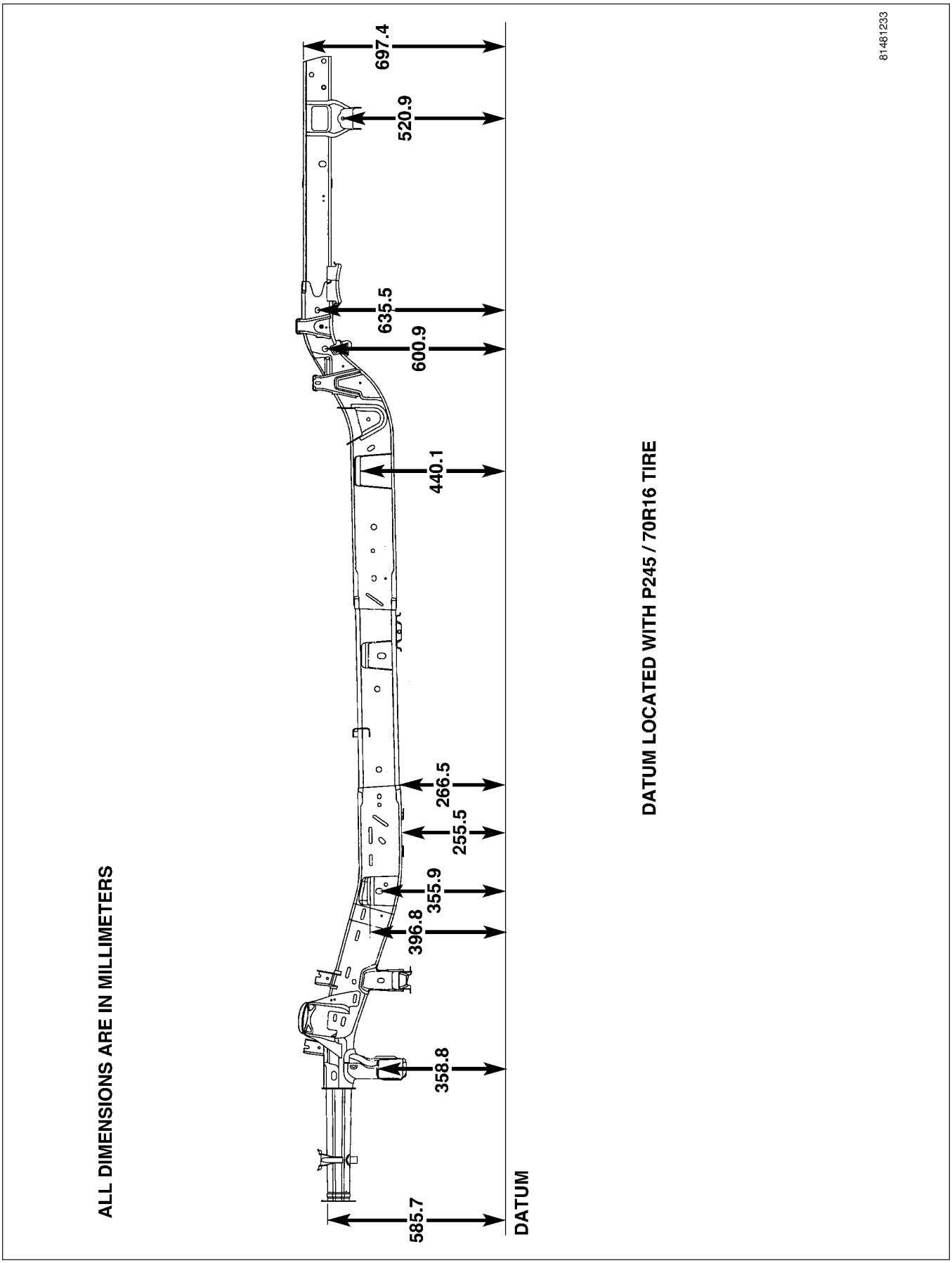
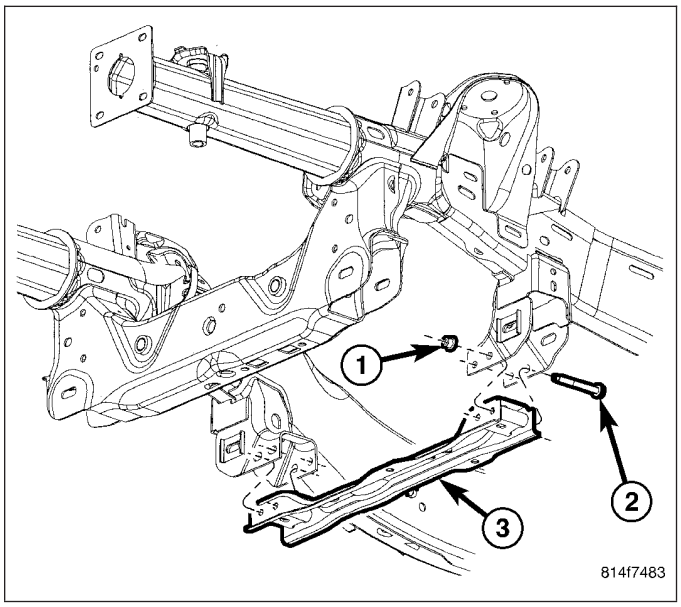


Fig. 8 ND 84 LEFT SIDE VIEW - (4 X 4)

CROSSMEMBER-UNDERBODY

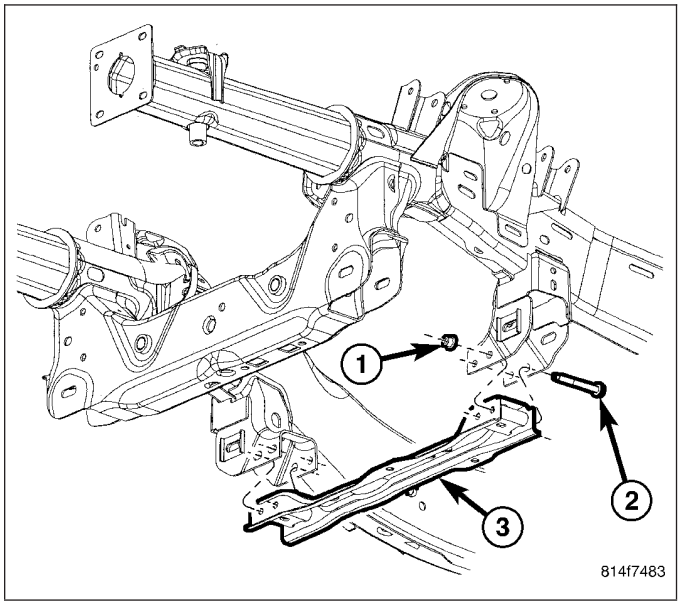
REMOVAL

1. Lift and support the vehicle.
2. Remove the four bolts (2) and nuts (1), and remove the crossmember.



INSTALLATION

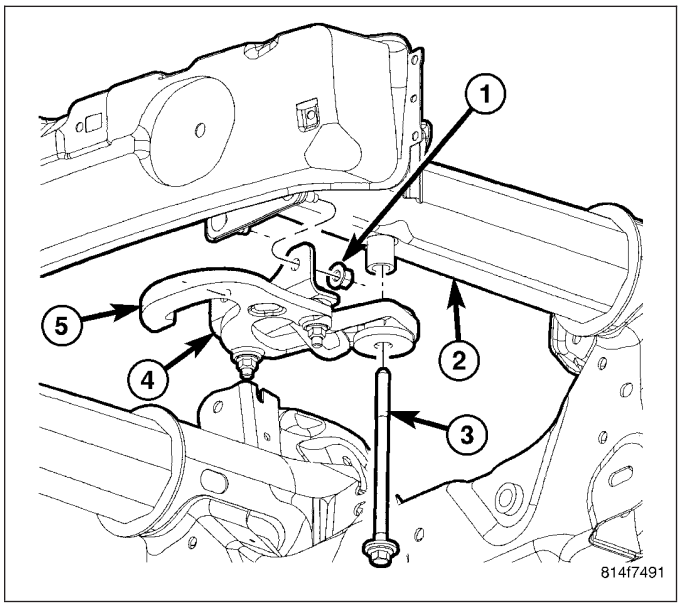
1. Install the crossmember (3) and install the bolts (2) and nuts (1).
2. Tighten the bolts and nuts to 102 N·m (75 ft. lbs.).



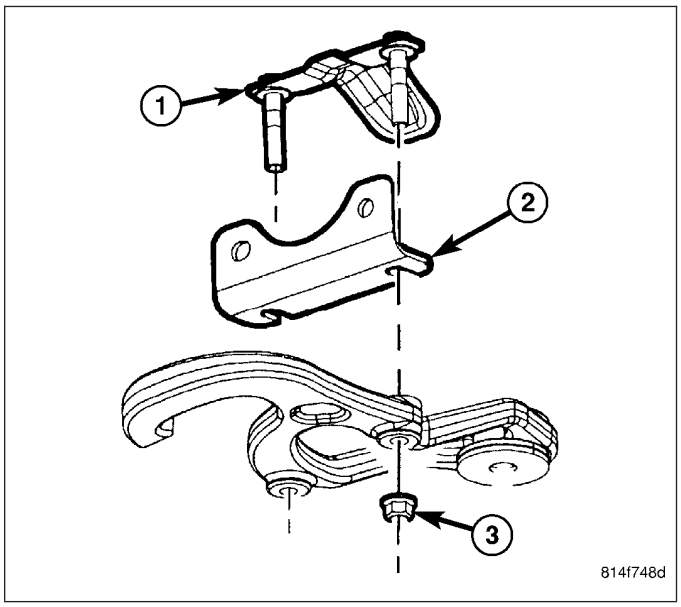
HOOK-TOW

REMOVAL

1. Remove the Front End Sheet Metal (FESM) mounting bolt (3).
2. Remove the two lower fascia support nuts (1) and remove the tow hook assembly (5).

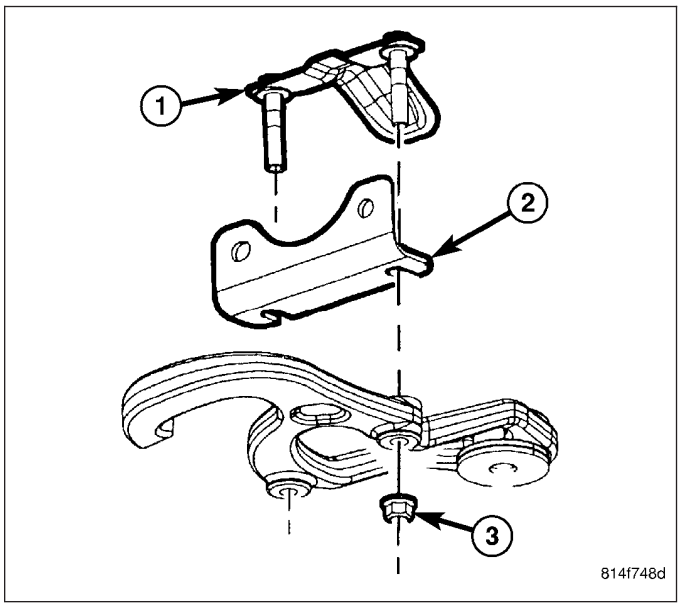


3. Remove the nuts (3) and remove the brackets (1 & 2).

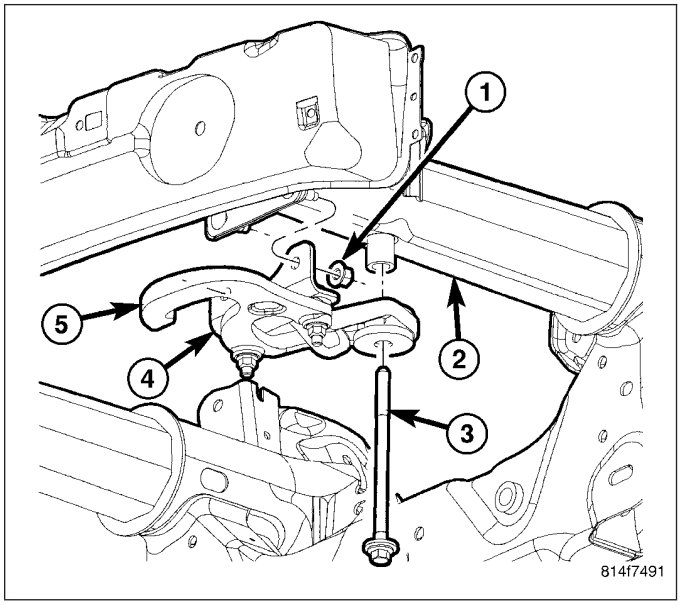


INSTALLATION

1. Install the brackets (1 & 2) and install the nuts (3).
2. Tighten the nuts to 95 N·m (70 ft. lbs.)



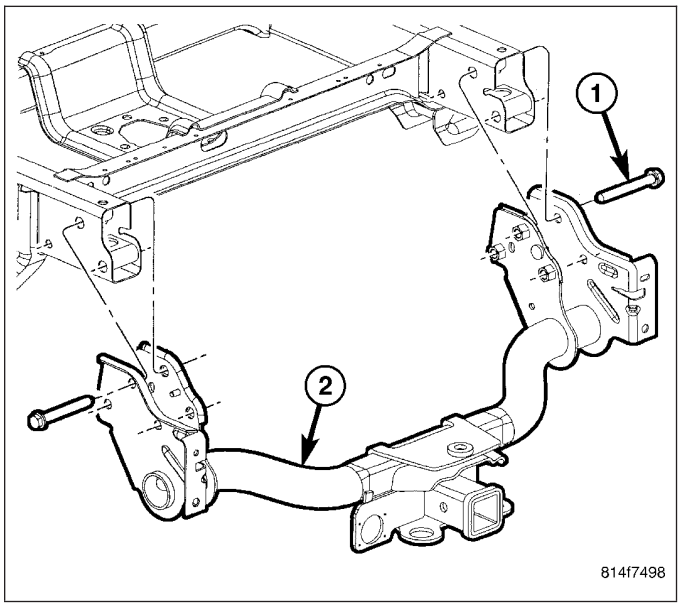
3. Install the hook assembly (5) and install the FESM bolt (3).
4. Install the fascia support nuts (1).
5. Tighten the FESM Bolt (3) to 75 N·m (55 ft. lbs.)
6. Tighten the fascia support nuts (1) to 94 N·m (70 ft. lbs.).



RECEIVER KIT-TRAILER TOW

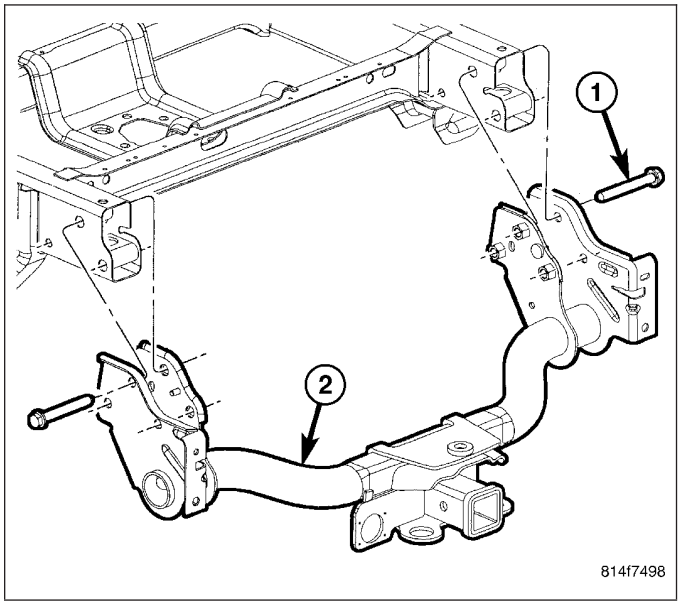
REMOVAL

1. Remove the bumper. (Refer to 13 - FRAME & BUMPERS/BUMPERS/BUMPER-STEP - REMOVAL)
2. Disconnect the trailer wiring electrical connectors.
3. Remove the bolts (1) and remove the hitch (2).



INSTALLATION

1. Install the hitch (2) and install the bolts (1).
2. Tighten the bolts to 170 N·m (125 ft. lbs.).
3. Connect the trailer wiring electrical connectors.
4. Install the bumper. (Refer to 13 - FRAME & BUMPERS/BUMPERS/BUMPER-STEP - INSTALLATION)



FUEL SYSTEM

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FUEL DELIVERY

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FUEL DELIVERY

STANDARD PROCEDURE - FUEL SYSTEM PRESSURE RELEASE

Use following procedure if the fuel injector rail is, or is not equipped with a fuel pressure test port.

1. Remove fuel fill cap.
2. Remove fuel pump relay from Power Distribution Center (PDC). For location of relay, refer to label on underside of PDC cover.
3. Start and run engine until it stalls.
4. Attempt restarting engine until it will no longer run.
5. Turn ignition key to OFF position.

CAUTION: Steps 1, 2, 3 and 4 must be performed to relieve high pressure fuel from within fuel rail. Do not attempt to use following steps to relieve this pressure as excessive fuel will be forced into a cylinder chamber.

6. Unplug connector from any fuel injector.
7. Attach one end of a jumper wire with alligator clips (18 gauge or smaller) to either injector terminal.
8. Connect other end of jumper wire to positive side of battery.
9. Connect one end of a second jumper wire to remaining injector terminal.

CAUTION: Powering an injector for more than a few seconds will permanently damage the injector.

10. Momentarily touch other end of jumper wire to negative terminal of battery for no more than a few seconds.
11. Place a rag or towel below fuel line quick-connect fitting at fuel rail.
12. Disconnect quick-connect fitting at fuel rail. Refer to Quick-Connect Fittings.
13. Return fuel pump relay to PDC.
14. One or more Diagnostic Trouble Codes (DTC's) may have been stored in PCM memory due to fuel pump relay removal. A diagnostic scan tool must be used to erase a DTC.

SPECIFICATIONS

FUEL SYSTEM PRESSURE

58 psi +/- 2 psi

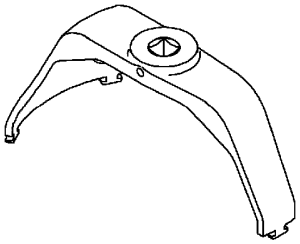
TORQUE - FUEL SYSTEM

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Accelerator Pedal Bracket Mounting	12	-	105
Crankshaft Position Sensor - 3.7L	28	21	-
Crankshaft Position Sensor - 4.7L	28	21	-
Camshaft Position Sensor - 3.7L	12	-	106
Camshaft Position Sensor - 4.7L	12	-	106
Engine Coolant Temperature Sensor - 3.7L	11	-	96
Engine Coolant Temperature Sensor - 4.7L	11	-	96
Fuel Filler Hose Clamp	3	-	30
Fuel Filler Housing-to-Body Screws	2	-	17
Fuel Rail Mounting Bolts - 3.7L	11	-	100
Fuel Rail Mounting Bolts - 4.7L	11	-	100
Fuel Tank Mounting Straps	41	30	-
IAC Motor Mounting Screws - 3.7L	7	-	60
IAC Motor Mounting Screws - 4.7L	7	-	60
NVLD Pump Mounting Bolt	8.5	-	75

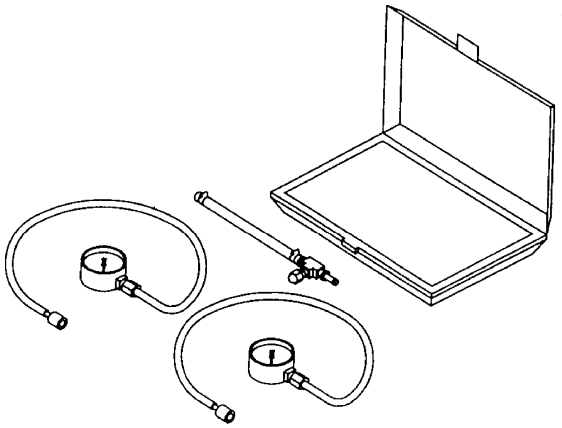
DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Map Sensor Mounting Screws - 3.7L	3	-	25
Map Sensor Mounting Screws - 4.7L	3	-	25
PCM-to-Mounting Bracket Mounting Screws	4	-	35
Power Steering Pressure Switch - 3.7L	14-22	-	124-195
Power Steering Pressure Switch - 4.7L	14-22	-	124-195
TPS Mounting Screws - 3.7L	7	-	60
TPS Mounting Screws - 4.7L	7	-	60
Throttle Body Mounting Bolts - 3.7L	11	-	100
Throttle Body Mounting Bolts - 4.7L	12	-	105
Oxygen Sensors	30	22	-

SPECIAL TOOLS

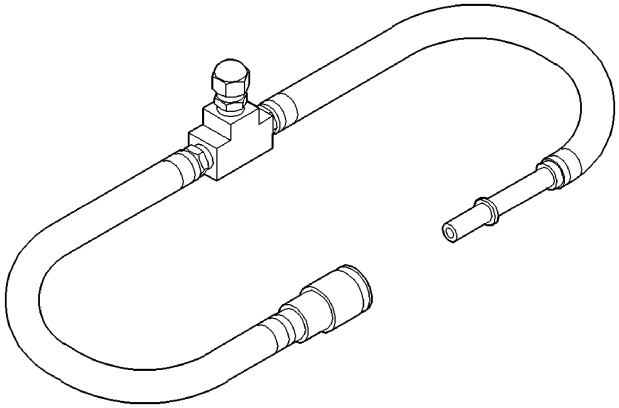
FUEL SYSTEM



LOCKRING REMOVER/INSTALLER #9340



TEST KIT, FUEL PRESSURE #5069



ADAPTERS, FUEL PRESSURE TEST - #6539 AND/OR #6631

O2S (OXYGEN SENSOR) REMOVER/INSTALLER - #C-4907

SENSOR-FUEL LEVEL SENDING UNIT

DESCRIPTION

Refer to Fuel Pump Module for information.

LINES, FUEL

DESCRIPTION

Also refer to Quick-Connect Fittings.

WARNING: THE FUEL SYSTEM MAY BE UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSES, FITTINGS, LINES, OR MOST COMPONENTS, FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE.

The lines/tubes/hoses used on fuel injected vehicles are of a special construction. This is due to the higher fuel pressures and the possibility of contaminated fuel in this system. If it is necessary to replace these lines/tubes/hoses, only those marked EFM/EFI may be used.

If equipped: The hose clamps used to secure rubber hoses on fuel injected vehicles are of a special rolled edge construction. This construction is used to prevent the edge of the clamp from cutting into the hose. Only these rolled edge type clamps may be used in this system. All other types of clamps may cut into the hoses and cause high-pressure fuel leaks.

Use new original equipment type hose clamps.

FITTING, QUICK CONNECT

DESCRIPTION

Different types of quick-connect fittings are used to attach various fuel system components, lines and tubes. These are: a single-tab type, a two-tab type or a plastic retainer ring type. Some are equipped with safety latch clips. Some may require the use of a special tool for disconnection and removal. Refer to Quick-Connect Fittings Removal/Installation for more information.

CAUTION: The interior components (o-rings, clips) of quick-connect fittings are not serviced separately, but new plastic spacers are available for some types. If service parts are not available, do not attempt to repair the damaged fitting or fuel line (tube). If repair is necessary, replace the complete fuel line (tube) assembly.

STANDARD PROCEDURE - QUICK-CONNECT FITTINGS

Also refer to Fuel Tubes/Lines/Hoses and Clamps.

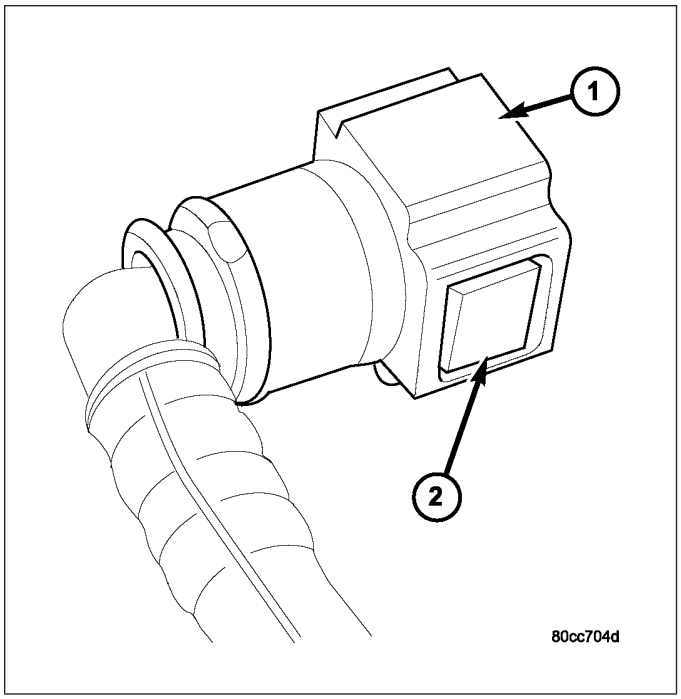
Different types of quick-connect fittings are used to attach various fuel system components, lines and tubes. These are: a single-tab type, a two-tab type or a plastic retainer ring type. Safety latch clips are used on certain components/lines. Certain fittings may require use of a special tool for disconnection.

DISCONNECTING

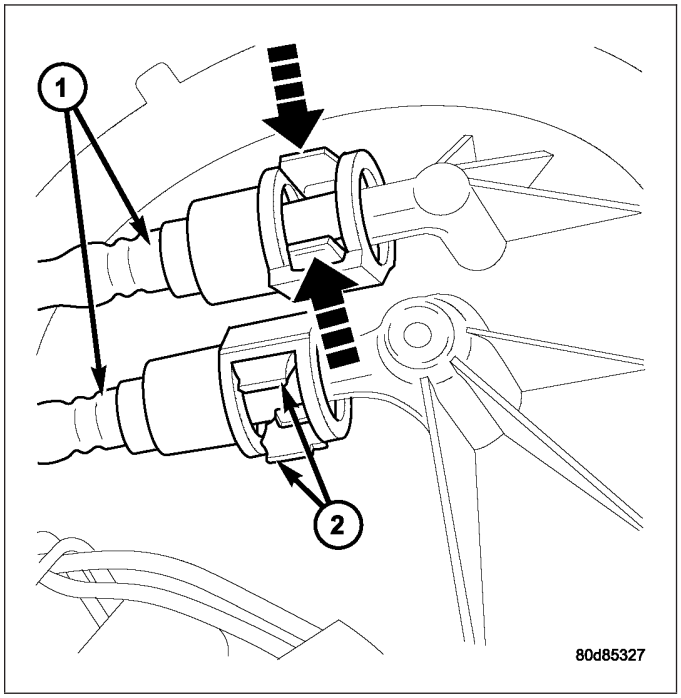
WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSE, FITTING OR LINE, FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO FUEL SYSTEM PRESSURE RELEASE PROCEDURE.

CAUTION: The interior components (o-rings, spacers) of some types of quick-connect fitting are not serviced separately. If service parts are not available, do not attempt to repair a damaged fitting or fuel line. If repair is necessary, replace complete fuel line assembly.

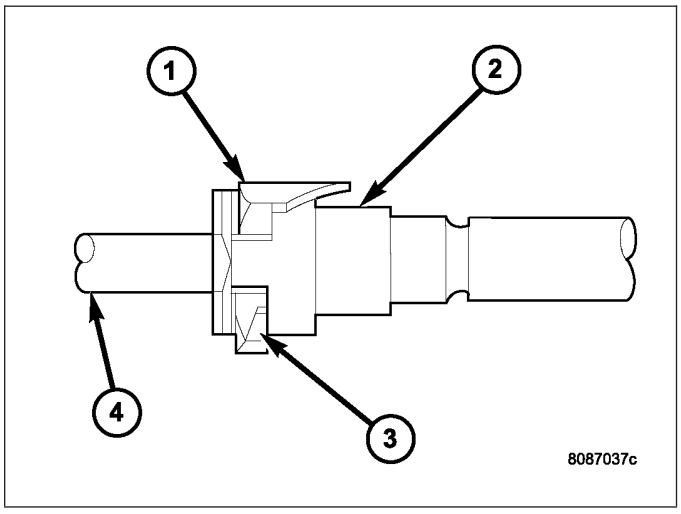
1. Perform fuel pressure release procedure. Refer to Fuel Pressure Release Procedure.
2. Disconnect negative battery cable from battery.
3. Clean fitting of any foreign material before disassembly.
4. **2–Button Type Fitting:** This type of fitting (1) is equipped with a push-button located on each side of quick-connect fitting (2). Press on both buttons simultaneously for removal. Special tools are not required for disconnection.



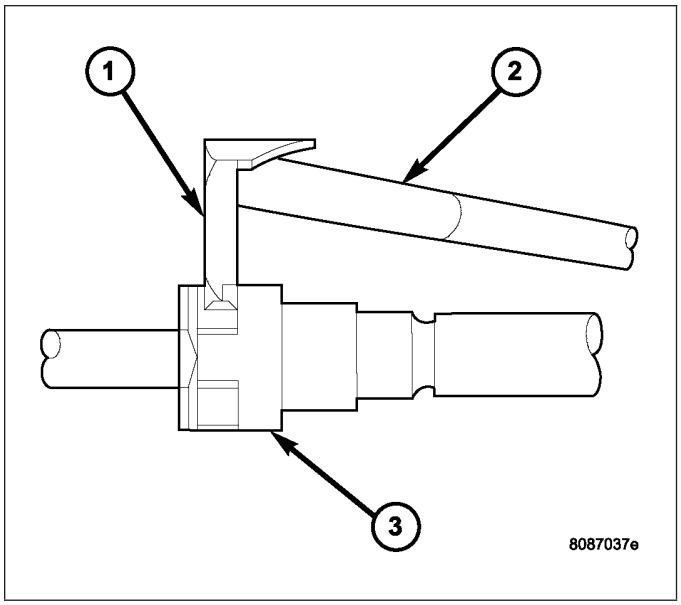
5. **Pinch-Type Fitting:** This fitting (1) is equipped with two finger tabs (2). Pinch both tabs together while removing fitting. Special tools are not required for disconnection.



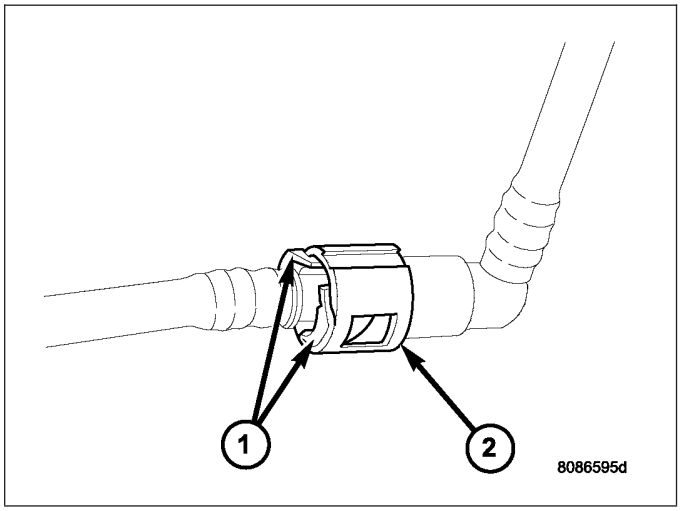
6. **Single-Tab Type Fitting:** This type of fitting (3) is equipped with a single pull tab (1). The tab is removable. After tab is removed, quick-connect fitting can be separated from fuel system component. Special tools are not required for disconnection.



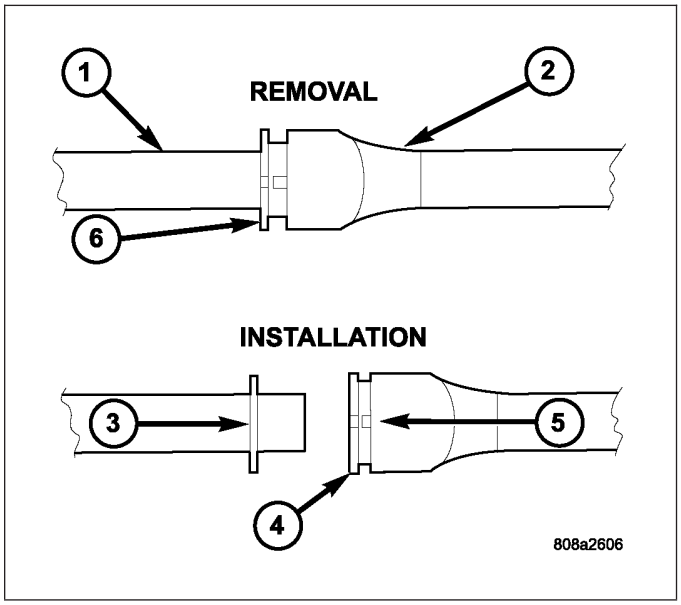
7. Press release tab on side of fitting to release pull tab (1). **If release tab is not pressed prior to releasing pull tab, pull tab will be damaged.**
8. While pressing release tab on side of fitting, use screwdriver (2) to pry up pull tab.
9. Raise pull tab until it separates from quick-connect fitting.



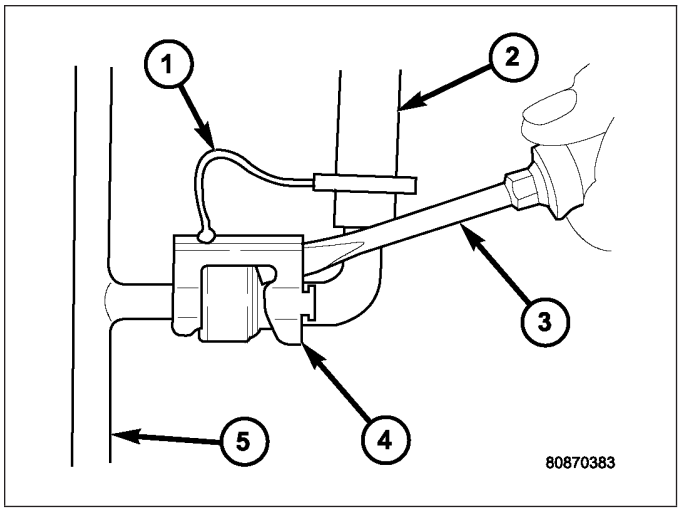
10. **Two-Tab Type Fitting:** This type of fitting (2) is equipped with tabs located on both sides of fitting (1). The tabs are supplied for disconnecting quick-connect fitting from component being serviced.
    a. To disconnect quick-connect fitting, squeeze plastic retainer tabs (1) against sides of quick-connect fitting with your fingers. Tool use is not required for removal and may damage plastic retainer.
    b. Pull fitting from fuel system component being serviced.
    c. The plastic retainer will remain on component being serviced after fitting is disconnected. The o-rings and spacer will remain in quick-connect fitting connector body.



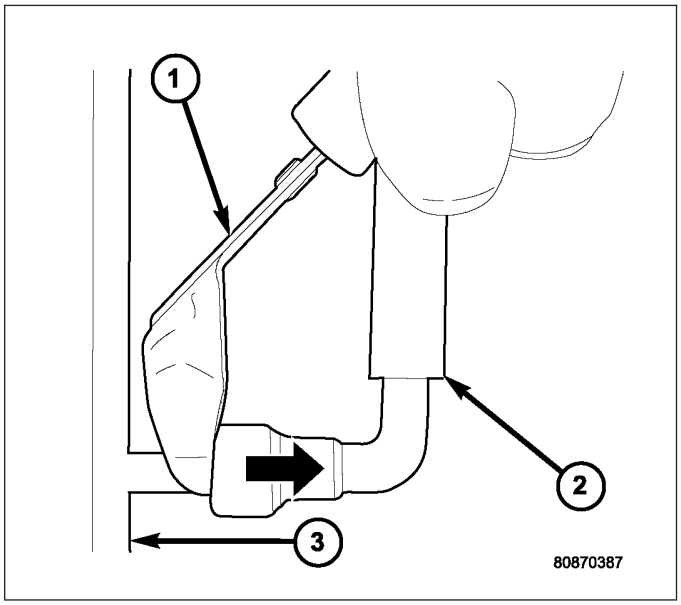
11. **Plastic Retainer Ring Type Fitting:** This type of fitting can be identified by the use of a full-round plastic retainer ring (4) usually black in color.
    a. To release fuel system component from quick-connect fitting, firmly push fitting towards component being serviced while firmly pushing plastic retainer ring into fitting (6). With plastic ring depressed, pull fitting from component. **The plastic retainer ring must be pressed squarely into fitting body. If this retainer is cocked during removal, it may be difficult to disconnect fitting. Use an open-end wrench on shoulder of plastic retainer ring to aid in disconnection.**
    b. After disconnection, plastic retainer ring will remain with quick-connect fitting connector body.
    c. Inspect fitting connector body, plastic retainer ring and fuel system component for damage. Replace as necessary.



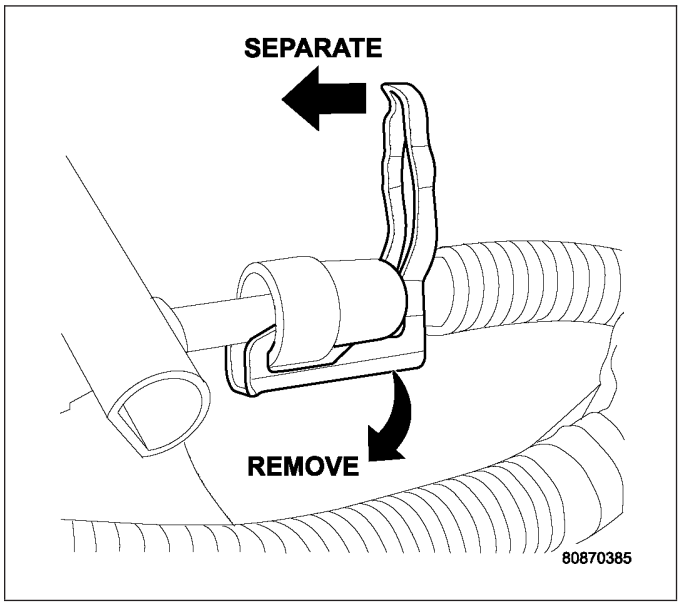
12. **Latch Clips — Type 1:** Depending on vehicle model and engine, 2 different types of safety latch clips are used. Type-1 (4) is tethered to fuel line and type-2 is not. A special tool will be necessary to disconnect fuel line after latch clip is removed. The latch clip may be used on certain fuel line/ fuel rail connection, or to join fuel lines together.
13. Pry up on latch clip with a screwdriver (3).
14. Slide latch clip toward fuel rail while lifting with screwdriver.



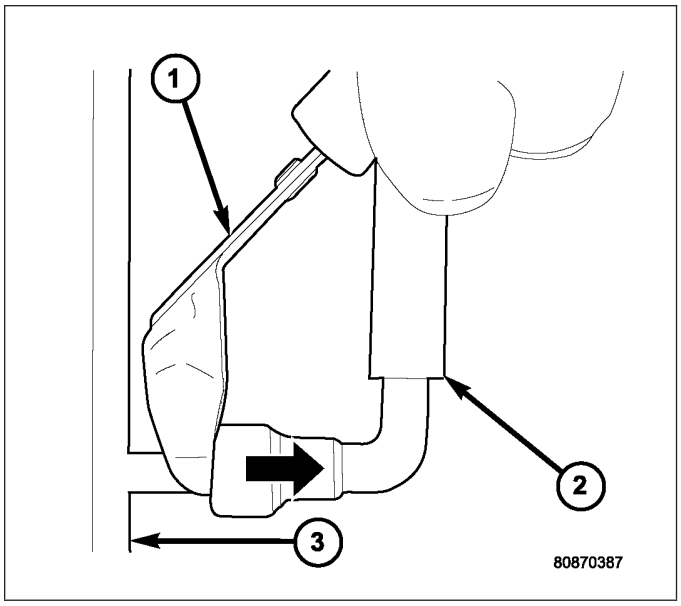
15. Insert special fuel line removal tool (Snap-On number FIH 9055-1 or equivalent) into fuel line (1). Use tool to release locking fingers in end of line.
16. With special tool still inserted, pull fuel line from fuel rail.
17. After disconnection, locking fingers will remain within quick-connect fitting at end of fuel line.
18. Disconnect quick-connect fitting from fuel system component being serviced.



19. **Latch Clips — Type 2:** Depending on vehicle model and engine, 2 different types of safety latch clips are used. Type-1 is tethered to fuel line and type-2 is not. A special tool will be necessary to disconnect fuel line after latch clip is removed. The latch clip may be used on certain fuel line/ fuel rail connection, or to join fuel lines together.
20. Type 2: Separate and unlatch 2 small arms (1) on end of clip and swing away from fuel line.
21. Slide latch clip toward fuel rail while lifting with screwdriver.



22. Insert special fuel line removal tool (Snap-On number FIH 9055-1 or equivalent) into fuel line (1). Use tool to release locking fingers in end of line.
23. With special tool still inserted, pull fuel line from fuel rail.
24. After disconnection, locking fingers will remain within quick-connect fitting at end of fuel line.
25. Disconnect quick-connect fitting from fuel system component being serviced.



CONNECTING

1. Inspect quick-connect fitting body and fuel system component for damage. Replace as necessary.
2. Prior to connecting quick-connect fitting to component being serviced, check condition of fitting and component. Clean parts with a lint-free cloth. Lubricate with clean engine oil.
3. Insert quick-connect fitting into fuel tube or fuel system component until built-on stop on fuel tube or component rests against back of fitting.
4. Continue pushing until a click is felt.
5. Single-tab type fitting: Push new tab down until it locks into place in quick-connect fitting.
6. Verify a locked condition by firmly pulling on fuel tube and fitting (15-30 lbs.).
7. Latch Clip Equipped: Install latch clip (snaps into position). **If latch clip will not fit, this indicates fuel line is not properly installed to fuel rail (or other fuel line). Recheck fuel line connection.**
8. Connect negative cable to battery.
9. Start engine and check for leaks.

PUMP-FUEL

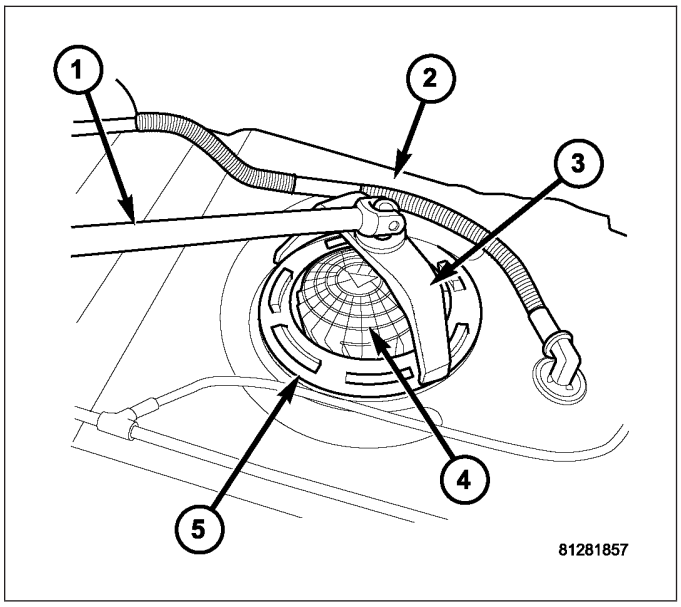
DESCRIPTION

Refer to Fuel Pump Module for information.

MODULE-FUEL PUMP

DESCRIPTION

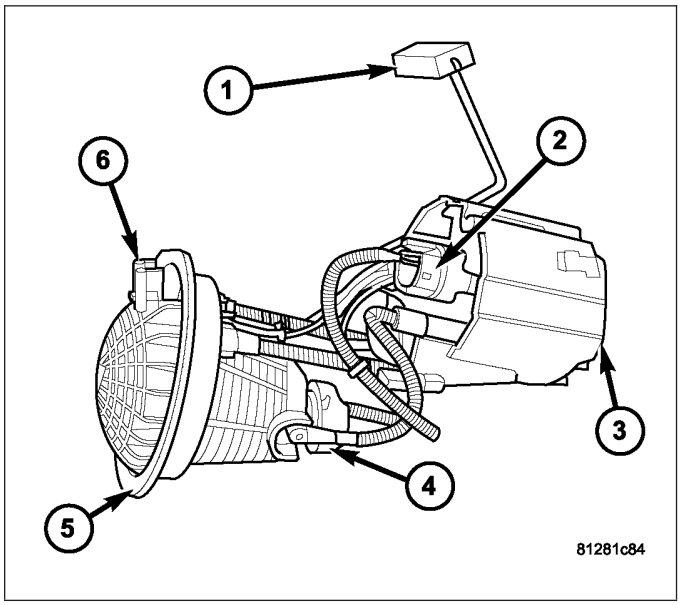
The fuel pump module assembly (4) is located on the top of the fuel tank (2).



The module assembly (5) contains the following components:

- An internal fuel filter
- A separate fuel pick-up, or inlet filter (3)
- A fuel pressure regulator (4)
- An electric fuel pump (2)
- A lockring to retain pump module to tank
- A soft gasket between tank flange and module
- A fuel gauge sending unit (fuel level sensor) (1)
- Fuel line connection (6)

If the fuel gauge sending unit , electrical fuel pump, primary inlet filter, fuel filter or fuel pressure regulator require service, the fuel pump module must be replaced.



Electric Fuel Pump

The electric fuel pump is located inside of the fuel pump module. A 12 volt, permanent magnet, electric motor powers the fuel pump. The electric fuel pump is not a separate, serviceable component.

Fuel Filters

Two fuel filters are used. One is located at the bottom of the fuel pump module. The other is located inside the module. A separate frame mounted fuel filter is not used with any engine.

Both fuel filters are designed for extended service. They do not require normal scheduled maintenance. Filters should only be replaced if a diagnostic procedure indicates to do so.

Fuel Pressure Regulator

The fuel pressure regulator is located within fuel pump module.

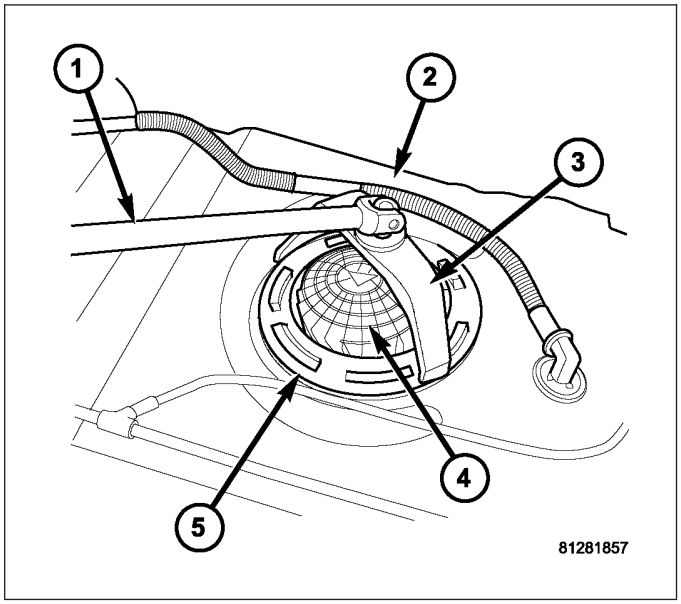
Fuel Gauge Sending Unit (Fuel level sensor)

The fuel gauge sending unit (fuel level sensor) is attached to the side of the fuel pump module. The sending unit consists of a float, an arm, and a variable resistor track (card).

REMOVAL

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING THE FUEL PUMP MODULE, THE FUEL SYSTEM PRESSURE MUST BE RELEASED.

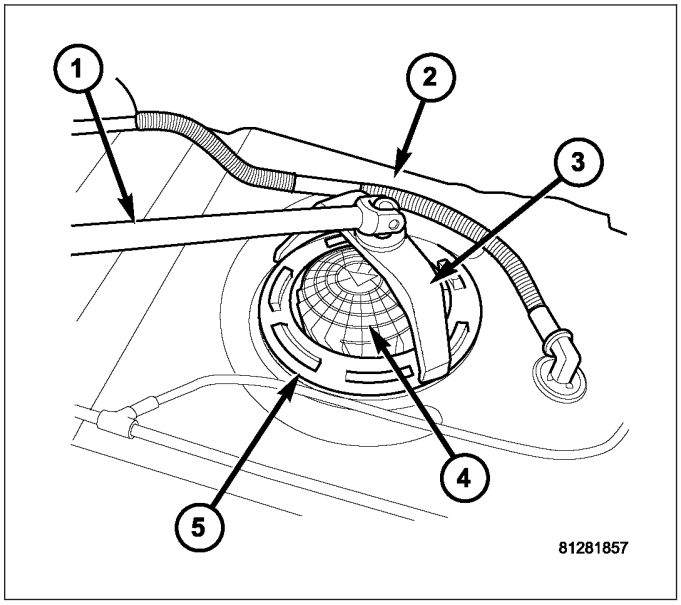
1. Drain and remove fuel tank. Refer to Fuel Tank Removal/Installation.
2. Note rotational position of module before attempting removal. An indexing arrow is located on top of module for this purpose.
3. Position Special Tool 9340 (3) into notches on outside edge of lockring (5).
4. Install 1/2 inch drive breaker bar (1) to tool 9340 (3).
5. Rotate breaker bar counter-clockwise to remove lockring.
6. Remove lockring. The module will spring up slightly when lockring is removed.
7. Remove module from fuel tank. Be careful not to bend float arm while removing.



INSTALLATION

CAUTION: Whenever the fuel pump module is serviced, the rubber seal (gasket) must be replaced.

1. Using a new seal (gasket), position fuel pump module into opening in fuel tank.
2. Position lockring (5) over top of fuel pump module.
3. Rotate module until embossed alignment arrow points to center alignment mark. This step must be performed to prevent float from contacting side of fuel tank. Also be sure fuel fitting on top of pump module is pointed to drivers side of vehicle.
4. Install Special Tool 9340 (3) to lockring.
5. Install 1/2 inch drive breaker (1) into Special Tool 9340 (3).
6. Tighten lockring (clockwise) until all seven notches have engaged.
7. Install fuel tank. Refer to Fuel Tank Removal/Installation.



RAIL-FUEL

DESCRIPTION

The fuel injector rail is used to mount the fuel injectors to the engine.

OPERATION

High pressure from the fuel pump is routed to the fuel rail. The fuel rail then supplies the necessary fuel to each individual fuel injector.

A quick-connect fitting with a safety latch clip is used to attach the fuel line to the fuel rail.

The fuel rail is not repairable.

CAUTION: The left and right sections of the fuel rail are connected with either a flexible connecting hose, or joints. Do not attempt to separate the rail halves at these connecting hose or joints. Due to the design of the connecting hose or joint, it does not use any clamps. Never attempt to install a clamping device of any kind to the hose or joint. When removing the fuel rail assembly for any reason, be careful not to bend or kink the connecting hose or joint.

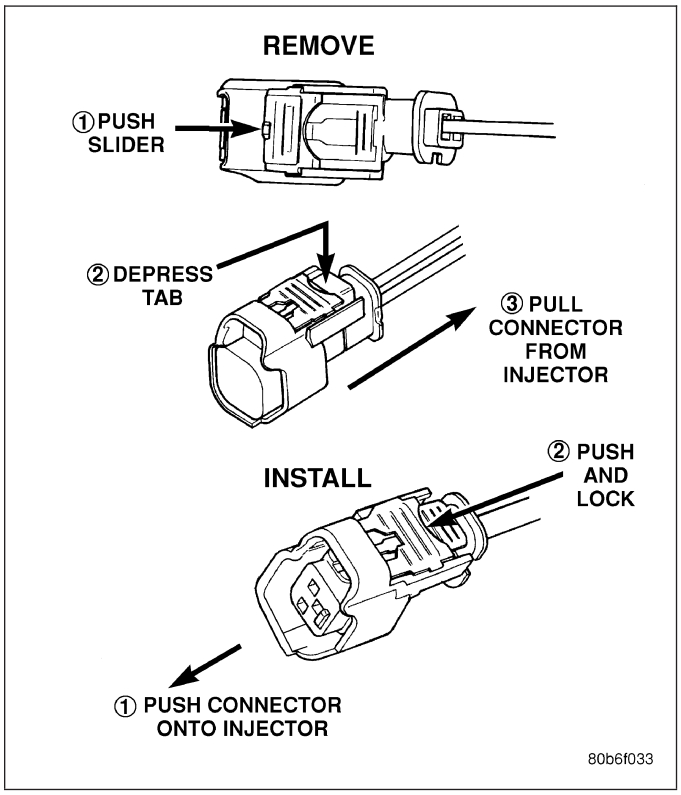
REMOVAL

3.7L V-6

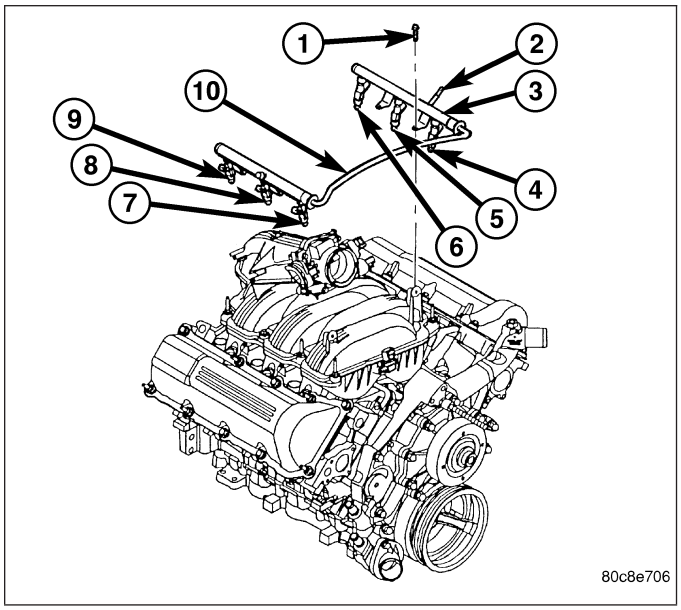
WARNING: THE FUEL SYSTEM IS UNDER CONSTANT PRESSURE EVEN WITH ENGINE OFF. BEFORE SERVICING FUEL RAIL, FUEL SYSTEM PRESSURE MUST BE RELEASED.

CAUTION: The left and right fuel rails are replaced as an assembly. Do not attempt to separate rail halves at connector tubes. Due to design of tubes, it does not use any clamps. Never attempt to install a clamping device of any kind to tubes. When removing fuel rail assembly for any reason, be careful not to bend or kink tubes.

1. Remove fuel tank filler tube cap.
2. Perform Fuel System Pressure Release Procedure.
3. Remove negative battery cable at battery.
4. Remove air duct at throttle body air box.
5. Remove air box at throttle body.
6. Remove air resonator mounting bracket at front of throttle body (2 bolts).
7. Disconnect fuel line latch clip and fuel line at fuel rail. A special tool will be necessary for fuel line disconnection. Refer to Quick-Connect Fittings.
8. Remove necessary vacuum lines at throttle body.
9. Disconnect electrical connectors at all 6 fuel injectors. Refer to graphic. Push red colored slider away from injector (1). While pushing slider, depress tab (2) and remove connector (3) from injector. The factory fuel injection wiring harness is numerically tagged (INJ 1, INJ 2, etc.) for injector position identification. If harness is not tagged, note wiring location before removal.
10. Disconnect electrical connectors at all throttle body sensors.
11. Remove 6 ignition coils. Refer to Ignition Coil Removal/Installation.



12. Remove four fuel rail mounting bolts (1).
13. Gently rock and pull **left** side of fuel rail until fuel injectors just start to clear machined holes in cylinder head. Gently rock and pull **right** side of rail until injectors just start to clear cylinder head holes. Repeat this procedure (left/right) until all injectors have cleared cylinder head holes.
14. Remove fuel rail (with injectors attached) from engine.
15. If fuel injectors are to be removed, refer to Fuel Injector Removal/Installation.

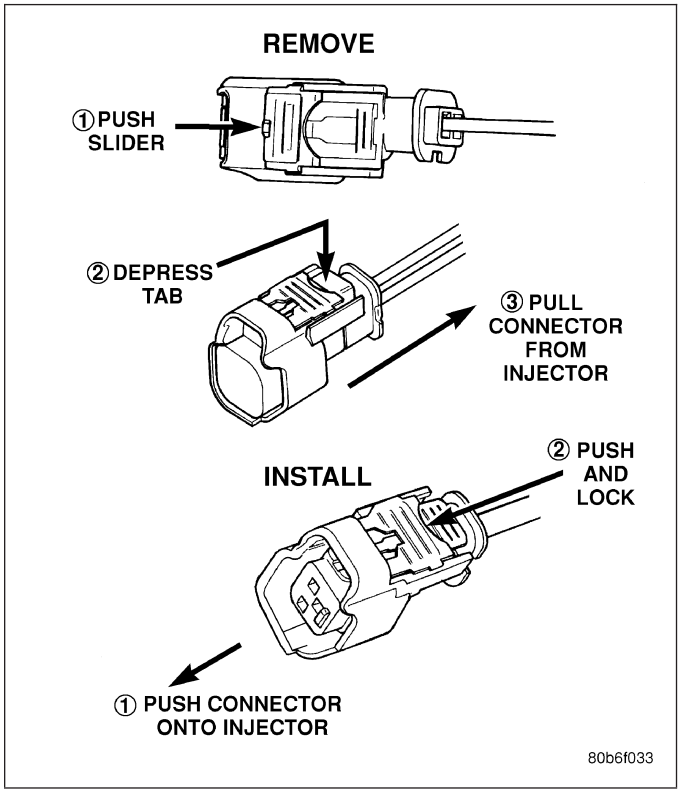


4.7L V-8

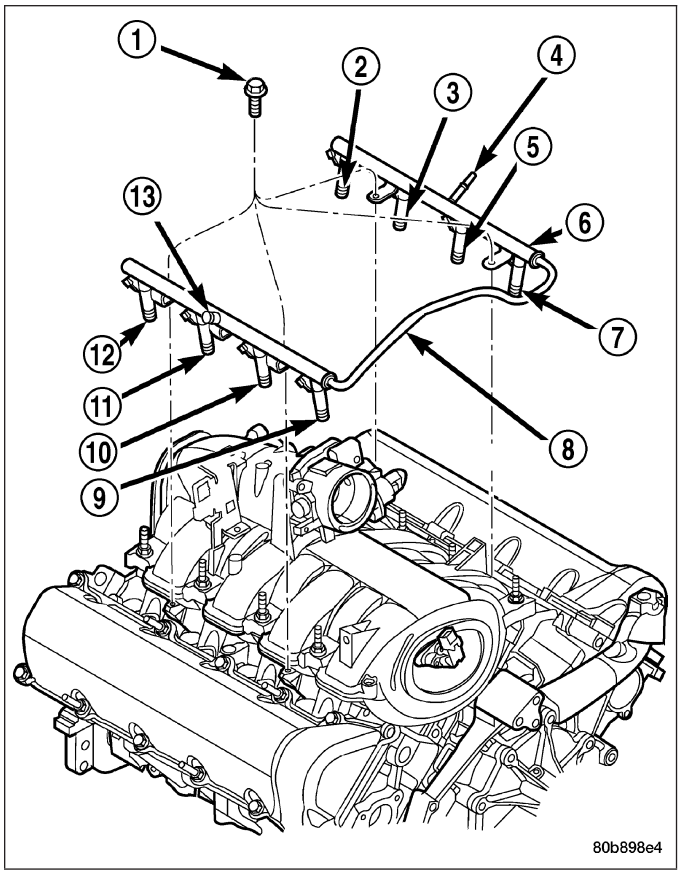
WARNING: THE FUEL SYSTEM IS UNDER CONSTANT PRESSURE EVEN WITH ENGINE OFF. BEFORE SERVICING FUEL RAIL, FUEL SYSTEM PRESSURE MUST BE RELEASED.

CAUTION: The left and right fuel rails are replaced as an assembly. Do not attempt to separate rail halves at connector tubes. Due to design of tubes, it does not use any clamps. Never attempt to install a clamping device of any kind to tubes. When removing fuel rail assembly for any reason, be careful not to bend or kink tubes.

1. Remove fuel tank filler tube cap.
2. Perform Fuel System Pressure Release Procedure.
3. Remove negative battery cable at battery.
4. Remove air duct at throttle body air box.
5. Remove air box at throttle body.
6. Remove air resonator mounting bracket at front of throttle body (2 bolts).
7. Disconnect fuel line latch clip and fuel line at fuel rail. A special tool will be necessary for fuel line disconnection. Refer to Quick-Connect Fittings.
8. Remove necessary vacuum lines at throttle body.
9. Disconnect electrical connectors at all 8 fuel injectors. Refer to graphic. Push red colored slider away from injector (1). While pushing slider, depress tab (2) and remove connector (3) from injector. The factory fuel injection wiring harness is numerically tagged (INJ 1, INJ 2, etc.) for injector position identification. If harness is not tagged, note wiring location before removal.
10. Disconnect electrical connectors at all throttle body sensors.
11. Remove 8 ignition coils. Refer to Ignition Coil Removal/Installation.



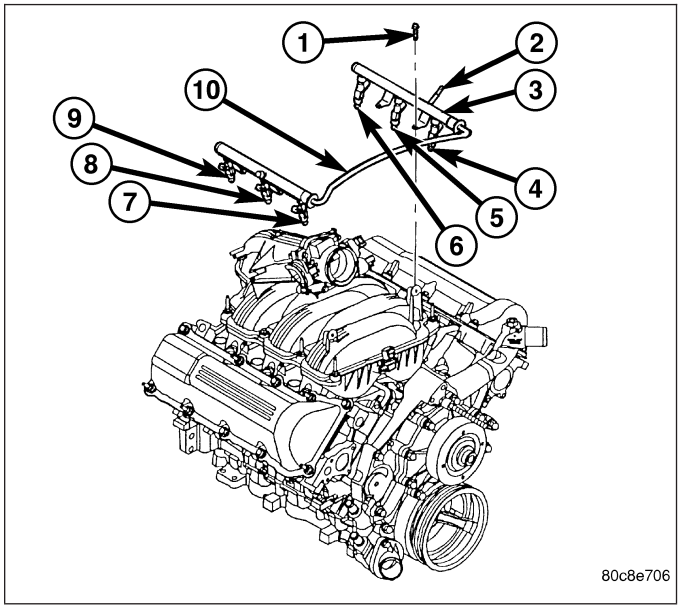
12. Remove 4 fuel rail mounting bolts (1).
13. Gently rock and pull **left** side of fuel rail until fuel injectors just start to clear machined holes in cylinder head. Gently rock and pull **right** side of rail until injectors just start to clear cylinder head holes. Repeat this procedure (left/right) until all injectors have cleared cylinder head holes.
14. Remove fuel rail (with injectors attached) from engine.
15. If fuel injectors are to be removed, refer to Fuel Injector Removal/Installation.



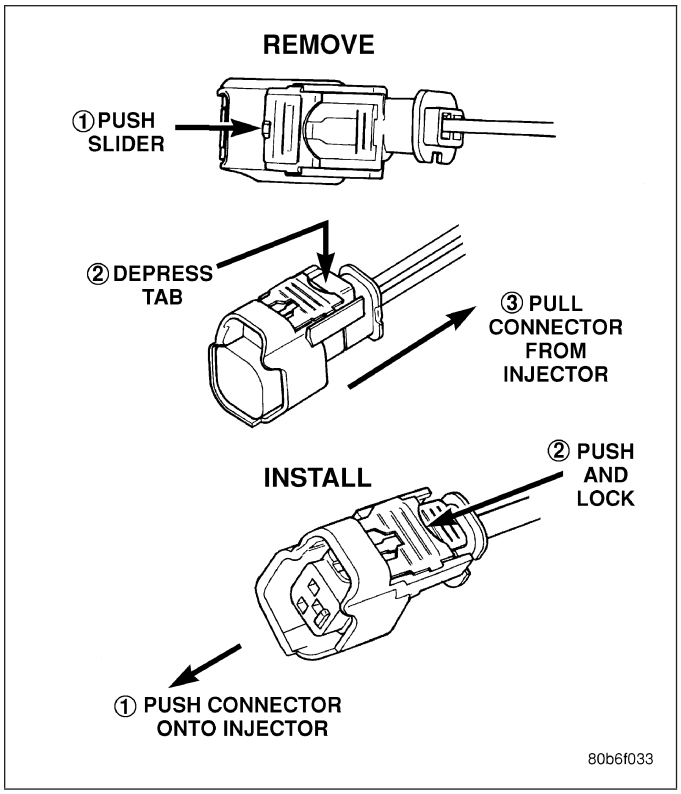
INSTALLATION

3.7L V-6

1. If fuel injectors are to be installed, refer to Fuel Injector Removal/Installation.
2. Clean out fuel injector machined bores in intake manifold.
3. Apply a small amount of engine oil to each fuel injector o-ring. This will help in fuel rail installation.
4. Position fuel rail/fuel injector assembly to machined injector openings in cylinder head.
5. Guide each injector into cylinder head. Be careful not to tear injector o-rings.
6. Push **right** side of fuel rail down until fuel injectors have bottomed on cylinder head shoulder. Push **left** fuel rail down until injectors have bottomed on cylinder head shoulder.
7. Install four fuel rail mounting bolts (1) and tighten. Refer to torque specifications.
8. Install 6 ignition coils. Refer to Ignition Coil Removal/Installation.
9. Connect electrical connectors to throttle body.

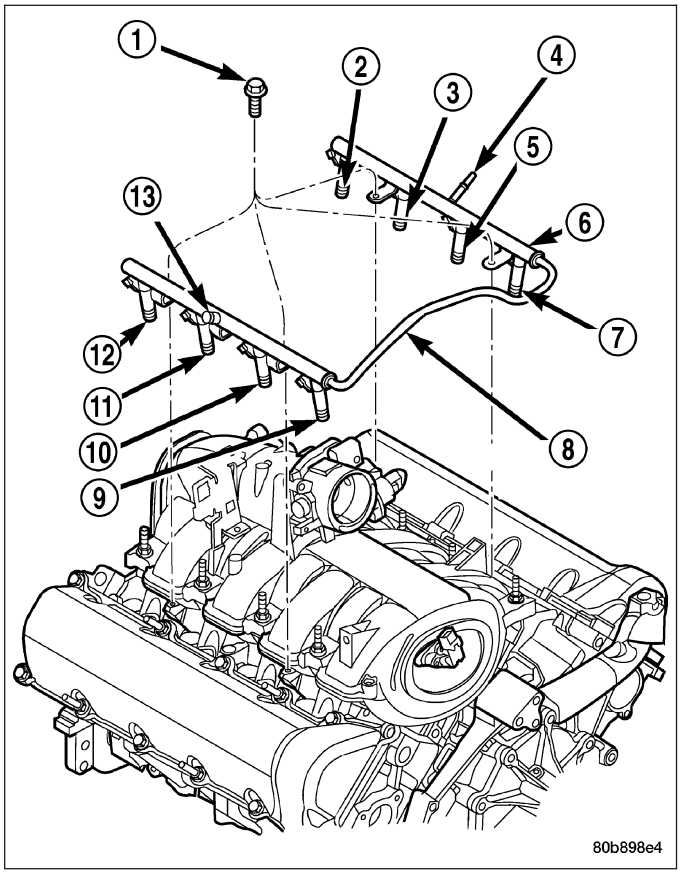


10. Connect electrical connectors at all fuel injectors. Refer to graphic. Push connector onto injector (1) and then push and lock red colored slider (2). Verify connector is locked to injector by lightly tugging on connector.
11. Connect necessary vacuum lines to throttle body.
12. Install air resonator mounting bracket near front of throttle body (2 bolts).
13. Connect fuel line latch clip and fuel line to fuel rail. Refer to Quick-Connect Fittings.
14. Install air box to throttle body.
15. Install air duct to air box.
16. Connect battery cable to battery.
17. Start engine and check for leaks.



4.7L V-8

1. If fuel injectors are to be installed, refer to Fuel Injector Removal/Installation.
2. Clean out fuel injector machined bores in intake manifold.
3. Apply a small amount of engine oil to each fuel injector o-ring. This will help in fuel rail installation.
4. Position fuel rail/fuel injector assembly to machined injector openings in cylinder head.
5. Guide each injector into cylinder head. Be careful not to tear injector o-rings.
6. Push **right** side of fuel rail down until fuel injectors have bottomed on cylinder head shoulder. Push **left** fuel rail down until injectors have bottomed on cylinder head shoulder.
7. Install four fuel rail mounting bolts (1) and tighten. Refer to torque specifications.
8. Install 8 ignition coils. Refer to Ignition Coil Removal/Installation.
9. Connect electrical connectors to throttle body.



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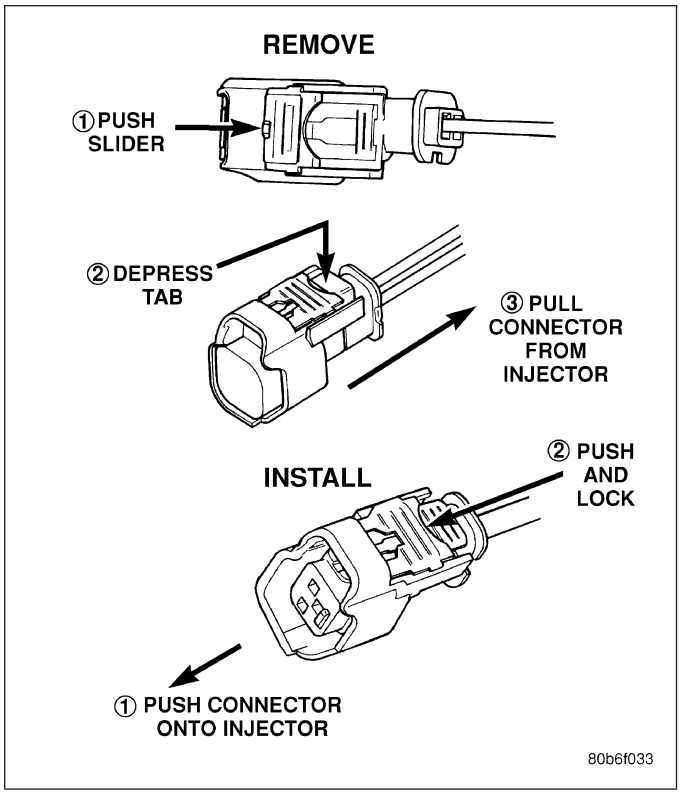
14. Install air box to throttle body.
15. Install air duct to air box.
16. Connect battery cable to battery.
17. Start engine and check for leaks.



TANK-FUEL

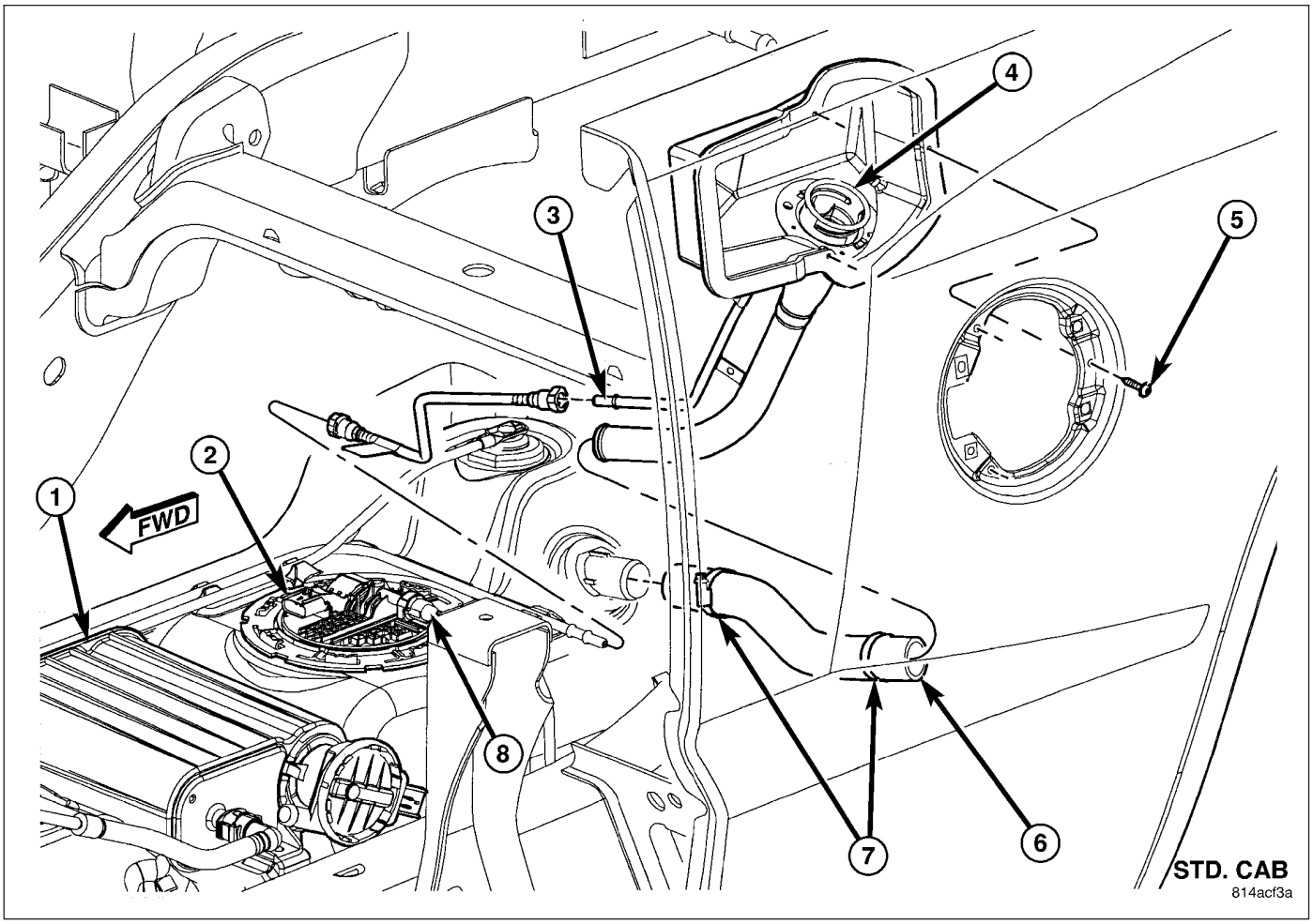
DESCRIPTION

The fuel tank is constructed of a plastic material. Its main functions are for fuel storage and for placement of the fuel pump module, and (if equipped) certain ORVR components.

REMOVAL

Fuel Tank Draining

WARNING: THE FUEL SYSTEM MAY BE UNDER CONSTANT FUEL PRESSURE EVEN WITH THE ENGINE OFF. THIS PRESSURE MUST BE RELEASED BEFORE SERVICING FUEL TANK.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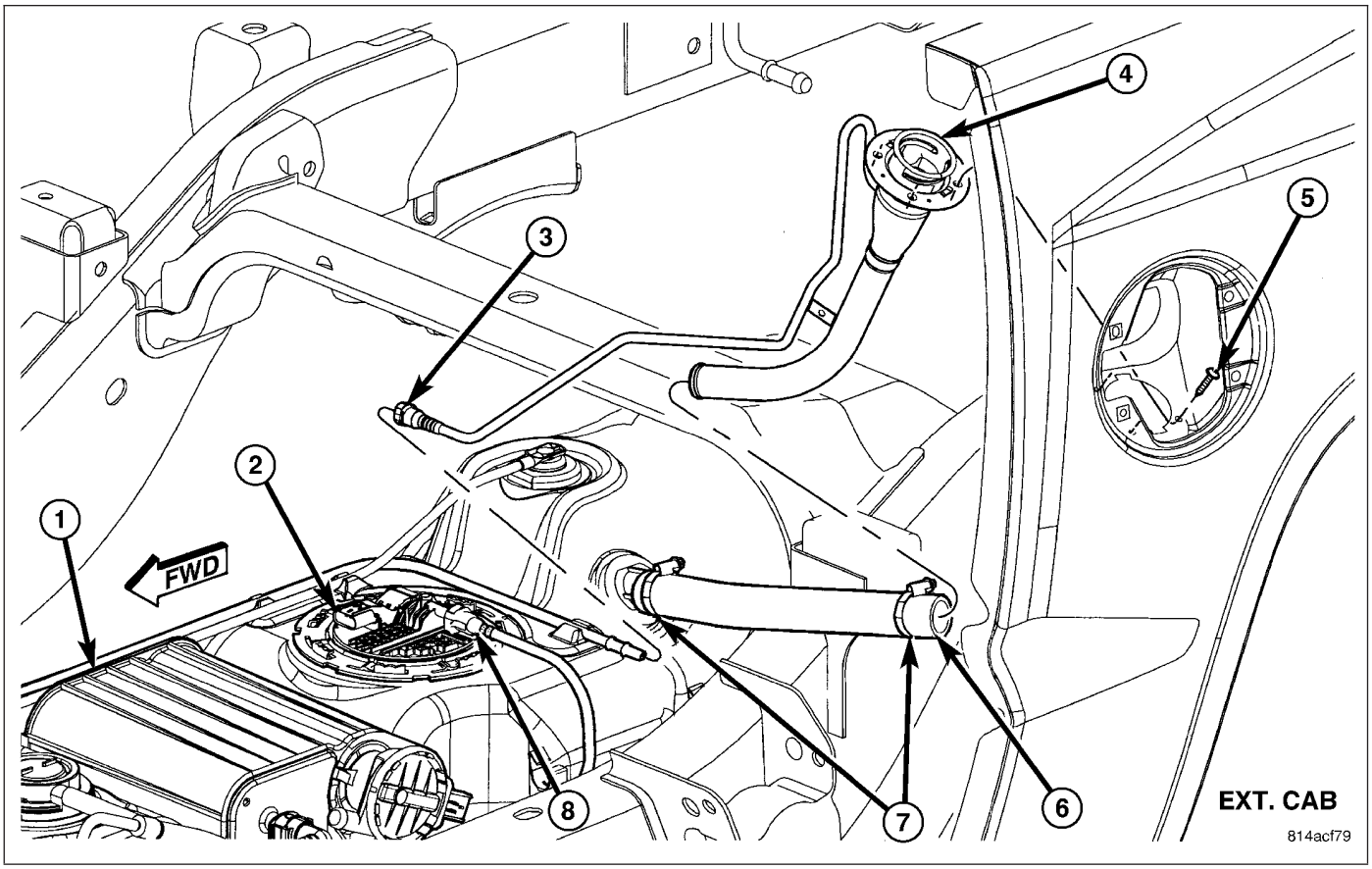
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EXT. CAB
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Two different procedures may be used to drain fuel tank: through the fuel fill fitting on tank, or using a diagnostic scan tool to activate the fuel pump relay.

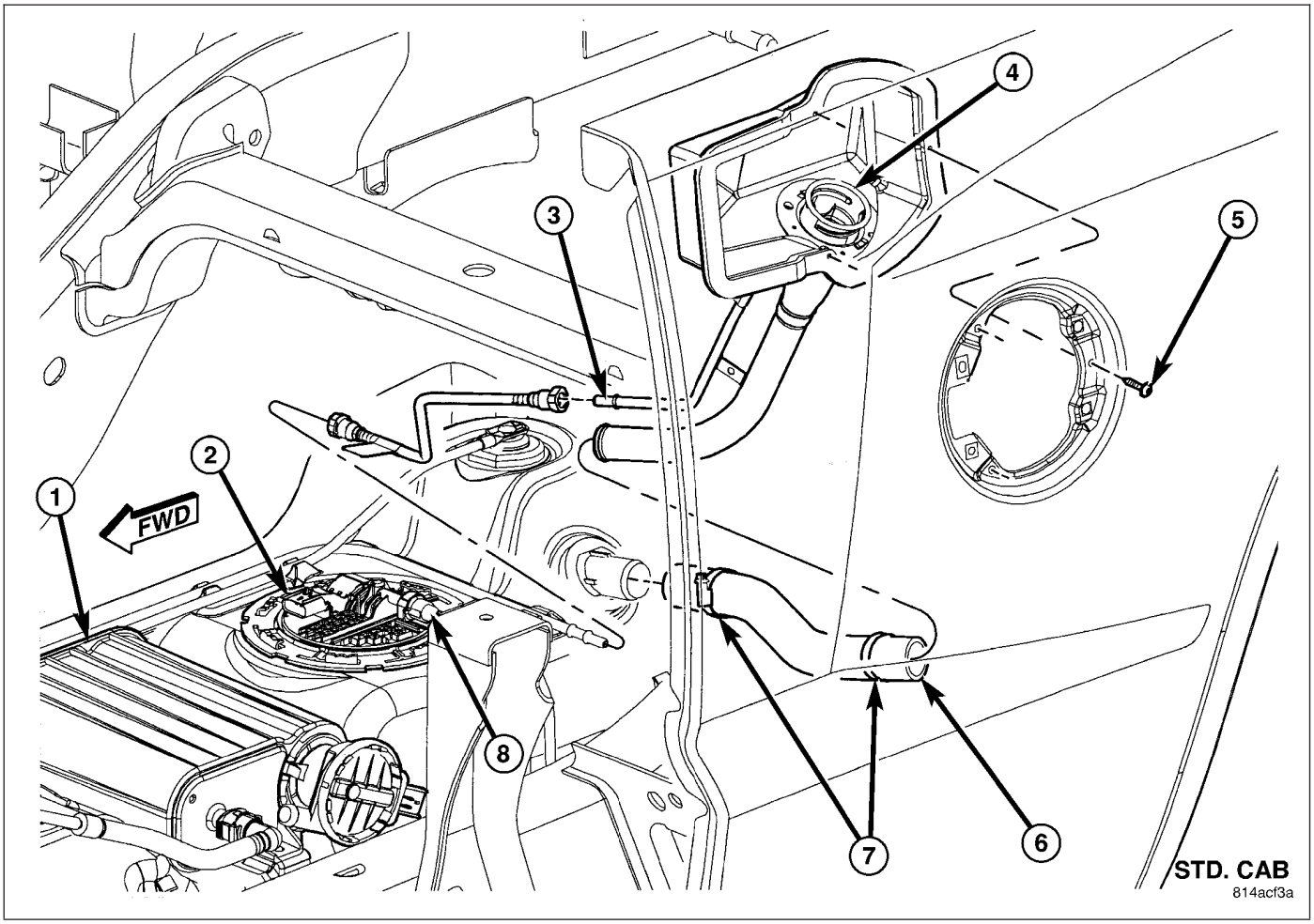
The quickest draining procedure involves removing the rubber fuel fill hose at the fuel tank fill fitting.

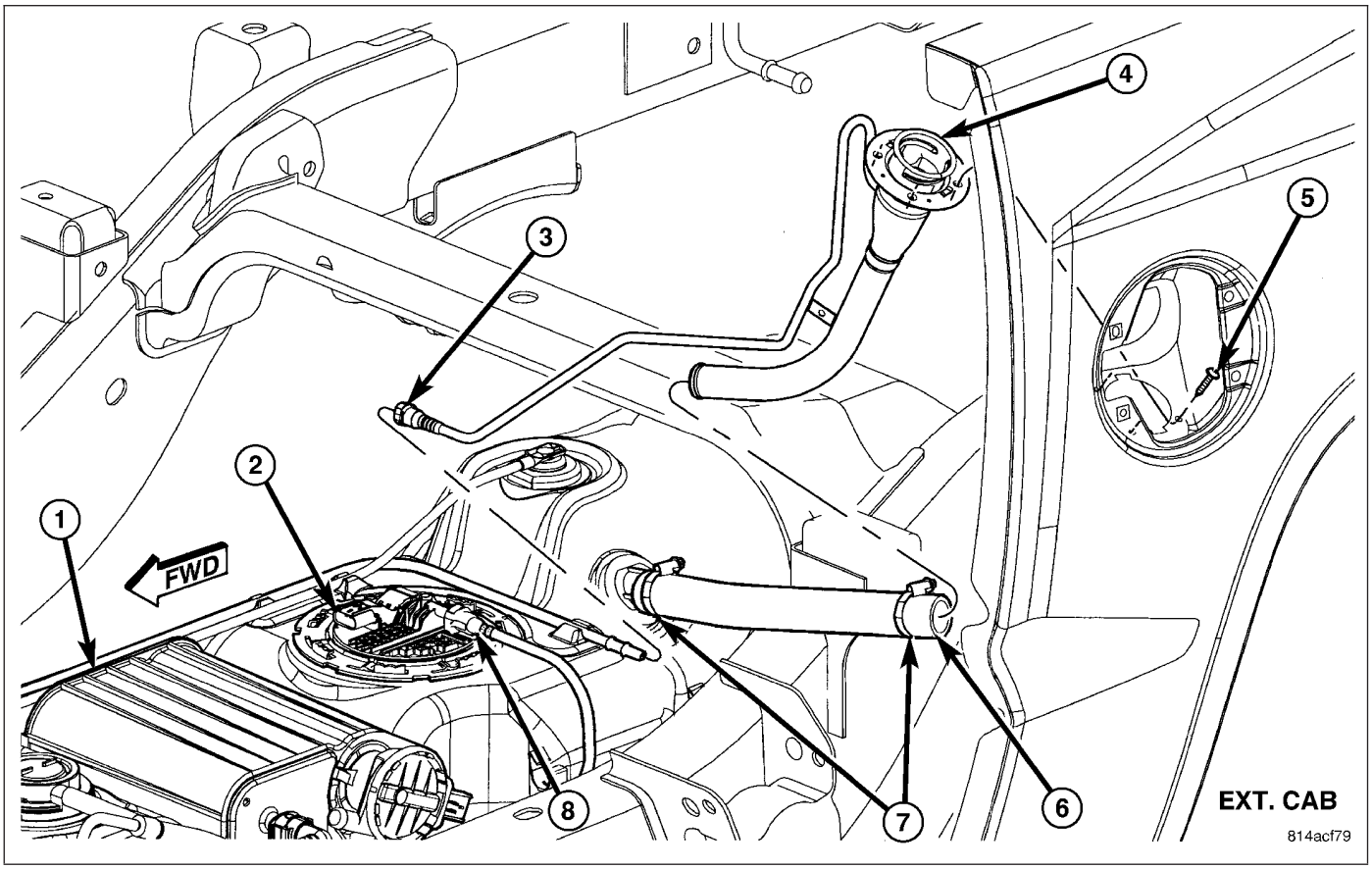
As an alternative procedure, the electric fuel pump may be activated allowing tank to be drained at fuel rail connection. Refer to scan tool for fuel pump activation procedures. Before disconnecting fuel line at fuel rail, release fuel pressure. Refer to the Fuel System Pressure Release Procedure for procedures. Attach end of special test hose tool number 6541, 6539, 6631 or 6923 at fuel rail disconnection (tool number will depend on model and/or engine application). Position opposite end of this hose tool to an approved gasoline draining station. Activate fuel pump and drain tank until empty.

If electric fuel pump is not operating, fuel must be drained through fuel fill fitting at tank. Refer to following procedures.

1. Release fuel system pressure.
2. Raise vehicle.
3. Remove left-rear tire/wheel.
4. Remove plastic fender liner in front of left-rear tire/wheel.
5. Thoroughly clean area around fuel fill fitting and rubber fuel fill hose (6) at fuel tank.
6. Loosen clamp (7) and disconnect rubber fuel fill hose at fuel tank fitting. Using an approved gas holding tank, drain fuel tank through this fitting.

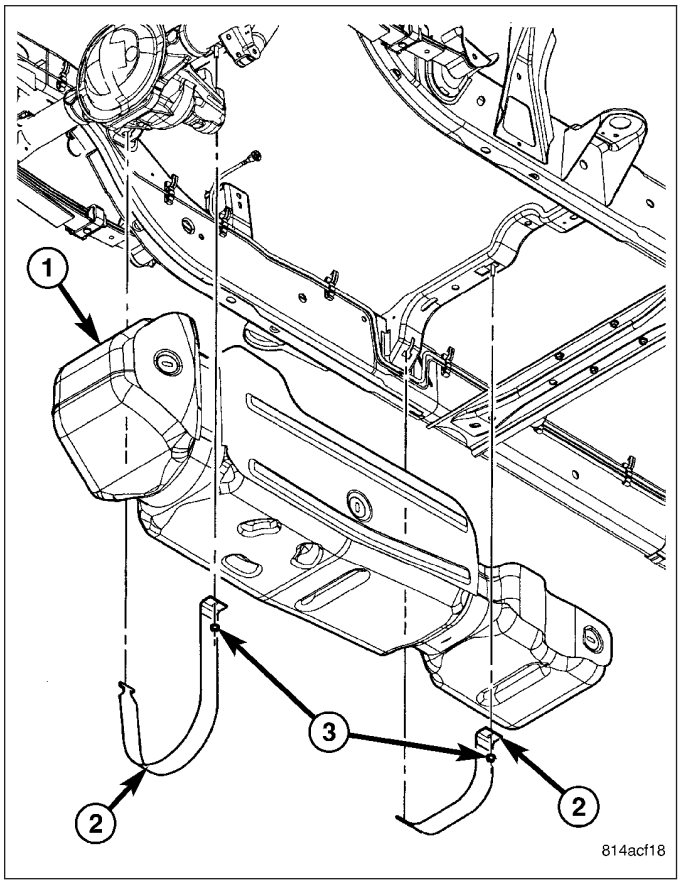
Tank Removal





1. Disconnect vent line (3) from tank.
2. If equipped, remove fuel tank skid plate.
3. Disconnect NVLD, ORVR and EVAP lines at front of tank.

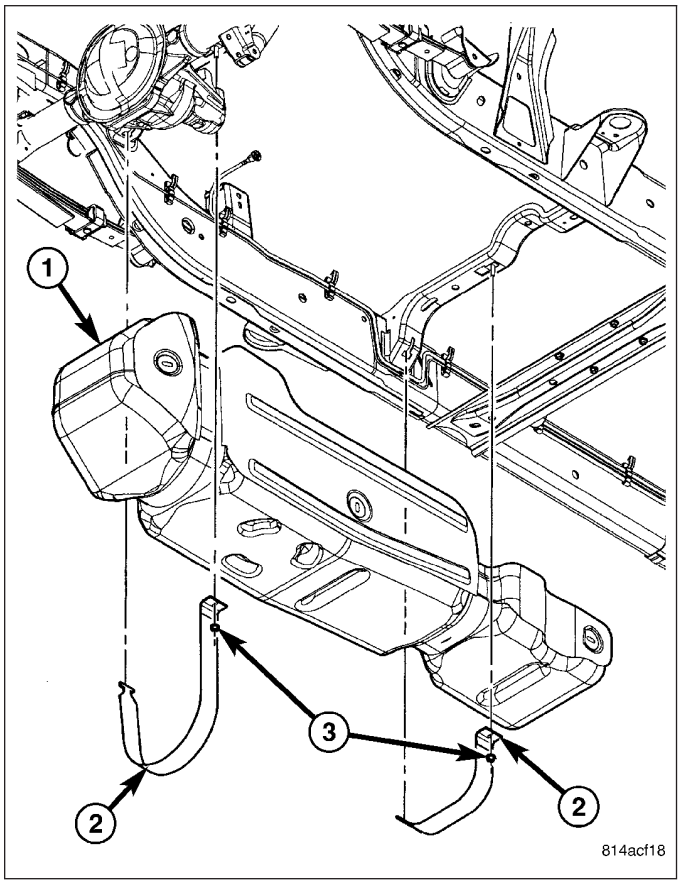
4. Disconnect electrical connector at NVLD pump.
5. Support tank with a hydraulic jack.
6. Remove two fuel tank strap nuts (3) and remove both tank support straps (2).
7. Carefully lower tank a few inches and disconnect fuel pump module electrical connector at top of tank. To disconnect electrical connector: Push upward on red colored tab to unlock. Push on black colored tab while removing connector.
8. Disconnect fuel line at fuel pump module fitting by pressing on tabs at side of quick-connect fitting.
9. Continue to lower tank for removal.
10. If fuel tank is to be replaced, remove fuel pump module from tank. Refer to Fuel Pump Module Removal/Installation procedures.

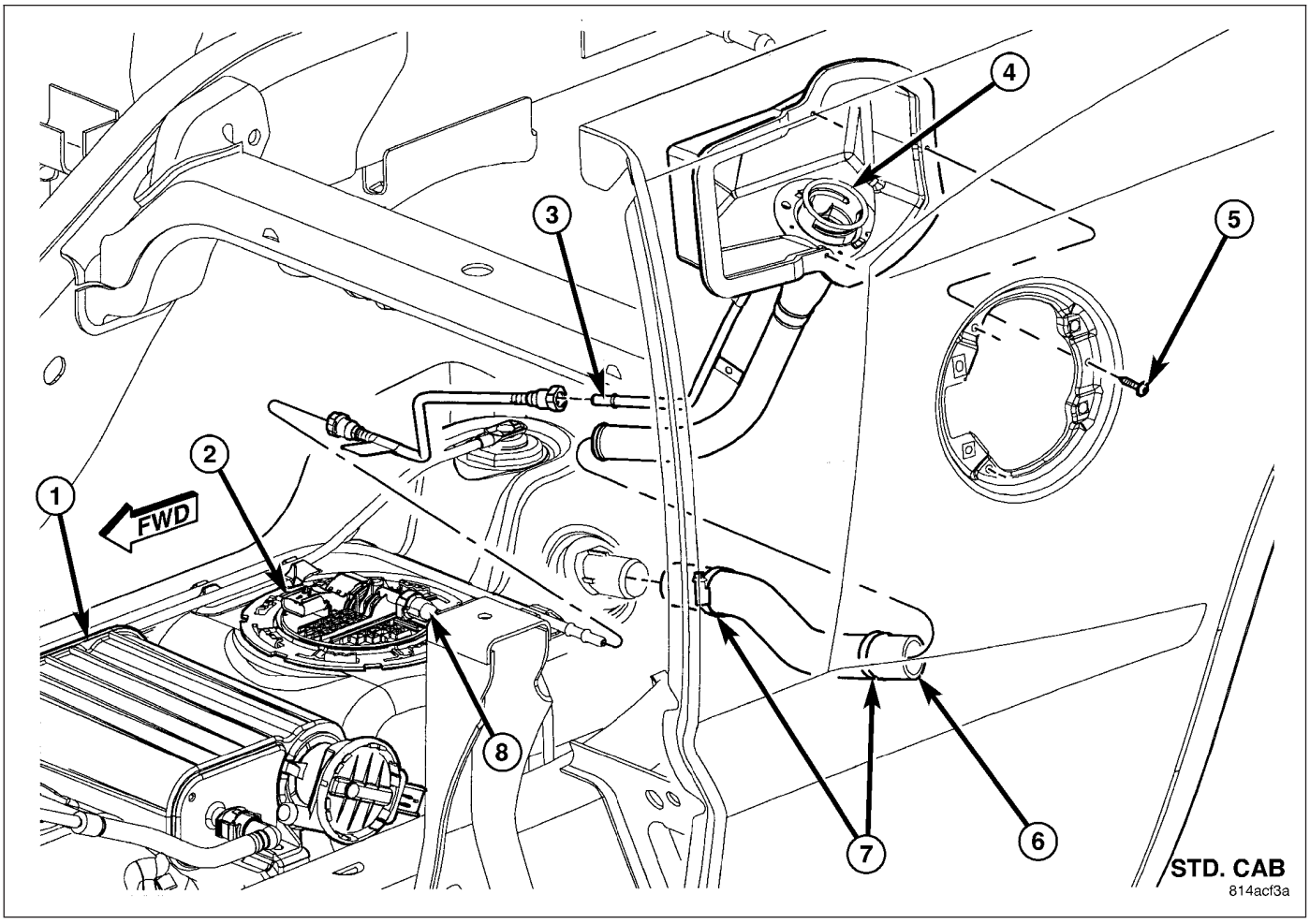


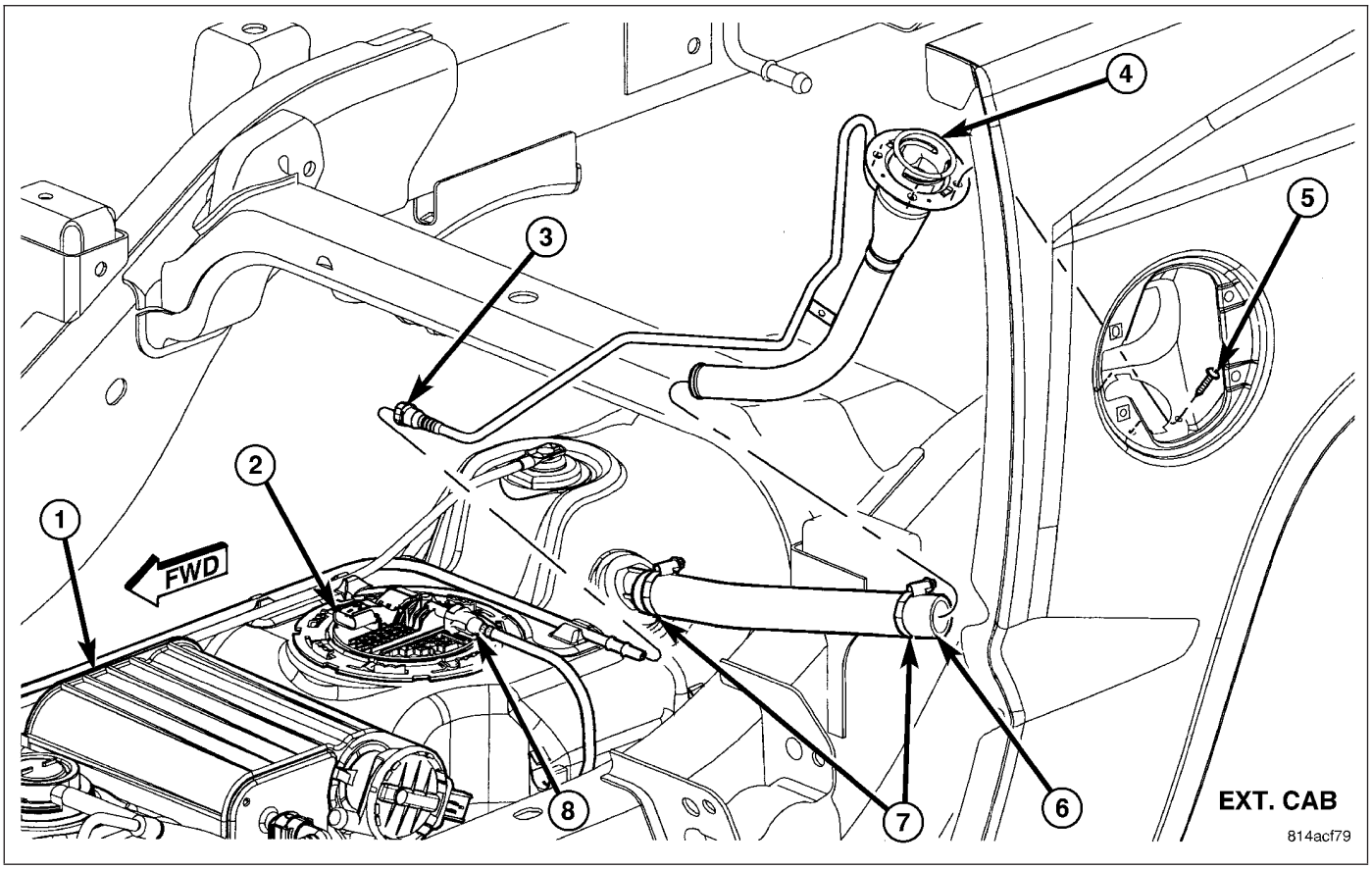
INSTALLATION

1. If fuel tank is to be replaced, install fuel pump module into tank. Refer to Fuel Pump Module Removal/Installation procedures.

2. Position fuel tank to hydraulic jack.
3. Raise tank until positioned near body.
4. Connect fuel pump module electrical connector at top of tank.
5. Connect NVLD pump electrical connector to NVLD pump.
6. Connect fuel line quick-connect fitting to pump module.
7. Continue raising tank until positioned snug to body.
8. Install and position both tank support straps (2). Install two fuel tank strap nuts (3) and tighten. Refer to Torque Specifications.
9. Connect EVAP, ORVR and NVLD lines at front of tank.







10. Connect vent line (3).
11. Connect rubber fill hose (6) to fuel tank fitting and tighten hose clamps (7).
12. **The vapor/vacuum lines and hoses must be firmly connected. Also check the vapor/vacuum lines at the NVLD pump, NVLD filter and EVAP canister purge solenoid for damage or leaks. If a leak is present, a Diagnostic Trouble Code (DTC) may be set.**
13. If equipped, install fuel tank skid plate.
14. Install plastic liner in front of left-rear tire/wheel.
15. Install left-rear tire/wheel.
16. Lower vehicle.
17. Fill fuel tank with fuel.
18. Start engine and check for fuel leaks near top of module.

FILTER-INLET

DESCRIPTION

Refer to Fuel Pump Module for information.

REGULATOR-FUEL PRESSURE

DESCRIPTION

Refer to Fuel Pump Module for information.

FILTER-FUEL

DESCRIPTION

Refer to Fuel Pump Module for information.

FUEL INJECTION

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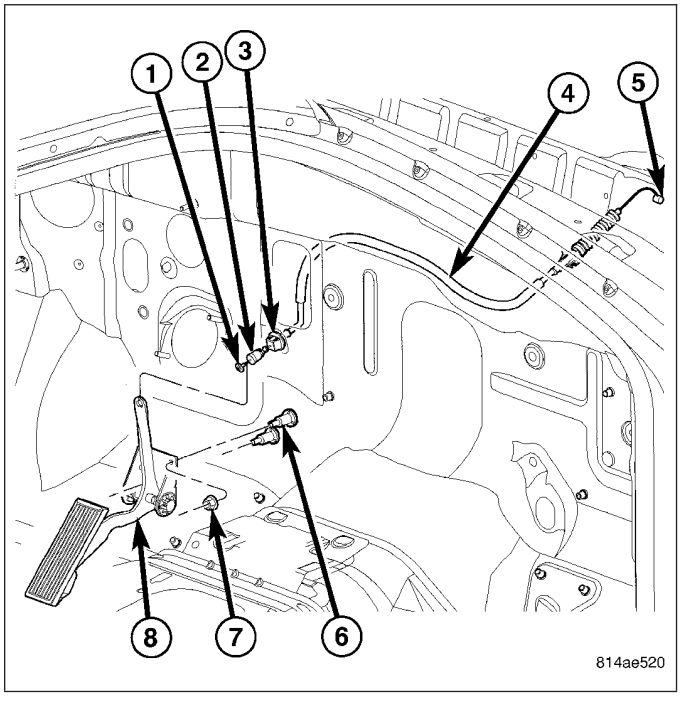
PEDAL-ACCELERATOR

REMOVAL

The accelerator pedal is serviced as a complete assembly (8) including the bracket.

The accelerator cable (4) is connected to the upper part of the accelerator pedal arm by a plastic retainer (clip) (2). This plastic retainer snaps into the top of the accelerator pedal arm.

1. From inside the vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) (2) and throttle cable core wire from upper end of accelerator pedal arm. Plastic cable retainer (clip) snaps into pedal arm.
2. Remove two accelerator pedal mounting bracket nuts (7). Remove accelerator pedal assembly (8).

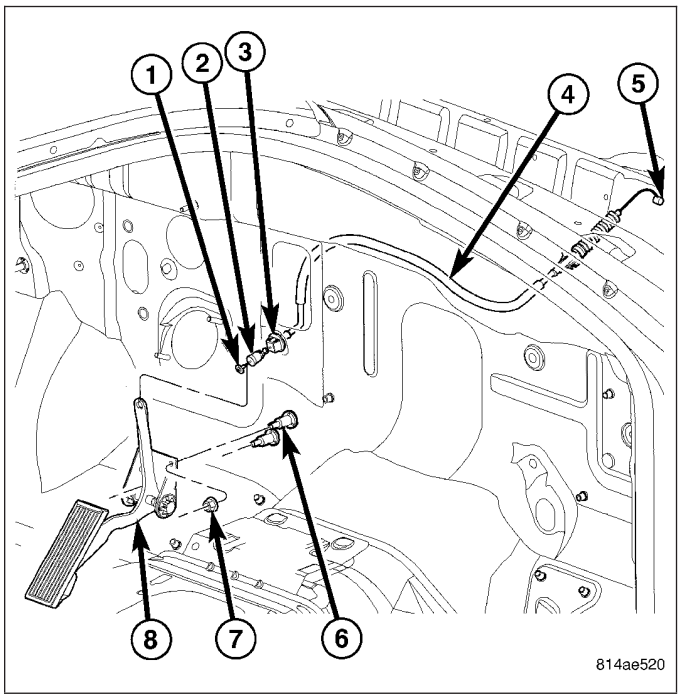


INSTALLATION

The accelerator pedal is serviced as a complete assembly (8) including the bracket.

The accelerator cable is connected to the upper part of the accelerator pedal arm by a plastic retainer (clip) (7). This plastic retainer snaps into the top of the accelerator pedal arm.

1. Place accelerator pedal assembly (8) over two mounting studs (6).
2. Install and tighten two mounting nuts (7). Refer to Torque Specifications.
3. Slide throttle cable (1) into opening slot in top of pedal arm.
4. Push plastic cable retainer (clip) (2) into accelerator pedal arm opening until it snaps into place.
5. Before starting engine, operate accelerator pedal to check for any binding.

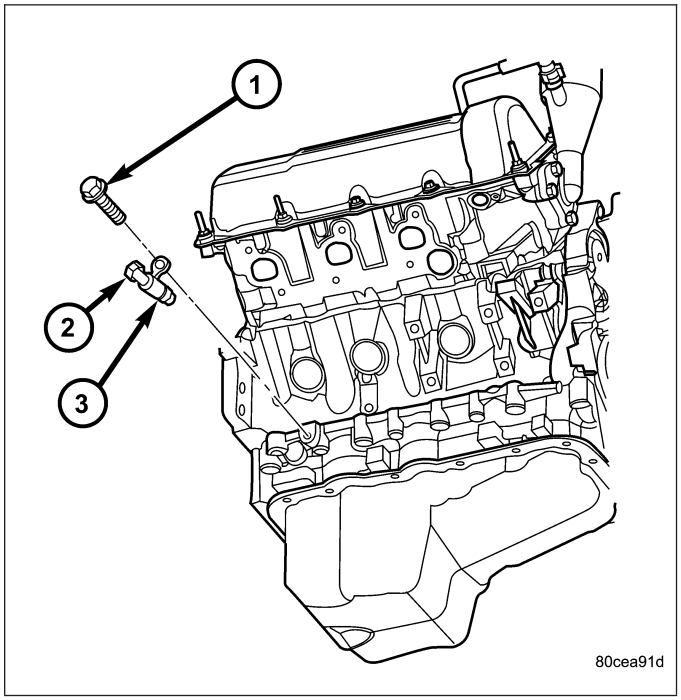


SENSOR-CRANKSHAFT POSITION

DESCRIPTION

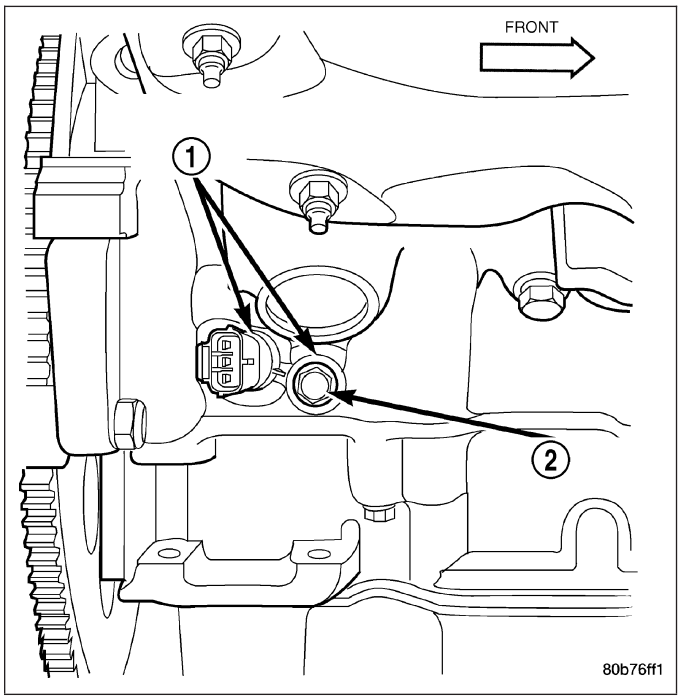
3.7L V-6

The Crankshaft Position (CKP) sensor (2) is mounted into the right rear side of the cylinder block. It is positioned and bolted into a machined hole.



4.7L V-8

The Crankshaft Position (CKP) sensor (1) is mounted into the right rear side of the cylinder block. It is positioned and bolted into a machined hole.



OPERATION

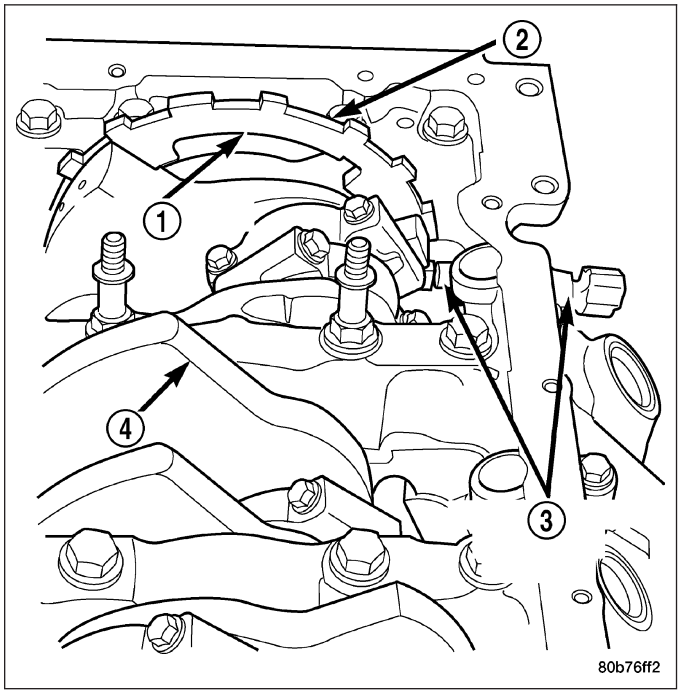
3.7L V-6

Engine speed and crankshaft position are provided through the CKP (Crankshaft Position) sensor. The sensor generates pulses that are the input sent to the Powertrain Control Module (PCM). The PCM interprets the sensor input to determine the crankshaft position. The PCM then uses this position, along with other inputs, to determine injector sequence and ignition timing.

The sensor (3) is a hall effect device combined with an internal magnet. It is also sensitive to steel within a certain distance from it.

A tonewheel (targetwheel) is bolted to the engine crankshaft (1). This tonewheel has sets of notches (2) at its outer edge.

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM.



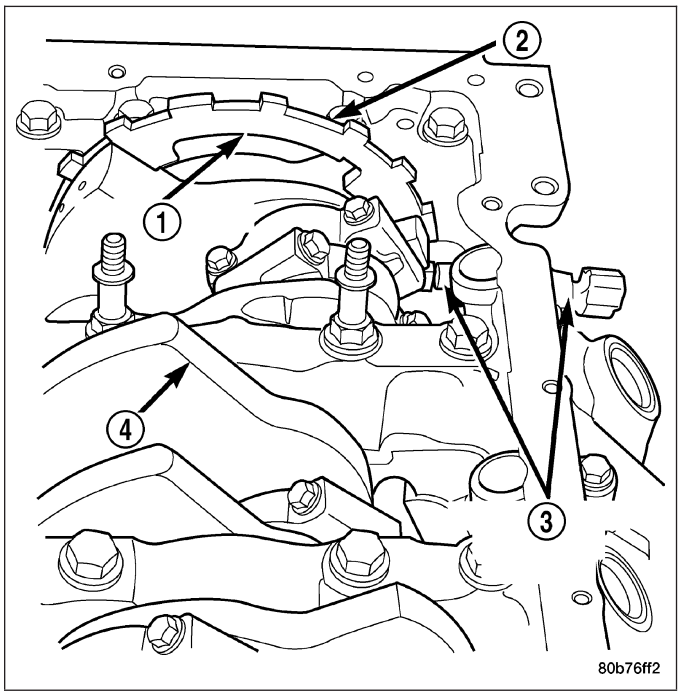
4.7L V-8

Engine speed and crankshaft position are provided through the crankshaft position sensor. The sensor generates pulses that are the input sent to the powertrain control module (PCM). The PCM interprets the sensor input to determine the crankshaft position. The PCM then uses this position, along with other inputs, to determine injector sequence and ignition timing.

The sensor (3) is a hall effect device combined with an internal magnet. It is also sensitive to steel within a certain distance from it.

On the 4.7L V–8 engine, a tonewheel (1) is bolted to the engine crankshaft. This tonewheel has sets of notches (2) at its outer edge.

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM.

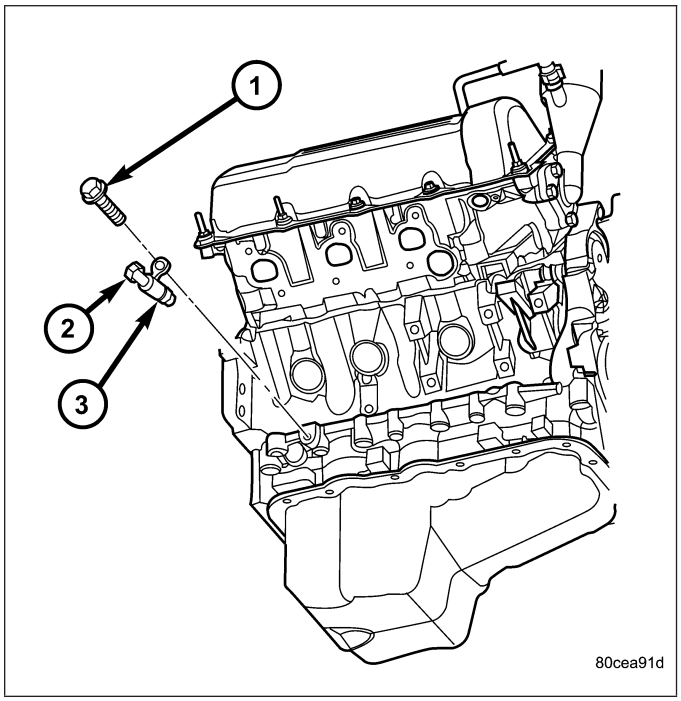


REMOVAL

3.7L V-6

The Crankshaft Position (CKP) sensor (2) is mounted into the right rear side of the cylinder block. It is positioned and bolted into a machined hole.

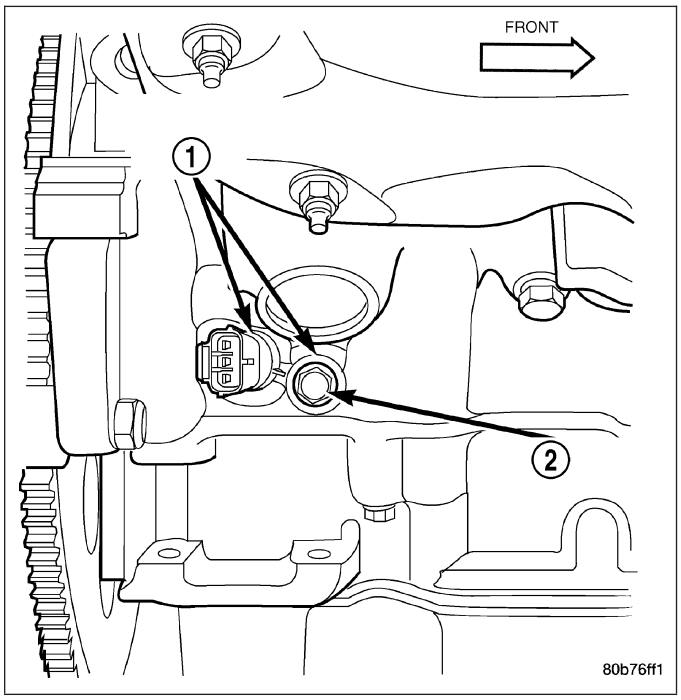
1. Raise vehicle.
2. Disconnect sensor electrical connector.
3. Remove sensor mounting bolt (1).
4. Carefully twist sensor from cylinder block.
5. Check condition of sensor o-ring (3).



4.7L V-8

The Crankshaft Position (CKP) sensor (1) is located at the right-rear side of the engine cylinder block. It is positioned and bolted into a machined hole in the engine block.

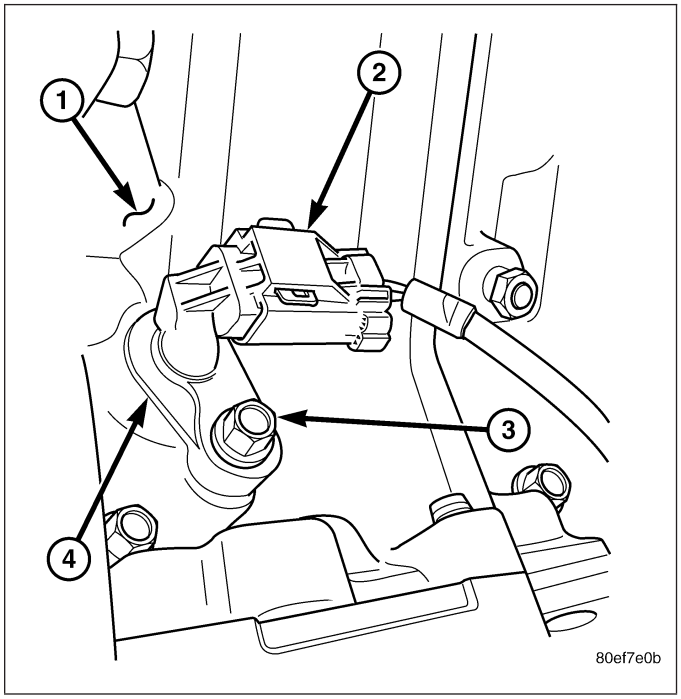
1. Raise vehicle.
2. Disconnect CKP electrical connector at sensor.
3. Remove CKP mounting bolt (2).
4. Carefully twist sensor from cylinder block.
5. Remove sensor from vehicle.
6. Check condition of sensor o-ring.



5.7L V-8

The Crankshaft Position (CKP) sensor (4) is located at the right-rear side of the engine cylinder block (1). It is positioned and bolted into a machined hole in the engine block.

1. Raise vehicle.
2. Disconnect CKP electrical connector (2) at sensor.
3. Remove CKP mounting bolt (3).
4. Carefully twist sensor from cylinder block.
5. Remove sensor from vehicle.
6. Check condition of sensor o-ring.



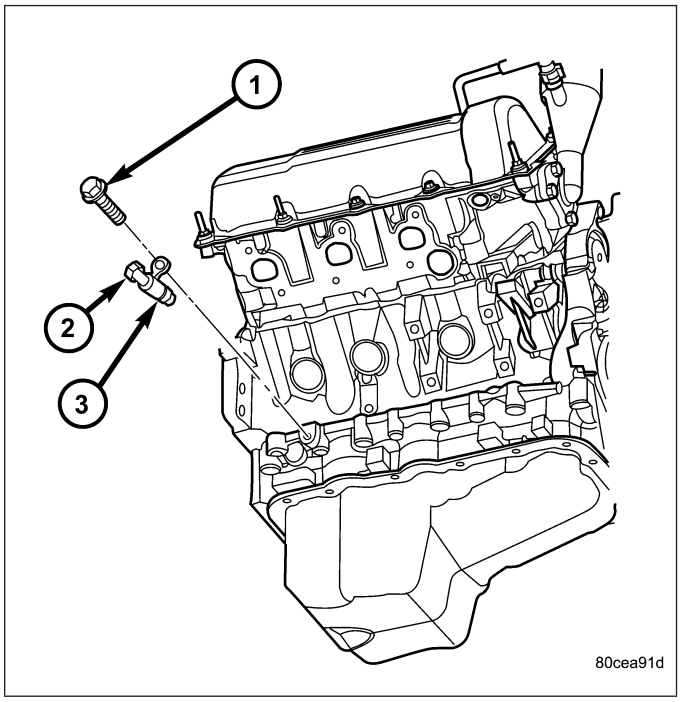
INSTALLATION

3.7L V-6

1. Clean out machined hole in engine block.
2. Apply a small amount of engine oil to sensor o-ring (3).
3. Install sensor (2) into engine block with a slight rocking and twisting action.

CAUTION: Before tightening sensor mounting bolt (1), be sure sensor is completely flush to cylinder block. If sensor is not flush, damage to sensor mounting tang may result.

4. Install mounting bolt (1) and tighten to 28 N·m (21 ft. lbs.) torque.
5. Connect electrical connector to sensor.
6. Lower vehicle.

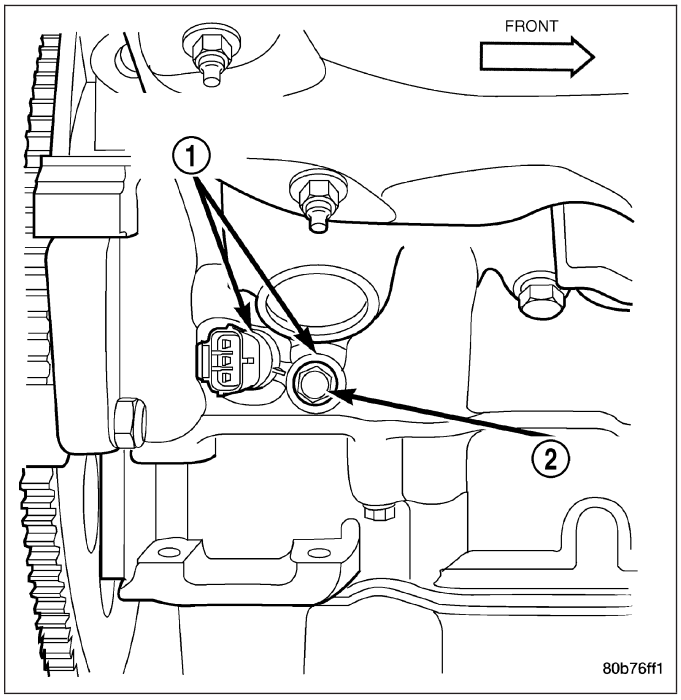


4.7L V-8

1. Clean out machined hole in engine block.
2. Apply a small amount of engine oil to sensor o-ring.
3. Install sensor (1) into engine block with a slight rocking and twisting action.

CAUTION: Before tightening sensor mounting bolt (2) , be sure sensor is completely flush to cylinder block. If sensor is not flush, damage to sensor mounting tang may result.

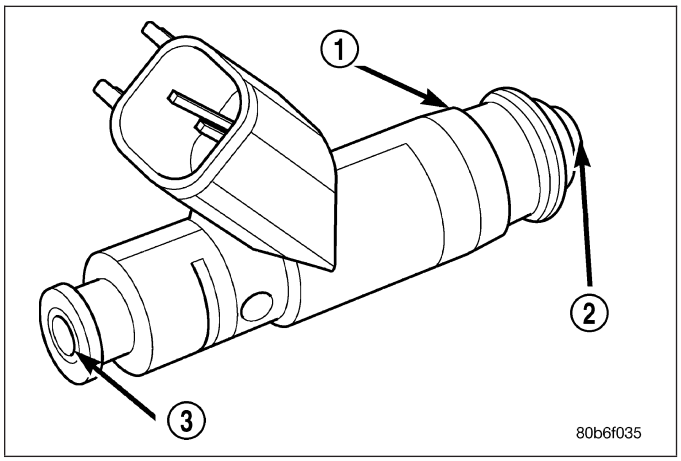
4. Install mounting bolt (2) and tighten to 28 N·m (21 ft. lbs.) torque.
5. Connect electrical connector to sensor.
6. Lower vehicle.



INJECTOR-FUEL

DESCRIPTION

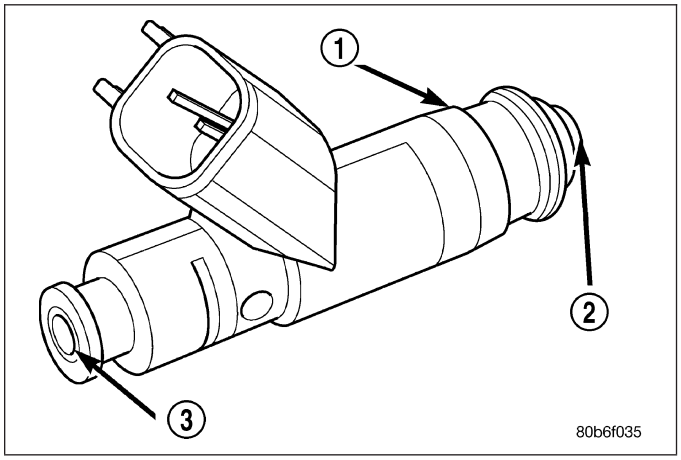
An individual fuel injector (1) is used for each individual cylinder.



OPERATION - FUEL INJECTOR

The top (fuel entry) end of the injector (3) is attached into an opening on the fuel rail.

The fuel injectors are electrical solenoids. The injector contains a pintle that closes off an orifice at the nozzle end. When electric current is supplied to the injector, the armature and needle move a short distance against a spring, allowing fuel to flow out the orifice. Because the fuel is under high pressure, a fine spray is developed in the shape of a pencil stream. The spraying action atomizes the fuel, adding it to the air entering the combustion chamber.



The nozzle (outlet) ends of the injectors (2) are positioned into openings in the intake manifold just above the intake valve ports of the cylinder head. The engine wiring harness connector for each fuel injector is equipped with an attached numerical tag (INJ 1, INJ 2 etc.). This is used to identify each fuel injector.

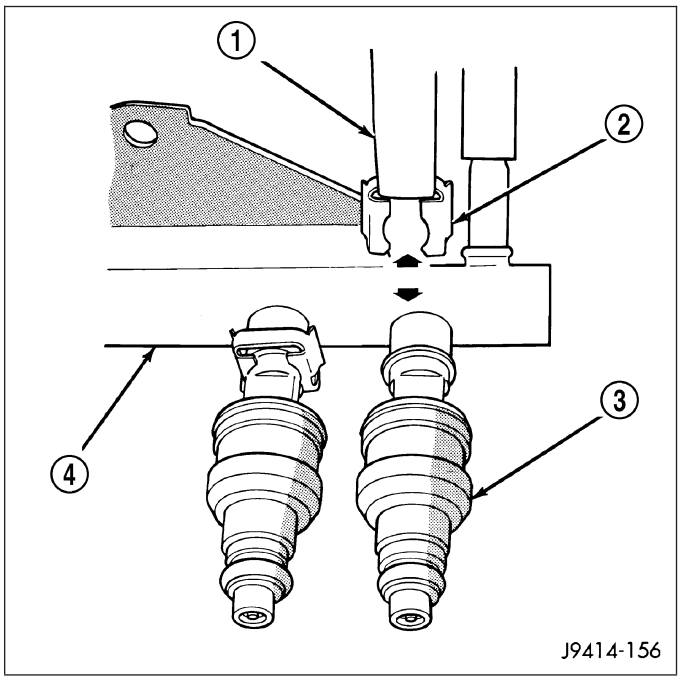
The injectors are energized individually in a sequential order by the Powertrain Control Module (PCM). The PCM will adjust injector pulse width by switching the ground path to each individual injector on and off. Injector pulse width is the period of time that the injector is energized. The PCM will adjust injector pulse width based on various inputs it receives.

Battery voltage is supplied to the injectors through the ASD relay.

The PCM determines injector pulse width based on various inputs.

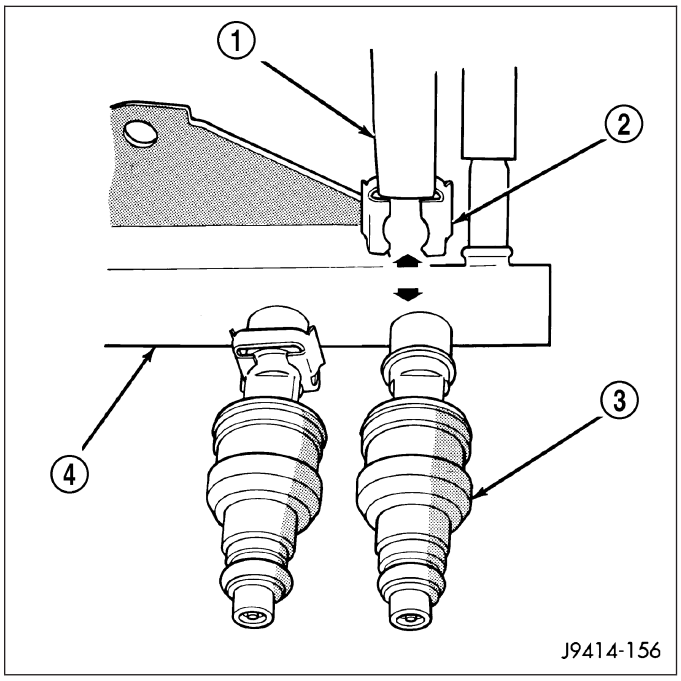
REMOVAL

1. Remove fuel rail. Refer to Fuel Injector Rail Removal.
2. Disconnect clip(s) (2) that retain fuel injector(s) to fuel rail (4).



INSTALLATION

1. Install fuel injector(s) (3) into fuel rail assembly (4) and install retaining clip(s) (2).
2. If same injector(s) is being reinstalled, install new o-ring(s).
3. Apply a small amount of clean engine oil to each injector o-ring. This will aid in installation.
4. Install fuel rail. Refer to Fuel Rail Installation.
5. Start engine and check for fuel leaks.



RELAY-FUEL PUMP

DESCRIPTION

The 5–pin, 12–volt, fuel pump relay is located in the Power Distribution Center (PDC). Refer to the label on the PDC cover for relay location.

OPERATION

The Powertrain Control Module (PCM) energizes the electric fuel pump through the fuel pump relay. The fuel pump relay is energized by first applying battery voltage to it when the ignition key is turned ON, and then applying a ground signal to the relay from the PCM.

Whenever the ignition key is turned ON, the electric fuel pump will operate. But, the PCM will shut-down the ground circuit to the fuel pump relay in approximately 1–3 seconds unless the engine is operating or the starter motor is engaged.

REMOVAL

The fuel pump relay is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

1. Remove PDC cover.
2. Remove relay from PDC.
3. Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.
4. Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

INSTALLATION

The fuel pump relay is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

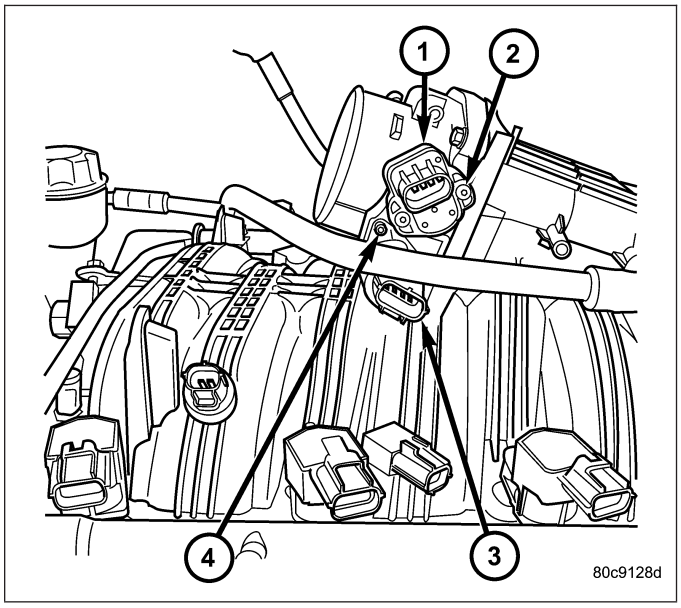
1. Install relay to PDC.
2. Install cover to PDC.

MOTOR-IDLE AIR CONTROL

DESCRIPTION

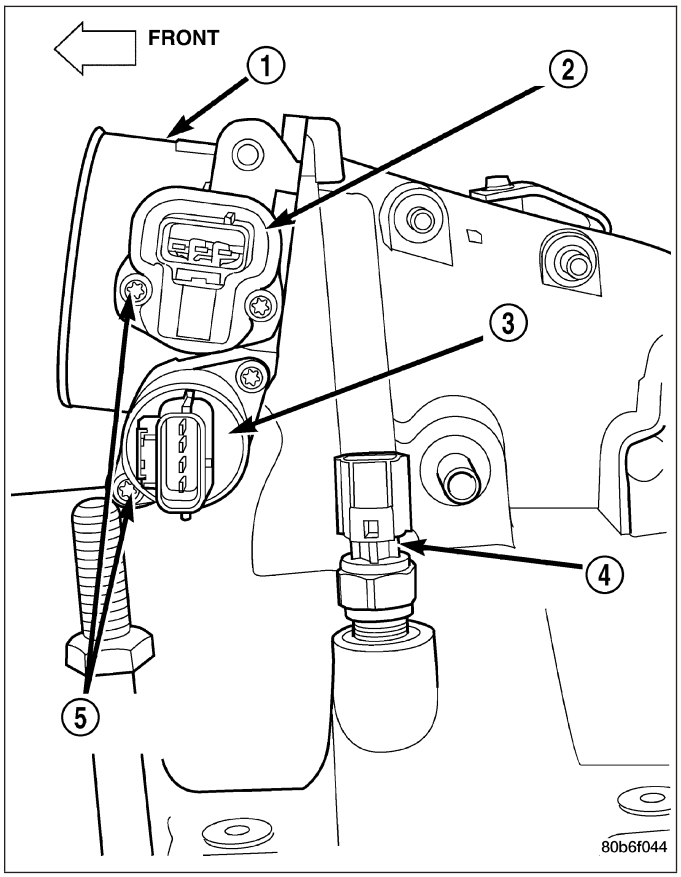
3.7L Engine

The Idle Air Control (IAC) stepper motor (3) is mounted to the throttle body.



4.7L Engine

The Idle Air Control (IAC) stepper motor (3) is mounted to the throttle body.



OPERATION

A separate IAC motor is not used with the 5.7L V-8 engine.

At idle, engine speed can be increased by retracting the IAC motor pintle and allowing more air to pass through the port, or it can be decreased by restricting the passage with the pintle and diminishing the amount of air bypassing the throttle plate.

The IAC is called a stepper motor because it is moved (rotated) in steps, or increments. Opening the IAC opens an air passage around the throttle blade which increases RPM.

The PCM uses the IAC motor to control idle speed (along with timing) and to reach a desired MAP during decel (keep engine from stalling).

The IAC motor has 4 wires with 4 circuits. Two of the wires are for 12 volts and ground to supply electrical current to the motor windings to operate the stepper motor in one direction. The other 2 wires are also for 12 volts and ground to supply electrical current to operate the stepper motor in the opposite direction.

To make the IAC go in the opposite direction, the PCM just reverses polarity on both windings. If only 1 wire is open, the IAC can only be moved 1 step (increment) in either direction. To keep the IAC motor in position when no movement is needed, the PCM will energize both windings at the same time. This locks the IAC motor in place.

In the IAC motor system, the PCM will count every step that the motor is moved. This allows the PCM to determine the motor pintle position. If the memory is cleared, the PCM no longer knows the position of the pintle. So at the first key ON, the PCM drives the IAC motor closed, regardless of where it was before. This zeros the counter. From this point the PCM will back out the IAC motor and keep track of its position again.

When engine rpm is above idle speed, the IAC is used for the following:

- Off-idle dashpot (throttle blade will close quickly but idle speed will not stop quickly)
- Deceleration air flow control
- A/C compressor load control (also opens the passage slightly before the compressor is engaged so that the engine rpm does not dip down when the compressor engages)
- Power steering load control

The PCM can control polarity of the circuit to control direction of the stepper motor.

IAC Stepper Motor Program: The PCM is also equipped with a memory program that records the number of steps the IAC stepper motor most recently advanced to during a certain set of parameters. For example: The PCM was attempting to maintain a 1000 rpm target during a cold start-up cycle. The last recorded number of steps for that may have been 125. That value would be recorded in the memory cell so that the next time the PCM recognizes the identical conditions, the PCM recalls that 125 steps were required to maintain the target. This program allows for greater customer satisfaction due to greater control of engine idle.

Another function of the memory program, which occurs when the power steering switch (if equipped), or the A/C request circuit, requires that the IAC stepper motor control engine rpm, is the recording of the last targeted steps into the memory cell. The PCM can anticipate A/C compressor loads. This is accomplished by delaying compressor operation for approximately 0.5 seconds until the PCM moves the IAC stepper motor to the recorded steps that were loaded into the memory cell. Using this program helps eliminate idle-quality changes as loads change. Finally, the PCM incorporates a ″No-Load″ engine speed limiter of approximately 1800 - 2000 rpm, when it recognizes that the TPS is indicating an idle signal and IAC motor cannot maintain engine idle.

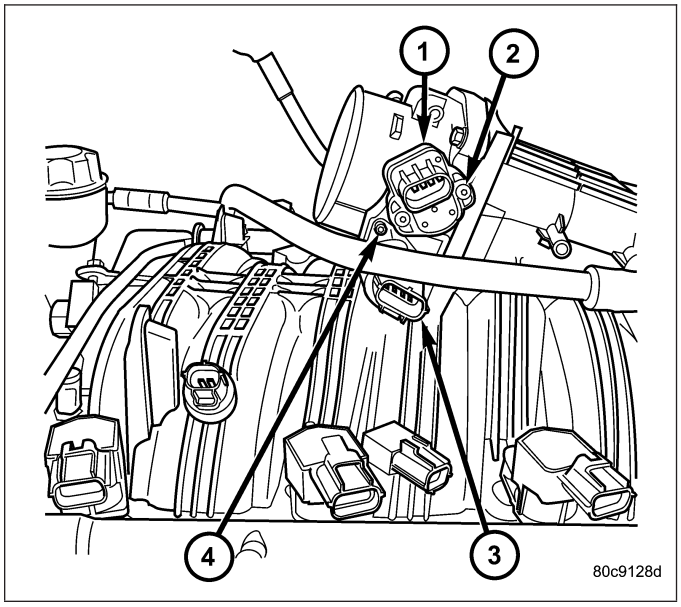
A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the IAC motor through the PCM.

REMOVAL

3.7L V-6

The Idle Air Control (IAC) motor (3) is located on the side of the throttle body.

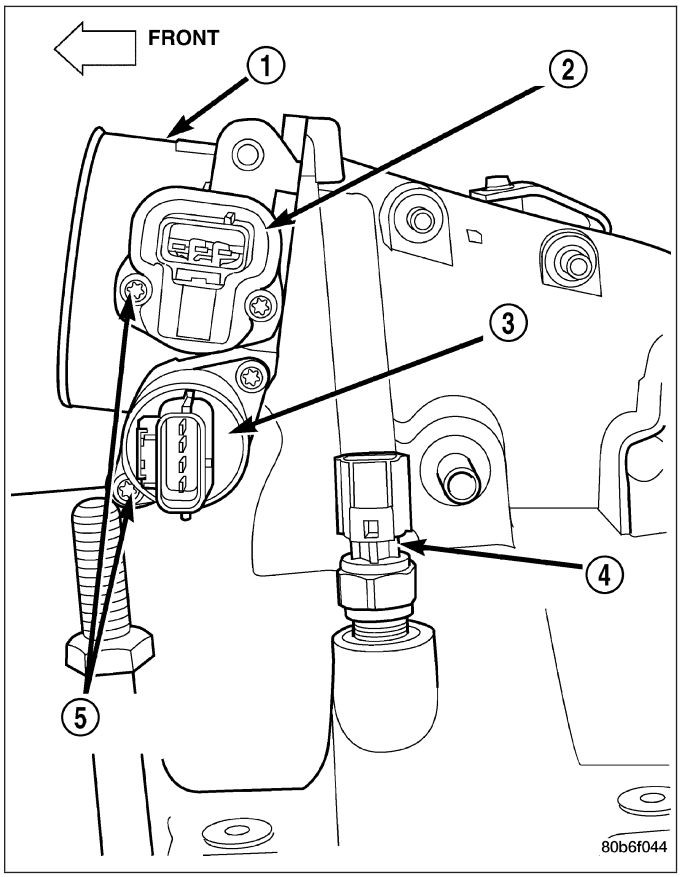
1. Remove air resonator box at throttle body.
2. Disconnect electrical connector from IAC motor.
3. Remove two mounting bolts (screws).
4. Remove IAC motor from throttle body.



4.7L V-8

The Idle Air Control (IAC) motor (3) is located on the side of the throttle body.

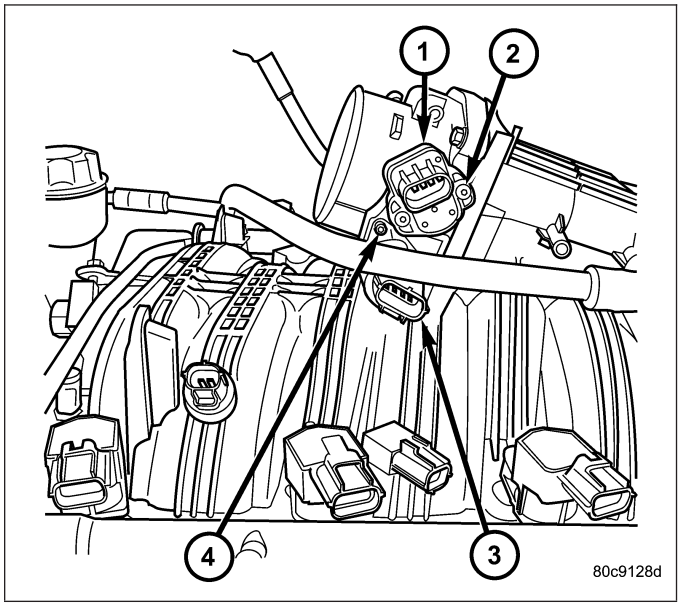
1. Remove air resonator box at throttle body.
2. Disconnect electrical connector from IAC motor.
3. Remove two mounting bolts (screws).
4. Remove IAC motor from throttle body.



INSTALLATION

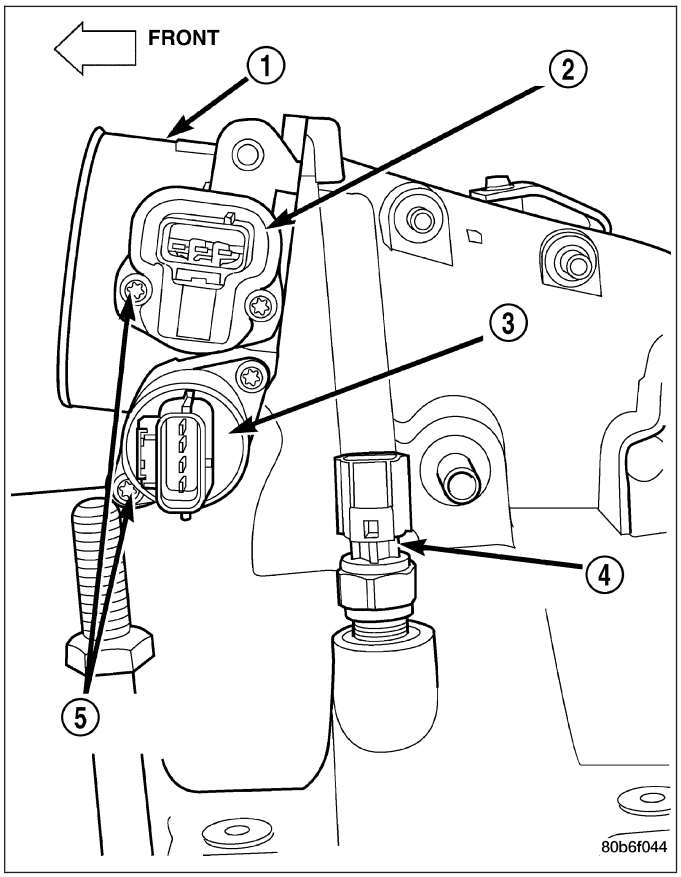
3.7L V-6

1. Install IAC motor (3) to throttle body.
2. Install and tighten two mounting bolts (screws) to 7 N·m (60 in. lbs.) torque.
3. Install electrical connector.
4. Install air resonator to throttle body.



4.7L V-8

1. Install IAC motor (3) to throttle body.
2. Install and tighten two mounting bolts (screws) to 7 N·m (60 in. lbs.) torque.
3. Install electrical connector.
4. Install air resonator to throttle body.

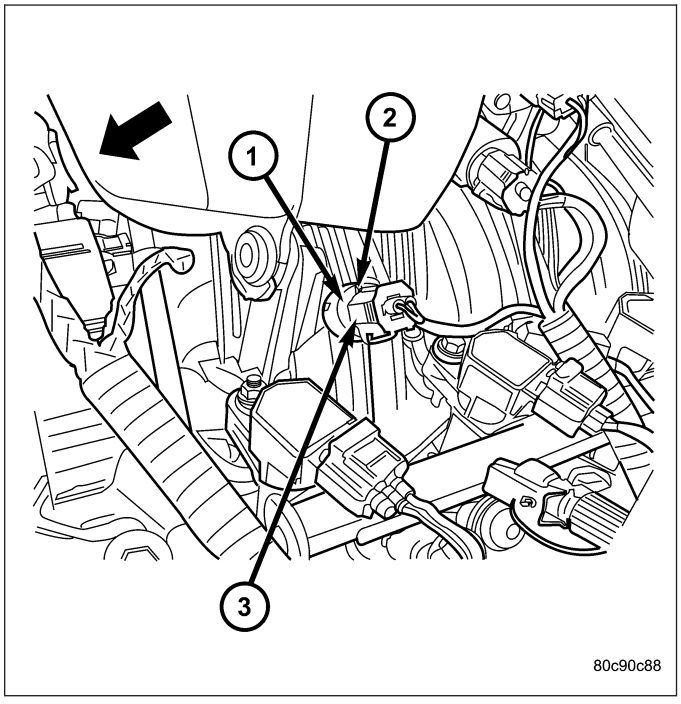


SENSOR-INTAKE AIR TEMPERATURE

DESCRIPTION

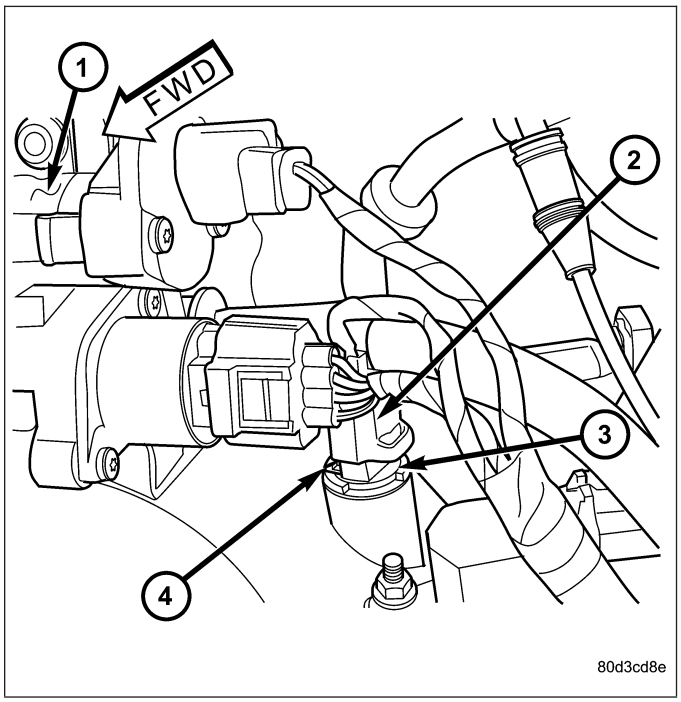
3.7L V-6

The intake manifold air temperature (IAT) sensor (1) is installed into the left side of intake manifold plenum.



4.7L V-8

The intake manifold air temperature (IAT) sensor (3) is installed into the left side of intake manifold plenum.



OPERATION

The IAT sensor provides an input voltage to the Powertrain Control Module (PCM) indicating the density of the air entering the intake manifold based upon intake manifold temperature. At key-on, a 5–volt power circuit is supplied to the sensor from the PCM. The sensor is grounded at the PCM through a low-noise, sensor-return circuit.

The PCM uses this input to calculate the following:

- Injector pulse-width
- Adjustment of spark timing (to help prevent spark knock with high intake manifold air-charge temperatures)

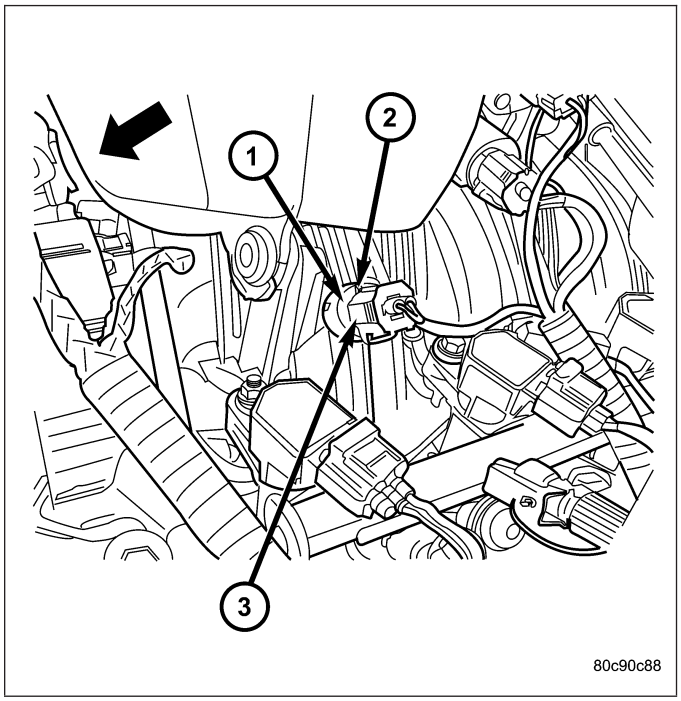
The resistance values of the IAT sensor is the same as for the Engine Coolant Temperature (ECT) sensor.

REMOVAL

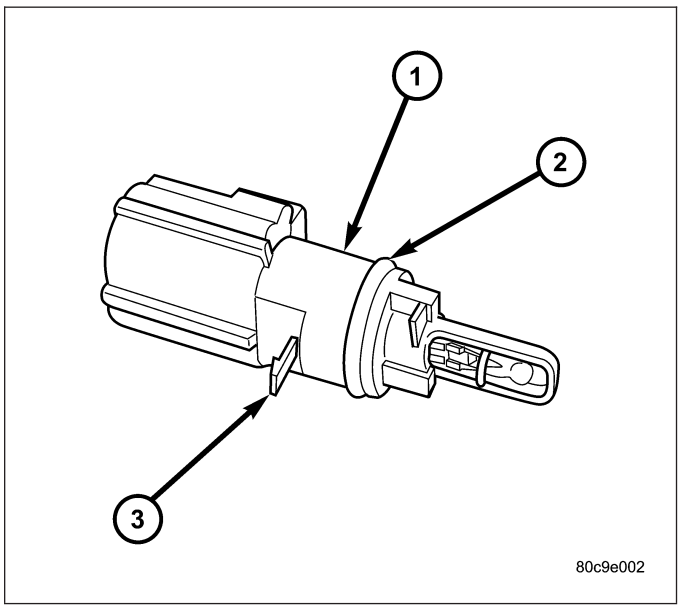
3.7L V-6

The intake manifold air temperature (IAT) sensor (1) is installed into the left side of intake manifold plenum.

1. Disconnect electrical connector (3) from IAT sensor.
2. Clean dirt from intake manifold at sensor base.



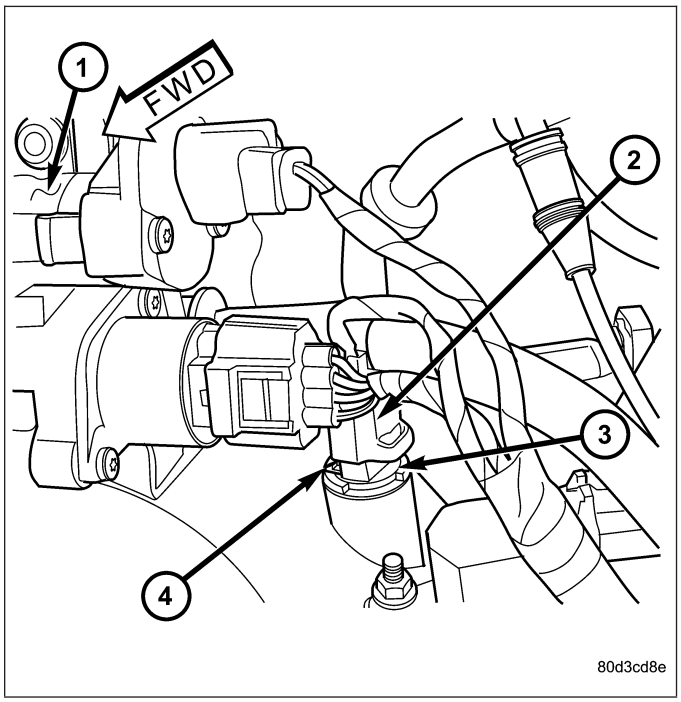
3. Gently lift on small plastic release tab (3) and rotate sensor about 1/4 turn counter-clockwise for removal.
4. Check condition of sensor o-ring (2).



4.7L V-8

The intake manifold air temperature (IAT) sensor (3) is installed into the left side of intake manifold plenum.

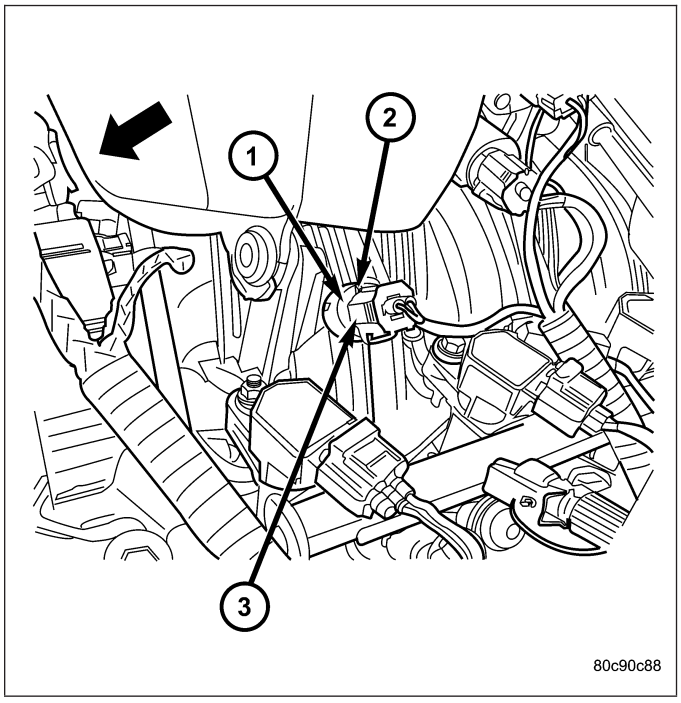
1. Disconnect electrical connector from IAT sensor.
2. Clean dirt from intake manifold at sensor base.
3. Gently lift on small plastic release tab (4) and rotate sensor about 1/4 turn counter-clockwise for removal.
4. Check condition of sensor o-ring.



INSTALLATION

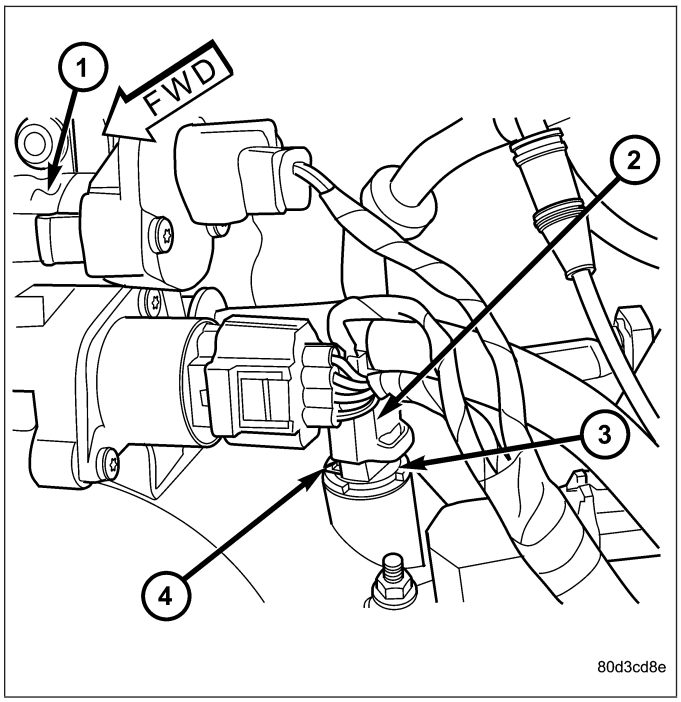
3.7L V-6

1. Check condition of sensor o-ring.
2. Clean sensor mounting hole in intake manifold.
3. Position sensor (2) into intake manifold and rotate clockwise until past release tab.
4. Install electrical connector (3).



4.7L V-8

1. Check condition of sensor o-ring.
2. Clean sensor mounting hole in intake manifold.
3. Position sensor (3) into intake manifold and rotate clockwise until past release tab.
4. Install electrical connector (2).

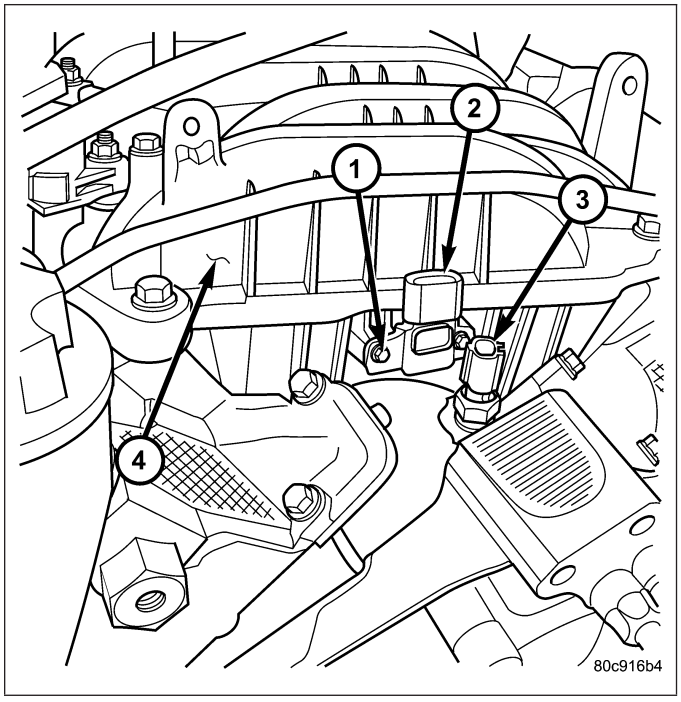


SENSOR-MAP

DESCRIPTION

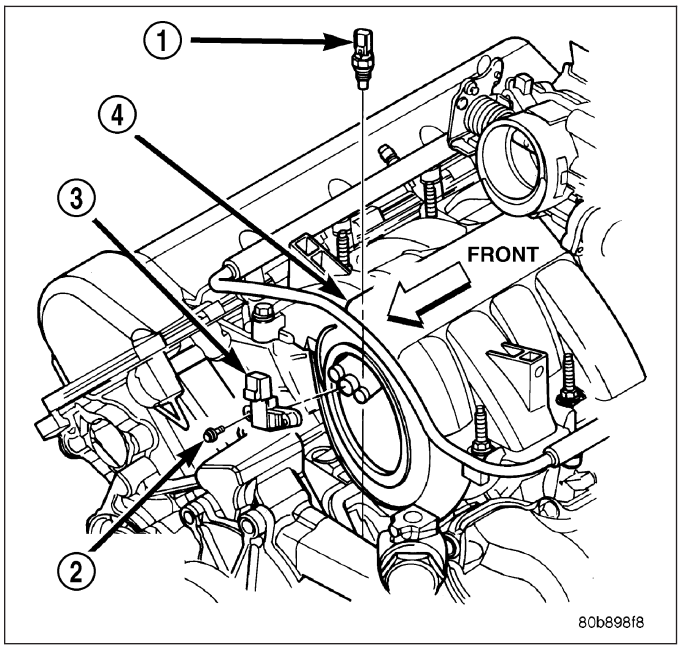
3.7L V-6

The Manifold Absolute Pressure (MAP) sensor (2) is mounted into the front of the intake manifold with 2 screws.



4.7L V-8

The Manifold Absolute Pressure (MAP) sensor (3) is mounted into the front of the intake manifold with 2 screws.



OPERATION

The MAP sensor is used as an input to the Powertrain Control Module (PCM). It contains a silicon based sensing unit to provide data on the manifold vacuum that draws the air/fuel mixture into the combustion chamber. The PCM requires this information to determine injector pulse width and spark advance. When manifold absolute pressure (MAP) equals Barometric pressure, the pulse width will be at maximum.

A 5 volt reference is supplied from the PCM and returns a voltage signal to the PCM that reflects manifold pressure. The zero pressure reading is 0.5V and full scale is 4.5V. For a pressure swing of 0–15 psi, the voltage changes 4.0V. To operate the sensor, it is supplied a regulated 4.8 to 5.1 volts. Ground is provided through the low-noise, sensor return circuit at the PCM.

The MAP sensor input is the number one contributor to fuel injector pulse width. The most important function of the MAP sensor is to determine barometric pressure. The PCM needs to know if the vehicle is at sea level or at a higher altitude, because the air density changes with altitude. It will also help to correct for varying barometric pressure. Barometric pressure and altitude have a direct inverse correlation; as altitude goes up, barometric goes down. At key-on, the PCM powers up and looks at MAP voltage, and based upon the voltage it sees, it knows the current barometric pressure (relative to altitude). Once the engine starts, the PCM looks at the voltage again, continuously every 12 milliseconds, and compares the current voltage to what it was at key-on. The difference between current voltage and what it was at key-on, is manifold vacuum.

During key-on (engine not running) the sensor reads (updates) barometric pressure. A normal range can be obtained by monitoring a known good sensor.

As the altitude increases, the air becomes thinner (less oxygen). If a vehicle is started and driven to a very different altitude than where it was at key-on, the barometric pressure needs to be updated. Any time the PCM sees Wide Open Throttle (WOT), based upon Throttle Position Sensor (TPS) angle and RPM, it will update barometric pressure in the MAP memory cell. With periodic updates, the PCM can make its calculations more effectively.

The PCM uses the MAP sensor input to aid in calculating the following:

- Manifold pressure
- Barometric pressure
- Engine load
- Injector pulse-width
- Spark-advance programs
- Shift-point strategies (certain automatic transmissions only)
- Idle speed
- Decel fuel shutoff

The MAP sensor signal is provided from a single piezoresistive element located in the center of a diaphragm. The element and diaphragm are both made of silicone. As manifold pressure changes, the diaphragm moves causing the element to deflect, which stresses the silicone. When silicone is exposed to stress, its resistance changes. As manifold vacuum increases, the MAP sensor input voltage decreases proportionally. The sensor also contains electronics that condition the signal and provide temperature compensation.

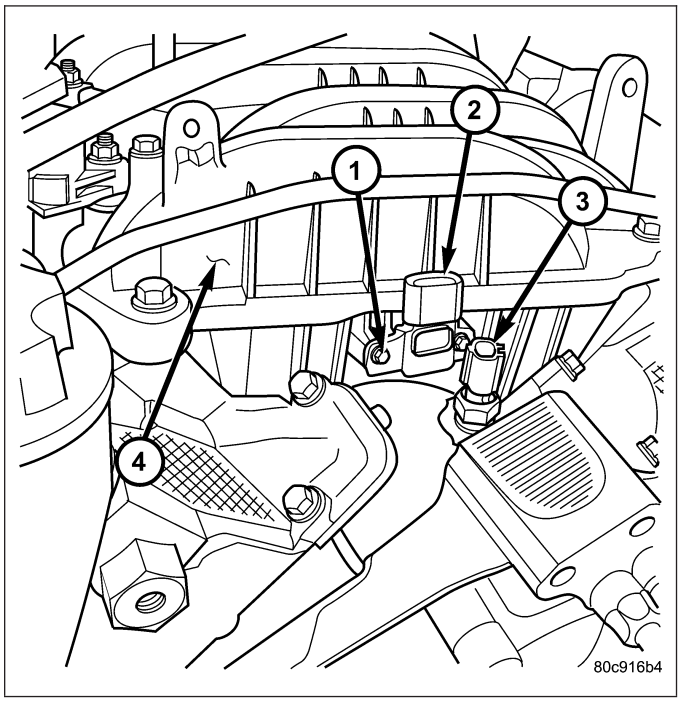
The PCM recognizes a decrease in manifold pressure by monitoring a decrease in voltage from the reading stored in the barometric pressure memory cell. The MAP sensor is a linear sensor; meaning as pressure changes, voltage changes proportionately. The range of voltage output from the sensor is usually between 4.6 volts at sea level to as low as 0.3 volts at 26 in. of Hg. Barometric pressure is the pressure exerted by the atmosphere upon an object. At sea level on a standard day, no storm, barometric pressure is approximately 29.92 in Hg. For every 100 feet of altitude, barometric pressure drops 0.10 in. Hg. If a storm goes through, it can change barometric pressure from what should be present for that altitude. You should know what the average pressure and corresponding barometric pressure is for your area.

REMOVAL

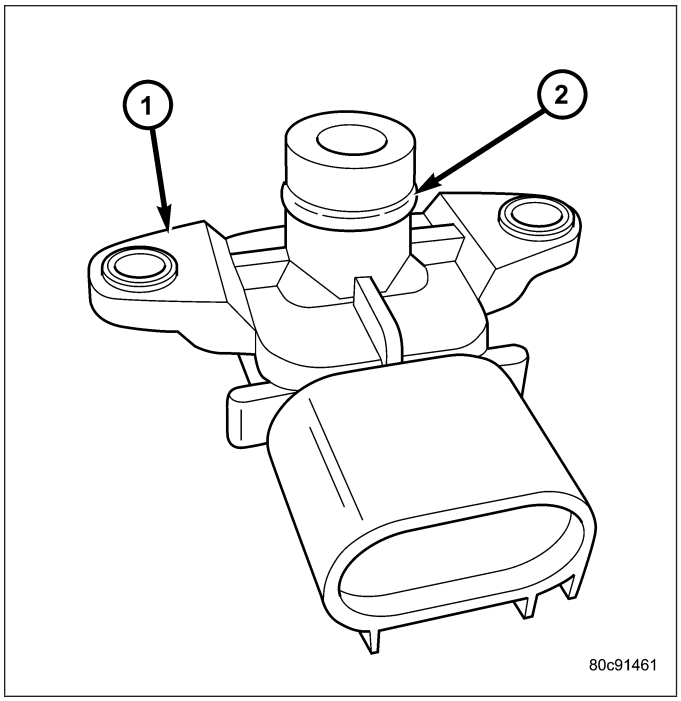
3.7L V-6

The Manifold Absolute Pressure (MAP) sensor (2) is mounted into the front of the intake manifold.

1. Disconnect electrical connector at sensor.
2. Clean area around MAP sensor.
3. Remove two sensor mounting screws (1).
4. Remove MAP sensor from intake manifold.



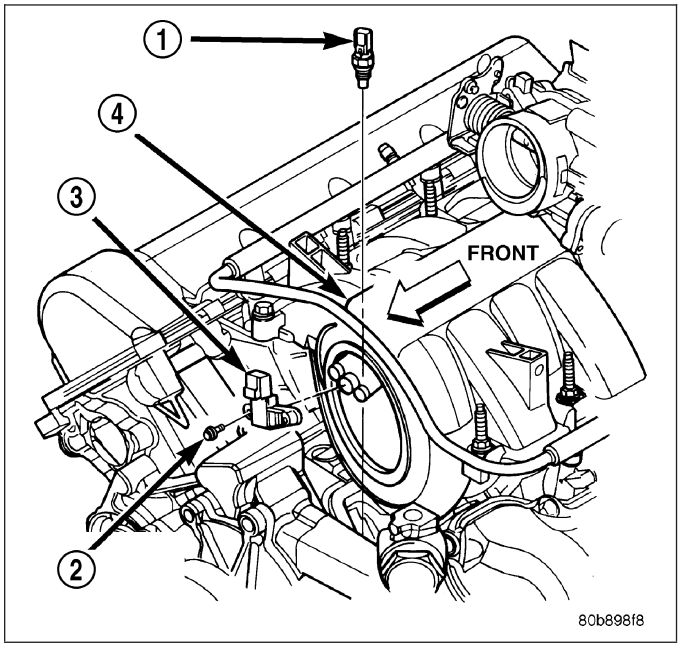
5. Check condition of sensor o-ring (2) .



4.7L V-8

The MAP sensor (3) is located on the front of the intake manifold. An o-ring seals the sensor to the intake manifold.

1. Disconnect electrical connector at sensor.
2. Clean area around MAP sensor.
3. Remove two sensor mounting bolts (2).
4. Remove MAP sensor from intake manifold.
5. Check condition of sensor o-ring.

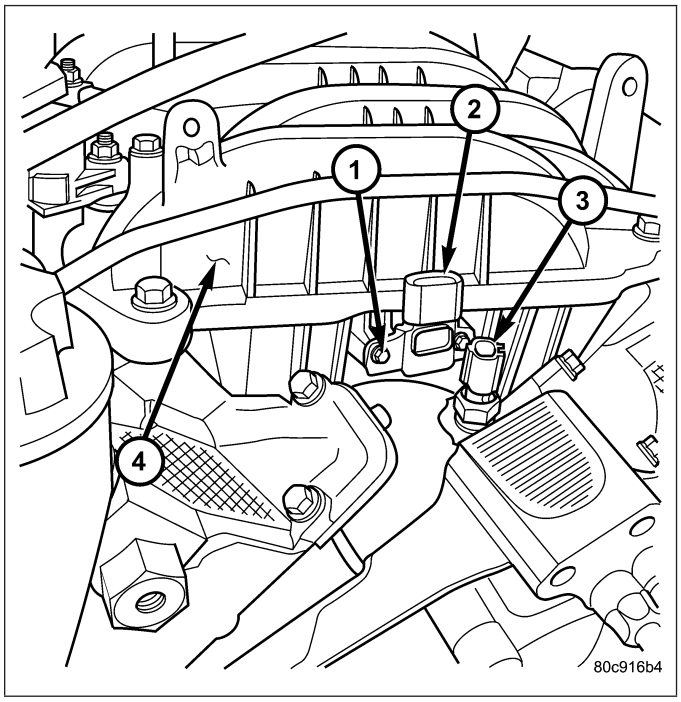


INSTALLATION

3.7L V-6

The Manifold Absolute Pressure (MAP) sensor (2) is mounted into the front of the intake manifold. An o-ring is used to seal the sensor to the intake manifold.

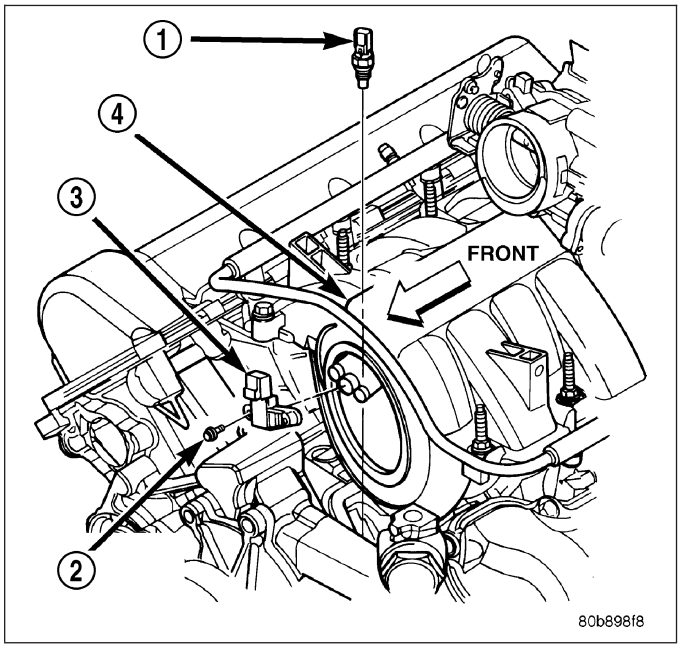
1. Clean MAP sensor mounting hole at intake manifold.
2. Check MAP sensor o-ring seal for cuts or tears.
3. Position sensor into manifold.
4. Install MAP sensor mounting bolts (screws). Refer to Torque Specifications.
5. Connect electrical connector.



4.7L V-8

The MAP sensor (3) is located on the front of the intake manifold. An o-ring seals the sensor to the intake manifold.

1. Clean MAP sensor mounting hole at intake manifold.
2. Check MAP sensor o-ring seal for cuts or tears.
3. Position sensor into manifold.
4. Install MAP sensor mounting bolts (screws). Refer to Torque Specifications.
5. Connect electrical connector.



SENSOR-OXYGEN

DESCRIPTION

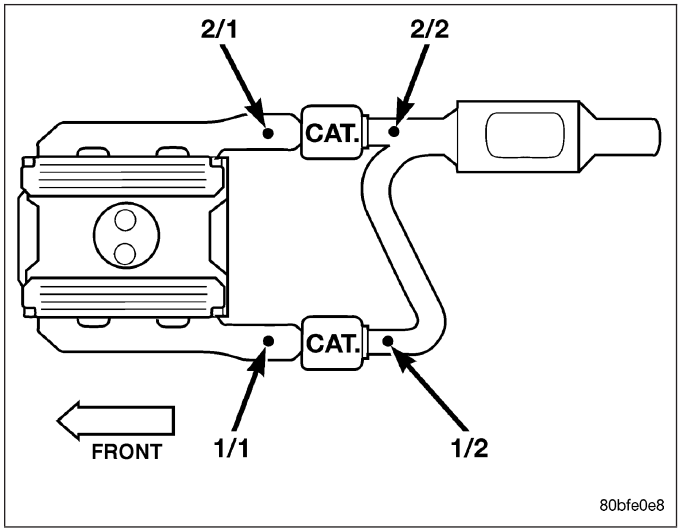
The Oxygen Sensors (O2S) are attached to, and protrude into the vehicle exhaust system. Depending on the engine or emission package, the vehicle may use a total of either 2 or 4 sensors.

Federal Emission Packages : Two sensors are used: upstream (referred to as 1/1) and downstream (referred to as 1/2). With this emission package, the upstream sensor (1/1) is located just before the main catalytic convertor. The downstream sensor (1/2) is located just after the main catalytic convertor.

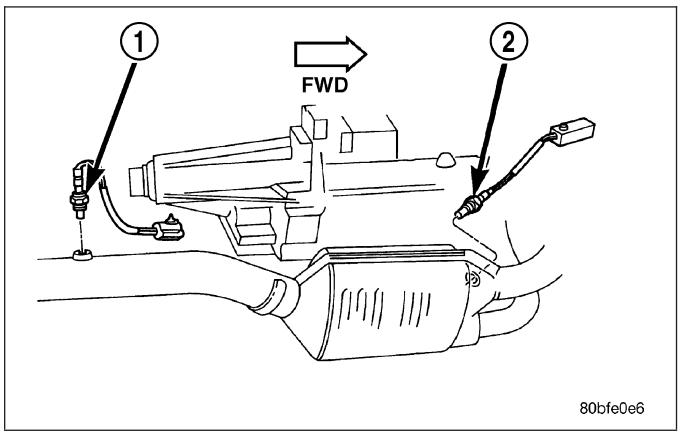
California Emission Packages: On this emissions package, 4 sensors are used: 2 upstream (referred to as 1/1 and 2/1) and 2 downstream (referred to as 1/2 and 2/2). With this emission package, the right upstream sensor (2/1) is located in the right exhaust downpipe just before the mini-catalytic convertor. The left upstream sensor (1/1) is located in the left exhaust downpipe just before the mini-catalytic convertor. The right downstream sensor (2/2) is located in the right exhaust downpipe just after the mini-catalytic convertor, and before the main catalytic convertor. The left downstream sensor (1/2) is located in the left exhaust downpipe just after the mini-catalytic convertor, and before the main catalytic convertor.

REMOVAL

Refer to graphic for typical O2S (oxygen sensor) locations if equipped with four oxygen sensors.



Refer to graphic for typical O2S (oxygen sensor) locations if equipped with two oxygen sensors.



CAUTION: Never apply any type of grease to the oxygen sensor electrical connector, or attempt any soldering of the sensor wiring harness.

WARNING: THE EXHAUST MANIFOLD, EXHAUST PIPES AND CATALYTIC CONVERTER BECOME VERY HOT DURING ENGINE OPERATION. ALLOW ENGINE TO COOL BEFORE REMOVING OXYGEN SENSOR.

1. Raise and support vehicle.
2. **4–Sensor System** If removing the right-upstream (2/1) sensor, remove the right-front tire/wheel, and then remove the plastic inner fender liner.
3. Disconnect wire connector from O2S sensor.

CAUTION: When disconnecting sensor electrical connector, do not pull directly on wire going into sensor.

4. Remove O2S sensor with an oxygen sensor removal and installation tool.

5. Clean threads in exhaust pipe using appropriate tap.

INSTALLATION

Threads of new oxygen sensors are factory coated with anti-seize compound to aid in removal. **DO NOT add any additional anti-seize compound to threads of a new oxygen sensor.**

1. Install O2S sensor. Tighten to 30 N·m (22 ft. lbs.) torque.
2. Connect O2S sensor wire connector.
3. **4–Sensor System:** If installing the right-upstream (2/1) sensor, install plastic inner fender liner, and right-front tire/wheel.
4. Lower vehicle.

THROTTLE BODY

DESCRIPTION

The throttle body is located on the intake manifold. Fuel does not enter the intake manifold through the throttle body. Fuel is sprayed into the manifold by the fuel injectors.

OPERATION

Filtered air from the air cleaner enters the intake manifold through the throttle body. The throttle body contains an air control passage controlled by an Idle Air Control (IAC) motor. The air control passage is used to supply air for idle conditions. A throttle valve (plate) is used to supply air for above idle conditions.

Certain sensors are attached to the throttle body. The accelerator pedal cable, speed control cable and transmission control cable (when equipped) are connected to the throttle body linkage arm.

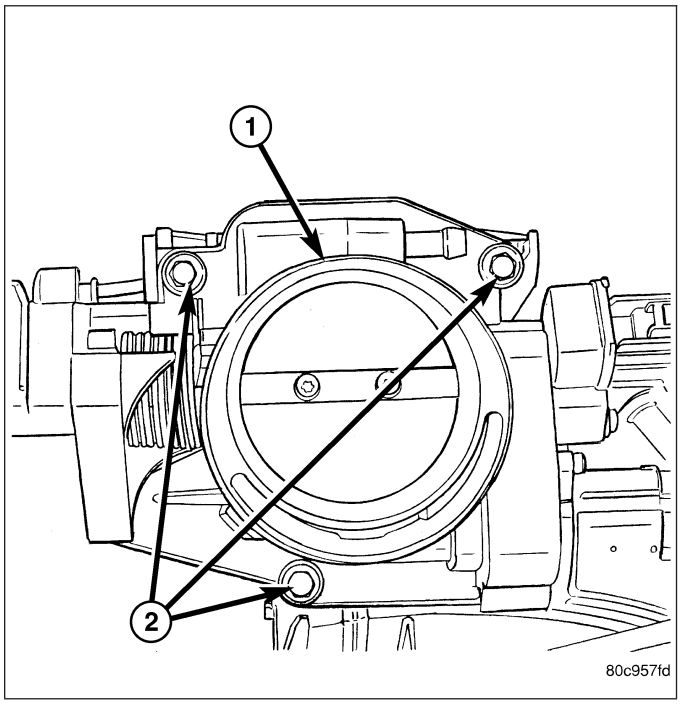
A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the PCM.

REMOVAL

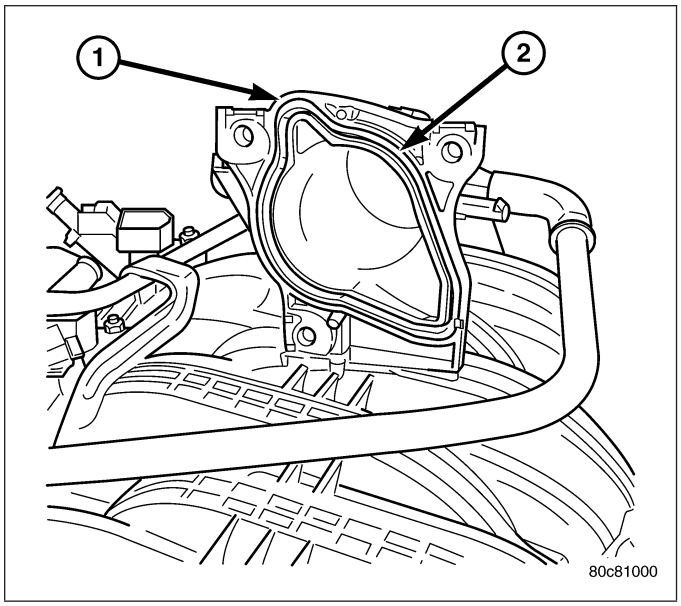
3.7L V-6

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the Powertrain Control Module (PCM).

1. Remove air cleaner tube at throttle body.
2. Disconnect throttle body electrical connectors at IAC motor and TPS.
3. Remove all control cables from throttle body (lever) arm. Refer to the Accelerator Pedal and Throttle Cable section for removal/installation procedures.
4. Disconnect necessary vacuum lines at throttle body.
5. Remove three throttle body mounting bolts (2).
6. Remove throttle body from intake manifold.

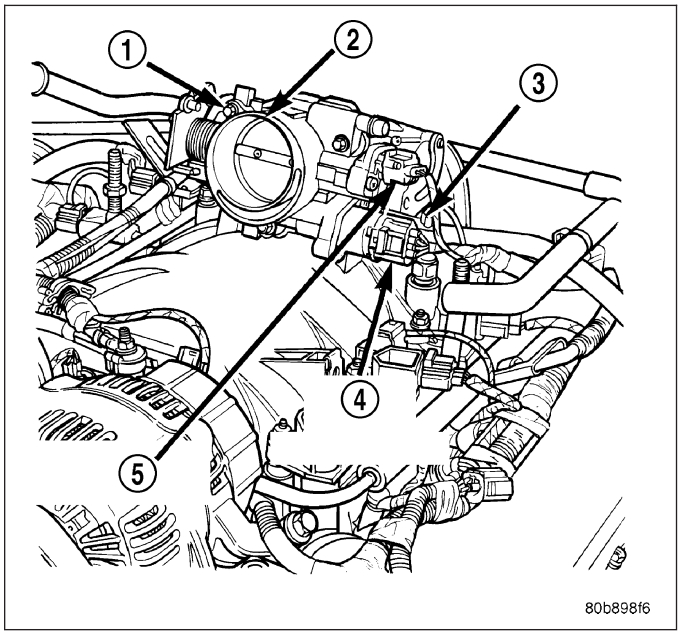


7. Check condition of old throttle body-to-intake manifold o-ring (2).



4.7L V-8

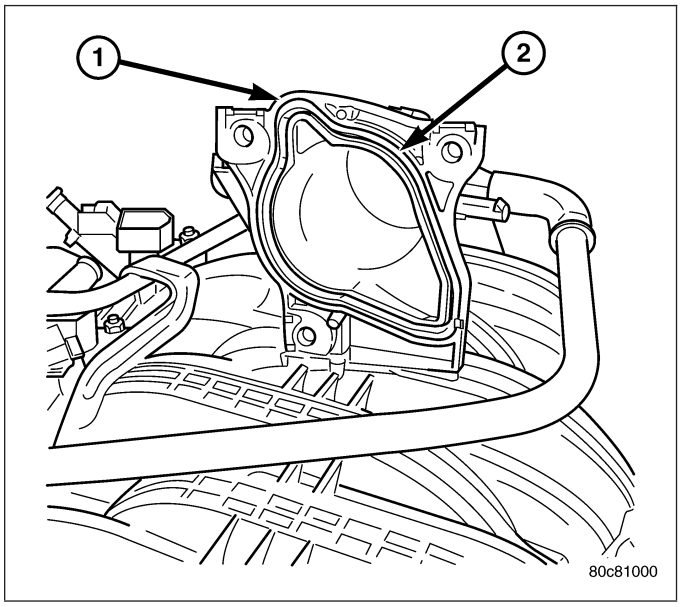
1. Remove air duct and air resonator box at throttle body.
2. Disconnect throttle body electrical connectors at IAC motor and TPS (3) , (4), and (5).
3. Remove vacuum line at throttle body.
4. Remove all control cables from throttle body (lever) arm. Refer to Accelerator Pedal and Throttle Cable.
5. Remove three throttle body mounting bolts (1).
6. Remove throttle body from intake manifold.



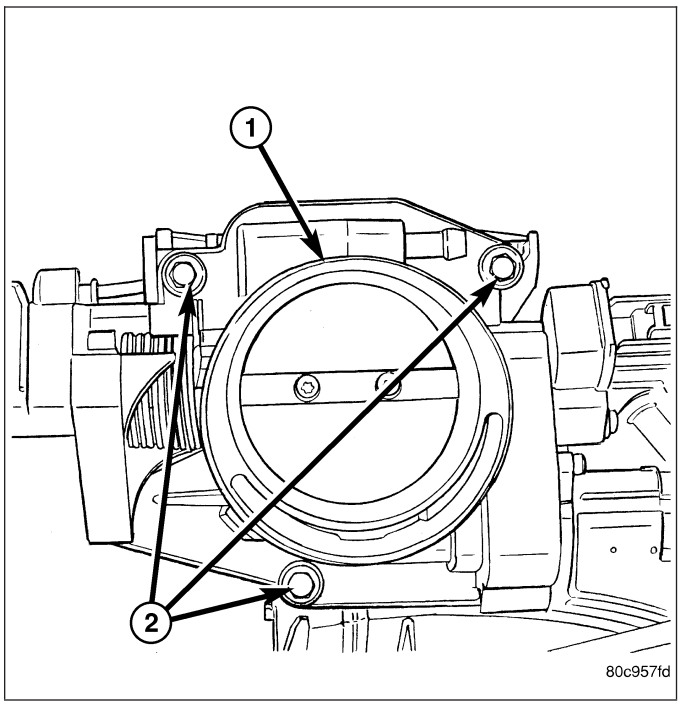
INSTALLATION

3.7L V-6

1. Check condition of throttle body-to-intake manifold o-ring (2). Replace as necessary.

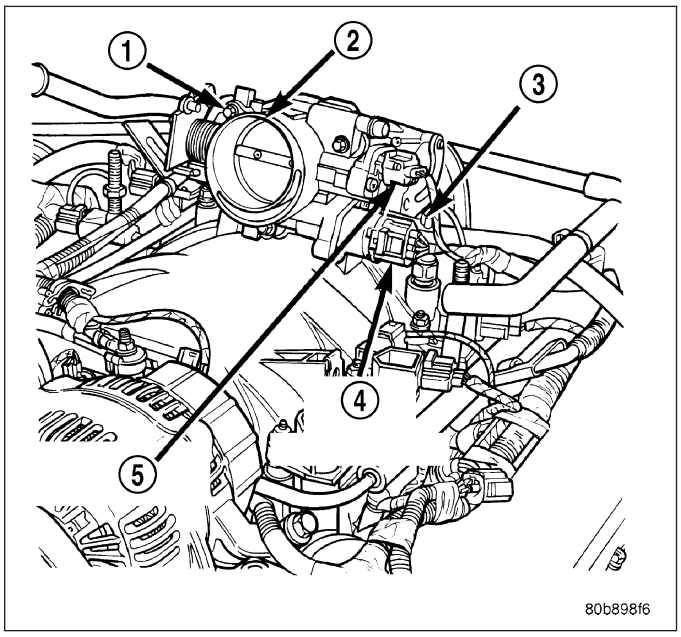


2. Clean mating surfaces of throttle body and intake manifold.
3. Install throttle body-to-intake manifold o-ring.
4. Install throttle body to intake manifold.
5. Install three mounting bolts (2). Tighten bolts to 12 N·m (105 in. lbs.) torque.
6. Install control cables.
7. Install electrical connectors.
8. Install necessary vacuum lines.
9. Install air plenum.



4.7L V-8

1. Clean throttle body-to-intake manifold o-ring (2).
2. Clean mating surfaces of throttle body and intake manifold.
3. Install throttle body to intake manifold by positioning throttle body to manifold alignment pins.
4. Install three mounting bolts (1). Tighten bolts to 12 N·m (105 in. lbs.) torque.
5. Install control cables.
6. Install vacuum line to throttle body.
7. Install electrical connectors.
8. Install air plenum.



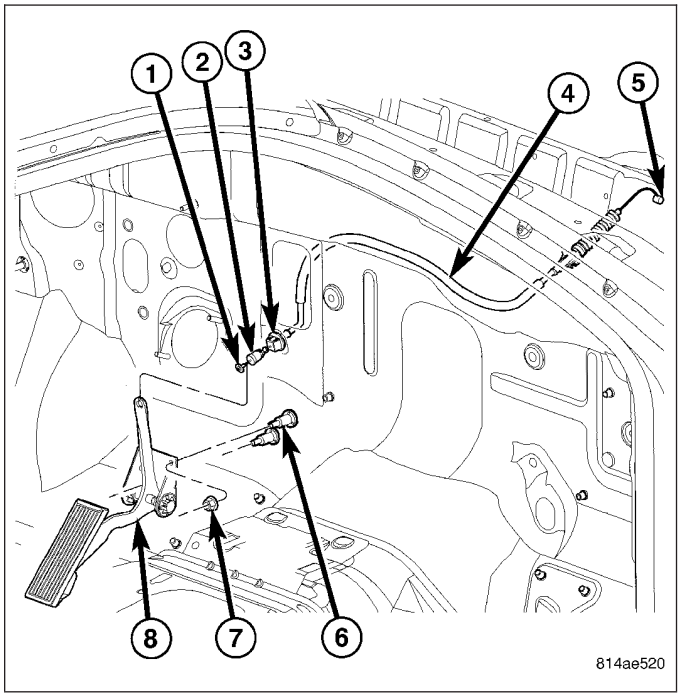
CABLE-THROTTLE CONTROL

REMOVAL

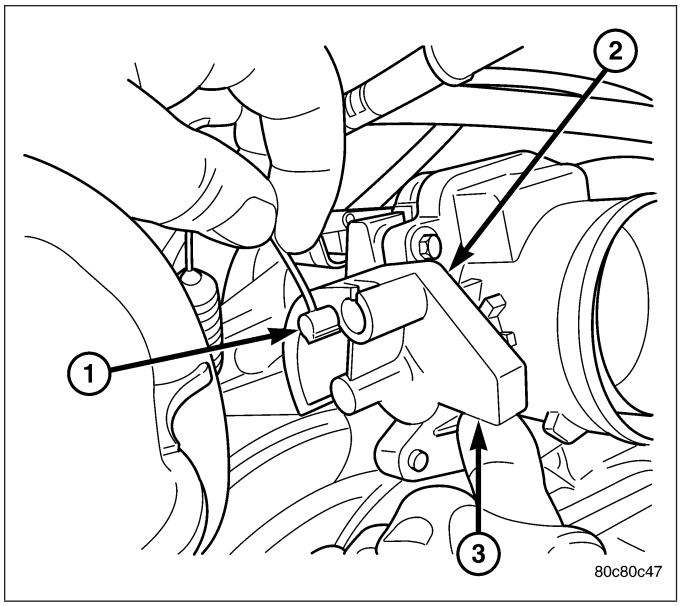
3.7L V-6

CAUTION: Be careful not to damage or kink cable core wire (within cable sheathing) while servicing accelerator pedal or throttle cable.

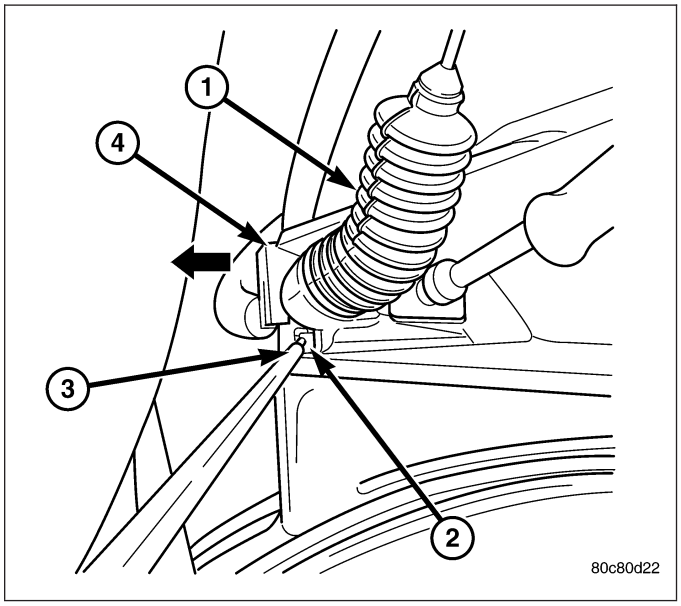
1. From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of pedal arm. Plastic cable retainer (2) snaps into top of pedal arm.
2. Remove cable core wire at pedal arm.
3. From inside vehicle, remove metal clip holding cable to dashpanel.
4. Remove air resonator box at throttle body.
5. Unsnap cable from dashpanel routing clip.
6. Remove cable housing from dash panel and pull into engine compartment
   .



7. Hold throttle in wide open position. While held in this position, slide throttle cable pin (1) from throttle body bellcrank.



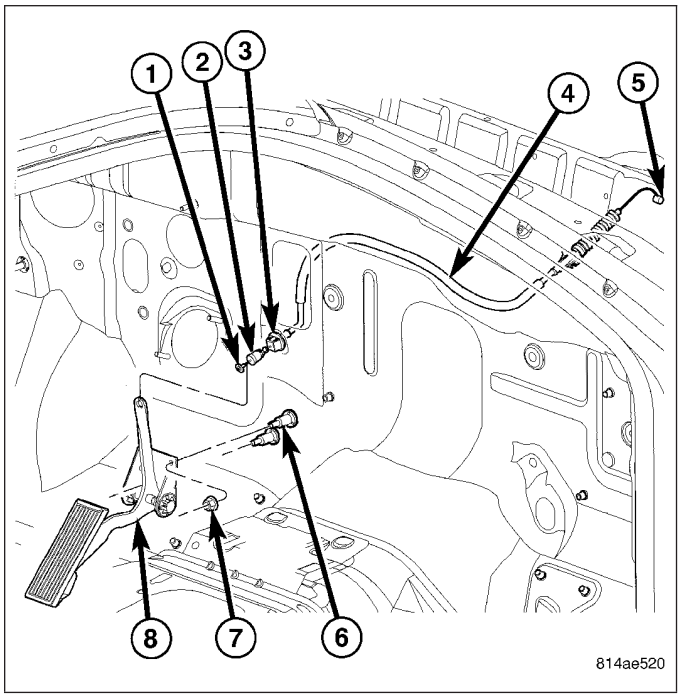
8. Using a pick or small screwdriver (3), press release tab (2) to release plastic cable mount from bracket. **Press on tab only enough to release cable from bracket. If tab is pressed too much, it will be broken.** Slide plastic mount (4) towards right side of vehicle to remove throttle cable from throttle body bracket.
9. Remove throttle cable from vehicle.



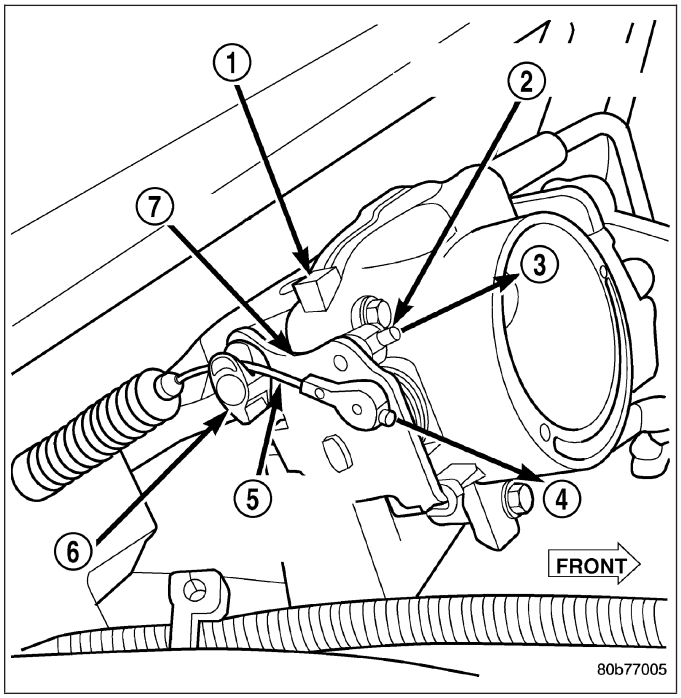
4.7L V-8

CAUTION: Be careful not to damage or kink cable core wire (within cable sheathing) while servicing accelerator pedal or throttle cable.

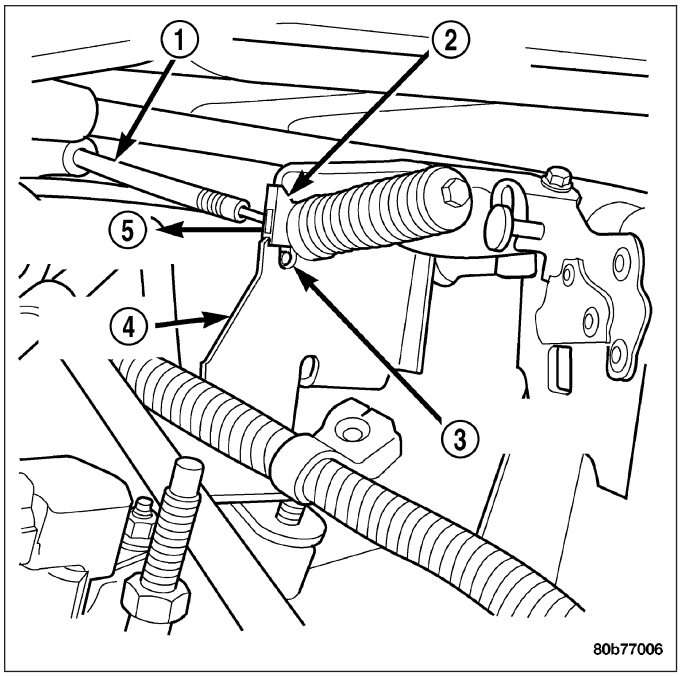
1. From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of pedal arm. Plastic cable retainer (clip) (2) snaps into pedal arm.
2. Remove cable core wire at pedal arm.
3. From inside vehicle, remove cable clip holding cable to dashpanel.
4. Remove air box at throttle body.
5. Unsnap cable from dashpanel routing clip.
6. Remove cable housing from dash panel and pull into engine compartment.



7. Using finger pressure only, disconnect accelerator cable connector at throttle body bellcrank pin by pushing connector off bellcrank pin towards front of vehicle (4). **DO NOT try to pull connector off perpendicular to bellcrank pin. Connector will be broken.**
8. Lift accelerator cable from top of cable cam (6).



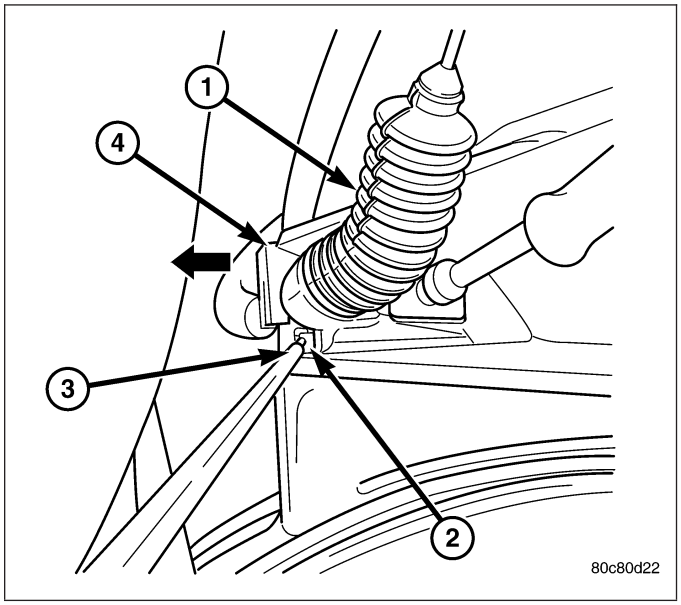
9. Press tab (3) to release plastic cable mount from bracket. **Press on tab only enough to release cable from bracket. If tab is pressed too much, it will be broken.** Slide plastic mount (2) towards passenger side of vehicle to remove cable from bracket.
10. Remove throttle cable from vehicle.



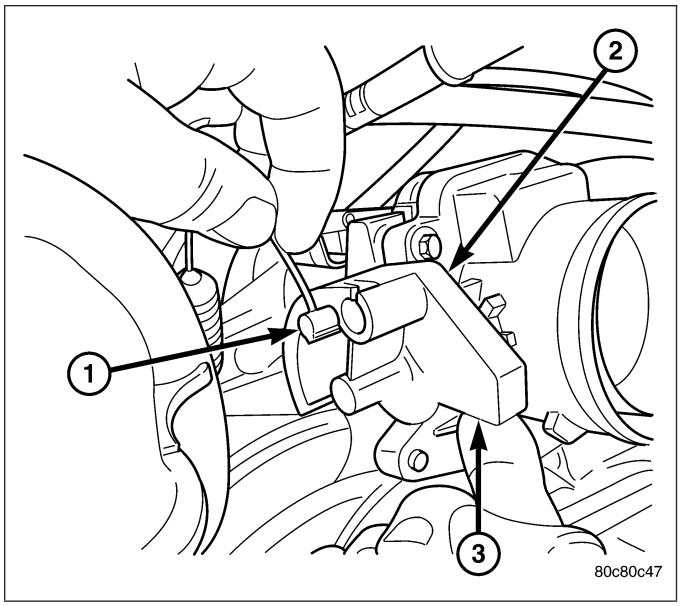
INSTALLATION

3.7L V-6

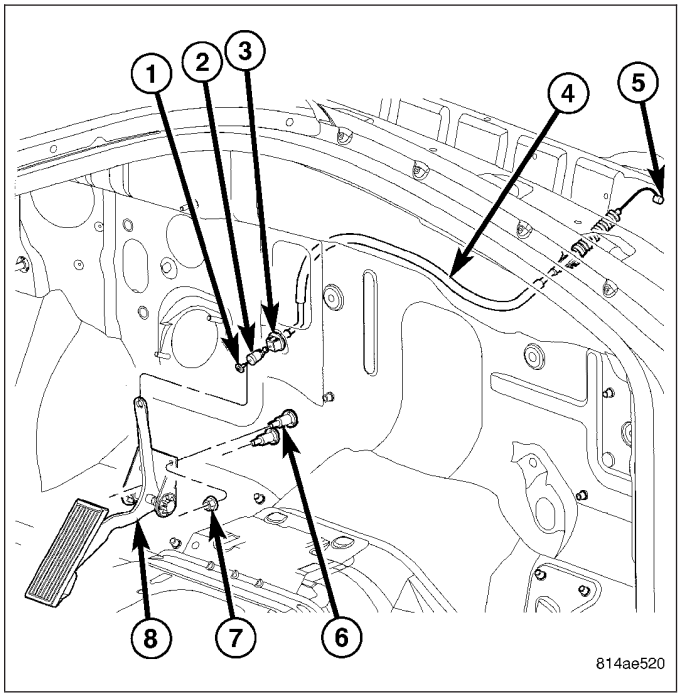
1. Slide accelerator cable plastic mount into throttle body mounting bracket. Continue sliding until release tab (2) is aligned to hole in mounting bracket.



2. Hold throttle in wide open position. While held in this position, slide throttle cable pin (1) into throttle body bellcrank.
3. Push cable housing into rubber grommet and through opening in dash panel.

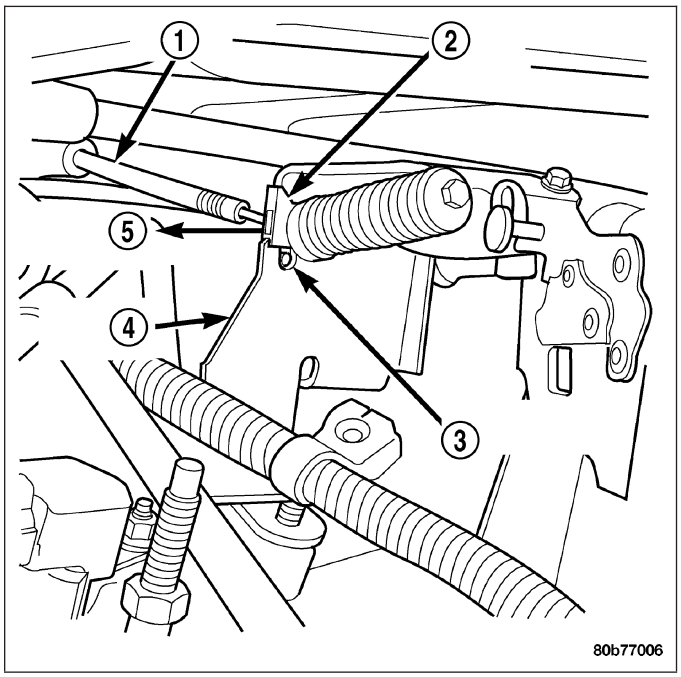


4. From inside vehicle, install metal clip holding cable to dashpanel.
5. From inside vehicle, slide throttle cable core wire into opening (slot) in top of pedal arm.
6. Push plastic cable retainer (clip) (2) into pedal arm opening until it snaps in place.
7. Install air resonator tube to throttle body.
8. Before starting engine, operate accelerator pedal to check for any binding.

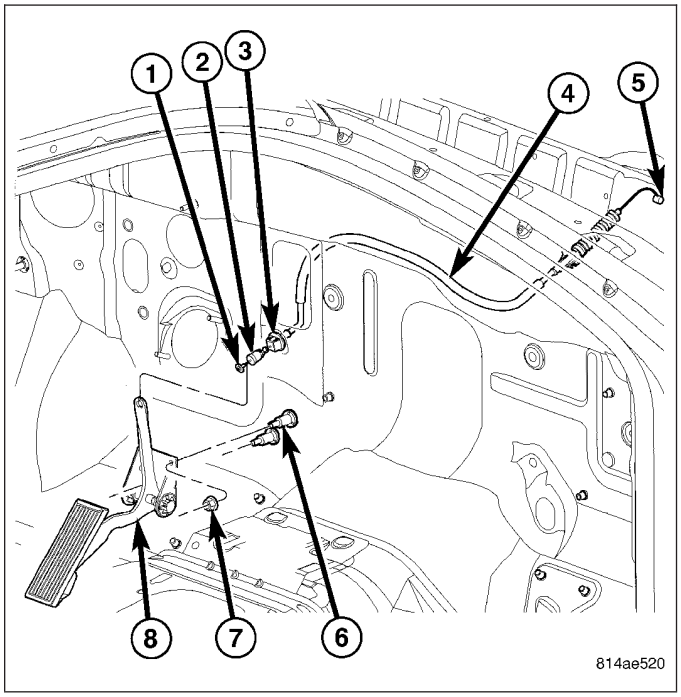


4.7L V-8

1. Slide accelerator cable plastic mount into bracket. Continue sliding until tab (3) is aligned to hole in mounting bracket.
2. Route accelerator cable over top of cable cam.
3. Connect cable end to throttle body bellcrank pin (snaps on rearward).
4. Slide rubber grommet away from plastic cable housing.
5. Install rubber grommet into dash panel until seated.
6. Push cable housing into rubber grommet and through opening in dash panel.



7. From inside vehicle, install clip holding cable to dashpanel.
8. From inside vehicle, slide throttle cable core wire into opening in top of pedal arm.
9. Push cable retainer (clip) (2) into pedal arm opening until it snaps in place.
10. Snap cable into dashpanel routing clip.
11. Install air resonator tube to throttle body.
12. Before starting engine, operate accelerator pedal to check for any binding.

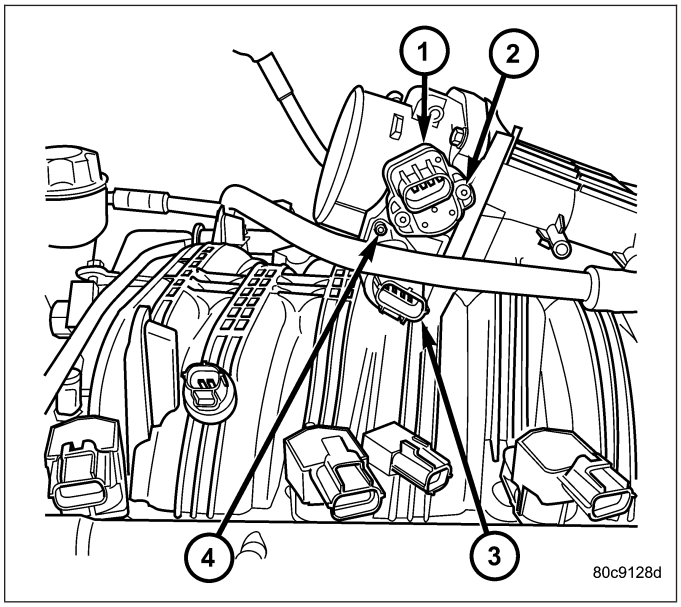


SENSOR-THROTTLE POSITION

DESCRIPTION

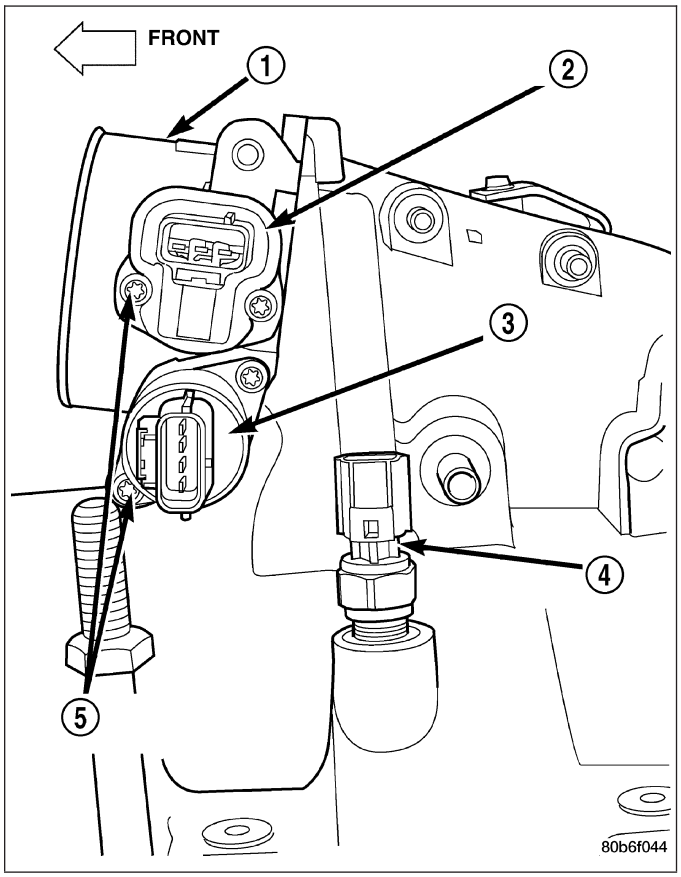
3.7L Engine

The 3-wire Throttle Position Sensor (TPS) is mounted on the throttle body (1) and is connected to the throttle blade shaft.



4.7L Engine

The 3-wire Throttle Position Sensor (TPS) is mounted on the throttle body (2) and is connected to the throttle blade shaft.



OPERATION

The 3–wire TPS provides the Powertrain Control Module (PCM) with an input signal (voltage) that represents the throttle blade position of the throttle body. The sensor is connected to the throttle blade shaft. As the position of the throttle blade changes, the output voltage of the TPS changes.

The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the TPS. This will vary in an approximate range of from .26 volts at minimum throttle opening (idle), to 4.49 volts at wide open throttle. Along with inputs from other sensors, the PCM uses the TPS input to determine current engine operating conditions. In response to engine operating conditions, the PCM will adjust fuel injector pulse width and ignition timing.

The PCM needs to identify the actions and position of the throttle blade at all times. This information is needed to assist in performing the following calculations:

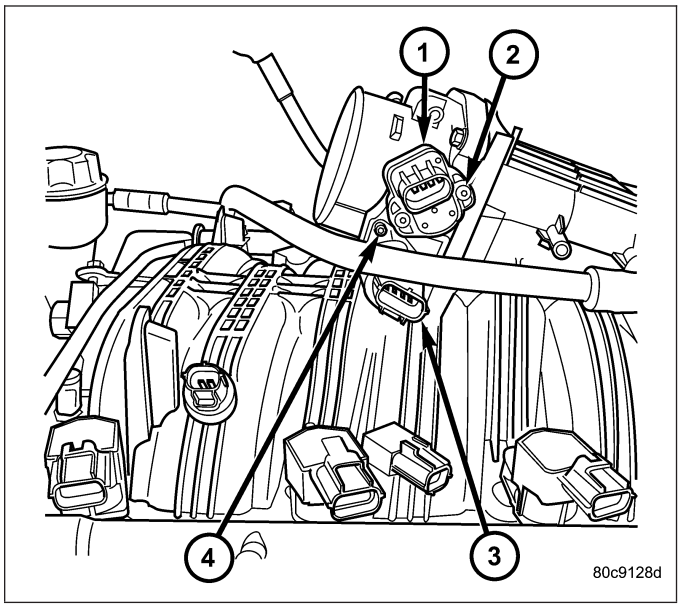
- Ignition timing advance
- Fuel injection pulse-width
- Idle (learned value or minimum TPS)
- Off-idle (0.06 volt)
- Wide Open Throttle (WOT) open loop (2.608 volts above learned idle voltage)
- Deceleration fuel lean out
- Fuel cutoff during cranking at WOT (2.608 volts above learned idle voltage)
- A/C WOT cutoff (certain automatic transmissions only)

REMOVAL

3.7L V6

The Throttle Position Sensor (TPS) is mounted to the throttle body (1).

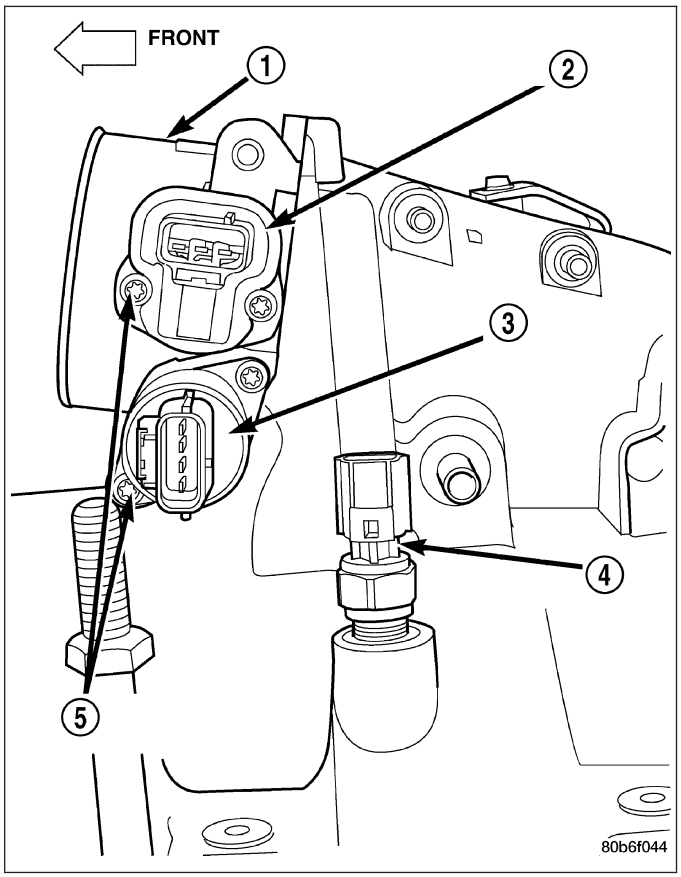
1. Remove air resonator tube at throttle body.
2. Disconnect TPS electrical connector.
3. Remove two TPS mounting screws (2).
4. Remove TPS.



4.7L V-8

The TPS is located on the throttle body (2).

1. Remove air duct and tube at throttle body.
2. Disconnect TPS electrical connector.
3. Remove two TPS mounting bolts (screws) (5).
4. Remove TPS from throttle body.

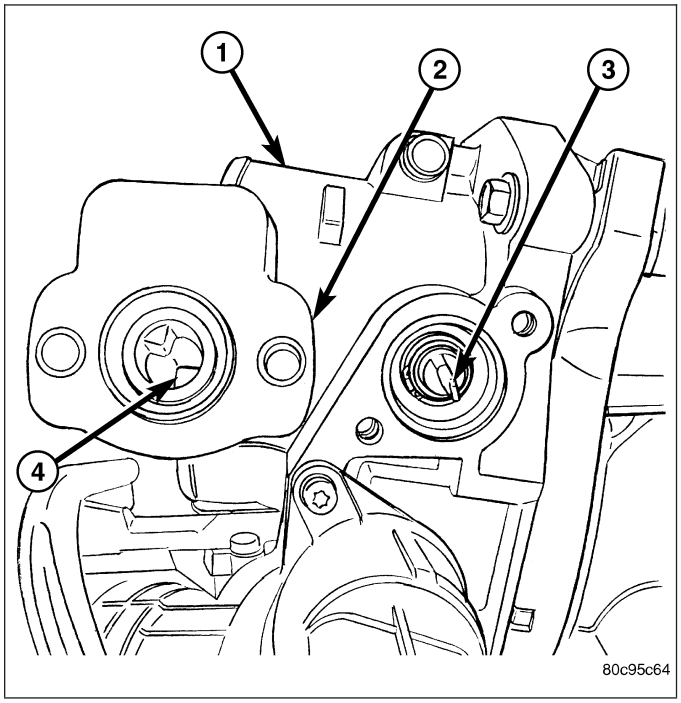


INSTALLATION

3.7L V-6

The throttle shaft end of throttle body (3) slides into a socket in TPS (4). The TPS must be installed so that it can be rotated a few degrees. (If sensor will not rotate, install sensor with throttle shaft on other side of socket tangs). The TPS will be under slight tension when rotated.

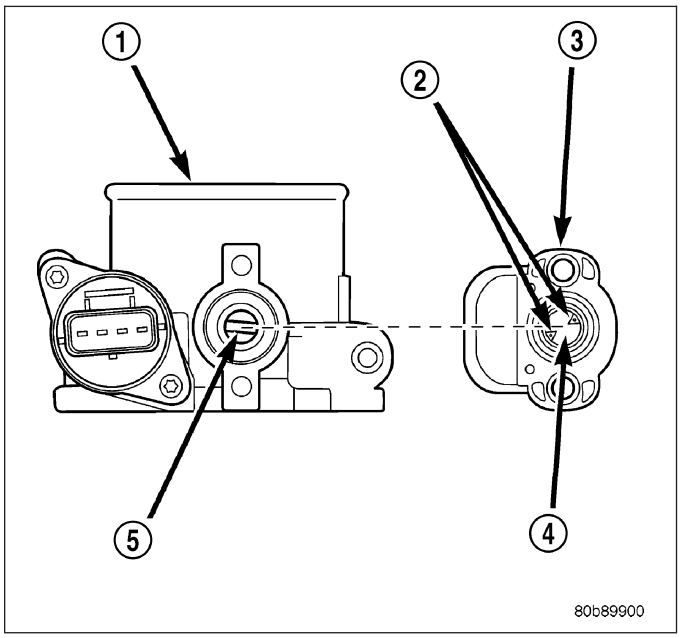
1. Install TPS and retaining screws.
2. Tighten screws to 7 N·m (60 in. lbs.) torque.
3. Connect TPS electrical connector to TPS.
4. Manually operate throttle (by hand) to check for any TPS binding before starting engine.
5. Install air cleaner tube to throttle body.



4.7L V-8

The throttle shaft end of throttle body (5) slides into a socket in TPS (4). The TPS must be installed so that it can be rotated a few degrees. If sensor will not rotate, install sensor with throttle shaft on other side of socket tangs. The TPS will be under slight tension when rotated.

1. Install TPS and two retaining bolts.
2. Tighten bolts to 7 N·m (60 in. lbs.) torque.
3. Manually operate throttle control lever by hand to check for any binding of TPS.
4. Connect TPS electrical connector to TPS.
5. Install air duct/air box to throttle body.



STEERING

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STEERING

DESCRIPTION

Power steering systems consist of:

- Steering column
- Rack and pinion steering gear
- Intermediate Shaft
- Belt driven hydraulic steering pump
- Pump pressure and return hoses
- Oil Cooler

OPERATION

The steering column shaft is attached to the gear pinion. The rotation of the pinion moves the gear rack from side-to-side. This lateral action of the rack pushes and pulls the tie rods to change the direction of the front wheels.

Power assist is provided by an engine mounted hydraulic pump, the pump supplies hydraulic fluid pressure to the steering gear. Some vehicles are equipped with an oil cooler mounted in front of Radiator..

DIAGNOSIS AND TESTING

POWER STEERING SYSTEM

There is some noise in all power steering systems. One of the most common is a hissing sound evident at a standstill parking. Or when the steering wheel is at the end of it's travel. Hiss is a high frequency noise similar to that of a water tap being closed slowly. The noise is present in all valves that have a high velocity fluid passing through an orifice. There is no relationship between this noise and steering performance.

STEERING NOISE

CONDITION	POSSIBLE CAUSES	CORRECTION
OBJECTIONAL HISS OR WHISTLE	1. Steering intermediate shaft to dash panel seal.	1. Check and repair seal at dash panel.
	2. Noisy valve in power steering gear.	2. Replace steering gear.
RATTLE OR CLUNK	1. Gear mounting bolts loose.	1. Tighten bolts to specification.
	2. Loose or damaged suspension components.	2. Inspect and repair suspension.
	3. Internal gear noise.	3. Replace steering gear.
	4. Pressure hose in contact with other components.	4. Reposition hose.
	5. Loose or damaged intermediate shaft or column.	5. Inspect and repair or replace.
CHIRP OR SQUEAL	1. Loose belt.	1. Adjust or replace.
	2. Loose Pump	2. Check Pump Bolts
	3. Pulley Loose or Bent	3. Check Pulley or Replace
WHINE OR GROWL	1. Low fluid level.	1. Fill to proper level.
	2. Pressure hose in contact with other components.	2. Reposition hose.
	3. Internal pump noise.	3. Replace pump.
SUCKING AIR SOUND	1. Loose return line clamp.	1. Replace clamp.
	2. O-ring missing or damaged on hose fitting.	2. Replace o-ring.
	3. Low fluid level.	3. Fill to proper level.
	4. Air leak between pump and reservoir.	4. Repair as necessary.
	5. Reservoir cap not installed correctly.	5. Install reservoir cap correctly.
SCRUBBING OR KNOCKING	1. Wrong tire size.	1. Verify tire size.
	2. Wrong gear.	2. Verify gear.

BINDING AND STICKING

CONDITION	POSSIBLE CAUSE	CORRECTION
DIFFICULT TO TURN WHEEL STICKS OR BINDS	1. Low fluid level.	1. Fill to proper level.
	2. Tire pressure.	2. Adjust tire pressure.
	3. Steering components (ball joints/tie rod ends).	3 Inspect and repair as necessary.
	4. Loose belt.	4. Adjust or replace.
	5. Low pump pressure.	5. Pressure test and replace if necessary.
	6. Column shaft coupler binding.	6. Replace coupler.
	7. Steering gear worn.	7. Replace gear.

INSUFFICIENT ASST. OR POOR RETURN TO CENTER

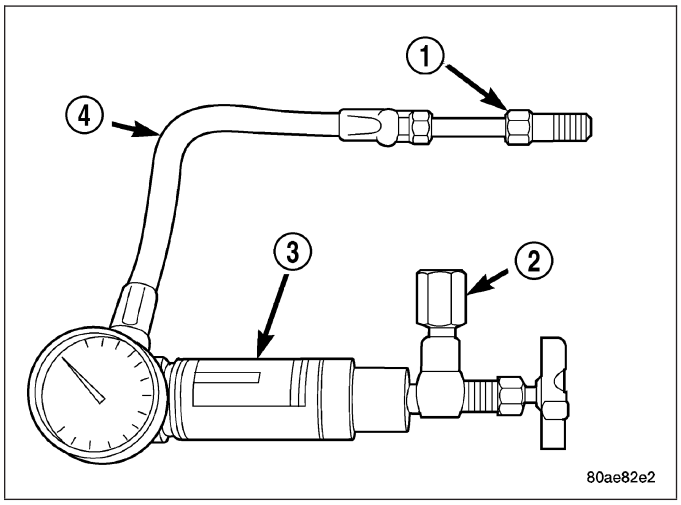
CONDITION	POSSIBLE CAUSE	CORRECTION
HARD TURNING OR MOMENTARY INCREASE IN TURNING EFFORT	1. Tire pressure.	1. Adjust tire pressure.
	2. Low fluid level.	2. Fill to proper level.
	3. Loose belt.	3. Adjust or replace.
	4. Low pump pressure.	4. Pressure test and repair as necessary.
	5. Internal gear leak.	5. Replace gear.
STEERING WHEEL DOES NOT WANT TO RETURN TO CENTER POSITION	1. Tire pressure.	1. Adjust tire pressure.
	2. Wheel alignment.	2. Align front end.
	3. Lack of lubrication.	3. Inspect and lubricate suspension compnents.
	4. High friction in steering gear.	4. Replace gear.
	5. Intermediate Shaft Binding.	5. Check Intermediate Shaft Replace if needed.
	6. Steering Column Friction High.	6. Check Steering Column, Replace as needed.
	7. High Steering System Friction.	7. Check Steering System Friction, Replace as needed.

LOOSE STEERING AND VEHICLE LEAD

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE PLAY IN STEERING WHEEL	1. Worn or loose suspension or steering components.	1. Inspect and repair as necessary.
	2. Worn or loose wheel bearings.	2. Inspect and repair or adjust bearings.
	3. Steering gear mounting.	3. Tighten gear mounting bolts to specification.
	4. Gear out of adjustment.	4. Replace gear.
	5. Worn or loose steering coupler.	5. Inspect and replace as necessary.
VEHICLE PULLS OR LEADS TO ONE SIDE.	1. Tire Pressure.	1. Adjust tire pressure.
	2. Radial tire lead.	2. Rotate tires.
	3. Brakes dragging.	3. Repair as necessary.
	4. Wheel alignment.	4. Align front end.

POWER STEERING FLOW AND PRESSURE

The following procedure is used to test the operation of the power steering system on the vehicle. This test will provide the gallons per minute (GPM) or flow rate of the power steering pump along with the maximum relief pressure. Perform test any time a power steering system problem is present. This test will determine if the power steering pump or power steering gear is not functioning properly. The following pressure and flow test is performed using Power Steering Analyzer Tool kit 6815 (3) Adapter Kit 6893 and 6825A.



FLOW AND PRESSURE TEST

1. Check the power steering belt to ensure it is in good condition and adjusted properly.
2. Connect pressure gauge hose from the Power Steering Analyzer to Tube 6825A.
3. Connect Adapter 6826 to Power Steering Analyzer test valve end.
4. Disconnect the high pressure hose from the power steering pump.
5. Connect the tube to the pump hose fitting.
6. Connect the power steering hose from the steering gear to the adapter.
7. Open the test valve completely.
8. Start engine and let idle long enough to circulate power steering fluid through flow/pressure test gauge and to get air out of the fluid. Then shut off engine.
9. Check fluid level, add fluid as necessary. Start engine again and let idle.
10. Gauge should read below 862 kPa (125 psi), if above, inspect the hoses for restrictions and repair as necessary. The initial pressure reading should be in the range of 345-552 kPa (50-80 psi).
11. Increase the engine speed to 1500 RPM and read the flow meter. If the flow rate (GPM) is below specification, (refer to pump specification chart for GPM) the pump should be replaced.

CAUTION: The following test procedure involves testing maximum pump pressure output and flow control valve operation. Do not leave valve closed for more than three seconds as the pump could be damaged.

12. Close valve fully three times and record highest pressure indicated each time. **All three readings must be above specifications and within 345 kPa (50 psi) of each other.**
    - Pressures above specifications but not within 345 kPa (50 psi) of each other, replace pump.
    - Pressures within 345 kPa (50 psi) of each other but below specifications, replace pump.
13. Open the test valve and turn the steering wheel to the extreme left and right positions three times against the stops. Record the highest pressure reading at each position. Compare readings to the pump specifications chart. If pressures readings are not within 50 psi of each other, the gear is leaking internally and must be replaced.

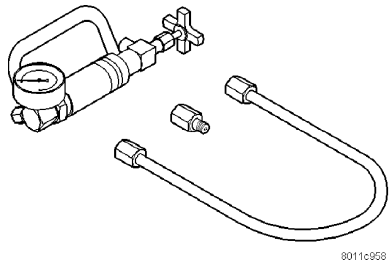
CAUTION: Do not force the pump to operate against the stops for more than 2 to 3 seconds at a time because, pump damage will result.

PUMP SPECIFICATION

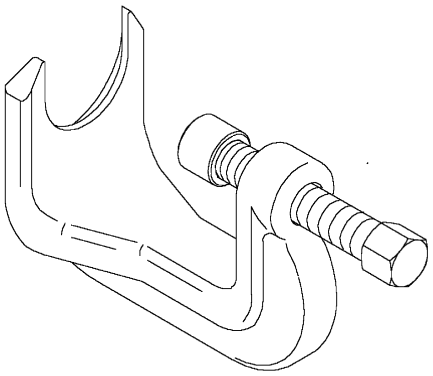
ENGINE	RELIEF PRESSURE ± 50	FLOW RATE (GPM) AT 1500 RPM
All	11652 kPa (1690 psi)	2.6

SPECIAL TOOLS

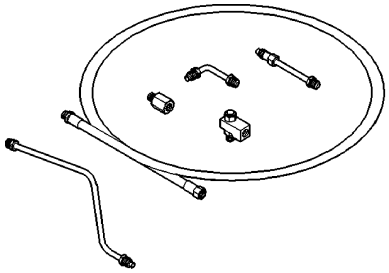
POWER STEERING PUMP



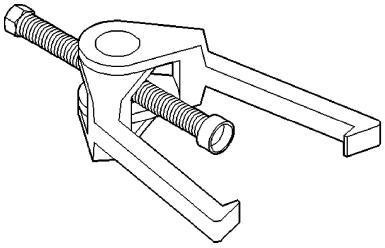
Analyzer Set, Power Steering Flow/Pressure 6815

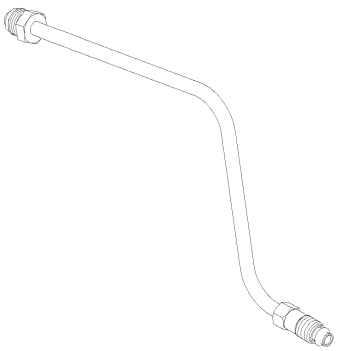


PULLER - 8677



Adapters, Power Steering Flow/Pressure Tester 6893





ADAPTER, POWER STEERING FLOW/PRESSURE - 6825A

COLUMN

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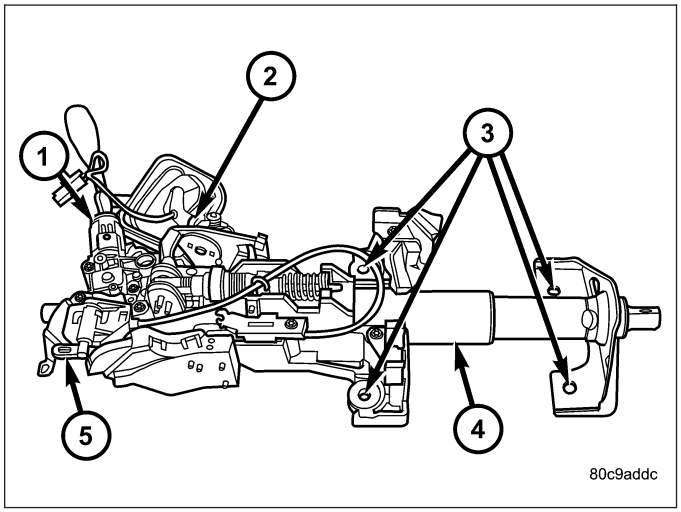
COLUMN

DESCRIPTION

NOTE: The steering column on vehicles with an automatic transmission may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.

The tilt and standard column (4) has been designed to be serviced as an assembly; less wiring, switches, shrouds, steering wheel, etc. Most steering column components can be serviced without removing the steering column from the vehicle.

To service the steering wheel, switches or airbag, refer to Restraints and follow all WARNINGS and CAUTIONS.



WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIRBAG SYSTEM COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY. THE FASTENERS, SCREWS, AND BOLTS, ORIGINALLY USED FOR THE AIRBAG COMPONENTS, HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANYTIME A NEW FASTENER IS NEEDED, REPLACE WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR FASTENERS LISTED IN THE PARTS BOOKS.

CAUTION: Do not hammer on steering column shaft. This may cause damage to the shaft or bearing.

CAUTION: Do not attempt to remove the pivot bolts to disassemble the tilting mechanism. Do not remove shaft lock plate or plate retainer. This will damage the column.

CAUTION: Do not attempt to remove or modify the park lock slider or link.

NOTE: When servicing the steering wheel after removing the old bolt a new bolt must be used when installing.

NOTE: When servicing the coupler a new bolt must be used when installing.

DIAGNOSIS AND TESTING

STEERING COLUMN

If the vehicle is involved in a front end collision/the air bag has deployed the column must be inspected. This inspection will determine if the Column has collapsed. Inspect the column mounting capsules visually and manually push and pull them to check for separation or fractures. If capsules are fractured or have moved the column MUST be replaced.

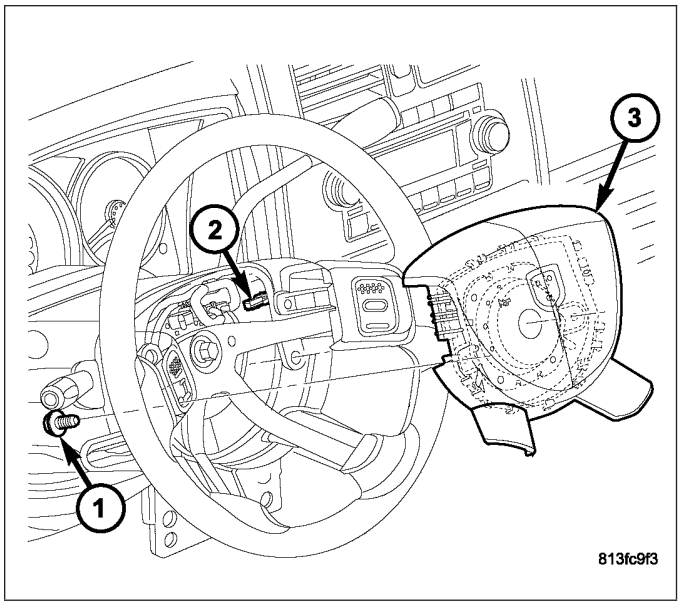
REMOVAL

WARNING: BEFORE SERVICING THE STEERING COLUMN THE AIRBAG SYSTEM MUST BE DISARMED. REFER TO ELECTRICAL RESTRAINT SYSTEM FOR SERVICE PROCEDURES. FAILURE TO DO SO MAY RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY.

CAUTION: All fasteners must be torqued to specification to ensure proper operation of the steering column.

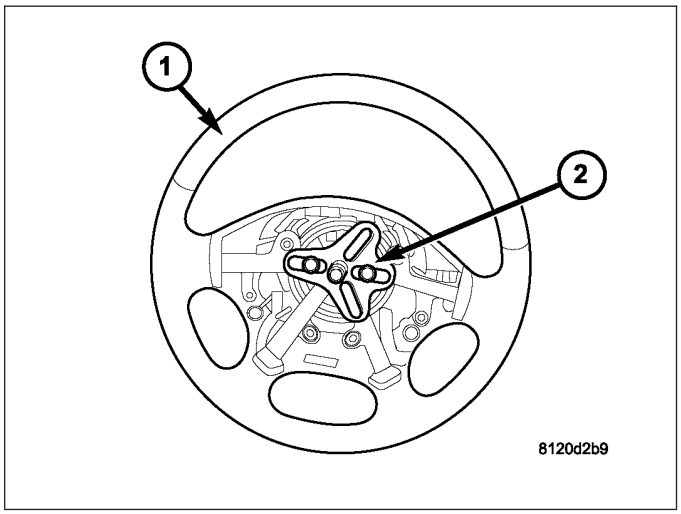
1. Position the front wheels **straight ahead**.
2. Disconnect the negative (ground) cable from the battery.

3. Remove the airbag (3), (Refer to 8 - ELECTRICAL/ RESTRAINTS/DRIVER AIRBAG - REMOVAL).
4. Disconnect the electrical connector (2) from the air bag.

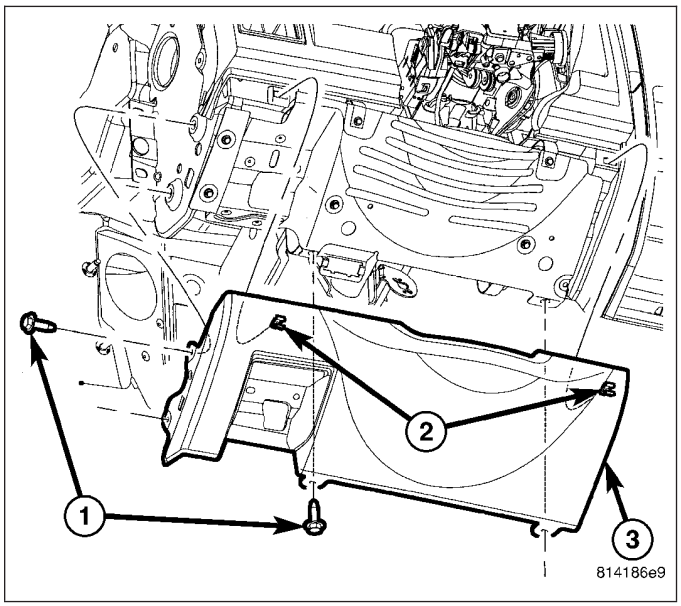


5. Remove the steering wheel (1) with special tool CJ98–1 (2) or an appropriate steering wheel puller.

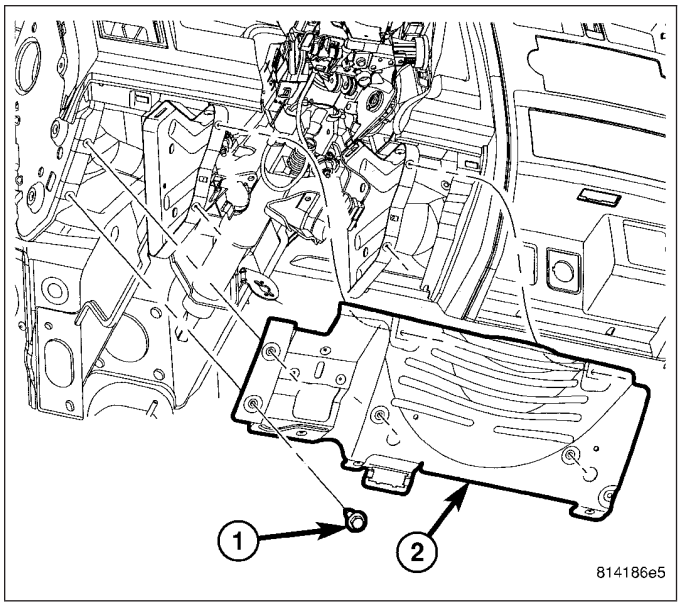
CAUTION: Ensure the puller bolts are fully engaged into the steering wheel and not into the clockspring, before attempting to remove the wheel. Failure to do so may damage the steering wheel/clockspring.



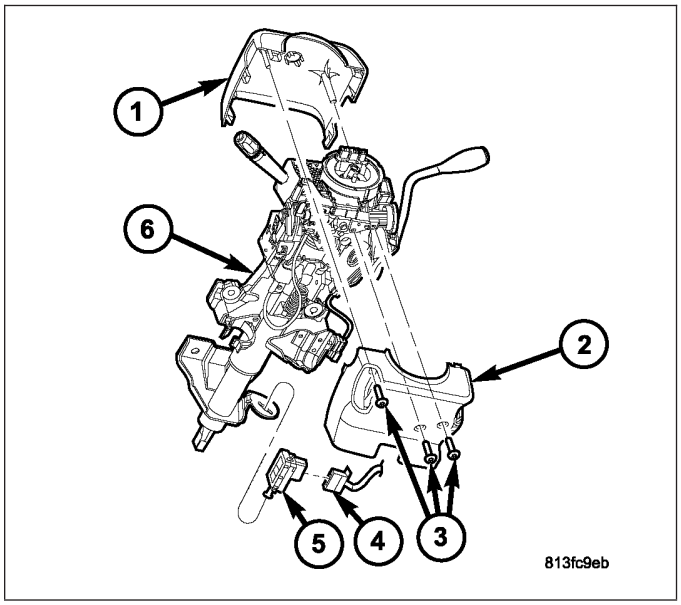
6. Remove the steering column opening cover (3) (Refer to 23 - BODY/INSTRUMENT PANEL/ STEERING COLUMN OPENING COVER - REMOVAL).



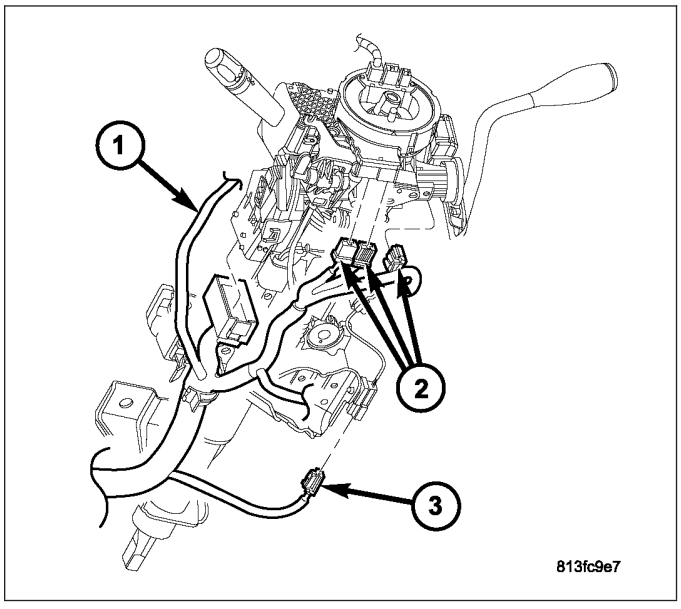
7. Remove the steering column opening cover reinforcement (2).



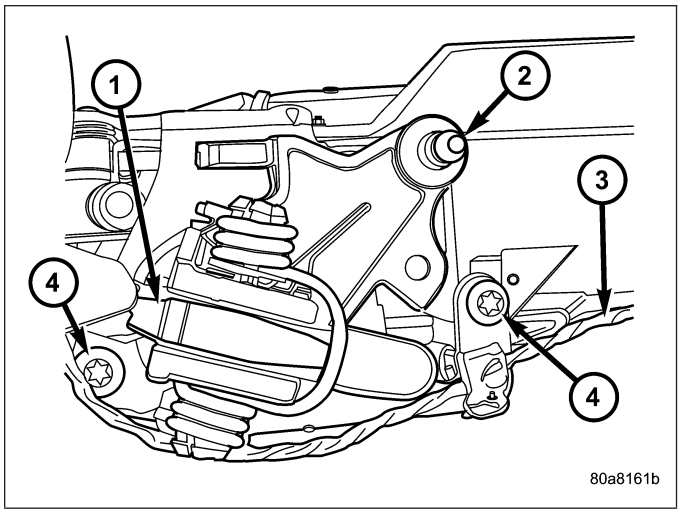
8. Remove the tilt lever.
9. Remove the column shrouds (1&2).



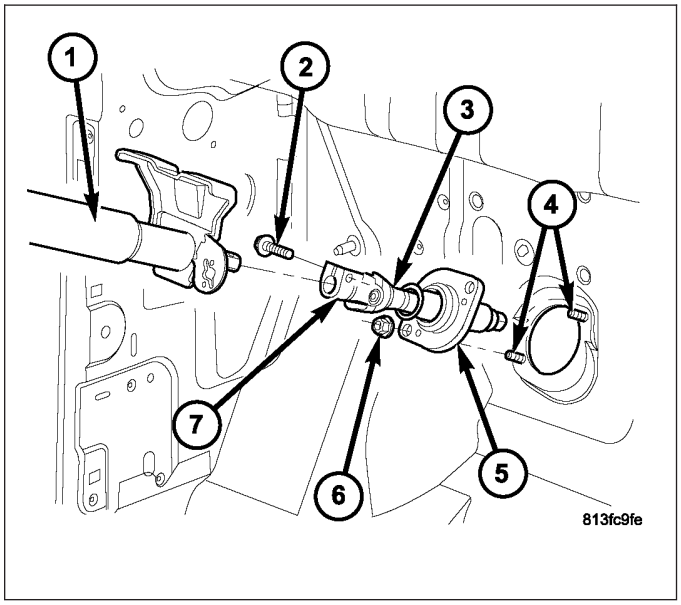
10. Remove the clock spring, (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).
11. Disconnect the wiring harness to the column (1.2&3).



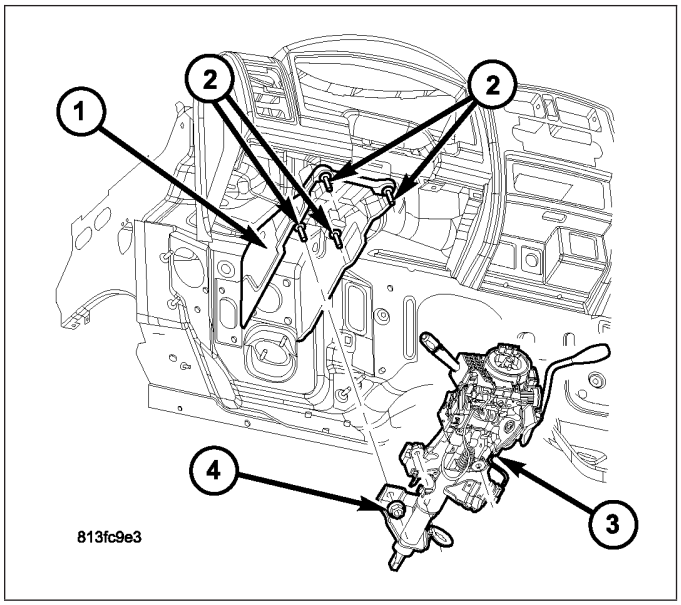
12. Remove the shift cable (2) from the column shift lever actuator (1) (Refer to 21 - TRANSMISSION/ TRANSAXLE/AUTOMATIC - 32RH/GEAR SHIFT CABLE - REMOVAL).
13. Release the shift cable from the column bracket and remove it from the bracket.
14. Remove the SKIM module in order to disconnect the electrical connector.



15. Remove the upper steering shaft coupler bolt (2) from the column (1).
16. Separate the shaft from the coupler (7).



17. Remove the brake light switch and discard (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - REMOVAL).
18. Remove the four steering column mounting nuts (4).
19. Remove the steering column assembly (3) from the vehicle.

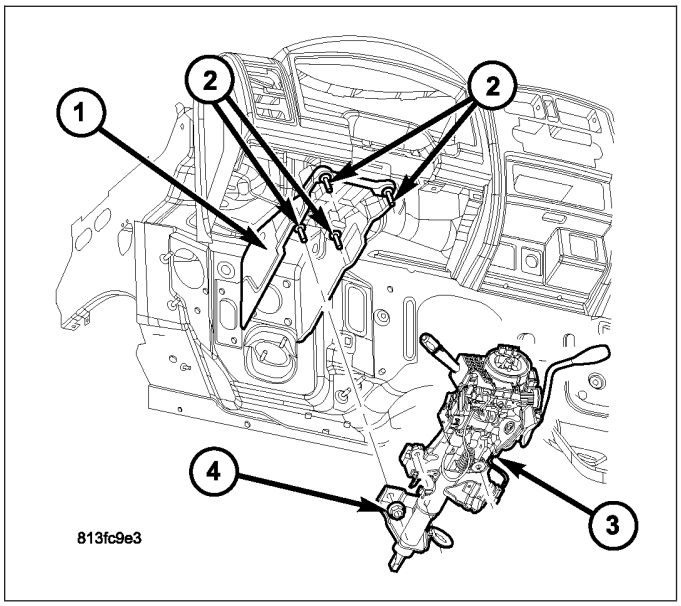


INSTALLATION

WARNING: BEFORE SERVICING THE STEERING COLUMN THE AIRBAG SYSTEM MUST BE DISARMED. REFER TO ELECTRICAL RESTRAINT SYSTEM FOR SERVICE PROCEDURES. FAILURE TO DO SO MAY RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY.

CAUTION: All fasteners must be torqued to specification to ensure proper operation of the steering column.

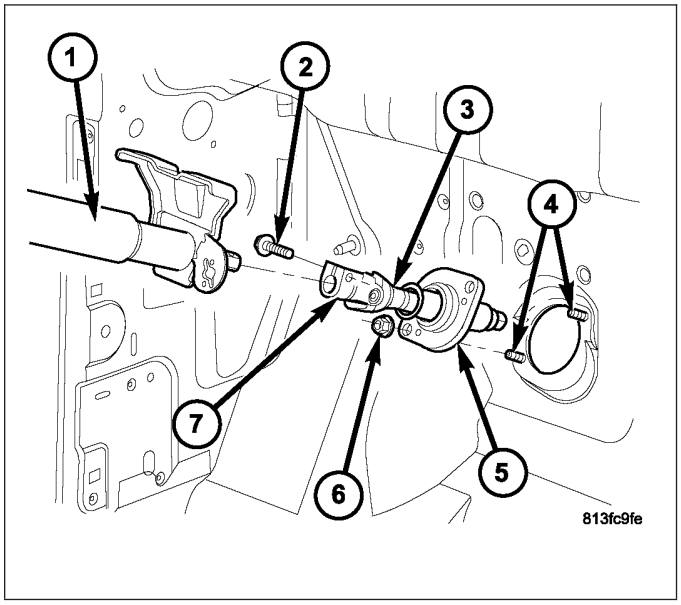
1. Position the steering column (3) on the dash panel support (1) and loosely install the mounting nuts (4).
2. Firmly slide the steering column upward against the studs (2) in dash panel and hand tighten the nuts.



3. Center steering column (3) in dash opening and tighten mounting nuts (4) to 28 N·m (250 in. lbs.).

NOTE: Torque the upper left nut first then the lower right nut. Then torque the lower left nut then the upper right nut.

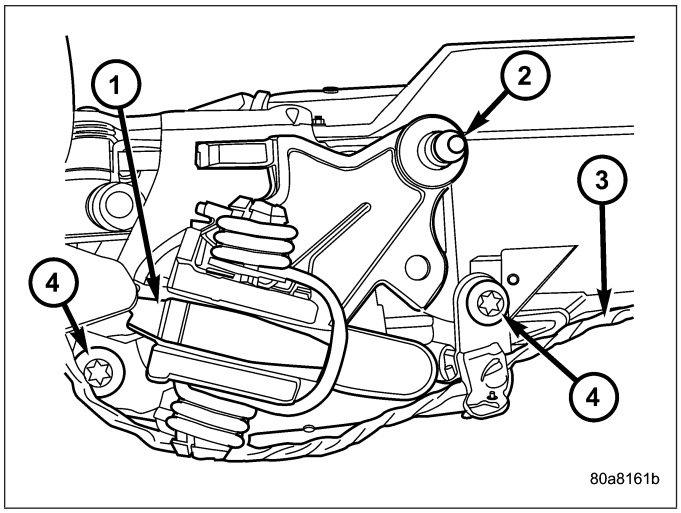
4. Install the steering shaft coupler (7) on the steering shaft (1) and loosely install a **new** bolt (2).



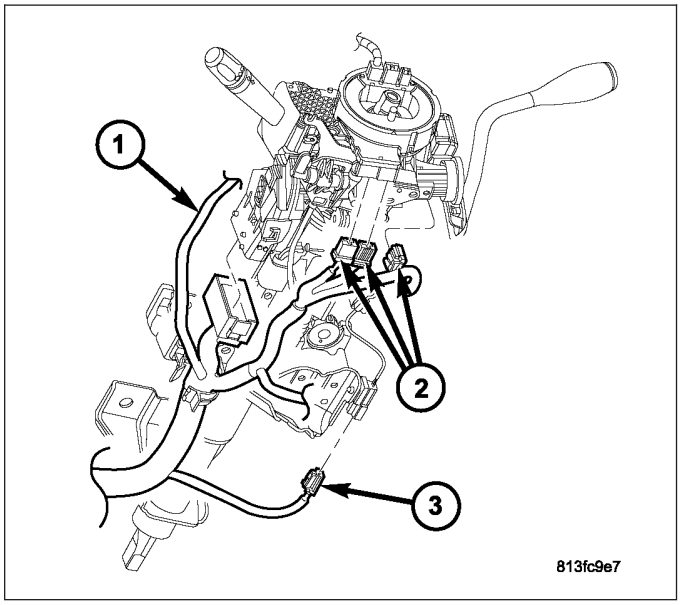
NOTE: A new bolt must be used for reinstallation.

5. Tighten the coupler bolt (2) to 57 N·m (42 ft. lbs.).

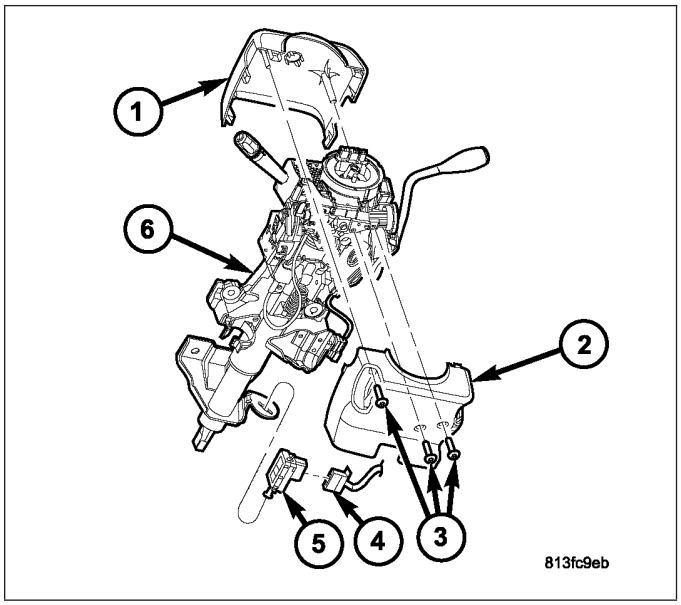
6. Install a new brake light switch (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - REMOVAL).
7. Install the shifter cable (2). (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 32RH/GEAR SHIFT CABLE - INSTALLATION).



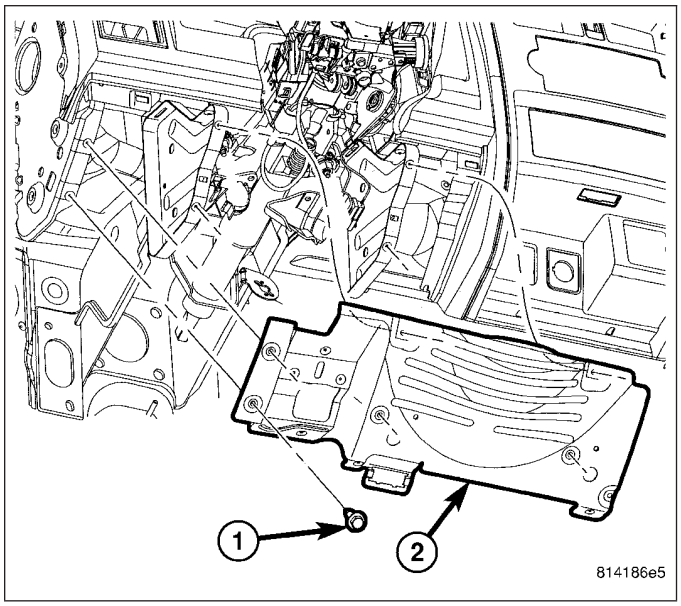
8. Connect the wiring harness (1,2&3) to the column.
9. Install the SKIM module.
10. Install the clockspring (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).



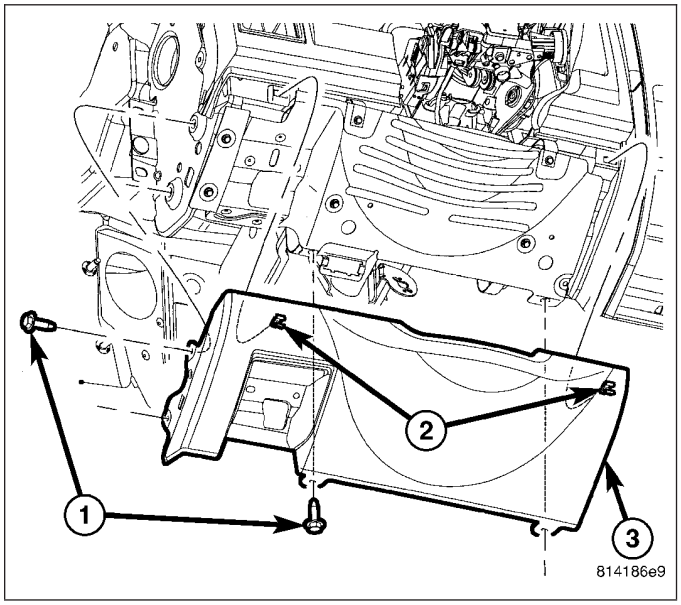
11. Install the shrouds (1&2).



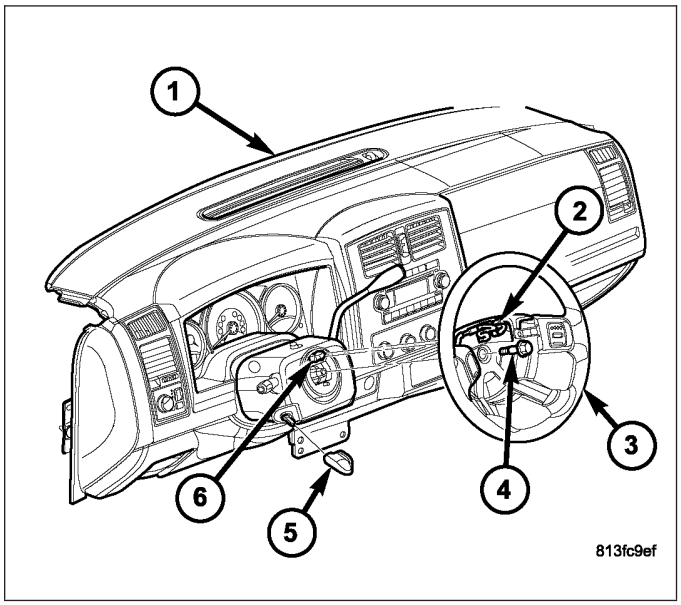
12. Install the steering column opening cover reinforcement (2) (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).



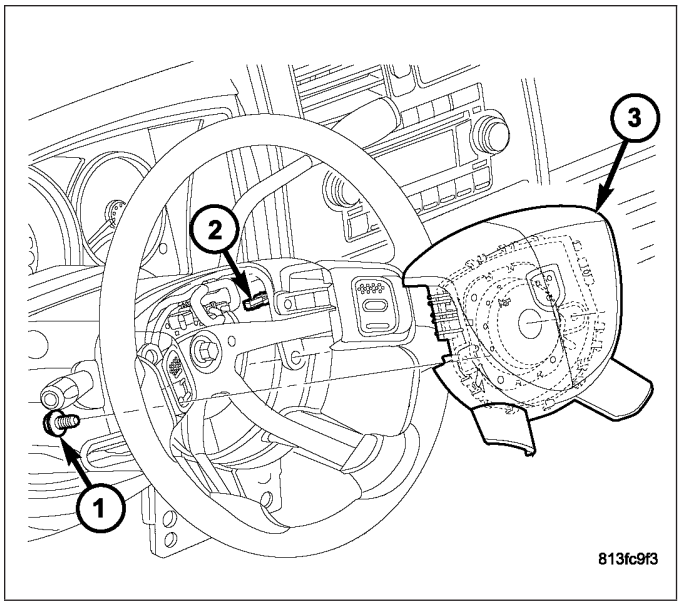
13. Install the steering column opening cover (3).



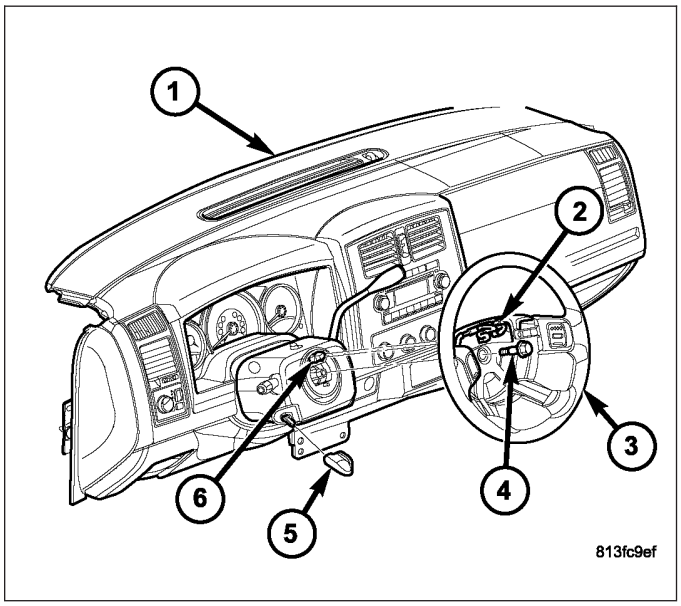
14. Align the spline on the wheel hub to shaft.
15. Then install the steering wheel (3) and install a **new** bolt (4). Tighten the bolt to 61 N·m (45 ft. lbs.).



16. Reconnect the electrical connectors (2) for the air bag (3).
17. Install the airbag (3) (Refer to 8 - ELECTRICAL/ RESTRAINTS/DRIVER AIRBAG - INSTALLATION).



18. Install the tilt lever handle (5).
19. Install the negative battery terminal.
20. Test the operation of the horn, Electronic PRNDL Indicator, lights and any other functions that are steering column operated.



SPECIFICATIONS

TORQUE CHART

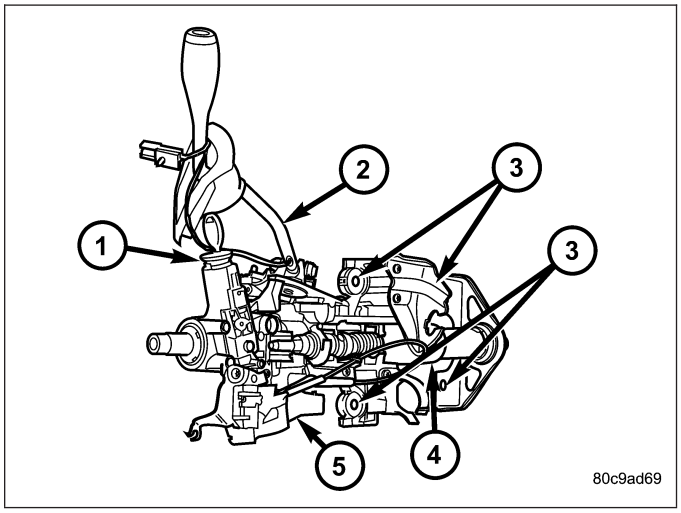
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Tilt Lever Release Knob Bracket Mounting Screws	4.5	—	40
Gear Shift Lever Assembly Mounting Screws	12	—	105
Steering Column Mounting Nuts	28	—	250
Steering Wheel Bolt	61	45	—
Steering Coupler Shaft Upper Pinch Bolt	38	28	—
Steering Coupler Shaft Lower Pinch Bolt	38	28	—
Toe Plate Nuts	12	—	105

SWITCH-IGNITION

DESCRIPTION

The ignition switch (5) is located on the steering column (4). It is used as the main on/off switching device for most electrical components. The mechanical key cylinder is used to engage/disengage the electrical ignition switch.



OPERATION

Vehicles equipped with an automatic transmission and a steering column mounted shifter: an interlock device is located within the shift cable. This interlock device is used to lock the transmission shifter in the PARK position when the key cylinder is in any position and the brake pedal is not depressed.

DIAGNOSIS AND TESTING

IGNITION SWITCH

TEST AND REPAIR

If the key removal effort is excessive on a vehicle with a automatic transmission first adjust the shift linkage, (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 46RE/GEAR SHIFT CABLE - ADJUSTMENTS).

If the ignition switch effort is excessive remove the ignition key cylinder from the steering column. (Refer to 19 - STEERING/COLUMN/LOCK CYLINDER HOUSING - REMOVAL). Check the turning effort of the key cylinder. If the ignition key cylinder effort is excessive replace the key cylinder. If the ignition key cylinder operates properly look for the following conditions.

REMOVAL

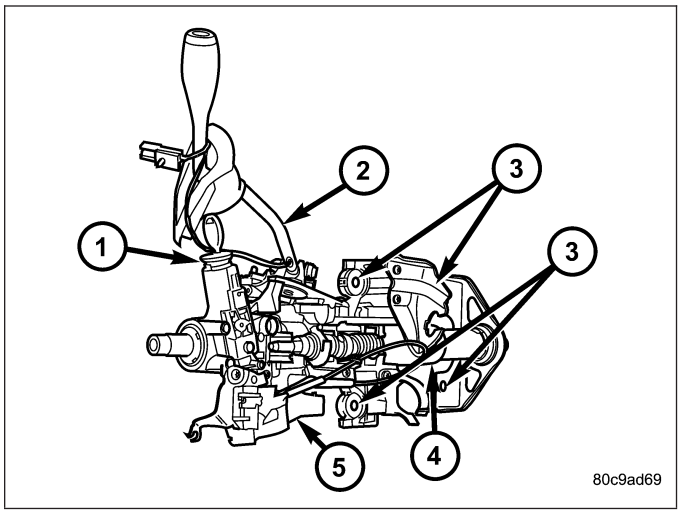
SERVICE PRECAUTIONS

NOTE: The steering column on vehicles equipped with an automatic transmission is not equipped with an internal locking shaft with the ignition cylinder. Alternative methods of locking the steering wheel for service will have to be used.

The tilt and standard column (4) have been designed to be serviced as an assembly; without wiring, switches, shrouds, steering wheel, etc. Most steering column components can be serviced without removing the steering column from the vehicle.

Safety goggles should be worn at all times when working on steering columns.

To service the steering wheel, switches or airbag, Refer to Electrical Restraints and follow all WARNINGS and CAUTIONS.



WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIRBAG SYSTEM COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY. THE FASTENERS, SCREWS, AND BOLTS, ORIGINALLY USED FOR THE AIRBAG COMPONENTS, HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANYTIME A NEW FASTENER IS NEEDED, REPLACE WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR FASTENERS LISTED IN THE PARTS BOOKS.

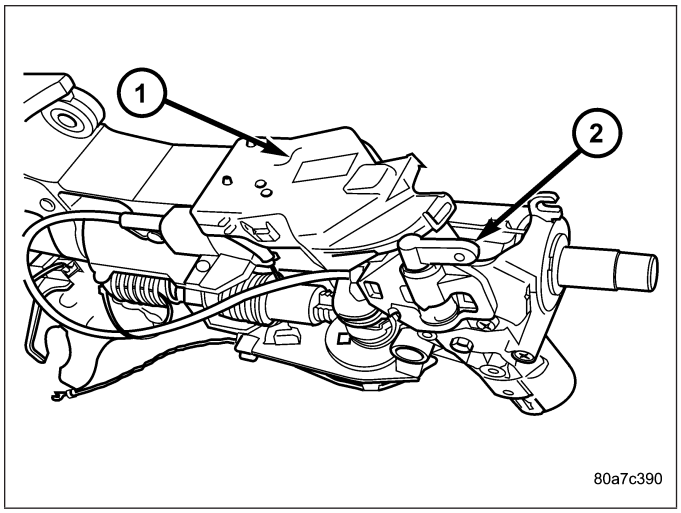
CAUTION: Do not hammer on steering column shaft. This may cause damage to the shaft or bearing.

CAUTION: Do not attempt to remove the pivot bolts to disassemble the tilting mechanism.

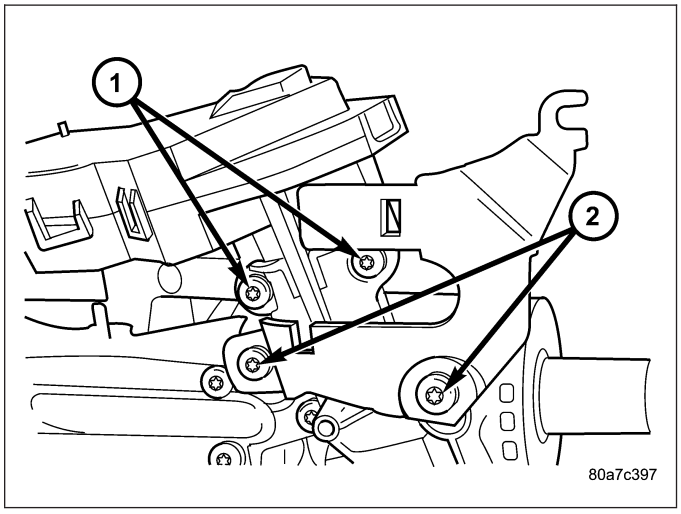
The ignition key must be in the key cylinder for cylinder removal. The key cylinder must be removed first before removing ignition switch.

1. Remove the negative (ground) cable from the battery.
2. Disable the airbag, (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).
3. Remove the lower and upper shrouds.
4. Remove key cylinder. (Refer to 19 - STEERING/COLUMN/LOCK CYLINDER HOUSING - REMOVAL).
5. Disconnect the lower clockspring connectors.
6. Remove the wire retainer from the tilt lever bracket.

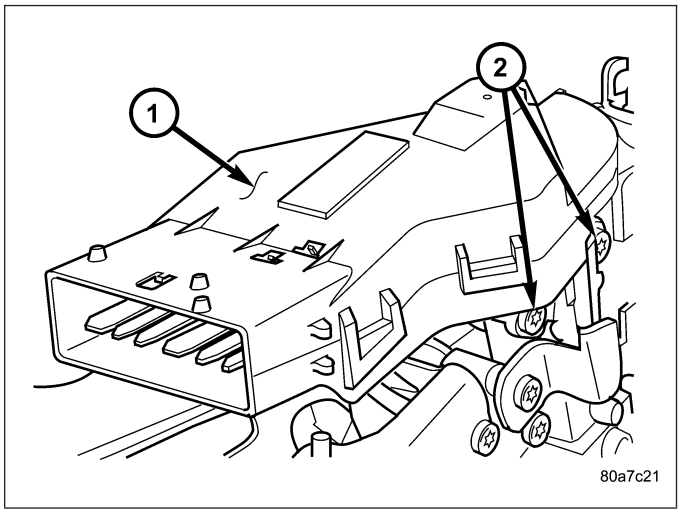
7. Remove the tilt lever mounting screws to gain access to the ignition switch (1) mounting screws.



8. For columns without tilt remove the bracket (2) to gain access to the ignition switch mounting screws (2).



9. Disconnect the electrical connector at rear of ignition switch (1).
10. Remove ignition switch mounting screw (2).
11. Using a small screwdriver, push on locking tab and remove switch from steering column.

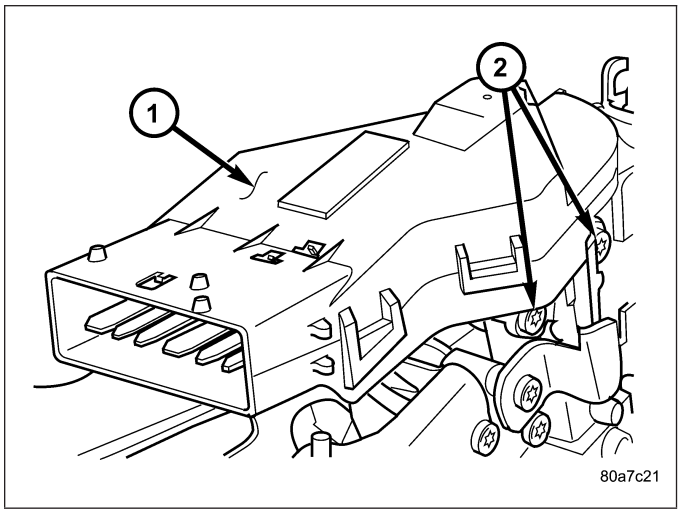


INSTALLATION

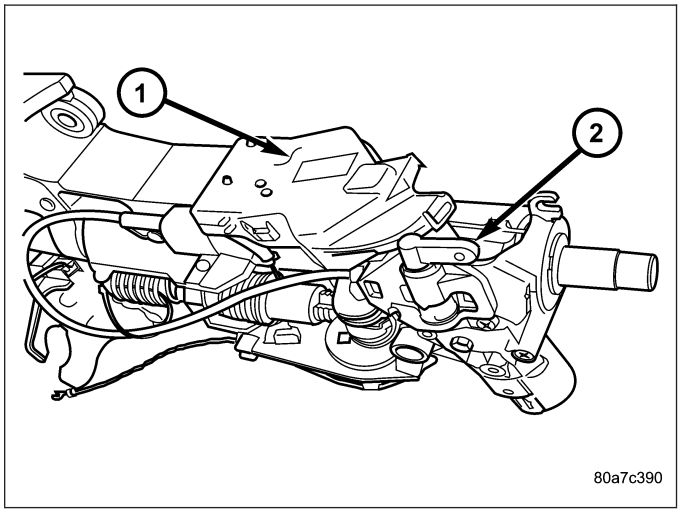
The ignition key must be in the key cylinder for cylinder removal. The key cylinder must be removed first before installing ignition switch.

1. Before installing ignition switch, rotate the slot in the switch to the ON position.

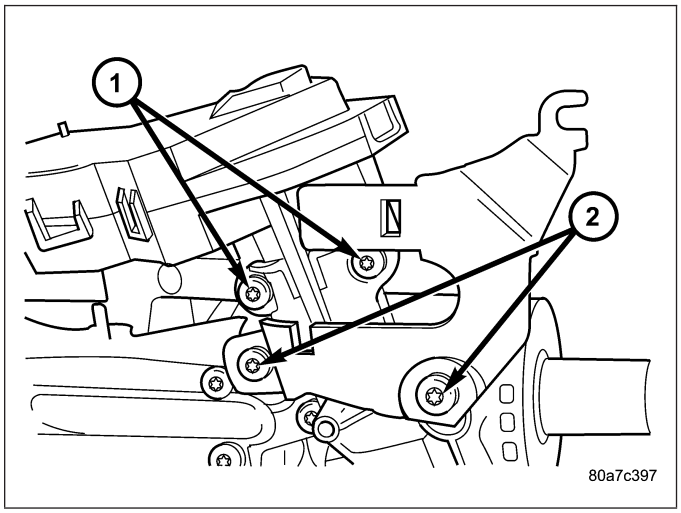
2. Connect the electrical connector to rear of the ignition switch. Make sure that locking tabs are fully seated into wiring connector.
3. Position switch (1) to column and install the mounting screw (2). Tighten screw to 3 N·m (26 in. lbs.).



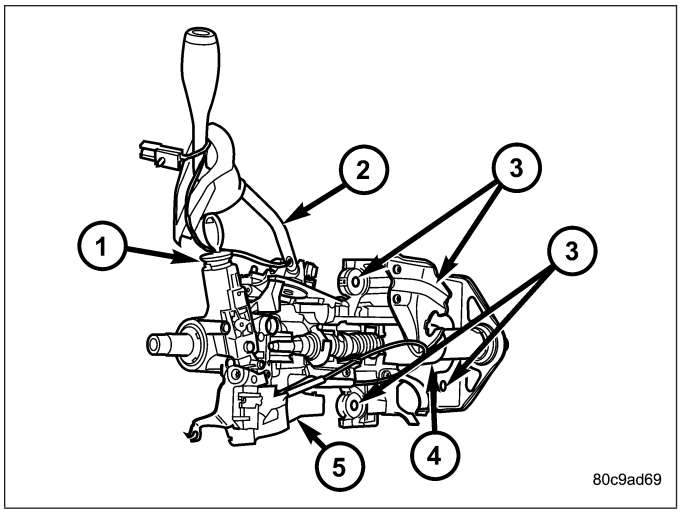
4. Install the tilt lever bracket (2) mounting screws. Tighten screws to 4.5 N·m (40 in. lbs.).



5. If the column is non-tilt install the bracket (2). Tighten screws to 4.5 N·m (40 in. lbs.)



6. Position the wire retainer into the tilt lever bracket.
7. Reconnect the lower clockspring connectors.
8. Install the key cylinder (1)
9. Install steering column upper and lower shrouds.
10. Enable the airbag system. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).



SWITCH-KEY-IN IGNITION

DESCRIPTION

The key-in ignition switch is integral to the ignition switch, which is mounted on the left side of the steering column. It closes a path to ground for the Central Timer Module (CTM) when the ignition key is inserted in the ignition key cylinder and the driver door ajar switch is closed (driver door is open). The key-in ignition switch opens the ground path when the key is removed from the ignition key cylinder. The ground path is also opened when the driver door ajar switch is open (driver door is closed).

The key-in ignition switch cannot be repaired and, if faulty or damaged, the entire ignition switch must be replaced, (Refer to 19 - STEERING/COLUMN/IGNITION SWITCH - REMOVAL).

DIAGNOSIS AND TESTING

IGNITION SWITCH AND KEY LOCK CYLINDER

ELECTRICAL DIAGNOSIS

For ignition switch electrical schematics, refer to Ignition Switch in the appropriate section of Electrical Wiring Diagrams.

MECHANICAL DIAGNOSIS (KEY DIFFICULT TO ROTATE)

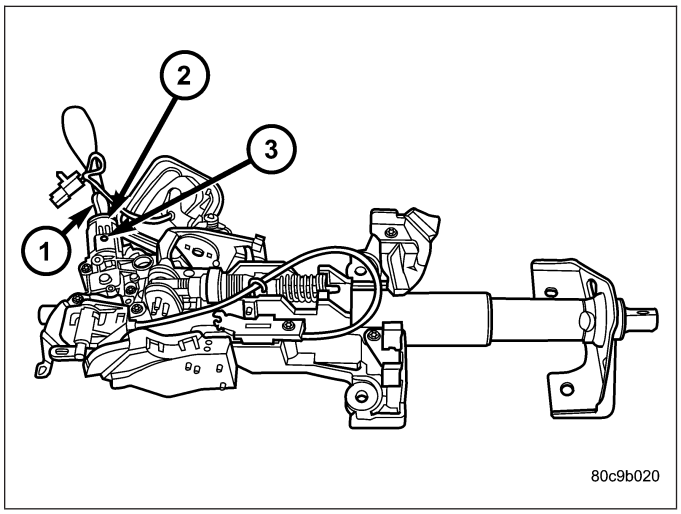
(Refer to 19 - STEERING/COLUMN/IGNITION SWITCH - DIAGNOSIS AND TESTING).

KEY/LOCK CYLINDER

REMOVAL

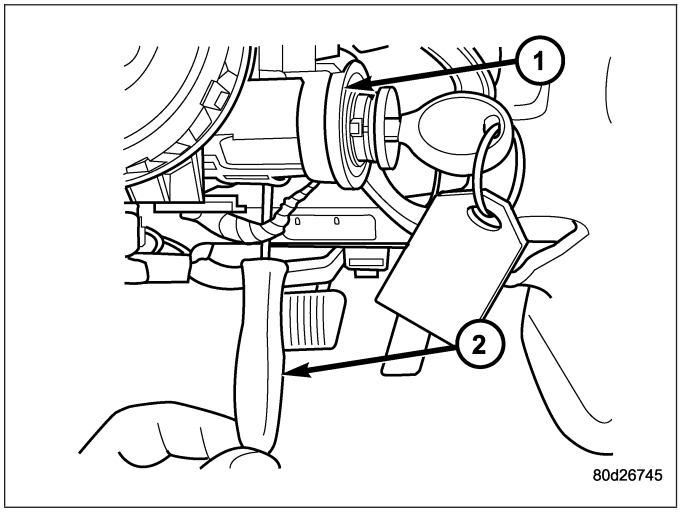
The ignition key (1) must be in the key cylinder (2) for cylinder removal.

1. Disconnect negative cable from battery.
2. Remove upper and lower covers (shrouds) from steering column.
3. Place shifter in PARK position.
4. A retaining pin is located at side of key cylinder assembly (2).



a. Rotate key to RUN position.

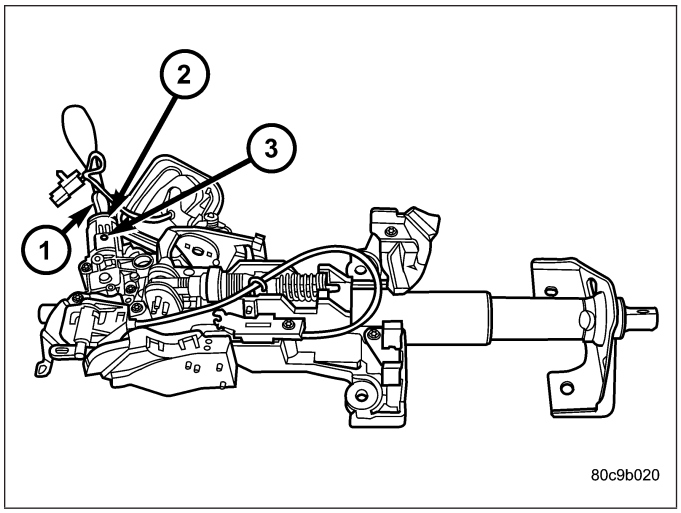
b. Press in on retaining pin while pulling key cylinder (1) from ignition switch.



INSTALLATION

The ignition key (1) must be in the key cylinder (2) for cylinder installation.

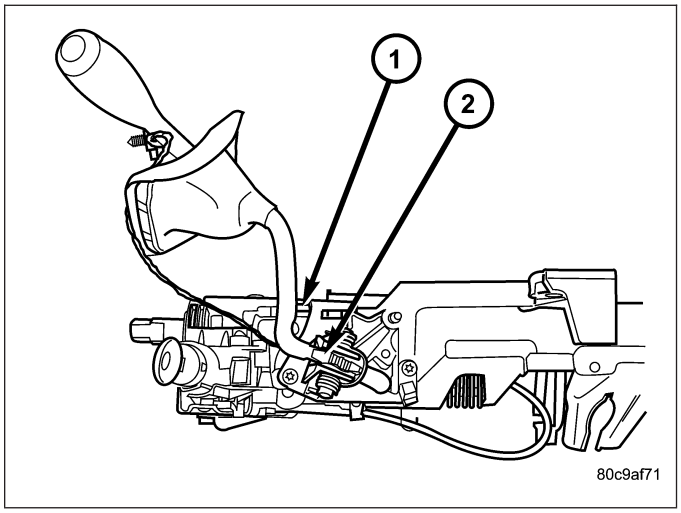
1. Install the key cylinder into the housing using care to align the end of the key cylinder (2) with the ignition switch.
2. Push the key cylinder (2) in until it clicks.
3. Replace the upper and lower shrouds.
4. Reconnect the battery.



GEAR SHIFT LEVER

REMOVAL

1. Remove the kneeblocker. (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - REMOVAL).
2. Remove the upper and lower column shroud.
3. Remove and discard the brake light switch.
4. Loosen the column bolts and lower the column enough to allow clearance for the gear shift lever removal.
5. Disconnect the overdrive switch harness (if equipped).
6. Disconnect the shift cable from the shift lever.
7. Remove the SKIM.
8. Remove the gear shift lever mounting screws and remove the lever (2).
9. Remove the blocker pin from the inhibit link slot (1).

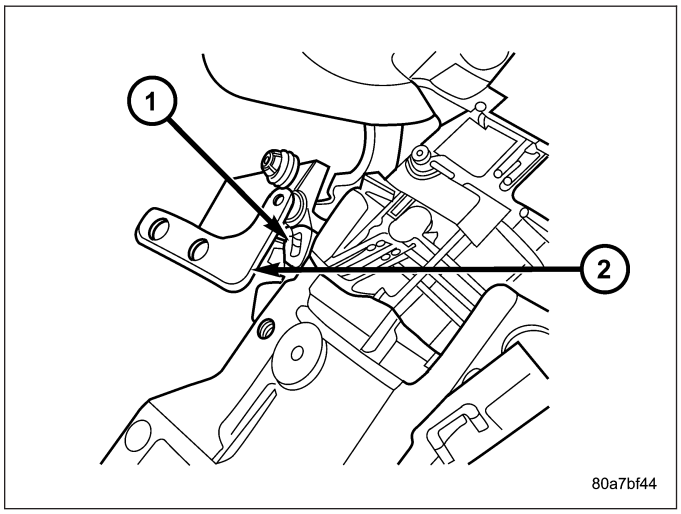


INSTALLATION

1. Install the lever assembly (2) using care to install the pin in the blocker to slider slot (1) and install the mounting screws and tighten to 12 N·m (105 in. lbs.).
2. Cycle the key from ACC to RUN and ensure that the blocker does not stick or bind.
3. Turn the key to the OFF position and ensure that the shifter will not pull from the PARK position.
4. Connect the over drive switch harness (if equipped).

NOTE: Route and tie off harness to original location.

5. Connect the shift cable to the lever (2).

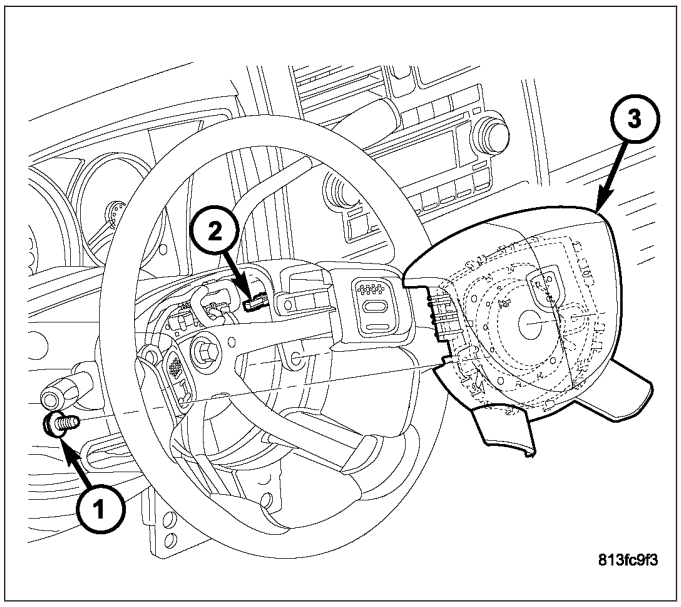


6. Ensure the gear shift lever and transmission are in the PARK position and snap the cable adjust clip in place.
7. Install a new brake light switch (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - INSTALLATION).
8. Install the SKIM and halo.
9. Install the upper and lower column shroud.
10. Install the column back into place and tighten.
11. Install the kneeblocker. (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - INSTALLATION).

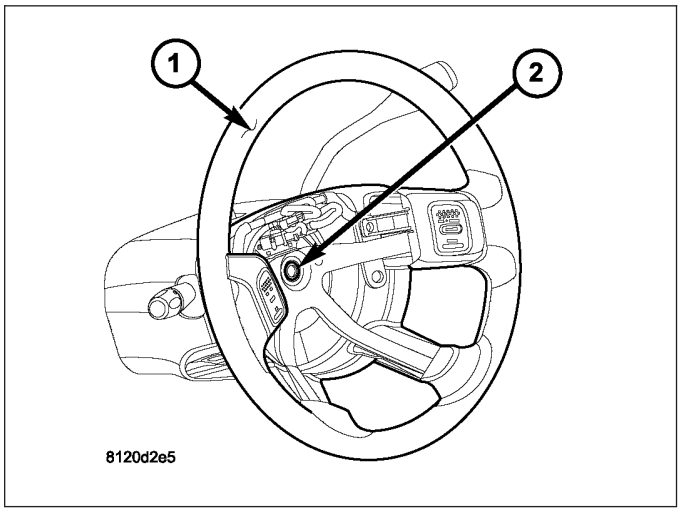
STEERING WHEEL

REMOVAL

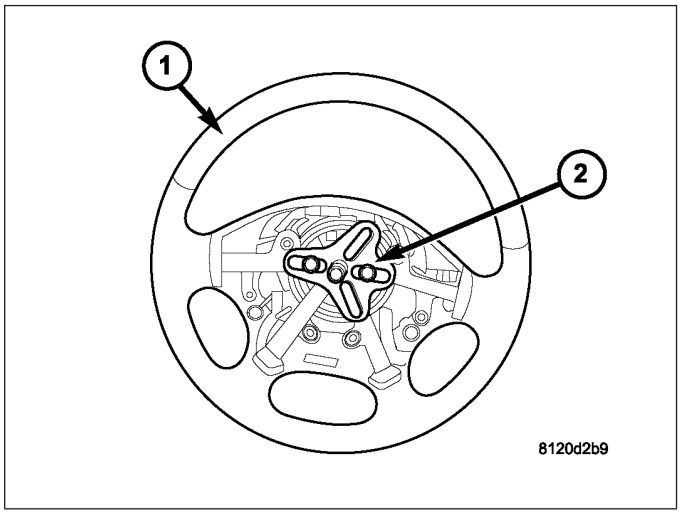
1. Disable and remove the driver's side airbag (3). (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).



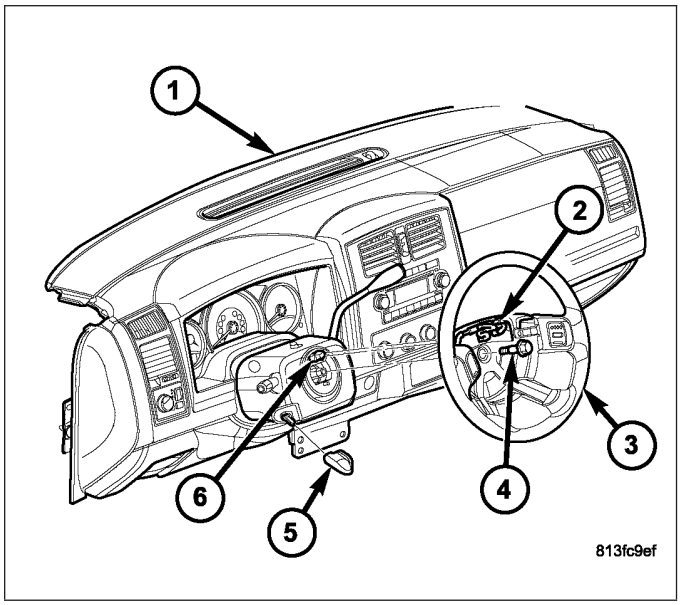
2. Partially remove the steering wheel bolt (2) and leave the bolt in the column.



3. Install puller CJ98-1(2) or equivalent using the top of the bolt to push on.



4. Remove and discard the steering wheel bolt (4).
5. Remove the steering wheel (3).



INSTALLATION

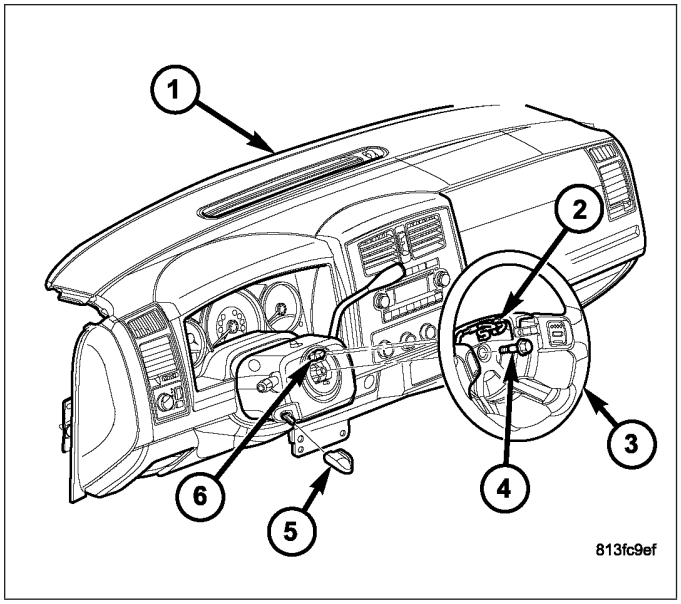
NOTE: Do not reuse the old steering wheel bolt (4) (a new bolt must be used)

NOTE: Make sure to align the spline on the steering wheel hub to the column shaft.

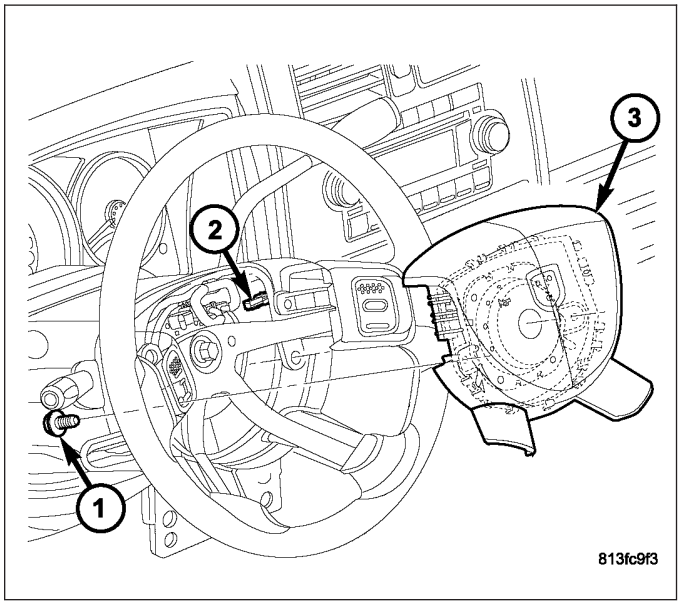
1. Install steering wheel (3) to the column (6).

NOTE: Be certain that the steering wheel mounting bolt is tightened to the proper torque specification to ensure proper clockspring operation.

2. Install the new steering wheel bolt (4). Tighten the bolt to 61 N·m (45 ft. lbs.).



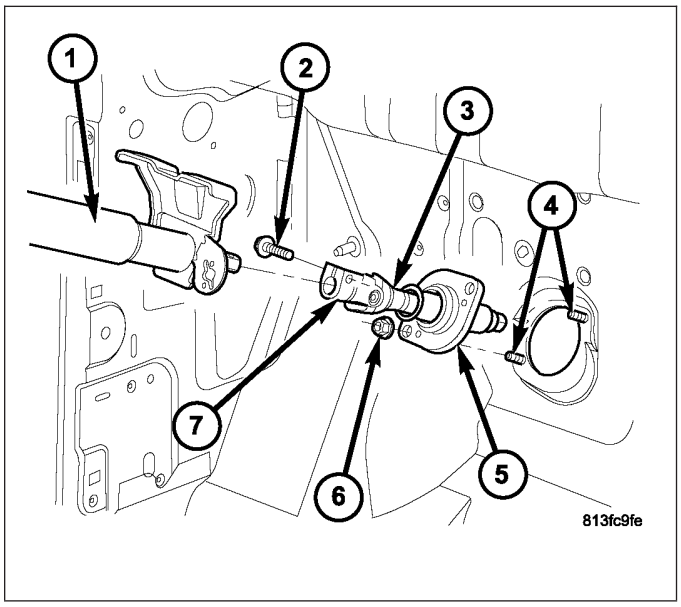
3. Install the driver's side air bag (3) to the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/ DRIVER AIRBAG - INSTALLATION).



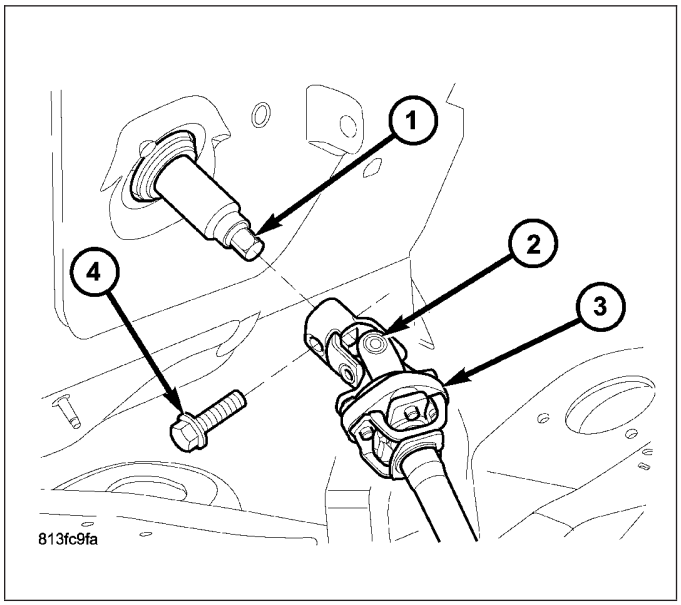
STEERING COUPLING SHAFT

REMOVAL

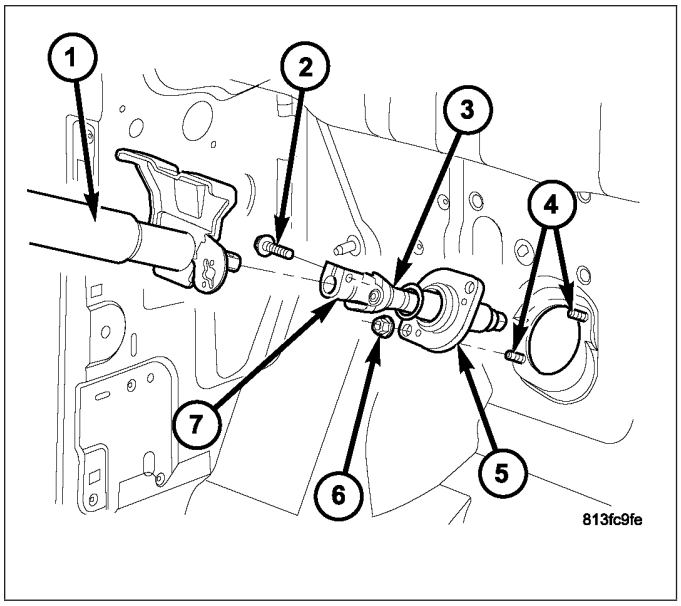
1. Disconnect the negative battery cable.
2. Lock the steering wheel with the tire in the straight position.
3. Remove and discard the upper pinch bolt (2) from the upper coupling at the cloumn (1).
4. Lower the steering coupler shaft (3) from the column (1).
5. Remove the toe plate (6) nuts (5).



6. Remove and discard the lower coupler pinch bolt (4) from the lower steering coupling shaft (3).



7. Remove the steering coupling shaft (3) from the vehicle.

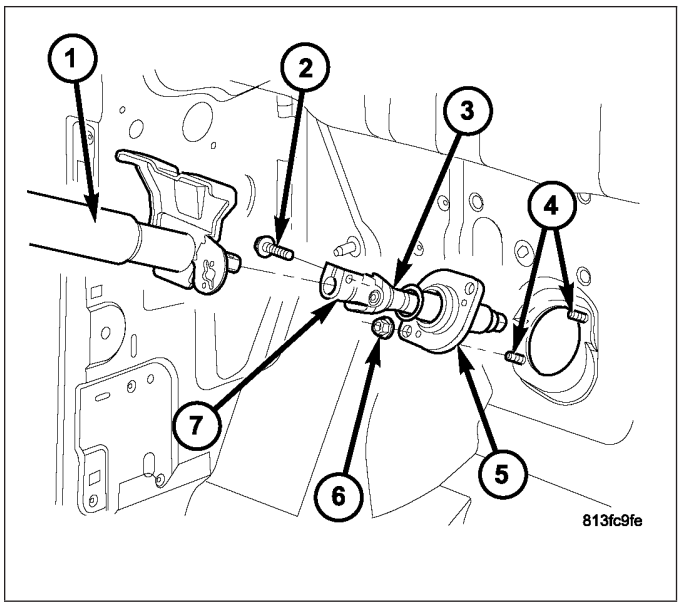


INSTALLATION

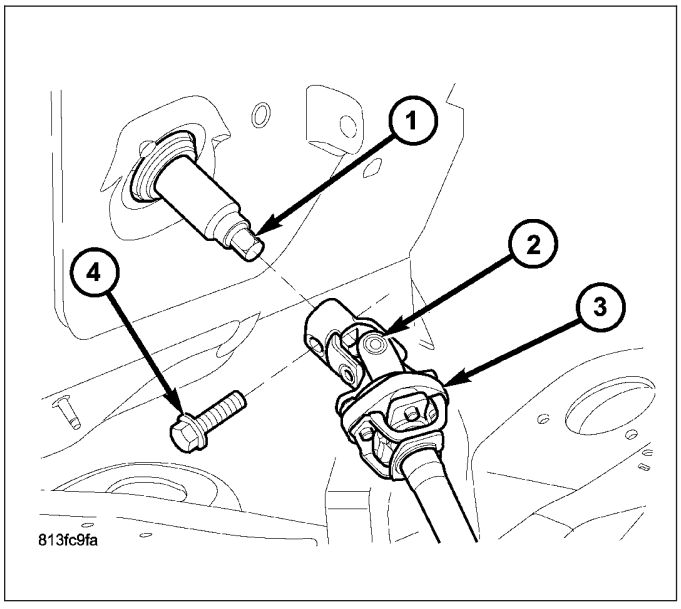
1. Install the upper steering coupling shaft (3) to the vehicle.

NOTE: Note: A new steering coupling shaft pinch bolt for the upper and lower shafts must be used.

2. Install the upper coupling (7) to the column (1).
3. Install the upper pinch bolt (2) use a new bolt and tighten to 38 N.m (28 ft.lbs).
4. Install the toe plate (5) nuts (6) and tighten to 12 N.m (105 in.lbs).



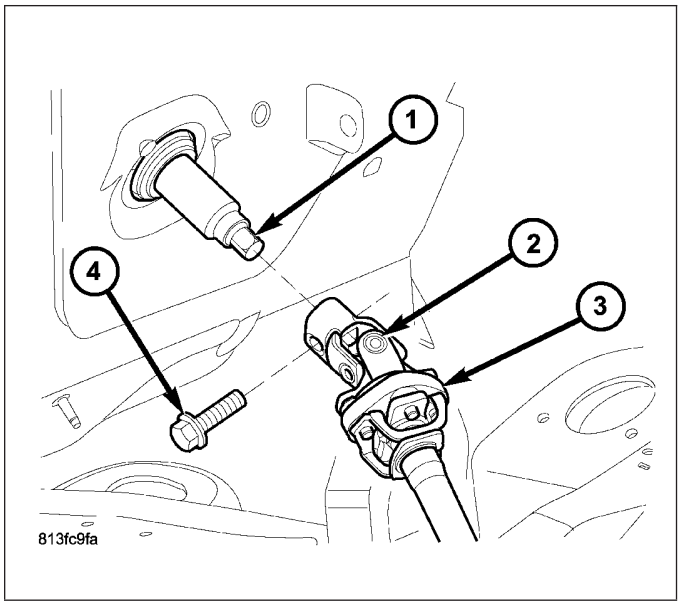
5. Install the shaft (1) to the lower coupling (2).
6. Install the lower pinch bolt (4) use new bolt and tighten to 38 N.m (28 ft.lbs).
7. Unlock the steering wheel.
8. Reconnect the negative battery cable.



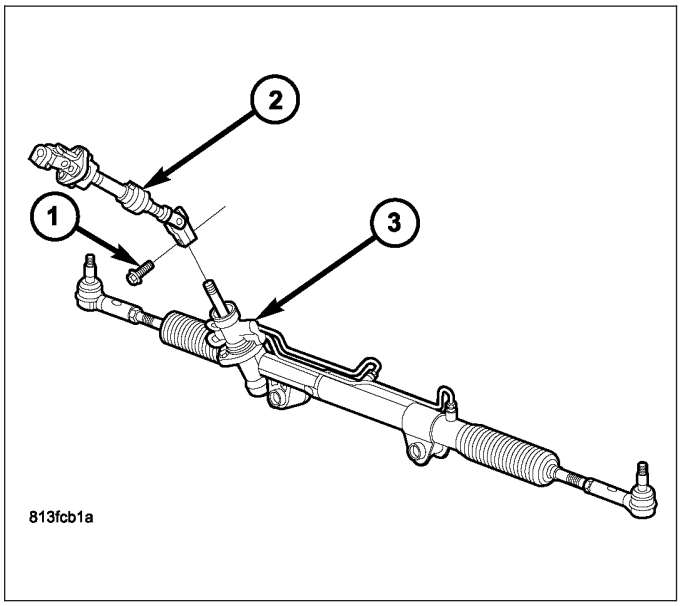
LOWER STEERING COUPLING

REMOVAL

1. Disconnect the negative battery cable.
2. Raise and support the vehicle.
3. Lock the steering wheel with the tire in the straight position.
4. Remove and discard the lower coupling (2) upper pinch bolt (4).

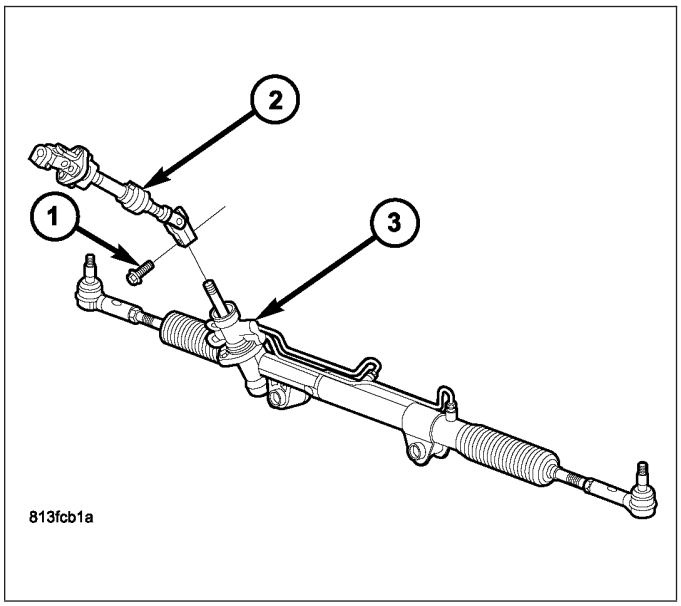


5. Remove and discard the lower coupling (2) pinch bolt (1).
6. Remove the lower steering shaft coupling (2) from the steering gear (3).



INSTALLATION

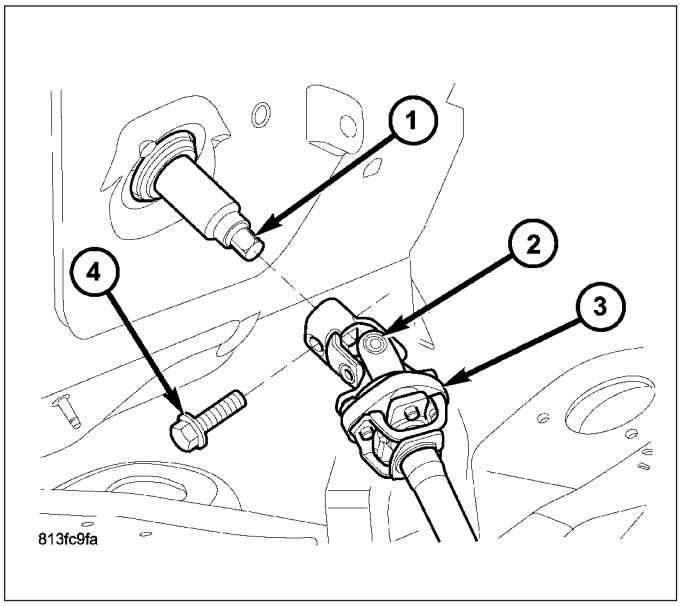
1. Install the coupling (2) to the steering gear (3).
2. Install the lower pinch bolt (1) and tighten to 38 N·m (28 ft. lbs.).



3. Install the other end of the coupling (2) to the steering shaft (1).

NOTE: New pinch bolts must be used for reinstallation.

4. Install the upper pinch bolt (4) and tighten to 38 N·m (28 ft. lbs.).



5. Lower the vehicle.
6. Reconnect the negative battery cable.
7. Unlock the steering wheel.

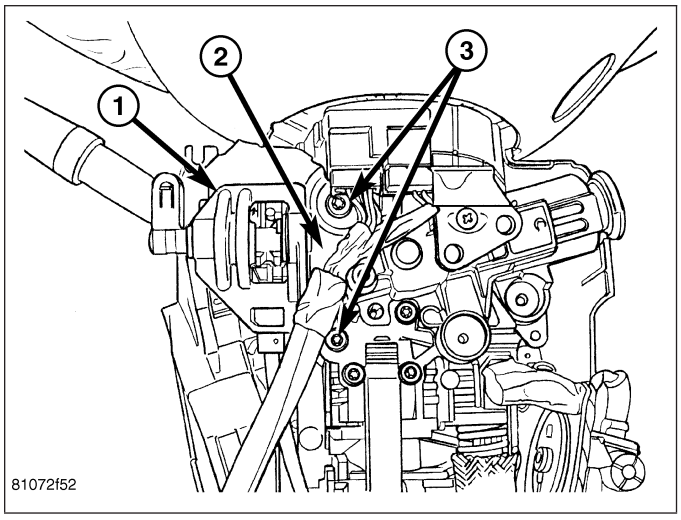
TILT LEVER KNOB RELEASE

REMOVAL

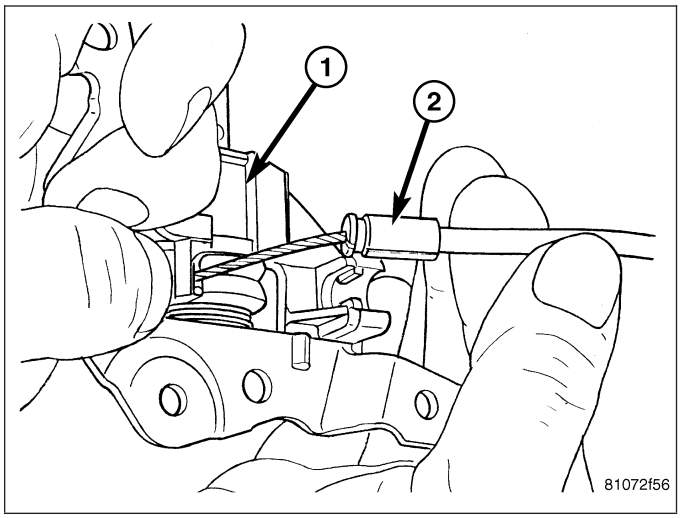
1. Remove the tilt lever handle.
2. Remove the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).
3. Remove the lower shroud.

NOTE: Use special care not to pry on the clockspring electrical connector when removing or installing the mounting screw located next to the clockspring.

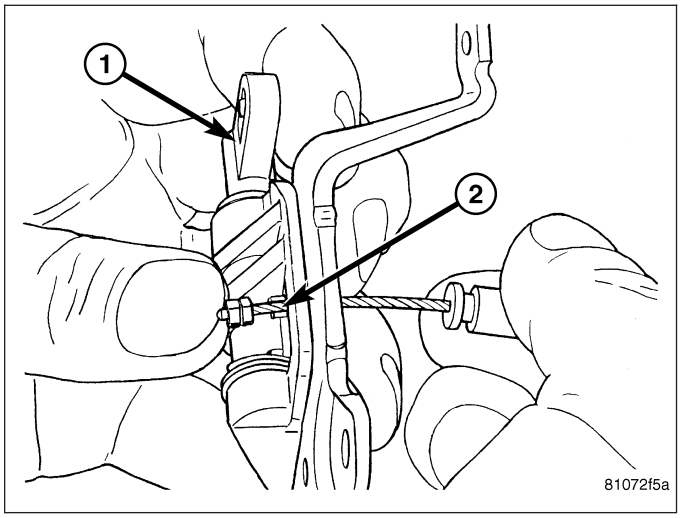
4. Remove the two mounting screws (3) from the tilt lever knob release bracket (1).
5. Disconnect the electrical harness plastic mounting tab (2) from the the bracket (1).



6. Unsnap the cable (2) from the bracket (1).

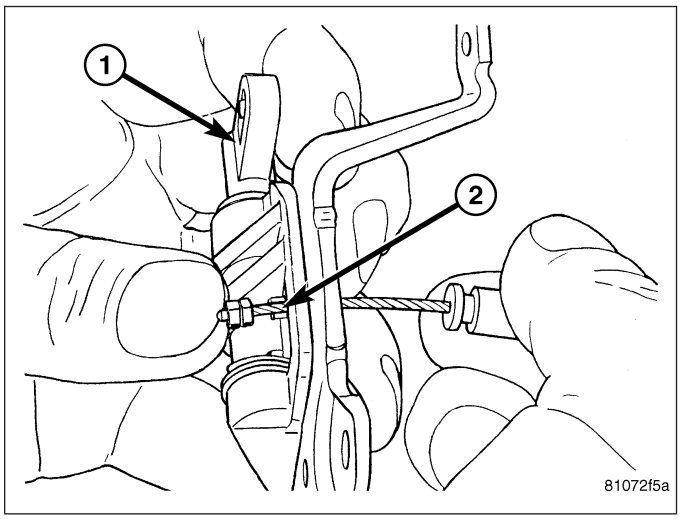


7. Remove the end of the cable (2) from the tilt lever knob release bracket (1).

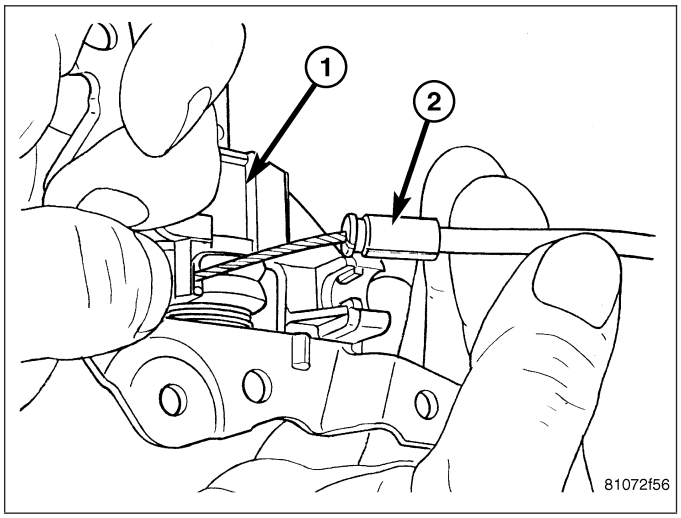


INSTALLATION

1. Route the cable (2) into the tilt lever release knob bracket (1).



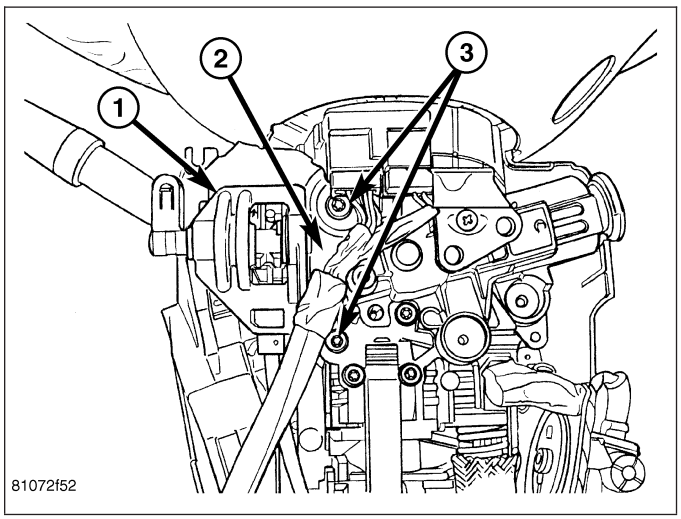
2. Snap the cable end (2) into the bracket (1).



NOTE: Use special care not to pry on the clockspring electrical connector when removing or installing the mounting screw located next to the clockspring.

NOTE: New screws should be used when installing the tilt lever release knob bracket to the column.

3. Install the tilt lever release knob bracket (1) to the column and install the two new mounting screws (3) Tighten the two new screws to 4.5 N·m (40 in. lbs.).
4. Install the electrical harness plastic mounting tab (2) to the bracket (1).



5. Install the lower shroud.
6. Install the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).
7. Install the tilt lever handle.

GEAR

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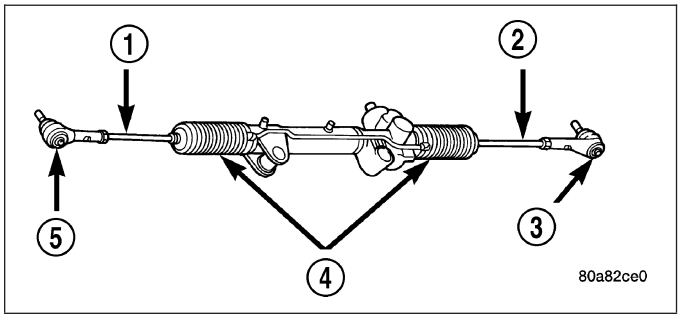
GEAR

DESCRIPTION

A rack and pinion steering gears is made up of two main components, the pinon shaft and the rack. Other components are the outer tie rod ends (3&5), inner tie rod ends (1&2), Mounting Bushings and the boots (4). The gear cannot be adjusted or internally serviced. If a malfunction or a fluid leak occurs, the gear must be replaced as an assembly. The only serviceable component on the steering gear is the outer tie rod ends (3&5).

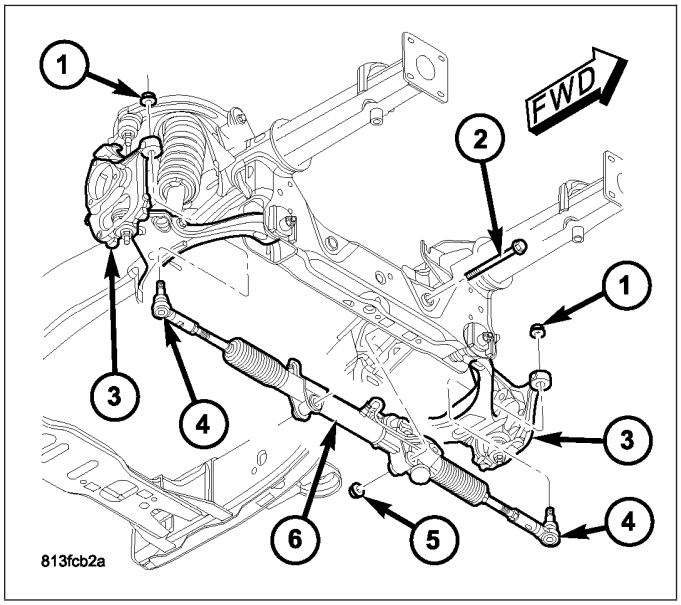


OPERATION

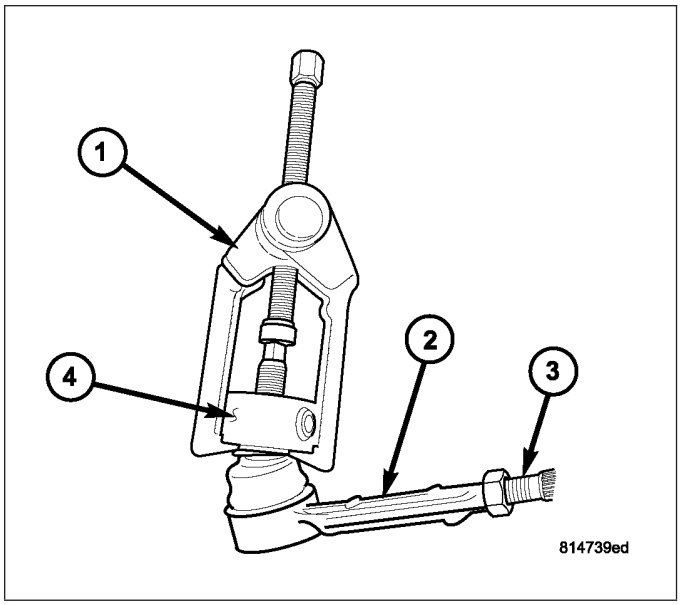
The steering column shaft is attached to the gear pinion. The rotation of the pinion moves the gear rack from side-to-side. This lateral action of the rack pushes and pulls the tie rods to change the direction of the front wheels.

REMOVAL

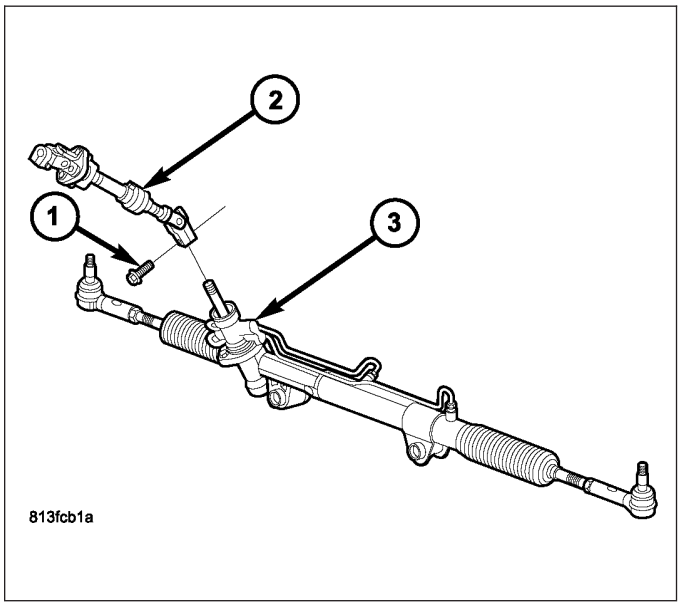
1. Siphon out as much power steering fluid as possible from the pump.
2. Lock the steering wheel.
3. Raise and support the vehicle.
4. Remove the front tires.
5. Remove the nuts (1) from the tie rod ends (4).



6. Separate tie rod ends (2) from the knuckles with Puller C3894–A (1) (Refer to 19 - STEERING/ LINKAGE/TIE ROD END - REMOVAL).

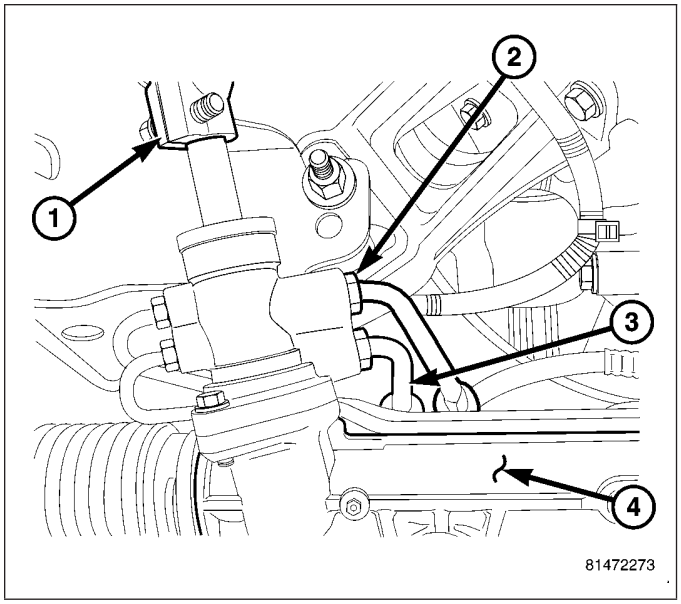


7. Remove the steering gear pinch bolt (1).
8. Remove the lower steering coupling (2) from the steering gear (3).
9. Turn the steering gear to the full right position.

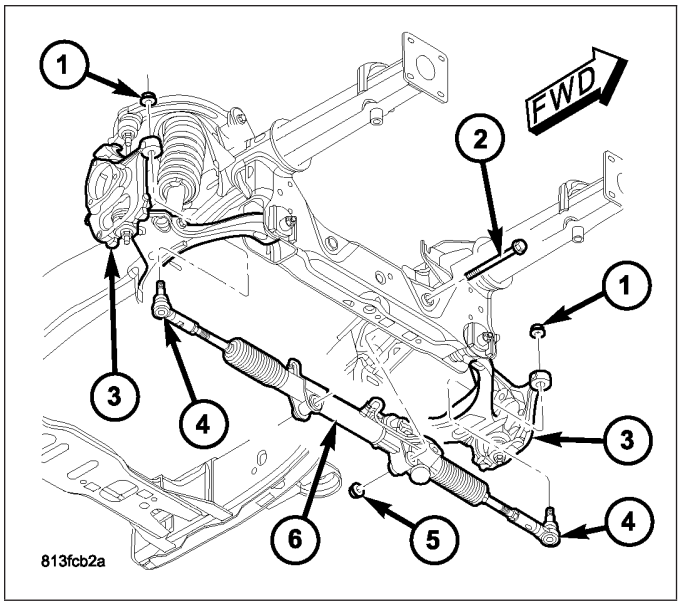


NOTE: Protect the end of hoses to prevent contamination to the system and damage to the o-rings.

10. Remove the power steering lines (2&3) from the gear (4). (Refer to 19 - STEERING/PUMP/HOSES - REMOVAL).



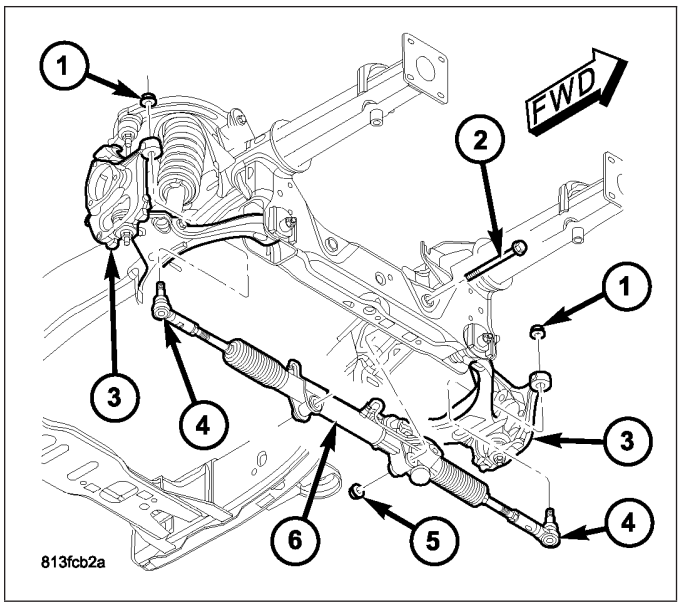
11. Remove the steering gear mounting bolts (2) and nuts (5).
12. Tip the gear (6) forward to allow clearance and move to the right then tip the gear downward on the left side to remove from the vehicle.



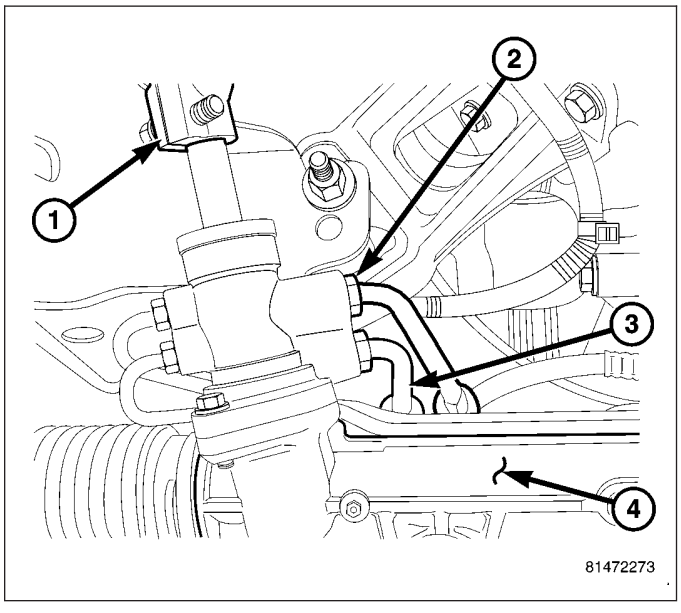
INSTALLATION

NOTE: Before installing gear inspect bushings and replace if worn or damaged.

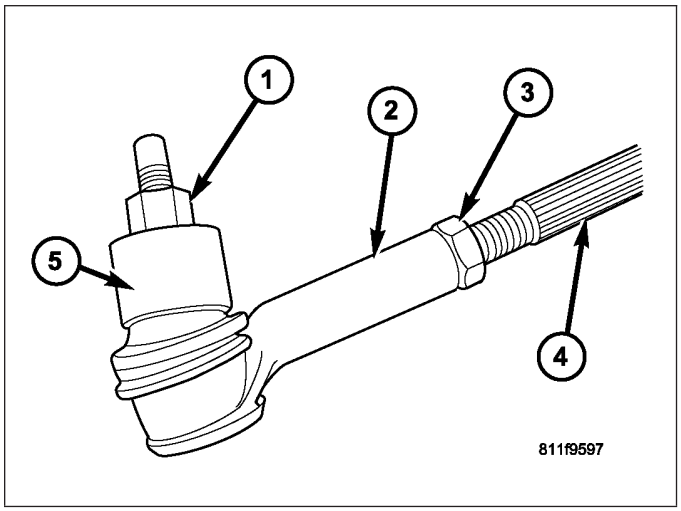
1. Install gear (6) to the vehicle and tighten mounting nuts (5) and bolts (2) to 258 N·m (190 ft. lbs.).



2. Install power steering lines (2&3) to steering gear (4) and tighten the pressure hose to 31 N·m (23 ft. lbs.) and tighten the return hose to 37 N·m (27 ft. lbs.). (Refer to 19 - STEERING/PUMP/HOSES - INSTALLATION).
3. Slide the shaft coupler (1) onto gear (4). Install **new** bolt (1) and tighten to 49 N·m (36 ft. lbs.).



4. Clean tie rod end studs and knuckle tapers (5).
5. Install tie rod ends (2) into the steering knuckles (5) and tighten the nuts (1) to 75 N·m (55 ft. lbs.). (Refer to 19 - STEERING/LINKAGE/TIE ROD END - INSTALLATION).



6. Install the front tires.
7. Remove the support and lower the vehicle.
8. Unlock the steering wheel.
9. Fill system with fluid, (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).
10. Adjust the toe position. (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

SPECIFICATIONS

TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Rack and Pinion Steering Gear Gear to Frame Bolts	258	190	—
Rack and Pinion Steering Gear Intermediate Shaft Bolt	38	28	—
Tie Rod End Knuckle Nut	75	55	—
Tie Rod End Jam Nut	75	55	—
Power Steering Line Pressure Line	31	23	—
Power Steering Line Return Line	37	27	—

LINKAGE

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LINKAGE

DIAGNOSIS AND TESTING

OUTER TIE ROD END

NOTE: If the outer tie rod end is equipped with a lubrication fitting, grease the joint then road test the vehicle before performing test.

1. Raise the front of the vehicle. Place safety floor stands under both lower control arms as far outboard as possible. Lower the vehicle to allow the stands to support some or all of the vehicle weight.
2. Remove the front tires.
3. Mount a dial indicator solidly to the vehicle steering knuckle and then zero the dial indicator.
4. Position indicator plunger on the topside of the outer tie rod end.

NOTE: The dial indicator plunger must be perpendicular to the machined surface of the outer tie rod end.

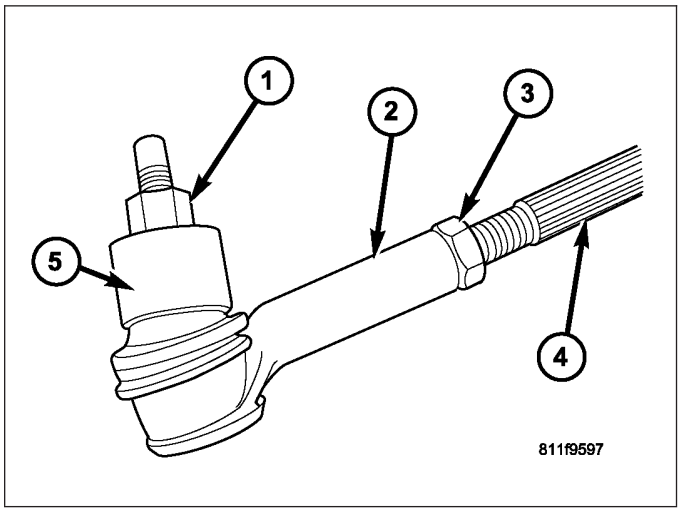
5. Position a pry bar in order to pry downwards on the outer tie rod end.
6. If the travel exceeds 0.5 mm (0.020 in.), replace the outer tie rod end (Refer to 19 - STEERING/LINKAGE/TIE ROD END - REMOVAL).
7. If the outer tie rod end is within specs reinstall the front tires (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

TIE ROD END

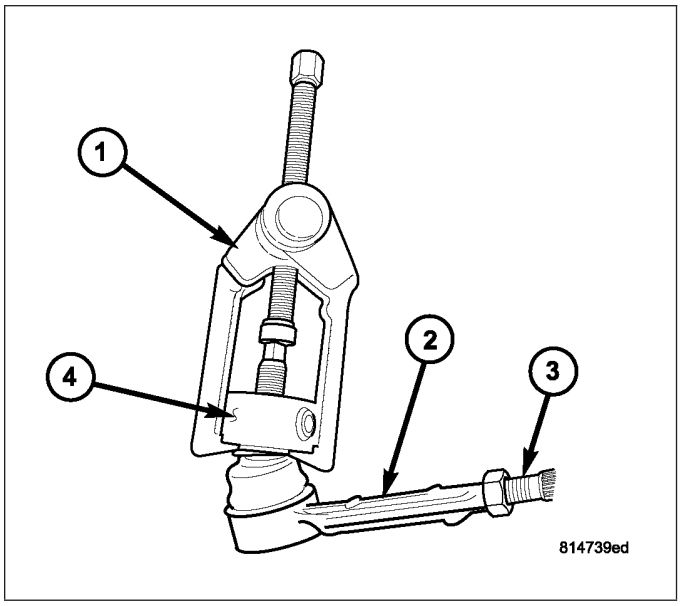
REMOVAL - OUTER TIE ROD END

NOTE: Do not twist the boot anytime during removal or installation.

1. Loosen the jam nut (3).
2. Remove the outer tie rod end (2) nut (1) from the ball stud.



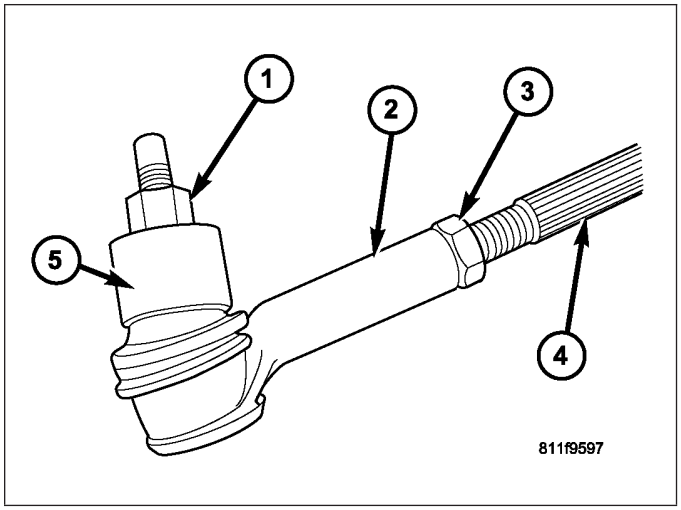
3. Separate the outer tie rod end (2) from the knuckle with Remover C3894–A (1).
4. Unthread the outer tie rod end (2) from the inner tie rod (3). **Count the number of turns when removing the tie rod end, This will give a good starting point when reassembiling and toe adjustment.**



INSTALLATION - OUTER TIE ROD END

NOTE: Do not twist the boot at anytime during removal or installation.

1. Thread the outer tie rod end (2) onto the inner tie rod (4), to it's original position.
2. Install the outer tie rod end into the steering knuckle (5).
3. Tighten the ball stud nut (1) on the ball stud to 75 N·m (55 ft. lbs.).
4. Set wheel toe pattern, (Refer to 2 - SUSPENSION/ WHEEL ALIGNMENT - STANDARD PROCEDURE).
5. Tighten jam nut (3) to 75 N·m (55 ft. lbs.).



PUMP

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PUMP

DESCRIPTION

The pump is connected to the steering gear via the pressure hose and the return hoses. The pump shaft has a pressed-on pulley that is belt driven by the crankshaft pulley.

The power steering oil cooler is mounted to the front lower part of the radiator.

NOTE: Power steering pumps are not interchangeable with pumps installed on other vehicles.

OPERATION

Hydraulic pressure is provided for the power steering gear by the belt driven power steering pump. The power steering pumps are constant flow rate and displacement, vane-type pumps.

DIAGNOSIS AND TESTING

PUMP LEAKAGE

The pump is serviced as an assembly and should not be disassembled. Plastic pump reservoirs can be replace and the reservoir O-ring.

Check for leaks in the following areas:

- Pump shaft seal behind the pulley
- Pump to reservoir O-ring
- Reservoir cap
- Pressure and return lines
- Flow control valve fitting

STANDARD PROCEDURE

POWER STEERING PUMP - INITIAL OPERATION

WARNING: THE FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING COMPONENTS.

CAUTION: MOPAR® ATF+4 is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **COLD** when the fluid is at normal temperature.

1. Turn steering wheel all the way to the left
2. Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two (2) minutes.
3. Raise the front wheels off the ground.
4. Slowly turn the steering wheel lock-to-lock 20 times with the engine off while checking the fluid level.

NOTE: Vehicles with long return lines or oil coolers turn wheel 40 times.

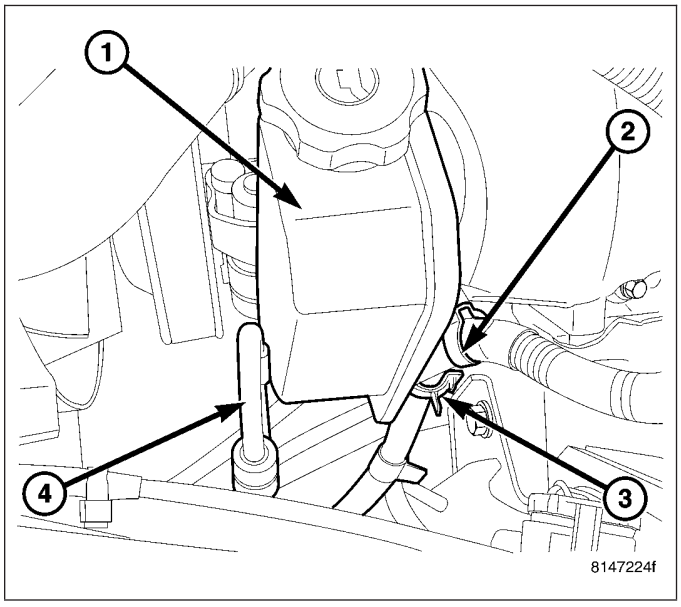
5. Start the engine. With the engine idling maintain the fluid level.
6. Lower the front wheels and let the engine idle for two minutes.
7. Turn the steering wheel in both direction and verify power assist and quiet operation of the pump.

If the fluid is extremely foamy or milky looking, allow the vehicle to stand a few minutes and repeat the procedure.

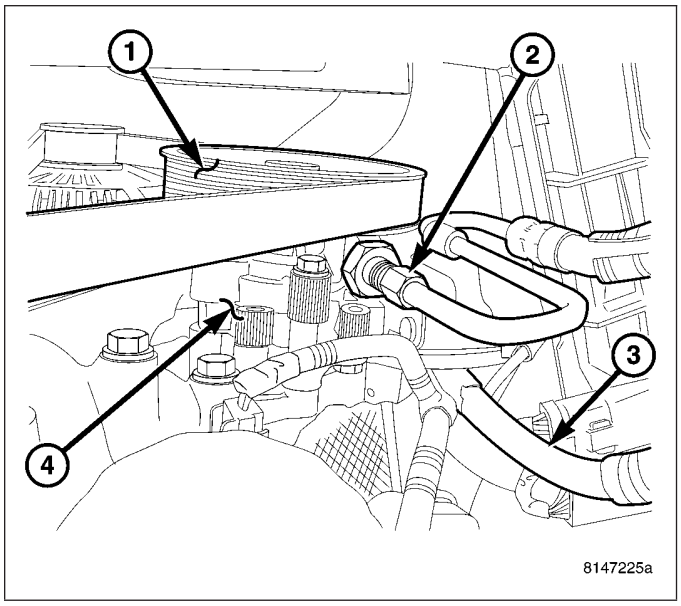
CAUTION: Do not run a vehicle with foamy fluid for an extended period. This may cause pump damage.

REMOVAL

1. Drain and siphon the power steering fluid from the pump.
2. Remove the serpentine drive belt, (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Remove the reservoir return hose (3) at the reservoir (1).

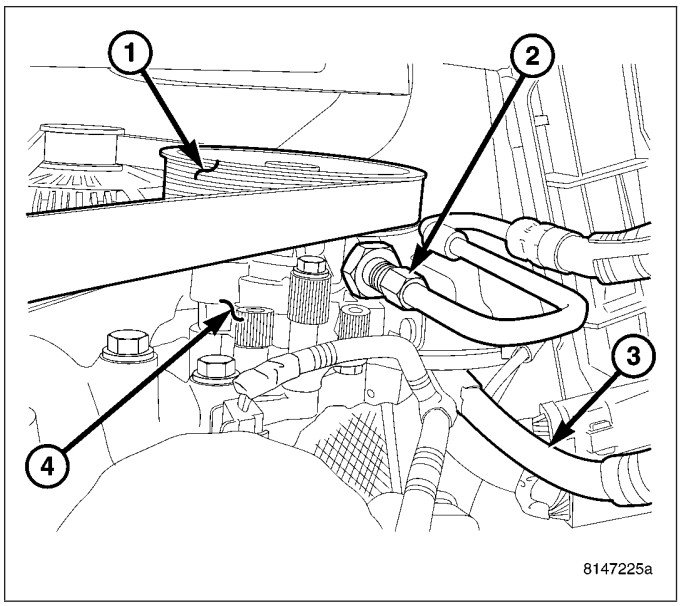


4. Remove the pressure hose (2) from the pump.
5. Remove 3 pump mounting bolts through pulley (1) access holes.
6. Remove the pump (4) from the engine.

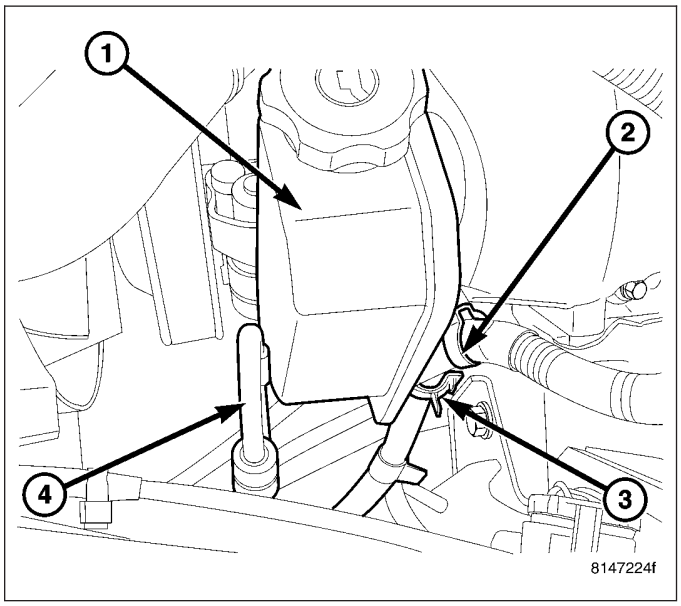


INSTALLATION

1. Align the pump (4) with the mounting holes on the engine.
2. Install 3 pump mounting bolts through the pulley access holes (1). Tighten the bolts to 28 N·m (21 ft. lbs.).
3. Install the pressure hose (2) to the pump (4). Tighten the pressure hose to 31 N·m (23 ft. lbs.).



4. Install reservoir return hose (3) to the reservoir (1).
5. Install the serpentine drive belt, (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
6. Fill the power steering pump, (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).



SPECIFICATIONS

TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Power Steering Pump Pump Mounting Bolts	28	21	—
Power Steering Pump Pressure Line	31	23	—
Power Steering Pressure line to Gear	31	23	—
Power Steering Return line to Gear	37	27	—

FLUID

DESCRIPTION

The recommended fluid for the power steering system is Mopar® ATF +4.

Mopar® ATF+4, when new is red in color. The ATF+4 is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition, As the vehicle is driven, the ATF+4 will begin to look darker in color and may eventually become brown. **THIS IS NORMAL.** ATF+4 also has a unique odor that may change with age. Consequently, odor and color cannot be used to indicate the fluid condition or the need for a fluid change.

STANDARD PROCEDURE

POWER STEERING FLUID LEVEL CHECKING

WARNING: FLUID LEVEL SHOULD BE CHECKED WITH THE ENGINE OFF TO PREVENT PERSONAL INJURY FROM MOVING PARTS.

CAUTION: MOPAR® ATF+4 is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.

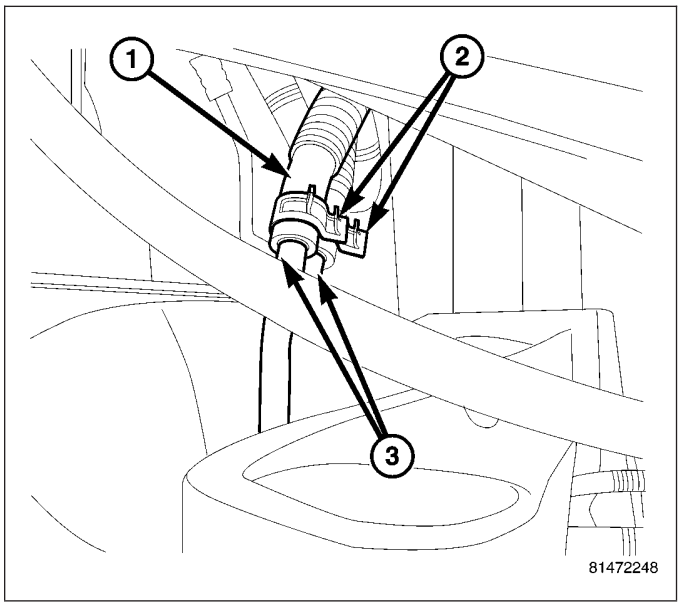
The power steering fluid level can be viewed on the dipstick attached to the filler cap. There are two ranges listed on the dipstick, ADD line and FULL line. Before opening power steering system, wipe the reservoir filler cap free of dirt and debris. Remove the cap and check the fluid level on its dipstick. When the fluid is at normal ambient temperature, approximately 21°C to 27°C (70°F to 80°F), the fluid level should read between the minimum and maximum area of the cold range. When the fluid is hot, fluid level is allowed to read up to the highest end of the HOT range. Only add fluid when the vehicle is cold. Fluid may read low on the dipstick at extremely low temperatures.

Use only Mopar® ATF+4 Do not overfill the power steering system.

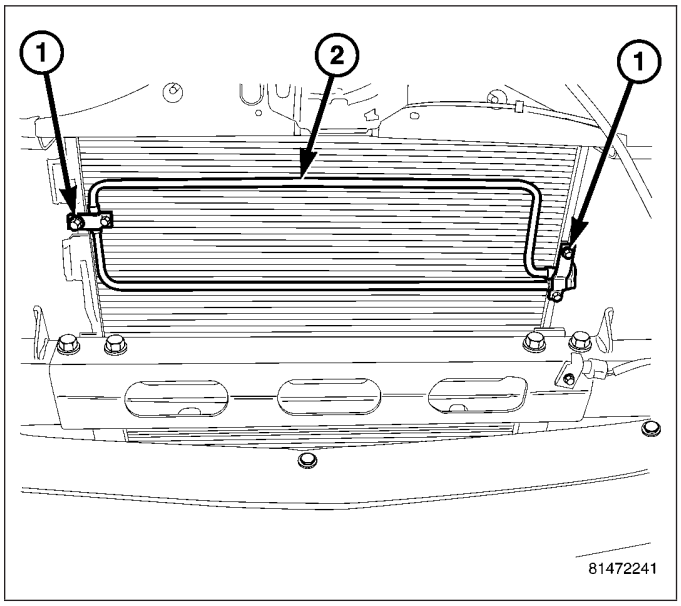
FLUID COOLER

REMOVAL

1. Siphon the power steering system.
2. Raise and support the vehicle.
3. Disconnect the hose clamps (2).
4. Disconnect the hoses (1) at the cooler.

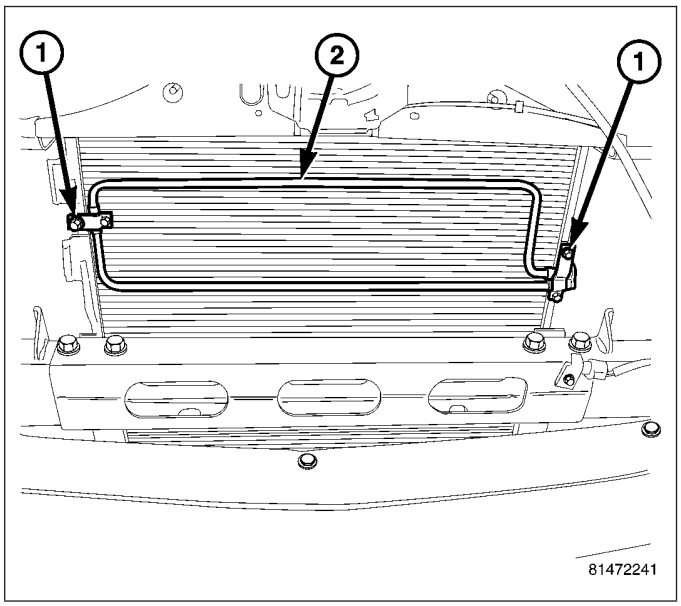


5. Remove the cooler mounting bolts (1).
6. Remove the cooler (2).

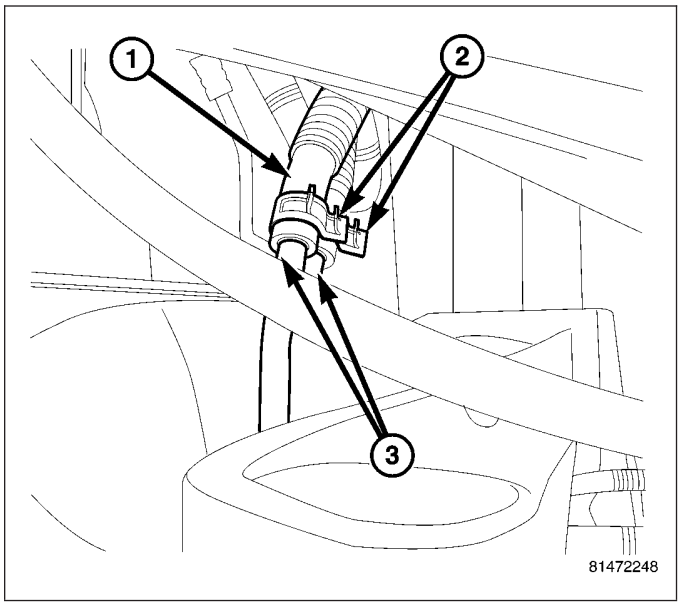


INSTALLATION

1. Install the cooler (2) to the vehicle.
2. Install the cooler mounting nut (1).



3. Reconnect the hoses (1) at the cooler (3).
4. Reconnect the hose clamps (2).
5. Remove the support and lower the vehicle.
6. Refill the power steering system, (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

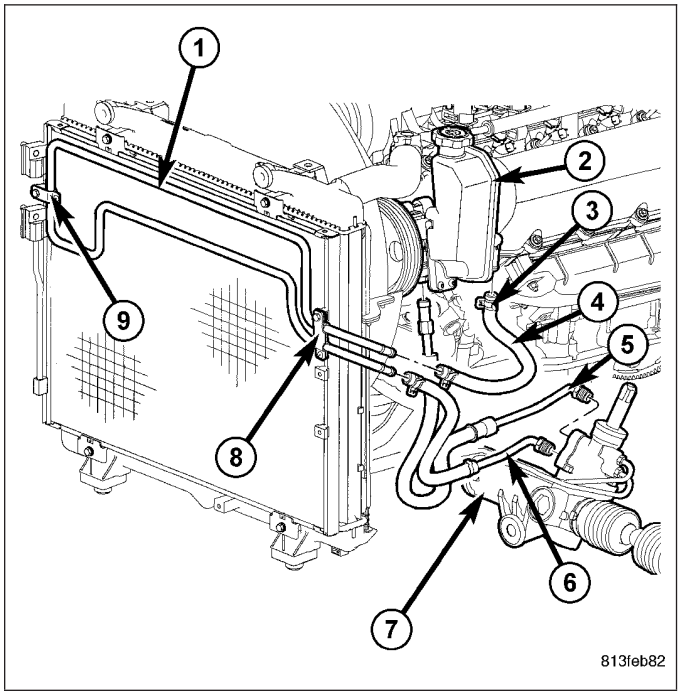


HOSES

REMOVAL

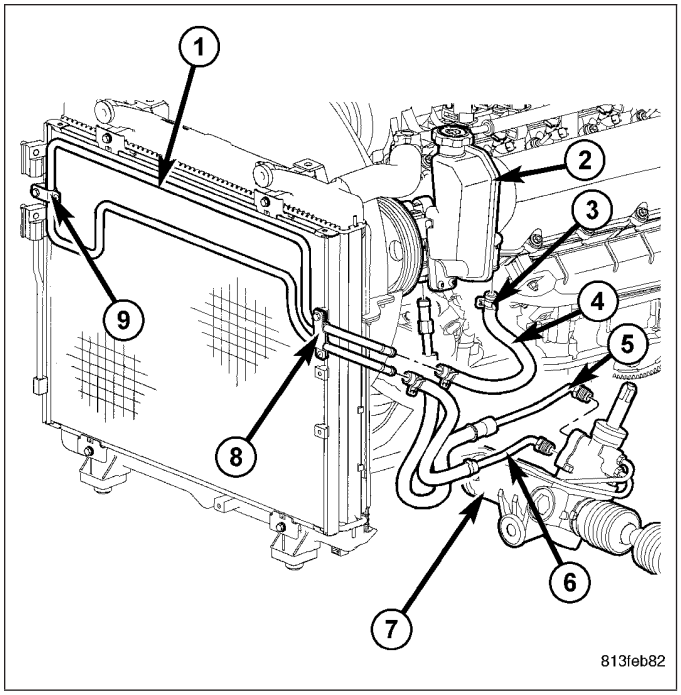
RETURN HOSE - GEAR TO COOLER

1. Siphon the power steering system.
2. Raise and support the vehicle.
3. Disconnect the return hose (6) at the gear (7).
4. Disconnect the return hose (6) at the cooler (1).
5. Remove the return hose from the vehicle.



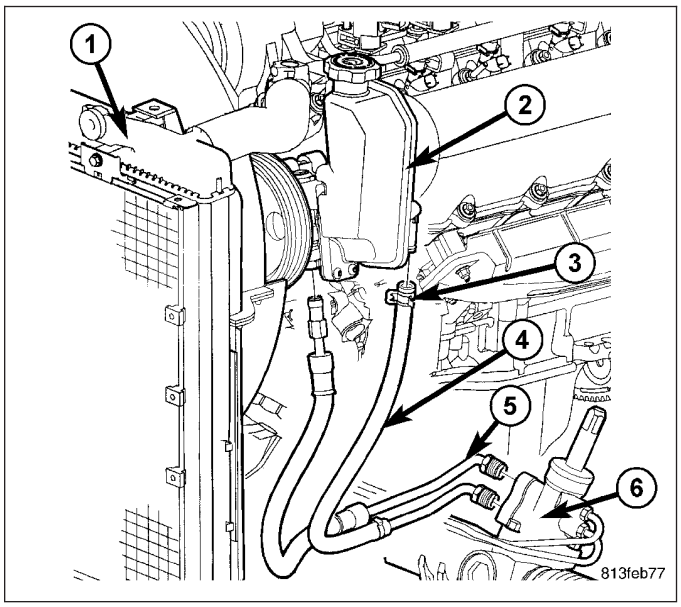
RETRUN HOSE - COOLER TO RESERVOIR

1. Siphon the power steering system.
2. Disconnect the return hose (4) at the reservoir (2).
3. Disconnect the return hose (4) at the cooler (1).
4. Remove the return hose from the vehicle.



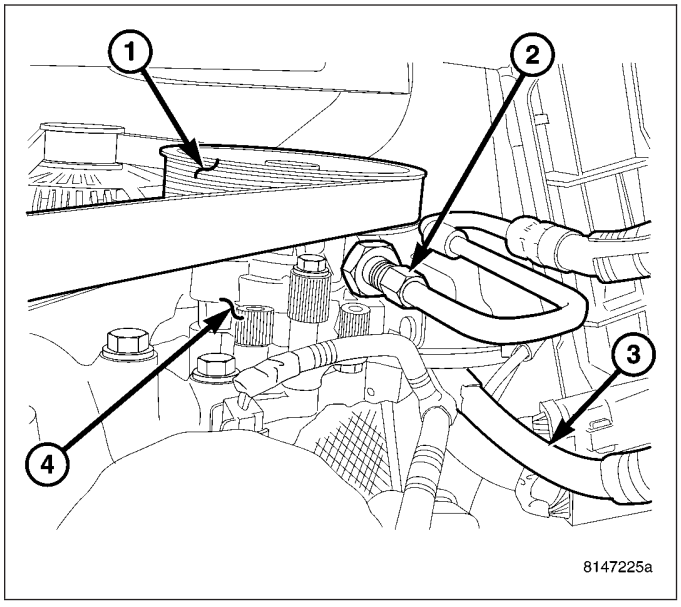
RETURN HOSE - WITHOUT COOLER

1. Siphon the power steering system.
2. Raise and support the vehicle.
3. Disconnect the return hose (4) at the gear (6).
4. Disconnect the return hose (4) at the reservoir (2).
5. Remove the return hose from the vehicle.

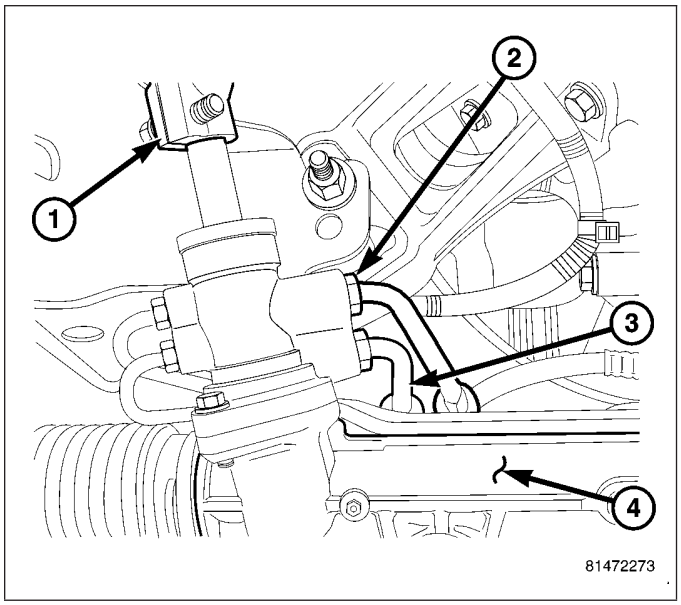


PRESSURE HOSE

1. Siphon the power steering system.
2. Remove the pressure hose (2) at the pump (4).



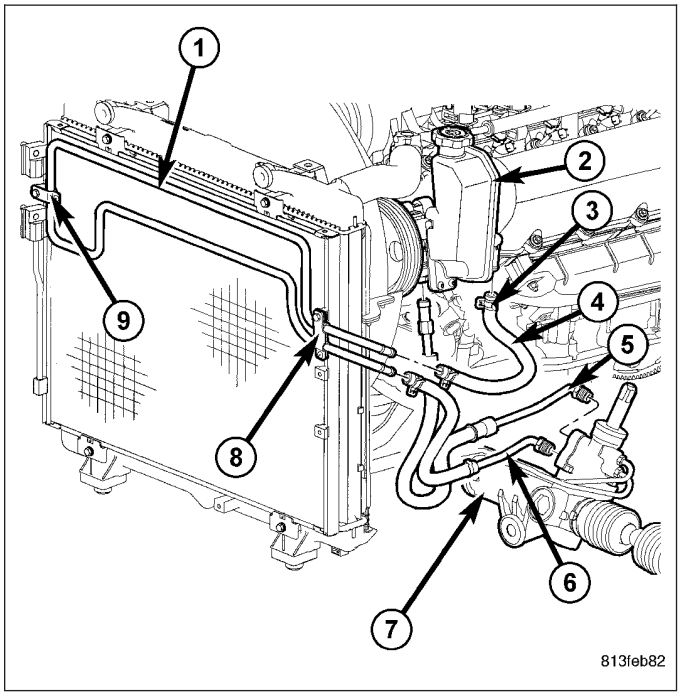
3. Raise and support the vehicle.
4. Remove the pressure hose (2) at the gear (4).
5. Remove the pressure hose from the vehicle.



INSTALLATION

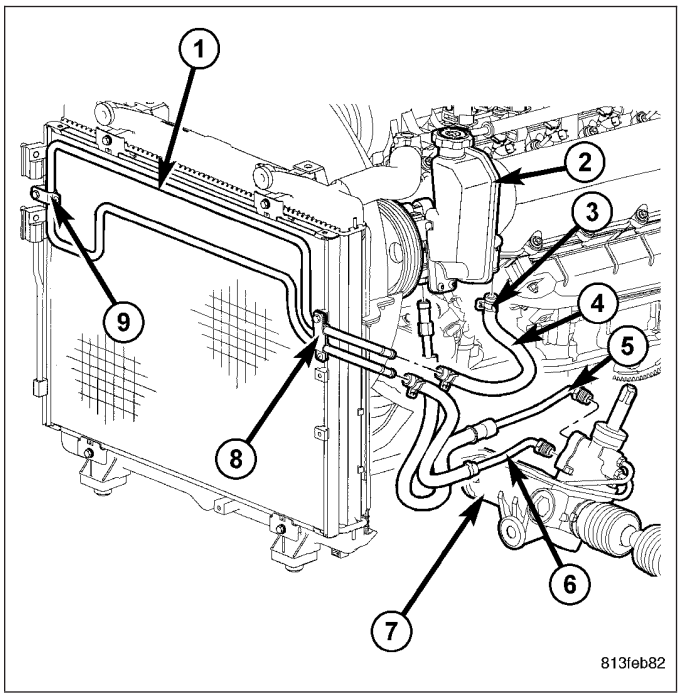
RETURN HOSE - GEAR TO COOLER

1. Install the return hose to the vehicle.
2. Reconnect the return hose (6) at the cooler (1).
3. Reconnect the return hose (6) at the gear (7). Tighten the hose to 37 N·m (27 ft. lbs.).
4. Route the return hose and secure.
5. Remove the support and lower the vehicle.
6. Refill the power steering system, (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).



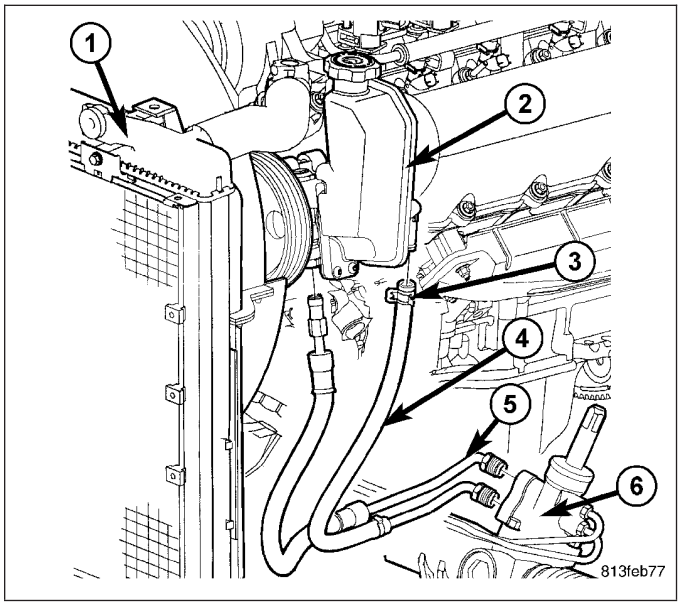
RETURN HOSE - COOLER TO RESERVOIR

1. Install the return hose to the vehicle.
2. Reconnect the return hose (4) at the cooler (1).
3. Reconnect the return hose (4) at the reservoir (2). Tighten the hose to 38 N·m (28 ft. lbs.).
4. Refill the power steering system, (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).



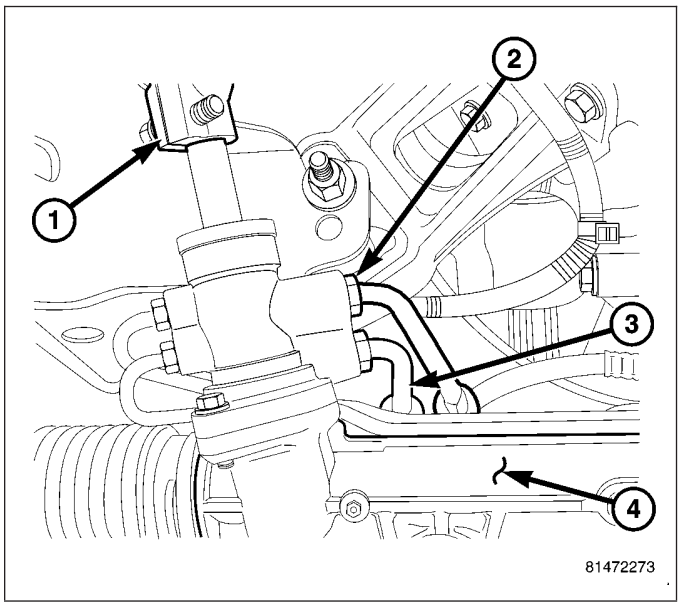
RETURN HOSE - WITHOUT COOLER

1. Install the return hose to the vehicle.
2. Reconnect the return hose (4) at the reservoir (2).
3. Reconnect the return hose (4) at the gear (6). Tighten the hose to 38 N·m (28 ft. lbs.).
4. Route the return hose and secure.
5. Remove the support and lower the vehicle.
6. Refill the power steering system, (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

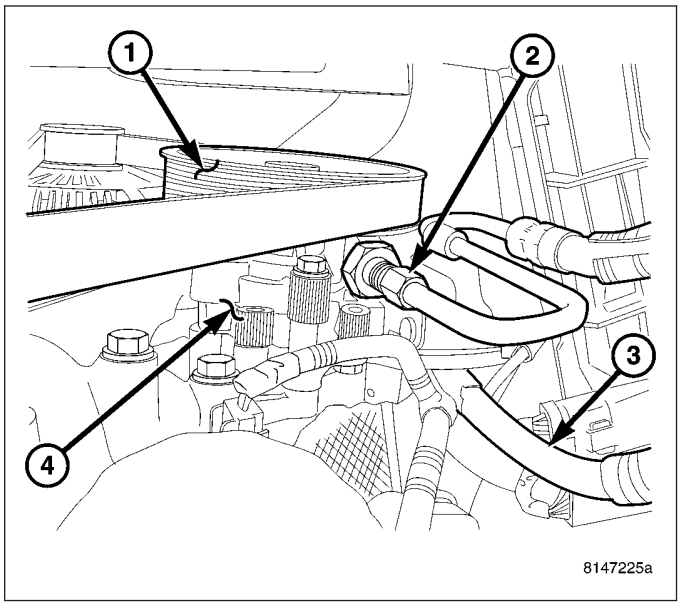


PRESSURE HOSE

1. Install the pressure hose (2) to the vehicle.
2. Reconnect the pressure hose (2) at the gear (4). Tighten the hose to 31 N·m (23 ft. lbs.).
3. Remove the support and lower the vehicle.



4. Reconnect the pressure hose (2) at the pump (4). Tighten the hose to 34 N·m (25 ft. lbs.).
5. Refill the power steering system, (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).



RESERVOIR

REMOVAL

1. Remove the power steering pump (Refer to 19 - STEERING/PUMP - REMOVAL).
2. With the pump on the bench drain the rest of the fluid out into a container.
3. Remove the two bolts and separate the reservoir from the pump body.

INSTALLATION

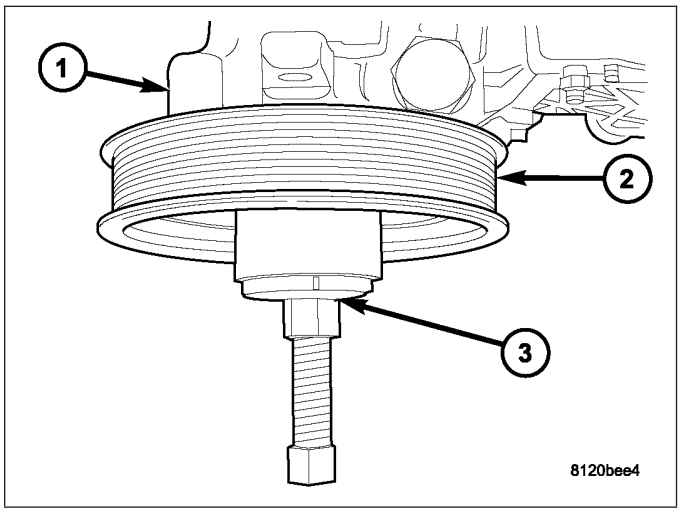
1. Install a new o-ring on the port of the reservoir.
2. Install the reservoir on the pump body.
3. Install the two bolts securing the reservoir to the body and tighten.
4. Install the power steering pump (Refer to 19 - STEERING/PUMP - INSTALLATION).

PULLEY

REMOVAL

CAUTION: Do not reuse the old power steering pump pulley it is not intended for reuse. A new pulley must be installed if removed.

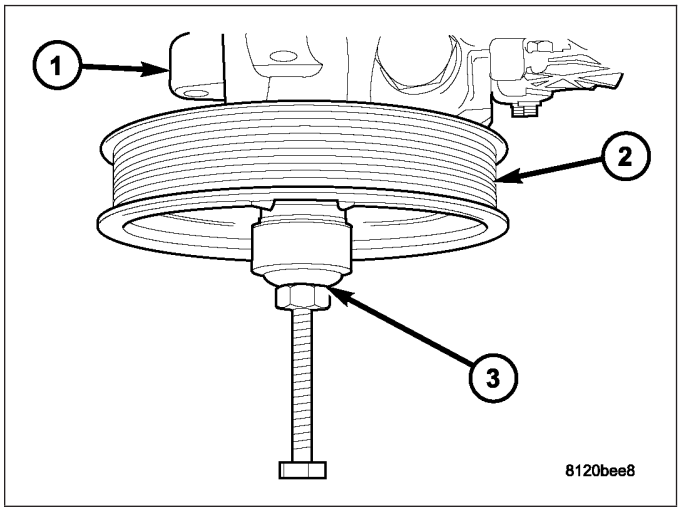
1. Remove the power steering pump assembly, (Refer to 19 - STEERING/PUMP - REMOVAL).
2. Remove the pulley (2) from the pump (1) using (OTC® 7185) power steering pulley removal tool (3) or equivalent.



INSTALLATION

CAUTION: Do not reuse the old power steering pump pulley it is not intended for reuse. A new pulley must be installed if removed.

1. Replace the pulley if it's bent, cracked, or loose.
2. Install the pulley (2) on the pump (1) using (OTC® 7771) power steering pulley installation tool (3) or equivalent making sure it is flush with the end of the shaft. Ensure the tool and pulley remain aligned with the pump shaft.
3. Install the power steering pump assembly, (Refer to 19 - STEERING/PUMP - INSTALLATION).
4. Run engine until warm (5 min.) and note any belt chirp. If chirp exists, move pulley outward approximately 0.5 mm (0.020 in.). If noise increases, press on 1.0 mm (0.040 in.). **Be careful that pulley does not contact mounting bolts.**



TRANSMISSION AND TRANSFER CASE

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MANUAL TRANSMISSION-GETRAG 238

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MANUAL TRANSMISSION-GETRAG 238

DIAGNOSIS AND TESTING

MANUAL TRANSMISSION - GETRAG 238

LOW LUBRICANT LEVEL

A low transmission lubricant level is generally the result of a leak, inadequate lubricant fill or incorrect lubricant level check.

Rear transmission leaks will be from the oil seals or component mating surfaces.

Front transmission leaks will be from the front input shaft retainer seal. Lubricant may drip from the clutch housing after extended operation. If leak is severe, it may contaminate the clutch disc.

Lubricant level check can only be made when the vehicle is level and allowing the lubricant to settle for a minute before checking. This will ensure an accurate check and avoid an under or overfill condition.

HARD SHIFTING

Hard shifting is usually caused by low lubricant level, improper or contaminated lubricants. This will cause noise, excessive wear, internal bind, and hard shifting. Substantial lubricant leaks can result in gear, shift rail, synchro, and bearing damage. The first indications of component damage is usually hard shifting and noise.

Shift component damage, clutch adjustment, worn pressure plate or disc are also causes of increased shift effort. If clutch problem is advanced, gear clash during shifts can result. Worn or damaged synchronizer rings can cause

gear clash when shifting into any forward gear. In some new or rebuilt transmissions, new synchro rings may tend to stick slightly causing hard or noisy shifts. In most cases, this condition will decline as the rings wear-in.

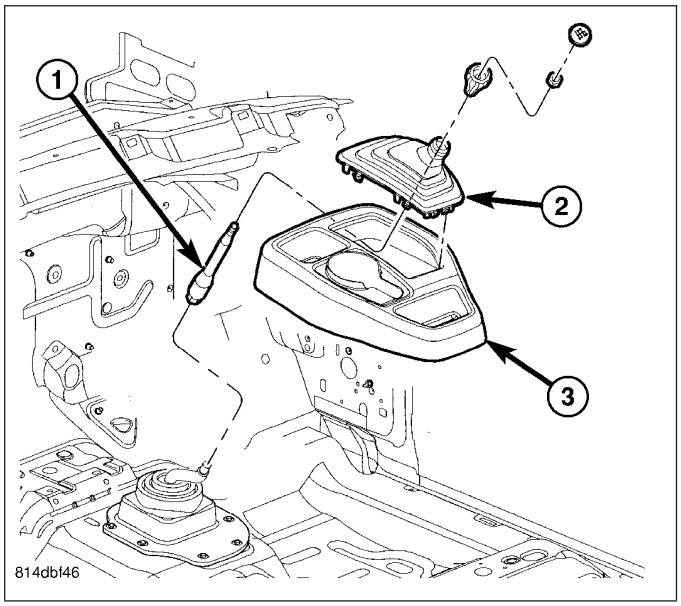
TRANSMISSION NOISE

Most manual transmissions make some noise during normal operation. Rotating gears generate a mild whine that is audible, but generally only at extreme speeds.

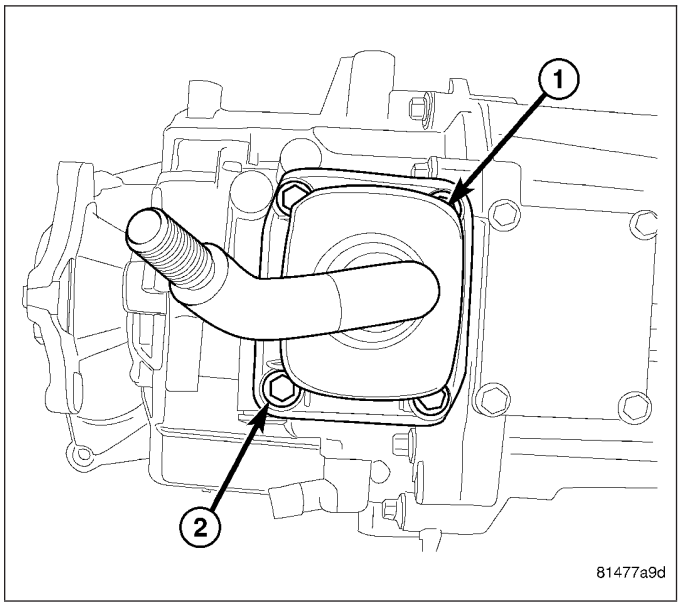
Severe, highly audible transmission noise is generally the initial indicator of a lubricant problem. Insufficient, improper or contaminated lubricant will promote rapid wear of gears, synchronizer rings, shift rails, forks and bearings. The overheating caused by a lubricant problem, can also lead to gear and bearing damage.

REMOVAL

1. Disconnect battery negative cable.
2. Shift transmission into Neutral.
3. Remove the upper shift lever boot (2). (Refer to 23 - BODY/INTERIOR/SHIFT BOOT - REMOVAL)
4. Remove floor console (3). (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
5. Remove the shift lever extension (1) from the shift tower and lever assembly.
6. Remove the screws holding the lower shift lever boot assembly to the floorpan and remove the lower shift boot assembly.



7. Through the hole in the floorpan, remove the bolts (2) holding the shift tower (1) to the transmission.
8. Remove the shift tower (1) from the transmission.



9. Raise vehicle.
10. Remove skid plate, if equipped (4WD).
11. If transmission will be disassembled for repair, remove drain plug and drain lubricant from transmission.
12. Mark propeller shafts and companion flange for assembly reference.
13. Disconnect and remove propeller shafts.

14. Disconnect and remove exhaust system Y-pipe. Then disconnect and lower remaining exhaust pipes for clearance as necessary.
15. Disconnect backup light switch wires.

2WD

1. Remove bolts/nuts attaching transmission to rear mount.
2. Support transmission with a transmission jack. Secure transmission to jack with safety chains.
3. Remove rear crossmember.
4. Remove bolts attaching clutch slave cylinder to clutch housing. Then move cylinder aside for working clearance.
5. Remove starter.
6. Remove transmission dust shield.
7. Remove transmission harness wires from clips on transmission shift cover.
8. Lower transmission slightly.
9. Remove bolts attaching transmission to engine.

CAUTION: Do not remove structural dust cover from enigne block. If cover is removed clutch housing and cover must be aligned with the engine.

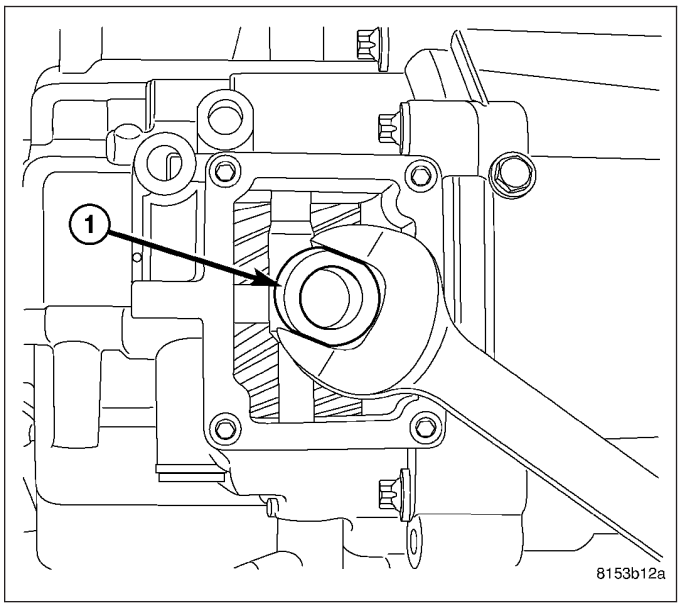
10. Slide transmission and jack rearward until input shaft clears clutch disc.
11. Lower transmission jack and remove transmission from under vehicle.

4WD

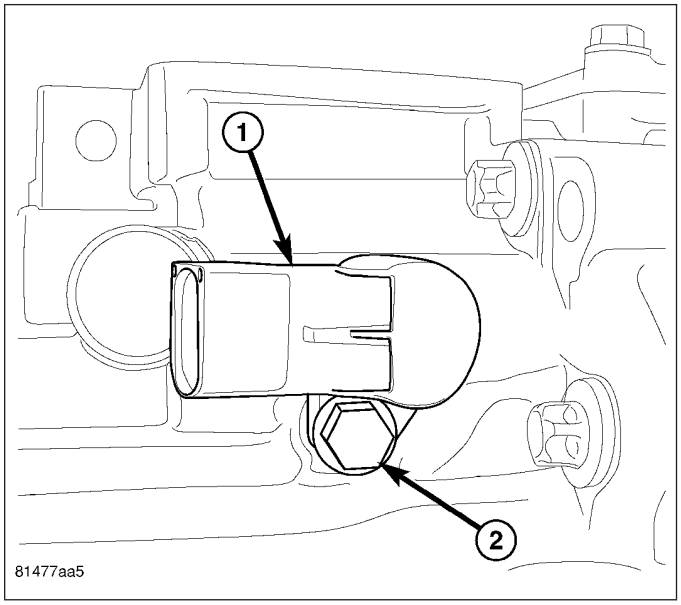
1. Support engine with adjustable safety stand.
2. Remove transfer case. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - REMOVAL)
3. Remove bolts/nuts attaching transmission to rear support.
4. Remove crossmember bolts/nuts and remove crossmember.
5. Support transmission with transmission jack. Secure transmission to jack with safety chains.
6. Remove transmission harness from retaining clips on transmission shift cover.
7. Remove clutch slave cylinder splash shield, if equipped.
8. Remove clutch slave cylinder attaching nuts. Move cylinder aside for working clearance.
9. Remove starter.
10. Remove transmission splash shield.
11. Lower transmission slightly.
12. Remove bolts attaching transmission to engine.
13. Move transmission rearward until input shaft clears clutch disc.
14. Lower transmission and remove it from under vehicle.

DISASSEMBLY

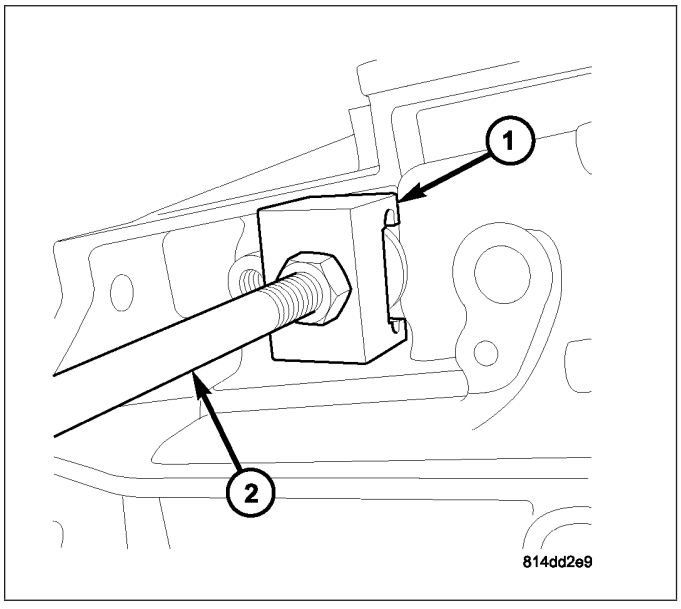
1. Remove shifter socket (1) from main shift rail.



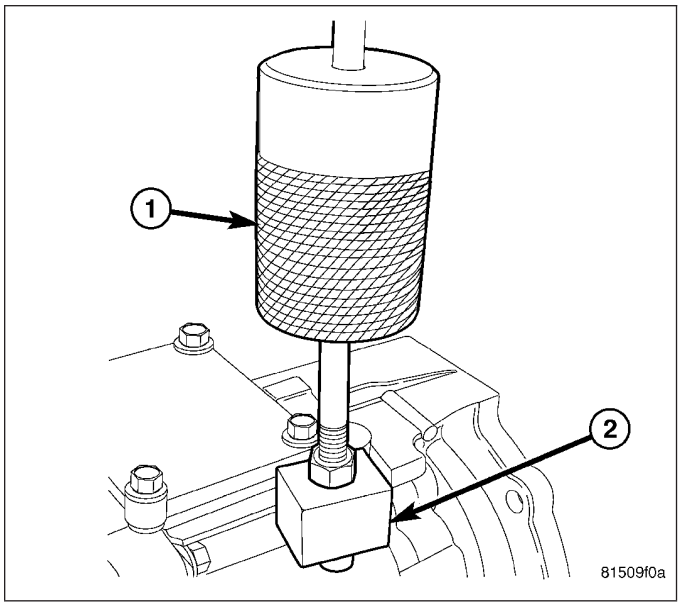
2. Remove back up lamp switch (1) bolt (2) and remove switch.



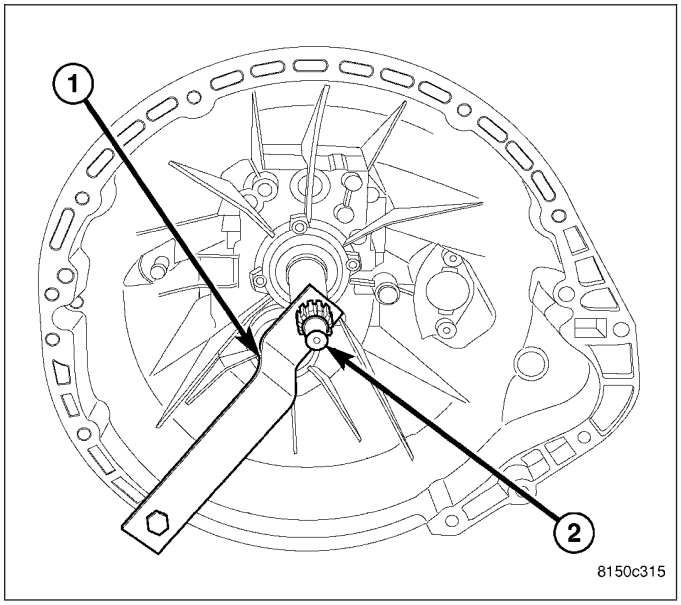
3. Remove large detent plug, next to back up lamp switch opening with Remover 9583 (1) and Slide Hammer C-3752 (2).



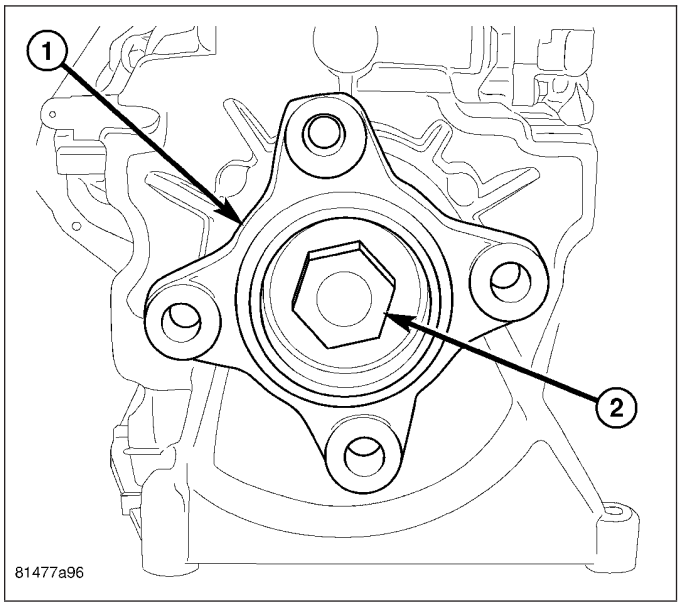
4. Remove two small detent plugs on top of rear housing with Remover 8870 (2) and Slide Hammer C-3752 (1).



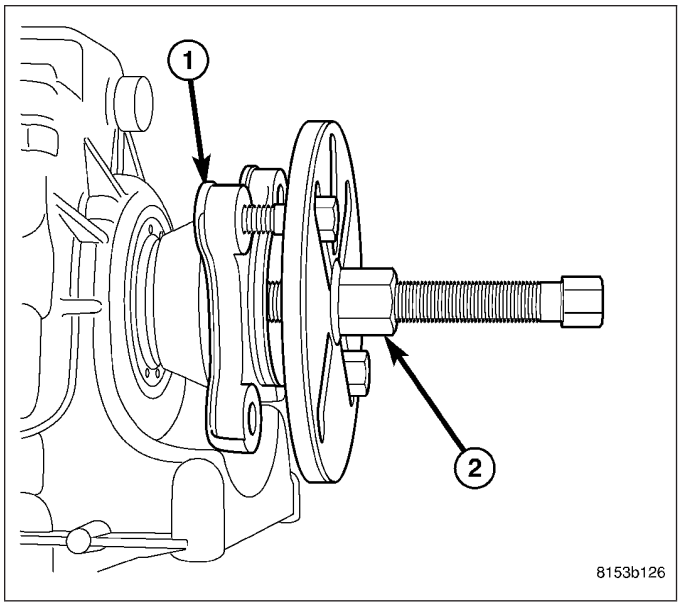
5. Install Wrench 9586 (1) on input shaft (2).



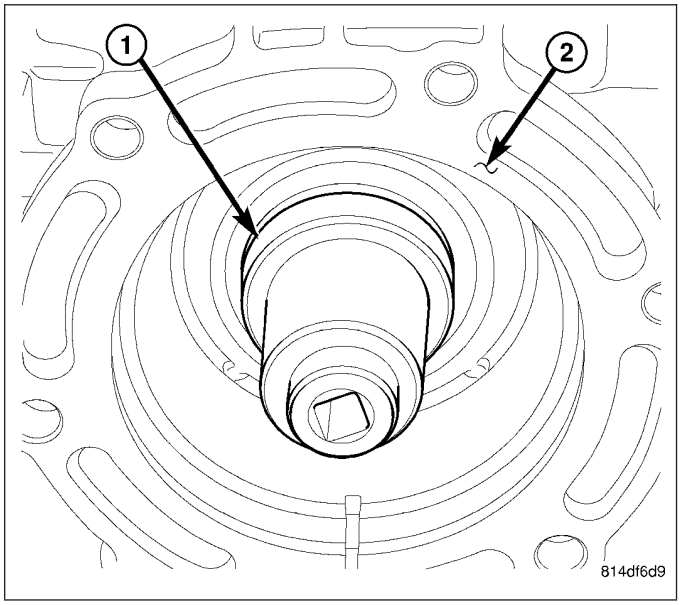
6. Remove output flange (1) nut (2) on 4x2 transmission.



7. Remove output flange (1) on 4x2 transmission with Puller 8992 (2) and Button 9618-2.

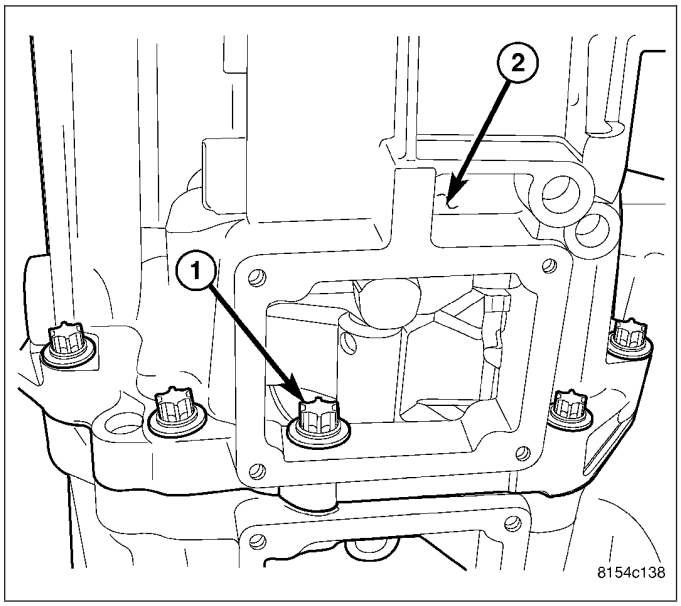


8. Remove output shaft nut with Socket 9584 (1) on 4x4 transmission (2).
9. Remove Wrench 9586 from input shaft.

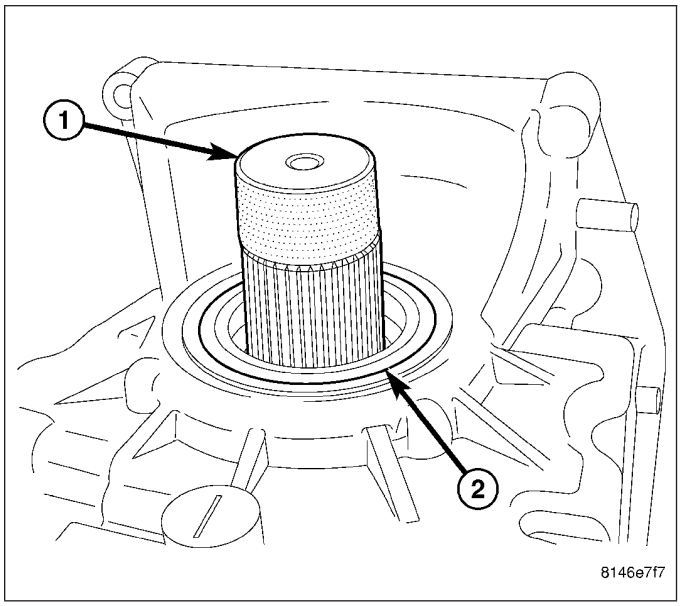


If necessary, remove the cover plate to access the one rear housing (2) bolt (1) located in the opening.

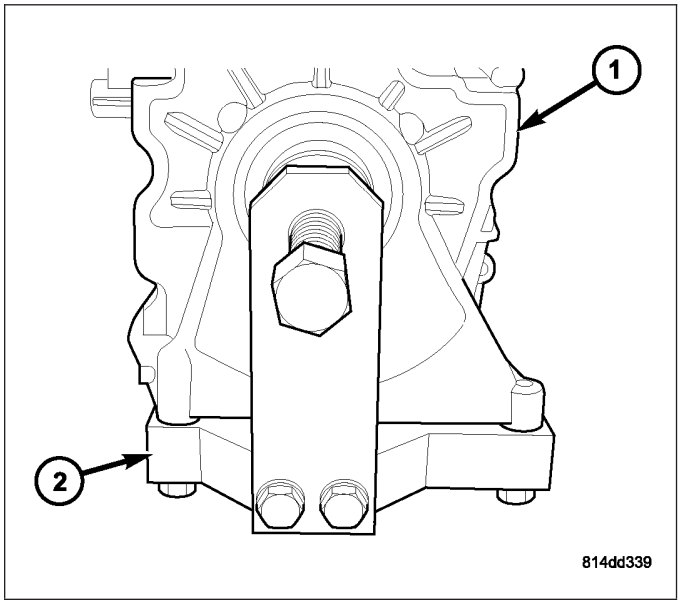
10. Place transmission on front housing and remove rear housing (2) bolts (1).



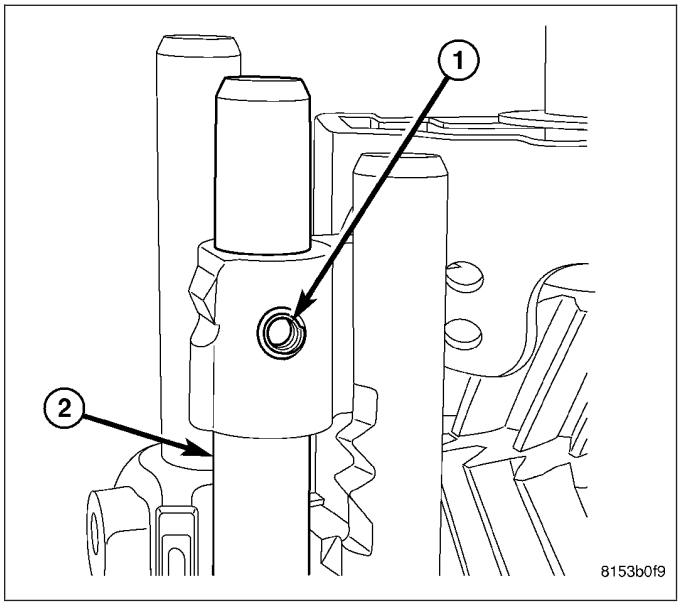
11. Install Button 9618-2 (1) into output shaft (2).



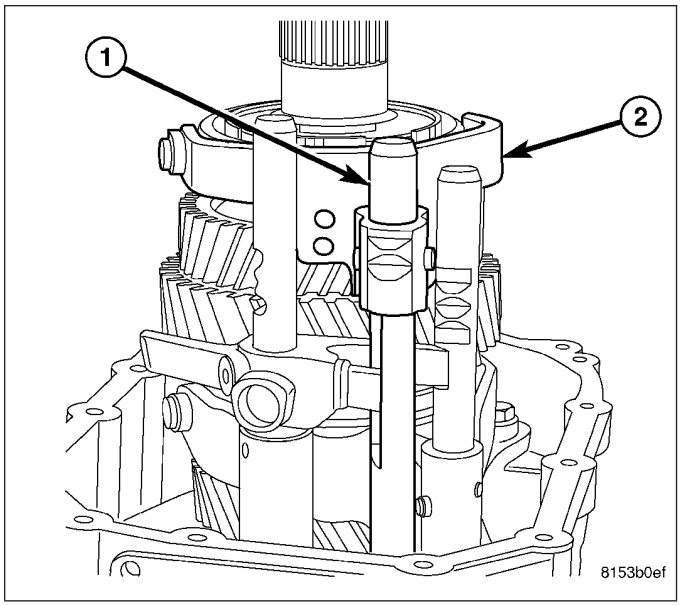
12. Separate rear housing (1) from mainshaft with Puller 9621(2). Bolt puller to the bottom of the rear housing, then turn puller bolt to push mainshaft out of the housing.



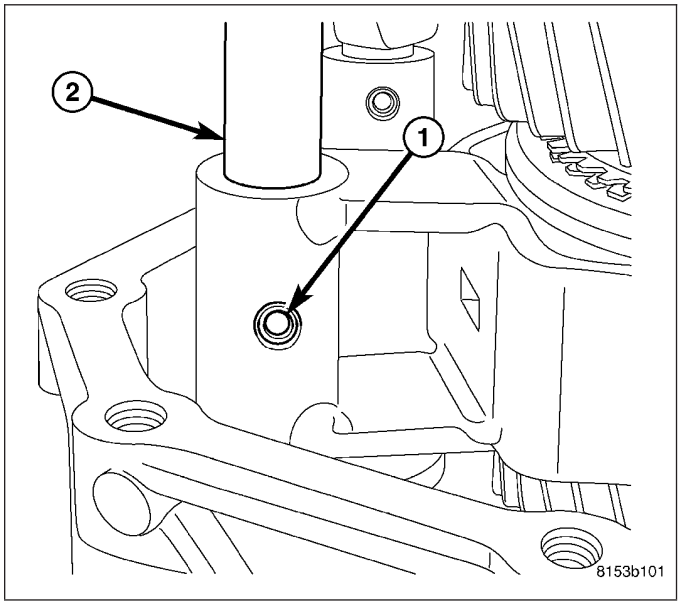
13. Remove reverse shift fork roll pin (1) from reverse shift rail (2).



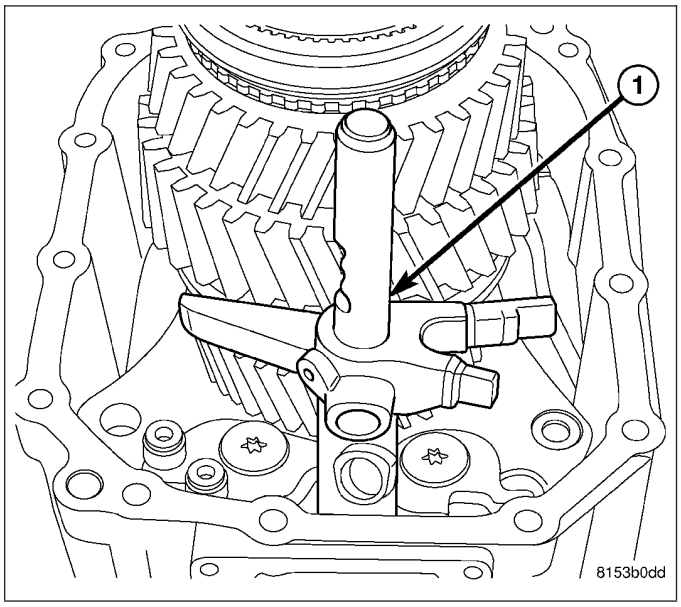
14. Slid reverse shift rail (1) down out of the shift fork (2) and remove reverse shift fork. Then slid shift rail up and out of the front housing.



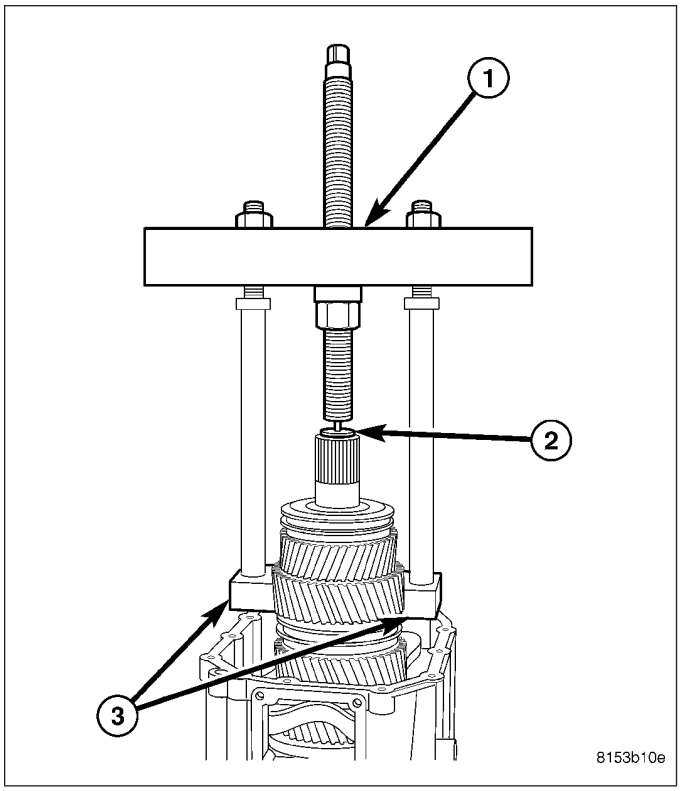
15. Remove 1-2 shift fork roll pin (1) from shift rail (2). Slid shift rail up out of shift fork and rear housing. Remove 1-2 shift fork.



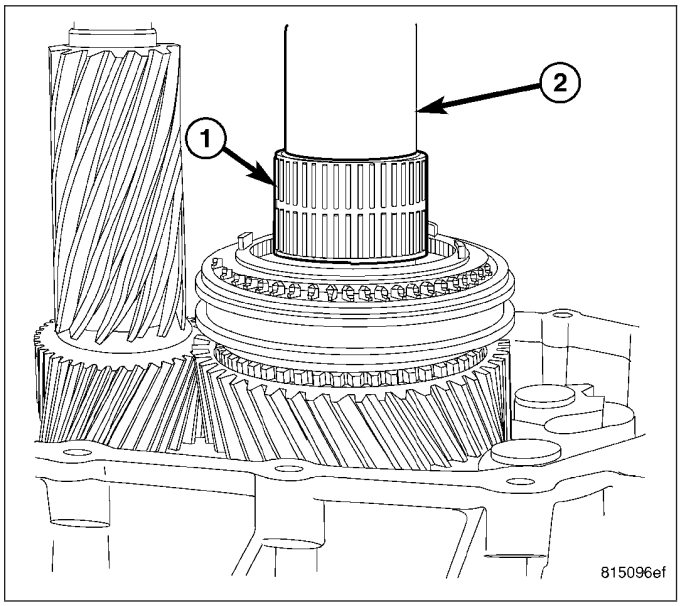
16. Rotate main shift rail (1) clockwise and pull up and out of the front housing.



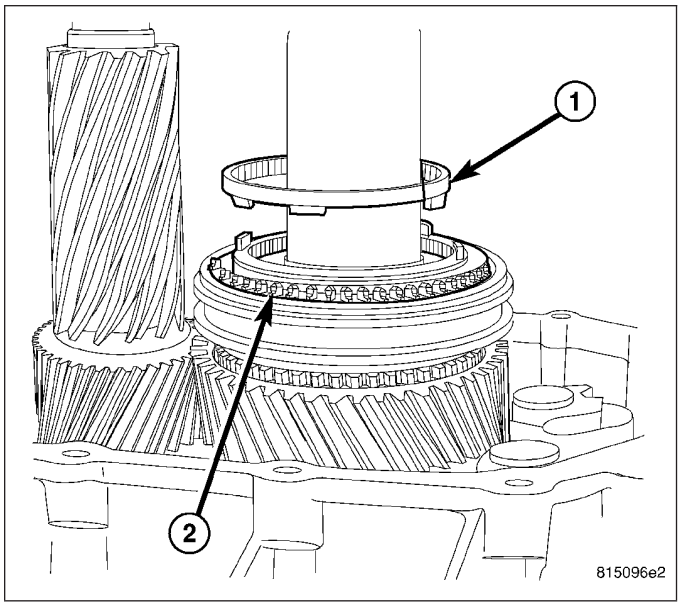
17. Remove first gear, reverse gear, reverse bearing, reverse gear bearing race and reverse synchronizer with Bridge 938 (1), Button 9618-2 (2) and puller Adapters 9628 (3). Position puller Adapters 9628 (3) under first gear.



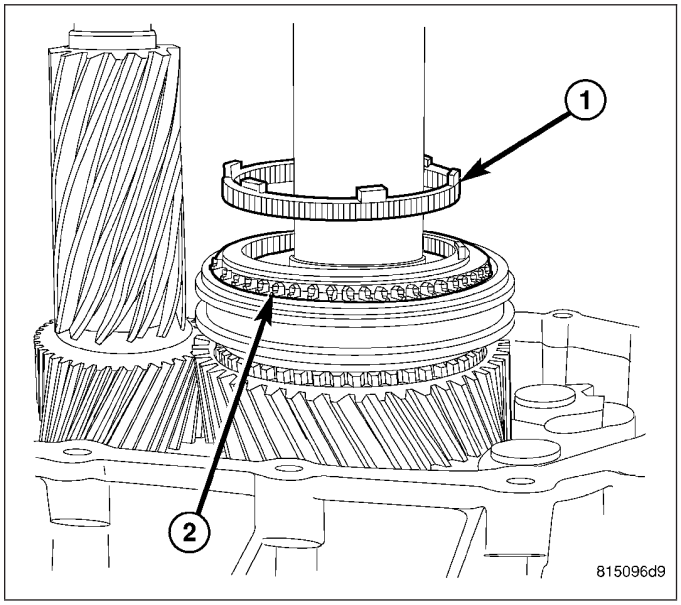
18. Remove first gear bearing (1) from mainshaft (2).



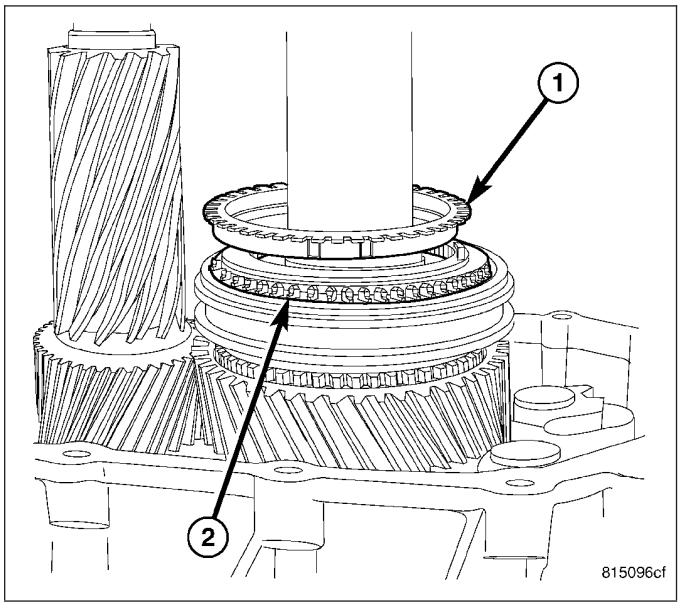
19. Remove first gear synchronizer inner friction ring (1) from 1-2 synchronizer hub (2).



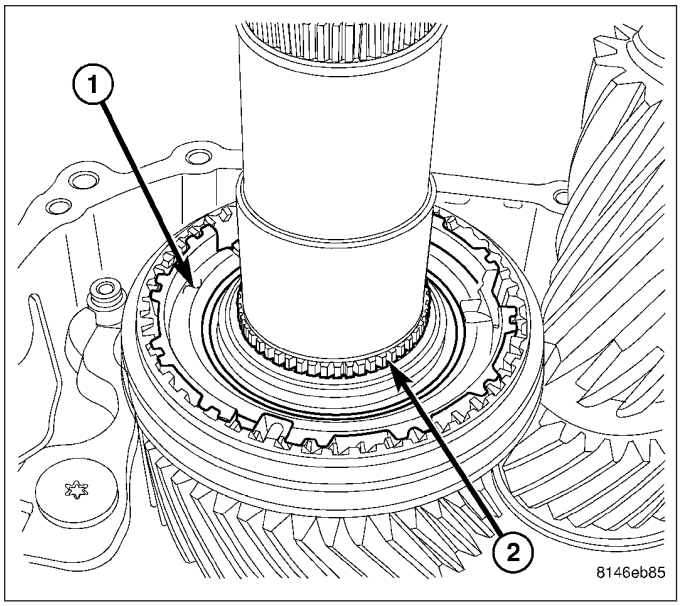
20. Remove first gear synchronizer outer friction ring (1) from 1-2 synchronizer hub (2).



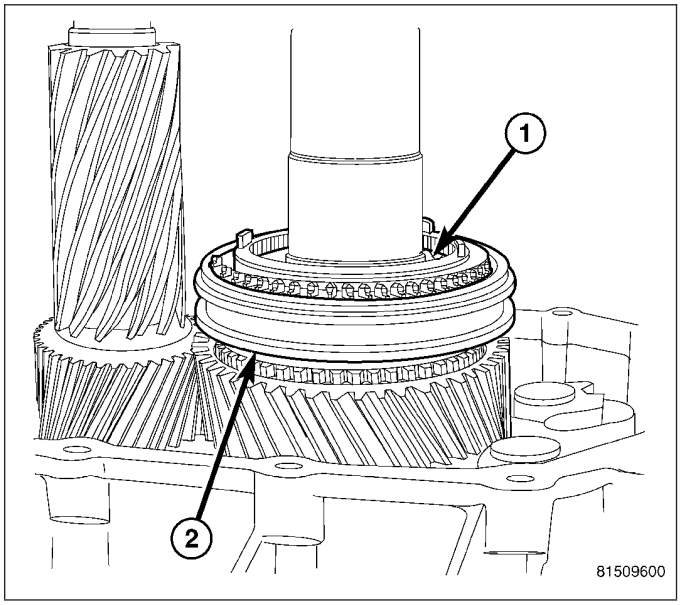
21. Remove first gear synchronizer blocker ring (1) from 1-2 synchronizer hub (2).



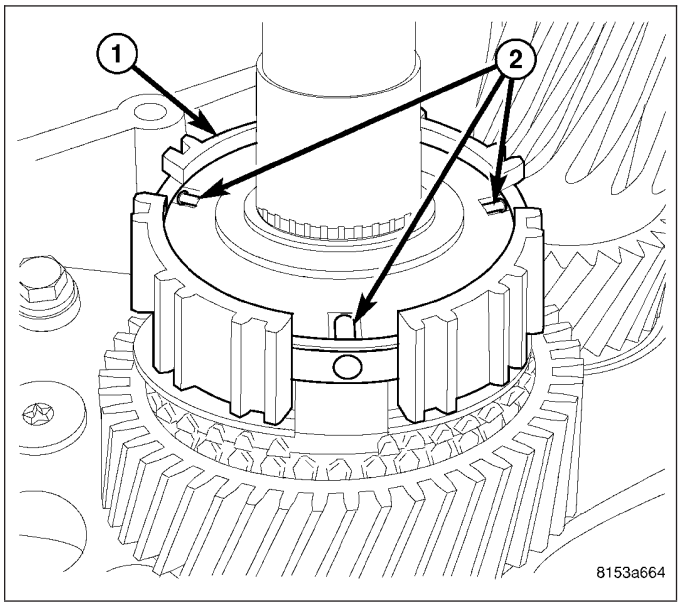
22. Remove 1-2 synchronizer hub (1) snap ring (2).



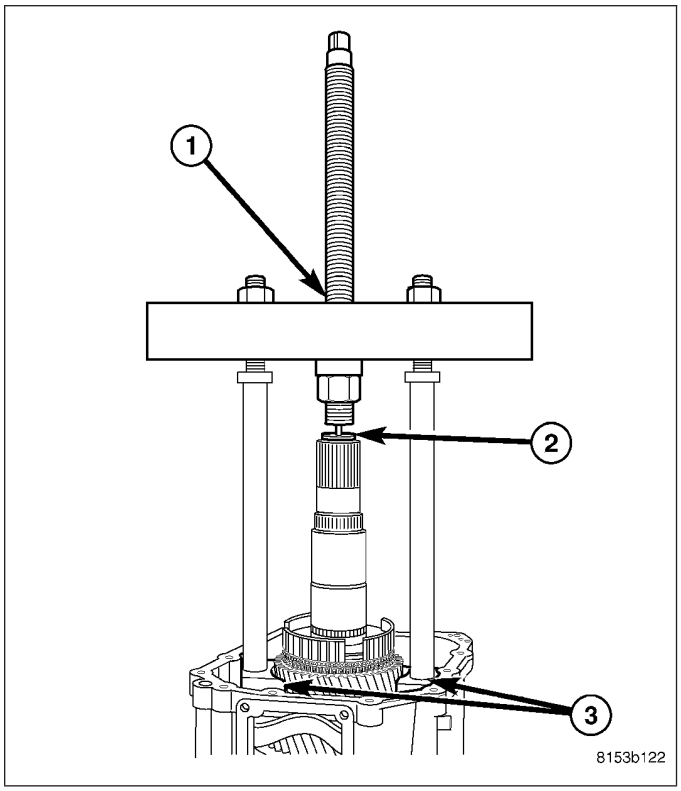
23. Remove 1-2 synchronizer sleeve (1) from 1-2 synchronizer hub (2).



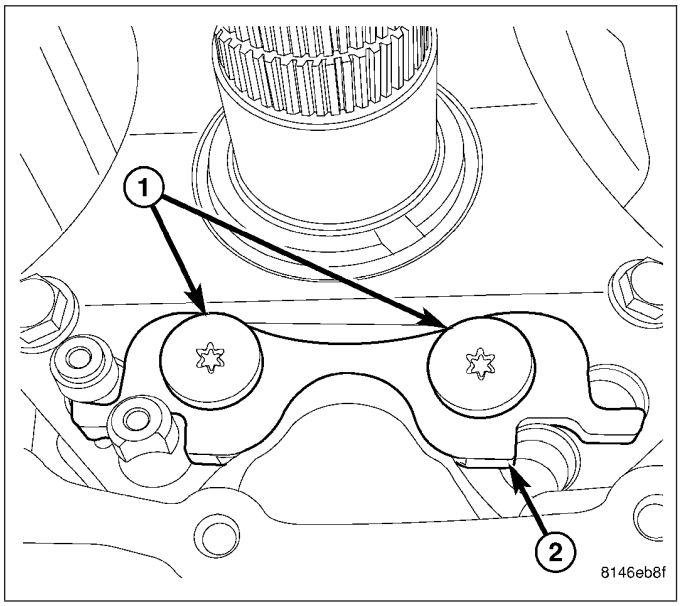
24. Remove 1-2 synchronizer hub (1) detents (2).



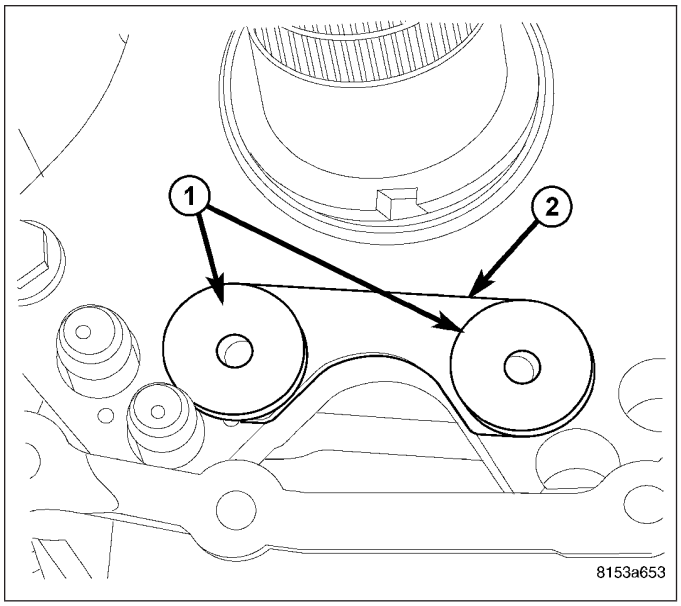
25. Remove second gear and 1-2 synchronizer hub with Bridge 938 (1), Button 9618-2 (2) and Puller Adapters 9627 (3).



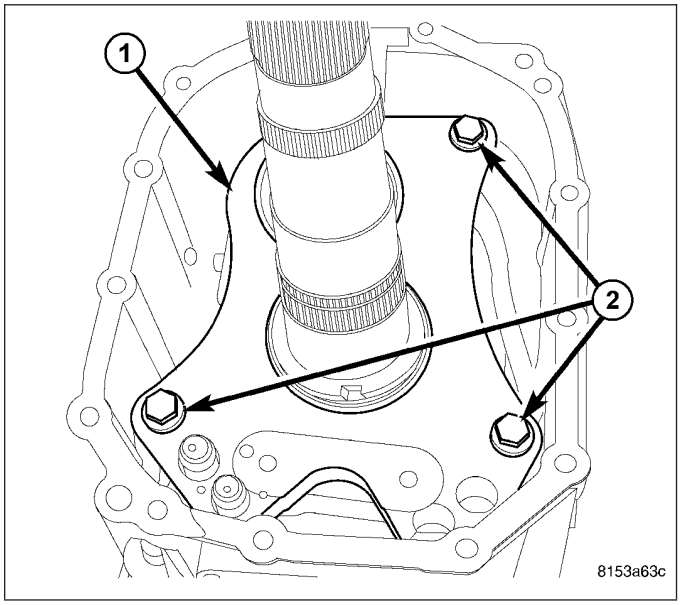
26. Remove interlock plate bolts (1) and remove interlock plate (2).



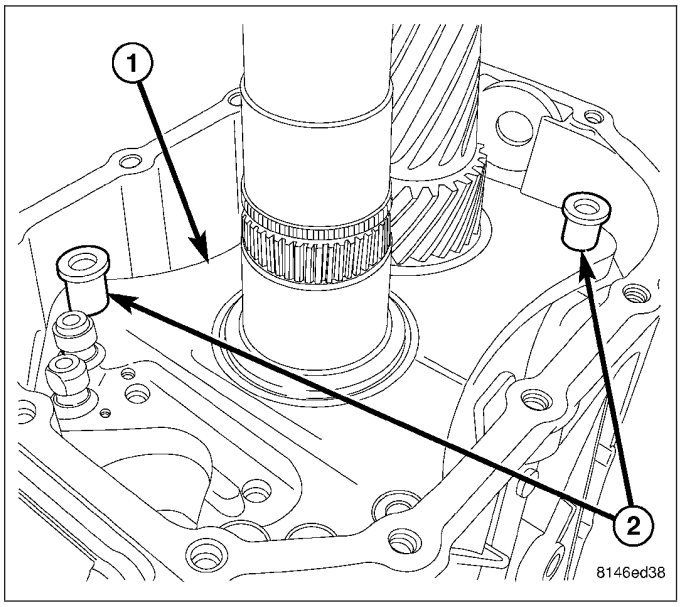
27. Remove washers (1) from intermediate plate (2).



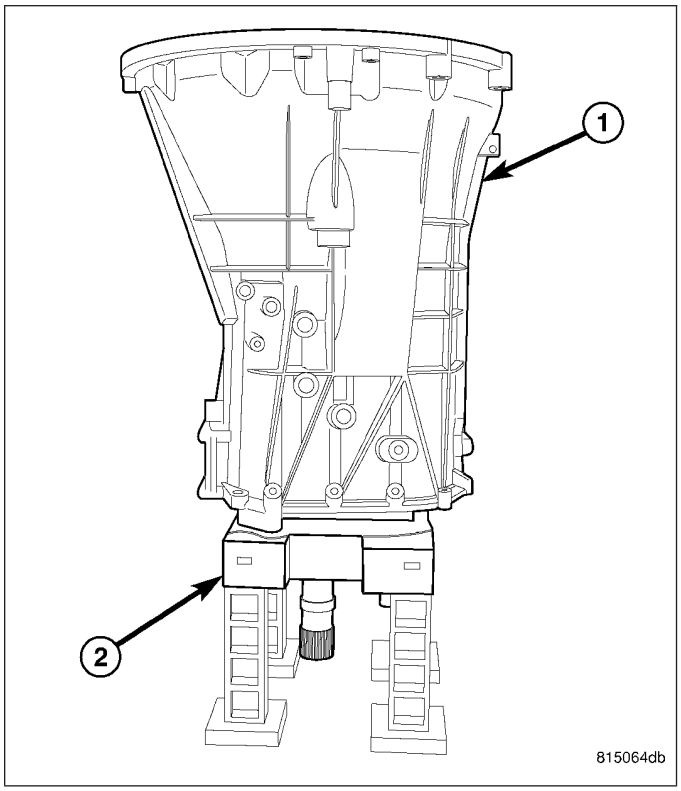
28. Remove intermediate plate (1) bolts (2).



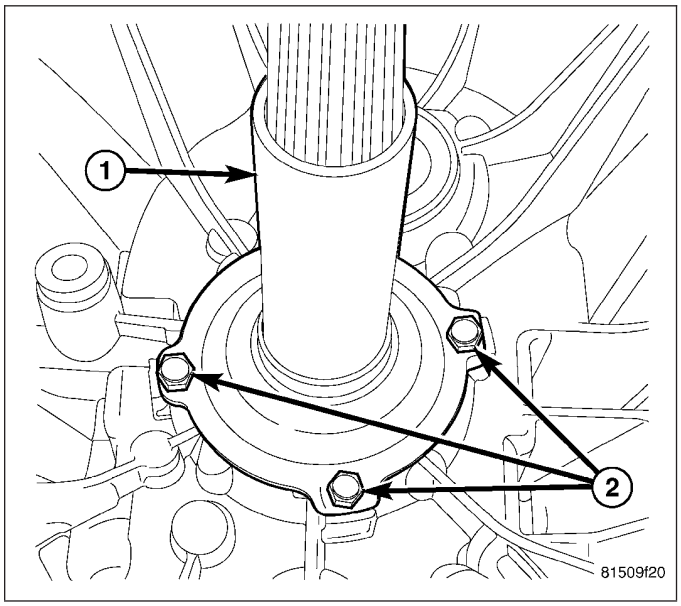
29. Remove intermediate plate (1) dowels (2) with a suitable tool and remove intermediate plate.



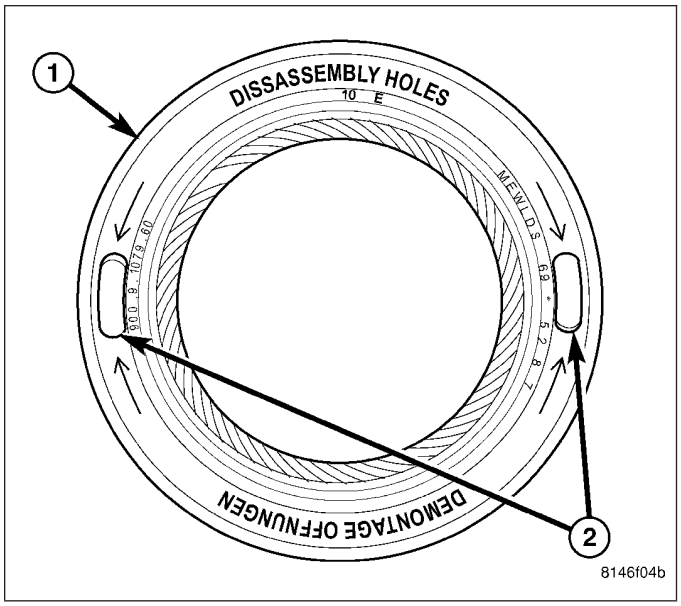
30. Install Fixture 9626 (2) on main/countershaft and shift rails. Turn fixture (2) with transmission (1) over onto the fixture.



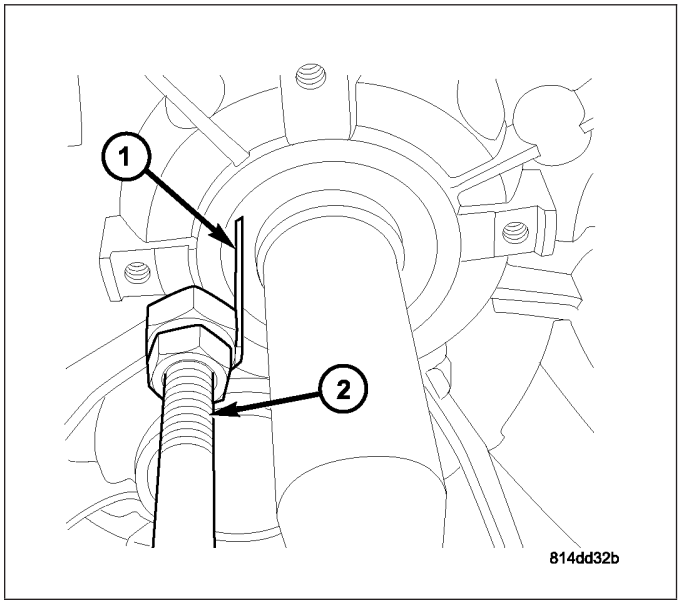
31. Remove clutch release bearing support bolts (2) and retainer (1).



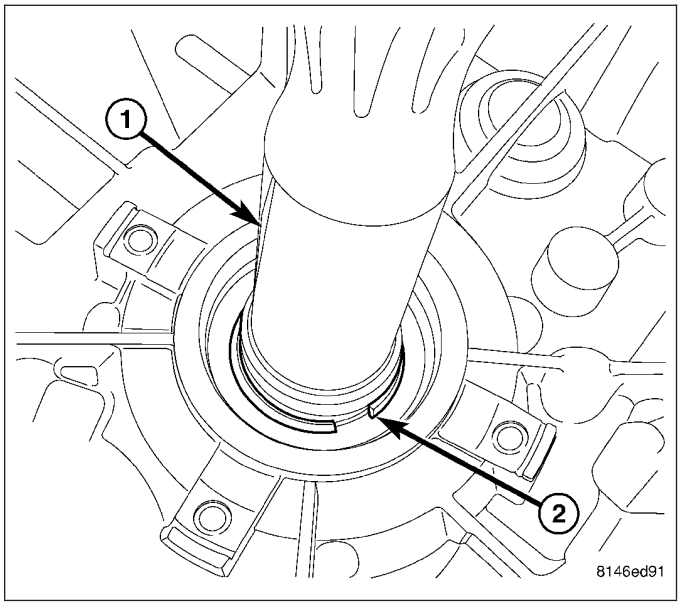
32. Insert seal Remover 9667 through one input shaft seal (1) disassembly hole (2).



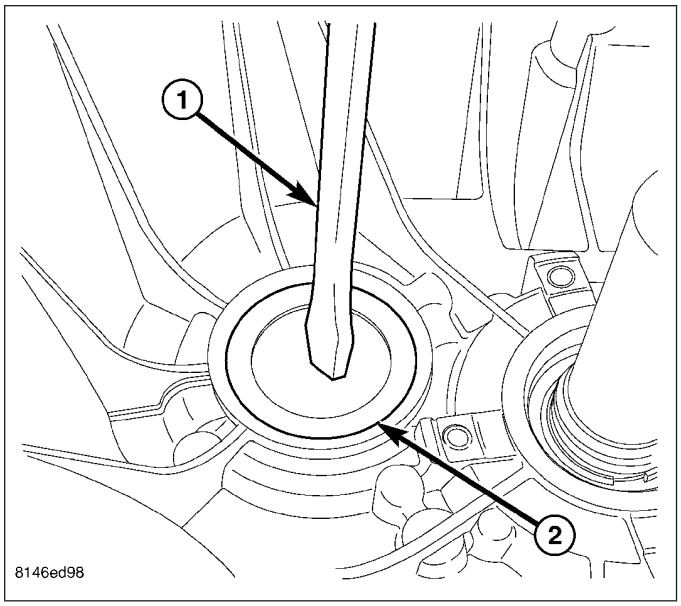
33. Remove input shaft seal with Remover 9667 (1) and Slide Hammer C-3752 (2).



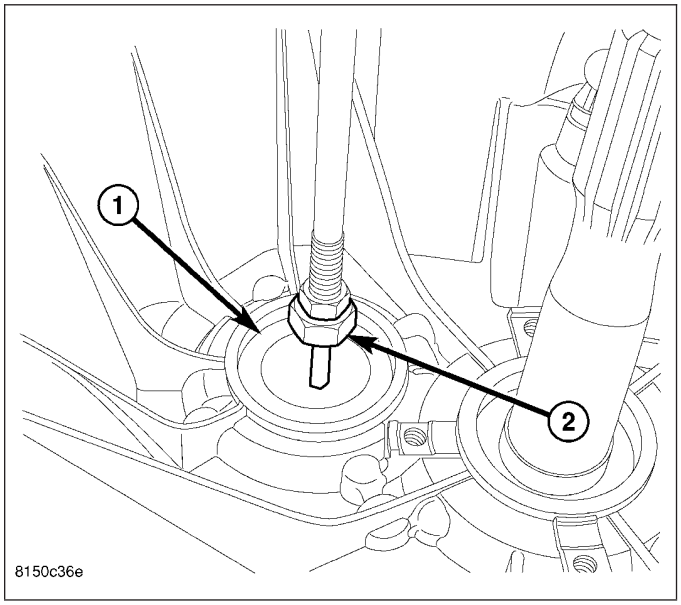
34. Remove input shaft snap ring.



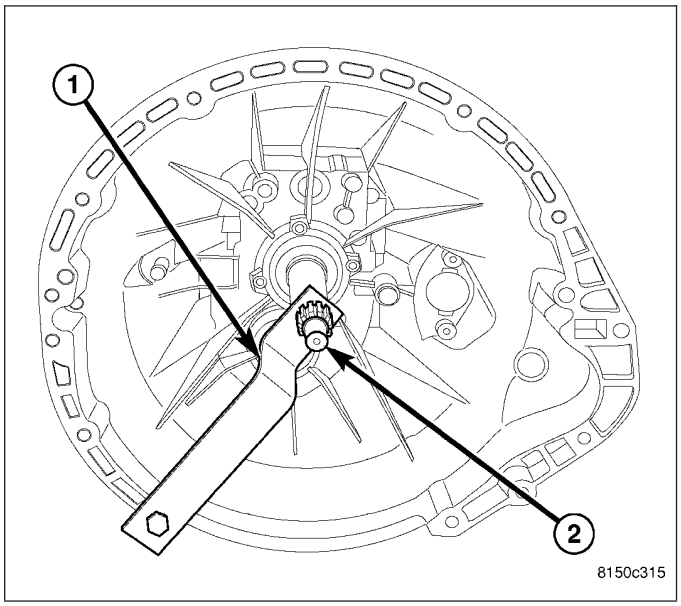
35. Put a hole in the center of the countershaft plug (2) with a punch (1).



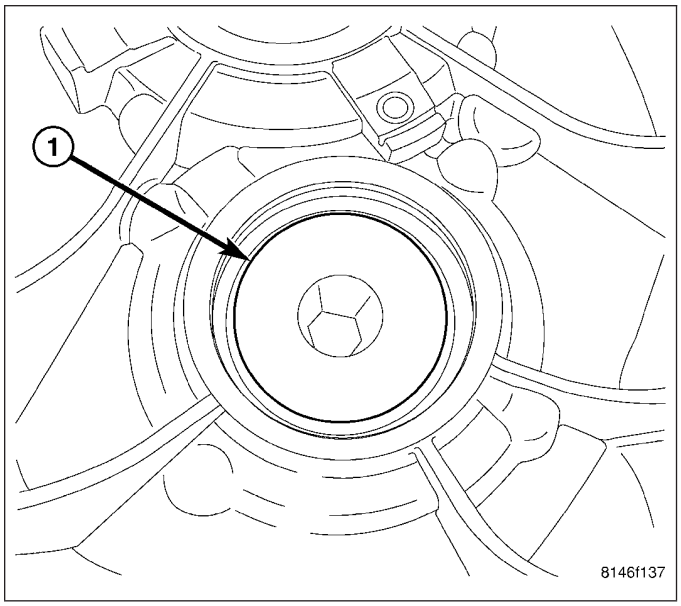
36. Remove countershaft plug (1) from front housing with Puller 9667 (2) and Slid Hammer C-3752.



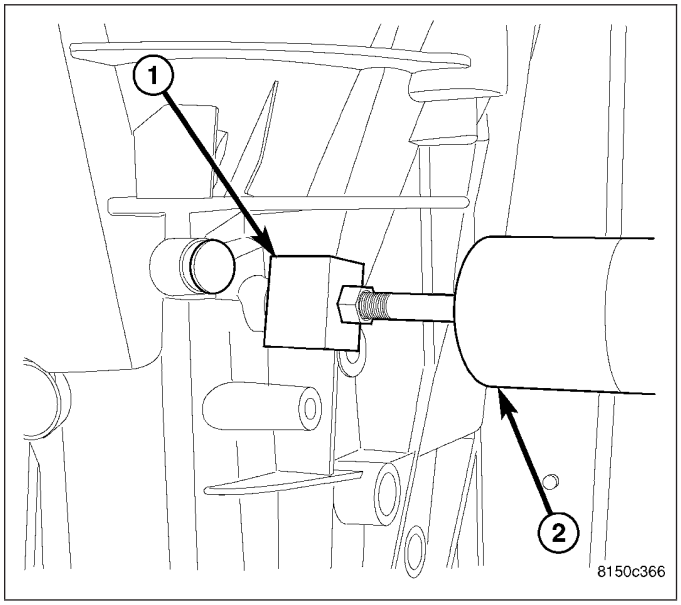
37. Install Wrench 9586 (1) on input shaft (2).



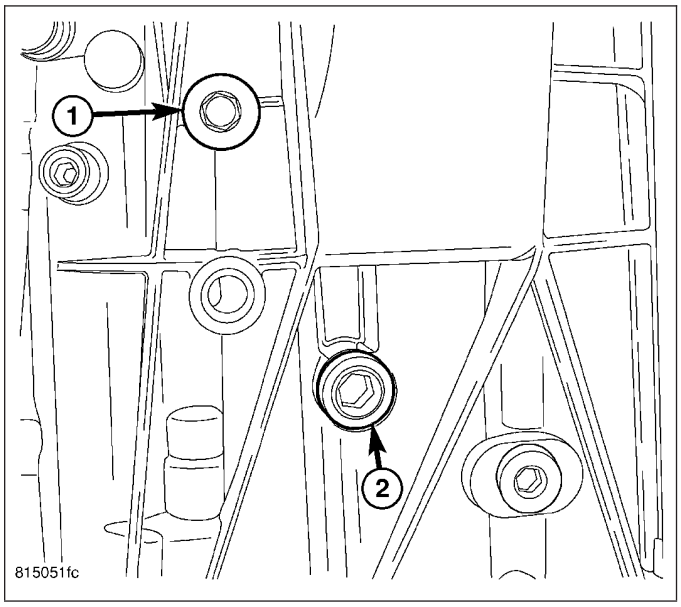
38. Remove countershaft allen bolt (1).
39. Remove input shaft wrench.



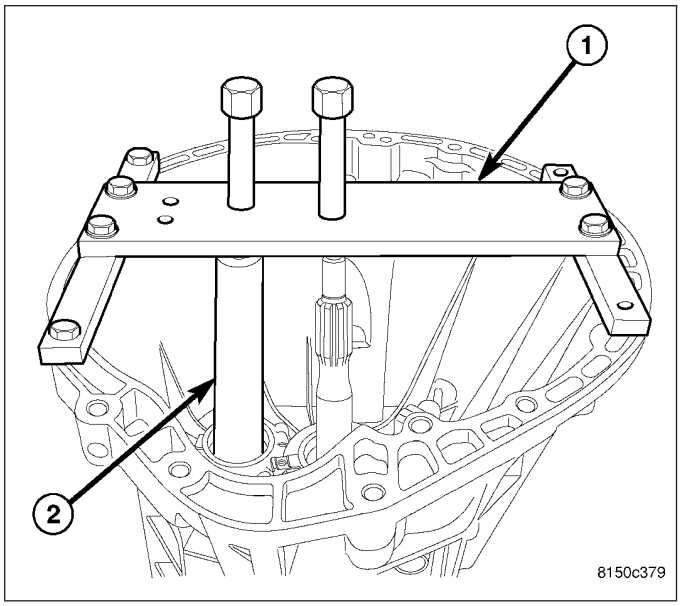
40. Remove two detent plugs from the side of the housing with Remover 8870 (1) and Slide Hammer C-3752 (2).



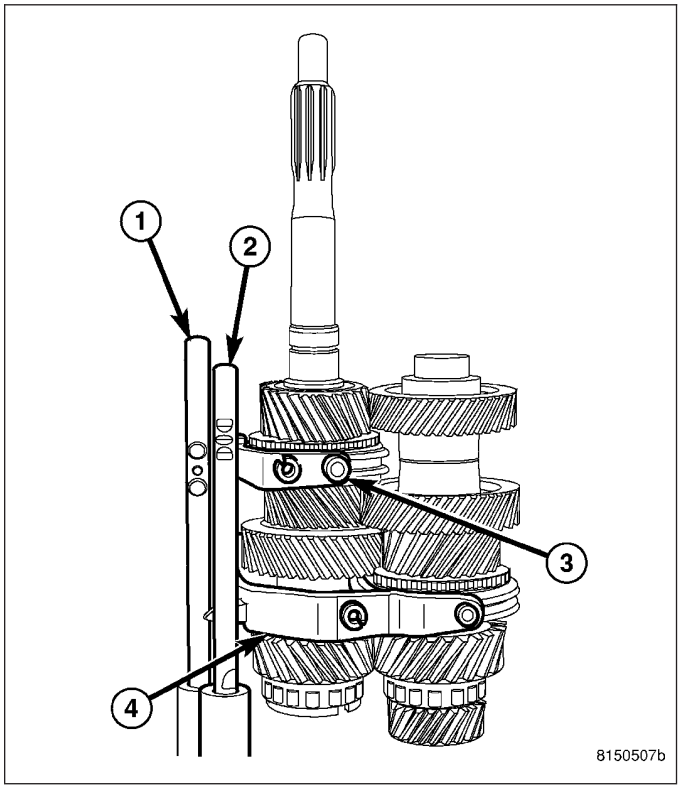
41. Remove 3-4 (2) and 5-6 (1) shift fork pivot bolts from both sides of the front housing.



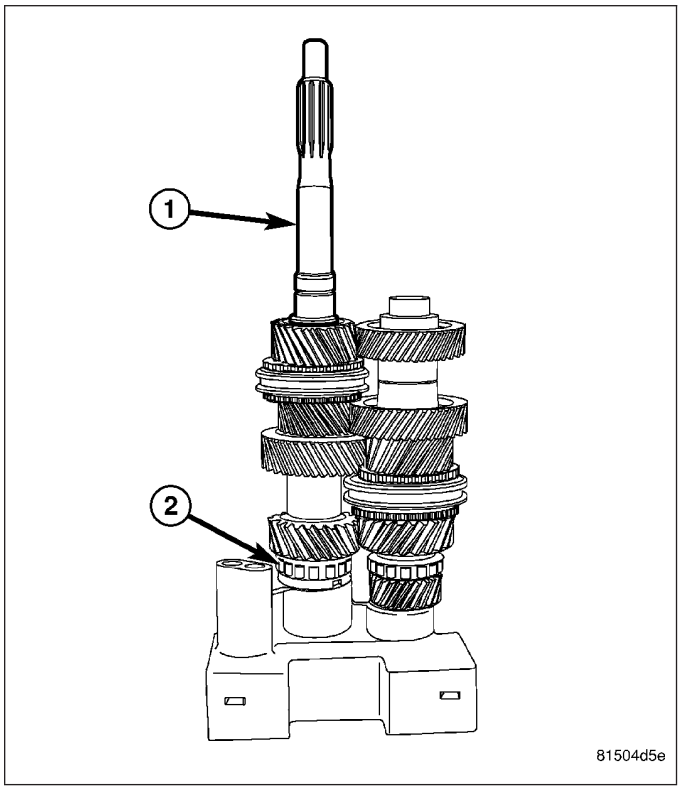
42. Install Puller 9621(1) with puller Plug 9621-2 (2) on front housing. Tighten puller bolts evenly and remove front housing from the mainshaft and countershaft.



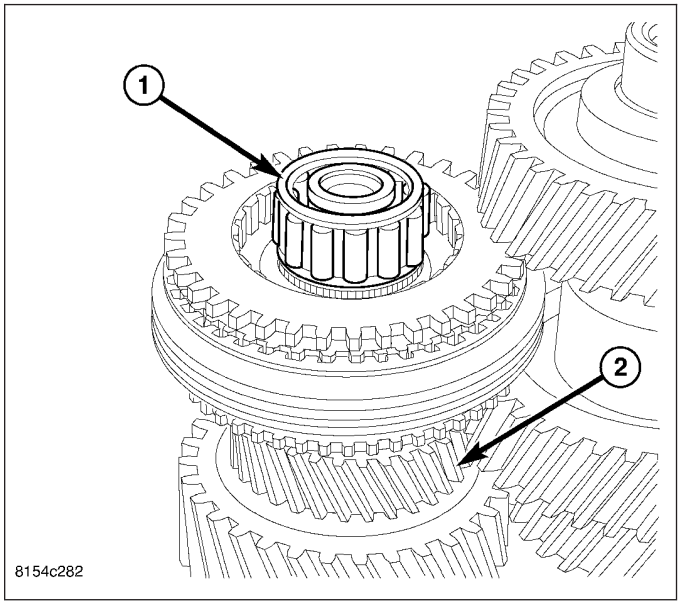
43. Remove 5-6 shift fork (3) and 3-4 shift fork (4). Then remove 5-6 shift rail (1) and 3-4 shift rail (2) from Fixture 9626.



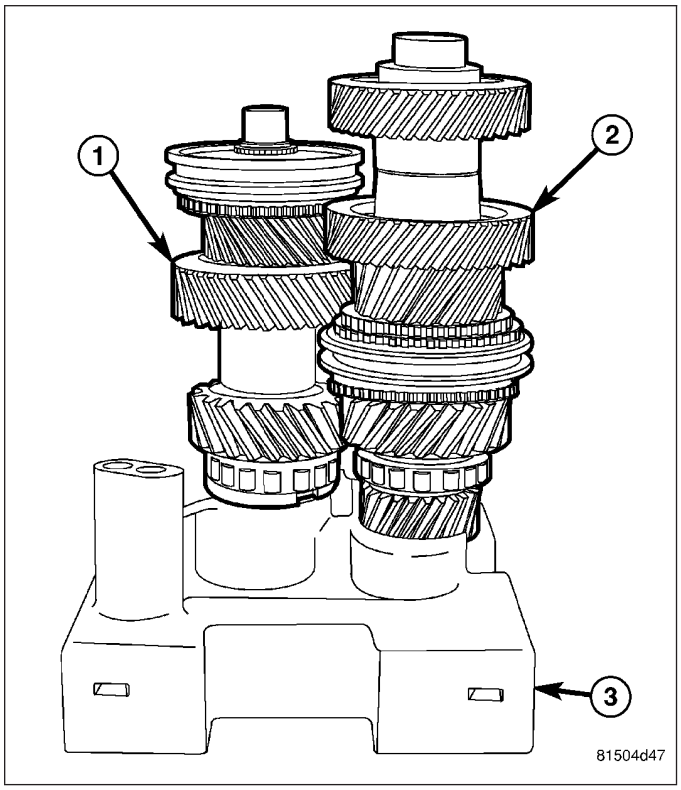
44. Remove input shaft (1) from mainshaft (2).



45. Remove input shaft bearing (1) from mainshaft (2).

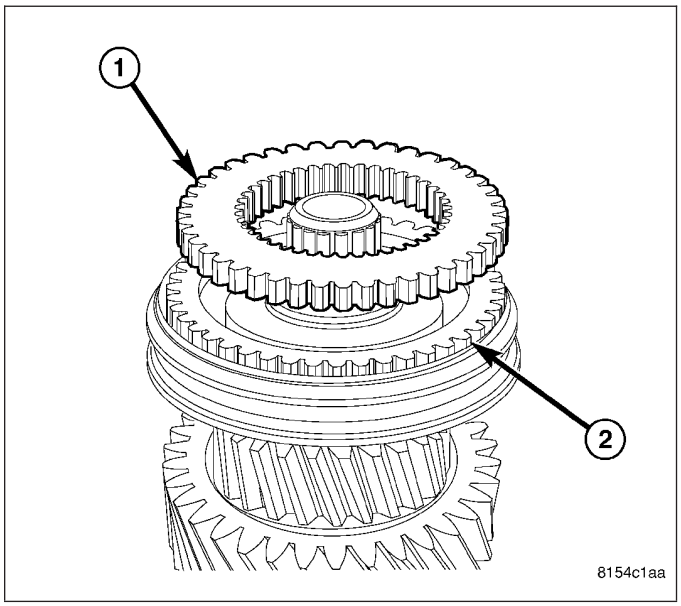


46. Remove countershaft (2) from fixture (3).

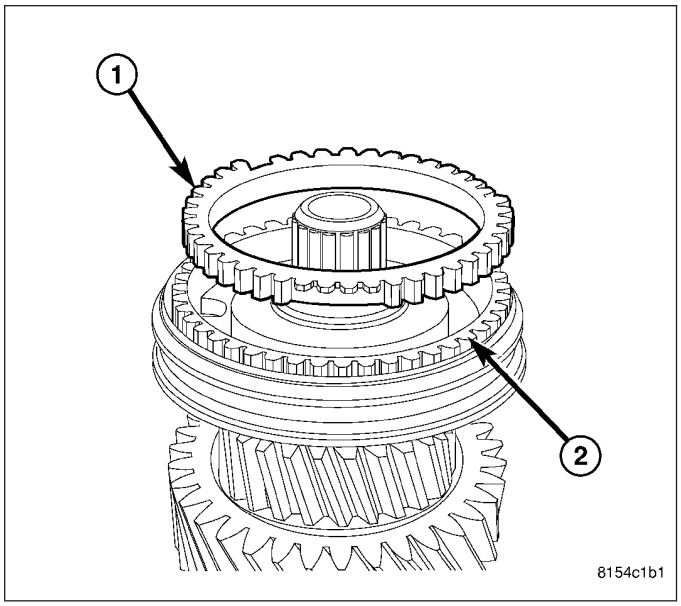


MAINSHAFT

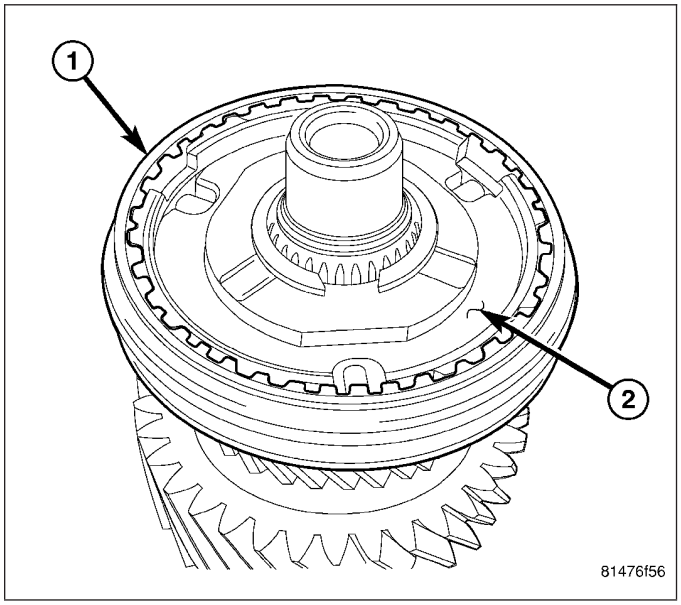
1. Remove fifth gear synchronizer clutch body (1) from 5-6 synchronizer hub (2).



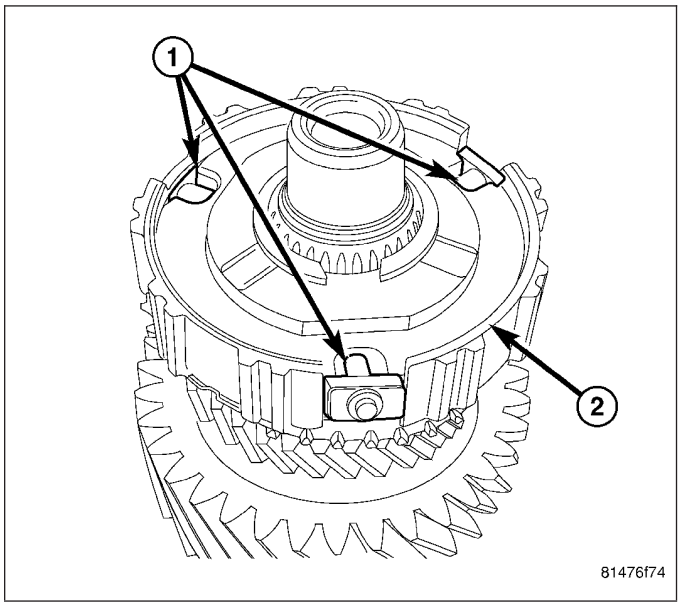
2. Remove fifth gear synchronizer friction ring (1) from 5-6 synchronizer hub (2).



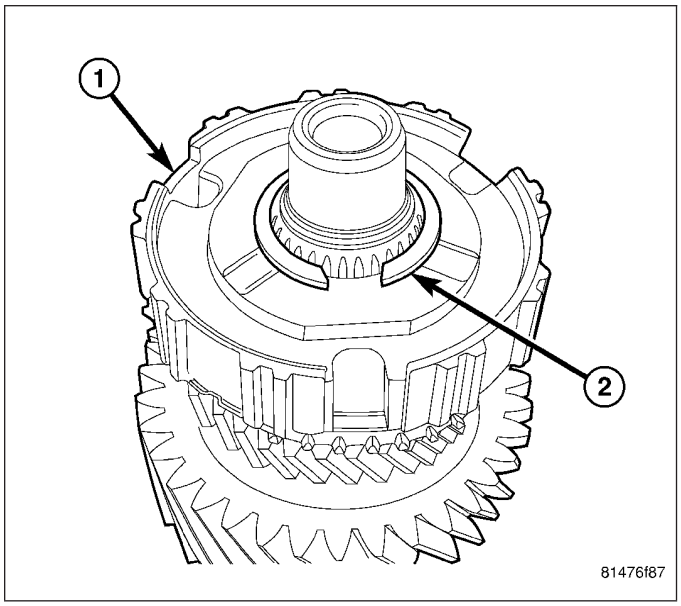
3. Remove 5-6 synchronizer sleeve (1) from hub (2).



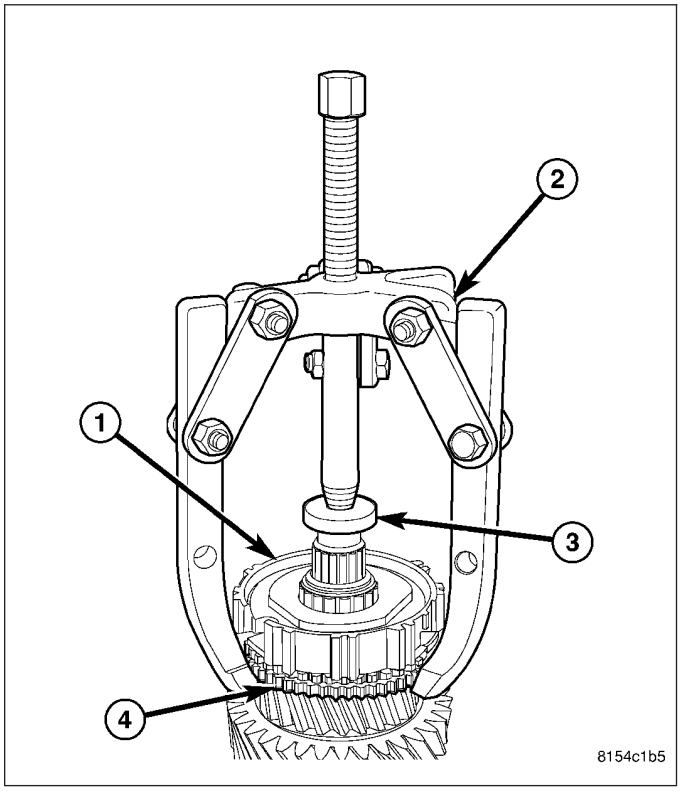
4. Remove 5-6 synchronizer detents (1) from hub (2).



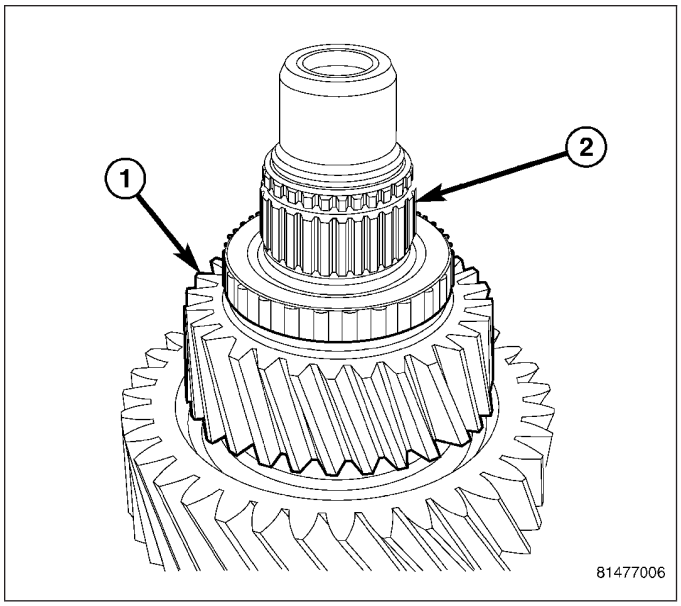
5. Remove 5-6 synchronizer hub (1) snap ring (2).



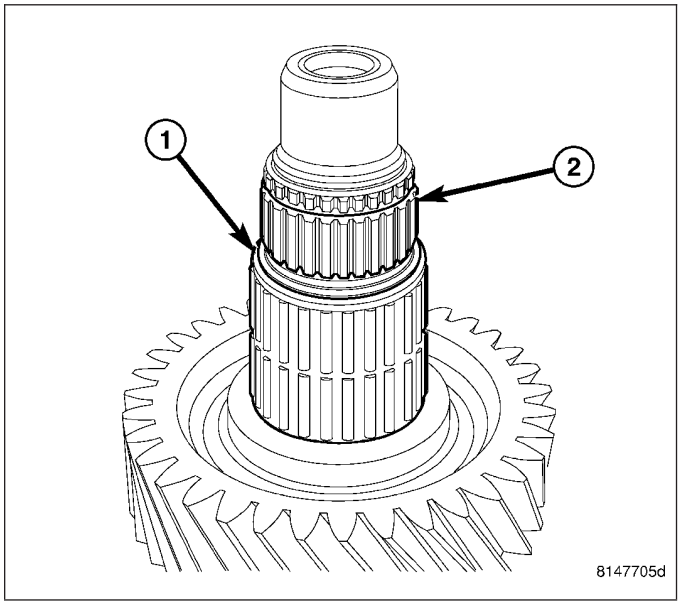
6. Remove 5-6 synchronizer hub (1) with three jaw puller (2) and Button 9618-2 (3). Position jaws under sixth gear clutch body (4).



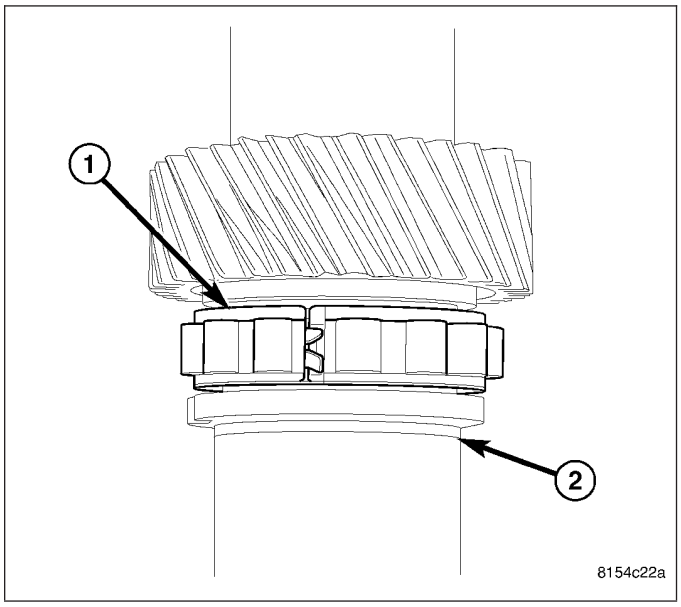
7. Remove sixth gear (1) from mainshaft (2).



8. Remove sixth gear bearing (1) from mainshaft (2).



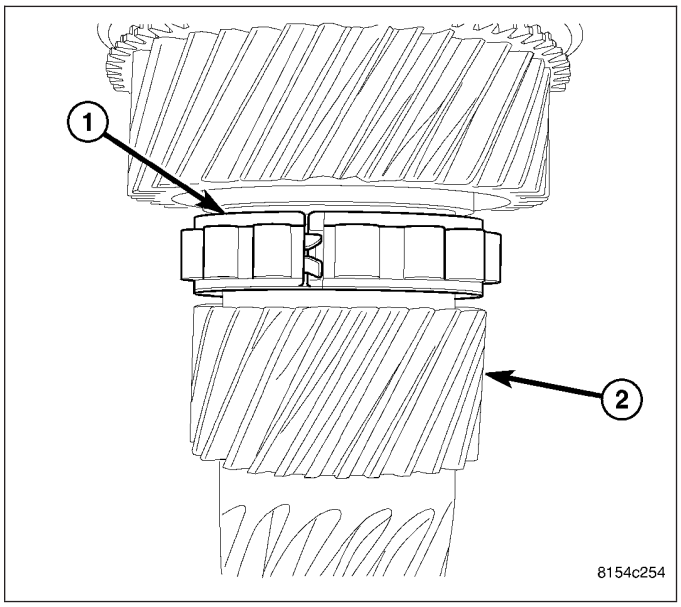
9. Remove mainshaft center support bearing (1) from mainshaft (2).



COUNTERSHAFT

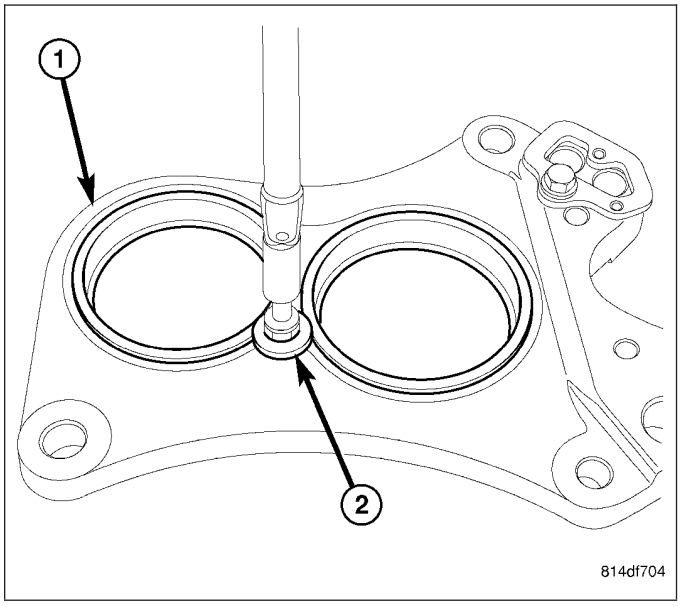
1. Remove countershaft center support bearing (1) from counter shaft (2).

NOTE: Countershaft with 3-4 synchronizer, is serviced as an assembly except bearings.

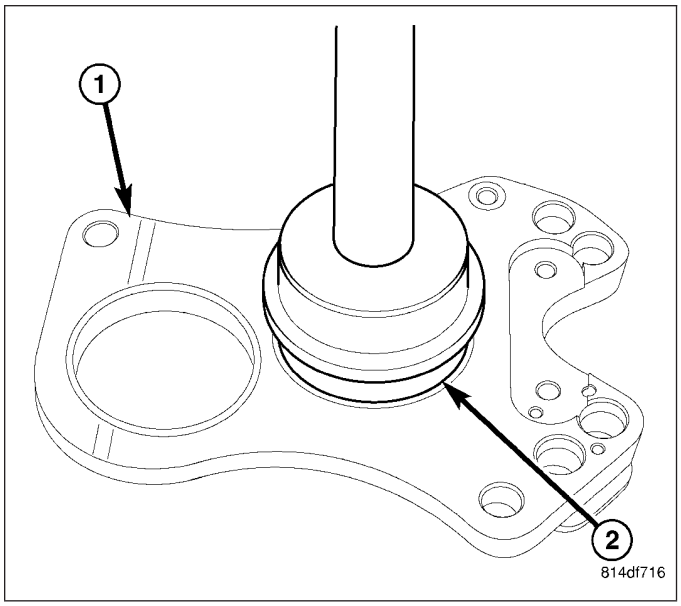


CENTER SUPPORT PLATE

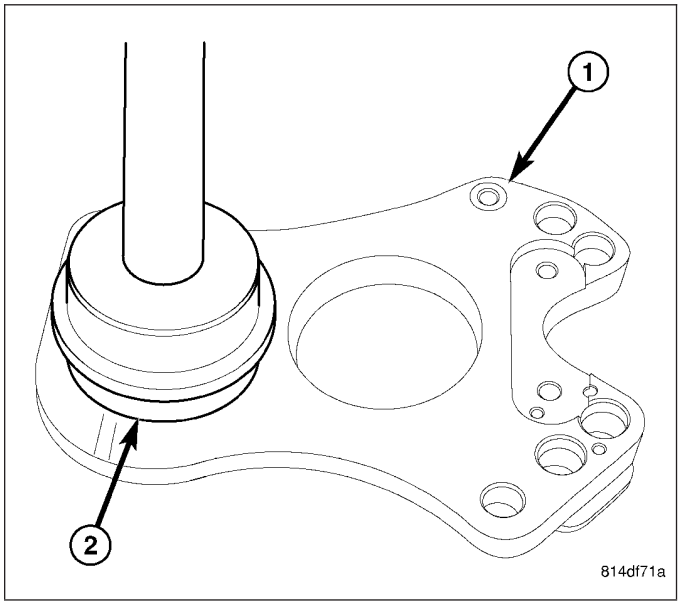
1. Remove center support (1) roller bearing race retainer (2).



2. Remove mainshaft center support (1) bearing race with Remove/Installer 9668 (2) and Handle C4171.

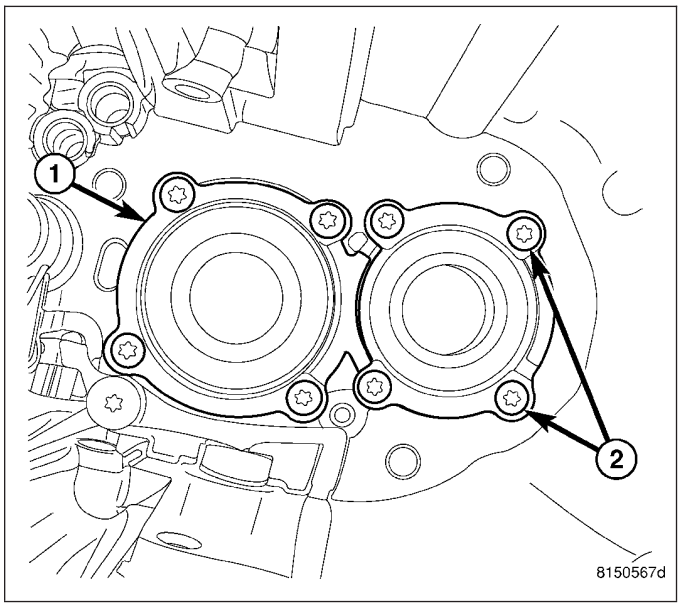


3. Remove countershaft center support (1) bearing race with Remove/Installer 9617 (2) and Handle C4171.



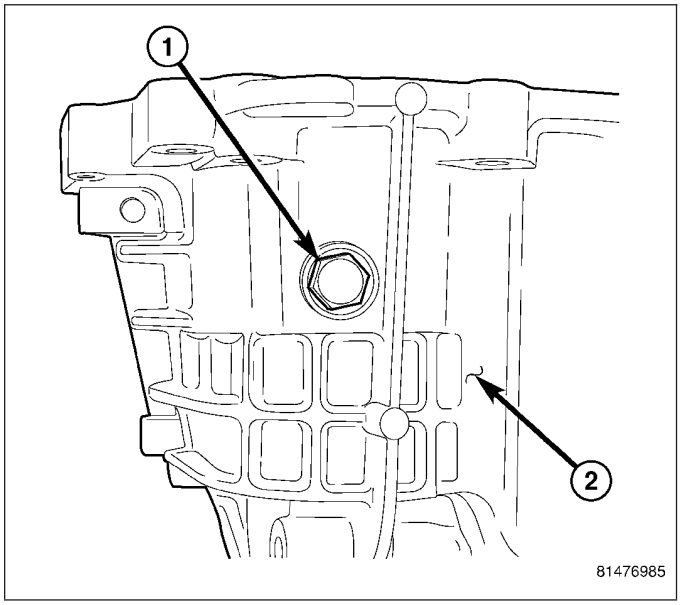
FRONT HOUSING

1. Remove mainshaft bearing retainer (1) and countershaft bearing retainers (2).
2. Remove mainshaft bearing and countershaft bearing with hammer and driver.

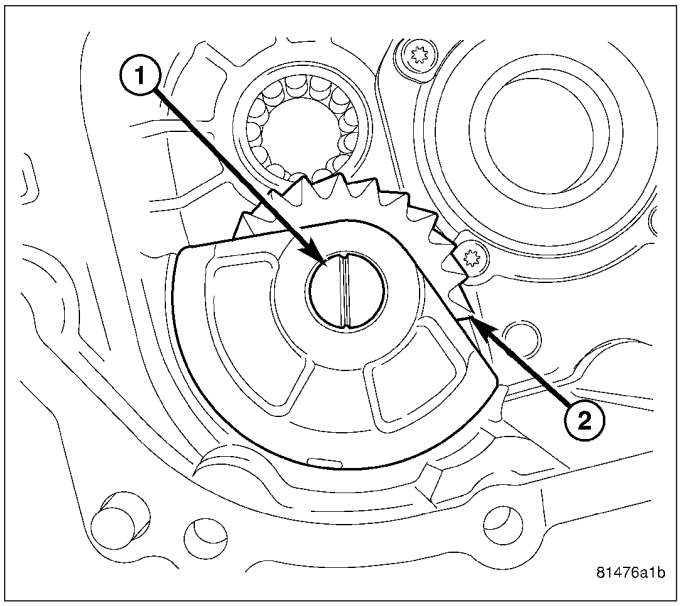


REAR HOUSING

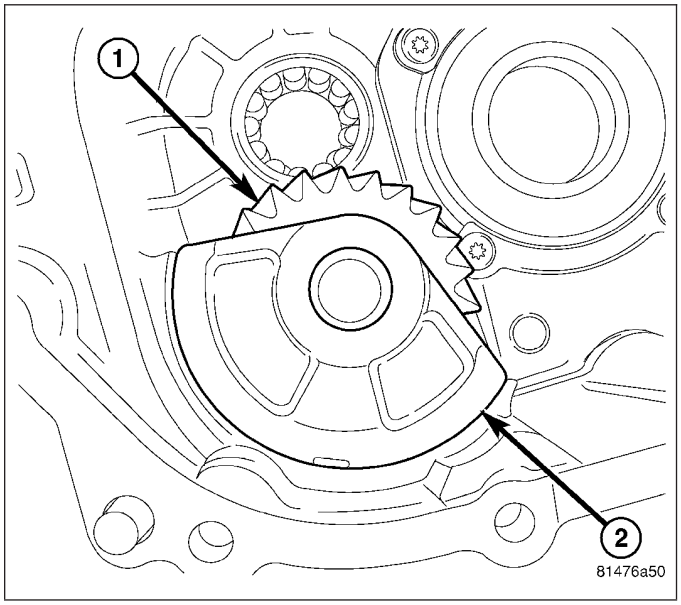
1. Remove reverse idler gear shaft bolt (1) from housing (2).



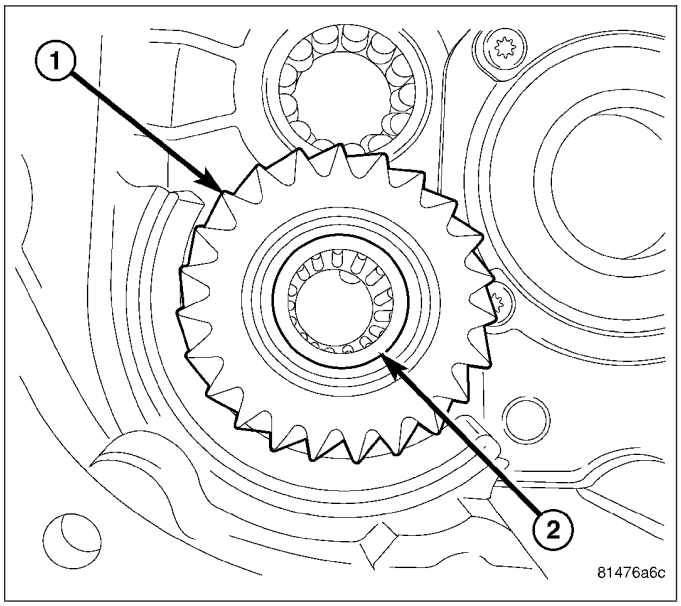
2. Remove reverse idler gear shaft (1) from idler gear (2).



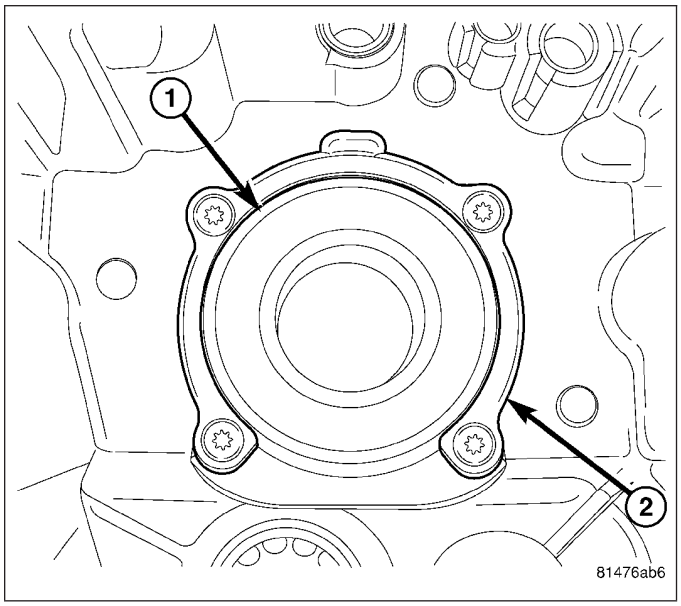
3. Remove reverse idler gear (1) shaft support (2).



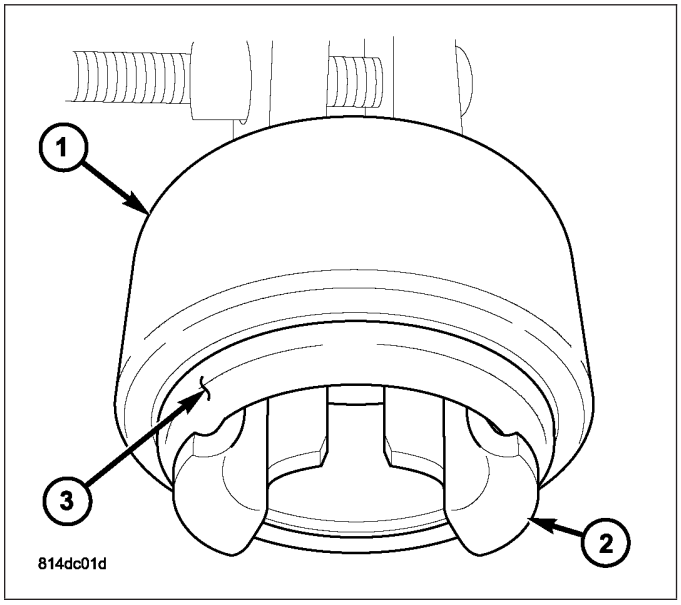
4. Remove reverse idler gear (1) and bearing (2).



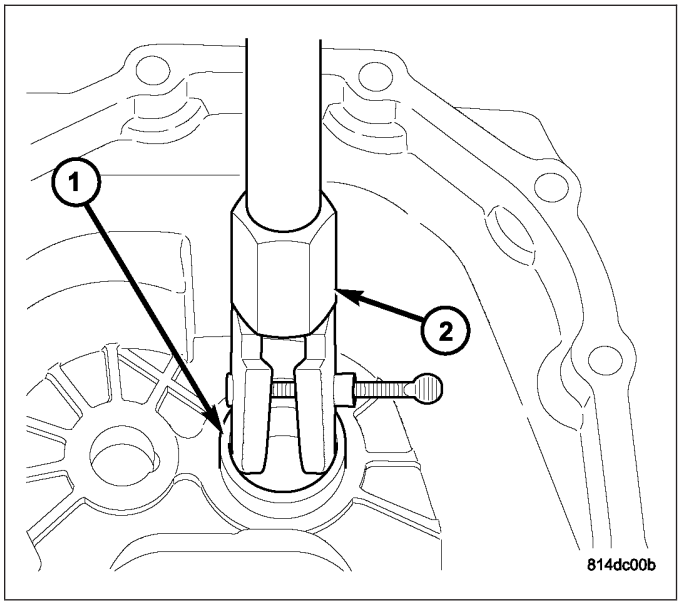
5. Remove mainshaft bearing (1) retainer (2) bolts and remove retainer.
6. Remove bearing from housing with a hammer and driver.



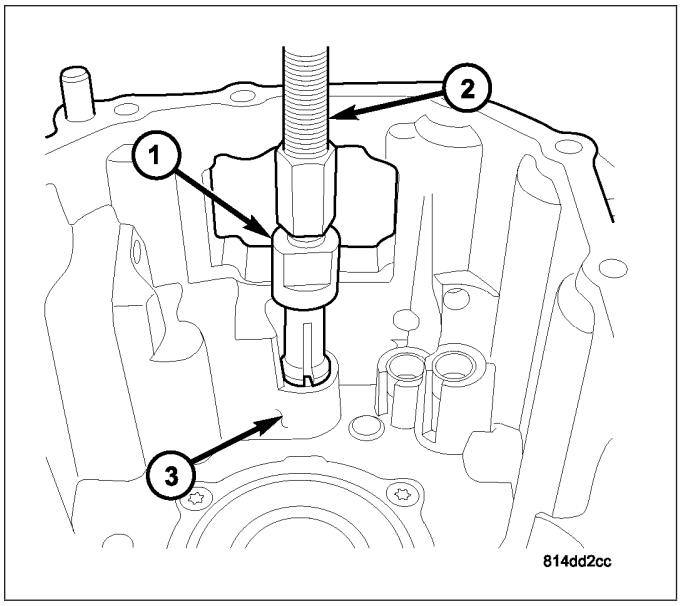
7. Break plastic countershaft roller bearing cage with a screw driver. Then remove cage and roller bearing.
8. Insert Remover 9585 through the countershaft roller bearing shell (1) and expand the tool (2) to grab the bottom (3) of the bearing shell (1).



9. Remove countershaft roller bearing shell (1) from the rear housing with Remover 9585 (2) and Slide Hammer C-637.



10. Remove shift rail roller bearing from rear housing (3) with Remover 9609 (1) and Slide Hammer C-637 (2).



CLEANING

Clean gears, shafts, shift components and transmission housings with a standard parts cleaning solvent. Do not use acid or corrosive base solvents. Dry all parts except bearings with compressed air.

Clean shaft bearings with a mild solvent such as MOPAR® degreasing solvent, Gunk® or similar solvents. Do not dry the bearings with compressed air. Allow the bearings to either air dry or wipe them dry with clean shop towels.

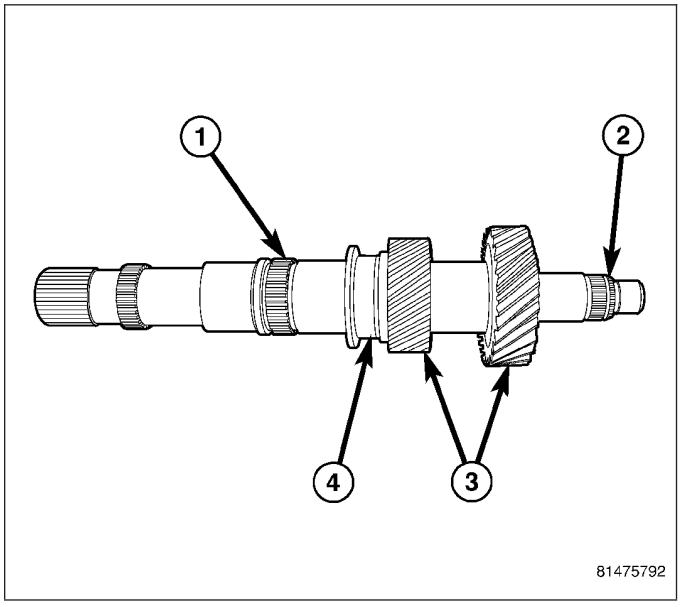
INSPECTION

NOTE: Minor corrosion, nicks, or pitting can be smoothed with 400 grit emery and polished out with crocus cloth.

Bearings: Inspect roller bearings for wear, chips, cracks, flat-spots or brinnelling. Inspect sealed bearings, and verify bearings roll smoothly.

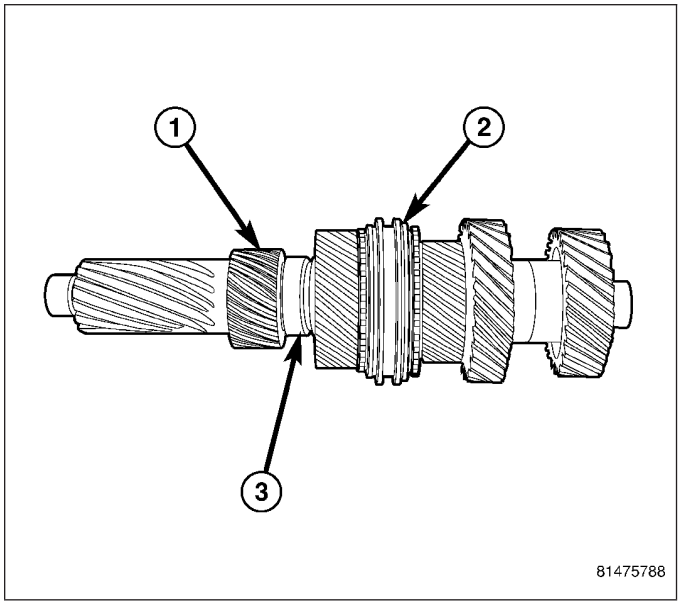
Gears: Inspect for worn, chipped, or cracked teeth. Inspect bearing surfaces for wear or flat-spots.

Mainshaft: Inspect for worn splines (1), snap ring grooves (2) and worn, chipped or cracked teeth (3). Inspect all bearing surfaces (4) for wear or flat-spots. **Third and fourth gear (3) are serviced with mainshaft.**

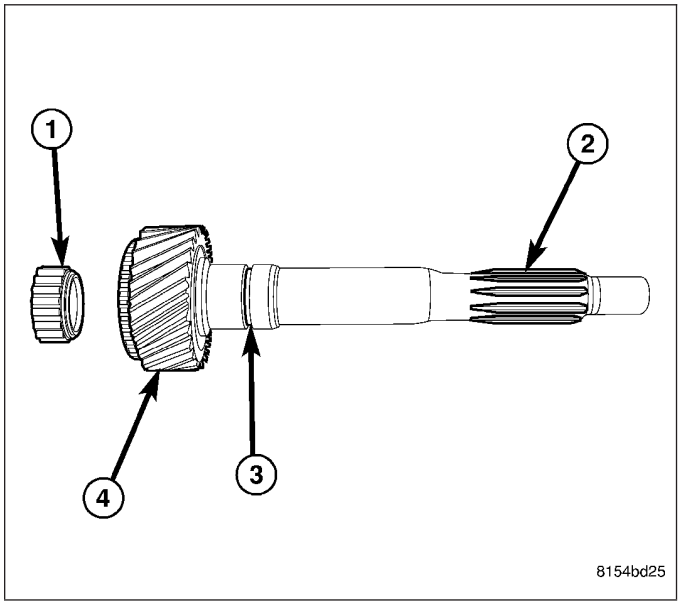


Countershaft: Inspect all gears for worn, chipped or cracked teeth (1). Inspect 3-4 synchronizer assembly for wear (2). Inspect center support bearing surfaces (3) for wear or flat-spots. **The countershaft with 3-4 synchronizer is serviced as an assembly, except for bearings.**

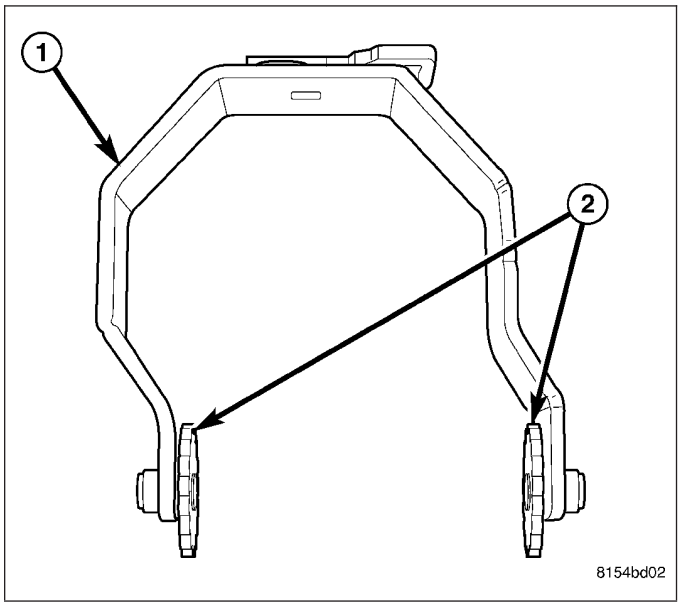
Synchronizer components: Inspect for worn, chipped, or cracked teeth and burned or flaking off friction material. **Synchronizers are serviced as an assembly.**



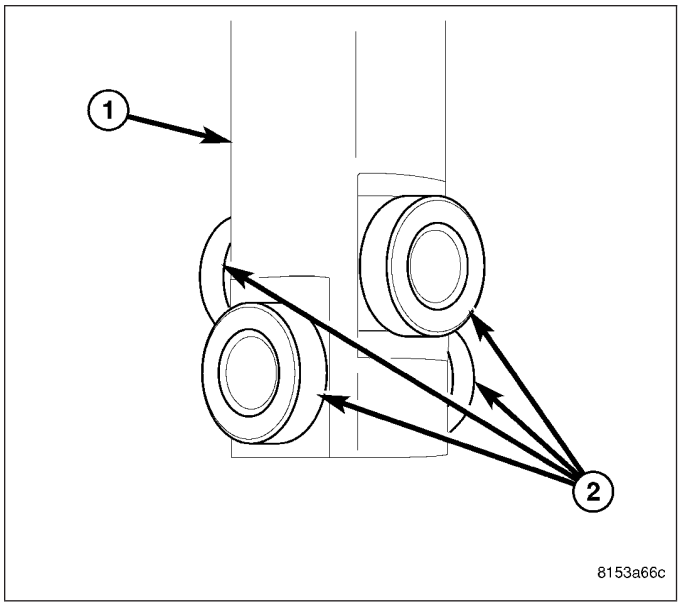
Input Shaft: Inspect input shaft bearing (1) and bearing surfaces for wear or flat-spots. Inspect input shaft splines (2) for wear. Inspect snap ring groove (3) for wear. Inspect fifth gear (4) for worn, chipped, or cracked teeth.



Shift forks: Inspect shift forks (1) for distortion. Inspect fork shoes (2) for wear and fit shoes in synchronizer sleeve to ensure parts fit and work smoothly.

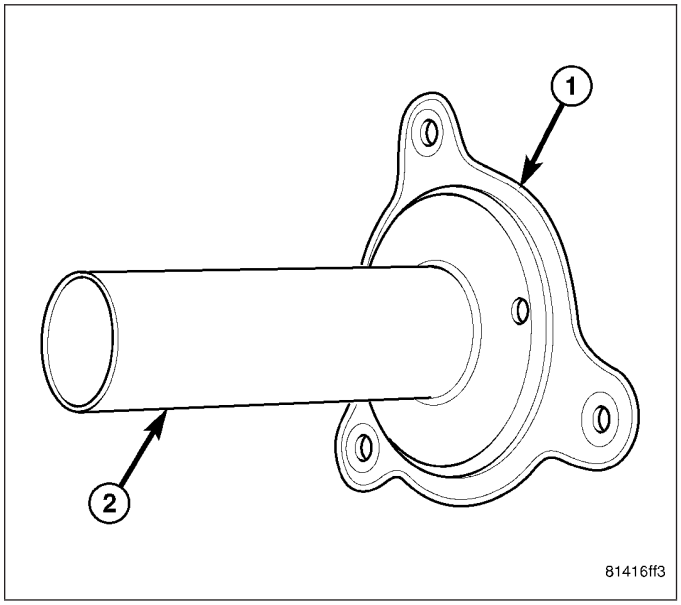


Shift Rails: Inspect shift rails, bushings, and bearing for wear. Verify main shift rail (1) bearings (2) roll smoothly.



Clutch Release Bearing Support: Inspect clutch release bearing support (1) release bearing slide surface (2) for damage.

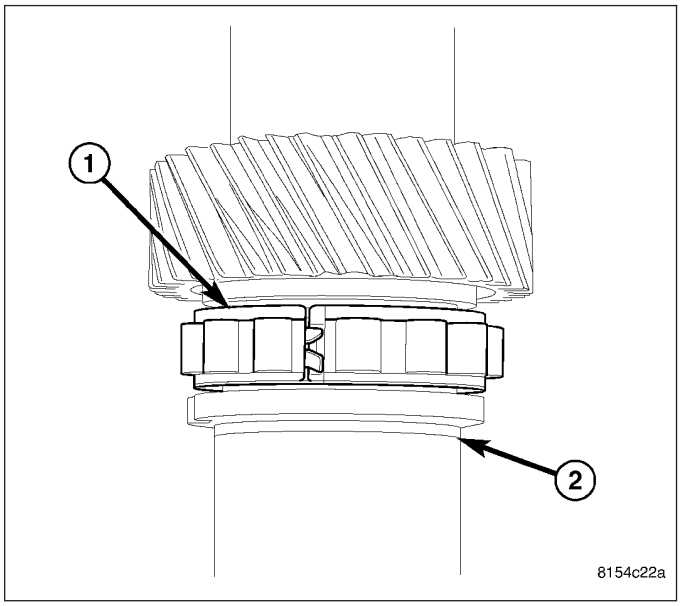
Housing/Tail housing: Inspect sealing and mating surfaces are free of burrs and nicks. Inspect alignment dowels are tight and in good condition. Inspect shift rail bushings for wear.



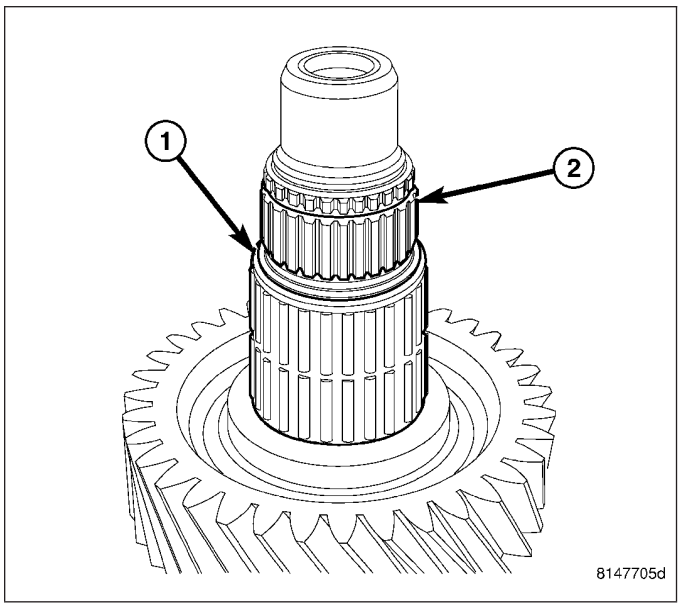
ASSEMBLY

MAINSHAFT

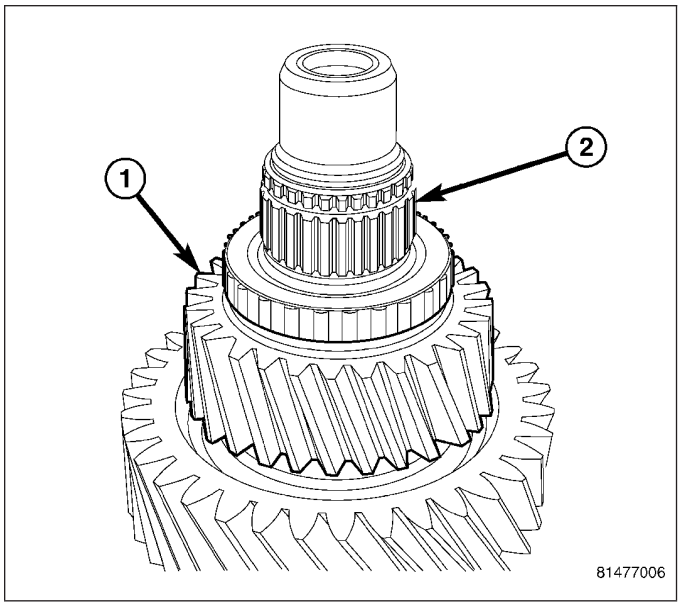
1. Install mainshaft center support bearing (1) on mainshaft (2).



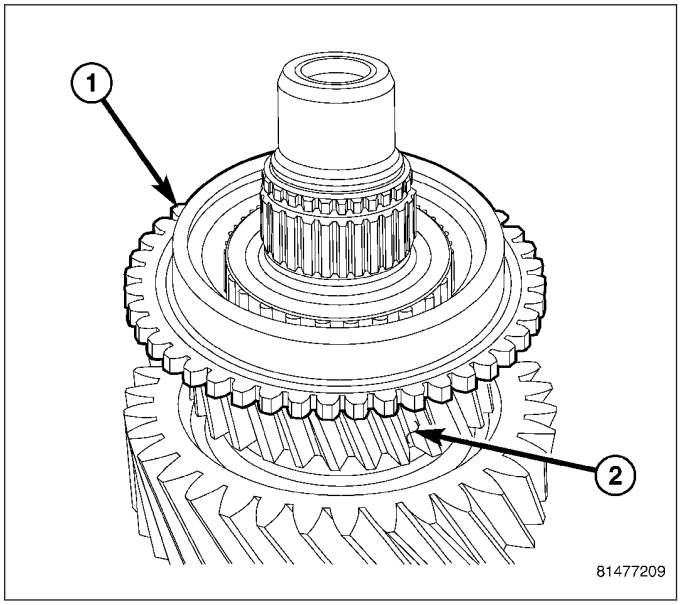
2. Install sixth gear bearing (1) on mainshaft (2).



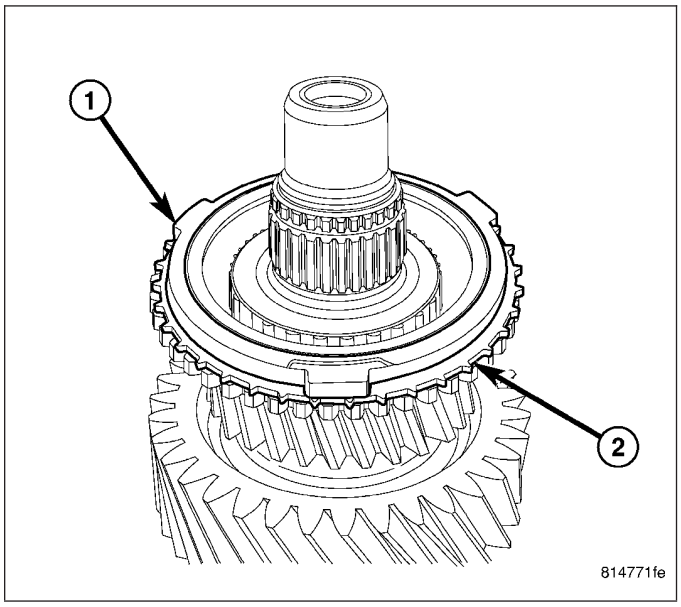
3. Install sixth gear (1) on mainshaft (2).



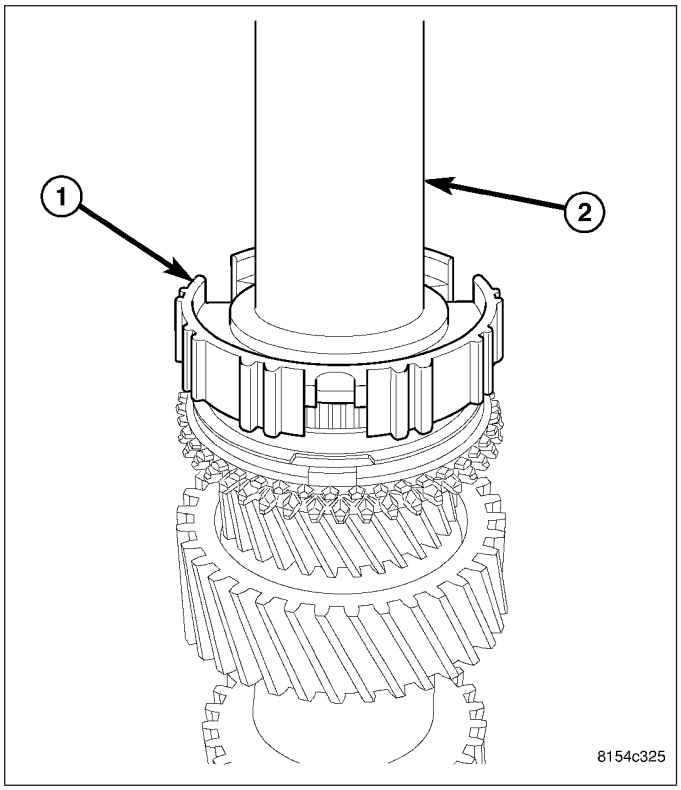
4. Install sixth gear clutch body (1) on sixth gear (2).



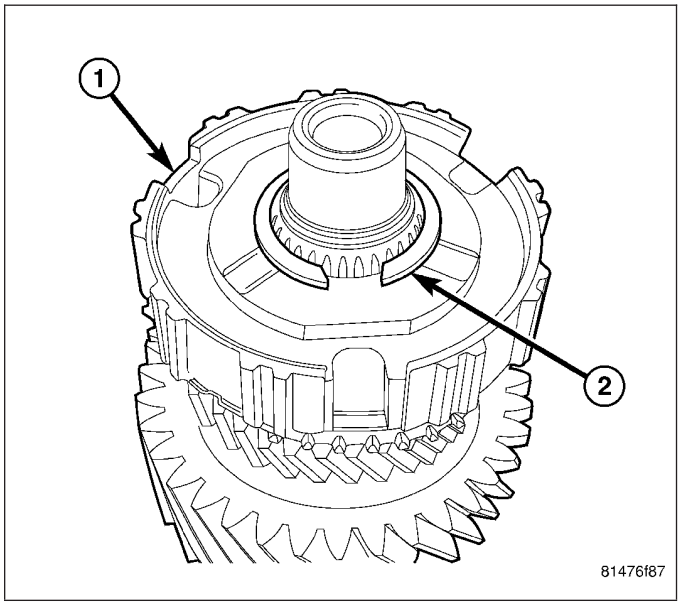
5. Install sixth gear friction ring (1) on clutch body (2).



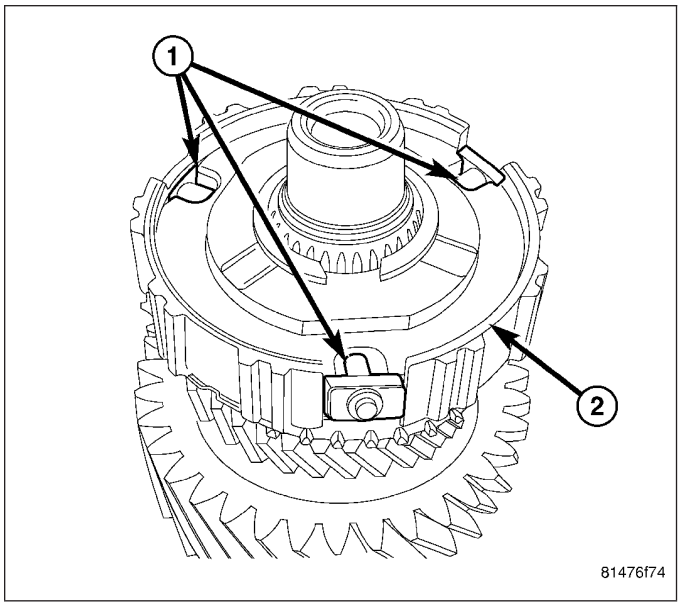
6. Install 5-6 synchronizer hub (1) on mainshaft with Installer W-262 (2).



7. Install 5-6 synchronizer hub (1) snap ring (2).

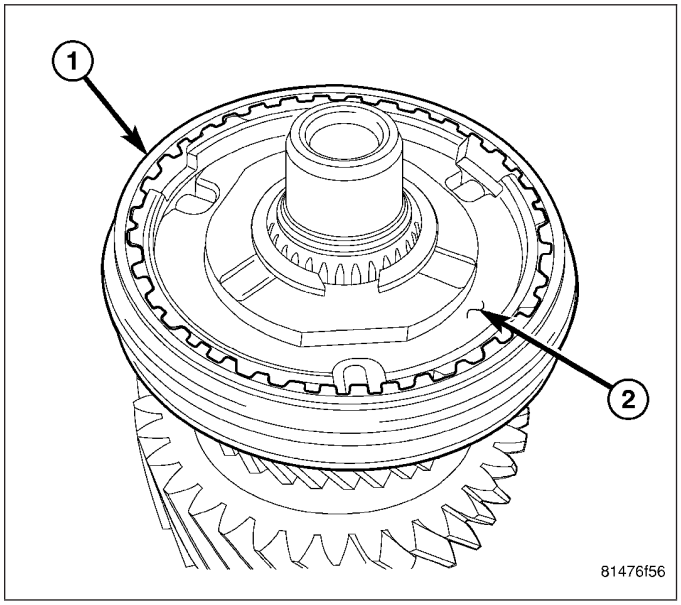


8. Install 5-6 synchronizer detents (1) in hub (2).

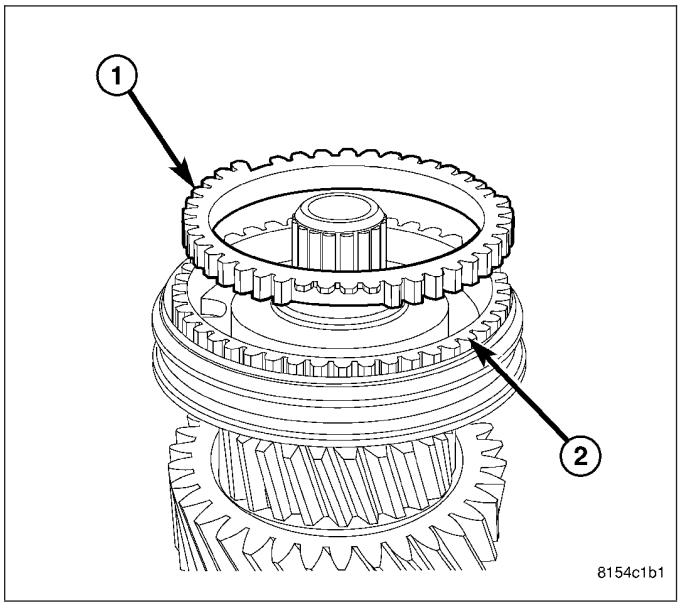


NOTE: Whenever installing a synchronizer sleeve onto the hub, make sure that the grooves in the sleeve are aligned with the detents in the hub.

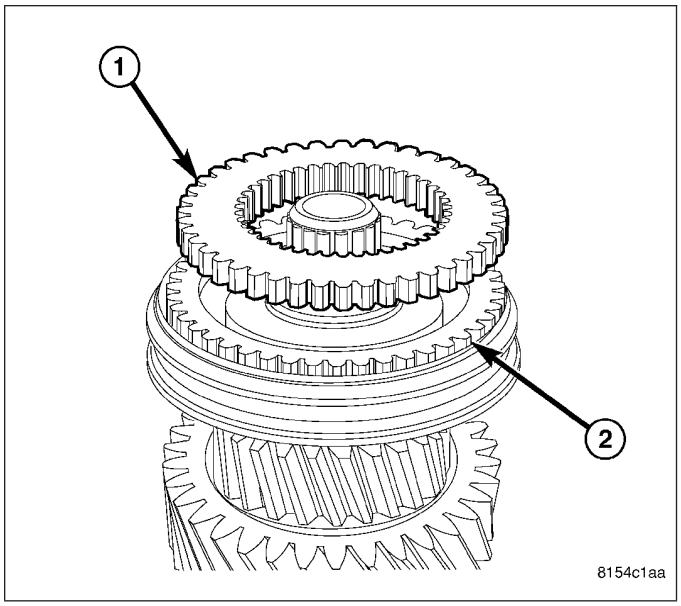
9. Install 5-6 synchronizer sleeve (1) on hub (2).



10. Install fifth gear synchronizer friction ring (1) on 5-6 synchronizer hub (2).

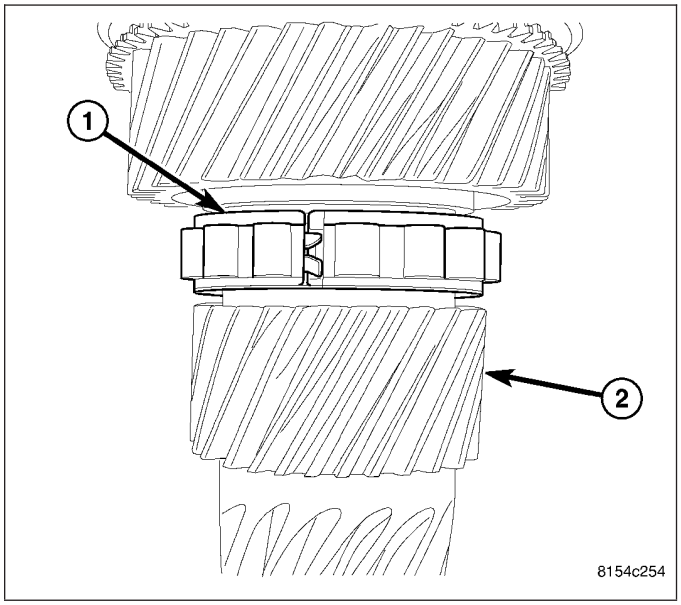


11. Install fifth gear synchronizer clutch body (1) on 5-6 synchronizer hub (2).



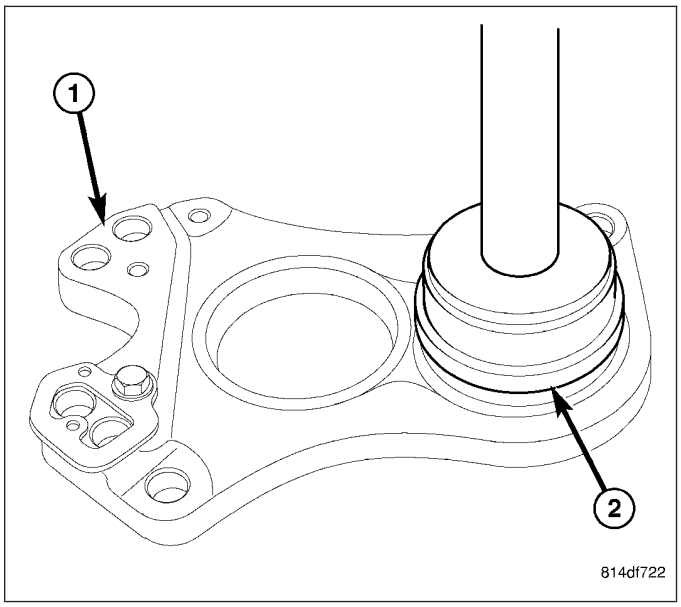
COUNTERSHAFT

1. Install countershaft center support bearing (1) on countershaft (2).

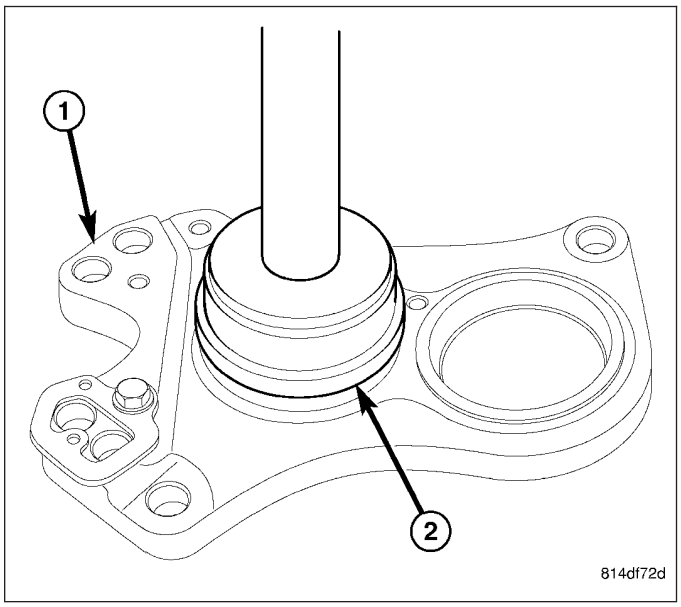


CENTER SUPPORT

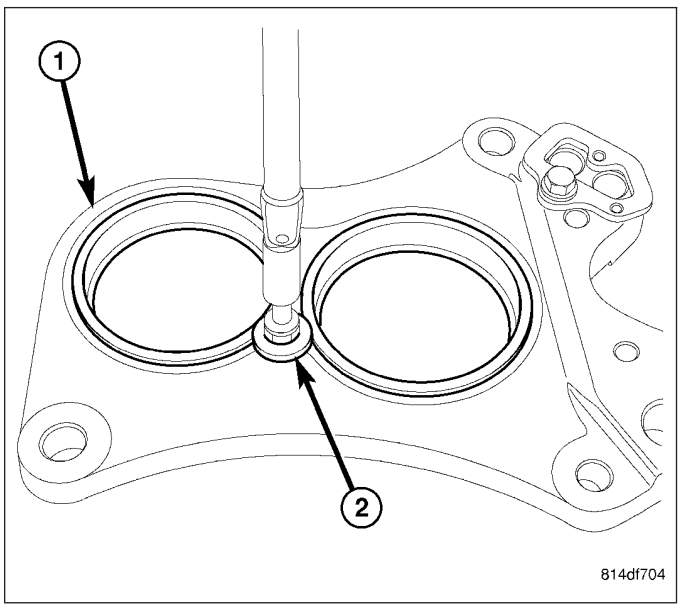
1. Install center support (1) countershaft roller bearing race with Installer/Remover 9617 (2) and Handle C-4171.



2. Install center support (1) mainshaft roller bearing race with Installer/Remover 9668 (2) and Handle C-4171.

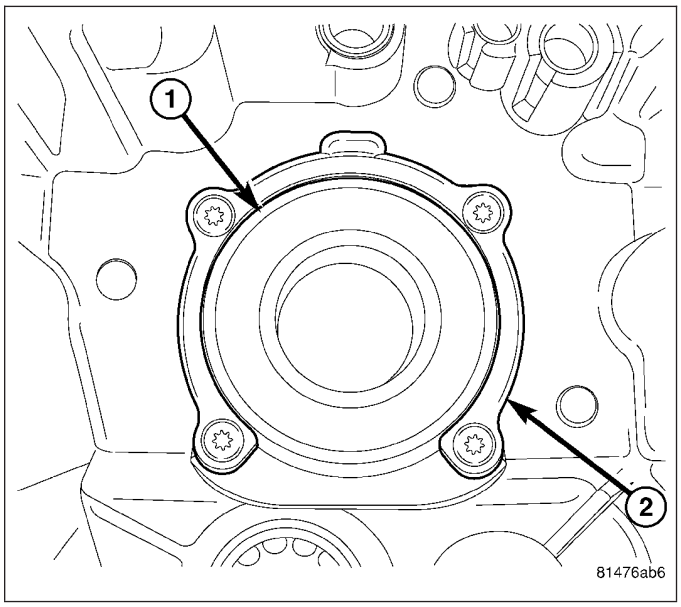


3. Install center support (1) race retainer screw (2) and tighten to 22 N·m (16 ft. lbs.).

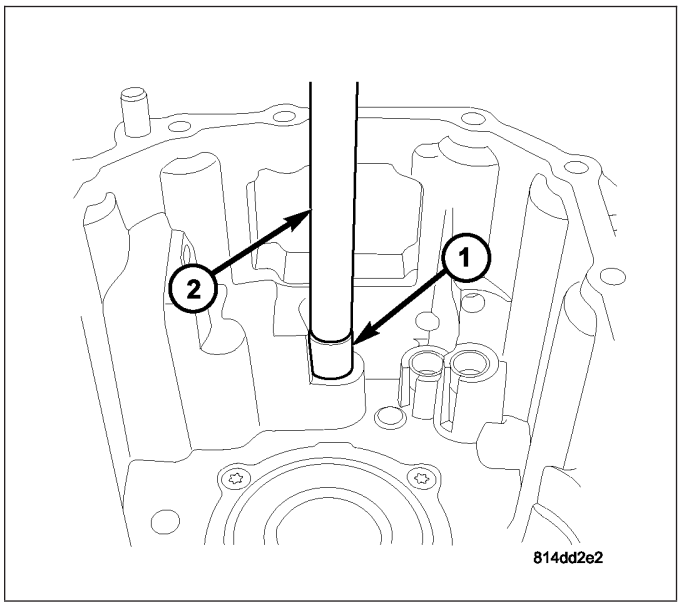


REAR HOUSING

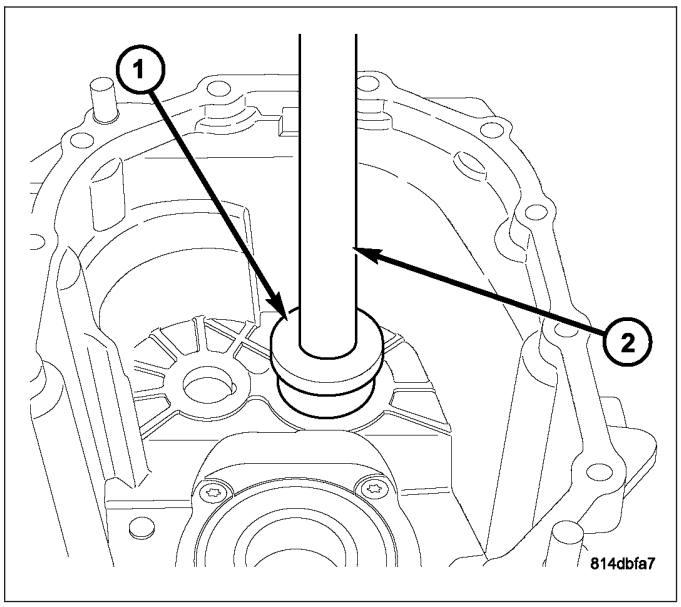
1. Install mainshaft bearing (1) in rear housing with hammer and driver.
2. Install mainshaft bearing (1) retainer (2). Apply Mopar® Lock & Seal Adhesive or equivalent to retainer bolts and tighten to 10 N·m (88 in. lbs.).



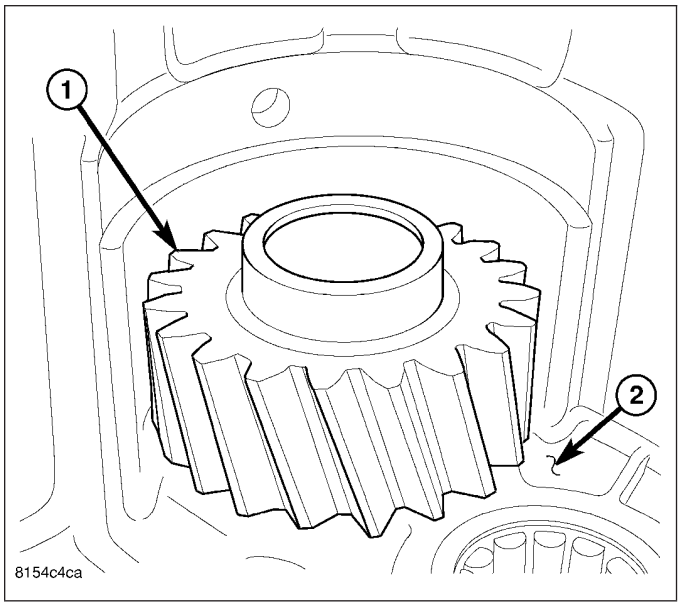
3. Install shift rail roller bearing (1) with Installer 8475 (2).



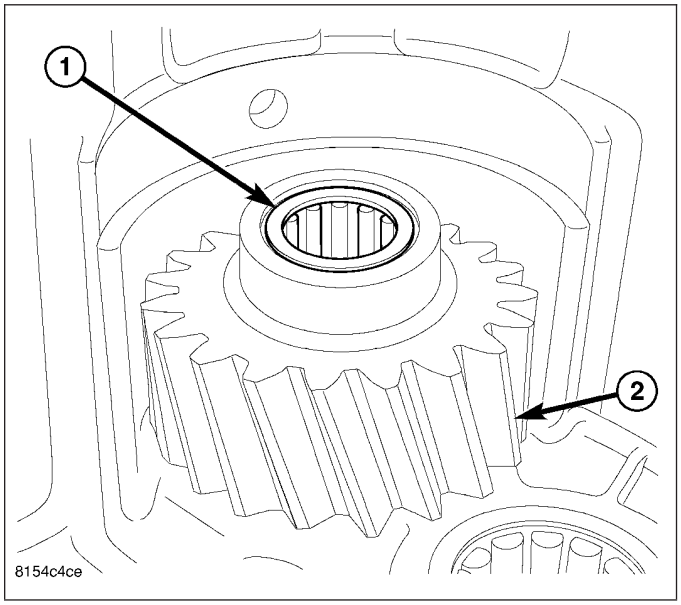
4. Install countershaft bearing with Installer 9624 (1) and Handle C-4171 (2).



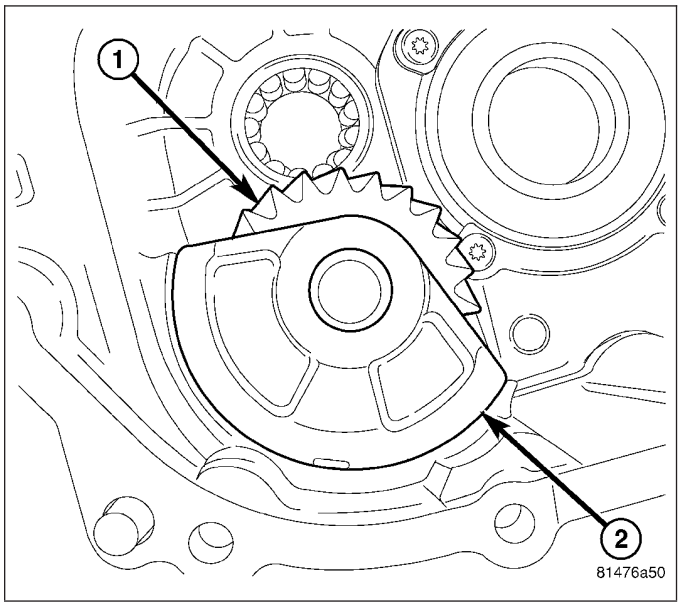
5. Install idler gear (1) in rear housing (2).



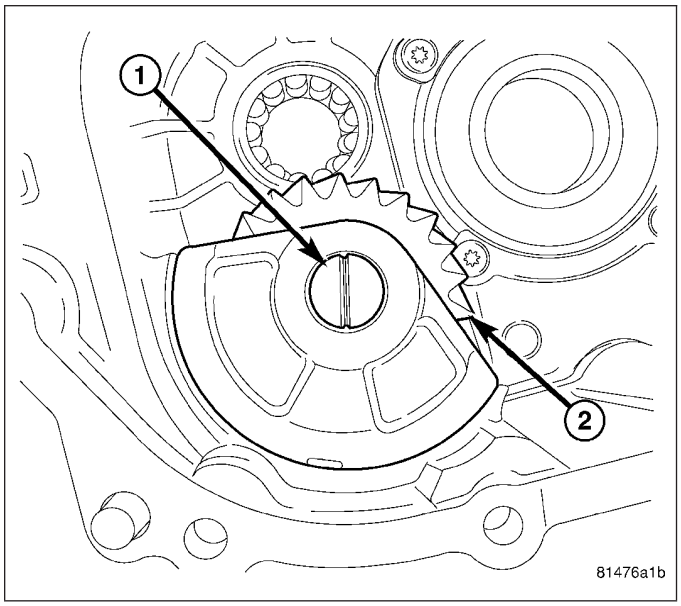
6. Install idler gear bearing (1) in idler gear (2).



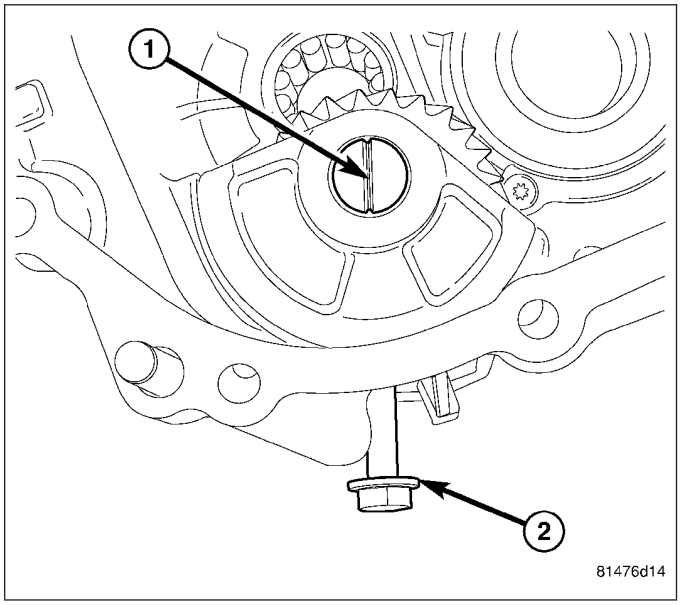
7. Install idler gear (1) shaft support (2).



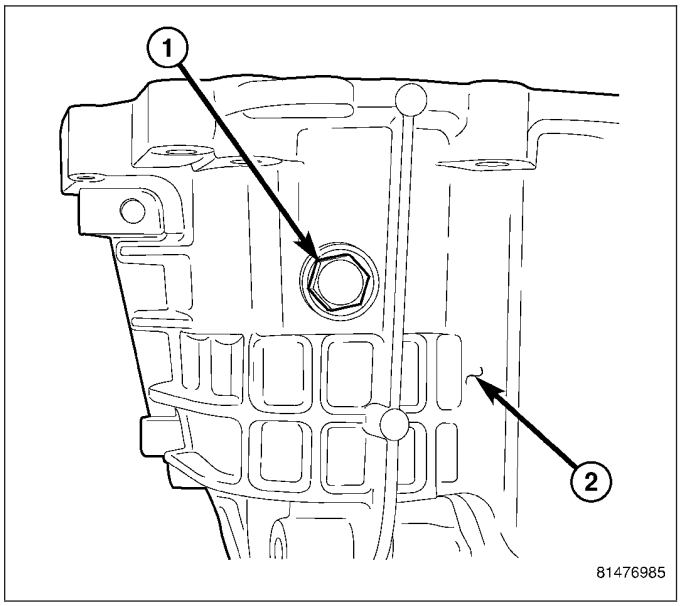
8. Install idler gear (1) shaft (2).



9. Install shaft bolt and align idler gear shaft (1) with shaft bolt (2).

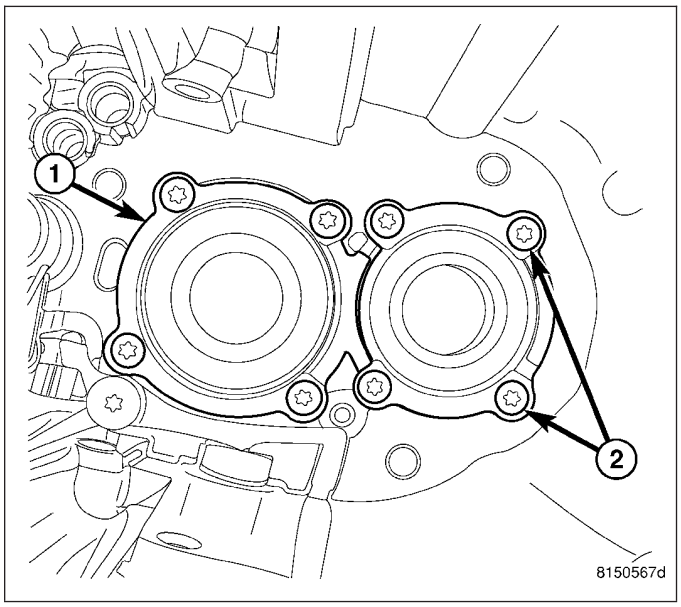


10. Apply Mopar® Lock & Seal Adhesive or equivalent to idler shaft bolt. Tighten bolt (1) in rear housing (2) to 25 N·m (18 ft. lbs.).

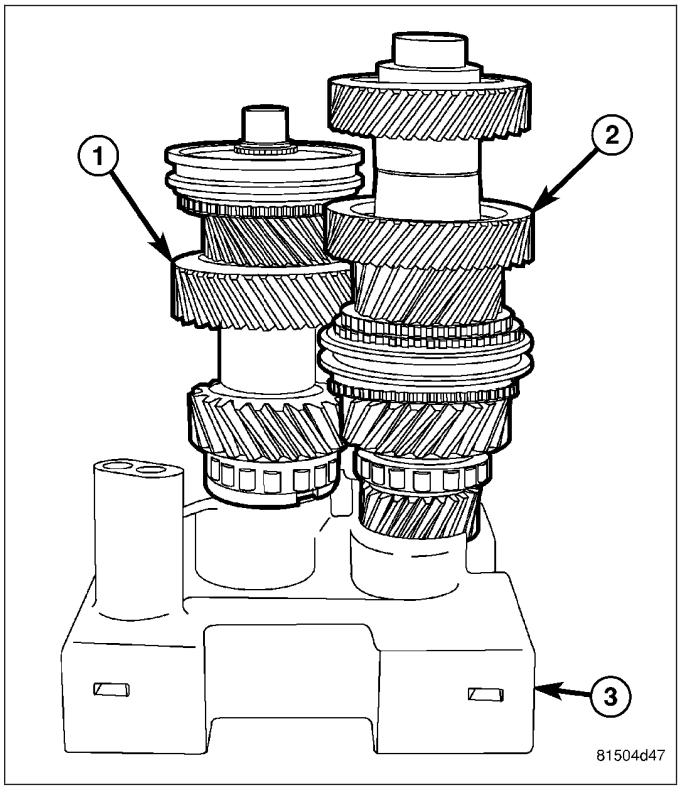


FRONT HOUSING

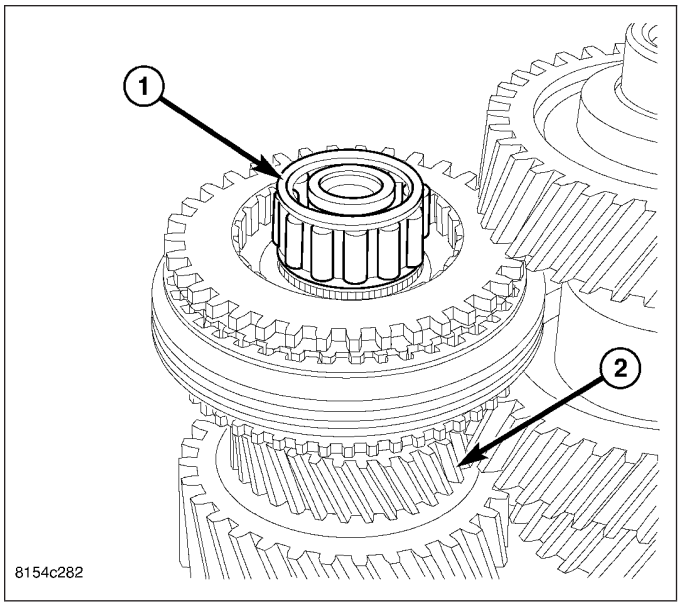
1. Install mainshaft and countershaft bearings in front housing with hammer and driver.
2. Install mainshaft bearing retainer (1) and countershaft bearing retainers (2). Apply Mopar® Lock & Seal Adhesive or equivalent to retainer bolts and tighten to 10 N·m (88 in. lbs.).



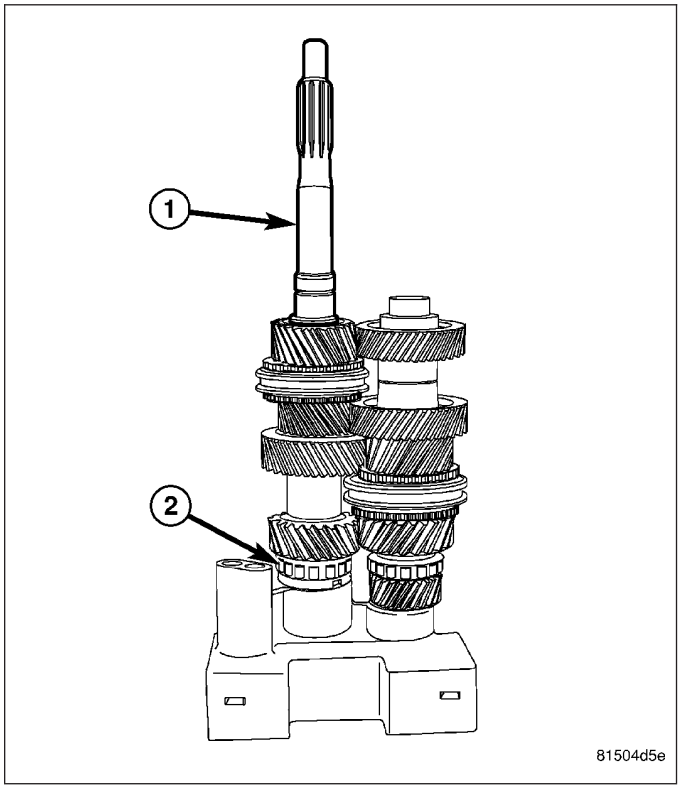
3. Install mainshaft (1) and countershaft (2) in build Fixture 9626 (3).



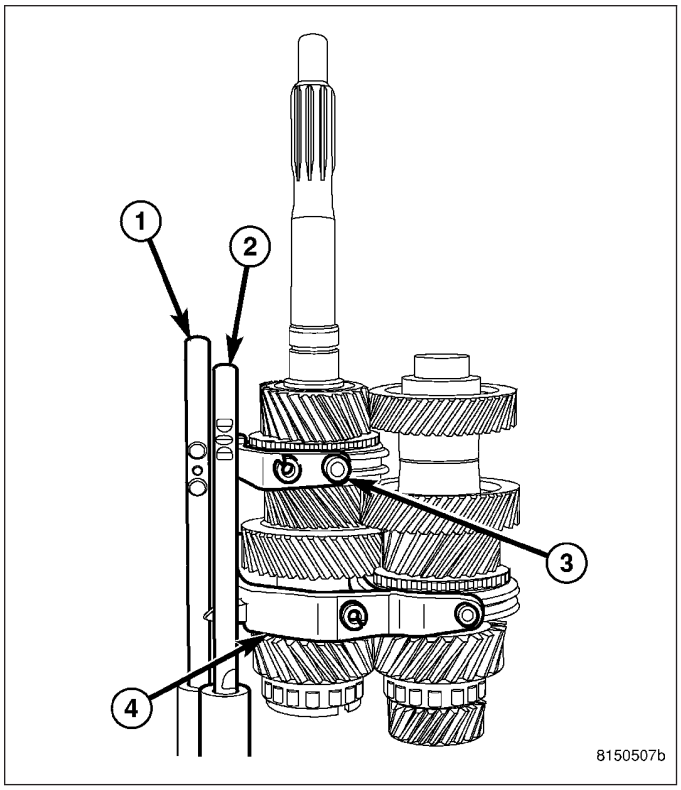
4. Install input shaft bearing (1) on mainshaft (2).



5. Install input shaft (1) on mainshaft (2).



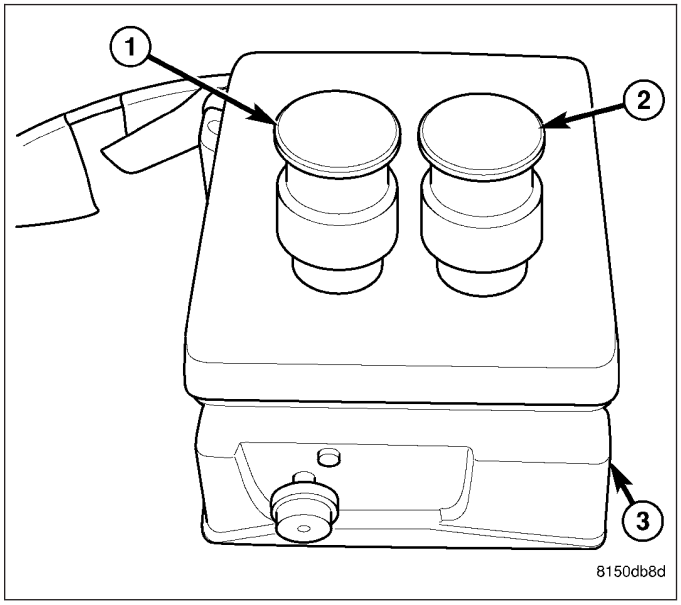
6. Install 5-6 shift rail (1) and 3-4 shift rail (2) in build Fixture 9626. Then install 5-6 shift fork (3) and 3-4 shift fork (4)



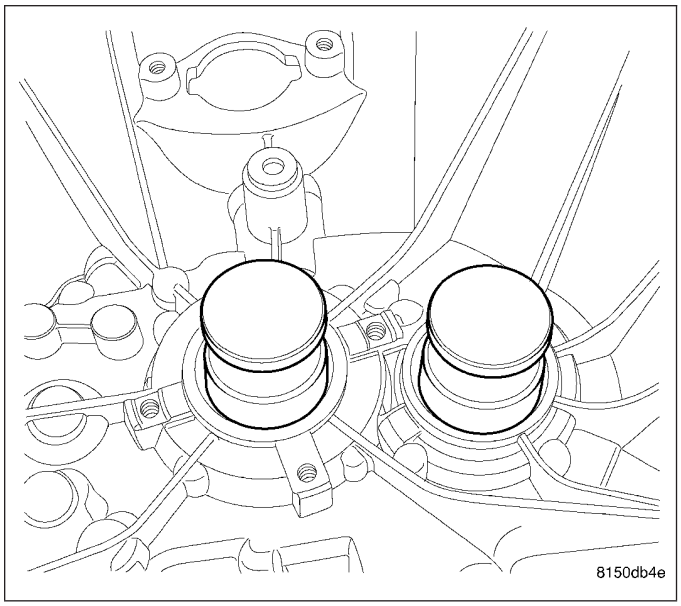
WARNING: Use tongs when handling heated components. Failure to follow these instructions will result in personal injury.

CAUTION: A bearing heater (3) is used to heat Plug 9625 (1) and Plug 9619-1 (2). Use only a bearing heater/hot plate and follow manufactures instructions. Heat components to 100 - 177 Celsius (212° Min - 350° Max Fahrenheit). Never use an open flame to heat components. Never leave components on heater for an extended amount of time. If component is discolored after heating the component has been overheated and must not be used. Failure to follow these instructions will result in component damage.

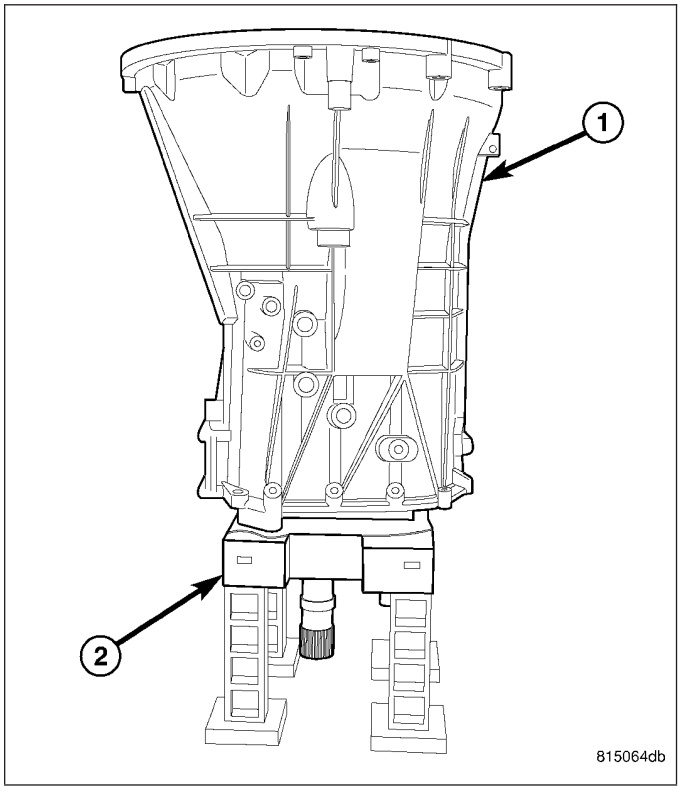
7. Heat Plug 9625 (1) and Plug 9619-1 (2) to 177 Celsius (350° Fahrenheit) with bearing heater (3).



8. With tongs place heated Plug 9625 in countershaft bearing and heated Plug 9619-1 into mainshaft bearing. Allow plugs to heat bearings for two minutes.

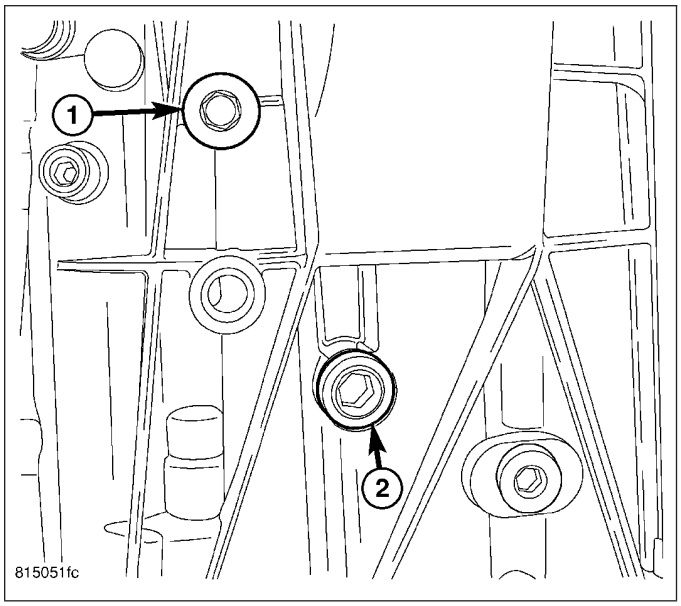


9. Remove Plug 9625 and Plug 9619 with welding gloves or tongs, then install front housing (1) on mainshaft and countershaft in fixture (2).

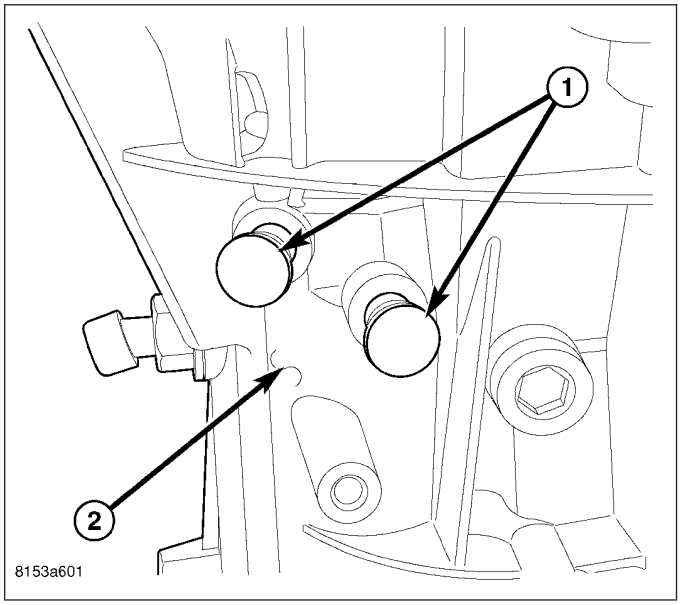


10. Apply Mopar® Lock & Seal Adhesive or equivalent to shift fork pivot bolts. Install 5-6 (1) and 3-4 (2) shift fork pivot bolts, in both sides of the front housing and tighten to 35 N·m (26 ft. lbs.).

NOTE: Verify shift fork pivot holes are aligned with pivot bolt holes before installing bolts.

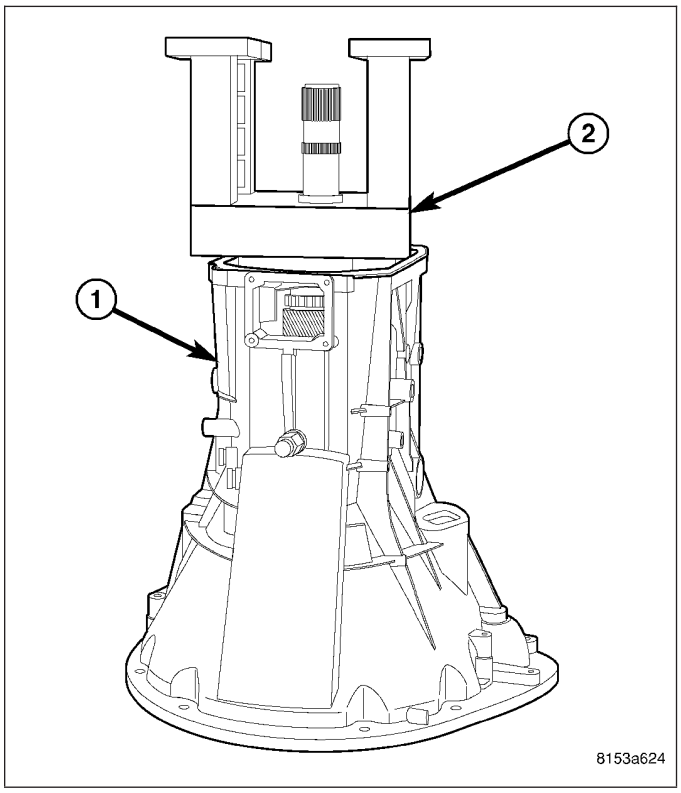


11. Install two detents (1) in the side of the front housing (2).

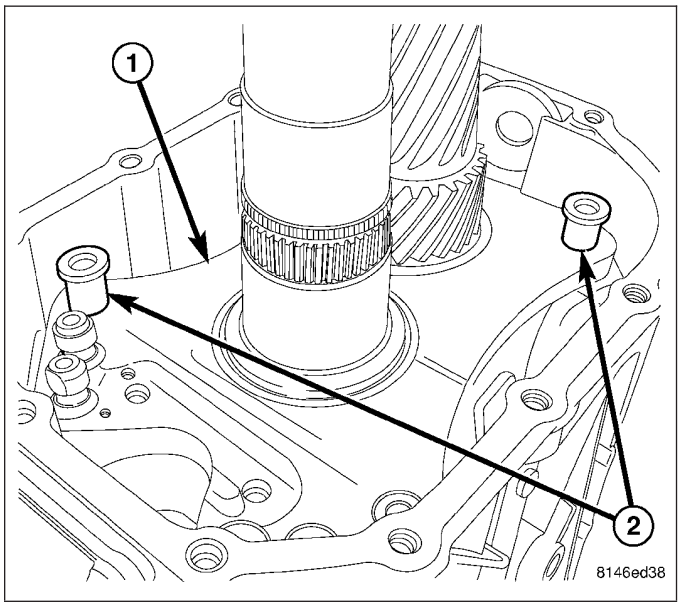


FINAL ASSEMBLY

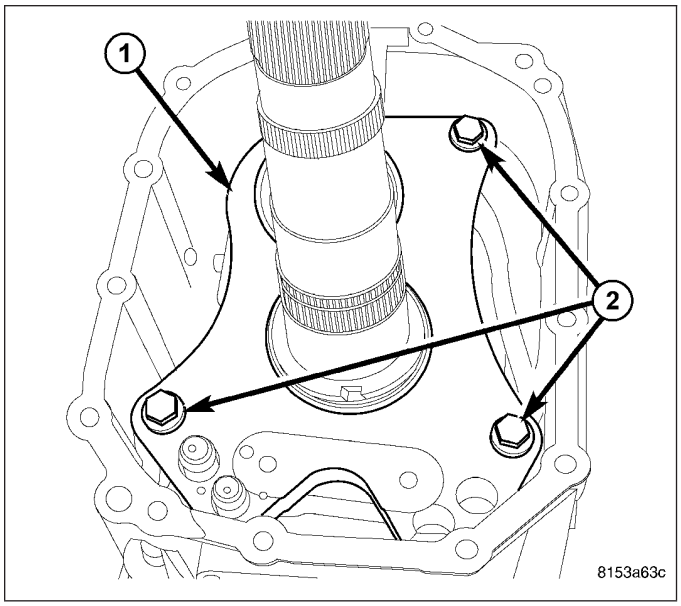
1. Turn front housing (1) with fixture (2) over onto the front housing and remove fixture.



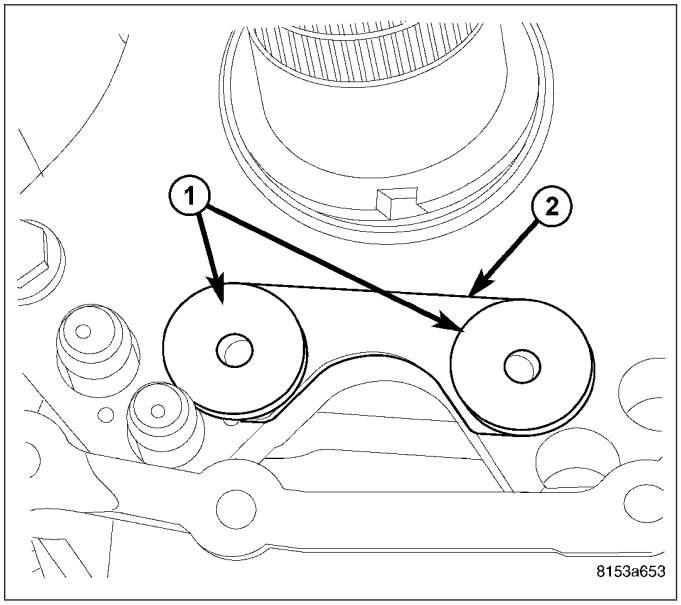
2. Install intermediate plate (1) and two dowels (2).



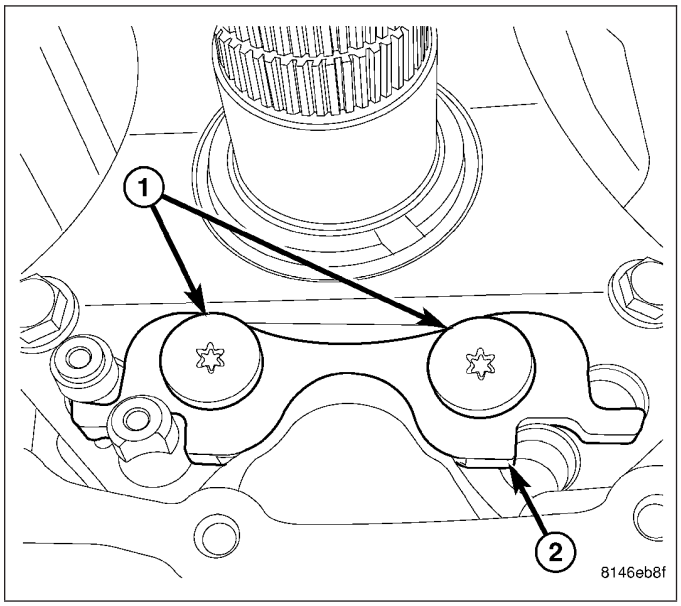
3. Install intermediate plate (1) bolts (2) and tighten to 22 N·m (16 ft. lbs.).



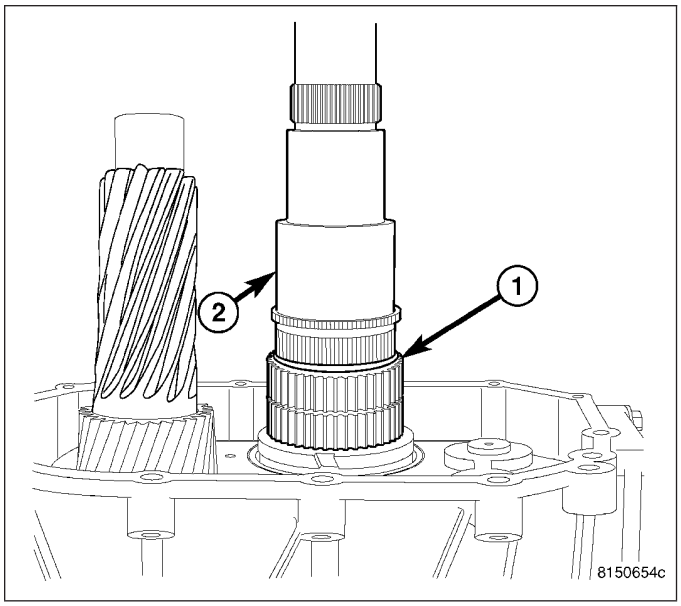
4. Install interlock plate washers (1) on support (2).



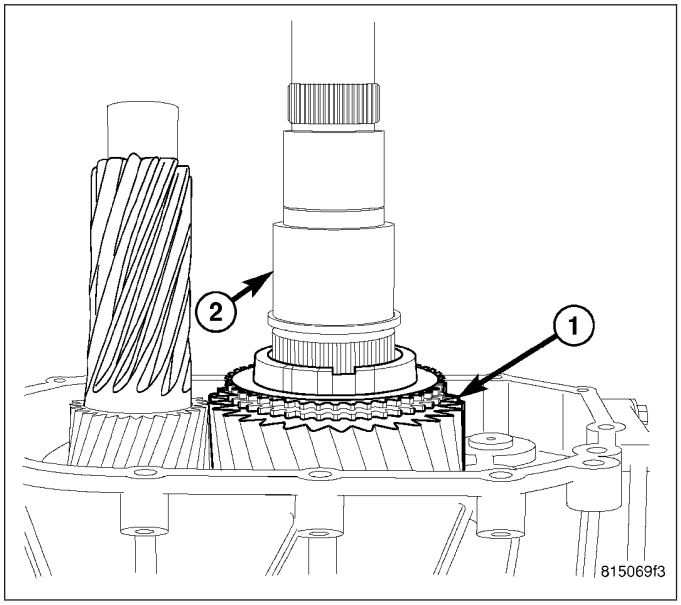
5. Install interlock plate (2) and tighten bolts (1) to 10 N·m (88 in. lbs.).



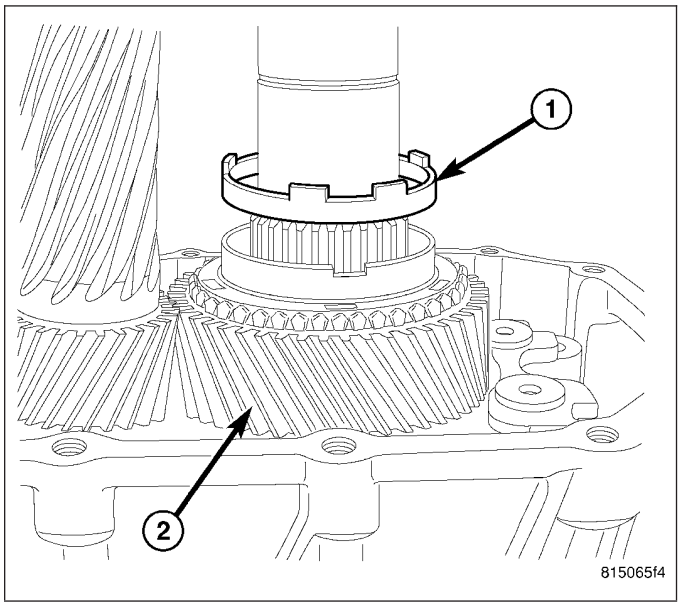
6. Install second gear bearing (1) on mainshaft (2).



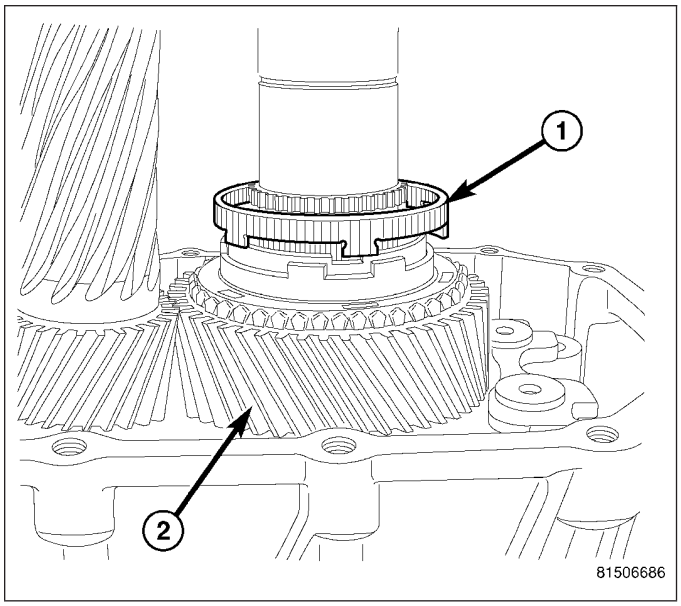
7. Install second gear (1) on mainshaft (2).



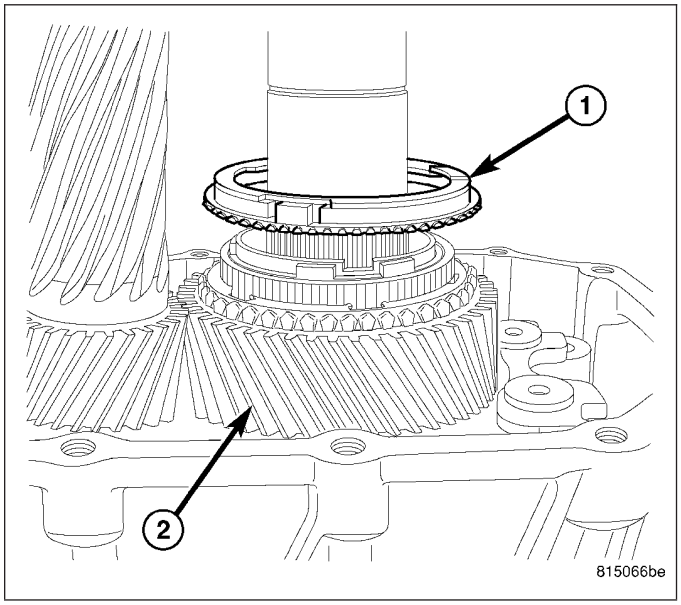
8. Install second gear inner friction ring (1) on second gear (2).



9. Install second gear outer friction ring (1) on second gear (2).

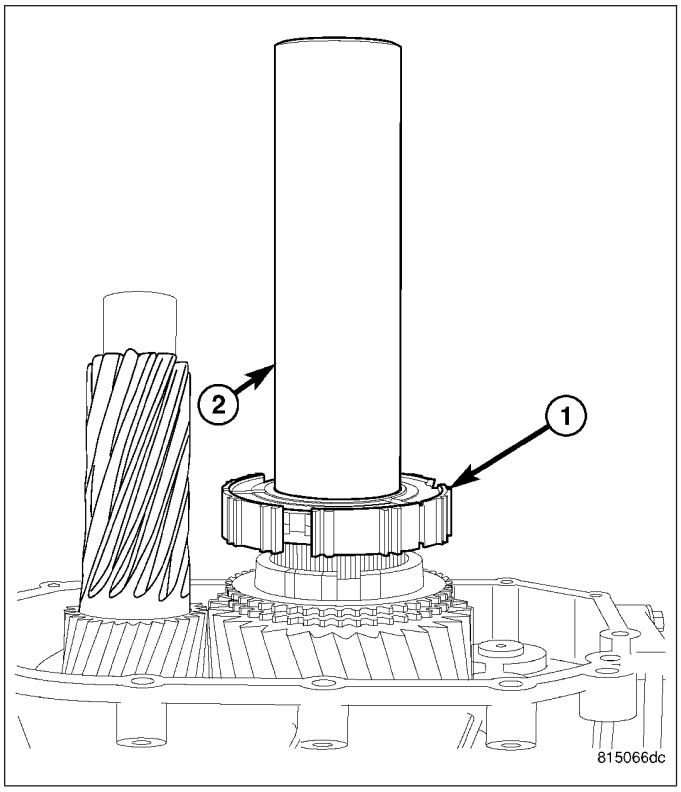


10. Install second gear blocker ring (1) on second gear (2).

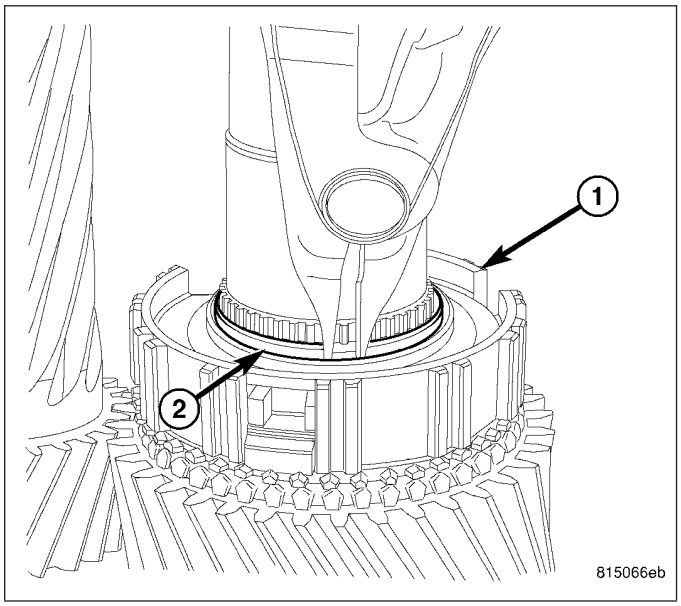


11. Align 1-2 synchronizer hub (1) with blocker ring on mainshaft and install hub with Installer D-389 (2).

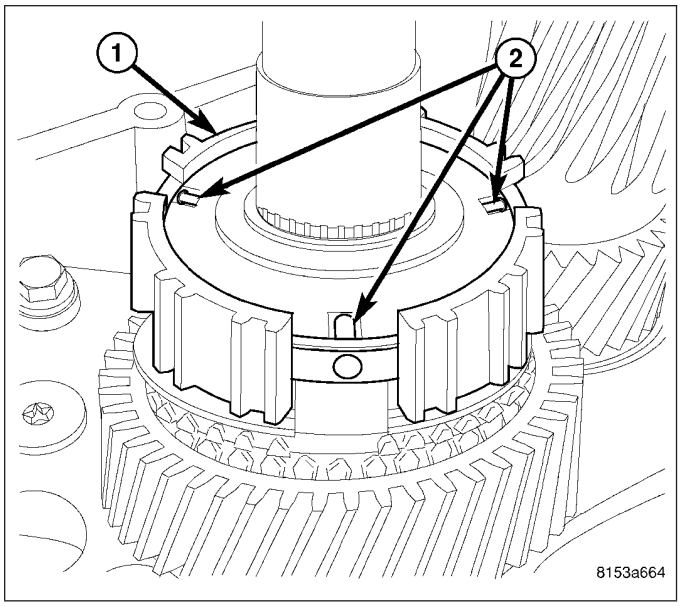
NOTE: If 1-2 synchronizer hub is installed incorrectly the snap ring groove will not be visible.



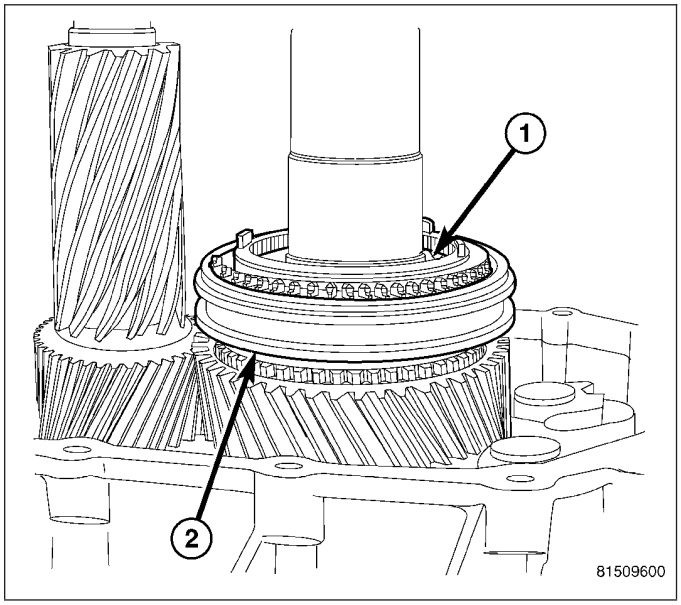
12. Install 1-2 synchronizer hub (1) snap ring (2).



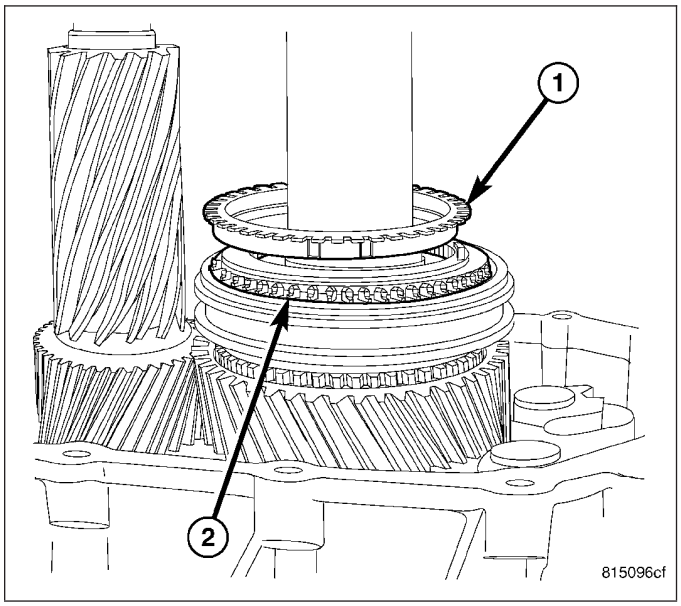
13. Install 1-2 synchronizer hub (1) detents (2).



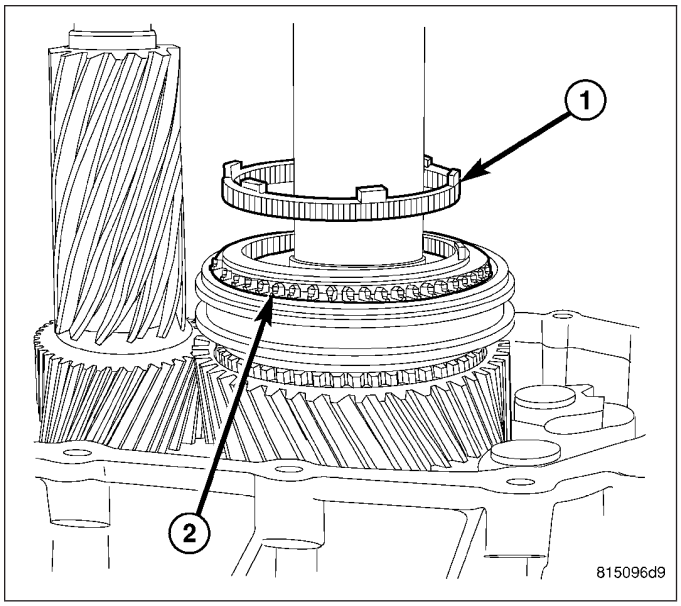
14. Install 1-2 synchronizer sleeve (2) on 1-2 hub (1).



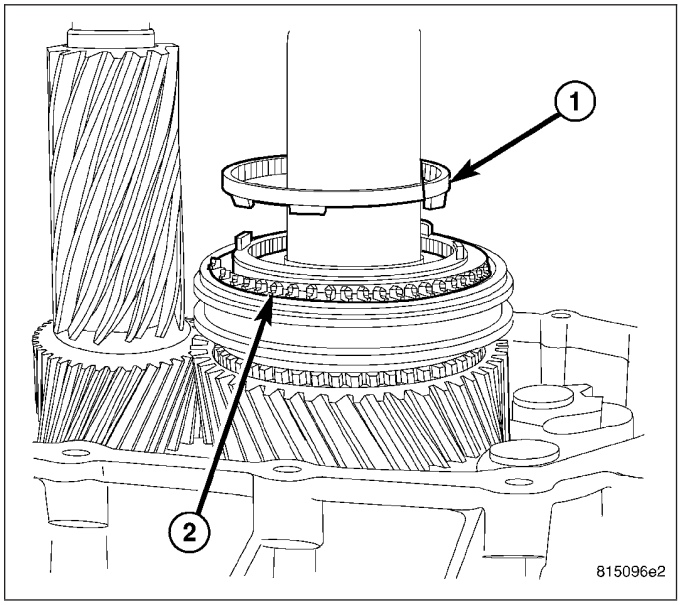
15. Install first gear blocker ring (1) on 1-2 hub (2).



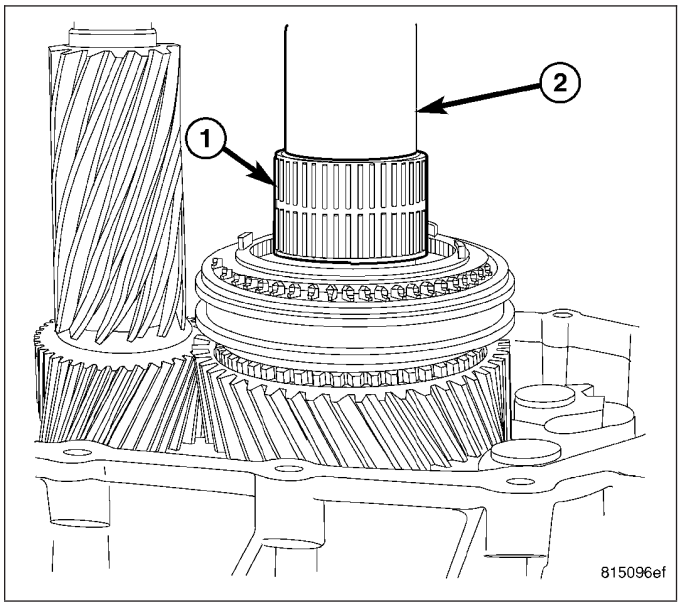
16. Install first gear outer friction ring (1) on 1-2 hub (2).



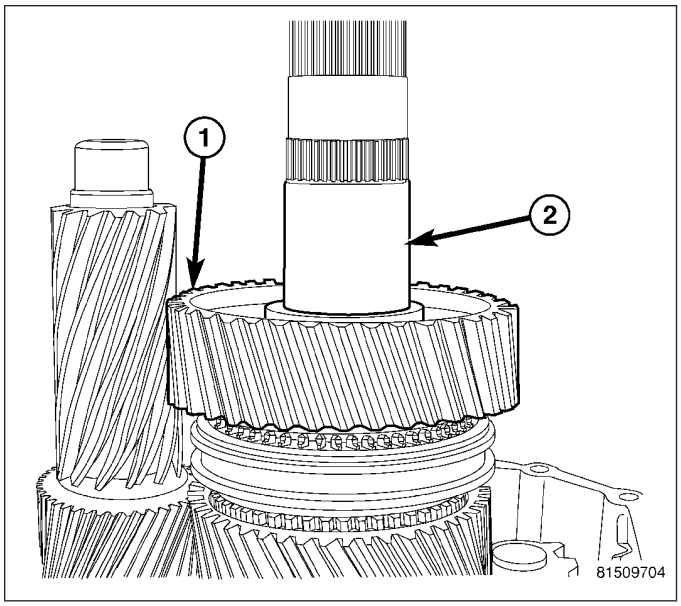
17. Install first gear inner friction ring (1) on 1-2 hub (2).



18. Install first gear bearing (1) on mainshaft (2).



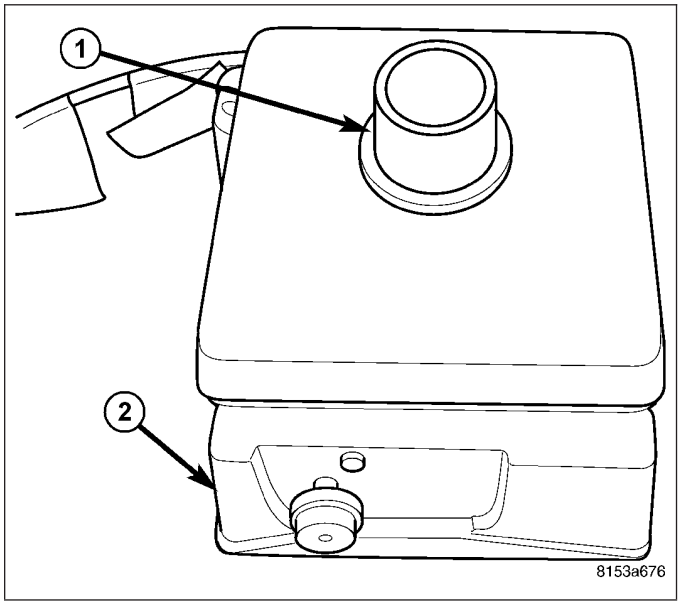
19. Install first gear (1) on mainshaft (2).



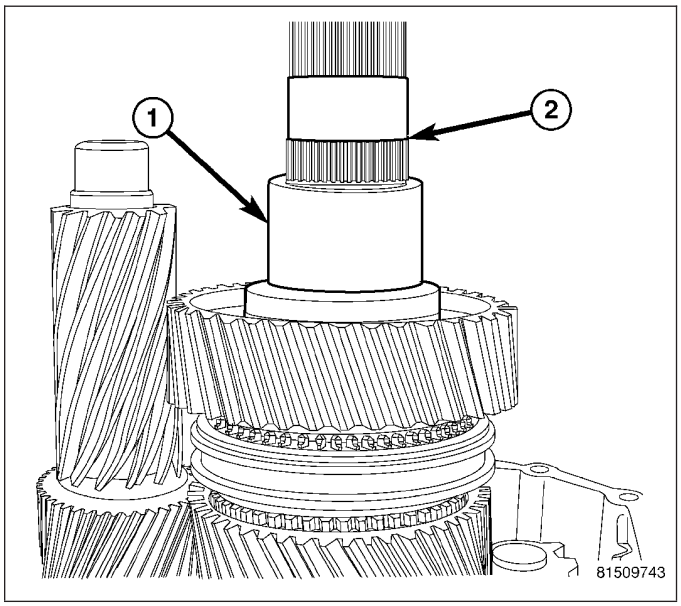
WARNING: Use welding gloves or tongs when handling heated components. Failure to follow these instructions will result in personal injury.

CAUTION: A bearing heater is used to heat reverse bearing race (1). Use only a bearing heater/hot plate and follow manufacturer's instructions. Heat components to 100 - 177 Celsius (212° Min - 350° Max Fahrenheit). Never use an open flame to heat components. Never leave components on heater for an extended amount of time. If component is discolored after heating the component has been overheated and must not be used. Failure to follow these instructions will result in component damage.

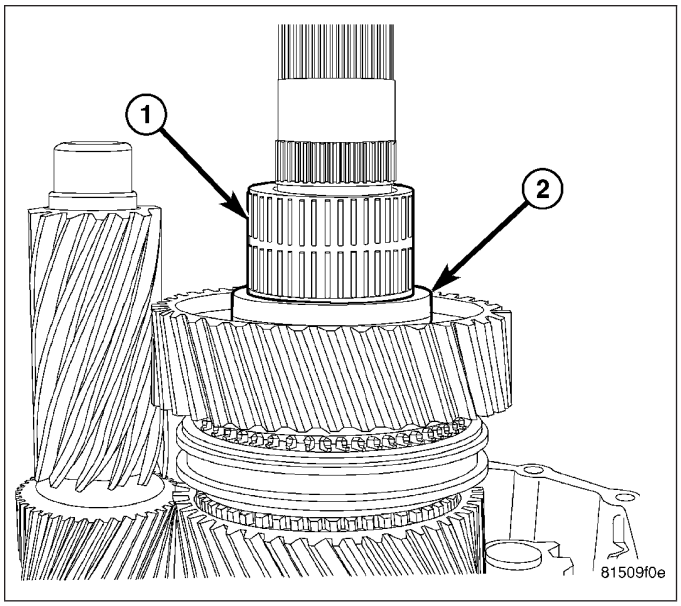
20. Heat reverse bearing race (1) with bearing (2) to 121 Celsius (250° Fahrenheit).



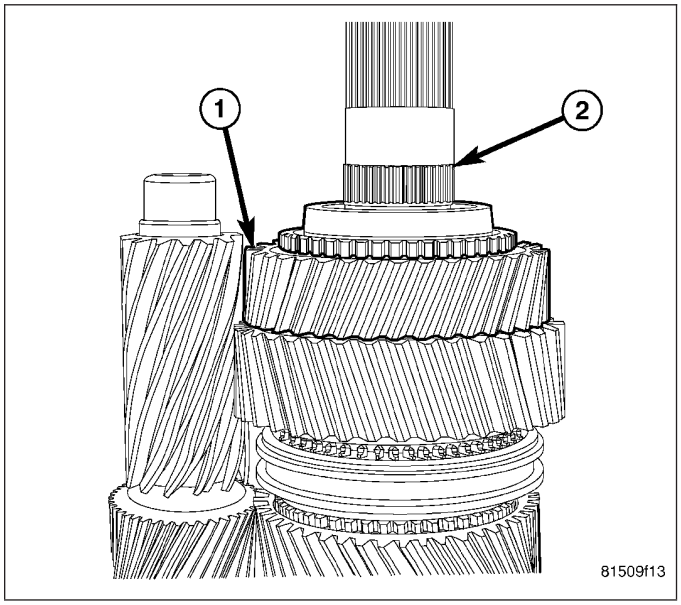
21. With welding gloves or tongs install reverse bearing race (1) on mainshaft (2).



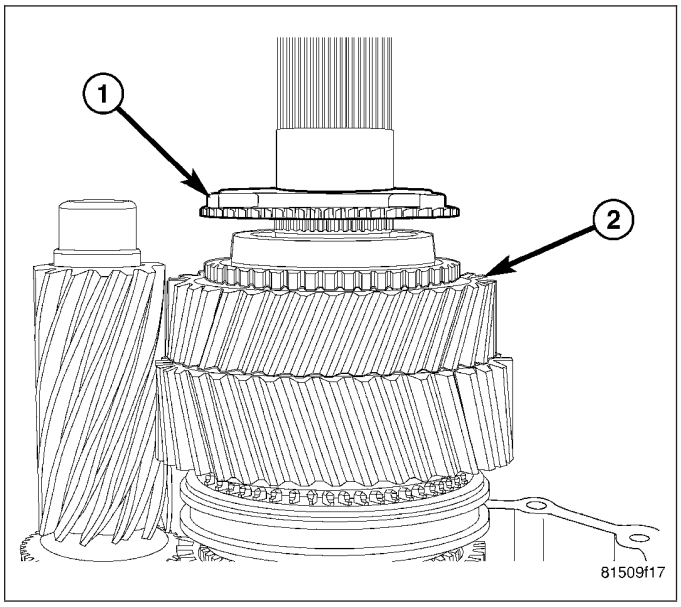
22. Install reverse gear bearing (1) on bearing race (2).



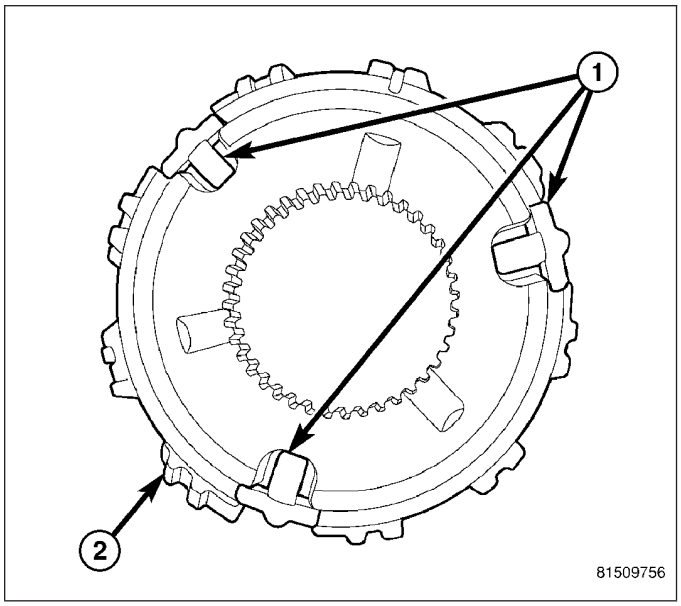
23. Install reverse gear (1) on mainshaft (2).



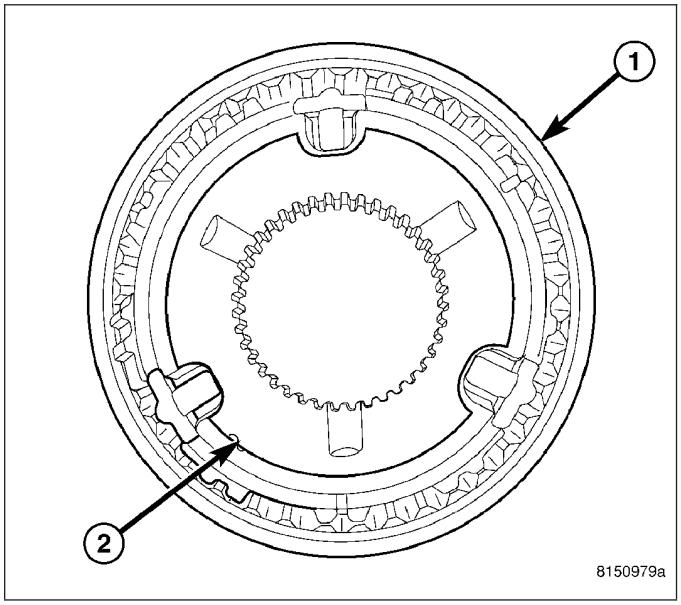
24. Install reverse gear friction/blocker ring (1) on reverse gear (2).



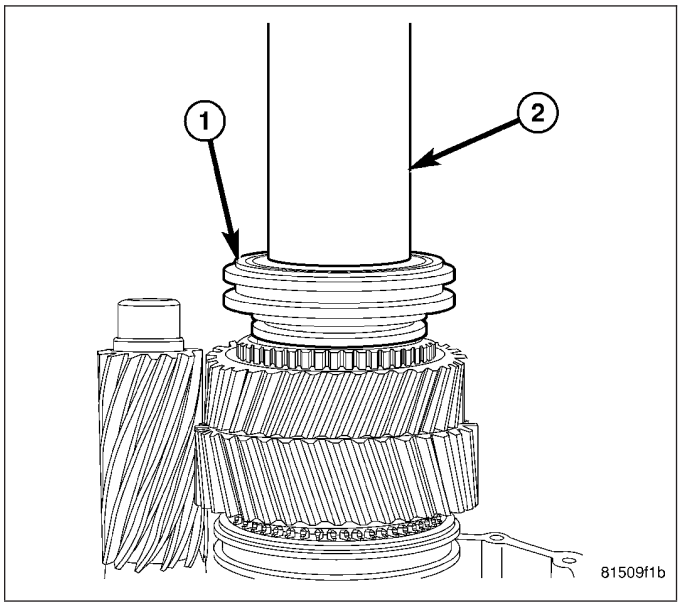
25. Install reverse synchronizer detents (1) in reverse hub (2).



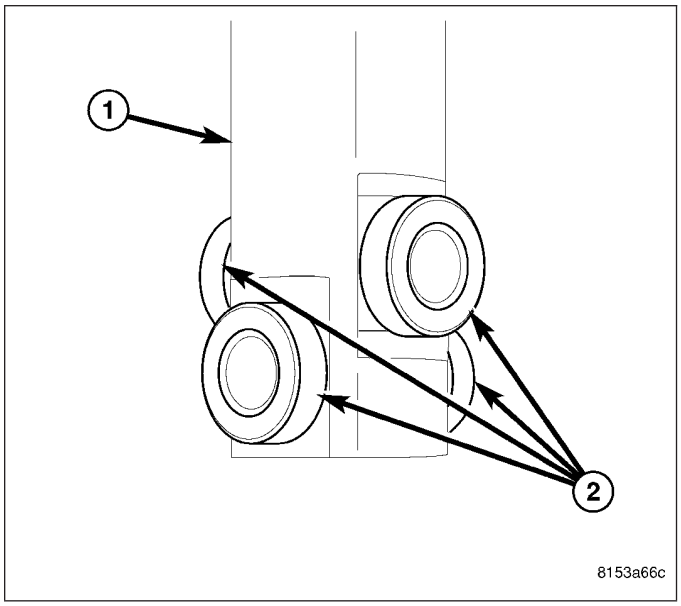
26. Install reverse synchronizer sleeve (1) on reverse hub (2).



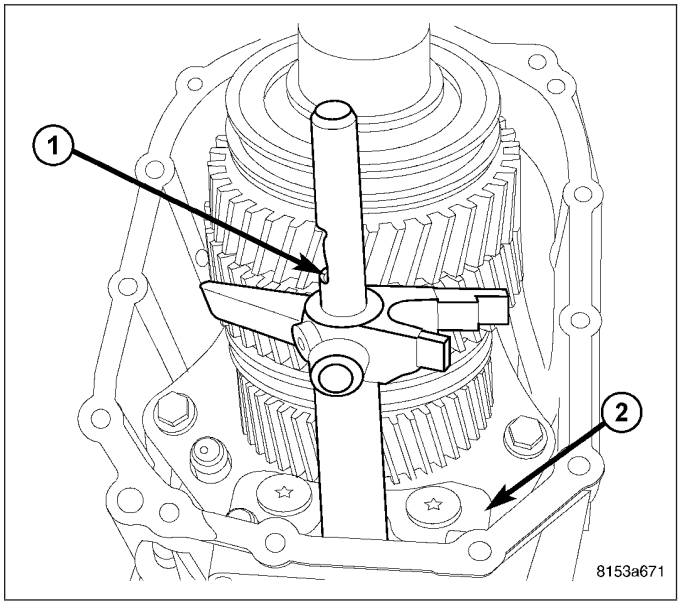
27. Install reverse gear synchronizer hub (1) with Installer D-389 (2).



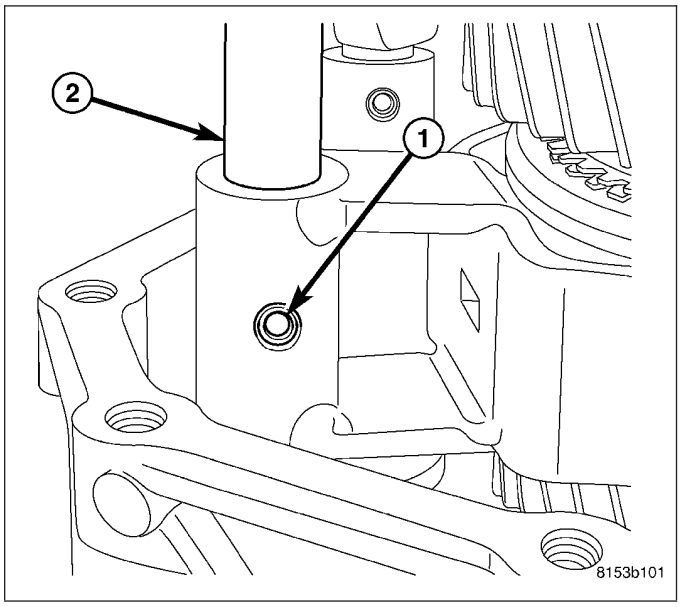
28. Install main shift rail (1) bearings (2) on main shift rail.



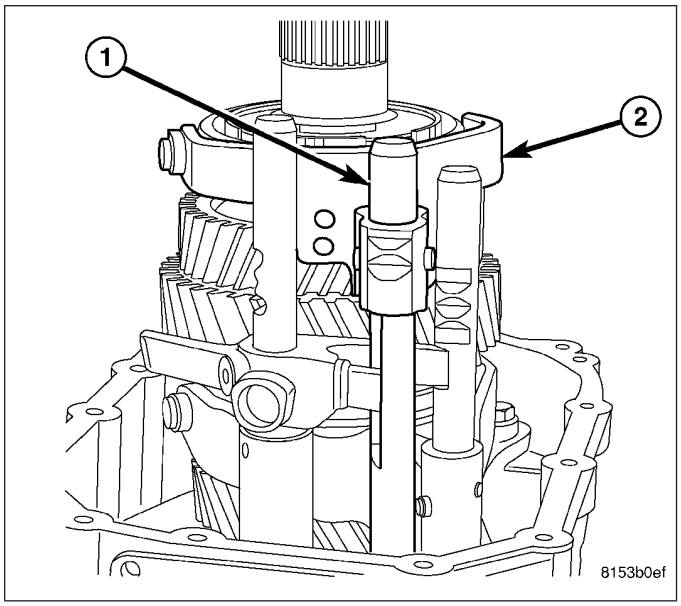
29. Install main shift rail (1) through rail support (2) and housing, then rotate counterclockwise into place.



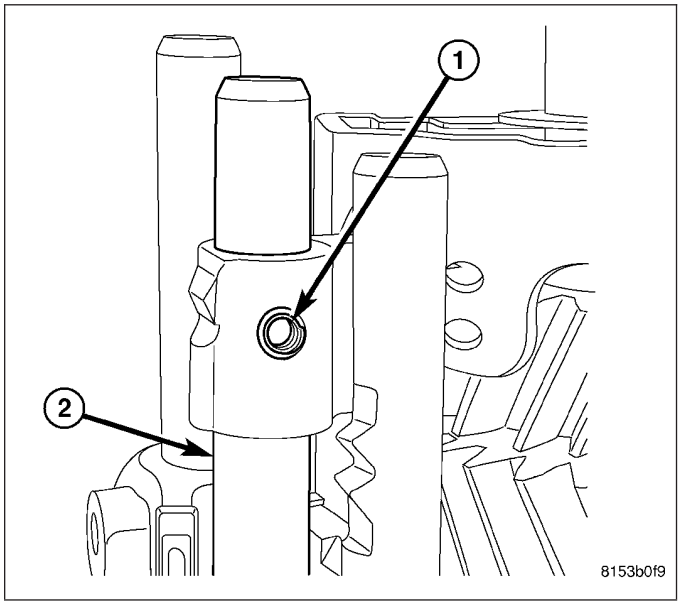
30. Install 1-2 shift fork then, install 1-2 shift rail (2) into shift fork and housing. Install shift fork roll pin (1).



31. Install reverse shift rail (1) into the housing. Then install reverse shift fork (2) and pull shift rail (1) up into the shift fork.



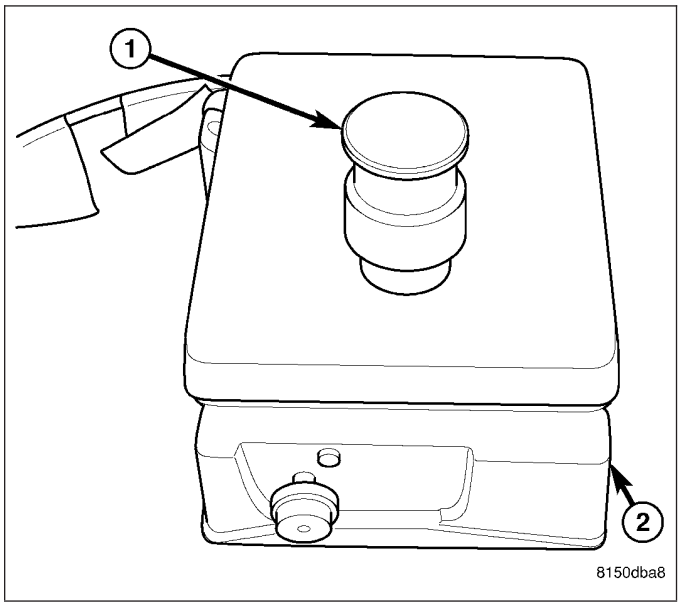
32. Install reverse shift fork roll pin (1).



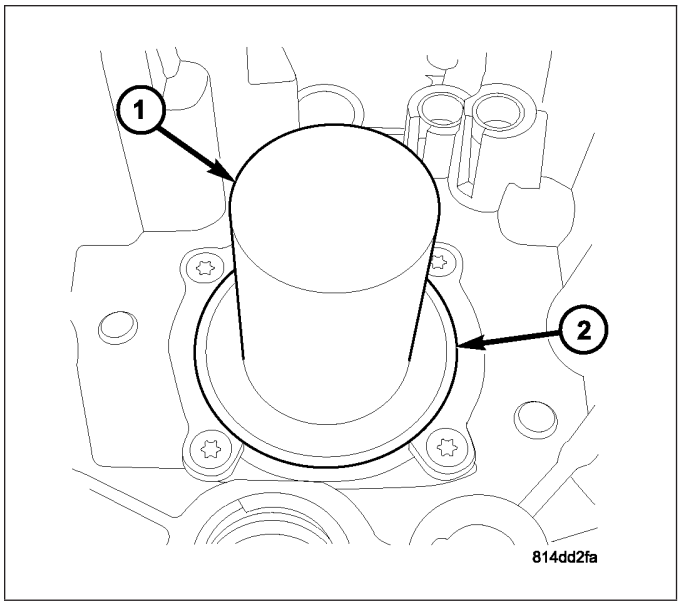
WARNING: Use tongs when handling heated components. Failure to follow these instructions will result in personal injury.

CAUTION: A bearing heater (2) is used to heat Plug 9619-2 (1). Use only a bearing heater/hot plate and follow manufacturer's instructions. Heat components to 100 - 177 Celsius (212° Min - 350° Max Fahrenheit). Never use an open flame to heat components. Never leave components on heater for an extended amount of time. If component is discolored after heating the component has been overheated and must not be used. Failure to follow these instructions will result in component damage.

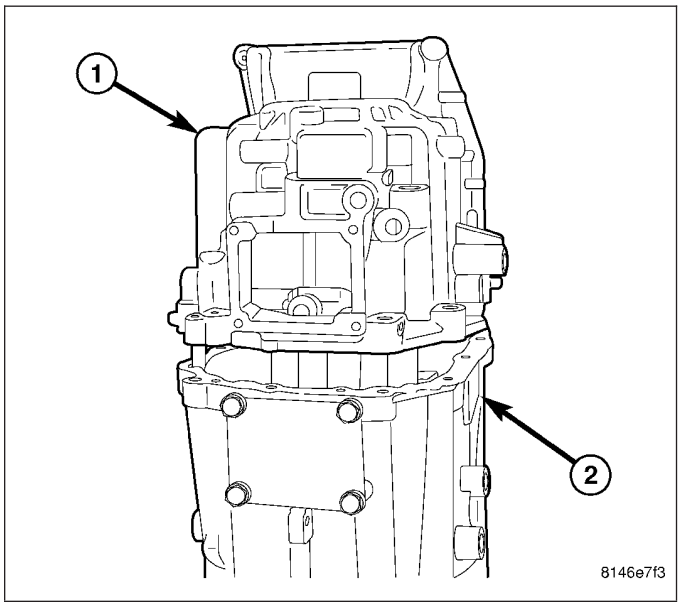
33. Heat Plug 9619-2 (1) to 177 Celsius (350° Fahrenheit) with bearing heater (2).



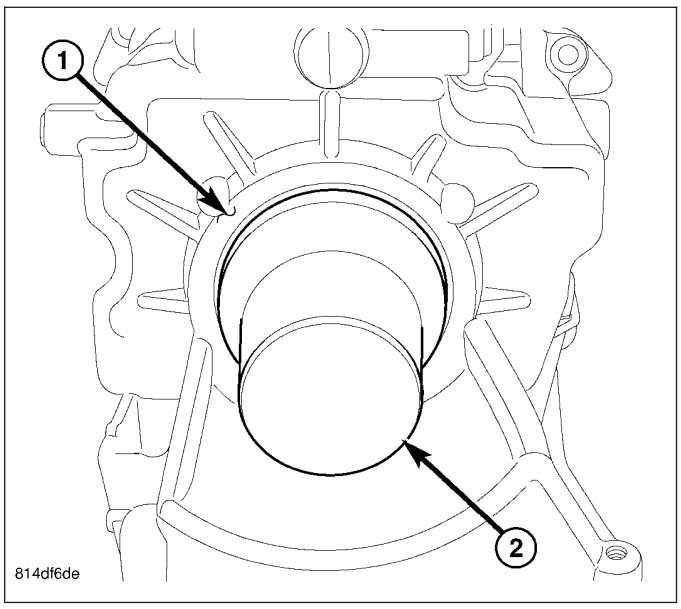
34. With tongs place Plug 9619-2 in rear housing mainshaft bearing (2). Allow plug to heat bearing for two minutes.



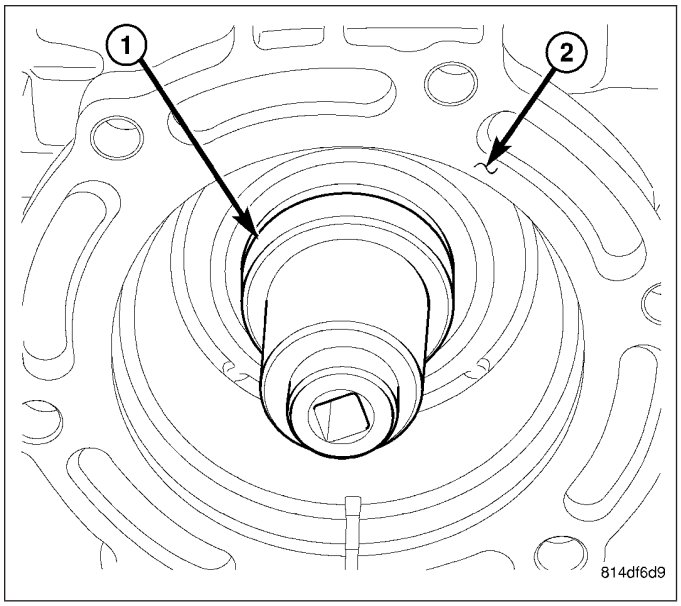
35. Apply a bead of Mopar® Gasket Maker or equivalent to the front housing sealing surface.
36. Remove plug and install rear housing (1) on front housing (2).
37. Install housing bolts and tighten to 22 N·m (16 ft. lbs.).



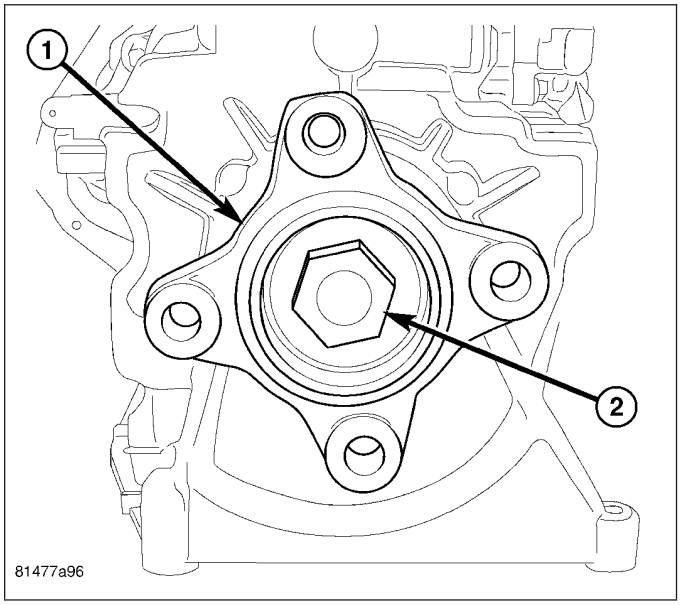
38. Install output shaft seal in rear housing (1) with Installer 9629 (2).



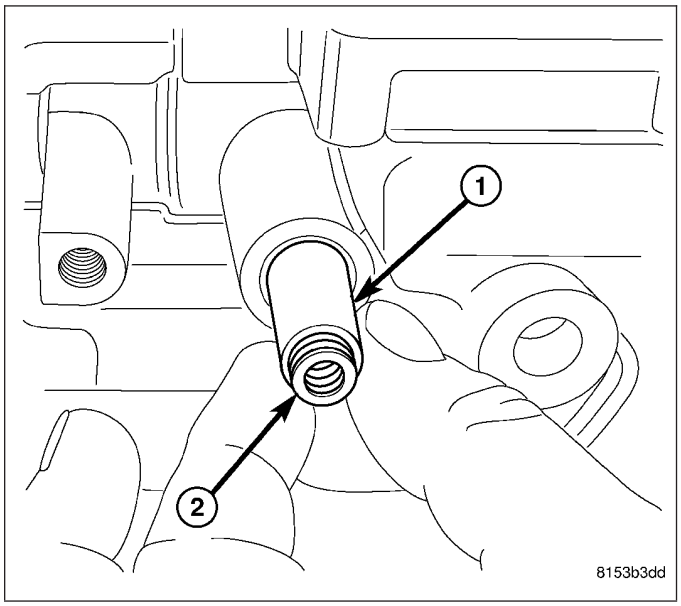
39. Install 4x4 transmission output shaft nut with Socket 9584 and tighten to 200 N·m (147 ft. lbs.). Then loosen nut and tighten to 170 N·m (125 ft. lbs.).



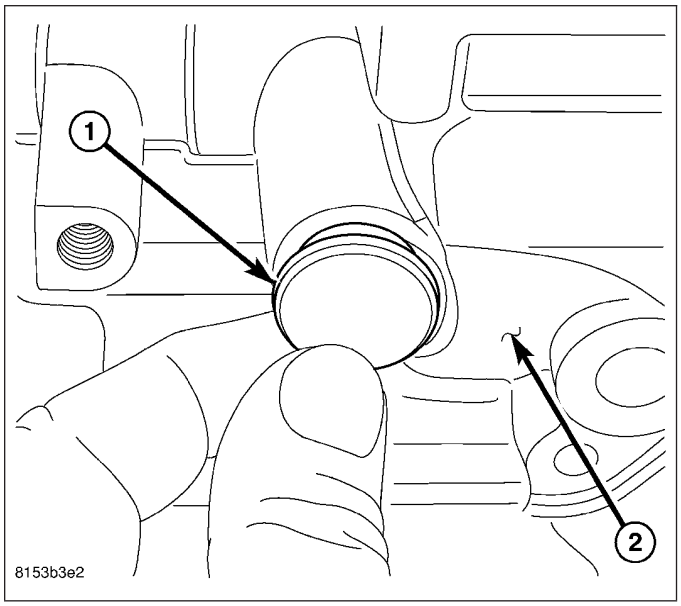
40. Drive output shaft flange onto the output shaft with Installer D-389.
41. Install 4x2 transmission output shaft flange (1) and tighten bolt (2) to 200 N·m (147 ft. lbs.). Then loosen bolt and tighten to 170 N·m (125 ft. lbs.). Remove Wrench 9586 from input shaft.



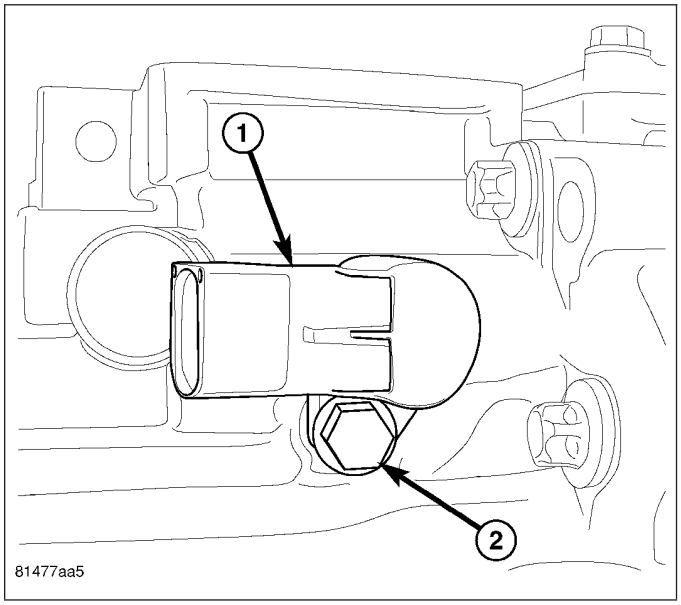
42. Install two detent plugs in the top of the rear housing.
43. Install large detent plunger (1) and spring (2) in the side of the rear housing.



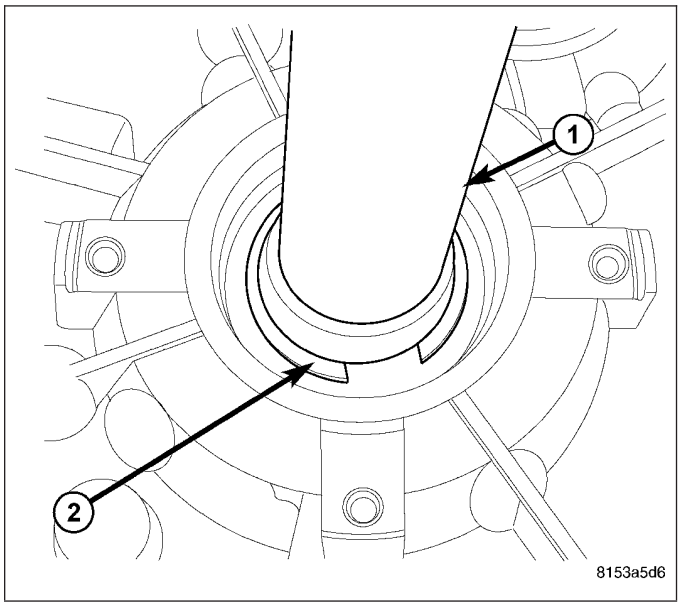
44. Install large detent plug (1) in the side of the rear housing (2).



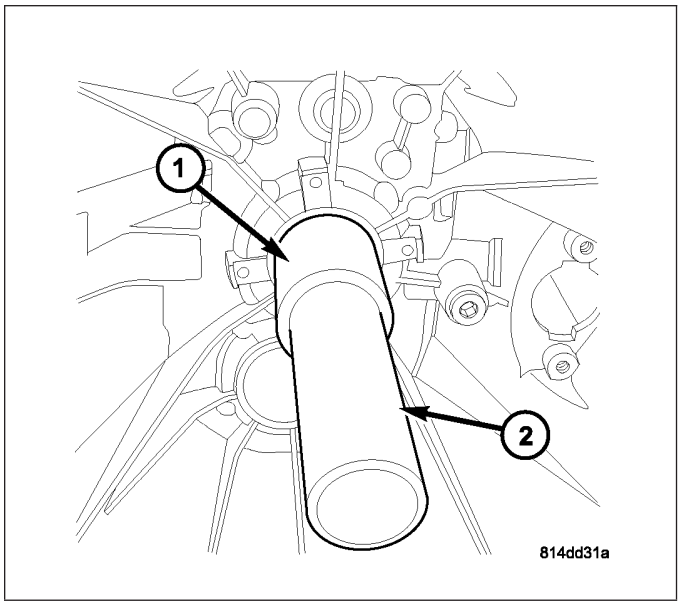
45. Install back up lamp switch (1) and tighten bolt (2) to 10 N·m (88 in. lbs.). Then lay transmission down on bench.



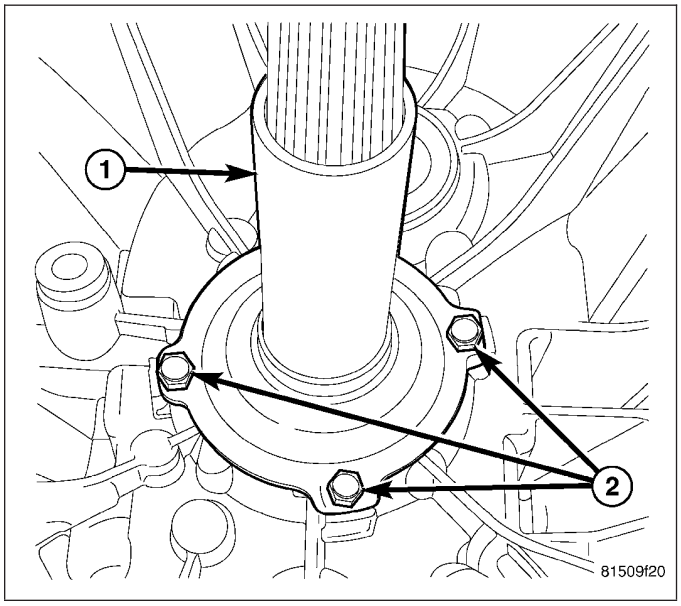
46. Install input shaft (1) snap ring (2).



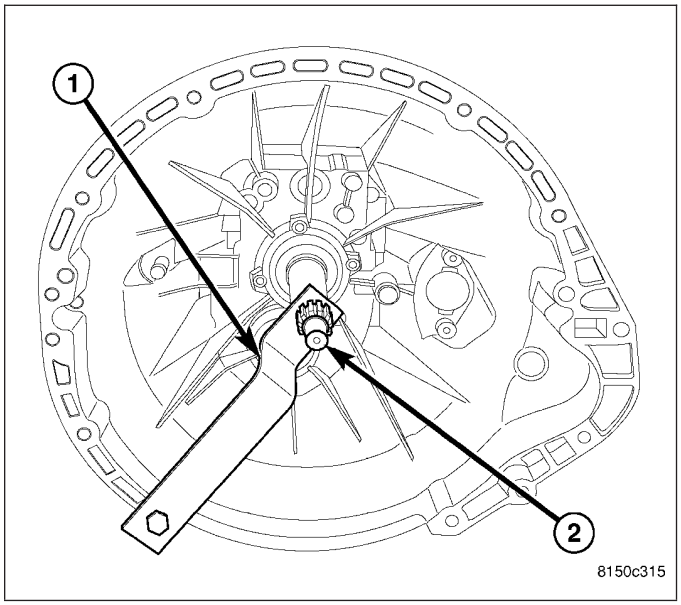
47. Install input shaft seal in front housing with Installer 9620 (1) and Tube C-3717 (2).



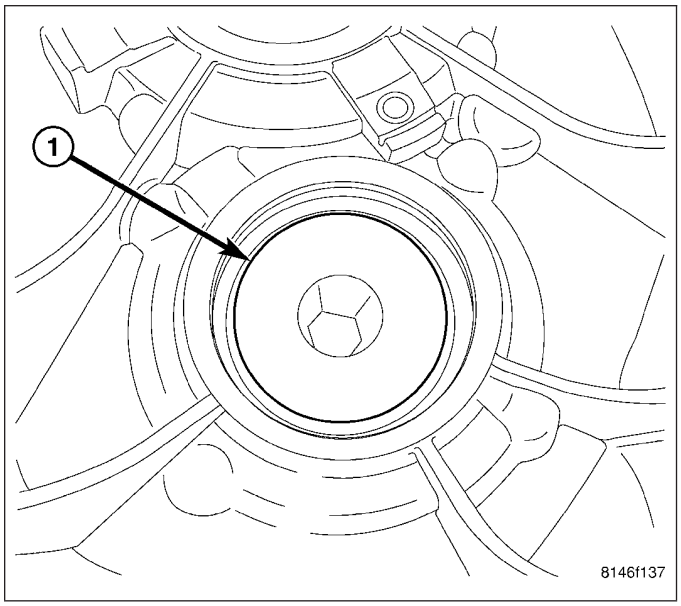
48. Install clutch bearing release support (1) and tighten bolts (2) to 10 N·m (88 in. lbs.).



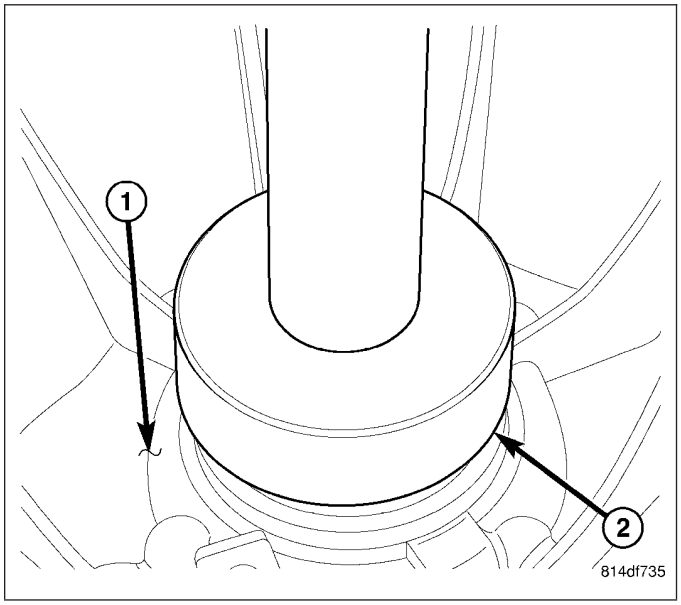
49. Install Wrench 9586 (1) on input shaft (2).



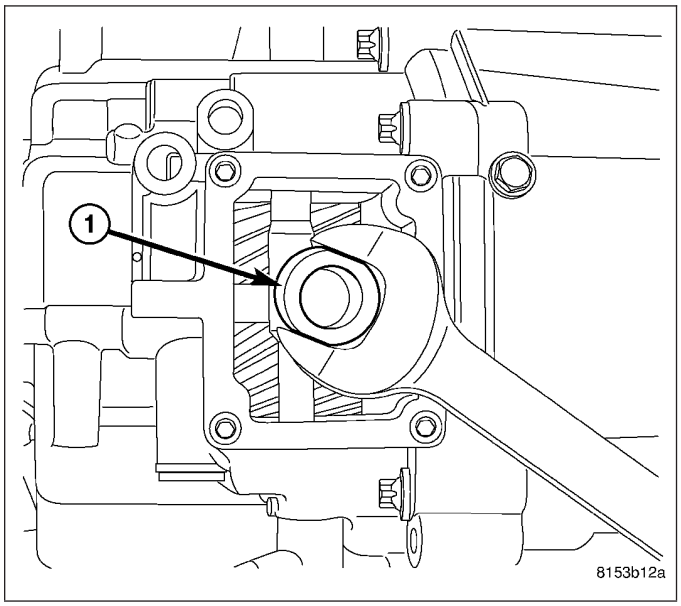
50. Install countershaft allen bolt (1) in front housing. Tighten allen bolt (1) to 90 N·m (66 ft. lbs.).



51. Install countershaft plug in front housing (1) with Installer 9622 (2) and Handle C-4171.



52. Install the cover plate for the second shift tower location, if necessary.
53. Apply Mopar® Lock & Seal or equivalent to shifter socket threads and install shifter socket (1).



INSTALLATION

NOTE: If a new transmission is being installed, be sure to use all components supplied with the new transmission. For example, if a new shift tower is supplied with the new transmission, do not re-use the original shift tower.

1. Apply light coat of Mopar® high temperature bearing grease to contact surfaces of following components:
   - input shaft splines.
   - release bearing slide surface of front retainer.
   - release bearing bore.
   - release fork.
   - release fork ball stud.
   - propeller shaft slip yoke.
2. Apply sealer to threads of drain plug, then install plug in case.
3. Mount transmission on jack and position transmission under vehicle. Secure transmission to jack with safety chains.
4. Raise transmission until input shaft is centered in clutch disc hub.
5. Move transmission forward and start input shaft in clutch disc.
6. Work transmission forward until seated against engine.

NOTE: Do not allow transmission to remain unsupported after input shaft has entered clutch disc.

7. Install and tighten transmission to engine bolts to:
   - 3/8 in. Diameter housing to engine bolts 41 N·m (30 ft. lbs.)
   - 10 mm Diameter structural dust cover bolts 54 N·m (40 ft. lbs.) (Refer to 9 - ENGINE/ENGINE BLOCK/ STRUCTURAL COVER - INSTALLATION).
   - 7/16 in. Diameter engine to housing bolts 68 N·m (50 ft. lbs.)
   - 1/4 in. Diameter dust shield bolt 4.5 N·m (40 in. lbs.)
8. Position transmission harness wires in clips on shift cover.
9. Install slave cylinder and shield, if equipped.
10. Install transmission mount on transmission or rear crossmember.

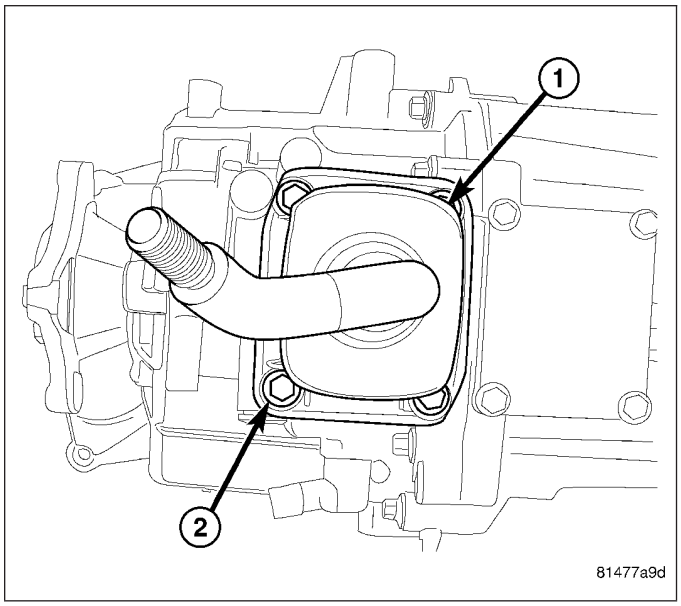
2WD

1. Install rear crossmember.

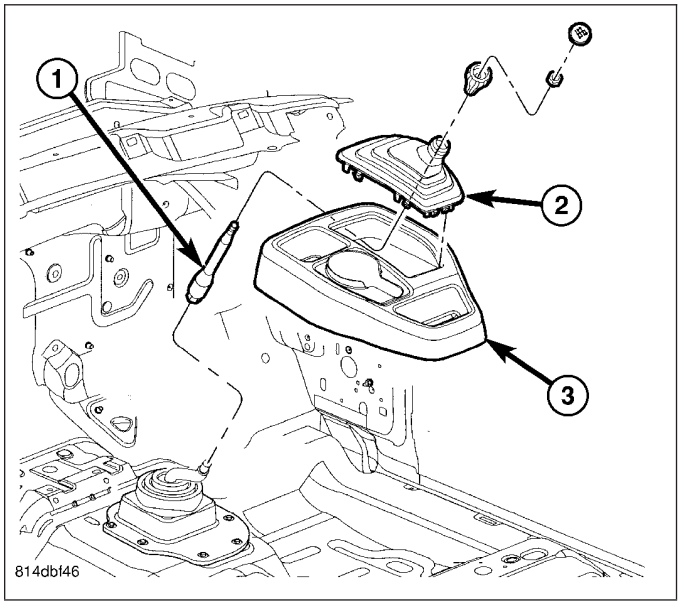
NOTE: Ensure wiring harness is clear before installing crossmember.

2. Remove transmission jack and engine support fixture.
3. Align and install propeller shaft.
4. Lower vehicle.

5. Install shift tower and lever assembly (1). Tighten shift tower bolts (2) to 7-10 N·m (5-7 ft. lbs.).



6. Install the lower shift boot assembly to the floor pan.
7. Install floor console (3). (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)
8. Install the shift lever extension (1) to the shift tower lever.
9. Install the upper shift boot (2). (Refer to 23 - BODY/INTERIOR/SHIFT BOOT - INSTALLATION)
10. Connect battery negative cable.



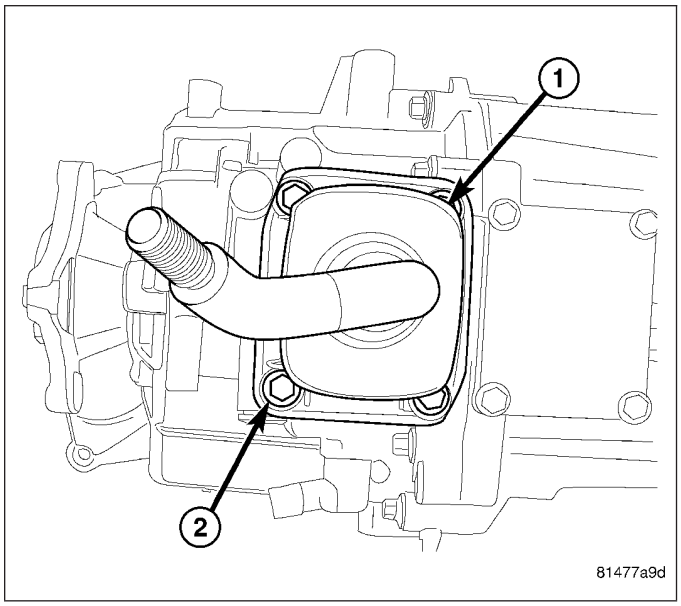
4WD

1. Install rear crossmember.

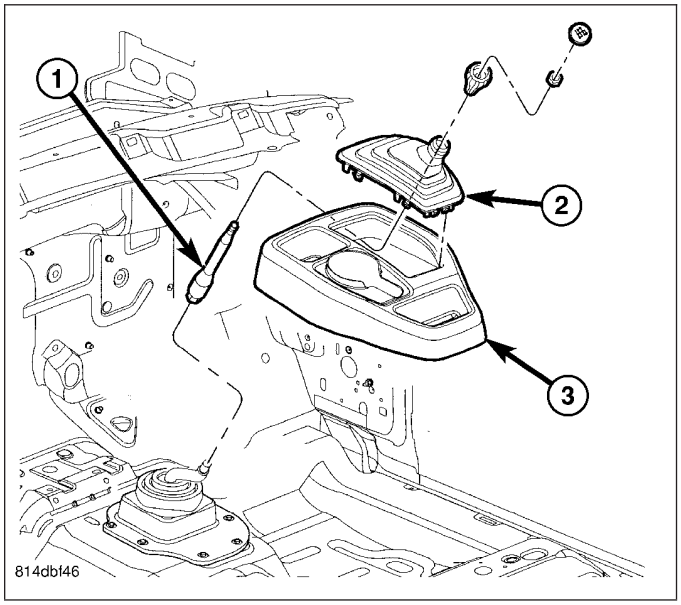
NOTE: Ensure wiring harness is clear before installing crossmember.

2. Remove transmission jack and engine support fixture.
3. Install transfer case. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - INSTALLATION)
4. Connect backup light switch wires.
5. Install transmission dust cover.
6. Install starter.
7. Align and connect propeller shafts.
8. Fill transmission with required lubricant. Check lubricant level in transfer case and add lubricant if necessary.
9. Install exhaust system components.
10. Lower vehicle.

11. Install shift tower and lever assembly (1). Tighten shift tower bolts (2) to 7-10 N·m (5-7 ft. lbs.).



12. Install the lower shift boot assembly to the floor pan.
13. Install floor console (3). (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)
14. Install the shift lever extension (1) to the shift tower lever.
15. Install the upper shift boot (2). (Refer to 23 - BODY/INTERIOR/SHIFT BOOT - INSTALLATION)
16. Connect battery negative cable.

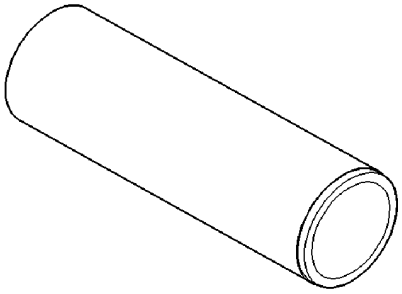


SPECIFICATIONS

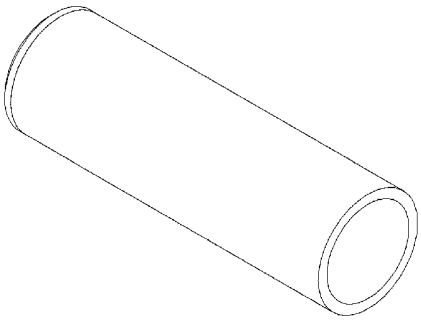
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Drain Plug	50	37	-
Fill Plug	50	37	-
Shift Tower Bolts	10	-	88
Back Up Lamp Switch Bolt	10	-	88
4x2 Output Flange Bolt	200 then loosen and tighten to 170	147 then loosen and tighten to 125	-
4x4 Output Shaft Nut	200 then loosen and tighten to 170	147 then loosen and tighten to 125	-
Housing Bolts	22	16	-
Shift Rail Support Bolts	10	-	88
Intermediate Support Bolts	22	16	-
Intermediate Support Race Retainer Bolt	22	16	-
Countershaft Bolt	90	66	-
Reverse Idler Gear Shaft Bolt	25	18	-
Mainshaft, Countershaft Bearing Retainer Bolts	10	-	88
Input Shaft Retainer Bolts	10	-	88
Shift Fork Pivot Bolts	35	26	-
Support Braket to Trans Bolts	54	40	-

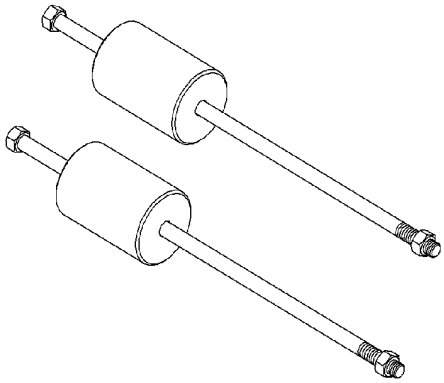
SPECIAL TOOLS



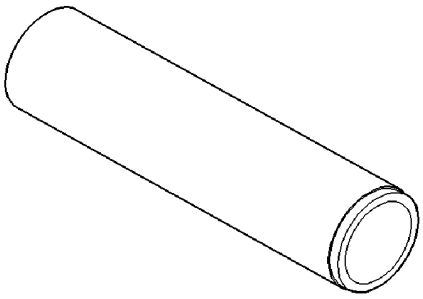
TUBE C-3717



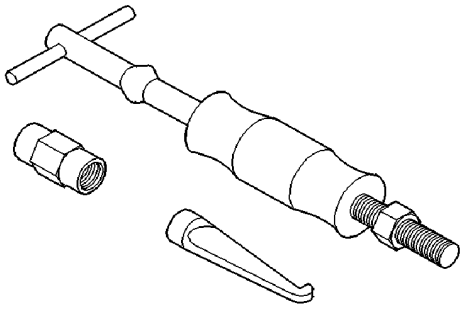
TUBE D-389



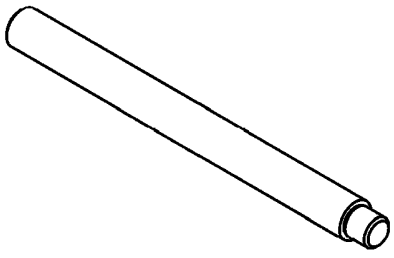
SLIDE HAMMER C-3752



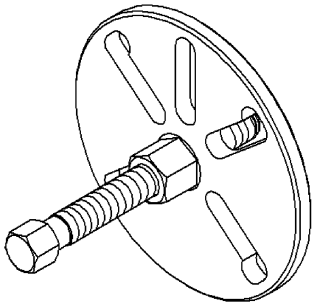
TUBE W-262



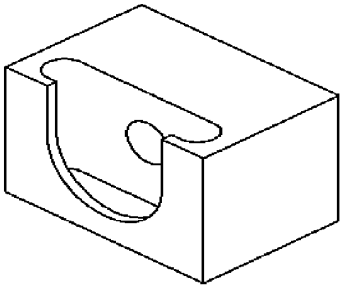
SLIDE HAMMER C-637



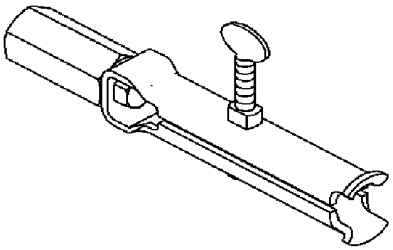
BEARING INSTALLER 8475



FLANGE PULLER 8992



DETENT PULLER 9583



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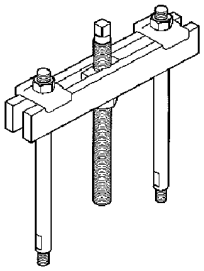
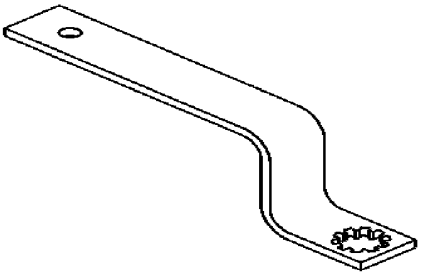
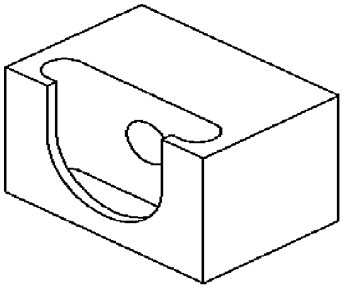


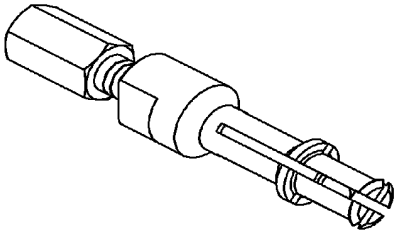
BRIDGE 938



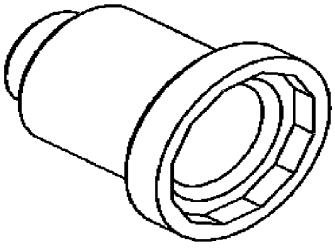
INPUT SHAFT WRENCH 9586



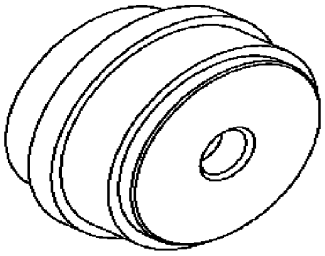
DETENT PULLER 9583



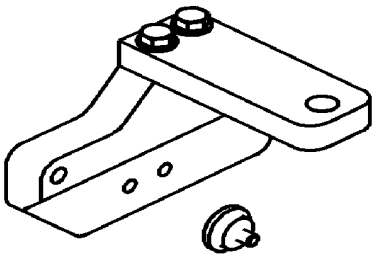
BEARING PULLER 9609



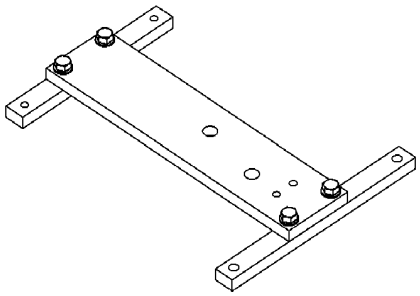
SOCKET 9584



RACE REMOVER/INSTALLER 9617

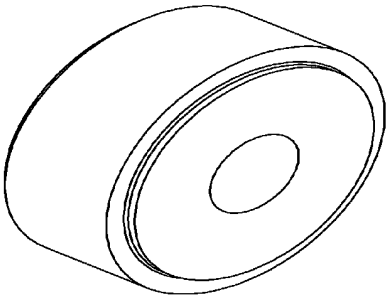


HOUSING PULLER 9618

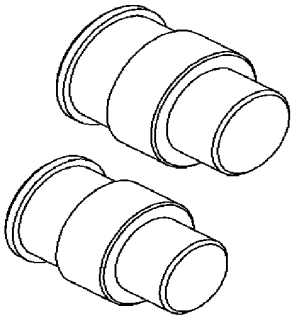


HOUSING PULLER 9621

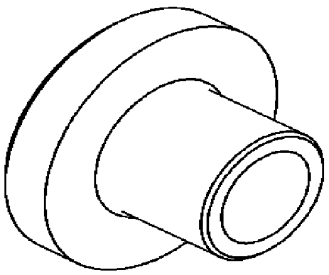
BUTTON 9618-2



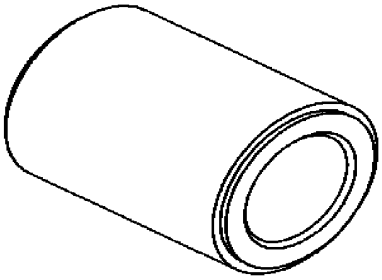
PLUG INSTALLER 9622



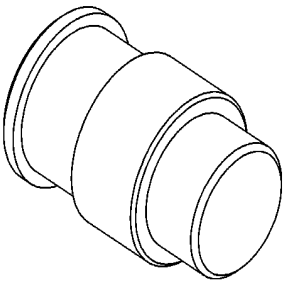
HEAT PLUG 9619-1 & 9619-2



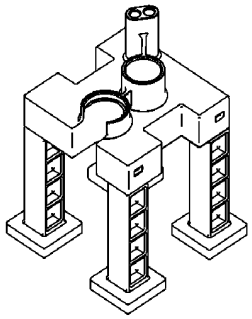
BEARING INSTALLER 9624



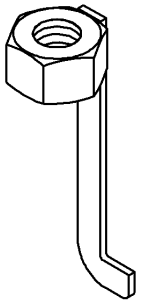
INPUT SEAL INSTALLER 9620



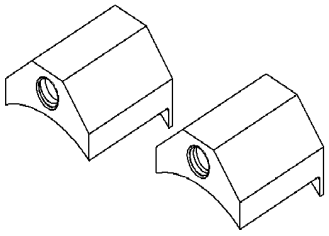
HEAT PLUG 9625



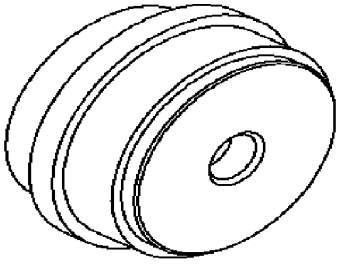
BUILD FIXTURE 9626



SEAL REMOVER 9667



GEAR PULLER ADAPTER 9627



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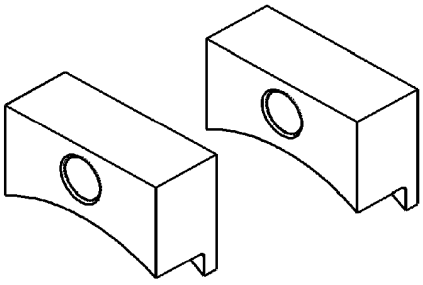

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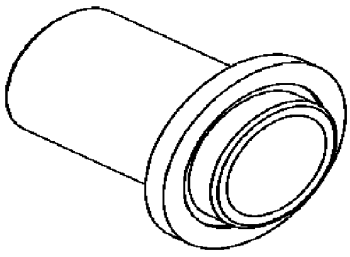

SEAL INSTALLER 9629

AUTOMATIC TRANSMISSION 42RLE - ELECTRICAL DIAGNOSTICS

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AUTOMATIC TRANSMISSION 42RLE - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

P0122-TPS/APP CIRCUIT LOW

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored TPS voltage drops below .078 volts for the period of 0.48 seconds.

Possible Causes
RELATED TPS ENGINE DTCS PRESENT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The powertrain controller receives the throttle position signal from the Throttle Position Sensor (TPS). The controller provides the TPS with a 5 volt pull up and a sensor ground. The signal is checked for being out of range as well as for intermittent operation (excessive signal changes). The engine controller transmits the throttle value onto the Bus. Most engine controllers will calculate the throttle value if the throttle signal is lost. If an error is detected by the transmission controller and the throttle value is available on the Bus, the Bus value will be used, normal operation will continue, and a TPS code will be set. If an error is detected and the throttle value is not available on the Bus, normal operation will be discontinued, a TPS DTC will be set, and the MIL will be turned on after 5 minutes of calculated operation.

Diagnostic Test

1. DETERMINING IF RELATED ENGINE TPS DTCS ARE PRESENT

With the scan tool, check Engine DTCs, including pending DTCs and one trip failures.

Are there any Engine TPS DTCs present?

Yes >> Refer to the Driveability category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, record the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.
With the scan tool, erase Transmission DTCs.

NOTE: To erase EATX EVENT DATA information, a BATTERY DISCONNECT must be performed. Performing a BATTERY DISCONNECT will reset all learned Transmission values to controller defaults which may lead to erratic shift schedules.
Drive the vehicle and try to duplicate the conditions in which the DTC was reported by the EATX DTC EVENT DATA.
With the scan tool, read Transmission DTCs.

Does this DTC reset?

Yes >> Go To 3

No >> Go To 4

P0122-TPS/APP CIRCUIT LOW (CONTINUED)

3. POWERTRAIN CONTROL MODULE

NOTE: Due to the integration of the Powertrain and Transmission Control Modules, bus communication between the modules is internal.

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

Verify the flash level of the controller and update the controller if available.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool PERFORM QUICK LEARN, then program Pinion Factor in the Front Control Module.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

Pay particular attention to the TPS signal and sensor ground circuits.

With the scan tool, check the EATX EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0123-TPS/APP CIRCUIT HIGH

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored TPS voltage rises above 4.94 volts for the period of 0.48 seconds.

Possible Causes
RELATED TPS ENGINE DTCS PRESENT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The powertrain controller receives the throttle position signal from the Throttle Position Sensor (TPS). The controller provides the TPS with a 5 volt pull up and a sensor ground. The signal is checked for being out of range as well as for intermittent operation (excessive signal changes). The engine controller transmits the throttle value onto the Bus. Most engine controllers will calculate the throttle value if the throttle signal is lost. If an error is detected by the transmission controller and the throttle value is available on the Bus, the Bus value will be used, normal operation will continue, and a TPS code will be set. If an error is detected and the throttle value is not available on the Bus, normal operation will be discontinued, a TPS DTC will be set, and the MIL will be turned on after 5 minutes of calculated operation.

Diagnostic Test

1. DETERMINING IF RELATED ENGINE TPS DTCS ARE PRESENT

With the scan tool, check Engine DTCs, including pending DTCs and one trip failures.

Are there any Engine TPS DTCs present?

Yes >> Refer to the Driveability category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, record the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.
With the scan tool, erase Transmission DTCs.

NOTE: To erase EATX EVENT DATA information, a BATTERY DISCONNECT must be performed. Performing a BATTERY DISCONNECT will reset all learned Transmission values to controller defaults which may lead to erratic shift schedules.
Drive the vehicle and try to duplicate the conditions in which the DTC was reported by the EATX DTC EVENT DATA.
With the scan tool, read Transmission DTCs.

Does this DTC reset?

Yes >> Go To 3

No >> Go To 4

P0123-TPS/APP CIRCUIT HIGH (CONTINUED)

3. POWERTRAIN CONTROL MODULE

NOTE: Due to the integration of the Powertrain and Transmission Control Modules, communication between the modules is internal.

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool PERFORM QUICK LEARN, then program Pinion Factor in the Front Control Module.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

Pay particular attention to the TPS signal and sensor ground circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0124-TPS/APP INTERMITTENT

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored TPS throttle angle between the angles of 6° and 120° and the degree change is greater than 5° within a period of less than 7.0 ms.

Possible Causes
RELATED TPS ENGINE DTCS PRESENT
THROTTLE POSITION SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The powertrain controller receives the throttle position signal from the Throttle Position Sensor (TPS). The controller provides the TPS with a 5 volt pull up and a sensor ground. The signal is checked for being out of range as well as for intermittent operation (excessive signal changes). The engine controller transmits the throttle value onto the Bus. Most engine controllers will calculate the throttle value if the throttle signal is lost. If an error is detected by the transmission controller and the throttle value is available on the Bus, the Bus value will be used, normal operation will continue, and a TPS code will be set. If an error is detected and the throttle value is not available on the Bus, normal operation will be discontinued, a TPS DTC will be set, and the MIL will be turned on after 5 minutes of calculated operation.

Diagnostic Test

1. DETERMINING IF RELATED ENGINE TPS DTCS ARE PRESENT

With the scan tool, check Engine DTCs, including pending DTCs and one trip failures.

Are there any Engine TPS DTCs present?

Yes >> Refer to the Driveability category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, record the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.
With the scan tool, erase Transmission DTCs.

NOTE: To erase EATX EVENT DATA information, a BATTERY DISCONNECT must be performed. Performing a BATTERY DISCONNECT will reset all learned Transmission values to controller defaults which may lead to erratic shift schedules.

Drive the vehicle and try to duplicate the conditions in which the DTC was reported by the EATX EVENT DATA.
With the scan tool, read Transmission DTCs.

Does this DTC reset?

Yes >> Go To 3

No >> Go To 5

P0124-TPS/APP INTERMITTENT (CONTINUED)

3. CHECK THROTTLE POSITION SENSOR OPERATION

Ignition On, Engine Not Running.

With the scan tool, under Transmission Sensors, monitor the TPS voltage in the following step.

Slowly open and close the throttle while checking for erratic voltage changes.

Did the TPS voltage change smooth and consistent?

Yes >> Go To 4

No >> Replace the Throttle Position Sensor per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. POWERTRAIN CONTROL MODULE

NOTE: Due to the integration of the Powertrain and Transmission Control Modules, communication between the modules is internal.

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

Check for any Service Bulletins for any possible causes that may apply.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN, then program the Pinion Factor in the Front Control Module.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

Pay particular attention to the TPS signal and sensor ground circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0218-HIGH TEMPERATURE OPERATION ACTIVATED

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running.
- **Set Condition:**
  Immediately when a Overheat shift schedule is activated when the Transmission Oil Temperature reaches 155° C or 240° F.

Possible Causes
ENGINE COOLING SYSTEM OPERATION
TRANSMISSION OIL COOLER PLUGGED
HIGH TEMPERATURE OPERATIONS ACTIVATED

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

If the transmission oil temperature rises above 115 C (240 F), the overheat shift schedule is activated refer to Transmission Operation as a function of Transmission Oil Temperature and the code is set. The DTC is an informational code only and is being set to aid the technician in determining root cause of a customer driveability issue. The code is also intended to alert the technician to determine if a cooling system malfunction has occurred or if an additional transmission air to oil cooler should be added to the vehicle if the customer regularly drives in a manner that overheats the transmission. Extended operation above 115 C (240 F) will reduce the durability of the transmission and should be avoided. Correcting the cooling system malfunction or installing an additional transmission oil cooler will improve transmission durability especially for customers who operate in city/construction stop and go traffic, tow trailers regularly, drive aggressively in low gear or drive regularly in mountainous areas.

Diagnostic Test

1. CHECK ENGINE COOLING SYSTEM

Perform Engine Cooling System diagnostics per the Service Information.

Is the Engine Cooling System functioning properly?

Yes >> Go To 2

No >> Repair the cause of the engine overheating. Refer to the Service Information for the related diagnostic or repair procedures.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

2. TRANSMISSION OIL COOLER RESTRICTED

Check the Transmission Oil Cooler Flow in accordance with the Service Information.

Is the transmission oil cooler restricted or plugged?

Yes >> Go To 3

No >> Repair or replace the Transmission Oil Cooler per the Service Information. Repair the cause of the plugged Transmission Oil Cooler as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0218-HIGH TEMPERATURE OPERATION ACTIVATED (CONTINUED)

3. HIGH TEMPERATURE OPERATION

This DTC is an informational DTC designed to aid the Technician in diagnosing shift quality complaints.

This DTC indicates that the transmission has been operating in the ″Overheat″ shift schedule which may generate a customer complaint.

The customer driving patterns may indicate the need for an additional transmission oil cooler.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

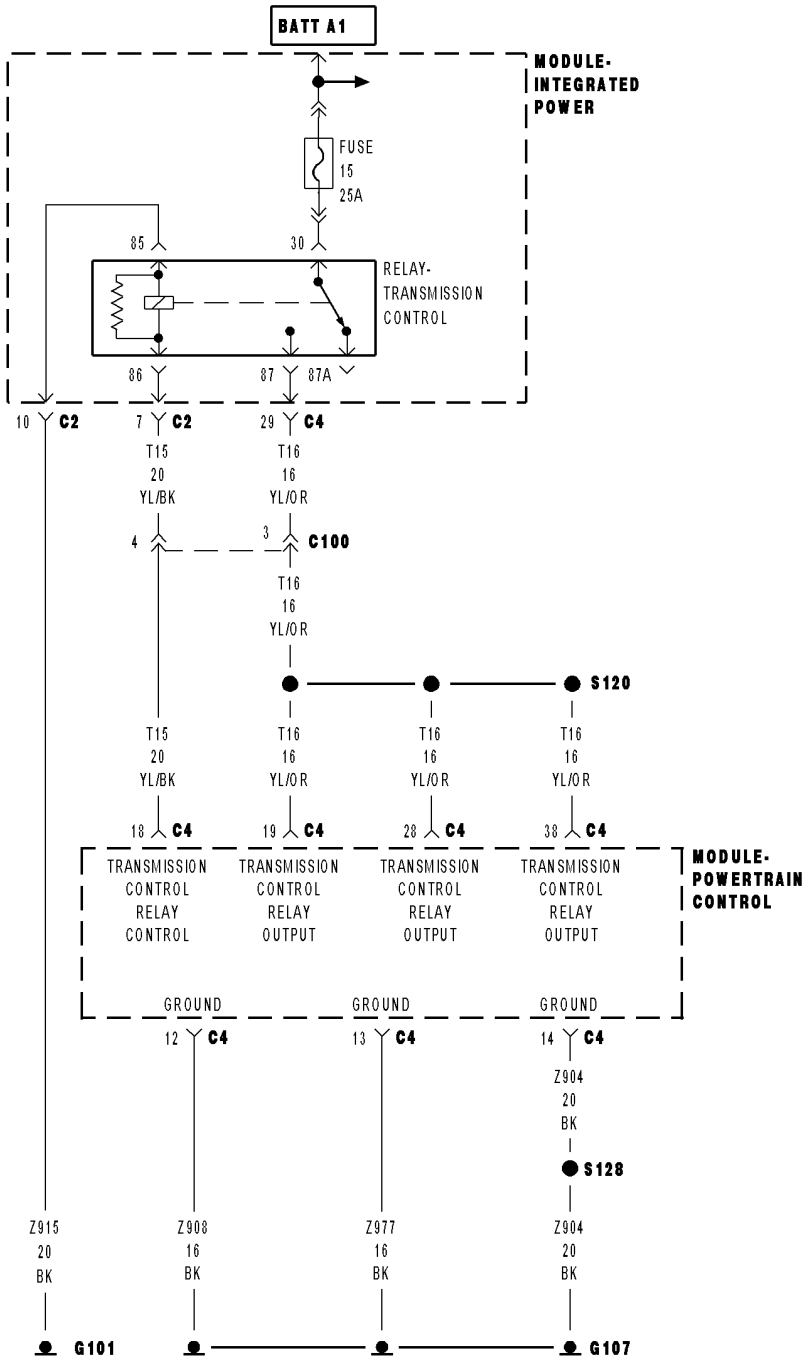
View repair options.

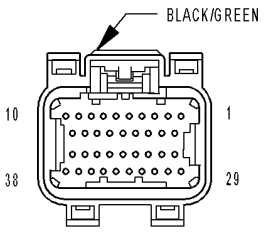
Repair

Repair the cause of transmission overheating per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0562-BATTERY VOLTAGE LOW





MODULE-
POWERTRAIN
CONTROL C4
(42RLE)

81475083

P0562-BATTERY VOLTAGE LOW (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running and the PCM has closed the Transmission Control Relay.
- **Set Condition:**
  If the battery voltage of the Transmission Control Relay Output Sense circuit(s) to the PCM is less than 10.0 volts for the period of 15 seconds. Note: P0562 generally indicates a gradually falling battery voltage or a resistive connection(s) to the PCM. The DTC will also set if the battery voltage sensed at the PCM is less than 6.5v for 200ms or where Transmission Control Relay Output circuits is less than 7.2v for 200ms.

Possible Causes
RELATED CHARGING SYSTEM DTC'S
(Z908) OR (Z977) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
(A104) FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE
(T16) TRANSMISSION CONTROL RELAY OUTPUT TO TCM OPEN OR HIGH RESISTANCE
TRANSMISSION CONTROL RELAY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

Transmission damage may occur if there is insufficient supply voltage to properly control the solenoids. To prevent this possibility, the battery voltage is monitored and the system is placed in logical limp-in if the battery voltage drops below the limit.

Diagnostic Test

1. RELATED CHARGING SYSTEM DTC'S

With the scan tool, read the Engine DTC's.

Are there any Charging System related DTCs present?

Yes >> Refer to the Charging System category and repair any Charging System DTCs before proceeding. After repairing the Charging System DTCs, perform the Transmission Verification test to verify the transmission and or controller was not damaged.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CONDITION FOR DTC P0562 PRESENT

NOTE: Generator, battery, and charging system must be fully functional before performing this test.
With the scan tool, read DTCs.

Is the status for this DTC Active or the STARTS SINCE SET counter set at 0?

Yes >> Go To 3

No >> Go To 8

P0562-BATTERY VOLTAGE LOW (CONTINUED)

3. CHECKING THE (Z908) and (Z977) GROUND CIRCUITS

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: DO NOT PROBE THE PCM HARNESS CONNECTORS. PROBING THE PCM HARNESS CONNECTORS WILL DAMAGE THE PCM TERMINALS RESULTING IN POOR TERMINAL TO PIN CONNECTION. INSTALL MILLER TOOL #8815 TO PERFORM DIAGNOSIS.

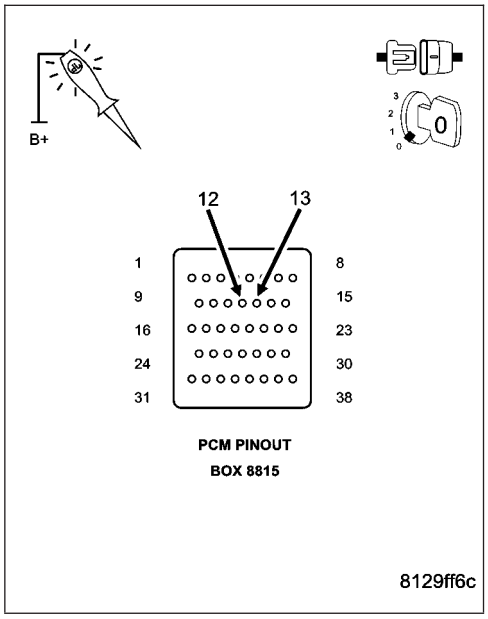
Using a 12-volt test light connected to 12-volts, check the (Z908) and (Z977) Ground circuits in the appropriate terminal of MILLER TOOL #8815.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly for all the Ground circuits?

Yes >> Go To 4

No >> Repair the (Z908) and/or (Z977) Ground circuit for an open circuit or high resistance.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.



4. CHECKING (A104) FUSED B+ CIRCUIT

Turn the ignition off to the lock position.

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

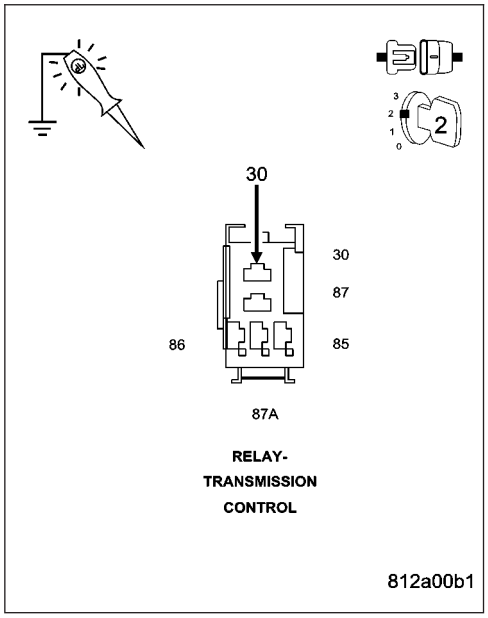
Using a 12-volt test light connected to ground, check the (A104) Fused B+ circuit in the Transmission Control Relay connector.

NOTE: The Test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly?

Yes >> Go To 5

No >> Repair the (A104) Fused B+ circuit for an open or high resistance.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.



P0562-BATTERY VOLTAGE LOW (CONTINUED)

5. CHECKING THE (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

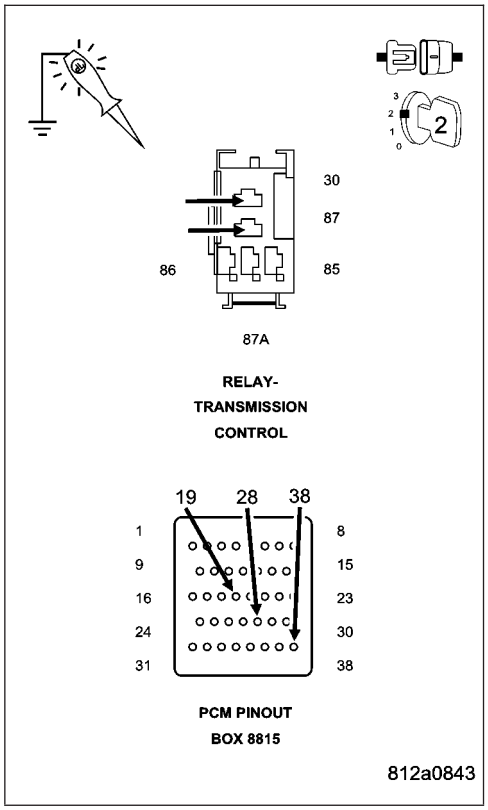
CAUTION: DO NOT PROBE THE PCM HARNESS CONNECTORS. PROBING THE PCM HARNESS CONNECTORS WILL DAMAGE THE PCM TERMINALS RESULTING IN POOR TERMINAL TO PIN CONNECTION. INSTALL MILLER TOOL #8815 TO PERFORM DIAGNOSIS.

Connect a jumper wire between (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, check all (T16) Transmission Control Relay Output circuits in the appropriate terminal of MILLER TOOL #8815.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.



Does the test light illuminate brightly?

Yes >> Go To 6

No >> Repair the (T16) Transmission Control Relay Output circuit(s) for an open or high resistance.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

6. TRANSMISSION CONTROL RELAY

Turn the ignition off to the lock position.

Install a substitute Relay in place of the Transmission Control Relay.

Start the engine.

Using a voltmeter, measure the battery voltage.

With the scan tool, monitor the Transmission Switched Battery Voltage.

Compare the scan tool Transmission Switched Battery voltage to the actual battery voltage.

Is the scan tool voltage within 2.0 volts of the battery voltage?

Yes >> Replace the Transmission Control Relay.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7

P0562-BATTERY VOLTAGE LOW (CONTINUED)

7. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

Check for any Service Bulletins and S.T.A.R. ON-LINE for any possible causes that may apply.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN then program Pinion Factor in the Front Control Module.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

8. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorts and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0602-CONTROL MODULE PROGRAMMING ERROR/NOT PROGRAMMED

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Check for generic software is made at power-up.
- **Set Condition:**
  If generic software is found , the MIL will light immediately. This DTC is designed to signal the technician that the controller still has generic software installed.

Possible Causes
PCM - PROGRAMMING ERROR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The controller is programmed during manufacturing with generic software to facilitate testing. This software does not have the proper calibrations to control a transmission in a vehicle. The check for generic software is made at power-up. If generic software is found , the MIL will light immediately and the MIL will stay on even if the fault is cleared, until the proper software is installed. Note: Transmission will be placed in limp-in mode.

Diagnostic Test

1. CONTROL MODULE PROGRAMMING ERROR

NOTE: Controller is programmed with generic software and will not allow the correct vehicle Powertrain management.

Record the controller part number.

Update the controller with the correct software in accordance with the Service Information.

Verify that the controller updated successfully.

Test Complete

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0604-INTERNAL CONTROL MODULE RAM

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  One time after the ignition key is turned to the run position.
- **Set Condition:**
  The read value does not match the written value in any RAM location.

Possible Causes
PCM - INTERNAL ERROR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING.

Theory of Operation

After the controller is reset, the microprocessor checks the integrity of each RAM location by writing to it and reading back from it. The read value should be the same as the written value. MIL on after 10 seconds of vehicle operation and transmission will be placed in limp-in.

Diagnostic Test

1. PCM - INTERNAL ERROR

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module. With the scan tool perform QUICK LEARN, then program Pinion Factor in the Front Control Module.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0605-INTERNAL CONTROL MODULE ROM

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  One time after the ignition key is turned to the run position.
- **Set Condition:**
  If the ROM checksum does not match a known constant.

Possible Causes
PCM - INTERNAL ERROR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

After the controller is reset, the microprocessor checks the integrity of the program memory (ROM). A checksum is calculated by adding all used bytes in the program memory. The sum should be the same as a known constant stored in memory. MIL on after 10 seconds of vehicle operation and transmission will be placed in limp-in.

Diagnostic Test

1. PCM - INTERNAL ERROR

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module. With the scan tool perform QUICK LEARN, then program Pinion Factor in the Front Control Module.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0613-INTERNAL TRANSMISSION PROCESSOR

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  After the ignition key is turned to the run position and 60 seconds thereafter.
- **Set Condition:**
  Either of the following conditions occur 3 times in less than 590 milliseconds: The watchdog line remains high after the watchdog test or the transmission relay coil is energized and remains on after the watchdog delay expires.

Possible Causes
PCM - INTERNAL ERROR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The internal watchdog is a separate hardware circuit which continuously monitors the microprocessor. To make sure the transmission is operating properly, the watchdog must receive a signal from the microprocessor within a specific time window. MIL on after 10 seconds of vehicle operation and transmission will be placed in limp-in.

Diagnostic Test

1. PCM - INTERNAL ERROR

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

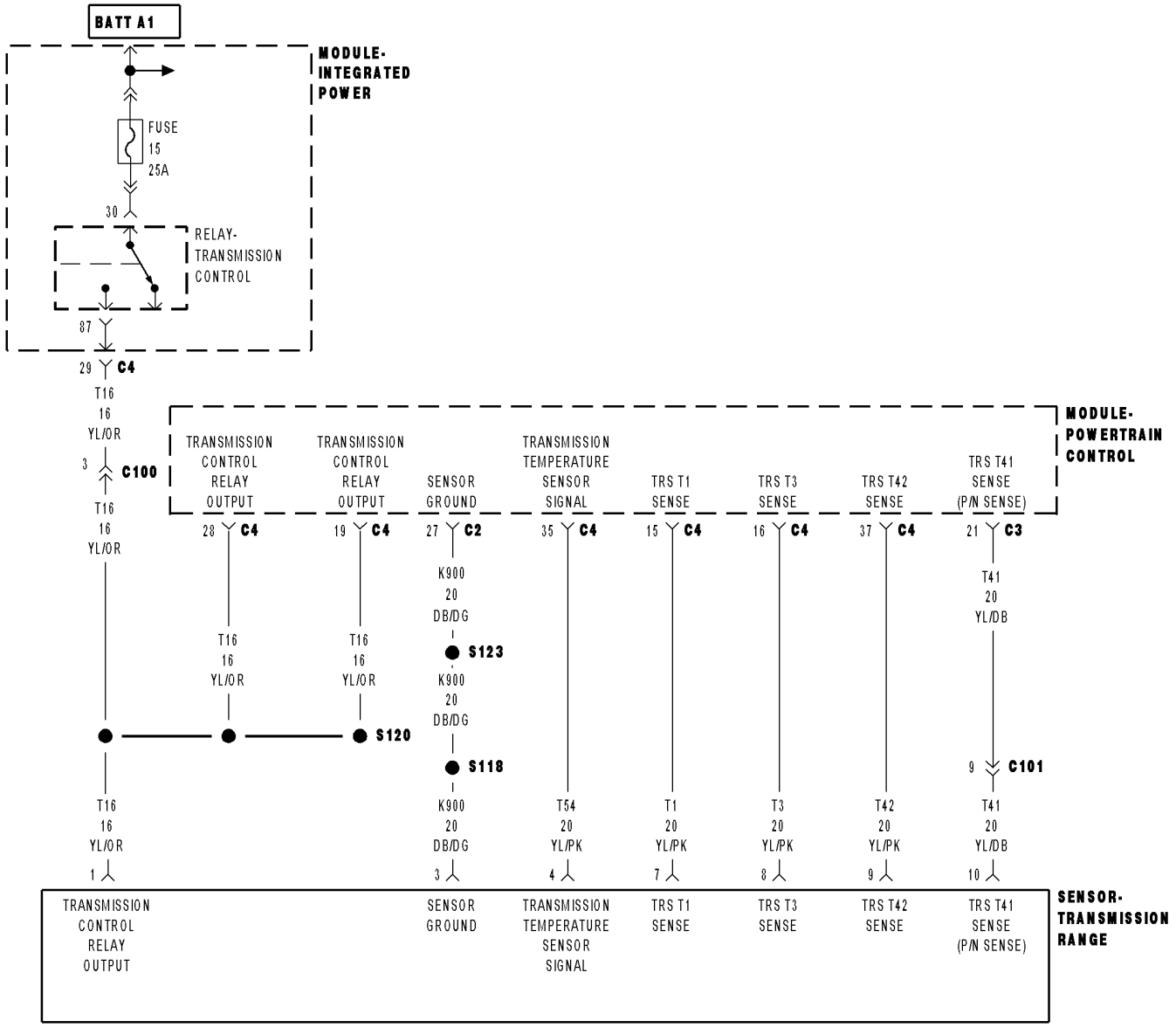
If there are no possible causes remaining, view repair.

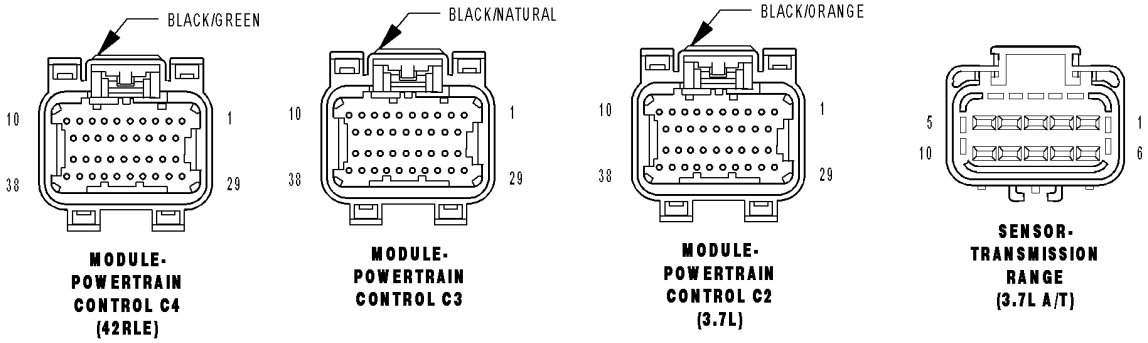
Repair

Replace the Powertrain Control Module. With the scan tool perform QUICK LEARN, then program Pinion Factor in the Front Control Module.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0706-TRANSMISSION RANGE SENSOR RATIONALITY





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P0706-TRANSMISSION RANGE SENSOR RATIONALITY (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition in the run position.
- **Set Condition:**
  The DTC will set if an invalid PRNDL code which lasts for more than 100 milliseconds and within 1 second of power-up or the PRNDL code error does not correct itself before a change in input occurs.

Possible Causes
SHIFTER OUT OF ADJUSTMENT
TRS (T1) SENSE CIRCUIT OPEN
TRS (T3) SENSE CIRCUIT OPEN
TRS (T41) SENSE CIRCUIT OPEN
TRS (T42) SENSE CIRCUIT OPEN
TRS (T1) SENSE CIRCUIT SHORT TO GROUND
TRS (T3) SENSE CIRCUIT SHORT TO GROUND
TRS (T41) SENSE CIRCUIT SHORT TO GROUND
TRS (T42) SENSE CIRCUIT SHORT TO GROUND
TRS (T1) SENSE CIRCUIT SHORT TO VOLTAGE
TRS (T3) SENSE CIRCUIT SHORT TO VOLTAGE
TRS (T41) SENSE CIRCUIT SHORT TO VOLTAGE
TRS (T42) SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION RANGE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The C1 through C4 (T1, T3, T41, and T42) sense circuits communicate the shift lever position to the PCM. Each circuit is terminated at the transmission with a switch. Each switch can be either open or closed, depending on the shift lever position. The PCM can decode this information and determine the shift lever position. Each shift lever position has a certain combination of switches, which will be open and closed, this is called a PRNDL code. There are 4 switches, therefore: there are many possible combinations of open and closed switches (codes). However, there are only 9 valid codes (8 for AutoStick), one for each gear position and three recognized between gear codes. The remainder of the codes should never occur, these are called invalid codes. The following chart shows the normal switch states for each shift lever position.

TRS SWITCH STATES

SLP	T42	T41	T3	T1
P	CL	CL	CL	OP
R	CL	OP	OP	OP
N	CL	CL	OP	CL
OD	OP	OP	OP	CL
3	OP	OP	CL	OP
L	CL	OP	CL	CL

P0706-TRANSMISSION RANGE SENSOR RATIONALITY (CONTINUED)
Diagnostic Test

1. CHECK IF THE DTC P0706 IS CURRENT

With the scan tool, erase Transmission DTCs.

Cycle the ignition off, then start the vehicle.

Firmly apply the brakes and shift into Overdrive.

NOTE: Vehicle must remain in Overdrive for at least three seconds.

With the brakes firmly applied, shift slowly through all gears (PRNDL) as least three times, pausing momentarily in each gear.

NOTE: If all the PRNDL lights box individually then the error was cleared.

Shift into park and turn the ignition off to the lock position.

Ignition on, engine not running.

With the scan tool, read Transmission DTCs.

Does the DTC P0706 reset, or do all the PRNDL indicators remain boxed in park or neutral?

Yes >> Go To 2

No >> Go To 20

---

2. CHECK SHIFTER OPERATION

With the scan tool, perform the Shift Lever Position Test.

Select the test outcome from the following:

Test passes
Go To 20

Test fails with error code
Go To 3

Test fails without error code
Go To 18

---

3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

Ignition on, engine not running.

With the scan tool, perform the Shift Lever Position Test.

When the scan tool instructs you to put the Gear Selector in a particular position, you must do so using the Transmission Simulator.

The LED for the gear position in question must be illuminated on the Transmission Simulator, prior to pressing the ENTER key on the scan tool.

NOTE: After completion of this procedure, make sure to disconnect the Transmission Simulator, Miller tool #8333 and Electronic Transmission adaptor cable kit, Miller tool #8333-1A and reconnect all connectors.

Did the Shift Lever Position Test pass?

Yes >> Replace the Transmission Range Sensor per the Service Information.
Go To 19

No >> Go To 4

P0706-TRANSMISSION RANGE SENSOR RATIONALITY (CONTINUED)

4. MONITOR TRS SENSE CIRCUITS

Reconnect all disconnected connectors. Turn the ignition on, engine not running.

With the scan tool, monitor the TRS Sense circuits - C1 through C4.

Move the shift lever through all gear positions, pausing momentarily in each gear position. Watch for one of the circuits to not change state.

Select the circuit that did not change state.

TRS (T1) sense (C4)
Go To 5

TRS (T3) sense (C3)
Go To 8

TRS (T41) sense (C1)
Go To 11

TRS (T42) sense (C2)
Go To 14

---

5. TRS (T1) SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

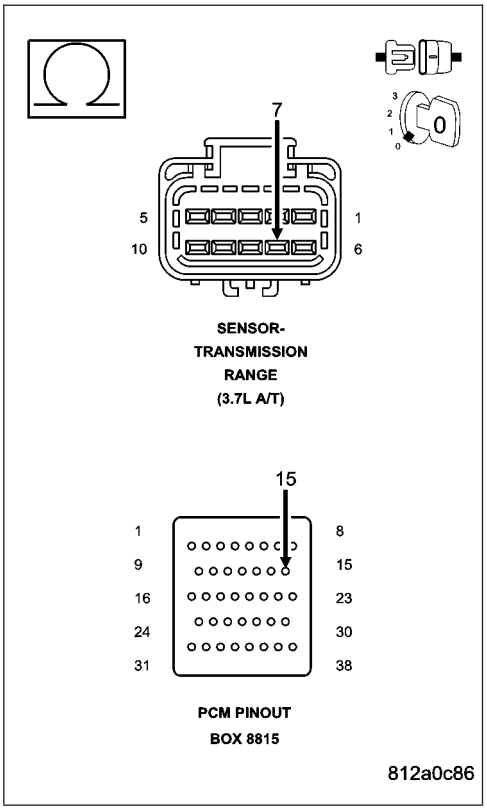
Disconnect the TRS harness connector.

Disconnect the PCM C4 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Tool #8815 to perform diagnosis.

Measure the resistance of the TRS (T1) Sense circuit from the appropriate terminal of special tool #8815 to the TRS harness connector.



Is the resistance above 5.0 ohms?

Yes >> Repair the TRS (T1) Sense circuit for an open.
Go To 19

No >> Go To 6

P0706-TRANSMISSION RANGE SENSOR RATIONALITY (CONTINUED)

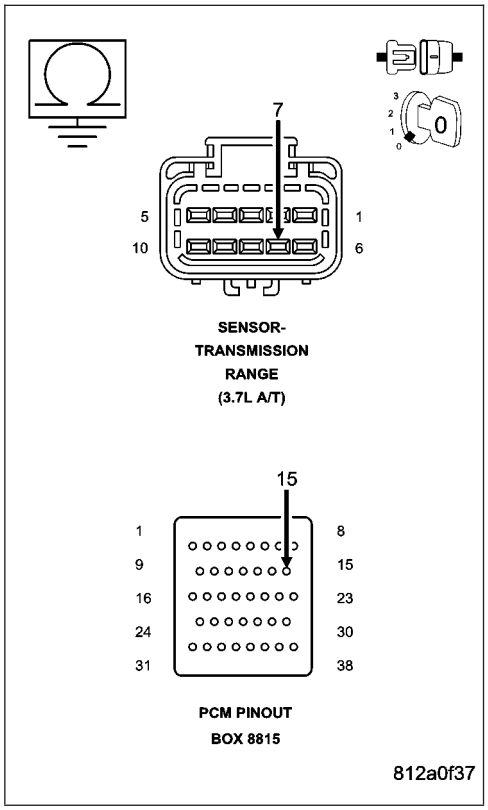
6. TRS (T1) SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the TRS (T1) Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the TRS (T1) Sense circuit for a short to ground. Go To 19

No >> Go To 7



7. TRS (T1) SENSE CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay from the PDC.

NOTE: Check connectors - Clean/repair as necessary.

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

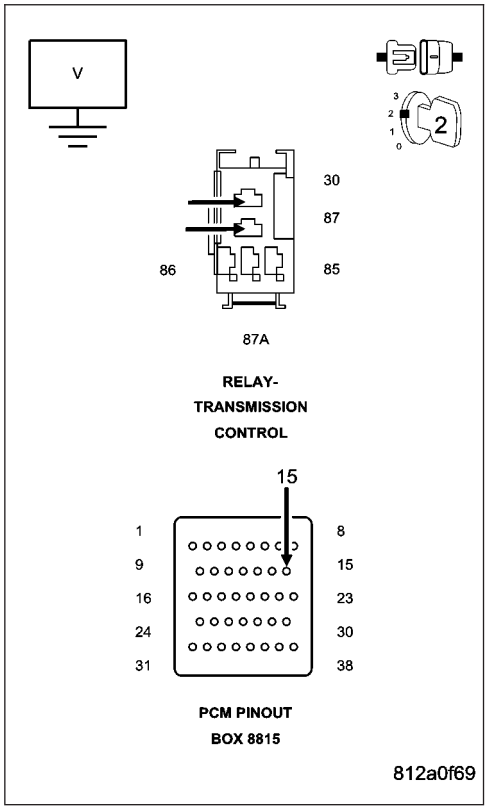
Ignition on, engine not running.

Measure the voltage of the TRS (T1) Sense circuit at the appropriate terminal of special tool #8815.

Is the voltage above 0.5 volt?

Yes >> Repair the TRS (T1) Sense circuit for a short to voltage. Go To 19

No >> Go To 17



P0706-TRANSMISSION RANGE SENSOR RATIONALITY (CONTINUED)

8. TRS (T3) SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the TRS harness connector.

Disconnect the PCM C4 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

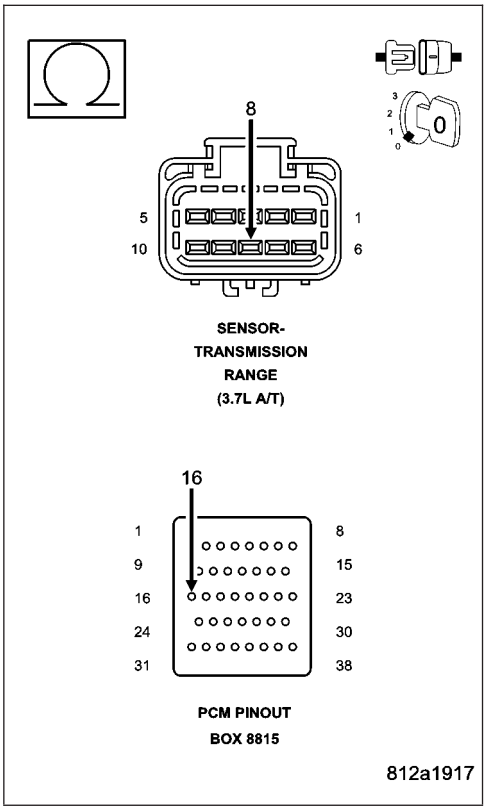
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Tool #8815 to perform diagnosis.

Measure the resistance of the TRS (T3) Sense circuit from the appropriate terminal of special tool #8815 to the TRS harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the TRS (T3) Sense circuit for an open. Go To 19

No >> Go To 9



P0706-TRANSMISSION RANGE SENSOR RATIONALITY (CONTINUED)

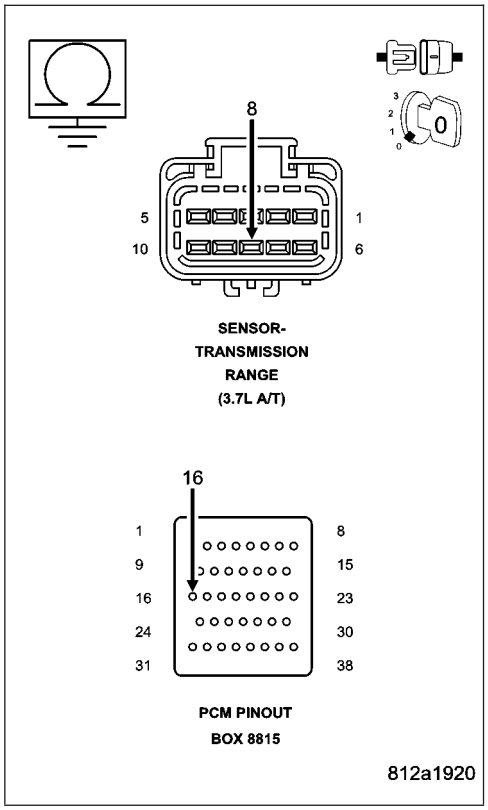
9. TRS (T3) SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the TRS (T3) Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the TRS (T3) Sense circuit for a short to ground. Go To 19

No >> Go To 10



10. TRS (T3) SENSE CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

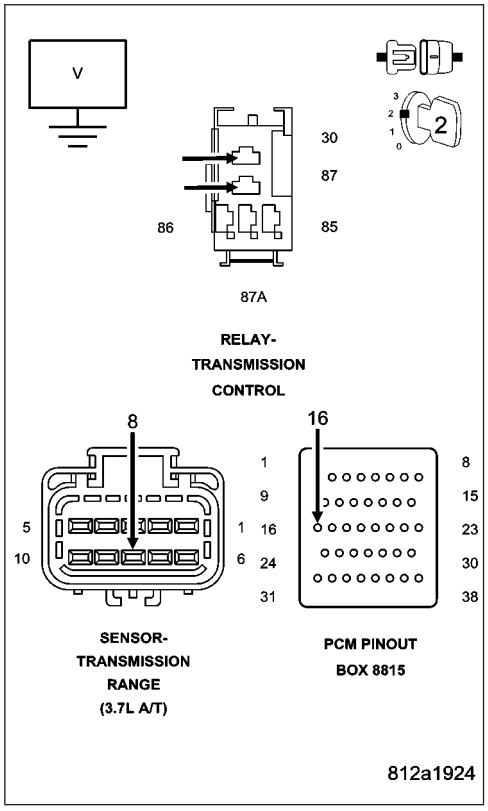
Ignition on, engine not running.

Measure the voltage of the TRS (T3) Sense circuit.

Is the voltage above 0.5 volt?

Yes >> Repair the TRS (T3) Sense circuit for a short to voltage. Go To 19

No >> Go To 17



P0706-TRANSMISSION RANGE SENSOR RATIONALITY (CONTINUED)

11. TRS (T41) SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the TRS harness connector.

Disconnect the PCM C3 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

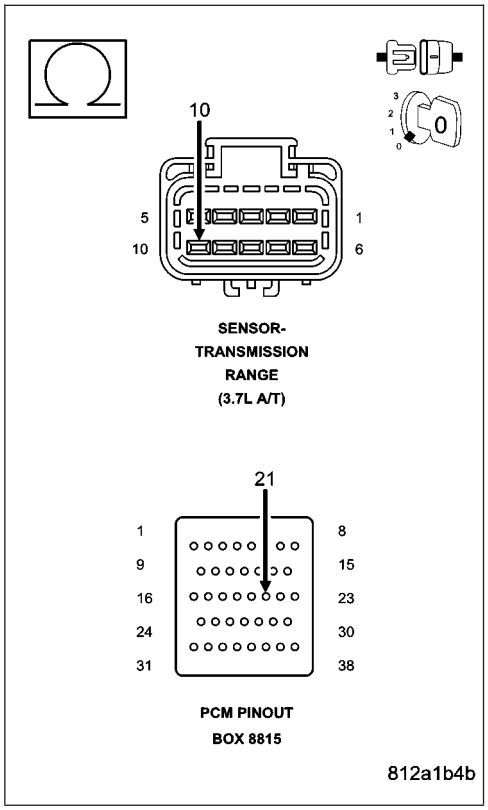
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Tool #8815 to perform diagnosis.

Measure the resistance of the TRS (T41) Sense circuit from the appropriate terminal of special tool #8815 to the TRS harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the TRS (T41) Sense circuit for an open. Go To 19

No >> Go To 12



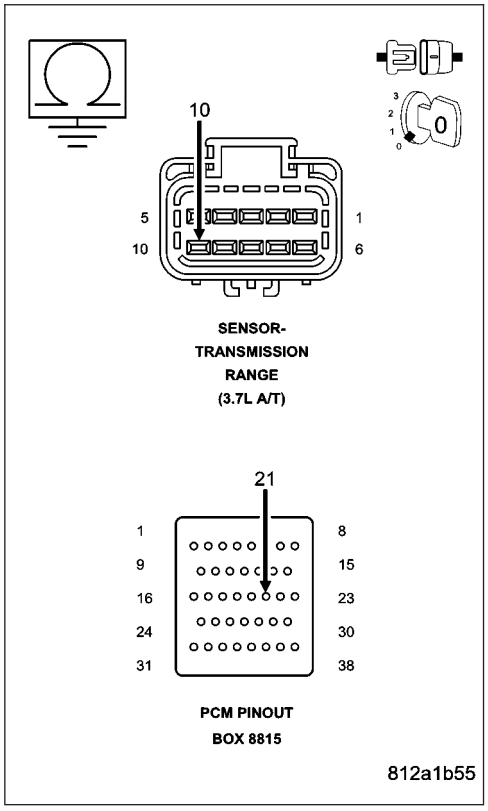
12. TRS (T41) SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the TRS (T41) Sense circuit

Is the resistance below 5.0 ohms?

Yes >> Repair the TRS (T41) Sense circuit for a short to ground. Go To 19

No >> Go To 13



P0706-TRANSMISSION RANGE SENSOR RATIONALITY (CONTINUED)

13. TRS (T41) SENSE CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

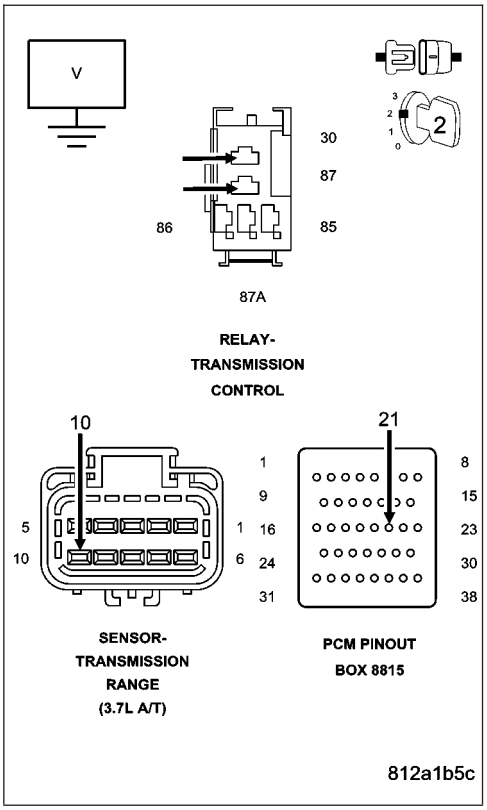
Ignition on, engine not running.

Measure the voltage of the TRS (T41) Sense circuit.

Is the voltage above 0.5 volt?

Yes >> Repair the TRS (T1) Sense circuit for a short to voltage. Go To 19

No >> Go To 17



14. TRS (T42) SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the TRS harness connector.

Disconnect the PCM C4 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

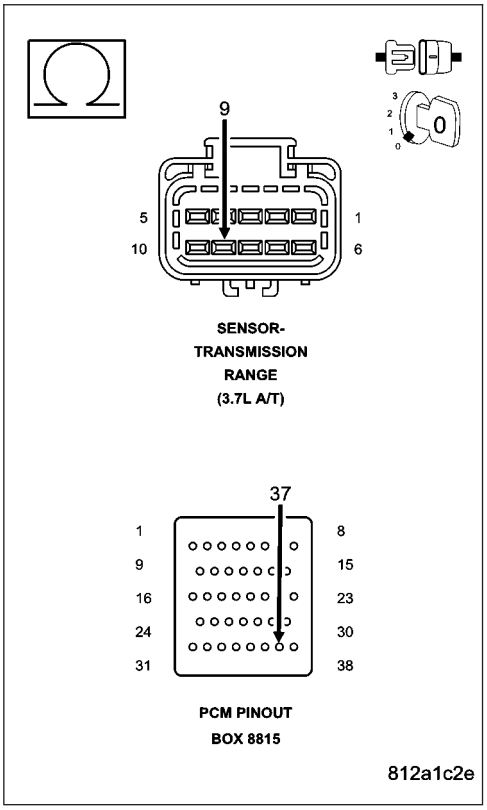
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Tool #8815 to perform diagnosis.

Measure the resistance of the TRS (T42) Sense circuit from the appropriate terminal of special tool #8815 to the TRS harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the TRS (T42) Sense circuit for an open. Go To 19

No >> Go To 15



P0706-TRANSMISSION RANGE SENSOR RATIONALITY (CONTINUED)

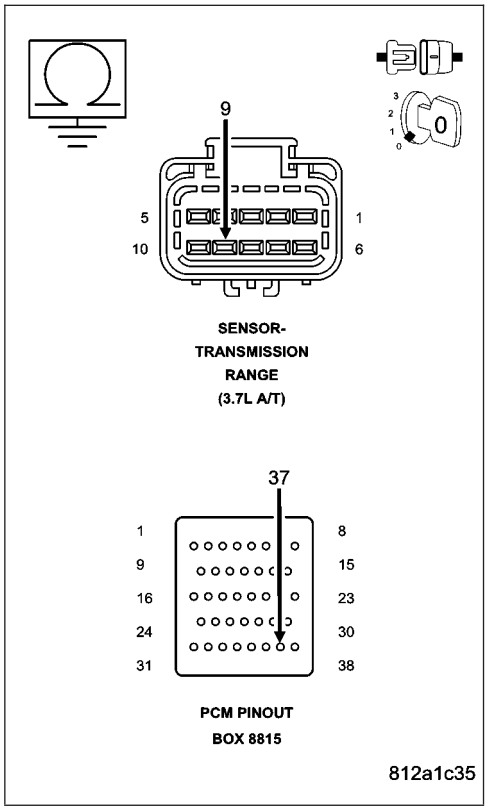
15. TRS (T42) SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the TRS (T42) Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the TRS (T42) Sense circuit for a short to ground. Go To 19

No >> Go To 16



16. TRS (T42) SENSE CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

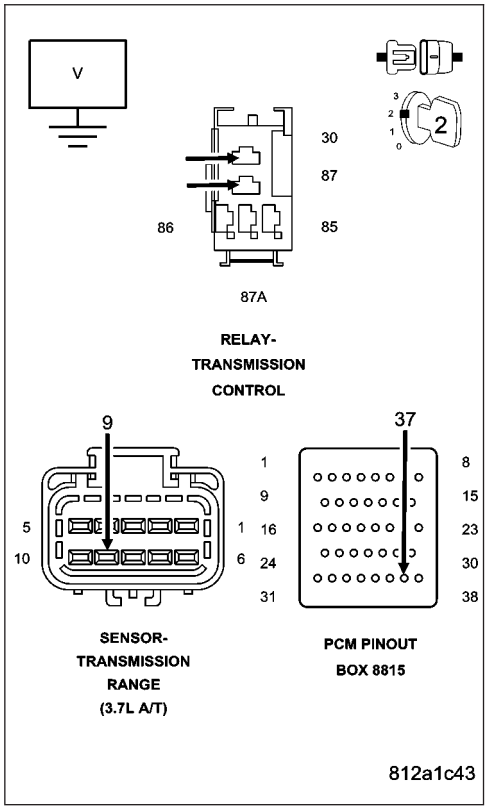
Ignition on, engine not running.

Measure the voltage of the TRS (T42) Sense circuit.

Is the voltage above 0.5 volt?

Yes >> Repair the TRS (T42) Sense circuit for a short to voltage. Go To 19

No >> Go To 17



P0706-TRANSMISSION RANGE SENSOR RATIONALITY (CONTINUED)

17. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.

Go To 19

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18. CHECK AND ADJUST SHIFTER

If there are no possible causes remaining, view repair.

Repair

Adjust the Shift Linkage and/or cable per the Service Information.

Go To 19

---

19. PRNDL FAULT CLEARING PROCEDURE

With the scan tool, erase Transmission DTCs.

Cycle the ignition off, then start the vehicle.

Firmly apply the brakes and shift into Overdrive.

NOTE: NOTE: Vehicle must remain in Overdrive for at least 3.0 seconds.
With the brakes firmly applied, shift slowly through all gears (PRNDL) as least three times, pausing momentarily in each gear.

NOTE: NOTE: If all the PRNDL lights box individually then the error was cleared.
Shift into park and turn the ignition off to the lock position.

Ignition on, engine not running.

With the DRBIII®, read Transmission DTCs.

Does the DTC P0706 reset, or do all the PRNDL indicators remain boxed in park or neutral?

Yes >> Return to the symptom list and perform diagnostics for P0706 CHECK SHIFTER SIGNAL.
Go To 1

No >> Test Complete.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

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20. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

Check the Shift Linkage and cable for proper operation per the Service Information.

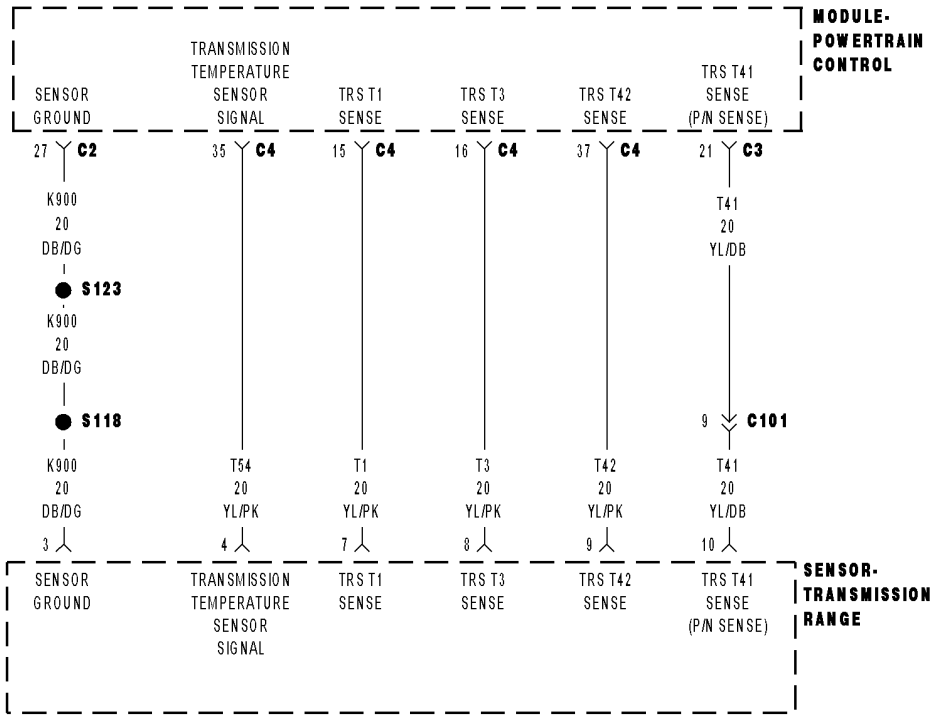
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

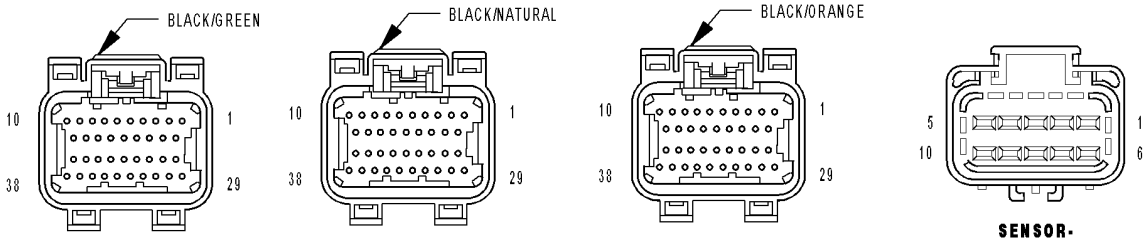
Were there any problems found?

Yes >> Repair as necessary.
Go To 19

No >> Test Complete.

P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE





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42RLE MINI TEMP CKTS

P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  DTC will set when the transmission temperature does not reach a normal operating temperature within a given time frame. Time is variable due to ambient temperature. Approximate DTC set time is 10 to 35 minutes. The following are starting temperature to warm up times to set this DTC: starting temp -40° C (-40° F) warm up time 35 minutes, starting temp -28° C (-20° F) 25 min, starting temp -6.6° C (20° F) 20 minutes, starting temp 15.5 ° C (60° F) 10 minutes. When the fault is set, calculated temperature is substituted for measured temperature, however the fault code is stored only after three consecutive occurrences of the fault.

Possible Causes
RELATED TRANSMISSION TEMPERATURE DTC'S PRESENT
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The temperature sensor is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter operation and when or if some diagnostics are run. A failed temperature sensor could affect the OBD diagnostics. If a problem occurs in the transmission temperature sensor circuit, transmission temperature will be based on a calculated value.

Diagnostic Test

1. DETERMINE IF RELATED TRANSMISSION TEMPERATURE DTCS ARE PRESENT

With the scan tool, check Transmission DTCs.

Are there any other Transmission Temperature Sensor related DTCs present?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF DTC IS ACTIVE

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 3

No >> Go To 6

P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match the scan tool readings ± 0.2 volts?

Yes >> Go To 4

No >> Go To 5

---

4. TRANSMISSION TEMPERATURE SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace Transmission Solenoid/TRS Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

5. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

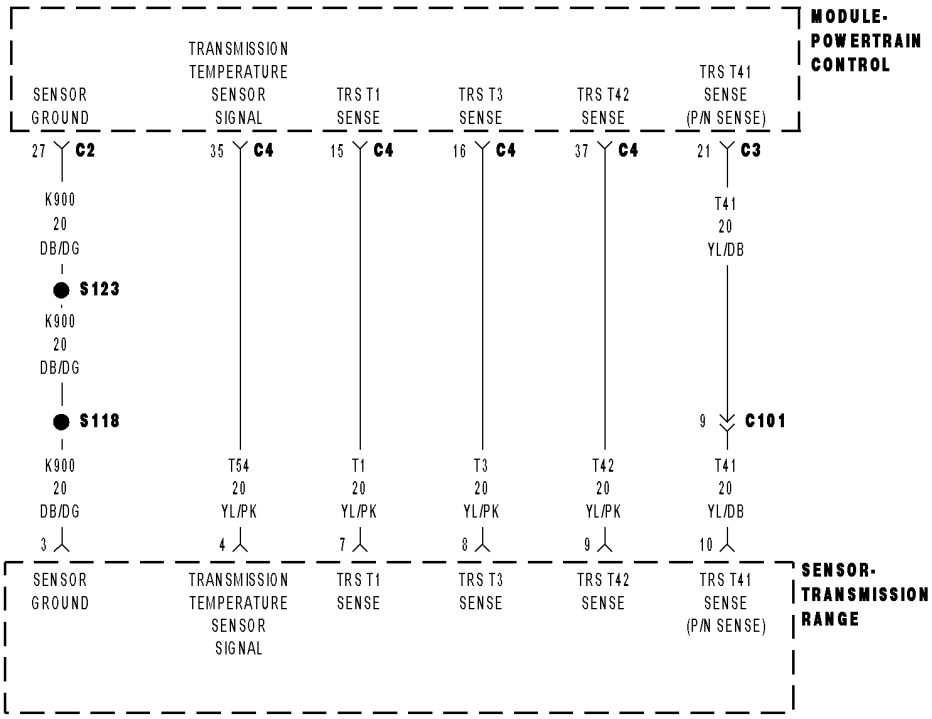
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

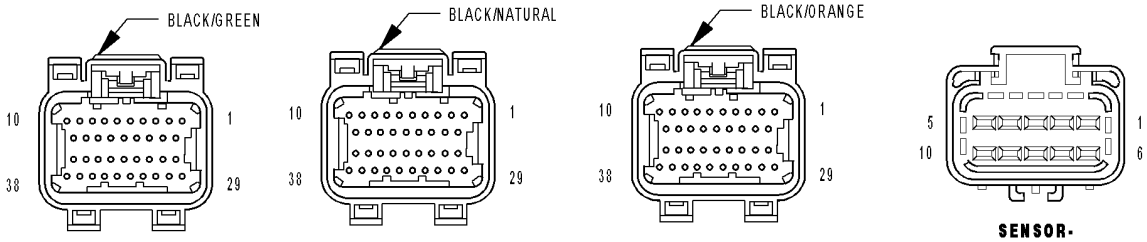
Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0712-TRANSMISSION TEMPERATURE SENSOR LOW





MODULE-
POWERTRAIN
CONTROL C4
(42RLE)

MODULE-
POWERTRAIN
CONTROL C3

MODULE-
POWERTRAIN
CONTROL C2
(3.7L)

SENSOR-
TRANSMISSION
RANGE
(3.7L A/T)

814750ea

P0712-TRANSMISSION TEMPERATURE SENSOR LOW (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set when the monitored Temperature Sensor voltage drops below 0.078 volts for the period of 1.45 seconds. When the fault is set, calculated temperature is substituted for measured temperature, however the fault code is stored only after three consecutive occurrences of the fault.

Possible Causes
RELATED DTCS PRESENT
(T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The temperature sensor is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter operation and when or if some diagnostics are run. A failed temperature sensor could affect the OBD diagnostics. If a problem occurs in the transmission temperature sensor circuit, transmission temperature will be based on a calculated value.

Diagnostic Test

1. DETERMINE IF RELATED DTCS ARE PRESENT

With the scan tool, check Transmission DTCs.

Are there any Speed Sensor DTCs present?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF DTC IS ACTIVE

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 3

No >> Go To 7

P0712-TRANSMISSION TEMPERATURE SENSOR LOW (CONTINUED)

3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match the scan tool readings ± 0.2 volts?

Yes >> Go To 4

No >> Go To 5

---

4. TRANSMISSION TEMPERATURE SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace Transmission Solenoid/TRS Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

5. (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the TRS harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Tool #8815 to perform diagnosis.

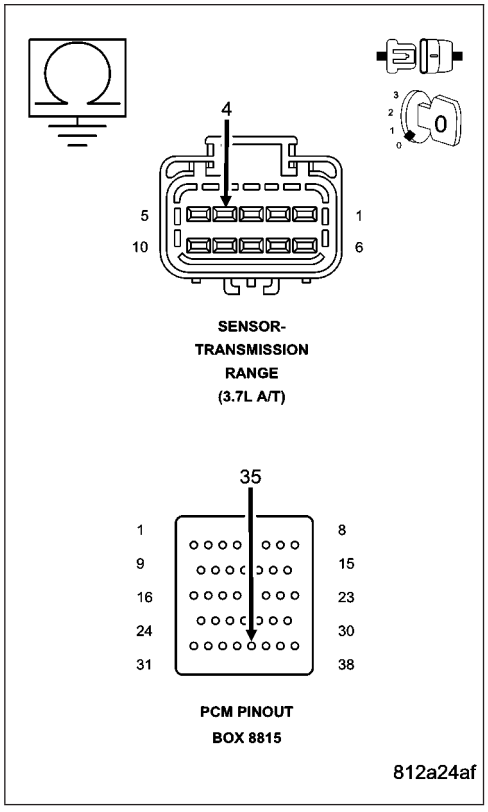
Measure the resistance between ground and the (T54) Transmission Temperature Sensor Signal circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T54) Transmission Temperature Sensor Signal circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



P0712-TRANSMISSION TEMPERATURE SENSOR LOW (CONTINUED)

6. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

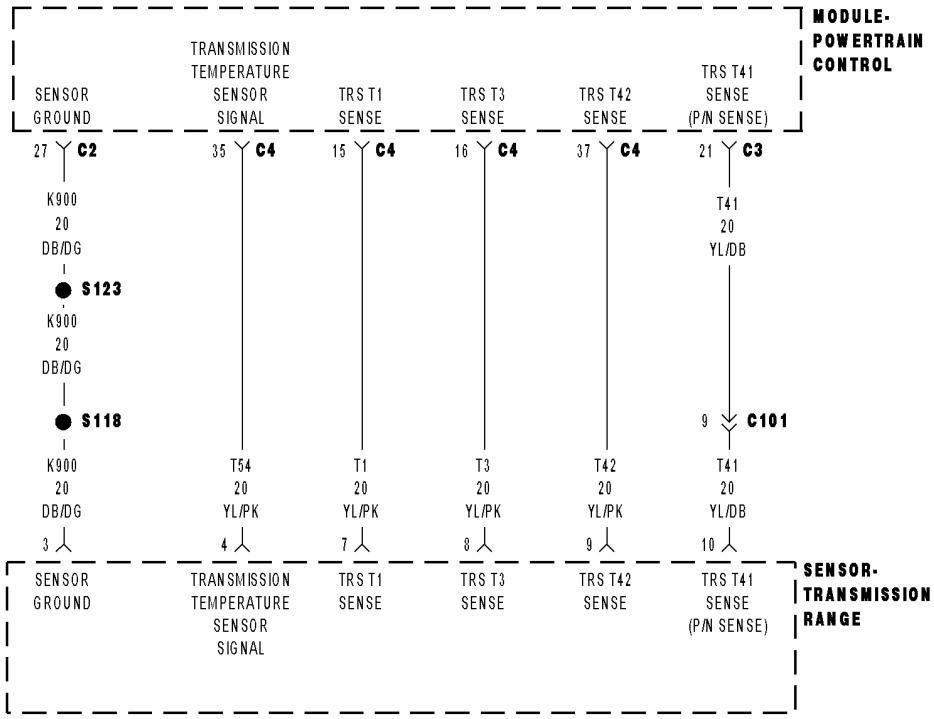
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

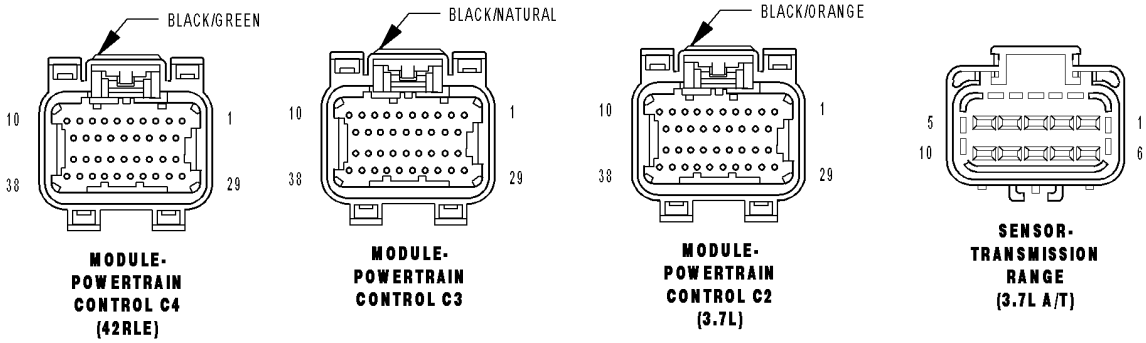
Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0713-TRANSMISSION TEMPERATURE SENSOR HIGH





MODULE-
POWERTRAIN
CONTROL C4
(42RLE)

MODULE-
POWERTRAIN
CONTROL C3

MODULE-
POWERTRAIN
CONTROL C2
(3.7L)

SENSOR-
TRANSMISSION
RANGE
(3.7L A/T)

814750ea

P0713-TRANSMISSION TEMPERATURE SENSOR HIGH (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set when the monitored Temperature Sensor voltage rises above 4.94 volts for the period of 1.45 seconds. When the fault is set, calculated temperature is substituted for measured temperature, however the fault code is stored only after three consecutive occurrences of the fault.

Possible Causes
(K900) SENSOR GROUND OPEN
(T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN
(T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The temperature sensor is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter operation and when or if some diagnostics are run. A failed temperature sensor could affect the OBD diagnostics. If a problem occurs in the transmission temperature sensor circuit, transmission temperature will be based on a calculated value.

1. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is STARTS SINCE SET counter 2 or less?

Yes >> Go To 2

No >> Go To 8

P0713-TRANSMISSION TEMPERATURE SENSOR HIGH (CONTINUED)

2. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match the scan tool readings ± 0.2 volts?

Yes >> Go To 3

No >> Go To 4

---

3. TRANSMISSION TEMPERATURE SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace Transmission Solenoid/TRS Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the TRS harness connector

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Tool #8815 to perform diagnosis.

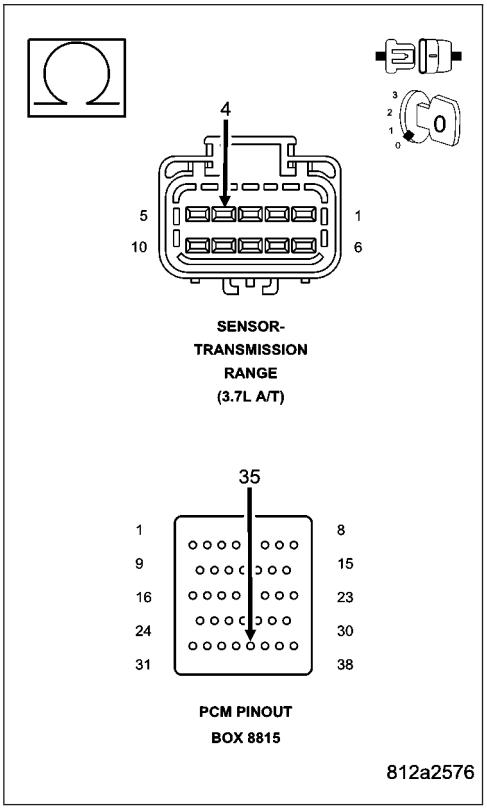
Measure the resistance of the Transmission Temperature Sensor Signal circuit from the appropriate terminal of special tool #8815 to the TRS harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the Transmission Temperature Sensor Signal circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5



P0713-TRANSMISSION TEMPERATURE SENSOR HIGH (CONTINUED)

5. (K900) SENSOR GROUND CIRCUIT OPEN

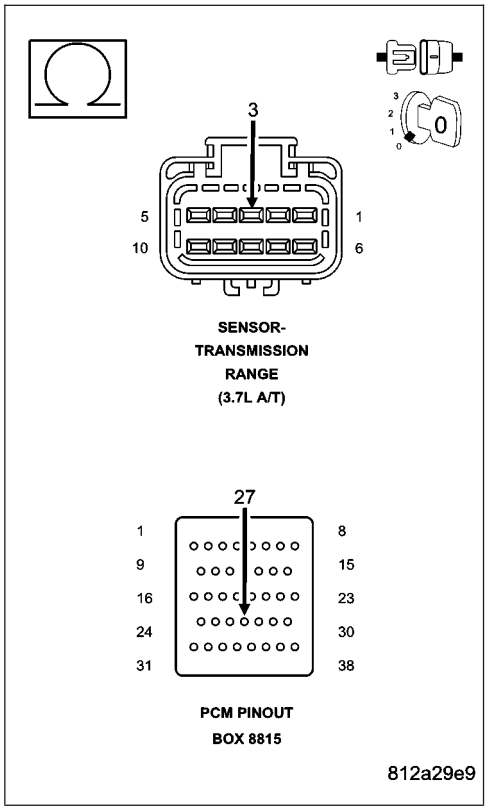
Disconnect the PCM C2 harness connector

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance of the (K900) Sensor Ground circuit from the appropriate terminal of special tool #8815 to the TRS harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (K900) Sensor Ground circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



P0713-TRANSMISSION TEMPERATURE SENSOR HIGH (CONTINUED)

6. (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

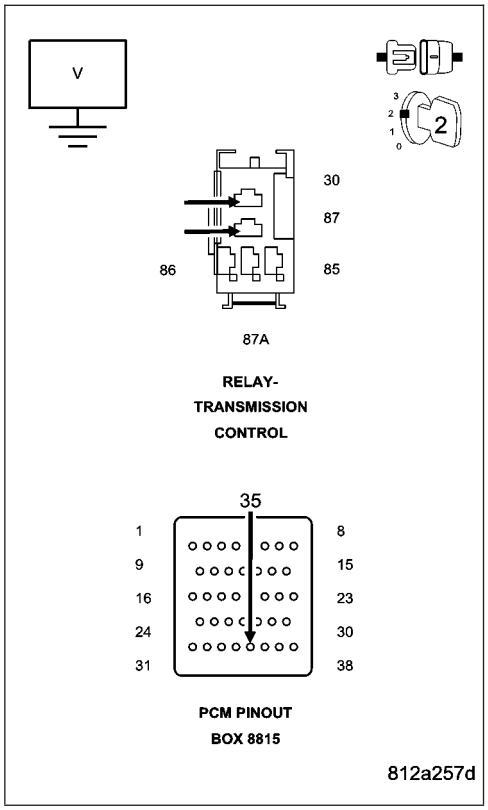
Ignition on, engine not running.

Measure the voltage of the (T54) Transmission Temperature Sensor Signal circuit in the appropriate terminal of special tool #8815.

Is the voltage above 0.5 volts?

Yes >> Repair the (T54) Transmission Temperature Sensor Signal circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7



---

7. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

8. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

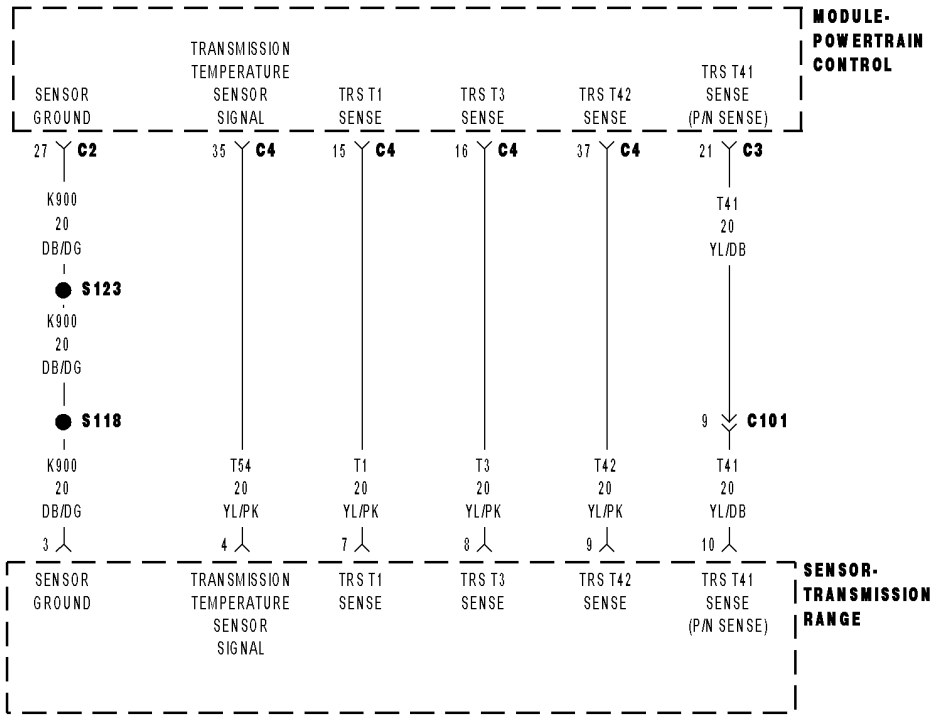
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

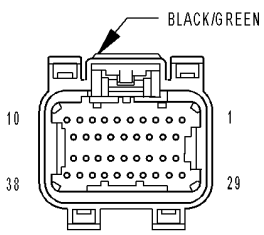
Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

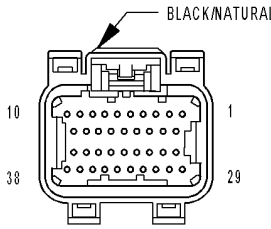
No >> Test Complete.

P0714-TRANSMISSION TEMPERATURE SENSOR INTERMITTENT

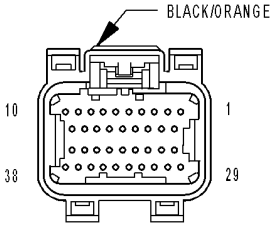




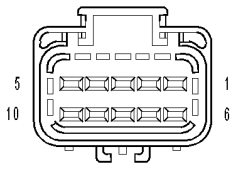
MODULE-
POWERTRAIN
CONTROL C4
(42RLE)



MODULE-
POWERTRAIN
CONTROL C3



MODULE-
POWERTRAIN
CONTROL C2
(3.7L)



SENSOR-
TRANSMISSION
RANGE
(3.7L A/T)

814750ea

P0714-TRANSMISSION TEMPERATURE SENSOR INTERMITTENT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set when the monitored Temperature Sensor voltage fluctuates or changes abruptly within a predetermined period of time.

Possible Causes
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The temperature sensor is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter operation and when or if some diagnostics are run. A failed temperature sensor could affect the OBD diagnostics. If a problem occurs in the transmission temperature sensor circuit, transmission temperature will be based on a calculated value.

1. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 2

No >> Go To 5

---

2. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: CAUTION: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

NOTE: Note: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool , monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match a non-fluctuating scan tool reading ± 0.2 volts?

Yes >> Go To 3

No >> Go To 4

P0714-TRANSMISSION TEMPERATURE SENSOR INTERMITTENT (CONTINUED)

3. TRANSMISSION TEMPERATURE SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace Transmission Solenoid/TRS Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

5. INTERMITTENT WIRING AND CONNECTORS

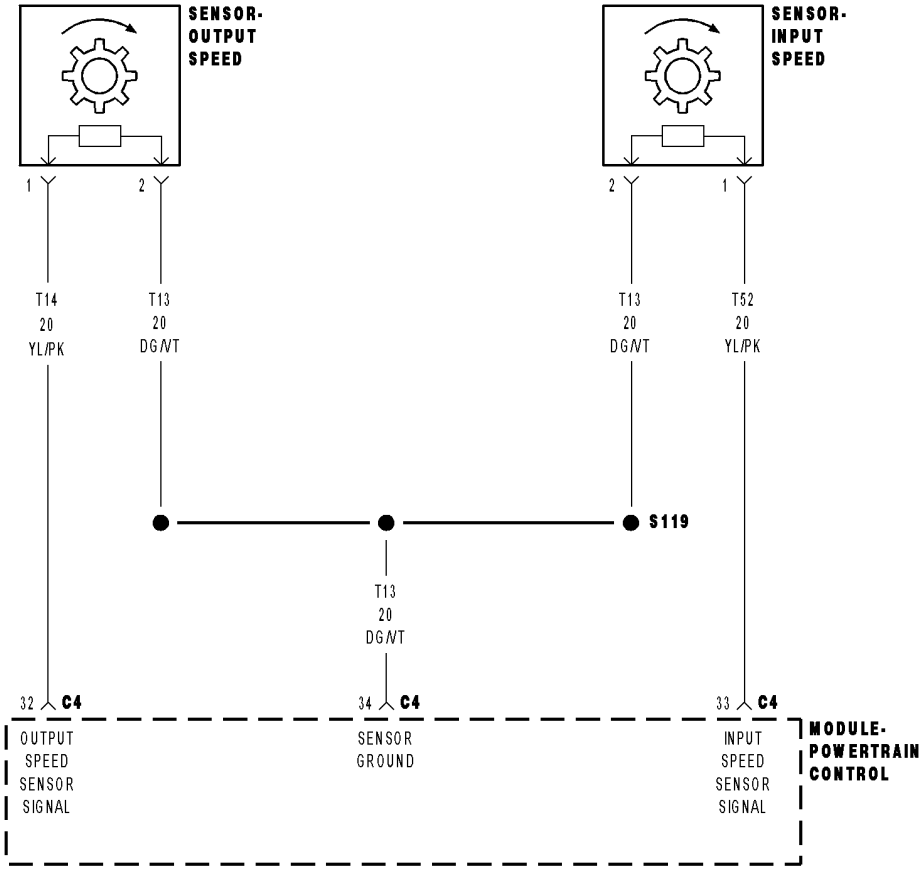
The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool , check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

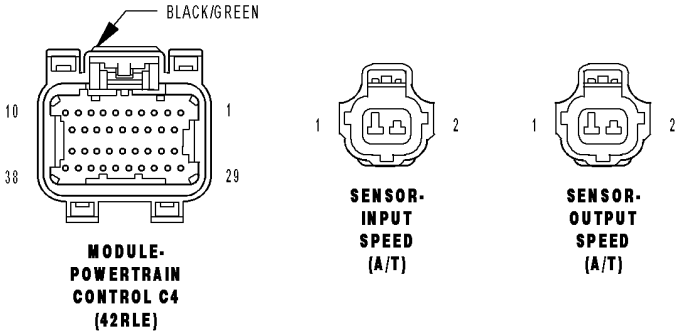
Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0715-INPUT SPEED SENSOR 1 CIRCUIT





8147515d

P0715-INPUT SPEED SENSOR 1 CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If there is an excessive change in the Input RPM in any valid gear (R, 1st, 2nd, 3rd, or 4th).

Possible Causes
(T52) INPUT SPEED SENSOR SIGNAL CIRCUIT OPEN
(T13) SPEED SENSOR GROUND CIRCUIT OPEN
(T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
INPUT SPEED SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through system checks.

Diagnostic Test

1. CHECK TO SEE IF DTC P0715 IS CURRENT

Start the engine.

Place the shifter in park.

With the scan tool , read the Input Speed Sensor RPM.

Is the Input Speed Sensor reading below 400 RPM?

Yes >> Go To 2

No >> Go To 10

P0715-INPUT SPEED SENSOR 1 CIRCUIT (CONTINUED)

2. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

Ignition on, engine not running.

With the Transmission Simulator, set the ″Input/Output Speed″ switch to ″ON″ and the rotary switch to the ″3000/1250″ position.

With the scan tool, read the Input and Output RPM.

Does the Input speed read 3000 RPM and the Output speed read 1250 RPM ± 50 RPM?

Yes >> Go To 3

No >> Go To 4

---

3. INPUT SPEED SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the Input Speed Sensor per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off to the lock position.

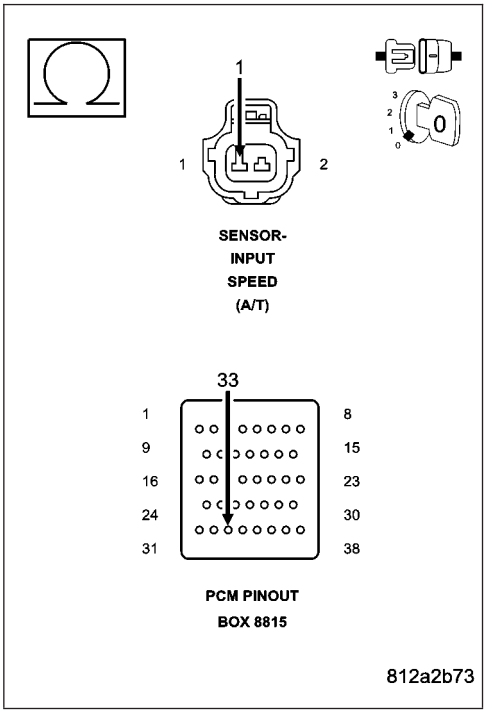
Disconnect the PCM C4 harness connector.

Disconnect the Input Speed Sensor harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (T52) Input Speed Sensor Signal circuit from the appropriate terminal of special tool #8815 to the Input Speed Sensor connector.



Is the resistance above 5.0 ohms?

Yes >> Repair the (T52) Input Speed Sensor Signal circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

P0715-INPUT SPEED SENSOR 1 CIRCUIT (CONTINUED)

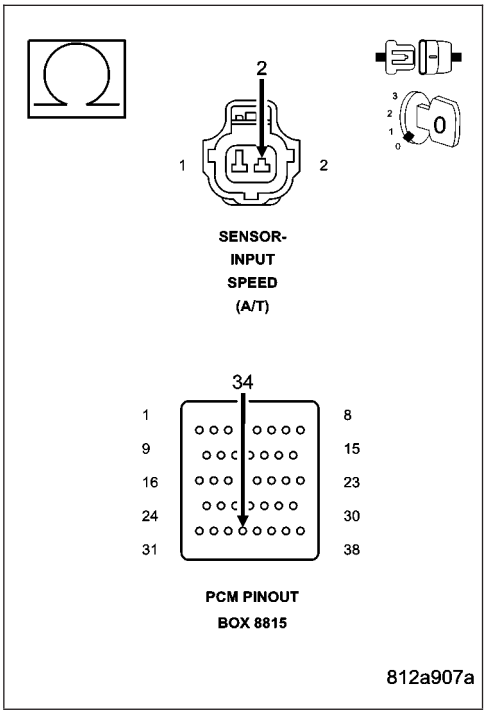
5. (T13) SPEED SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (T13) Speed Sensor Ground circuit from the from the appropriate terminal of special tool #8815 to the Input Speed Sensor harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T13) Speed Sensor Ground circuit for an open.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



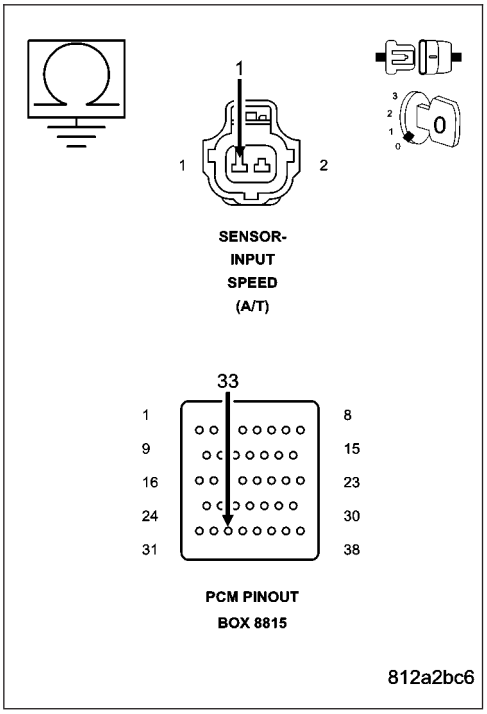
6. (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T52) Input Speed Sensor Signal circuit.

Is the resistance Below 5.0 ohms?

Yes >> Repair the (T52) Input Speed Sensor Signal circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7



P0715-INPUT SPEED SENSOR 1 CIRCUIT (CONTINUED)

7. (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Disconnect the Output Speed Sensor harness connector.

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Connect a jumper wire between the (A104) Fused B+ circuit and (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

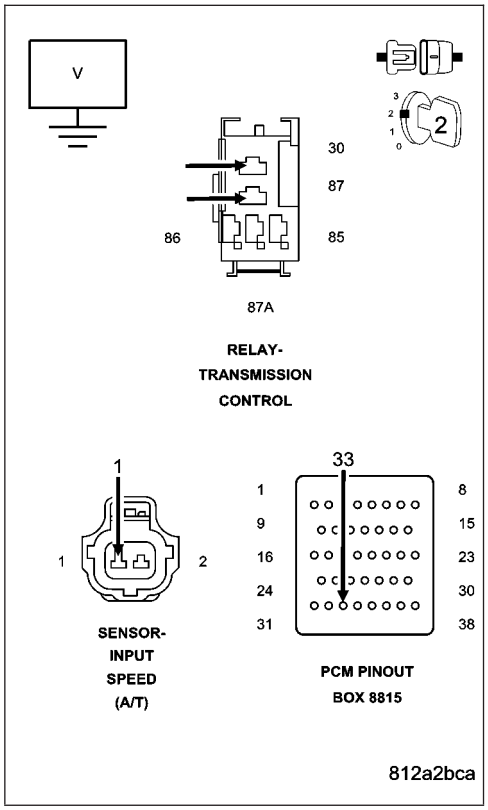
Ignition on, engine not running.

Measure the voltage of the (T52) Input Speed Sensor Signal circuit.

Is the voltage above 0.5 volt?

Yes >> Repair the (T52) Input Speed Sensor Signal circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8



8. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE

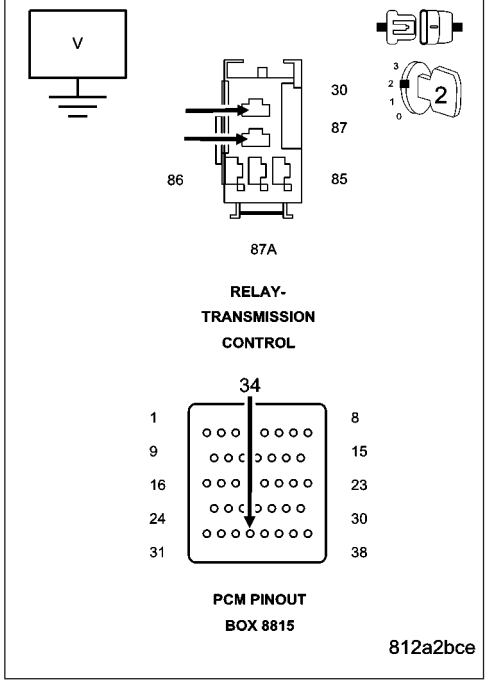
NOTE: The jumper wire must still be connected.

Measure the voltage of the (T13) Speed Sensor Ground circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T13) Speed Sensor Ground circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9



P0715-INPUT SPEED SENSOR 1 CIRCUIT (CONTINUED)

9. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

10. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

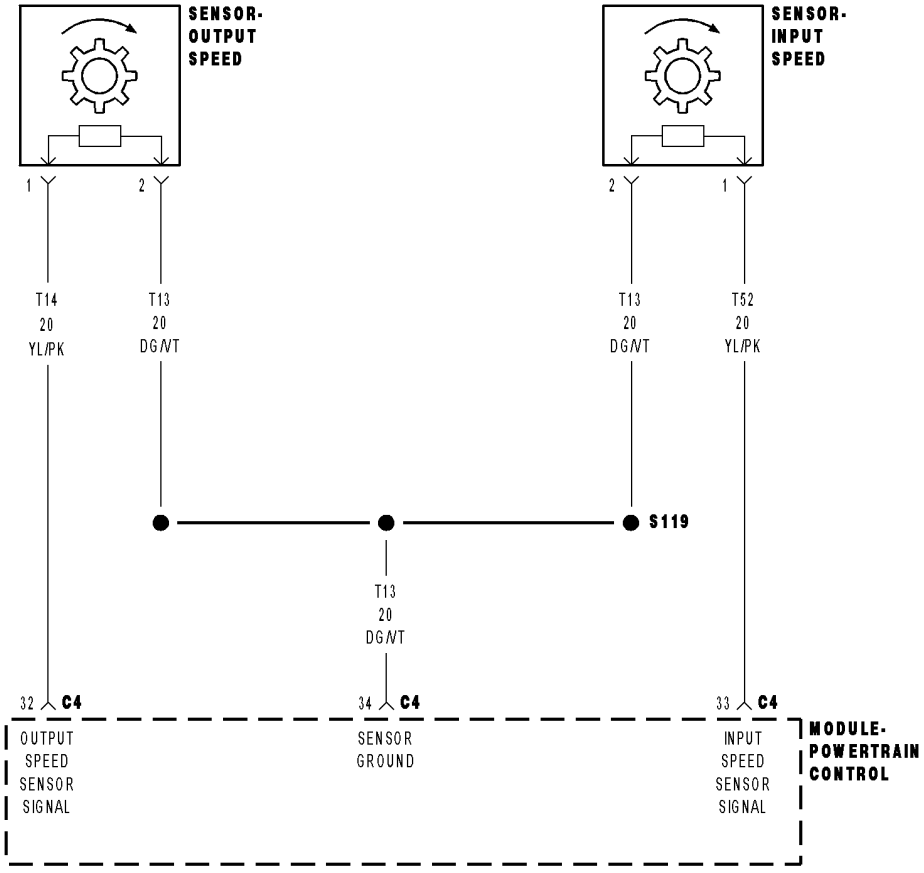
With the scan tool , check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

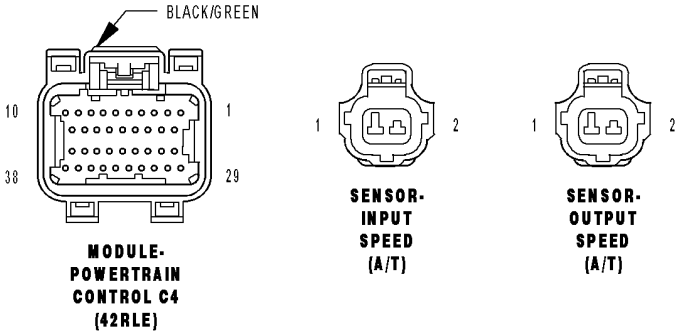
Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0720-OUTPUT SPEED SENSOR CIRCUIT





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42RLE MINI SPD SEN CKTS

P0720-OUTPUT SPEED SENSOR CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If there is an excessive change in the Output RPM in any gear.

Possible Causes
(T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT OPEN
(T13) SPEED SENSOR GROUND CIRCUIT OPEN
(T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
OUTPUT SPEED SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through system checks.

Diagnostic Test

1. CHECK TO SEE IF DTC P0720 IS CURRENT

Start the engine in park.

Raise the drive wheels off of the ground.

WARNING: Properly support the vehicle.

Firmly apply the brakes and place the transmission selector in drive.

WARNING: Be sure to keep hands and feet clear of rotating wheels.

Release the brakes and allow the drive wheels to spin freely.

NOTE: The drive wheels must be turning at this point.

With the scan tool, read the Output RPM

Is the Output RPM below 100?

Yes >> Go To 2

No >> Go To 10

P0720-OUTPUT SPEED SENSOR CIRCUIT (CONTINUED)

2. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

Ignition on, engine not running.

With the Transmission Simulator, set the ″Input/Output Speed″ switch to ″ON″ and the rotary switch to the ″3000/1250″ position.

With the scan tool , read the Input and Output RPM.

Does the Input RPM read 3000 and the Output RPM read 1250 (within 50 RPM)?

Yes >> Go To 3

No >> Go To 4

---

3. OUTPUT SPEED SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the Output Speed Sensor per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off to the lock position.

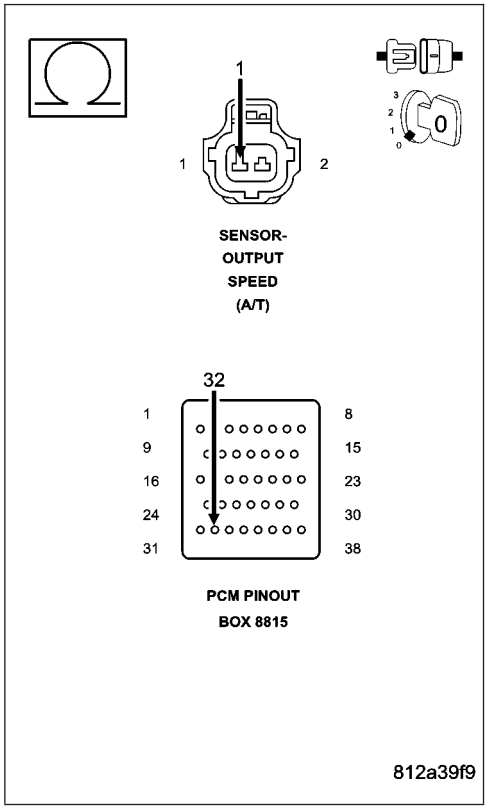
Disconnect the PCM C4 harness connector.

Disconnect the Output Speed Sensor harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (T14) Output Speed Sensor Signal circuit from appropriate terminal of special tool #8815 to the Output Speed Sensor harness connector.



Is the resistance above 5.0 ohms?

Yes >> Repair the (T14) Output Speed Sensor Signal circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

P0720-OUTPUT SPEED SENSOR CIRCUIT (CONTINUED)

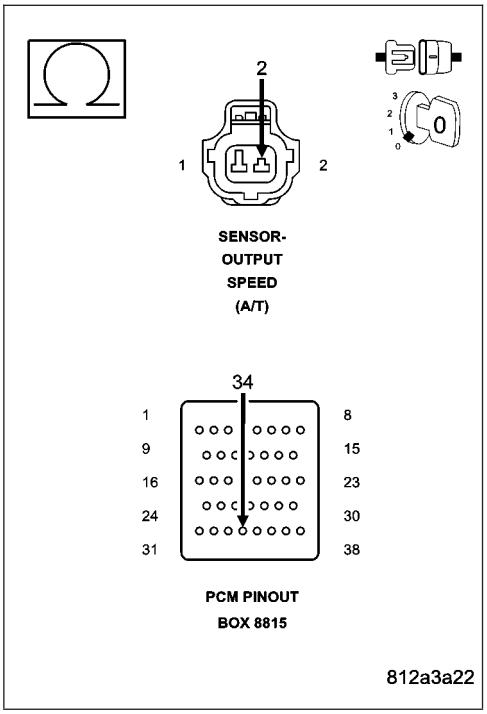
5. (T13) SPEED SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the Speed Sensor Ground circuit from the appropriate terminal of special tool #8815 to the Output Speed Sensor harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T13) Speed Sensor Ground circuit for an open.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



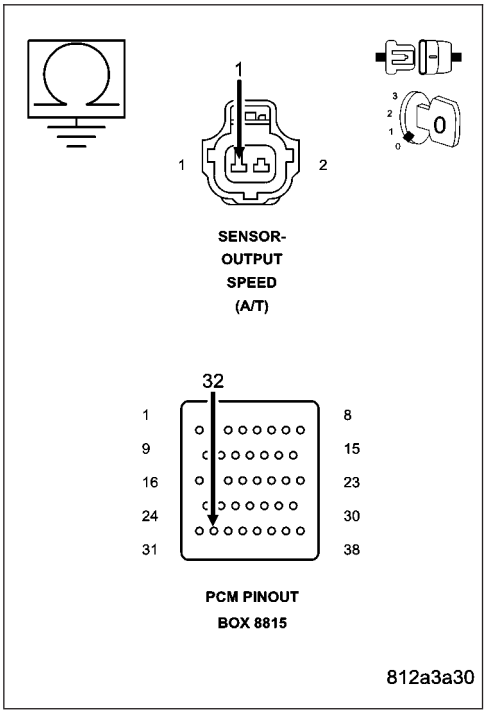
6. (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T14) Output Speed Sensor Signal circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T14) Output Speed Sensor Signal circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7



P0720-OUTPUT SPEED SENSOR CIRCUIT (CONTINUED)

7. (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.
Connect a jumper wire between the (A104) Fused B+ circuit and (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

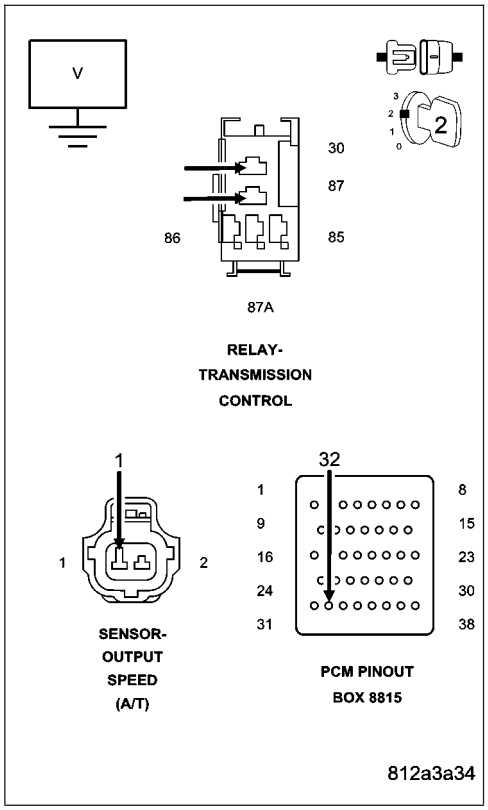
Ignition on, engine not running.

Measure the voltage of the (T14) Output Speed Sensor Signal circuit.

Is the voltage above 0.5 volt?

Yes >> Repair the (T14) Output Speed Sensor Signal circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8



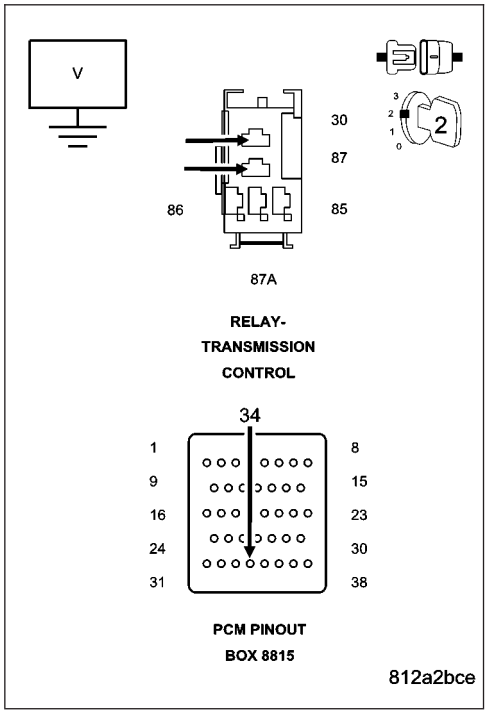
8. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE

NOTE: The jumper wire must still be connected.
Measure the voltage of the (T13) Speed Sensor Ground circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T13) Speed Sensor Ground circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9



P0720-OUTPUT SPEED SENSOR CIRCUIT (CONTINUED)

9. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

10. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool , check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0725-ENGINE SPEED SENSOR CIRCUIT

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running.
- **Set Condition:**
  The Engine RPM is less than 390 or greater than 8000 for more than 2 seconds while the engine is running.

Possible Causes
ENGINE DTCS PRESENT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The PCM uses a dual port RAM internal to the controller to send the engine speed signal to the Transmission Control System. The calculated engine RPM is compared to a minimum and maximum value. If the PCM interprets this signal to be out of range when the engine is running the code is set. The MIL illuminates after 10 seconds of vehicle operation and the transmission system defaults to Limp-in mode.

Diagnostic Test

1. CONDITION FOR DTC P0725 IS PRESENT

Start the engine.

NOTE: This DTC is not a Transmission Input Speed Sensor DTC.
With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter set at 0?

Yes >> Go To 2

No >> Go To 4

---

2. ENGINE DTCS PRESENT

With the scan tool, read Engine DTCs.

Are there any Engine DTC's present?

Yes >> Refer to Section 9 – Engine Electrical Diagnostics and perform the appropriate diagnostic procedure. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

P0725-ENGINE SPEED SENSOR CIRCUIT (CONTINUED)

3. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN, then program the Pinion Factor in the Front Control Module.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0731-GEAR RATIO ERROR IN 1ST

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio when compared to the known gear ratio.

Possible Causes
RELATED TRANSMISSION DTCS PRESENT
INTERMITTENT GEAR RATIO ERRORS
INTERNAL TRANSMISSION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into Limp-in mode after four gear ratio error events occur in a given driving cycle.

Diagnostic Test

1. DETERMINING IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCs.

If any of these DTCs are present, perform their respective tests first.

Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCs present?

Yes >> Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTC's are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF P0731 IS CURRENT

With the scan tool, perform the 1st gear clutch test. Follow the instructions on the scan tool.

Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

Did the Clutch Test pass, Input Speed remain at zero?

Yes >> Go To 3

No >> Go To 4

P0731-GEAR RATIO ERROR IN 1ST (CONTINUED)

3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Relay.

CAUTION: removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Check the wiring and connectors for the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

This DTC can also be set under extreme temperature conditions. This is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

---

4. INTERNAL TRANSMISSION

If there are no possible causes remaining, view repair.

Repair

Repair internal Transmission per the Service Information. Check all of the components related to the UD and LR clutches. Inspect the Oil Pump and repair or replace per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0732-GEAR RATIO ERROR IN 2ND

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio when compared to the known gear ratio.

Possible Causes
RELATED TRANSMISSION DTCS PRESENT
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
INTERMITTENT GEAR RATIO ERRORS
INTERNAL TRANSMISSION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into Limp-in mode after four gear ratio error events occur in a given driving cycle.

Diagnostic Test

1. DETERMINING IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCs.

If any of these DTCs are present, perform their respective tests first.

Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCs present?

Yes >> Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTCs are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF P0732 IS CURRENT

With the scan tool, perform the 2nd gear clutch test. Follow the instructions on the scan tool.

Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

Did the Clutch Test pass, Input Speed remain at zero?

Yes >> Go To 3

No >> Go To 4

P0732-GEAR RATIO ERROR IN 2ND (CONTINUED)

3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Relay.

CAUTION: removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Check the wiring and connectors to the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

This DTC can also be set under extreme temperature conditions. This is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

---

4. CHECK FOR RELATED PRESSURE SWITCH DTC'S

With the scan tool, read Transmission DTC's.

Are the DTC's P0845 and/or P0846 present also?

Yes >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

---

5. INTERNAL TRANSMISSION

If there are no possible causes remaining, view repair.

Repair

Repair internal Transmission per the Service Information. Check all of the components related to the UD and 2/4 clutches. Inspect the Oil Pump and repair or replace per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0733-GEAR RATIO ERROR IN 3RD

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio when compared to the known gear ratio.

Possible Causes
RELATED TRANSMISSION DTCS PRESENT
INTERMITTENT GEAR RATIO ERRORS
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
INTERNAL TRANSMISSION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into Limp-in mode after four gear ratio error events occur in a given driving cycle.

Diagnostic Test

1. DETERMINING IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCs.

If any of these DTCs are present, perform their respective tests first.

Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCs present?

Yes >> Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTCs are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF P0733 IS CURRENT

With the scan tool, perform the 3rd gear clutch test. Follow the instructions on the scan tool.

Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

Did the Clutch Test pass, Input Speed remain at zero?

Yes >> Go To 3

No >> Go To 4

P0733-GEAR RATIO ERROR IN 3RD (CONTINUED)

3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Relay.

CAUTION: removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Check the wiring and connectors for the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

---

4. CHECK FOR RELATED PRESSURE SWITCH DTCS

With the scan tool, read Transmission DTCs.

Are the DTCs P0870 and/or P0871 present also?

Yes >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

---

5. INTERNAL TRANSMISSION

If there are no possible causes remaining, view repair.

Repair

Repair internal Transmission per the Service Information. Check all of the components related to the UD and O/D clutches. Inspect the Oil Pump and repair or replace per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0734-GEAR RATIO ERROR IN 4TH

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio when compared to the known gear ratio.

Possible Causes
RELATED TRANSMISSION DTCS PRESENT
INTERMITTENT GEAR RATIO ERRORS
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
INTERNAL TRANSMISSION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into Limp-in mode after four gear ratio error events occur in a given driving cycle.

Diagnostic Test

1. DETERMINING IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCs.

If any of these DTCs are present, perform their respective tests first.

Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCs present?

Yes >> Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTCs are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF P0733 IS CURRENT

With the scan tool, perform the 4th gear clutch test. Follow the instructions on the scan tool.

Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

Did the Clutch Test pass, Input Speed remain at zero?

Yes >> Go To 3

No >> Go To 4

P0734-GEAR RATIO ERROR IN 4TH (CONTINUED)

3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTC's can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets a Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Check the wiring and connectors for the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

---

4. CHECK FOR RELATED PRESSURE SWITCH DTC'S

With the scan tool, read Transmission DTC's.

Are the DTC's P0870 and/or P0871 present also?

Yes >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

---

5. INTERNAL TRANSMISSION

If there are no possible causes remaining, view repair.

Repair

Repair internal Transmission per the Service Information. Check all of the components related to the O/D and 2/4 clutches. Inspect the Oil Pump and repair or replace per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0736-GEAR RATIO ERROR IN REVERSE

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio when compared to the known gear ratio.

Possible Causes
RELATED TRANSMISSION DTCS PRESENT
INTERMITTENT GEAR RATIO ERRORS
INTERNAL TRANSMISSION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into Limp-in mode after four gear ratio error events occur in a given driving cycle.

Diagnostic Test

1. DETERMINING IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCs.

If any of these DTCs are present, perform their respective tests first.

Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCs present?

Yes >> Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTCs are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF P0731 IS CURRENT

With the scan tool, perform the Reverse gear clutch test. Follow the instructions on the scan tool.

Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

Did the Clutch Test pass, Input Speed remain at zero?

Yes >> Go To 3

No >> Go To 4

P0736-GEAR RATIO ERROR IN REVERSE (CONTINUED)

3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Check the wiring and connectors for the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

---

4. INTERNAL TRANSMISSION

If there are no possible causes remaining, view repair.

Repair

Repair internal Transmission per the Service Information. Check all of the components related to the Reverse and LR clutches. Inspect the Oil Pump and repair or replace per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0740-TCC OUT OF RANGE

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Torque Converter Clutch (TCC) is in FEMCC or PEMCC, Transmission temperature is hot, Engine temperature is greater than 38° C or 100° F, Transmission Input Speed greater than engine speed, TPS less than 30°, and brake not applied.
- **Set Condition:**
  The TCC is modulated by controlling the duty cycle of the L/R Solenoid until the difference between the Engine RPM and the Transmission Input Speed RPM or duty cycle is within a desired range. The DTC is set after the period of 10 seconds and 3 occurrences of either: FEMCC - with slip greater than 100 RPM or PEMCC - duty cycle greater than 85%.

Possible Causes
RELATED L/R SOLENOID OR PRESSURE SWITCH DTCS PRESENT
INTERNAL TRANSMISSION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

When in 2nd, 3rd, or 4th gear, the torque converter clutch (TCC) can be locked or partially locked when certain conditions are met. The TCC piston is electronically modulated by increasing the duty cycle of the LR/TCC solenoid until the torque converter slip difference (difference between engine and turbine speed) is within 60 RPM. Then the LR/TCC solenoid is fully energized (FEMCC / 100% duty cycle). Torque converter slip is monitored in FEMCC to ensure adequate clutch capacity. The transmission will attempt normal EMCC operation (not in Limp-in) even after the MIL is illuminated. MIL will illuminate after 5 minutes of accumulated slip in FEMCC.

Diagnostic Test

1. RELATED L/R SOLENOID OR PRESSURE SWITCH DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

Are the DTCs P0750 and/or P0841 present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0740-TCC OUT OF RANGE (CONTINUED)

2. CHECK TO SEE IF DTC P0740 IS CURRENT

Ignition on, engine not running.

With the scan tool, record and erase DTCs.

Drive the vehicle until it is fully warmed up to at least 110 degrees (F).

Perform the following step 3 times.

Drive the vehicle at 50 MPH and allow 4th gear to engage for at least 10 seconds. Close the throttle, then tip back in until the throttle angle is between 25 and 29 degrees. Note that if you go over 30 degrees, you must back off of the throttle and retry.

Did the TCC engage during any of the attempts?

Yes >> Go To 4

No >> Go To 3

---

3. INTERNAL TRANSMISSION

If there are no possible causes remaining, view repair.

Repair

Perform the Hydraulic Pressure test per the Service Information and repair the internal transmission components and Torque convertor as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

This DTC can also be set under extreme temperature conditions. This is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

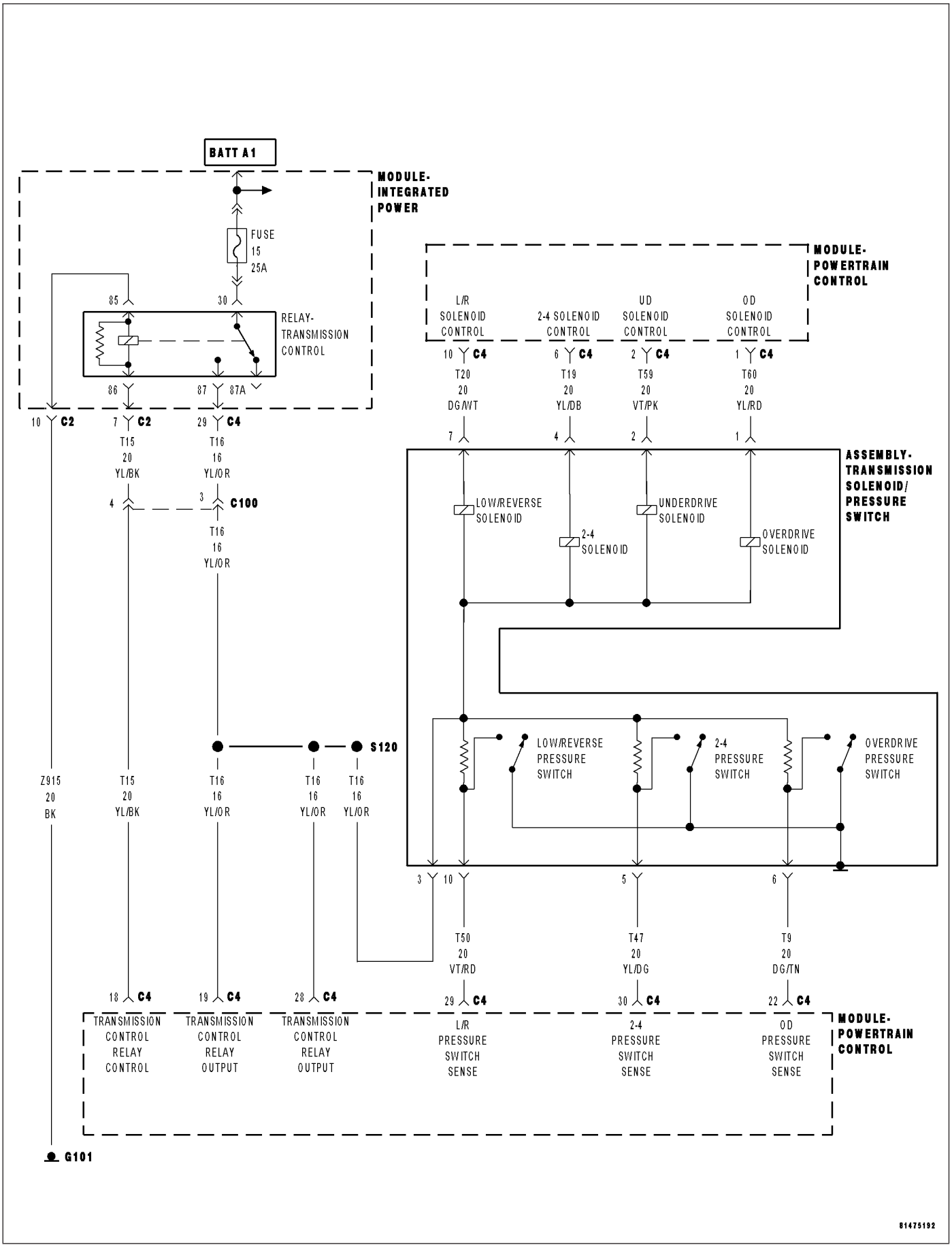
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0750-LR SOLENOID CIRCUIT



P0750-LR SOLENOID CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Initially at ignition on, then every 10 seconds thereafter. The solenoids will also be tested immediately after a gear ratio error or pressure switch error is detected.
- **Set Condition:**
  Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

Possible Causes
RELATED TRANSMISSION RELAY DTCS PRESENT
(T20) LR SOLENOID CONTROL CIRCUIT OPEN
(T20) LR SOLENOID CONTROL CIRCUIT SHORT TO GROUND
(T20) LR SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

Four solenoids are used to control the friction elements (clutches). The continuity of the solenoids circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the PCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a gear ratio or pressure switch error occurs. In this case, one failure will result in the appropriate DTC being set. The MIL will illuminate and the transmission goes into neutral, if the DTC is set above 35 Km/h (22 MPH), Limp-in mode when vehicle speed is below 35 Km/h (22 MPH).

Diagnostic Test

1. DETERMINING IF RELATED RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

Are there any Transmission Control Relay DTCs present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF P0750 IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter for P0750 set at 0?

Yes >> Go To 3

No >> Go To 9

P0750-LR SOLENOID CIRCUIT (CONTINUED)

3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

Ignition on, engine not running.

With the scan tool, actuate the L/R Solenoid.

Monitor the L/R Solenoid LED on the Transmission Simulator.

Did the L/R Solenoid LED on the Transmission Simulator blink on and off during actuation?

Yes >> Go To 7

No >> Go To 4

---

4. (T20) LR SOLENOID CONTROL CIRCUIT OPEN

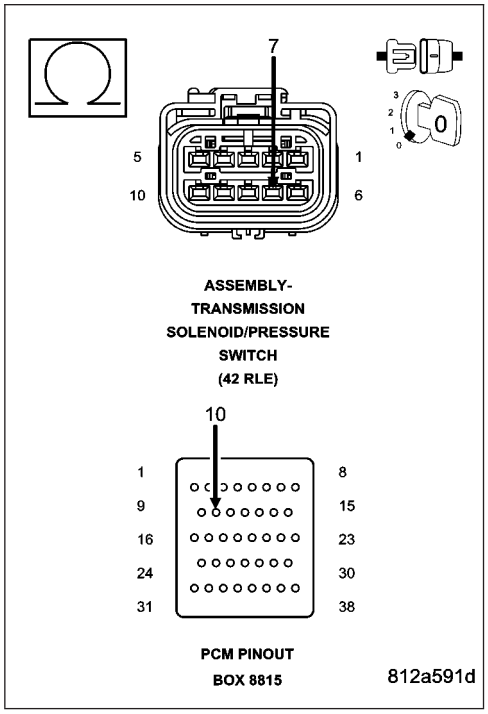
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (T20) LR Solenoid Control circuit from the appropriate terminal of special tool #8815 to the Solenoid/Pressure Switch Assembly harness connector.



Is the resistance above 5.0 ohms?

Yes >> Repair the (T20) LR Solenoid Control circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

P0750-LR SOLENOID CIRCUIT (CONTINUED)

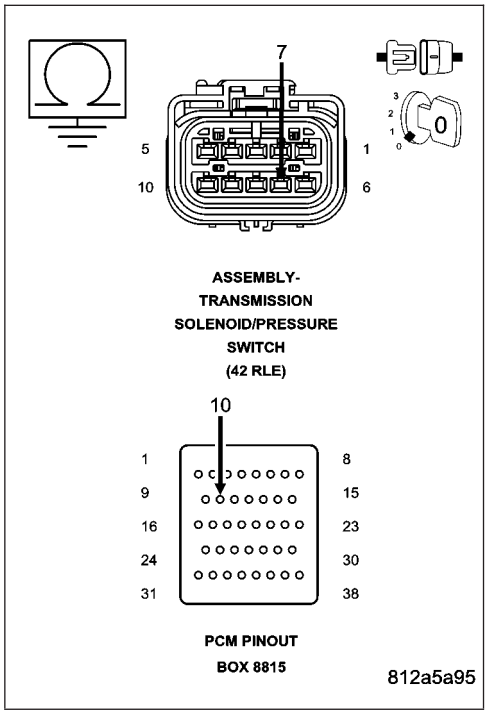
5. (T20) LR SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T20) LR Solenoid Control circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T20) LR Solenoid Control circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



6. (T20) LR SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.
Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

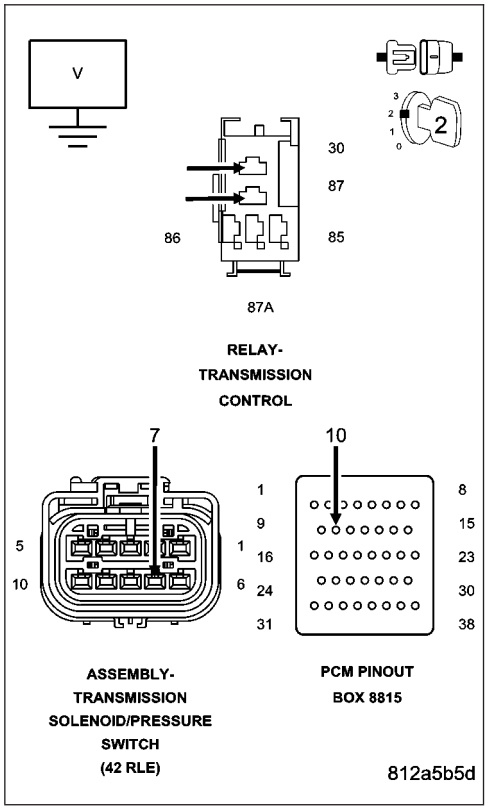
Ignition on, engine not running.

Measure the voltage of the (T20) LR Solenoid Control circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T20) LR Solenoid Control circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8



P0750-LR SOLENOID CIRCUIT (CONTINUED)

7. LR SOLENOID/PRESSURE SWITCH ASSEMBLY

If there are no possible causes remaining, view repair.

Repair

Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

8. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

9. INTERMITTENT WIRING AND CONNECTORS

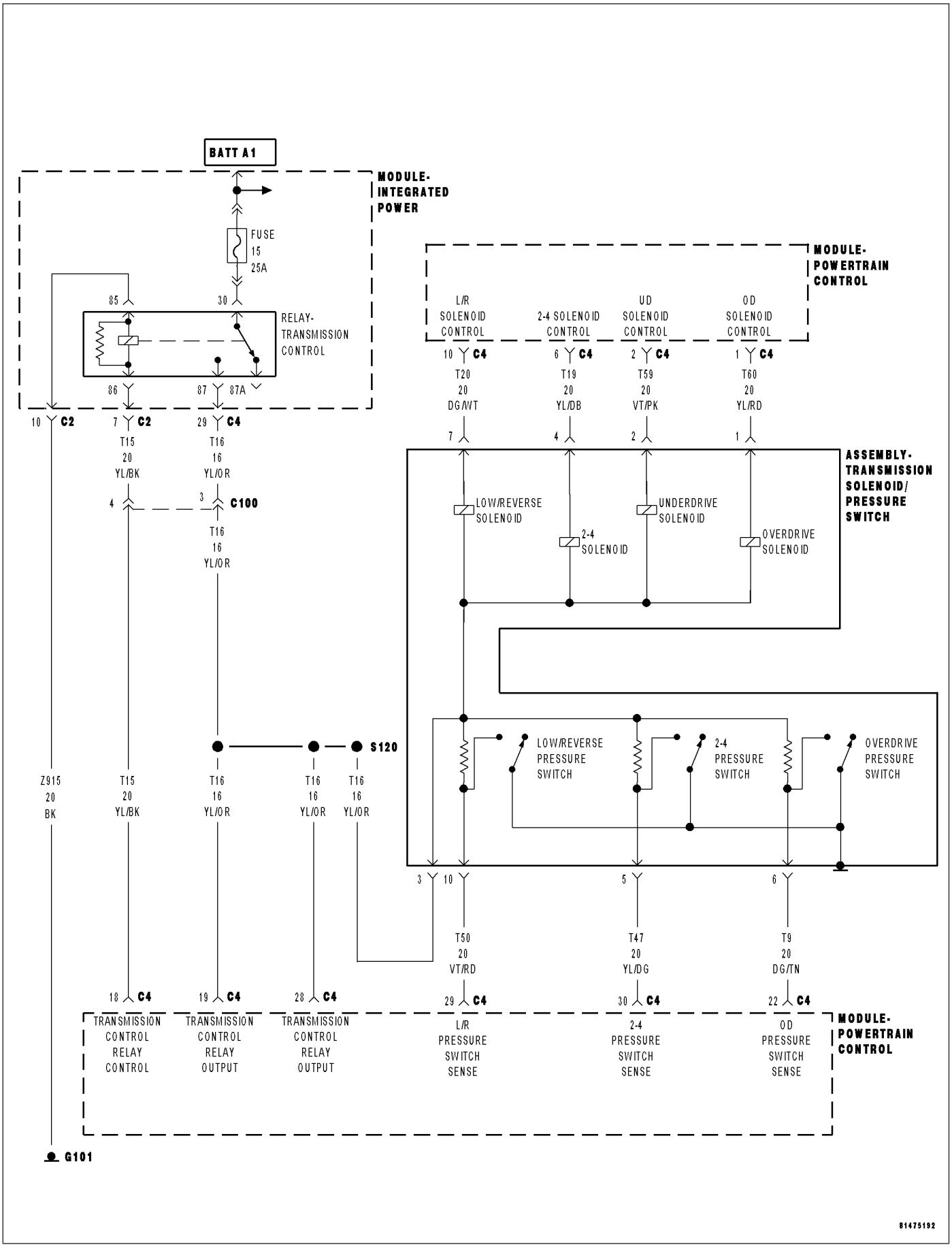
The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0755-2/4 SOLENOID CIRCUIT



P0755-2/4 SOLENOID CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Initially at ignition on, then every 10 seconds thereafter. The solenoids will also be tested immediately after a gear ratio error or pressure switch error is detected.
- **Set Condition:**
  Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

Possible Causes
RELATED TRANSMISSION RELAY DTCS PRESENT
(T19) 2/4 SOLENOID CONTROL CIRCUIT OPEN
(T19) 2/4 SOLENOID CONTROL CIRCUIT SHORT TO GROUND
(T19) 2/4 SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

Four solenoids are used to control the friction elements (clutches). The continuity of the solenoids circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the PCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a gear ratio or pressure switch error occurs. In this case, one failure will result in the appropriate DTC being set. The MIL will illuminate and the transmission goes into neutral, if the DTC is set above 35 Km/h (22 MPH), Limp-in mode when vehicle speed is below 35 Km/h (22 MPH).

Diagnostic Test

1. DETERMINING IF RELATED TRANSMISSION RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

Are there any Transmission Control Relay DTCs present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF P0755 IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter set to 0?

Yes >> Go To 3

No >> Go To 9

P0755-2/4 SOLENOID CIRCUIT (CONTINUED)

3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

Ignition on, engine not running.

With the scan tool, actuate the 2/4 Solenoid.

Monitor the 2/4 Solenoid LED on the Transmission Simulator.

Did the 2/4 Solenoid LED on the Transmission Simulator blink on and off during actuation?

Yes >> Go To 7

No >> Go To 4

---

4. (T19) 2/4 SOLENOID CONTROL CIRCUIT OPEN

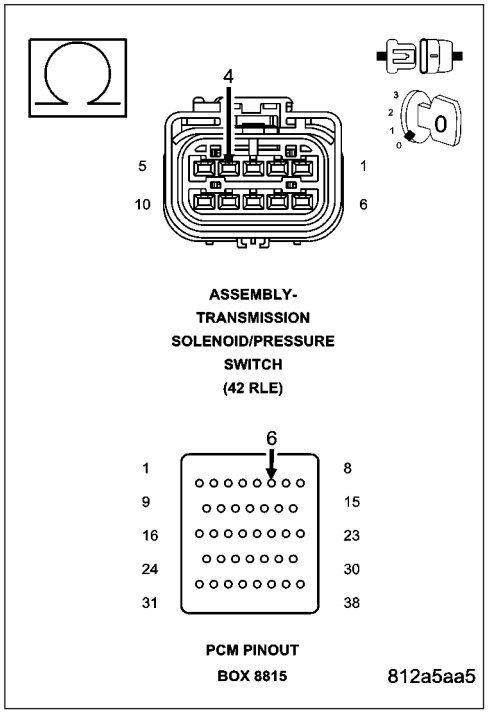
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (T19) 2/4 Solenoid Control circuit from the appropriate terminal of special tool #8815 to the Solenoid/Pressure Switch Assembly harness connector.



Is the resistance above 5.0 ohms?

Yes >> Repair the (T19) 2/4 Solenoid Control circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

P0755-2/4 SOLENOID CIRCUIT (CONTINUED)

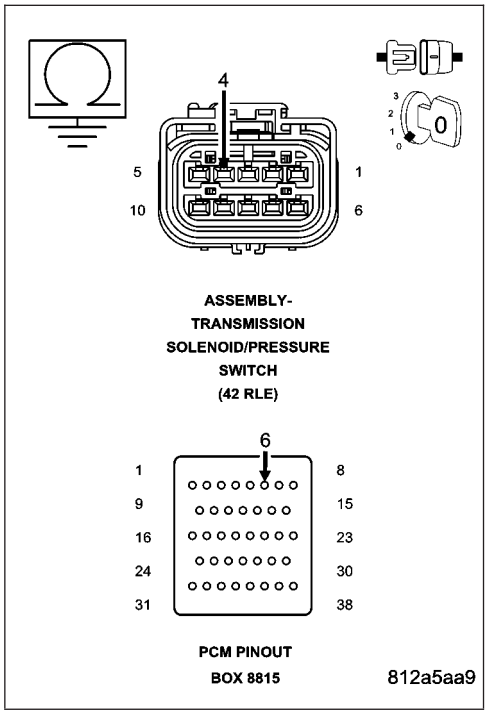
5. (T19) 2/4 SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T19) 2/4 Solenoid Control circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T19) 2/4 Solenoid Control circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



6. (T19) 2/4 SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.
Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

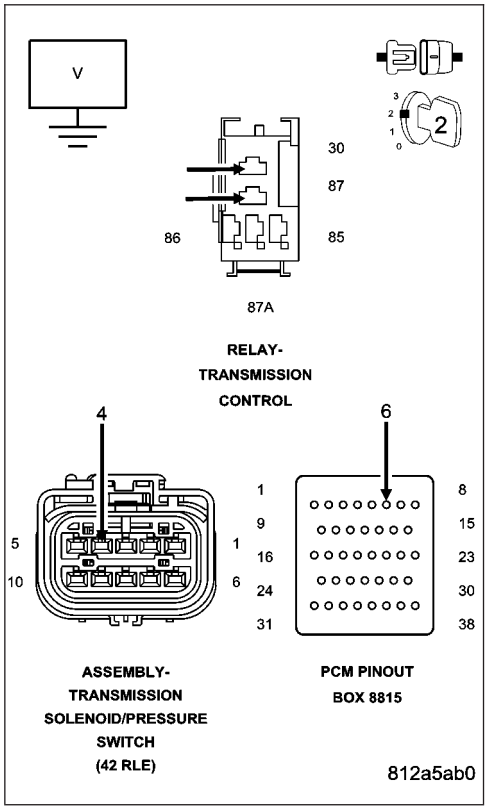
Ignition on, engine not running.

Measure the voltage of the (T19) 2/4 Solenoid Control circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T19) 2/4 Solenoid Control circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8



P0755-2/4 SOLENOID CIRCUIT (CONTINUED)

7. 2/4 SOLENOID/PRESSURE SWITCH ASSEMBLY

If there are no possible causes remaining, view repair.

Repair

Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

8. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

9. INTERMITTENT WIRING AND CONNECTORS

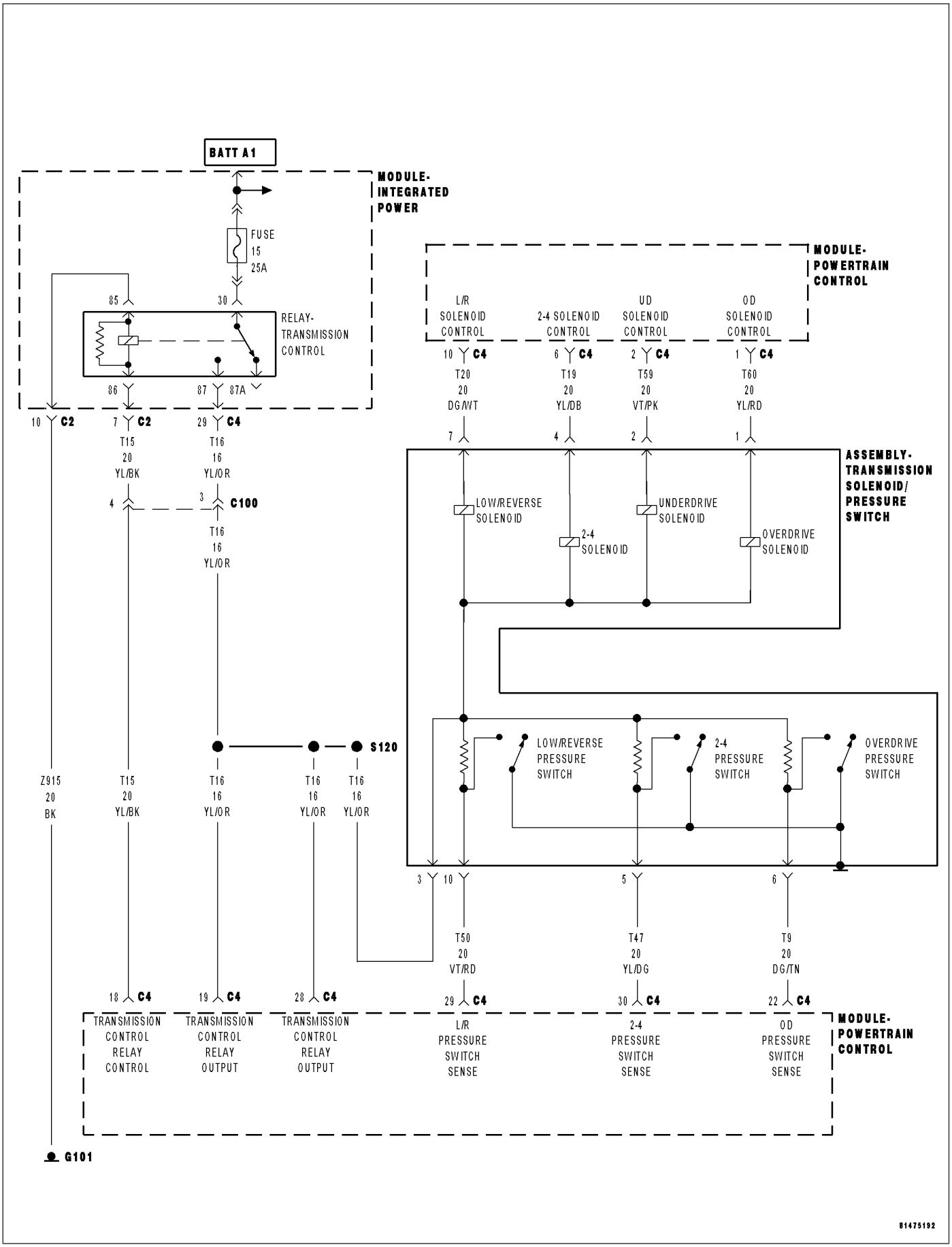
The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0760-OD SOLENOID CIRCUIT



P0760-OD SOLENOID CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Initially at ignition on, then every 10 seconds thereafter. The solenoids will also be tested immediately after a gear ratio error or pressure switch error is detected.
- **Set Condition:**
  Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

Possible Causes
RELATED TRANSMISSION RELAY DTC'S PRESENT
(T60) OD SOLENOID CONTROL CIRCUIT OPEN
(T60) OD SOLENOID CONTROL CIRCUIT SHORT TO GROUND
(T60) OD SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

Four solenoids are used to control the friction elements (clutches). The continuity of the solenoid circuits is periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the PCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a gear ratio or pressure switch error occurs. In this case, one failure will result in the appropriate DTC being set. The MIL will illuminate and the transmission goes into neutral, if the DTC is set above 35 Km/h (22 MPH), Limp-in mode when vehicle speed is below 35 Km/h (22 MPH).

Diagnostic Test

1. DETERMINING IF RELATED RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

Are there any Transmission Control Relay DTCs present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF P0760 IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter set to 0?

Yes >> Go To 3

No >> Go To 9

P0760-OD SOLENOID CIRCUIT (CONTINUED)

3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

Ignition on, engine not running.

With the scan tool, actuate the OD Solenoid.

Monitor the OD Solenoid LED on the Transmission Simulator.

Did the OD Solenoid LED on the Transmission Simulator blink on and off during actuation?

Yes >> Go To 7

No >> Go To 4

---

4. (T60) OD SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off to the lock position.

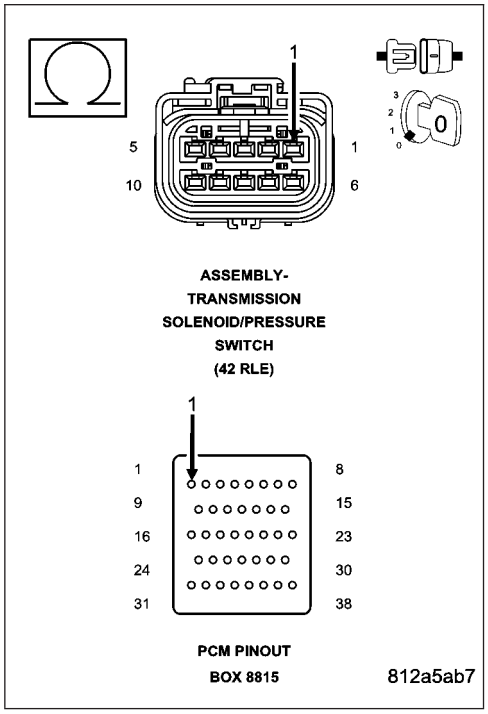
Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (T60) OD Solenoid Control circuit from the appropriate terminal of special tool #8815 to the Solenoid/Pressure Switch Assembly harness connector.



Is the resistance above 5.0 ohms?

Yes >> Repair the (T60) OD Solenoid Control circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

P0760-OD SOLENOID CIRCUIT (CONTINUED)

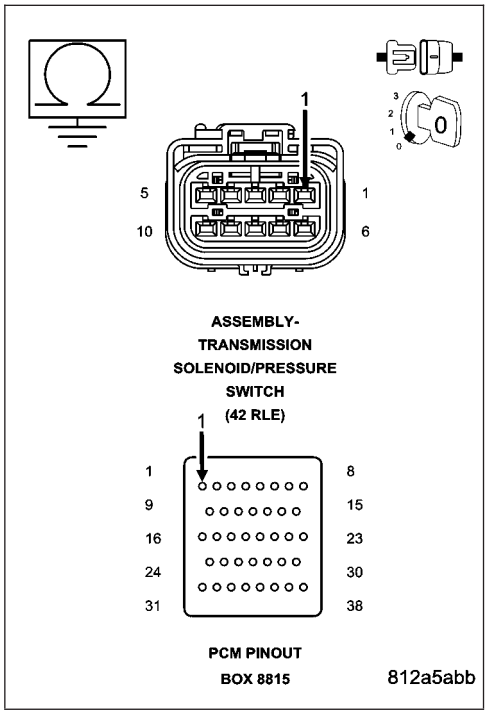
5. (T60) OD SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T60) OD Solenoid Control circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T60) OD Solenoid Control circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



6. (T60) OD SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.
Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

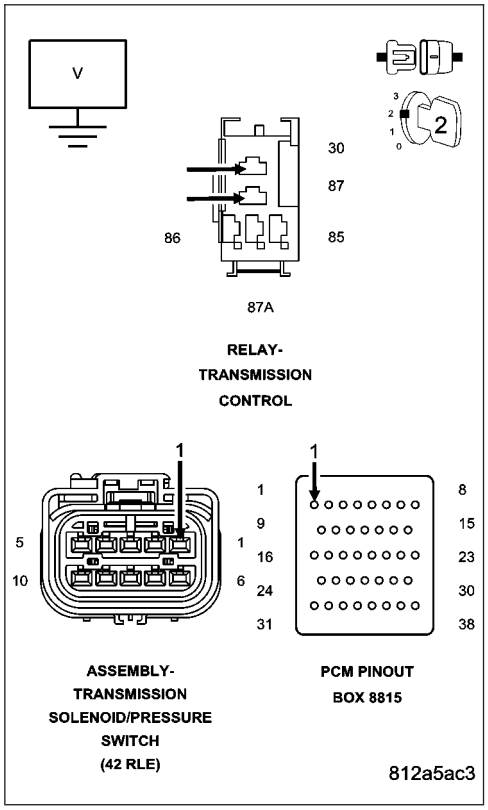
Ignition on, engine not running.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the voltage of the (T60) OD Solenoid Control circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T60) OD Solenoid Control circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8



P0760-OD SOLENOID CIRCUIT (CONTINUED)

7. OD SOLENOID/PRESSURE SWITCH ASSEMBLY

If there are no possible causes remaining, view repair.

Repair

Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

8. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

9. INTERMITTENT WIRING AND CONNECTORS

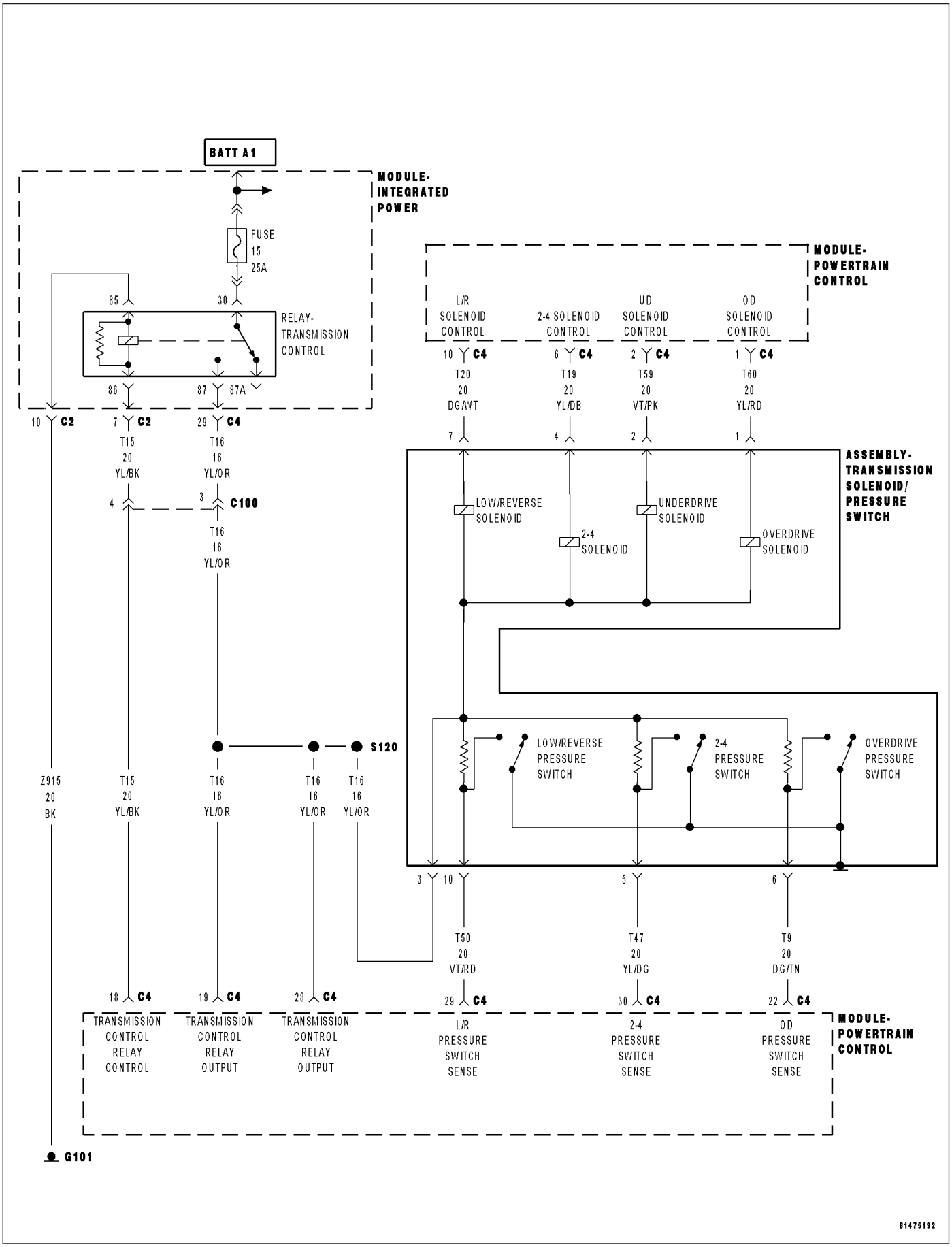
The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0765-UD SOLENOID CIRCUIT



P0765-UD SOLENOID CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Initially at ignition on, then every 10 seconds thereafter. The solenoids will also be tested immediately after a gear ratio error or pressure switch error is detected.
- **Set Condition:**
  Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

Possible Causes
RELATED TRANSMISSION RELAY DTCS PRESENT
(T59) UD SOLENOID CONTROL CIRCUIT OPEN
(T59) UD SOLENOID CONTROL CIRCUIT SHORT TO GROUND
(T59) UD SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

Four solenoids are used to control the friction elements (clutches). The continuity of the solenoid circuits is periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the PCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a gear ratio or pressure switch error occurs. In this case, one failure will result in the appropriate DTC being set. The MIL will illuminate and the transmission goes into neutral, if the DTC is set above 35 Km/h (22 MPH), Limp-in mode when vehicle speed is below 35 Km/h (22 MPH).

Diagnostic Test

1. DETERMINING IF RELATED RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

Are there any Transmission Control Relay DTCs present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF P0765 IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter set to 0?

Yes >> Go To 3

No >> Go To 9

P0765-UD SOLENOID CIRCUIT (CONTINUED)

3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

Ignition on, engine not running.

With the scan tool, actuate the UD Solenoid.

Monitor the UD Solenoid LED on the Transmission Simulator.

Did the UD Solenoid LED on the Transmission Simulator blink on and off during actuation?

Yes >> Go To 7

No >> Go To 4

---

4. (T59) UD SOLENOID CONTROL CIRCUIT OPEN

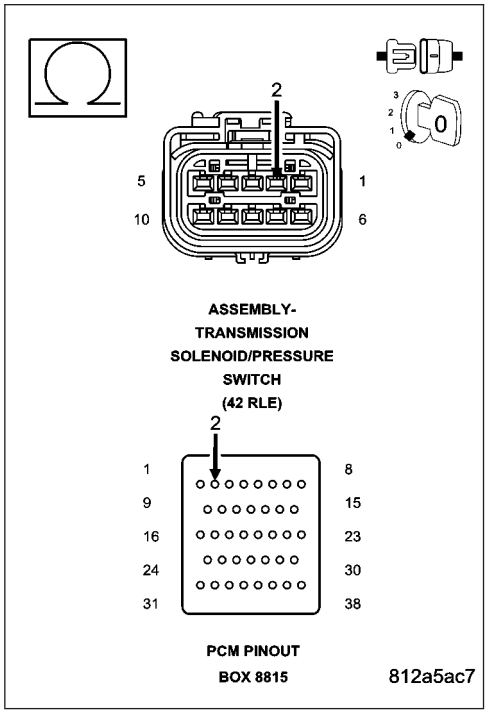
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (T59) UD Solenoid Control circuit from the appropriate terminal of special tool #8815 to the Solenoid/Pressure Switch Assembly harness connector.



Is the resistance above 5.0 ohms?

Yes >> Repair the (T59) UD Solenoid Control circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

P0765-UD SOLENOID CIRCUIT (CONTINUED)

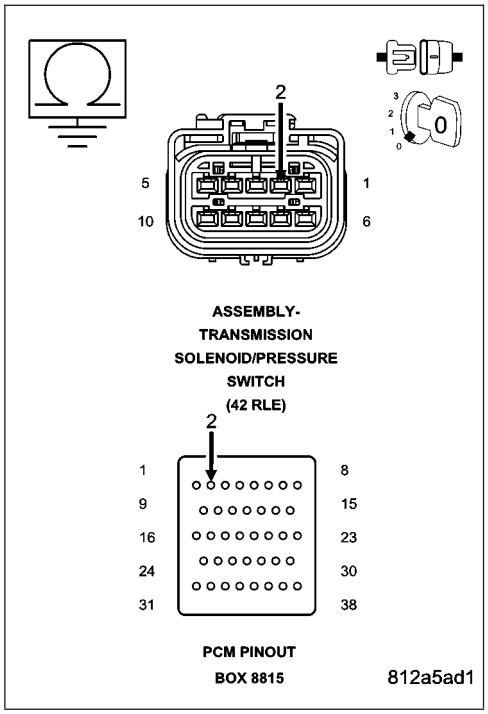
5. (T59) UD SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T59) UD Solenoid Control circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T59) UD Solenoid Control circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



6. (T59) UD SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.
Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

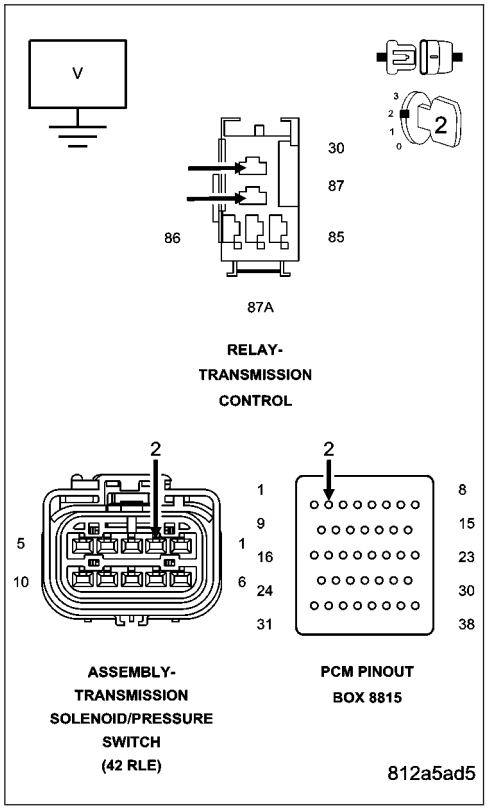
Ignition on, engine not running.

Measure the voltage of the (T59) UD Solenoid Control circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T59) UD Solenoid Control circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8



P0765-UD SOLENOID CIRCUIT (CONTINUED)

7. UD SOLENOID/PRESSURE SWITCH ASSEMBLY

If there are no possible causes remaining, view repair.

Repair

Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

8. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

9. INTERMITTENT WIRING AND CONNECTORS

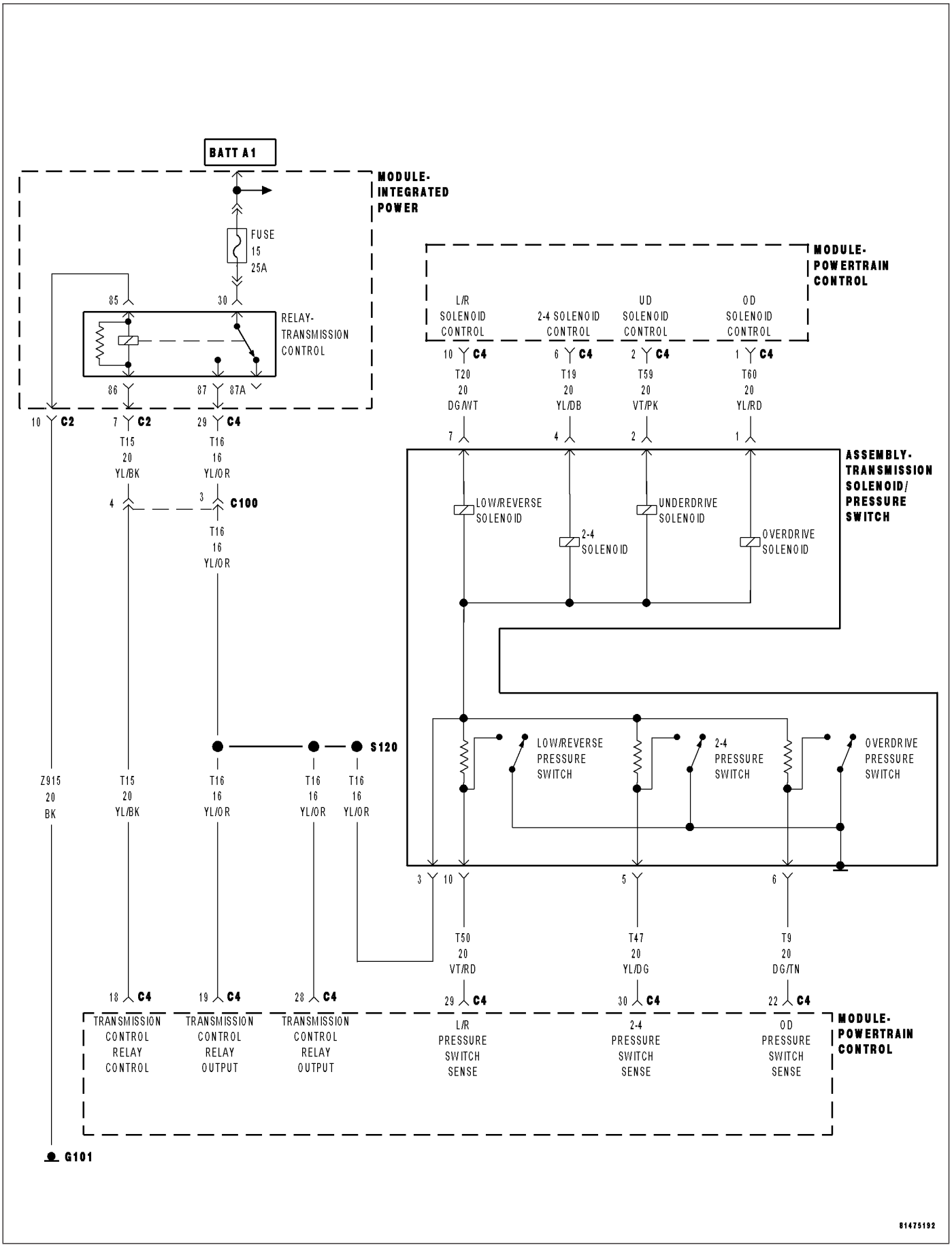
The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0841-LR PRESSURE SWITCH RATIONALITY



P0841-LR PRESSURE SWITCH RATIONALITY (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running.
- **Set Condition:**
  The DTC is set if one of the pressure switches are open or closed at the wrong time in a given gear. If the problem is identified for 3 successive key starts, the transmission will go into Limp-in mode and the MIL will turn on after 10 seconds of vehicle operation.

Possible Causes
RELATED TRANSMISSION RELAY DTCS PRESENT
LOSS OF PRIME DTC PRESENT
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission system uses three pressure switches to monitor the fluid pressure in the LR, 2/4, and OD elements. The pressure switches are continuously monitored for the correct states in each gear. If a set condition is identified, 1st gear and torque converter lock-up (EMCC) will be inhibited. The vehicle will launch in 2nd gear and shift normally through the gears without allowing EMCC. If during the same key start, the set condition is no longer valid, the transmission will return to normal operation (1st and EMCC available). Limp-in will not occur unless DTC P0841 is accompanied by a code P0706 and the MIL will illuminate after 5 minutes of substituted operation.

PRESSURE SWITCH STATES

GEAR	L/R	2/4	OD
R	OP	OP	OP
P/N	CL	OP	OP
1st	CL	OP	OP
2nd	OP	CL	OP
D	OP	OP	CL
OD	OP	CL	CL

OP = OPEN

CL = CLOSED

P0841-LR PRESSURE SWITCH RATIONALITY (CONTINUED)

Diagnostic Test

1. DETERMINING IF RELATED TRANSMISSION RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

Are there any Transmission Control Relay DTCs present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK FOR LOSS OF PRIME DTC

With the scan tool, check for other Transmission DTCs.

Is the DTC P0944 present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. CHECK TO SEE IF P0841 IS CURRENT

With the scan tool, view DTCs.

Is the status active for this DTC or is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 4

No >> Go To 10

---

4. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector to L/R.

With the scan tool , monitor the L/R Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the L/R Pressure Switch state change?

Yes >> Go To 8

No >> Go To 5

P0841-LR PRESSURE SWITCH RATIONALITY (CONTINUED)

5. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

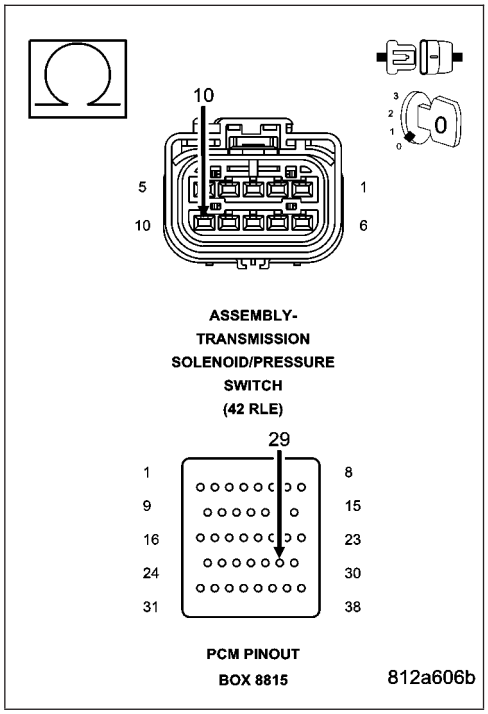
Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (T50) L/R Pressure Switch Sense circuit from the appropriate terminal of special tool #8815 to the Transmission Solenoid/Pressure Switch Assembly harness connector.



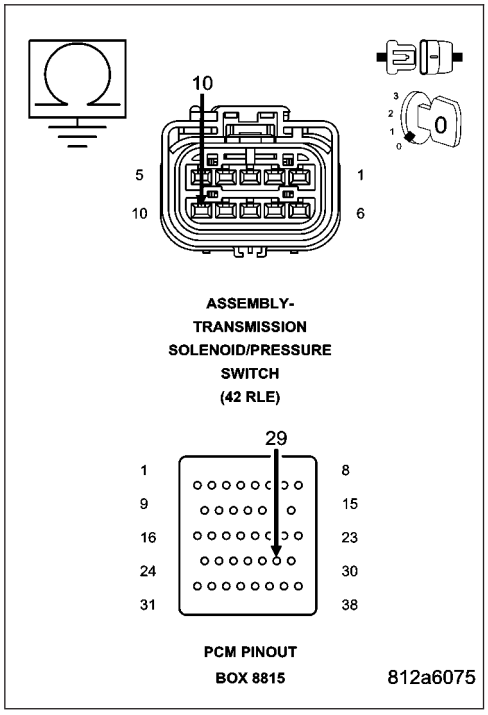
Is the resistance above 5.0 ohms?

Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for an open.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6

6. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T50) L/R Pressure Switch Sense circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7

P0841-LR PRESSURE SWITCH RATIONALITY (CONTINUED)

7. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

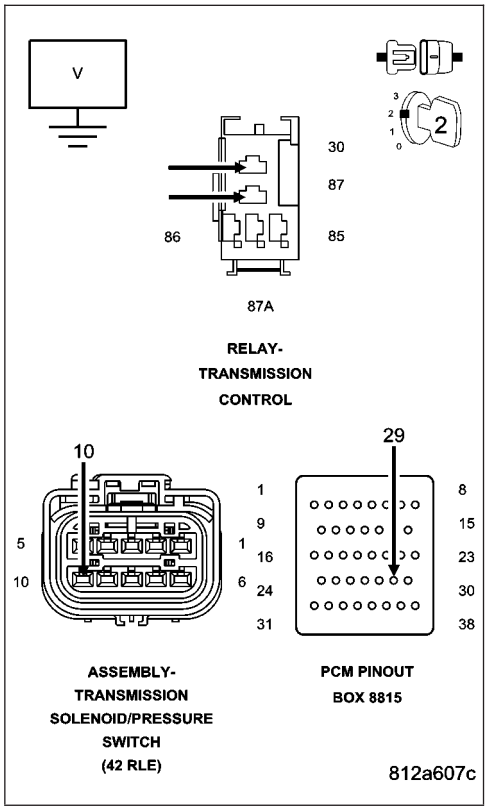
Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.
Connect a jumper wire between the (A104)Fused B+ circuit and (T16) Transmission Control Relay Output circuit.
Ignition on, engine not running.
Measure the voltage of the (T50) L/R Pressure Switch Sense circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9



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8. L/R PRESSURE SWITCH

If there are no possible causes remaining, view repair.

Repair

Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

9. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0841-LR PRESSURE SWITCH RATIONALITY (CONTINUED)

10. INTERMITTENT WIRING AND CONNECTORS

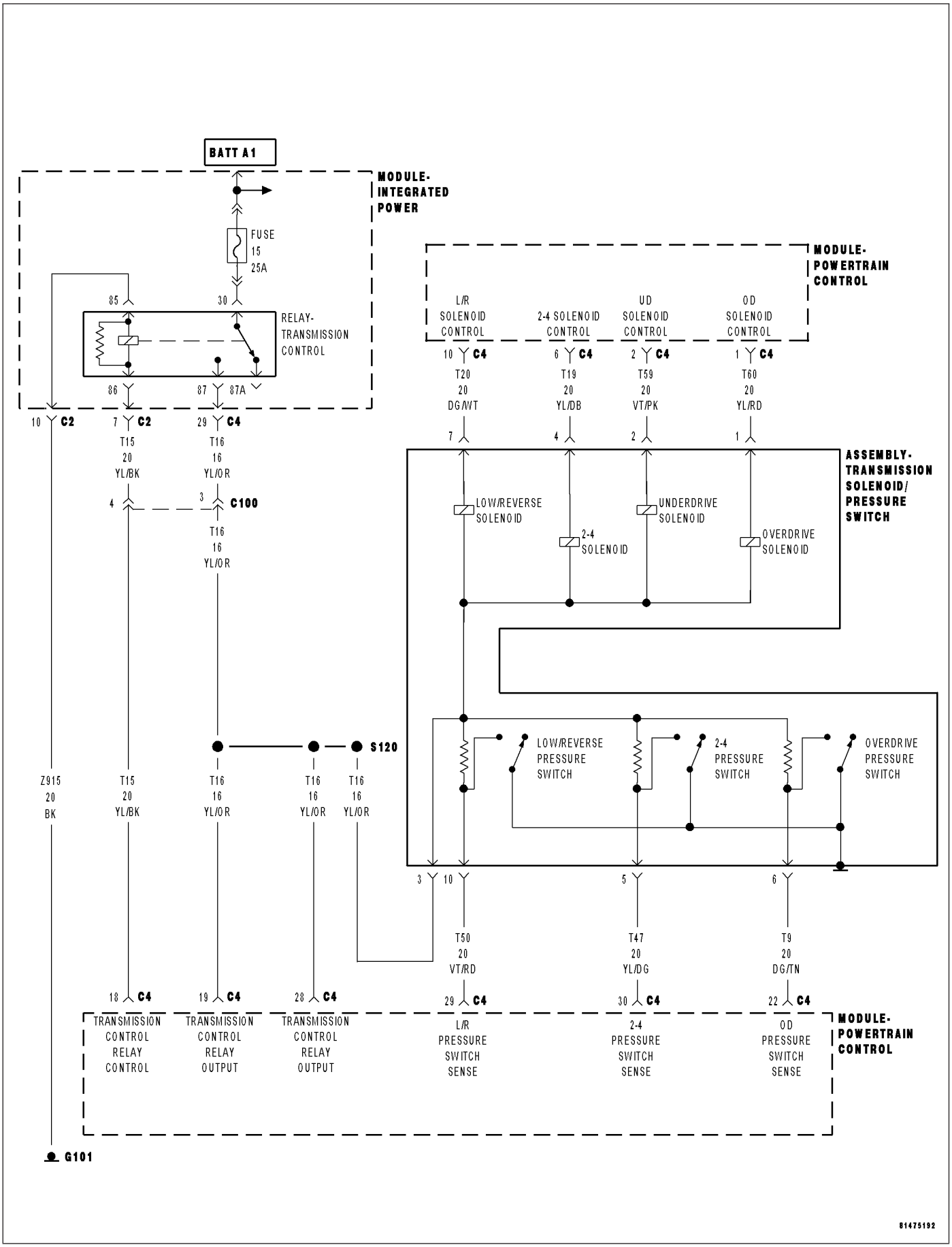
The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0845-2/4 HYDRAULIC PRESSURE TEST



42RLE MINI SOL PRS CKTS

P0845-2/4 HYDRAULIC PRESSURE TEST (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM, shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed greater than 1000 RPM, the PCM momentarily turns on element pressure to the clutch circuits that don't have pressure to verify that the correct pressure switch closes. If the pressure switch does not close 2 times the DTC sets

Possible Causes
LOSS OF PRIME P0944 PRESENT
(T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
(T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT OPEN
(T47) 2/4 PRESSURE SWITCH CIRCUIT SHORT TO GROUND
(T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

Pressure switches are normally off or open (no pressure applied) and read high (+12 volts). When an element is applied, the corresponding pressure switch closes to ground (0 volts) or turns on. The controller tests the OD and 2/4 pressure switches when they are off (when the corresponding friction element is not applied) by briefly applying the OD and 2/4 elements which will cause the corresponding pressure switch to close. The test verifies that the switches are operational and that the switch will close when the corresponding element is applied. If a switch fails to respond, it is re-tested. The MIL illuminates and the transmission system defaults to Limp-in mode.

Diagnostic Test

1. CHECKING FOR LOSS OF PRIME DTC

With the scan tool, check for other Transmission DTCs.

Is the DTC P0944 present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0845-2/4 HYDRAULIC PRESSURE TEST (CONTINUED)

2. CHECK FOR RELATED TRANSMISSION DTCS

With the scan tool, read Transmission DTCs.

Are any of the DTCs P0732, P0734 and/or P0846 present also?

Yes >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. CHECK TO SEE IF DTC P0845 IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 4

No >> Go To 11

---

4. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to 2/4.

With the scan tool, monitor the UD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Wiggle the wires leading to the PCM while pressing and holding the Pressure Switch Test button.

Did the 2/4 Pressure Switch state change to closed and remain closed while wiggling the wires?

Yes >> Go To 5

No >> Go To 6

---

5. INTERNAL TRANSMISSION

If there are no possible causes remaining, view repair.

Repair

Disassemble and inspect the Valve Body per the Service Information and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/Pressure Switch Assembly.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0845-2/4 HYDRAULIC PRESSURE TEST (CONTINUED)

6. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

NOTE: Check connectors - Clean/repair as necessary.

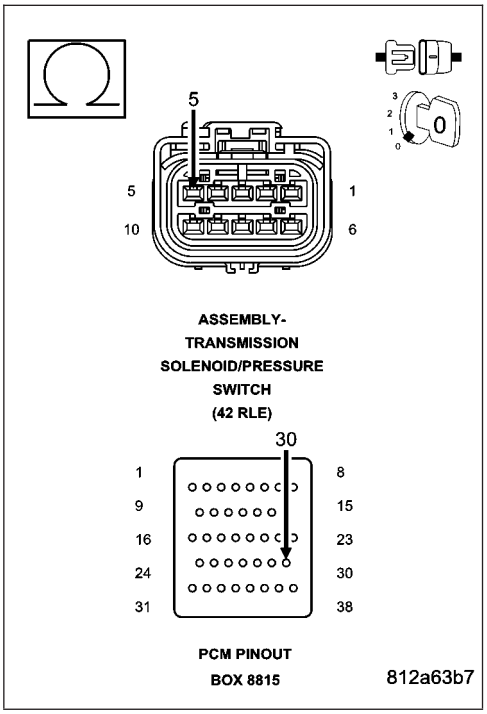
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (T47) 2/4 Pressure Switch Sense circuit from the appropriate terminal of special tool #8815 to the Transmission Solenoid/Pressure Switch Assembly harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T47) 2/4 Pressure Switch Sense circuit for an open.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7



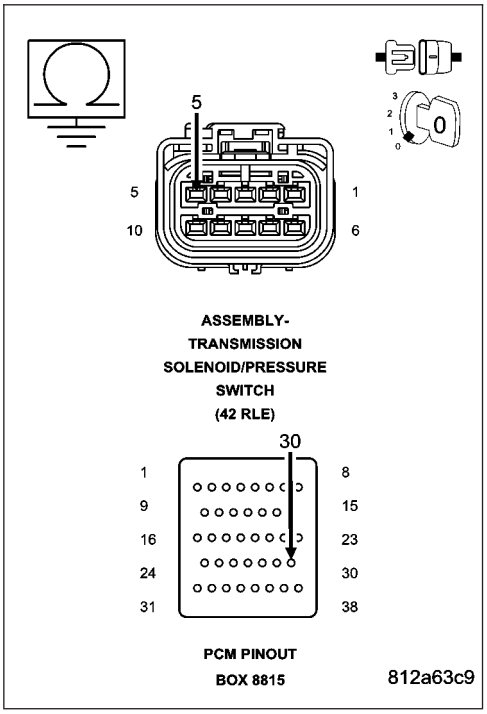
7. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T47) 2/4 Pressure Switch Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T47) 2/4 Pressure Switch Sense circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8



P0845-2/4 HYDRAULIC PRESSURE TEST (CONTINUED)

8. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit.

Ignition on, engine not running.

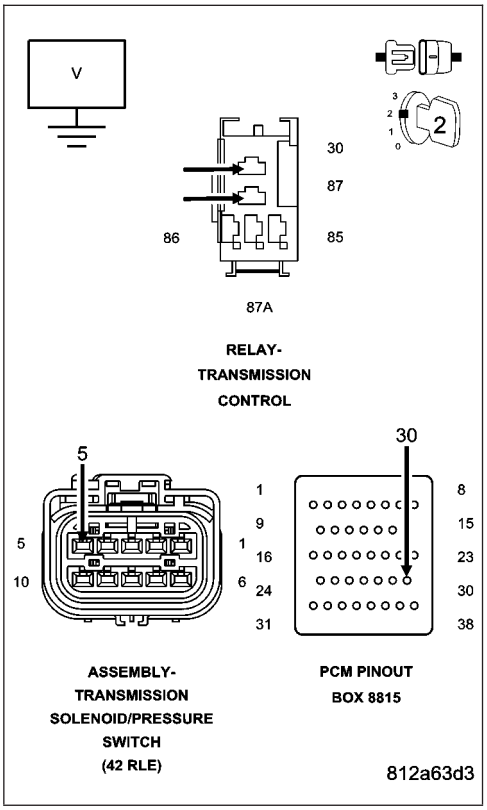
Measure the voltage of the (T47) 2/4 Pressure Switch Sense circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T47) 2/4 Pressure Switch Sense circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9



9. TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN

NOTE: The jumper wire must still be in place.

Using a 12-volt test light connected to ground, check (T16) Transmission Control Relay Output circuit in the Transmission Solenoid/Pressure Switch Assembly harness connector.

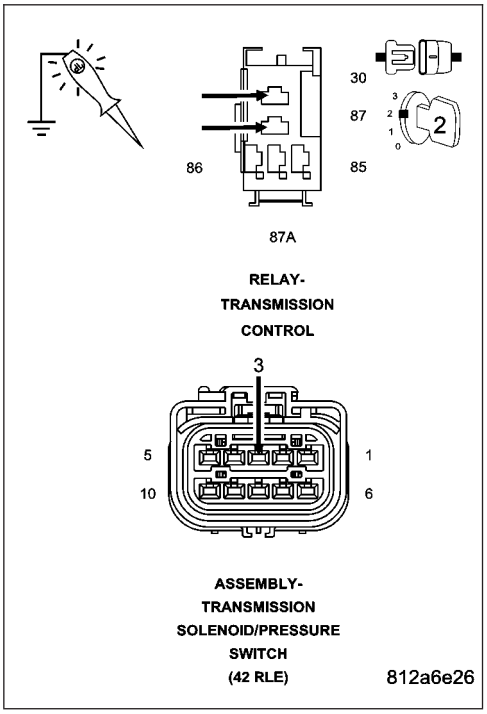
NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly?

Yes >> Go To 10

No >> Repair the Transmission Control Relay Output circuit for an open or high resistance. If the fuse is open make sure to check for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.



P0845-2/4 HYDRAULIC PRESSURE TEST (CONTINUED)

10. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

11. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

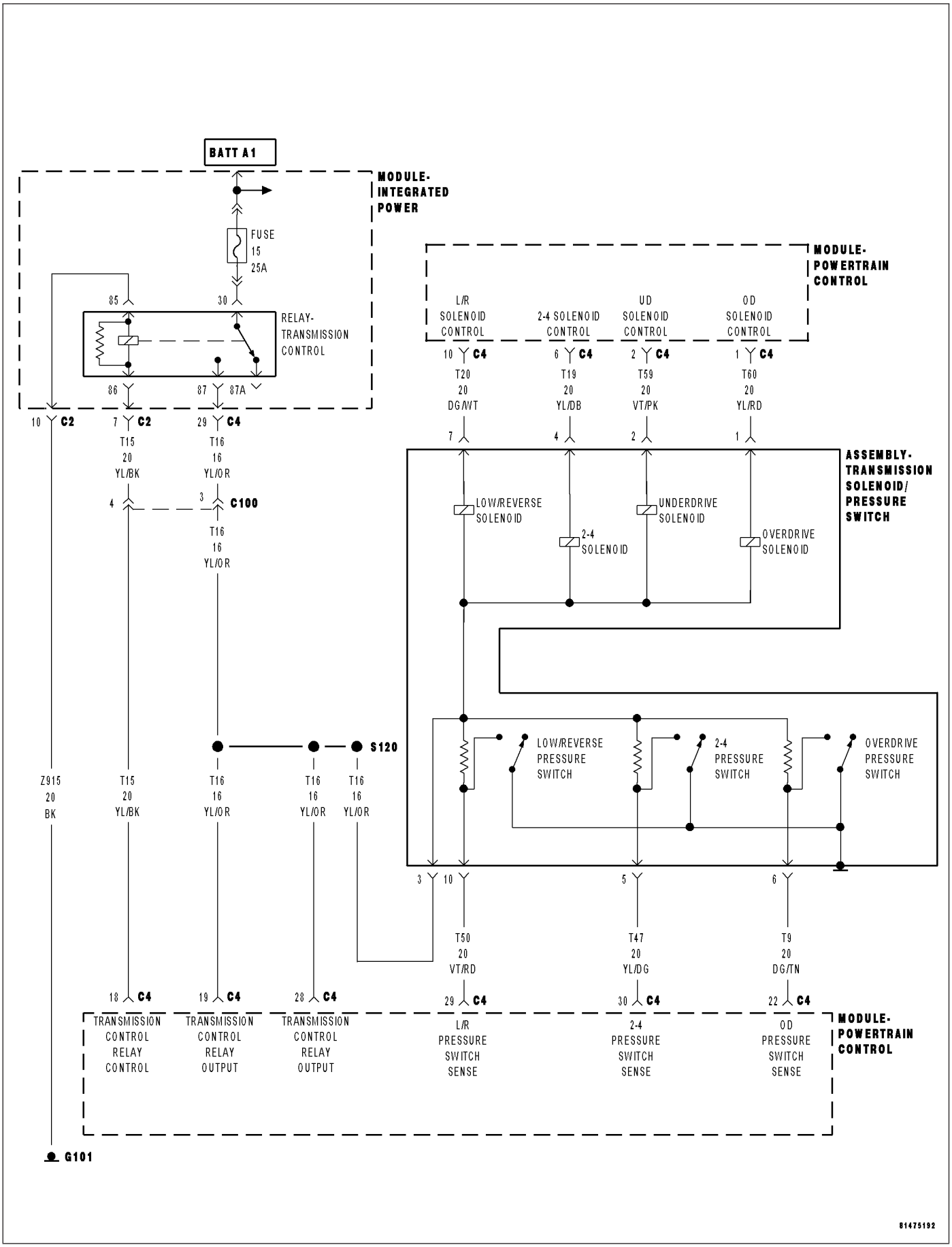
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0846-2/4 PRESSURE SWITCH RATIONALITY



P0846-2/4 PRESSURE SWITCH RATIONALITY (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running.
- **Set Condition:**
  The DTC is set if one of the pressure switches are open or closed at the wrong time in a given gear. If the problem is identified for 3 successive key starts, the transmission will go into Limp-in mode and the MIL will turn on after 10 seconds of vehicle operation.

Possible Causes
RELATED TRANSMISSION RELAY DTCS PRESENT
LOSS OF PRIME DTC PRESENT
(T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT OPEN
(T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission system uses three pressure switches to monitor the fluid pressure in the LR, 2/4, and OD elements. The pressure switches are continuously monitored for the correct states in each gear. The 2/4 pressure switch monitors the fluid pressure to the 2/4 clutch to confirm proper operation of the 2/4 solenoid. If the 2/4 pressure switch is identified as closed in P or N, the code will immediately be set and normal operation will be allowed for that given key start. If the problem is identified for 3 successive ignition cycles, the transmission will go into Limp-in mode.

PRESSURE SWITCH STATES

GEAR	L/R	2/4	OD
R	OP	OP	OP
P/N	CL	OP	OP
1st	CL	OP	OP
2nd	OP	CL	OP
D	OP	OP	CL
OD	OP	CL	CL

OP = OPEN

CL = CLOSED

P0846-2/4 PRESSURE SWITCH RATIONALITY (CONTINUED)

Diagnostic Test

1. DETERMINING IF RELATED TRANSMISSION RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

Are there any Transmission Control Relay DTCs present also?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK FOR LOSS OF PRIME DTC

With the scan tool, check for other Transmission DTCs.

Is the DTC P0944 present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. CHECK TO SEE IF P0846 IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 4

No >> Go To 10

---

4. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector to 2/4.

With the scan tool , monitor the 2/4 Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the 2/4 Pressure Switch state change?

Yes >> Go To 8

No >> Go To 5

P0846-2/4 PRESSURE SWITCH RATIONALITY (CONTINUED)

5. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

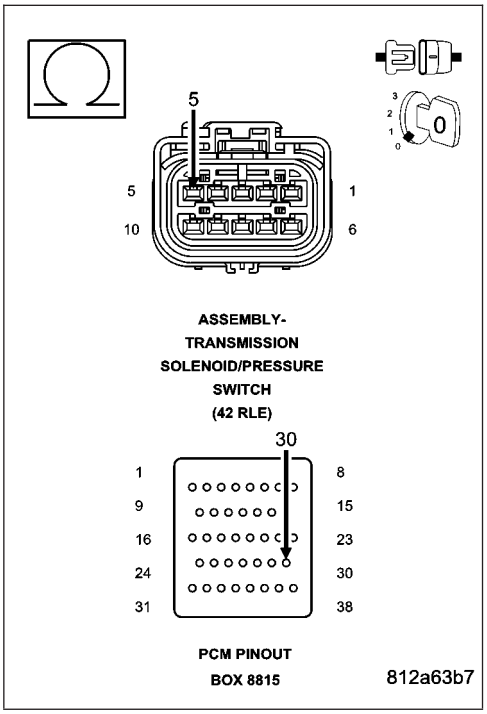
Measure the resistance of the (T47) 2/4 Pressure Switch Sense circuit from the appropriate terminal of special tool #8815 to the Transmission Solenoid/Pressure Switch Assembly harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T47) 2/4 Pressure Switch Sense circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



6. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

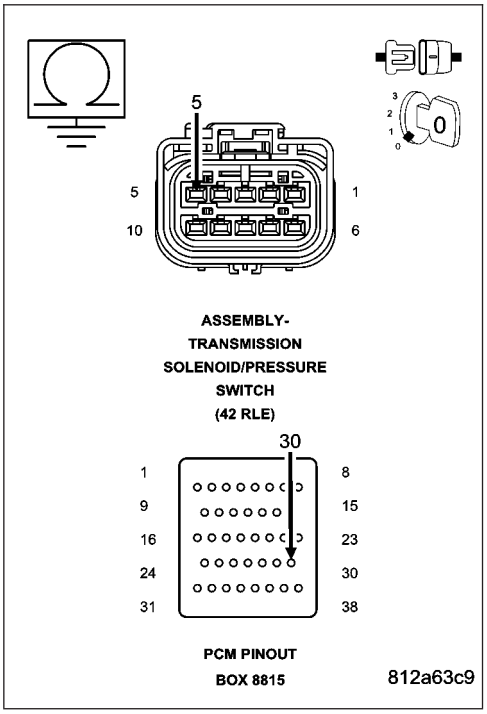
Measure the resistance between ground and the (T47) 2/4 Pressure Switch Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T47) 2/4 Pressure Switch Sense circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7



P0846-2/4 PRESSURE SWITCH RATIONALITY (CONTINUED)

7. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

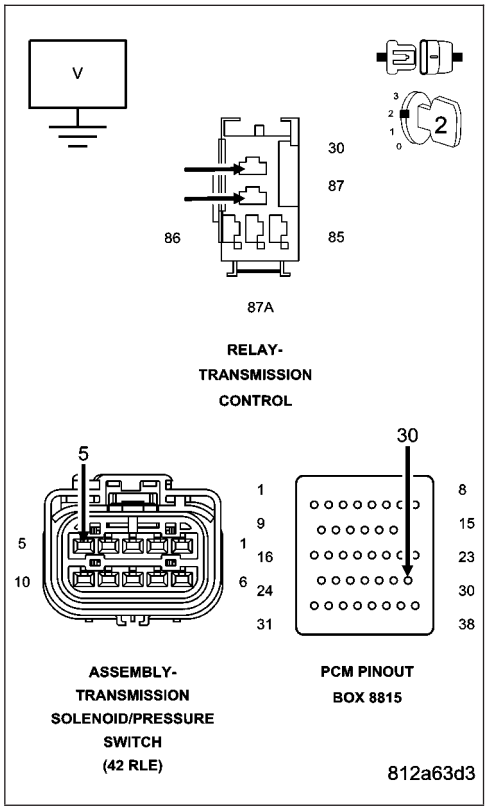
Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.
Connect a jumper wire between the (A104) Fused B+ circuit and (T16) Transmission Control Relay Output circuit.
Ignition on, engine not running.
Measure the voltage of the (T47) 2/4 Pressure Switch Sense circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T47) 2/4 Pressure Switch Sense circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9



---

8. 2/4 PRESSURE SWITCH

If there are no possible causes remaining, view repair.

Repair

Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

9. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0846-2/4 PRESSURE SWITCH RATIONALITY (CONTINUED)

10. INTERMITTENT WIRING AND CONNECTORS

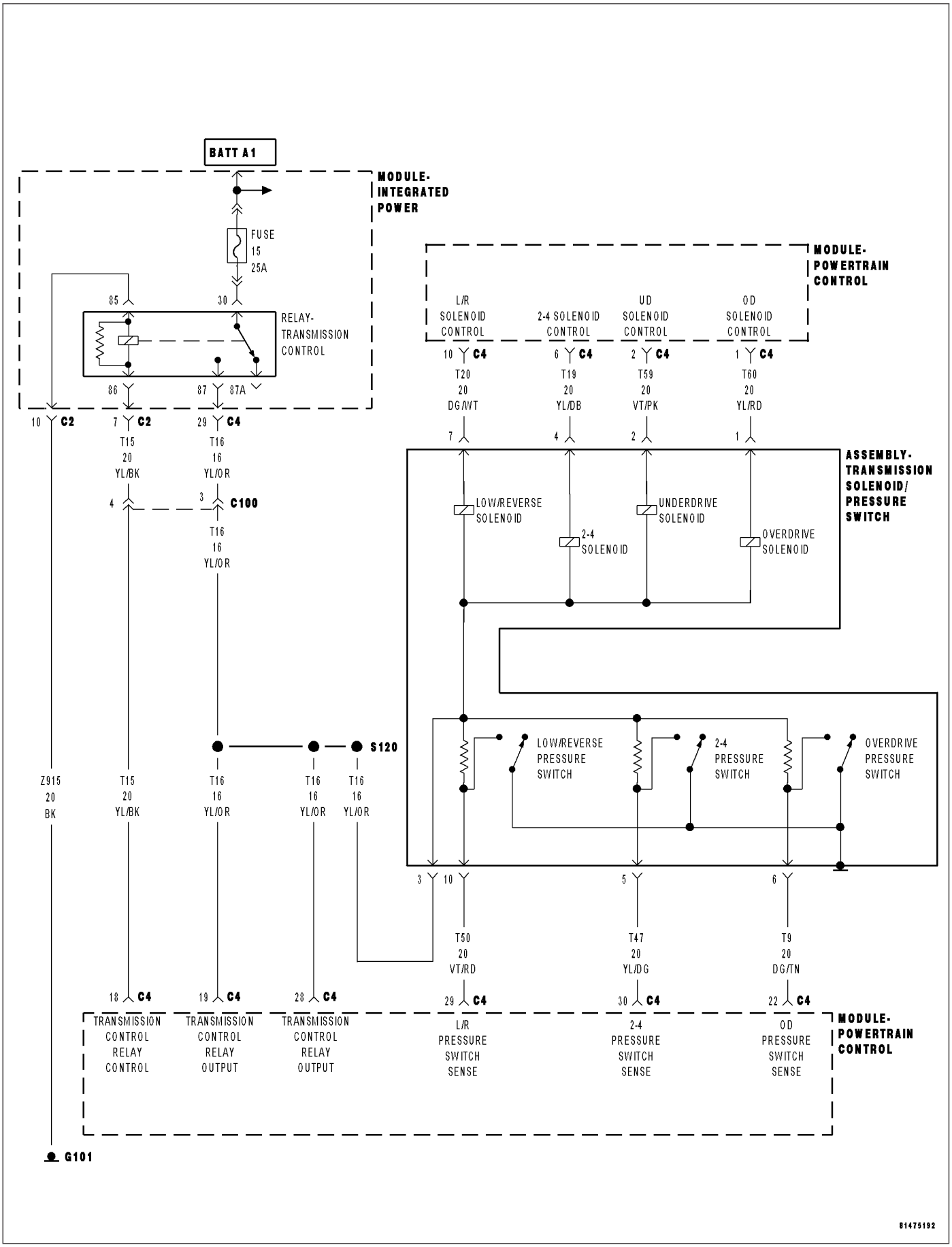
The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0870-OD HYDRAULIC PRESSURE TEST



42RLE MINI SOL PRS CKTS

P0870-OD HYDRAULIC PRESSURE TEST (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM, shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed greater than 1000 RPM, the PCM momentarily turns on element pressure to the clutch circuits that don't have pressure to identify the correct pressure switch closes. If the pressure switch does not close 2 times the DTC sets.

Possible Causes
LOSS OF PRIME P0944 PRESENT
(T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
(T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN
(T9) OD PRESSURE SWITCH CIRCUIT SHORT TO GROUND
(T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

Pressure switches are normally off or open (no pressure applied) and read high (+12 volts). When an element is applied, the corresponding pressure switch closes to ground (0 volts) or turns on. The controller tests the OD and 2/4 pressure switches when they are off (when the corresponding friction element is not applied) by briefly applying the OD and 2/4 elements which will cause the corresponding pressure switch to close. The test verifies that the switches are operational and that the switch will close when the corresponding element is applied. If a switch fails to respond, it is re-tested. The MIL illuminates and the transmission system defaults to Limp-in mode.

Diagnostic Test

1. CHECKING FOR LOSS OF PRIME DTC

With the scan tool, check for other Transmission DTCs.

Is the DTC P0944 present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0870-OD HYDRAULIC PRESSURE TEST (CONTINUED)

2. CHECK FOR RELATED TRANSMISSION DTCS

With the scan tool, read Transmission DTCs.

Are any of the DTCs P0732, P0734 and/or P0846 present also?

Yes >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. CHECK TO SEE IF DTC P0870 IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 4

No >> Go To 11

---

4. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to OD.

With the scan tool, monitor the UD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Wiggle the wires leading to the PCM while pressing and holding the Pressure Switch Test button.

Did the OD Pressure Switch state change to closed and remain closed while wiggling the wires?

Yes >> Go To 5

No >> Go To 6

---

5. INTERNAL TRANSMISSION

If there are no possible causes remaining, view repair.

Repair

Disassemble and inspect the Valve Body per the Service Information and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/Pressure Switch Assembly.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0870-OD HYDRAULIC PRESSURE TEST (CONTINUED)

6. (T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

NOTE: Check connectors - Clean/repair as necessary.

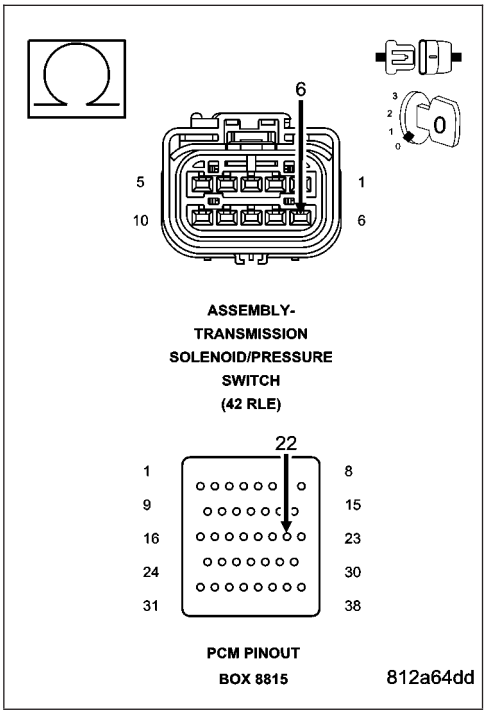
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (T9) OD Pressure Switch Sense circuit from the appropriate terminal of special tool #8815 to the Transmission Solenoid/Pressure Switch Assembly harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T9) OD Pressure Switch Sense circuit for an open.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7



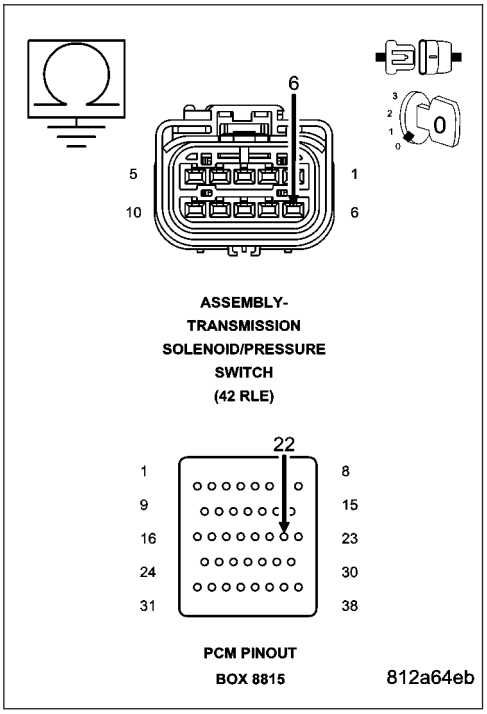
7. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T9) OD Pressure Switch Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T9) OD Pressure Switch Sense circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8



P0870-OD HYDRAULIC PRESSURE TEST (CONTINUED)

8. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

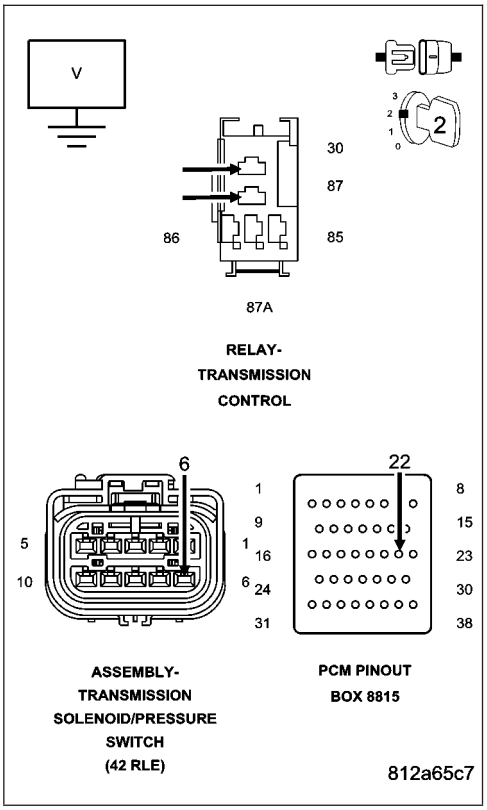
Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.
Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit.
Ignition on, engine not running.
Measure the voltage of the (T9) OD Pressure Switch Sense circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T9) OD Pressure Switch Sense circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9



9. (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN

Remove the Transmission Control Relay.

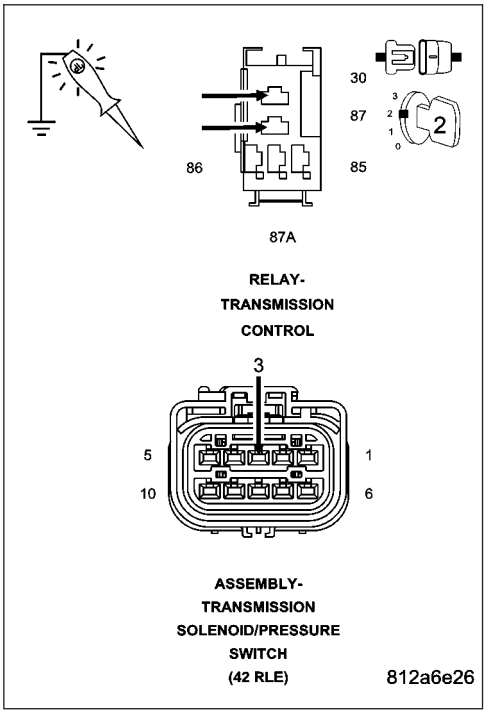
NOTE: The jumper wire must still be in place.
Using a 12-volt test light connected to ground, check (T16) Transmission Control Relay Output circuit in the Transmission Solenoid/Pressure Switch Assembly harness connector.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly?

Yes >> Go To 10

No >> Repair the (T16) Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.



P0870-OD HYDRAULIC PRESSURE TEST (CONTINUED)

10. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

11. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

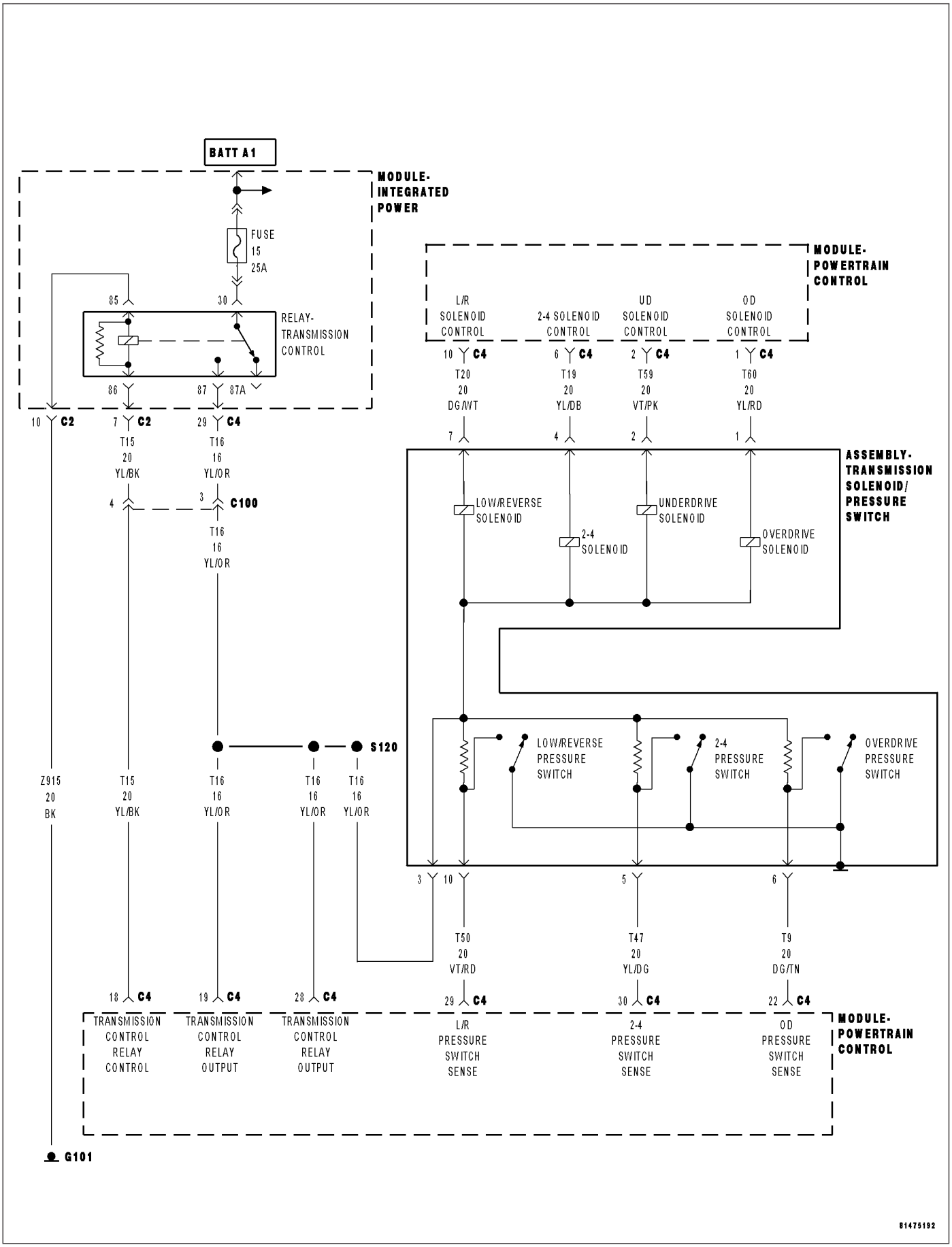
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0871-OD PRESSURE SWITCH RATIONALITY



P0871-OD PRESSURE SWITCH RATIONALITY (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running.
- **Set Condition:**
  The DTC is set if one of the pressure switches are open or closed at the wrong time in a given gear. If the problem is identified for 3 successive key starts, the transmission will go into Limp-in mode and the MIL will turn on after 10 seconds of vehicle operation.

Possible Causes
RELATED TRANSMISSION RELAY DTCS PRESENT
LOSS OF PRIME DTC PRESENT
(T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN
(T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

: The Transmission system uses three pressure switches to monitor the fluid pressure in the LR, 2/4, and OD elements. The pressure switches are continuously monitored for the correct states in each gear. Normal operation will be experienced if no other codes are present. Transmission Control System will ignore the code. Limp-in condition will only occur if DTC P0871 is present with a DTC P0706.

PRESSURE SWITCH STATES

GEAR	L/R	2/4	OD
R	OP	OP	OP
P/N	CL	OP	OP
1st	CL	OP	OP
2nd	OP	CL	OP
D	OP	OP	CL
OD	OP	CL	CL

OP = OPEN

CL = CLOSED

P0871-OD PRESSURE SWITCH RATIONALITY (CONTINUED)

Diagnostic Test

1. DETERMINING IF RELATED TRANSMISSION RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

Are there any Transmission Control Relay DTCs present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK FOR LOSS OF PRIME DTC

With the scan tool, check for other Transmission DTCs.

Is the DTC P0944 present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. CHECK TO SEE IF P0841 IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 4

No >> Go To 10

---

4. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector to OD.

With the scan tool , monitor the OD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the OD Pressure Switch state change?

Yes >> Go To 8

No >> Go To 5

P0871-OD PRESSURE SWITCH RATIONALITY (CONTINUED)

5. (T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

NOTE: Check connectors - Clean/repair as necessary.

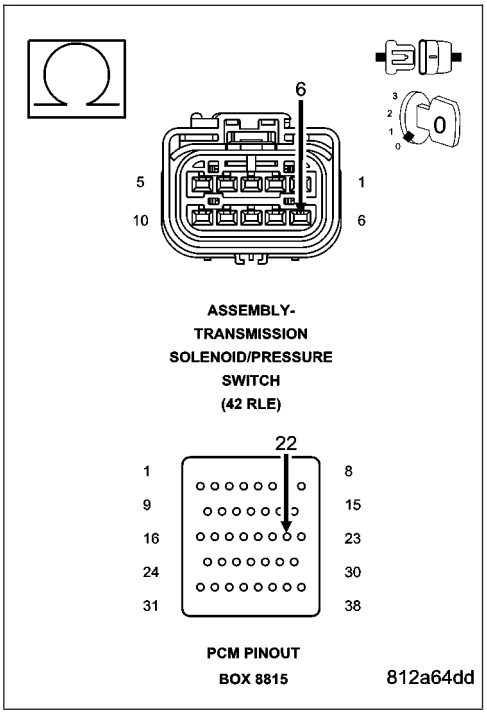
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (T9) OD Pressure Switch Sense circuit from the appropriate terminal of special tool #8815 to the Transmission Solenoid/Pressure Switch Assembly harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T9) OD Pressure Switch Sense circuit for an open.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



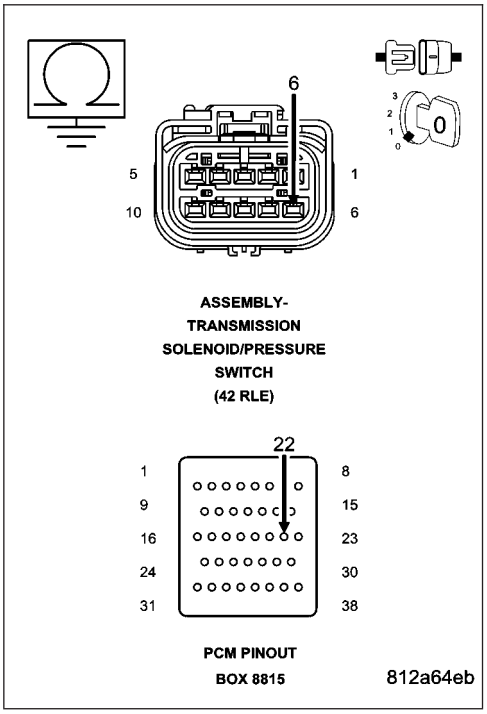
6. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T9) OD Pressure Switch Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T9) OD Pressure Switch Sense circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7



P0871-OD PRESSURE SWITCH RATIONALITY (CONTINUED)

7. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

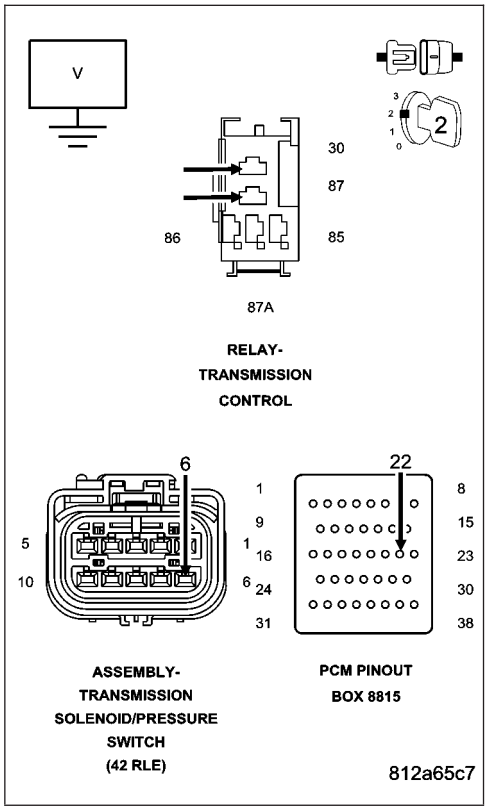
Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.
Connect a jumper wire between the (A104) Fused B+ circuit and (T16) Transmission Control Relay Output circuit.
Ignition on, engine not running.
Measure the voltage of the (T9) OD Pressure Switch Sense circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T9) OD Pressure Switch Sense circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9



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8. OD PRESSURE SWITCH

If there are no possible causes remaining, view repair.

Repair

Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

9. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0871-OD PRESSURE SWITCH RATIONALITY (CONTINUED)

10. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0884-POWER UP AT SPEED

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  One time after each controller reset. Note: the Transmission Control Module is integrated with Powertrain Control Module. The Transmission Control Module has separate powers and grounds specifically to its portion of the PCM.
- **Set Condition:**
  This DTC will set if the PCM powers up and senses the vehicle in a valid forward gear (no PRNDL DTCs) with a output speed above 800 RPM, approximately 32Km/h or 20 MPH.

Possible Causes
INTERMITTENT POWER AND GROUND CIRCUITS

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

If a vehicle loses power to the PCM, the vehicle will go to the 2nd gear mode since there is no power available to control the transmission solenoids. However if power is restored, the PCM will power-up and normal operation will be restored. This DTC identifies that power to the PCM was restored when the gear selector was in a ″Drive″ position while the vehicle was moving at speeds above 32 Km/h (20 MPH). If a customer shifts to Neutral and cycles the ignition key and quickly shifts to ″Drive″ while moving before the PCM comes out of its START ROUTINE, the DTC can be set. Therefore it is critical that this DTC diagnosis repair procedure should only be used if the vehicle is experiencing intermittent 2nd gear operation and subsequently a return to normal operation during normal driving. The transmission will not be placed in Limp-in. This is an informational DTC to be used when attempting to diagnose an intermittent 2nd gear operation and subsequent return to normal transmission operation.

Diagnostic Test

1. CHECK THE POWER AND GROUND CIRCUITS

This DTC is set when the PCM is initialized while the vehicle is moving in a valid forward gear. This is usually caused by a momentary loss of power to the Transmission portion of the PCM.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

NOTE: Due to the integration of the Powertrain and Transmission Control Modules, the transmission part of the PCM has its own specific power and ground circuits.

Check all of the Fused B+, Fused Ignition Switch Output, and Ground circuits related to the PCM for an intermittent open or short to ground.

Perform a wiggle test on all wiring and connectors pertaining to the PCM while looking for shorted or open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

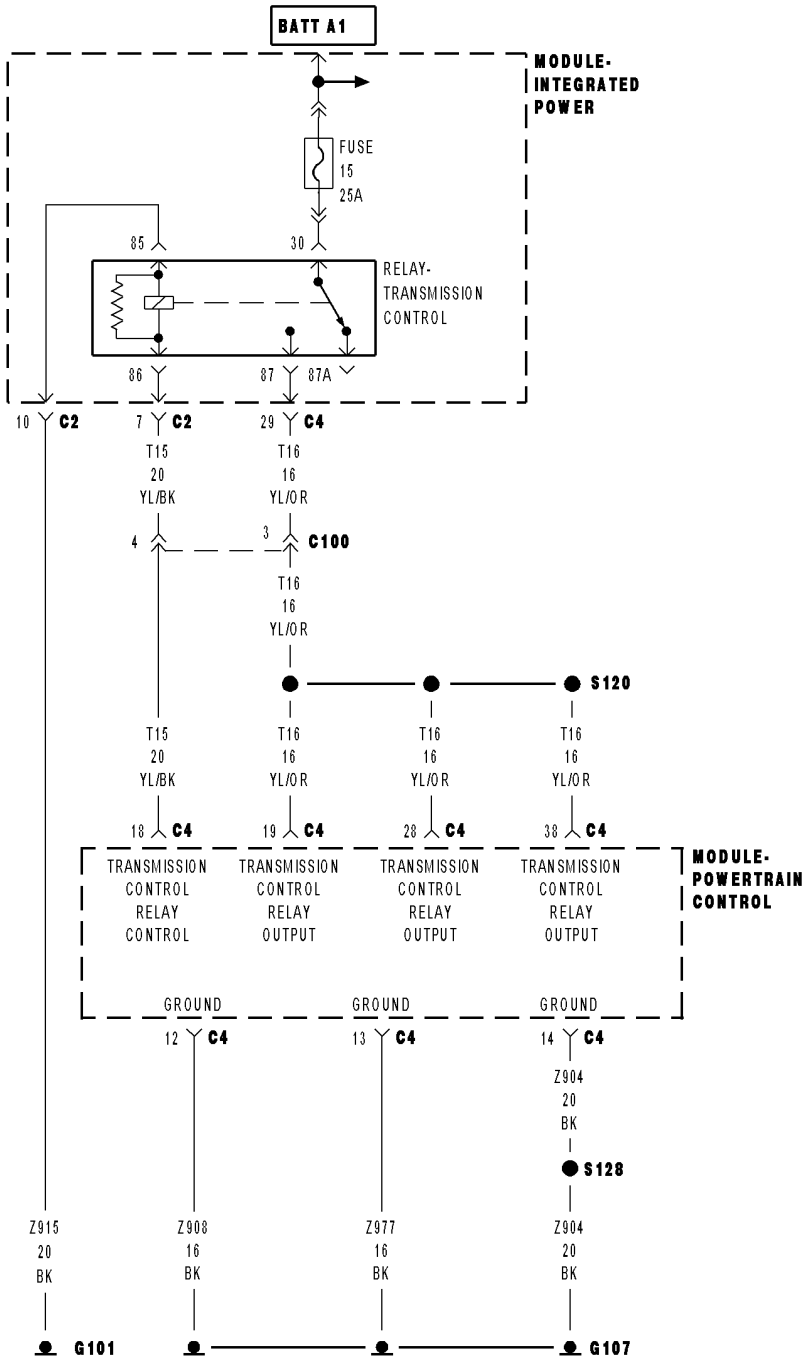
If there are no possible causes remaining, view repair.

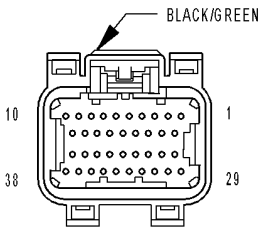
Repair

Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0888-TRANSMISSION RELAY ALWAYS OFF





MODULE-
POWERTRAIN
CONTROL C4
(42RLE)

81475083

P0888-TRANSMISSION RELAY ALWAYS OFF (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  This DTC is set when the Transmission Control Relay output circuit voltage at the Powertrain Control Module is less than 3 volts when the PCM is energizing the relay. Note: Due to the integration of the Powertrain and Transmission Control Modules, the transmission part of the PCM has its own specific power and ground circuits.

Possible Causes
(A104) FUSED B+ CIRCUIT OPEN
(T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
(T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT OPEN
(Z915) TRANSMISSION CONTROL RELAY GROUND CIRCUIT OPEN
(T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO GROUND
(T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT SHORT TO GROUND
TRANSMISSION CONTROL RELAY
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission control relay is used to supply power to the solenoid pack when the transmission is in normal operating mode. When the relay is off, no power is supplied to the solenoid pack and the transmission is in Limp-in mode. The relay output is fed back to the PCM. It is referred to as the Trans Relay Output circuit or switched battery. After a controller reset (ignition key turned to the run position or after cranking engine), the controller energizes the relay. Prior to this, the PCM verifies that the contacts are open by checking for no voltage at the transmission control relay outputs (switched battery) terminals. After the relay is energized, the PCM monitors the terminals to verify that the voltage is greater than 3 volts. The MIL illuminates and the transmission will be placed in Limp-in.

Diagnostic Test

1. CHECK TO SEE IF DTC P0888 IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter equal to 0?

Yes >> Go To 2

No >> Go To 12

P0888-TRANSMISSION RELAY ALWAYS OFF (CONTINUED)

2. CHECK THE (A104) FUSED B+ CIRCUIT

Turn the ignition off to the lock position.

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

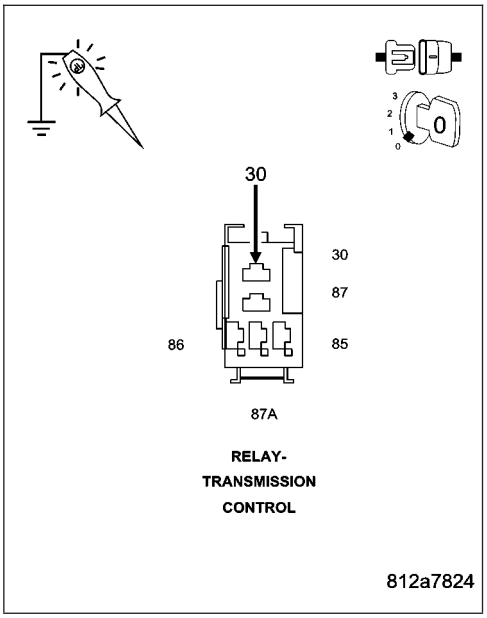
Using a 12-volt test light connected to ground, check the (A104) Fused B+ circuit in the Transmission Control Relay connector.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Go To 9



3. (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuits at the Transmission Control Relay connector.

Ignition on, engine not running.

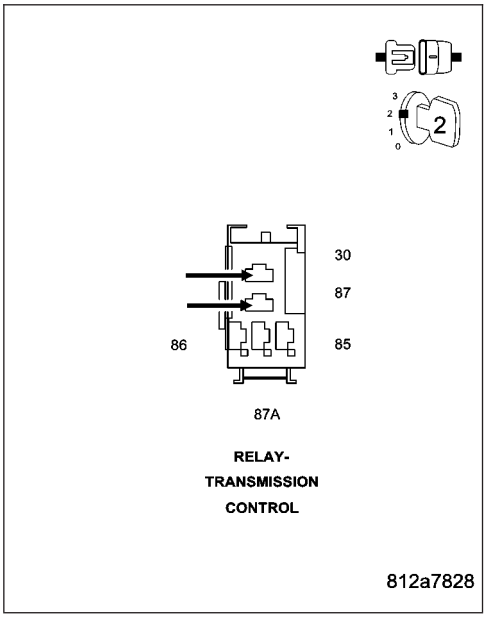
With the scan tool, read the Transmission Switched Battery voltage.

Is the Switched Battery voltage equal to battery voltage?

Yes >> Go To 4

No >> Repair the (T16) Transmission Control Relay Output circuits for an open or high resistance. Note: There are multiple Transmission Control Relay Output circuits.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.



P0888-TRANSMISSION RELAY ALWAYS OFF (CONTINUED)

4. TRANSMISSION CONTROL RELAY

Turn the ignition off to the lock position.
Install a substitute Relay in place of the Transmission Control Relay.
Ignition on, engine not running.
With the scan tool, read the Transmission Switched Battery voltage.

Is the Switched Battery voltage equal to battery voltage?

Yes >> Replace the Transmission Control Relay.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

5. (Z915) TRANSMISSION CONTROL RELAY GROUND CIRCUIT OPEN

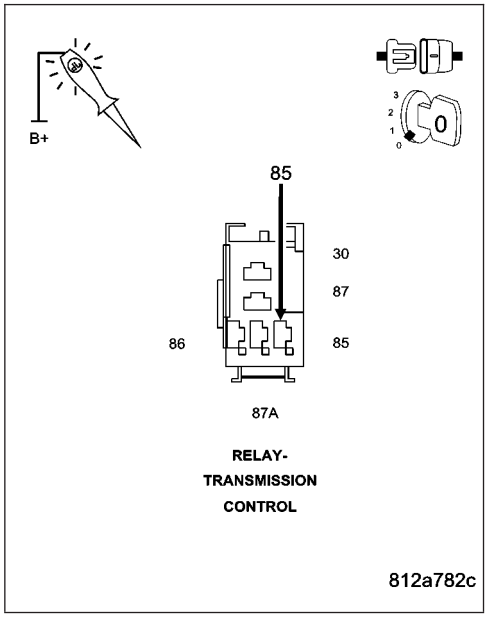
Using a 12-volt test light connected to 12-volts, check the (Z915) Transmission Control Relay Ground circuit.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly?

Yes >> Go To 6

No >> Repair the (Z915) Transmission Control Relay Ground circuit for an open.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.



P0888-TRANSMISSION RELAY ALWAYS OFF (CONTINUED)

6. (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT OPEN

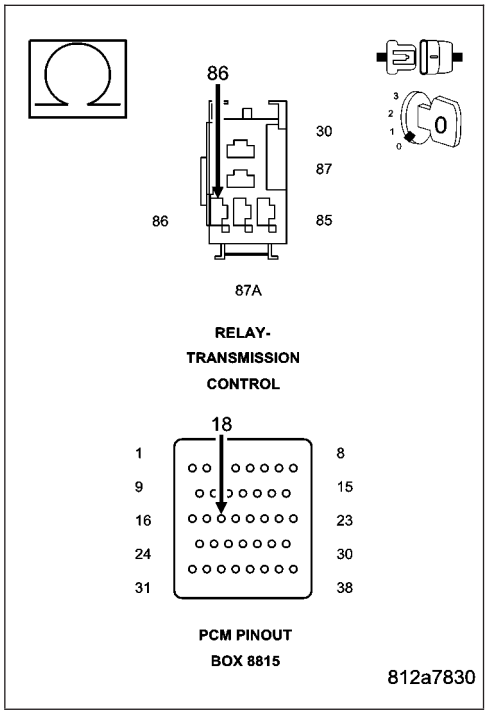
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (T15) Transmission Control Relay Control circuit between the Transmission Control Relay connector and the appropriate terminal of special tool #8815.



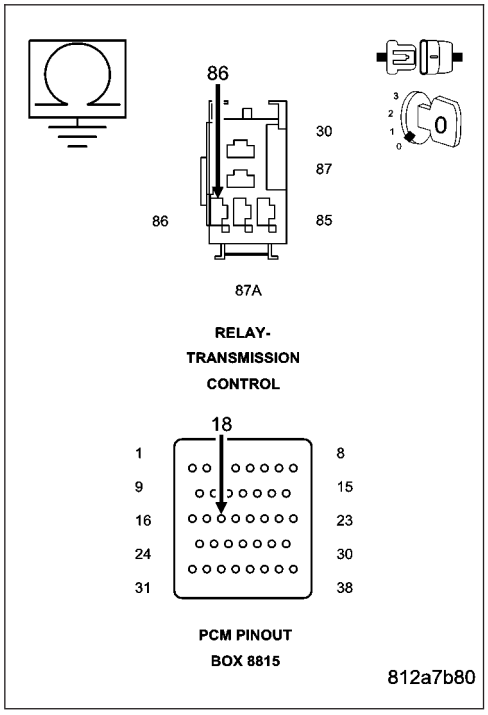
Is the resistance above 5.0 ohms?

Yes >> Repair the (T15) Transmission Control Relay Control circuit for an open.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7

7. (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T15) Transmission Control Relay Control circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T15) Transmission Control Relay Control circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8

P0888-TRANSMISSION RELAY ALWAYS OFF (CONTINUED)

8. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool PERFORM QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

9. OPEN FUSE

Turn the ignition off to the lock position.

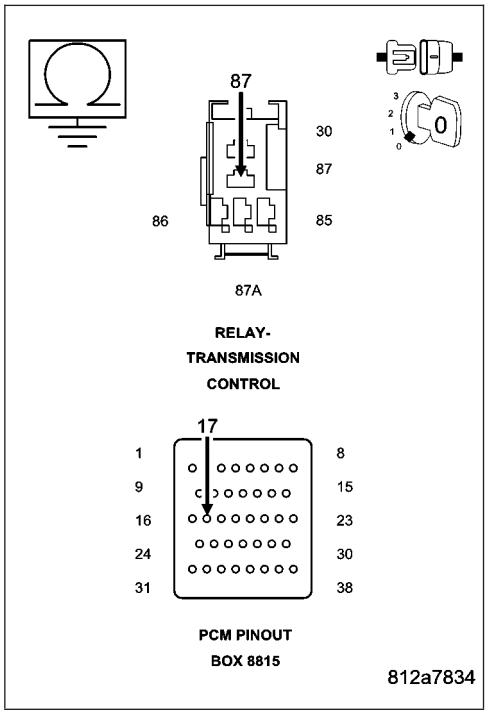
Remove the Transmission Control Relay.

Disconnect the PCM C4 harness connectors.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance between ground and the (T16) Transmission Control Relay Output circuit.



Is the resistance below 5.0 ohms?

Yes >> Go To 10

No >> Repair the Fused B+ circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0888-TRANSMISSION RELAY ALWAYS OFF (CONTINUED)

10. (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT SHORT TO GROUND

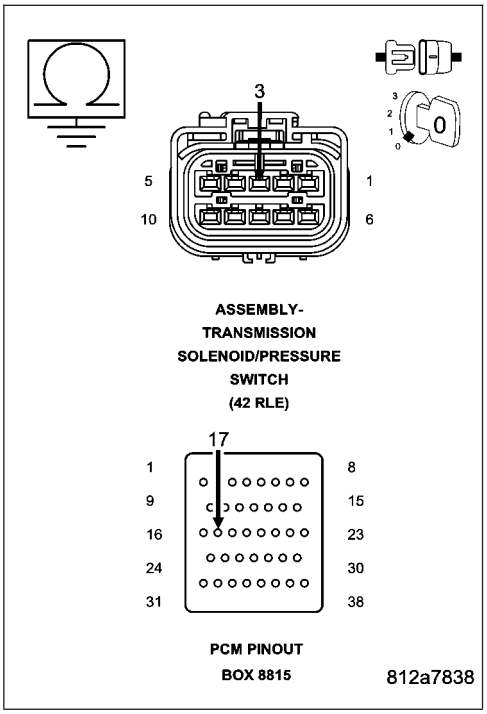
Disconnect the Transmission Solenoid/Pressure Switch harness connector.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance between ground and the (T16) Transmission Control Relay Output circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T16) Transmission Control Relay Output circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 11



11. TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

12. INTERMITTENT WIRING AND CONNECTORS

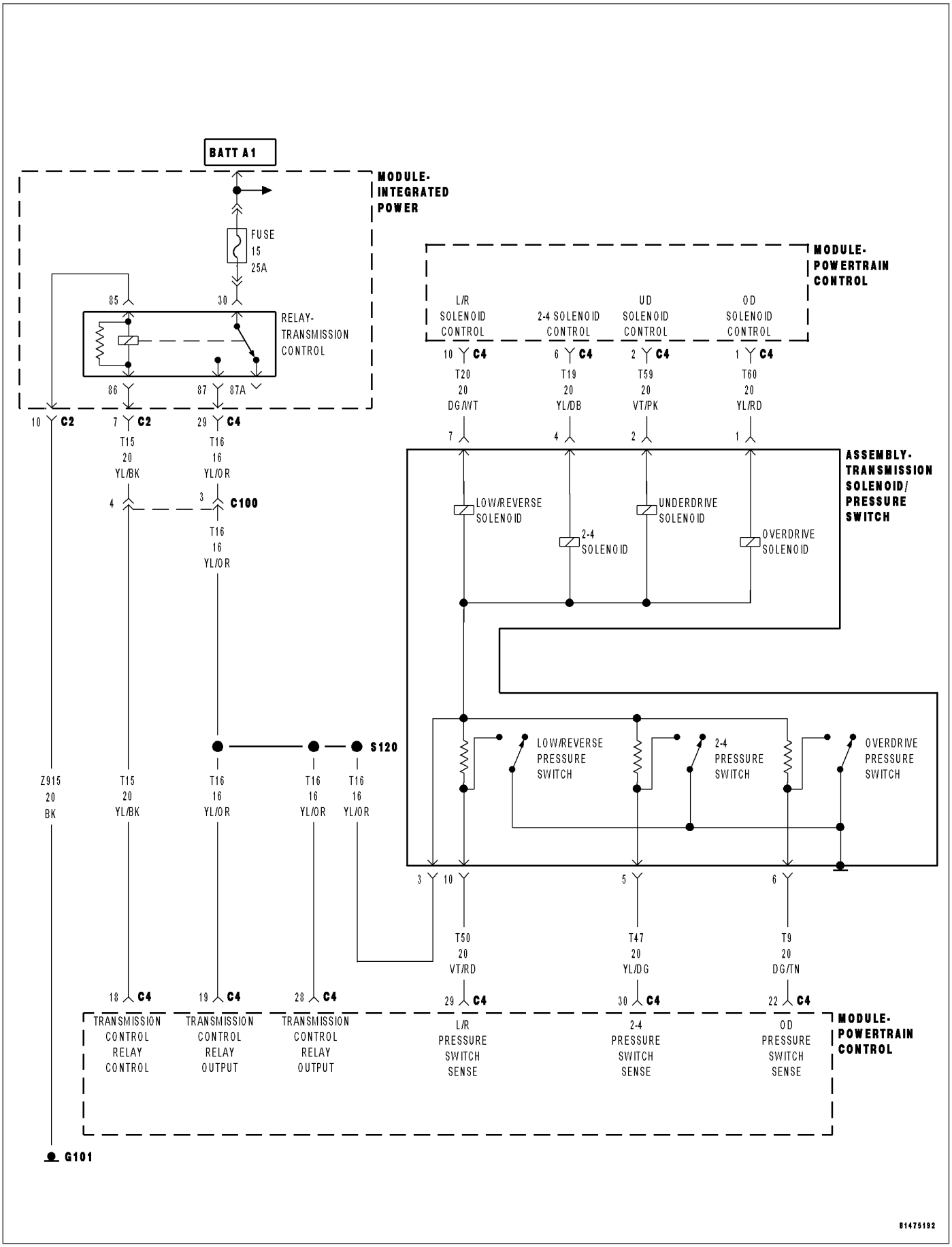
The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wiring and connectors while checking for shorted and open circuits.
With the scan tool, check the EATX EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0890-SWITCHED BATTERY



P0890-SWITCHED BATTERY (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  One time after a reset (ignition key turned to the RUN position or after cranking engine).
- **Set Condition:**
  A fault is set if voltage greater than 4.5 volts is detected for 7 msec on any of the pressure switch circuits before the relay is energized. The transmission is placed in Limp-In. The MIL is on after 10 seconds. of vehicle operation.

Possible Causes
(T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
(T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission relay is used to supply power to the solenoid pack when in normal operating mode and to turn off power to produce transmission ″limp-in″ mode. The relay output (which supplies power to the solenoid pack) is fed back to the controller. It is referred to as SWITCHED BATTERY. After a controller reset (ignition key turned to the RUN position or after cranking engine), the controller verifies that the relay contacts are open by checking for no voltage on Switched battery line (transmission control relay output) before the relay is energized. After switched battery is verified for no voltage, the voltage of each of the solenoid pack pressure switches is also checked. Since the solenoid pack is not powered up, there should be no voltage on any of the pressure switches.

Diagnostic Test

1. CHECK TO SEE IF DTC P0890 IS PRESENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter set at 0?

Yes >> Go To 2

No >> Go To 6

P0890-SWITCHED BATTERY (CONTINUED)

2. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Connect a jumper wire between the (A104) Fused B+ circuit and (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

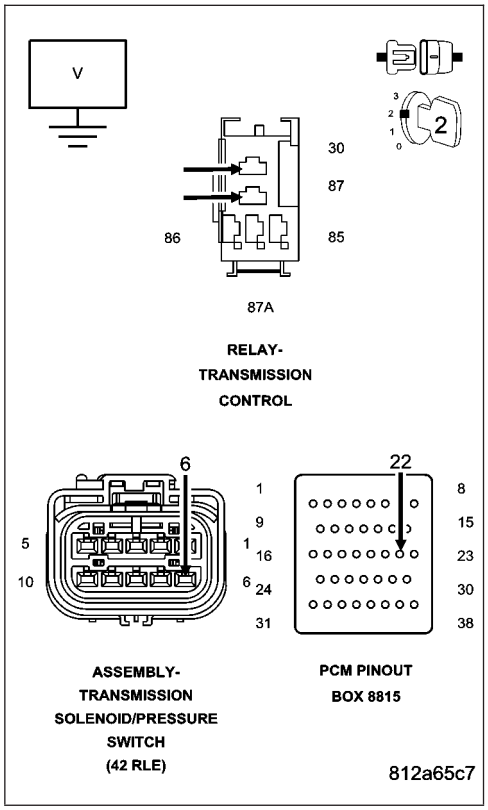
Ignition on, engine not running.

Measure the voltage of the (T9) OD Pressure Switch Sense circuit.

Is the voltage above 0.5 volt?

Yes >> Repair the (T9) OD Pressure Switch Sense circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3



3. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

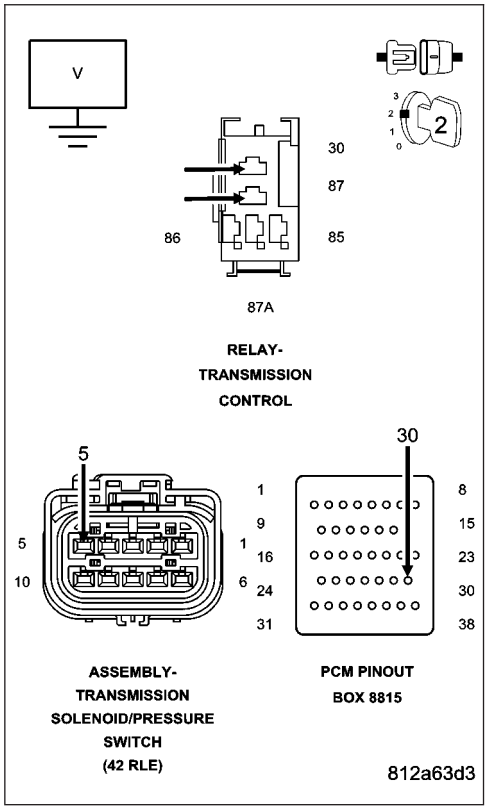
NOTE: The jumper wire must still be in place.

Measure the voltage of the (T47) 2/4 Pressure Switch Sense circuit.

Is the voltage above 0.5 volt?

Yes >> Repair the (T47) 2/4 Pressure Switch Sense circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4



P0890-SWITCHED BATTERY (CONTINUED)

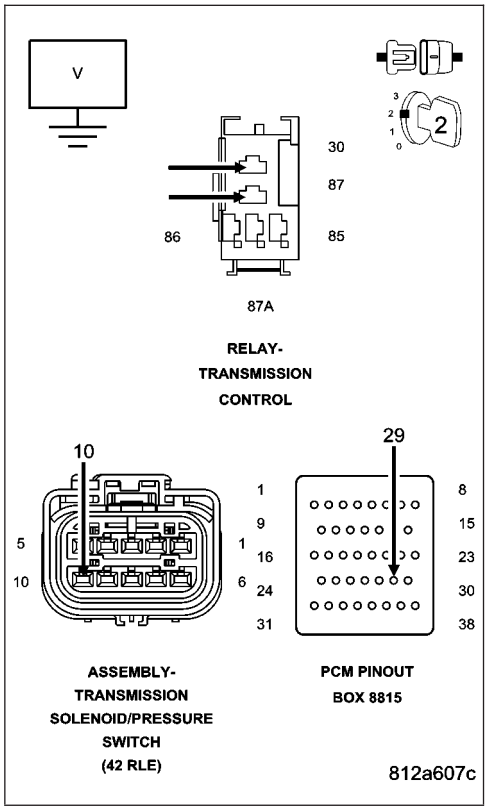
4. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

NOTE: The jumper wire must still be in place.
Measure the voltage of the (T50) L/R Pressure Switch Sense circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5



5. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

6. INTERMITTENT WIRING AND CONNECTORS

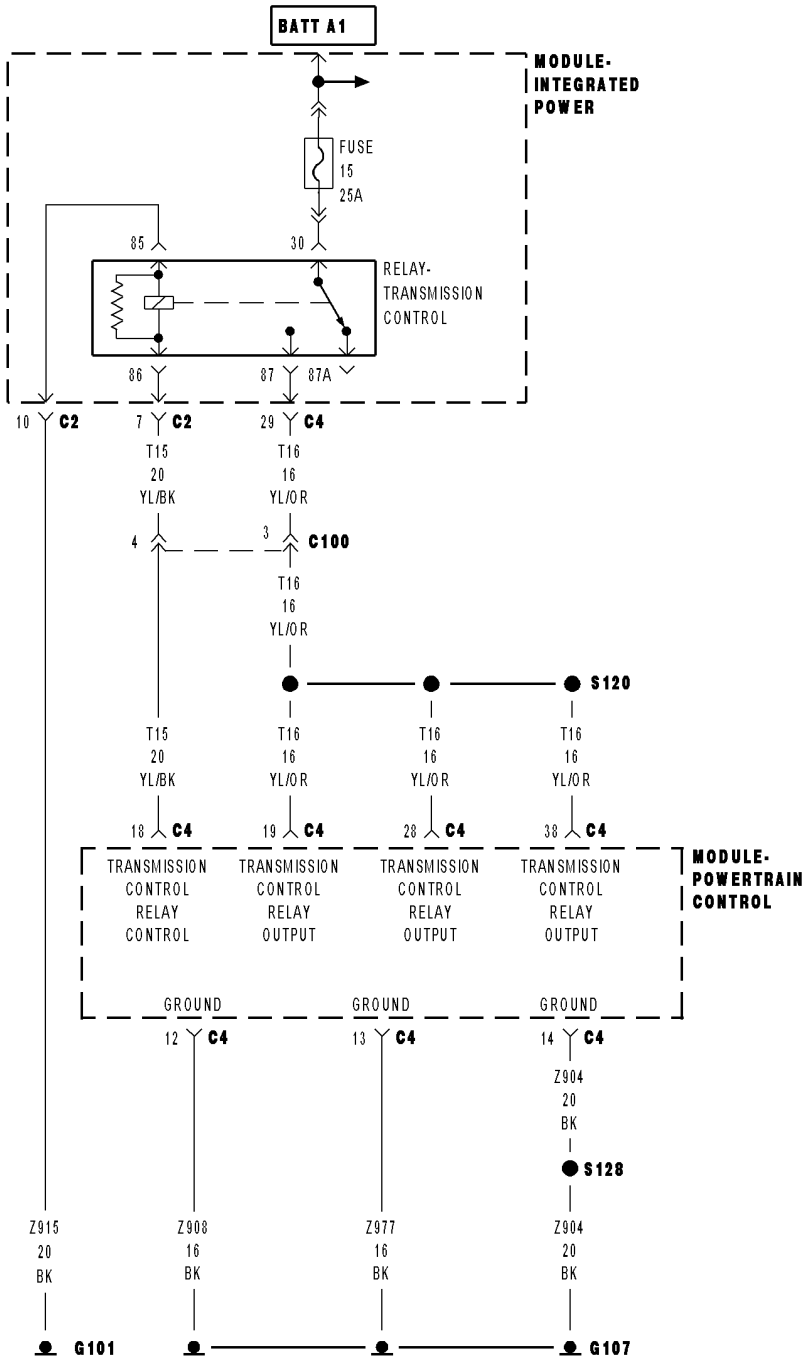
The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wiring and connectors while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

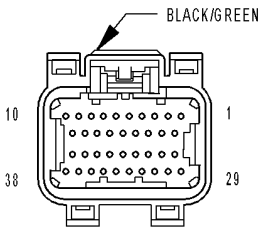
Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0891-TRANSMISSION RELAY ALWAYS ON





MODULE-
POWERTRAIN
CONTROL C4
(42RLE)

81475083

P0891-TRANSMISSION RELAY ALWAYS ON (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  After a reset (ignition key turned to the RUN position) and after a power down.
- **Set Condition:**
  Relay output (Switched Battery) is higher than 3 volts when relay is not energized by the controller. Fault Set Time: Less than 100 msec

Possible Causes
TRANSMISSION CONTROL RELAY STUCK CLOSED
(T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO VOLTAGE
(T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUITS SHORT TO VOLTAGE
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission relay is used to supply power to the solenoid pack when in normal operating mode and to turn off power to produce transmission ″limp-in″ mode. The relay output (which supplies power to the solenoid pack) is fed back to the controller This is referred to as SWITCHED BATTERY. After a controller reset (ignition key turned to the RUN position or after cranking engine), the controller verifies that the relay contacts are open by checking for no voltage on Switched battery line (relay output) before the relay is energized. Transmission locked in Limp-In. MIL on after 10 seconds of vehicle operation.

Diagnostic Test

1. CHECK TO SEE IF DTC P0891 IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter equal to 0?

Yes >> Go To 2

No >> Go To 6

---

2. TRANSMISSION CONTROL RELAY CONTACTS STUCK CLOSED

Turn the ignition off to the lock position.

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the Fused B+ circuit and the Transmission Control Relay Output Circuit at the terminals of the Transmission Control Relay.

Is the resistance above 5.0 ohms?

Yes >> Go To 3

No >> Replace the Transmission Control Relay.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0891-TRANSMISSION RELAY ALWAYS ON (CONTINUED)

3. (T16) TRANSMISSION RELAY OUTPUT CIRCUIT SHORT TO VOLTAGE

Ignition on, engine not running.

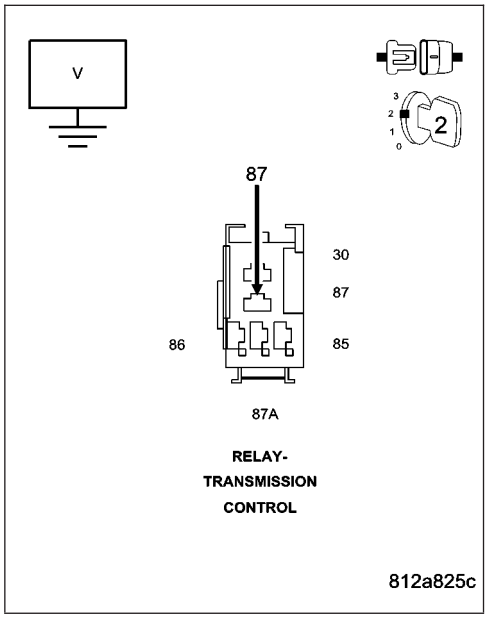
Measure the voltage at the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Is the voltage above 0.5 volts?

Yes >> Repair the (T16) Transmission Control Relay Output circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4



4. (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO VOLTAGE

NOTE: The Transmission Controller will power up the Transmission Control Relay Control circuit for approximately 3.0 seconds after initial ignition on. Wait at least 3.0 seconds after turning the ignition to the on position before performing the following voltage check.

NOTE: P0888 Relay Always Off may set. Disregard this DTC.

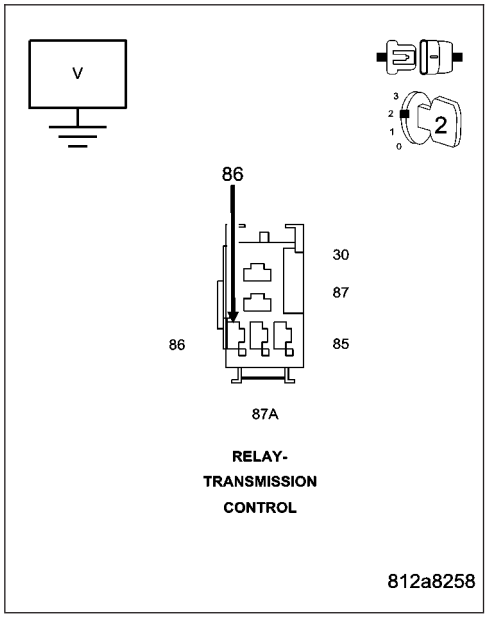
Measure the voltage at the (T15) Transmission Control Relay Control circuit after a 3.0 second wait period.

Is the voltage above 0.5 volts?

Yes >> Repair the (T15) Transmission Control Relay Control circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5



P0891-TRANSMISSION RELAY ALWAYS ON (CONTINUED)

5. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0897-TRANSMISSION FLUID DETERIORATED

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Each transition from full EMCC to partial EMCC for A/C bump prevention.
- **Set Condition:**
  DTC set if 20 occurrences of a turbine acceleration sum. Fault Set Time: 20 transitions from full EMCC to partial EMCC. Transmission will not use partial EMCC. Established for A/C bump prevention.

Possible Causes
WORN OUT/ BURNT TRANSAXLE FLUID

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

To prevent a bump due to A/C clutch engagement, a temporary torque converter partial EMCC condition is established prior to A/C clutch engagement. A message is received over the bus indicating that A/C clutch engagement is imminent. Partial EMCC is then established and a reply message, ″OK to engage A/C clutch″ is sent via the bus. Partial EMCC will be held for 450 ms before returning to full EMCC. During the transition from full to partial EMCC, a turbine acceleration sum is calculated, if this value exceeds a threshold value for several transitions, degraded transmission fluid is indicated.

Diagnostic Test

1. WORN OUT/ BURNT TRANSMISSION FLUID

Turn the ignition off to the lock position.

Flush the Transmission Oil Cooler and lines, replace the Transmission Oil Filter, refill with new Transmission Fluid, start the engine, and adjust the fluid per the Service Information.

NOTE: The Transmission Cooler must be flushed before proceeding.

Allow the engine to idle for 10 minutes, in Park.

Turn the ignition off to the lock position.

Again, flush the Transmission Oil Cooler and lines, replace the Transmission Oil Filter, refill with new Transmission Fluid, start the engine, and adjust the fluid per the Service Information.

With the scan tool, perform a Battery Disconnect.

NOTE: The Battery Disconnect must be done to re-enable EMCC during an A/C Clutch engagement.

NOTE: The vehicle may exhibit intermittent shudder during the first few hundred miles. The new Transmission Fluid will gradually penetrate the Torque Convertor Clutch friction material and the shudder should disappear.

Erase the DTC and return the vehicle to the customer.

Did the DTC reset and/or does the vehicle still shudder after a few thousand miles?

Yes >> Replace the Torque Converter per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0944-LOSS OF HYDRAULIC PUMP PRIME

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram**Refer to Section 8W**.

- **When Monitored:**
  Every 350 msec
- **Set Condition:**
  If the transmission begins to slip in any forward gear, and the pressure switch or switches that should be closed for a given gear are open, a loss of prime test begins. All available elements (in 1st gear LR, 2/4 and OD, in 2nd, 3rd, and 4th gear 2/4 and OD) are turned on by the PCM to see if pump prime exists. The code is set if none of the pressure switches respond. The PCM will continue to run the loss of prime test until pump pressure returns. The vehicle will not move or the transmission will slip. Normal operation will continue if pump prime returns.

Possible Causes
LOW TRANSMISSION FLUID LEVEL
SHIFT LEVER POSITION
PLUGGED TRANSMISSION FILTER
TRANSMISSION OIL PUMP

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The Loss of Prime Test is used to prevent transmission defaults and erroneous fault codes during temporary loss of pump prime that may occur with low transmission fluid under severe braking conditions, start-up, etc. and to point towards more subtle problems such as a plugged or ruptured oil filter. The Loss of Prime fault is set by a loss of hydraulic pressure in the transmission system. This condition, if sustained, will result in the vehicle being unable to move.

Diagnostic Test

1. CHECK TO SEE IF DTC P0944 IS CURRENT

Place the gear selector in park.

Start the engine.

NOTE: The Transmission Temperature must be at least 43° C (110° F) before performing the following steps. The Transmission must be at operating temperature prior to checking pressure. Cold transmission fluid will result in higher pressure readings.

Place the Transmission in Reverse.

With the scan tool, observe the Transmission Pressure Switch states.

Are any of the Pressure Switches closed?

Yes >> Go To 2

No >> Go To 4

P0944-LOSS OF HYDRAULIC PUMP PRIME (CONTINUED)

2. INTERMITTENT OPERATION

The conditions necessary to set this DTC are not present at this time.
Test drive the vehicle. Allow the Transmission to shift through all gears and ranges.

Was a delayed engagement and/or a no drive condition present during the test drive?

Yes >> Go To 4

No >> Go To 3

---

3. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wiring while checking for shorted and open circuits.
With the scan tool, check the EATX EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

---

4. SHIFT LEVER POSITION TEST

With the scan tool, perform a Shift Lever Position test. Follow the instructions on the screen.

Did the Shift Lever Position Test pass?

Yes >> Go To 5

No >> Perform the diagnostic procedure for P0706–CHECK SHIFTER SIGNAL.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

5. CHECK FOR PLUGGED TRANSMISSION FILTER

Remove the Transmission Pan and inspect the Transmission Fluid and Transmission Filter per the Service Information.

Does the Transmission Oil Pan contain excessive debris and/or is the Oil Filter plugged?

Yes >> Repair the cause of the plugged Transmission Filter. Refer to the Service Information for the proper repair procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6

---

6. TRANSMISSION OIL PUMP

If there are no possible causes remaining, view repair.

Repair

Replace the Transmission Oil Pump per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P0992-2/4/OD HYDRAULIC PRESSURE TEST

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM, shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed greater than 1000 RPM, the PCM momentarily turns on element pressure to the clutch circuits that do not have pressure to identify that the correct pressure switch closes. If the pressure switch does not close 2 times the DTC sets.

Possible Causes
CONDITION P0992 PRESENT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

Pressure switches are normally off or open (no pressure applied) and read high (+12 volts). When an element is applied, the corresponding pressure switch closes to ground (0 volts) or turns on. The controller tests the OD and 2/4 pressure switches when they are off (when the corresponding friction element is not applied) by briefly applying the OD and 2/4 elements which will cause the corresponding pressure switch to close. The test verifies that the switches are operational and that the switch will close when the corresponding element is applied. If a switch fails to respond, it is re-tested. The MIL illuminates and the transmission system defaults to Limp-in mode.

1. CHECK TO SEE IF DTC P0992 IS CURRENT

NOTE: The vehicle must be driven to set this DTC. The transmission must at operating temperature with the Engine RPM above 1000 RPM.

This DTC is an indication of both the 2/4 and the O/D Hydraulic Pressure Switch DTCs present.

Perform the diagnostic procedures for both P0845 and P0870.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

If there are no possible causes remaining, view repair.

Repair

Refer to the Transmission category and perform the diagnostic procedures for P0845 and P0870.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P1684-BATTERY WAS DISCONNECTED

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  After a reset (ignition key turned to the RUN position).
- **Set Condition:**
  The checksum of the battery backed RAM does not match the stored checksum. Set Time: Less than 7 msec.

Possible Causes
BATTERY WAS DISCONNECTED
PCM WAS REPLACED OR DISCONNECTED
QUICK LEARN WAS PERFORMED
(A919) FUSED B+ CIRCUIT TO PCM OPEN
(Z908 and Z977) GROUND CIRCUIT OPEN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

Note: This is not a fault code. It exists to provide reference information only. A battery backed RAM is used to maintain some learned values. When the battery is disconnected, this memory is lost. When the battery is reconnected, the loss of learned values will be detected by the controller. The code will be set and the learned values will be initialized to known constants and the learning process will continue. Setting the code has no effect except for re-initialization of learned values.

Diagnostic Test

1. BATTERY WAS DISCONNECTED

Has the battery been disconnected, lost it's charge, or been replaced recently?

Yes >> Disconnecting or replacing the battery will set this DTC. Erase the DTC.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. WAS QUICK LEARN PERFORMED

Has a Quick Learn procedure been performed?

Yes >> Performing Quick Learn will set this DTC. Erase the DTC.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. PCM REPLACED OR DISCONNECTED

Has the PCM been replaced or disconnected?

Yes >> Replacing or disconnecting the PCM will set this DTC. Erase the DTC.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

P1684-BATTERY WAS DISCONNECTED (CONTINUED)

4. (A919) FUSED B+ CIRCUIT

Turn the ignition off to the lock position.

Disconnect the PCM C1 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

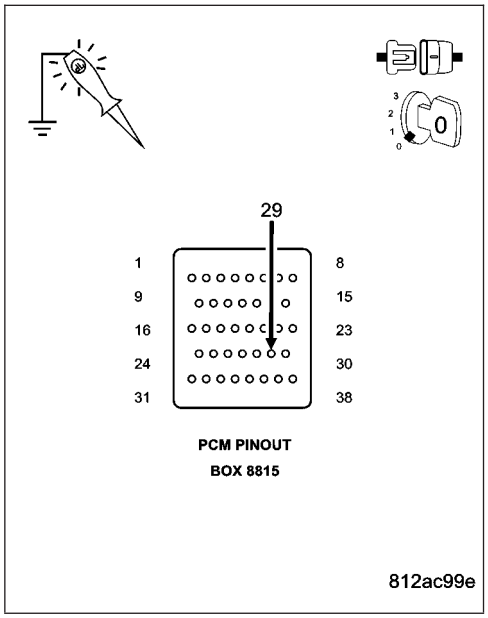
Using a 12-volt test light connected to ground, check the (A919) Fused B+ circuit.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly?

Yes >> Go To 5

No >> Repair the Fused B+ circuit for an open. If the fuse is open make sure to check for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.



5. (Z908) AND (Z977) GROUND CIRCUITS

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

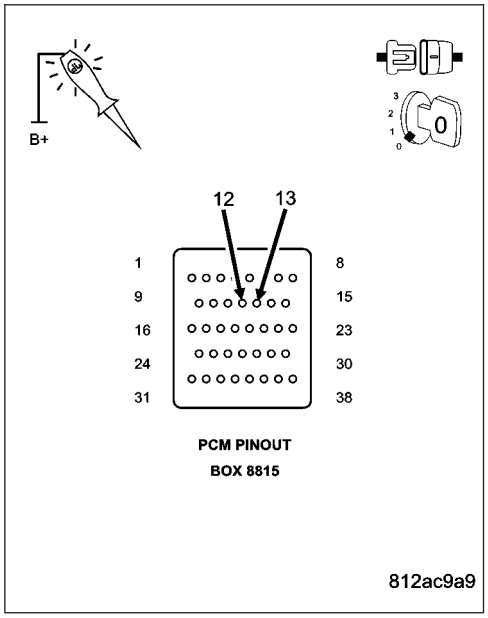
Using a 12-volt test light connected to 12-volts, check the (Z908) and (Z977) Ground circuits in the appropriate terminal of special tool #8815.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly for all of the ground circuits?

Yes >> Go To 6

No >> Repair the Ground circuits for an open.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.



P1684-BATTERY WAS DISCONNECTED (CONTINUED)

6. INTERMITTENT WIRING AND CONNECTORS

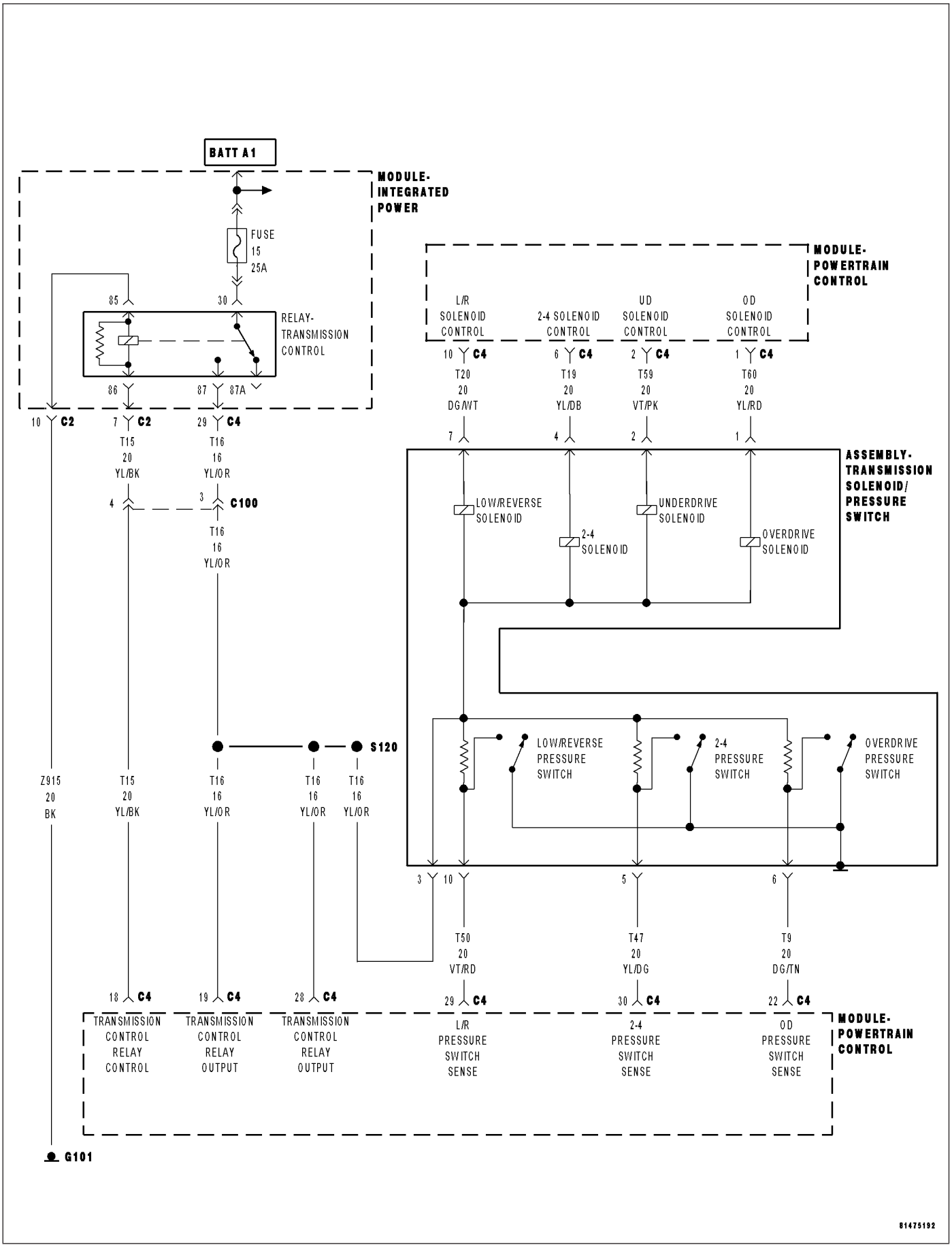
The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLETRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION



42RLE MINI SOL PRS CKTS

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Prior to a shift into 1st gear.
- **Set Condition:**
  Transmission temperature must be hot. DTC is set after six unsuccessful attempts to shift into 1st gear.

Possible Causes
RELATED DTC P0841 PRESENT
(T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The Solenoid Switch Valve, an internal, hydraulically operated valve, controls the direction of the transmission fluid when the LR solenoid is energized. When the solenoid switch valve is in the downshifted position and the LR solenoid is energized, fluid is directed to the LR element for 1st gear. When the solenoid switch valve is In the upshifted position (2nd, 3rd, and 4th gear) and the LR solenoid is energized, fluid is directed into the Lockup Switch Valve which controls the Torque Converter Clutch. When shifting into 1st gear, a special sequence is followed to insure solenoid switch valve movement into the downshifted position. The LR pressure switch is monitored to confirm switch valve movement. If the solenoid switch valve movement is not confirmed (i.e. no LR pressure when the LR solenoid is energized), 2nd gear is substituted for 1st. No 1st gear (2nd gear is substituted). The transmission Torque converter FEMCC operation is inhibited. MIL on after 5 min. of substituted operation.

Diagnostic Test

1. DETERMINING IF RELATED DTCS ARE PRESENT

With the scan tool, check for other Transmission DTCs

Is the DTC P0841 present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF DTC P1775 IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 3

No >> Go To 10

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION (CONTINUED)

3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to L/R.

With the scan tool, monitor the L/R Pressure Switch State while pressing the Pressure Switch Test button.

Did the Pressure Switch state change from open to closed when the test button was pressed?

Yes >> Go To 4

No >> Go To 5

---

4. INTERNAL TRANSMISSION

If there are no possible causes remaining, view repair.

Repair

Repair internal transmission as necessary per the Service Information. Inspect the Solenoid Switch Valve per the Service Information and repair or replace as necessary. If no problems are found, replace the Transmission Solenoid/Pressure Switch Assembly.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION (CONTINUED)

5. (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

Disconnect the PCM C4 harness connector.

Remove the Transmission Control Relay.

Remove the Starter Relay.

NOTE: Check connectors - Clean/repair as necessary.

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit at the Transmission Control Relay connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to ground, check all (T16) Transmission Control Relay Output circuits in the appropriate terminals of special tool #8815.

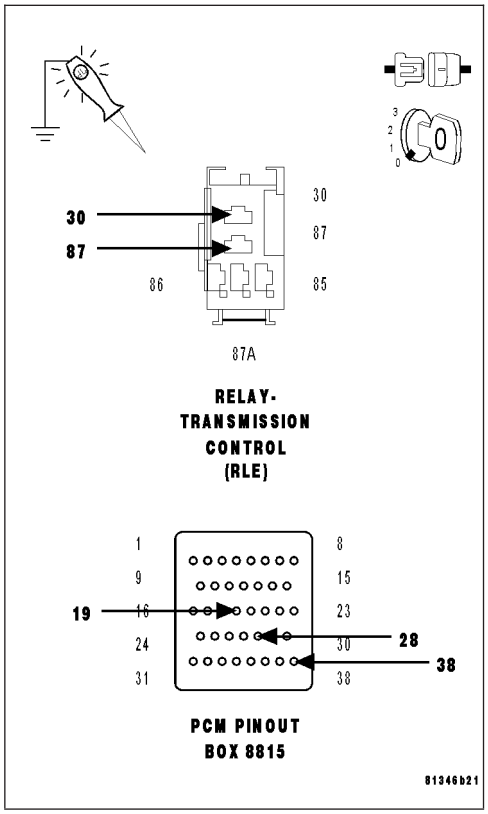
NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly on all Transmission Control Relay Output circuits?

Yes >> Go To 6

No >> Repair the (T16) Transmission Control Relay Output circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.



6. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN

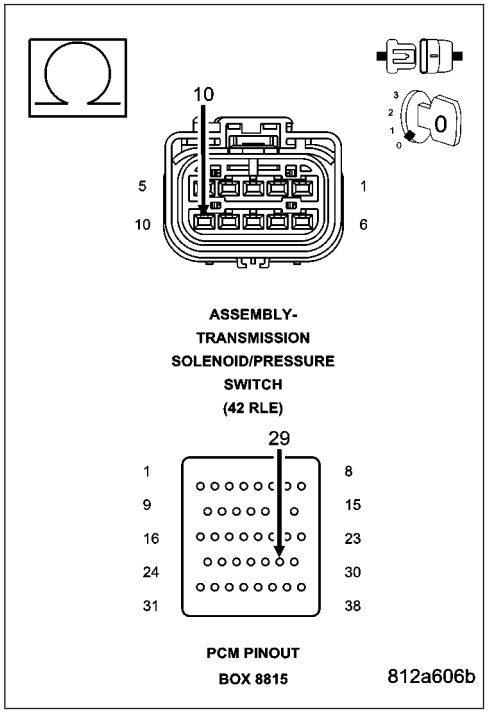
Measure the resistance of the (T50) L/R Pressure Switch Sense circuit from the appropriate terminal of special tool #8815 to the Transmission Solenoid/Pressure Switch Assembly harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7



P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION (CONTINUED)

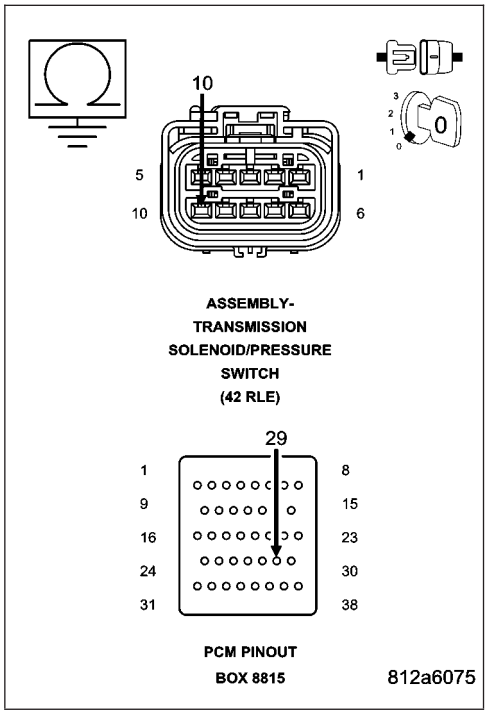
7. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T50) L/R Pressure Switch Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8



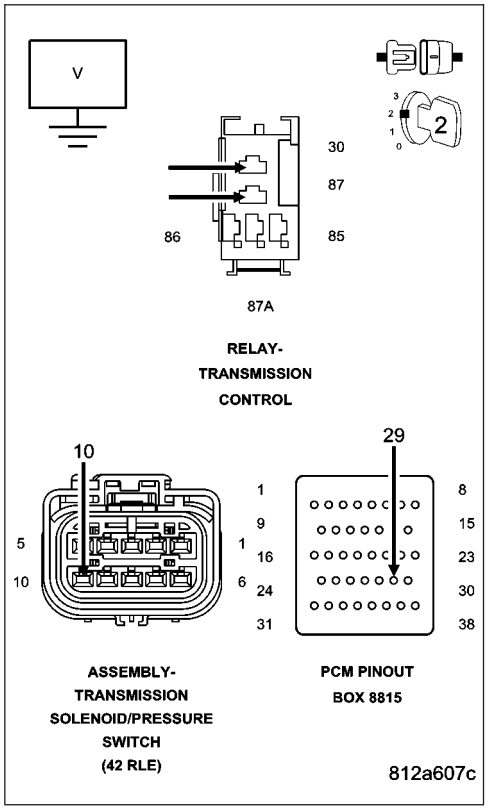
8. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

NOTE: The jumper wire must still be in place.
Ignition on, engine not running.
Measure the voltage of the (T50) L/R Pressure Switch Sense circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9



P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION (CONTINUED)

9. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

10. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Test drive and verify if the transmission is launching in 2nd gear and/or no TCC engagement.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

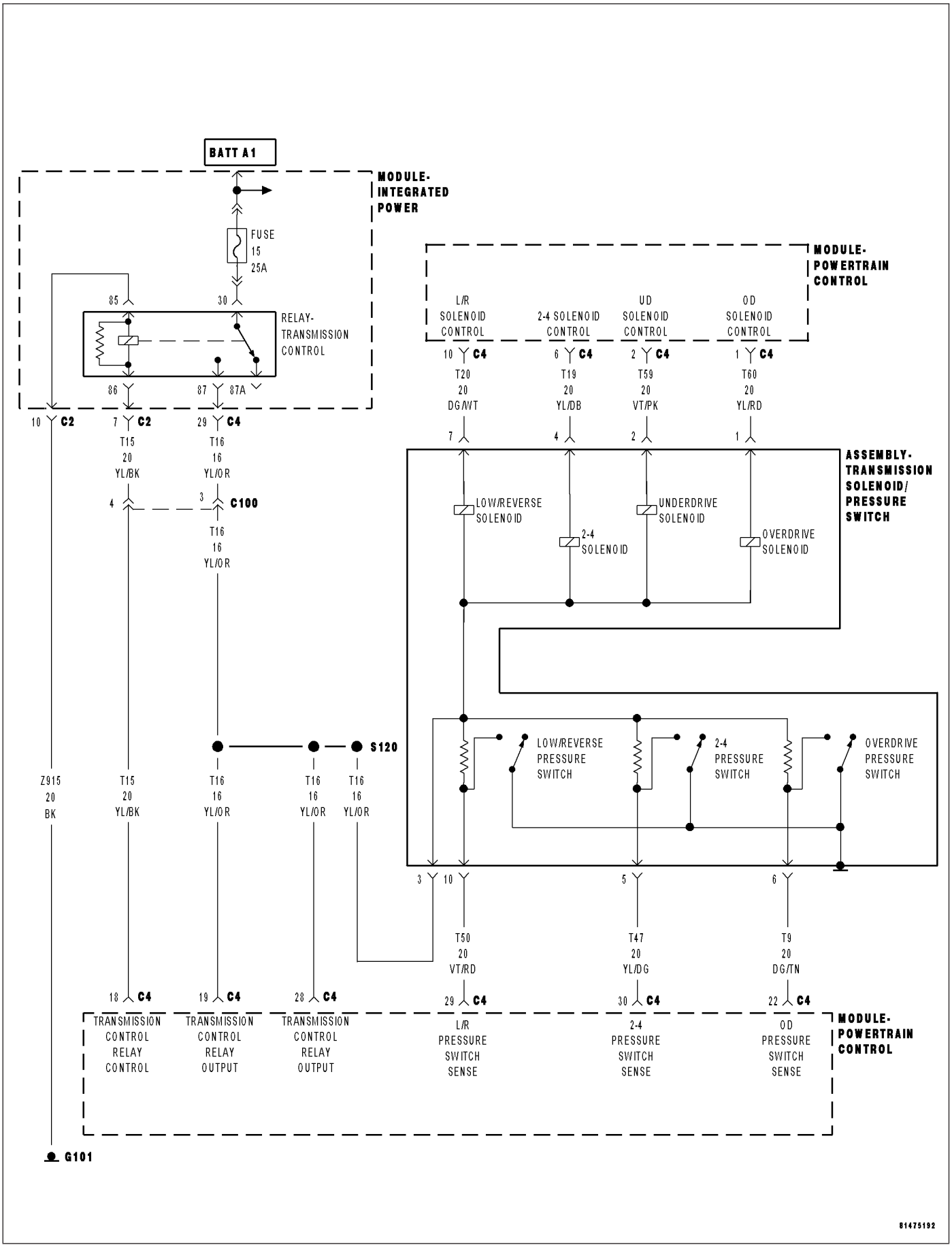
Are there 2nd gear launches and/or no TCC engagement?

Yes >> Disassemble and inspect the Valve Body per the Service Information and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid Pressure Switch Assembly.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION



42RLE MINI SOL PRS CKTS

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Every 7 ms during PEMCC or FEMCC.
- **Set Condition:**
  Must be in partial or full EMCC. The DTC is set if LR pressure is detected high for the fourth time.

Possible Causes
RELATED DTC P0841 PRESENT
(T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The Solenoid Switch Valve, an internal, hydraulically operated valve, controls the direction of the transmission fluid when the LR solenoid is energized. When the solenoid switch valve is in the downshifted position and the LR solenoid is energized, fluid is directed to the LR element for 1st gear. When the solenoid switch valve is in the up-shifted position (2nd, 3rd, and 4th gear) and the LR solenoid is energized, fluid is directed into the Lockup Switch Valve which controls the Torque Converter Clutch. When doing PEMCC or FEMCC, the LR pressure switch should indicate no pressure if the solenoid switch valve is in the TCC position. If the LR pressure switch indicates pressure while in partial or full EMCC, the EMCC operation is aborted and momentarily inhibited to avoid accidental application of the LR clutch. EMCC is attempted again when there is no LR pressure. The fourth detection of LR pressure while in PEMCC or FEMCC will result in setting the DTC. Torque converter EMCC operation inhibited. MIL on after 5 min. of substituted operation.

Diagnostic Test

1. DETERMINING IF RELATED DTCS ARE PRESENT

With the scan tool, check for other Transmission DTCs

Is the DTC P0841 present also?

Yes >> Refer to the Transmission category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF DTC P1776 IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 3

No >> Go To 10

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION (CONTINUED)

3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to L/R.

With the scan tool, monitor the L/R Pressure Switch State while pressing the Pressure Switch Test button.

Did the Pressure Switch state change from open to closed when the test button was pressed?

Yes >> Go To 4

No >> Go To 5

---

4. INTERNAL TRANSMISSION

If there are no possible causes remaining, view repair.

Repair

Repair internal transmission as necessary per the Service Information. Inspect the Solenoid Switch Valve per the Service Information and repair or replace as necessary. If no problems are found, replace the Transmission Solenoid/Pressure Switch Assembly.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION (CONTINUED)

5. (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

Disconnect the PCM C4 harness connector.

Remove the Starter Relay.

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

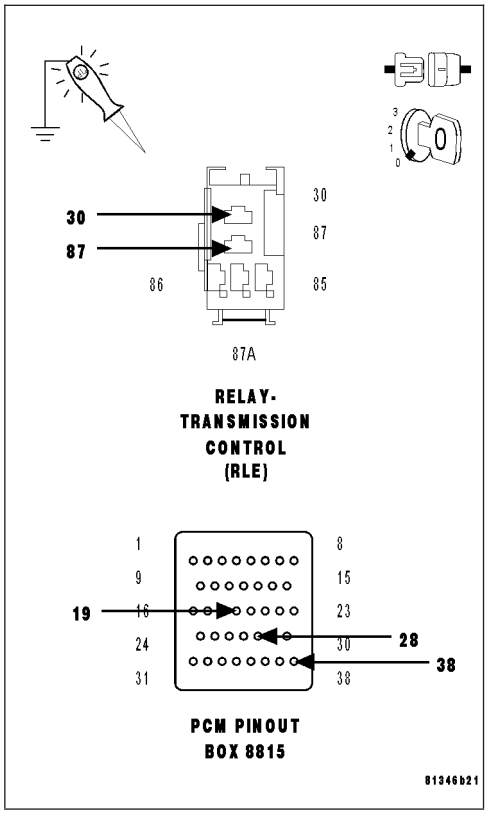
Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit at the Transmission Control Relay connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to ground, check all (T16) Transmission Control Relay Output circuits in the appropriate terminals of special tool #8815.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly on all Transmission Control Relay Output circuits?



Yes >> Go To 6

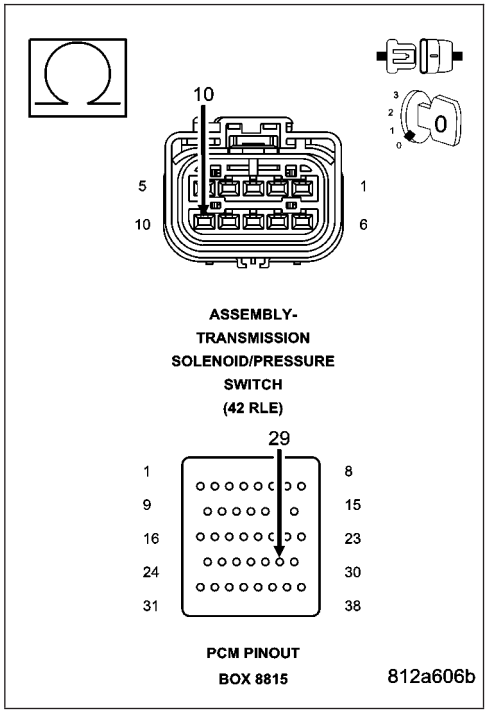
No >> Repair the (T16) Transmission Control Relay Output circuit(s) for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

6. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN

Measure the resistance of the (T50) L/R Pressure Switch Sense circuit from the appropriate terminal of special tool #8815 to the Transmission Solenoid/Pressure Switch Assembly harness connector.

Is the resistance above 5.0 ohms?



Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION (CONTINUED)

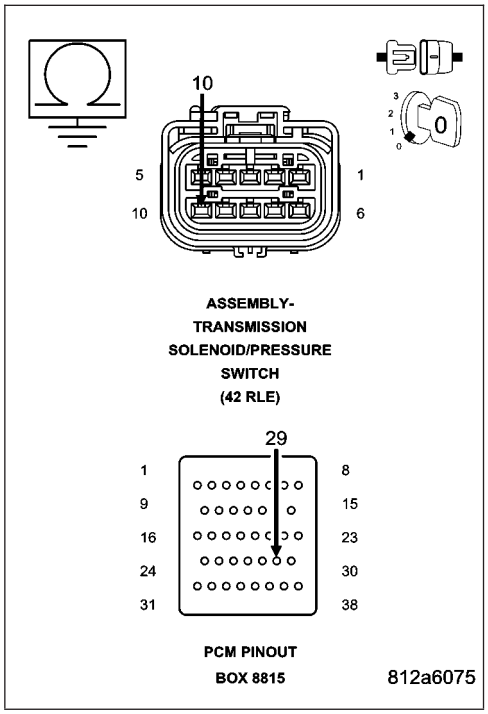
7. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T50) L/R Pressure Switch Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8



8. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

Turn the gnition off.

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit at the Transmission Control Relay connector.

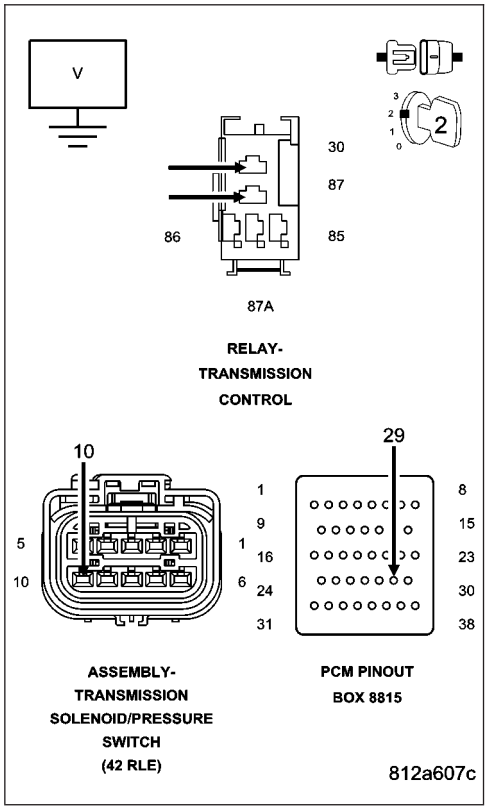
Ignition on, engine not running.

Measure the voltage of the (T50) L/R Pressure Switch Sense circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9



P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION (CONTINUED)

9. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

10. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Test drive and verify if the transmission is launching in 2nd gear and/or no TCC engagement.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Are there 2nd gear launches and/or no TCC engagement?

Yes >> Disassemble and inspect the Valve Body per the Service Information and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid Pressure Switch Assembly.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P1790-FAULT IMMEDIATELY AFTER SHIFT

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  After a Gear Ratio Error code is stored.
- **Set Condition:**
  After a Gear Ratio Error DTC has already been set. The DTC is set if the fault happened within 1.3 seconds of a shift. The DTC set time will vary from 1.214 seconds to 15 seconds.

Possible Causes
FAULT AFTER SHIFT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

This DTC is not stored alone. It is stored if a Gear Ratio DTC is detected immediately after shift. The existence of DTC P1790 indicates a mechanical or hydraulic (not electrical) related problems. It should be noted, however, that all mechanical problems don't necessarily result in DTC P1790. When this DTC exists, diagnosing the system should be based on the associated DTC and only mechanical causes should be considered.

Diagnostic Test

1. FAULT AFTER SHIFT

This DTC is set along with a Gear Ratio DTC. Perform the appropriate test for the Gear Ratio DTC stored.

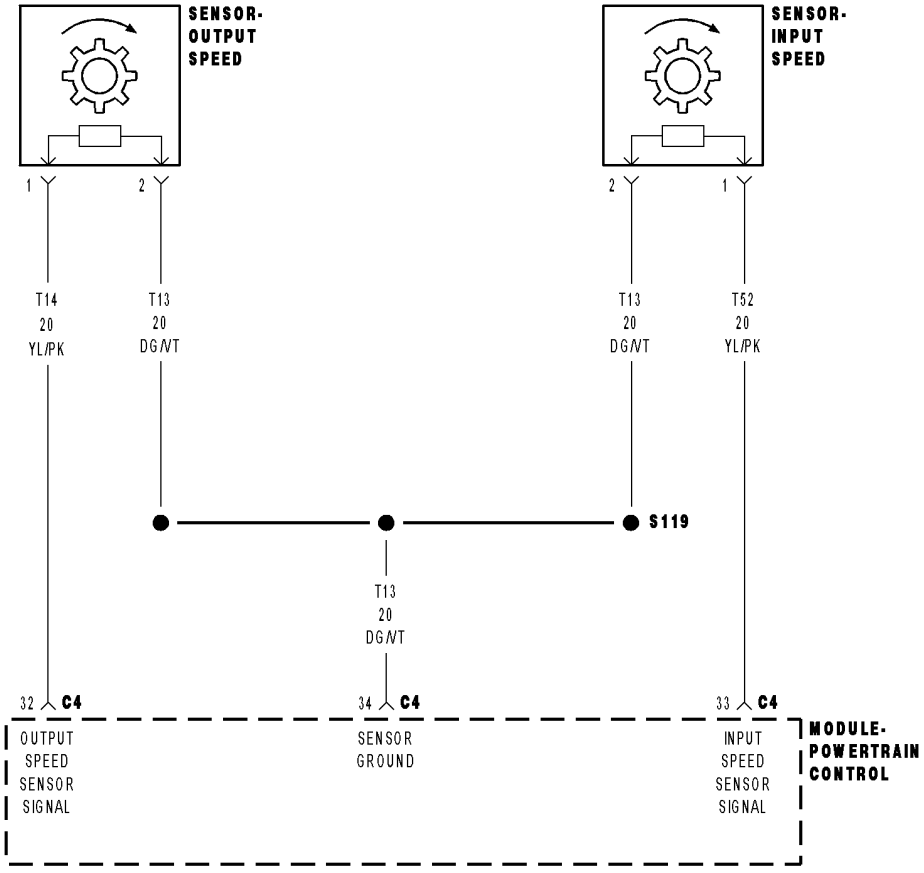
NOTE: Check Pending DTCs or 1 trip failures if there are no Active or Stored Gear Ratio DTCs.

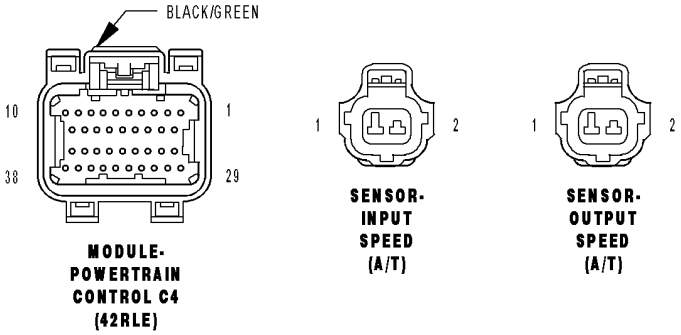
If there are no possible causes remaining, view repair.

Repair

Refer to the Transmission category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

P1794-SPEED SENSOR GROUND ERROR





8147515d

P1794-SPEED SENSOR GROUND ERROR (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Every 7ms after a controller reset with transmission in neutral.
- **Set Condition:**
  After a PCM reset in neutral and Input and Output sensor ratio equals 2.50 to 1.0 ± 50.0 RPM.

Possible Causes
SPEED SENSOR GROUND CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The input and output speed sensors use a common ground circuit. The loss of this common ground results in the input signal being sensed for both. After a reset in neutral, and after observing a specific ratio, the Speed Check Fault Counter will increment. Because the speed sensors and the thermistor share the same ground circuit, this DTC may indicate a loss of the common speed sensor ground. In some cases this fault will cause a Gear Ratio Error DTC to be set.

Diagnostic Test

1. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

Ignition on, engine not running.

With the Transmission Simulator, set the ″Input/Output Speed″ switch to ″ON″ and the rotary switch to the ″3000/1250″ position.

With the scan tool, monitor the Input and Output Speed Sensor readings.

Does the Input Speed read 3000 RPM and the Output Speed read 1250 RPM, ± 50 RPM?

Yes >> Go To 2

No >> Go To 4

P1794-SPEED SENSOR GROUND ERROR (CONTINUED)

2. (T13) SPEED SENSOR GROUND CIRCUIT OPEN

Turn the ignition off to the lock position.

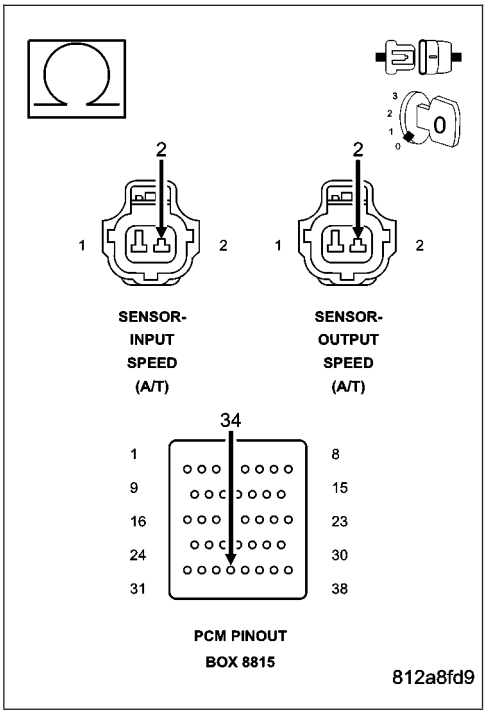
Disconnect the PCM C4 harness connector.

Disconnect the Input and Output Speed Sensor harness connectors.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of both of the (T13) Speed Sensor Ground circuits from the appropriate terminal of special tool #8815 to the Input and Output Speed Sensor harness connectors.



Is the resistance above 5.0 ohms on either circuit?

Yes >> Repair the (T13) Speed Sensor Ground circuit for an open.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

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3. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P1797-MANUAL SHIFT OVERHEAT

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with engine running.
- **Set Condition:**
  If the Engine Temperature exceeds 123° C (255° F) or the Transmission Temperature exceeds 135° C (275° F) while in AutoStick® mode. Note: Aggressive driving or driving in low for extended periods of time will set this DTC.

Possible Causes
MANUAL SHIFT OVERHEAT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).

Theory of Operation

The major cause of heat build up in the transmission is torque converter slip. With the transmission in the AutoStick® mode, the torque converter can slip during aggressive driving or heavy loading conditions such as trailer towing or driving up steep grades. In the non autostick mode, internal controller logic prevents the transmission from overheating by managing the shift and EMCC schedule. In the autostick mode, when the transmission or engine temperature approaches an overheat condition, the manual shift overheat DTC sets and the autostick mode is temporarily suspended until the temperature returns to normal.

Diagnostic Test

1. MANUAL SHIFT OVERHEAT

This is an informational DTC only.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check the engine and transmission cooling system for proper operation.

Check the Radiator Cooling Fan operation.

Check the Transmission Cooling operation.

Check the Transmission Fluid Level per the Service Information to verify that it is not overfilled.

NOTE: Aggressive driving or driving in low for extended periods of time will set this DTC.

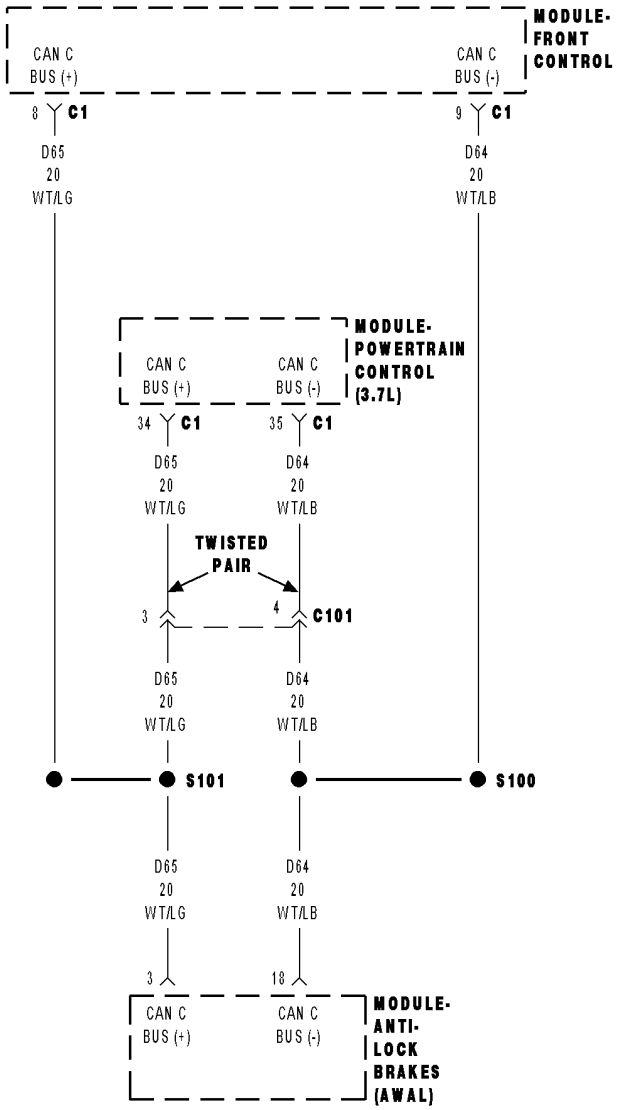
If there are no possible causes remaining, view repair.

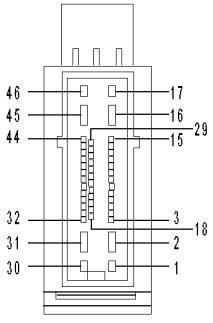
Repair

If the Transmission Fluid is low, repair any Transmission Fluid leak as necessary and adjust the Transmission Fluid Level per the Service Information. Refer to Service Information for the related symptoms and repair as necessary.

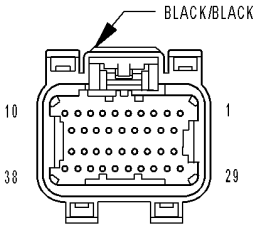
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

U0100 LOST COMMUNICATION WITH ECM/PCM

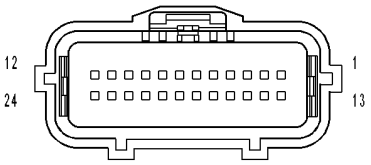




MODULE-
ANTI-LOCK
BRAKES
(AWAL)



MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
FRONT
CONTROL C1

814752cb

U0100 LOST COMMUNICATION WITH ECM/PCM (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

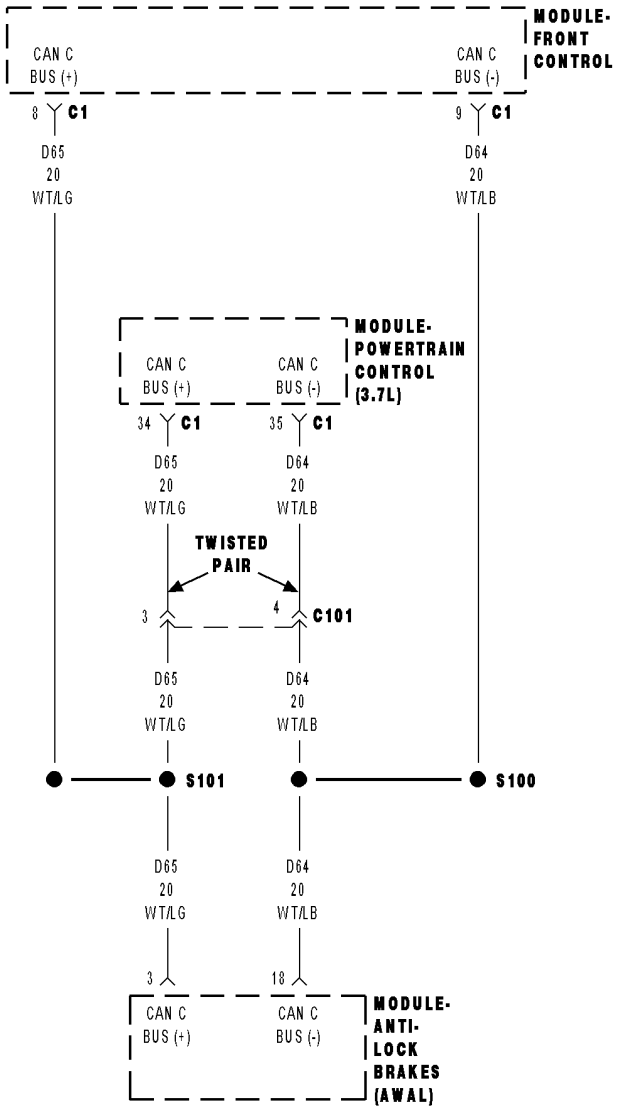
- **When Monitored:**
  Every 7 msec with:
  1) Engine speed greater than 500 RPM.
  2) Battery voltage between 10 and 16 volts.
- **Set Condition:**
  CAN C bus messages are not received for 10 seconds.

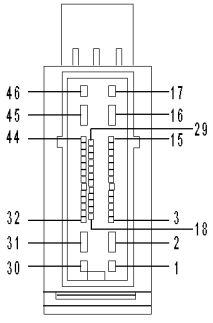
Theory of Operation

The NGC controller communicates over the CAN C bus. The transmission controller continuously monitors bus activity. The CAN C bus is also used to communicate transmission MIL status to the Engine Controller. If the Engine Controller is unable to communicate with the Transmission Controller, a DTC will set and the Engine Controller will illuminate the MIL.

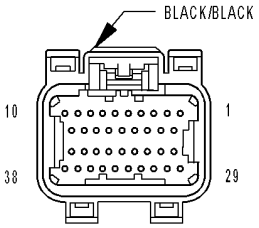
Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0002 CAN C BUS OFF PERFORMANCE

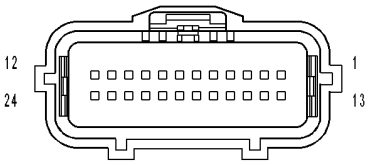




MODULE-
ANTI-LOCK
BRAKES
(AWAL)



MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
FRONT
CONTROL C1

814752cb

U0002 CAN C BUS OFF PERFORMANCE (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

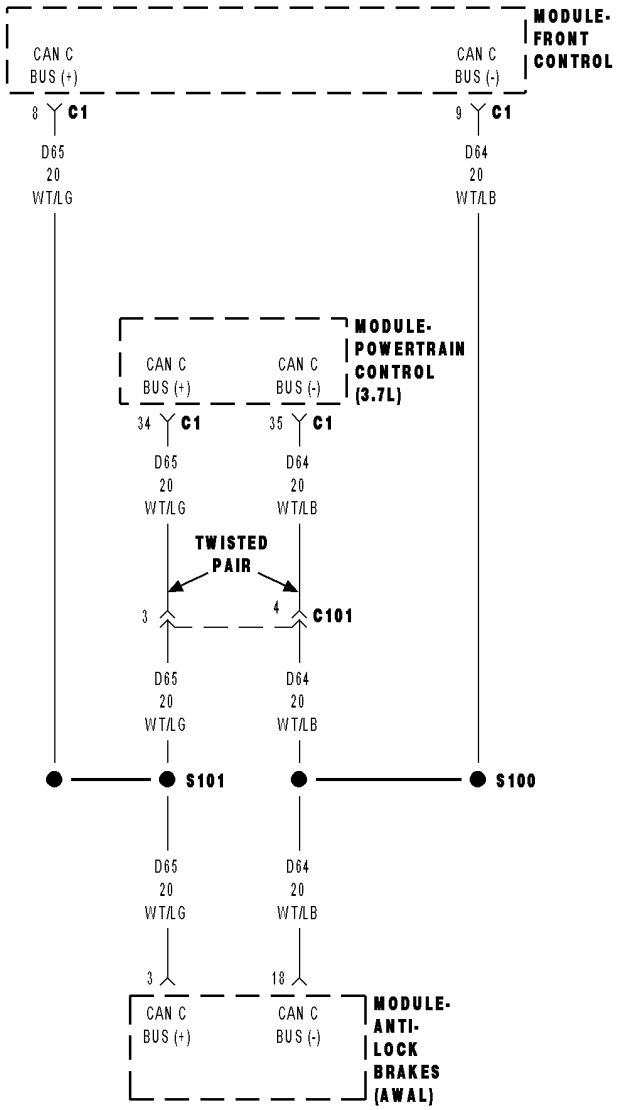
- **When Monitored:**
  Every 7 msec with:
  1) Engine speed greater than 500 RPM.
  2) Battery voltage between 10 and 16 volts.
- **Set Condition:**
  CAN C bus messages are not received for 10 seconds.

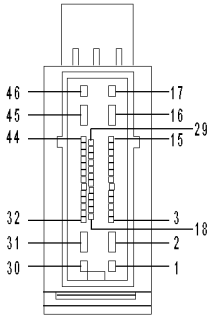
Theory of Operation

The NGC controller communicates over the CAN C bus. The transmission controller continuously monitors bus activity. The CAN C bus is also used to communicate transmission MIL status to the Engine Controller. If the Engine Controller is unable to communicate with the Transmission Controller, a DTC will set and the Engine Controller will illuminate the MIL.

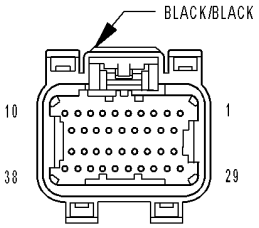
Diagnose the U0002 CAN C BUS OFF PERFORMANCE as the U0001 CAN C BUS CIRCUIT test in 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0121 LOST COMMUNICATION WITH ABS

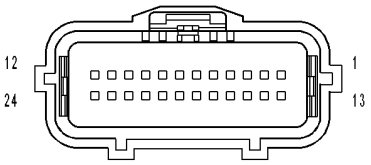




MODULE-
ANTI-LOCK
BRAKES
(AWAL)



MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
FRONT
CONTROL C1

814752cb

U0121 LOST COMMUNICATION WITH ABS (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

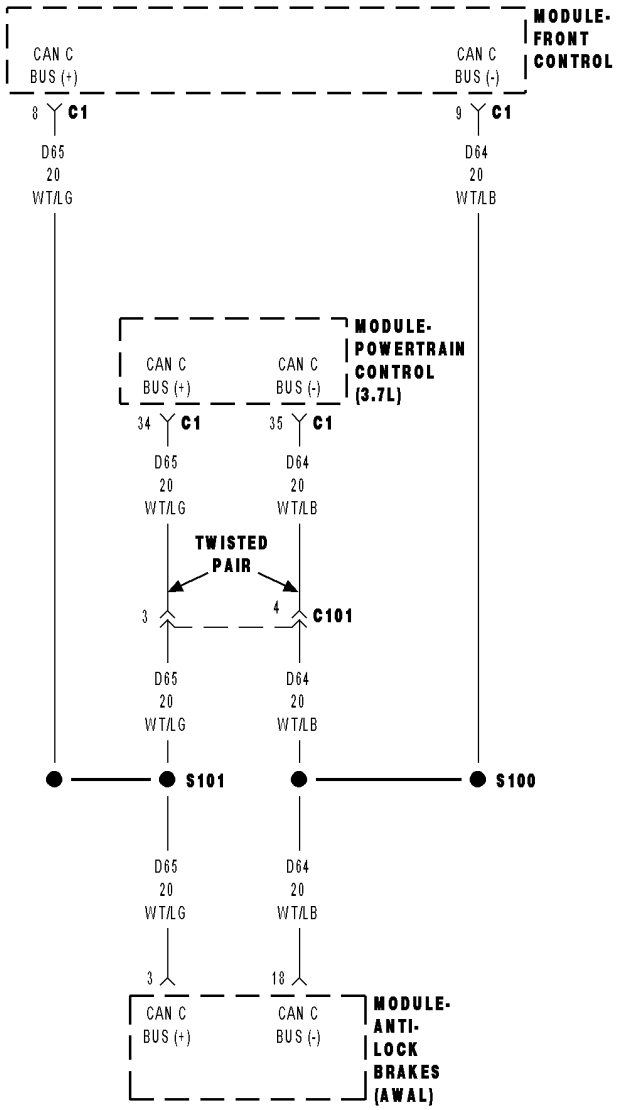
- **When Monitored:**
  Every 7 msec with:
  1) Engine speed greater than 500 RPM.
  2) Battery voltage between 10 and 16 volts.
- **Set Condition:**
  CAN C bus messages are not received for 10 seconds.

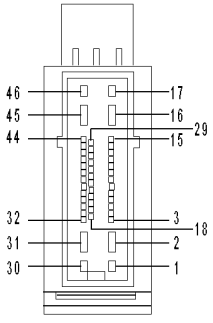
Theory of Operation

The NGC controller communicates over the CAN C bus. The transmission controller continuously monitors bus activity. The CAN C bus is also used to communicate transmission MIL status to the Engine Controller. If the Engine Controller is unable to communicate with the Transmission Controller, a DTC will set and the Engine Controller will illuminate the MIL.

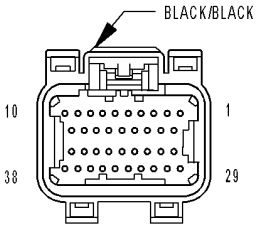
Refer to 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0141 LOST COMMUNICATION WITH FCM

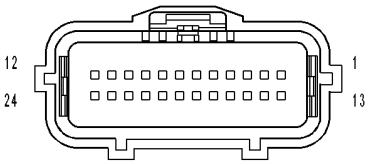




MODULE-
ANTI-LOCK
BRAKES
(AWAL)



MODULE-
POWERTRAIN
CONTROL C1
(3.7L)



MODULE-
FRONT
CONTROL C1

814752cb

U0141 LOST COMMUNICATION WITH FCM (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Every 7 msec with:
  1) Engine speed greater than 500 RPM.
  2) Battery voltage between 10 and 16 volts.
- **Set Condition:**
  CAN C bus messages are not received for 10 seconds.

Theory of Operation

The NGC controller communicates over the CAN C bus. The transmission controller continuously monitors bus activity. The CAN C bus is also used to communicate transmission MIL status to the Engine Controller. If the Engine Controller is unable to communicate with the Transmission Controller, a DTC will set and the Engine Controller will illuminate the MIL.

Refer to 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

STANDARD PROCEDURE

42RLE TRANSMISSION VERIFICATION TEST - VER 1

1.

1. After completion of the Transmission Verification Test, a Powertrain Verification Test must be performed. Refer to the Powertrain Category.

2. Connect the scan tool to the Data Link Connector (DLC).

3. Reconnect any disconnected components.

4. With the scan tool, erase all Transmission DTCs, also erase the PCM DTCs.

5. Perform *PRNDL FAULT CLEARING PROCEDURE after completion of repairs for P0706 CHECK SHIFTER SIGNAL.

6. With the scan tool, display Transmission Temperature. Start and run the engine until the Transmission Temperature is above 43° C (110° F).

7. Check the transmission fluid and adjust if necessary. Refer to the Service Information for the Fluid Fill procedure.

8. If the Powertrain Control Module or Torque Converter has been replaced, or if the Transmission has been repaired or replaced, perform a Quick Learn Procedure and reset the Pinion Factor with the scan tool.

9. Road test the vehicle. With the scan tool, monitor the engine RPM. Make 15 to 20 1-2, 2-3, 3-4 upshifts. Perform these shifts from a standing start to 45 M.p.h. with a constant throttle opening of 20 to 25 degrees.

10. Below 25 MPH, make 5 to 8 wide open throttle kickdowns to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown.

11. For a specific DTC, drive the vehicle according to the DTC When Monitored and Set Conditions in order to verify that the DTC is repaired.

12. If equipped with AutoStick®, upshift and downshift several times using the AutoStick® feature during the road test.

13. Where applicable, use the EATX OBDII task manager to run Good Trip time in each gear. This will confirm the repair.

14. Check for Diagnostic Trouble Codes (DTCs) after the road test. If a DTC sets during the road test , return to the Symptom list and perform the appropriate diagnostic procedure.

15. Erase the Engine DTC P0700 to turn the MIL off after making transmission repairs.

Were there any DTCs set during the road test?

Yes >> Refer to the Symptom List and perform the appropriate diagnostic procedure.

No >> Repair is complete.

42RLE TRANSMISSION VERIFICATION TEST - VER 1 (CONTINUED)

PRE-DIAGNOSTIC CHECK OUT

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. PRE-DIAGNOSTIC CHECK OUT

1. Check the transmission fluid level. If the fluid level is low, locate and repair any leaks and fill the transmission to the proper level. Refer to the appropriate Service Information for procedures. Many transmission symptoms can be caused by a low fluid level.

2. Check the battery. To avoid false diagnosis, testing should only be performed with the battery fully charged.

3. With the scan tool, read Engine (PCM) DTCs. If DTCs are present, refer to the Driveability Category and perform to the appropriate diagnostic procedure(s) before proceeding.

4. With the scan tool, read Transmission (TCM) DTCs. Record all Stored, Active, and Pending DTC information. Diagnose any Pending DTC as a matured DTC.

5. With the scan tool, read EATX DTC EVENT DATA. Use this data to identify the conditions in which the DTC was set.

6. Performing a Battery Disconnect will clear all EATX DTC EVENT DATA and reset all learned Transmission values to the default values, which may temporarily result in erratic shift schedules.

7. With the scan tool, perform the Shift Lever Position Test. If the test does not pass, refer to the diagnostic procedure for P0706 Check Shifter Signal.

8. For Gear Ratio Error DTCs, use the scan tool to view CVI Monitor data. Read and record the Clutch Volume Index information.

9. Use the wiring diagram as a guide. Inspect the wiring and connectors related to this circuit. Repair as necessary.

10. Refer to the When Monitored and Set Conditions for this DTC. DTCs can set at ignition on, at start up, after driving under specific conditions and after diagnostic monitors have been run.

11. Refer to applicable Technical Service Bulletins (TSBs) for controller software update information. Some conditions can be corrected by upgrading the Engine (PCM) or Transmission (TCM) controller software.

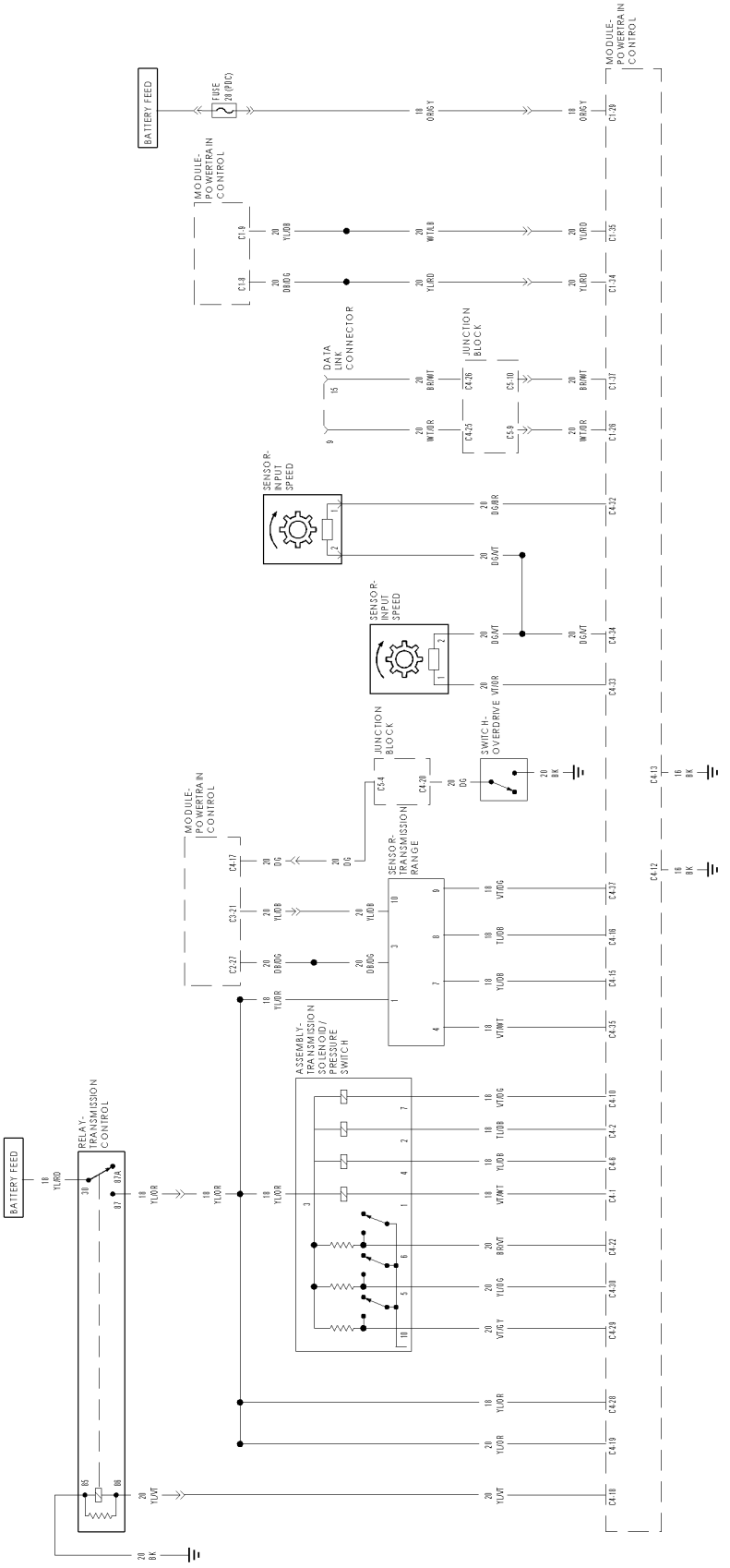
12. Refer to any Service Information Tune Ups or Technical Service Bulletins that apply to this symptom.

Were there any repairs made that fixed the vehicle?

Yes >> Testing complete.
Perform 42RLE VERIFICATION TEST - VER 1 (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No >> Refer to the Transmission category and perform the appropriate diagnostic procedure(s).

SCHEMATICS AND DIAGRAMS



42RLE SYSTEM SCHEMATIC

AUTOMATIC TRANSMISSION 42RLE - SERVICE INFORMATION

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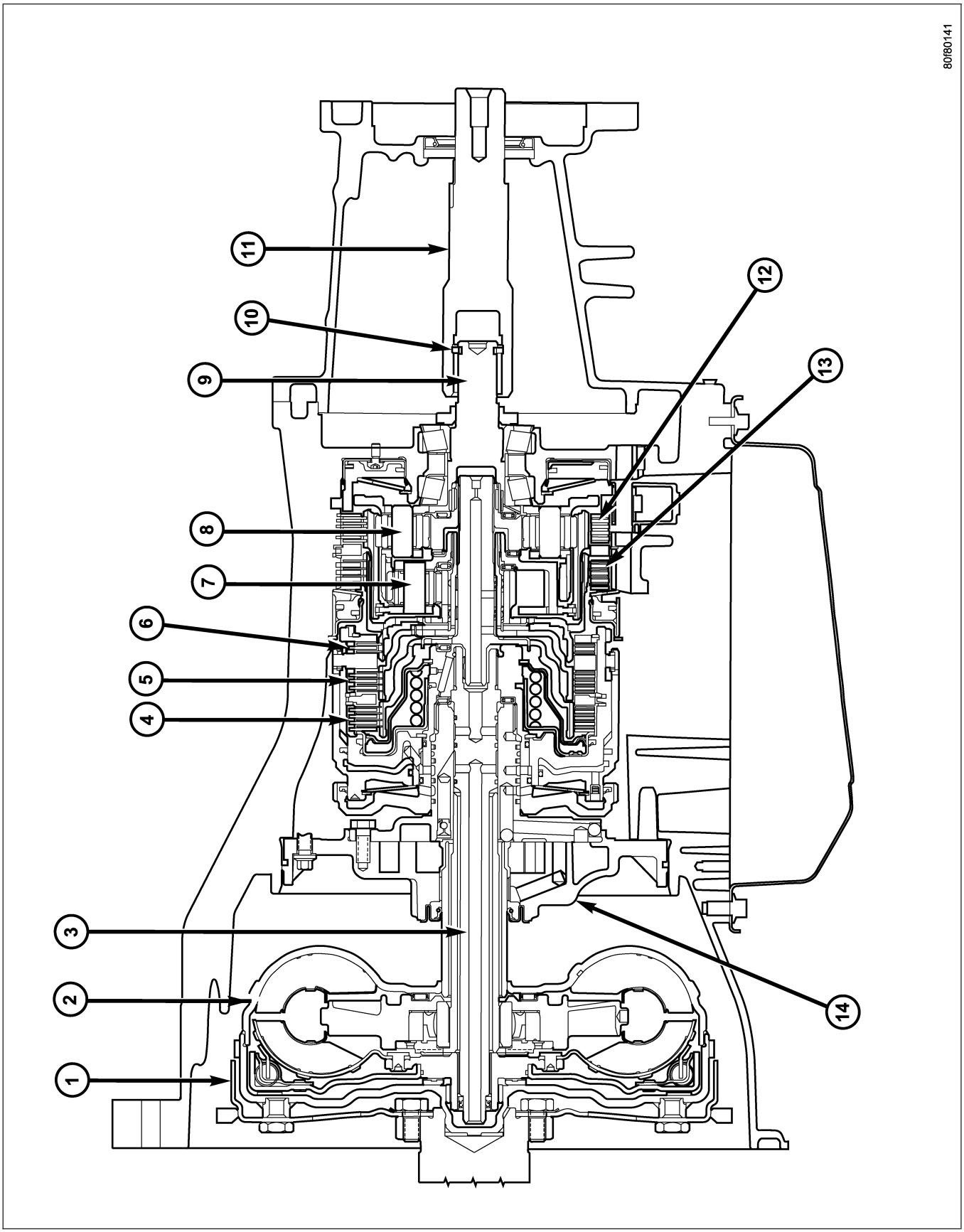
AUTOMATIC TRANSMISSION 42RLE - SERVICE INFORMATION

DESCRIPTION



42RLE Automatic Transmission

1 - DRIVEPLATE	6 - REVERSE CLUTCH	11 - STUB SHAFT
2 - TORQUE CONVERTER	7 - FRONT PLANET CARRIER	12 - LOW/REVERSE CLUTCH
3 - INPUT SHAFT	8 - REAR PLANET CARRIER	13 - 2/4 CLUTCH
4 - UNDERDRIVE CLUTCH	9 - OUTPUT SHAFT	14 - OIL PUMP
5 - OVERDRIVE CLUTCH	10 - SNAP RING	

The 42RLE is a four-speed transmission that is a conventional hydraulic/mechanical assembly controlled with adaptive electronic controls and monitors. The hydraulic system of the transmission consists of the transmission fluid, fluid passages, hydraulic valves, and various line pressure control components. An input clutch assembly which houses the underdrive, overdrive, and reverse clutches is used. It also utilizes separate holding clutches: 2nd/4th gear and Low/Reverse. The primary mechanical components of the transmission consist of the following:

- Three multiple disc input clutches
- Two multiple disc holding clutches
- Four hydraulic accumulators
- Two planetary gear sets
- Hydraulic oil pump
- Valve body
- Solenoid/Pressure switch assembly

Control of the transmission is accomplished by fully adaptive electronics. Optimum shift scheduling is accomplished through continuous real-time sensor feedback information provided to the Transmission Control Module (TCM) portion of the Powertrain Control Module (PCM).

The TCM is the heart of the electronic control system and relies on information from various direct and indirect inputs (sensors, switches, etc.) to determine driver demand and vehicle operating conditions. With this information, the TCM can calculate and perform timely and quality shifts through various output or control devices (solenoid pack, transmission control relay, etc.).

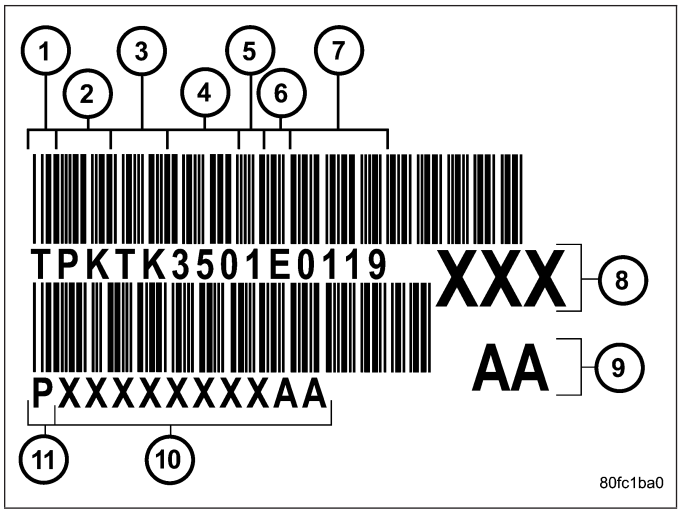
The TCM also performs certain self-diagnostic functions and provides comprehensive information (sensor data, DTC's, etc.) which is helpful in proper diagnosis and repair. This information can be viewed with the scan tool.

TRANSMISSION IDENTIFICATION

The 42RLE transmission can be identified by a bar-code label that is affixed to the upper left area of the bellhousing.

The label contains a series of digits that can be translated into useful information such as transmission part number (10), date of manufacture (4, 5), manufacturing origin (2), assembly line identifier (6), build sequence number (7), etc..

If the tag is not legible or is missing, the "PK" number, which is stamped into the left rear flange of the transmission case, can be referred to for identification. The entire part number, build code, and sequence number are stamped into the flange.

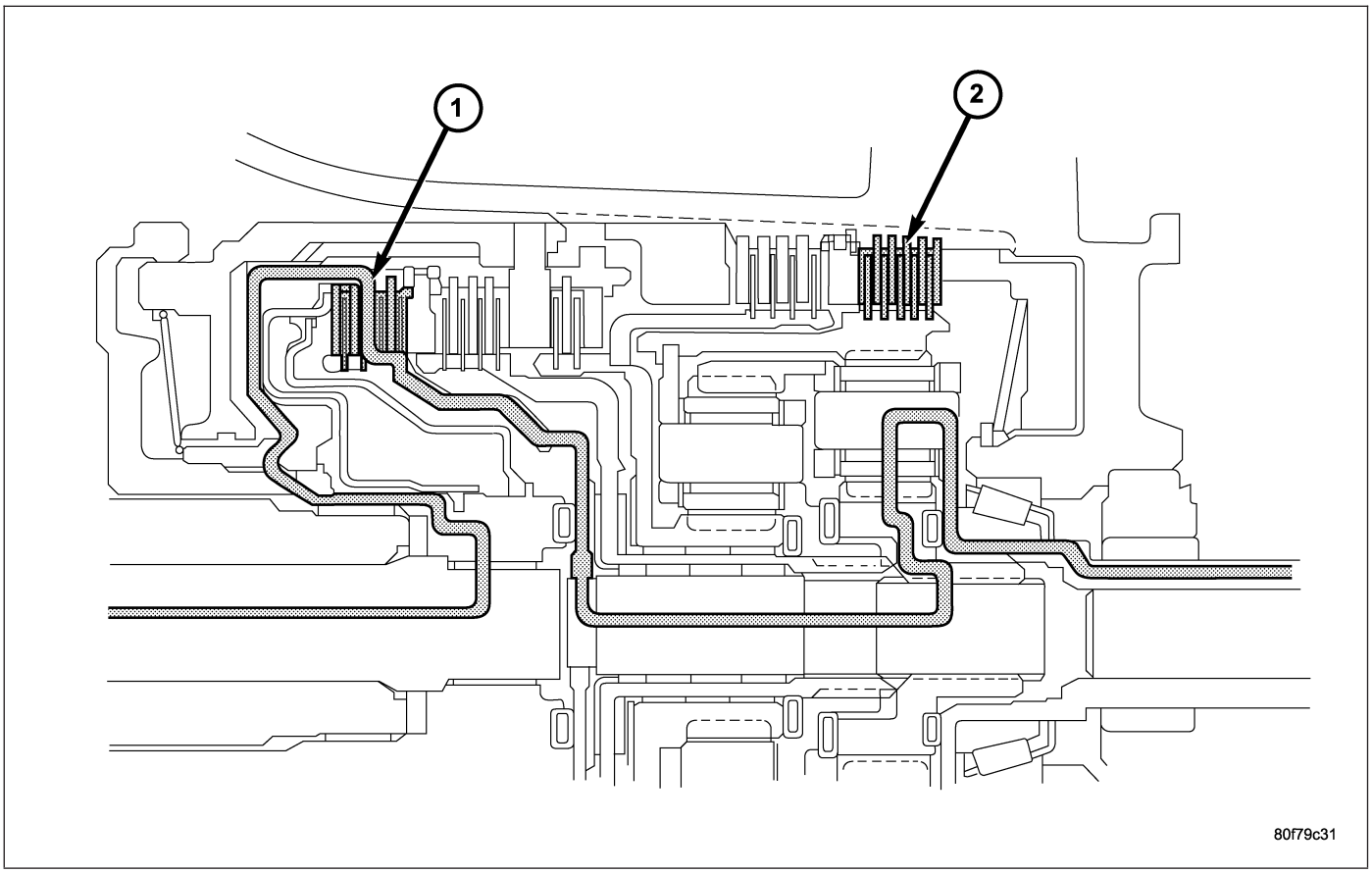


OPERATION

The 42RLE transmission ratios are:

First	2.84 : 1
Second	1.57 : 1
Third	1.00 : 1
Overdrive	0.69 : 1
Reverse	2.21 : 1

FIRST GEAR POWERFLOW

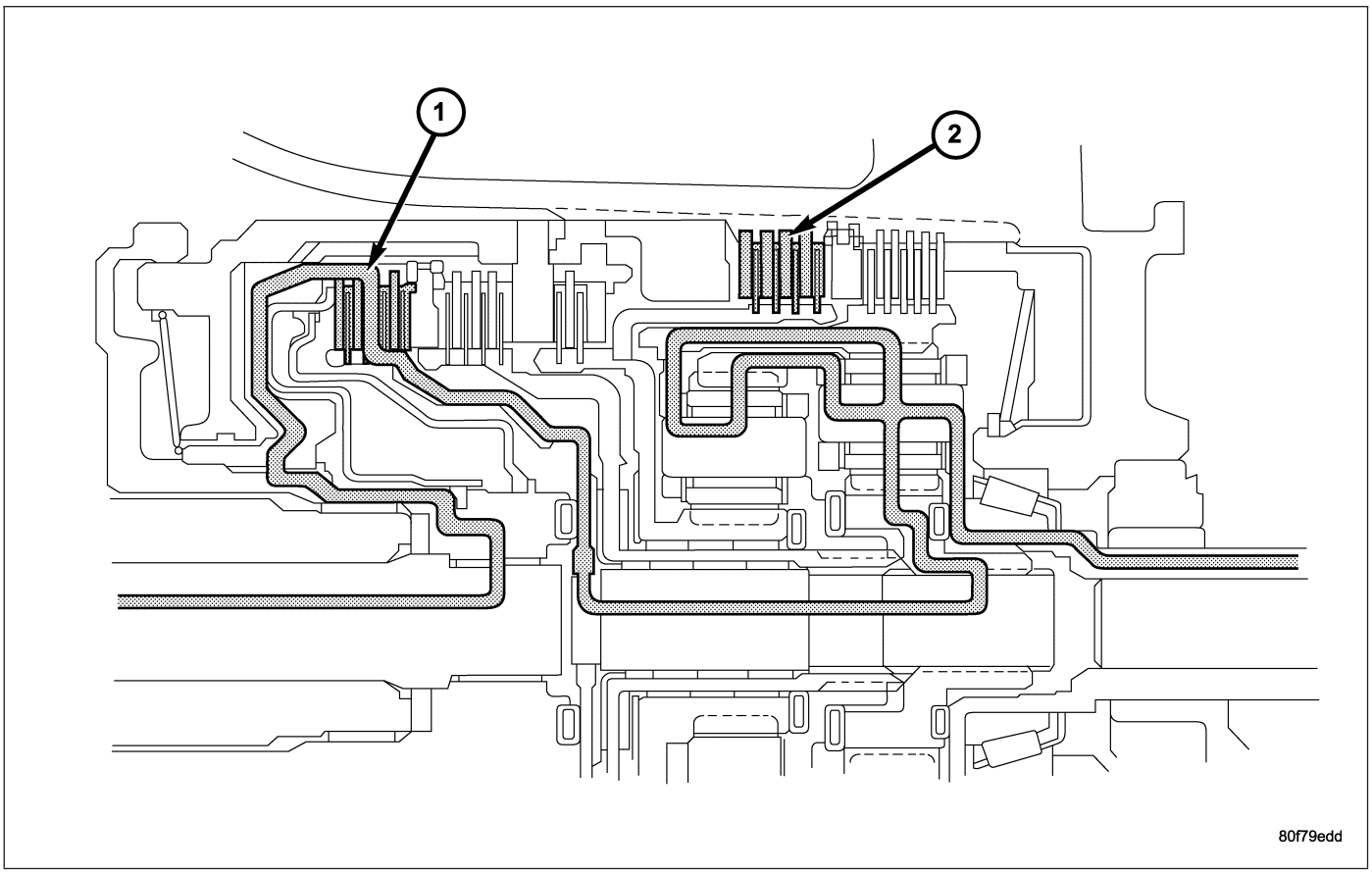


First Gear Powerflow

1 - UNDERDRIVE CLUTCH APPLIED (Turns Rear Sun)
2 - LOW-REVERSE CLUTCH APPLIED (Holds Rear Annulus/Front Carrier)

In first gear range, torque input is through the underdrive clutch (1) to the underdrive hub assembly. The underdrive hub is splined to the rear sun gear. When the underdrive clutch is applied, it rotates the underdrive hub and rear sun gear. The L/R clutch (2) is applied to hold the front carrier/rear annulus assembly. The rear sun gear drives the rear planetary pinion gears. The rear planetary pinion gears are forced to walk around the inside of the stationary rear annulus gear. The pinions are pinned to the rear carrier and cause the rear carrier assembly to rotate as they walk around the annulus gear. This provides the torque output for first gear. The other planetary gearset components are freewheeling. The first gear ratio is 2.84:1.

SECOND GEAR POWERFLOW

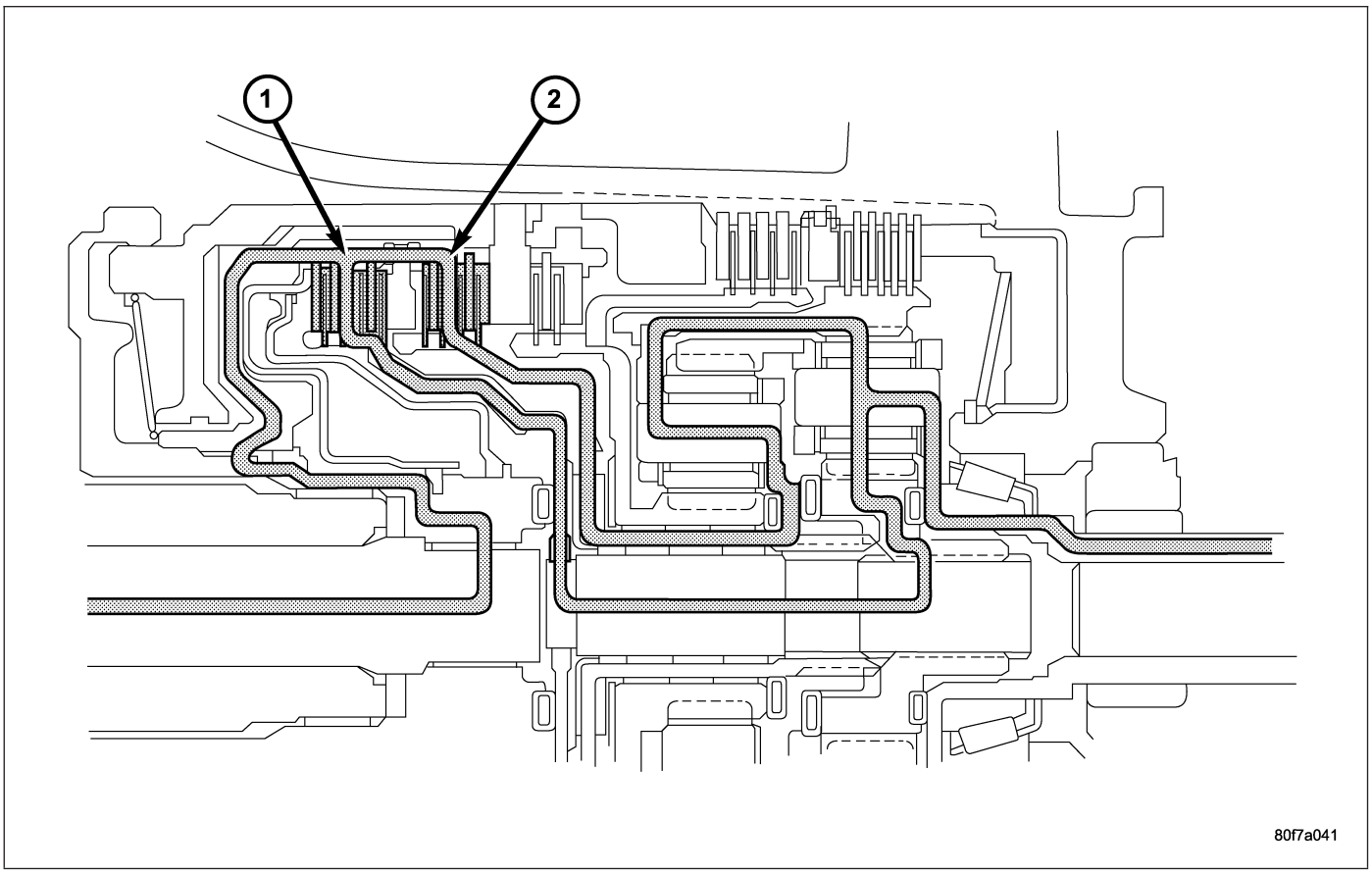


Second Gear Powerflow

1 - UNDERDRIVE CLUTCH APPLIED (Turns Rear Sun)
2 - 2-4 CLUTCH APPLIED (Holds Front Sun)

Second gear is achieved by having both planetary gear sets contribute to torque multiplication. As in first gear, torque input is through the underdrive clutch (1) to the rear sun gear. The 2/4 clutch (2) is applied to hold the front sun gear stationary. The rotating rear sun gear turns the rear planetary pinions. The rear pinions rotate the rear annulus/front carrier assembly. The pinions of the front carrier walk around the stationary front sun gear. This transmits torque to the front annulus/rear carrier assembly, which provides output torque and a gear ratio of 1.57:1.

THIRD GEAR POWERFLOW

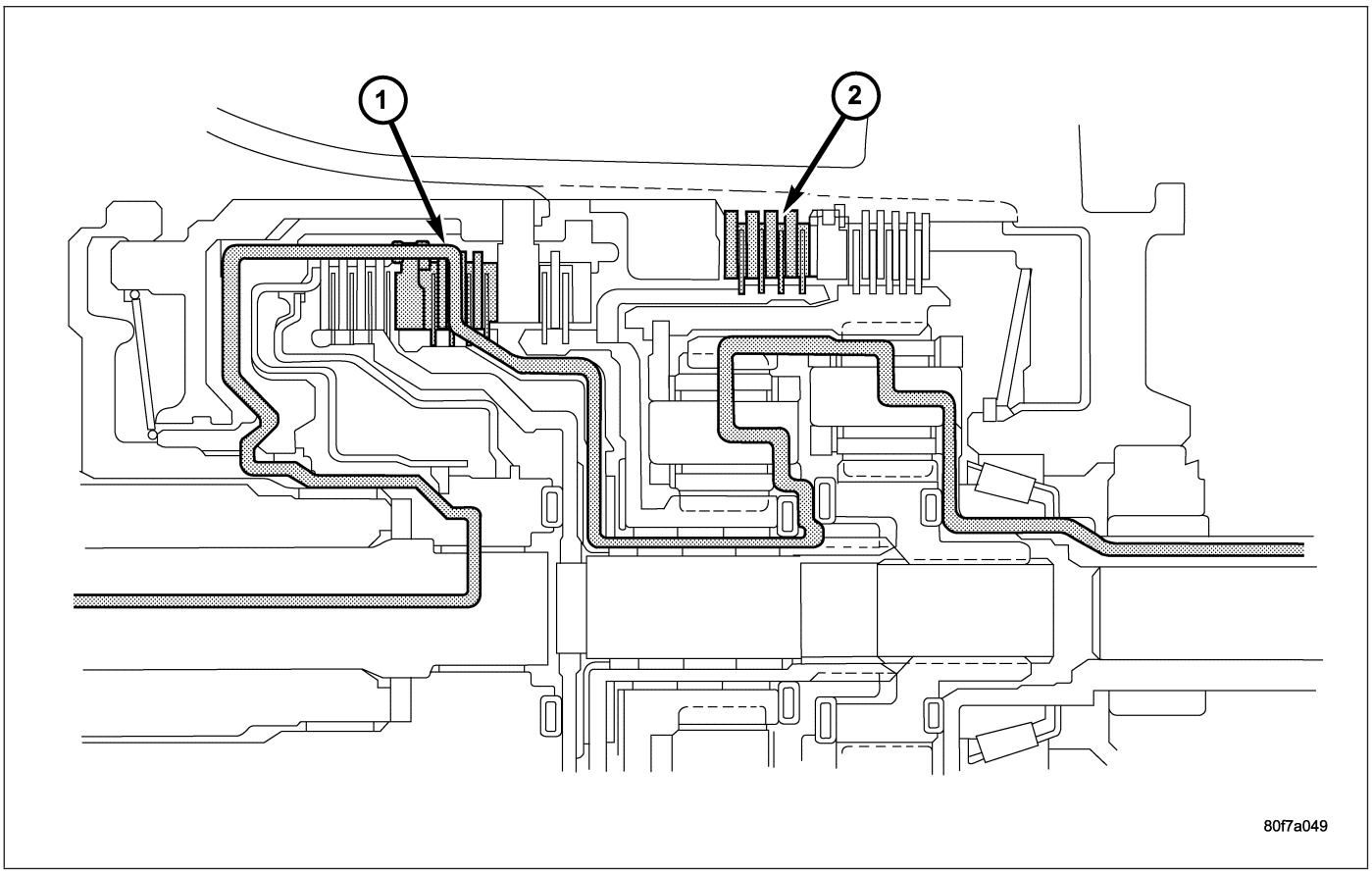


Third Gear Powerflow

1 - UNDERDRIVE CLUTCH APPLIED (Turns Rear Sun)
2 - OVERDRIVE CLUTCH APPLIED (Turns Front Carrier/Rear Annulus)

In third gear, two input clutches are applied to provide torque input: the underdrive clutch (1) and overdrive clutch (2). The underdrive clutch rotates the rear sun gear, while the overdrive clutch rotates the front carrier/rear annulus assembly. The result is two components (rear sun gear and rear annulus gear) rotating at the same speed and in the same direction. This effectively locks the entire planetary gearset together and is rotated as one unit. The gear ratio in third is 1:1.

FOURTH GEAR POWERFLOW

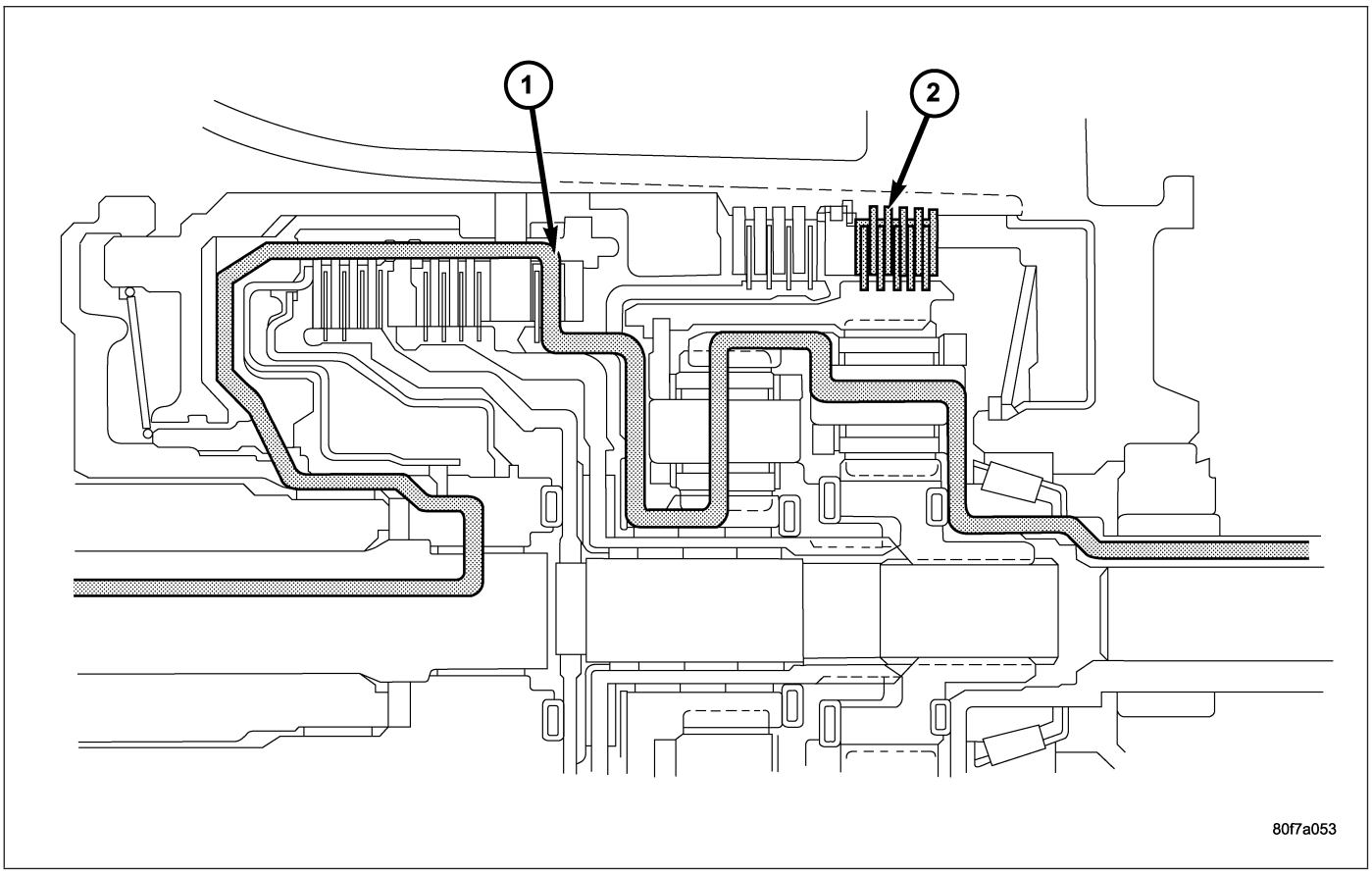


Fourth Gear Powerflow

1 - OVERDRIVE CLUTCH APPLIED (Turns Rear Sun)
2 - 2-4 CLUTCH APPLIED (Holds Front Sun)

In fourth gear input torque is through the overdrive clutch (1) which drives the front carrier. The 2/4 clutch (2) is applied to hold the front sun gear. As the overdrive clutch rotates the front carrier, it causes the pinions of the front carrier to walk around the stationary front sun gear. This causes the front carrier pinions to turn the front annulus/ rear carrier assembly which provides output torque. In fourth gear, transmission output speed is more than engine input speed. This situation is called overdrive and the gear ratio is 0.69:1.

REVERSE GEAR POWERFLOW



Reverse Gear Powerflow

1 - LOW-REVERSE CLUTCH APPLIED (Holds Rear Annulus Front Carrier)
2 - REVERSE CLUTCH APPLIED (Turns Front Sun)

In reverse, input power is through the reverse clutch (1). When applied, the reverse clutch drives the front sun gear through the overdrive hub and shaft. The L/R clutch (2) is applied to hold the front carrier/rear annulus assembly stationary. The front carrier is being held by the L/R clutch so the pinions are forced to rotate the front annulus/rear carrier assembly in the reverse direction. Output torque is provided, in reverse, with a gear ratio of 2.21:1.

DIAGNOSIS AND TESTING

AUTOMATIC TRANSMISSION

CAUTION: Before attempting any repair on the 42RLE Four Speed Automatic Transmission, always check for proper shift cable adjustment. Also check for diagnostic trouble codes with the scan tool and the 42RLE Transmission Diagnostic information.

42RLE automatic transmission malfunctions may be caused by these general conditions:

- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions
- Mechanical malfunctions
- Electronic malfunctions

When diagnosing a problem always begin with recording the complaint. The complaint should be defined as specific as possible. Include the following checks:

- Temperature at occurrence (cold, hot, both)
- Dynamic conditions (acceleration, deceleration, upshift, cornering)
- Elements in use when condition occurs (what gear is transmission in during condition)
- Road and weather conditions
- Any other useful diagnostic information.

After noting all conditions, check the easily accessible variables:

- Fluid level and condition
- Shift cable adjustment
- Diagnostic trouble code inspection

Then perform a road test to determine if the problem has been corrected or that more diagnosis is necessary. If the problem exists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

ROAD TEST

Prior to performing a road test, verify that the fluid level, fluid condition, and linkage adjustment have been approved.

During the road test, the transmission should be operated in each position to check for slipping and any variation in shifting.

If the vehicle operates properly at highway speeds, but has poor acceleration, the converter stator overrunning clutch may be slipping. If acceleration is normal, but high throttle opening is needed to maintain highway speeds, the converter stator clutch may have seized. Both of these stator defects require replacement of the torque converter and thorough transmission cleaning.

Slipping clutches can be isolated by comparing the “Elements in Use” chart with clutch operation encountered on a road test. This chart identifies which clutches are applied at each position of the selector lever.

A slipping clutch may also set a DTC and can be determined by operating the transmission in all selector positions.

ELEMENTS IN USE AT EACH POSITION OF SELECTOR LEVER

Shift Lever Position	INPUT CLUTCHES			HOLDING CLUTCHES	
	Underdrive	Overdrive	Reverse	2/4	Low/Reverse
P - PARK					X
R - REVERSE			X		X
N - NEUTRAL					X
OD - OVERDRIVE					
First	X				X
Second	X			X	
Direct	X	X			
Overdrive		X		X	
D - DRIVE*					
First	X				X
Second	X			X	
Direct	X	X			
L - LOW*					
First	X				X
Second	X			X	
Direct	X	X			
* Vehicle upshift and downshift speeds are increased when in these selector positions.					

The process of elimination can be used to detect any unit which slips and to confirm proper operation of good units. Road test analysis can diagnose slipping units, but the cause of the malfunction cannot be determined. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

HYDRAULIC PRESSURE TESTS

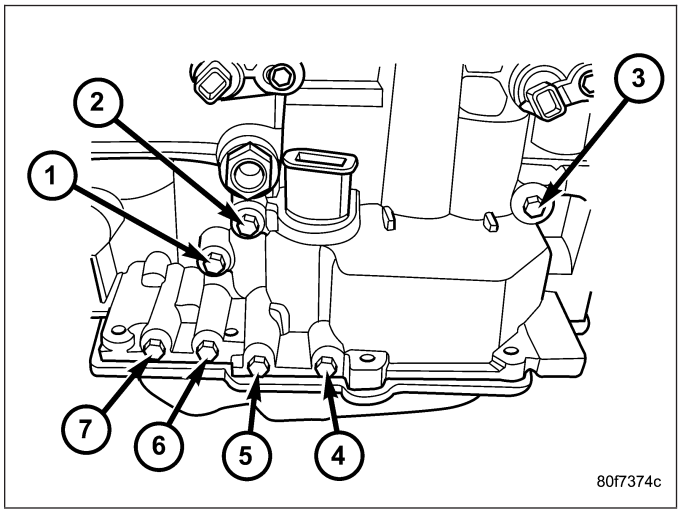
Pressure testing is a very important step in the diagnostic procedure. These tests usually reveal the cause of most transmission problems.

Before performing pressure tests, be certain that fluid level and condition, and shift cable adjustments have been checked and approved. Fluid must be at operating temperature (150 to 200 degrees F.).

Install an engine tachometer, raise vehicle on hoist which allows the wheels to turn, and position tachometer so it can be read.

Using special adapters L-4559, attach 300 psi gauge(s) C-3293SP to the port(s) required for test being conducted.

Test port locations are shown in the Pressure Taps graphic.



Pressure Taps

1 - TORQUE CONVERTER CLUTCH OFF
2 - REVERSE
3 - LOW/REVERSE
4 - 2/4
5 - UNDERDRIVE
6 - TORQUE CONVERTER CLUTCH ON
7 - OVERDRIVE

TEST ONE - SELECTOR IN MANUAL 1 (1st Gear)

NOTE: This test checks pump output, pressure regulation and condition of the low/reverse clutch hydraulic circuit and shift schedule.

1. Attach pressure gauge to the low/reverse clutch tap.
2. Move selector lever to the MANUAL 1 position.
3. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed to 20 mph.
4. Low/reverse clutch pressure should read 115 to 145 psi.

TEST TWO - SELECTOR IN MANUAL 2 (Second Gear)

NOTE: This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.

1. Attach gauge to the underdrive clutch tap.
2. Move selector lever to the MANUAL 2 position.
3. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 30 mph.
4. In second gear the underdrive clutch pressure should read 110 to 145 psi.

TEST TWO A - SELECTOR IN DRIVE (OD ON - Fourth Gear)

NOTE: This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.

1. Attach gauge to the underdrive clutch tap.
2. Move selector lever to the DRIVE position. Verfy that the OD switch is ON.

3. Allow wheels to rotate freely and increase throttle opening to achieve an indicated speed of 40 mph.
4. Underdrive clutch pressure should read below 5 psi. If not, than either the solenoid assembly or controller is at fault.

TEST THREE - SELECTOR IN DRIVE (OD OFF - Third and Second Gear)

NOTE: This test checks the overdrive clutch hydraulic circuit as well as the shift schedule.

1. Attach gauge to the overdrive clutch tap.
2. Move selector lever to the DRIVE position.
3. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 20 mph.
4. Overdrive clutch pressure should read 74 to 95 psi.
5. Move selector lever to the DRIVE position and increase indicated vehicle speed to 30 mph.
6. The vehicle should be in second gear and overdrive clutch pressure should be less than 5 psi.

TEST FOUR - SELECTOR IN DRIVE (OD ON - Fourth Gear)

NOTE: This test checks the 2/4 clutch hydraulic circuit.

1. Attach gauge to the 2/4 clutch tap.
2. Move selector lever to the DRIVE position.
3. Allow vehicle front wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 30 mph. Vehicle should be in fourth gear.
4. The 2/4 clutch pressure should read 75 to 95 psi.

TEST FIVE-SELECTOR IN DRIVE (OD ON - Fourth Gear, CC on)

NOTE: These tests check the torque converter clutch hydraulic circuit.

1. Attach gauge to the torque converter clutch off pressure tap.
2. Move selector lever to the DRIVE position.
3. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 50 mph. Vehicle should be in 4th gear, CC on.

CAUTION: Both wheels must turn at the same speed.

4. Torque converter clutch off pressure should be less than 5 psi.
5. Now attach the gauge to the torque converter clutch on pressure tap.
6. Move selector to the OD position.
7. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 50 mph.
8. Verify the torque converter clutch is applied mode using the RPM display of the scan tool.
9. Torque converter clutch on pressure should be 60-90 psi.

TEST SIX-SELECTOR IN REVERSE

NOTE: This test checks the reverse clutch hydraulic circuit.

1. Attach gauge to the reverse and low/reverse clutch tap.
2. Move selector lever to the REVERSE position.
3. Read reverse clutch pressure with output stationary (foot on brake) and throttle opened to achieve 1500 rpm.
4. Reverse and low/reverse clutch pressure should read 165 to 235 psi.

TEST RESULT INDICATIONS

1. If proper line pressure is found in any one test, the pump and pressure regulator are working properly.
2. Low pressure in all positions indicates a defective pump, a clogged filter, or a stuck pressure regulator valve.

3. Clutch circuit leaks are indicated if pressures do not fall within the specified pressure range.
4. If the overdrive clutch pressure is greater than 5 psi in Step 6 of Test Three, a worn reaction shaft seal ring or a defective solenoid assembly is indicated.
5. If the underdrive clutch pressure is greater than 5 psi in Step 4 of Test Two-A, a defective solenoid/pressure switch assembly or controller is the cause.

ALL PRESSURE SPECIFICATIONS ARE PSI (on hoist, with wheels free to turn)

Gear Selector Position	Actual Gear	PRESSURE TAPS						
		Under-drive Clutch	Over-drive Clutch	Reverse Clutch	Torque Converter Clutch Off	Torque Converter Clutch On	2/4 Clutch	Low/ Reverse Clutch
PARK - 0 mph *	PARK	0-2	0-5	0-2	60-110	45-100	0-2	115-145
REVERSE - 0 mph *	REVERSE	0-2	0-7	165-235	50-100	35-85	0-2	165-235
NEUTRAL - 0 mph *	NEUTRAL	0-2	0-5	0-2	60-110	45-100	0-2	115-145
Low - 20 mph #	FIRST	110-145	0-5	0-2	60-110	45-100	0-2	115-145
Third - 30 mph #	SECOND	110-145	0-5	0-2	60-110	45-100	115-145	0-2
Third - 45 mph #	DIRECT	75-95	75-95	0-2	60-90	45-80	0-2	0-2
OD - 30 mph #	OVERDRIVE	0-2	75-95	0-2	60-90	45-80	75-95	0-2
OD - 50 mph #	OVERDRIVE WITH TCC	0-2	75-95	0-2	0-5	60-95	75-95	0-2
*** Engine Speed at 1500 rpm**								
# CAUTION: Both wheels must be turning at same speed.								

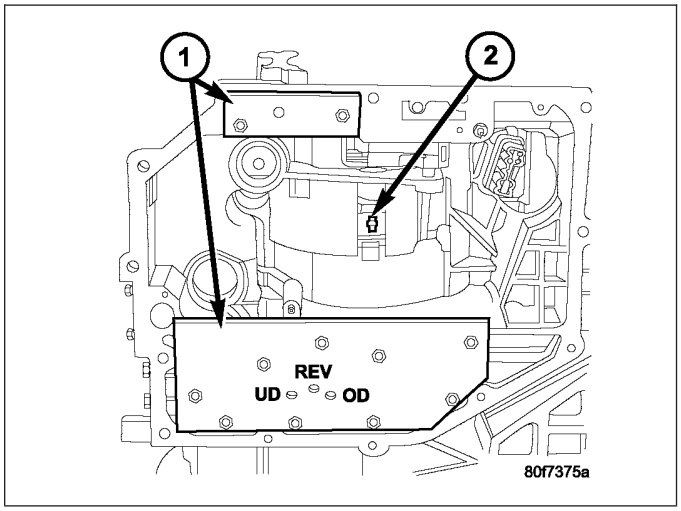
CLUTCH AIR PRESSURE TESTS

Inoperative clutches can be located by substituting air pressure for fluid pressure. The clutches may be tested by applying air pressure to their respective passages after the valve body has been removed. Use Special Tool 6599-1 (1) and 6599-2 (1) to perform test.

To make air pressure tests, proceed as follows:

NOTE: The compressed air supply must be free of all dirt and moisture. Use a pressure of 30 psi.

1. Remove oil pan and valve body. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/VALVE BODY - REMOVAL)
2. Apply air pressure to the holes in the special tool (1), one at a time.
3. Listen for the clutch to apply. It will give a slight thud sound. If a large amount of air is heard escaping, the transmission must be removed from vehicle, disassembled and all seals inspected.



Air Pressure Test Plate

1 - AIR PRESSURE TEST PLATES
2 - 2/4 CLUTCH RETAINER HOLE

2/4 CLUTCH

Apply air pressure to the feed hole located on the 2/4 clutch retainer (2). Look in the area where the 2/4 piston contacts the first separator plate and watch carefully for the 2/4 piston to move rearward. The piston should return to its original position after the air pressure is removed.

OVERDRIVE CLUTCH

Apply air pressure to the overdrive clutch apply passage and watch for the push/pull piston to move forward. The piston should return to its starting position when the air pressure is removed.

REVERSE CLUTCH

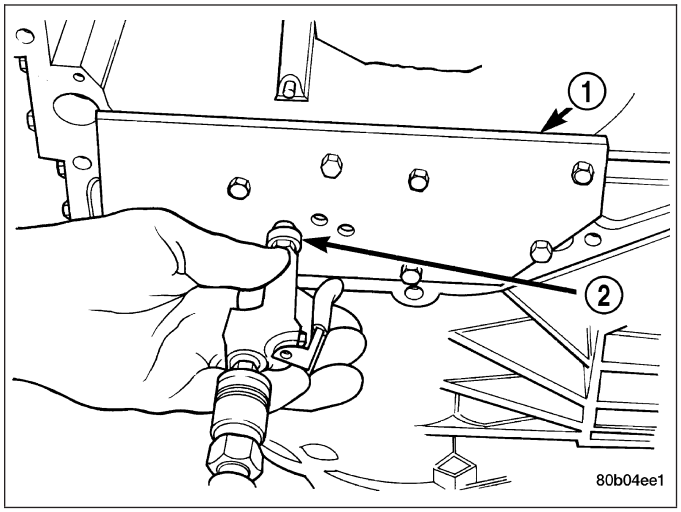
Apply air pressure to the reverse clutch apply passage and watch for the push/pull piston to move rearward. The piston should return to its starting position when the air pressure is removed.

LOW/REVERSE CLUTCH

Apply air pressure to the low/reverse clutch feed hole passage. Look in the area where the low/reverse piston contacts the first separator plate. Watch carefully for the piston to move forward. The piston should return to its original position after the air pressure is removed.

UNDERDRIVE CLUTCH

Because this clutch piston cannot be seen, its operation is checked by function. Use an air nozzle (2) to apply air pressure is to the low/reverse or the 2/4 clutch opening in Test Plate 6599-1 (2). This locks the output shaft. Use a piece of rubber hose wrapped around the input shaft and a pair of clamp-on pliers to turn the input shaft. Next apply air pressure to the underdrive clutch. The input shaft should not rotate with hand torque. Release the air pressure and confirm that the input shaft will rotate.



FLUID LEAKAGE

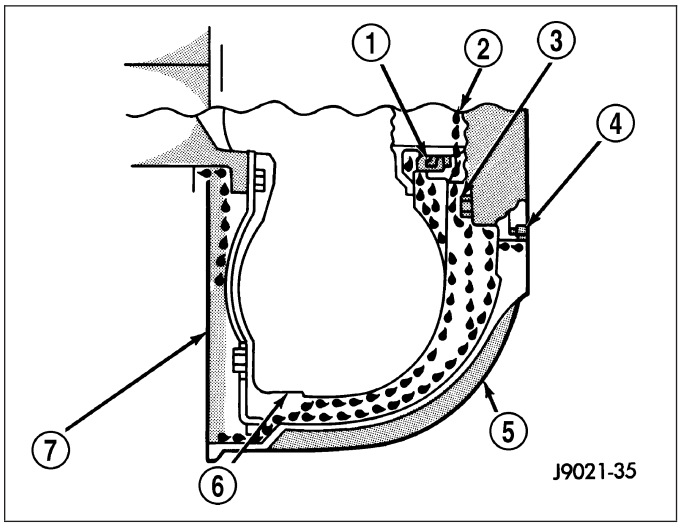
FLUID LEAKAGE - TORQUE CONVERTER HOUSING AREA

When diagnosing converter housing (5) fluid leaks, three actions must be taken before repair:

1. Verify proper transmission fluid level.
2. Verify that the leak originates from the converter housing area and is transmission fluid.
3. Determine the true source of the leak.

Fluid leakage at or around the torque converter area may originate from an engine oil leak (7). The area should be examined closely. Factory fill fluid is red and, therefore, can be distinguished from engine oil.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill, or fill after repair. Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair.

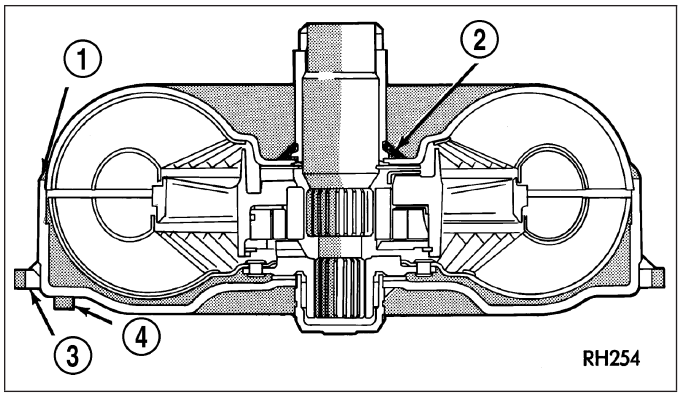


Pump seal (1) leaks tend to move along the drive hub and onto the rear of the converter. Pump o-ring or pump body leaks follow the same path as a seal leak. Pump attaching bolt (3) leaks are generally deposited on the inside of the converter housing (5) and not on the converter itself. Pump seal (1) or gasket (4) leaks usually travel down the inside of the converter housing.

TORQUE CONVERTER LEAKAGE

Possible sources of torque converter leakage are:

- Torque converter weld leaks at the outside diameter weld (1).
- Torque converter hub weld (2).



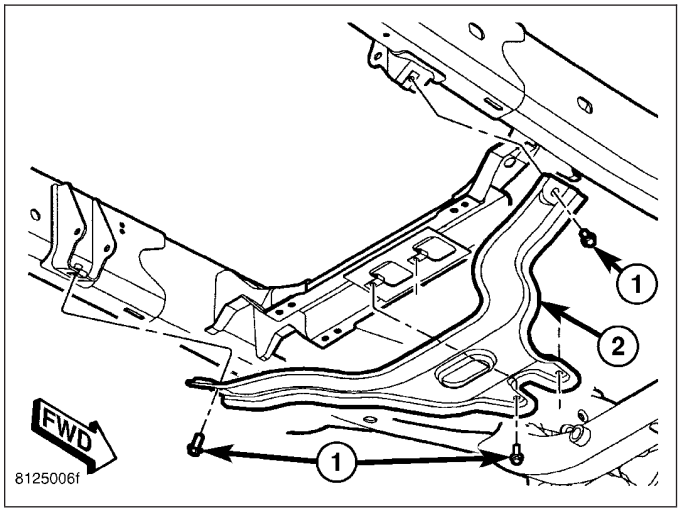
STANDARD PROCEDURE - ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils®, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil® tap, or equivalent, and installing a Heli-Coil® insert, or equivalent, into the hole. This brings the hole back to its original thread size.

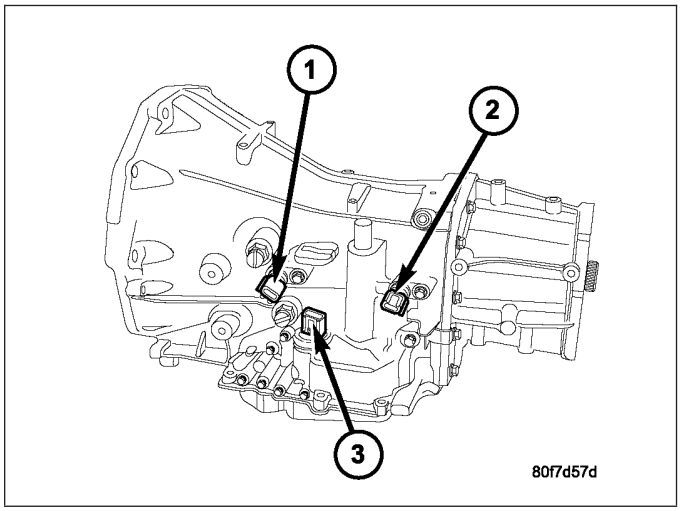
Heli-Coil®, or equivalent, tools, and inserts are readily available from most automotive parts suppliers.

REMOVAL

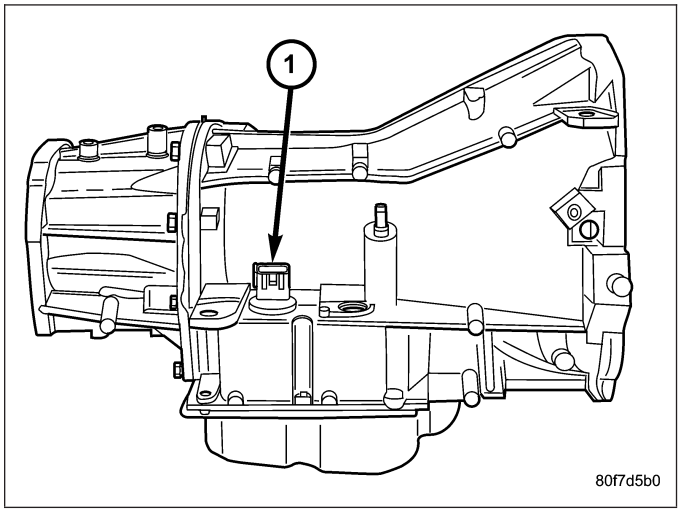
1. Disconnect the negative battery cable.
2. Raise and support the vehicle
3. Remove any necessary skid plates. (Refer to 13 - FRAMES & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - REMOVAL)



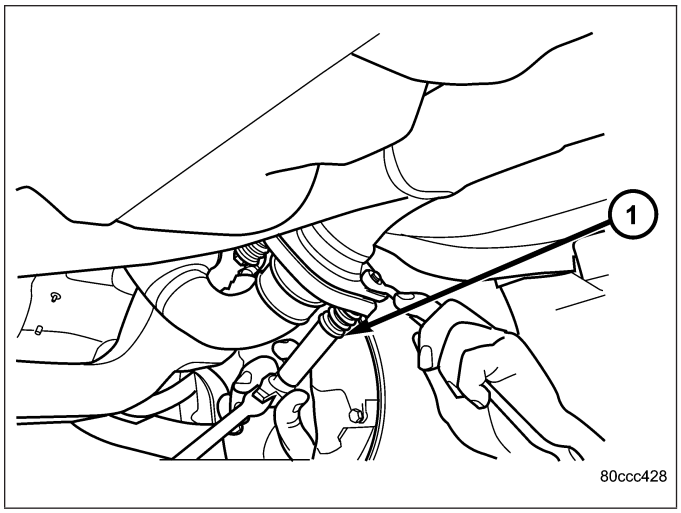
4. Mark propeller shaft and axle companion flanges for assembly alignment.
5. Remove the rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
6. Remove the front propeller shaft, if necessary. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
7. Disconnect wires from the input (1) and output (2) speed sensors.
8. Disconnect wires from the transmission range sensor (3).



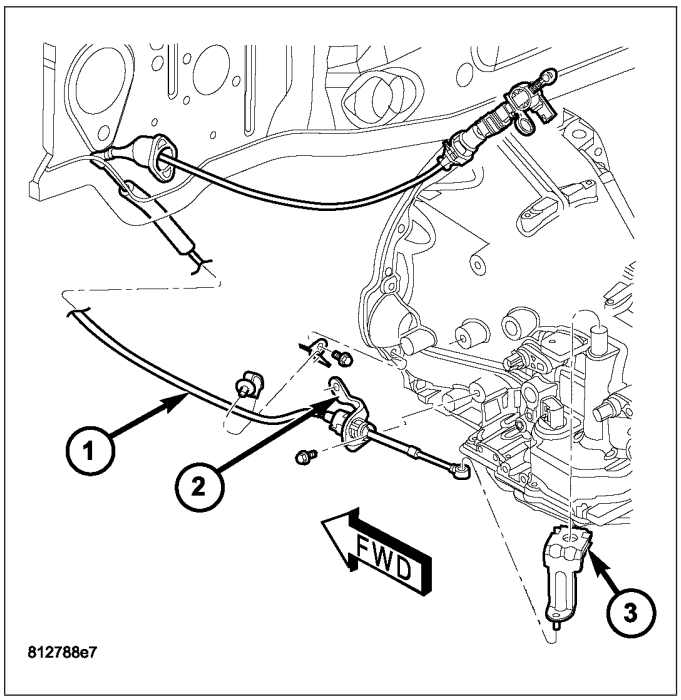
9. Disconnect wires from the solenoid/pressure switch assembly.



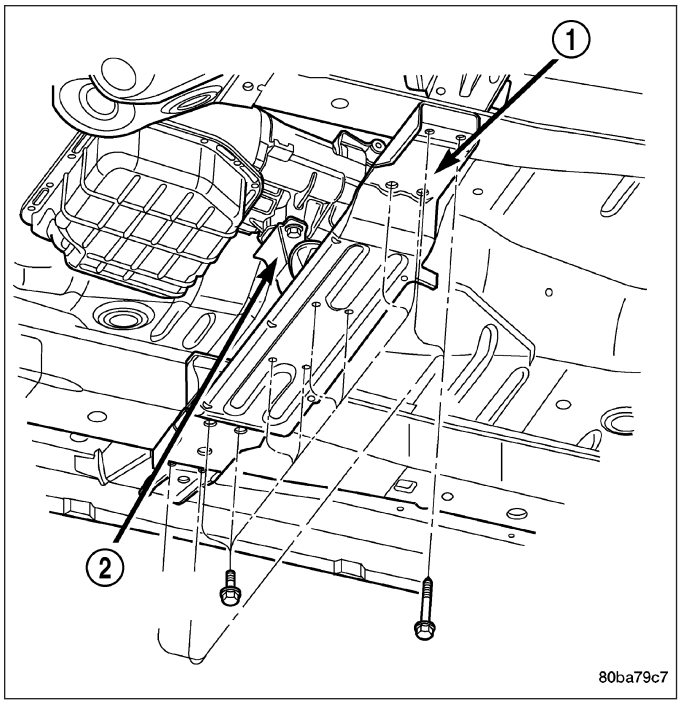
10. Remove the bolts holding the exhaust crossover pipe to the pre-catalytic converter pipe flanges (1).
11. Remove the bolts holding the exhaust crossover pipe to the catalytic converter flange.



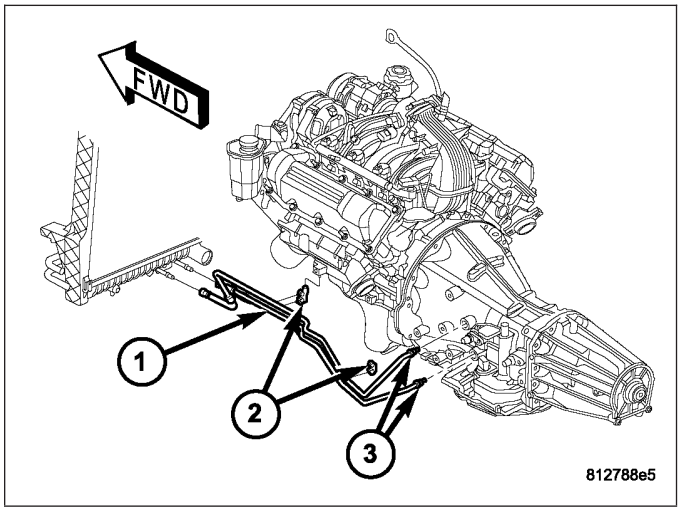
12. Disconnect gearshift cable (1) from transmission manual valve lever (3).
13. Disengage the shift cable (1) from the cable support bracket (2).



14. Remove the starter motor.
15. Remove the engine to transmission collar.
16. Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.
17. Disconnect the transmission vent hose from the transmission.
18. Remove transfer case. (Refer to 21 - TRANSMISSION/TRANSFER CASE - REMOVAL)
19. Support rear of engine with safety stand or jack.
20. Raise transmission slightly with service jack to relieve load on crossmember and supports.
21. Remove bolts securing rear support and cushion to transmission and crossmember.
22. Remove bolts attaching crossmember to frame and remove crossmember.



23. Disconnect transmission fluid cooler lines (1) at transmission fittings (3) and clips (2).
24. Remove all remaining converter housing bolts.
25. Carefully work transmission and torque converter assembly rearward off engine block dowels.
26. Hold torque converter in place during transmission removal.
27. Lower transmission and remove assembly from under the vehicle.
28. To remove torque converter, carefully slide torque converter out of the transmission.



DISASSEMBLY

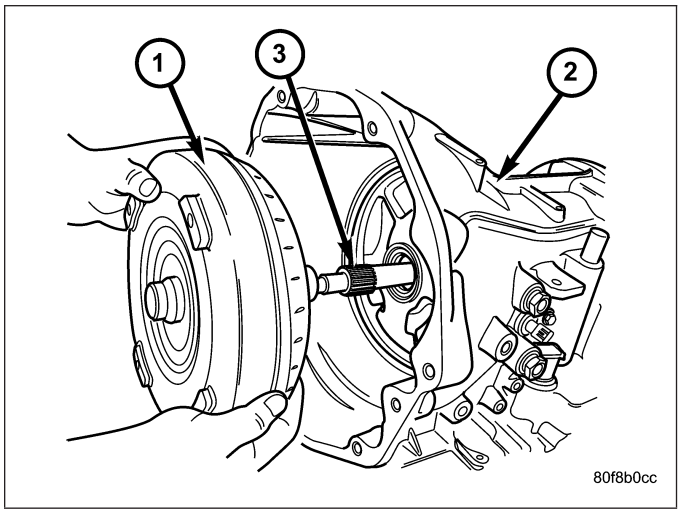
NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the Quick Learn Procedure using the scan tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE).

NOTE: Tag all clutch pack assemblies, as they are removed, for reassembly identification.

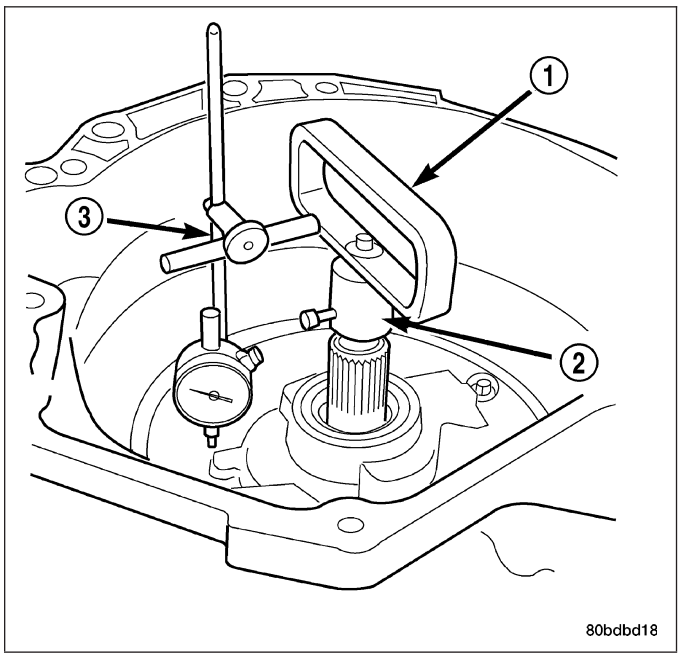
CAUTION: Do not intermix clutch discs or plates as the unit might then fail.

Before disassembling transmission, move the shift lever clockwise as far as it will go and then remove the shift lever.

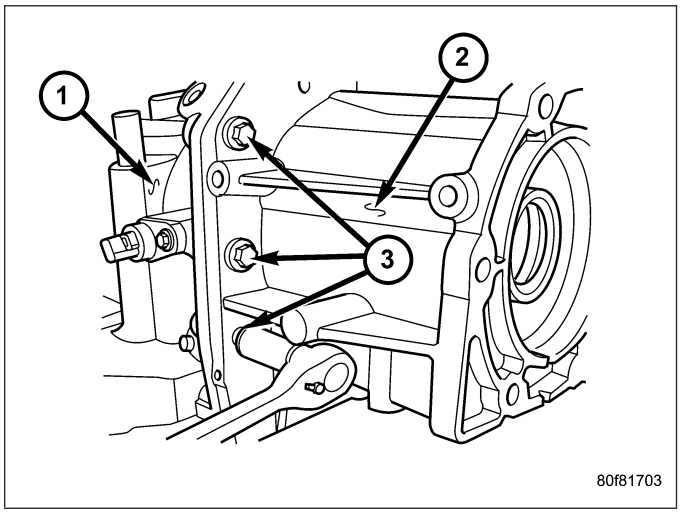
1. Remove the torque converter (1) from the transmission input shaft (3).



2. Measure input shaft end play using Tool 8266 (1, 2). Set up Tool 8266 and a dial indicator as shown.
3. Move input shaft in and out to obtain end play reading. End play specifications are 0.13 to 0.64 mm (0.005 to 0.025 inch). Record indicator reading for reference when reassembling the transmission. If endplay exceeds the specified range, the #4 thrust plate needs to be inspected and changed if necessary.

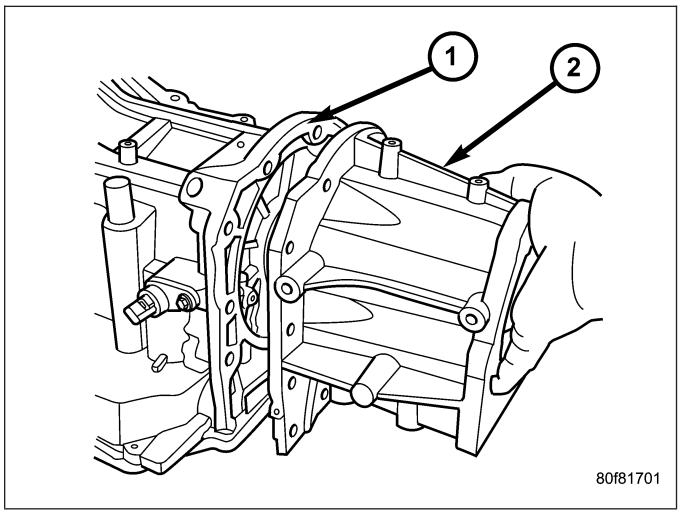


NOTE: The four bolts (3) along the bottom of the adapter or extension housing (2) have a sealing patch applied from the factory. Note the locations of these bolts and separate these bolts for reuse.

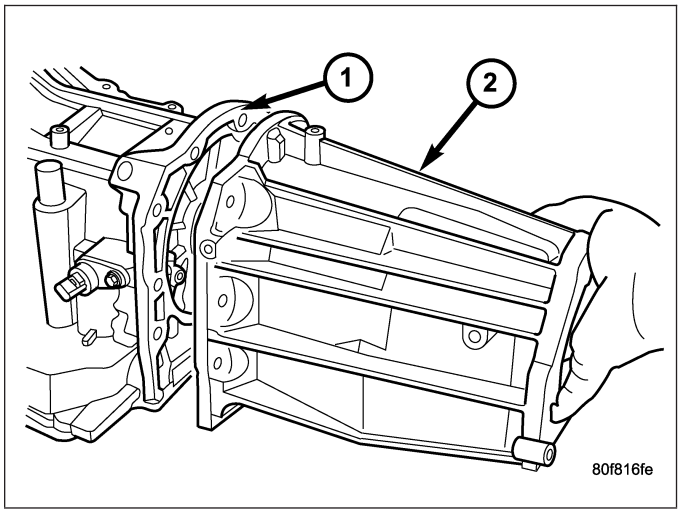


4. Remove the bolts that hold the adapter or extension housing (2) onto the transmission case.

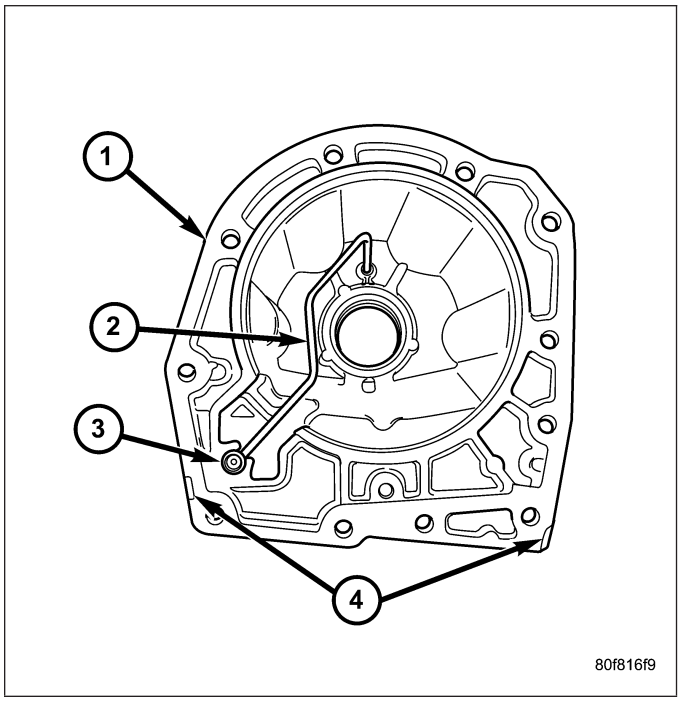
5. Remove the adapter (2) housing, 4X4 vehicles only, from the transmission case. There are two pry slots located near the bottom corners of the housing for separating the housing from the transmission case.



6. Remove the extension (2) housing, 4X2 vehicles only, from the transmission case. There are two pry slots located near the bottom corners of the housing for separating the housing from the transmission case.

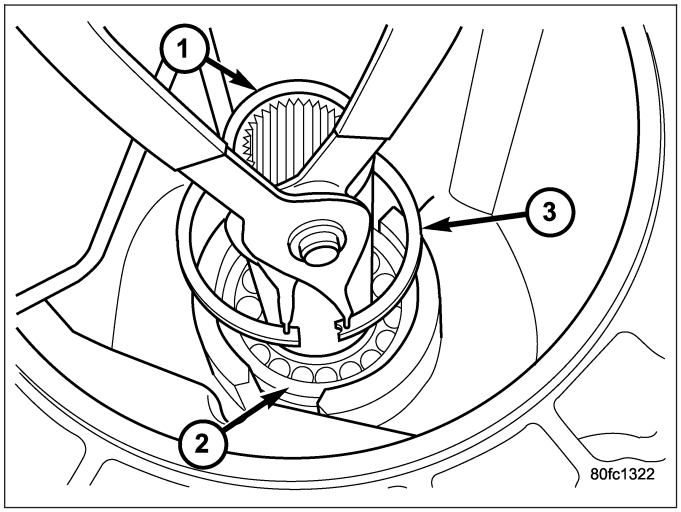


7. Inspect the lube tube grommet (3) for damage. If the grommet lip is damaged, it will need to be replaced.

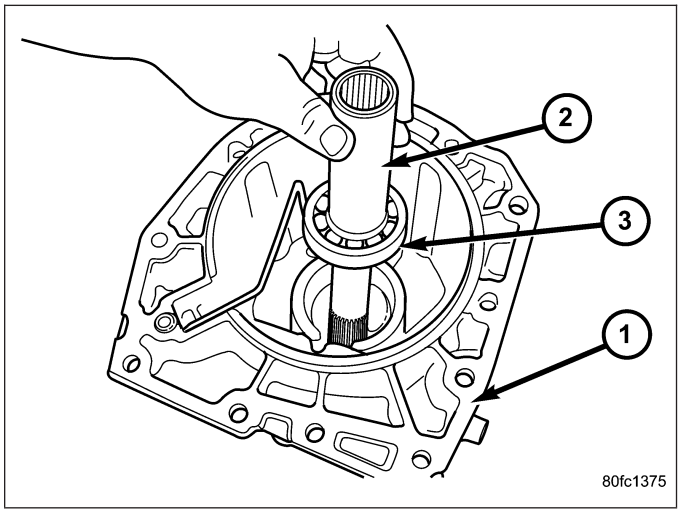


8. On 4X2 transmissions, perform the following, if necessary:

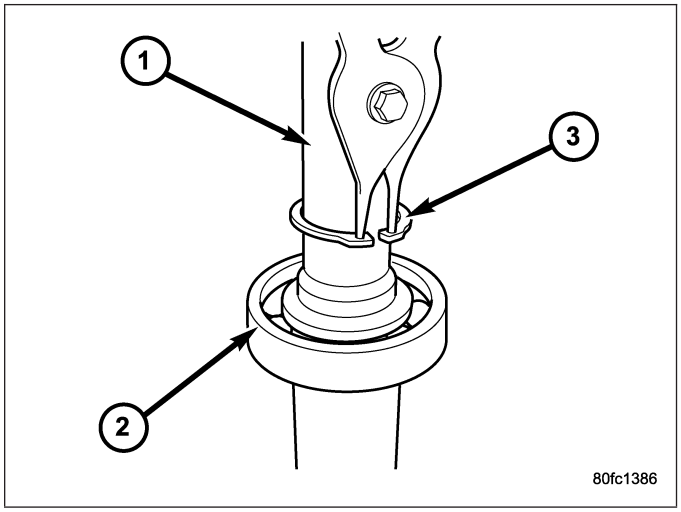
   a. Remove the extension shaft bearing snap ring (3) from the extension housing.



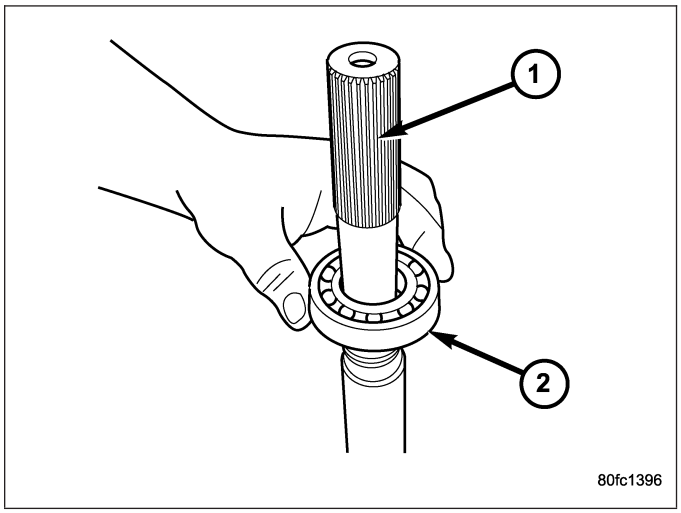
   b. Remove the extension shaft and bearing assembly (2) from the extension housing (1).



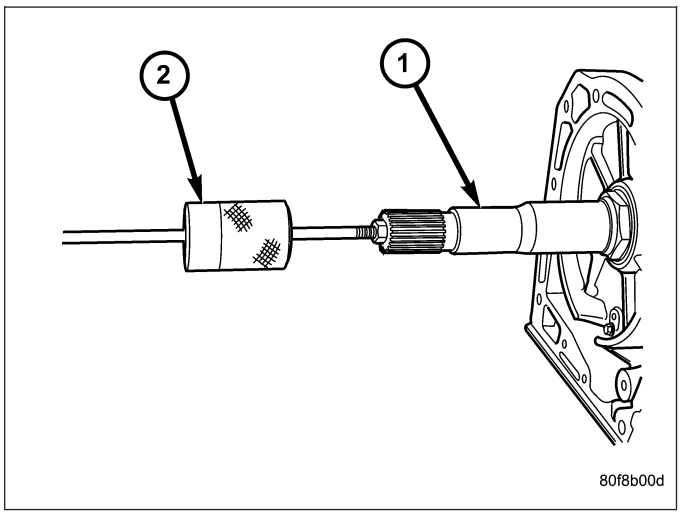
c. Remove the extension shaft bearing retaining ring (3) from the extension shaft (1).



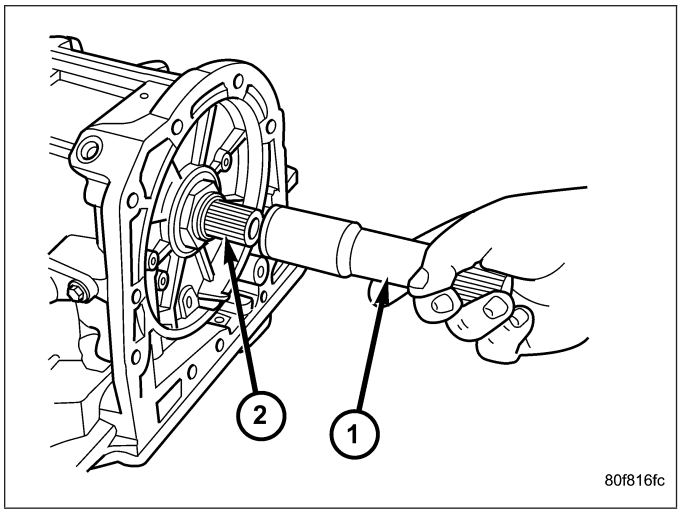
d. Remove the extension shaft bearing (2) from the extension shaft (1).



9. Using a Slide Hammer C-3752 (2), remove the 4X4 stub shaft (1).

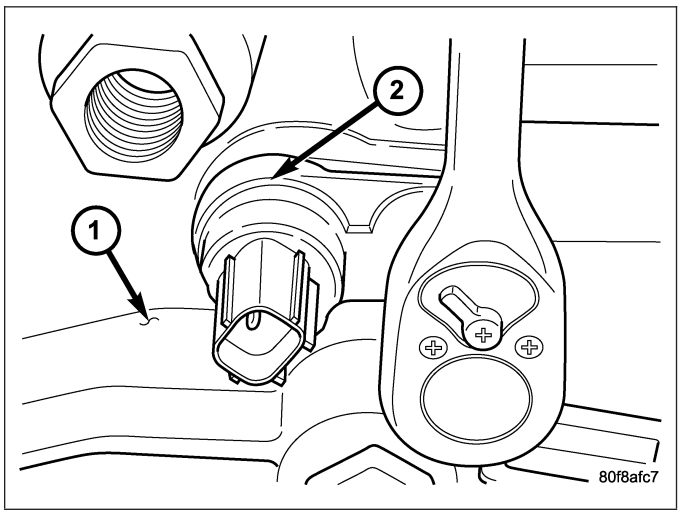


10. Remove the 4X4 stub shaft (1) from the transmission output shaft. Inspect the cir-clip on the shaft for damage and replace the clip if necessary.



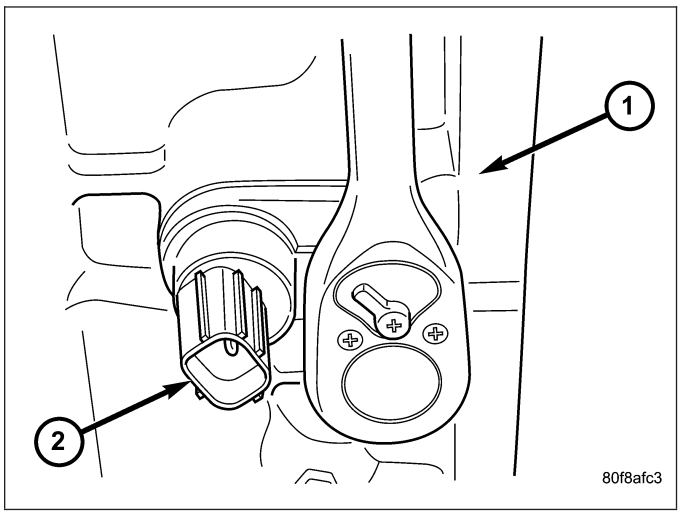
NOTE: The speed sensor bolts have a sealing patch applied from the factory. Separate these bolts for reuse.

11. Remove the input speed sensor bolt.

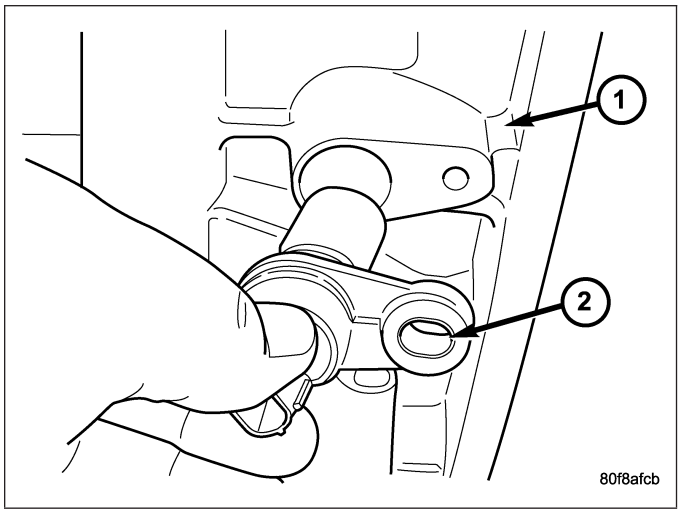


NOTE: The speed sensor bolts have a sealing patch applied from the factory. Separate these bolts for reuse.

12. Remove the output speed sensor bolt.

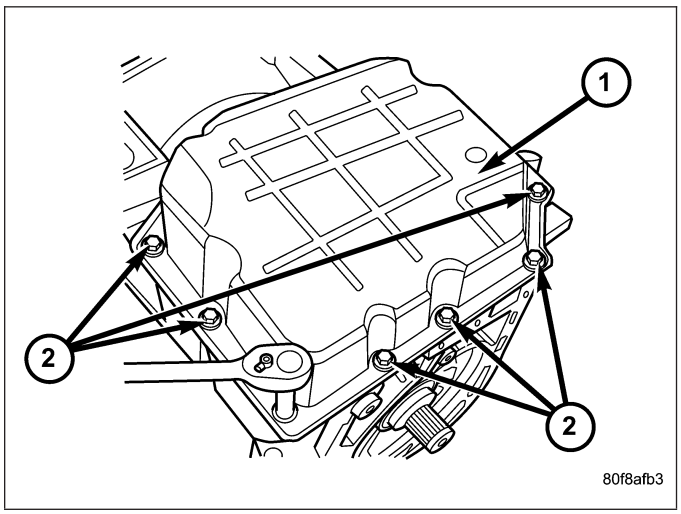


13. Remove the input and output (2) speed sensors. Identify the speed sensors for re-installation since they are not interchangeable.

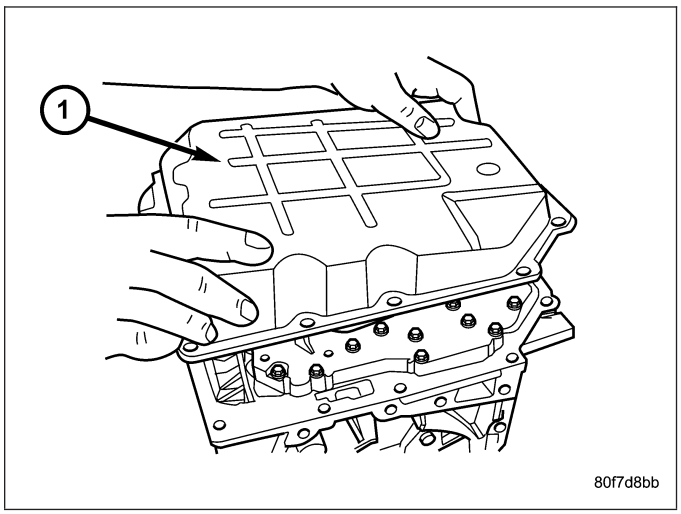


NOTE: One of the oil pan bolts has a sealing patch applied from the factory. Separate this bolt for reuse.

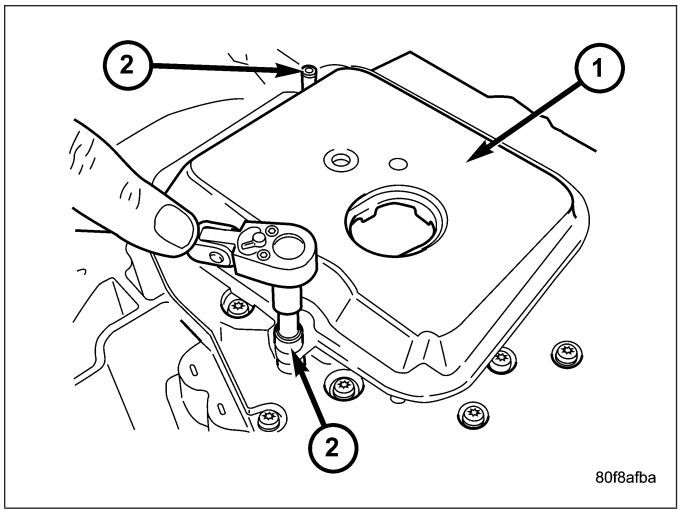
14. Remove the transmission oil pan bolts (2).



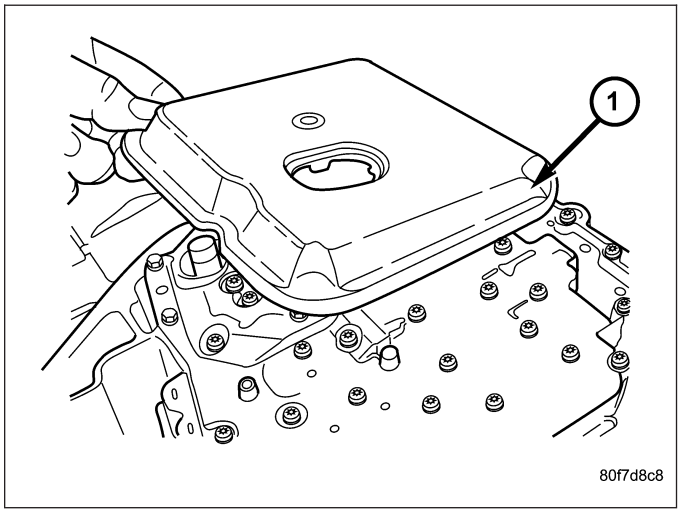
15. Remove the transmission oil pan (1).



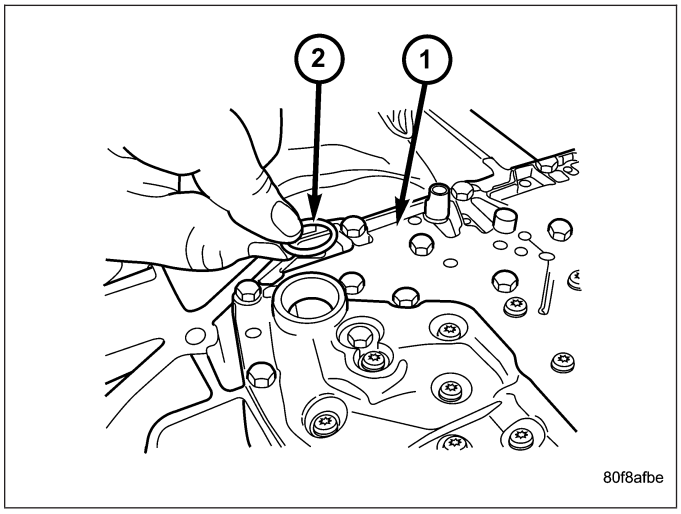
16. Remove the transmission oil filter screws (2).



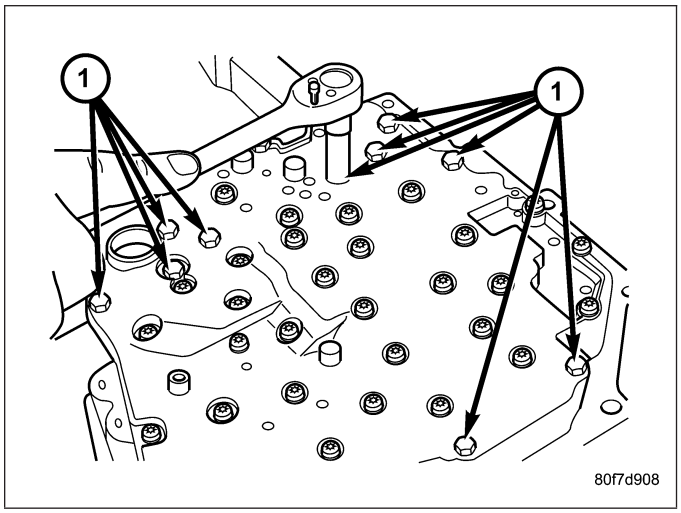
17. Remove transmission oil filter (1).



18. Remove the oil filter o-ring (2) from the valve body.

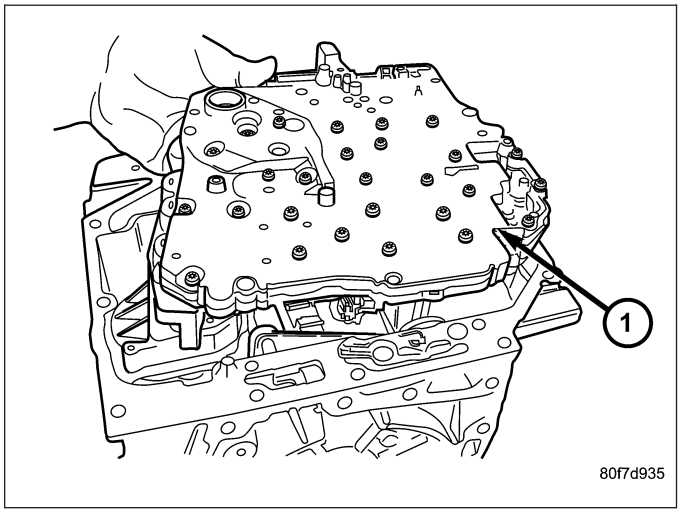


19. Remove valve body-to-case bolts (1).

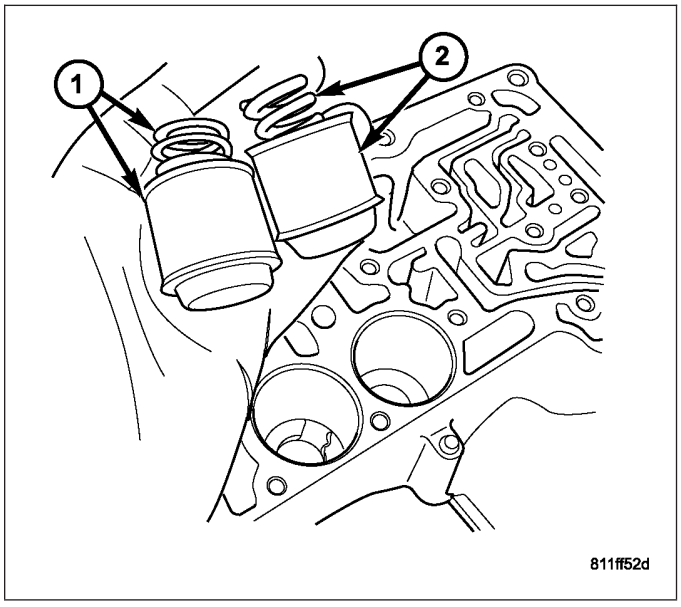


CAUTION: Do not handle the valve body by the manual shaft. Damage could result.

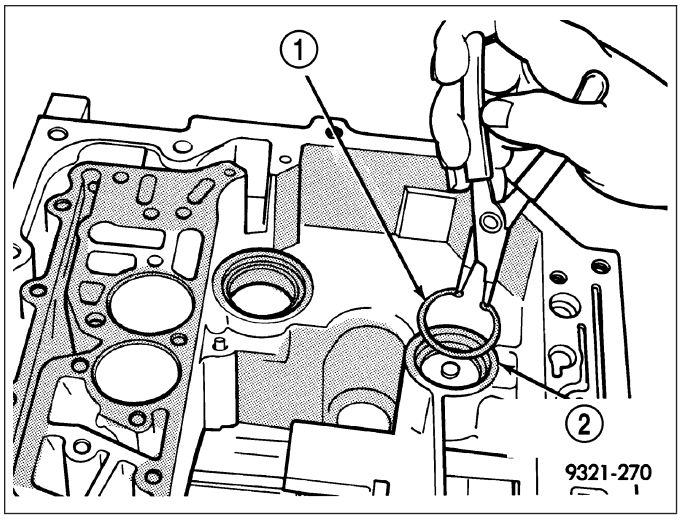
20. Remove valve body (1) from transmission.



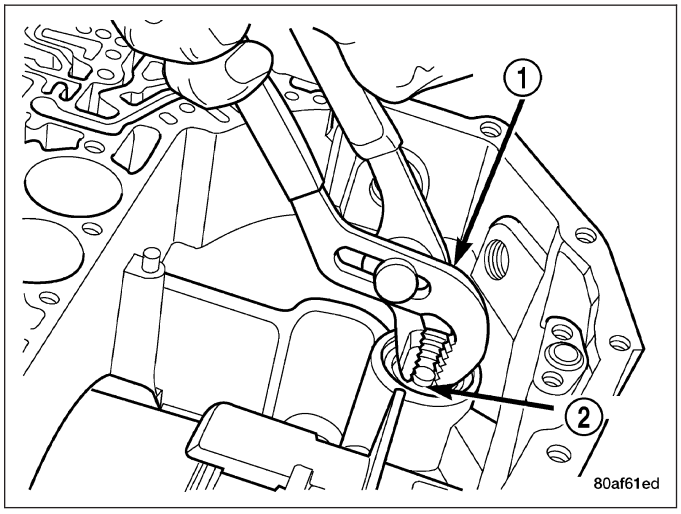
21. Remove underdrive and overdrive accumulators (1, 2).



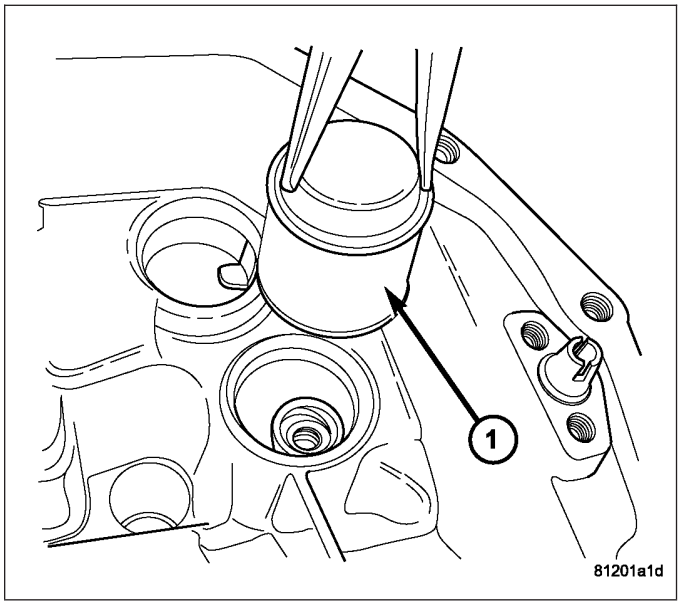
22. Remove the low/reverse accumulator snap ring (1).



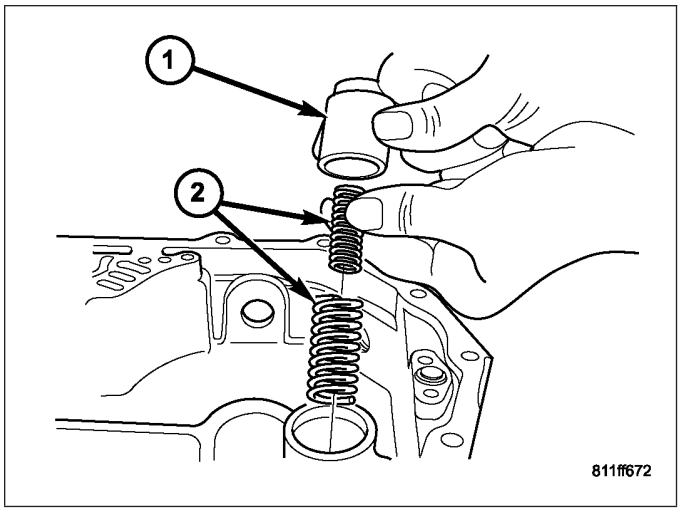
23. Remove the low/reverse accumulator plug (2).



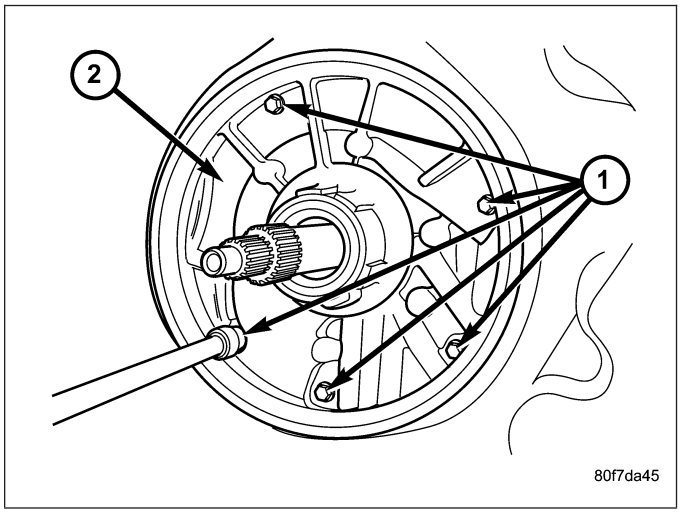
24. Remove low/reverse accumulator piston (1) using suitable pliers.



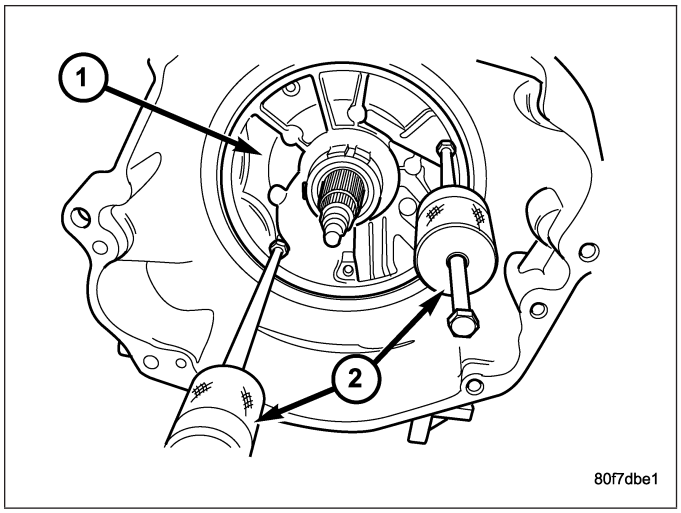
25. Remove piston (1) and springs (2).



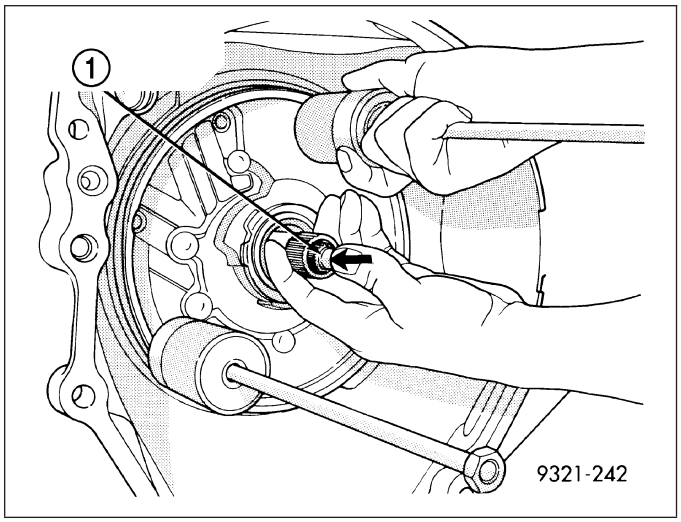
26. Remove and discard the oil pump-to-case bolts (1). The oil pump bolts are not to be reused.



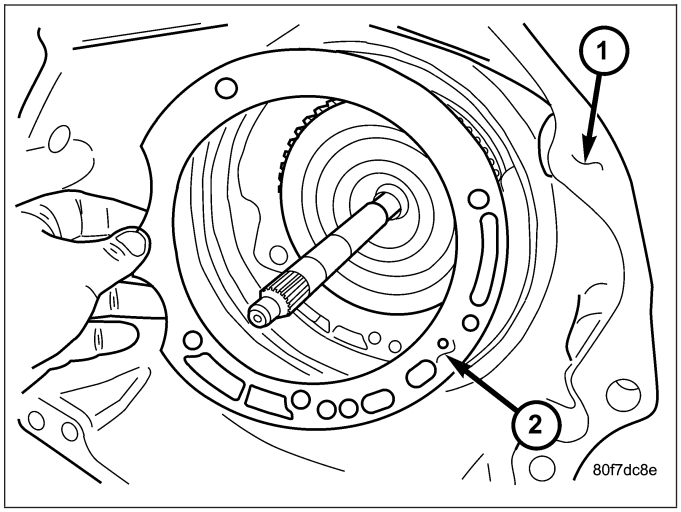
27. Remove oil pump using C-3752 Pullers (2).



28. Remove oil pump while pushing in on input shaft (1).

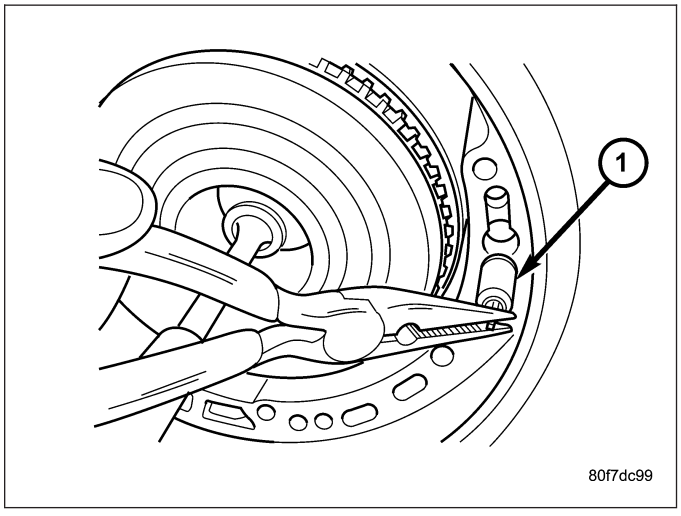


29. Remove oil pump gasket (2).

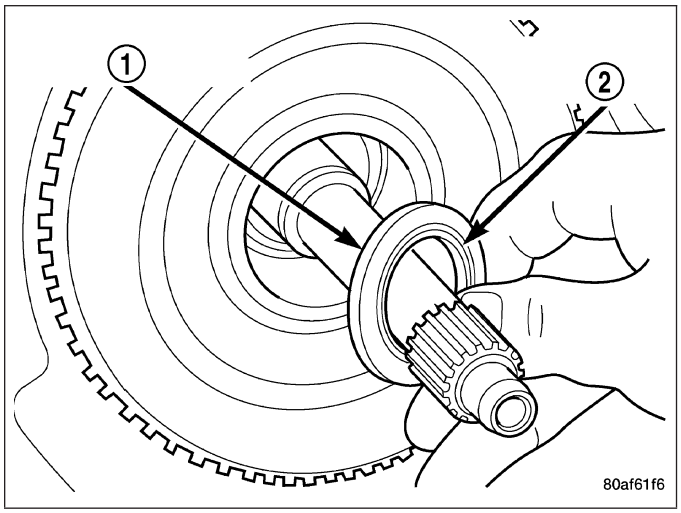


CAUTION: By-pass valve must be replaced if transmission failure occurs.

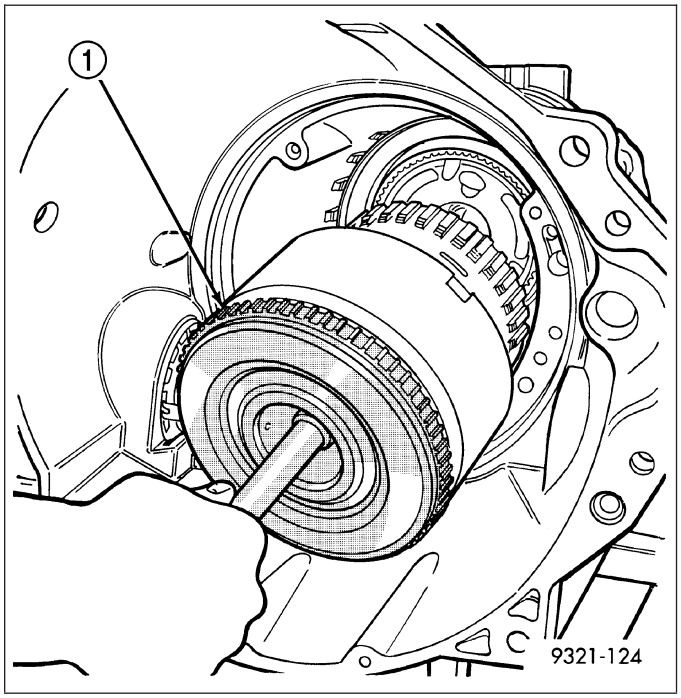
30. Remove the cooler by-pass valve (1).



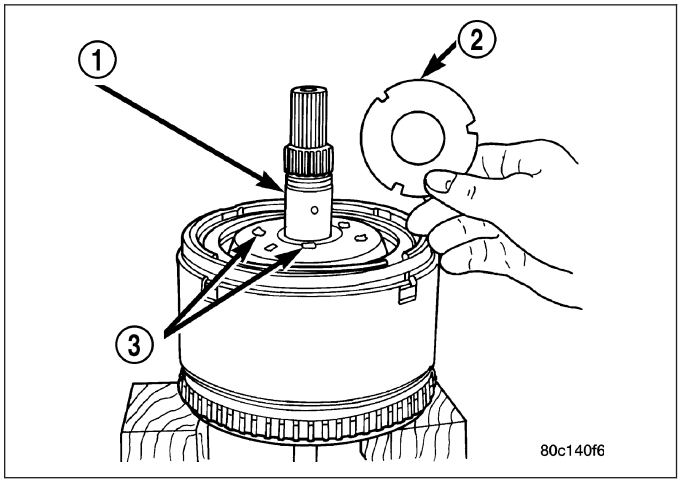
31. Remove the #1 caged needle bearing (1).



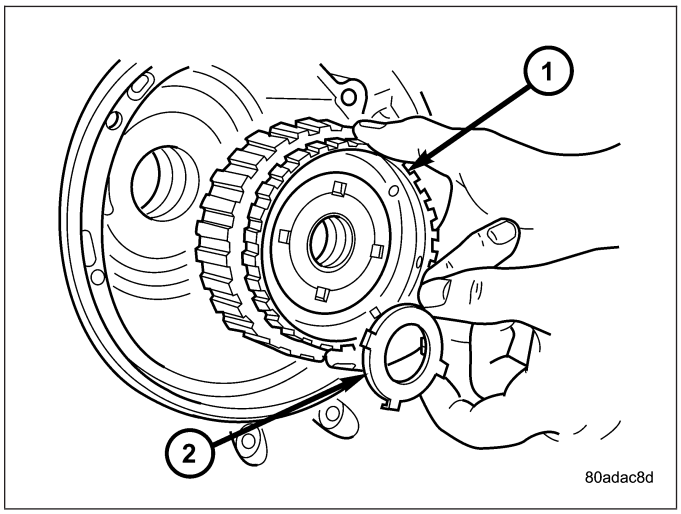
32. Remove the input clutch assembly (1).



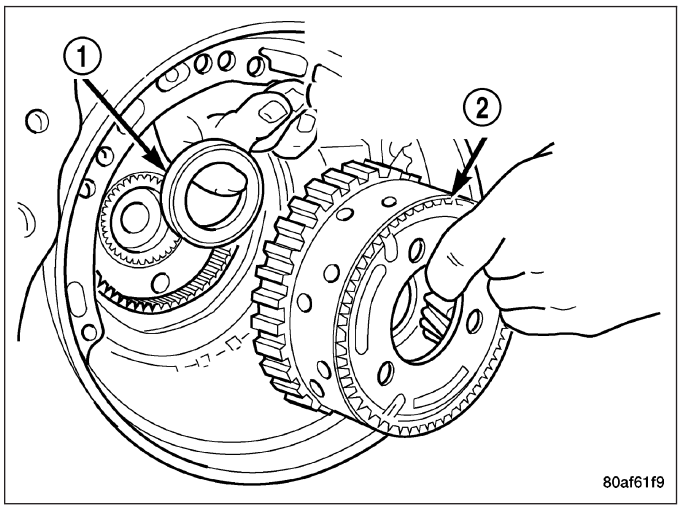
33. Remove the #4 thrust plate (2).



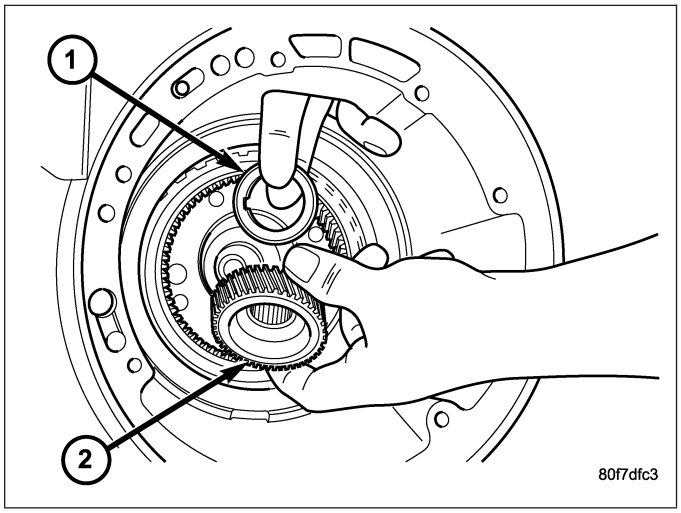
34. Remove the front sun gear assembly (1) and #4 thrust washer (if still in place).



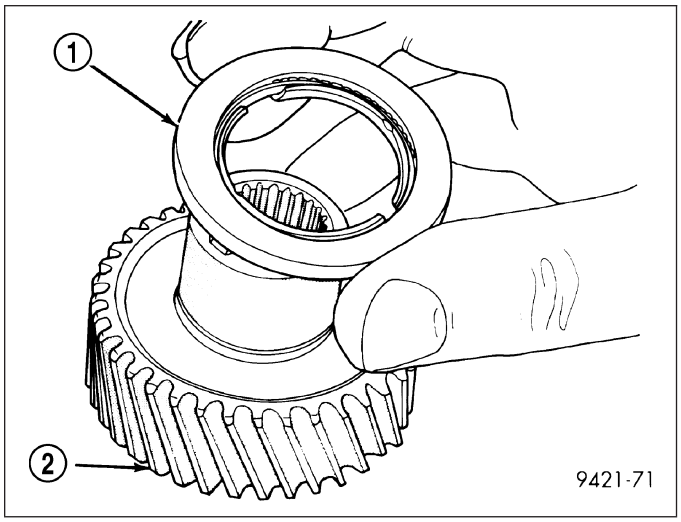
35. Remove the front carrier/rear annulus (2) and #6 needle bearing (1).



36. Remove the rear sun gear (2) and #7 needle bearing (1).

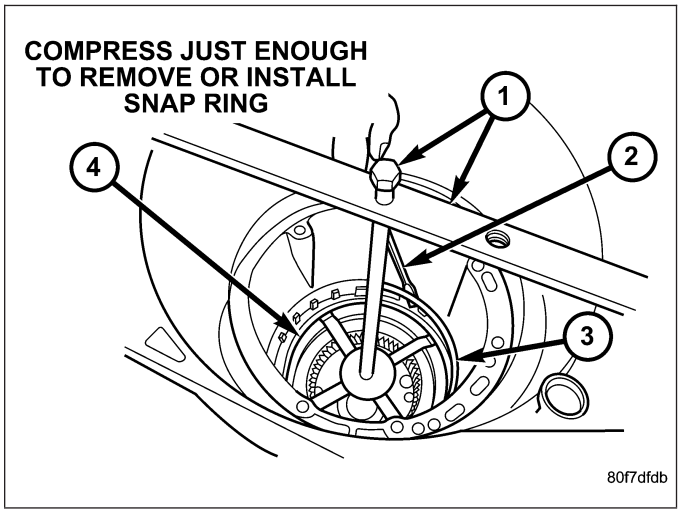


NOTE: The number seven needle bearing (1) has three antireversal tabs and is common with the number five and number two position. The orientation should allow the bearing to seat flat against the rear sun gear. A small amount of petrolatum can be used to hold the bearing to the rear sun gear.



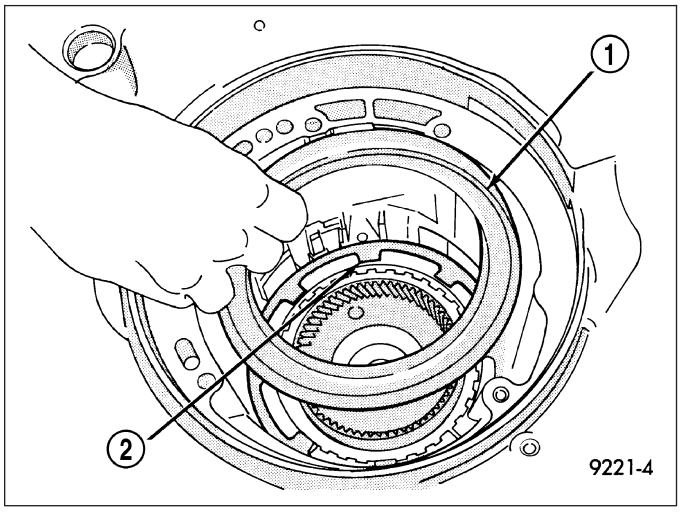
NOTE: Verify that Tool 5058A (1) is centered properly over the 2/4 clutch retainer (4) before compressing. If necessary, fasten the 5058A bar to the bellhousing flange with any combination of locking pliers and bolts to center the tool properly.

37. Install and load Tool 5058A to remove the 2/4 clutch retainer snap ring (3).

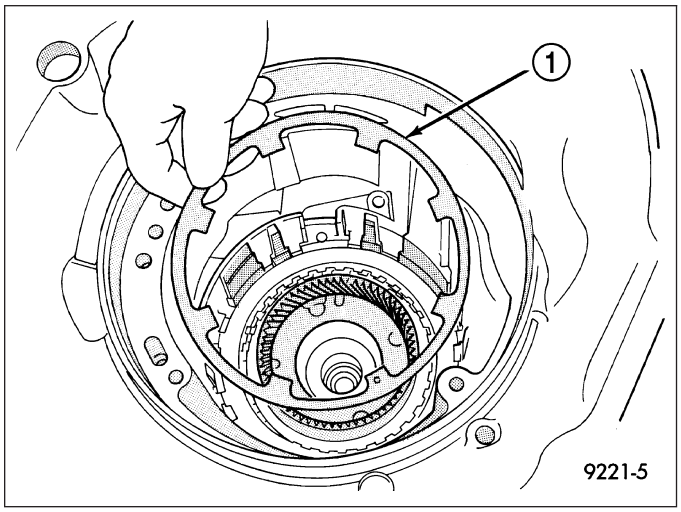


NOTE: The 2/4 Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.

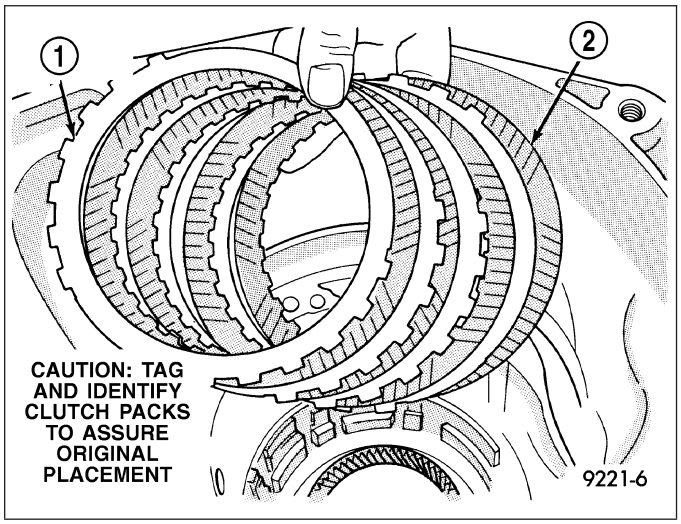
38. Remove the 2/4 clutch retainer (1).



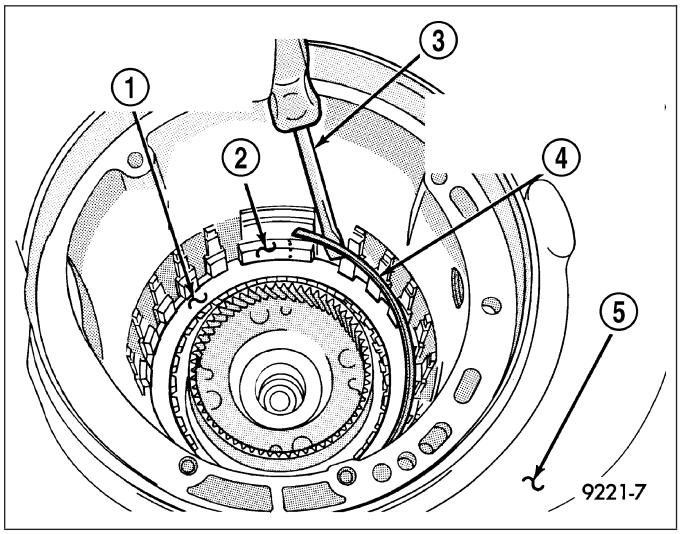
39. Remove the 2/4 clutch return spring (1).



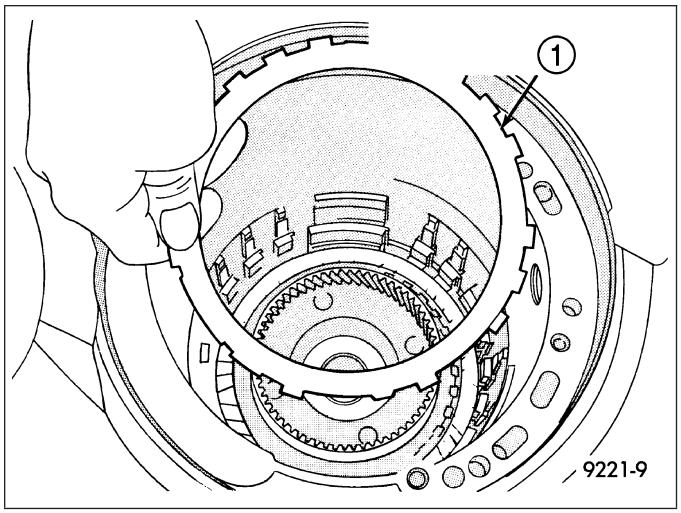
40. Remove the 2/4 clutch pack (1, 2).



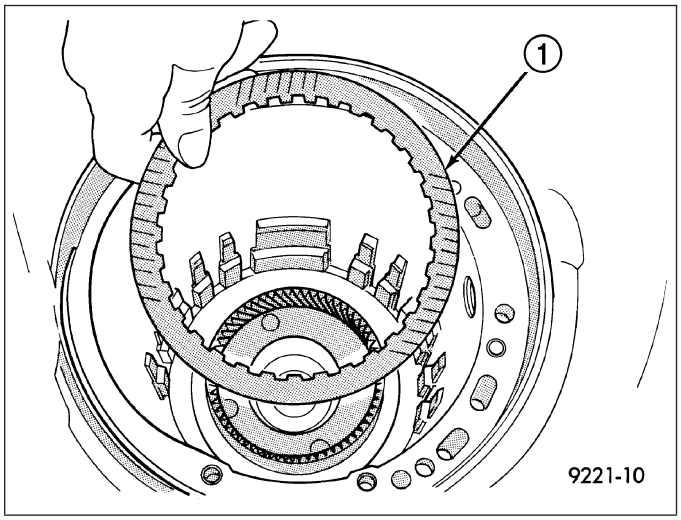
41. Remove the tapered snap ring (4).



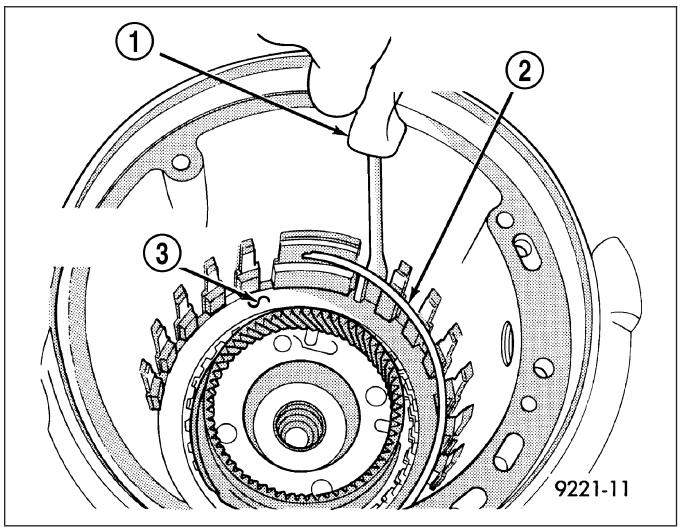
42. Remove the low/reverse reaction plate (1).



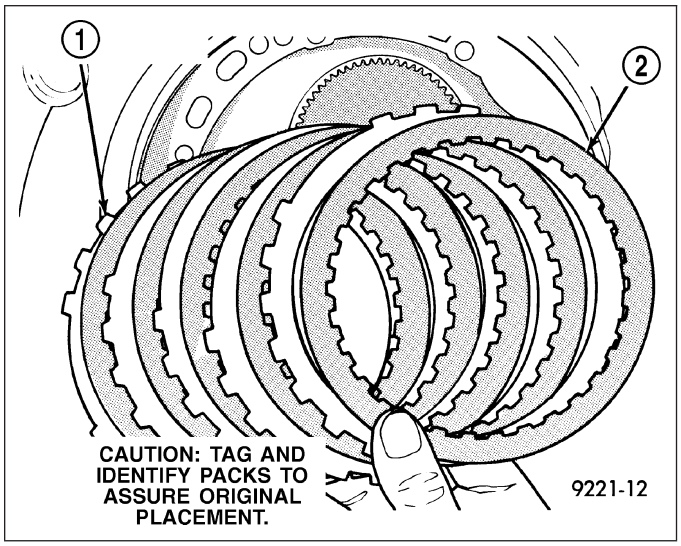
43. Remove one (1) low/reverse clutch disc to facilitate snap ring removal.



44. Remove the low/reverse reaction plate snap ring (2).

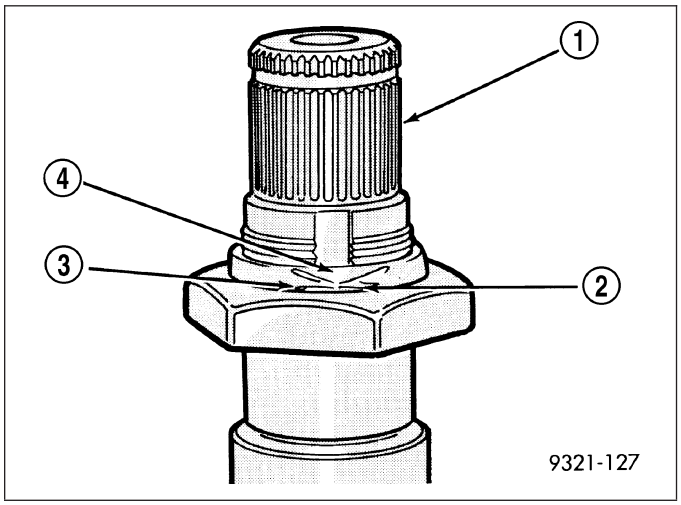


45. Remove the low/reverse clutch pack (1, 2).

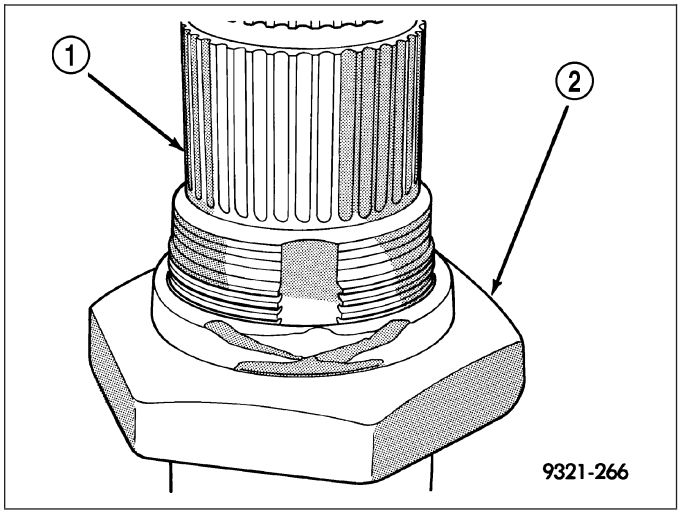


CAUTION: Failure to grind and open stakes (4) of the output shaft nut will result in thread damage to the shaft during nut removal.

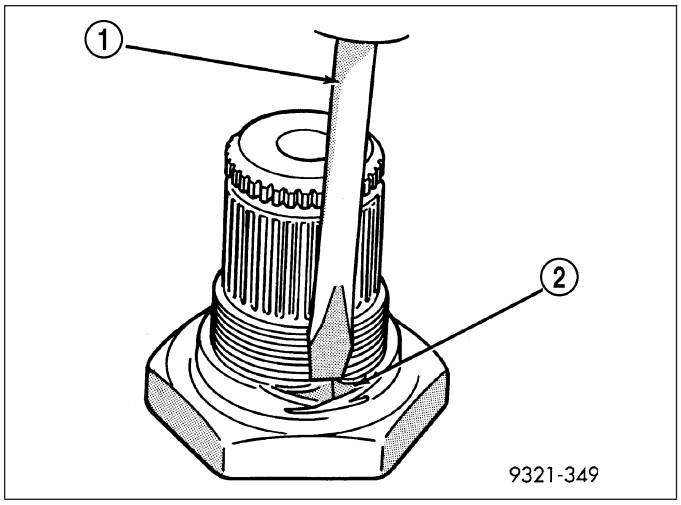
WARNING: WEAR SAFETY GOGGLES WHILE GRINDING STAKE NUTS.



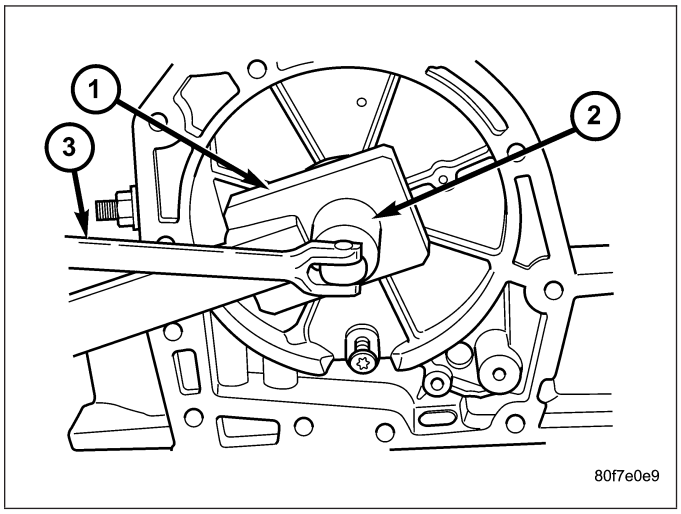
46. Using a die grinder or equivalent, grind the stakes in the shoulder of the shaft nut (2) as shown. Do not grind all the way through the nut and into the shaft. There are two stakes on each nut.



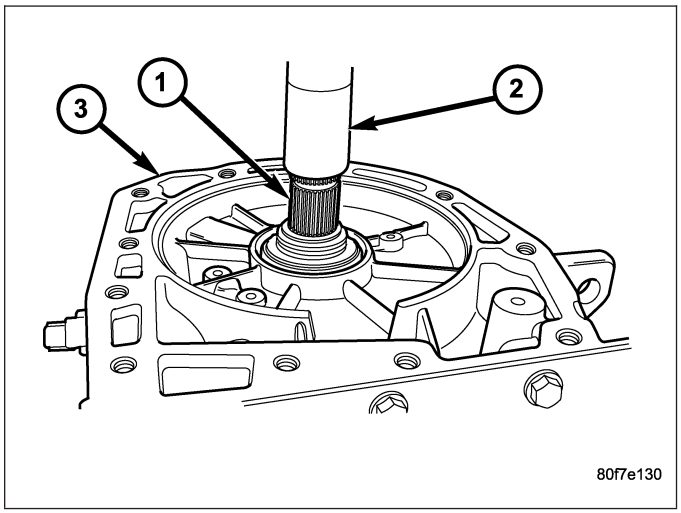
47. Using a small chisel (1), carefully open the stakes on nut (2).



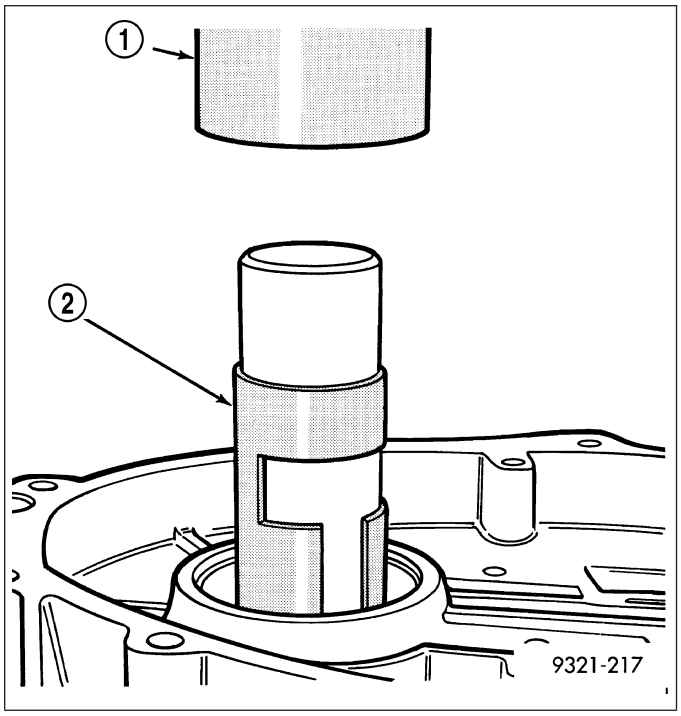
48. Use special tool 6497 (1) and 6498A (2) to remove the output shaft nut.



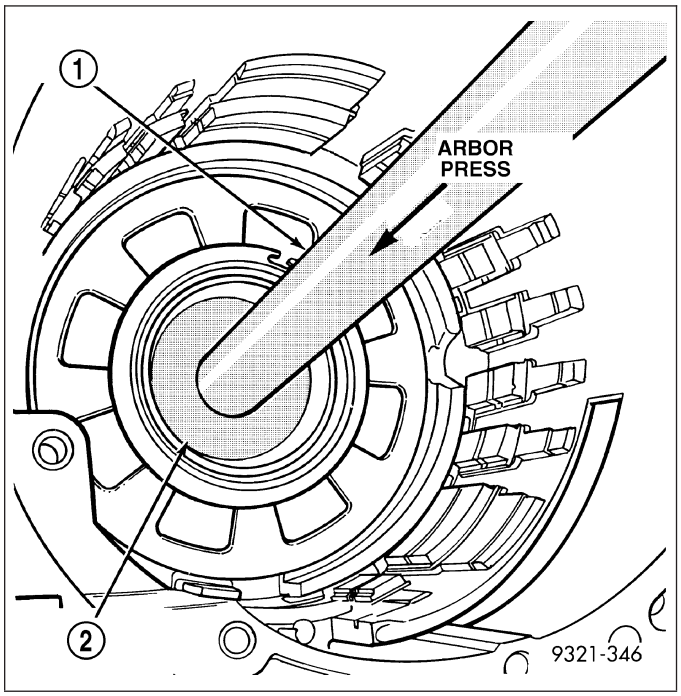
49. Remove the output shaft (1) from case (3) using a shop press (2).



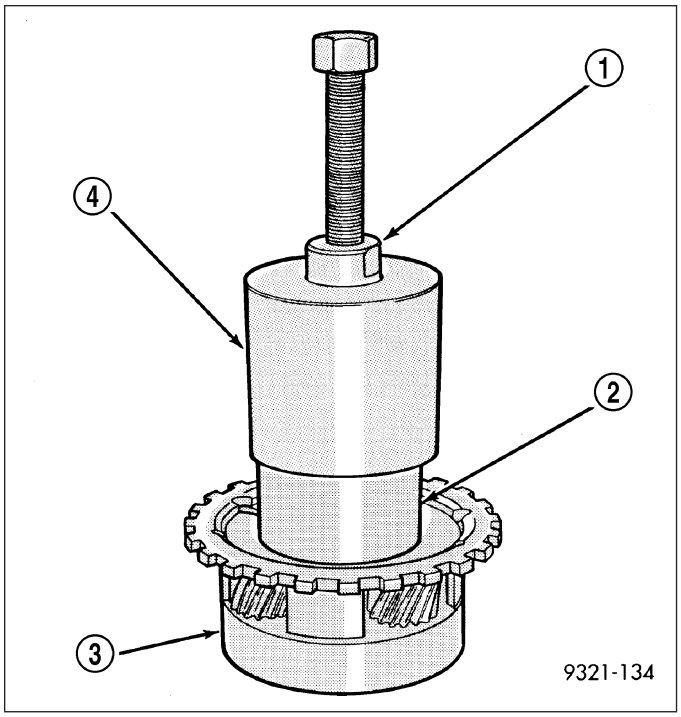
50. Use special tool 6596 (2) with a shop press (1) to remove the front output shaft bearing cup.



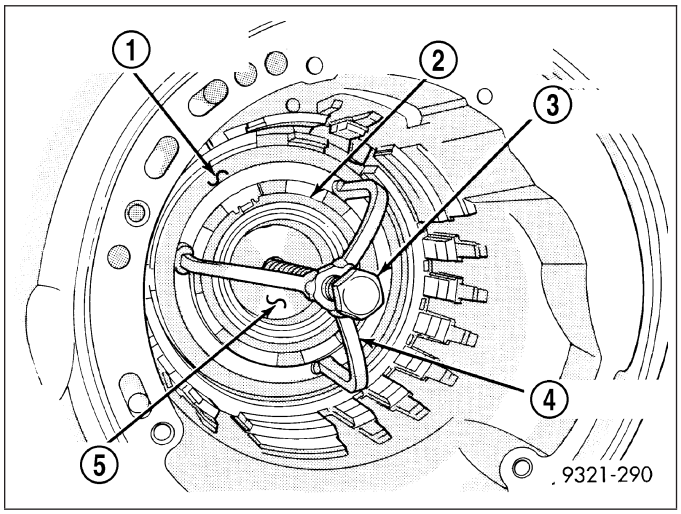
51. Use special tool 6597 (2) and handle C-4171 (1) and C-4171-2 to press the rear output shaft bearing cup rearward.



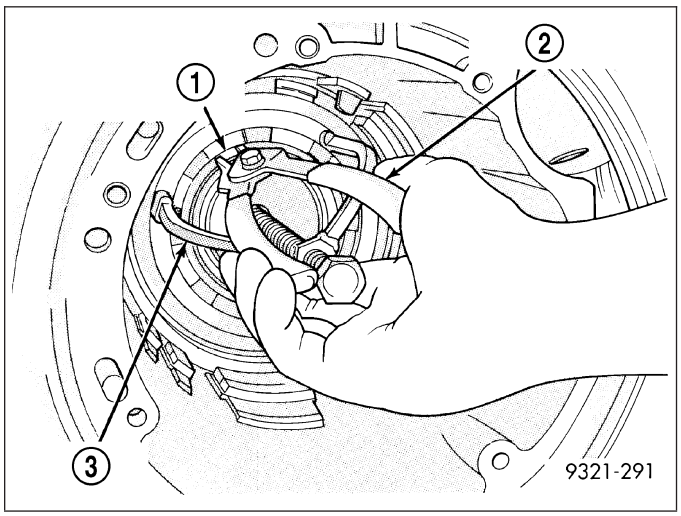
52. Remove the rear carrier front bearing cone (3).



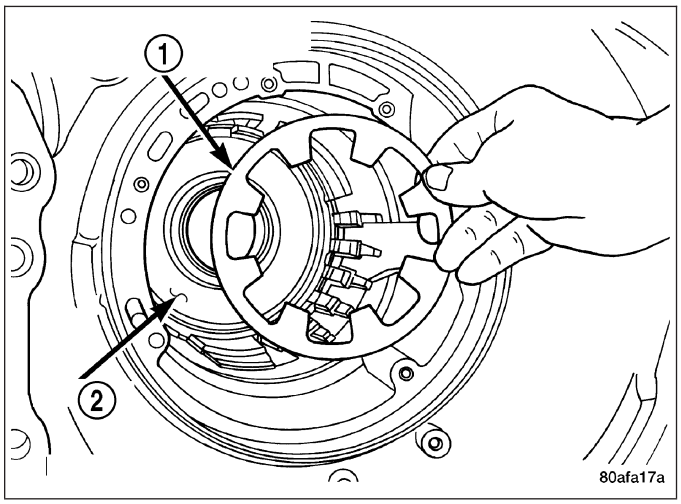
53. Install and load compressor 5059A (4) as shown.



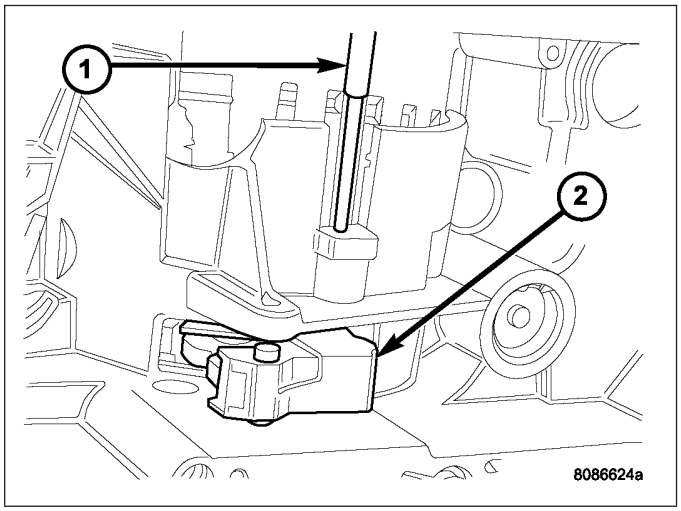
54. Remove the low/reverse belleville spring snap ring (1).



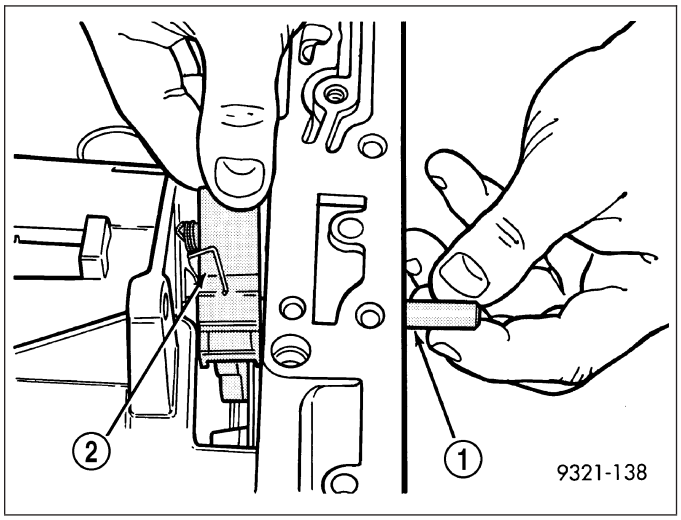
55. Remove the low/reverse piston belleville spring (1).



56. Remove the park sprag pivot retaining screw.
57. Drive out the anchor shaft using suitable punch (1).

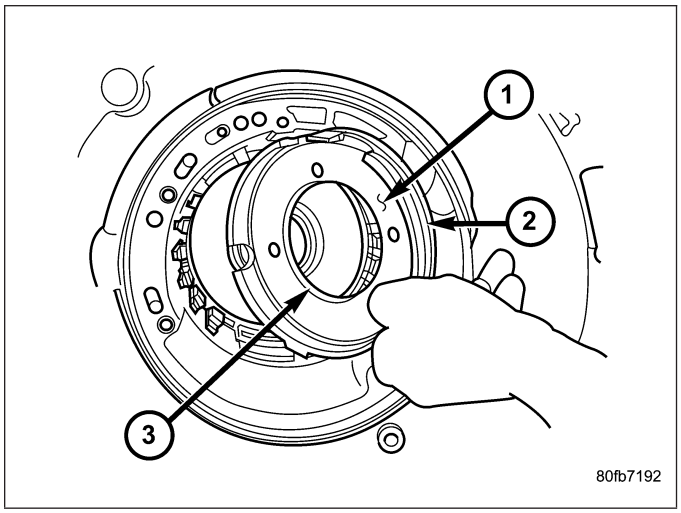


58. Remove the guide bracket pivot pin (1). Inspect all components for wear and replace if necessary.

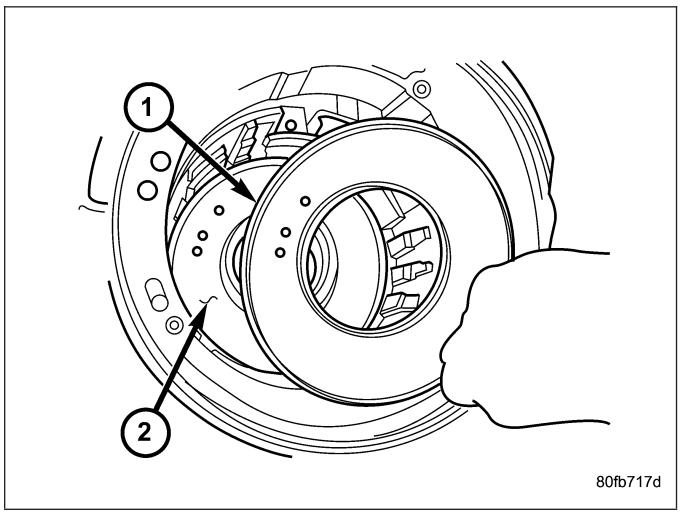


NOTE: The Low/Reverse Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.

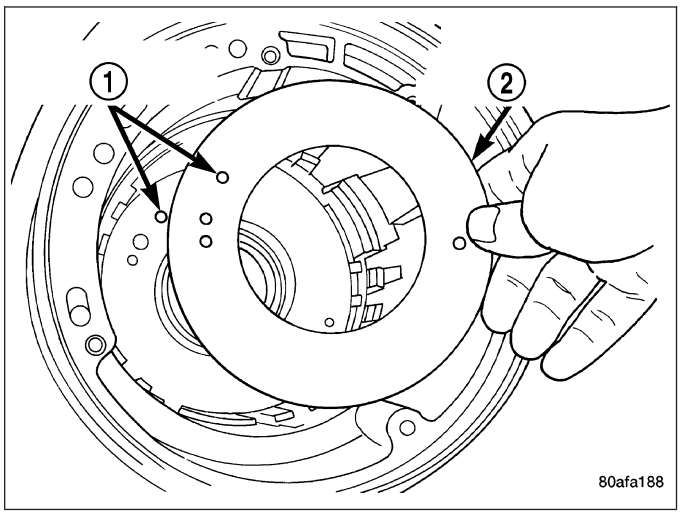
59. Remove the low/reverse clutch piston (1).
60. Remove the low/reverse piston retainer screws.



61. Remove low/reverse piston retainer (1).



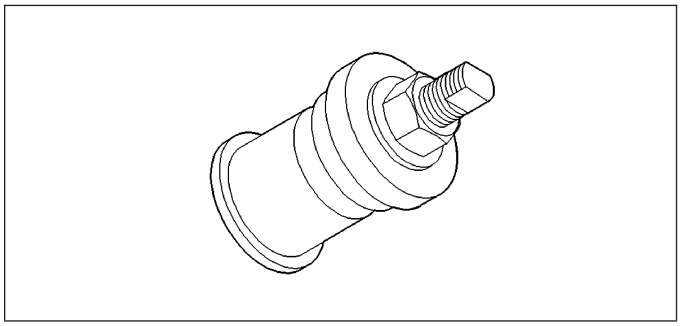
62. Remove the low/reverse piston retainer gasket (2).



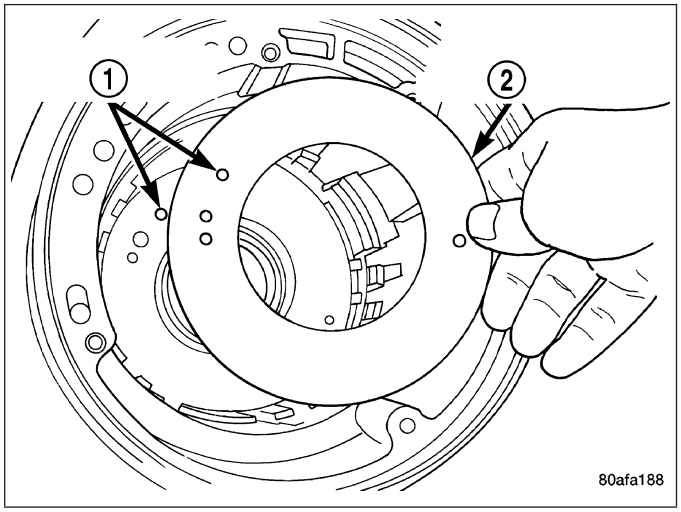
ASSEMBLY

NOTE: If the transmission assembly is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the Quick Learn Procedure using the scan tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE).

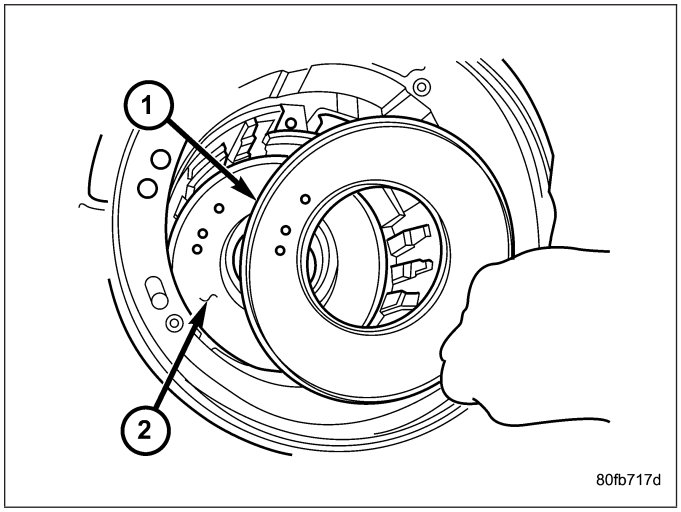
1. Install the output bearing cups using Special Tool - 5050A.



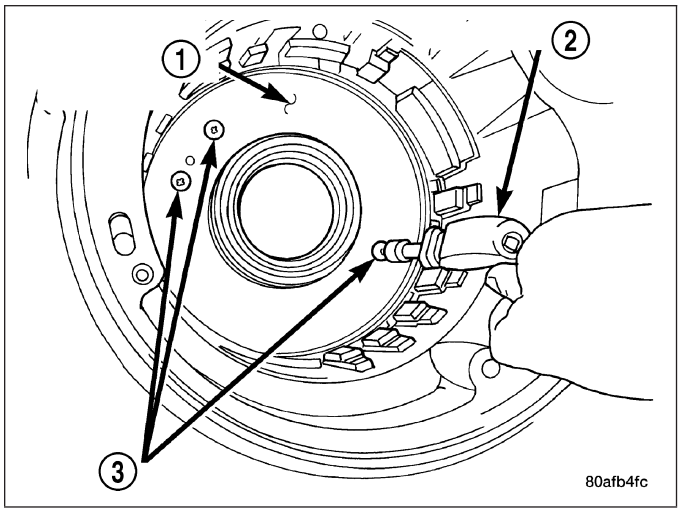
2. Install low/reverse piston retainer gasket (2).



3. Install low/reverse piston retainer (1).

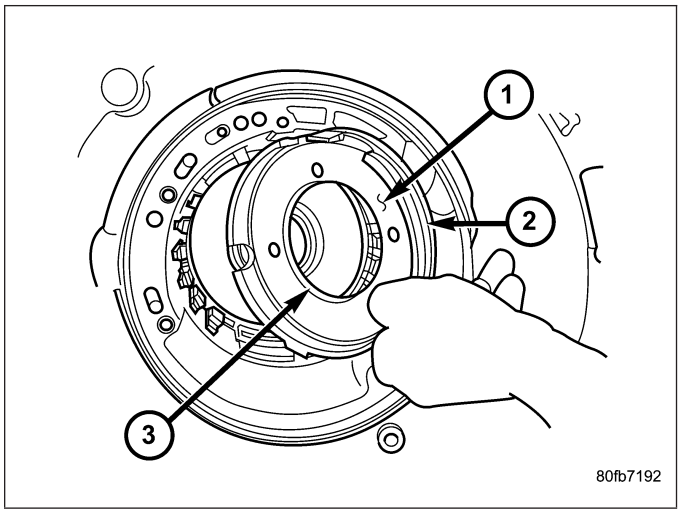


4. Install low/reverse piston retainer-to-case screws (3) and torque to 5 N·m (45 in. lbs.).

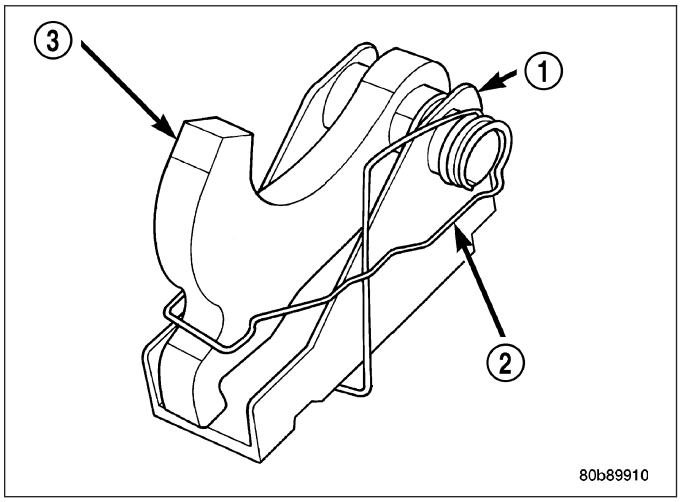


NOTE: The Low/Reverse Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.

5. Install low/reverse clutch piston (1).

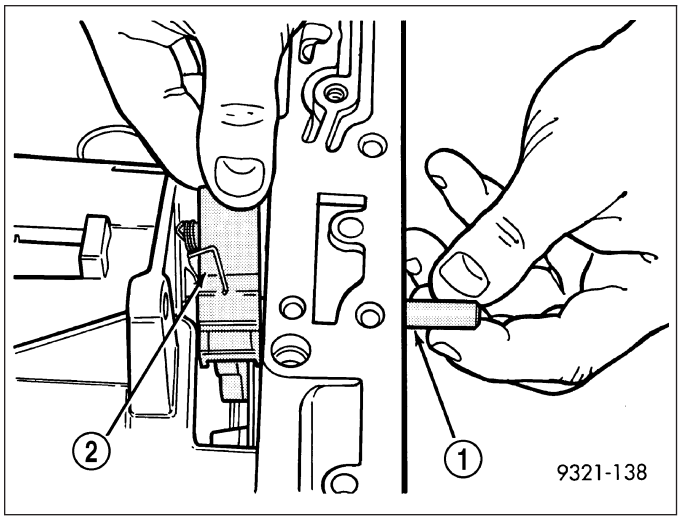


6. Assemble guide bracket (1) assembly as shown in , if necessary.

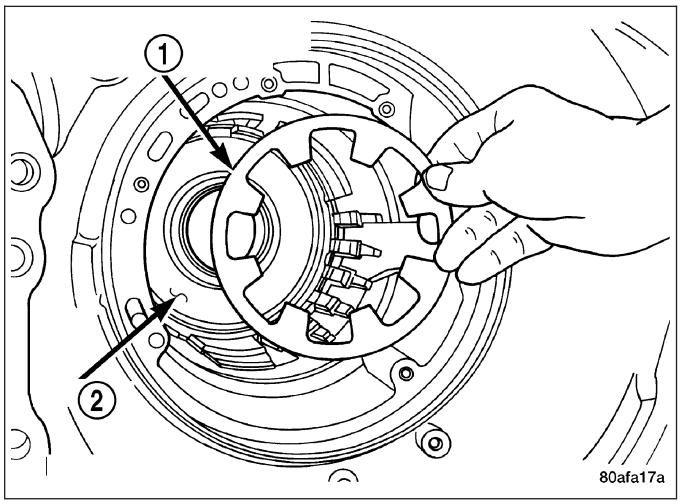


CAUTION: When installing, be sure guide bracket and split sleeve touch the rear of the transmission case.

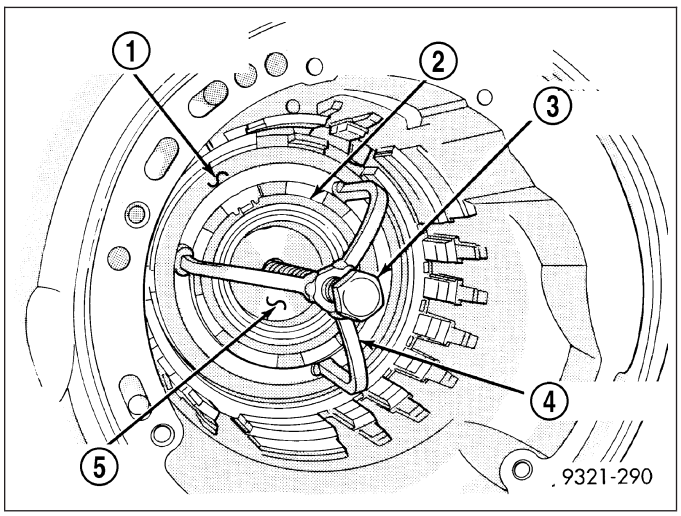
7. Install guide bracket pivot pin (1).
8. Install park sprag pivot retaining screw and torque to 4.5 N·m (40 in. lbs.).



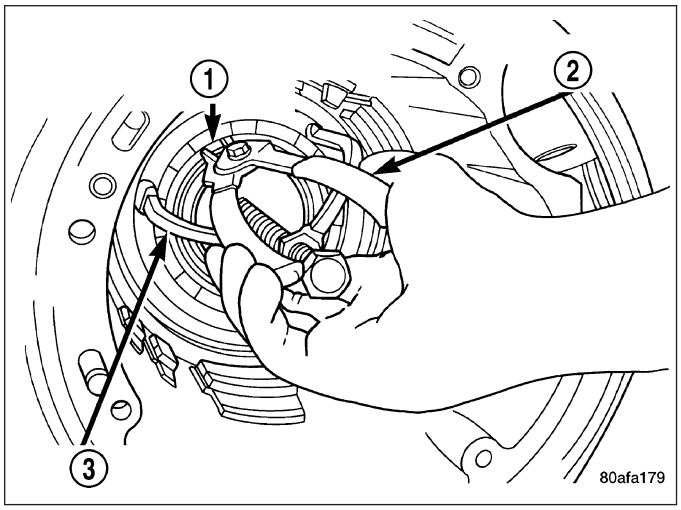
9. Install low/reverse piston belleville spring (1) into position.



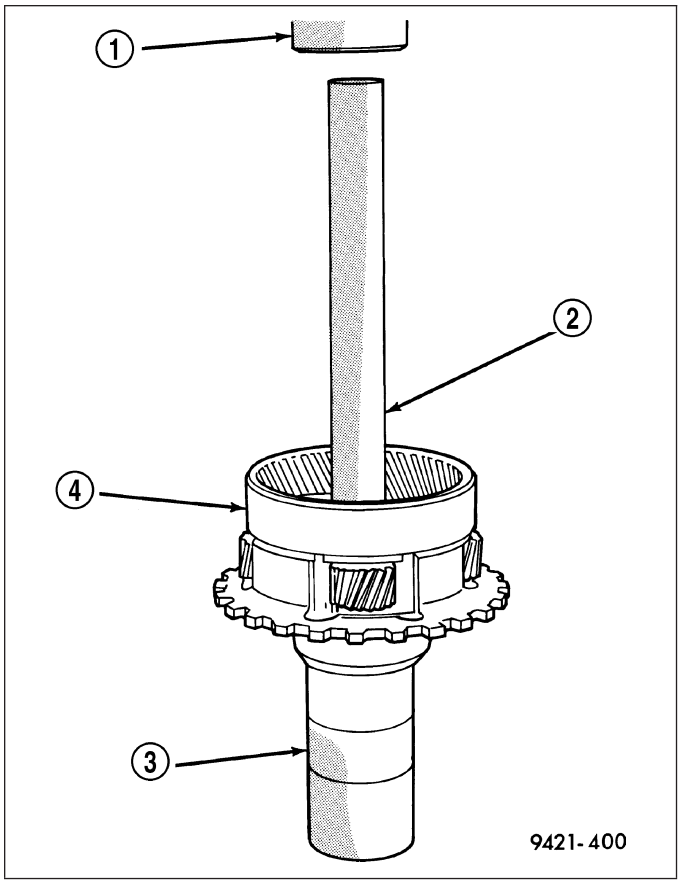
10. Install and load low/reverse spring compressor tool (3, 4, 5) as shown in to facilitate snap ring (2) installation.



11. Install snap ring (1) and remove compressor tool.



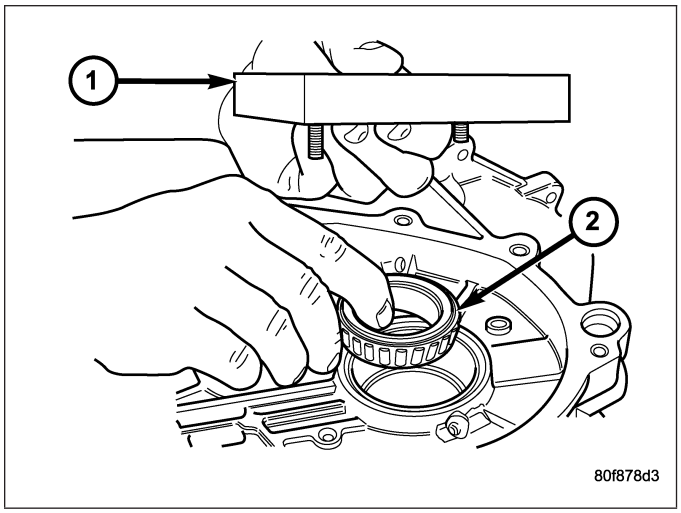
12. Install rear carrier (4) front bearing cone.



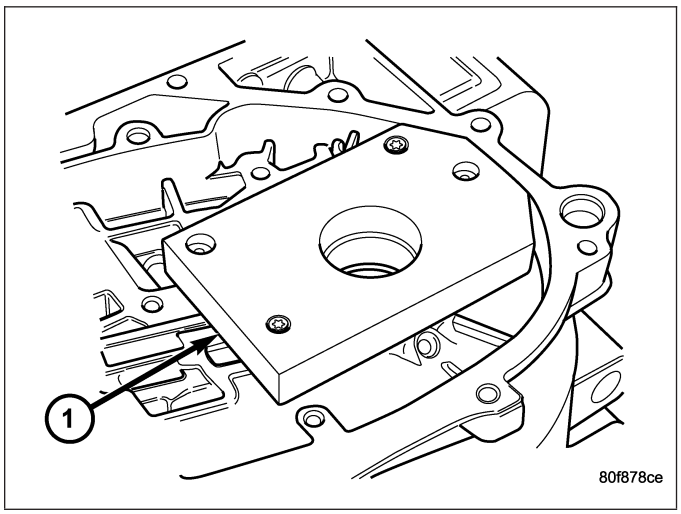
Check output bearing preload. **Output bearing preload must be checked and/or adjusted if any of the following items have been replaced:**

- Output shaft (rear carrier assembly)
- Output shaft bearings
- Transmission case

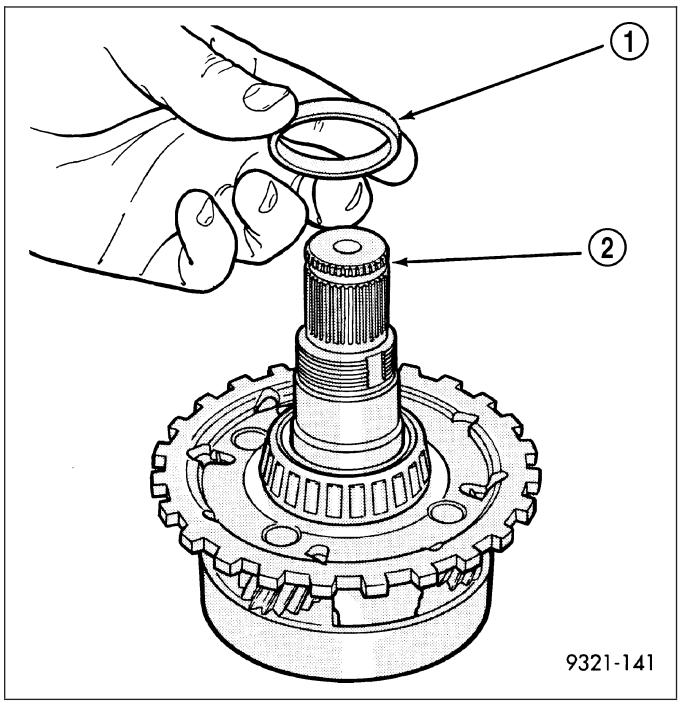
13. **PRELOAD CHECK/SHIM SELECTION:** Install rear output shaft bearing cone and special tool 6618A (1).



14. Install special tool 6618A (1). Lightly tighten retaining screws. Screws should be below the plate surface, but do not snug screws.
15. Turn case over on arbor press so that the plate is resting on the press base. **CAUTION: The output shaft will extend through the hole of tool 6618A. Ensure your press table has clearance for the output shaft.**

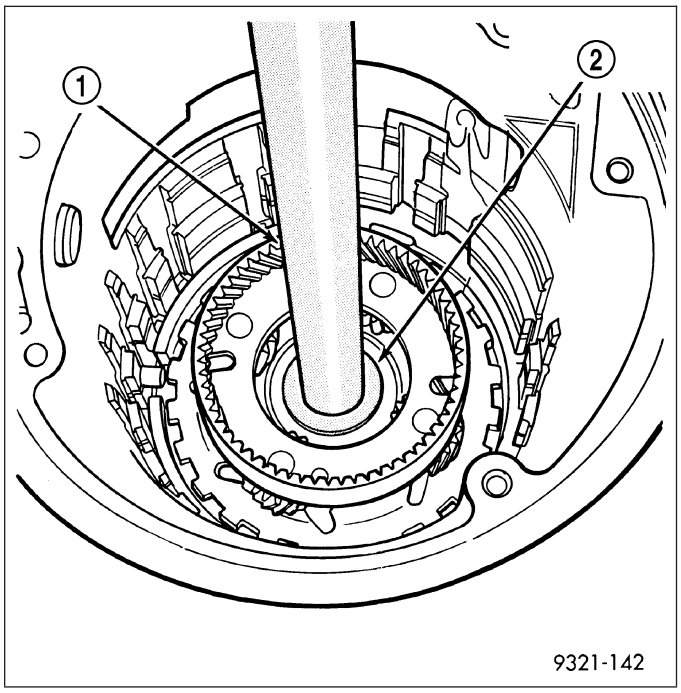


16. Install shim (1) on output shaft (2). Apply small amount of petrolatum onto the shim to hold it in place. Use the original shim as a starting point. If original shim is not available, use the thickest



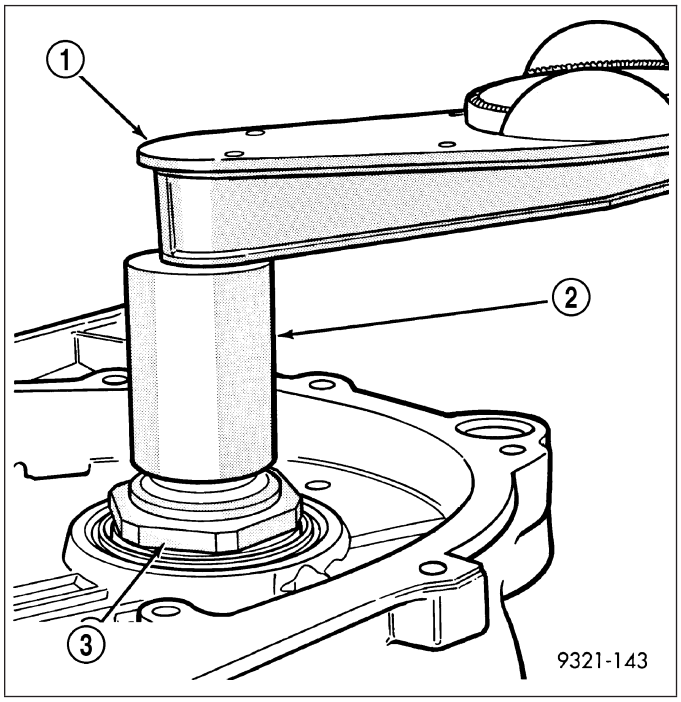
shim available.

17. Install output shaft/rear carrier into rear bearing. The shaft must be pressed into position. Use special tool MD-998911 (Disc) (2) and C- 4171 and C4171-2 (Handle) (1) to press shaft into rear bearing.



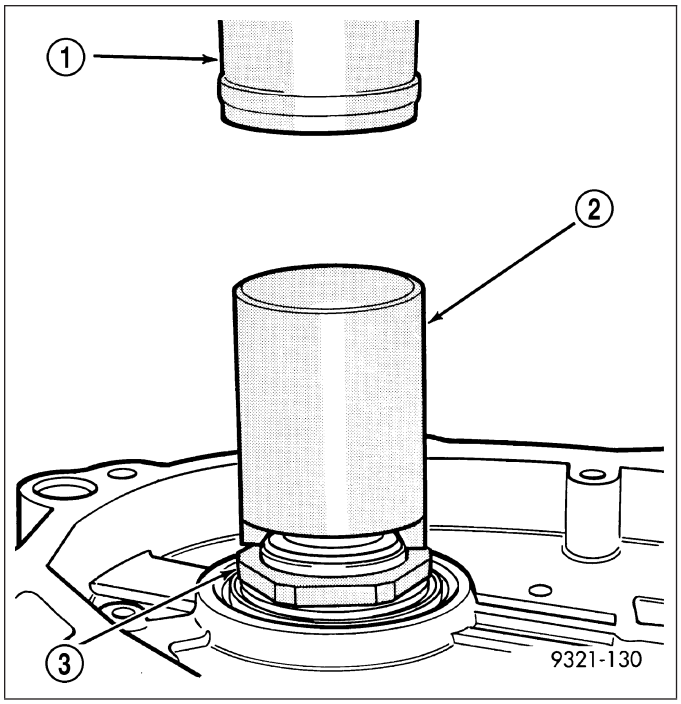
CAUTION: Do not re-use old output shaft nut because the removed stake weakens the nut flange. Using special tools 6497 and 6498-A, install new output shaft nut. Tighten new output shaft nut to 271 N·m (200 ft. lbs.).

18. Check the turning torque (1) of the output shaft. The shaft should have 1 to 8 in. lbs. of turning torque. If the turning torque is **higher than** 8 in. lbs., install a thicker shim. If turning torque is **less than** 1 in. lb., install a thinner shim. Make sure there is no end play.

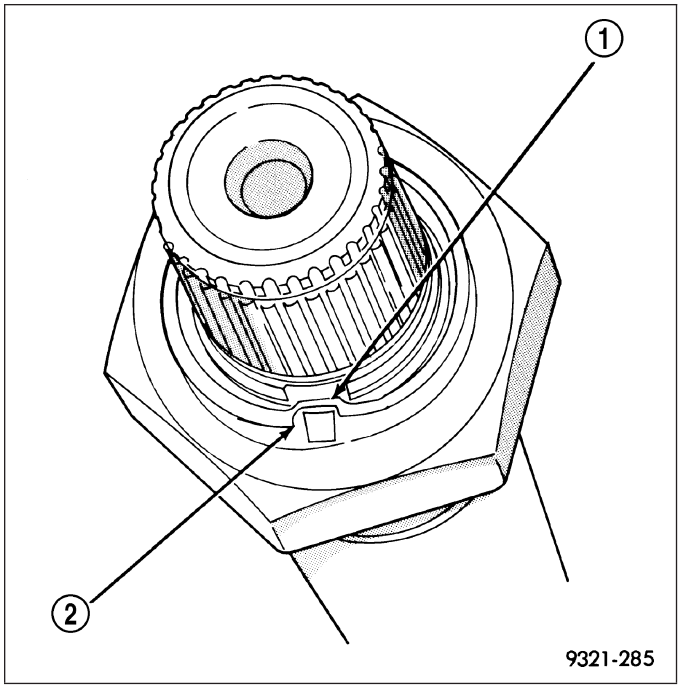


CAUTION: Failure to stake nut could allow the nut to back-off during use.

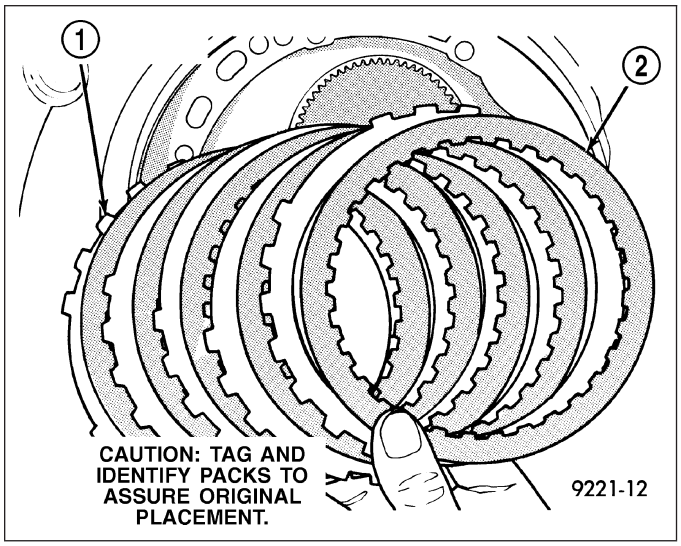
19. The new nut (3) must be staked after the correct turning torque is obtained. Use special tool 6639 (2) to stake output shaft nut.



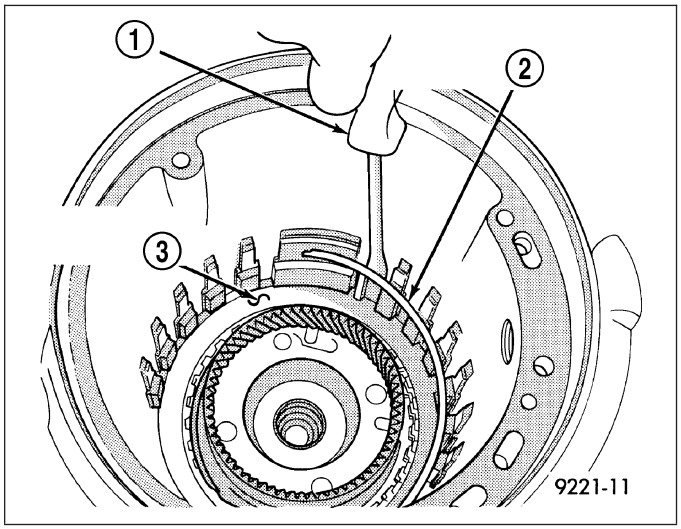
20. Verify that the nut has been properly staked to the output shaft.



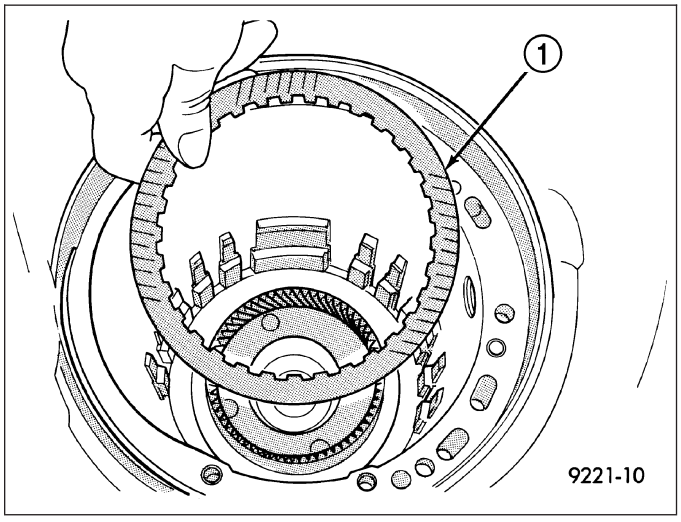
21. Install low/reverse clutch pack (1, 2). Leave uppermost disc out to facilitate snap ring installation.



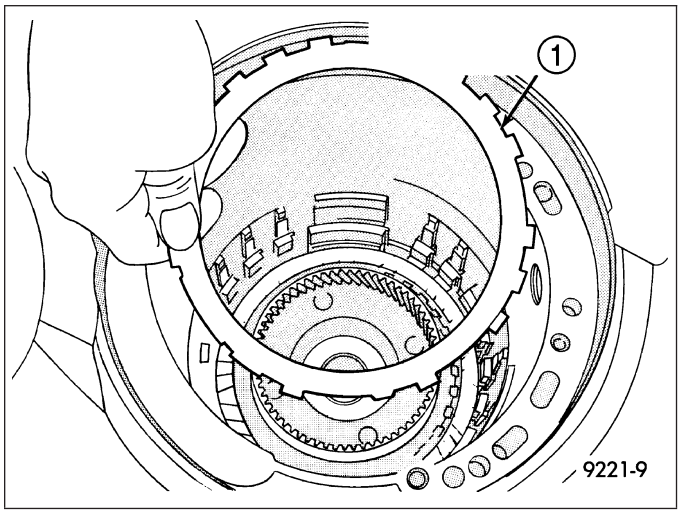
22. Install low/reverse reaction plate snap ring (2).



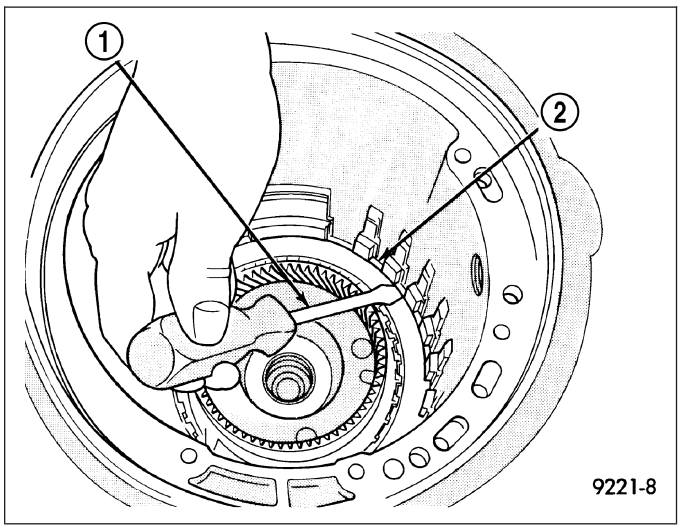
23. Install one low/reverse clutch disc (1).



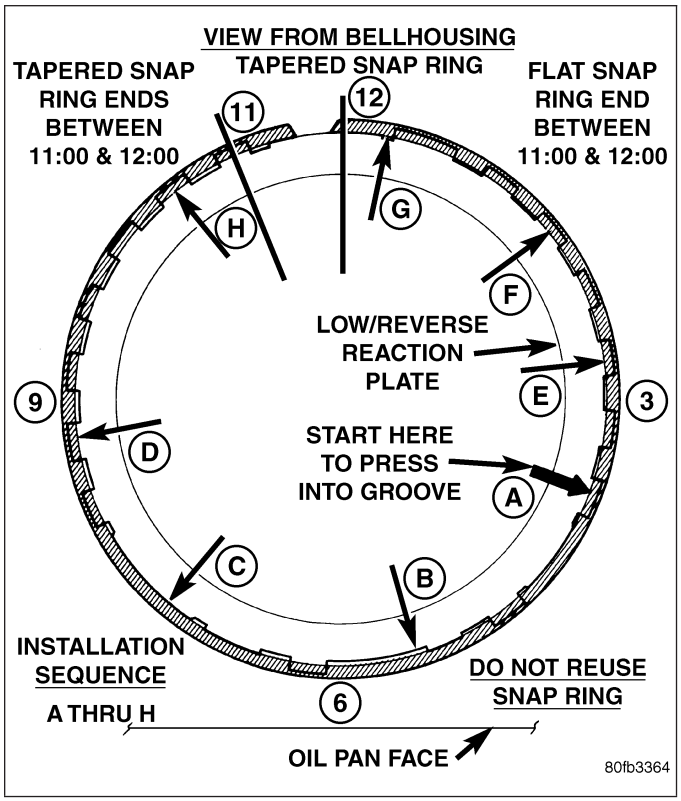
24. Install low/reverse reaction plate (1) with flat side up.



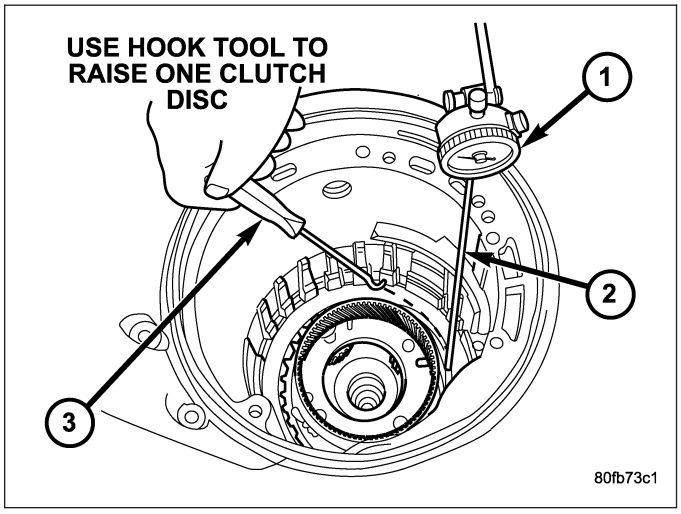
25. Install a new tapered snap ring (2) (tapered side out).



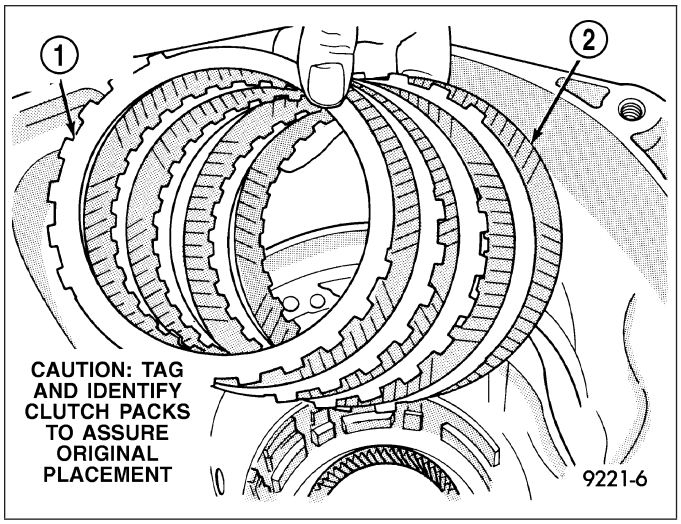
26. Make sure that the snap ring ends are oriented as shown.



27. Measure low/reverse clutch pack. Set up dial indicator (1) as shown. Press down clutch pack with finger and zero dial indicator. Record measurement in four (4) places and take average reading. **Low/Reverse clutch pack clearance is 0.84 to 1.60 mm (0.033 to 0.063 inch).**
28. Select the proper low/reverse reaction plate to achieve specifications.

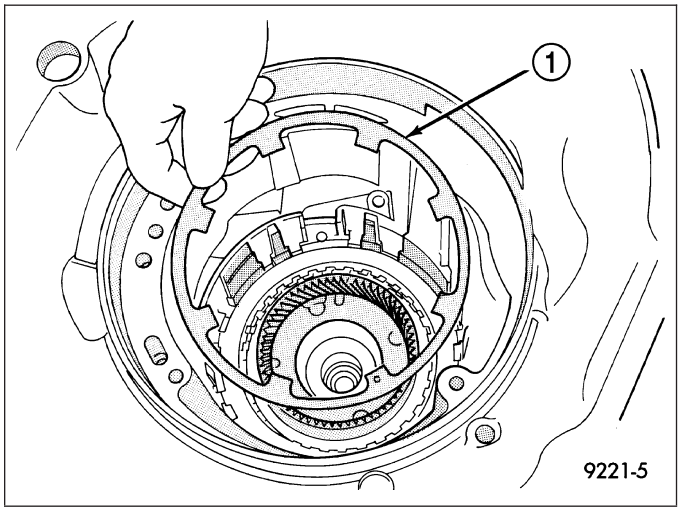


29. Install 2/4 clutch pack (1, 2).

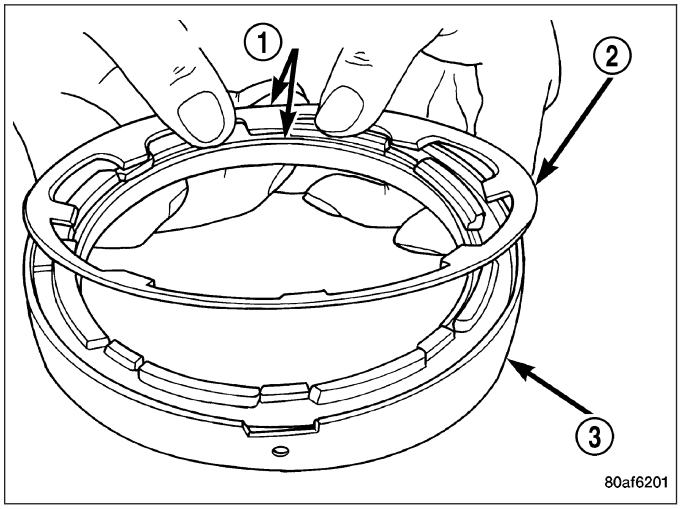


NOTE: The 2/4 Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.

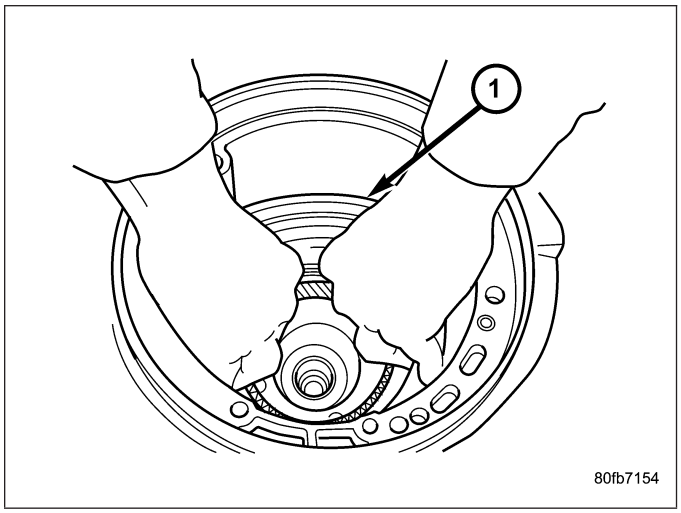
30. Install 2/4 clutch belleville spring (1).



31. Verify the proper orientation of the return spring (2) to the 2/4 retainer (3).

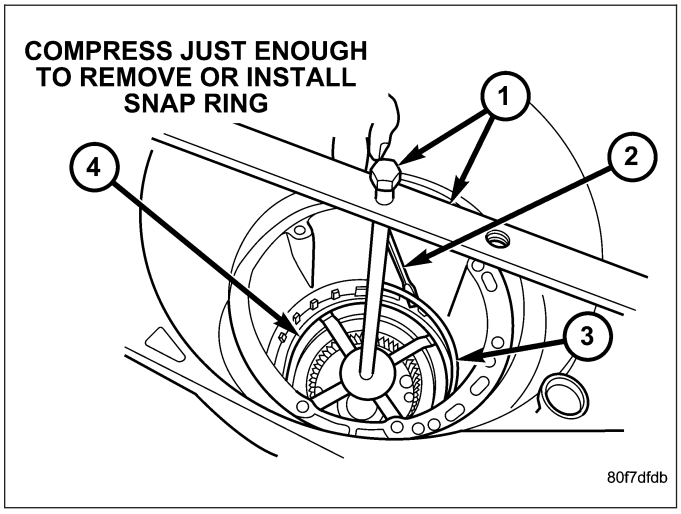


32. Install 2/4 clutch retainer (1).

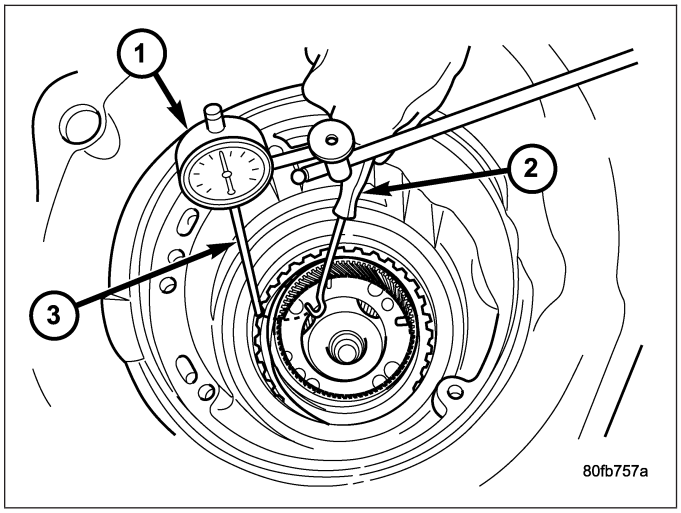


NOTE: Verify that Tool 5058A (1) is centered properly over the 2/4 clutch retainer (4) before compressing. If necessary, fasten the 5058A bar to the bellhousing flange with any combination of locking pliers and bolts to center the tool properly.

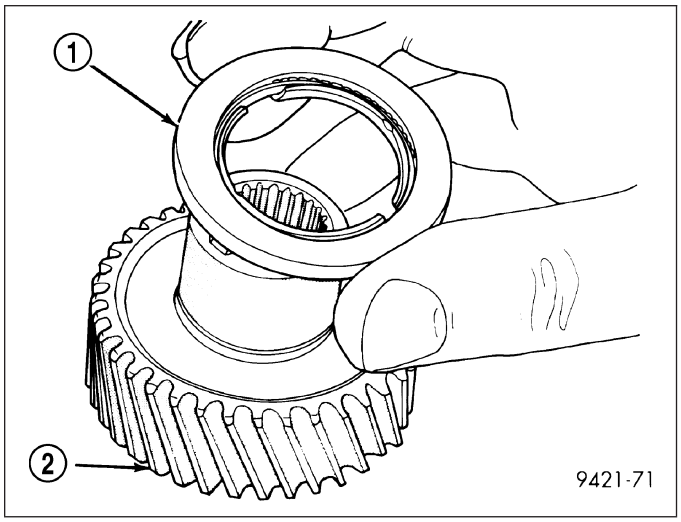
33. Set up Tool 5058 (1) as shown. Compress 2/4 clutch just enough to facilitate snap ring installation.



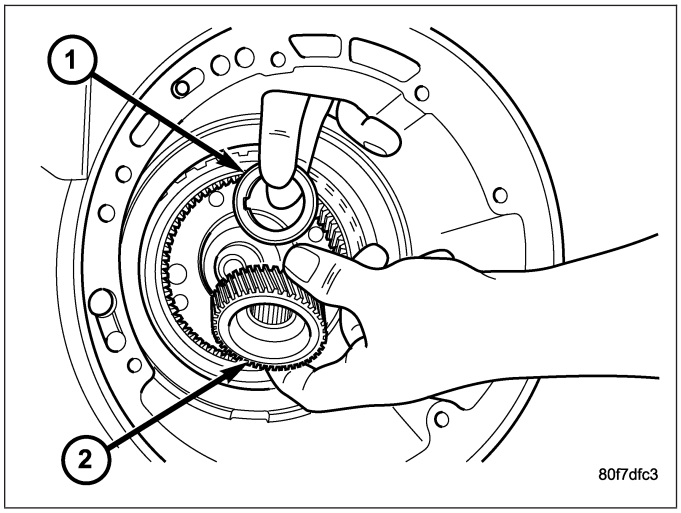
34. **Measure 2/4 clutch clearance:** Set up dial indicator (1) as shown. Press down clutch pack with finger and zero dial indicator. Record measurement in four (4) places and take average reading. **The 2/4 clutch pack clearance is 0.76 to 2.64 mm (0.030 to 0.104 inch).** If not within specifications, the clutch is not assembled properly or is excessively worn. **There is no adjustment for the 2/4 clutch clearance.**



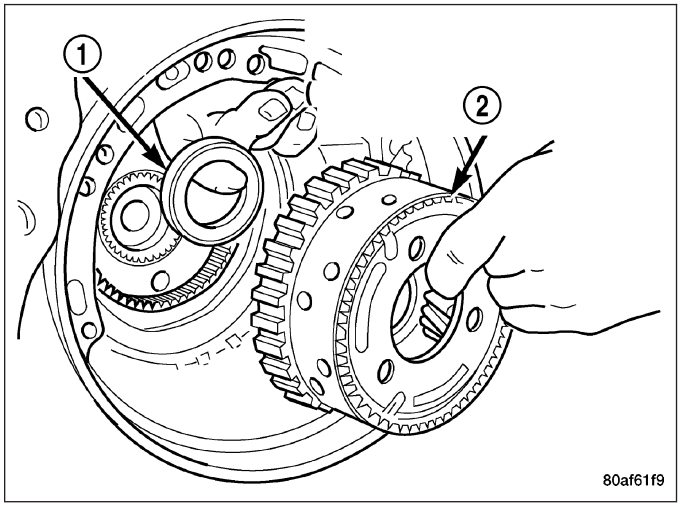
35. Install the #7 needle bearing (1) to the rear sun gear (2). **The number 7 needle bearing has three antireversal tabs and is common with the number 5 and number 2 position. The orientation should allow the bearing to seat flat against the rear sun gear. A small amount of petrolatum can be used to hold the bearing to the rear sun gear.**



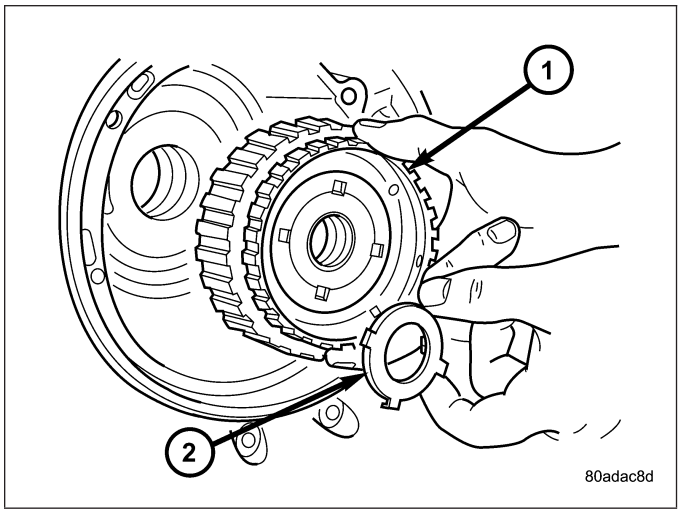
36. Install rear sun gear (2) and #7 needle bearing (1).



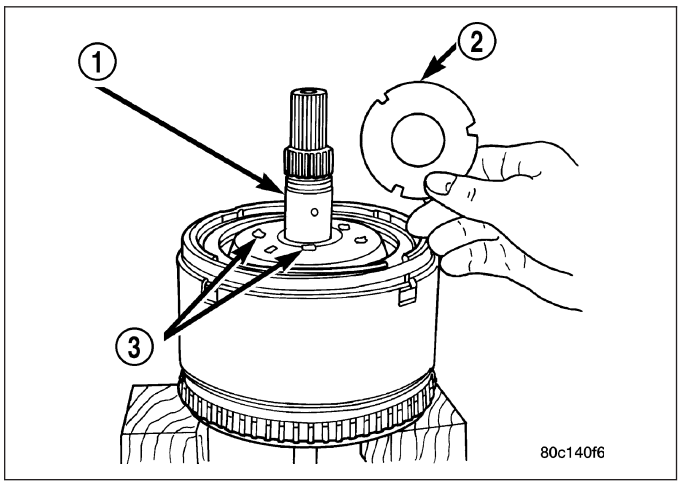
37. Install front carrier/rear annulus assembly (2) and #6 needle bearing (1).



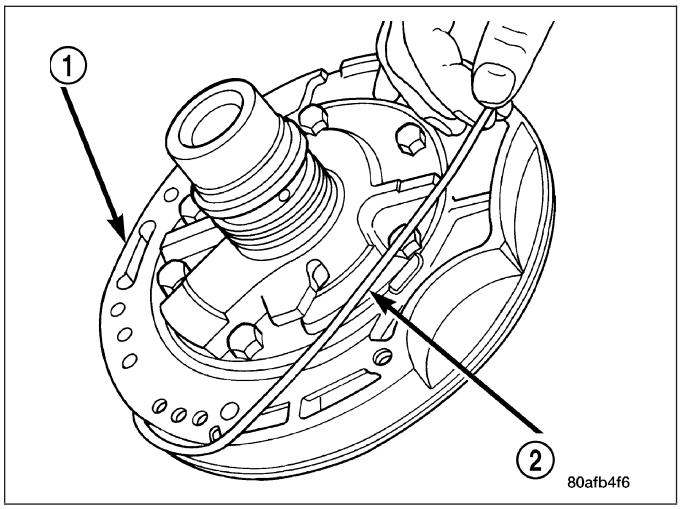
38. Install front sun gear assembly (1) and #4 thrust washer (2).



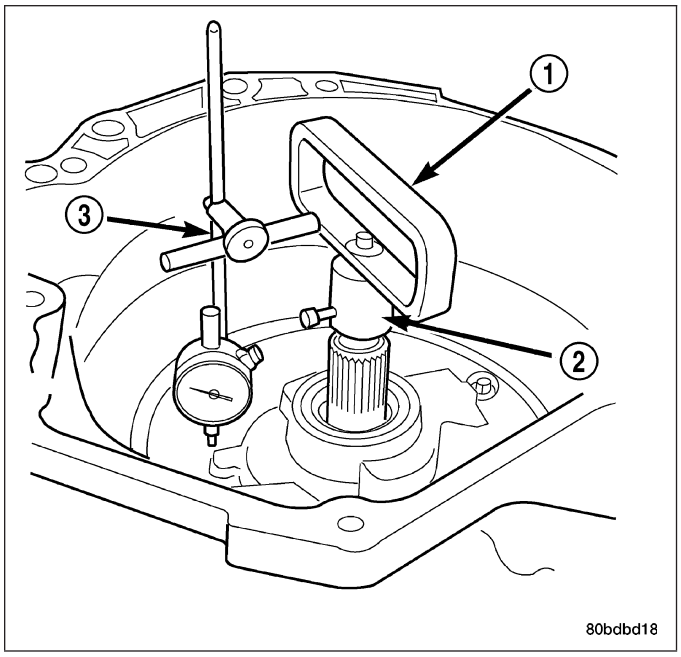
39. Determine proper #4 thrust plate thickness. Select the thinnest available #4 thrust plate.
40. Install #4 thrust plate (2) using petrolatum to hold into position.
41. Install input clutch assembly. Ensure the input clutch assembly is completely seated by viewing position through input speed sensor hole. **If the speed sensor tone wheel is not centered in the opening, the input clutches assembly is not seated properly.**



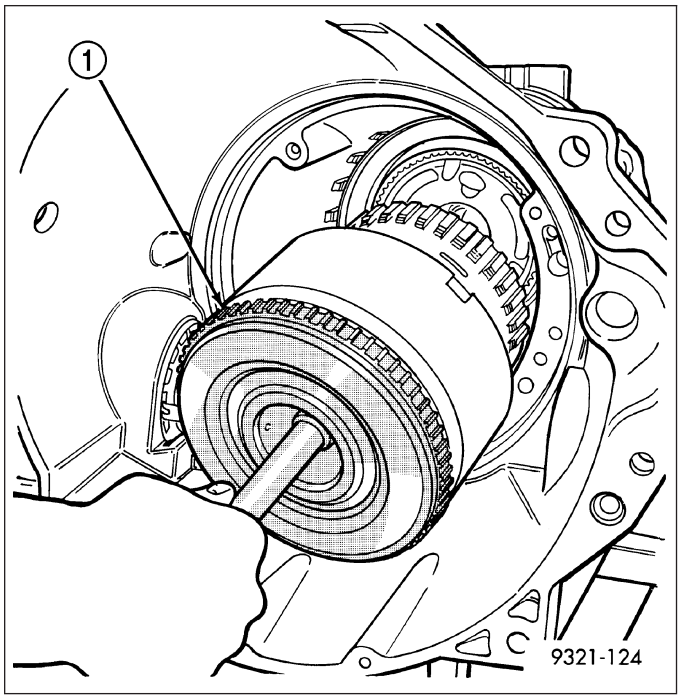
42. Remove the oil pump o-ring (2) and install oil pump and gasket to transmission. **Use screw-in dowels or phillips-head screwdrivers to align pump to case. Be sure to reinstall O-ring on oil pump after selecting the proper No. 4 thrust plate.**



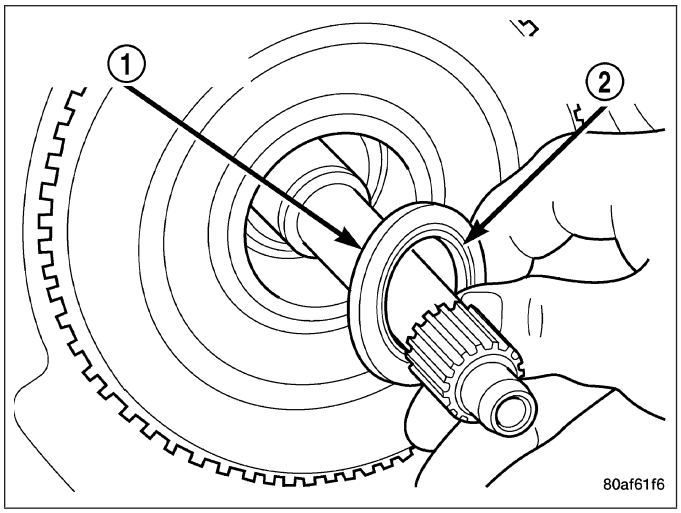
43. Measure the input shaft end play with the transmission in the vertical position. This will ensure that the measurement will be accurate.
44. Set up and measure endplay using End Play Set 8266 (1, 2) and Dial Indicator Set C3339 (3) as shown.
45. Measure input shaft end play. **Input shaft end play must be 0.127 to 0.635 mm (0.005 to 0.025 inch).** For example, if end play reading is 0.055 inch, select No. 4 Thrust Plate which is 0.071 to 0.074 thick. This should provide an input shaft end play reading of 0.020 inch, which is within specifications.



46. Remove oil pump, gasket, and input clutch assembly to gain access to and install proper #4 thrust plate.
47. Install input clutch assembly (1) with proper thrust plate.

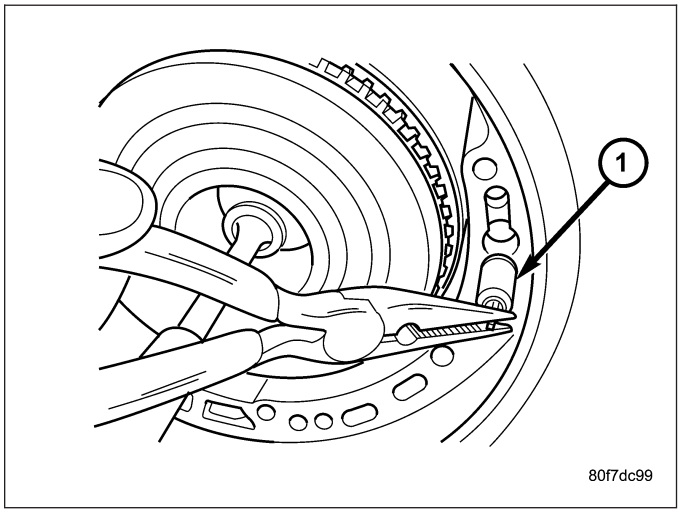


48. Install #1 caged needle bearing (1).



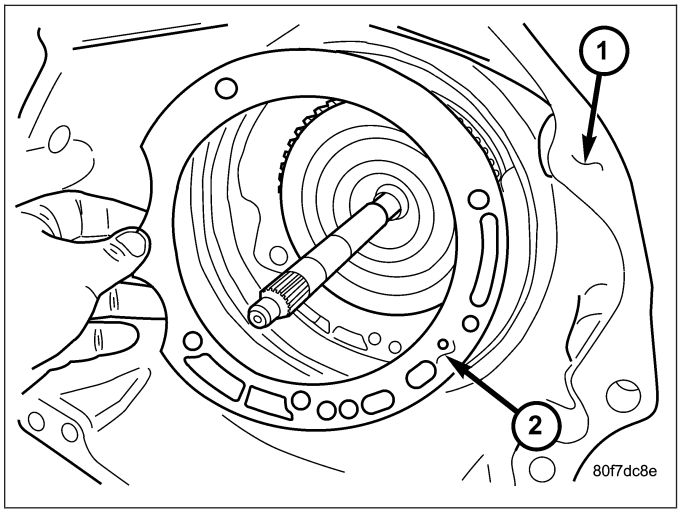
CAUTION: By-pass valve MUST be replaced if transmission failure occurs.

49. Replace cooler by-pass valve (1) if transmission failure has occurred.

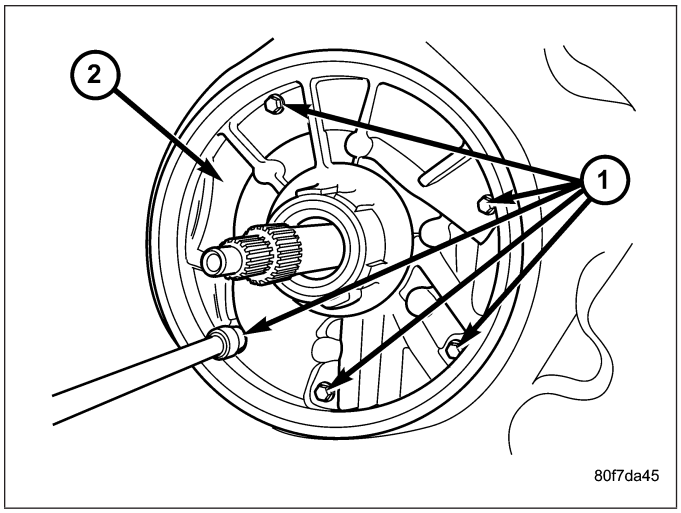


NOTE: To align oil pump, gasket, and case during installation, use threaded dowels or phillips screwdrivers.

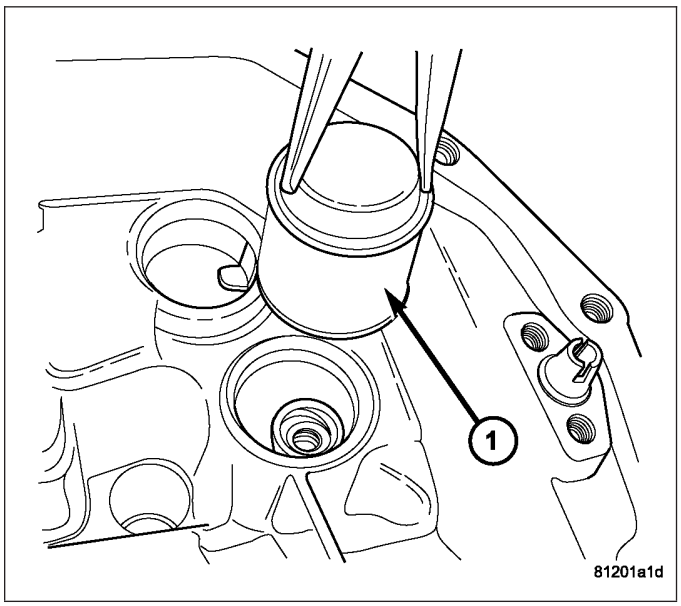
50. Install oil pump gasket (2).



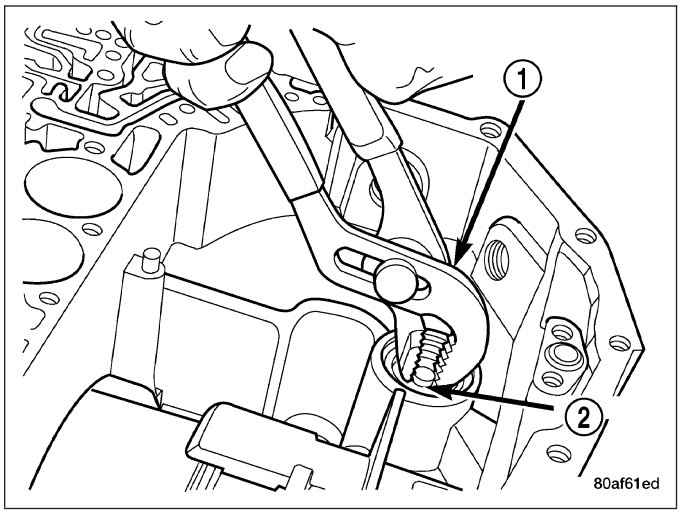
51. Install oil pump (2) and torque oil pump-to-case bolts (1) to 30 N·m (265 in. lbs.). Do not reuse original oil pump bolts.



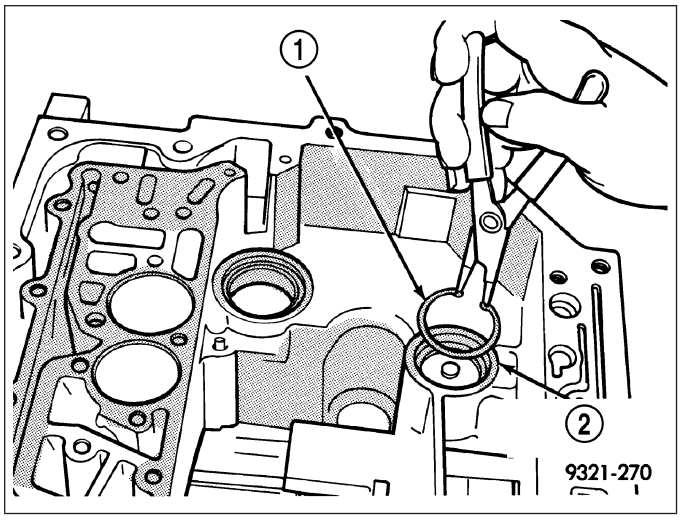
52. Install low/reverse accumulator (1) as shown.



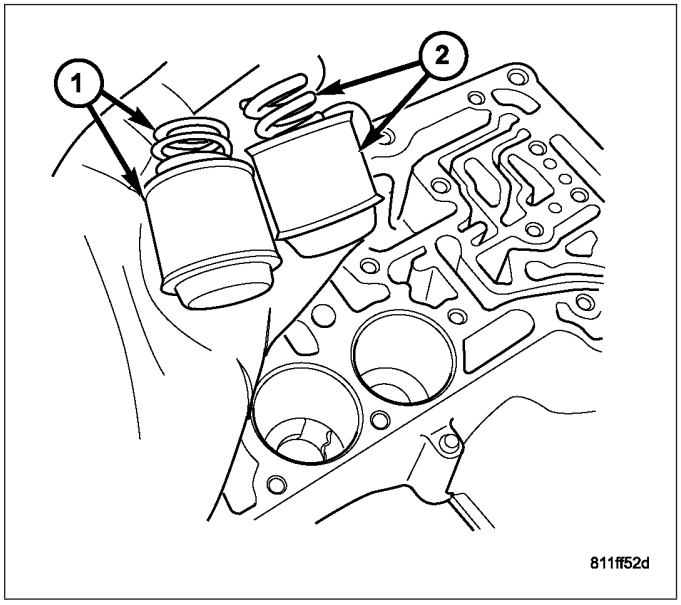
53. Install low/reverse accumulator plug (2).



54. Install low/reverse accumulator snap ring (1).

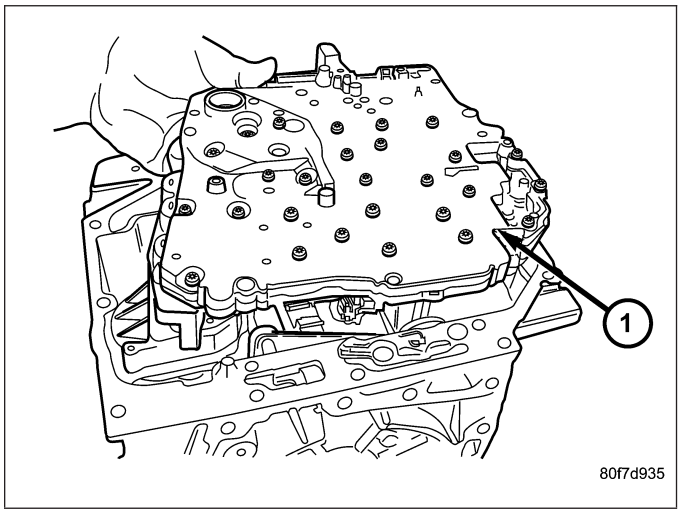


55. Install underdrive (2) and overdrive (1) accumulators and springs.

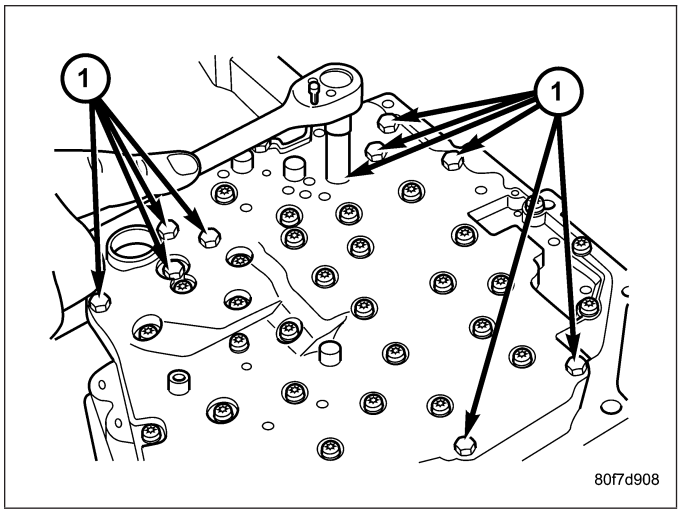


CAUTION: Do not handle the valve body by the manual shaft. Damage could result.

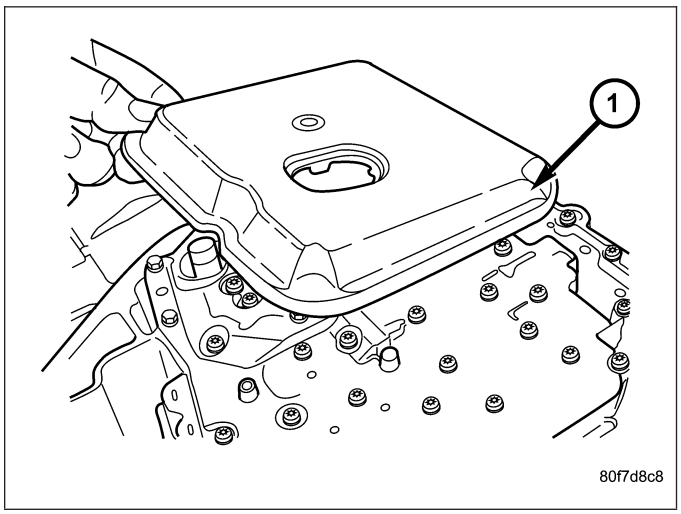
56. Install valve body (1) into place as shown.



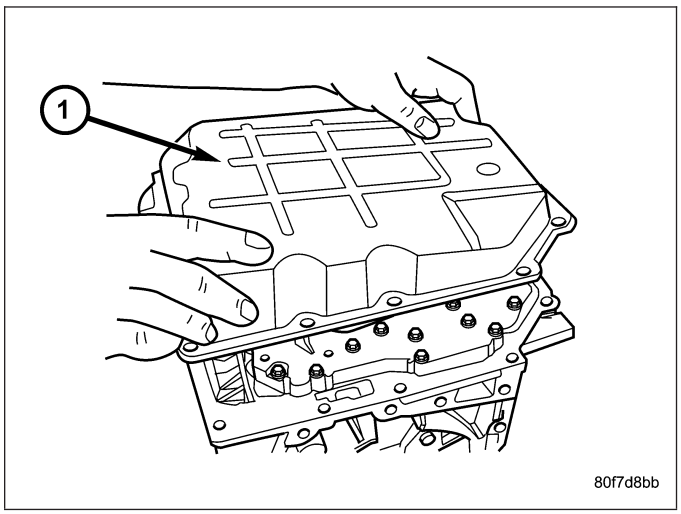
57. Install seven (7) valve body-to-case bolts (1) and torque to 12 N·m (105 in. lbs.).



58. Install transmission oil filter (1). Tighten the bolts to 5 N·m (45 in. lbs.).

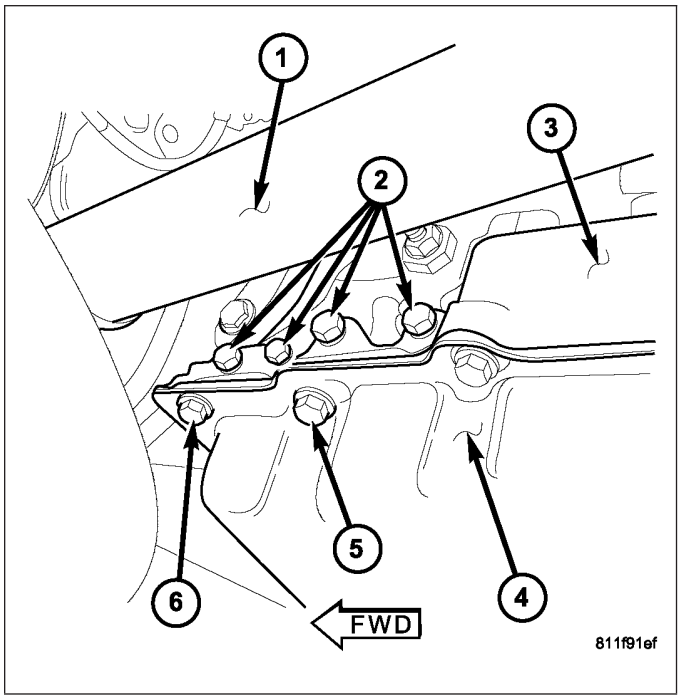


59. Install transmission oil pan (1) with a bead of Mopar® ATF RTV.



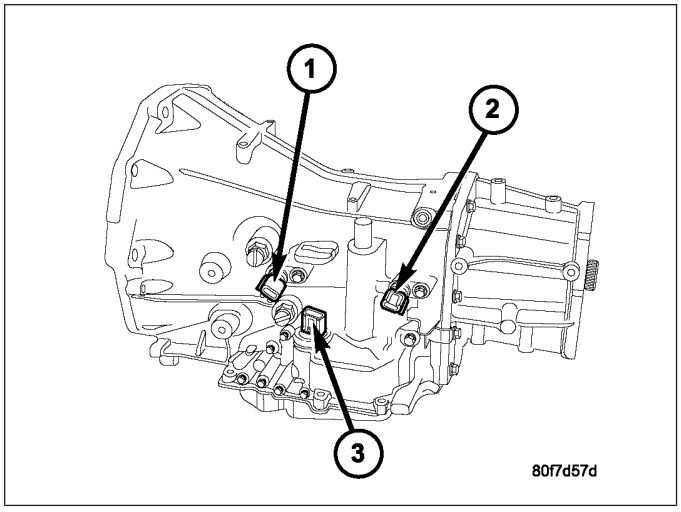
NOTE: Before installing the oil pan bolt in the bolt hole located between the torque converter clutch on and U/D clutch pressure tap circuits , it will be necessary to replentish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

60. Install and torque the oil pan-to-case bolts to 20 N·m (14.5 ft. lbs.).

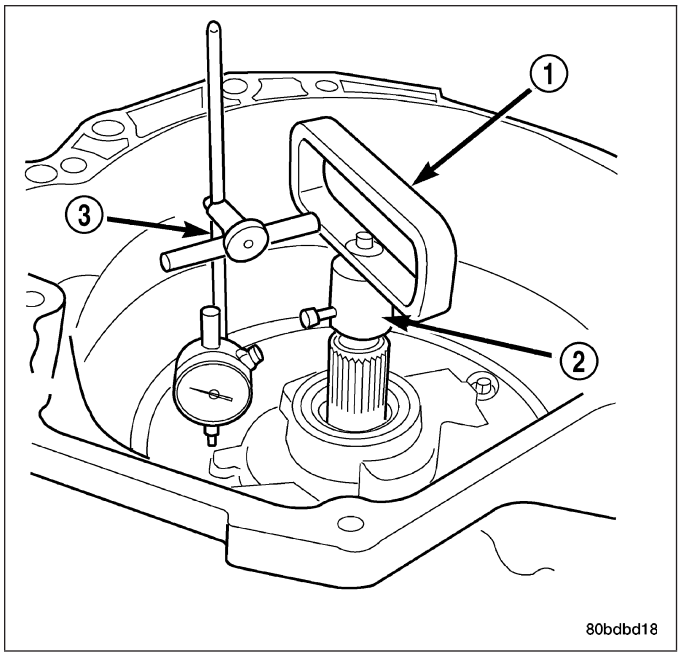


NOTE: Before installing either speed sensor bolt, it will be necessary to replentish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

61. Install both speed sensors (1, 2) into the transmission case. Torque the speed sensor bolts to 9 N·m (80 in. lbs.).

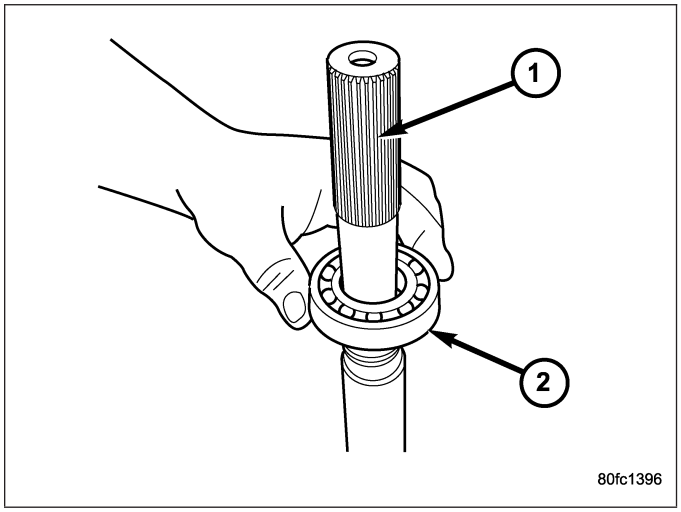


62. As a final check of the transmission, measure the input shaft end play. This will indicate when a #4 thrust plate change is required. The #4 thrust plate is located behind the overdrive clutch hub. Attach a dial indicator to transmission bell housing with its plunger seated against end of input shaft. Move input shaft in and out to obtain end play reading. **Input shaft end play must be 0.127 to 0.635 mm (0.005 to 0.025 inch).** If not within specifications, make the necessary thrust plate adjustment.

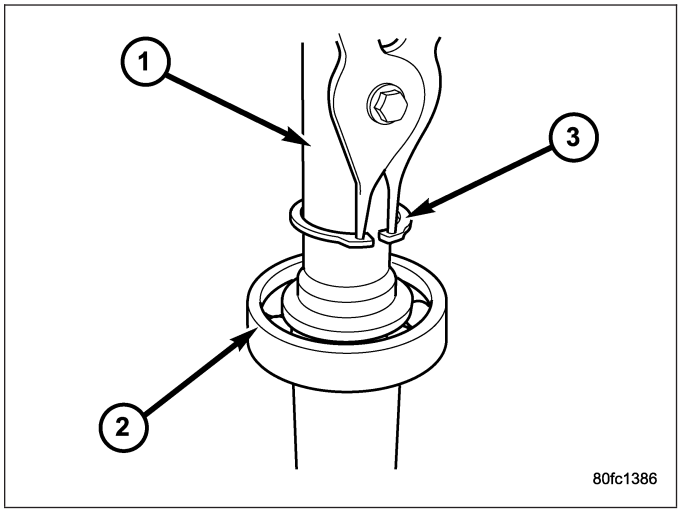


63. On 4X2 transmissions, perform the following, if necessary:

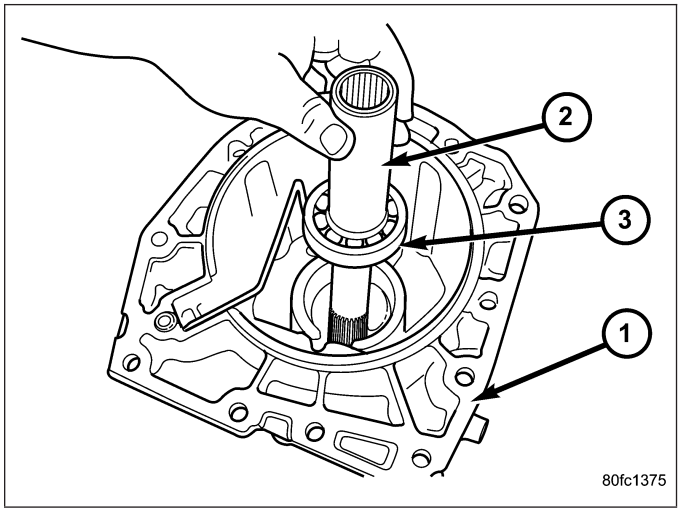
a. Install the extension shaft bearing (2) onto the extension shaft.



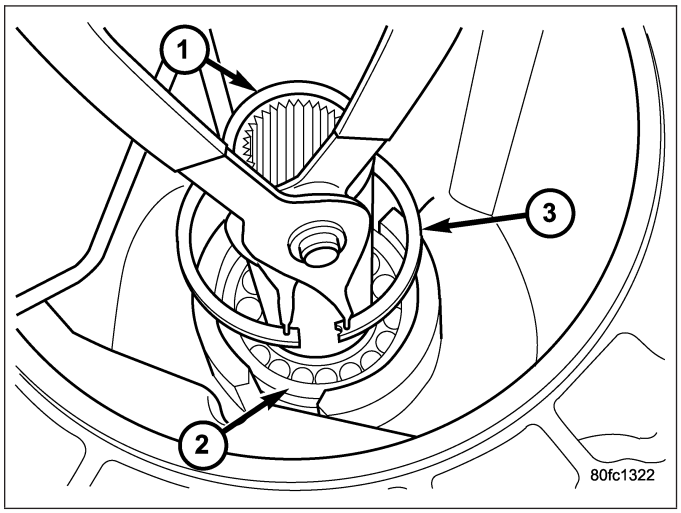
b. Install the extension shaft bearing retaining ring (3) onto the extension shaft (1).



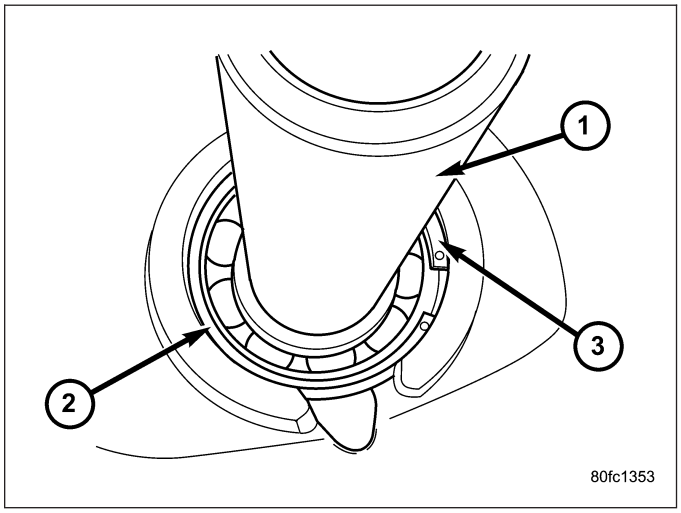
c. Install the extension shaft (2) and bearing assembly (3) into the extension housing (1).



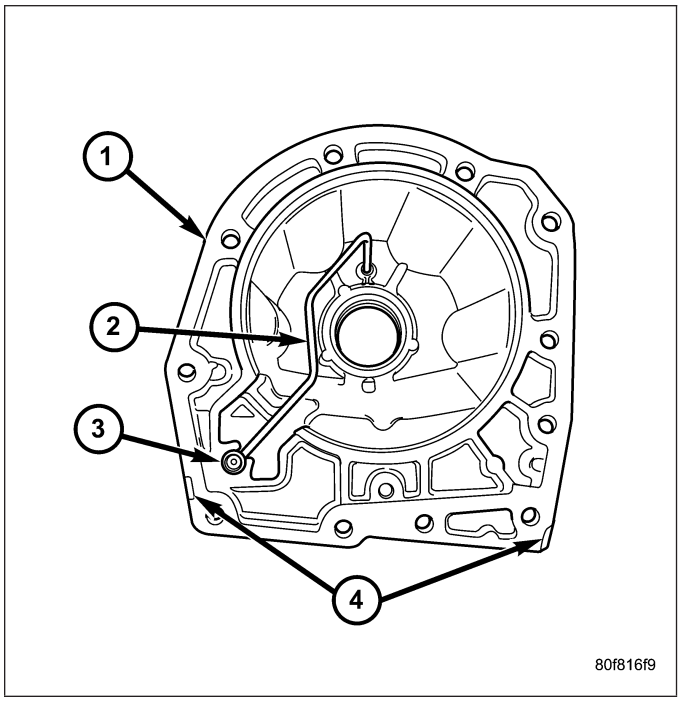
d. Install the extension shaft bearing snap ring (3) into the extension housing.



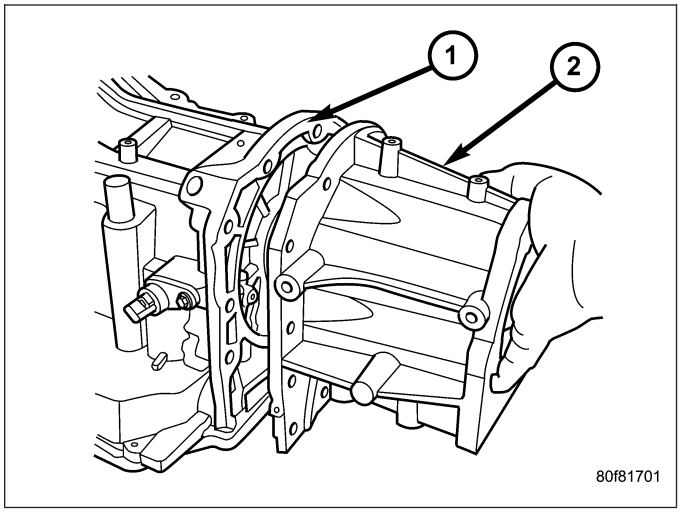
e. Verify that the extension shaft snap ring (3) is fully engaged in the snap ring groove.



64. Inspect the lube tube grommet (2) for damage. If the grommet lip is damaged, it will need to be replaced.

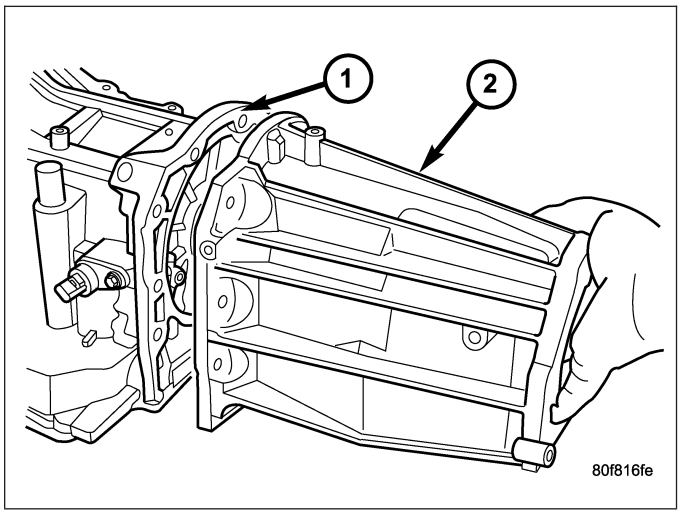


65. Install the 4X4 stub shaft onto the transmission output shaft.
66. Place a bead of Mopar® ATF RTV on the rear surface of the transmission case for the adapter/extension housing.

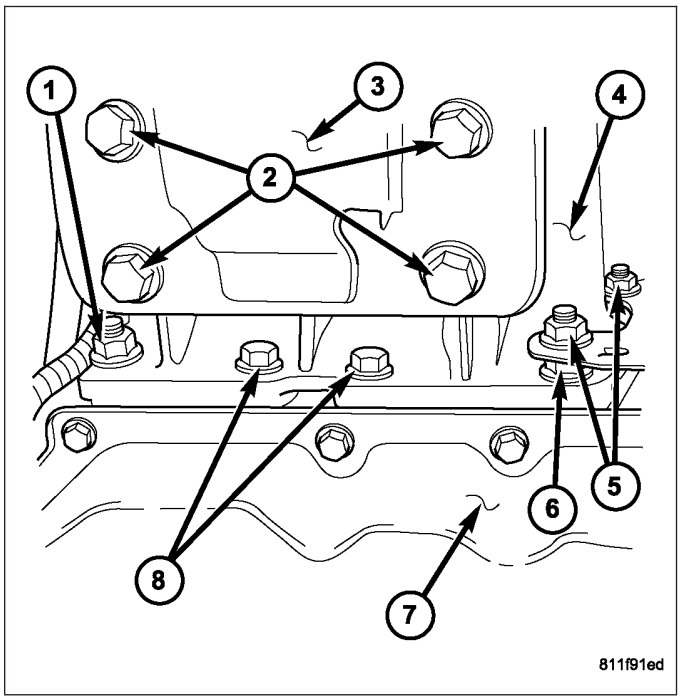


67. Install the adapter housing (2) onto the transmission case, 4X4 vehicles only.

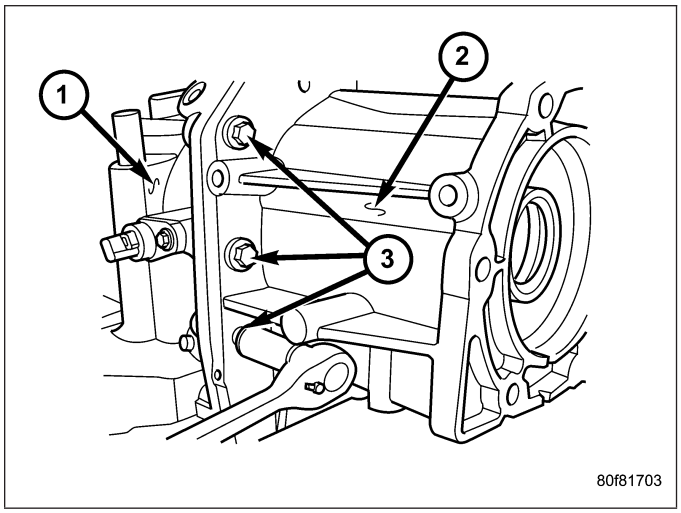
68. Install the extension housing (2) onto the transmission case, 4X2 vehicles only.



NOTE: Before installing the lowermost four adapter/extension housing bolts , it will be necessary to replentish the sealing patch on the bolts using Mopar® Lock & Seal Adhesive.



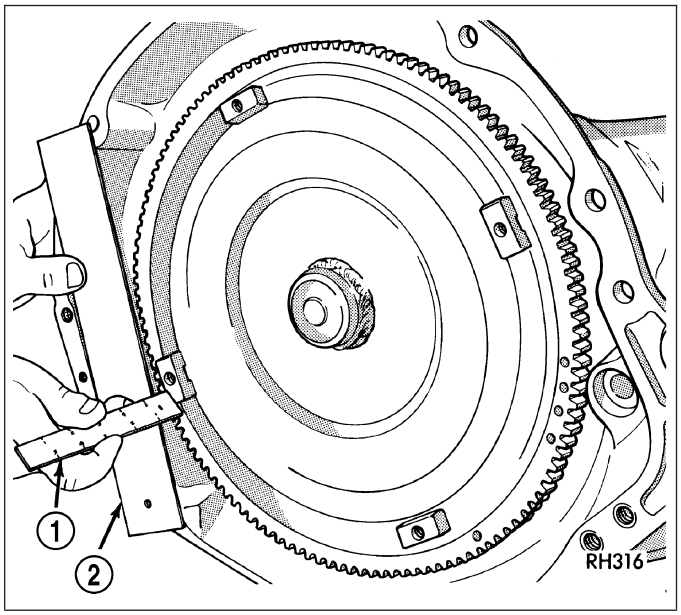
69. Install the bolts that hold the adapter or extension housing onto the transmission case. Be sure to install any stud bolts to their original locations. Tighten the bolts to 54 N·m (40 ft.lbs.).



INSTALLATION

NOTE: Check torque converter hub and hub drive flats for sharp edges burrs, scratches, or nicks. Polish the hub and flats with 320/400 grit paper and crocus cloth if necessary. The hub must be smooth to avoid damaging pump seal at installation.

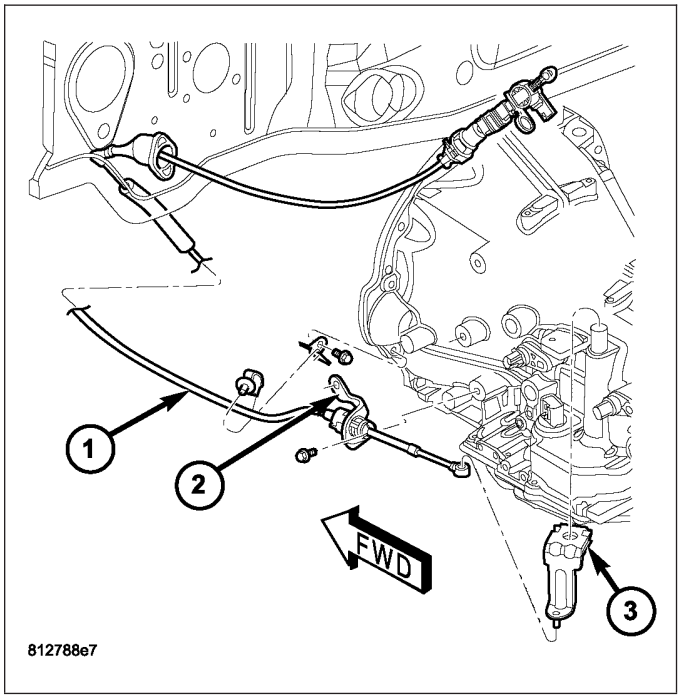
1. If a replacement transmission is being installed, transfer any components necessary, such as the manual shift lever and shift cable bracket, from the original transmission onto the replacement transmission.
2. Lubricate oil pump seal lip with transmission fluid.
3. Align converter and oil pump.
4. Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.
5. Check converter seating with steel scale (1) and straightedge (2). Surface of converter lugs should be at least 13mm (1/2 in.) to rear of straightedge when converter is fully seated.
6. Temporarily secure converter with C-clamp.



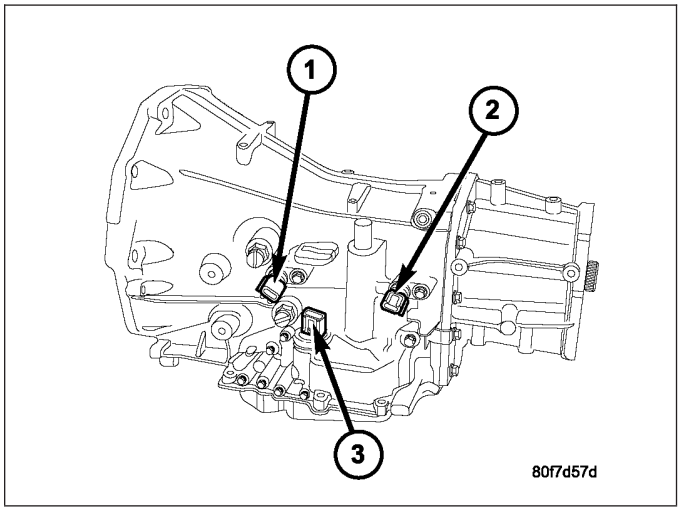
7. Position transmission on jack and secure it with chains.
8. Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.**
9. Apply a light coating of Mopar® High Temp Grease to the torque converter hub pocket in the rear pocket of the engine's crankshaft.
10. Raise transmission and align the torque converter with the drive plate and transmission converter housing with the engine block.
11. Move transmission forward. Then raise, lower or tilt transmission to align the converter housing with engine block dowels.

12. Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft. Verify that no wires, or the transmission vent hose, have become trapped between the engine block and the transmission.
13. Install two bolts to attach the transmission to the engine.
14. Install remaining torque converter housing to engine bolts. Tighten to 68 N·m (50 ft.lbs.).
15. Install transfer case, if equipped. Tighten transfer case nuts to 35 N·m (26 ft.lbs.).
16. Install rear transmission crossmember. Tighten crossmember to frame bolts to 68 N·m (50 ft.lbs.).
17. Install rear support to transmission. Tighten bolts to 47 N·m (35 ft.lbs.).
18. Lower transmission onto crossmember and install bolts attaching transmission mount to crossmember. Tighten clevis bracket to crossmember bolts to 47 N·m (35 ft.lbs.). Tighten the clevis bracket to rear support bolt to 68 N·m (50 ft.lbs.).

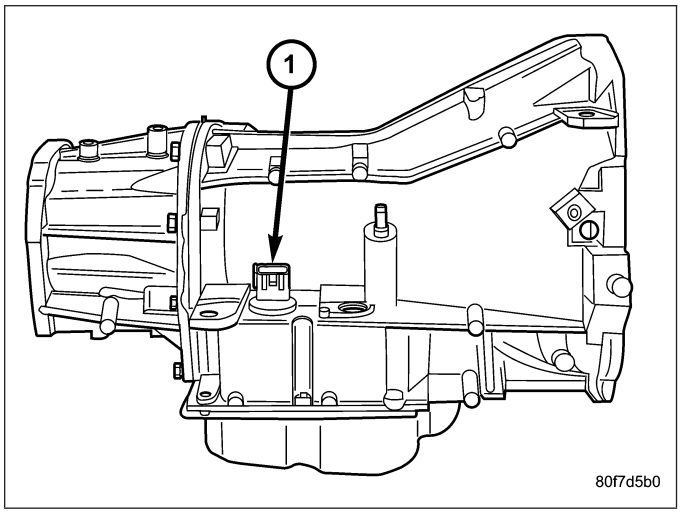
19. Connect gearshift cable (1) to support bracket (2) and transmission manual lever (3).



20. Connect input (1) and output (2) speed sensor wires and the transmission range sensor (3).

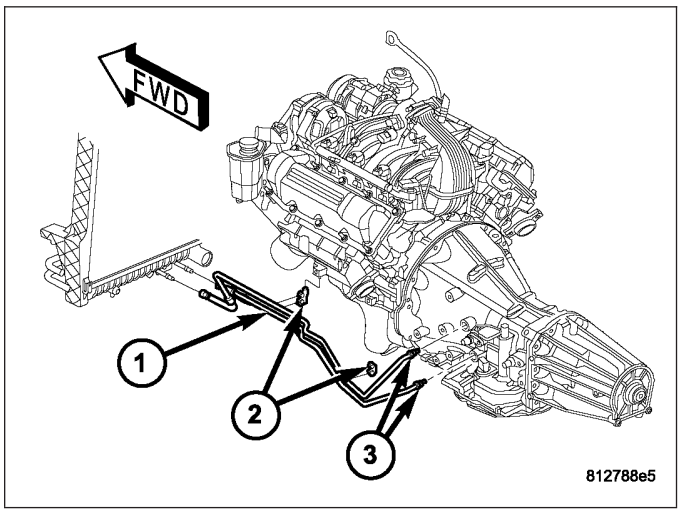


21. Connect wires to the solenoid/pressure switch assembly (1).

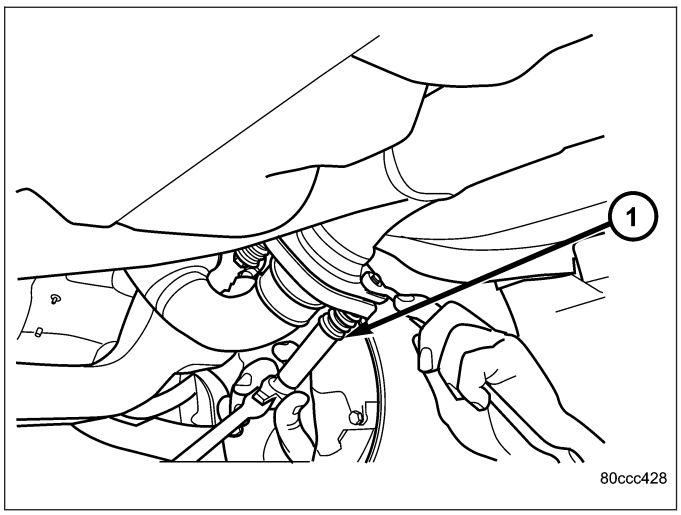


CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the clutch surface inside the converter.

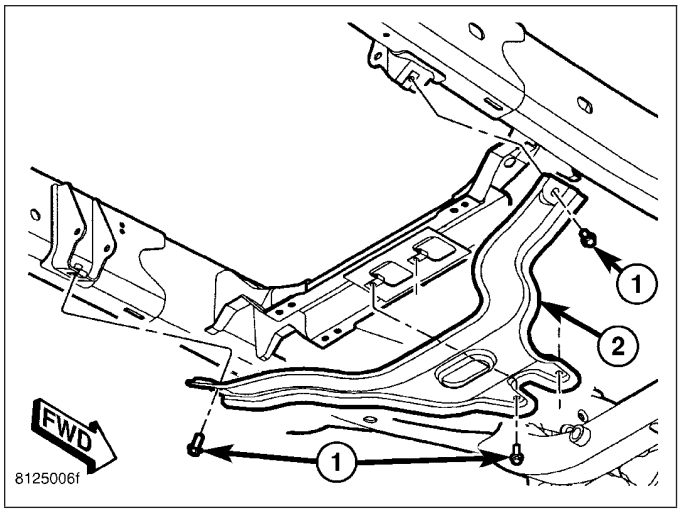
22. Install torque converter-to-driveplate bolts. Tighten bolts to 88 N·m (65 in. lbs.).
23. Install starter motor and cooler line bracket.
24. Connect cooler lines (1) to transmission.
25. Install transmission fill tube.



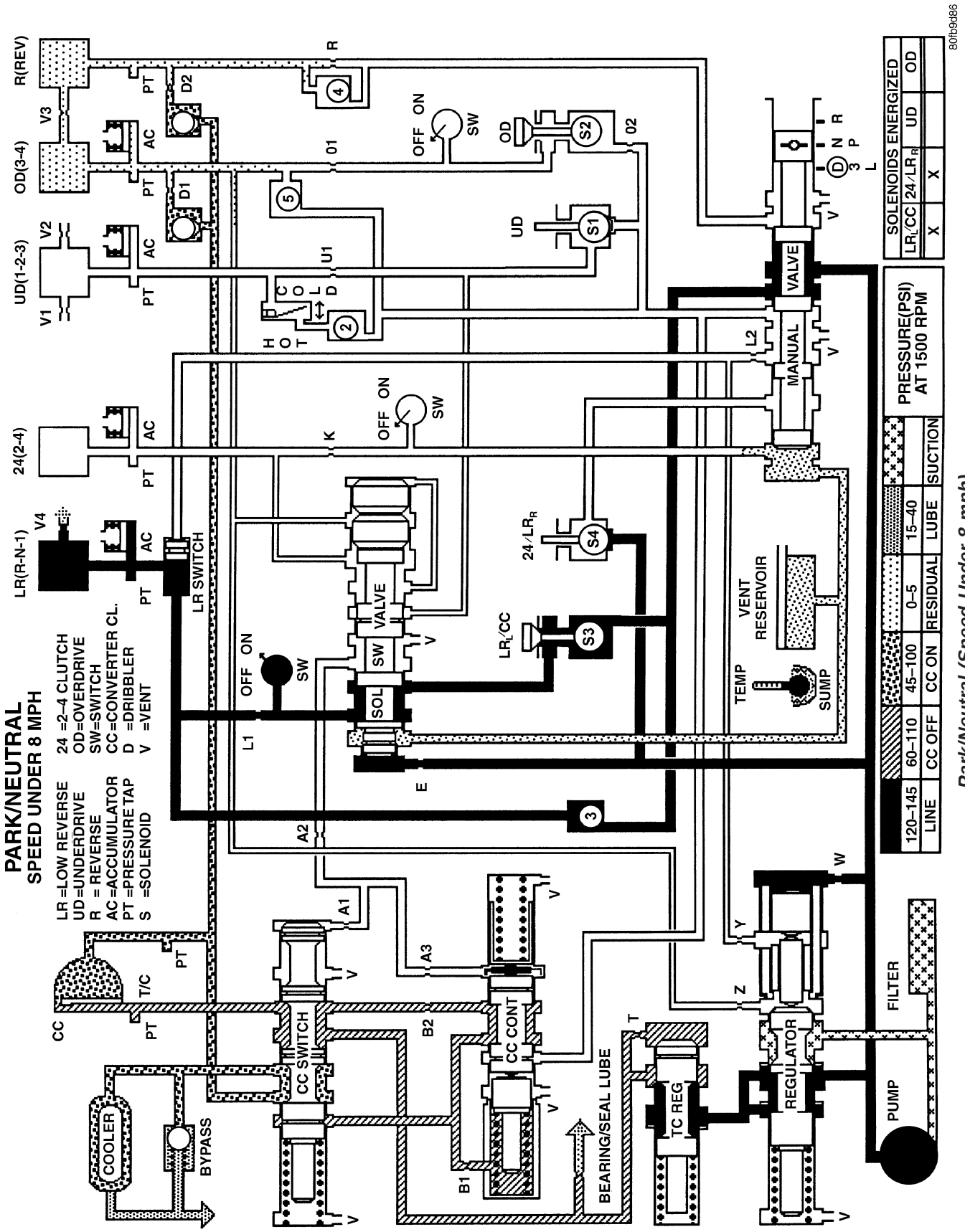
26. Install exhaust components (1).

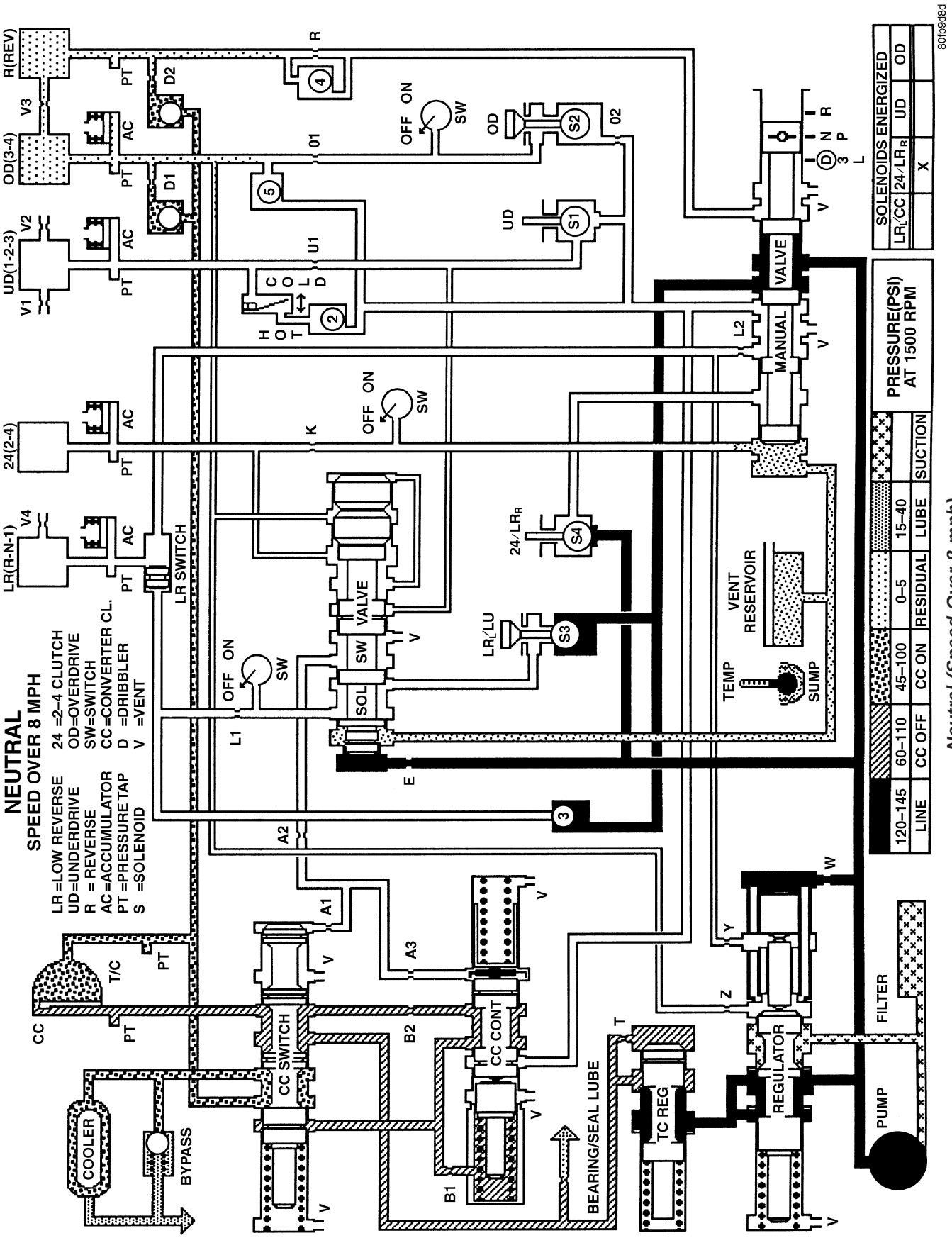


27. Align and connect propeller shaft(s).
28. Adjust gearshift cable if necessary.
29. Install any skid plates removed previously. (Refer to 13 - FRAMES & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION)
30. Lower vehicle.
31. Fill transmission with Mopar® ATF +4, Automatic Transmission Fluid.

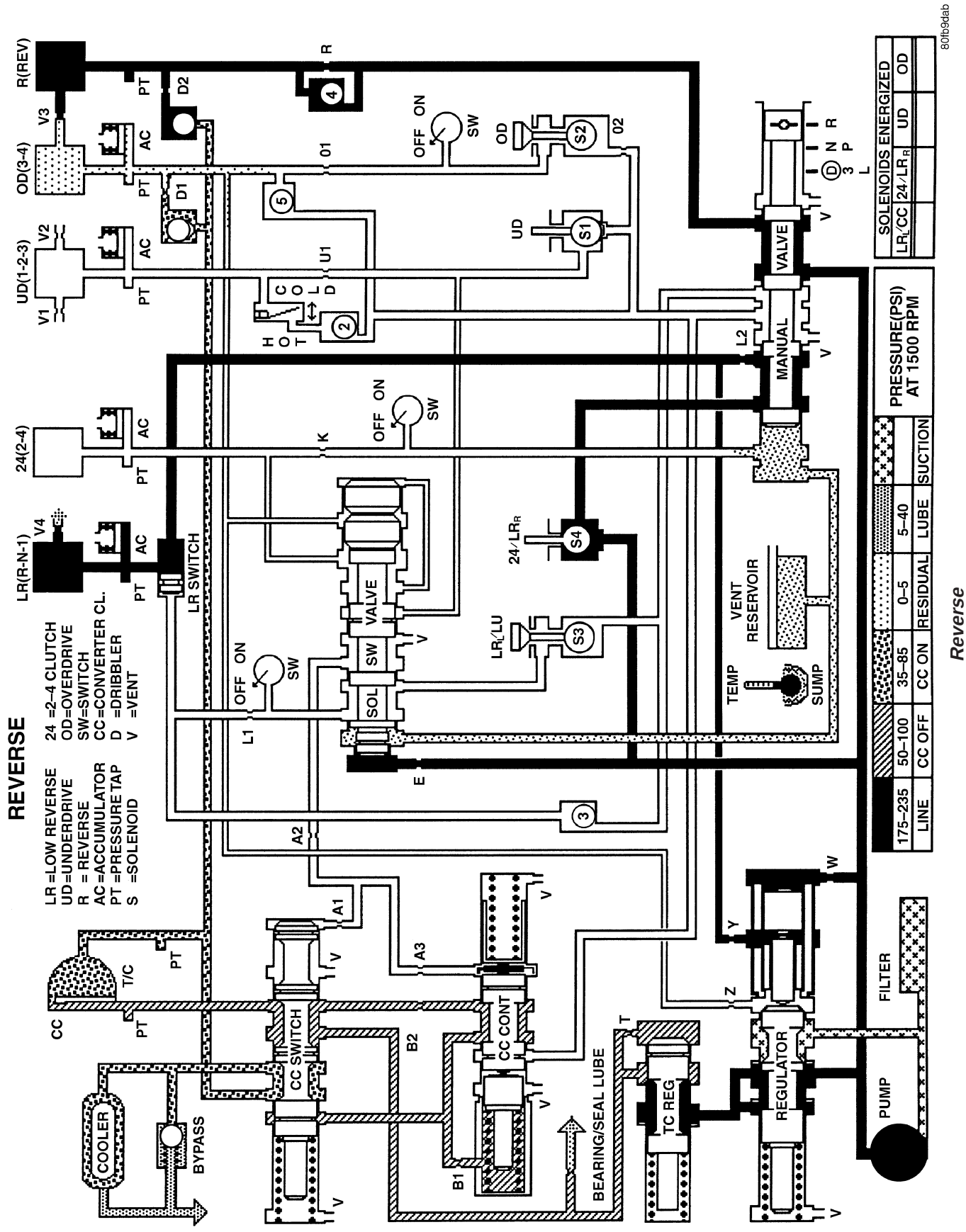


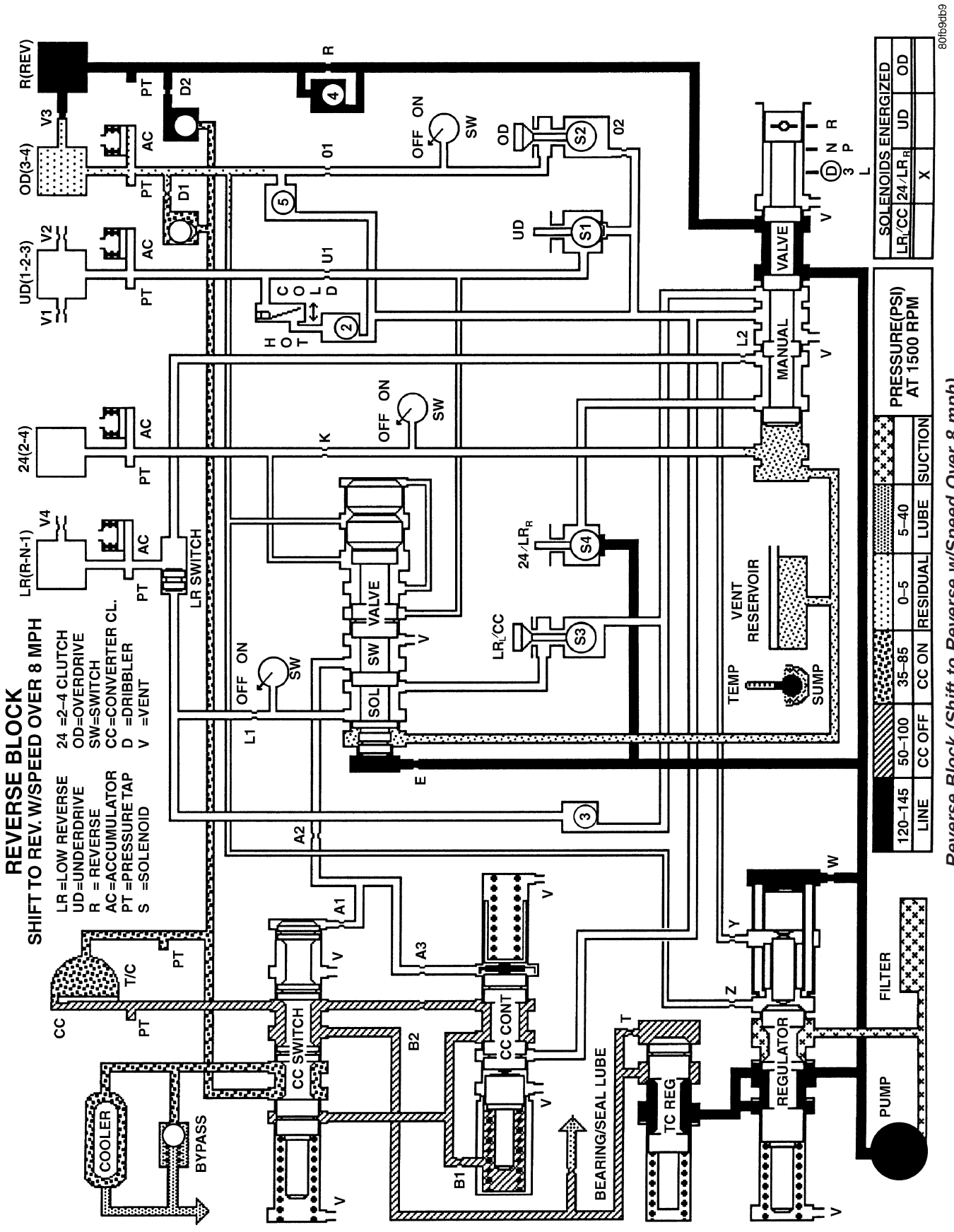
SCHEMATICS AND DIAGRAMS - 42RLE TRANSMISSION



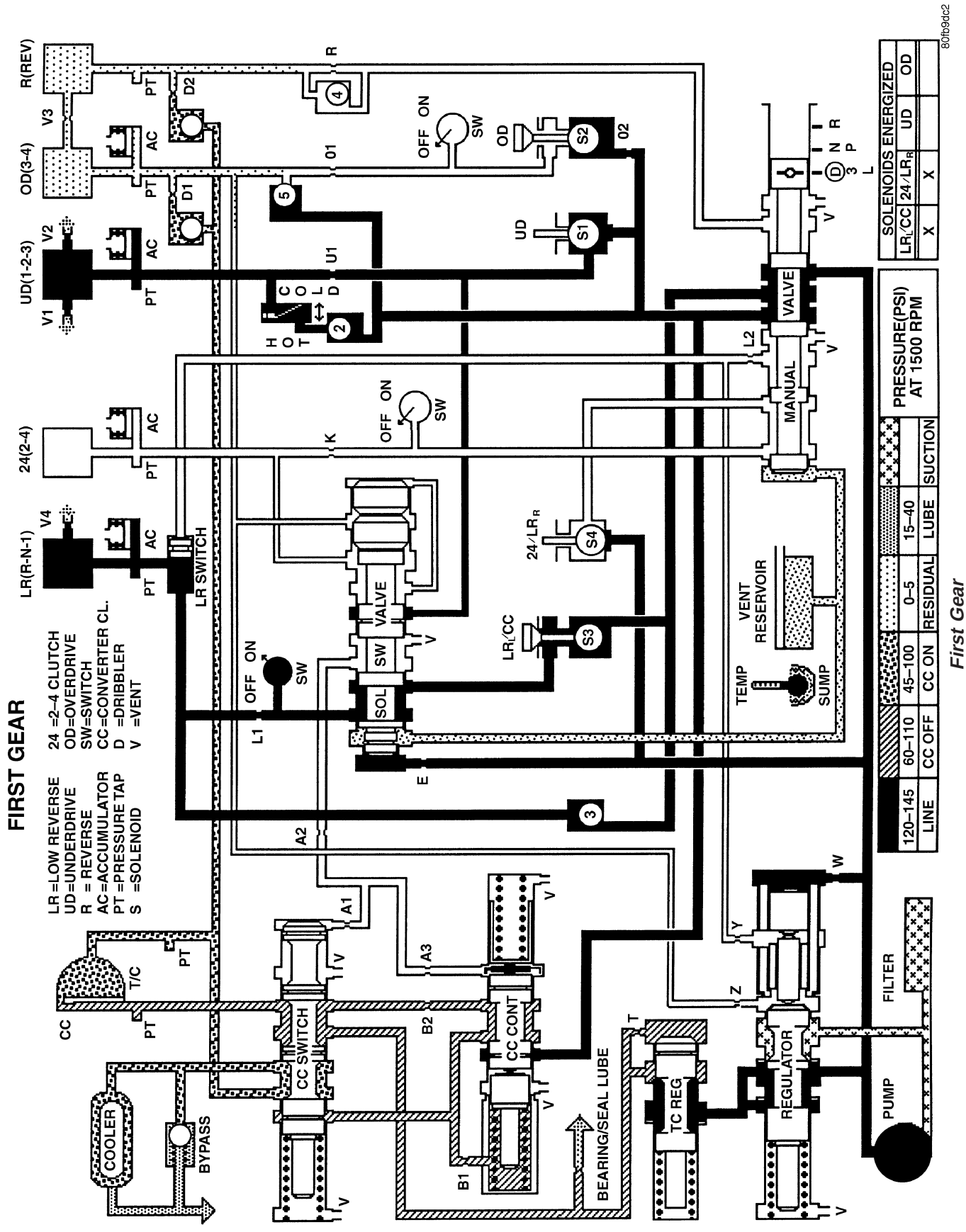


Neutral (Speed Over 8 mph)

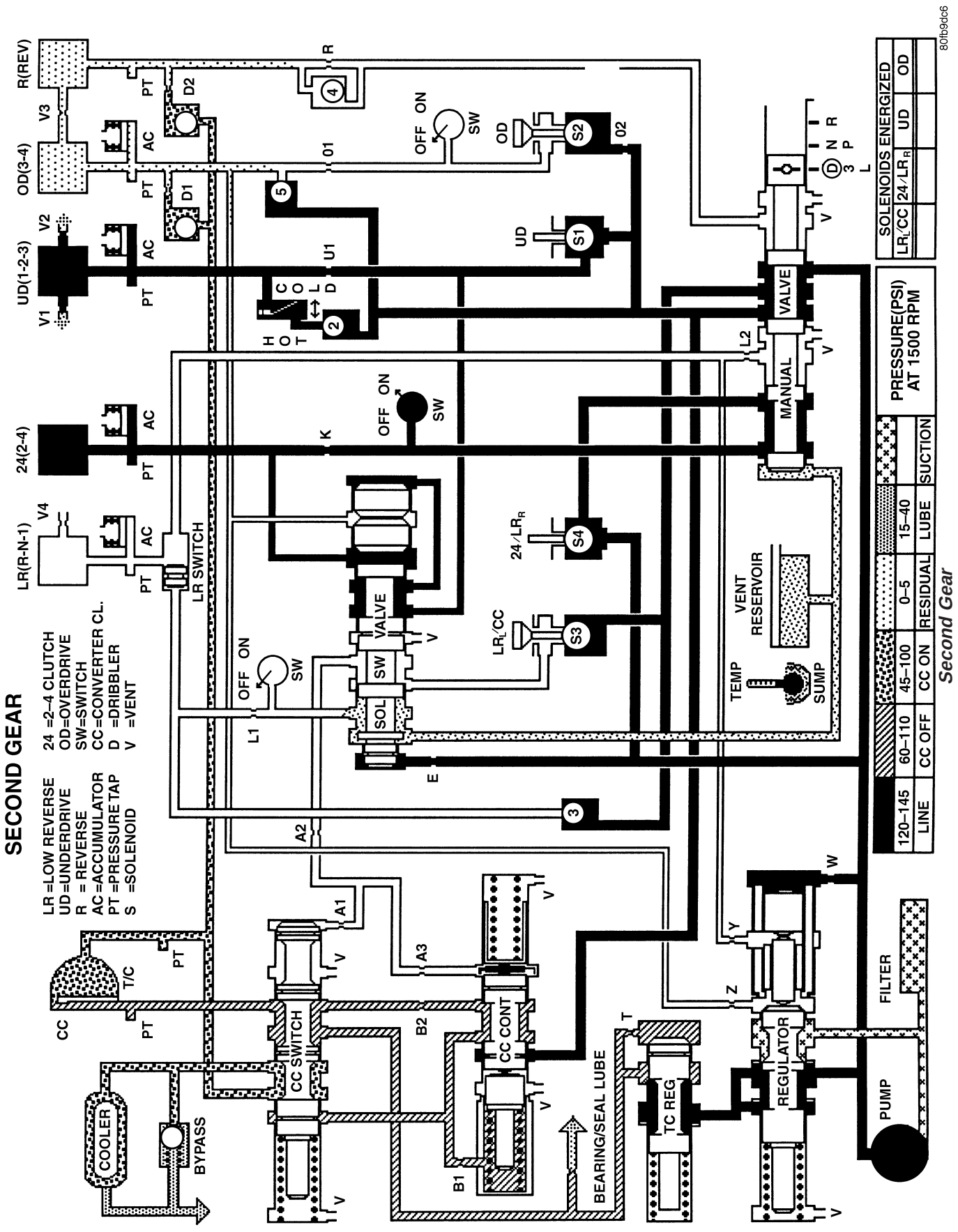

80fb9dab
REVERSE
LR =LOW REVERSE
UD=UNDERDRIVE
R = REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2-4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
R(REV)
OD(3-4)
UD(1-2-3)
24(2-4)
LR(R-N-1)
V3
V2
V1
V4
D2
D1
AC
PT
LR SWITCH
OFF ON
SW
VALVE
SOL
HOT
COLD
U1
01
02
K
L1
L2
A1
A2
A3
B1
B2
CC
T/C
COOLER
BYPASS
CC SWITCH
CC CONT
BEARING/SEAL LUBE
TC REG
REGULATOR
PUMP
FILTER
MANUAL
VALVE
P
R
N
D
3
L
S1
S2
S3
S4
OD
UD
24/LR
LR/LU
TEMP
VENT
RESERVOIR
SUMP
SOLENOIDS ENERGIZED
LR/CC
24/LR
UD
OD
PRESSURE(PSI)
AT 1500 RPM
LINE
175–235
CC ON
50–100
CC OFF
35–85
RESIDUAL
0–5
LUBE
5–40
SUCTION
Reverse

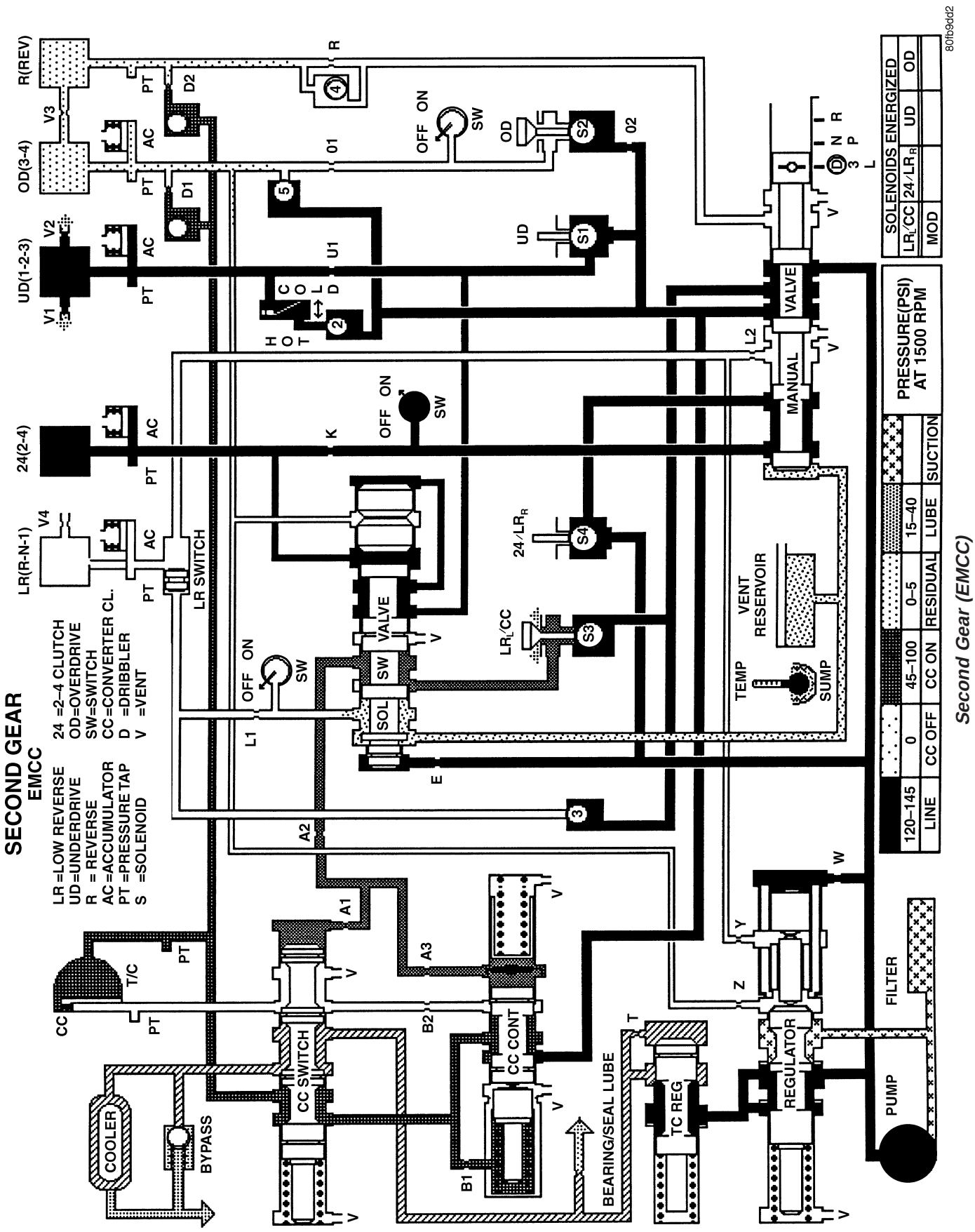


Reverse Block (Shift to Reverse w/Speed Over 8 mph)

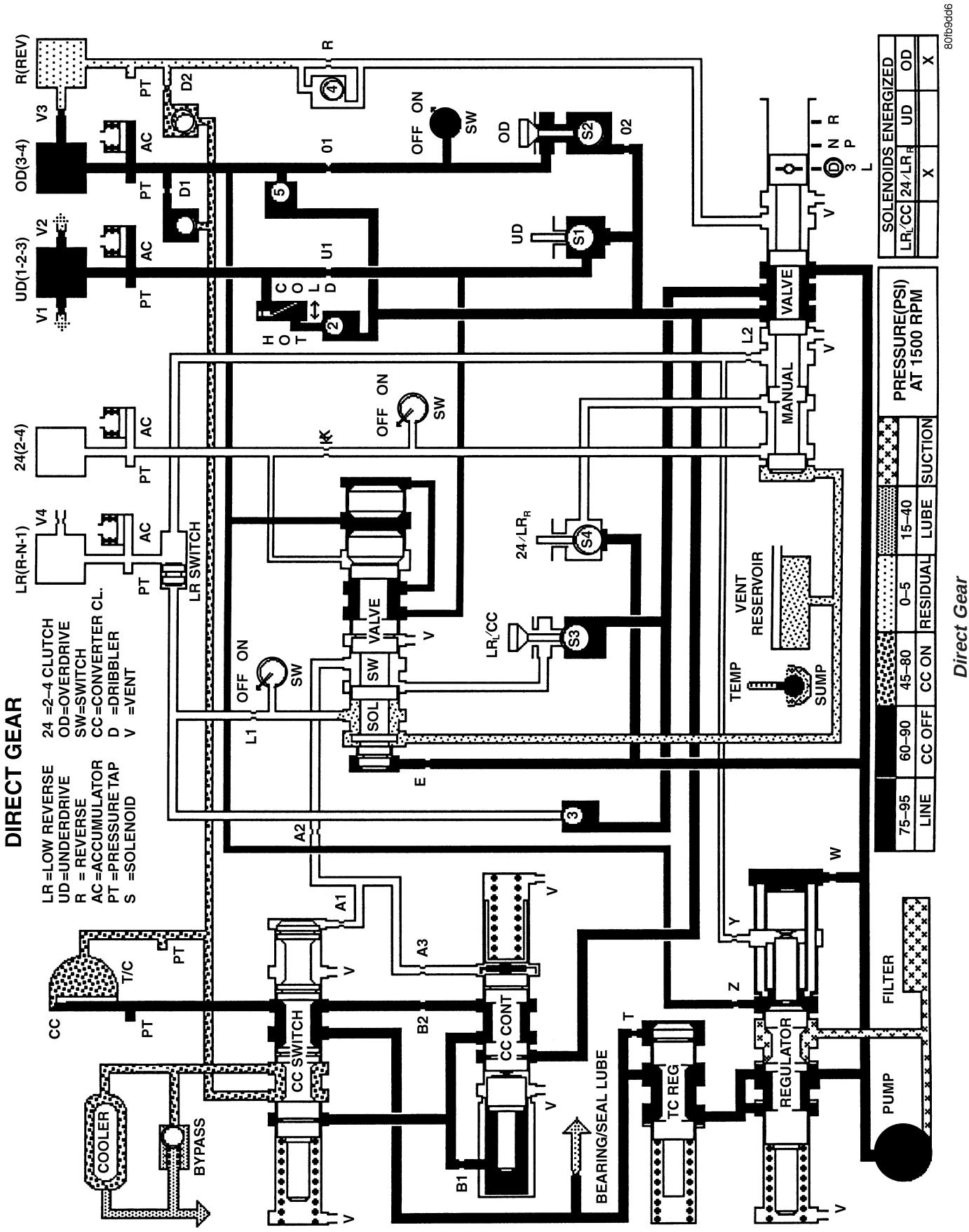

FIRST GEAR
LR =LOW REVERSE
UD =UNDERDRIVE
R = REVERSE
AC =ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
LR(R-N-1)
24(2-4)
UD(1-2-3)
OD(3-4)
R(REV)
V1
V2
V3
V4
AC
PT
LR SWITCH
OFF ON SW
VALVE
SOL
MANUAL VALVE
TEMP
VENT RESERVOIR
SUMP
PUMP
FILTER
REGULATOR
TC REG
CC SWITCH
CC CONT
COOLER
BYPASS
T/C
CC
BEARING/SEAL LUBE
HOT
COLD
S1
S2
S3
S4
SOLENOIDS ENERGIZED
LR/CC
24/LR
UD
OD
PRESSURE(PSI) AT 1500 RPM
LINE
CC OFF
CC ON
RESIDUAL
LUBE
SUCTION
120–145
60–110
45–100
0–5
15–40
80fb9dc2

First Gear

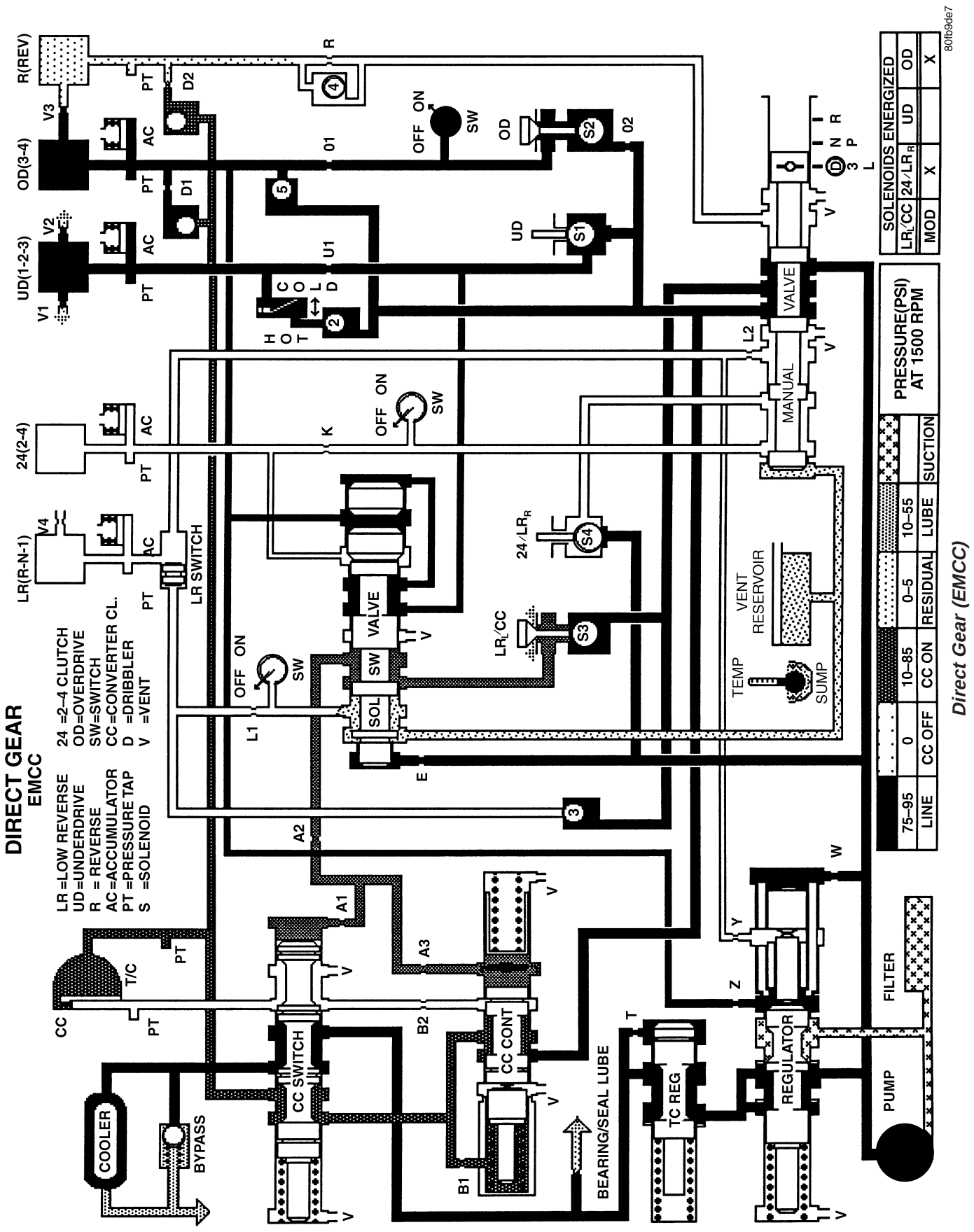

SECOND GEAR
LR =LOW REVERSE
UD=UNDERDRIVE
R = REVERSE
AC =ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
R(REV)
OD(3-4)
UD(1-2-3)
24(2-4)
LR(R-N-1)
V1
V2
V3
V4
AC
PT
D1
D2
R
01
02
U1
K
L1
L2
A1
A2
A3
B1
B2
E
T
Y
Z
W
OFF ON SW
SOL
VALVE
MANUAL
LR SWITCH
CC SWITCH
CC CONT
TC REG
REGULATOR
FILTER
PUMP
COOLER
BYPASS
BEARING/SEAL LUBE
VENT
RESERVOIR
TEMP
SUMP
HOT
COLD
S1
S2
S3
S4
UD
OD
24/LR
LR/CC
P N R
D 3 2 L
SOLENOIDS ENERGIZED
LR/CC
24/LR
UD
OD
PRESSURE(PSI) AT 1500 RPM
SUCTION
LUBE
RESIDUAL
CC ON
CC OFF
LINE
120–145
60–110
45–100
0–5
15–40
Second Gear
80fb9dc6



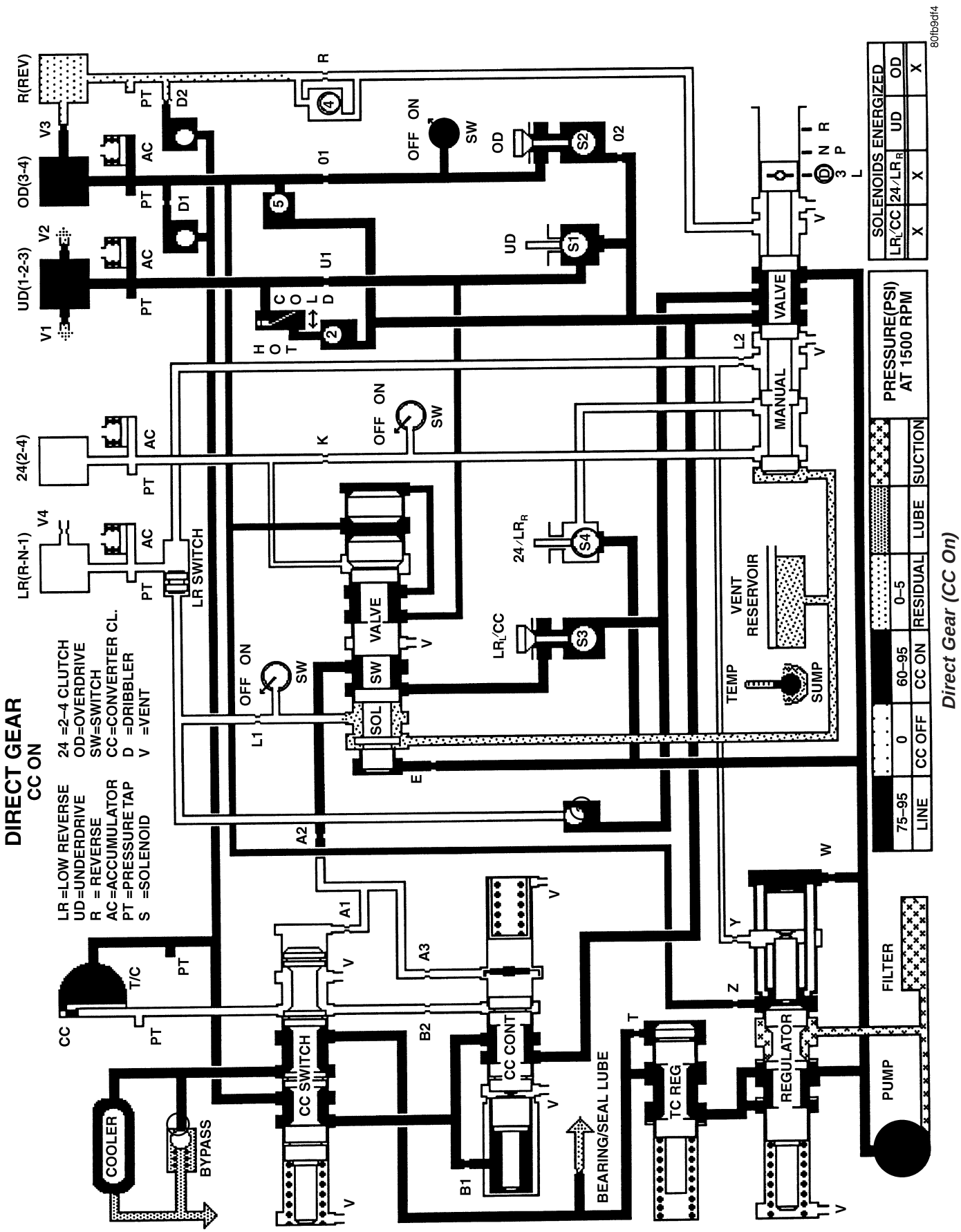
Second Gear (EMCC)


DIRECT GEAR
LR =LOW REVERSE
UD =UNDERDRIVE
R = REVERSE
AC =ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD =OVERDRIVE
SW =SWITCH
CC =CONVERTER CL.
D =DRIBBLER
V =VENT
R(REV)
OD(3-4)
UD(1-2-3)
24(2-4)
LR(R-N-1)
V1
V2
V3
V4
AC
PT
D1
D2
R
01
02
OD
UD
OFF ON SW
HOT
COLD
U1
K
L1
L2
A1
A2
A3
B1
B2
E
T
W
Y
Z
LR SWITCH
VALVE
SOL
SW
MANUAL VALVE
24/LR$_R$
LR$_L$/CC
S1
S2
S3
S4
VENT
RESERVOIR
TEMP
SUMP
T/C
CC
COOLER
BYPASS
CC SWITCH
CC CONT
TC REG
REGULATOR
FILTER
PUMP
BEARING/SEAL LUBE
P
R
N
D
3
L
SOLENOIDS ENERGIZED
LR$_L$/CC
24/LR$_R$
UD
OD
X
PRESSURE(PSI) AT 1500 RPM
75–95
60–90
45–80
0–5
15–40
LINE
CC OFF
CC ON
RESIDUAL
LUBE
SUCTION
80fb9dd6

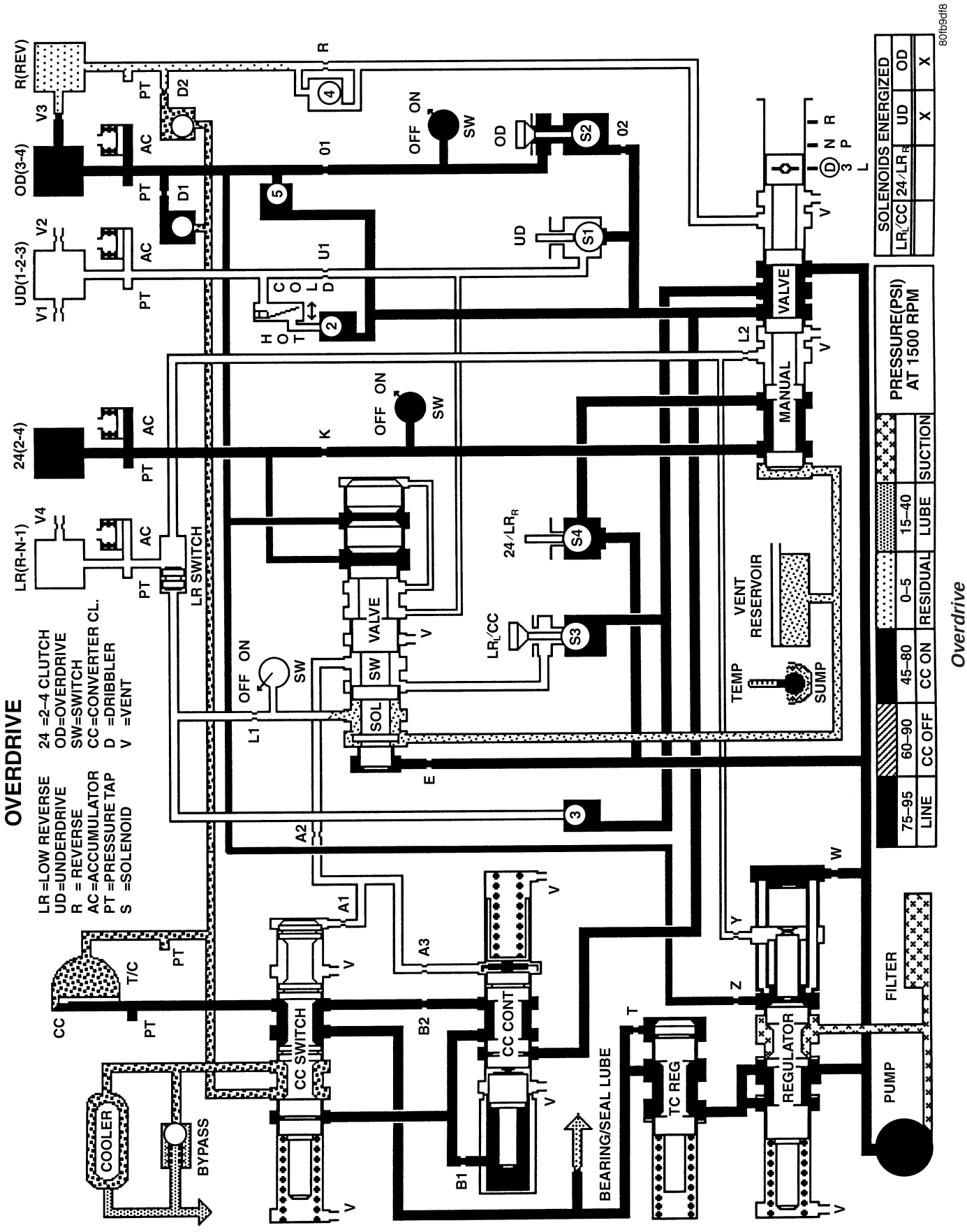
Direct Gear



Direct Gear (EMCC)



Direct Gear (CC On)


OVERDRIVE
LR =LOW REVERSE
UD=UNDERDRIVE
R = REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
R(REV)
OD(3-4)
UD(1-2-3)
24(2-4)
LR(R-N-1)
V1
V2
V3
V4
AC
PT
D1
D2
R
01
02
U1
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L1
L2
A1
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B2
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OFF ON
SW
OD
UD
HOT
COLD
LR SWITCH
VALVE
SOL
MANUAL
VENT
RESERVOIR
TEMP
SUMP
24/LR
LR/CC
S1
S2
S3
S4
CC
T/C
COOLER
BYPASS
CC SWITCH
CC CONT
TC REG
REGULATOR
FILTER
PUMP
BEARING/SEAL LUBE
P
R
N
D
3
L
SOLENOIDS ENERGIZED
LR/CC
24/LR
UD
OD
PRESSURE(PSI)
AT 1500 RPM
LINE
CC OFF
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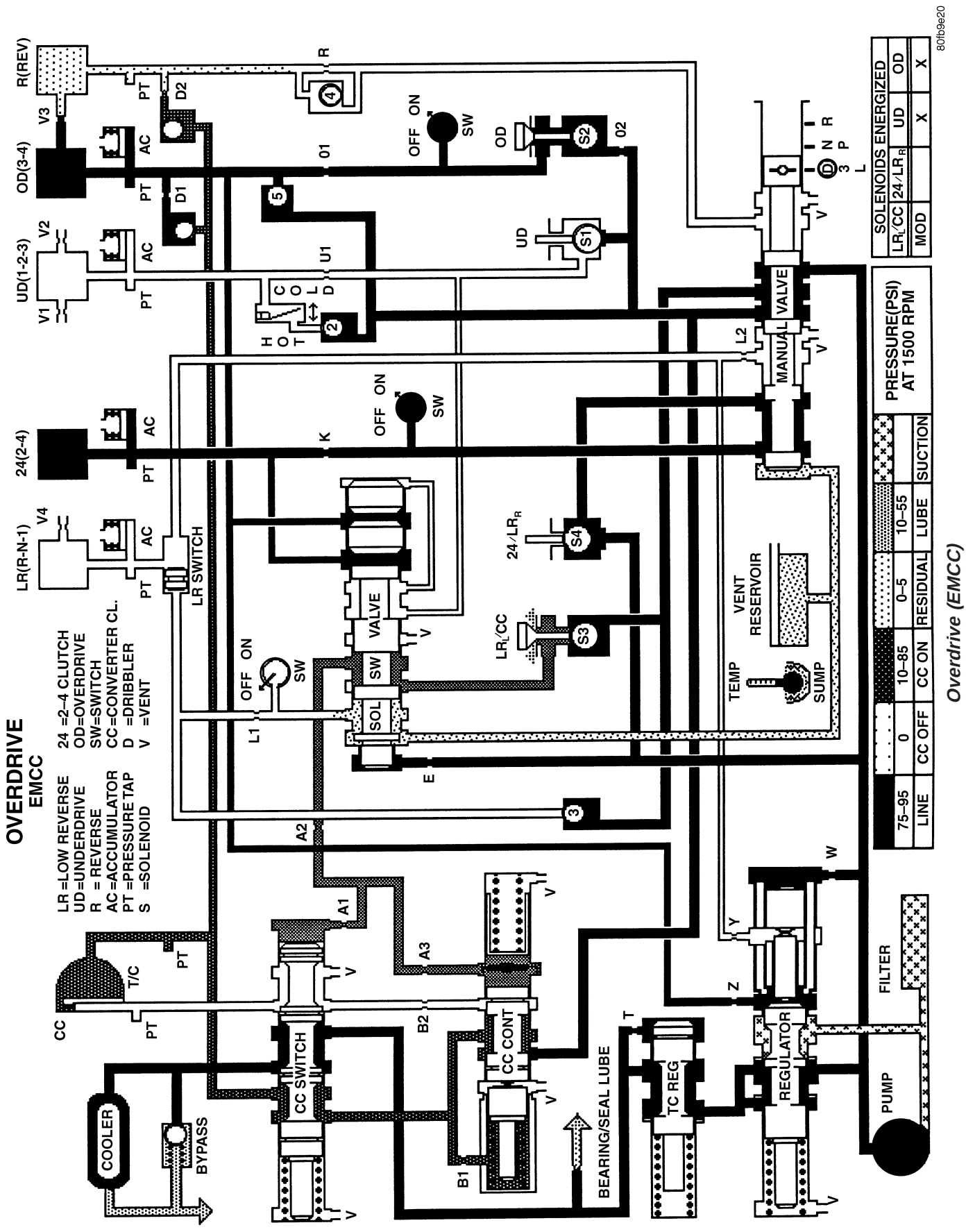
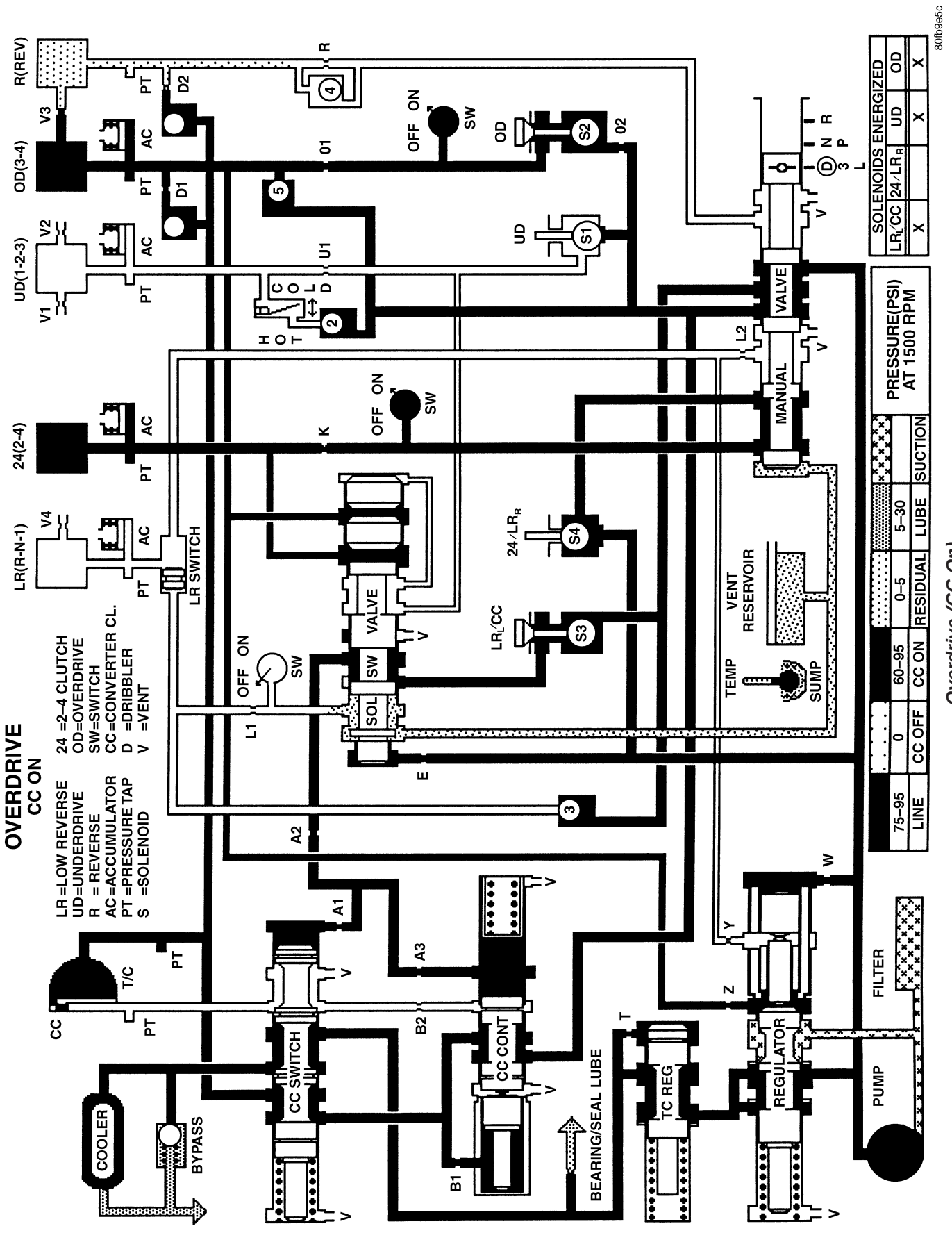
75–95
CC ON
45–80
RESIDUAL
0–5
LUBE
15–40
SUCTION
80fb9df8
Overdrive



Overdrive (EMCC)



Overdrive (CC On)

SPECIFICATIONS

42RLE AUTOMATIC TRANSMISSION

GENERAL SPECIFICATIONS

Transmission Type	Four-Speed Automatic, Electronically Controlled, Fully Adaptive, Electronically Modulated Torque Converter
Lubrication Method	Pump (internal - external gear-type)
Cooling Method	Water Heat Exchanger and/or Air-to-Oil Heat Exchanger

GEAR RATIOS

1st Gear	2.84:1
2nd Gear	1.57:1
3rd Gear (Direct)	1.00:1
4th Gear (Overdrive)	0.69:1
Reverse Gear	2.21:1

BEARING PRELOAD (Drag Torque)

Description	Metric	Standard
Output Shaft	0.22-0.903 N·m	1-8 in. lbs.

CLUTCH PACK

Description	Metric	Standard
Low/Reverse Clutch (Select Reaction Plate)	0.84-1.60 mm	0.033-0.063 in.
Two/Four Clutch (No Select)	0.76-2.64 mm	0.030-0.104 in.
Reverse Clutch (Select Snap Ring)	0.89-1.37 mm	0.035-0.054 in.
Overdrive Clutch (No Select)	1.07-3.25 mm	0.042-0.128 in.
Underdrive Clutch (Select Reaction Plate)	0.94-1.50 mm	0.037-0.059 in.

INPUT SHAFT

Description	Metric	Standard
End Play	0.127-0.635 mm	0.005-0.025 in.

OIL PUMP CLEARANCES

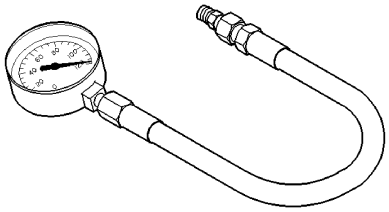
DESCRIPTION	METRIC	STANDARD
Outer Gear-to-Crescent	0.060-0.298 mm	0.0023-0.0117 in.
Inner Gear-to-Crescent	0.093-0.385 mm	0.0036-0.0151 in.
Outer Gear-to-Pocket	0.089-0.202 mm	0.0035-0.0079 in.
Outer Gear Side Clearance	0.020-0.046 mm	0.0008-0.0018 in.
Inner Gear Side Clearance	0.020-0.046 mm	0.0008-0.0018 in.

TORQUE SPECIFICATIONS

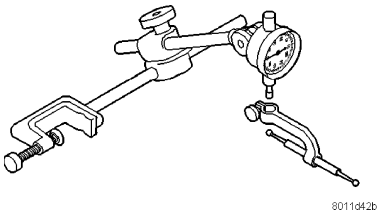
Description	N·m	Ft. Lbs.	In. Lbs.
Bolt, Torque Converter Housing to Engine	68	50	-
Bolt, Converter-to-Driveplate	88	65	-
Bolt, Fluid Filter-to-Valve Body	5	-	45
Bolt, L/R Clutch Retainer-to-Case	5	-	45
Bolt, Adapter/Extension Housing	54	40	-
Bolt, Manual Valve Lever-to-Manual Valve	5	-	45
Bolt, Oil Pan-to-Case	20	14.5	-
Bolt, Oil Pump-to-Case	30	-	265
Bolt, Park Sprag Retainer	4.5	-	40
Bolt, Reaction Shaft Support Halves	28	-	250
Bolt, Solenoid/Pressure Switch Assy-to-Valve Body	5.5	-	50
Bolt, Valve Body-to-Case	12	-	105
Bolt, Valve Body-to-Transfer Plate	5	-	45
Fitting, Cooler Line	47.5	35	-
Nut, Output Shaft	271	200	-
Plug, Pressure Tap	5	-	45
Bolt, Input Speed-to-Case Sensor	9	-	80
Bolt, Output Speed-to-Case Sensor	9	-	80

SPECIAL TOOLS

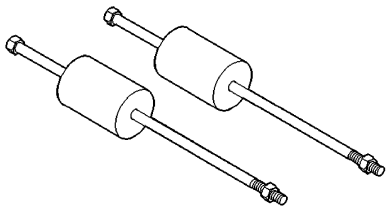
42RLE AUTOMATIC TRANSMISSION



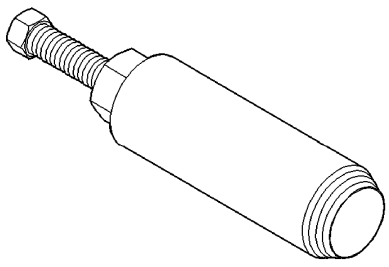
Pressure Gauge (High) C-3293SP



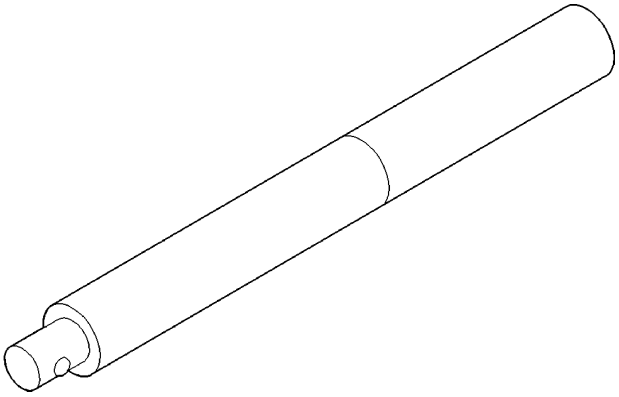
Dial Indicator C-3339



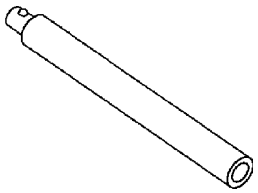
Hammer, Slide - C-3752



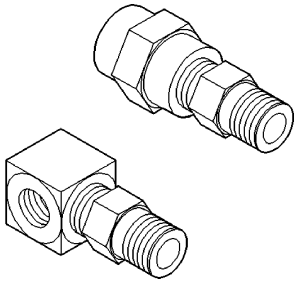
Puller, Seal - C-3981B



Universal Handle C-4171



Extension, Handle - C-4171-2



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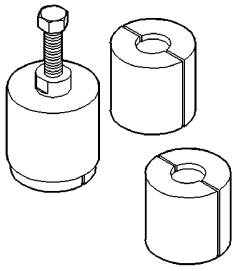
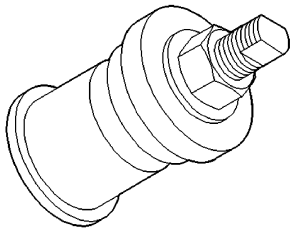


Puller Set 5048



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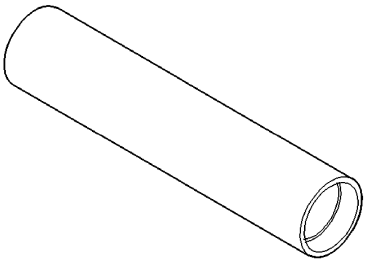

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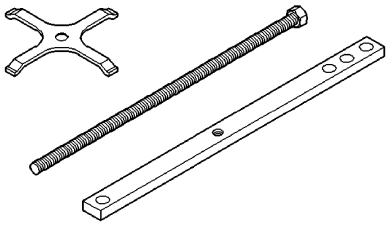

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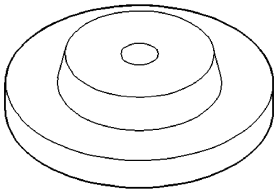

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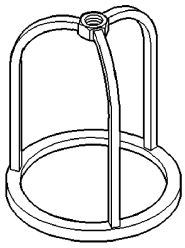

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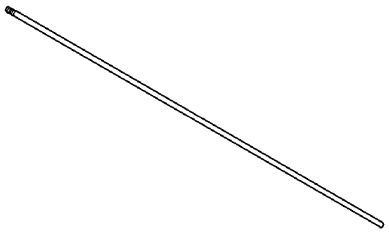
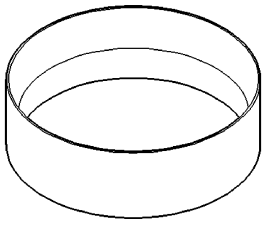
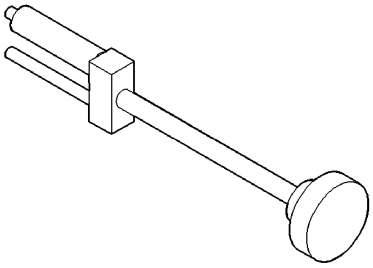


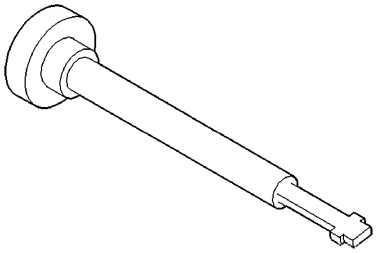
Tip - 6268



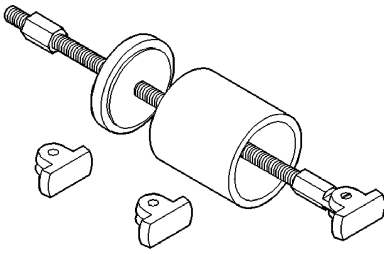
Installer - 5067



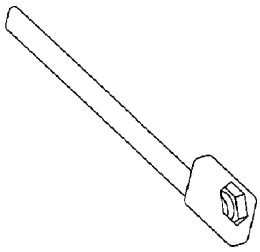
Remover/Installer - 6301



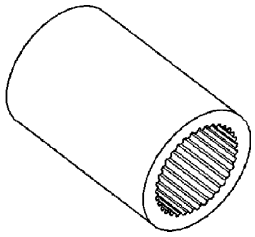
Remover/Installer - 6302



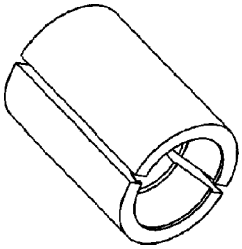
Remover - 6310



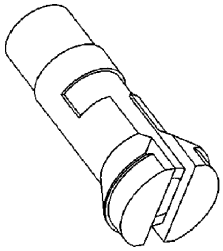
Wrench - 6497



Wrench - 6498-A



Puller Jaws - 6545



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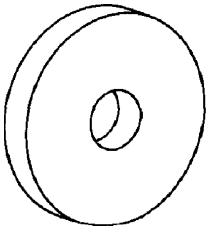

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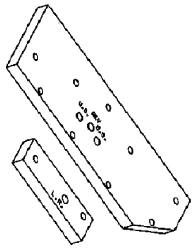

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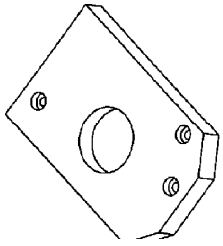
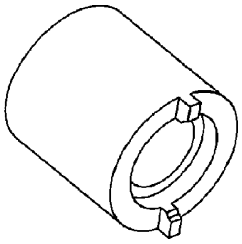
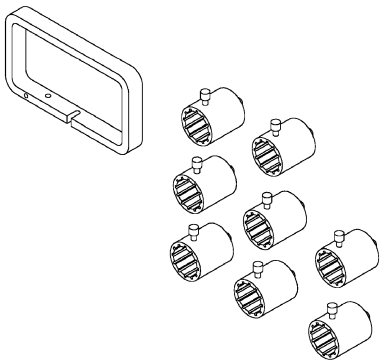


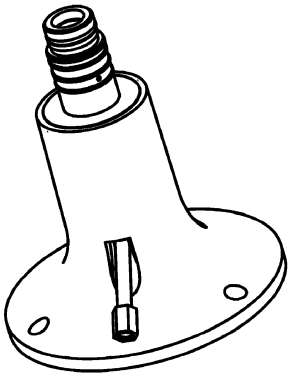
Plate, Support - 6618A



Tool, Staking - 6639



End Play Set - 8266

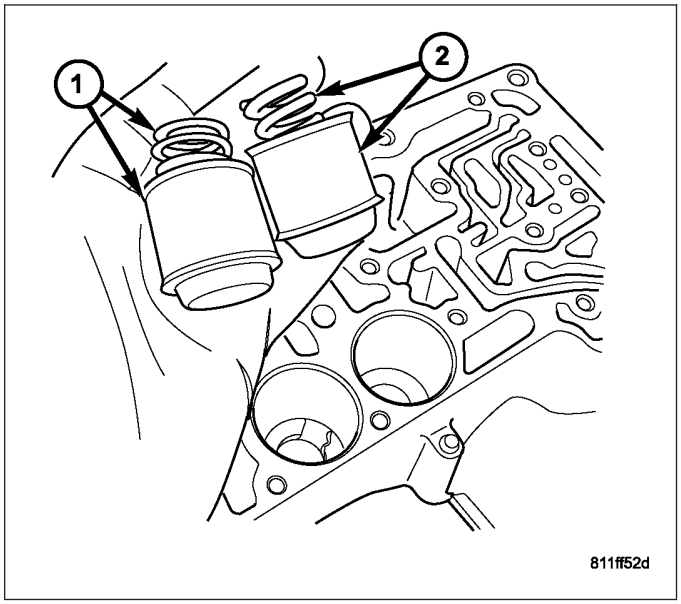


Fixture, Pressure - 8391

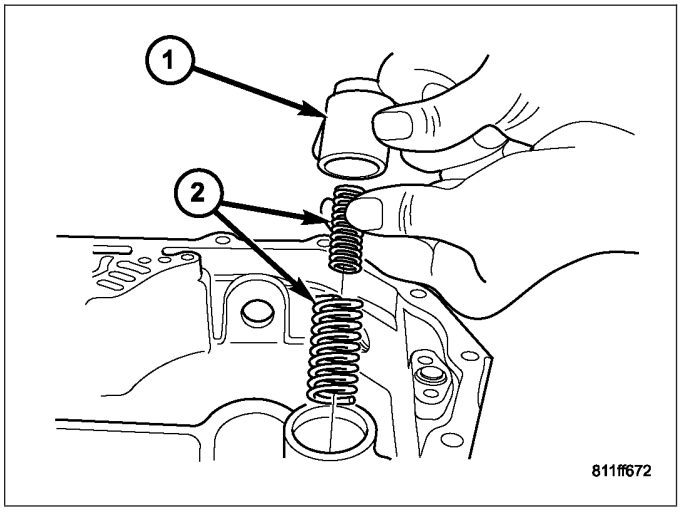
ACCUMULATOR

DESCRIPTION

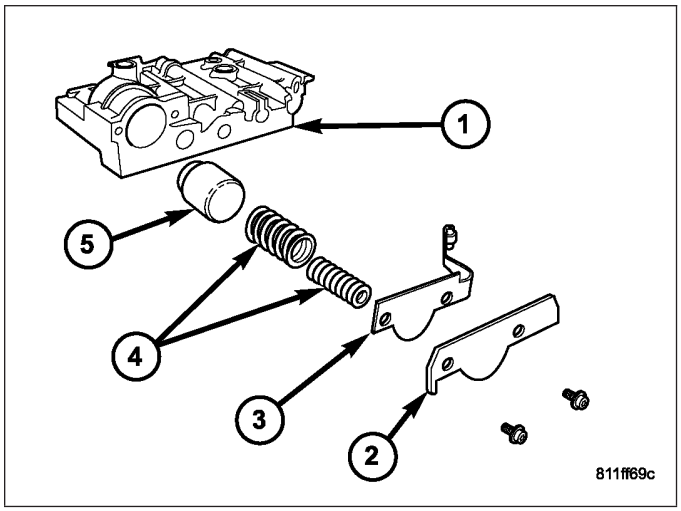
The 42RLE underdrive, overdrive, low/reverse, and 2/4 clutch hydraulic circuits each contain an accumulator. An accumulator typically consists of a piston, return spring(s), and a cover or plug. The overdrive (1) and underdrive (2) accumulators are located within the transmission case, and are retained by the valve body.



The low reverse (1) accumulator is also located within the transmission case, but the assembly is retained by a cover and a snap-ring.



The 2/4 accumulator (5) is located in the valve body. It is retained by a cover and retaining screws.



OPERATION

The function of an accumulator is to cushion the application of a frictional clutch element. When pressurized fluid is applied to a clutch circuit, the application force is dampened by fluid collecting in the respective accumulator chamber against the piston and springs. The intended result is a smooth, firm clutch application.

SEAL-ADAPTER HOUSING

REMOVAL

1. Remove the transfer case (Refer to 21 - TRANSMISSION/TRANSFER CASE - REMOVAL).
2. Using a screw mounted in a slide hammer, remove the adapter housing seal.

INSTALLATION

1. Install a new adapter housing seal with Tool Handle C-4171 and Installer C-3860-A.
2. Install the transfer case (Refer to 21 - TRANSMISSION/TRANSFER CASE - INSTALLATION).

BEARINGS

ADJUSTMENTS

BEARING ADJUSTMENT PROCEDURES

Take extreme care when removing and installing bearing cups and cones. **Use only an arbor press for installation,** as a hammer may not properly align the bearing cup or cone. Burrs or nicks on the bearing seat will give a false end play reading, while gauging for proper shims. Improperly seated bearing cup and cones are subject to low-mileage failure.

Bearing cups and cones should be replaced if they show signs of pitting or heat distress.

If distress is seen on either the cup or bearing rollers, both cup and cone must be replaced.

NOTE: Bearing drag torque specifications must be maintained to avoid premature bearing failures.

Used (original) bearing may lose up to 50 percent of the original drag torque after break-in.

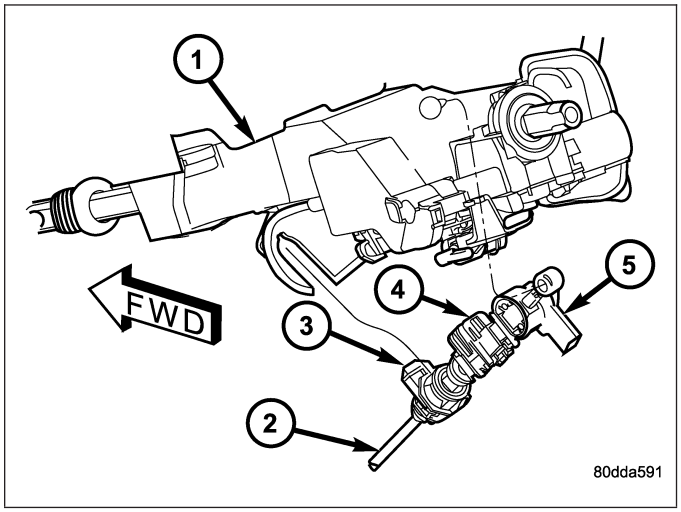
NOTE: All bearing adjustments must be made with no other component interference or gear inter-mesh.

Oil all bearings before checking turning torque.

MECHANISM-BRAKE TRANSMISSION SHIFT INTERLOCK

DESCRIPTION

The Brake Transmission Shifter Interlock (BTSI), is a solenoid operated system. It consists of a solenoid permanently mounted on the gearshift cable.



OPERATION

The system locks the shifter into the PARK position. The interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed approximately one-half an inch. A magnetic holding device in line with the park lock cable is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is fully locked into the PARK position.

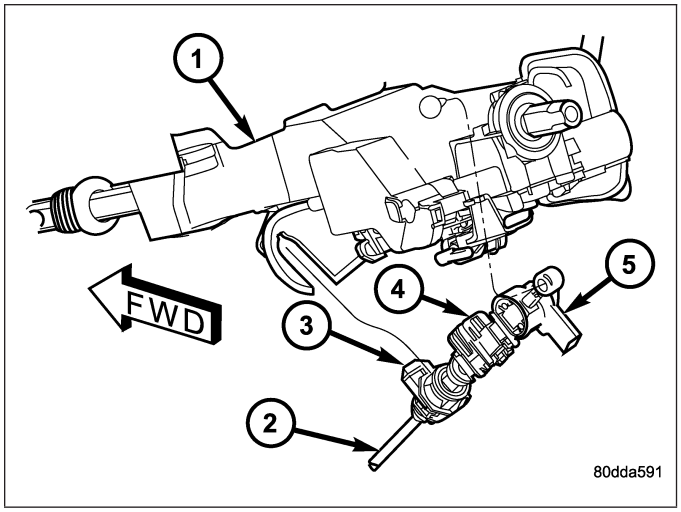
DIAGNOSIS AND TESTING - BRAKE TRANSMISSION SHIFT INTERLOCK

1. Verify that the key can only be removed in the PARK position.
2. When the shift lever is in PARK And the shift handle pushbutton is in the “OUT” position, the ignition key cylinder should rotate freely from OFF to LOCK. When the shifter is in any other gear or neutral position, the ignition key cylinder should not rotate to the LOCK position.
3. Shifting out of PARK should not be possible when the ignition key cylinder is in the OFF position.
4. Shifting out of PARK should not be possible while applying normal pushbutton force and ignition key cylinder is in the RUN or START positions unless the foot brake pedal is depressed approximately 1/2 inch (12mm).
5. Shifting out of PARK should not be possible when the ignition key cylinder is in the ACCESSORY or LOCK positions.
6. Shifting between any gears, NEUTRAL or into PARK may be done without depressing foot brake pedal with ignition switch in RUN or START positions.

ADJUSTMENTS - BRAKE TRANSMISSION SHIFT INTERLOCK

Correct cable adjustment is important to proper interlock operation. The gearshift cable must be correctly adjusted in order to shift out of PARK.

ADJUSTMENT PROCEDURE



1. Remove the steering column trim as necessary for access to the brake transmission shift interlock.
2. Shift the transmission into the PARK position.
3. Pull upward on both the BTSI lock tab (4) and the gearshift cable lock tab (3).
4. Verify that the shift lever is in the PARK position.
5. Verify positive engagement of the transmission park lock by attempting to rotate the propeller shaft. The shaft will not rotate when the park lock is engaged.
6. Turn ignition switch to LOCK position. **Be sure ignition key cylinder is in the LOCK position. Cable will not adjust correctly in any other position.**
7. Ensure that the cable is free to self-adjust by pushing cable rearward and releasing.
8. Push the gearshift cable lock tab (3) down until it snaps in place.
9. Locate the BTSI alignment hole in the bottom of the BTSI mechanism between the BTSI lock tab and the BTSI connector.
10. Move the BTSI assembly up or down on the gearshift cable until an appropriate size drill bit can be inserted into the alignment hole and through the assembly.
11. Push the BTSI lock tab (4) down until it snaps into place and remove the drill bit.
12. Install any steering column trim previously removed.

BTSI FUNCTION CHECK

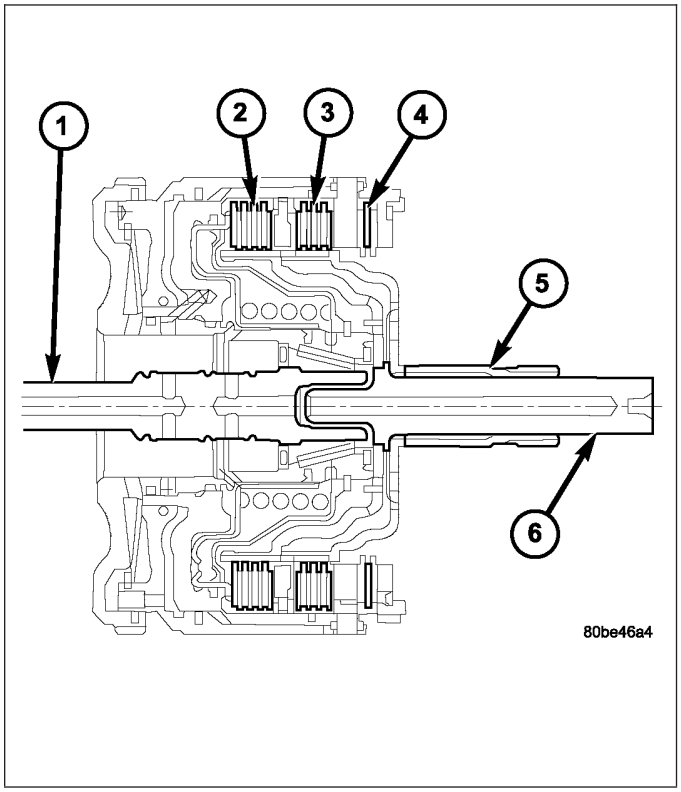
1. Verify removal of ignition key allowed in PARK position only.
2. When the shift lever is in PARK, the ignition key cylinder should rotate freely from off to lock. When the shifter is in any other position, the ignition key should not rotate from off to lock.
3. Shifting out of PARK should be possible when the ignition key cylinder is in the off position.
4. Shifting out of PARK should not be possible while applying normal force, and ignition key cylinder is in the run or start positions, unless the foot brake pedal is depressed approximately 1/2 inch (12mm).
5. Shifting out of PARK should not be possible when the ignition key cylinder is in the accessory or lock position.
6. Shifting between any gear and NEUTRAL, or PARK, may be done without depressing foot brake with ignition switch in run or start positions.
7. Engine starts must be possible with shifter lever in PARK or NEUTRAL positions only. Engine starts must not be possible in any position other than PARK or NEUTRAL.
8. With shifter lever in the:
   - PARK position - Apply upward force on the shift arm and remove pressure. Engine starts must be possible.
   - PARK position - Apply downward force on the shift arm and remove pressure. Engine starts must be possible.
   - NEUTRAL position - Normal position. Engine starts must be possible.
   - NEUTRAL position - Engine running and brakes applied, apply upward force on the shift arm. Transmission shall not be able to shift from neutral to reverse.

CLUTCHES-DRIVING

DESCRIPTION

Three hydraulically applied input clutches are used to drive planetary components. The underdrive (2), overdrive (3), and reverse (4) clutches are considered input/driving clutches and are contained within the input clutch assembly. The input clutch assembly also contains:

- Input shaft
- Input hub
- Clutch retainer
- Underdrive piston
- Overdrive/reverse piston
- Overdrive hub
- Underdrive hub



OPERATION

The three input clutches are responsible for driving different components of the planetary geartrain.

NOTE: (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING) for a collective view of which clutch elements are applied at each position of the selector lever.

UNDERDRIVE CLUTCH

The underdrive clutch is hydraulically applied in first, second, and third (direct) gears by pressurized fluid against the underdrive piston. When the underdrive clutch is applied, the underdrive hub drives the rear sun gear.

OVERDRIVE CLUTCH

The overdrive clutch is hydraulically applied in third (direct) and overdrive gears by pressurized fluid against the overdrive/reverse piston. When the overdrive clutch is applied, the overdrive hub drives the front planet carrier.

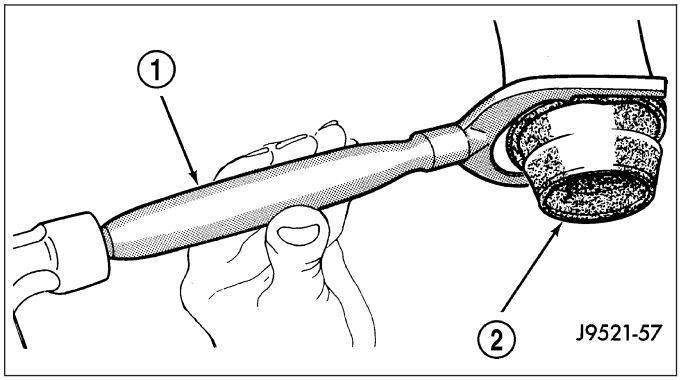
REVERSE CLUTCH

The reverse clutch is hydraulically applied in reverse gear only by pressurized fluid against the overdrive/reverse piston. When the reverse clutch is applied, the front sun gear assembly is driven.

SEAL-EXTENSION HOUSING

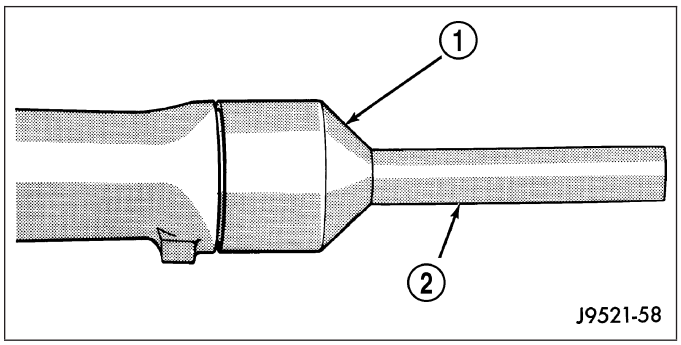
REMOVAL

1. Raise vehicle.
2. Mark propeller shaft and axle yoke, or companion flange, for alignment reference.
3. Disconnect and remove propeller shaft.
4. Remove old seal with Seal Remover C-3985-B (1) from overdrive extension housing.



INSTALLATION

1. Place seal in position on overdrive housing.
2. Drive seal into overdrive housing with Seal Installer C-3995-A (1).
3. Carefully guide propeller shaft slip yoke into housing and onto output shaft splines. Align marks made at removal and connect propeller shaft to rear axle pinion yoke.



FLUID AND FILTER

DIAGNOSIS AND TESTING

CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has two primary causes.

1. A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or improperly installed drainback valve, a damaged oil cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.
2. Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxidation, and varnish buildup which interferes with valve and clutch operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to replace contaminated converter after repair

The use of non-recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission, an overhaul is necessary.

The torque converter should be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

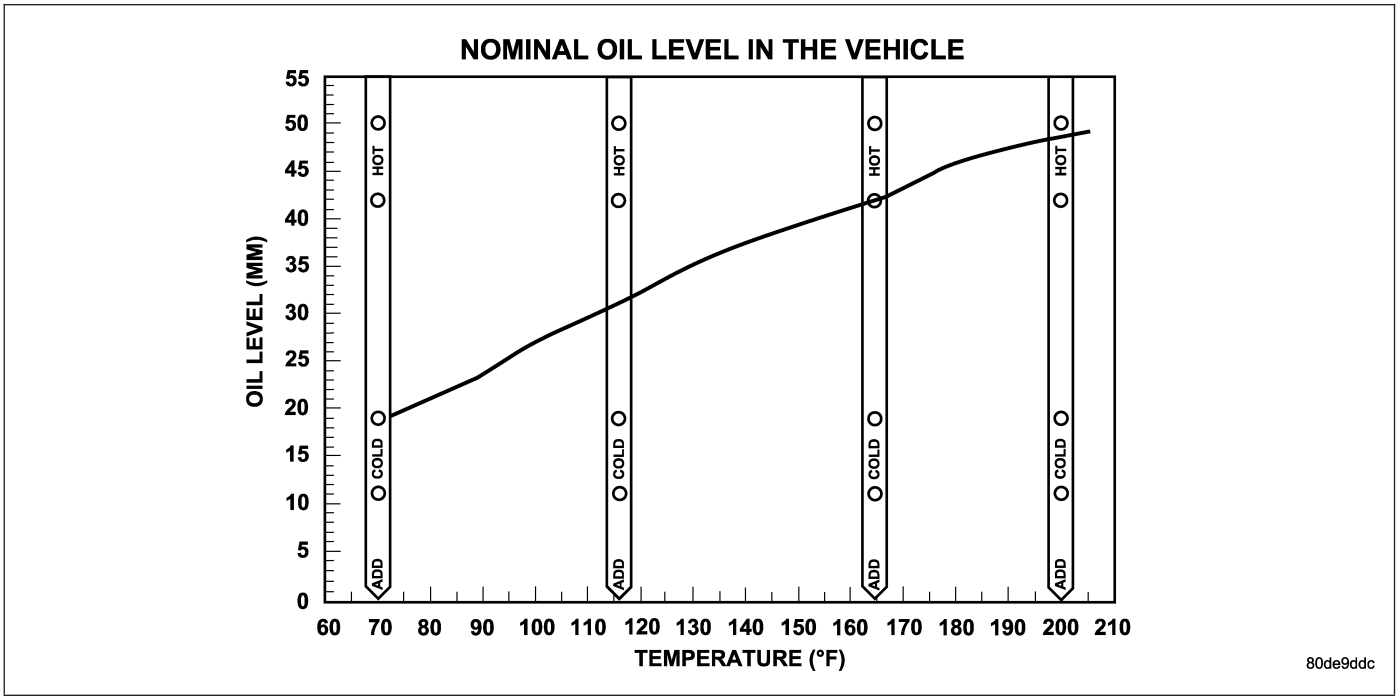
STANDARD PROCEDURE

FLUID LEVEL CHECK

The transmission sump has a dipstick to check oil similar to most automatic transmissions. It is located on the left side of the engine. Be sure to wipe all dirt from dipstick handle before removing.

The torque converter fills in both the PARK and NEUTRAL positions. Place the selector lever in PARK to be sure that the fluid level check is accurate. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground.** At normal operating temperature (approximately 82 C. or 180 F.), the fluid level is correct if it is in the HOT region (cross-hatched area) on the oil level indicator. The fluid level should be in COLD region at 70° F fluid temperature. Adjust fluid level as necessary. Use only Mopar® ATF+4, Automatic Transmission Fluid.

FLUID LEVEL CHECK USING SCAN TOOL



42RLE Fluid Temperature Chart

NOTE: Engine and Transmission should be at normal operating temperature before performing this procedure.

1. Start engine and apply parking brake.
2. Connect scan tool and select transmission.
3. Select sensors.
4. Read the transmission temperature value.
5. Compare the fluid temperature value with the chart.
6. Adjust transmission fluid level shown on the dipstick according to the 42RLE Fluid Temperature Chart. Use only Mopar® ATF+4, Automatic Transmission Fluid.
7. Check transmission for leaks.

FLUID/FILTER SERVICE

NOTE: Only fluids of the type labeled Mopar® ATF+4, Automatic Transmission Fluid, should be used in the transmission sump. A filter change should be made at the time of the transmission oil change. The magnet (on the inside of the oil pan) should also be cleaned with a clean, dry cloth.

NOTE: If the transmission is disassembled for any reason, the fluid and filter should be changed.

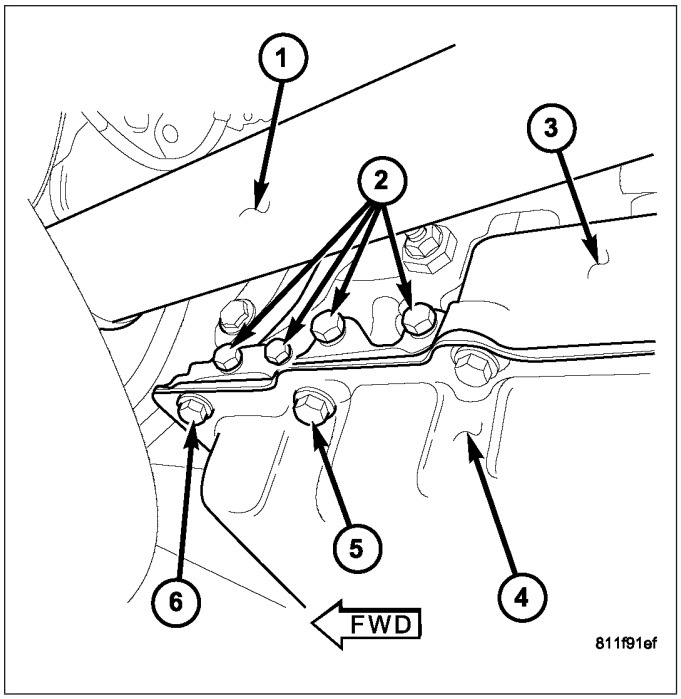
1. Raise vehicle on a hoist. Place a drain container with a large opening, under transmission oil pan.

NOTE: One of the oil pan bolts (5) has a sealing patch applied from the factory. Separate this bolt for reuse.

2. Loosen pan bolts and tap the pan at one corner to break it loose allowing fluid to drain, then remove the oil pan.
3. Install a new filter and o-ring on bottom of the valve body and tighten retaining screws to 5 N·m (40 in. lbs.).

NOTE: Before installing the oil pan bolt (5) in the bolt hole located between the torque converter clutch on and U/D clutch pressure tap circuits, it will be necessary to replentish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

4. Clean the oil pan and magnet. Reinstall pan using new Mopar® Silicone Adhesive sealant. Tighten oil pan bolts to 19 N·m (165 in. lbs.).
5. Pour four quarts of Mopar® ATF+4, Automatic Transmission Fluid, through the dipstick opening.



6. Start engine and allow to idle for at least one minute. Then, with parking and service brakes applied, move selector lever momentarily to each position, ending in the park or neutral position.
7. Check the transmission fluid level and add an appropriate amount to bring the transmission fluid level to 3mm (1/8 in.) below the lowest mark on the dipstick.
8. Recheck the fluid level after the transmission has reached normal operating temperature (180°F.).
9. To prevent dirt from entering transmission, make certain that dipstick is fully seated into the dipstick opening.

TRANSMISSION FILL

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

1. Remove dipstick and insert clean funnel in transmission fill tube.
2. Add following initial quantity of Mopar® ATF +4, Automatic Transmission Fluid, to transmission:
   a. If only fluid and filter were changed, add **3 pints (1-1/2 quarts)** of ATF +4 to transmission.
   b. If transmission was completely overhauled, or torque converter was replaced or drained, add **12 pints (6 quarts)** of ATF +4 to transmission.
3. Apply parking brakes.
4. Start and run engine at normal curb idle speed.
5. Apply service brakes, shift transmission through all gear ranges then back to NEUTRAL, set parking brake, and leave engine running at curb idle speed.
6. Remove funnel, insert dipstick and check fluid level. If level is low, **add fluid to bring level to MIN mark on dipstick.** Check to see if the oil level is equal on both sides of the dipstick. If one side is noticably higher than the other, the dipstick has picked up some oil from the dipstick tube. Allow the oil to drain down the dipstick tube and re-check.
7. Drive vehicle until transmission fluid is at normal operating temperature.
8. With the engine running at curb idle speed, the gear selector in NEUTRAL, and the parking brake applied, check the transmission fluid level.

CAUTION: Do not overfill transmission, fluid foaming and shifting problems can result.

9. Add fluid to bring level up to MAX arrow mark.

When fluid level is correct, shut engine off, release park brake, remove funnel, and install dipstick in fill tube.

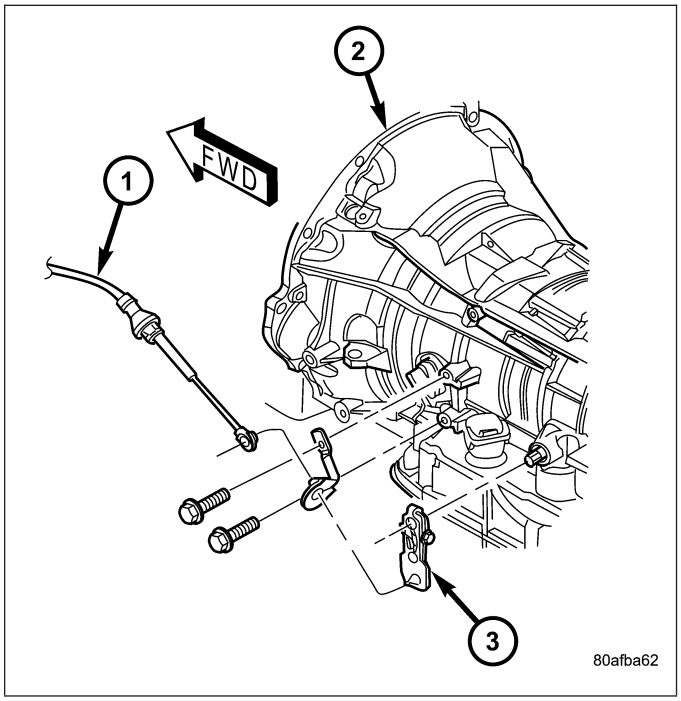
CABLE-GEARSHIFT

DIAGNOSIS AND TESTING - GEARSHIFT CABLE

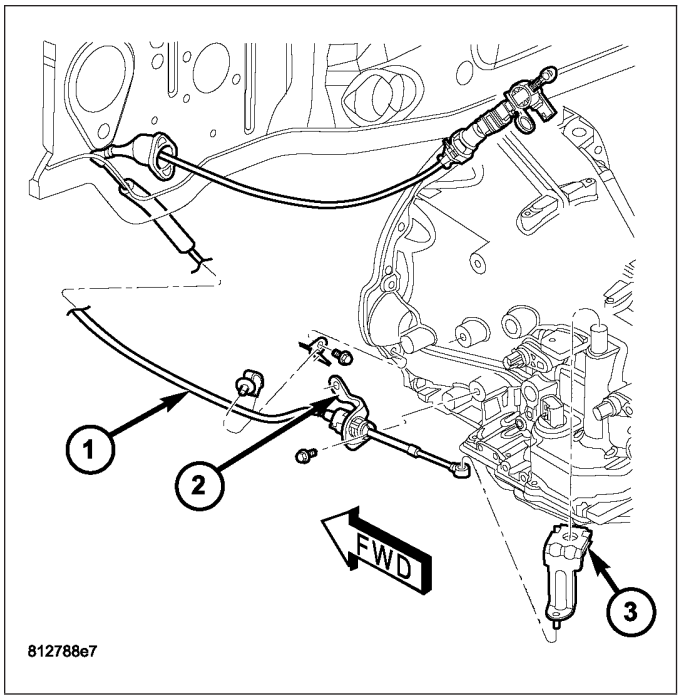
1. Engine starts must be possible with shift lever in PARK or NEUTRAL positions only. Engine starts must not be possible in any other gear position.
2. With the shift lever in the:
   a. PARK position - Apply upward force on the shift arm and remove pressure. Engine starts must be possible.
   b. PARK position - Apply downward force on the shift arm and remove pressure. Engine starts must be possible.
   c. NEUTRAL position - Normal position. Engine starts must be possible.
   d. NEUTRAL position - Engine running and brakes applied, apply upward force on the shift arm. Transmission shall not be able to shift from neutral to reverse.

REMOVAL

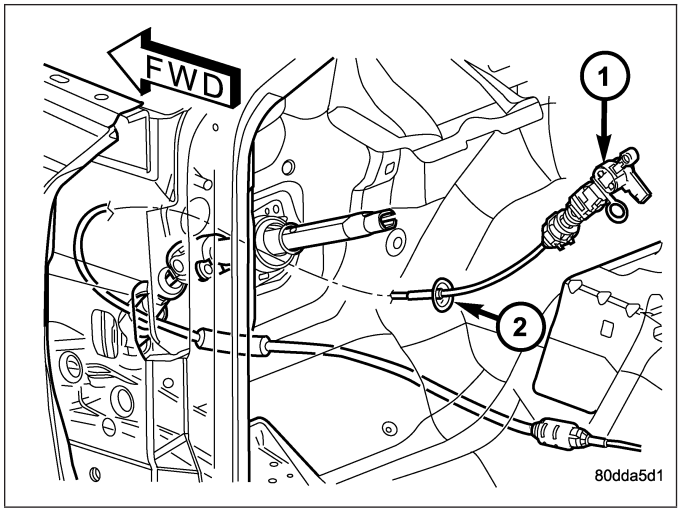
1. Shift transmission into PARK.
2. Raise vehicle.
3. Disengage cable (1) eyelet at transmission manual shift lever (3) and pull cable adjuster out of mounting bracket, RFE transmission equipped vehicles.



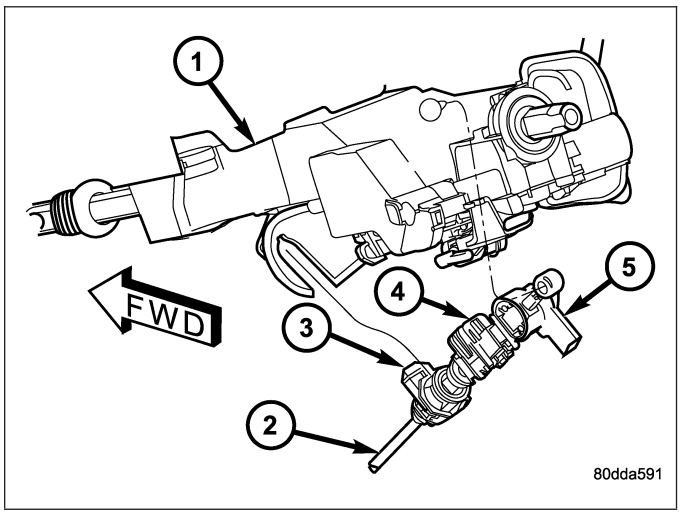
4. Disengage cable (1) eyelet at transmission manual shift lever (3) and pull cable adjuster out of mounting bracket (2), RLE transmission equipped vehicles.



5. Lower the vehicle.
6. Remove the dash panel insulation pad as necessary to access the gearshift cable grommet (2).
7. Remove grommet (2) from the dash panel.

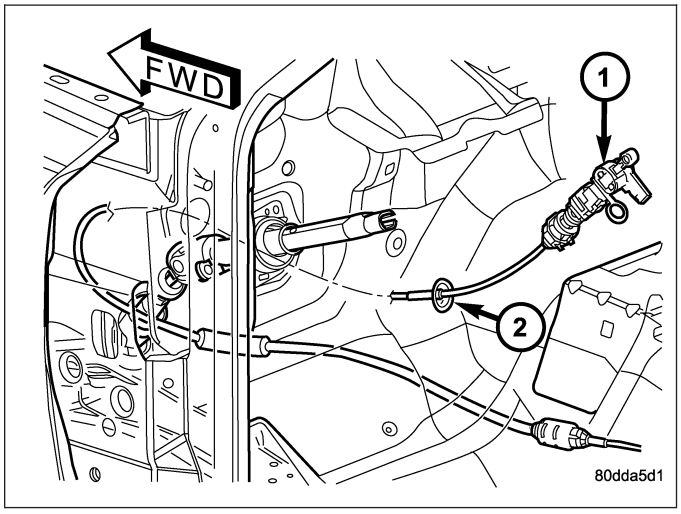


8. Remove any steering column (1) trim necessary to access the gearshift cable (2) and BTSI mechanism.
9. Disconnect the BTSI wiring connector (5).
10. Disconnect cable at lower column bracket and shift lever pin and pull the cable through the dash panel opening into the vehicle.
11. Remove gearshift cable (2) from vehicle.

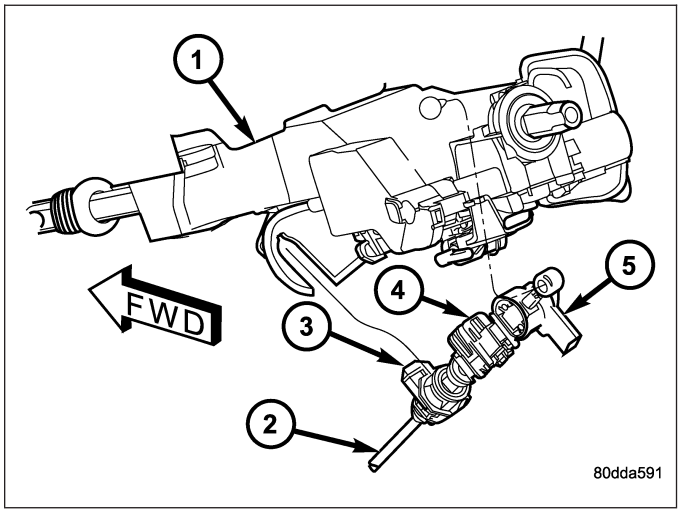


INSTALLATION

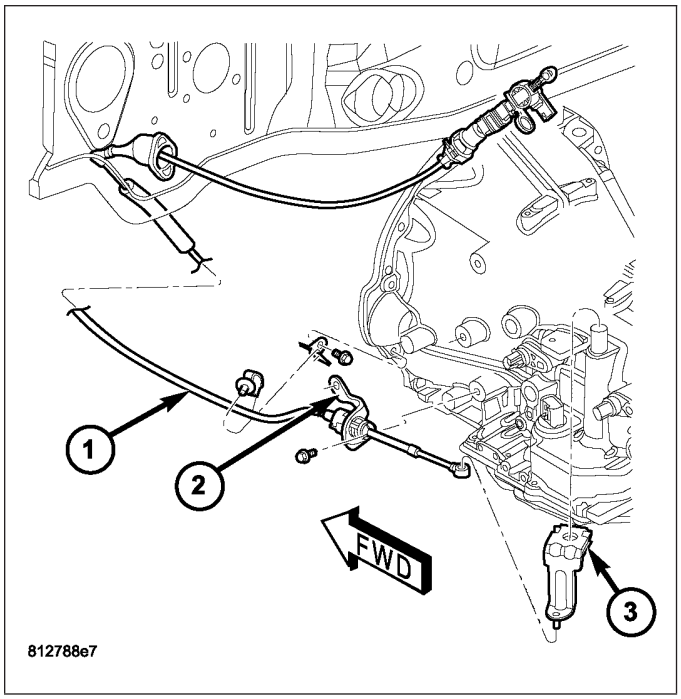
1. Route the transmission end of the gearshift cable (1) through the opening in the dash panel.
2. Seat the cable grommet (2) into the dash panel opening.



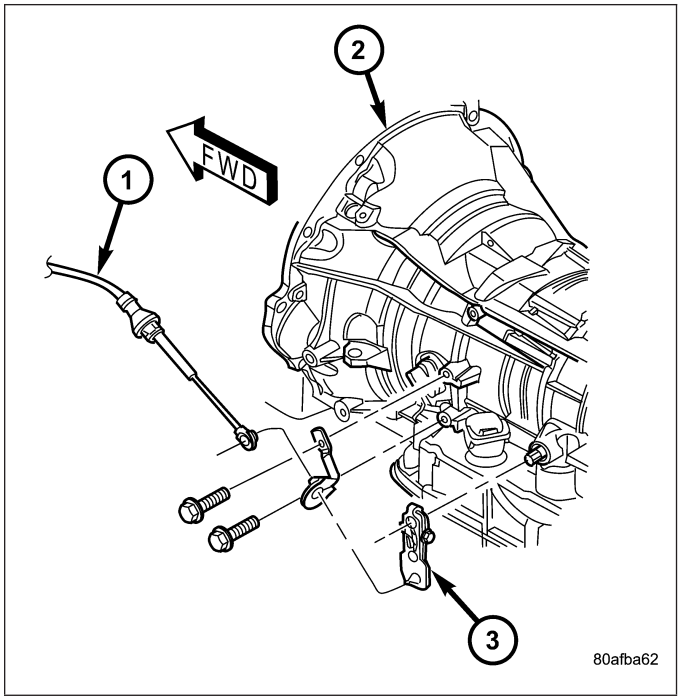
3. Snap the cable into the steering column (1) bracket so the retaining ears are engaged and snap the cable eyelet onto the shift lever ball stud.
4. Raise the vehicle.
5. Place the transmission manual shift lever in the “PARK” detent (rearmost) position and rotate prop shaft to ensure transmission is in PARK.



6. Route the gearshift cable (1) through the transmission mounting bracket (2) and secure the cable by snapping the cable retaining ears into the transmission bracket and snapping the cable eyelet on the manual shift lever (3) ball stud, RLE transmission equipped vehicles.



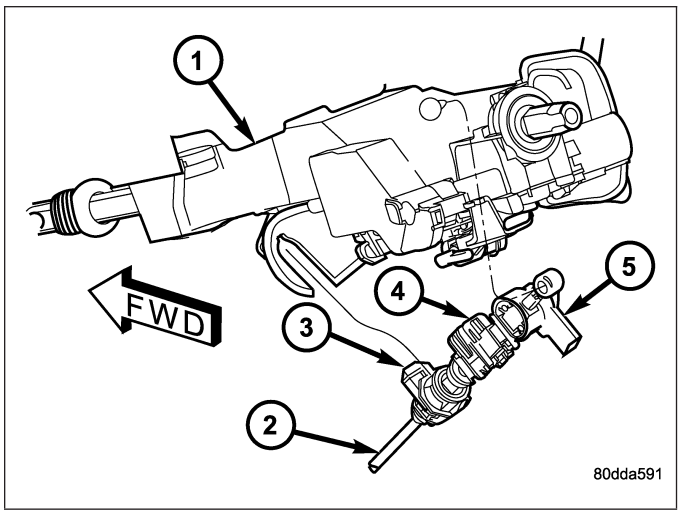
7. Route the gearshift cable (1) through the transmission mounting bracket and secure the cable by snapping the cable retaining ears into the transmission bracket and snapping the cable eyelet on the manual shift lever (3) ball stud, RFE transmission equipped vehicles.
8. Lower vehicle.
9. Lock the shift cable adjustment by pressing the cable adjuster lock tab (3) downward until it snaps into place.
10. Check for proper operation of the transmission range sensor.
11. Adjust the gearshift cable (Refer to 21 - TRANSMISSION/AUTOMATIC/GEAR SHIFT CABLE - ADJUSTMENTS) and BTSI mechanism (Refer to 21 - TRANSMISSION/AUTOMATIC/BRAKE TRANSMISSION SHIFT INTERLOCK SYSTEM - ADJUSTMENTS) as necessary.



ADJUSTMENTS - GEARSHIFT CABLE

Check adjustment by starting the engine in PARK and NEUTRAL. Adjustment is CORRECT if the engine starts only in these positions. Adjustment is INCORRECT if the engine starts in one but not both positions. If the engine starts in any position other than PARK or NEUTRAL, or if the engine will not start at all, the transmission range sensor may be faulty.

Gearshift Adjustment Procedure

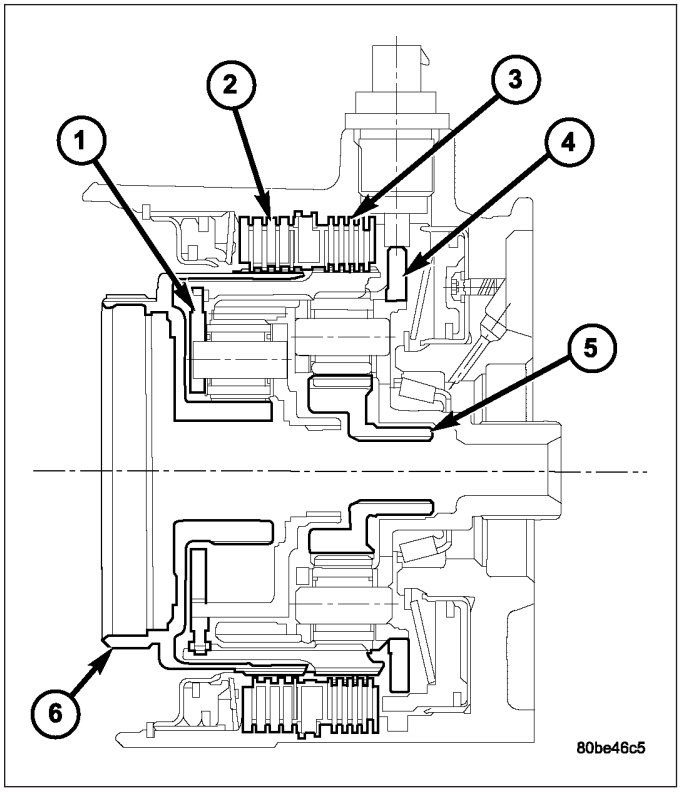


1. Shift transmission into PARK.
2. Release cable adjuster lock tab (3) (underneath the steering column) to unlock cable.
3. Raise vehicle.
4. Disengage the cable eyelet from the transmission manual shift lever.
5. Verify transmission shift lever is in PARK detent by moving lever fully rearward. Last rearward detent is PARK position.
6. Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.
7. Snap the cable eyelet onto the transmission manual shift lever.
8. Lower vehicle.
9. Lock shift cable by pressing cable adjuster lock tab (3) downward until it snaps into place.
10. Check engine starting. Engine should start only in PARK and NEUTRAL.

CLUTCHES-HOLDING

DESCRIPTION

Two hydraulically applied multi-disc clutches are used to hold planetary geartrain components stationary while the input clutches drive others. The 2/4 (2) and Low/Reverse (3) clutches are considered holding clutches and are contained at the rear of the transmission case.



OPERATION

NOTE: (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING) for a collective view of which clutch elements are applied at each position of the selector lever.

2/4 CLUTCH

The 2/4 clutch is hydraulically applied in second and fourth gears by pressurized fluid against the 2/4 clutch piston. When the 2/4 clutch is applied, the front sun gear assembly is held or grounded to the transmission case.

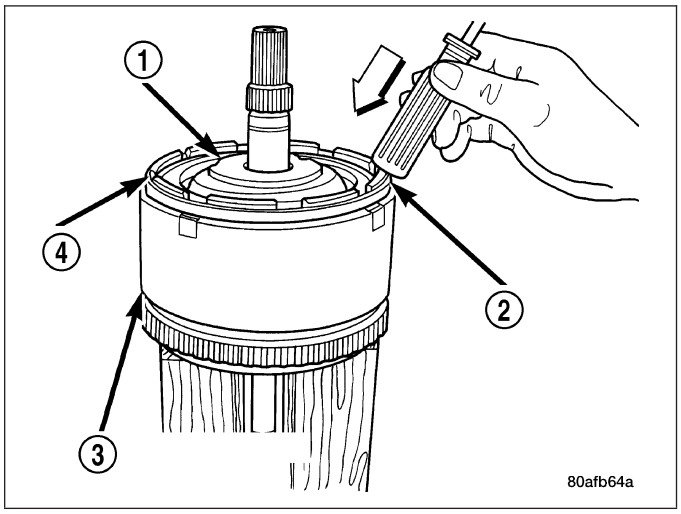
LOW/REVERSE CLUTCH

The Low/Reverse clutch is hydraulically applied in park, reverse, neutral, and first gears by pressurized fluid against the Low/Reverse clutch piston. When the Low/Reverse clutch is applied, the front planet carrier/rear annulus assembly is held or grounded to the transmission case.

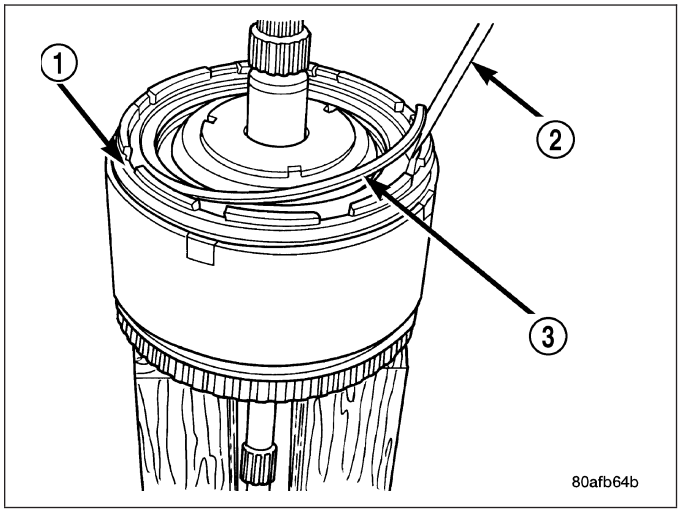
ASSEMBLY-INPUT CLUTCH

DISASSEMBLY

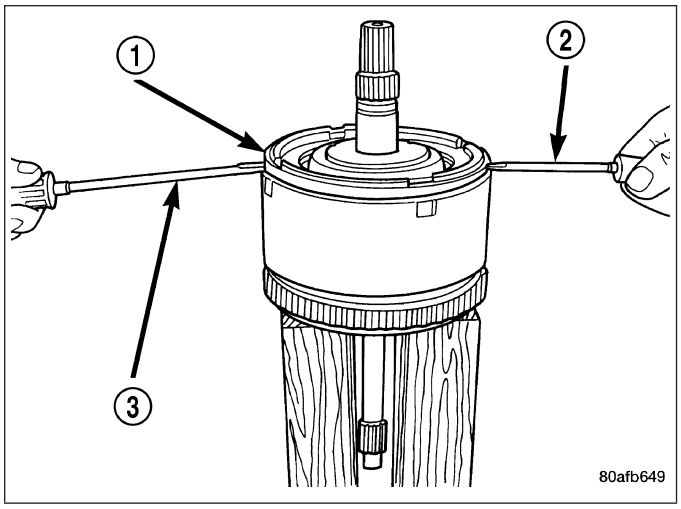
1. Mount input clutch assembly to Input Clutch Pressure Fixture (Tool 8391).
2. Tap down (2) reverse clutch reaction plate (4) to release pressure from snap ring.



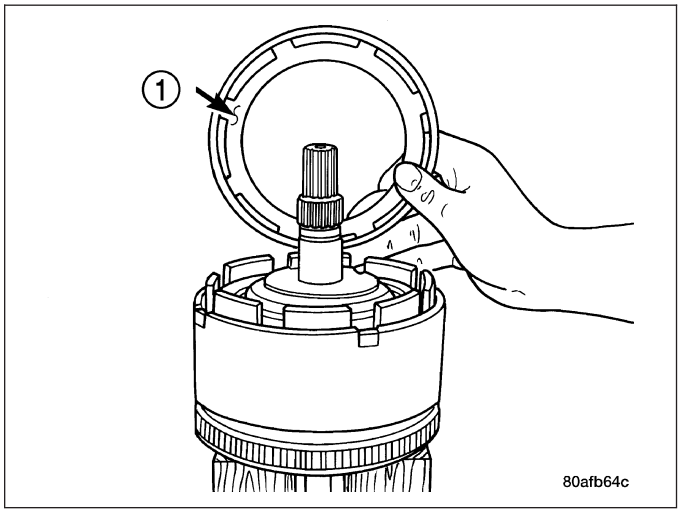
3. Remove reverse clutch snap ring (3).



4. Pry up reverse clutch reaction plate (1).

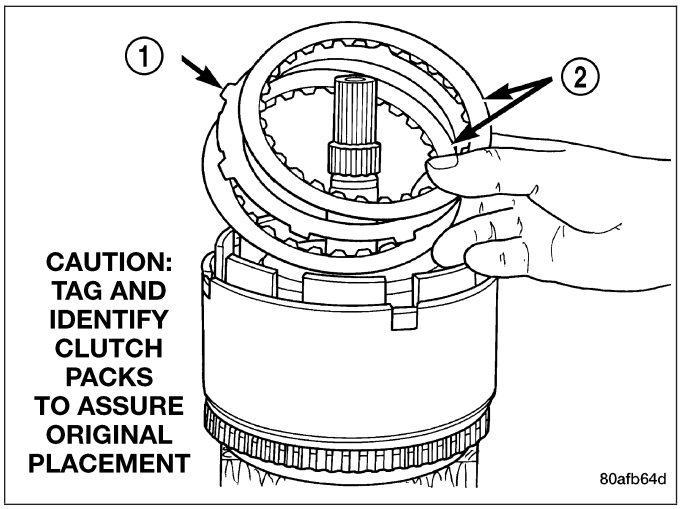


5. Remove reverse clutch reaction plate (1).

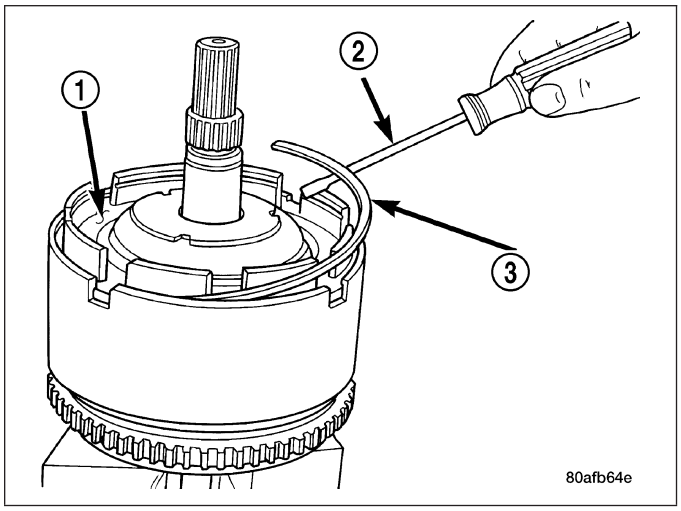


NOTE: Tag reverse clutch pack for reassembly identification.

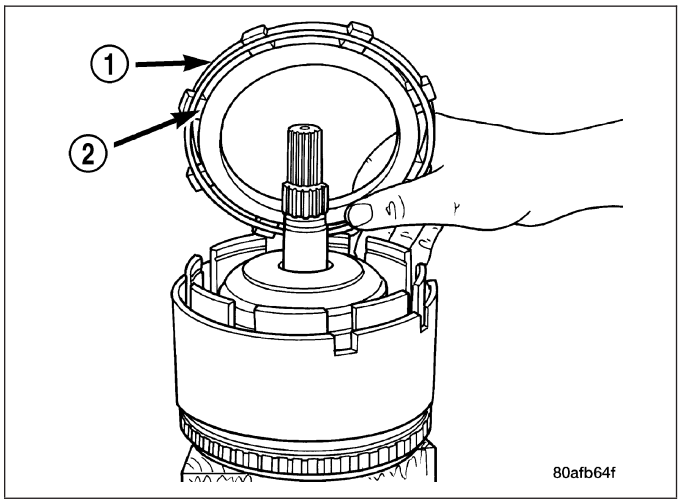
6. Remove the reverse clutch pack (two fibers/one steel) (1, 2).



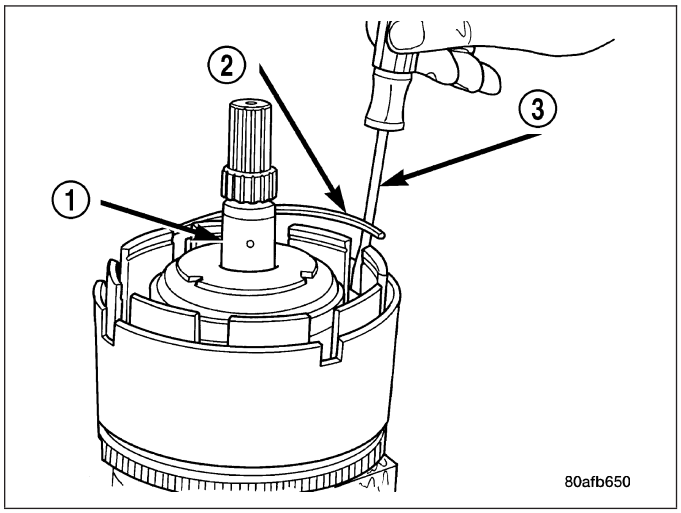
7. Remove the OD/Reverse reaction plate (1) snap ring (3).



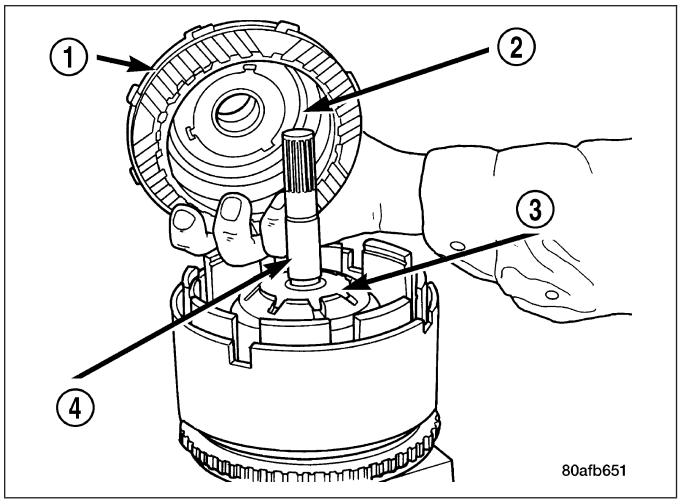
8. Remove OD/Reverse pressure plate (1).



9. Remove OD/Reverse reaction plate wave snap ring (2).

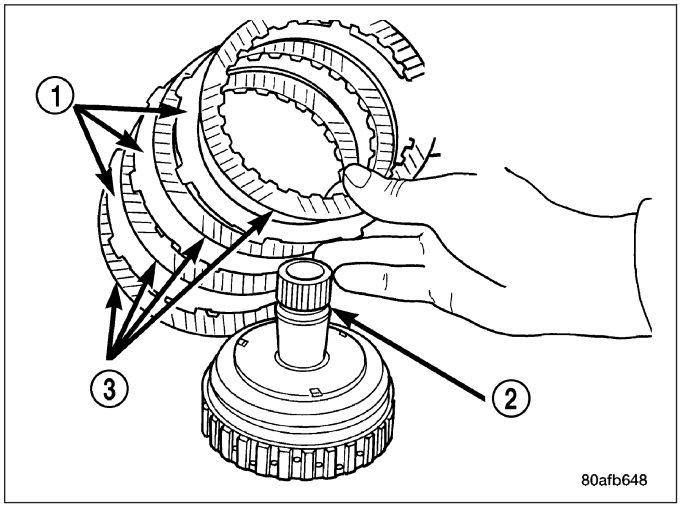


10. Remove OD shaft/hub and OD clutch pack (1).

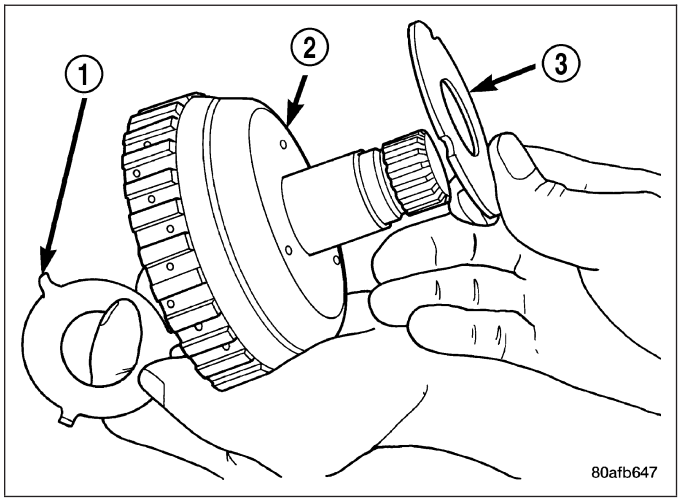


NOTE: Tag overdrive clutch pack for reassembly identification.

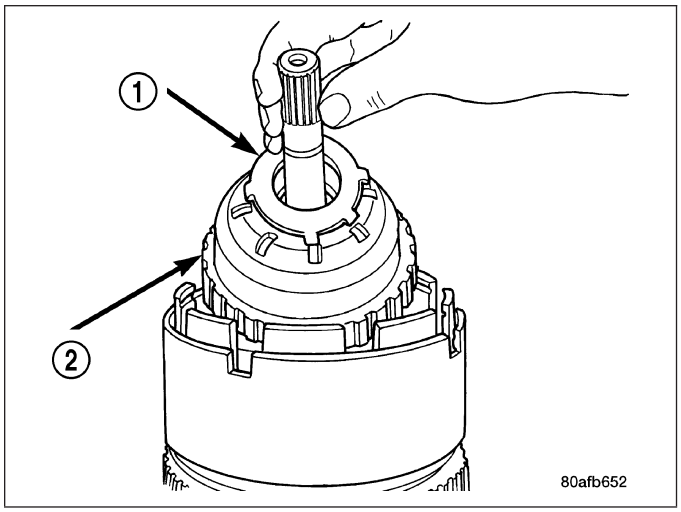
11. Remove the overdrive clutch (1, 3) from the overdrive hub/shaft (2).



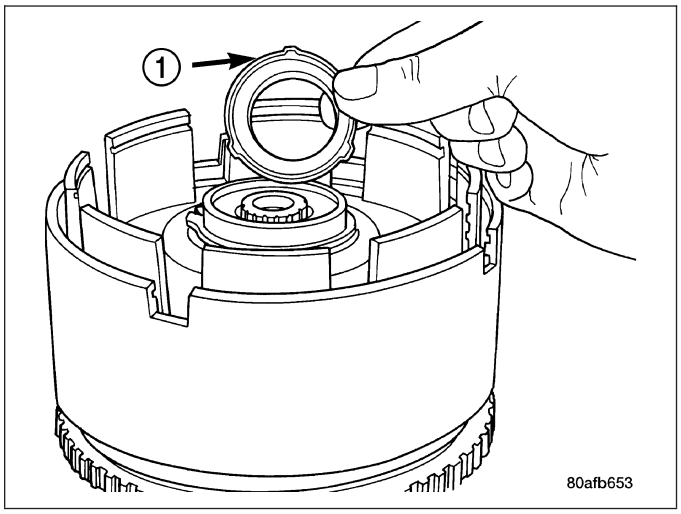
12. Remove and inspect number 3 and 4 thrust plates (1, 3).



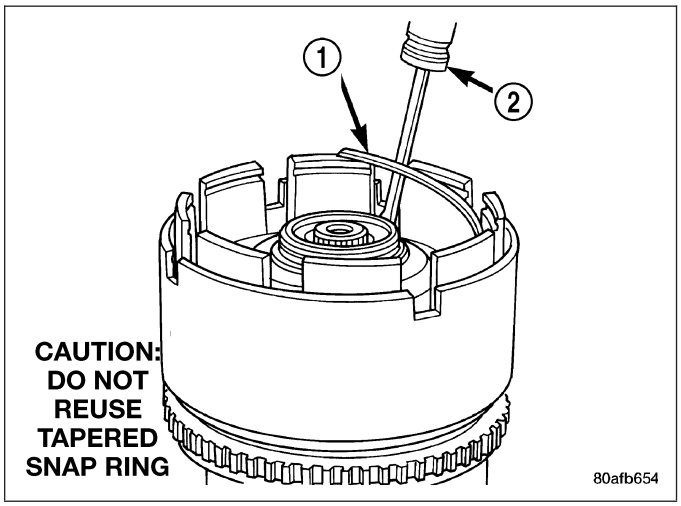
13. Remove the underdrive shaft assembly (2).



14. Remove the number 2 needle bearing (1).

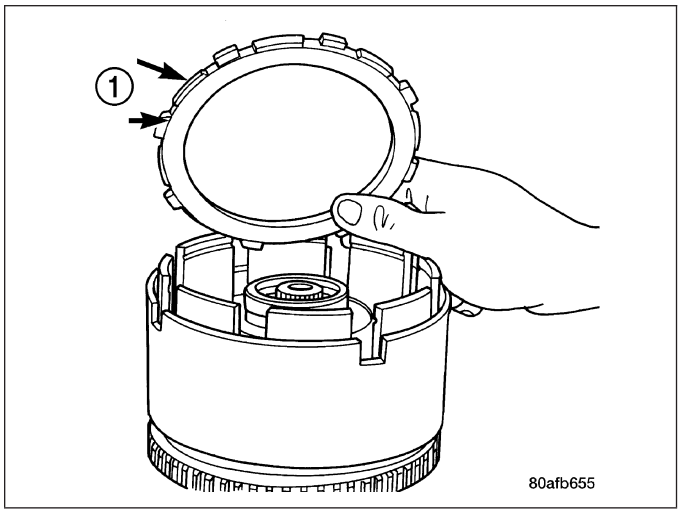


15. Remove the OD/UD reaction plate tapered snap ring (1).

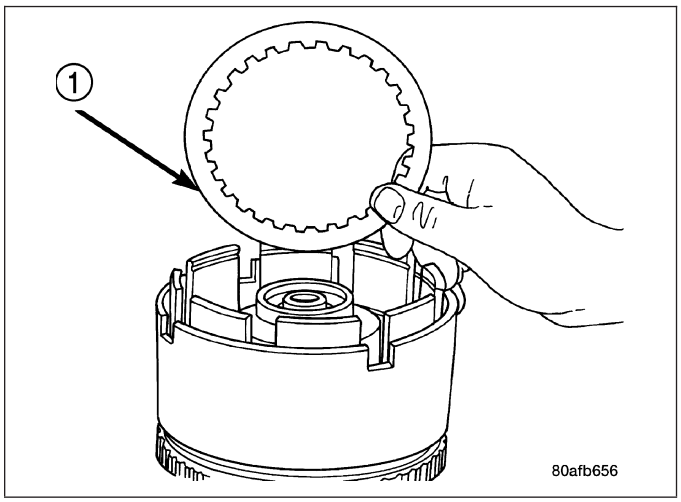


NOTE: The OD/UD clutch reaction plate has a step on both sides. The OD/UD clutches reaction plate goes tapered step side up.

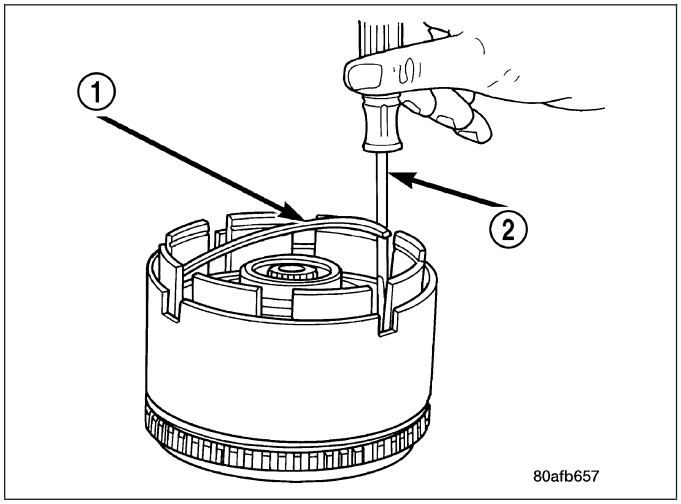
16. Remove the OD/UD reaction plate (1).



17. Remove the first UD clutch disc (1).

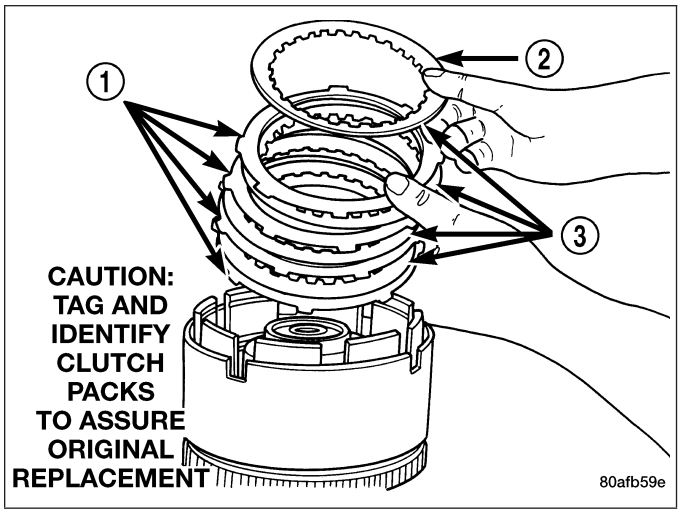


18. Remove the UD clutch flat snap ring (1).



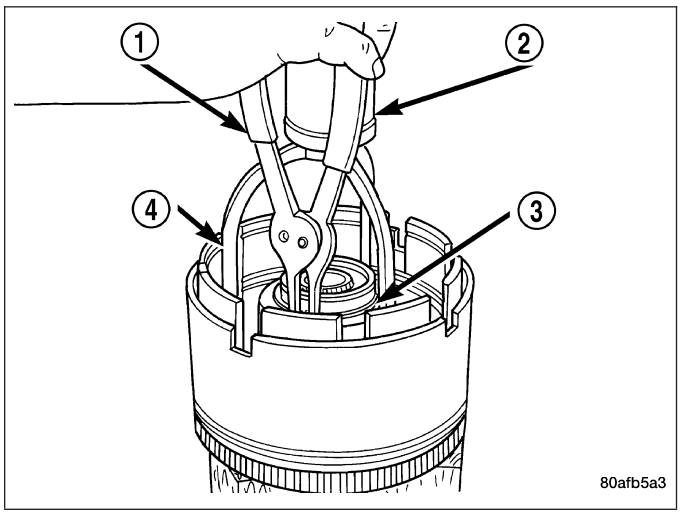
NOTE: Tag underdrive clutch pack for reassembly identification.

19. Remove the UD clutch pack (1, 3).

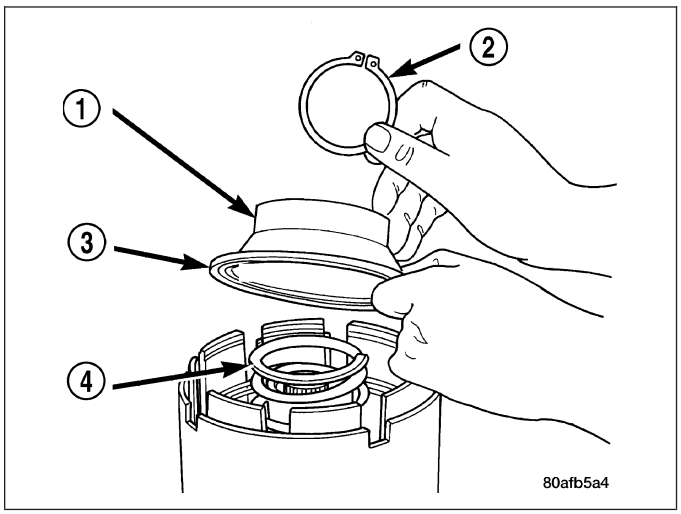


CAUTION: Compress return spring just enough to remove or install snap ring.

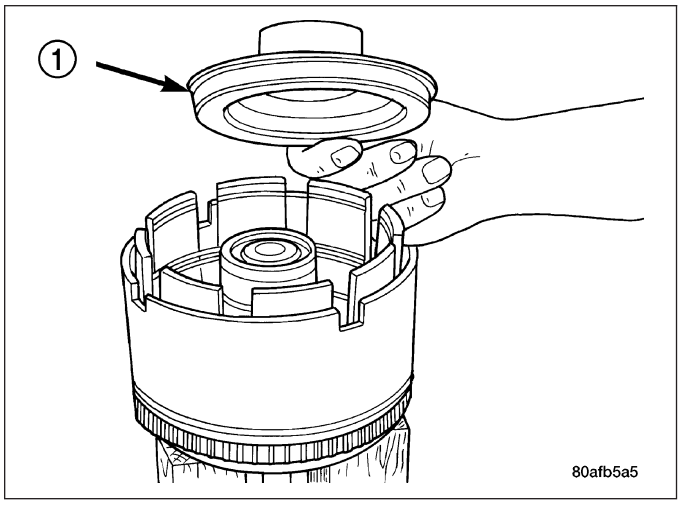
20. Using Tool 5059A (4) and an arbor press (2), compress UD clutch piston enough to remove snap ring (3).



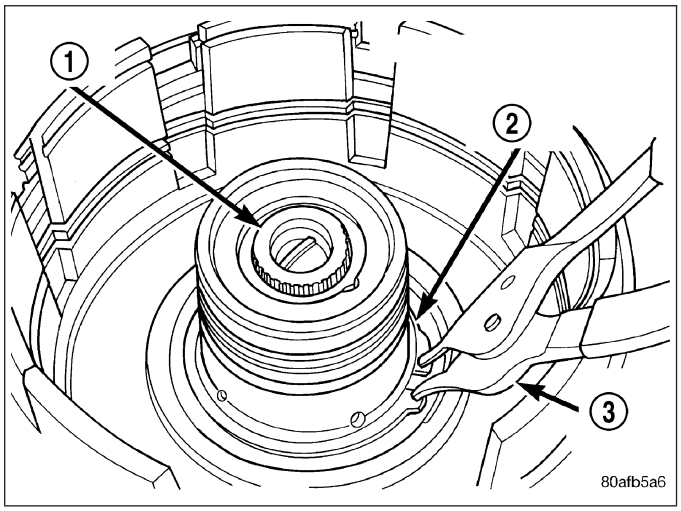
21. Remove the underdrive spring retainer snap ring (2), spring retainer (1), and spring (4).



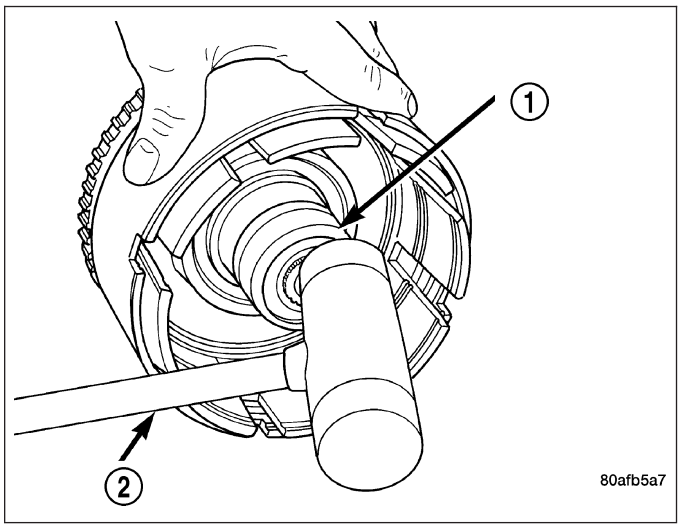
22. Remove the UD clutch piston (1).



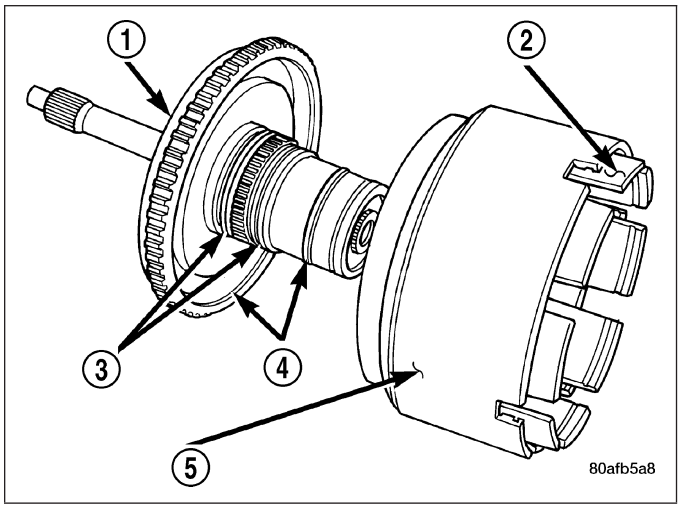
23. Remove the input hub tapered snap ring (2).



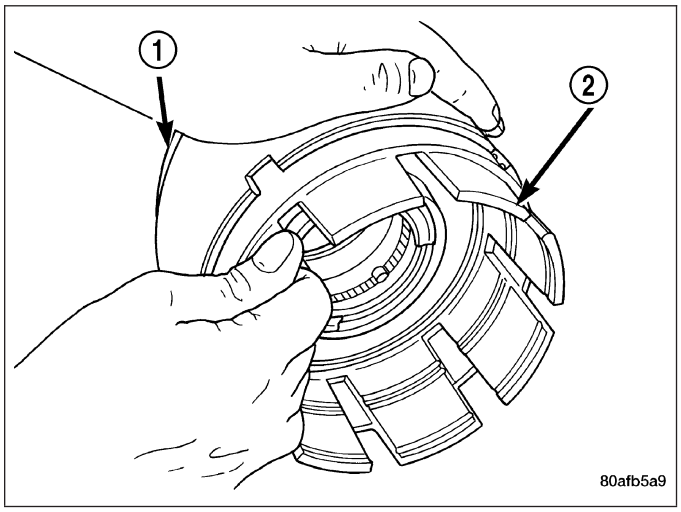
24. Tap on input hub (1) with soft faced hammer (2) and separate input hub from OD/Reverse piston and clutch retainer.



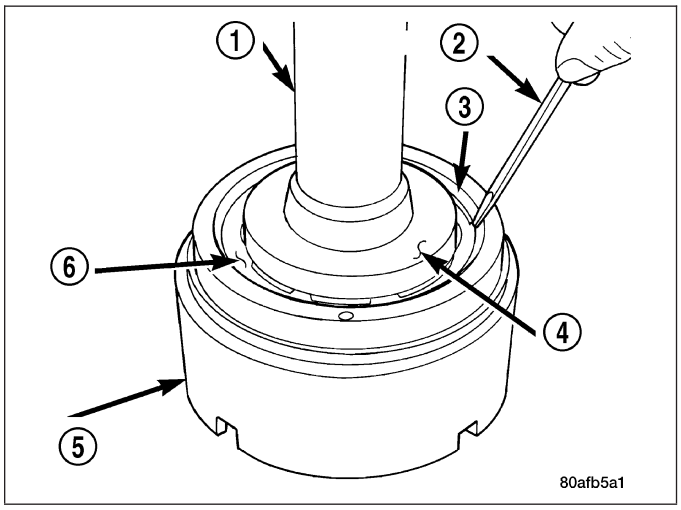
25. Separate the input hub from OD/Reverse piston (5) and clutch retainer (2).



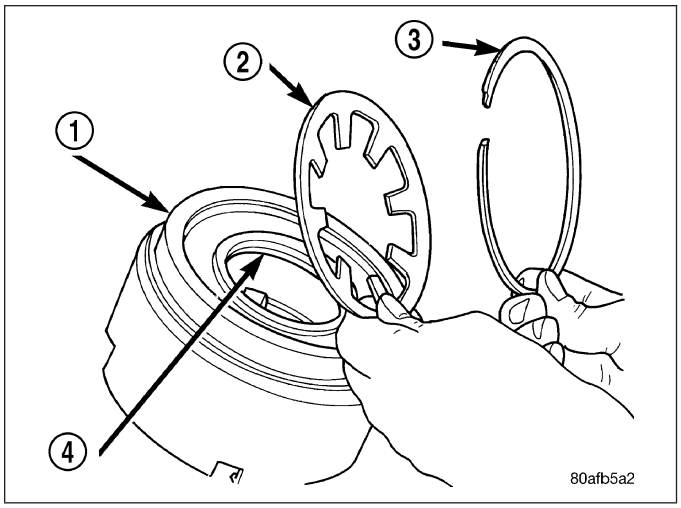
26. Separate clutch retainer (2) from OD/Reverse piston (1).



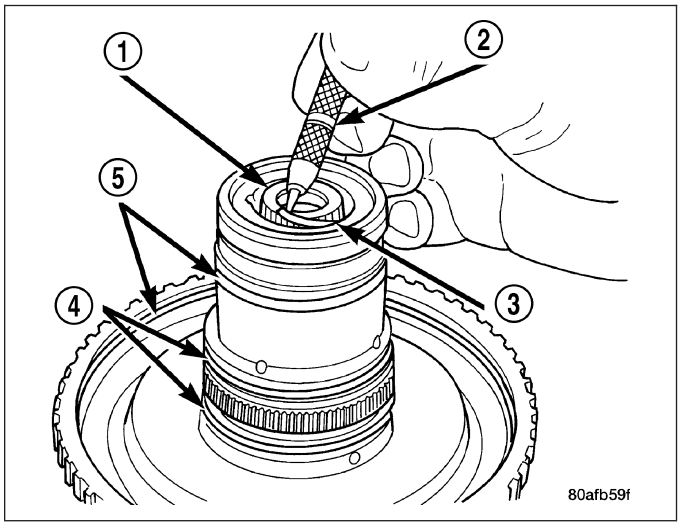
27. Using Tool 6057 (4) and an arbor press(1), compress OD/Reverse piston (5) return spring just enough to remove snap ring (3).



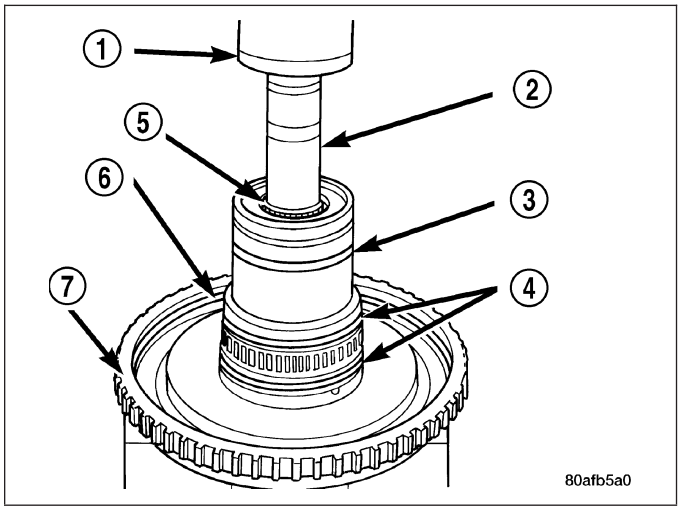
28. Remove the OD/Reverse piston (5) return spring and snap ring (3).



29. Remove input shaft (1) to input clutch hub snap ring (3).



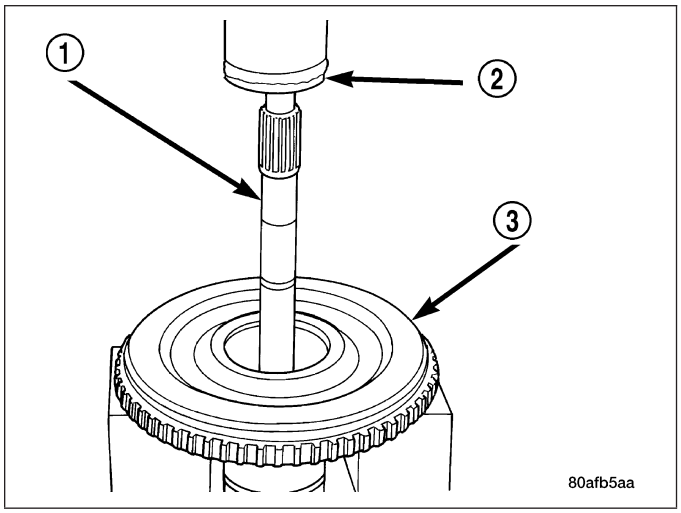
30. Using a suitably sized socket (2) and an arbor press (1), remove input shaft (5) from input shaft hub.



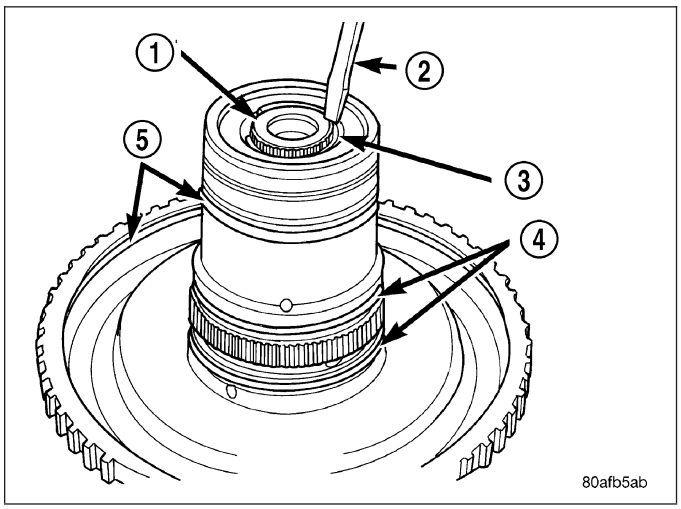
ASSEMBLY

Use petrolatum on all seals to ease assembly of components.

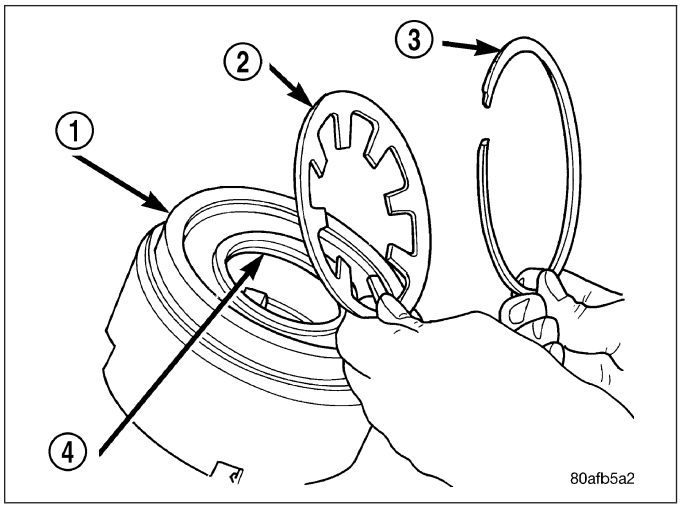
1. Using an arbor press(2), install input shaft (1) to input shaft hub (2).



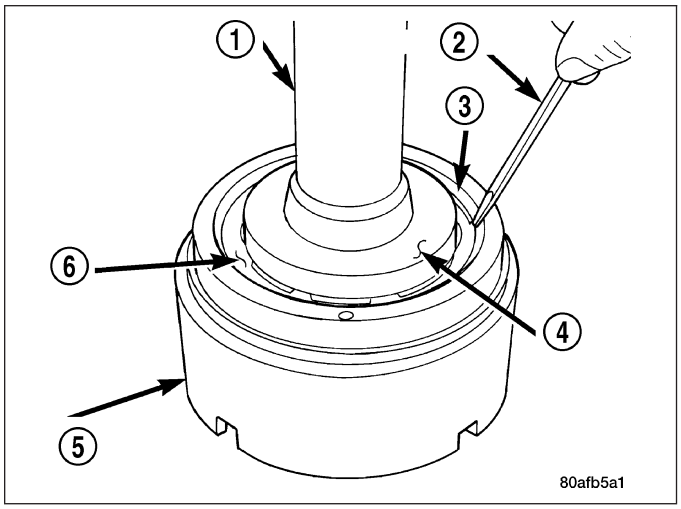
2. Install input shaft snap ring (3).



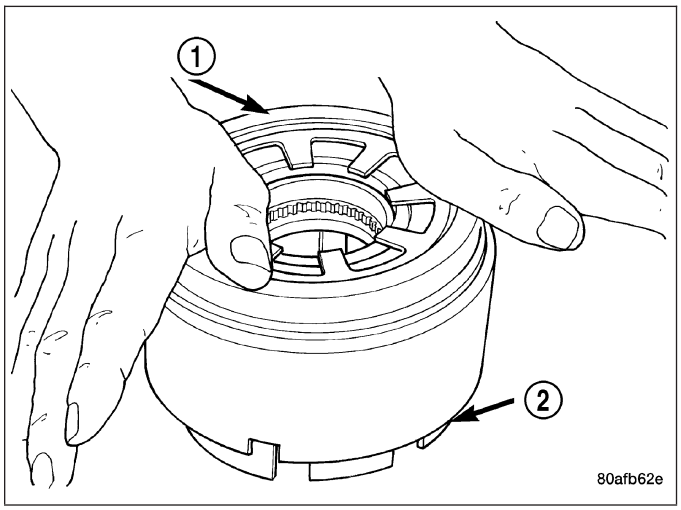
3. Position the OD/Reverse piston return spring (2) and snap ring (3) onto the OD/Reverse piston (1).



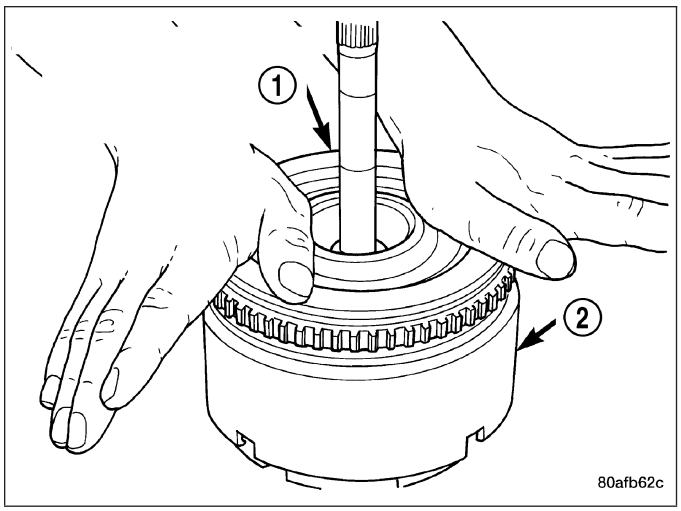
4. Using an arbor press (1) and Tool 6057 (4), install the OD/Reverse piston return spring (6) and snap ring (3).



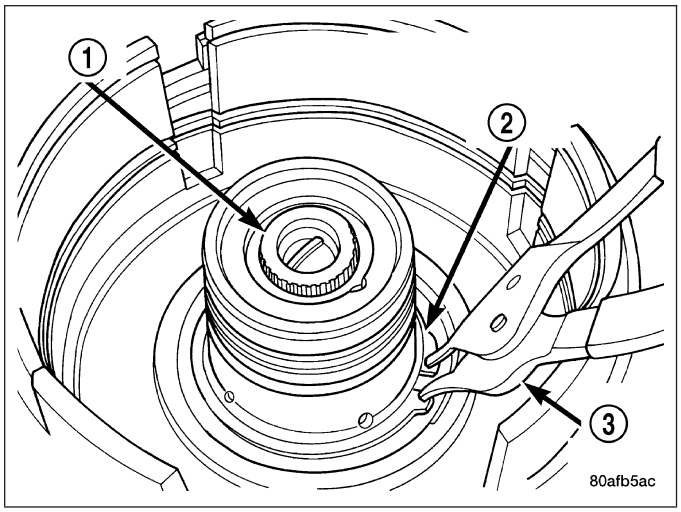
5. Install the OD/Reverse piston (1) assembly to the input clutch retainer (2).



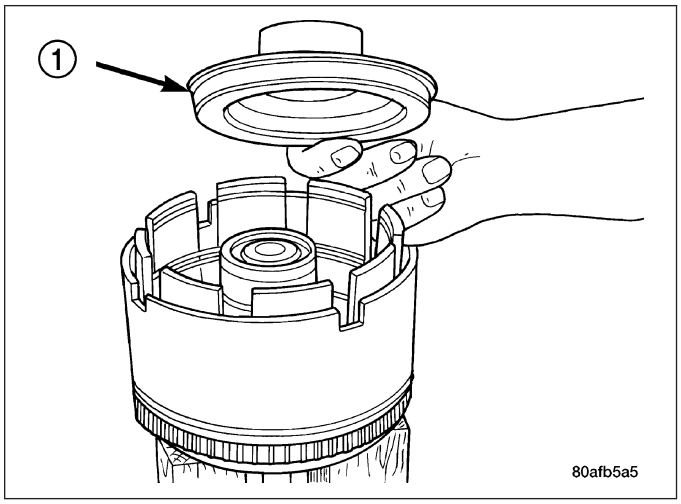
6. Install the input hub/shaft assembly (1) to the OD/Reverse piston/clutch retainer assembly (2).



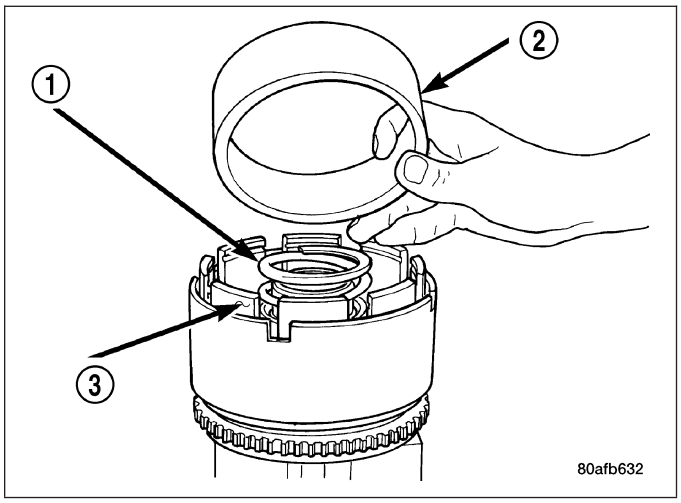
7. Install input hub tapered snap ring (2). **Make sure snap ring is fully seated.**



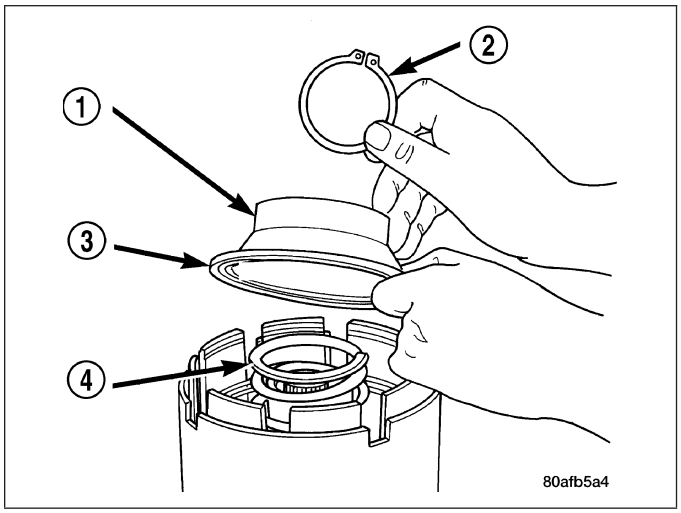
8. Install the UD clutch piston (1).



9. Install UD piston return spring (1)and Tool 5067 (2).

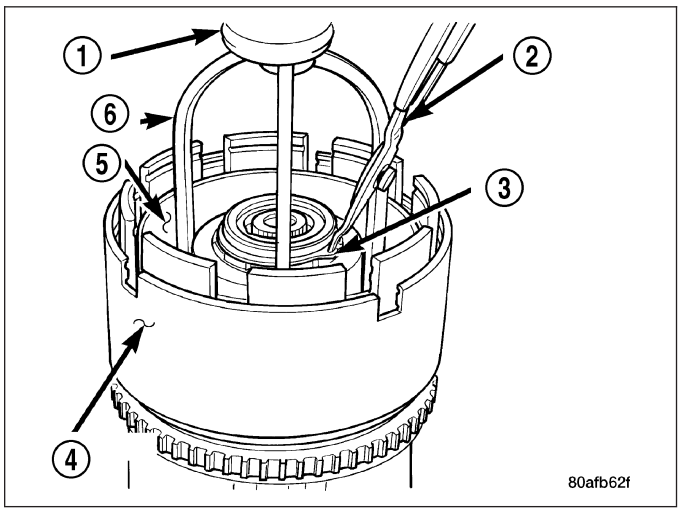


10. Position the UD spring retainer (1) and snap ring (2) on the piston return spring (4).

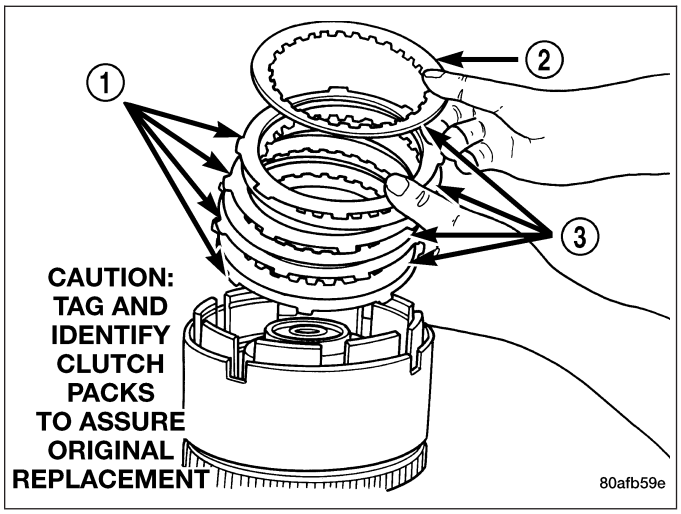


CAUTION: Compress return spring just enough to install snap ring.

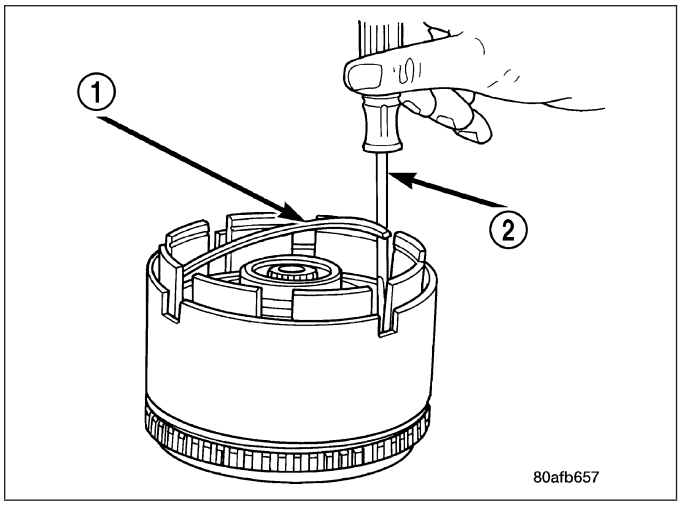
11. Using Tool 5059A (6) and an arbor press (1), install the UD spring retainer and snap ring (3).



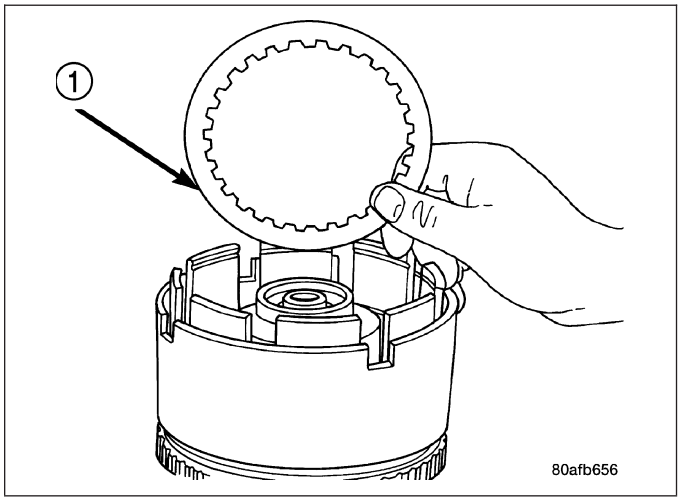
12. Install the UD clutch pack (four fibers/four steels) (1, 3). Leave the top disc (2) out until after the snap ring is installed.



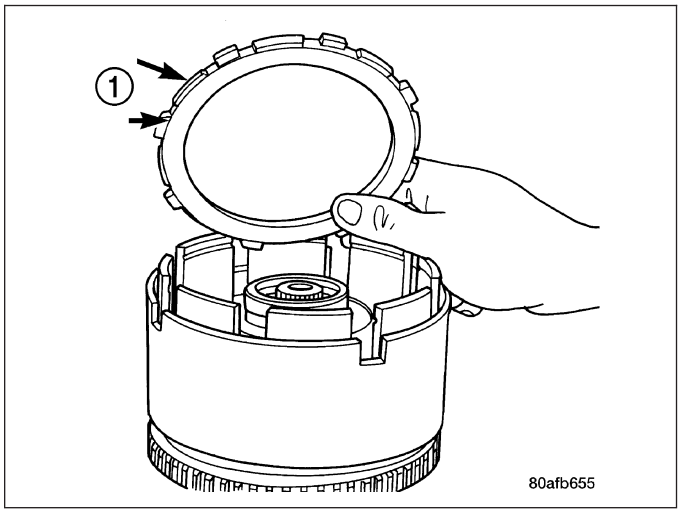
13. Install the UD clutch flat snap ring (1).



14. Install the last UD clutch disc (1).

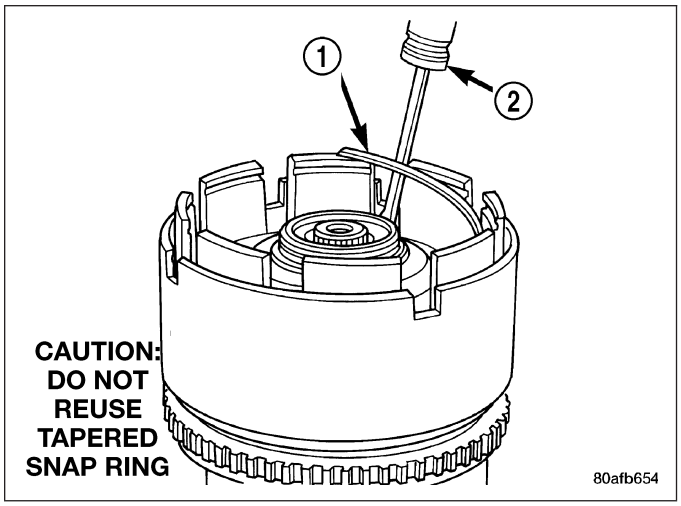


15. Install the OD/UD clutch reaction plate (1). The OD/UD clutches reaction plate has a step on both sides. Install the OD/UD clutches reaction plate tapered step side up.

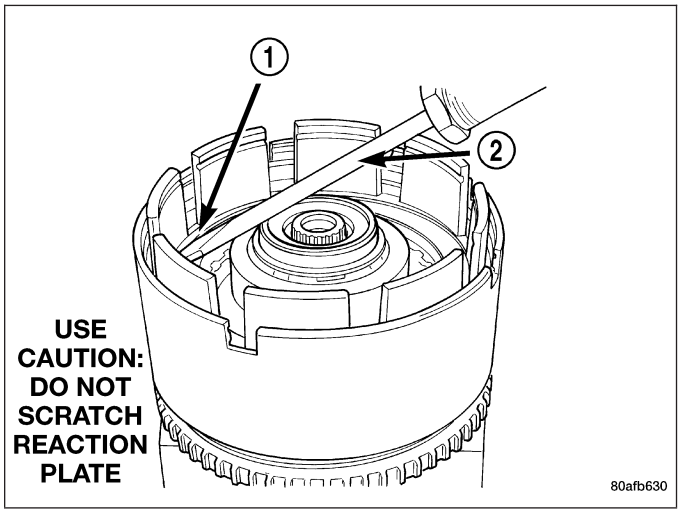


NOTE: Snap ring ends must be located within one finger of the input clutch hub. Be sure that snap ring is fully seated, by pushing with screwdriver, into snap ring groove all the way around.

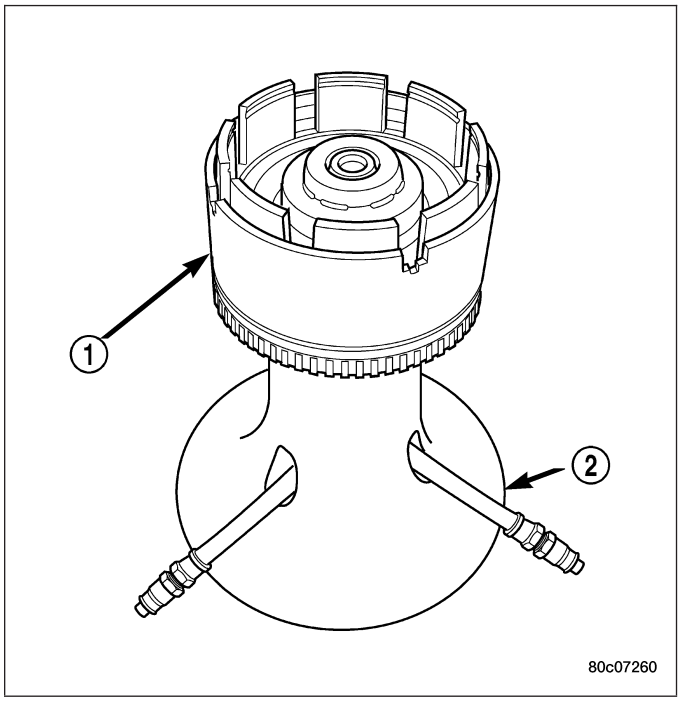
16. Install the UD/OD tapered snap ring (1).



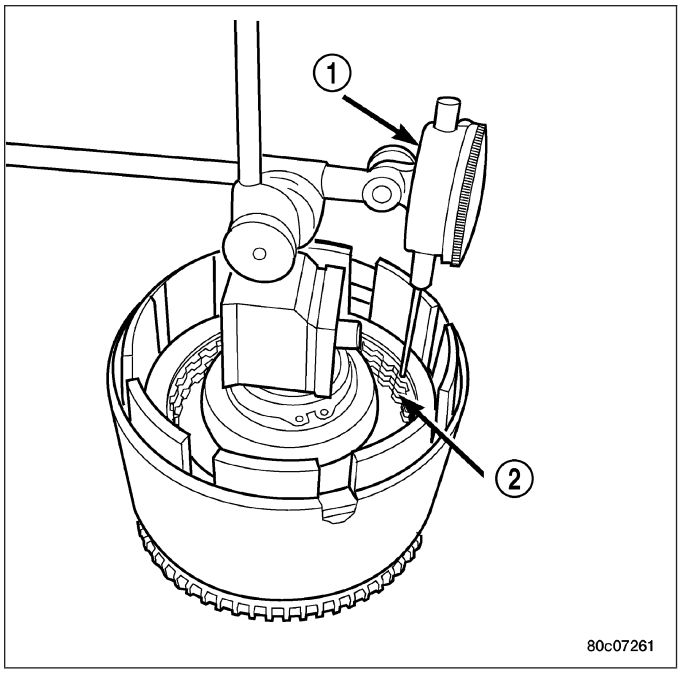
17. Seat tapered snap ring (1) to ensure proper installation.



18. Install input clutch assembly (1) to the Input Clutch Pressure Fixture 8391 (2).



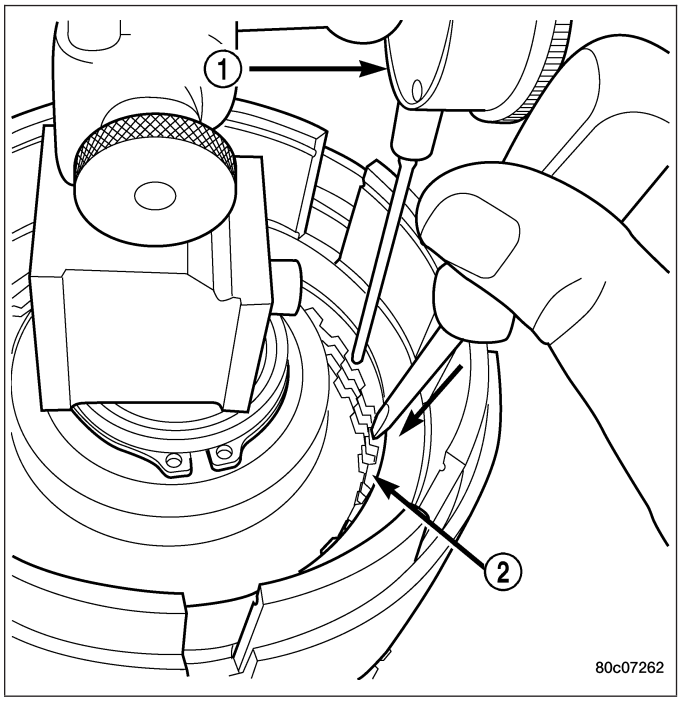
19. Set up dial indicator (1) on the UD clutch pack (2).



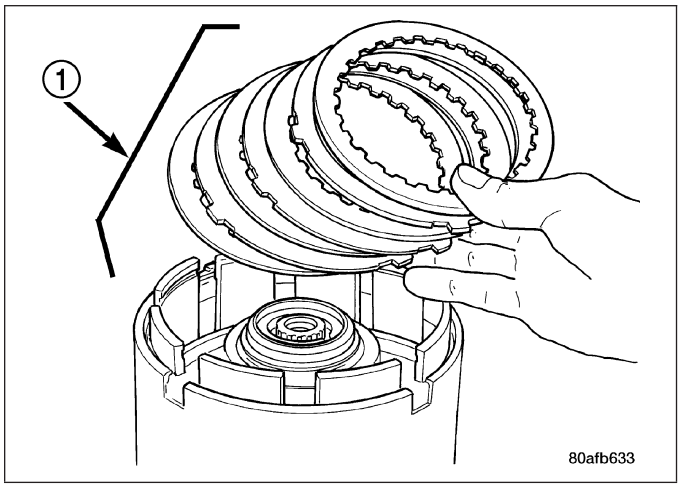
20. Using moderate pressure, press down and hold (near indicator) the UD clutch pack (2) with screwdriver or suitable tool and zero dial indicator (1). When releasing pressure on clutch pack, indicator reading should advance 0.005-0.010 inches.

CAUTION: Do not apply more than 30 psi (206 kPa) to the underdrive clutch pack.

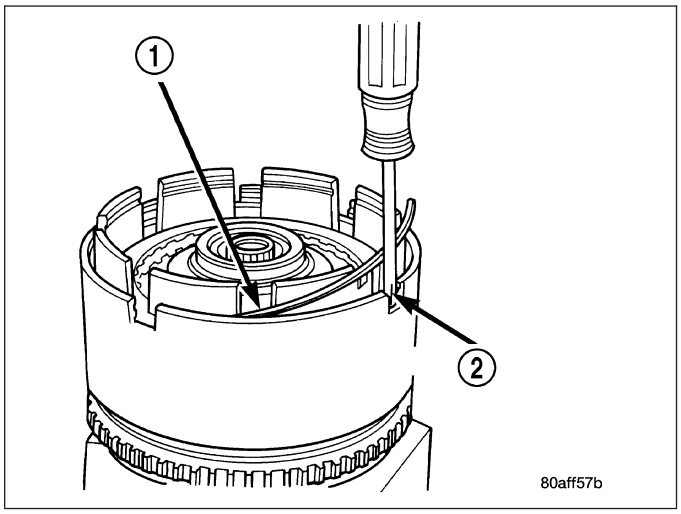
21. Apply 30 psi (206 kPa) to the underdrive hose on Tool 8391 and measure UD clutch clearance. Measure and record UD clutch pack measurement in four (4) places, 90° apart.
22. Take average of four measurements and compare with UD clutch pack clearance specification. **Underdrive clutch pack clearance must be 0.94-1.50 mm (0.037-0.059 in.).**
23. If necessary, select the proper reaction plate to achieve specifications.



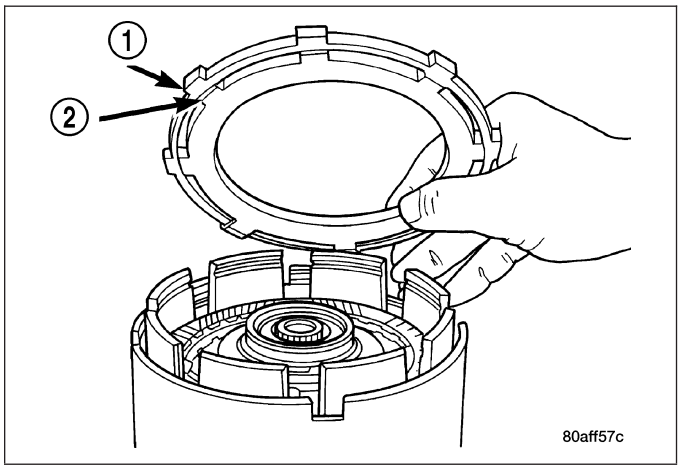
24. Install the OD clutch pack (four fibers/three steels) (1).



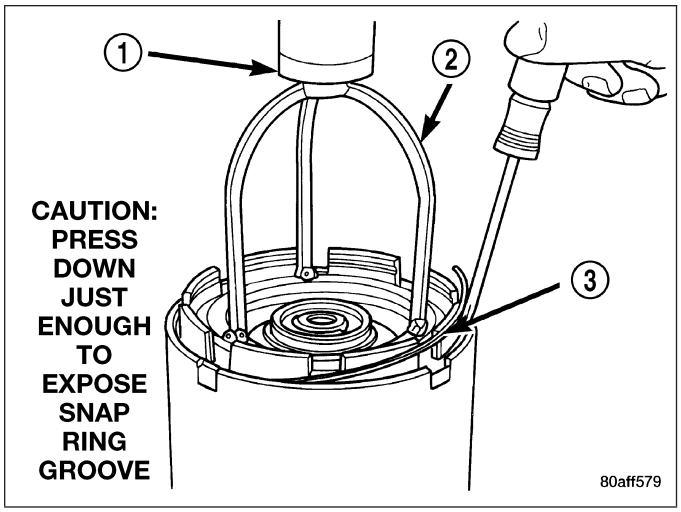
25. Install OD reaction plate waved snap ring (1).



26. Install the OD/Reverse reaction plate (1) with large step down (towards OD clutch pack).

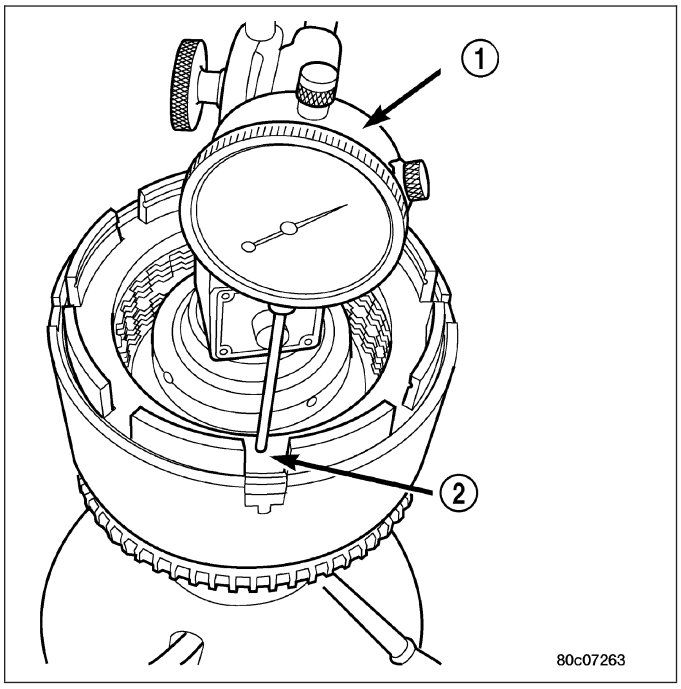


27. Install OD reaction plate flat snap ring (3).

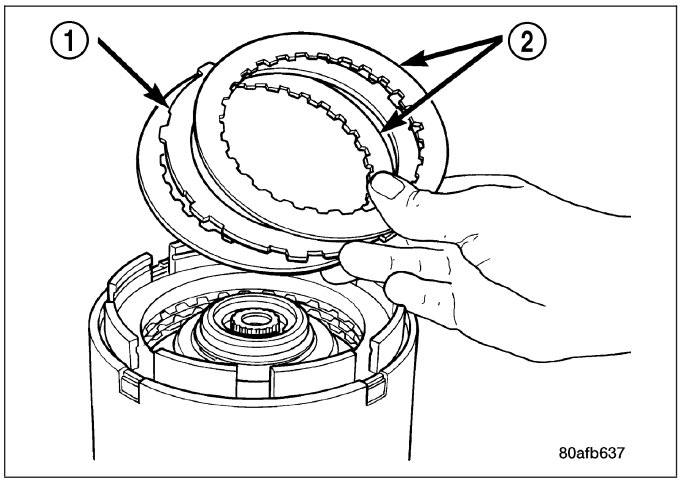


28. Measure OD clutch pack clearance. Set up dial indicator (1) on top of the OD/Reverse reaction plate (2).
29. Zero dial indicator and apply 30 psi (206 kPa) air pressure to the overdrive clutch hose on Tool 8391. Measure and record OD clutch pack measurement in four (4) places, 90° apart.
30. Take average of four measurements and compare with OD clutch pack clearance specification. **The overdrive (OD) clutch pack clearance is 1.07-3.25 mm (0.042-0.128 in.).**

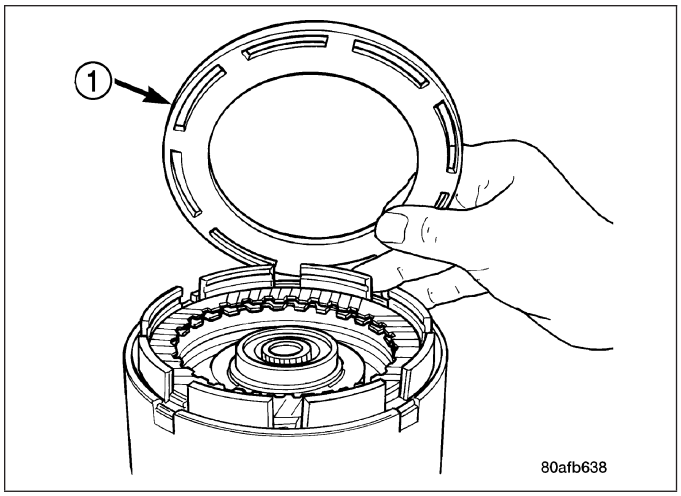
If not within specifications, the clutch is not assembled properly. There is no adjustment for the OD clutch clearance.



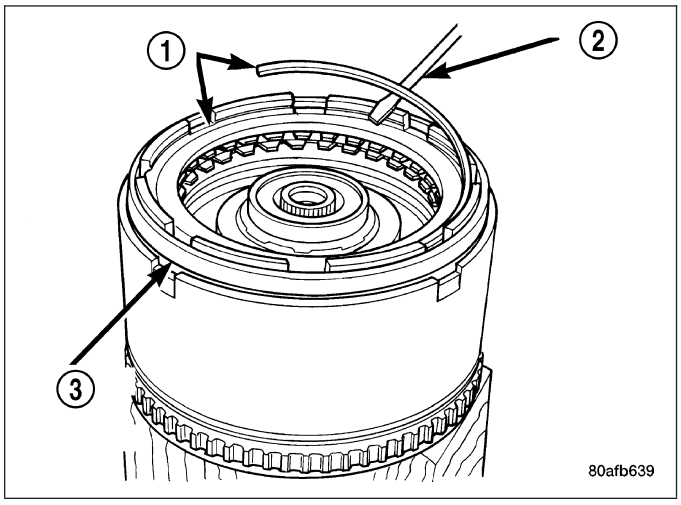
31. Install reverse clutch pack (two fibers/one steel) (1, 2).



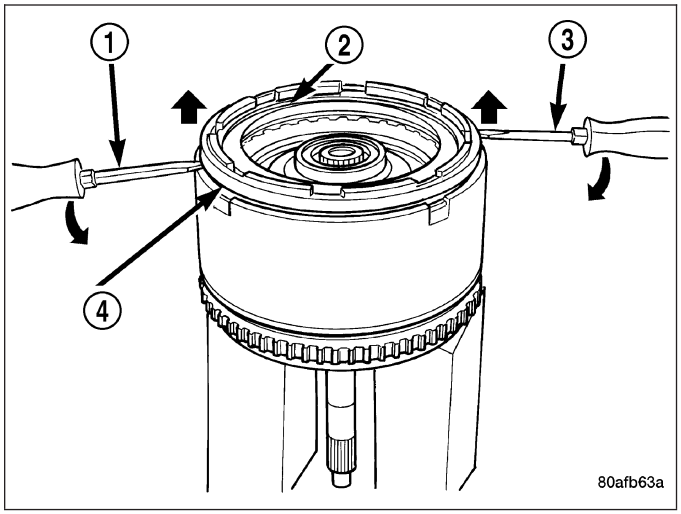
32. Install reverse clutch reaction plate (1) with the flat side down towards reverse clutch.



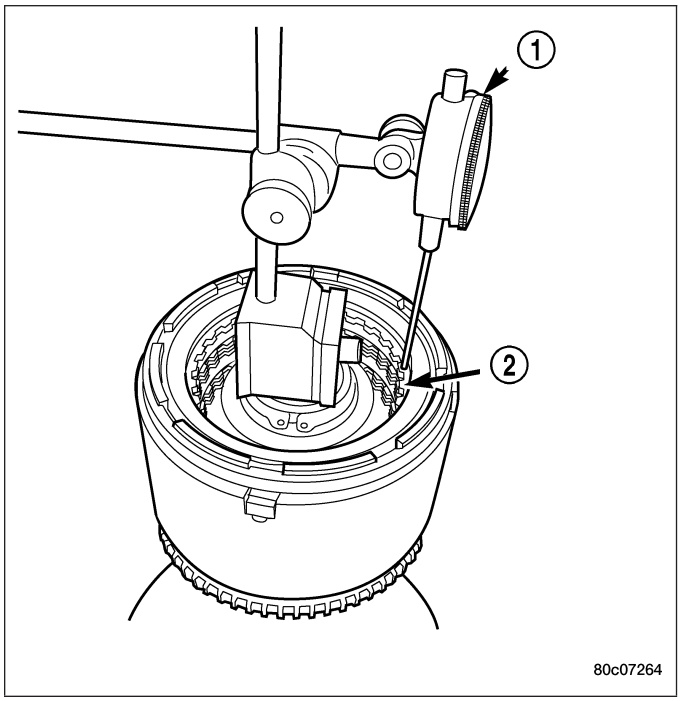
33. Tap reaction plate (3) down to allow installation of the reverse clutch snap ring (1). Install reverse clutch snap ring (1).



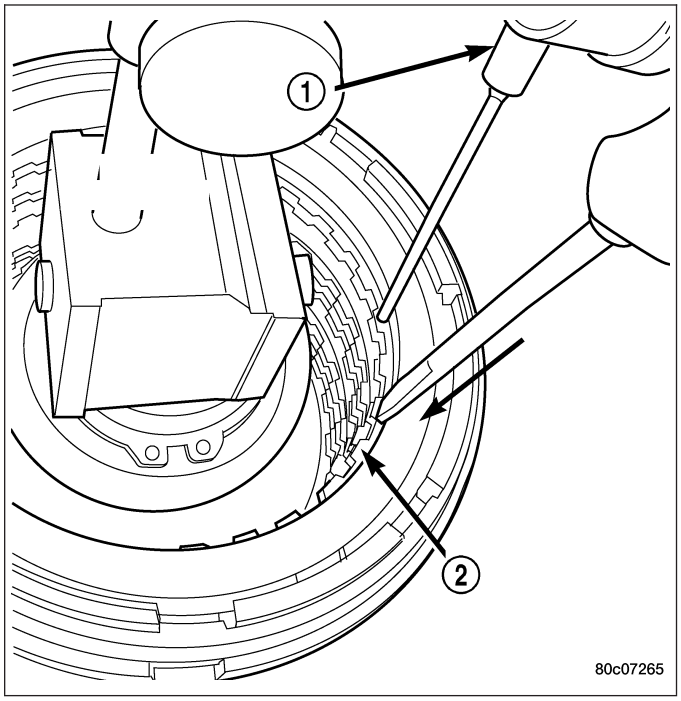
34. Pry up reverse reaction plate (4) to seat against snap ring (2).



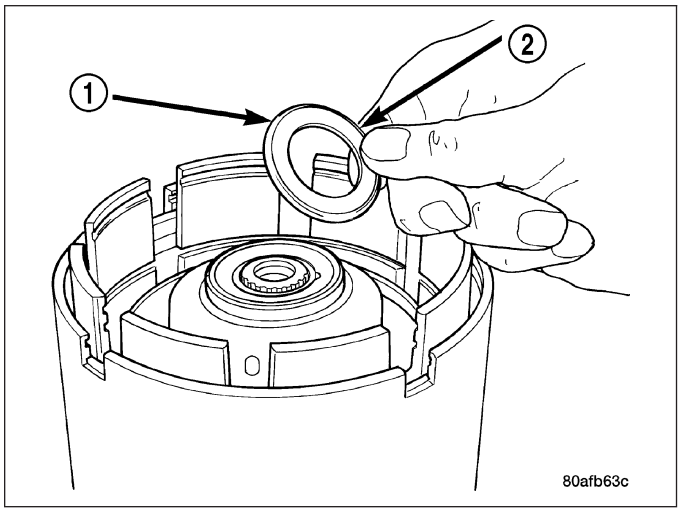
35. Set up a dial indicator (1) on the reverse clutch pack (2).



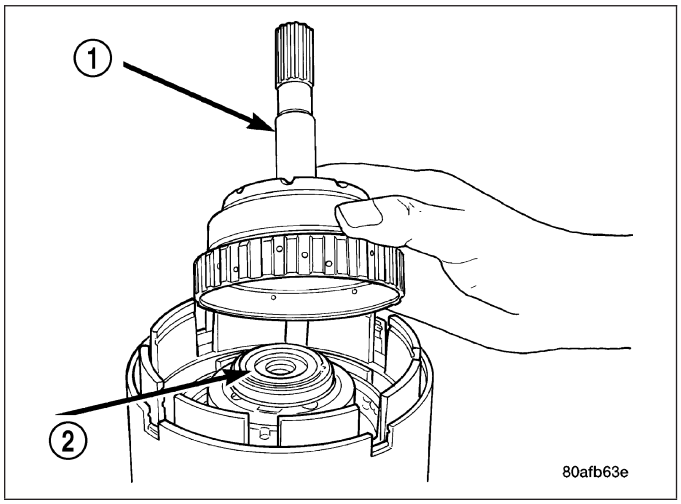
36. Using moderate pressure, press down and hold (near indicator) reverse clutch disc (2) with screwdriver or suitable tool and zero dial indicator (1). When releasing pressure, indicator should advance 0.005-0.010 inches as clutch pack relaxes.
37. Apply 30 psi (206 kPa) air pressure to the reverse clutch hose on Tool 8391. Measure and record reverse clutch pack measurement in four (4) places, 90° apart.
38. Take average of four measurements and compare with reverse clutch pack clearance specification. **The reverse clutch pack clearance is 0.89-1.37 mm (0.035-0.054 in.).** Select the proper reverse clutch snap ring to achieve specifications.
39. To complete the assembly, reverse clutch and overdrive clutch must be removed.



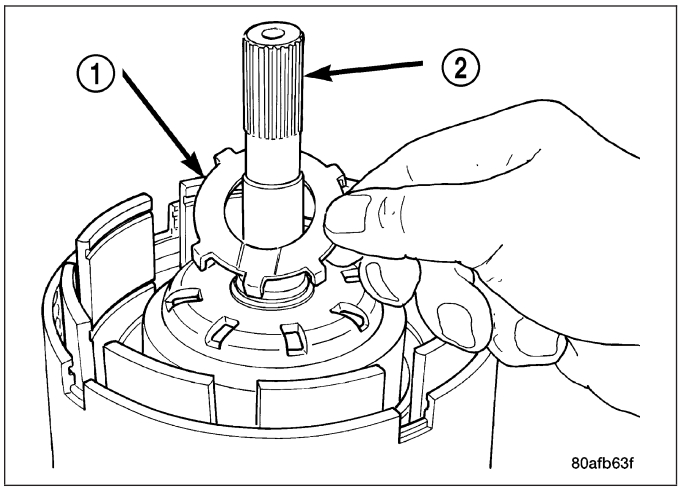
40. Install the number 2 needle bearing (1).



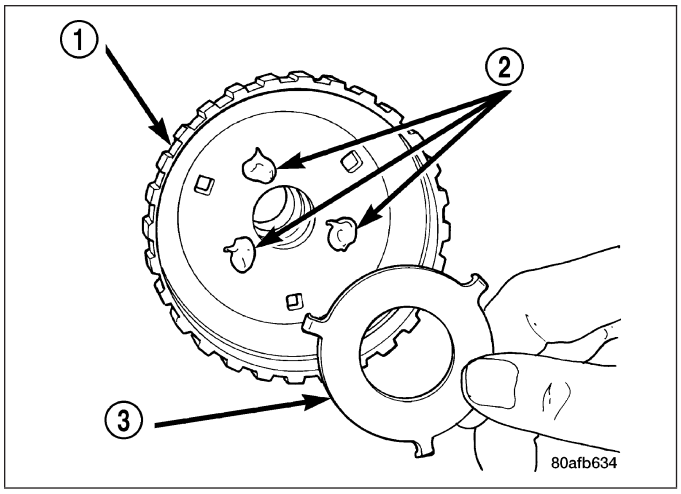
41. Install the underdrive shaft assembly (1).



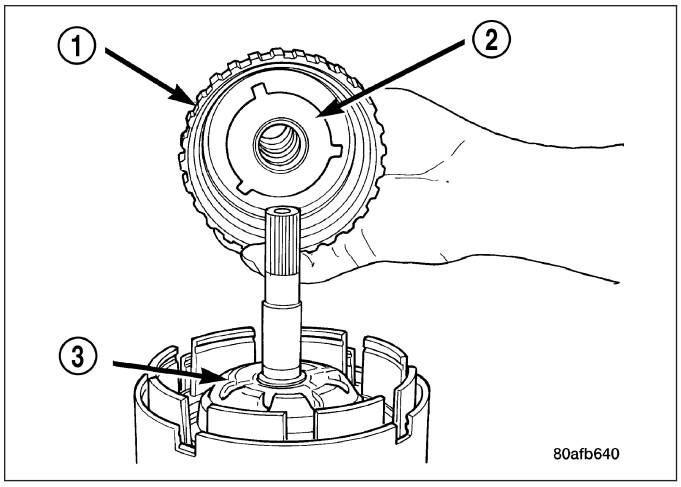
42. Install the number 3 thrust washer (1) to the underdrive shaft assembly (2). Be sure five tabs are seated properly.



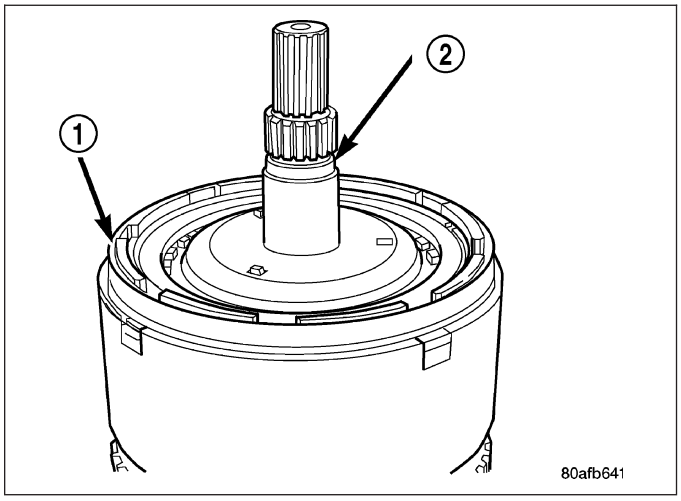
43. Install the number 3 thrust plate (3) to the bottom of the overdrive shaft assembly (1). Retain with petrolatum or transmission assembly gel (2).



44. Install the overdrive shaft assembly (1).



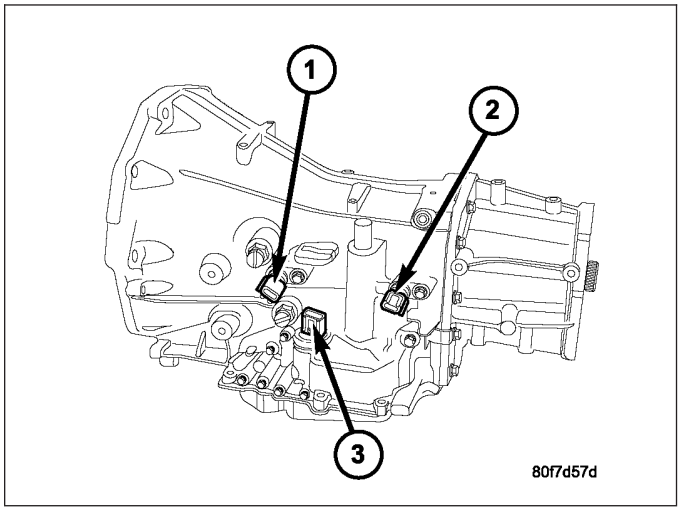
45. Reinstall overdrive and reverse clutch. **Rechecking these clutch clearances is not necessary.**



SENSOR-INPUT SPEED

DESCRIPTION

The Input (1) and Output (2) Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).



OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

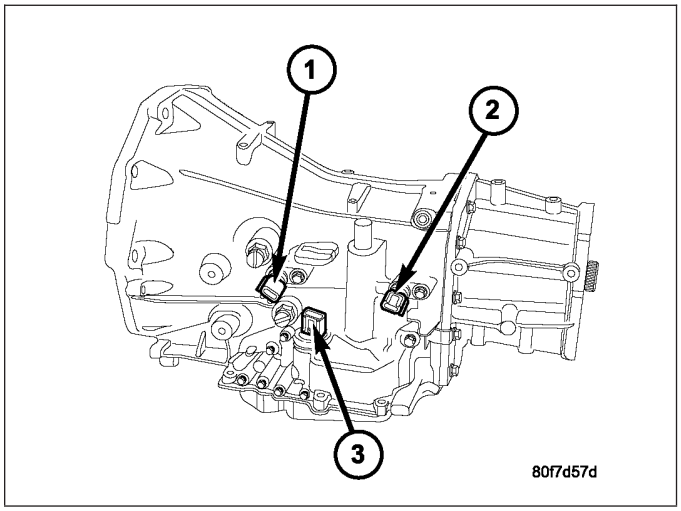
- Torque converter clutch slippage
- Torque converter element speed ratio

REMOVAL

1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the input speed sensor.

NOTE: The speed sensor bolt has a sealing patch applied from the factory. Be sure to reuse the same bolt.

4. Remove the bolt holding the input speed sensor to the transmission case.
5. Remove the input speed sensor from the transmission case.

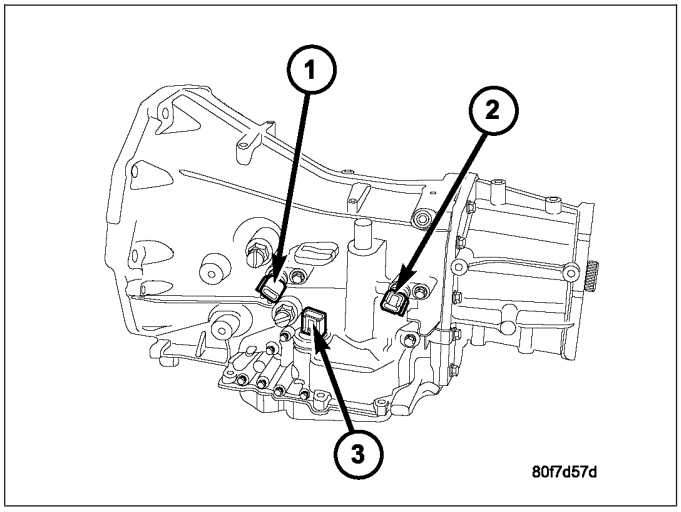


INSTALLATION

1. Install the input speed sensor (1) into the transmission case.

NOTE: Before installing the speed sensor bolt, it will be necessary to replentish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

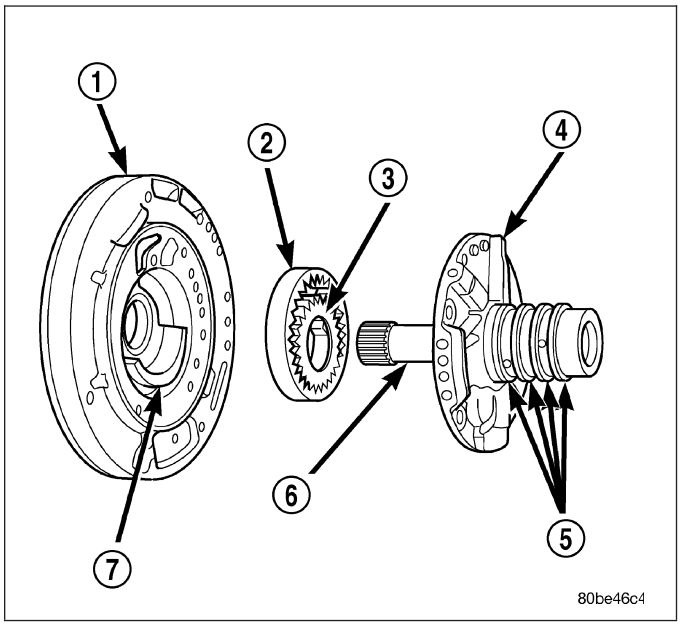
2. Install the bolt to hold the input speed sensor into the transmission case. Tighten the bolt to 9 N·m (80 in.lbs.).
3. Install the wiring connector onto the input speed sensor
4. Verify the transmission fluid level. Add fluid as necessary.
5. Lower vehicle.



PUMP-OIL

DESCRIPTION

The oil pump is located in the pump housing inside the bell housing of the transmission case. The oil pump assembly consists of an inner (3) and outer (2) gear, a housing (1), and a cover that also serves as the reaction shaft support (6).

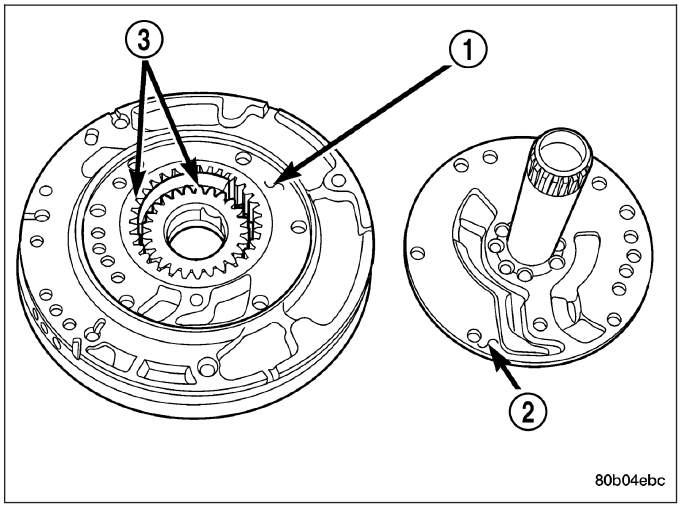


OPERATION

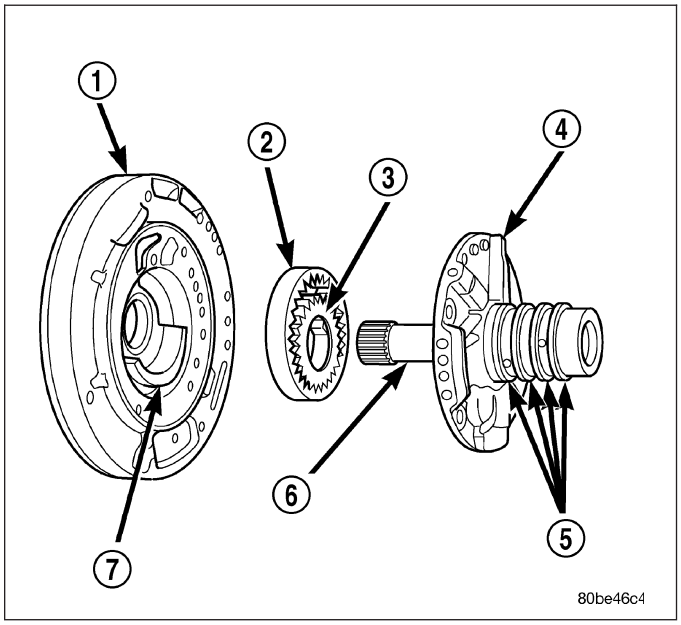
As the torque converter rotates, the converter hub rotates the inner and outer gears. As the gears rotate, the clearance between the gear teeth increases in the crescent area, and creates a suction at the inlet side of the pump. This suction draws fluid through the pump inlet from the oil pan. As the clearance between the gear teeth in the crescent area decreases, it forces pressurized fluid into the pump outlet and to the valve body.

DISASSEMBLY

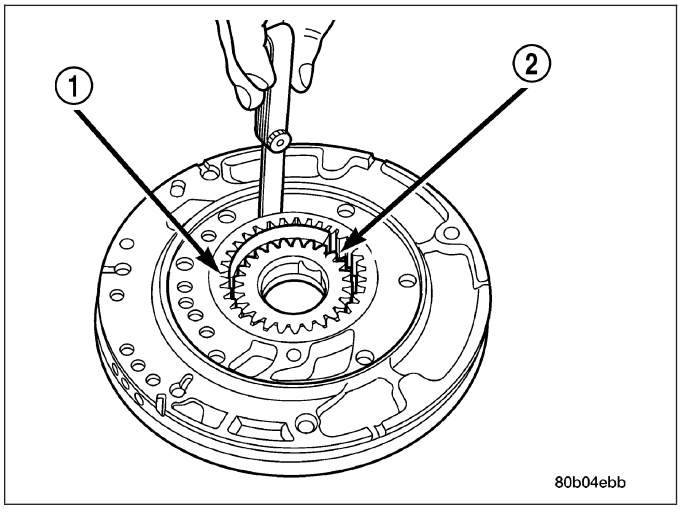
1. Remove the reaction shaft support bolts.
2. Remove the reaction shaft support(2) from the pump housing (1).



3. Remove the pump gears (2, 3) and check for wear and damage on pump housing (1) and gears (2, 3).



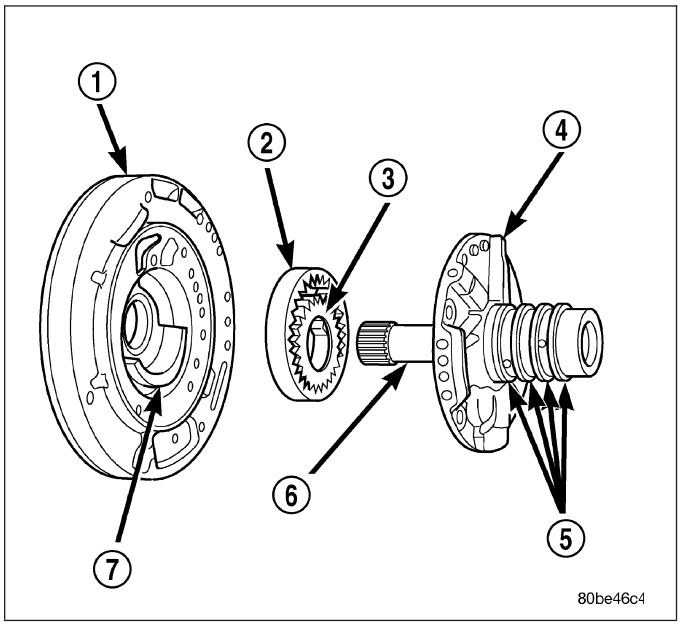
4. Re-install the gears and check clearances.
5. Measure the clearance between the outer gear (1) and the pump pocket (2). Clearance should be 0.089-0.202 mm (0.0035-0.0079 in.).
6. Measure clearance between outer gear and crescent. Clearance should be 0.060-0.298 mm (0.0023-0.0117 in.).
7. Measure clearance between inner gear and crescent. Clearance should be 0.093-0.385 mm (0.0036-0.0151 in.).
8. Position an appropriate piece of Plastigage across both pump gears.
9. Align the Plastigage to a flat area on the reaction shaft support housing.



10. Install the reaction shaft to the pump housing. Tighten the bolts to 27 N·m (20 ft. lbs.).
11. Remove bolts and carefully separate the housings. Measure the Plastigage following the instructions supplied.
12. Clearance between outer gear side and the reaction shaft support should be 0.020-0.046 mm (0.0008-0.0018 in.). Clearance between inner gear side and the reaction shaft support should be 0.020-0.046 mm (0.0008-0.0018 in.).

ASSEMBLY

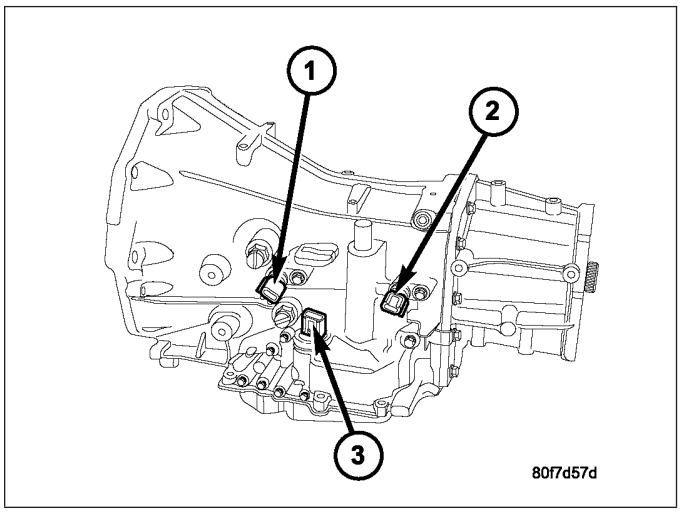
1. Assemble oil pump as shown
2. Install and torque reaction shaft support-to-oil pump housing bolts to 28 N·m (20 ft. lbs.) torque.



SENSOR-OUTPUT SPEED

DESCRIPTION

The Input (1) and Output (2) Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).



OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

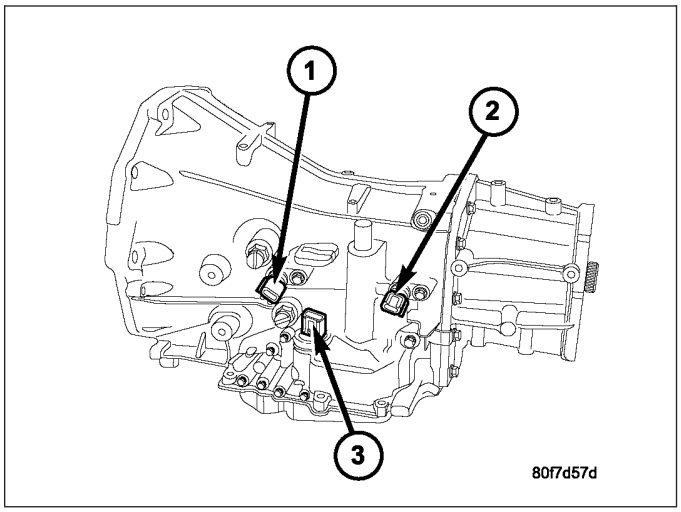
- Torque converter clutch slippage
- Torque converter element speed ratio

REMOVAL

1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the output speed sensor (2).

NOTE: The speed sensor bolt has a sealing patch applied from the factory. Be sure to reuse the same bolt.

4. Remove the bolt holding the output speed sensor to the transmission case.
5. Remove the output speed sensor (2) from the transmission case.

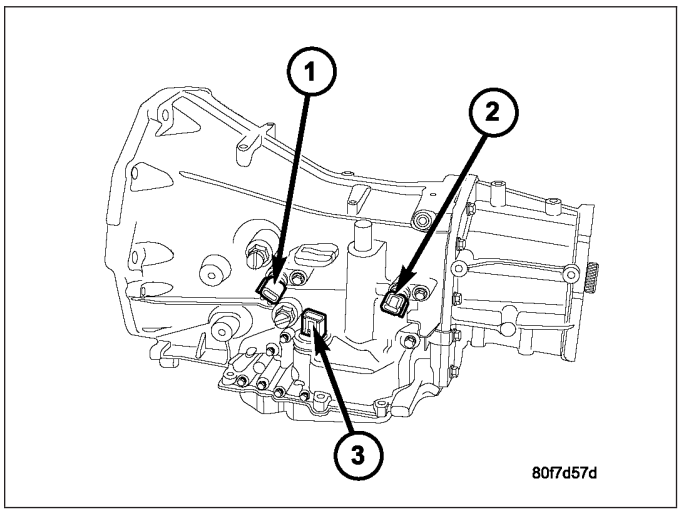


INSTALLATION

1. Install the output speed sensor (2) into the transmission case.

NOTE: Before installing the speed sensor bolt, it will be necessary to replentish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

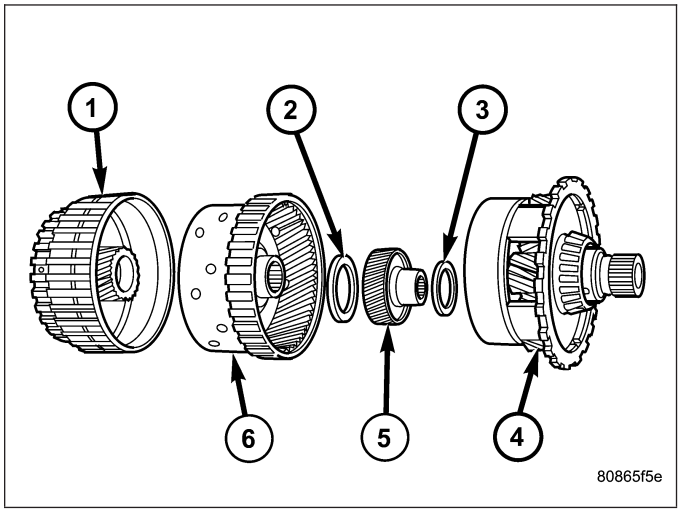
2. Install the bolt to hold the output speed sensor into the transmission case. Tighten the bolt to 9 N·m (80 in.lbs.).
3. Install the wiring connector onto the output speed sensor
4. Verify the transmission fluid level. Add fluid as necessary.
5. Lower vehicle.



GEARTRAIN-PLANETARY

DESCRIPTION

The planetary geartrain is located between the input clutch assembly and the rear of the transmission case. The planetary geartrain consists of two sun gears, two planetary carriers, two annulus (ring) gears, and one output shaft.



OPERATION

The planetary geartrain utilizes two planetary gear sets that connect the transmission input shaft to the output shaft. Input and holding clutches drive or lock different planetary members to change output ratio or direction.

SEAL-OIL PUMP

REMOVAL

1. Remove the transmission from the vehicle (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - REMOVAL).
2. Remove the torque converter from the transmission bellhousing.
3. Use special tool C-3981B to remove oil pump seal.

INSTALLATION

1. Clean and inspect oil pump seal seat. Then install seal using special tool C-4193-A.
2. Clean and inspect torque converter hub. If nicks, scratches or hub wear are found, torque converter replacement will be required.

CAUTION: If the torque converter is being replaced, apply a light coating of grease to the crankshaft pilot hole. Also inspect the engine drive plate for cracks. If any cracks are found replace the drive plate. Do not attempt to repair a cracked drive plate. Always use new torque converter to drive plate bolts.

3. Apply a light film of transmission oil to the torque converter hub and oil seal lips. Then install torque converter into transmission. Be sure that the hub lugs mesh with the front pump lugs when installing.
4. Reinstall the transmission into the vehicle. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - INSTALLATION)

MECHANISM-SHIFT

DESCRIPTION

The gear shift mechanism provides six shift positions which are:

- Park (P)
- Reverse (R)
- Neutral (N)

- Drive (D)
- Manual second (2)
- Manual low (1)

OPERATION

MANUAL LOW (1) range provides FIRST gear only. Overrun braking is also provided in this range. MANUAL SECOND (2) range provides FIRST and SECOND gear only.

DRIVE range provides FIRST, SECOND, THIRD and OVERDRIVE FOURTH gear ranges. The shift into OVERDRIVE FOURTH gear range occurs only after the transmission has completed the shift into D THIRD gear range. No further movement of the shift mechanism is required to complete the 3-4 shift.

The FOURTH gear upshift occurs automatically when the overdrive selector switch is in the ON position. An upshift to FOURTH gear may not occur or may be delayed in some of the possible shift schedules. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - OPERATION)

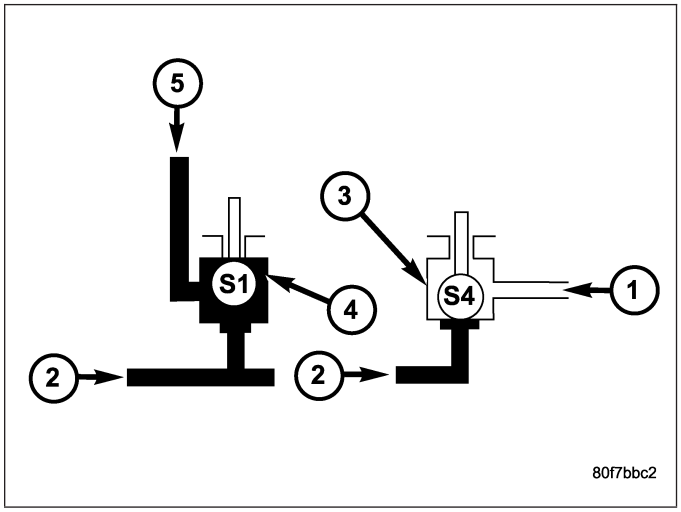
SOLENOID

DESCRIPTION

The typical electrical solenoid used in automotive applications is a linear actuator. It is a device that produces motion in a straight line. This straight line motion can be either forward or backward in direction, and short or long distance.

A solenoid is an electromechanical device that uses a magnetic force to perform work. It consists of a coil of wire, wrapped around a magnetic core made from steel or iron, and a spring loaded, movable plunger, which performs the work, or straight line motion.

The solenoids used in transmission applications are attached to valves which can be classified as **normally open** or **normally closed.** The **normally open** solenoid valve is defined as a valve which allows hydraulic flow when no current or voltage is applied to the solenoid. The **normally closed** solenoid valve is defined as a valve which does not allow hydraulic flow when no current or voltage is applied to the solenoid. These valves perform hydraulic control functions for the transmission and must therefore be durable and tolerant of dirt particles. For these reasons, the valves have hardened steel poppets and ball valves. The solenoids operate the valves directly, which means that the solenoids must have very high outputs to close the valves against the sizable flow areas and line pressures found in current transmissions. Fast response time is also necessary to ensure accurate control of the transmission.



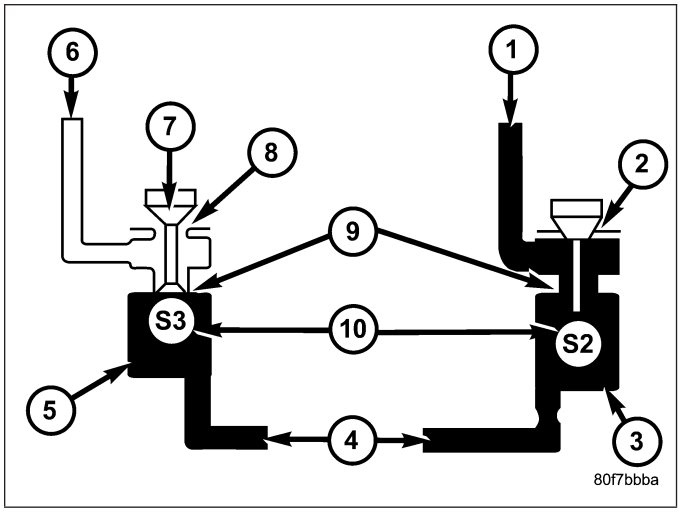
1 - MANUAL VALVE
2 - LINE PRESSURE
3 - 2/4 - LOW REVERSE SOLENOID ENERGIZED
4 - UNDERDRIVE SOLENOID DE-ENERGIZED
5 - UNDERDRIVE CLUTCH

The strength of the magnetic field is the primary force that determines the speed of operation in a particular solenoid design. A stronger magnetic field will cause the plunger to move at a greater speed than a weaker one. There are basically two ways to increase the force of the magnetic field:

1. Increase the amount of current applied to the coil or
2. Increase the number of turns of wire in the coil.

The most common practice is to increase the number of turns by using thin wire that can completely fill the available space within the solenoid housing. The strength of the spring and the length of the plunger also contribute to the response speed possible by a particular solenoid design.

A solenoid can also be described by the method by which it is controlled. Some of the possibilities include variable force, pulse-width modulated, constant ON, or duty cycle. The variable force and pulse-width modulated versions utilize similar methods to control the current flow through the solenoid to position the solenoid plunger at a desired position somewhere between full ON and full OFF. The constant ON and duty cycled versions control the voltage across the solenoid to allow either full flow or no flow through the solenoid's valve.



1 - OVERDRIVE CLUTCH
2 - NO VENT
3 - OVERDRIVE SOLENOID ENERGIZED
4 - MANUAL VALVE
5 - LOW REVERSE/CONVERTER CLUTCH SOLENOID DE-ENERGIZED
6 - SOLENOID SWITCH VALVE
7 - TAPER
8 - VENT TO SUMP
9 - ORIFICE
10 - CHECK BALL

OPERATION

When an electrical current is applied to the solenoid coil, a magnetic field is created which produces an attraction to the plunger, causing the plunger to move and work against the spring pressure and the load applied by the fluid the valve is controlling. The plunger is normally directly attached to the valve which it is to operate. When the current is removed from the coil, the attraction is removed and the plunger will return to its original position due to spring pressure.

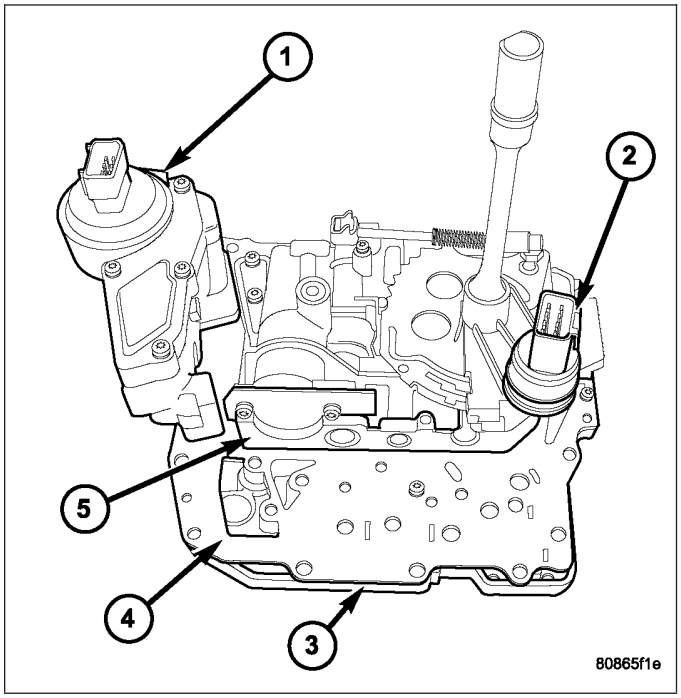
The plunger is made of a conductive material and accomplishes this movement by providing a path for the magnetic field to flow. By keeping the air gap between the plunger and the coil to the minimum necessary to allow free movement of the plunger, the magnetic field is maximized.

ASSEMBLY-TRANSMISSION SOLENOID/PRESSURE SWITCH

DESCRIPTION

The Solenoid/Pressure Switch Assembly (1) is inside the transmission and mounted to the valve body assembly. The assembly consists of four solenoids that control hydraulic pressure to the L/R, 2/4, OD, and UD friction elements (transmission clutches), and the torque converter clutch. The reverse clutch is controlled by line pressure from the manual valve in the valve body. The solenoids are contained within the Solenoid/Pressure Switch Assembly, and can only be serviced by replacing the assembly.

The solenoid assembly also contains pressure switches that monitor and send hydraulic circuit information to the TCM. Likewise, the pressure switches can only be service by replacing the assembly.



OPERATION

SOLENOIDS

The solenoids receive electrical power from the Transmission Control Relay through a single wire. The TCM energizes or operates the solenoids individually by grounding the return wire of the solenoid needed. When a solenoid is energized, the solenoid valve shifts, and a fluid passage is opened or closed (vented or applied), depending on its default operating state. The result is an apply or release of a frictional element.

The 2/4 and UD solenoids are normally applied, which allows fluid to pass through in their relaxed or “off” state. By design, this allows transmission limp-in (P,R,N,2) in the event of an electrical failure.

The continuity of the solenoids and circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the TCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a speed ratio or pressure switch error occurs.

PRESSURE SWITCHES

The TCM relies on three pressure switches to monitor fluid pressure in the L/R, 2/4, and OD hydraulic circuits. The primary purpose of these switches is to help the TCM detect when clutch circuit hydraulic failures occur. The range for the pressure switch closing and opening points is 11-23 psi. Typically the switch opening point will be approximately one psi lower than the closing point. For example, a switch may close at 18 psi and open at 17 psi. The switches are continuously monitored by the TCM for the correct states (open or closed) in each gear as shown in the following chart:

PRESSURE SWITCH STATES

GEAR	L/R	2/4	OD
R	OP	OP	OP
P/N	CL	OP	OP
1st	CL	OP	OP
2nd	OP	CL	OP
D	OP	OP	CL
OD	OP	CL	CL

OP = OPEN

CL = CLOSED

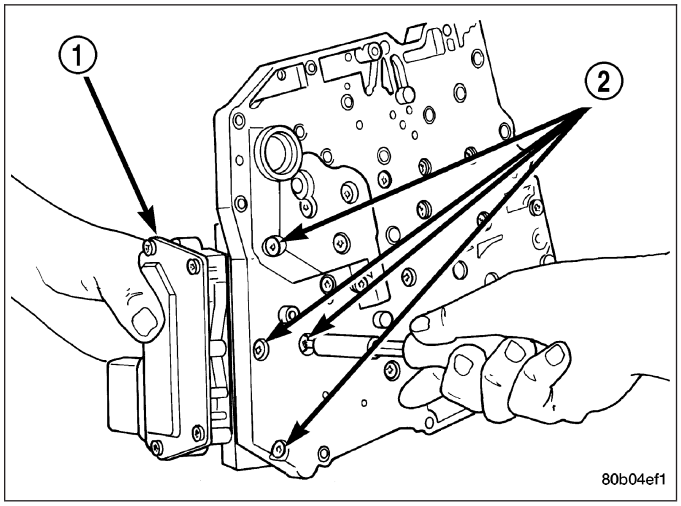
A Diagnostic Trouble Code (DTC) will set if the TCM senses any switch open or closed at the wrong time in a given gear.

The TCM also tests the 2/4 and OD pressure switches when they are normally off (OD and 2/4 are tested in 1st gear, OD in 2nd gear, and 2/4 in 3rd gear). The test simply verifies that they are operational, by looking for a closed state when the corresponding element is applied. Immediately after a shift into 1st, 2nd, or 3rd gear with the engine speed above 1000 rpm, the TCM momentarily turns on element pressure to the 2/4 and/or OD clutch circuits to identify that the appropriate switch has closed. If it doesn't close, it is tested again. If the switch fails to close the second time, the appropriate Diagnostic Trouble Code (DTC) will set.

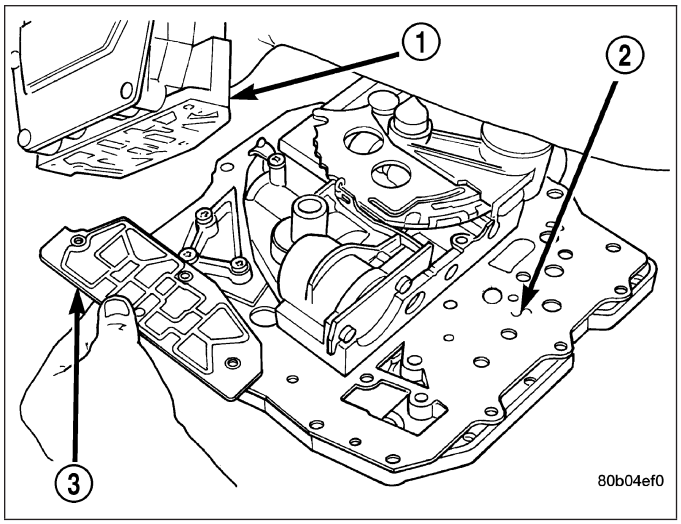
REMOVAL

NOTE: If the Solenoid/Pressure Switch Assembly is being replaced, the Quick Learn Procedure must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

1. Raise vehicle on hoist.
2. Remove valve body assembly from transmission. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/VALVE BODY - REMOVAL)
3. Remove Solenoid/Pressure Switch Assembly retaining screws (2) from solenoid.



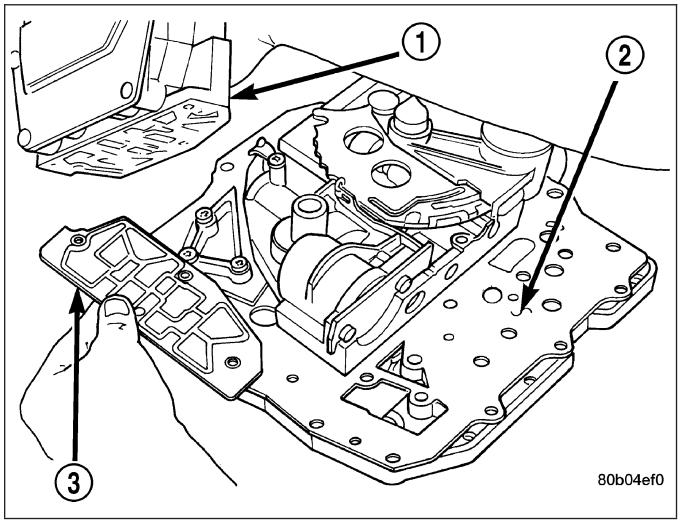
4. Remove Solenoid/Pressure Switch Assembly (1) and screen from valve body (2).



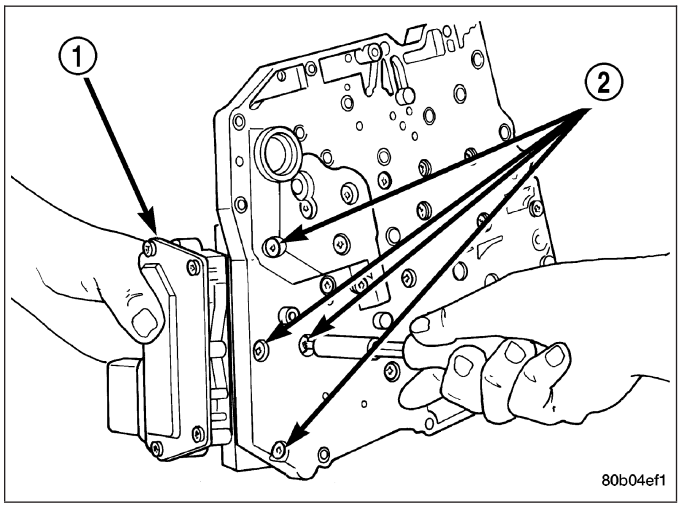
INSTALLATION

NOTE: If the Solenoid/Pressure Switch assembly is being replaced, the Quick Learn Procedure must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

1. Install Solenoid/Pressure Switch Assembly (1) and screen (3) to the separator and transfer plates.



2. Install and tighten retaining screws (2) to 5.5 N·m (50 in. lbs.) torque.
3. Install valve body. (Refer to 21 - TRANSMISSION/ AUTOMATIC - 42RLE/VALVE BODY - INSTALLATION)



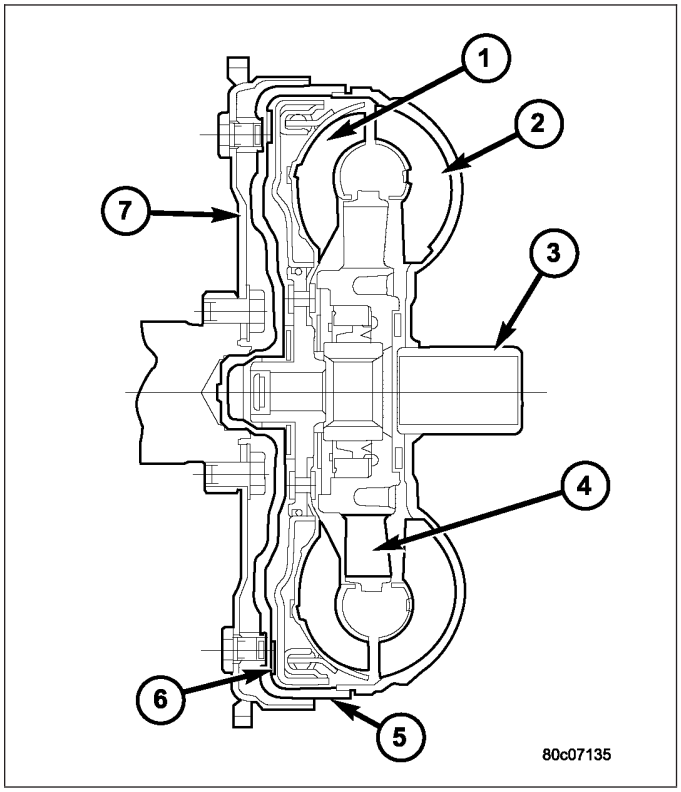
CONVERTER-TORQUE

DESCRIPTION

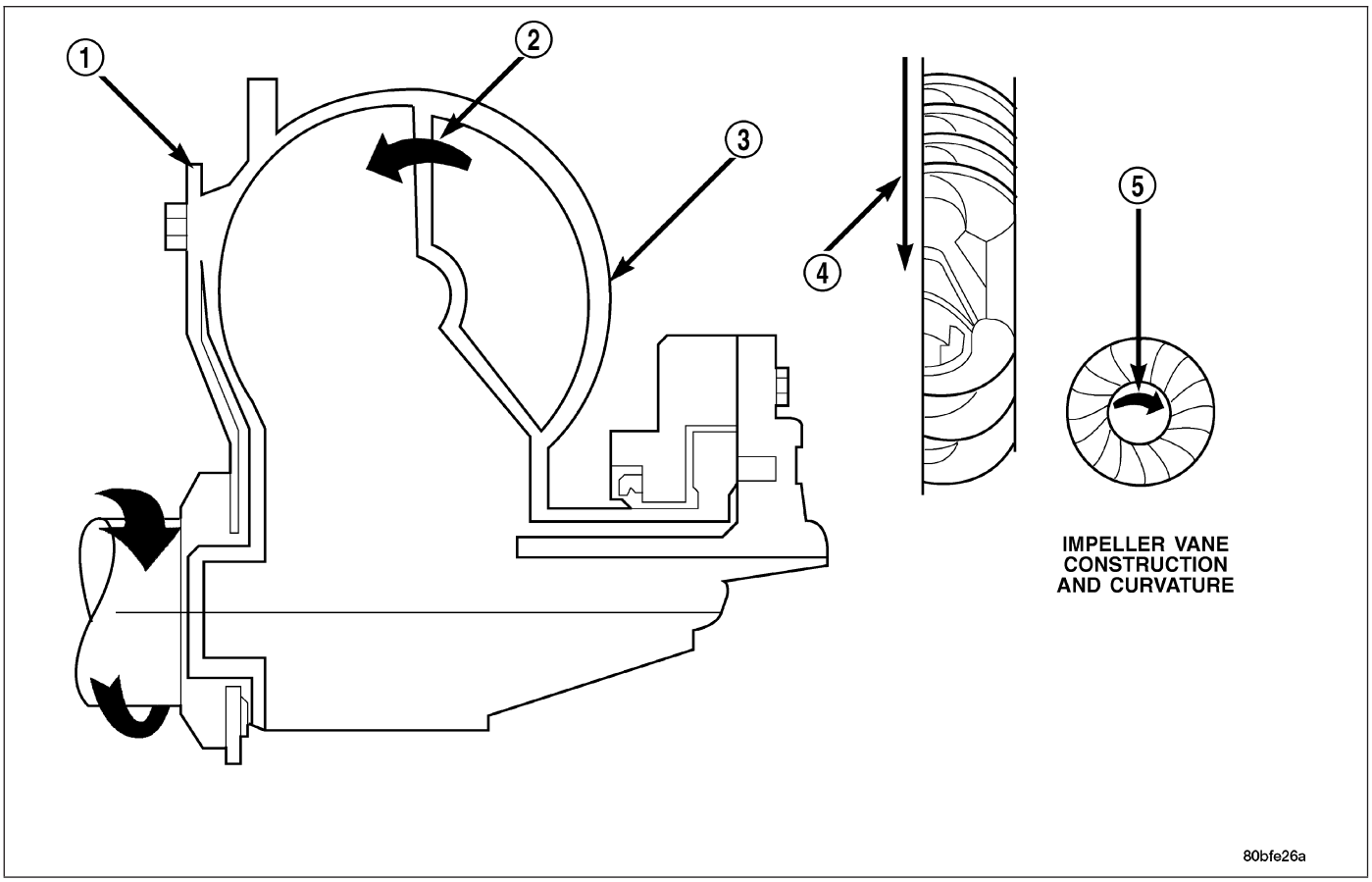
The torque converter is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller and an electronically applied converter clutch. The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The torque converter hub drives the transmission oil (fluid) pump.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid.



IMPELLER

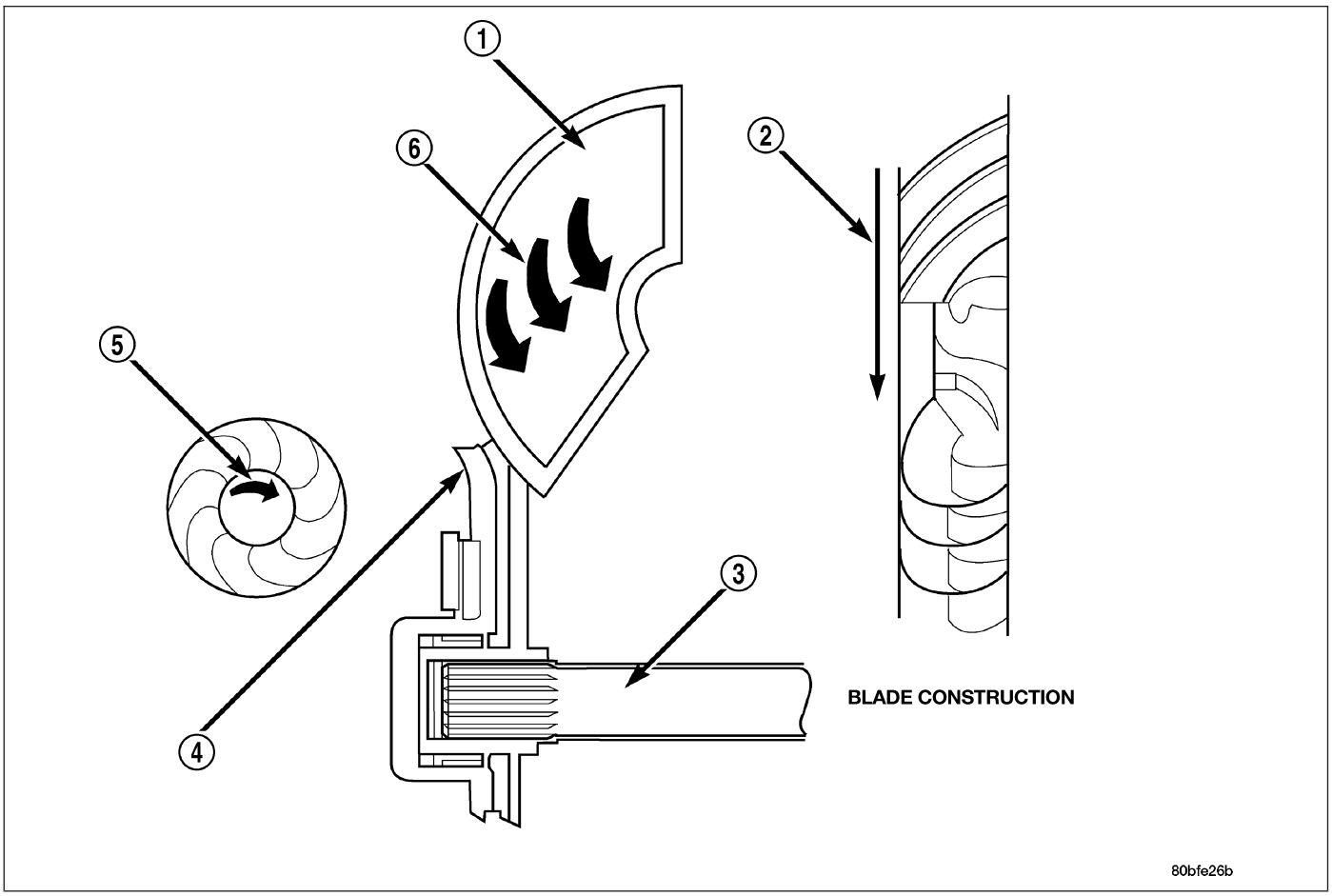


Impeller

1 - ENGINE FLEXPLATE
2 - OIL FLOW FROM IMPELLER SECTION INTO TURBINE SECTION
3 - IMPELLER VANES AND COVER ARE INTEGRAL
4 - ENGINE ROTATION
5 - ENGINE ROTATION

The impeller is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the impeller, because they are one and the same and are the driving members of the system.

TURBINE



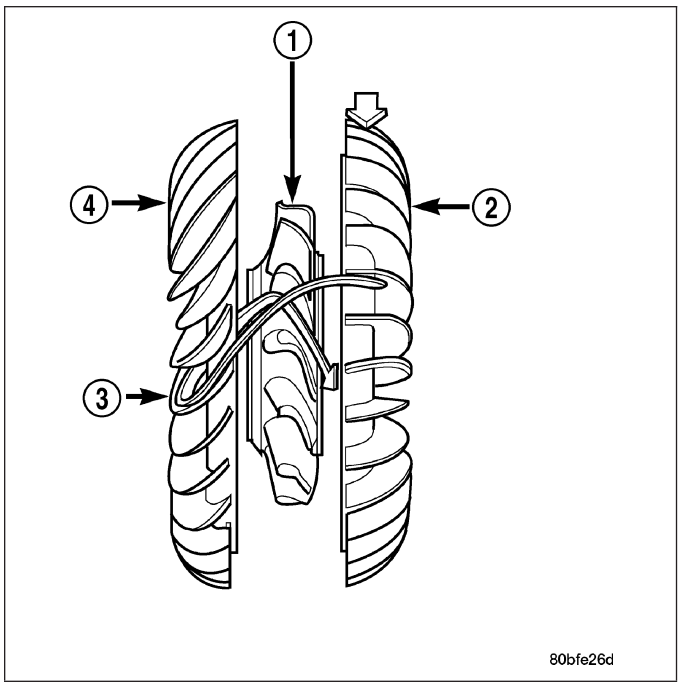
Turbine

1 - TURBINE VANE
2 - ENGINE ROTATION
3 - INPUT SHAFT
4 - PORTION OF TORQUE CONVERTER COVER
5 - ENGINE ROTATION
6 - OIL FLOW WITHIN TURBINE SECTION

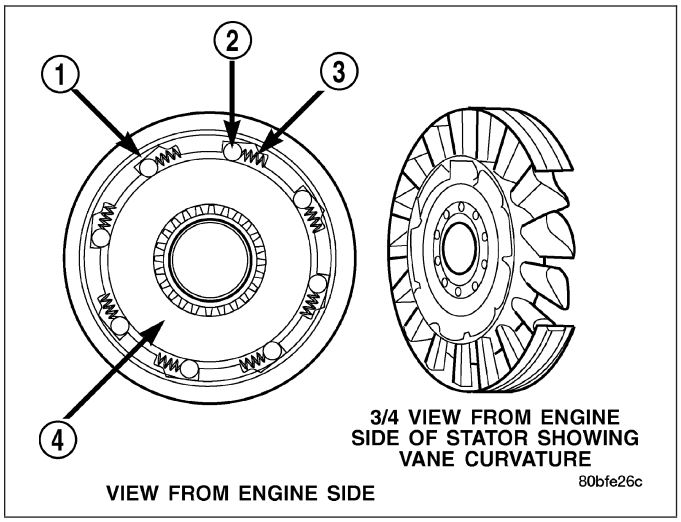
The turbine is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

STATOR

The stator assembly is mounted on a stationary shaft which is an integral part of the oil pump. The stator (1) is located between the impeller (2) and the turbine (4) within the torque converter case.

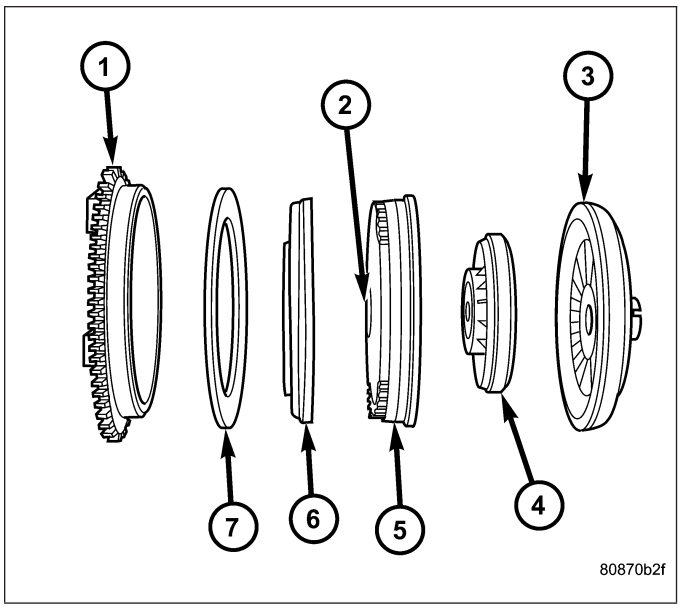


The stator contains an over-running clutch (1-4), which allows the stator to rotate only in a clockwise direction. When the stator is locked against the over-running clutch, the torque multiplication feature of the torque converter is operational.



TORQUE CONVERTER CLUTCH (TCC)

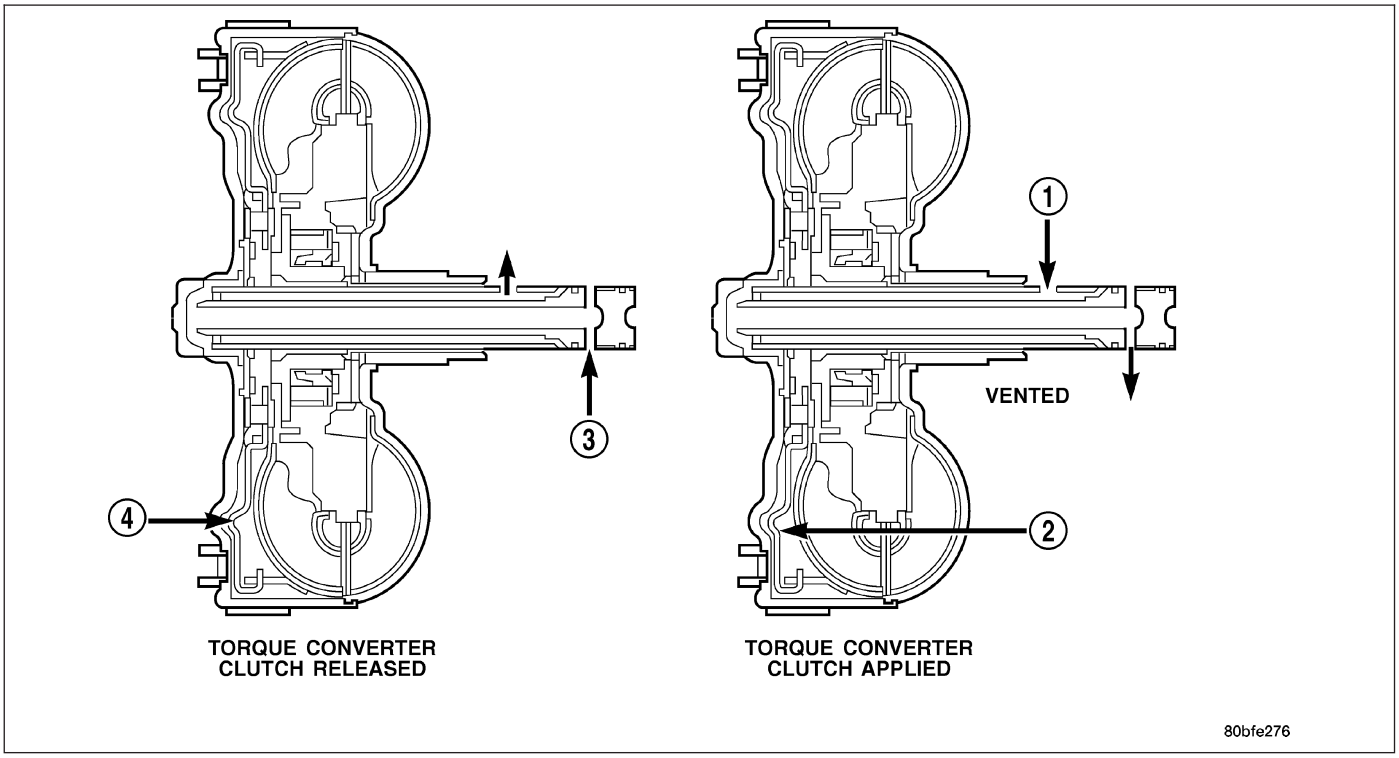
The TCC was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock-free power transfer, it is natural for all fluid couplings to slip. If the impeller (3) and turbine (5) were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston (6) with friction material (7) was added to the turbine assembly (5) to provide this mechanical lock-up.



In order to reduce heat build-up in the transmission and buffer the powertrain against torsional vibrations, the TCM can duty cycle the L/R-CC Solenoid to achieve a smooth application of the torque converter clutch. This function, referred to as Electronically Modulated Converter Clutch (EMCC) can occur at various times depending on the following variables:

- Shift lever position
- Current gear range
- Transmission fluid temperature
- Engine coolant temperature
- Input speed
- Throttle angle
- Engine speed

OPERATION



Torque Converter Fluid Operation - Typical

1 - APPLY PRESSURE
2 - THE PISTON MOVES SLIGHTLY FORWARD
3 - RELEASE PRESSURE
4 - THE PISTON MOVES SLIGHTLY REARWARD

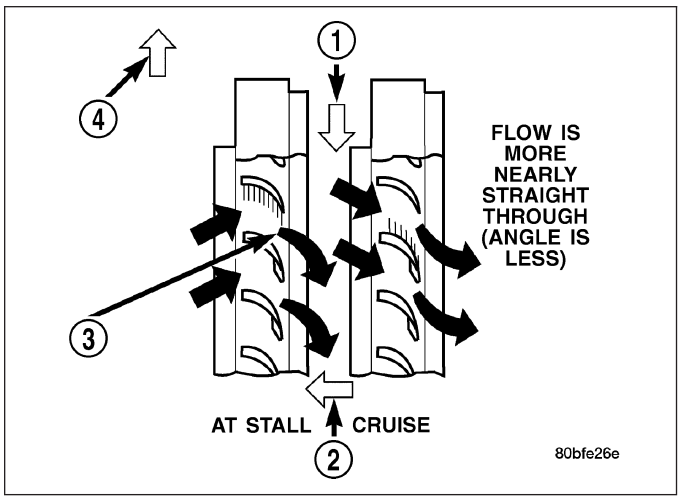
The converter impeller (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

TURBINE

As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a "hindering" direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft. Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counterclockwise direction. When this happens the over-running clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a "helping" direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.4:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such as way as to cause it to lock-up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.



TORQUE CONVERTER CLUTCH (TCC)

In a standard torque converter, the impeller and turbine are rotating at about the same speed and the stator is freewheeling, providing no torque multiplication. By applying the turbine's piston and friction material to the front cover, a total converter engagement can be obtained. The result of this engagement is a direct 1:1 mechanical link between the engine and the transmission.

The clutch can be engaged in second, third, and fourth gear ranges depending on overdrive control switch position. If the overdrive control switch is in the normal ON position, the clutch will engage after the shift to fourth gear. If the control switch is in the OFF position, the clutch will engage after the shift to third gear.

The TCM controls the torque converter by way of internal logic software. The programming of the software provides the TCM with control over the L/R-CC Solenoid. There are four output logic states that can be applied as follows:

- No EMCC
- Partial EMCC
- Full EMCC
- Gradual-to-no EMCC

NO EMCC

Under No EMCC conditions, the L/R Solenoid is OFF. There are several conditions that can result in NO EMCC operations. No EMCC can be initiated due to a fault in the transmission or because the TCM does not see the need for EMCC under current driving conditions.

PARTIAL EMCC

Partial EMCC operation modulates the L/R Solenoid (duty cycle) to obtain partial torque converter clutch application. Partial EMCC operation is maintained until Full EMCC is called for and actuated. During Partial EMCC some slip does occur. Partial EMCC will usually occur at low speeds, low load and light throttle situations.

FULL EMCC

During Full EMCC operation, the TCM increases the L/R Solenoid duty cycle to full ON after Partial EMCC control brings the engine speed within the desired slip range of transmission input speed relative to engine rpm.

GRADUAL-TO-NO EMCC

This operation is to soften the change from Full or Partial EMCC to No EMCC. This is done at mid-throttle by decreasing the L/R Solenoid duty cycle.

REMOVAL

1. Remove transmission and torque converter from vehicle. (Refer to 21 - TRANSMISSION/AUTOMATIC - 545RFE/42RLE - REMOVAL)
2. Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition. The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

3. Pull the torque converter forward until the center hub clears the oil pump seal.
4. Separate the torque converter from the transmission.

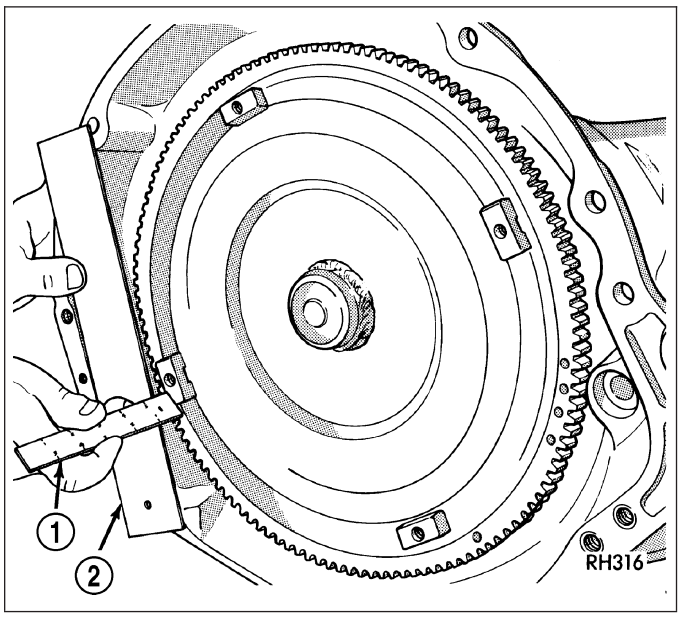
INSTALLATION

NOTE: Check converter hub and drive notches for sharp edges, burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation.

1. Lubricate oil pump seal lip with transmission fluid.
2. Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or bushing while inserting torque converter into the front of the transmission.

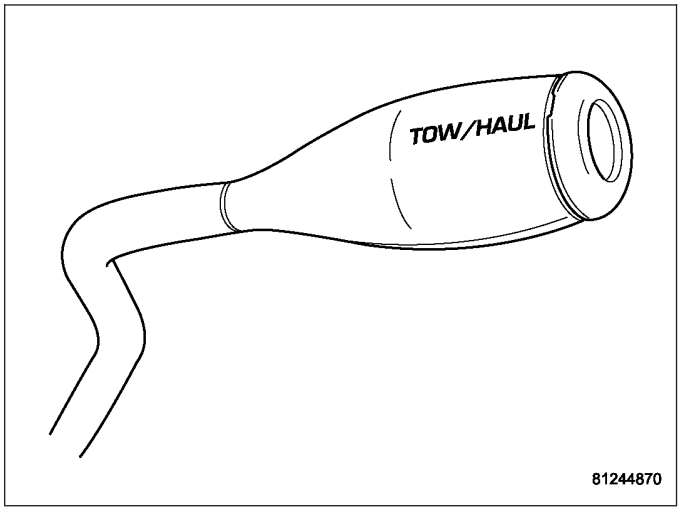
3. Align torque converter to oil pump seal opening.
4. Insert torque converter hub into oil pump.
5. While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.
6. Check converter seating with a scale (1) and straightedge (2). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.
7. If necessary, temporarily secure converter with C-clamp attached to the converter housing.
8. Install the transmission in the vehicle.
9. Fill the transmission with the recommended fluid.



SWITCH-TOW/HAUL OVERDRIVE

DESCRIPTION

The tow/haul overdrive OFF (control) switch is located in the shift lever arm. The switch is a momentary contact device that signals the PCM to toggle current status of the overdrive function.

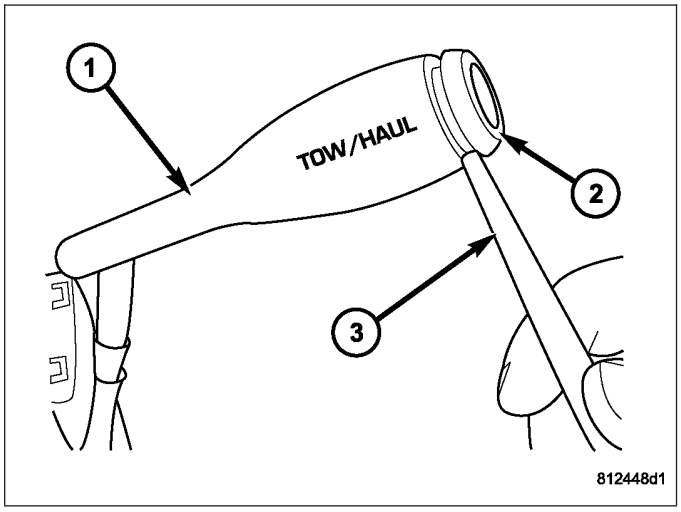


OPERATION

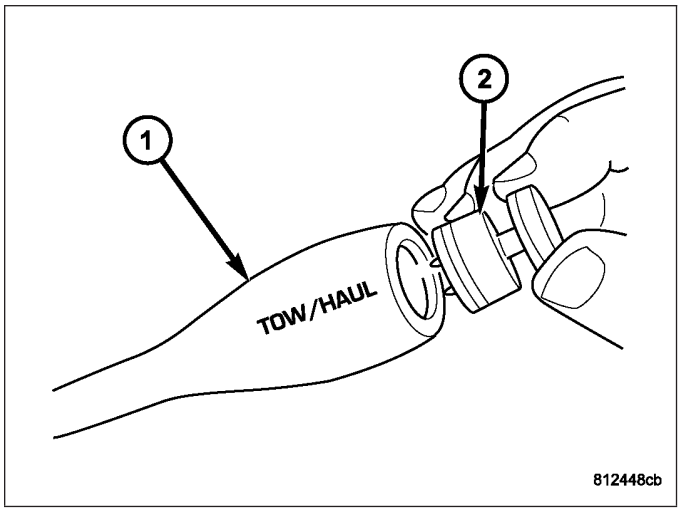
At key-on, overdrive operation is allowed. Pressing the switch once causes the tow/haul overdrive OFF mode to be entered and the Tow/Haul lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the tow/haul lamp to be turned off. The tow/haul overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoid and allow a 3-4 upshift. The control switch indicator light illuminates only when the tow/haul overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

REMOVAL

1. Using a plastic trim tool, remove the tow/haul overdrive off switch retainer (2) from the shift lever (1).



2. Pull the switch (2) outwards to release it from the connector in the lever (1)



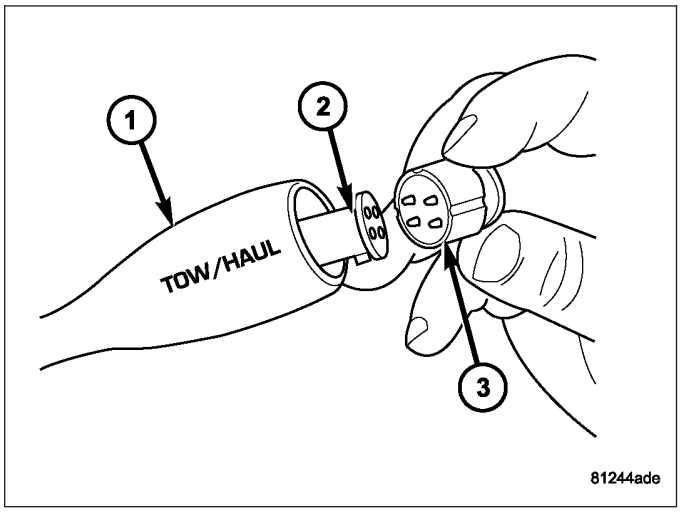
INSTALLATION

NOTE: There is enough slack in the wire to pull out the connector from the lever.

1. Pull the connector (2) out of the lever (1) just enough to grasp it.

CAUTION: Be careful not to bend the pins on the tow/haul overdrive off switch. Use care when installing the switch, as it is not indexed, and can be accidentally installed incorrectly.

2. Install the tow/haul overdrive off switch (3) into the connector (2)
3. Push the tow/haul overdrive off switch (3) and wiring into the shift lever (1).
4. Install the tow/haul overdrive off switch retainer onto the shift lever.



RELAY-TRANSMISSION CONTROL

DESCRIPTION

The relay is supplied fused B+ voltage, energized by the TCM, and is used to supply power to the solenoid pack when the transmission is in normal operating mode.

OPERATION

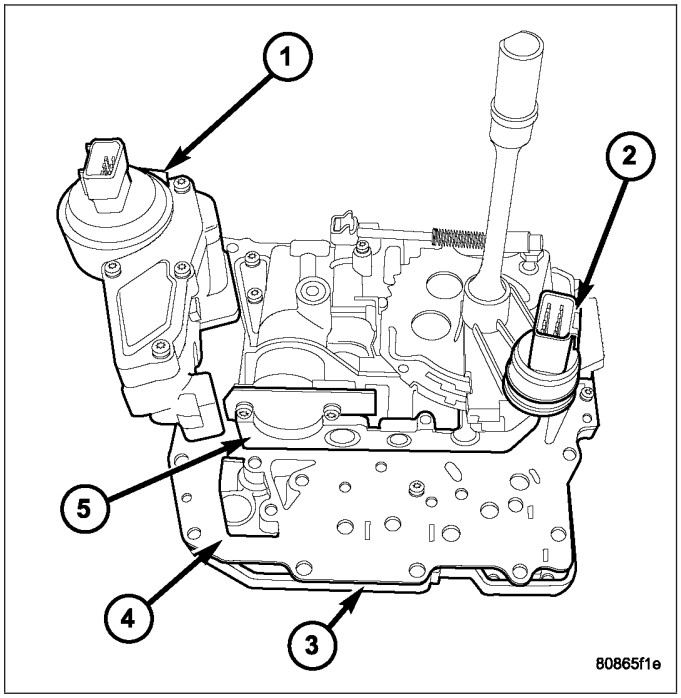
When the relay is “off”, no power is supplied to the solenoid pack and the transmission is in “limp-in” mode. After a controller reset, the TCM energizes the relay. Prior to this, the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After this is verified, the voltage at the solenoid pack pressure switches is checked. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.

SENSOR-TRANSMISSION RANGE

DESCRIPTION

The Transmission Range Sensor (TRS) (2) is mounted to the top of the valve body inside the transmission and can only be serviced by removing the valve body assembly. The electrical connector extends through the transmission case.

The Transmission Range Sensor (TRS) has four switch contacts that monitor shift lever position and send the information to the PCM.



OPERATION

The Transmission Range Sensor (TRS) communicates shift lever position (SLP) to the TCM as a combination of open and closed switches. Each shift lever position has an assigned combination of switch states (open/closed) that the TCM receives from four sense circuits. The TCM interprets this information and determines the appropriate transmission gear position and shift schedule.

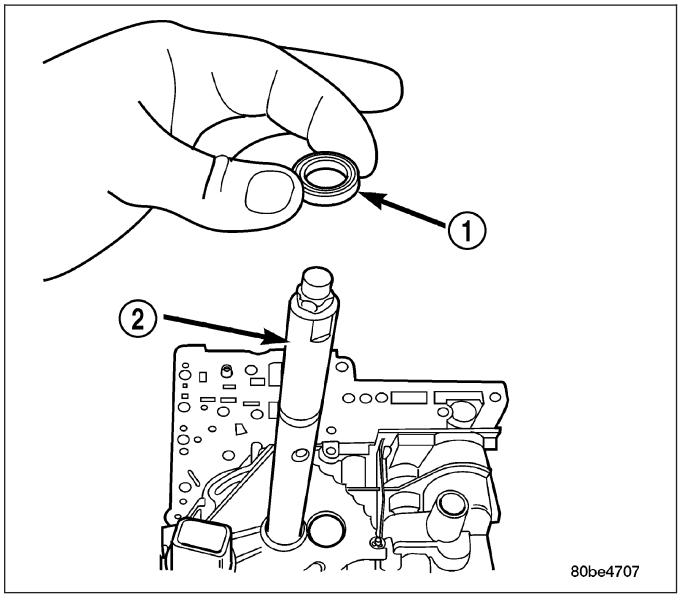
Since there are four switches, there are 16 possible combinations of open and closed switches (codes). Seven of these codes are related to gear position and three are recognized as “between gear” codes. This results in six codes which should never occur. These are called “invalid” codes. An invalid code will result in a DTC, and the TCM will then determine the shift lever position based on pressure switch data. This allows reasonably normal transmission operation with a TRS failure.

TRS SWITCH STATES

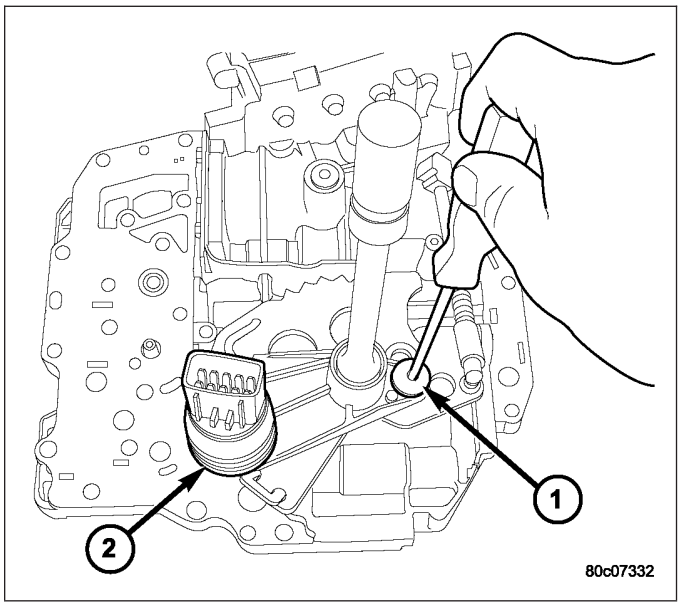
SLP	T42	T41	T3	T1
P	CL	CL	CL	OP
R	CL	OP	OP	OP
N	CL	CL	OP	CL
D	OP	OP	OP	CL
2	OP	OP	CL	OP
1	CL	OP	CL	CL

REMOVAL

1. Remove valve body assembly from vehicle. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/ VALVE BODY - REMOVAL)
2. Remove the manual shaft seal (1).

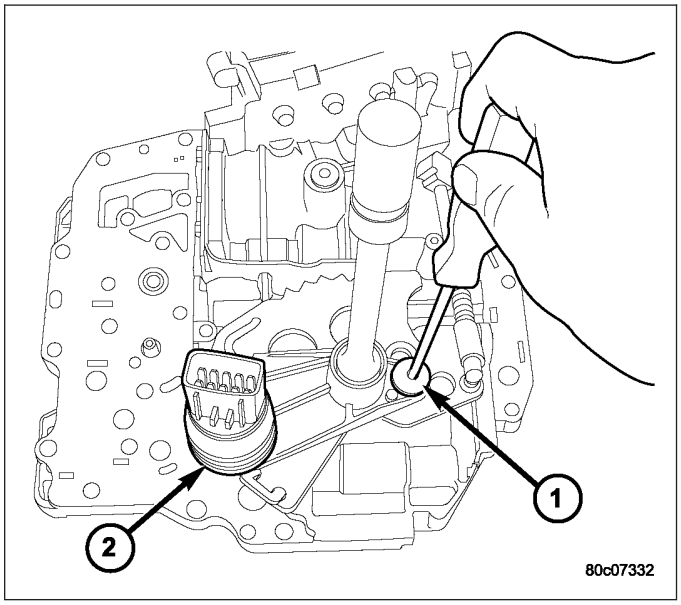


3. Remove manual shaft/TRS retaining screw (1).
4. Slide TRS off of manual valve shaft.

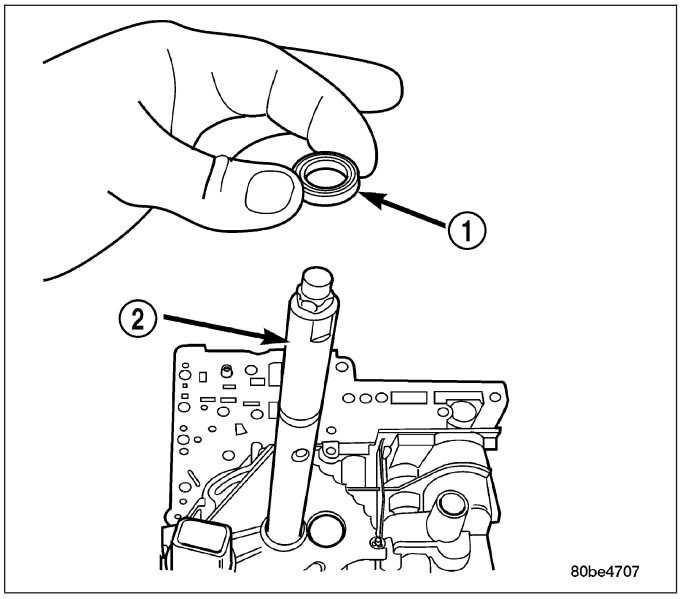


INSTALLATION

1. Install the TRS (2) to the manual shaft. Make sure TRS locating pin rests in manual valve bore slot.
2. Install the TRS/manual shaft retaining screw (1) and torque to 5 N·m (45 in. lbs.) torque.



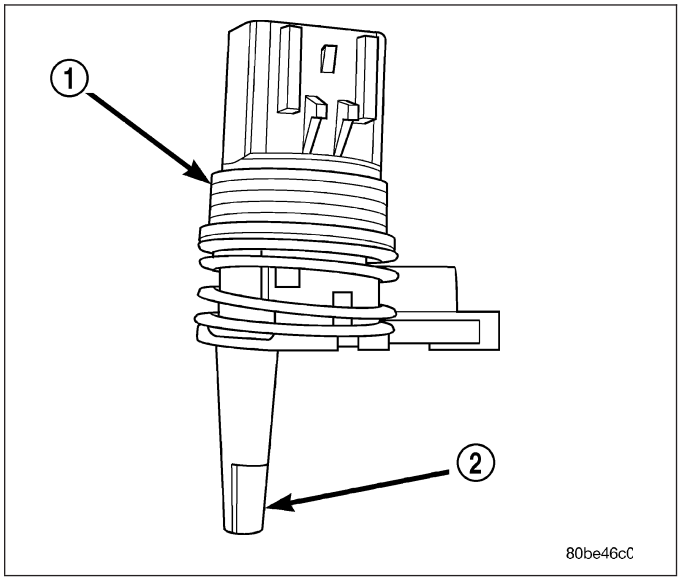
3. Install the manual shaft seal (1).
4. Install valve body to the transmission. (Refer to 21 - TRANSMISSION//AUTOMATIC - 42RLE/VALVE BODY - INSTALLATION)



SENSOR-TRANSMISSION TEMPERATURE

DESCRIPTION

The transmission temperature sensor (2) is located in the transmission range sensor (1) and communicates transmission sump temperature to the TCM.



OPERATION

The transmission range sensor (TRS) has an integrated thermistor that the TCM uses to monitor the transmission's sump temperature. Since fluid temperature can affect transmission shift quality and convertor lock up, the TCM requires this information to determine which shift schedule to operate in. The TCM also monitors this temperature data so it can energize the vehicle cooling fan(s) when a transmission "overheat" condition exists. If the thermistor circuit fails, the TCM will revert to calculated oil temperature usage.

CALCULATED TEMPERATURE

A failure in the temperature sensor or circuit will result in calculated temperature being substituted for actual temperature. Calculated temperature is a predicted fluid temperature which is calculated from a combination of inputs:

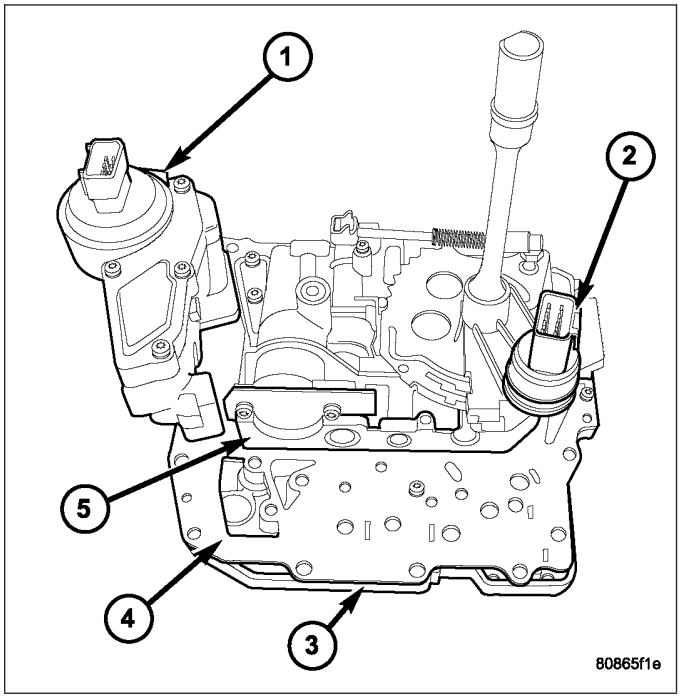
- Battery (ambient) temperature
- Engine coolant temperature
- In-gear run time since start-up

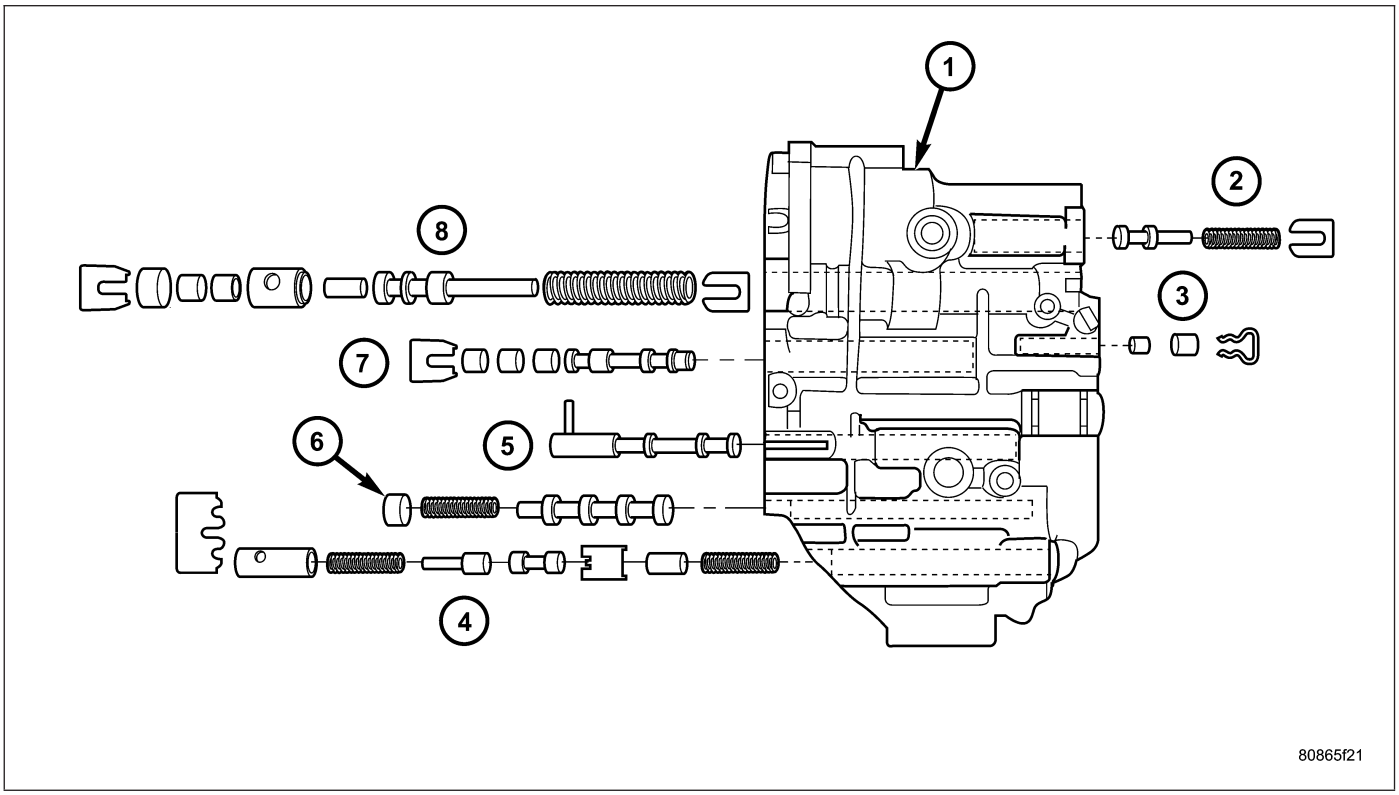
BODY-VALVE

DESCRIPTION

The valve body assembly consists of a cast aluminum valve body (5),separator plate (4), and transfer plate (3). The valve body contains valves and check balls that control fluid delivery to the torque converter clutch, solenoid/pressure switch assembly, and frictional clutches.

Also mounted to the valve body assembly are the solenoid/pressure switch assembly and the transmission range sensor (2).





Valve Body - Exploded

1 - VALVE BODY
2 - T/C REGULATOR VALVE
3 - L/R SWITCH VALVE
4 - CONVERTER CLUTCH CONTROL VALVE
5 - MANUAL VALVE
6 - CONVERTER CLUTCH SWITCH VALVE
7 - SOLENOID SWITCH VALVE
8 - REGULATOR VALVE

The valves contained within the valve body (1) include the following :

- Regulator valve(2)
- Solenoid switch valve(7)
- Manual valve(5)
- Converter clutch switch valve(6)
- Converter clutch control valve(4)
- Torque converter regulator valve(2)
- Low/Reverse switch valve(3)

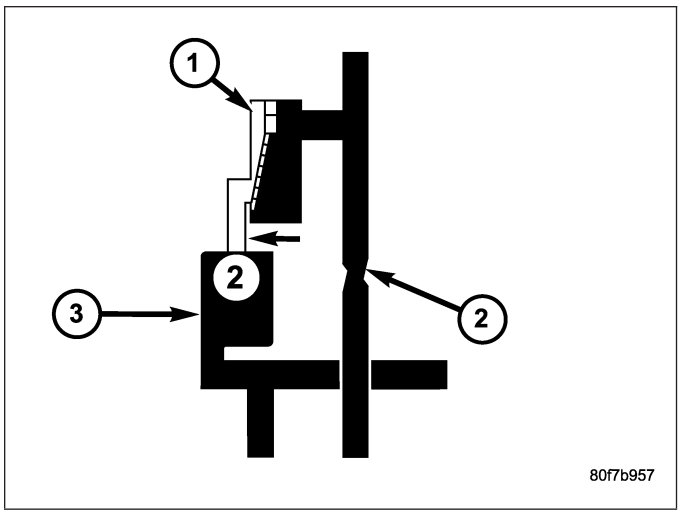
In addition, the valve body also contains the thermal valve, #2, 3, 4 & 5 check balls and the 2/4 accumulator assembly.

OPERATION

NOTE: (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS) for a visual aid in determining valve location, operation and design.

THERMAL VALVE

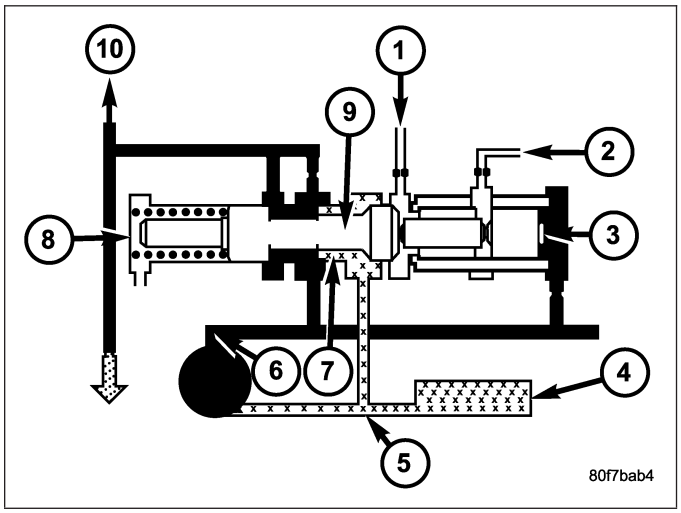
The thermal valve (1) is a bi-metallic shudder valve that helps control the venting rate of oil pressure in the underdrive clutch passage during release of the clutch. When the oil temperature is approximately 20 degrees Fahrenheit or less, the valve is fully open to assist in venting oil past the U1 orifice (2). At temperatures above 20 degrees, the valve starts to close and becomes fully closed at approximately 140 degrees. The thermal valve is located in the transfer plate of the valve body.



1 - THERMAL VALVE
2 - U1 ORIFICE
3 - NUMBER 2 CHECK BALL

REGULATOR VALVE

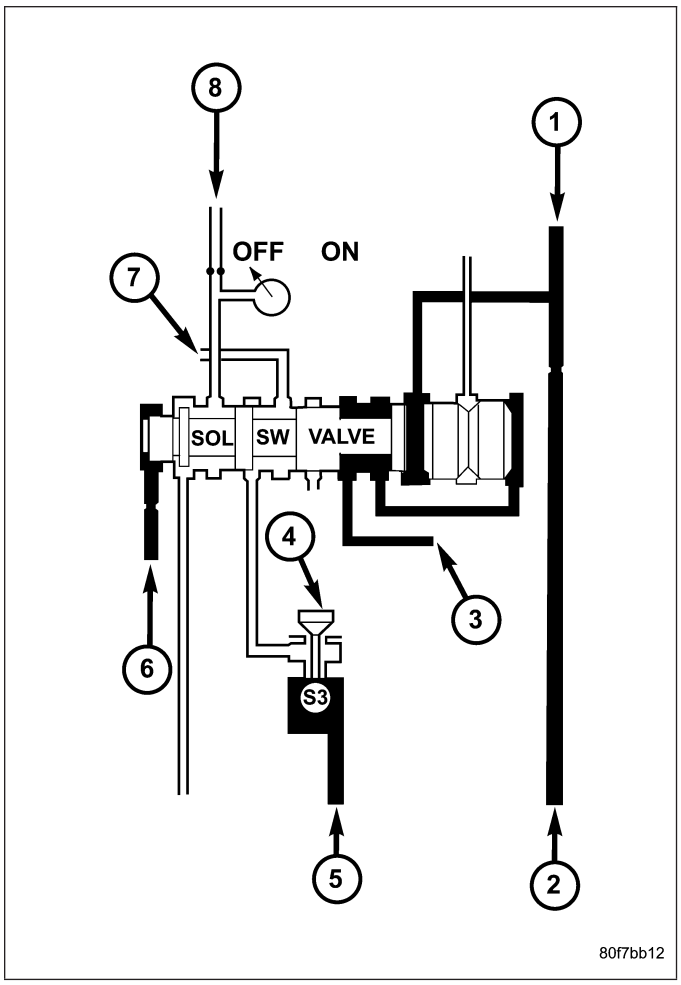
The regulator valve (9) controls hydraulic pressure in the transmission. It receives unregulated pressure from the pump (6), which works against spring tension (8) to maintain oil at specific pressures. A system of sleeves and ports allows the regulator valve to work at one of three predetermined pressure levels. Regulated oil pressure is also referred to as “line pressure.”



1 - FROM OVERDRIVE CLUTCH CIRCUIT
2 - FROM MANUAL VALVE
3 - HYDRAULIC PRESSURE
4 - FILTER
5 - PUMP INLET
6 - PUMP OUTLET
7 - OIL PRESSURE REGULATED AT THIS POINT
8 - SPRING TENSION
9 - REGULATOR VALVE
10 - TORQUE CONVERTER CONTROL VALVE

SOLENOID SWITCH VALVE

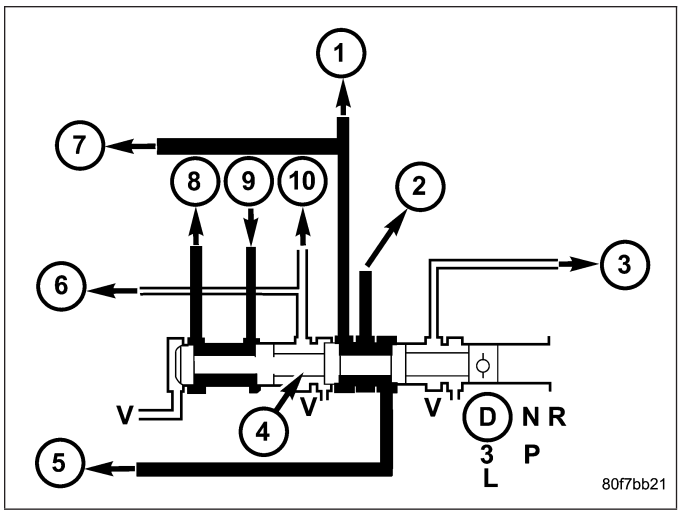
The solenoid switch valve controls line pressure from the LR/CC solenoid (4). In one position, it allows the low/reverse clutch to be pressurized. In the other, it directs line pressure to the converter control and converter clutch valves (7).



1 - 2/4 CLUTCH
2 - MANUAL VALVE
3 - UD CLUTCH
4 - LR/CC SOLENOID DE-ENERGIZED
5 - MANUAL VALVE
6 - LINE PRESSURE
7 - CONVERTER CLUTCH SWITCH AND CONTROL VALVES
8 - LR CLUTCH

MANUAL VALVE

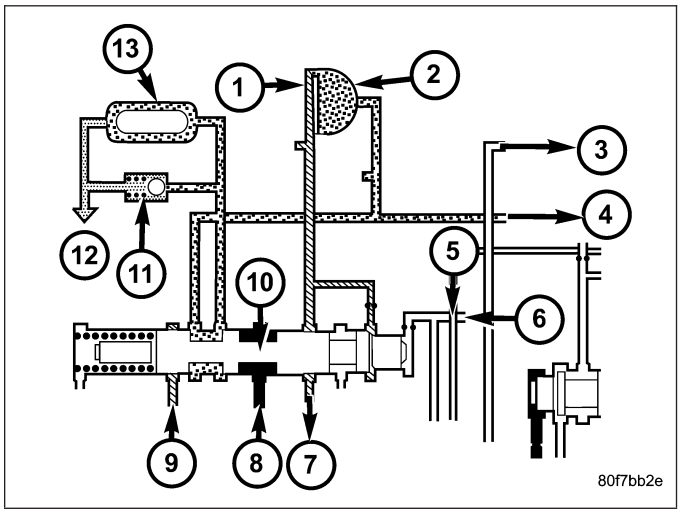
The manual valve (4) is operated by the mechanical shift linkage. Its primary responsibility is to send line pressure to the appropriate hydraulic circuits and solenoids. The valve has three operating ranges or positions.



1 - UD CLUTCH
2 - LR/CC CLUTCH
3 - REVERSE CLUTCH
4 - MANUAL VALVE
5 - REGULATOR VALVE
6 - REGULATOR VALVE
7 - CONVERTER CLUTCH CONTROL VALVE
8 - 2/4 CLUTCH
9 - 2/4 - L/R SOLENOID
10 - L/R CLUTCH

CONVERTER CLUTCH SWITCH VALVE

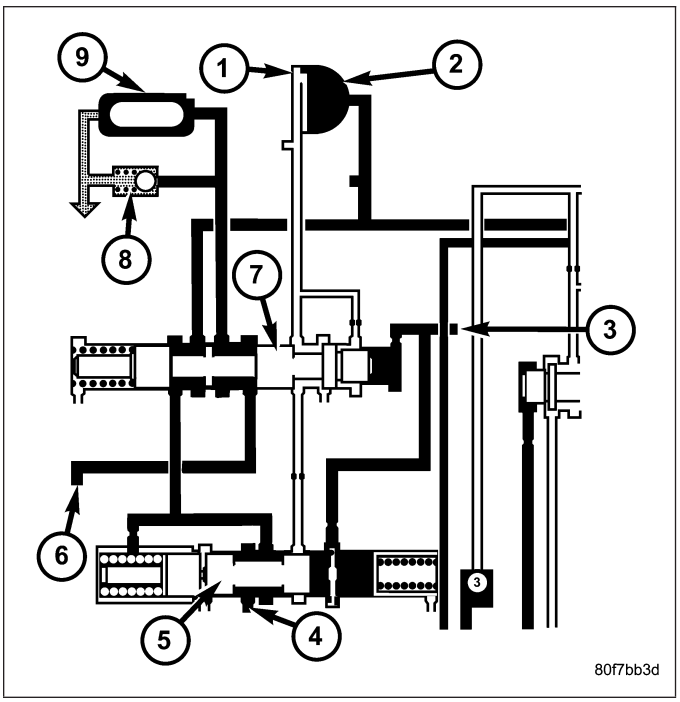
The main responsibility of the converter clutch switch valve (10) is to control hydraulic pressure applied to the front (off) side of the converter clutch piston. Line pressure from the regulator valve (5) is fed to the torque converter regulator valve (8). The pressure is then directed to the converter clutch switch valve (10) and to the front side of the converter clutch piston. This pressure pushes the piston back and disengages the converter clutch.



1 - CONVERTER CLUTCH
2 - TORQUE CONVERTER
3 - LR CLUTCH
4 - DRIBBLERS
5 - REGULATOR VALVE
6 - SOLENOID SWITCH VALVE
7 - CONVERTER CLUTCH CONTROL VALVE
8 - TORQUE CONVERTER REGULATOR VALVE
9 - CONVERTER CLUTCH CONTROL VALVE
10 - CONVERTER CLUTCH SWITCH VALVE
11 - BYPASS VALVE
12 - LUBE
13 - COOLER

CONVERTER CLUTCH CONTROL VALVE

The converter clutch control valve (5) controls the back (on) side of the torque converter clutch (1). When the controller energizes or modulates the LR/CC solenoid to apply the converter clutch piston, both the converter clutch control valve (5) and the converter control valve move, allowing pressure to be applied to the back side of the clutch.



1 - CONVERTER CLUTCH
2 - TORQUE CONVERTER
3 - LR/CC SOLENOID
4 - FROM MANUAL VALVE
5 - CONVERTER CLUTCH CONTROL VALVE
6 - TORQUE CONVERTER REGULATOR VALVE
7 - CONVERTER CLUTCH SWITCH VALVE
8 - BYPASS VALVE
9 - COOLER

T/C REGULATOR VALVE

The torque converter regulator valve slightly regulates the flow of fluid to the torque converter.

LOW/REVERSE SWITCH VALVE

The low/reverse clutch is applied from different sources, depending on whether low (1st) gear or reverse is selected. The low/reverse switch valve alternates positions depending on from which direction fluid pressure is applied. By design, when the valve is shifted by fluid pressure from one channel, the opposing channel is blocked. The switch valve alienates the possibility of a sticking ball check, thus providing consistent application of the low/reverse clutch under these operating conditions.

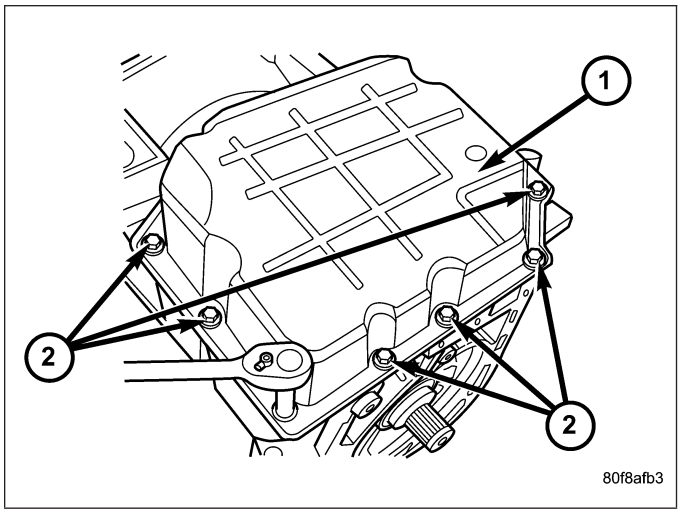
REMOVAL

NOTE: If valve body is being reconditioned or replaced, it is necessary to perform the Quick Learn Procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

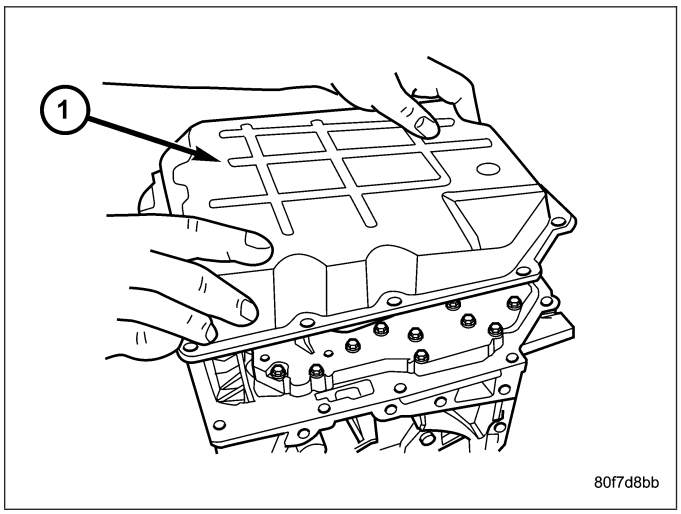
1. Disconnect the TRS and solenoid wiring connectors.
2. Disconnect the shift cable from the shift lever (at the transmission).
3. Move the manual shift lever clockwise as far as it will go. This should be one position past the L position. Then remove the manual shift lever.

NOTE: One of the oil pan bolts has a sealing patch applied from the factory. Separate this bolts for reuse.

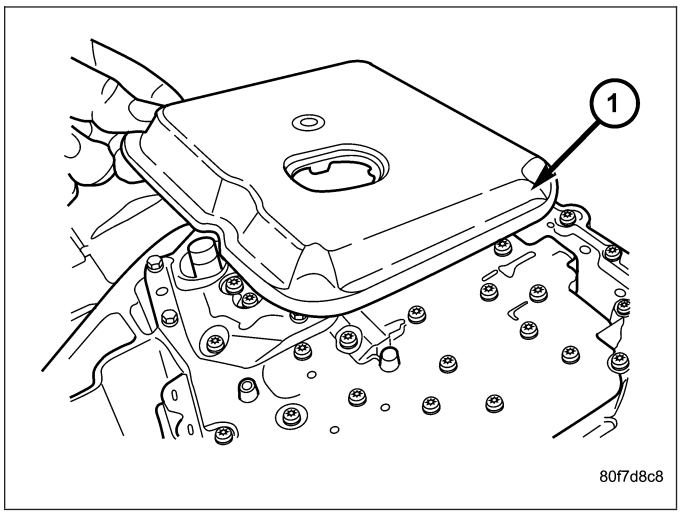
4. Remove transmission pan bolts (2).



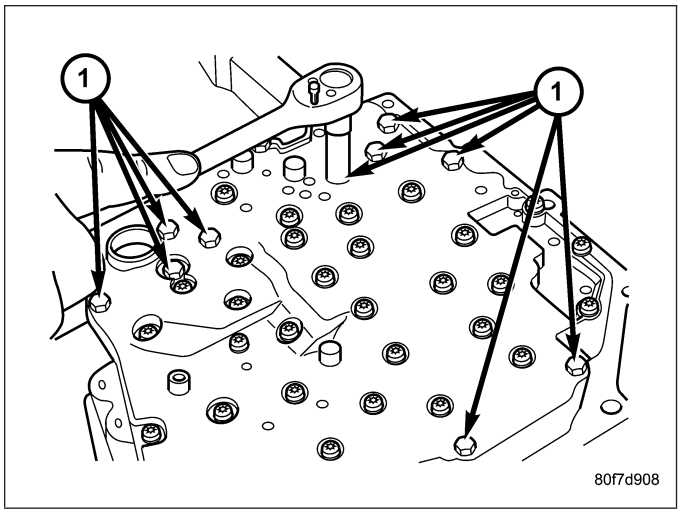
5. Remove transmission oil pan (1).



6. Remove oil filter (1) from valve body. It is held in place by two screws.

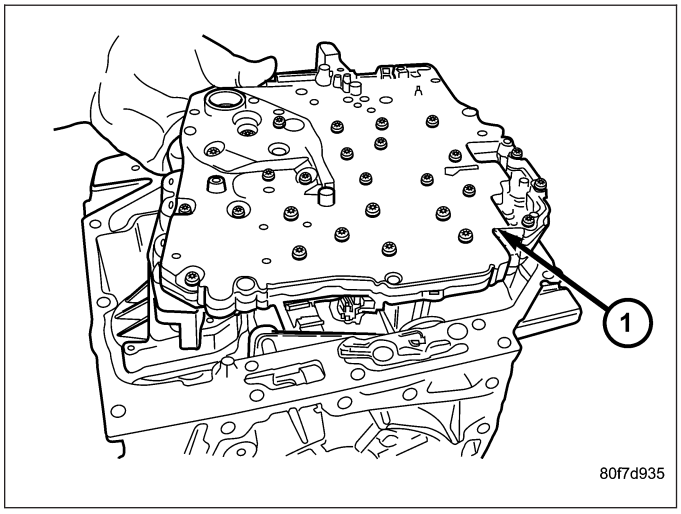


7. Remove valve body bolts-to-case (1).



CAUTION: The overdrive and underdrive accumulators and springs may fall out when removing the valve body.

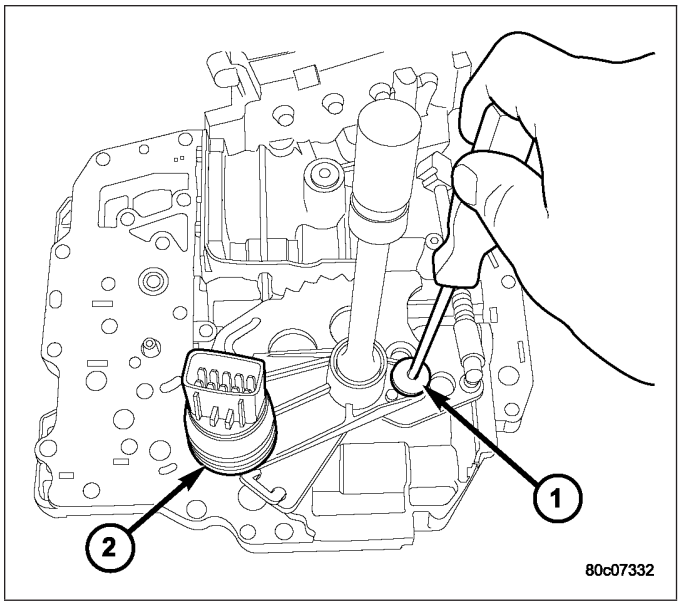
8. Carefully remove valve body assembly (1) from the transmission.



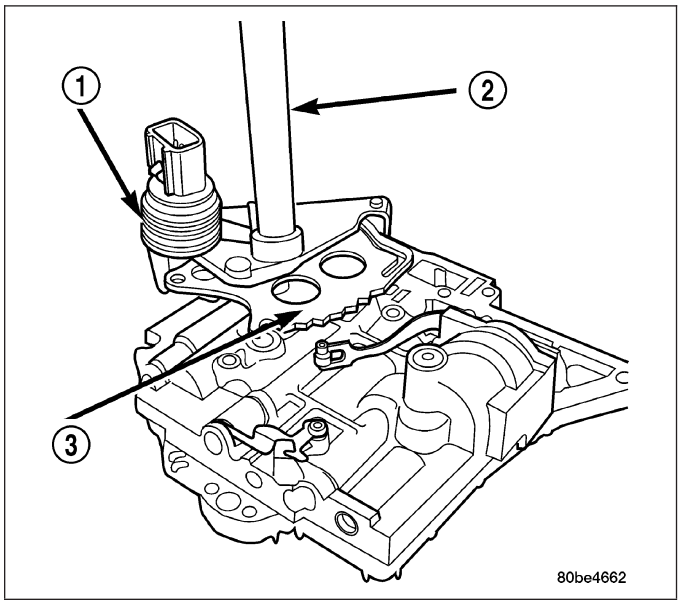
DISASSEMBLY

NOTE: If the valve body is being reconditioned or replaced, it is necessary to perform the Quick Learn Procedure using the scan tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

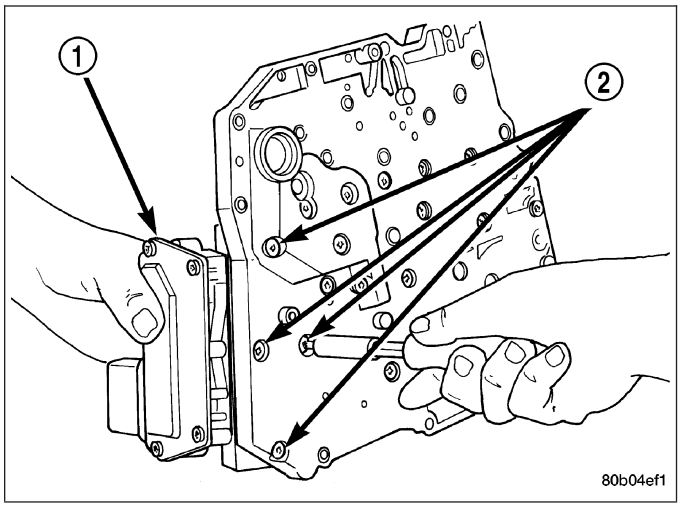
1. Remove manual shaft seal.
2. Remove manual shaft screw (1).



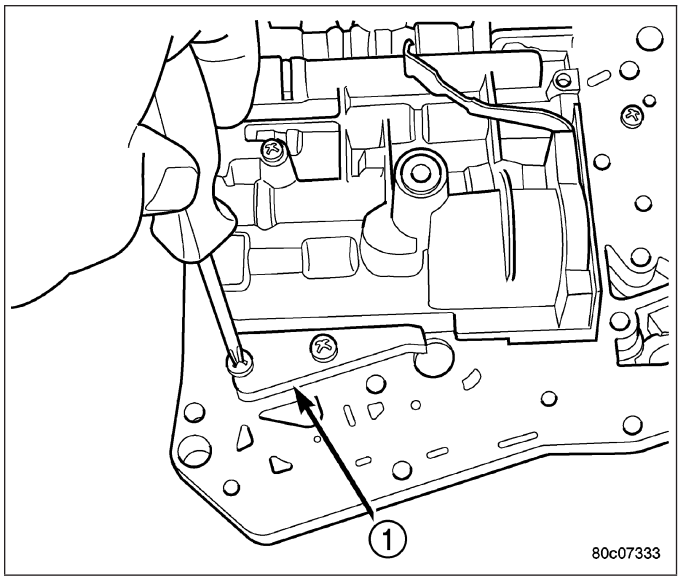
3. Remove Transmission Range Sensor (TRS) (1) and manual shaft (2).



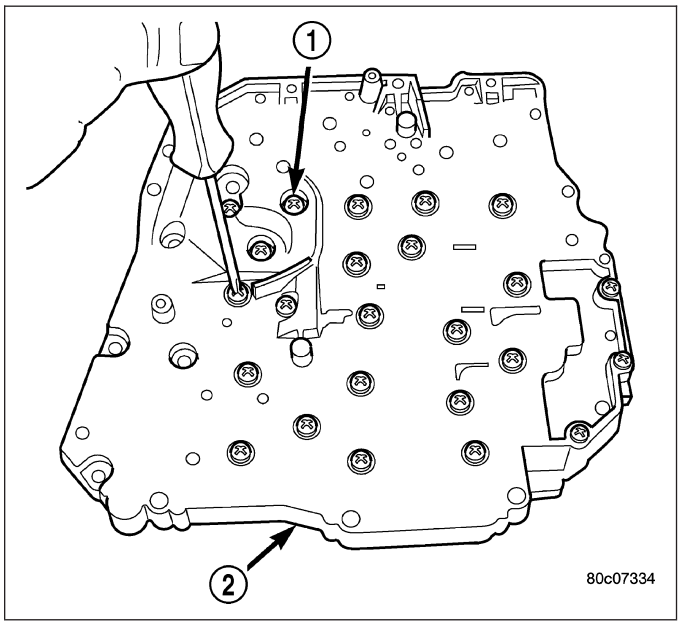
4. Remove Solenoid/Pressure Switch Assembly (1) from valve body.



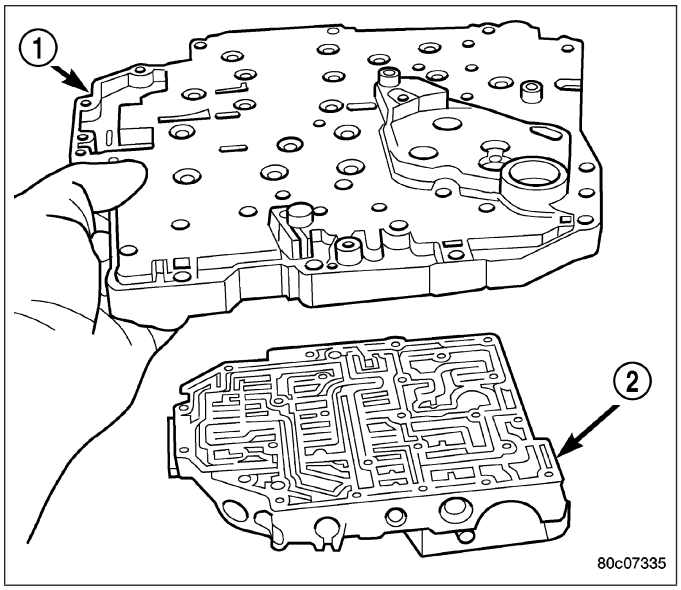
5. Remove valve body stiffener plate (1).



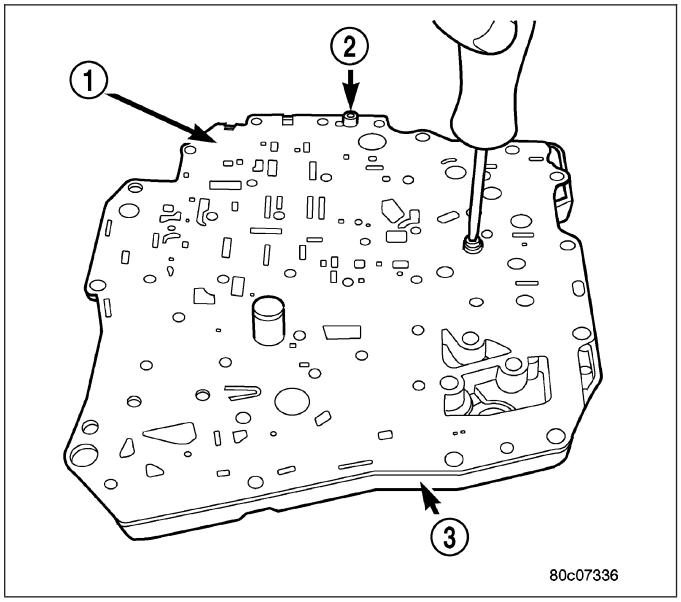
6. Invert valve body assembly and remove transfer plate-to-valve body screws (1).



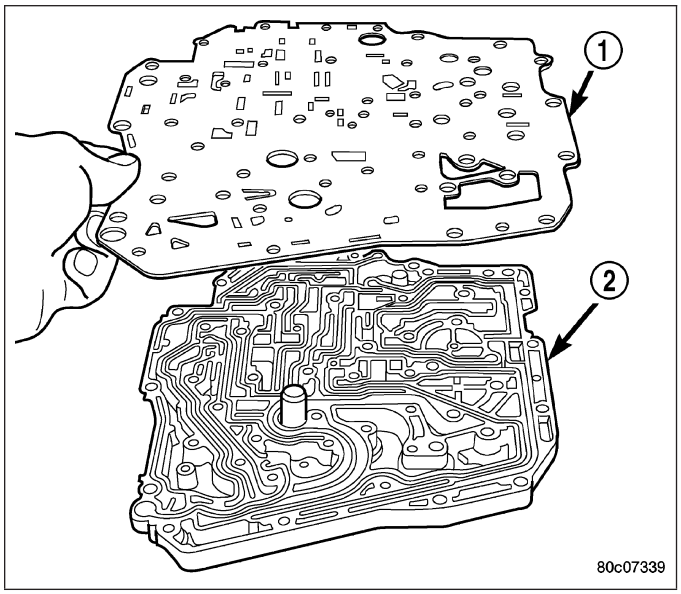
7. Remove transfer/separator plate (1) from valve body (2)



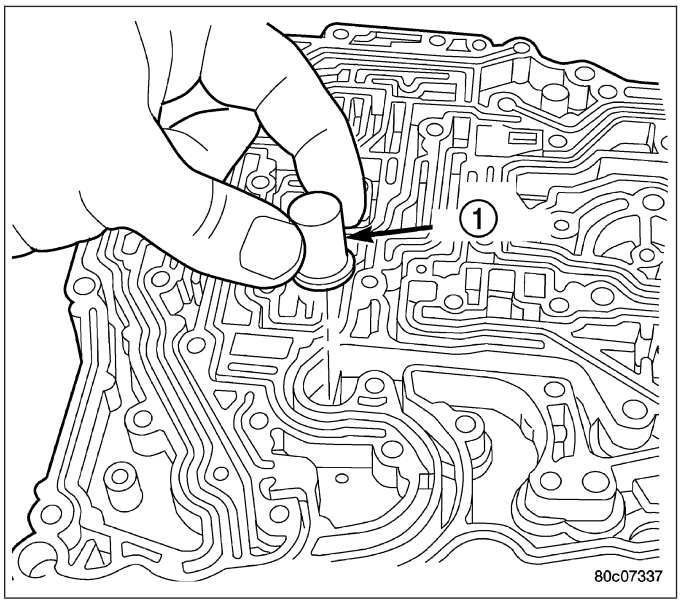
8. Remove separator plate-to-transfer plate screws (2).



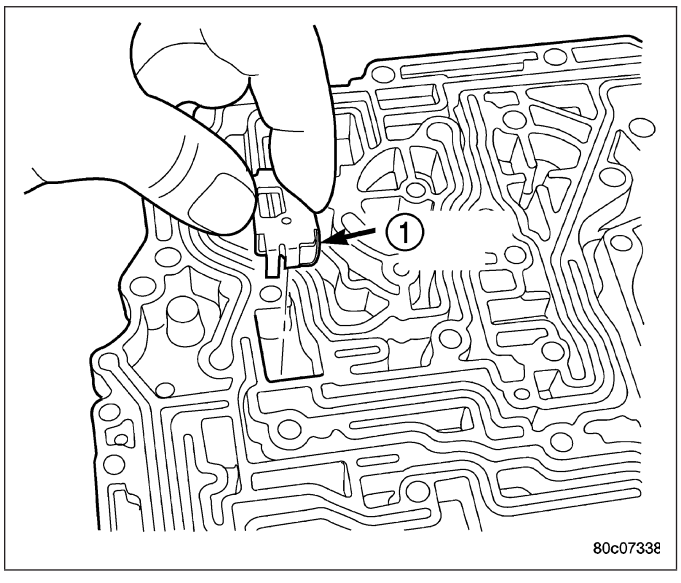
9. Remove separator plate (1) from transfer plate (2).

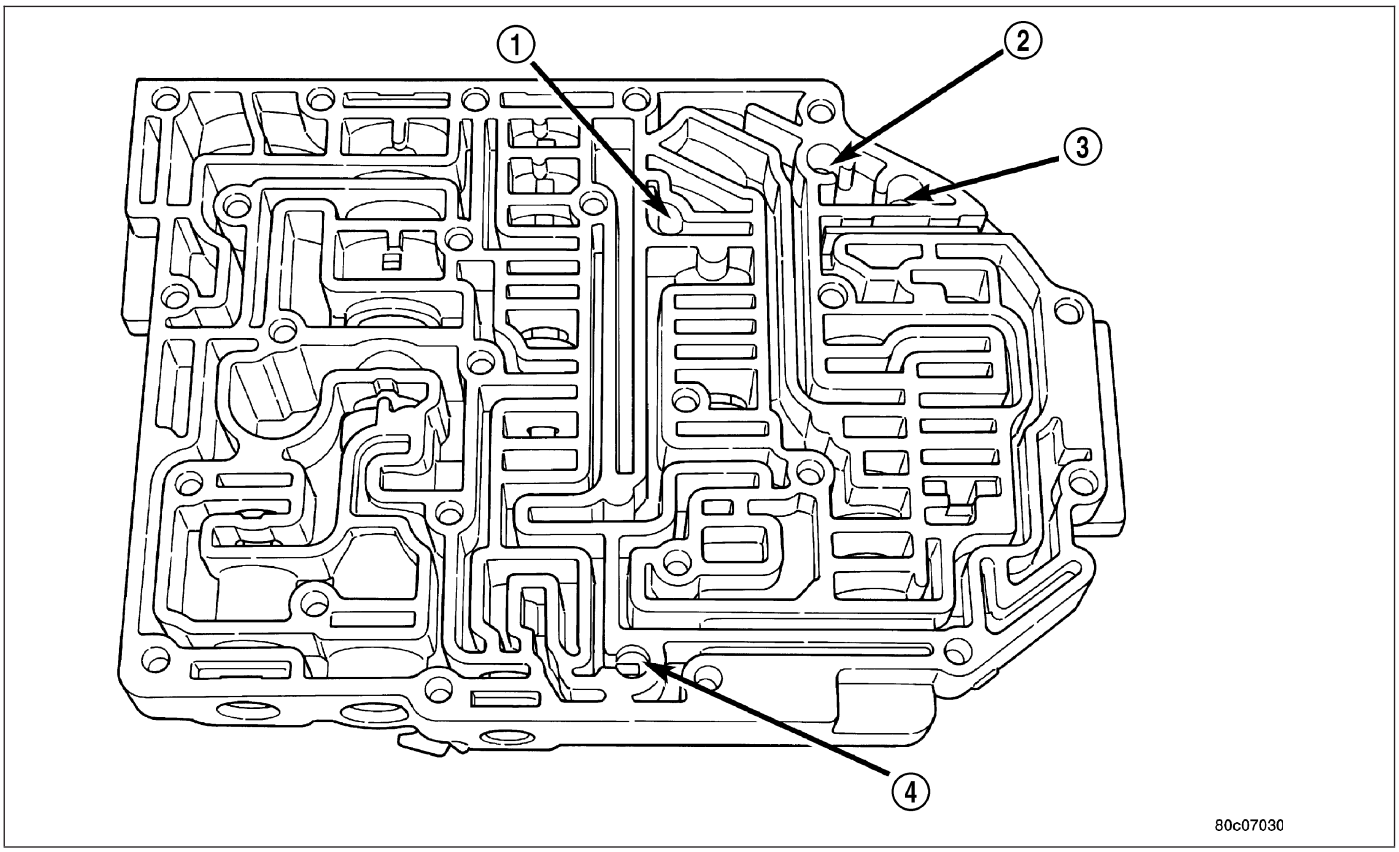


10. Remove the oil screen (1) from the transfer plate.



11. Remove thermal valve (1) from transfer plate.



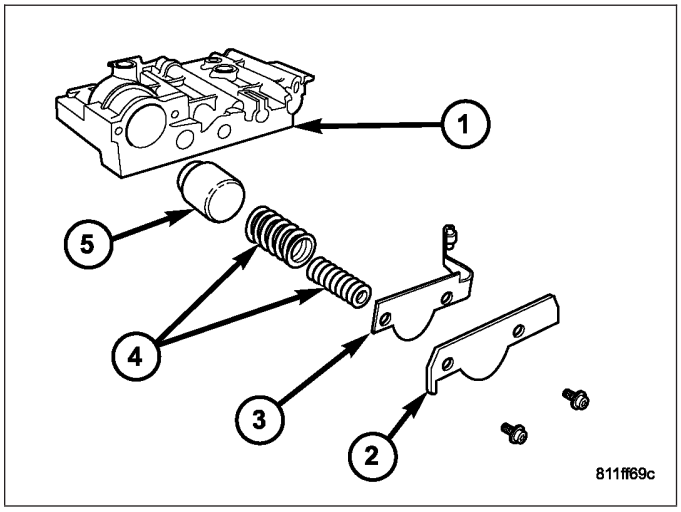


Ball Check Location

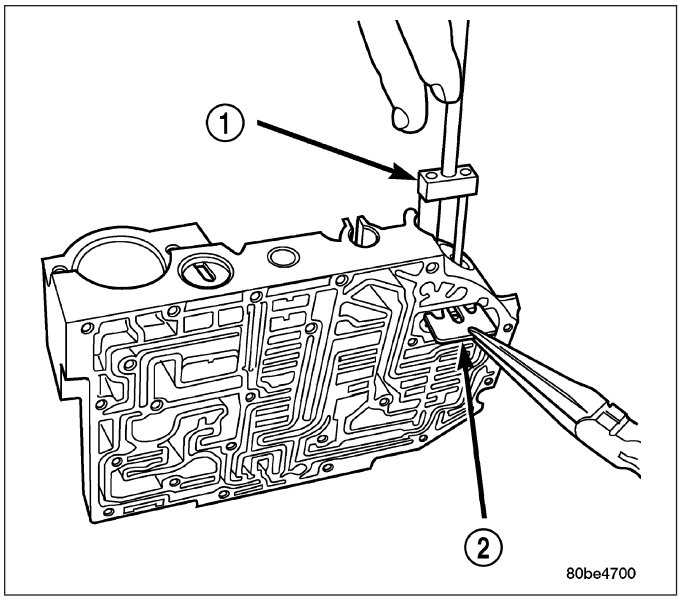
1 - (#4) BALL CHECK LOCATION
2 - (#2) BALL CHECK LOCATION
3 - (#5) BALL CHECK LOCATION
4 - (#3) BALL CHECK LOCATION

12. Remove valve body check balls (1-4). Note their location for assembly ease.

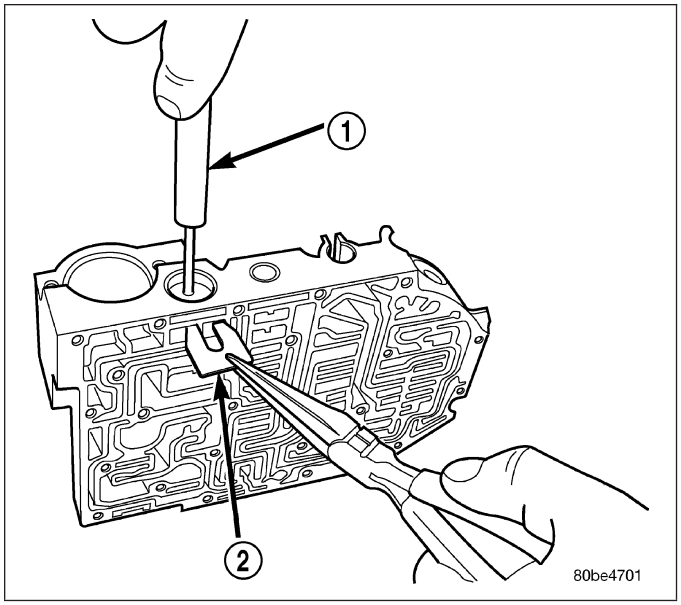
13. Remove 2/4 accumulator assembly (1-5).



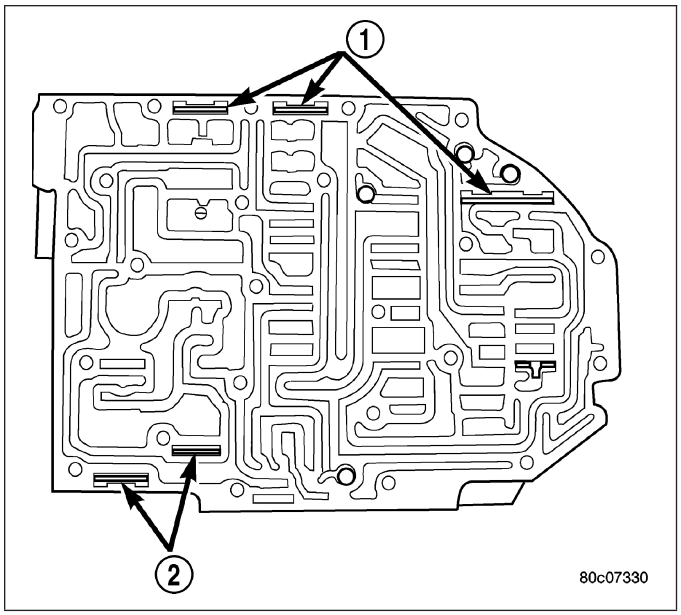
14. Remove dual retainer plate (2) from valve body. Use special tool 6301 (1) to remove plate (2).

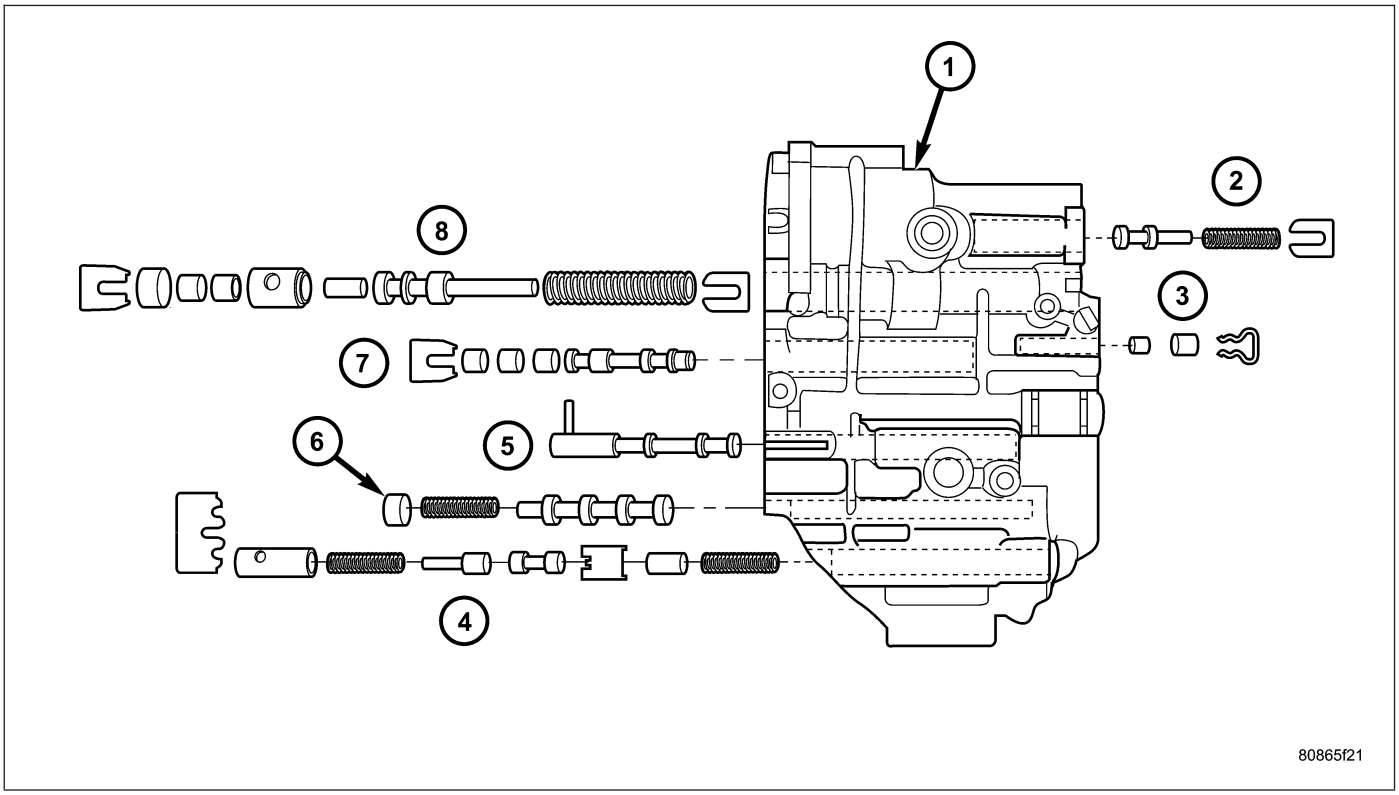


15. Remove regulator valve spring retainer (2).



16. Remove remaining retainers (1, 2).





Valve Body Assembly

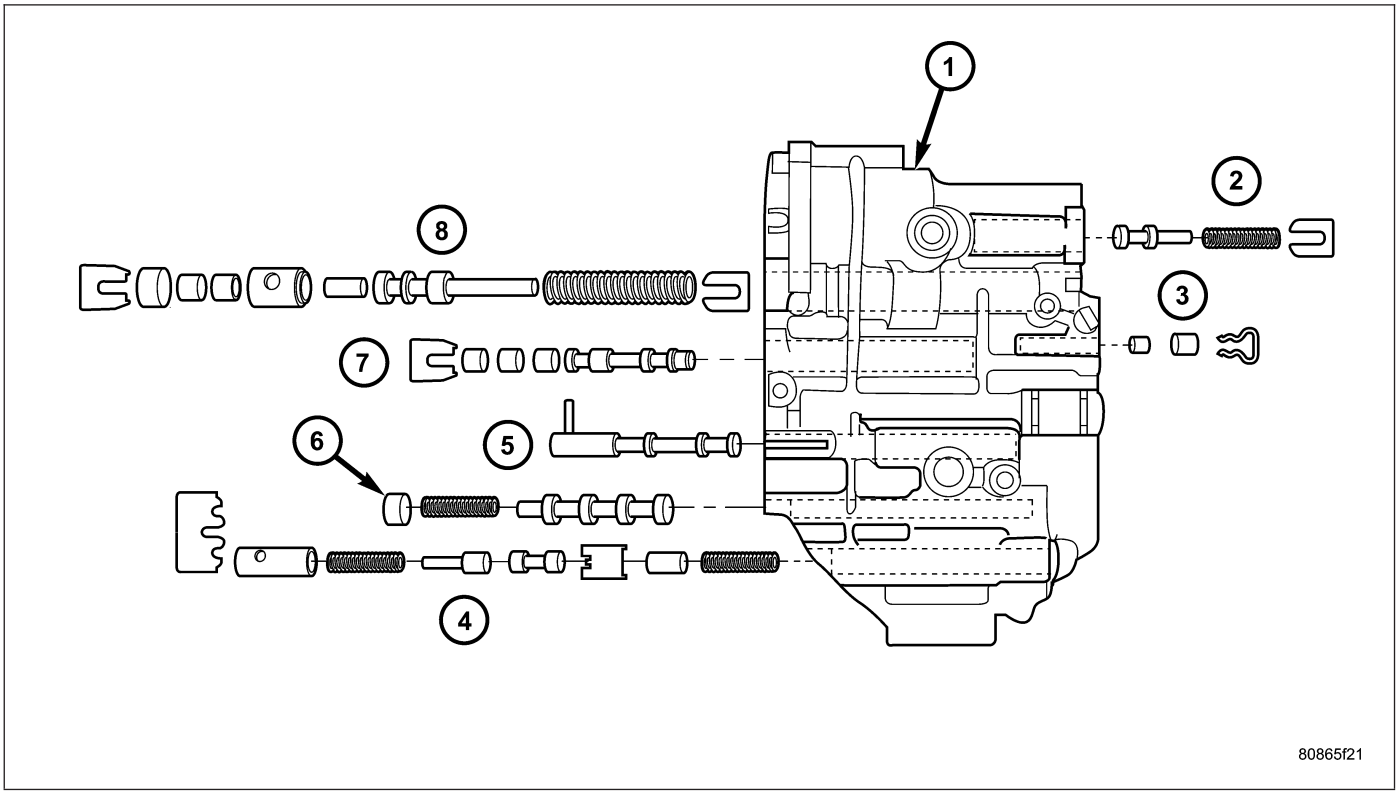
1 - VALVE BODY
2 - T/C REGULATOR VALVE
3 - L/R SWITCH VALVE
4 - CONVERTER CLUTCH CONTROL VALVE
5 - MANUAL VALVE
6 - CONVERTER CLUTCH SWITCH VALVE
7 - SOLENOID SWITCH VALVE
8 - REGULATOR VALVE

17. Remove all valves and springs.
18. Cleanliness through entire disassembly and assembly of the valve body cannot be overemphasized. When disassembling, each part should be washed in a suitable solvent, then dried by compressed air. **Do not wipe**

parts with shop towels. All mating surfaces in the valve body are accurately machined; therefore, careful handling of all parts must be exercised to avoid nicks or burrs.

ASSEMBLY

NOTE: If the valve body assembly is being reconditioned or replaced, it is necessary to perform the Quick Learn Procedure using the scan tool. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

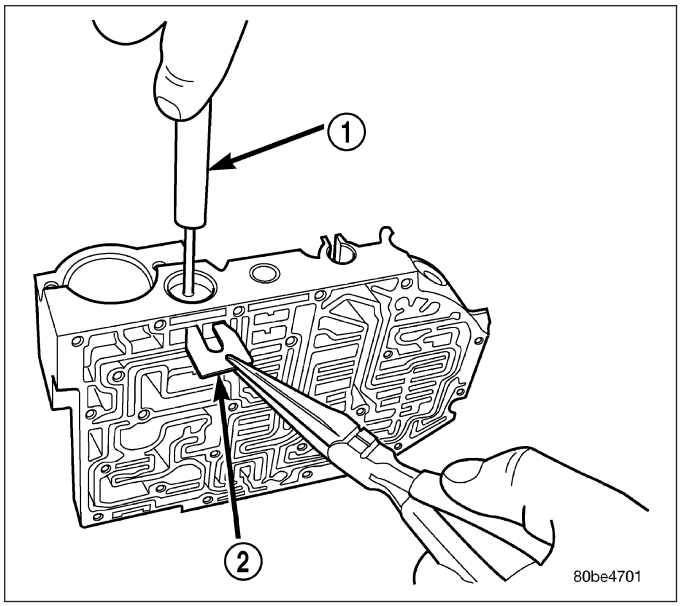


Valve Body Assembly

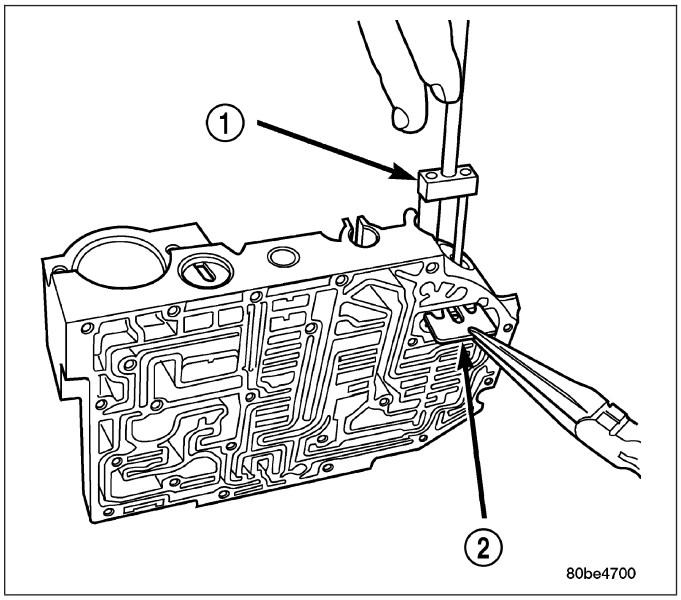
1 - VALVE BODY
2 - T/C REGULATOR VALVE
3 - L/R SWITCH VALVE
4 - CONVERTER CLUTCH CONTROL VALVE
5 - MANUAL VALVE
6 - CONVERTER CLUTCH SWITCH VALVE
7 - SOLENOID SWITCH VALVE
8 - REGULATOR VALVE

1. Install all valves and springs as shown.

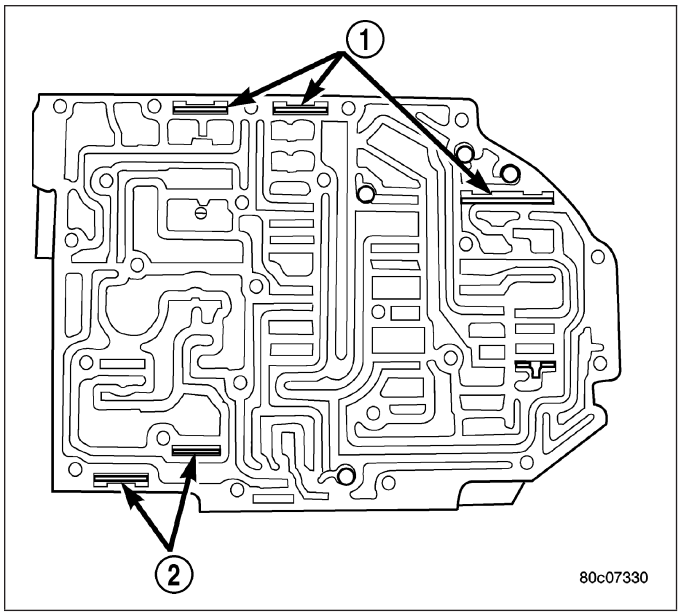
2. Install regulator valve spring retainer (2).



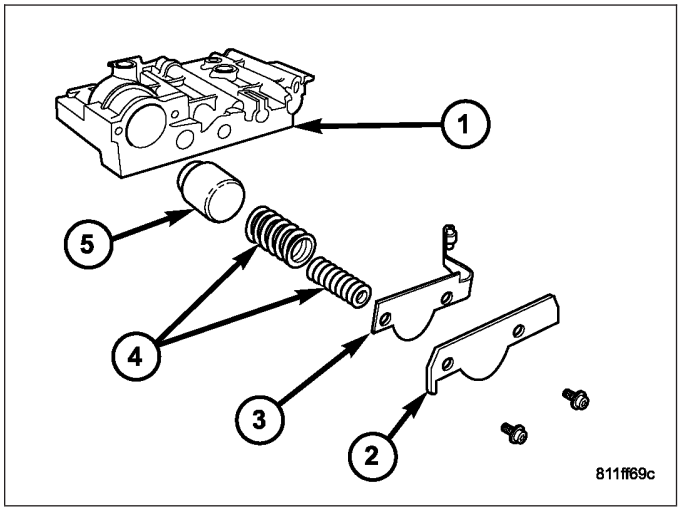
3. Install dual retainer plate (2) using Tool 6301 (1).

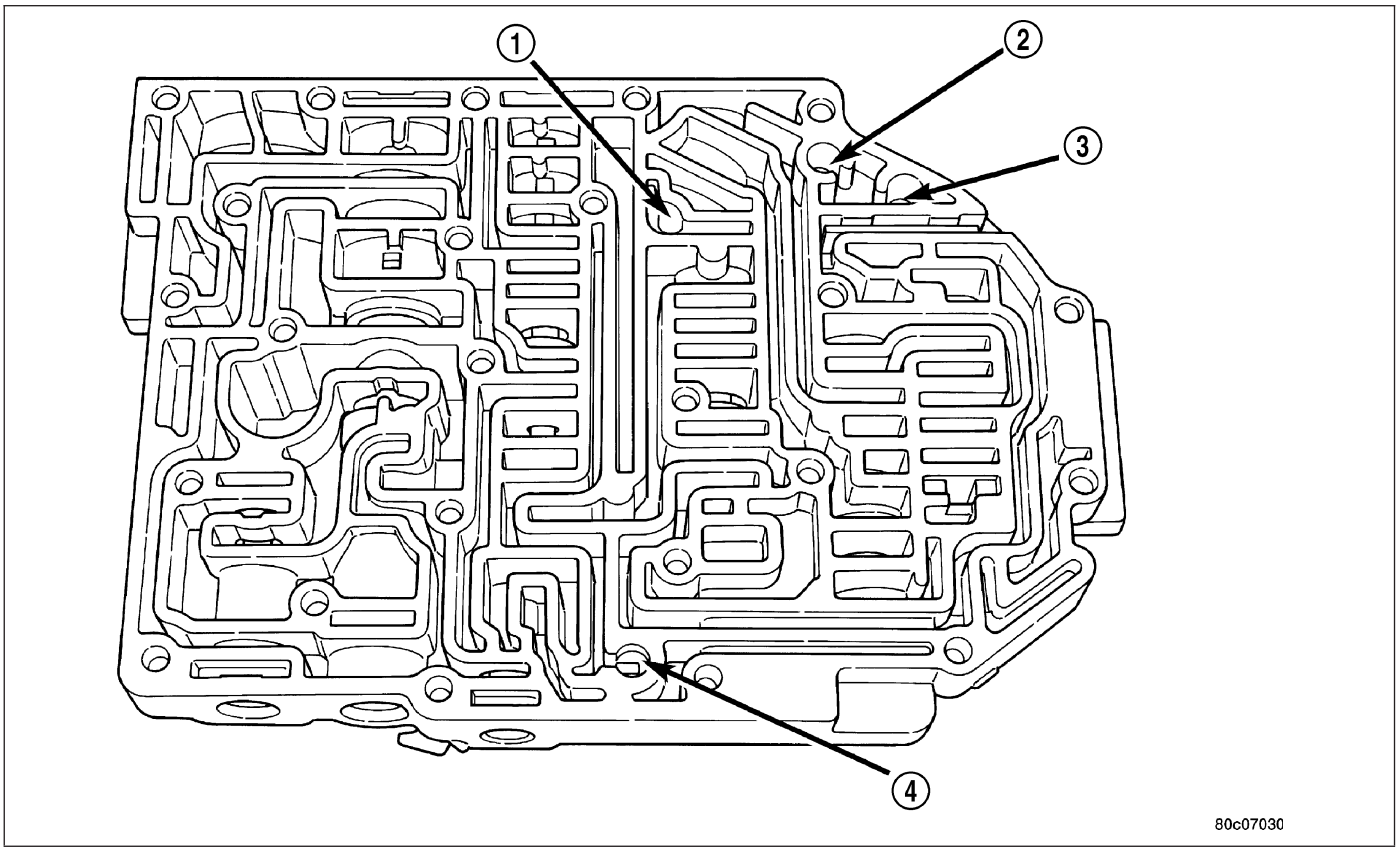


4. Verify that all retainers (1, 2) are installed as shown. Retainers should be flush or below valve body surface.



5. Install 2/4 Accumulator components (1-5) as shown. Torque 2/4 Accumulator retainer plate to 5 N·m (45 in. lbs.).



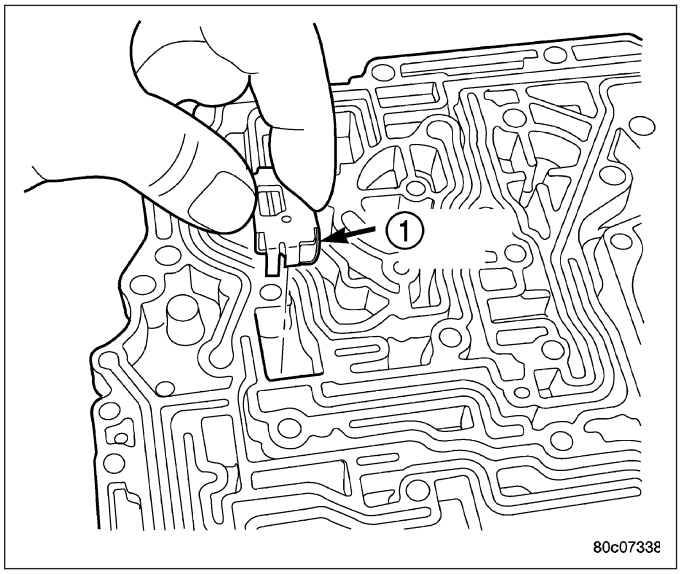


Ball Check Location

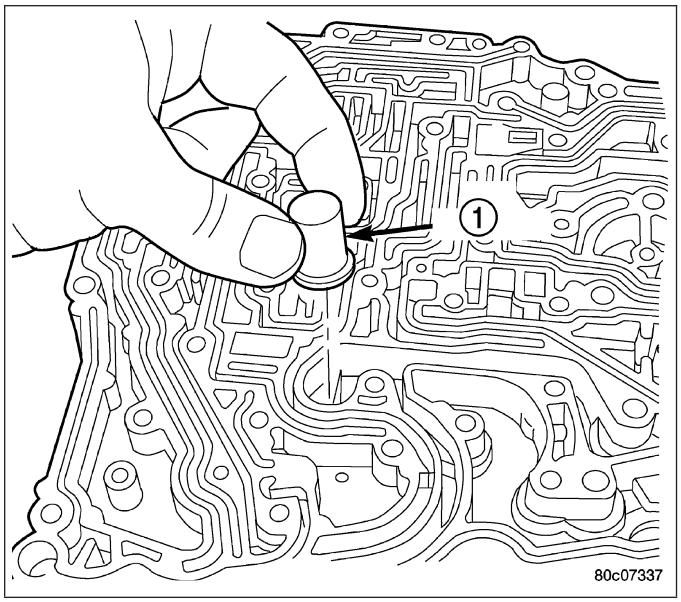
1 - (#4) BALL CHECK LOCATION
2 - (#2) BALL CHECK LOCATION
3 - (#5) BALL CHECK LOCATION
4 - (#3) BALL CHECK LOCATION

6. Install check balls into position as shown. If necessary, secure them with petrolatum or transmission assembly gel for assembly ease.

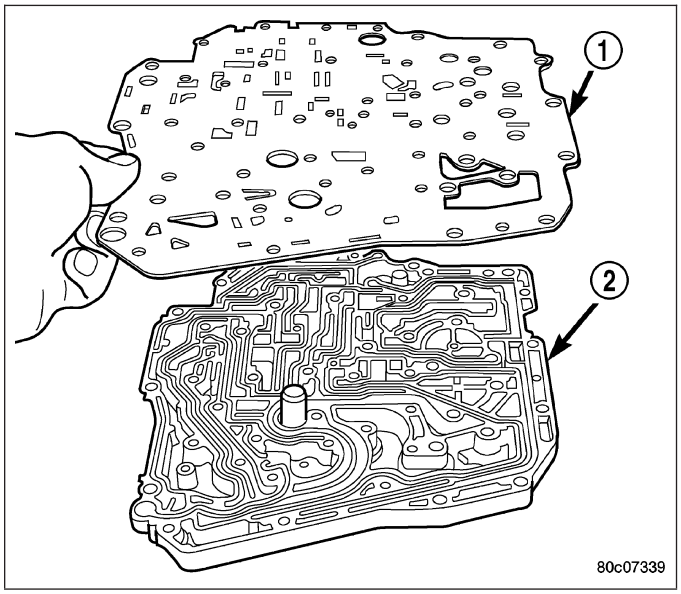
7. Install thermal valve (1) to the transfer plate.



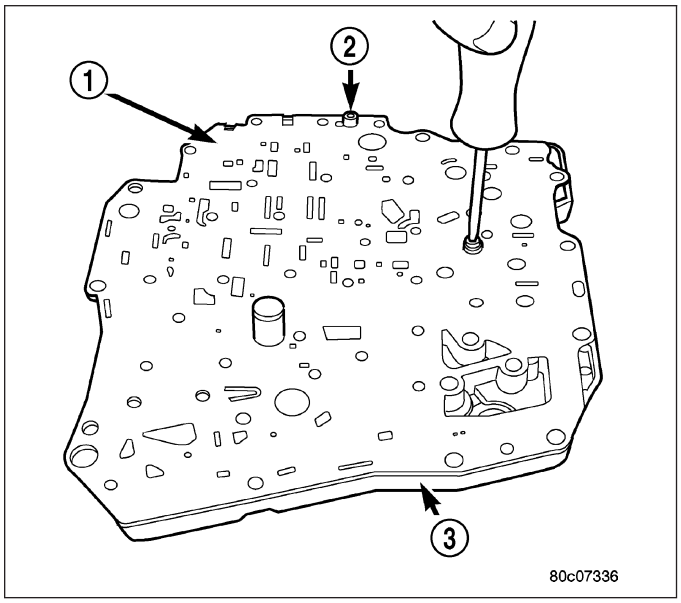
8. Install the oil screen (1) to the transfer plate.



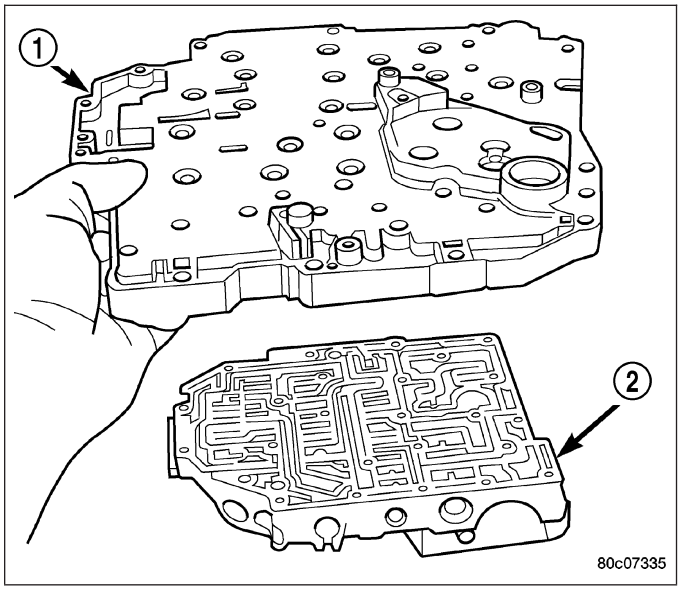
9. Install separator plate (1) to transfer plate (2).



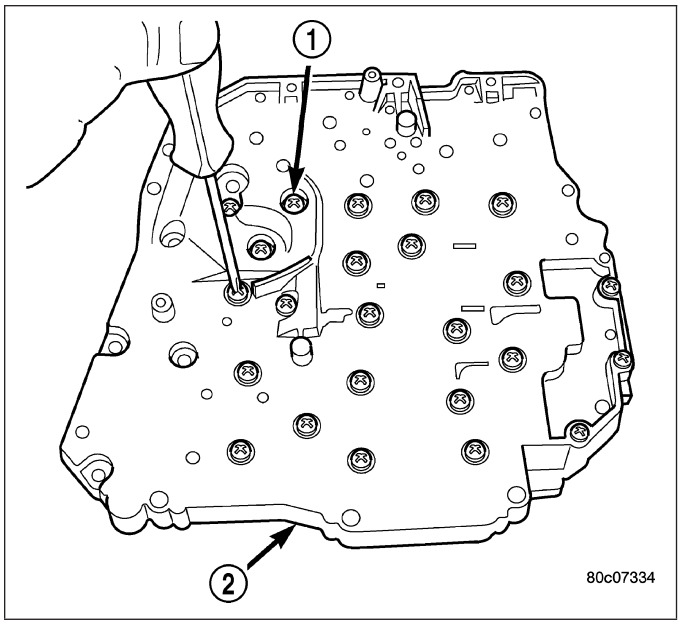
10. Install the two separator plate-to-transfer plate screws (2).



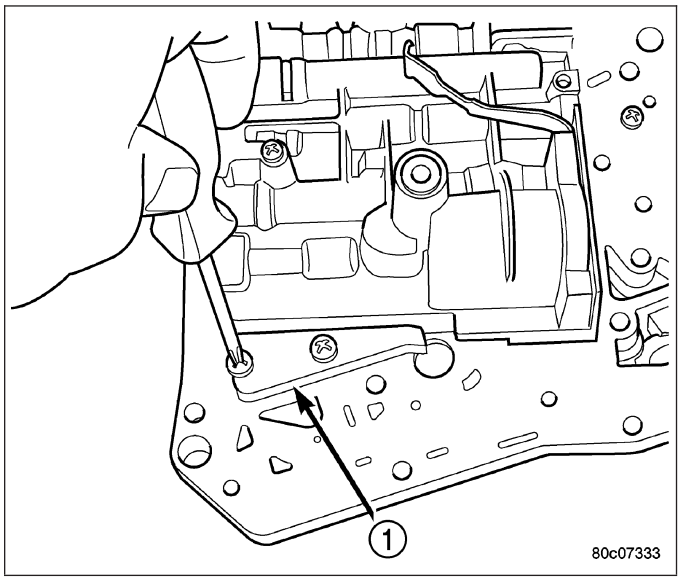
11. Install the transfer plate (1) to the valve body (2).



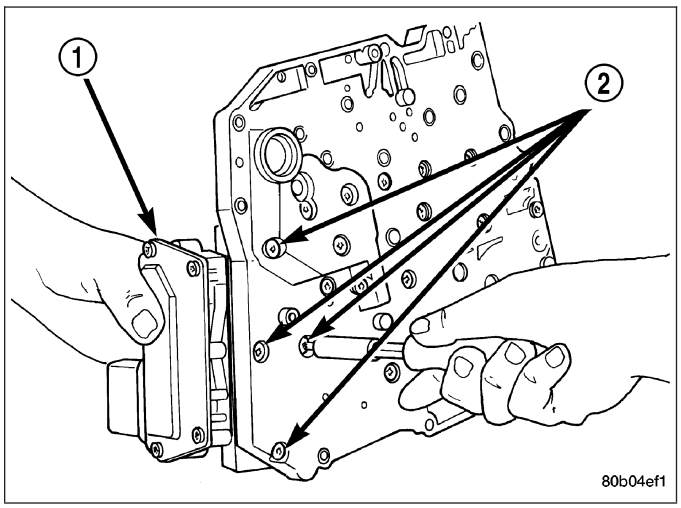
12. Install the transfer plate-to-valve body screws (1) and torque to 5 N·m (45 in. lbs.).



13. Install the stiffener plate (1).

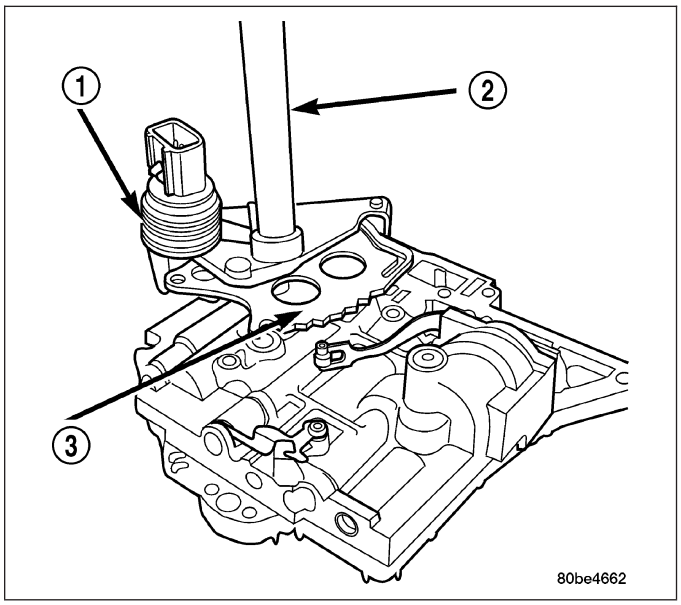


14. Install the solenoid/pressure switch assembly (1) and screws to the transfer plate and torque to 5.5

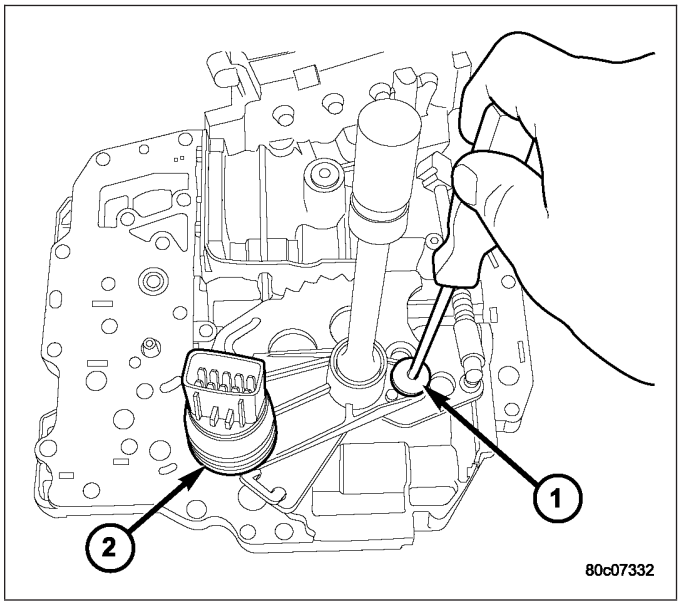


N·m (50 in. lbs.).

15. Install the manual shaft/rooster comb (3) and transmission range sensor (1) to the valve body.

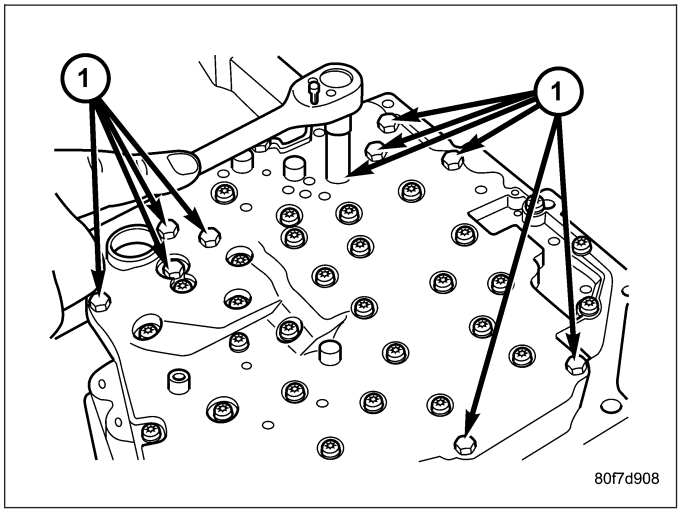


16. Install the TRS/manual shaft retaining screw (1) and torque to 5 N·m (45 in. lbs.).
17. Install manual shaft seal.

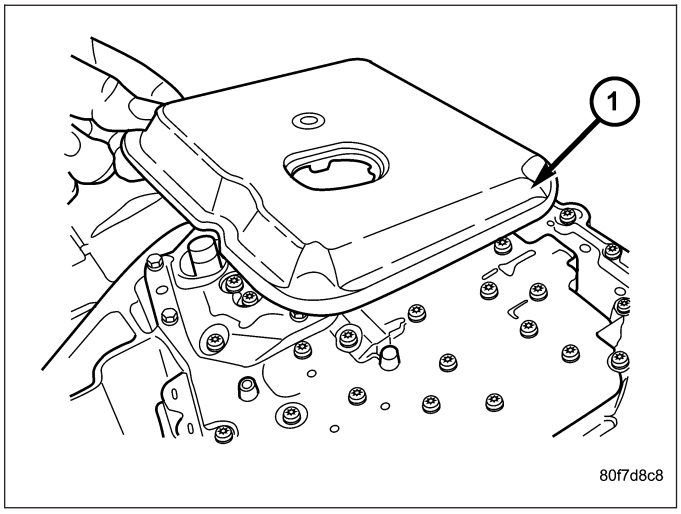


INSTALLATION

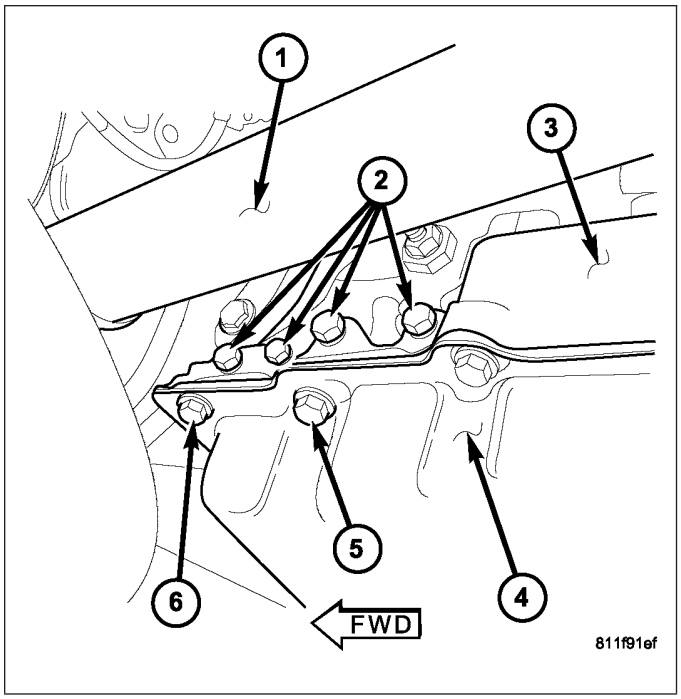
1. Install valve body into position and start bolts (1). Torque valve body to transmission case bolts (1) to 12 N·m (105 in. lbs.) torque.



2. Install transmission oil filter (1).

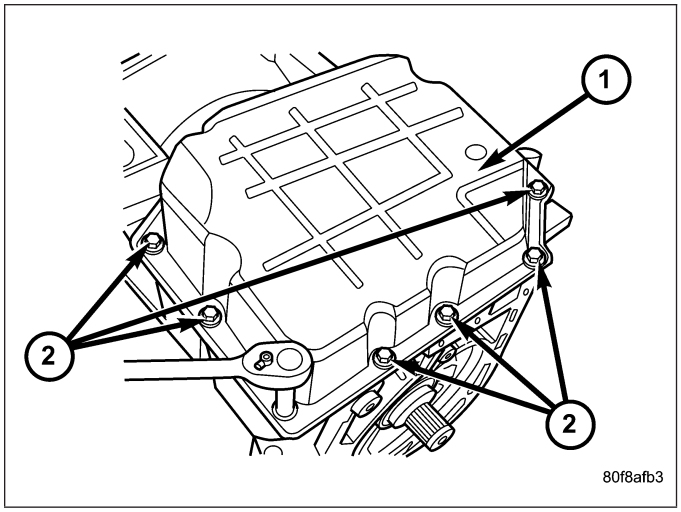


NOTE: Before installing the oil pan bolt in the bolt hole (5) located between the torque converter clutch on and U/D clutch pressure tap circuits , it will be necessary to replentish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.



3. Make sure oil pan (1) and case rail are clean and dry. Install an 1/8” bead of RTV to the transmission oil pan and install to case. Tighten bolts (2) to 20 N·m (14.5 ft. lbs.).
4. Lower vehicle and connect the TRS connector.
5. Connect solenoid/pressure switch assembly connector.
6. Lower vehicle.
7. Fill transmission with ATF+4, Automatic Transmission Fluid. Verify proper fluid level. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/FLUID - STANDARD PROCEDURE)

NOTE: If the valve body has been reconditioned or replaced, it is necessary to perform the Quick Learn Procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)



AUTOMATIC TRANSMISSION 545RFE - ELECTRICAL DIAGNOSTICS

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AUTOMATIC TRANSMISSION 545RFE - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1

For the Transmission circuit diagram (Refer to)(Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1

1. 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1

1. After completion of the Transmission Verification Test, the Powertrain Verification Test must be performed.

2. Connect the scan tool to the Data Link Connector (DLC).

3. Reconnect any disconnected components.

4. If the PCM has been replaced or reflashed, or the transmission has been repaired or replaced, it is necessary to perform the scan tool Quick Learn Procedure.

5. With the scan tool, erase all Transmission and Engine DTC's.

6. With the scan tool, display Transmission Temperature. Start and run the engine until the Transmission Temperature is HOT.

7. Check the Transmission fluid level and adjust if necessary. Refer to the Service Information for the Fluid Fill procedure. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/FLUID - STANDARD PROCEDURE)

8. Road test the vehicle.

9. Perform the following shifts from a standing start with a constant throttle opening of 20 to 25 degrees to the speeds of 97 Km/h or 60 MPH; make fifteen to twenty 1 to 2, 2 to 3, 3 to 4 upshifts and for 545RFE, 4 to 5.

10. Perform the following shifts with speeds below 40 Km/h or 25 MPH; make five to eight wide open throttle kickdowns to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown.

11. Check for DTC's during the road test.

12. Use the EATX OBDII task manager to run Good Trip time in each gear, this will confirm the repair and to ensure that the DTC has not re-matured.

13. With the scan tool, perform a BATTERY DISCONNECT, this will clear the EATX DTC EVENT DATA

Were there any Diagnostic Trouble Codes (DTCs) set during the road test?

Yes >> Refer to the Symptom List for the appropriate diagnostic tests.

No >> Repair is complete.

PRE-DIAGNOSTIC CHECK OUT

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. PRE-DIAGNOSTIC CHECK OUT

Check the transmission fluid level. If the fluid level is low, locate and repair any leaks and fill the transmission to the proper level. Refer to the appropriate Service Information for procedures. Many transmission symptoms can be caused by a low fluid level.

Check the battery. To avoid false diagnosis, testing should only be performed with the battery fully charged.

With the scan tool, read Engine (PCM) DTCs. If DTCs are present, refer to the Driveability Category and perform to the appropriate diagnostic procedure(s) before proceeding.

With the scan tool, read Transmission (TCM) DTCs. Record all Stored, Active, and Pending DTC information. Diagnose any Pending DTC as a matured DTC.

With the scan tool, read EATX DTC EVENT DATA. Use this data to identify the conditions in which the DTC was set.

Performing a Battery Disconnect will clear all EATX DTC EVENT DATA and reset all learned Transmission values to the default values, which may temporarily result in erratic shift schedules.

With the scan tool, perform the Shift Lever Position Test. If the test does not pass, refer to the diagnostic procedure for P0706 Check Shifter Signal.

For Gear Ratio Error DTCs, use the scan tool to view CVI Monitor data. Read and record the Clutch Volume Index information.

Use the wiring diagram as a guide. Inspect the wiring and connectors related to this circuit. Repair as necessary.

Refer to the When Monitored and Set Conditions for this DTC. DTCs can set at ignition on, at start up, after driving under specific conditions and after diagnostic monitors have been run.

Refer to applicable Technical Service Bulletins (TSBs) for controller software update information. Some conditions can be corrected by upgrading the Engine (PCM) or Transmission (TCM) controller software.

Refer to any Service Information Tune Ups or Technical Service Bulletins that apply to this symptom.

Were there any repairs made that fixed the vehicle?

Yes >> Testing complete.

No >> Refer to the Transmission category and perform the appropriate diagnostic procedure(s).

P0122-TPS/APP CIRCUITLOW

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - DIAGNOSIS AND TESTING).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored TPS voltage drops below .078 volts for the period of 0.48 seconds.

Possible Causes
RELATED ENGINE TPS/APPS DTC'S PRESENT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

Due to the integration of the Powertrain and Transmission Control Modules the New Generation Control Module III will be referred to as the Powertrain Control Module (PCM). The 3–wire TPS (4.7L V-8 Engine) provides the PCM with an input signal voltage that represents the throttle blade position of the throttle body. The Throttle Position Sensor (TPS) is connected to the throttle blade shaft. As the position of the throttle blade changes, the output voltage of the TPS changes.

The PCM supplies approximately 5.0 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the TPS. This will vary in an approximate range from 0.26 volts at minimum throttle opening (idle), to 4.49 volts at maximum opening (wide open throttle).

The Accelerator Pedal Position Sensor (APPS) is currently used only with the 5.7L V-8 engine. The APPS is a linear potentiometer. It provides the PCM with a voltage signal proportional to the angle, or position of the accelerator pedal. The APPS signal along with inputs from other sensors is used by the PCM to calculate the throttle plate position.

A mechanical cable is used between the accelerator pedal and the APPS assembly. Although a cable is used between the accelerator pedal and the APPS assembly, a mechanical cable is not used between the accelerator pedal and the throttle body. The throttle plate position is electronically controlled by the PCM.

Diagnostic Test

1. DETERMINING IF RELATED ENGINE TPS/APPS DTC'S ARE PRESENT

With the scan tool, check Engine DTC's.

Are there any Engine TPS/APPS DTCs present?

Yes >> Refer to the Drivability Category and perform the appropriate Symptom.

No >> Go To 2

P0122-TPS/APP CIRCUITLOW (CONTINUED)

2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, record the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

With the scan tool, erase Transmission DTCs.

NOTE: To erase EATX DTC DTC EVENT DATA information, a BATTERY DISCONNECT must be performed. Performing a BATTERY DISCONNECT may reset learned Transmission values to controller defaults which may lead to erratic shift schedules.

Drive the vehicle and try to duplicate the conditions in which the DTC was reported by the EATX DTC EVENT DATA.

With the scan tool, read Transmission DTCs.

Did the DTC P0122 TPS/APPS LOW, reset?

Yes >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0123- TPS/APP CIRCUIT HIGH

For the Transmission circuit diagram (Refer to) (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored TPS voltage rises above 4.94 volts for the period of 0.48 seconds.

Possible Causes
RELATED ENGINE TPS/APPS DTC'S PRESENT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

Due to the integration of the Powertrain and Transmission Control Modules the New Generation Control Module III will be referred as the Powertrain Control Module (PCM). The 4.7L V-8 Throttle Positioning Sensor (TPS) provides the PCM with an input signal voltage that represents the throttle blade position of the throttle body. The TPS is connected to the throttle blade shaft. As the position of the throttle blade changes, the output voltage of the TPS changes.

The 5.7L V-8 Accelerator Pedal Position Sensor (APPS) is a linear potentiometer that provides the PCM with a voltage signal proportional to the angle, or position of the accelerator pedal. The APPS signal along with inputs from other sensors is used by the PCM to calculate the throttle plate position which is electronically controlled.

Diagnostic Test

1. DETERMINING IF RELATED ENGINE TPS/APPS DTC'S ARE PRESENT

With the scan tool, check Engine DTC's, this includes all one trip failures.

Are there any Engine TPS/APPS DTCs present?

Yes >> Refer to the Drivability category and perform the appropriate symptom.

No >> Go To 2

P0123- TPS/APP CIRCUIT HIGH (CONTINUED)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, record the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

With the scan tool, erase Transmission DTCs.

NOTE: To erase EATX DTC EVENT DATA information, a BATTERY DISCONNECT must be performed. Performing a BATTERY DISCONNECT may reset all learned Transmission values to controller defaults that could lead to an inconsistent shift schedule.

Drive the vehicle and try to duplicate the conditions in which the DTC was reported by the EATX DTC EVENT DATA.

With the scan tool, read Transmission DTCs.

Did the DTC P0123 TPS/APPS HIGH, reset?

Yes >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0124-TPS/APP INTERMITTENT

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete Transmission wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored TPS throttle angle between the angles of 6° and 120° and the degree change is greater than 5° within a period of less than 7.0 ms

Possible Causes
RELATED TPS ENGINE DTC'S PRESENT
THROTTLE POSITION SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

Due to the integration of the Powertrain and Transmission Control Modules the New Generation Control Module III will be referred as the Powertrain Control Module (PCM). The 4.7L V-8 Throttle Positioning Sensor (TPS) provides the PCM with an input signal voltage that represents the throttle blade position of the throttle body. The TPS is connected to the throttle blade shaft. As the position of the throttle blade changes, the output voltage of the TPS changes.

The 5.7L V-8 Accelerator Pedal Position Sensor (APPS) is a linear potentiometer that provides the PCM with a voltage signal proportional to the angle, or position of the accelerator pedal. The APPS signal along with inputs from other sensors is used by the PCM to calculate the throttle plate position which is electronically controlled.

Diagnostic Test

1. DETERMINING IF RELATED ENGINE TPS DTC'S ARE PRESENT

With the scan tool, check Engine DTC's including all one trip failures.

Are there any Engine TPS/APPS DTCs present?

Yes >> Refer to the Powertrain category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, record the DTC EVENT DATA to help identify the conditions in which the DTC was set.

With the scan tool, erase Transmission DTCs.

NOTE: To erase EATX EVENT DATA information, a BATTERY DISCONNECT must be performed. Performing a BATTERY DISCONNECT may reset all learned transmission values to controller default. This may lead to erratic shift schedules.

Drive the vehicle and try to duplicate the conditions in which the DTC was reported by the DTC EVENT DATA.

With the scan tool, read Transmission DTCs.

Did the DTC P0124 TPS/APPS INTERMITTENT, reset?

Yes >> Go To 3

No >> Go To 4

P0124-TPS/APP INTERMITTENT (CONTINUED)

3. CHECK THROTTLE POSITION SENSOR OPERATION

Ignition On, Engine Not Running.

With the scan tool, under Transmission Sensors, monitor the TPS voltage in the following step.

Slowly open and close the throttle while checking for erratic voltage changes.

Was the TPS voltage change smooth and consistent?

Yes >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Throttle Position Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

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4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0218-HIGH TEMPERATURE OPERATION ACTIVATED

For the Transmission circuit diagram. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running.
- **Set Condition:**
  Immediately after a Overheat shift schedule is activated when the Transmission temperature exceeds 127° C or 260° F.

Possible Causes
HIGH TEMPERATURE OPERATION ACTIVATED
TORQUE CONVERTER CLUTCH SLIPPING / NOT ACTIVATING
EXCESSIVE TIME IDLING IN GEAR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

Theory of Operation

The DTC is intended as an informational DTC to aid the technician in determining the root cause of a customer dirveability issue. The DTC is also intended to alert the technicain to determine if a cooling system malfunction has occurred or if an additional transmission air to oil cooler is needed to support the customers driving behavior.

Diagnostic Test

1. HIGH TEMPERATURE OPERATION

This DTC is an informational DTC designed to aid the Technician in diagnosing shift quality complaints.

This DTC indicates that the transmission has been operating in the ″Overheat″ shift schedule which may generate a customer complaint.

The customer driving patterns may indicate the need for an additional transmission oil cooler.

Verify proper Engine cooling system operation which would affect proper transmission operation.

Verify proper torque converter clutch operation.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

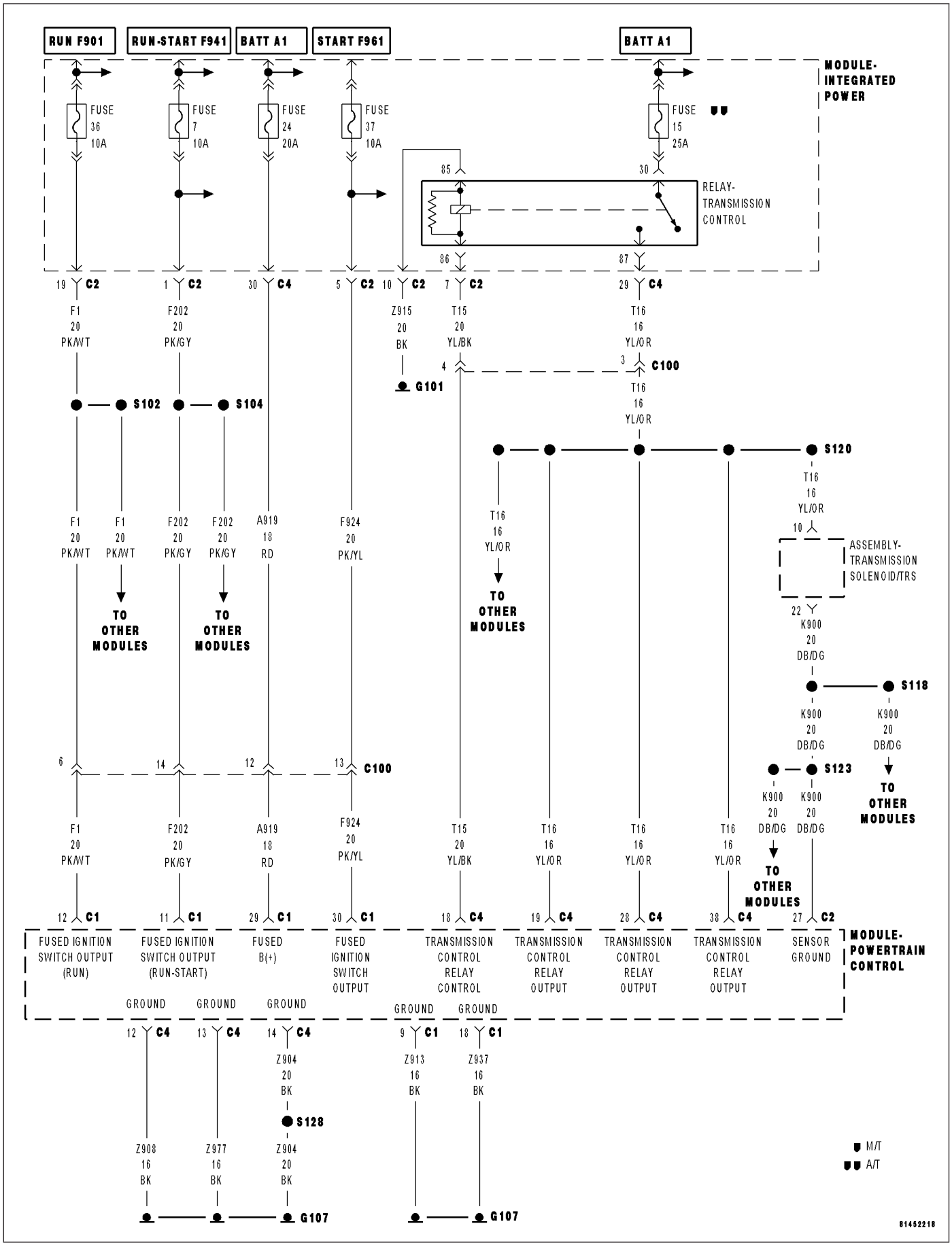
If there are no possible causes remaining, view repair.

Repair

Repair the cause of transmission overheating. Refer to the Service Information for the proper repair procedure. Make sure to check for any Service Bulletins pertaining to this problem.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0562-BATTERY VOLTAGE LOW



P0562-BATTERY VOLTAGE LOW (CONTINUED)

For the Transmission circuit diagram. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running and the PCM has closed the Transmission Control Relay.
- **Set Condition:**
  If the battery voltage of the Transmission Control Relay Output Sense circuit(s) to the PCM is less than 10.0 volts for the period of 15 seconds. Note: P0562 generally indicates a gradually falling battery voltage or a resistive connection(s) to the PCM. The DTC will also set if the battery voltage sensed at the PCM is less than 6.5-volts for 200ms or where Transmission Control Relay Output circuits are less than 7.2-volts for 200ms.

Possible Causes
RELATED CHARGING SYSTEM DTC'S
(Z908, Z977) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
(A104) FUSED B+ CIRCUIT TO PCM OPEN OR HIGH RESISTANCE
(T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
TRANSMISSION CONTROL RELAY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

Friction element distress could result from an insufficient supply voltage to properly control the solenoids. To prevent this possibility, the battery voltage is monitored and the system is placed in logical limp-in if the battery voltage drops below the limit.

Diagnostic Test

1. RELATED CHARGING SYSTEM DTC'S

With the scan tool, read the Engine DTC's.

Are there any related Charging System DTC's also present?

Yes >> Refer to the Charging System category and repair any Engine Charging System DTC's, before testing DTC P0562. NOTE: After repairing the Engine Charging System DTC's, perform the Transmission Verification test to verify the transmission was not damaged.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0562-BATTERY VOLTAGE LOW (CONTINUED)

2. CONDITION P0562 PRESENT

NOTE: Generator, battery, and charging system must be fully functional before performing this test.
With the scan tool, read Transmission DTC's.

With the scan tool, Check the STARTS SINCE SET counter for P0562.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter set at 0?

Yes >> Go To 3

No >> Go To 7

3. CHECKING (Z908, Z977) GROUND CIRCUITS

Turn the ignition off to the lock position.

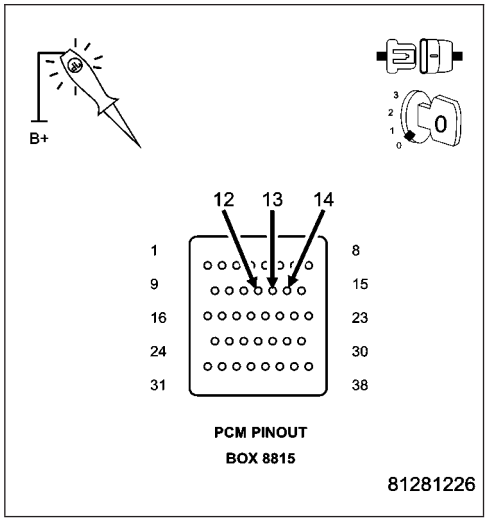
Disconnect the PCM C4 harness connector and connect Miller tool #8815.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Using a 12-volt test light connected to 12-volts, check the PCM (Z908, Z977) Ground circuits at the appropriate terminals of Miller tool #8815.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.



Does the test light illuminate brightly for the PCM (Z908, Z977) Ground circuits?

Yes >> Go To 4

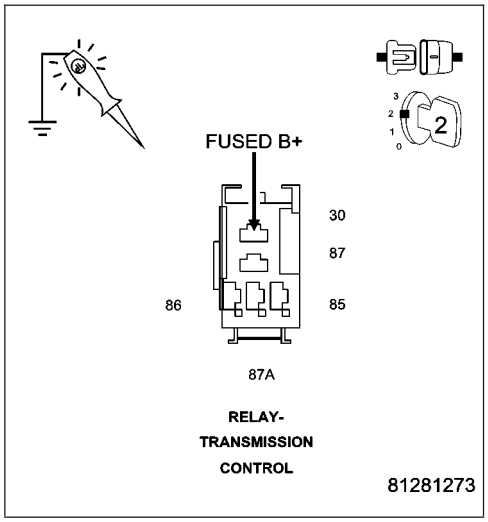
No >> Repair the (Z908, Z977) Ground circuit(s) for an open or high resistance.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

4. CHECKING (A104) FUSED B+ CIRCUIT

Remove the Transmission Control Relay.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, check the (A104) Fused B+ circuit at the Transmission Control Relay connector.



Does the test light illuminate brightly?

Yes >> Go To 5

No >> Repair the (A104) Fused B+ circuit for an open or high resistance.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0562-BATTERY VOLTAGE LOW (CONTINUED)

5. CHECKING THE (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT

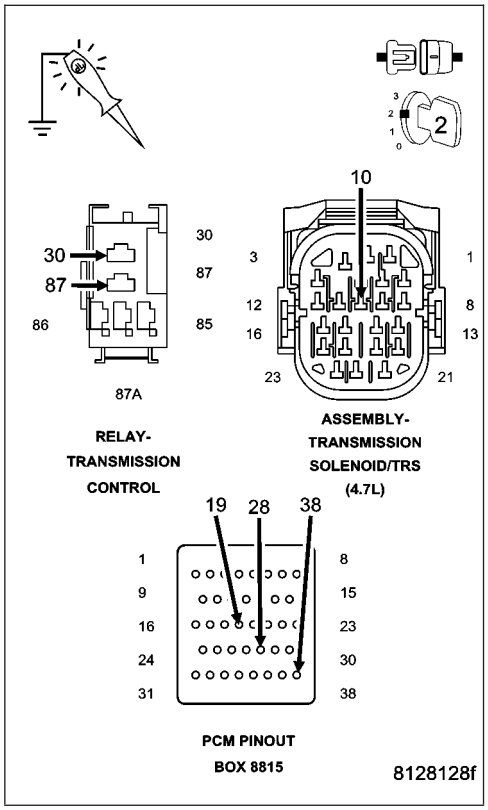
Turn the ignition off to the lock position.

NOTE: Check connectors - Clean/repair as necessary.

Connect a jumper wire between (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, check all (T16) Transmission Control Relay Output circuits at the appropriate terminals of Miller tool #8815.



Does the test light illuminate brightly?

Yes >> Go To 6

No >> Repair the (T16) Transmission Control Relay Output circuit for an open or high resistance.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

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6. TRANSMISSION CONTROL RELAY

Turn the ignition off to the lock position.

Reconnect all previously disconnected connectors.

Install a substitute Relay in place of the Transmission Control Relay.

Start the engine.

Using a voltmeter, measure the vehicles battery voltage.

With the scan tool, monitor the Transmission Switched Battery Voltage.

Compare the scan tool Transmission Switched Battery voltage to the actual battery voltage reading on the voltmeter.

Is the scan tool voltage within 1.0 volt of the battery voltage?

Yes >> Replace the Transmission Control Relay.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0562-BATTERY VOLTAGE LOW (CONTINUED)

7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0602-CONTROL MODULE PROGRAMMING ERROR/NOT PROGRAMMED

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Check for generic software is made at power-up
- **Set Condition:**
  If genic software is found , the MIL will light immediately. This DTC is designed to signal the technician that the controller still has generic software installed.

Possible Causes
PCM - PROGRAMMING ERROR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

Theory of Operation

The controller is programmed during manufacturing with generic software to facilitate testing. This software does not have the proper calibrations to control a transmission in a vehicle. The check for generic software is made at power-up. If generic software is found , the MIL will light immediately and the MIL will stay on even if the fault is cleared, until the proper software is installed. Note: Transmission will be placed in limp-in mode.

Diagnostic Test

1. CONTROL MODULE PROGRAMMING ERROR

NOTE: Controller is programmed with generic software and will not allow the correct vehicle Powertrain management.

With the scan tool.

Record the vehicles controller part number.

Select Use Controller Part Number under the Flash Tab.

Flash the controller with the correct software.

Verify the controller flashed successfully.

Test Complete

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. Perform Quick Learn Procedure.

P0604-INTERNAL CONTROL MODULE RAM

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  One time after the controller is reset (ignition turned to the RUN position).
- **Set Condition:**
  Whenever the Powertrain Control Module (PCM) detects an internal controller problem.

Possible Causes
POWER OR GROUND CIRCUIT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

After the controller is reset (ignition turned to the RUN position), the microprocessor checks the integrity of each RAM location by writing to it and reading back from it. The read value should be same as value written.

Diagnostic Test

1. CHECK WIRING AND CONNECTORS FOR INTERMITTENT OPERATION

Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

NOTE: Due to the integration of the Powertrain and Transmission Control Modules, the transmission part of the PCM has it's own specific power and ground circuits.
Wiggle the wires while checking for shorted and open circuits.

Check for any Service Bulletins that may apply.

Were there any problems found?

Yes >> Repair the power and/or ground circuits to the PCM and Transmission Control Relay as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0605-INTERNAL CONTROL MODULE ROM

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  One time after the controller is reset (ignition turned to the RUN position).
- **Set Condition:**
  Whenever the Powertrain Control Module (PCM) detects an internal controller problem.

Possible Causes
POWER OR GROUND CIRCUIT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

After the controller is reset (ignition turned to the RUN position) the microprocessor checks the integrity of the program memory (ROM). A checksum is calculated by adding all used bytes in the program memory. The sum should be the same as a known constant stored in the program memory.

Diagnostic Test

1. CHECK WIRING AND CONNECTORS FOR INTERMITTENT OPERATION

Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

NOTE: Due to the integration of the Powertrain and Transmission Control Modules, the transmission part of the PCM has it's own specific power and ground circuits.
Wiggle the wires while checking for shorted and open circuits.
Check for any Service Bulletins that may apply.

Were there any problems found?

Yes >> Repair the power and/or ground circuits as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0613-INTERNAL TCM

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  1) One time after the controller is reset (ignition turned to the RUN position) and every 60 seconds thereafter. The Delay Test is executed after a reset only.
  2) 2 seconds after an invalid test.
- **Set Condition:**
  If either of the following conditions occur 3 times:
  1) The watchdog fault line remains high after the period has elapsed for the too early - too late watchdog test.
  2) The Transmission Control Relay remains on after the watchdog delay expired.

Possible Causes
POWER OR GROUND CIRCUIT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The internal Watchdog (WD) is a separate hardware circuit that continuously monitors the microprocessor. To insure the proper operation of the EATX controller the watchdog must receive a signal from the microprocessor within a specific time window (14ms ± 1ms) to prevent a system shutdown after a short delay (570ms). The microprocessor periodically tests the WD's ability to provide this shutdown function using a three phase test;

1) Send the signal too late > 15ms

2) Send the signal too early < 13ms

3) Delay test < 590ms

If the watchdog input signal arrives too early or too late, the Watchdog Fault line will go low and the watchdog delay will start to time out. The delay will be reset by the correct timing of watchdog signal sent during subsequent operations.

The Delay Test checks the delay time out. The Delay Monitor line is pulled low, which forces the delay to start timing out. At the end of the delay time the Transmission Relay will be turned off. The delay test, upon detection of the relay turning off, will immediately turn the relay back on before shutdown can occur.

Diagnostic Test

1. CHECK THE WIRING AND CONNECTORS

Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

NOTE: Due to the integration of the Powertrain and Transmission Control Modules, the transmission part of the PCM has it's own specific power and ground circuits.
Wiggle the wires while checking for shorted and open circuits.

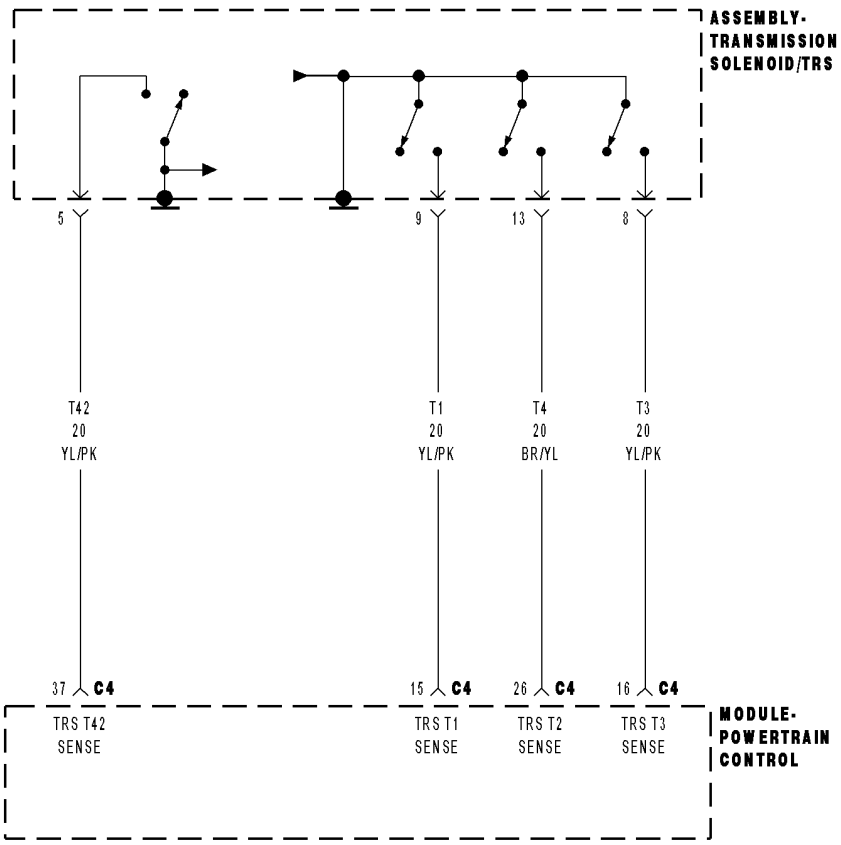
Check for any Service Bulletins that may apply.

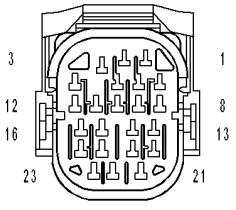
Were there any problems found?

Yes >> Repair the power and/or ground circuits as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

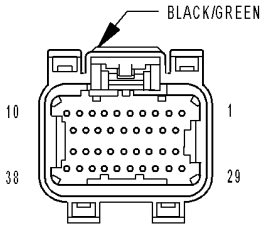
No >> Replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0706-TRANSMISSION RANGE SENSOR RATIONALITY





ASSEMBLY-
TRANSMISSION
SOLENOID/TRS
(4.7L)



MODULE-
POWERTRAIN
CONTROL C4
(545RFE)

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P0706-TRANSMISSION RANGE SENSOR RATIONALITY (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on.
- **Set Condition:**
  The DTC will set if the controller detects an invalid PRNDL code which lasts for more than 0.042 seconds.

Possible Causes
SHIFTER OUT OF ADJUSTMENT
TRS SENSE CIRCUIT OPEN
TRS SENSE CIRCUIT SHORT TO GROUND
TRS SENSE CIRCUIT SHORT TO VOLTAGE
METAL DEBRIS IN OIL PAN
TRANSMISSION RANGE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The T1, T2, T3, T41, or T42 (C1 - C5) Sense circuits communicate the shift lever position to the Transmission Control System. Each circuit is terminated at the transmission by a switch (TRS). Each switch can be either open or closed, depending on the shift lever position. The PCM can decode this information and determine the shift lever position.

Each shift lever position has it own unique combination of closed and open switches. This is called a PRNDL code. There are 5 switches, therefore: there are many possible combinations of open and closed switches (codes). There are 12 valid codes: two for neutral, one for each other gear position (5), and five temporary (transition zone) codes. The remainder of the codes should never occur, these are called invalid codes.

Diagnostic Test

1. CHECK TO SEE IF P0706 DTC IS CURRENT

With the scan tool, perform the Shift Lever Position Test.

Select the test outcome from the following:

Test passes:
Go To 6

Test fails with DTC:
Go To 2

Test fails without DTC:
Perform the Gearshift Adjustment Procedure per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0706-TRANSMISSION RANGE SENSOR RATIONALITY (CONTINUED)

2. ASSEMBLY-TRANSMISSION SOLENOID/TRS

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

NOTE: Check connectors - Clean/repair as necessary.

Install Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the scan tool, perform the Shift Lever Position Test.

When the scan tool instructs you to put the Gear Selector in a particular position, you must do so using the selector switch on the Transmission Simulator.

The LED for the gear position in question must be illuminated on the Transmission Simulator prior to pressing ″ENTER″ on the scan tool.

NOTE: When the scan tool requests the O/D off button be depressed, you must use the O/D OFF button in the vehicle or you will fail the Shift Lever Position Test with a an error code 11 or OD-TOW/HALL STUCK OPEN.

NOTE: If the Shift Lever Position test fails, make sure to note the identification of the TRS Sense circuit for future reference.

Did the Shift Lever Position test pass?

Yes >> Remove the Oil Pan and Main Valve Body Assembly per the Service Information. Check for metal debris on top of the Solenoid/TRS Assembly and the manual valve code plate. If debris is present, determine the cause of the debris repair transmission as necessary. If no problems are found, replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. TRS SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM harness connectors and install Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the identified (T1, T2, T3, T41, or T42) TRS Sense circuit, from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the identified (T1, T2, T3, T41, or T42) TRS Sense circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

P0706-TRANSMISSION RANGE SENSOR RATIONALITY (CONTINUED)

4. TRS SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the identified (T1, T2, T3, T41, or T42) TRS Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the identified (T1, T2, T3, T41, or T42) TRS Sense circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

---

5. TRS SENSE CIRCUIT SHORT TO OTHER CIRCUITS

Measure the resistance between the identified (T1, T2, T3, T41, or T42) TRS Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 100k ohms between the identified (T1, T2, T3, T41, or T42) TRS Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the identified (T1, T2, T3, T41, or T42) TRS Sense circuit for a short to other circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

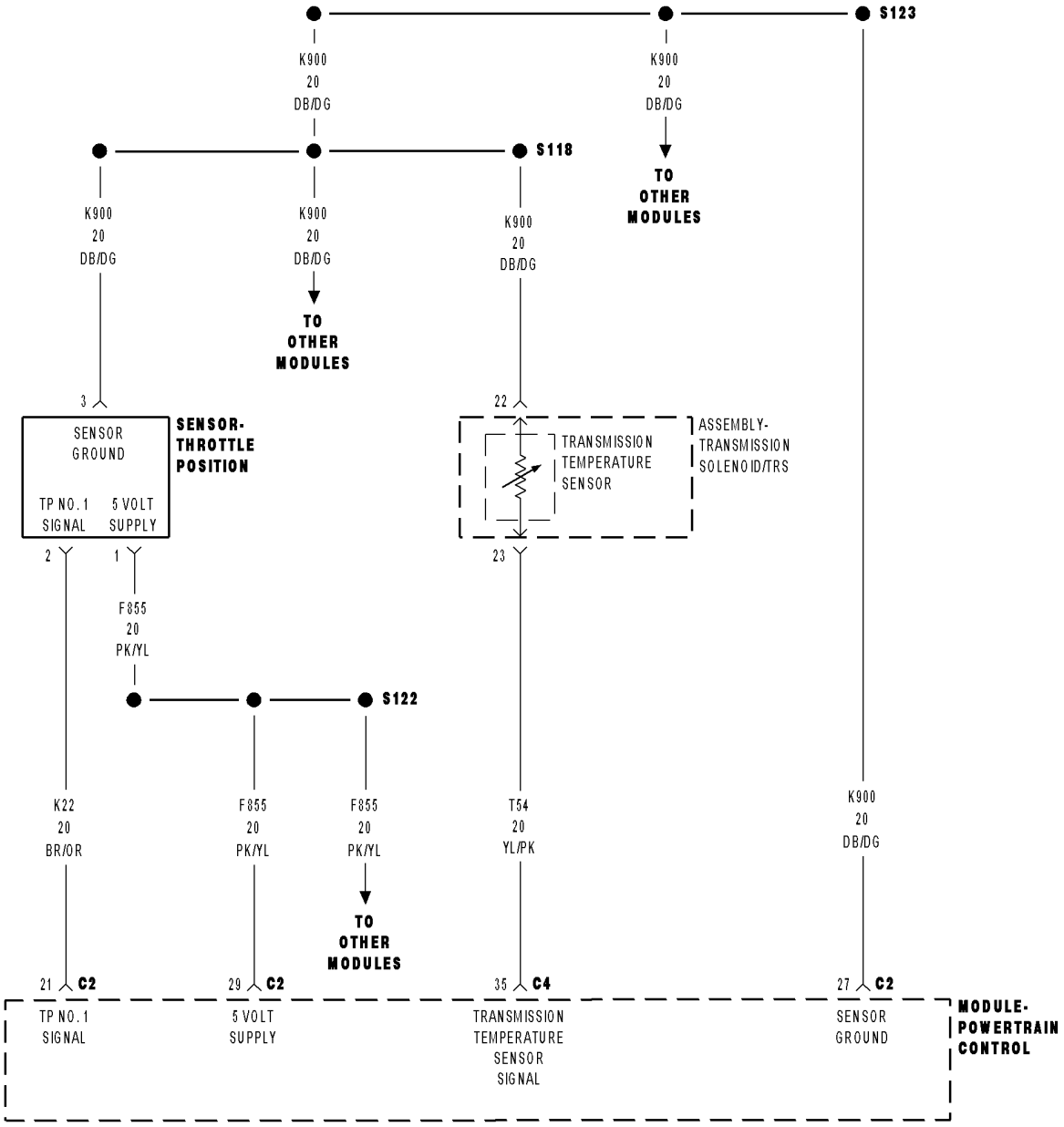
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

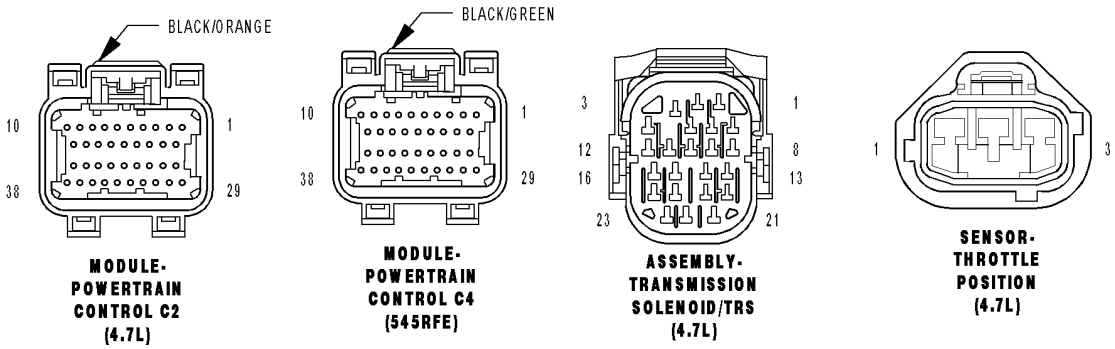
Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE





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P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS) .

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set when the desired transmission temperature does not reach a normal operating temperature within a given time frame. Time is variable due to ambient temperature. Approximate times are starting temperature to warm up time: (-40° F / -40° C - 35 min) (-20° F / -28° C - 25 min) (20° F / -6.6° C - 20 min) (60° F / 15.5 ° C - 10 min)

Possible Causes
RELATED DTC'S PRESENT
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Temperature Sensor is a variable resistor that changes with temperature, or otherwise known as a thermister. The temperature of the transmission fluid can affect a variety of electronically controlled transmission operations such as shift quality, torque converter lock-up, and when and/or if certain OBDII or system self-diagnostic test are performed. The Powertrain Control Module (PCM) substitutes a calculated transmission temperature value if a fault is detected in the Transmission Temperature Sensor circuit.

Diagnostic Test

1. DETERMINE IF RELATED DTC'S ARE PRESENT

With the scan tool, check Transmission DTC's.

Are there any other related Transmission Temperature Sensor DTCs present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0711.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 3

No >> Go To 4

P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

3. TRANSMISSION TEMPERATURE SENSOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings to the voltage readings listed on the Transmission Simulator.

Do the readings on the scan tool match the Transmission Simulator readings ± 0.2 volts?

Yes >> Replace Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

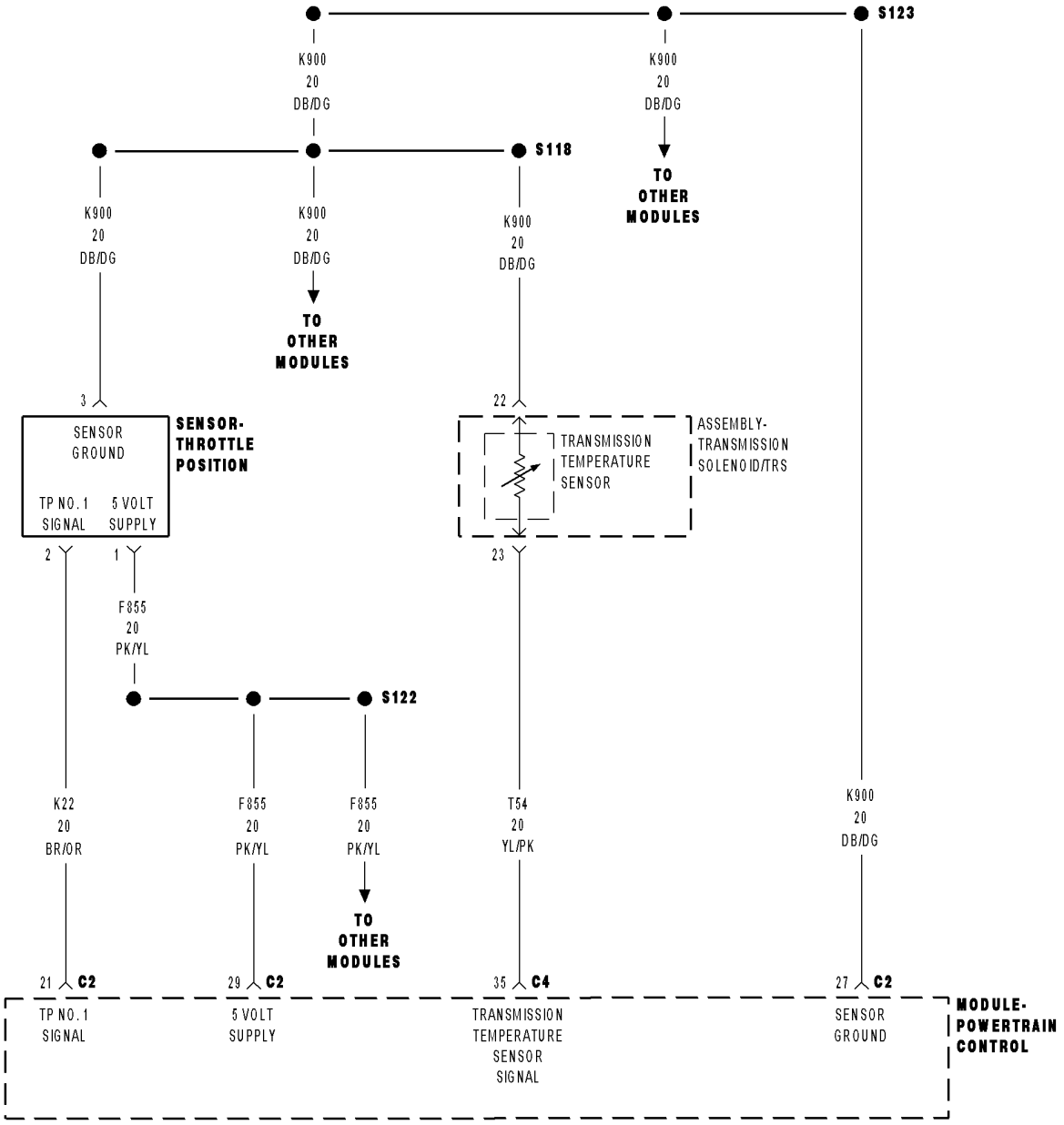
With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

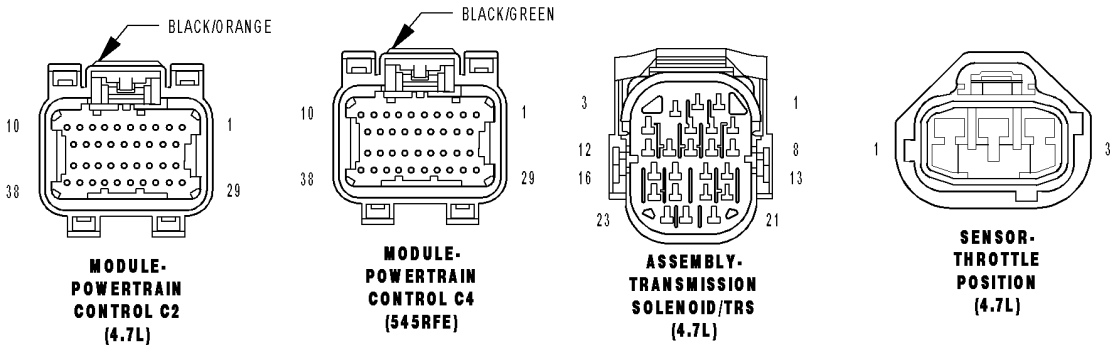
Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0712-TRANSMISSION TEMPERATURE SENSOR LOW





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P0712-TRANSMISSION TEMPERATURE SENSOR LOW (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set when the monitored Temperature Sensor voltage drops below 0.078 volts for the period of 0.45 seconds.

Possible Causes
RELATED DTC'S PRESENT
(T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Temperature Sensor is a variable resistor that changes with temperature, or otherwise known as a thermister. The temperature of the transmission fluid can affect a variety of electronically controlled transmission operations such as shift quality, torque converter lock-up, and when and/or if certain OBDII or system self-diagnostic test are performed. The Powertrain Control Module (PCM) substitutes a calculated transmission temperature value if a fault is detected in the Transmission Temperature Sensor circuit.

Diagnostic Test

1. DETERMINE IF RELATED DTC'S ARE PRESENT

With the scan tool, check Transmission DTC's.

Are there any line pressure sensor or throttle position sensor DTCs present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.

No >> Go To 2

---

2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0712.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 3

No >> Go To 5

P0712-TRANSMISSION TEMPERATURE SENSOR LOW (CONTINUED)

3. TRANSMISSION TEMPERATURE SENSOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match the scan tool readings ± 0.2 volts?

Yes >> Replace Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off to the lock position.

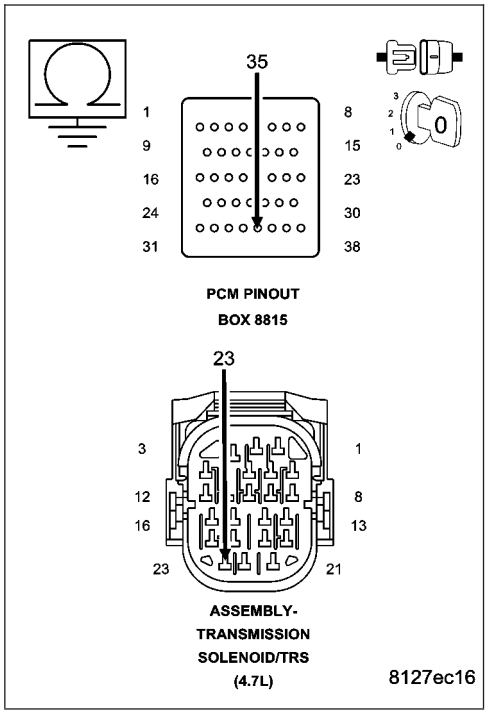
Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance between ground and the (T54) Transmission Temperature Sensor Signal circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T54) Transmission Temperature Sensor Signal circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0712-TRANSMISSION TEMPERATURE SENSOR LOW (CONTINUED)

5. INTERMITTENT WIRING AND CONNECTORS

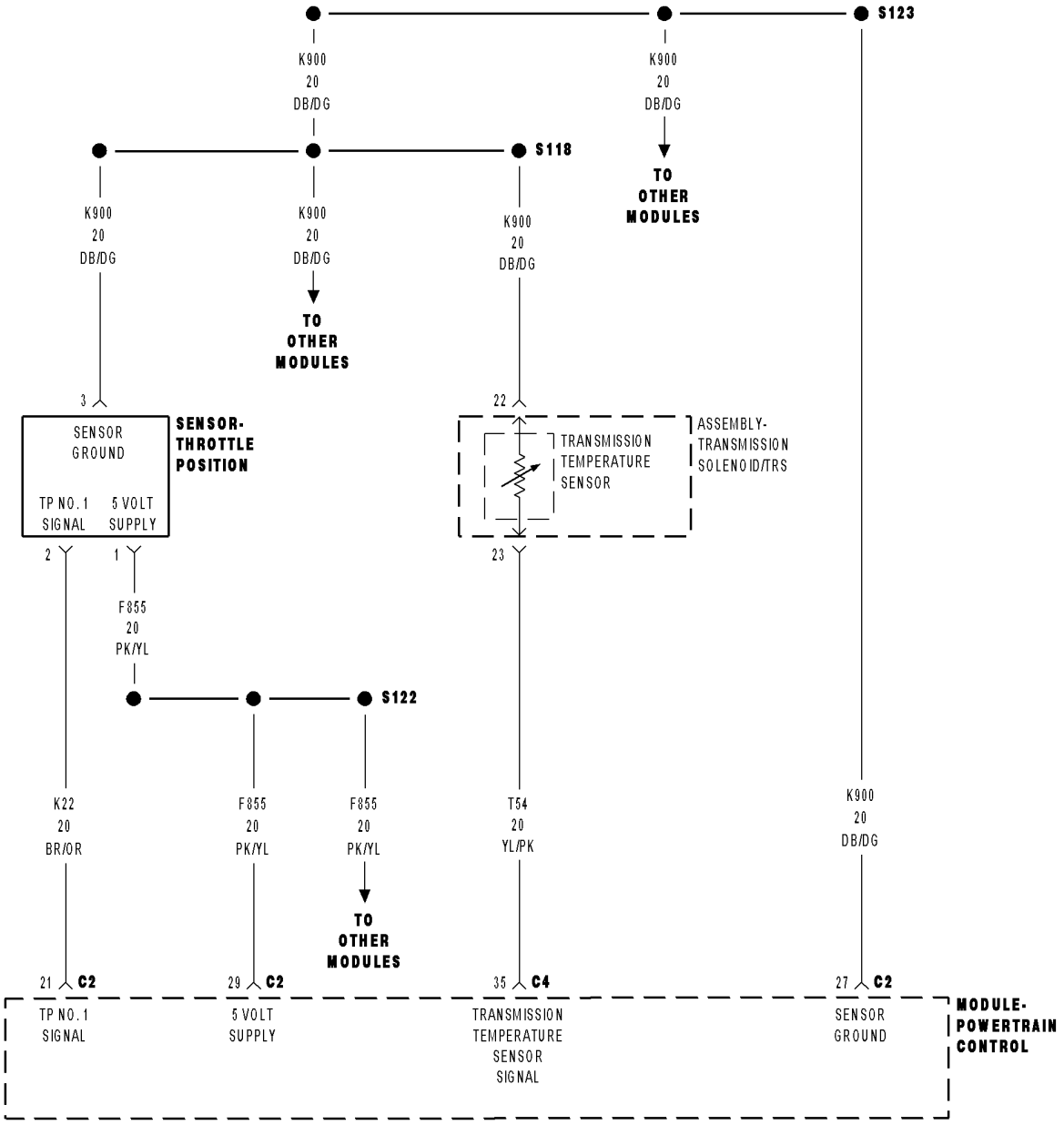
The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

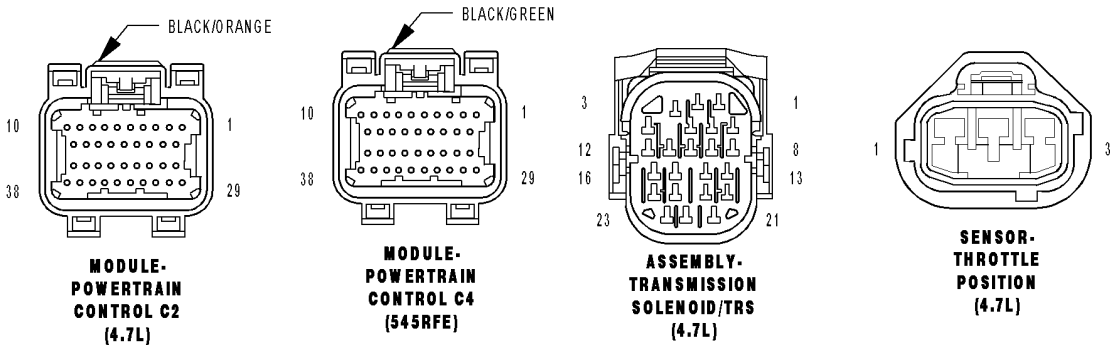
Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0713-TRANSMISSION TEMPERATURE SENSOR HIGH





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P0713-TRANSMISSION TEMPERATURE SENSOR HIGH (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set when the monitored Temperature Sensor voltage rises above 4.94 volts for the period of 0.45 seconds.

Possible Causes
RELATED DTC'S PRESENT
(T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO OTHER CIRCUITS
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Temperature Sensor is a variable resistor that changes with temperature, or otherwise known as a thermister. The temperature of the transmission fluid can affect a variety of electronically controlled transmission operations such as shift quality, torque converter lock-up, and when and/or if certain OBDII or system self-diagnostic test are performed. The Powertrain Control Module (PCM) substitutes a calculated transmission temperature value if a fault is detected in the Transmission Temperature Sensor circuit.

Diagnostic Test

1. DETERMINE IF RELATED DTC'S ARE PRESENT

With the scan tool, check Transmission DTC's.

Are there any line pressure sensor or throttle position sensor DTCs present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.

No >> Go To 2

---

2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0713.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 3

No >> Go To 5

P0713-TRANSMISSION TEMPERATURE SENSOR HIGH (CONTINUED)

3. TRANSMISSION TEMPERATURE SENSOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Note: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match the scan tool readings ± 0.2 volts?

Yes >> Replace Transmission Solenoid/TRS assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

---

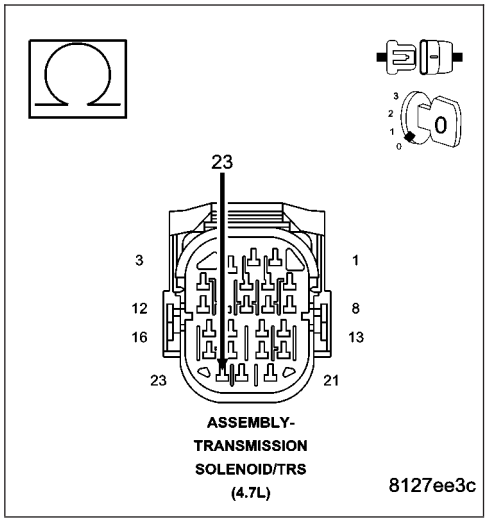
4. (T54) TRANSMISSION SENSOR SIGNAL CIRCUIT SHORT TO OTHER CIRCUITS

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM harness connectors.

Measure the resistance between the (T54) Transmission Temperature Sensor Signal circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T54) Transmission Temperature Sensor Signal circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the Transmission Temperature Sensor Signal circuit for a short to other circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0713-TRANSMISSION TEMPERATURE SENSOR HIGH (CONTINUED)

5. INTERMITTENT WIRING AND CONNECTORS

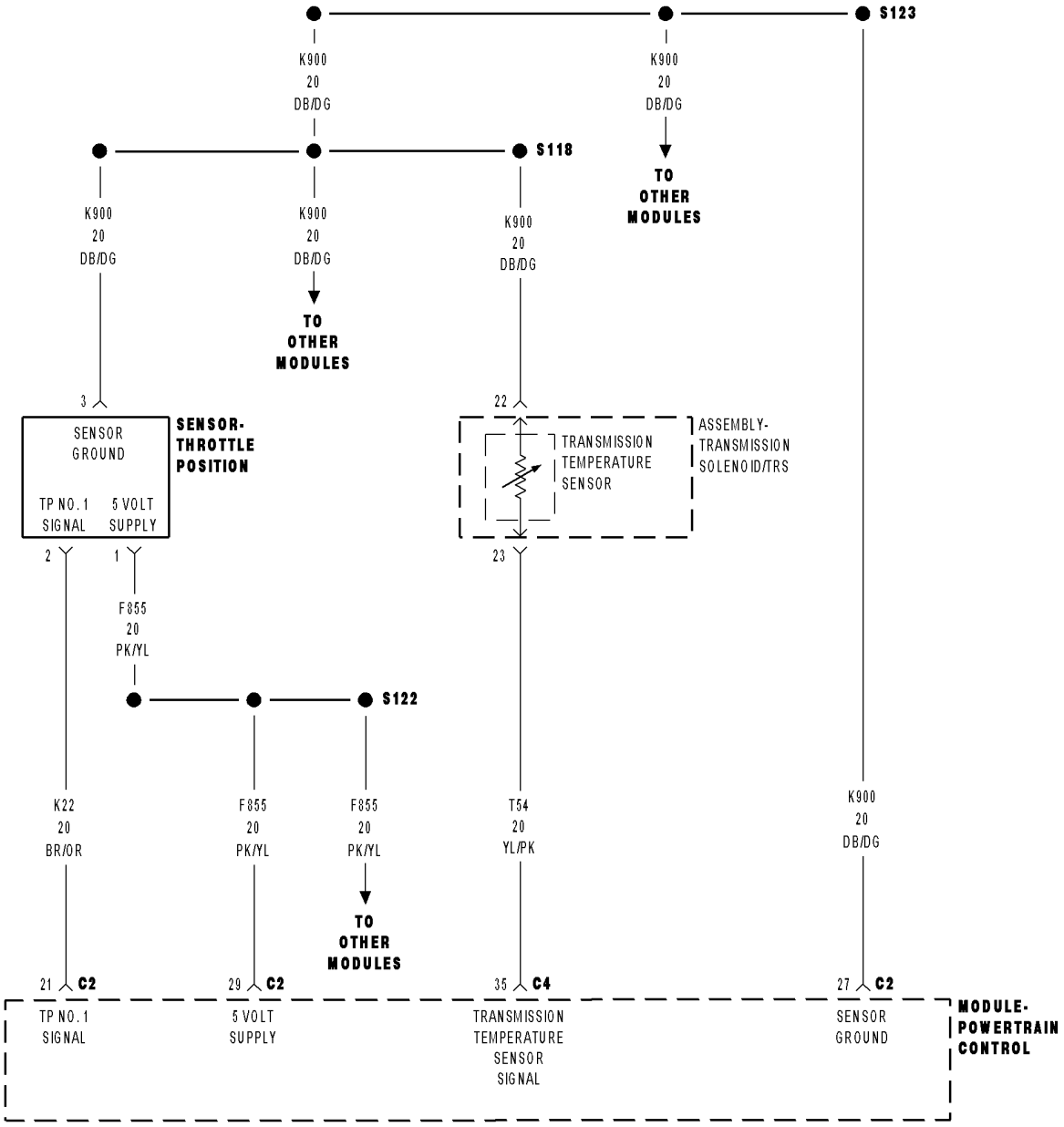
The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

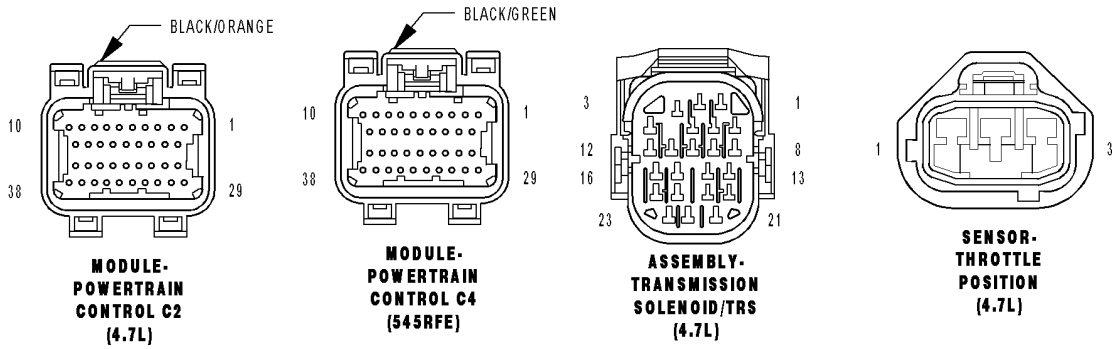
Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0714-TRANSMISSION TEMPERATURE SENSOR INTERMITTENT





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P0714-TRANSMISSION TEMPERATURE SENSOR INTERMITTENT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS) .

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set when the monitored Temperature Sensor voltage fluctuates or changes abruptly within a predetermined period of time.

Possible Causes
RELATED DTC'S PRESENT
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Temperature Sensor is a variable resistor that changes with temperature, or otherwise known as a thermister. The temperature of the transmission fluid can affect a variety of electronically controlled transmission operations such as shift quality, torque converter lock-up, and when and/or if certain OBDII or system self-diagnostic test are performed. The Powertrain Control Module (PCM) substitutes a calculated transmission temperature value if a fault is detected in the Transmission Temperature Sensor circuit.

Diagnostic Test

1. DETERMINE IF RELATED DTC'S ARE PRESENT

With the scan tool, check Transmission DTC's.

Are there any line pressure sensor or throttle position sensor DTCs present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.

No >> Go To 2

---

2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0714.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 3

No >> Go To 4

P0714-TRANSMISSION TEMPERATURE SENSOR INTERMITTENT (CONTINUED)

3. TRANSMISSION TEMPERATURE SENSOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match a non-fluctuating scan tool reading ± 0.2 volts?

Yes >> Replace Transmission Solenoid/TRS assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

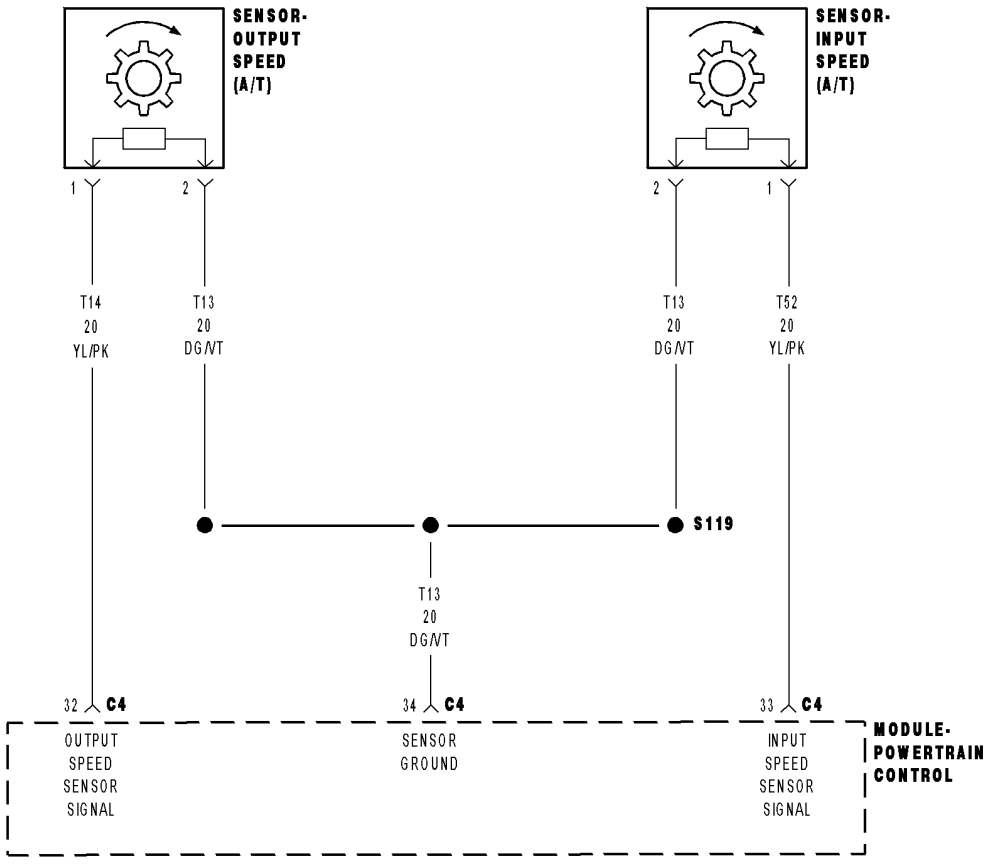
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

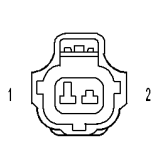
Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

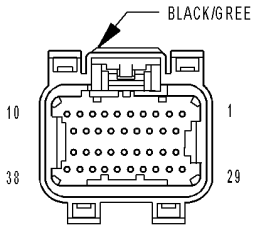
No >> Test Complete.

P0715-INPUT SPEED SENSOR 1 CIRCUIT

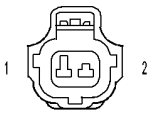




SENSOR-
INPUT
SPEED
(A/T)



MODULE-
POWERTRAIN
CONTROL C4
(545RFE)



SENSOR-
OUTPUT
SPEED
(A/T)

8145212a

P0715-INPUT SPEED SENSOR 1 CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS) .

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If there is an excessive change in input RPM in any gear. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
(T52) INPUT SPEED SENSOR SIGNAL CIRCUIT OPEN
(T13) SPEED SENSOR GROUND CIRCUIT OPEN
(T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND
(T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
INPUT SPEED SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding in-gear trouble code is set (DTCs P0731–36).

2) An excessive change in input or output speeds indicating signal intermittent which may result in the DTCs P0715 and/or P0720 to set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the signal from the input speed sensor at idle in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set when at a stop.

Diagnostic Test

1. CHECK TO SEE IF DTC P0715 IS CURRENT

Start the engine in park.

With the scan tool, monitor the Input Speed Sensor RPM.

Is the Input Speed Sensor RPM below 400 RPM?

Yes >> Go To 2

No >> Go To 9

P0715-INPUT SPEED SENSOR 1 CIRCUIT (CONTINUED)

2. INPUT SPEED SENSOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, set the selector switch to 3000/1000 and the Input/Output switch to ON.

With the scan tool, monitor the Input and Output Speed Sensor RPM.

Does the Input speed read 3000 RPM and the Output speed read 1000 RPM ± 50 RPM?

Yes >> Replace the Input Speed Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

NOTE: Make sure to leave the Speed Sensor, Transmission Solenoid/TRS Assembly, and Line Pressure Sensor harness connectors disconnected.

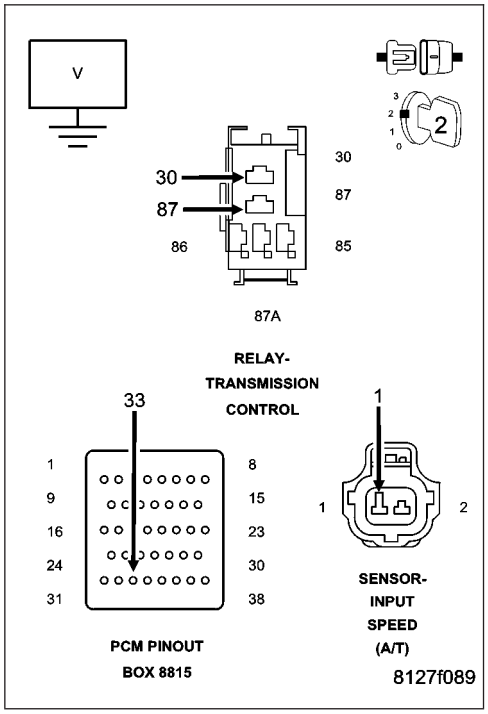
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Remove the Transmission Control Relay.

Place a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T52) Input Speed Sensor Signal circuit.



Is the voltage above 0.5 volts?

Yes >> Repair the (T52) Input Speed Sensor Signal circuit for a short to voltage.
Perform (NGC) 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

P0715-INPUT SPEED SENSOR 1 CIRCUIT (CONTINUED)

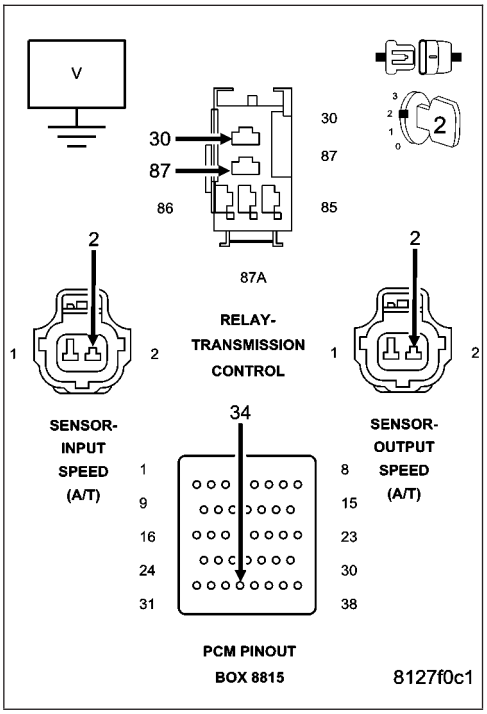
4. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE

Measure the voltage of the (T13) Speed Sensor Ground circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T13) Speed Sensor Ground circuit for a short to voltage.
Perform (NGC) 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5



5. (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off to the lock position.

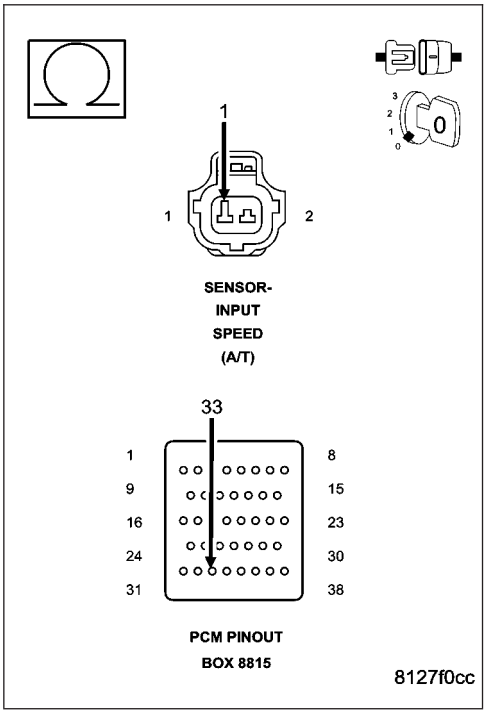
Disconnect the jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Measure the resistance of the (T52) Input Speed Sensor Signal circuit between the Input Speed Sensor harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T52) Input Speed Sensor Signal circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



P0715-INPUT SPEED SENSOR 1 CIRCUIT (CONTINUED)

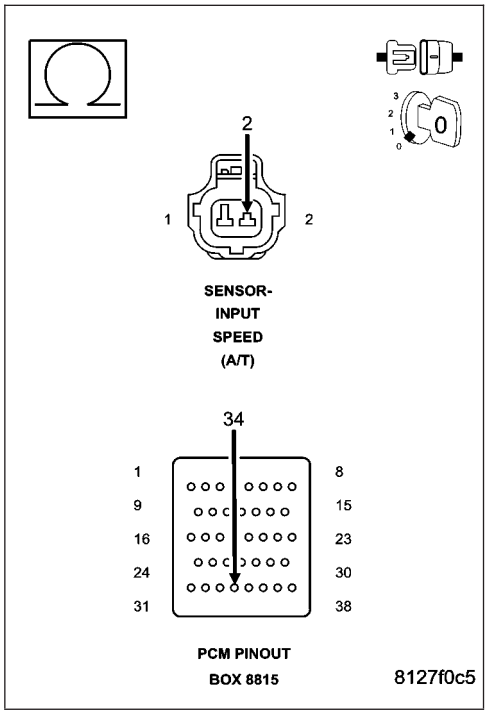
6. (T13) SPEED SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (T13) Speed Sensor Ground circuit between the Input Speed Sensor harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T13) Speed Sensor Ground circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7



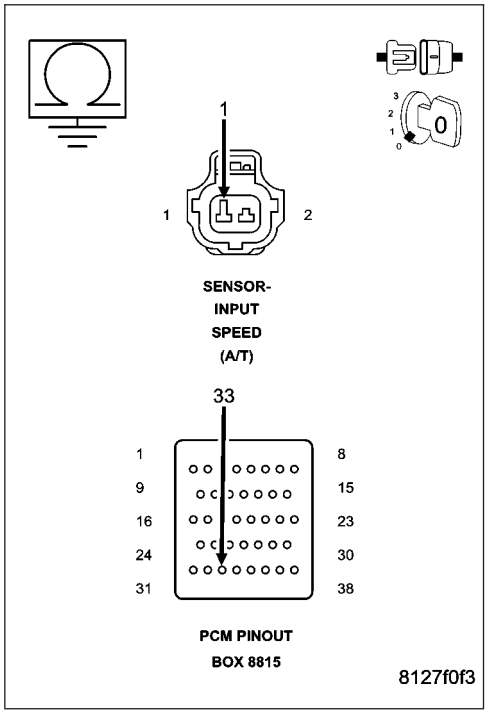
7. (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the Input Speed Sensor Signal circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T52) Input Speed Sensor Signal circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

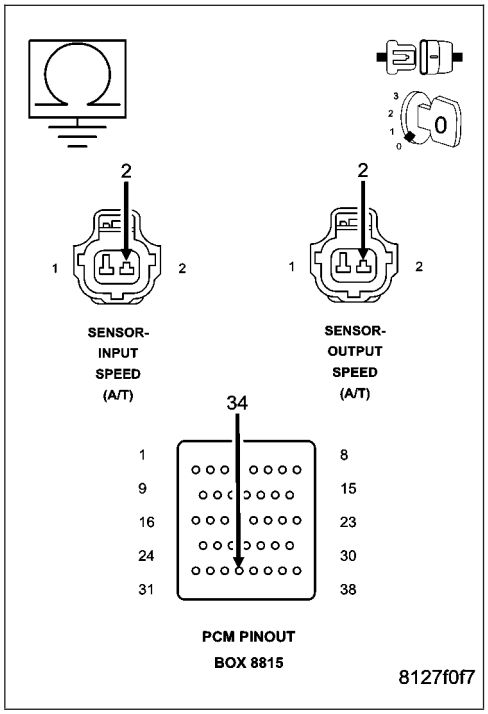
No >> Go To 8



P0715-INPUT SPEED SENSOR 1 CIRCUIT (CONTINUED)

8. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T13) Speed Sensor Ground circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T13) Speed Sensor Ground circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

9. INTERMITTENT WIRING AND CONNECTORS

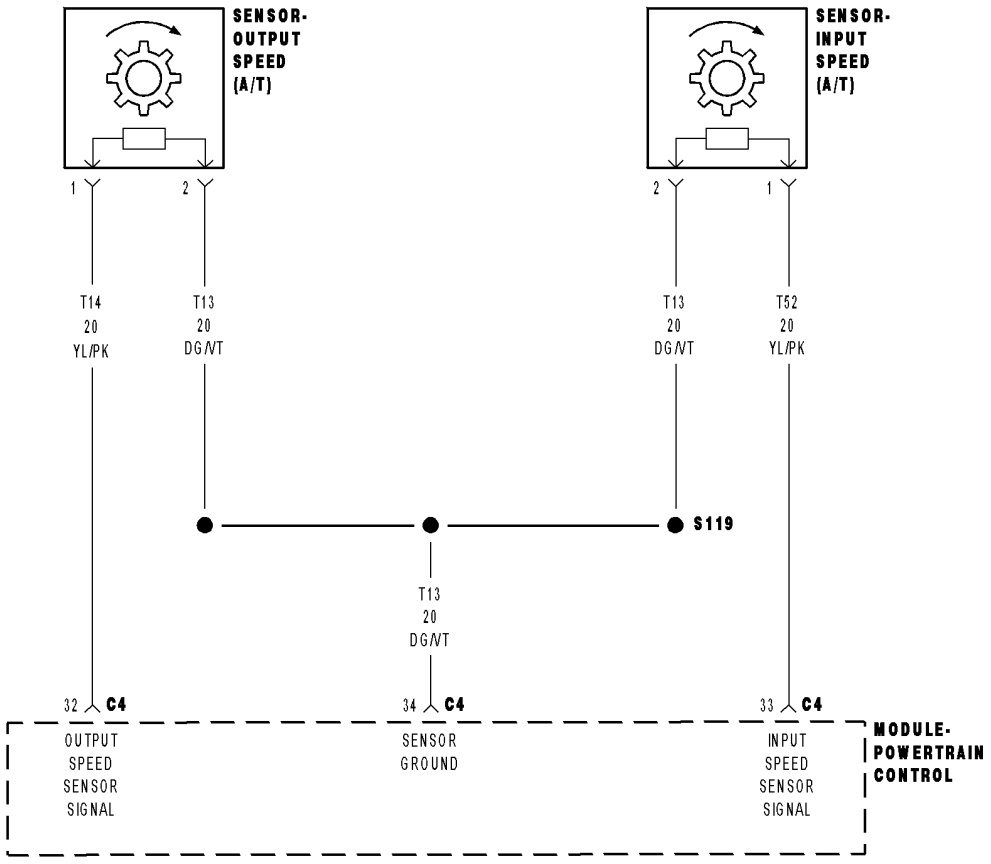
The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

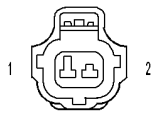
Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

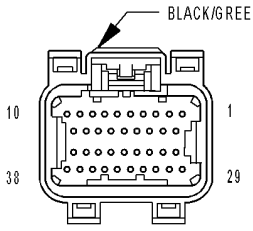
No >> Test Complete.

P0720-OUTPUT SPEED SENSOR CIRCUIT

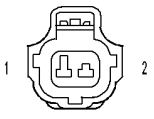




SENSOR-
INPUT
SPEED
(A/T)



MODULE-
POWERTRAIN
CONTROL C4
(545RFE)



SENSOR-
OUTPUT
SPEED
(A/T)

8145212a

P0720-OUTPUT SPEED SENSOR CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If there is an excessive change in output RPM in any gear. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
(T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT OPEN
(T13) SPEED SENSOR GROUND CIRCUIT OPEN
(T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND
(T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
OUTPUT SPEED SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding in-gear trouble code is set (codes P0731 through P0736).

2) An excessive change in input or output speeds indicating signal intermittent will result in codes P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the signal from the input speed sensor at idle in neutral. Since the input speed sensor has 60 teeth and the output speed sensor has 30 teeth, this results in a an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

P0720-OUTPUT SPEED SENSOR CIRCUIT (CONTINUED)

Diagnostic Test

1. CHECK TO SEE IF DTC P0720 IS CURRENT

Turn the ignition off to the lock position.

CAUTION: Properly support the vehicle and raise all drive wheels off the ground.

Release the parking brake.

Start the engine in park.

Place the transmission gear selector in drive, release foot from brake.

WARNING: BE SURE TO KEEP HANDS AND FEET CLEAR OF ROTATING WHEELS.

With the scan tool, monitor the Output Speed Sensor RPM.

Is the Output Speed Sensor RPM below 100 RPM?

Yes >> Go To 2

No >> Go To 9

---

2. OUTPUT SPEED SENSOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, set the selector switch to 3000/1000 and the Input/Output switch to ON.

With the scan tool, monitor the Input and Output Speed Sensor RPM

Does the Input Speed read 3000 RPM and the Output Speed read 1000 RPM, ± 50 RPM?

Yes >> Replace the Output Speed Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

P0720-OUTPUT SPEED SENSOR CIRCUIT (CONTINUED)

3. (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT OPEN

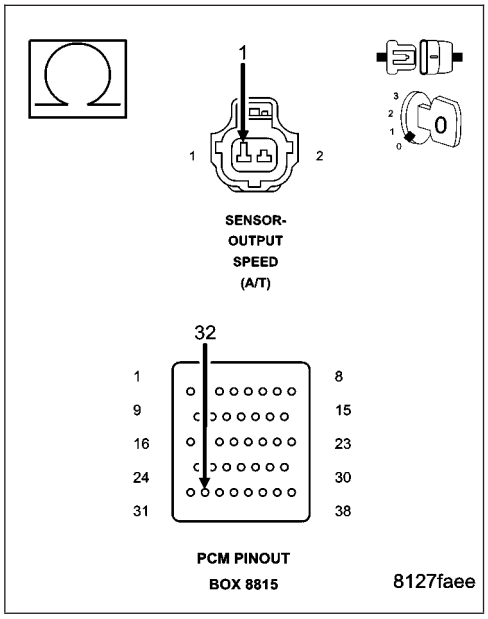
Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM harness connectors and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T14) Output Speed Sensor Signal circuit from the Output Speed Sensor harness connector to the appropriate terminal of Miller tool #8815.



Is the resistance above 5.0 ohms?

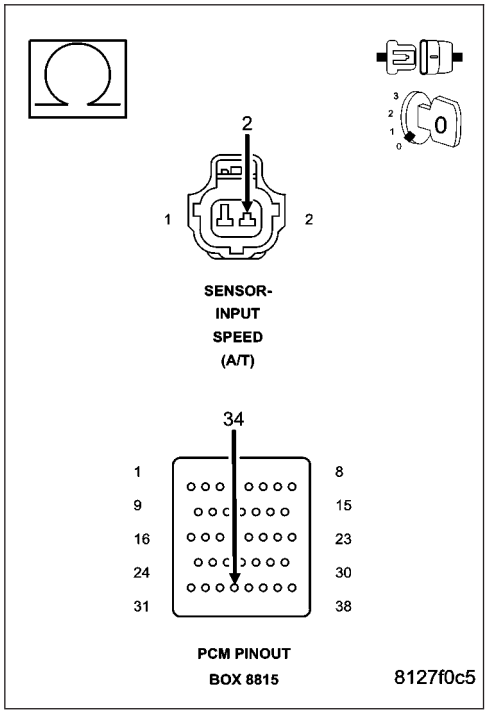
Yes >> Repair the (T14) Output Speed Sensor Signal circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

4. (T13) SPEED SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (T13) Speed Sensor Ground circuit from the Output Speed Sensor harness connector to the appropriate terminal in the Miller tool #8815.



Is the resistance above 5.0 ohms?

Yes >> Repair the (T13) Speed Sensor Ground circuit for an open.

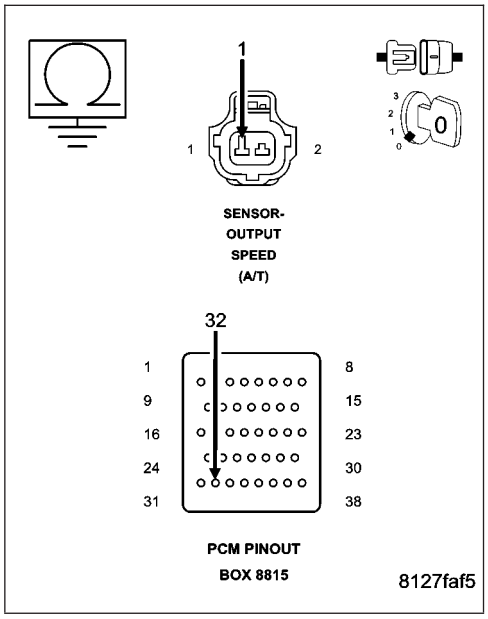
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

P0720-OUTPUT SPEED SENSOR CIRCUIT (CONTINUED)

5. (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T14) Output Speed Sensor Signal circuit.



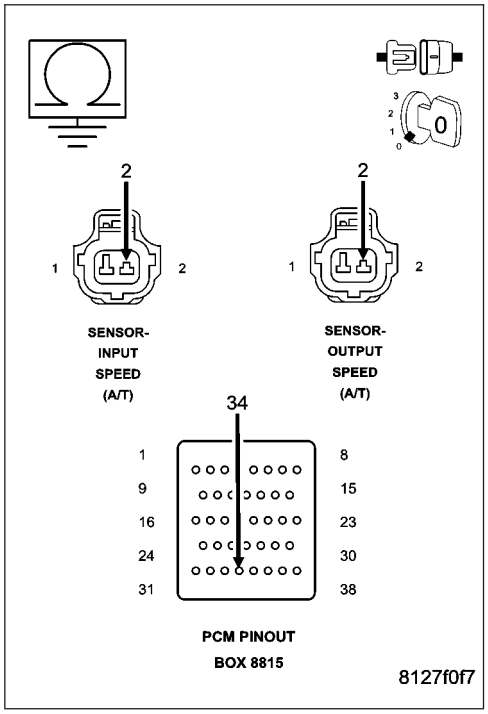
Is the resistance below 5.0 ohms?

Yes >> Repair the (T14) Output Speed Sensor Signal circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6

6. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T13) Speed Sensor Ground circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T13) Speed Sensor Ground circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7

P0720-OUTPUT SPEED SENSOR CIRCUIT (CONTINUED)

7. (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay.

Place a jumper wire between the Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

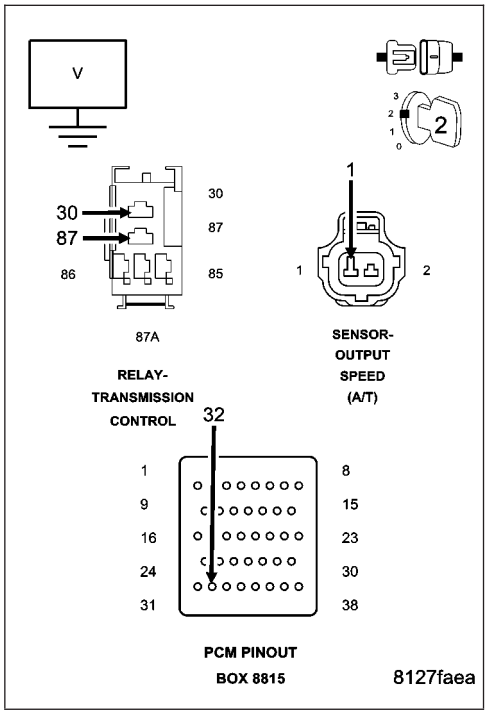
Measure the voltage of the (T14) Output Speed Sensor Signal circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T14) Output Speed Sensor Signal circuit for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8



8. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE

Measure the voltage of the (T13) Speed Sensor Ground circuit.

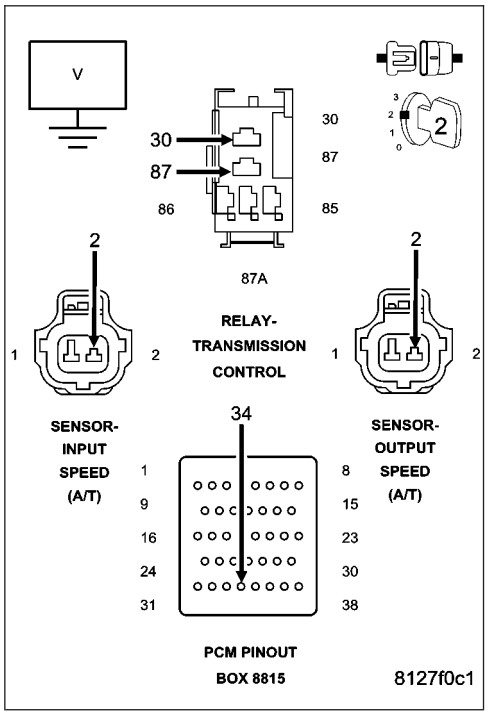
Is the voltage above 0.5 volts?

Yes >> Repair the (T13) Speed Sensor Ground circuit for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



P0720-OUTPUT SPEED SENSOR CIRCUIT (CONTINUED)

9. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0725-ENGINE SPEED SENSOR CIRCUIT

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously every 7 msec with the ignition on and engine running.
- **Set Condition:**
  This DTC will set when the calculated engine speed is less than 390 RPM with the engine running, or greater than 8000 RPM, for the period of 2.0 seconds. The PCM will place the Transmission in Limp-in when this DTC is set. **Note: This is not a Transmission Input Speed Sensor DTC.**

Possible Causes
RELATED ENGINE DTC'S PRESENT
CRANK POSITION SENSOR OR WIRING
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Control System calculates the engine RPM by directly reading the engine crank position sensor. It compares the calculated value to the engine speed sensor signal transmitted from the Engine Control System over the controllers internal bus. The calculated engine RPM is also compared to a minimum and a maximum value. **Note: Due to the integration of the Powertrain Control Module (PCM) and Transmission Control Module (TCM), bus communication between the modules is internal and unserviceable.**

Diagnostic Test

1. RELATED ENGINE DTCS PRESENT

NOTE: This is not a Transmission Input Speed Sensor DTC.
Ignition on, engine not running.
With the scan tool, read all Engine DTC's. This includes any active or stored or one trip DTCs.

Are there any engine RPM related DTCs present?

Yes >> Refer to the Powertrain category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0725-ENGINE SPEED SENSOR CIRCUIT (CONTINUED)

2. VERIFY IF THE DTC IS CURRENT

Ignition on, engine not running.

With a scan tool, read and record all EATX DTC EVENT DATA.

With the scan tool, erase all active and stored transmission DTCs. (Note: it may be necessary to perform a battery disconnect with the scan tool to clear EATX DTC EVENT DATA.)

Using the EATX DTC EVENT DATA, duplicate the conditions in which the origional DTC set.

With the scan tool, read transmission and engine DTCs.

NOTE: Refer to all engine DTCs first in the following question.

Pick the answer below that best decribes your findings, (this includes one trip failures).

Transmission DTC P0725 set

Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Also check the Crank Position sensor and wiring. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

Engine DTC set

Refer to the Driveability category and perform the appropriate symptom.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No DTC set at all

Go To 3

---

3. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0731-GEAR RATIO ERROR IN 1ST

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

Possible Causes
CUT UD PISTON SEAL
LOW FLUID LEVEL
CRACKED OR MISINSTALLED PRIMARY OIL FILTER OR SEAL
STUCK OR STICKING MAIN REGULATOR VALVE
FAILED OVERRUNNING CLUTCH
CUT UD ACCUMULATOR SEAL RING
BROKEN UD ACCUMULATOR PISTON
BROKEN REACTION SHAFT SUPPORT SEAL RING
LOW LINE PRESSURE
BROKEN / MISSING MAIN VALVE BODY BLEED ORIFICE
BROKEN / MISSING DRIBBLER ORIFICE ASSEMBLY IN REACTION SHAFT SUPPORT
POOR MACHINING ON PUMP VALVE BODY FACE
INPUT SPEED SENSOR AND RELATED WIRING
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731–36).

2) An excessive change in input or output speeds indicating signal intermittent may result in the DTCs P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

P0731-GEAR RATIO ERROR IN 1ST (CONTINUED)
Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

If any of these DTC's are present, perform their respective tests first.

Are there any Transmission; solenoid, line pressure, speed sensor, and/or loss of prime DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom. If any of these DTCs are present, they may cause a Speed Ratio Error. Perform the test for P0944 first if it is present.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF DTC P0731 IS CURRENT

With the scan tool, perform the 1st Gear Clutch Test. Follow the instructions on the scan tool.

Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

Did the Clutch Test pass, Input Speed remain at zero?

Yes >> Go To 3

No >> Go To 4

---

3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not currently present.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

- If the DTC Event Data shows fault P0731 was set in Park, Reverse, or Neutral, replace the Powertrain Control Module.

- If the DTC Event Data shows fault P0731 set with input RPM = zero, check the input speed sensor and related wiring.

- If the DTC Event Data shows fault P0731 set with line pressure significantly below desired line pressure, check for the cause of low line pressure (i.e., oil level, misinstalled or damaged primary filter or filter seal, sticking main regulator valve in pump, etc.).

- If the DTC Event Data shows fault P0731 set with the UD pressure switch open (but line pressure matches Desired Line Pressure), air check the UD hydraulic clutch circuit for leakage per the Service Information. If the UD hydraulic clutch circuit is OK, replace the solenoid/TRS assembly.

Check the gearshift linkage adjustment.

Intermittent Gear Ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Remove the Starter Relay.

NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.

Install Transmission Simulator, Miller tool #8333.

Wiggle wiring and connectors while checking for intermittent operation with the Transmission Simulator.

Gear ratio DTC's can also be set under extreme temperature conditions.

Verify if the problem is only experienced under extreme hot or cold conditions.

Were there any problems found.

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0731-GEAR RATIO ERROR IN 1ST (CONTINUED)

4. INTERNAL TRANSMISSION

Repair internal transmission as necessary. Refer to the Service Information.

If there were any line pressure DTC's present along with this DTC, make sure to inspect the: Primary oil filter and seal, Transmission Oil Pump, and the Main regulator valve per the Service Information.

If DTC's P0876 and/or P0875 were present in addition to the P0731, replace the Transmission Solenoid/TRS Assembly in addition to necessary internal repairs.

Pay particular attention to the following list of possible causes when repairing the transmission condition.

- Cut UD piston seal
- Failed overrunning clutch
- Cut UD accumulator seal ring
- Broken UD accumulator piston
- Broken reaction shaft support seal ring
- Low line pressure
- Broken/missing main valve body bleed orifice
- Broken/missing dribbler orifice assembly in reaction shaft support
- Poor machining on pump valve body face
- Transmission Solenoid/TRS Assembly

View repair.

Repair

Repair internal transmission per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0732-GEAR RATIO ERROR IN 2ND

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

Possible Causes
RELATED DTC'S PRESENT
INPUT SPEED SENSOR OR WIRING
LOW FLUID LEVEL
CRACKED OR MISINSTALLED PRIMARY OIL FILTER OR SEAL
WORN SOLENOID SWITCH VALVE OR PLUGS
STUCK OR STICKING MAIN REGULATOR VALVE
BURNED UD OR 2C CLUTCH
CUT 2C OR UD PISTON SEAL
BROKEN 2C PISTON CASTING
BROKEN OR MISSING 2C BLEED ORIFICE
BROKEN OR MISSING UD BLEED ORIFICE
CUT 2C OR UD ACCUMULATOR PISTON SEAL
CRACKED 2C OR UD ACCUMULATOR PISTON
CUT OR MISSING #5 OR #7 CHECK BALL
TRANSMISSION SOLENOID/TRS ASSEMBLY
BROKEN WELD - REACTION CARRIER TO REVERSE SUN GEAR
MISSING TEETH ON INPUT CLUTCH HUB TONE WHEEL

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731–36).

2) An excessive change in input or output speeds indicating signal intermittent may result in the DTCs P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

P0732-GEAR RATIO ERROR IN 2ND (CONTINUED)

Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

Are there any Transmission; solenoid, line pressure, speed sensor, and/or loss of prime DTC's present?

Yes >> Refer to appropriate symptom in the Transmission category. Perform the test for P0944–LOSS OF PRIME first if it is present.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK IF DTC IS CURRENT

With the scan tool, read and record the EATX DTC EVENT DATA.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the EATX DTC EVENT DATA display information for the DTC P0732?

Yes >> Go To 4

No >> Go To 3

---

3. CHECK EATX DTC EVENT DATA

In the EATX DTC EVENT DATA, identify the DTC that was recorded earlier.

Does the EATX DTC EVENT DATA display information for the DTC P1790, with target gear = 2nd, or with both 2C and UD clutches applying?

Yes >> Go To 4

No >> Go To 7

---

4. CHECK RPM IN EATX DTC EVENT DATA

Refer to the EATX DTC EVENT DATA recorded earlier.

Does the Input RPM read zero?

Yes >> Check the input speed sensor and wiring. Refer to test P0715 and diagnose as if the DTC is current.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

---

5. CHECK LINE PRESSURE READING

Refer to the EATX DTC EVENT DATA recorded earlier.

Is the line pressure reading more than 10 psi below the desired line pressure?

Yes >> Go To 6

No >> Go To 7

P0732-GEAR RATIO ERROR IN 2ND (CONTINUED)

6. CHECK TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

NOTE: Make sure the Primary Transmission Oil Filter and seal are properly installed and are not cracked or split.

Does the Oil Pan contain excessive debris and/or is the Primary Oil Filter cracked, plugged or misinstalled?

Yes >> Repair the plugged, cracked, or split Primary Transmission Oil Filter and/or seal. If excessive clutch debris is present, check the clutches for damage. Refer to the Service Information for the proper hydraulic clutch repair procedure.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Remove the Transmission Oil Pump per the Service Information. Check the main Regulator Valve for sticking in its bore, scoring, and/or damage and clean and repair as necessary. If no problem is found, replace the Transmission Solenoid/TRS Assembly.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

7. CHECK TO SEE IF DTC P0732 IS CURRENT

With the scan tool, perform the 2nd Gear Clutch Test. Follow the instructions on the scan tool.

Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

NOTE: If the 2C clutch is faulty, the overrunning clutch will hold and the slip test will pass. The 2nd gear clutch test will not detect a faulty 2C clutch. However, it will detect a faulty UD clutch.

Did the clutch test pass, did the Input Speed remain at zero?

Yes >> Go To 8

No >> Go To 10

---

8. CHECK FOR INTERMITTENT OPERATION

Check the Shifter adjustment per the Service Information.

Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333.

Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9

P0732-GEAR RATIO ERROR IN 2ND (CONTINUED)

9. CHECK FOR SLIPPAGE

With the scan tool, erase Transmission DTCs.

Road test the vehicle.

Is there an obvious slippage noticed in 2nd gear, or runaway on the 1–2 shift?

Yes >> Go To 12

No >> Go To 15

---

10. UD HYDRAULIC CLUTCH CIRCUIT

Remove Transmission Oil Pan and check for excessive debris.

Remove the Valve Body and air check the UD hydraulic clutch circuit (in the case) per the Service Information.

NOTE: The UD clutch passage contains a small bleed orifice, a small amount of air leakage is normal.

Were there any problems found, excessive debris and/or excessive air leakage in the UD clutch hydraulic circuit?

Yes >> Repair as necessary. Check the UD clutch piston seals, reaction shaft support seal rings and the dribbler assembly, and the flatness of the pump valve body and pump housing faces. Check main regulator valve for sticking in the bore.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 11

---

11. UD ACCUMULATOR PISTON

Check the UD bleed orifice, accumulator piston, and accumulator piston seal in the main valve body.

Were there any problems found?

Yes >> Repair as necessary. Refer to the Service Information for proper repair procedures.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

12. EXCESSIVE DEBRIS

Remove the Transmission Oil Pan and check for excessive debris.

If grey sludge is present, check for a improperly assembled 2C clutch with the thick reaction plate not against the case.

Remove the valve body and air check the 2C hydraulic clutch circuit (in the 2C/4C clutch retainer) per the Service Information.

NOTE: The 2C clutch passage contains a small bleed orifice, a small amount of air leakage is normal.

Were there any problems found, excessive debris, improperly assembled 2C clutch and/or excessive air leakage in the 2C hydraulic clutch circuit?

Yes >> Repair as necessary. Refer to the Service Information for proper repair procedures. Note: Check the 2C piston seals and bleed orifice.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 13

P0732-GEAR RATIO ERROR IN 2ND (CONTINUED)

13. 2C ACCUMULATOR

Check the 2C Accumulator piston for cracks or a cut seal.

Check for a cut or missing #7 or #5 check balls.

Check the Solenoid Switch Valve and its plugs for sticking in its bore or excessive wear.

Were there any problems found

Yes >> Repair as necessary. Refer to the Service Information for proper repair procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 14

---

14. CHECK FOR BROKEN REVERSE SUN GEAR WELD

Working through the windows in the bottom of the case, check for a broken Reverse Sun gear weld to the reaction carrier as follows:

(1) Hold the Transmission Output Shaft by holding the Transmission Manual Lever in the park position.

(2) Rotate the Input Annulus gear and drive shell, (the drum that encloses the two rearmost carriers).

(3) Check to see if the reaction carrier (the frontmost carrier, whose outer shell is splined to the 2C clutch) is rotating faster than the drive shell is being turned.

Is the reaction carrier turning faster than the drive shell?

Yes >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the reaction carrier per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

15. CHECK IF DTC RESET

Did the DTC P0732 reset during the road test?

Yes >> Go To 16

No >> Go To 17

P0732-GEAR RATIO ERROR IN 2ND (CONTINUED)

16. LIST OF POSSIBLE CAUSES

If any other DTC's set during the road test, refer to the appropriate symptom in the Transmission category.

If no other DTC's set during the road test, below is a list of possible causes, but not strictly limited to those:

— Check for excessive debris in the Transmission Oil pan, plugged, cracked, or misinstalled Primary Transmission Oil Filter and/or seal.

— Check for cut and/or missing #7 and #5 check balls in the main valve body.

— Check the 2C and UD accumulator pistons and seals, UD bleed orifice, and the Solenoid Switch Valve and Plugs in the main valve body.

— Check the UD clutch piston seals, reaction shaft support seal rings and dribbler assembly.

— Check the 2C clutch piston seals, and bleed orifice.

— Check the main regulator valve for sticking in its bore and the flatness of the pump valve body and pump housing faces.

— Check for a improperly assembled 2C clutch with the thick reaction plate not against the case.

View repair

Repair

Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

17. INTERMITTENT DTC

The conditions to set this DTC are not currently present.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

- If the DTC Event Data shows fault P0732 was set in Park, Reverse, or Neutral, replace the Powertrain Control Module.

- If the DTC Event Data shows fault P0732 set with input RPM = zero, check the input speed sensor and related wiring.

- If the DTC Event Data shows fault P0732 set with line pressure significantly below desired line pressure, check for the cause of low line pressure (i.e., oil level, misinstalled or damaged primary filter or filter seal, sticking main regulator valve in pump, etc.).

- If the DTC Event Data shows fault P0732 set with the UD or 2C pressure switch open (but line pressure matches Desired Line Pressure), air check the UD and 2C hydraulic clutch circuits for leakage per the Service Information. If the UD and 2C hydraulic clutch circuits are OK, replace the Transmission Solenoid/TRS assembly.

Check the gearshift linkage adjustment.

Intermittent Gear Ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Remove the Starter Relay.

NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.

Install Transmission Simulator, Miller tool #8333.

Wiggle wiring and connectors while checking for intermittent operation with the Transmission Simulator.

Gear ratio DTC's can also be set under extreme temperature conditions.

Verify if the problem is only experienced under extreme hot or cold conditions.

Were there any problems found.

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0733-GEAR RATIO ERROR IN 3RD

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

Possible Causes
RELATED DTC'S PRESENT
INPUT SPEED SENSOR OR WIRING
LOW FLUID LEVEL
CRACKED OR MISINSTALLED PRIMARY OIL FILTER OR SEAL
BENT OR BROKEN ACCUMULATOR COVER ON MAIN VALVE BODY
WORN SOLENOID SWITCH VALVE OR PLUGS
STUCK OR STICKING MAIN REGULATOR VALVE
BURNED UD OR OD CLUTCH
CUT OD OR UD PISTON SEAL
BROKEN OR MISSING UD OR OD BLEED ORIFICE IN MAIN VALVE BODY
BROKEN OR MISSING BLEED ORIFICE IN UD OR OD CLUTCH PISTON
CUT OD OR UD ACCUMULATOR PISTON SEAL
CRACKED OD OR UD ACCUMULATOR PISTON
CUT OR MISSING #6 CHECK BALL
TRANSMISSION SOLENOID/TRS ASSEMBLY
BROKEN WELD - REVERSE CARRIER HUB TO CARRIER
BROKEN REACTION SHAFT SUPPORT SEAL RING
POOR MACHINING ON PUMP VALVE BODY FACE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731–36).

2) An excessive change in input or output speeds indicating signal intermittent may result in the DTCs P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

P0733-GEAR RATIO ERROR IN 3RD (CONTINUED)

Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

Are there any Transmission; solenoid, line pressure, speed sensor, and/or loss of prime DTC's present?

Yes >> Refer to appropriate symptom in the Transmission category. Perform the test for P0944–LOSS OF PRIME first if it is present.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK EATX DTC EVENT DATA

With the scan tool, read and record the EATX DTC EVENT DATA.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the EATX DTC EVENT DATA display information for the DTC P0733?

Yes >> Go To 4

No >> Go To 3

---

3. TARGET GEAR IN EATX DTC EVENT DATA

In the EATX DTC EVENT DATA, identify the DTC that was recorded earlier.

Does the EATX DTC EVENT DATA display information for the DTC P1790, with target gear = 3rd, or with both OD and UD clutches applying?

Yes >> Go To 4

No >> Go To 7

---

4. CHECK RPM IN EATX DTC EVENT DATA

Refer to the EATX DTC EVENT DATA recorded earlier.

Does the Input RPM read zero?

Yes >> Check the input speed sensor and wiring. Refer to test P0715 and diagnose as if the DTC is current.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

---

5. CHECK LINE PRESSURE READING

Refer to the EATX DTC EVENT DATA recorded earlier.

Is the line pressure reading more than 10 psi below the desired line pressure?

Yes >> Go To 6

No >> Go To 7

P0733-GEAR RATIO ERROR IN 3RD (CONTINUED)

6. CHECK TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

NOTE: Make sure the Primary Transmission Oil Filter and seal are properly installed and are not cracked or split.

Does the Oil Pan contain excessive debris and/or is the Primary Oil Filter cracked, plugged or misinstalled?

Yes >> Repair the plugged, cracked, or split Primary Transmission Oil Filter and/or seal. If excessive clutch debris is present, check the clutches for damage. Refer to the Service Information for the proper hydraulic clutch repair procedure.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Remove the Transmission Oil Pump per the Service Information. Check the main Regulator Valve for sticking in its bore, scoring, and/or damage and clean and repair as necessary. If no problem is found, replace the Transmission Solenoid/TRS Assembly.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

7. CHECK TO SEE IF DTC P0733 IS CURRENT

With the scan tool, perform the 3rd Gear Clutch Test. Follow the instructions on the scan tool.

Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

NOTE: If the OD clutch is faulty, the overrunning clutch will hold and the slip test will pass. The 3rd gear clutch test will not detect a faulty OD clutch. However, it will detect a faulty UD clutch.

Did the clutch test pass, did the Input Speed remain at zero?

Yes >> Go To 8

No >> Go To 10

---

8. CHECK FOR INTERMITTENT OPERATION

Check the Shifter adjustment per the Service Information.

Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333.

Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9

P0733-GEAR RATIO ERROR IN 3RD (CONTINUED)

9. CHECK FOR SLIPPAGE

With the scan tool, erase Transmission DTCs.

Road test the vehicle. Check operation in 3rd gear, 4th gear, and Reverse.

Is there an obvious slippage noticed in 3rd gear, or runaway on the 2–3 shift?

Yes >> Go To 12

No >> Go To 16

---

10. UD HYDRAULIC CLUTCH CIRCUIT

Remove Transmission Oil Pan and check for excessive debris.

Remove the Valve Body and air check the UD hydraulic clutch circuit (in the case) per the Service Information.

NOTE: The UD clutch passage contains a small bleed orifice, a small amount of air leakage is normal.

Were there any problems found, excessive debris and/or excessive air leakage in the UD hydraulic clutch circuit?

Yes >> Repair as necessary. Check the UD clutch piston seals, reaction shaft support seal rings and dribbler assemblies, and the flatness of the pump valve body and pump housing faces. Check main regulator valve for sticking in the bore.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 11

---

11. UD ACCUMULATOR PISTON

Check the UD bleed orifice, accumulator piston, and accumulator piston seal in the main valve body.

Were there any problems found?

Yes >> Repair as necessary. Refer to the Service Information for proper repair procedures.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

12. EXCESSIVE DEBRIS

Remove the Transmission Oil Pan and check for excessive debris.

Remove the valve body and check if the accumulator cover is intact.

Air check the OD hydraulic clutch circuit (in the case) per the Service Information.

NOTE: The OD clutch passage contains a small bleed orifice which connects to the Reverse clutch hydraulic circuit, a small amount of air leakage into the Reverse clutch passage is normal.

Were there any problems found, excessive debris, and/or excessive air leakage in the OD hydraulic clutch circuit?

Yes >> Repair as necessary. Refer to the Service Information for proper repair procedures. Note: Check the bleed orifice in the OD/Reverse clutch piston.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 13

P0733-GEAR RATIO ERROR IN 3RD (CONTINUED)

13. OD ACCUMULATOR

Check the OD Accumulator piston for cracks or a cut seal.
Check for a cut or missing #6 check ball.
Check the Solenoid Switch Valve and its plugs for sticking in its bore or excessive wear.

Were there any problems found?

Yes >> Repair as necessary. Refer to the Service Information for proper repair procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 14

---

14. CHECK FOR NO REVERSE

During the road test on a previous test, did the vehicle have no reverse and no 3rd gear, but 1st and 2nd gears were OK?

Yes >> Go To 15

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

15. CHECK FOR BROKEN REVERSE CARRIER WELD

Remove the Transmission per the Service Information and inspect the weld on the reverse carrier hub.

Were there any problems found?

Yes >> Repair as necessary.

No >> Disassemble and inspect the input clutch assembly. Check the OD and Reverse clutch seals, discs, and bleed orifice (in the OD/Reverse clutch piston). Check the OD hub and shaft. Repair as necessary. Refer to the Service Information for proper repair procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

16. CHECK IF DTC RESET

Did the DTC P0733 reset during the road test?

Yes >> Go To 17

No >> Go To 18

P0733-GEAR RATIO ERROR IN 3RD (CONTINUED)

17. LIST OF POSSIBLE CAUSES

If any other DTC's set during the road test, refer to the appropriate symptom in the Transmission category.

If no other DTC's set during the road test, below is a list of possible causes, but not strictly limited to those.

Check for:

— Excessive debris in the Transmission Oil pan, plugged, cracked, or misinstalled Primary Transmission Oil Filter and/or seal.

— Cut or missing #6 check ball in the main valve body.

— OD and UD accumulator pistons and seals and bleed orifices, and the Solenoid Switch Valve and Plugs in the main valve body.

— OD and UD clutch piston seals, reaction shaft support seal rings and dribbler assemblies, and the flatness of the pump valve body and pump housing faces.

— Main regulator valve for sticking in its bore.

View repair

Repair

Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

18. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not currently present.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

— If the DTC Event Data shows fault P0733 was set in the Park, Reverse, or Neutral, replace the Powertrain Control Module.

— If the DTC Event Data shows fault P0733 set with input RPM = zero, check the input speed sensor and related wiring.

— If the DTC Event Data shows fault P0733 set with line pressure significantly below desired line pressure, check for the cause of low line pressure (i.e., oil level, misinstalled or damaged primary filter or filter seal, sticking main regulator valve in pump, etc.).

— If the DTC Event Data shows fault P0733 set with the OD or UD pressure switch open (but line pressure matches Desired Line Pressure), air check the OD and UD hydraulic clutch circuits for leakage per the Service Information. If the OD and UD hydraulic clutch circuits are OK, replace the Transmission Solenoid/TRS assembly.

Check the gearshift linkage adjustment.

Intermittent Gear Ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Remove the Starter Relay.

NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.

Install the Transmission Simulator, Miller tool #8333.

Wiggle wiring and connectors while checking for intermittent operation with the Transmission Simulator.

Gear ratio DTC's can also be set under extreme temperature conditions.

Verify if the problem is only experienced under extreme hot or cold conditions.

Were there any problems found.

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0734-GEAR RATIO ERROR IN 4TH

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
LOW FLUID LEVEL
INPUT SPEED SENSOR OR WIRING
VALVE BODY ACCUMULATOR COVER FAILED
CUT OD OR 4C ACCUMULATOR SEAL
CRACKED OD OR 4C ACCUMULATOR PISTON
BROKEN OR MISSING OD BLEED ORIFICE IN MAIN VALVE BODY
CUT 4C TOWER SEAL
TRANSMISSION SOLENOID/TRS ASSEMBLY
CUT OR MISSING #5 OR #6 CHECK BALL
WORN SOLENOID SWITCH VALVE OR PLUGS
CUT OD OR 4C PISTON SEAL
STUCK MAIN REGULATOR VALVE
BURNED OD OR 4C CLUTCH
BROKEN OR MISSING 4C BLEED ORIFICE IN 2C/4C RETAINER
BROKEN REACTION SHAFT SUPPORT SEAL RING
POOR MACHINING ON PUMP VALVE BODY FACE
LOOSE / MISSING DRIBBLER ORIFICE ASSEMBLY IN REACTION SHAFT SUPPORT
CRACKED / LOOSE / MISSING OD/REVERSE PISTON BLEED ORIFICE
BROKEN REVERSE CARRIER HUB WELD
BROKEN REVERSE SUN GEAR WELD TO REACTION CARRIER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

P0734-GEAR RATIO ERROR IN 4TH (CONTINUED)

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731–36).

2) An excessive change in input or output speeds indicating signal intermittent may result in the DTCs P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

If any of these DTC's are present, perform their respective tests first.

Are there any Transmission; solenoid, line pressure, speed sensor, and/or loss of prime DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom. If any of these DTCs are present, they may cause a Speed Ratio Error. Perform the test for P0944 first if it is present.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK DTC EVENT DATA

With the scan tool, read and record the DTC EVENT DATA.

NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the DTC EVENT DATA display information for the DTC P0734?

Yes >> Go To 4

No >> Go To 3

---

3. CHECK FOR OTHER DTC

In the DTC EVENT DATA recorded earlier, does the DTC EVENT DATA show the DTC P1790, with Target Gear = 4th, or with both the 4C and OD clutches applying?

Yes >> Go To 4

No >> Go To 6

---

4. CHECK INPUT RPM

In the DTC EVENT DATA recorded earlier, does the Input RPM read zero?

Yes >> Refer to the Transmission category and perform the diagnostic procedure for P0715 (Input Speed Sensor Error). Diagnose the DTC as if it is set and current.

No >> Go To 5

P0734-GEAR RATIO ERROR IN 4TH (CONTINUED)

5. CHECK LINE PRESSURE READING

In the DTC EVENT DATA recorded earlier, is the line pressure reading more than 10 PSI below the desired line pressure reading?

Yes >> Remove the Transmission Oil pan and check the Transmission Oil filter for improper installation or plugged, if Primary oil filter is OK, check the main regulator valve in pump. If excessive debris is in the oil pan, check clutches and repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6

---

6. CHECK TRANSMISSION FOR SLIPPAGE

Erase DTCs and road test the vehicle.

Check the transmission operation in reverse and all forward gears.

During the road test, was there any obvious slippage noted in 4th gear or a runaway during the 3–4 shift?

Yes >> Go To 8

No >> Go To 7

---

7. CHECK IF DTC RESET

With the scan tool, check for Transmission DTCs after the road test.

Did the DTC P0734 reset?

Yes >> Go To 8

No >> Test Complete.

---

8. CHECK INTERNAL TRANSMISSION

— Remove the Transmission Oil Pan and Valve Body per the Service Information and check for the following:
— Excessive debris in the oil pan.
— Remove the Valve Body and check if the accumulator cover is intact and the 4C tower seal is not cut or split.
— OD and 4C accumulator pistons for cracks and/or cut seals.
— Solenoid Switch Valve and its plugs for stickiness or wear.
— Cut or missing #5 and/or #6 check ball.
— OD bleed orifice on top of the Valve Body
— Air check the OD and 4C hydraulic clutch circuits for excessive leakage. Refer to the Service information.

NOTE: Both the OD and 4C hydraulic clutch circuits contain a small bleed orifice. A small amount of air leakage is considered normal. The OD hydraulic clutch circuit bleed orifice connects to the Reverse input clutch hydraulic cavity. A small amount of air leakage into the Reverse hydraulic clutch circuit is considered normal.

Were there any problems found?

Yes >> Repair as necessary. Refer to the Service Information for proper repair procedures.

No >> Go To 9

P0734-GEAR RATIO ERROR IN 4TH (CONTINUED)

9. TRANSMISSION SOLENOID/TRS ASSEMBLY

Was there no reverse gear during the road test?

Yes >> Go To 10

No >> Replace the Solenoid/TRS Assembly per the Service Information.

---

10. CHECK ROAD TEST RESULTS

During the road test, was there no 2nd gear and no 4th gear, but 3rd gear (limp-in) was OK?

Yes >> Go To 11

No >> Go To 12

---

11. CHECK FOR BROKEN REVERSE SUN GEAR WELD

Working through the windows in the bottom of the case, check for a broken Reverse Sun gear weld to the reaction carrier as follows:

(1) Hold the Transmission Output Shaft by holding the Transmission Manual Lever in the park position.

(2) Rotate the Input Annulus gear and drive shell, (the drum that encloses the two rearmost carriers).

(3) Check to see if the reaction carrier (the frontmost carrier, whose outer shell is splined to the 2C clutch) is rotating faster than the drive shell is being turned.

Is the reaction carrier turning faster than the drive shell?

Yes >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the reaction carrier per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

12. CHECK FOR NO REVERSE

Remove the Transmission per the Service Information and inspect the weld on the reverse carrier hub.

Were there any problems found?

Yes >> Repair as necessary. Refer to the Service Information for proper repair procedures.

No >> Disassemble and inspect the input clutch assembly. Check the OD and Reverse clutch seals, discs, and bleed orifice (in the OD/Reverse clutch piston). Check the OD hub and shaft. Repair as necessary. Refer to the Service Information for proper repair procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0735-GEAR RATIO ERROR IN 5TH

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
LOW FLUID LEVEL
INPUT SPEED SENSOR OR WIRING
VALVE BODY ACCUMULATOR COVER FAILED
CUT OD OR 2C ACCUMULATOR SEAL
CRACKED OD OR 2C ACCUMULATOR PISTON
BROKEN OR MISSING OD BLEED ORIFICE IN MAIN VALVE BODY
CUT 2C TOWER SEAL
TRANSMISSION SOLENOID/TRS ASSEMBLY
CUT OR MISSING #5, #6, OR #7 CHECK BALL
WORN SOLENOID SWITCH VALVE OR PLUGS
CUT OD OR 2C PISTON SEAL
STUCK MAIN REGULATOR VALVE
BURNED OD OR 2C CLUTCH
BROKEN OR MISSING 2C BLEED ORIFICE IN 2C/4C RETAINER
BROKEN REACTION SHAFT SUPPORT SEAL RING
POOR MACHINING ON PUMP VALVE BODY FACE
LOOSE / MISSING DRIBBLER ORIFICE ASSEMBLY IN REACTION SHAFT SUPPORT
CRACKED / LOOSE / MISSING OD/REVERSE PISTON BLEED ORIFICE
BROKEN REVERSE CARRIER HUB WELD
BROKEN REVERSE SUN GEAR WELD TO REACTION CARRIER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731–36).

2) An excessive change in input or output speeds indicating signal intermittent may result in the DTCs P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

P0735-GEAR RATIO ERROR IN 5TH (CONTINUED)

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

If any of these DTC's are present, perform their respective tests first.

Are there any Transmission; solenoid, line pressure, speed sensor, and/or loss of prime DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom. If any of these DTCs are present, they may cause a Speed Ratio Error. Perform the test for P0944 first if it is present.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK EATX DTC EVENT DATA

With the scan tool, read and record the EATX DTC EVENT DATA.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the EATX DTC EVENT DATA display information for the DTC P0735?

Yes >> Go To 4

No >> Go To 3

---

3. CHECK TARTET GEAR

In the EATX DTC EVENT DATA recorded earlier, does the DTC EVENT DATA show the DTC P1790, with Target gear = 5th, or with both the 2C and OD clutches applying?

Yes >> Go To 4

No >> Go To 6

---

4. CHECK INPUT RPM

In the EATX DTC EVENT DATA recorded earlier, does the Input RPM read zero?

Yes >> Refer to the Transmission category and perform the diagnostic procedure for P0715 (Input Speed Sensor Error). Diagnose the DTC as if it is set and current.

No >> Go To 5

---

5. CHECK LINE PRESSURE READING

In the EATX DTC EVENT DATA recorded earlier, is the line pressure reading more than 10 PSI below the desired line pressure reading?

Yes >> Remove the Transmission Oil pan and check the Transmission Oil filter for improper installation or plugged, if Primary oil filter is OK, check the main regulator valve in pump. If excessive debris is in the oil pan, check clutches and repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6

P0735-GEAR RATIO ERROR IN 5TH (CONTINUED)

6. CHECK TRANSMISSION FOR SLIPPAGE

Erase DTCs and road test the vehicle.

Check the transmission operation in reverse and all forward gears.

During the road test, was there any obvious slippage noted in 5th gear or a runaway during the 4–5 shift?

Yes >> Go To 8

No >> Go To 7

---

7. CHECK IF DTC RESET

With the scan tool, check for Transmission DTCs after the road test.

Did the DTC P0735 reset?

Yes >> Go To 8

No >> Test Complete.

---

8. CHECK INTERNAL TRANSMISSION

Remove the Transmission Oil Pan and Valve Body, per the Service Information, and check for the following:

— Excessive clutch and or metal debris in the oil pan.

— If the accumulator cover is intact and the 2C tower seal is not cut or split.

— OD and 2C accumulator pistons for cracks or cut seals.

— Solenoid Switch Valve and its plugs for stickiness or wear.

— Cut or missing #5, #6, or #7 check ball.

— OD bleed orifice on top of the valve body.

— Air check the OD and 2C hydraulic clutch circuits for excessive leakage. Refer to the Service information.

NOTE: Both the OD and 2C hydraulic clutch circuits contain a small bleed orifice. A small amount of air leakage is considered normal. The OD hydraulic clutch circuit bleed orifice connects to the Reverse input clutch hydraulic cavity. A small amount of air leakage into the Reverse hydraulic clutch circuit is considered normal.

Were there any problems found?

Yes >> Repair as necessary. Refer to the Service Information for proper repair procedures.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

P0736-GEAR RATIO ERROR IN REVERSE

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

Possible Causes
LOW FLUID LEVEL
CUT LR TOWER SEAL ON MAIN VALVE BODY
CUT LR CLUTCH PISTON SEALS
BROKEN OR MISSING LR CLUTCH BLEED ORIFICE (IN LR CLUTCH RETAINER)
CUT LR ACCUMULATOR PISTON SEAL IN MAIN VALVE BODY
CRACKED LR ACCUMULATOR PISTON IN MAIN VALVE BODY
CUT OD/REV PISTON SEALS
BROKEN OR MISSING OD/REV BLEED ORIFICE (IN OD/REV CLUTCH PISTON)
BROKEN REVERSE CARRIER HUB WELD
BROKEN REVERSE SUN GEAR WELD TO THE REACTION CARRIER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731–36).

2) An excessive change in input or output speeds indicating signal intermittent may result in the DTCs P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

Are there any Transmission; solenoid, line pressure, speed sensor, and/or loss of prime DTC's present?

Yes >> Refer to appropriate symptom in the Transmission category. Perform the test for P0944–LOSS OF PRIME first if it is present.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0736-GEAR RATIO ERROR IN REVERSE (CONTINUED)

2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, perform the Reverse Gear Clutch test. Follow the instructions on the scan tool.

Increase the throttle angle, TPS degree, to 30°, for no more than a few seconds.

CAUTION: Do not overheat the transmission.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Did the clutch test pass, input speed remain at zero?

Yes >> Go To 3

No >> Go To 4

---

3. CHECK DTC EVENT DATA

The conditions necessary to set this DTC are not currently present.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Does the DTC EVENT DATA show an input speed reading of zero?

Yes >> Go To 8

No >> Go To 4

---

4. POSSIBLE INTERNAL TRANSMISSION CAUSES

Remove the Transmission Oil Pan and Valve Body and check the following per the Service Information:

Clutch or metal debris in the pan

LR clutch tower seal on the main valve body or cuts and the LR accumulator piston and seals.

Air check the Reverse and LR Hydraulic Clutch circuits (in the case) for excessive air leakage.

NOTE: Both Hydraulic Clutch circuits contain a small bleed orifice , a small amount of air leakage is normal. The Reverse hydraulic clutch circuit bleed orifice connects to the OD hydraulic clutch cavity. A small amount of air leakage into the OD hydraulic clutch circuit is considered normal.

Were there any problems found?

Yes >> Repair as necessary. If clutch debris is present, remove the transmission and inspect the Reverse and LR clutches, and inspect the Transmission Oil Pump and Main Regulator Valve for damage or sticking in its bore.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

---

5. CLUTCH TEST FAILURE

Did the clutch test fail in reverse?

Yes >> Go To 6

No >> Test complete.

P0736-GEAR RATIO ERROR IN REVERSE (CONTINUED)

6. CHECK FOR BROKEN REVERSE SUN GEAR WELD

Working through the windows in the bottom of the case, check for a broken Reverse Sun gear weld to the reaction carrier as follows:

(1) Hold the Transmission Output Shaft by holding the Transmission Manual Lever in the park position.

(2) Rotate the Input Annulus gear and drive shell, (the drum that encloses the two rearmost carriers).

(3) Check to see if the reaction carrier (the frontmost carrier, whose outer shell is splined to the 2C clutch) is rotating faster than the drive shell is being turned.

Is the reaction carrier turning faster than the drive shell?

Yes >> Go To 7

No >> Replace the reaction carrier per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

7. CHECK REVERSE CARRIER HUB

Remove the Transmission per the Service Information and inspect the weld on the reverse carrier hub.

Were there any problems found?

Yes >> Repair as necessary. Refer to the Service Information for proper repair procedures.

No >> Disassemble and inspect the input clutch assembly. Check the Reverse clutch reaction plate snap ring. Check the OD and Reverse clutch seals, discs, and bleed orifice (in the OD/Reverse clutch piston). Check the Reverse hub and shaft. Repair as necessary. Refer to the Service Information for proper repair procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

8. CHECK FOR INTERMITTENT OPERATION

Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Remove the Starter Relay

NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.
Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333.

Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test complete.

P0740–TCC OUT OF RANGE

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS) .

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  During Electronically Modulated Converter Clutch (EMCC) Operation.
- **Set Condition:**
  Transmission must be in EMCC, with input speed greater than 1750 RPM. TCC-L/R Solenoid achieves the maximum duty cycle and can not pull engine speed within 60 RPM of input speed. Also when the transmission is in FEMCC and the engine slips TCC less than 100 RPM for 10 seconds. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
RELATED DTC P0750 PRESENT
L/R SOLENOID
TORQUE CONVERTER AND/OR INTERNAL TRANSMISSION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

When in 2nd, 2nd Prime, 3rd, or 4th gear, the torque converter clutch (TCC) can be engaged when certain conditions are met. The TCC piston is electronically modulated by increasing the duty cycle of the LR Solenoid until the torque converter slip difference (difference between engine and transmission input speed) is within 60 RPM. Then the LR solenoid is fully energized (FEMCC / 100% duty cycle). Torque converter slip is monitored in FEMCC to ensure adequate clutch capacity.

Diagnostic Test

1. DETERMINING IF RELATED DTC P0750 IS PRESENT

With the scan tool, read transmission DTC's

Is the DTC P0750 present also?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0740–TCC OUT OF RANGE (CONTINUED)

2. CHECK TO SEE IF DTC P0740 IS CURRENT

With the scan tool, Read and RECORD ALL Transmission DTC's. After recording DTC's, erase DTC's.

Drive the vehicle until the transmission temperature is at least 43° C or 110° F and the engine temperature at least 49° C or 120° F.

Perform the following steps 3 times.

Drive the vehicle to the speed of at least 88 km/h or 55 MPH.

Allow 4th gear to engage for at least 10 seconds.

Close the throttle.

Tip back into the throttle until the TPS angle is between 25 and 29 degrees.

NOTE: If the throttle angle goes over 30 degrees, you must close the throttle and try again.

Did the TCC engage during any of the attempts, Engine speed approximately equal to input speed?

Yes >> Go To 3

No >> Go To 4

---

3. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorts and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

---

4. LR SOLENOID

With the scan tool, check for other transmission DTC's.

Are the DTCs P1775 and P0841 present also?

Yes >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

P0740–TCC OUT OF RANGE (CONTINUED)

5. TORQUE CONVERTER AND/OR INTERNAL TRANSMISSION

Repair internal transmission as necessary.

Check for the following possible causes. Refer to the Service information for the proper repair procedures.

Inspect the Transmission Oil Pump.

If no problems are found, replace the Transmission Solenoid/TRS Assembly.

Check the Torque Converter Switch Valve and the Torque Converter Clutch Control Valve for sticking in the bore.

Check the Teflon seal rings on the input shaft.

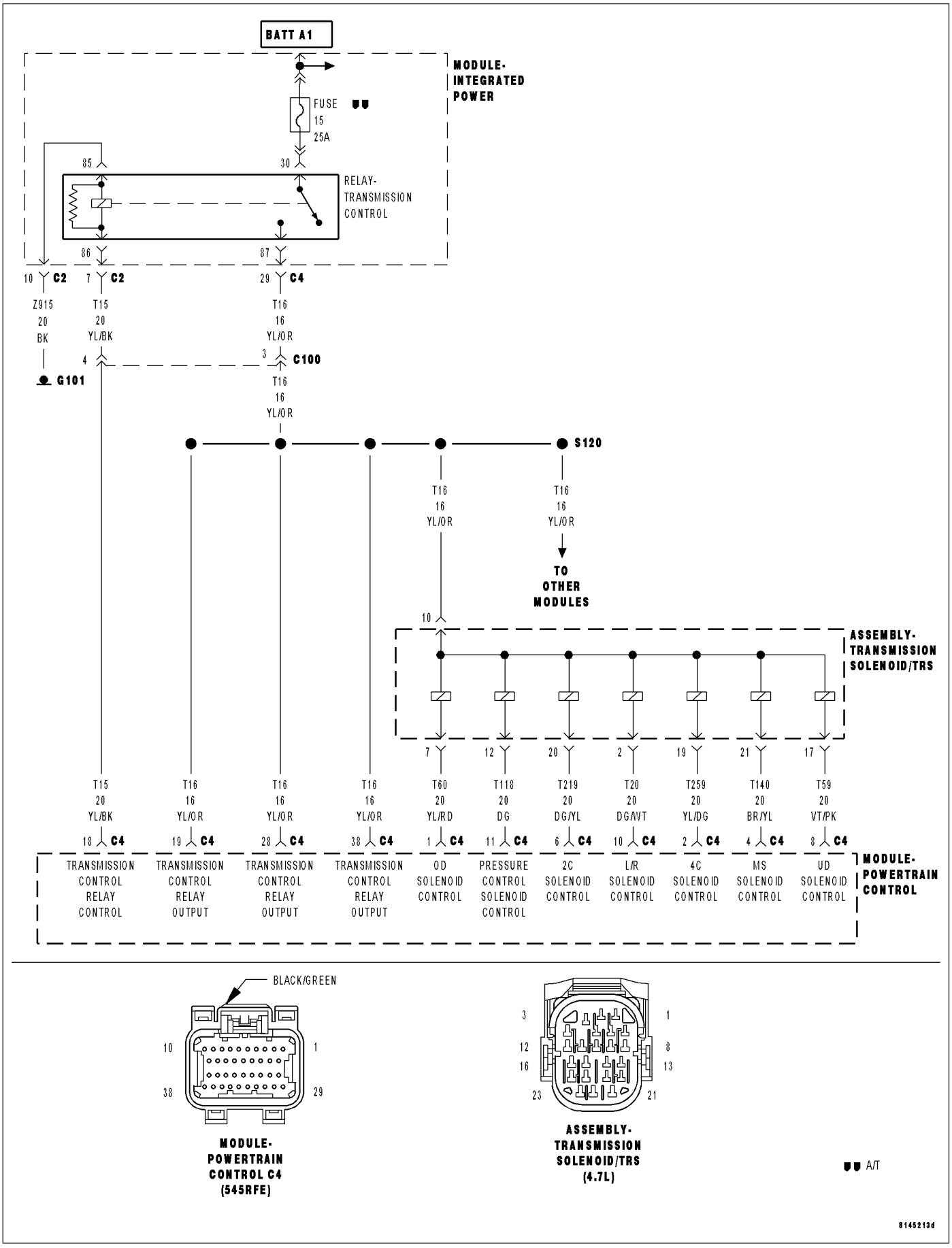
View repair.

Repair

In all cases, replace the Torque Converter. Make sure to check all other possible causes in addition to the Torque Converter.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0750-LR SOLENOID CIRCUIT



P0750-LR SOLENOID CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.
- **Set Condition:**
  After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

Possible Causes
RELATED RELAY DTC'S PRESENT
(T20) LR SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
(T20) LR SOLENOID CONTROL CIRCUIT OPEN
(T20) LR SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

Diagnostic Test

1. RELATED TRANSMISSION RELAY DTC'S PRESENT

With the scan tool, check for other transmission DTC's.

Are there any Transmission Control Relay DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0750-LR SOLENOID CIRCUIT (CONTINUED)

2. CHECK TO SEE IF P0750 IS PRESENT

Ignition on, engine not running.

With the scan tool, erase all Transmission DTC's.

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the scan tool, actuate the LR Solenoid.

Monitor the LR Solenoid LED on the Transmission Simulator.

Did the LR Solenoid LED on the Transmission Simulator blink on and off?

Yes >> Go To 3

No >> Go To 4

---

3. TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool, continue to actuate the LR Solenoid for the period of 2 minutes with the Transmission Simulator still connected.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0750 reset during the actuation test?

Yes >> Go To 4

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

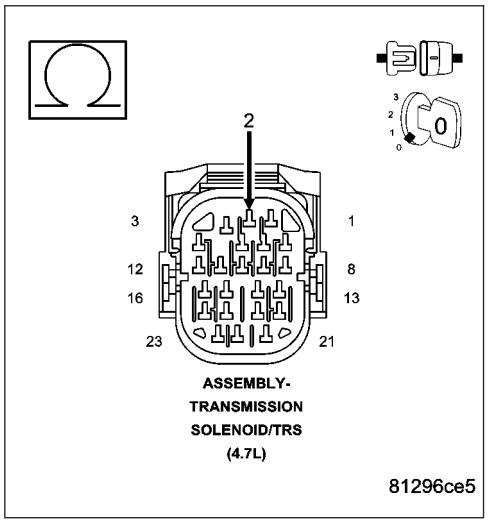
4. (T20) LR SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM harness connectors.

Measure the resistance between the (T20) LR Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T20) LR Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T20) LR Solenoid Control circuit for a short to other circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

P0750-LR SOLENOID CIRCUIT (CONTINUED)

5. (T20) LR SOLENOID CONTROL CIRCUIT OPEN

Connect Miller tool #8815 to the PCM C4 harness connector.

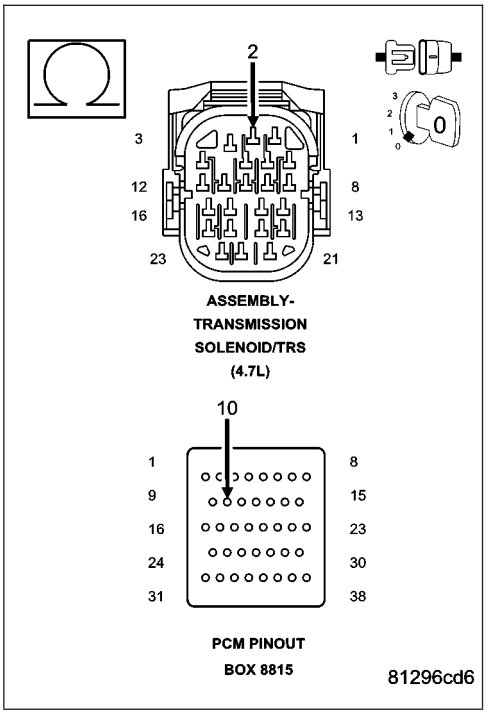
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T20) LR Solenoid Control circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T20) LR Solenoid Control circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



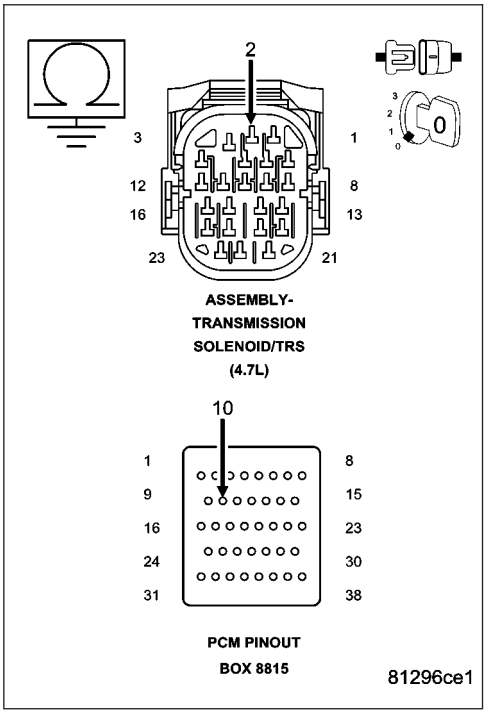
6. (T20) LR SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T20) LR Solenoid Control circuit.

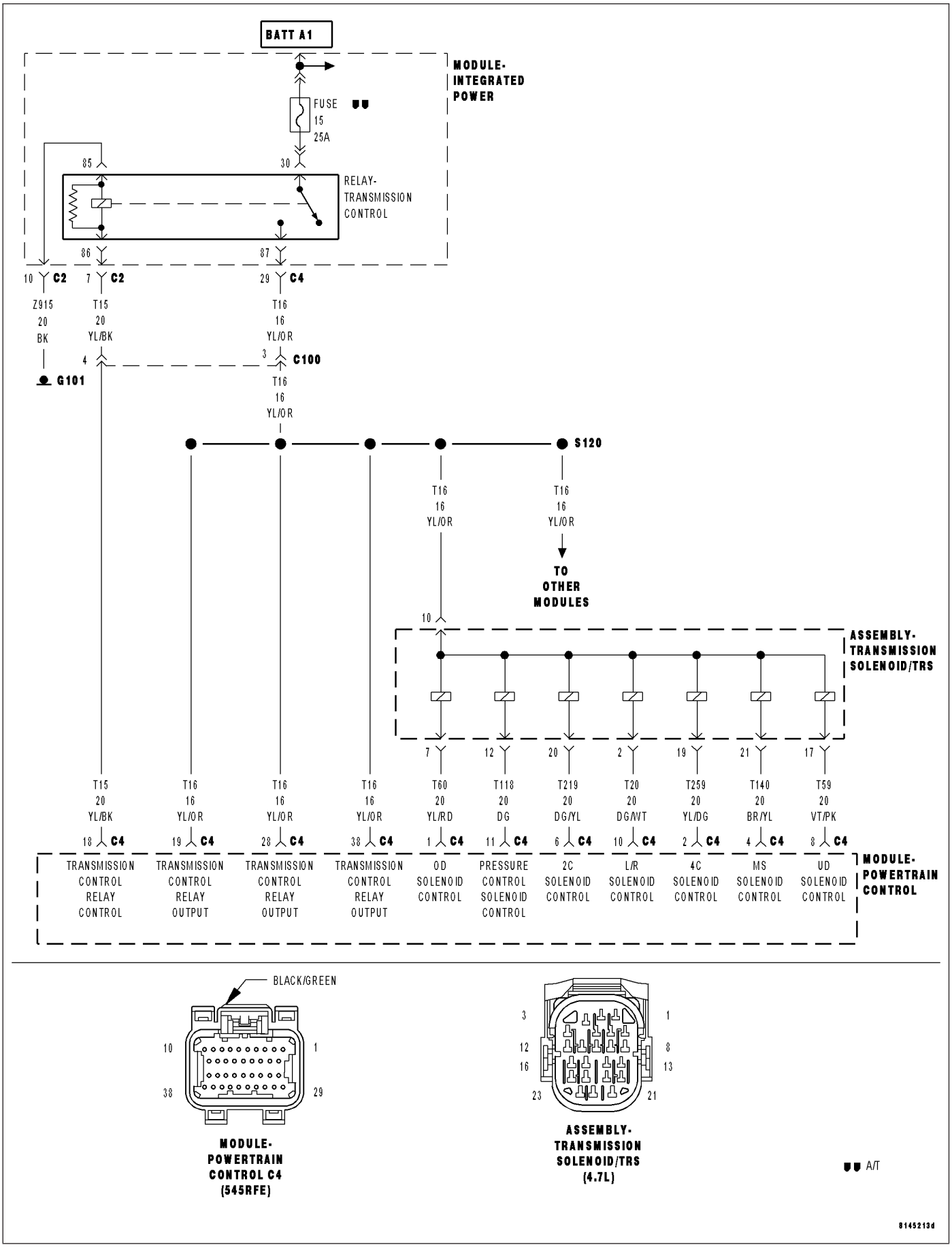
Is the resistance below 5.0 ohms?

Yes >> Repair the (T20) LR Solenoid Control circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



P0755-2C SOLENOID CIRCUIT



P0755-2C SOLENOID CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.
- **Set Condition:**
  After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

Possible Causes
RELATED RELAY DTC'S PRESENT
(T219) 2C SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
(T219) 2C SOLENOID CONTROL CIRCUIT OPEN
(T219) 2C SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

Diagnostic Test

1. RELATED TRANSMISSION RELAY DTC'S PRESENT

With the scan tool, check for other transmission DTC's.

Are there any Transmission Control Relay DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0755-2C SOLENOID CIRCUIT (CONTINUED)

2. CHECK TO SEE IF P0755 IS PRESENT

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the scan tool, actuate the 2C Solenoid.

Did the 2C Solenoid LED blink on and off on the Transmission Simulator?

Yes >> Go To 3

No >> Go To 4

---

3. TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool, continue to actuate the 2C Solenoid for the period of 2 minutes with the Transmission Simulator still connected.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0755 reset during the actuation test?

Yes >> Go To 4

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

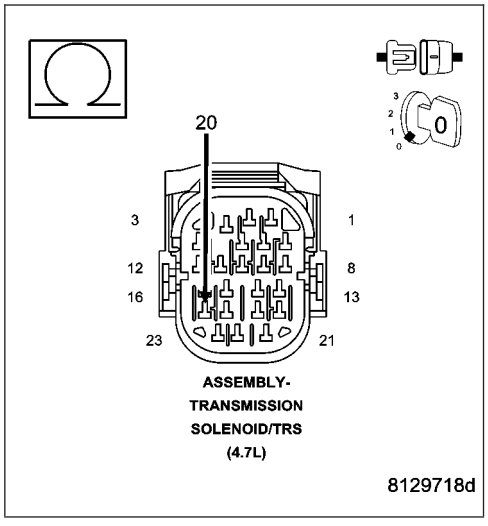
4. (T219) 2C SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM harness connectors.

Measure the resistance between the (T219) 2C Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T219) 2C Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T219) 2C Solenoid Control circuit for a short to other circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

P0755-2C SOLENOID CIRCUIT (CONTINUED)

5. (T219) 2C SOLENOID CONTROL CIRCUIT OPEN

Connect Miller tool #8815 to the PCM C4 harness connector.

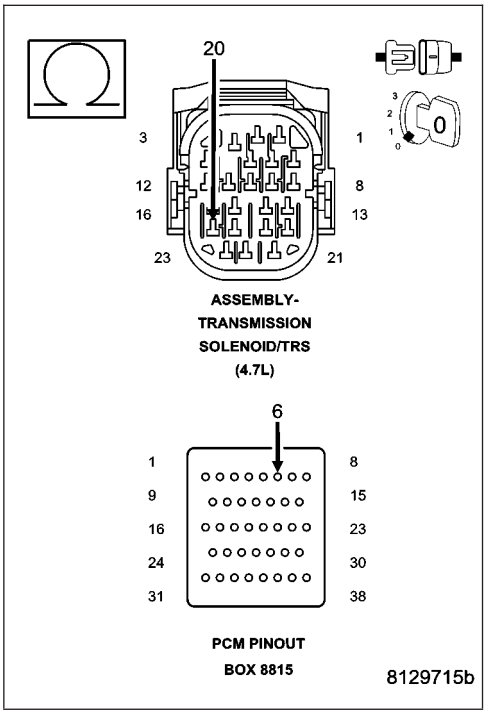
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T219) 2C Solenoid Control circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T219) 2C Solenoid Control circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



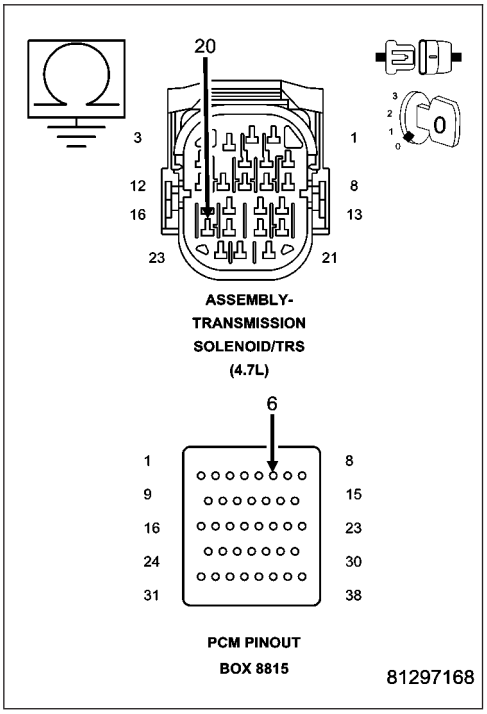
6. (T219) 2C SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T219) 2C Solenoid Control circuit.

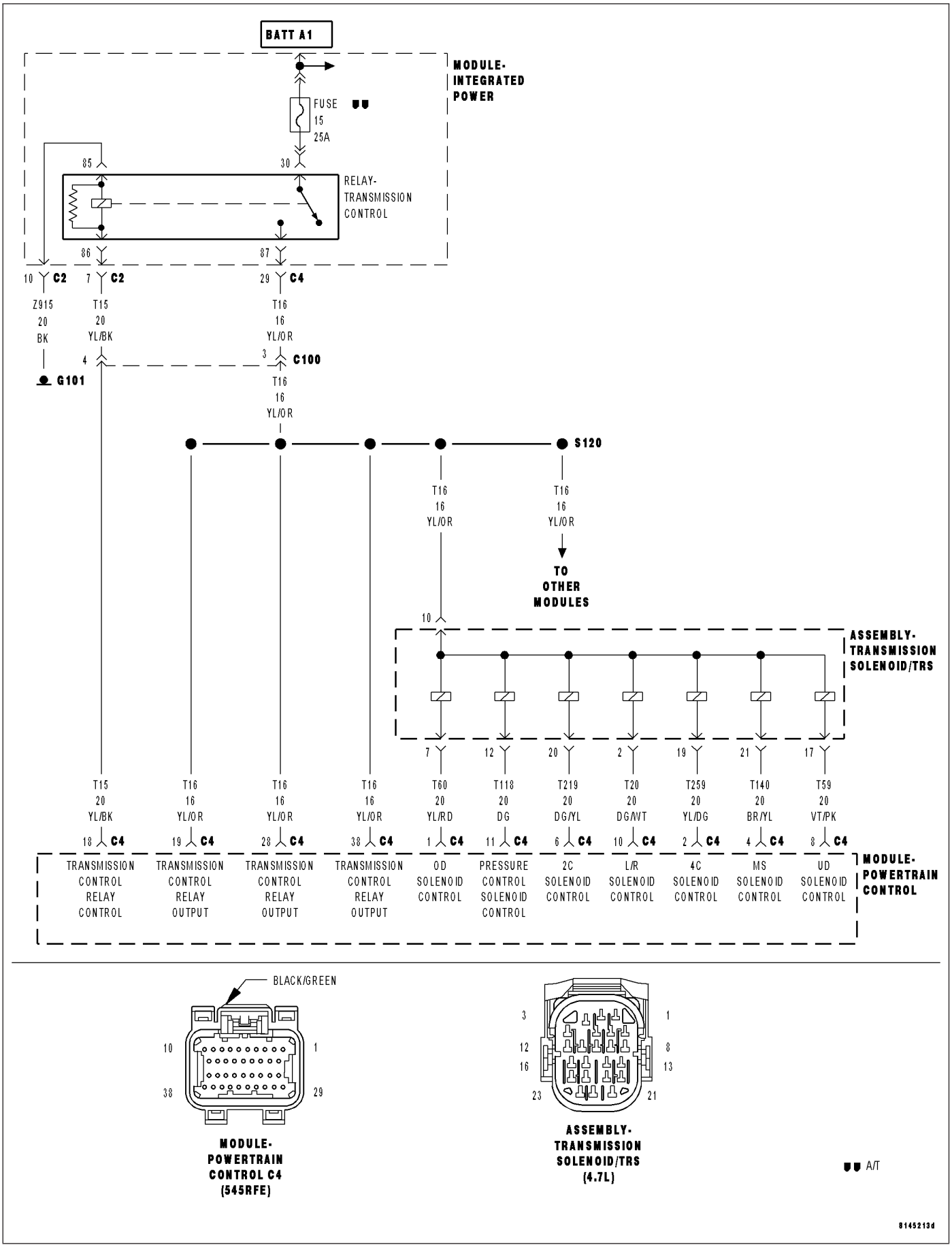
Is the resistance below 5.0 ohms?

Yes >> Repair the (T219) 2C Solenoid Control circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



P0760-OD SOLENOID CIRCUIT



P0760-OD SOLENOID CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS) .

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.
- **Set Condition:**
  After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

Possible Causes
RELATED RELAY DTC'S PRESENT
(T60) OD SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
(T60) OD SOLENOID CONTROL CIRCUIT OPEN
(T60) OD SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

Diagnostic Test

1. RELATED TRANSMISSION RELAY DTC'S PRESENT

With the scan tool, check for other transmission DTC's.

Are there any Transmission Control Relay DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0760-OD SOLENOID CIRCUIT (CONTINUED)

2. CHECK TO SEE IF P0760 IS PRESENT

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the scan tool, actuate the OD Solenoid.

Monitor the OD Solenoid LED on the Transmission Simulator.

Did the OD Solenoid LED on the Transmission Simulator blink on and off?

Yes >> Go To 3

No >> Go To 4

---

3. TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool, continue to actuate the OD Solenoid for the period of 2 minutes with the Transmission Simulator still connected.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0760 reset during the actuation test?

Yes >> Go To 4

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. (T60) OD SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

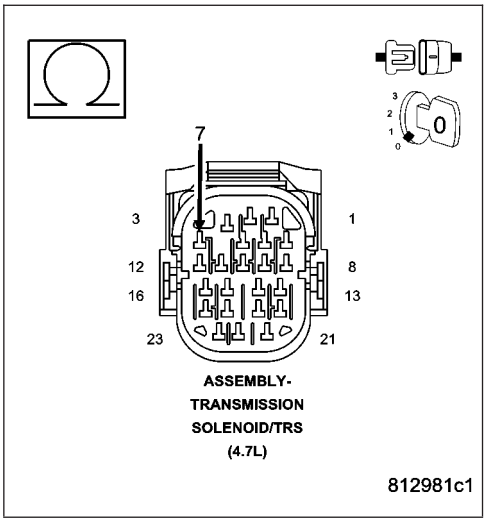
Disconnect the PCM harness connectors.

Measure the resistance between the (T60) OD Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T60) OD Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T60) OD Solenoid Control circuit for a short to other circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5



P0760-OD SOLENOID CIRCUIT (CONTINUED)

5. (T60) OD SOLENOID CONTROL CIRCUIT OPEN

Connect Miller tool #8815 to the PCM C4 harness connector.

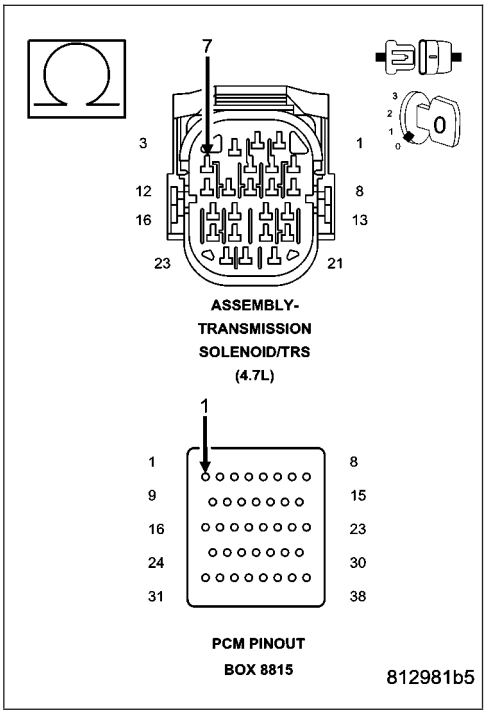
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller special tool #8815 to perform diagnosis.

Measure the resistance of the (T60) OD Solenoid Control circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T60) OD Solenoid Control circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



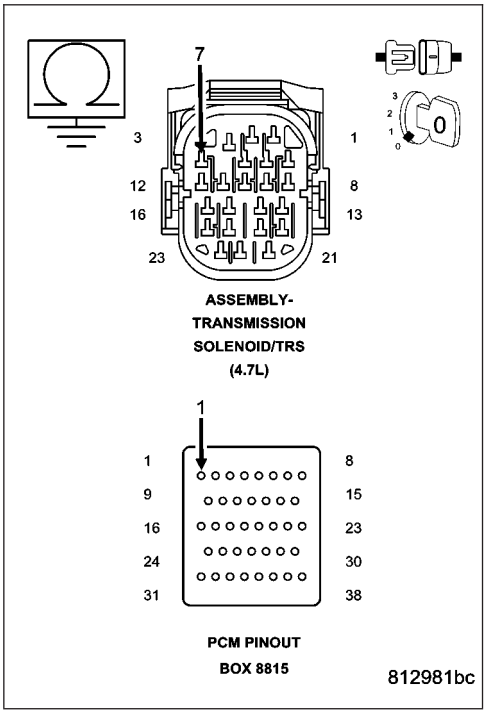
6. (T60) OD SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T60) OD Solenoid Control circuit.

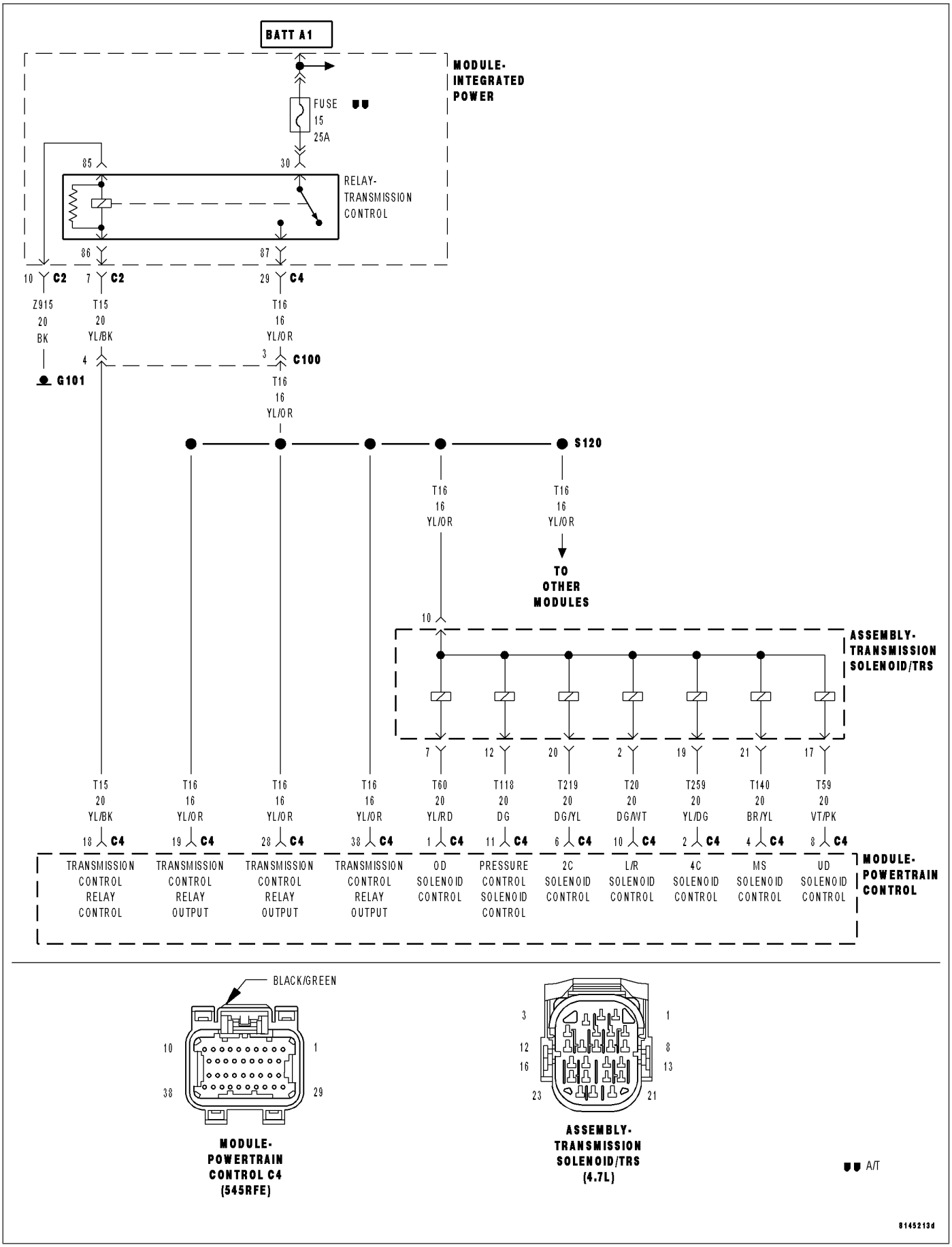
Is the resistance below 5.0 ohms?

Yes >> Repair the (T60) OD Solenoid Control circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



P0765-UD SOLENOID CIRCUIT



P0765-UD SOLENOID CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.
- **Set Condition:**
  After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

Possible Causes
RELATED RELAY DTC'S PRESENT
(T59) UD SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
(T59) UD SOLENOID CONTROL CIRCUIT OPEN
(T59) UD SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

Diagnostic Test

1. RELATED TRANSMISSION RELAY DTC'S PRESENT

With the scan tool, check for other transmission DTC's.

Are there any Transmission Control Relay DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0765-UD SOLENOID CIRCUIT (CONTINUED)

2. CHECK TO SEE IF P0765 IS PRESENT

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the scan tool, actuate the UD Solenoid.

Monitor the UD Solenoid LED on the Transmission Simulator.

Did the UD Solenoid LED on the Transmission Simulator blink on and off?

Yes >> Go To 3

No >> Go To 4

---

3. TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool, continue to actuate the UD Solenoid for the period of 2 minutes with the Transmission Simulator still connected.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0765 reset during the actuation test?

Yes >> Go To 4

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. (T59) UD SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

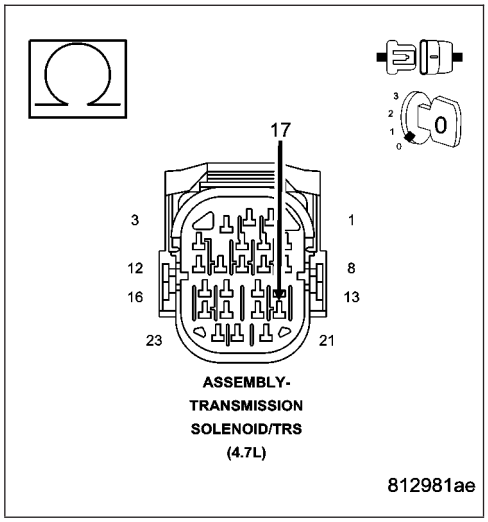
Disconnect the PCM harness connectors.

Measure the resistance between the (T59) UD Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T59) UD Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T59) UD Solenoid Control circuit for a short to other circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5



P0765-UD SOLENOID CIRCUIT (CONTINUED)

5. (T59) UD SOLENOID CONTROL CIRCUIT OPEN

Connect Miller tool #8815 to the PCM C4 harness connector.

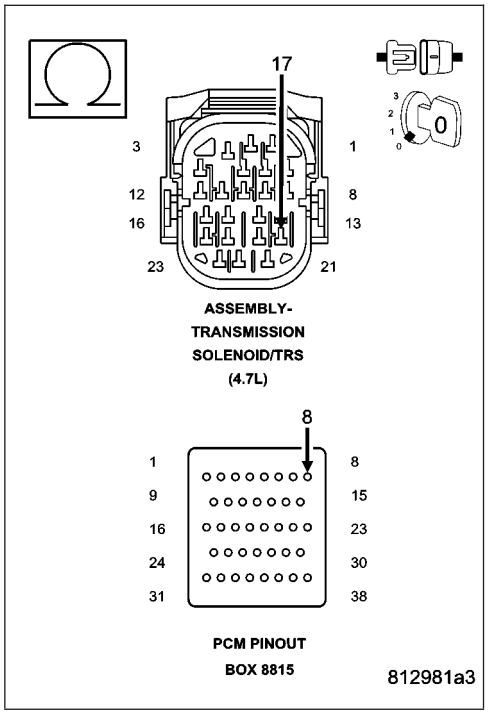
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T59) UD Solenoid Control circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T59) UD Solenoid Control circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



6. (T59) UD SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T59) UD Solenoid Control circuit.

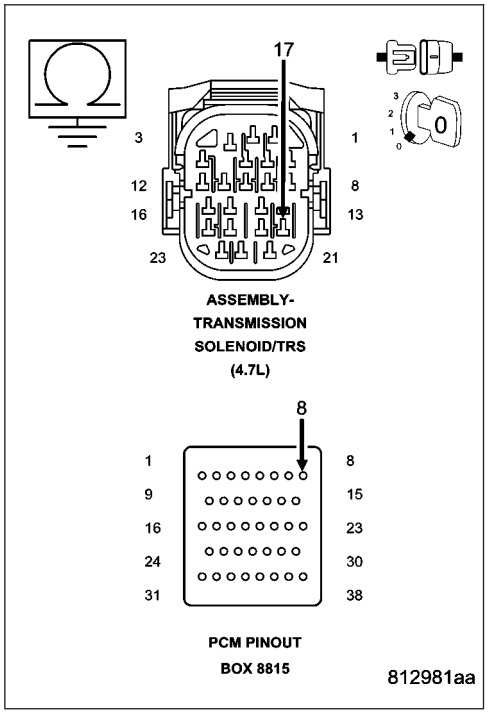
Is the resistance below 5.0 ohms?

Yes >> Repair the (T59) UD Solenoid Control circuit for a short to ground.

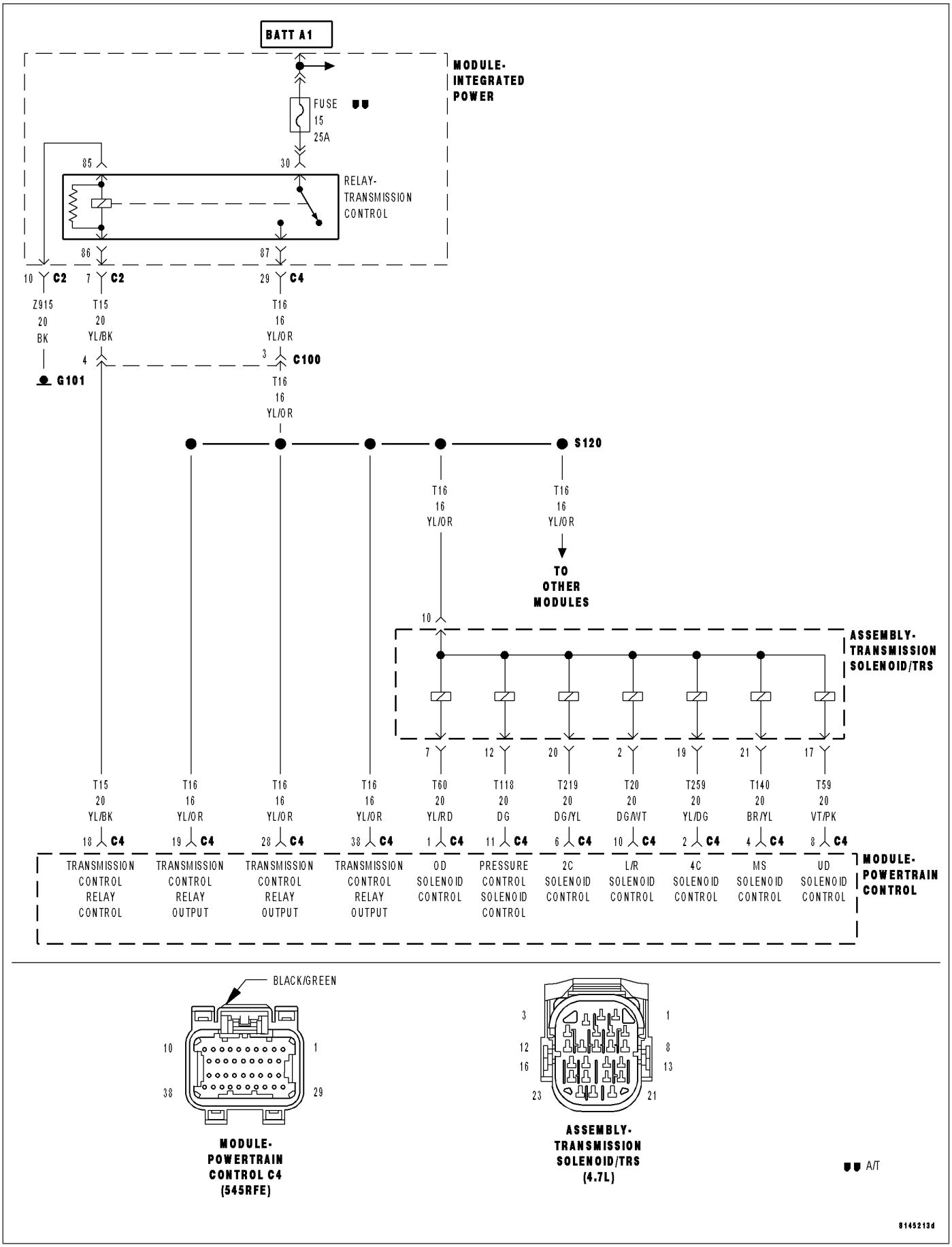
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



P0770-4C SOLENOID CIRCUIT



P0770-4C SOLENOID CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.
- **Set Condition:**
  After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

Possible Causes
RELATED RELAY DTC'S PRESENT
(T259) 4C SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
(T259) 4C SOLENOID CONTROL CIRCUIT OPEN
(T259) 4C SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

Diagnostic Test

1. RELATED TRANSMISSION RELAY DTC'S PRESENT

With the scan tool, check for other transmission DTC's.

Are there any Transmission Control Relay DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0770-4C SOLENOID CIRCUIT (CONTINUED)

2. CHECK TO SEE IF P0770 IS PRESENT

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the scan tool, actuate the 4C Solenoid.

Monitor the 4C Solenoid LED on the Transmission Simulator.

Did the 4C Solenoid LED on the Transmission Simulator blink on and off?

Yes >> Go To 3

No >> Go To 4

---

3. TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool, continue to actuate the 4C Solenoid for the period of 2 minutes with the Transmission Simulator still connected.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0770 reset during the actuation test?

Yes >> Go To 4

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

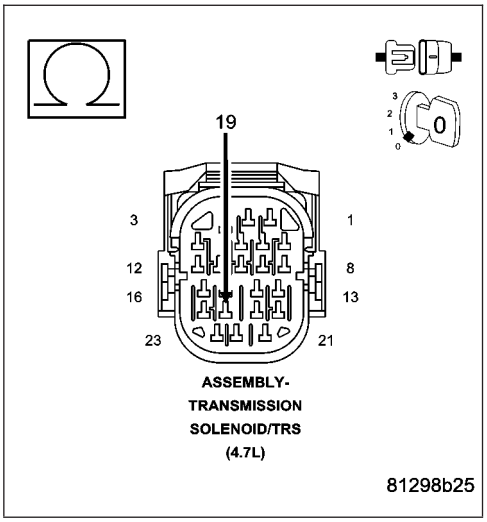
4. (T259) 4C SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM harness connectors.

Measure the resistance between the (T259) 4C Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T259) 4C Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T259) 4C Solenoid Control circuit for a short to other circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

P0770-4C SOLENOID CIRCUIT (CONTINUED)

5. (T259) 4C SOLENOID CONTROL CIRCUIT OPEN

Connect Miller tool #8815 to the PCM C4 harness connector.

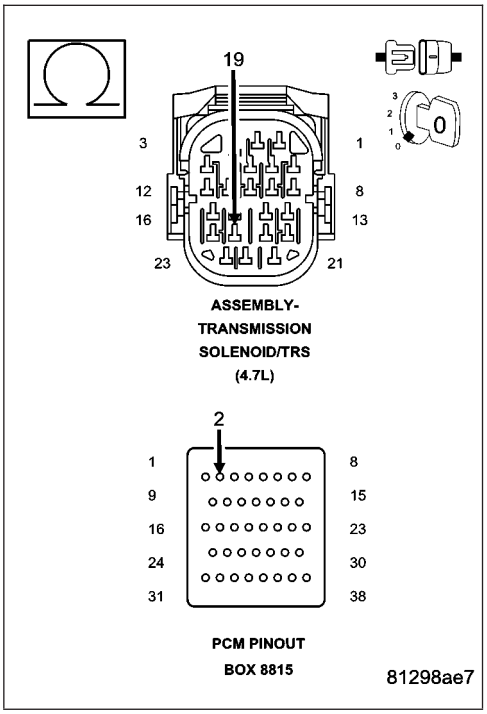
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller special tool #8815 to perform diagnosis.

Measure the resistance of the (T259) 4C Solenoid Control circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T259) 4C Solenoid Control circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



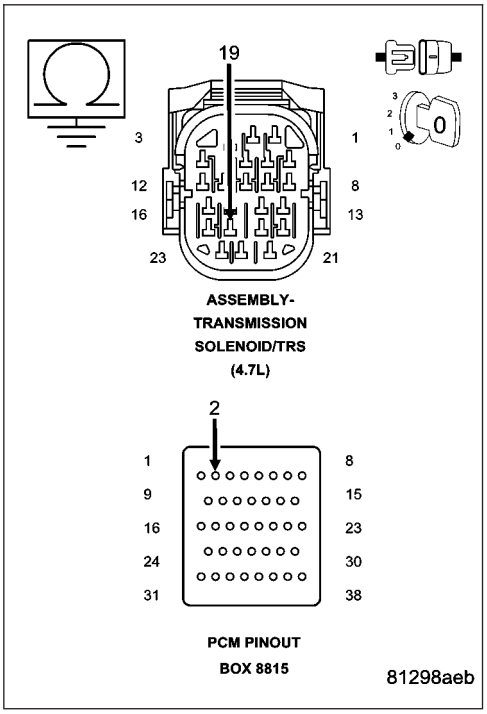
6. (T259) 4C SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T259) 4C Solenoid Control circuit.

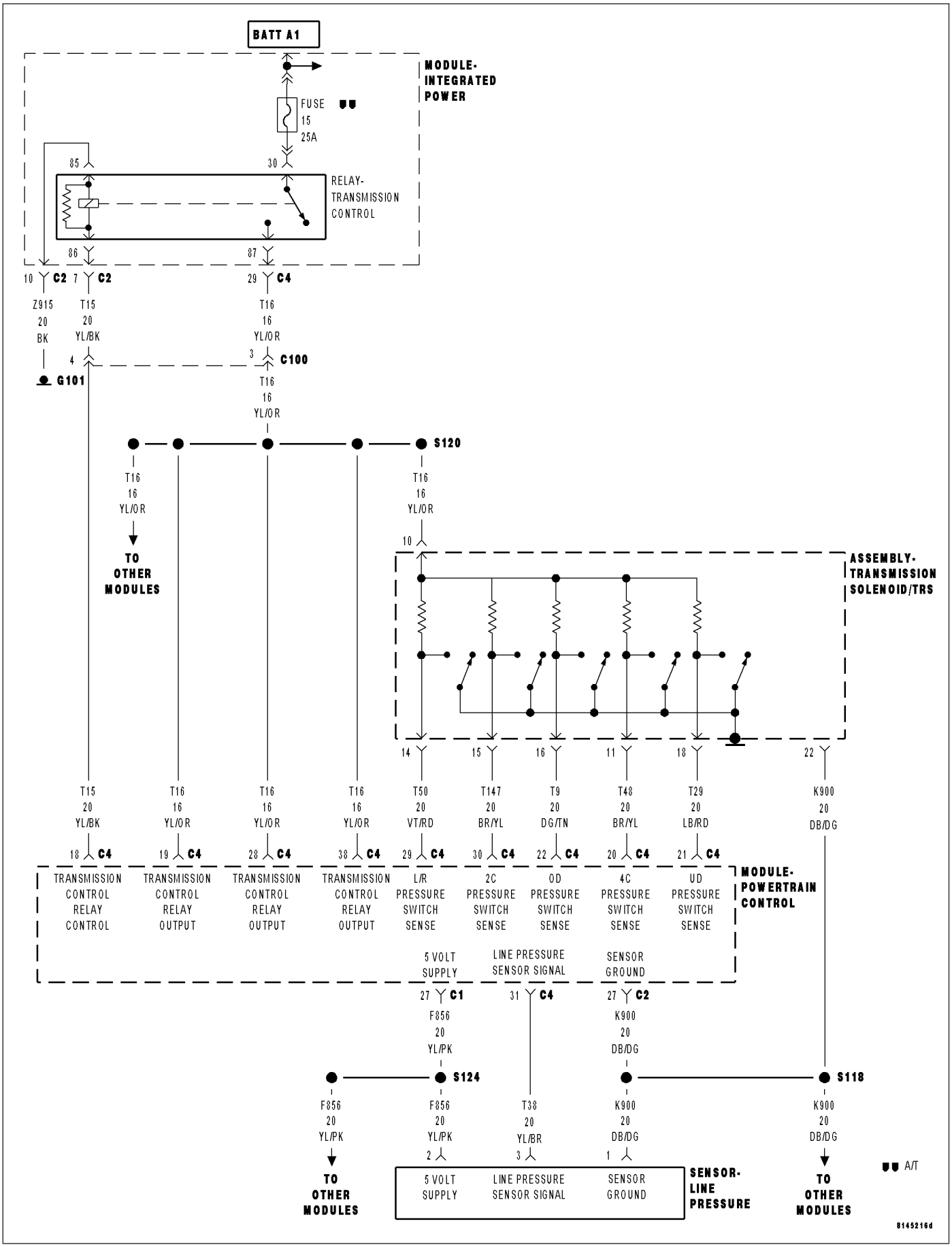
Is the resistance below 5.0 ohms?

Yes >> Repair the (T259) 4C Solenoid Control circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



P0841-LR PRESSURE SWITCH RATIONALITY



P0841-LR PRESSURE SWITCH RATIONALITY (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set if the L/R Pressure Switch reads open or closed at the wrong time in a given gear.

Possible Causes
LOSS OF PRIME AND/OR TRANSMISSION CONTROL RELAY DTC PRESENT
LOW FLUID LEVEL
LOW LINE PRESSURE
REVERSE CARRIER SNAP RING DISLODGED
CRACKED OR MISINSTALLED PRIMARY OIL FILTER OR FILTER SEAL
STICKING MAIN REGULATOR VALVE IN PUMP VALVE BODY
NO. 1 CHECK BALL CUT OR DAMAGED
WIRING AND CONNECTORS
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the L/R, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

GEAR	L/R	2C	4C	UD	OD
REVERSE	OPEN	OPEN	OPEN	OPEN	OPEN
P/N	CLOSED**	OPEN	OPEN	OPEN	OPEN
1ST	CLOSED*	OPEN	OPEN	CLOSED	OPEN
2ND	OPEN	CLOSED	OPEN	CLOSED	OPEN
2ND PRIME	OPEN	OPEN	CLOSED	CLOSED	OPEN
3RD	OPEN	OPEN	OPEN	CLOSED	CLOSED
4TH	OPEN	OPEN	CLOSED	OPEN	CLOSED
5TH	OPEN	CLOSED	OPEN	OPEN	CLOSED

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is closed in Manual 1.

**May be open when rolling in Neutral or at low oil temperatures.

P0841-LR PRESSURE SWITCH RATIONALITY (CONTINUED)

Diagnostic Test

1. OTHER RELATED DTC'S PRESENT

Ignition on, engine not running.

With the scan tool, check for other transmission DTC's.

Are there any Loss of Prime and/or Transmission Control Relay related DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom. If the DTC P0944 is present, perform its respective test first.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CONDITION P0841 PRESENT

With the scan tool, check the EATX DTC EVENT DATA for P0841.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the EATX DTC EVENT DATA show the DTC P0841?

Yes >> Go To 3

No >> Refer to the Symptom Catagory and perform diagnostics for the DTC reported in the EATX DTC EVENT DATA.

---

3. DTC SET IN REVERSE

Does the EATX DTC EVENT DATA show the DTC P0841 set while in Reverse?

Yes >> Go To 10

No >> Go To 4

---

4. L/R PRESSURE SWITCH CLOSED

Does the EATX DTC EVENT DATA show the L/R Pressure Switch reading CLOSED when the DTC P0841 was set?

Yes >> Go To 5

No >> Go To 14

P0841-LR PRESSURE SWITCH RATIONALITY (CONTINUED)

5. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

Turn the Pressure Switch selector to L/R on the Transmission Simulator.

With the scan tool, monitor the L/R Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the L/R Pressure Switch state change from open to closed while pressing the Pressure Switch Test button on the Transmission Simulator?

Yes >> Go To 6

No >> Go To 10

---

6. POOR WIRING AND CONNECTIONS

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7

---

7. DTC SET IN FIRST GEAR

With the EATX DTC EVENT DATA recorded earlier, check what gear the transmission was in when the DTC P0841 was set.

Does the EATX DTC EVENT DATA show the Present Gear as first gear when the DTC P0841 was set ?

Yes >> Go To 8

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

8. NO. 1 CHECK BALL CUT OR DAMAGED

Turn the ignition off to the lock position.

Remove the Transmission Valve Body per the Service Information.

Check the No. 1 Check Ball for any possible cuts or damage.

Is the No. 1 Check Ball cut or damaged?

Yes >> Replace the No. 1 Check Ball and check for clutch debris in the transmission oil pan. If there is excessive debris, perform internal repairs to the L/R Clutch assembly. Refer to the Service Information for proper repair procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9

P0841-LR PRESSURE SWITCH RATIONALITY (CONTINUED)

9. REVERSE CARRIER SNAP RING DISLODGED OR TRANSMISSION SOLENOID/TRS ASSEMBLY

Looking through the windows in the bottom of the case, check whether the snap ring at the front of the Reverse (center) Carrier has dislodged.

NOTE: It may be necessary to pry the Input Annulus Gear Shell rearward to check this snap ring.

Is the Reverse Carrier Snap Ring dislodged?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

10. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

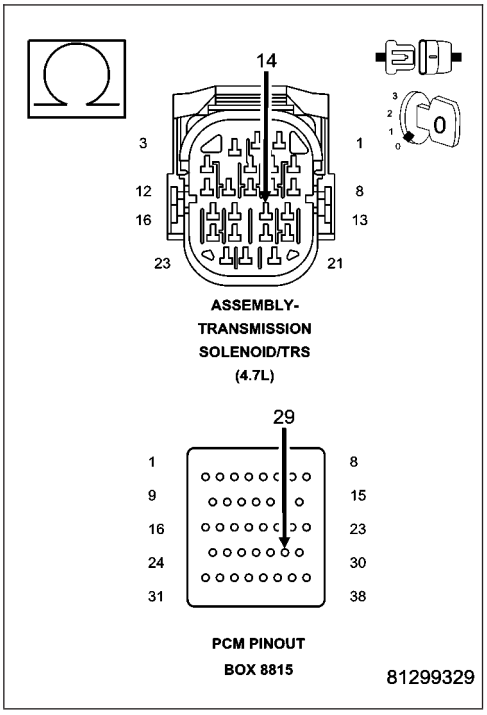
Disconnect the Transmission Simulator, Miller tool #8333 if connected in a previous step or disconnect the Transmission Solenoid /TRS Assembly harness connector.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T50) L/R Pressure Switch Sense circuit from the Solenoid/TRS Assembly harness connector to the appropriate terminal of the Miller tool #8815.



Is the resistance above 5.0 ohms?

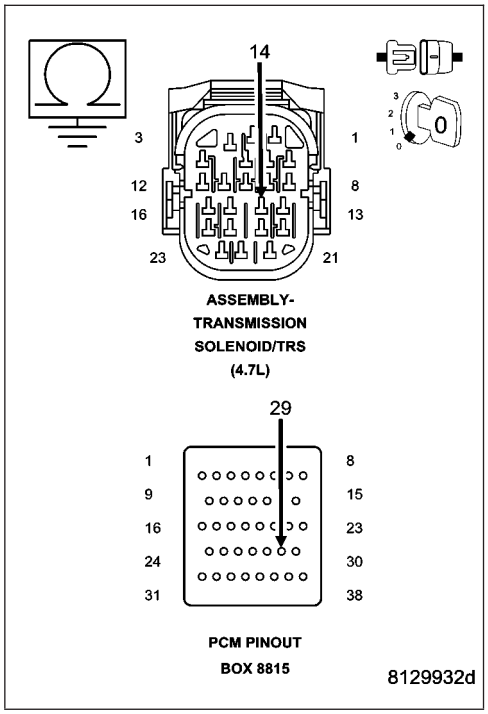
Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 11

P0841-LR PRESSURE SWITCH RATIONALITY (CONTINUED)

11. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T50) L/R Pressure Switch Sense circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 12

---

12. PCM POWERS AND GROUNDS

Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 13

---

13. ROAD TEST THE VEHICLE

With the scan tool, clear the DTC and road test the vehicle.

Try to duplicate the conditions in which the DTC originally set using the EATX DTC EVENT DATA recorded earlier.

Did the DTC P0841 reset?

Yes >> Replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 17

P0841-LR PRESSURE SWITCH RATIONALITY (CONTINUED)

14. LOW LINE PRESSURE

In the EATX DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?

Yes >> Repair as necessary to correct low line pressure. Check for low fluid level. Check the Primary Oil Filter seal for a split, crack, or improperly installed. Refer to the Service Information for the proper installation procedure. If the fluid level and Primary Oil Filter are OK, check the Main Regulator Valve in the Oil Pump per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 15

---

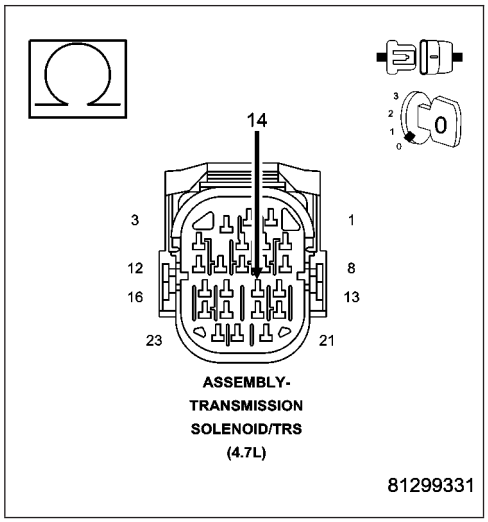
15. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS

Turn the ignition off to the lock position.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

Disconnect all PCM harness connectors.

Measure the resistance between the (T50) L/R Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T50) L/R Pressure Switch Sense circuit and all other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to other circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 16

---

16. ROAD TEST THE VEHICLE

With the scan tool, clear the DTC and road test the vehicle.

Try to duplicate the conditions in which the DTC originally set using the EATX DTC EVENT DATA recorded earlier.

Did the DTC P0841 reset?

Yes >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 17

P0841-LR PRESSURE SWITCH RATIONALITY (CONTINUED)

17. INTERMITTENT WIRING AND CONNECTORS

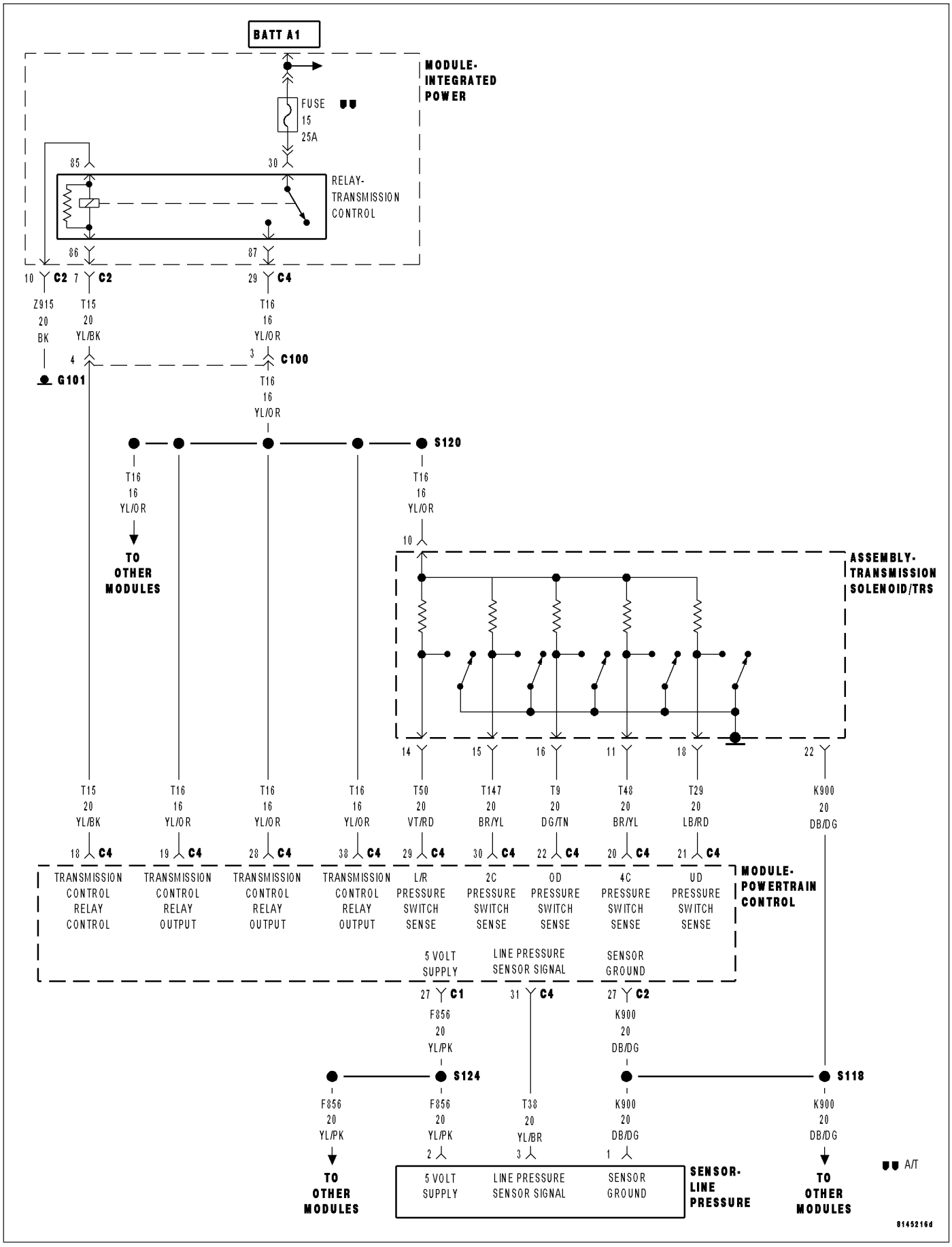
The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0845-2C HYDRAULIC PRESSURE TEST



P0845-2C HYDRAULIC PRESSURE TEST (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed above 1000 RPM, the PCM momentarily turns on element pressure to the Clutch circuits that don't have pressure to identify the correct Pressure Switch closes. If the Pressure Switch does not close 2 times, the DTC sets.

Possible Causes
LINE PRESSURE SENSOR
TRANSMISSION FLUID CONTAMINATION
RELATED DTC'S PRESENT
TRANSMISSION SOLENOID/TRS ASSEMBLY
EXCESSIVE DEBRIS IN OIL PAN
POOR LINE PRESSURE SENSOR CONNECTION
(T147) 2C PRESSURE SWITCH SENSE CIRCUIT OPEN
TRANSMISSION CONTROL RELAY DTCS PRESENT
(T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO ANOTHER CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Control System tests the pressure switches when they are off. The test verifies that the switches are operational (They will close with pressure applied). The Transmission Control System verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is re-tested. If it fails the second test, the DTC will set, the MIL will illuminate and the transmission system will default to the orderly Shutdown routine.

Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

Is there any Loss of Prime, Transmission Control Relay, and/or Line Pressure Sensor DTCs present?

Yes >> Refer to the Transmission category and perform the appropriate symptom. If the DTC, P0944-LOSS OF PRIME is present, perform its respective test first.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0845-2C HYDRAULIC PRESSURE TEST (CONTINUED)

2. DTC P0755 PRESENT

With the scan tool, check Transmission DTCs.

Is the DTC P0755 also present?

Yes >> Refer to the symptom list and perform diagnostics for P0755–2C SOLENOID CIRCUIT.

No >> Go To 3

---

3. DTCS P0732, P0735 AND/OR P0846 PRESENT

With the scan tool, check for other transmission DTC's

Are the DTCs P0732, P0735, and/or P0846 present also?

Yes >> Go To 12

No >> Go To 4

---

4. CHECK TO SEE IF DTC P0845 IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0845.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 5

No >> Go To 17

---

5. LINE PRESSURE STAYS THE SAME

Start the engine.

Warm the transmission to 82° C or 180° F.

Firmly apply the brakes.

With the scan tool, monitor the Line Pressure during the following step.

Move the shift lever to each gear position, pausing momentarily in each position and record the line pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range.

Did the line pressure remain at a steady value between 585 and 655 kPa or 85 and 95 PSI in each position?

Yes >> Go To 6

No >> Go To 10

---

6. CHECK LINE PRESSURE SENSOR CONNECTION

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

Did the Line Pressure reading on the scan tool change to about 207 kPa or 30 PSI when the connector was pushed inward?

Yes >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7

P0845-2C HYDRAULIC PRESSURE TEST (CONTINUED)

7. LINE PRESSURE SENSOR OPERATION

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while turning the Pressure Switch selector to each of the 3 line pressure positions on the Transmission Simulator.

NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 PSI of the reading specified on the Transmission Simulator.

Did the scan tool Line Pressure readings match the specified readings on the Transmission Simulator and remain steady in all three positions?

Yes >> Replace the Line Pressure Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8

---

8. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

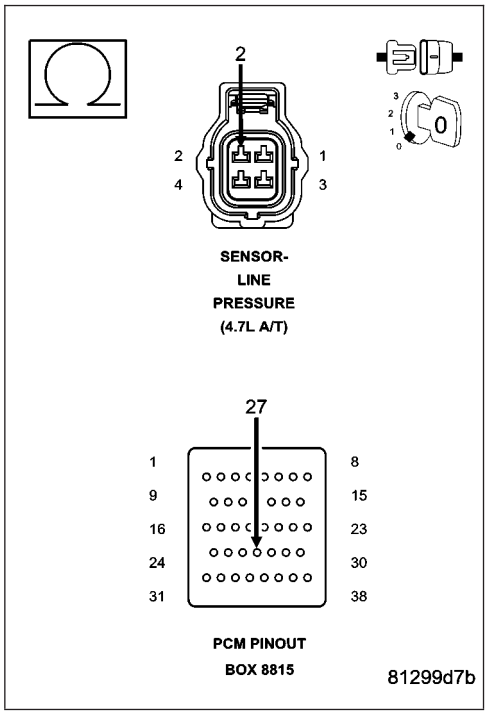
Turn the ignition off to the lock position.

Disconnect Transmission Simulator.

Disconnect the PCM C1 harness connector and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the Line Pressure Sensor harness connector to the appropriate terminal of Miller tool #8815.



Is the resistance above 5.0 ohms?

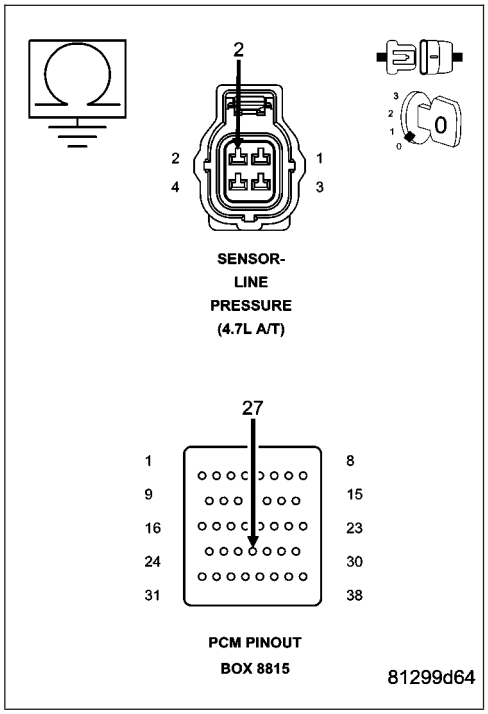
Yes >> Repair the (F856) 5-volt Supply circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9

P0845-2C HYDRAULIC PRESSURE TEST (CONTINUED)

9. (F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (F856) 5-volt Supply circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

10. COMPARE SCAN TOOL TO PRESSURE GAUGE

Turn the ignition off to the lock position.

Connect the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP. Refer to the Service Information for proper installation procedure.

CAUTION: Apply parking brake.

Start the engine.

In the following steps, compare the scan tool Line Pressure to the Pressure Gauge readings in each gear.

CAUTION: Do not overheat transmission.

With the gear selector in park, raise the RPM to 1500, and compare line pressure readings.

Firmly apply the brakes, move the gear selector into reverse, raise the RPM to 1500, and compare the line pressure readings.

Firmly apply the brakes, move the gear selector into drive, raise the RPM to 1500, and compare the line pressure readings.

Does the scan tool Line Pressure readings match the Pressure Gauge readings ± 10 psi?

Yes >> Go To 11

No >> Replace the Line Pressure Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0845-2C HYDRAULIC PRESSURE TEST (CONTINUED)

11. WIRING AND CONNECTORS

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.

Remove the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP.

Install the Transmission Simulator, Miller tool #8333.

On the Transmission Simulator, turn the Pressure Switch selector switch to 2C.

Ignition on, engine not running.

With the scan tool, monitor the 2C Pressure Switch state while pressing and holding the Pressure Switch test button and wiggling the wire harness and connectors that pertain to the 2C Pressure Switch.

Did the 2C Pressure Switch state change to closed and remain closed while wiggling the wires?

Yes >> Go To 12

No >> Go To 14

---

12. CHECK FOR EXCESSIVE DEBRIS

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Remove and inspect the Transmission Oil Pan per the Service Information.

Does the Transmission Oil Pan contain excessive debris or contamination?

Yes >> Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 13

---

13. CHECK THE 2C HYDRAULIC CLUTCH CIRCUIT

Remove the Valve Body and air check the 2C clutch hydraulic circuit, in the 2C/4C clutch retainer, for leakage per the Service Information.

NOTE: The 2C hydraulic clutch circuit contains a small bleed orifice, a small amount of air leakage is normal.

Was there excessive air leakage noticed during the air check?

Yes >> Repair as necessary. Check the 2C clutch piston, piston seals and bleed orifice assembly.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Disassemble and inspect the Valve Body and repair as necessary. Inspect the 2C Accumulator piston and seals. Check for an extra check ball downstream from the #7 check ball pocket and repair as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0845-2C HYDRAULIC PRESSURE TEST (CONTINUED)

14. CHECK THE (T147) 2C PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

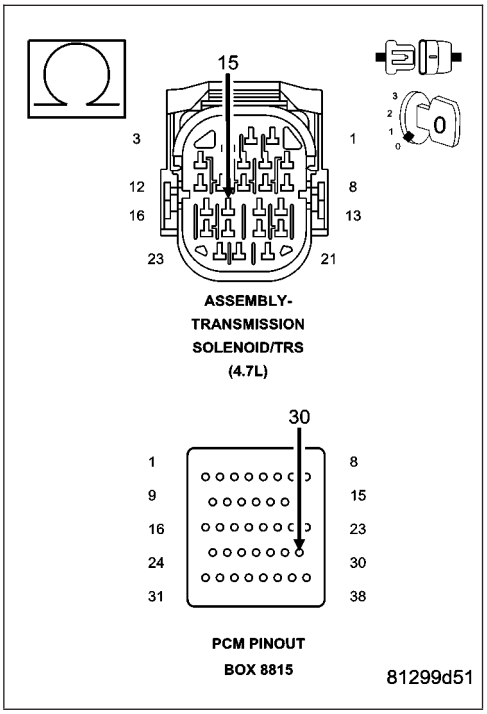
Disconnect the PCM C4 harness connector and connect Miller tool #8815.

Measure the resistance of the (T147) 2C Pressure Switch Sense circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T147) 2C Pressure Switch Sense circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 15



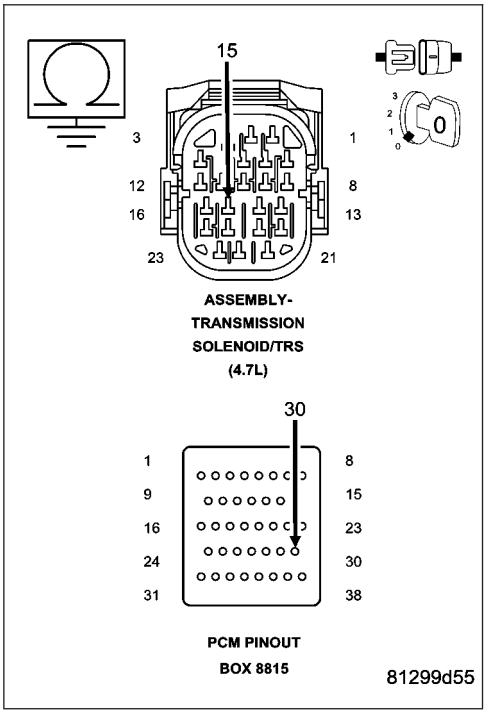
15. CHECK THE (T147) 2C PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T147) 2C Pressure Switch Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T147) 2C Pressure Switch Sense circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 16



P0845-2C HYDRAULIC PRESSURE TEST (CONTINUED)

16. (T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO ANOTHER CIRCUIT

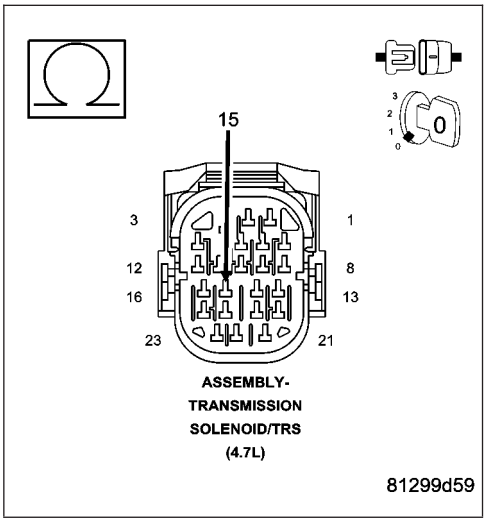
Disconnect all PCM harness connectors.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the (T147) 2C Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T147) 2C Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T147) 2C Pressure Switch Sense circuit for a short to another circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

17. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

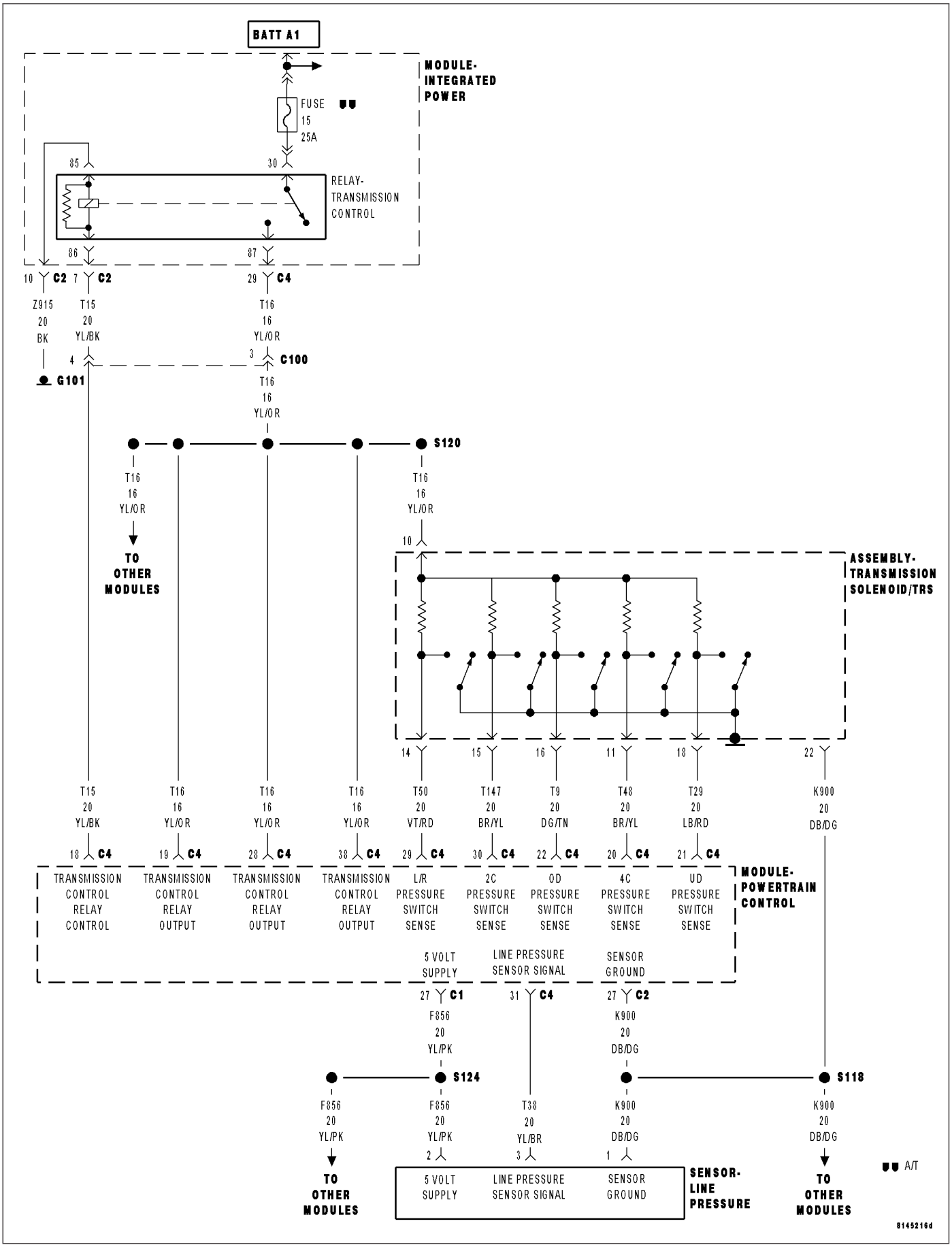
If the EATX DTC EVENT DATA shows the DTC P0845 set while the Line Pressure was significantly below the Desired Line Pressure reading, check for causes of low line pressure (low fluid level, broken or mis-installed primary oil filter or filter seal, sticking Main Regulator Valve in the Pump Valve Body etc.). If the data shows the DTC set while the Line Pressure reading was significantly higher than the Desired Line Pressure, check the Line Pressure Sensor and related wiring.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0846-2C PRESSURE SWITCH RATIONALITY



P0846-2C PRESSURE SWITCH RATIONALITY (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  The DTC is set if the 2C Pressure Switch reads open or closed at the wrong time in a given gear.

Possible Causes
RELATED RELAY DTC'S PRESENT
(T147) 2C PRESSURE SWITCH SENSE CIRCUIT OPEN
(T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS
EXCESSIVE FLUID LEAKAGE IN 2C CLUTCH CIRCUIT
NO. 5 AND/OR NO. 7 CHECK BALL CUT OR DAMAGED
EXTRA CHECK BALL DOWNSTREAM OF THE NO. 7 CHECK BALL SOCKET
LOW LINE PRESSURE
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE
WIRING AND CONNECTORS

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the LR, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

GEAR	L/R	2C	4C	UD	OD
REVERSE	OPEN	OPEN	OPEN	OPEN	OPEN
P/N	CLOSED**	OPEN	OPEN	OPEN	OPEN
1ST	CLOSED*	OPEN	OPEN	CLOSED	OPEN
2ND	OPEN	CLOSED	OPEN	CLOSED	OPEN
2ND PRIME	OPEN	OPEN	CLOSED	CLOSED	OPEN
3RD	OPEN	OPEN	OPEN	CLOSED	CLOSED
4TH	OPEN	OPEN	CLOSED	OPEN	CLOSED
5TH	OPEN	CLOSED	OPEN	OPEN	CLOSED

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is closed in Manual 1.

**May be open when rolling in Neutral or at low oil temperatures.

P0846-2C PRESSURE SWITCH RATIONALITY (CONTINUED)

Diagnostic Test

1. DETERMINING IF RELATED RELAY DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's.

Are there any Transmission Control Relay related DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. EATX DTC DATA SHOW CURRENT DTC

With the scan tool, check the EATX DTC EVENT DATA.

Does the EATX DTC EVENT DATA show data for DTC P0846?

Yes >> Go To 3

No >> Refer to the Transmission category and perform the appropriate symptom shown in the EATX DTC EVENT DATA.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

3. MULTIPLE DTCS PRESENT

With the scan tool, check for other transmission DTC's.

Are there two or more related pressure switch rationality DTCs present in addition to P0846?

Yes >> Go To 4

No >> Go To 7

---

4. RELATED DTC PRESENT

With the scan tool, check the EATX DTC EVENT DATA for P0846.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Do all the pressure switches read CLOSED in the EATX DTC EVENT DATA for P0846?

Yes >> Refer to Transmission category and perform diagnostics for P0888.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

---

5. EATX DTC EVENT DATA READ OPEN

In the EATX DTC EVENT DATA recorded earlier, read the state of all pressure switches.

Do all the pressure switches read OPEN?

Yes >> Go To 6

No >> Go To 7

P0846-2C PRESSURE SWITCH RATIONALITY (CONTINUED)

6. LOW LINE PRESSURE

In the EATX DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?

Yes >> Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

7. EATX DTC EVENT DATA READS DTC SET IN PARK REVERSE OR NEUTRAL

With the scan tool, check the EATX DTC EVENT DATA for P0846.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the EATX DTC EVENT DATA show the DTC P0846 set in Park, Neutral, or Reverse?

Yes >> Go To 12

No >> Go To 8

---

8. EATX DTC EVENT DATA READS 2C PRESSURE SWITCH READING CLOSED

With the scan tool, check the EATX DTC EVENT DATA for P0846.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the EATX DTC EVENT DATA show the 2C Pressure Switch reading CLOSED?

Yes >> Go To 10

No >> Go To 9

---

9. PRIMARY OIL FILTER SEAL

In the EATX DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?

Yes >> Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 15

P0846-2C PRESSURE SWITCH RATIONALITY (CONTINUED)

10. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to the 2C position.

With the scan tool, monitor the 2C Pressure Switch while pressing the Pressure Switch test button on the Transmission Simulator.

Did the state of the 2C Pressure Switch change while pressing the Pressure Switch Test button?

Yes >> Go To 11

No >> Go To 12

---

11. TRANSMISSION SOLENOID/TRS ASSEMBLY

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

12. (T147) 2C PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM C4 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Connect Miller tool #8815 to the PCM C4 harness connector.

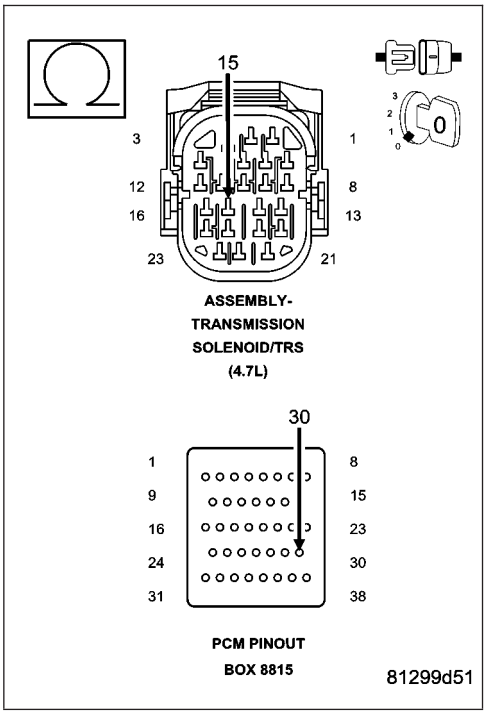
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T147) 2C Pressure Switch Sense circuit from the appropriate terminal of Miller tool #8815 to the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T147) 2C Pressure Switch Sense circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 13



P0846-2C PRESSURE SWITCH RATIONALITY (CONTINUED)

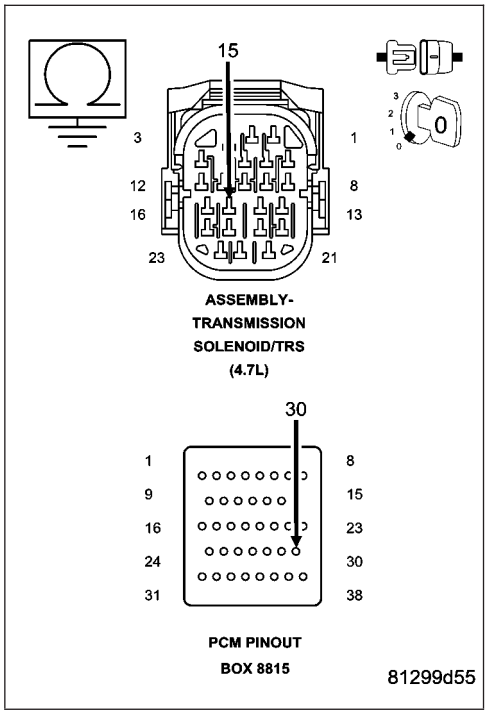
13. (T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T147) 2C Pressure Switch Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T147) 2C Pressure Switch Sense circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 14



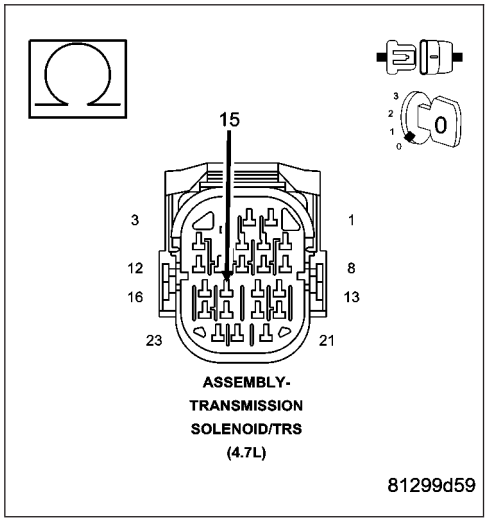
14. (T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO ANOTHER CIRCUIT

Measure the resistance between the (T147) 2C Pressure Switch Sense circuit and all the other circuits in the Transmission Solenoid/ TRS Assembly harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T147) 2C Pressure Switch Sense circuit for a short to another circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Powertrain Control Module per the Service Information. With the scan tool, perform the QUICK LEARN procedure.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



P0846-2C PRESSURE SWITCH RATIONALITY (CONTINUED)

15. #5 AND/OR #7 CHECK BALL CUT OR DAMAGED

Turn the Ignition off to the lock position.

Remove the Valve Body Assembly per the Service Information.

Inspect the #5 and #7 check balls for any cuts or damage.

Inspect the 2C accumulator piston and seals and also the 2C tower seal on top of the valve body. Refer to the Service Information.

Where there any problems found?

Yes >> Repair as necessary. Check for excessive clutch debris in the transmission oil pan. If excessive clutch debris is present, repair 2C clutch as necessary. Refer to the Service Information for proper repair procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 16

---

16. EXCESSIVE FLUID LEAKAGE WITH 2C CLUTCH CIRCUIT

Air check the 2C Clutch hydraulic circuit. Refer to the Service Information.

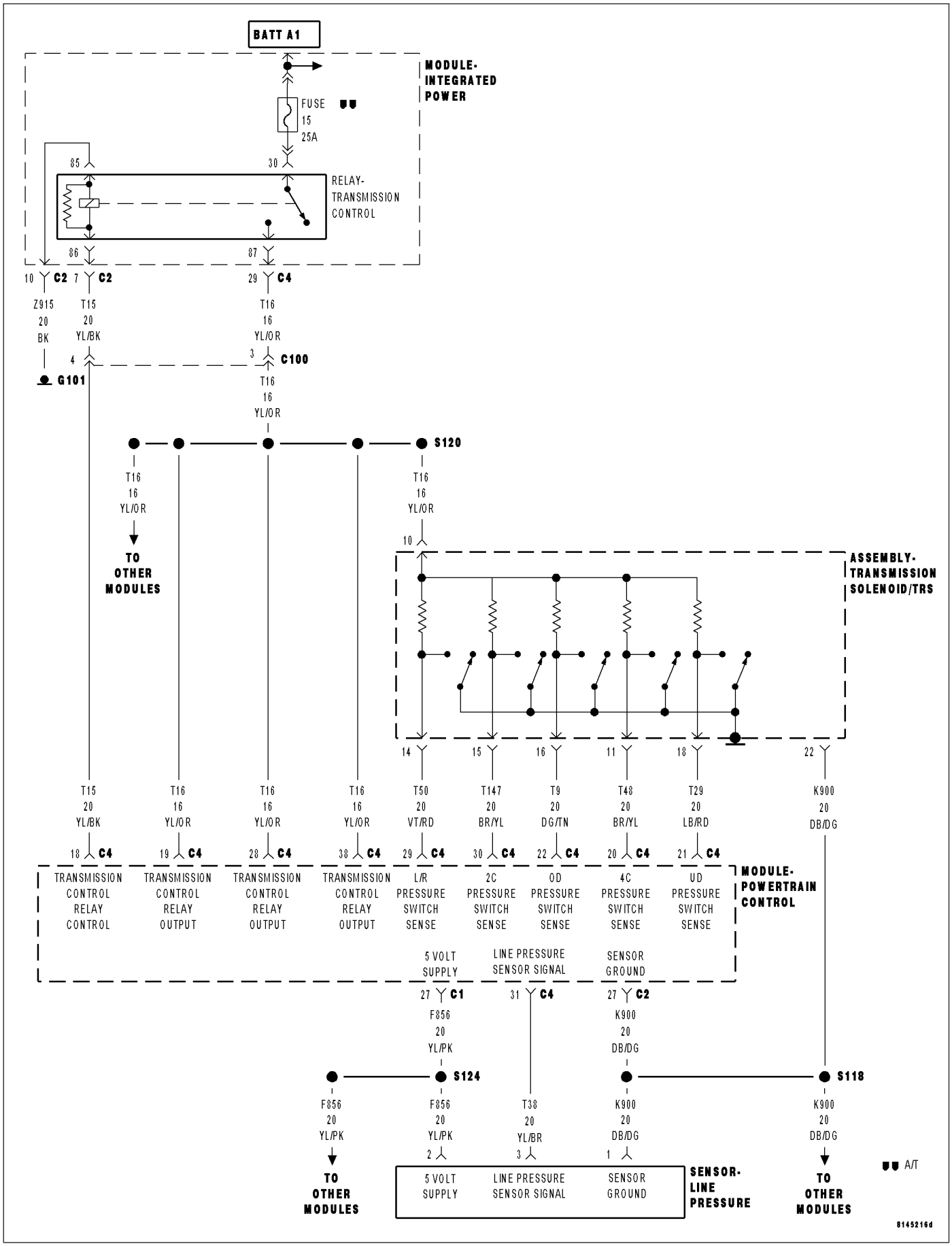
NOTE: This hydraulic clutch circuit contains a small bleed orifice. Small leakage is considered normal.

Was there excessive air leakage in the 2C Clutch hydraulic circuit?

Yes >> Repair as necessary. Refer to the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0868-LINE PRESSURE LOW



P0868-LINE PRESSURE LOW (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously while driving in a forward gear.
- **Set Condition:**
  The PCM continuously monitors Actual Line Pressure and compares it to Desired Line Pressure. If the Actual Line Pressure is more than 10 PSI below Desired Line Pressure, this DTC will set.

Possible Causes
CHECK FOR RELATED DTC'S
LOW FLUID LEVEL
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
POOR LINE PRESSURE SENSOR CONNECTION
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO VOLTAGE
(T140) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT SHORT TO ANOTHER CIRCUIT
INTERNAL TRANSMISSION
LINE PRESSURE SENSOR
CRACKED, PLUGGED, OR MISINSTALLED PRIMARY OIL FILTER
STUCK OR STICKING MAIN REGULATOR VALVE
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

Line pressure is measured by the Line Pressure Sensor (LPS) and regulation is achieved by changing the duty cycle of the Pressure Control Solenoid (PCS) controlled by the Transmission Control System. (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure). The Transmission Control System calculates the desired line pressure based on inputs from both the engine and transmission.

The Transmission Control System calculates torque input to the transmission and uses it as the primary input to the desired line pressure calculation. This is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 or 931kPa (120 or 135 PSI) during shifts and in Park and Neutral to ensure consistent shift quality. The desired line pressure is continuously being compared to the actual line pressure. If the actual line pressure is consistently lower than the target while driving, the line pressure low DTC P0868 will set.

Diagnostic Test

1. CHECK FOR RELATED DTC'S

With the scan tool, check for other transmission DTC's

Is the DTC P0932 present also?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0868-LINE PRESSURE LOW (CONTINUED)

2. CONDITION P0868 PRESENT

With the scan tool, check the STARTS SINCE SET counter for P0868.

NOTE: This counter only applies to the last DTC set.

Is the START SINCE SET COUNTER 2 or less?

Yes >> Go To 3

No >> Go To 11

---

3. CHECK LINE PRESSURE SENSOR CONNECTION

Ignition on, **engine not running.**

With the scan tool, monitor the Line Pressure, firmly push the Line Pressure Sensor harness connector towards the Transmission.

Did the Line Pressure change to about 207 kPa or 30 PSI when the connector was pushed?

Yes >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure during the following steps.

Using the Transmission Simulator, set the rotary knob to each of the 3 line pressure positions.

NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 PSI of the reading specified on the Transmission Simulator.

Did the Line Pressure read within ±14 kPa or 2.0 PSI in all three positions?

Yes >> Go To 5

No >> Go To 7

P0868-LINE PRESSURE LOW (CONTINUED)

5. LINE PRESSURE SENSOR

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333 and reconnect all previously disconnected connectors.

Install the Line Pressure Adaptor, Miller tool #8259, and the Pressure Gauge, Miller tool #C-3293, 0 to 2000 kPa or 0 to 300 PSI.

Start the engine in park.

Monitor the line pressure readings of both the scan tool and the pressure gauge and compare the two readings.

Is the line pressure gauge reading within 34 kPa or 5 PSI of the scan tool reading?

Yes >> Go To 6

No >> Replace the Line Pressure Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

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6. PLUGGED TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

NOTE: Make sure the Primary Transmission Oil Filter and/or O-ring is not cracked or split.

Does the Oil Pan contain excessive debris and/or is the Primary Oil Filter cracked or plugged?

Yes >> Repair the plugged, cracked, or split Primary Transmission Oil Filter and/or O-ring. If the Primary Transmission Oil Filter is plugged refer to the Service Information for the proper Hydraulic repair procedure.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Repair internal transmission and inspect the Transmission Oil Pump per the Service Information and replace if necessary. If no problem is found, replace the Solenoid/TRS Assembly.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

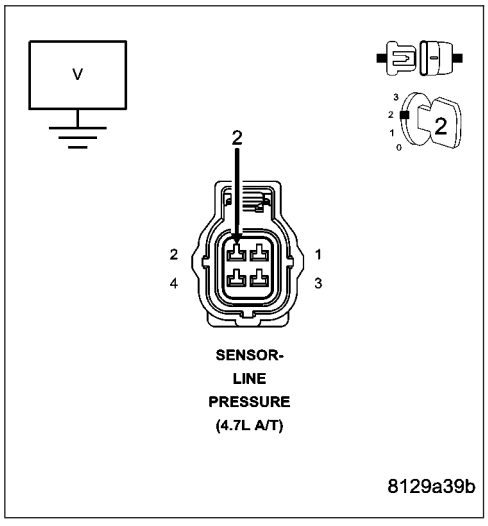
7. (F856) 5-VOLT SUPPLY CIRCUIT SHORT TO VOLTAGE

Disconnect the Transmission Simulator, Miller tool #8333.

Reconnect all previously disconnected connectors except the Line Pressure Sensor harness connector.

Ignition on, engine not running.

Measure the voltage of the (F856) 5-volt Supply circuit in the Line Pressure Sensor harness connector.



Is the voltage above 5.5 volts?

Yes >> Repair the (F856) 5-volt Supply circuit for a short to voltage.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8

P0868-LINE PRESSURE LOW (CONTINUED)

8. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C1 harness connector and connect Miller tool #8815.

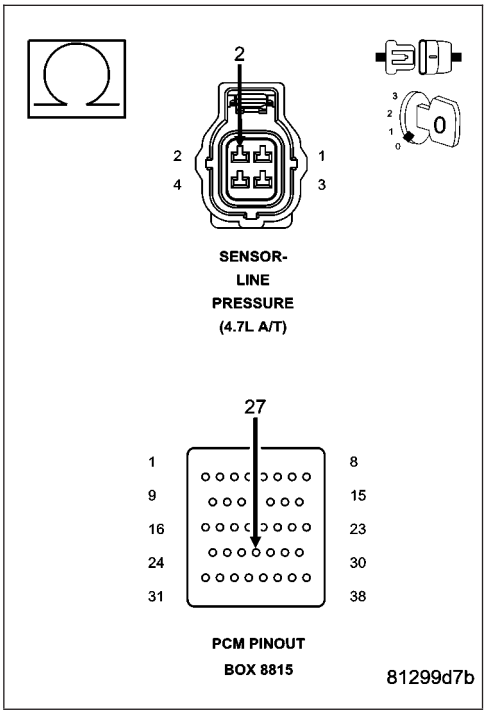
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the Line Pressure Sensor harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (F856) 5-volt Supply circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9



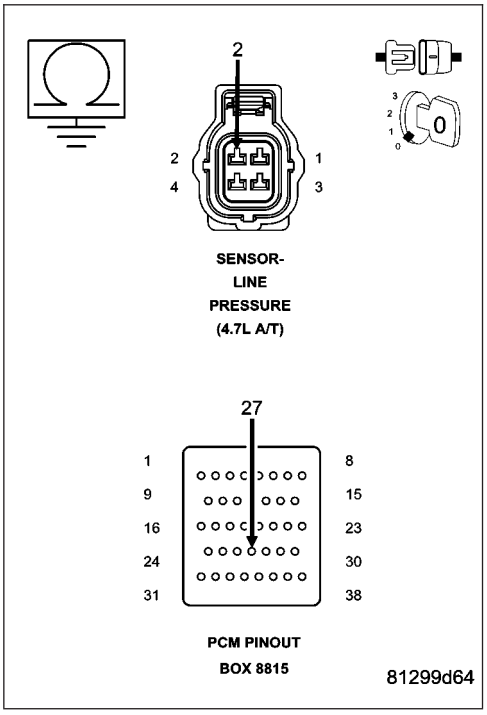
9. (F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (F856) 5-volt Supply circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 10



P0868-LINE PRESSURE LOW (CONTINUED)

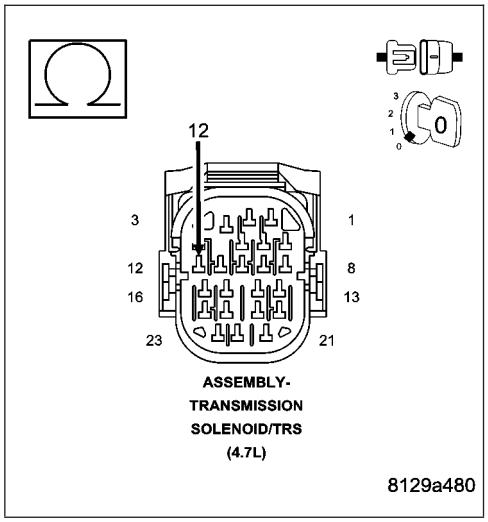
10. (T140) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

Disconnect all PCM harness connectors.

Measure the resistance between the (T140) Pressure Control Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T140) Pressure Control Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T140) Pressure Control Solenoid Control circuit for a short to another circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

11. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

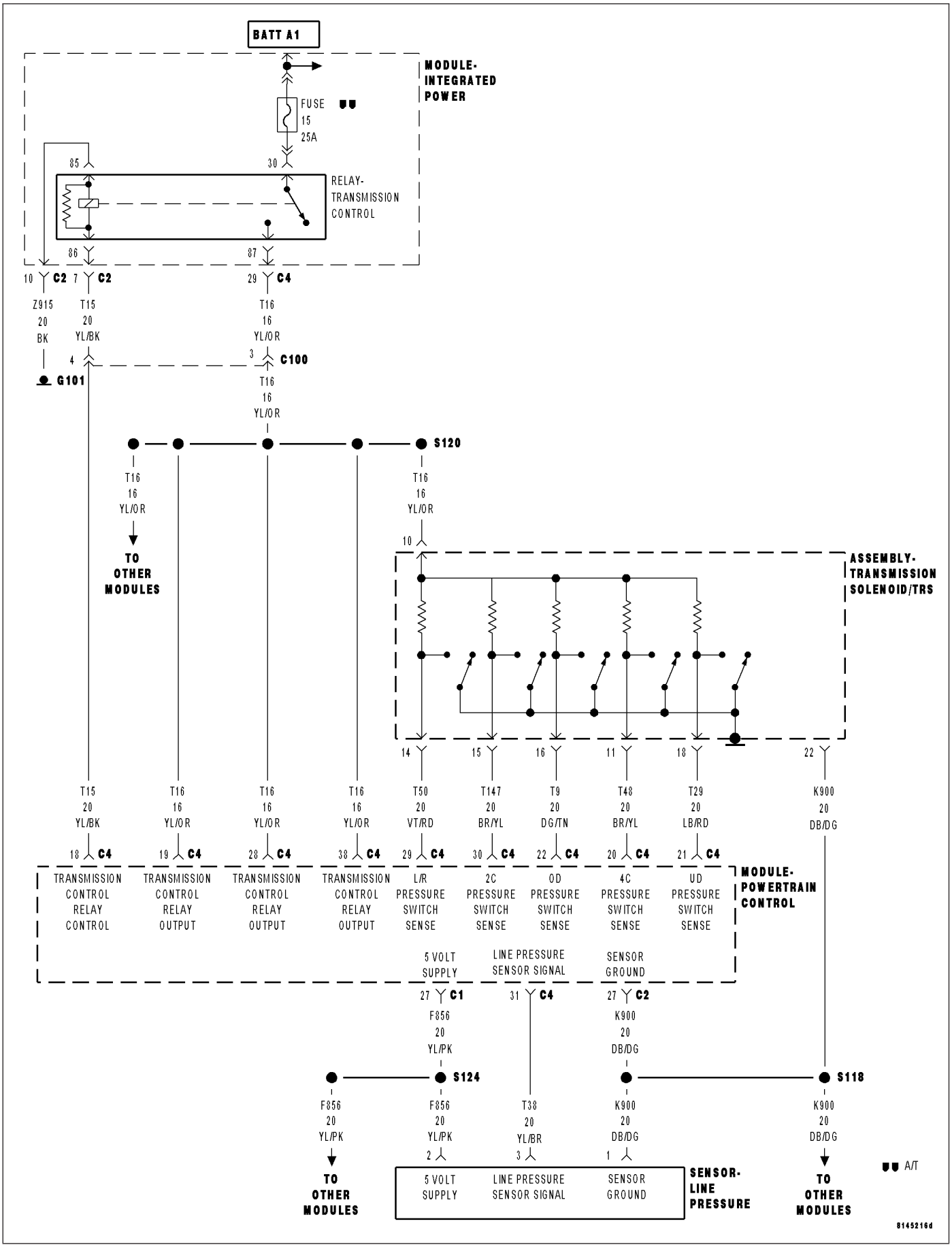
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0869-LINE PRESSURE HIGH



P0869-LINE PRESSURE HIGH (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously while driving in a forward gear.
- **Set Condition:**
  The PCM continuously monitors Actual Line Pressure. If the Actual Line Pressure reading is greater than the highest Desired Line Pressure ever used in the current gear, while the Pressure Control Solenoid duty cycle is at or near its maximum value (which should result in minimum line pressure), the DTC will set.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
LINE PRESSURE SENSOR CONNECTION
(T140) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(T140) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT SHORT TO GROUND
ITRANSMISSION CONTROL RELAY OUTPUT CIRCUIT
LINE PRESSURE SENSOR
STUCK OR STICKING MAIN REGULATOR VALVE
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

Line pressure is measured by the Line Pressure Sensor (LPS) and regulation is achieved by changing the duty cycle of the Pressure Control Solenoid (PCS) controlled by the Transmission Control System. (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure). The Transmission Control System calculates the desired line pressure based on inputs from both the engine and transmission.

The Transmission Control System calculates torque input to the transmission and uses it as the primary input to the desired line pressure calculation. This is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 or 931kPa (120 or 135 PSI) during shifts and in Park and Neutral to ensure consistent shift quality. The desired line pressure is continuously being compared to the actual line pressure. If the actual line pressure is consistently higher than the highest desired line pressure ever used in the current gear, the line pressure high DTC P0869 will set.

Diagnostic Test

1. CHECK FOR RELATED DTC'S

With the scan tool, check for other Transmission DTC's

Is the DTC P0932 or P0888 present also?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0869-LINE PRESSURE HIGH (CONTINUED)

2. CONDITION P0869 PRESENT

With the scan tool, check the STARTS SINCE SET counter for P0869.

Is the DTC P0932 or P0888 present also?

Yes >> Go To 3

No >> Go To 10

---

3. CHECK LINE PRESSURE SENSOR CONNECTION

Ignition on, engine not running.

With the scan tool, monitor the Transmission Line Pressure.

Firmly push the Line Pressure Sensor harness connector inward towards the Transmission.

Did the Line Pressure change to about 207 kPa or 30 PSI when the sensor connector was pushed?

Yes >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure during the following step.

Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 PSI of the reading specified on the Transmission Simulator.

Did the Line Pressure read within ±14 kPA or 2.0 PSI in all three positions?

Yes >> Go To 5

No >> Go To 6

P0869-LINE PRESSURE HIGH (CONTINUED)

5. CHECK LINE PRESSURE SENSOR CALIBRATION

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333 and reconnect all previously disconnected connectors.

Install the Line Pressure Adaptor, Miller tool #8259, and Pressure Gauge, Miller tool #C-3293, 0 to 2000 kPa or 0 to 300 PSI.

Start the engine in park.

Monitor the Line Pressure readings on the scan tool and the pressure gauge.

Compare the Line Pressure readings between the scan tool and the pressure gauge.

Is the pressure gauge reading within 34 kPa or 5 PSI of the scan tool reading?

Yes >> Repair the internal transmission and inspect the Transmission Oil Pump per the Service Information and replace if necessary. If no problem is found, replace the Transmission Solenoid/TRS Assembly, possible cause is a stuck Pressure Control Solenoid.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Line Pressure Sensor per the Service information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

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6. (T140) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT OPEN

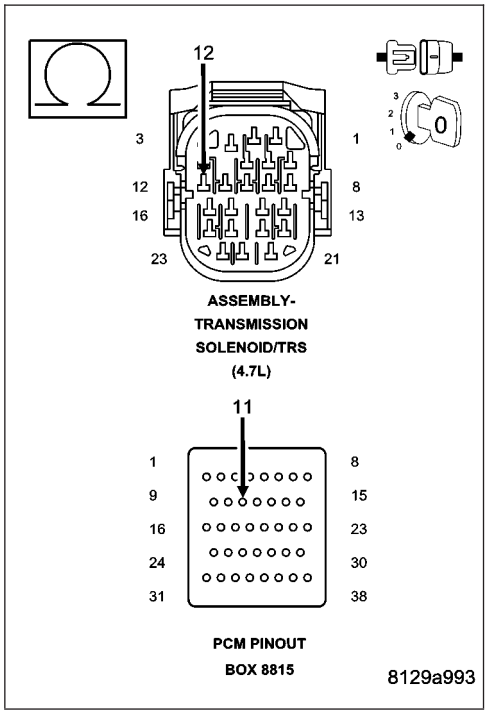
Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the Powertrain Control Module C4 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T140) Pressure Control Solenoid Control circuit from the appropriate terminal of Miller tool #8815 to the Solenoid/TRS harness connector.



Is the resistance above 5.0 ohms?

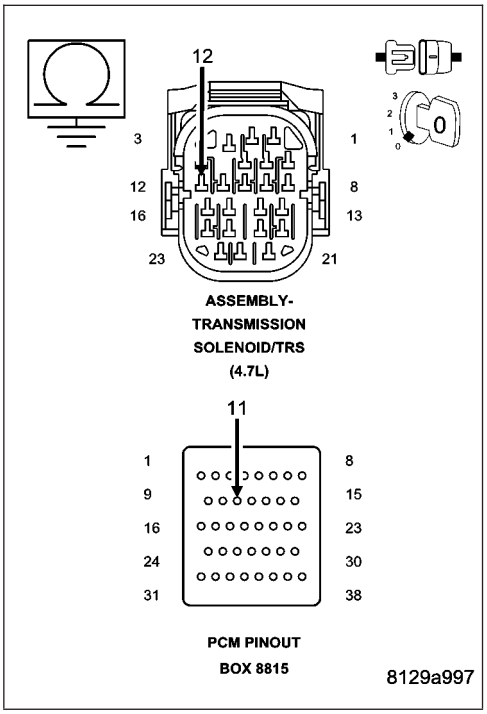
Yes >> Repair the (T140) Pressure Control Solenoid Control circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7

P0869-LINE PRESSURE HIGH (CONTINUED)

7. (T140) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T140) Pressure Control Solenoid Control circuit.



Is the resistance below 5.0 ohms?

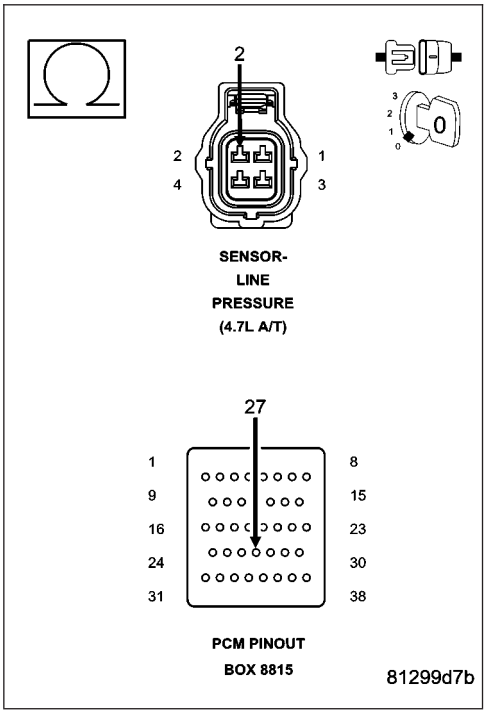
Yes >> Repair the (T140) Pressure Control Solenoid Control circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8

---

8. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Measure the resistance of the (F856) 5-volt Supply circuit between the Line Pressure Sensor harness connector to the appropriate terminal of Miller tool #8815.



Is the resistance above 5.0 ohms?

Yes >> Repair the (F856) 5-volt Supply circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9

P0869-LINE PRESSURE HIGH (CONTINUED)

9. (F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND

Disconnect the PCM C1 harness connector.

Disconnect the Line Pressure Sensor harness connector.

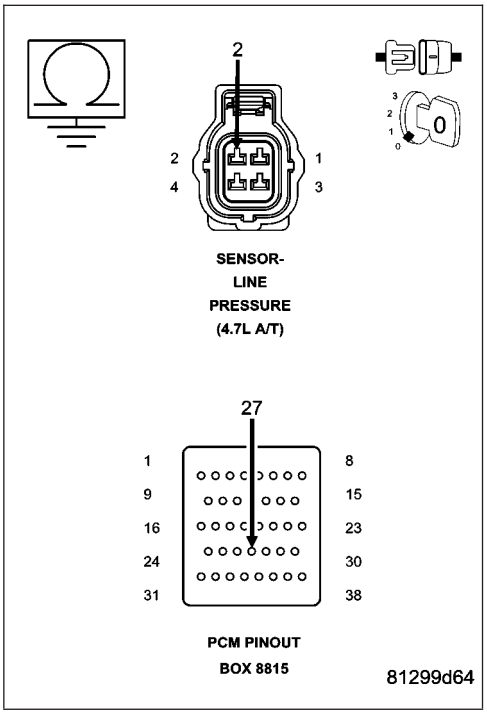
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (F856) 5-volt Supply circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Powertrain Control Module per the Service Information. With the scan tool perform the QUICK LEARN procedure.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



10. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

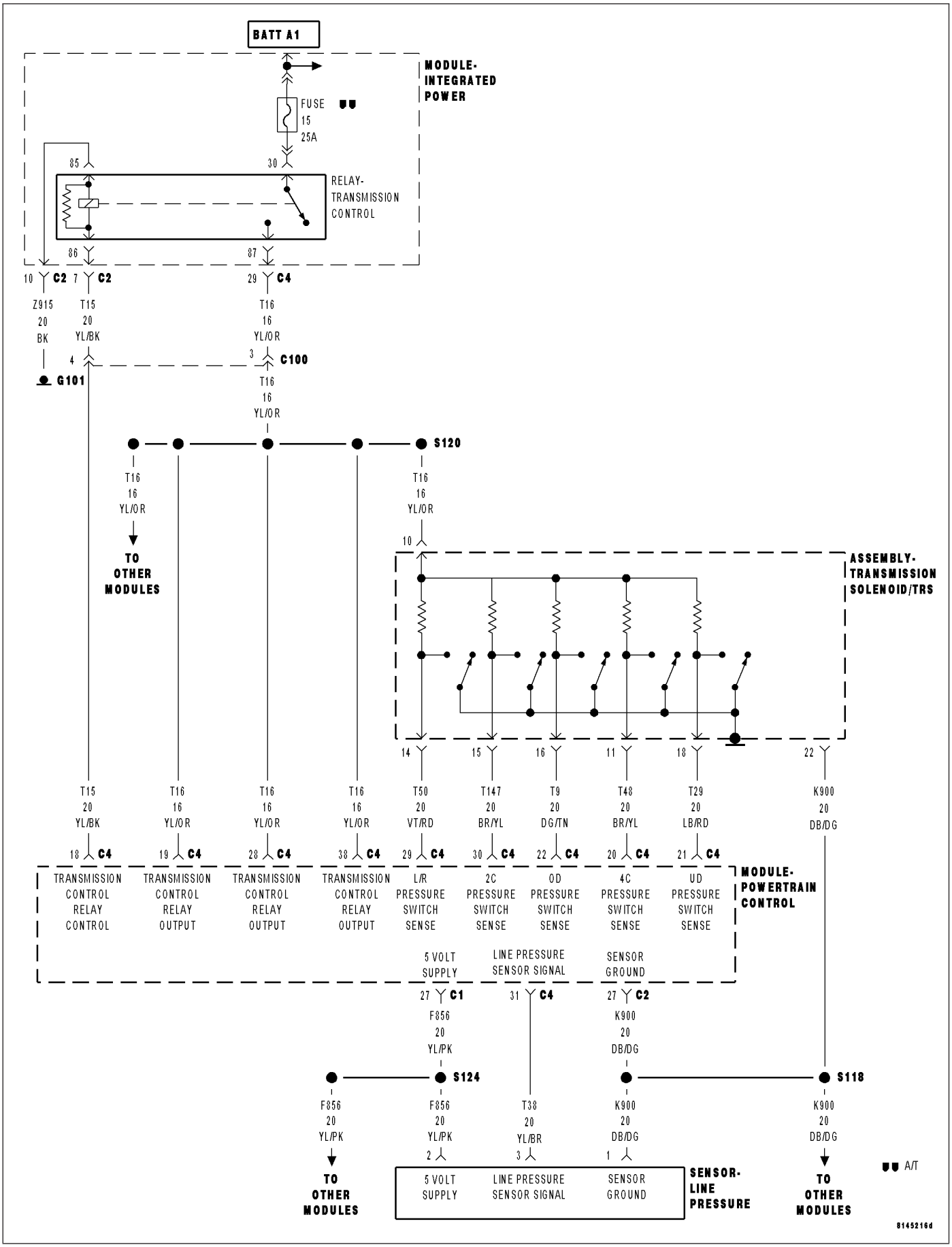
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0870-OD HYDRAULIC PRESSURE TEST



P0870-OD HYDRAULIC PRESSURE TEST (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed above 1000 RPM, the PCM momentarily turns on element pressure to the Clutch circuits that don't have pressure to identify the correct Pressure Switch closes. If the Pressure Switch does not close 2 times, the DTC sets.

Possible Causes
LINE PRESSURE SENSOR
TRANSMISSION FLUID CONTAMINATION
RELATED DTC'S PRESENT
TRANSMISSION SOLENOID/TRS ASSEMBLY
EXCESSIVE DEBRIS IN OIL PAN
POOR LINE PRESSURE SENSOR CONNECTION
(T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN
TRANSMISSION CONTROL RELAY DTCS PRESENT
(T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO ANOTHER CIRCUIT
TRANSMISSION SOLENOID/TRS ASSEMBLY
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Control System tests the pressure switches when they are off. The test verifies that the switches are operational (They will close with pressure applied). The Transmission Control System verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is re-tested. If it fails the second test, the DTC will set, the MIL will illuminate and the transmission system will default to the orderly Shutdown routine.

Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

Is there any Loss of Prime, Transmission Control Relay, and/or Line Pressure Sensor DTCs present?

Yes >> Refer to the Transmission category and perform the appropriate symptom. If the DTC, P0944-LOSS OF PRIME is present, perform its respective test first.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0870-OD HYDRAULIC PRESSURE TEST (CONTINUED)

2. DTC P0760 PRESENT

With the scan tool, check Transmission DTCs.

Is the DTC P0760 also present?

Yes >> Refer to the symptom list and perform diagnostics for P0760–OD SOLENOID CIRCUIT.

No >> Go To 3

---

3. OTHER DTCS PRESENT

With the scan tool, check for other transmission DTC's

Are any of the DTCs, P0733, P0734 ,P0735 and/or P0871 present also?

Yes >> Go To 12

No >> Go To 4

---

4. CHECK TO SEE IF DTC P0870 IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0870.

Is the STARTS SINCE SET COUNTER 2 or less?

Yes >> Go To 5

No >> Go To 17

---

5. LINE PRESSURE STAYS THE SAME

Start the engine.

Warm the transmission to 82° C or 180° F.

Firmly apply the brakes.

With the scan tool, monitor the Line Pressure during the following step.

Move the shift lever to each gear position, pausing momentarily in each position and record the line pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range.

Did the line pressure remain at a steady value between 585 and 655 kPa or 85 and 95 PSI in each position?

Yes >> Go To 6

No >> Go To 10

---

6. CHECK LINE PRESSURE SENSOR CONNECTION

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

Did the Line Pressure reading on the scan tool change to about 207 kPa or 30 PSI when the connector was pushed inward?

Yes >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7

P0870-OD HYDRAULIC PRESSURE TEST (CONTINUED)

7. LINE PRESSURE SENSOR OPERATION

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while turning the Pressure Switch selector to each of the 3 line pressure positions on the Transmission Simulator.

NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 PSI of the reading specified on the Transmission Simulator.

Did the scan tool Line Pressure readings match the specified readings on the Transmission Simulator and remain steady in all three positions?

Yes >> Replace the Line Pressure Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8

---

8. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

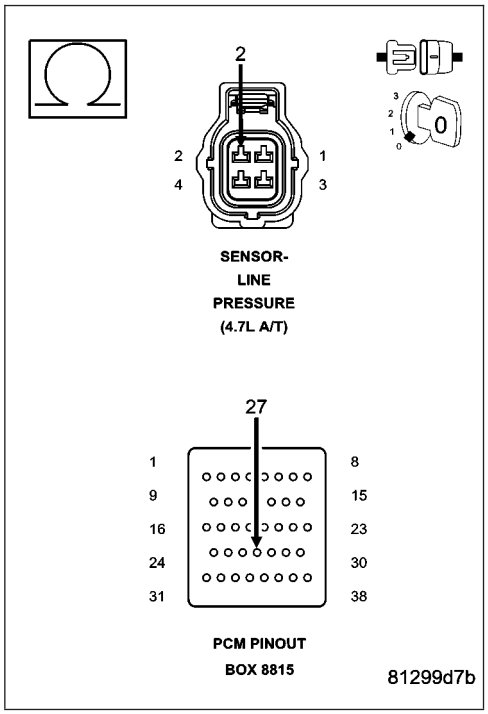
Turn the ignition off to the lock position.

Disconnect Transmission Simulator.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the Line Pressure Sensor harness connector to the appropriate terminal of Miller tool #8815.



Is the resistance above 5.0 ohms?

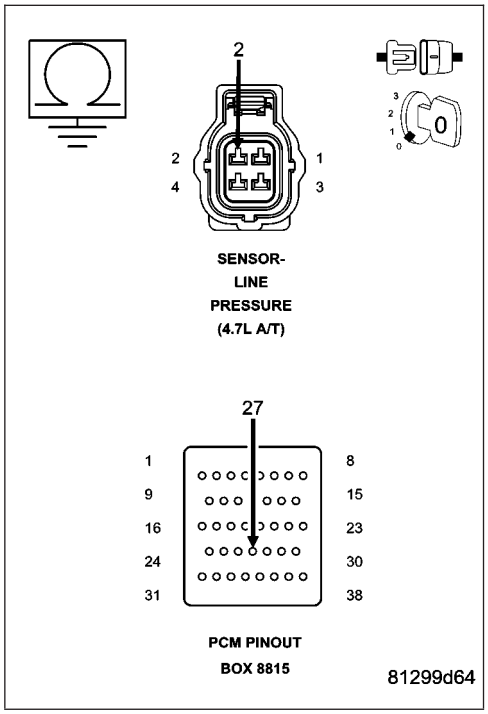
Yes >> Repair the (F856) 5-volt Supply circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9

P0870-OD HYDRAULIC PRESSURE TEST (CONTINUED)

9. (F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (F856) 5-volt Supply circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

10. COMPARE SCAN TOOL TO PRESSURE GAUGE

Turn the ignition off to the lock position.

Connect the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP. Refer to the Service Information for proper installation procedure.

CAUTION: Apply parking brake.

Start the engine.

In the following steps, compare the scan tool Line Pressure to the Pressure Gauge readings in each gear.

CAUTION: Do not overheat transmission.

With the gear selector in park, raise the RPM to 1500, and compare line pressure readings.

Firmly apply the brakes, move the gear selector into reverse, raise the RPM to 1500, and compare the line pressure readings.

Firmly apply the brakes, move the gear selector into drive, raise the RPM to 1500, and compare the line pressure readings.

Does the scan tool Line Pressure readings match the Pressure Gauge readings ± 10 psi?

Yes >> Go To 11

No >> Replace the Line Pressure Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0870-OD HYDRAULIC PRESSURE TEST (CONTINUED)

11. WIRING AND CONNECTORS

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.

Remove the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP.

Install the Transmission Simulator, Miller tool #8333.

On the Transmission Simulator, turn the Pressure Switch selector switch to OD.

Ignition on, engine not running.

With the scan tool, monitor the OD Pressure Switch state while pressing and holding the Pressure Switch test button and wiggling the wire harness and connectors that pertain to the OD Pressure Switch.

Did the OD Pressure Switch state change to closed and remain closed while wiggling the wires?

Yes >> Go To 12

No >> Go To 14

---

12. CHECK FOR EXCESSIVE DEBRIS

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Remove and inspect the Transmission Oil Pan per the Service Information.

Does the Transmission Oil Pan contain excessive debris or contamination?

Yes >> Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 13

---

13. CHECK OD HYDRAULIC CLUTCH CIRCUIT

Remove the Valve Body and air check the OD hydraulic clutch circuit (in the case) for leakage per the Service Information.

NOTE: The OD hydraulic clutch circuit contains a small bleed orifice which connects to the Reverse hydraulic clutch circuit. A small amount of air leakage is normal.

Was there excessive air leakage noticed during the air check?

Yes >> Repair as necessary. Check the OD/Rev clutch piston seals, bleed orifice assembly, reaction shaft support seal rings, and machining of the main mating faces on the pump housing, pump valve boday, and reaction shaft support..

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Disassemble and inspect the Valve Body and repair as necessary. Inspect the OD Accumulator piston and seals. Check for an extra check ball downstream from the #6 check ball pocket and repair as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0870-OD HYDRAULIC PRESSURE TEST (CONTINUED)

14. (T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

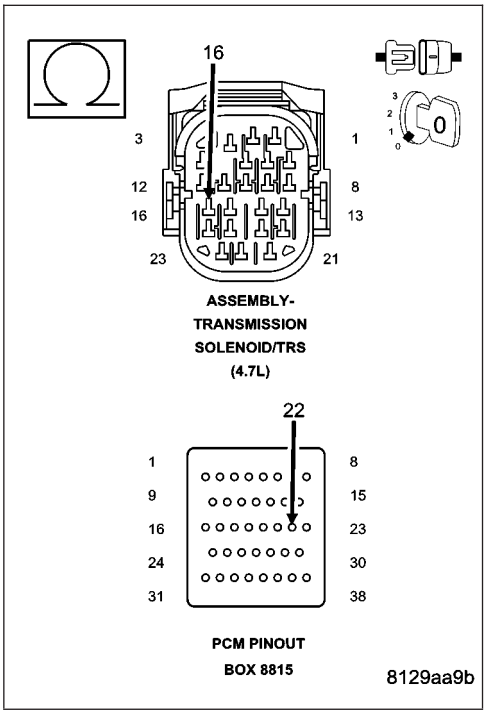
Measure the resistance of the (T9) OD Pressure Switch Sense circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T9) OD Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 15



15. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

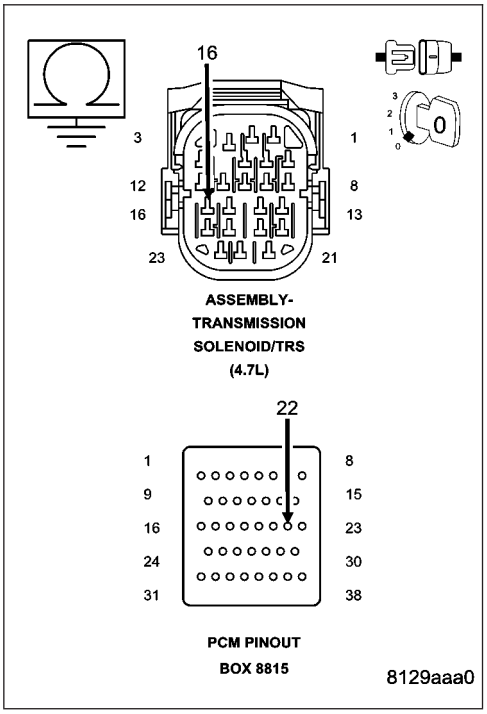
Measure the resistance between ground and the (T9) OD Pressure Switch Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T9) OD Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 16



P0870-OD HYDRAULIC PRESSURE TEST (CONTINUED)

16. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS

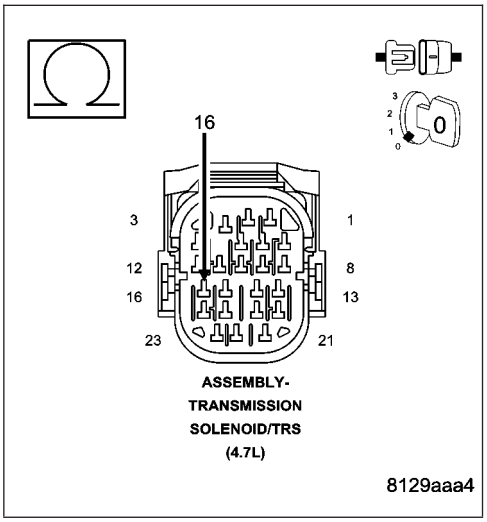
Disconnect all PCM harness connectors.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the (T9) OD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T9) OD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T9) OD Pressure Switch Sense circuit for a short to other circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

17. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

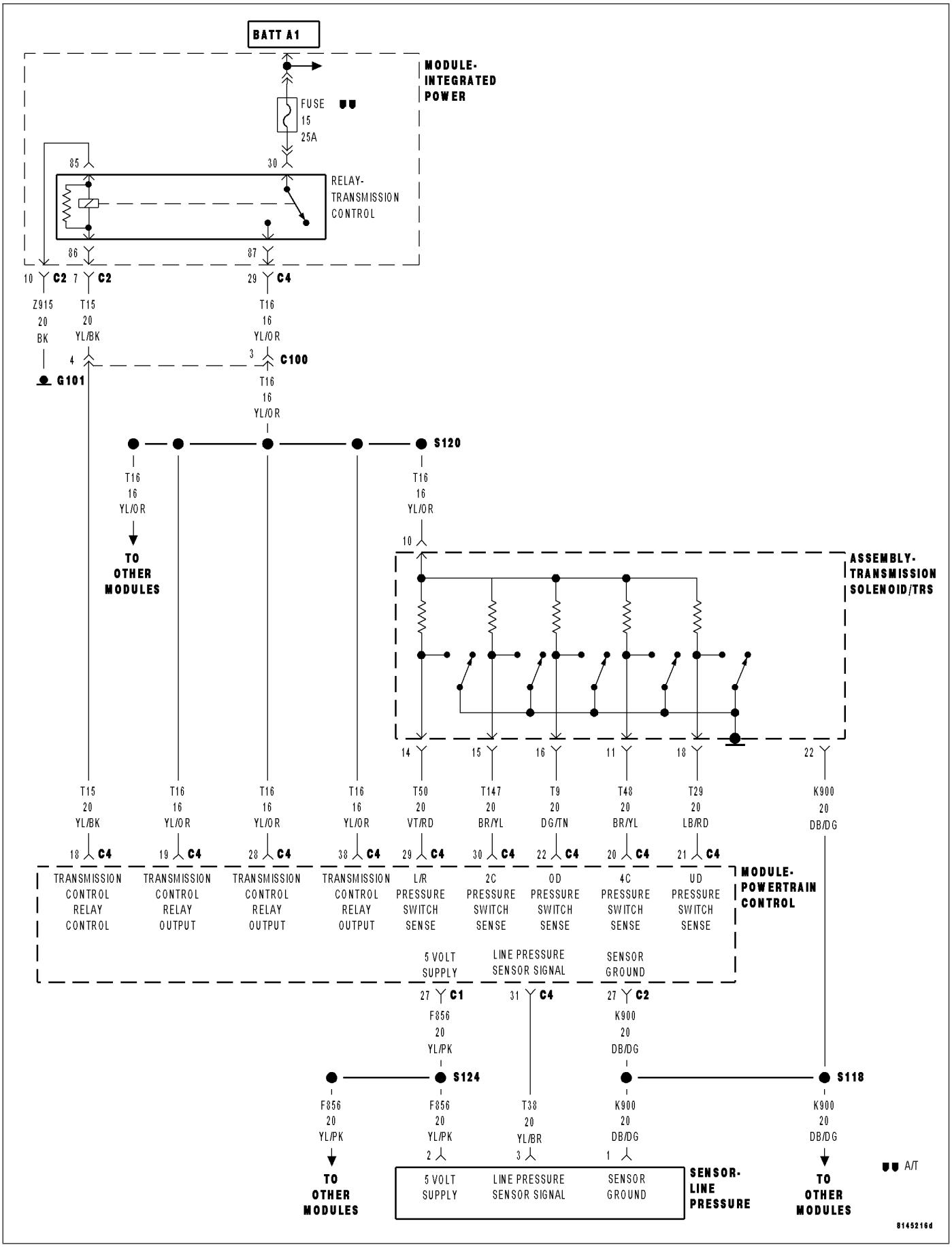
If the EATX DTC EVENT DATA shows the DTC P0870 set while the Line Pressure was significantly below the Desired Line Pressure reading, check for causes of low line pressure (low fluid level, broken or mis-installed primary oil filter or filter seal, sticking Main Regulator Valve in the Pump Valve Body etc.). If the data shows the DTC set while the Line Pressure reading was significantly higher than the Desired Line Pressure, check the Line Pressure Sensor and related wiring.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0871-OD PRESSURE SWITCH RATIONALITY



P0871-OD PRESSURE SWITCH RATIONALITY (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The appropriate DTC is set if one of the pressure switches are open or closed at the wrong time in a given gear.

Possible Causes
RELATED RELAY DTC'S PRESENT
LINE PRESSURE DTCS PRESENT
NO. 4 OR 6 CHECK BALL CUT OR DAMAGED
(T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN
(T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO ANOTHER CIRCUIT
LOW LINE PRESSURE
WIRING AND CONNECTORS
CUT OD/REV PISTON SEAL
BROKEN OR MISSING DO/REV PISTON BLEED ORIFICE
BROKEN REACTION SHAFT SUPPORT SEAL RING
POOR MACHINING ON PUMP VALVE BODY FACE
BROKEN OR MISSING DRIBBLER ORIFICE ASSEMBLY IN REACTION SHAFT SUPPORT
TRANSMISSION SOLENOID/TRS ASSEMBLY
CUT OD ACCUMULATOR PISTON SEAL
CRACKED OD ACCUMULATOR PISTON
BROKEN OR MISSING OD BLEED ORIFICE IN MAIN VALVE BODY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

P0871-OD PRESSURE SWITCH RATIONALITY (CONTINUED)

Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the LR, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

GEAR	L/R	2C	4C	UD	OD
REVERSE	OPEN	OPEN	OPEN	OPEN	OPEN
P/N	CLOSED**	OPEN	OPEN	OPEN	OPEN
1ST	CLOSED*	OPEN	OPEN	CLOSED	OPEN
2ND	OPEN	CLOSED	OPEN	CLOSED	OPEN
2ND PRIME	OPEN	OPEN	CLOSED	CLOSED	OPEN
3RD	OPEN	OPEN	OPEN	CLOSED	CLOSED
4TH	OPEN	OPEN	CLOSED	OPEN	CLOSED
5TH	OPEN	CLOSED	OPEN	OPEN	CLOSED

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is closed in Manual 1.

**May be open when rolling in Neutral or at low oil temperatures.

Diagnostic Test

1. DETERMINING IF RELATED RELAY DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's.

Are there any Transmission Control Relay related DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. LINE PRESSURE DTCS PRESENT

With the scan tool, read Transmission DTCs.

Are there any Line Pressure DTCs present?

Yes >> Refer to the Transmission category and perform the appropriate symptom. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. CHECK FOR OTHER PRESSURE SWITCH DTCS

With the scan tool, check Transmission DTCs.

Are there two or more other pressure switch rationality DTCs present in addition to P0871?

Yes >> Go To 5

No >> Go To 4

P0871-OD PRESSURE SWITCH RATIONALITY (CONTINUED)

4. CHECK IF DTC IS CURRENT

With the scan tool, check and record the EATX DTC EVENT DATA.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the EATX DTC EVENT DATA show data for P0871

Yes >> Go To 8

No >> Refer to the Transmission Category and perform the appropriate symptom.

---

5. RELATED DTC PRESENT

With the scan tool, check and record the EATX DTC EVENT DATA.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Do all the pressure switches read CLOSED in the EATX DTC EVENT DATA?

Yes >> Refer to the Transmission category and perform diagnostics for P0888. Follow instructions as if the DTC is current.

No >> Go To 6

---

6. CHECK IF PRESSURE SWITCHES READ OPEN

In the EATX DTC EVENT DATA recorded earlier, read the state of all pressure switches.

Do all the pressure switches read open?

Yes >> Go To 7

No >> Go To 8

---

7. CHECK FOR LOW LINE PRESSURE

In the EATX DTC EVENT DATA recorded earlier, compare the Line Pressure to the Desired Line Pressure.

Is the Line Pressure less than 40 PSI, and significantly below the Desired Line Pressure?

Yes >> Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter weal for a spit, crack , or improperly installed. If the filer and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0871-OD PRESSURE SWITCH RATIONALITY (CONTINUED)

8. CHECK IF IN PARK, NEUTRAL, OR REVERSE

Ignition on, engine not running.

With the scan tool, read and record the EATX DTC EVENT DATA for P0871.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the EATX DTC EVENT DATA show the OD Pressure Switch DTC set while in Park, Neutral, or Reverse?

Yes >> Go To 18

No >> Go To 9

---

9. OD PRESSURE SWITCH OPEN

Refer to the EATX DTC EVENT DATA recorded earlier for P0871.

Did the OD Pressure Switch read OPEN?

Yes >> Go To 10

No >> Go To 15

---

10. LOW LINE PRESSURE

Refer to the EATX DTC EVENT DATA recorded earlier and compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?

Yes >> Repair as necessary to correct low line pressure. Check the fluid level. Check the Primary Oil Filter seal for a split, crack, or improperly installed. Refer to the Service Information for the proper installation procedure. If the fluid level and filter are OK, check the Main Regulator Valve in the Oil Pump.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 11

---

11. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO ANOTHER CIRCUIT

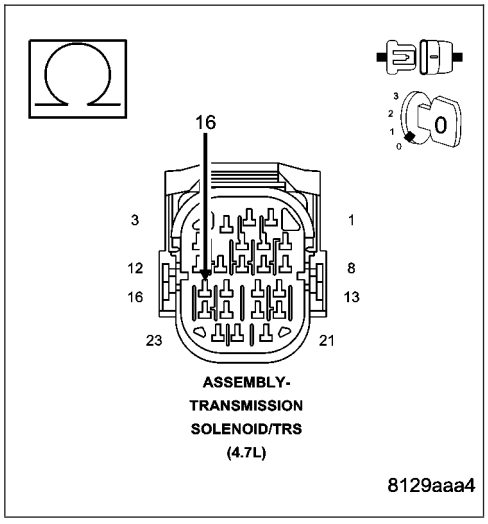
Turn the ignition off to the lock position.

Disconnect all PCM harness connectors.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the (T9) OD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T9) OD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T9) OD Pressure Switch Sense circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 12

P0871-OD PRESSURE SWITCH RATIONALITY (CONTINUED)

12. CHECK TO SEE IF DTC RESETS

Reconnect all previously disconnected connectors.

With the scan too, erase transmission DTCs.

Test drive the vehicle, use the EATX DTC EVENT DATA recored earlier to help duplicate the conditions when the DTC originality set.

Does the DTC P0871 reset?

Yes >> Go To 13

No >> Go To 22

---

13. POWERTRAIN CONTROL MODULE

Remove the Transmission Control Relay.

Operate the vehicle in Drive.

Is the transmission slipping while in Drive?

Yes >> Go To 14

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

14. INTERNAL TRANSMISSION

Perform an Air Check Transmission Clutch Operation procedure per the Service Information.

NOTE: The OD/Rev piston contains a small bleed orifice, a small amount of leakage between the OD and Reverse hydraulic clutch circuits is considered normal.

Is there excessive air leakage in any clutch circuit?

Yes >> Check the OD/Rev piston seals and bleed orifice, reaction shaft support seal rings, dribbler orifice assemblies in the reaction shaft support and for poor machine on the pump valve body faces. Refer to the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Repair the Valve Body. Check the OD Accumulator piston and seals, OD bleed orifice, and No.6 check ball cuts or damage. If no problems are found in the Valve Body, replace the Transmission Solenoid/ TRS Assembly. Refer to the Service Information for proper repair procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0871-OD PRESSURE SWITCH RATIONALITY (CONTINUED)

15. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to OD.

With the scan tool, monitor the OD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the state of the OD Pressure Switch change from OPEN to CLOSED while pressing the Test button?

Yes >> Go To 16

No >> Go To 18

---

16. NO. 4 AND/OR NO. 6 CHECK BALL CUT OR DAMAGED

With the scan tool, erase previously stored DTC's and test drive the vehicle, use the EATX DTC EVENT DATA to help duplicate the conditions when the DTC originality set. Note any DTCs that may set.

Remove the Transmission Valve Body per the Service Information.

Check the No. 4 and No. 6 Check Balls for cuts or damage.

Is the No. 4 and/or No. 6 Check Ball cut or damaged?

Yes >> Replace the No. 4 and/or No. 6 Check Ball and check for clutch debris in the transmission oil pan. If there is excessive debris, perform internal repairs to the OD Clutch Assembly. Refer to the Service Information for proper repair procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 17

---

17. TRANSMISSION SOLENOID/TRS ASSEMBLY

Did the DTC P0871 reset during the test drive in the previous step?

Yes >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 22

P0871-OD PRESSURE SWITCH RATIONALITY (CONTINUED)

18. (T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

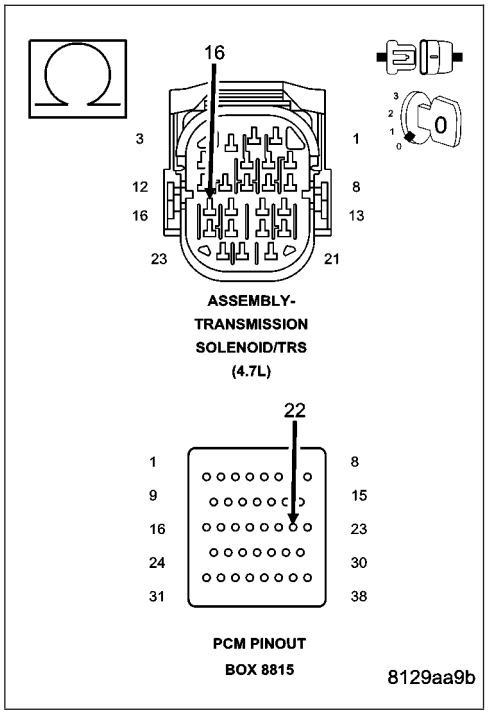
Disconnect the PCM C4 harness connector and connect Miller tool #8815.

Disconnect the Transmission Solenoid /TRS Assembly harness connector

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T9) OD Pressure Switch Sense circuit from the appropriate terminal of Miller tool #8815 to the Solenoid/TRS Assembly harness connector.



Is the resistance above 5.0 ohms?

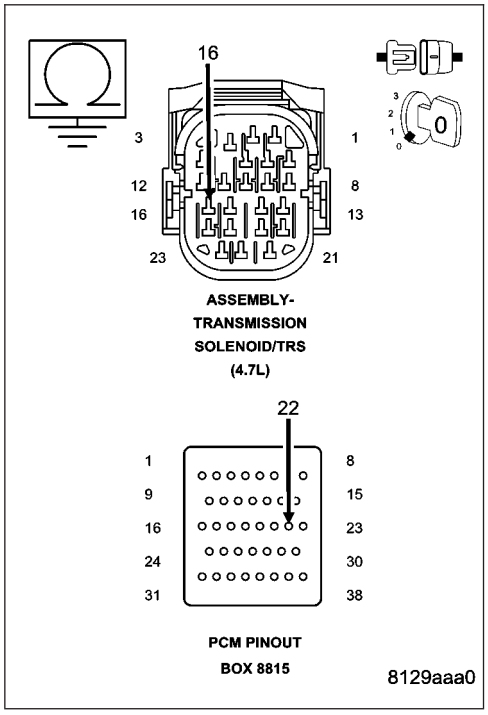
Yes >> Repair the (T9) OD Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 19

19. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T9) OD Pressure Switch Sense circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T9) OD Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 20

P0871-OD PRESSURE SWITCH RATIONALITY (CONTINUED)

20. WIRING AND CONNECTORS

Using the schematics as a guide, inspect the wiring and connectors. Pay particular attention to all power and ground circuits.

Were there any problems found

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 21

---

21. POWERTRAIN CONTROL MODULE

Reconnect all previously disconnected connectors.

Make sure all EATX DTC EVENT DATA is recorded.

With the scan tool, erase previously stored DTC's and test drive the vehicle, use the EATX DTC EVENT DATA to help duplicate the conditions when the DTC originality set.

Does the DTC P0871 reset?

Yes >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 22

---

22. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

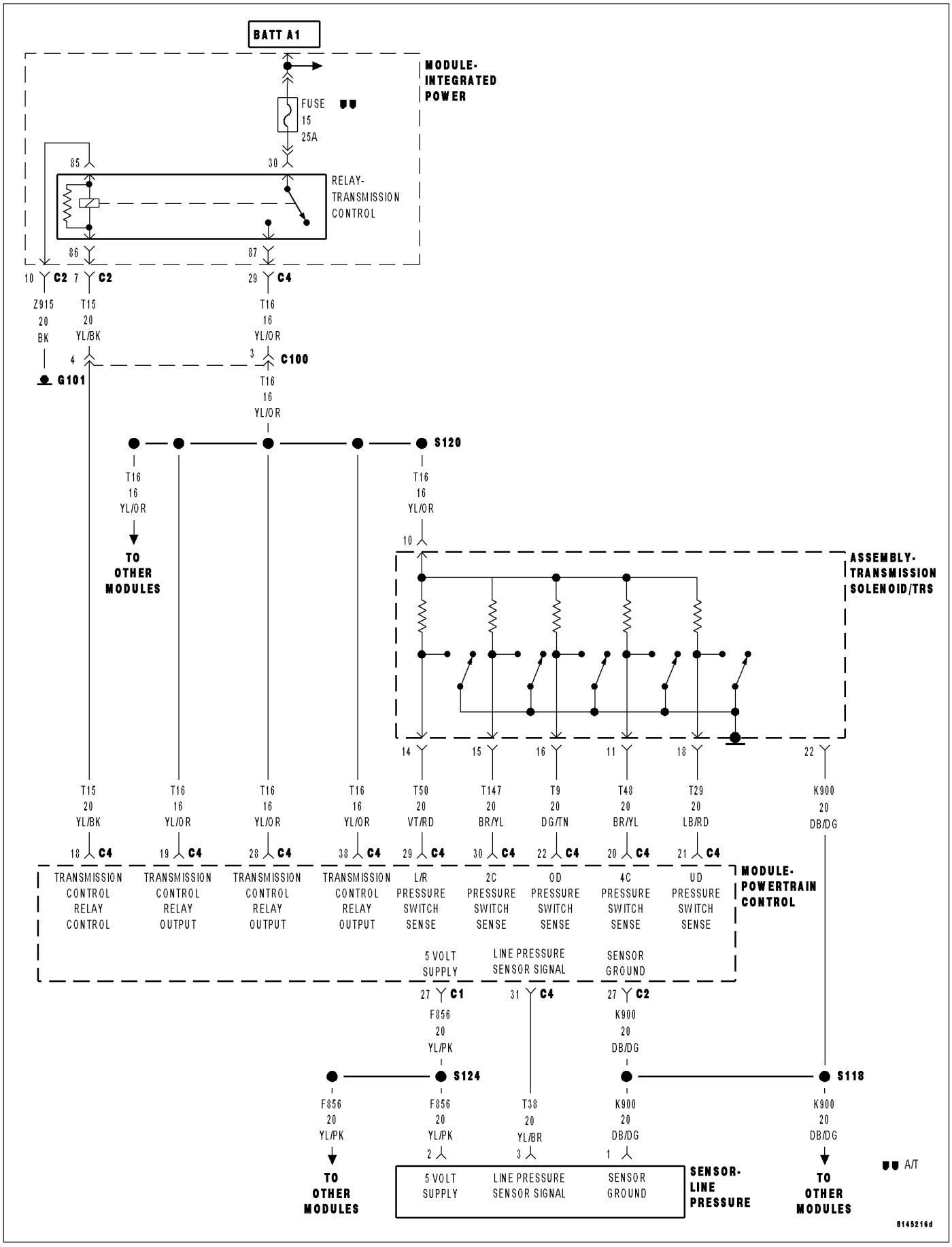
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0875-UD HYDRAULIC PRESSURE TEST



P0875-UD HYDRAULIC PRESSURE TEST (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed above 1000 RPM, the PCM momentarily turns on element pressure to the Clutch circuits that don't have pressure to identify the correct Pressure Switch closes. If the Pressure Switch does not close 2 times, the DTC sets.

Possible Causes
LINE PRESSURE SENSOR
TRANSMISSION FLUID CONTAMINATION
RELATED DTC'S PRESENT
TRANSMISSION SOLENOID/TRS ASSEMBLY
EXCESSIVE DEBRIS IN OIL PAN
POOR LINE PRESSURE SENSOR CONNECTION
(T29) UD PRESSURE SWITCH SENSE CIRCUIT OPEN
TRANSMISSION CONTROL RELAY DTCS PRESENT
(T29) UD PRESSURE SWITCH SENSE CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/TRS ASSEMBLY
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Control System tests the pressure switches when they are off. The test verifies that the switches are operational (They will close with pressure applied). The Transmission Control System verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is re-tested. If it fails the second test, the DTC will set, the MIL will illuminate and the transmission system will default to the orderly Shutdown routine.

Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

Is there any Loss of Prime, Transmission Control Relay, and/or Line Pressure Sensor DTCs present?

Yes >> Refer to the Transmission category and perform the appropriate symptom. If the DTC, P0944-LOSS OF PRIME is present, perform its respective test first.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0875-UD HYDRAULIC PRESSURE TEST (CONTINUED)

2. DTC P0765 PRESENT

With the scan tool, check Transmission DTCs.

Is the DTC P0765 also present?

Yes >> Refer to the symptom list and perform diagnostics for P0765–UD SOLENOID CIRCUIT.

No >> Go To 3

---

3. OTHER DTCS PRESENT

With the scan tool, check for other transmission DTC's

Are any of the DTCs, P0731, P0732, P0733, P0876, and/or P1736 present also?

Yes >> Go To 12

No >> Go To 4

---

4. CHECK TO SEE IF DTC P0875 IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0875.

Is the STARTS SINCE SET COUNTER 2 or less?

Yes >> Go To 5

No >> Go To 17

---

5. LINE PRESSURE STAYS THE SAME

Start the engine.

Warm the transmission to 82° C or 180° F.

Firmly apply the brakes.

With the scan tool, monitor the Line Pressure during the following step.

Move the shift lever to each gear position, pausing momentarily in each position and record the line pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range.

Did the line pressure remain at a steady value between 585 and 655 kPa or 85 and 95 PSI in each position?

Yes >> Go To 6

No >> Go To 10

---

6. CHECK LINE PRESSURE SENSOR CONNECTION

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

Did the Line Pressure reading on the scan tool change to about 207 kPa or 30 PSI when the connector was pushed inward?

Yes >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7

P0875-UD HYDRAULIC PRESSURE TEST (CONTINUED)

7. LINE PRESSURE SENSOR OPERATION

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while turning the Pressure Switch selector to each of the 3 line pressure positions on the Transmission Simulator.

NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 PSI of the reading specified on the Transmission Simulator.

Did the scan tool Line Pressure readings match the specified readings on the Transmission Simulator and remain steady in all three positions?

Yes >> Replace the Line Pressure Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8

---

8. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

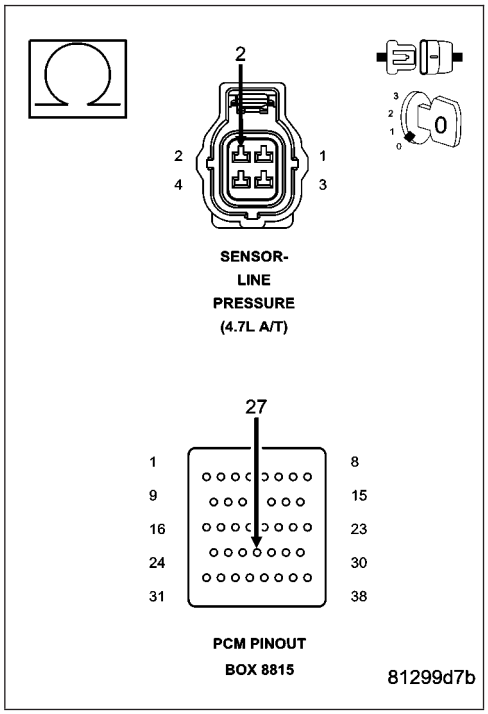
Turn the ignition off to the lock position.

Disconnect Transmission Simulator.

Disconnect the PCM C1 harness connector and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the Line Pressure Sensor harness connector to the appropriate terminal of Miller tool #8815.



Is the resistance above 5.0 ohms?

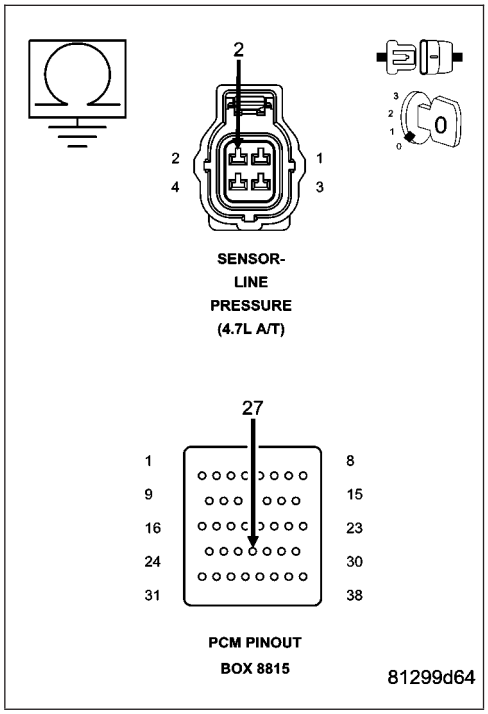
Yes >> Repair the (F856) 5-volt Supply circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9

P0875-UD HYDRAULIC PRESSURE TEST (CONTINUED)

9. (F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (F856) 5-volt Supply circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

10. COMPARE SCAN TOOL TO PRESSURE GAUGE

Turn the ignition off to the lock position.

Connect the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP. Refer to the Service Information for proper installation procedure.

CAUTION: Apply parking brake.

Start the engine.

In the following steps, compare the scan tool Line Pressure to the Pressure Gauge readings in each gear.

CAUTION: Do not overheat transmission.

With the gear selector in park, raise the RPM to 1500, and compare line pressure readings.

Firmly apply the brakes, move the gear selector into reverse, raise the RPM to 1500, and compare the line pressure readings.

Firmly apply the brakes, move the gear selector into drive, raise the RPM to 1500, and compare the line pressure readings.

Does the scan tool Line Pressure readings match the Pressure Gauge readings ± 10 psi?

Yes >> Go To 11

No >> Replace the Line Pressure Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0875-UD HYDRAULIC PRESSURE TEST (CONTINUED)

11. WIRING AND CONNECTORS

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.

Remove the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP.

Install the Transmission Simulator, Miller tool #8333.

On the Transmission Simulator, turn the Pressure Switch selector switch to UD.

Ignition on, engine not running.

With the scan tool, monitor the UD Pressure Switch state while pressing and holding the Pressure Switch test button and wiggling the wire harness and connectors that pertain to the UD Pressure Switch.

Did the UD Pressure Switch state change to closed and remain closed while wiggling the wires?

Yes >> Go To 12

No >> Go To 14

---

12. CHECK FOR EXCESSIVE DEBRIS

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Remove and inspect the Transmission Oil Pan per the Service Information.

Does the Transmission Oil Pan contain excessive debris or contamination?

Yes >> Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 13

---

13. CHECK UD HYDRAULIC CLUTCH CIRCUIT

Remove the Valve Body and air check the UD hydraulic clutch circuit (in the case) for leakage per the Service Information.

NOTE: The UD hydraulic clutch circuit contains a small bleed orifice. A small amount of air leakage is normal.

Was there excessive air leakage noticed during the air check?

Yes >> Repair as necessary. Check the UD clutch piston, piston seals and bleed orifice, reaction shaft support seal rings, and machining of the main mating faces of the pump housing, pump valve body, and reaction shaft support.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Disassemble and inspect the Valve Body and repair as necessary. Inspect the UD Accumulator piston and seals. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0875-UD HYDRAULIC PRESSURE TEST (CONTINUED)

14. (T29) UD PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

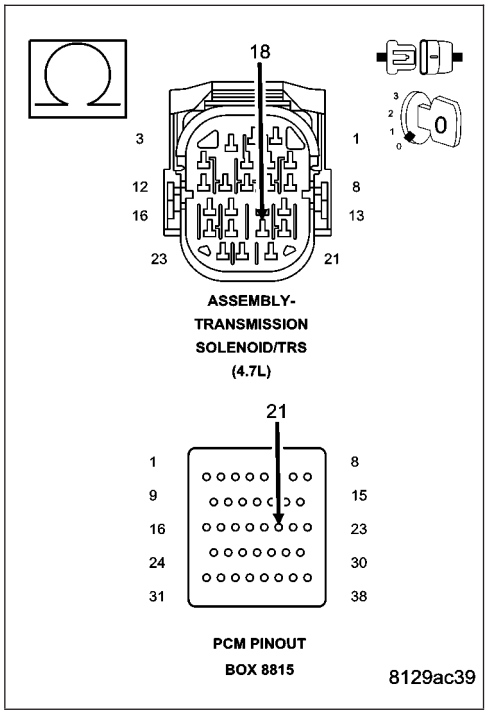
Measure the resistance of the (T29) UD Pressure Switch Sense circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T29) UD Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 15



15. (T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

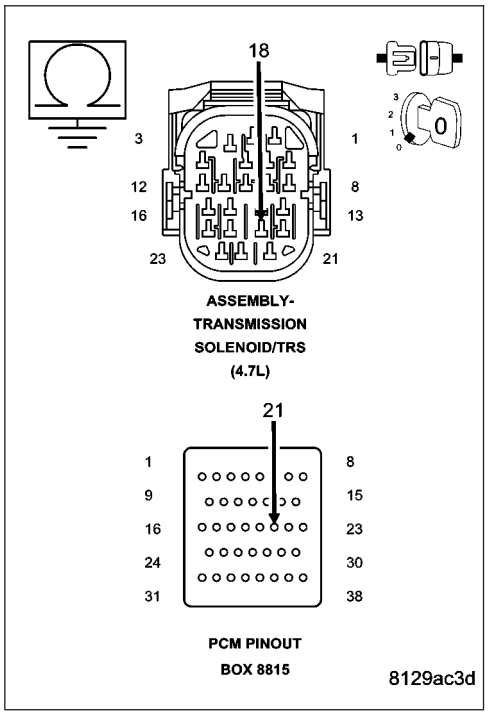
Measure the resistance between ground and the (T29) UD Pressure Switch Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T29) UD Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 16



P0875-UD HYDRAULIC PRESSURE TEST (CONTINUED)

16. (T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS

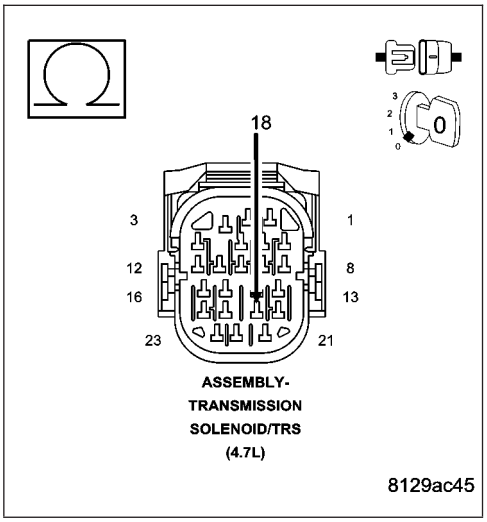
Disconnect all PCM harness connectors.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the (T29) UD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T29) UD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T29) UD Pressure Switch Sense circuit for a short to other circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

17. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

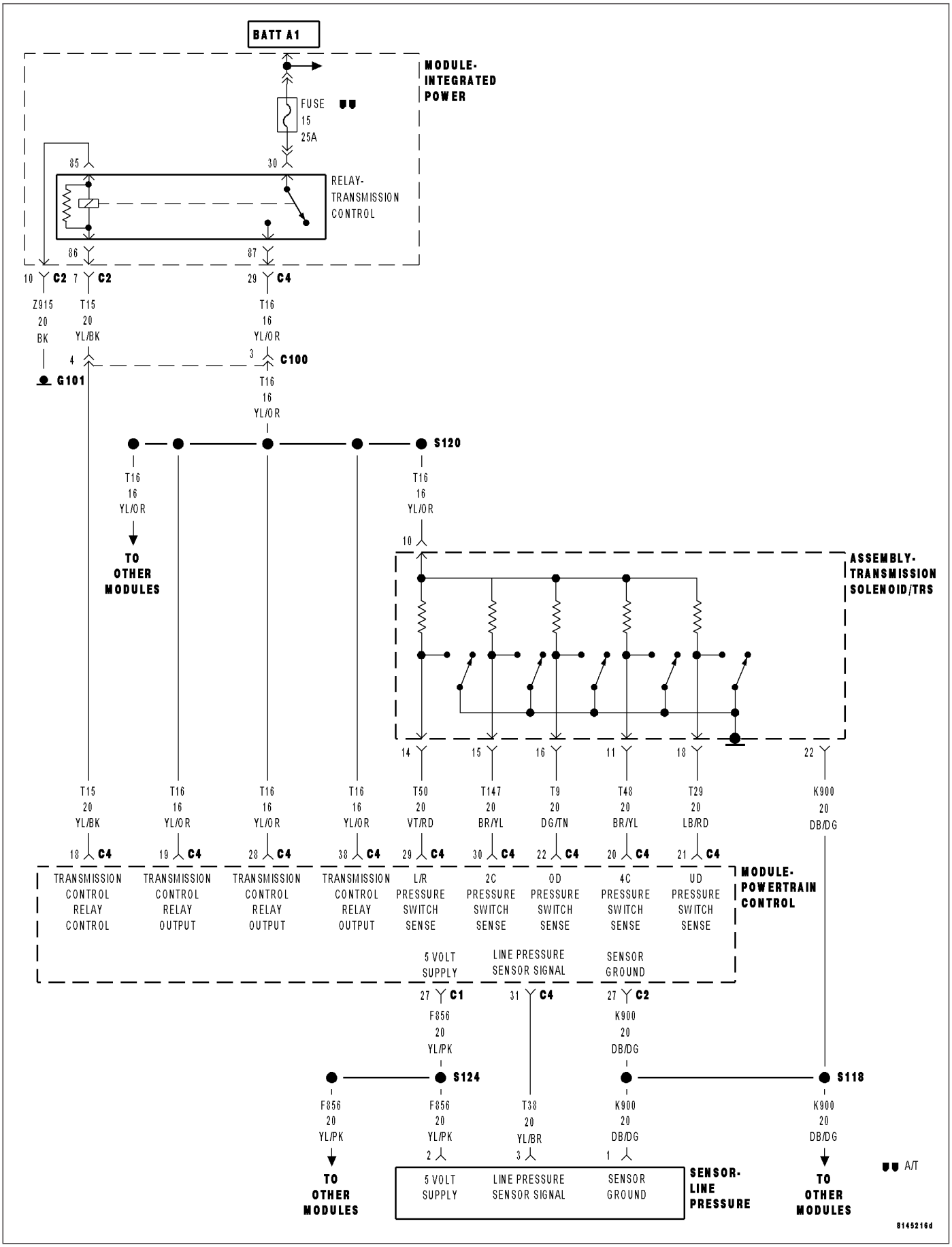
If the EATX DTC EVENT DATA shows the DTC P0875 set while the Line Pressure was significantly below the Desired Line Pressure reading, check for causes of low line pressure (low fluid level, broken or mis-installed primary oil filter or filter seal, sticking Main Regulator Valve in the Pump Valve Body etc.). If the data shows the DTC set while the Line Pressure reading was significantly higher than the Desired Line Pressure, check the Line Pressure Sensor and related wiring.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0876-UD PRESSURE SWITCH RATIONALITY



P0876-UD PRESSURE SWITCH RATIONALITY (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC is set if the UD pressure switch is in the wrong state for the current gear. For example, this code would be set if the UD pressure switch remained off while the transmission was in second gear.

Possible Causes
RELATED RELAY DTC'S PRESENT
LOW FLUID LEVEL
NO. 2 CHECK BALL CUT OR DAMAGED
LOW LINE PRESSURE
CRACKED OR MISINSTALLED SUMP FILTER OR SEAL
STICKING MAIN REGULATOR VALVE IN PUMP VALVE BODY
(T29) UD PRESSURE SWITCH SENSE CIRCUIT OPEN
(T29) UD PRESSURE SWITCH CIRCUIT SHORT TO GROUND
(T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO ANOTHER CIRCUIT
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the LR, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

GEAR	L/R	2C	4C	UD	OD
REVERSE	OPEN	OPEN	OPEN	OPEN	OPEN
P/N	CLOSED**	OPEN	OPEN	OPEN	OPEN
1ST	CLOSED*	OPEN	OPEN	CLOSED	OPEN
2ND	OPEN	CLOSED	OPEN	CLOSED	OPEN
2ND PRIME	OPEN	OPEN	CLOSED	CLOSED	OPEN
3RD	OPEN	OPEN	OPEN	CLOSED	CLOSED
4TH	OPEN	OPEN	CLOSED	OPEN	CLOSED
5TH	OPEN	CLOSED	OPEN	OPEN	CLOSED

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is closed in Manual 1.

**May be open when rolling in Neutral or at low oil temperatures.

P0876-UD PRESSURE SWITCH RATIONALITY (CONTINUED)

Diagnostic Test

1. CHECK IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's.

Are there any Transmission Control Relay, Line Pressure, and/or Loss of Prime DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom. If a Loss of Prime DTC is present, perform its respective test first.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK FOR PRESSURE SWITCH DTCS

Are there two or more other pressure switch rationality DTC's present in addition to P0876?

Yes >> Go To 3

No >> Go To 4

---

3. CHECK IF ALL PRESSURE SWITCHES READ CLOSED

With the scan tool, read and record all EATX DTC EVENT DATA.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the EATX DTC EVENT DATA show all pressure switches reading CLOSED?

Yes >> Refer to the symptom category and perform diagnostics for P0888. Diagnose the symptom as if the DTC is current.

No >> Go To 4

---

4. CHECK FOR OTHER DTCS

With the scan tool, check for other transmission DTC's.

Is the DTC P2704 present also?

Yes >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

---

5. CHECK EATX DTC EVENT DATA

With the scan tool, read and record the DTC EVENT DATA.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the DTC EVENT DATA display information for the DTC P0876?

Yes >> Go To 6

No >> Refer to the symptom list and perform diagnostics for the DTC listed in the EATX DTC EVENT DATA.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0876-UD PRESSURE SWITCH RATIONALITY (CONTINUED)

6. CHECK IF DTC EVENT DATA WAS SET IN PARK, NEUTRAL OR REVERSE

Refer to the DTC EVENT DATA recorded earlier.

Did the DTC P0876 set in Park, Neutral, or Reverse?

Yes >> Go To 10

No >> Go To 7

---

7. CHECK FOR UD PRESSURE SWITCH STATUS

Refer to the DTC EVENT DATA recorded earlier.

Did the DTC P0876 set with the UD Pressure Switch closed?

Yes >> Go To 10

No >> Go To 8

---

8. CHECK LINE PRESSURE

In the EATX DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 PSI, and significantly below the Desired Line Pressure?

Yes >> Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9

---

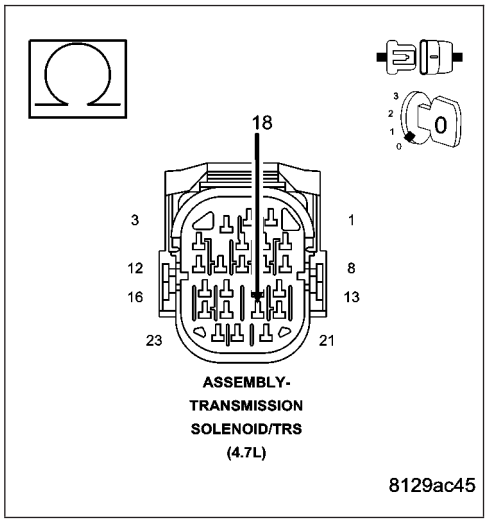
9. (T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS

Turn the ignition off to the lock position.

Disconnect all PCM harness connectors.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

Measure the resistance between the (T29) UD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T29) UD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T29) UD Pressure Switch Sense circuit for a short to other circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0876-UD PRESSURE SWITCH RATIONALITY (CONTINUED)

10. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to the UD position.

With the scan tool, monitor the UD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the state of the UD Pressure Switch change while pressing the Pressure Switch Test button?

Yes >> Go To 14

No >> Go To 11

---

11. (T29) UD PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

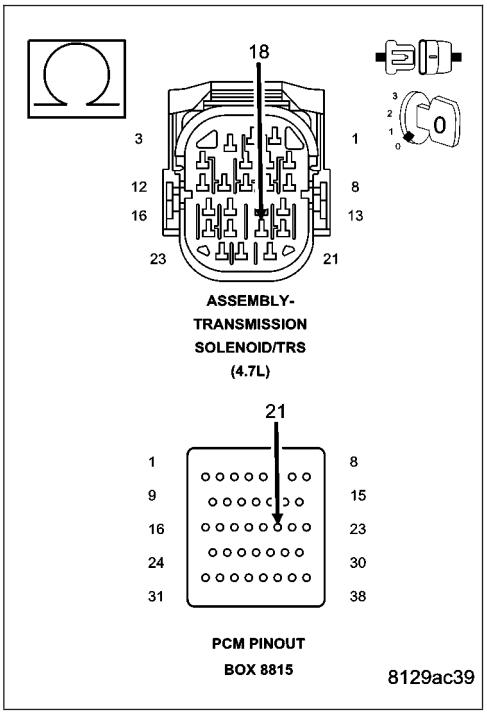
Measure the resistance of the (T29) UD Pressure Switch Sense circuit from the Transmission Solenoid/TRS Assembly harness connector and the appropriate terminal of the special tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T29) UD Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

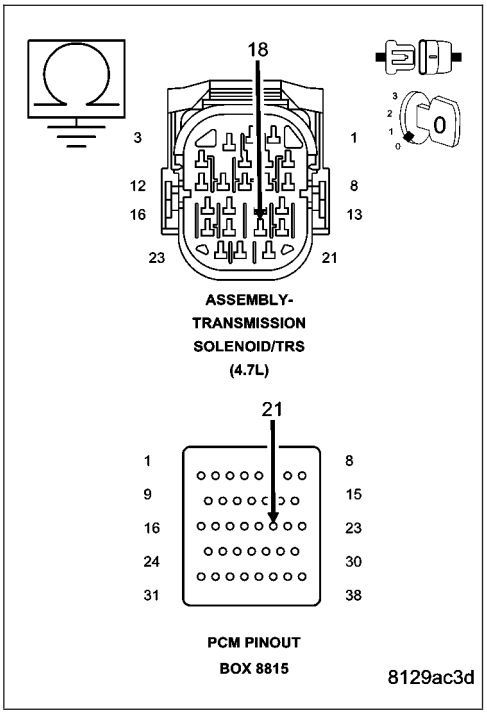
No >> Go To 12



P0876-UD PRESSURE SWITCH RATIONALITY (CONTINUED)

12. (T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T29) UD Pressure Switch Sense circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T29) UD Pressure Switch Sense circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

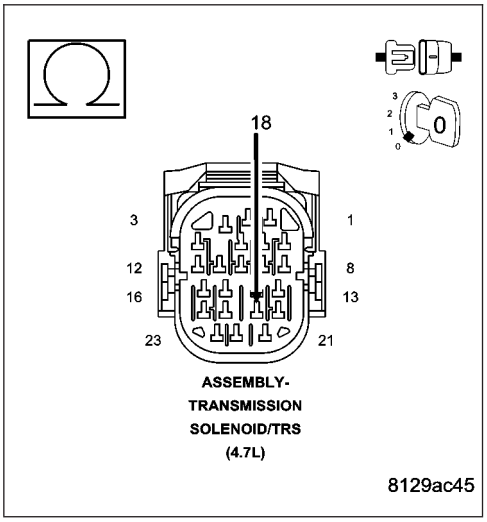
No >> Go To 13

---

13. (T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO ANOTHER CIRCUIT

Disconnect all PCM harness connectors.

NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.
Measure the resistance between the (T29) UD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T29) UD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T29) UD Pressure Switch Sense circuit for a short to another circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0876-UD PRESSURE SWITCH RATIONALITY (CONTINUED)

14. WIGGLE TEST WITH SIMULATOR

Perform the steps in the previous test while wiggling the wiring harness and connectors pertaining to the UD Pressure Switch.

Did the state of the UD Pressure Switch change while pressing the Pressure Switch Test button?

Yes >> Repair the wiring harness and/or connectors as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 15

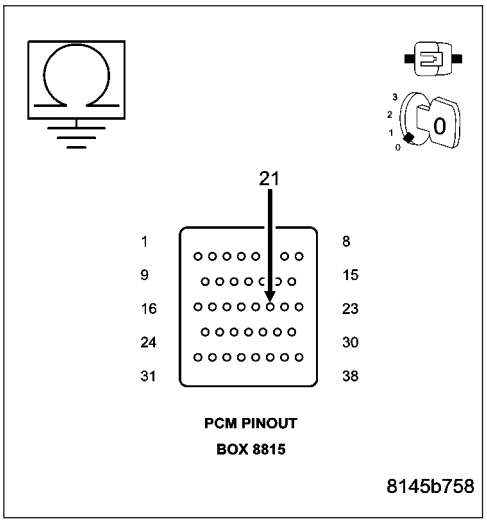
---

15. CHECK FOR TRANSMISSION SOLENOID/TRS ASSEMBLY FOR A SHORT TO GROUND

Disconnect the Transmission Simulator and reconnect the Transmission Solenoid/TRS Assembly harness connector.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

Measure the resistance between ground and the (T29) UD Pressure Switch Sense circuit in the appropriate terminal of Miller tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 16

---

16. CHECK IF DTC RESETS

Reconnect all previously disconnected connectors.

With the scan tool, erase all transmission DTCs.

Test drive the vehicle. Using the EATX DTC EVENT DATA recorded earlier, try to duplicate the conditions in which the DTC originally set.

Does the DTC P0876 reset?

Yes >> Go To 17

No >> Go To 18

P0876-UD PRESSURE SWITCH RATIONALITY (CONTINUED)

17. CHECK FOR CUT NO. 2 CHECK BALL

Remove the Valve Body per the Service Information.

Check the No. 2 check ball for cuts or damage.

Is the No. 2 check ball cut or damaged?

Yes >> Replace the No. 2 check ball. Check for excessive clutch debris in the oil pan. If excessive debris is present, check the UD Clutch and repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information. Check for excessive clutch debris in the oil pan. If excessive debris is present, check the UD Clutch and repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

18. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

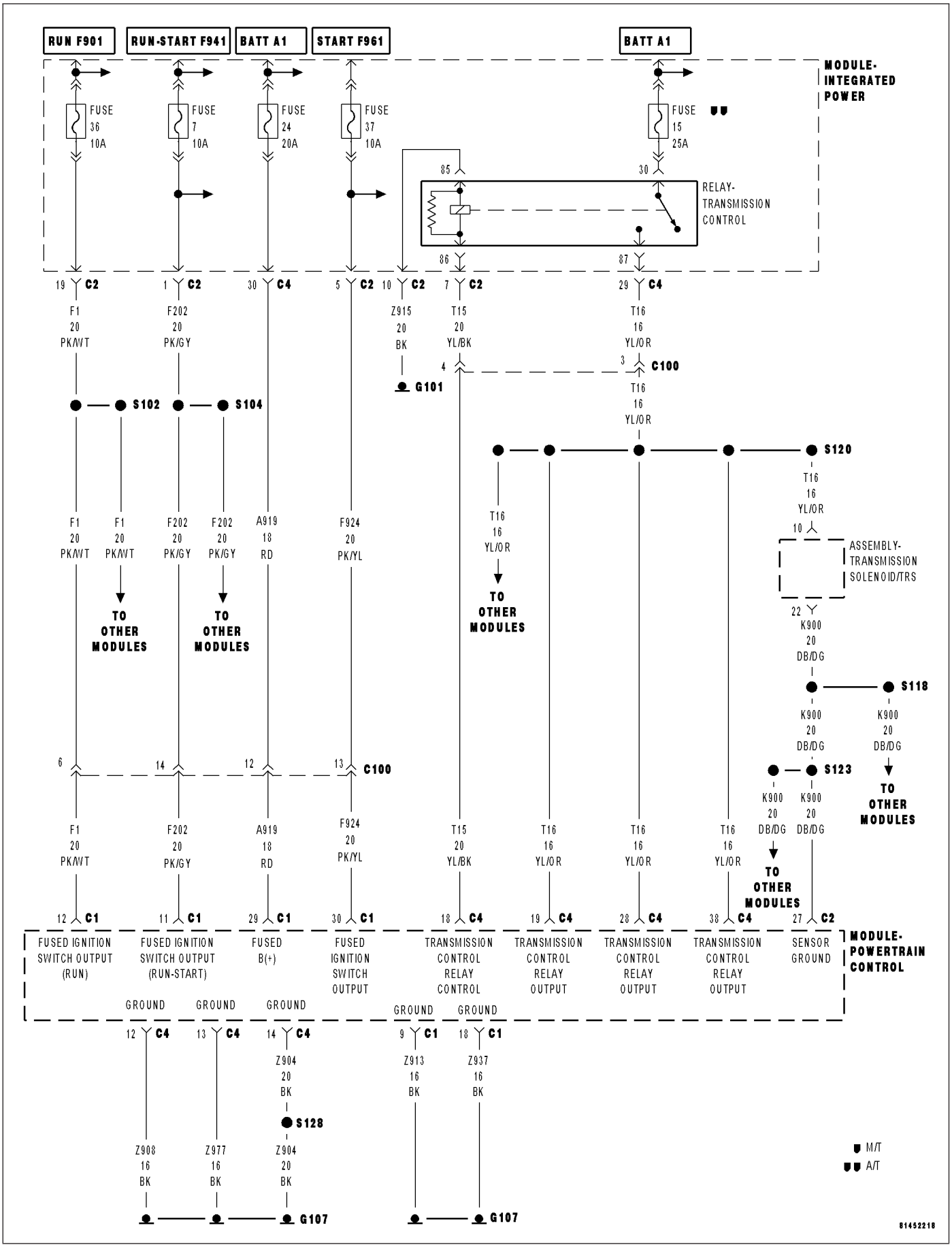
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0884-POWER UP AT SPEED



P0884-POWER UP AT SPEED (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When Powertrain Control Module initially powers up. Due to the integration of the Powertrain and Transmission Control Modules, the transmission part of the PCM has its own specific power and ground circuits.
- **Set Condition:**
  This DTC will set if the PCM powers up and senses the vehicle in a valid forward gear, with no PRNDL DTCs, and an output speed above 800 RPM, approximately 32Km/h or 20 MPH.

Possible Causes
POWER UP AT SPEED

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

If a vehicle loses power to the Transmission Control System, the solenoids (LR, 2C, OD, UD, 4C) will go to their respective power off state. Some solenoids are normally vented and some are normally applied in their power off state. The transmission is designed to be in 3rd gear with all of the solenoids in this state. However, if power is restored, the Transmission Control System will power-up and normal operation will be restored.

This code identifies that power to the Transmission Control System was restored when the gear selector was in a ″Drive″ position while the vehicle was moving at speeds above 32 km/h (20 MPH). **This DTC does not indicate a problem with the transmission or Transmission Control System,** instead, it suggests intermittent problems in the fused ignition switch output, fused B(+), or ground circuits to the TCM. Alternately, if a person performs a rolling restart maneuver, the DTC can be set. Therefore it is critical that this DTC be investigated if the vehicle is experiencing intermittent 3rd gear operation and a subsequent return to normal operation.

Diagnostic Test

1. CHECK FOR INTERMITTENT POWER AND GROUND CIRCUITS

This DTC is set when the Transmission portion of the Powertrain Control Module is initialized while the vehicle is moving down the road in a valid forward gear.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

NOTE: Due to the integration of the Powertrain and Transmission Control Modules, the transmission part of the PCM has its own specific power and ground circuits.

Check all of the Fused B+, Fused Ignition Switch Output, and ground circuits to the PCM for an intermittent open or short to ground.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

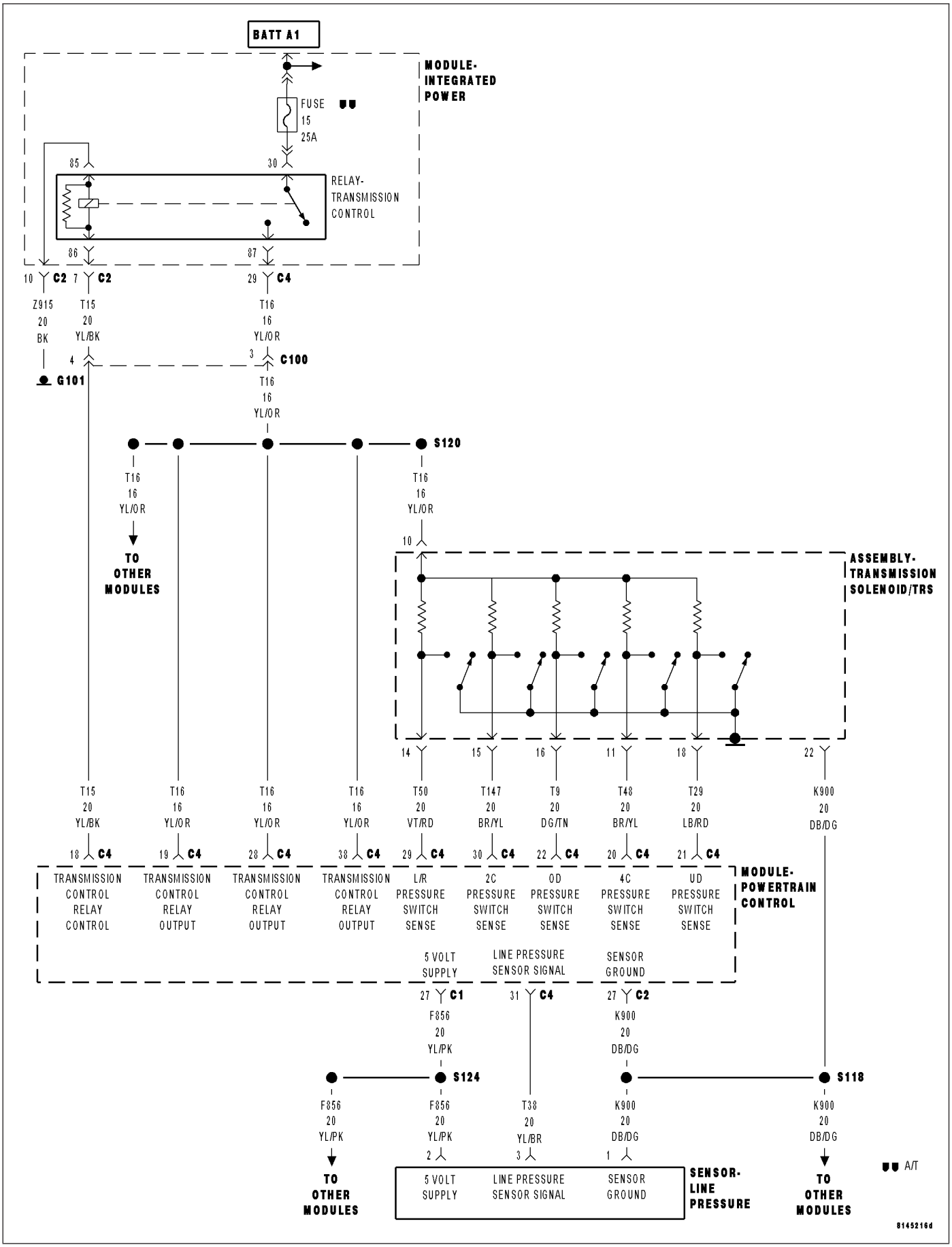
If there are no possible causes remaining, view repair.

Repair

Check all power and ground circuits to the PCM and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0888-TRANSMISSION RELAY ALWAYS OFF



P0888-TRANSMISSION RELAY ALWAYS OFF (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  When the ignition is turned from ″OFF″ position to ″RUN″ position and/or the ignition is turned from ″START″ position to ″RUN″ position.
- **Set Condition:**
  This DTC is set when less than 3.0 volts are present at the transmission control relay output circuits at the Powertrain Control Module when the PCM is energizing the relay.

Possible Causes
(A104) FUSED B+ CIRCUIT OPEN
(T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
(T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT SHORT TO GROUND
(T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT OPEN
(T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO GROUND
(Z915) TRANSMISSION CONTROL RELAY GROUND CIRCUIT OPEN
TRANSMISSION CONTROL RELAY STUCK OPEN
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission control relay is used to supply power to the solenoids and pressure switches when the transmission is in normal operating mode. The relay output is fed back to the TCM through pins 16, 17, and 36. It is referred to as ″Transmission Control Relay Output″. This circuit does not supply power to the TCM, it is only a sense circuit. When the relay is off, no power is supplied to the solenoids and pressure switches, and the transmission is in ″limp-in″ or ″default″ mode. **Note: Inadequate Transmission Control Relay Output voltage can also cause DTCs P0846, P0869, P0871, P0876 or P0988 to set. This does not indicate an internal transmission or solenoid/TRS problem. Repairing the P0888 fault should also eliminate the related DTCs.**

Diagnostic Test

1. CHECK TO SEE IF DTC P0888 IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0888.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter equal to 0?

Yes >> Go To 2

No >> Go To 9

P0888-TRANSMISSION RELAY ALWAYS OFF (CONTINUED)

2. (A104) FUSED B+ CIRCUIT OPEN

Turn the ignition off to the lock position.

Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

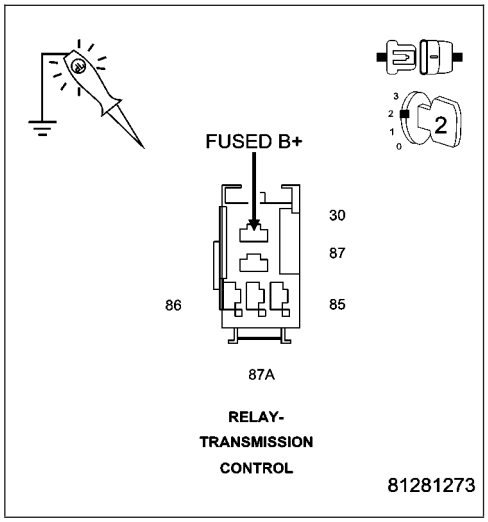
Using a 12-volt test light connected to ground, check the (A104) Fused B+ circuit in the Transmission Control Relay connector.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the (A104) Fused B+ circuit for an open. If the fuse is open make sure to check for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



3. (Z915) TRANSMISSION CONTROL RELAY GROUND CIRCUIT OPEN

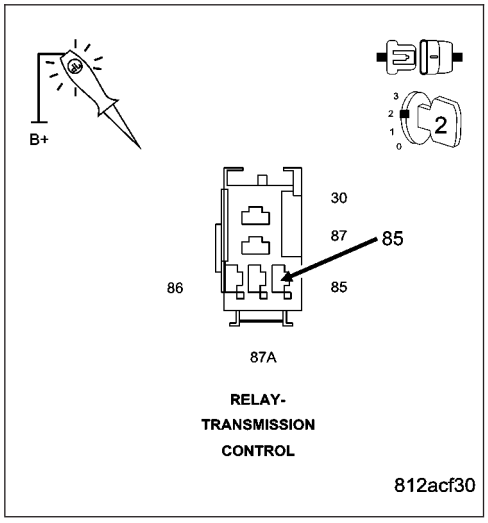
Turn the ignition off to the lock position.

Using a 12-volt test light connected to 12-volts, check the (Z915) Transmission Control Relay Ground circuit in the Transmission Control Relay connector.

Does the test light illuminate brightly?

Yes >> Repair the (Z915) Transmission Control Relay Ground circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4



4. TRANSMISSION CONTROL RELAY

Install a substitute relay in place of the Transmission Control Relay.

Start the vehicle.

With the scan tool, check transmission DTCs.

Did the DTC P0888 reset?

Yes >> Replace the Transmission Control Relay.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

P0888-TRANSMISSION RELAY ALWAYS OFF (CONTINUED)

5. (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

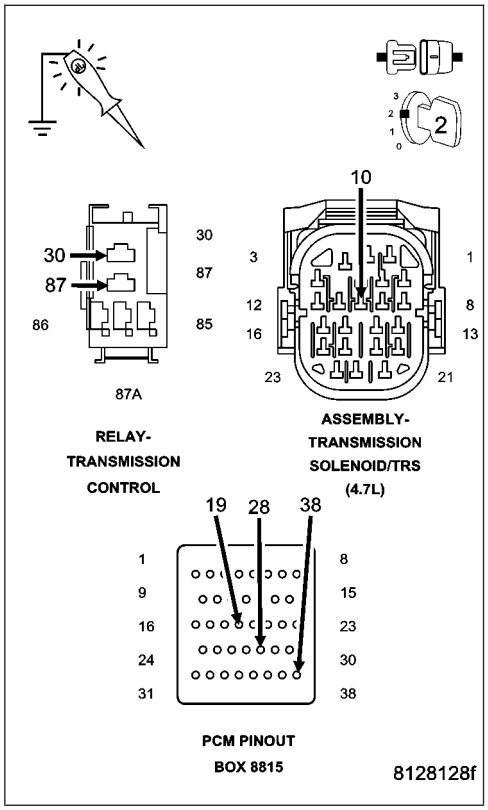
Disconnect the Transmission Solenoid/TRS Assembly harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Connect a jumper wire between the (A104) Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, check all four (T16) Transmission Control Relay Output circuits in the PCM C4 harness connector and Transmission Solenoid/TRS Assembly harness connector.



Does the test light illuminate brightly on all four (T16) Transmission Control Relay Output circuits?

Yes >> Go To 6

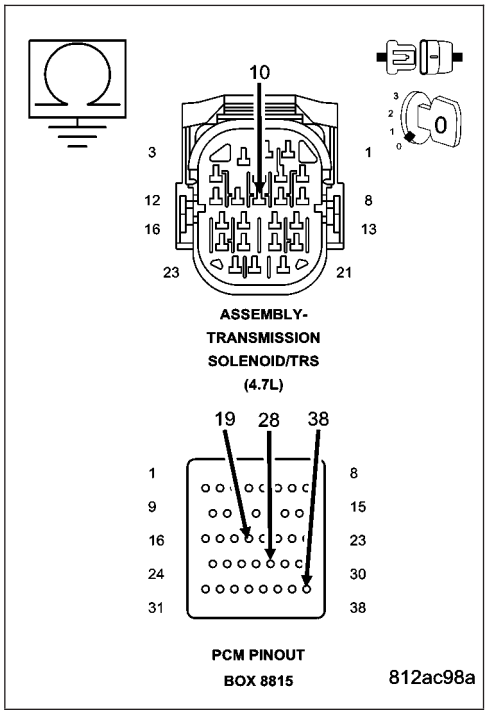
No >> Repair the (T16) Transmission Control Relay Output circuit(s) for an open or high resistance.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

6. (T16) TRANSMISSION RELAY OUTPUT CIRCUIT SHORT TO GROUND

Turn the ignition off to the lock position.

Measure the resistance between ground and the (T16) Transmission Control Relay Output circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T16) Transmission Control Relay Output circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7

P0888-TRANSMISSION RELAY ALWAYS OFF (CONTINUED)

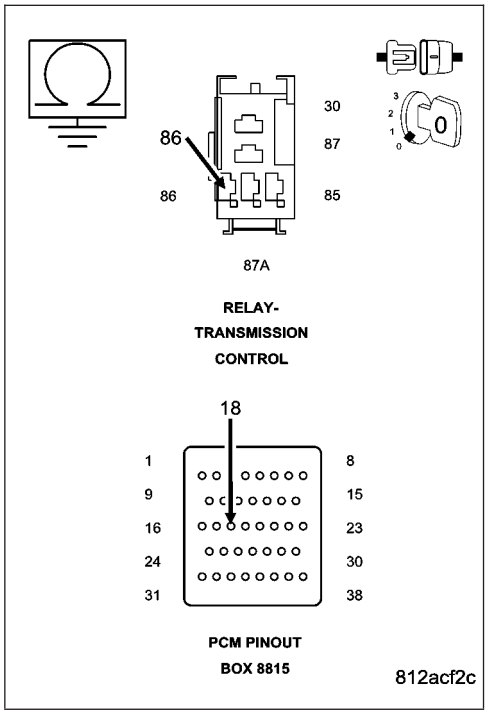
7. (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T15) Transmission Control Relay Control circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T15) Transmission Control Relay Control circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8



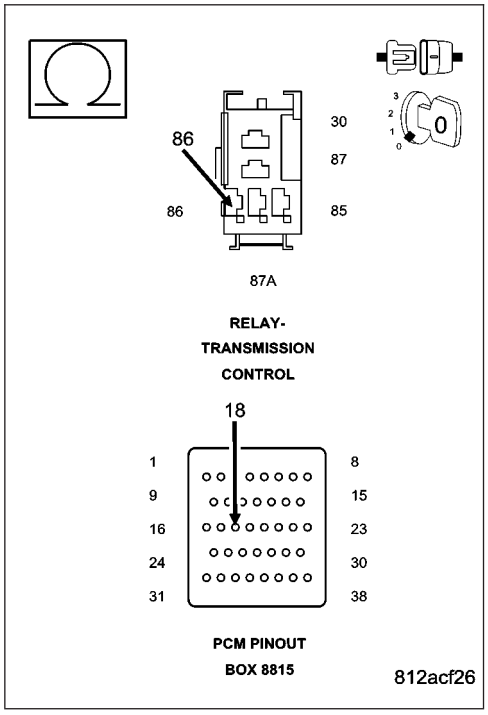
8. (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT OPEN

Measure the resistance of the (T15) Transmission Control Relay Control circuit between the Transmission Control Relay connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T15) Transmission Control Relay Control circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



P0888-TRANSMISSION RELAY ALWAYS OFF (CONTINUED)

9. INTERMITTENT WIRING AND CONNECTORS

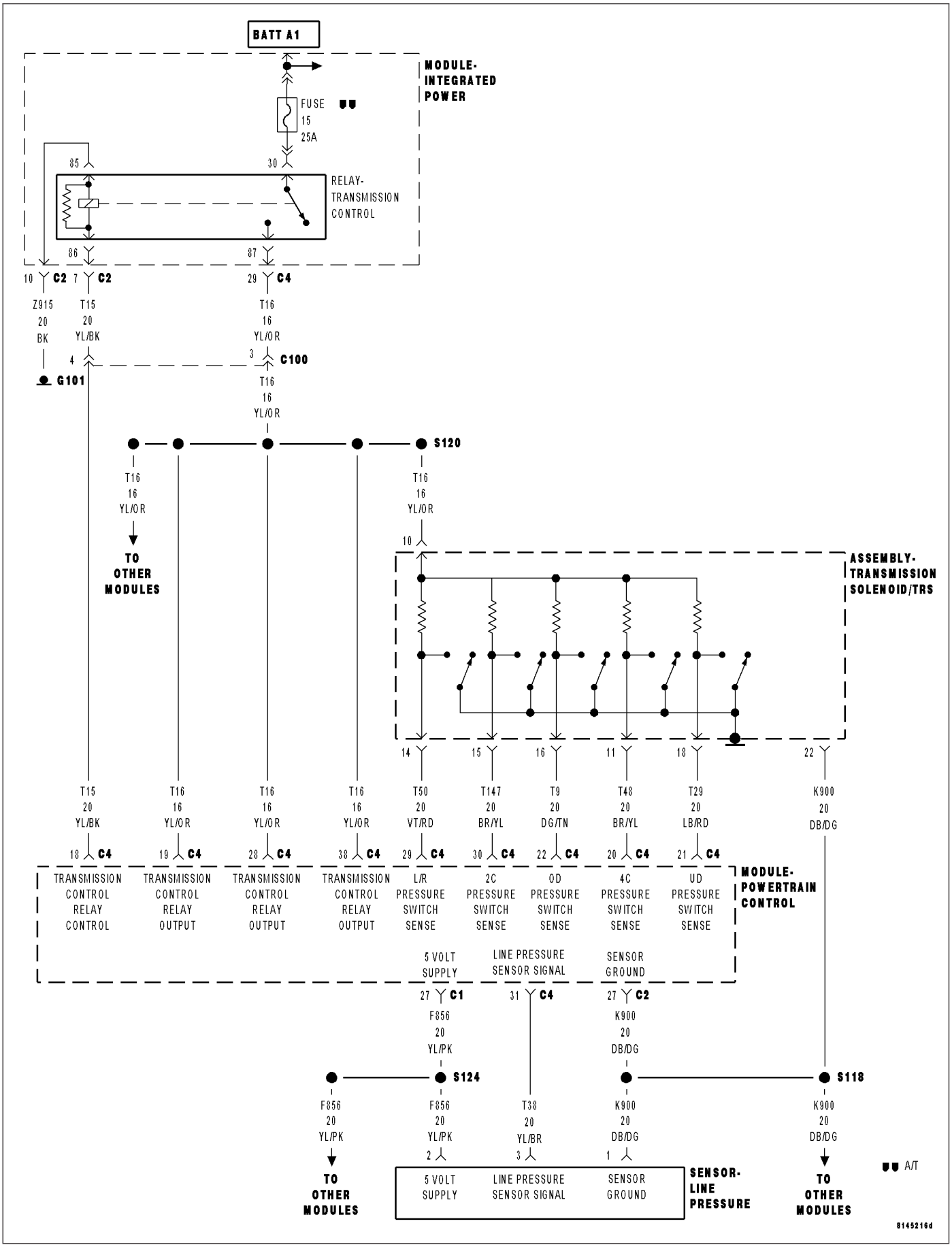
The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0890-SWITCHED BATTERY



P0890-SWITCHED BATTERY (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is turned from ″OFF″ position to ″RUN″ position and/or the ignition is turned from ″START″ position to ″RUN″ position.
- **Set Condition:**
  This DTC is set if the Powertrain Control Module senses voltage on any of the pressure switch inputs prior to the Transmission Control Relay being energized.

Possible Causes
PRESSURE SWITCH SENSE CIRCUITS SHORT TO VOLTAGE
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission control relay is used to supply power to the solenoids and pressure switches (Transmission Solenid/TRS Assembly) when the transmission is in normal operating mode. When the relay is off, no power is supplied and the transmission is in ″limp-in″ mode. The relay output is fed back to the PCM through pins C4–19, C4–28 and C4–38 and are referred to as ″Transmission Control Relay Output″.

Immediately after a controller reset (ignition key turned to the ″run″ position or after cranking engine), the TCM verifies that the relay contacts are open by checking for no voltage at the transmission control relay output terminals. After this is verified, the voltage at the pressure switches are checked. There should be no voltage on the pressure switches at this time. The PCM will then activate the relay.

Diagnostic Test

1. CHECK TO SEE IF DTC P0890 IS PRESENT

With the scan tool, Check the STARTS SINCE SET counter for P0890.

NOTE: This counter only applies to the last DTC set.

Is the ″Starts Since Set″ counter set at 0?

Yes >> Go To 2

No >> Go To 4

P0890-SWITCHED BATTERY (CONTINUED)

2. PRESSURE SWITCH SENSE CIRCUITS SHORT TO VOLTAGE

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

Remove the Transmission Control Relay.

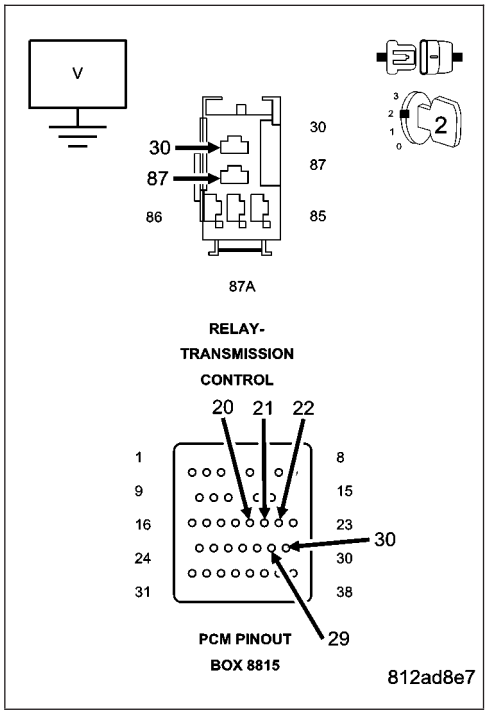
NOTE: Note: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T147) 2C, (T48) 4C, (T50) LR, (T9) OD, and (T29) UD Pressure Switch Sense circuits in Miller tool #8815.



Is the voltage above 0.5 volt on any of the measured circuits?

Yes >> Repair the (T147) 2C, (T48) 4C, (T50) LR, (T9) OD, and/or (T29) UD Pressure Switch Sense circuit(s) for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

3. TRANSMISSION SOLENOID/TRS ASSEMBLY

Turn the ignition off.

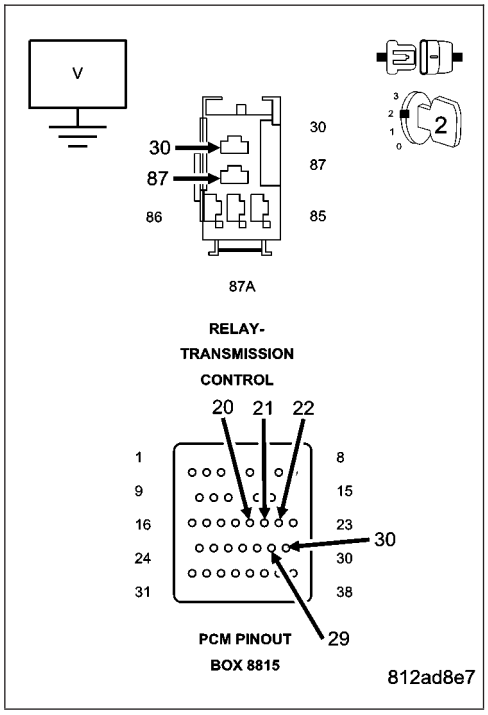
Remove the jumper wire.

NOTE: Do not reinstall the Transmission Relay.

Reconnect the Transmission Solenoid/TRS Assembly harness connector.

Ignition on, engine not running.

Measure the voltage of the (T147) 2C, (T48) 4C, (T50) LR, (T9) OD, and (T29) UD Pressure Switch Sense circuits in Miller tool #8815.



Is the voltage above 0.5 volts on any of the sense circuits?

Yes >> Replace the Transmission Solenoid/TRS Assembly.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0890-SWITCHED BATTERY (CONTINUED)

4. INTERMITTENT WIRING AND CONNECTORS

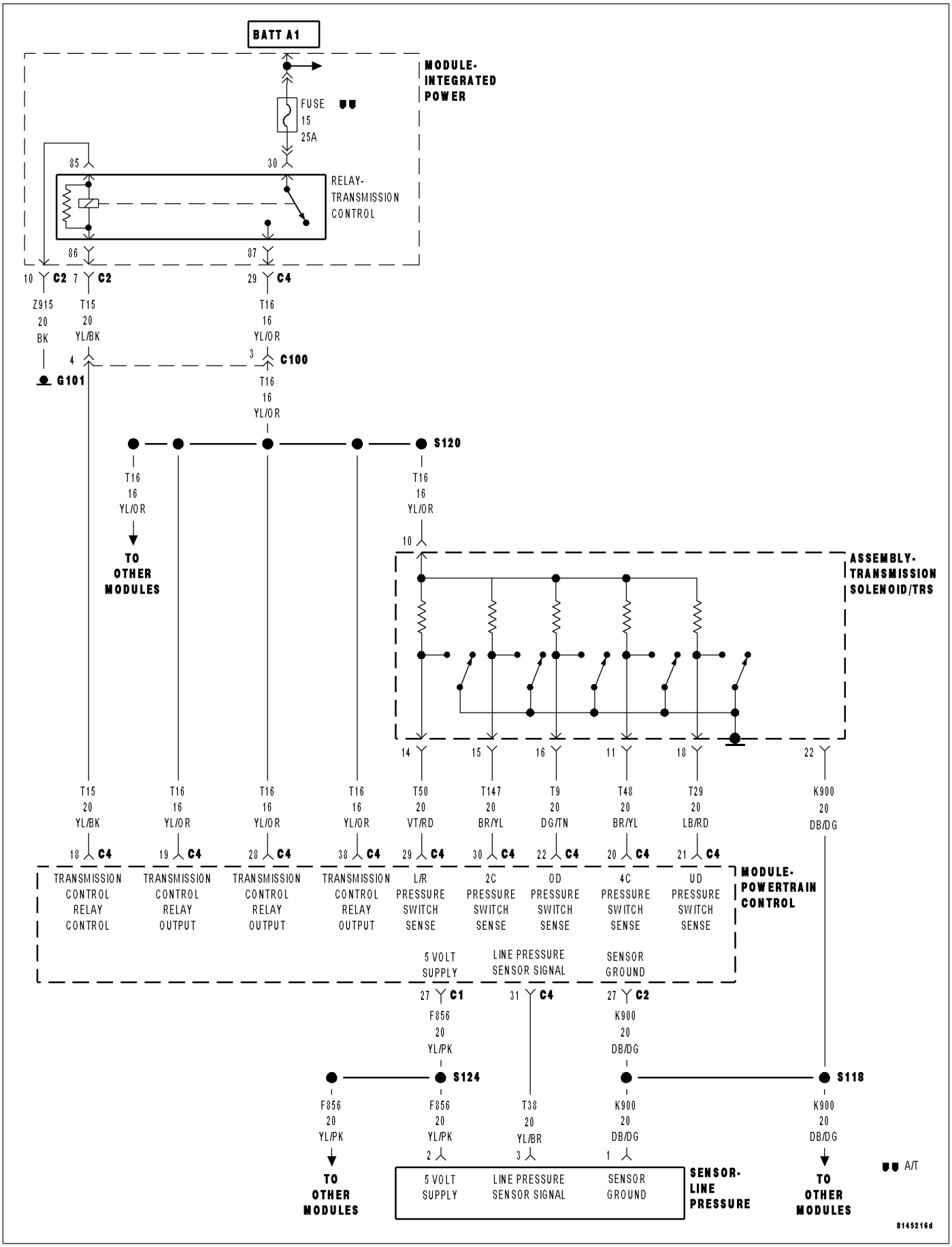
The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0891-TRANSMISSION RELAY ALWAYS ON



P0891-TRANSMISSION RELAY ALWAYS ON (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is turned from ″OFF″ position to ″RUN″ position and/or the ignition is turned from ″START″ position to ″RUN″ position.
- **Set Condition:**
  This DTC is set if the Powertrain Control Module senses greater than 3.0 volts on the Transmission Control Relay Output circuits prior to a request from the PCM to energize the Transmission Control Relay.

Possible Causes
(T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO VOLTAGE
(T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT SHORT VOLTAGE
TRANSMISSION CONTROL RELAY
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Control Relay is used to supply power (Transmission Control Relay Output) to the Transmission Solenoid/TRS Assembly when in normal operating mode and to pins C4–19, C4–28 and C4–38 of the PCM. The purpose of the Transmission Control Relay is to allow the PCM to turn off the power to the Transmission Solenoid/TRS Assembly in event that the transmission should need to be placed into “limp-in” mode due to a DTC.

After a PCM reset, (ignition switch turned to the run position, or after cranking engine) the PCM verifies that the Transmission Control Relay contacts are open by checking for voltage on the Transmission Control Relay Output circuit before the Transmission Control Relay is energized. If voltage is detected, the DTC will set.

Diagnostic Test

1. CHECK TO SEE IF DTC P0891 IS CURRENT

With the scan tool, check the STARTS SINCE SET counter.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter set to 0?

Yes >> Go To 2

No >> Go To 6

P0891-TRANSMISSION RELAY ALWAYS ON (CONTINUED)

2. TRANSMISSION CONTROL RELAY

Turn the ignition off to the lock position.

Disconnect the Transmission Control Relay.

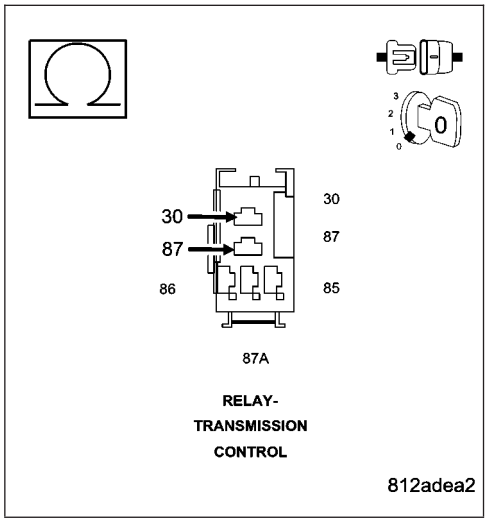
NOTE: Note: Check connectors - Clean/repair as necessary.

Measure the resistance between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output Circuit of the Transmission Control Relay.

Is the resistance above 5.0 ohms?

Yes >> Go To 3

No >> Replace the Transmission Control Relay.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



3. (T16) TRANSMISSION RELAY OUTPUT CIRCUIT SHORT TO VOLTAGE

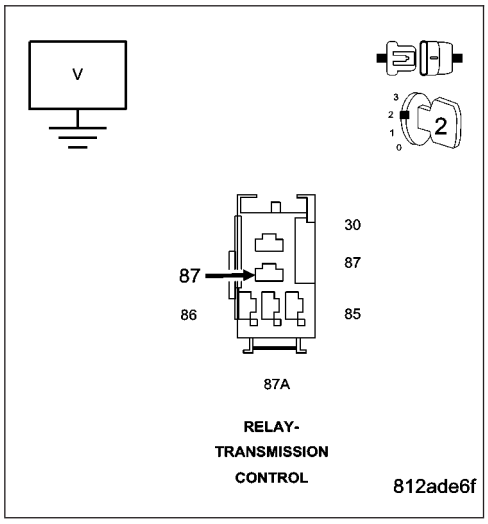
Ignition on, engine not running.

Measure the voltage at the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Is the voltage above 0.5 volts?

Yes >> Go To 4

No >> Go To 5



P0891-TRANSMISSION RELAY ALWAYS ON (CONTINUED)

4. TRANSMISSION SOLENOID/TRS ASSEMBLY

Turn the ignition off to the lock position.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

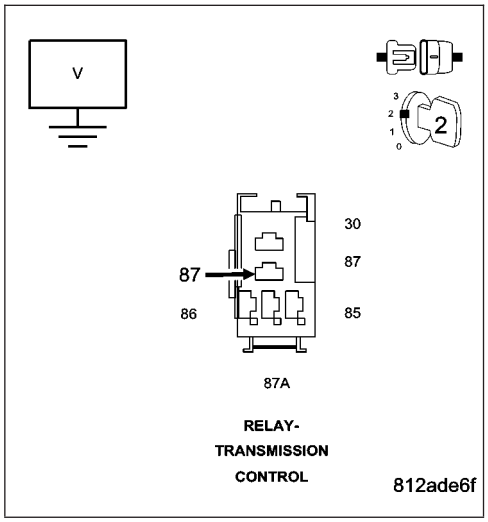
NOTE: NOTE: Check connectors - Clean/repair as necessary.
Ignition on, engine not running.

Measure the voltage at the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Is the voltage above 0.5 volts?

Yes >> Repair the (T16) Transmission Control Relay Output circuit for a short to voltage.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



5. (T15)TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.
Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

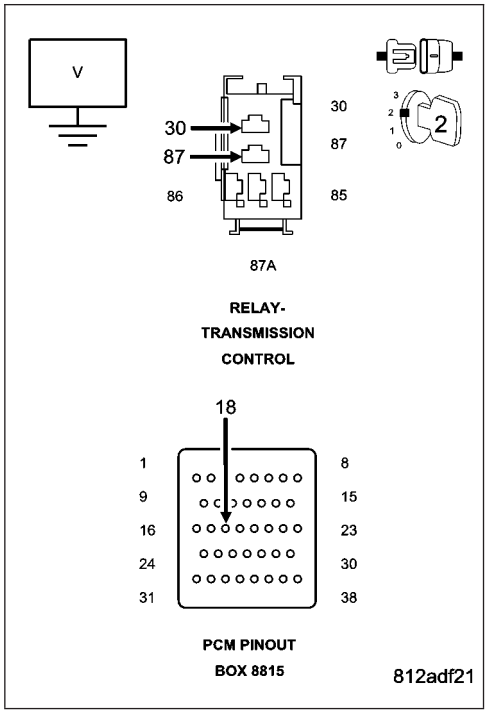
Ignition on, engine not running.

Measure the voltage of the (T15) Transmission Control Relay Control circuit.

Is the voltage above 0.5 volts?

Yes >> Repair the (T15) Transmission Control Relay Control circuit for a short to voltage.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



P0891-TRANSMISSION RELAY ALWAYS ON (CONTINUED)

6. INTERMITTENT WIRING AND CONNECTORS

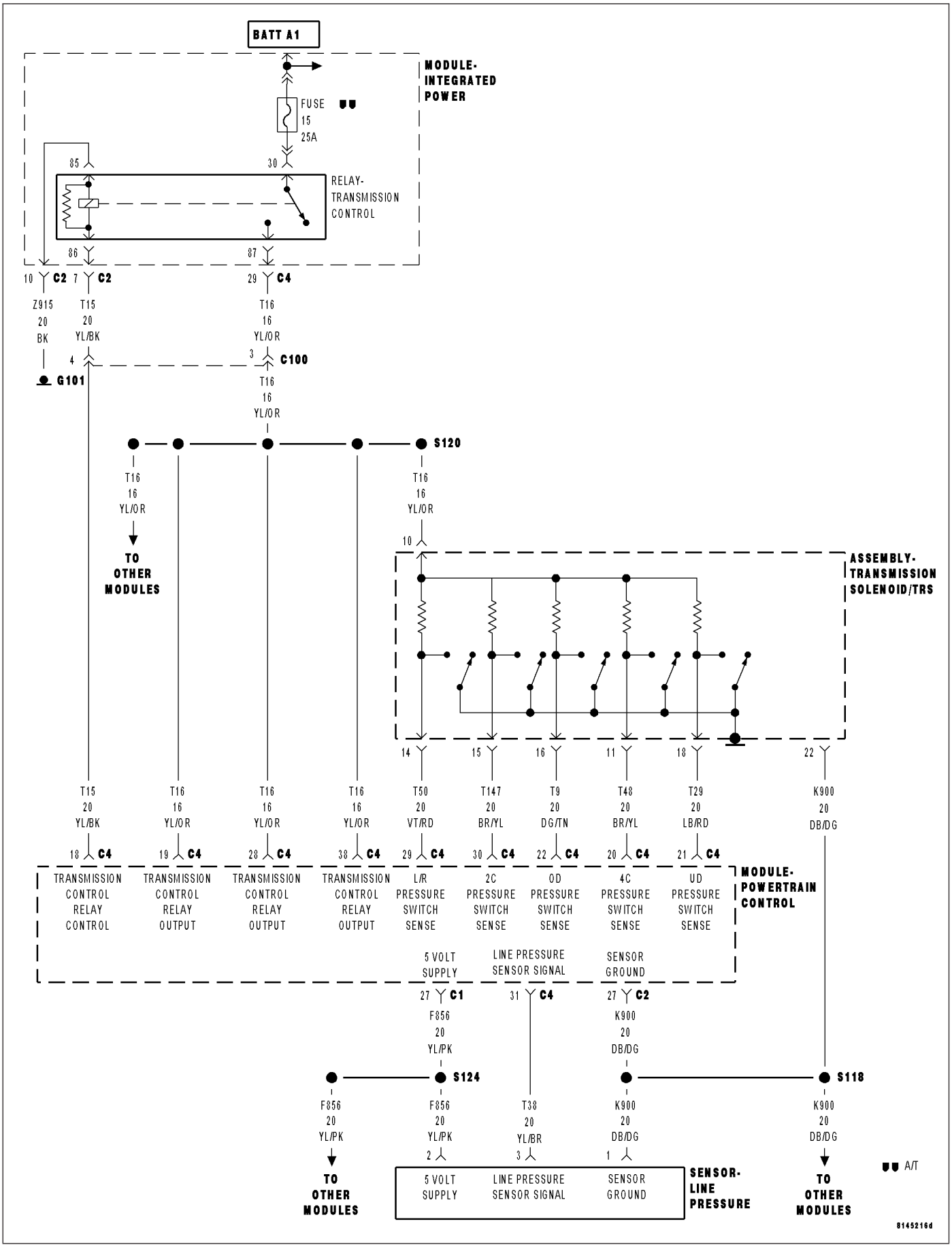
The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0932-LINE PRESSURE SENSOR CIRCUIT



P0932-LINE PRESSURE SENSOR CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  The PCM continuously monitors Actual Line Pressure and compares it to Desired Line Pressure. If the Actual Line Pressure reading is more than 172.4 kPa (25 psi) higher than the Desired Line Pressure, but is less than the highest Line Pressure ever used in the current gear, the DTC sets.

Possible Causes
RELATED DTC'S PRESENT
LINE PRESSURE CONNECTOR AND WIRING
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931kPa (120 to 135 PSI) during shifts and in Park and Neutral to ensure consistent shift quality.

Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's.

Are there any other line pressure related DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom. Perform the test for P0934 and/or P0935 first if present.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0932-LINE PRESSURE SENSOR CIRCUIT (CONTINUED)

2. CONDITION P0932 PRESENT

CAUTION: Apply Parking Brake
Start the engine.

CAUTION: Firmly apply the brakes.
With the scan tool, monitor the Line Pressure, Desired Line Pressure and the TPS degrees.

While firmly applying the brakes, place the shifter in reverse, then slowly press the accelerator pedal to a TPS degree of 15°.

Compare the Line Pressure reading to the Desired Line Pressure reading on the scan tool.

Does the Line Pressure stay within ± 34 kPa or 5 PSI of the Desired Line Pressure?

No >> Go To 3

Yes >> Go To 5

---

3. CHECK LINE PRESSURE CONNECTOR AND WIRING

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure Sensor voltage while wiggling the wiring harness and connectors pertaining to the Line Pressure Sensor and the Transmission Solenoid/TRS Assembly.

Did the voltage remain steady while wiggling the wiring harness and connectors?

Yes >> Go To 4

No >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

4. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure during the following step.

With the Transmission Simulator, turn the selector switch to each of the 3 Line Pressure positions.

NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 PSI of the reading specified on the Transmission Simulator.

Does the Line Pressure on the scan tool fluctuate up and down more than 69 kPa or 10 PSI at any of the 3 line pressure positions on the Transmission Simulator?

Yes >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Repair internal transmission and inspect the oil pump per the Service information and replace if necessary. If no problems are found, replace the Transmission Solenoid/TRS Assembly — possible cause is the Pressure Control Solenoid is stuck.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0932-LINE PRESSURE SENSOR CIRCUIT (CONTINUED)

5. INTERMITTENT WIRING AND CONNECTORS

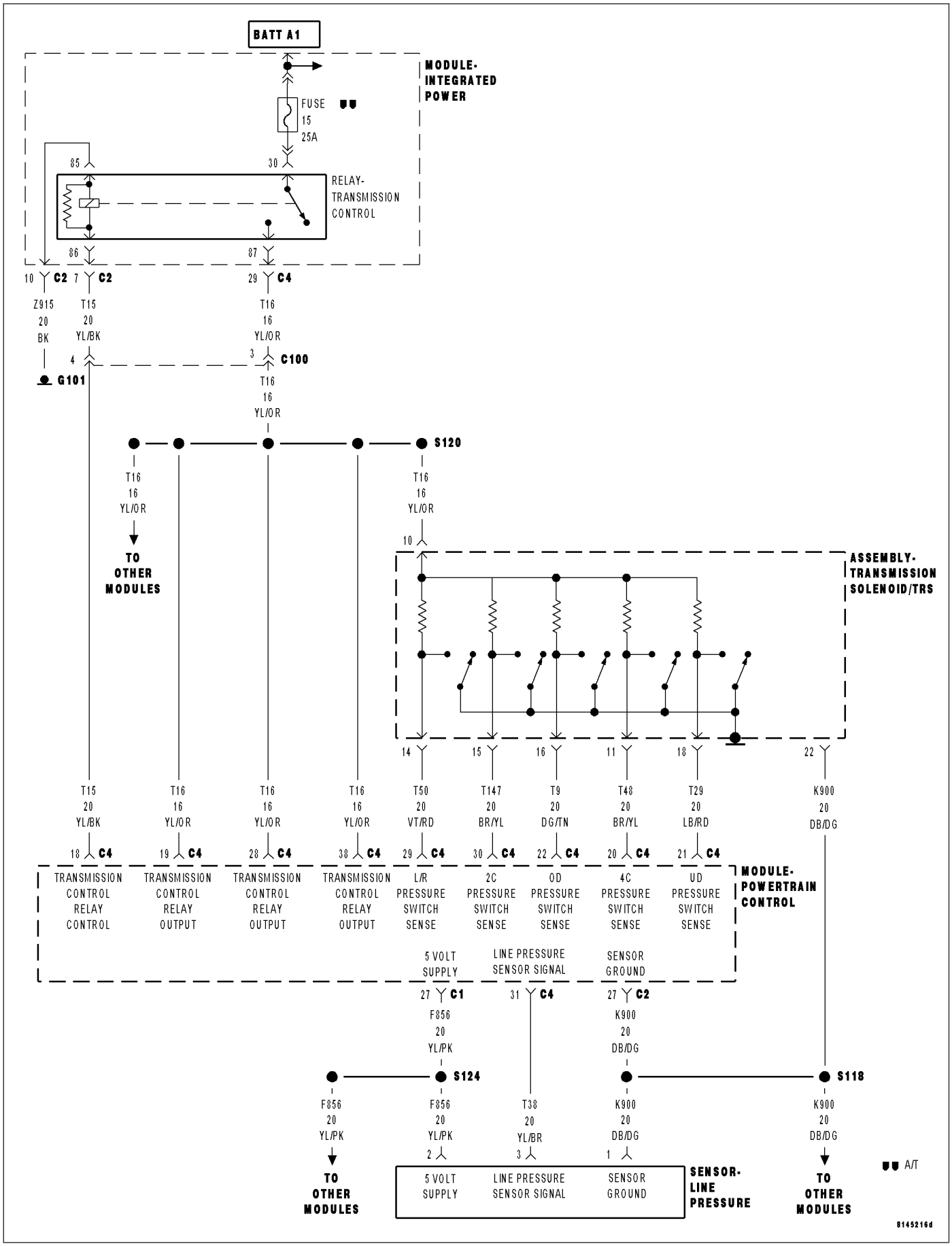
The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0934-LINE PRESSURE SENSOR CIRCUIT LOW



P0934-LINE PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set when the monitored Line Pressure Sensor voltage is less than or equal to 0.35 volts for 0.18 seconds.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND
LINE PRESSURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 PSI) during shifts and in Park and Neutral to ensure consistent shift quality.

The monitored Line Pressure Sensor voltage should always be between 0.35 and 4.75 volts. Any monitored voltages outside these parameters indicate an Line Pressure Sensor or wiring problem and will cause either DTC P0934 or P0935 to set.

Diagnostic Test

1. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0934.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 2

No >> Go To 6

P0934-LINE PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

2. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the scan tool, under Transmission Sensors, monitor the Line Pressure.

Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

NOTE: The readings should be within ±14 kPa or 2.0 PSI on the scan tool to the pressure readings specified on Transmission Simulator.

Does the Line Pressure on the scan tool match the line pressures on the Transmission Simulator?

Yes >> Replace the Line Pressure Sensor per the Service Information.
Perform (NGC) 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND

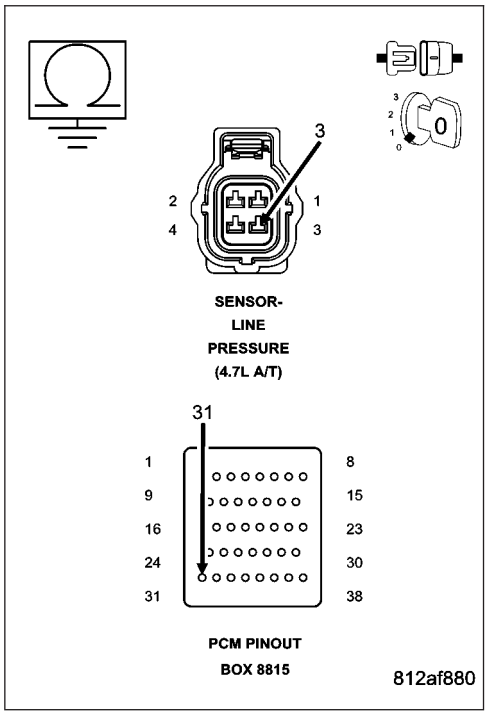
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

Disconnect the Transmission Simulator, Miller tool #8333.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance between ground and the (T38) Line Pressure Sensor Signal circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T38) Line Pressure Sensor Signal circuit for a short to ground.
Perform (NGC) 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

P0934-LINE PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

4. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

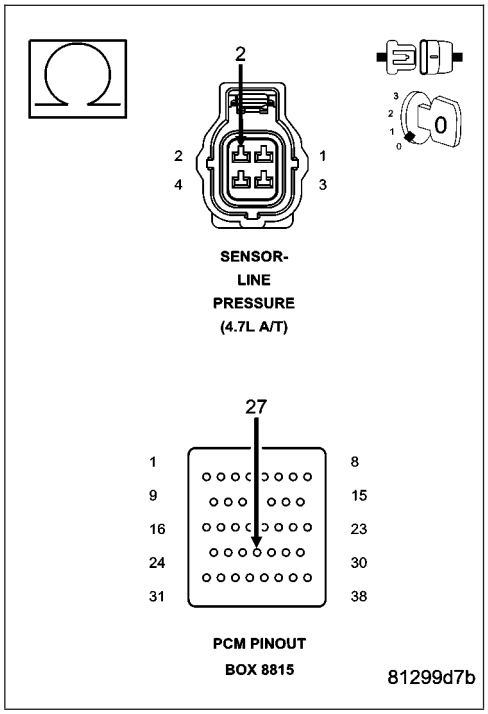
Disconnect the PCM C1 harness connector and connect Miller tool #8815.

Measure the resistance of the (F856) 5-volt Supply circuit between Line Pressure sensor harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Repair the (F856) 5-volt Supply circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5



5. (F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND

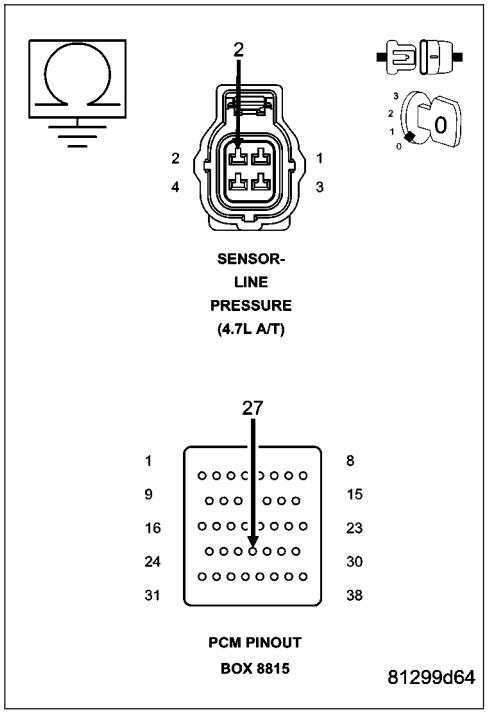
Disconnect the PCM C1 harness connector and connect Miller tool #8815.

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (F856) 5-volt Supply circuit for a short to ground.
Perform (NGC) 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



P0934-LINE PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

6. INTERMITTENT WIRING AND CONNECTORS

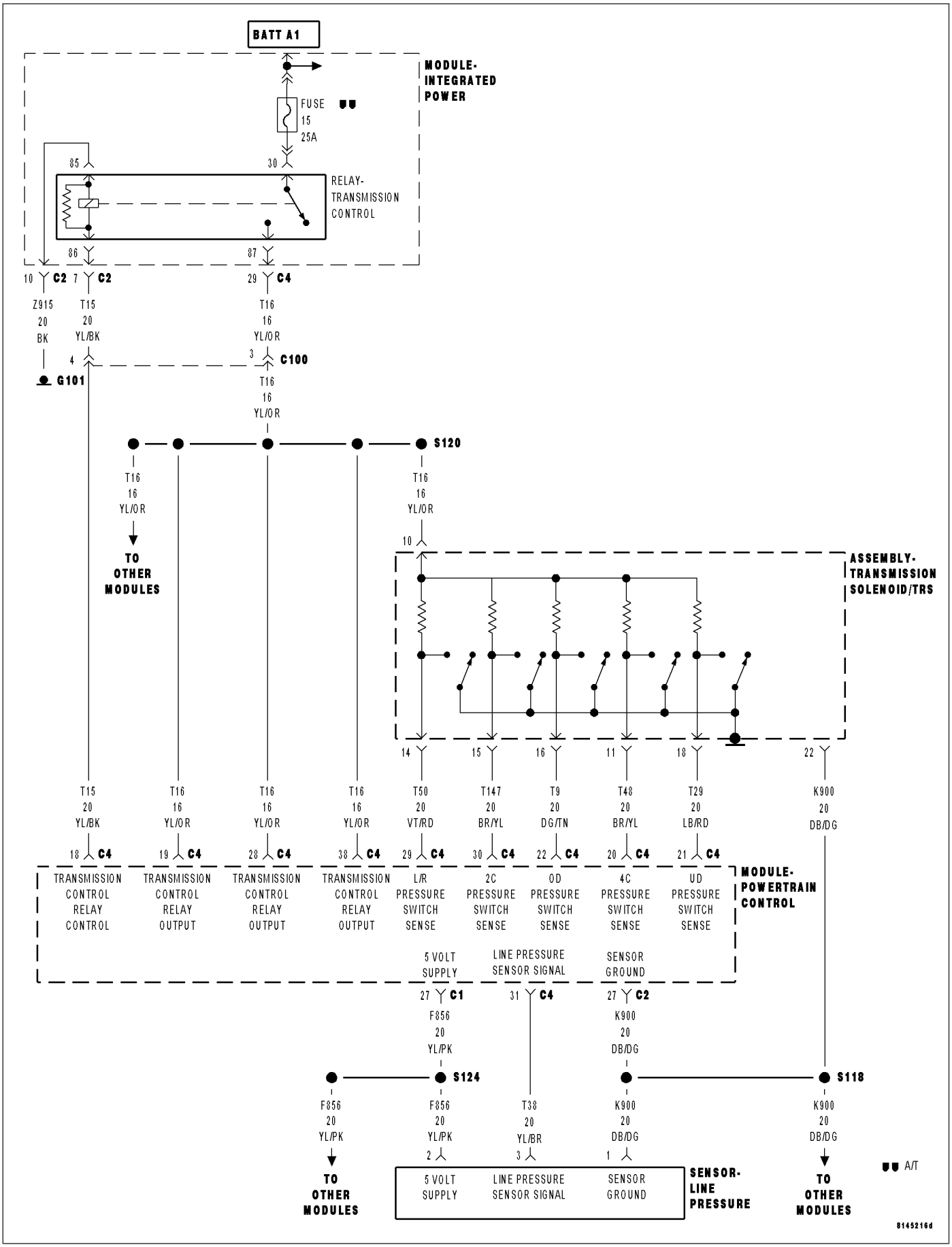
The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0935-LINE PRESSURE SENSOR CIRCUIT HIGH



P0935-LINE PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored Line Pressure Sensor voltage is greater than or equal to 4.75 volts for the period of 0.18 seconds

Possible Causes
(T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
LINE PRESSURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 PSI) during shifts and in Park and Neutral to ensure consistent shift quality.

The monitored Line Pressure Sensor voltage should always be between 0.35 and 4.75 volts. Any monitored voltages outside these parameters indicate an Line Pressure Sensor or wiring problem and will cause either DTC P0934 or P0935 to set.

Diagnostic Test

1. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0935.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 2

No >> Go To 6

P0935-LINE PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

2. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure.

Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

NOTE: The readings should be within ±14 kPa or 2.0 PSI on the scan tool of the pressure reading specified on Transmission Simulator.

Does the 3 line pressures on the scan tool match the Line pressure readings on the Transmission Simulator?

Yes >> Replace the Line Pressure Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. (K900) SENSOR GROUND CIRCUIT OPEN

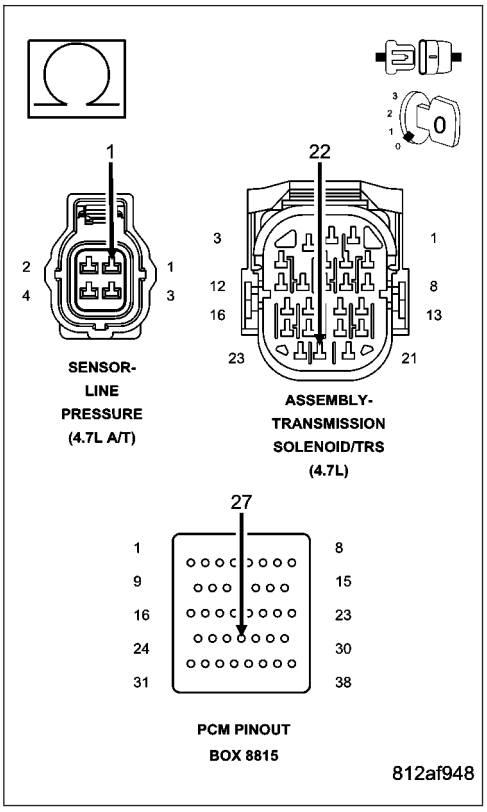
Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM C2 harness connector and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor Ground circuit from the Line Pressure Sensor harness connector to the appropriate terminal of Miller tool #8815.



Is the resistance above 5.0 ohms?

Yes >> Repair the (K900) Sensor Ground circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

P0935-LINE PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

4. (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT OPEN

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

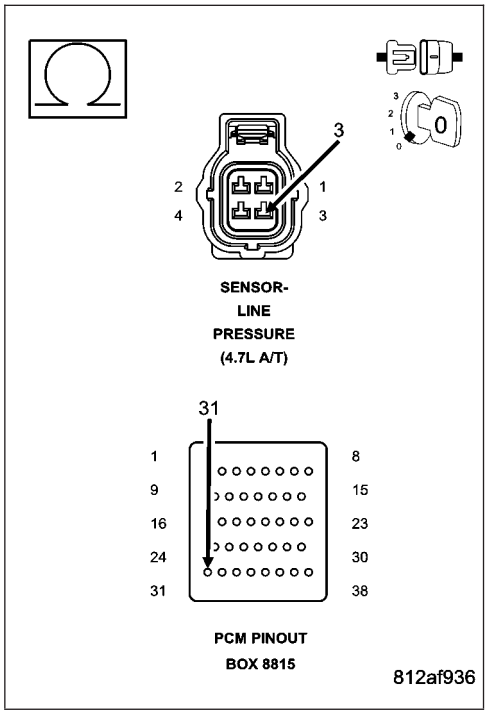
Measure the resistance of the (T38) Line Pressure Sensor Signal circuit from the Line Pressure Sensor harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T38) Line Pressure Sensor Signal circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5



5. (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay.

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T38) Line Pressure Sensor Signal circuit.

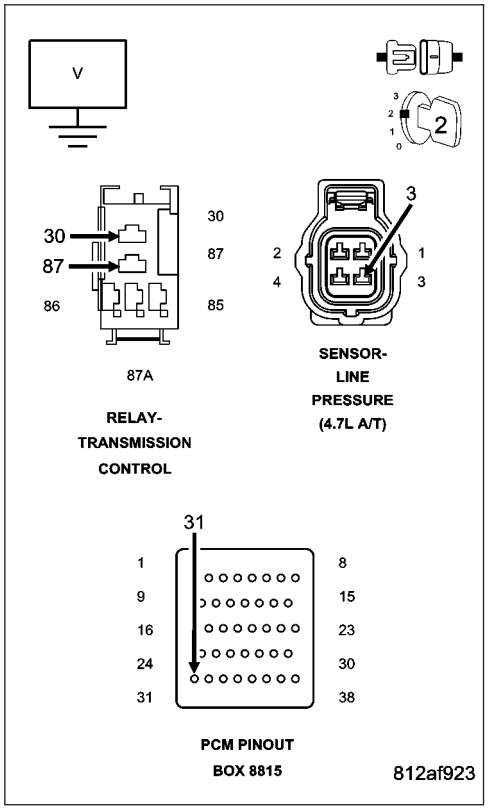
Is the voltage above 5.5 volts?

Yes >> Repair the (T38) Line Pressure Sensor Signal circuit for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



P0935-LINE PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0944-LOSS OF HYDRAULIC PUMP PRIME

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  If the transmission is slipping in any forward gear and all the pressure switches are not indicating pressure, a loss of prime test is run.
- **Set Condition:**
  If the transmission begins to slip in a forward gear and all the pressure switch(s) that should be closed are open a loss of prime test begins. Available elements are turned on by the PCM to see if pump prime exists. The DTC sets if no pressure switch(s) respond.

Possible Causes
SHIFT LEVER OUT OF ADJUSTMENT
INPROPER FLUID LEVEL
CRACKED OR IMPROPERLY INSTALLED PRIMARY OIL FILTER OR SEAL
LOOSE COOLER RETURN FILTER
STUCK OR STICKING MAIN REGULATOR VALVE
TRANSMISSION OIL PUMP

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Loss of prime test is used to prevent transmission defaults and erroneous fault codes during temporary loss of pump prime that may occur with low transmission fluid under severe braking conditions, start-up, etc. and to point towards more subtle problems such as a plugged or cracked oil filter.

The Loss of Prime DTC is set by a loss of hydraulic pressure in the transmission system. This condition, if sustained, will result in the vehicle being unable to move.

Diagnostic Test

1. SHIFT LEVER POSITION TEST

Using the scan tool, perform a Shift Lever Position test. Follow the instructions on the scan tool.

Did the Shift Lever Position Test pass?

Yes >> Go To 2

No >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0944-LOSS OF HYDRAULIC PUMP PRIME (CONTINUED)

2. CHECK TO SEE IF DTC P0944 IS CURRENT

Place the gear selector in Park.

Start the engine.

The transmission must be at operating temperature prior to checking pressure. A cold transmission will give higher readings.

Run the engine at 1500 RPM.

With the scan tool, monitor the Transmission Line Pressure.

Does the Line Pressure match the Desired Line Pressure within ± 5 psi?

No >> Go To 6

Yes >> Go To 3

---

3. CHECK LINE PRESSURE IN DRIVE AND REVERSE

Firmly apply the brake and repeat the previous test in both Drive and the Reverse gear positions.

With the scan tool, monitor the Transmission Line Pressure.

Does the Line Pressure match the Desired Line Pressure within ± 5 psi in all gear ranges?

Yes >> Go To 4

No >> Go To 5

---

4. REVIEW CUSTOMER COMMENTS

The conditions necessary to set this DTC are not present at this time.

Verify with the customer if a delayed engagement and/or an intermittent ″No Drive″ condition has occurred.

If the customers answer is ″No″ erase the DTC and return the vehicle to the customer.

Make sure to check for any TSBs or controller flash updates that my apply.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Has the customer experienced any delayed engagement and/or ″No Drive″ conditions?

Yes >> Repair internal transmission as necessary. Replace the Transmission Oil Pump if inspection reveals no signs of internal seal leakage. Refer to the Service Information for the proper repair procedure.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

---

5. DTC VERIFICATION

Read and record the DTC and the EATX DTC EVENT DATA information.

Test drive the vehicle and attempt to operate the vehicle within the parameters in which the DTC set.

With the scan tool, read DTCs.

Did any following DTCs set, P0868, P0944, P0841, P0846, P0871, P0876, or P0988?

Yes >> Go To 6

No >> Test Complete.

P0944-LOSS OF HYDRAULIC PUMP PRIME (CONTINUED)

6. CHECK TRANSMISSION OIL FILTER

Remove and inspect the Transmission Oil Pan per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

Inspect the oil filter seal for damage and proper installation.

Does the Oil Pan contain excessive debris and/or is the Oil Filter plugged or seal damaged?

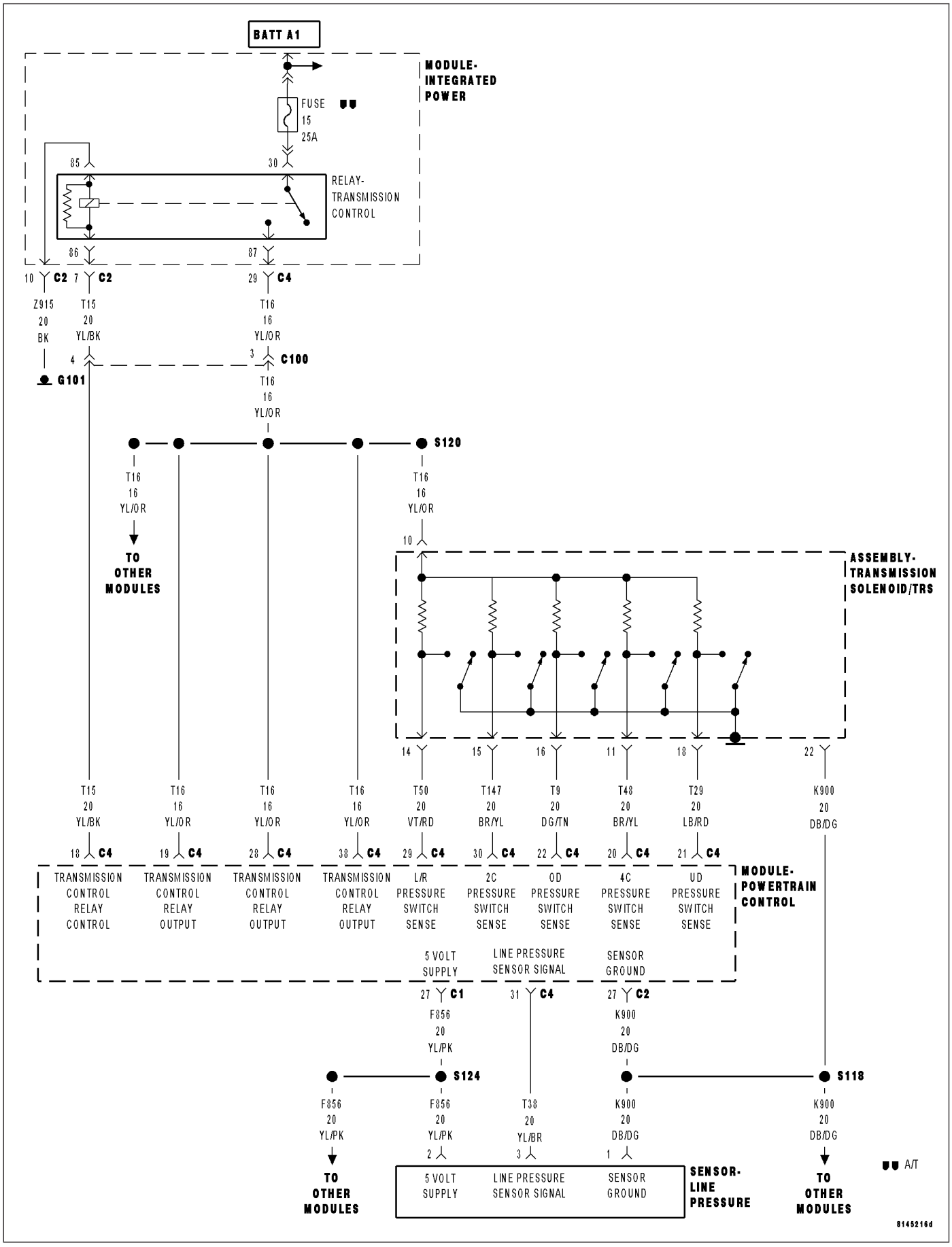
Yes >> Repair the cause of the plugged transmission oil filter or excessive debris. Check the Transmission Oil Filter seal for improper installation onto filter neck instead of into the pump bore, not fully seated against pump housing, filter neck not engaged into pump. Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Repair the Transmission Oil Pump as necessary. Check for a stuck main regulator valve and clean if necessary. Refer to the Service Information for the proper repair procedure.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0987-4C HYDRAULIC PRESSURE TEST



P0987-4C HYDRAULIC PRESSURE TEST (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed above 1000 RPM, the PCM momentarily turns on element pressure to the Clutch circuits that don't have pressure to identify the correct Pressure Switch closes. If the Pressure Switch does not close 2 times, the DTC sets.

Possible Causes
LINE PRESSURE SENSOR
TRANSMISSION FLUID CONTAMINATION
RELATED DTC'S PRESENT
TRANSMISSION SOLENOID/TRS ASSEMBLY
EXCESSIVE DEBRIS IN OIL PAN
POOR LINE PRESSURE SENSOR CONNECTION
TRANSMISSION CONTROL RELAY DTCS PRESENT
(T48) 4C PRESSURE SWITCH SENSE CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHERS
TRANSMISSION SOLENOID/TRS ASSEMBLY
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Control System tests the pressure switches when they are off. The test verifies that the switches are operational (They will close with pressure applied). The Transmission Control System verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is re-tested. If it fails the second test, the DTC will set, the MIL will illuminate and the transmission system will default to the orderly Shutdown routine.

Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

Is there any Loss of Prime, Transmission Control Relay, and/or Line Pressure Sensor DTCs present?

Yes >> Refer to the Transmission category and perform the appropriate symptom. If the DTC P0944 is present, perform its respective test first.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P0987-4C HYDRAULIC PRESSURE TEST (CONTINUED)

2. DTC P0770 PRESENT

With the scan tool, check Transmission DTCs.

Is the DTC P0770 also present?

Yes >> Refer to the symptom list and perform diagnostics for P0770.

No >> Go To 3

---

3. OTHER DTCS PRESENT

With the scan tool, check for other transmission DTC's

Are the DTCs P0988 and/or P1736 present also?

Yes >> Go To 12

No >> Go To 4

---

4. CHECK TO SEE IF DTC P0987 IS CURRENT

With the scan tool, check if the DTC P0987-4C HYDRAULIC PRESSURE TEST FAILURE is active or stored.

Is the DTC P0987-4C HYDRAULIC PRESSURE TEST FAILURE active?

Yes >> Go To 5

No >> Go To 17

---

5. LINE PRESSURE STAYS THE SAME

Start the engine.

Warm the transmission to 82° C or 180° F.

Firmly apply the brakes.

With the scan tool, monitor the Line Pressure during the following step.

Move the shift lever to each gear position, pausing momentarily in each position and record the line pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range.

Did the line pressure remain at a steady value between 585 and 655 kPa or 85 and 95 PSI in each position?

Yes >> Go To 6

No >> Go To 10

---

6. CHECK LINE PRESSURE SENSOR CONNECTION

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

Did the Line Pressure reading on the scan tool change to about 207 kPa or 30 PSI when the connector was pushed inward?

Yes >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7

P0987-4C HYDRAULIC PRESSURE TEST (CONTINUED)

7. LINE PRESSURE SENSOR OPERATION

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while turning the Pressure Switch selector to each of the 3 line pressure positions on the Transmission Simulator.

NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 PSI of the reading specified on the Transmission Simulator.

Did the scan tool Line Pressure readings match the specified readings on the Transmission Simulator and remain steady in all three positions?

Yes >> Replace the Line Pressure Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8

---

8. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

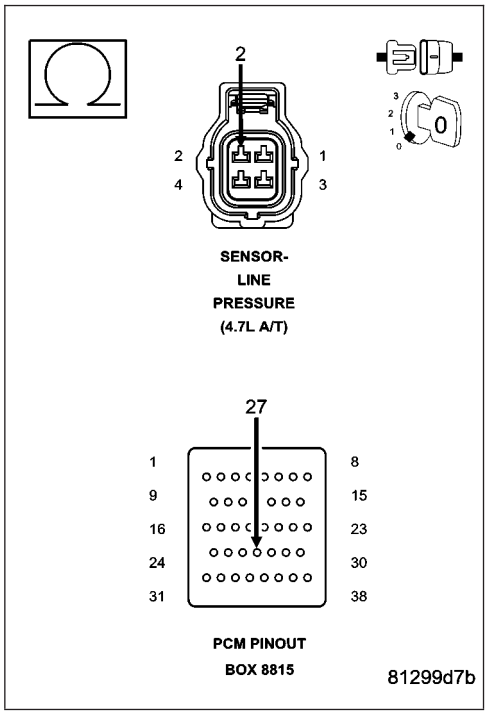
Turn the ignition off to the lock position.

Disconnect Transmission Simulator.

Disconnect the PCM C1 harness connector and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the Line Pressure Sensor harness connector to the appropriate terminal of Miller tool #8815.



Is the resistance above 5.0 ohms?

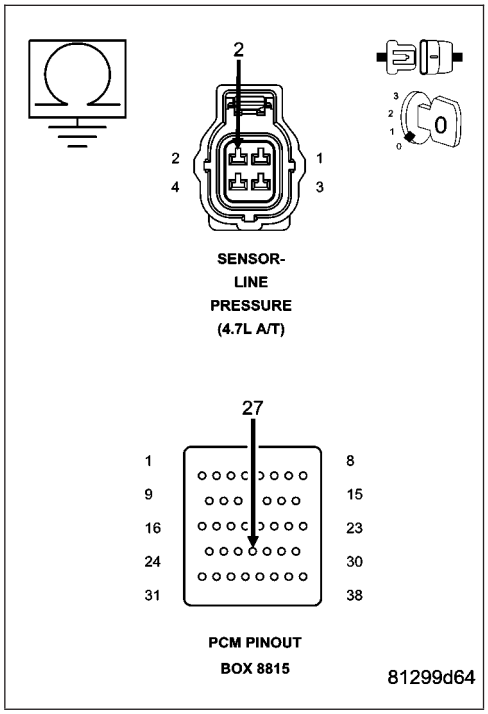
Yes >> Repair the (F856) 5-volt Supply circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 9

P0987-4C HYDRAULIC PRESSURE TEST (CONTINUED)

9. (F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (F856) 5-volt Supply circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

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10. COMPARE SCAN TOOL TO PRESSURE GAUGE

Turn the ignition off to the lock position.

Connect the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP. Refer to the Service Information for proper installation procedure.

CAUTION: Apply parking brake.

Start the engine.

In the following steps, compare the scan tool Line Pressure to the Pressure Gauge readings in each gear.

CAUTION: Do not overheat transmission.

With the gear selector in park, raise the RPM to 1500, and compare line pressure readings.

Firmly apply the brakes, move the gear selector into reverse, raise the RPM to 1500, and compare the line pressure readings.

Firmly apply the brakes, move the gear selector into drive, raise the RPM to 1500, and compare the line pressure readings.

Does the scan tool Line Pressure readings match the Pressure Gauge readings ± 10 psi?

Yes >> Go To 11

No >> Replace the Line Pressure Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0987-4C HYDRAULIC PRESSURE TEST (CONTINUED)

11. WIRING AND CONNECTORS

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.

Remove the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP.

Install the Transmission Simulator, Miller tool #8333.

On the Transmission Simulator, turn the Pressure Switch selector switch to 4C.

Ignition on, engine not running.

With the scan tool, monitor the 4C Pressure Switch state while pressing and holding the Pressure Switch test button and wiggling the wire harness and connectors that pertain to the 4C Pressure Switch.

Did the 4C Pressure Switch state change to closed and remain closed while wiggling the wires?

Yes >> Go To 12

No >> Go To 14

---

12. CHECK FOR EXCESSIVE DEBRIS

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Remove and inspect the Transmission Oil Pan per the Service Information.

Does the Transmission Oil Pan contain excessive debris or contamination?

Yes >> Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 13

---

13. CHECK 4C HYDRAULIC CLUTCH CIRCUIT

Remove the Valve Body and air check the 4C hydraulic clutch circuit (in the case) for leakage per the Service Information.

NOTE: The 4C hydraulic clutch circuit contains a small bleed orifice. A small amount of air leakage is normal.

Was there excessive air leakage noticed during the air check?

Yes >> Repair as necessary. Check the 4C clutch piston, piston seals and bleed orifice assembly.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Disassemble and inspect the Valve Body and repair as necessary. Inspect the 4C Accumulator piston and seals. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0987-4C HYDRAULIC PRESSURE TEST (CONTINUED)

14. (T48) 4C PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333 and connect Miller tool #8815.

Disconnect the PCM C4 harness connector.

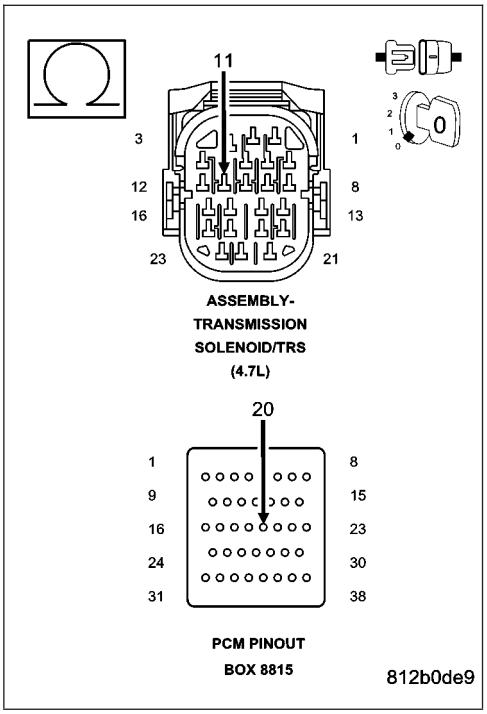
Measure the resistance of the (T48) 4C Pressure Switch Sense circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T48) 4C Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 15



15. (T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

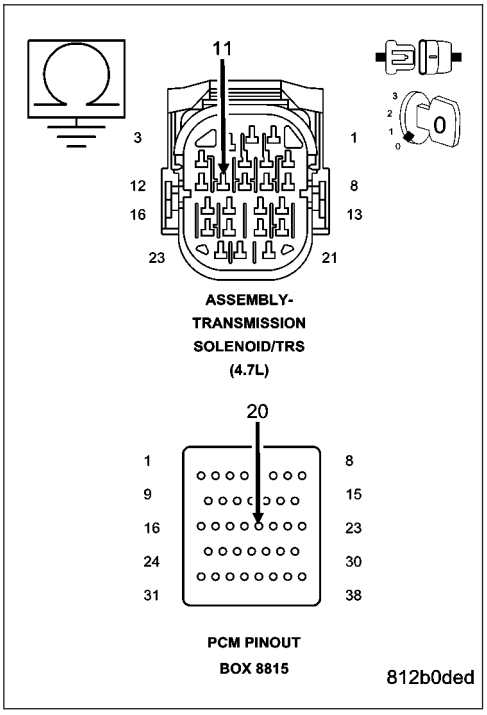
Measure the resistance between ground and the (T48) 4C Pressure Switch Sense circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T48) 4C Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 16



P0987-4C HYDRAULIC PRESSURE TEST (CONTINUED)

16. (T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS

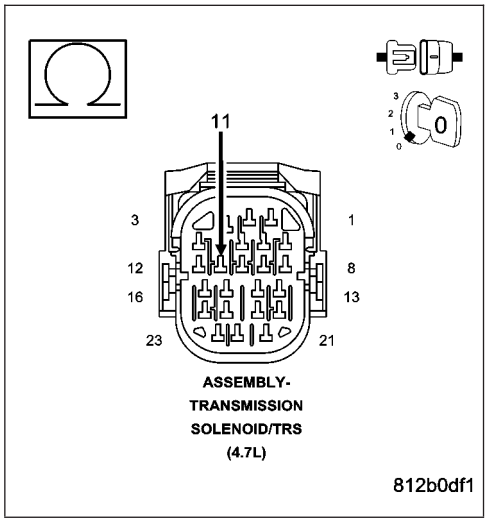
Disconnect all PCM harness connectors.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the (T48) 4C Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T48) 4C Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T48) 4C Pressure Switch Sense circuit for a short to other circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

17. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

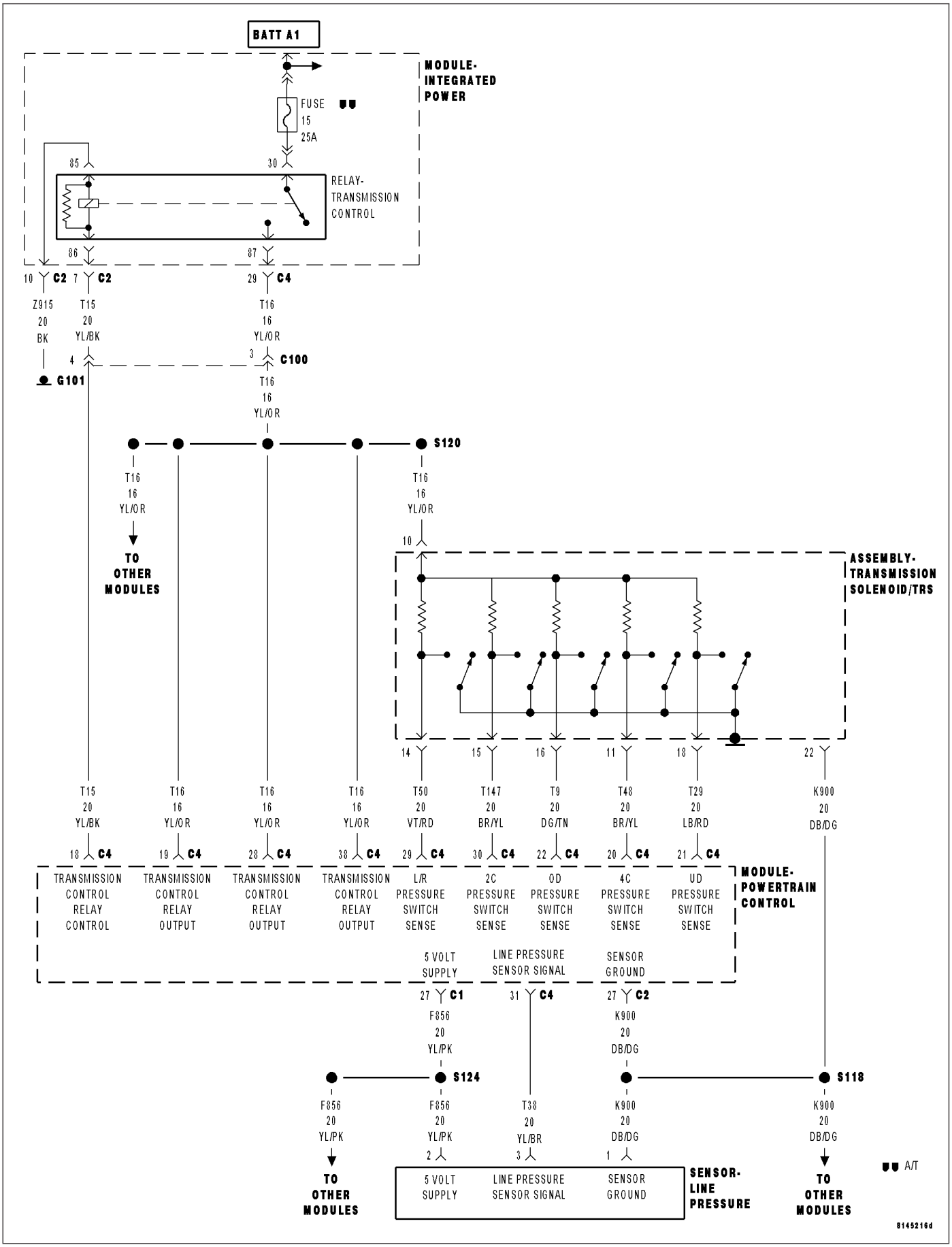
If the EATX DTC EVENT DATA shows the DTC P0987 set while the Line Pressure was significantly below the Desired Line Pressure reading, check for causes of low line pressure (low fluid level, broken or mis-installed primary oil filter or filter seal, sticking Main Regulator Valve in the Pump Valve Body etc.). If the data shows the DTC set while the Line Pressure reading was significantly higher than the Desired Line Pressure, check the Line Pressure Sensor and related wiring.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P0988-4C PRESSURE SWITCH RATIONALITY



P0988-4C PRESSURE SWITCH RATIONALITY (CONTINUED)

For the Transmission circuit diagram (Refer to)(Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  The DTC is set if the 4C Pressure Switch reads open or closed at the wrong time in a given gear.

Possible Causes
RELATED RELAY DTC'S PRESENT
DTC P0871 ALSO PRESENT
LOSS OF 12-VOLT FEED
(T48) 4C PRESSURE SWITCH SENSE CIRCUIT OPEN
(T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
EXCESSIVE FLUID LEAKAGE WITH 2C CLUTCH CIRCUIT
#5 AND/OR #7 CHECK BALL CUT OR DAMAGED
LOW LINE PRESSURE
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE
WIRING AND CONNECTORS

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the LR, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

GEAR	L/R	2C	4C	UD	OD
REVERSE	OPEN	OPEN	OPEN	OPEN	OPEN
P/N	CLOSED	OPEN	OPEN	OPEN	OPEN
1ST	CLOSED*	OPEN	OPEN	CLOSED	OPEN
2ND	OPEN	CLOSED	OPEN	CLOSED	OPEN
2ND PRIME	OPEN	OPEN	CLOSED	CLOSED	OPEN
DRIVE	OPEN	OPEN	OPEN	CLOSED	CLOSED
4TH	OPEN	OPEN	CLOSED	OPEN	CLOSED
5TH	OPEN	CLOSED	OPEN	OPEN	CLOSED

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is open in Manual 1.

P0988-4C PRESSURE SWITCH RATIONALITY (CONTINUED)

Diagnostic Test

1. DETERMINING IF RELATED RELAY DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's.

Are there any Transmission Control Relay related DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. EATX DTC DATA SHOW CURRENT DTC

With the scan tool, check the EATX DTC EVENT DATA.

Does the EATX DTC EVENT DATA show data for DTC P0988?

Yes >> Go To 3

No >> Refer to the Transmission category and perform the appropriate symptom shown in the EATX DTC EVENT DATA.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

3. MULTIPLE DTCS PRESENT

With the scan tool, check for other transmission DTC's.

Are there two or more related Pressure Switch Sense DTCs present in addition to P0988?

Yes >> Go To 4

No >> Go To 7

---

4. RELATED DTC PRESENT

With the scan tool, check the EATX DTC EVENT DATA for P0988.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Do all the pressure switches read CLOSED in the EATX DTC EVENT DATA for P0988?

Yes >> Refer to Transmission category and perform diagnostics for the DTC P0888.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

---

5. EATX DTC EVENT DATA READ OPEN

In the EATX DTC EVENT DATA recorded earlier, read the state of all pressure switches.

Do all the pressure switches read OPEN?

Yes >> Go To 6

No >> Go To 7

P0988-4C PRESSURE SWITCH RATIONALITY (CONTINUED)

6. LOW LINE PRESSURE

In the EATX DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?

Yes >> Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

7. DTC P0871 ALSO PRESENT

With the scan tool, check Transmission DTCs.

Is the DTC P0871 also present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8

---

8. EATX DTC EVENT DATA READ PARK REVERSE OR NEUTRAL

With the scan tool, check the EATX DTC EVENT DATA for P0988.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the EATX DTC EVENT DATA show the DTC set in Park, Neutral, or Reverse for P0988?

Yes >> Go To 13

No >> Go To 9

---

9. EATX DTC EVENT DATA READ CLOSED

With the scan tool, check the EATX DTC EVENT DATA for P0988.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the EATX DTC EVENT DATA show the 4C Pressure Switch reading CLOSED?

Yes >> Go To 11

No >> Go To 10

P0988-4C PRESSURE SWITCH RATIONALITY (CONTINUED)

10. PRIMARY OIL FILTER SEAL

In the EATX DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?

Yes >> Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 15

---

11. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to the 4C position.

With the scan tool, monitor the 4C Pressure Switch while pressing the Pressure Switch test button on the Transmission Simulator.

Did the state of the 4C Pressure Switch change while pressing the Pressure Switch Test button?

Yes >> Go To 12

No >> Go To 13

---

12. TRANSMISSION SOLENOID/TRS ASSEMBLY

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0988-4C PRESSURE SWITCH RATIONALITY (CONTINUED)

13. (T48) 4C PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

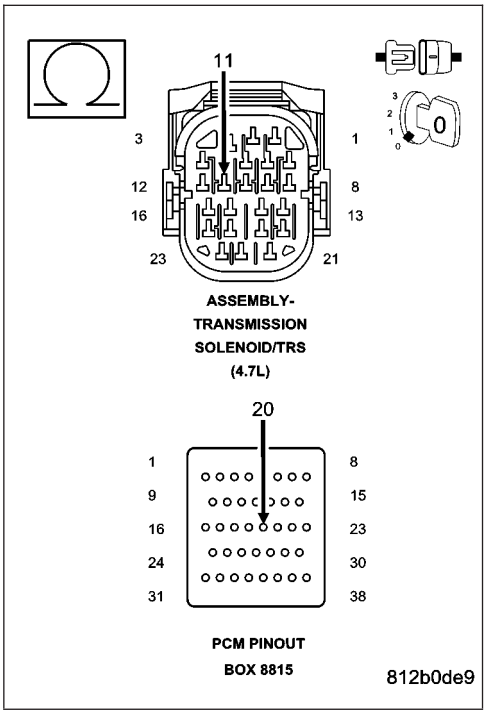
Disconnect the PCM C4 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Connect Miller tool #8815 to the PCM C4 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T48) 4C Pressure Switch Sense circuit from the appropriate terminal of Miller tool #8815 to the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance above 5.0 ohms?

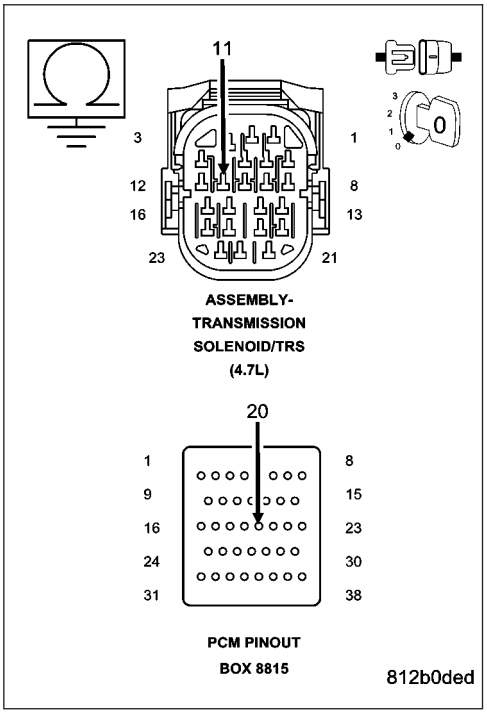
Yes >> Repair the (T48) 4C Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 14

14. (T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T48) 4C Pressure Switch Sense circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T48) 4C Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Powertrain Control Module per the Service Information. With the scan tool, perform the QUICK LEARN procedure.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P0988-4C PRESSURE SWITCH RATIONALITY (CONTINUED)

15. #5 AND/OR #7 CHECK BALL CUT OR DAMAGED

Turn the Ignition off to the lock position.

Remove the Valve Body Assembly per the Service Information.

Inspect the #5 and #7 check balls for any cuts or damage.

Inspect the 4C accumulator piston and seals and also the 4C tower seal on top of the valve body. Refer to the Service Information.

Where there any problems found?

Yes >> Repair as necessary. Check for excessive clutch debris in the transmission oil pan. If excessive clutch debris is present, repair 4C clutch as necessary. Refer to the Service Information for proper repair procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 16

---

16. EXCESSIVE FLUID LEAKAGE WITH 4C CLUTCH CIRCUIT

Air check the 4C Clutch hydraulic circuit. Refer to the Service Information.

NOTE: This hydraulic clutch circuit contains a small bleed orifice. Small leakage is considered normal.

Was there excessive air leakage in the 4C Clutch hydraulic circuit?

Yes >> Repair as necessary. Refer to the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P1684-BATTERY WAS DISCONNECTED

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the ignition is in the Run/Start position.
- **Set Condition:**
  This DTC will set whenever Powertrain Control Module is disconnected from Fused B+ or ground. It will also be set during the DRBIII® Battery Disconnect and/or Quick Learn procedure.

Possible Causes
BATTERY WAS DISCONNECTED
SCAN TOOL BATTERY DISCONNECT PERFORMED
PCM WAS REPLACED OR DISCONNECTED
QUICK LEARN WAS PERFORMED

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The PCM uses a battery backed RAM (Random Access Memory) is used to maintain some learned values. When the battery B(+) is disconnected, the memory is lost. When the B(+) is restored, this memory loss is detected by the Transmission Control System. The DTC is set and the learned values are initialized to known constants or previously learned values from EEPROM (Electronic Erasable Programmable Read Only Memory). This results in the reinitialization of some parameters.

Diagnostic Test

1. POSSIBLE CAUSES

This DTC is an informational DTC only.

This DTC is set due to a momentary loss of power and/or the ground circuits to the PCM.

Below are a list of possible causes associated with this DTC.

Battery was disconnected.

The BATTERY DISCONNECT feature on the scan tool was performed.

The QUICK LEARN feature on the scan tool was performed.

PCM was replaced or disconnected.

Were any of the above possible causes performed?

Yes >> This is the cause of the DTC. Erase the DTC and return vehicle to customer. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P1684-BATTERY WAS DISCONNECTED (CONTINUED)

2. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

NOTE: Check all power and ground circuits to the PCM for a intermittent or high resistance condition.
Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P1715-RESTRICTED MANUAL VALVE IN T3 RANGE

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Whenever the PRNDL code indicates Temp3.
- **Set Condition:**
  This DTC sets when conditions for the DTC P1776 are satisfied or 3 unsuccessful attempts to engage 1st gear while the shifter is in the temp3 zone. This indicates a restricted port at the manual valve because the shifter is not fully engaged in the drive position.

Possible Causes
RELATED TRANSMISSION DTC'S PRESENT
CUSTOMER DRIVING HABITS
MISADJUSTED SHIFTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

Are any of the following DTC's P0731, P0732, P0733, P0734, P1736 or P0715 present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK SHIFTER ADJUSTMENT

Check Shifter adjustment per the Service Information.

Is the shifter properly adjusted?

Yes >> Go To 3

No >> Adjust the Shifter Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P1715-RESTRICTED MANUAL VALVE IN T3 RANGE (CONTINUED)

3. CHECK CUSTOMER DRIVING HABIT

This DTC can be set if the customer rests their hand on the shift lever while they are driving. The transmission can be put in the T3 position if just enough forward pressure is exerted on the shift lever.

When this occurs, the feed port to the clutch is restricted, the transmission will declare neutral, and this DTC will be set. The customer should be informed not to rest their hand on the shifter while driving.

This DTC can also be set by simply bumping the shift lever toward neutral while accelerating.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

If there are no possible causes remaining, view repair.

Repair

This DTC can be set by putting too much forward pressure on the shift lever while it is in the OD position. Make sure the customer is informed.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P1736-GEAR RATIO ERROR IN 2ND PRIME

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

Possible Causes
RELATED DTC'S PRESENT
INPUT SPEED SENSOR OR WIRING
LOW FLUID LEVEL
CRACKEC OR MISINSTALLED PRIMARY OIL FILTER OR SEAL
WORN SOLENOID SWITCH VALVE OR PLUGS
STUCK OR STICKING MAIN REGULATOR VALVE
BURNED UD OR 4C CLUTCH
CUT 4C OR UD PISTON SEAL
BROKEN 4C PISTON CASTING
BROKEN OR MISSING 4C BLEED ORIFICE
BROKEN OR MISSING UD BLEED ORIFICE
CUT 4C OR UD ACCUMULATOR PISTON SEAL
CRACKED 4C OR UD ACCUMULATOR PISTON
EXTRA CHECK BALL IN PASSAGE DOWNSTREAM OF #7 CHECK BALL POCKET
TRANSMISSION SOLENOID/TRS ASSEMBLY
BROKEN WELD - REACTION CARRIER TO REVERSE SUN GEAR
MISSING TEETH ON INPUT CLUTCH HUB TONE WHEEL

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding in-gear trouble code is set (DTCs P0731–36).

2) An excessive change in input or output speeds indicating signal intermittent which may result in the DTCs P0715 and/or P0720 to set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the signal from the input speed sensor at idle in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set when at a stop.

P1736-GEAR RATIO ERROR IN 2ND PRIME (CONTINUED)

Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

Are any Transmission: solenoid, line pressure, speed sensor, or loss of prime DTC's present?

Yes >> Refer to appropriate symptom in the Transmission category. Perform the test for P0944–LOSS OF PRIME first if it is present.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK EATX DTC EVENT DATA

With the scan tool, read and record the EATX DTC EVENT DATA.

NOTE: Make sure to record all EATX DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the EATX DTC EVENT DATA display information for the DTC P1736?

Yes >> Go To 3

No >> Go To 6

---

3. CHECK RPM IN EATX DTC EVENT DATA

Refer to the EATX DTC EVENT DATA recorded earlier.

Does the Input RPM read zero?

Yes >> Check the input speed sensor and wiring. Refer to test P0715 and diagnose as if the DTC is current. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. CHECK LINE PRESSURE READING

Refer to the EATX DTC EVENT DATA recorded earlier.

Is the line pressure reading more than 10 psi below the desired line pressure?

Yes >> Go To 5

No >> Go To 6

P1736-GEAR RATIO ERROR IN 2ND PRIME (CONTINUED)

5. PLUGGED TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

NOTE: Make sure the Primary Transmission Oil Filter and/or seal is not cracked or split.

Does the Oil Pan contain excessive debris and/or is the Primary Oil Filter cracked or plugged?

Yes >> Repair the plugged, cracked, or split Primary Transmission Oil Filter and/or seal. If the Primary Transmission Oil Filter is plugged, refer to the Service Information for the proper hydraulic clutch repair procedure.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Remove the Transmission Oil Pump per the Service Information. Check the main Regulator Valve for sticking in its bore, scoring, and/or damage and clean and repair as necessary. If no problem is found, replace the Transmission Solenoid/TRS Assembly.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

6. CHECK TO SEE IF DTC P1736 IS CURRENT

With the scan tool, perform the 2nd Prime Gear Clutch Test. Follow the instructions on the scan tool.

Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

NOTE: If the 4C clutch is faulty, the overrunning clutch will hold and the slip test will pass. The 2nd prime gear clutch test will not detect a faulty 4C clutch. However, it will detect a faulty UD clutch.

Did the clutch test pass, did the Input Speed remain at zero?

Yes >> Go To 7

No >> Go To 9

---

7. CHECK FOR INTERMITTENT OPERATION

Check the Shifter adjustment per the Service Information.

Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333.

Were there any problems found?

Yes >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 8

---

8. CHECK FOR SLIPPAGE

With the scan tool, erase Transmission DTCs.

Road test the vehicle.

Durning the road test, operate in 4th gear, and perform kickdown shifts from 4th to 2nd (prime) gear.

Is there an obvious slippage noticed in 4th or 2nd prime gears, or runaway on the 4-2 shift?

Yes >> Go To 11

No >> Go To 14

P1736-GEAR RATIO ERROR IN 2ND PRIME (CONTINUED)

9. UD CLUTCH HYDRAULIC CIRCUIT

Remove Transmission Oil Pan and check for excessive debris.

Remove the Valve Body and air check the UD clutch hydraulic circuit (in the case) per the Service Information.

NOTE: The UD clutch passage contains a small bleed orifice, a small amount of air leakage is normal.

Were there any problems found, excessive debris and/or excessive air leakage in the UD clutch hydraulic circuit?

Yes >> Repair as necessary. Check the UD clutch piston seals and the dribbler assembly, reaction shaft support seal rings, and the flatness of the pump valve body and pump housing faces. Check main regulator valve for sticking in the bore.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 10

---

10. UD ACCUMULATOR PISTON

Check the UD bleed orifice, accumulator piston, and accumulator piston seal in the main valve body.

Were there any problems found?

Yes >> Repair as necessary. Refer to the Service Information for proper repair procedures.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

11. EXCESSIVE DEBRIS

Remove the Transmission Oil Pan and check for excessive debris.

If grey sludge is present, check for a improperly assembled 4C clutch with the thick reaction plate not against the case.

Remove the valve body and air check the 4C clutch hydraulic circuit per the Service Information.

NOTE: The 4C clutch passage contains a small bleed orifice, a small amount of air leakage is normal.

Were there any problems found, excessive debris, improperly assembled 4C clutch and/or excessive air leakage in the 4C clutch hydraulic circuit?

Yes >> Repair as necessary. Refer to the Service Information for proper repair procedures. Note: Check the 4C piston seals and bleed orifice.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 12

---

12. 4C ACCUMULATOR

Check the 4C Accumulator piston for cracks or a cut seal.

Check for a cut or missing #7 or #5 check balls.

Check the Solenoid Switch Valve and its plugs for sticking in its bore or excessive wear.

Were there any problems found

Yes >> Repair as necessary. Refer to the Service Information for proper repair procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 13

P1736-GEAR RATIO ERROR IN 2ND PRIME (CONTINUED)

13. CHECK FOR BROKEN REVERSE SUN GEAR WELD

Working through the windows in the bottom of the case, check for a broken Reverse Sun gear weld to the reaction carrier as follows:

(1) Hold the Transmission Output Shaft by holding the Transmission Manual Lever in the park position.

(2) Rotate the Input Annulus gear and drive shell, (the drum that encloses the two rearmost carriers).

(3) Check to see if the reaction carrier (the frontmost carrier, whose outer shell is splined to the 4C clutch) is rotating faster than the drive shell is being turned.

Is the reaction carrier turning faster than the drive shell?

Yes >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the reaction carrier per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

14. CHECK IF DTC RESET

Did the DTC P1736 reset during the road test?

Yes >> Go To 15

No >> Go To 16

---

15. LIST OF POSSIBLE CAUSES

If any other DTC's set during the road test, refer to the appropriate symptom in the Transmission category.

If no other DTC's set during the road test, below is a list of possible causes, but not strictly limited to those:

Check for excessive debris in the Transmission Oil pan, plugged, cracked, or split Primary Transmission Oil Filter and/or seal.

Check for cuts or missing #7 and #5 check balls in the main valve body.

Check the 4C and UD accumulator pistons and seals, UD bleed orifice, and the Solenoid Switch Valve and Plugs in the main valve body.

Check the UD clutch piston seals, reaction shaft support seal rings, and the flatness of the pump valve body and pump housing faces.

Check the 4C clutch piston seals, and bleed orifice.

Check the UD clutch piston seals, reaction shaft support seal rings, and dribbler assemblies, and the flatness of the pump valve body and pump housing faces.

View repair

Repair

Repair as necessary. Refer to the Service Information for proper repair procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P1736-GEAR RATIO ERROR IN 2ND PRIME (CONTINUED)

16. INTERMITTENT DTC

The conditions necessary to set this DTC are not present at this time.

Use the EATX DTC EVENT DATA to help identify the conditions and/or possible causes that may have caused the DTC to set.

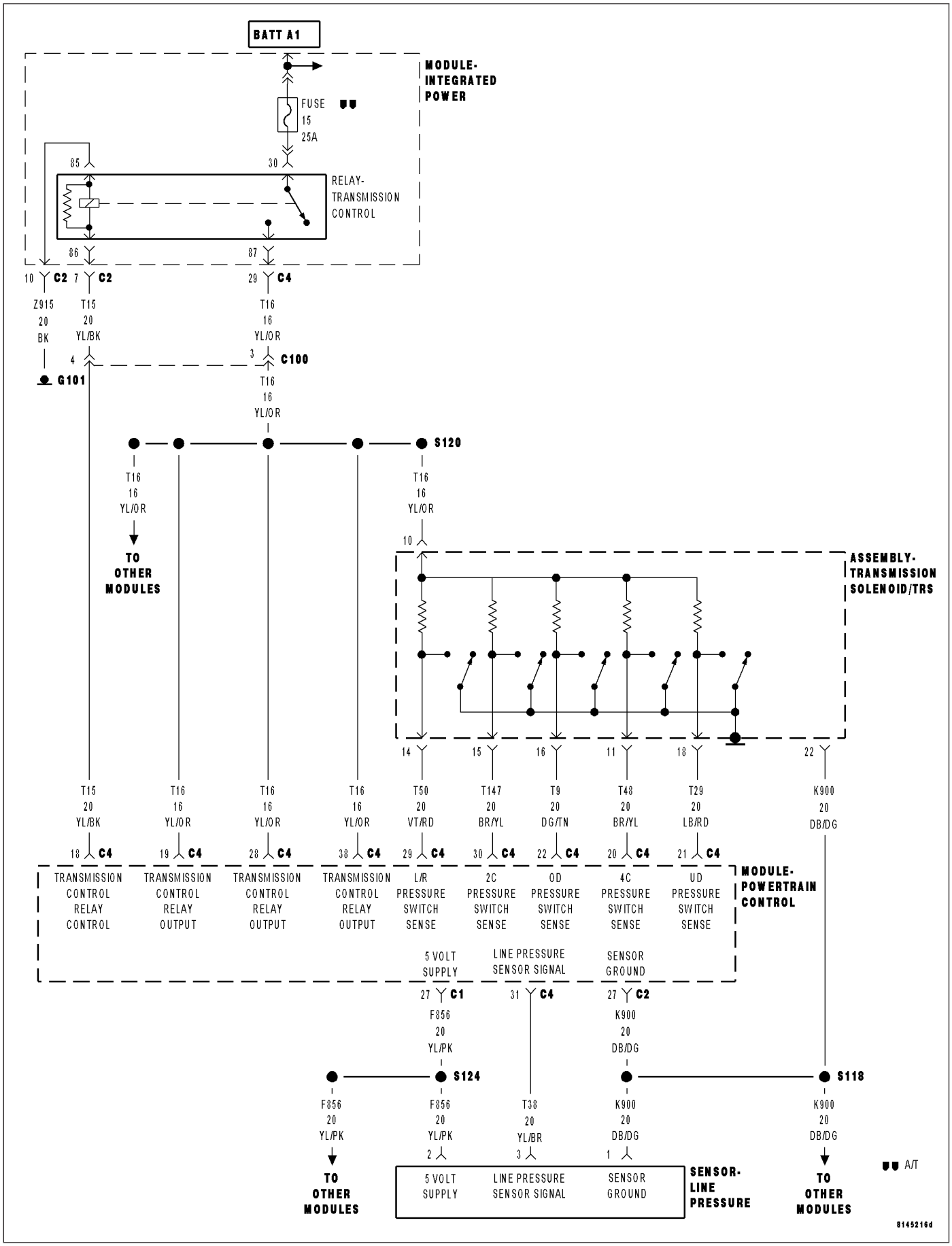
Check for any Service Information Tune-ups or Technical Service Bulletins that may apply.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION



P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During an attempted shift into 1st gear.
- **Set Condition:**
  This DTC is set if three unsuccessful attempts are made to shift the Solenoid Switch Valve (SSV) into the downshifted position in one given ignition start. This DTC can take up to five minutes to mature before illuminating the MIL.

Possible Causes
RELATED DTC P0841 PRESENT
SOLENOID SWITCH VALVE STICKING
LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Solenoid Switch Valve (SSV) controls the direction of the transmission fluid when the L/R Solenoid is energized. The SSV will be in the downshifted position in 1st gear, thus directing the fluid to the L/R clutch circuit. In 2nd through 5th gears, it will be in the upshifted position and directing the fluid into the torque converter clutch (TCC).

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R Pressure Switch is monitored to confirm SSV movement. If movement is not confirmed (the L/R pressure switch does not close), EMCC is inhibited until SSV operation is confirmed.

Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

Is the DTC P0841 present also?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF DTC P1775 IS CURRENT

Perform a visual inspection of all connectors, wiring, and cooler connections before proceeding. Repair as necessary.

With the scan tool, Check the STARTS SINCE SET counter.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter for P1775 at 2 or less?

Yes >> Go To 3

No >> Go To 6

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION (CONTINUED)

3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to L/R.

With the scan tool, monitor the L/R Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the state of the L/R Pressure Switch change while pressing the Pressure Switch Test button?

Yes >> Go To 4

No >> Go To 5

---

4. SOLENOID SWITCH VALVE STICKING

Turn the ignition off to the lock position.

Remove the Transmission Oil Pan per the Service Information.

Remove the Transmission Valve body per the Service Information.

Inspect the Solenoid Switch Valve and Plugs for sticking.

Is the Solenoid Switch Valve or Plugs sticking?

Yes >> Clean and inspect per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION (CONTINUED)

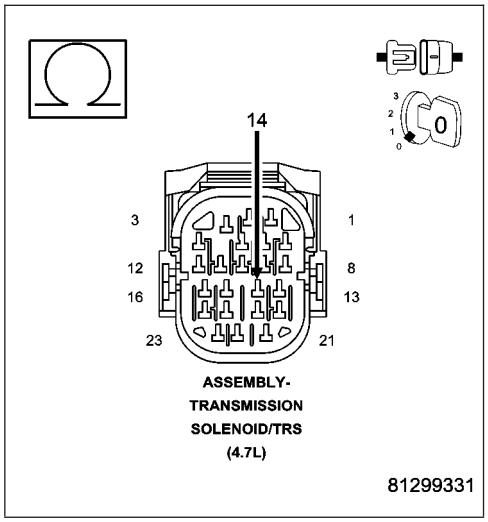
5. LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS

Turn the ignition off to the lock position.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

Disconnect all PCM harness connectors.

Measure the resistance between the (T50) L/R Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T50) L/R Pressure Switch Sense circuit and all other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to other circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

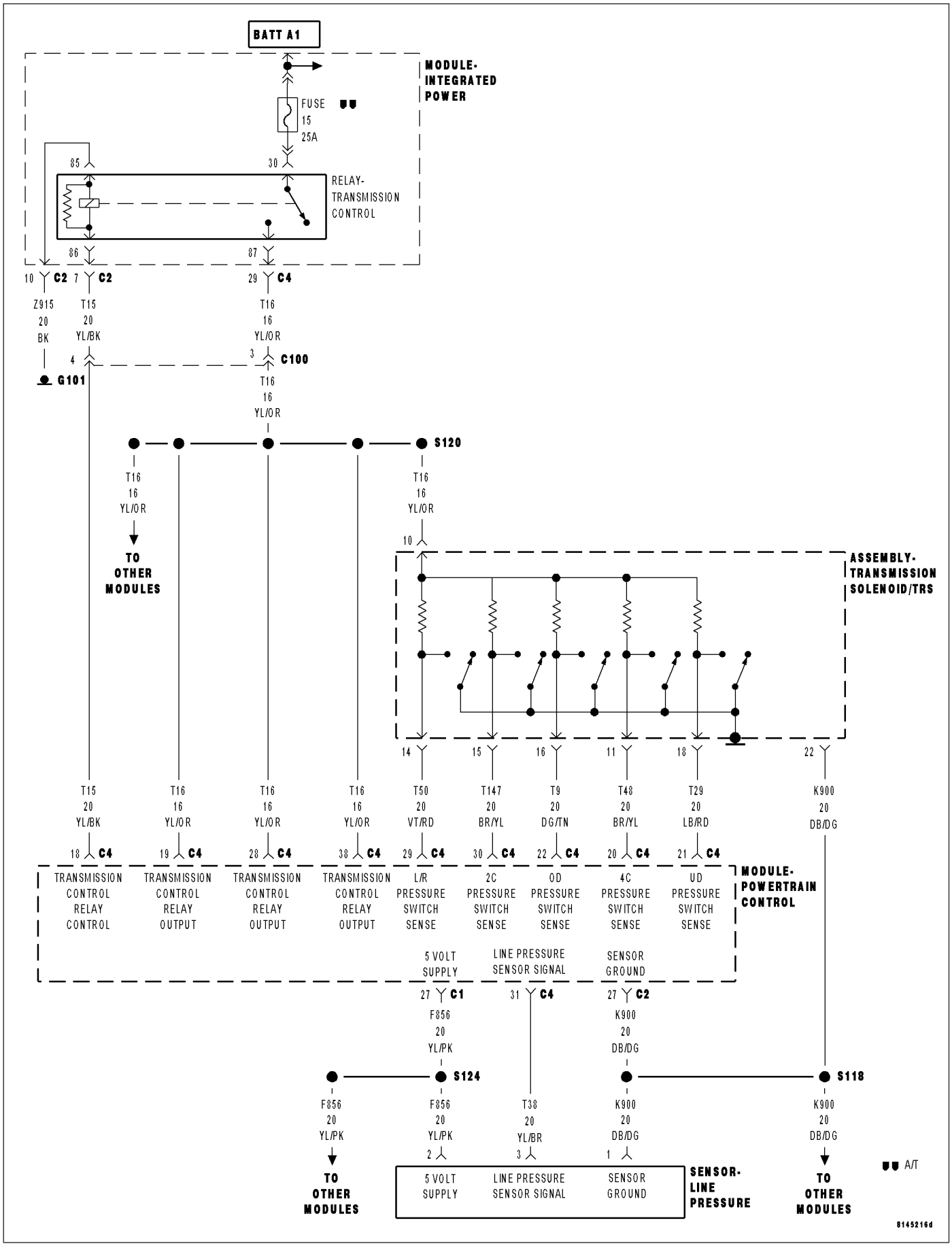
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION



P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously when performing partial or full EMCC - PEMCC or FEMCC.
- **Set Condition:**
  If the transmission senses the L/R pressure switch closing while performing PEMCC or FEMCC. This DTC will set after two unsuccessful attempts to perform PEMCC or FEMCC. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
RELATED DTC P0841 PRESENT
LR PRESSURE SWITCH SENSE CIRCUIT OPEN
LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
SOLENOID SWITCH VALVE
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Solenoid Switch Valve (SSV) controls the direction of the transmission fluid when the L/R Solenoid is energized. The SSV will be in the downshifted position in 1st gear, thus directing the fluid to the L/R clutch circuit. In 2nd through 5th gears, it will be in the upshifted position and directing the fluid into the torque converter clutch (TCC).

When in 2nd, 2nd Prime, 3rd, 4th, or 5th gear, the Torque Converter Clutch (TCC) can be engaged when certain conditions are met. The TCC piston is electronically modulated by increasing the duty cycle of the L/R solenoid until the torque converter slip difference (difference between engine and transmission input speed) is within 60 RPM. Then the L/R solenoid is fully energized (FEMCC / 100% duty cycle). Torque converter slip is monitored in FEMCC to ensure adequate clutch capacity.

Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

Is the DTC P0841 present also?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK TO SEE IF DTC P1776 IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter.

NOTE: NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes >> Go To 3

No >> Go To 7

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION (CONTINUED)

3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to the LR position.

With the scan tool, monitor the LR Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the state of the LR Pressure Switch change while pressing the Pressure Switch Test button?

Yes >> Go To 4

No >> Go To 5

---

4. SOLENOID SWITCH VALVE

Remove the Valve Body per the Service Information.

Inspect the Solenoid Switch Valve and plugs for sticking in the bore and/or wear.

Were there any problems found?

Yes >> Clean and repair as necessary per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 7

---

5. LR PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

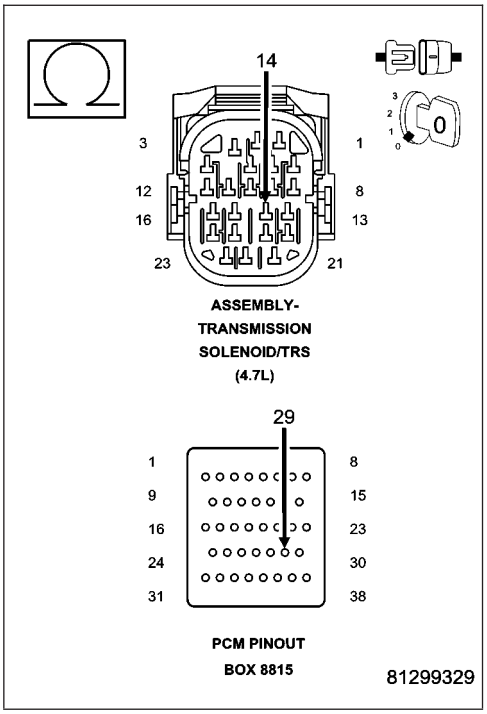
Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

NOTE: Note: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T50) LR Pressure Switch Sense circuit between the appropriate terminal of Miller tool #8815 to the Solenoid/ TRS Assembly harness connector.



Is the resistance above 5.0 ohms?

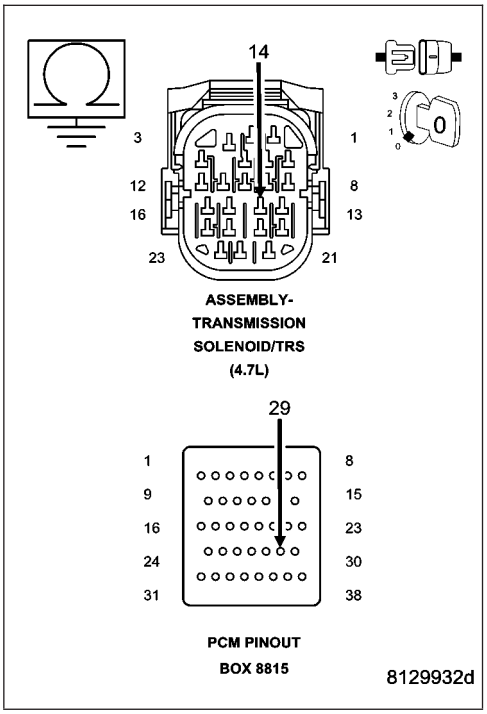
Yes >> Repair the (T50) LR Pressure Switch Sense circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION (CONTINUED)

6. (T50) LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T50) LR Pressure Switch Sense circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T50) LR Pressure Switch Sense circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

This DTC can also be set by the Solenoid Switch Valve intermittently sticking in it's bore under extreme temperature conditions, or by a worn Solenid Switch Valve or plugs.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P1790-FAULT IMMEDIATELY AFTER SHIFT

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  After a speed ratio error is stored.
- **Set Condition:**
  This DTC is set if the associated speed ratio DTC is stored within 1.3 seconds after a shift.

Possible Causes
FAULT AFTER SHIFT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

This DTC will only be stored along with a gear ratio DTC. If this DTC is set, it indicates a probable hydraulic (line pressure) or mechanical problem exists. Diagnosing the transmission should be based on the associated speed ratio DTC and mechanical causes should be considered first.

INTENDED GEAR	CLUTCHES APPLYING	RECOMENDED DTC
REVERSE	UD** - MS	P0738
1ST	UD - LR*	P0731
2ND	UD - 2C	P0732
2ND PRIME	UD - 4C	P1736
3RD	UD - OD/MS	P0733
4TH	OD/MS - 2C	P0734
5TH	OD/MS - 2C	P0735

* L/R is used only up to 150 output RPM in 1st gear. ** UD will show as applied in Reverse but the UD clutch is actually released. OD/MS is OD and/or MS.

Diagnostic Test

1. INTENDED GEAR TO APPLIED CLUTCH

With the scan tool, check the EATX DTC EVENT DATA to determine in which gear the slippage occurred and the clutches that were applied.

With the EATX DTC EVENT DATA, use the information provided above to determine the proper symptom for diagnosis.

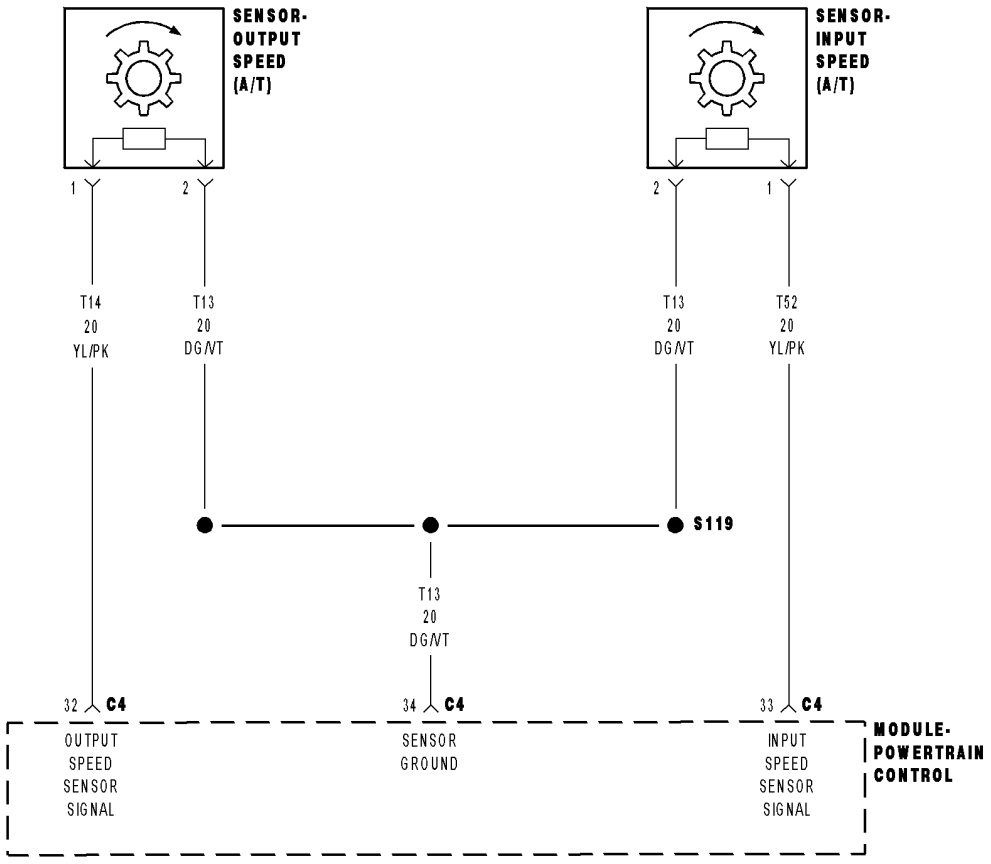
View repair

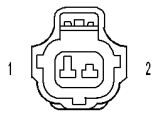
Repair

Refer to the Transmission category and perform the appropriate symptom identified from the EATX DTC EVENT DATA, intended gear, and applied clutches.

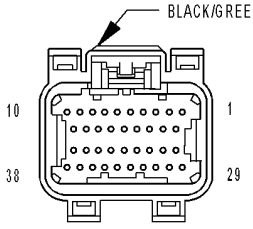
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

P1794-SPEED SENSOR GROUND ERROR

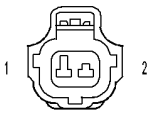




SENSOR-
INPUT
SPEED
(A/T)



MODULE-
POWERTRAIN
CONTROL C4
(545RFE)



SENSOR-
OUTPUT
SPEED
(A/T)

8145212a

P1794-SPEED SENSOR GROUND ERROR (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  The gear ratio is monitored continuously while the Transmission is in gear.
- **Set Condition:**
  After a controller reset in neutral and a ratio of input to output, of 1 to 2. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
(T13) SPEED SENSOR GROUND CIRCUIT OPEN
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding in-gear trouble code is set (DTCs P0731–36).

2) An excessive change in input or output speeds indicating signal intermittent which may result in the DTCs P0715 and/or P0720 to set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the signal from the input speed sensor at idle in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set when at a stop.

Diagnostic Test

1. CHECK TO SEE IF DTC P1794 IS CURRENT

Engine Running, Shift lever in park.

With the scan tool, read the Transmission Output and Input Speed Sensor states.

Is the Output Speed Sensor reading twice the Input Speed Sensor reading?

Yes >> Go To 2

No >> Go To 6

P1794-SPEED SENSOR GROUND ERROR (CONTINUED)

2. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install the Transmission Simulator, Miller tool 8333.

NOTE: Check connectors - Clean/repair as necessary.

With the Transmission Simulator, set the Input/Output Speed selector switch to the ″3000/1000″ position. Turn the Input/Output Speed switch to ″ON″.

Ignition on, engine not running.

With the scan tool, monitor the Input and Output Speed Sensor state.

Does the Input speed read 3000 RPM and the Output speed read 1000 RPM, within 50 RPM?

Yes >> Go To 6

No >> Go To 3

---

3. (T13) SPEED SENSOR GROUND CIRCUIT OPEN

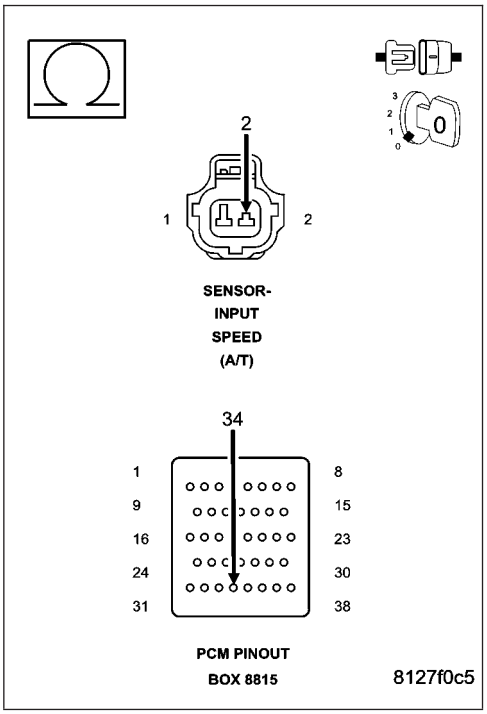
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

Disconnect the Transmission Simulator, Miller tool #8333.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T13) Speed Sensor Ground circuit from the appropriate terminal of Miller tool #8815 to the Transmission Solenoid/TRS Assembly and both Input and Output Speed Sensor harness connectors.



Is the resistance above 5.0 ohms on any of the above measurements?

Yes >> Repair the (T13) Speed Sensor Ground circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

P1794-SPEED SENSOR GROUND ERROR (CONTINUED)

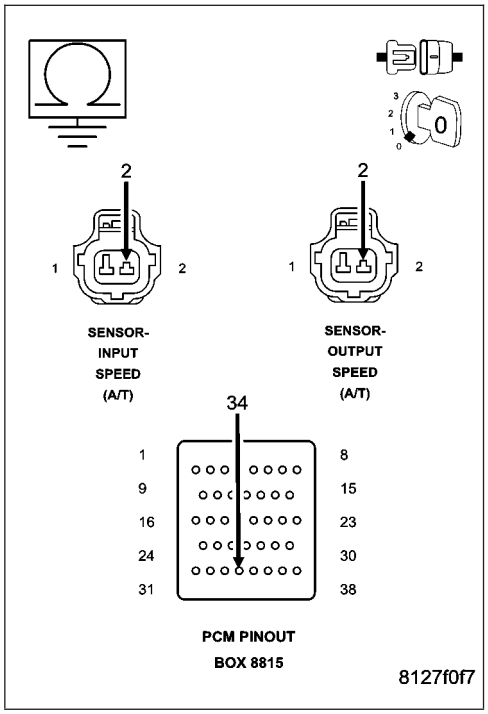
4. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T13) Speed Sensor Ground circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T13) Speed Sensor Ground circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5



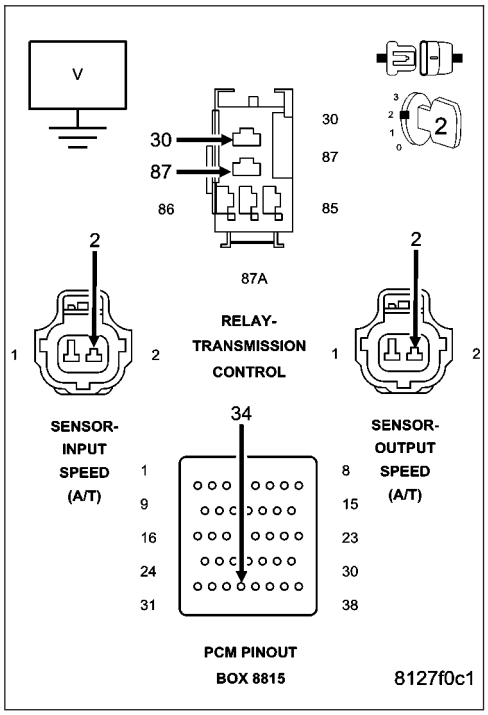
5. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE

Ignition on, engine not running.
Measure the voltage of the (T13) Speed Sensor Ground circuit.

Is the voltage above 0.5 volt?

Yes >> Repair the (T13) Speed Sensor Ground circuit for a short to voltage.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.



P1794-SPEED SENSOR GROUND ERROR (CONTINUED)

6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P2700-INADEQUATE ELEMENT VOLUME LR

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running. The L/R clutch volume index (CVI) is updated during a 3-1 or 2-1 manual downshift with throttle angle below 5 degrees. Transmission temperature must be at least 43° C (110° F).
- **Set Condition:**
  When the L/R clutch volume index (CVI) falls below 16.

Possible Causes
HYDRAULIC LEAK IN THE VALVE BODY
BROKEN L/R CLUTCH PISTON RETURN SPRING OR SPRING RETAINERS
BROKEN L/R ACCUMULATOR SPRING(S)
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTC's, which indicates an internal transmission problem.

Diagnostic Test

1. OTHER DTCS PRESENT

With the scan tool, check for other transmission DTCs.

Are there any Pressure Switch Sense circuit DTCs present also?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK L/R CLUTCH VOLUME INDEX

With the scan tool, erase DTCs.

Start the engine and warm the transmission.

NOTE: The TRANS TEMP LEG must be at least 43° C or 110° F before performing the following steps.
Drive the vehicle and perform at least ten 3-1 manual downshifts at closed throttle from speeds of about 32 Kmh or 20 MPH.

With the scan tool, read the LR CL VOL INDEX.

Is the LR CL VOL INDEX below 20?

Yes >> Go To 3

No >> Go To 5

P2700-INADEQUATE ELEMENT VOLUME LR (CONTINUED)

3. L/R CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan per the Service Information.

Remove the valve body per the Service Information.

Check condition of the L/R accumulator springs.

Look for possible leak paths into the L/R clutch hydraulics circuit within the valve body.

Were any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. AIR CHECK L/R CLUTCH CIRCUITS

Perform an air check on the L/R Clutch circuit per the Service Information.

Watch and listen for L/R Clutch piston movement.

Does the L/R piston stroke and return properly?

Yes >> Replace the Transmission/TRS Solenoid Assembly per the service information. With the scan tool, perform Quick Learn.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Repair internal transmission as necessary. Pay attention to the components related to the L/R clutch. A broken or weak L/R clutch return spring, Accumulator Spring, and/or dislocated snap ring could cause this problem.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

5. VERIFY PCM OPERATION

NOTE: The TRANS TEMP LEG must be at least 43° C or 110° F before performing the following steps.

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 km/h or 50 MPH, then brake lightly to a stop. Turn off engine.

With the scan tool, record the CL VOL INDEX (CVI) for all clutches

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVI's and compare them to the readings recorded before the BATTERY DISCONNECT.

Are any of the CVI's less than 5 or different than before the BATTERY DISCONNECT?

Yes >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P2701-INADEQUATE ELEMENT VOLUME 2C

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running. The 2C clutch volume index (CVI) is updated during a 3-2 kickdown with throttle angle between 10 and 54 degrees. Transmission temperature must be at least 43° C (110° F).
- **Set Condition:**
  When the 2C CVI falls below 5.

Possible Causes
HYDRAULIC LEAK IN THE VALVE BODY
BROKEN 2C CLUTCH PISTON RETURN SPRING / DISLODGED SNAP RING
BROKEN ACCUMULATOR SPRING(S)
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTC's, which indicates an internal transmission problem.

Diagnostic Test

1. OTHER DTCS PRESENT

With the scan tool, check for other transmission DTCs.

Are there any Pressure Switch Sense circuit DTCs present also?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK 2C CLUTCH VOLUME INDEX

With the scan tool, erase Transmission DTCs.

Drive the vehicle at about 80 Kmh or 50 MPH, then depress the OD off button. This will put the vehicle into third gear.

NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.
Perform at least ten 3-2 kickdowns by depressing the throttle between 10 and 54 TPS DEGREES at speeds of about 80 Kmh or 50 MPH.

With the scan tool, read the 2C CL VOL INDEX.

Is the 2C CL VOL INDEX below 10?

Yes >> Go To 3

No >> Go To 5

P2701-INADEQUATE ELEMENT VOLUME 2C (CONTINUED)

3. 2C CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan per the Service Information.

Remove the valve body per the service information.

Check condition of the 2C accumulator springs.

Look for possible leak paths into the 2C clutch hydraulics circuit within the valve body.

Were any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. AIR CHECK 2C CLUTCH CIRCUIT

Turn the ignition off to the lock position.

Perform an air check on the 2C Clutch circuit per the Service Information.

Watch and listen for 2C Clutch piston movement.

Dose the piston stroke and return properly?

Yes >> Replace the Transmission/TRS Solenoid Assembly per the service information. With the scan tool, perform Quick Learn.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Repair internal transmission as necessary. Pay attention to the components related to the 2C clutch. A broken or dislodged 2C return spring, snap ring or broken 2C Accumulator Spring could cause this problem.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

5. VERIFY PCM OPERATION

NOTE: NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 Kmh or 50 MPH, then brake lightly to a stop. Turn off engine.

With the scan tool, record the CL VOL INDEX (CVI) for all clutches

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVI's and compare them to the readings recorded before the BATTERY DISCONNECT.

Are any of the CVI's less than 5 or different than before the BATTERY DISCONNECT?

Yes >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P2702-INADEQUATE ELEMENT VOLUME OD

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running. The OD clutch volume index (CVI) is updated during a 2-3 upshift with throttle angle between 10 and 54 degrees. Transmission temperature must be at least 43° C (110° F).
- **Set Condition:**
  When the OD CVI falls below 5.

Possible Causes
HYDRAULIC LEAK IN THE VALVE BODY
BROKEN OD ACCUMULATOR SPRING
BROKEN OD/REV PISTON BELLEVILLE SPRING OR DISLODGED SNAP RING
INTERNAL LEAKAGE IN PUMP ASSEMBLY
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTC's, which indicates an internal transmission problem.

Diagnostic Test

1. OTHER DTCS PRESENT

With the scan tool, check for other transmission DTCs.

Are there any Pressure Switch Sense circuit DTCs present also?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK THE OD CLUTCH VOLUME INDEX

With the scan tool, erase DTCs.

NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.
Drive the vehicle and perform at least ten 2-3 upshifts with the TPS degree between 10 and 54.
With the scan tool, read the OD CL VOL INDEX.

Is the OD CL VOL INDEX below 10?

Yes >> Go To 3

No >> Go To 5

P2702-INADEQUATE ELEMENT VOLUME OD (CONTINUED)

3. OD CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan per the Service Information.

Remove the valve body per the service information.

Check condition of the OD accumulator springs.

Look for possible leak paths into the OD clutch hydraulics circuit within the valve body.

Were any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. AIR CHECK OD CLUTCH CIRCUIT

Perform an air check on the OD Clutch circuit per the Service Information.

Watch and listen for OD Clutch piston movement.

Air check all other pump passages and watch for air leakage into the OD clutch passage.

NOTE: There is a bleed orifice between the OD and Reverse Clutch passages, so a small amount of air leakage from Reverse to OD is normal.

Were any problems found?

Yes >> Repair internal transmission. Pay attention to the OD Clutch. Broken or weak return spring or a dislocated snap ring could cause this problem. If no problems were found in the OD clutch, or if leakage into the OD passage was noted, replace Pump Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information. With the scan tool, perform Quick Learn.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

5. VERIFY PCM OPERATION

NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 Kmh or 50 MPH, then brake lightly to a stop. Turn off engine.

With the scan tool, record the CL VOL INDEX (CVI) for all clutches.

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVI's and compare them to the readings recorded before the BATTERY DISCONNECT.

Are any of the CVI's less than 5 or different than before the BATTERY DISCONNECT?

Yes >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P2703- INADEQUATE ELEMENT VOLUME UD

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running. The UD clutch volume index (CVI) is updated during a 4-3 kickdown with throttle angle between 10 and 54 degrees. Transmission temperature must be at least 43° C (110° F).
- **Set Condition:**
  When the UD CVI falls below 11.

Possible Causes
BROKEN UD ACCUMULATOR SPRING(S)
BROKEN UD CLUTCH PISTON SPRING OR DISLODGED SNAP RING
INTERNAL LEAKAGE IN PUMP OR VALVE BODY ASSEMBLIES
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTC's, which indicates an internal transmission problem.

Diagnostic Test

1. OTHER DTCS PRESENT

With the scan tool, check for other transmission DTCs.

Are there any Pressure Switch Sense circuit DTCs present also?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. CHECK UD CLUTCH VOLUME INDEX

With the scan tool, erase Transmission DTCs.

NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.
Drive the vehicle and perform at least ten 4-3 kickdowns by depressing the throttle between 30 and 54 TPS degrees at speeds about 80 Kmh or 50 MPH.

With the scan tool, read the UD clutch volume index (CVI).

Is the UD CVI below 10?

Yes >> Go To 3

No >> Go To 5

P2703- INADEQUATE ELEMENT VOLUME UD (CONTINUED)

3. UD CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan and valve body per the Service Information.

Check the condition of the UD accumulator springs.

Look for possible leak paths into the UD clutch hydraulics circuit within the valve body.

Were there any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. AIR CHECK UD CLUTCH CIRCUIT

Perform an air check on the UD Clutch circuit per the Service Information.

Watch and listen for UD Clutch piston movement.

Air check all other pump passages for air leakage into the UD Clutch circuit.

Were any problems found?

Yes >> Repair internal transmission. Pay attention to components related to the UD clutch. Broken or weak return spring or a dislocated snap ring. If no trouble is found in UD clutch component or UD clutch leakage was noted in passage, replace the Pump Assembly.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission/TRS Solenoid Assembly per the service information. With the scan tool, perform Quick Learn.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

5. VERIFY PCM OPERATION

NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 Kmh or 50 MPH, then brake lightly to a stop. Turn off engine.

With the scan tool, record the clutch volume index (CVI) for all clutches.

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVI's and compare them to the readings recorded before the BATTERY DISCONNECT.

Are any of the CVI's less than 5 or different than before the BATTERY DISCONNECT?

Yes >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P2704-INADEQUATE ELEMENT VOLUME 4C

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running. The 4C clutch volume index (CVI) is updated during a 3-4 upshift with throttle angle between 10 and 54 degrees. Transmission temperature must be at least 43° C (110° F).
- **Set Condition:**
  When the 4C CVI falls below 5.

Possible Causes
BROKEN 4C RETURN SPRING OR DISLODGED SNAP RING
BROKEN 4C ACCUMULATOR SPRING(S)
HYDRAULIC LEAK IN THE VALVE BODY
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTC's, which indicates an internal transmission problem.

Diagnostic Test

1. CHECK THE 4C CLUTCH VOLUME

With the scan tool, record the 4C clutch volume index (CVI) and erase DTC's.

Perform at least 10, 3-4 upshifts with the throttle between 10 and 54 degrees. The Transmission temperature must be at least 43 °C or 110 °F.

With the scan tool, read the 4C CVI.

Is the current 4C CVI below 10?

Yes >> Go To 2

No >> Go To 5

---

2. DTC P0876 PRESENT

With the scan tool, read DTCs.

NOTE: The DTC P0876 must also be set with P2704 in order for this test to be valid.

Is the DTC P0876 also present?

Yes >> Replace the Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

P2704-INADEQUATE ELEMENT VOLUME 4C (CONTINUED)

3. 4C CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan per the Service Information.

Remove the valve body per the Service Information.

Check condition of the 4C accumulator springs.

Look for possible leak paths into the 4C clutch hydraulics circuit within the valve body.

Were any problems found?

Yes >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 4

---

4. AIR CHECK 4C CLUTCH CIRCUIT

Perform an air check on the 4C Clutch circuit per the Service Information.

Listen for proper 4C Clutch piston movement.

Were any problems found?

Yes >> Repair Internal transmission as necessary. Pay attention to the mechanical components related to the 4th clutch. A broken or weak return spring or a dislocated snap ring could cause this problem.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Replace the Transmission Solenoid/TRS Assembly per the service information. With the scan tool, perform Quick Learn.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

5. VERIFY PCM OPERATION

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 50 MPH, then brake lightly to a stop. Turn off engine.

With the scan tool, record Transmission CL VOL INDEX (CVI) for all clutches.

With the scan tool, perform a BATTERY DISCONNECT.

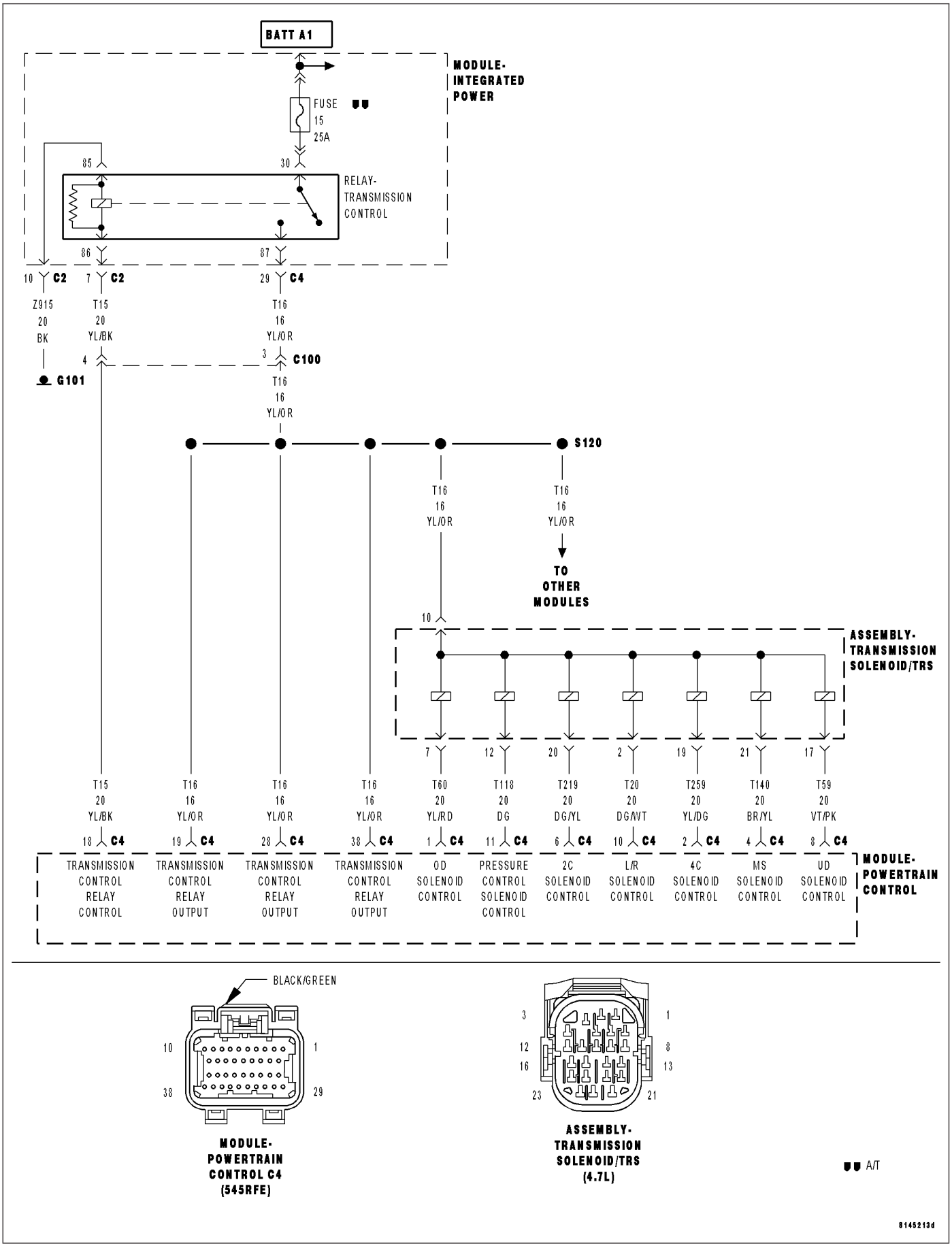
With the scan tool, read the CVI's and compare them to the reading recorded before the BATTERY DISCONNECT.

Are any of the CVI's less than 5 or are they different than before the battery disconnect?

Yes >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Test Complete.

P2706-MS SOLENOID CIRCUIT



P2706-MS SOLENOID CIRCUIT (CONTINUED)

For the Transmission circuit diagram (Refer to)(Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.
- **Set Condition:**
  After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

Possible Causes
RELATED RELAY DTC'S PRESENT
(T118) MS SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
(T118) MS SOLENOID CONTROL CIRCUIT OPEN
(T118) MS SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

Diagnostic Test

1. RELATED TRANSMISSION RELAY DTC'S PRESENT

With the scan tool, check for other transmission DTC's.

Are there any Transmission Control Relay DTC's present?

Yes >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 2

P2706-MS SOLENOID CIRCUIT (CONTINUED)

2. CHECK THE WIRING AND CONNECTORS

Turn the ignition off to the lock position.

Remove the Starter Relay.

NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.

Install Transmission Simulator, Miller tool #8333.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the scan tool, actuate the MS Solenoid.

Monitor the MS Solenoid LED on the Transmission Simulator.

Did the MS Solenoid LED on the Transmission Simulator blink on and off?

Yes >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 3

---

3. TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool, continue to actuate the MS Solenoid for the period of 2 minutes with the Transmission Simulator still connected.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P2706 reset during the actuation test?

Yes >> Go To 4

No >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

---

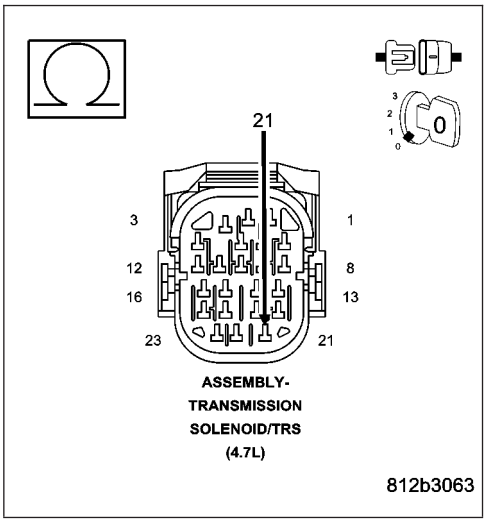
4. (T118) MS SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM harness connectors.

Measure the resistance between the (T118) MS Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.



Is the resistance below 5.0 ohms between the (T118) MS Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes >> Repair the (T118) MS Solenoid Control circuit for a short to other circuit(s).
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 5

P2706-MS SOLENOID CIRCUIT (CONTINUED)

5. (T118) MS SOLENOID CONTROL CIRCUIT OPEN

Connect Miller tool #8815 to the PCM C4 harness connector.

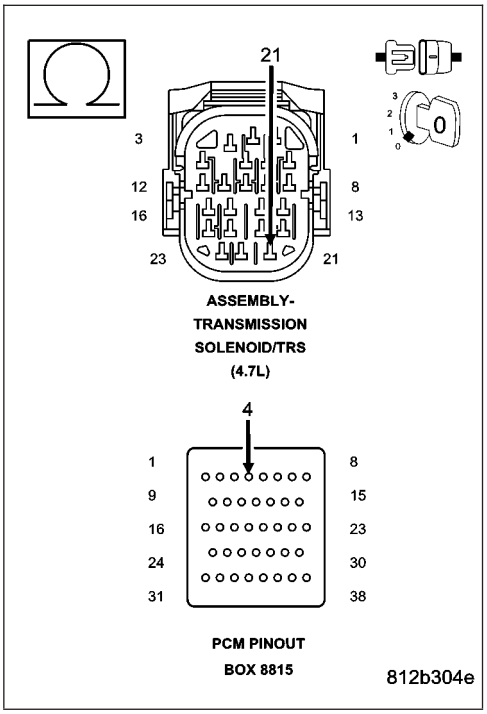
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller special tool #8815 to perform diagnosis.

Measure the resistance of the (T118) MS Solenoid Control circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T118) MS Solenoid Control circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Go To 6



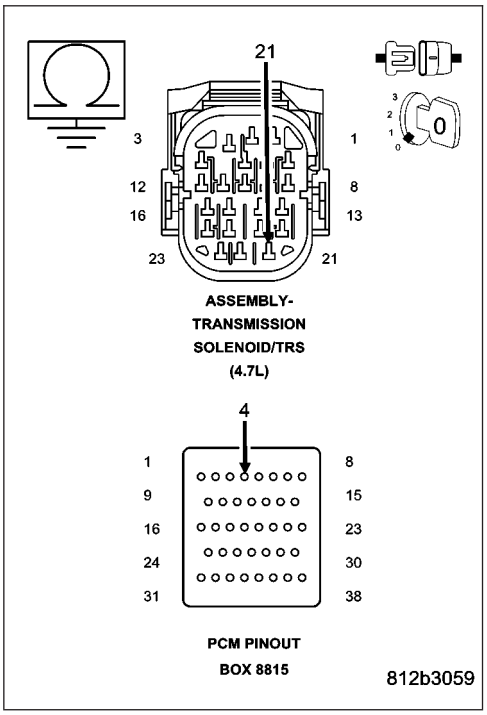
6. (T118) MS SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T118) MS Solenoid Control circuit.

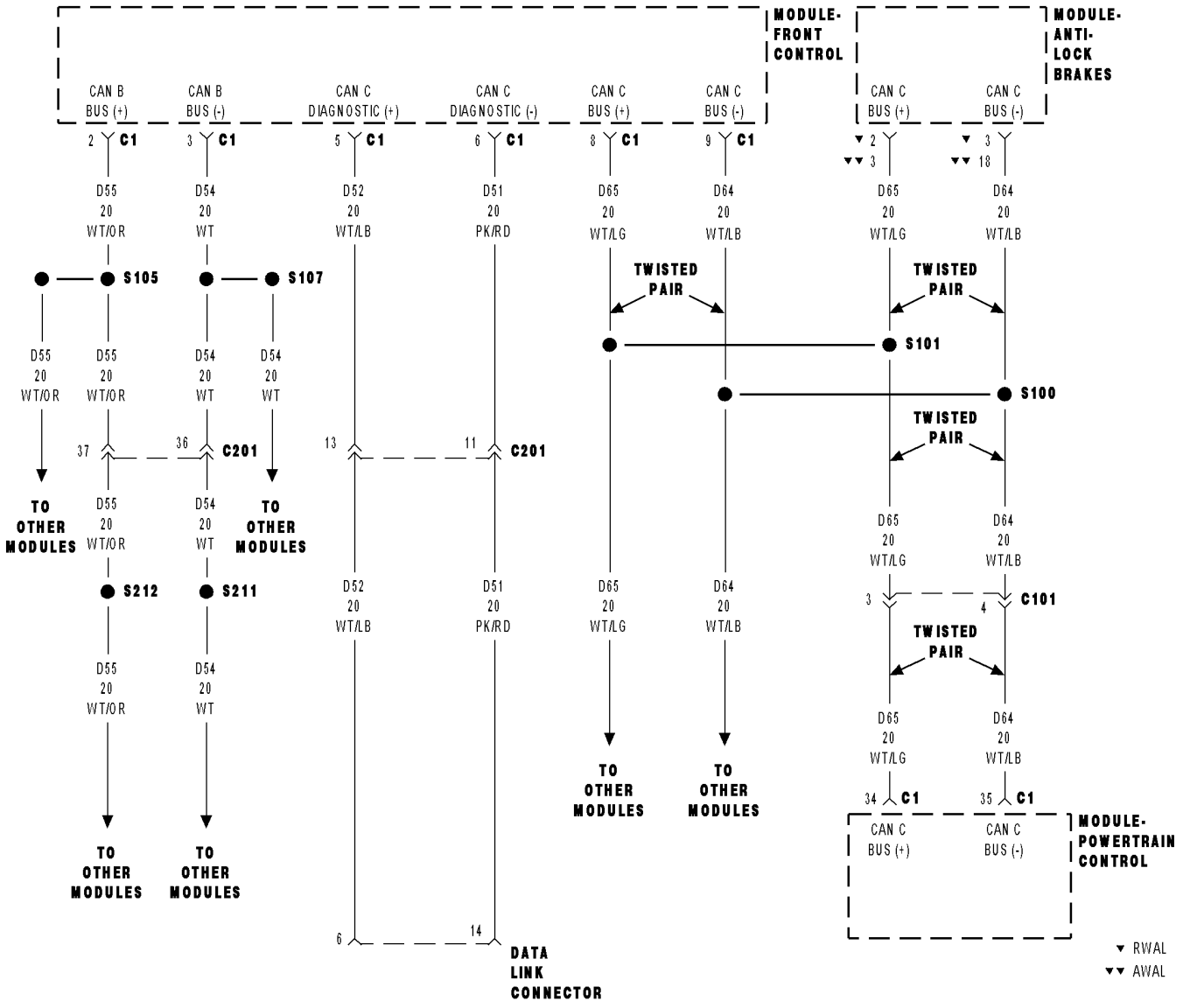
Is the resistance below 5.0 ohms?

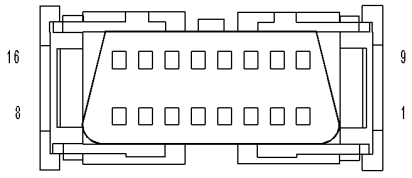
Yes >> Repair the (T118) MS Solenoid Control circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

No >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

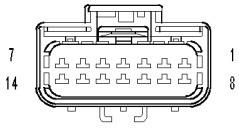


U0002 CAN C BUS OFF PERFORMANCE

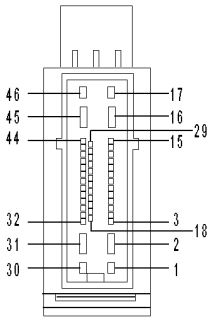




DATA
LINK
CONNECTOR



MODULE-
ANTI-
LOCK
BRAKES
(RWAL)



MODULE-
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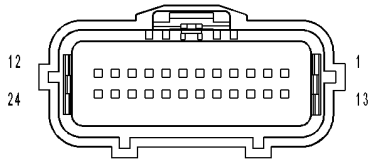
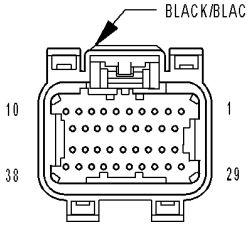
BRAKES
(AWAL)



MODULE-
FRONT
CONTROL C1



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)

814631cB

U0002 CAN C BUS OFF PERFORMANCE (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

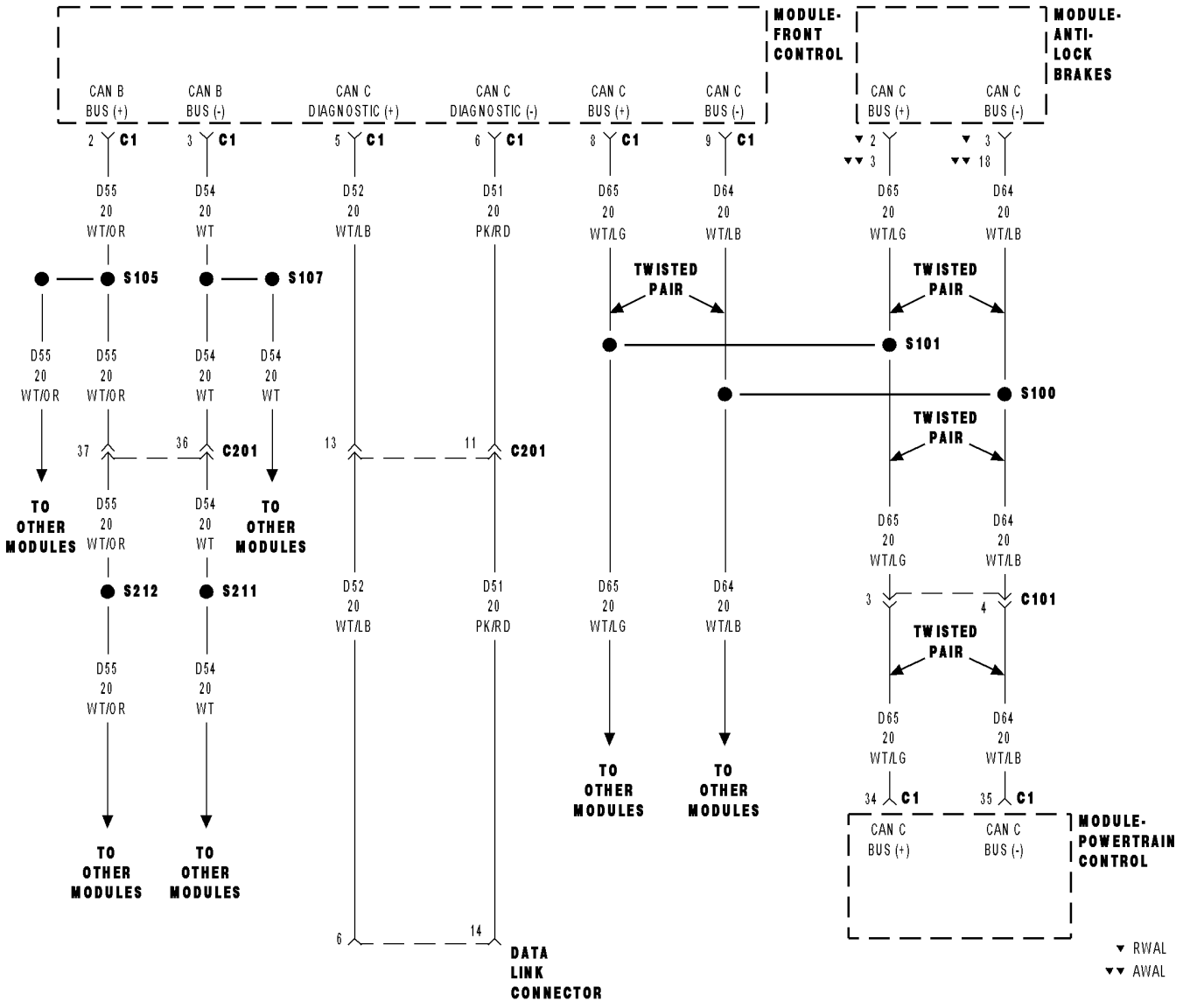
- **When Monitored:**
  Every 7 msec. Conditions: 1) Engine speed greater than 500 RPM. 2) Battery voltage greater than 10v but less than 16v.
- **Set Condition:**
  CAN C bus messages not received for 10 seconds.

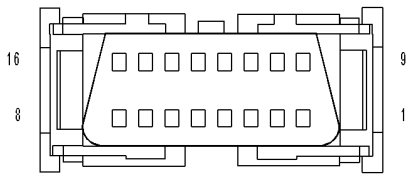
Theory of Operation

Some NGC controllers communicate with other controllers over the CAN C bus. The transmission controller continuously monitors the bus activity and receives the messages it needs. The CAN C bus is also used to communicate transmission MIL status to the Engine Controller, therefor if the Engine Controller is unable to communicate with the Transmission Controller, the Engine Controller will light the MIL.

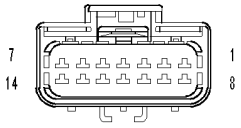
Diagnose the U0002 CAN C BUS OFF PERFORMANCE as the U0001 CAN C BUS CIRCUIT test in 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0100–NO COMMUNICATION WITH THE ECM/PCM





DATA
LINK
CONNECTOR



MODULE-
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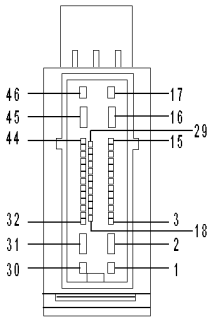
BRAKES
(RWAL)



MODULE-
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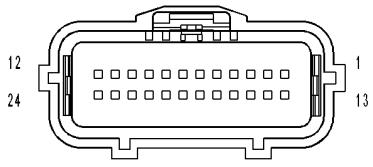
BRAKES
(AWAL)



MODULE-
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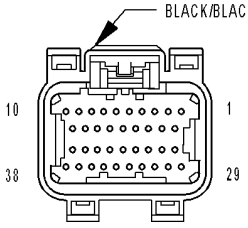
CONTROL C1



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)

814631cB

U0100–NO COMMUNICATION WITH THE ECM/PCM (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

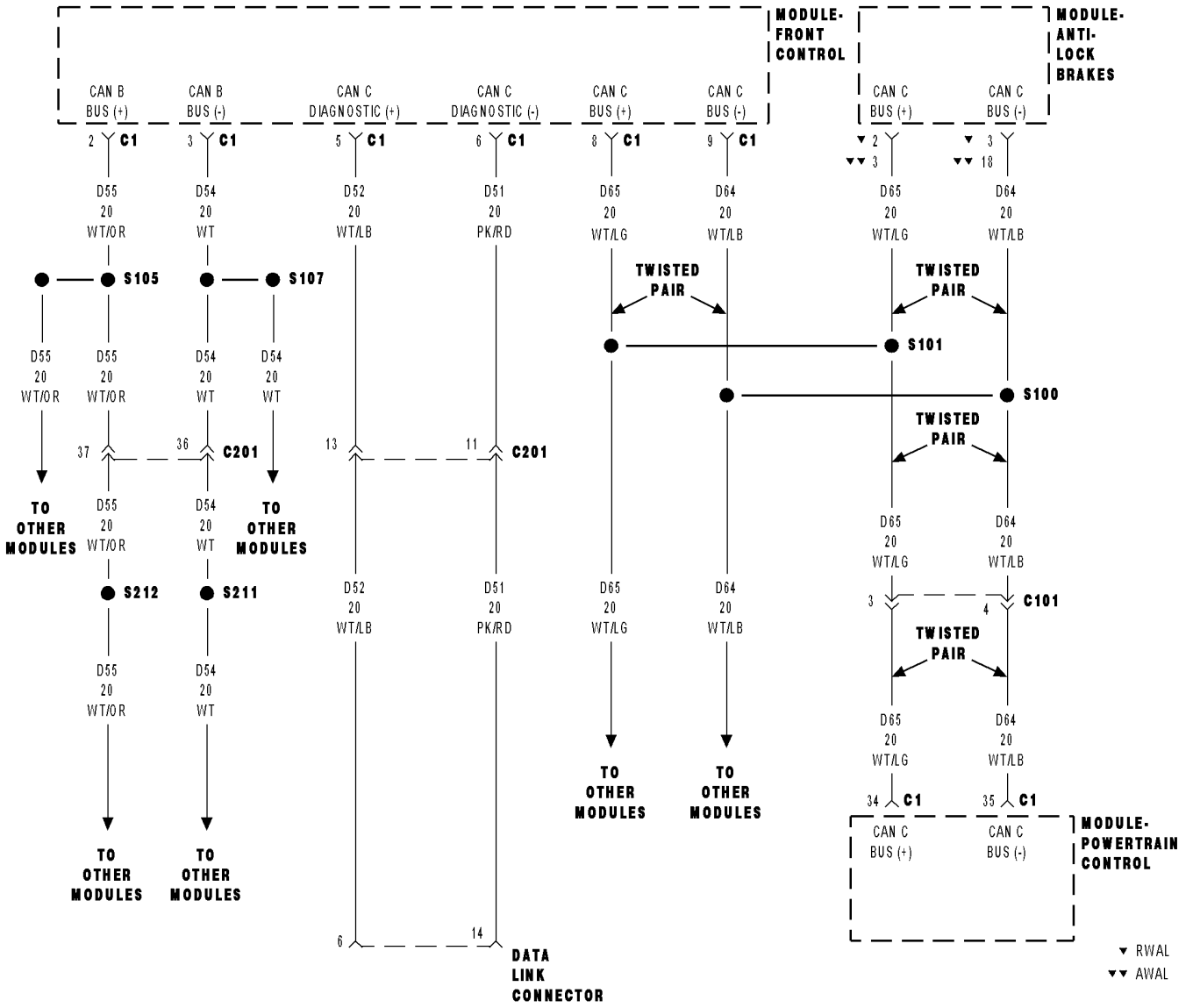
- **When Monitored:**
  Every 7 msec. with the ignition on.
- **Set Condition:**
  ECM/PCM CAN bus message not received by the Transmission Control System for the period of 10 seconds.

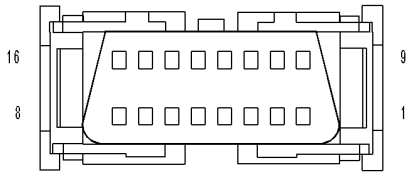
Theory of Operation

Communication over the CAN bus is continuously monitored between the Engine Control System and the Transmission Control System. Due to the integration of both systems into one module, (Powertrain Control Module) the bus communication between the systems is internally transmitted over the duel port ram.

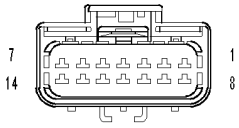
Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0121–LOST COMMUNICATION WITH ABS

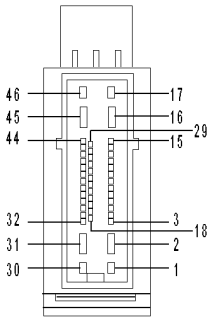




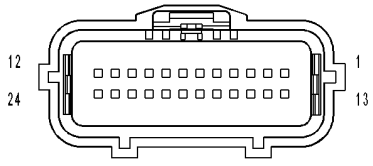
DATA
LINK
CONNECTOR



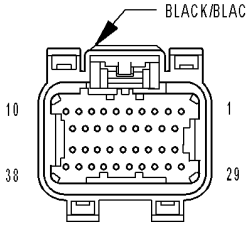
MODULE-
ANTI-
LOCK
BRAKES
(RWAL)



MODULE-
ANTI-LOCK
BRAKES
(AWAL)



MODULE-
FRONT
CONTROL C1



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)

814631cB

U0121–LOST COMMUNICATION WITH ABS (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

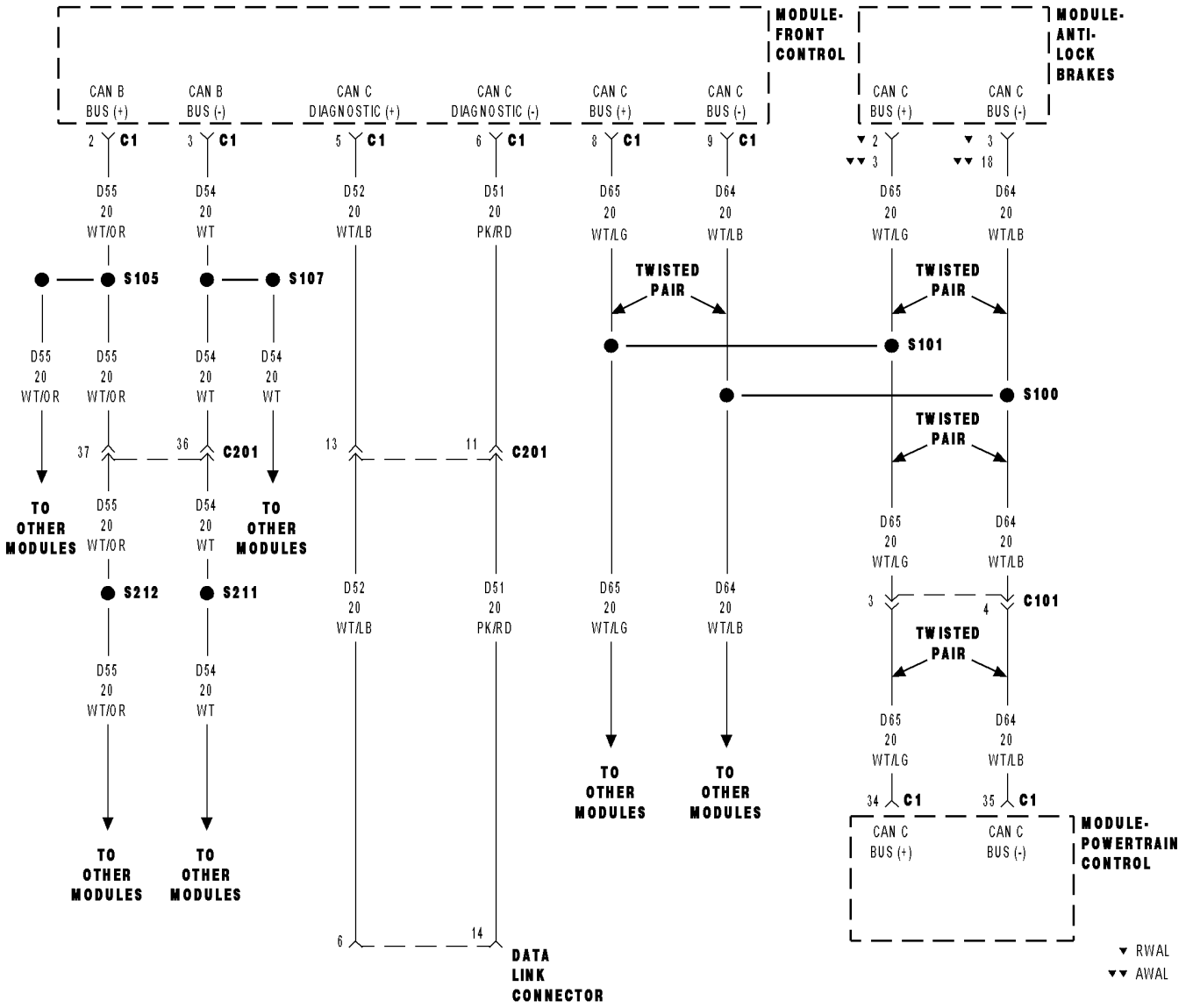
- **When Monitored:**
  Every 7 msec. Conditions: 1) Engine speed greater than 500 RPM. 2) Battery voltage greater than 10v but less than 16v.
- **Set Condition:**
  CAN C bus messages not received for 10 seconds.

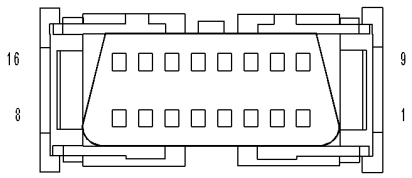
Theory of Operation

Some NGC controllers communicate with other controllers over the CAN C bus. The transmission controller continuously monitors the bus activity and receives the messages it needs. The CAN C bus is also used to communicate transmission MIL status to the Engine Controller, therefor if the Engine Controller is unable to communicate with the Transmission Controller, the Engine Controller will light the MIL.

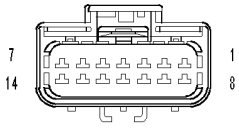
Refer to 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0141 LOST COMMUNICATION WITH FCM

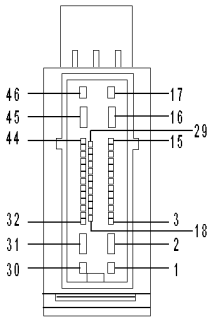




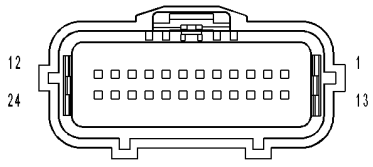
DATA
LINK
CONNECTOR



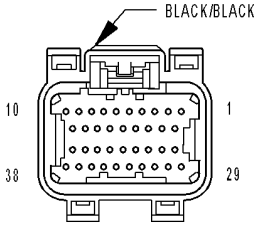
MODULE-
ANTI-
LOCK
BRAKES
(RWAL)



MODULE-
ANTI-LOCK
BRAKES
(AWAL)



MODULE-
FRONT
CONTROL C1



MODULE-
POWERTRAIN
CONTROL C1
(4.7L)

814631cB

U0141 LOST COMMUNICATION WITH FCM (CONTINUED)

For the Transmission circuit diagram (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

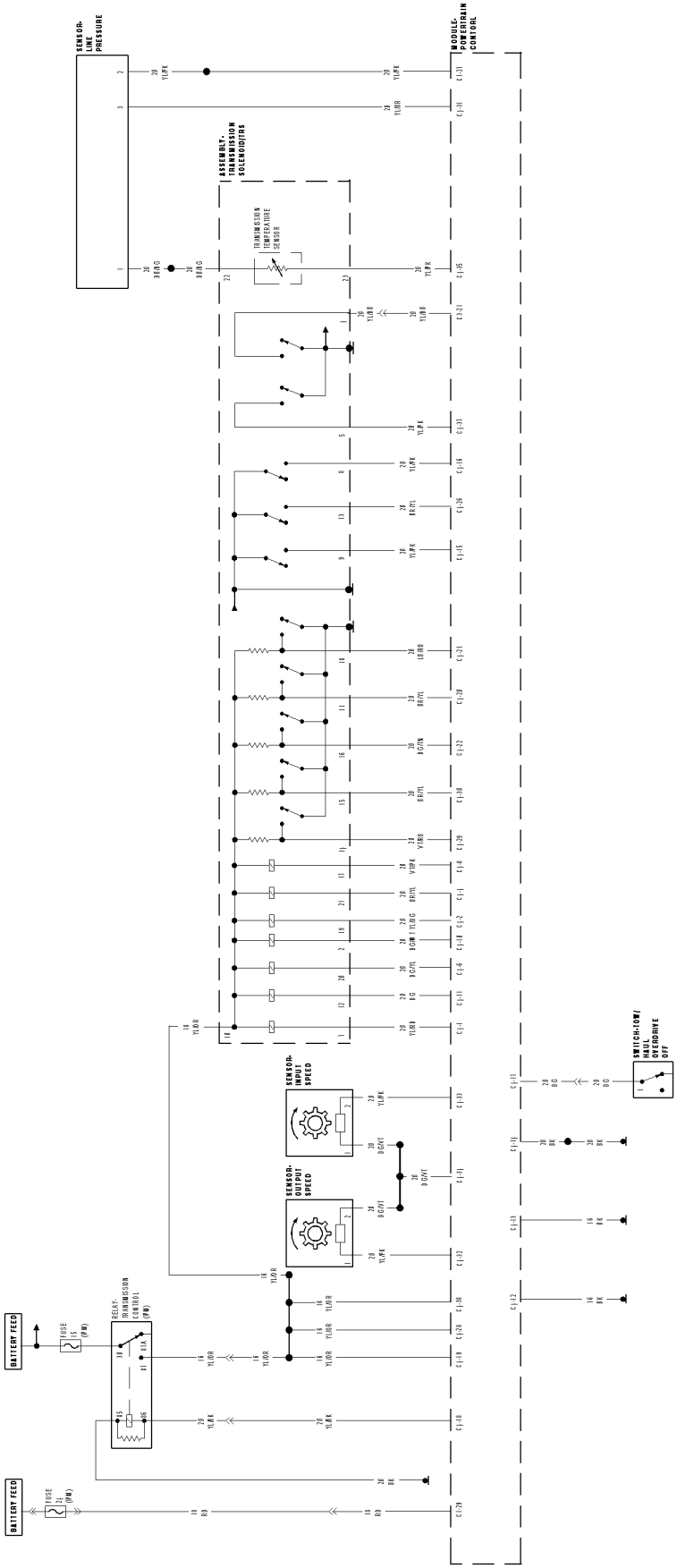
- **When Monitored:**
  Every 7 msec. Conditions: 1) Engine speed greater than 500 RPM. 2) Battery voltage greater than 10v but less than 16v.
- **Set Condition:**
  CAN C bus messages not received for 10 seconds.

Theory of Operation

Some NGC controllers communicate with other controllers over the CAN C bus. The transmission controller continuously monitors the bus activity and receives the messages it needs. The CAN C bus is also used to communicate transmission MIL status to the Engine Controller, therefor if the Engine Controller is unable to communicate with the Transmission Controller, the Engine Controller will light the MIL.

Refer to 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

SCHEMATICS AND DIAGRAMS



RFE TRANSMISSION CIRCUIT DIAGRAM

AUTOMATIC TRANSMISSION 545RFE - SERVICE INFORMATION

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AUTOMATIC TRANSMISSION 545RFE - SERVICE INFORMATION

DESCRIPTION

The 545RFE automatic transmission is a sophisticated, multi-range, electronically controlled transmission which combines optimized gear ratios for responsive performance, state of the art efficiency features and low NVH. Other features include driver adaptive shifting and three planetary gear sets to provide wide ratio capability with precise ratio steps for optimum driveability. The three planetary gear sets also make available a unique alternate second gear ratio. The primary 2nd gear ratio fits between 1st and 3rd gears for normal through-gear accelerations. The alternate second gear ratio (2prime) allows smoother 4-2 kickdowns at high speeds to provide 2nd gear passing performance over a wider highway cruising range. An additional overdrive ratio (0.67:1) is also provided for greater fuel economy and less NVH at highway speeds.

The hydraulic portion of the transmission consists of the transmission fluid, fluid passages, hydraulic valves, and various line pressure control components.

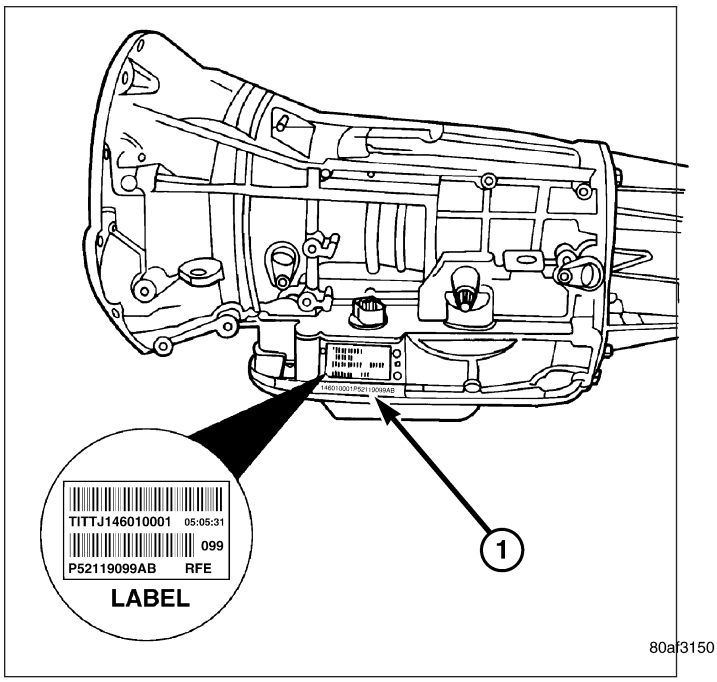
The primary mechanical components of the transmission consist of the following:

- Three multiple disc input clutches
- Three multiple disc holding clutches
- Five hydraulic accumulators
- Three planetary gear sets
- Dual Stage Hydraulic oil pump
- Valve body
- Solenoid pack

The Transmission Control Module (TCM) is the “heart” or “brain” of the electronic control system and relies on information from various direct and indirect inputs (sensors, switches, etc.) to determine driver demand and vehicle operating conditions. Depending on the vehicle configuration, the TCM may be a standalone module or it it may be housed along with the Powertrain Control Module (PCM) in a single module. With this information, the TCM can calculate and perform timely and quality shifts through various output or control devices (solenoid pack, transmission control relay, etc.).

TRANSMISSION IDENTIFICATION

Transmission identification numbers (1) are stamped on the left side of the case just above the oil pan sealing surface. Refer to this information when ordering replacement parts. A label is attached to the transmission case above the stamped numbers. The label gives additional information which may also be necessary for identification purposes.



GEAR RATIOS

The 545RFE gear ratios are:

1st	3.00:1
2nd	1.67:1
2nd Prime	1.50:1
3rd	1.00:1
4th	0.75:1
5th	0.67:1
Reverse	3.00:1

OPERATION

The 545RFE offers full electronic control of all automatic up and downshifts, and features real-time adaptive closed-loop shift and pressure control. Electronic shift and torque converter clutch controls help protect the transmission from damage due to high temperatures, which can occur under severe operating conditions. By altering shift schedules, line pressure, and converter clutch control, these controls reduce heat generation and increase transmission cooling.

To help reduce efficiency-robbing parasitic losses, the transmissions includes a dual-stage transmission fluid pump with electronic output pressure control. Under most driving conditions, pump output capacity greatly exceeds that which is needed to keep the clutches applied. The 45RFE/545RFE pump-pressure control system monitors input torque and adjusts the pump pressure accordingly. The primary stage of the pump works continuously; the second stage is bypassed when demand is low. The control system also monitors input and output speed and, if incipient clutch slip is observed, the pressure control solenoid duty cycle is varied, increasing pressure in proportion to demand.

A high-travel torque converter damper assembly allows earlier torque converter clutch engagement to reduce slippage. Needle-type thrust bearings reduce internal friction. The 45RFE/545RFE is packaged in a one-piece die-cast aluminum case. To reduce NVH, the case has high lateral, vertical and torsional stiffness. It is also designed to maximize the benefit of the structural dust cover that connects the bottom of the bell housing to the engine bedplate, enhancing overall power train stiffness. Dual filters protect the pump and other components. A cooler return filter is added to the customary main sump filter. Independent lubrication and cooler circuits assure ample pressure for normal transmission operation even if the cooler is obstructed or the fluid cannot flow due to extremely low temperatures.

The hydraulic control system design (without electronic assist) provides the transmission with PARK, REVERSE, NEUTRAL, SECOND, and THIRD gears, based solely on driver shift lever selection. This design allows the vehicle to be driven (in "limp-in" mode) in the event of a electronic control system failure, or a situation that the Transmission Control Module (TCM) recognizes as potentially damaging to the transmission.

The TCM also performs certain self-diagnostic functions and provides comprehensive information (sensor data, DTC's, etc.) which is helpful in proper diagnosis and repair. This information can be viewed with the scan tool.

DIAGNOSIS AND TESTING

AUTOMATIC TRANSMISSION

CAUTION: Before attempting any repair on a RFE automatic transmission, check for Diagnostic Trouble Codes with the scan tool.

Transmission malfunctions may be caused by these general conditions:

- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions
- Mechanical malfunctions
- Electronic malfunctions

Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and condition, gearshift cable adjustment. Then perform a road test to determine if the problem has been corrected or if more diagnosis is necessary. If the problem persists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

PRELIMINARY

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVABLE

1. Check for transmission fault codes using scan tool.
2. Check fluid level and condition.
3. Adjust gearshift cable if complaint was based on delayed, erratic, or harsh shifts.
4. Road test and note how transmission upshifts, downshifts, and engages.
5. Perform hydraulic pressure test if shift problems were noted during road test.
6. Perform air-pressure test to check clutch operation.

VEHICLE IS DISABLED

1. Check fluid level and condition.
2. Check for broken or disconnected gearshift cable.
3. Check for cracked, leaking cooler lines, or loose or missing pressure-port plugs.
4. Raise and support vehicle on safety stands, start engine, shift transmission into gear, and note following:
   a. If propeller shaft turns but wheels do not, problem is with differential or axle shafts.
   b. If propeller shaft does not turn and transmission is noisy, stop engine. Remove oil pan, and check for debris. If pan is clear, remove transmission and check for damaged driveplate, converter, oil pump, or input shaft.
   c. If propeller shaft does not turn and transmission is not noisy, perform hydraulic-pressure test to determine if problem is hydraulic or mechanical.

ROAD TESTING

Before road testing, be sure the fluid level and control cable adjustments have been checked and adjusted if necessary. Verify that all diagnostic trouble codes have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare which indicates slippage. Note if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

Slippage indicated by engine flare, usually means clutch, overrunning clutch, or line presure problems.

A slipping clutch can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch Application chart provides a basis for analyzing road test results.

545RFE CLUTCH APPLICATION CHART

SLP	UD	OD	R	2C	4C	L/R	OVERRUNNING
P–PARK						ON	
R–REVERSE			ON			ON	
N-NEUTRAL						ON	
D–FIRST	ON					ON*	ON
D–SECOND	ON			ON			
D–SECOND PRIME	ON				ON		
D–THIRD	ON	ON					
D–FOURTH		ON			ON		
D–FIFTH		ON		ON			
D–LIMP-IN	ON	ON					
2–FIRST	ON					ON*	ON
2–SECOND	ON			ON			
2–LIMP-IN	ON			ON			
1–LOW	ON					ON	ON

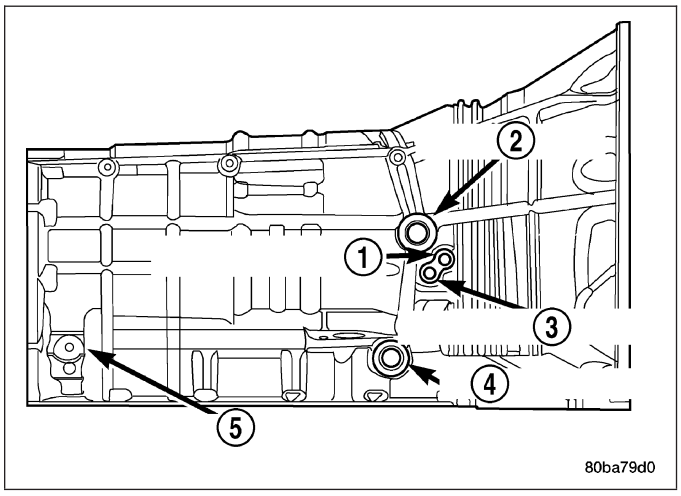
*L/R clutch is on only with the output shaft speed below 150 rpm.

HYDRAULIC PRESSURE TEST

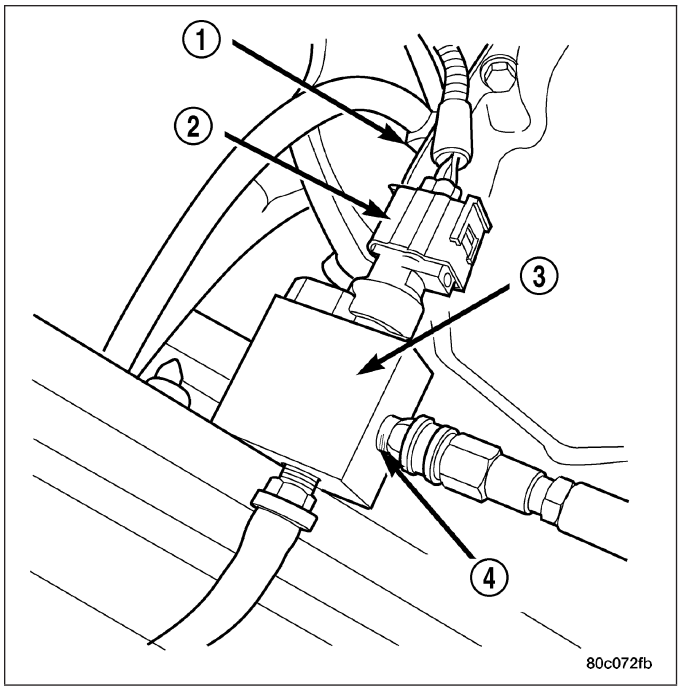
An accurate tachometer and pressure test gauges are required. Test Gauge C-3293-SP has a 300 psi range and is used at all locations where pressures exceed 100 psi.

Pressure Test Port Locations

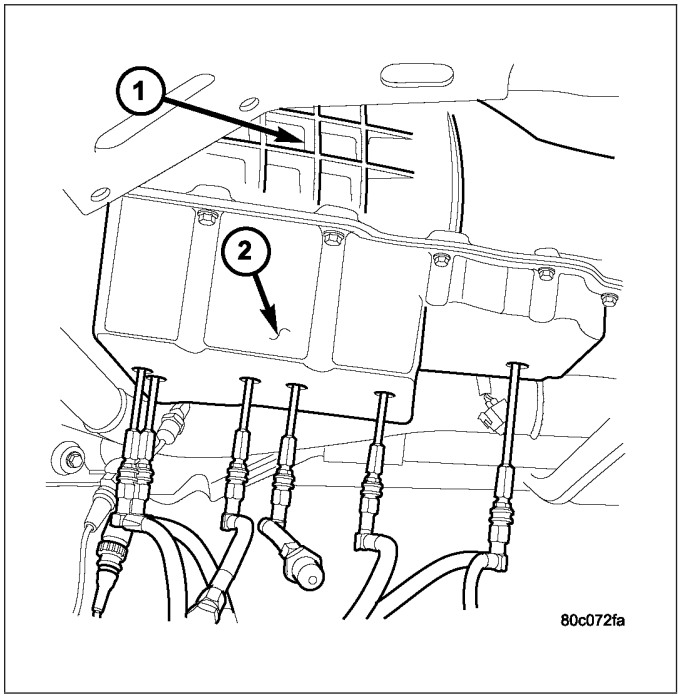
Only two pressure ports are supplied on the transmission case. The torque converter clutch apply (3) and release (1) ports are located on the right side of the transmission case.



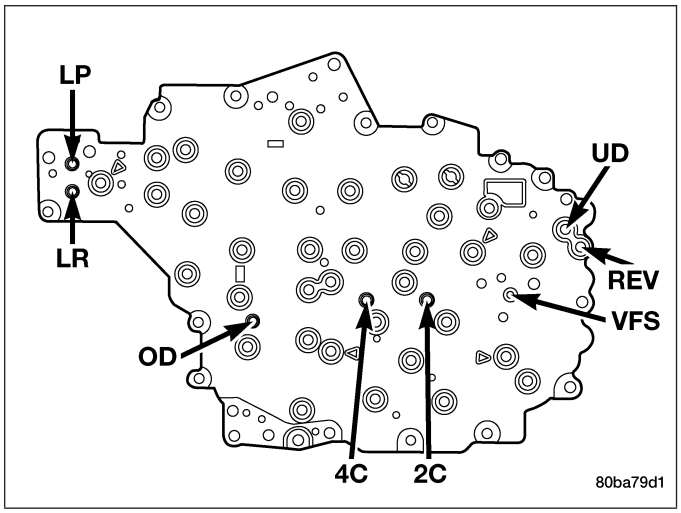
To determine the line pressure, there are two available methods. The scan tool can be used to read line pressure from the line pressure sensor. The second method is to install Line Pressure Adapter 8259 (3) into the transmission case and then install the pressure gauge and the original sensor (2) into the adapter. This will allow a comparison of the scan tool readings and the gauge reading to determine the accuracy of the line pressure sensor. The scan tool line pressure reading should match the gauge reading within ±10 psi.



In order to access any other pressure tap locations, the transmission oil pan must be removed, the pressure port plugs removed and Valve Body Pressure Tap Adapter 8258-A (2) installed. The extensions supplied with Adapter 8258-A will allow the installation of pressure gauges to the valve body.



Refer to the Pressure Tap Locations graphic for correct pressure tap location identification.



TEST PROCEDURE

All pressure readings should be taken with the transmission fluid level full, transmission oil at the normal operating temperature, and the engine at 1500 rpm. Check the transmission for proper operation in each gear position that is in question or if a specific element is in question, check the pressure readings in at least two gear positions that employ that element. Refer to the Hydraulic Schematics at the rear of this section to determine the correct pressures for each element in a given gear position.

NOTE: The RFE utilizes closed loop control of pump line pressure. The pressure readings may therefore vary greatly but should always follow line pressure.

Some common pressures that can be measured to evaluate pump and clutch performance are the upshift/downshift pressures and the garage shift pressures. The upshift/downshift pressure for all shifts is 120 psi. The garage shift pressure when performing a N-R shift is 220 psi. The garage shift pressure for the R-N shift is 120 psi and 135 psi for N-1 shifts.

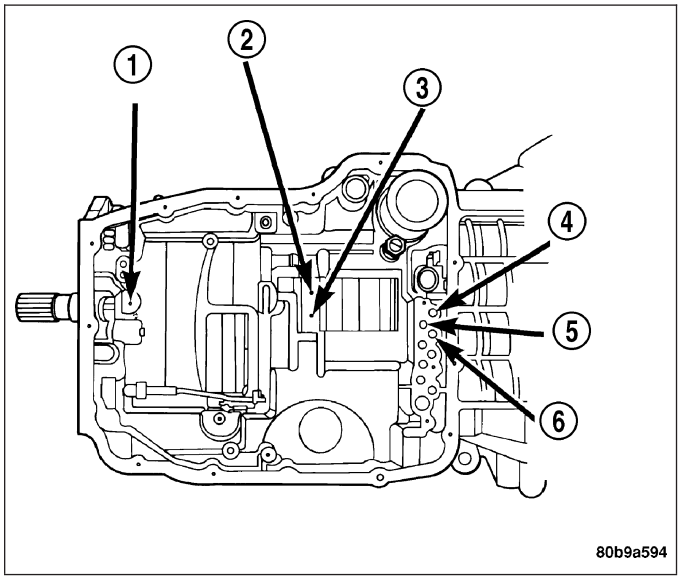
AIR CHECKING TRANSMISSION CLUTCH OPERATION

Air-pressure testing can be used to check transmission clutch operation. The test can be conducted with the transmission either in the vehicle or on the work bench, as a final check.

Air-pressure testing requires that the oil pan and valve body be removed from the transmission. The clutch apply passages are shown in the Air Pressure Test Passages graphic.

NOTE: The air supply which is used must be free of moisture and dirt. Use a pressure of 30 psi to test clutch operation.

Apply air pressure at each port. If the clutch is functioning, a soft thump will be heard as the clutch is applied. The clutch application can also be felt by touching the appropriate element while applying air pressure. As the air pressure is released, the clutch should also release.



Air Pressure Test Passages

1 - LOW REVERSE CLUTCH
2 - 4TH CLUTCH
3 - 2ND CLUTCH
4 - OVERDRIVE CLUTCH
5 - UNDERDRIVE CLUTCH
6 - REVERSE CLUTCH

CONVERTER HOUSING FLUID LEAK

When diagnosing converter housing fluid leaks, two items must be established before repair.

1. Verify that a leak condition actually exists.
2. Determined the true source of the leak.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill or fill after repair. Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair. Torque converter seal leaks tend to move along the drive hub and onto the rear of the converter. Pump cover seal leaks tend to run down the cover and the inside surface of the bellhousing.

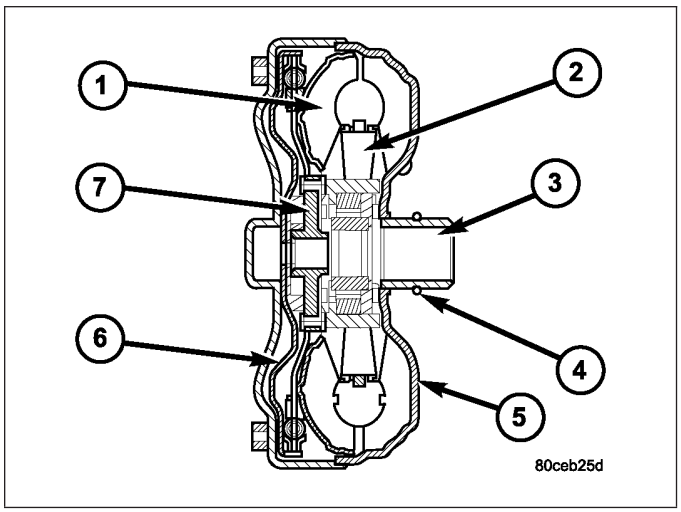
Some leaks, or suspected leaks, may be particularly difficult to locate. If necessary, a Mopar® approved dye should be used to locate and confirm a leak.

TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are:

1. Leaks at the weld joint around the outside diameter weld.
2. Leaks at the converter hub weld.

In most cases, a torque converter which is wet from transmission fluid indicates a leak at one of these areas.



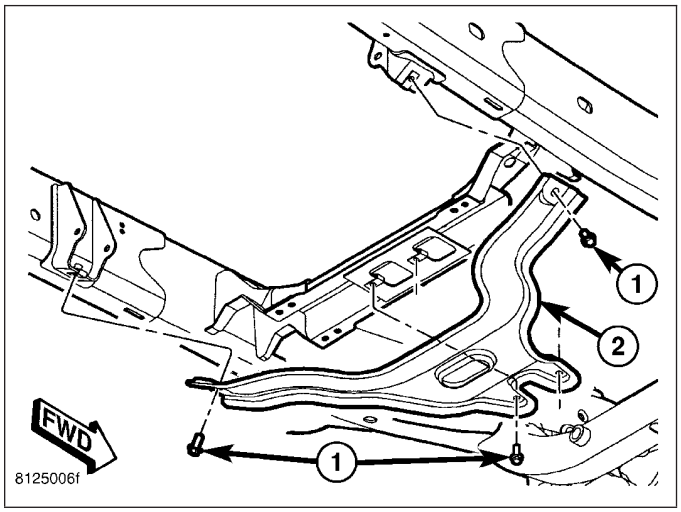
STANDARD PROCEDURE - ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils™, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil™ tap, or equivalent, and installing a Heli-Coil™ insert, or equivalent, into the hole. This brings the hole back to its original thread size.

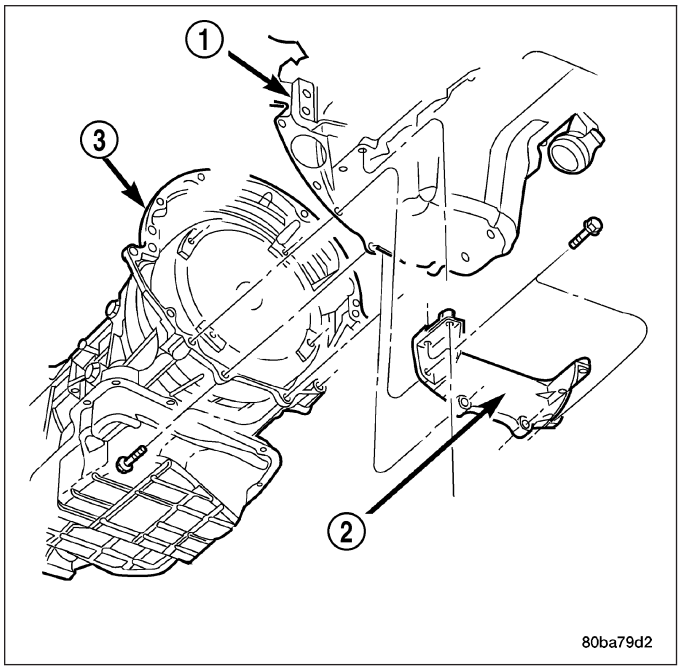
Heli-Coil™, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

REMOVAL

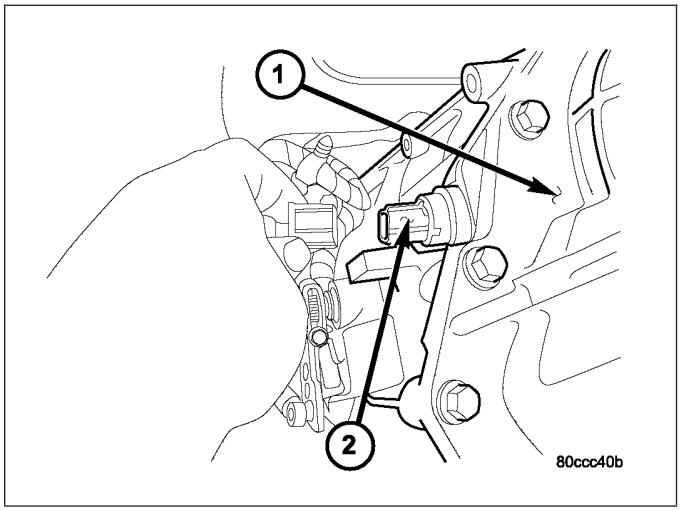
1. Disconnect the negative battery cable.
2. Raise and support the vehicle
3. Remove any necessary skid plates. (Refer to 13 - FRAMES & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - REMOVAL)
4. Mark propeller shaft and axle companion flanges for assembly alignment.
5. Remove the rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT - REAR/PROPELLER SHAFT - REMOVAL)
6. Remove the front propeller shaft, if necessary. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT - FRONT/PROPELLER SHAFT - REMOVAL)



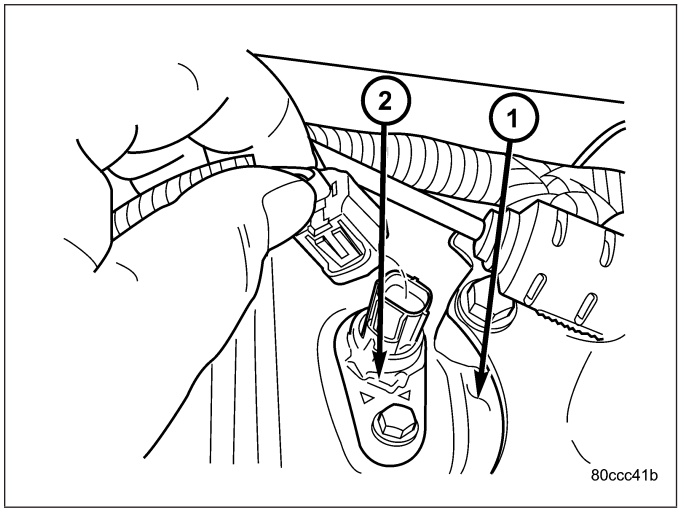
7. Remove the engine to transmission collar (2).
8. Remove the exhaust support bracket from the rear of the transmission.
9. Disconnect and lower or remove any necessary exhaust components.
10. Remove the starter motor.
11. Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.



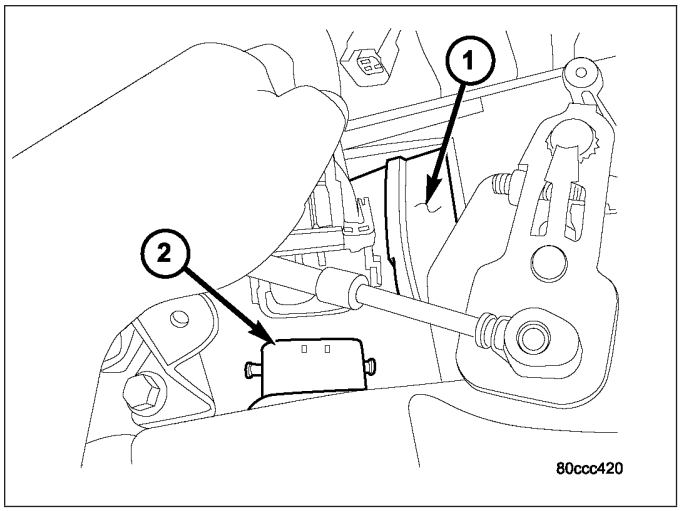
12. Disengage the output speed sensor (2) connector from the output speed sensor.



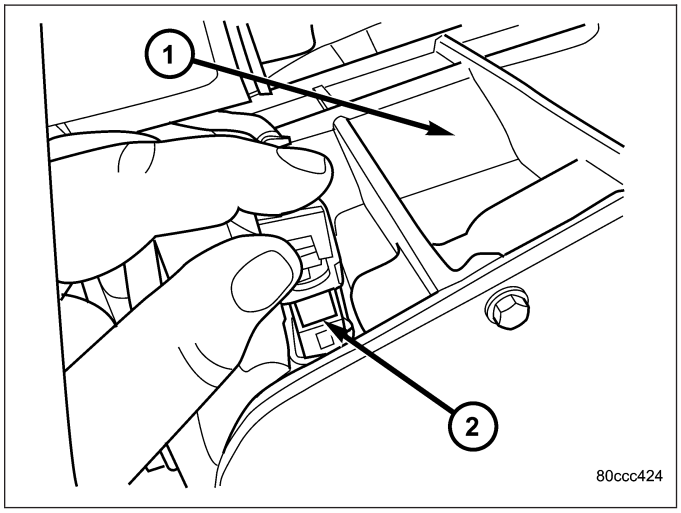
13. Disengage the input speed sensor (2) connector from the input speed sensor.



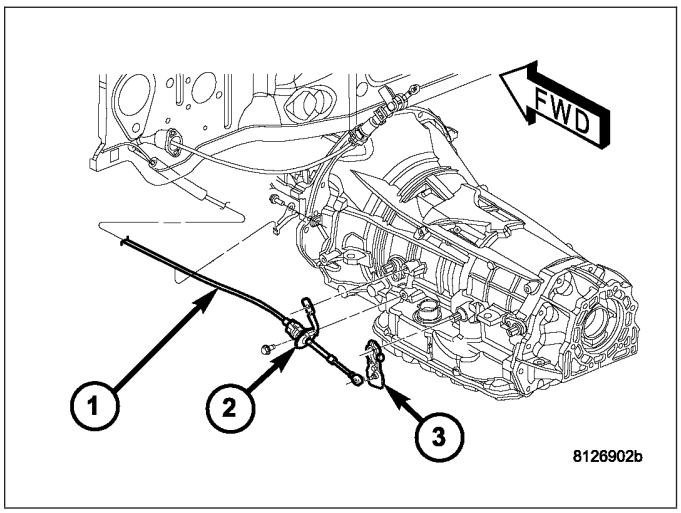
14. Disengage the transmission solenoid/TRS assembly (2) connector from the transmission solenoid/ TRS assembly.



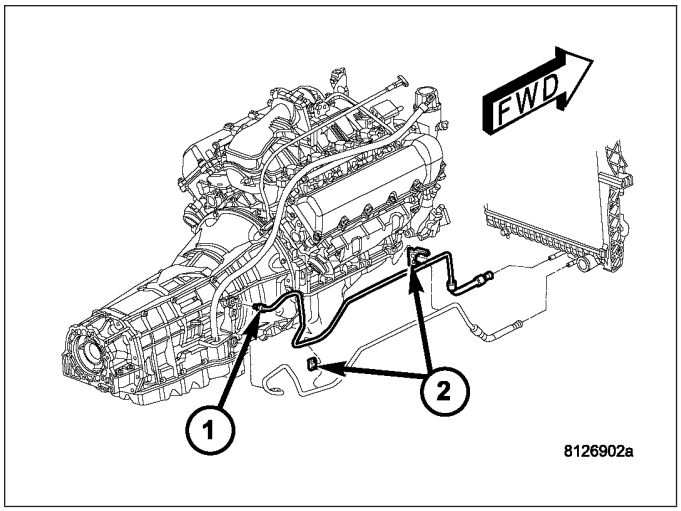
15. Disengage the line pressure sensor (2) connector from the line pressure sensor.



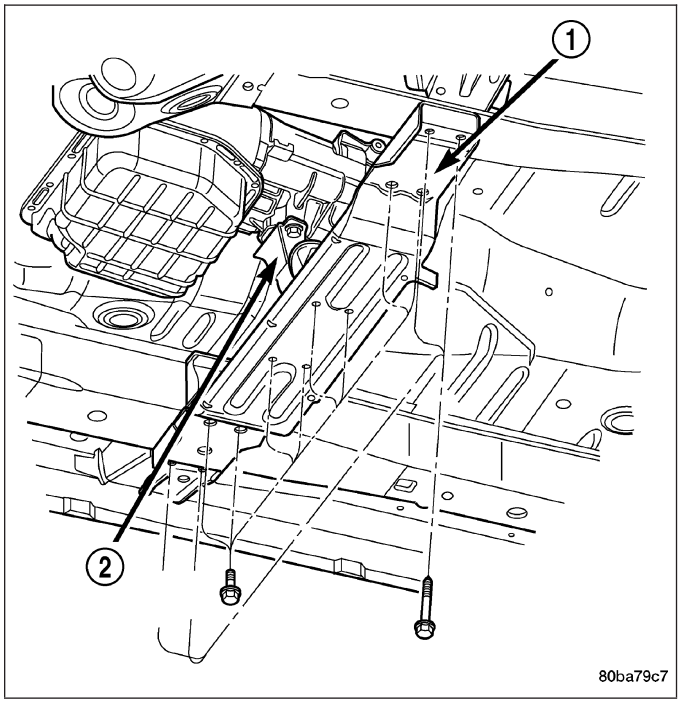
16. Disconnect gearshift cable (1) from transmission manual valve lever (3).
17. Remove the gearshift cable (1) from the shift cable support bracket (2).



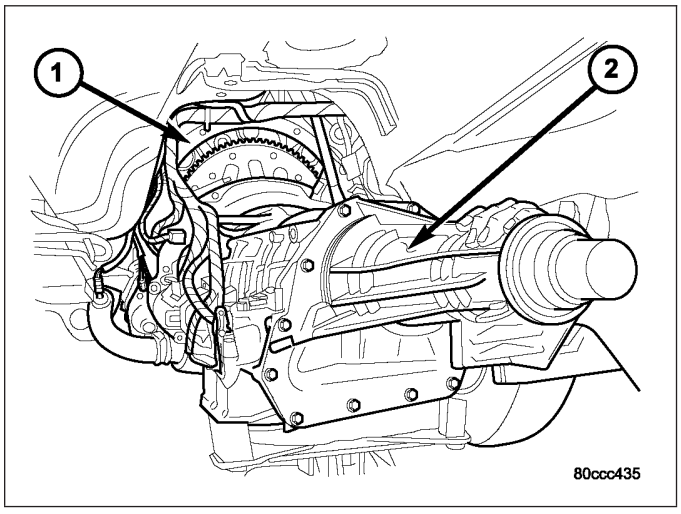
18. Disconnect transmission fluid cooler lines at transmission fittings (1) and clips (2).



19. Support rear of engine with safety stand or jack.
20. Raise transmission slightly with service jack to relieve load on crossmember (1) and supports (2).
21. Remove bolts securing rear support and cushion to transmission and crossmember.
22. Remove bolts attaching crossmember to frame and remove crossmember.

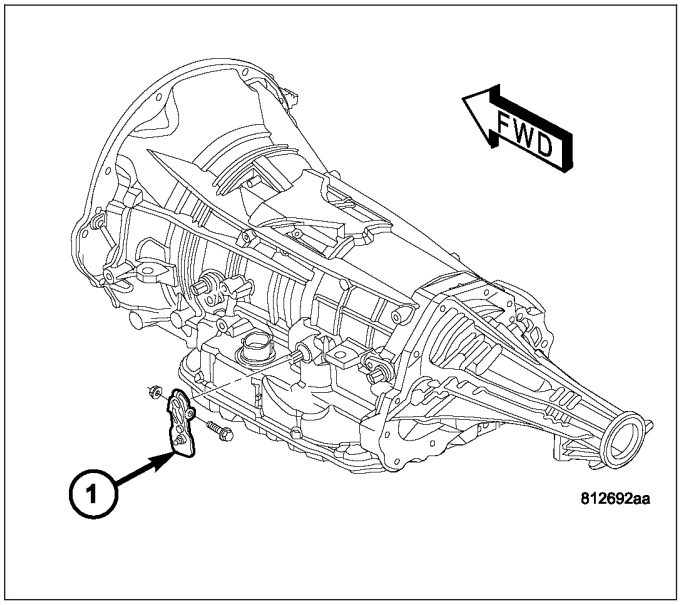


23. Remove transfer case.
24. Remove all remaining converter housing bolts.
25. Carefully work transmission and torque converter assembly (2) rearward off engine (1) block dowels.
26. Hold torque converter in place during transmission removal.
27. Lower transmission and remove assembly from under the vehicle.
28. To remove torque converter, carefully slide torque converter out of the transmission.

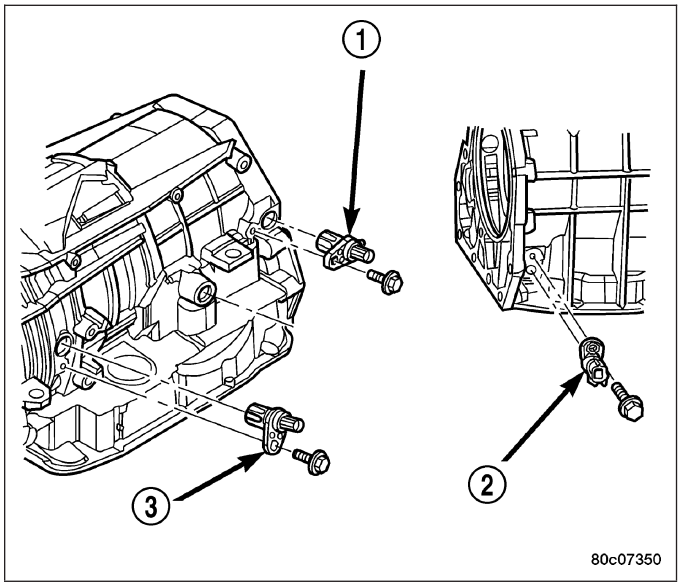


DISASSEMBLY

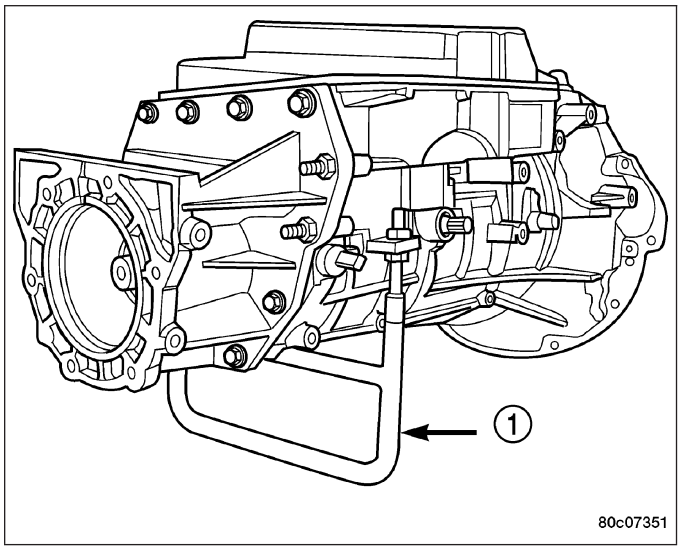
1. Drain fluid from transmission.
2. Clean exterior of transmission with suitable solvent or pressure washer.
3. Remove the torque converter from the transmission.
4. Remove the manual shift lever (1) from the transmission.



5. Remove the input (3), output (1), and line pressure sensors (2) from the transmission case.
6. Inspect the ends of the sensors for debris, which may indicate the nature of the transmission failure.

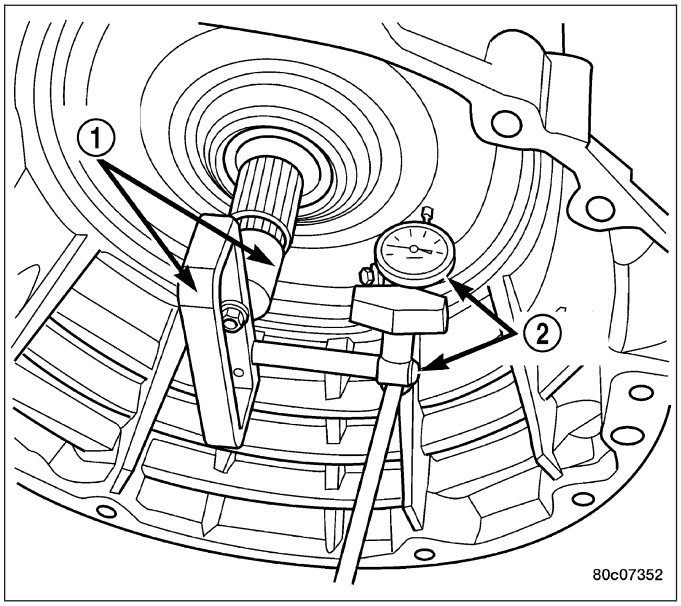


7. Install Support Stand 8257 (1) onto the transmission case.

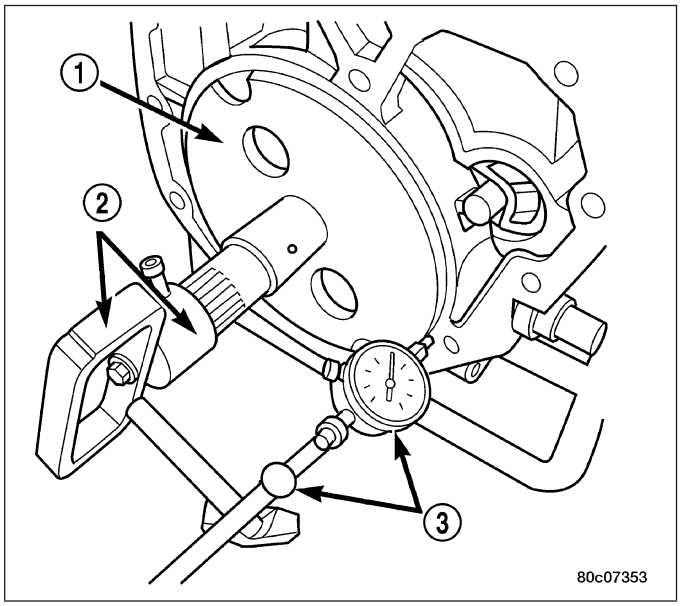


8. Using Adapter 8266-1 from End-Play Tool Set 8266 (1) and Dial Indicator C-3339 (2), measure and record the input shaft end-play.

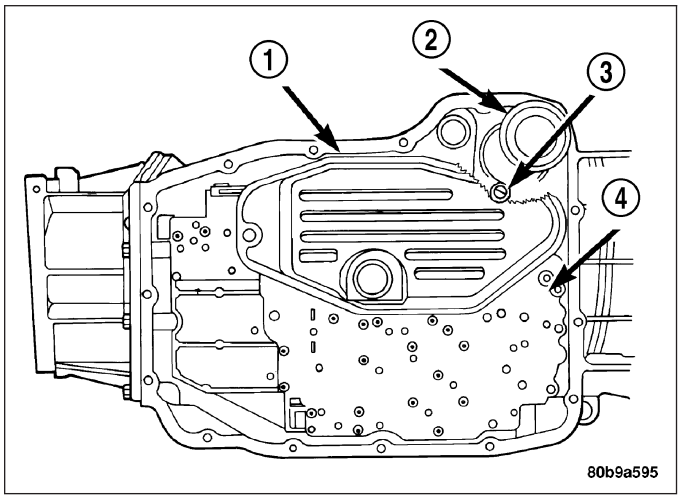
NOTE: When measuring the input shaft end-play, two ″stops″ will be felt. When the input shaft is pushed inward and the dial indicator zeroed, the first ″stop″ felt when the input shaft is pulled outward is the movement of the input shaft in the input clutch housing hub. This value should not be included in the end-play measured value and therefore must be recorded and subtracted from the dial indicator reading.



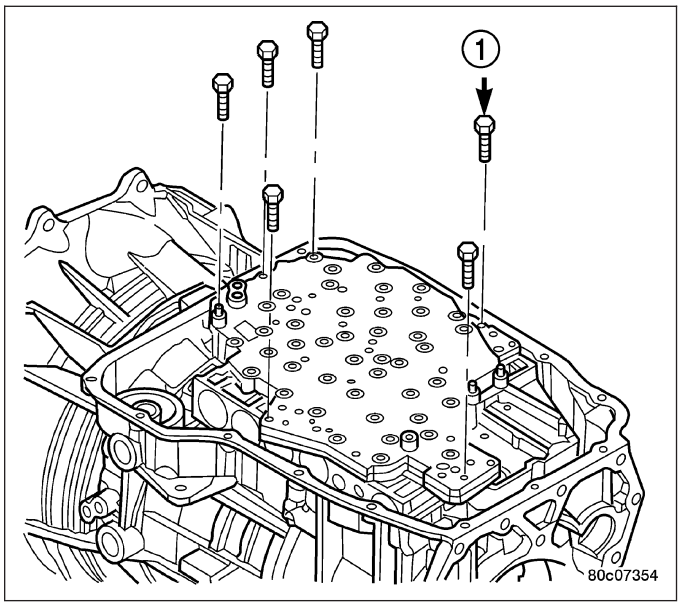
9. Remove the bolts holding the transmission extension/adapter housing to the transmission case.
10. Remove the extension/adapter housing from the transmission case.
11. Using Alignment Plate 8261 (1), Adapter 8266-17 from End-Play Tool Set 8266 (2) and Dial Indicator C-3339 (3), measure and record the output shaft end-play.



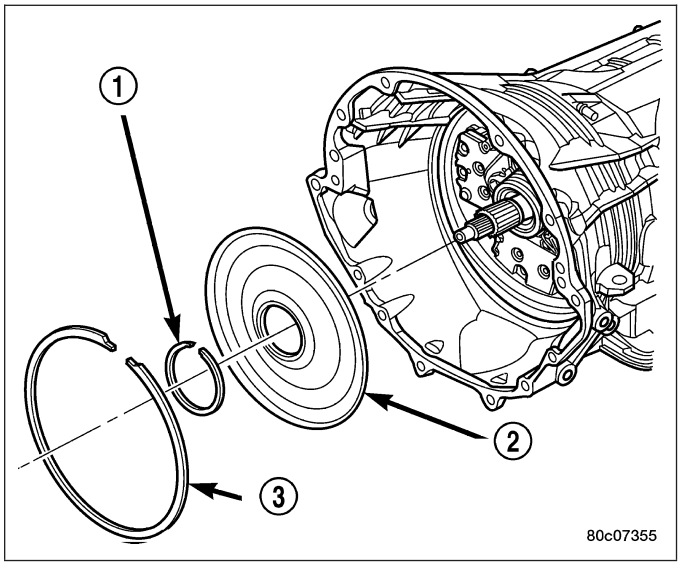
12. Remove the bolts holding the transmission oil pan to the transmission case.
13. Remove the transmission oil pan from the transmission case.
14. Remove the primary oil filter (1) and the oil cooler return filter (2).
15. Remove the cooler return filter bypass valve (3).



16. Remove the bolts (1) holding the valve body to the transmission case.
17. Remove the valve body from the transmission case.

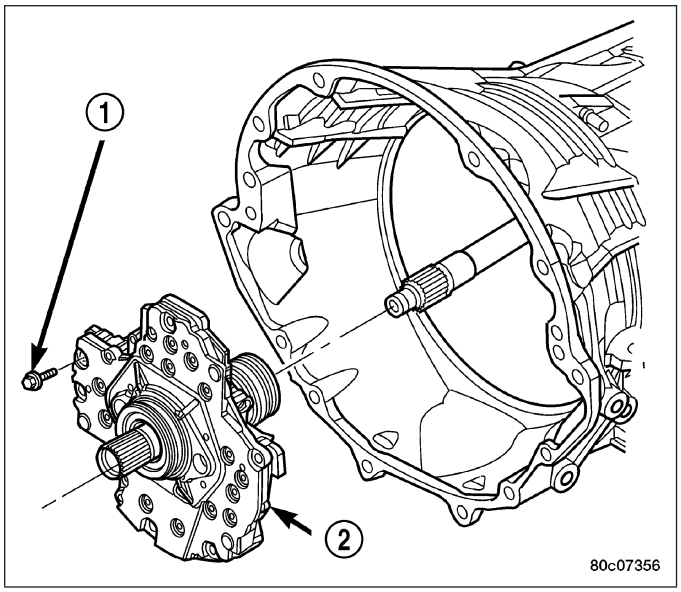


18. Remove the outer snap-ring (3) securing the transmission front cover (2) into the transmission case.
19. Remove the inner snap-ring (1) securing the transmission front cover to the oil pump.
20. Reaching through a case opening in the valve body area with a long blunted tool, remove the transmission front cover from the transmission case.

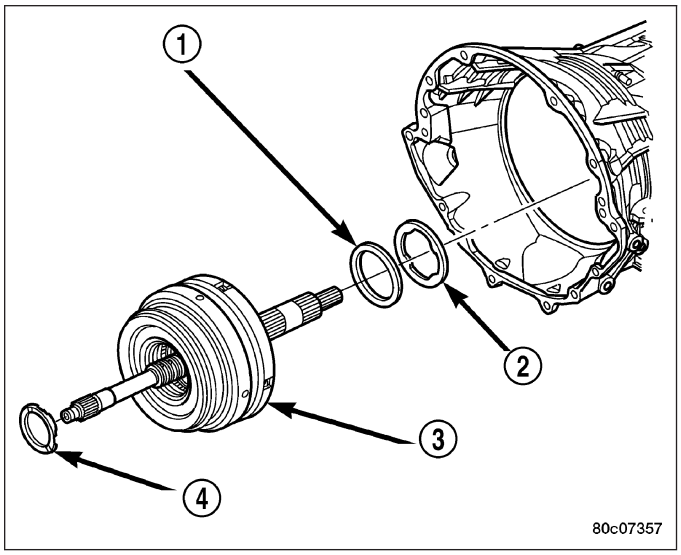


21. Remove the bolts (1) holding the oil pump into the transmission case.
22. Remove the oil pump (2). Hold inward on the input shaft to prevent pulling the input clutch assembly with the oil pump.

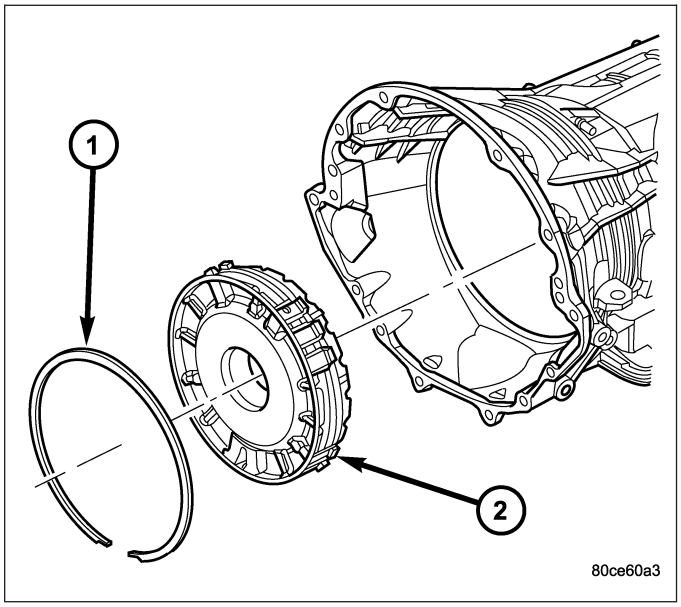
CAUTION: If the input shaft is not held during oil pump removal, the input clutch assembly will attempt to move forward with the oil pump and the numbers 2, 3, or 4 bearings inside the input clutch assembly may become dislodged.



23. Remove the number 1 thrust bearing (4) from the input clutch assembly.
24. Remove the input clutch assembly (3) from the transmission case.
25. Remove the number 5 thrust bearing (1) and selective thrust plate (2) from the input clutch assembly (3) , or the 4C clutch retainer/bulkhead.

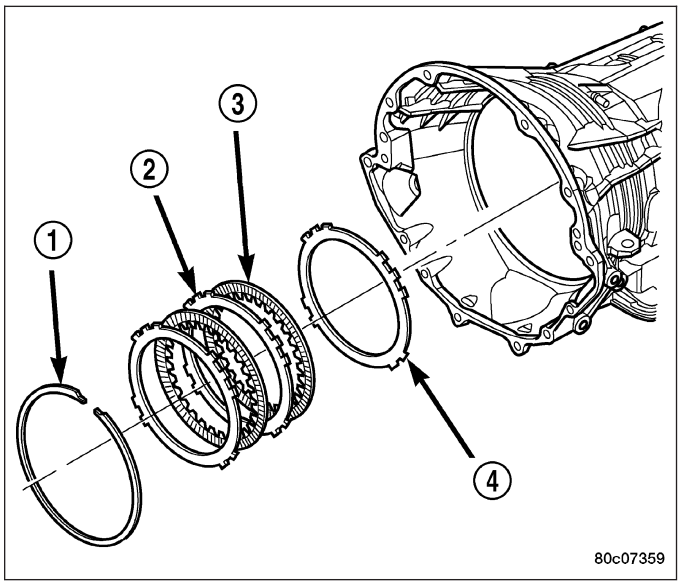


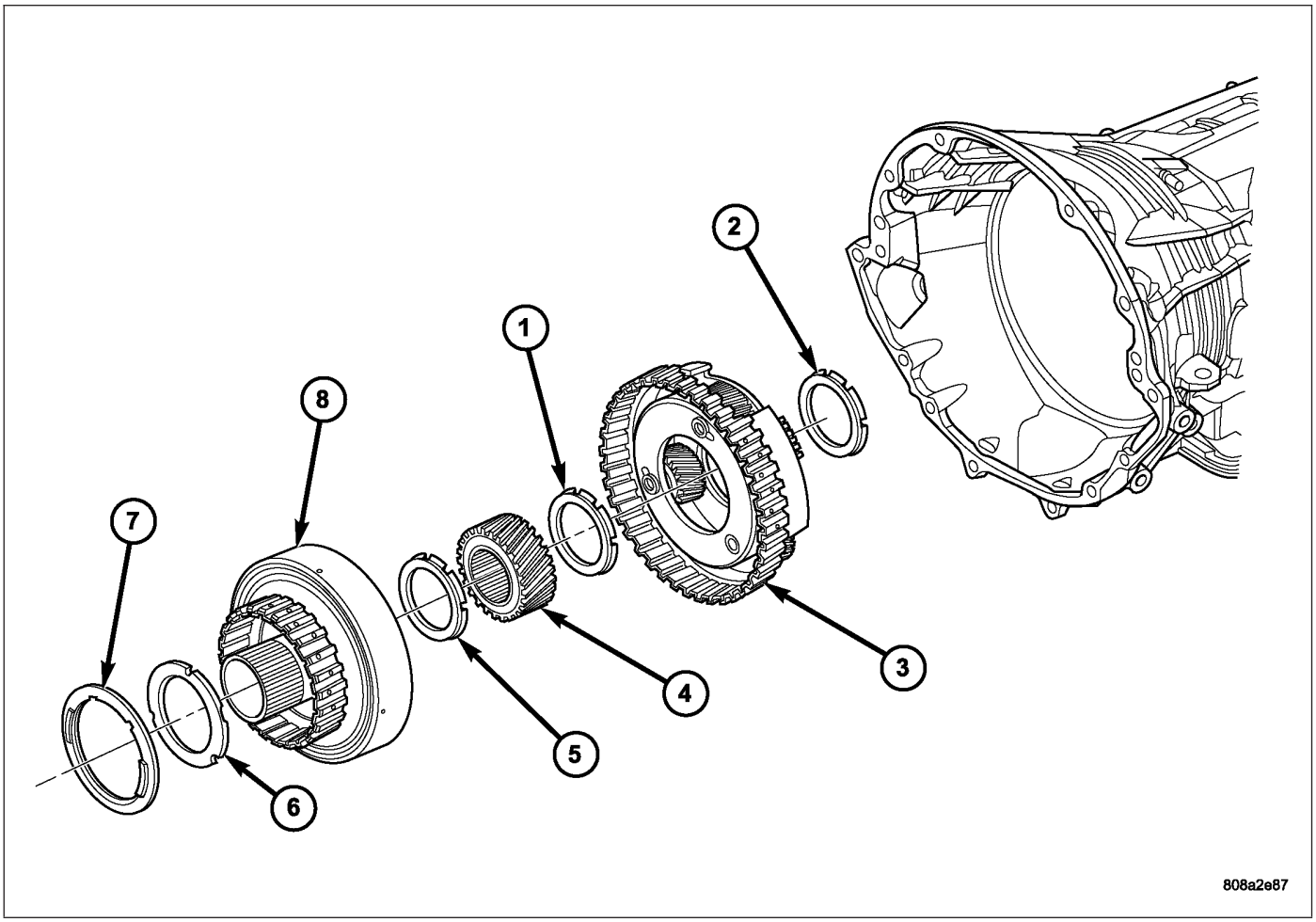
26. Remove the 4C clutch retainer/bulkhead tapered snap-ring (1) from the transmission case.



27. Remove the 4C clutch retainer/bulkhead (2) from the transmission case.

28. Remove the front 2C clutch pack snap-ring (1) from the transmission case.
29. Remove the 2C clutch pack (2, 3, 4) from the transmission case.



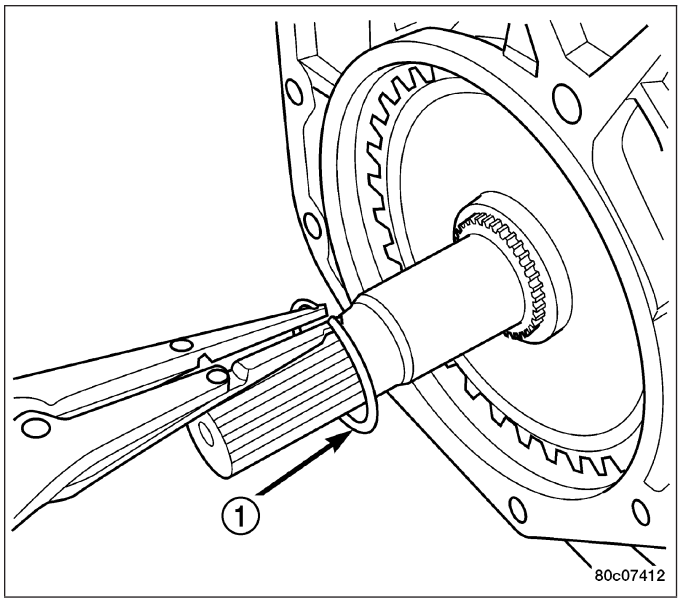


Remove Reaction Annulus and Carrier

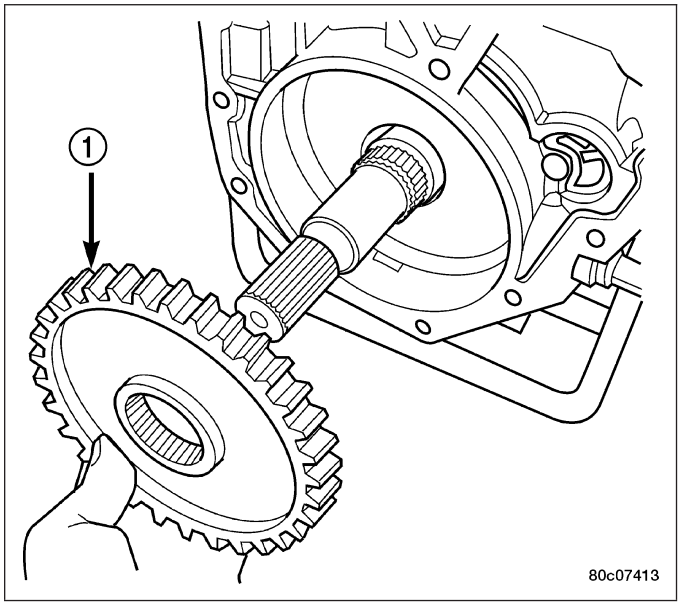
1 - THRUST BEARING NUMBER 8
2 - THRUST BEARING NUMBER 9
3 - REACTION PLANETARY CARRIER
4 - REACTION SUN GEAR
5 - THRUST BEARING NUMBER 7
6 - THRUST PLATE (SELECT)
7 - THRUST BEARING NUMBER 6
8 - REACTION ANNULUS

30. Remove the rear selective plate (6) and number 6 thrust bearing (7) from the reaction annulus (8).
31. Remove the reaction annulus (8) from the reaction planetary carrier (3).
32. Remove the number 7 thrust bearing (5).
33. Remove the reaction sun gear (4).
34. Remove the number 8 thrust bearing (1) from the reaction planetary carrier (3).
35. Remove the reaction planetary carrier (3). Note that this planetary gear set has three pinion gears.
36. Remove the number 9 thrust bearing (2) from the reverse planetary gear set.

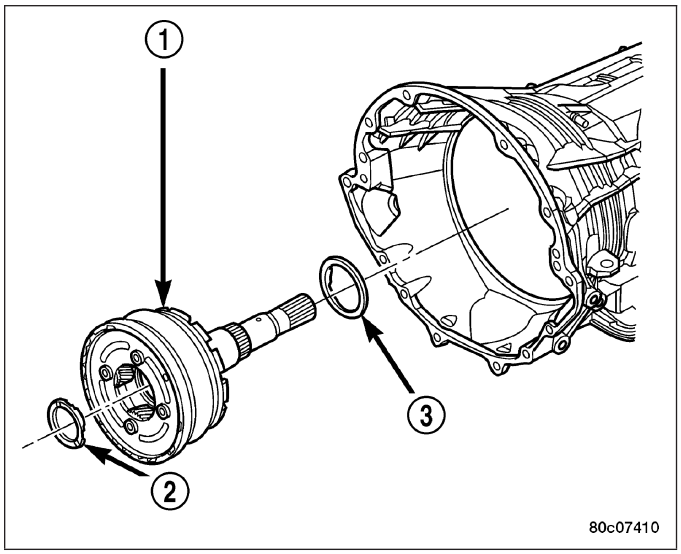
37. Remove the snap-ring (1) holding the park sprag gear onto the output shaft.



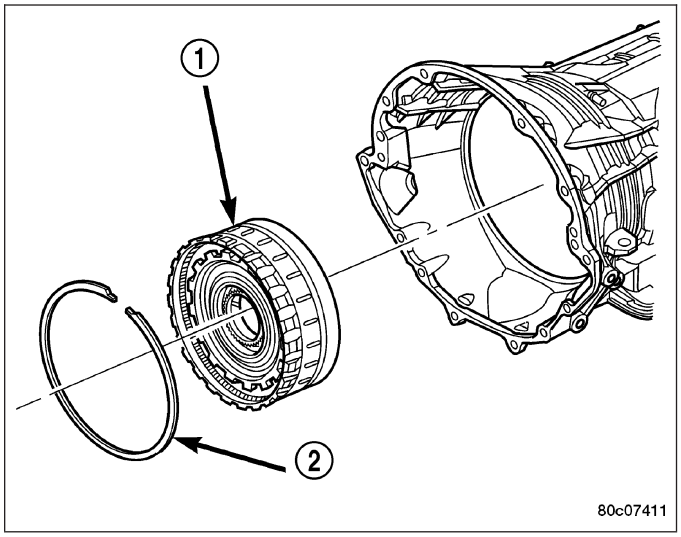
38. Remove the park sprag gear (1) from the output shaft.



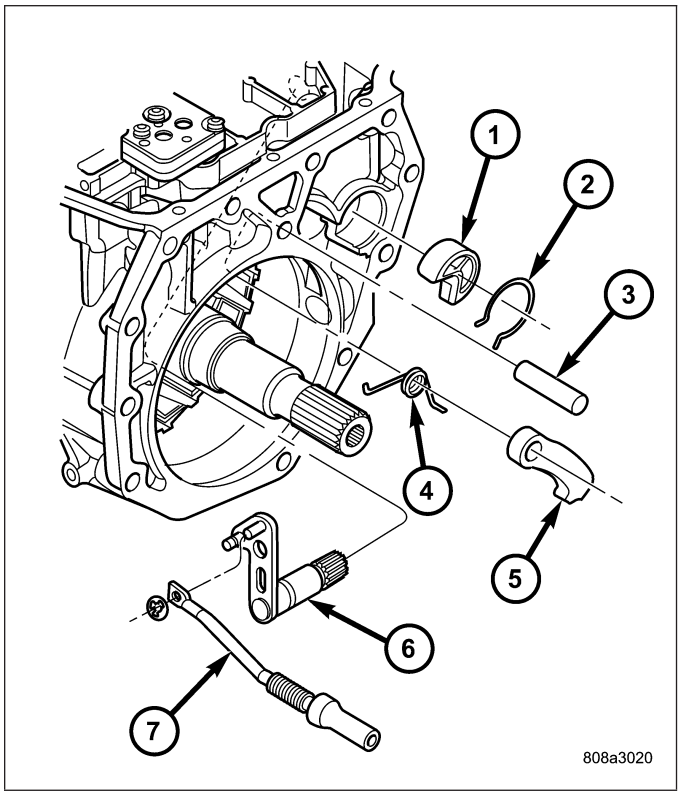
39. Remove the input/reverse planetary assembly (1).
40. Remove the number 12 thrust bearing (3) from the input/reverse planetary assembly (1).



41. Remove the snap-ring (2) holding the low/reverse clutch retainer (1) into the transmission case.
42. Remove the low/reverse clutch retainer (1) from the transmission case.



43. Remove the park rod (7) and e-clip.
44. Remove the park rod guide snap-ring (2).
45. Remove the park rod guide (1).
46. Remove the park pawl pivot shaft (3), park pawl (5), and spring (4).
47. Remove the manual selector shaft (6).
48. Remove the manual selector shaft seal.
49. Remove the dipstick tube seal.



CLEANING

The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on shafts, or valves, use extreme care to avoid rounding off sharp edges. Sharp edges are vital as they prevent foreign matter from getting between the valve and valve bore.

Do not reuse oil seals, gaskets, seal rings, or O-rings during overhaul. Replace these parts as a matter of course. Also do not reuse snap rings or E-clips that are bent or distorted. Replace these parts as well.

Lubricate transmission parts with Mopar® ATF +4, Automatic Transmission Fluid, during overhaul and assembly. Use petroleum jelly, Mopar® Door Ease, or Ru-Glyde to prelubricate seals, O-rings, and thrust washers. Petroleum jelly can also be used to hold parts in place during reassembly.

Clean the case in a solvent tank. Flush the case bores and fluid passages thoroughly with solvent. Dry the case and all fluid passages with compressed air. Be sure all solvent is removed from the case and that all fluid passages are clear.

NOTE: Do not use shop towels or rags to dry the case (or any other transmission component) unless they are made from lint-free materials. Lint will stick to case surfaces and transmission components and circulate throughout the transmission after assembly. A sufficient quantity of lint can block fluid passages and interfere with valve body operation.

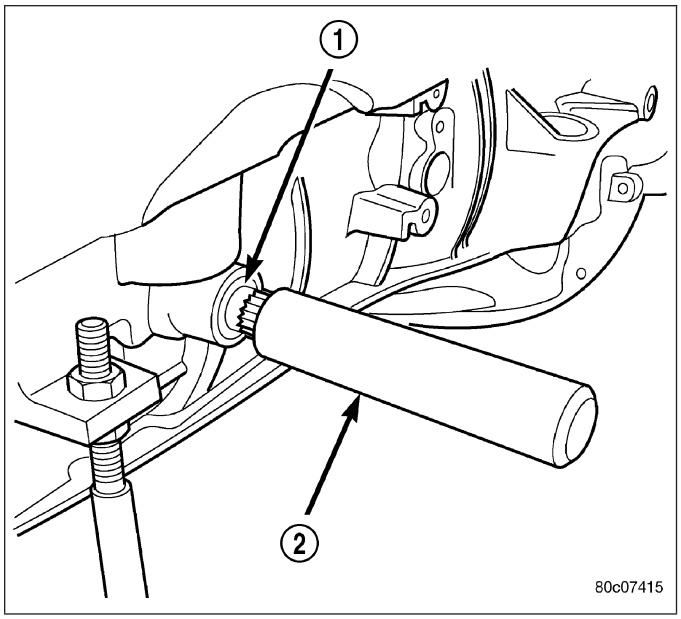
INSPECTION

Inspect the case for cracks, porous spots, worn bores, or damaged threads. Damaged threads can be repaired with Helicoil® thread inserts. However, the case will have to be replaced if it exhibits any type of damage or wear.

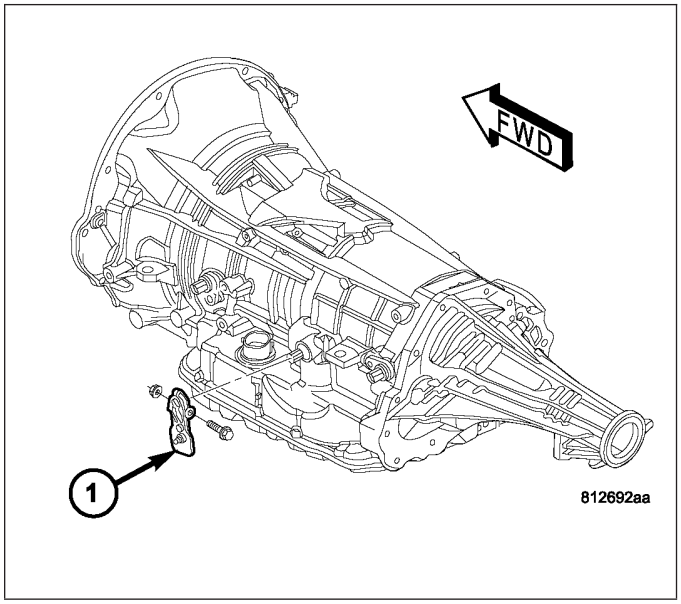
ASSEMBLY

NOTE: Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.

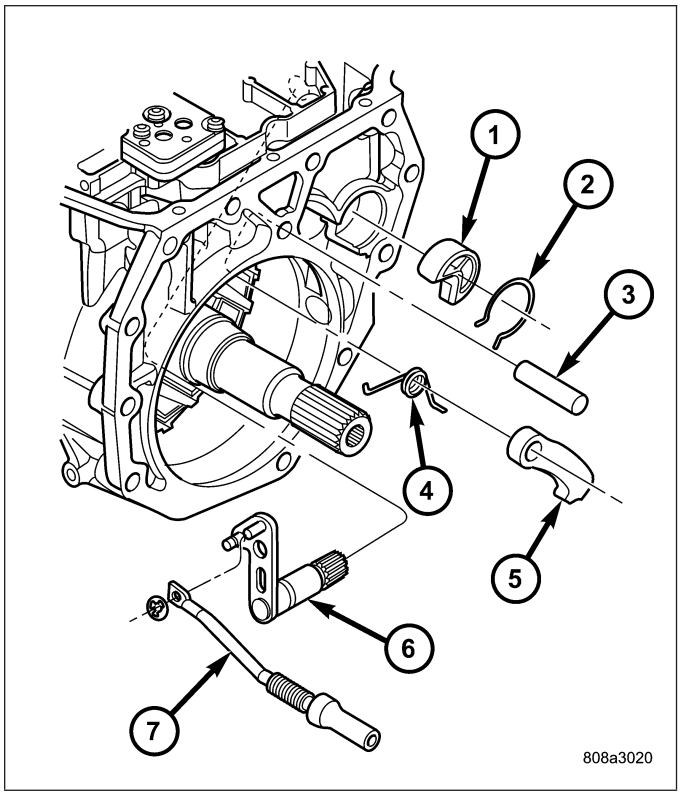
1. Install the cooler filter bypass valve. Torque the bypass valve to specification. The valve uses a tapered pipe thread and excessive torque can damage the transmission case. Tighten the cooler filter bypass valve to 4.5 N·m (40 in.lbs.).
2. Install a new selector shaft seal (1) using Seal Installer 8253 (2).



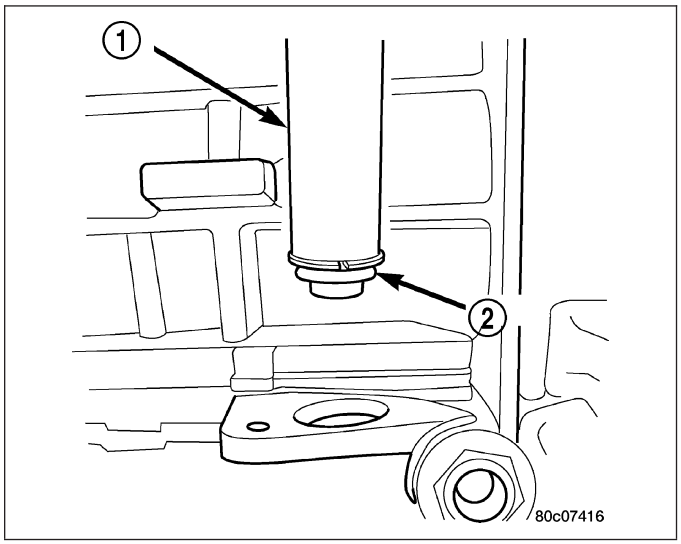
3. Install the manual selector shaft and retaining screw. Tighten the manual selector shaft retaining screw to 28 N·m (250 in.lbs.).
4. Install the manual shift lever (1) onto the manual selector shaft. Torque the retaining cross-bolt to 16 N·m (140 in.lbs.).



5. Install the park pawl (5), spring (4), and shaft (3).
6. Install the park rod (7) and e-clip.
7. Install the park rod guide (1) and snap-ring (2).

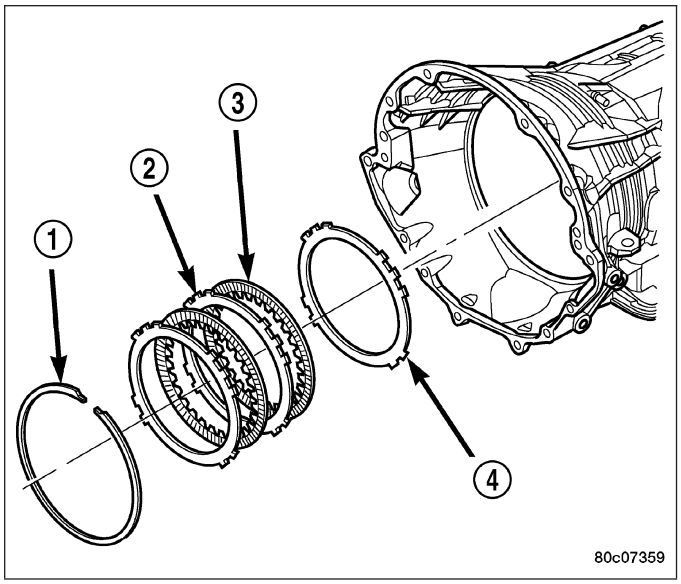


8. Install a new dipstick tube seal (2) using Seal Installer 8254 (1).

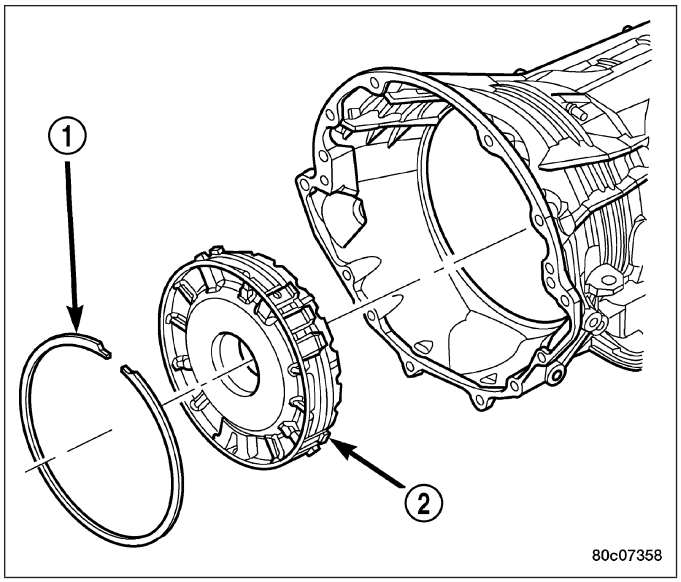


NOTE: Before final assembly of transmission centerline, the 2C/4C clutch components should be installed into position and measured as follows:

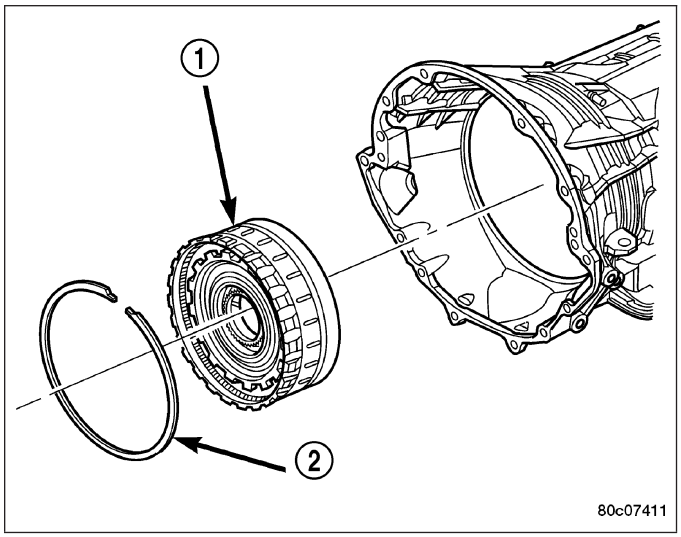
9. Install the 2C reaction plate (4) into the transmission case.
10. Install the 2C clutch pack (2, 3) into the transmission case.
11. Install the flat 2C clutch snap-ring (1) into the transmission case.



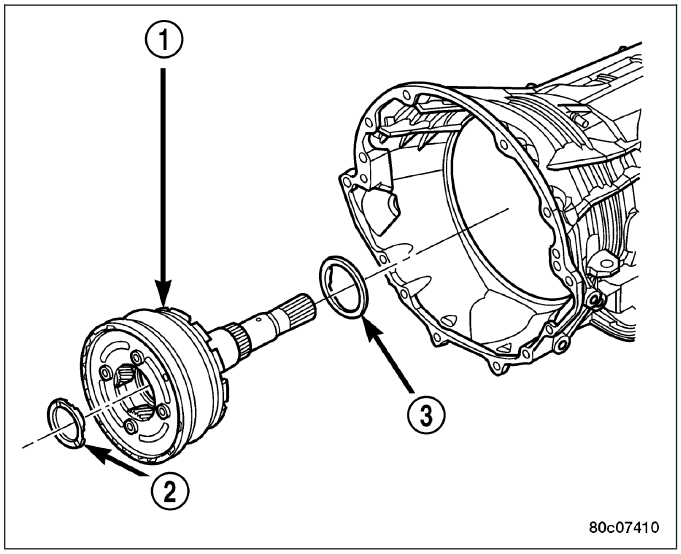
12. Install the 4C retainer/bulkhead (2) into the transmission case. Make sure that the oil feed holes are pointing toward the valve body area.
13. Install the 4C retainer/bulkhead tapered snap-ring (1) into the transmission case. Make sure that the open ends of the snap-ring are located in the case opening toward the valve body area.
14. Using a feeler gauge through the opening in the rear of the transmission case, measure the 2C clutch pack clearance between the 2C reaction plate and the transmission case at four different points. The average of these measurements is the 2C clutch pack clearance. The correct clutch clearance is 0.455-1.335 mm (0.018-0.053 in.). The reaction plate is not selective. If the clutch pack clearance is not within specification, the reaction plate, all the friction discs, and steels must be replaced.
15. Remove the 4C retainer/bulkhead and all of the 2C clutch components from the transmission case.



16. Install the low/reverse clutch assembly (1). Make sure that the oil feed hole points toward the valve body area and that the bleed orifice is aligned with the notch in the rear of the transmission case.
17. Install the snap-ring (2) to hold the low/reverse clutch retainer into the transmission case. The snap-ring is tapered and must be installed with the tapered side forward. Once installed, verify that the snap-ring is fully seated in the snap-ring groove.
18. Air check the low/reverse clutch and verify correct overrunning clutch operation.

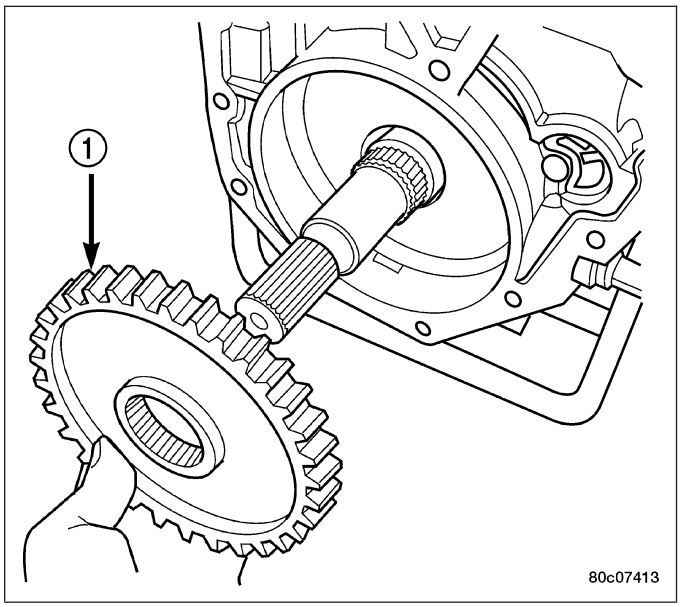


19. Install the number 12 thrust bearing (3) over the output shaft and against the rear planetary gear set. The flat side of the bearing goes toward the planetary gearset and the raised tabs on the inner race should face the rear of the transmission.

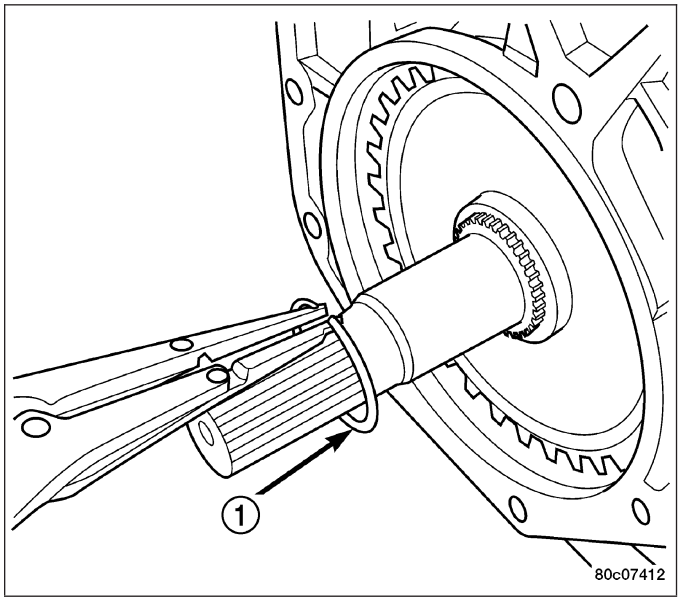


20. Install the reverse/input planetary assembly (1) through the low/reverse clutch assembly.

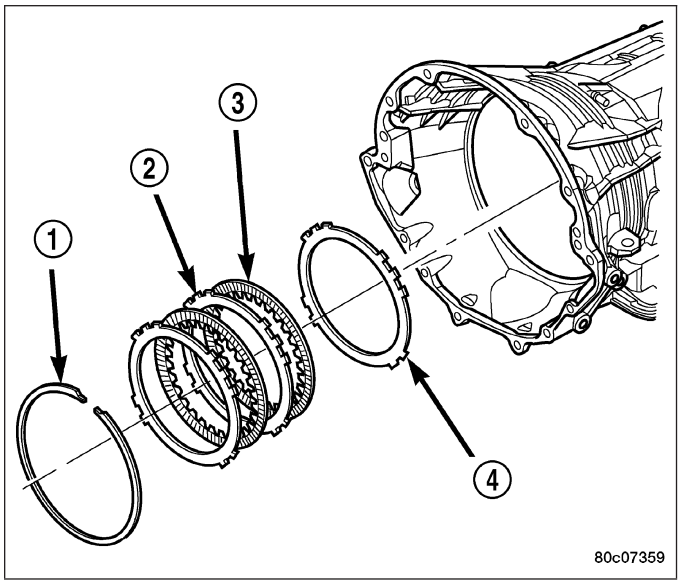
21. Install the park sprag gear (1) onto the output shaft.

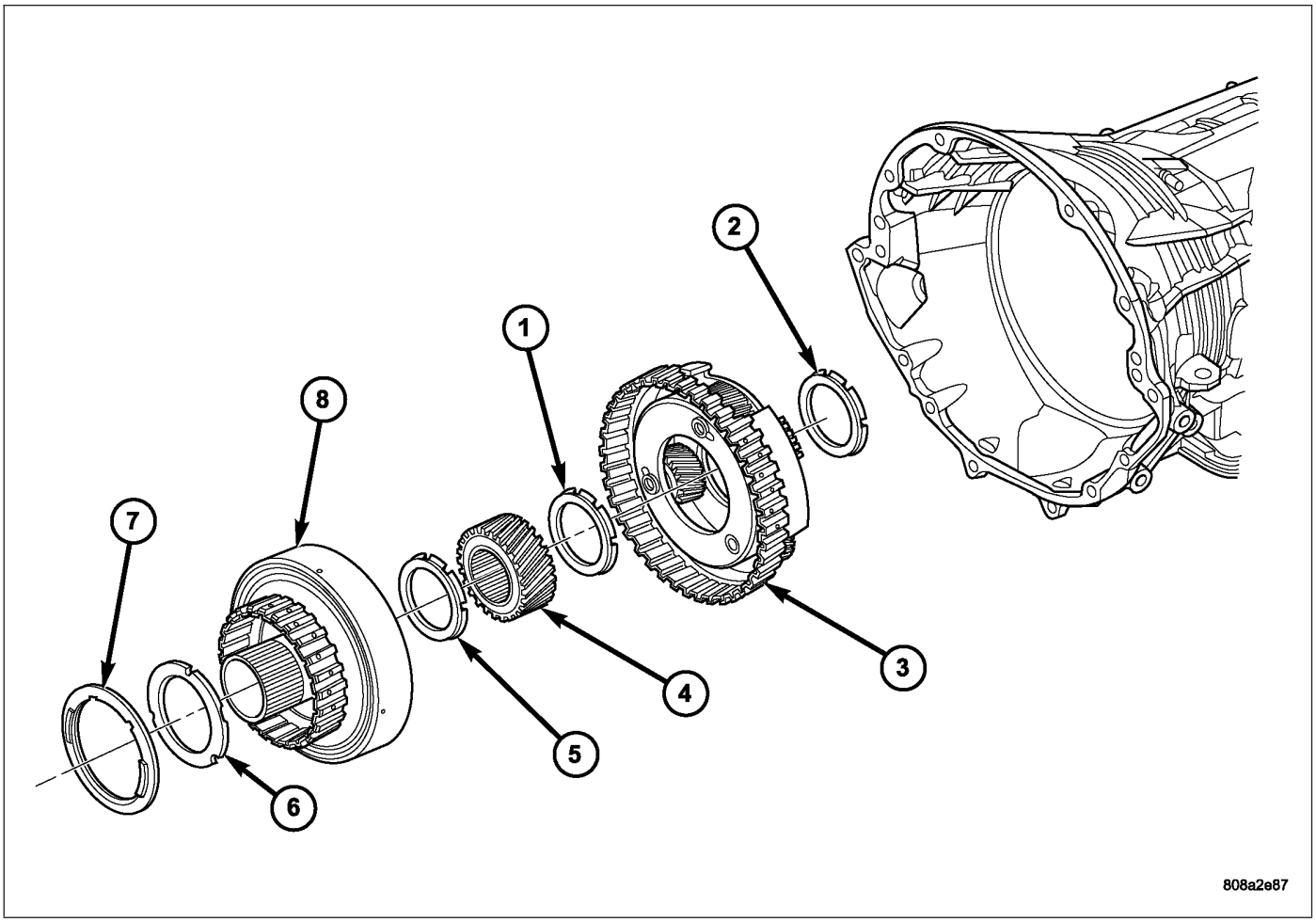


22. Install the snap-ring (1) to hold the park sprag onto the output shaft.



23. Install the 2C reaction plate (4) into the transmission case.
24. Install the 2C clutch pack (2, 3, 4) into the transmission case.

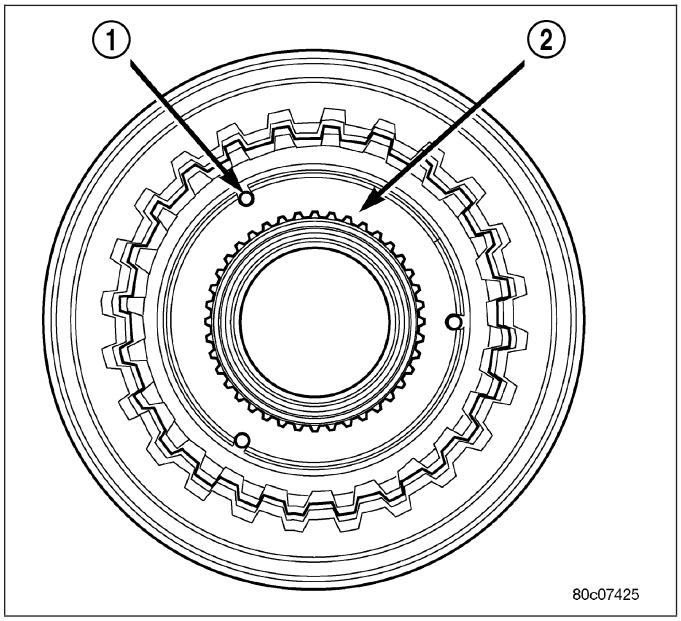




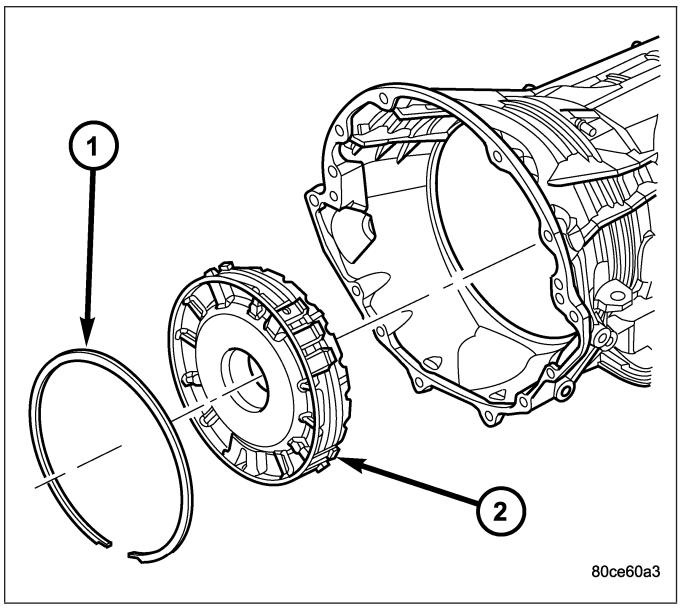
Install Reaction Annulus and Carrier

1 - THRUST BEARING NUMBER 8
2 - THRUST BEARING NUMBER 9
3 - REACTION PLANETARY CARRIER
4 - REACTION SUN GEAR
5 - THRUST BEARING NUMBER 7
6 - THRUST PLATE (SELECT)
7 - THRUST BEARING NUMBER 6
8 - REACTION ANNULUS

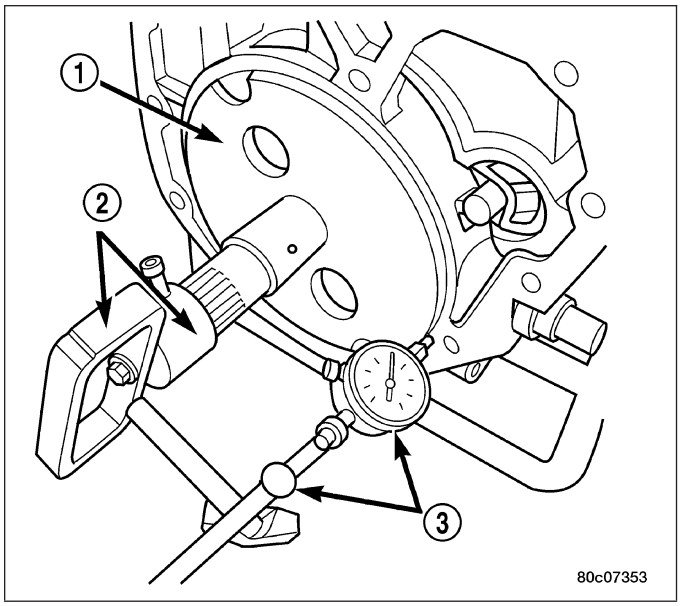
25. Install the number 8 thrust bearing (1) inside the reaction carrier with the outer race against the reaction planetary carrier (3).
26. Install the reaction planetary gear set and the number 9 thrust bearing (2), with the inner race against the reaction planetary carrier (3), into the transmission case.
27. Install the flat 2C clutch snap-ring into the transmission case.
28. Install the reaction sun gear (4) into the reaction planetary gear set. **Make sure** the small shoulder is facing the front of the transmission.
29. Install the number 7 thrust bearing (5) onto the reaction sun gear (4) with the inner race against the sun gear.
30. Install the output shaft selective thrust plate (2) onto the reaction annulus with the oil grooves facing the annulus gear and the lugs (1) and notches aligned as shown.
31. Install the number 6 thrust bearing (7) against the output shaft selective thrust plate (6) with the flat side against the thrust plate and the raised tabs on the inner race facing the front of the transmission.
32. Install the reaction annulus (8) into the reaction planetary gear set.



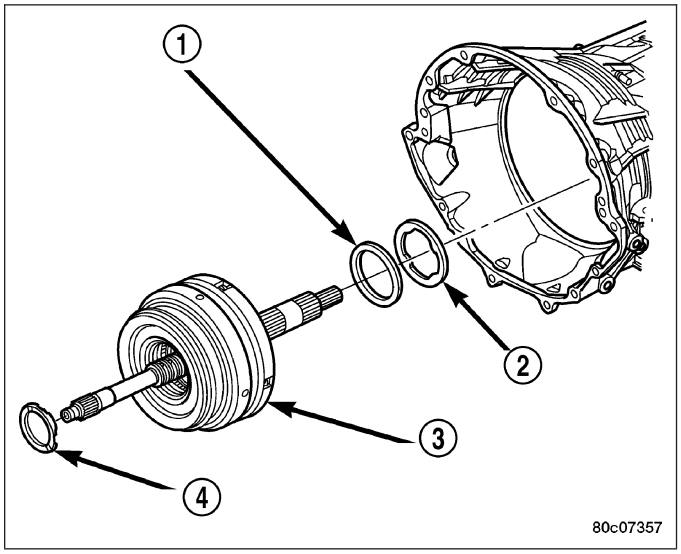
33. Install the 4C retainer/bulkhead (2) into the transmission case. Make sure that the oil feed holes are pointing toward the valve body area. Rotate the reaction annulus during the installation of the 4C retainer/bulkhead to ease installation.
34. Install the 4C retainer/bulkhead tapered snap-ring (1) into the transmission case with the taper toward the front of the case. Make sure that the open ends of the snap-ring are located in the case opening toward the valve body area.
35. Air check the 2C and 4C clutch operation.



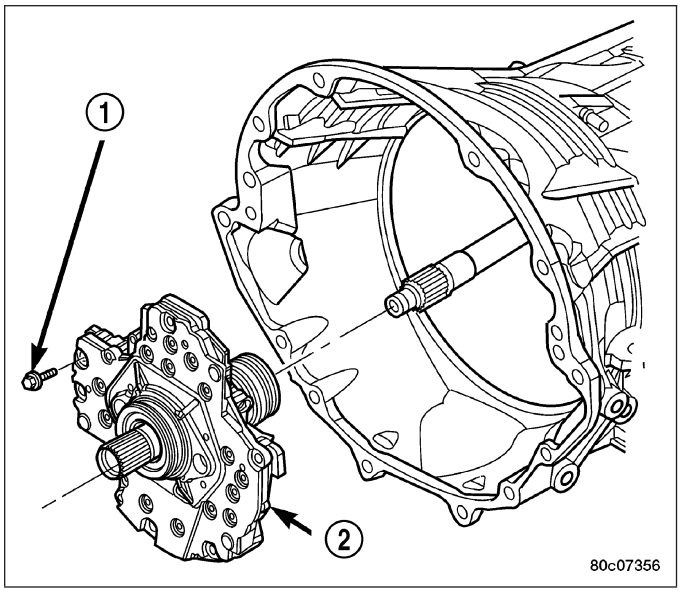
36. Using Alignment Plate 8261 (1), Adapter 8266-17 from End-Play Tool Set 8266 (2) and Dial Indicator C-3339 (3), measure and record the output shaft end-play. The correct output shaft end-play is 0.22-0.55 mm (0.009-0.021 in.). Adjust as necessary. Install the chosen output shaft selective thrust plate and re-measure end-play to verify selection.
37. Apply a bead of RTV silicone and install the extension/adapter housing onto the transmission case.
38. Install and torque the bolts to hold the extension/adapter housing onto the transmission case. The correct torque is 54 N·m (40 ft.lbs.).



39. Install the number 5 thrust bearing (1) and selective thrust plate (2) onto the 4C retainer/bulkhead. Be sure that the outer race of the bearing is against the thrust plate.
40. Install the input clutch assembly (3) into the transmission case. Make sure that the input clutch assembly is fully installed by performing a visual inspection through the input speed sensor hole. If the tone wheel teeth on the input clutch assembly are centered in the hole, the assembly is fully installed.
41. Install the number 1 thrust bearing (4) with the outer race up in the pocket of the input clutch assembly.

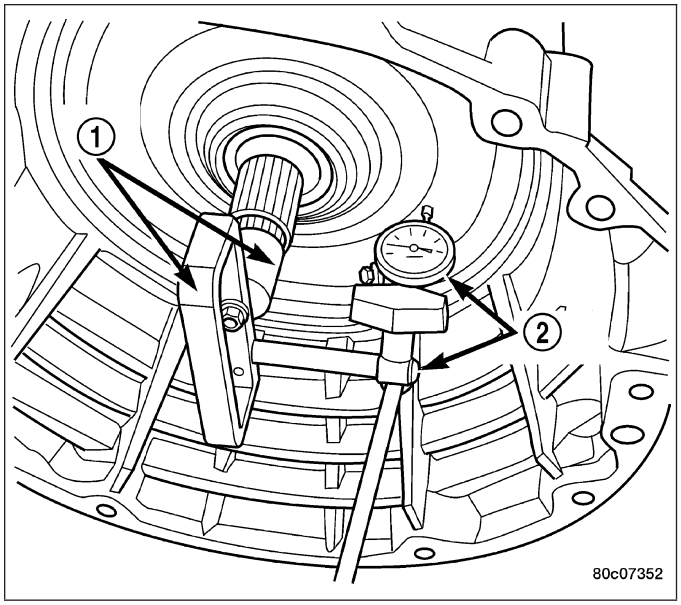


42. Install the oil pump (2) into the transmission case.
43. Install the bolts (1) to hold the oil pump into the transmission case. Tighten the oil pump bolts to 28 N·m (250 in.lbs.).

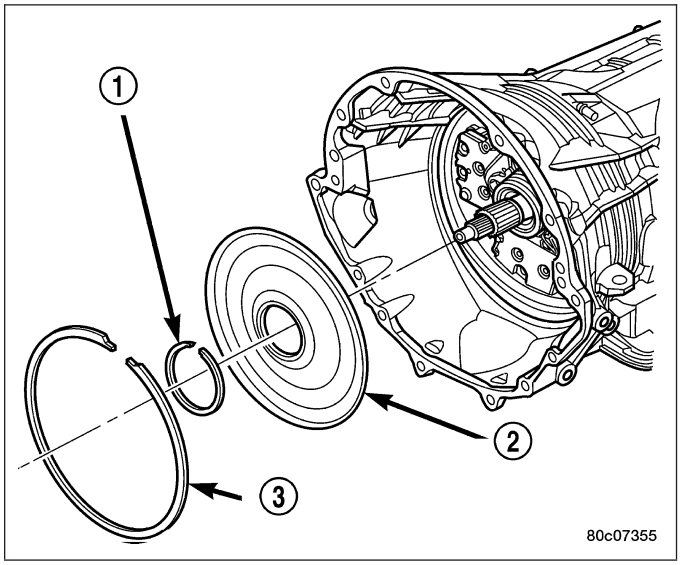


44. Using Adapter 8266-1 from End-Play Tool Set 8266 (1) and Dial Indicator C-3339 (2), measure and record the input shaft end-play. The correct end-play is 0.46-0.89 mm (0.018-0.035 in.). Adjust as necessary. Install the chosen thrust plate on the number 5 thrust bearing and re-measure end-play to verify selection.

NOTE: When measuring the input shaft end-play, two ″stops″ will be felt. When the input shaft is pushed inward and the dial indicator zeroed, the first ″stop″ felt when the input shaft is pulled outward is the movement of the input shaft in the input clutch housing hub. This value should not be included in the end-play measured value and therefore must be recorded and subtracted from the dial indicator reading.

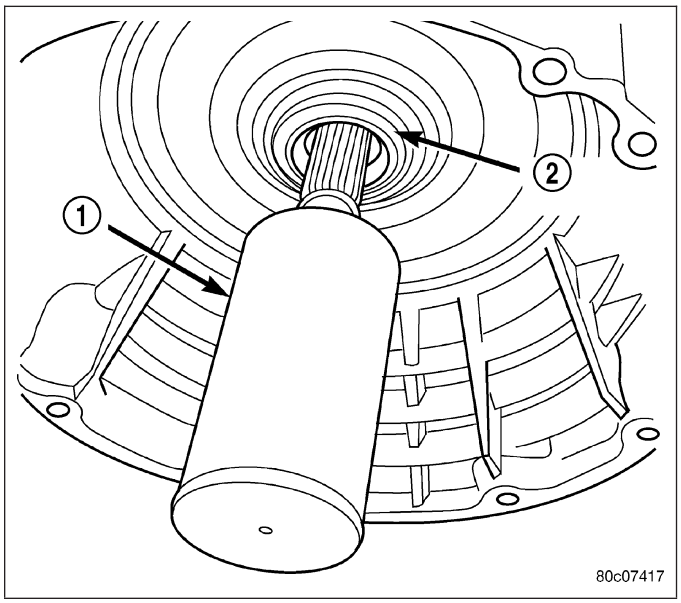


45. Install the transmission front cover (2) into the transmission case.
46. Install the outer snap-ring (3) to hold the transmission front cover (2) into the transmission case.

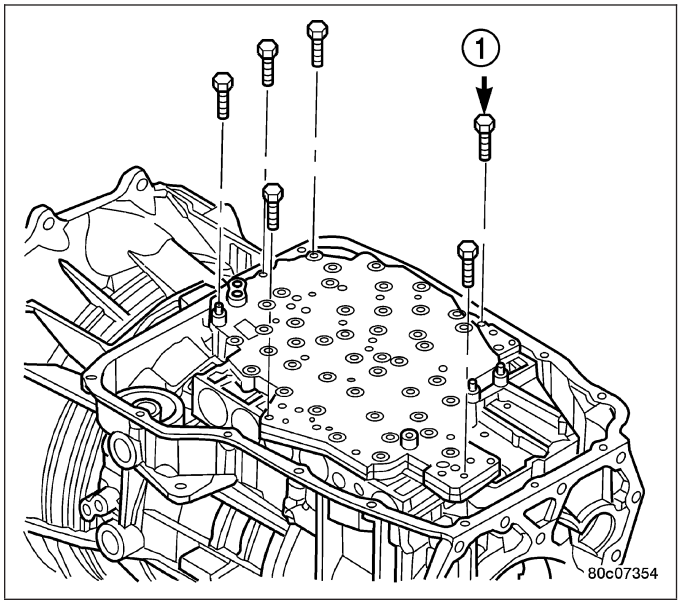


47. Partially install the inner transmission front cover snap-ring (1) onto the oil pump.

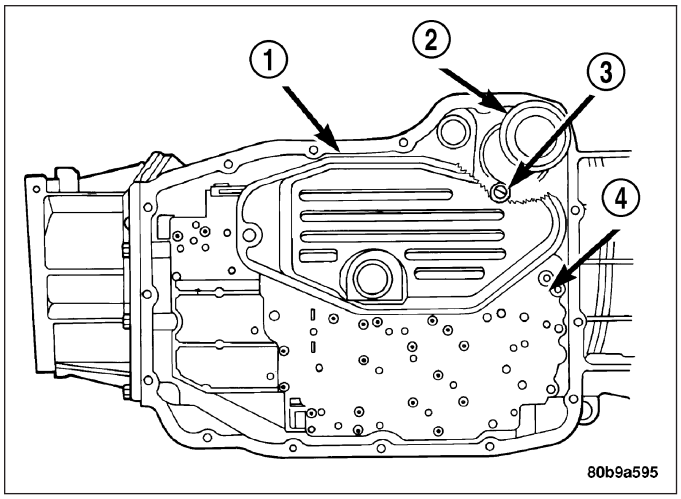
48. Using Installer 8255 (1), install the inner transmission front cover snap-ring (2) the remainder of the way onto the oil pump.



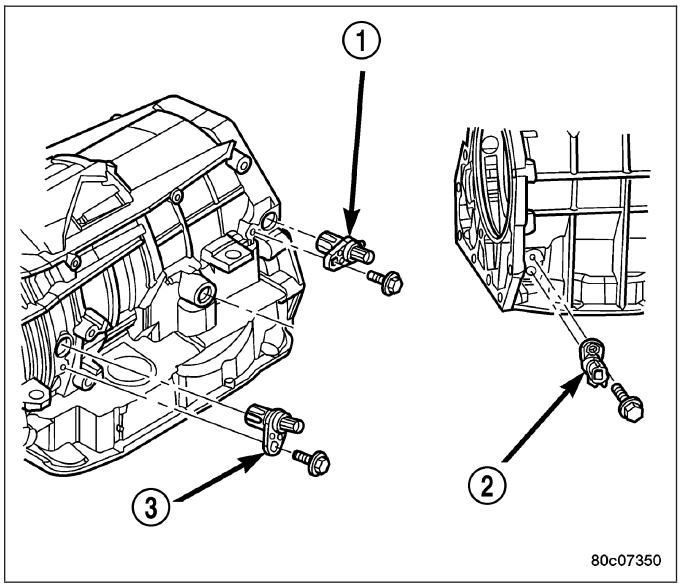
49. Install the valve body. Verify that the pin on the manual lever has properly engaged the TRS selector plate. Tighten the valve body to transmission case bolts (1) to 12 N·m (105 in.lbs.).



CAUTION: The primary oil filter seal MUST be fully installed flush against the oil pump body. DO NOT install the seal onto the filter neck and attempt to install the filter and seal as an assembly. Damage to the transmission will result.



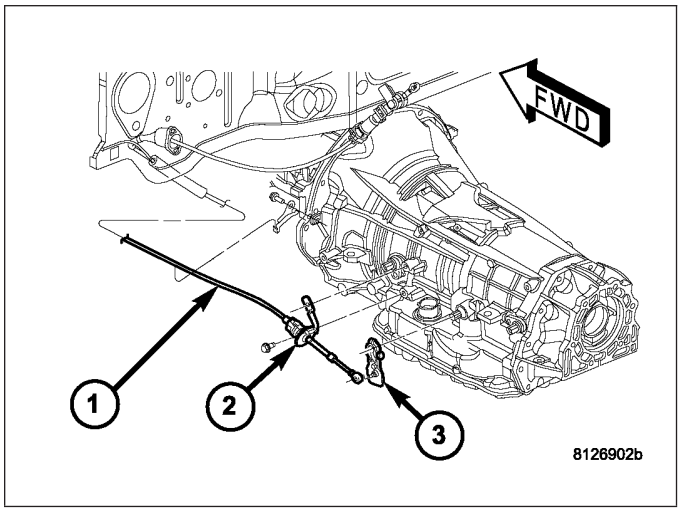
50. Install a new primary oil filter seal in the oil pump inlet bore. Seat the seal in the bore with the butt end of a hammer, or other suitable tool.
51. Install the primary oil filter (1) and the oil cooler return filter (2). Tighten the screw to hold the primary oil filter to the valve body to 4.5 N·m (40 in.lbs.). Using Oil Filter Wrench 8321, tighten the cooler return oil filter to the transmission case to 14 N·m (125 in.lbs.).
52. Apply RTV silicone to the oil pan and install the transmission oil pan. Tighten the bolts to 12 N·m (105 in.lbs.).
53. Install the input (3), output (1), and line pressure sensors (2). Tighten the bolts to 12 N·m (105 in.lbs.).



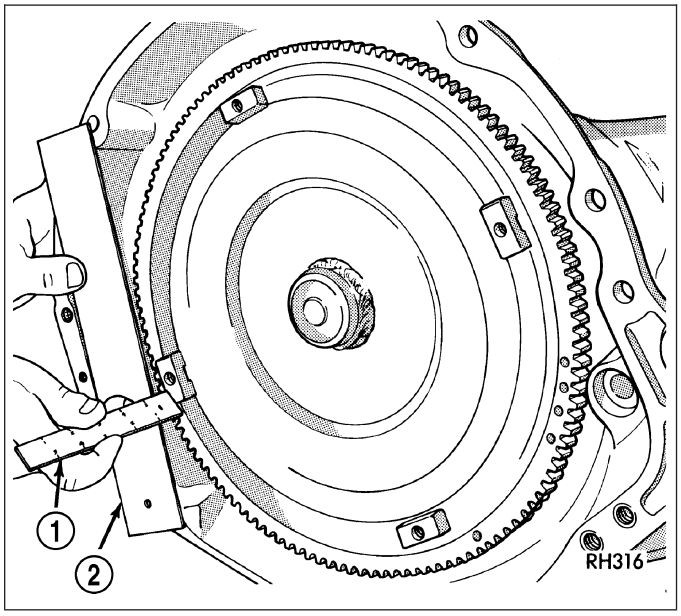
INSTALLATION

NOTE: Check torque converter hub and hub drive flats for sharp edges burrs, scratches, or nicks. Polish the hub and flats with 320/400 grit paper and crocus cloth if necessary. Verify that the converter hub o-ring is properly installed and is free of any debris. The hub must be smooth to avoid damaging pump seal at installation.

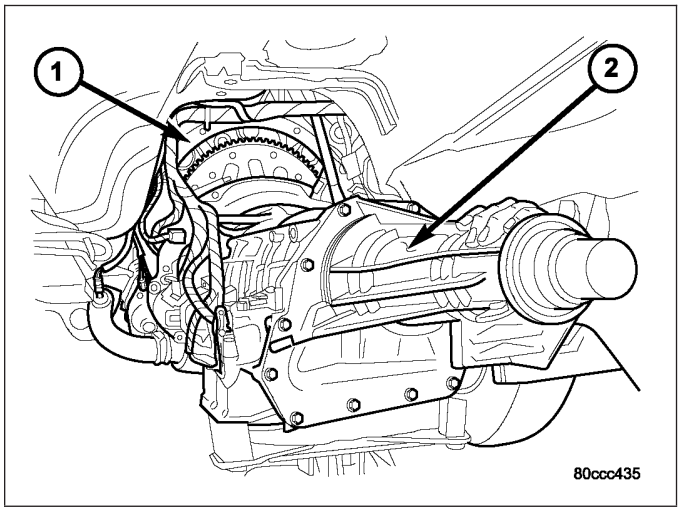
1. If a replacement transmission is being installed, transfer any components necessary, such as the manual shift lever (3) and shift cable bracket (2), from the original transmission onto the replacement transmission.



2. Lubricate oil pump seal lip with transmission fluid.
3. Align converter and oil pump.
4. Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.
5. Check converter seating with steel scale and straightedge. Surface of converter lugs should be at least 13mm (1/2 in.) (1) to rear of straightedge (2) when converter is fully seated.
6. Temporarily secure converter with C-clamp.

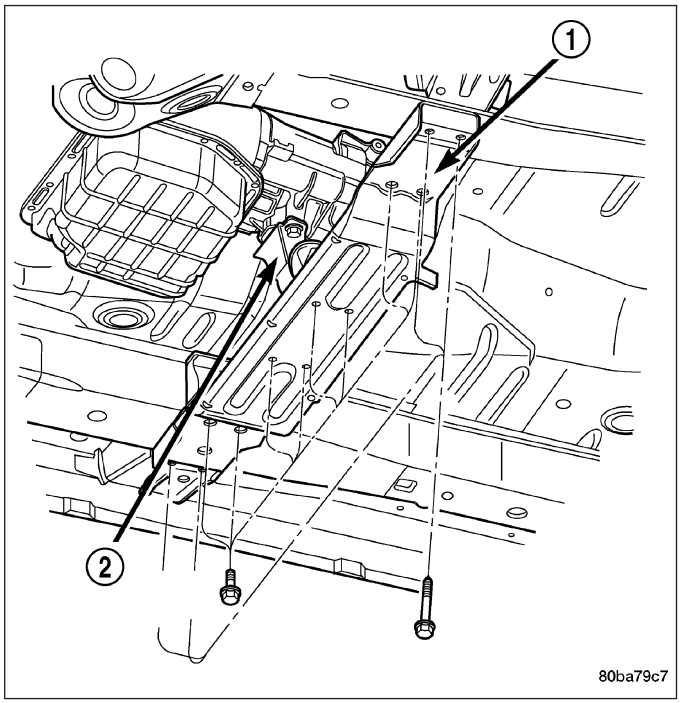


7. Position transmission on jack and secure it with chains.
8. Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.**
9. Apply a light coating of Mopar® High Temp Grease to the torque converter hub pocket in the rear pocket of the engine's crankshaft.
10. Raise transmission and align the torque converter with the drive plate and transmission converter housing with the engine block.
11. Move transmission forward. Then raise, lower or tilt transmission to align the converter housing with engine block dowels.

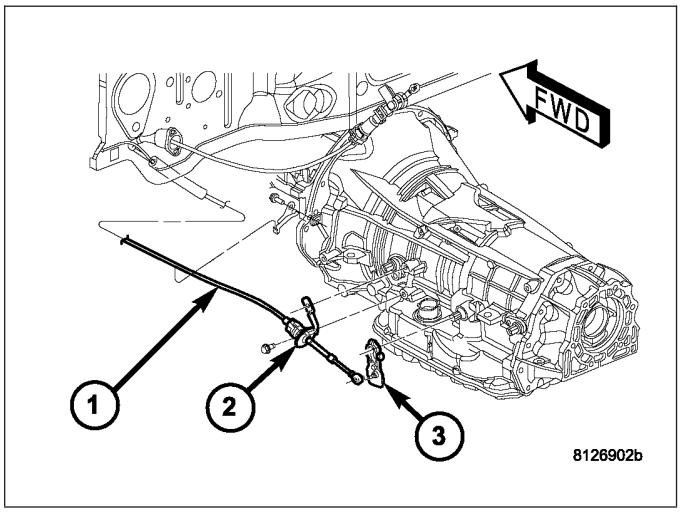


12. Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft. Verify that no wires, or the transmission vent hose, have become trapped between the engine block and the transmission.
13. Install two bolts to attach the transmission to the engine.
14. Install remaining torque converter housing to engine bolts. Tighten to 68 N·m (50 ft.lbs.).
15. Install transfer case, if equipped. Tighten transfer case nuts to 35 N·m (26 ft.lbs.).

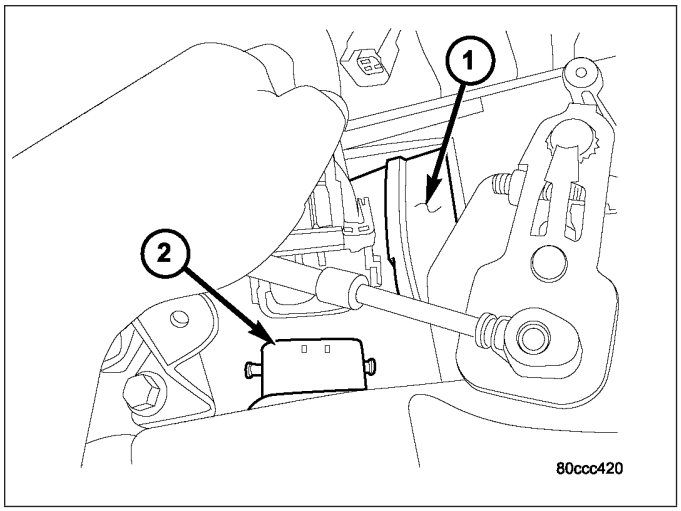
16. Install rear transmission crossmember (1). Tighten crossmember to frame bolts to 68 N·m (50 ft.lbs.).
17. Install rear support to transmission (2). Tighten bolts to 47 N·m (35 ft.lbs.).
18. Lower transmission onto crossmember and install bolts attaching transmission mount to crossmember. Tighten clevis bracket to crossmember bolts to 47 N·m (35 ft.lbs.). Tighten the clevis bracket to rear support bolt to 68 N·m (50 ft.lbs.).
19. Remove engine support fixture.



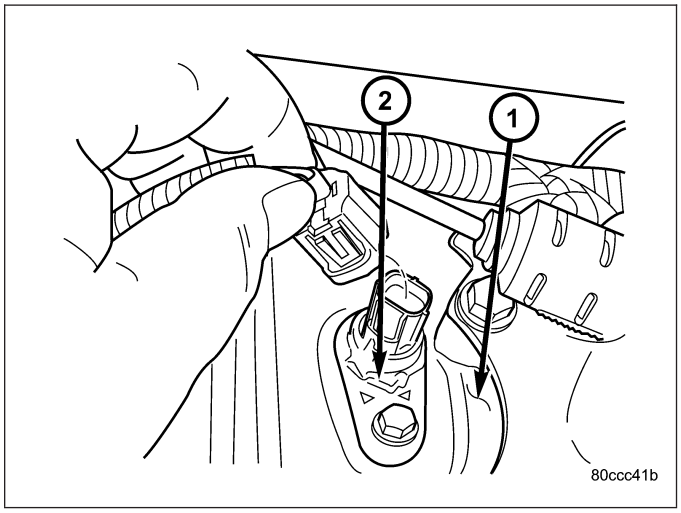
20. Connect gearshift cable (1) to transmission.



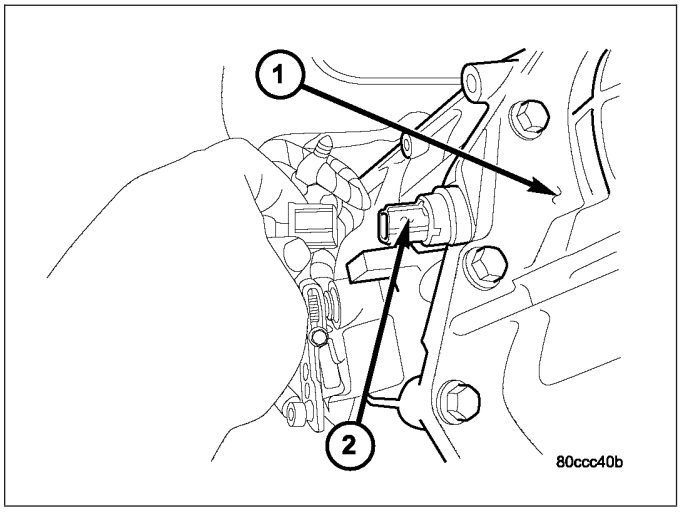
21. Connect the wiring harness connector to the solenoid and pressure switch assembly (2) connector. Be sure transmission harnesses are properly routed.



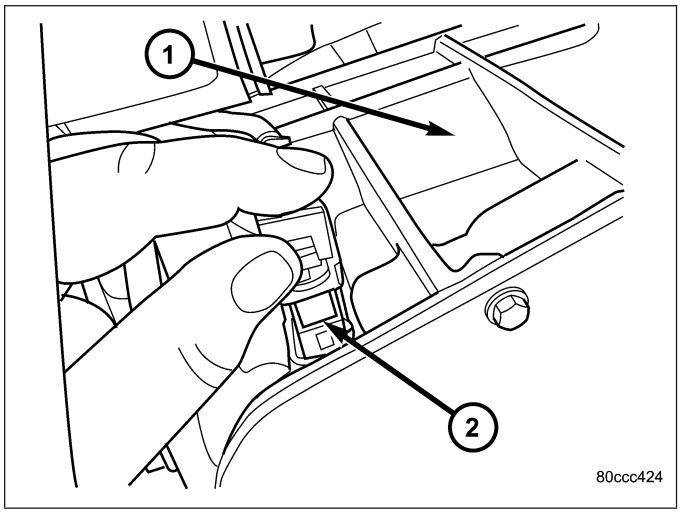
22. Connect the wiring harness connector to the input speed sensor (2).



23. Connect the wiring harness connector to the output speed sensor (2).

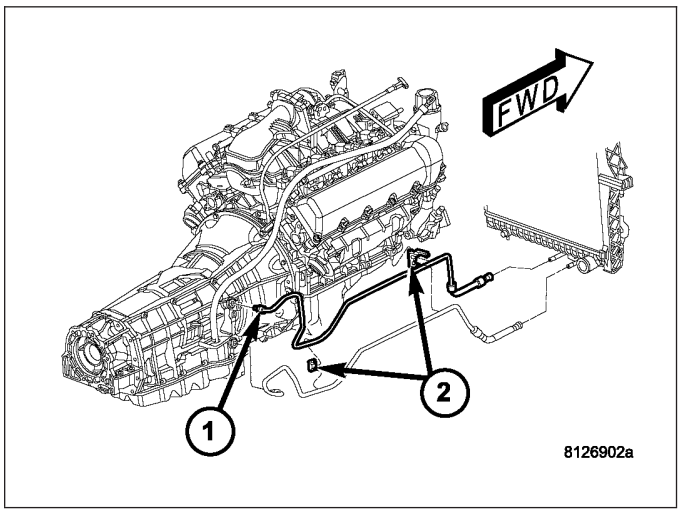


24. Connect the wiring harness connector to the line pressure sensor (2).

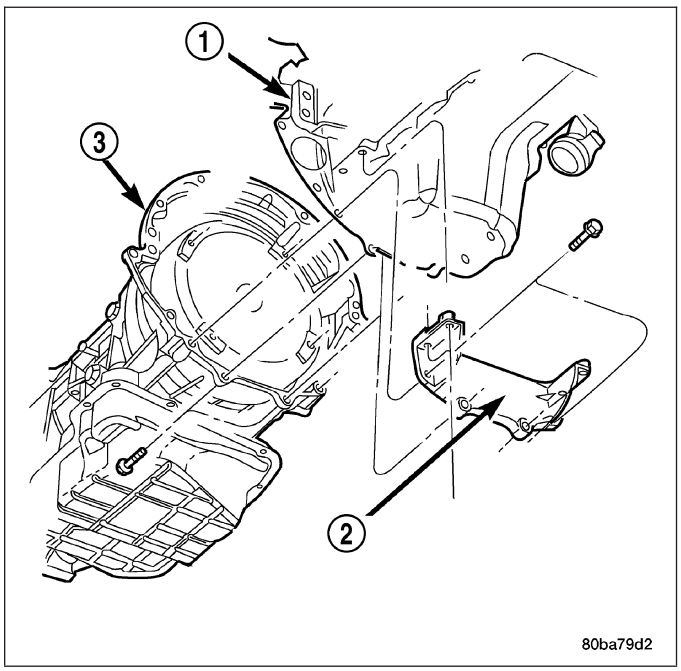


CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the clutch surface inside the converter.

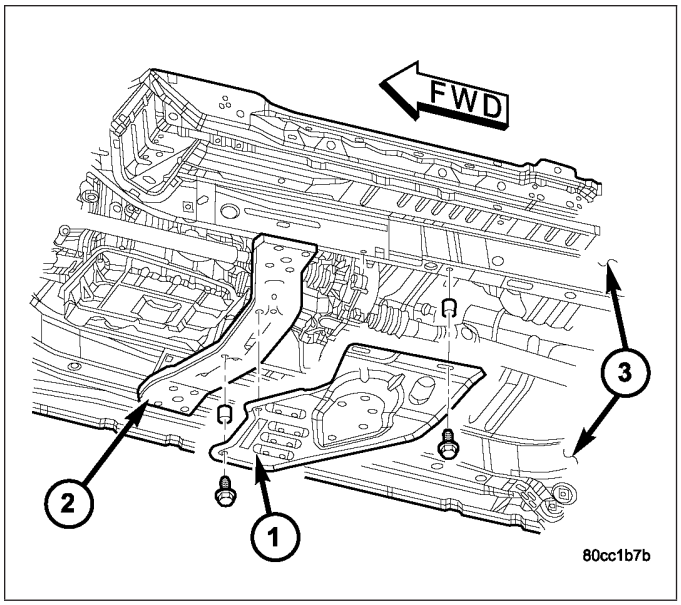
25. Install torque converter-to-driveplate bolts. Tighten bolts to 31 N·m (270 in. lbs.).
26. Install starter motor and cooler line bracket.
27. Connect cooler lines to transmission.



28. Install transmission fill tube.
29. Install exhaust components.
30. Install the structural dust cover (2) onto the transmission and the engine. (Refer to 9 - ENGINE/ ENGINE BLOCK/STRUCTURAL COVER - INSTALLATION)

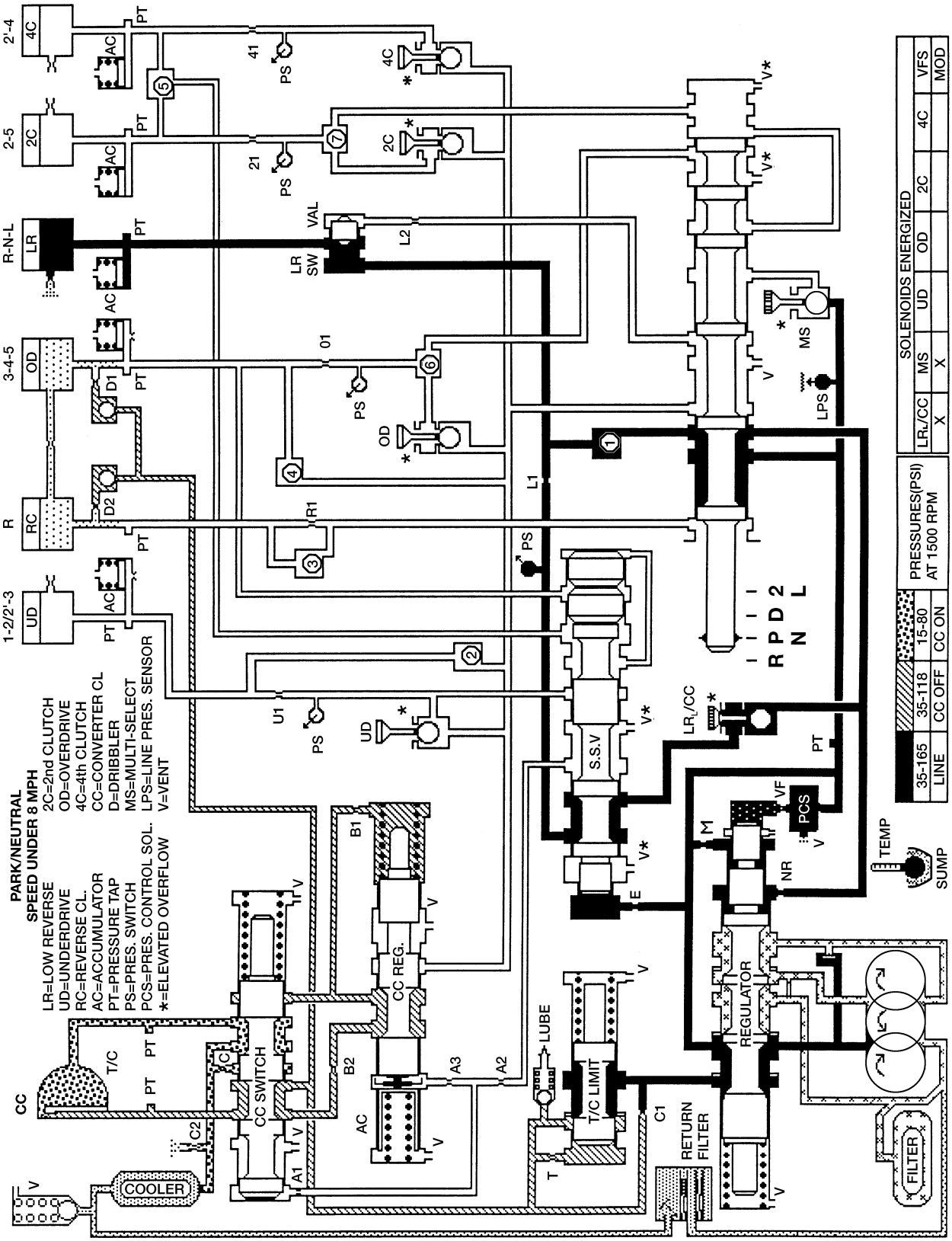


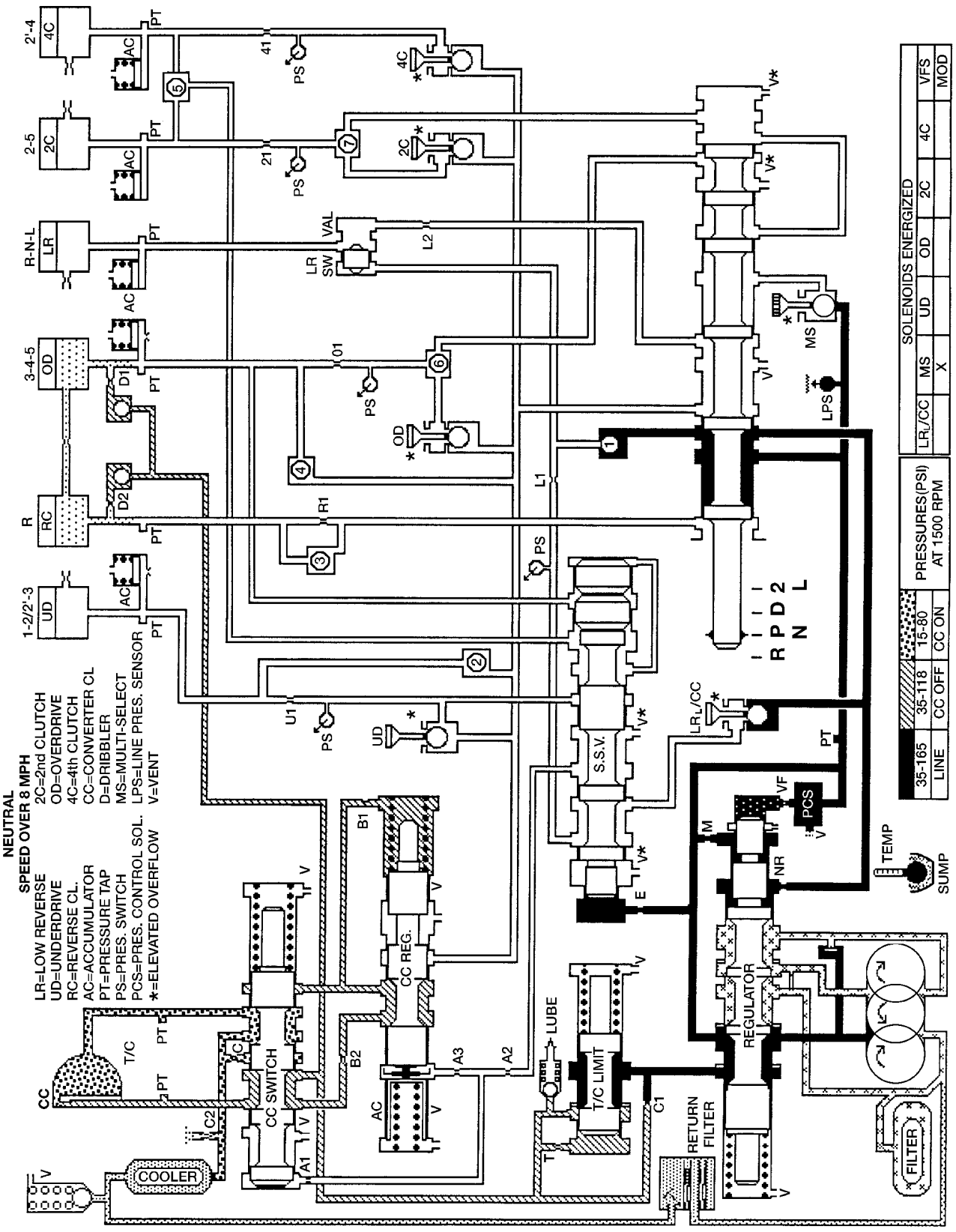
31. Align and install the front propeller shaft, if necessary. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT - FRONT/PROPELLER SHAFT - INSTALLATION)
32. Align and install the rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT - REAR/PROPELLER SHAFT - INSTALLATION)
33. Adjust gearshift cable if necessary.
34. Install any skid plates (1) removed previously. (Refer to 13 - FRAMES & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION)
35. Lower vehicle.
36. Fill transmission with Mopar® ATF +4, Automatic Transmission Fluid.



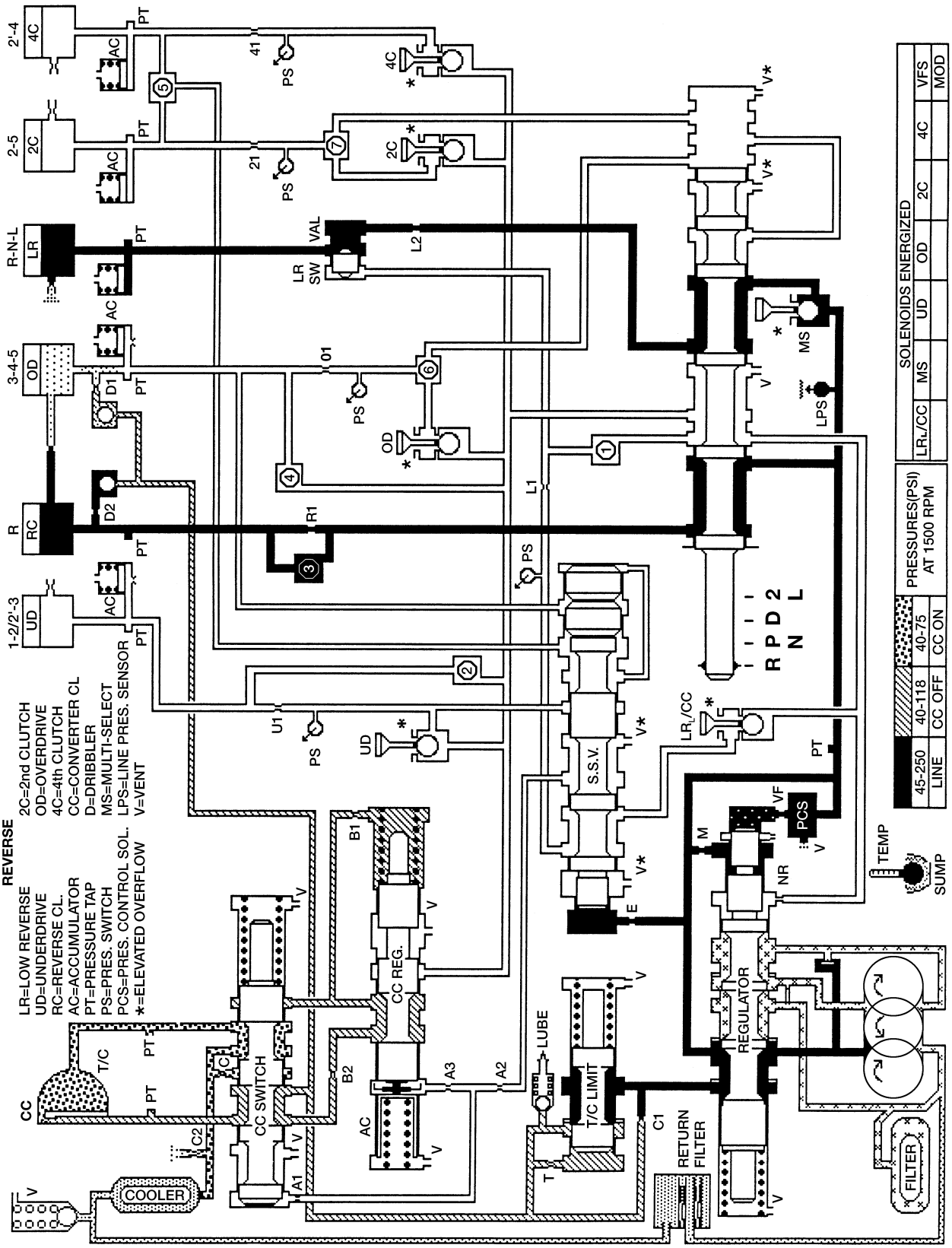
SCHEMATICS AND DIAGRAMS

HYDRAULIC SCHEMATICS

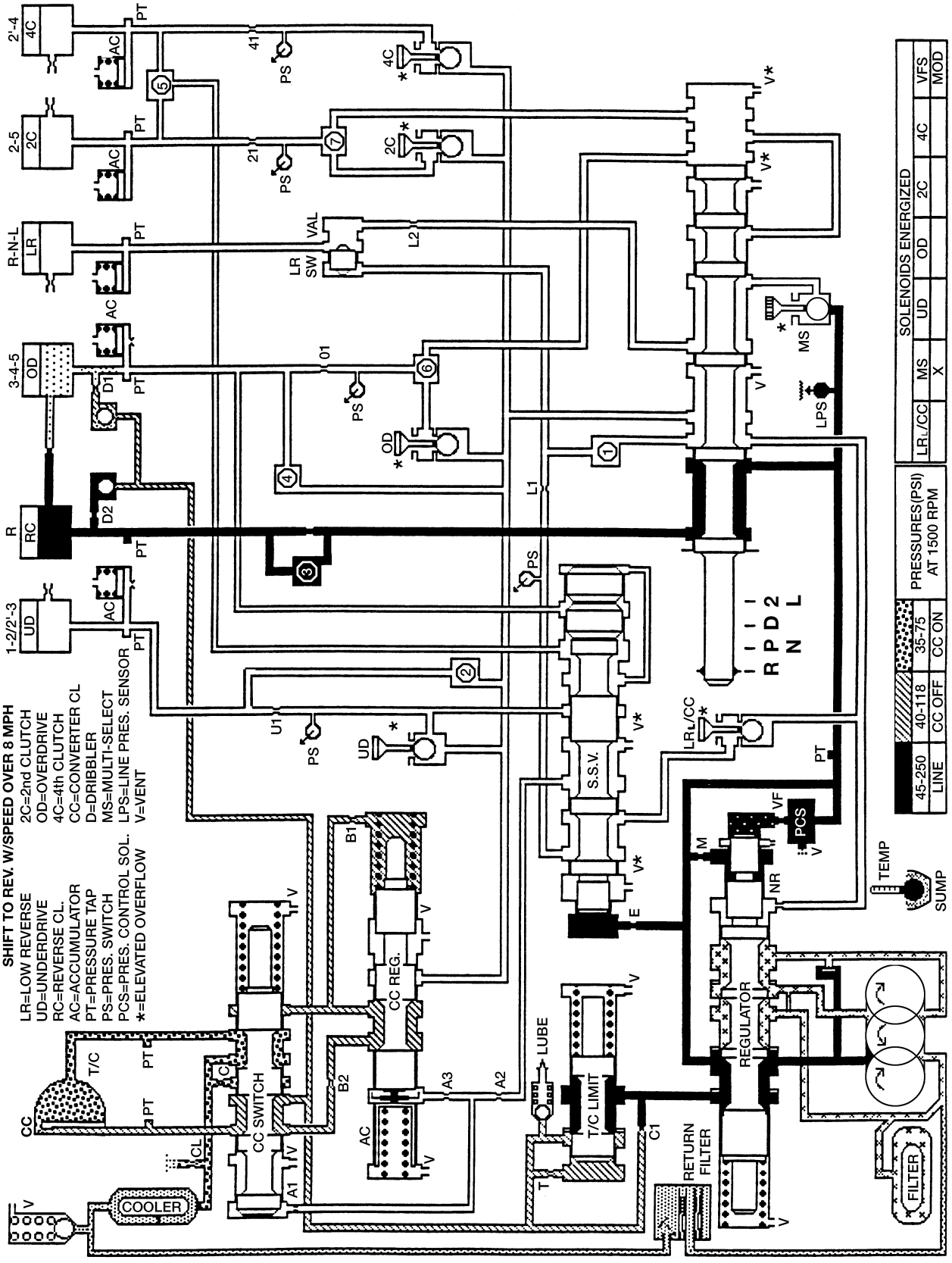




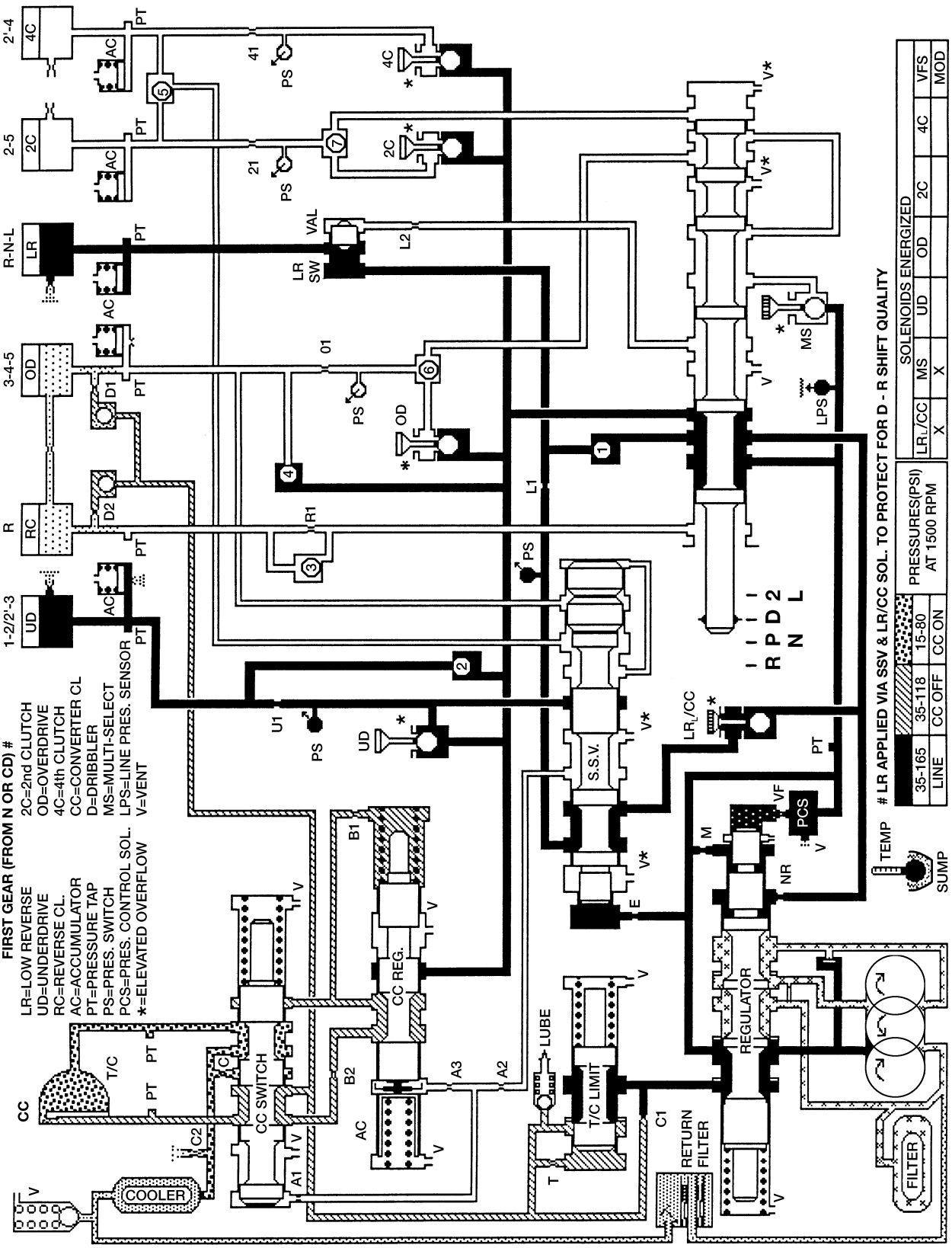
HYDRAULIC FLOW IN NEUTRAL OVER 8MPH



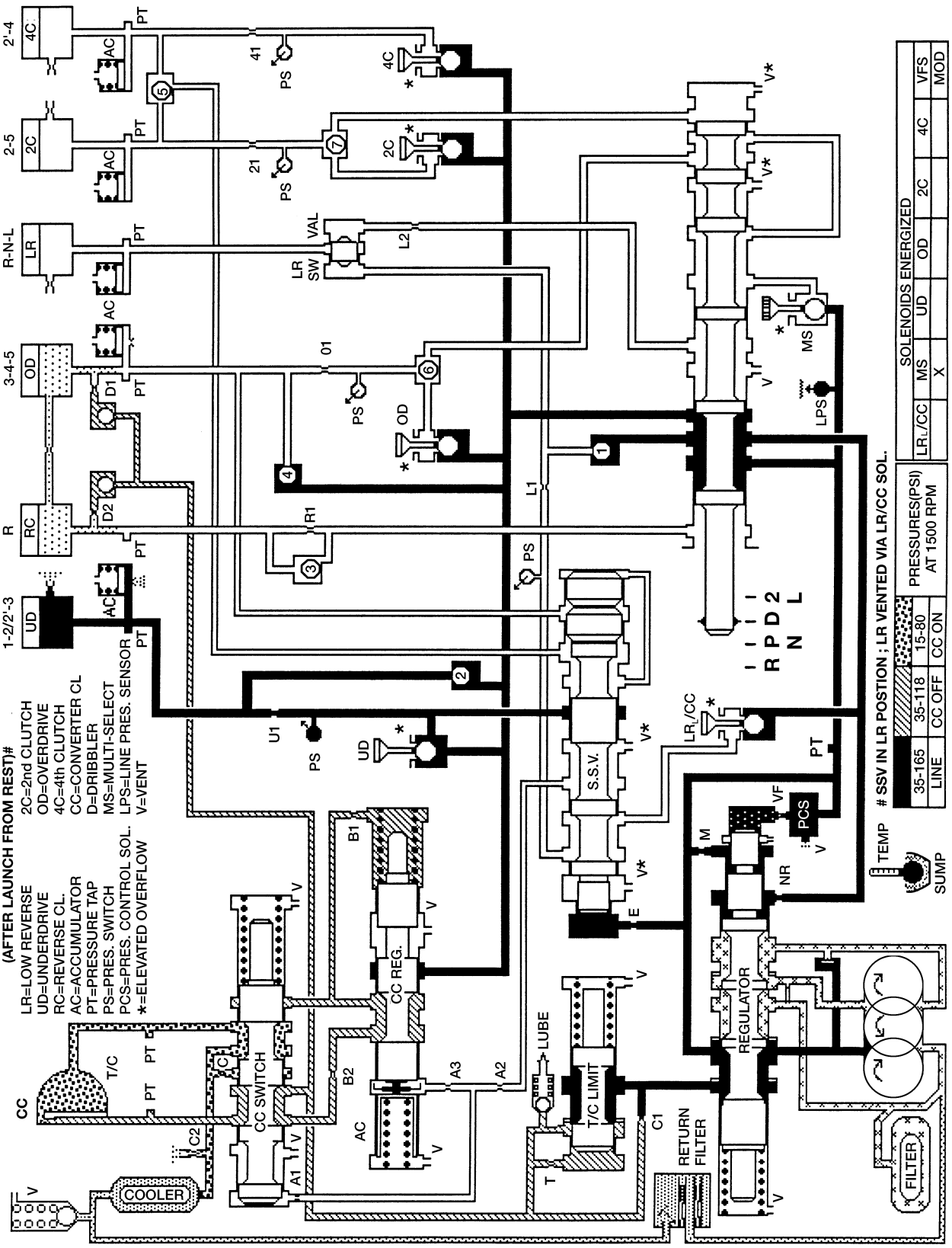
HYDRAULIC FLOW IN REVERSE



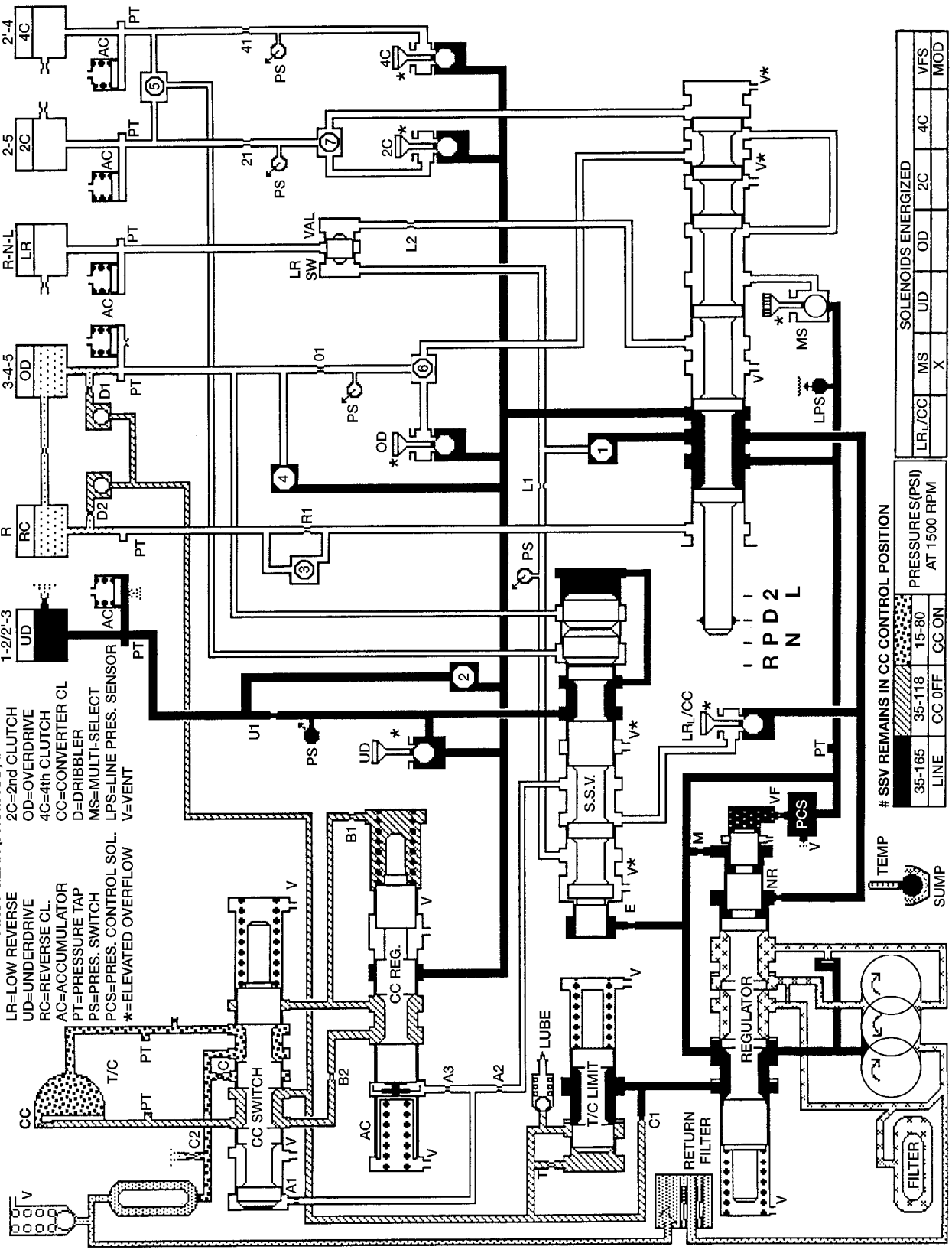
HYDRAULIC FLOW IN REVERSE BLOCK



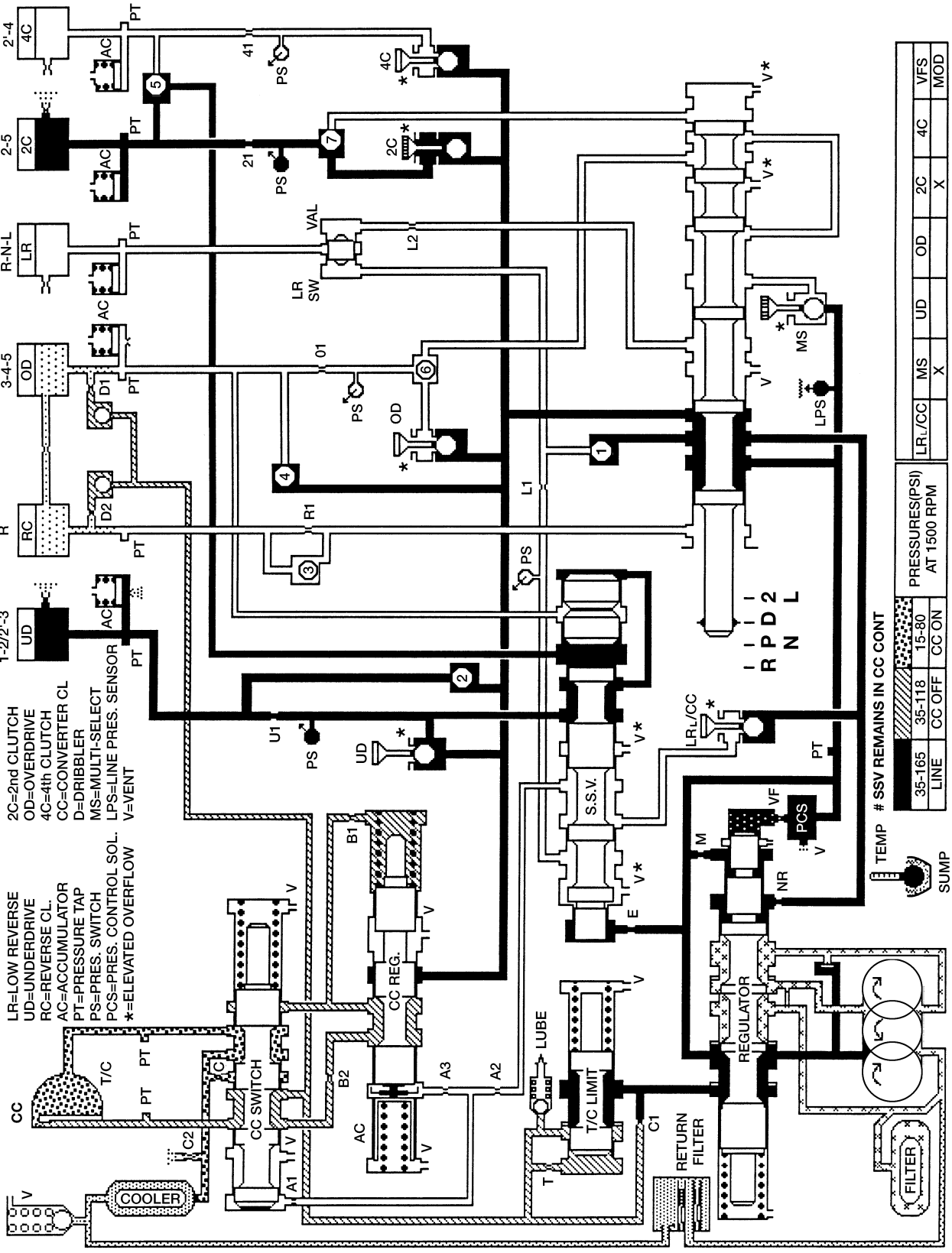
HYDRAULIC FLOW IN FIRST GEAR (FROM N OR OD)



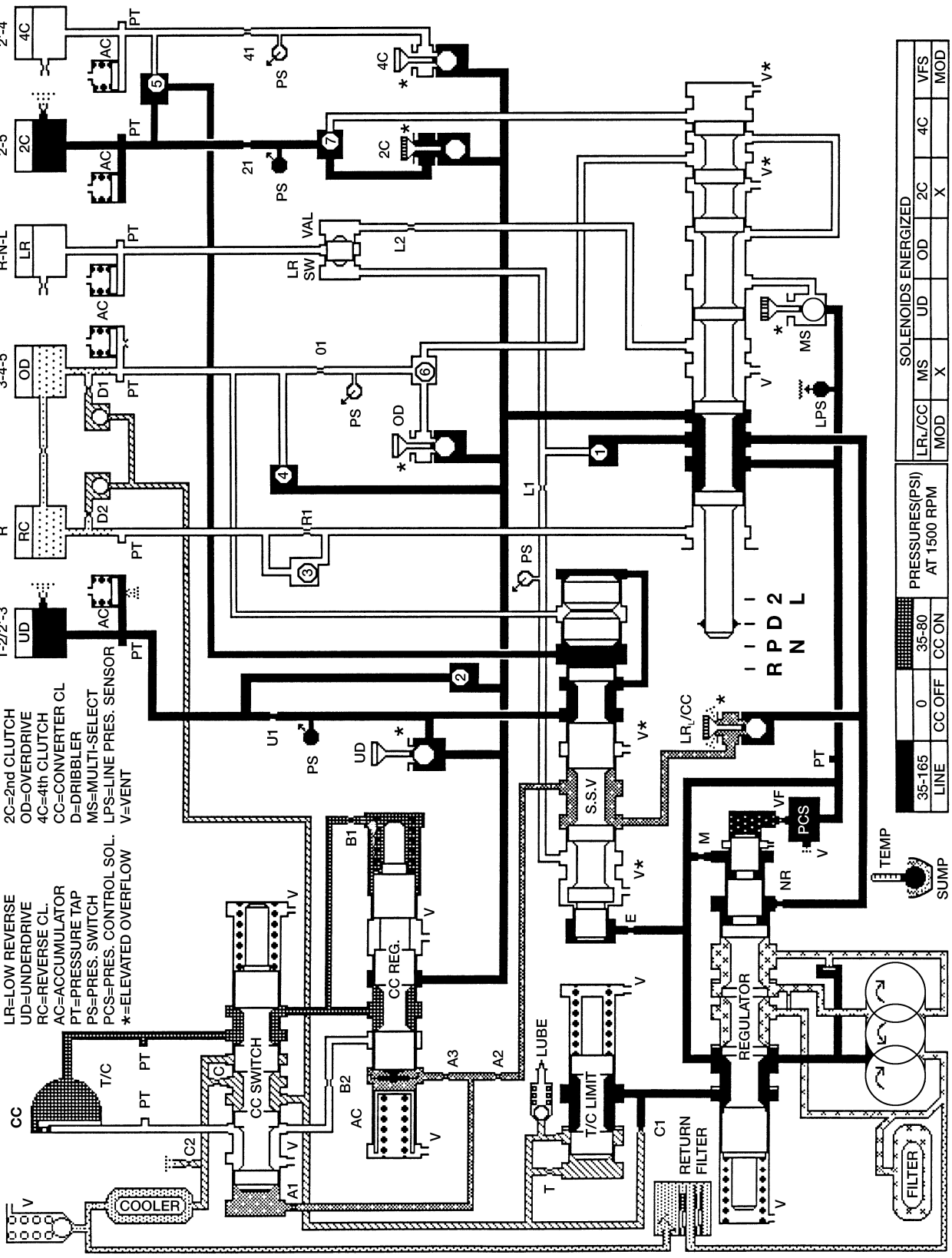
HYDRAULIC FLOW IN FIRST GEAR (AFTER LAUNCH FROM REST)



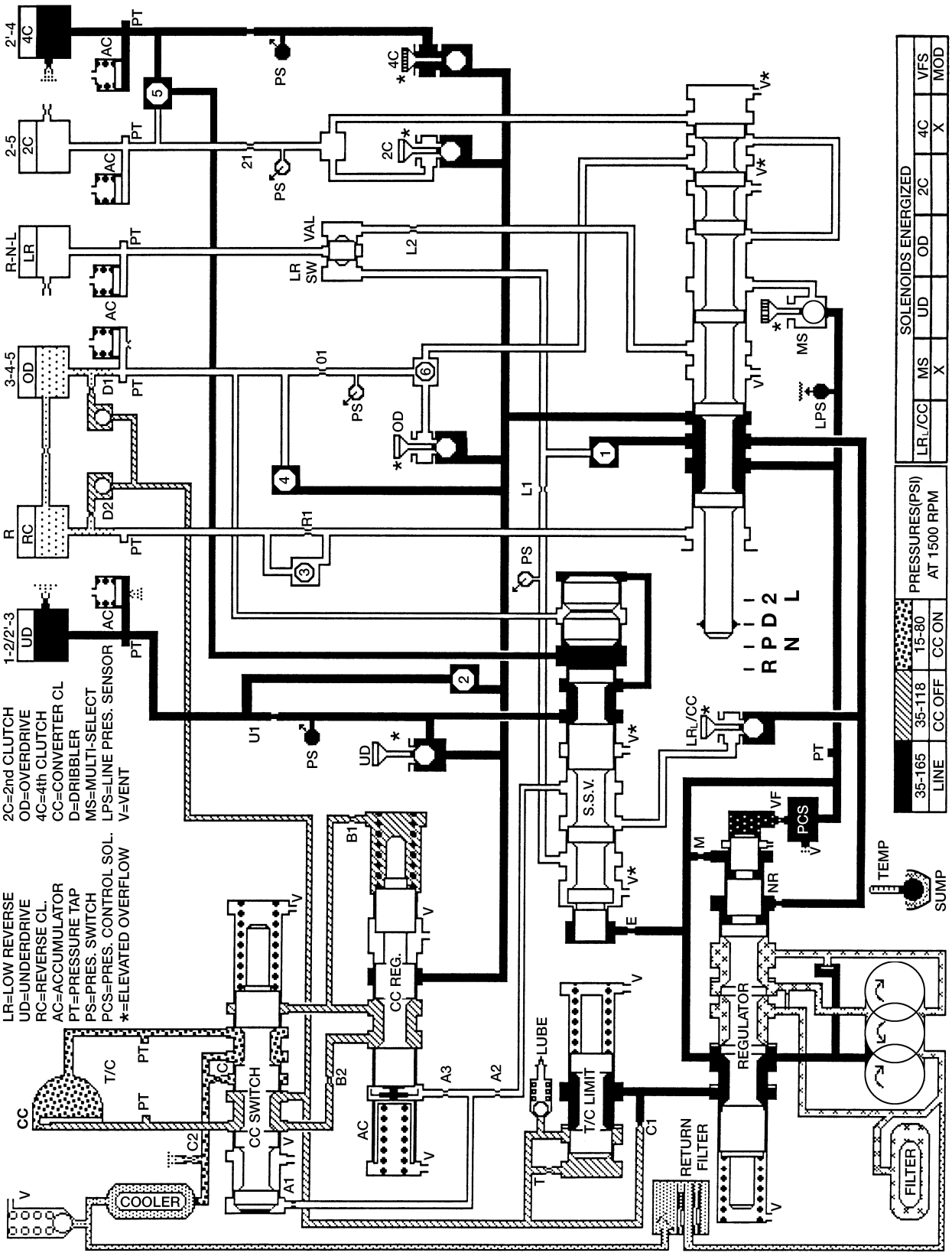
HYDRAULIC FLOW IN FIRST GEAR (FROM K/D)



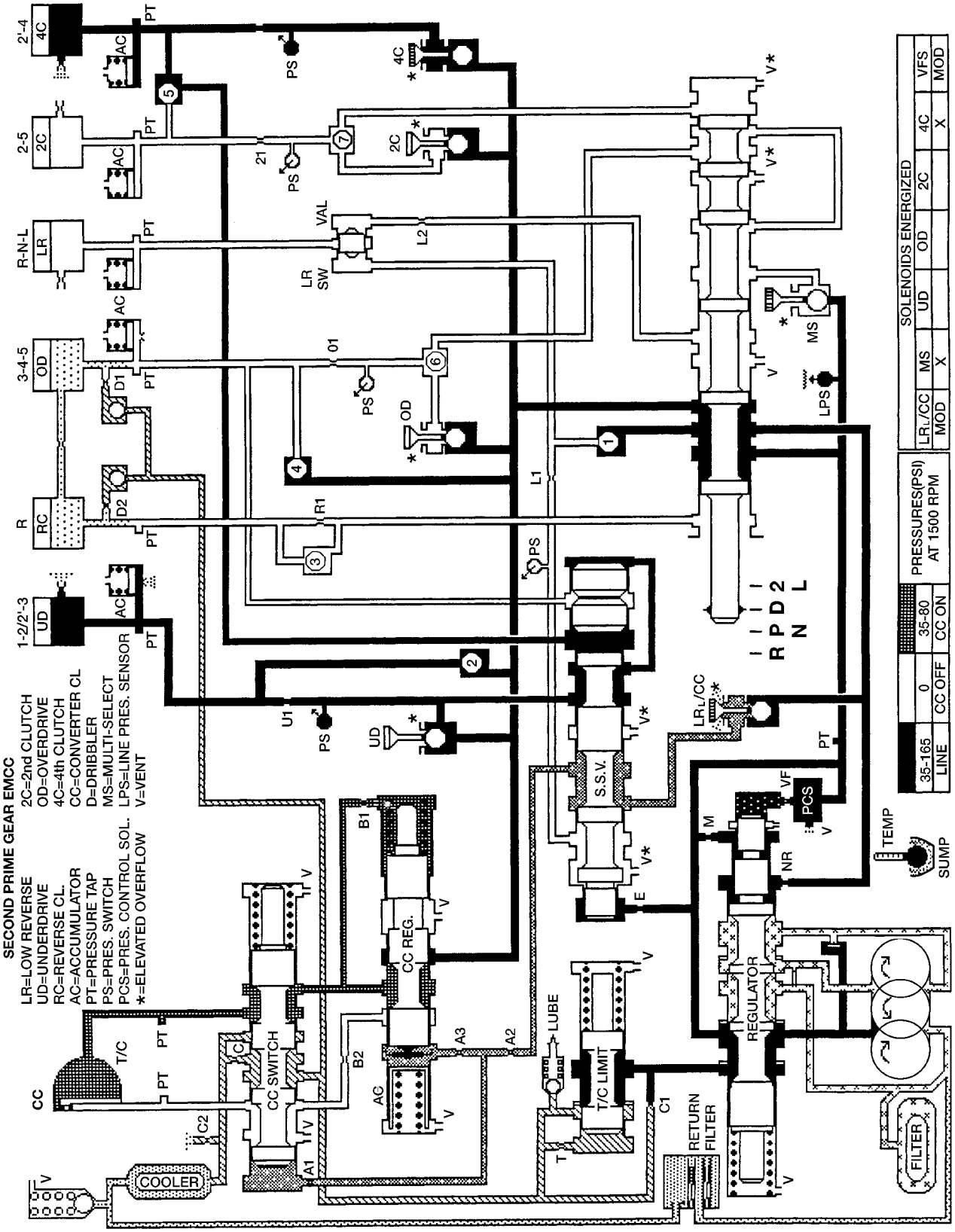
HYDRAULIC FLOW IN SECOND GEAR

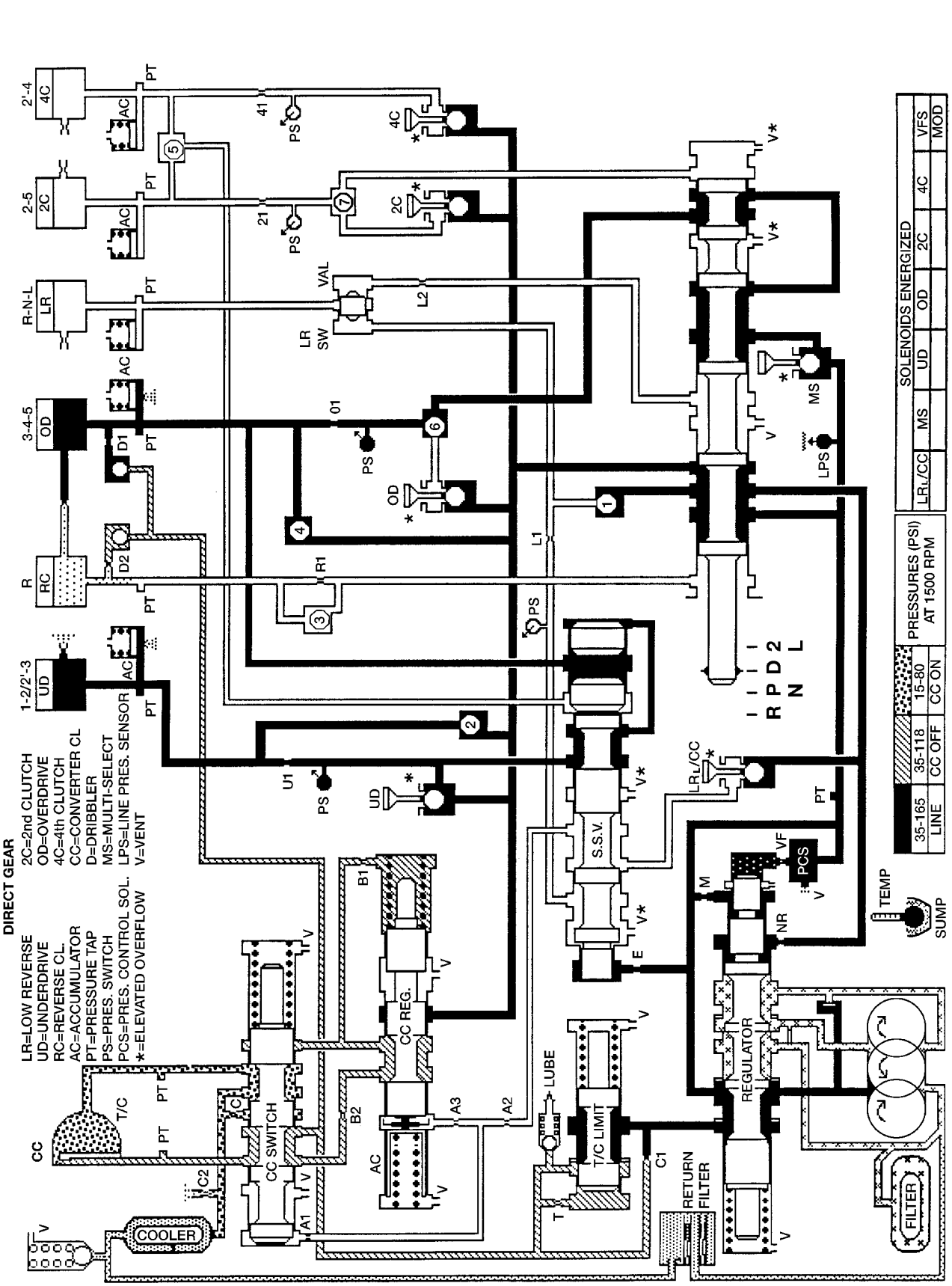


HYDRAULIC FLOW IN SECOND GEAR EMCC

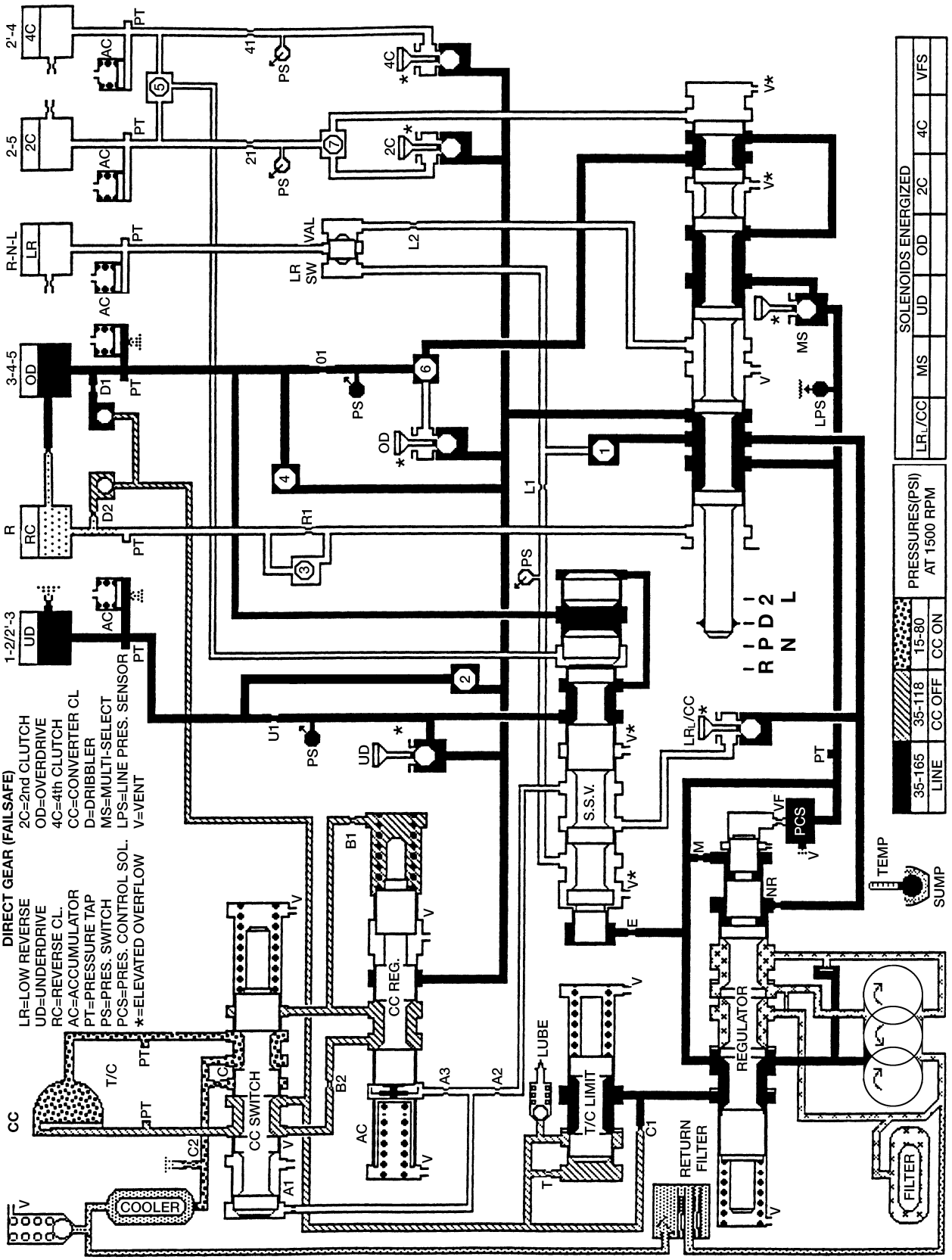


HYDRAULIC FLOW IN SECOND PRIME GEAR

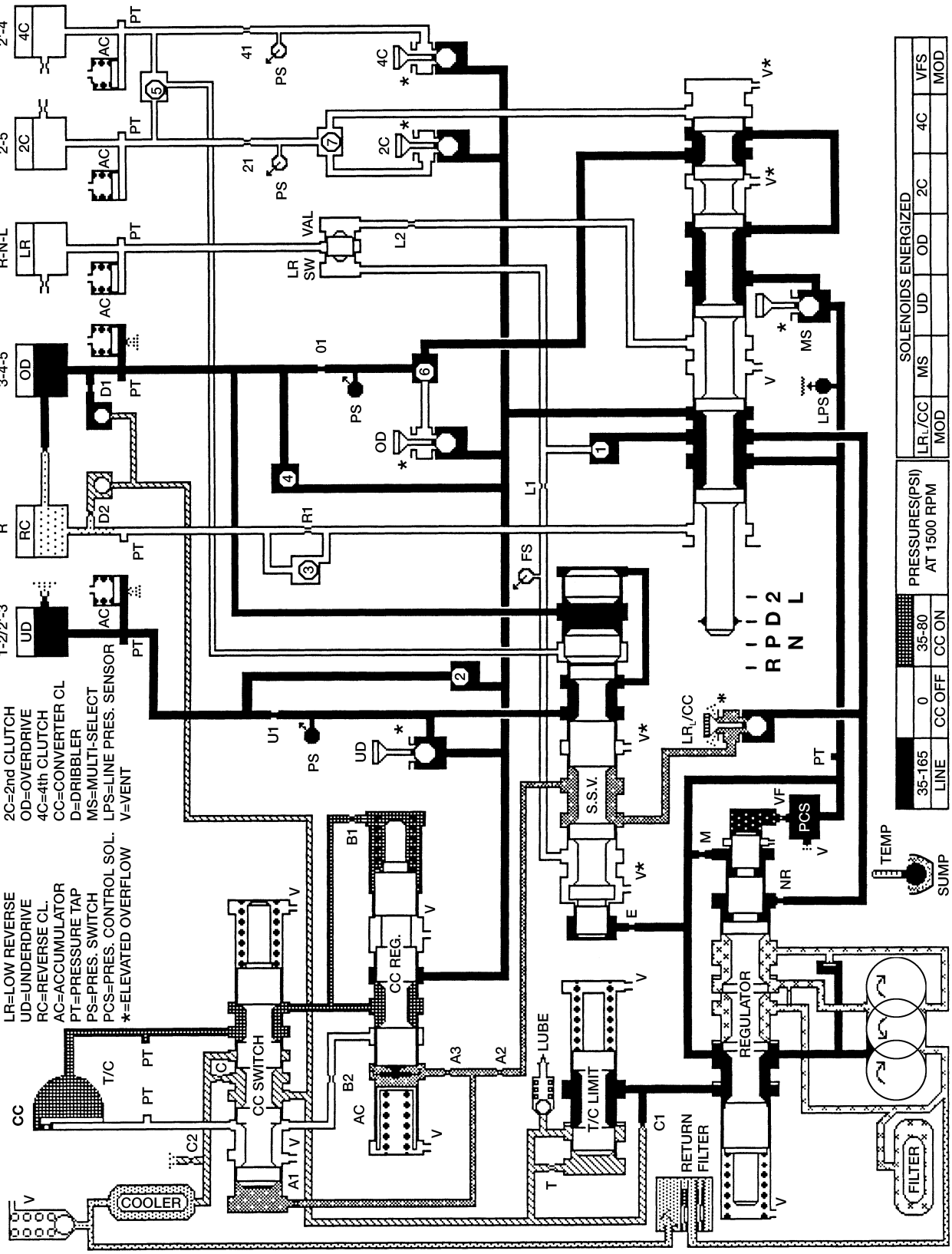

80a0e238
SECOND PRIME GEAR EMCC
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
*=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
2'-4 4C
2-5 2C
R-N-L LR
3-4-5 OD
R RC
1-2/2'-3 UD
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
0 CC OFF
35-80 CC ON
SOLENOIDS ENERGIZED
LR./CC MOD
MS X
UD
OD
2C
4C X
VFS MOD
R P D 2 N L
S.S.V.
PCS
LR./CC
REGULATOR
CC REG.
CC SWITCH
T/C LIMIT
LUBE
RETURN FILTER
FILTER
COOLER
SUMP
TEMP
HYDRAULIC FLOW IN SECOND PRIME GEAR EMCC



HYDRAULIC FLOW IN DIRECT GEAR

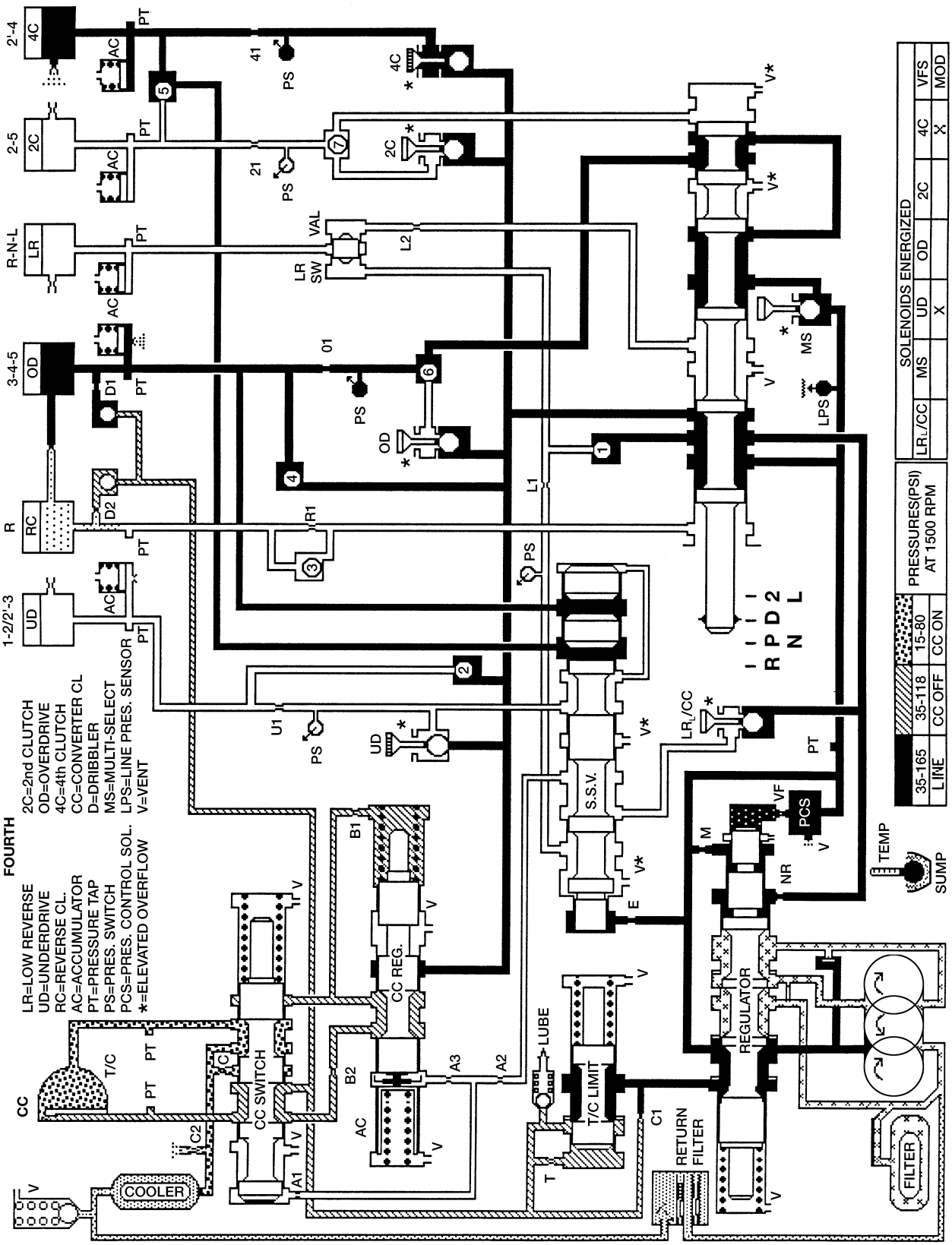


HYDRAULIC FLOW IN DIRECT GEAR (FAILSAFE)

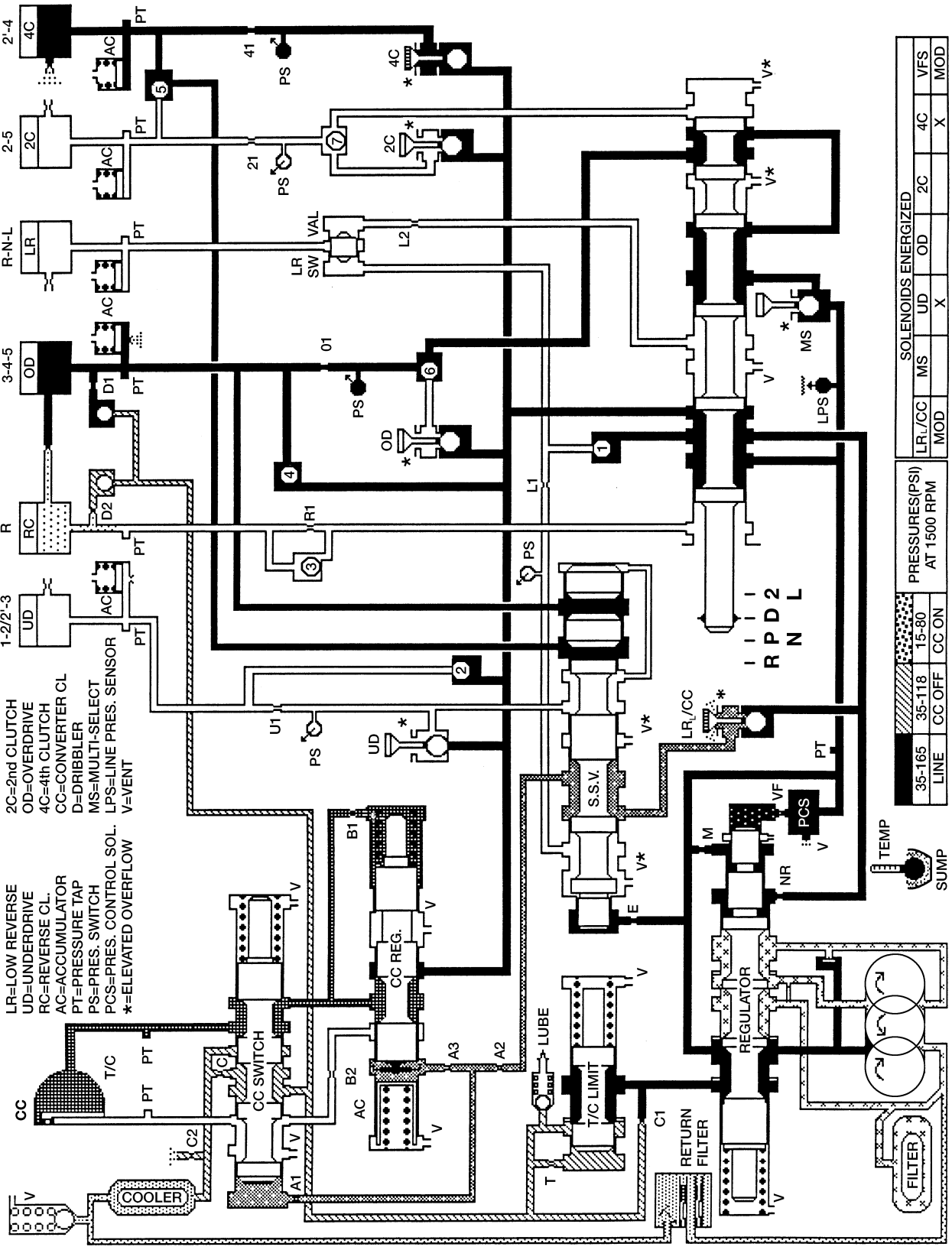


80a0e328

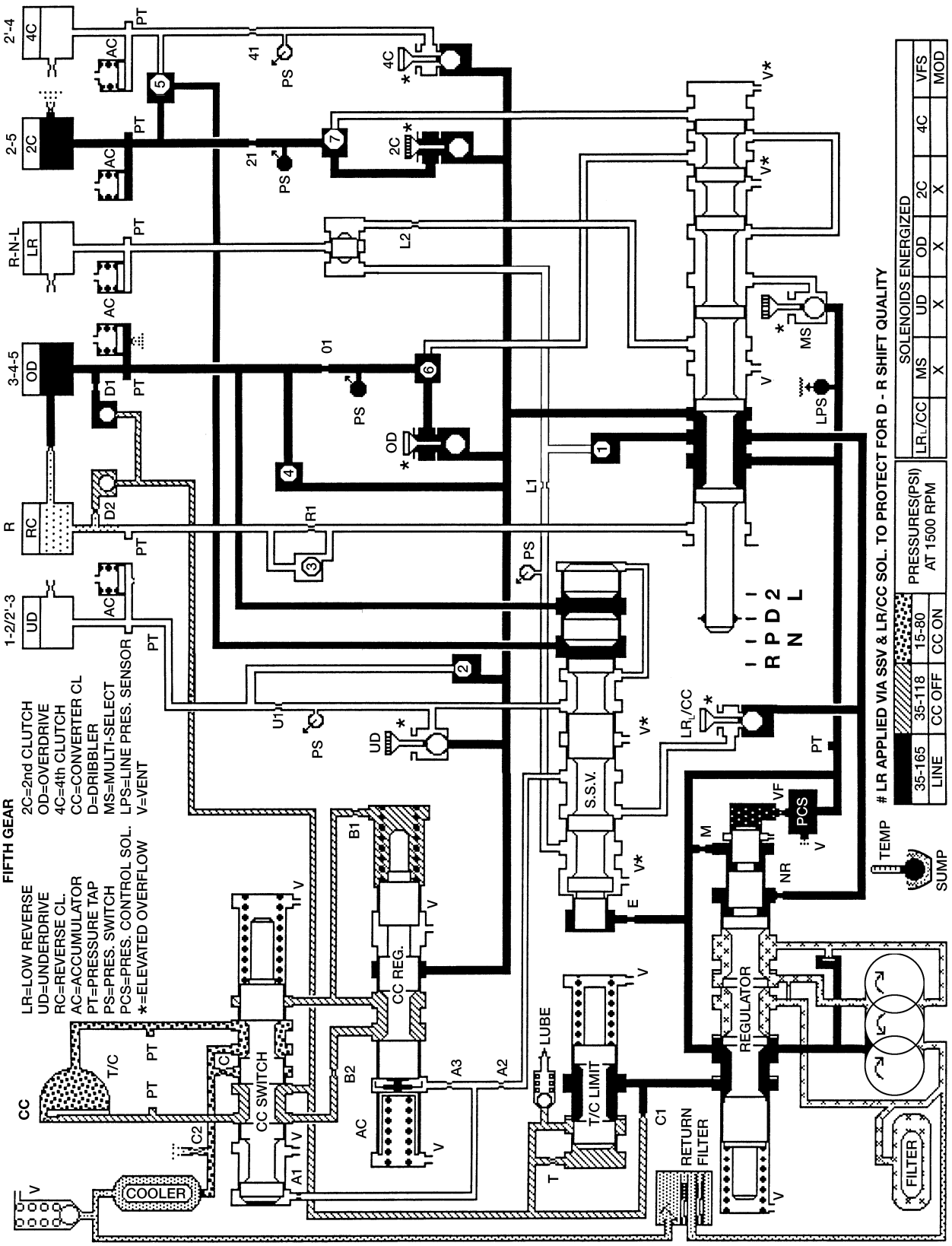
HYDRAULIC FLOW IN DIRECT GEAR EMCC

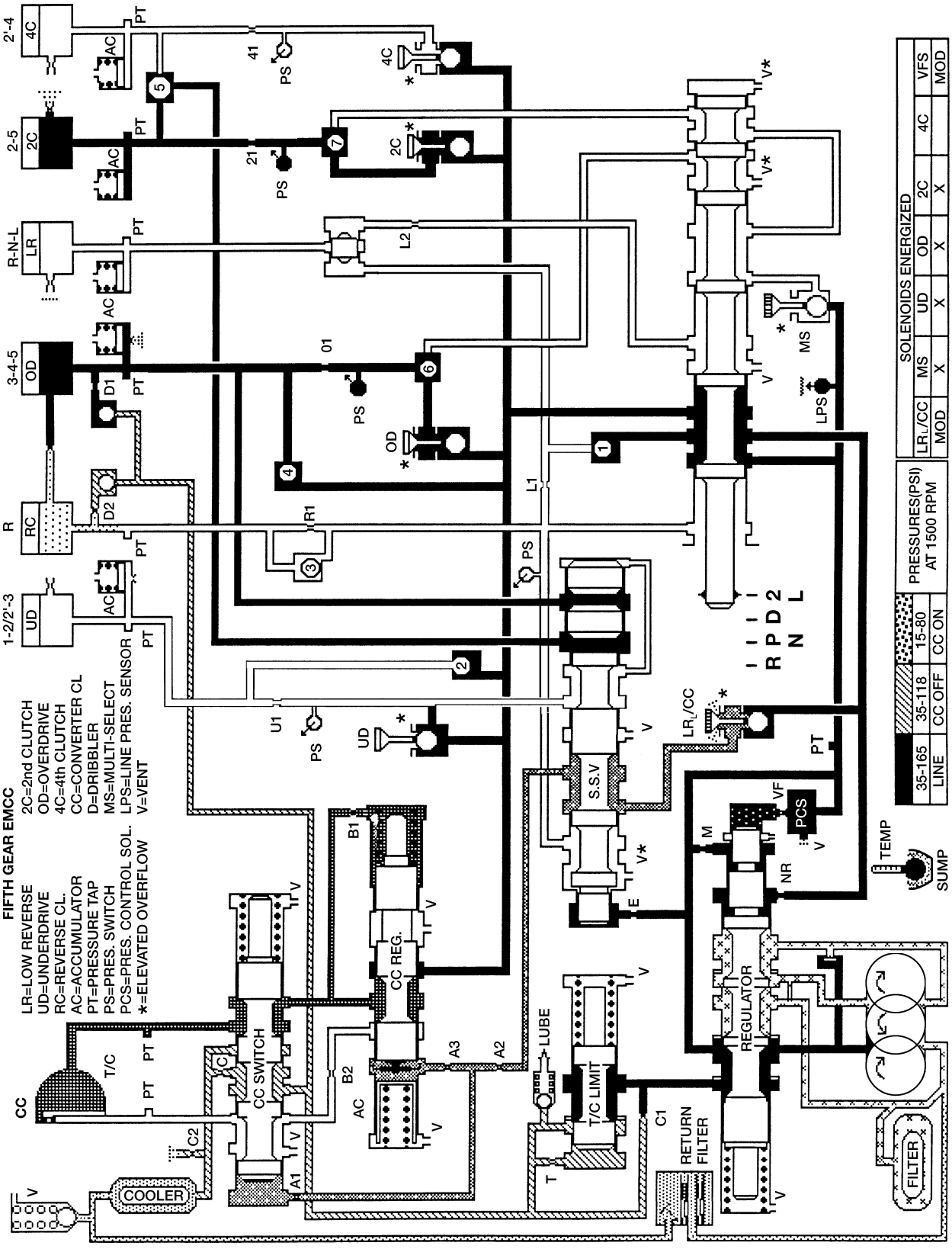


HYDRAULIC FLOW IN FOURTH

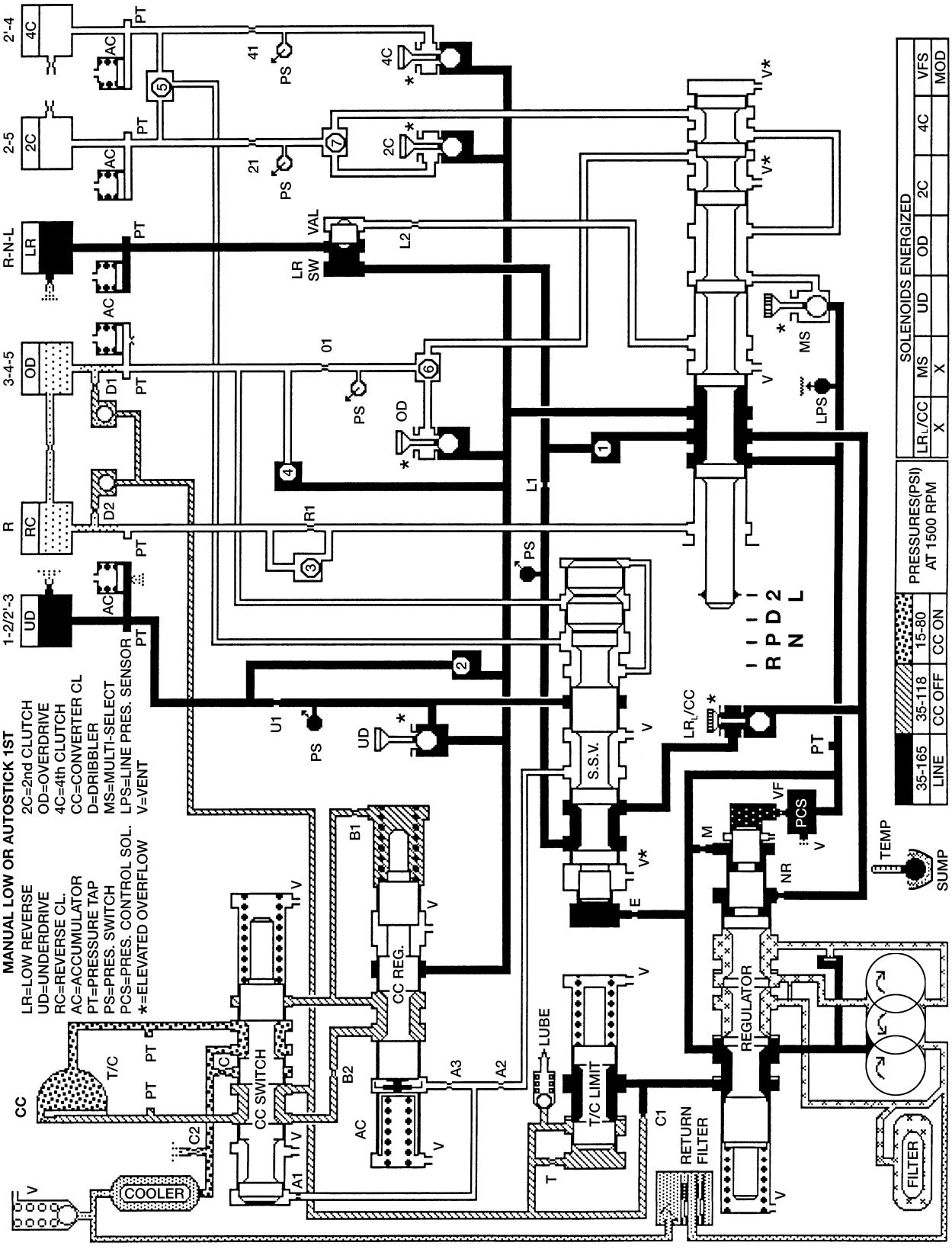


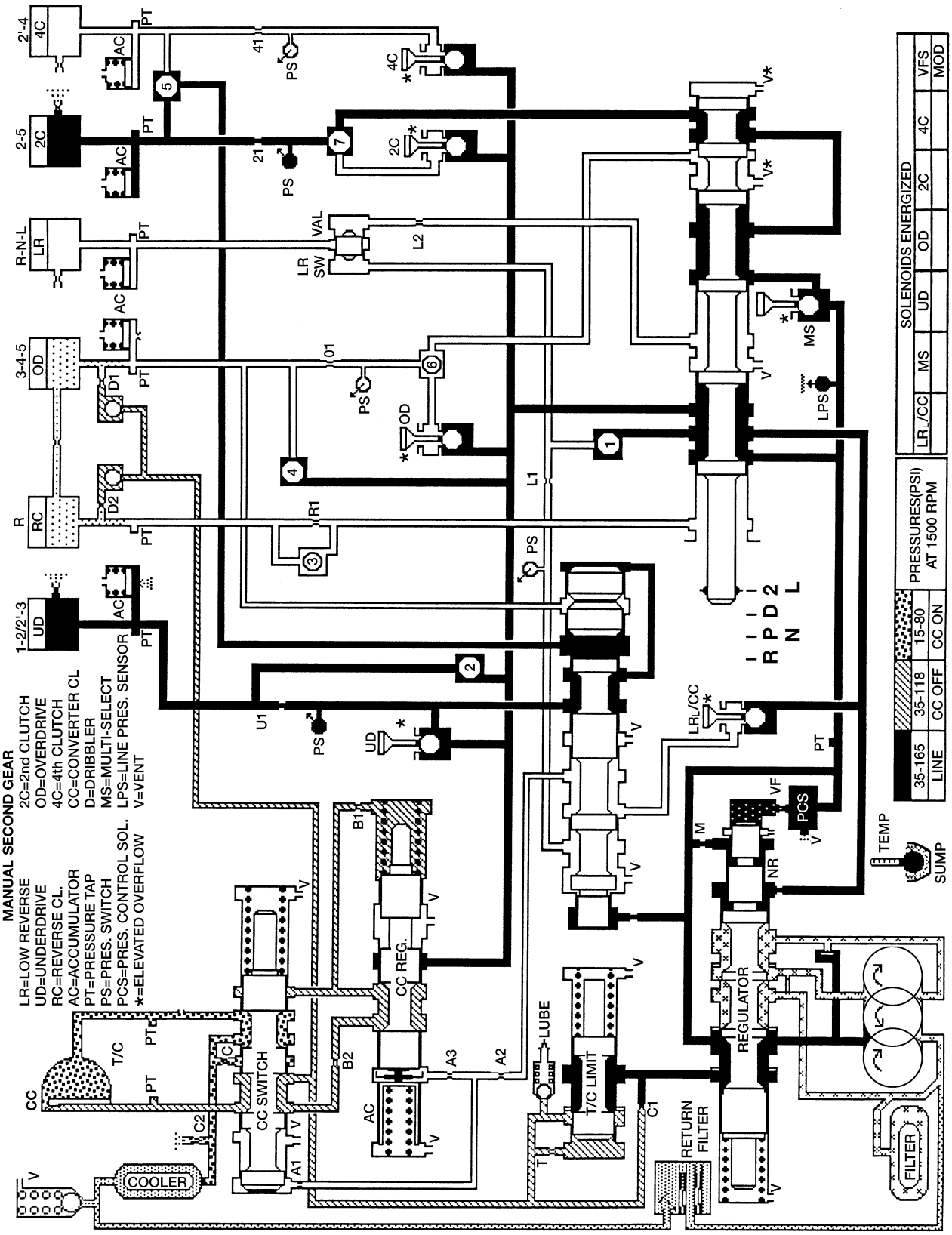
HYDRAULIC FLOW IN FOURTH EMCC


80a0e564
FIFTH GEAR
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
*=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
2'-4
2-5
R-N-L
3-4-5
1-2/2'-3
R
CC
T/C
CC SWITCH
CC REG.
COOLER
FILTER
RETURN FILTER
T/C LIMIT
REGULATOR
LUBE
S.S.V.
PCS
TEMP
SUMP
P
R
N
D
2
1
LR APPLIED VIA SSV & LR/CC SOL. TO PROTECT FOR D - R SHIFT QUALITY
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
SOLENOIDS ENERGIZED
LRL/CC
MS
UD
OD
2C
4C
VFS
MOD
X
HYDRAULIC FLOW IN FIFTH

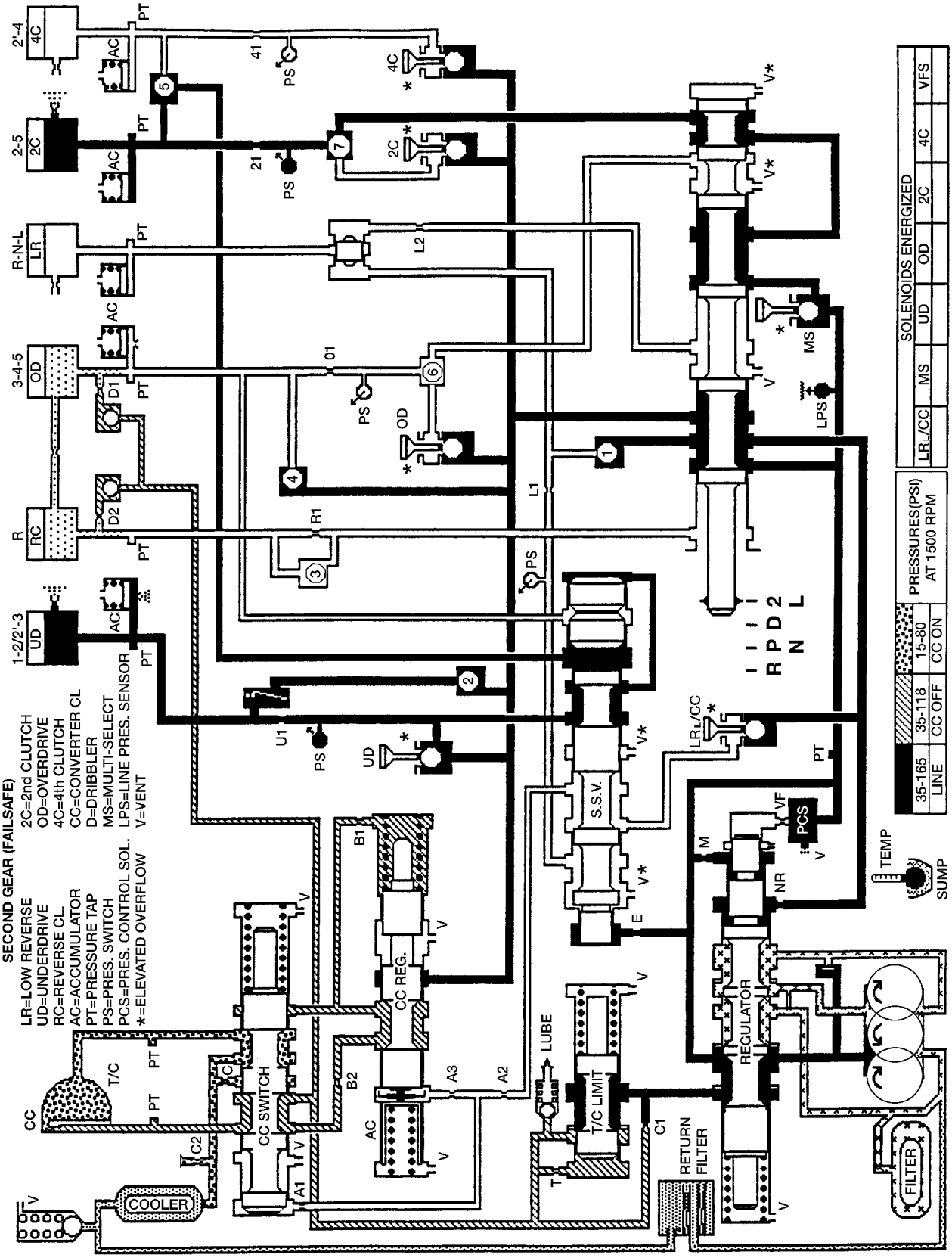


HYDRAULIC FLOW IN FIFTH EMCC


80a0e3c7
MANUAL LOW OR AUTOSTICK 1ST
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
*=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
SOLENOIDS ENERGIZED
LR/CC
MS
UD
OD
2C
4C
VFS
MOD
HYDRAULIC FLOW IN MANUAL LOW OR AUTOSTICK 1ST



HYDRAULIC FLOW IN MANUAL SECOND



HYDRAULIC FLOW IN MANUAL SECOND (FAILSAFE)

SPECIFICATIONS

TRANSMISSION

GENERAL

Component	Metric	Inch
Output Shaft End Play	0.22-0.55 mm	0.009-0.021 in.
Input Shaft End Play	0.46-0.89 mm	0.018-0.035 in.
2C Clutch Pack Clearance	0.455-1.335 mm	0.018-0.053 in.
4C Clutch Pack Clearance	0.770-1.390 mm	0.030-0.055 in.
L/R Clutch Pack Clearance	1.00-1.74 mm	0.039-0.069 in.
OD Clutch Pack Clearance	1.103-1.856 mm	0.043-0.073 in.
UD Clutch Pack Clearance	0.84-1.54 mm	0.033-0.061 in.
Reverse Clutch Pack Clearance	0.81-1.24 mm	0.032-0.049 in.
Recommended fluid	Mopar® ATF +4	

GEAR RATIOS

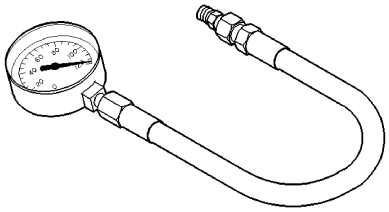
1ST	3.00:1
2ND	1.67:1
2ND Prime	1.50:1
3RD	1.0:1
4TH	0.75:1
5TH	0.67:1
REVERSE	3.00:1

TORQUE SPECIFICATIONS

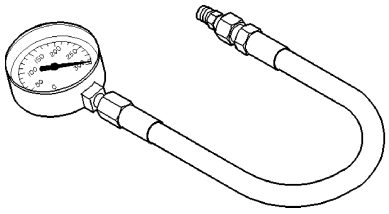
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Fitting, cooler line at trans	17.5	-	155
Bolt, torque converter	31	23	-
Bolt, Torque Converter Housing	68	50	-
Bolt/nut, crossmember	68	50	-
Bolt, driveplate to crankshaft	75	55	-
Bolt, oil pan	11.8	-	105
Screw, primary fluid filter	4.5	-	40
Bolt, oil pump	28.2	-	250
Bolt, oil pump body to cover	4.5	-	40
Screw, plate to oil pump body	4.5	-	40
Bolt, valve body to case	11.8	-	105
Plug, pressure test port	5.1	-	45
Bolt, reaction shaft support	11.8	-	105
Screw, valve body to transfer plate	5.6	-	50
Screw, solenoid module to transfer plate	5.7	-	50
Screw, accumulator cover	7	-	60
Screw, detent spring	4.5	-	40
Bolt, input speed sensor	11.8	-	105
Bolt, output speed sensor	11.8	-	105
Bolt, line pressure sensor	11.8	-	105
Bolt, extension housing	54	40	-
Valve, cooler return filter bypass	4.5	-	40
Screw, manual valve cam retaining	4.5	-	40
Bolt, manual lever	28.2	-	250

SPECIAL TOOLS

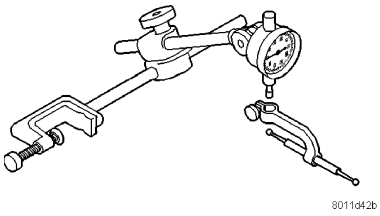
AUTOMATIC TRANSMISSION - RFE



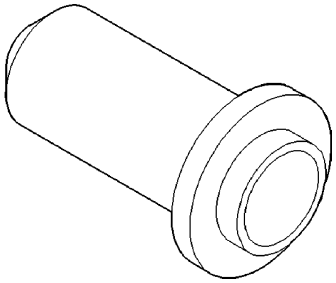
Gauge, Oil Pressure - C-3292



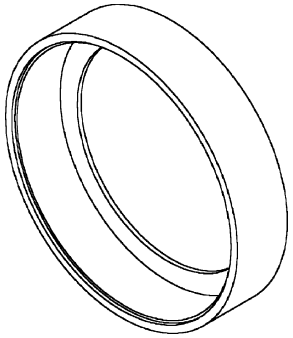
Gauge, Oil Pressure - C-3293SP



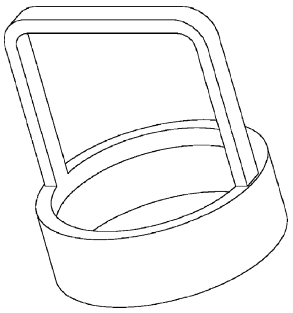
Dial Indicator - C-3339



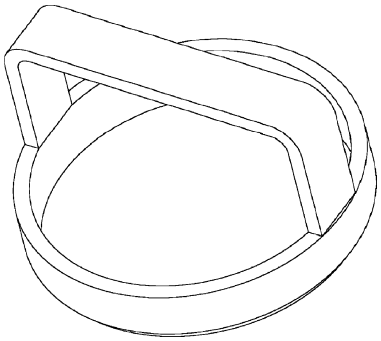
Installer, Seal - C-3860-A



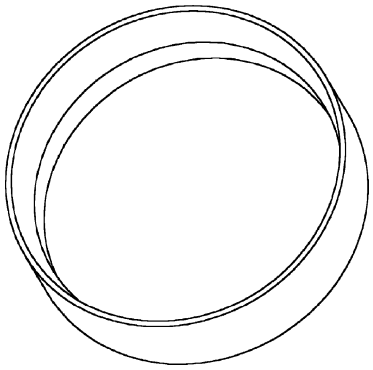
Compressor, Spring - 8249



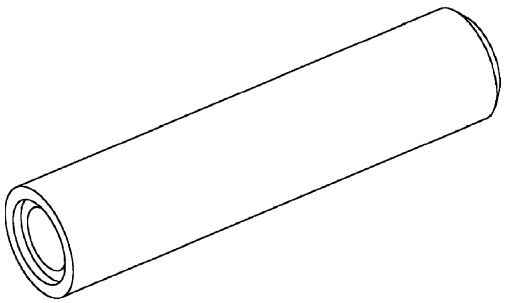
Compressor, Spring - 8250



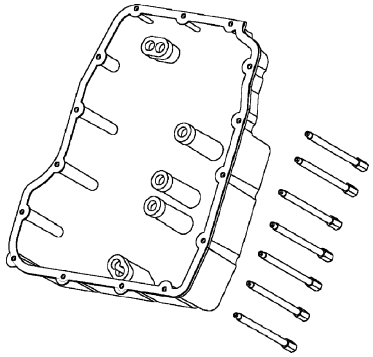
Compressor, Spring - 8251



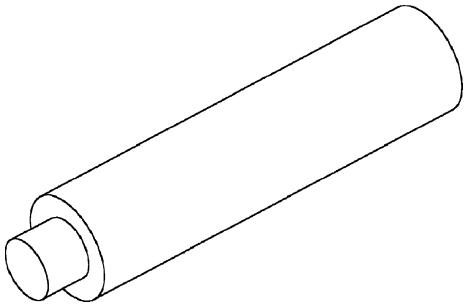
Installer, Piston - 8252



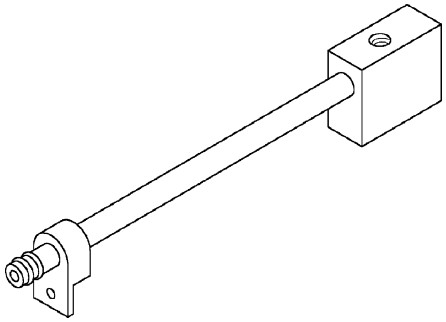
Installer, Seal - 8253



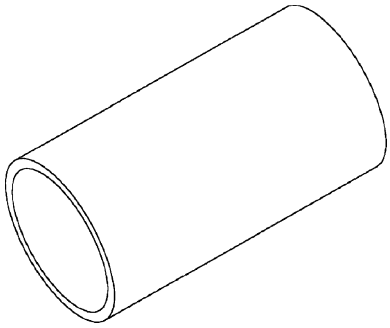
Adapter, Pressure Tap - 8258-A



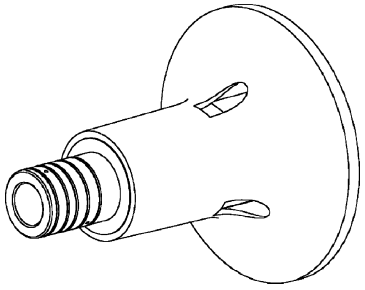
Installer, Seal - 8254



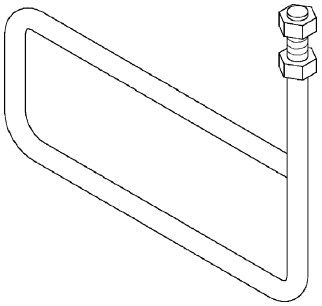
Adapter, Line Pressure - 8259



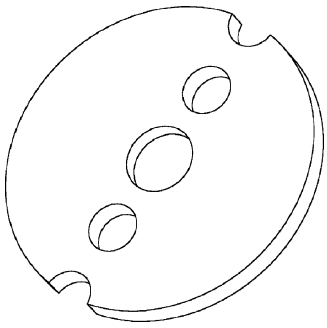
Installer, Snap-ring - 8255



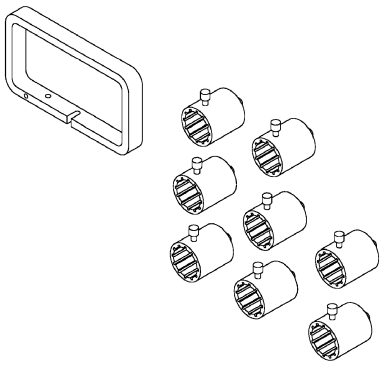
Fixture, Input Clutch Pressure - 8260



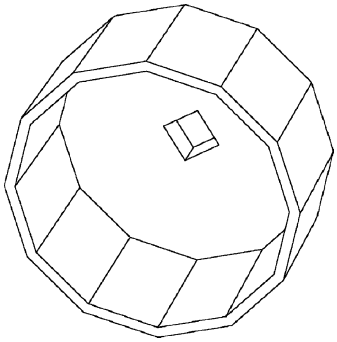
Stand, Support - 8257



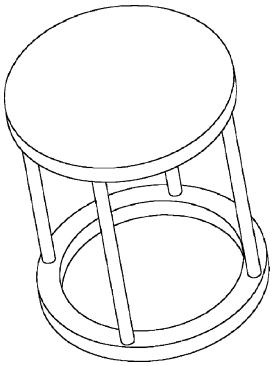
Plate, Alignment - 8261



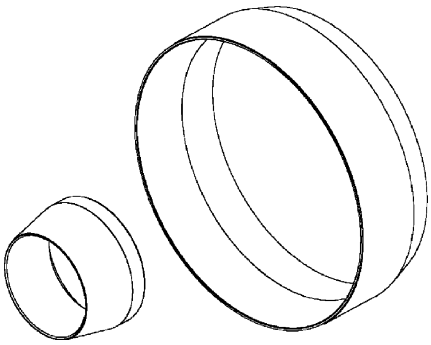
End Play Set - 8266



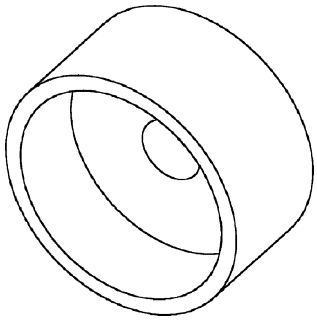
Wrench, Filter - 8321



Compressor, Spring - 8285



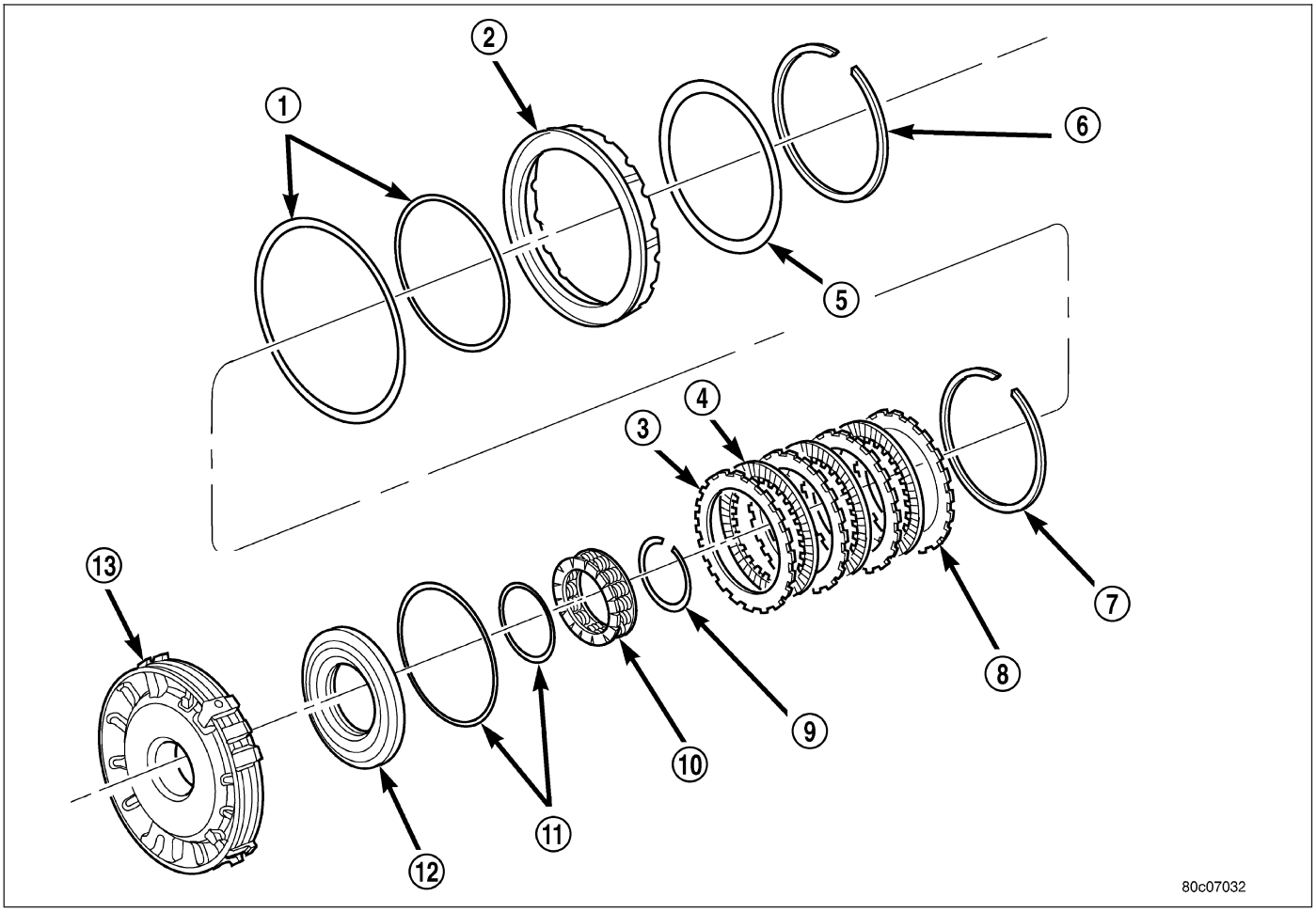
Installer, Piston - 8504



Installer, Bearing - 8320

RETAINER/BULKHEAD-4C

DISASSEMBLY

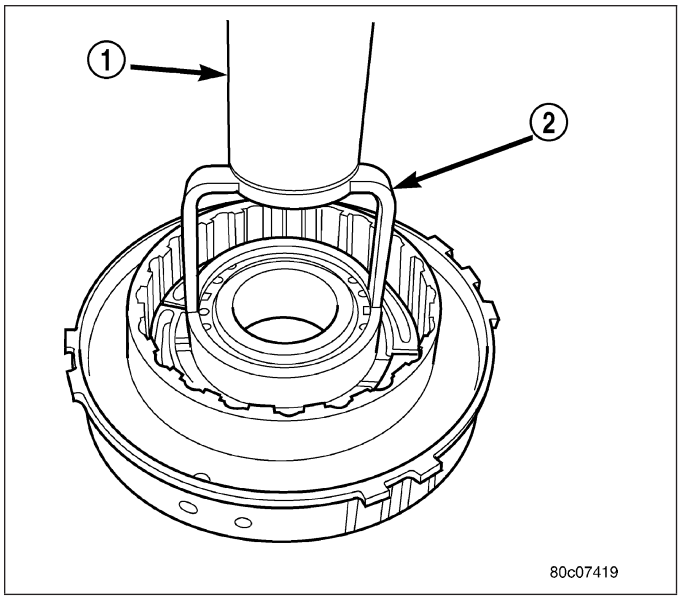


4C Retainer/Bulkhead Components

1 - SEAL
2 - 2C PISTON
3 - PLATE
4 - DISC
5 - 2C BELLEVILLE SPRING
6 - SNAP-RING
7 - SNAP-RING (SELECT)
8 - REACTION PLATE
9 - SNAP-RING
10 - RETURN SPRING
11 - SEAL
12 - 4C PISTON
13 - 4C RETAINER/BULKHEAD

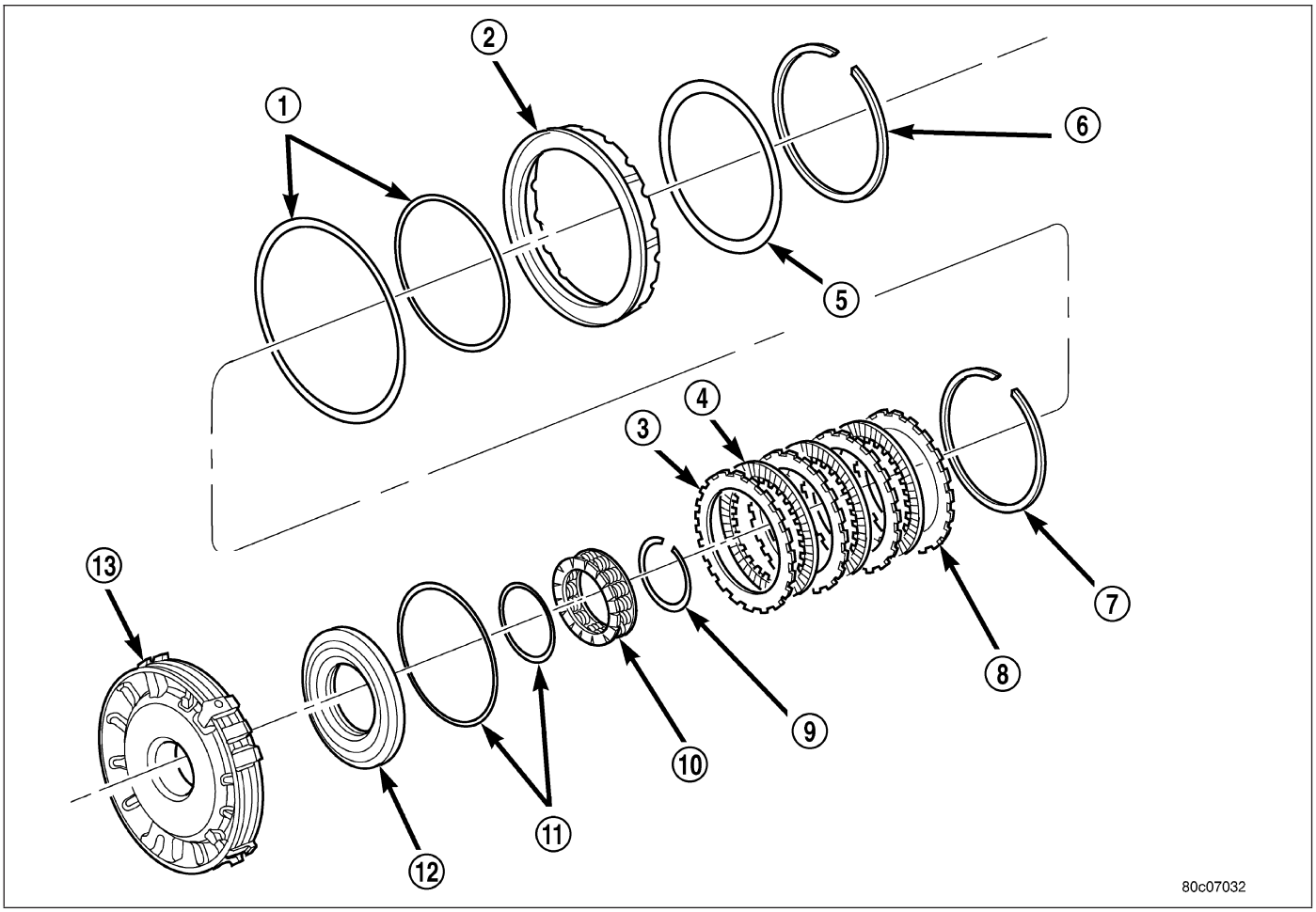
1. Remove the 2C piston Belleville spring snap-ring (6) from the 4C retainer /bulkhead (13).
2. Remove the 2C piston Belleville spring (5) from the retainer/bulkhead (13).
3. Remove the 2C piston (2) from the retainer/bulkhead (13). Use 20 psi of air pressure to remove the piston if necessary.
4. Remove the 4C clutch snap-ring (7) from the retainer/bulkhead (13).
5. Remove the 4C clutch pack (3, 4, 8) from the retainer/bulkhead (13).

6. Using Spring Compressor 8250 (2) and a suitable shop press (1), compress the 4C piston return spring (10) and remove the snap-ring (9).
7. Remove the 4C piston return spring (10) and piston (12) from the retainer/bulkhead (13). Use 20 psi of air pressure to remove the piston if necessary.



ASSEMBLY

NOTE: Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.

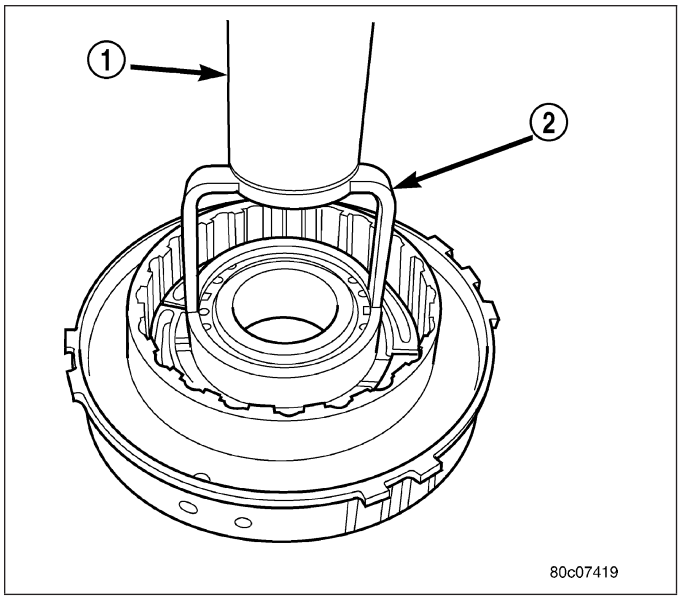


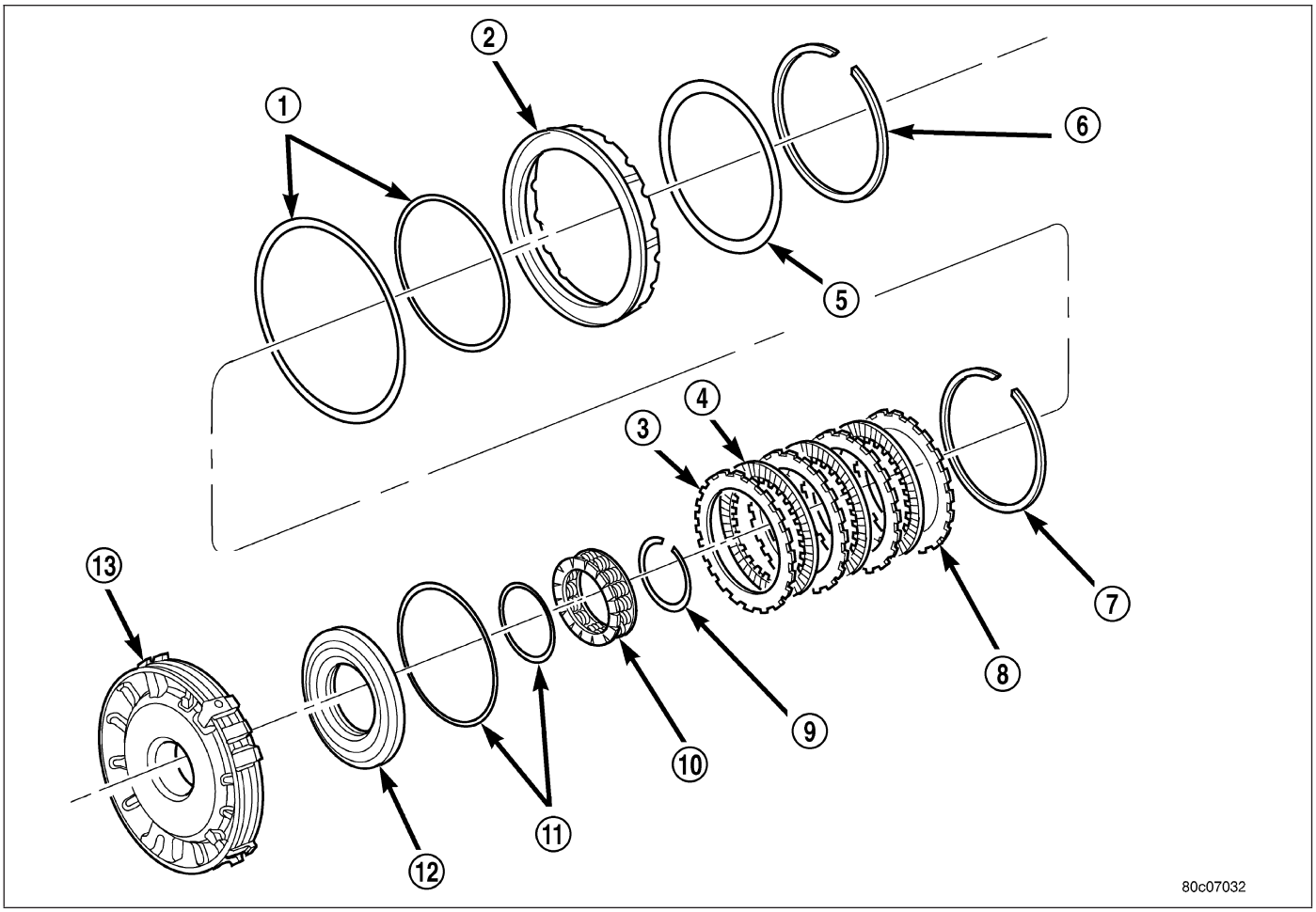
4C Retainer/Bulkhead Components

1 - SEAL
2 - 2C PISTON
3 - PLATE
4 - DISC
5 - 2C BELLEVILLE SPRING
6 - SNAP-RING
7 - SNAP-RING (SELECT)
8 - REACTION PLATE
9 - SNAP-RING
10 - RETURN SPRING
11 - SEAL
12 - 4C PISTON
13 - 4C RETAINER/BULKHEAD

1. Install new seals (1, 11) on the 2C and 4C pistons or in the piston retainers.
2. Lubricate all seals with Mopar® ATF +4 prior to installation.
3. Install the 4C piston (12) into the 4C retainer/bulkhead (13).
4. Position the 4C piston return spring (10) onto the 4C piston (12).

5. Using Spring Compressor 8250 (2) and a suitable shop press (1), compress the 4C piston return spring and install the snap-ring.



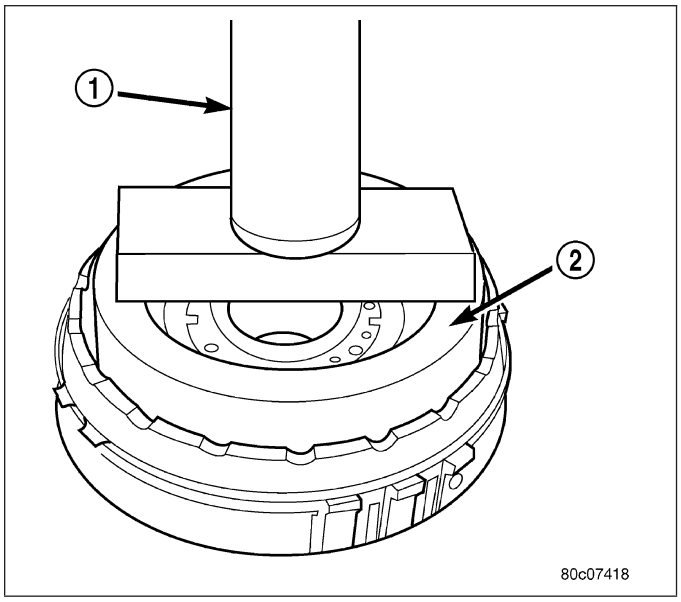


4C Retainer/Bulkhead Components

1 - SEAL
2 - 2C PISTON
3 - PLATE
4 - DISC
5 - 2C BELLEVILLE SPRING
6 - SNAP-RING
7 - SNAP-RING (SELECT)
8 - REACTION PLATE
9 - SNAP-RING
10 - RETURN SPRING
11 - SEAL
12 - 4C PISTON
13 - 4C RETAINER/BULKHEAD

6. Assemble and install the 4C clutch pack (3, 4) into the retainer/bulkhead (13) with the steel separator plate against the piston.
7. Install the 4C reaction plate (8) and snap-ring (7) into the retainer/bulkhead (13). The 4C reaction plate is non-directional.
8. Measure the 4C clutch clearance. The correct clutch clearance is 0.77-1.39 mm (0.030-0.055 in.). The snap-ring (7) is selectable. Install the chosen snap-ring and re-measure to verify the selection.
9. Install the 2C piston (2) into the retainer/bulkhead (13).
10. Position the 2C Belleville spring (5) onto the 2C piston (2).
11. Position the 2C Belleville spring snap-ring (6) onto the 2C Belleville spring (5).

12. Using Spring Compressor 8249 (2) and a suitable shop press (1), compress the Belleville spring (5) until the snap-ring (6) is engaged with the snap-ring groove in the retainer/bulkhead.



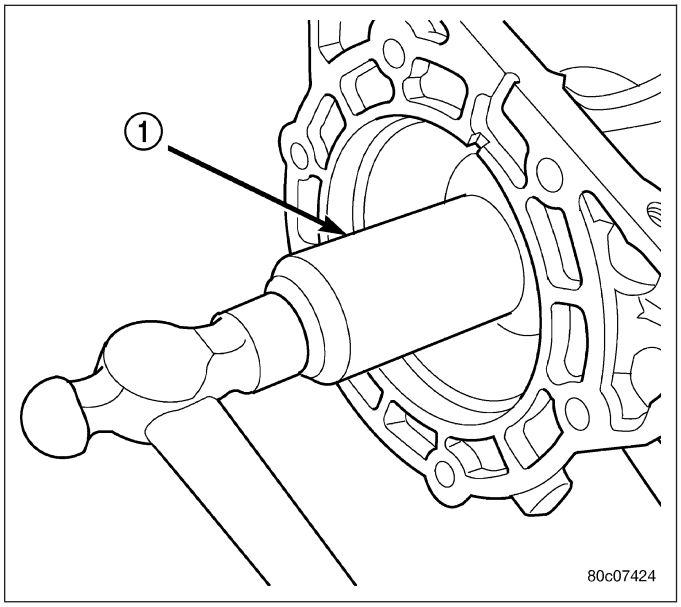
SEAL-ADAPTER HOUSING

REMOVAL

1. Remove the transfer case from the transmission.
2. Using a screw mounted on a slide hammer, remove the adapter housing seal.

INSTALLATION

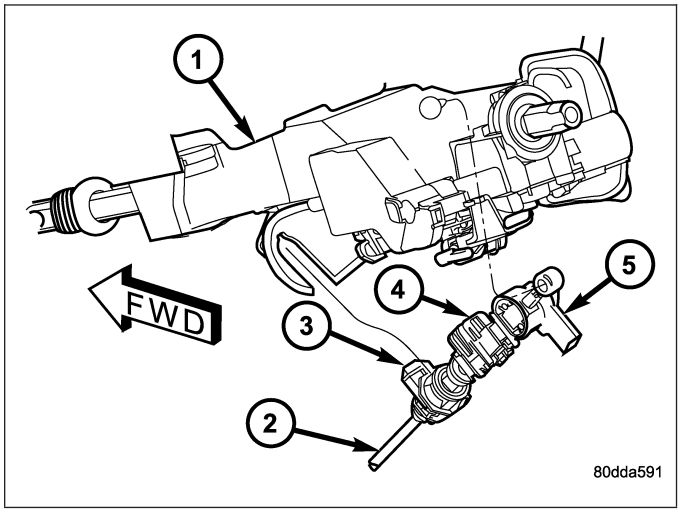
1. Clean the adapter seal bore in the adapter housing of any residue or particles remaining from the original seal.
2. Install new oil seal in the adapter housing using Seal Installer C-3860-A (1). A properly installed seal is flush to the face of the seal bore.
3. Install the transfer case onto the transmission.



SYSTEM-BRAKE TRANSMISSION SHIFT INTERLOCK

DESCRIPTION

The Brake Transmission Shifter Interlock (BTSI), is a solenoid operated system. It consists of a solenoid permanently mounted on the gearshift cable.



OPERATION

The system locks the shifter into the PARK position. The interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed approximately one-half an inch. A magnetic holding device in line with the park lock cable is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is fully locked into the PARK position.

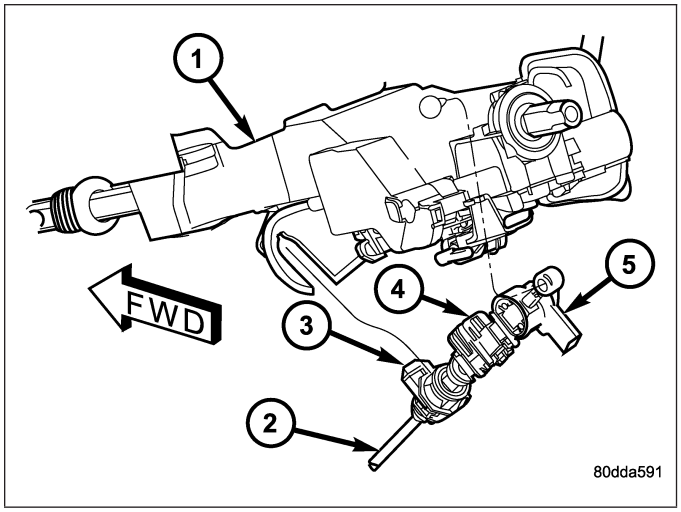
DIAGNOSIS AND TESTING - BRAKE TRANSMISSION SHIFT INTERLOCK

1. Verify that the key can only be removed in the PARK position.
2. When the shift lever is in PARK And the shift handle pushbutton is in the “OUT” position, the ignition key cylinder should rotate freely from OFF to LOCK. When the shifter is in any other gear or neutral position, the ignition key cylinder should not rotate to the LOCK position.
3. Shifting out of PARK should not be possible when the ignition key cylinder is in the OFF position.
4. Shifting out of PARK should not be possible while applying normal pushbutton force and ignition key cylinder is in the RUN or START positions unless the foot brake pedal is depressed approximately 1/2 inch (12mm).
5. Shifting out of PARK should not be possible when the ignition key cylinder is in the ACCESSORY or LOCK positions.
6. Shifting between any gears, NEUTRAL or into PARK may be done without depressing foot brake pedal with ignition switch in RUN or START positions.

ADJUSTMENTS - BRAKE TRANSMISSION SHIFT INTERLOCK

Correct cable adjustment is important to proper interlock operation. The gearshift cable must be correctly adjusted in order to shift out of PARK.

ADJUSTMENT PROCEDURE



1. Remove the steering column trim as necessary for access to the brake transmission shift interlock.
2. Shift the transmission into the PARK position.
3. Pull upward on both the BTSI lock tab (4) and the gearshift cable lock tab (3).
4. Verify that the shift lever is in the PARK position.
5. Verify positive engagement of the transmission park lock by attempting to rotate the propeller shaft. The shaft will not rotate when the park lock is engaged.
6. Turn ignition switch to LOCK position. **Be sure ignition key cylinder is in the LOCK position. Cable will not adjust correctly in any other position.**
7. Ensure that the cable is free to self-adjust by pushing cable rearward and releasing.
8. Push the gearshift cable lock tab (3) down until it snaps in place.
9. Locate the BTSI alignment hole in the bottom of the BTSI mechanism between the BTSI lock tab and the BTSI connector.
10. Move the BTSI assembly up or down on the gearshift cable until an appropriate size drill bit can be inserted into the alignment hole and through the assembly.
11. Push the BTSI lock tab (4) down until it snaps into place and remove the drill bit.
12. Install any steering column trim previously removed.

BTSI FUNCTION CHECK

1. Verify removal of ignition key allowed in PARK position only.
2. When the shift lever is in PARK, the ignition key cylinder should rotate freely from off to lock. When the shifter is in any other position, the ignition key should not rotate from off to lock.
3. Shifting out of PARK should be possible when the ignition key cylinder is in the off position.
4. Shifting out of PARK should not be possible while applying normal force, and ignition key cylinder is in the run or start positions, unless the foot brake pedal is depressed approximately 1/2 inch (12mm).
5. Shifting out of PARK should not be possible when the ignition key cylinder is in the accessory or lock position.
6. Shifting between any gear and NEUTRAL, or PARK, may be done without depressing foot brake with ignition switch in run or start positions.
7. Engine starts must be possible with shifter lever in PARK or NEUTRAL positions only. Engine starts must not be possible in any position other than PARK or NEUTRAL.
8. With shifter lever in the:
   - PARK position - Apply upward force on the shift arm and remove pressure. Engine starts must be possible.
   - PARK position - Apply downward force on the shift arm and remove pressure. Engine starts must be possible.
   - NEUTRAL position - Normal position. Engine starts must be possible.
   - NEUTRAL position - Engine running and brakes applied, apply upward force on the shift arm. Transmission shall not be able to shift from neutral to reverse.

FLUID AND FILTER

DIAGNOSIS AND TESTING

EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxidation, and varnish buildup which interferes with valve and clutch operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has three primary causes.

1. Internal clutch slippage, usually caused by low line pressure, inadequate clutch apply pressure, or clutch seal failure.
2. A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or improperly installed drainback valve, a damaged oil cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.
3. Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to replace contaminated converter after repair

The use of non-recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission, an overhaul is necessary.

The torque converter should be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

STANDARD PROCEDURE

FLUID LEVEL CHECK

Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

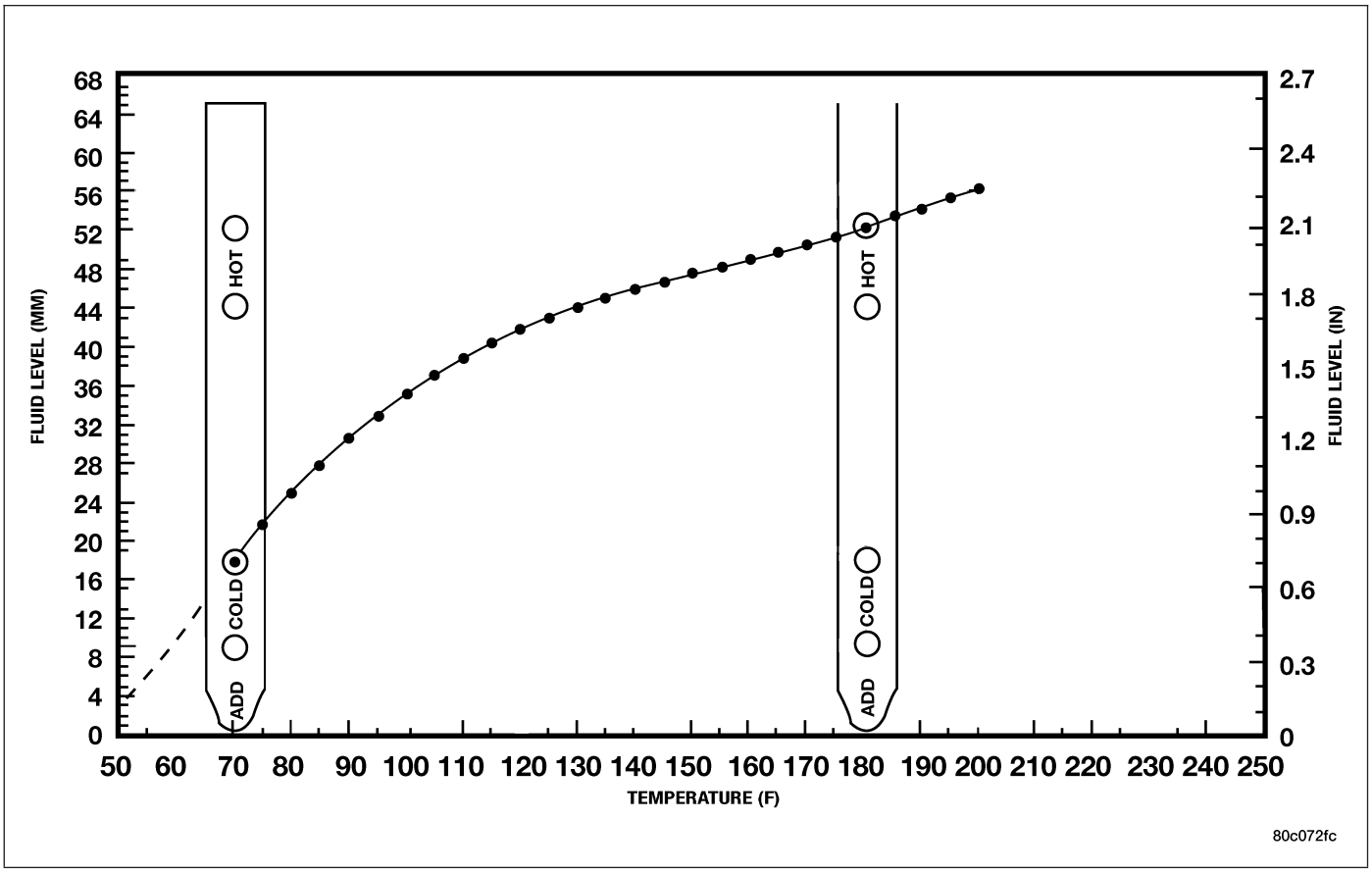
Improper filling can also raise the fluid level too high. When the transmssion has too much fluid, the geartrain churns up foam and cause the same conditions which occur with a low fluid level.

In either case, air bubbles can cause overheating and/or fluid oxidation, and varnishing. This can interfere with normal valve, clutch, and accumulator operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.

After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

The transmission has a dipstick to check oil level. It is located on the right side of the engine. Be sure to wipe all dirt from dipstick handle before removing.

The torque converter fills in both the P (PARK) and N (NEUTRAL) positions. Place the selector lever in P (PARK) to be sure that the fluid level check is accurate. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground.** At normal operating temperature (approximately 82 C. or 180 F.), the fluid level is correct if it is in the HOT region (cross-hatched area) on the oil level indicator. The fluid level will be approximately at the upper COLD hole of the dipstick at 70° F fluid temperature.



Transmission Fluid Temperature Chart

NOTE: Engine and Transmission should be at normal operating temperature before performing this procedure.

1. Start engine and apply parking brake.
2. Shift the transmission into DRIVE for approximately 2 seconds.
3. Shift the transmission into REVERSE for approximately 2 seconds.
4. Shift the transmission into PARK.
5. Hook up scan tool and select transmission.
6. Select sensors.
7. Read the transmission temperature value.
8. Compare the fluid temperature value with the chart.
9. Adjust transmission fluid level shown on the dipstick according to the Transmission Fluid Temperature Chart.

NOTE: After adding any fluid to the transmission, wait a minimum of 2 minutes for the oil to fully drain from the fill tube into the transmission before rechecking the fluid level.

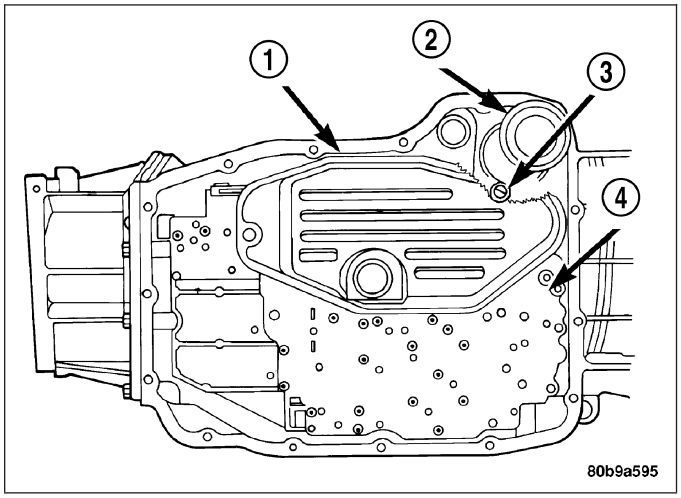
10. Check transmission for leaks.

FLUID AND FILTER REPLACEMENT

For proper service intervals (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION).

REMOVAL

1. Hoist and support vehicle on safety stands.
2. Place a large diameter shallow drain pan beneath the transmission pan.
3. Remove bolts holding front and sides of pan to transmission.
4. Loosen bolts holding rear of pan to transmission.
5. Slowly separate front of pan away from transmission allowing the fluid to drain into drain pan.
6. Hold up pan and remove remaining bolts holding pan to transmission.
7. While holding pan level, lower pan away from transmission.
8. Pour remaining fluid in pan into drain pan.
9. Remove the screw holding the primary oil filter (1) to valve body.
10. Separate filter from valve body and oil pump and pour fluid in filter into drain pan.
11. Inspect the oil filter seal in the bottom of the oil pump. If the seal is not installed completely in the oil pump, or is otherwise damaged, then remove and discard the oil filter seal from the bottom of the oil pump. If the seal is installed correctly and is in good condition, it can be reused.
12. If replacing the cooler return filter (2), use Oil Filter Wrench 8321 to remove the filter from the transmission.
13. Dispose of used trans fluid and filter(s) properly.



INSPECTION

Inspect bottom of pan and magnet for excessive amounts of metal. A light coating of clutch material on the bottom of the pan does not indicate a problem unless accompanied by a slipping condition or shift lag. If fluid and pan are contaminated with excessive amounts of debris, refer to the diagnosis section of this group.

CLEANING

1. Using a suitable solvent, clean pan and magnet.
2. Using a suitable gasket scraper, clean original sealing material from surface of transmission case and the transmission pan.

INSTALLATION

CAUTION: The primary oil filter seal MUST be fully installed flush against the oil pump body. DO NOT install the seal onto the filter neck and attempt to install the filter and seal as an assembly. Damage to the transmission will result.

1. If necessary, install a new primary oil filter seal in the oil pump inlet bore. Seat the seal in the bore with a suitable tool (appropriately sized drift or socket, the butt end of a hammer, or other suitable tool).

2. Place replacement filter in position on valve body and into the oil pump.
3. Install screw to hold the primary oil filter (1) to valve body. Tighten screw to 4.5 N·m (40 in. lbs.) torque.
4. Install new cooler return filter (2) onto the transmission, if necessary. Torque the filter to 14.12 N·m (125 in.lbs.).
5. Place bead of Mopar® RTV sealant onto the transmission case sealing surface.
6. Place pan in position on transmission.
7. Install bolts to hold pan to transmission. Tighten bolts to 11.8 N·m (105 in. lbs.) torque.
8. Lower vehicle and fill transmission with Mopar® ATF +4.

TRANSMISSION FILL

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

1. Remove dipstick and insert clean funnel in transmission fill tube.
2. Add following initial quantity of Mopar® ATF +4 to transmission:
   a. If only fluid and filter were changed, add **10 pints (5 quarts)** of ATF +4 to transmission.
   b. If transmission was completely overhauled and the torque converter was replaced or drained, add **24 pints (12 quarts)** of ATF +4 to transmission.
3. Check the transmission fluid (Refer to 21 - TRANSMISSION/AUTOMATIC - RFE/FLUID - STANDARD PROCEDURE) and adjust as required.

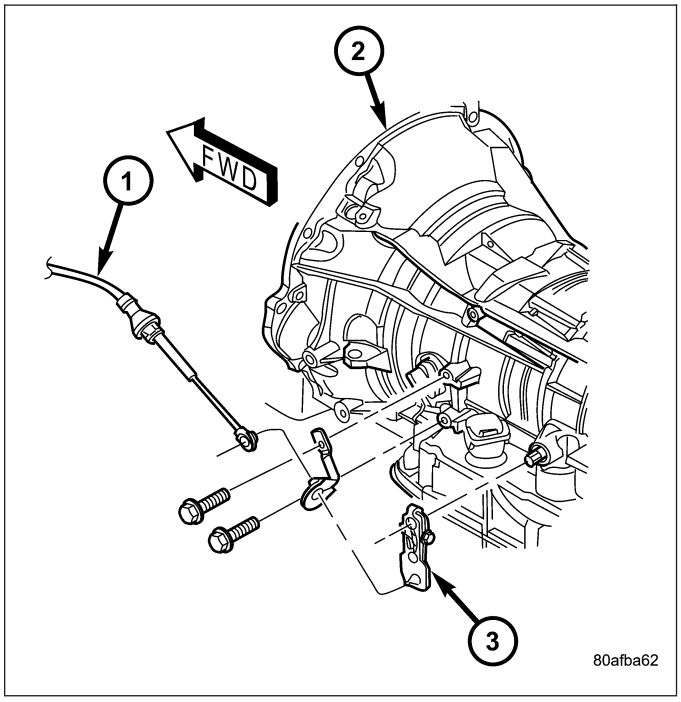
CABLE-GEARSHIFT

DIAGNOSIS AND TESTING - GEARSHIFT CABLE

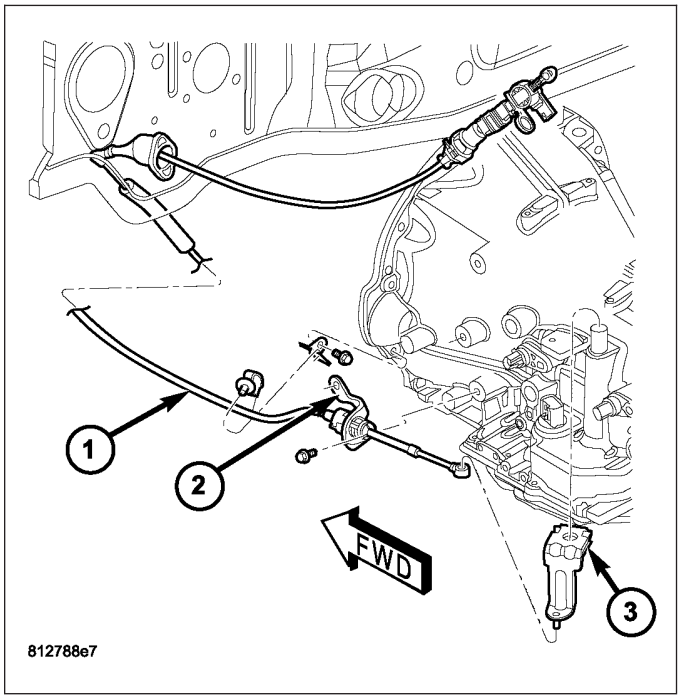
1. Engine starts must be possible with shift lever in PARK or NEUTRAL positions only. Engine starts must not be possible in any other gear position.
2. With the shift lever in the:
   a. PARK position - Apply upward force on the shift arm and remove pressure. Engine starts must be possible.
   b. PARK position - Apply downward force on the shift arm and remove pressure. Engine starts must be possible.
   c. NEUTRAL position - Normal position. Engine starts must be possible.
   d. NEUTRAL position - Engine running and brakes applied, apply upward force on the shift arm. Transmission shall not be able to shift from neutral to reverse.

REMOVAL

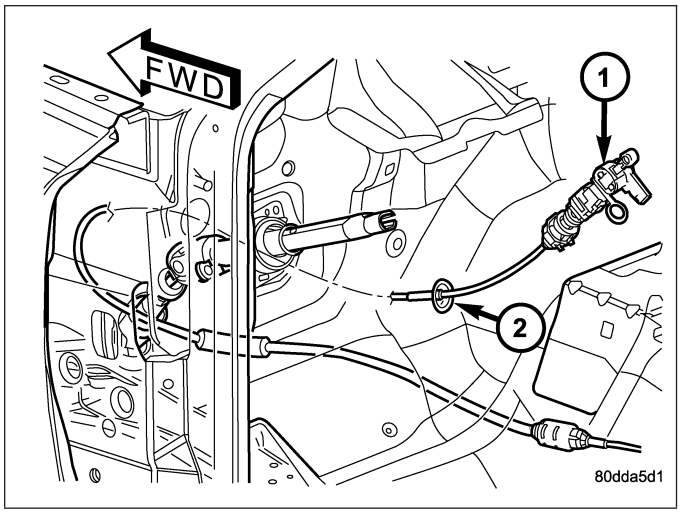
1. Shift transmission into PARK.
2. Raise vehicle.
3. Disengage cable (1) eyelet at transmission manual shift lever (3) and pull cable adjuster out of mounting bracket, RFE transmission equipped vehicles.



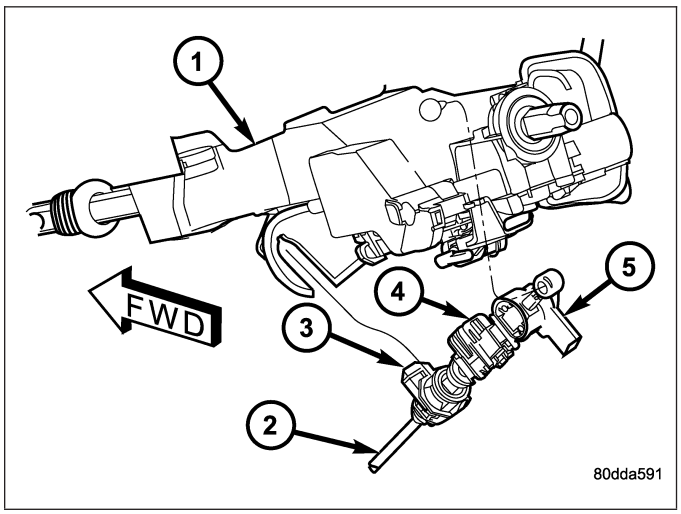
4. Disengage cable (1) eyelet at transmission manual shift lever (3) and pull cable adjuster out of mounting bracket (2), RLE transmission equipped vehicles.



5. Lower the vehicle.
6. Remove the dash panel insulation pad as necessary to access the gearshift cable grommet (2).
7. Remove grommet (2) from the dash panel.

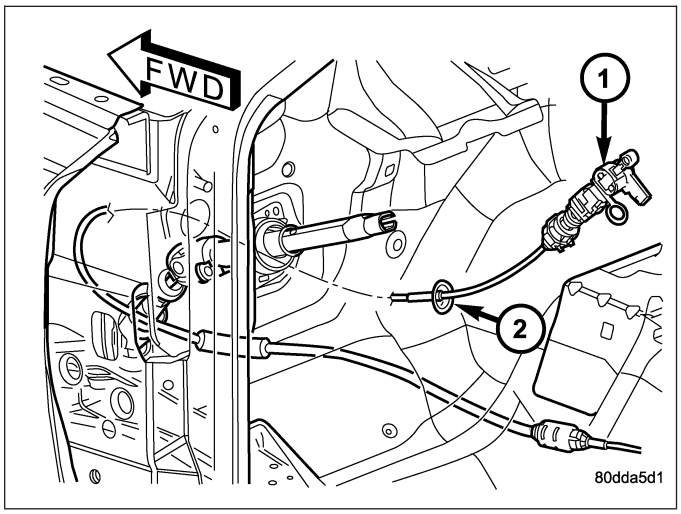


8. Remove any steering column (1) trim necessary to access the gearshift cable (2) and BTSI mechanism.
9. Disconnect the BTSI wiring connector (5).
10. Disconnect cable at lower column bracket and shift lever pin and pull the cable through the dash panel opening into the vehicle.
11. Remove gearshift cable (2) from vehicle.

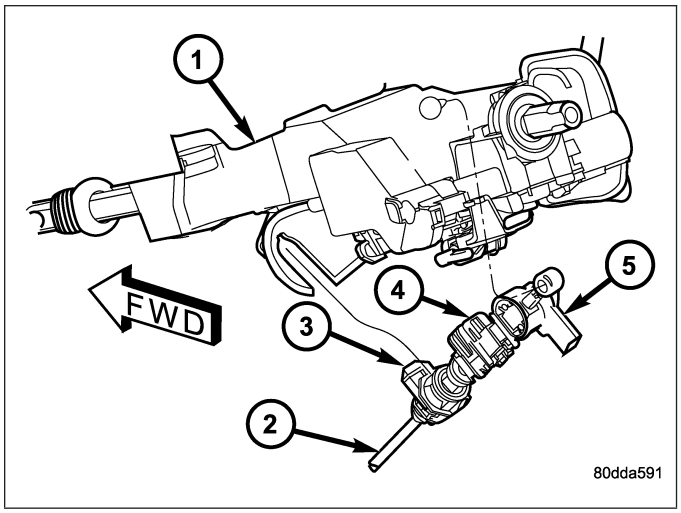


INSTALLATION

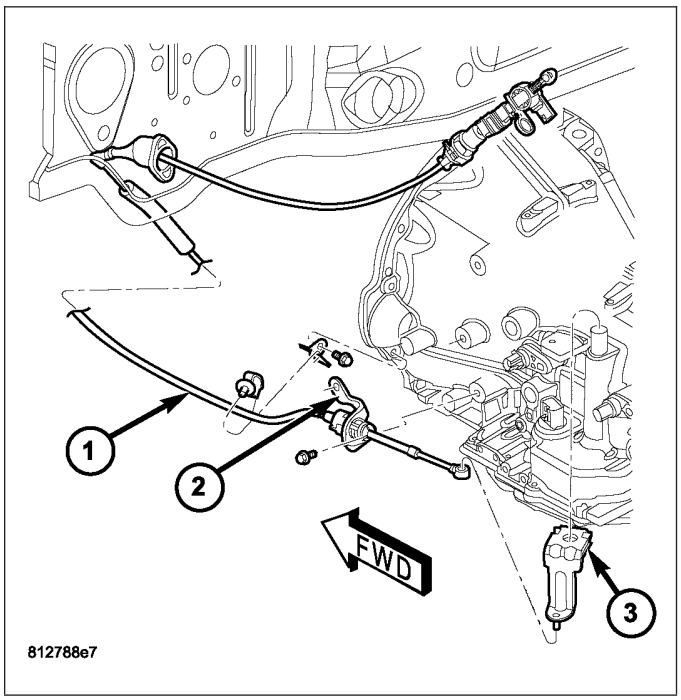
1. Route the transmission end of the gearshift cable (1) through the opening in the dash panel.
2. Seat the cable grommet (2) into the dash panel opening.



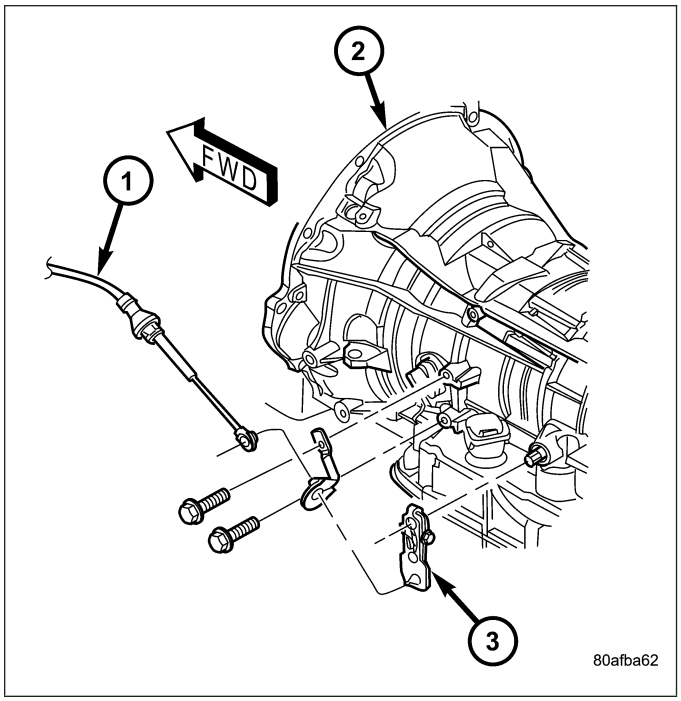
3. Snap the cable into the steering column (1) bracket so the retaining ears are engaged and snap the cable eyelet onto the shift lever ball stud.
4. Raise the vehicle.
5. Place the transmission manual shift lever in the “PARK” detent (rearmost) position and rotate prop shaft to ensure transmission is in PARK.



6. Route the gearshift cable (1) through the transmission mounting bracket (2) and secure the cable by snapping the cable retaining ears into the transmission bracket and snapping the cable eyelet on the manual shift lever (3) ball stud, RLE transmission equipped vehicles.



7. Route the gearshift cable (1) through the transmission mounting bracket and secure the cable by snapping the cable retaining ears into the transmission bracket and snapping the cable eyelet on the manual shift lever (3) ball stud, RFE transmission equipped vehicles.
8. Lower vehicle.
9. Lock the shift cable adjustment by pressing the cable adjuster lock tab (3) downward until it snaps into place.
10. Check for proper operation of the transmission range sensor.
11. Adjust the gearshift cable (Refer to 21 - TRANSMISSION/AUTOMATIC/GEAR SHIFT CABLE - ADJUSTMENTS) and BTSI mechanism (Refer to 21 - TRANSMISSION/AUTOMATIC/BRAKE TRANSMISSION SHIFT INTERLOCK SYSTEM - ADJUSTMENTS) as necessary.

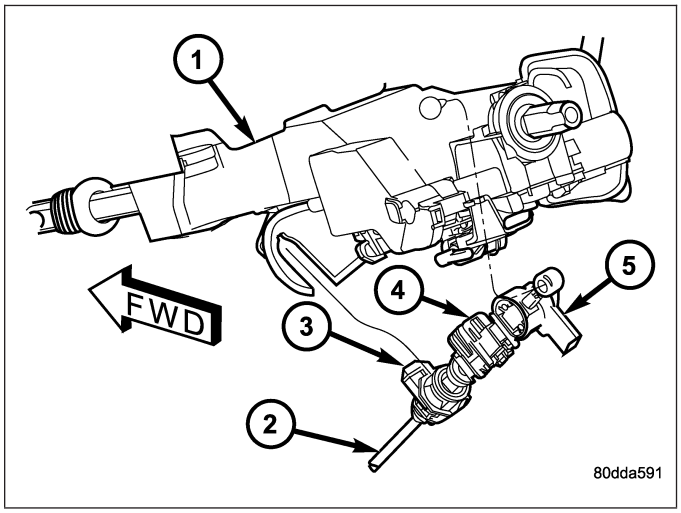


ADJUSTMENTS - GEARSHIFT CABLE

Check adjustment by starting the engine in PARK and NEUTRAL. Adjustment is CORRECT if the engine starts only in these positions. Adjustment is INCORRECT if the engine starts in one but not both positions. If the engine starts in any position other than PARK or NEUTRAL, or if the engine will not start at all, the transmission range sensor may be faulty.

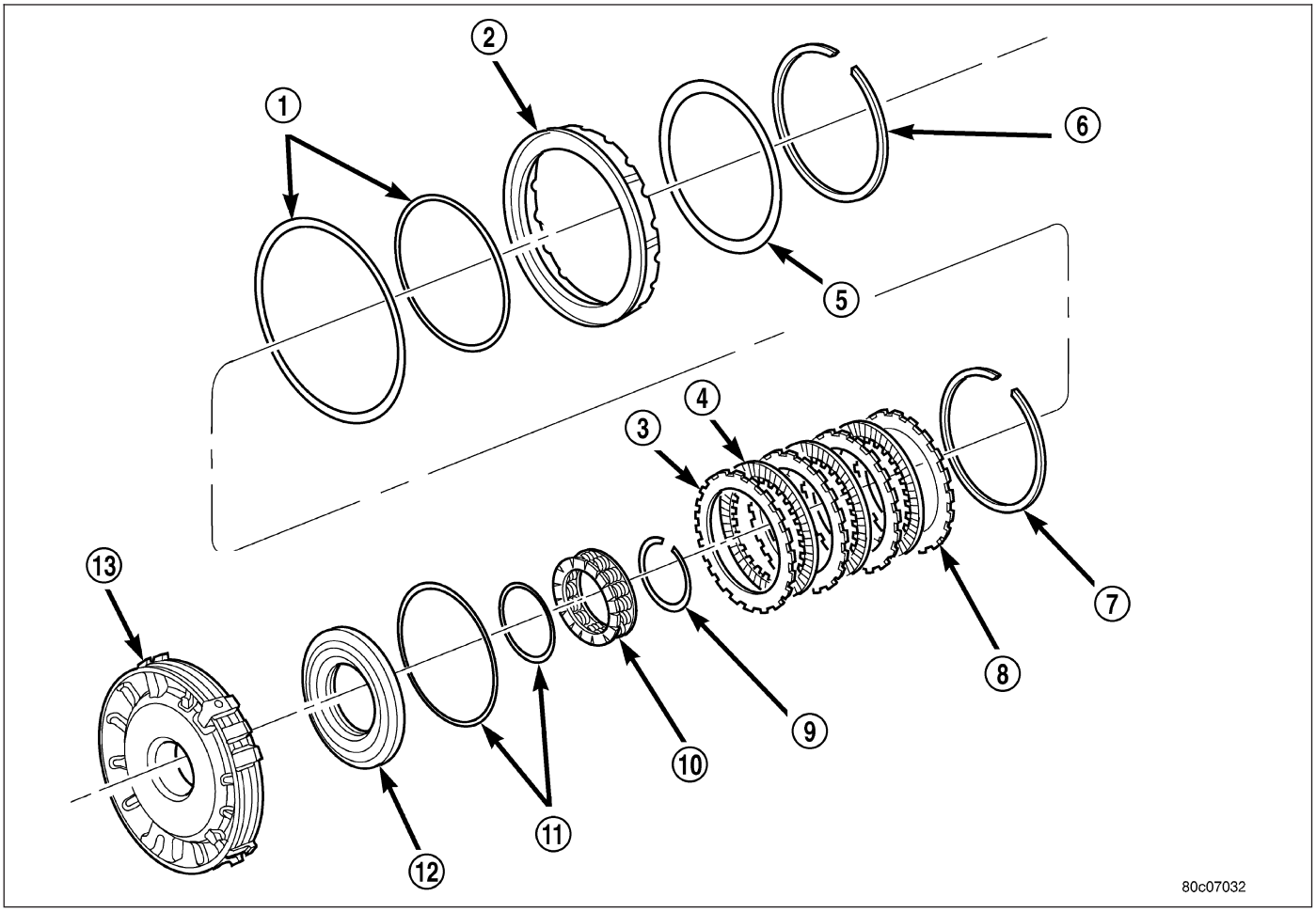
Gearshift Adjustment Procedure

1. Shift transmission into PARK.
2. Release cable adjuster lock tab (3) (underneath the steering column) to unlock cable.
3. Raise vehicle.
4. Disengage the cable eyelet from the transmission manual shift lever.
5. Verify transmission shift lever is in PARK detent by moving lever fully rearward. Last rearward detent is PARK position.
6. Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.
7. Snap the cable eyelet onto the transmission manual shift lever.
8. Lower vehicle.
9. Lock shift cable by pressing cable adjuster lock tab (3) downward until it snaps into place.
10. Check engine starting. Engine should start only in PARK and NEUTRAL.



CLUTCHES-HOLDING

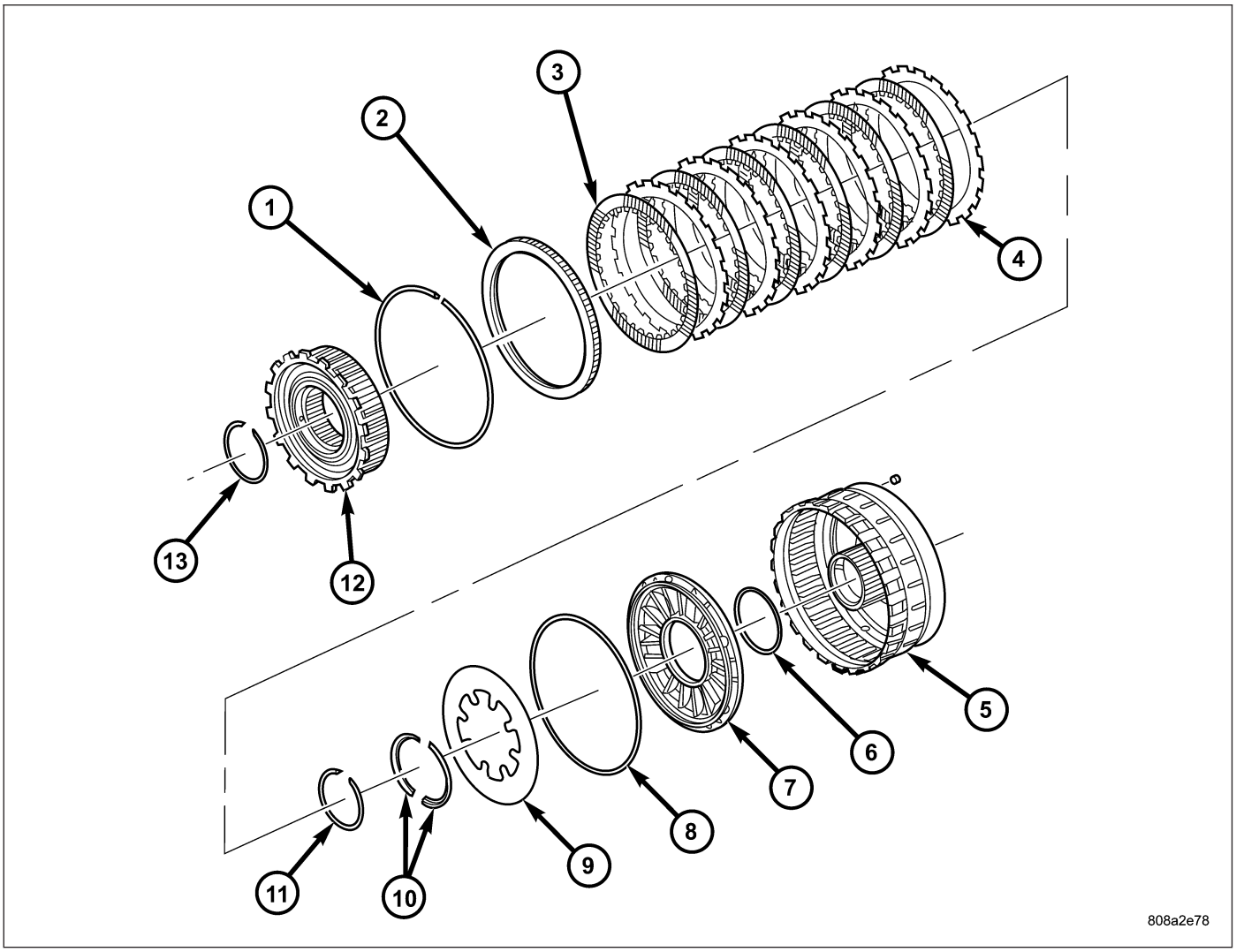
DESCRIPTION



2C and 4C Clutches

1 - SEAL
2 - 2C PISTON
3 - PLATE
4 - DISC
5 - 2C BELLEVILLE SPRING
6 - SNAP-RING
7 - SNAP-RING (SELECT)
8 - REACTION PLATE
9 - SNAP-RING
10 - RETURN SPRING
11 - SEAL
12 - 4C PISTON
13 - 4C RETAINER/BULKHEAD

Three hydraulically applied multi-disc clutches are used to hold some planetary geartrain components stationary while the input clutches drive others. The 2C, 4C, and Low/Reverse clutches are considered holding clutches. The 2C and 4C clutches are located in the 4C retainer/bulkhead (13).



Low/Reverse Clutch

1 - SNAP-RING (SELECT)
2 - REACTION PLATE
3 - DISC
4 - PLATE
5 - L/R CLUTCH RETAINER
6 - SEAL
7 - PISTON
8 - SEAL
9 - BELLEVILLE SPRING
10 - RETAINER
11 - SNAP-RING
12 - OVERRUNNING CLUTCH
13 - SNAP-RING

The Low/Reverse clutch is located at the rear of the transmission case.

OPERATION

2C CLUTCH

The 2C clutch is hydraulically applied in second and fifth gear by pressurized fluid against the 2C piston. When the 2C clutch is applied, the reverse sun gear assembly is held or grounded to the transmission case by holding the reaction planetary carrier.

4C CLUTCH

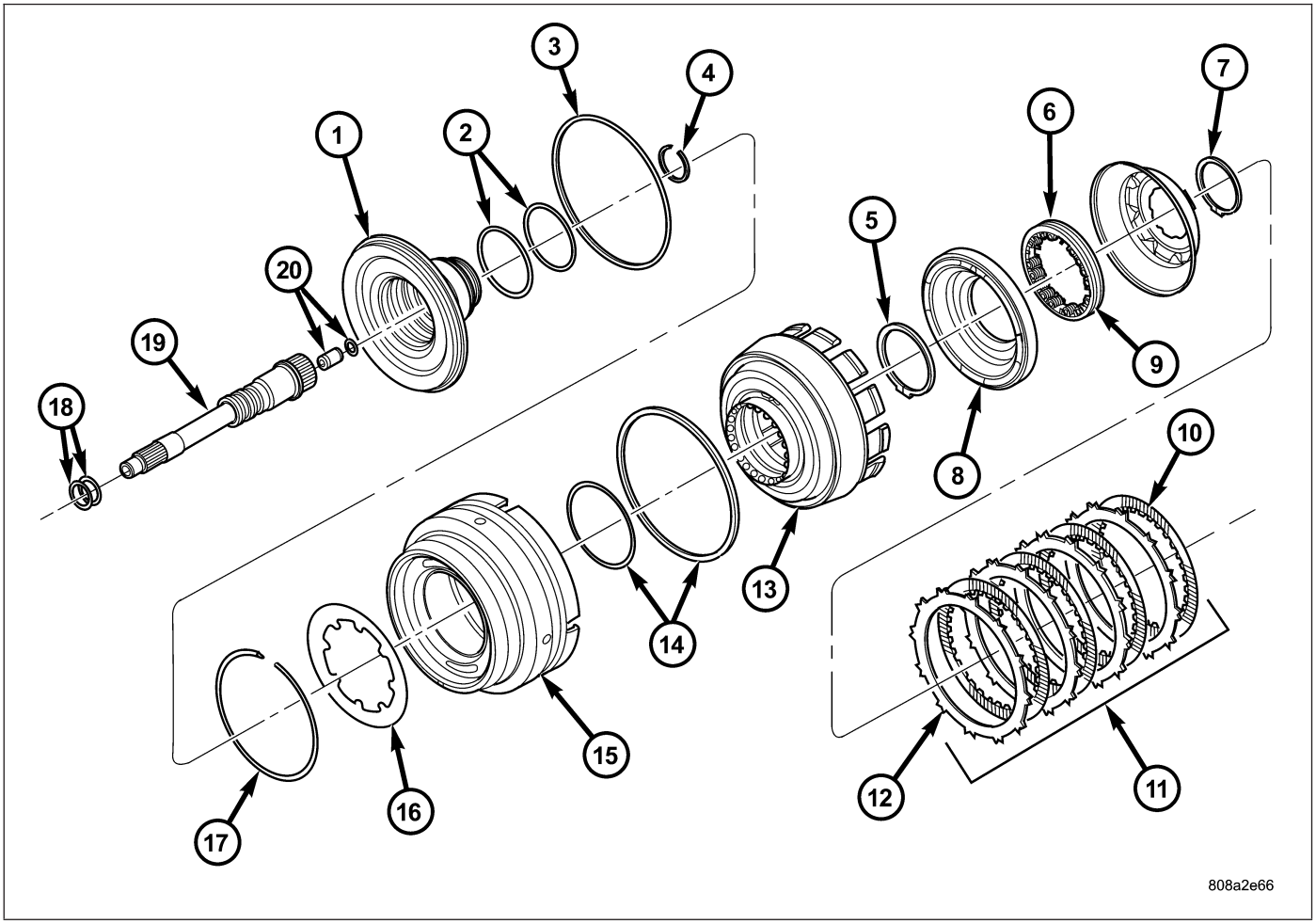
The 4C clutch is hydraulically applied in second prime and fourth gear by pressurized fluid against the 4C clutch piston. When the 4C clutch is applied, the reaction annulus gear is held or grounded to the transmission case.

LOW/REVERSE CLUTCH

The Low/Reverse clutch is hydraulically applied in park, reverse, neutral, and first gear, only at low speeds, by pressurized fluid against the Low/Reverse clutch piston. When the Low/Reverse clutch is applied, the input annulus assembly is held or grounded to the transmission case.

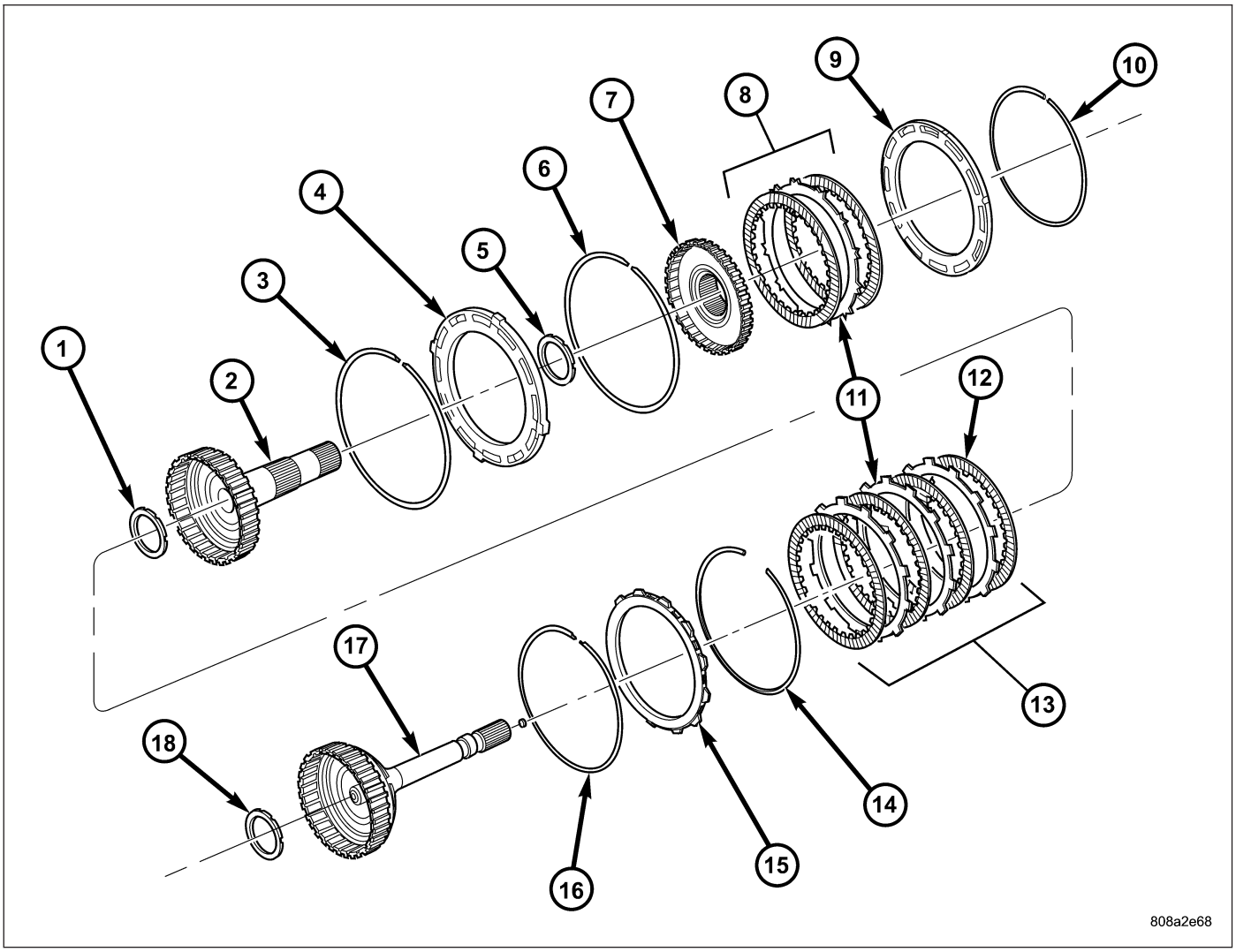
ASSEMBLY-INPUT CLUTCH

DESCRIPTION



Input Clutch Assembly - Part 1

1 - INPUT CLUTCH HUB
2 - O-RING SEALS
3 - SEAL
4 - SNAP-RING
5 - SNAP-RING
6 - UD BALANCE PISTON
7 - SNAP-RING
8 - UD PISTON
9 - SPRING
10 - DISC
11 - UD CLUTCH
12 - PLATE
13 - CLUTCH RETAINER
14 - SEAL
15 - OD/REV PISTON
16 - BELLEVILLE SPRING
17 - SNAP-RING
18 - SEAL RINGS
19 - INPUT SHAFT
20 - LUBRICATION CHECK VALVE AND SNAP-RING



Input Clutch Assembly - Part 2

1 - THRUST BEARING NUMBER 3
2 - OD HUB/SHAFT
3 - SNAP-RING (WAVE)
4 - REV/OD REACTION PLATE
5 - THRUST BEARING NUMBER 4
6 - SNAP-RING (FLAT)
7 - REVERSE HUB/SHAFT
8 - REVERSE CLUTCH
9 - REVERSE REACTION PLATE
10 - SNAP-RING (SELECT)
11 - PLATE
12 - DISC
13 - OD CLUTCH
14 - SNAP-RING (TAPERED)
15 - UD/OD REACTION PLATE
16 - SNAP-RING (FLAT)
17 - UD HUB/SHAFT
18 - THRUST BEARING NUMBER 2

Three hydraulically applied input clutches are used to drive planetary components. The underdrive, overdrive, and reverse clutches are considered input clutches and are contained within the input clutch assembly.

The input clutch assembly also contains:

- Input shaft
- Input hub
- Clutch retainer
- Underdrive piston
- Overdrive/reverse piston
- Overdrive hub
- Underdrive hub

OPERATION

The three input clutches are responsible for driving different components of the planetary geartrain.

UNDERDRIVE CLUTCH

The underdrive clutch is hydraulically applied in first, second, second prime, and third (direct) gears by pressurized fluid against the underdrive piston. When the underdrive clutch is applied, the underdrive hub drives the input sun gear.

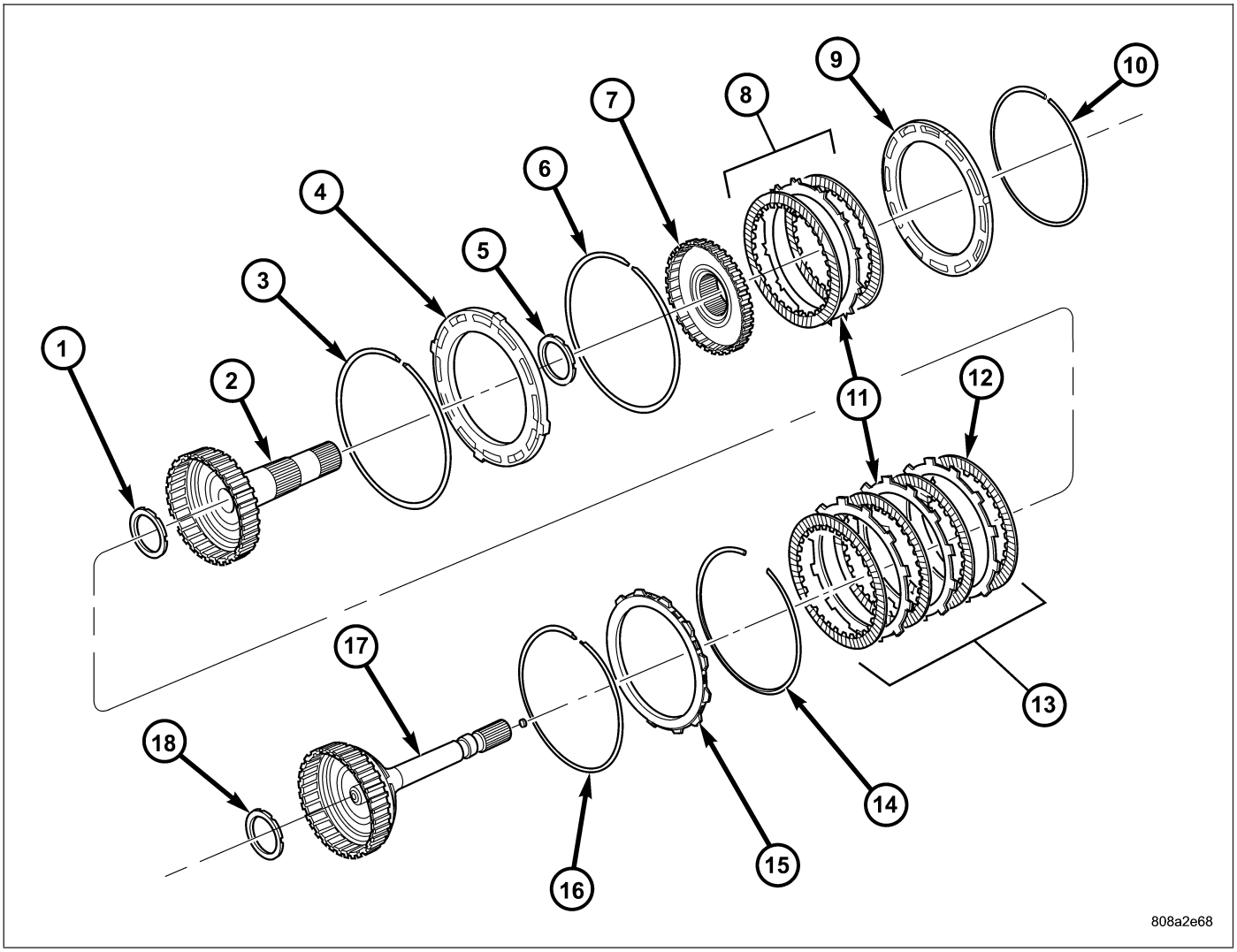
OVERDRIVE CLUTCH

The overdrive clutch is hydraulically applied in third (direct), fourth, and fifth gears by pressurized fluid against the overdrive/reverse piston. When the overdrive clutch is applied, the overdrive hub drives the reverse carrier/input annulus assembly.

REVERSE CLUTCH

The reverse clutch is hydraulically applied in reverse gear by pressurized fluid against the overdrive/reverse piston. When the reverse clutch is applied, the reaction annulus gear is driven.

DISASSEMBLY



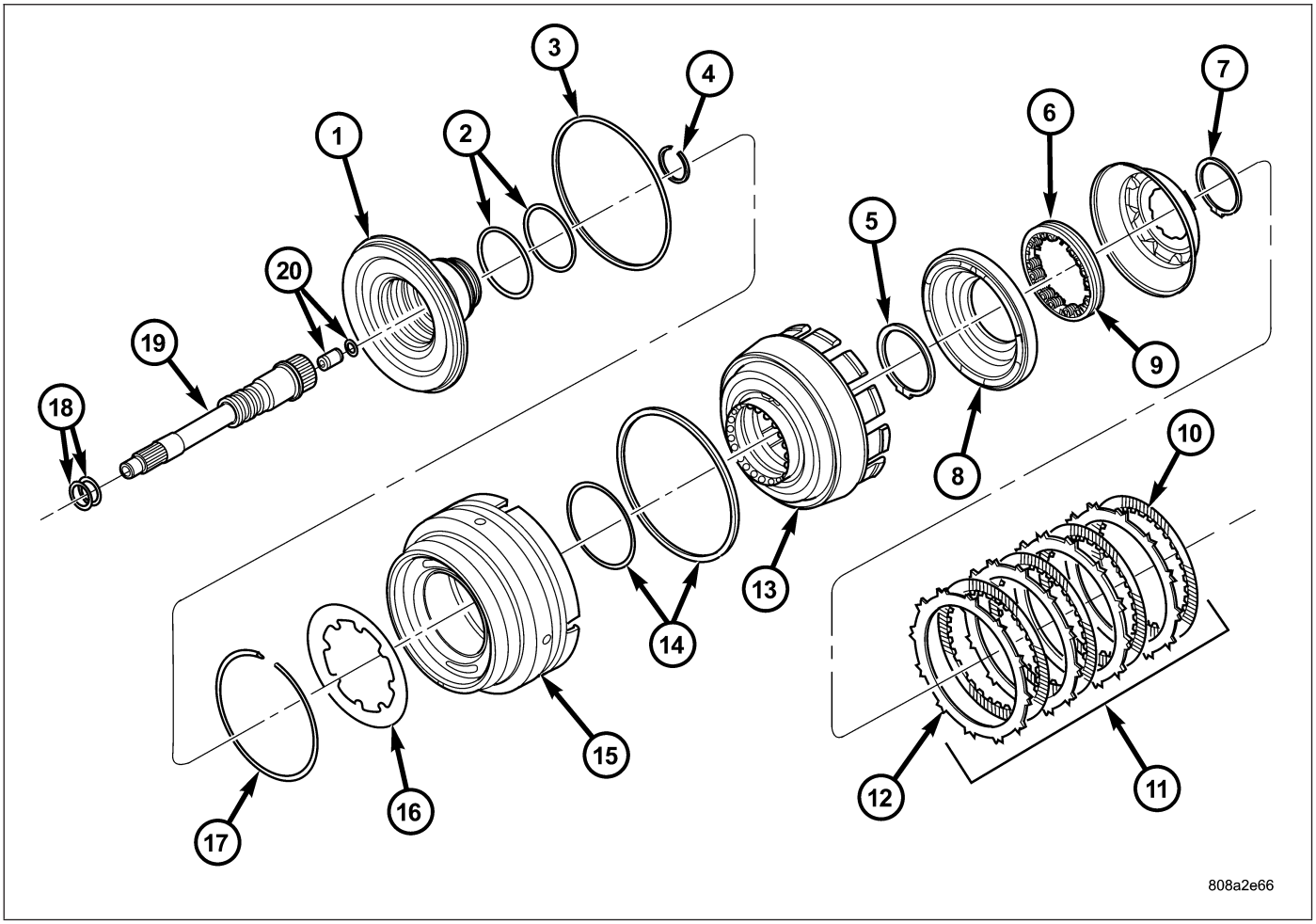
Input Clutch Assembly - Part 2

1 - THRUST BEARING NUMBER 3
2 - OD HUB/SHAFT
3 - SNAP-RING (WAVE)
4 - REV/OD REACTION PLATE
5 - THRUST BEARING NUMBER 4
6 - SNAP-RING (FLAT)
7 - REVERSE HUB/SHAFT
8 - REVERSE CLUTCH
9 - REVERSE REACTION PLATE
10 - SNAP-RING (SELECT)
11 - PLATE
12 - DISC
13 - OD CLUTCH
14 - SNAP-RING (TAPERED)
15 - UD/OD REACTION PLATE
16 - SNAP-RING (FLAT)
17 - UD HUB/SHAFT
18 - THRUST BEARING NUMBER 2

1. Remove the reverse reaction plate selective snap-ring (10) from the input clutch retainer (13).
2. Remove the reverse reaction plate (9) from the input clutch retainer (13).
3. Remove the reverse hub (7) and reverse clutch pack (8) from the input clutch retainer (13).
4. Remove the number 4 thrust bearing (5) from the overdrive hub (2).
5. Remove the overdrive hub (2) from the input clutch retainer (13).
6. Remove the number 3 thrust bearing (1) from the underdrive hub (17).
7. Remove the OD/reverse reaction plate snap-ring (6) from the input clutch retainer (13).
8. Remove the underdrive hub (17), overdrive clutch (13), and overdrive reaction plate (15) from the input clutch retainer (13).

NOTE: The overdrive friction discs and steel discs are thicker than the matching components in the underdrive and reverse clutches.

9. Remove the number 2 thrust bearing (18) from the input clutch hub (1).
10. Remove the overdrive clutch wave snap-ring (3) from the input clutch retainer (13).
11. Remove the UD/OD reaction plate tapered snap-ring (14) from the input clutch retainer (13).
12. Remove the UD/OD reaction plate (15) from the input clutch retainer (13).
13. Remove the UD/OD reaction plate flat snap-ring (16) from the input clutch retainer (13).

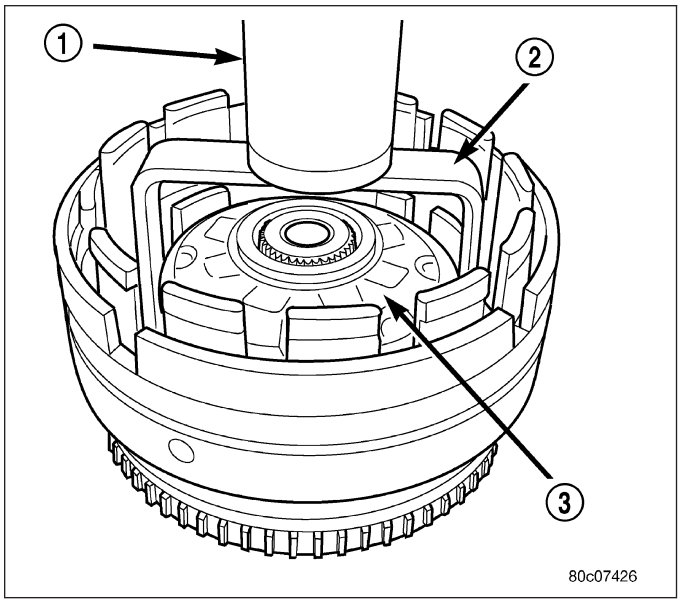


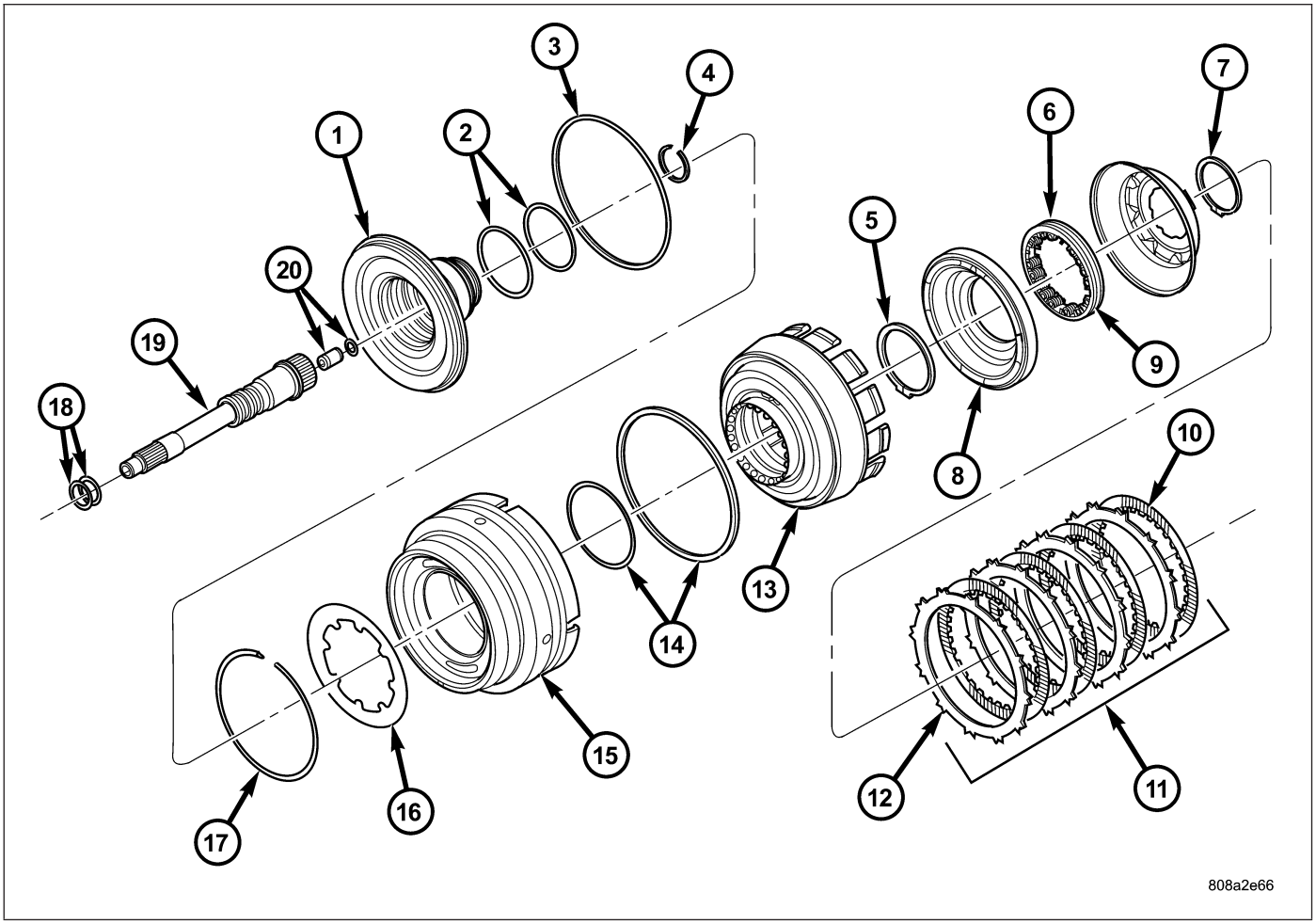
Input Clutch Assembly - Part 1

1 - INPUT CLUTCH HUB
2 - O-RING SEALS
3 - SEAL
4 - SNAP-RING
5 - SNAP-RING
6 - UD BALANCE PISTON
7 - SNAP-RING
8 - UD PISTON
9 - SPRING
10 - DISC
11 - UD CLUTCH
12 - PLATE
13 - CLUTCH RETAINER
14 - SEAL
15 - OD/REV PISTON
16 - BELLEVILLE SPRING
17 - SNAP-RING
18 - SEAL RINGS
19 - INPUT SHAFT
20 - LUBRICATION CHECK VALVE AND SNAP-RING

14. Remove the underdrive clutch pack (11) from the input clutch retainer (13).

15. Using Spring Compressor 8251 (2) , compress the UD/OD balance piston (3) and remove the snap-ring from the input clutch hub (1).





Input Clutch Assembly - Part 1

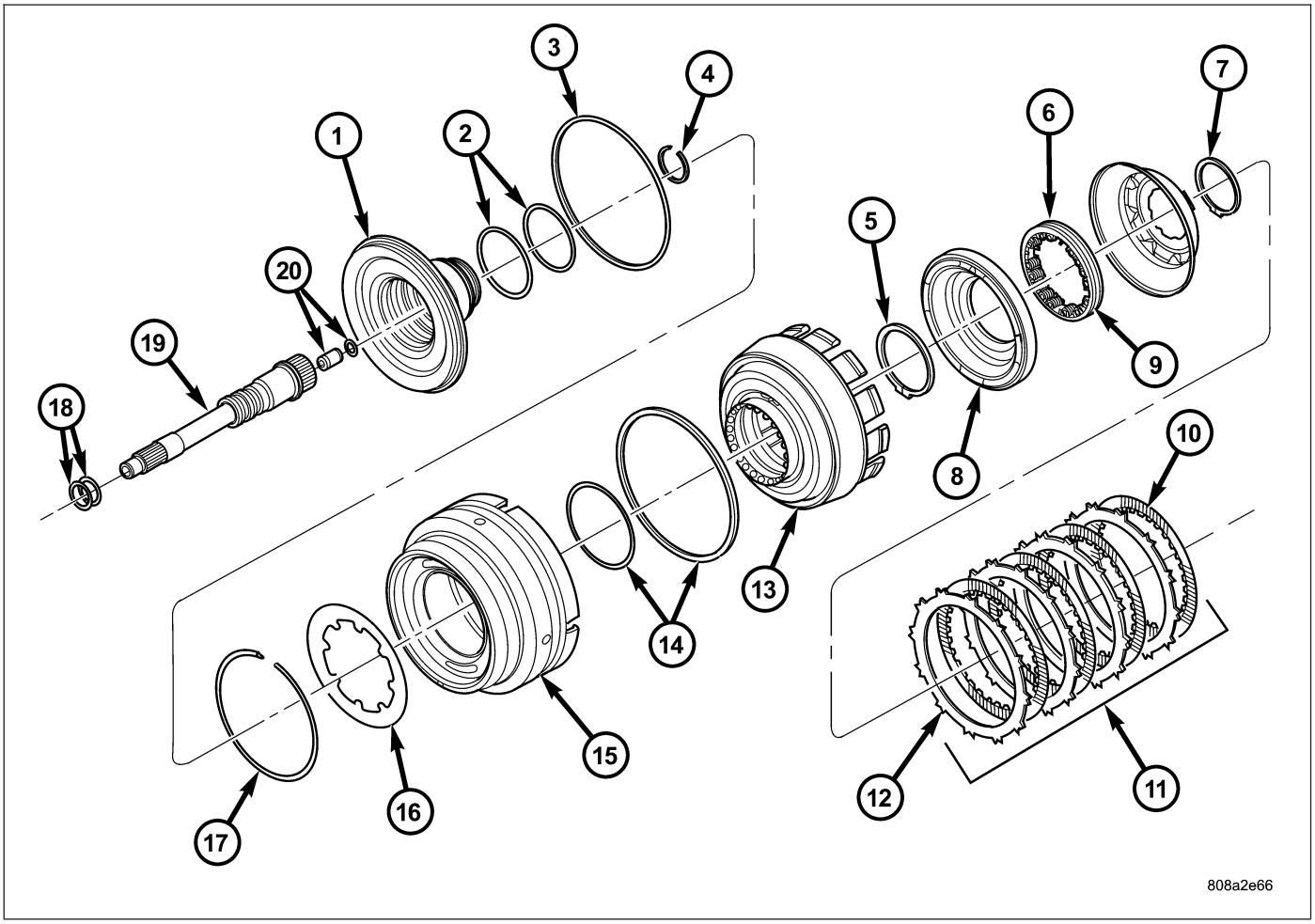
1 - INPUT CLUTCH HUB	11 - UD CLUTCH
2 - O-RING SEALS	12 - PLATE
3 - SEAL	13 - CLUTCH RETAINER
4 - SNAP-RING	14 - SEAL
5 - SNAP-RING	15 - OD/REV PISTON
6 - UD BALANCE PISTON	16 - BELLEVILLE SPRING
7 - SNAP-RING	17 - SNAP-RING
8 - UD PISTON	18 - SEAL RINGS
9 - SPRING	19 - INPUT SHAFT
10 - DISC	20 - LUBRICATION CHECK VALVE AND SNAP-RING

16. Remove the UD/OD balance piston (6) and piston return spring (9) from the input clutch retainer (13).
17. Remove the underdrive piston (8) from the input clutch retainer (13).

NOTE: Both the UD/OD balance piston and the underdrive piston have seals molded onto them. If the seal is damaged, do not attempt to install a new seal onto the piston. The piston/seal must be replaced as an assembly.

18. Remove the input clutch retainer tapered snap-ring (5).
19. Separate input clutch retainer (13) from input clutch hub (1).
20. Separate OD/reverse piston (15) from input clutch hub retainer (13).
21. Remove all seals and o-rings from the input shaft and input hub. The o-rings on the input hub are color coded. Be sure to make note of which o-ring belongs in which location.

ASSEMBLY



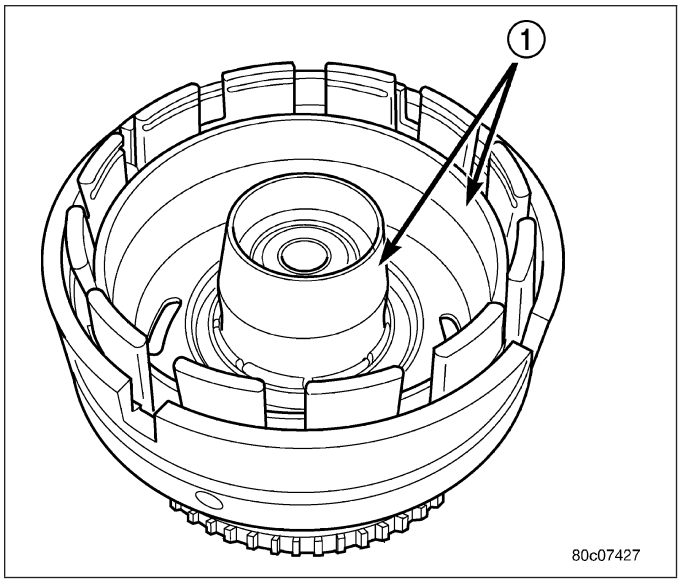
Input Clutch Assembly - Part 1

1 - INPUT CLUTCH HUB
2 - O-RING SEALS
3 - SEAL
4 - SNAP-RING
5 - SNAP-RING
6 - UD BALANCE PISTON
7 - SNAP-RING
8 - UD PISTON
9 - SPRING
10 - DISC
11 - UD CLUTCH
12 - PLATE
13 - CLUTCH RETAINER
14 - SEAL
15 - OD/REV PISTON
16 - BELLEVILLE SPRING
17 - SNAP-RING
18 - SEAL RINGS
19 - INPUT SHAFT
20 - LUBRICATION CHECK VALVE AND SNAP-RING

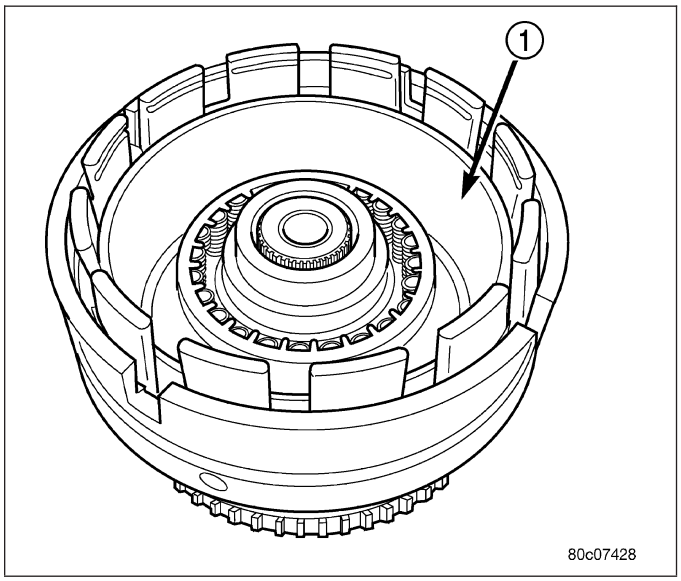
NOTE: Install all new seals and o-rings onto the input shaft and input hub. The o-rings on the input hub are color coded. Be sure to install the correct o-ring in the correct location.

1. Check the transmission lubrication check valve (20) located in the input shaft using shop air. The valve should only allow air flow in one direction. If the valve allows no air flow, or air flow in both directions, the valve will need to be replaced.
2. Lubricate all seals with Mopar® ATF +4, Automatic Transmission Fluid, prior to installation.
3. Assemble the OD/reverse piston (15) onto the input clutch hub (1).
4. Assemble the input clutch retainer (13) onto the input clutch hub (1).
5. Install the input clutch retainer tapered snap-ring (5) with tapered side up onto the input clutch hub (1).

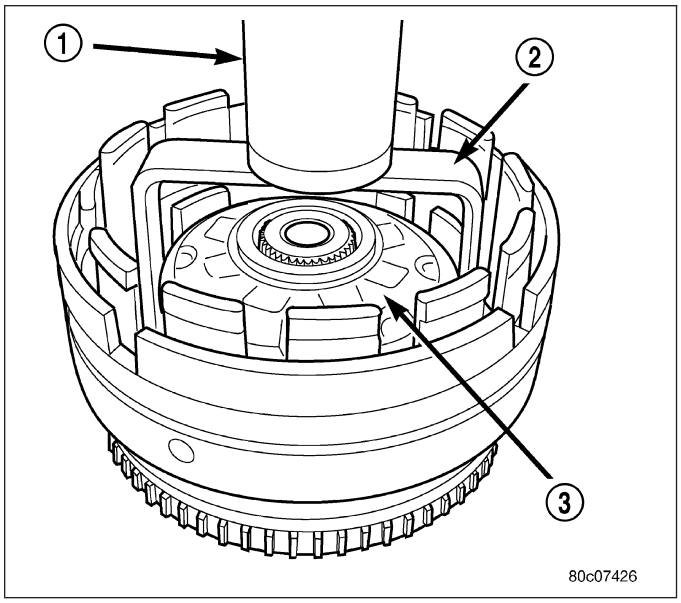
6. Install Piston Guides 8504 (1) into the input clutch retainer (13) and onto the input clutch hub (1) to guide the inner and outer underdrive piston (8) seals into position.
7. Install the underdrive piston (8) into the input clutch retainer (13) and over the input clutch hub (1).

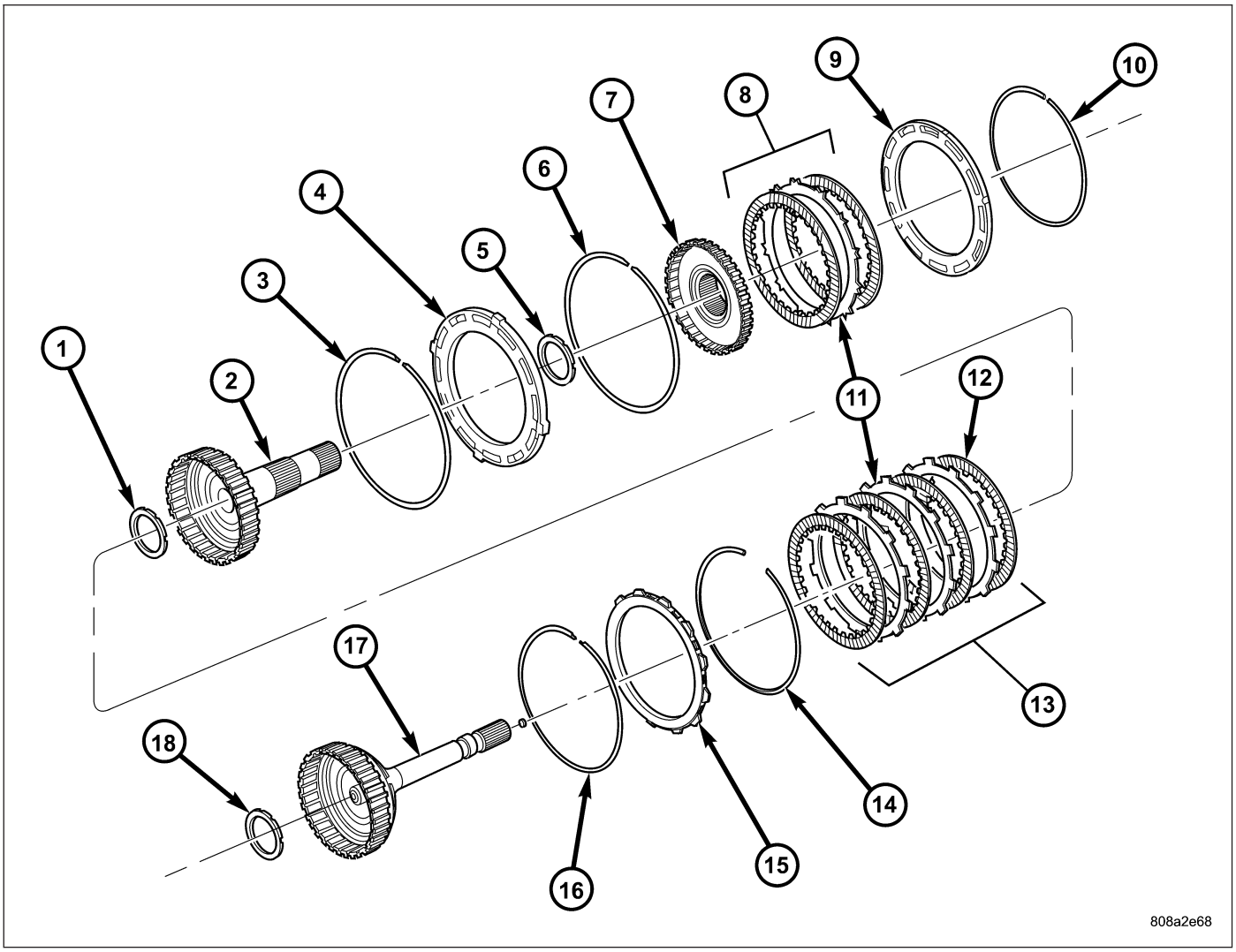


8. Install the UD/OD balance piston return spring pack (9) into the input clutch retainer (13).
9. Install Piston Guide 8252 (1) into the input clutch retainer (13) to guide the UD/OD balance piston (6) seal into position inside the underdrive piston (8).



10. Install the UD/OD balance piston (3) into the input clutch retainer and the underdrive piston.
11. Using Spring Compressor 8251 (2), compress the UD/OD return spring pack and secure the piston in place with the snap-ring.
12. Install the underdrive clutch pack (11) into the input clutch retainer.



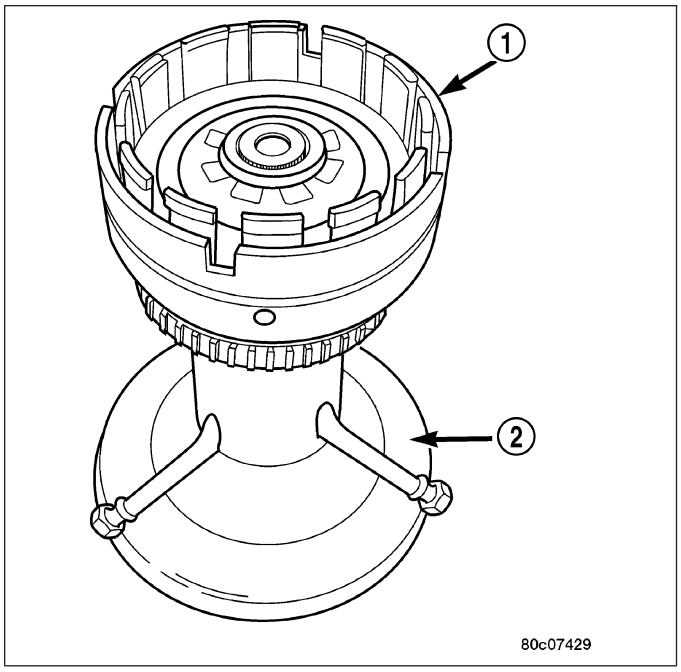


Input Clutch Assembly - Part 2

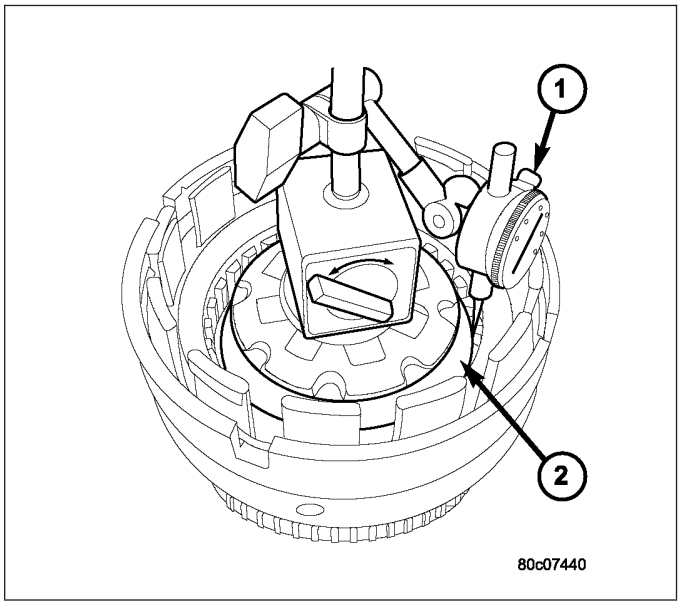
1 - THRUST BEARING NUMBER 3
2 - OD HUB/SHAFT
3 - SNAP-RING (WAVE)
4 - REV/OD REACTION PLATE
5 - THRUST BEARING NUMBER 4
6 - SNAP-RING (FLAT)
7 - REVERSE HUB/SHAFT
8 - REVERSE CLUTCH
9 - REVERSE REACTION PLATE
10 - SNAP-RING (SELECT)
11 - PLATE
12 - DISC
13 - OD CLUTCH
14 - SNAP-RING (TAPERED)
15 - UD/OD REACTION PLATE
16 - SNAP-RING (FLAT)
17 - UD HUB/SHAFT
18 - THRUST BEARING NUMBER 2

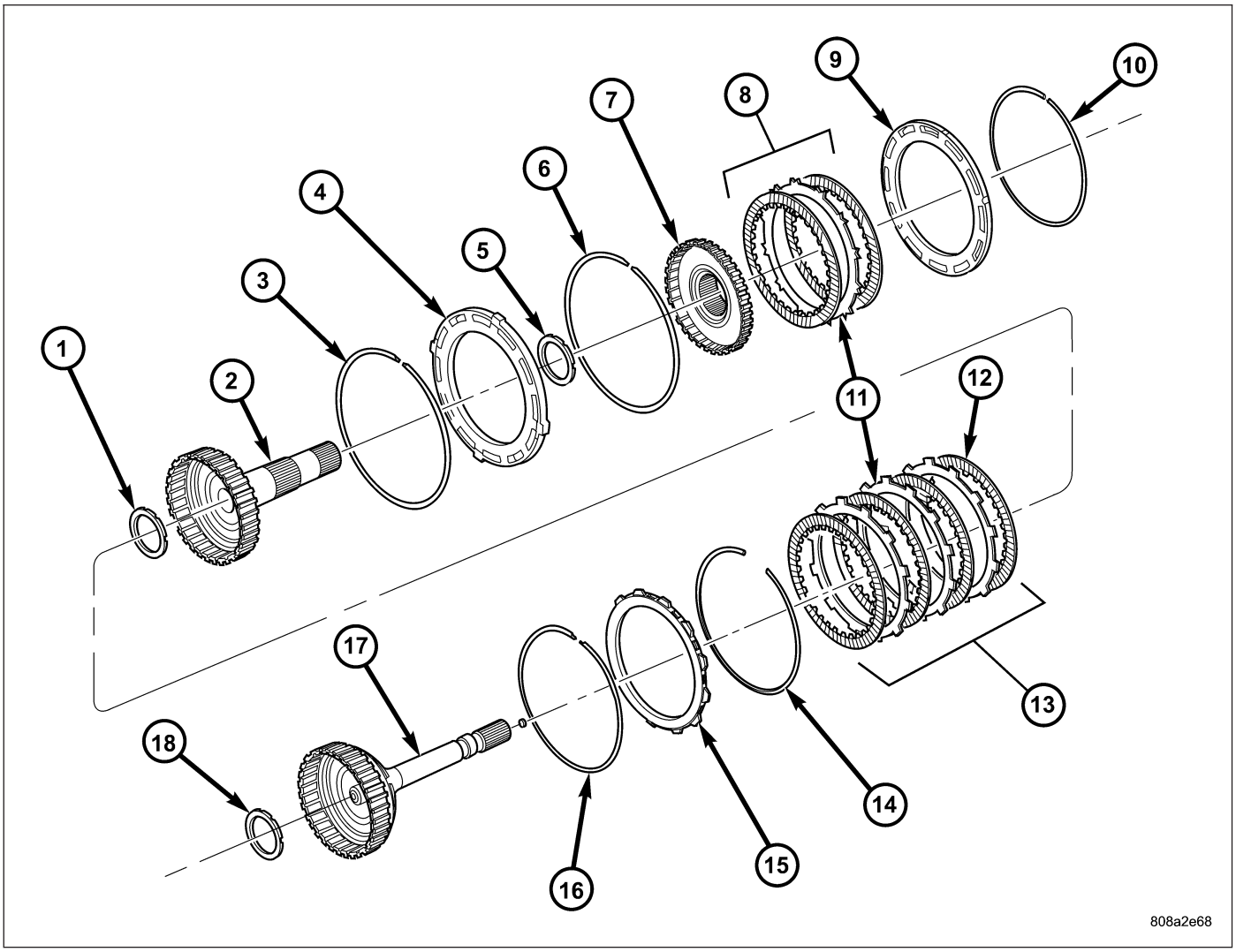
13. Install the UD/OD reaction plate lower flat snap-ring (16). The correct snap-ring can be identified by the two tabbed ears.
14. Install the UD/OD reaction plate (15) into the input clutch retainer. The reaction plate is to be installed with the big step down.
15. Install the UD/OD reaction plate upper tapered snap-ring (14) with tapered side up.

16. Install the input clutch assembly into Input Clutch Pressure Fixture 8260 (2).



17. Mount a dial indicator to the assembly, push down on the clutch discs and zero the indicator against the underdrive clutch discs. Apply 20 psi of air pressure to the underdrive clutch and record the dial indicator reading. Measure and record UD clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with UD clutch pack clearance specification. The correct clutch clearance is 0.84-1.54 mm (0.033-0.061 in.). The reaction plate is not selective. If the clutch clearance is not within specification, replace the reaction plate along with all the friction and steel discs.



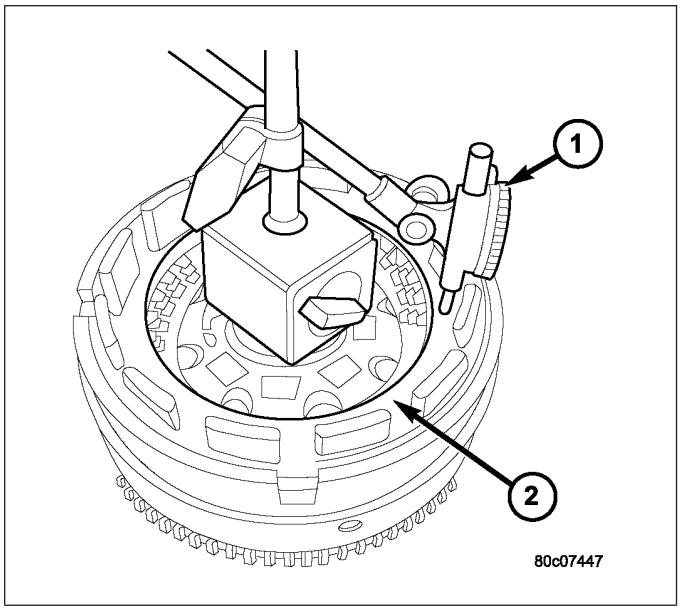


Input Clutch Assembly - Part 2

1 - THRUST BEARING NUMBER 3
2 - OD HUB/SHAFT
3 - SNAP-RING (WAVE)
4 - REV/OD REACTION PLATE
5 - THRUST BEARING NUMBER 4
6 - SNAP-RING (FLAT)
7 - REVERSE HUB/SHAFT
8 - REVERSE CLUTCH
9 - REVERSE REACTION PLATE
10 - SNAP-RING (SELECT)
11 - PLATE
12 - DISC
13 - OD CLUTCH
14 - SNAP-RING (TAPERED)
15 - UD/OD REACTION PLATE
16 - SNAP-RING (FLAT)
17 - UD HUB/SHAFT
18 - THRUST BEARING NUMBER 2

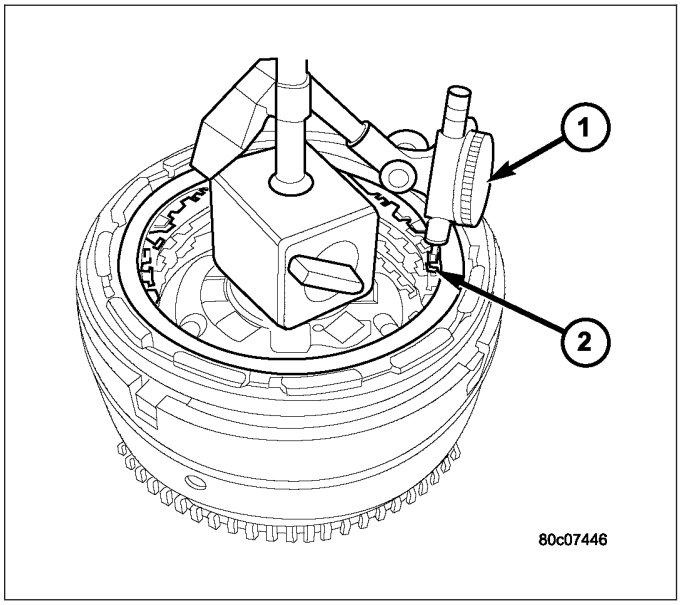
18. Install the overdrive clutch pack (13) into the input clutch retainer. The overdrive steel separator plates can be identified by the lack of the half-moon cuts in the locating tabs.
19. Install the overdrive clutch wavy snap-ring (3) with the two tabbed ears into the input clutch retainer.
20. Install the OD/reverse reaction plate (4) into the input clutch retainer. The reaction plate is non-directional.
21. Install the OD/reverse reaction plate flat snap-ring (6) into the input clutch retainer.

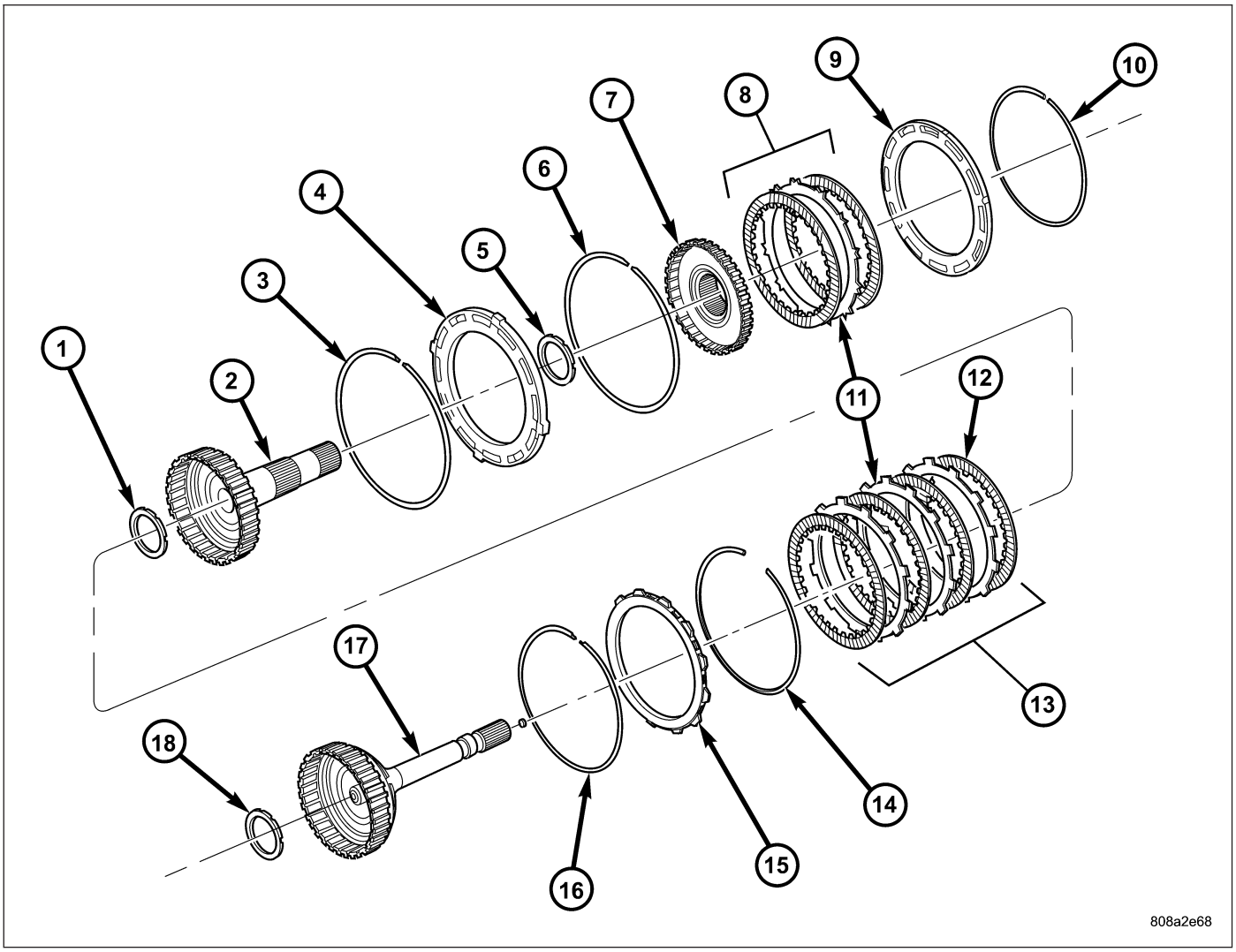
22. Mount a dial indicator to the assembly and zero the indicator against the OD/reverse reaction plate (2). Apply 20 psi of air pressure to the overdrive clutch and record the dial indicator reading. Measure and record OD clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with OD clutch pack clearance specification.Verify that the clutch clearance is 1.103-1.856 mm (0.043-0.073 in.). The reaction plate is not selective. If the clutch clearance is not within specification, replace the reaction plate along with all the friction and steel discs.



23. Install the reverse clutch pack (8) into the input clutch retainer.
24. Install the reverse reaction plate(9) into the input clutch retainer.
25. Install the reverse reaction plate selective snap-ring (10) into the input clutch retainer.

26. Mount a dial indicator to the assembly, push down on the clutch discs, pull up on the reaction plate to ensure the plate is properly seated and zero the indicator against the reverse clutch discs (2). Apply 20 psi of air pressure to the reverse clutch and record the dial indicator reading. Measure and record Reverse clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with Reverse clutch pack clearance specification. The correct clutch clearance is 0.58-1.47 mm (0.023-0.058 in.). Adjust as necessary. Install the chosen snap-ring and re-measure to verify selection.





Input Clutch Assembly - Part 2

1 - THRUST BEARING NUMBER 3
2 - OD HUB/SHAFT
3 - SNAP-RING (WAVE)
4 - REV/OD REACTION PLATE
5 - THRUST BEARING NUMBER 4
6 - SNAP-RING (FLAT)
7 - REVERSE HUB/SHAFT
8 - REVERSE CLUTCH
9 - REVERSE REACTION PLATE
10 - SNAP-RING (SELECT)
11 - PLATE
12 - DISC
13 - OD CLUTCH
14 - SNAP-RING (TAPERED)
15 - UD/OD REACTION PLATE
16 - SNAP-RING (FLAT)
17 - UD HUB/SHAFT
18 - THRUST BEARING NUMBER 2

27. Remove the reverse clutch pack (8) from the input clutch retainer.
28. Install the number 2 thrust bearing (18) onto the underdrive hub (17) with outer race against the hub with petroleum jelly.
29. Install the underdrive hub (17) into the input clutch retainer.
30. Install the number 3 thrust bearing (1) into the overdrive hub (2) with the outer race against the hub with petroleum jelly.
31. Install the overdrive hub (2) into the input clutch retainer.
32. Install the number 4 thrust bearing (5) into the reverse hub with outer race against the hub with petroleum jelly.
33. Install the reverse hub (7) into the input clutch retainer.
34. Install the complete reverse clutch pack (8).
35. Install the reverse reaction plate (9) and snap-ring (10).
36. Push up on reaction plate to allow reverse clutch to move freely.

SENSOR-INPUT SPEED

DESCRIPTION

The Input and Output Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).

OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

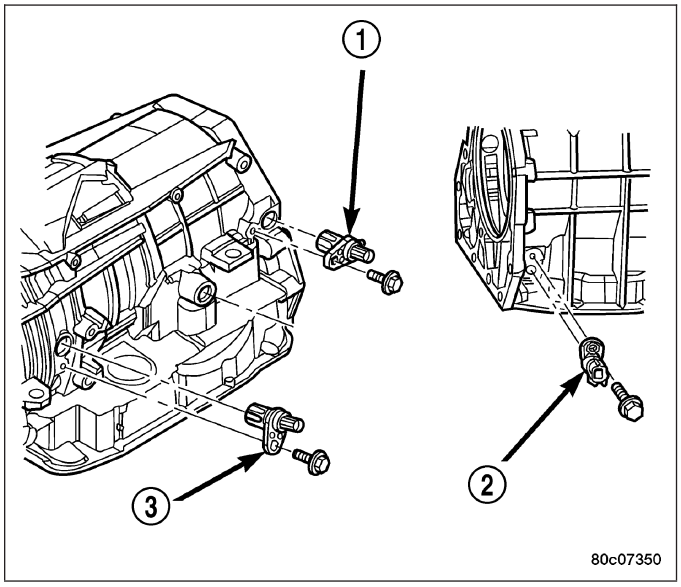
- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

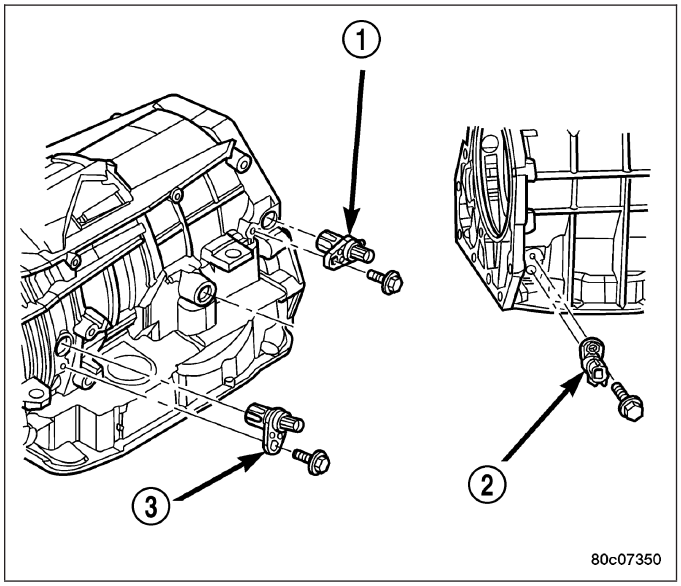
REMOVAL

1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the input speed sensor (3).
4. Remove the bolt holding the input speed sensor to the transmission case.
5. Remove the input speed sensor (3) from the transmission case.



INSTALLATION

1. Install the input speed sensor (3) into the transmission case.
2. Install the bolt to hold the input speed sensor (3) into the transmission case. Tighten the bolt to 11.9 N·m (105 in.lbs.).
3. Install the wiring connector onto the input speed sensor.
4. Verify the transmission fluid level. Add fluid as necessary.
5. Lower vehicle.



SENSOR-LINE PRESSURE

DESCRIPTION

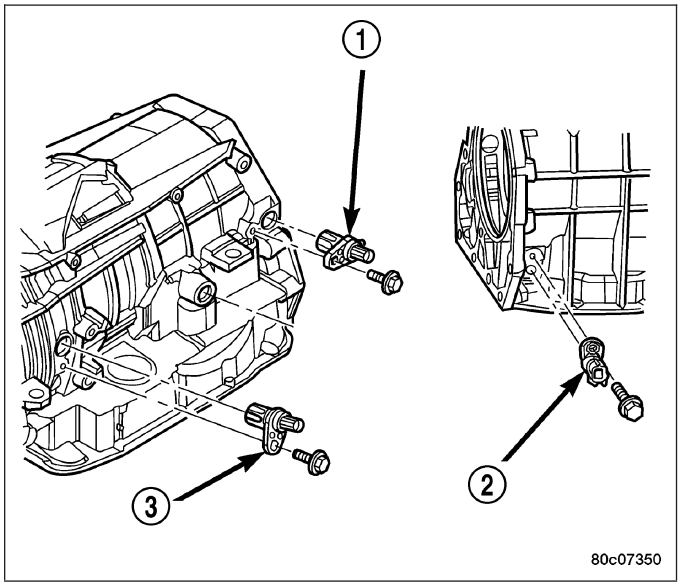
The TCM utilizes a closed-loop system to control transmission line pressure. The system contains a variable force style solenoid, the Pressure Control Solenoid, mounted on the side of the solenoid and pressure switch assembly. The solenoid is duty cycle controlled by the TCM to vent the unnecessary line pressure supplied by the oil pump back to the sump. The system also contains a variable pressure style sensor, the Line Pressure Sensor, which is a direct input to the TCM. The line pressure solenoid monitors the transmission line pressure and completes the feedback loop to the TCM. The TCM uses this information to adjust its control of the pressure control solenoid to achieve the desired line pressure.

OPERATION

The TCM calculates the desired line pressure based upon inputs from the transmission and engine. The TCM calculates the torque input to the transmission and uses that information as the primary input to the calculation. The line pressure is set to a predetermined value during shifts and when the transmission is in the PARK and NEUTRAL positions. This is done to ensure consistent shift quality. During all other operation, the actual line pressure is compared to the desired line pressure and adjustments are made to the pressure control solenoid duty cycle.

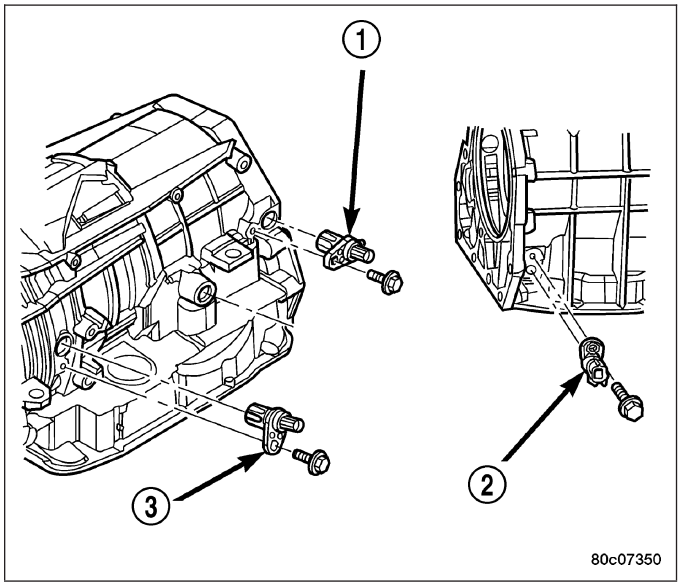
REMOVAL

1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the line pressure sensor (2).
4. Remove the bolt holding the line pressure sensor (2) to the transmission case.
5. Remove the line pressure sensor (2) from the transmission case.



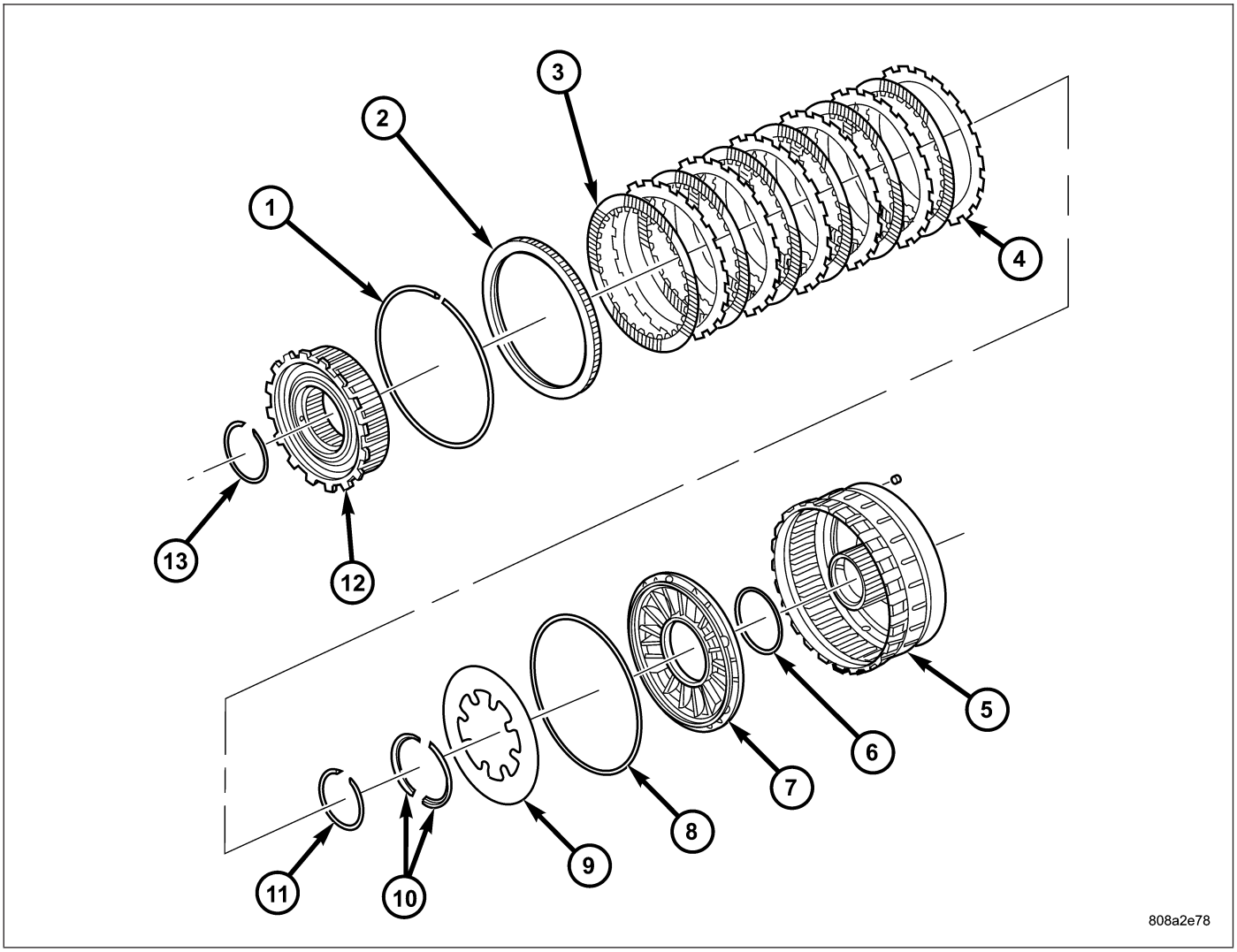
INSTALLATION

1. Install the line pressure sensor (2) into the transmission case.
2. Install the bolt to hold the line pressure sensor (2) into the transmission case. Tighten the bolt to 11.9 N·m (105 in.lbs.).
3. Install the wiring connector onto the line pressure sensor (2).
4. Verify the transmission fluid level. Add fluid as necessary.
5. Lower vehicle.



CLUTCH-LOW/REVERSE

DISASSEMBLY

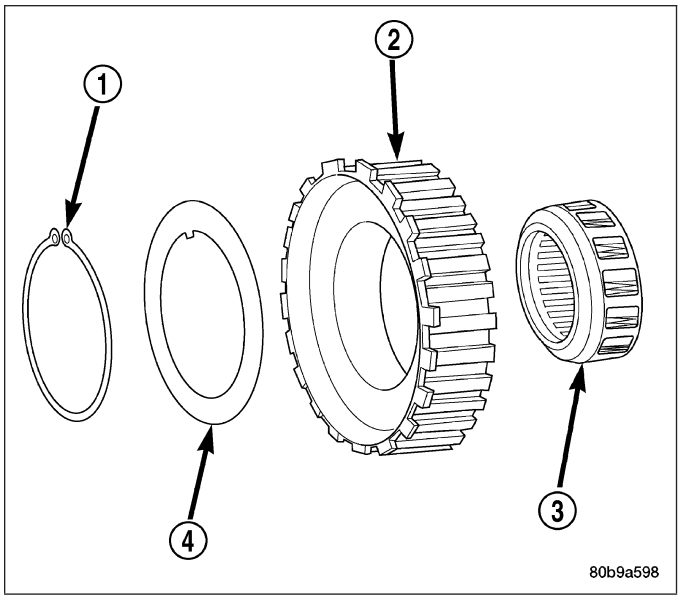


Low/Reverse Clutch Assembly

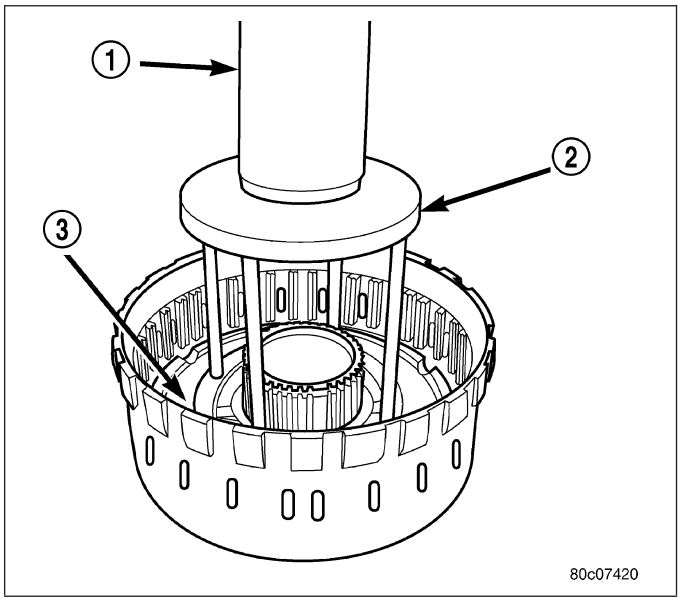
1 - SNAP-RING (SELECT)
2 - REACTION PLATE
3 - DISC
4 - PLATE
5 - L/R CLUTCH RETAINER
6 - SEAL
7 - PISTON
8 - SEAL
9 - BELLEVILLE SPRING
10 - RETAINER
11 - SNAP-RING
12 - OVERRUNNING CLUTCH
13 - SNAP-RING

1. Remove the inner overrunning clutch snap-ring (13) from the low/reverse clutch retainer (5).
2. Remove the outer low/reverse reaction plate flat snap-ring (1.
3. Remove the low/reverse clutch (3, 4) and the overrunning clutch (12) from the low/reverse clutch retainer (5) as an assembly.
4. Separate the low/reverse clutch (3, 4) from the overrunning clutch (12).

5. Remove the overrunning clutch snap-ring (1).
6. Remove the spacer (4) from the overrunning clutch (3).
7. Separate the inner and outer races (2) of the overrunning clutch (3).
8. Remove the overrunning clutch lower snap-ring.



9. Using Spring Compressor 8285 (2) and a suitable shop press (1), compress the low/reverse piston Belleville spring (3) and remove the split retaining ring holding the Belleville spring into the low/reverse clutch retainer.
10. Remove the low/reverse clutch Belleville spring (3) and piston from the low/reverse clutch retainer. Use 20 psi of air pressure to remove the piston if necessary.



CLEANING

Clean the overrunning clutch assembly, clutch cam, and low-reverse clutch retainer. Dry them with compressed air after cleaning.

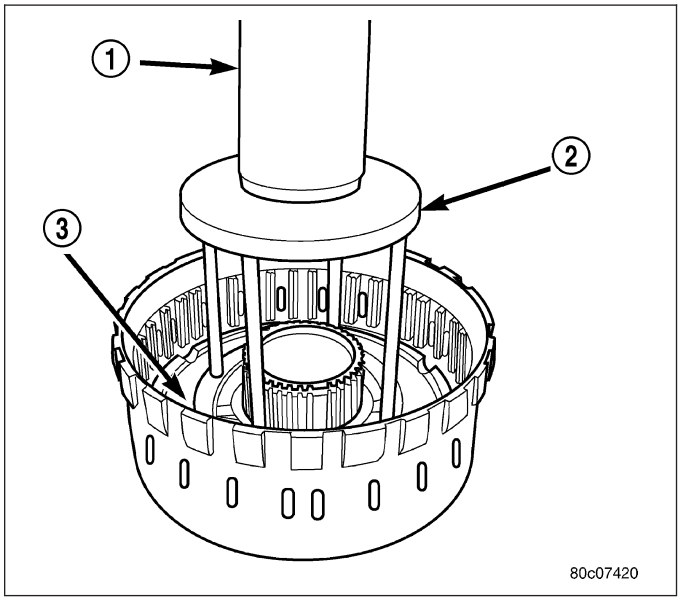
INSPECTION

Inspect condition of each clutch part after cleaning. Replace the overrunning clutch roller and spring assembly if any rollers or springs are worn or damaged, or if the roller cage is distorted, or damaged. Replace the cam if worn, cracked or damaged.

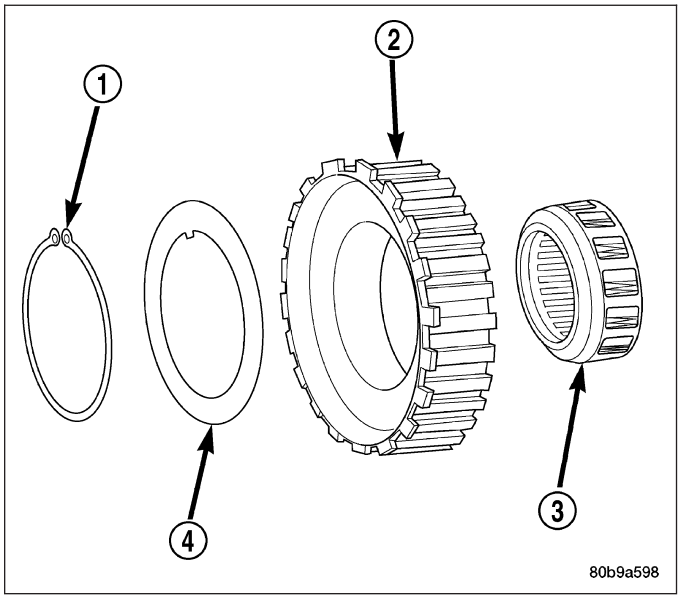
Replace the low-reverse clutch retainer if the clutch race, roller surface or inside diameter is scored, worn or damaged.

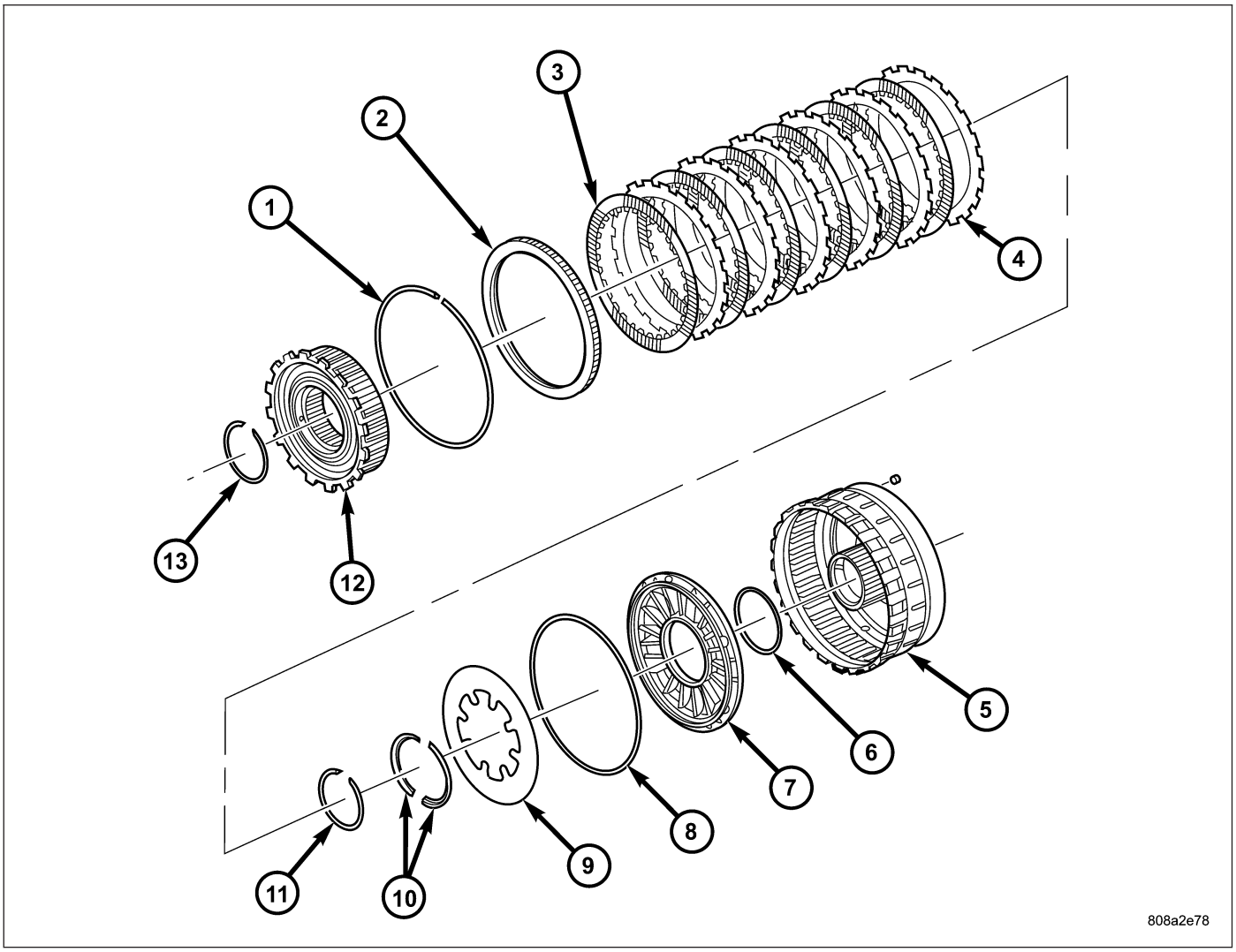
ASSEMBLY

1. Check the bleed orifice to ensure that it is not plugged or restricted.
2. Install a new seal on the low/reverse piston. Lubricate the seal with Mopar® ATF +4, Automatic Transmission Fluid, prior to installation.
3. Install the low/reverse piston into the low/reverse clutch retainer.
4. Position the low/reverse piston Belleville spring (3) on the low/reverse piston.
5. Using Spring Compressor 8285 (2) and a suitable shop press (1), compress the low/reverse piston Belleville spring (3) and install the split retaining ring to hold the Belleville spring into the low/reverse clutch retainer.



6. Install the lower overrunning clutch snap-ring.
7. Assemble the inner and outer races (2) of the overrunning clutch (3).
8. Position the overrunning clutch spacer (4) on the overrunning clutch (3).
9. Install the upper overrunning clutch snap-ring (1).





Low/Reverse Clutch Assembly

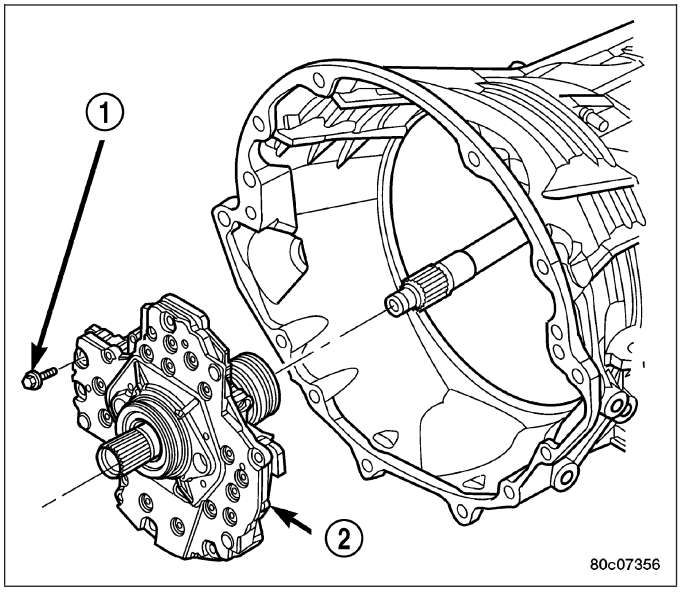
1 - SNAP-RING (SELECT)
2 - REACTION PLATE
3 - DISC
4 - PLATE
5 - L/R CLUTCH RETAINER
6 - SEAL
7 - PISTON
8 - SEAL
9 - BELLEVILLE SPRING
10 - RETAINER
11 - SNAP-RING
12 - OVERRUNNING CLUTCH
13 - SNAP-RING

10. Assemble and install the low/reverse clutch pack (3, 4) into the low/reverse clutch retainer (5).
11. Install the low/reverse reaction plate (2) into the low/reverse clutch retainer (5). The reaction plate is directional and must be installed with the flat side down.
12. Install the low/reverse clutch pack snap-ring (1). The snap-ring is selectable and should be chosen to give the correct clutch pack clearance.
13. Measure the low/reverse clutch pack clearance and adjust as necessary. The correct clutch clearance is 1.00-1.74 mm (0.039-0.075 in.).
14. Install the overrunning clutch (12) into the low/reverse clutch retainer (5) making sure that the index splines are aligned with the retainer.
15. Install the overrunning clutch inner snap-ring (13).

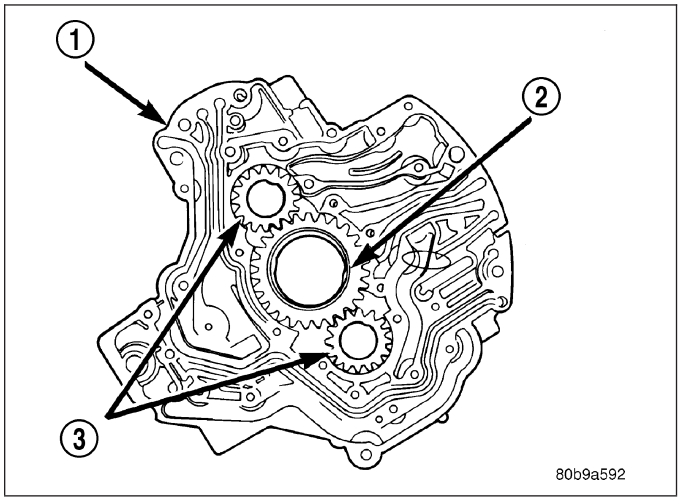
PUMP-OIL

DESCRIPTION

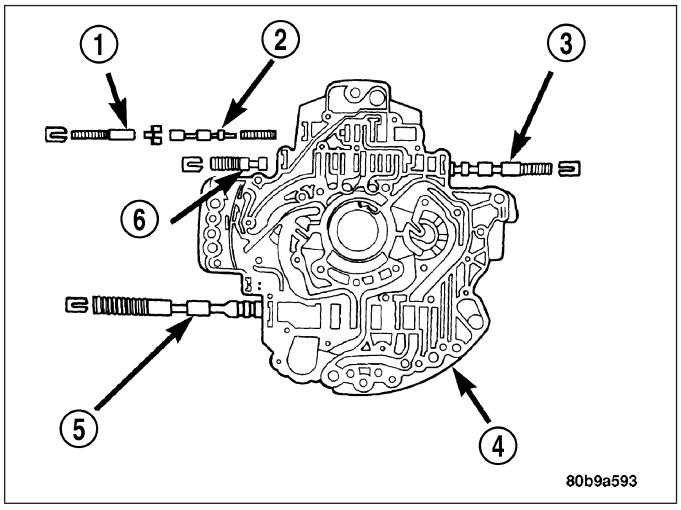
The oil pump (2) is located at the front of the transmission inside the bell housing and behind the transmission front cover.



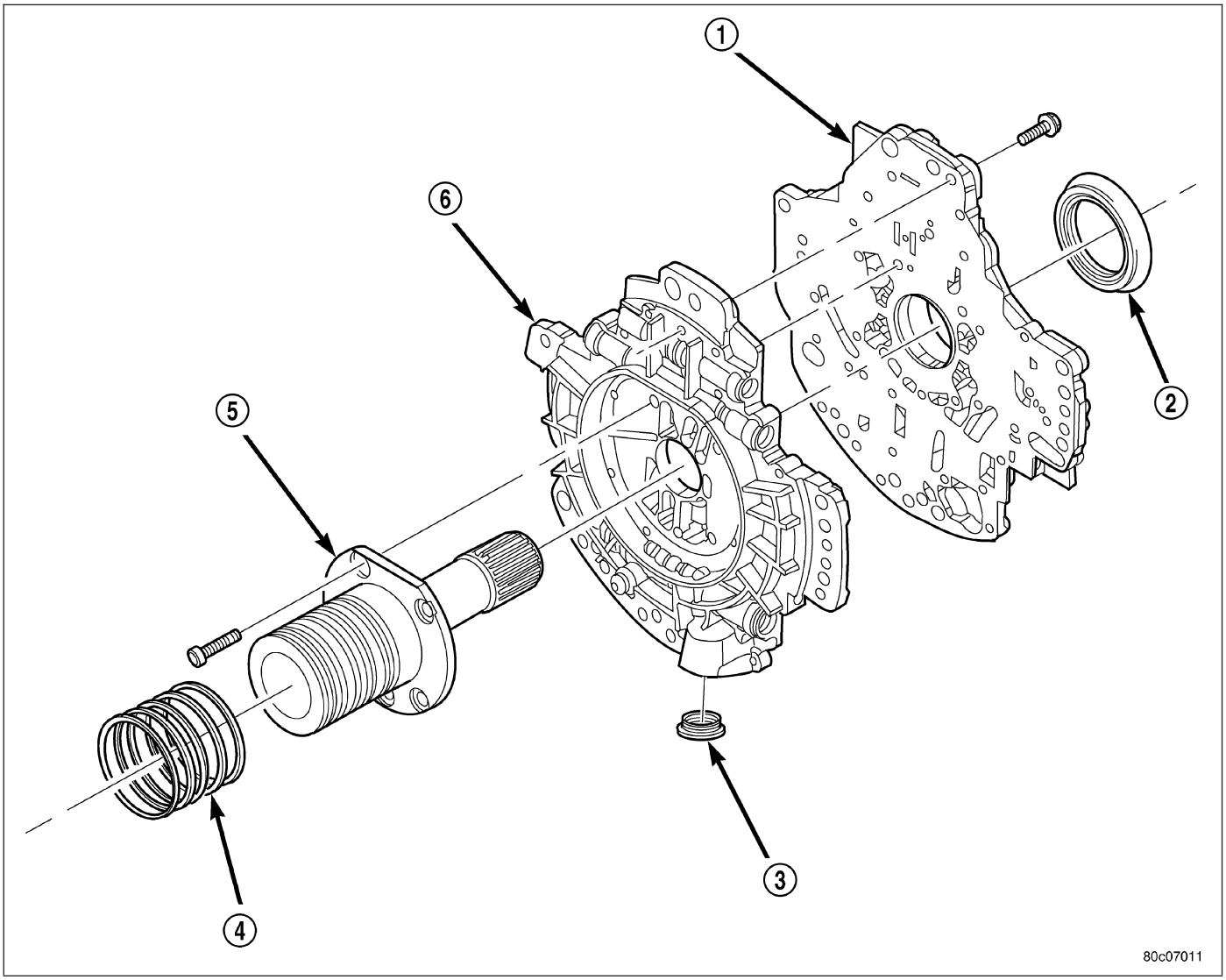
The oil pump consists of two independent pumps.



The oil pump also contains a number of valves. The converter clutch switch (3) and control valves (2), pressure regulator valve (5), and converter pressure limit valve (6) are all located in the oil pump valve



body.



Oil Pump Reaction Shaft

1 - PUMP HOUSING
2 - SEAL
3 - OIL FILTER SEAL
4 - SEAL RING (5)
5 - REACTION SHAFT SUPPORT
6 - PUMP VALVE BODY

A front seal (2), and a bolt on reaction shaft (5) complete the oil pump assembly.

OPERATION

As the torque converter rotates, the converter hub rotates the oil pump drive gear. As the drive gear rotates both driven gears, a vacuum is created when the gear teeth come out of mesh. This suction draws fluid through the pump inlet from the oil pan. As the gear teeth come back into mesh, pressurized fluid is forced into the pump outlet and to the oil pump valves.

At low speeds, both sides of the pump supply fluid to the transmission. As the speed of the torque converter increases, the flow from both sides increases until the flow from the primary side alone is sufficient to meet system demands. At this point, the check valve located between the two pumps closes. The secondary side is shut down and the primary side supplies all the fluid to the transmission.

CONVERTER CLUTCH SWITCH VALVE

The converter clutch switch valve is used to control the hydraulic pressure supplied to the front (OFF) side of the torque converter clutch.

CONVERTER CLUTCH REGULATOR VALVE

The converter clutch regulator valve is used to control the hydraulic pressure supplied to the back (ON) side of the torque converter clutch.

TORQUE CONVERTER LIMIT VALVE

The torque converter limit valve serves to limit the available line pressure to the torque converter clutch.

STANDARD PROCEDURE - OIL PUMP VOLUME CHECK

Measuring the oil pump output volume will determine if sufficient oil flow to the transmission oil cooler exists, and whether or not an internal transmission failure is present.

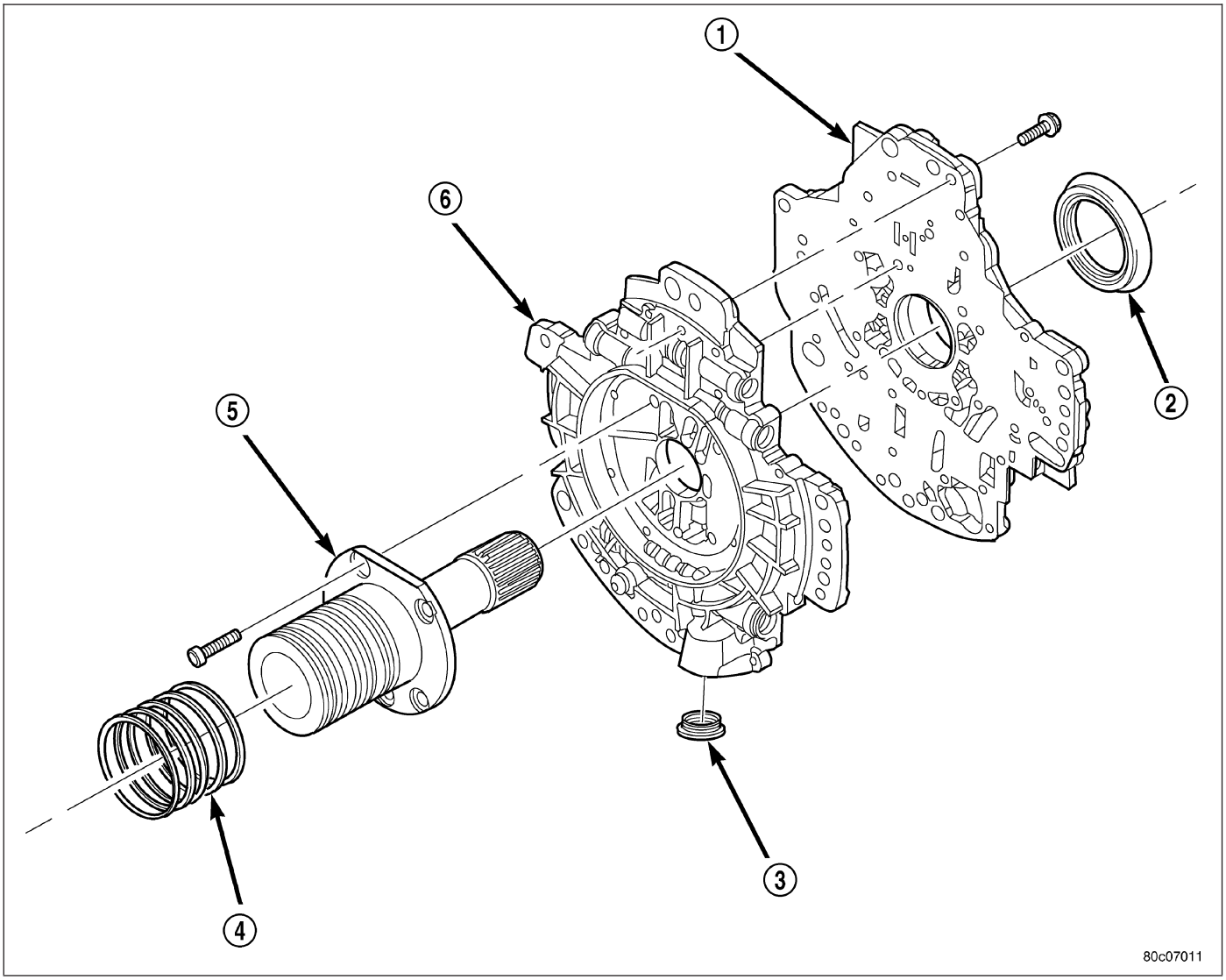
Verify that the transmission fluid is at the proper level. Refer to the Fluid Level Check procedure in this section. If necessary, fill the transmission to the proper level with Mopar® ATF +4, Automatic Transmission Fluid.

1. Disconnect the **To cooler** line at the cooler inlet and place a collecting container under the disconnected line.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

2. Run the engine **at 1800 rpm**, with the shift selector in neutral. Verify that the transmission fluid temperature is below 104.5° C (220° F) for this test.
3. If one quart of transmission fluid is collected in the container in 30 seconds or less, oil pump flow volume is within acceptable limits. If fluid flow is intermittent, or it takes more than 30 seconds to collect one quart of fluid, refer to the Hydraulic Pressure tests in this section for further diagnosis.
4. Re-connect the **To cooler** line to the transmission cooler inlet.
5. Refill the transmission to proper level.

DISASSEMBLY

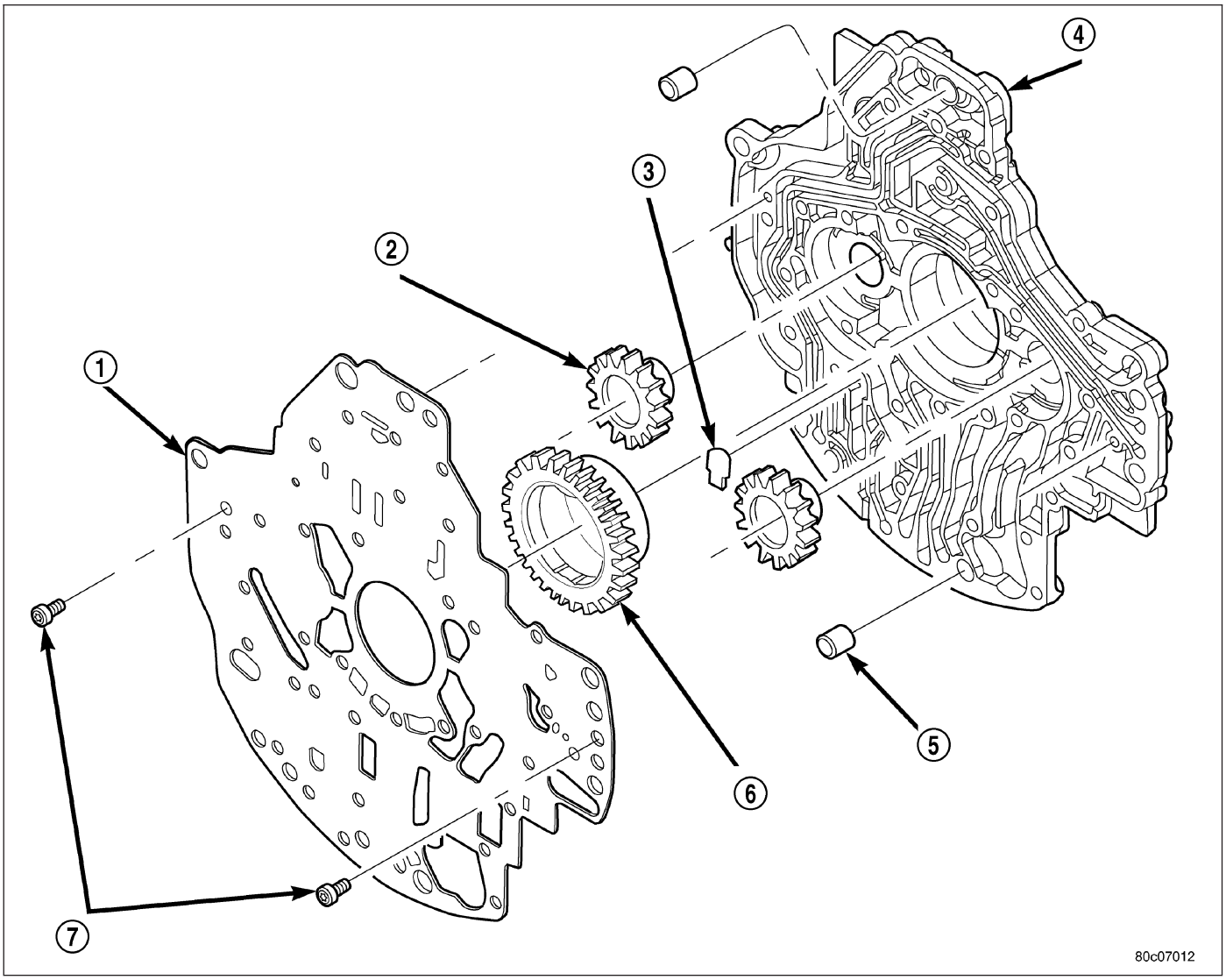


Oil Pump Assembly

1 - PUMP HOUSING
2 - SEAL
3 - OIL FILTER SEAL
4 - SEAL RING (5)
5 - REACTION SHAFT SUPPORT
6 - PUMP VALVE BODY

1. Remove the bolts holding the reaction shaft support (5) to the oil pump.
2. Remove the reaction shaft support (5) from the oil pump.
3. Remove all bolts holding the oil pump halves together.
4. Using suitable prying tools, separate the oil pump sections by inserting the tools in the supplied areas and prying the halves apart.

NOTE: The oil pump halves are aligned to each other through the use of two dowels. Be sure to pry upward evenly to prevent damage to the oil pump components.

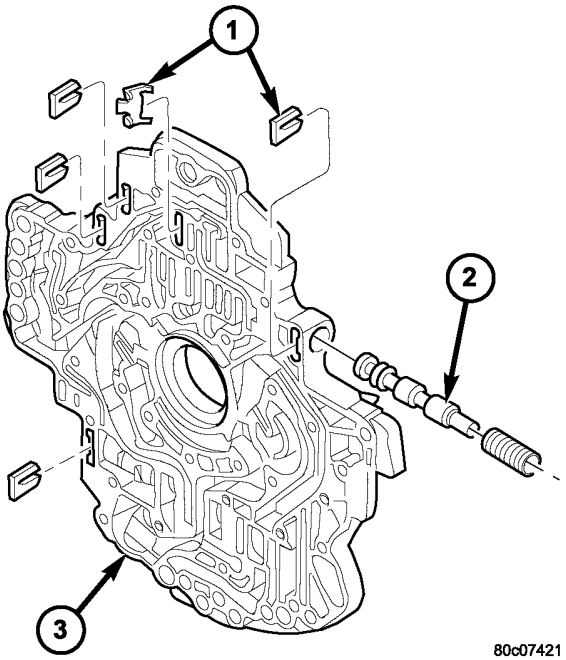


Oil Pump Housing and Gears

1 - SEPARATOR PLATE
2 - DRIVEN GEAR (2)
3 - CHECK VALVE
4 - PUMP HOUSING
5 - DOWEL (2)
6 - DRIVE GEAR
7 - SCREW

5. Remove the screws (7) holding the separator plate (1) onto the oil pump housing (4).
6. Remove the separator plate (1) from the oil pump housing (4).
7. Mark all gears for location. The gears are select fit and if the oil pump is to be reused, the gears must be returned to their original locations.
8. Remove the oil pump gears (2, 6) from the oil pump housing (4).

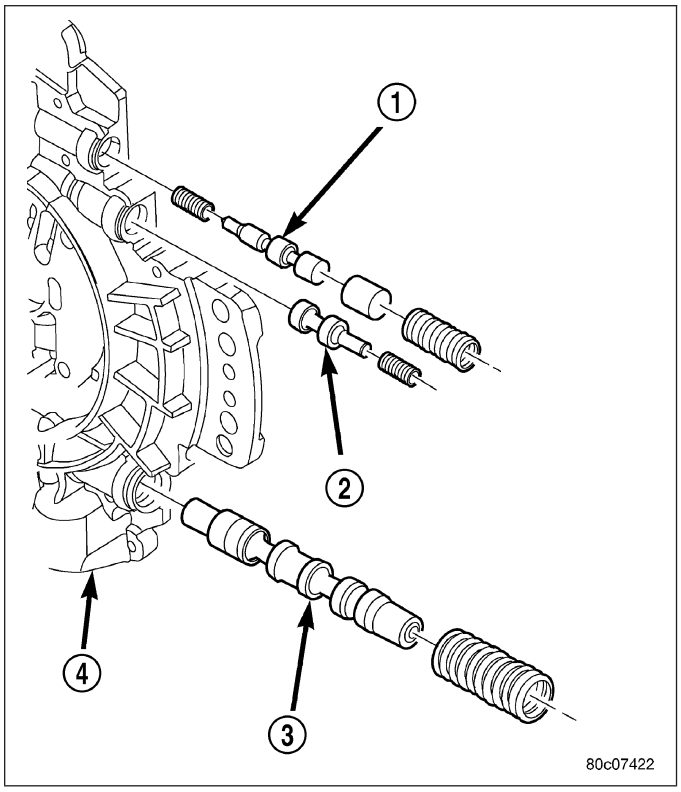
9. Remove the oil pump valve retainers (1) and associated valve (2) and spring one at a time. Mark the combination of components as a group and tag them as to the location from which they were removed.



T/C Switch Valve

1 - RETAINER
2 - T/C SWITCH VALVE
3 - OIL PUMP VALVE BODY

10. Remove the T/C regulator valve (1), T/C limit valve (2), and regulator valve (3).



Oil Pump Valve Body

1 - T/C REGULATOR VALVE
2 - T/C LIMIT VALVE
3 - REGULATOR VALVE
4 - OIL PUMP VALVE BODY

CLEANING

Clean pump and support components with solvent and dry them with compressed air.

INSPECTION

Check condition of the seal rings and thrust washer on the reaction shaft support. The seal rings do not need to be replaced unless cracked, broken, or severely worn.

Inspect the pump and support components. Replace the pump or support if the seal ring grooves or machined surfaces are worn, scored, pitted, or damaged. Replace the pump gears if pitted, worn chipped, or damaged.

Inspect the pump reaction shaft support bushings. Replace either bushing only if heavily worn, scored or damaged. It is not necessary to replace the bushings unless they are actually damaged.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands.** Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

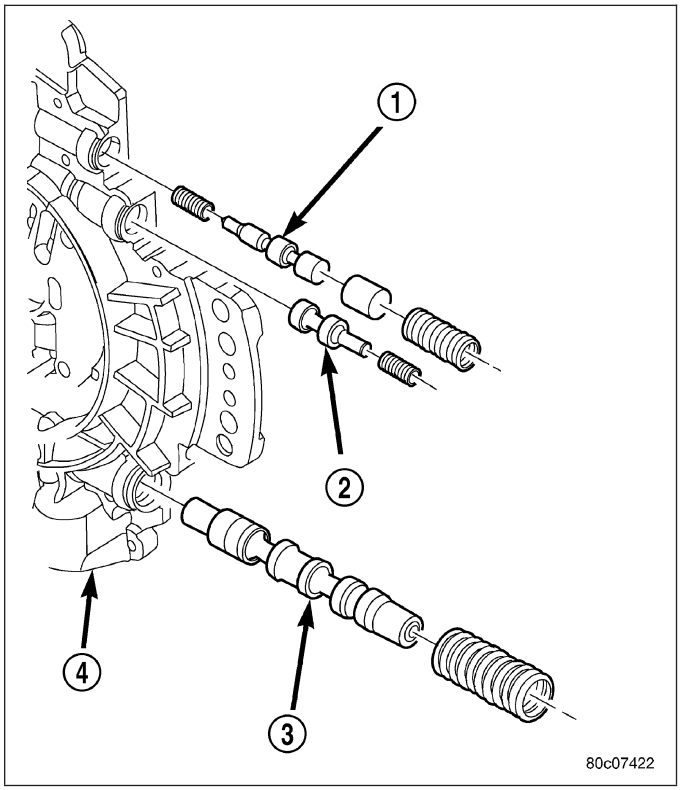
Inspect all the valve and plug bores in the oil pump cover. Use a penlight to view the bore interiors. Replace the oil pump if any bores are distorted or scored. Inspect all of the valve springs. The springs must be free of distortion, warpage or broken coils.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

ASSEMBLY

NOTE: Clean and inspect all components. Make sure that all passages are thoroughly cleaned and are free from dirt or debris. Make sure that all valves move freely in their proper bore. Make sure that all gear pockets and bushings are free from excessive wear and scoring. Replace the oil pump if any excessive wear or scoring is found.

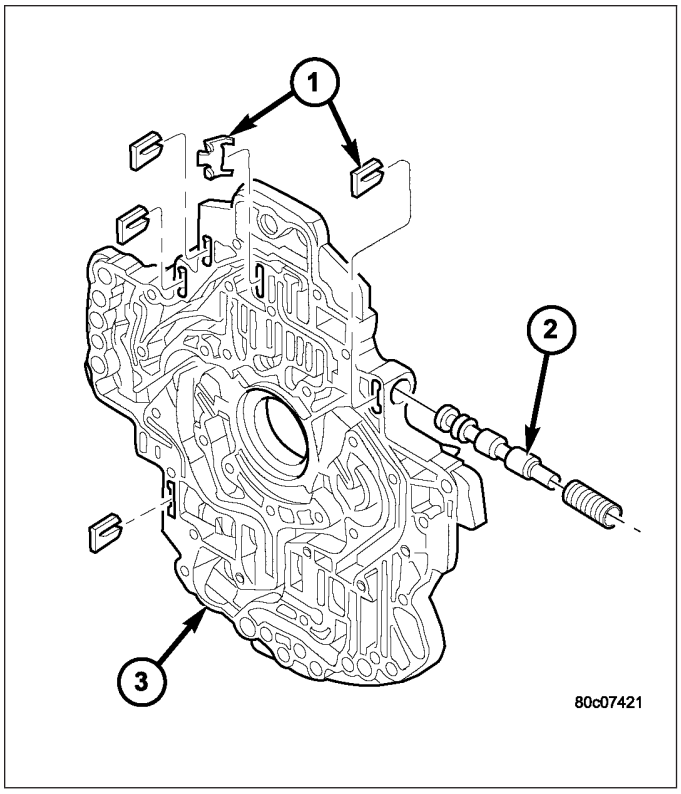
1. Install the T/C regulator valve (1), T/C limit valve (2), and regulator valve (3).



Oil Pump Valve Body

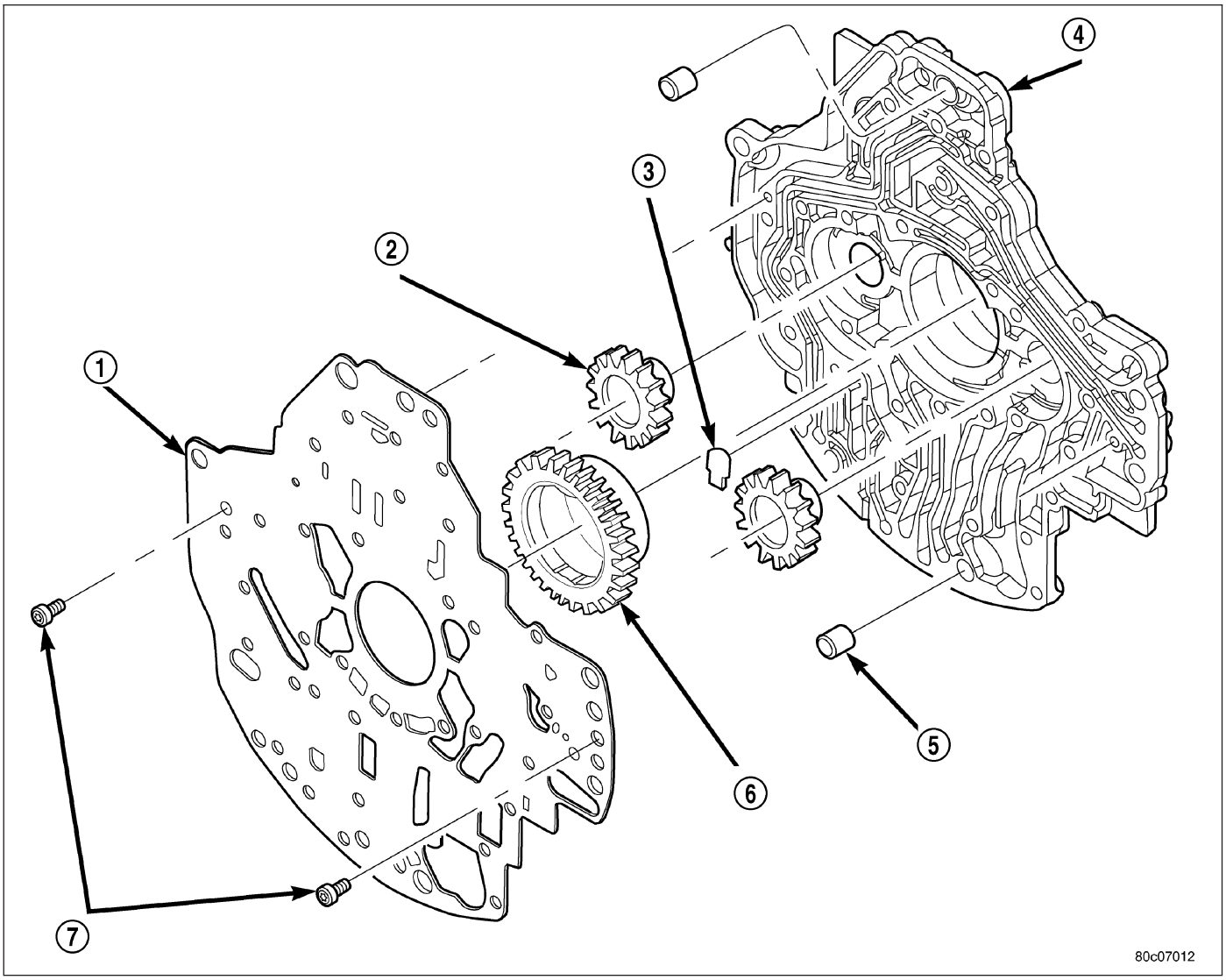
1 - T/C REGULATOR VALVE
2 - T/C LIMIT VALVE
3 - REGULATOR VALVE
4 - OIL PUMP VALVE BODY

2. Lubricate the oil pump valves with Mopar® ATF +4 and install the valve (2), spring, and retainer (1) into the appropriate oil pump valve body (3) bore.



T/C Switch Valve

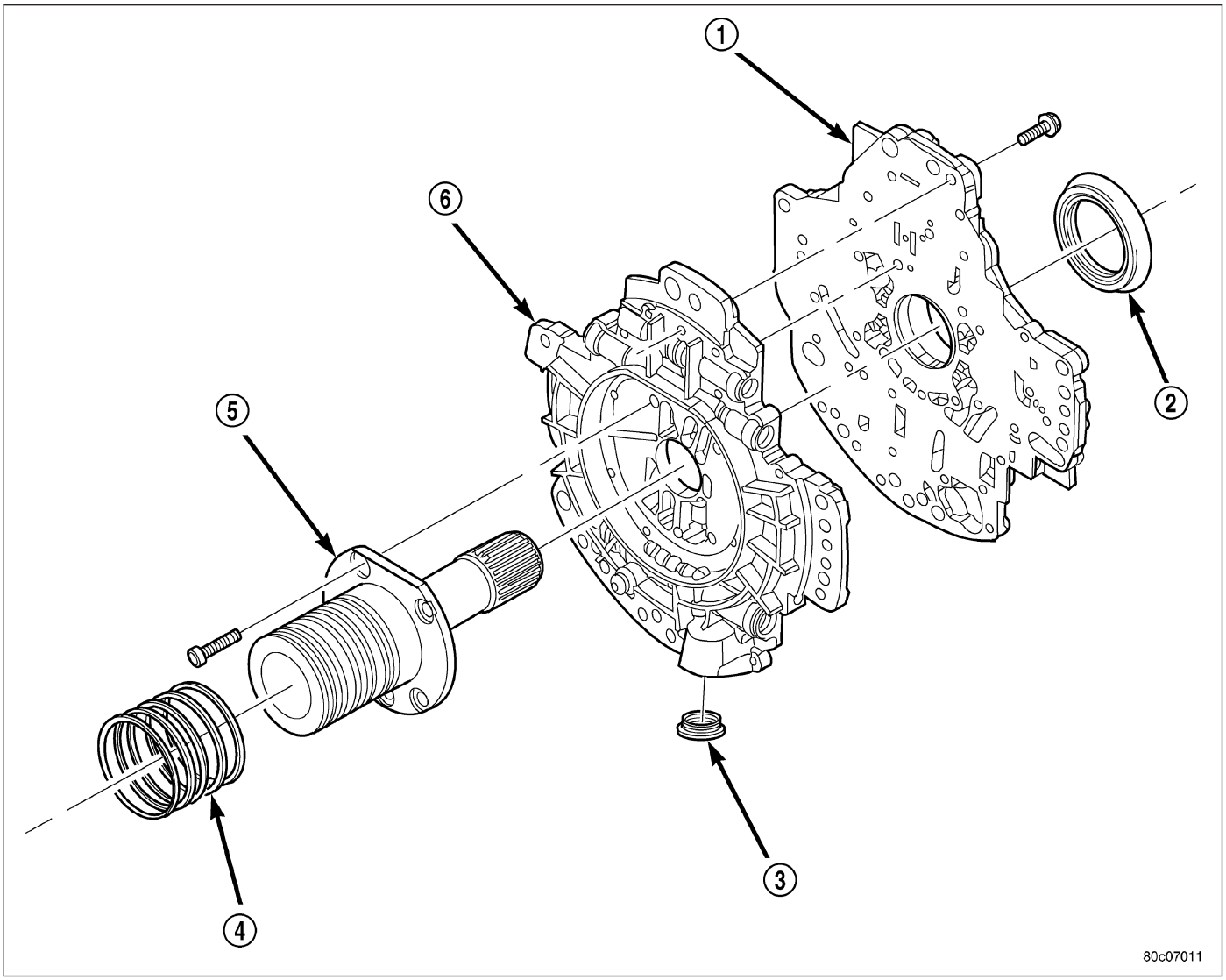
1 - RETAINER
2 - T/C SWITCH VALVE
3 - OIL PUMP VALVE BODY



Oil Pump Housing and Gears

1 - SEPARATOR PLATE
2 - DRIVEN GEAR (2)
3 - CHECK VALVE
4 - PUMP HOUSING
5 - DOWEL (2)
6 - DRIVE GEAR
7 - SCREW

3. Coat the gears (2, 6) with Mopar® ATF +4 and install into their original locations.
4. Place the separator plate (1) onto the oil pump housing (4).
5. Install the screws(7) to hold the separator plate (1) onto the oil pump housing (4). Tighten the screws to 4.5 N·m (40 in.lbs.).



Oil Pump Assembly

1 - PUMP HOUSING	4 - SEAL RING (5)
2 - SEAL	5 - REACTION SHAFT SUPPORT
3 - OIL FILTER SEAL	6 - PUMP VALVE BODY

6. Position the oil pump valve body (6) onto the locating dowels.
7. Seat the two oil pump halves together and install all bolts finger tight.
8. Torque all bolts down slowly starting in the center and working outward. The correct torque is 4.5 N·m (40 in.lbs.).
9. Verify that the oil pump gears rotate freely and smoothly.
10. Position the reaction shaft support (5) onto the oil pump valve body (6).
11. Install and torque the bolts to hold the reaction shaft support (5) to the oil pump valve body (6). The correct torque is 12 N·m (105 in.lbs.).

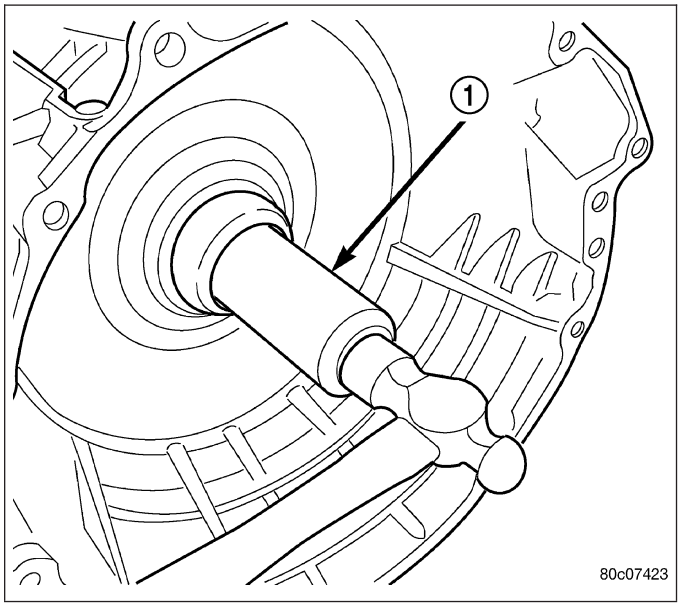
SEAL-OIL PUMP FRONT

REMOVAL

1. Remove transmission from the vehicle.
2. Remove the torque converter from the transmission.
3. Using a screw mounted in a slide hammer, remove the oil pump front seal.

INSTALLATION

1. Clean seal bore of the oil pump of any residue or particles from the original seal.
2. Install new oil seal in the oil pump housing using Seal Installer C-3860-A (1).



SENSOR-OUTPUT SPEED

DESCRIPTION

The Input and Output Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).

OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

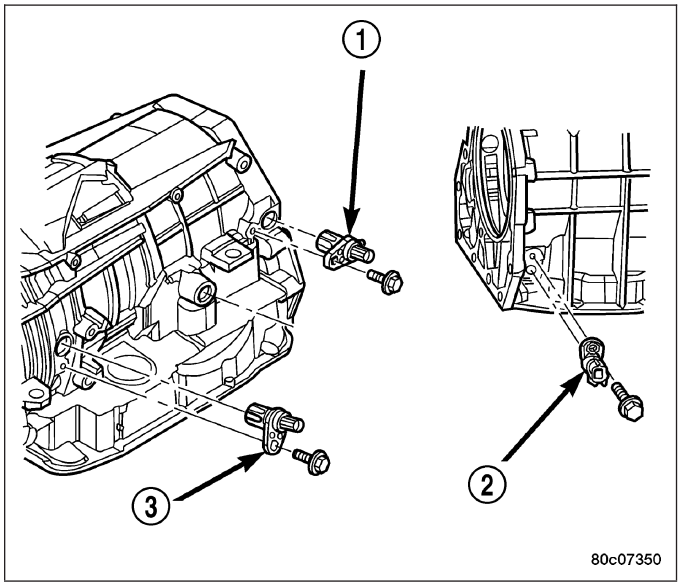
- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

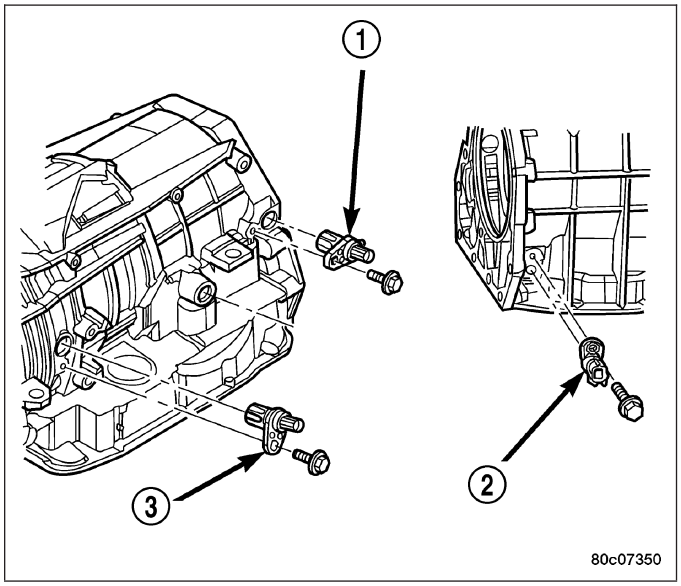
REMOVAL

1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the output speed sensor (1).
4. Remove the bolt holding the output speed sensor (1) to the transmission case.
5. Remove the output speed sensor (1) from the transmission case.



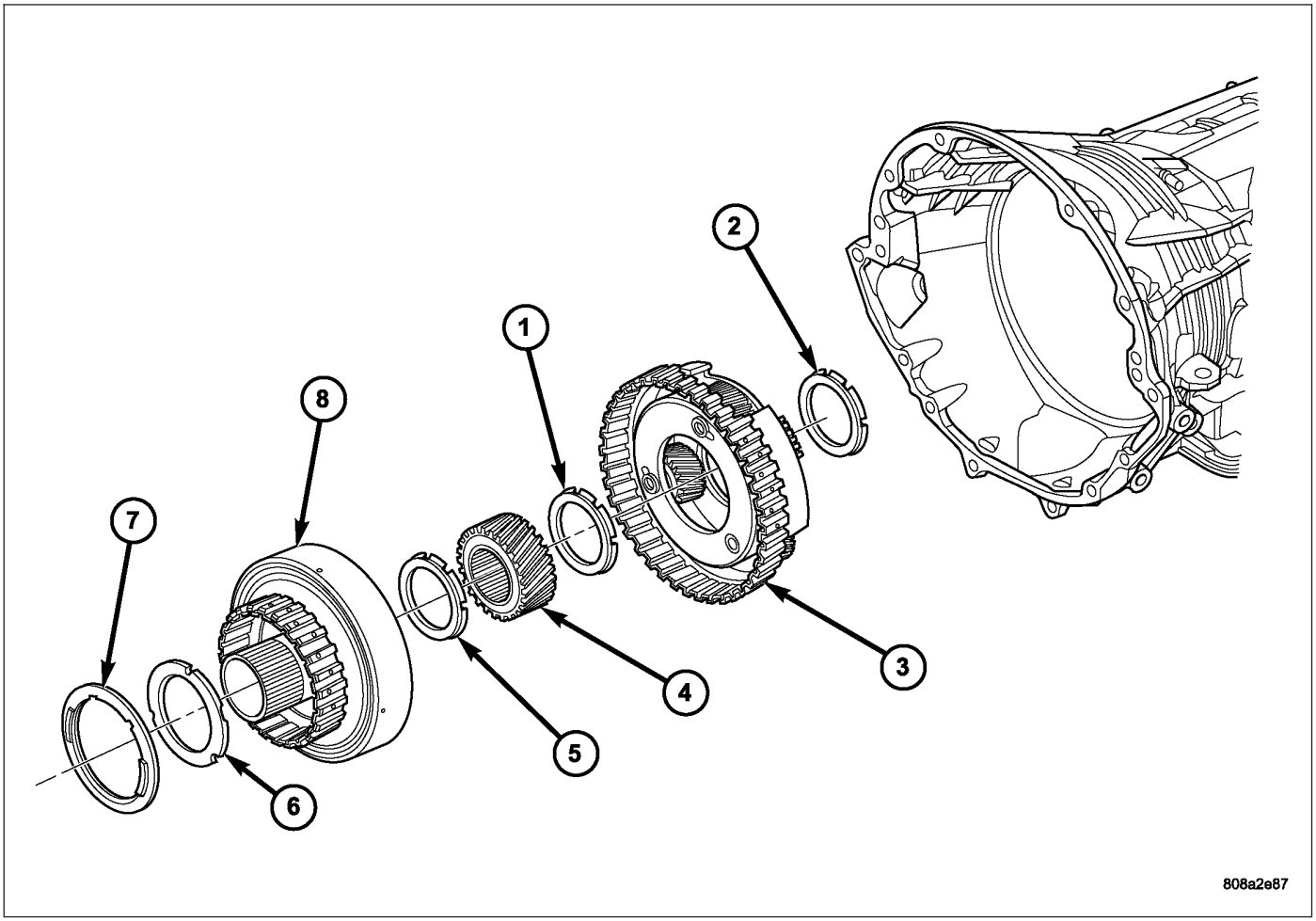
INSTALLATION

1. Install the output speed sensor (1) into the transmission case.
2. Install the bolt to hold the output speed sensor (1) into the transmission case. Tighten the bolt to 11.9 N·m (105 in.lbs.).
3. Install the wiring connector onto the output speed sensor (1).
4. Verify the transmission fluid level. Add fluid as necessary.
5. Lower vehicle.



GEARTRAIN-PLANETARY

DESCRIPTION

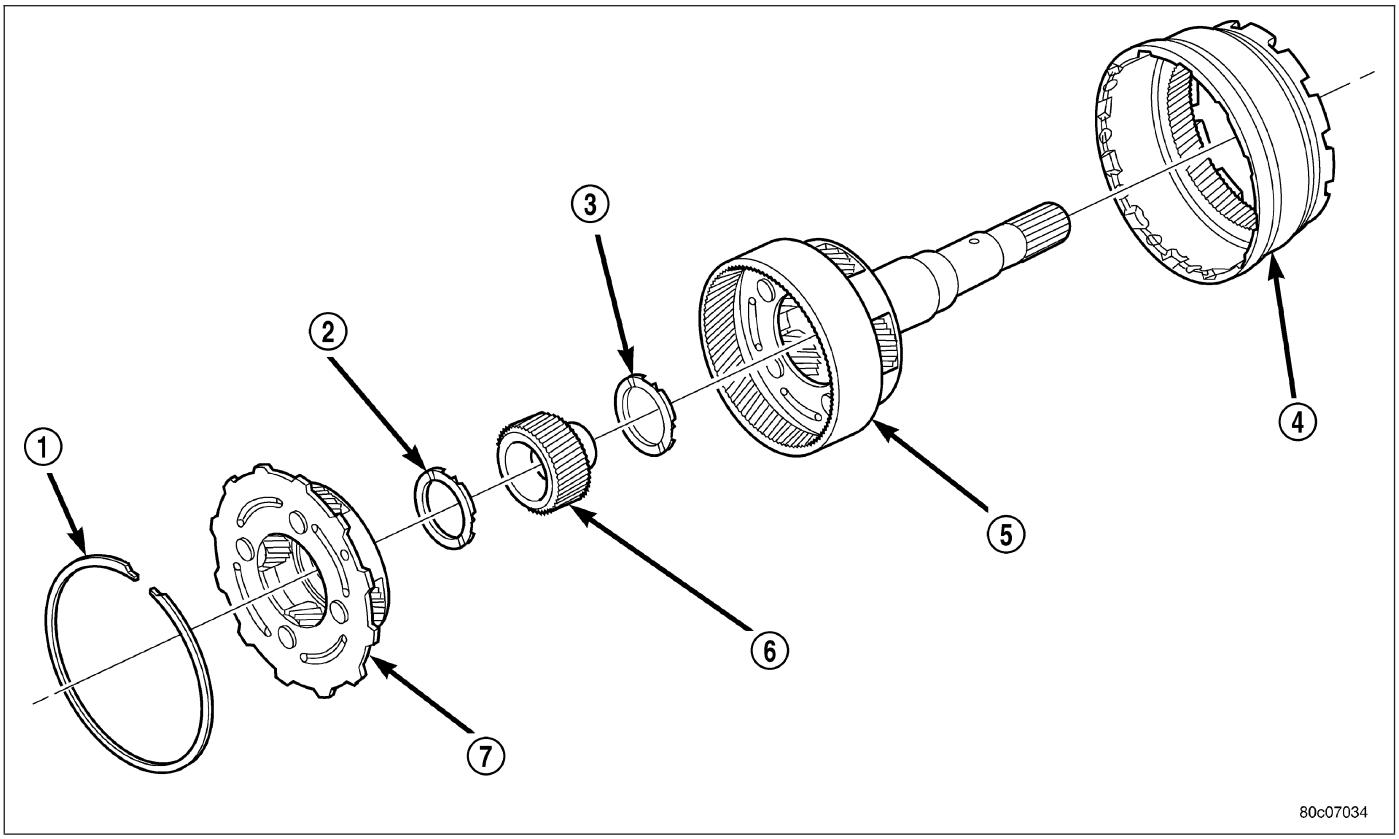


Reaction Planetary Geartrain

1 - THRUST BEARING NUMBER 8
2 - THRUST BEARING NUMBER 9
3 - REACTION PLANETARY CARRIER
4 - REACTION SUN GEAR
5 - THRUST BEARING NUMBER 7
6 - THRUST PLATE (SELECT)
7 - THRUST BEARING NUMBER 6
8 - REACTION ANNULUS

The planetary geartrain is located behind the 4C retainer/bulkhead, toward the rear of the transmission. The planetary geartrain consists of three primary assemblies:

- Reaction (3, 4, 8).



Reverse/Input Planetary Geartrain

1 - SNAP-RING
2 - THRUST BEARING NUMBER 10
3 - THRUST BEARING NUMBER 11
4 - INPUT ANNULUS
5 - INPUT PLANETARY CARRIER
6 - INPUT SUN GEAR
7 - REVERSE PLANETARY CARRIER

- Reverse (7).
- Input (4, 5, 6).

OPERATION

REACTION PLANETARY GEARTRAIN

The reaction planetary carrier and reverse sun gear of the reaction planetary geartrain are a single component which is held by the 2C clutch when required. The reaction annulus gear is a stand alone component that can be driven by the reverse clutch or held by the 4C clutch. The reaction sun gear is driven by the overdrive clutch.

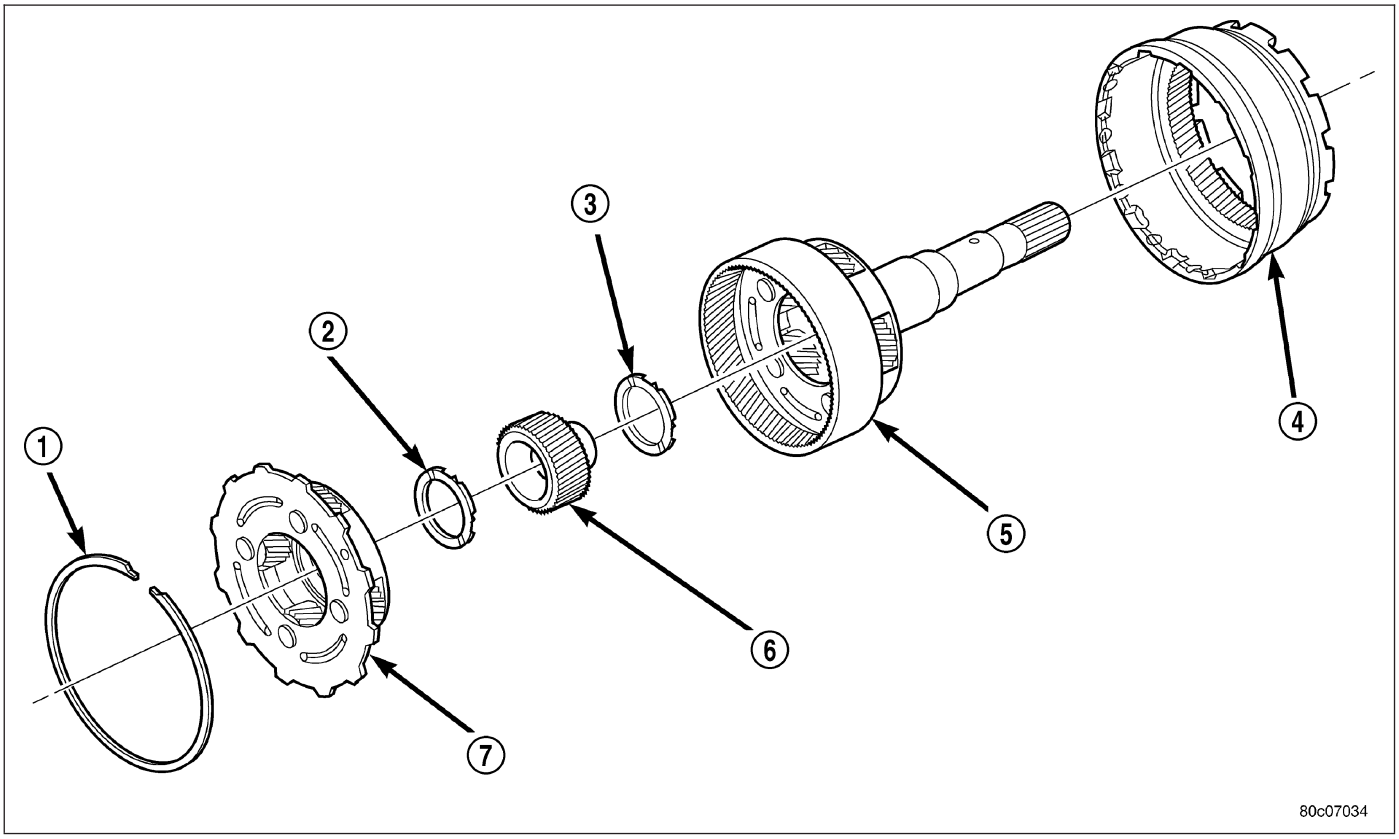
REVERSE PLANETARY GEARTRAIN

The reverse planetary geartrain is the middle of the three planetary sets. The reverse planetary carrier can be driven by the overdrive clutch as required. The reverse planetary carrier is also splined to the input annulus gear, which can be held by the low/reverse clutch. The reverse planetary annulus, input planetary carrier, and output shaft are all one piece.

INPUT PLANETARY GEARTRAIN

The input sun gear of the input planetary geartrain is driven by the underdrive clutch.

DISASSEMBLY



Reverse/Input Planetary Carrier Assembly

1 - SNAP-RING
2 - THRUST BEARING NUMBER 10
3 - THRUST BEARING NUMBER 11
4 - INPUT ANNULUS
5 - INPUT PLANETARY CARRIER
6 - INPUT SUN GEAR
7 - REVERSE PLANETARY CARRIER

1. Remove the snap-ring (1) holding the input annulus (4) into the input carrier (5).
2. Remove the input annulus (4) from the input carrier (5).
3. Remove the number 9 thrust bearing from the reverse planetary carrier. Note that this planetary carrier has four pinion gears.
4. Remove the reverse planetary gear carrier (7).
5. Remove the number 10 thrust bearing (2) from the input sun gear (6).
6. Remove the input sun gear (6) from the input carrier (5).
7. Remove the number 11 thrust bearing (3) from the input carrier (5).

CLEANING

Clean the planetary components in solvent and dry them with compressed air.

INSPECTION

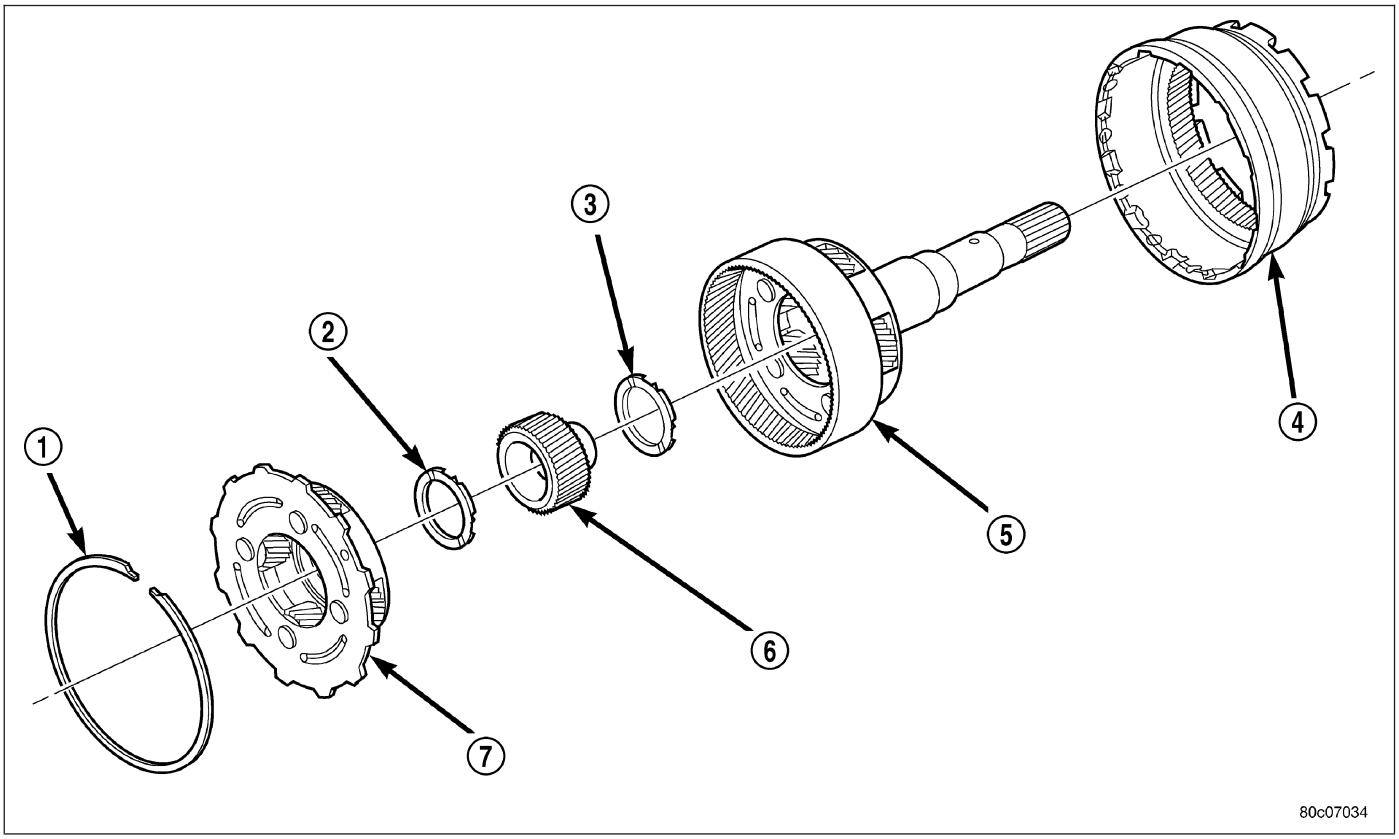
Check sun gear and driving shell condition. Replace the gear if damaged or if the bushings are scored or worn. The bushings are not serviceable. Replace the driving shell if worn, cracked or damaged.

Replace planetary gear sets if gears, pinion pins, or carrier are damaged in any way. Replace the annulus gears and supports if either component is worn or damaged.

Replace the output shaft if the machined surfaces are scored, pitted, or damaged in any way. Also replace the shaft if the splines are damaged, or exhibits cracks at any location.

ASSEMBLY

NOTE: Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.



Reverse/Input Planetary Carrier Assembly

1 - SNAP-RING
2 - THRUST BEARING NUMBER 10
3 - THRUST BEARING NUMBER 11
4 - INPUT ANNULUS
5 - INPUT PLANETARY CARRIER
6 - INPUT SUN GEAR
7 - REVERSE PLANETARY CARRIER

1. Install the number 11 thrust bearing (3) into the input planetary carrier (5) so that the inner race will be toward the front of the transmission.
2. Install the input sun gear (6) into the input carrier (5).
3. Install the number 10 thrust bearing (2) onto the rear of the reverse planetary carrier (7) with the inner race toward the carrier.
4. Install the number 9 thrust bearing onto the front of the reverse planetary carrier (7) with the outer race toward the carrier and the inner race facing upward.
5. Install the reverse planetary gear carrier (7) into the input carrier (5).
6. Install the input annulus gear (4) into the input carrier (5).
7. Install the snap-ring (1) to hold the input annulus gear (4) into the input carrier (5).

MECHANISM-SHIFT

DESCRIPTION

The gear shift mechanism provides six shift positions which are:

- Park (P)
- Reverse (R)

- Neutral (N)
- Drive (D)
- Manual second (2)
- Manual low (1)

OPERATION

MANUAL LOW (1) range provides FIRST gear only. Overrun braking is also provided in this range. MANUAL SECOND (2) range provides FIRST and SECOND gear only.

DRIVE range provides FIRST, SECOND, THIRD and OVERDRIVE FOURTH and FIFTH gear ranges. The shift into OVERDRIVE FOURTH and FIFTH gear range occurs only after the transmission has completed the shift into D THIRD gear range. No further movement of the shift mechanism is required to complete the 3-4 or 4-5 shifts.

The FOURTH and FIFTH gear upshifts occurs automatically when the overdrive selector switch is in the ON position. An upshift to FOURTH and FIFTH gears may not occur or may be delayed in some of the possible shift schedules. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - OPERATION)

SWITCH VALVE-SOLENOID

DESCRIPTION

The Solenoid Switch Valve (SSV) is located in the valve body and controls the direction of the transmission fluid when the L/R-TCC solenoid is energized.

OPERATION

The Solenoid Switch Valve controls line pressure from the LR-TCC solenoid. In 1st gear, the SSV will be in the downshifted position, thus directing fluid to the L/R clutch circuit. In 2nd, 3rd, 4th, and 5th gears, the solenoid switch valve will be in the upshifted position and directs the fluid into the torque converter clutch (TCC) circuit.

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R pressure switch is monitored to confirm SSV movement. If the movement is not confirmed (the L/R pressure switch does not close), 2nd gear is substituted for 1st. A DTC will be set after three unsuccessful attempts are made to get into 1st gear in one given key start.

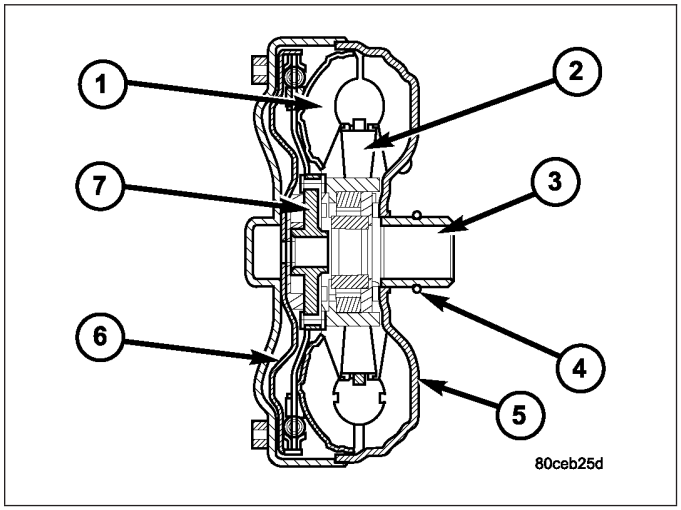
CONVERTER-TORQUE

DESCRIPTION

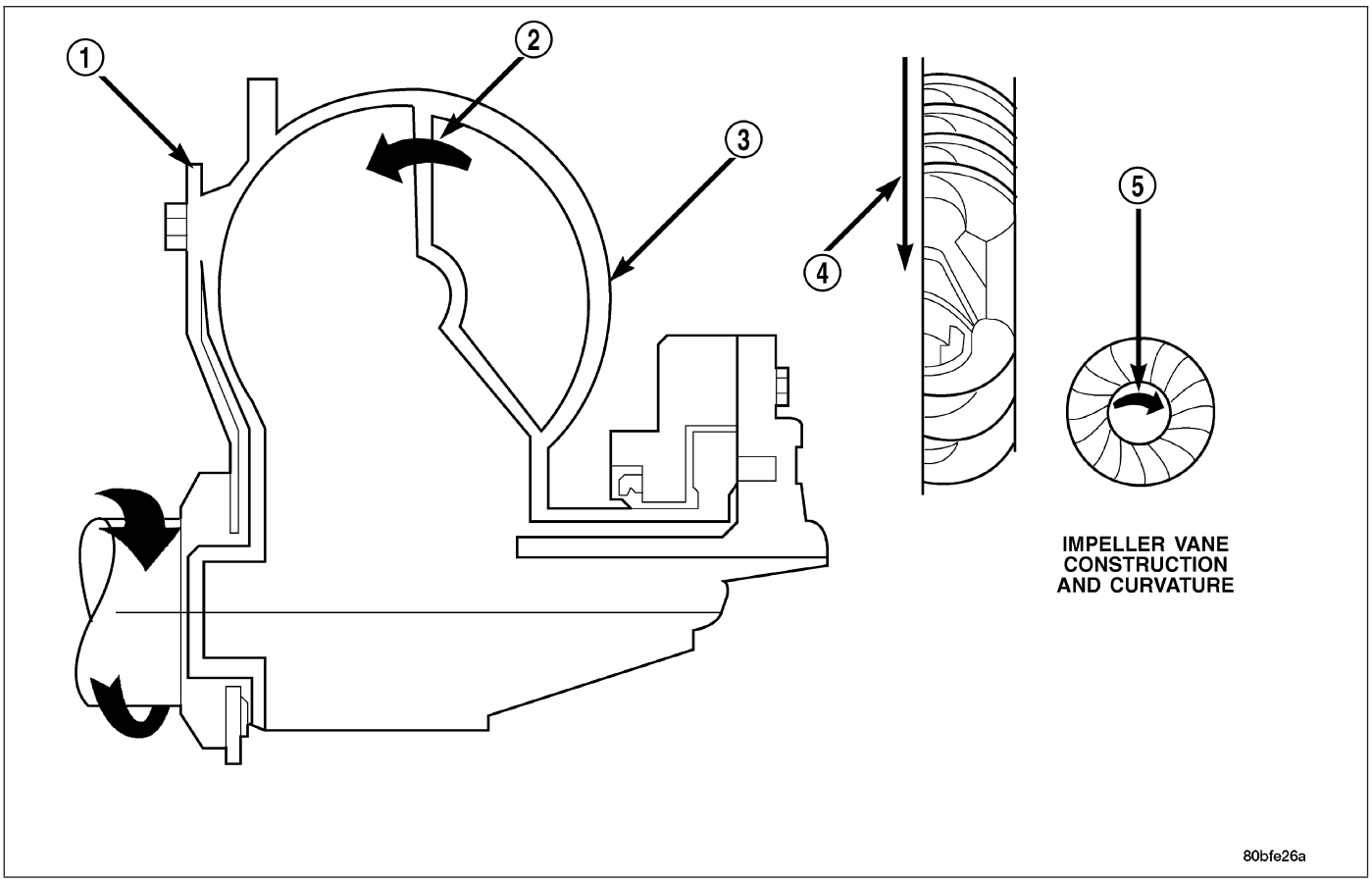
The torque converter is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine (1), a stator (2), an overrunning clutch, an impeller (5), and an electronically applied converter clutch (6). The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The torque converter hub (3) drives the transmission oil (fluid) pump and contains an o-ring seal (4) to better control oil flow.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid.



IMPELLER

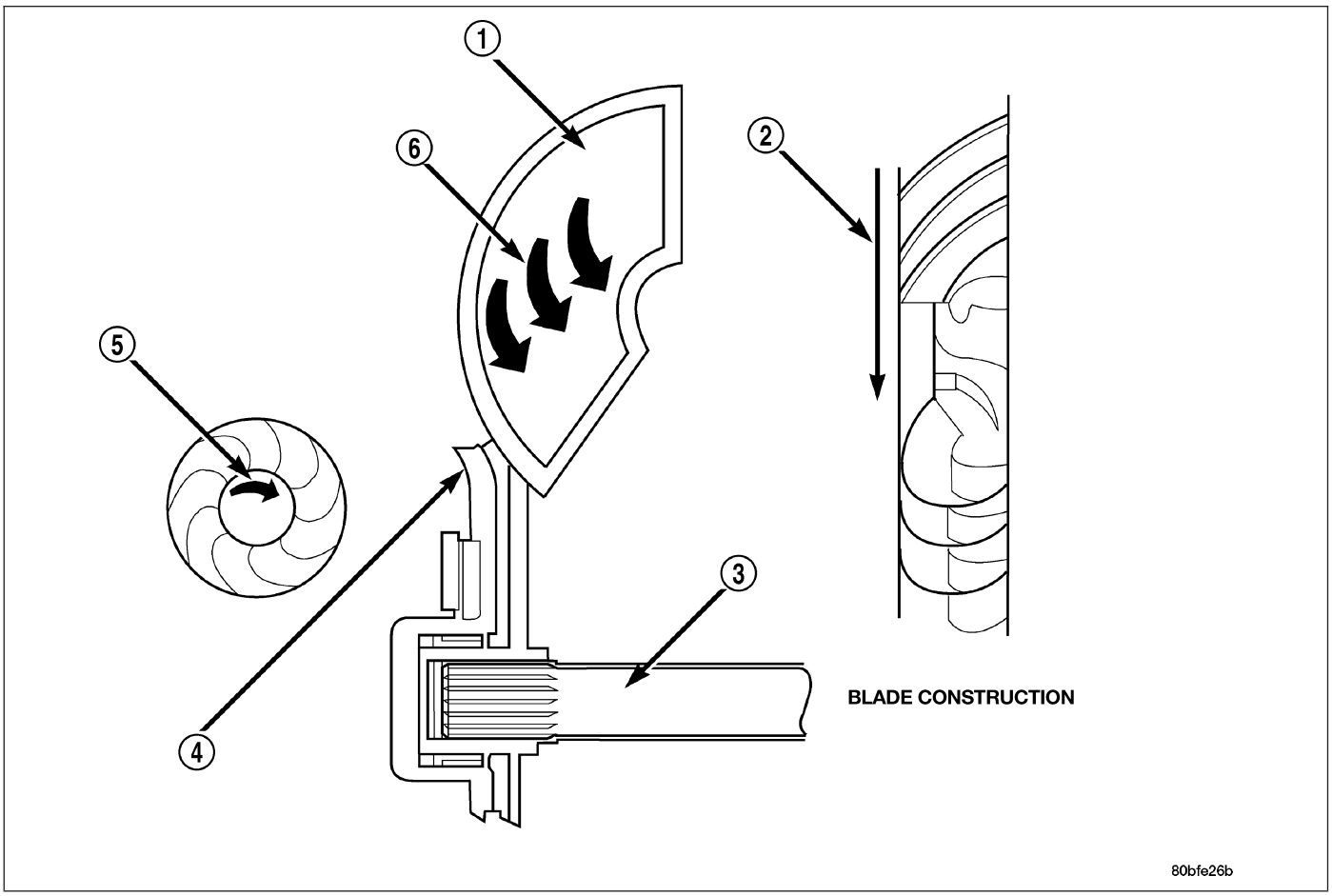


Impeller

1 - ENGINE FLEXPLATE
2 - OIL FLOW FROM IMPELLER SECTION INTO TURBINE SECTION
3 - IMPELLER VANES AND COVER ARE INTEGRAL
4 - ENGINE ROTATION
5 - ENGINE ROTATION

The impeller is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the impeller, because they are one and the same and are the driving members of the system.

TURBINE



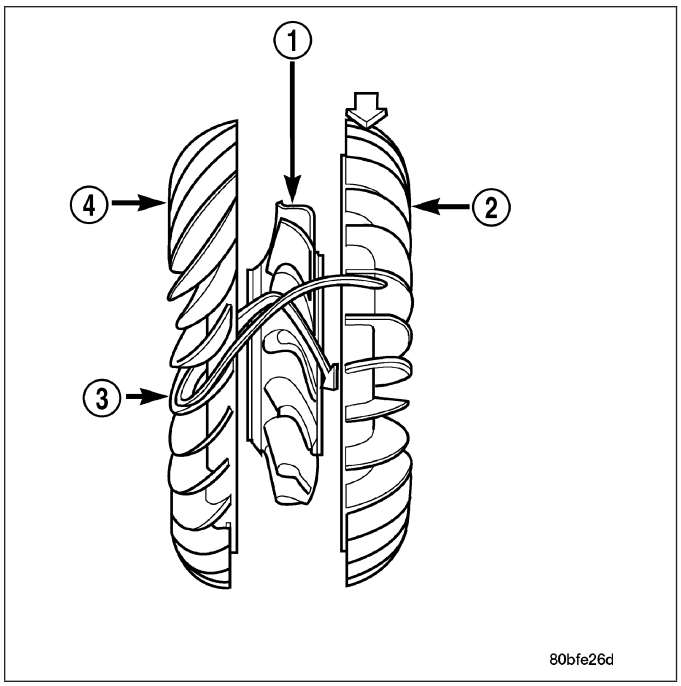
Turbine

1 - TURBINE VANE
2 - ENGINE ROTATION
3 - INPUT SHAFT
4 - PORTION OF TORQUE CONVERTER COVER
5 - ENGINE ROTATION
6 - OIL FLOW WITHIN TURBINE SECTION

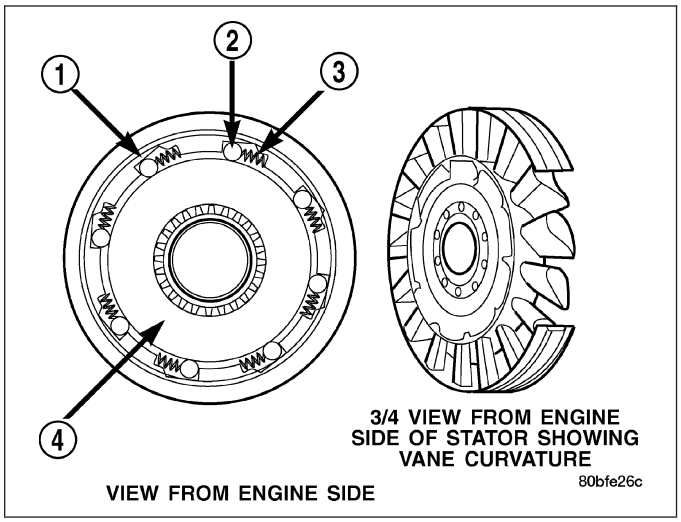
The turbine is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

STATOR

The stator assembly is mounted on a stationary shaft which is an integral part of the oil pump. The stator (1) is located between the impeller (2) and the turbine (4) within the torque converter case.

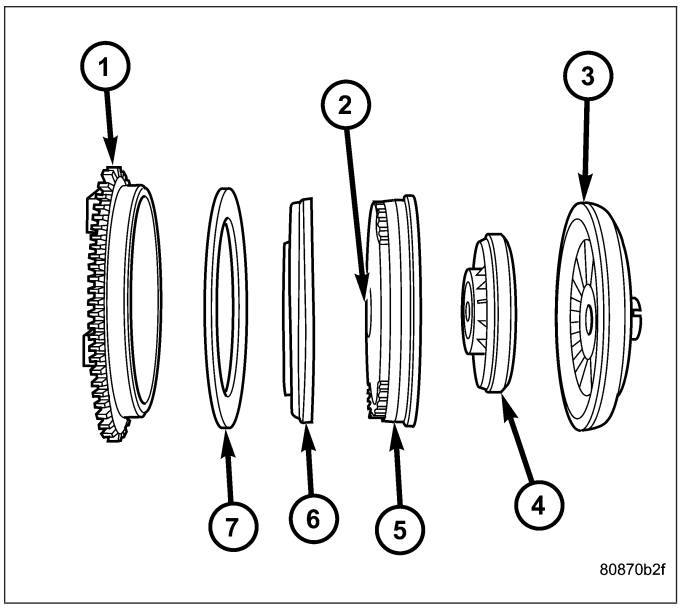


The stator contains an over-running clutch (1-4), which allows the stator to rotate only in a clockwise direction. When the stator is locked against the over-running clutch, the torque multiplication feature of the torque converter is operational.



TORQUE CONVERTER CLUTCH (TCC)

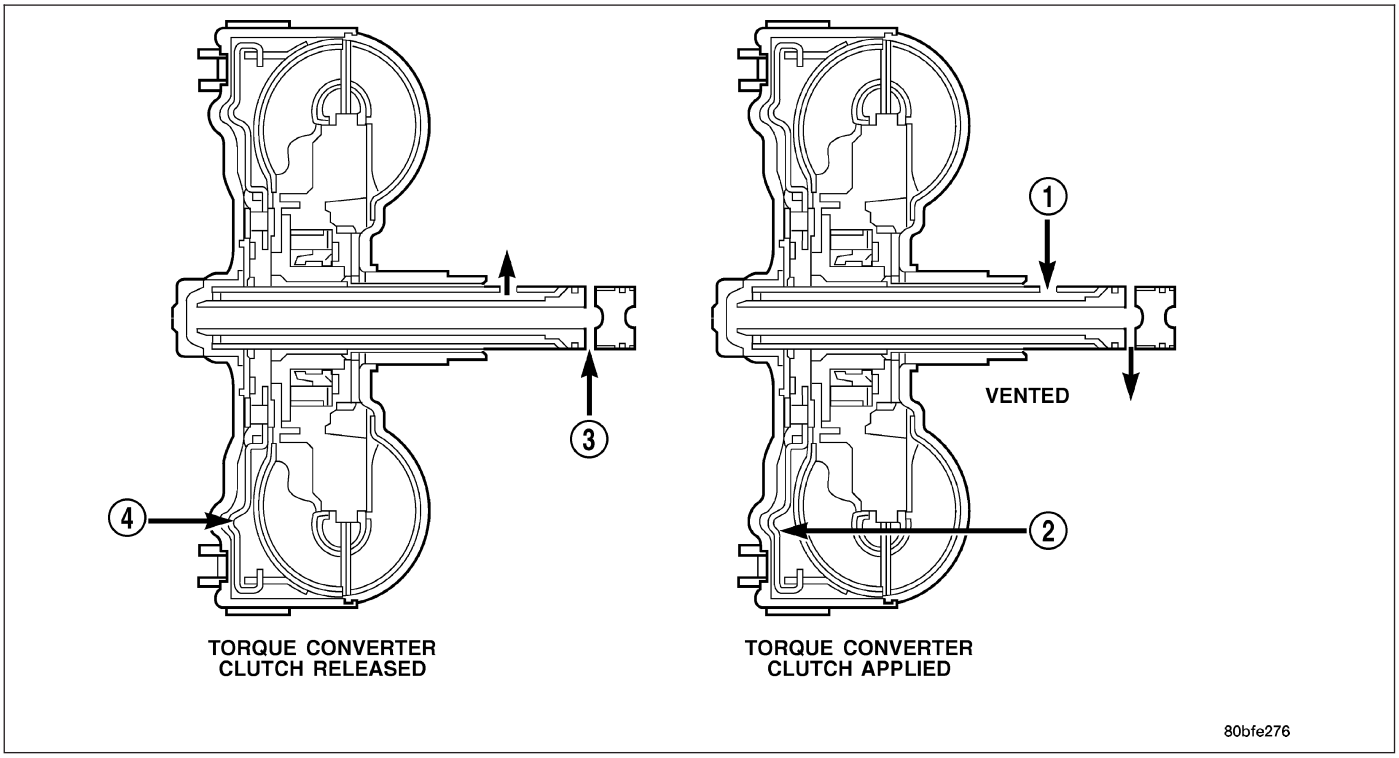
The TCC was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock-free power transfer, it is natural for all fluid couplings to slip. If the impeller (3) and turbine (5) were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston (6) with friction material (7) was added to the turbine assembly (5) to provide this mechanical lock-up.



In order to reduce heat build-up in the transmission and buffer the powertrain against torsional vibrations, the TCM can duty cycle the L/R-CC Solenoid to achieve a smooth application of the torque converter clutch. This function, referred to as Electronically Modulated Converter Clutch (EMCC) can occur at various times depending on the following variables:

- Shift lever position
- Current gear range
- Transmission fluid temperature
- Engine coolant temperature
- Input speed
- Throttle angle
- Engine speed

OPERATION



Torque Converter Fluid Operation - Typical

1 - APPLY PRESSURE
2 - THE PISTON MOVES SLIGHTLY FORWARD
3 - RELEASE PRESSURE
4 - THE PISTON MOVES SLIGHTLY REARWARD

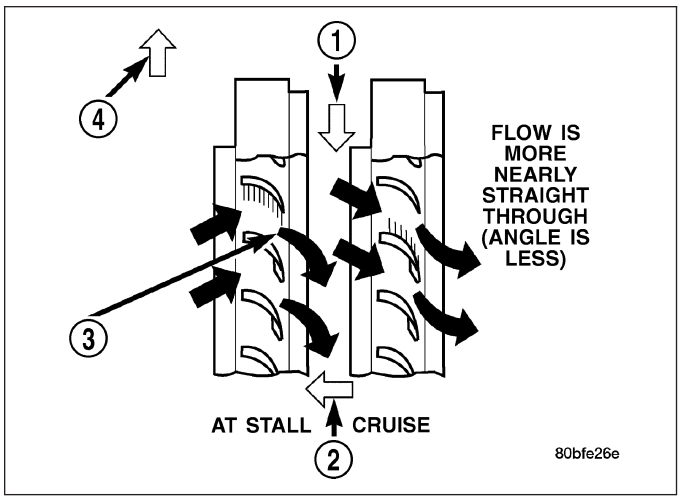
The converter impeller (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

TURBINE

As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a "hindering" direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft. Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counterclockwise direction. When this happens the over-running clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a "helping" direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.4:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such as way as to cause it to lock-up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.



TORQUE CONVERTER CLUTCH (TCC)

In a standard torque converter, the impeller and turbine are rotating at about the same speed and the stator is freewheeling, providing no torque multiplication. By applying the turbine's piston and friction material to the front cover, a total converter engagement can be obtained. The result of this engagement is a direct 1:1 mechanical link between the engine and the transmission.

The clutch can be engaged in second, third, and fourth gear ranges depending on overdrive control switch position. If the overdrive control switch is in the normal ON position, the clutch will engage after the shift to fourth gear. If the control switch is in the OFF position, the clutch will engage after the shift to third gear.

The TCM controls the torque converter by way of internal logic software. The programming of the software provides the TCM with control over the L/R-CC Solenoid. There are four output logic states that can be applied as follows:

- No EMCC
- Partial EMCC
- Full EMCC
- Gradual-to-no EMCC

NO EMCC

Under No EMCC conditions, the L/R Solenoid is OFF. There are several conditions that can result in NO EMCC operations. No EMCC can be initiated due to a fault in the transmission or because the TCM does not see the need for EMCC under current driving conditions.

PARTIAL EMCC

Partial EMCC operation modulates the L/R Solenoid (duty cycle) to obtain partial torque converter clutch application. Partial EMCC operation is maintained until Full EMCC is called for and actuated. During Partial EMCC some slip does occur. Partial EMCC will usually occur at low speeds, low load and light throttle situations.

FULL EMCC

During Full EMCC operation, the TCM increases the L/R Solenoid duty cycle to full ON after Partial EMCC control brings the engine speed within the desired slip range of transmission input speed relative to engine rpm.

GRADUAL-TO-NO EMCC

This operation is to soften the change from Full or Partial EMCC to No EMCC. This is done at mid-throttle by decreasing the L/R Solenoid duty cycle.

REMOVAL

1. Remove transmission and torque converter from vehicle. (Refer to 21 - TRANSMISSION/AUTOMATIC - 545RFE/42RLE - REMOVAL)
2. Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition. The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

3. Pull the torque converter forward until the center hub clears the oil pump seal.
4. Separate the torque converter from the transmission.

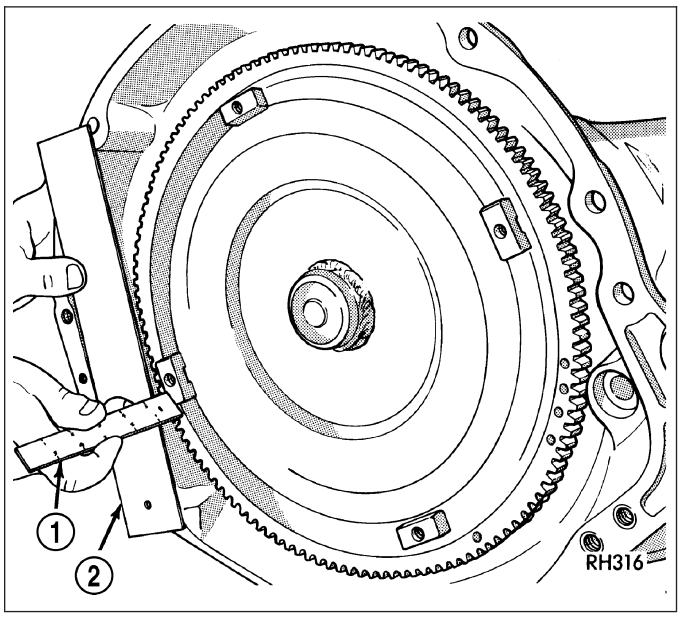
INSTALLATION

NOTE: Check converter hub and drive flats for sharp edges, burrs, scratches, or nicks. Polish the hub and flats with 320/400 grit paper or crocus cloth if necessary. Verify that the converter hub o-ring is properly installed and is free from debris. The hub must be smooth to avoid damaging the pump seal at installation.

1. Lubricate oil pump seal lip with transmission fluid.
2. Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or converter hub o-ring while inserting torque converter into the front of the transmission.

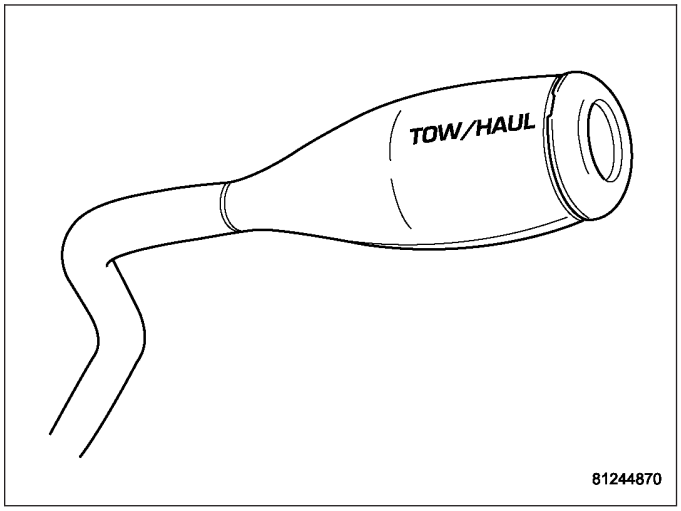
3. Align torque converter to oil pump seal opening.
4. Insert torque converter hub into oil pump.
5. While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.
6. Check converter seating with a scale (1) and straightedge (2). Surface of converter lugs should be at least 13 mm (1/2 in.) to rear of straightedge when converter is fully seated.
7. If necessary, temporarily secure converter with C-clamp attached to the converter housing.
8. Install the transmission in the vehicle.
9. Fill the transmission with the recommended fluid.



SWITCH-TOW/HAUL OVERDRIVE

DESCRIPTION

The tow/haul overdrive OFF (control) switch is located in the shift lever arm. The switch is a momentary contact device that signals the PCM to toggle current status of the overdrive function.

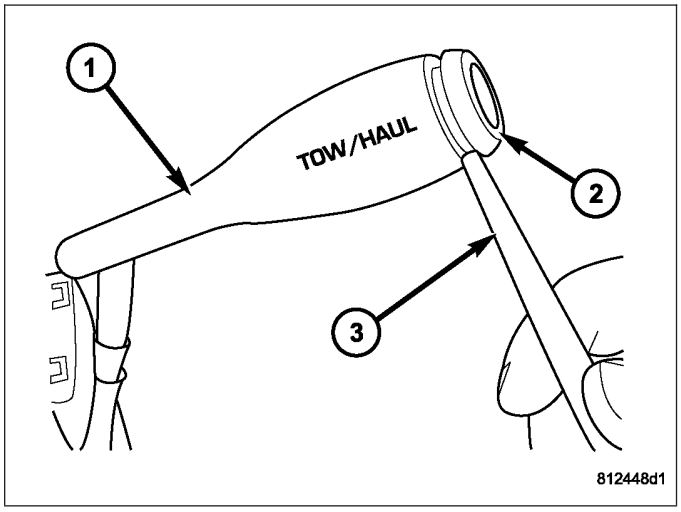


OPERATION

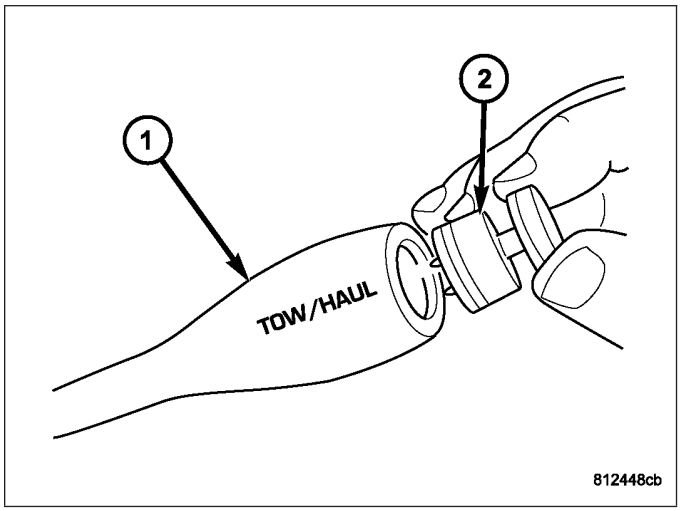
At key-on, overdrive operation is allowed. Pressing the switch once causes the tow/haul overdrive OFF mode to be entered and the Tow/Haul lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the tow/haul lamp to be turned off. The tow/haul overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoid and allow a 3-4 upshift. The control switch indicator light illuminates only when the tow/haul overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

REMOVAL

1. Using a plastic trim tool, remove the tow/haul overdrive off switch retainer (2) from the shift lever (1).



2. Pull the switch (2) outwards to release it from the connector in the lever (1)



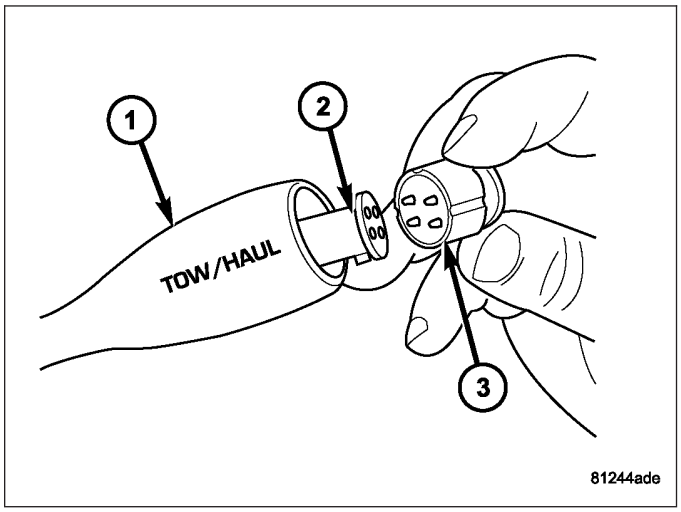
INSTALLATION

NOTE: There is enough slack in the wire to pull out the connector from the lever.

1. Pull the connector (2) out of the lever (1) just enough to grasp it.

CAUTION: Be careful not to bend the pins on the tow/haul overdrive off switch. Use care when installing the switch, as it is not indexed, and can be accidentally installed incorrectly.

2. Install the tow/haul overdrive off switch (3) into the connector (2)
3. Push the tow/haul overdrive off switch (3) and wiring into the shift lever (1).
4. Install the tow/haul overdrive off switch retainer onto the shift lever.



RELAY-TRANSMISSION CONTROL

DESCRIPTION

The relay is supplied fused B+ voltage, energized by the TCM, and is used to supply power to the solenoid pack when the transmission is in normal operating mode.

OPERATION

When the relay is “off”, no power is supplied to the solenoid pack and the transmission is in “limp-in” mode. After a controller reset, the TCM energizes the relay. Prior to this, the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After this is verified, the voltage at the solenoid pack pressure switches is checked. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.

SENSOR-TRANSMISSION RANGE

DESCRIPTION

The Transmission Range Sensor (TRS) is part of the solenoid module, which is mounted to the top of the valve body inside the transmission.

The Transmission Range Sensor (TRS) has five switch contact pins that:

- Determine shift lever position
- Supply ground to the Starter Relay in Park and Neutral only.
- Supply +12 V to the backup lamps in Reverse only.

The TRS also has an integrated temperature sensor (thermistor) that communicates transmission temperature to the TCM and PCM.

OPERATION

The Transmission Range Sensor (TRS) communicates shift lever position to the TCM as a combination of open and closed switches. Each shift lever position has an assigned combination of switch states (open/closed) that the TCM receives from four sense circuits. The TCM interprets this information and determines the appropriate transmission gear position and shift schedule.

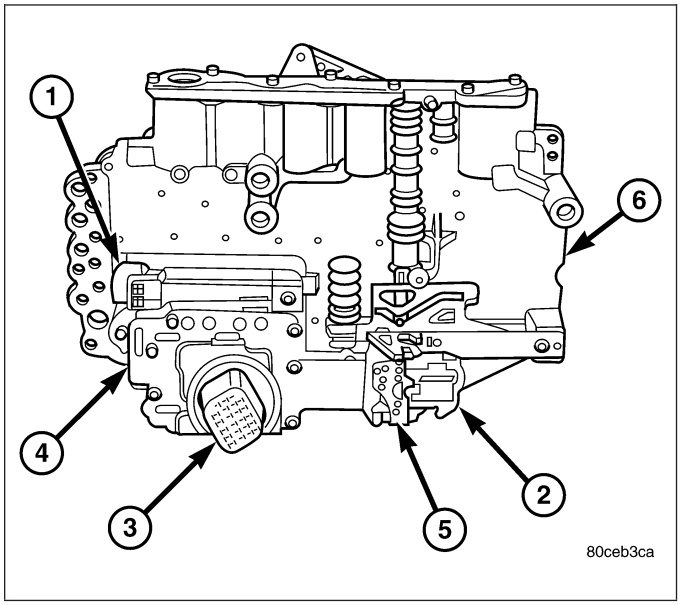
There are many possible combinations of open and closed switches (codes). Seven of these possible codes are related to gear position and five are recognized as “between gear” codes. This results in many codes which should **never occur**. These are called “invalid” codes. An invalid code will result in a DTC, and the TCM will then determine the shift lever position based on pressure switch data. This allows reasonably normal transmission operation with a TRS failure.

GEAR	C5	C4	C3	C2	C1
Park	CL	OP	OP	CL	CL
Temp 1	CL	OP	OP	CL	OP
Reverse	OP	OP	OP	CL	OP
Temp 2	OP	OP	CL	CL	OP
Neutral 1	OP	OP	CL	CL	CL
Neutral 2	OP	CL	CL	CL	CL
Temp 3	OP	CL	CL	CL	OP
Drive	OP	CL	CL	OP	OP
Temp 4	OP	CL	OP	OP	OP
Manual 2	CL	CL	OP	OP	OP
Temp 5	CL	OP	OP	OP	OP
Manual 1	CL	OP	CL	OP	OP

ASSEMBLY-TRANSMISSION SOLENOID/TRS

DESCRIPTION

The transmission solenoid/TRS assembly is internal to the transmission and mounted on the valve body assembly. The assembly consists of six solenoids that control hydraulic pressure to the six friction elements (transmission clutches), and the torque converter clutch. The pressure control solenoid is located on the side of the solenoid/TRS assembly. The solenoid/TRS assembly also contains five pressure switches that feed information to the TCM.



OPERATION

SOLENOIDS

Solenoids are used to control the L/R, 2C, 4C, OD, and UD friction elements. The reverse clutch is controlled by line pressure and the position of the manual valve in the valve body. All the solenoids are contained within the Solenoid and Pressure Switch Assembly. The solenoid and pressure switch assembly contains one additional solenoid, Multi-Select (MS), which serves primarily to provide 2nd and 3rd gear limp-in operation.

The solenoids receive electrical power from the Transmission Control Relay through a single wire. The TCM energizes or operates the solenoids individually by grounding the return wire of the solenoid as necessary. When a solenoid is energized, the solenoid valve shifts, and a fluid passage is opened or closed (vented or applied), depending on its default operating state. The result is an apply or release of a frictional element.

The MS and UD solenoids are normally applied to allow transmission limp-in in the event of an electrical failure.

The continuity of the solenoids and circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the TCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a speed ratio or pressure switch error occurs.

PRESSURE SWITCHES

The TCM relies on five pressure switches to monitor fluid pressure in the L/R, 2C, 4C, UD, and OD hydraulic circuits. The primary purpose of these switches is to help the TCM detect when clutch circuit hydraulic failures occur. The switches close at approximately 23 psi and open at approximately 11 psi, and simply indicate whether or not pressure exists. The switches are continuously monitored by the TCM for the correct states (open or closed) in each gear as shown in the following chart:

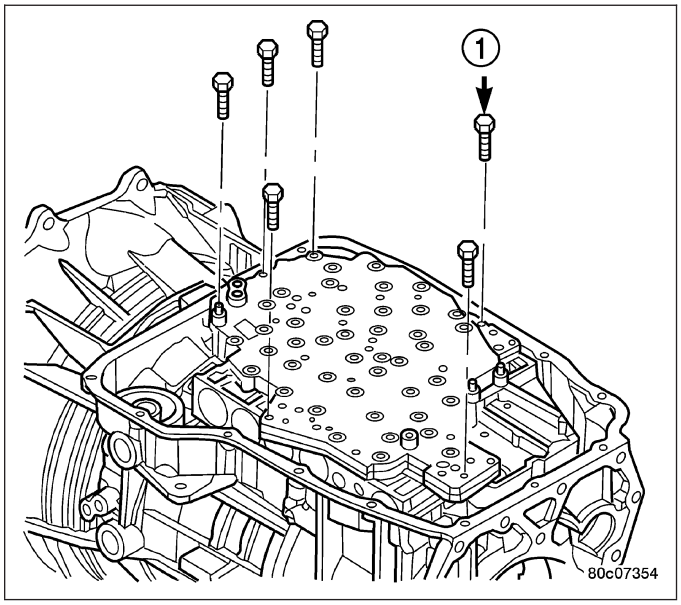
GEAR	L/R	2C	4C	UD	OD
R	OP	OP	OP	OP	OP
P/N	CL	OP	OP	OP	OP
1ST	CL*	OP	OP	CL	OP
2ND	OP	CL	OP	CL	OP
2ND PRIME	OP	OP	CL	CL	OP
D	OP	OP	OP	CL	CL
4TH	OP	OP	CL	OP	CL
5TH	OP	CL	OP	OP	CL

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is open in Manual 1.

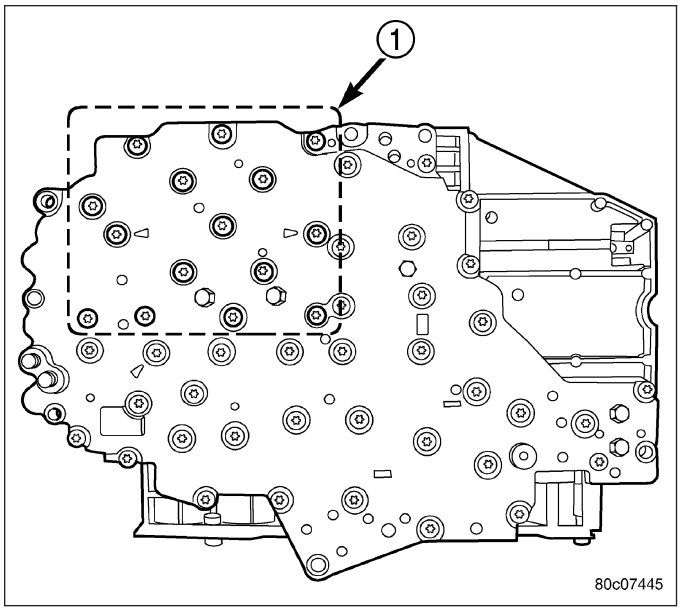
A Diagnostic Trouble Code (DTC) will set if the TCM senses any switch open or closed at the wrong time in a given gear.

REMOVAL

1. Remove the valve body from the transmission. (Refer to 21 - TRANSMISSION/AUTOMATIC - 45RFE/545RFE/VALVE BODY - REMOVAL)

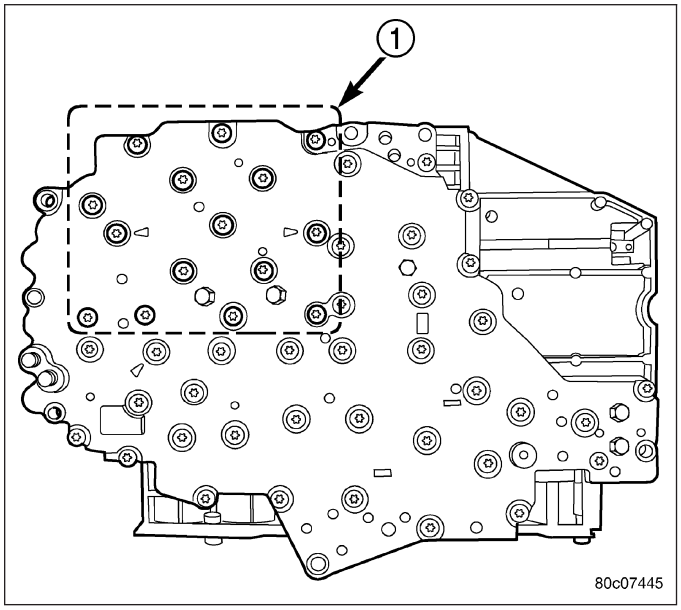


2. Remove the bolts (1) holding the transmission solenoid/TRS assembly onto the valve body.
3. Separate the transmission solenoid/TRS assembly from the valve body.



INSTALLATION

1. Place TRS selector plate in the PARK position.
2. Position the transmission solenoid/TRS assembly onto the valve body. Be sure that both alignment dowels are fully seated in the valve body and that the TRS switch contacts are properly positioned in the selector plate
3. Install the bolts (1) to hold the transmission solenoid/TRS assembly onto the valve body.
4. Tighten the solenoid assembly screws adjacent to the arrows cast into the bottom of the valve body first. Tighten the screws to 5.7 N·m (50 in.lbs.).
5. Tighten the remainder of the solenoid assembly screws to 5.7 N·m (50 in.lbs.).
6. Install the valve body into the transmission.



SENSOR-TRANSMISSION TEMPERATURE

DESCRIPTION

The transmission temperature sensor is a thermistor that is integral to the Transmission Range Sensor (TRS).

OPERATION

The transmission temperature sensor is used by the TCM to sense the temperature of the fluid in the sump. Since fluid temperature can affect transmission shift quality and convertor lock up, the TCM requires this information to determine which shift schedule to operate in.

Calculated Temperature

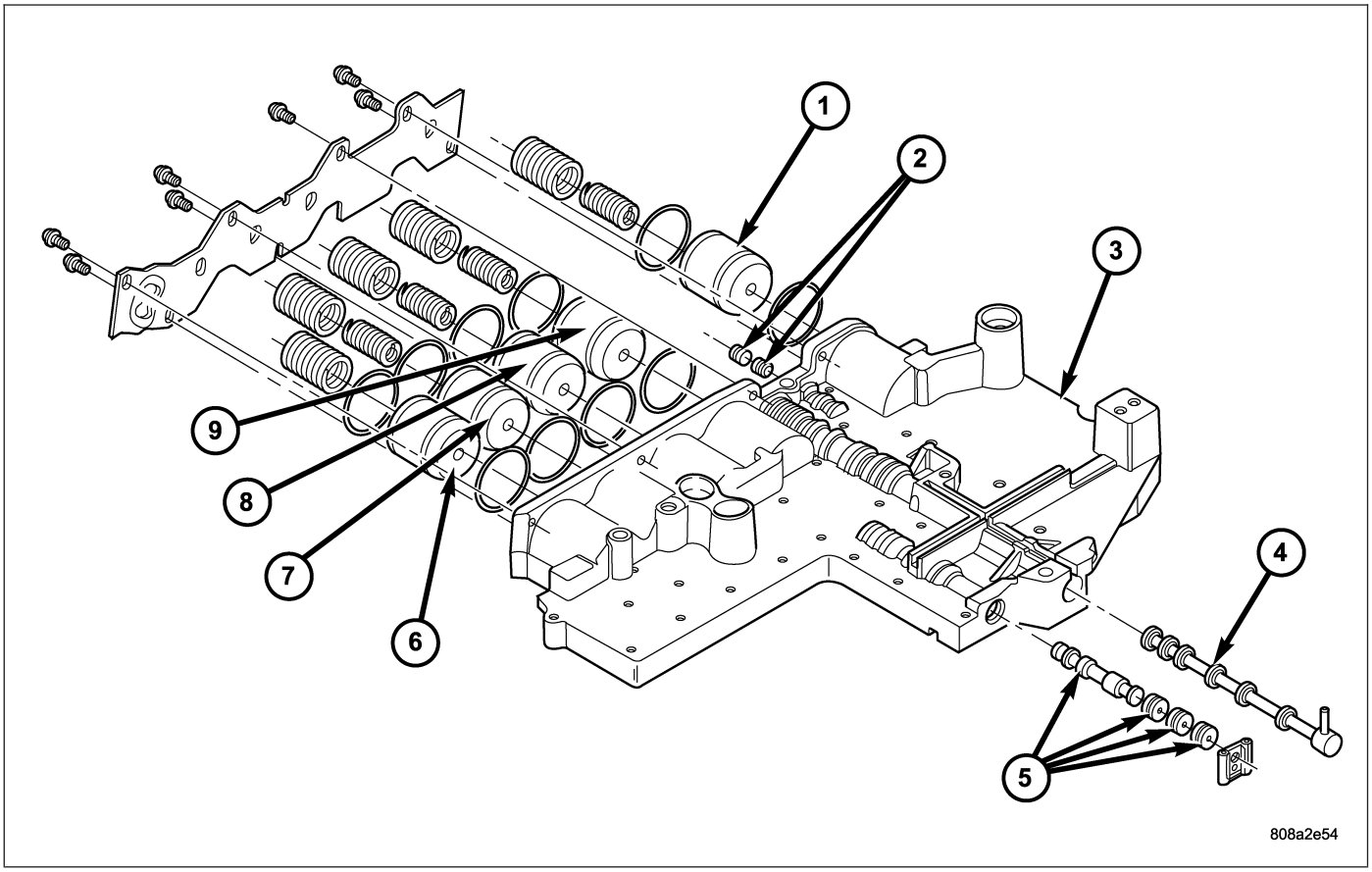
A failure in the temperature sensor or circuit will result in calculated temperature being substituted for actual temperature. Calculated temperature is a predicted fluid temperature which is calculated from a combination of inputs:

- Battery (ambient) temperature

- Engine coolant temperature
- In-gear run time since start-up

ASSEMBLY-VALVE BODY

DESCRIPTION



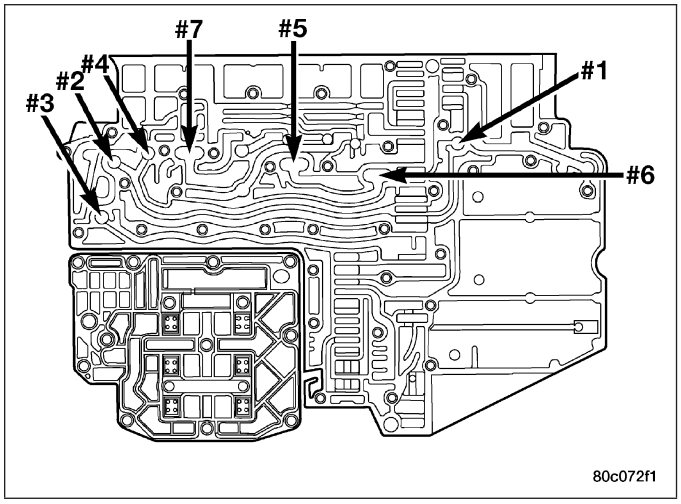
Valve Body Components

1 - LOW/REVERSE ACCUMULATOR
2 - LOW/REVERSE SWITCH VALVE
3 - UPPER VALVE BODY
4 - MANUAL VALVE
5 - SOLENOID SWITCH VALVE
6 - OVERDRIVE ACCUMULATOR
7 - UNDERDRIVE ACCUMULATOR
8 - 4C ACCUMULATOR
9 - 2C ACCUMULATOR

The valve body consists of a cast aluminum valve body, a separator plate, and a transfer plate. The valve body contains valves and check balls that control fluid delivery to the torque converter clutch, bands, and frictional clutches. The valve body contains the following components :

- Solenoid switch valve
- Manual valve
- Low/reverse switch valve
- 5 Accumulators

- 7 check balls



OPERATION

NOTE: Refer to the Hydraulic Schematics for a visual aid in determining valve location, operation and design.

SOLENOID SWITCH VALVE

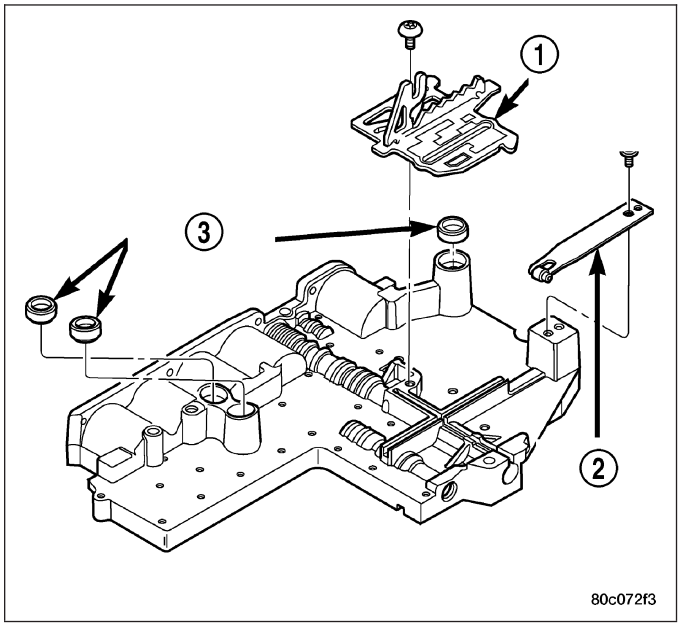
The Solenoid Switch Valve (SSV) controls the direction of the transmission fluid when the L/R-TCC solenoid is energized.

The Solenoid Switch Valve controls line pressure from the LR-TCC solenoid. In 1st gear, the SSV will be in the downshifted position, thus directing fluid to the L/R clutch circuit. In 2nd, 3rd, 4th, and fifth gears, the solenoid switch valve will be in the upshifted position and directs the fluid into the torque converter clutch (TCC) circuit.

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R pressure switch is monitored to confirm SSV movement. If the movement is not confirmed (the L/R pressure switch does not close), 2nd gear is substituted for 1st. A DTC will be set after three unsuccessful attempts are made to get into 1st gear in one given key start.

MANUAL VALVE

The manual valve is a relay valve. The purpose of the manual valve is to direct fluid to the correct circuit needed for a specific gear or driving range. The manual valve, as the name implies, is manually operated by the driver with a lever located on the top of the valve body. The valve is connected mechanically by a cable to the gearshift mechanism. The valve is held in each of its positions by a roller detent spring (2) that engages the “roostercomb” of the TRS selector plate (1).



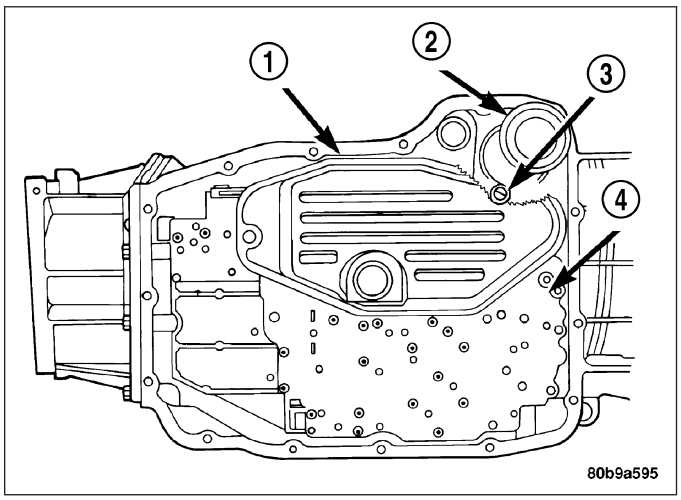
LOW/REVERSE SWITCH VALVE

The low/reverse switch valve allows the low/reverse clutch to be operated by either the LR/CC solenoid or the MS solenoid.

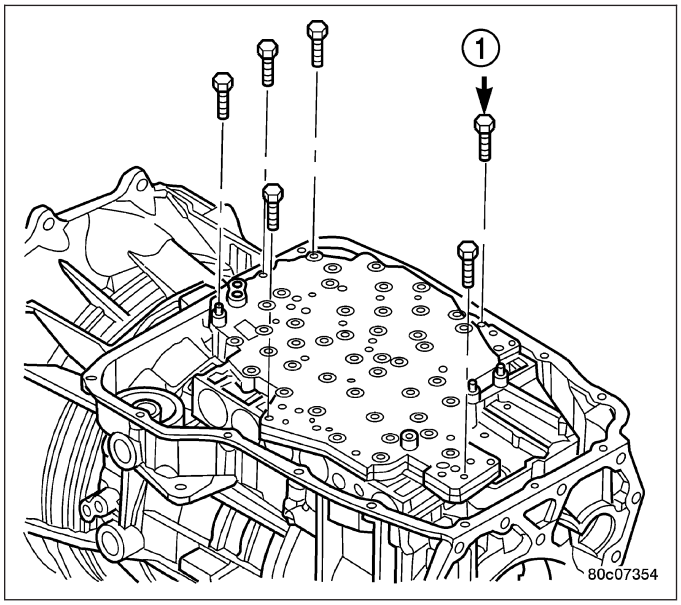
REMOVAL

NOTE: The valve body can be removed for service without having to remove the transmission assembly. The valve body can be disassembled for cleaning and inspection of the individual components. (Refer to 21 - TRANSMISSION/AUTOMATIC - 45RFE/VALVE BODY - DISASSEMBLY)

1. Shift transmission into PARK.
2. Raise vehicle.
3. Disconnect wires at the solenoid and pressure switch assembly connector.
4. Position drain pan under transmission oil pan.
5. Remove transmission oil pan.
6. Remove the primary oil filter (1) from valve body.

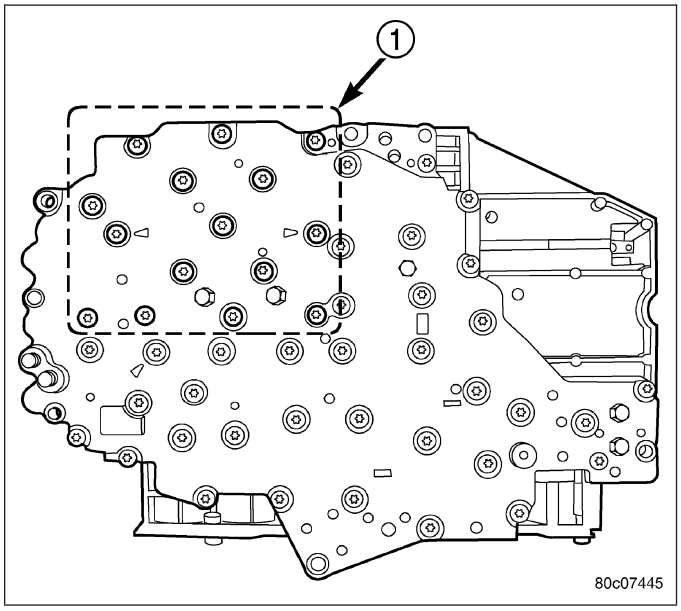


7. Remove bolts (1) attaching valve body to transmission case.
8. Lower the valve body and work the electrical connector out of transmission case.
9. Separate the valve body from the transmission.

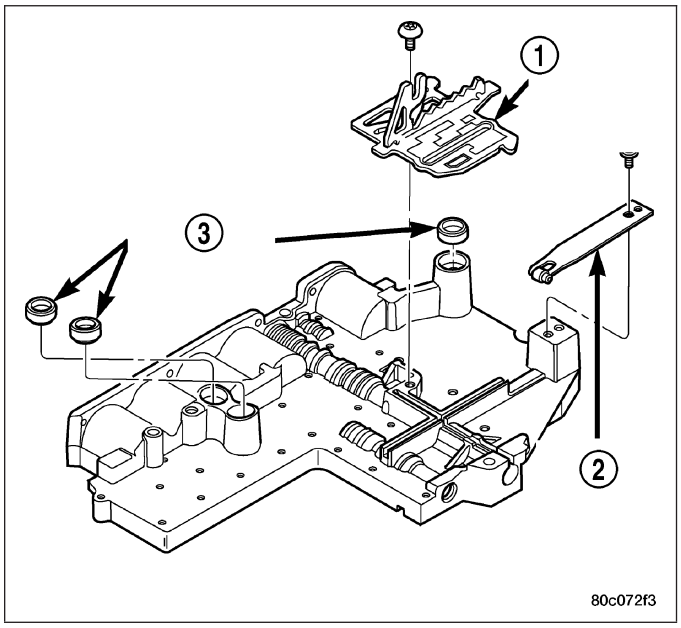


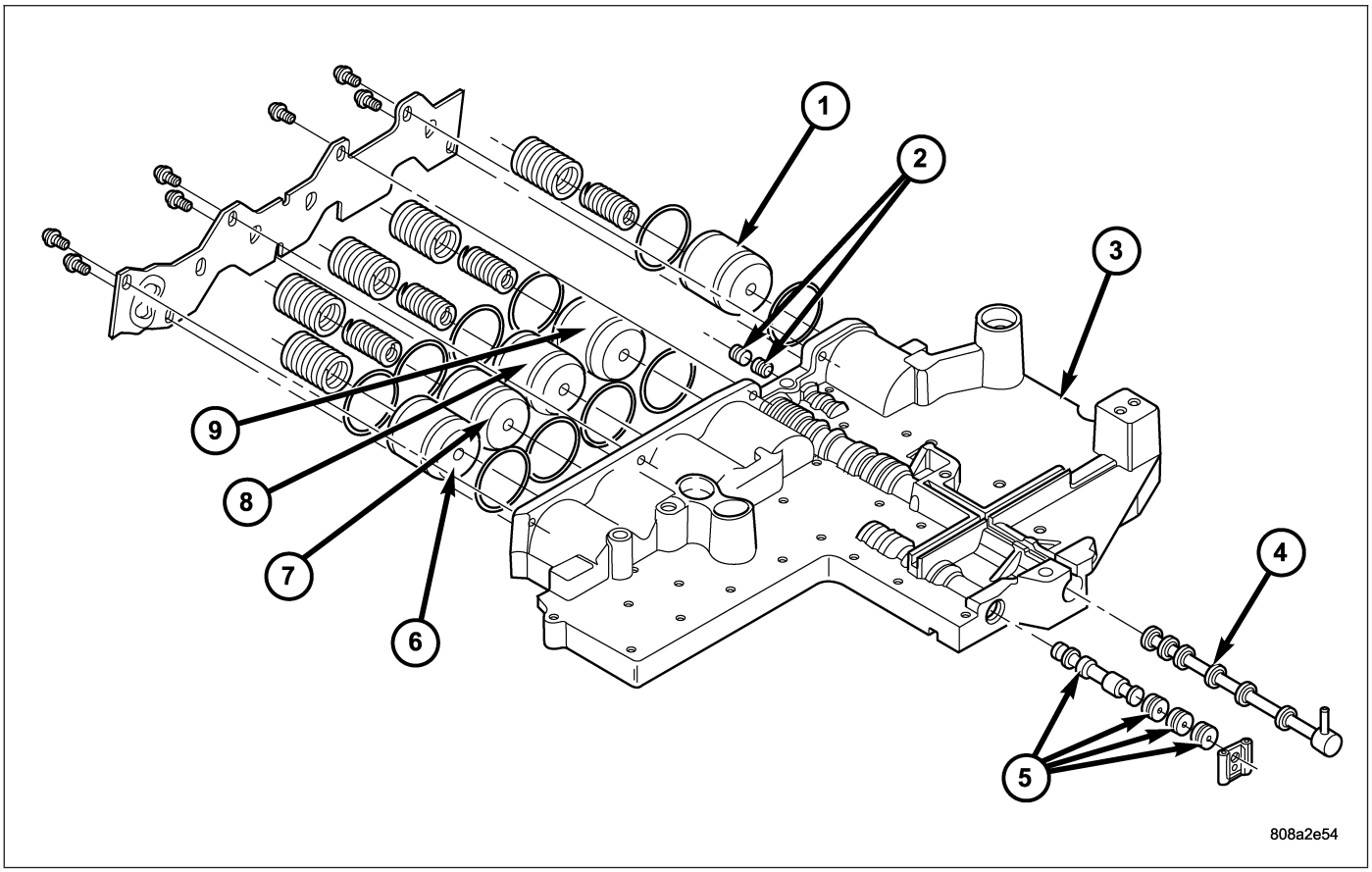
DISASSEMBLY

1. Remove the bolts (1) holding the solenoid and pressure switch assembly to the valve body. Do not remove the screws on the top of the solenoid and pressure switch assembly.
2. Separate the solenoid and pressure switch assembly from the valve body.



3. Remove the screw holding the detent spring (2) onto the valve body.
4. Remove the detent spring (2) from the valve body.
5. Remove the TRS selector plate (1) from the valve body and the manual valve.
6. Remove the clutch passage seals (3) from the valve body, if necessary.





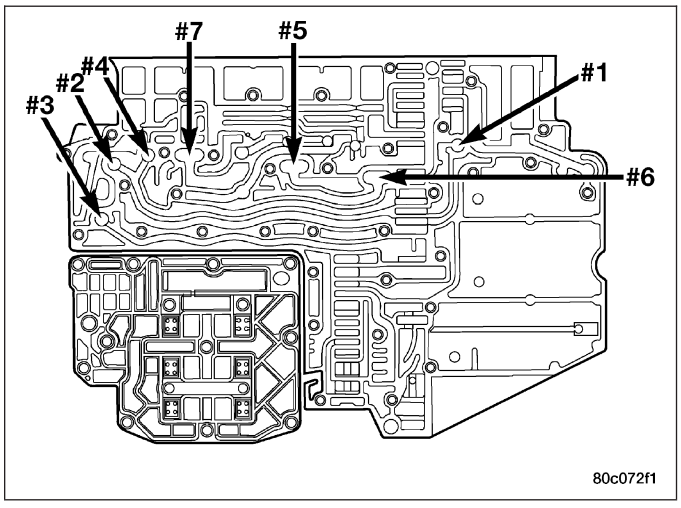
Valve Body Components

1 - LOW/REVERSE ACCUMULATOR
2 - LOW/REVERSE SWITCH VALVE
3 - UPPER VALVE BODY
4 - MANUAL VALVE
5 - SOLENOID SWITCH VALVE
6 - OVERDRIVE ACCUMULATOR
7 - UNDERDRIVE ACCUMULATOR
8 - 4C ACCUMULATOR
9 - 2C ACCUMULATOR

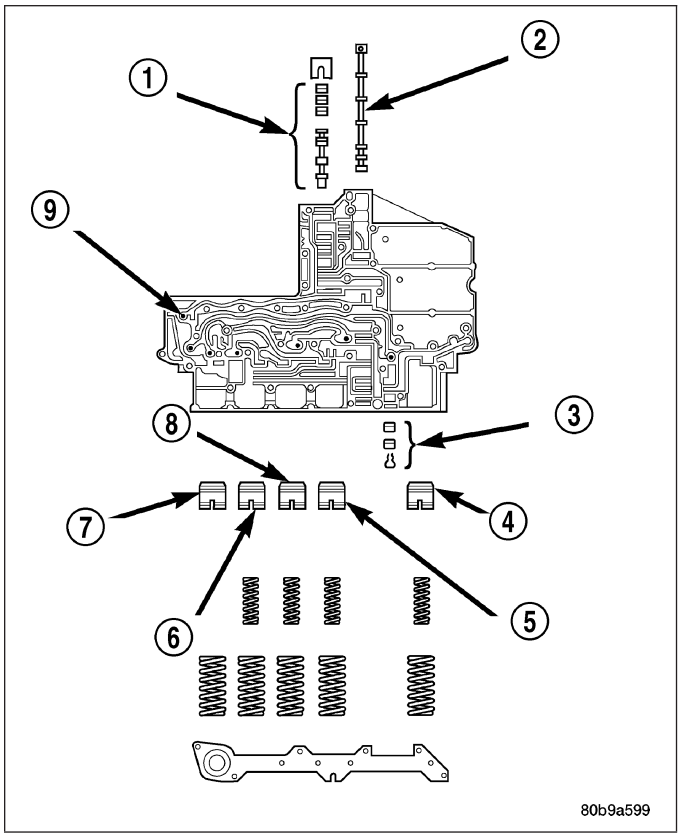
7. Remove the screws holding the accumulator cover onto the valve body.
8. Remove the accumulator springs and pistons (1, 6-9) from the valve body. Note which accumulator piston and spring belong in each location.
9. Place the valve body on the bench with the transfer plate upward.

NOTE: The valve body contains seven check balls. The transfer plate must be placed upward to prevent losing the check balls when the transfer plate is removed from the valve body.

10. Remove the screws holding the valve body to the valve body transfer plate.
11. Remove the transfer plate from the valve body. Note the location of all check balls.
12. Remove the check balls from the valve body.



13. Remove the retainers securing the solenoid switch valve (1), manual valve (2), and the low/reverse switch valve (3) from the valve body and remove the associated valve and spring. Tag each valve and spring combination with location information to aid in assembly.

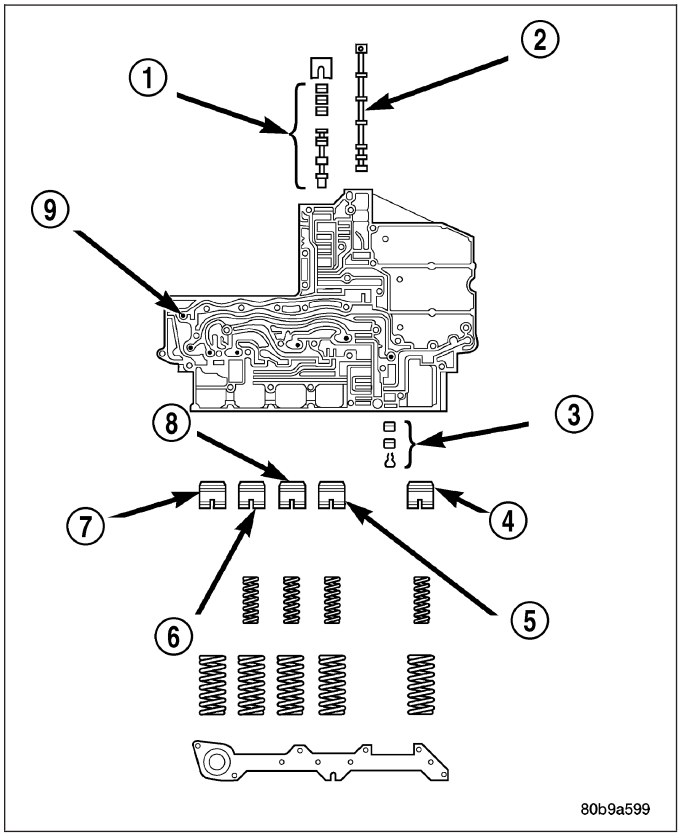


CLEANING

Clean the valve housings, valves, plugs, springs, and separator plates with a standard parts cleaning solution only. Do not use gasoline, kerosene, or any type of caustic solution.

Do not immerse any of the electrical components in cleaning solution. Clean the electrical components by wiping them off with dry shop towels only.

Dry all except the electrical parts with compressed air. Make sure all passages are clean and free from obstructions. **Do not use rags or shop towels to dry or wipe off valve body components. Lint from these materials can stick to valve body parts, interfere with valve operation, and clog filters and fluid passages.**



INSPECTION

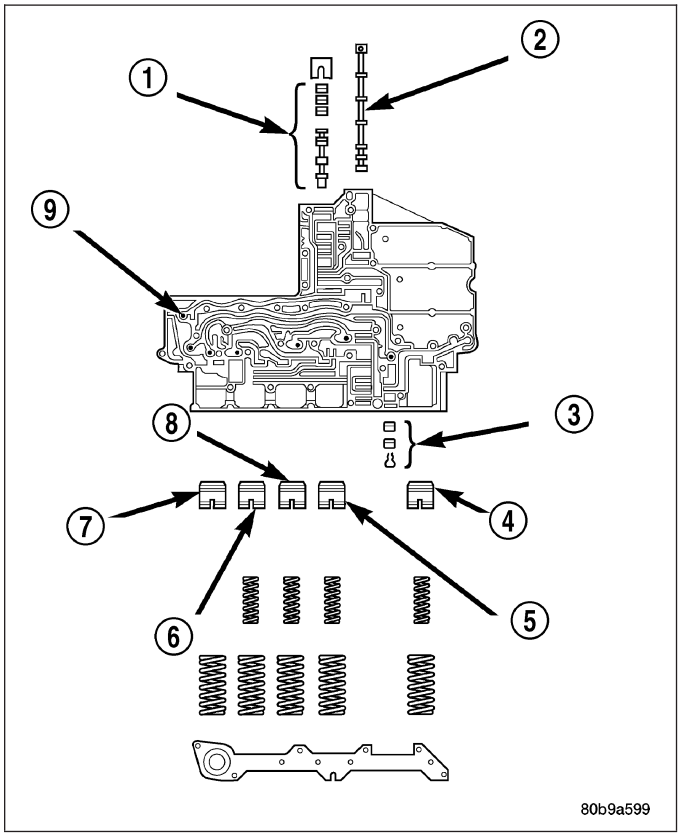
Inspect all of the valve body mating surfaces for scratches, nicks, burrs, or distortion. Use a straight-edge to check surface flatness. Minor scratches may be removed with crocus cloth using only very light pressure.

Minor distortion of a valve body mating surface may be corrected by smoothing the surface with a sheet of crocus cloth. Position the crocus cloth on a surface plate, sheet of plate glass or equally flat surface. If distortion is severe or any surfaces are heavily scored, the valve body will have to be replaced.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands.** Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

Inspect all the valve and plug bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the valve body springs. The springs must be free of distortion, warpage or broken coils.

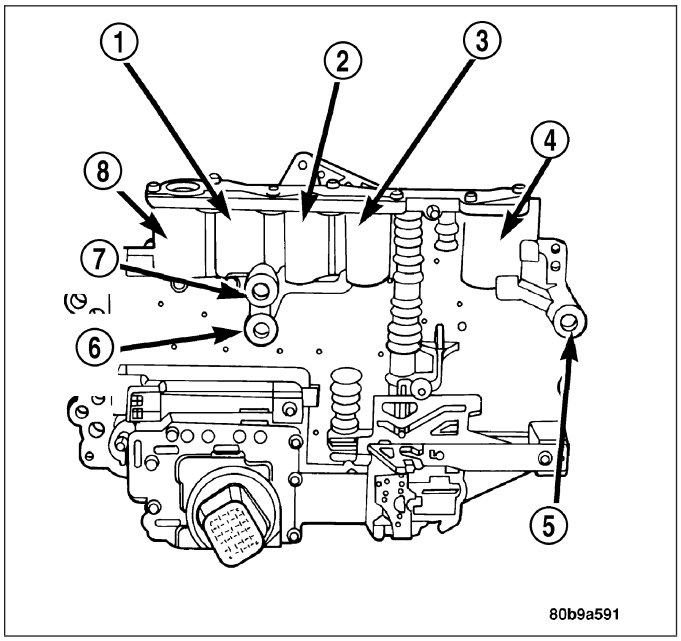
Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.



Valve body bores do not change dimensionally with use. If the valve body functioned correctly when new, it will continue to operate properly after cleaning and inspection. It should not be necessary to replace a valve body assembly unless it is damaged in handling.

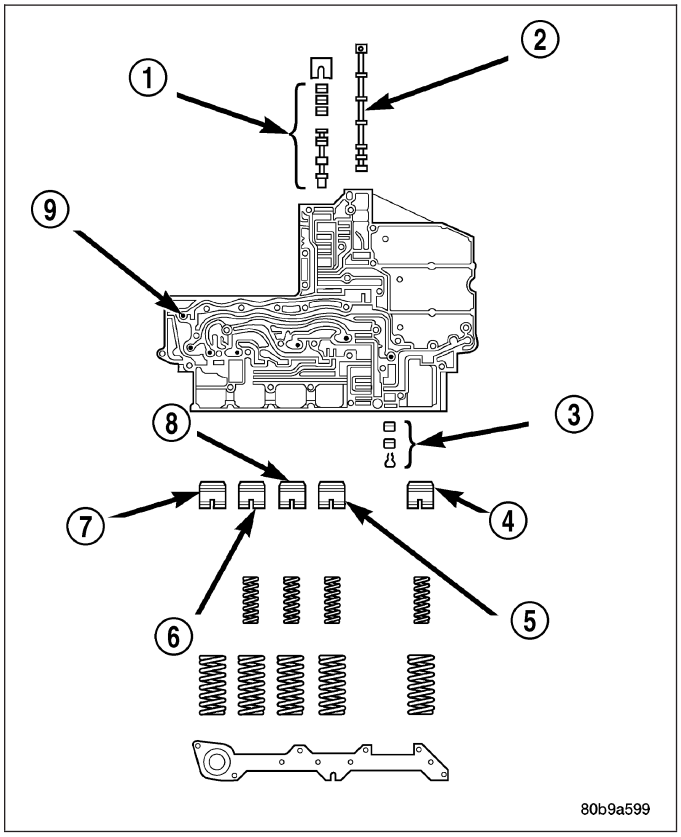
Inspect all the accumulator bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the accumulator springs. The springs must be free of distortion, warpage or broken coils.

Inspect all the fluid seals on the valve body. Replace any seals that are cracked, distorted, or damaged in any way. These seals pass fluid pressure directly to the clutches. Any pressure leak at these points, may cause transmission performance problems.

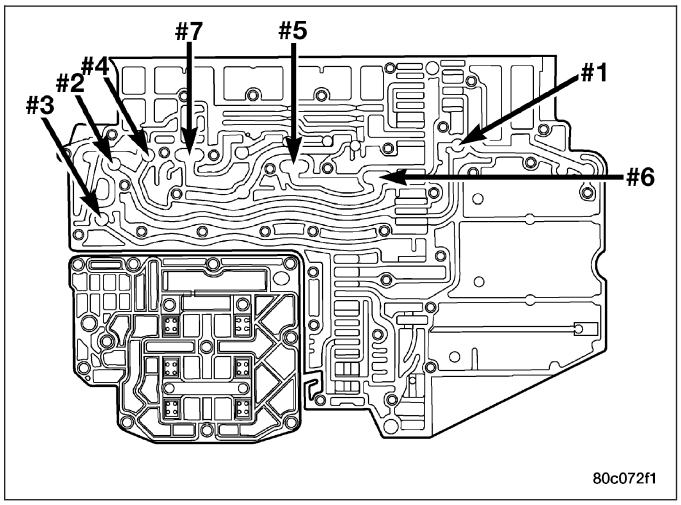


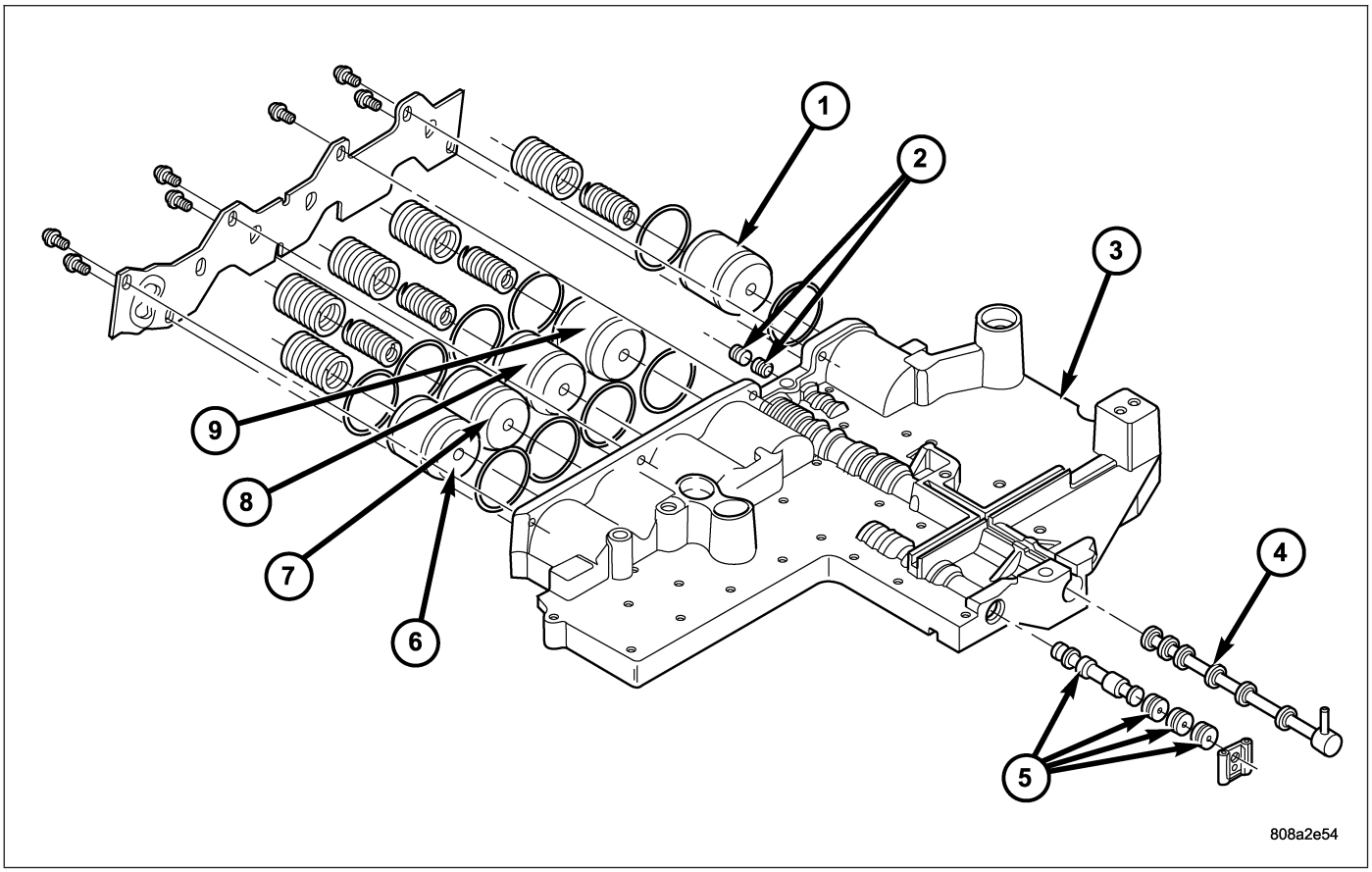
ASSEMBLY

1. Lubricate valves, springs, and the housing valve bores with clean transmission fluid.
2. Install solenoid switch valve (1), manual valve (2), and the low/reverse switch valve (3) into the valve body.
3. Install the retainers to hold each valve into the valve body.



4. Install the valve body check balls into their proper locations.
5. Position the transfer plate onto the valve body.
6. Install the screws to hold the transfer plate to the valve body. Tighten the screws to 5.6 N·m (50 in. lbs.).





Valve Body Components

1 - LOW/REVERSE ACCUMULATOR
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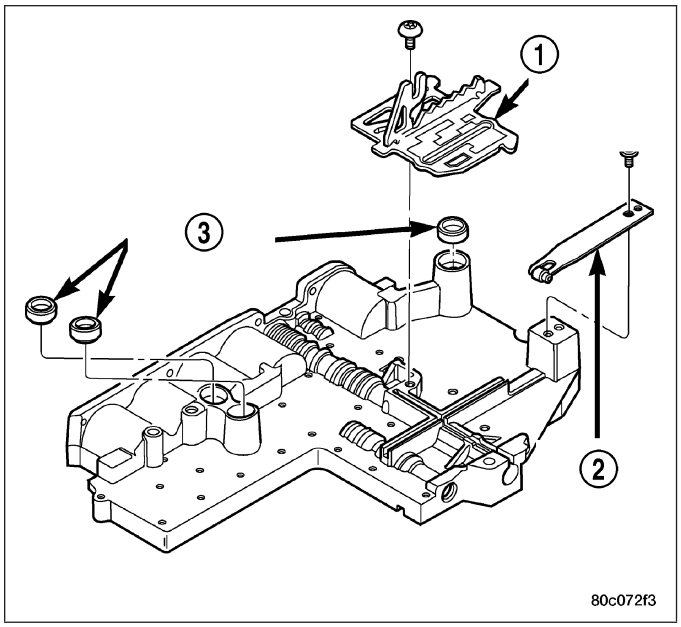
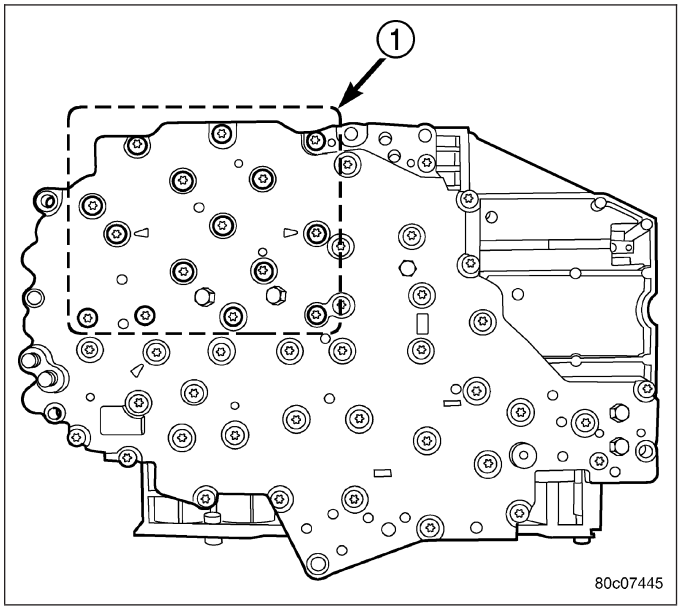
5 - SOLENOID SWITCH VALVE
6 - OVERDRIVE ACCUMULATOR
7 - UNDERDRIVE ACCUMULATOR
8 - 4C ACCUMULATOR
9 - 2C ACCUMULATOR

7. Install the accumulator pistons (1, 6-9) and springs into the valve body in the location from which they were removed. Note that all accumulators except the overdrive have two springs. The overdrive accumulator piston (6) has only one spring.
8. Position the accumulator cover onto the valve body.
9. Install the screws to hold the accumulator cover onto the valve body. Tighten the screws to 7 N·m (60 in. lbs.).

10. Install the TRS selector plate (1) onto the valve body and the manual valve.
11. Position the detent spring (2) onto the valve body.
12. Install the screw to hold the detent spring (2) onto the valve body. Tighten the screw to 4.5 N·m (40 in. lbs.).
13. Install new clutch passage seals (3) onto the valve body, if necessary.

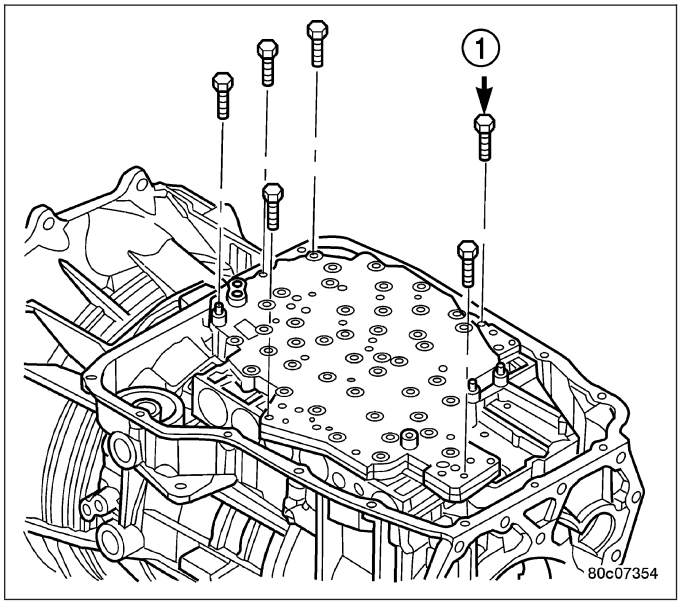


14. Install the solenoid and pressure switch assembly onto the valve body.
15. Install the bolts (1) to hold the solenoid and pressure switch assembly onto the valve body. Tighten the bolts to 5.7 N·m (50 in. lbs.). Tighten the bolts adjacent to the arrows cast into the bottom of the transfer plate first.



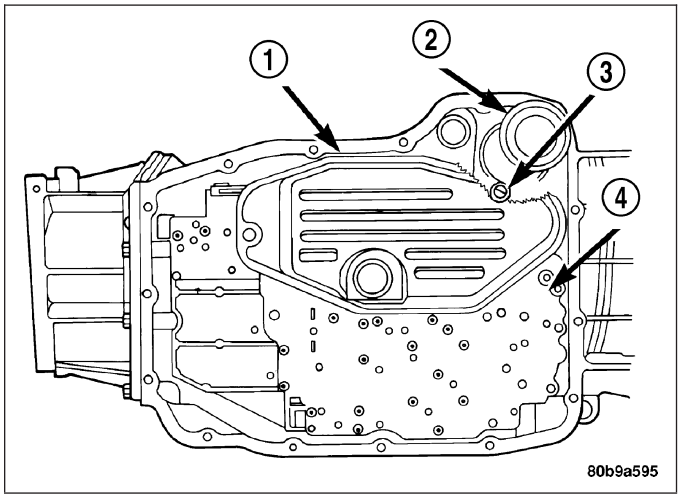
INSTALLATION

1. Check condition of seals on valve body and the solenoid and pressure switch assembly. Replace seals if cut or worn.
2. Place TRS selector plate in the PARK position.
3. Place the transmission in the PARK position.
4. Lubricate seal on the solenoid and pressure switch assembly connector with petroleum jelly.
5. Position valve body in transmission and align the manual lever on the valve body to the pin on the transmission manual shift lever.
6. Seat valve body in case and install one or two bolts to hold valve body in place.
7. Tighten valve body bolts alternately and evenly to 12 N·m (105 in. lbs.) torque.



CAUTION: The primary oil filter seal MUST be fully installed flush against the oil pump body. DO NOT install the seal onto the filter neck and attempt to install the filter and seal as an assembly. Damage to the transmission will result.

8. Install a new primary oil filter seal in the oil pump inlet bore. Seat the seal in the bore with the butt end of a hammer, or other suitable tool.
9. Place replacement filter (1) in position on valve body and into the oil pump.
10. Install screw to hold filter to valve body. Tighten screw to 4.5 N·m (40 in. lbs.) torque.
11. Connect the solenoid and pressure switch assembly connector.



12. Install oil pan. Tighten pan bolts to 12 N·m (105 in. lbs.) torque.
13. Lower vehicle and fill transmission with Mopar® ATF +4.
14. Check and adjust gearshift cable, if necessary.

TRANSFER CASE - ELECTRICAL DIAGNOSTICS

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TRANSFER CASE - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

TRANSFER CASE VERIFICATION TEST VER 1

Diagnostic Test

1. TRANSFER CASE VERIFICATION TEST— VER 1

Disconnect all jumper wires and reconnect all previously disconnected components and connectors.

With the scan tool, select Clear Stored DTCs.

Make sure that all accessories are turned off and that the battery is fully charged.

Test drive the vehicle in each Transfer Case range and verify proper operation in each range.

NOTE: To select or deselect 2WD, AWD or 4HI mode, vehicle speed must be below 55 M.P.H. (88 KM/H) with all wheels at vehicle speed.

NOTE: Shifts will not take place with a wheel speed difference of greater than 13 M.P.H. between the front and rear wheels.

NOTE: To select or deselect 4LO (if equipped), vehicle speed must be below 3 M.P.H. (5 KM/H) with the ignition ON and the transmission in neutral (auto trans) or the clutch pedal pressed (man trans).

NOTE: To select or deselect Transfer Case Neutral, vehicle speed must be 0 M.P.H. with the ignition ON, engine OFF, the brake pedal applied, and the transmission in neutral (auto trans) or the clutch pedal pressed (man trans). Press the Neutral button (if equipped) on the Transfer Case Selector Switch until the Neutral Indicator is illuminated.

WARNING: Apply the parking brake. The vehicle may roll with the Transfer Case in neutral.

NOTE: To verify that the Transfer Case is in Neutral, shift the automatic transmission into reverse and release the brake pedal for three seconds or shift the manual transmission into gear and slowly release the clutch pedal. There should be no vehicle movement if the Transfer Case is in Neutral.

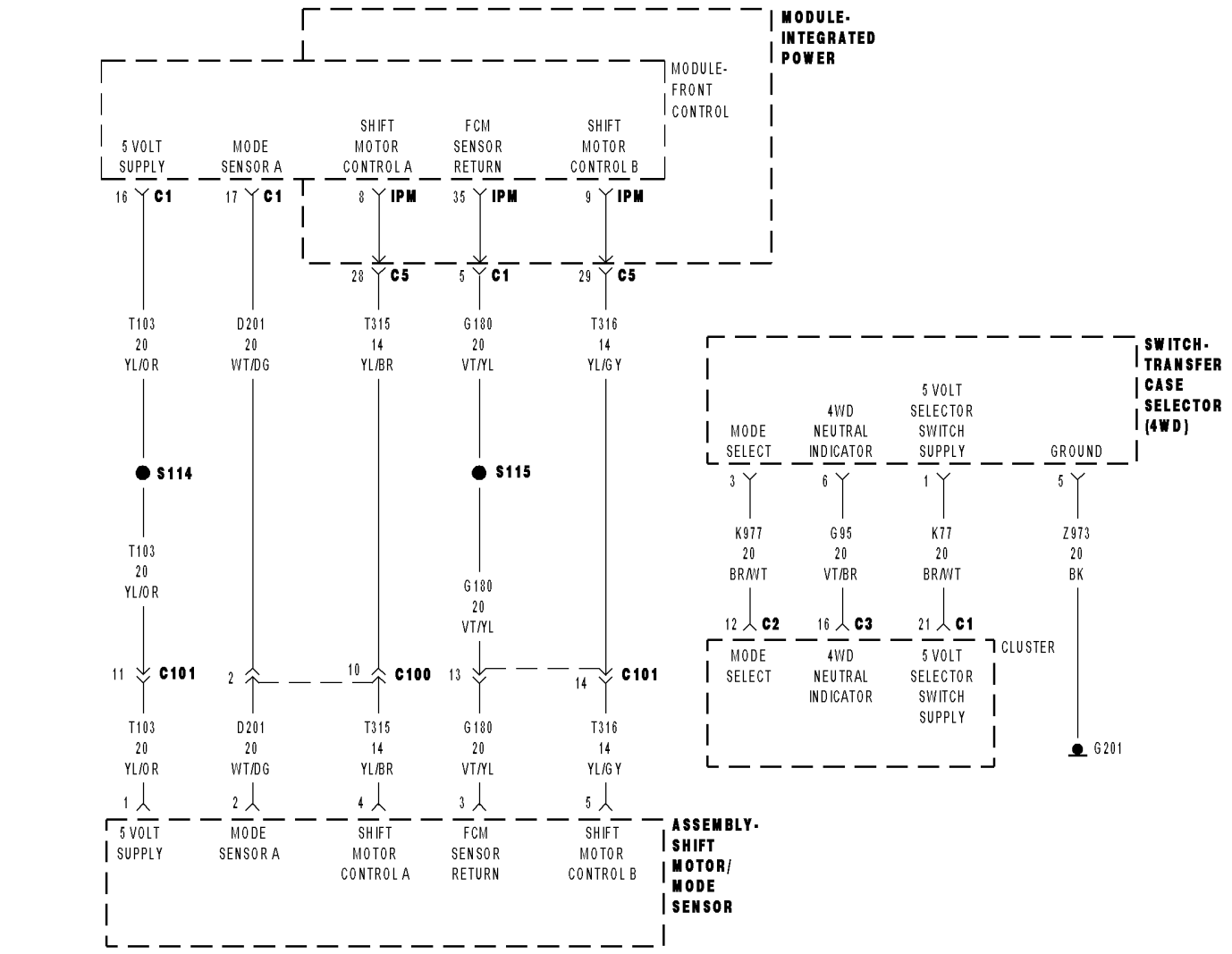
With the scan tool, select View DTCs in the Front Control Module (FCM) and in the Cluster (CCN).

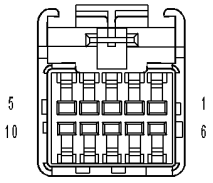
Are there any DTCs present in the Front Control Module (FCM) or in the Cluster (CCN)?

Yes >> Return to the symptom list and perform the appropriate diagnostic test.

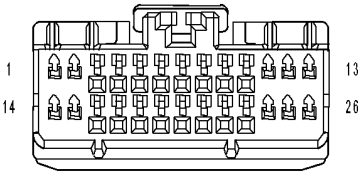
No >> Repair is complete.

C1401- TRANSFER CASE RANGE SELECT SWITCH CIRCUIT LOW

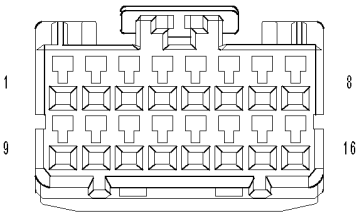




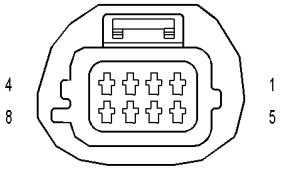
SWITCH- TRANSFER CASE SELECTOR (4X4)



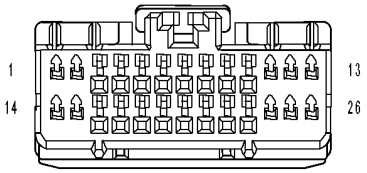
CLUSTER C1



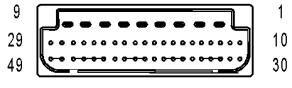
CLUSTER C2



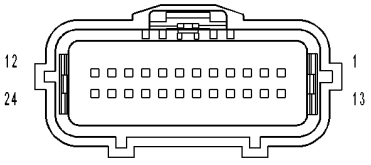
ASSEMBLY- SHIFT MOTOR/ MODE SENSOR (4X4)



CLUSTER C3



MODULE- FRONT CONTROL (IPM)



MODULE- FRONT CONTROL C1

81460930

C1401- TRANSFER CASE RANGE SELECT SWITCH CIRCUIT LOW (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Transfer Case Range Select Switch voltage less than 0.1568 volts for 5 seconds

Possible Causes
INTERMITTENT CONDITION
(K77) 5 VOLT SELECTOR SWITCH SUPPLY CIRCUIT OPEN
(K77) 5 VOLT SELECTOR SWITCH SUPPLY CIRCUIT SHORTED TO GROUND
(K977) MODE SELECT CIRCUIT OPEN
(K977) MODE SELECT CIRCUIT SHORT TO GROUND
TRANSFER CASE SELECTOR SWITCH
INSTRUMENT CLUSTER

Diagnostic Test

1. TCASE (DTCM) SWITCH VOLTAGE LESS THAN 0.2 VOLTS

Ignition on, engine not running.
With the scan tool under Data Display, read the TCASE (DTCM) Switch voltage.

Is the voltage less than 0.2 volts?

Yes >> Go To 2
No >> Go To 9

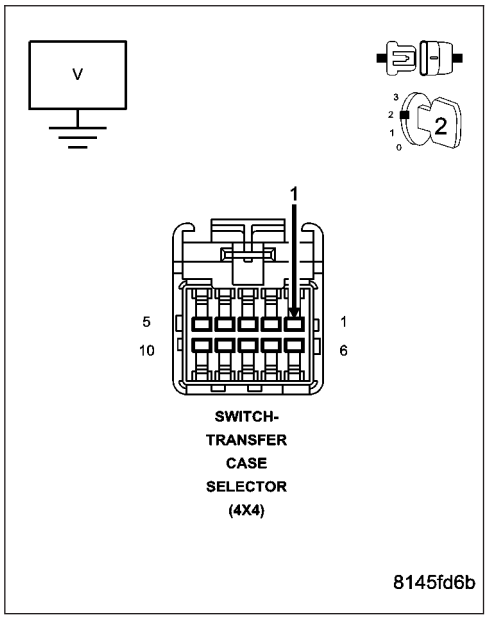
---

2. (K77) 5 VOLT SELECTOR SWITCH SUPPLY CIRCUIT VOLTAGE LESS THAN 0.2 VOLTS

Turn the ignition off.
Disconnect the Transfer Case Selector Switch connector.
Turn the ignition on.
Measure the voltage of the (K77) 5 Volt Selector Switch Supply circuit.

Is the voltage less than 0.2 volts?

Yes >> Go To 3
No >> Go To 5



C1401- TRANSFER CASE RANGE SELECT SWITCH CIRCUIT LOW (CONTINUED)

3. (K77) 5 VOLT SELECTOR SWITCH SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the Instrument Cluster C1 connector.

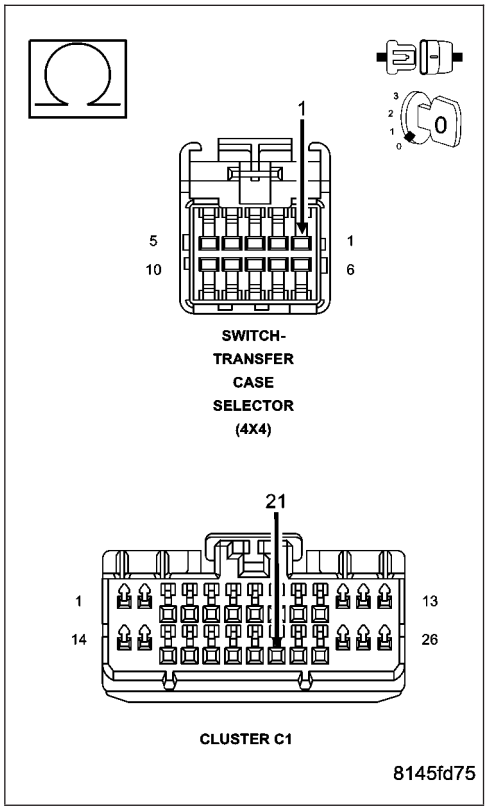
Measure the resistance of the (K77) 5 Volt Selector Switch Supply circuit.

Is the resistance greater than 5.0 ohms?

Yes >> Repair the (K77) 5 Volt Selector Switch Supply circuit for an open.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4



4. (K77) 5 VOLT SELECTOR SWITCH SUPPLY CIRCUIT SHORTED TO GROUND

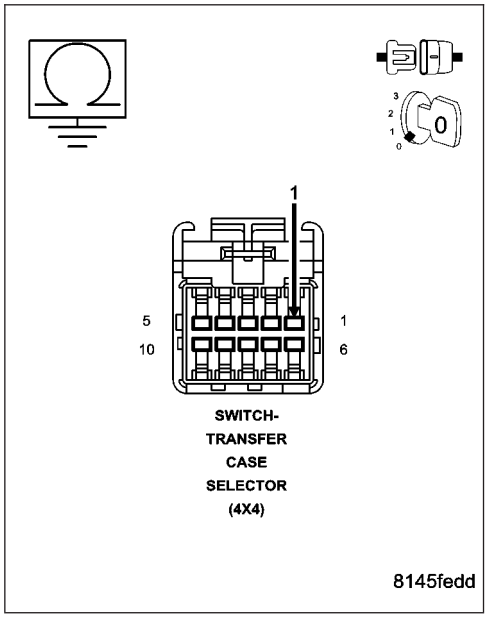
Measure the resistance between the (K77) 5 Volt Selector Switch Supply circuit and ground.

Is the resistance less than 5.0 ohms?

Yes >> Repair the (K77) 5 Volt Selector Switch Supply circuit for a short to ground.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 8



C1401- TRANSFER CASE RANGE SELECT SWITCH CIRCUIT LOW (CONTINUED)

5. TRANSFER CASE SELECTOR SWITCH

Turn the ignition off.

Connect a jumper wire between the (K77) 5 Volt Selector Switch Supply circuit and the (K977) Mode Select circuit in the Transfer Case Selector Switch connector.

Ignition on, engine not running.

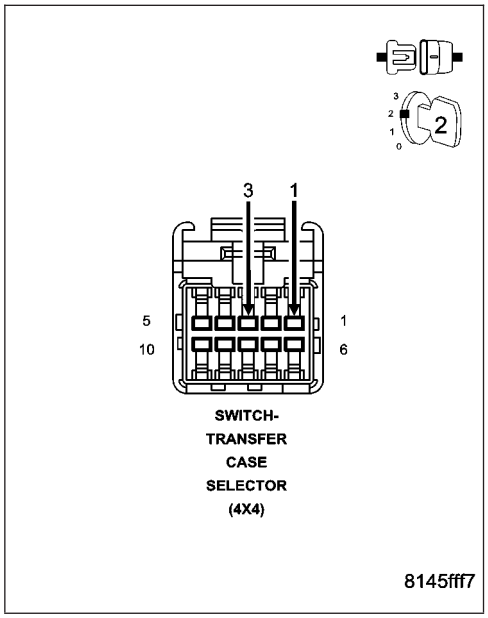
With the scan tool in Data Display, read the Range Switch voltage.

The switch voltage should be approximately 5 volts.

Does the voltage display as described?

Yes >> Replace the Transfer Case Selector Switch.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 6



6. (K977) MODE SELECT CIRCUIT SHORT TO GROUND

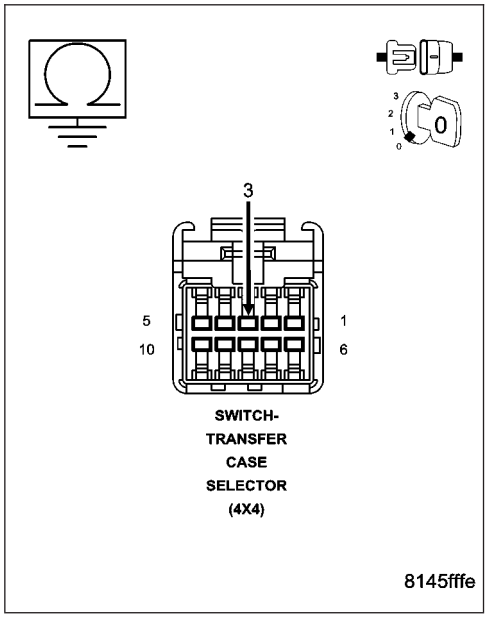
Disconnect the Instrument Cluster C2 connector.

Measure the resistance between the (K977) Mode Select circuit and ground.

Is the resistance less than 5.0 ohms?

Yes >> Repair the (K977) Mode Select circuit for a short to ground.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 7



C1401- TRANSFER CASE RANGE SELECT SWITCH CIRCUIT LOW (CONTINUED)

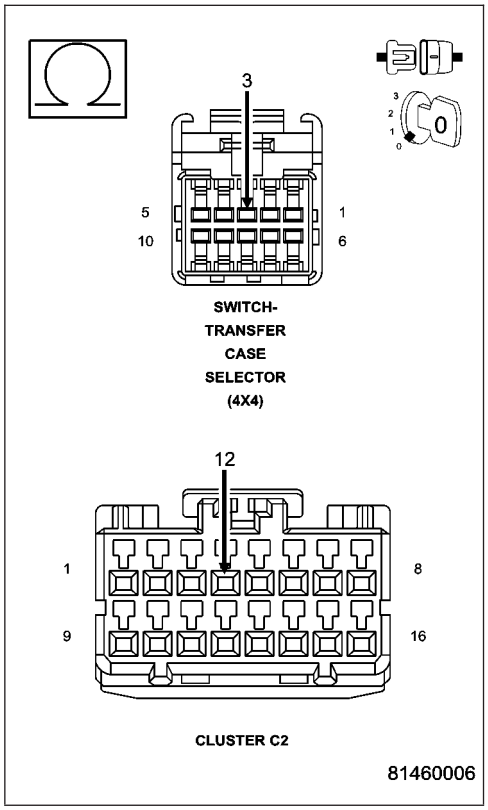
7. (K977) MODE SELECT CIRCUIT OPEN

Measure the resistance of the (K977) Mode Select circuit.

Is the resistance above 5.0 ohms?

Yes >> Repair the (K977) Mode Select circuit for an open.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 8



8. INSTRUMENT CLUSTER

View repair.

Repair

Replace the Instrument Cluster in accordance with the Service Information.

Perform the BODY VERIFICATION TEST-VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

9. INTERMITTENT WIRING AND CONNECTORS

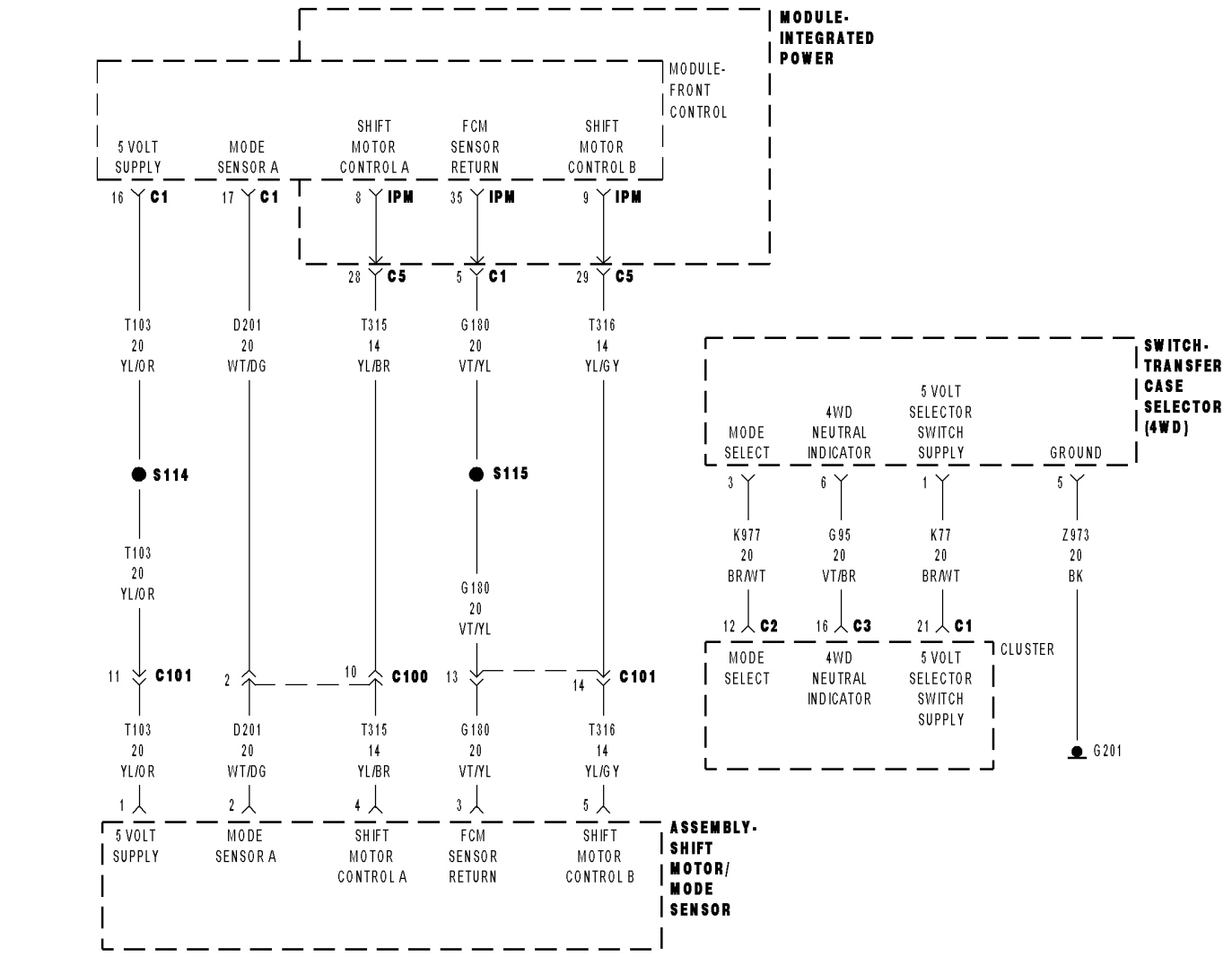
The conditions necessary to set this DTC are not present at this time.
Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.
Look for the data to change or for the DTC to reset during the wiggle test.

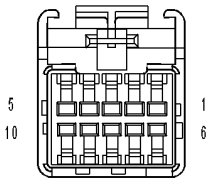
Were any problems found?

Yes >> Repair as necessary.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

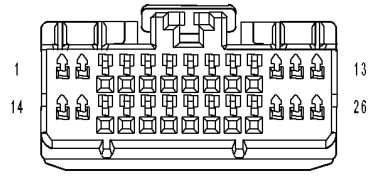
No >> Test complete.

C1402- TRANSFER CASE RANGE SELECT SWITCH CIRCUIT HIGH

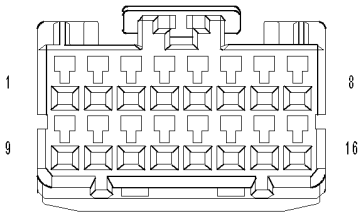




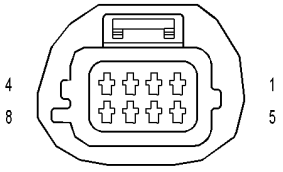
SWITCH- TRANSFER CASE SELECTOR (4X4)



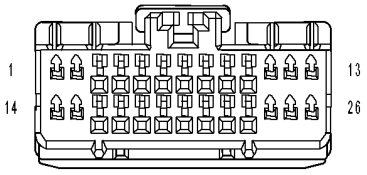
CLUSTER C1



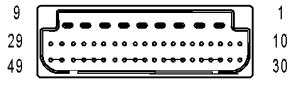
CLUSTER C2



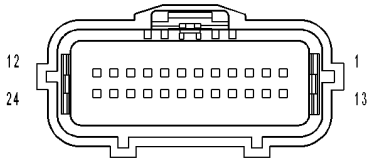
ASSEMBLY- SHIFT MOTOR/ MODE SENSOR (4X4)



CLUSTER C3



MODULE- FRONT CONTROL (IPM)



MODULE- FRONT CONTROL C1

81460930

C1402- TRANSFER CASE RANGE SELECT SWITCH CIRCUIT HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Transfer Case Range Select Switch voltage greater than 4.86 volts for 5 seconds

Possible Causes
INTERMITTENT CONDITION
(K77) 5 VOLT SELECTOR SWITCH SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K977) MODE SELECT CIRCUIT SHORTED TO VOLTAGE
(K977) MODE SELECT CIRCUIT OPEN
(Z973) TRANSFER CASE SELECTOR SWITCH GROUND CIRCUIT OPEN
TRANSFER CASE SELECTOR SWITCH
INSTRUMENT CLUSTER

Diagnostic Test

1. TCASE (DTCM) SWITCH VOLTAGE ABOVE 4.8 VOLTS

Ignition on, engine not running.

With the scan tool under Data Display, read the TCASE (DTCM) Switch voltage.

Is the volage above 4.8 volts?

Yes >> Go To 2

No >> Go to 8

---

2. (K77) 5 VOLT SELECTOR SWITCH SUPPLY CIRCUIT SHORTED TO VOLTAGE

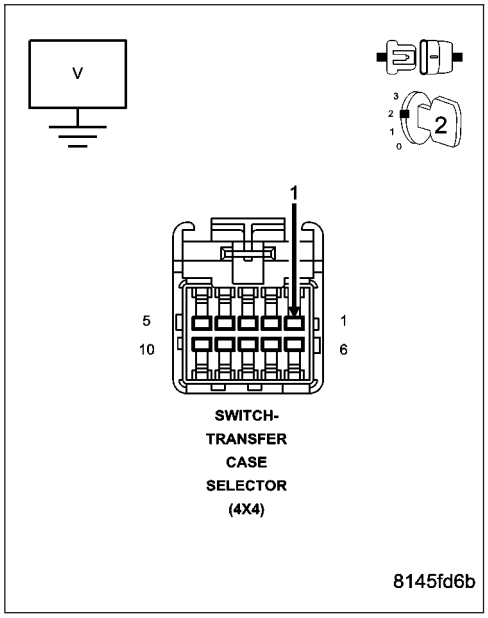
Turn the ignition off.

Disconnect the Transfer Case Selector Switch connector.

Disconnect the Instrument Cluster C2 connector.

Turn the ignition on.

Measure the voltage of the (K77) 5 Volt Selector Switch Supply circuit.



Is there any voltage present?

Yes >> Repair the (K77) 5 Volt Selector Switch Supply circuit for a short to voltage.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 3

C1402- TRANSFER CASE RANGE SELECT SWITCH CIRCUIT HIGH (CONTINUED)

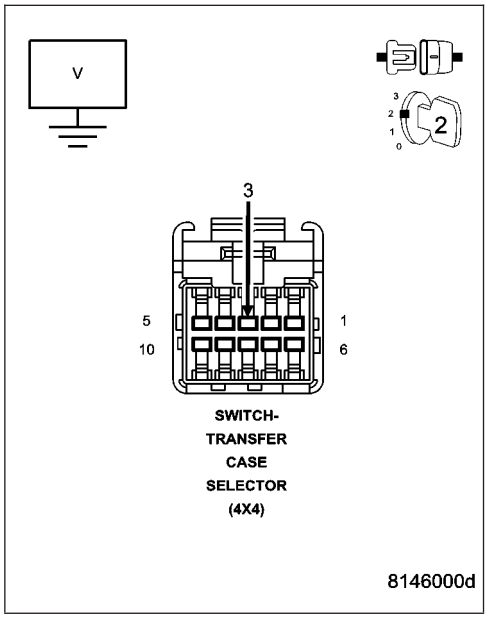
3. (K977) MODE SELECT CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (K977) Mode Select circuit.

Is there any voltage present?

Yes >> Repair the (K977) Mode Select circuit for a short to voltage.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 4



4. TRANSFER CASE SELECTOR SWITCH

Turn the ignition off.
Connect the Instrument Cluster C2 connector.
Turn the ignition on.
With the scan tool under Data Display, read the TCASE (DTCM) Switch voltage.

Is the voltage equal to 0 volts?

Yes >> Replace the Transfer Case Selector Switch.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 5

C1402- TRANSFER CASE RANGE SELECT SWITCH CIRCUIT HIGH (CONTINUED)

5. (K977) MODE SELECT CIRCUIT OPEN

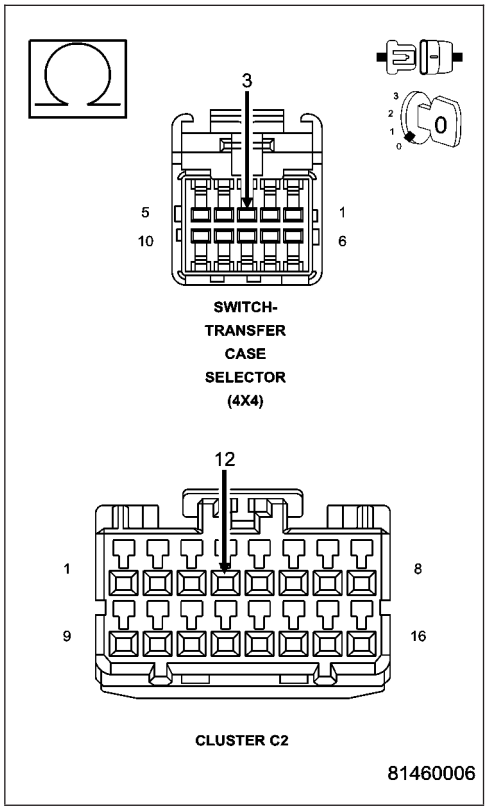
Turn the ignition off.

Measure the resistance of the (K977) Mode Select circuit.

Is the resistance above 5.0 ohms?

Yes >> Repair the (K977) Mode Select circuit for an open.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 6



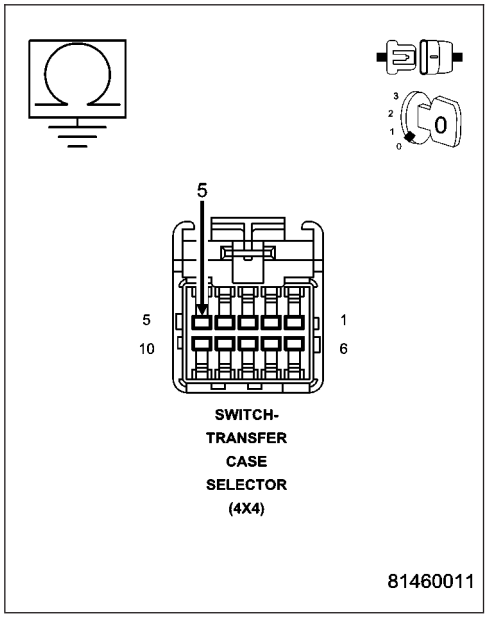
6. TRANSFER CASE SELECTOR SWITCH (Z973) GROUND CIRCUIT OPEN

Measure the resistance between the Transfer Case Selector Switch (Z973) Ground circuit and ground.

Is the resistance above 5.0 ohms?

Yes >> Repair the Transfer Case Selector Switch (Z973) ground circuit for an open.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 7



C1402- TRANSFER CASE RANGE SELECT SWITCH CIRCUIT HIGH (CONTINUED)

7. INSTRUMENT CLUSTER

Repair

Replace the Instrument Cluster in accordance with the Service Information.

Perform the BODY VERIFICATION TEST-VER 1 and TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

8. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

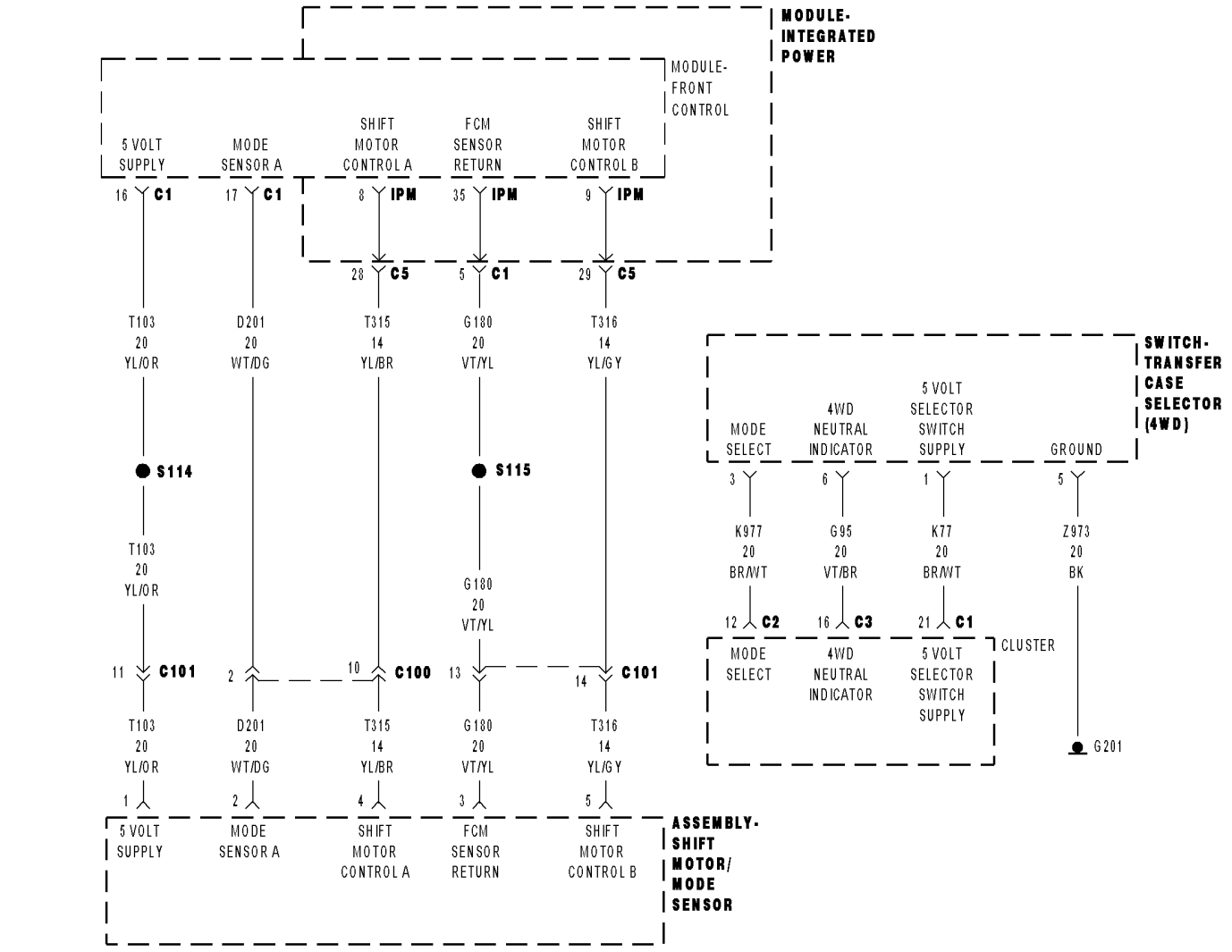
Were any problems found?

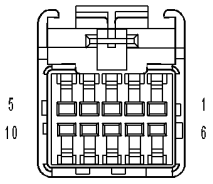
Yes >> Repair as necessary.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

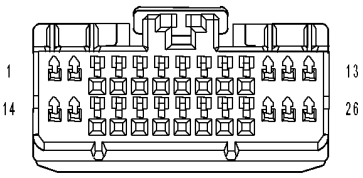
No >> Test complete.

C1404- TRANSFER CASE RANGE POSITION SENSOR CIRCUIT LOW

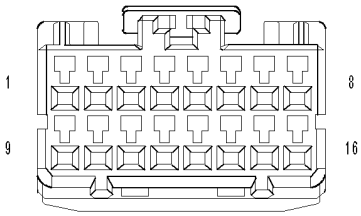




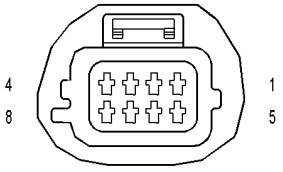
SWITCH- TRANSFER CASE SELECTOR (4X4)



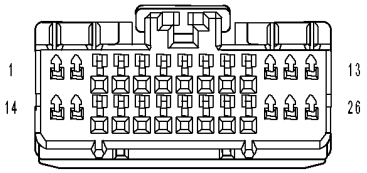
CLUSTER C1



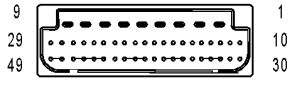
CLUSTER C2



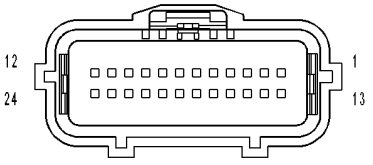
ASSEMBLY- SHIFT MOTOR/ MODE SENSOR (4X4)



CLUSTER C3



MODULE- FRONT CONTROL (IPM)



MODULE- FRONT CONTROL C1

81460930

C1404- TRANSFER CASE RANGE POSITION SENSOR CIRCUIT LOW (CONTINUED)
For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition on. Battery voltage between 9 and 16 volts.
- **Set Condition:**
  FCM detects a short to ground on the Transfer Case Position Sensor signal circuit for 2 seconds.

Possible Causes
INTERMITTENT CONDITION
(T103) 5 VOLT SUPPLY CIRCUIT OPEN
(T103) 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(D201) MODE SENSOR A CIRCUIT SHORTED TO GROUND
(D201) MODE SENSOR A CIRCUIT SHORTED TO (G180) FCM SENSOR RETURN CIRCUIT
SHIFT MOTOR/MODE SENSOR ASSEMBLY
FRONT CONTROL MODULE

Diagnostic Test

1. T-CASE POSITION SENSOR VOLTAGE BELOW 0.2 VOLTS

Ignition on, engine not running.
With the scan tool under Data Display, read the T-Case Position Sensor voltage.

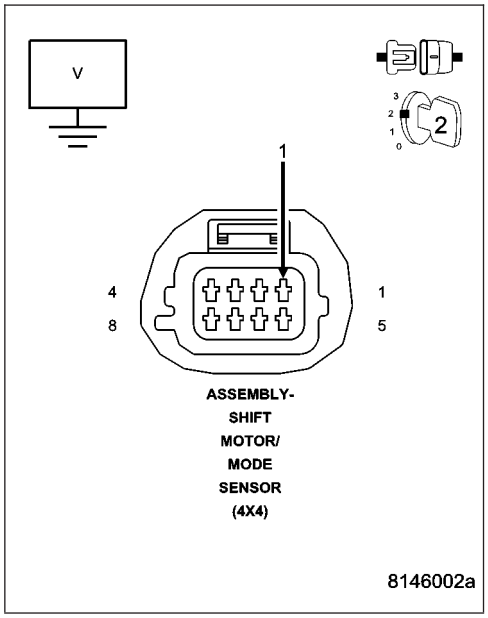
Is the voltage below 0.2 volts?

Yes >> Go to 2
No >> Go to 9

---

2. (T103) 5 VOLT SUPPLY CIRCUIT VOLTAGE BELOW 0.2 VOLTS

Turn the ignition off.
Disconnect the Shift Motor/Mode Sensor connector.
Turn the ignition on.
Measure the voltage of the (T103) 5 Volt Supply circuit.



Is the voltage below 0.2 volts?

Yes >> Go to 3
No >> Go to 5

C1404- TRANSFER CASE RANGE POSITION SENSOR CIRCUIT LOW (CONTINUED)

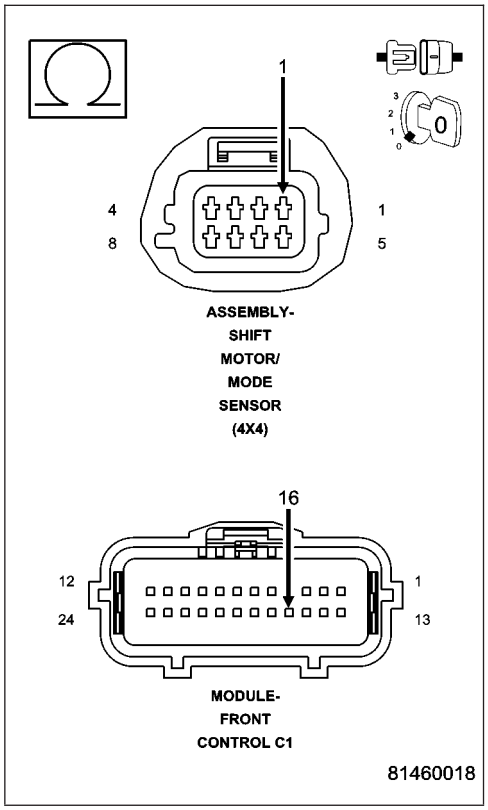
3. (T103) 5 VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.
Disconnect the Front Control Module C1 connector.
Measure the resistance of the (T103) 5 Volt Supply circuit.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T103) 5 Volt Supply circuit for an open.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 4



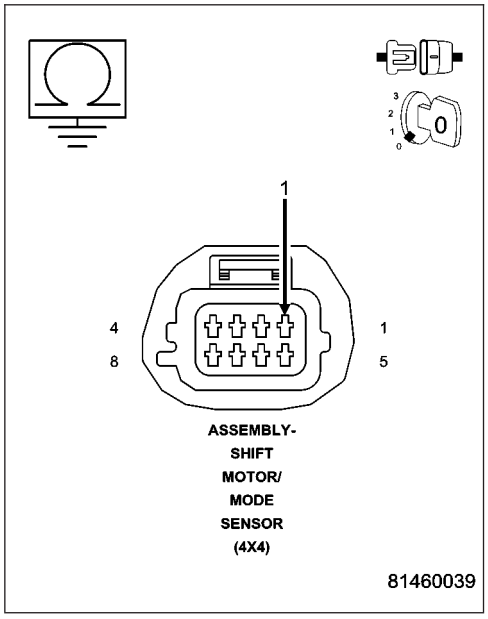
4. (T103) 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (T103) 5 Volt Supply circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T103) 5 Volt Supply circuit for a short to ground.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 8



C1404- TRANSFER CASE RANGE POSITION SENSOR CIRCUIT LOW (CONTINUED)

5. SHIFT MOTOR/MODE SENSOR ASSEMBLY

With the scan tool under Data Display, read the T-Case Position Sensor voltage.

Is the voltage above 4.5 volts?

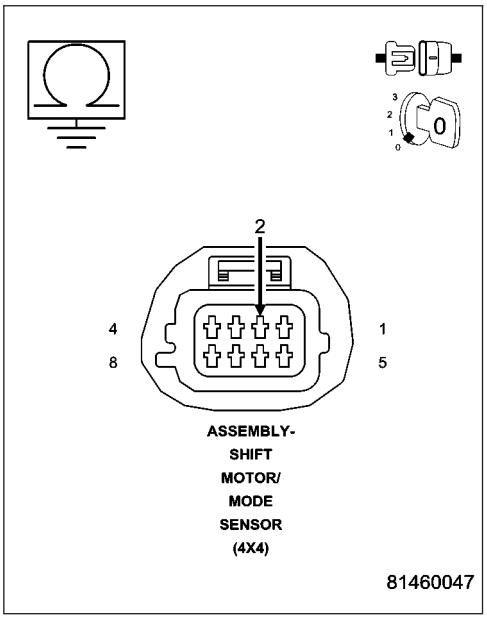
Yes >> Replace the Shift Motor/Mode Sensor Assembly.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 6

---

6. (D201) MODE SENSOR A CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (D201) Mode Sensor A circuit.



Is the resistance below 5.0 ohms?

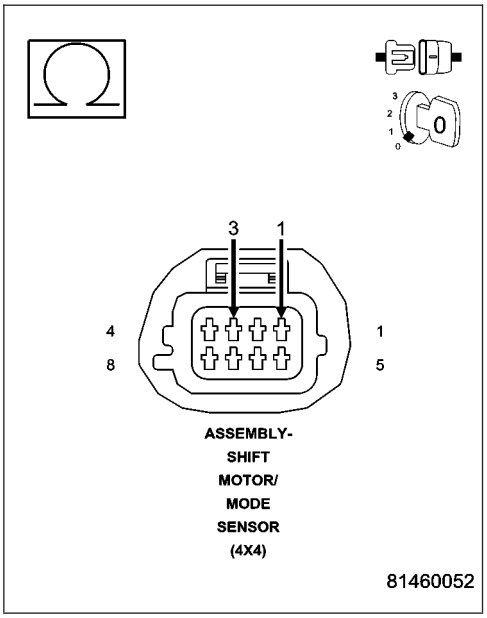
Yes >> Repair the (D201) Mode Sensor A circuit for a short to ground.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 7

---

7. (D201) MODE SENSOR A CIRCUIT SHORTED TO (G180) FCM SENSOR RETURN CIRCUIT

Measure the resistance between the (D201) Mode Sensor A circuit and the (G180) FCM Sensor Return circuit.



Is the resistance below 5.0 ohms?

Yes >> Repair the (D201) Mode Sensor A circuit for a short to the (G180) FCM Sensor Return circuit.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 8

C1404- TRANSFER CASE RANGE POSITION SENSOR CIRCUIT LOW (CONTINUED)

8. FRONT CONTROL MODULE

View repair.

Repair

Replace the Front Control Module in accordance with the Service Information.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

9. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

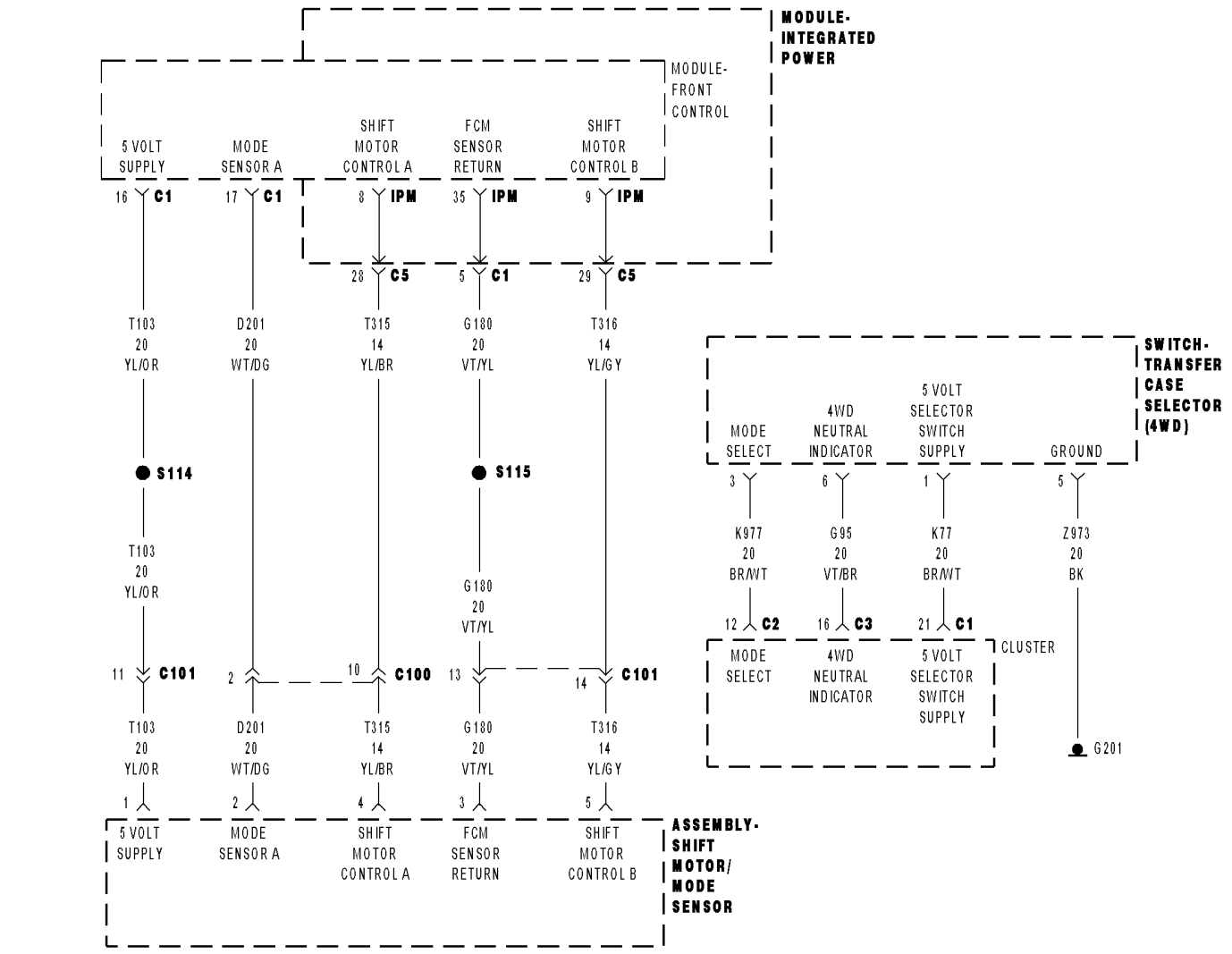
Were any problems found?

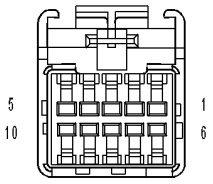
Yes >> Repair as necessary.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

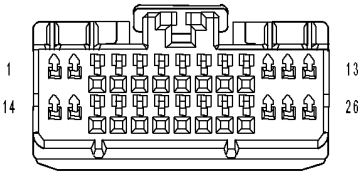
No >> Test complete.

C1405- TRANSFER CASE RANGE POSITION SENSOR CIRCUIT HIGH

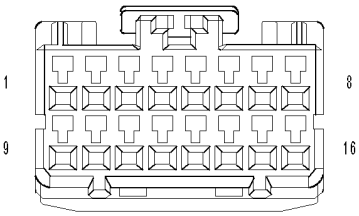




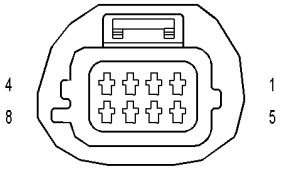
SWITCH- TRANSFER CASE SELECTOR (4X4)



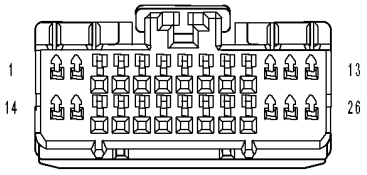
CLUSTER C1



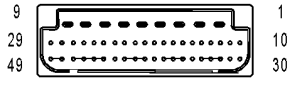
CLUSTER C2



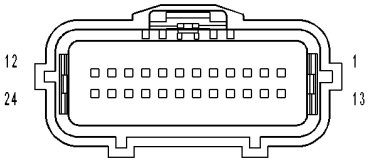
ASSEMBLY- SHIFT MOTOR/ MODE SENSOR (4X4)



CLUSTER C3



MODULE- FRONT CONTROL (IPM)



MODULE- FRONT CONTROL C1

81460930

C1405- TRANSFER CASE RANGE POSITION SENSOR CIRCUIT HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition on. Battery voltage between 9 and 16 volts
- **Set Condition:**
  FCM detects 5 volts on the Transfer Case Range Position Sensor signal circuit for 2 seconds

Possible Causes
INTERMITTENT CONDITION
(T103) 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(D201) MODE SENSOR A CIRCUIT SHORTED TO VOLTAGE
(D201) MODE SENSOR A CIRCUIT OPEN
(G180) FCM SENSOR RETURN CIRCUIT OPEN
SHIFT MOTOR/MODE SENSOR ASSEMBLY
INTEGRATED POWER MODULE
FRONT CONTROL MODULE

Diagnostic Test

1. T-CASE POSITION SENSOR VOLTAGE ABOVE 4.8 VOLTS

Ignition on, engine not running.
With the scan tool under Data Display, read the T-Case Position Sensor voltage.

Is the voltage above 4.8 volts?

Yes >> Go To 2

No >> Go to 10

---

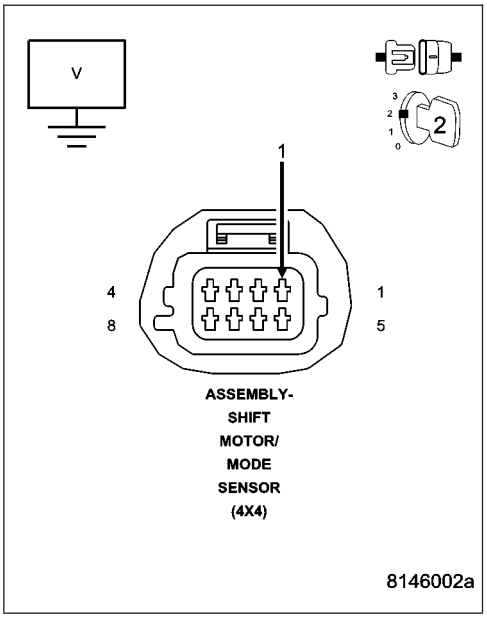
2. (T103) 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the Shift Motor/Mode Sensor connector.
Turn the ignition on.
Measure the voltage of the (T103) 5 Volt Supply circuit.

Is the voltage above 5.5 volts?

Yes >> Repair the (T103) 5 Volt Supply circuit for a short to voltage.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 3



C1405- TRANSFER CASE RANGE POSITION SENSOR CIRCUIT HIGH (CONTINUED)

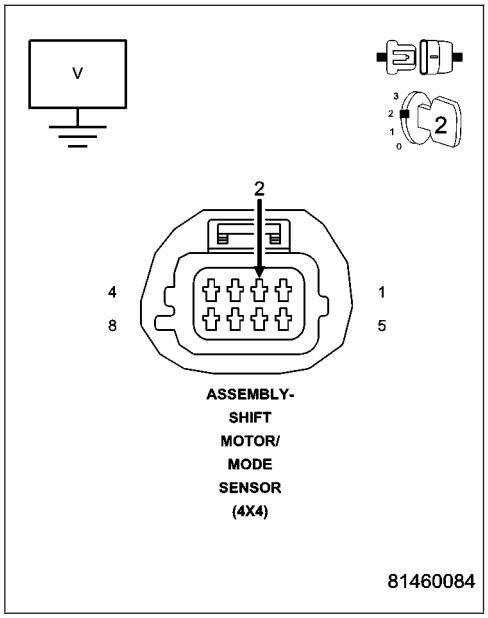
3. (D201) MODE SENSOR A CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (D201) Mode Sensor A circuit.

Is the voltage above 5.5 volts?

Yes >> Repair the (D201) Mode Sensor A circuit for a short to voltage.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 4



4. SHIFT MOTOR/MODE SENSOR ASSEMBLY

Turn the ignition off.

Connect a jumper wire between the (G180) FCM Sensor Return circuit and the (D201) Mode Sensor A circuit in the Shift Motor/Mode Sensor connector.

Turn the ignition on.

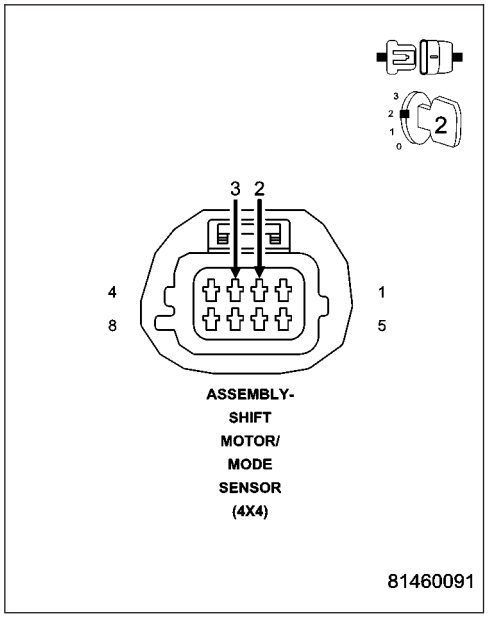
With the scan tool under Data Display, read the T-Case Position Sensor voltage.

NOTE: Remove the jumper wire before continuing.

Is the voltage below 0.2 volts?

Yes >> Replace the Shift Motor/Mode Sensor assembly.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 5



C1405- TRANSFER CASE RANGE POSITION SENSOR CIRCUIT HIGH (CONTINUED)

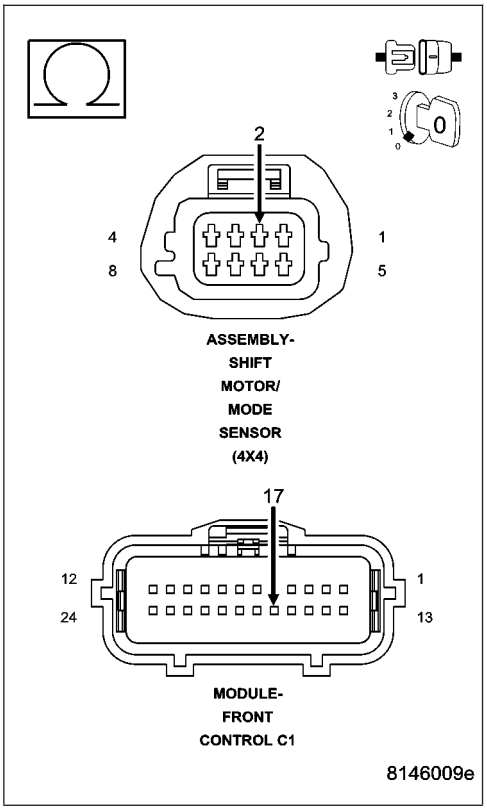
5. (D201) MODE SENSOR A CIRCUIT OPEN

Turn the ignition off.
Disconnect the Front Control Module C1 connector.
Measure the resistance of the (D201) Mode Sensor A circuit.

Is the resistance above 5.0 ohms?

Yes >> Repair the (D201) Mode Sensor A circuit for an open. Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 6



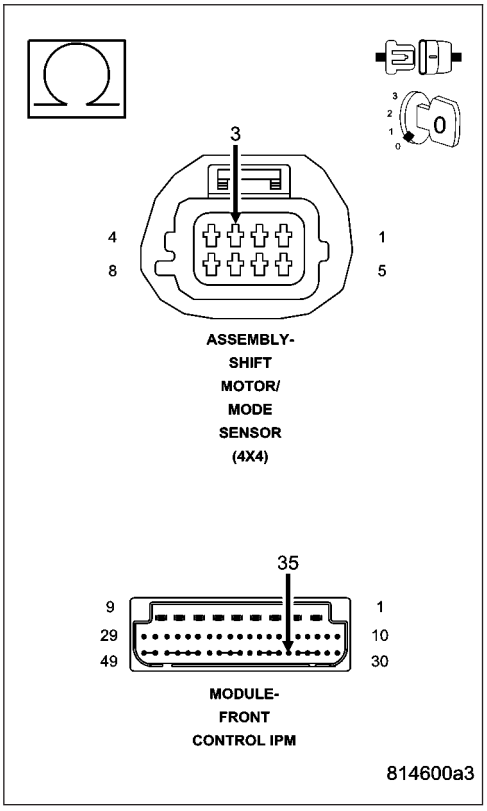
6. (G180) FCM SENSOR RETURN CIRCUIT OPEN

Measure the resistance of the (G180) FCM Sensor Return circuit from the Shift Motor/Mode Sensor harness connector to the FCM connector in the IPM.

Is the resistance above 5.0 ohms?

Yes >> Go to 7

No >> Go to 9



C1405- TRANSFER CASE RANGE POSITION SENSOR CIRCUIT HIGH (CONTINUED)

7. (G180) FCM SENSOR RETURN CIRCUIT OPEN (IPM)

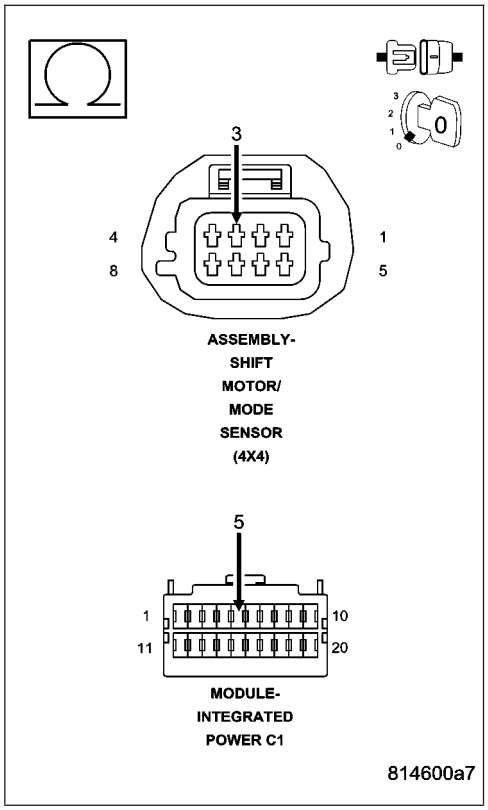
Disconnect the Integrated Power Module C1 harness connector.

Measure the resistance of the (G180) FCM Sensor Return circuit from the Shift Motor/Mode Sensor harness connector to the Integrated Power Module C1 harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (G180) FCM Sensor Return circuit for an open. Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 8



8. INTEGRATED POWER MODULE

View repair.

Repair

Replace the Integrated Power Module in accordance with the Service information.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

9. FRONT CONTROL MODULE

View repair.

Repair

Replace the Front Control Module in accordance with the Service information.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

C1405- TRANSFER CASE RANGE POSITION SENSOR CIRCUIT HIGH (CONTINUED)

10. INTERMITTENT WIRING AND CONNECTORS

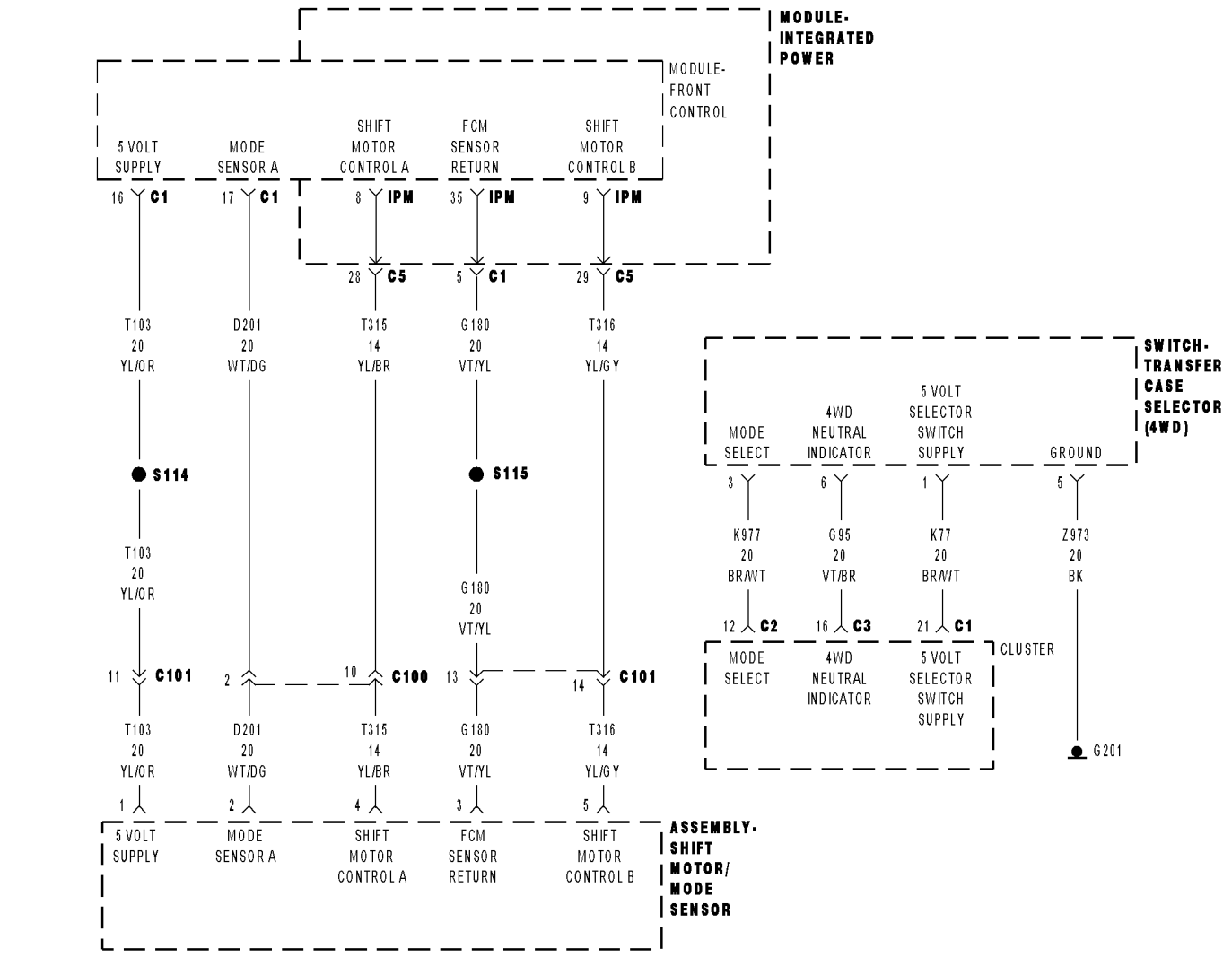
The conditions necessary to set this DTC are not present at this time.
Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.
Look for the data to change or for the DTC to reset during the wiggle test.

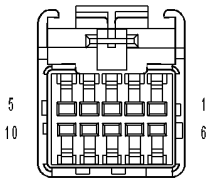
Were any problems found?

Yes >> Repair as necessary.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

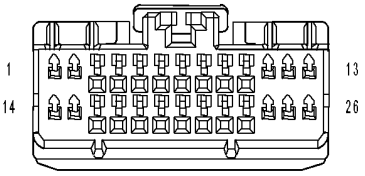
No >> Test complete.

C140B- TRANSFER CASE MOTOR CONTROL CIRCUIT LOW

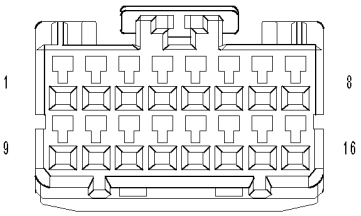




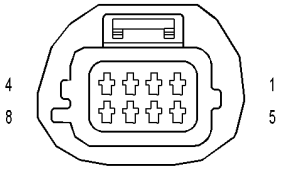
SWITCH- TRANSFER CASE SELECTOR (4X4)



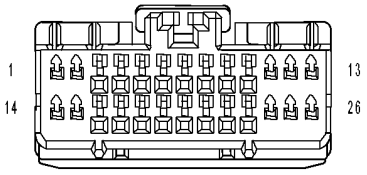
CLUSTER C1



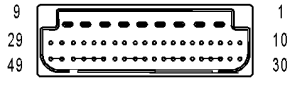
CLUSTER C2



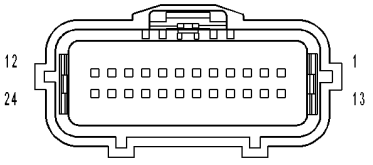
ASSEMBLY- SHIFT MOTOR/ MODE SENSOR (4X4)



CLUSTER C3



MODULE- FRONT CONTROL (IPM)



MODULE- FRONT CONTROL C1

81460930

C140B- TRANSFER CASE MOTOR CONTROL CIRCUIT LOW (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition on. Battery voltage between 9 and 16 volts.
- **Set Condition:**
  FCM detects low voltage on the Transfer Case Motor Control Circuit for 0.5 seconds.

Possible Causes
INTERMITTENT TRANSFER CASE MOTOR CONTROL CIRCUIT LOW
(T315) SHIFT MOTOR CONTROL A CIRCUIT OPEN
(T316) SHIFT MOTOR CONTROL B CIRCUIT OPEN
(T315) SHIFT MOTOR CONTROL A CIRCUIT SHORTED TO GROUND
(T316) SHIFT MOTOR CONTROL B CIRCUIT SHORTED TO GROUND
(T315) SHIFT MOTOR CONTROL A CIRCUIT SHORTED TO THE (T316) SHIFT MOTOR CONTROL B CIRCUIT
SHIFT MOTOR/MODE SENSOR ASSEMBLY
INTEGRATED POWER MODULE
FRONT CONTROL MODULE

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go to 2

No >> Go to 16

---

2. SHIFT MOTOR CIRCUIT RESISTANCE

Turn the ignition off.

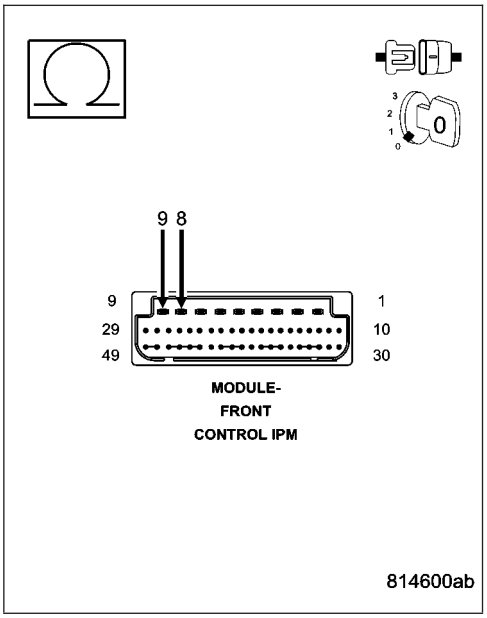
Remove the Front Control Module (FCM) from the Integrated Power Module (IPM).

Measure the resistance between the (T315) Shift Motor Control A circuit and the (T316) Shift Motor Control B circuit at the FCM connector in the IPM.

Is the resistance between 40 and 100 ohms?

Yes >> Go to 15

No >> Go to 3



C140B- TRANSFER CASE MOTOR CONTROL CIRCUIT LOW (CONTINUED)

3. (T315) SHIFT MOTOR CONTROL A CIRCUIT OPEN

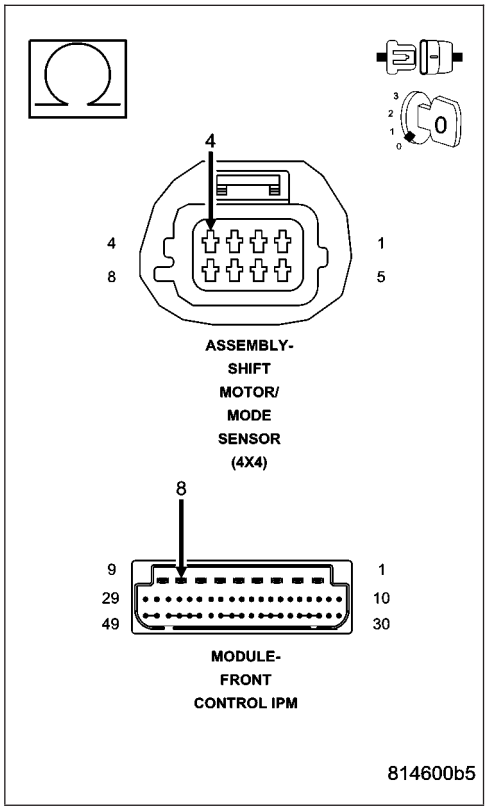
Disconnect the Shift Motor/Mode Sensor Assembly harness connector.

Measure the resistance of the (T315) Shift Motor Control A circuit from the Shift Motor/Mode Sensor Assembly harness connector to the FCM connector in the IPM.

Is the resistance above 5.0 ohms?

Yes >> Go to 4

No >> Go to 5



4. (T315) SHIFT MOTOR CONTROL A CIRCUIT OPEN (IPM)

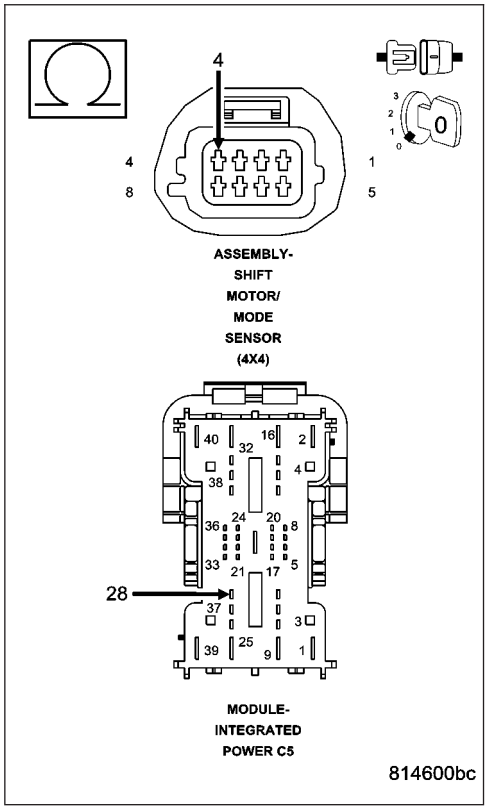
Disconnect the Integrated Power Module C5 harness connector.

Measure the resistance of the (T315) Shift Motor Control A circuit from the Shift Motor/Mode Sensor Assembly harness connector to the Integrated Power Module C5 harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T315) Shift Motor Control A circuit for an open. Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

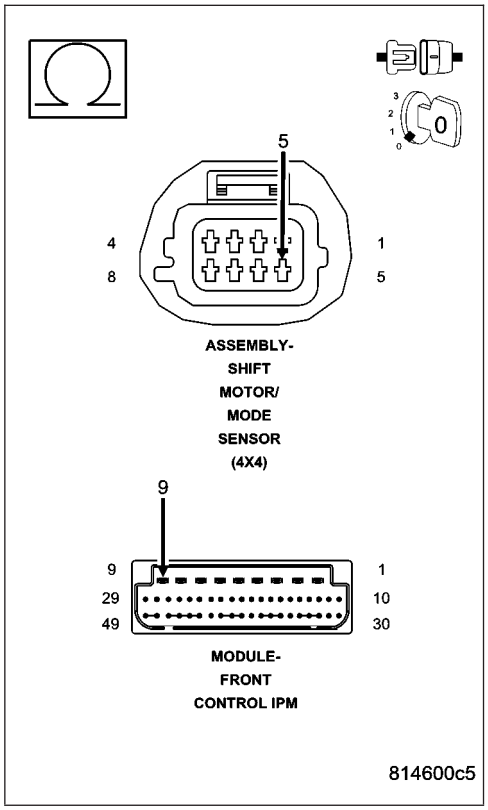
No >> Go to 14



C140B- TRANSFER CASE MOTOR CONTROL CIRCUIT LOW (CONTINUED)

5. (T316) SHIFT MOTOR CONTROL B CIRCUIT OPEN

Measure the resistance of the (T316) Shift Motor Control B circuit from the Shift Motor/Mode Sensor Assembly harness connector to the FCM connector in the IPM.



Is the resistance above 5.0 ohms?

Yes >> Go to 6

No >> Go to 7

C140B- TRANSFER CASE MOTOR CONTROL CIRCUIT LOW (CONTINUED)

6. (T316) SHIFT MOTOR CONTROL B CIRCUIT OPEN (IPM)

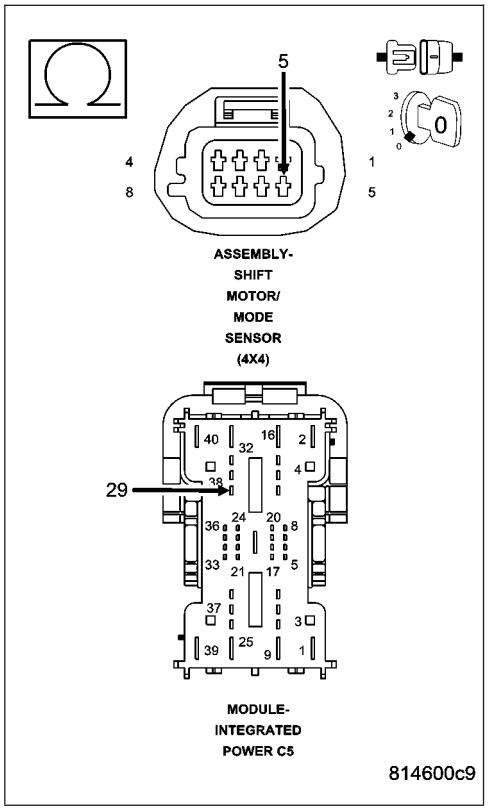
Disconnect the Integrated Power Module C5 harness connector.

Measure the resistance of the (T316) Shift Motor Control B circuit from the Shift Motor/Mode Sensor Assembly harness connector to the Integrated Power Module C5 harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T316) Shift Motor Control B circuit for an open. Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 14



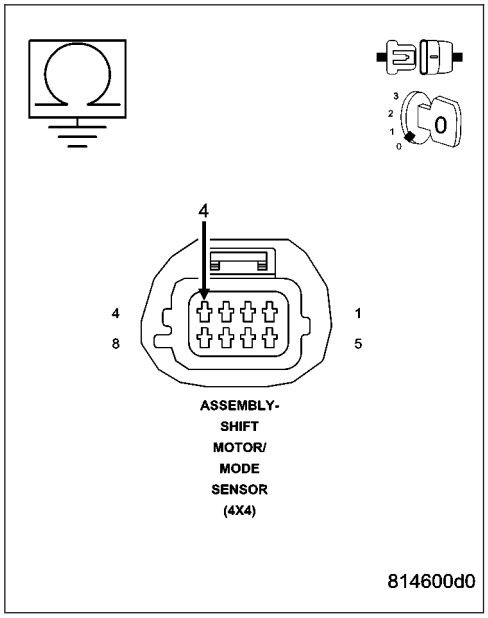
7. (T315) SHIFT MOTOR CONTROL A CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (T315) Shift Motor Control A circuit at the Shift Motor/Mode Sensor Assembly harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go to 8

No >> Go to 9



C140B- TRANSFER CASE MOTOR CONTROL CIRCUIT LOW (CONTINUED)

8. (T315) SHIFT MOTOR CONTROL A CIRCUIT SHORTED TO GROUND (IPM)

Disconnect the Integrated Power Module C5 harness connector.

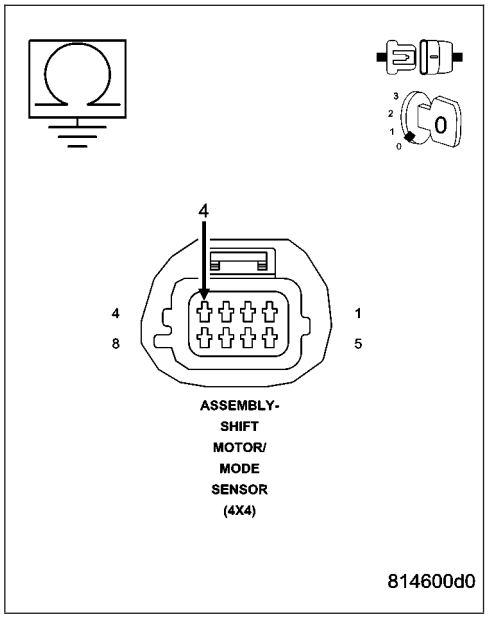
Measure the resistance between ground and the (T315) Shift Motor Control A circuit at the Shift Motor/Mode Sensor Assembly harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T315) Shift Motor Control A circuit for a short to ground.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 14



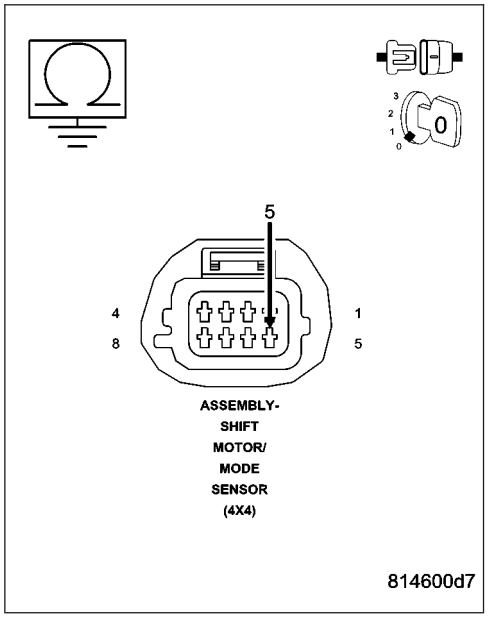
9. (T316) SHIFT MOTOR CONTROL B CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (T316) Shift Motor Control B circuit at the Shift Motor/Mode Sensor Assembly harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go to 10

No >> Go to 11



C140B- TRANSFER CASE MOTOR CONTROL CIRCUIT LOW (CONTINUED)

10. (T316) SHIFT MOTOR CONTROL B CIRCUIT SHORTED TO GROUND (IPM)

Disconnect the Integrated Power Module C5 harness connector.

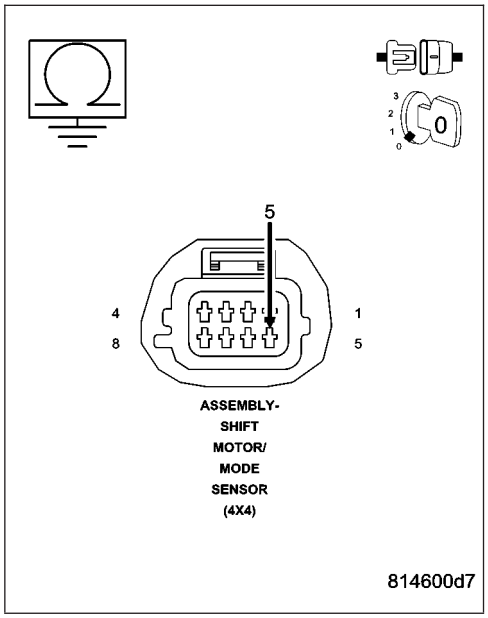
Measure the resistance between ground and the (T316) Shift Motor Control B circuit at the Shift Motor/Mode Sensor Assembly harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the (T316) Shift Motor Control B circuit for a short to ground.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 14



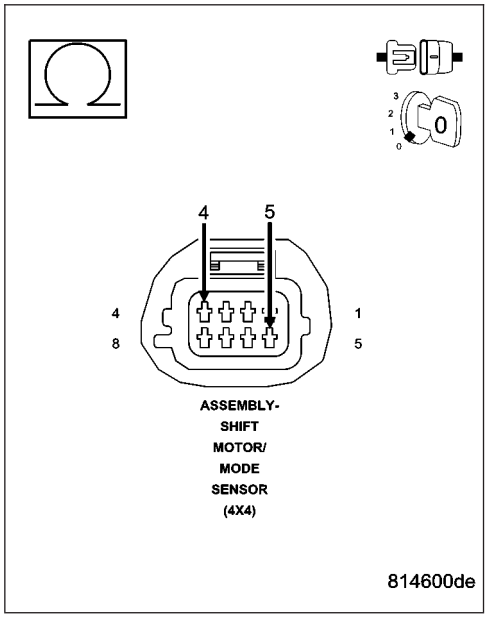
11. (T315) SHIFT MOTOR CONTROL A CIRCUIT SHORTED TO (T316) SHIFT MOTOR CONTROL B CIRCUIT

Measure the resistance between (T315) Shift Motor Control A circuit and the (T316) Shift Motor Control B circuit at the Shift Motor/Mode Sensor Assembly harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go to 12

No >> Go to 13

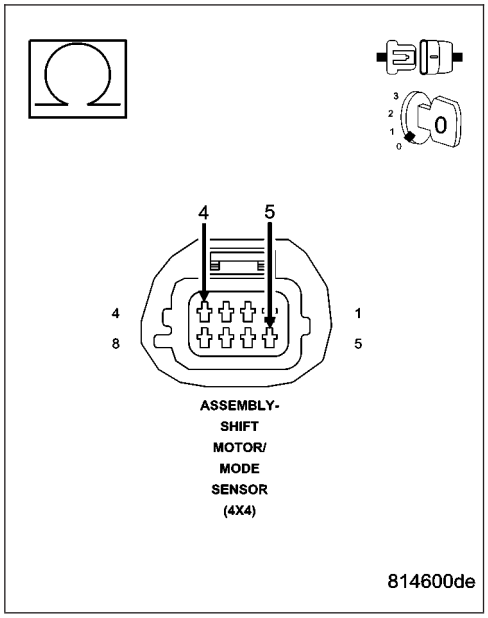


C140B- TRANSFER CASE MOTOR CONTROL CIRCUIT LOW (CONTINUED)

12. (T315) SHIFT MOTOR CONTROL A CIRCUIT SHORTED TO (T316) SHIFT MOTOR CONTROL B CIRCUIT (IPM)

Disconnect the Integrated Power Module C5 harness connector.

Measure the resistance between (T315) Shift Motor Control A circuit and the (T316) Shift Motor Control B circuit at the Shift Motor/Mode Sensor Assembly harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T315) Shift Motor Control A circuit for a short to the (T316) Shift Motor Control B circuit.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 14

---

13. SHIFT MOTOR/MODE SENSOR ASSEMBLY

Using the wiring diagram/schematic as a guide, inspect all wiring and connectors that pertain to this circuit.

Were any problems found?

Yes >> Repair as necessary.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the Shift Motor/Mode Sensor assembly in accordance with the Service Information.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

14. INTEGRATED POWER MODULE

Using the wiring diagram/schematic as a guide, inspect all wiring and connectors that pertain to this circuit.

Were any problems found?

Yes >> Repair as necessary.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the Integrated Power Module in accordance with the Service Information.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

C140B- TRANSFER CASE MOTOR CONTROL CIRCUIT LOW (CONTINUED)

15. FRONT CONTROL MODULE

Using the wiring diagram/schematic as a guide, inspect all wiring and connectors that pertain to this circuit.

Were any problems found?

Yes >> Repair as necessary.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the Front Control Module in accordance with the Service Information.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

16. INTERMITTENT WIRING AND CONNECTORS

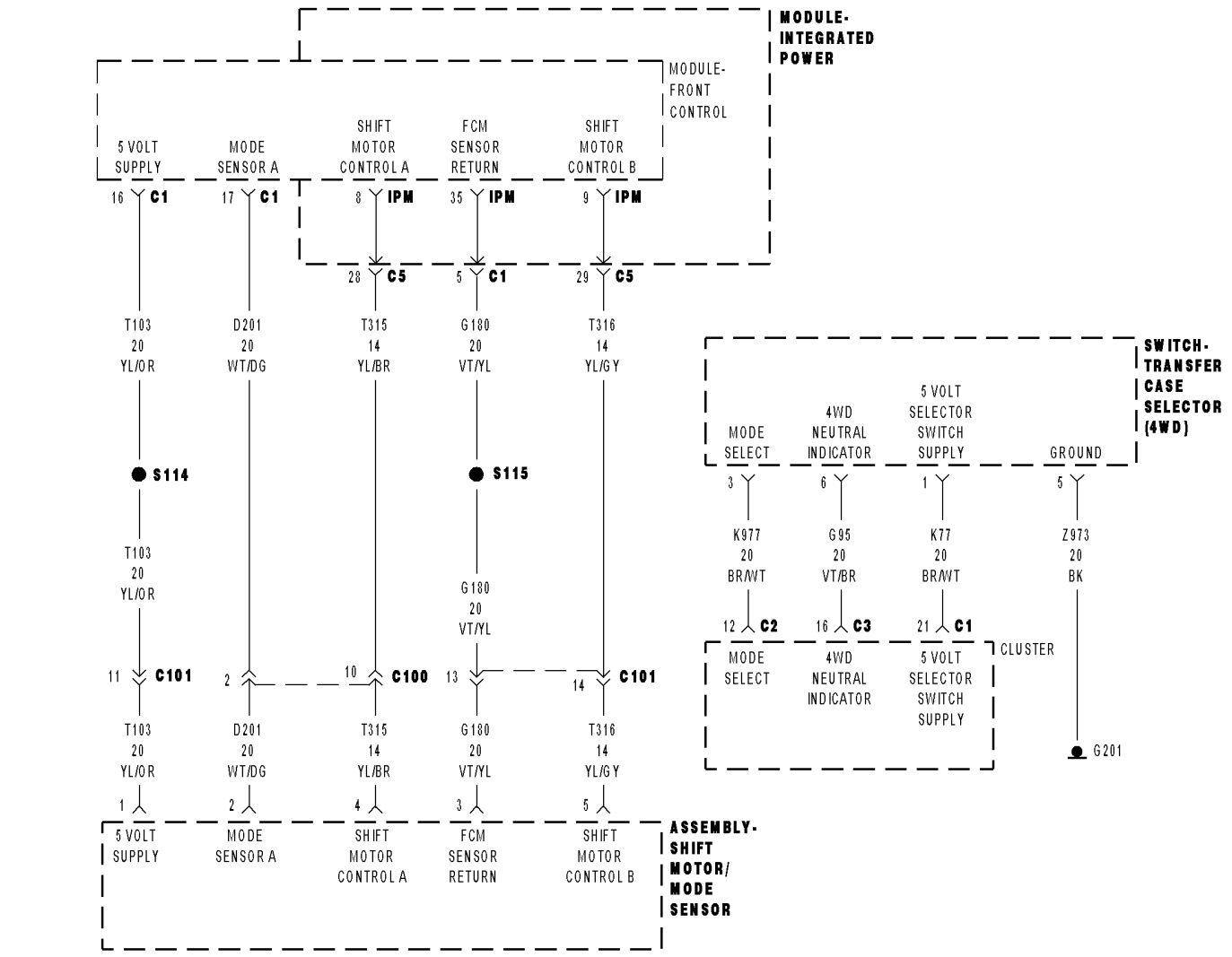
The conditions necessary to set this DTC are not present at this time.
Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.
Look for the data to change or for the DTC to reset during the wiggle test.

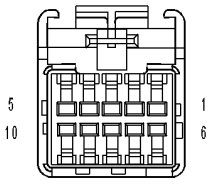
Were any problems found?

Yes >> Repair as necessary.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

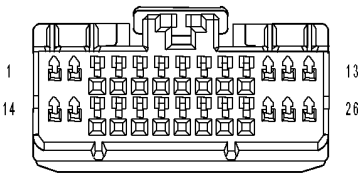
No >> Test complete.

C140C- TRANSFER CASE MOTOR CONTROL CIRCUIT HIGH

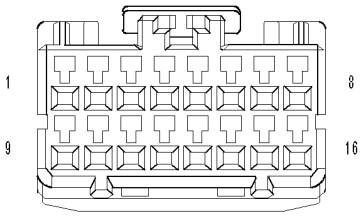




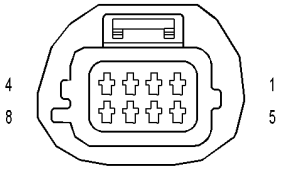
SWITCH- TRANSFER CASE SELECTOR (4X4)



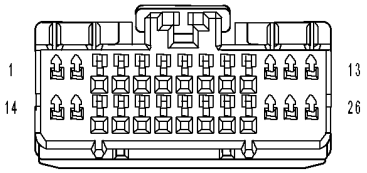
CLUSTER C1



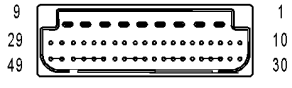
CLUSTER C2



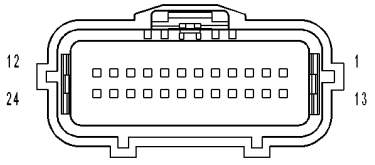
ASSEMBLY- SHIFT MOTOR/ MODE SENSOR (4X4)



CLUSTER C3



MODULE- FRONT CONTROL (IPM)



MODULE- FRONT CONTROL C1

81460930

C140C- TRANSFER CASE MOTOR CONTROL CIRCUIT HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition on. Battery voltage between 9 and 16 volts.
- **Set Condition:**
  The FCM detects high voltage on the Transfer Case Motor Control Circuit for 2 seconds.

Possible Causes
INTERMITTENT TRANSFER CASE MOTOR CONTROL CIRCUIT HIGH
(T315) SHIFT MOTOR CONTROL A CIRCUIT OPEN
(T316) SHIFT MOTOR CONTROL B CIRCUIT OPEN
(T315) SHIFT MOTOR CONTROL A CIRCUIT SHORTED TO VOLTAGE
(T316) SHIFT MOTOR CONTROL B CIRCUIT SHORTED TO VOLTAGE
(T315) SHIFT MOTOR CONTROL A CIRCUIT SHORTED TO (T316) SHIFT MOTOR CONTROL B CIRCUIT
SHIFT MOTOR/MODE SENSOR ASSEMBLY
INTEGRATED POWER MODULE
FRONT CONTROL MODULE

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes >> Go to 2

No >> Go to 14

---

2. (T315) SHIFT MOTOR CONTROL A CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Shift Motor/Mode Sensor Assembly connector.

Remove the Front Control Module (FCM) from the Integrated Power Module (IPM).

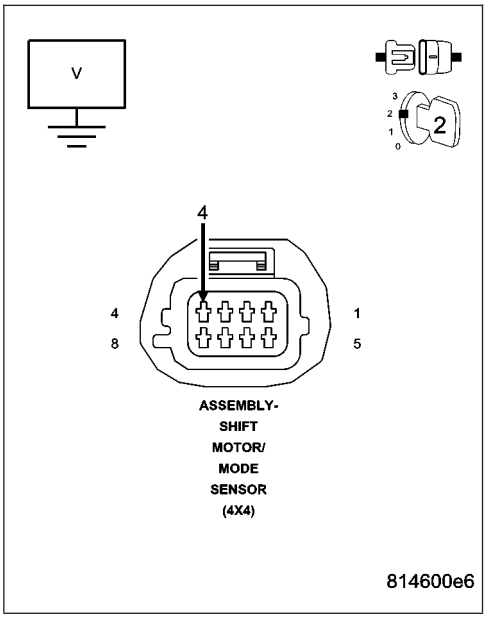
Turn the ignition on.

Measure the voltage of the (T315) Shift Motor Control A circuit at the Shift Motor/Mode Sensor Assembly connector.

Is there any voltage present?

Yes >> Repair the (T315) Shift Motor Control A circuit for a short to voltage.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 3



C140C- TRANSFER CASE MOTOR CONTROL CIRCUIT HIGH (CONTINUED)

3. (T316) SHIFT MOTOR CONTROL B CIRCUIT SHORTED TO VOLTAGE

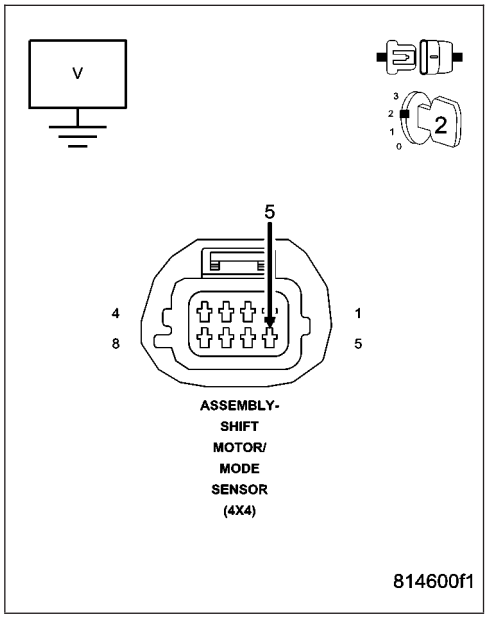
Measure the voltage of the (T316) Shift Motor Control B circuit at the Shift Motor/Mode Sensor Assembly connector.

Is there any voltage present?

Yes >> Repair the (T316) Shift Motor Control B circuit for a short to voltage.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 4



4. SHIFT MOTOR CIRCUIT RESISTANCE AT FCM CONNECTOR

Turn the ignition off.

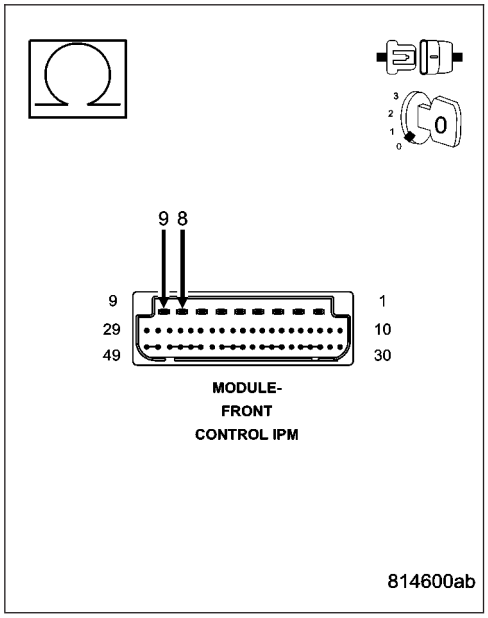
Connect the Shift Motor/Mode Sensor Assembly connector.

Measure the resistance between the (T315) Shift Motor Control A circuit and the (T316) Shift Motor Control B circuit in the FCM connector of the IPM.

Is the resistance between 40 and 100 ohms?

Yes >> Go to 13

No >> Go to 5



C140C- TRANSFER CASE MOTOR CONTROL CIRCUIT HIGH (CONTINUED)

5. (T315) SHIFT MOTOR CONTROL A CIRCUIT OPEN

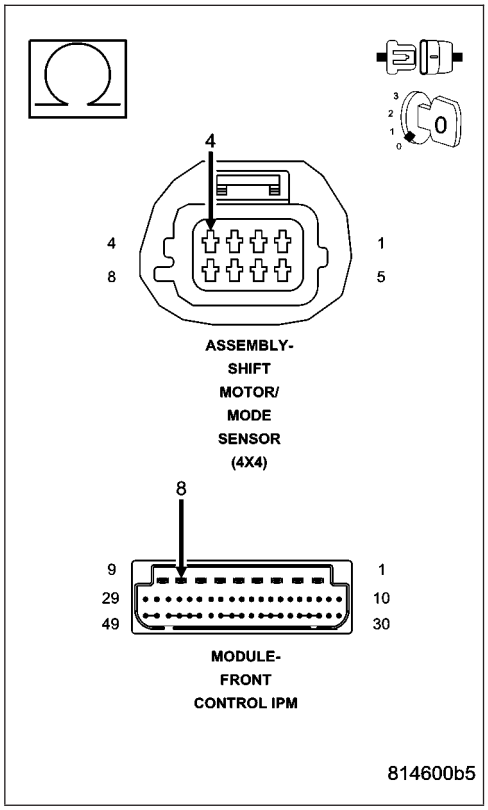
Disconnect the Shift Motor/Mode Sensor Assembly harness connector.

Measure the resistance of the (T315) Shift Motor Control A circuit from the Shift Motor/Mode Sensor Assembly harness connector to the FCM connector in the IPM.

Is the resistance above 5.0 ohms?

Yes >> Go to 6

No >> Go to 7



6. (T315) SHIFT MOTOR CONTROL A CIRCUIT OPEN (IPM)

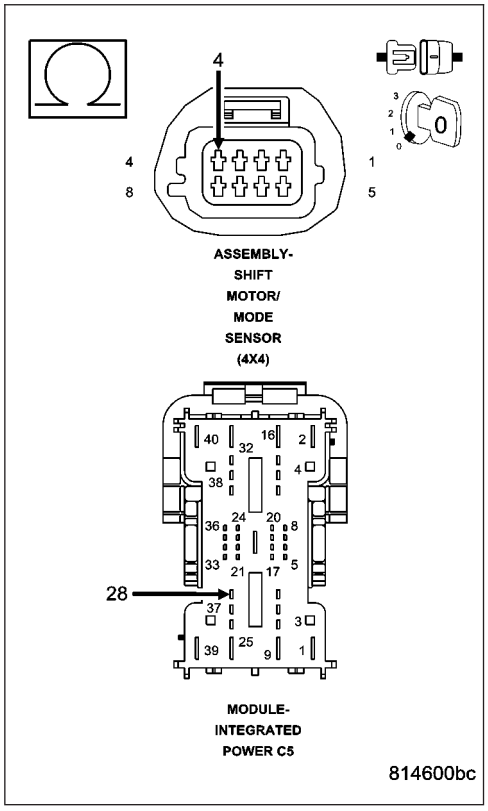
Disconnect the Integrated Power Module C5 harness connector.

Measure the resistance of the (T315) Shift Motor Control A circuit from the Shift Motor/Mode Sensor Assembly harness connector to the Integrated Power Module C5 harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T315) Shift Motor Control A circuit for an open. Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

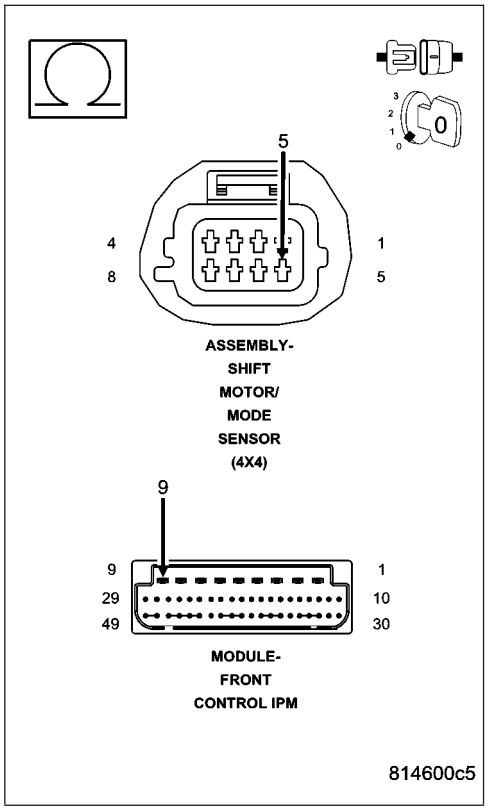
No >> Go to 12



C140C- TRANSFER CASE MOTOR CONTROL CIRCUIT HIGH (CONTINUED)

7. (T316) SHIFT MOTOR CONTROL B CIRCUIT OPEN

Measure the resistance of the (T316) Shift Motor Control B circuit from the Shift Motor/Mode Sensor Assembly harness connector to the FCM connector in the IPM.



Is the resistance above 5.0 ohms?

Yes >> Go to 8

No >> Go to 9

C140C- TRANSFER CASE MOTOR CONTROL CIRCUIT HIGH (CONTINUED)

8. (T316) SHIFT MOTOR CONTROL B CIRCUIT OPEN (IPM)

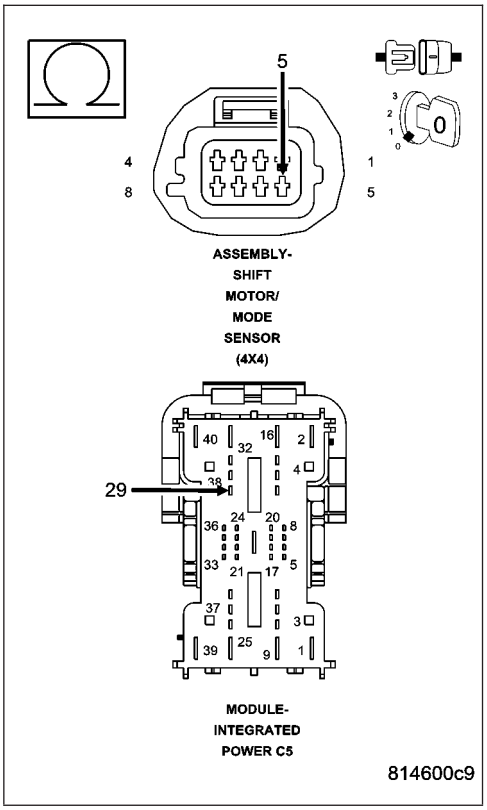
Disconnect the Integrated Power Module C5 harness connector.

Measure the resistance of the (T316) Shift Motor Control B circuit from the Shift Motor/Mode Sensor Assembly harness connector to the Integrated Power Module C5 harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the (T316) Shift Motor Control B circuit for an open. Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 12



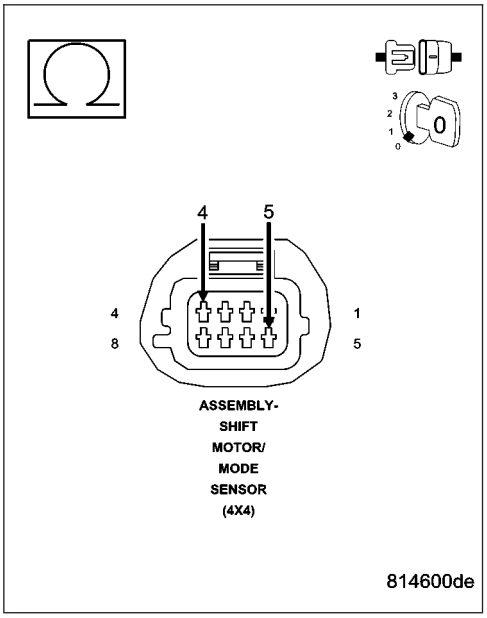
9. (T315) SHIFT MOTOR CONTROL A CIRCUIT SHORTED TO (T316) SHIFT MOTOR CONTROL B CIRCUIT

Measure the resistance between (T315) Shift Motor Control A circuit and the (T316) Shift Motor Control B circuit at the Shift Motor/Mode Sensor Assembly harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go to 10

No >> Go to 11

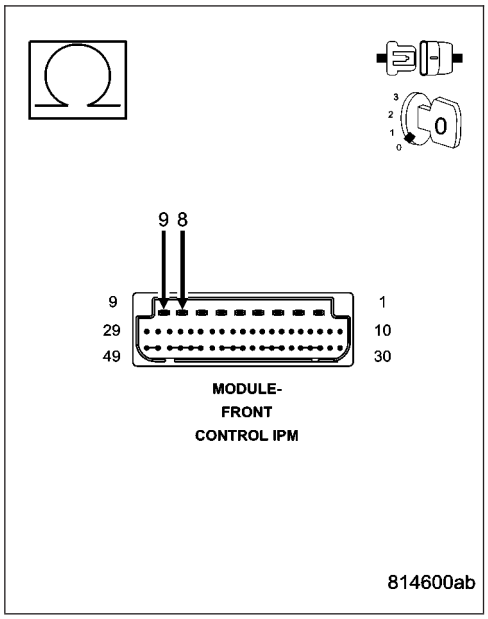


C140C- TRANSFER CASE MOTOR CONTROL CIRCUIT HIGH (CONTINUED)

10. (T315) SHIFT MOTOR CONTROL A CIRCUIT SHORTED TO (T316) SHIFT MOTOR CONTROL B CIRCUIT (IPM)

Disconnect the Integrated Power Module C5 harness connector.

Measure the resistance between (T315) Shift Motor Control A circuit and the (T316) Shift Motor Control B circuit at the Shift Motor/Mode Sensor Assembly harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the (T315) Shift Motor Control A circuit for a short to the (T316) Shift Motor Control B circuit.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 12

---

11. SHIFT MOTOR/MODE SENSOR ASSEMBLY

Using the wiring diagram/schematic as a guide, inspect all wiring and connectors that pertain to this circuit.

Were any problems found?

Yes >> Repair as necessary.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the Shift Motor/Mode Sensor assembly in accordance with the Service Information.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

12. INTEGRATED POWER MODULE

Using the wiring diagram/schematic as a guide, inspect all wiring and connectors that pertain to this circuit.

Were any problems found?

Yes >> Repair as necessary.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the Integrated Power Module in accordance with the Service Information.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

C140C- TRANSFER CASE MOTOR CONTROL CIRCUIT HIGH (CONTINUED)

13. FRONT CONTROL MODULE

Using the wiring diagram/schematic as a guide, inspect all wiring and connectors that pertain to this circuit.

Were any problems found?

Yes >> Repair as necessary.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the Front Control Module in accordance with the Service Information.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

14. INTERMITTENT WIRING AND CONNECTORS

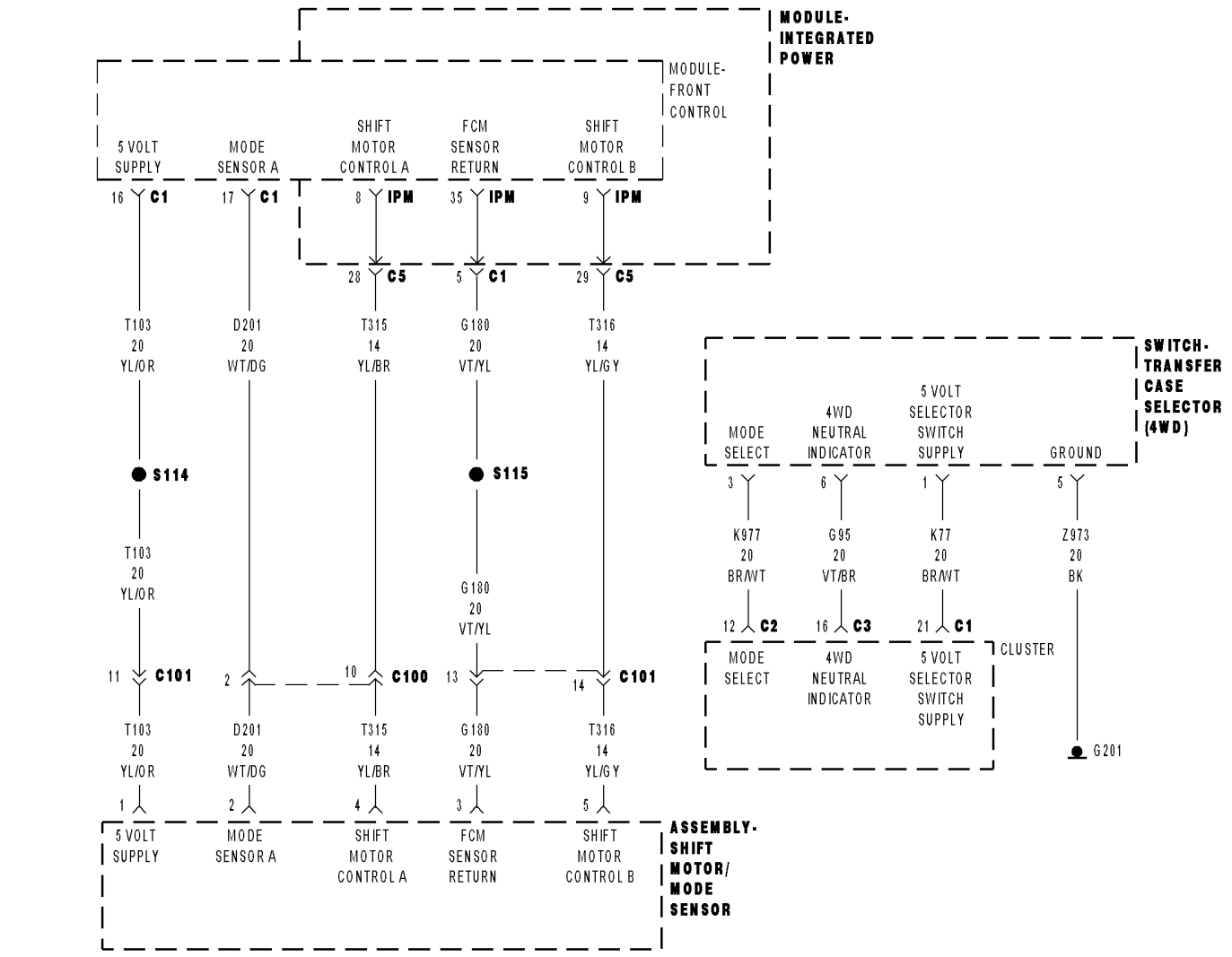
The conditions necessary to set this DTC are not present at this time.
Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.
Look for the data to change or for the DTC to reset during the wiggle test.

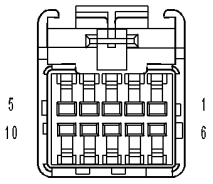
Were any problems found?

Yes >> Repair as necessary.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

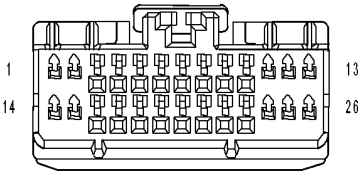
No >> Test complete.

C230A- NEUTRAL INDICATOR CONTROL CIRCUIT LOW

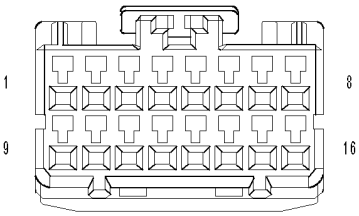




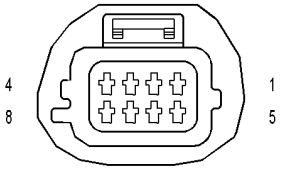
SWITCH- TRANSFER CASE SELECTOR (4X4)



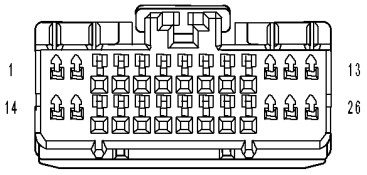
CLUSTER C1



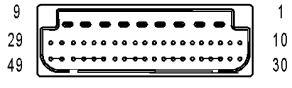
CLUSTER C2



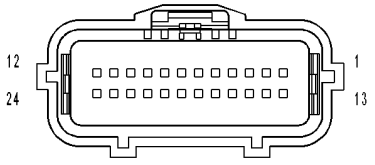
ASSEMBLY- SHIFT MOTOR/ MODE SENSOR (4X4)



CLUSTER C3



MODULE- FRONT CONTROL (IPM)



MODULE- FRONT CONTROL C1

81460930

C230A- NEUTRAL INDICATOR CONTROL CIRCUIT LOW (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Cluster detects low voltage on the Neutral Indicator Control Circuit.

Possible Causes
INTERMITTENT CONDITION
(G95) 4WD NEUTRAL INDICATOR CIRCUIT OPEN
(G95) 4WD NEUTRAL INDICATOR CIRCUIT SHORTED TO GROUND
TRANSFER CASE SELECTOR SWIITCH
INSTRUMENT CLUSTER

Diagnostic Test

1. DTC IS ACTIVE

Ignition on.

With the scan tool, Clear DTCs.

Shift the Transfer Case into neutral for 30 seconds in accordance with the Service Information.

With the scan tool, select View DTCs.

Does this DTC reset?

Yes >> Go to 2

No >> Go to 7

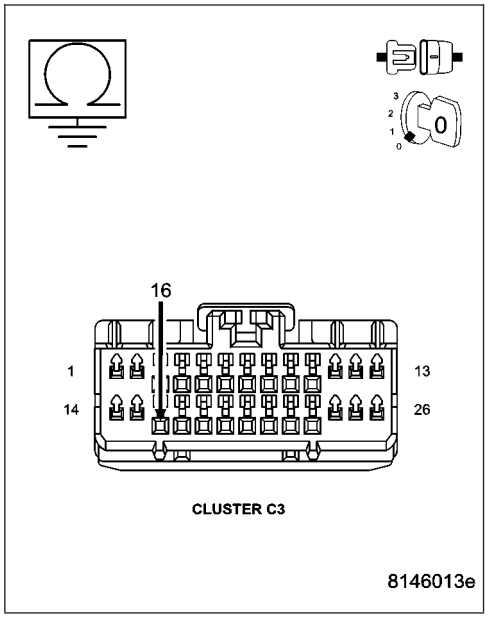
---

2. (G95) 4WD NEUTRAL INDICATOR CIRCUIT RESISTANCE TO GROUND

Turn the ignition off.

Disconnect the Instrument Cluster C3 connector.

Measure the resistance between ground and the (G95) 4WD Neutral Indicator circuit.



Is the resistance below 5.0 ohms?

Yes >> Go to 3

No >> Go to 4

C230A- NEUTRAL INDICATOR CONTROL CIRCUIT LOW (CONTINUED)

3. (G95) 4WD NEUTRAL INDICATOR CIRCUIT SHORTED TO GROUND

Disconnect the Transfer Case Selector Switch connector.

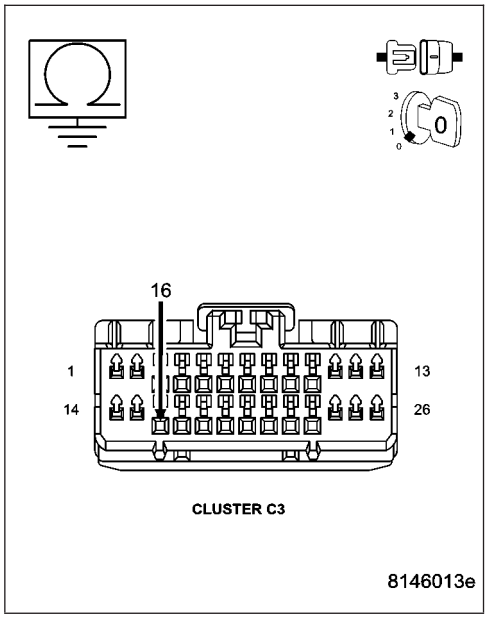
Measure the resistance between ground and the (G95) 4WD Neutral Indicator circuit.

Is the resistance below 5.0 ohms?

Yes >> Repair the (G95) 4WD Neutral Indicator circuit for a short to ground.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 5



4. (G95) 4WD NEUTRAL INDICATOR CIRCUIT OPEN

Disconnect the Transfer Case Selector Switch connector.

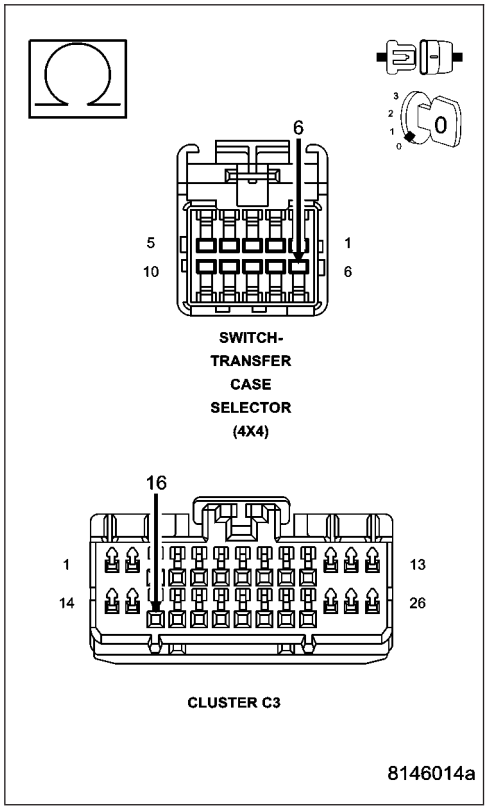
Measure the resistance of the (G95) 4WD Neutral Indicator circuit.

Is the resistance above 5.0 ohms?

Yes >> Repair the open (G95) 4WD Neutral Indicator circuit.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 5



C230A- NEUTRAL INDICATOR CONTROL CIRCUIT LOW (CONTINUED)

5. TRANSFER CASE SELECTOR SWITCH

View repair.

Repair

Replace the Transfer Case Selector Switch in accordance with the Service information.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. INSTRUMENT CLUSTER

View repair.

Repair

Replace the Instrument Cluster in accordance with the Service information.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

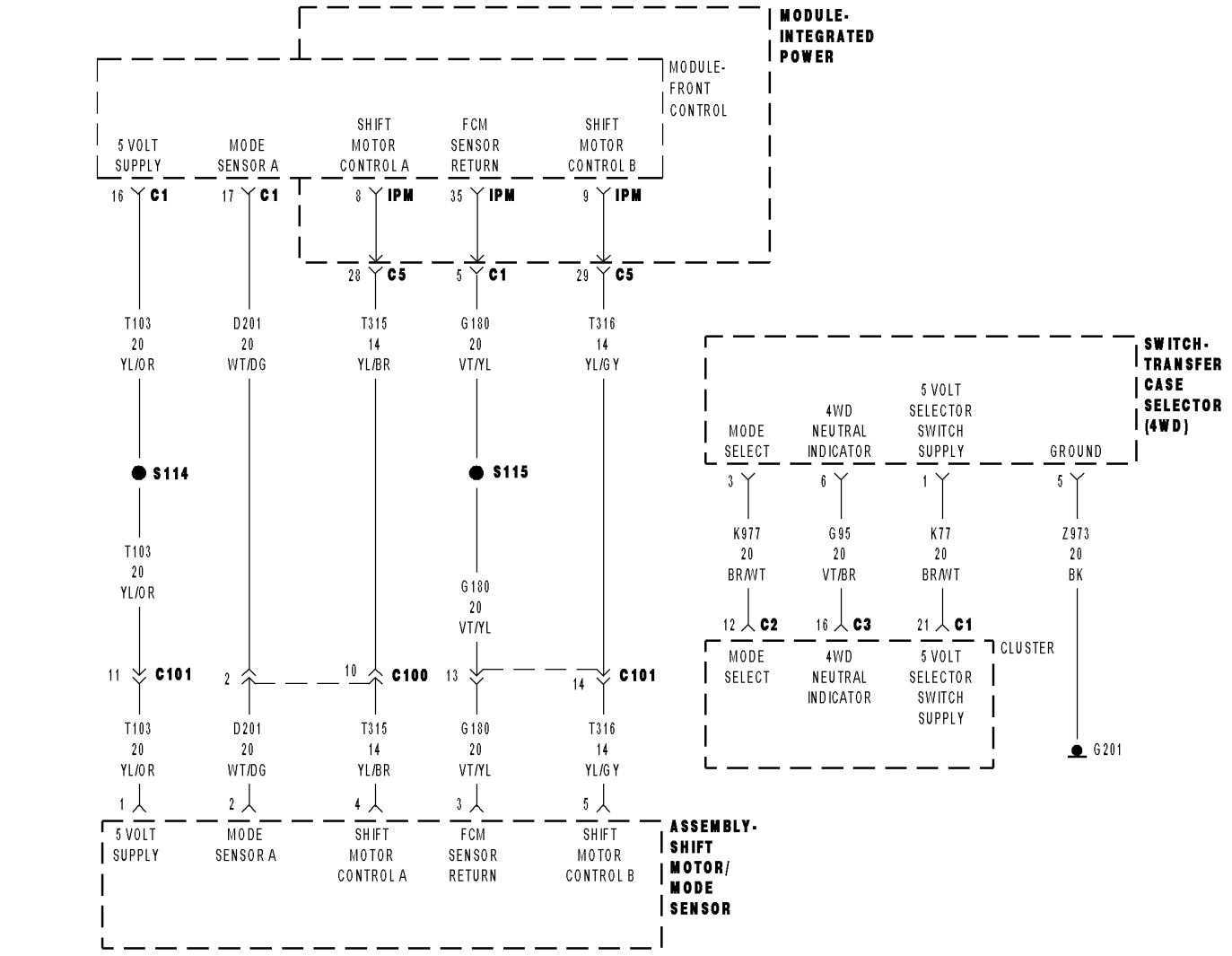
Were any problems found?

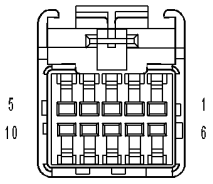
Yes >> Repair as necessary.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

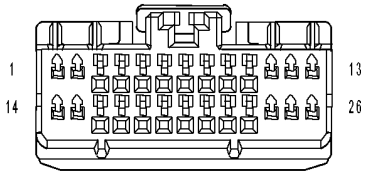
No >> Test complete.

C230B- NEUTRAL INDICATOR CONTROL CIRCUIT HIGH

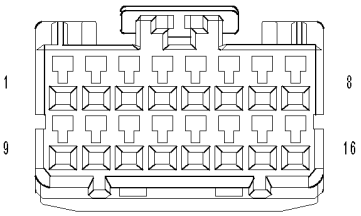




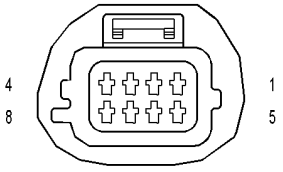
SWITCH- TRANSFER CASE SELECTOR (4X4)



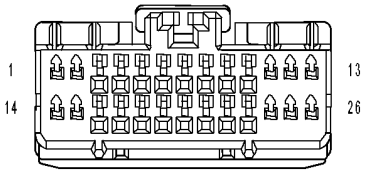
CLUSTER C1



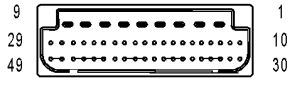
CLUSTER C2



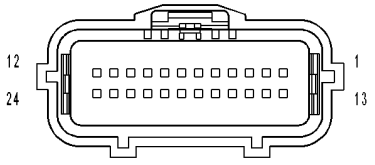
ASSEMBLY- SHIFT MOTOR/ MODE SENSOR (4X4)



CLUSTER C3



MODULE- FRONT CONTROL (IPM)



MODULE- FRONT CONTROL C1

81460930

C230B- NEUTRAL INDICATOR CONTROL CIRCUIT HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Cluster detects high voltage on the Neutral Indicator Control Circuit.

Possible Causes
INTERMITTENT CONDITION
(G95) 4WD NEUTRAL INDICATOR CIRCUIT OPEN
(G95) 4WD NEUTRAL INDICATOR CIRCUIT SHORTED TO VOLTAGE
TRANSFER CASE SELECTOR SWIITCH
INSTRUMENT CLUSTER

Diagnostic Test

1. DTC IS ACTIVE

Ignition on.
With the scan tool, Clear DTCs.
Shift the Transfer Case into neutral for 30 seconds in accordance with the Service Information.
With the scan tool, select View DTCs.

Does this DTC reset?

Yes >> Go to 2
No >> Go to 7

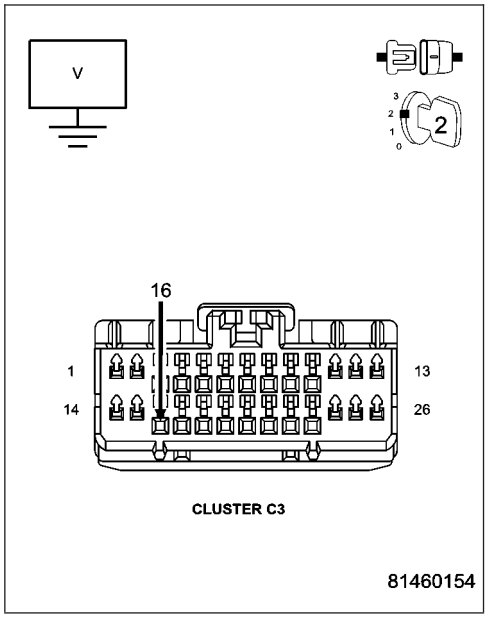
---

2. (G95) 4WD NEUTRAL INDICATOR CIRCUIT VOLTAGE

Turn the ignition off.
Disconnect the Instrument Cluster C3 connector.
Turn the ignition on.
Measure the voltage of the (G95) 4WD Neutral Indicator circuit.

Is there any voltage present?

Yes >> Go to 3
No >> Go to 4



C230B- NEUTRAL INDICATOR CONTROL CIRCUIT HIGH (CONTINUED)

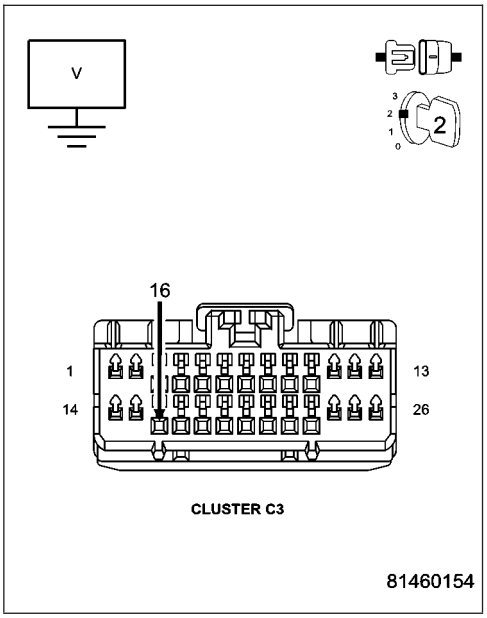
3. (G95) 4WD NEUTRAL INDICATOR CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the Transfer Case Selector Switch connector.
Turn the ignition on.
Measure the voltage of the (G95) 4WD Neutral Indicator circuit.

Is there any voltage present?

Yes >> Repair the (G95) 4WD Neutral Indicator circuit for a short to voltage.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 5



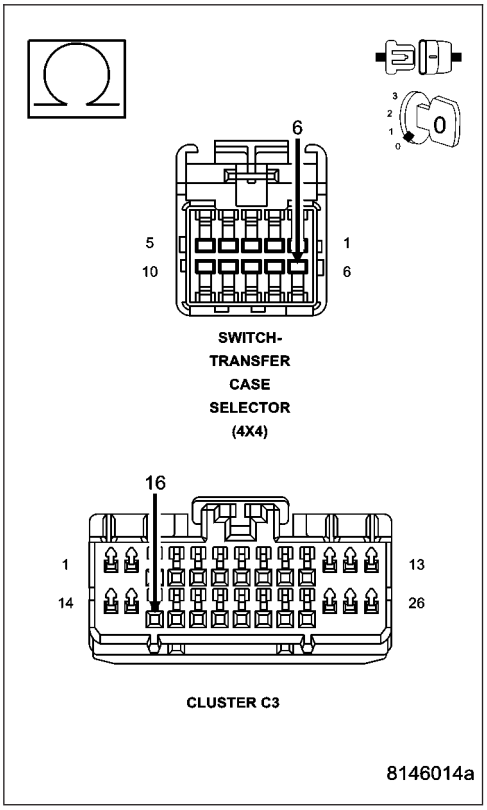
4. (G95) 4WD NEUTRAL INDICATOR CIRCUIT OPEN

Disconnect the Transfer Case Selector Switch connector.
Measure the resistance of the (G95) 4WD Neutral Indicator Control circuit.

Is the resistance above 5.0 ohms?

Yes >> Repair the open (G95) 4WD Neutral Indicator circuit.
Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go to 6



C230B- NEUTRAL INDICATOR CONTROL CIRCUIT HIGH (CONTINUED)

5. TRANSFER CASE SELECTOR SWITCH

View repair.

Repair

Replace the Transfer Case Selector Switch in accordance with the Service information.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. INSTRUMENT CLUSTER

View repair.

Repair

Replace the Instrument Cluster in accordance with the Service information.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

Yes >> Repair as necessary.

Perform the TRANSFER CASE VERIFICATION TEST-VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Test complete.

TRANSFER CASE - NV233

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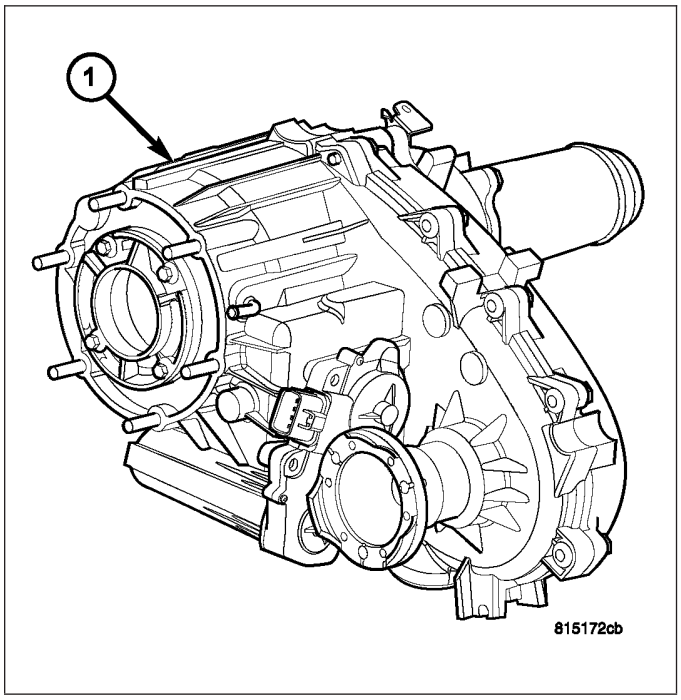
TRANSFER CASE - NV233

DESCRIPTION

The NV233 (1) is an electronically controlled part-time transfer case with a low range gear reduction system. The NV233 has three operating ranges plus a NEUTRAL position. The low range system provides a gear reduction ratio for increased low speed torque capability.

The geartrain is mounted in two aluminum case halves attached with bolts. The mainshaft front and rear bearings are mounted in aluminum retainer housings bolted to the case halves.



OPERATING RANGES

Transfer case operating ranges are:

- 2WD (2-wheel drive)
- 4HI (4-wheel drive)
- 4LO (4-wheel drive low range)
- NEUTRAL

The 2WD range is for use on any road surface at any time.

The 4HI and 4LO ranges are for off road use only. They are not for use on hard surface roads. The only exception being when the road surface is wet or slippery or covered by ice and snow.

The low range reduction gear system is operative in 4LO range only. This range is for extra pulling power in off road situations. Low range reduction ratio is 2.72:1.

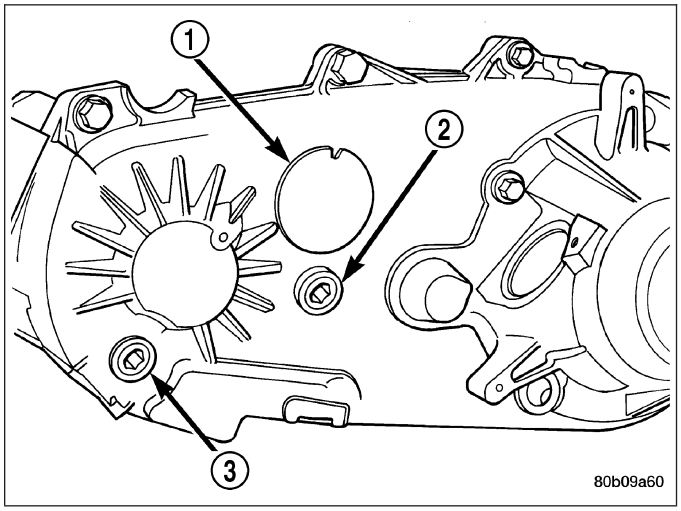
SHIFT MECHANISM

Operating ranges are selected with a dash mounted shift selector switch. The shift selector switch provides a input to the Front Control Module (FCM) to indicate the driver's desire to change operating ranges. The FCM uses this input, along with input from the transfer case mounted mode sensor and information from the vehicle's bus, to determine if a shift is permitted. If the FCM decides the shift is permitted, the FCM controls the shift motor, mounted to the exterior of the transfer case, to perform the shift.

IDENTIFICATION

A circular ID tag (1) is attached to the rear case of each transfer case. The ID tag provides the transfer case model number, assembly number, serial number, and low range ratio.

The transfer case serial number also represents the date of build.



OPERATION

The input gear is splined to the transmission output shaft. The input gear drives the mainshaft through the planetary assembly and range sleeve. The front output shaft is operated by a drive chain that connects the shaft to a drive sprocket on the mainshaft. The drive sprocket is engaged/disengaged by the mode fork, which operates the mode sleeve and hub. The sleeve and hub are not equipped with a synchronizer mechanism for shifting.

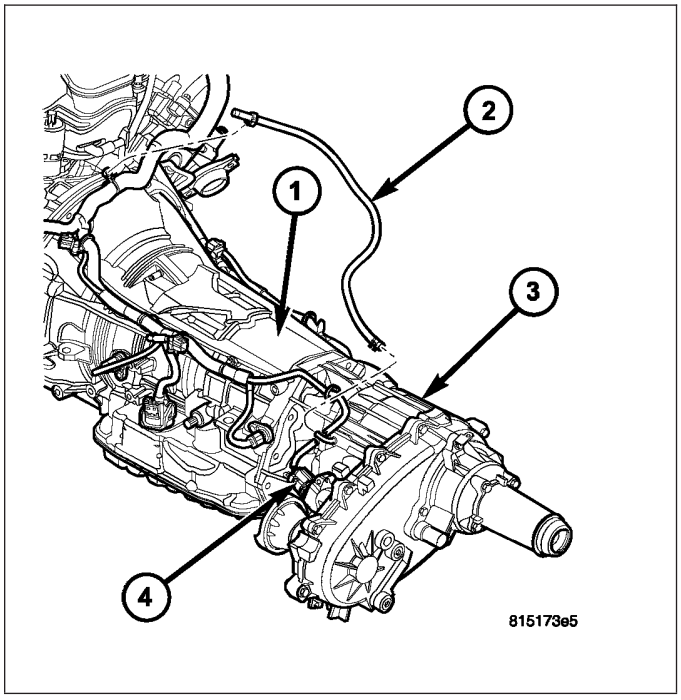
DIAGNOSIS AND TESTING - TRANSFER CASE - NV233

DIAGNOSIS CHART

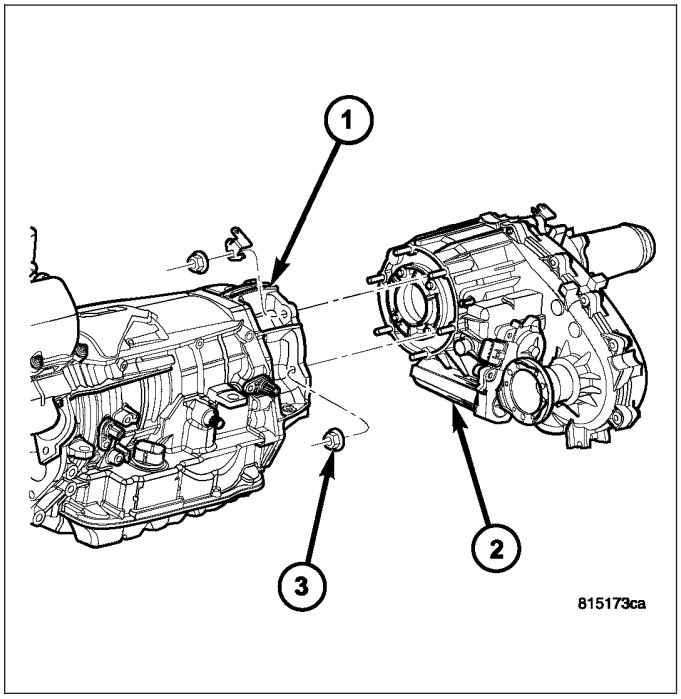
Condition	Possible Cause	Correction
Transfer case difficult to shift or will not shift into desired range.	1) Transfer case electronically controlled shift system malfunction.	1) Verify proper operation per the appropriate diagnostic manual.
	2) If vehicle was operated for an extended period in 4HI mode on dry surface, driveline torque load may cause difficulty.	2) Drive the vehicle in a straight line and momentarily release the accelerator. The transfer case can then be shifted to the desired mode.
	3) Insufficient or incorrect lubricant.	3) Drain and refill transfer case with the correct quantity of Mopar® ATF +4, Automatic Transmission Fluid.
	4) Internal transfer case components binding, worn, or damaged.	4) Repair or replace components as necessary.
Transfer case noisy in all drive modes.	1) Insufficient or incorrect lubricant.	1) Drain and refill transfer case with the correct quantity of Mopar® ATF +4, Automatic Transmission Fluid.
	2) Internal transfer case components binding, worn, or damaged.	2) Repair or replace components as necessary.
Transfer case noisy while in, or jumps out of, 4LO mode.	1) Transfer case not completely engaged in 4LO position.	1) While rolling 2-3 MPH and the transmission in NEUTRAL, or clutch depressed on vehicles equipped with a manual transmission, shift transfer case to the 2WD or 4HI position, and then back into the 4LO position.
	2) Range fork damaged, inserts worn, or fork is binding on the shift rail.	2) Repair or replace components as necessary.
	3) Low range gear worn or damaged.	3) Repair or replace components as necessary.
Lubricant leaking from transfer case seals or vent.	1) Transfer case overfilled.	1) Drain lubricant to the correct level.
	2) Transfer case vent closed or restricted.	2) Clean or replace vent as necessary.
	3) Transfer case seals damaged or installed incorrectly.	3) Replace suspect seal.
Abnormal tire wear.	1) Extended operation in 4HI mode on dry surfaces,	1) Operate vehicle in 2WD mode on dry surfaces.

REMOVAL

1. Shift transfer case into 2WD.
2. Raise vehicle.
3. Drain transfer case lubricant.
4. Support transmission with jack stand.
5. Remove rear crossmember and skid plate, if equipped.
6. Disconnect front and rear propeller shafts at transfer case. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
7. Disconnect transfer case shift motor and mode sensor wire connectors (4).
8. Disconnect transfer case vent hose (2) from the transfer case (3).



9. Support transfer case with transmission jack.
10. Secure transfer case to jack with chains.
11. Remove nuts (3) attaching transfer case (2) to transmission (1).
12. Pull transfer case and jack rearward to disengage transfer case.
13. Remove transfer case from under vehicle.

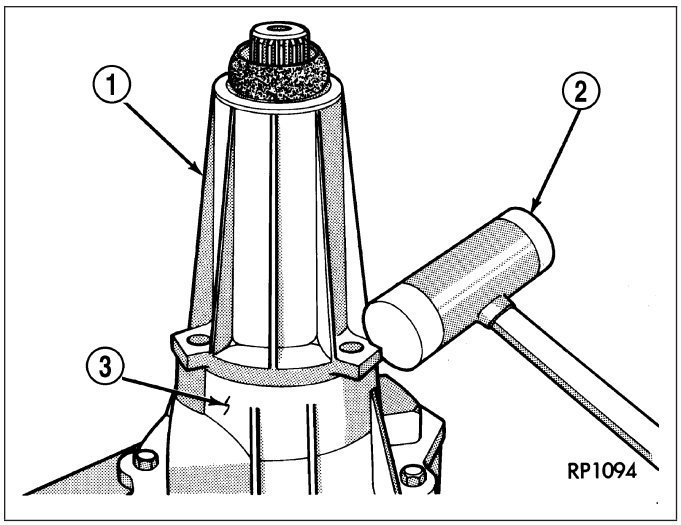


DISASSEMBLY

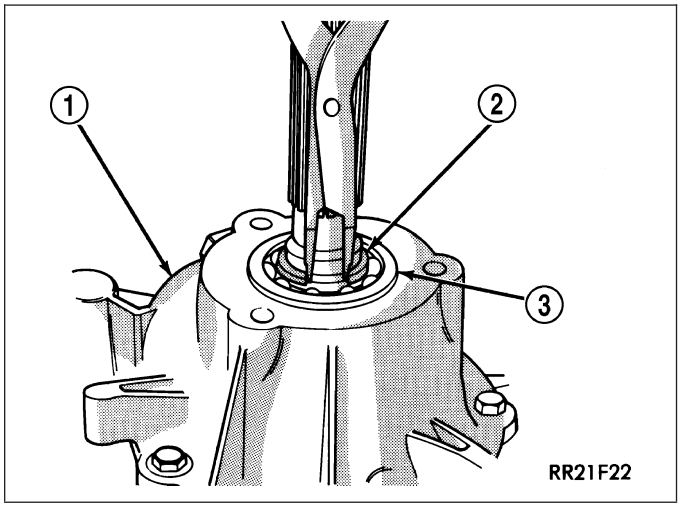
Position transfer case on shallow drain pan. Remove drain plug and drain lubricant remaining in case.

REAR RETAINER AND OIL PUMP

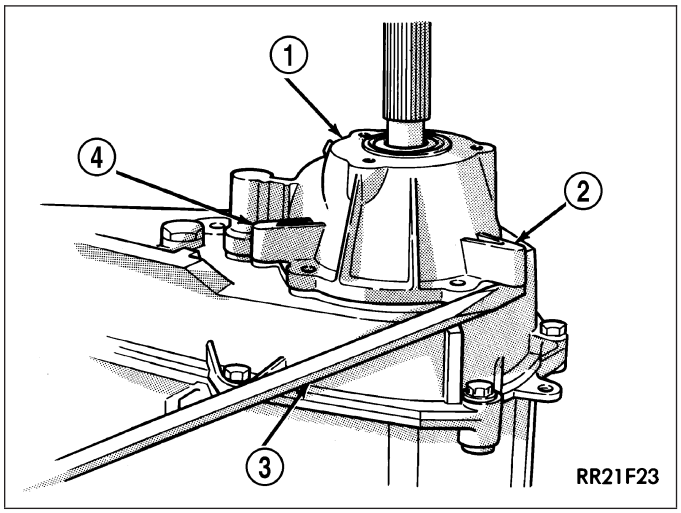
1. Remove extension housing bolts.
2. Tap extension housing (1) with plastic or rawhide mallet (2) to loosen sealer.



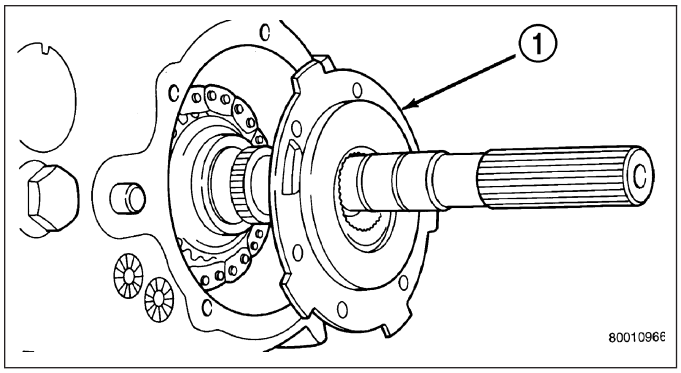
3. Separate extension housing from rear retainer.
4. Remove rear bearing snap-ring.



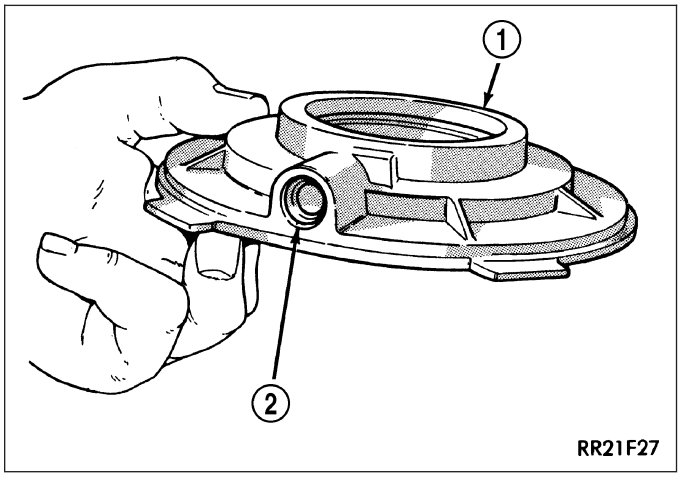
5. Remove bolts holding rear retainer to rear case half.
6. Loosen rear retainer (1) with pry tool (3) to break sealer bead. Pry only against retainer boss as shown.



7. Disengage oil pickup tube from oil pump (1) and remove oil pump assembly.

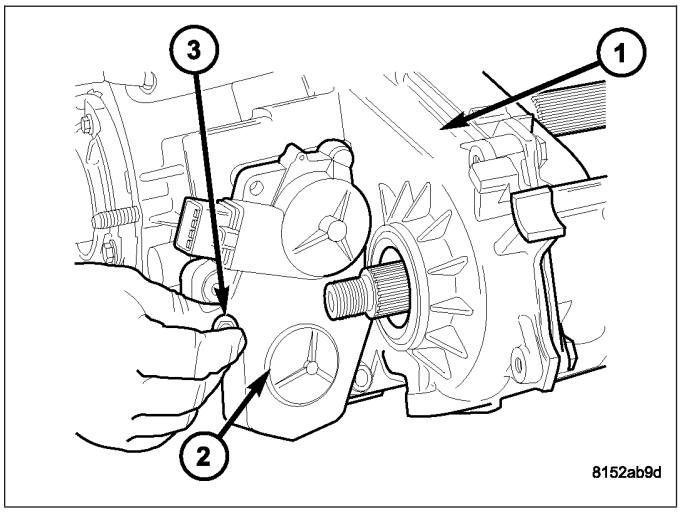


8. Remove pick-up tube o-ring (2) from oil pump (1), if necessary. Do not disassemble the oil pump, it is not serviceable.



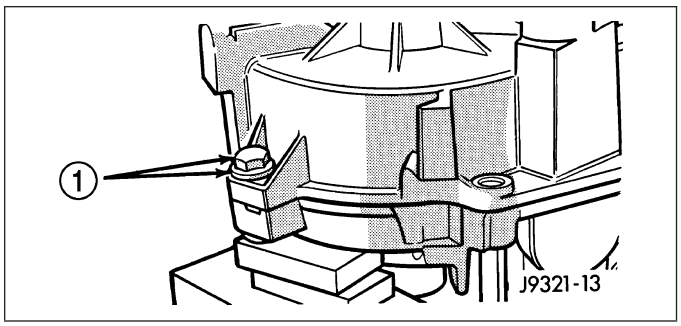
COMPANION FLANGE AND SHIFT MOTOR ASSEMBLY

1. Remove front companion flange nut with a socket and impact wrench
2. Remove the front companion flange. If the flange is difficult to remove by hand, remove it with bearing splitter, or with standard two jaw puller. Be sure puller tool is positioned on the flange and not on the slinger, as slinger will be damaged.
3. Remove seal washer from front output shaft. Discard washer as it should not be reused.
4. Remove the bolts (3) which hold the shift motor and mode sensor assembly (2) to the transfer case (1).
5. Remove the shift motor and mode sensor assembly from the transfer case.

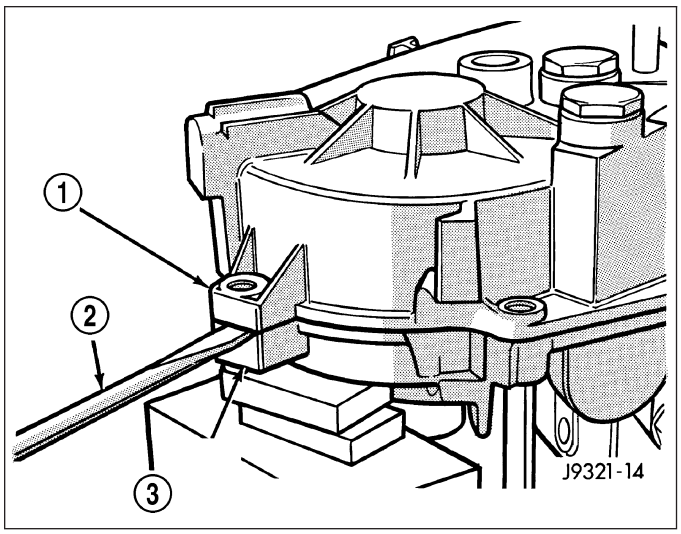


FRONT OUTPUT SHAFT AND DRIVE CHAIN

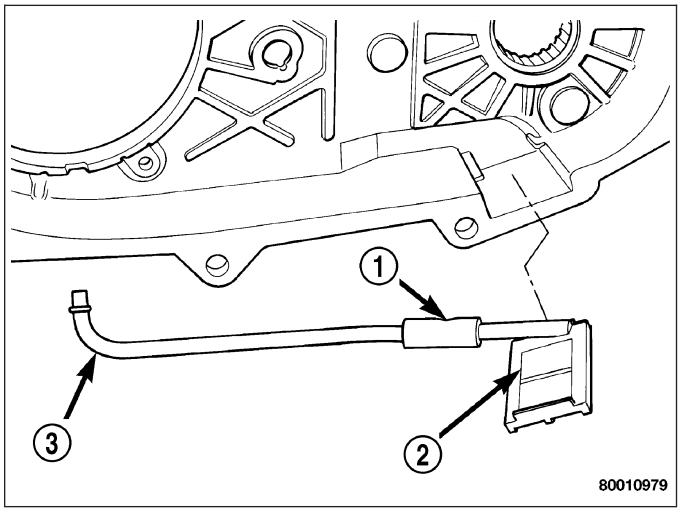
1. Support transfer case so rear case is facing upward.
2. Remove bolts holding front case to rear case. The case alignment bolts require flat (1).



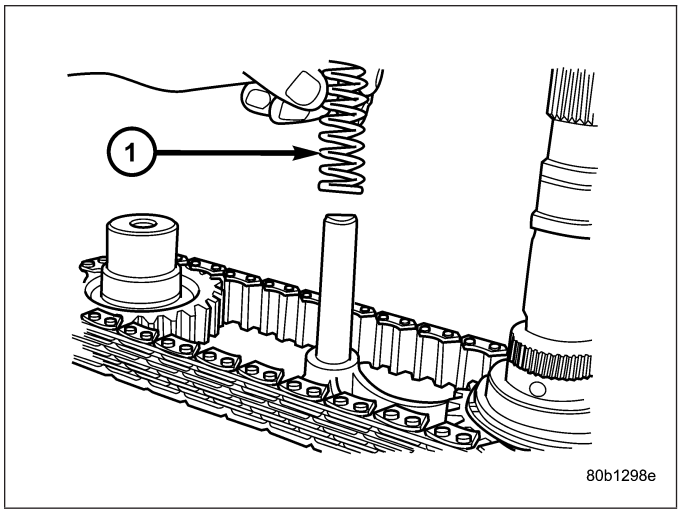
3. Loosen rear case (1) with flat blade screwdriver (2) to break sealer bead. Insert pry tool blade only into notches provided at each end of case.
4. Remove rear case from front case.



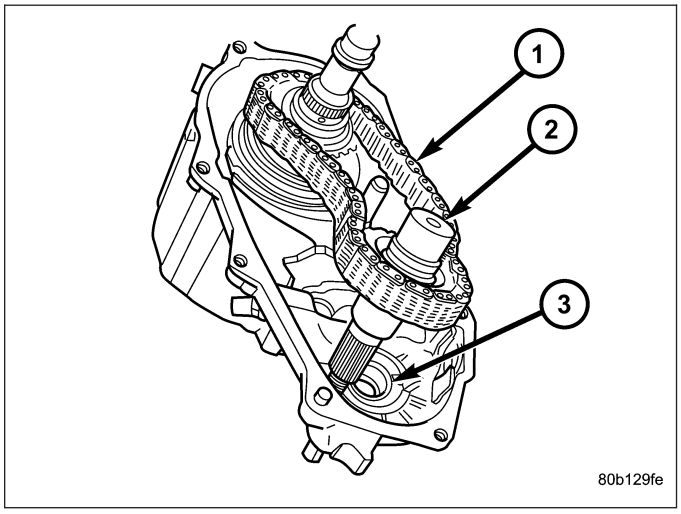
5. Remove oil pickup tube (3) from rear case.



6. Remove mode fork spring (1).

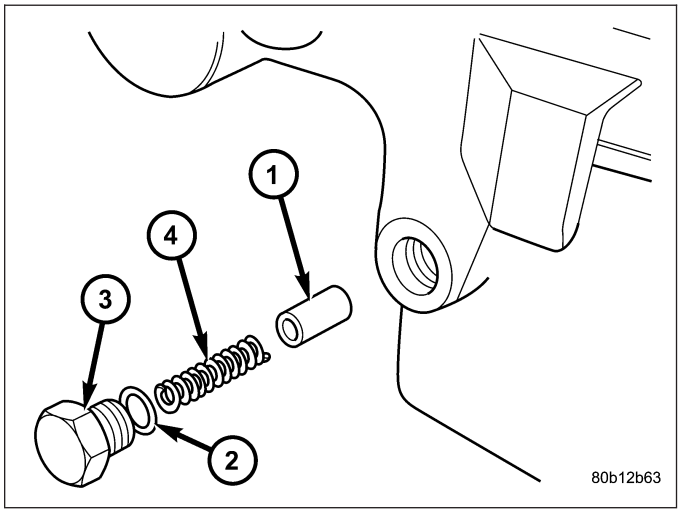


7. Pull front output shaft (2) upward and out of front output shaft bearing (3).
8. Remove front output shaft (2) and chain (1).

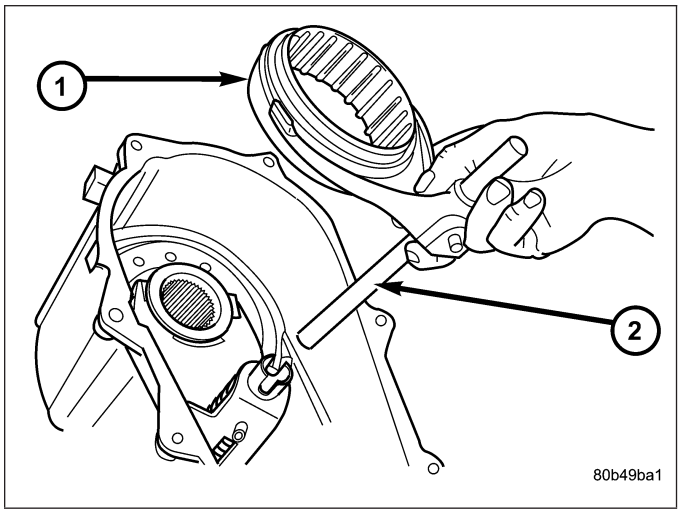


SHIFT FORKS AND MAINSHAFT

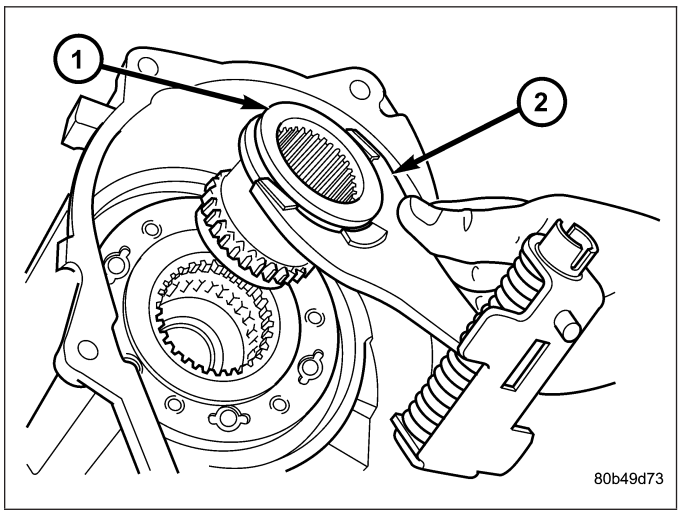
1. Remove detent plug (3), O-ring (2), detent spring (4), and detent plunger (1).



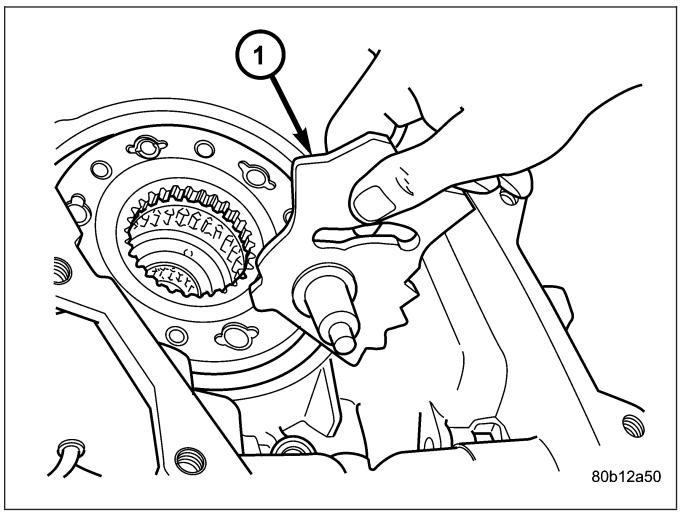
2. Remove mainshaft from mode sleeve and input gear pilot bearing.
3. Remove mode fork (2) and sleeve (1) as an assembly. Note position of sleeve for assembly reference. The short side of the sleeve faces upward.



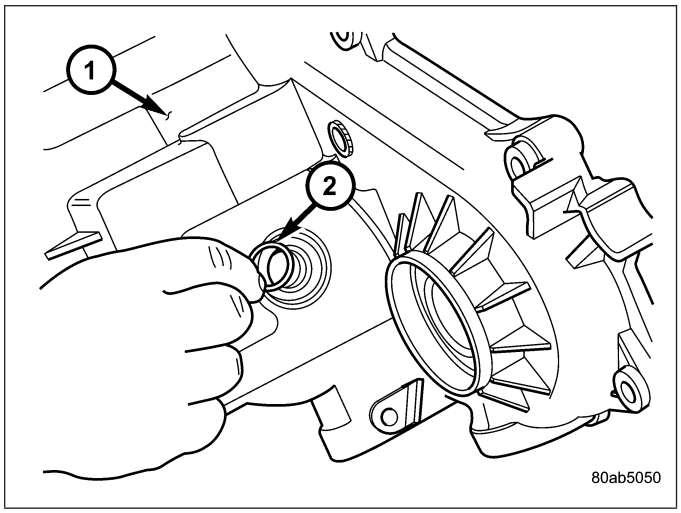
4. Remove range fork (2) and hub (1) as an assembly. Note fork position for installation reference.



5. Remove shift sector (1) from front case.

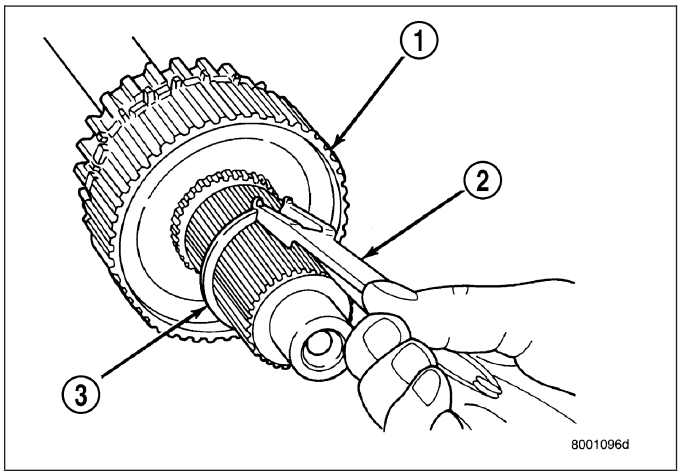


6. Remove shift sector o-ring (2).

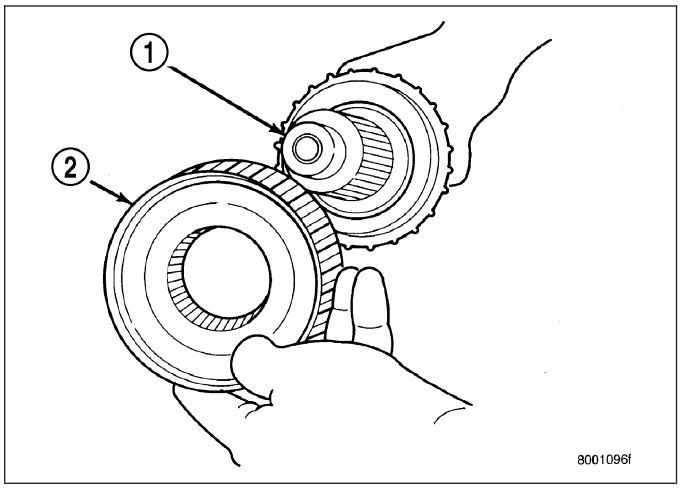


MAINSHAFT

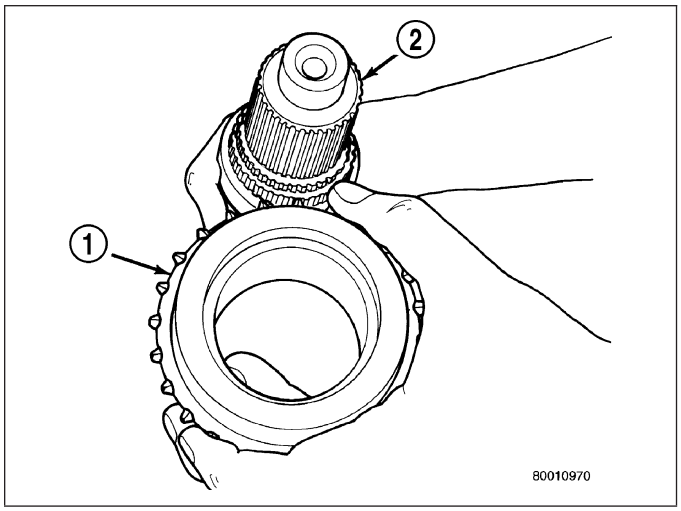
1. Remove mode hub (1) retaining ring (3) with heavy duty snap-ring pliers (2).



2. Slide mode hub (2) off mainshaft (1).

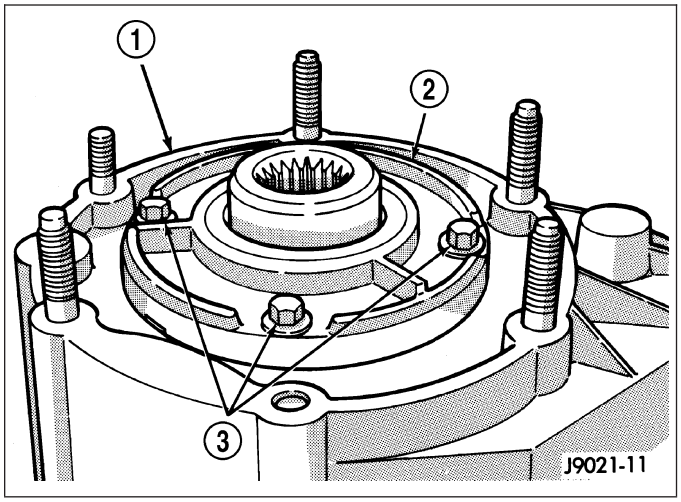


3. Slide drive sprocket (1) off mainshaft (2).

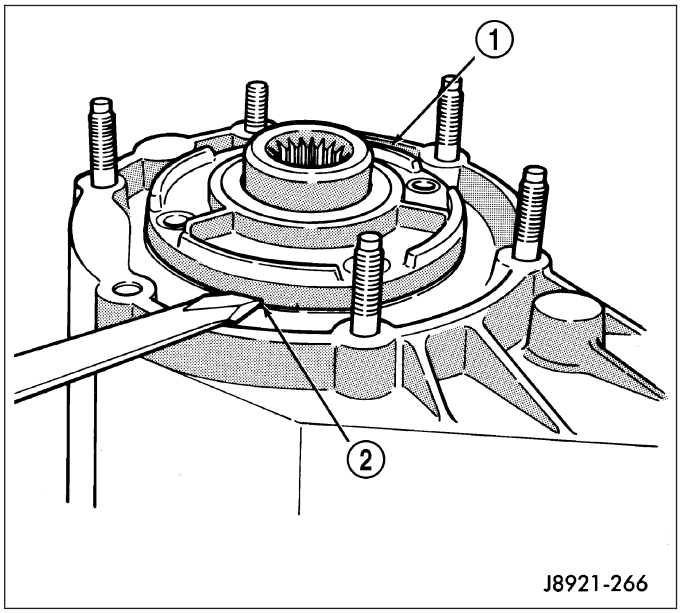


INPUT GEAR AND LOW RANGE GEAR

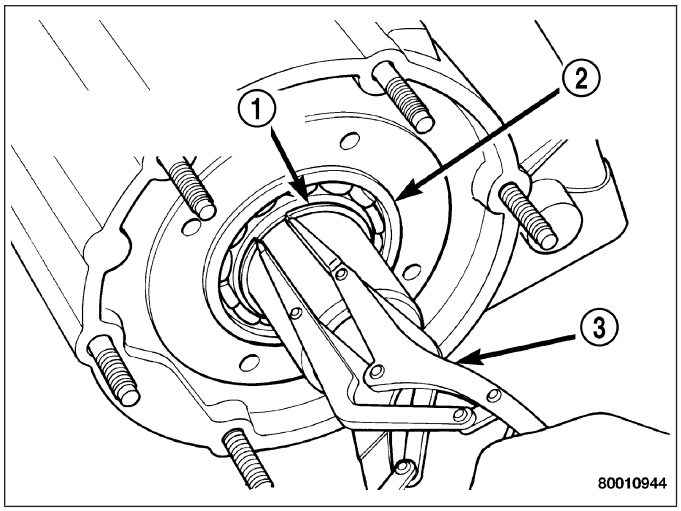
1. Remove front bearing retainer (2) attaching bolts (3).



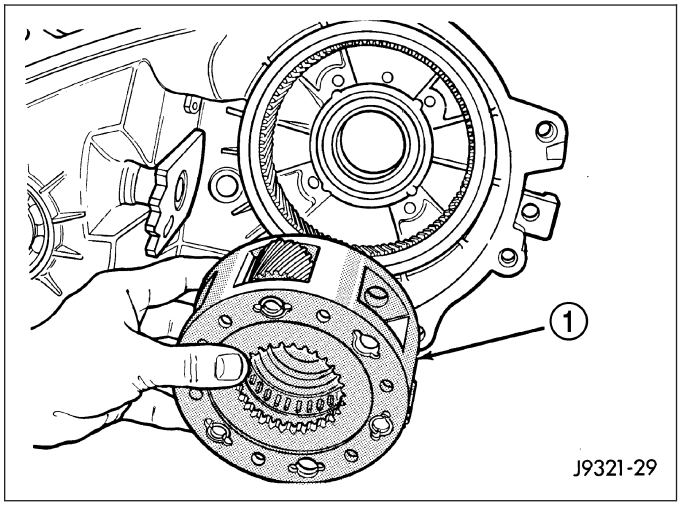
2. Remove front bearing retainer. Pry retainer (1) loose with pry tool positioned in slots (2) at each end of retainer.



3. Remove front bearing retainer seal. Tap seal out with drift and hammer.
4. Remove input gear retaining ring (1) with heavy duty snap-ring pliers (3)

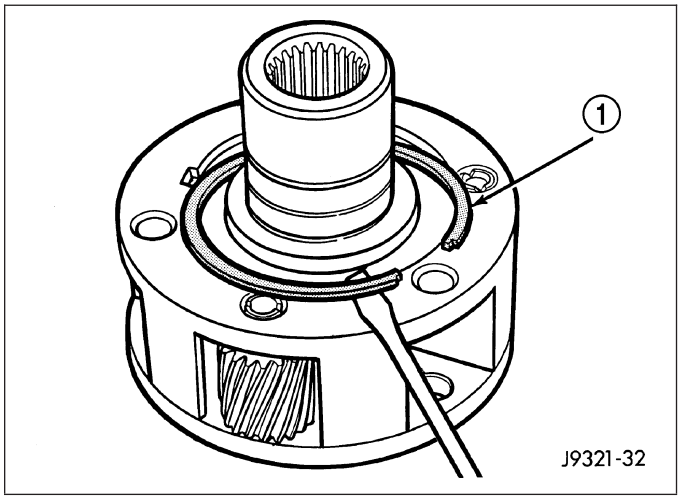


5. Place front case in horizontal position. Then remove input gear and low range gear as an assembly (1). Tap gear out of bearing with plastic mallet if necessary.

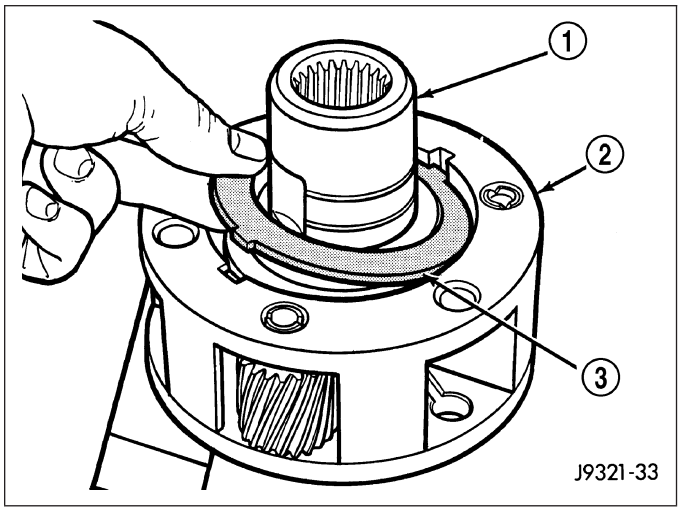


INPUT AND LOW RANGE GEAR

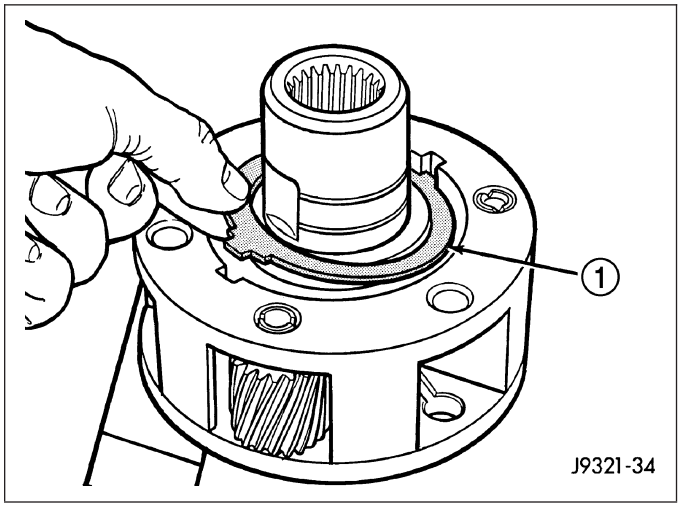
1. Remove snap-ring (1) that retains input gear in low range gear.



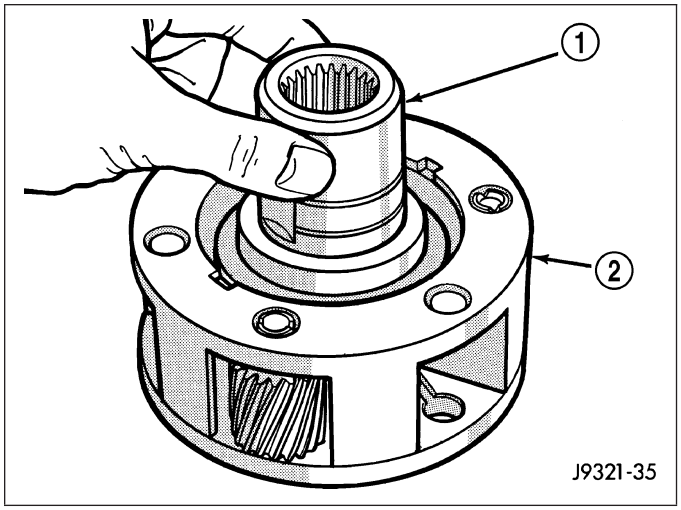
2. Remove retainer (3) from the low range gear.



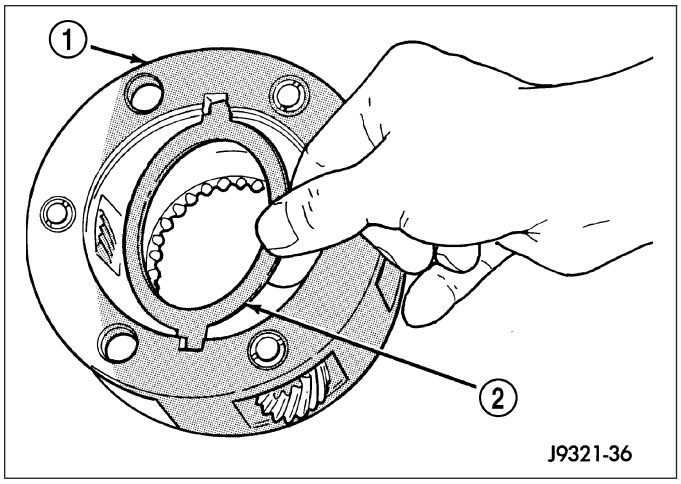
3. Remove front tabbed thrust washer (1).



4. Remove input gear (1).



5. Remove rear tabbed thrust washer from low range gear.



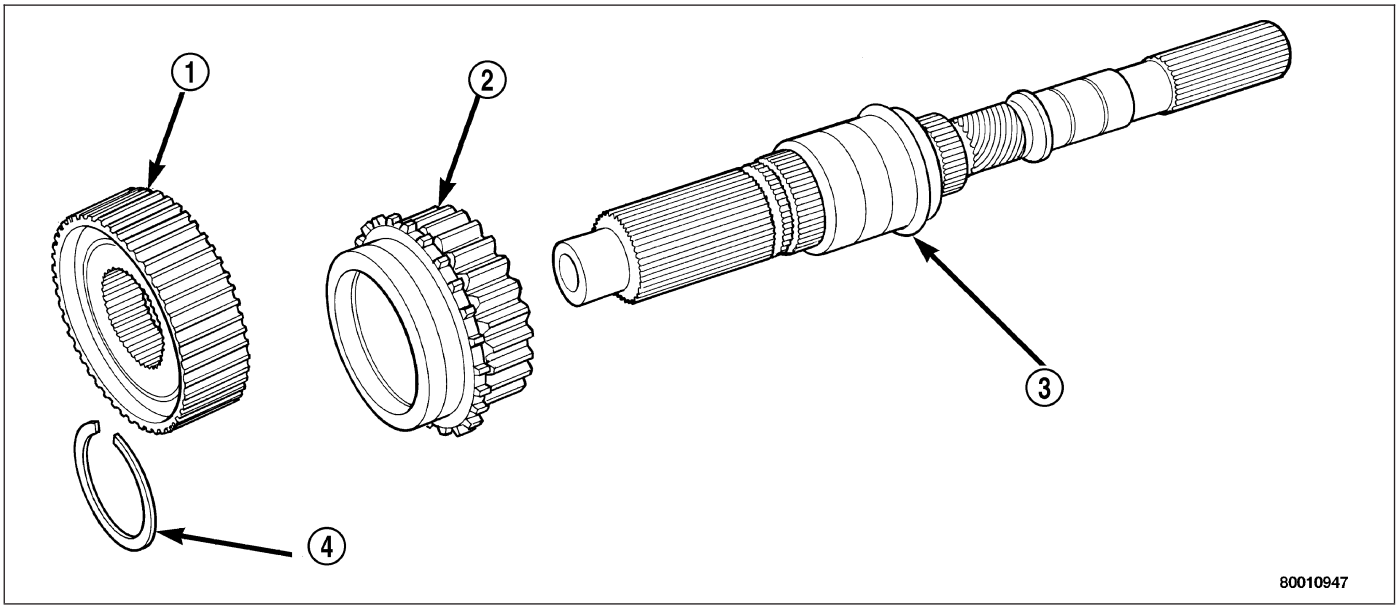
CLEANING

Clean the transfer case parts with a standard parts cleaning solvent. Remove all traces of sealer from the cases and retainers with a scraper and 3M™ all purpose cleaner. Use compressed air to remove solvent residue from oil feed passages in the case halves, retainers, gears, and shafts.

The oil pickup screen can be cleaned with solvent. Shake excess solvent from the screen after cleaning and allow it to air dry. Do not use compressed air.

INSPECTION

MAINSHAFT/SPROCKET/HUB INSPECTION



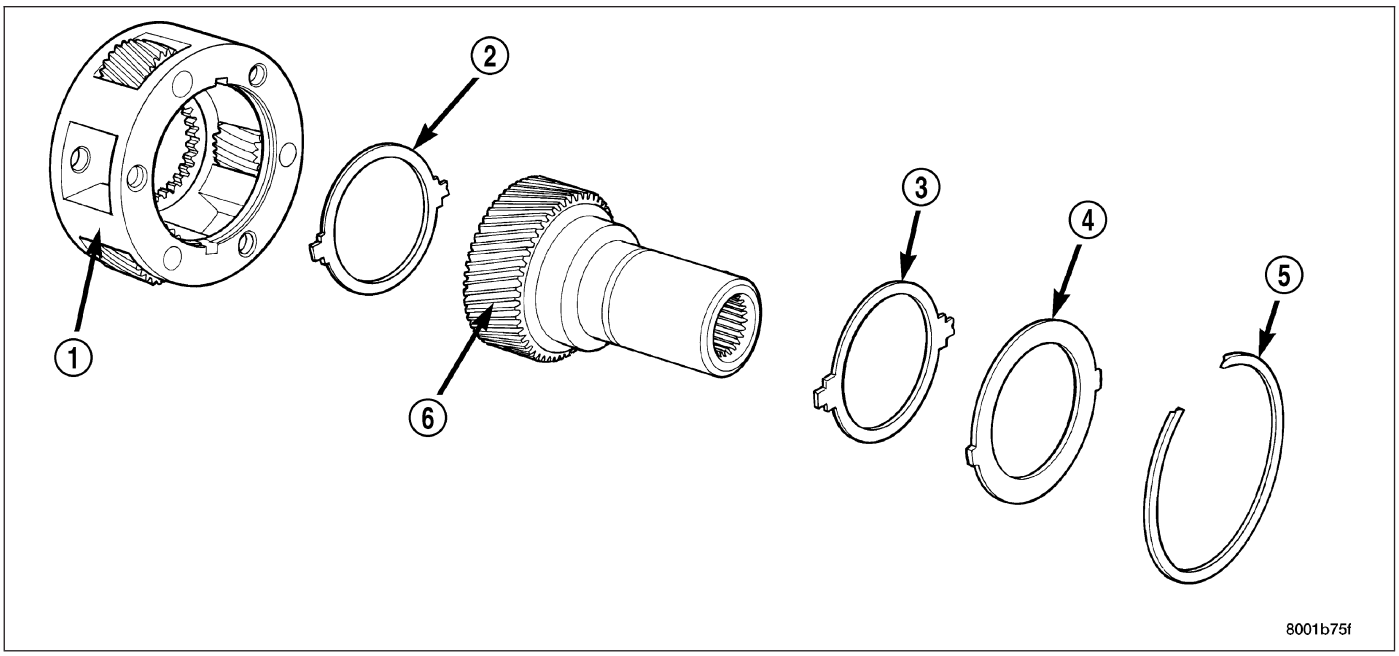
Mainshaft, Mode Hub, And Drive Sprocket

1 - MODE HUB
2 - DRIVE SPROCKET
3 - MAINSHAFT
4 - MODE HUB RETAINING RING

Inspect the splines on the hub (1), shaft (3), and the teeth on the sprocket (2). Minor nicks and scratches can be smoothed with an oilstone. However, replace any part that is damaged.

Check the contact surfaces in the sprocket bore and on the mainshaft. Minor nicks and scratches can be smoothed with 320-400 grit emery cloth but do not try to salvage the shaft if nicks or wear is severe.

INPUT GEAR AND PLANETARY CARRIER



Input Gear and Carrier Components

1 - PLANETARY CARRIER
2 - REAR THRUST WASHER
3 - FRONT THRUST WASHER
4 - CARRIER LOCK RING
5 - CARRIER LOCK RETAINING RING
6 - INPUT GEAR

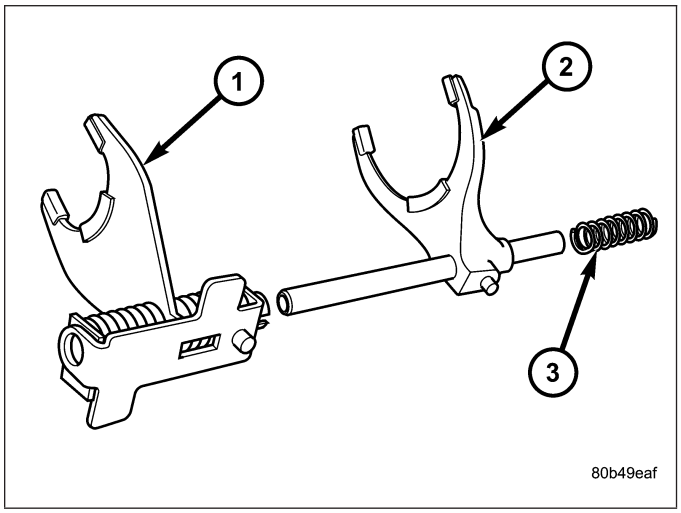
Check the teeth on the gear (6). Minor nicks can be dressed off with an oilstone but replace the gear if any teeth are broken, cracked, or chipped. The bearing surface on the gear can be smoothed with 300-400 grit emery cloth if necessary.

Examine the carrier body (1) and pinion gears for wear or damage. The carrier will have to be replaced as an assembly if the body, pinion pins, or pinion gears are damaged.

Check the lock ring (4) and both thrust washers (2, 3) for wear or cracks. Replace them if necessary. Also replace the lock retaining ring if bent, distorted, or broken.

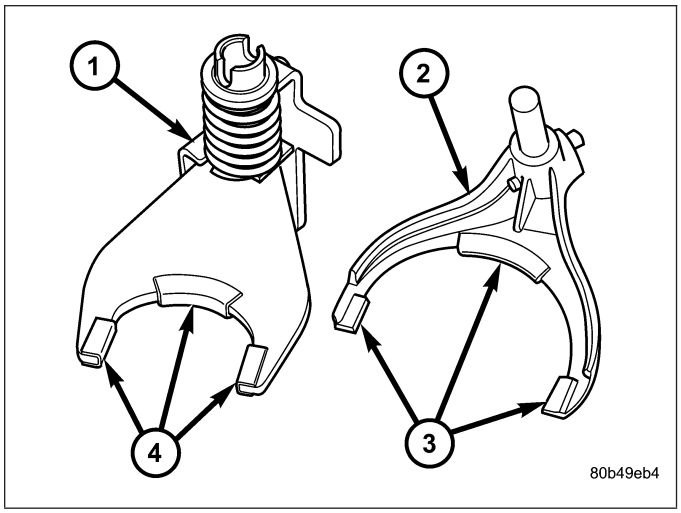
SHIFT FORKS/HUBS/SLEEVES

Check condition of the shift forks (1, 2) and mode fork shift rail (2). Minor nicks on the shift rail can be smoothed with 320-400 grit emery cloth.



Inspect the shift fork wear pads (3, 4). The mode and range fork pads are serviceable and can be replaced if necessary.

Check both of the sleeves for wear or damage, especially on the interior teeth. Replace the sleeves if wear or damage is evident.



REAR RETAINER AND EXTENSION HOUSING

Inspect the retainer components. Replace the bearing if rough or noisy. Check the retainer for cracks or wear in the bearing bore. Clean the retainer sealing surfaces with a scraper and 3M™ all purpose cleaner. This will ensure proper adhesion of the sealer during reassembly.

Inspect the retaining rings and washers. Replace any part if distorted, bent, or broken. Reuse is not recommended.

Inspect the extension housing seal and bushing. Replace both components if either show any sign of wear or damage.

FRONT OUTPUT SHAFT/FLANGE/DRIVE CHAIN

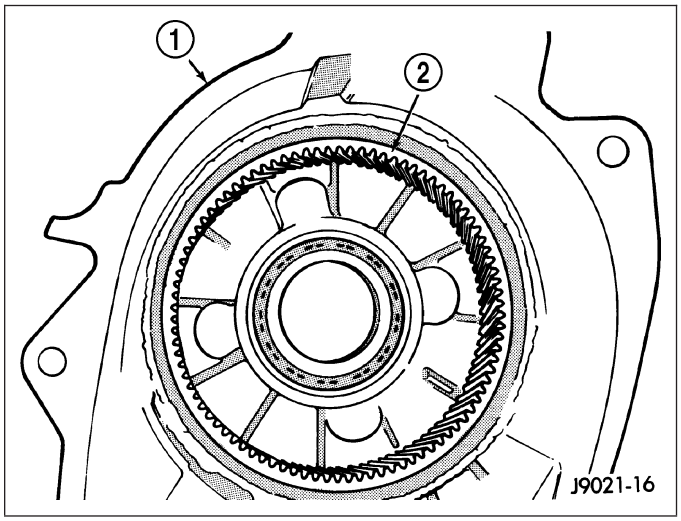
Check condition of the seal contact surfaces on the companion flange slinger. This surface must be clean and smooth to ensure proper seal life. Replace the flange nut and seal washer as neither part should be reused.

Inspect the shaft threads, sprocket teeth, and bearing surfaces. Minor nicks on the teeth can be smoothed with an oilstone. Use 320-400 grit emery to smooth minor scratches on the shaft bearing surfaces. Rough threads on the shaft can be chased if necessary. Replace the shaft if the threads are damaged, bearing surfaces are scored, or if any sprocket teeth are cracked or broken.

Examine the drive chain and shaft bearings. Replace the chain and both sprockets if the chain is stretched, distorted, or if any of the links bind. Replace the bearings if rough, or noisy.

LOW RANGE ANNULUS GEAR

Inspect annulus gear condition carefully. The gear is only serviced as part of the front case. If the gear is damaged, it will be necessary to replace the gear and front case as an assembly. Do not attempt to remove the gear (2)



FRONT/REAR CASES AND FRONT RETAINER

Inspect the cases and retainer for wear and damage. Replace the input retainer seal; do not reuse it.

Check case condition. If leaks were a problem, look for gouges and severe scoring of case sealing surfaces. Also make sure the front case mounting studs are in good condition.

Check the front case mounting studs and vent tube. The tube can be secured with Loctite™ 271 or 680 if loose. The stud threads can be cleaned up with a die if necessary. Also check condition of the fill/drain plug threads in the rear case. The threads can be repaired with a thread chaser or tap if necessary. Or the threads can be repaired with Helicoil® stainless steel inserts if required.

OIL PUMP/OIL PICKUP

Examine the oil pump pickup parts. Replace the pump if any part appears to be worn or damaged. Do not disassemble the pump as individual parts are not available. The pump is only available as a complete assembly. The pickup screen, hose, and tube are the only serviceable parts and are available separately.

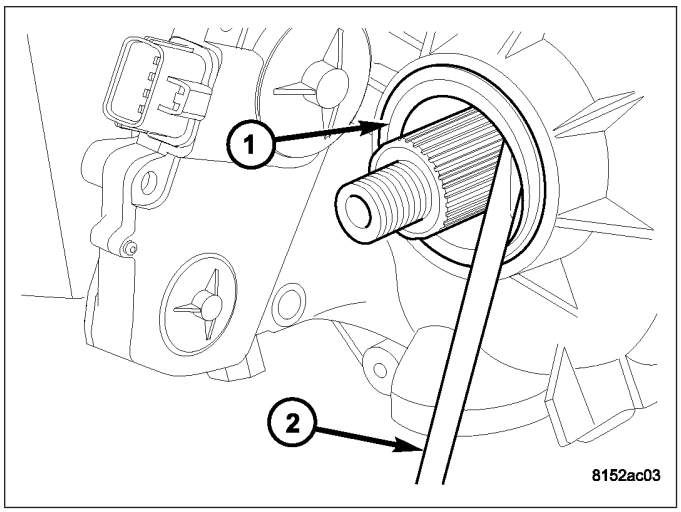
ASSEMBLY

Lubricate transfer case components with Mopar® ATF +4, Automatic Transmission Fluid or petroleum jelly (where indicated) during assembly.

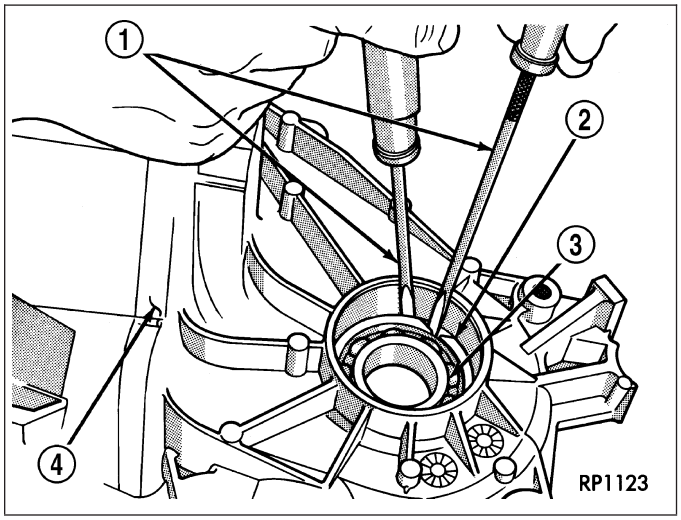
BEARINGS AND SEALS

CAUTION: The bearing bores in various transfer case components contain oil feed holes. Make sure replacement bearings do not block the holes.

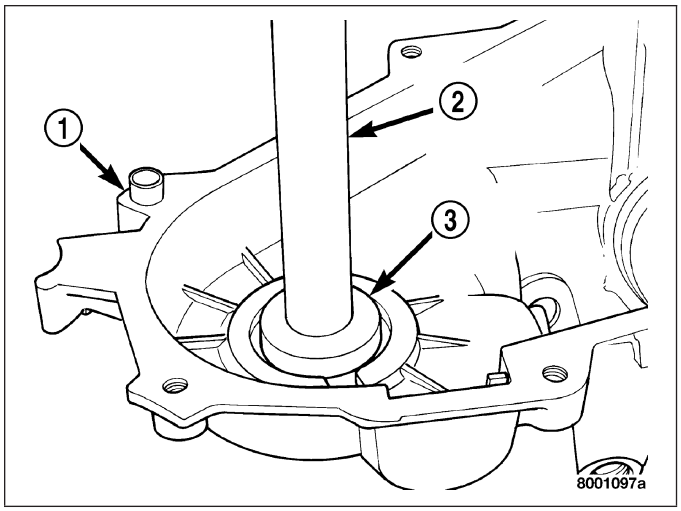
1. Remove the front output shaft seal (1) from case with pry tool (2).



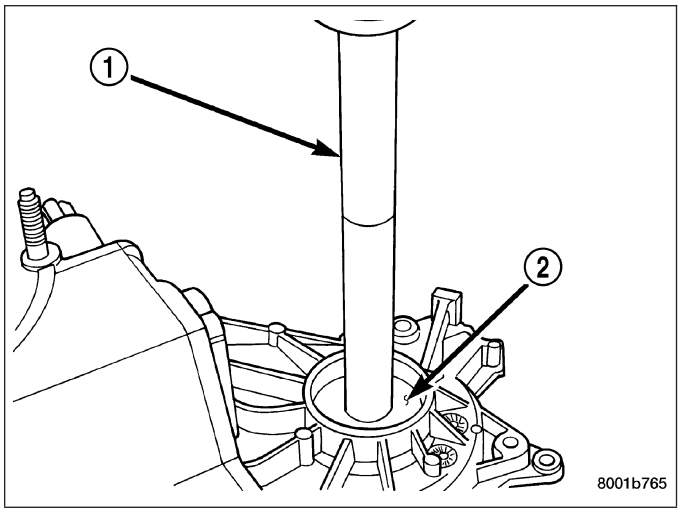
2. Remove bearing retaining ring with screwdriver.



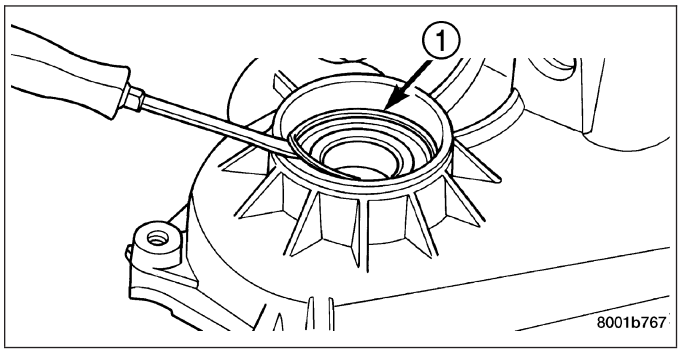
3. Remove bearing with Tool Handle C-4171 (2) and Tool 5065 (3).



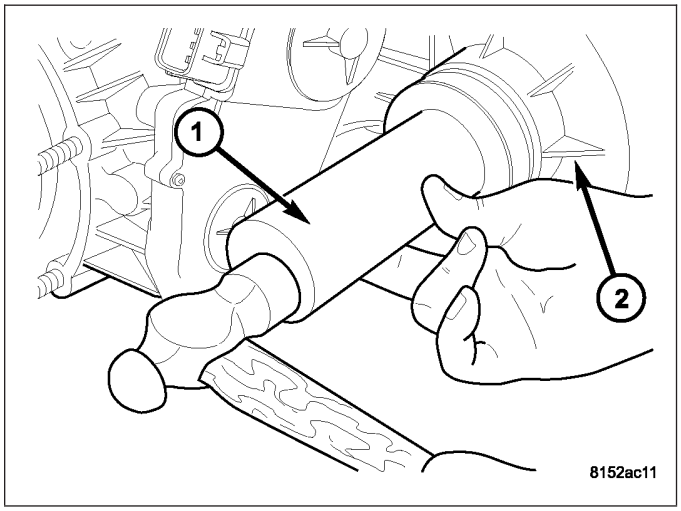
4. Install front output shaft front bearing in case with Tool Handle C-4171 (1) and Installer 5064 (2).



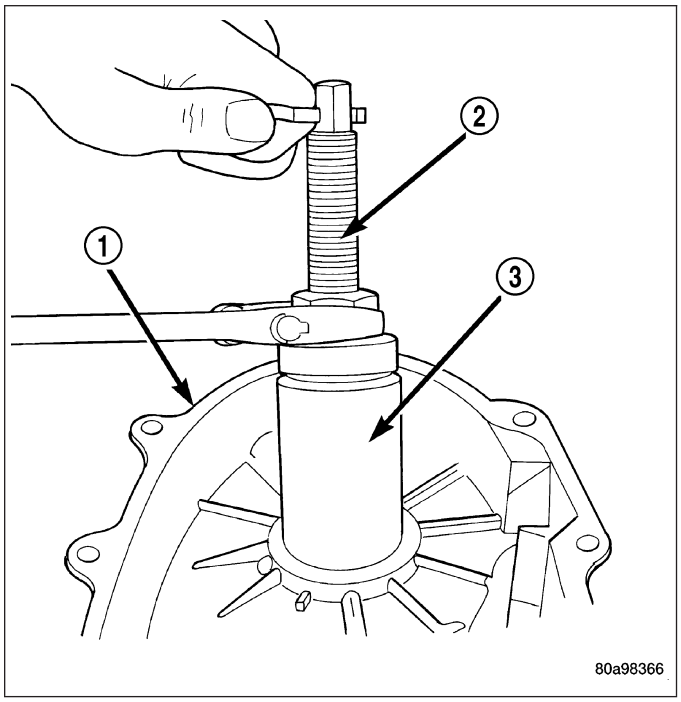
5. Install output shaft front bearing retaining ring (1). Start ring into place by hand. Then use small screwdriver to work ring into case groove. Be sure ring is fully seated before proceeding.



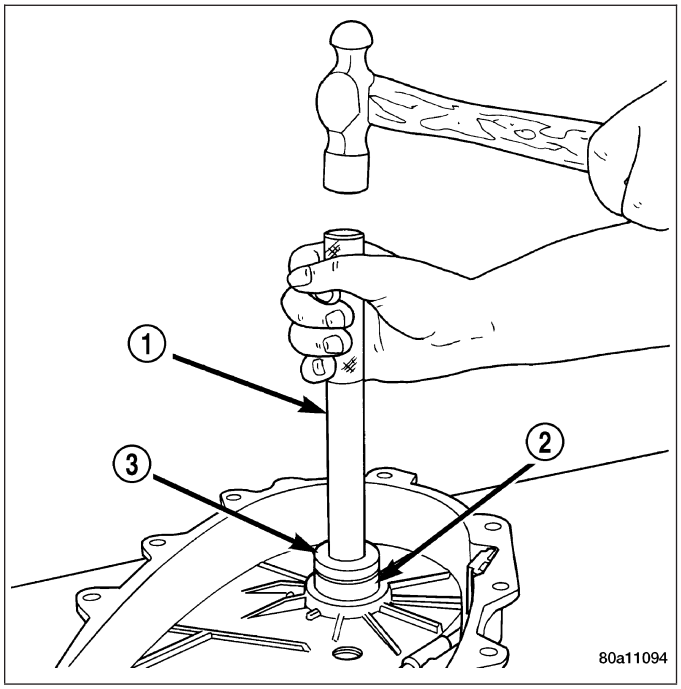
6. Install new front output seal in front case with Installer Tool 8143-A (1) as follows:
   a. Place new seal on tool. **Garter spring on seal goes toward interior of case.**
   b. Start seal in bore with light taps from hammer. Once seal is started, continue tapping seal into bore until installer tool bottoms against case.



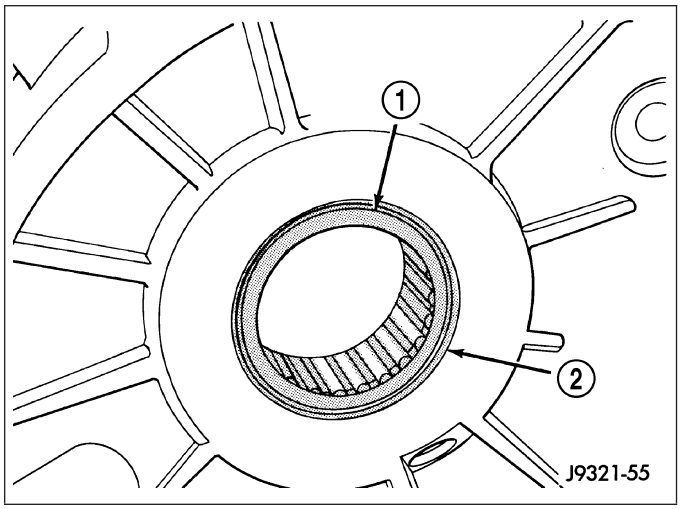
7. Remove the output shaft rear bearing with the screw and jaws from Remover L-4454 (2) and Cup 8148 (3).



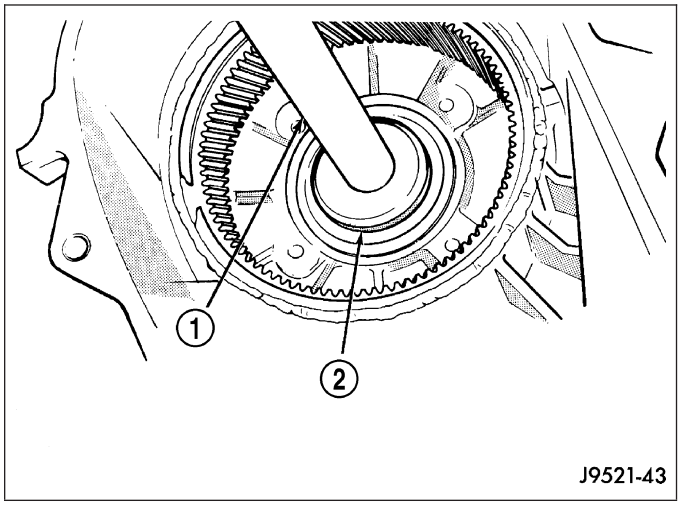
8. Install new bearing with Tool Handle C-4171 (1) and Installer 5066 (3).



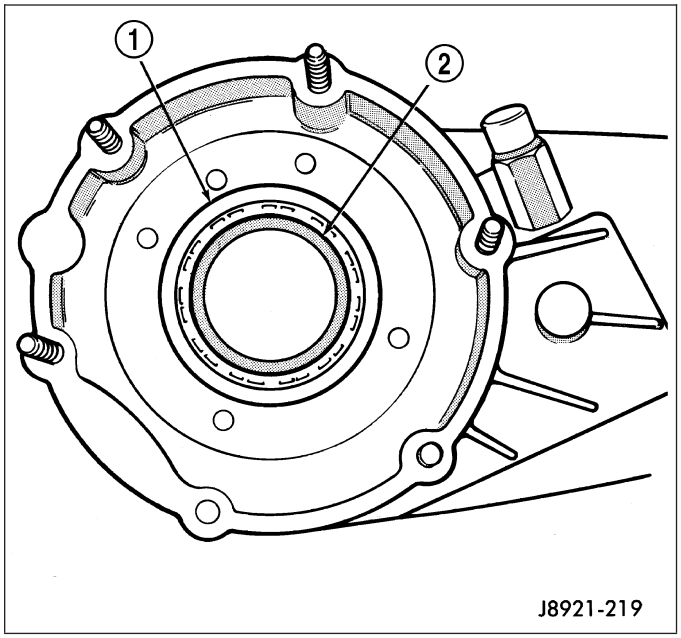
9. The bearing bore is chamfered at the top. Install the bearing (1) so it is flush with the lower edge of this chamfer (2).



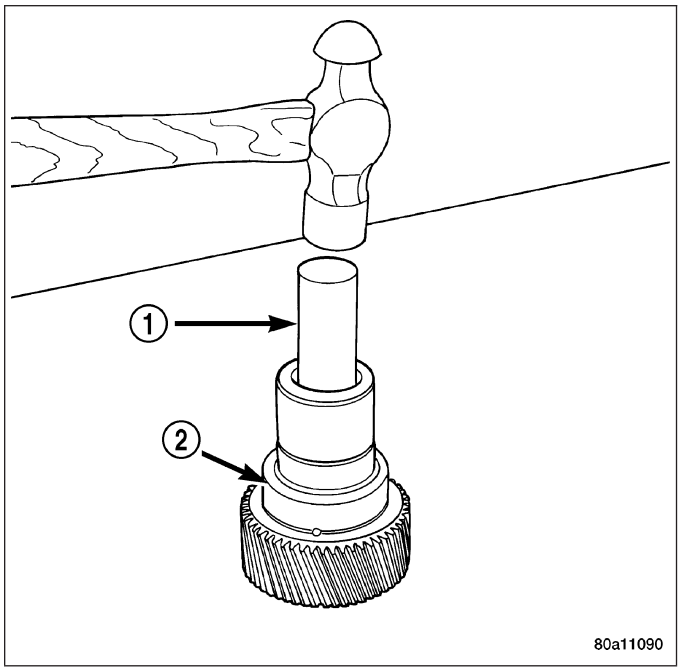
10. Using Remover C-4210 (2) and Handle C-4171 (1), drive input shaft bearing from inside the annulus gear opening in the case.



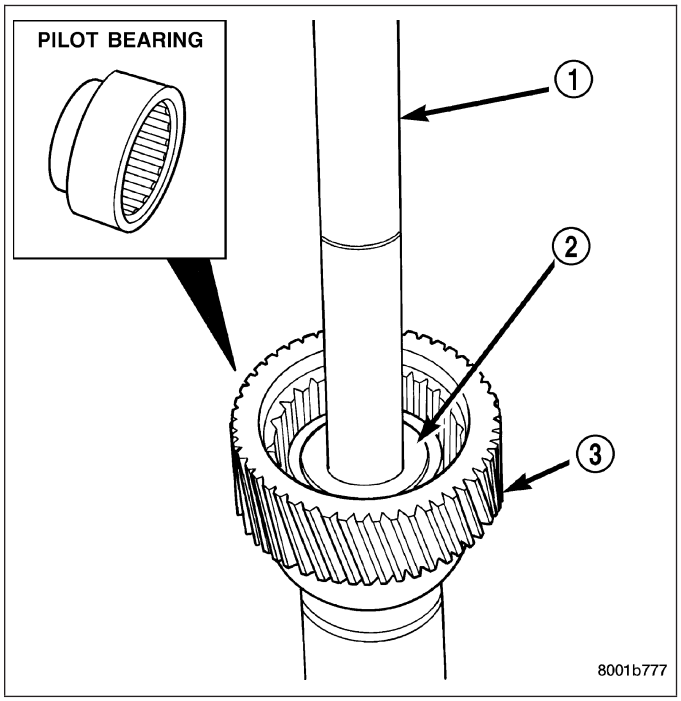
11. Install locating ring on new bearing.
12. Position case so forward end is facing upward.
13. Using Remover C-4210 and Handle C-4171, drive input shaft bearing into case. The bearing locating ring (1) must be fully seated against case surface.



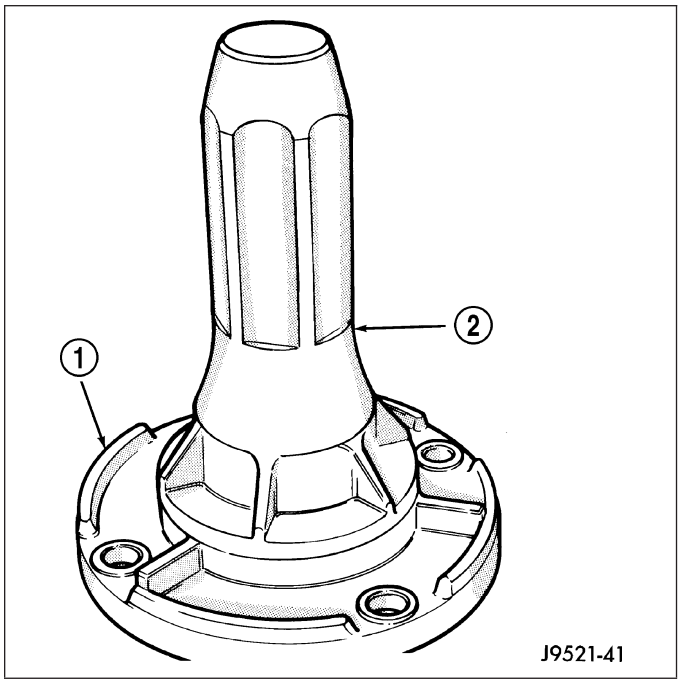
14. Remove input gear pilot bearing by inserting a suitably sized drift (1) into the splined end of the input gear (2) and driving the bearing out with the drift and a hammer.



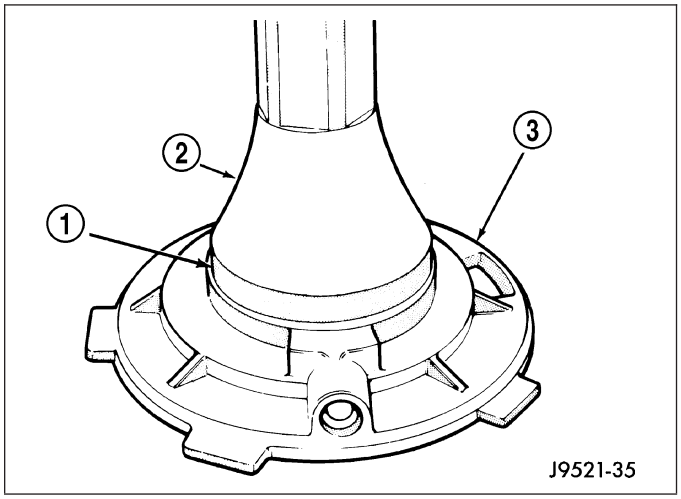
15. Install new pilot bearing with Installer 5065 (2) and Handle C-4171 (1).



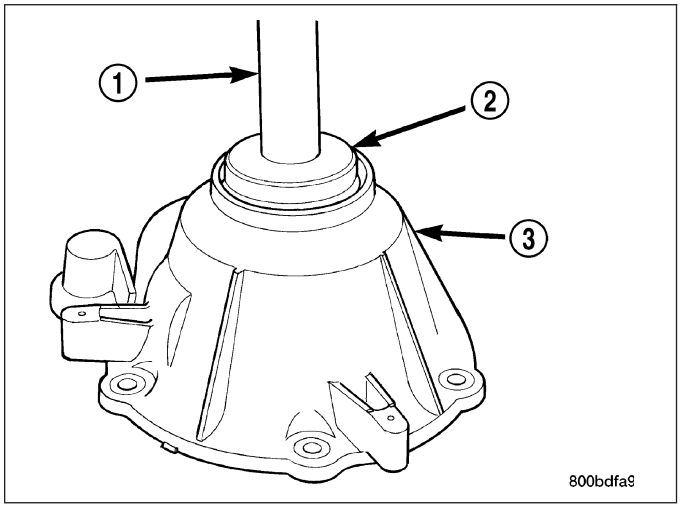
16. Remove front bearing retainer seal with suitable pry tool.
17. Install new front bearing retainer (1) with Installer 7884 (2).



18. Remove seal from oil pump housing with a suitable pry tool
19. Install new seal (1) in oil pump housing (3) with Installer 7888 (2).

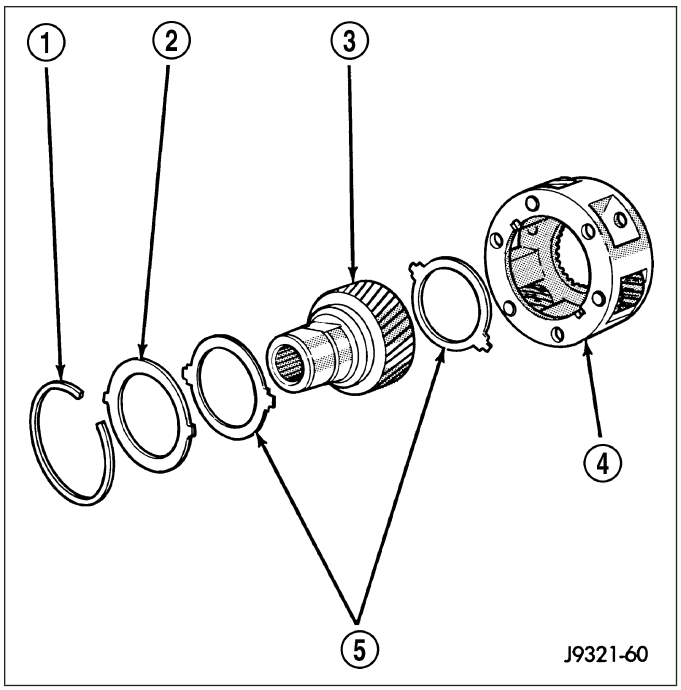


20. Remove rear retainer bearing with Installer 5065 and Handle C-4171.
21. Install rear bearing in retainer (3) with Handle C-4171 (1) and Installer 5064 (2).



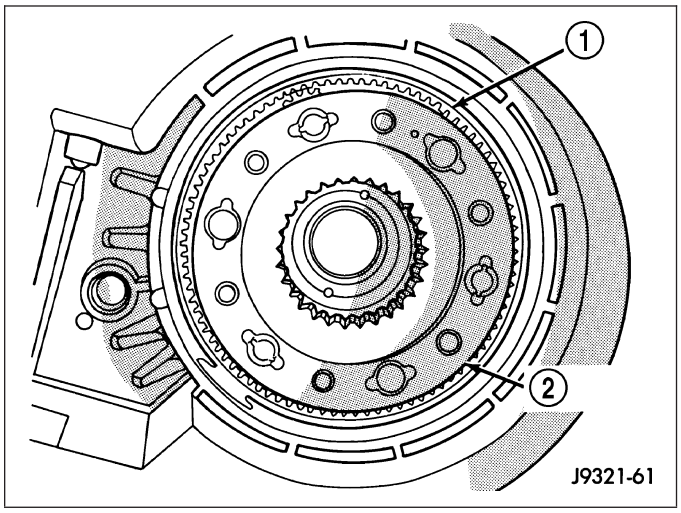
INPUT AND LOW RANGE GEAR

1. Lubricate gears (3, 4) and thrust washers (5) with recommended transmission fluid.
2. Install first thrust washer (5) in low range gear (4). Be sure washer tabs are properly aligned in gear notches.
3. Install input gear (3) in low range gear (4). Be sure input gear is fully seated.
4. Install remaining thrust washer in low range gear and on top of input gear. Be sure washer tabs are properly aligned in gear notches.
5. Install retainer on input gear and install snap-ring.

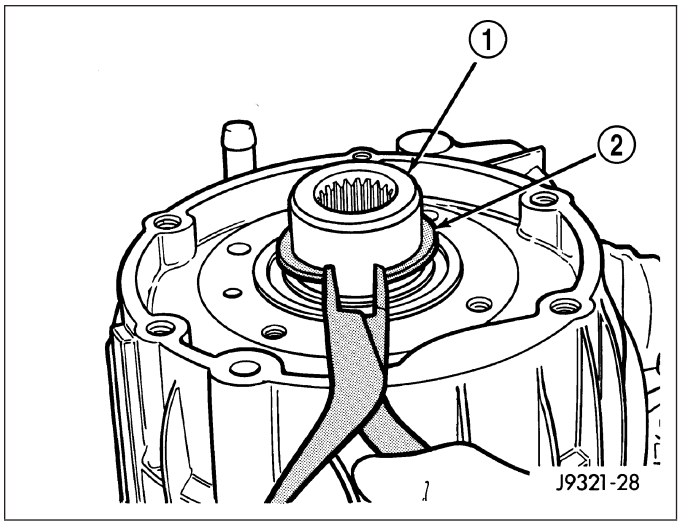


INPUT GEAR AND LOW RANGE GEAR

1. Align and install low range/input gear assembly (2) in front case. Be sure low range gear pinions are engaged in annulus gear and that input gear shaft is fully seated in front bearing.



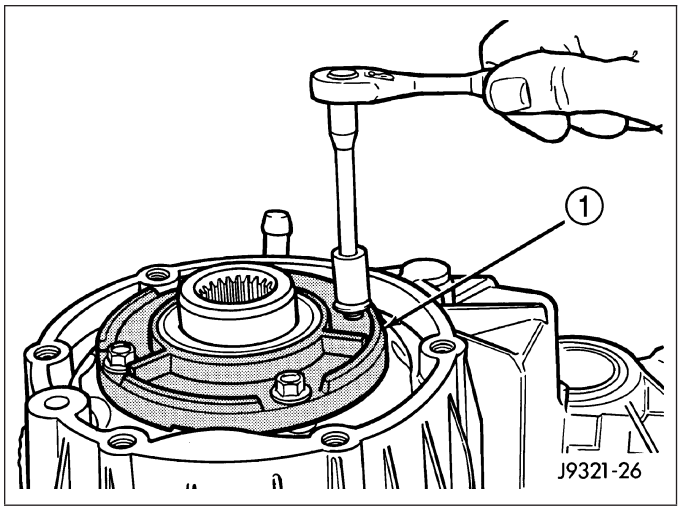
2. Install snap-ring (2) to hold input/low range gear (1) into front bearing.



3. Clean gasket sealer residue from retainer and inspect retainer for cracks or other damage.
4. Apply a 3 mm (1/8 in.) bead of Mopar® Gasket Maker, or equivalent silicone adhesive, to sealing surface of retainer.
5. Align cavity in seal retainer with fluid return hole in front of case.

CAUTION: Do not block fluid return cavity on sealing surface of retainer when applying Mopar® Gasket Maker, or equivalent silicone adhesive sealer. Seal failure and fluid leak can result.

6. Install bolts to hold retainer (1) to transfer case. Tighten to 16-25 N·m (12-18 ft. lbs.) of torque.

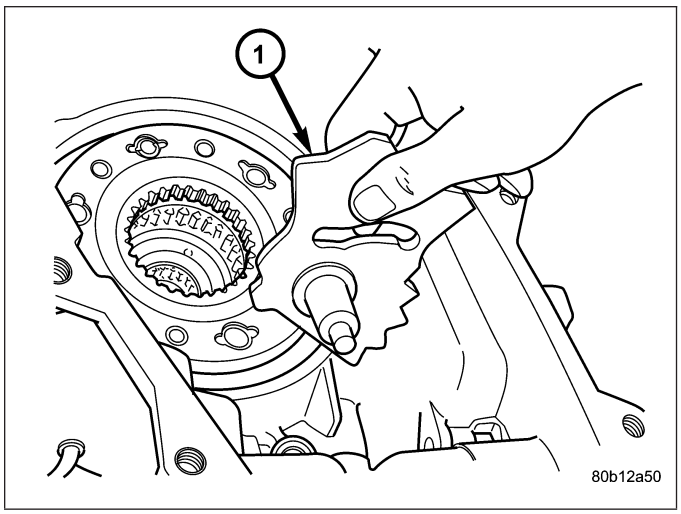


MAINSHAFT

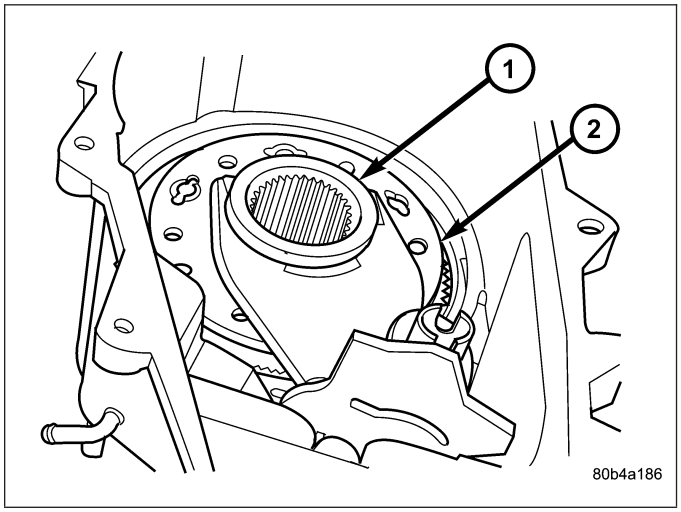
1. Lubricate mainshaft splines with recommended transmission fluid.
2. Slide drive sprocket onto mainshaft.
3. Slide mode hub onto mainshaft.
4. Install mode hub retaining ring. Verify that the retaining ring is fully seated in mainshaft groove.

SHIFT FORKS AND MAINSHAFT

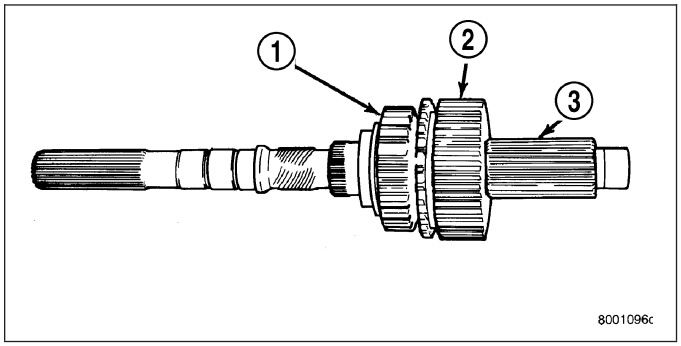
1. Install new sector shaft O-ring.
2. Install shift sector (1) in case. Lubricate sector shaft with transmission fluid before installation.



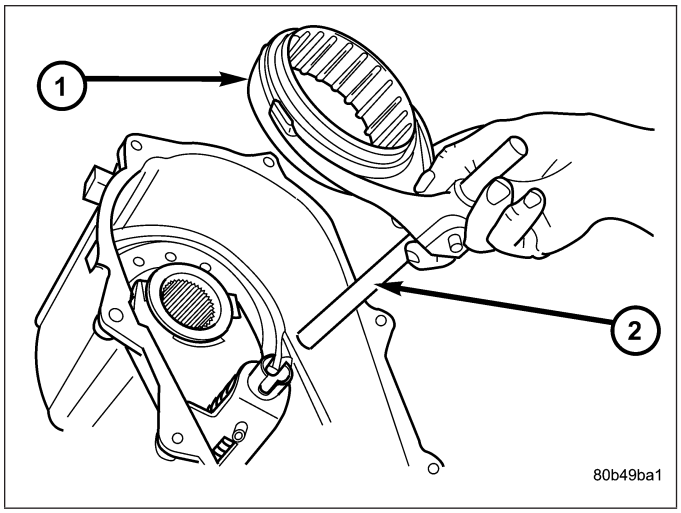
3. Assemble and install range fork (2) and hub (1). Be sure hub is properly seated in low range gear and engaged to the input gear.
4. Align and insert range fork pin in shift sector slot.



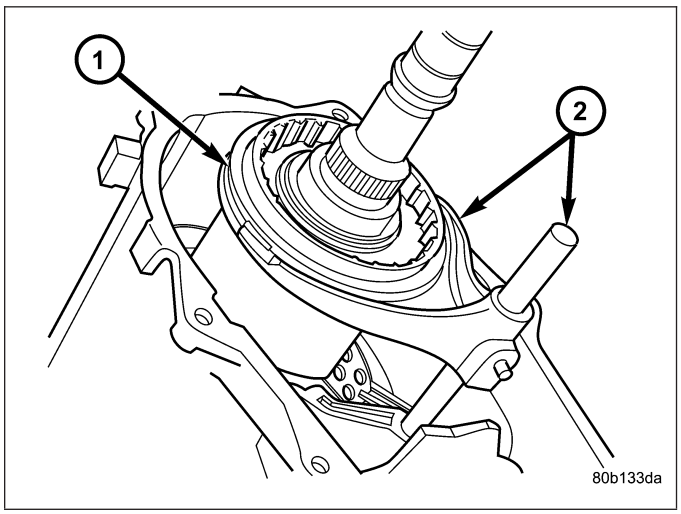
5. Install assembled mainshaft (3). Be sure shaft is seated in pilot bearing and input gear.



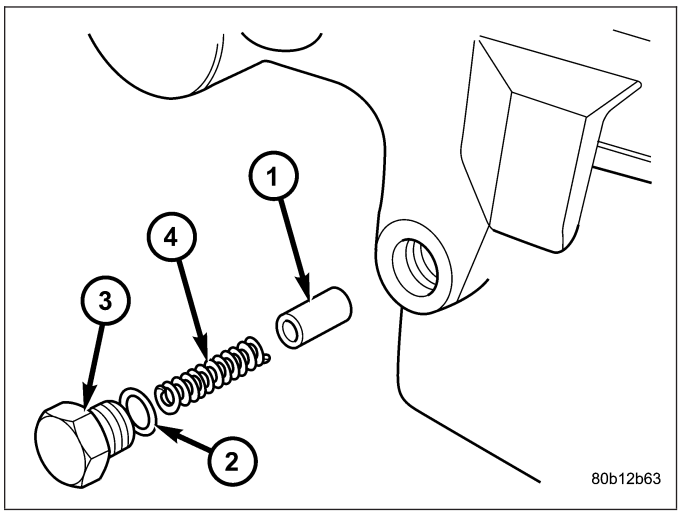
6. Install new pads on mode fork if necessary.
7. Insert mode sleeve (1) in mode fork mode fork. Be sure long side of sleeve is toward long end of shift rail (2).



8. Install assembled mode fork and sleeve (1). Be sure fork rail goes through range fork and into case bore. Also be sure sleeve is aligned and seated on mainshaft hub.

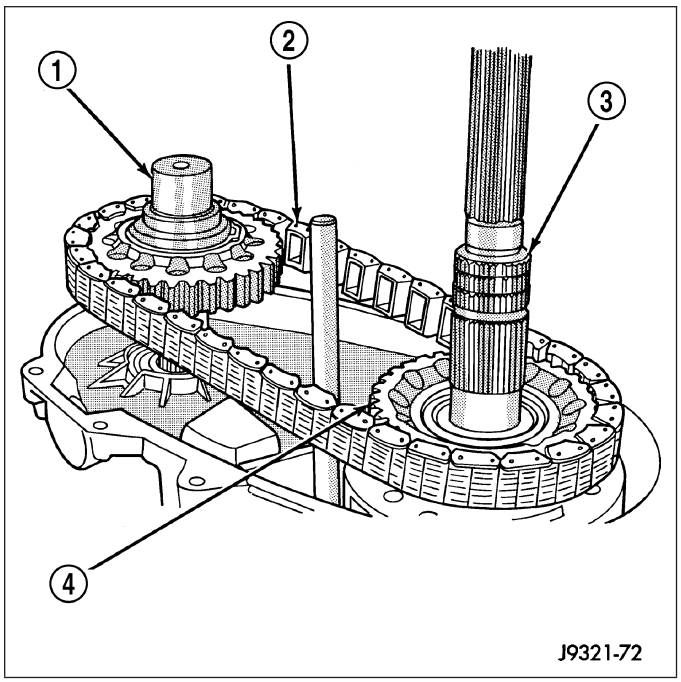


9. Rotate sector to NEUTRAL position.
10. Install new O-ring on detent plug (3).
11. Lubricate detent plunger with transmission fluid or light coat of petroleum jelly.
12. Install detent plunger (1), spring (4), and plug (2).
13. Verify that plunger is properly engaged in sector.

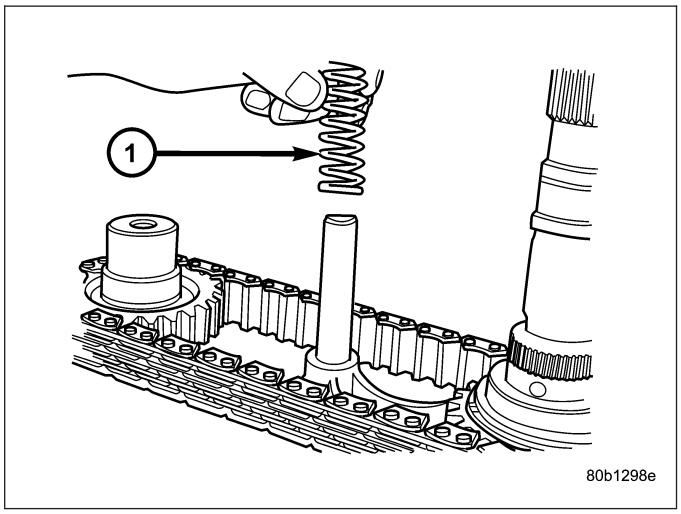


FRONT OUTPUT SHAFT AND DRIVE CHAIN

1. Lubricate front output shaft-sprocket assembly, drive chain and drive sprocket with transmission fluid.
2. Assemble drive chain (2) and front output shaft (1).
3. Start chain on mainshaft drive sprocket.
4. Guide front shaft into bearing and drive sprocket onto mainshaft drive gear.

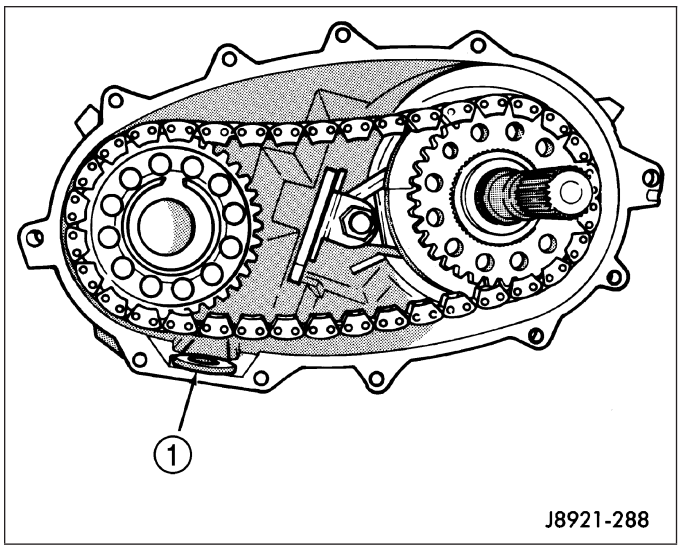


5. Install mode spring (1) on upper end of mode fork shift rail.

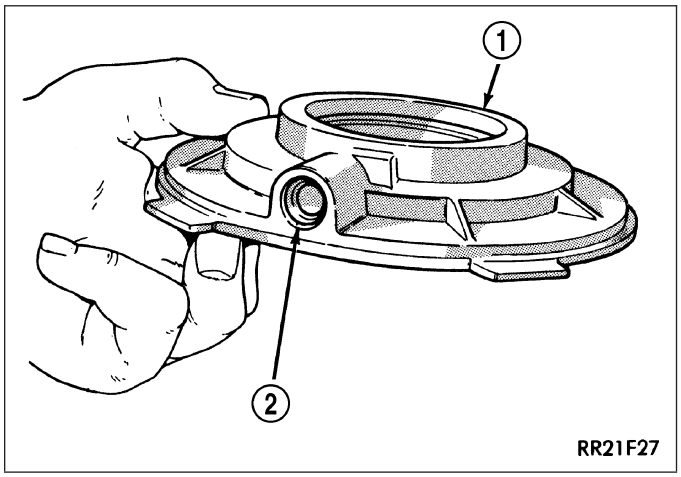


OIL PUMP AND REAR CASE

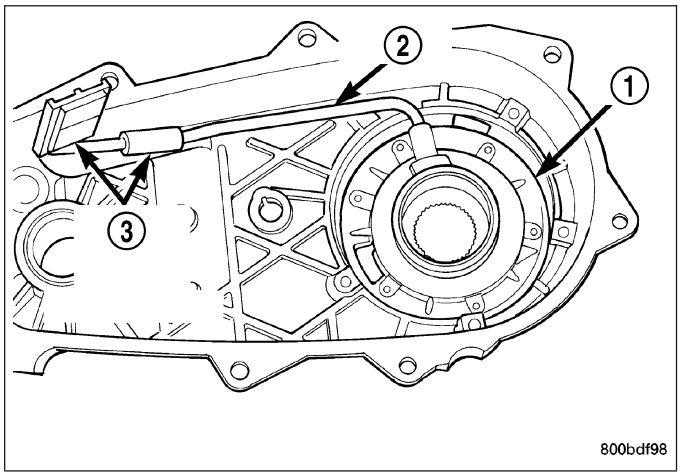
1. Install magnet in front case pocket (1).



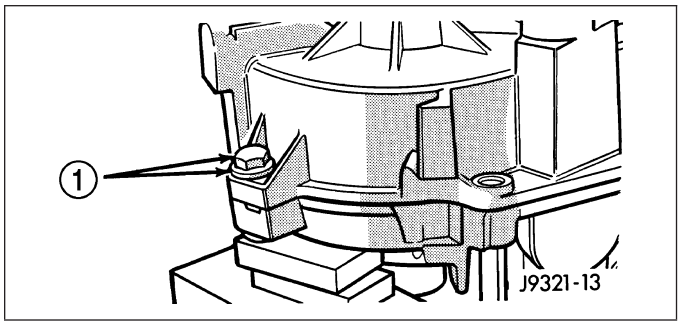
2. Assemble oil pickup screen, connecting hose, and tube.
3. Install new pickup tube O-ring (2) in oil pump (1).



4. Insert oil pickup tube (2) in oil pump inlet.
5. Position assembled oil pump and pickup tube in rear case. Be sure pickup screen is securely seated in case slot. Also be sure oil pump locating tabs are outside rear case.



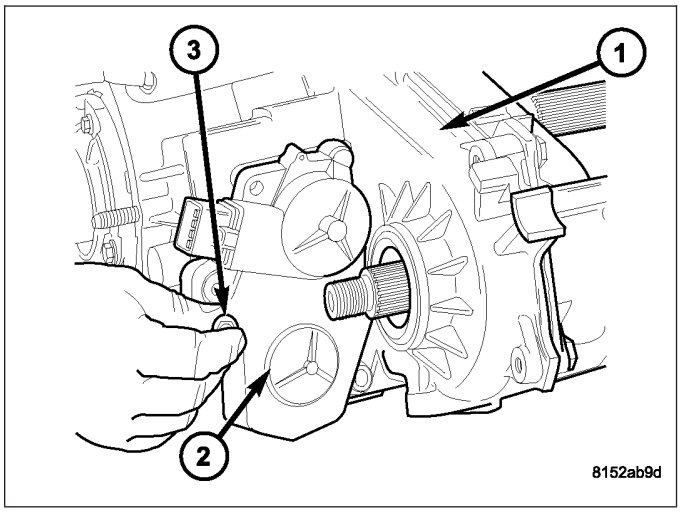
6. Apply 3 mm (1/8 in.) wide bead of Mopar® Gasket Maker, or equivalent silicone adhesive sealer, to mounting flange of front case. Work sealer bead around bolt holes.
7. Lift rear case and oil pump and carefully position assembly on front case. Be sure case dowels are aligned and that mode fork rail extends through rear case before seating rear case on front case.
8. Install case attaching bolts. Alignment bolts at each end of case are only ones requiring washers (1).
9. Tighten case bolts to 27-34 N·m (20-25 ft. lbs.) torque.



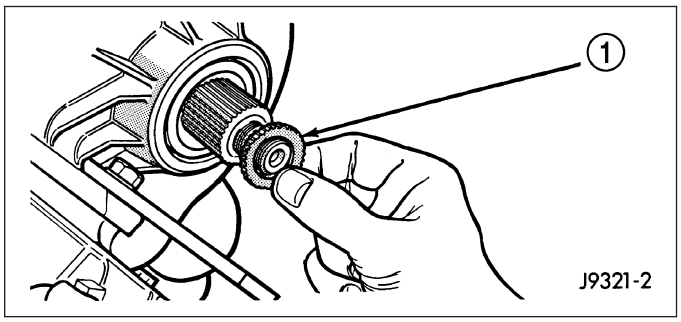
COMPANION FLANGE AND SHIFT MOTOR AND MODE SENSOR ASSEMBLY

CAUTION: If the original shift motor and mode sensor assembly bolts are reused, be sure to use Mopar® Lock & Seal or Loctite™ 242 to replenish the lock patch material originally found on the bolts

1. Position the shift motor and mode sensor assembly (2) onto the transfer case.
2. Install the bolts (3) to hold the shift motor and mode sensor assembly (2) to the transfer case (1). Tighten the bolts to 16-25 N·m (12-18 ft. lbs.) torque.

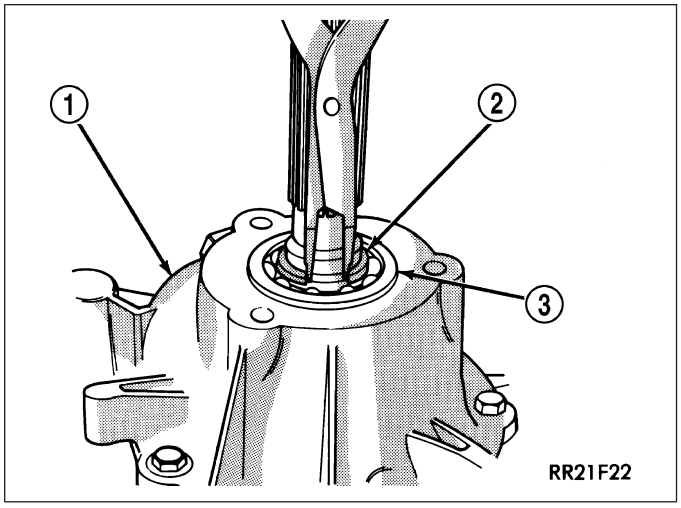


3. Install new seal washer (1) onto the front output shaft.
4. Lubricate the companion flange hub with transmission fluid and install the flange onto the front output shaft.
5. Install a new companion flange nut onto the front output shaft.
6. Tighten the flange nut to 122-176 N·m (90-130 ft. lbs.) torque. Use Tool 6958, or similar tool to hold flange while tightening nut.



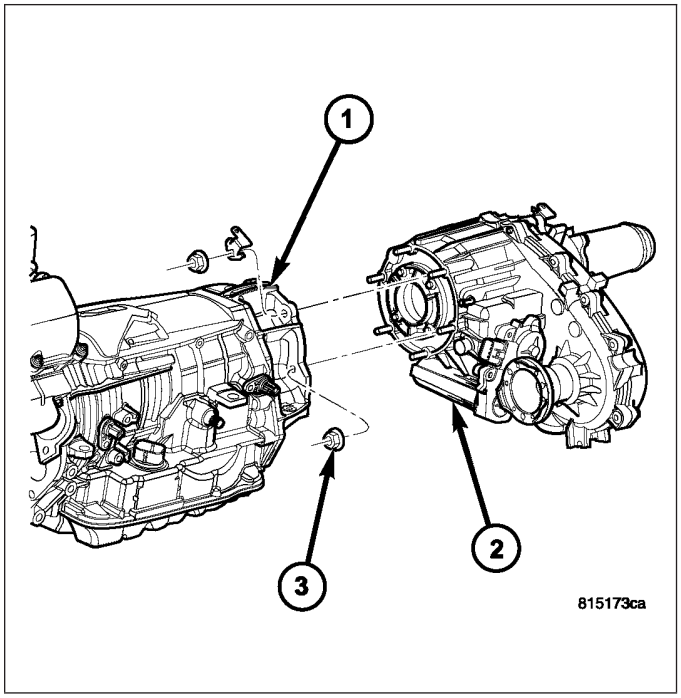
REAR RETAINER

1. Apply 3 mm (1/8 in.) wide bead of Mopar® Gasket Maker, or equivalent silicone adhesive sealer, to mounting surface of rear retainer. Allow sealer to set-up slightly before proceeding.
2. Install rear retainer on rear case. Tighten retainer bolts to 27-34 N·m (20-25 ft. lbs.).
3. Install new output shaft bearing snap-ring (2). Lift mainshaft slightly to seat snap-ring in shaft groove, if necessary.
4. Apply 3 mm (1/8 in.) wide bead of Mopar® Gasket Maker, or equivalent silicone adhesive sealer, to mounting surface of extension housing. Allow sealer to set-up slightly before proceeding.
5. Install extension housing on rear retainer.
6. Install extension housing bolts and tighten to 27-34 N·m (20-25 ft. lbs.).

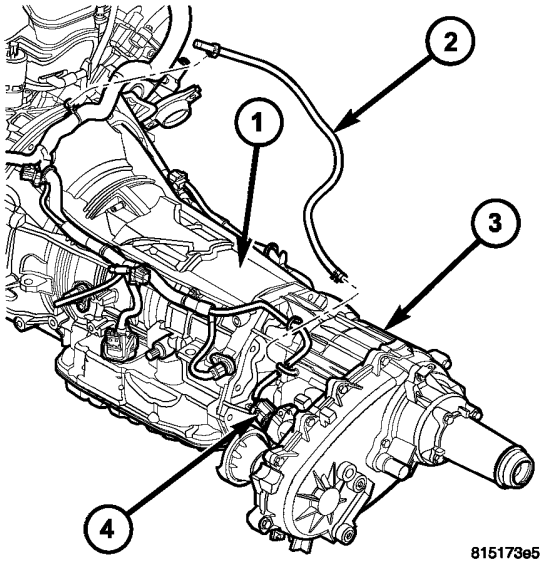


INSTALLATION

1. Mount transfer case on a transmission jack.
2. Secure transfer case to jack with chains.
3. Position transfer case under vehicle.
4. Align transfer case and transmission shafts and install transfer case (2) onto the transmission (1).
5. Install and tighten transfer case attaching nuts (3) to 27-34 N·m (20-25 ft. lbs.) torque.



6. Connect the vent hose (2) to the transfer case (3).
7. Connect the shift motor and mode sensor wiring connectors (4). Secure wire harness to clips on transfer case.
8. Align and connect the propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)
9. Fill transfer case with correct fluid. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE/ FLUID - STANDARD PROCEDURE)
10. Install rear crossmember and skid plate, if equipped. Tighten crossmember bolts to 41 N·m (30 ft. lbs.) torque.
11. Remove transmission jack and support stand.
12. Lower vehicle and verify transfer case shift operation.



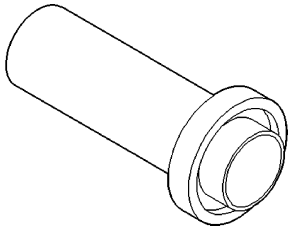
SPECIFICATIONS - TRANSFER CASE - NV233

TORQUE SPECIFICATIONS

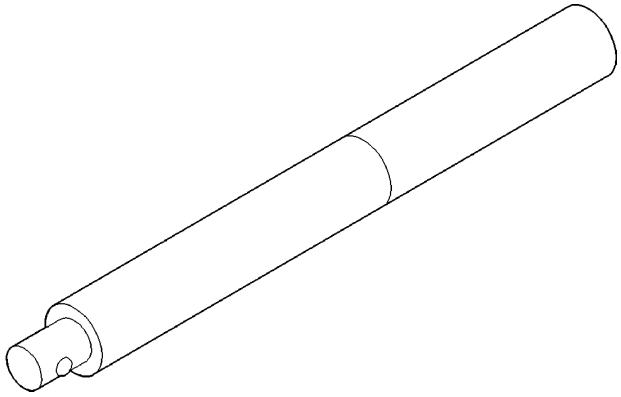
DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Plug, Detent	16-24	12-18	-
Plug, Drain/Fill	20-34	15-25	-
Bolt, Front Brg. Retainer	16-25	12-18	-
Bolt, Case Half	27-34	20-25	-
Nut, Companion Flange	122-176	90-130	-
Bolt, Shift motor and Mode Sensor Assembly	16-25	12-18	-
Bolt, Rear Retainer	27-34	20-25	-
Bolt, Extension Housing	27-34	20-25	-
Nut, Mounting	27-34	20-25	-

SPECIAL TOOLS

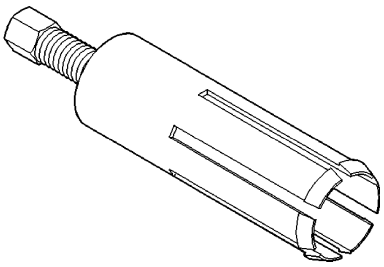
TRANSFER CASE - NV233



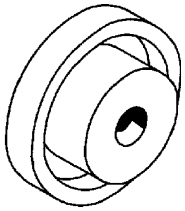
Installer, Seal - 8143-A



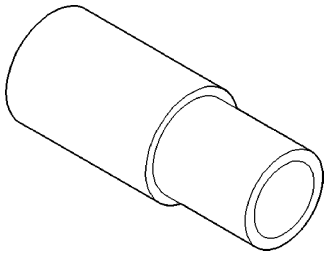
Handle, Universal - C-4171



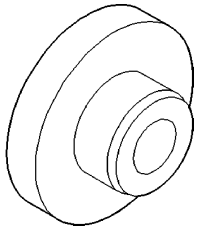
Remover, Bushing - 8158



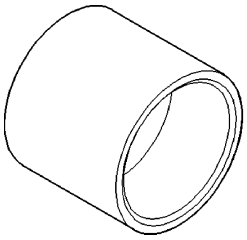
Installer, Seal - C-4210



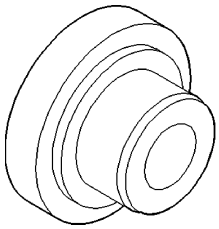
Installer, Bushing - 8157



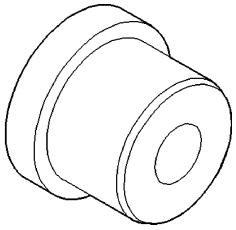
Installer, Bearing - 5064



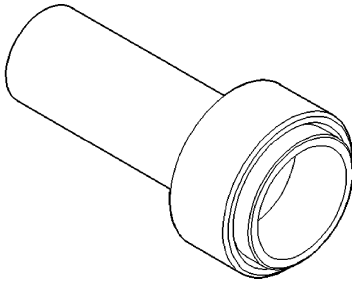
Installer, Seal - D-163



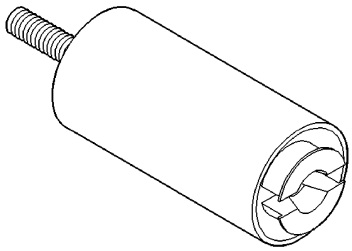
Installer, Bearing - 5065



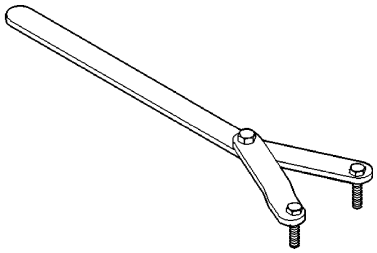
Installer, Bushing - 5066



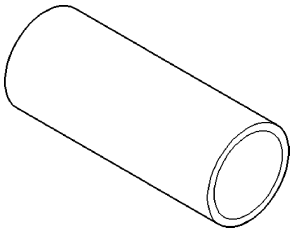
Installer, Pump Housing Seal - 7888



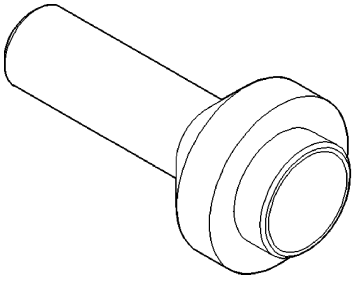
Remover - L-4454



Wrench, Spanner - 6958



Cup - 8148



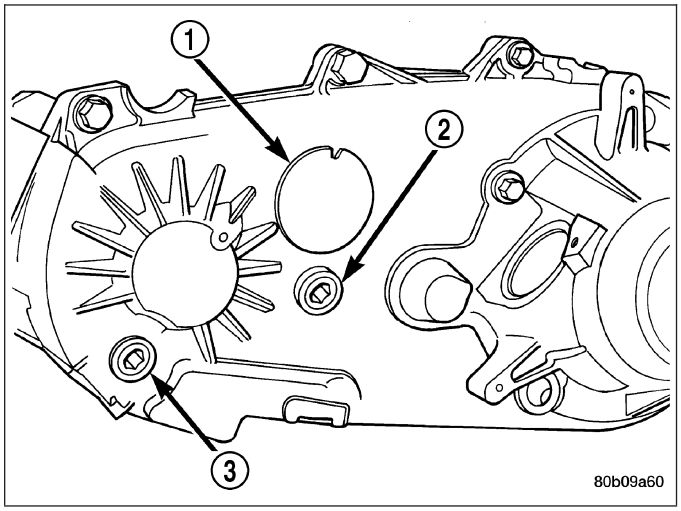
Installer, Seal - 7884

FLUID

STANDARD PROCEDURE - FLUID DRAIN AND REFILL

The fill (2) and drain (3) plugs are both in the rear case.

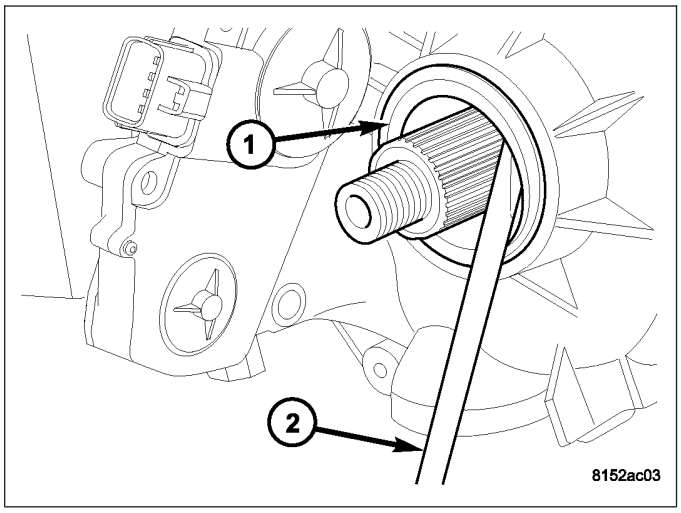
1. Raise vehicle.
2. Position drain pan under transfer case.
3. Remove drain and fill plugs and drain lubricant completely.
4. Install drain plug. Tighten plug to 20-34 N·m (15-25 ft. lbs.).
5. Remove drain pan.
6. Fill transfer case to bottom edge of fill plug opening with Mopar® ATF +4, Automatic Transmission fluid.
7. Install and tighten fill plug to 20-34 N·m (15-25 ft. lbs.).
8. Lower vehicle.



SEAL-FRONT OUTPUT SHAFT

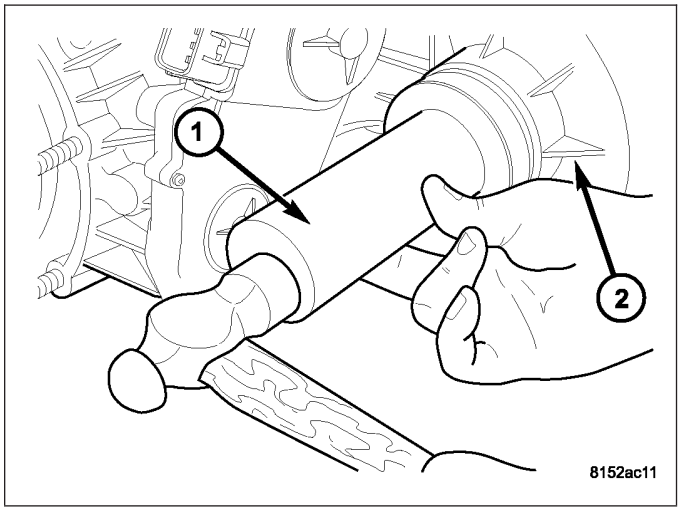
REMOVAL

1. Raise vehicle.
2. Remove front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
3. Remove front output shaft companion flange.
4. Remove seal (1) from front case with suitable pry tool.



INSTALLATION

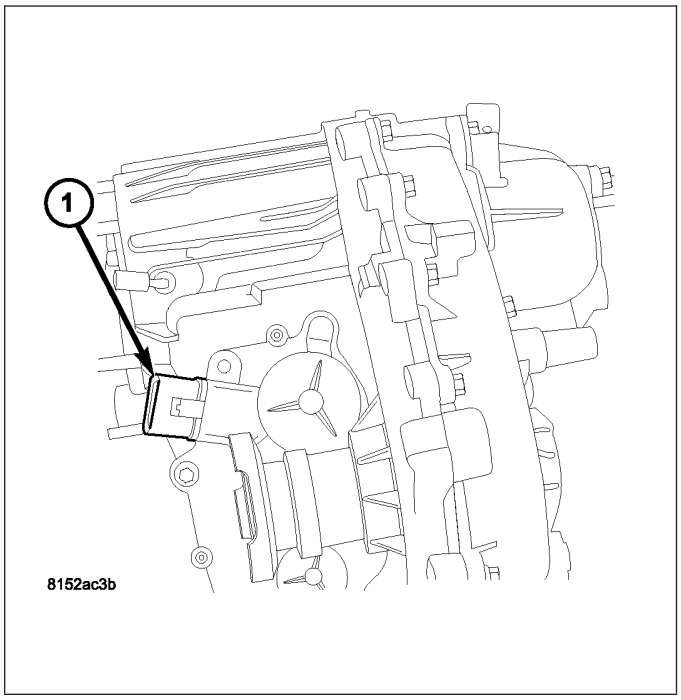
1. Install new front output seal in front case (2) with Installer Tool 8143-A (1) as follows:
   a. Place new seal on tool. Garter spring on seal goes toward interior of case.
   b. Start seal in bore with light taps from hammer. Once seal is started, continue tapping seal into bore until installer tool seats against case.
2. Install the front output shaft companion flange. Tighten the flange nut to 122-176 N·m (90-130 ft.lbs.).
3. Install the front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)



SENSOR-MODE

DESCRIPTION

The transfer case mode sensor (1) provides the Front Control Module (FCM) feedback about the position of the transfer case. The sensor consists of a linear analog position sensor that converts the motor output shaft position into a DC signal. The FCM must supply 5VDC (+/- 0.5v) to the sensor whenever the FCM is not in sleep mode and monitor the shift motor position. The sensor position is monitored when the ignition is in the RUN position and for 10 seconds after the ignition is shifted to the OFF position. The sensor is mechanically linked to the shaft of the cam which allows the transfer case to shift. The mode sensor will draw less than 20 mA of current during operation.



OPERATION

During normal vehicle operation, the Front Control Module (FCM) monitors the mode sensor outputs at least every 2 milliseconds when the shift motor is stationary or active.

Refer to SECTOR ANGLES vs. TRANSFER CASE POSITION for the relative angles of the transfer case shift sector versus the interpreted transfer case gear operating mode.

SECTOR ANGLES vs. TRANSFER CASE POSITION

Shaft Angle (Degrees)	Transfer Case Position
+20	4LO
0	N
-20	2WD
-40	4HI

NOTE: All the parameter voltages referred to in the following information are calibrated items in the controller software and are subject to change.

NOTE: For a further explanation of Phase 1 through 3 shifting, (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - OPERATION).

The following information describes the different mode sensor positions:

- 4LO TARGET REGION - The position shall be considered 4LO if the voltage is greater than or equal to encoder_4LO_min Volts and it is also less than or equal to encoder_4LO_max Volts.
- 4LO SHIFT LIMIT - During Phase 2 and Phase 3 shifting, shifts may become unidirectional when a voltage is less than or equal to encoder_4LO_min Volts has been reached.
- 4HI TARGET REGION - The position shall be considered 4HI if the voltage is greater than or equal to encoder_4HI_min Volts and it is also less than or equal to encoder_4HI_max Volts.
- NEUTRAL TARGET REGION - The position shall be considered NEUTRAL if the voltage is greater than or equal to encoder_Neutral_min Volts and it is also less than or equal to encoder_Neutral_max Volts.
- 2WD TARGET REGION - The position shall be considered 2WD if the voltage is greater than or equal to encoder_2WD_min Volts and it is also less than or equal to encoder_2WD_max Volts.
- 2WD SHIFT LIMIT - During Phase 2 and Phase 3 shifting, shifts may become unidirectional when a voltage is greater than or equal to encoder_2WD_min Volts has been reached.

The mode sensor position will be considered invalid by the FCM if the voltage is greater than or equal to encoder_High_Range_Limit Volts or if it is less than or equal to encoder_Low_Range_Limit Volts.

Refer to MODE SENSOR VOLTAGES - NV233 table for the mode sensor voltages.

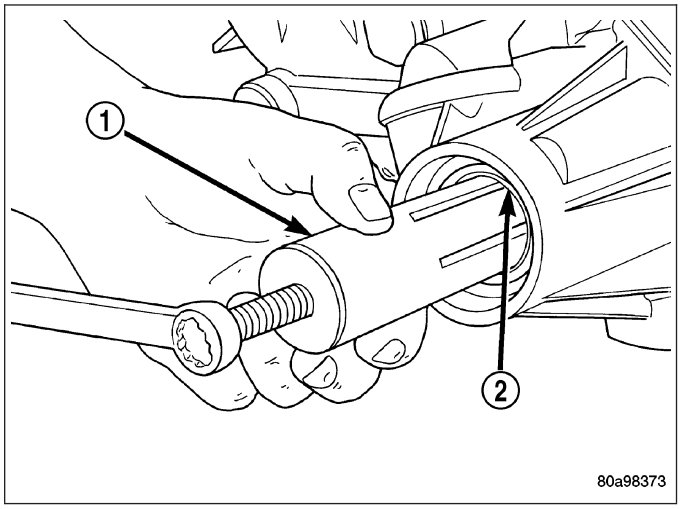
MODE SENSOR VOLTAGES - NV233

Parameter Name	Voltage
encoder_4HI_Min	4.26
encoder_4HI_Max	4.36
encoder_2WD_Min	3.36
encoder_2WD_Max	3.44
encoder_Neutral_Min	2.45
encoder_Neutral_Max	2.54
encoder_4LO _Min	1.48
encoder_4LO _Max	1.57
encoder_High_Range_Limit	4.51
encoder_Low_Range _Limit	0.50

BUSHING/SEAL-REAR RETAINER

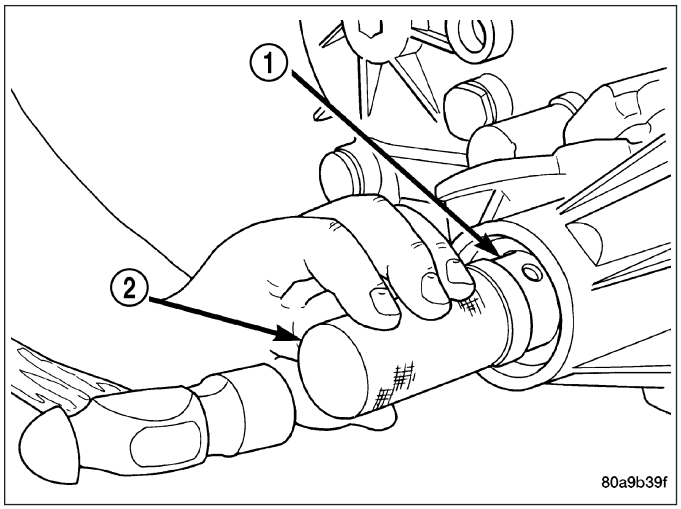
REMOVAL

1. Raise vehicle.
2. Remove rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
3. Using a suitable pry tool or slide-hammer mounted screw, remove the rear retainer seal.
4. Using Remover 8158 (1), remove the bushing from rear retainer.

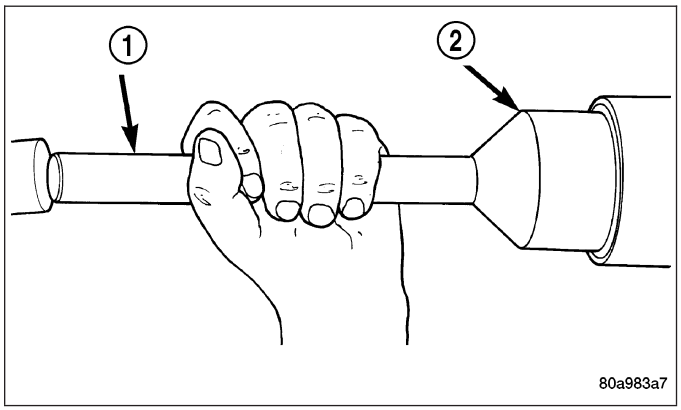


INSTALLATION

1. Clean fluid residue from sealing surface and inspect for defects.
2. Position replacement bushing in rear retainer with fluid port in bushing aligned with slot in retainer.
3. Using Installer 8157 (2), drive bushing (1) into retainer until installer seats against case.



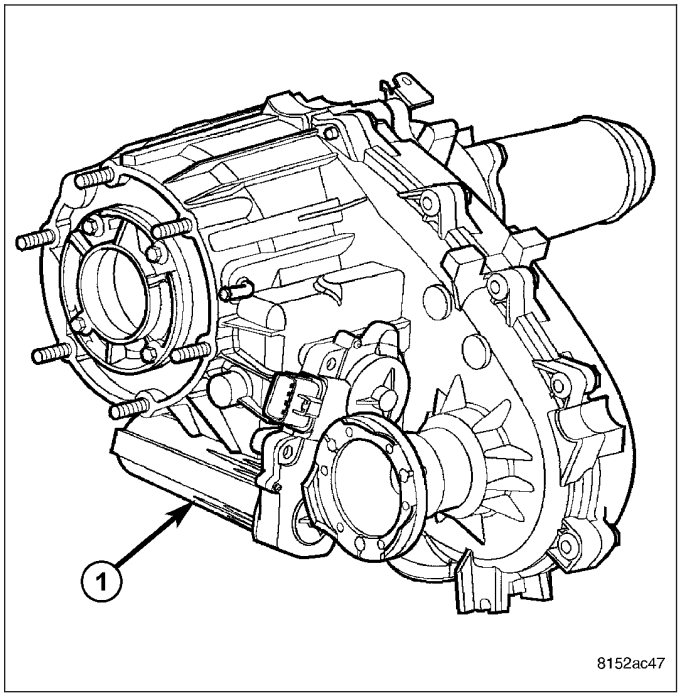
4. Using Installer D-163 (2), install seal in rear retainer.
5. Install the rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)
6. Verify proper fluid level.
7. Lower vehicle.



ASSEMBLY-SHIFT MOTOR/MODE SENSOR

DESCRIPTION

The shift motor (1) is an electromechanical device consisting of a DC permanent magnet motor, gear train, and an analog position sensor. The shift motors' overall function is to move and lock a gear that moves the mode and range forks found in the transfer case. This allows the transfer case to be shifted electrically to multiple operating positions (4HI, 2WD, N (neutral), and 4LO). The operating current of the shift motor under stall conditions is 30 amps maximum at 72° F with 13.5 volts, at the motor leads.



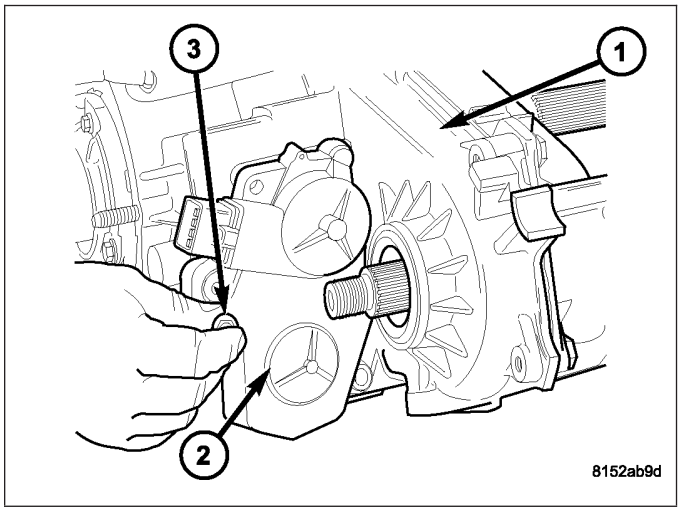
OPERATION

Shifting in the transfer case occurs when a Pulse Width Modulated (PWM) voltage is supplied to the shift motor by the Front Control Module (FCM). A linear analog position sensor located inside the shift motor, provides the FCM with the motors' angular, rotational position. With this information, the FCM continuously knows the motors' position, and therefore allows it to accurately control the motors' operation, including voltage polarity which is used to control motor direction.

REMOVAL

NOTE: New shift motor assemblies are shipped in the 2WD/AWD position. If a new shift motor assembly must be installed, it will be necessary to shift the transfer case to the 2WD/AWD position prior to motor installation.

1. Raise the vehicle on a suitable hoist.
2. Disengage the wiring connector from the shift motor and mode sensor assembly.
3. Remove the bolts (3) holding the shift motor and mode sensor assembly (2) onto the transfer case (1).
4. Separate the shift motor and mode sensor assembly (2) from the transfer case (1).

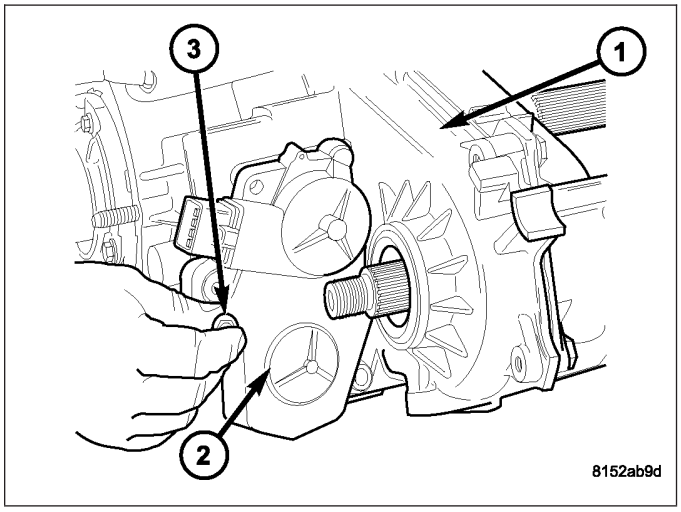


INSTALLATION

1. Verify that the shift motor o-ring is clean and properly positioned inside the machined o-ring groove of the shift motor.
2. Add high temperature grease between the actuator and the transfer case mating surface for sealing purposes.

NOTE: Verify that the shift motor position and sector shaft orientation are aligned. It may be necessary to manually shift the transfer case if the shift motor and sector shaft are not aligned.

3. Position the shift motor and mode sensor assembly (2) onto the transfer case (1).
4. Install the bolts (3) to hold the assembly (2) onto the transfer case (1). Tighten the bolts to 16-24 N·m (12-18 ft.lbs.).



CAUTION: If the original shift motor and mode sensor assembly bolts are reused, be sure to use Mopar® Lock & Seal or Loctite™ 242 to replenish the lock patch material originally found on the bolts

5. Engage the wiring connector to the shift motor and mode sensor assembly.
6. Refill the transfer case as necessary.
7. Lower vehicle and verify transfer case operation.

SWITCH-TRANSFER CASE SELECTOR

DESCRIPTION

The selector switch assembly is mounted in the right side of the vehicle's Instrument Panel (IP) and consists of a rotary knob connected to a resistive network for the mode and range shift selections. Also located in this assembly is a recessed, normally open momentary switch for making shifts into and out of transfer case NEUTRAL. A pen, or similar instrument, is used to make a NEUTRAL shift selection, thus reducing the likelihood of an inadvertent shift request.

OPERATION

As the position of the selector switch varies, the resistance between the Mode Sensor supply voltage pin and the Mode Sensor output will vary. Hardware, software, and calibrations within the Front Control Module (FCM) are provided that interpret the selector switch resistance as given in the table below: SELECTOR SWITCH INTERPRETATION

SELECTOR SWITCH INTERPRETATION

Required Interpretation	Resistance Range (ohms)
Shorted	<150
2WD+NEUTRAL	176-200
4HI+NEUTRAL	190-216
4LO+NEUTRAL	199-226
2WD (Default)	1159-1287
4HI	2259-2503
4LO	4820-5334
Open/Diagnostic	>19K

The internal structure and function of the selector switch is such that the connection is made to the Open/Diagnostic resistor before the connection to the individual position resistors is broken. Because of this characteristic, if the resistance between the Mode Sensor supply voltage pin and the Mode Sensor output pin is >19k ohms, the position resistor is open.

TRANSFER CASE - NV244

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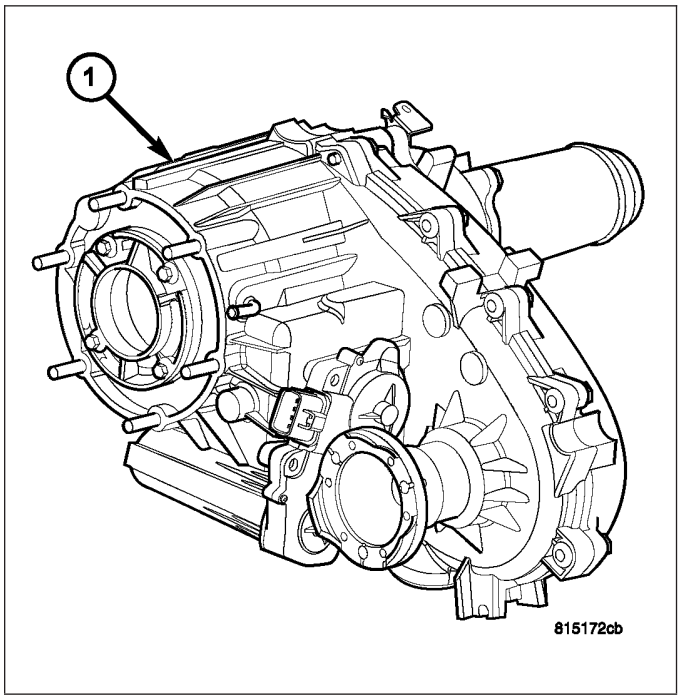
TRANSFER CASE - NV244

DESCRIPTION

The NV244 (1) is an electronically controlled full and part-time transfer case with no two wheel drive operation.

A differential in the transfer case is used to control torque transfer to the front and rear axles. A low range gear reduction system provides increased low speed torque capability for off road operation. The low range provides a 2.72:1 reduction ratio.

The geartrain is mounted in two aluminum case halves attached with bolts. The mainshaft front and rear bearings are mounted in aluminum retainer housings bolted to the case halves.



OPERATING RANGES

NV244 operating ranges are:

- AWD(All-Wheel Drive)
- 4HI (Part-time)
- 4LO
- NEUTRAL

The AWD mode can be used at any time and on any road surface.

The 4HI (Part-time) and 4LO ranges are for off road use only. The only time these ranges can be used is when the road surface is covered with snow, ice, or other loose slippery material.

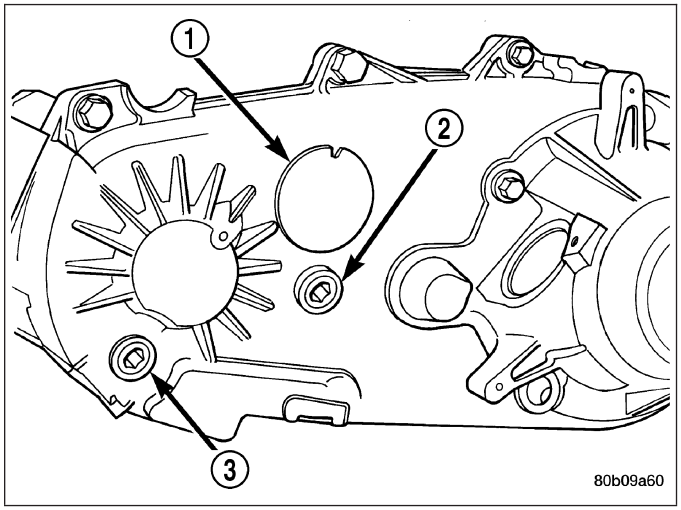
SHIFT MECHANISM

Operating ranges are selected with a dash mounted shift selector switch. The shift selector switch provides a input to the Transfer Case Control Module (TCCM) to indicate the driver's desire to change operating ranges. The TCCM uses this input, along with the input from the transfer case mounted mode sensor and information from the vehicle's bus, to determine if a shift is permitted. If the TCCM decides the shift is permitted, the TCCM controls the shift motor, mounted to the exterior of the transfer case, to perform the shift.

IDENTIFICATION

A circular ID tag (1) is attached to the rear case of each transfer case. The ID tag provides the transfer case model number, assembly number, serial number, and low range ratio.

The transfer case serial number also represents the date of build.



OPERATION

The input gear is splined to the transmission output shaft. The input gear drives the mainshaft through the planetary assembly and range sleeve. The front output shaft is operated by a drive chain that connects the shaft to a drive sprocket on the mainshaft. The drive sprocket is engaged/disengaged by the mode fork, which operates the mode sleeve and hub. The sleeve and hub are not equipped with a synchronizer mechanism for shifting.

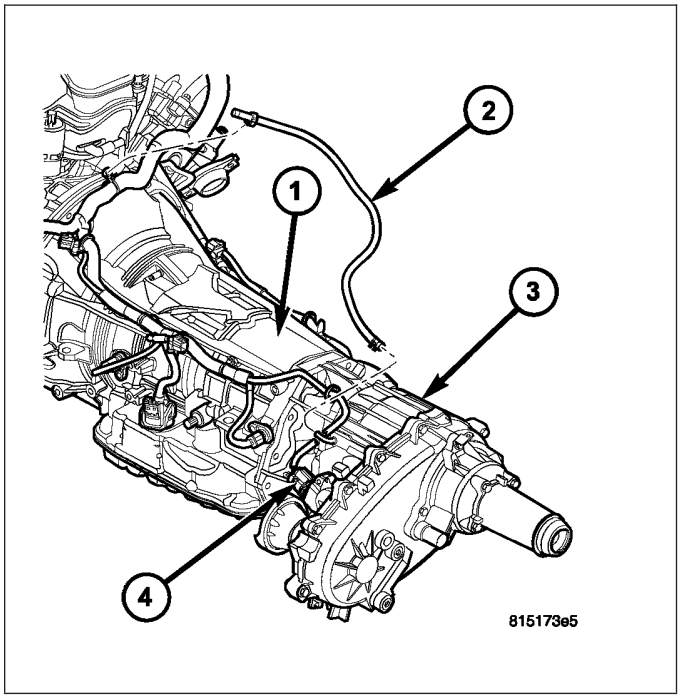
DIAGNOSIS AND TESTING - TRANSFER CASE - NV244

DIAGNOSIS CHART

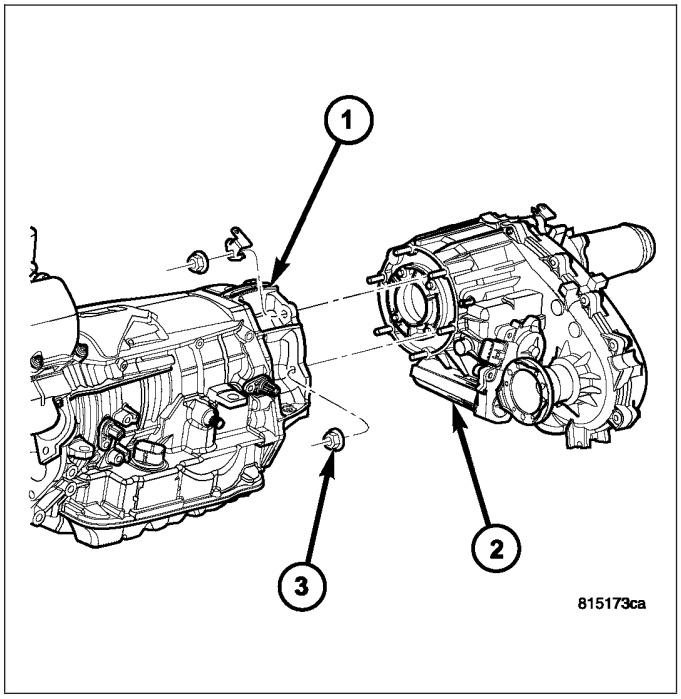
CONDITION	POSSIBLE CAUSE	CORRECTION
Transfer case difficult to shift or will not shift into desired range.	1) Transfer case electronically controlled shift system malfunction.	1) Verify proper operation per the appropriate diagnostic manual.
	2) Insufficient or incorrect lubricant.	2) Drain and refill transfer case with the correct quantity of Mopar® ATF +4, Automatic Transmission Fluid.
	3) Internal transfer case components binding, worn, or damaged.	3) Repair or replace components as necessary.
Transfer case noisy in all drive modes.	1) Insufficient or incorrect lubricant.	1) Drain and refill transfer case with the correct quantity of Mopar® ATF +4, Automatic Transmission Fluid.
	2) Internal transfer case components binding, worn, or damaged.	2) Repair or replace components as necessary.
Transfer case noisy while in, or jumps out of, 4LO.	1) Transfer case not completely engaged in 4LO position.	1) While rolling 2-3 MPH and the transmission in NEUTRAL, or the clutch depressed on vehicles equipped with a manual transmission, shift the transfer case to the AWD or 4HI position, and then back into the 4LO position.
	2) Range fork damaged, inserts worn, or fork is binding on the shift rail.	2) Repair or replace components as necessary.
	3) Low range gear worn or damaged.	3) Repair or replace components as necessary.
Lubricant leaking from transfer case seals or vent.	1) Transfer case overfilled.	1) Drain lubricant to the correct level.
	2) Transfer case vent closed or restricted.	2) Clean or replace vent as necessary.
	3) Transfer case seals damaged or installed incorrectly.	3) Replace suspect seal.
Transfer case will not shift through 4HI (Part-time) range.	1) Incomplete shift due to drivetrain torque load.	1) Drive in a straight line and momentarily release the accelerator pedal to complete the shift.
	2) Incorrect tire pressure.	2) Correct tire pressure as necessary.
	3) Excessive tire wear.	3) Correct tire condition as necessary.
	4) Excessive vehicle loading.	4) Correct as necessary.

REMOVAL

1. Shift transfer case into 2WD.
2. Raise vehicle.
3. Drain transfer case lubricant.
4. Support transmission with jack stand.
5. Remove rear crossmember and skid plate, if equipped.
6. Disconnect front and rear propeller shafts at transfer case. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
7. Disconnect transfer case shift motor and mode sensor wire connectors (4).
8. Disconnect transfer case vent hose (2) from the transfer case (3).



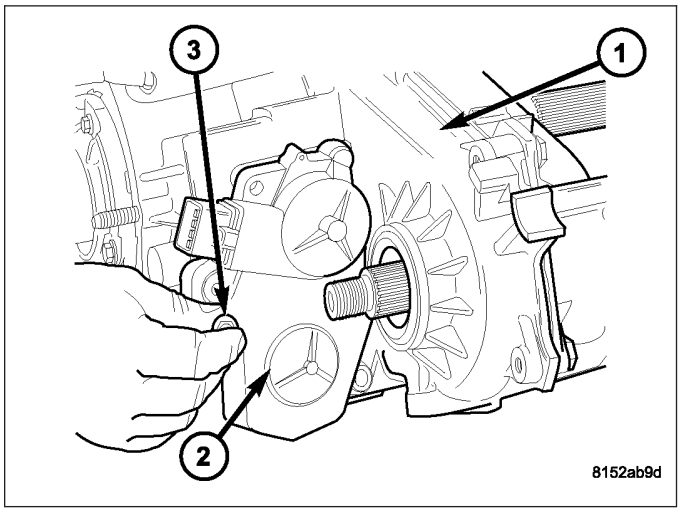
9. Support transfer case with transmission jack.
10. Secure transfer case to jack with chains.
11. Remove nuts (3) attaching transfer case (2) to transmission (1).
12. Pull transfer case and jack rearward to disengage transfer case.
13. Remove transfer case from under vehicle.



DISASSEMBLY

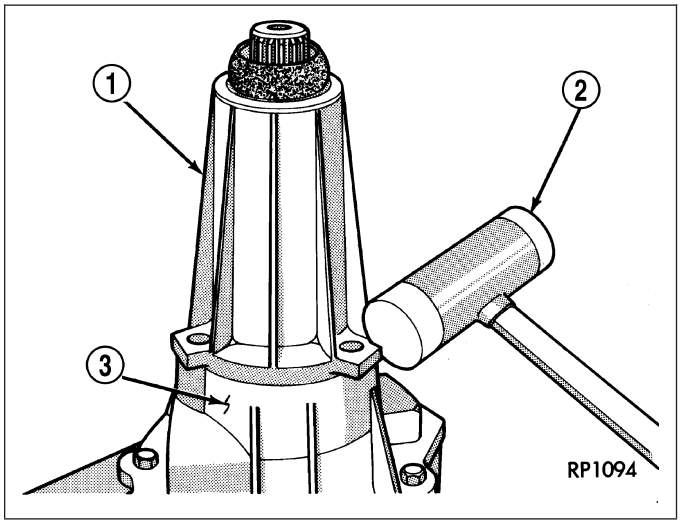
COMPANION FLANGE AND SHIFT MOTOR ASSEMBLY

1. Remove front companion flange nut with a socket and impact wrench
2. Remove the front companion flange. If the flange is difficult to remove by hand, remove it with bearing splitter, or with standard two jaw puller. Be sure puller tool is positioned on the flange and not on the slinger, as slinger will be damaged.
3. Remove seal washer from front output shaft. Discard washer as it should not be reused.
4. Remove the bolts (3) which hold the shift motor and mode sensor assembly to the transfer case.
5. Remove the shift motor and mode sensor assembly (2) from the transfer case.

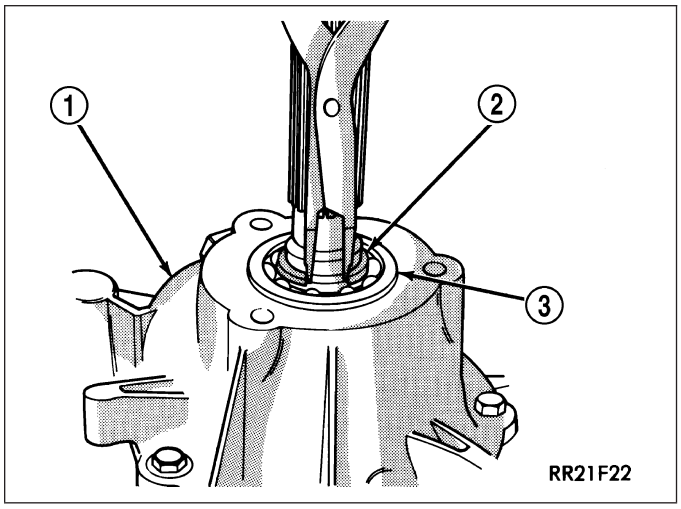


REAR RETAINER

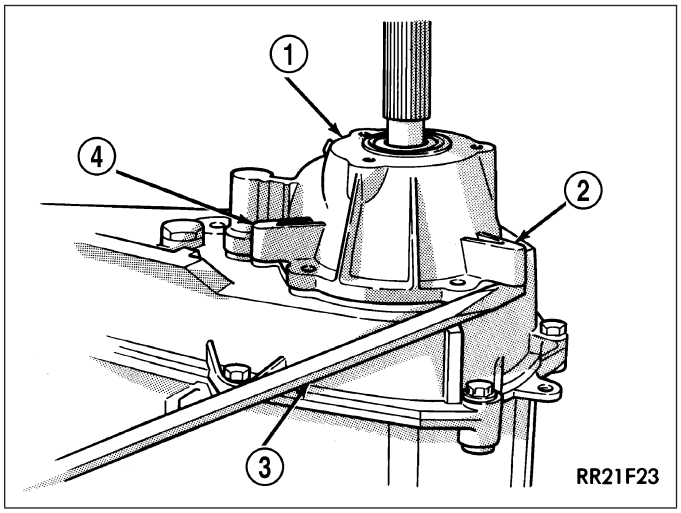
1. Remove extension housing bolts.
2. Tap extension housing (1) with plastic or rawhide mallet (2) to loosen sealer.



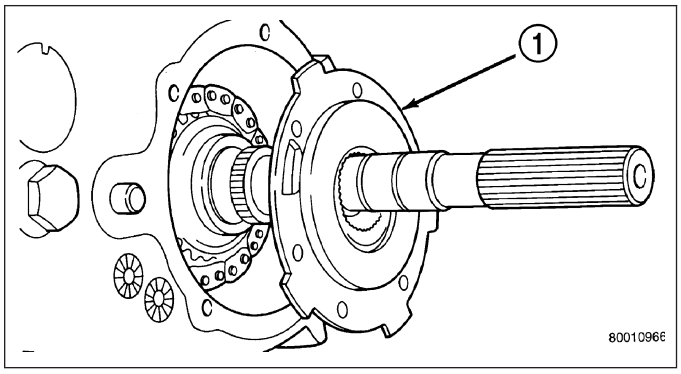
3. Separate extension housing from rear retainer (1).
4. Remove rear bearing snap-ring (2).



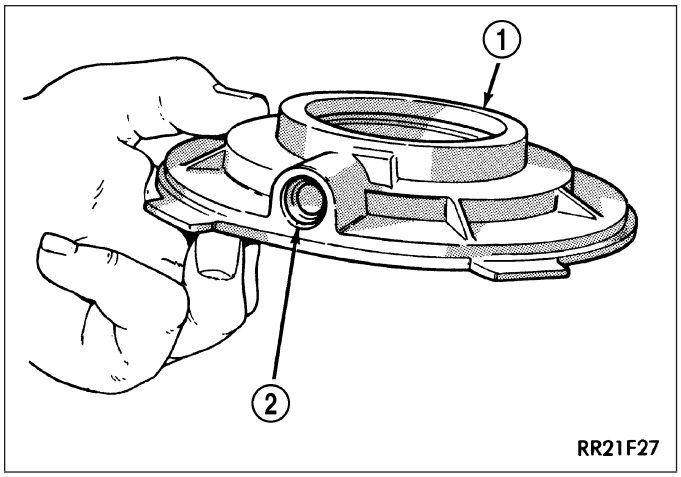
5. Remove bolts holding rear retainer to rear case half.
6. Loosen rear retainer (1) with pry tool (3) to break sealer bead. Pry only against retainer boss as shown.



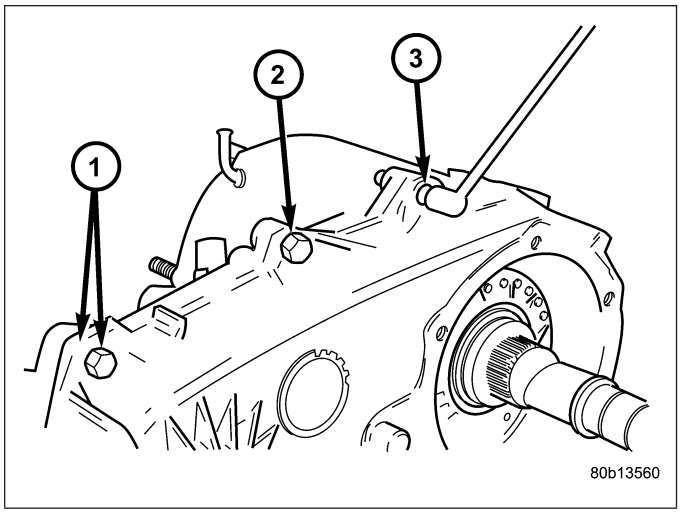
7. Remove rear bearing O.D. retaining ring with snap-ring pliers. Then tilt pump (1) and slide it off output shaft.



8. Remove pickup tube o-ring (2) from pump, but do not disassemble pump (1); it is not a repairable part.
9. Remove seal from oil pump with pry tool.

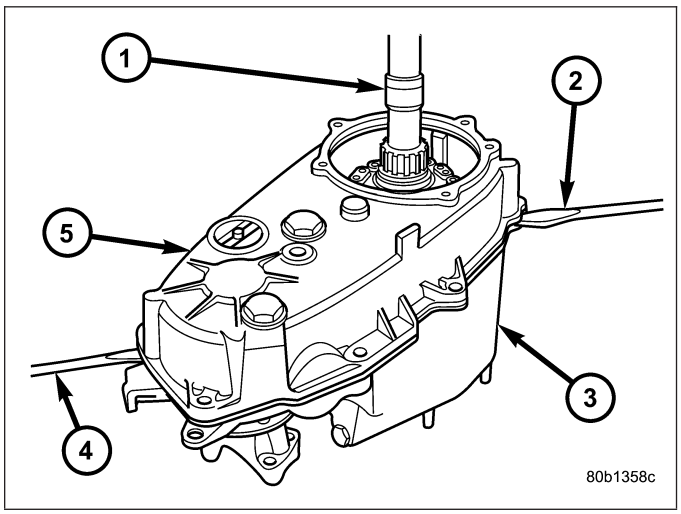


10. Remove bolts (2) attaching rear case to front case. Note position of the two black finish bolts at each end of the case. These bolts go through the case dowels and require a washer under the bolt head.

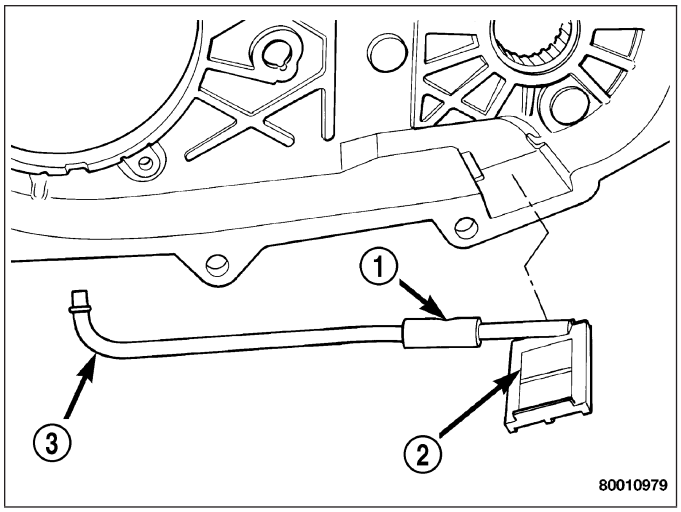


CAUTION: Do not pry on the sealing surface of either case half as the surfaces will become damaged.

11. Remove rear case (5) from front case (3). Insert screwdrivers (2,4) into slots cast into each end of case. Then pry upward to break sealer bead and remove rear case.

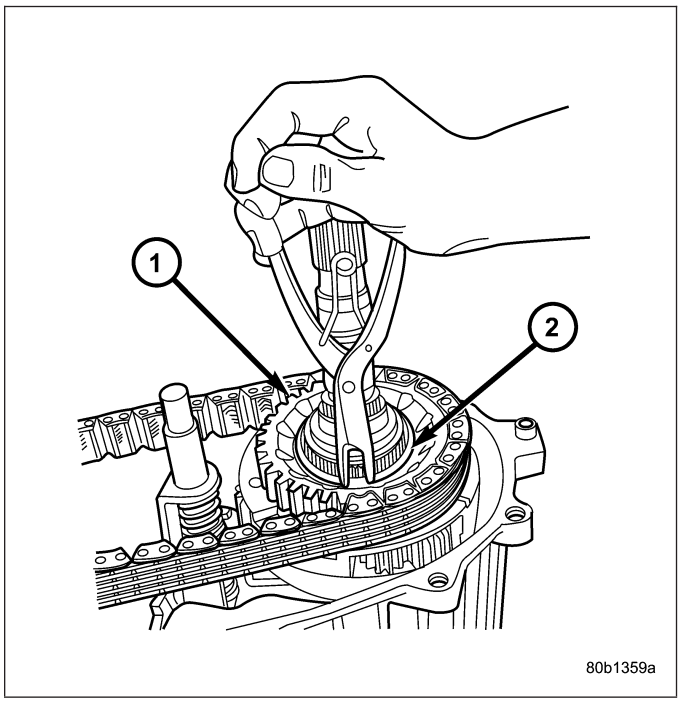


12. Remove oil pickup tube (3) and screen (2) from rear case.

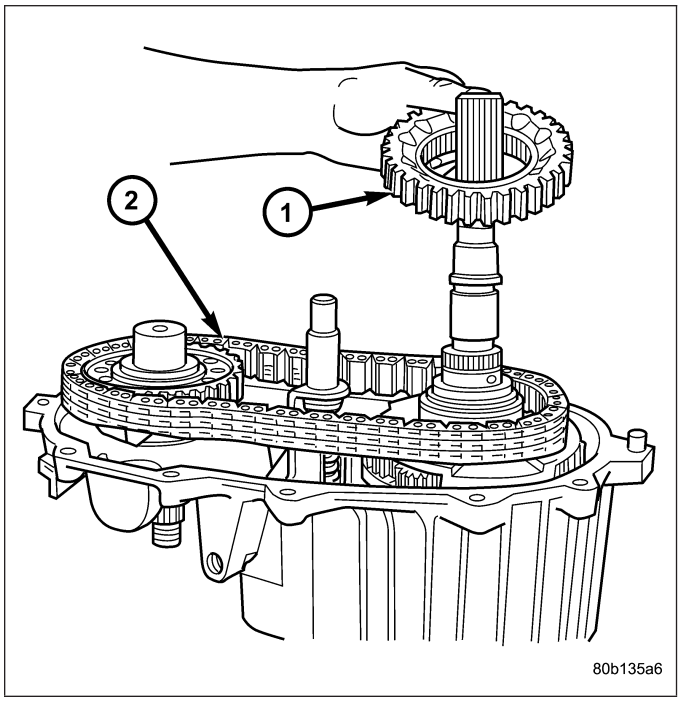


FRONT OUTPUT SHAFT AND DRIVE CHAIN

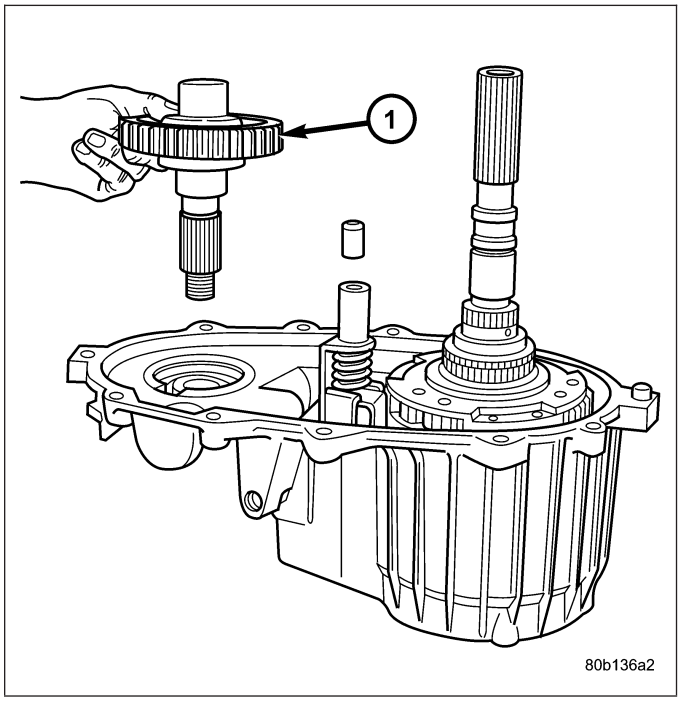
1. Remove drive sprocket snap-ring (2).



2. Remove drive sprocket (1) and chain (2).

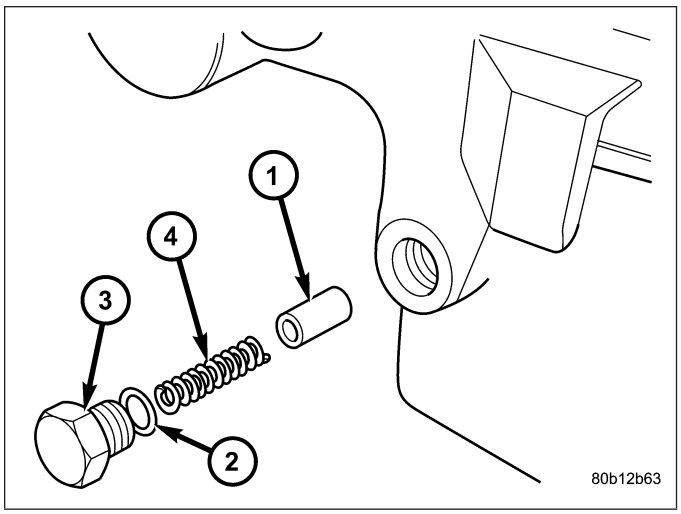


3. Remove front output shaft (1).

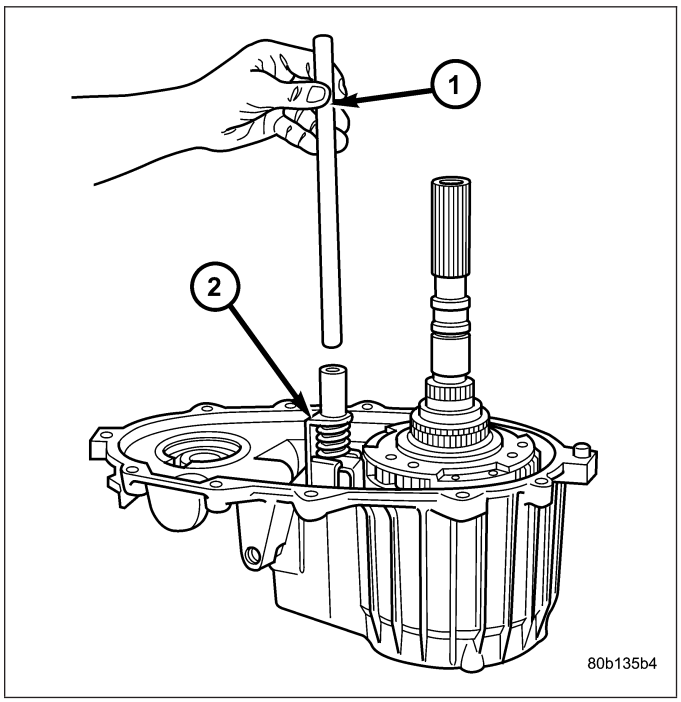


SHIFT FORKS AND MAINSHAFT

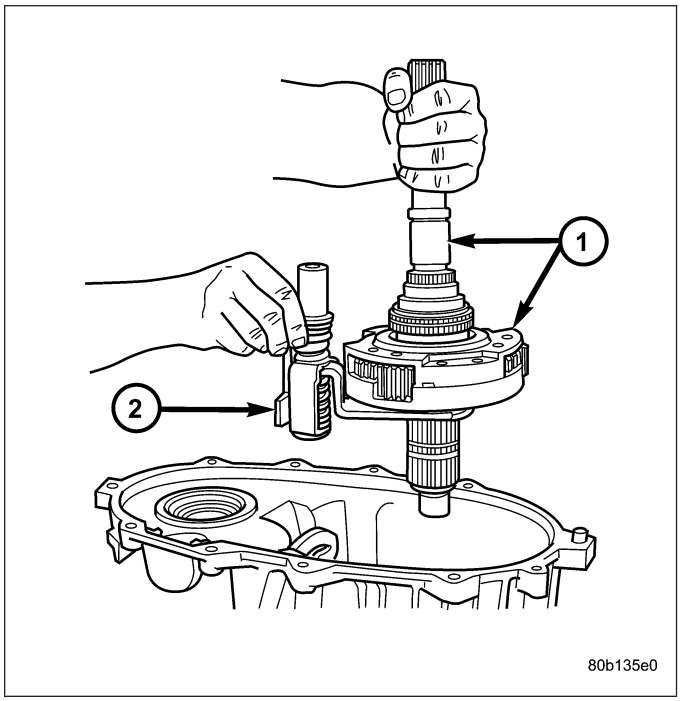
1. Remove shift detent plug (3), spring (4) and plunger (1).



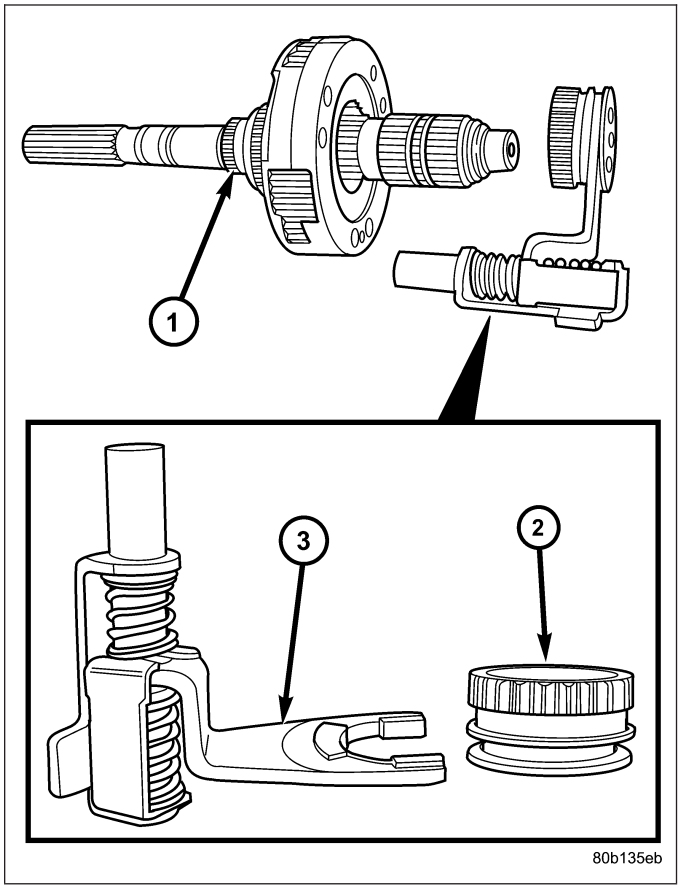
2. Remove shift rail (1) by pulling it straight up and out of fork (2).



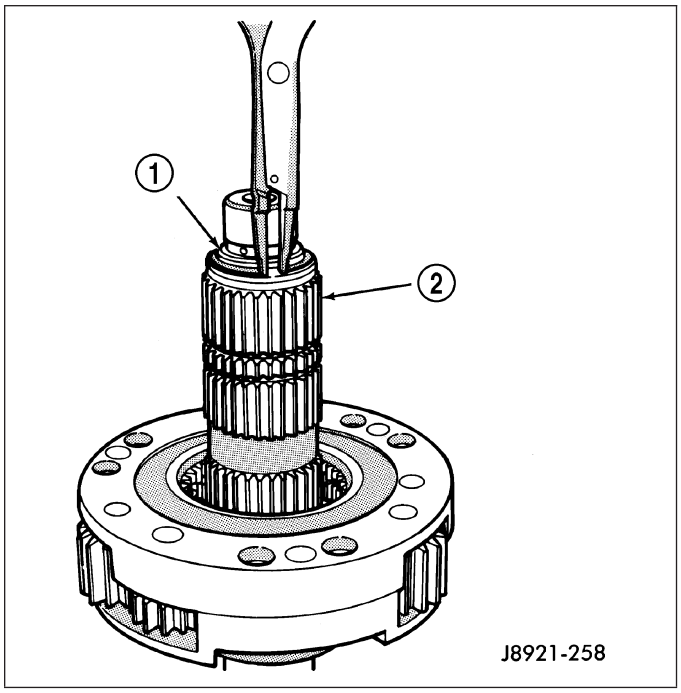
3. Remove mode fork (2) and mainshaft (1) as assembly.



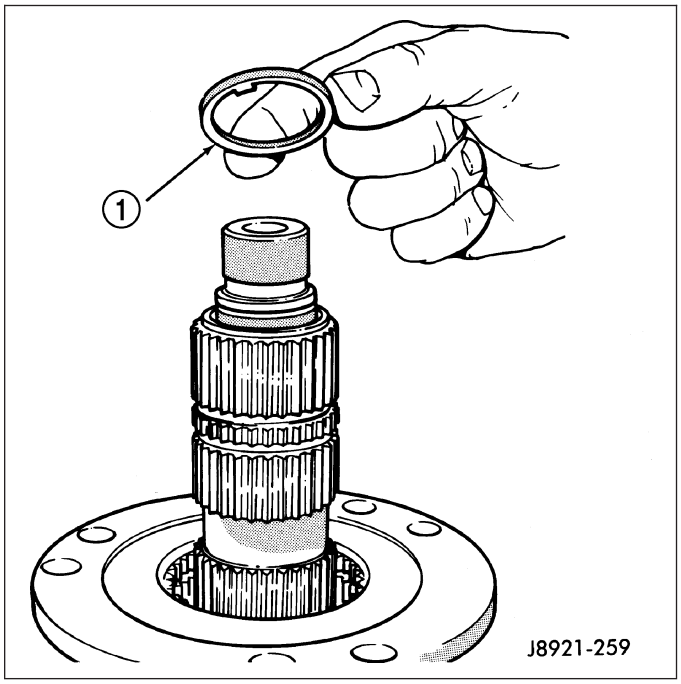
4. Remove mode shift sleeve (2) and mode fork assembly (3) from mainshaft (1). Note position of mode sleeve in fork and remove sleeve.



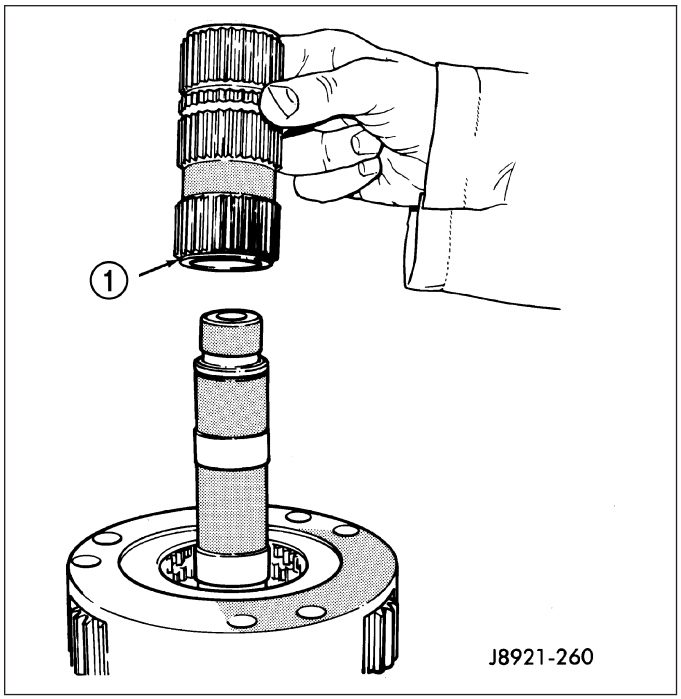
5. Remove intermediate clutch shaft snap-ring (1).



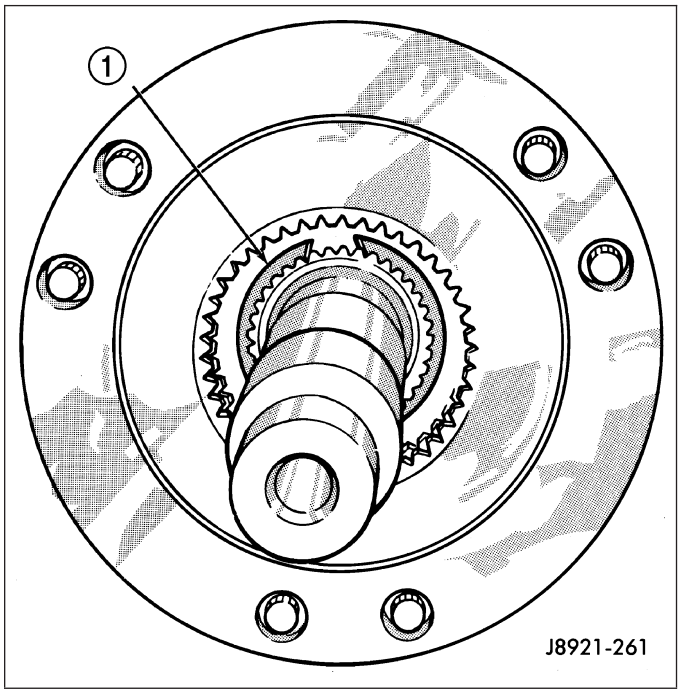
6. Remove clutch shaft thrust ring (1).



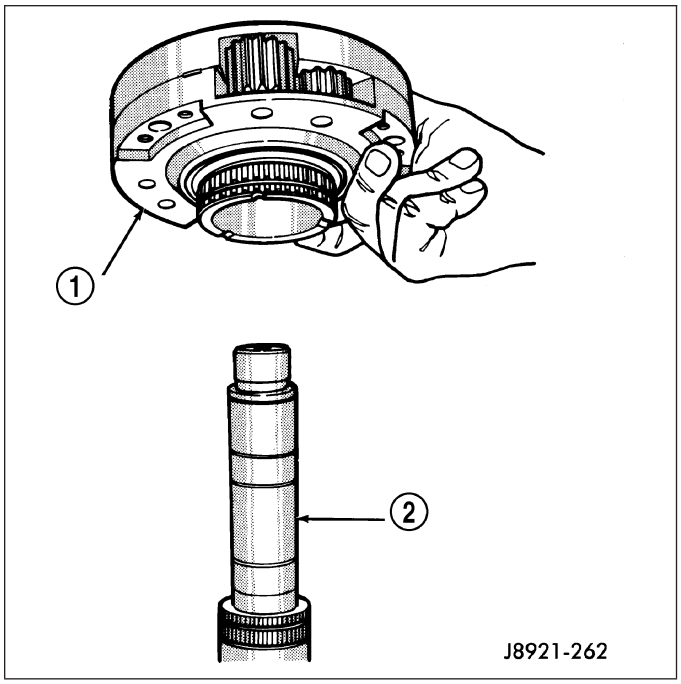
7. Remove intermediate clutch shaft (1).



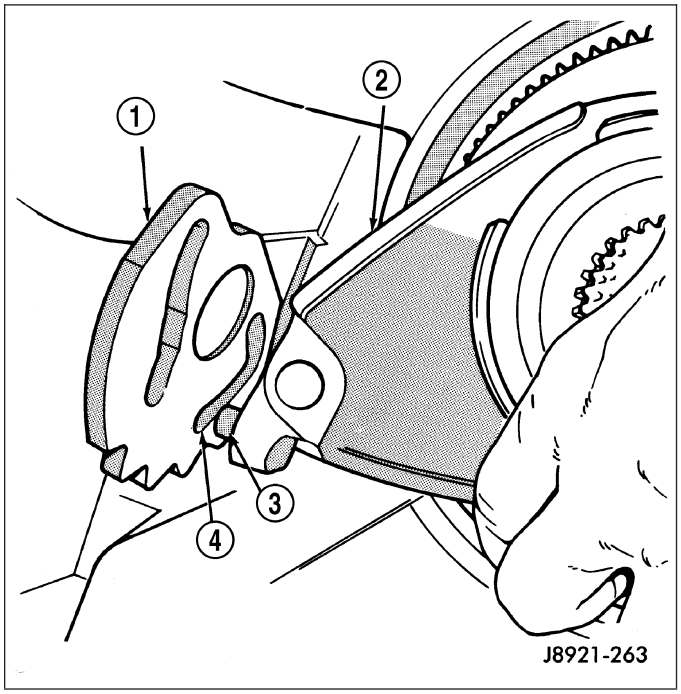
8. Remove differential snap-ring (1).



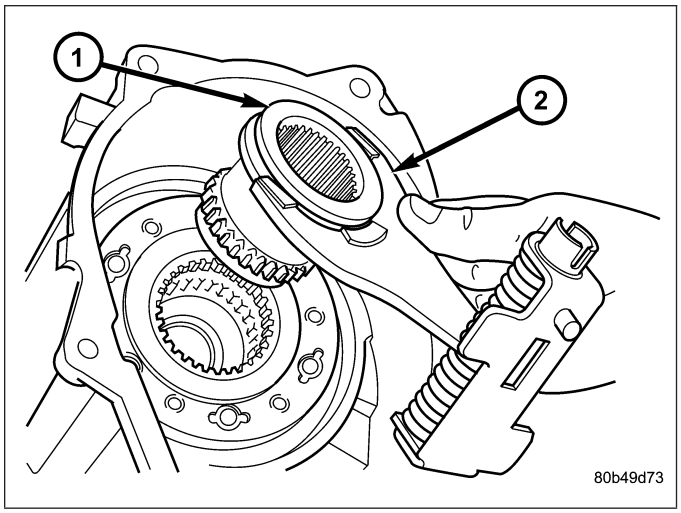
9. Remove differential (1).



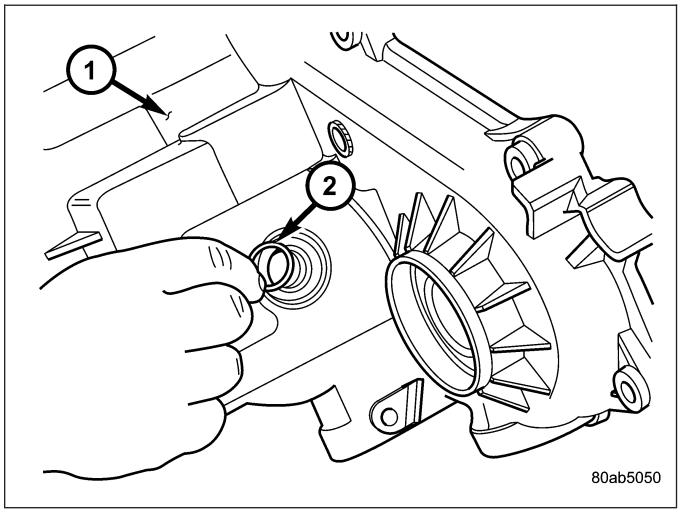
10. Remove differential needle bearings and both needle bearing thrust washers from mainshaft.
11. Slide low range fork pin out of shift sector slot (4).



12. Remove low range fork (2) and hub (1).

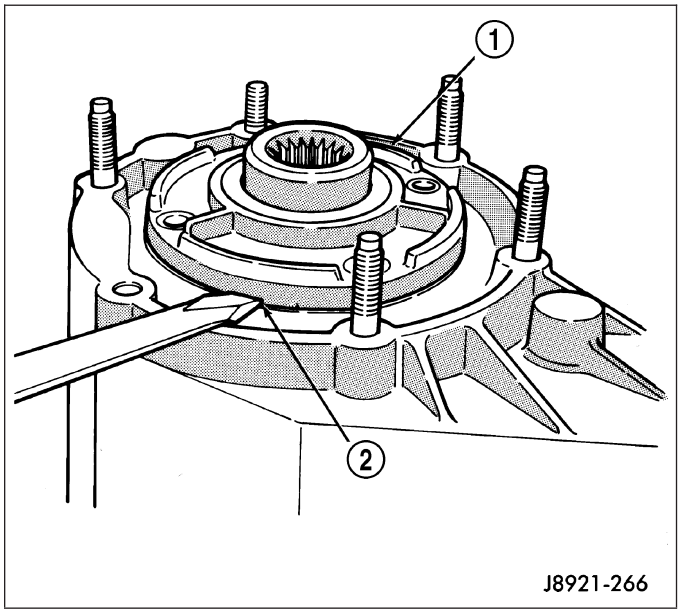


13. Remove shift sector.
14. Remove shift sector o-ring (2).



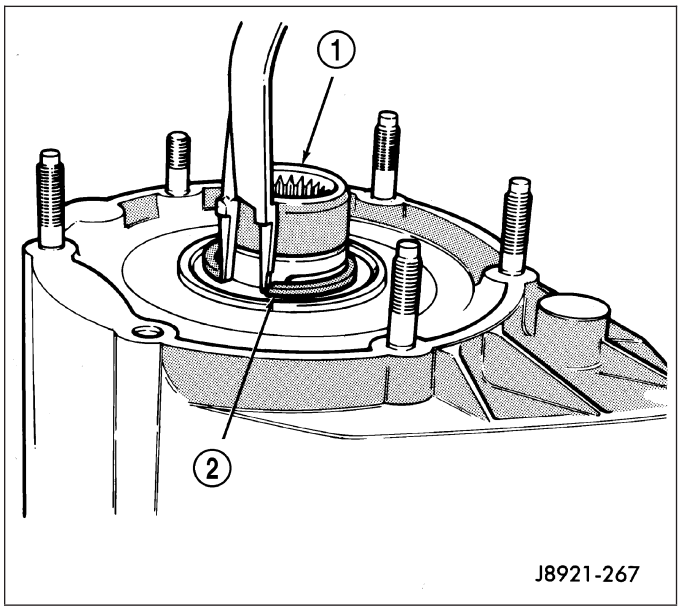
INPUT GEAR/LOW RANGE ASSEMBLY

1. Remove front bearing retainer bolts.
2. Remove front bearing retainer (1). Carefully pry retainer loose with screwdriver. Position screw-

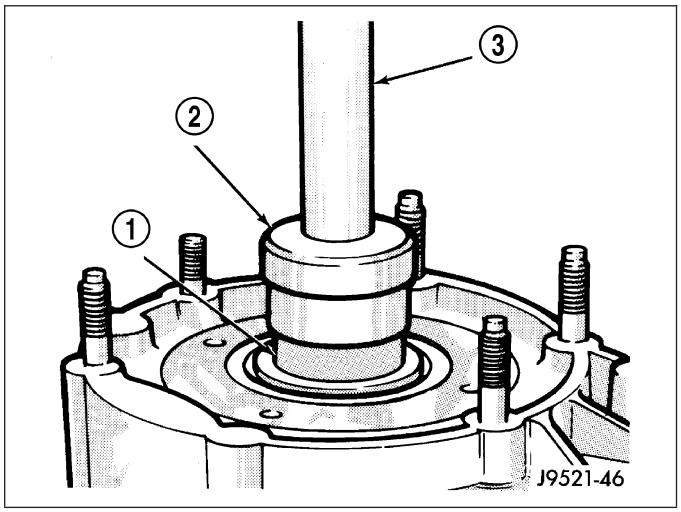


driver in slots (2) cast into retainer.

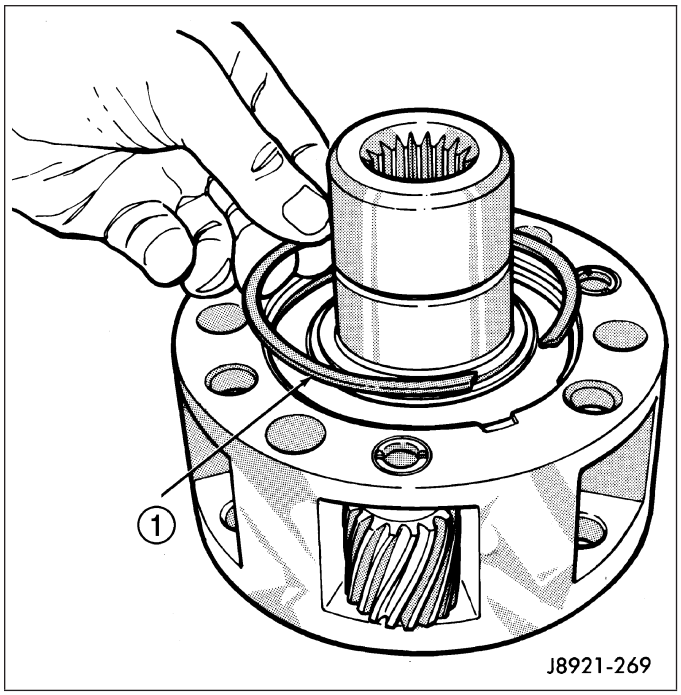
3. Remove input gear snap-ring (2).



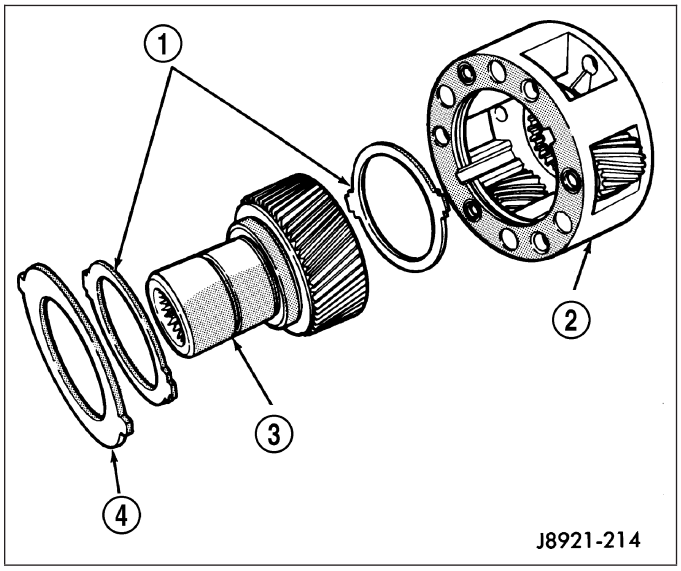
4. Remove input/low range gear assembly (1) from bearing with Tool Handle C-4171 (3) and Tool 7829-A (2).



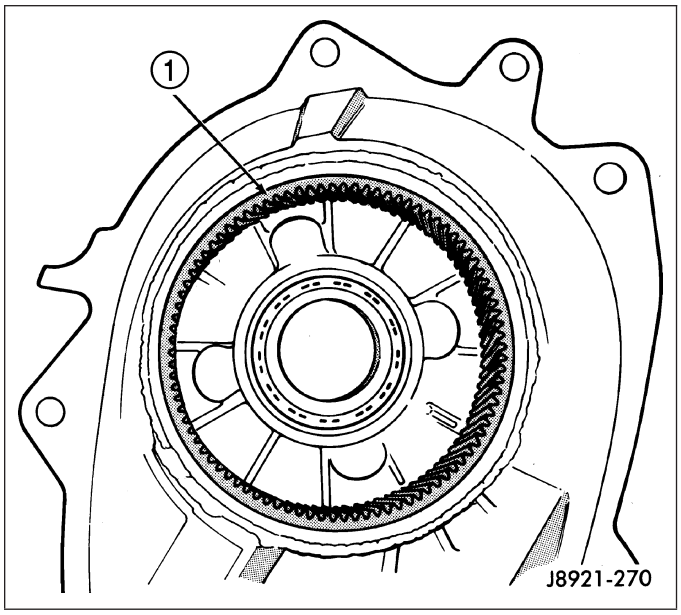
5. Remove low range gear snap-ring (1).



6. Remove input gear retainer (4), thrust washers (1), and input gear (3) from low range gear (2).

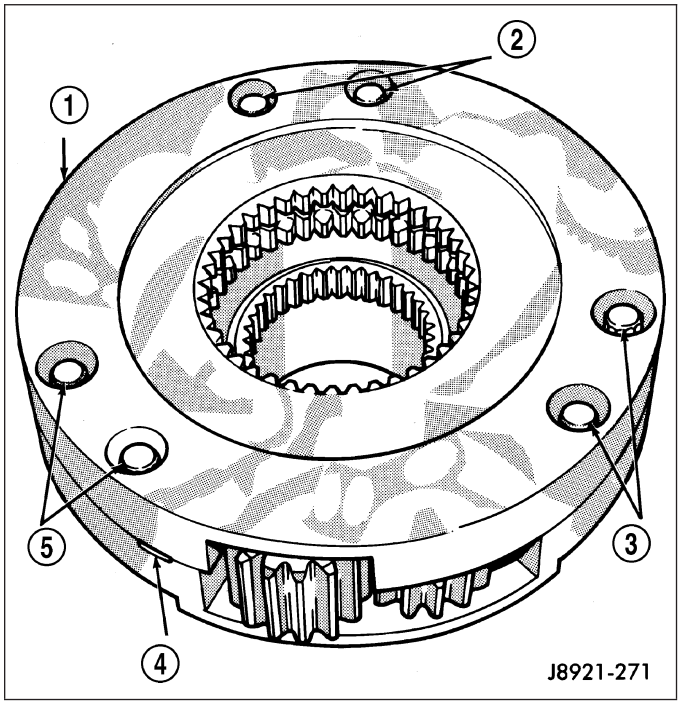


7. Inspect low range annulus gear (1). **Gear is not a serviceable component. If damaged, replace gear and front case as an assembly.**
8. Remove oil seals from the following components:
   - front bearing retainer.
   - rear retainer.
   - oil pump.
   - case halves.

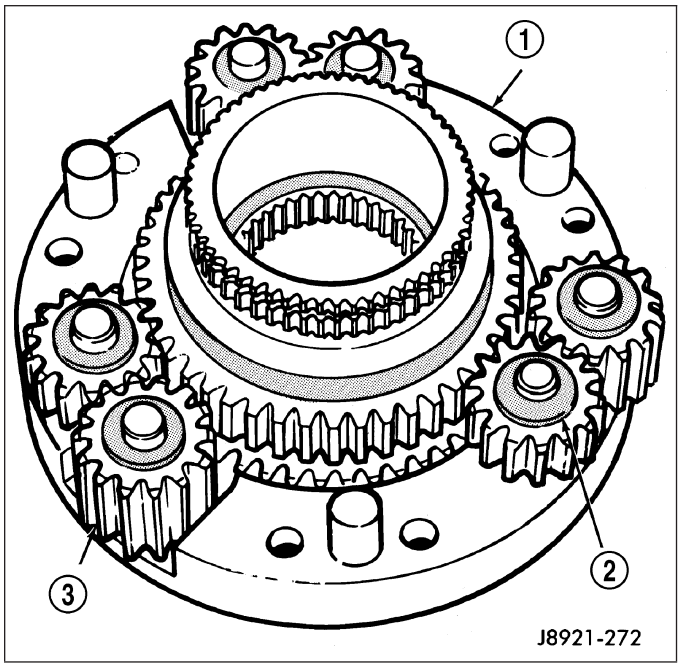


DIFFERENTIAL

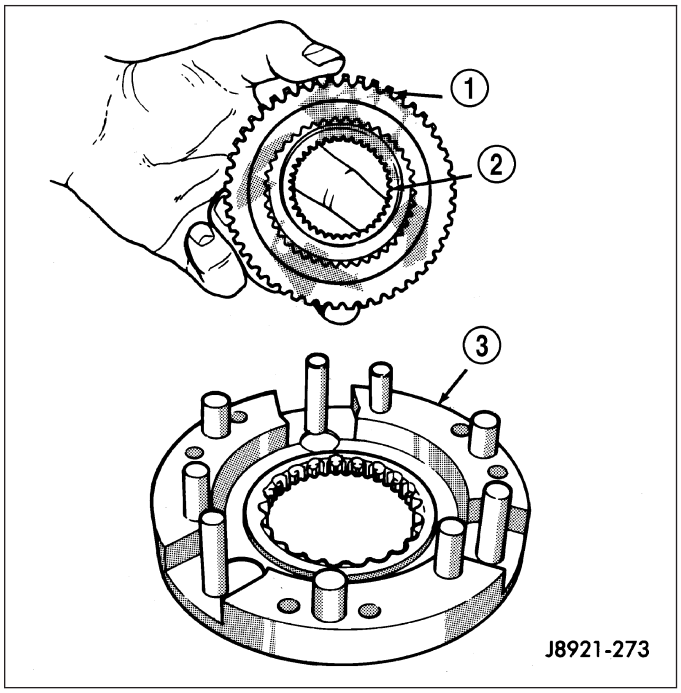
1. Mark differential case halves for reference.
2. Remove differential case bolts (2,3,4,5).
3. Invert differential on workbench.
4. Separate top case from bottom case. Use slots in case halves to pry them apart.



5. Remove thrust washers (2) and planet gears from case pins.



6. Remove mainshaft and sprocket gears (1,2) from bottom case (3). Note gear position for reference before separating them.



CLEANING

Clean the transfer case parts with a standard parts cleaning solvent. Remove all traces of sealer from the cases and retainers with a scraper and 3M™ all purpose cleaner. Use compressed air to remove solvent residue from oil feed passages in the case halves, retainers, gears, and shafts.

The oil pickup screen can be cleaned with solvent. Shake excess solvent from the screen after cleaning and allow it to air dry. Do not use compressed air.

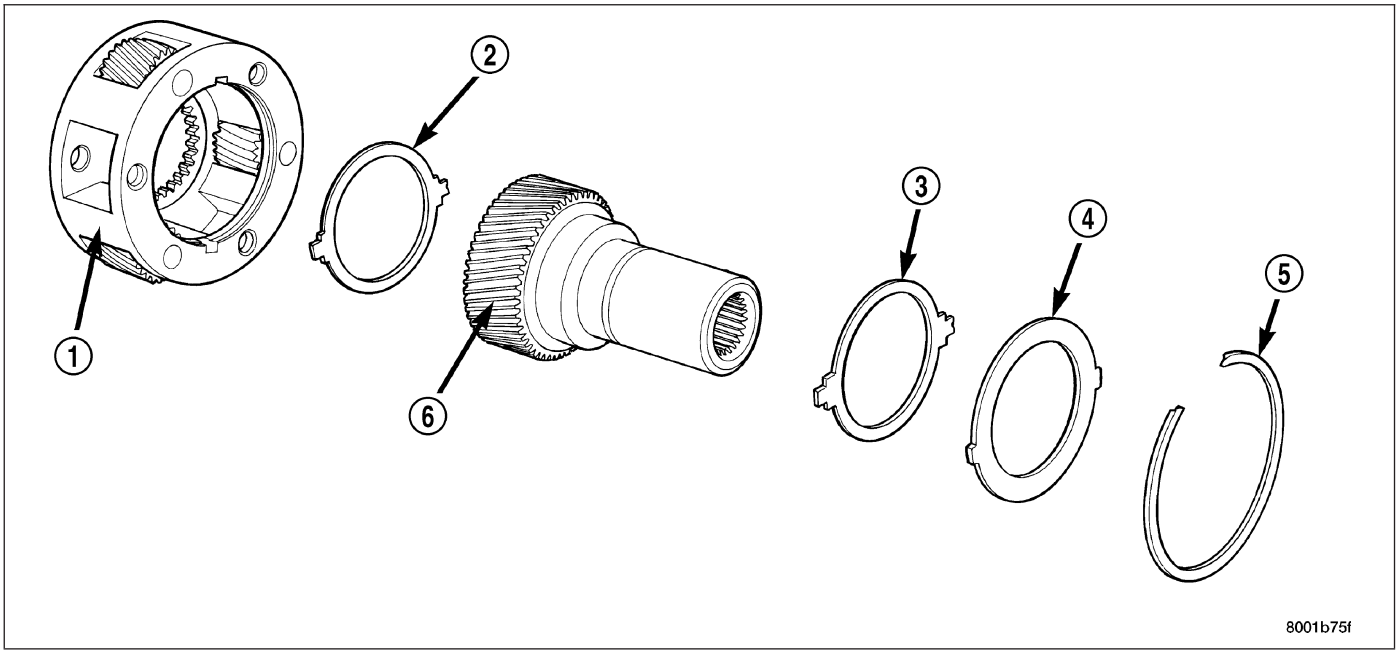
INSPECTION

MAINSHAFT/SPROCKET/HUB INSPECTION

Inspect the splines on the hub and shaft and the teeth on the sprocket. Minor nicks and scratches can be smoothed with an oilstone. However, replace any part that is damaged.

Check the contact surfaces in the sprocket bore and on the mainshaft. Minor nicks and scratches can be smoothed with 320-400 grit emery cloth but do not try to salvage the shaft if nicks or wear is severe.

INPUT GEAR AND PLANETARY CARRIER



Input Gear And Carrier Components

1 - PLANETARY CARRIER
2 - REAR THRUST WASHER
3 - FRONT THRUST WASHER
4 - CARRIER LOCK RING
5 - CARRIER LOCK RETAINING RING
6 - INPUT GEAR

Check the teeth on the gear (6). Minor nicks can be dressed off with an oilstone but replace the gear if any teeth are broken, cracked, or chipped. The bearing surface on the gear can be smoothed with 300-400 grit emery cloth if necessary.

Examine the carrier body (1) and pinion gears for wear or damage. The carrier will have to be replaced as an assembly if the body, pinion pins, or pinion gears are damaged.

Check the lock ring (4) and both thrust washers (2, 3) for wear or cracks. Replace them if necessary. Also replace the lock retaining ring if bent, distorted, or broken.

SHIFT FORKS/HUBS/SLEEVES

Check condition of the shift forks and mode fork shift rail. Minor nicks on the shift rail can be smoothed with 320-400 grit emery cloth.

Inspect the shift fork wear pads. The mode and range fork pads are serviceable and can be replaced if necessary.

Check both of the sleeves for wear or damage, especially on the interior teeth. Replace the sleeves if wear or damage is evident.

REAR RETAINER AND EXTENSION HOUSING

Inspect the retainer components. Replace the bearing if rough or noisy. Check the retainer for cracks or wear in the bearing bore. Clean the retainer sealing surfaces with a scraper and 3M™ all purpose cleaner. This will ensure proper adhesion of the sealer during reassembly.

Inspect the retaining rings and washers. Replace any part if distorted, bent, or broken. Reuse is not recommended.

Inspect the extension housing seal and bushing. Replace both components if either show any sign of wear or damage.

FRONT OUTPUT SHAFT/FLANGE/DRIVE CHAIN

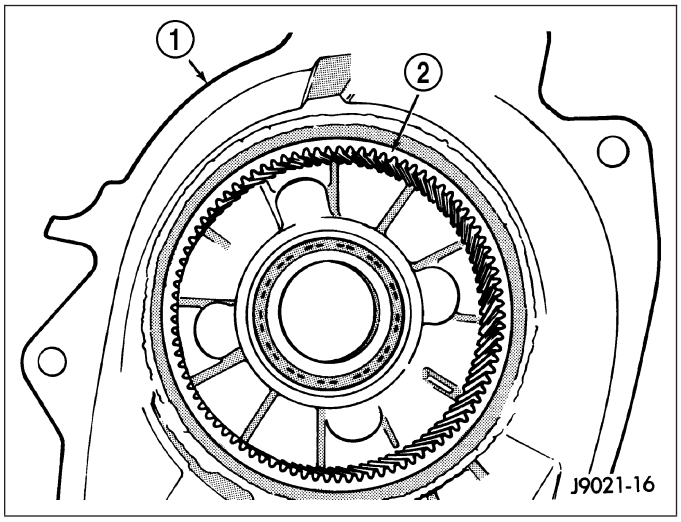
Check condition of the seal contact surfaces on the companion flange slinger. This surface must be clean and smooth to ensure proper seal life. Replace the flange nut and seal washer as neither part should be reused.

Inspect the shaft threads, sprocket teeth, and bearing surfaces. Minor nicks on the teeth can be smoothed with an oilstone. Use 320-400 grit emery to smooth minor scratches on the shaft bearing surfaces. Rough threads on the shaft can be chased if necessary. Replace the shaft if the threads are damaged, bearing surfaces are scored, or if any sprocket teeth are cracked or broken.

Examine the drive chain and shaft bearings. Replace the chain and both sprockets if the chain is stretched, distorted, or if any of the links bind. Replace the bearings if rough, or noisy.

LOW RANGE ANNULUS GEAR

Inspect annulus gear condition carefully. The gear is only serviced as part of the front case. If the gear is damaged, it will be necessary to replace the gear and front case as an assembly. Do not attempt to remove the gear (2)



FRONT/REAR CASES AND FRONT RETAINER

Inspect the cases and retainer for wear and damage. Replace the input retainer seal; do not reuse it.

Check case condition. If leaks were a problem, look for gouges and severe scoring of case sealing surfaces. Also make sure the front case mounting studs are in good condition.

Check the front case mounting studs and vent tube. The tube can be secured with Loctite™ 271 or 680 if loose. The stud threads can be cleaned up with a die if necessary. Also check condition of the fill/drain plug threads in the rear case. The threads can be repaired with a thread chaser or tap if necessary. Or the threads can be repaired with Helicoil® stainless steel inserts if required.

OIL PUMP/OIL PICKUP

Examine the oil pump pickup parts. Replace the pump if any part appears to be worn or damaged. Do not disassemble the pump as individual parts are not available. The pump is only available as a complete assembly. The pickup screen, hose, and tube are the only serviceable parts and are available separately.

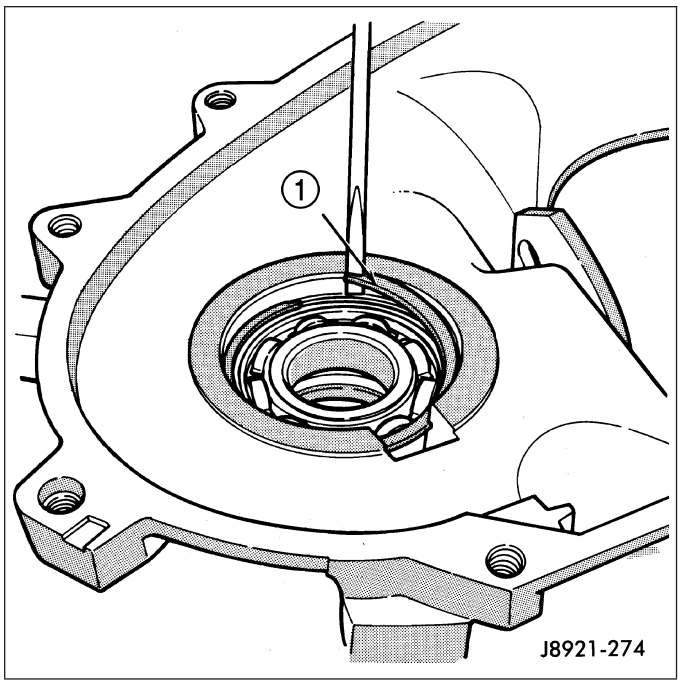
ASSEMBLY

Lubricate transfer case components with automatic transmission fluid or petroleum jelly (where indicated) during assembly.

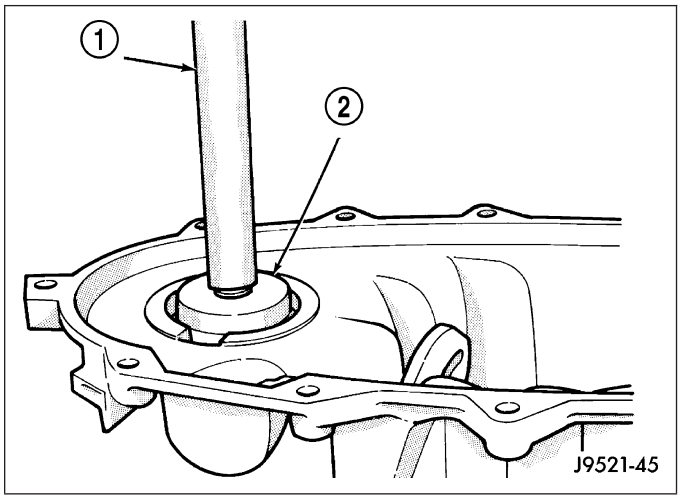
CAUTION: The bearing bores in various transfer case components contain oil feed holes. Make sure replacement bearings do not block the holes.

BEARINGS AND SEALS

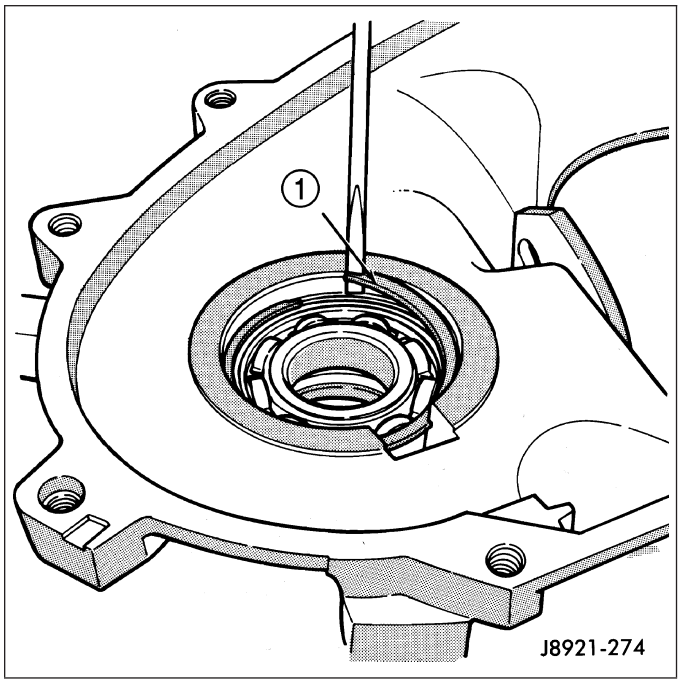
1. Remove snap-ring (1) that retains front output shaft front bearing in case. Then remove bearing. Use hammer handle, or hammer and brass punch to tap bearing out of case.



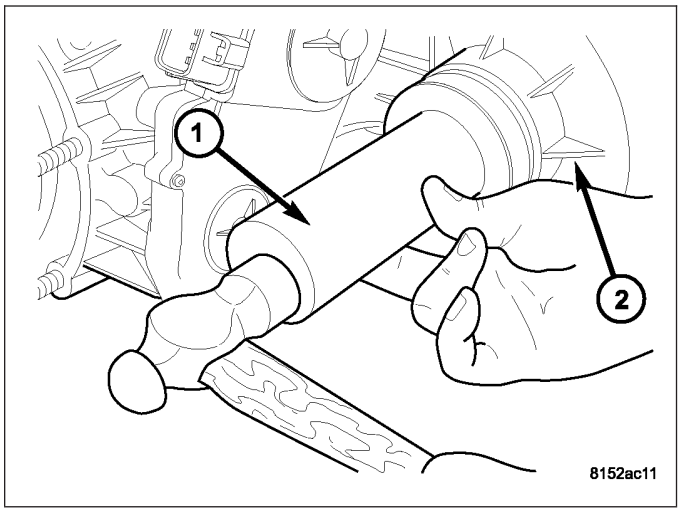
2. Install new front output shaft front bearing with Tool Handle C-4171(1) and Installer 8033-A (2) with the tapered cone upward.



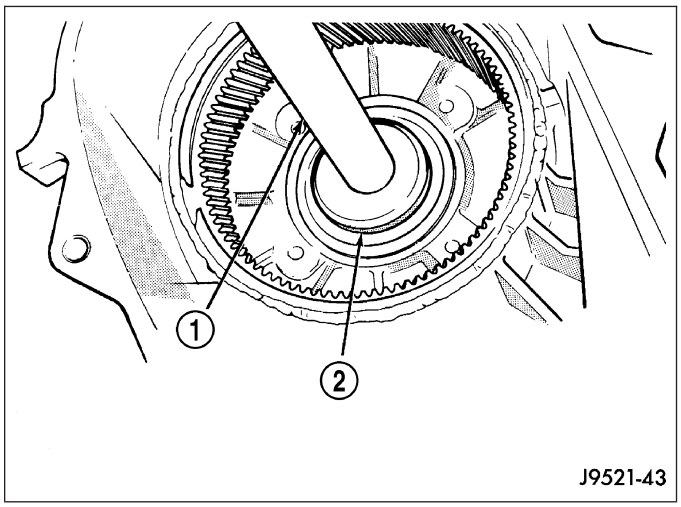
3. Install front bearing snap-ring (1).



4. Install new front output shaft oil seal with Installer 6952-A (1).

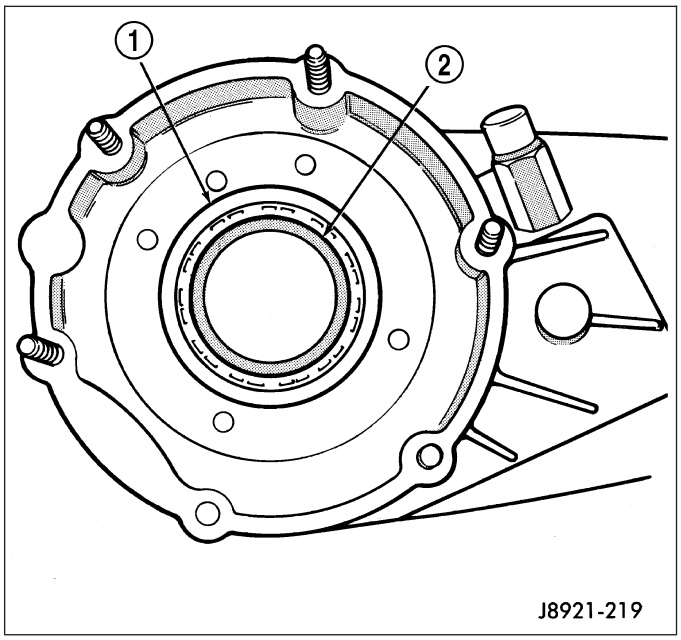


5. Install snap-ring on new input shaft bearing.

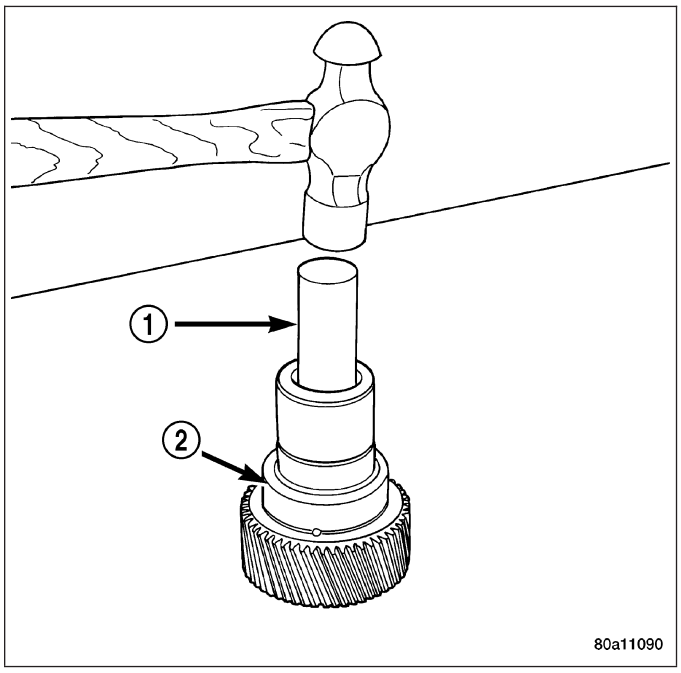


6. Remove input shaft bearing with Tool Handle C-4171 (1) and Remover C-4210 (2).

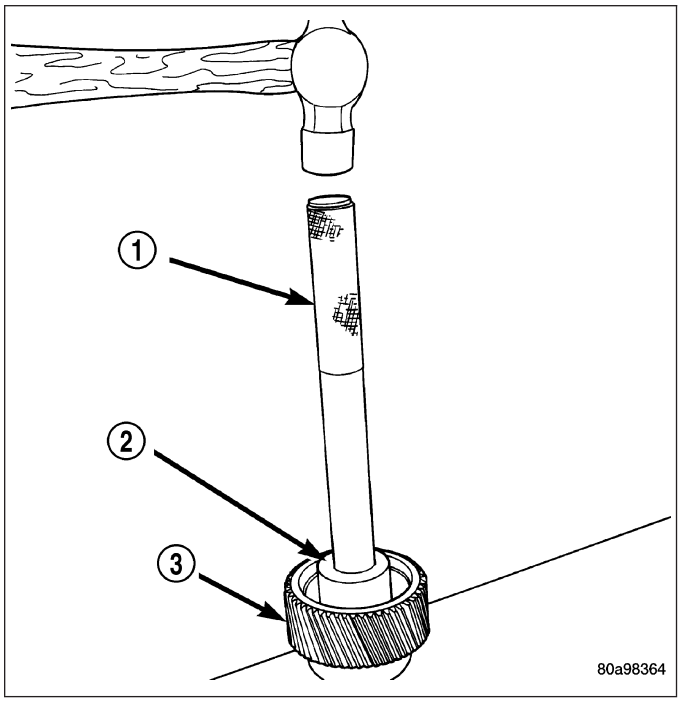
7. Install new input shaft bearing (2) with Tool Handle C-4171 and Remover C-4210. Install bearing far enough to seat snap-ring (1) against case.



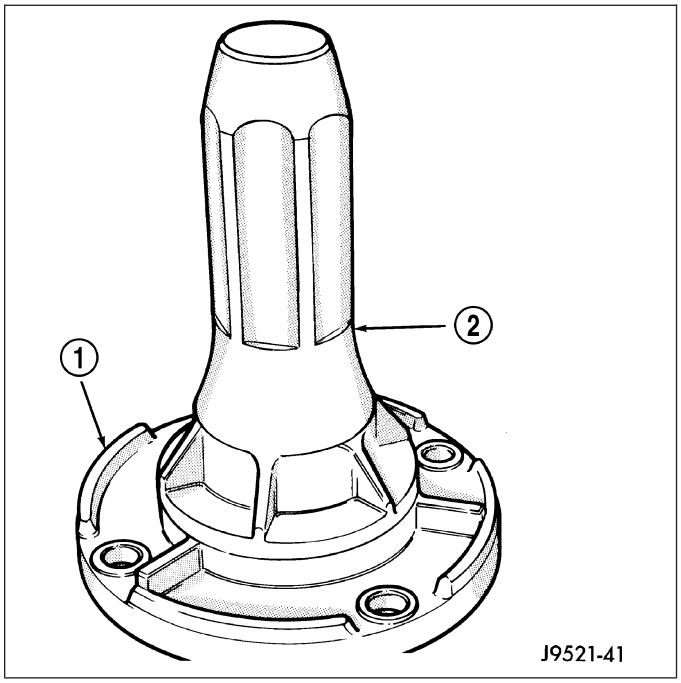
8. Remove the input gear pilot bearing by inserting a suitably sized drift (1) into the splined end of the input gear (2) and driving the bearing out with the drift and a hammer.



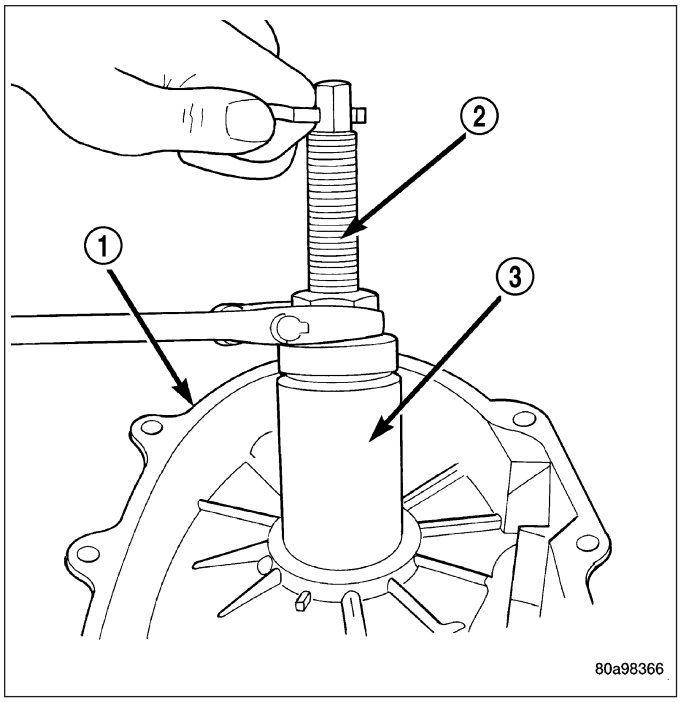
9. Install new pilot bearing with Installer 8128 (2) and Handle C-4171 (1).



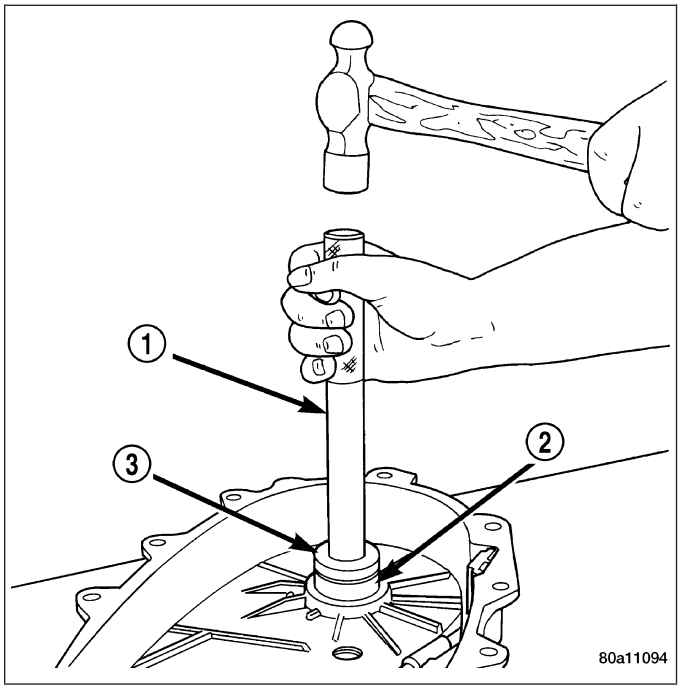
10. Install new seal in front bearing retainer (1) with Installer 7884 (2).



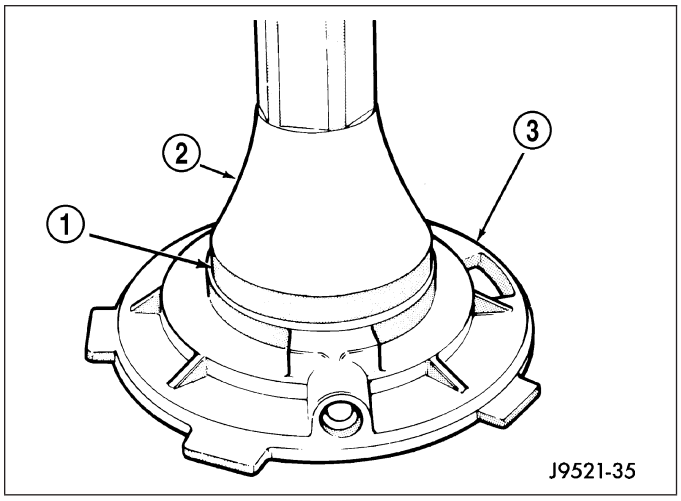
11. Remove front output shaft rear bearing with the screw and jaws from Remover L-4454 (2) and Cup 8148 (3).



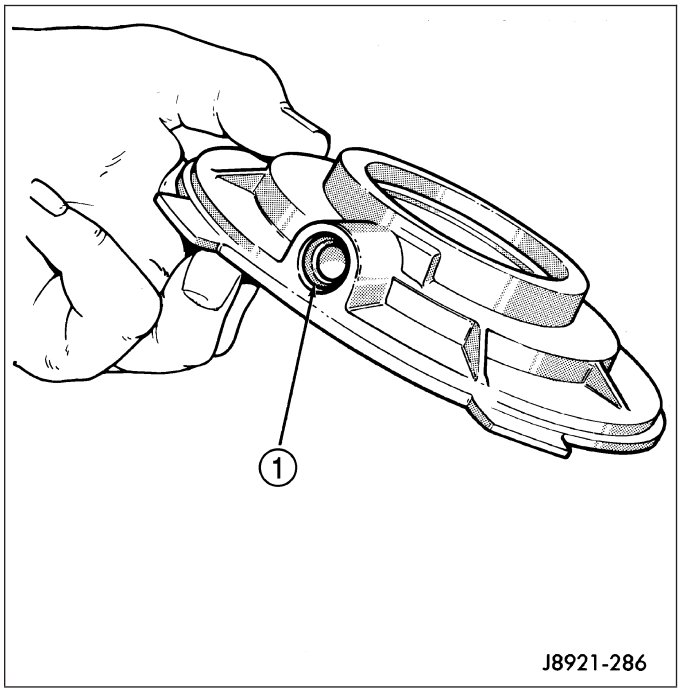
12. Install new bearing (2) with Tool Handle C-4171 (1) and Installer 5066 (3). Lubricate bearing after installation.



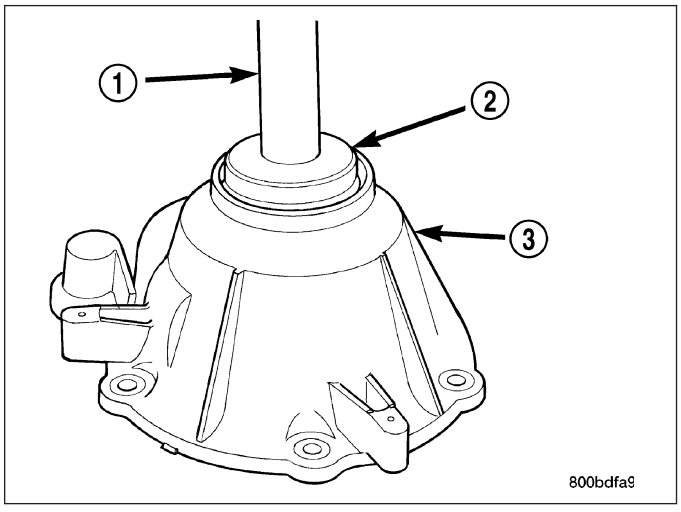
13. Install new seal (1) in oil pump feed housing with Special Tool 7888 (2).



14. Install new pickup tube o-ring (1) in oil pump.

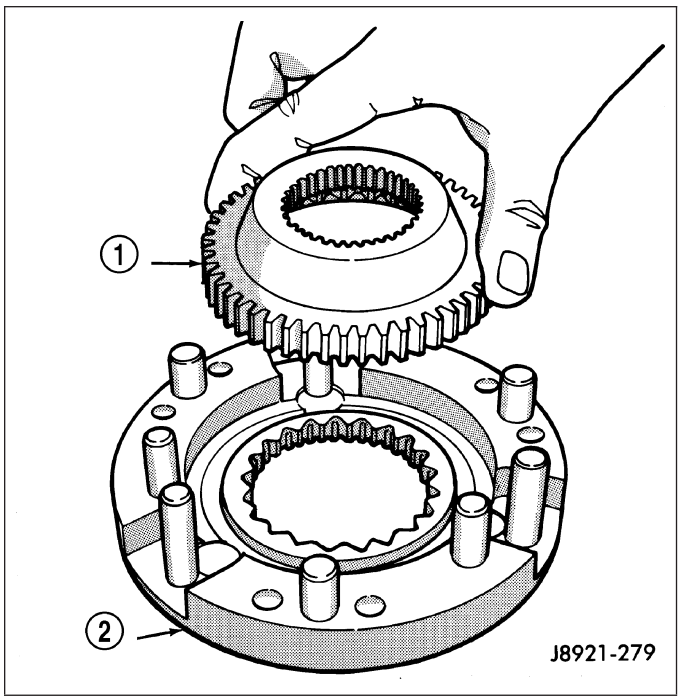


15. Remove rear retainer bearing with Remover 5065 and Handle C-4171.
16. Install rear bearing in retainer with Handle C-4171 (1) and Installer 5064 (2).

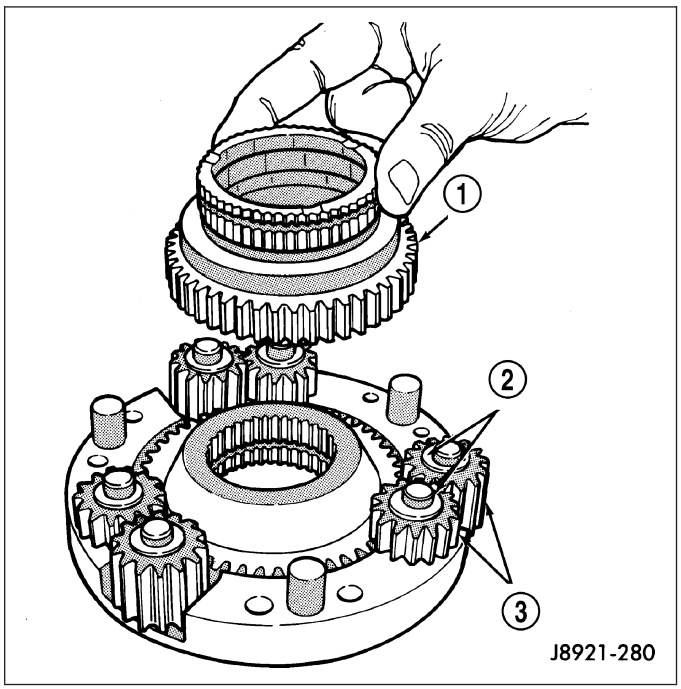


DIFFERENTIAL

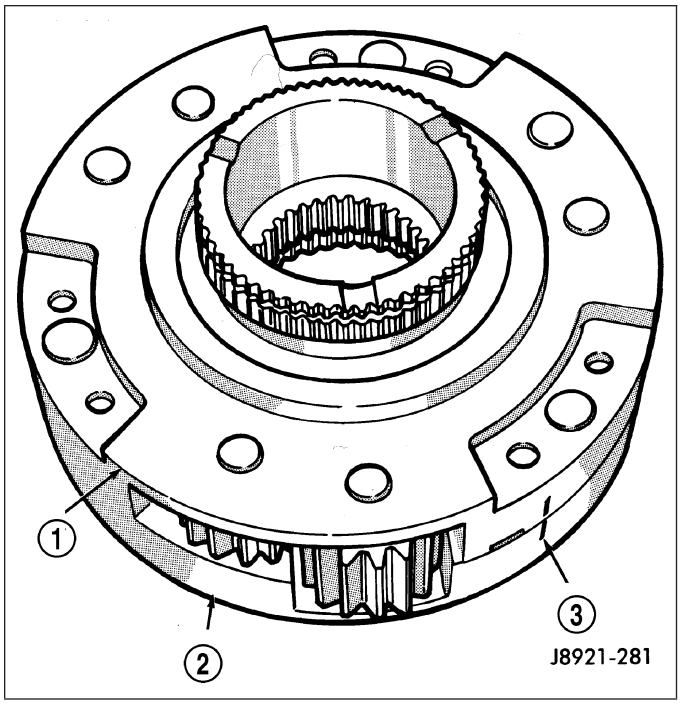
1. Lubricate differential components with automatic transmission fluid.
2. Install sprocket gear (1) in differential bottom case.



3. Install differential planet gears (3) and new thrust washers (2). **Be sure thrust washers are installed at top and bottom of each planet gear.**
4. Install differential mainshaft gear (1).

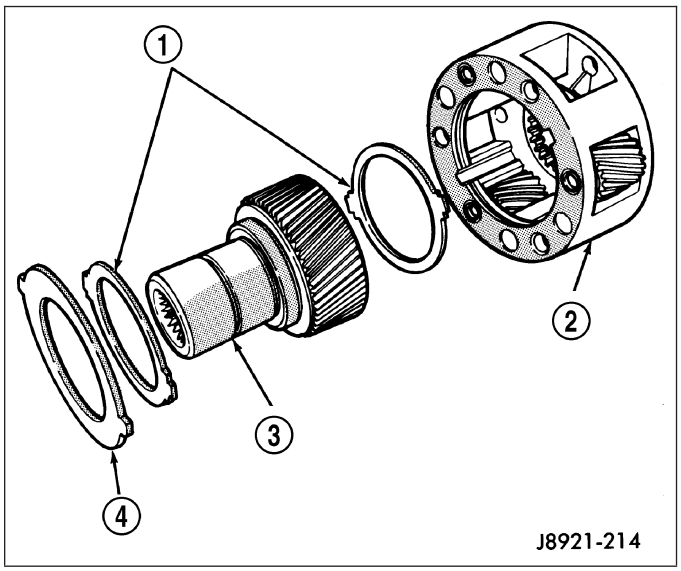


5. Align and position differential top case (1) on bottom case (2). Align using scribe marks (3) made at disassembly.
6. While holding differential case halves together, invert the differential and start the differential case bolts.
7. Tighten differential case bolts to specified torque.

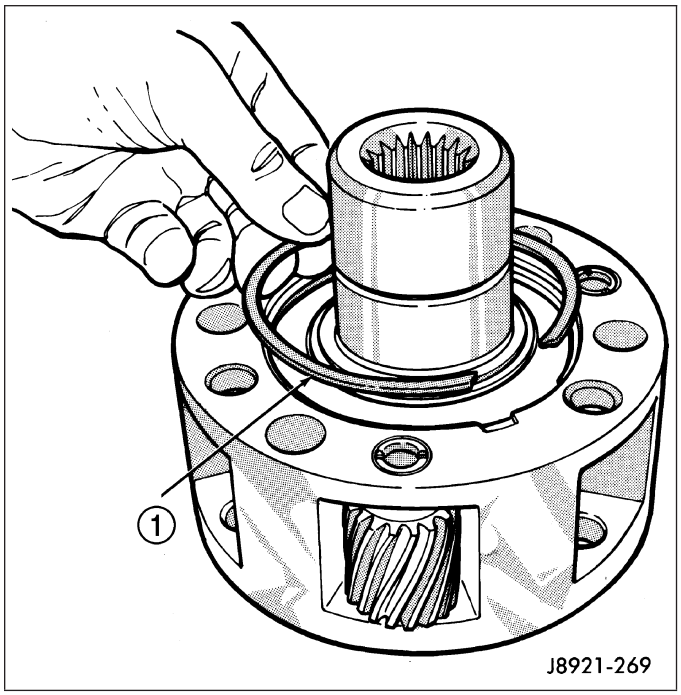


INPUT GEAR/LOW RANGE

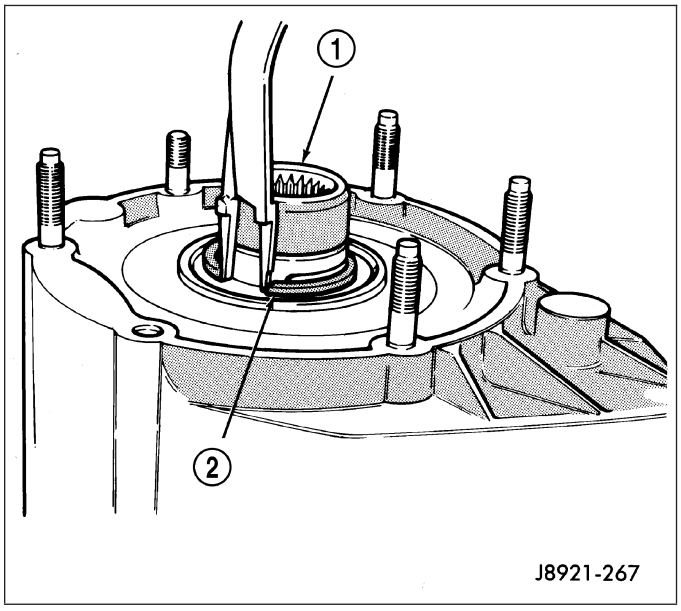
1. Assemble low range gear (2), input gear thrust washers (1), input gear (3) and input gear retainer (2).



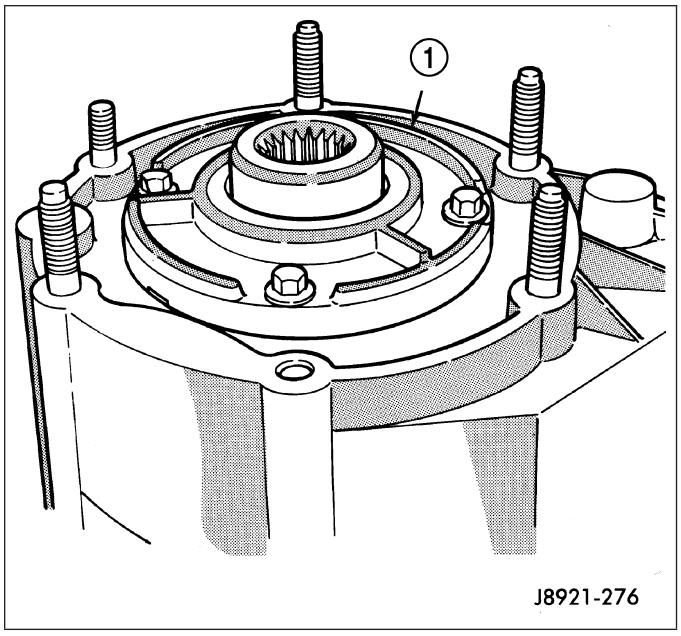
2. Install low range gear snap-ring (1).



3. Lubricate input gear and low range gears with automatic transmission fluid.
4. Start input gear shaft into front case bearing.
5. Press input gear (1) shaft into front bearing.
6. Install new input gear snap-ring (2).

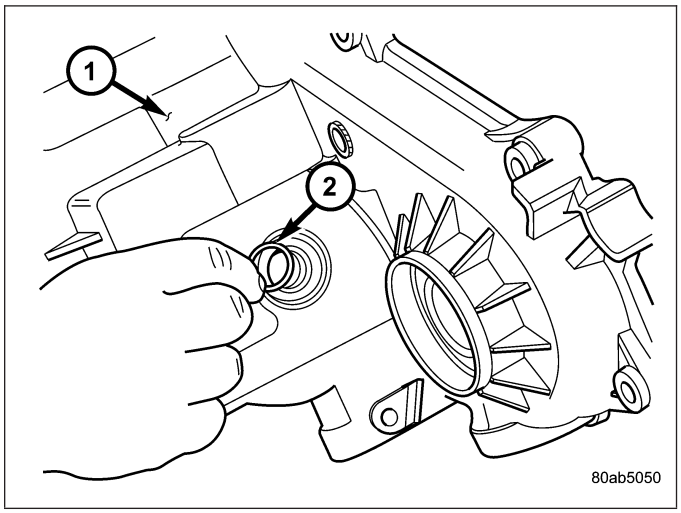


7. Apply 3 mm (1/8 in.) wide bead of Mopar® Gasket Maker, or equivalent silicone adhesive sealer, to seal surface of front bearing retainer (1).
8. Install front bearing retainer (1). Tighten retainer bolts to 16-25 N·m (12-18 ft. lbs.) torque.

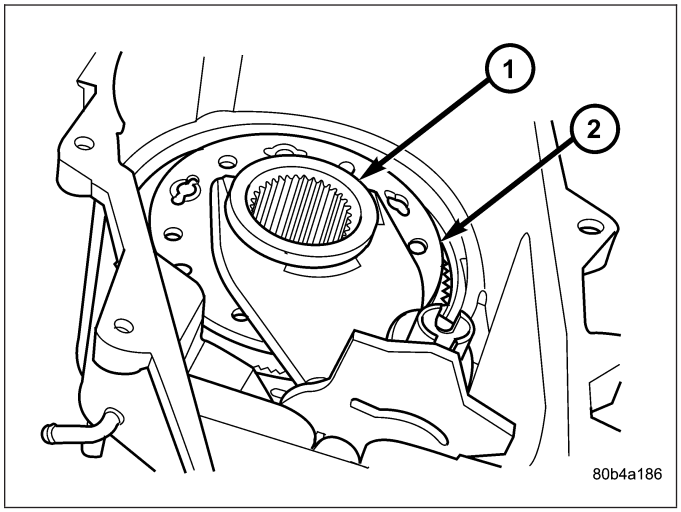


SHIFT FORKS AND MAINSHAFT

1. Install new sector shaft o-ring (2).

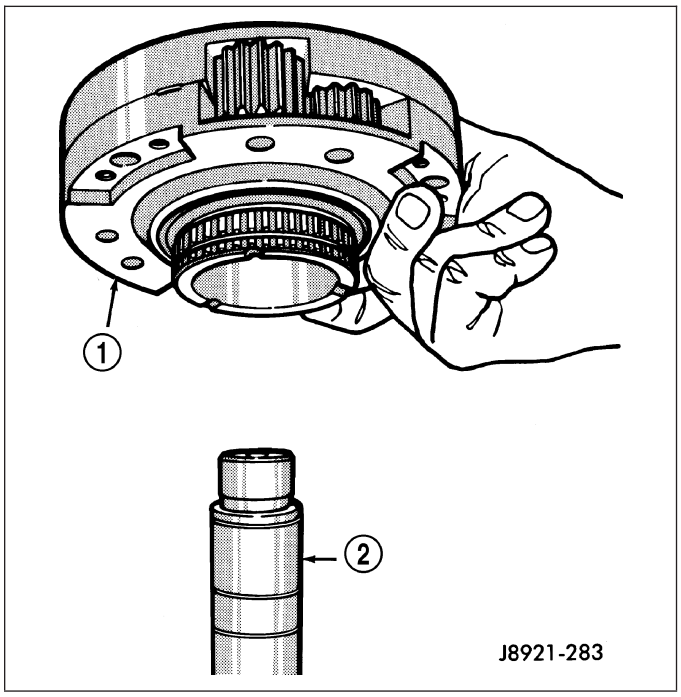


2. Install shift sector.
3. Install new pads on low range fork, if necessary.
4. Assemble low range fork and hub (1,2).

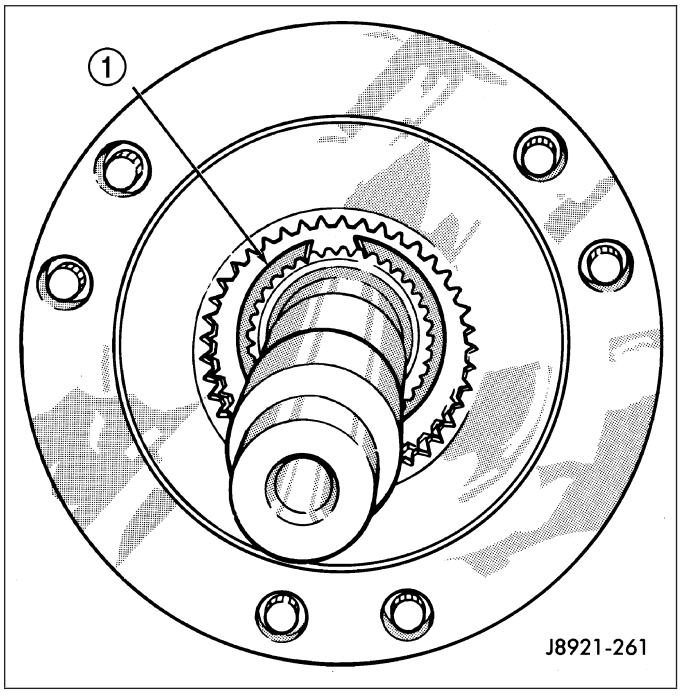


5. Position low range fork and hub in case. Be sure low range fork pin is engaged in shift sector slot.

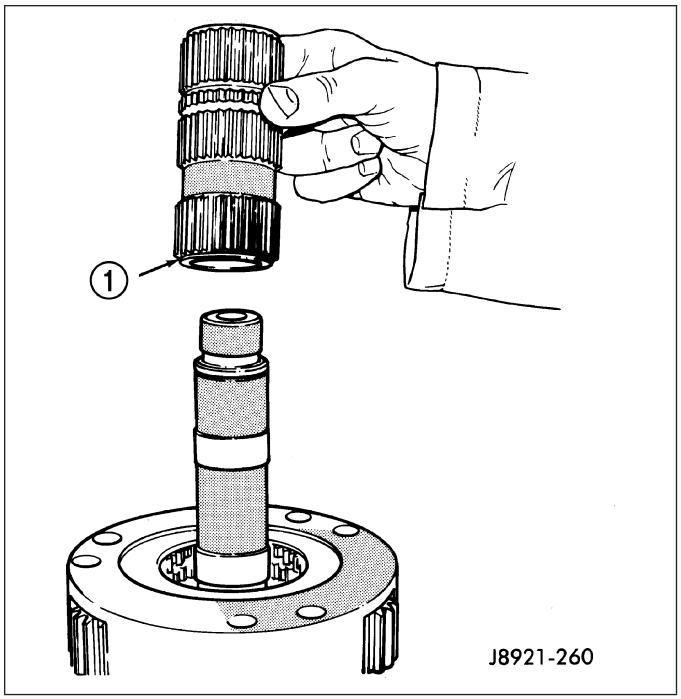
6. Install bearing on mainshaft (2).
7. Install differential (1)



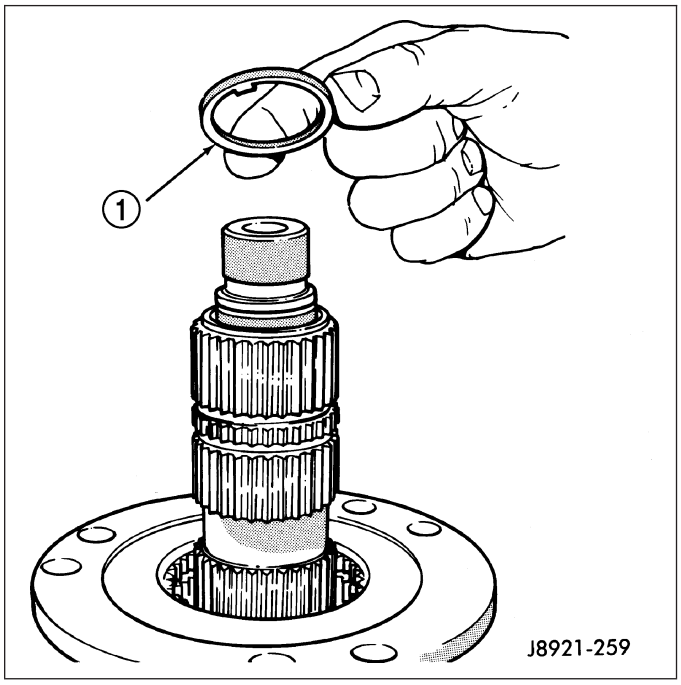
8. Install differential snap-ring (1).



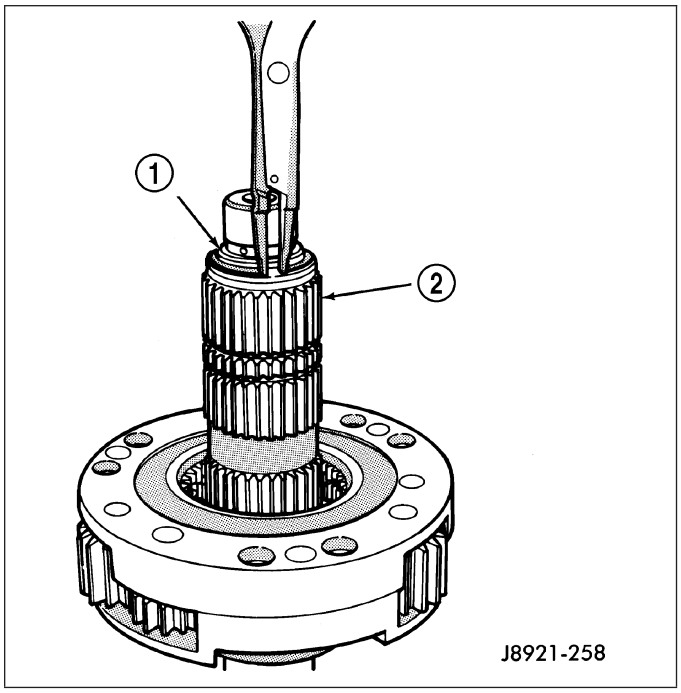
9. Install intermediate clutch shaft (1).



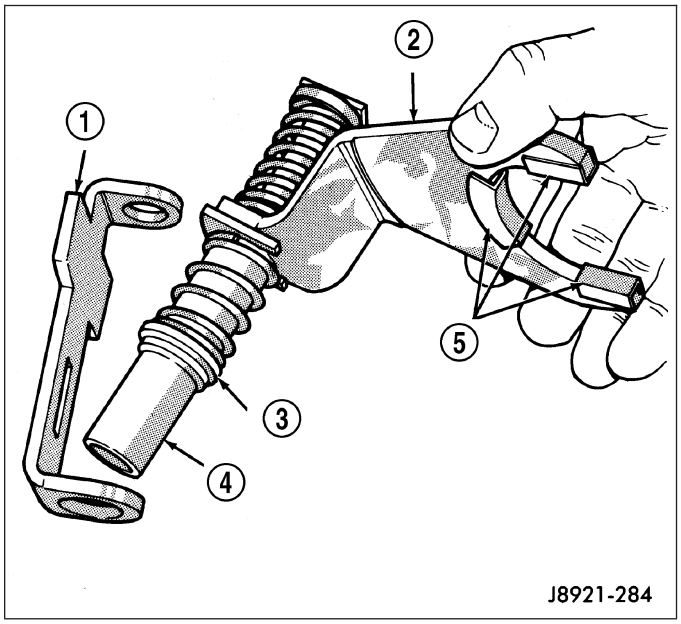
10. Install clutch shaft thrust ring (1)



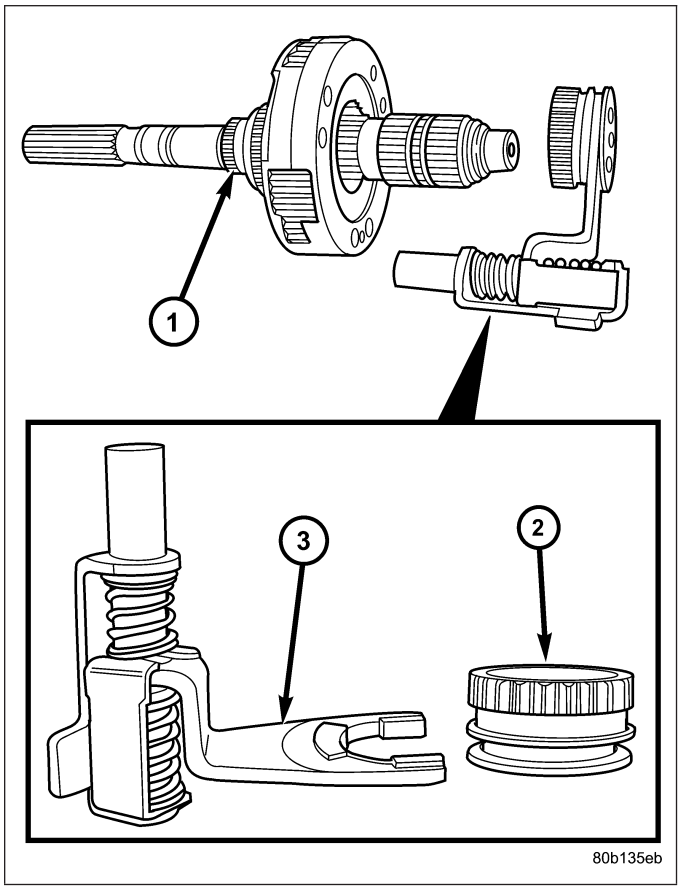
11. Install clutch shaft snap-ring (1)



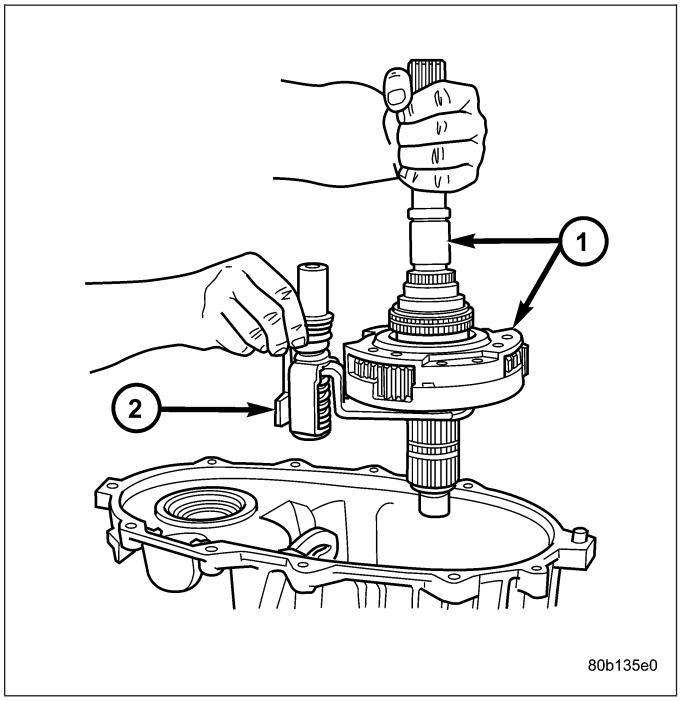
12. Inspect mode fork assembly. Replace pads and bushing (3) if necessary. Replace fork tube (4) if bushings inside tube are worn or damaged. Also check springs and slider bracket (1). Replace worn or damaged components.



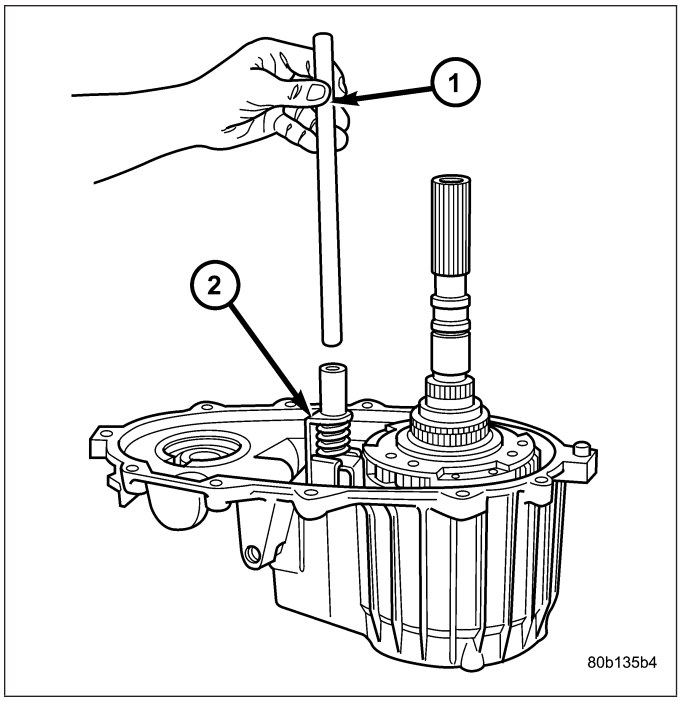
13. Install mode sleeve (2) in mode fork (3). Then install assembled sleeve and fork on mainshaft (1). Be sure mode sleeve splines are engaged in differential splines.



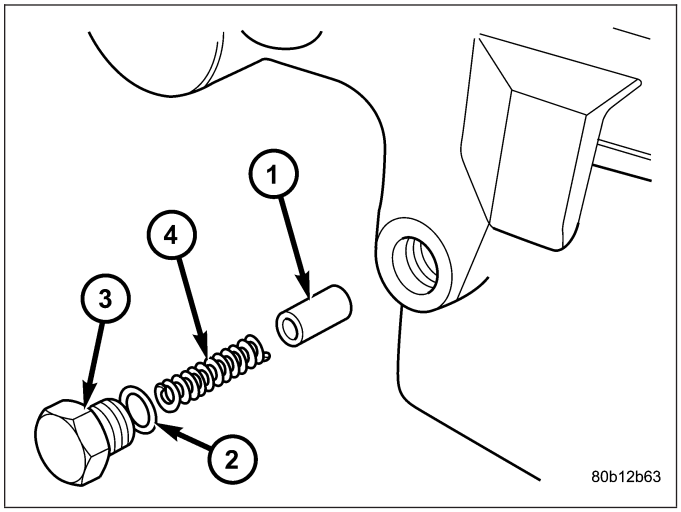
14. Install mode fork and mainshaft assembly (1,2) in case. Rotate mainshaft (1) slightly to engage shaft with low range gears.



15. Rotate mode fork pin into shift sector slot.
16. Install shift rail (1) with the taper to the rear of the transfer case. **Be sure rail is seated in both shift forks.**

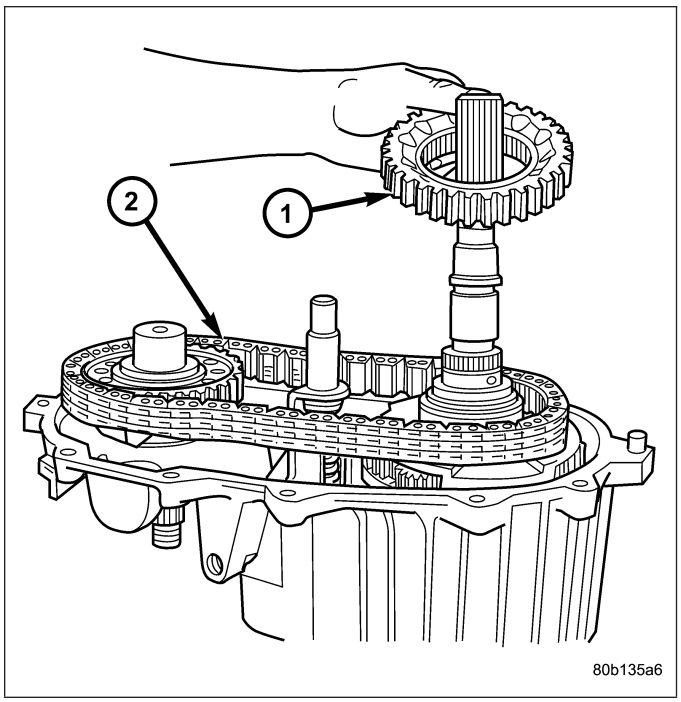


17. Install detent plunger (1), detent spring (4), and detent plug (3) in case.

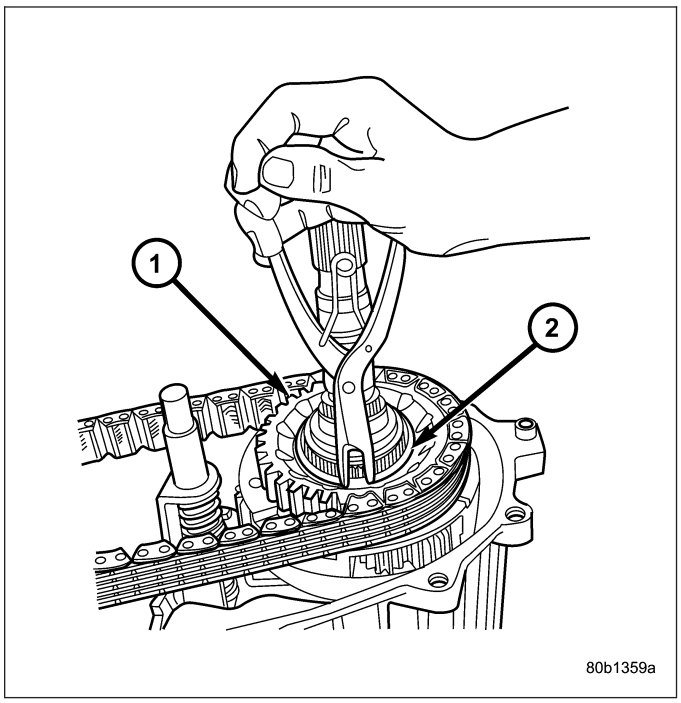


FRONT OUTPUT SHAFT AND DRIVE CHAIN

1. Install front output shaft.
2. Install drive chain (2). Engage chain with front output shaft sprocket teeth.
3. Install drive sprocket (1). Engage drive sprocket teeth with chain (2). Then engage sprocket splines with mainshaft splines.

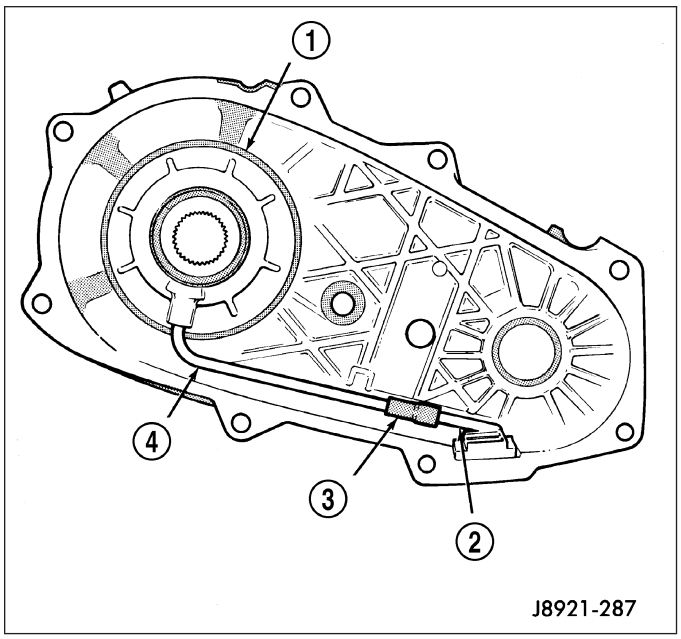


4. Install drive sprocket snap-ring (2).

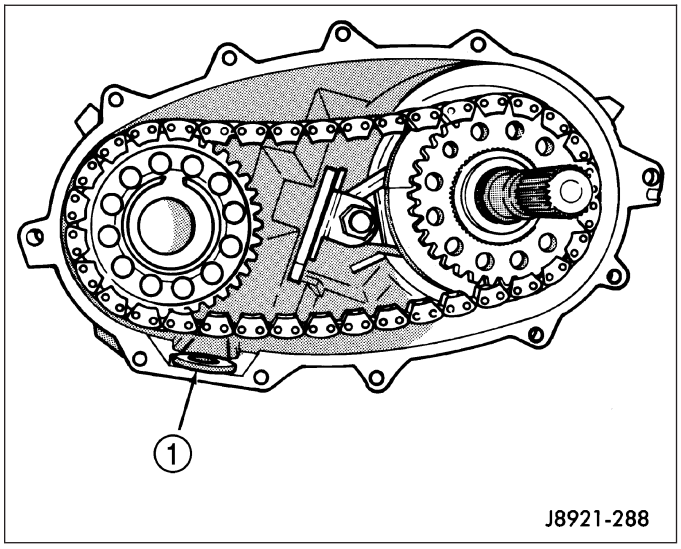


OIL PUMP AND REAR CASE

1. Insert oil pickup tube (4) in oil pump and attach oil screen (2) and connector hose (3) to pickup tube. Then install assembled pump, tube and screen in rear case. Be sure screen is seated in case slot as shown.

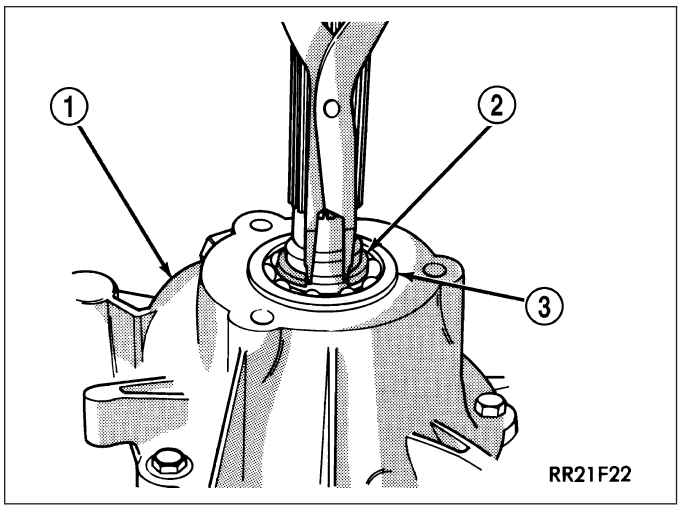


2. Clean the transfer case magnet (1).
3. Install magnet in front case pocket.
4. Apply 3 mm (1/8 in.) wide bead of Mopar® Gasket Maker, or equivalent silicone adhesive sealer, to seal surface of front case.
5. Align and install rear case on front case. Be sure case locating dowels are in place and that mainshaft splines are engaged in oil pump inner gear.
6. Install and tighten front case to rear case bolts to 27-34 N·m (20-25 ft. lbs.) torque. **Be sure to install a washer under each bolt used at case dowel locations.**



REAR RETAINER

1. Apply bead of Mopar® Sealer, or Loctite™ Ultra Gray, to mating surface of rear retainer. Sealer bead should be a maximum of 3/16 in.
2. Install rear retainer on rear case. Tighten retainer bolts to 27-34 N·m (20-25 ft. lbs.) torque.
3. Install new output shaft bearing snap-ring (2). Lift mainshaft slightly to seat snap-ring in shaft groove, if necessary.
4. Apply 3 mm (1/8 in.) wide bead of Mopar® Gasket Maker, or equivalent silicone adhesive sealer, to mounting surface of extension housing. Allow sealer to set-up slightly before proceeding.
5. Install extension housing on rear retainer.
6. Install extension housing bolts and tighten to 27-34 N·m (20-25 ft. lbs.).

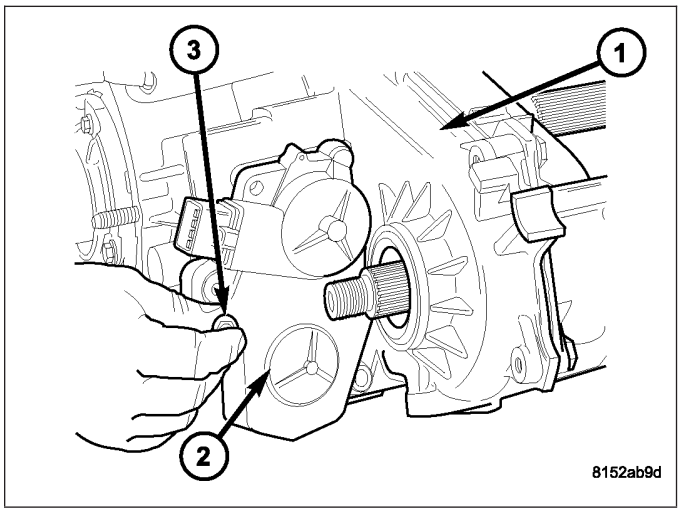


COMPANION FLANGE AND SHIFT MOTOR AND MODE SENSOR ASSEMBLY

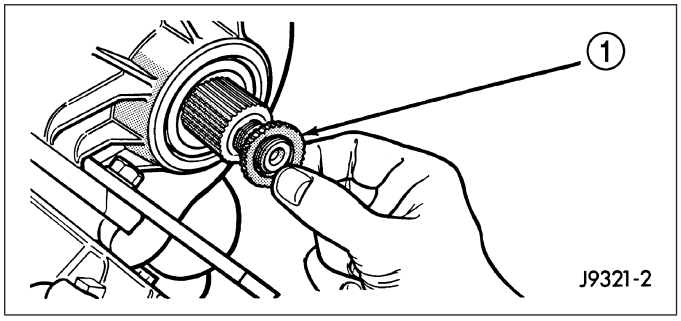
1. Position the shift motor and mode sensor assembly onto the transfer case.

CAUTION: If the original shift motor and mode sensor assembly bolts are reused, be sure to use Mopar® Lock & Seal or Loctite™ 242 to replenish the lock patch material originally found on the bolts

2. Install the bolts to hold the shift motor and mode sensor assembly to the transfer case. Tighten the bolts to 16-24 N·m (12-18 ft. lbs.) torque.

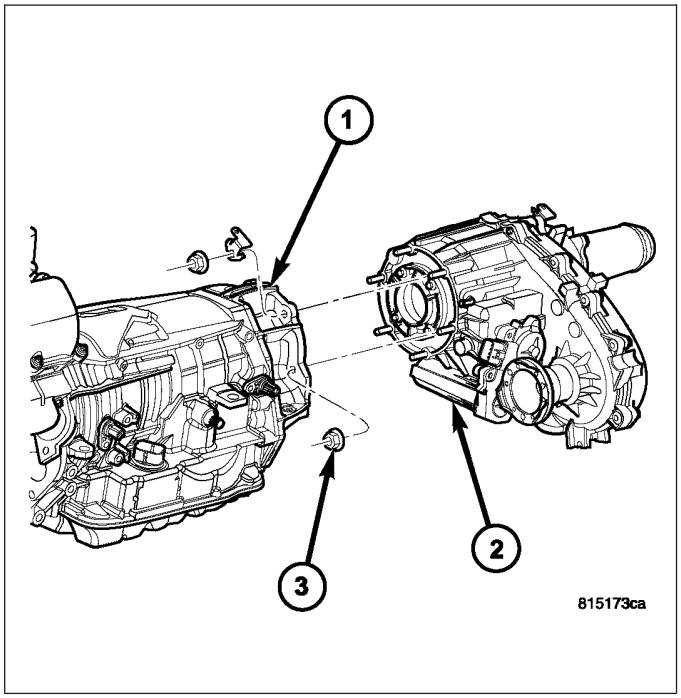


3. Install new seal washer (1) onto the front output shaft.
4. Lubricate the companion flange hub with transmission fluid and install the flange onto the front output shaft.
5. Install a new companion flange nut onto the front output shaft.
6. Tighten the flange nut to 122-176 N·m (90-130 ft. lbs.) torque. Use Tool 6958, or similar tool to hold flange while tightening nut.

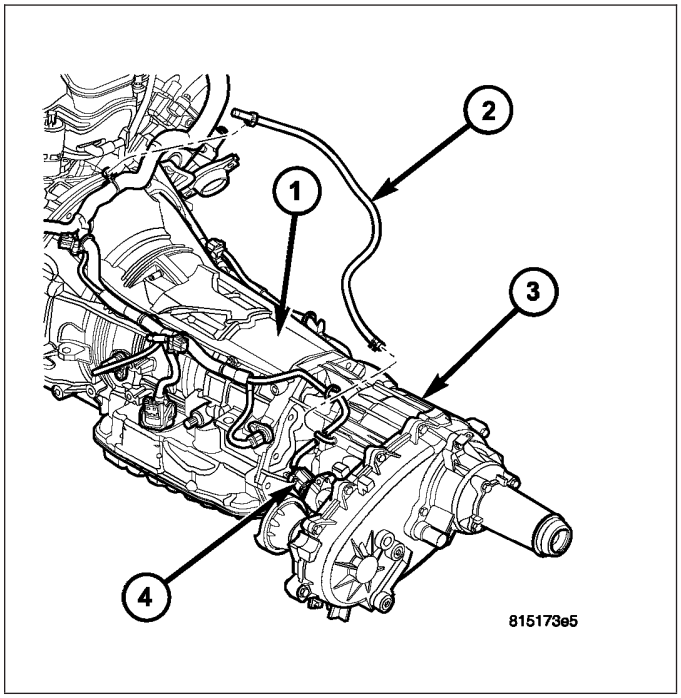


INSTALLATION

1. Mount transfer case on a transmission jack.
2. Secure transfer case to jack with chains.
3. Position transfer case under vehicle.
4. Align transfer case and transmission shafts and install transfer case (2) onto the transmission (1).
5. Install and tighten transfer case attaching nuts (3) to 27-34 N·m (20-25 ft. lbs.) torque.



6. Connect the vent hose (2) to the transfer case (3).
7. Connect the shift motor and mode sensor wiring connectors (4). Secure wire harness to clips on transfer case.
8. Align and connect the propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)
9. Fill transfer case with correct fluid. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE/ FLUID - STANDARD PROCEDURE)
10. Install rear crossmember and skid plate, if equipped. Tighten crossmember bolts to 41 N·m (30 ft. lbs.) torque.
11. Remove transmission jack and support stand.
12. Lower vehicle and verify transfer case shift operation.



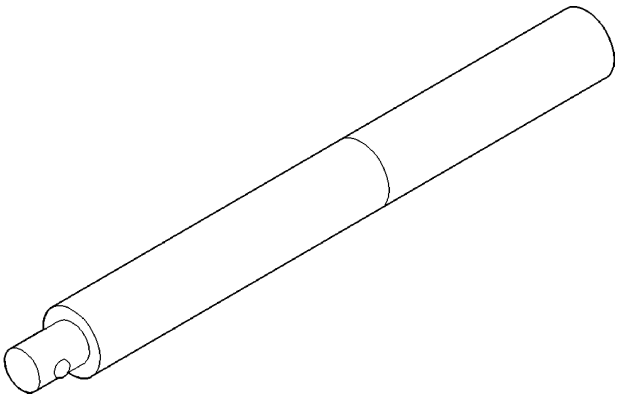
SPECIFICATIONS - TRANSFER CASE - NV244

TORQUE SPECIFICATIONS

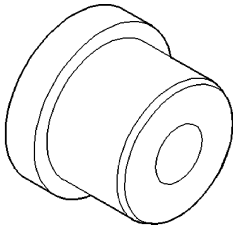
DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Plug, Detent	16-24	12-18	-
Bolt, Differential Case	17-27	15-24	-
Plug, Drain/Fill	20-34	15-25	-
Bolt, Front Brg. Retainer	16-25	12-18	-
Bolt, Case Half	27-34	20-25	-
Nut, Companion Flange	122-176	90-130	-
Bolt, Shift Motor and Mode Sensor Assembly	16-25	12-18	-
Bolt, Rear Retainer	27-34	20-25	-
Bolt, Extension Housing	27-34	20-25	-
Nut, Mounting	27-34	20-25	-

SPECIAL TOOLS

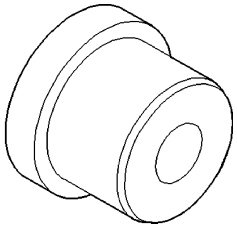
TRANSFER CASE - NV244



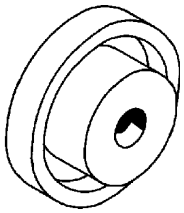
Handle, Universal - C-4171



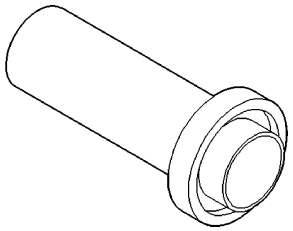
Installer, Bearing - 5066



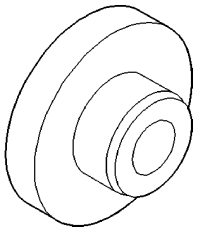
Installer, Bearing - 5066



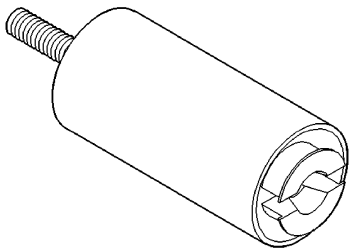
Remover, Bearing - C-4210



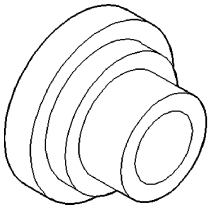
Installer, Seal - 6952-A



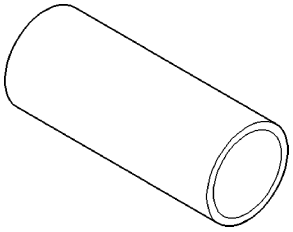
Installer, Bearing - 5064



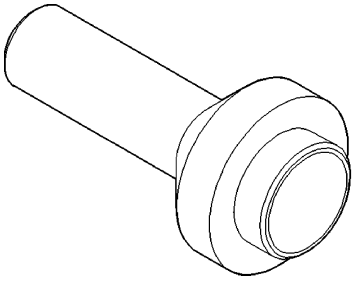
Remover, Bearing - L-4454



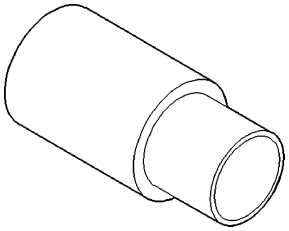
Installer, Bearing - 8128



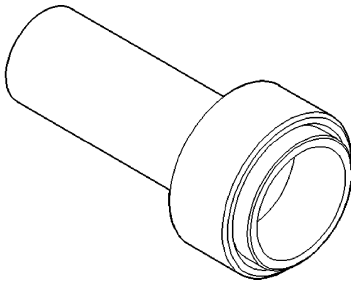
Cup - 8148



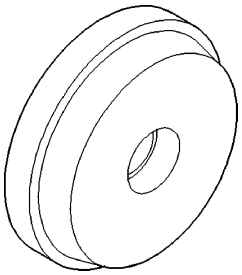
Installer, Seal - 7884



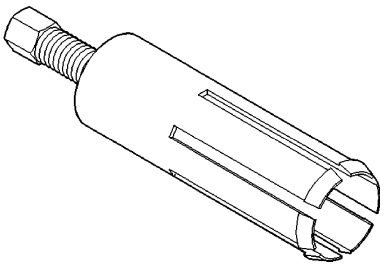
Installer, Bushing - 8157



Installer, Pump Housing Seal - 7888



Installer, Bearing - 8033-A



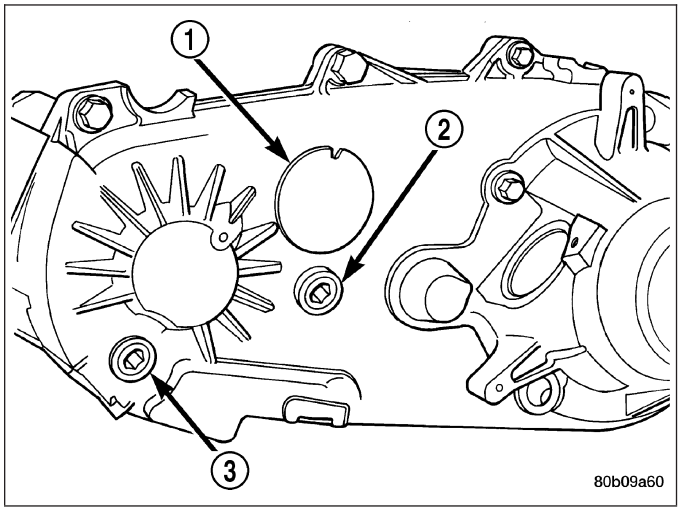
Remover, Bushing - 8158

FLUID

STANDARD PROCEDURE - FLUID DRAIN AND REFILL

The fill (2) and drain (3) plugs are both in the rear case.

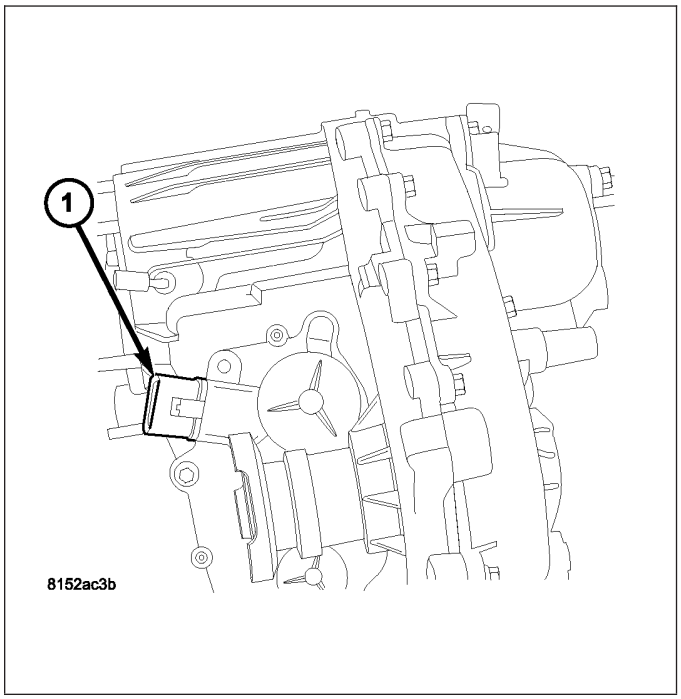
1. Raise vehicle.
2. Position drain pan under transfer case.
3. Remove drain and fill plugs and drain lubricant completely.
4. Install drain plug. Tighten plug to 20-34 N·m (15-25 ft. lbs.).
5. Remove drain pan.
6. Fill transfer case to bottom edge of fill plug opening with Mopar® ATF +4, Automatic Transmission fluid.
7. Install and tighten fill plug to 20-34 N·m (15-25 ft. lbs.).
8. Lower vehicle.



SENSOR-MODE

DESCRIPTION

The transfer case mode sensor (1) provides the Front Control Module (FCM) feedback about the position of the transfer case. The sensor consists of a linear analog position sensor that converts the motor output shaft position into a DC signal. The FCM must supply 5VDC (+/- 0.5v) to the sensor whenever the FCM is not in sleep mode and monitor the shift motor position. The sensor position is monitored when the ignition is in the RUN position and for 10 seconds after the ignition is shifted to the OFF position. The sensor is mechanically linked to the shaft of the cam which allows the transfer case to shift. The mode sensor will draw less than 20 mA of current during operation.



OPERATION

During normal vehicle operation, the Front Control Module (FCM) monitors the mode sensor outputs at least every 2 milliseconds when the shift motor is stationary or active.

Refer to SECTOR ANGLES vs. TRANSFER CASE POSITION for the relative angles of the transfer case shift sector versus the interpreted transfer case gear operating mode.

SECTOR ANGLES vs. TRANSFER CASE POSITION

Shaft Angle (Degrees)	Transfer Case Position
+20	4LO
0	N
-20	AWD
-40	4LOCK

NOTE: All the parameter voltages referred to in the following information are calibrated items in the controller software and are subject to change.

NOTE: For a further explanation of Phase 1 through 3 shifting, (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSFER CASE CONTROL MODULE - OPERATION).

The following information describes the different mode sensor positions:

- 4LO TARGET REGION - The position shall be considered 4LO if the voltage is greater than or equal to encoder_4LO_min Volts and it is also less than or equal to encoder_4LO_max Volts.
- 4LO SHIFT LIMIT - During Phase 2 and Phase 3 shifting, shifts may become unidirectional when a voltage is less than or equal to encoder_4LO_min Volts has been reached.
- 4LOCK TARGET REGION - The position shall be considered 4LOCK if the voltage is greater than or equal to encoder_4LOCK_min Volts and it is also less than or equal to encoder_4LOCK_max Volts.
- NEUTRAL TARGET REGION - The position shall be considered NEUTRAL if the voltage is greater than or equal to encoder_Neutral_min Volts and it is also less than or equal to encoder_Neutral_max Volts.
- AWD TARGET REGION - The position shall be considered AWD if the voltage is greater than or equal to encoder_AWD_min Volts and it is also less than or equal to encoder_AWD_max Volts.
- AWD SHIFT LIMIT - During Phase 2 and Phase 3 shifting, shifts may become unidirectional when a voltage is greater than or equal to encoder_AWD_min Volts has been reached.

The mode sensor position will be considered invalid by the FCM if the voltage is greater than or equal to encoder-_High_Range_Limit Volts or if it is less than or equal to encoder_Low_Range_Limit Volts.

Refer to MODE SENSOR VOLTAGES - NV244 table for the mode sensor voltages.

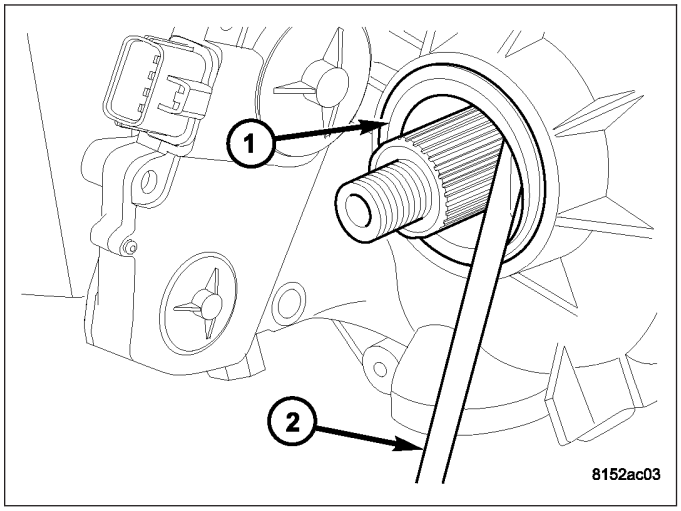
MODE SENSOR VOLTAGES - NV244

Parameter Name	Voltage
encoder_4LOCK_Min	4.26
encoder_4LOCK_Max	4.36
encoder_AWD_Min	3.36
encoder_AWD_Max	3.44
encoder_Neutral_Min	2.45
encoder_Neutral_Max	2.54
encoder_4LO _Min	1.48
encoder_4LO _Max	1.57
encoder_High_Range_Limit	4.51
encoder_Low_Range _Limit	0.50

SEAL-FRONT OUTPUT SHAFT

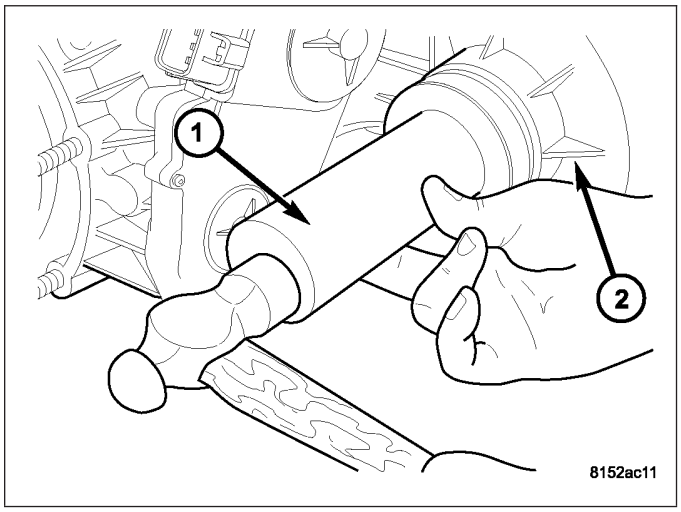
REMOVAL

1. Raise vehicle.
2. Remove front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
3. Remove front output shaft companion flange.
4. Remove seal (1) from front case with suitable pry tool.



INSTALLATION

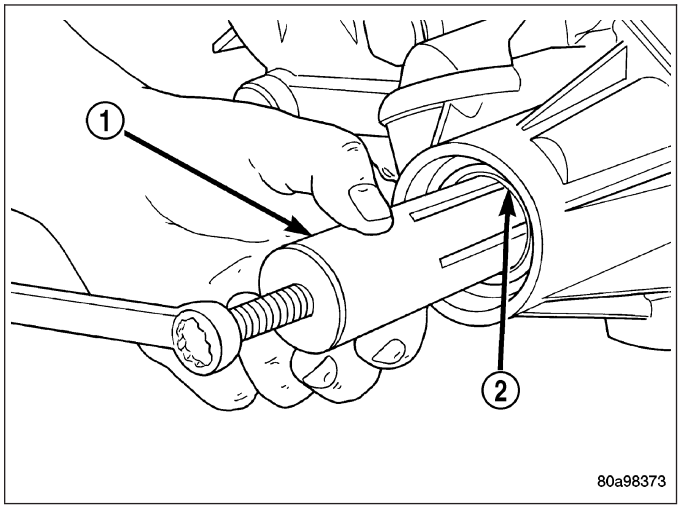
1. Install new front output seal in front case (2) with Installer Tool 8143-A (1) as follows:
   a. Place new seal on tool. Garter spring on seal goes toward interior of case.
   b. Start seal in bore with light taps from hammer. Once seal is started, continue tapping seal into bore until installer tool seats against case.
2. Install the front output shaft companion flange. Tighten the flange nut to 122-176 N·m (90-130 ft.lbs.).
3. Install the front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)



BUSHING/SEAL-REAR RETAINER

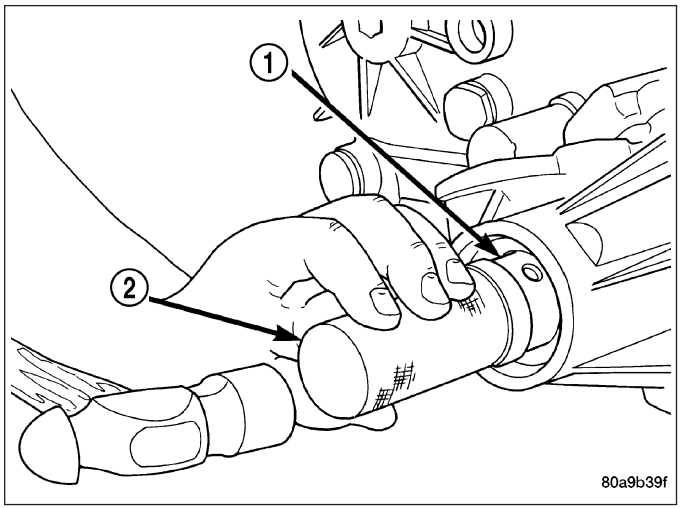
REMOVAL

1. Raise vehicle.
2. Remove rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
3. Using a suitable pry tool or slide-hammer mounted screw, remove the rear retainer seal.
4. Using Remover 8158 (1), remove the bushing from rear retainer.

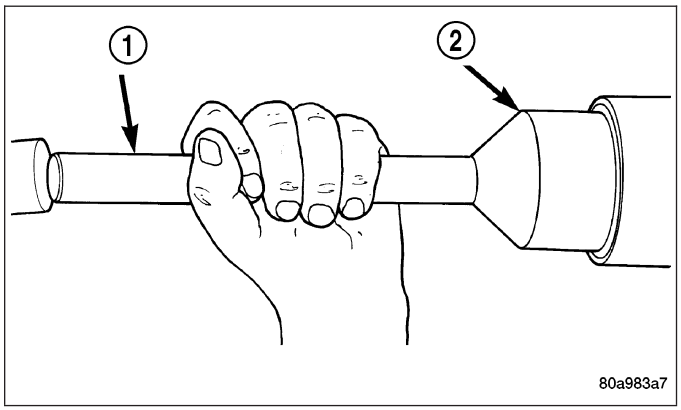


INSTALLATION

1. Clean fluid residue from sealing surface and inspect for defects.
2. Position replacement bushing in rear retainer with fluid port in bushing aligned with slot in retainer.
3. Using Installer 8157 (2), drive bushing (1) into retainer until installer seats against case.



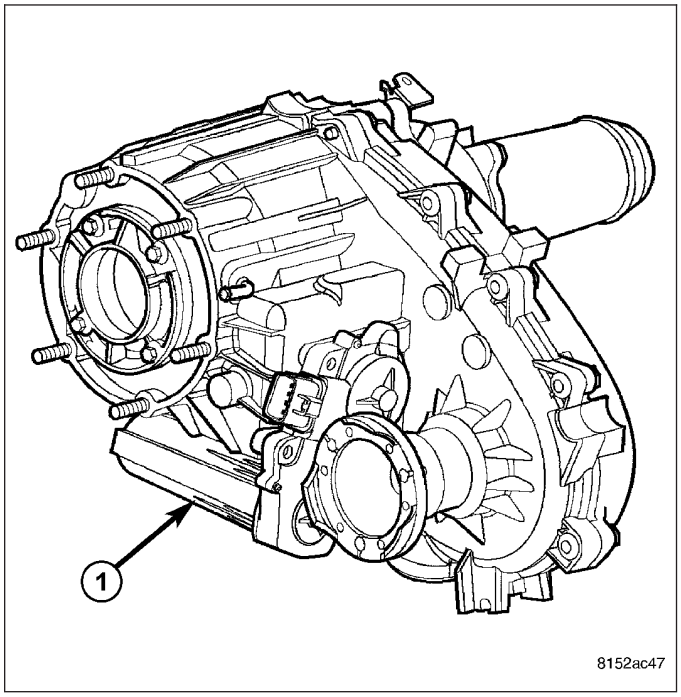
4. Using Installer D-163 (2), install seal in rear retainer.
5. Install the rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)
6. Verify proper fluid level.
7. Lower vehicle.



ASSEMBLY-SHIFT MOTOR/MODE SENSOR

DESCRIPTION

The shift motor (1) is an electromechanical device consisting of a DC permanent magnet motor, gear train, and an analog position sensor. The shift motors' overall function is to move and lock a gear that moves the mode and range forks found in the transfer case. This allows the transfer case to be shifted electrically to multiple operating positions (4LOCK, AWD, N (neutral), and 4LO). The operating current of the shift motor under stall conditions is 30 amps maximum at 72° F with 13.5 volts, at the motor leads.



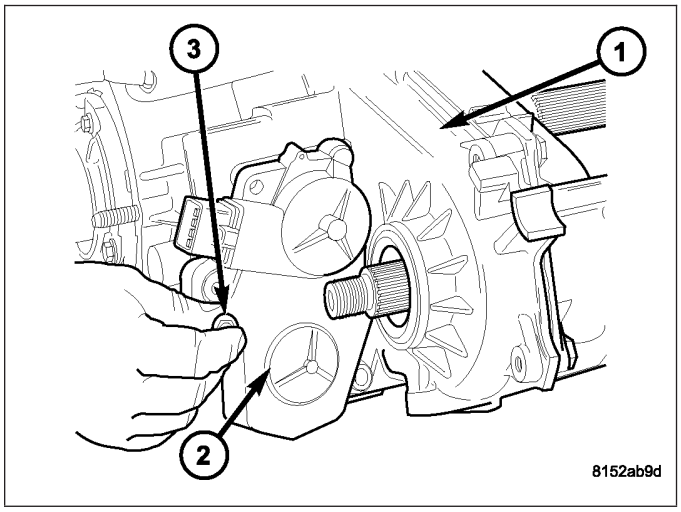
OPERATION

Shifting in the transfer case occurs when a Pulse Width Modulated (PWM) voltage is supplied to the shift motor by the Front Control Module (FCM). A linear analog position sensor located inside the shift motor, provides the FCM with the motors' angular, rotational position. With this information, the FCM continuously knows the motors' position, and therefore allows it to accurately control the motors' operation, including voltage polarity which is used to control motor direction.

REMOVAL

NOTE: New shift motor assemblies are shipped in the 2WD/AWD position. If a new shift motor assembly must be installed, it will be necessary to shift the transfer case to the 2WD/AWD position prior to motor installation.

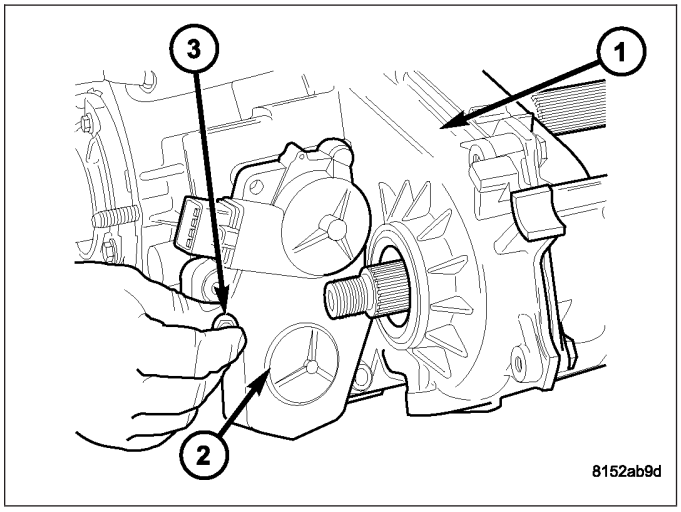
1. Raise the vehicle on a suitable hoist.
2. Disengage the wiring connector from the shift motor and mode sensor assembly.
3. Remove the bolts (3) holding the shift motor and mode sensor assembly (2) onto the transfer case (1).
4. Separate the shift motor and mode sensor assembly (2) from the transfer case (1).



INSTALLATION

1. Verify that the shift motor o-ring is clean and properly positioned inside the machined o-ring groove of the shift motor.
2. Add high temperature grease between the actuator and the transfer case mating surface for sealing purposes.

NOTE: Verify that the shift motor position and sector shaft orientation are aligned. It may be necessary to manually shift the transfer case if the shift motor and sector shaft are not aligned.



3. Position the shift motor and mode sensor assembly (2) onto the transfer case (1).
4. Install the bolts (3) to hold the assembly (2) onto the transfer case (1). Tighten the bolts to 16-24 N·m (12-18 ft.lbs.).

CAUTION: If the original shift motor and mode sensor assembly bolts are reused, be sure to use Mopar® Lock & Seal or Loctite™ 242 to replenish the lock patch material originally found on the bolts

5. Engage the wiring connector to the shift motor and mode sensor assembly.
6. Refill the transfer case as necessary.
7. Lower vehicle and verify transfer case operation.

SWITCH-TRANSFER CASE SELECTOR

DESCRIPTION

The selector switch assembly is mounted in the right side of the vehicle's Instrument Panel (IP) and consists of a rotary knob connected to a resistive network for the mode and range shift selections. Also located in this assembly is a recessed, normally open momentary switch for making shifts into and out of transfer case NEUTRAL. A pen, or similar instrument, is used to make a NEUTRAL shift selection, thus reducing the likelihood of an inadvertent shift request.

OPERATION

As the position of the selector switch varies, the resistance between the Mode Sensor supply voltage pin and the Mode Sensor output will vary. Hardware, software, and calibrations within the Front Control Module (FCM) are provided that interpret the selector switch resistance as given in the table below: SELECTOR SWITCH INTERPRETATION

SELECTOR SWITCH INTERPRETATION

Required Interpretation	Resistance Range (ohms)
Shorted	<150
AWD+NEUTRAL	176-200
4LOCK+NEUTRAL	190-216
4LO+NEUTRAL	199-226
AWD (Default)	1159-1287
4LOCK	2259-2503
4LO	4820-5334
Open/Diagnostic	>19K

The internal structure and function of the selector switch is such that the connection is made to the Open/Diagnostic resistor before the connection to the individual position resistors is broken. Because of this characteristic, if the resistance between the Mode Sensor supply voltage pin and the Mode Sensor output pin is >19k ohms, the position resistor is open.

TIRES/WHEELS

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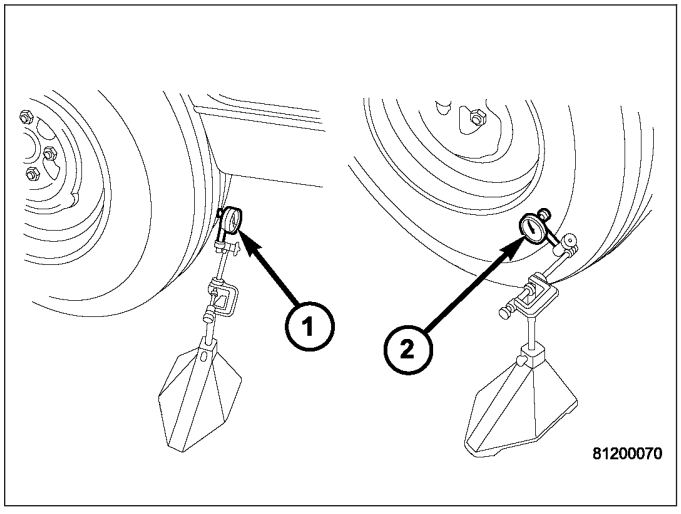
TIRES/WHEELS

DIAGNOSIS AND TESTING

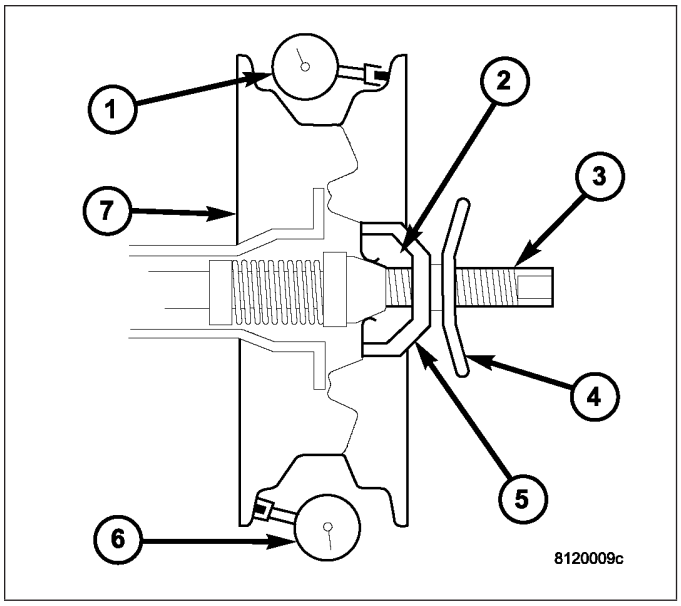
TIRE AND WHEEL RUNOUT

Radial runout is the difference between the high and low points on the tire or wheel.



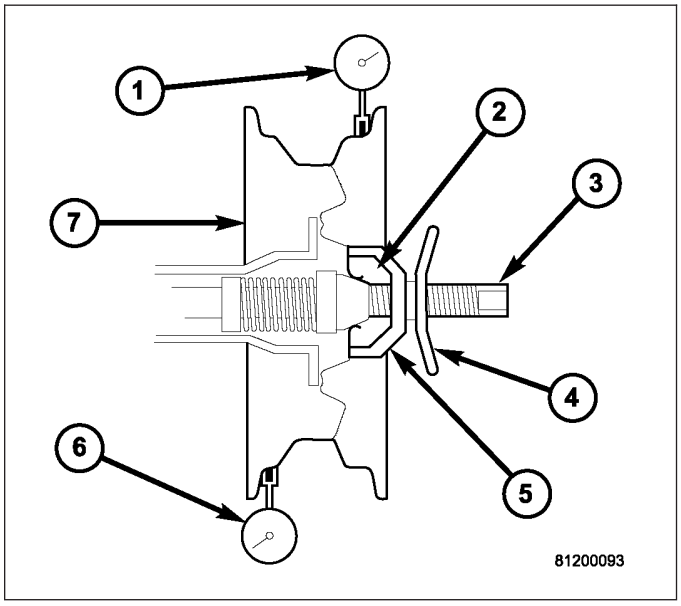
Lateral runout is the **wobble** of the tire or wheel.

Lateral runout of more than 2.0 mm (.080 inch) measured near the shoulder of the tire may cause the vehicle to shake.



Radial runout of more than 1.5 mm (.060 inch) measured at the center line of the tread may cause the vehicle to shake.

Sometimes radial runout can be reduced. Relocate the wheel and tire assembly on the mounting studs (See Method 1). If this does not reduce runout to an acceptable level, the tire can be rotated on the wheel. (See Method 2).



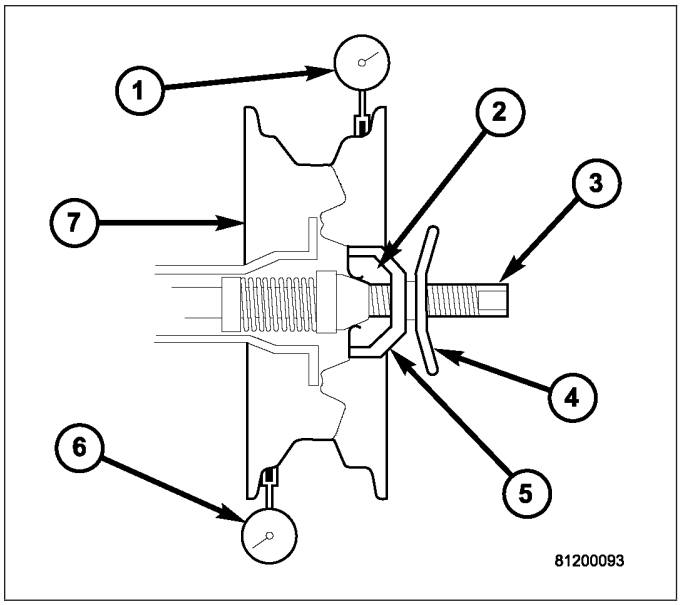
METHOD 1 (RELOCATE WHEEL ON HUB)

1. Drive vehicle a short distance to eliminate tire flat spotting from a parked position.
2. Check wheel bearings and adjust if adjustable or replace if necessary.
3. Check the wheel mounting surface.
4. Relocate wheel on the mounting, two studs over from the original position.
5. Tighten wheel nuts until all are properly torqued, to eliminate brake distortion.
6. Check radial runout. If still excessive, mark tire sidewall, wheel, and stud at point of maximum runout and proceed to Method 2.

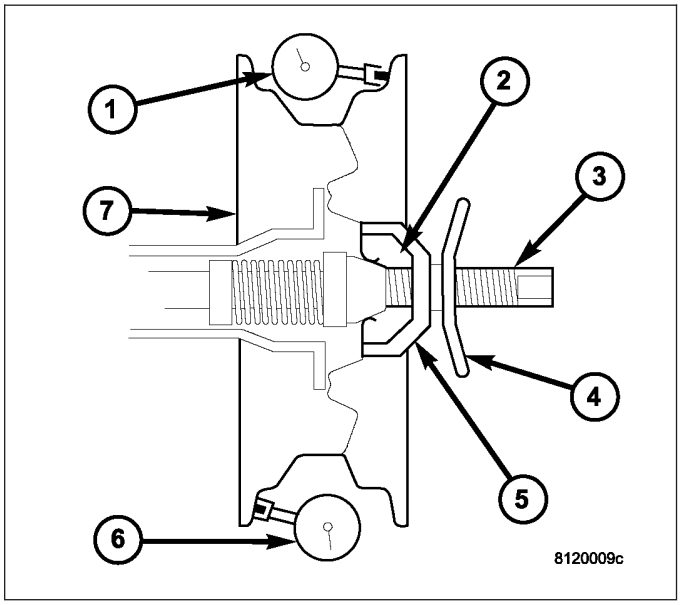
METHOD 2 (RELOCATE TIRE ON WHEEL)

NOTE: Rotating the tire on wheel is particularly effective when there is runout in both tire and wheel.

1. Remove tire from wheel and mount wheel on service dynamic balance machine.
2. Check the wheel radial runout.



3. Check the wheel lateral runout.
   - STEEL WHEELS: Radial runout 0.031 in., Lateral runout 0.031 in. (maximum)
   - ALUMINUM WHEELS: Radial runout 0.02 in., Lateral runout 0.025 in. (maximum)
4. If point of greatest wheel lateral runout is near original chalk mark, remount tire 180 degrees. Recheck runout.



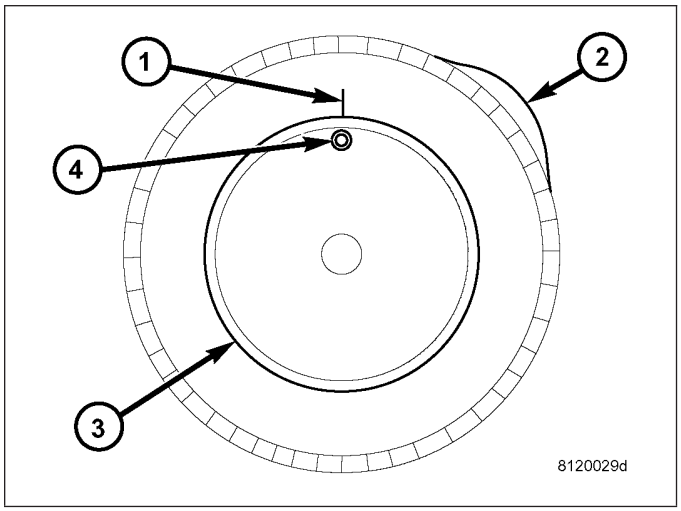
STANDARD PROCEDURE

MATCH MOUNTING

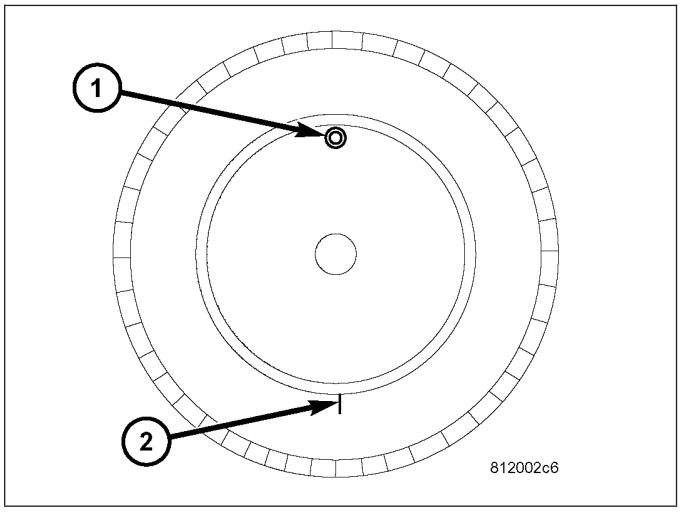
Wheels and tires are match mounted at the factory. This means that the high spot of the tire is matched to the low spot on the wheel rim. Each are marked with a bright colored temporary label on the outboard surface for alignment. The wheel is also marked permanently on the inside of the rim in the tire well. This permanent mark may be a paint dot or line, a permanent label or a stamped impression such as an X. An optional location mark is a small spherical indentation on the vertical face of the outboard flange on some non styled base steel wheels. The tire must be removed to locate the permanent mark on the inside of the wheel.

Before dismounting a tire from its wheel, a reference mark should be placed on the tire at the valve stem location. This reference will ensure that it is remounted in the original position on the wheel.

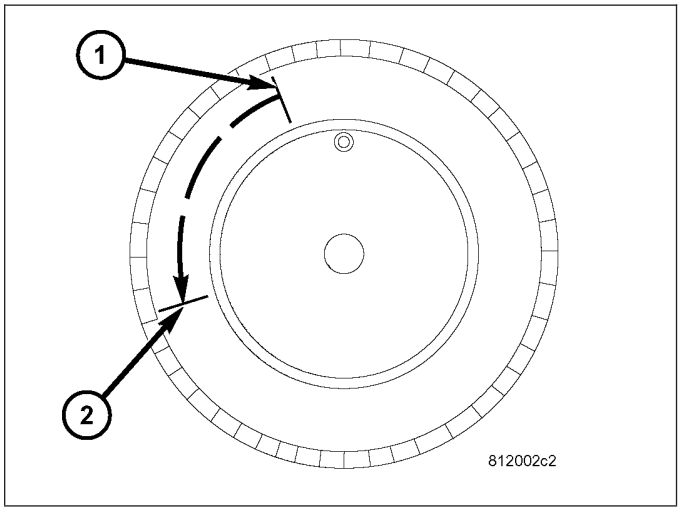
1. Remove the tire and wheel assembly from the vehicle and mount on a service dynamic balance machine.
2. Measure the total runout on the center of the tire tread rib (3) with a dial indicator. Record the indicator reading. Mark the tire to indicate the high spot (2). Place a mark on the tire at the valve stem (4) location (1).



3. Break down the tire and remount it 180 degrees on the rim (1)(2).
4. Measure the total indicator runout again. Mark the tire to indicate the high spot.



5. If runout is still excessive, the following procedures must be done.
   - If the high spot is within 101.6 mm (4.0 in.) of the first spot and is still excessive, replace the tire.
   - If the high spot is within 101.6 mm (4.0 in.) of the first spot on the wheel, the wheel may be out of specifications. Refer to Wheel and Tire Runout.
   - If the high spot is NOT within 101.6 mm (4.0 in.) of either high spot, draw an arrow on the tread from second high spot (1) to first (2). Break down the tire and remount it 90 degrees on rim in that direction. This procedure will normally reduce the runout to an acceptable amount, if not replace the rim.

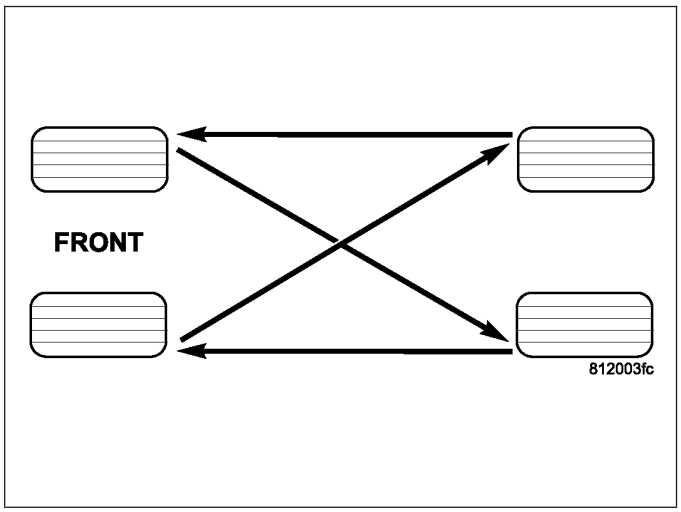


ROTATION

Tires on the front and rear operate at different loads and perform different steering, driving, and braking functions. For these reasons they wear at unequal rates and tend to develop irregular wear patterns. These effects can be reduced by rotating the tires at regular intervals. The benefits of tire rotation are:

- Increase tread life
- Maintain traction levels
- A smooth, quiet ride

The suggested method of tire rotation is shown in graphic. Other rotation methods can be used, but they will not provide all the tire longevity benefits.



TIRE AND WHEEL BALANCE

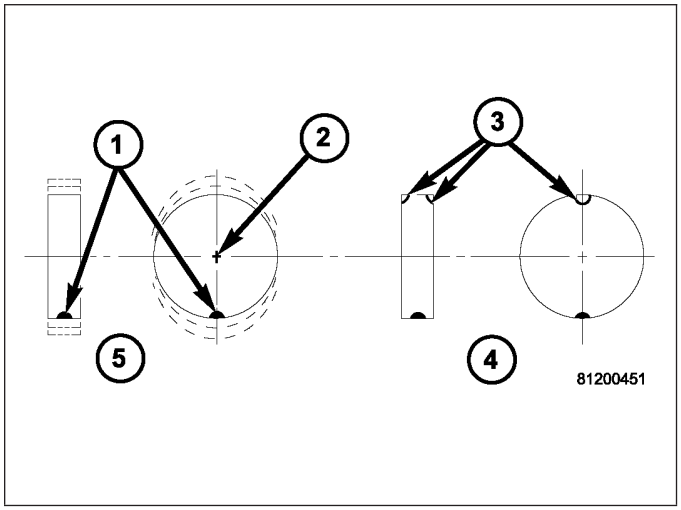
It is recommended that a two plane service dynamic balancer be used when a tire and wheel assembly require balancing. Refer to balancer operation instructions for proper cone mounting procedures. Typically use front cone mounting method for steel wheels. For aluminum wheel use back cone mounting method without cone spring.

NOTE: Static should be used only when a two plane balancer is not available.

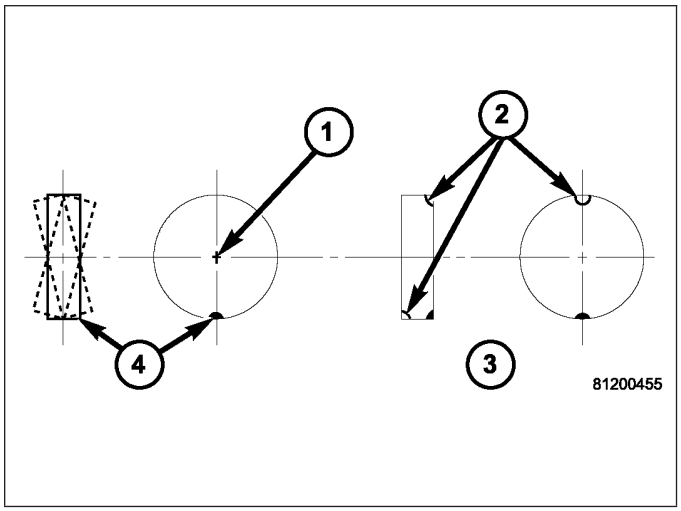
NOTE: Cast aluminum and forged aluminum wheels require coated balance weights and special alignment equipment.

Wheel balancing can be accomplished with either on or off vehicle equipment. When using on-vehicle balancing equipment, remove the opposite wheel/tire. Off-vehicle balancing is recommended.

For static balancing, find the location of the heavy spot (1) causing the imbalance (5). Counter balance wheel directly opposite the heavy spot. Determine weight required to counter balance the area of imbalance (4). Place half of this weight on the **inner** rim flange (3) and the other half on the **outer** rim flange (3).



For dynamic balancing (3), the balancing equipment is designed to locate the amount of weight to be applied to both the inner and outer rim flange (2).



SPECIFICATIONS

CAUTION: DO NOT USE CHROME PLATED LUG NUTS WITH CHROME PLATED WHEELS.

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Wheel Lug Nut	183 ± 10	135 ± 10	—
Spare Tire Winch	39	28	250

TIRES

DESCRIPTION

TIRES

Tires are designed and engineered for each specific vehicle. They provide the best overall performance for normal operation. The ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability, traction, skid resistance, and tread life.

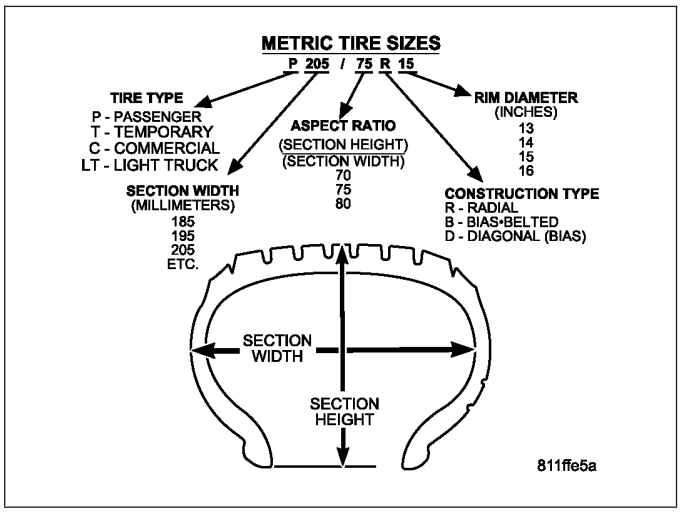
Driving habits have more effect on tire life than any other factor. Careful drivers will obtain in most cases, much greater mileage than severe use or careless drivers. A few of the driving habits which will shorten the life of any tire are:

- Rapid acceleration
- Severe brake applications
- High speed driving
- Excessive speeds on turns
- Striking curbs and other obstacles

Radial-ply tires are more prone to irregular tread wear. It is important to follow the tire rotation interval (Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE). This will help to achieve a greater tread life.

TIRE IDENTIFICATION

Tire type, size, aspect ratio and speed rating are encoded in the letters and numbers imprinted on the side wall of the tire. Refer to the chart to decipher the tire identification code.



Performance tires have a speed rating letter after the aspect ratio number. The speed rating is not always printed on the tire sidewall. These ratings are:

- **Q** up to 100 mph
- **S** up to 112 mph
- **T** up to 118 mph
- **U** up to 124 mph
- **H** up to 130 mph
- **V** up to 149 mph
- **Z** more than 149 mph (consult the tire manufacturer for the specific speed rating)

An All Season type tire will have either **M + S, M & S or M–S** (indicating mud and snow traction) imprinted on the side wall.

TIRE CHAINS

Tire snow chains may be used on **certain** models. Refer to the Owner's Manual for more information.

RADIAL-PLY TIRES

Radial-ply tires improve handling, tread life and ride quality, and decrease rolling resistance.

Radial-ply tires must always be used in sets of four. Under no circumstances should they be used on the front only. They may be mixed with temporary spare tires when necessary. A maximum speed of 50 MPH is recommended while a temporary spare is in use.

Radial-ply tires have the same load-carrying capacity as other types of tires of the same size. They also use the same recommended inflation pressures.

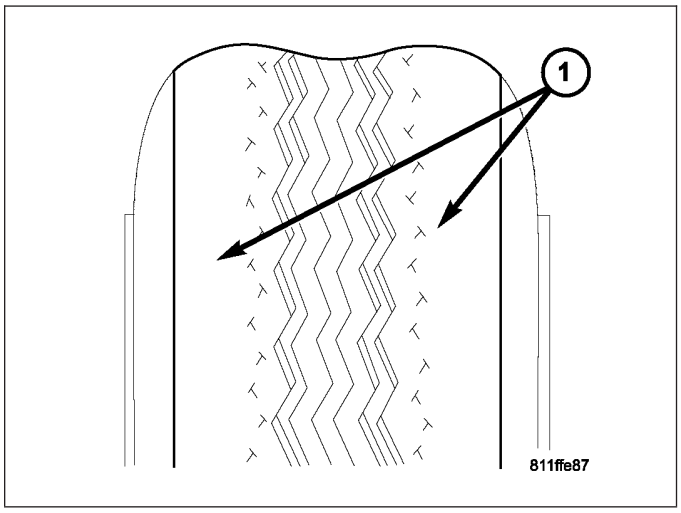
The use of oversized tires, either in the front or rear of the vehicle, can cause vehicle drive train failure. This could also cause inaccurate wheel speed signals when the vehicle is equipped with Anti-Lock Brakes.

The use of tires from different manufactures on the same vehicle is NOT recommended. The proper tire pressure should be maintained on all four tires.

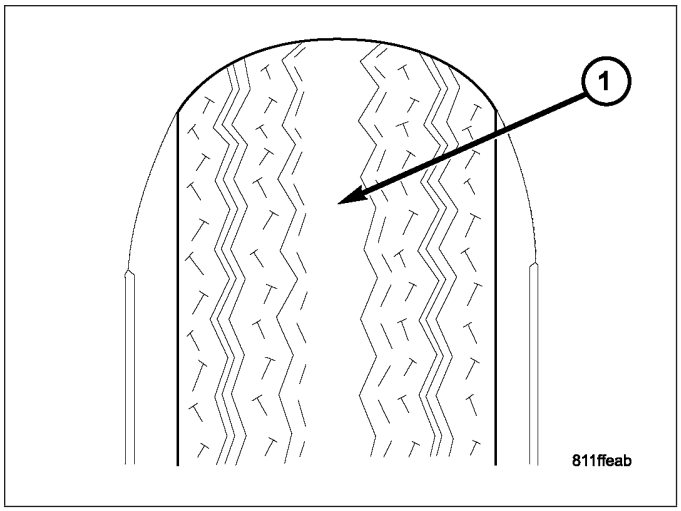
TIRE INFLATION PRESSURES

WARNING: OVER OR UNDER INFLATED TIRES CAN AFFECT VEHICLE HANDLING AND TREAD WEAR. THIS MAY CAUSE THE TIRE TO FAIL SUDDENLY, RESULTING IN LOSS OF VEHICLE CONTROL.

Under inflation will cause rapid shoulder wear (1), tire flexing, and possible tire failure.



Over inflation will cause rapid center wear (1) reduction in the tire's ability to cushion shocks.



Improper inflation can cause:

- Uneven wear patterns
- Reduced tread life
- Reduced fuel economy
- Unsatisfactory ride
- Vehicle drift

For proper tire pressure specification refer to the vehicles Owners Manual.

TIRE PRESSURE FOR HIGH SPEED

Refer to the Vehicles Owners Manual package.

SPARE / TEMPORARY TIRE

The temporary spare tire is designed for emergency use only. The original tire should be repaired or replaced at the first opportunity, then reinstalled. Do not exceed speeds of 50 M.P.H. when using the temporary spare tire. Refer to Owner's Manual for complete details.

FULL SIZE, SPARE WHEEL WITH MATCHING TIRE

The spare is a full usage wheel with a matching tire, It can be used within the (posted legal) speed limits or distance limitations as of the rest of the vehicles four tires. Refer to Owner's Manual for complete details.

REPLACEMENT TIRES

The original equipment tires provide a proper balance of many characteristics such as:

- Ride
- Noise
- Handling
- Durability
- Tread life
- Traction
- Rolling resistance
- Speed capability

It is recommended that tires equivalent to the original equipment tires be used when replacement is needed.

Failure to use equivalent replacement tires may adversely affect the safety and handling of the vehicle.

The use of oversize tires may cause interference with vehicle components. Under extremes of suspension and steering travel, interference with vehicle components may cause tire damage.

WARNING: FAILURE TO EQUIP THE VEHICLE WITH TIRES HAVING ADEQUATE SPEED CAPABILITY CAN RESULT IN SUDDEN TIRE FAILURE.

DIAGNOSIS AND TESTING

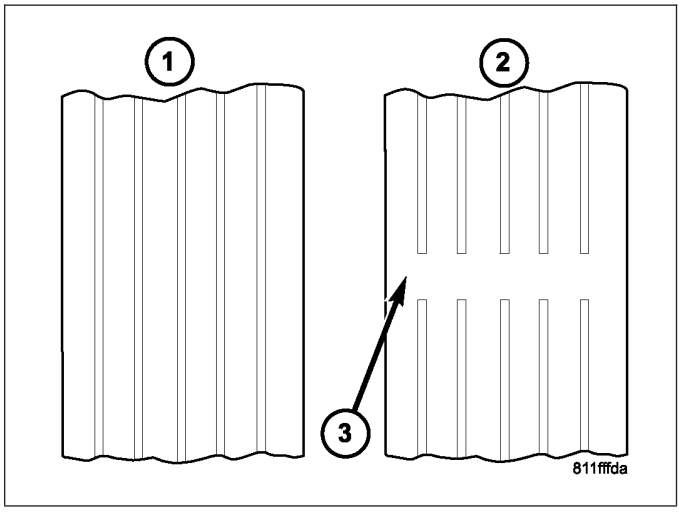
PRESSURE GAUGES

A quality air pressure gauge is recommended to check tire pressure. After checking the air pressure, replace valve cap finger tight.

TREAD WEAR INDICATORS

Tread wear indicators (3) are molded into the bottom of the tread grooves. When tread depth is 1.6 mm (1/16 in.), the tread wear indicators (3) will appear as a 13 mm (1/2 in.) band.

Tire replacement is necessary when indicators appear in two or more grooves or if localized balding occurs.



TIRE WEAR PATTERNS

CONDITION	RAPID WEAR AT SHOULDERS	RAPID WEAR AT CENTER	CRACKED TREADS	WEAR ON ONE SIDE	FEATHERED EDGE	BALD SPOTS	SCALLOPED WEAR
EFFECT	1. 2.						
CAUSE	UNDER-INFLATION OR LACK OF ROTATION	OVER-INFLATION OR LACK OF ROTATION	UNDER-INFLATION OR EXCESSIVE SPEED*	EXCESSIVE CAMBER	INCORRECT TOE	UNBALANCED WHEEL OR TIRE DEFECT*	LACK OF ROTATION OF TIRES OR WORN OR OUT-OF-ALIGNMENT SUSPENSION.
CORRECTION	ADJUST PRESSURE TO SPECIFICATIONS WHEN TIRES ARE COOL ROTATE TIRES			ADJUST CAMBER TO SPECIFICATIONS	ADJUST TOE-IN TO SPECIFICATIONS	DYNAMIC OR STATIC BALANCE WHEELS	ROTATE TIRES AND INSPECT SUSPENSION SEE GROUP 2

* HAVE TIRE INSPECTED FOR FUTURE USE.

812014d7

Under inflation will cause wear on the shoulders of tire. Over inflation will cause wear at the center of tire.

Excessive camber causes the tire to run at an angle to the road. One side of tread is then worn more than the other.

Excessive toe-in or toe-out causes wear on the tread edges and a feathered effect across the tread.

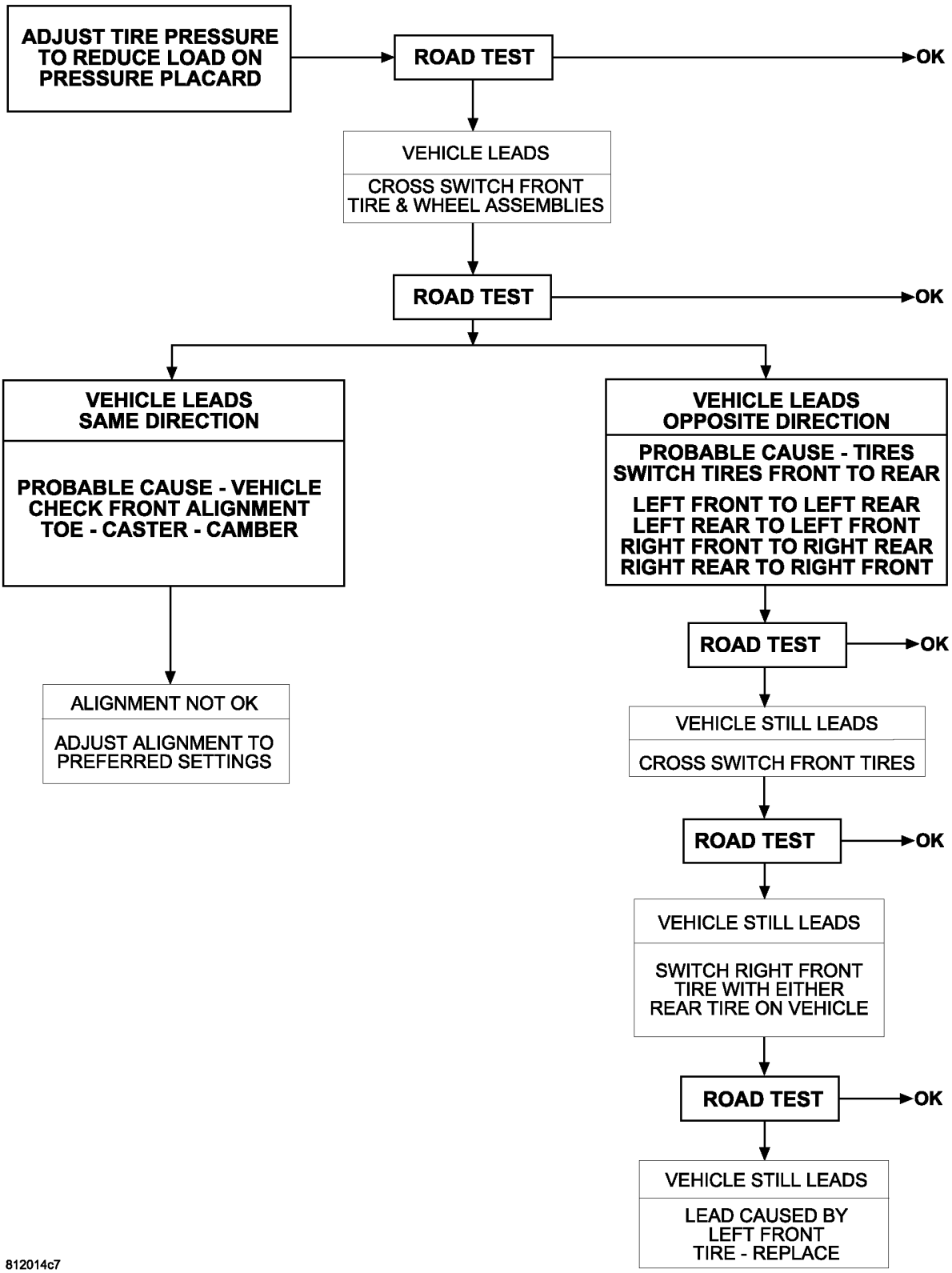
TIRE NOISE OR VIBRATION

Radial-ply tires are sensitive to force impulses caused by improper mounting, vibration, wheel defects, or possibly tire imbalance.

To find out if tires are causing the noise or vibration, drive the vehicle over a smooth road at varying speeds. Note the noise level during acceleration and deceleration. The engine, differential and exhaust noises will change as speed varies, while the tire noise will usually remain constant.

TIRE/VEHICLE LEAD

Use the following Vehicle Lead Diagnosis And Correction Chart to diagnose and correct a vehicle lead or drift problem.


ADJUST TIRE PRESSURE TO REDUCE LOAD ON PRESSURE PLACARD
ROAD TEST
OK
VEHICLE LEADS
CROSS SWITCH FRONT TIRE & WHEEL ASSEMBLIES
ROAD TEST
OK
VEHICLE LEADS SAME DIRECTION
PROBABLE CAUSE - VEHICLE CHECK FRONT ALIGNMENT TOE - CASTER - CAMBER
ALIGNMENT NOT OK
ADJUST ALIGNMENT TO PREFERRED SETTINGS
VEHICLE LEADS OPPOSITE DIRECTION
PROBABLE CAUSE - TIRES SWITCH TIRES FRONT TO REAR
LEFT FRONT TO LEFT REAR
LEFT REAR TO LEFT FRONT
RIGHT FRONT TO RIGHT REAR
RIGHT REAR TO RIGHT FRONT
ROAD TEST
OK
VEHICLE STILL LEADS
CROSS SWITCH FRONT TIRES
ROAD TEST
OK
VEHICLE STILL LEADS
SWITCH RIGHT FRONT TIRE WITH EITHER REAR TIRE ON VEHICLE
ROAD TEST
OK
VEHICLE STILL LEADS
LEAD CAUSED BY LEFT FRONT TIRE - REPLACE
812014c7

STANDARD PROCEDURE

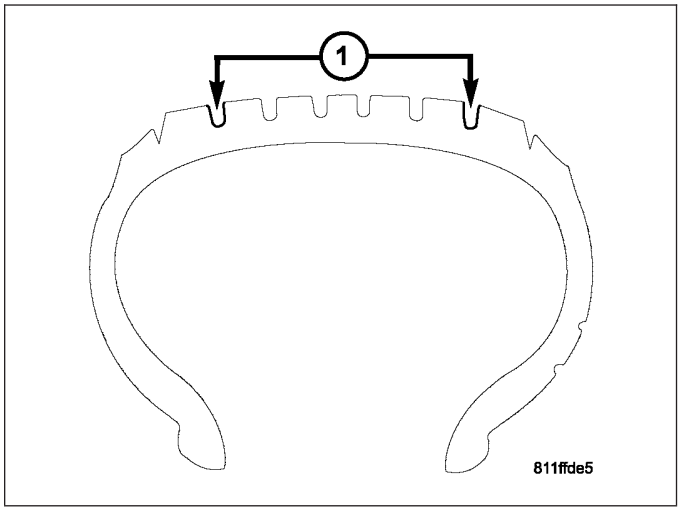
TIRE REPAIR AREA

For proper repairing, a radial tire must be removed from the wheel. Repairs should only be made if the defect, or puncture, is in the tread area (1). The tire should be replaced if the puncture is located in the sidewall.

Deflate tire completely before removing the tire from the wheel. Use lubrication such as a mild soap solution when dismounting or mounting tire. Use tools free of burrs or sharp edges which could damage the tire or wheel rim.

Before mounting tire on wheel, make sure all rust is removed from the rim bead and repaint if necessary.

Install wheel on vehicle, and tighten to proper torque specification.



CLEANING

TIRES

Remove the protective coating on the tires before delivery of a vehicle. This coating may cause deterioration of the tires.

To remove the protective coating, apply warm water and let it soak for a few minutes. Afterwards, scrub the coating away with a soft bristle brush. Steam cleaning may also be used to remove the coating.

NOTE: DO NOT use gasoline, mineral oil, oil-based solvent or a wire brush for cleaning.

SPECIFICATIONS

TIRE REVOLUTIONS PER MILE

DESCRIPTION	SPECIFICATION
TIRE SIZE	REVOLUTIONS PER MILE
P245/70R16	713
P255/65R16	724
P265/70R16	687
P265/65R17	684
P275/60R17	695

SPARE TIRE WINCH

REMOVAL

NOTE: ″Do NOT use impact tools on the Spare Tire Winch assembly to raise or lower the Spare Tire.

1. Remove the spare tire.
2. Raise and support the vehicle.
3. Remove the three bolts securing the spare tire winch to the crossmember and then remove the winch.

INSTALLATION

1. Install the winch to the crossmember and tighten the three bolts to 39 N·m (28 ft.lbs.).
2. Lower the vehicle.

NOTE: ″Do NOT use impact tools on the Spare Tire Winch assembly to raise or lower the Spare Tire.

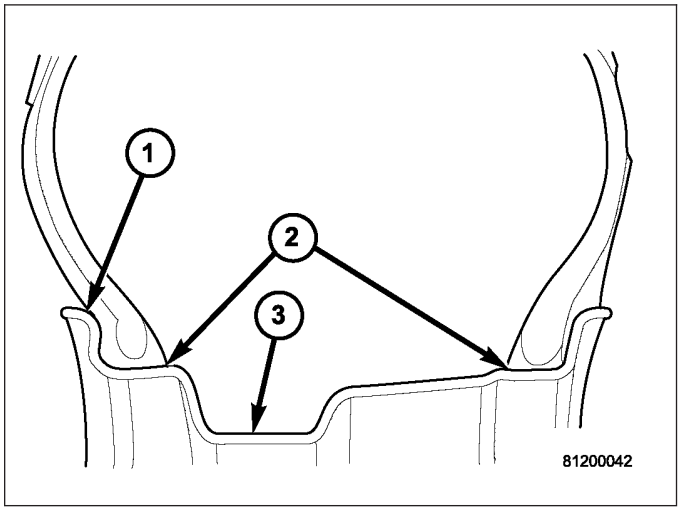
3. Install the spare tire back into position.

WHEELS

DESCRIPTION

WHEEL DESIGN

The rim size is on the vehicle safety certification label located on the drivers door shut face. The size of the rim is determined by the drivetrain package. Original equipment wheels/rims are designed for operation up to the specified maximum vehicle capacity.



All models use stamped steel, cast aluminum or forged aluminum wheels. Every wheel has raised sections between the rim flanges (1) and rim drop well (3) called safety humps.

Initial inflation of the tire forces the bead over these raised sections. In case of rapid loss of air pressure, the raised sections help hold the tire on the wheel.

The wheel studs and nuts are designed for specific applications. All aluminum and some steel wheels have wheel stud nuts with an enlarged nose. This enlarged nose is necessary to ensure proper retention of the wheels. Do not use replacement studs or nuts with a different design or lesser quality.

DIAGNOSIS AND TESTING

WHEEL INSPECTION

Inspect wheels for:

- Excessive run out
- Dents or cracks
- Damaged wheel lug nut holes
- Air Leaks from any area or surface of the rim

NOTE: Do not attempt to repair a wheel by hammering, heating or welding.

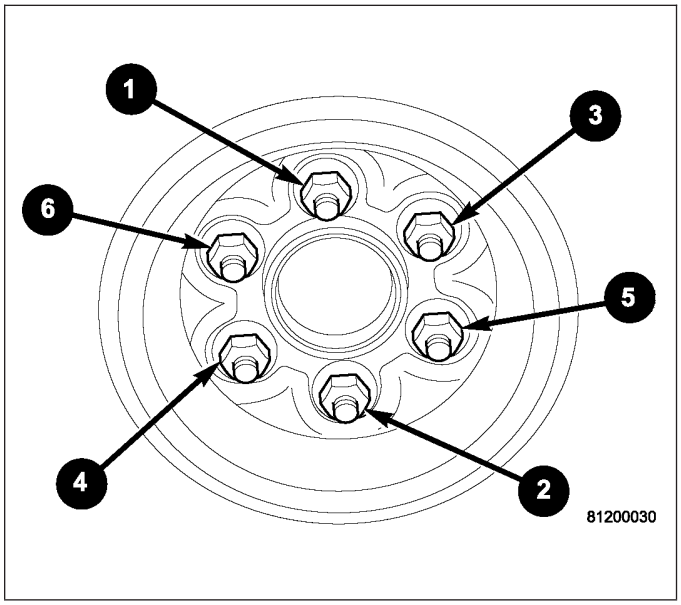
If a wheel is damaged an original equipment replacement wheel should be used. When obtaining replacement wheels, they should be equivalent in load carrying capacity. The diameter, width, offset, pilot hole and bolt circle of the wheel should be the same as the original wheel.

WARNING: FAILURE TO USE EQUIVALENT REPLACEMENT WHEELS MAY ADVERSELY AFFECT THE SAFETY AND HANDLING OF THE VEHICLE. USED WHEELS ARE NOT RECOMMENDED. THE SERVICE HISTORY OF THE WHEEL MAY HAVE INCLUDED SEVERE TREATMENT OR VERY HIGH MILEAGE. THE RIM COULD FAIL WITHOUT WARNING.

STANDARD PROCEDURE

WHEEL INSTALLATION

The wheel studs and nuts are designed for specific applications. They must be replaced with equivalent parts. Do not use replacement parts of lesser quality or a substitute design. All aluminum and some steel wheels have wheel stud nuts which feature an enlarged nose. This enlarged nose is necessary to ensure proper retention of the aluminum wheels.



NOTE: Do not use chrome plated lug nuts with chrome plated wheels.

Before installing the wheel, be sure to remove any build up of corrosion on the wheel mounting surfaces. Ensure wheels are installed with good metal-to-metal contact. Improper installation could cause loosening of wheel nuts. This could affect the safety and handling of your vehicle.

To install the wheel, first position it properly on the mounting surface. All wheel nuts should then be tightened just snug. Gradually tighten them in sequence to the proper torque specification. **Never use oil or grease on studs or nuts.**

WHEEL REPLACEMENT

The wheel studs and nuts are designed for specific applications. They must be replaced with equivalent parts. Do not use replacement parts of lesser quality or a substitute design. All aluminum and some steel wheels have wheel stud nuts which feature an enlarged nose. This enlarged nose is necessary to ensure proper retention of the aluminum wheels.

NOTE: Do not use chrome plated lug nuts with chrome plated wheels.

Before installing the wheel, be sure to remove any build up of corrosion on the wheel mounting surfaces. Ensure wheels are installed with good metal-to-metal contact. Improper installation could cause loosening of wheel nuts. This could affect the safety and handling of your vehicle.

To install the wheel, first position it properly on the mounting surface. All wheel nuts should then be tightened just snug. Gradually tighten them in sequence to the proper torque specification. **Never use oil or grease on studs or nuts.**

Wheels must be replaced if they have:

- Excessive runout
- Bent or dented
- Leak air through welds
- Have damaged bolt holes

Wheel repairs employing hammering, heating, or welding are not allowed.

Original equipment wheels are available through your dealer. Replacement wheels from any other source should be equivalent in:

- Load carrying capacity
- Diameter

- Pilot Bore Diameter
- Width
- Offset
- Mounting configuration

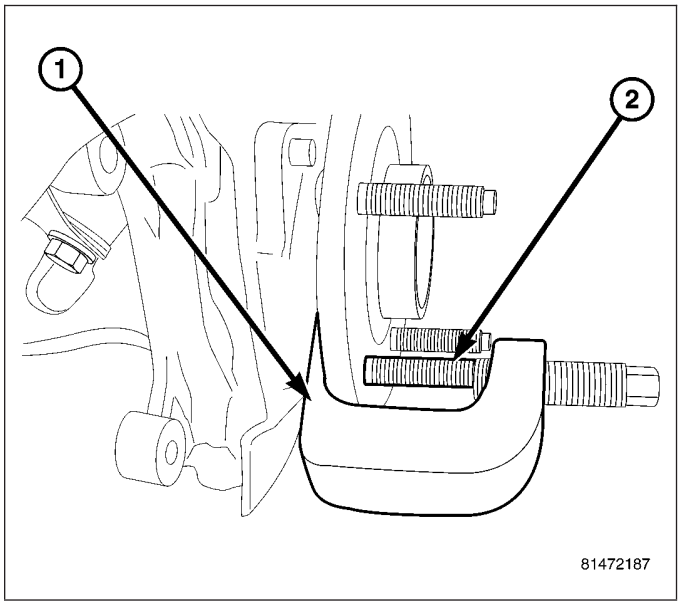
Failure to use equivalent replacement wheels may affect the safety and handling of your vehicle. Replacement with **used** wheels is not recommended. Their service history may have included severe treatment.

STUDS

REMOVAL

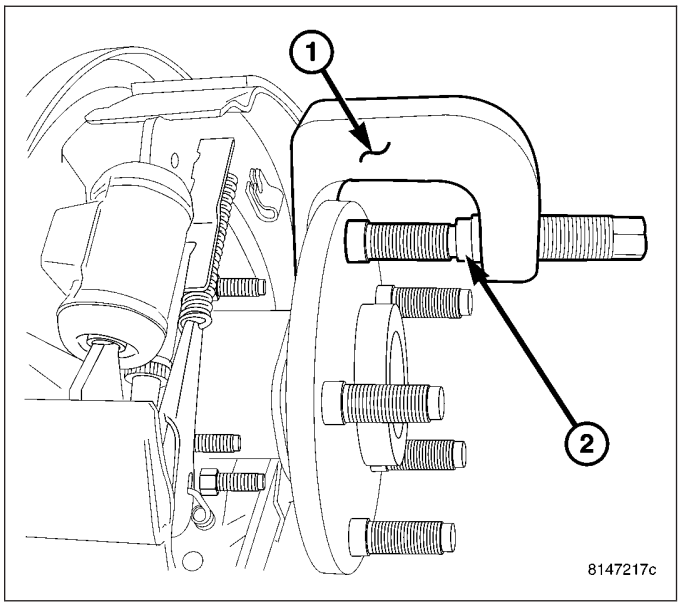
FRONT WHEEL STUDS

1. Raise and support the vehicle.
2. Remove the wheel and tire assembly.
3. Remove the brake caliper, caliper adapter and rotor, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
4. Remove the wheel speed sensor from the hub.
5. Press the stud (2) from the hub using special tool C-4150A (1).



REAR WHEEL STUDS

1. Remove the wheel and tire assembly.
2. Remove the brake drum.
3. Press the stud (2) from the hub using special tool C-4150A (1).



INSTALLATION

1. Install the new stud into the hub flange.
2. Install three proper sized washers onto the stud, then install lug nut with the flat side of the nut against the washers.
3. Tighten the lug nut until the stud is pulled into the hub flange. Verify that the stud is properly seated into the flange.
4. Remove the lug nut and washers.
5. Install the brake rotor, caliper adapter, and caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
6. Install the brake drum.
7. Install the wheel and tire assembly, use new lug nut on the stud or studs that were replaced.
8. Remove the support and lower the vehicle.

BODY

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BODY

WARNING

SAFETY PRECAUTIONS AND WARNINGS

WARNING: Use an osha approved breathing filter when spraying paint or solvents in a confined area. Personal injury can result.

- **Avoid prolonged skin contact with petroleum or alcohol – based cleaning solvents. Personal injury can result.**
- **Do not stand under a hoisted vehicle that is not properly supported on safety stands. Personal injury can result.**

CAUTION: When holes must be drilled or punched in an inner body panel, verify depth of space to the outer body panel, electrical wiring, or other components. Damage to vehicle can result.

- **Do not weld exterior panels unless combustible material on the interior of vehicle is removed from the repair area. Fire or hazardous conditions, can result.**
- **Always have a fire extinguisher ready for use when welding.**
- **Disconnect the negative (-) cable clamp from the battery when servicing electrical components that are live when the ignition is OFF. Damage to electrical system can result.**
- **Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result.**
- **Do not use harsh alkaline based cleaning solvents on painted or upholstered surfaces. Damage to finish or color can result.**
- **Do not hammer or pound on plastic trim panel when servicing interior trim. Plastic panels can break.**

DIAGNOSIS AND TESTING

WATER LEAKS

Water leaks can be caused by poor sealing, improper body component alignment, body seam porosity, missing plugs, or blocked drain holes. Centrifugal and gravitational force can cause water to drip from a location away from the actual leak point, making leak detection difficult. All body sealing points should be water tight in normal wet-driving conditions. Water flowing downward from the front of the vehicle should not enter the passenger or luggage compartment. Moving sealing surfaces will not always seal water tight under all conditions. At times, side glass or

door seals will allow water to enter the passenger compartment during high pressure washing or hard driving rain (severe) conditions. Overcompensating on door or glass adjustments to stop a water leak that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After completing a repair, water test vehicle to verify leak has stopped before returning vehicle to use.

VISUAL INSPECTION BEFORE WATER LEAK TESTS

Verify that floor and body plugs are in place, body drains are clear, and body components are properly aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

WATER LEAK TESTS

WARNING: Do not use electric shop lights or tools in water test area. Personal injury can result.

When the conditions causing a water leak have been determined, simulate the conditions as closely as possible.

- If a leak occurs with the vehicle parked in a steady light rain, flood the leak area with an open-ended garden hose.
- If a leak occurs while driving at highway speeds in a steady rain, test the leak area with a reasonable velocity stream or fan spray of water. Direct the spray in a direction comparable to actual conditions.
- If a leak occurs when the vehicle is parked on an incline, hoist the end or side of the vehicle to simulate this condition. This method can be used when the leak occurs when the vehicle accelerates, stops or turns. If the leak occurs on acceleration, hoist the front of the vehicle. If the leak occurs when braking, hoist the back of the vehicle. If the leak occurs on left turns, hoist the left side of the vehicle. If the leak occurs on right turns, hoist the right side of the vehicle. For hoisting recommendations (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE).

WATER LEAK DETECTION

To detect a water leak point-of-entry, do a water test and watch for water tracks or droplets forming on the inside of the vehicle. If necessary, remove interior trim covers or panels to gain visual access to the leak area. If the hose cannot be positioned without being held, have someone help do the water test.

Some water leaks must be tested for a considerable length of time to become apparent. When a leak appears, find the highest point of the water track or drop. The highest point usually will show the point of entry. After leak point has been found, repair the leak and water test to verify that the leak has stopped.

Locating the entry point of water that is leaking into a cavity between panels can be difficult. The trapped water may splash or run from the cavity, often at a distance from the entry point. Most water leaks of this type become apparent after accelerating, stopping, turning, or when on an incline.

MIRROR INSPECTION METHOD

When a leak point area is visually obstructed, use a suitable mirror to gain visual access. A mirror can also be used to deflect light to a limited-access area to assist in locating a leak point.

BRIGHT LIGHT LEAK TEST METHOD

Some water leaks in the luggage compartment can be detected without water testing. Position the vehicle in a brightly lit area. From inside the darkened luggage compartment inspect around seals and body seams. If necessary, have a helper direct a drop light over the suspected leak areas around the luggage compartment. If light is visible through a normally sealed location, water could enter through the opening.

PRESSURIZED LEAK TEST METHOD

When a water leak into the passenger compartment cannot be detected by water testing, pressurize the passenger compartment and soap test exterior of the vehicle. To pressurize the passenger compartment, close all doors and windows, start engine, and set heater control to high blower in HEAT position. If engine can not be started, connect a charger to the battery to ensure adequate voltage to the blower. With interior pressurized, apply dish detergent solution to suspected leak area on the exterior of the vehicle. Apply detergent solution with spray device or soft bristle brush. If soap bubbles occur at a body seam, joint, seal or gasket, the leak entry point could be at that location.

WIND NOISE

Wind noise is the result of most air leaks. Air leaks can be caused by poor sealing, improper body component alignment, body seam porosity, or missing plugs in the engine compartment or door hinge pillar areas. All body sealing points should be airtight in normal driving conditions. Moving sealing surfaces will not always seal airtight under all conditions. At times, side glass or door seals will allow wind noise to be noticed in the passenger compartment during high cross winds. Over compensating on door or glass adjustments to stop wind noise that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After a repair procedure has been performed, test vehicle to verify noise has stopped before returning vehicle to use.

VISUAL INSPECTION BEFORE TESTS

Verify that floor and body plugs are in place and body components are aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

ROAD TESTING WIND NOISE

1. Drive the vehicle to verify the general location of the wind noise.
2. Apply 50 mm (2 in.) masking tape in 150 mm (6 in.) lengths along weatherstrips, weld seams or moldings. After each length is applied, drive the vehicle. If noise goes away after a piece of tape is applied, remove tape, locate, and repair defect.

POSSIBLE CAUSE OF WIND NOISE

- Moldings standing away from body surface can catch wind and whistle.
- Gaps in sealed areas behind overhanging body flanges can cause wind-rushing sounds.
- Misaligned movable components.
- Missing or improperly installed plugs in pillars.
- Weld burn through holes.

STANDARD PROCEDURE

BODY LUBRICATION

All mechanisms and linkages should be lubricated when necessary. This will maintain ease of operation and provide protection against rust and excessive wear. The weatherstrip seals should be lubricated to prolong their life as well as to improve door sealing.

All applicable exterior and interior vehicle operating mechanisms should be inspected and cleaned. Pivot/sliding contact areas on the mechanisms should then be lubricated.

1. When necessary, lubricate the operating mechanisms with the specified lubricants.
2. Apply silicone lubricant to a cloth and wipe it on door seals to avoid over-spray that can soil passenger's clothing.
3. Before applying lubricant, the component should be wiped clean. After lubrication, any excess lubricant should be removed.
4. The hood latch, latch release mechanism, latch striker, and safety latch should be lubricated periodically.
5. The door lock cylinders should be lubricated twice each year (preferably autumn and spring).
   - Spray a small amount of lock cylinder lubricant directly into the lock cylinder.
   - Apply a small amount to the key and insert it into the lock cylinder.
   - Rotate it to the locked position and then back to the unlocked position several times.
   - Remove the key. Wipe the lubricant from it with a clean cloth to avoid soiling of clothing.

HEAT STAKING

1. Remove trim panel.
2. Bend or move the trim panel components at the heat staked joints. Observe the heat staked locations and/or component seams for looseness.
3. Heat stake the components.

a. If the heat staked or component seam location is loose, hold the two components tightly together and using a soldering gun with a flat tip, melt the material securing the components together. Do not over heat the affected area, damage to the exterior of the trim panel may occur.

b. If the heat staked material is broken or missing, use a hot glue gun to apply new material to the area to be repaired. The panels that are being heat staked must be held together while the applying the glue. Once the new material is in place, it may be necessary to use a soldering gun to melt the newly applied material. Do not over heat the affected area, damage to the exterior of the trim panel may occur.

4. Allow the repaired area to cool and verify the repair.
5. Install trim panel.

PLASTIC BODY PANEL REPAIR

There are many different types of plastics used in today's automotive environment. We group plastics in three different categories: Rigid, Semi-Rigid, and Flexible. Any of these plastics may require the use of an adhesion promoter for repair. These types of plastic are used extensively on DaimlerChrysler Motors vehicles. Always follow repair material manufacturer's plastic identification and repair procedures.

Rigid Plastics:

Examples of rigid plastic use: Fascias, Hoods, Doors, and other Body Panels, which include SMC, ABS, and Polycarbonates.

Semi-Rigid Plastics:

Examples of semi-rigid plastic use: Interior Panels, Under Hood Panels, and other Body Trim Panels.

Flexible Plastics:

Examples of flexible plastic use: Fascias, Body Moldings, and upper and lower Fascia Covers.

Repair Procedure:

The repair procedure for all three categories of plastics is basically the same. The one difference is the material used for the repair. The materials must be specific for each substrate, rigid repair material for rigid plastic repair, semi-rigid repair material for semi-rigid plastic repair and flexible repair material for flexible plastic repair.

Adhesion Promoter/Surface Modifier:

Adhesion Promoters/Surface Modifiers are required for certain plastics. All three categories may have plastics that require the use of adhesion promoter/surface modifiers. Always follow repair material manufacturer's plastic identification and repair procedures.

SAFETY PRECAUTION AND WARNINGS

WARNING:

- **Eye protection should be used when servicing components. Personal injury can result.**
- **Use an OSHA approved breathing mask when mixing epoxy, grinding, and spraying paint or solvents in a confined area. Personal injury can result.**
- **Avoid prolonged skin contact with resin, petroleum, or alcohol based solvents. Personal injury can result.**
- **Do not venture under a hoisted vehicle that is not properly supported on safety stands. Personal injury can result.**

NOTE:

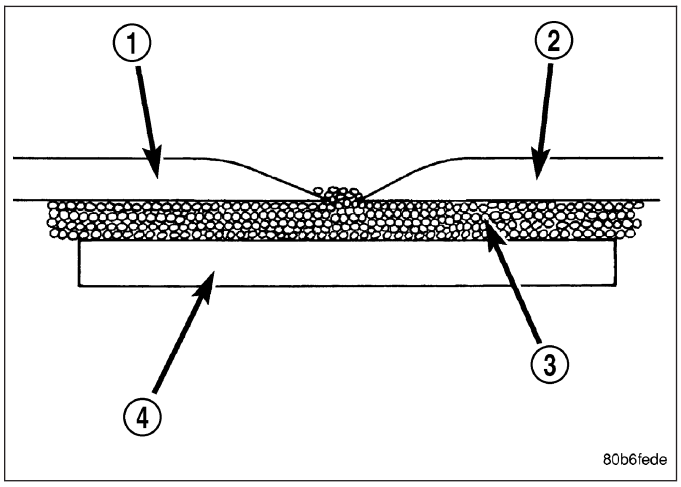
- **When holes must be drilled or cut in body panels, verify locations of internal body components and electrical wiring. Damage to vehicle can result.**
- **Do not use abrasive chemicals or compounds on undamaged painted surfaces around repair areas. Damage to finish can result.**

RIGID, SEMI-RIGID, AND FLEXIBLE PLASTIC PARTS TYPES

CODE	FAMILY NAME	COMMON TRADE NAME	TYPICAL APPLICATION
ASA	ACRYLONITRILE STYRENE ACRYLITE	LURAN S	CONSOLES, GRILLES
ABS	ACRYLONITRILE BUTADIENE STYRENE	TERLURAN	″A″ PILLARS, CONSOLES, GRILLES
ABS/PC	ABS/PC ALLOY	PULSE, PROLOY, BAYBLEND	DOORS, INSTRUMENT PANELS
ABS/PVC	ABS/PV ALLOY	PROLOY, PULSE, LUSTRAN, CYCLOVIN	DOOR PANELS, GRILLES, TRIM
BMC	BULK MOLDING COMPOUND	BMC	FENDER EXTENSIONS
EMA	EHTYLENE METHYL ACRYLATE/IONOMER	SURLYN, EMA, IONOMER	BUMPER GUARDS, PADS
METTON	METTON	METTON	GRILLES, KICK PANELS, RUNNING BOARDS
MPPO	MODIFIED POLYPHENYLENE OXIDE	MPPO	SPOILER ASSEMBLY
PA	POLYAMID	ZYTEL, VYDYNE, PA, MINLON	FENDERS, QUARTER PANELS
PET	THERMOPLASTIC POLYESTER	RYNITE	TRIM
PBT/PPO	PBT/PPO ALLOY	GERMAX	CLADDINGS
PBTP	POLYBUTYLENE THEREPTHALATE	PBT, PBTP, POCAN, VALOX	WHEEL COVERS, FENDERS, GRILLES
PBTP/EEBC	POLYBUTYLENE THEREPTHALATE/EEBC ALLOY	BEXLOY, ″M″, PBTP/EEBC	FASCIAS, ROCKER PANEL, MOLDINGS
PC	POLYCARBONATE	LEXAN, MERLON, CALIBRE, MAKROLON PC	TAIL LIGHT LENSES, IP TRIM, VALANCE PANELS
PC/ABS	PC/ABS ALLOY	GERMAX, BAY BLENDS, PULSE	DOORS, INSTRUMENT PANELS
PPO	POLYPHENYLENE OXIDE	AZDEL, HOSTALEN, MARLEX, PRFAX, NORYL, GTX, PPO	INTERIOR TRIM, DOOR PANELS, SPLASH SHIELDS, STEERING COLUMN SHROUD
PPO/PA	POLYPHENYLENE/ POLYAMID	PPO/PA, GTX 910	FENDERS, QUARTER PANELS
PR/FV	FIBERGLASS REINFORCED PLASTIC	FIBERGLASS, FV, PR/FV	BODY PANELS
PS	POLYSTYRENE	LUSTREX, STYRON, PS	DOOR PANELS, DASH PANELS
RTM	RESIN TRANSFER MOLDING COMPOUND	RTM	BODY PANELS
SMC	SHEET MOLDED COMPOUND	SMC	BODY PANELS
TMC	TRANSFER MOLDING COMPOUND	TMC	GRILLES

CODE	FAMILY NAME	COMMON TRADE NAME	TYPICAL APPLICATION
UP	UNSATURATED POLYESTER (THERMOSETTING)	SMC, BMC, TMC, ZMC, IMC, XSMC, UP	GRILLE OPENING PANEL, LIFTGATES, FLARESIDE FENDERS, FENDER EXTENSIONS
EEBC	ETHER/ESTER BLOCKED CO-POLYMER	EEBC	BUMPERS
EEBC/PBTP	EEBC/POLYBUTYLENE TEREPTHALATE	EEBC, PBTP, BEXLOY	BUMPER, ROCKER PANELS
EMPP	ETHYLENE MODIFIED POLYPROPYLENE	EMPP	BUMPER COVERS
EPDM	ETHYLENE/ PROPROPYLENE DIENE MONOMER	EPDM, NORDEL, VISTALON	BUMPERS
EPM	ETHYLENE/ PROPROPYLENE CO-POLYMER	EPM	FENDERS
MPU	FOAM POLYURETHANE	MPU	SPOILERS
PE	POLYETHYLENE	ALATHON, DYLAN, LUPOLEN, MARLEX	-
PP	POLYPROPYLENE (BLENDS)	NORYL, AZDEL, MARLOX, DYLON, PRAVEX	INNER FENDER, SPOILERS, KICK PANELS
PP/EPDM	PP/EPDM ALLOY	PP/EPDM	SPOILERS, GRILLES
PUR	POLYURETHANE	COLONELS, PUR, PU	FASCIAS, BUMPERS
PUR/PC	PUR/PC ALLOY	TEXIN	BUMPERS
PVC	POLYVINYL CHLORIDE	APEX, GEON, VINYLITE	BODY MOLDINGS, WIRE INSULATION, STEERING WHEELS
RIM	REACTION INJECTED MOLDED POLYURETHANE	RIM, BAYFLEX	FRONT FASCIAS, MODULAR WINDOWS
RRIM	REINFORCED REACTION INJECTED MOLDED	PUR, RRIM	FASCIAS, BODY PANELS, BODY TRIMS
TPE	THERMO POLYETHYLENE	TPE, HYTREL, BEXLOY-V	FASCIAS, BUMPERS, CLADDINGS
TPO	THERMOPOLYOLEFIN	POLYTROPE, RENFLEX, SANTOPRENE, VISAFLEX, ETA, APEX, TPO, SHIELDS, CLADDINGS	BUMPERS, END CAPS, TELCAR, RUBBER, STRIPS, SIGHT, INTERIOR B POST
TPP	THERMO-POLYPROPYLENE	TPP	BUMPERS
TPU	THERMOPOLYURETHANE, POLYESTER	TPU, HYTREL, TEXIN, ESTANE	BUMPERS, BODY SIDE, MOLDINGS, FENDERS, FASCIAS

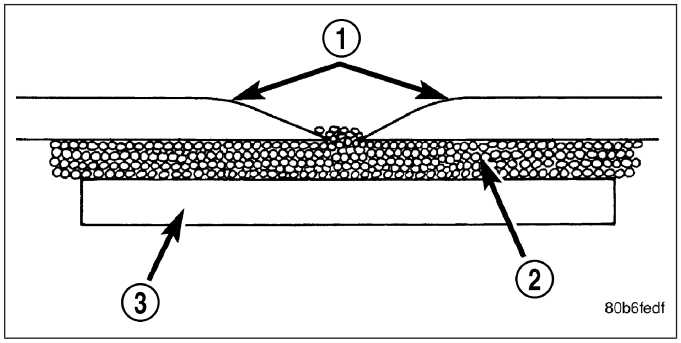
PANEL SECTIONING



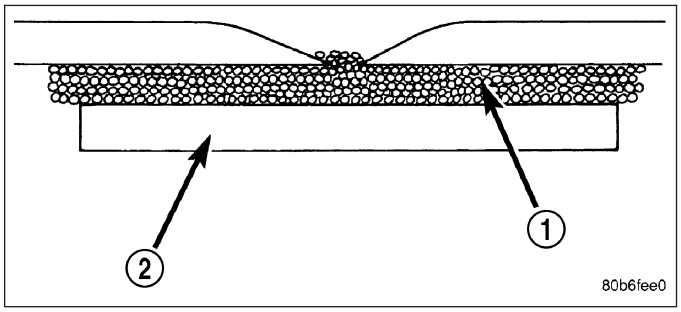
If it is required to section a large panel for a plastic repair, it will be necessary to reinforce the panel. To bond two plastic panels together, a reinforcement must overlap both panels. The panels must be “V’d” at a 20 degree angle. The area to be reinforced should be washed, then sanded. Be sure to wipe off any excess soap and water when finished. Lightly sand or abrade the plastic with an abrasive pad or sandpaper. Blow off any dust with compressed air or wipe with a clean dry rag.

When bonding plastic panels, Follow repair material manufacturers recommendations. Be sure that enough adhesive has been applied to allow squeeze out and to fill the full bond line. Once the pieces have been brought together, do not move them until the adhesive is cured. The assembly can be held together with clamps, rivets, etc. A faster cure can be obtained by heating with a heat lamp or heat gun. After the parts have been bonded and have had time to cure, rough sand the seam and apply the final adhesive filler to the area being repaired. Smooth the filler with a spreader, wooden tongue depressor, or squeegee. For fine texturing, a small amount of water can be applied to the filler surface while smoothing. The cured filler can be sanded as necessary and, as a final step, cleanup can be done with soapy water. Wipe the surface clean with a dry cloth allowing time for the panel to dry before moving on with the repair.

PANEL REINFORCEMENT

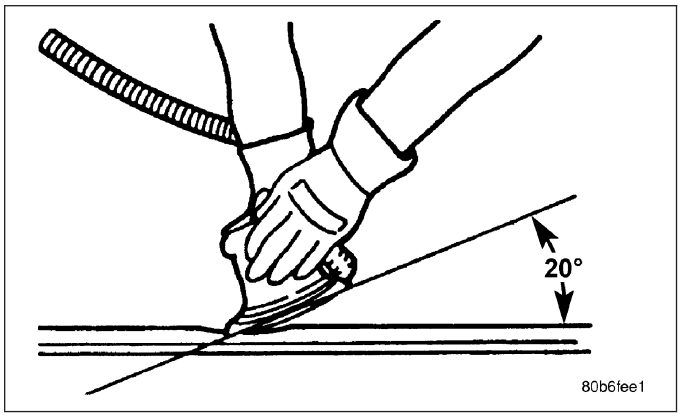


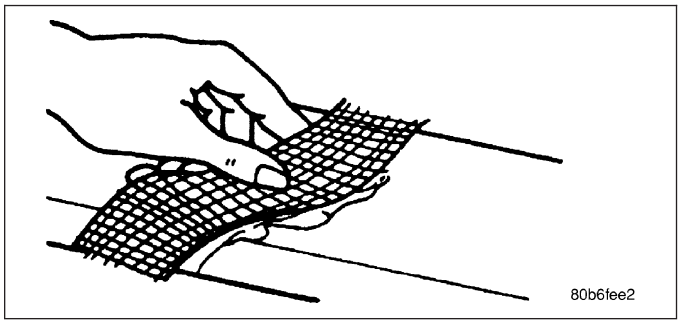
Structural repair procedures for rigid panels with large cracks and holes will require a reinforcement backing. Reinforcements can be made with several applications of glass cloth saturated with structural adhesive. Semi-rigid or flexible repair materials should be used for semi-rigid or flexible backing reinforcement and. Open meshed fiberglass dry wall tape can be used to form a reinforcement. The dry wall tape allows the resin to penetrate through and make a good bond between the panel and the adhesive. Structurally, the more dry wall tape used, the stronger the repair.



Another kind of repair that can be done to repair large cracks and holes is to use a scrap piece of similar plastic and bond with structural adhesive. The reinforcement should cover the entire break and should have a generous amount of overlap on either side of the cracked or broken area.

When repairing plastic, the damaged area is first “V’d” out, or beveled. Large bonding areas are desirable when repairing plastic because small repairs are less likely to hold permanently. Beveling the area around a crack at a 20 degree angle will increase the bonding surface for a repair. It is recommended that sharp edges be avoided because the joint may show through after the panel is refinished.



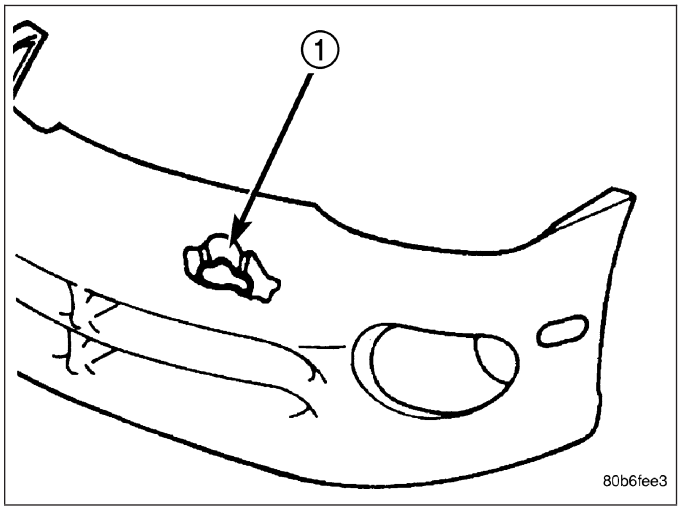


- Panel repair for both flexible and rigid panels are basically the same. The primary difference between flexible panel repair and rigid panel repair is in the adhesive materials used.
- The technician should first decide what needs to be done when working on any type of body panel. One should determine if it is possible to return the damage part to its original strength and appearance without exceeding the value of the replacement part.
- When plastic repairs are required, it is recommended that the part be left on the vehicle when every possible. That will save time, and the panel will remain stationary during the repair. Misalignment can cause stress in the repair areas and can result in future failure.

VISUAL INSPECTION

Composite materials can mask the severity of an accident. Adhesive bond lines, interior structure of the doors, and steel structures need to be inspected carefully to get a true damage assessment. Close inspection may require partial removal of interior trim or inner panels.

Identify the type of repair: Puncture or Crack - Damage that has penetrated completely through the panel. Damage is confined to one general area; a panel section is not required. However, a backer panel, open fiberglass tape, or matted material must be bonded from behind.

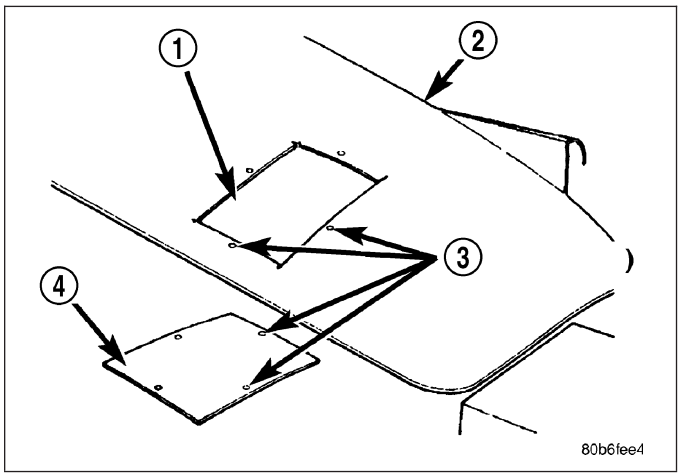


PANEL SURFACE PREPARATION

If a body panel has been punctured, cracked, or crushed, the damaged area must be removed from the panel to achieve a successful repair. All spider web cracks leading away from a damaged area must be stopped or removed. To stop a running crack in a panel, drill a 6 mm (0.250 in.) hole at the end of the crack farthest away from the damage. If spider web cracks can not be stopped, the panel would require replacement. The surfaces around the damaged area should be stripped of paint and freed from wax and oil. Scuff surfaces around repair area with 360 grit wet/dry sandpaper, or equivalent, to assure adhesion of repair materials.

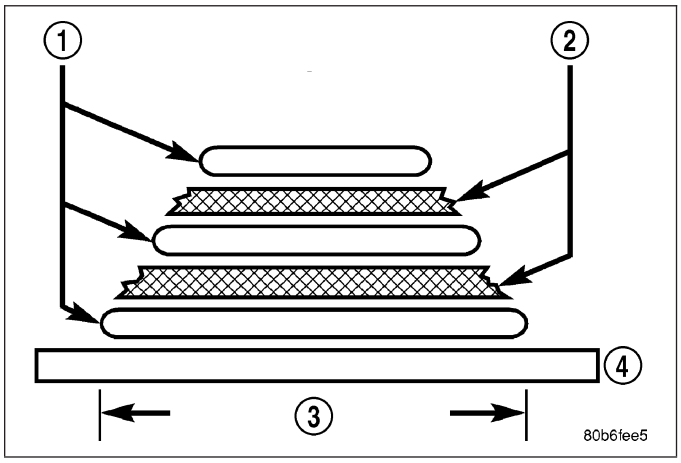
PATCHING PANELS

An panel that has extensive puncture type damage can be repaired by cutting out the damaged material. Use a suitable reciprocating saw or cut off wheel to remove the section of the panel that is damaged. The piece cut out can be used as a template to shape the new patch. It is not necessary to have access to the back of the panel to install a patch. Bevel edges of cutout at 20 degrees to expose a larger bonding area on the outer side. This will allow for an increased reinforcement areas.



PANEL PATCH FABRICATIONS

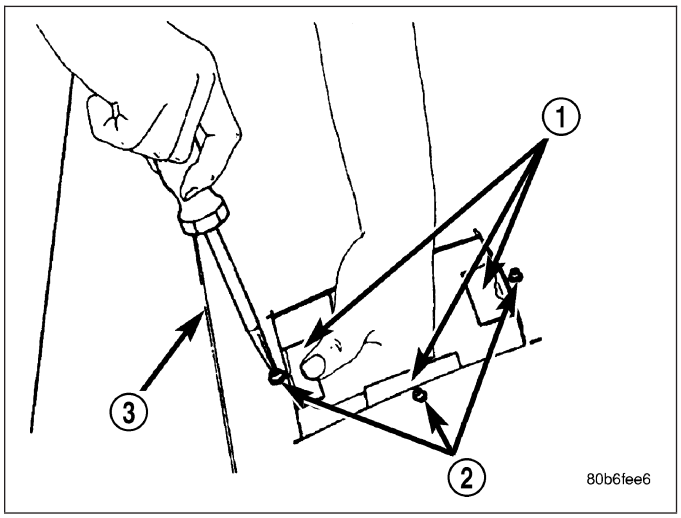
A patch can be fabricated from any rigid fiberglass panel that has comparable contour with the repair area. Lift gates and fenders can be used to supply patch material. If existing material is not available or compatible, a patch can be constructed with adhesive and reinforcement mesh (dry wall tape). Perform the following operation if required:



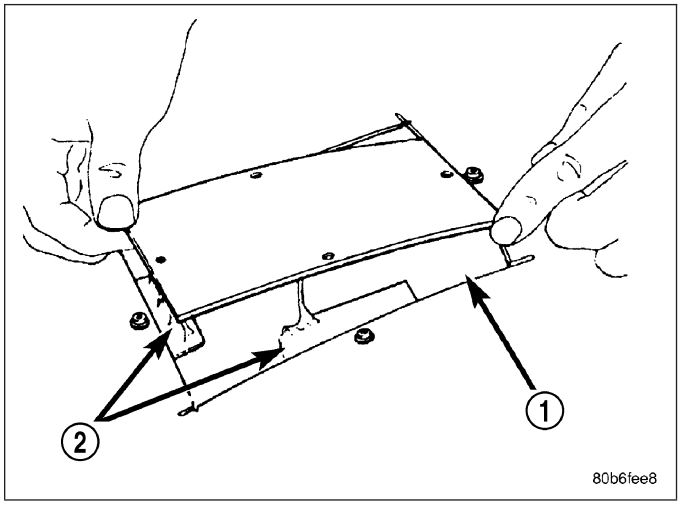
1. Cover waxed paper or plastic with adhesive backed nylon mesh (dry wall tape) larger than the patch required.
2. Tape waxed paper or plastic sheet with mesh to a surface that has a compatible contour to the repair area.
3. Apply a liberal coat of adhesive over the reinforcement mesh. If necessary apply a second or third coat of adhesive and mesh after first coat has cured. The thickness of the patch should be the same as the repair area.
4. After patch has cured, peel waxed paper or plastic from the back of the patch.
5. If desired, a thin film coat of adhesive can be applied to the back of the patch to cover mesh for added strength.

PANEL PATCH INSTALLATION

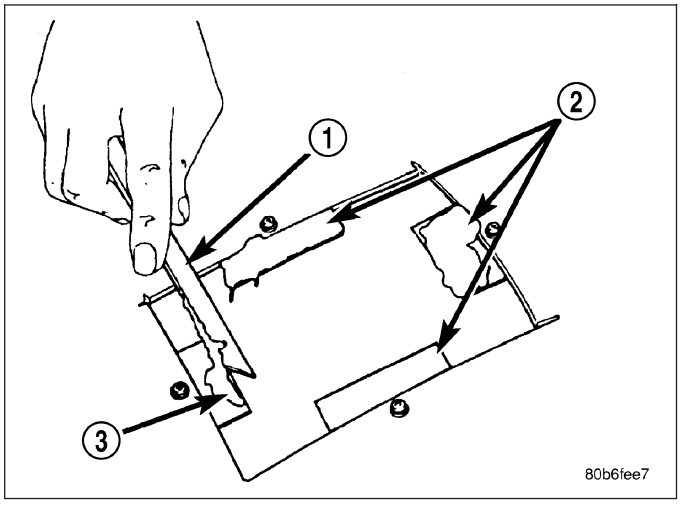
1. Make a paper or cardboard pattern the size and shape of the cutout hole in the panel.
2. Trim 3 mm (0.125 in.) from edges of pattern so patch will have a gap between connecting surfaces.
3. Using the pattern as a guide, cut the patch to size.
4. Cut scrap pieces of patch material into 50 mm (2 in.) squares to use as patch supports to sustain the patch in the cutout.
5. Drill 4 mm (0.160 in.) holes 13 mm (0.5 in.) in from edge of cutout hole.
6. Drill 4 mm (0.160 in.) holes 13 mm (0.5 in.) away from edge of patch across from holes drilled around cutout.
7. Drill 3 mm (0.125 in.) holes in the support squares 13 mm (0.5 in.) from the edge in the center of one side.



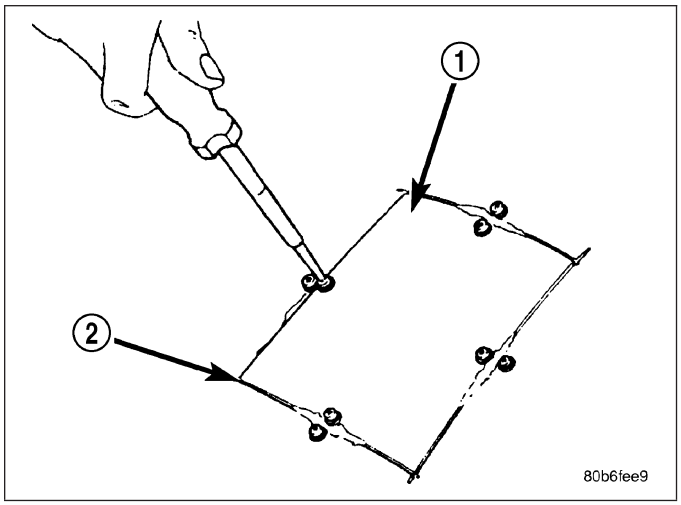
8. Scuff the backside of the body panel around the cutout hole with a scuff pad or sandpaper.
9. Mix enough adhesive to cover one side of all support squares.
10. Apply adhesive to cover one side of all support squares.
11. Using number 8 sheet metal screws, secure support squares to back side of body panel with adhesive sandwiched between the panel and squares.
12. Position patch in cutout against support squares and adjust patch until the gap is equal along all sides.
13. Drill 3 mm (0.125 in.) holes in the support squares through the pre-drilled holes in the patch.



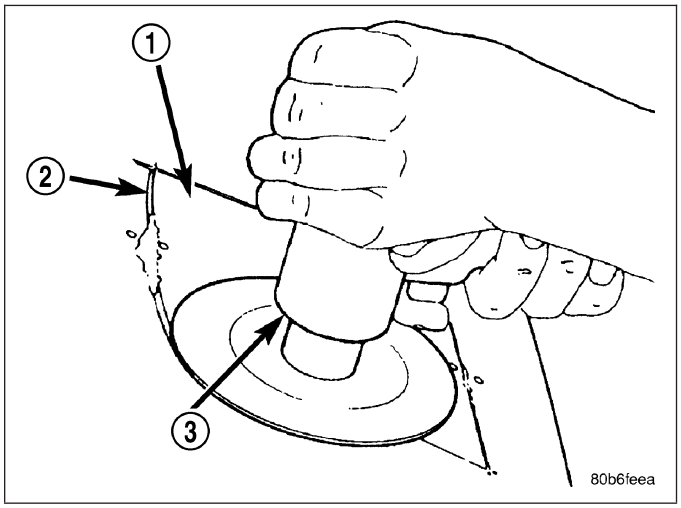
14. Apply a coat of adhesive to the exposed ends of the support squares.



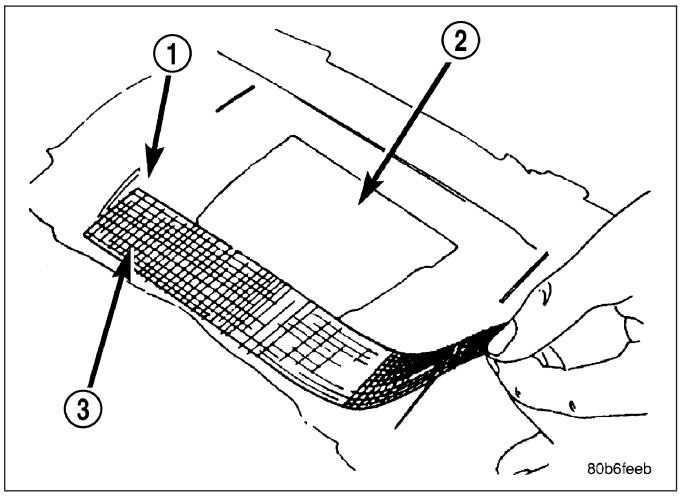
15. Install screws to hold the patch to support squares. Tighten screws until patch surface is flush with panel surface.
16. Allow adhesive to cure, and remove all screws.



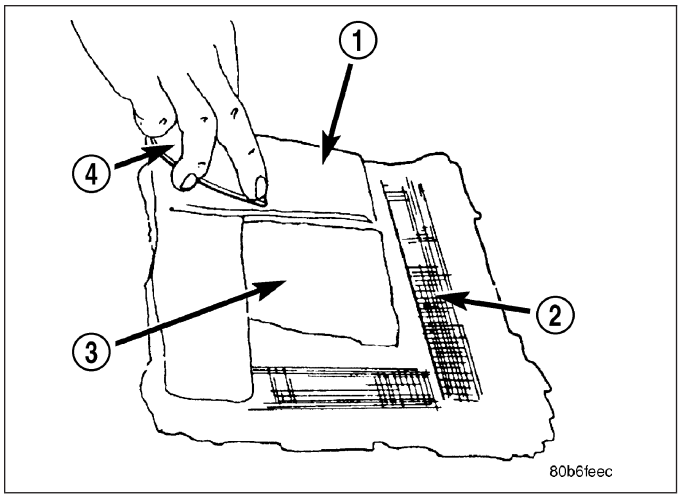
17. Using a 125 mm (5 in.) 24 grit disc grinder, grind a 50 mm (2 in.) to 75 mm (3 in.) wide and 2 mm (0.080 in.) deep path across the gaps around the patch. With compressed air, blow dust from around patch.



18. Apply adhesive backed nylon mesh (dry wall tape) over gaps around patch.
19. Mix enough adhesive to cover the entire patch area.



20. Apply adhesive over the mesh around patch, and smooth epoxy with a wide spreader to reduce finish grinding. Use two to three layers of mesh and adhesive to create a stronger repair.



PATCHED PANEL SURFACING

After patch panel is installed, the patch area can be finished using the same methods as finishing other types of body panels. If mesh material is exposed in the patched area, grind surface down, and apply a coat of high quality rigid plastic body filler. Prime, block sand, and paint as required.

BUZZ, SQUEAK & RATTLE

Buzz, Squeak & Rattles (BSR) may be caused by any one or more of the following and may be corrected as indicated:

- Loose fasteners should be tightened to specifications.
- Damaged or missing clips should be replaced.
- Damaged trim panels should be replaced.
- Incorrectly installed trim panels should be reinstalled properly.

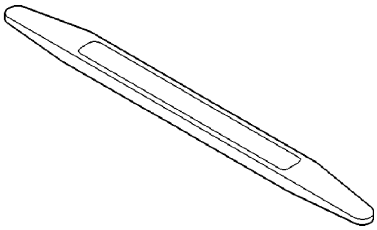
Many BSR complaints such as loose trim, can be serviced using the Mopar® Parts BSR Noise Reduction Kit. This kit contains various tapes including foam, flock and anti-squeak used to eliminate noises caused by metal, plastic and vinyl components. Long life lubricants and greases can also be used on a variety of components. Refer to the Buzz, Squeak & Rattle Kit table for material contents and usage.

Buzz, Squeak & Rattle Kit

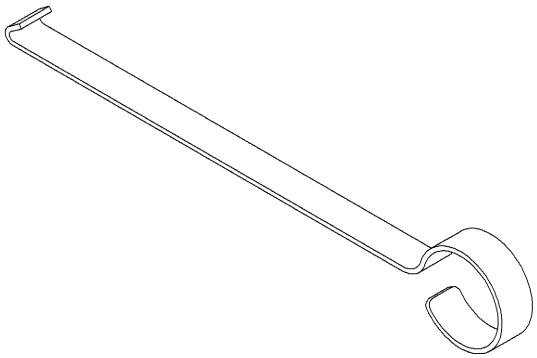
ITEM	FEATURES	APPLICATIONS	SERVICE TEMP
Itch And Squeak Tape	An abrasion resistant material thin enough to conform to most irregular surfaces. Stops most itches and squeaks.	Between metal and metal, metal and plastic, metal and vinyl, vinyl and plastic. Interior. Examples: Trim panels and bezels.	-40° to 225° Fahrenheit (-40° to 107° Celsius)
Black Nylon Flock	Nylon Flock with an aggressive acrylic adhesive. Provides for cushioning and compression fit, also isolates components. Water-resistant.	Between metal and metal, metal and plastic, vinyl and plastic. Examples: Pull cups, bezels, clips, ducts, top cover to glass, cowl panel.	-40° to 180° Fahrenheit (-40° to 82° Celsius)
High Density Urethane Foam	Tear resistant, highly resilient and durable.	Between metal and metal, metal and plastic. Water-resistant. Examples: I/P, heavy metal rattles, isolating brackets.	-40° to 180° Fahrenheit (-40° to 82° Celsius)
Open Cell Foam Tape	Soft foam conforms to irregular surfaces.	Wire harness and connector wrap. Examples: Seals, gasket, wiring, heat ducts.	-40° to 180° Fahrenheit (-40° to 82° Celsius)
Closed Cell Low Density Foam Tape	Soft, conformable. Water-resistant.	Wherever bulk is needed. Prevents closing flutters and rattles when applied to door watershield. Examples: Door, I/P.	-40° to 180° Fahrenheit (-40° to 82° Celsius)
NYE® Grease 880	Long life.	Suspensions. Examples: Strut busings, sway bars.	-40° to 390° Fahrenheit (-40° to 200° Celsius)
Krytox® Oil	Long life. Will not dry out or harm plastics or rubber.	When access is not possible, oil will migrate to condition. Vinyl, rubber, plastic, metal. Examples: Convertible top bushings, pull cups trim panel inserts.	-30° to 400° Fahrenheit (-34° to 205° Celsius)
Krytox® Grease	Long life. Will not dry out or harm plastics or rubber.	Vinyl, rubber, plastic, metal, glass. Examples: Weather-strips, backlite and windshield moldings.	-30° to 400° Fahrenheit (-34° to 205° Celsius)

SPECIAL TOOLS

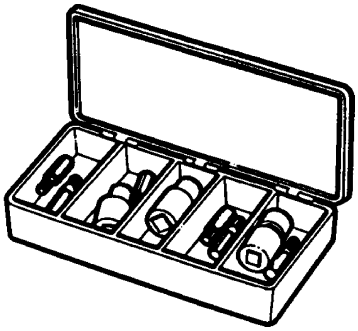
BODY



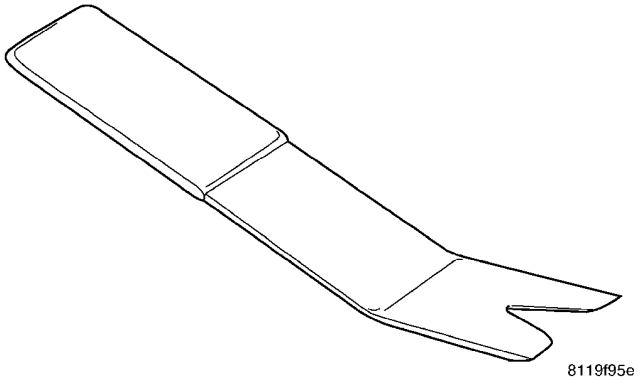
Trim Stick C-4755



Outer Belt Molding Remover - 9093



TORX BIT SET C-4794-B



REMOVER, MOLDINGS C-4829-A

DOOR - CARGO

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CABLE-LATCH

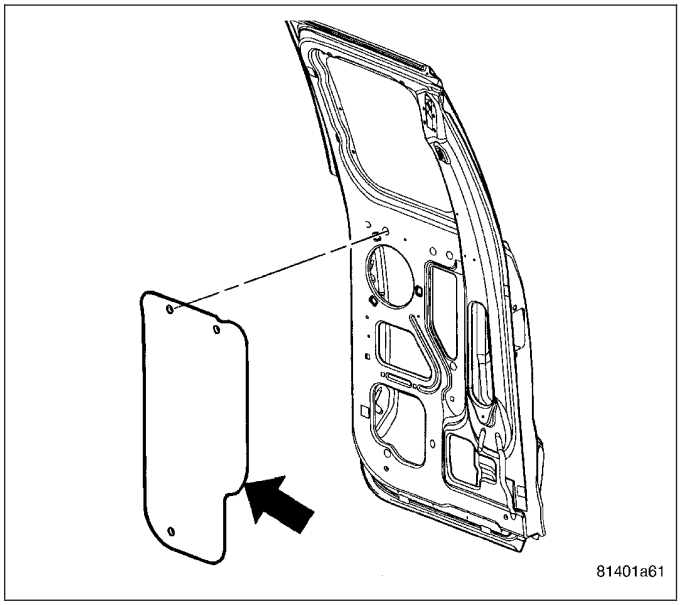
REMOVAL

CAUTION: Do not allow the watershield or adhesive to become contaminated with dirt or other foreign substances.

Do not damage the watershield during removal and installation.

If the watershield becomes contaminated or damaged, replace the watershield.

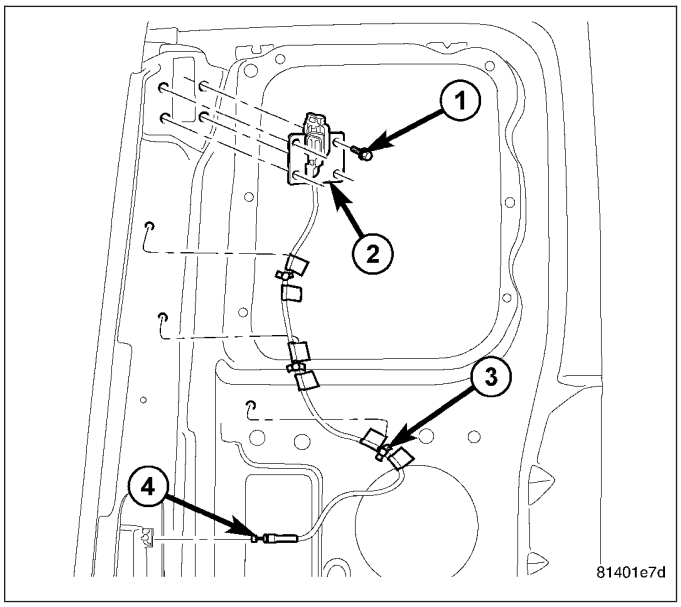
1. Remove the watershield. (Refer to 23 - BODY/ DOOR - CARGO/WATERSHIELD - REMOVAL)



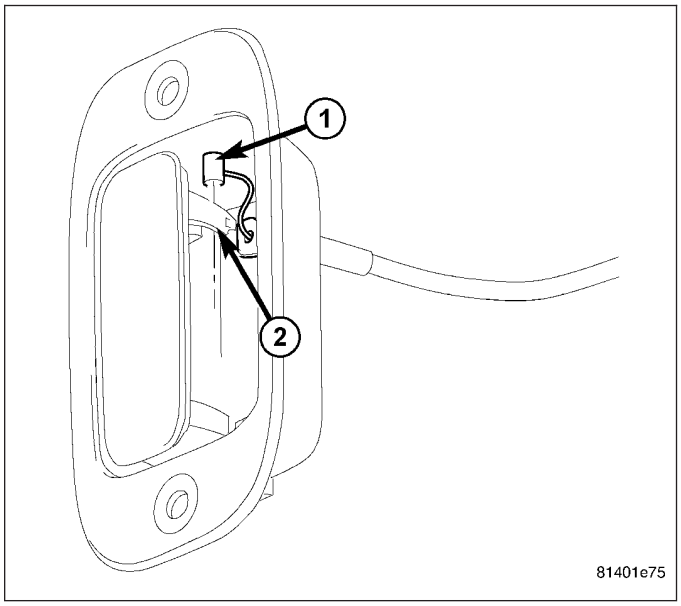
Upper Latch Cable

NOTE: The upper latch cable is serviced as an assembly with the upper latch.

1. Remove the upper latch bolts (1).
2. Separate the cable support clips (2).



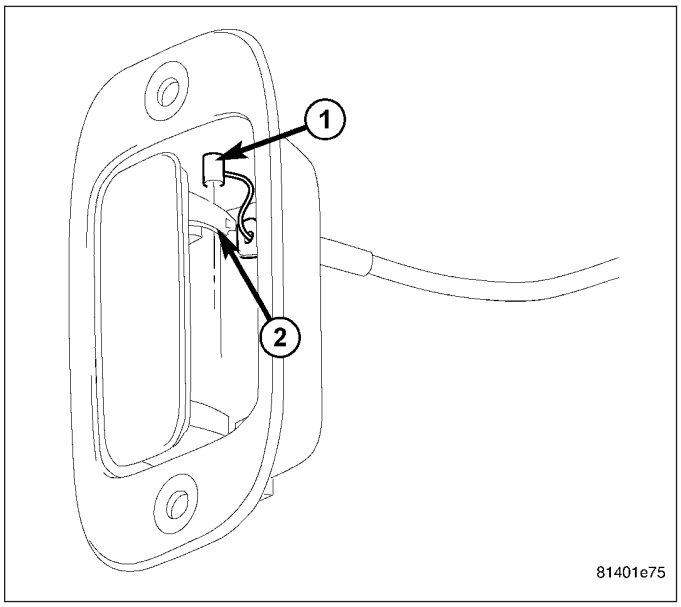
3. Disconnect the cable end (1) from the shut face handle (2) and remove the latch/cable assembly.



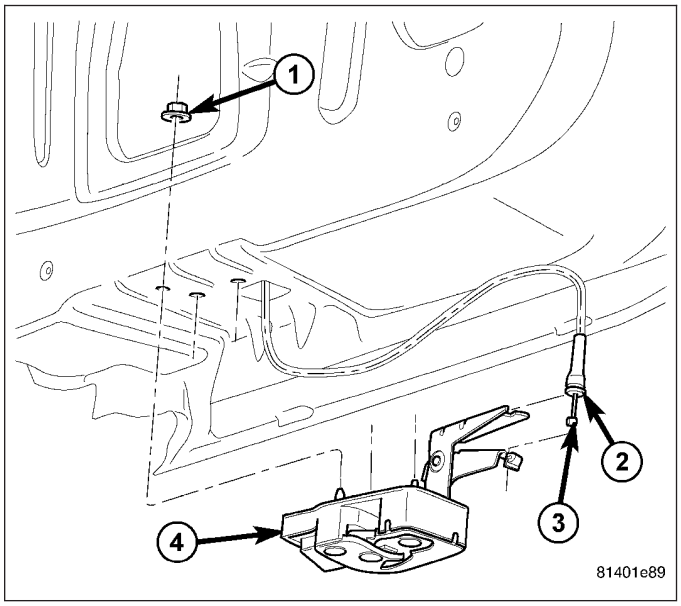
Lower Latch Cable

NOTE: Upper cable end shown, lower cable end similar.

1. Disconnect the lower cable end (1) from the shut face handle (2).



2. Disconnect the lower cable end (3) and the cable (2) from the lower latch and remove the cable.

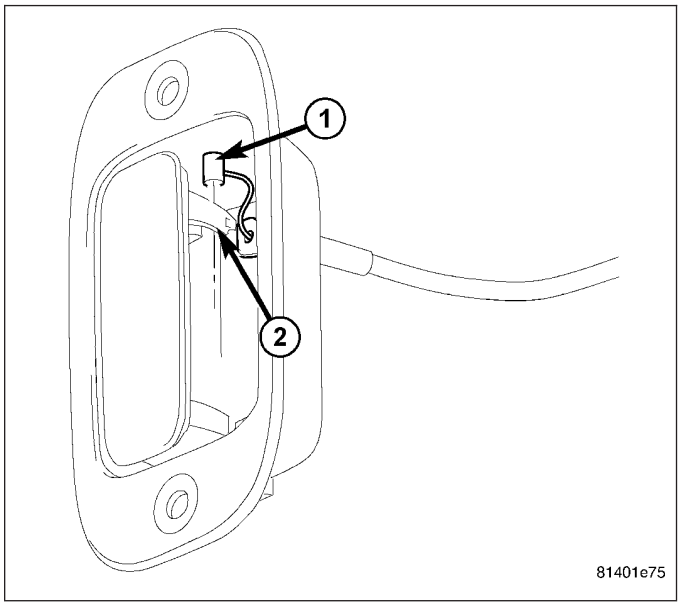


INSTALLATION

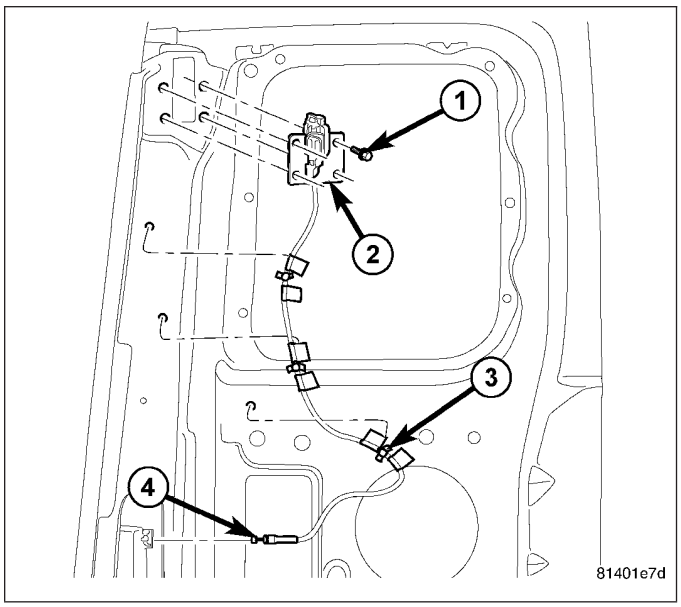
Upper Latch Cable

NOTE: The upper latch cable is serviced as an assembly with the upper latch.

1. Connect the cable housing to the shut face handle and connect the cable end (1).

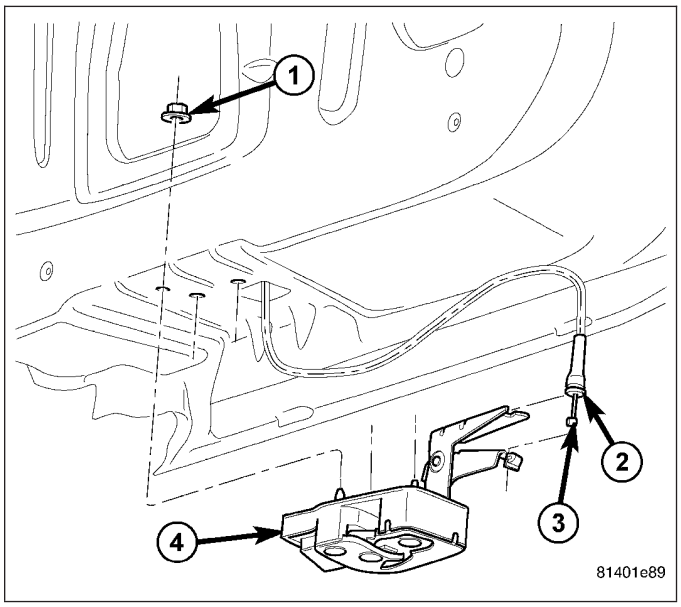


2. Install the cable support clips (3).
3. Install the latch assembly (2) and install the bolts (1).
4. Tighten the bolts to 12 N·m (105 in. lbs.).



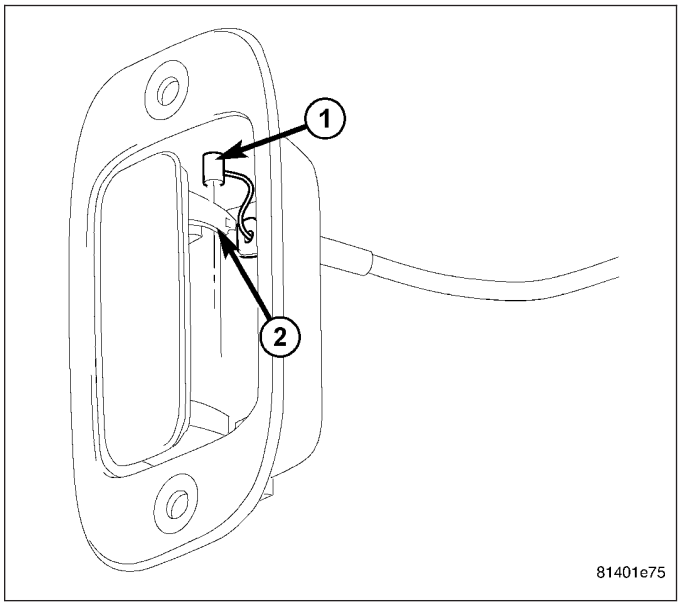
Lower Latch Cable

1. Install the lower cable and attach the cable housing (2) to the latch assembly.
2. Connect the cable end (3) to the latch arm.



NOTE: Upper cable end shown, lower cable end similar.

3. Connect the cable housing to the shut face handle and connect the cable end (1).

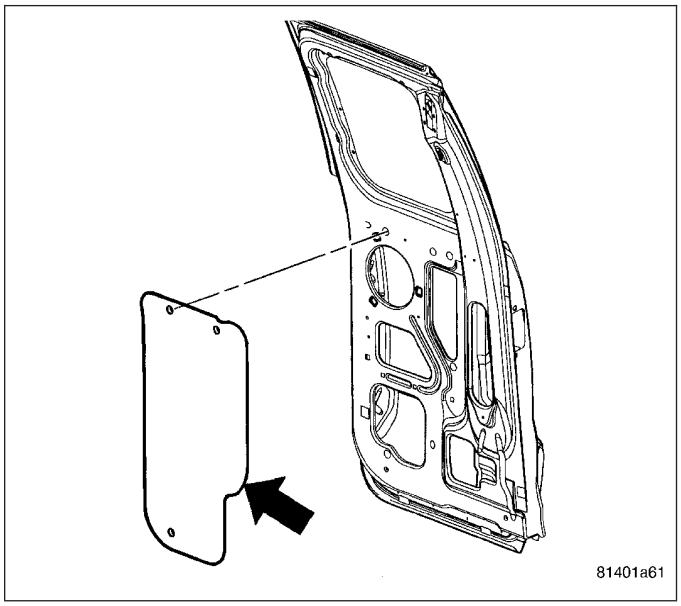


CAUTION: Do not allow the watershield or adhesive to become contaminated with dirt or other foreign substances.

Do not damage the watershield during removal and installation.

If the watershield becomes contaminated or damaged, replace the watershield.

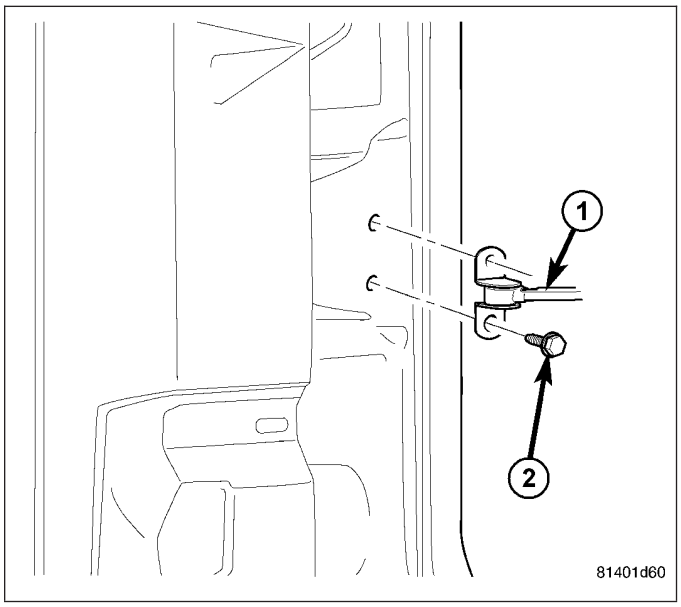
1. Install the watershield. (Refer to 23 - BODY/DOOR - CARGO/WATERSHIELD - INSTALLATION)



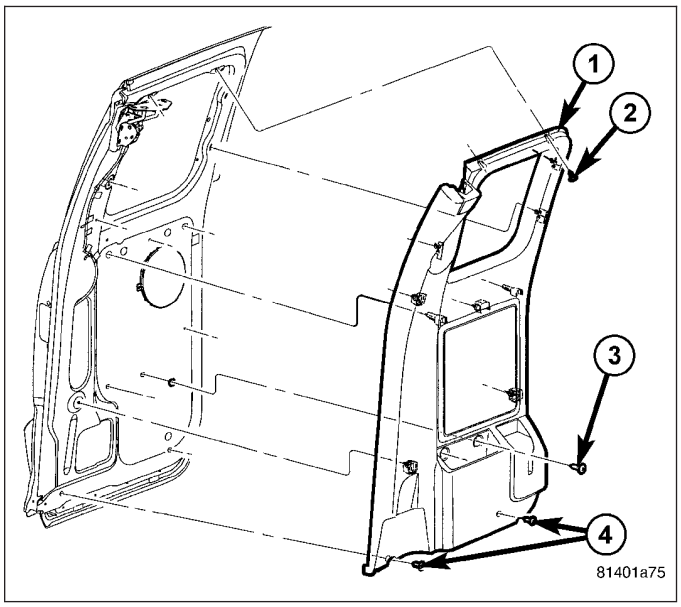
CHECK

REMOVAL

1. Open the door and remove the body bolts (2) connecting the check (1) to the pillar.



2. Remove the door trim panel. (Refer to 23 - BODY/ DOOR - CARGO/PANEL-TRIM - REMOVAL)

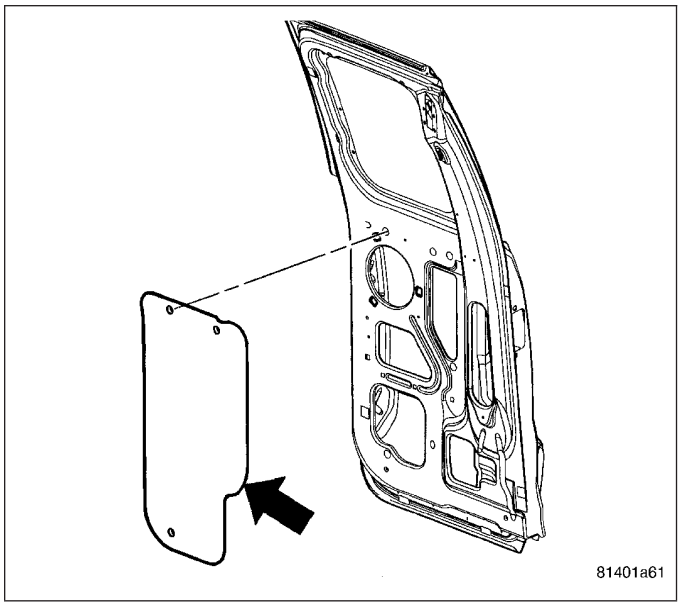


CAUTION: Do not allow the watershield or adhesive to become contaminated with dirt or other foreign substances.

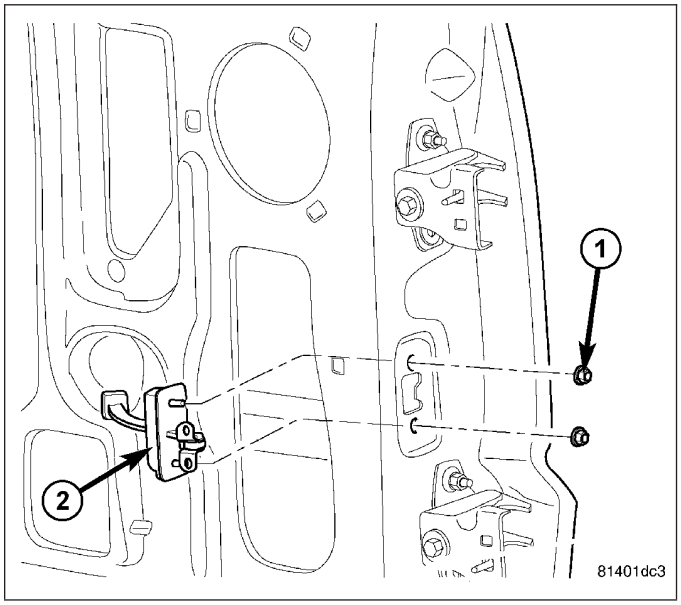
Do not damage the watershield during removal and installation.

If the watershield becomes contaminated or damaged, replace the watershield.

3. Partially separate the watershield to gain access to the inner door.

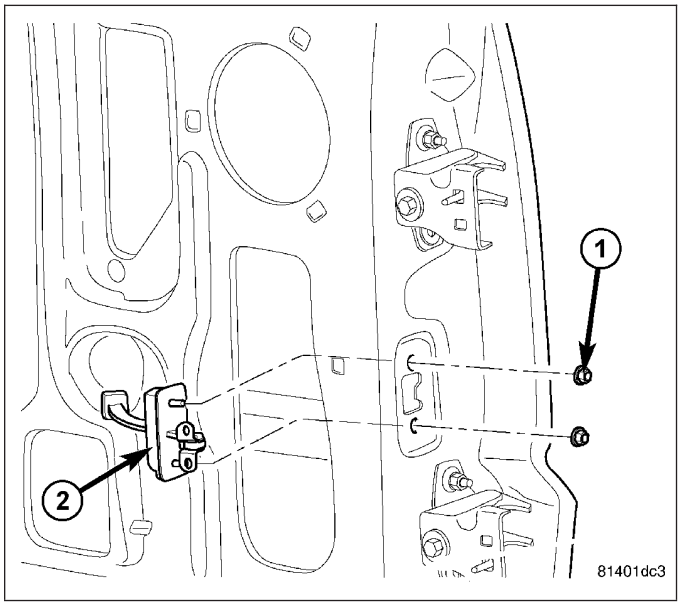


4. Remove the nuts (1) and remove the door check (2).

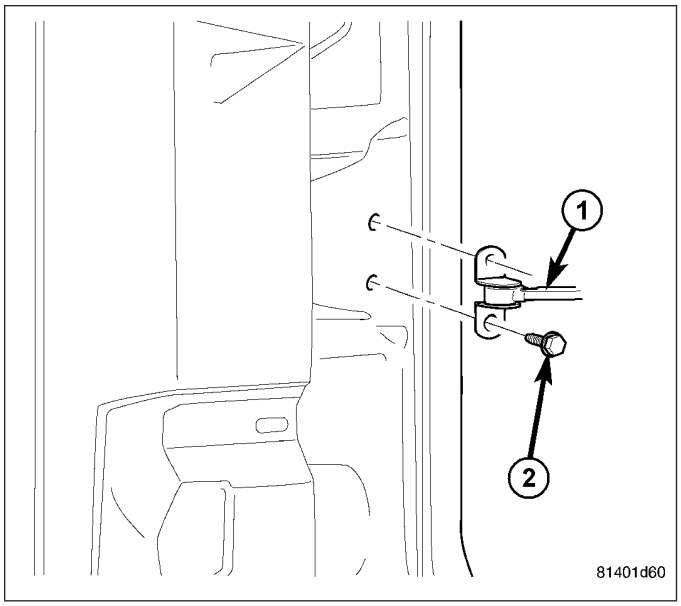


INSTALLATION

1. Position the check (2) into the door and install the nuts (1).
2. Tighten the nuts to 23 N·m (200 in. lbs.).



3. Attach the check (1) to the pillar and install the bolts (2).
4. Tighten the bolts to 23 N·m (200 in. lbs.).

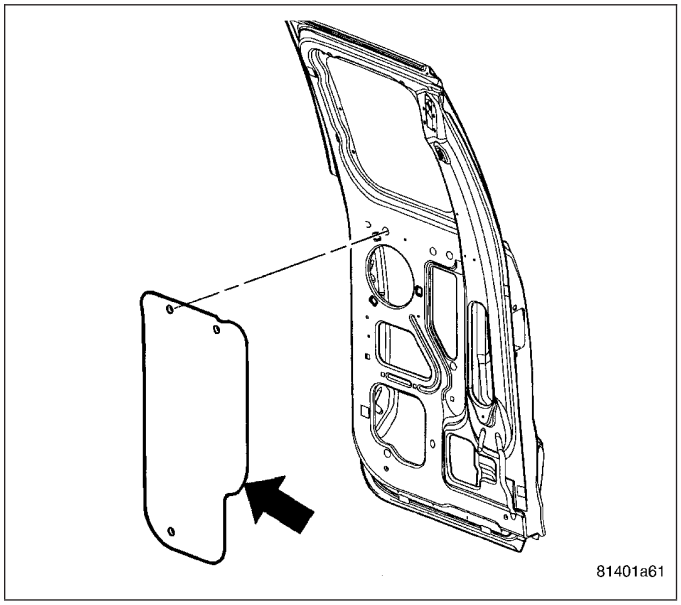


CAUTION: Do not allow the watershield or adhesive to become contaminated with dirt or other foreign substances.

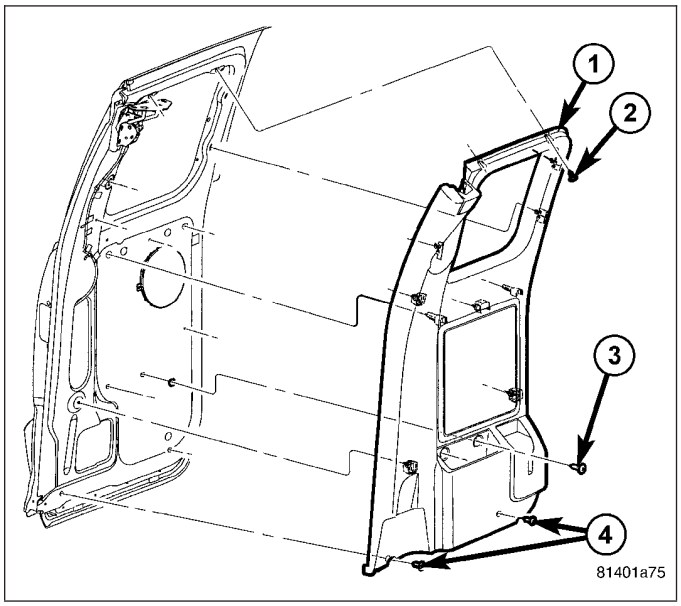
Do not damage the watershield during removal and installation.

If the watershield becomes contaminated or damaged, replace the watershield.

5. Secure the watershield to the inner door panel.



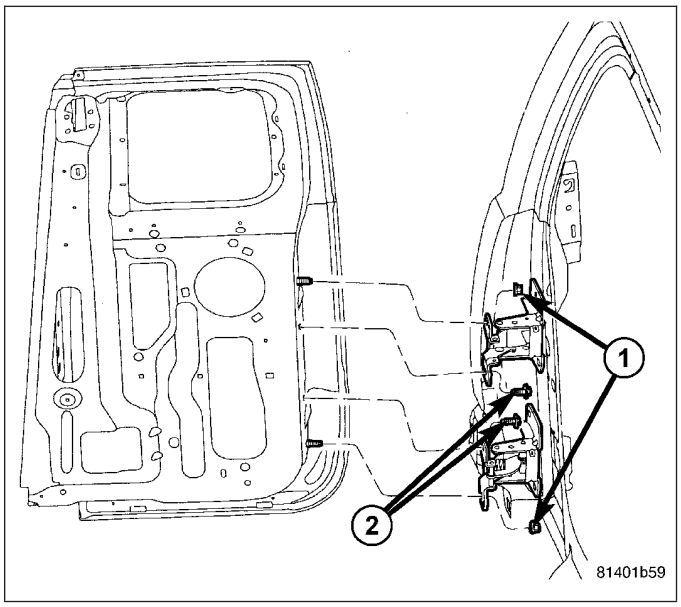
6. Install the door trim panel (1). (Refer to 23 - BODY/ DOOR - CARGO/PANEL-TRIM - INSTALLATION)



DOOR

REMOVAL

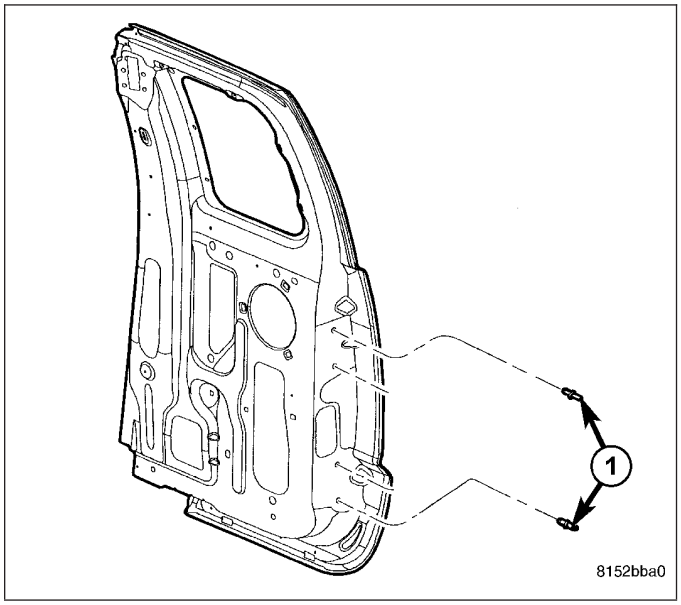
1. Using a grease pencil or equivalent, mark the outline of the door hinges on the door end to aid installation.
2. Support the door with a suitable lifting device.
3. Remove the nuts (1) and the bolts (2) attaching the door hinges to the door.



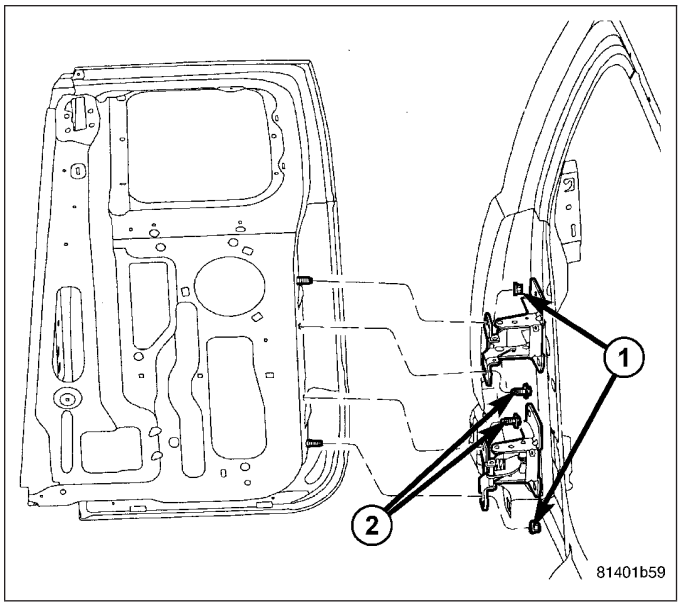
INSTALLATION

NOTE: When installing a door it will be necessary to replace the shouldered door studs (1) with service studs without the shoulder in order to achieve correct door position adjustments.

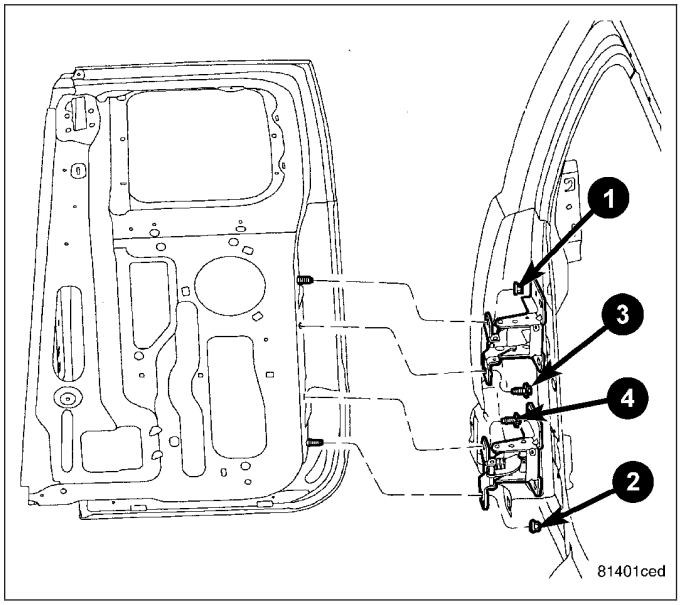
1. Install the service studs (1) and tighten to 12 N·m (105 in. lbs.).



2. Install the door onto the hinges and install the nuts (1) and bolts (2).



3. Line up the door using the marks made during removal and tighten the fasteners to 23 N·m (17 ft. lbs.) using the sequence shown.
4. Check and adjust the door position. (Refer to 23 - BODY/DOOR - CARGO/DOOR - ADJUSTMENTS)



ADJUSTMENTS

ADJUSTMENT

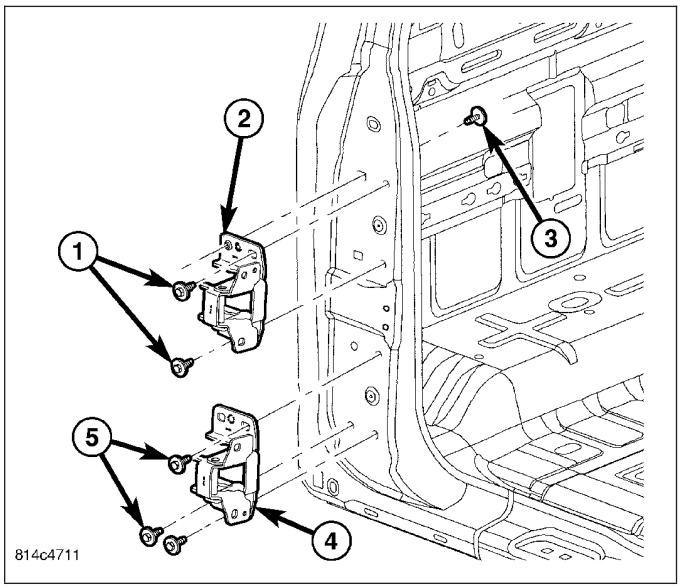
NOTE: For four door vehicles, it is recommended that you adjust the rear door before adjusting the front door.

- **Door adjustment measurements should be taken from stationary or welded body panels like the roof, rocker or quarter panels.**
- **During adjustment procedures, it is recommended that all the hinge fasteners be loosened except for the upper most fasteners. Adjustments can be made using the upper fasteners to hold the door with final torque of the fasteners occurring after correct door positioning is achieved.**
- **A suitable body sealant should be used when removing or moving the hinges.**

FORE/AFT

NOTE: Fore/aft (lateral) door adjustment is done by loosening the hinge to the hinge pillar fasteners one hinge at a time and moving the door to the correct position.

1. Support the door with a suitable lifting device.
2. Loosen the hinge to hinge pillar fasteners (1, 3 and 5). (Refer to 23 - BODY/DOORS - REAR/HINGE - REMOVAL)
3. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
4. Tighten the hinge pillar fasteners to 28 N·m (21 ft. lbs.). (Refer to 23 - BODY/DOORS - REAR/HINGE - INSTALLATION)



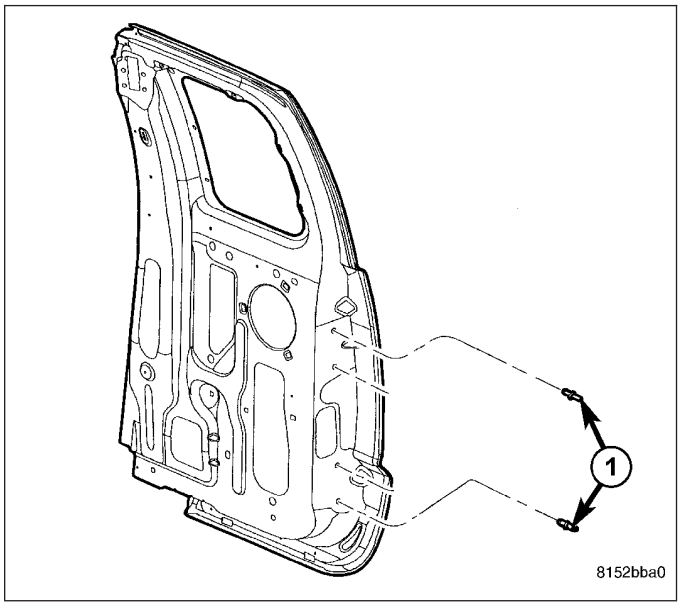
UP/DOWN

NOTE: Up/down door adjustment is done by loosening either the hinge to the hinge pillar fasteners or the hinge to door fasteners and moving the door to the correct position.

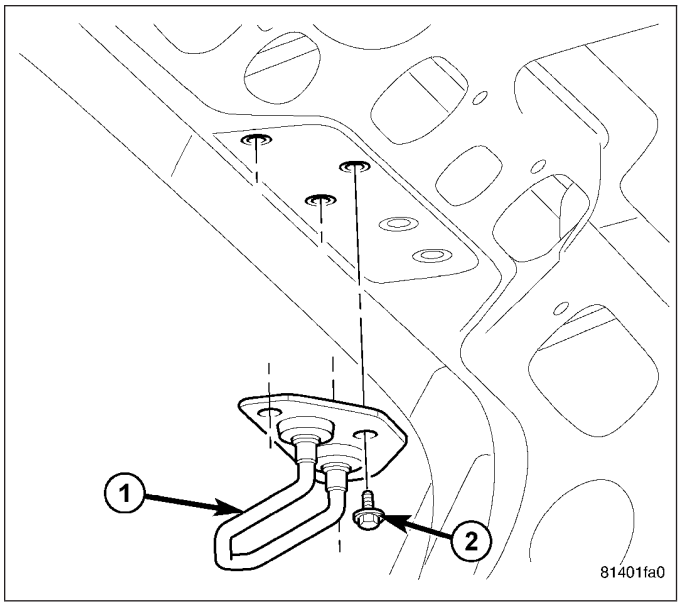
NOTE: When adjustment of the door requires the loosening of the door to hinge fasteners, it will be necessary to separate the epoxy bonded washers with a chisel or other suitable tool.

NOTE: When adjusting a door with the door to hinge fasteners, it will be necessary to replace the shouldered door studs (1) with service studs without the shoulder in order to achieve correct door position adjustments.

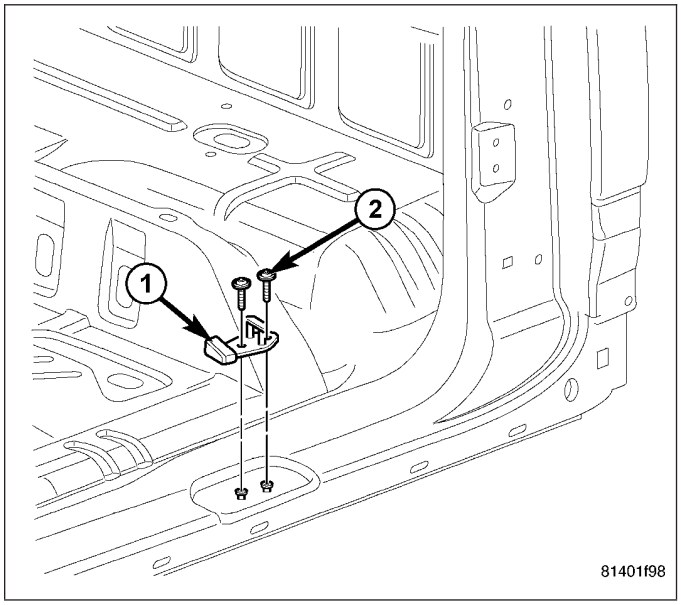
1. If required, install the service studs (1) and tighten to 12 N·m (105 in. lbs.).



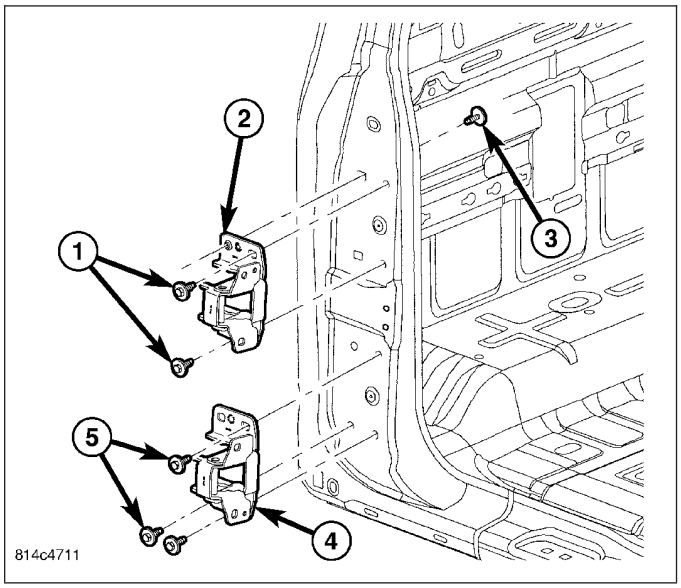
2. Support the door with a suitable lifting device.
3. Remove the upper striker. (Refer to 23 - BODY/ DOOR - CARGO/STRIKER-UPPER LATCH - REMOVAL)



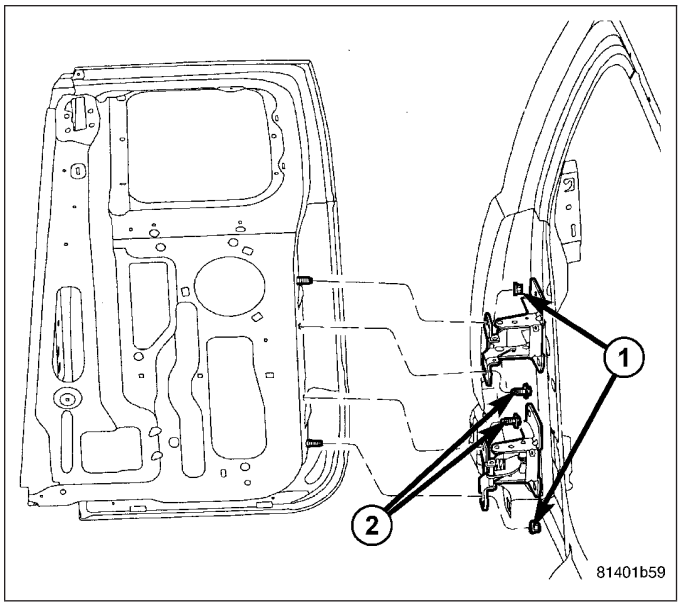
4. Remove the lower striker (2). (Refer to 23 - BODY/ DOOR - CARGO/STRIKER-LOWER LATCH - REMOVAL)



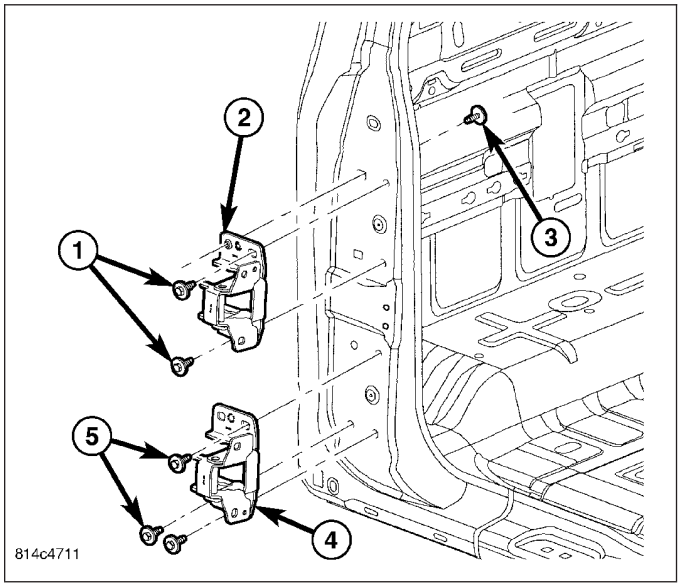
5. If necessary, loosen the hinge to hinge pillar fasteners (Refer to 23 - BODY/DOORS - REAR/HINGE - REMOVAL)



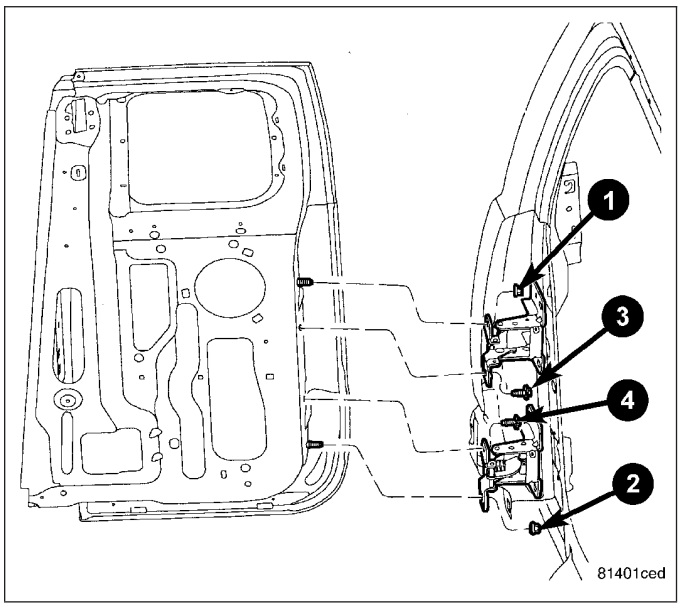
6. If necessary, loosen the hinge to door fasteners (1 and 2). (Refer to 23 - BODY/DOORS - REAR/ DOOR - REMOVAL)
7. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)



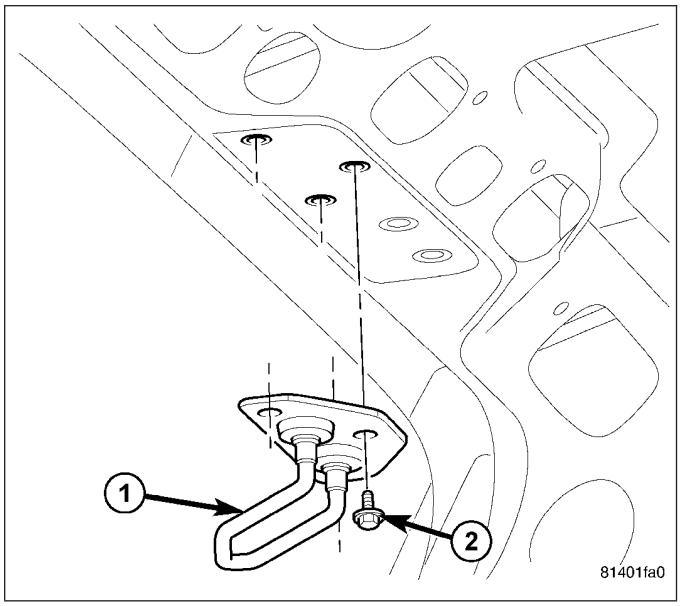
8. If necessary, tighten the hinge to pillar bolts (1, 3 and 5) to 28 N·m (21 ft. lbs.). (Refer to 23 - BODY/ DOORS - REAR/HINGE - INSTALLATION)



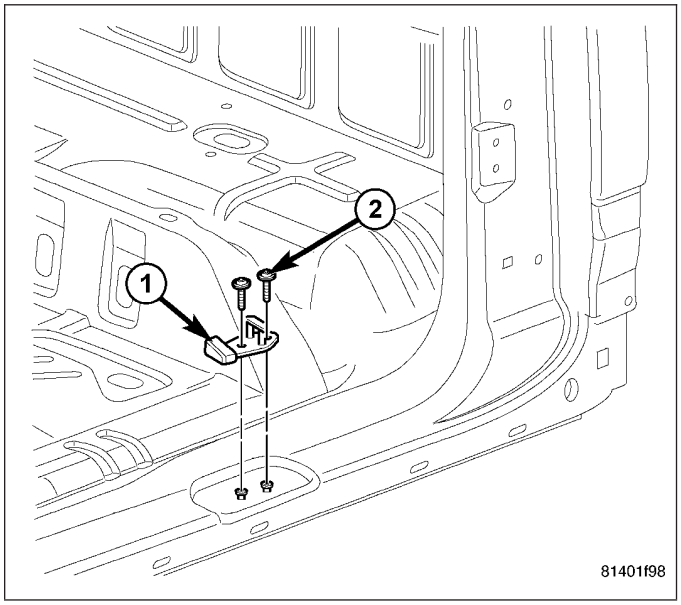
9. Tighten the door to hinge fasteners to 23 N·m (17 ft. lbs.) using the sequence shown. (Refer to 23 - BODY/DOORS - REAR/HINGE - INSTALLATION)



10. Install the upper striker (1). (Refer to 23 - BODY/ DOOR - CARGO/STRIKER-UPPER LATCH - INSTALLATION)



11. Install the lower striker (1). (Refer to 23 - BODY/ DOOR - CARGO/STRIKER-LOWER LATCH - INSTALLATION)



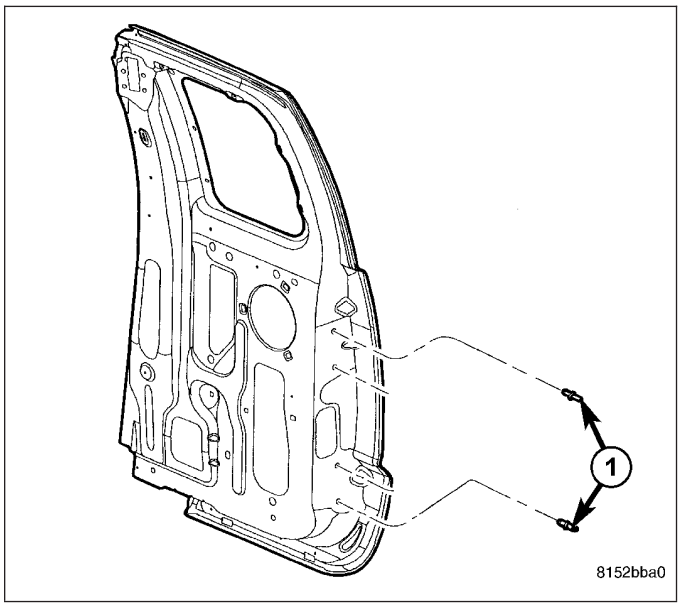
IN/OUT

NOTE: In/out door adjustment is done by loosening the hinge to door fasteners one hinge at a time and moving the door to the correct position.

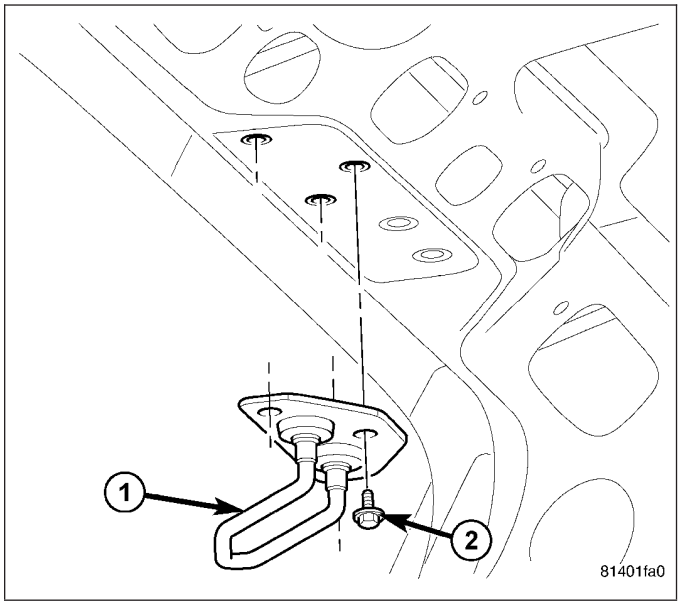
NOTE: When adjustment of the door requires the loosening of the door to hinge fasteners, it will be necessary to separate the epoxy bonded washers with a chisel or other suitable tool.

NOTE: When adjusting a door with the door to hinge fasteners, it will be necessary to replace the shouldered door studs (1) with service studs without the shoulder in order to achieve correct door position adjustments.

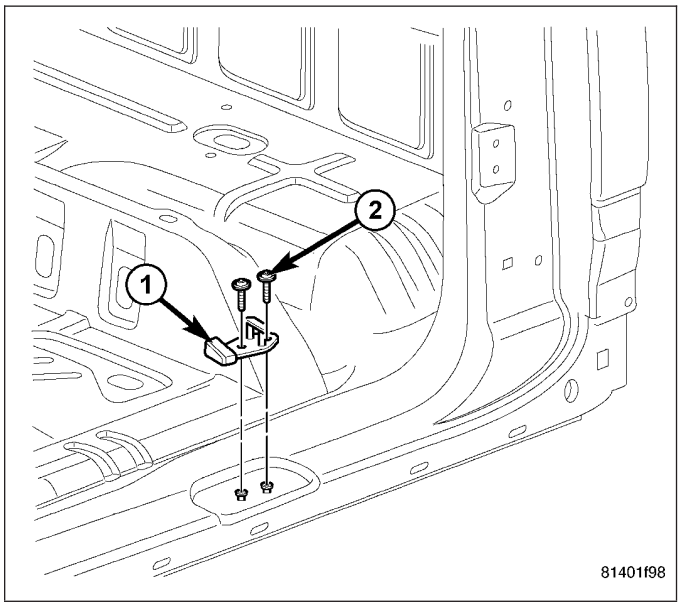
1. Install the service studs (1) and tighten to 12 N·m (105 in. lbs.).



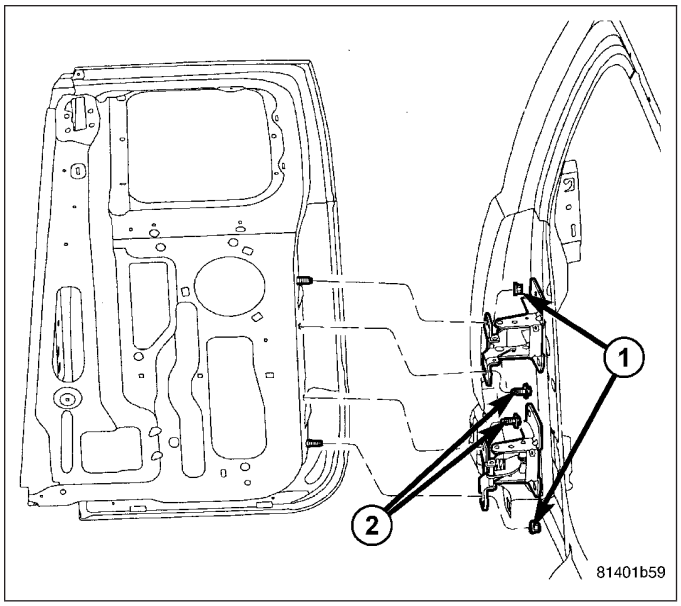
2. Remove the upper striker. (Refer to 23 - BODY/DOOR - CARGO/STRIKER-UPPER LATCH - REMOVAL)



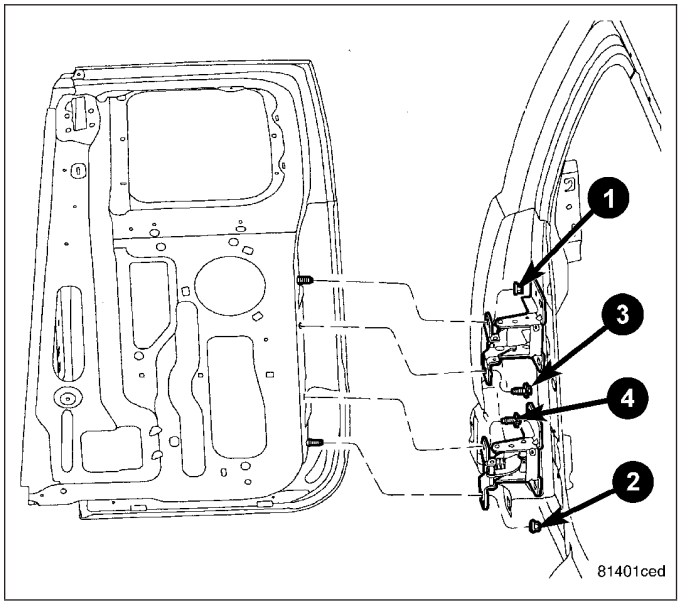
3. Remove the lower striker (2). (Refer to 23 - BODY/DOOR - CARGO/STRIKER-LOWER LATCH - REMOVAL)



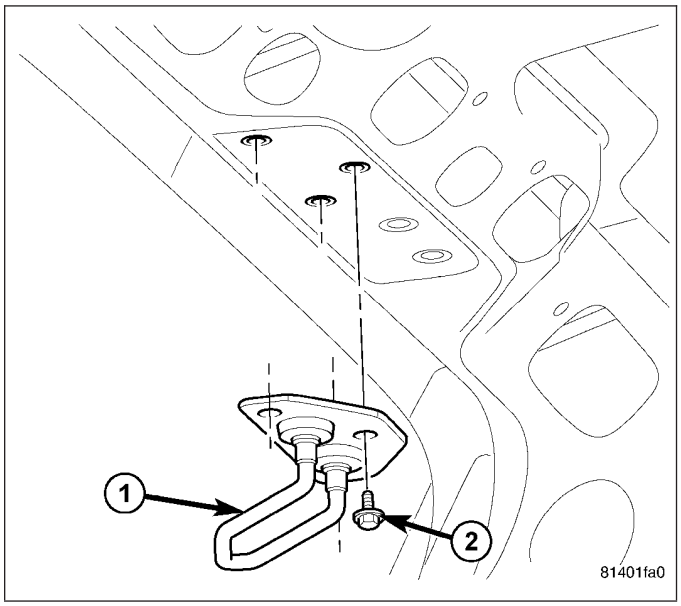
4. Support the door with a suitable lifting device.
5. Loosen the hinge to door fasteners (1) and (2). (Refer to 23 - BODY/DOORS - REAR/DOOR - REMOVAL)



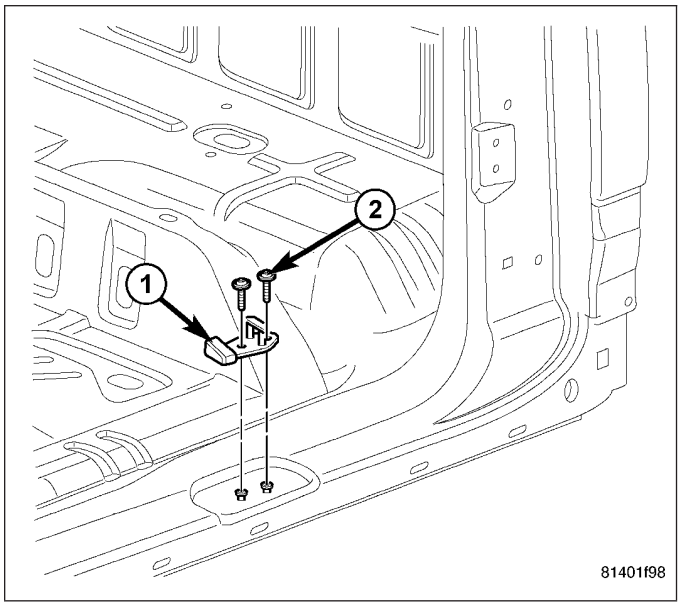
6. Adjust the front of the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
7. Tighten the fasteners to 23 N·m (17 ft. lbs.) using the sequence shown.



8. Install the upper striker (1). (Refer to 23 - BODY/DOOR - CARGO/STRIKER-UPPER LATCH - INSTALLATION)



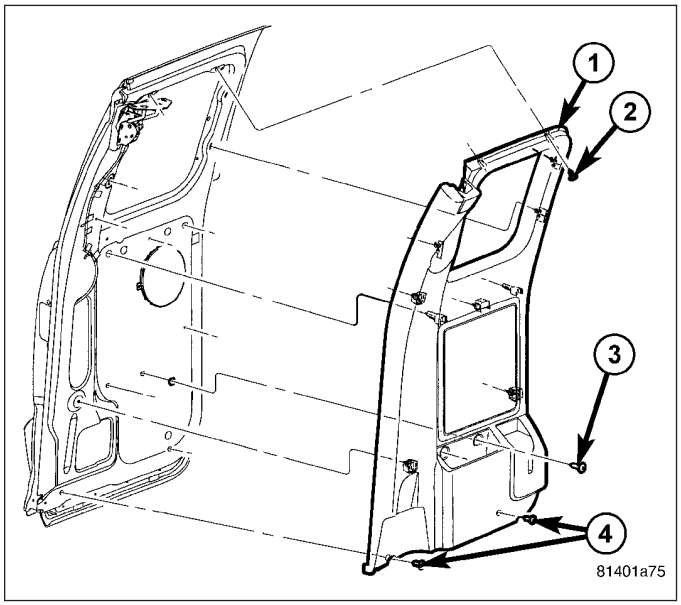
9. Install the lower striker (1). (Refer to 23 - BODY/DOOR - CARGO/STRIKER-LOWER LATCH - INSTALLATION)



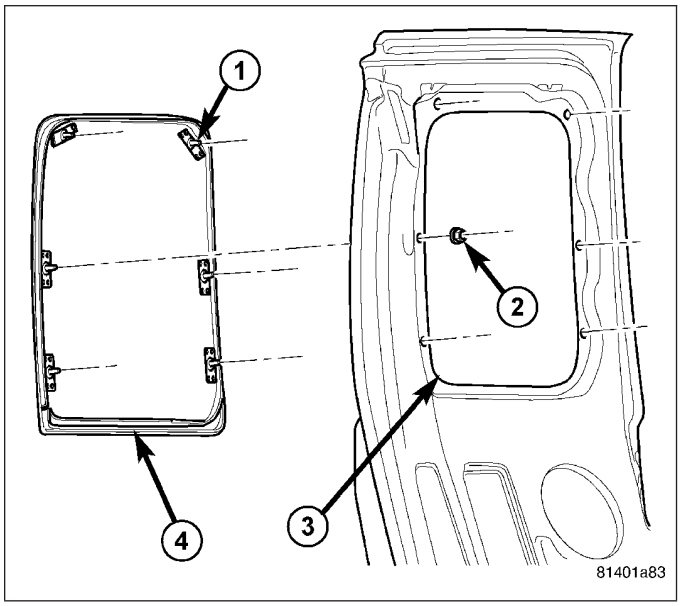
GLASS-DOOR

REMOVAL

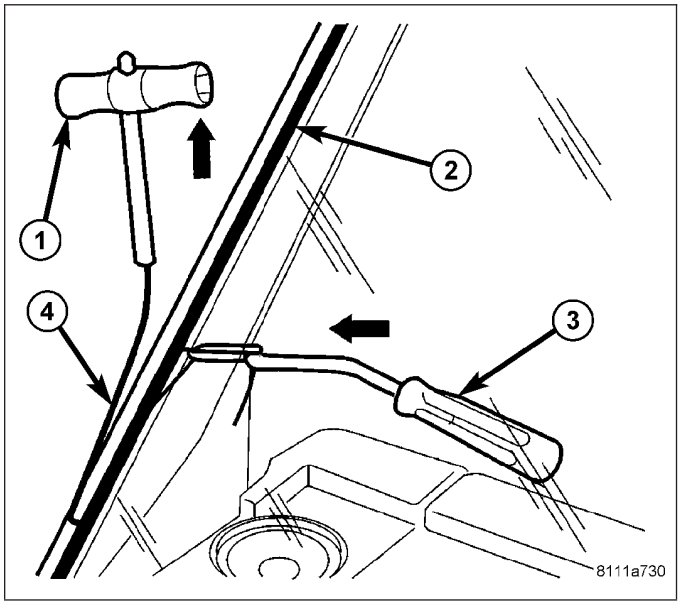
1. Remove the door trim panel (1). (Refer to 23 - BODY/DOOR - CARGO/PANEL-TRIM - REMOVAL)



2. Remove the six nuts (2) holding the glass (4) onto the door fence line (3).



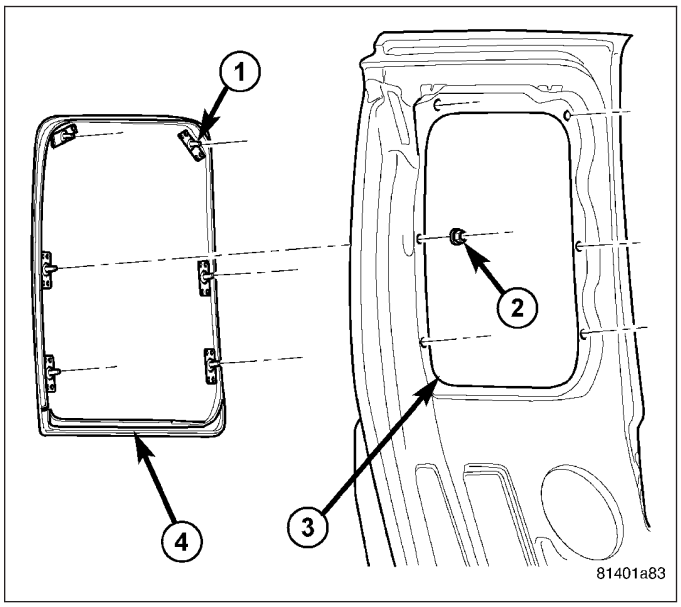
3. Using an adhesive cutting wire (4) or equivalent separate the glass adhesive (2) and remove the glass.



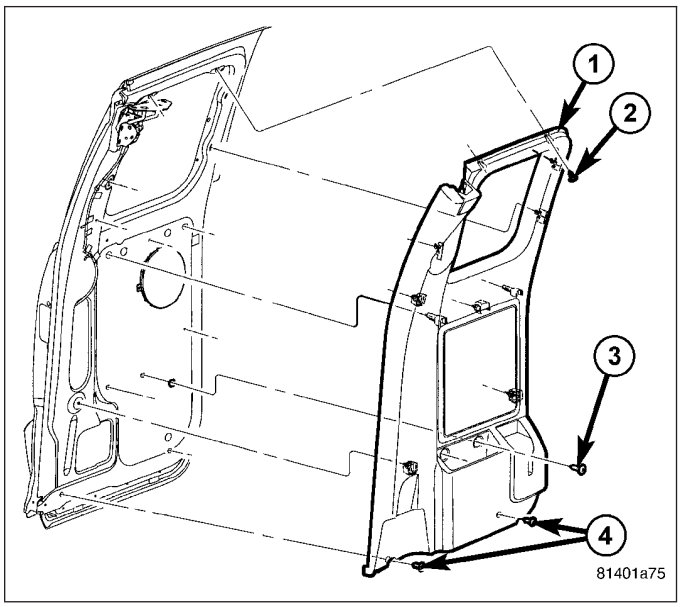
1 - T-HANDLE
2 - WINDSHIELD ADHESIVE
3 - COUNTER SUPPORT
4 - CUTTING WIRE

INSTALLATION

1. Clean the old glass sealer from the glass fence line.
2. Install new butel sealer around the edge of the glass if necessary.
3. Install the glass (1) and install the six nuts (2).
4. Tighten the nuts (2) to 4 N·m (35 in. lbs.).



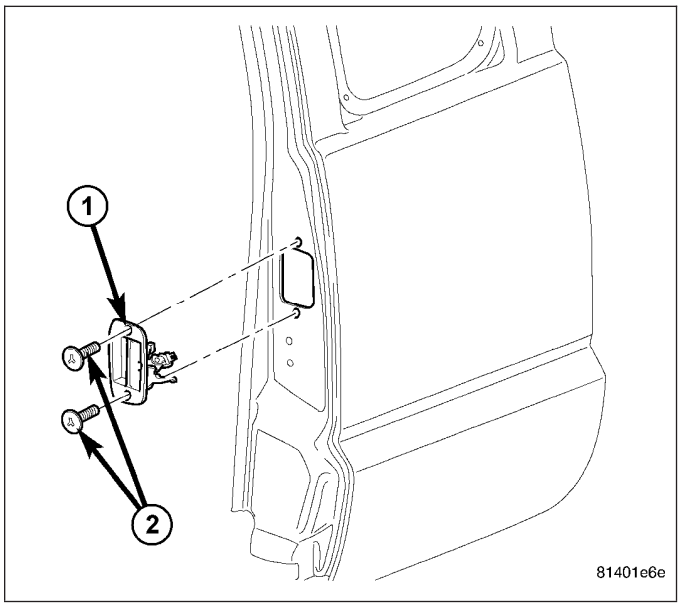
5. Install the trim panel. (Refer to 23 - BODY/DOOR - CARGO/PANEL-TRIM - INSTALLATION)



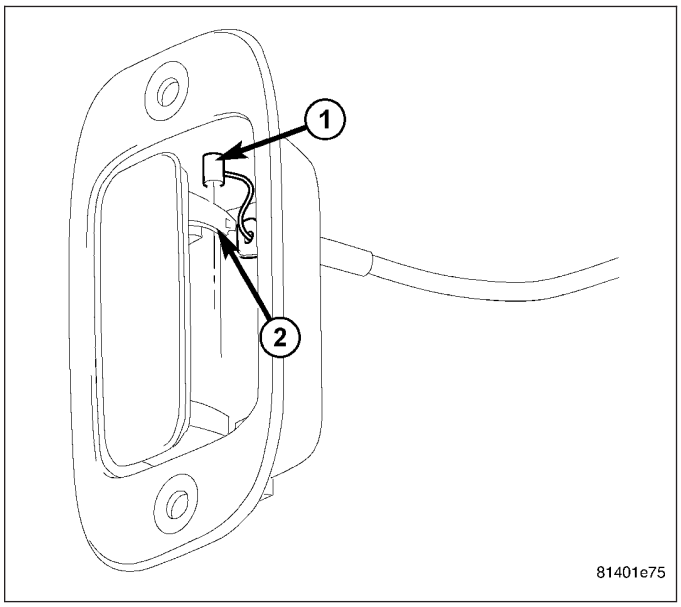
HANDLE-SHUTFACE

REMOVAL

1. Remove the two screws (2) and separate the handle (1) from the door.

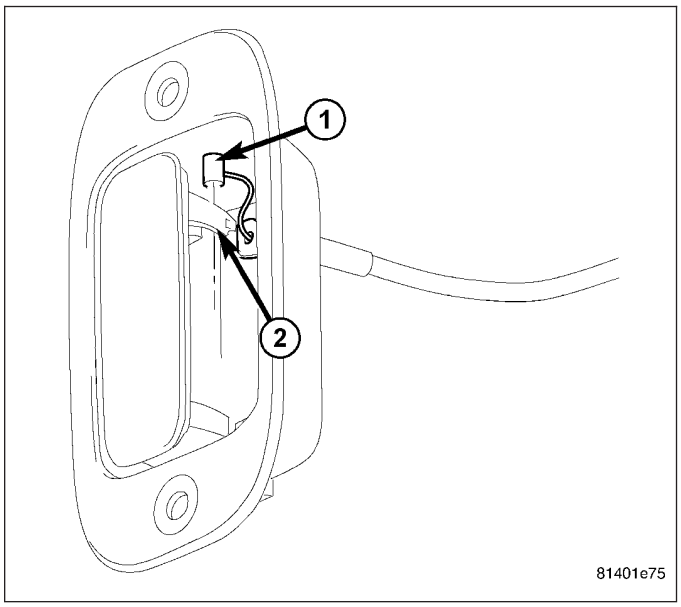


2. Disconnect the upper and lower cables (1) from the handle (2) and remove the handle.

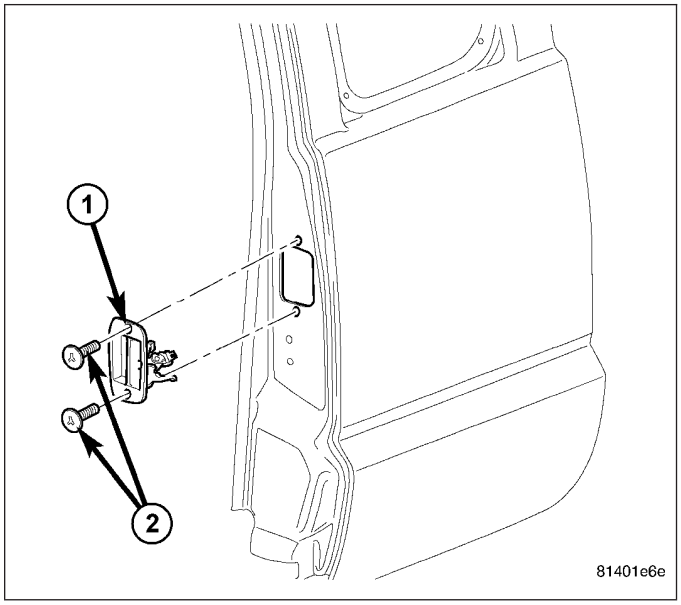


INSTALLATION

1. Connect the upper and lower cable ends (1) to the handle arms (2).



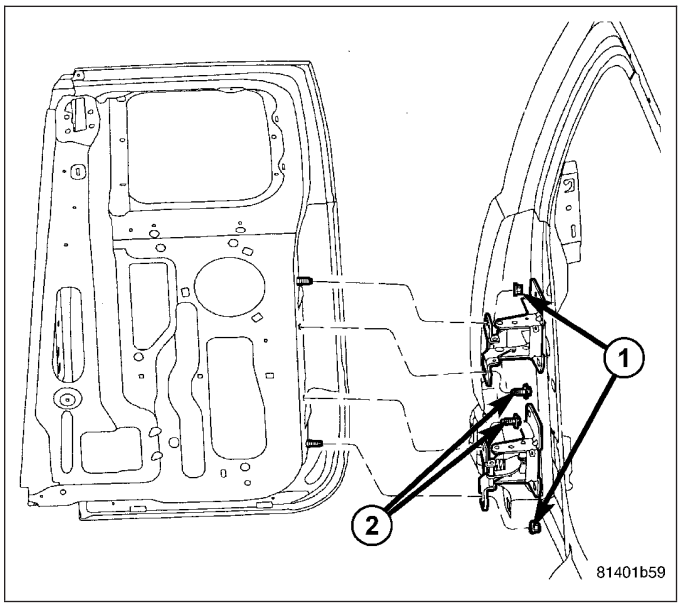
2. Install the handle (1) and install the screws (2).



HINGE

REMOVAL

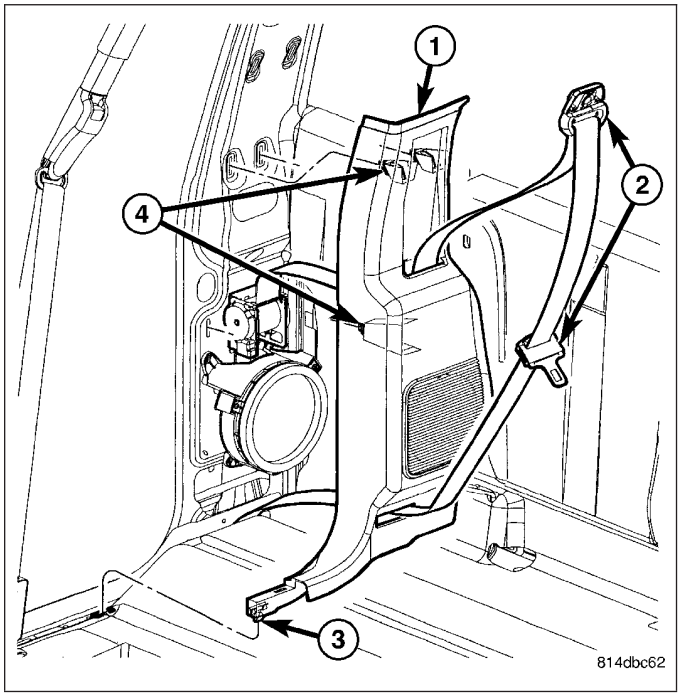
1. Remove the door. (Refer to 23 - BODY/DOOR - CARGO/DOOR - REMOVAL)



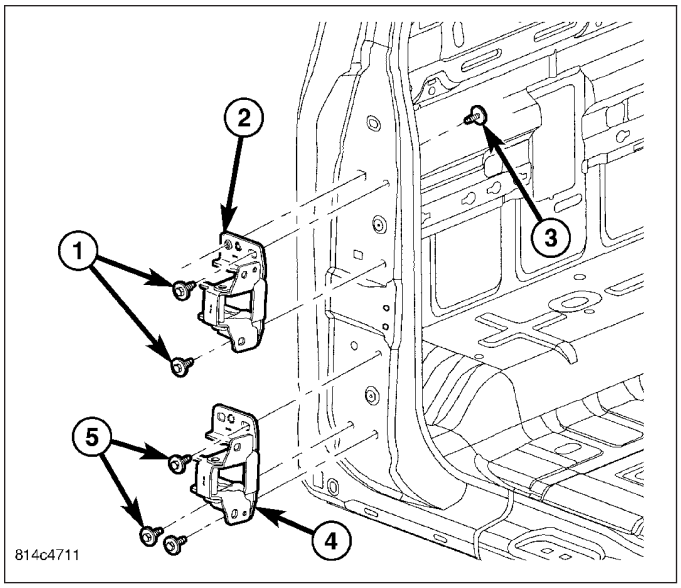
Upper Hinge

NOTE: A suitable body sealant should be used when removing or moving the hinges.

1. Remove the lower c-pillar trim (1). (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR TRIM - REMOVAL)



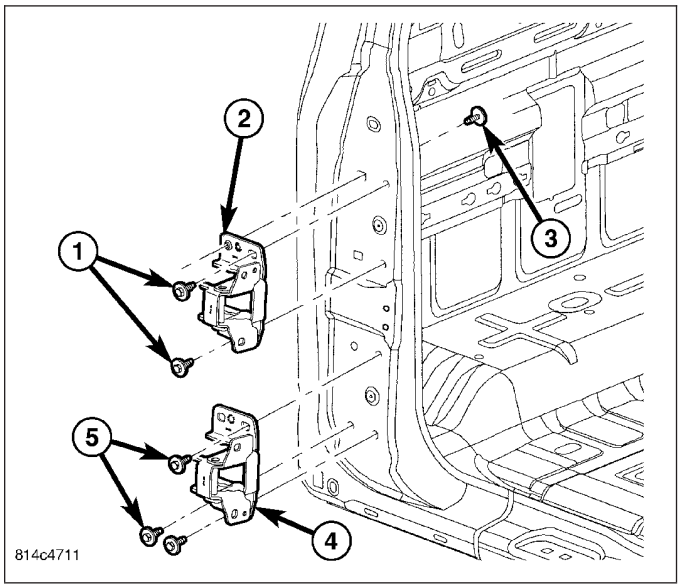
2. Using a grease pencil or equivalent, mark the location of the hinges on the pillar to aid installation.
3. Remove the two upper hinge inner bolts (3).
4. Remove the two outer bolts (1) and remove the hinge (2).



Lower Hinge

NOTE: A suitable body sealant should be used when removing or moving the hinges.

1. Remove the four hinge bolts (5) and remove the hinge (4).

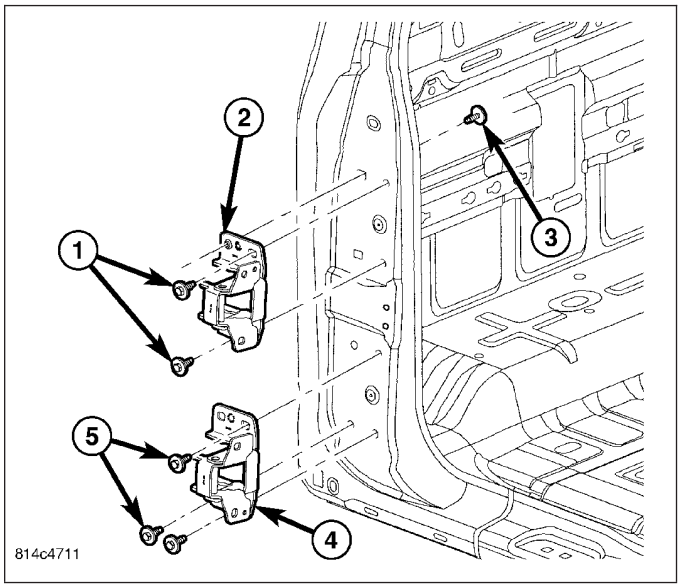


INSTALLATION

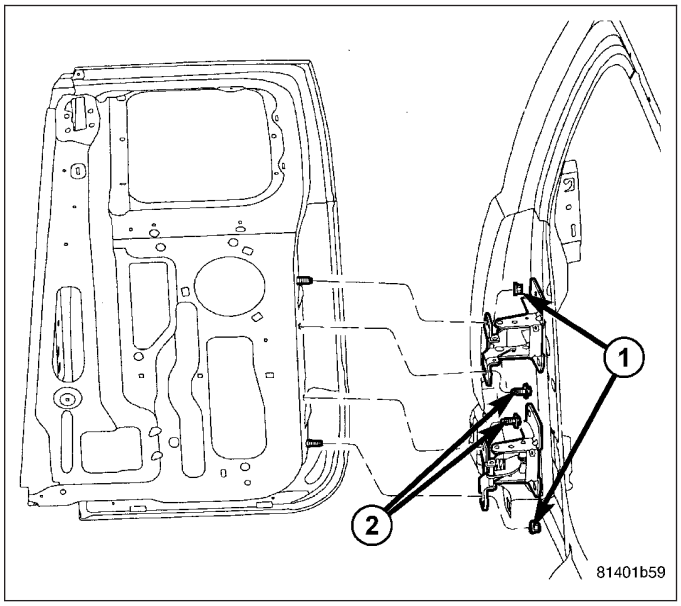
Upper Hinge

NOTE: A suitable body sealant should be used when removing or moving the hinges.

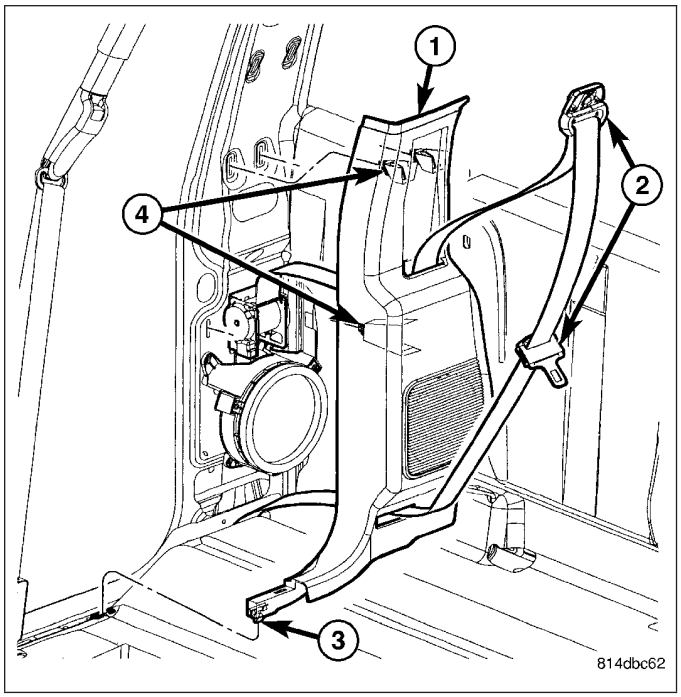
1. Install the hinge (2) and align with the marks made during removal.
2. Install the two outer bolts (1) and tighten to 28 N·m (21 ft. lbs.).
3. Install the two inner bolts (3) and tighten to 28 N·m (21 ft. lbs.).



4. Install the door and adjust the door position if required. (Refer to 23 - BODY/DOOR - CARGO/ DOOR - ADJUSTMENTS)



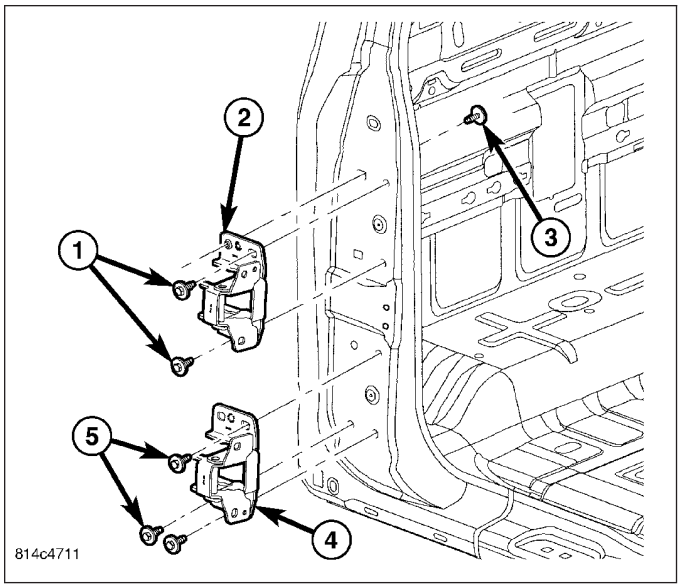
5. Install the lower c-pillar trim. (Refer to 23 - BODY/ INTERIOR/PANEL-C PILLAR TRIM - INSTALLATION)



Lower Hinge

NOTE: A suitable body sealant should be used when removing or moving the hinges.

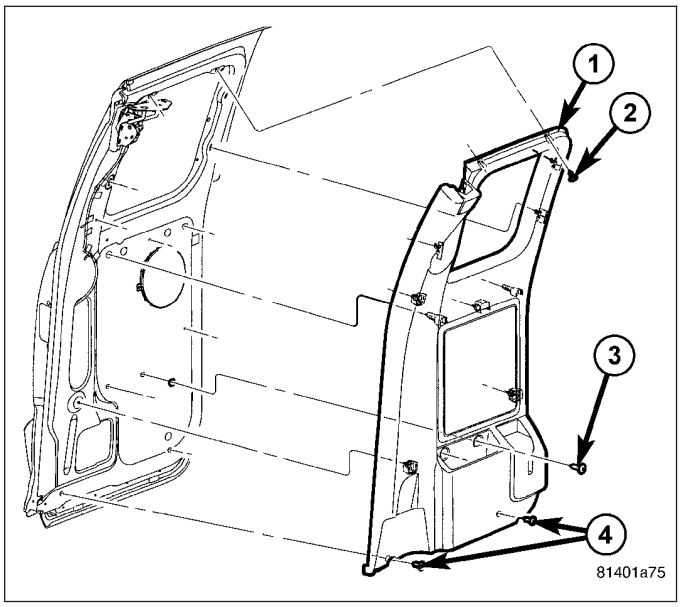
1. Install the hinge (4) and align with the marks made during removal.
2. Install the three hinge bolts (5) and tighten to 28 N·m (21 ft. lbs.).
3. Install the door and adjust the door position if required. (Refer to 23 - BODY/DOOR - CARGO/ DOOR - ADJUSTMENTS)



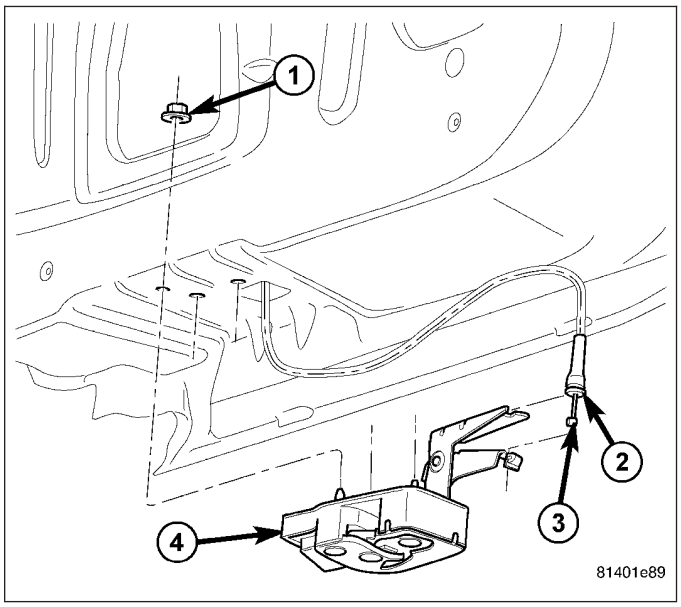
LATCH-LOWER

REMOVAL

1. Remove the trim panel (1). (Refer to 23 - BODY/ DOOR - CARGO/PANEL-TRIM - REMOVAL)

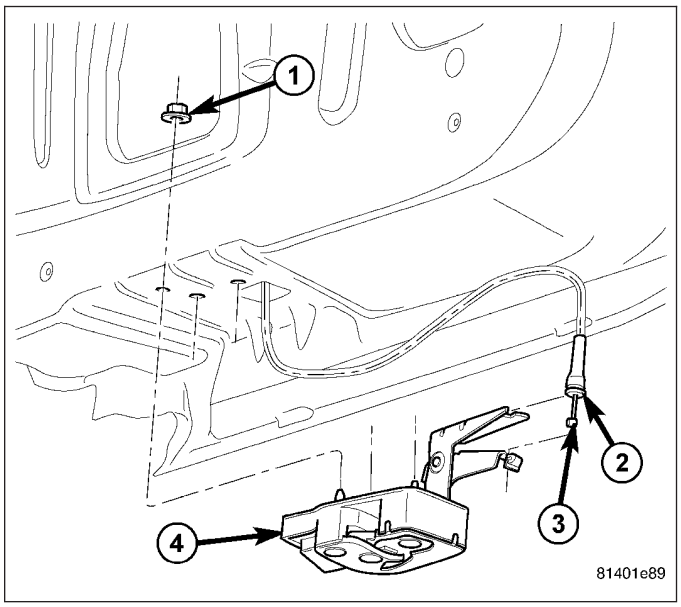


2. Remove the nuts (1) and separate the latch (4) from the door.
3. Disconnect the cable end (3) and disconnect the cable housing (2) from the latch.

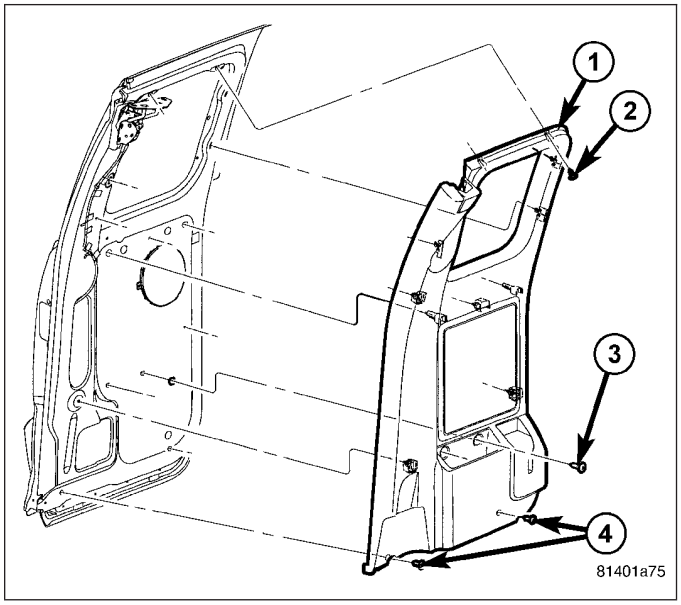


INSTALLATION

1. Connect the cable housing (2) to the latch and connect the cable end (3).
2. Install the latch (4) and install the nuts (1).
3. Tighten the nuts (1) to 12 N·m (105 in. lbs.)



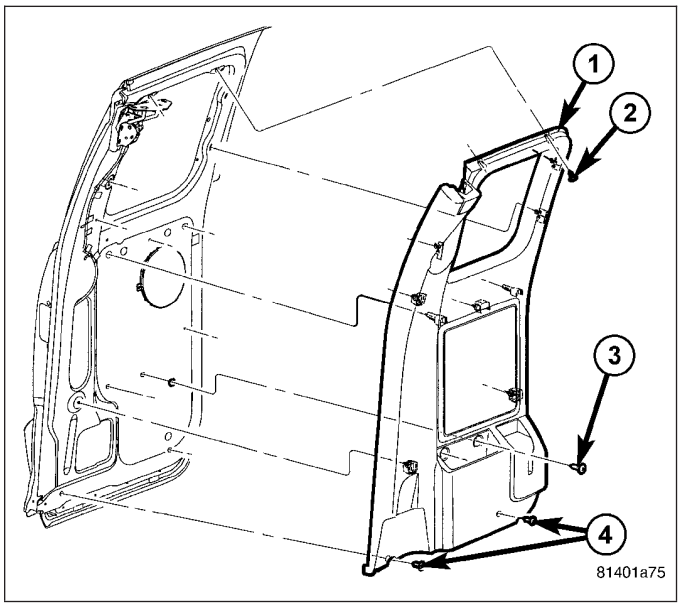
4. Install the trip panel (1). (Refer to 23 - BODY/ DOOR - CARGO/PANEL-TRIM - INSTALLATION)



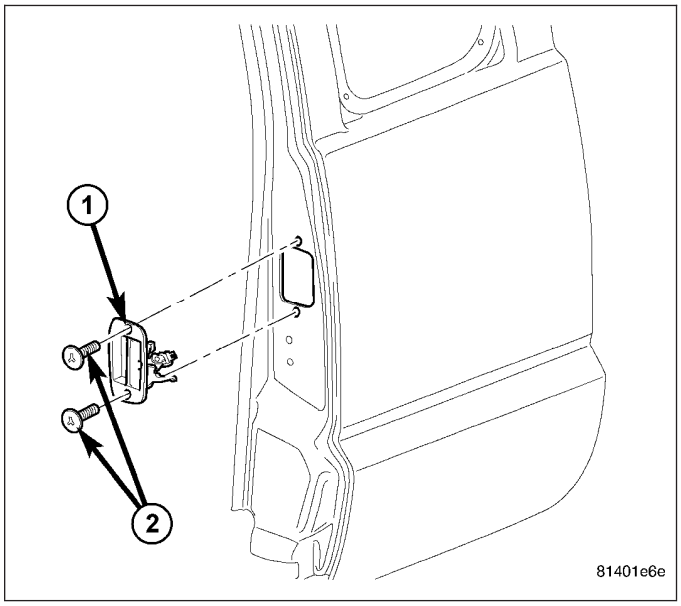
LATCH-UPPER

REMOVAL

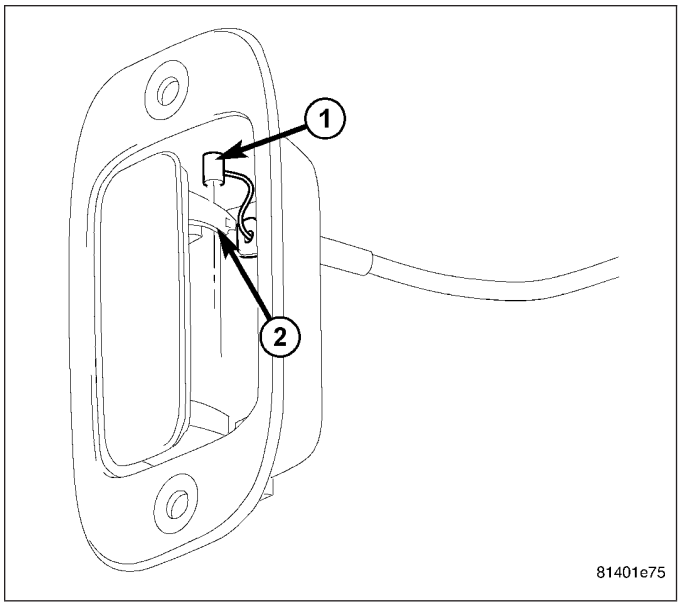
1. Remove the trim panel (1). (Refer to 23 - BODY/ DOOR - CARGO/TRIM PANEL - REMOVAL)



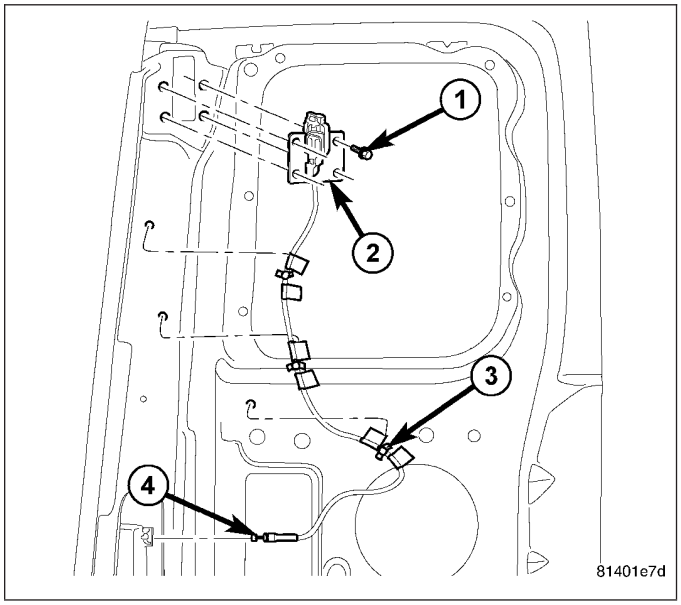
2. Remove the screws (2) and separate the door handle (1) from the door.



3. Disconnect the upper cable (1) from the door handle (2).

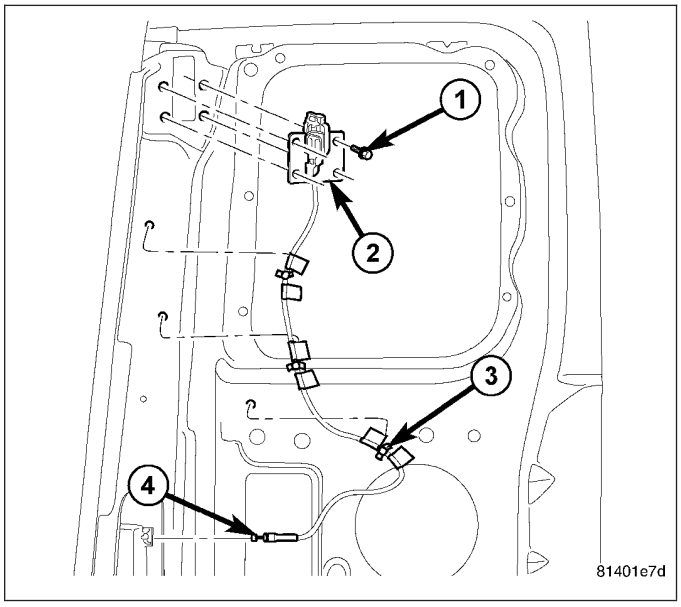


4. Separate the push pin hangers (3) from the door and separate the cable.
5. Remove the four screws (1) and remove the latch assembly (2) from the door.

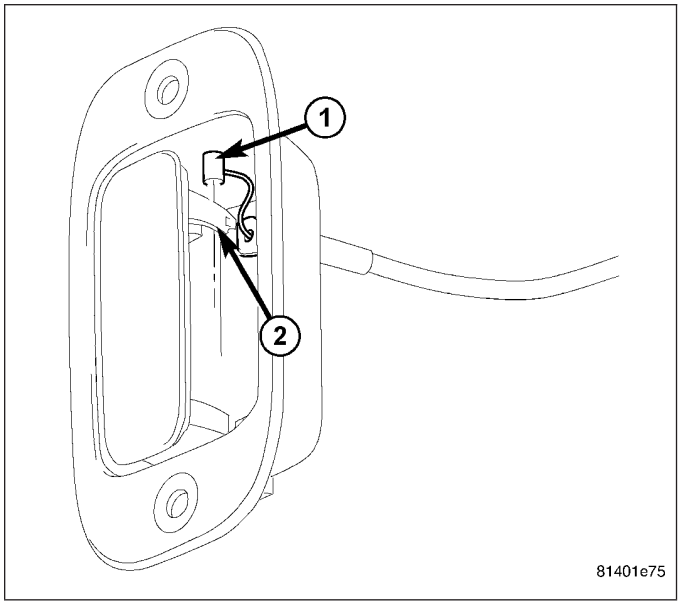


INSTALLATION

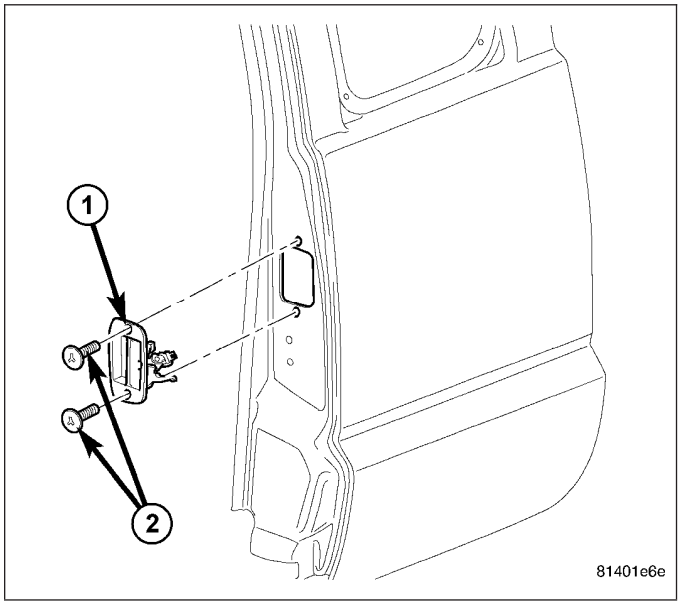
1. Install the latch assembly (2) and install the screws (1).
2. Tighten the screws to 12 N·m (105 in. lbs.).
3. Install the cable hanger push pins (3) and seat fully.



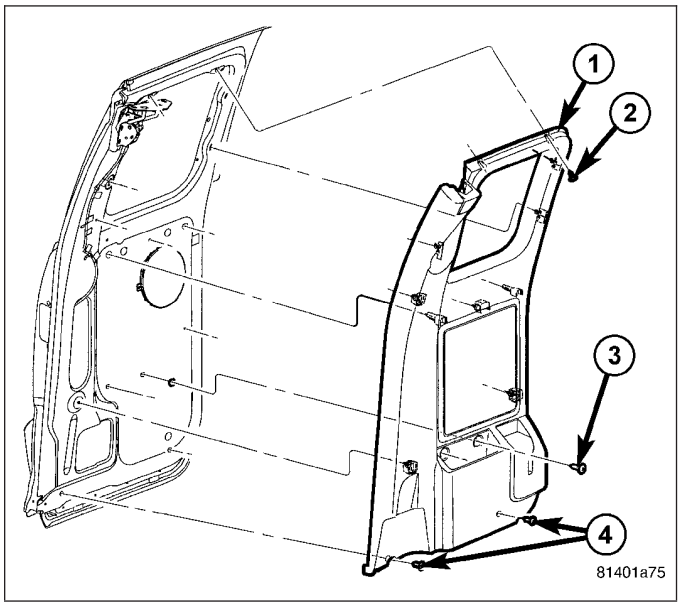
4. Connect the cable (1) to the door handle (2).



5. Install the door handle (1) and install the screws (2).



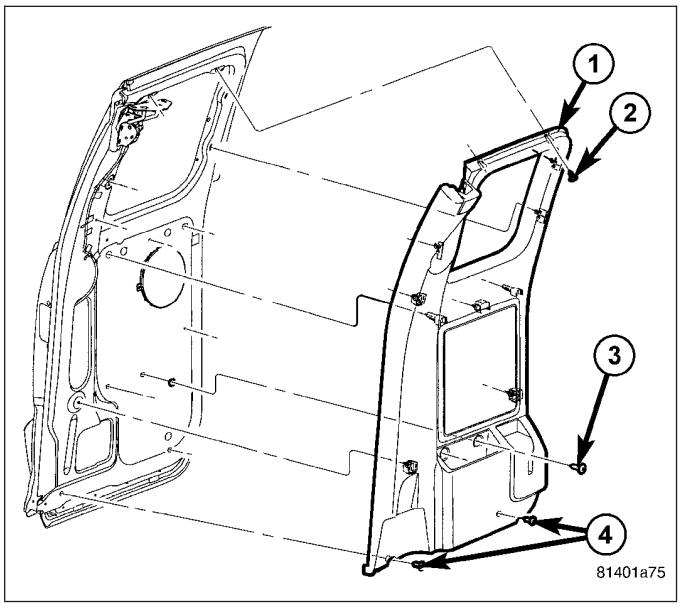
6. Install the door trim panel (1). (Refer to 23 - BODY/ DOOR - CARGO/PANEL-TRIM - INSTALLATION)



PANEL-TRIM

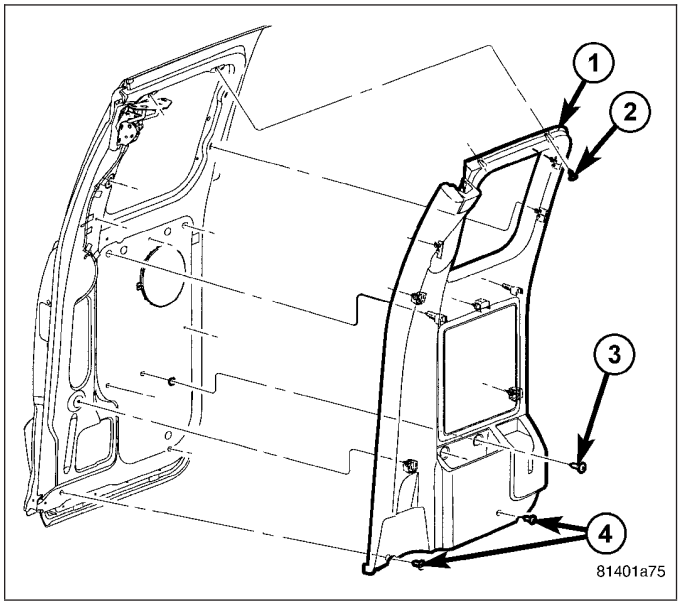
REMOVAL

1. Remove the two lower screws (4).
2. Remove the two screws in the pull cup (3).
3. Remove the two upper screws (2).
4. Using a trim tool C-4829-A or equivalent, separate the support clips and remove the trim panel (1).



INSTALLATION

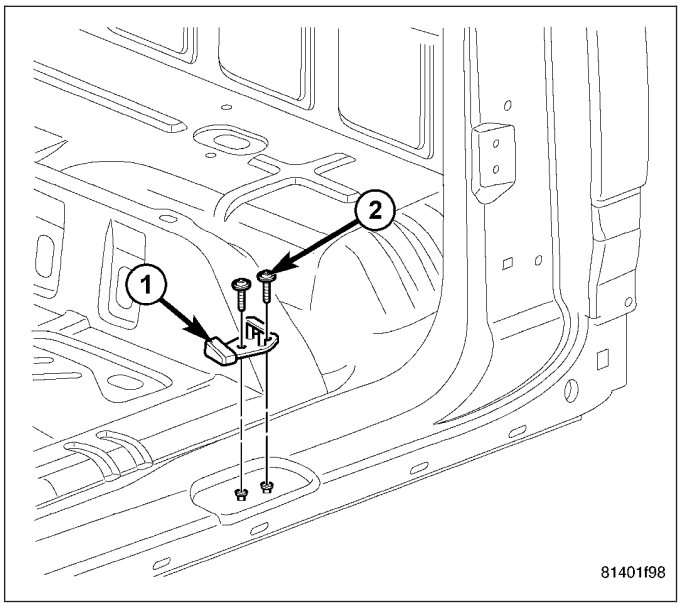
1. Position the trim panel (1) and seat the support clips fully.
2. Install the two upper screws (2).
3. Install the two screws at the pull handle (3).
4. Install the two lower screws (4).



STRIKER-LOWER LATCH

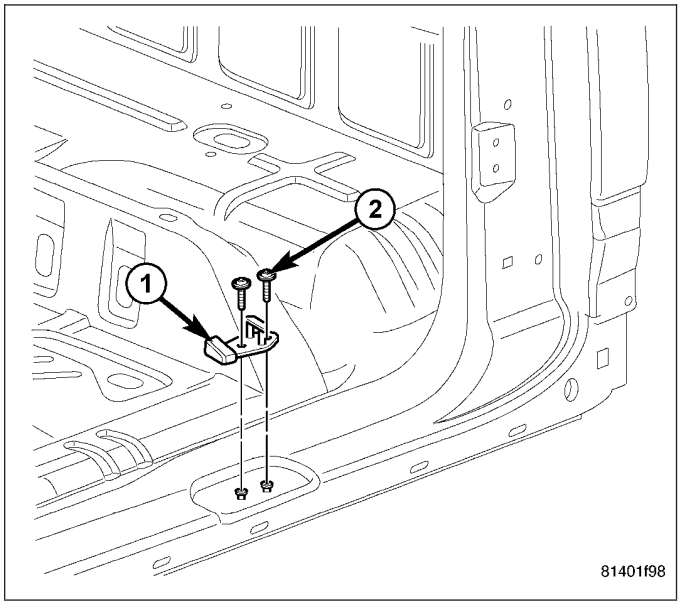
REMOVAL

1. Using a grease pencil or equivalent, mark the position of the striker to aid installation.
2. Remove the screws (2) and remove the striker (1).



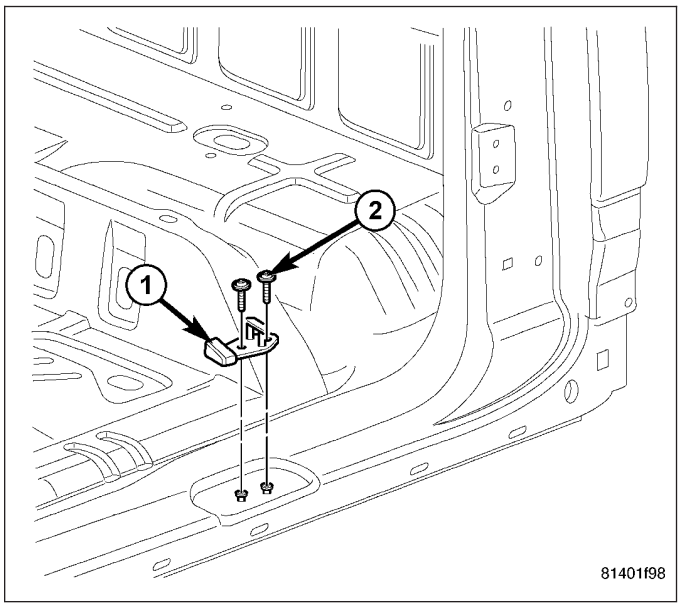
INSTALLATION

1. Position the door latch striker (1) onto the vehicle and loosely install the two screws (2).
2. Align the door latch striker using the reference marks made during the removal procedure and tighten the screws to 28 N·m (21 ft. lbs.).
3. If necessary, adjust the door latch striker. (Refer to 23 - BODY/DOOR - CARGO/STRIKER-LOWER LATCH - ADJUSTMENTS)



ADJUSTMENTS

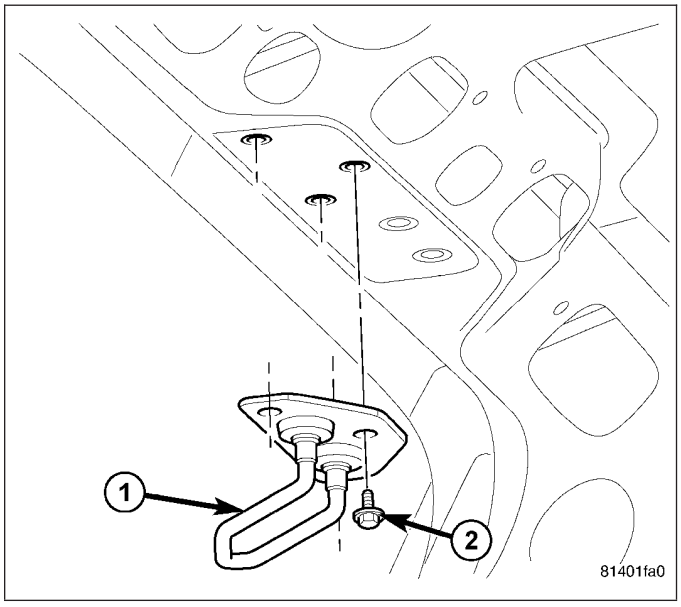
1. Using a grease pencil or equivalent, mark the location of the door latch striker (1) on floor sill to aid in adjustment.
2. Loosen the two bolts (2) that secure the door latch striker to the floor sill.
3. To adjust the lower front gap and flush measurement, change the position of the door latch striker and then tighten the two bolts to 28 N·m (21 ft. lbs.) (Refer to 23 - BODY/BODY STRUCTURE/ GAP AND FLUSH - SPECIFICATIONS).
4. Verify correct door and latch position.



STRIKER-UPPER LATCH

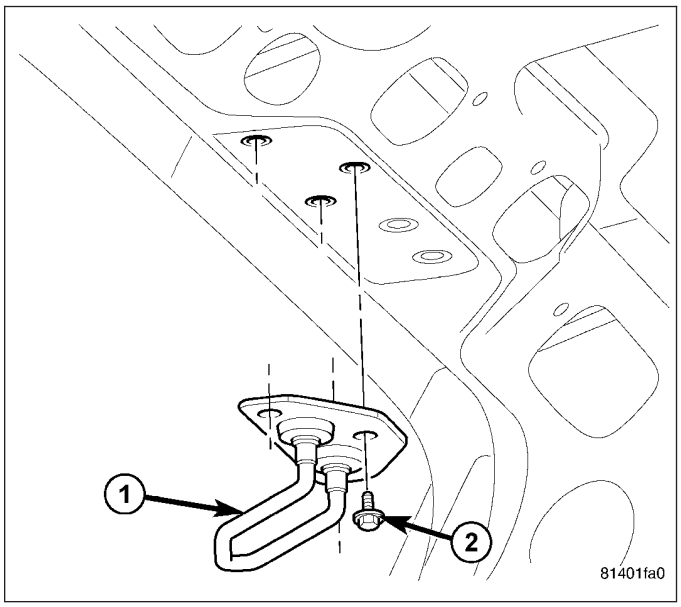
REMOVAL

1. Using a grease pencil or equivalent, mark the position of the striker to aid installation.
2. Remove the screws (2) and remove the striker (1).



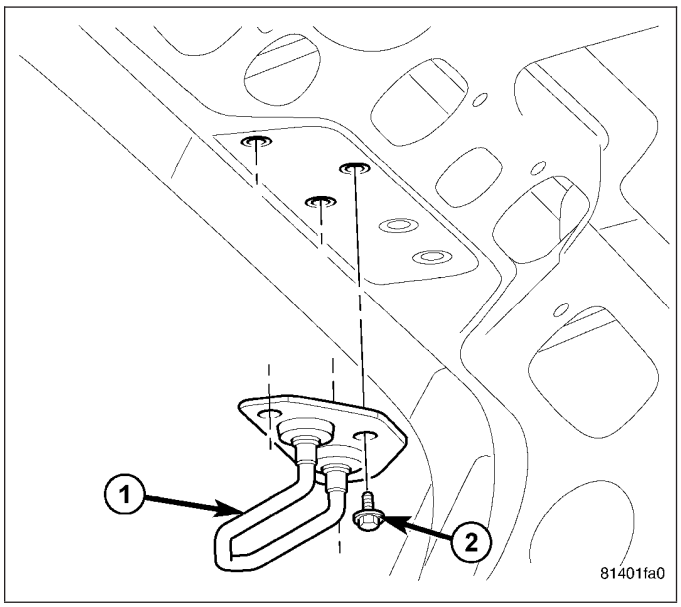
INSTALLATION

1. Position the door latch striker (1) onto the vehicle and loosely install the two screws (2).
2. Align the door latch striker using the reference marks made during the removal procedure and tighten the screws to 28 N·m (21 ft. lbs.).
3. If necessary, adjust the door latch striker. (Refer to 23 - BODY/DOOR - CARGO/STRIKER-UPPER LATCH - ADJUSTMENTS)



ADJUSTMENTS

1. Using a grease pencil or equivalent, mark the location of the door latch striker (1) on roof rail to aid in adjustment.
2. Loosen the two bolts (2) that secure the door latch striker to the roof rail.
3. To adjust the upper front gap and flush measurement, change the position of the door latch striker and then tighten the two bolts to 28 N·m (21 ft. lbs.) (Refer to 23 - BODY/BODY STRUCTURE/ GAP AND FLUSH - SPECIFICATIONS).
4. Verify correct door and latch position.



WATERSHIELD

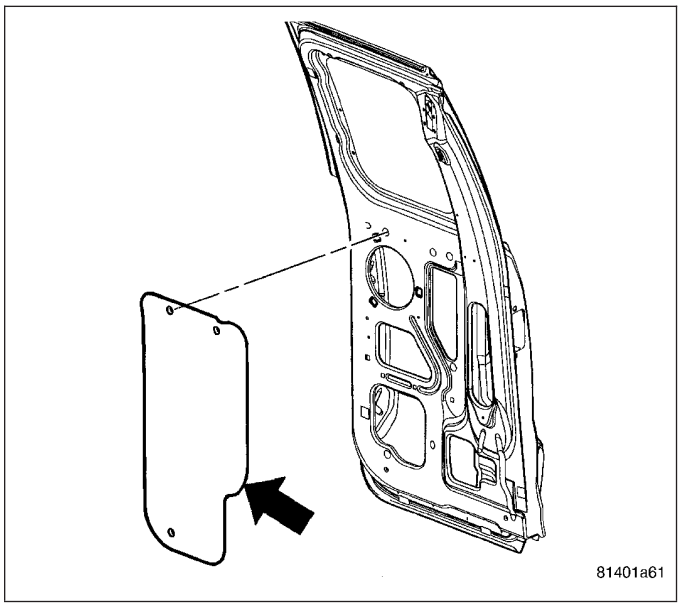
REMOVAL

CAUTION: Do not allow the watershield or adhesive to become contaminated with dirt or other foreign substances.

Do not damage the watershield during removal and installation.

If the watershield becomes contaminated or damaged, replace the watershield.

1. Remove the trim panel. (Refer to 23 - BODY/ DOOR - CARGO/PANEL-TRIM - REMOVAL)
2. Separate the watershield from the inner door panel and remove.



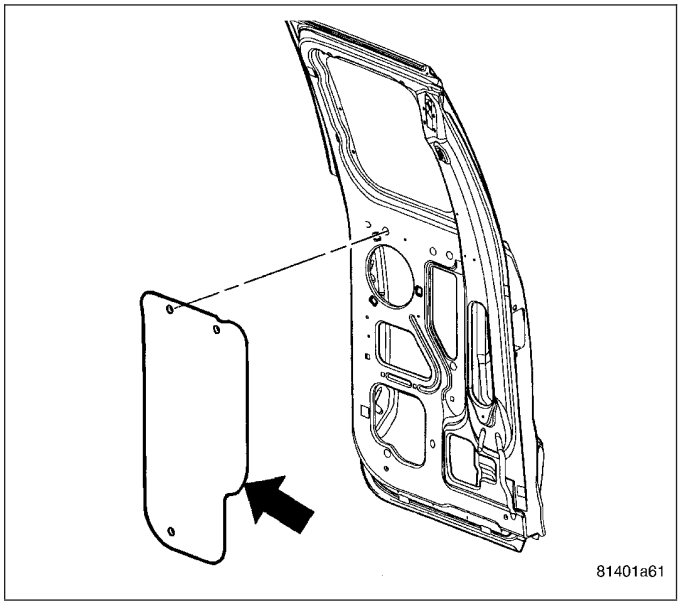
INSTALLATION

CAUTION: Do not allow the watershield or adhesive to become contaminated with dirt or other foreign substances.

Do not damage the watershield during removal and installation.

If the watershield becomes contaminated or damaged, replace the watershield.

1. Secure the watershield to the inner door panel.
2. Install the door trim panel. (Refer to 23 - BODY/ DOOR - CARGO/PANEL-TRIM - INSTALLATION)



DOOR - FRONT

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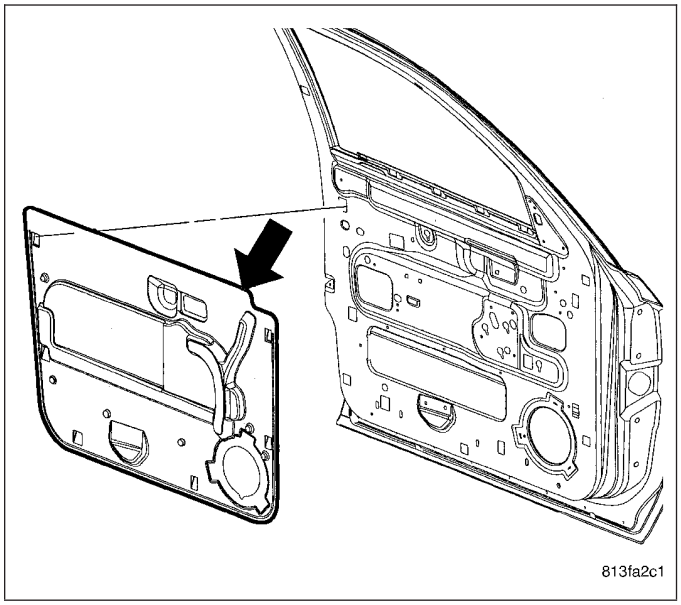
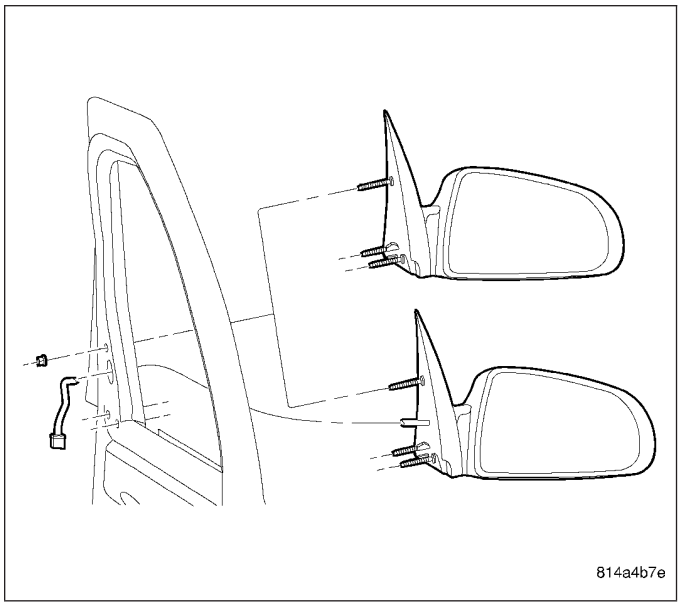
CHANNEL-GLASS

REMOVAL

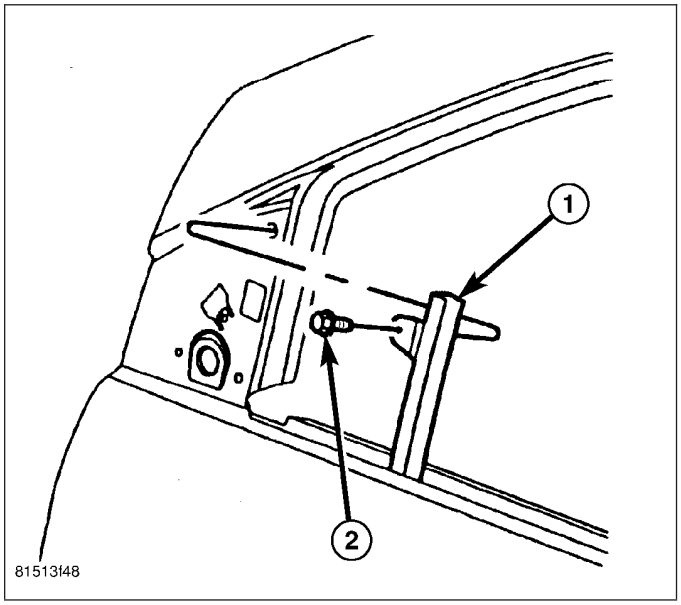
1. Remove the watershield. (Refer to 23 - BODY/ DOOR - FRONT/WATERSHIELD - REMOVAL)



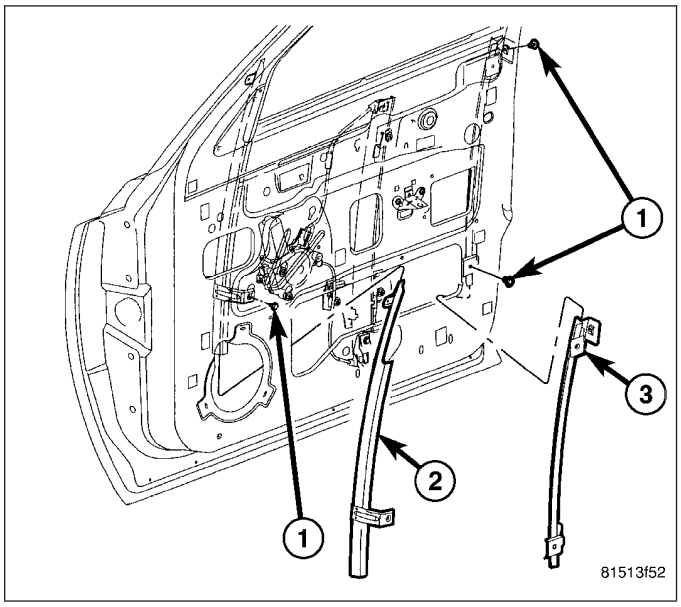
2. Remove the outside mirror. (Refer to 23 - BODY/ EXTERIOR/SIDE VIEW MIRROR - REMOVAL)



3. Remove the upper screw (2) for the front channel (1) from under the mirror.

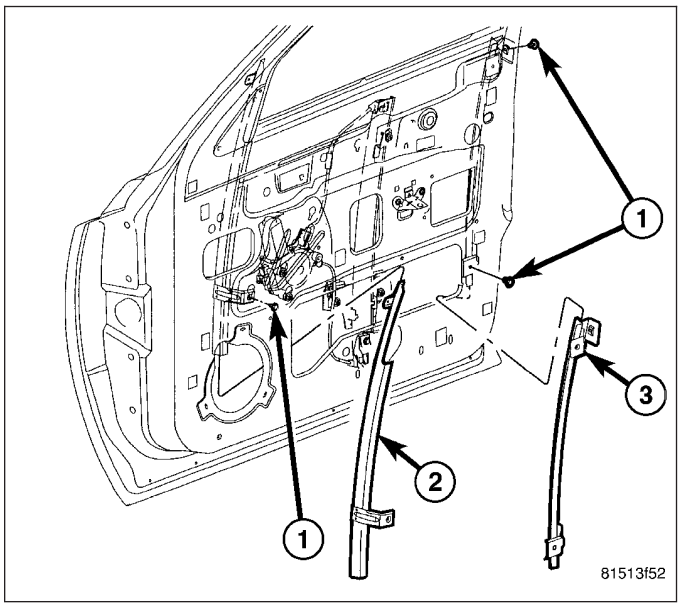


4. Remove the remaining screws (1) and remove the front (2) and rear (3) run channels.

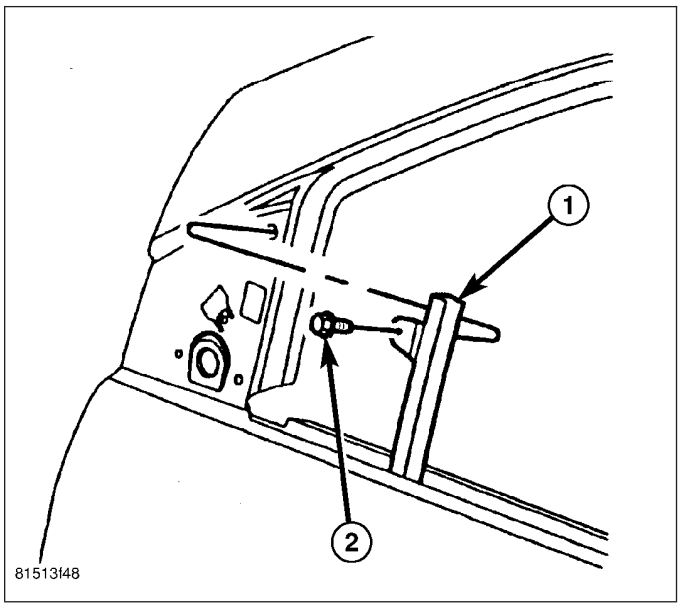


INSTALLATION

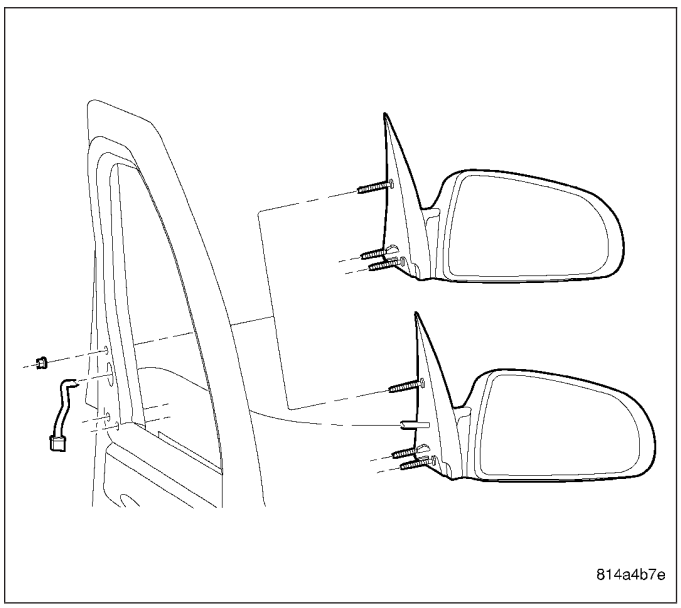
1. Install the rear glass run channel (3) and install the three screws (1).
2. Tighten the screws to 10 N·m (85 in. lbs.).
3. Install the front glass run channel (2) and install the lower screw (1).
4. Tighten the screw to 10 N·m (85 in. lbs.).



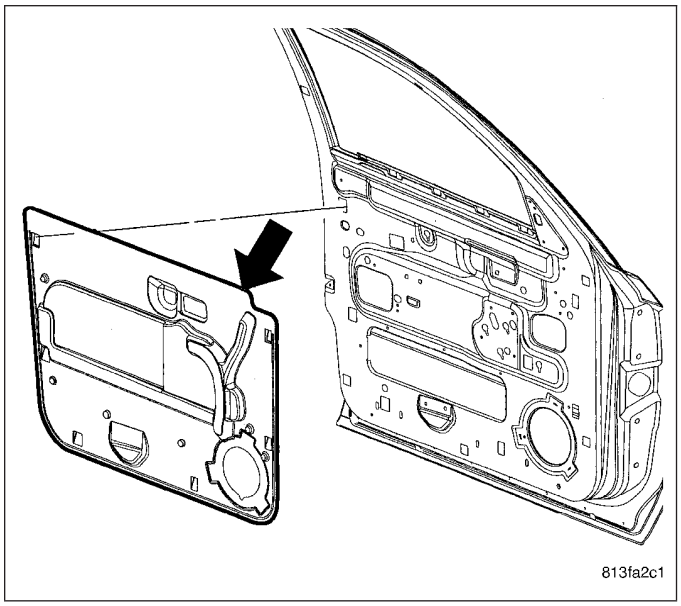
5. Install the upper screw (2) of the front channel (1) under the exterior mirror.



6. Install the outside mirror. (Refer to 23 - BODY/EXTERIOR/SIDE VIEW MIRROR - INSTALLATION)



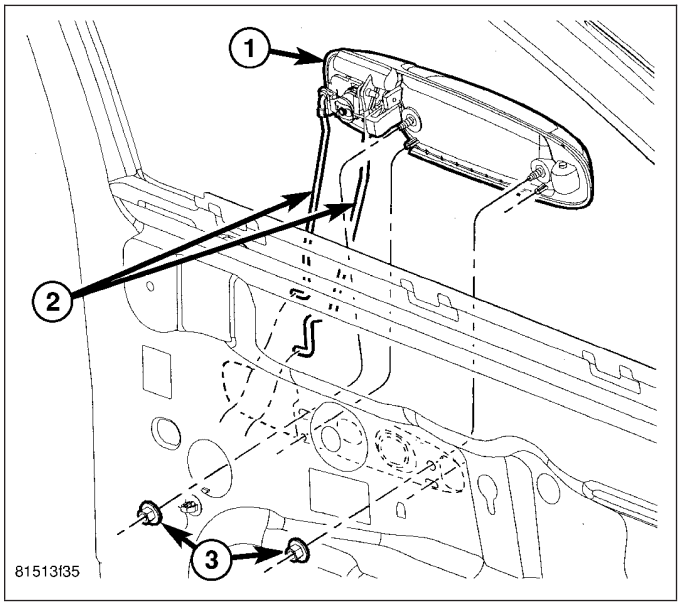
7. Install the watershield. (Refer to 23 - BODY/DOOR - FRONT/WATERSHIELD - INSTALLATION)



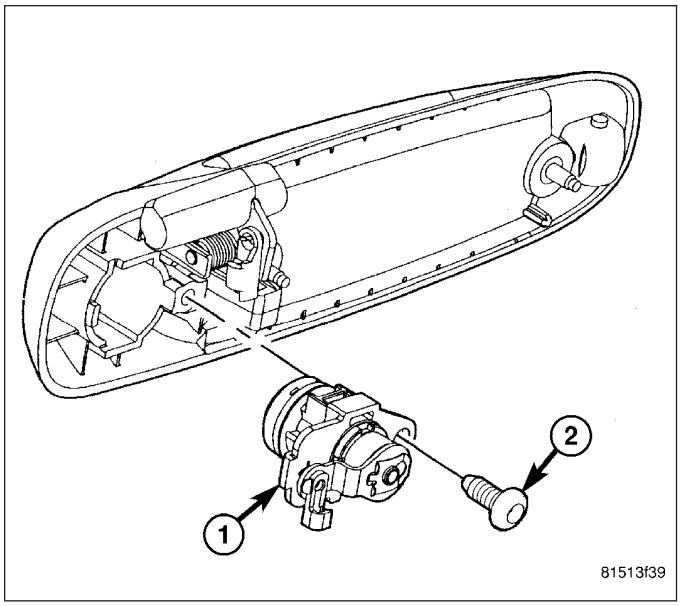
CYLINDER-LOCK

REMOVAL

1. Remove the exterior handle (1). (Refer to 23 - BODY/DOOR - FRONT/EXTERIOR HANDLE - REMOVAL)

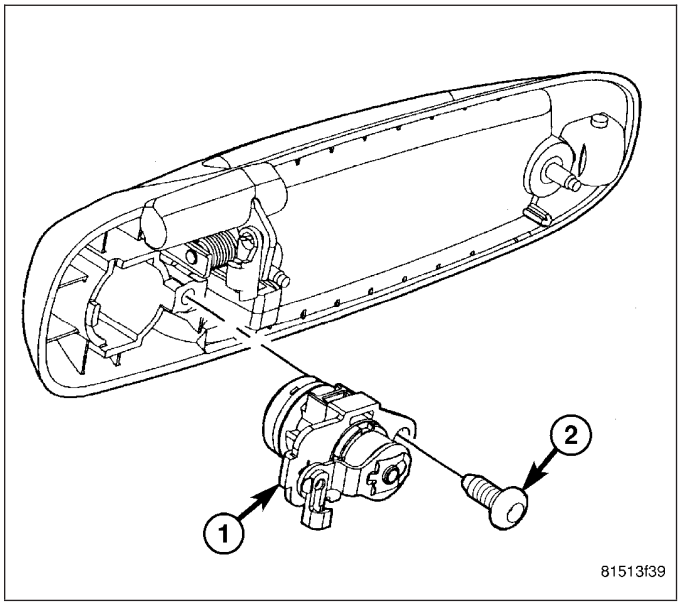


2. Remove the screw (2) and remove the lock cylinder (1).

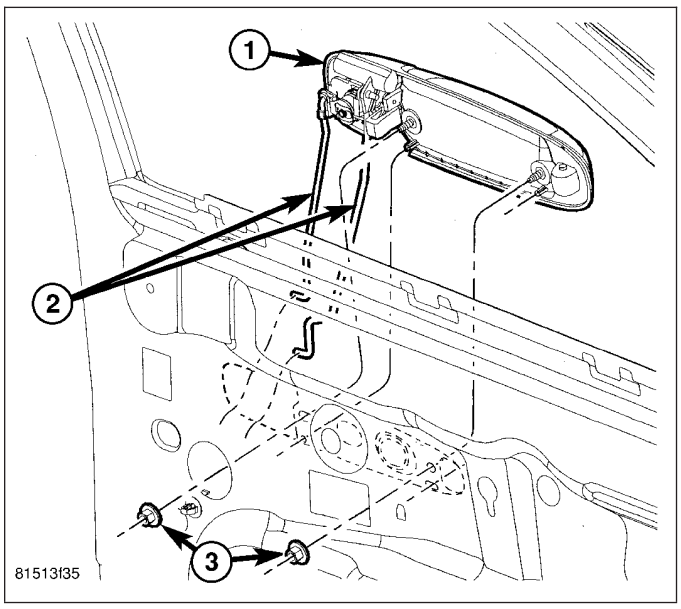


INSTALLATION

1. Install the lock cylinder (1) and install the screw (2).



2. Install the exterior handle (1). (Refer to 23 - BODY/ DOOR - FRONT/EXTERIOR HANDLE - INSTALLATION)



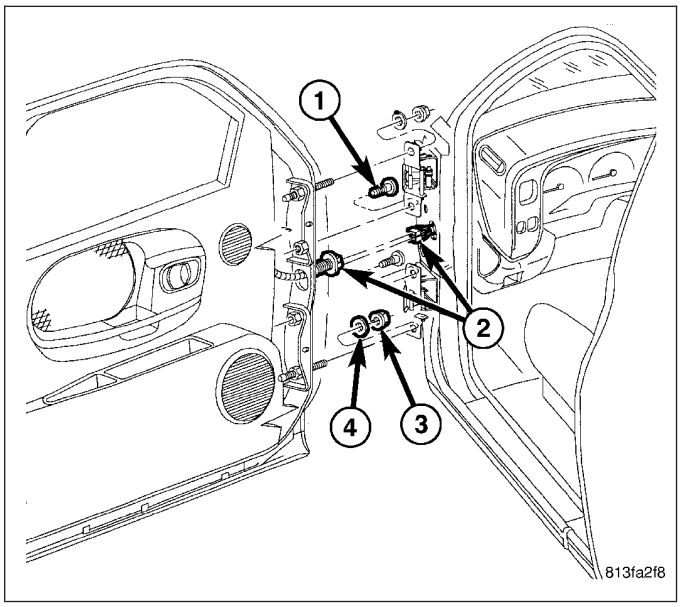
DOOR

REMOVAL

1. Disconnect the door wire harness electrical connector (2) at the a-pillar.
2. Using a grease pencil or equivalent, mark the outline of the door hinges on the door end to aid installation.
3. Support the door with a suitable lifting device.

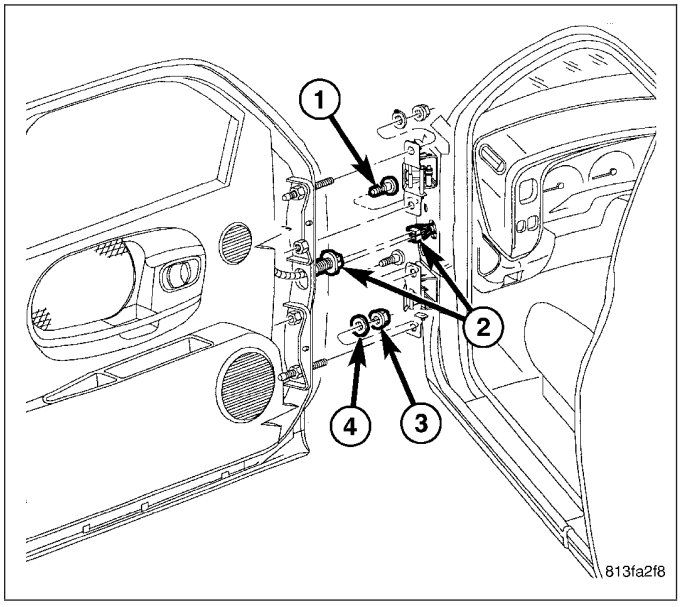
NOTE: The epoxy bonded washers (4) do not need to be separated from the hinges. If the washers are removed, the door may need to be re-adjusted.

4. Remove the nuts (3) and bolts (1) attaching the door hinges to the door.



INSTALLATION

1. Support the door with a suitable lifting device and install the door onto the hinges.
2. Install the washers (4), if they were removed previously, nuts (3) and bolts (1) and tighten to 28 N·m (21 ft. lbs.).
3. Connect the electrical connectors (2).
4. Adjust the door as necessary. (Refer to 23 - BODY/ DOOR - FRONT/DOOR - ADJUSTMENTS)



ADJUSTMENTS

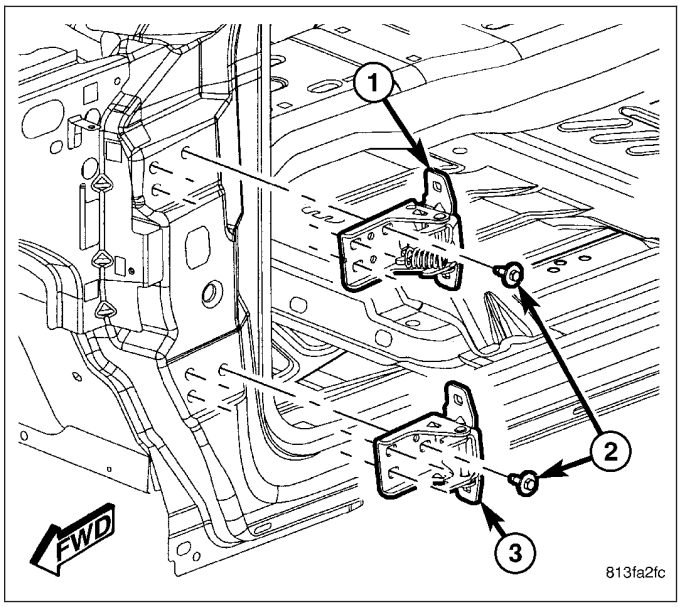
NOTE: It is recommended that you adjust the rear door before adjusting the front door. (Refer to 23 - BODY/ DOORS - REAR/DOOR - ADJUSTMENTS)

- **Door adjustment measurements should be taken from stationary or welded body panels like the roof, rocker or quarter panels.**
- **During adjustment procedures, it is recommended that all the hinge fasteners be loosened except for the upper most fasteners. Adjustments can be made using the upper bolts to hold the door with final torque of the fasteners occurring after correct door positioning is achieved.**
- **A suitable body sealant should be used when removing or moving the hinges.**

FORE/AFT

NOTE: Fore/aft (lateral) door adjustment is done by loosening the hinge to the hinge pillar fasteners one hinge at a time and moving the door to the correct position.

1. Support the door with a suitable lifting device.
2. Loosen the upper and lower hinge to hinge pillar fasteners (2). (Refer to 23 - BODY/DOOR - FRONT/HINGE - REMOVAL)
3. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
4. Tighten the hinge bolts (2) to hinge pillar to 28 N·m (21 ft. lbs.).



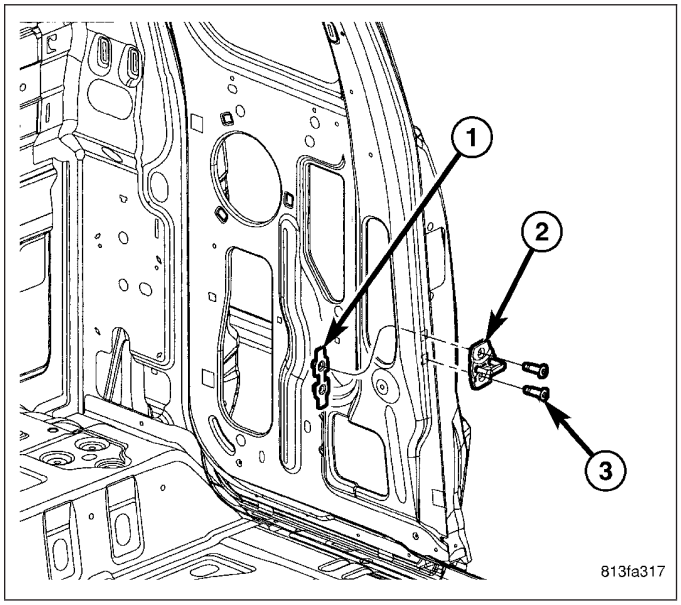
UP/DOWN

NOTE: Up/down door adjustment is done by loosening either the hinge to the hinge pillar fasteners or the hinge to door fasteners and moving the door to the correct position.

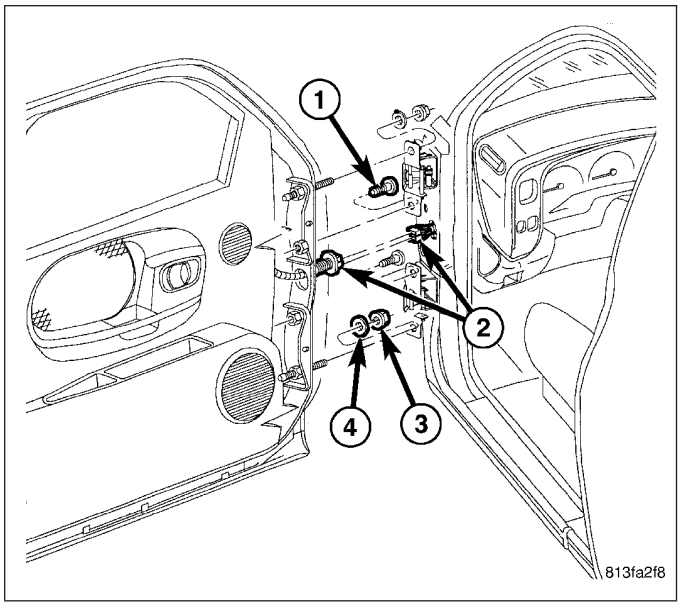
NOTE: When adjustment of the door requires the loosening of the door to hinge fasteners, it will be necessary to separate the epoxy bonded washers with a chisel or other suitable tool.

NOTE: When the up/down adjustments are done correctly, the top of the door is positioned over flush to the roof. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)

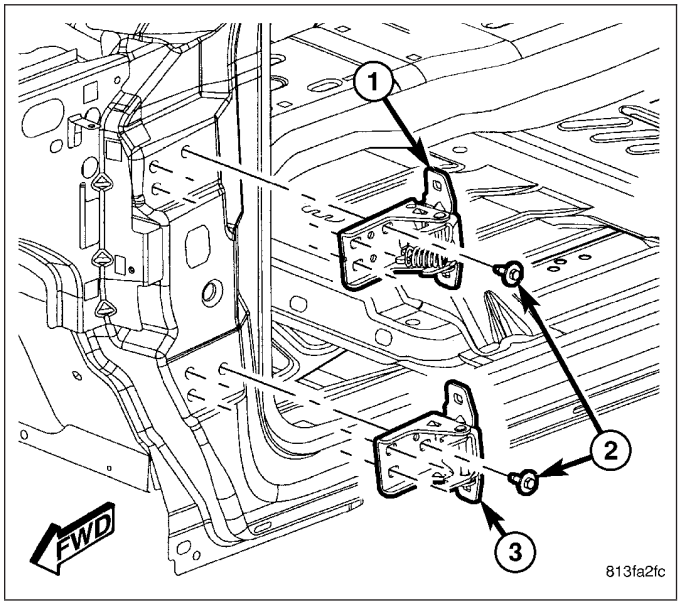
1. Support the door with a suitable lifting device.
2. Loosen the latch striker bolts (3). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)



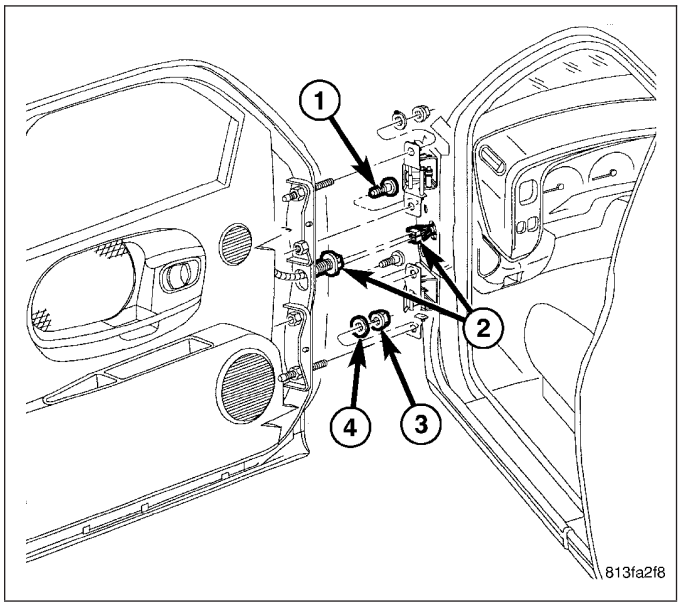
3. If necessary, Loosen the hinge to door fasteners (1) and (3). (Refer to 23 - BODY/DOOR - FRONT/ DOOR - REMOVAL)



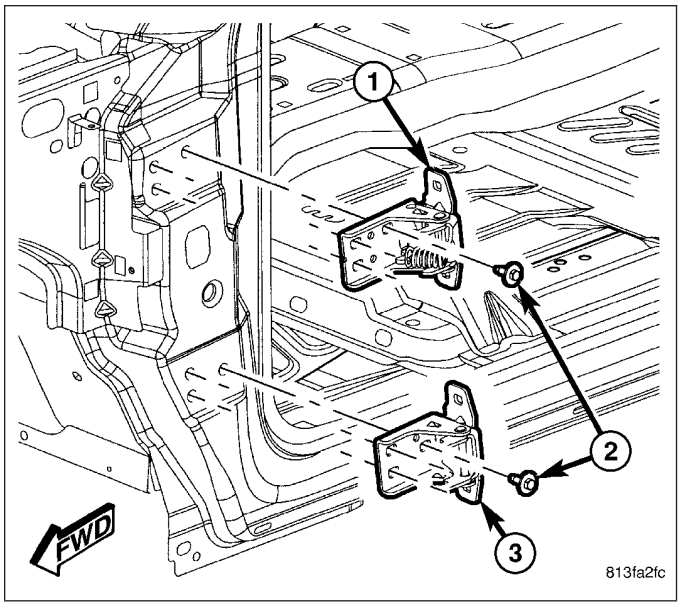
4. If necessary, loosen the hinge to hinge pillar fasteners (2). (Refer to 23 - BODY/DOOR - FRONT/ HINGE - REMOVAL)



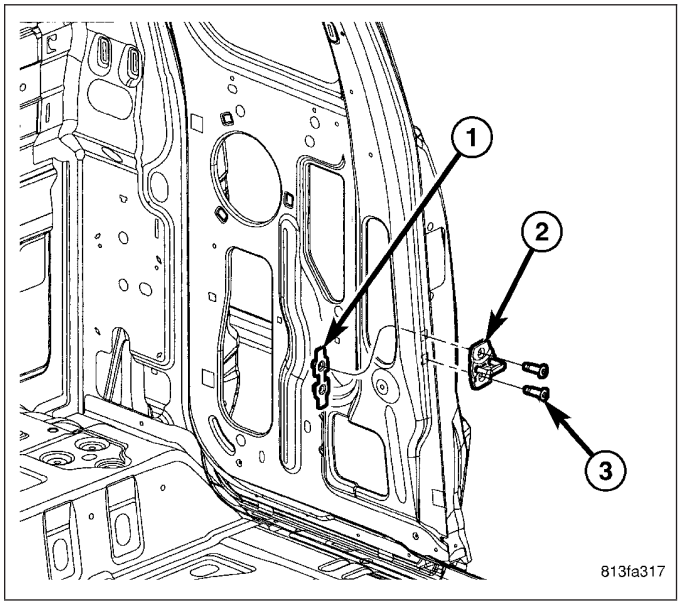
5. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
6. Tighten the door to hinges fasteners to 23 N·m (17 ft. lbs.).



7. Tighten the hinge bolts (2) to hinge pillar to 28 N·m (21 ft. lbs.).



8. Tighten the latch striker bolts (3). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - INSTALLATION)

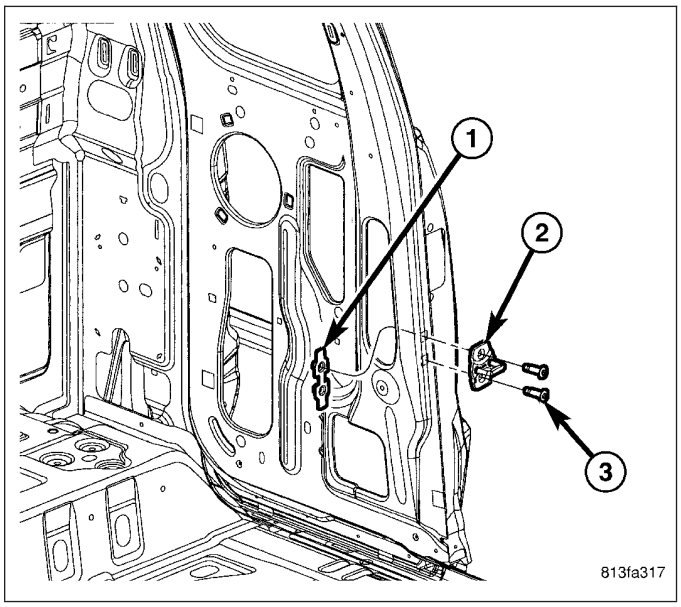


IN/OUT

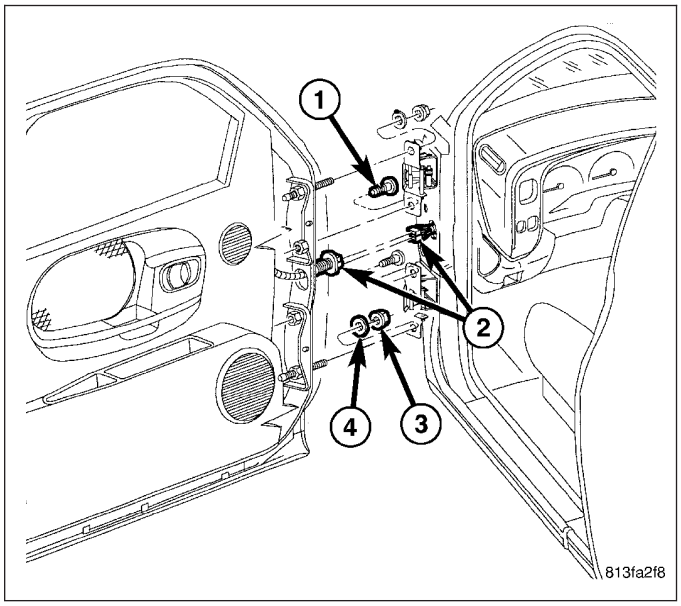
NOTE: In/out door adjustment is done by loosening the hinge to door fasteners one hinge at a time and moving the door to the correct position.

NOTE: When adjustment of the door requires the loosening of the door to hinge fasteners, it will be necessary to separate the epoxy bonded washers with a chisel or other suitable tool.

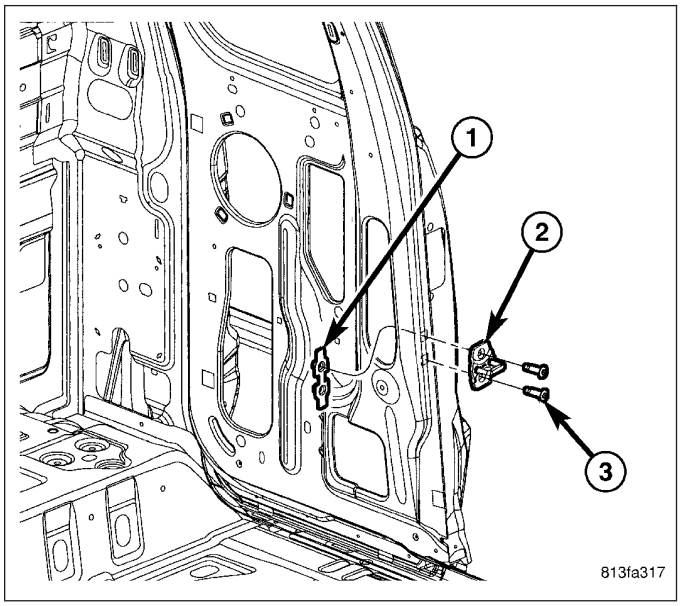
1. Support the door with a suitable lifting device.
2. Loosen the latch striker bolts (3). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)



3. Loosen the hinge to door fasteners (1 & 3). (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)
4. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. Tighten the door to hinges fasteners to 23 N·m (17 ft. lbs.).



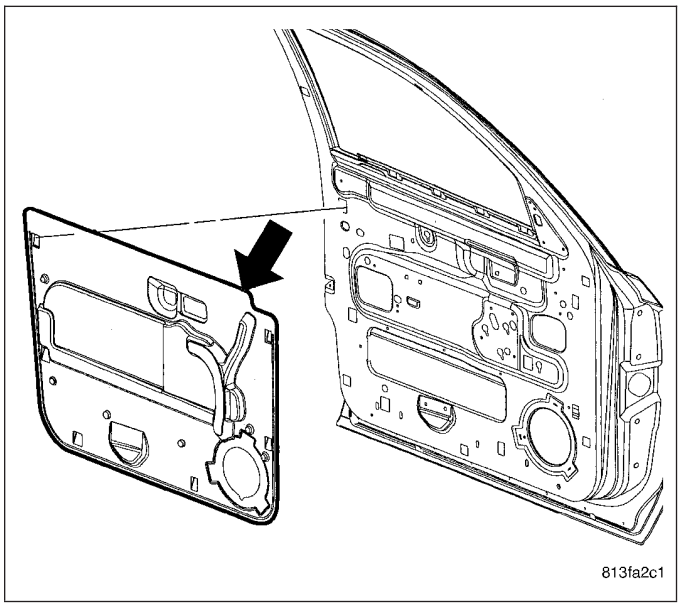
6. Tighten the latch striker bolts (3). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - INSTALLATION)



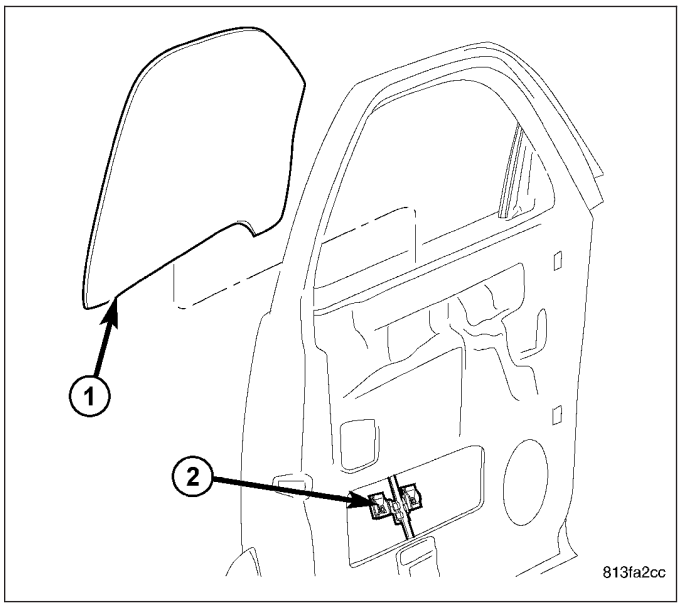
GLASS

REMOVAL

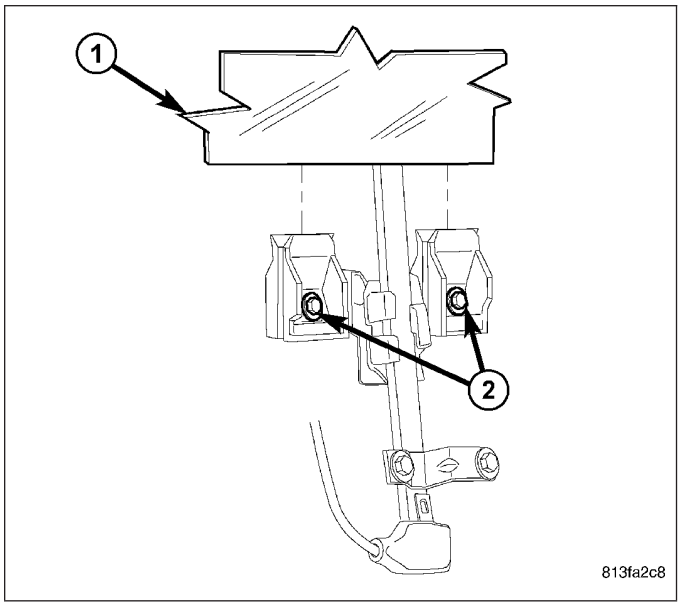
1. Remove the watershield. (Refer to 23 - BODY/ DOOR - FRONT/WATERSHIELD - REMOVAL)



2. Temporarily install the window switch or window handle and position the glass (1) to gain access to the glass clamp screws (4).

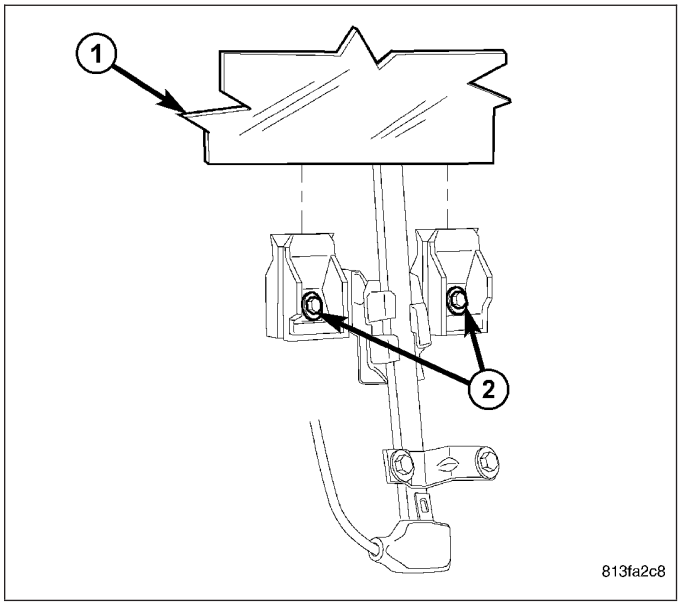


3. Loosen the glass clamp screws (2) and carefully remove the glass (1) from the door.

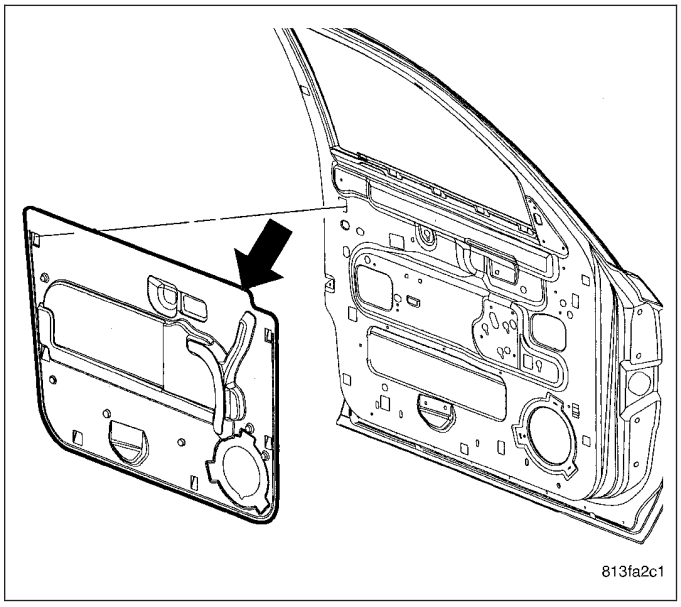


INSTALLATION

1. Install the glass into the door and position the glass (1) into the glass clamps.
2. Temporarily install the window crank handle or window switches and raise the glass into the full up position.
3. Tighten the glass clamp screws (2) securely.



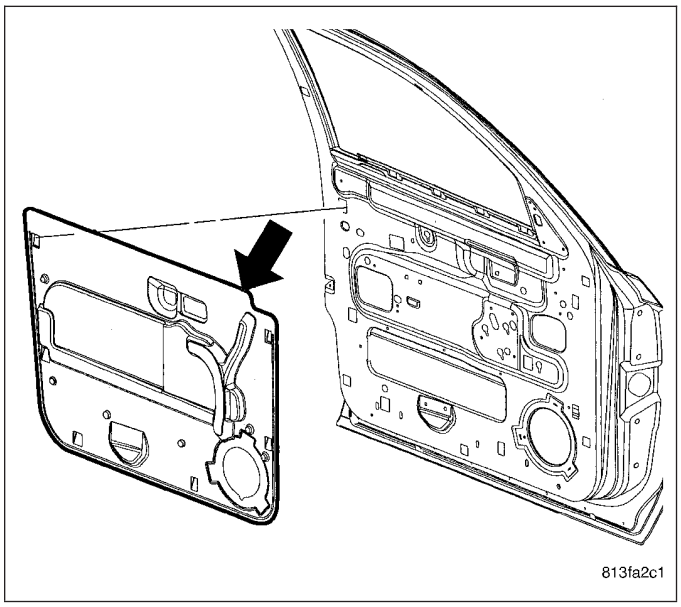
4. Remove the manual window crank or window switches, and install the watershield. (Refer to 23 - BODY/DOOR - FRONT/WATERSHIELD - INSTALLATION)



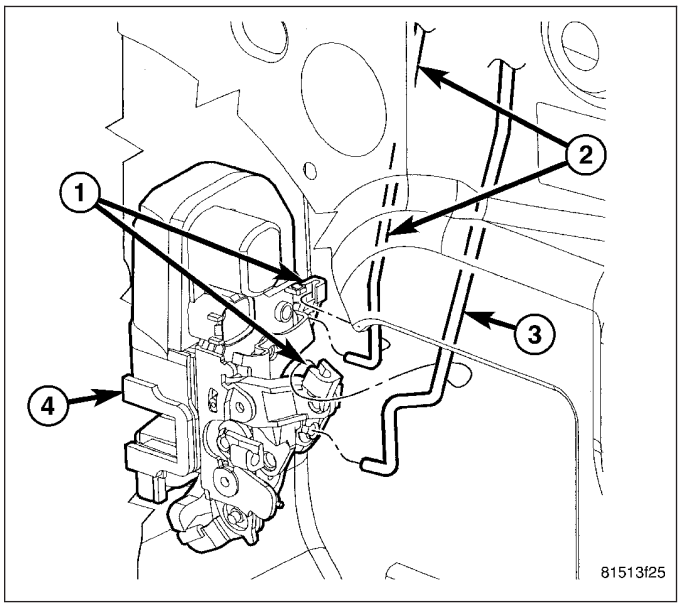
HANDLE-EXTERIOR

REMOVAL

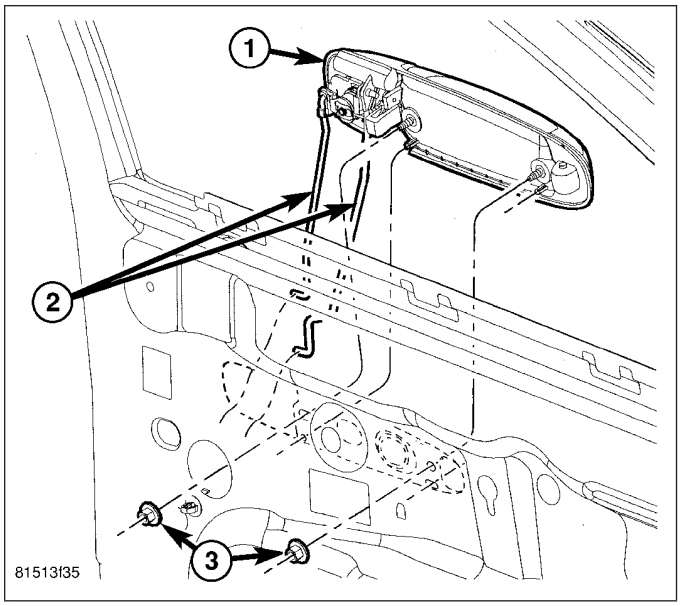
1. Remove the watershield. (Refer to 23 - BODY/ DOOR - FRONT/WATERSHIELD - REMOVAL)



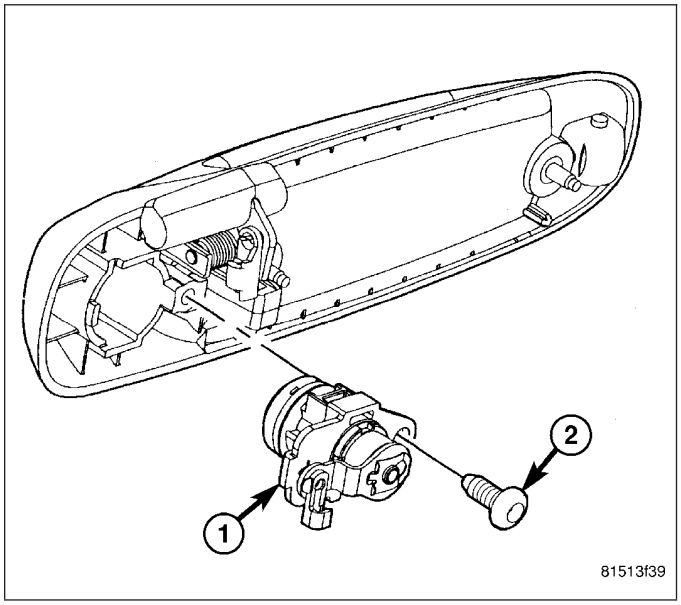
2. Separate the clips (1) and disconnect the lock cylinder (2) and exterior handle (3) links from the latch (4).



3. Remove the nuts (3), the handle (1) and disconnect the electrical connector, if equipped.
4. Separate the clips and remove the links (2).

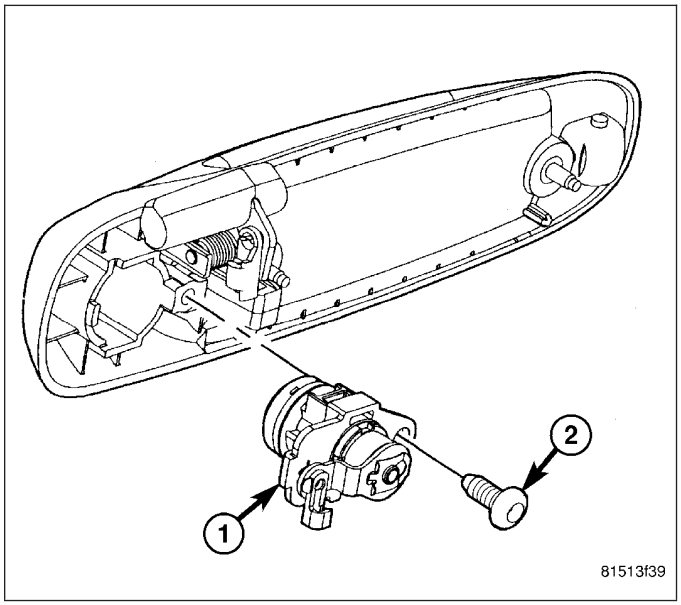


5. Remove the lock cylinder (1), if equipped. (Refer to 23 - BODY/DOOR - FRONT/LOCK CYLINDER - REMOVAL)

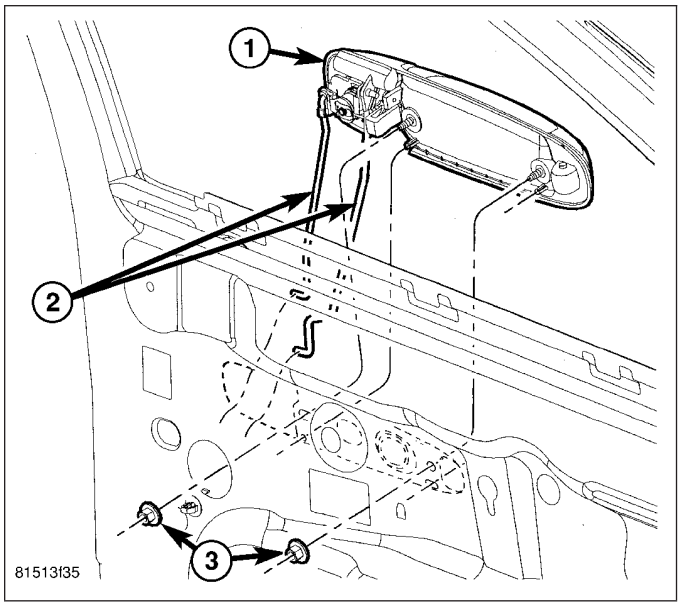


INSTALLATION

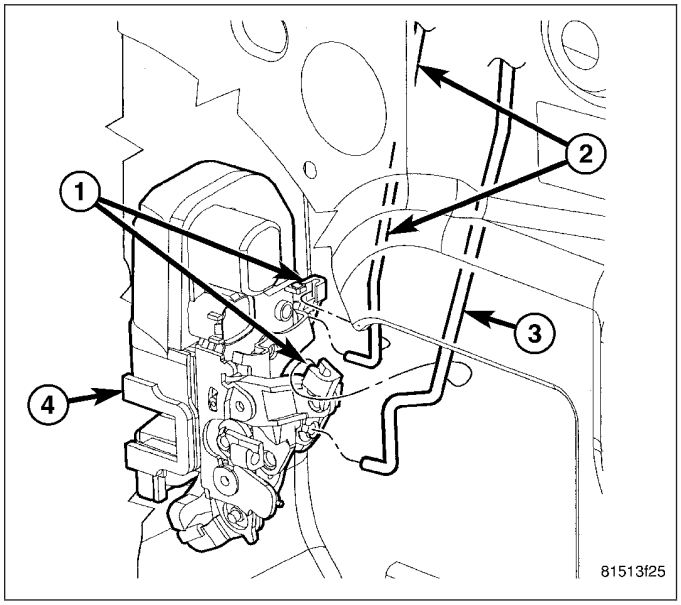
1. Install the lock cylinder (1), if equipped. (Refer to 23 - BODY/DOOR - FRONT/LOCK CYLINDER - INSTALLATION)



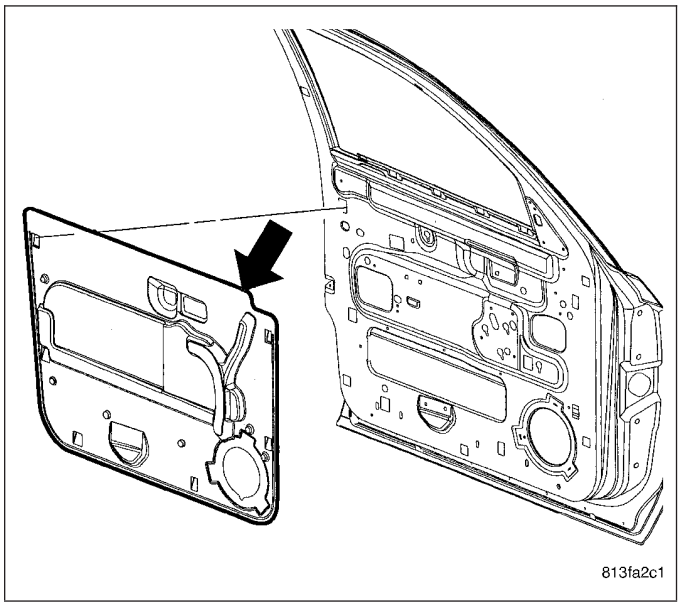
2. Install the links (2) into the clips on the handle.
3. Connect the electrical connector, if equipped, install the nuts (3) and tighten to 4 N·m (38 in. lbs.).



4. Connect the outside handle (3) and lock cylinder (2) links to the latch (4).



5. Install the watershield. (Refer to 23 - BODY/DOOR - FRONT/WATERSHIELD - INSTALLATION) (Refer to 23 - BODY/DOOR - FRONT/WATERSHIELD - INSTALLATION)
6. Adjust the latch as needed. (Refer to 23 - BODY/DOOR - FRONT/LATCH - ADJUSTMENTS)

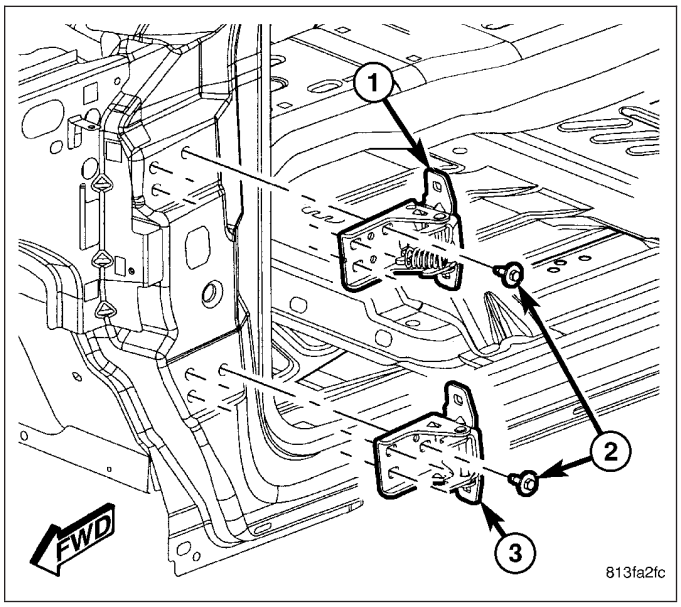


HINGE

REMOVAL

NOTE: A suitable body sealant should be used when removing or moving the hinges.

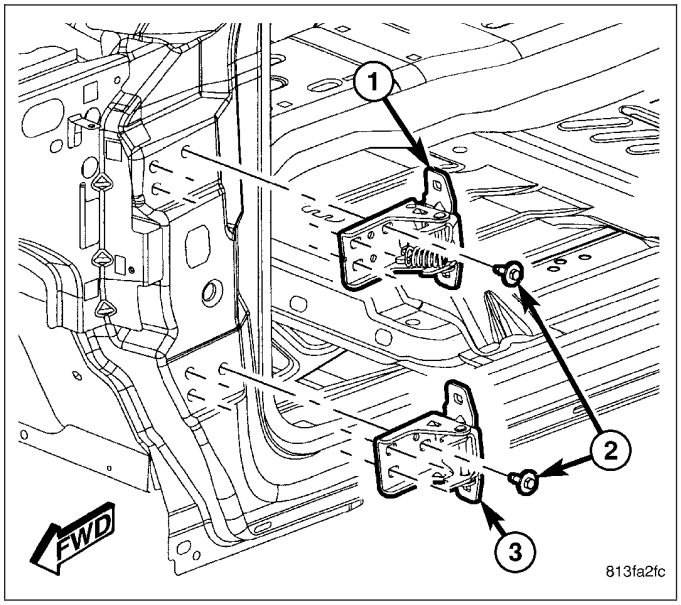
1. Remove the door. (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)
2. Using a grease pencil or equivalent, mark the outline of the door hinges on a-pillar end to aid installation.
3. Remove the bolts (2) and remove the hinge (2 or 4).



INSTALLATION

NOTE: A suitable body sealant should be used when removing or moving the hinges.

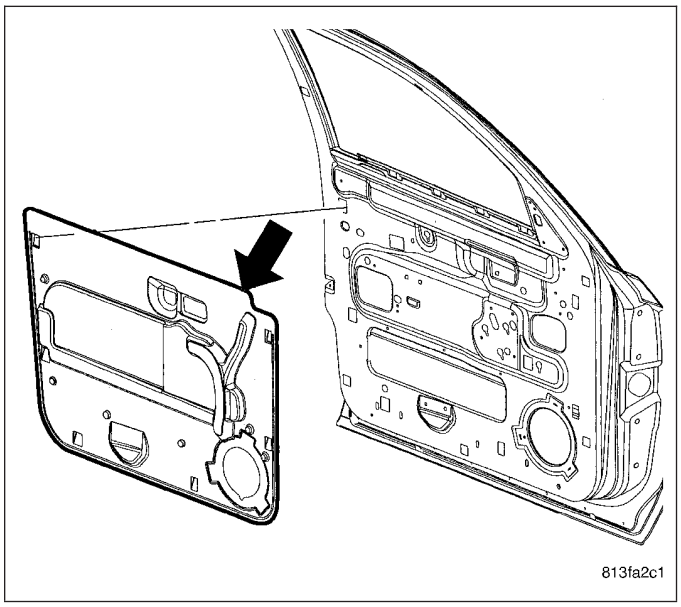
1. If necessary, paint replacement door hinge before installation.
2. Position door hinge (1 or 2) on hinge pillar using the marks made during removal and install the bolts (2).
3. Tighten the bolts to 28 N·m (21 ft. lbs.).
4. Install the door. (Refer to 23 - BODY/DOOR - FRONT/DOOR - INSTALLATION)



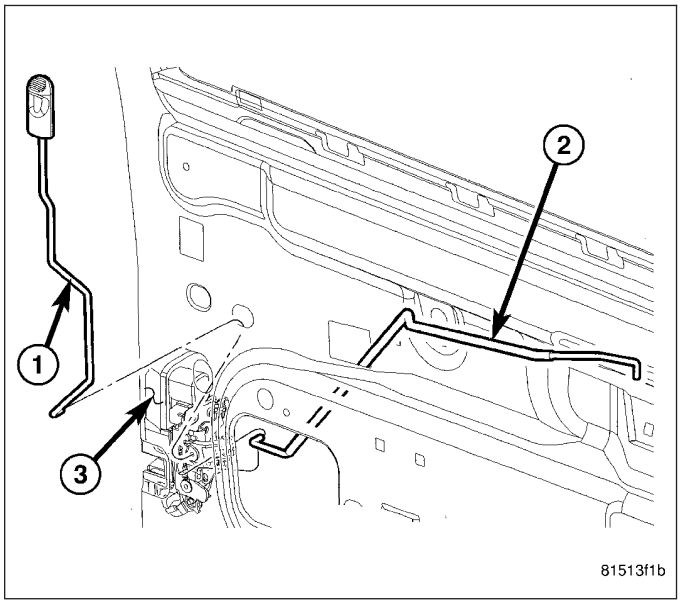
LATCH

REMOVAL

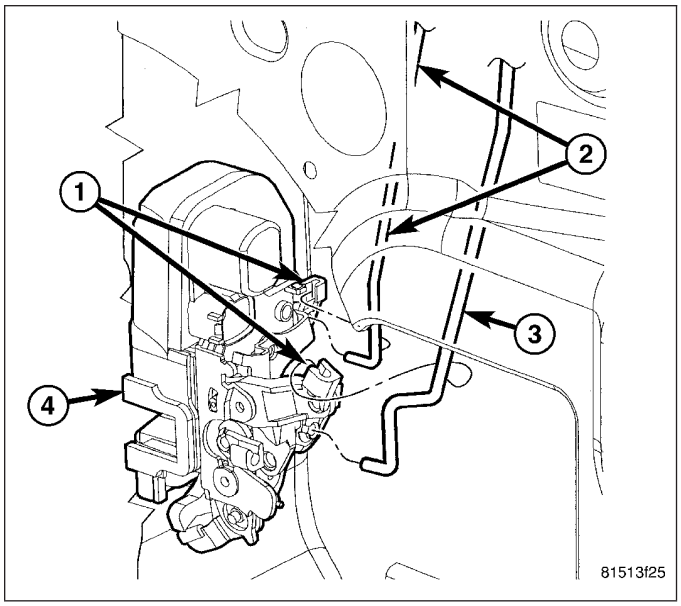
1. Remove the watershield. (Refer to 23 - BODY/ DOOR - FRONT/WATERSHIELD - REMOVAL)



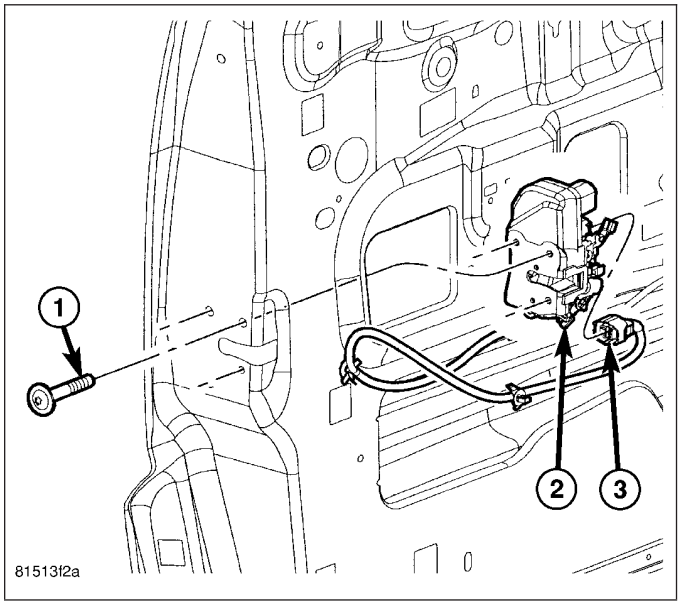
2. Disconnect the lock knob (1) and inside handle(2) links.



3. Disconnect the lock cylinder (2) and exterior handle (3) links.

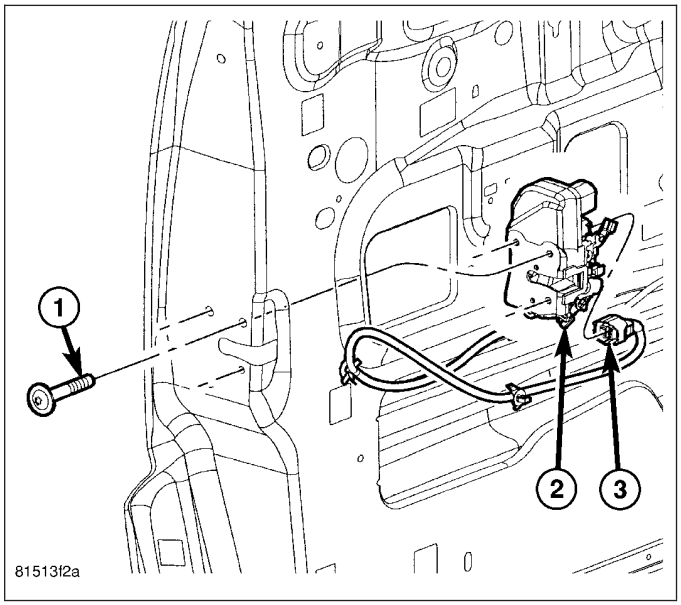


4. Remove the latch screws (1).
5. Disconnect the electrical connector (3).

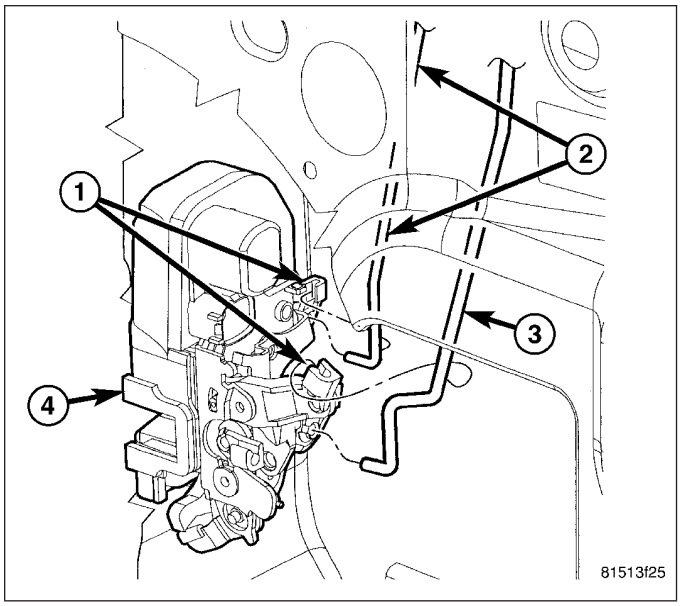


INSTALLATION

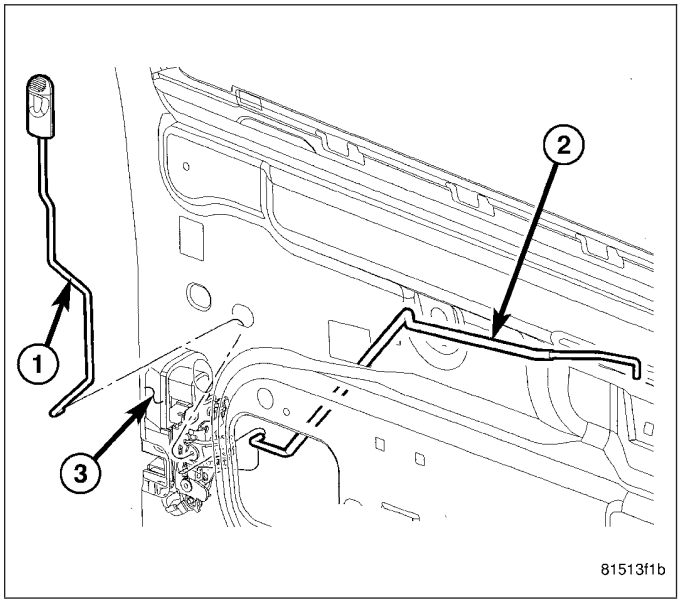
1. Install the latch (2) into the door.
2. Connect the electrical connectors (3).
3. Install the screws (1) and tighten to 10 N·m (85 in. lbs.).



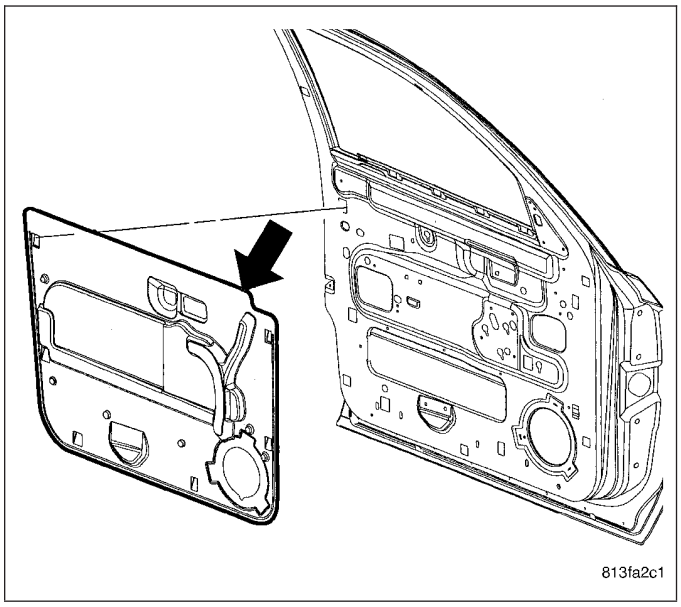
4. Connect the outside handle (3) and lock cylinder (2) links.



5. Connect the lock knob (1) and the inside handle (2) links.



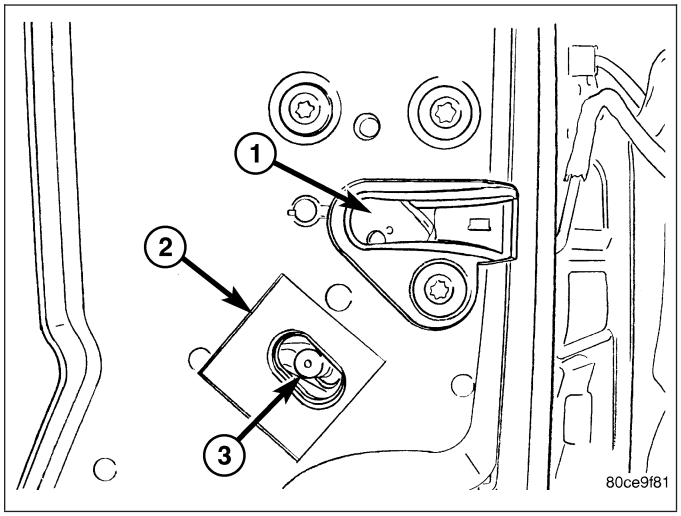
6. Install the watershield. (Refer to 23 - BODY/DOOR - FRONT/WATERSHIELD - INSTALLATION) (Refer to 23 - BODY/DOOR - FRONT/WATERSHIELD - INSTALLATION)
7. Adjust the latch as needed. (Refer to 23 - BODY/DOOR - FRONT/LATCH - ADJUSTMENTS)



ADJUSTMENTS

ADJUSTMENT

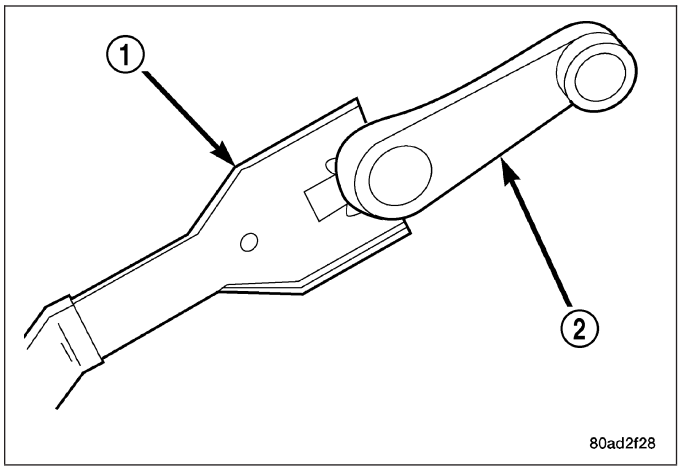
1. Locate access hole (3) and remove the trim plug covering it.
2. Insert a 5/32-inch hex-wrench through hole and into adjustment screw. Loosen screw.
3. Operate outside handle several times to release any restriction because of mis-alignment.
4. Tighten adjustment screw to 3 N·m (30 in. lbs.).
5. Test handle for proper operation.



PANEL-TRIM

REMOVAL

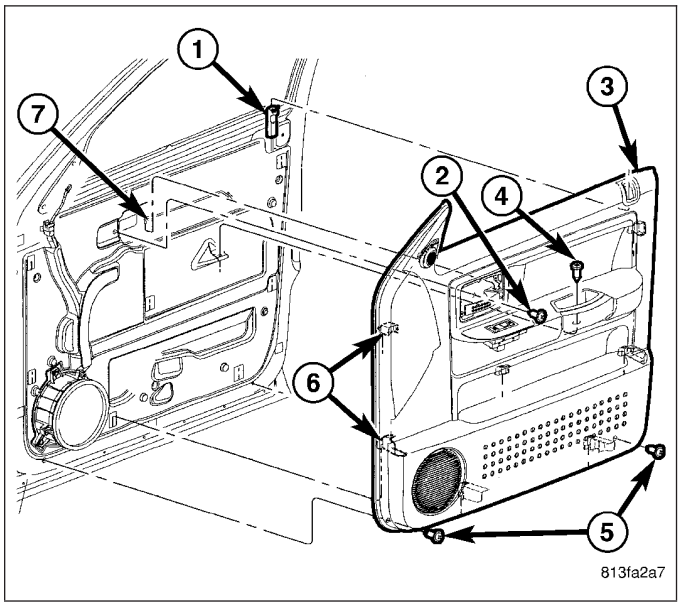
1. If equipped, remove the manual window crank (2) using a window crank removal tool (1).



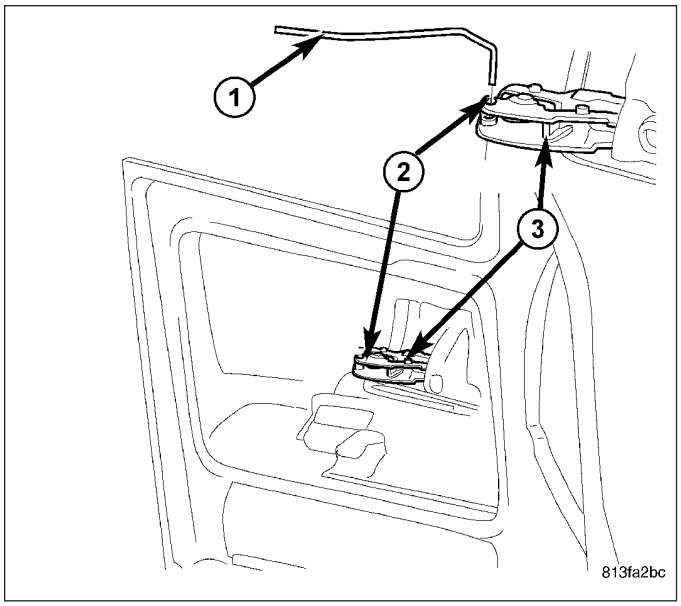
2. Disconnect and isolate battery negative cable.
3. Remove the screw (2) at the interior handle.
4. Remove the screw (4) from the pull cup.
5. Remove the lower screws (5).

CAUTION: The door trim panel is attached to the door by molded plastic retaining clips that are integral to the door trim panel. Do not pull the door trim panel directly off of the door or damage to the trim panel and/or the power switch assembly will occur.

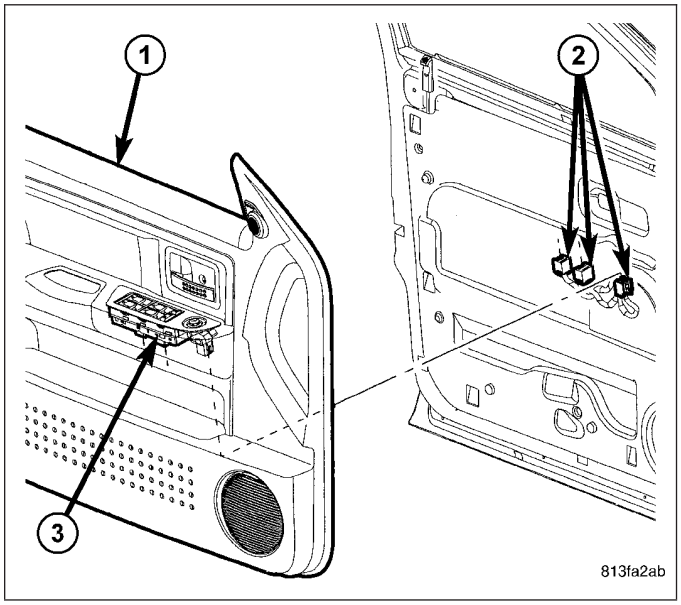
6. Lift the door trim panel straight upward to disconnect the molded plastic retaining clips (6) from the door.



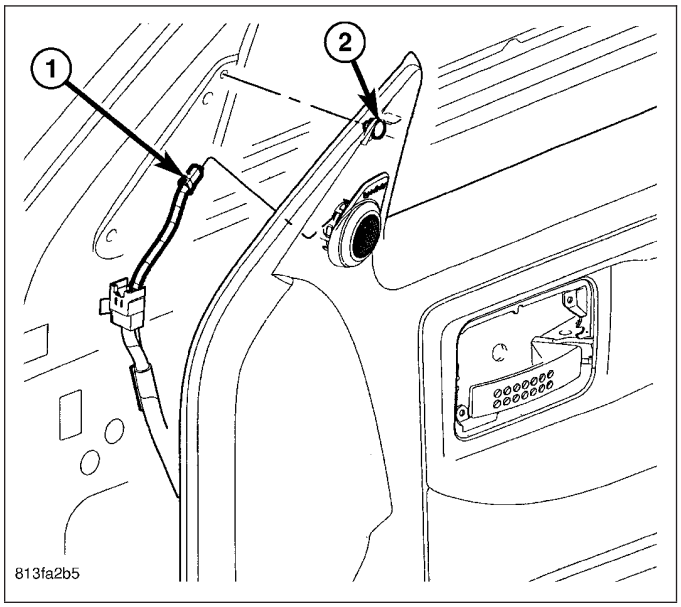
7. Disconnect the interior handle (3) actuator rod (1) from the handle (2).



8. Disconnect the electrical connectors (2) for the window switch assembly (3), if equipped.

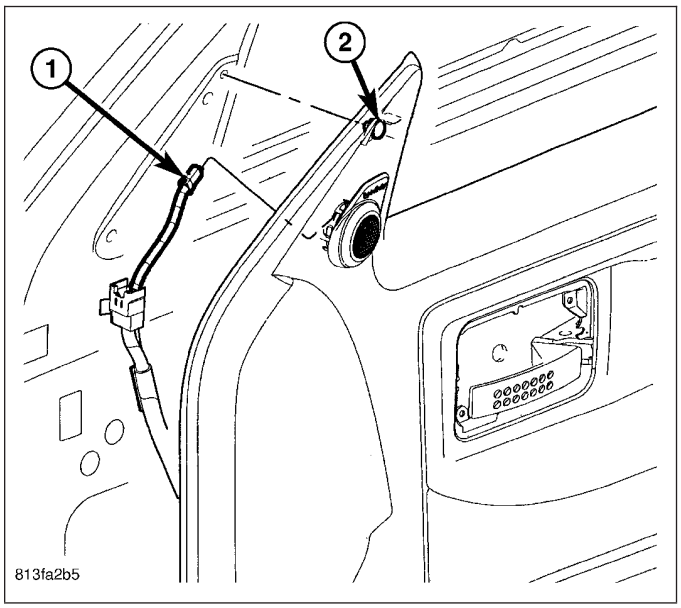


9. Disconnect the trim panel speaker electrical connector (1), if equipped.

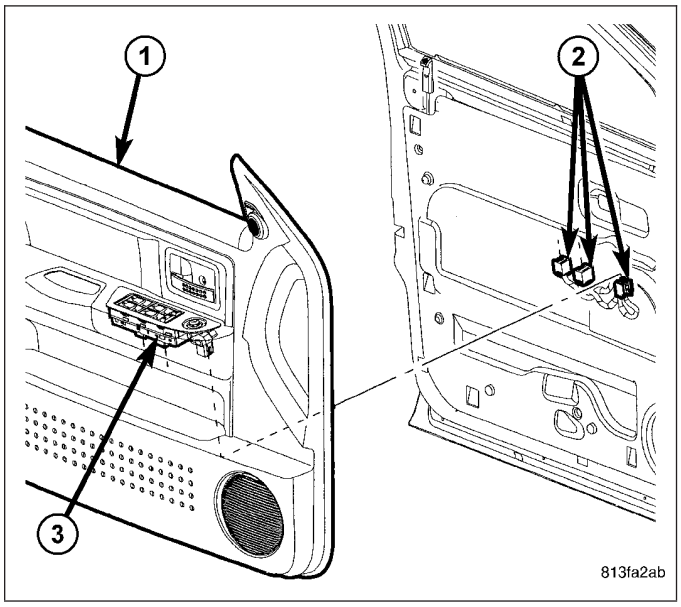


INSTALLATION

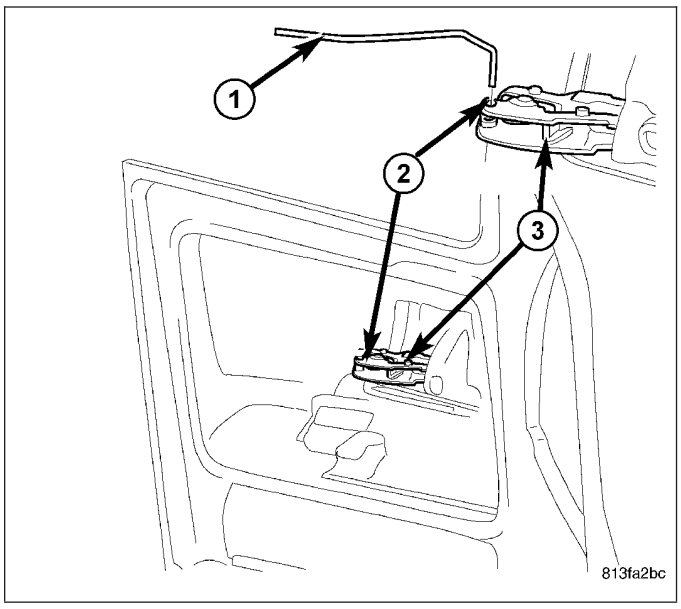
1. Connect the trim panel speaker electrical connector (1), if equipped.



2. Connect the electrical connectors (2) for the window switch assembly (3), if equipped.

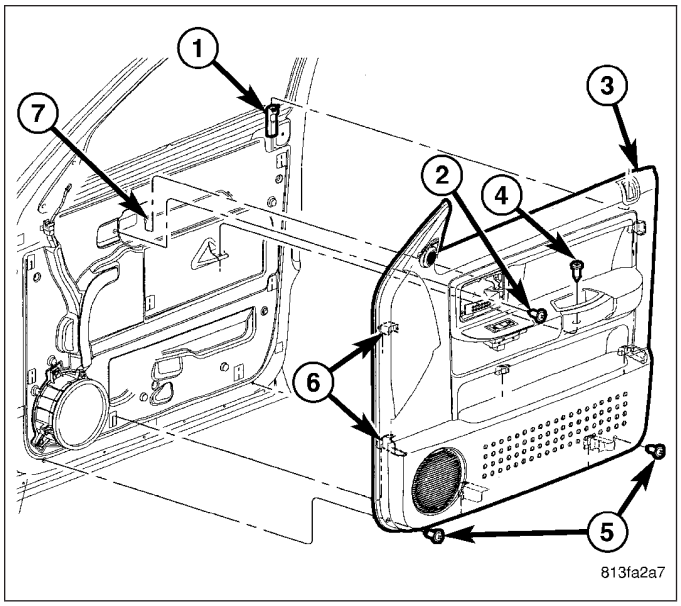


3. Connect the interior handle (3) actuator rod (1) to the handle (2).

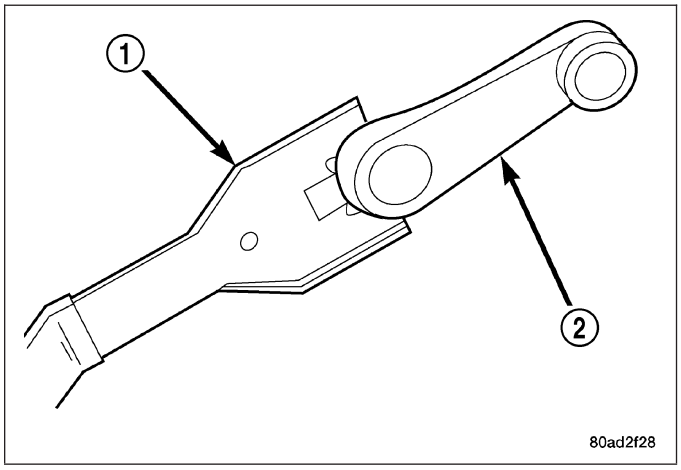


CAUTION: The door trim panel is attached to the door by molded plastic retaining clips that are integral to the door trim panel. Do not pull the door trim panel directly off of the door or damage to the trim panel and/or the power switch assembly will occur.

4. Position the door trim panel (3) and align the molded plastic retaining clips (6) to the door.
5. Lift the trim panel up and onto the lock rod (1) and attachment hooks (6).
6. Push the door trim panel straight downward until all of the retaining clips are fully engaged to the door.
7. Install the lower screws (5).
8. Install the screw (4) from the pull cup.
9. Install the screw (2) at the interior handle.



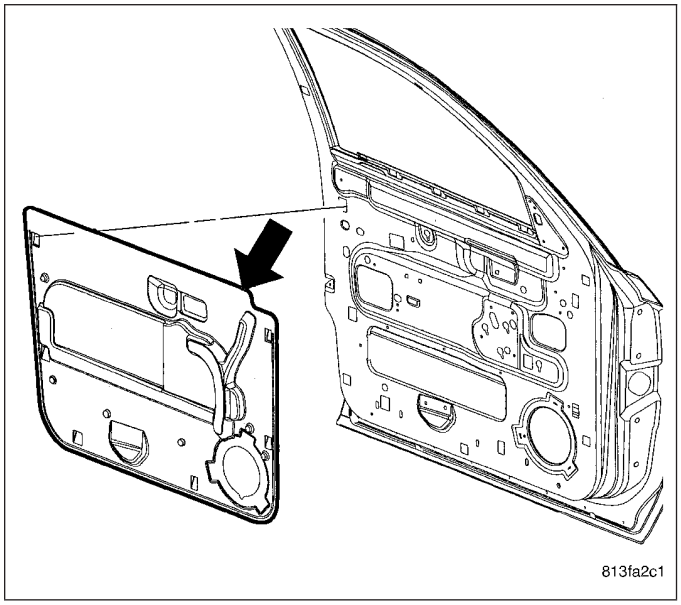
10. Install the manual window crank handle (2), if equipped.
11. Connect battery negative cable.



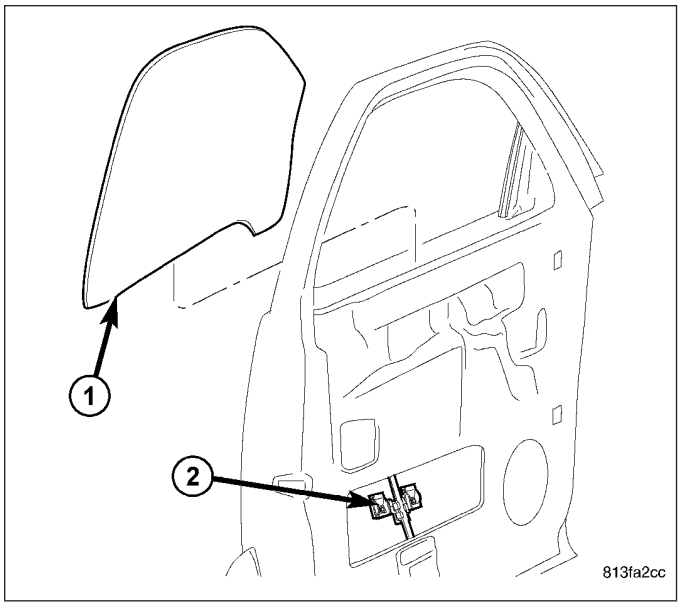
REGULATOR-WINDOW - MANUAL

REMOVAL

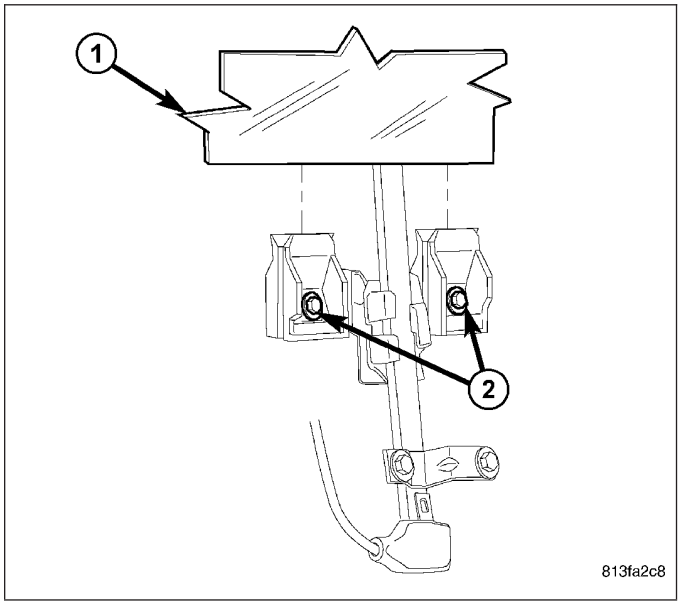
1. Remove the watershield. (Refer to 23 - BODY/ DOOR - FRONT/WATERSHIELD - REMOVAL)



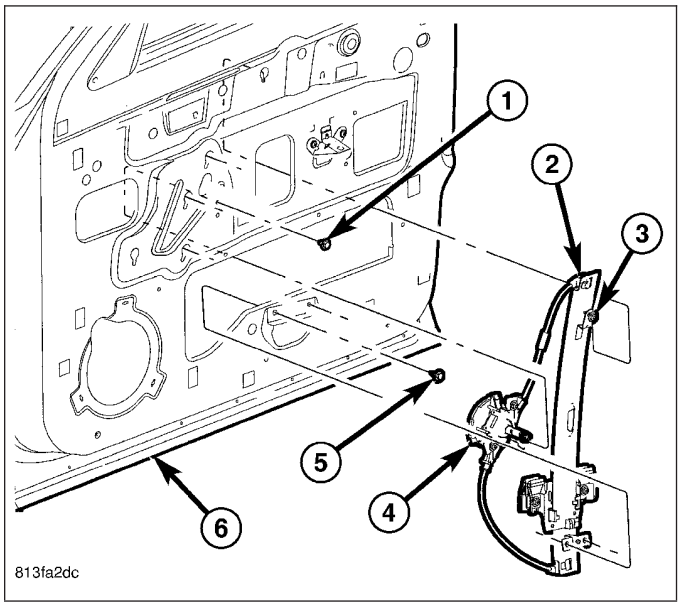
2. Reinstall the manual window crank and raise the door glass to the position shown (2).



3. Loosen the glass clamp screws (2).
4. Raise the glass into the full up position and secure into place with tape or equivalent.

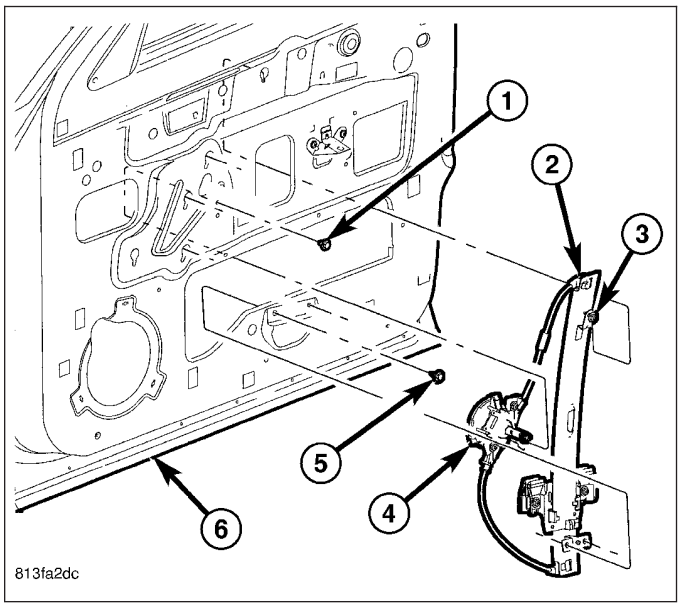


5. Remove the two lower regulator bolts (5).
6. Remove the one bolt (1) at the crank mechanism (4).
7. Loosen the remaining three regulator bolts (3) located at the keyhole slots.
8. Lift regulator up and out of the keyhole slots and remove from door.

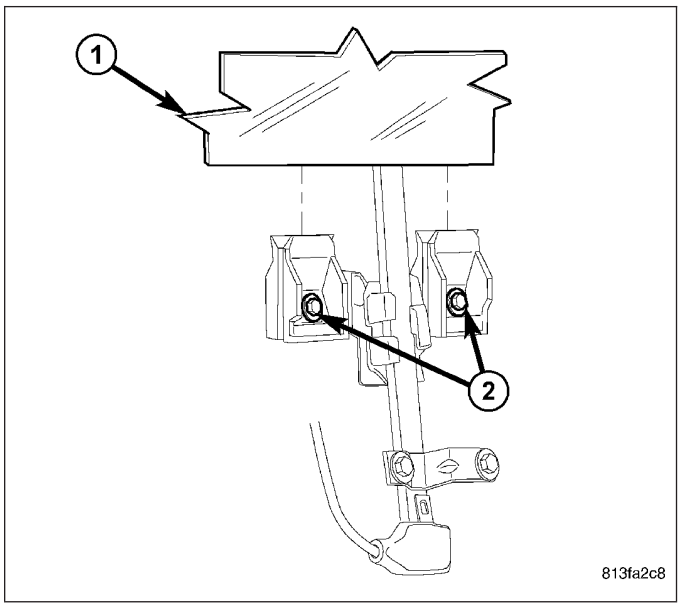


INSTALLATION

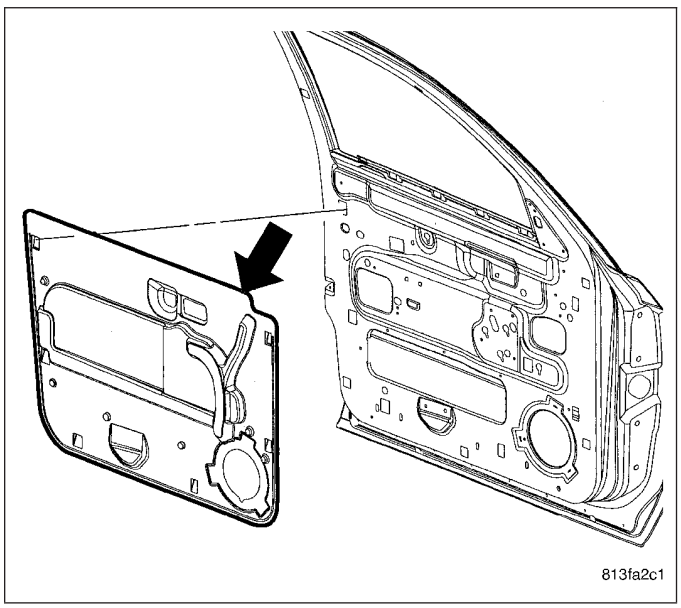
1. Place the regulator into the door and engage the bolts (5 and 3) into the keyhole slots in the door.
2. Install the regulator mechanism bolt (1).
3. Install the two lower bolts (5).
4. Tighten all the regulator bolts to 10 N·m (85 in. lbs.).



5. Remove the tape used to secure the glass during removal and position the glass (1) into the glass clamps.
6. Temporarily install the window crank handle and raise the glass into the full up position.
7. Tighten the glass clamp screws (2) securely.



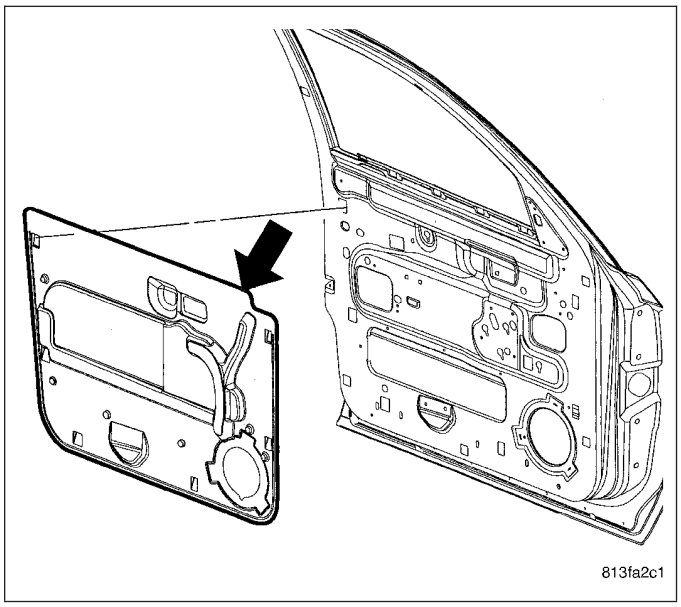
8. Remove the manual window crank and install the watershield. (Refer to 23 - BODY/DOOR - FRONT/ WATERSHIELD - INSTALLATION)



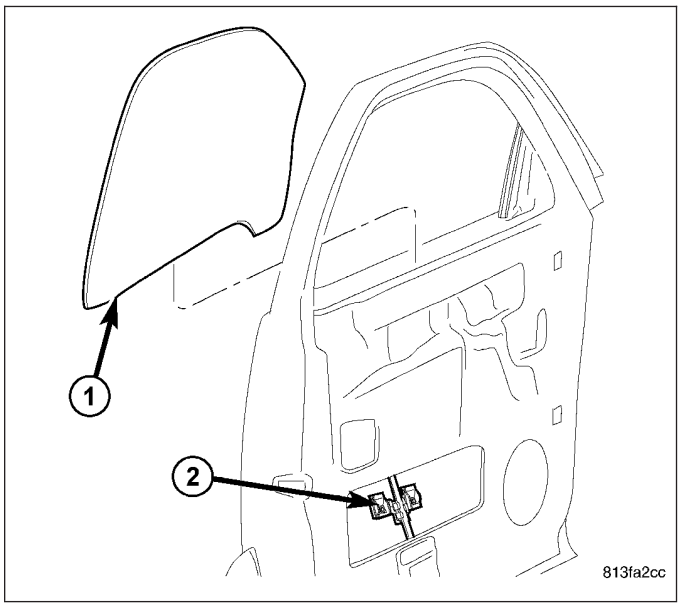
REGULATOR-WINDOW - POWER

REMOVAL

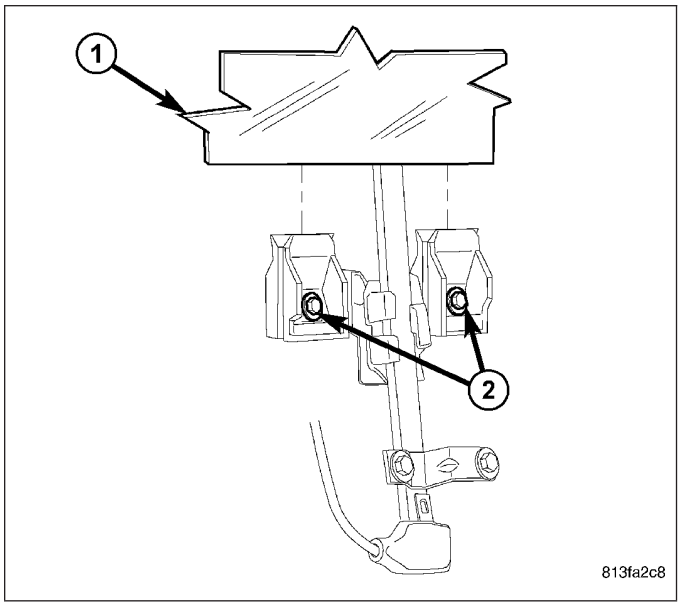
1. Remove the watershield. (Refer to 23 - BODY/ DOOR - FRONT/WATERSHIELD - REMOVAL)



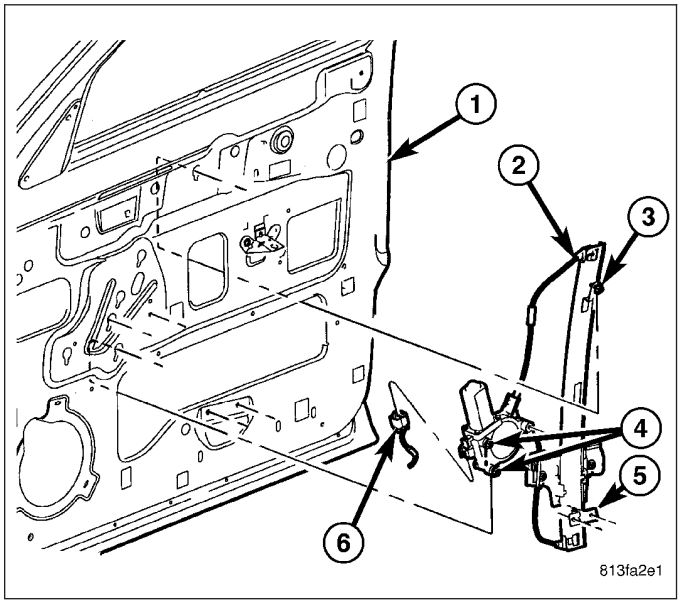
2. Temporarily install the window switch and position the glass (1) to gain access to the glass clamp screws(4).



3. Loosen the glass clamp screws (2).
4. Raise the glass into the full up position and secure into place with tape or equivalent.

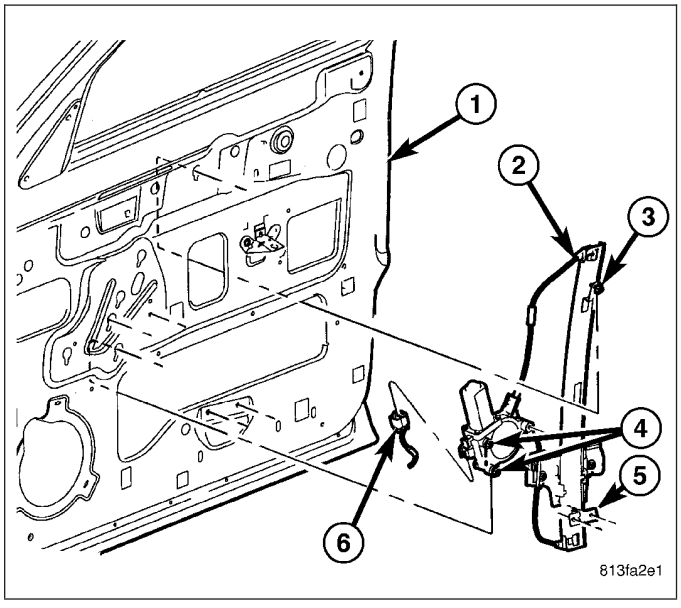


5. Disconnect the electrical connector (6).
6. Remove the two lower regulator bolts (5).
7. Remove the one bolt at the motor.
8. Loosen the remaining three regulator bolts (3 and 4) located at the keyhole slots.
9. Lift regulator up and out of the keyhole slots and remove from door.

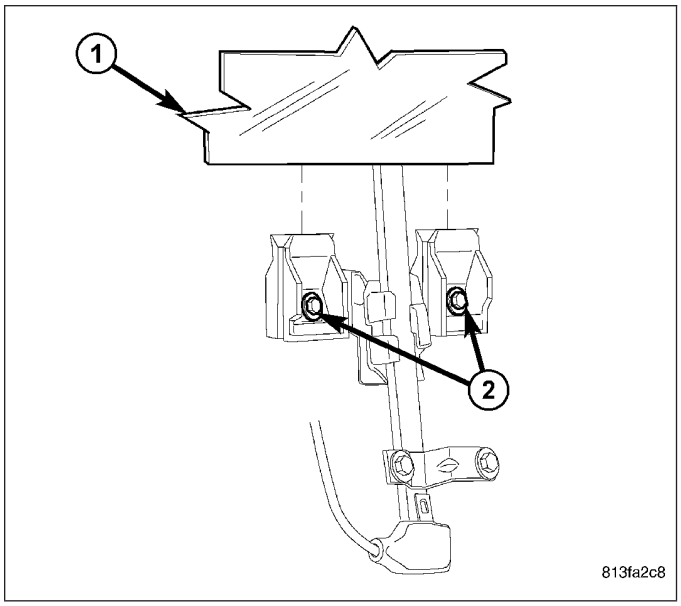


INSTALLATION

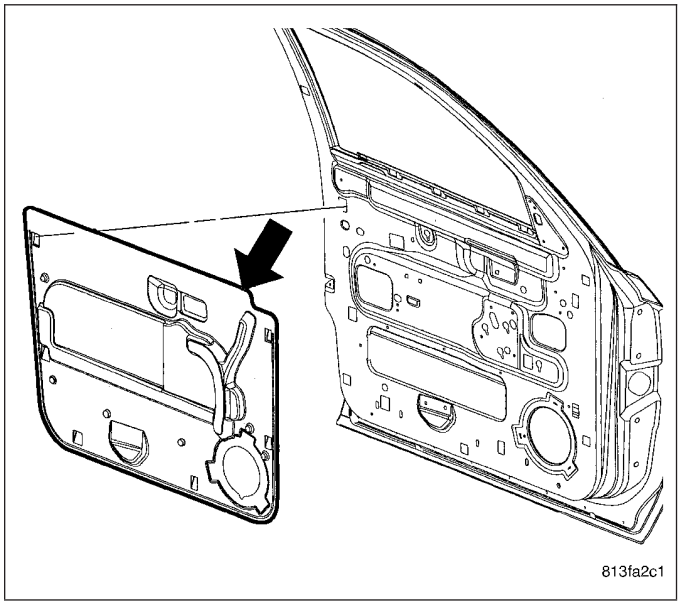
1. Place the regulator into the door and engage the bolts (3 and 4) into the keyhole slots in the door (1).
2. Install the one bolt at the motor.
3. Install the two lower bolts (5).
4. Tighten all the regulator bolts to 10 N·m (85 in. lbs.).
5. Connect the electrical connector (6).



6. Remove the tape used to secure the glass during removal and position the glass (1) into the glass clamps.
7. Temporarily install the window switch and raise the glass into the full up position.
8. Tighten the glass clamp screws (2) securely.



9. Remove the window switch and install the watershield. (Refer to 23 - BODY/DOOR - FRONT/WATERSHIELD - INSTALLATION)

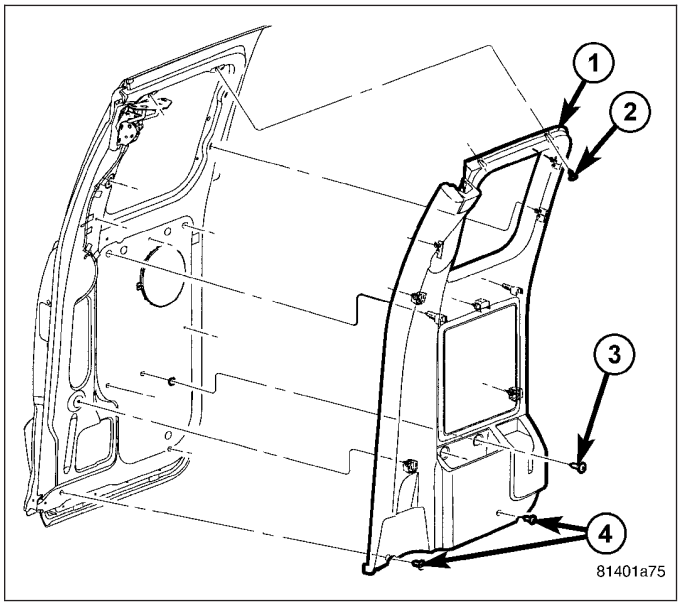


STRIKER

REMOVAL

Club Cab

1. Remove the cargo door trim panel (1). (Refer to 23 - BODY/DOOR - CARGO/TRIM PANEL - REMOVAL)

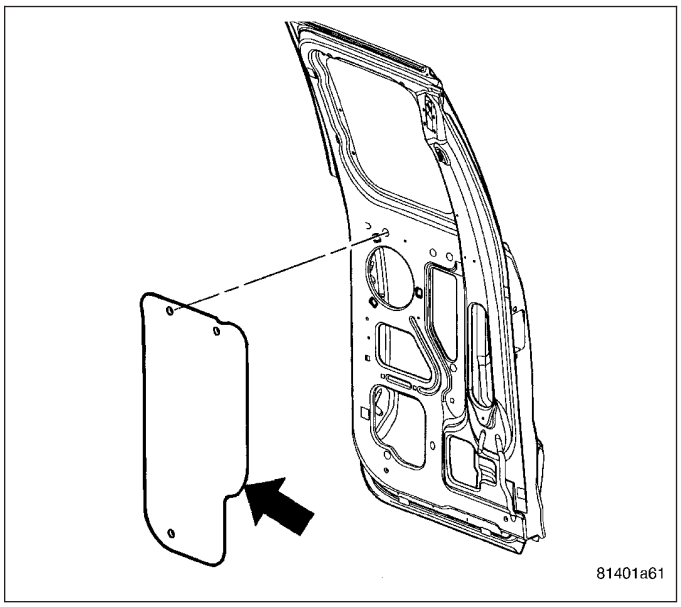


CAUTION: Do not allow the watershield or adhesive to become contaminated with dirt or other foreign substances.

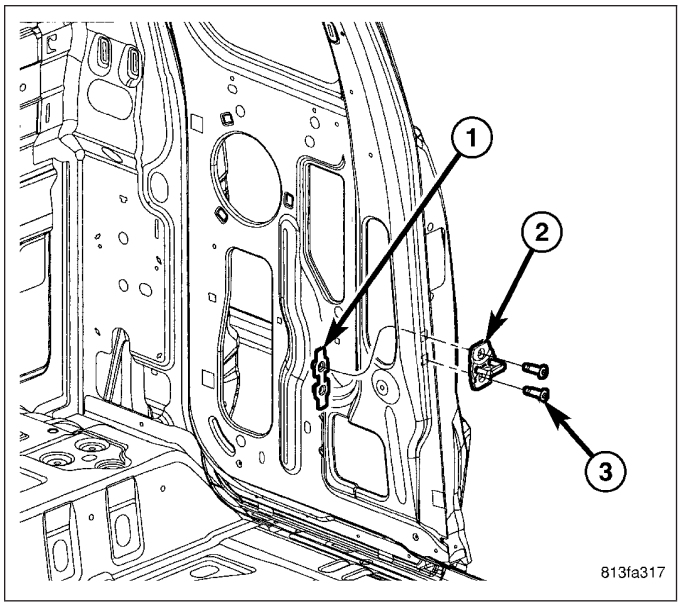
Do not damage the watershield during removal and installation.

If the watershield becomes contaminated or damaged, replace the watershield.

2. Position aside the watershield.

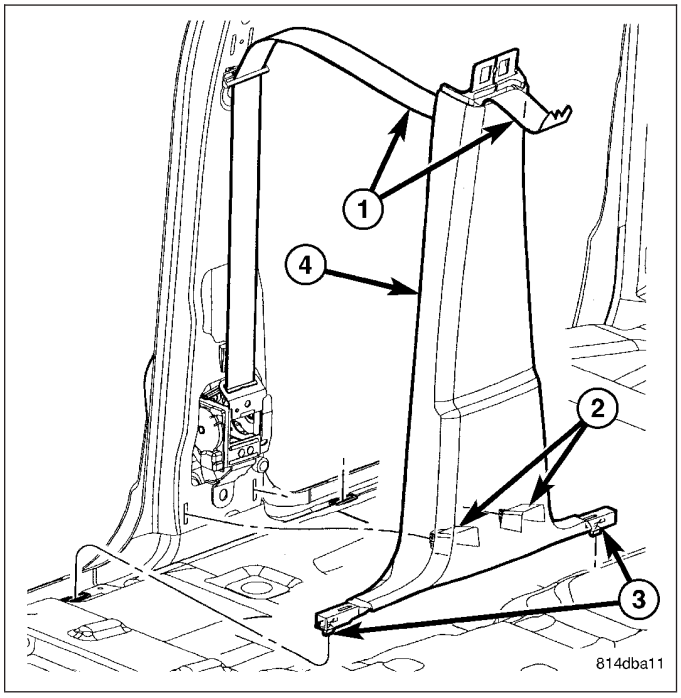


3. Using a grease pencil or equivalent, mark the position of the striker (2).
4. Remove the bolts (3) and remove the striker.

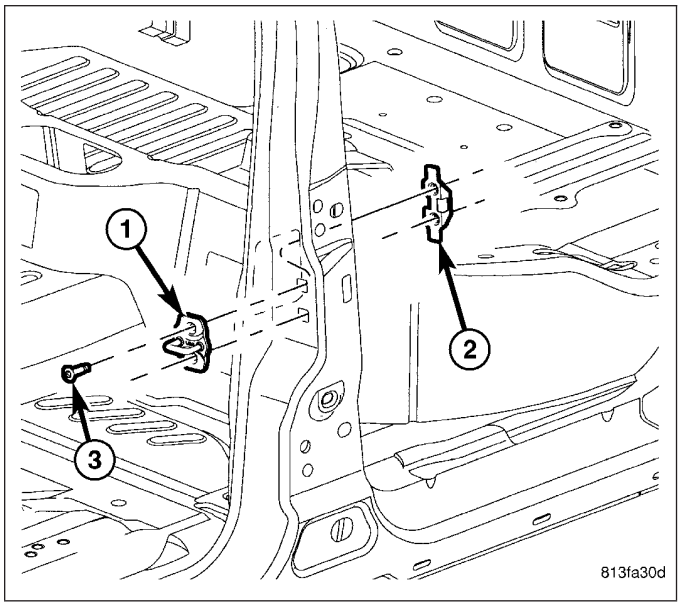


Quad Cab

1. Remove the lower b-pillar trim (4). (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL)



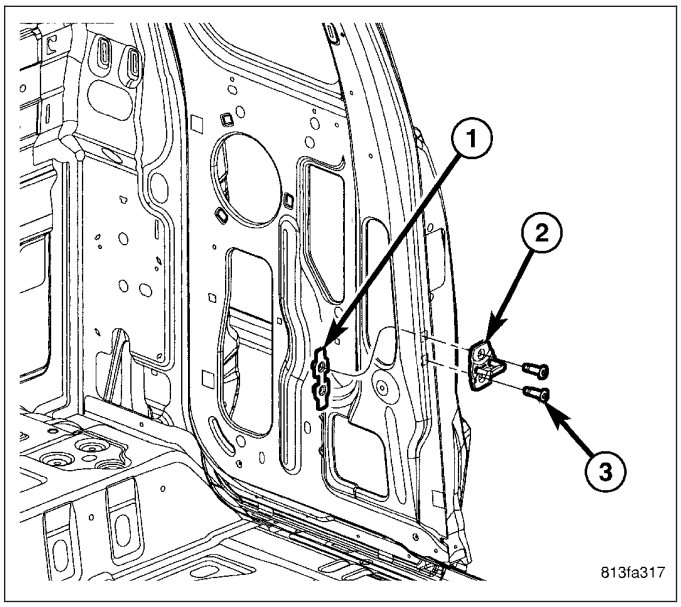
2. Using a grease pencil or equivalent, mark the position of the striker (1).
3. Remove the bolts (3) and remove the striker.



INSTALLATION

Club Cab

1. Position the tapping plate into the rear cargo door (1).
2. Install the striker and install the bolts.
3. Tighten the bolts to 28 N·m (21 ft. lbs.).
4. Adjust the striker if needed. (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - ADJUSTMENTS)

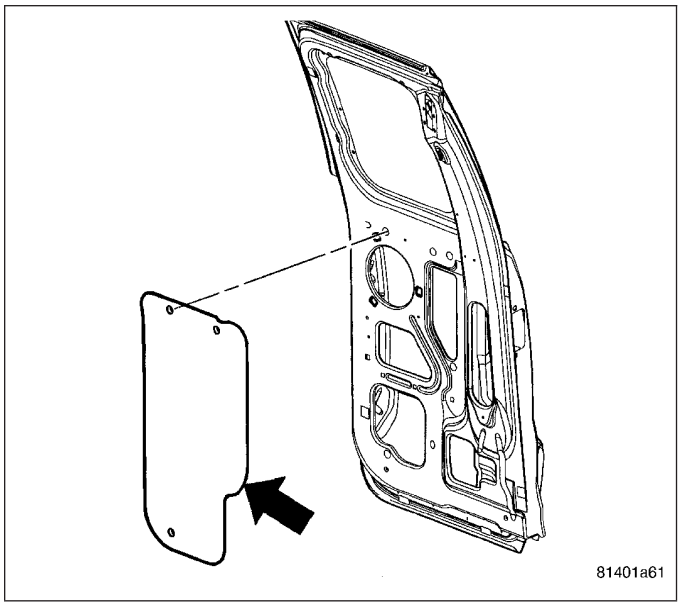


CAUTION: Do not allow the watershield or adhesive to become contaminated with dirt or other foreign substances.

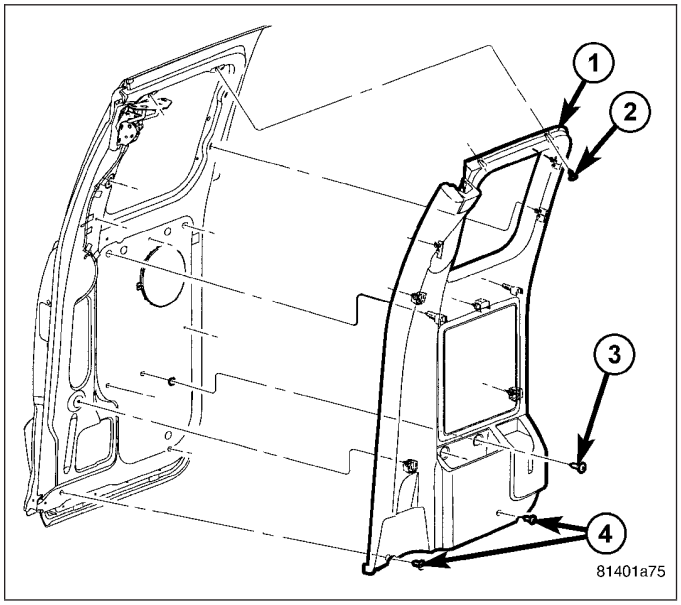
Do not damage the watershield during removal and installation.

If the watershield becomes contaminated or damaged, replace the watershield.

5. Position the watershield back into place.

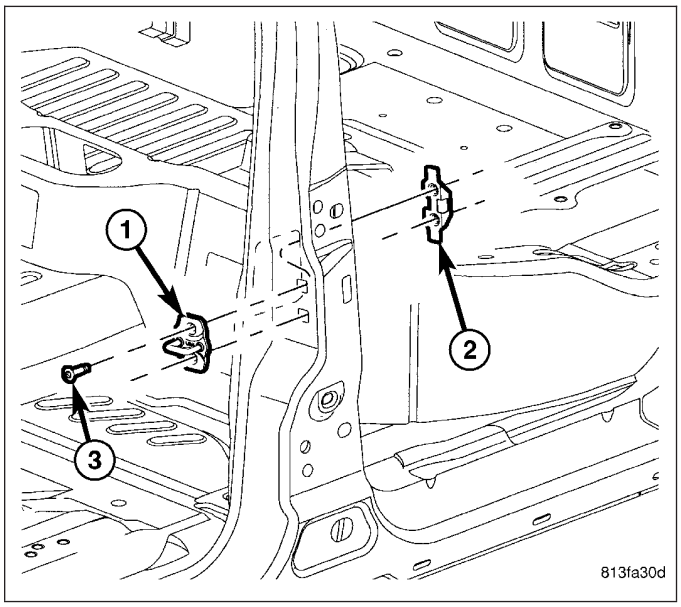


6. Install the cargo door trim panel. (Refer to 23 - BODY/DOOR - CARGO/TRIM PANEL - INSTALLATION)



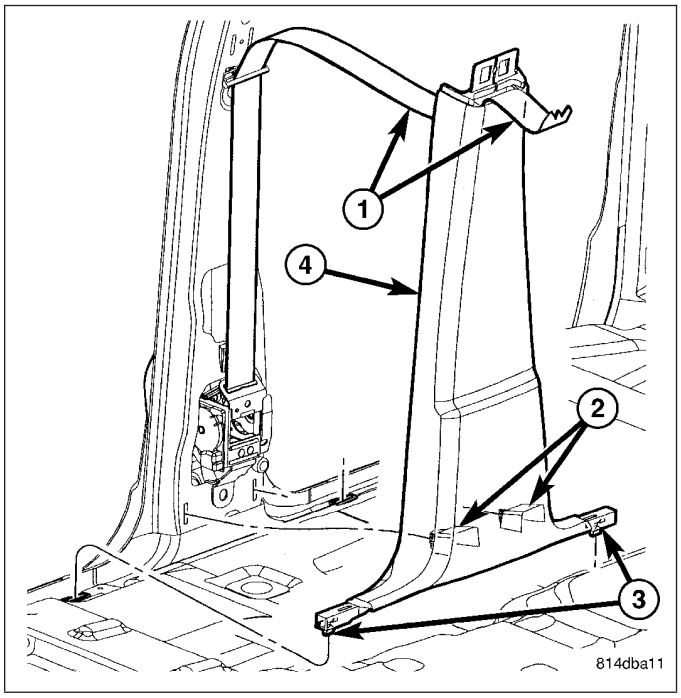
Quad Cab

1. Position the tapping plate (2) into the b-pillar.
2. Install the striker (1) and install the bolts (3).
3. Tighten the bolts to 28 N·m (21 ft. lbs.).



Install the lower b-pillar trim (4). (Refer to 23 - BODY/ INTERIOR/B-PILLAR TRIM - INSTALLATION)

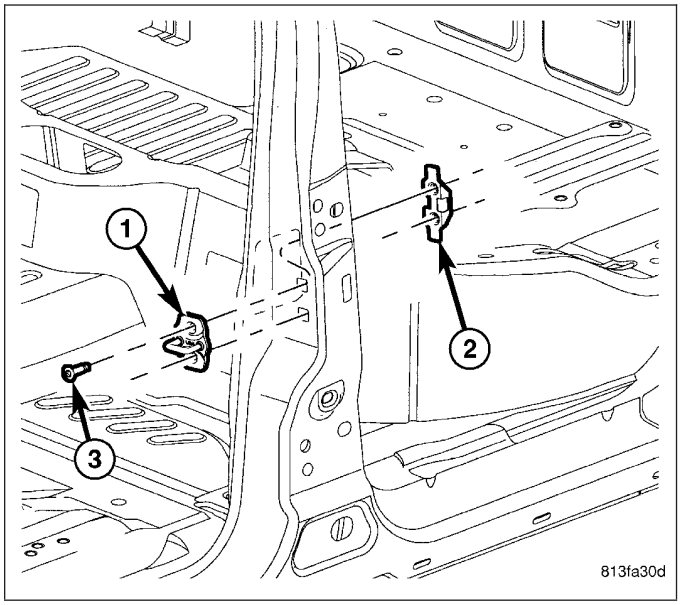
4. Adjust the striker if needed. (Refer to 23 - BODY/ DOOR - FRONT/LATCH STRIKER - ADJUSTMENTS)

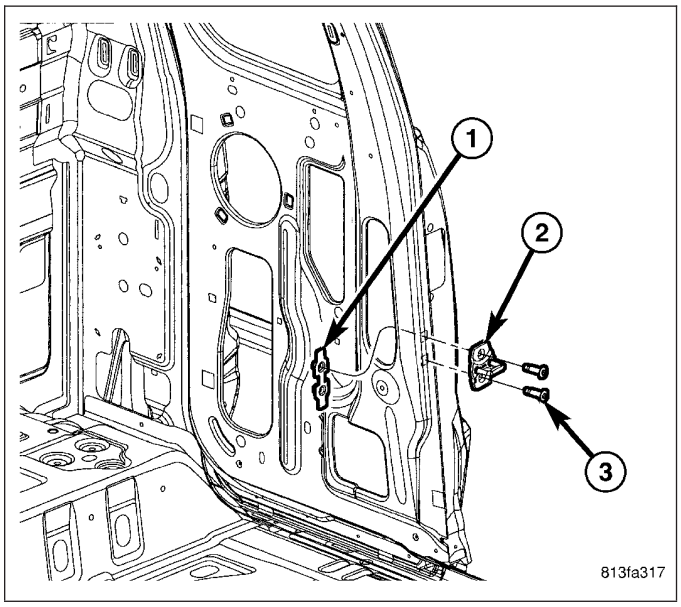


ADJUSTMENTS

ADJUSTMENT

1. Using a grease pencil or equivalent, mark the position of the striker (1) to aid in adjustment.
2. Loosen the striker bolts (3).
3. Change the striker position to adjust the rear gap and flush measurement. (Refer to 23 - BODY/ BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
4. Tighten the bolts to 28 N·m (21 ft. lbs.).

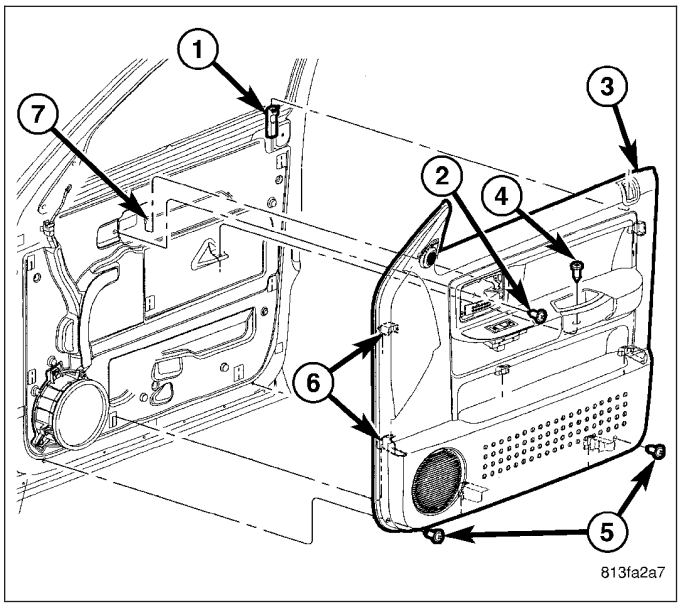




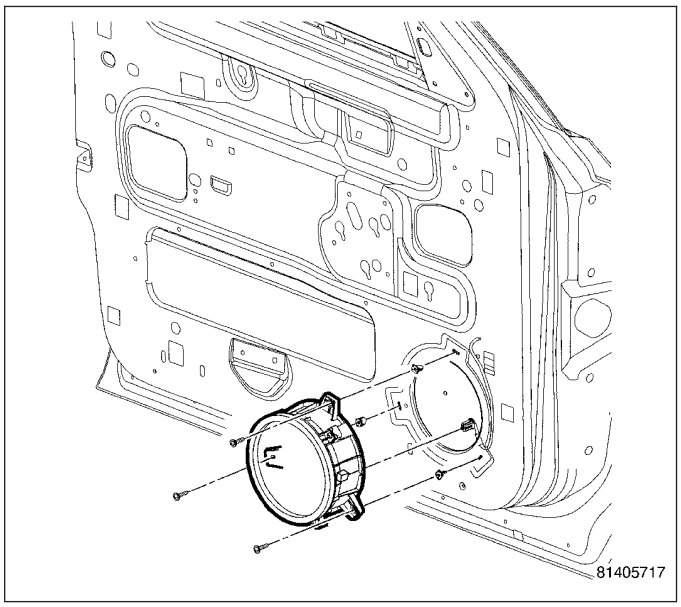
WATERSHIELD

REMOVAL

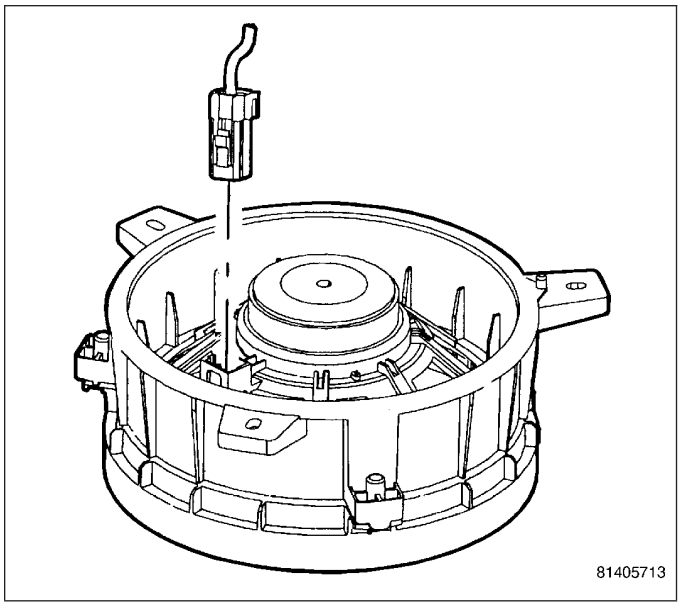
1. Disconnect and isolate the battery negative cable.
2. Remove the front door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).
3. Remove the pull cup bracket bolts and bracket.



4. Remove the speaker mounting fasteners.



5. Remove speaker and disconnect the electrical harness connector.

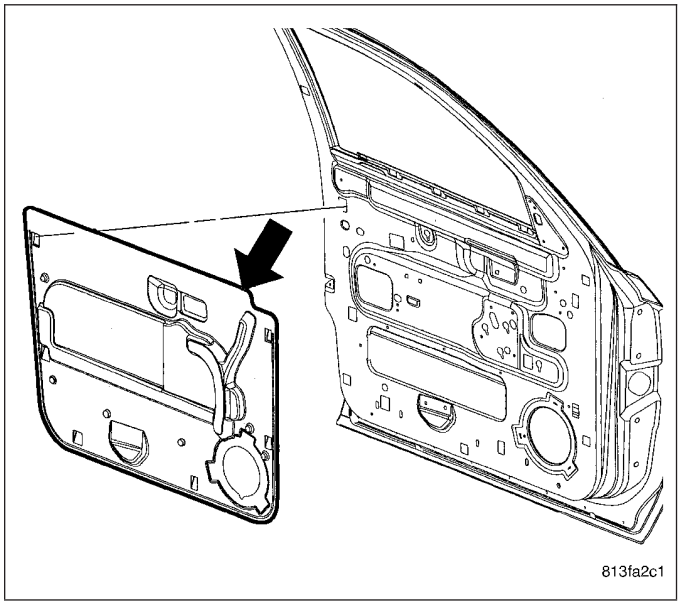


CAUTION: Do not allow the watershield or adhesive to become contaminated with dirt or other foreign substances.

Do not damage the watershield during removal and installation.

If the watershield becomes contaminated or damaged, replace the watershield.

6. Carefully remove the watershield from around the perimeter of the door.
7. Separate the watershield from the interior handle actuator rod and the door wire harness (if equipped) and remove the watershield.



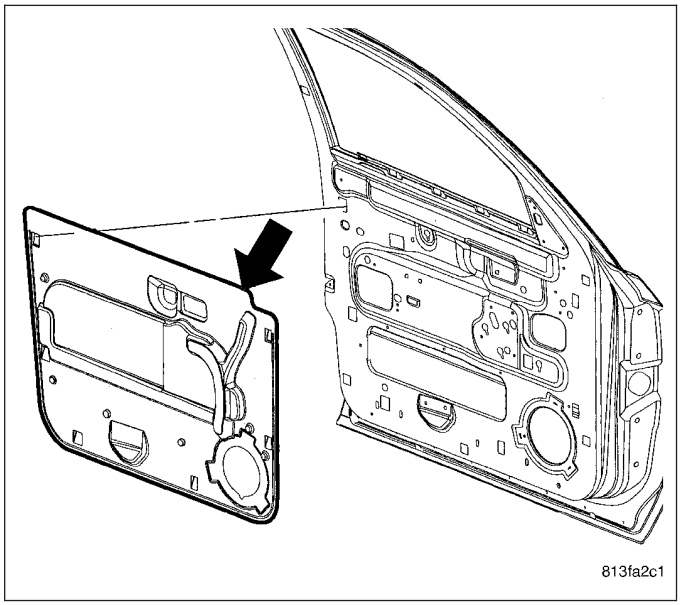
INSTALLATION

CAUTION: Do not allow the watershield or adhesive to become contaminated with dirt or other foreign substances.

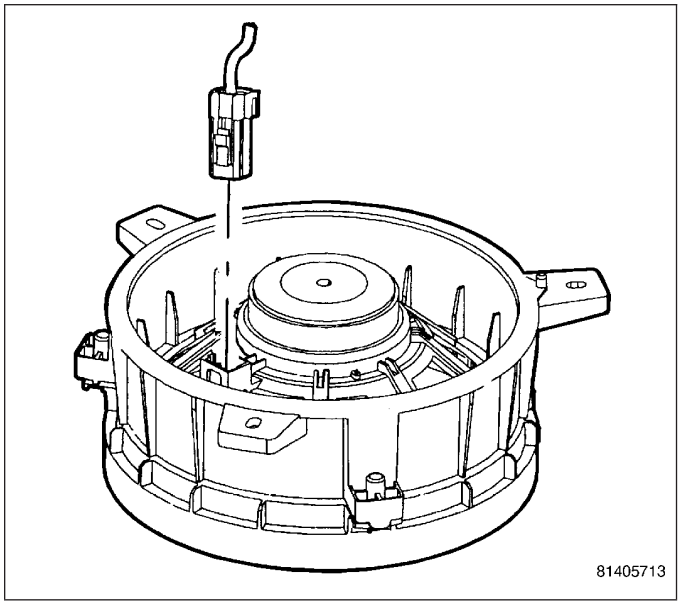
Do not damage the watershield during removal and installation.

If the watershield becomes contaminated or damaged, replace the watershield.

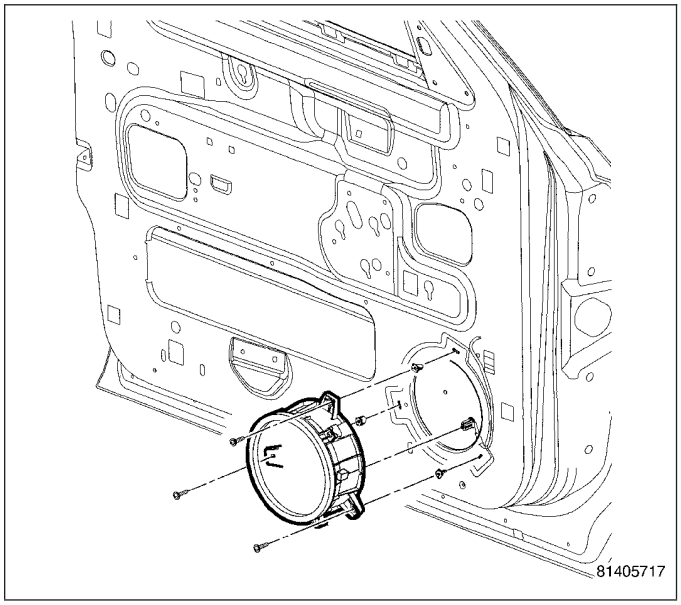
1. Position the wire harness and actuator rods through the holes in the watershield.
2. Secure the watershield to the inner door panel.



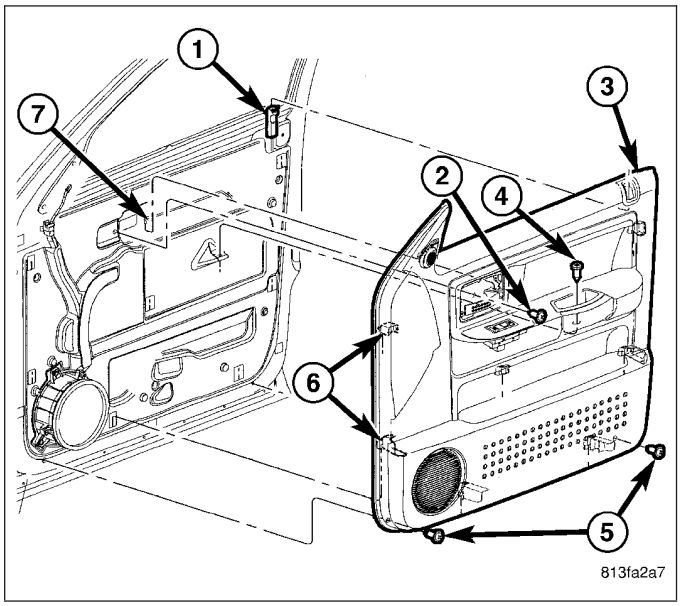
3. Connect electrical harness connector and position speaker to door.



4. Install and tighten mounting fasteners.



5. Install the door pull cup bracket and install the bolts.
6. Install door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION).
7. Connect battery negative cable.



DOORS - REAR

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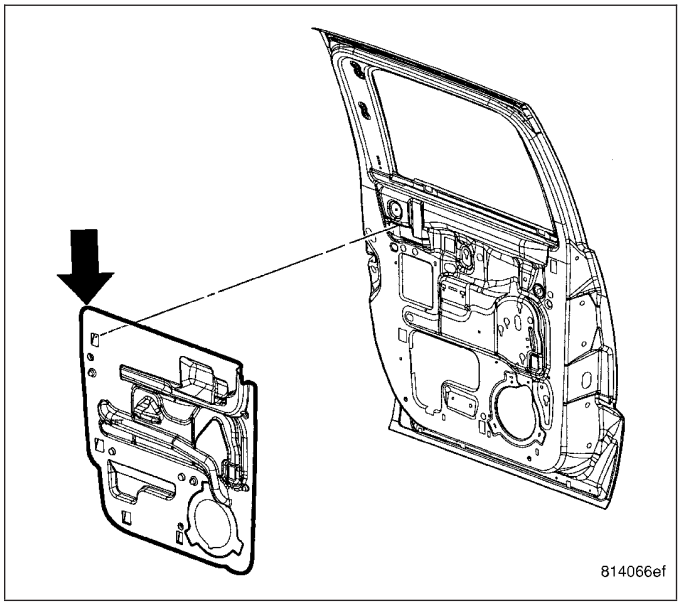
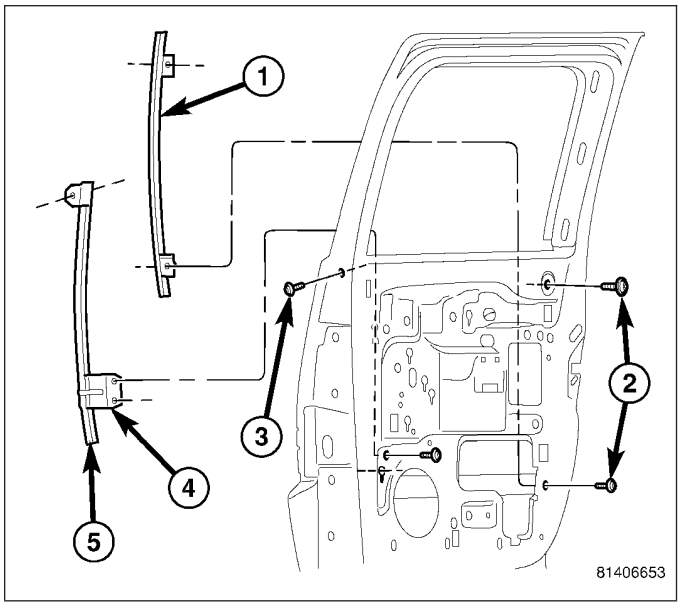
CHANNEL-GLASS

REMOVAL

1. Raise glass to the up position and remove the watershield. (Refer to 23 - BODY/DOORS - REAR/ WATERSHIELD - REMOVAL)

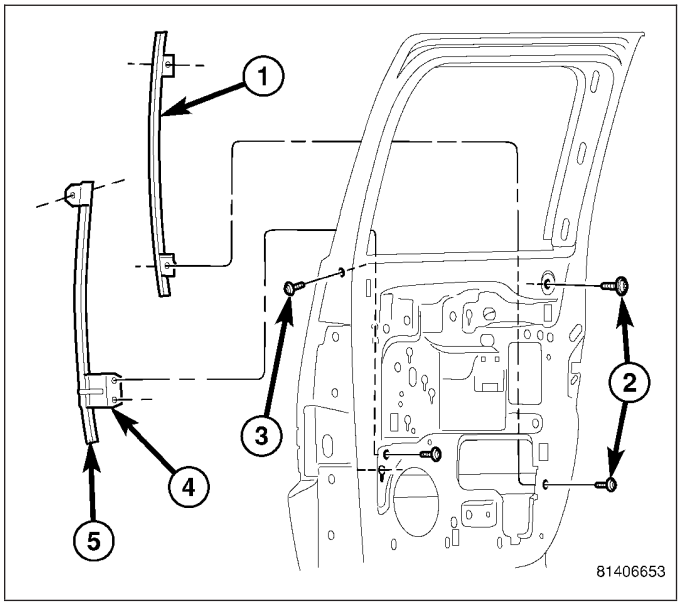


2. Remove the screws (3) and remove the front channel (5).
3. Remove the screws (2) and remove the rear channel (1).

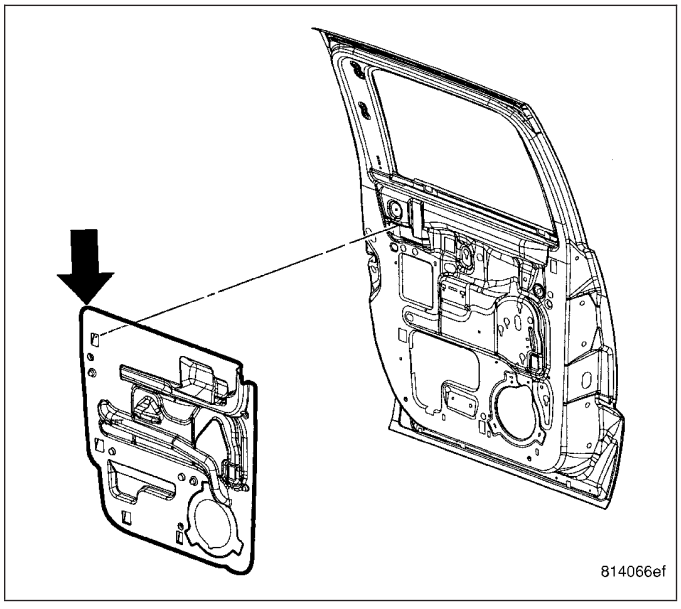


INSTALLATION

1. Install the rear channel (1) and install the nut and screw (2).
2. Tighten the fasteners to 10 N·m (85 in. lbs.).
3. Install the front channel (5) and install the screws (3).
4. Tighten the fasteners to 10 N·m (85 in. lbs.).



5. Install the watershield. (Refer to 23 - BODY/ DOORS - REAR/WATERSHIELD - INSTALLATION)



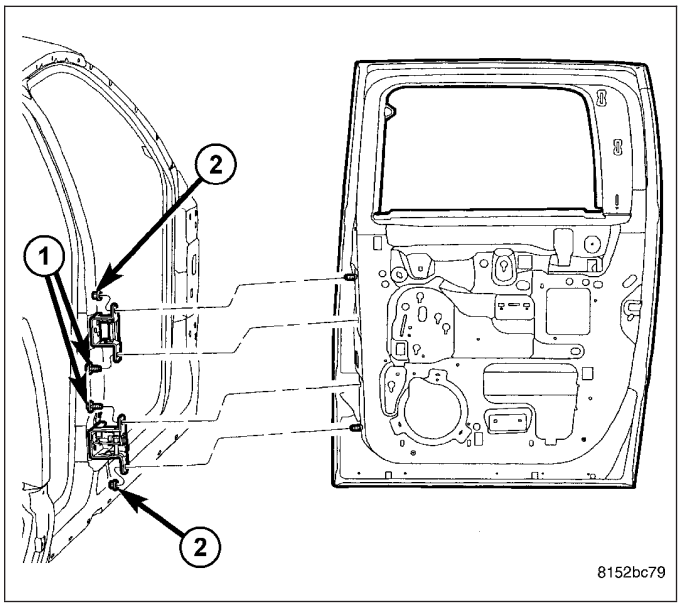
DOOR

REMOVAL

1. Disconnect and isolate the negative battery cable.
2. Disconnect the door wire harness connector from the body wire harness.
3. Using a grease pencil or equivalent, mark the location of the door hinges on the door.

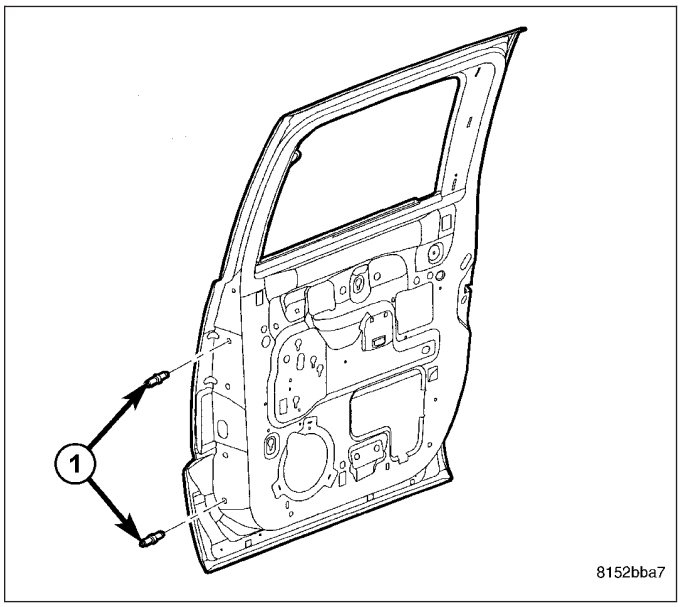
NOTE: The epoxy bonded washers do not need to be separated from the hinges. If the washers are removed, the door may need to be re-adjusted.

4. Support the door with a suitable lifting device and remove the two nuts (2) and two bolts (1) that secure the door to the hinges.
5. Carefully remove the door from the hinges.



NOTE: When installing a door it will be necessary to replace the shouldered door studs (1) with service studs without the shoulder in order to achieve correct door position adjustments.

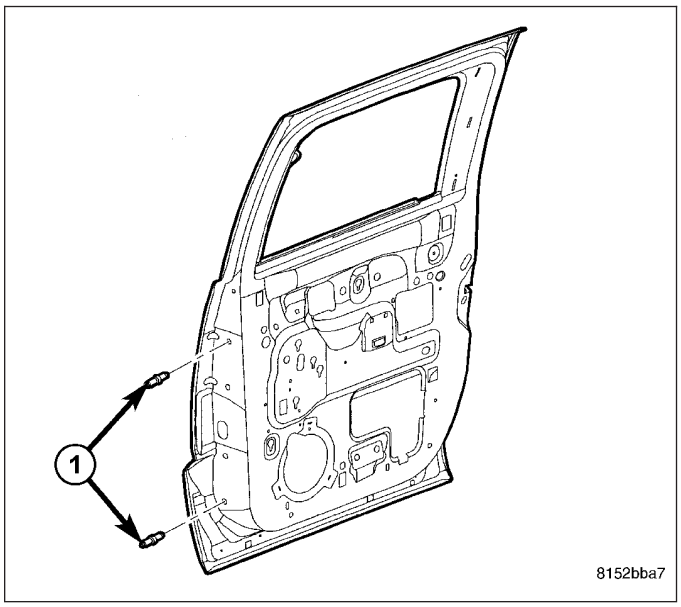
6. If required, remove the two studs (1) from the door.



INSTALLATION

NOTE: When installing a door it will be necessary to replace the shouldered door studs (1) with service studs without the shoulder in order to achieve correct door position adjustments.

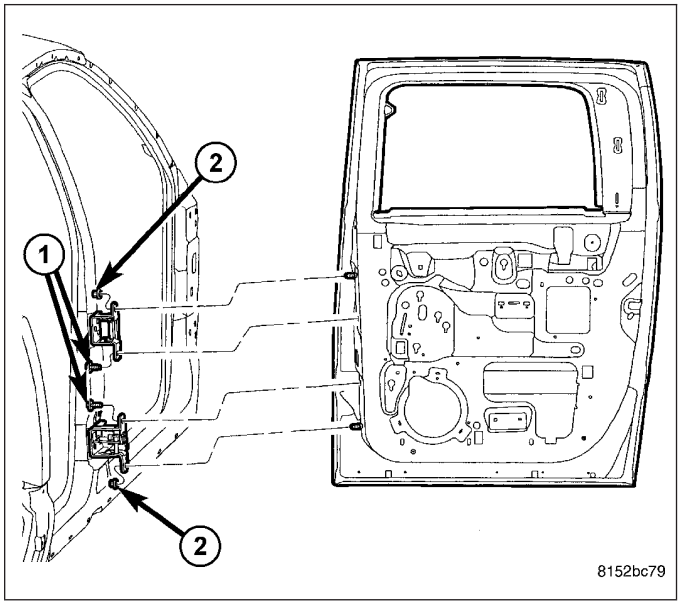
1. Install the service studs (1) and tighten to 12 N·m (105 in. lbs.).



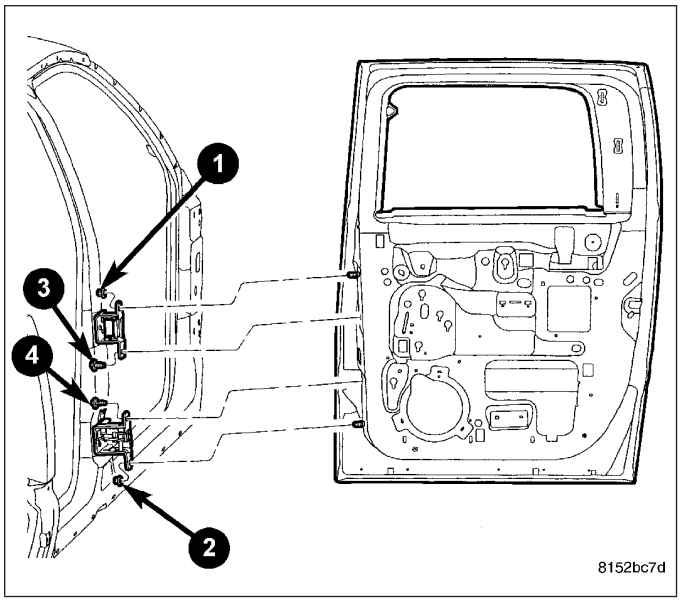
2. Carefully position the door onto the hinges and support the door with a suitable lifting device.

NOTE: If the epoxy bonded washers are separated from the hinges, the door may need to be adjusted.

3. If removed, install the epoxy bonded washers.
4. Loosely install the two nuts (2) and the two bolts (1) that secure the door to the hinges.



5. Align the door to the hinges using the reference marks made during the removal procedure and tighten the nuts and bolts to 28 N·m (21 ft. lbs.) using the sequence shown.
6. Connect the door wire harness to the body wire harness.
7. Reconnect the negative battery cable.
8. If necessary, adjust the door (Refer to 23 - BODY/ DOORS - REAR/DOOR - ADJUSTMENTS).



ADJUSTMENTS

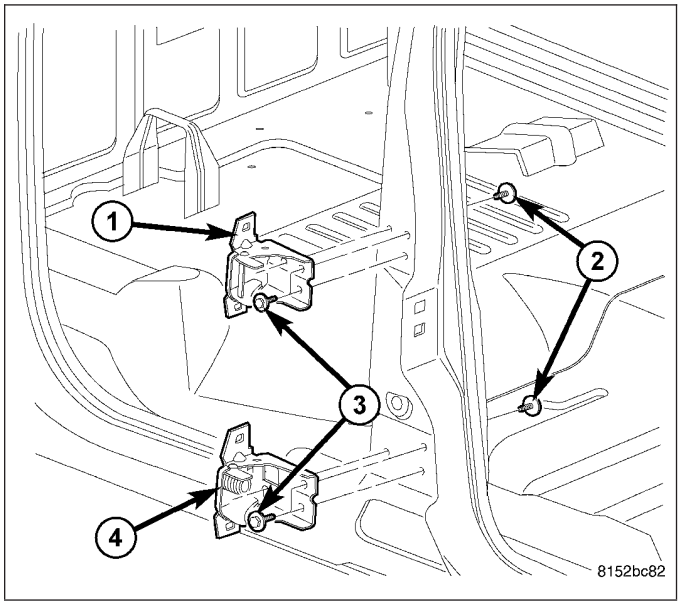
NOTE: For vehicles with four doors, it is recommended that you adjust the rear door before adjusting the front door. (Refer to 23 - BODY/DOORS - REAR/DOOR - ADJUSTMENTS)

- **Door adjustment measurements should be taken from stationary or welded body panels like the roof, rocker or quarter panels.**
- **During adjustment procedures, it is recommended that all the hinge fasteners be loosened except for the upper most fasteners. Adjustments can be made using the upper bolts to hold the door with final torque of the fasteners occurring after correct door positioning is achieved.**
- **A suitable body sealant should be used when removing or moving the hinges.**

FORE/AFT

NOTE: Fore/aft (lateral) door adjustment is done by loosening the hinge to the hinge pillar fasteners one hinge at a time and moving the door to the correct position.

1. Support the door with a suitable lifting device.
2. Loosen the hinge (1 and 4) to hinge pillar fasteners (2 and 3). (Refer to 23 - BODY/DOOR - FRONT/ HINGE - REMOVAL)
3. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
4. Tighten the hinge pillar fasteners to 28 N·m (21 ft. lbs.). (Refer to 23 - BODY/DOORS - REAR/HINGE - INSTALLATION)



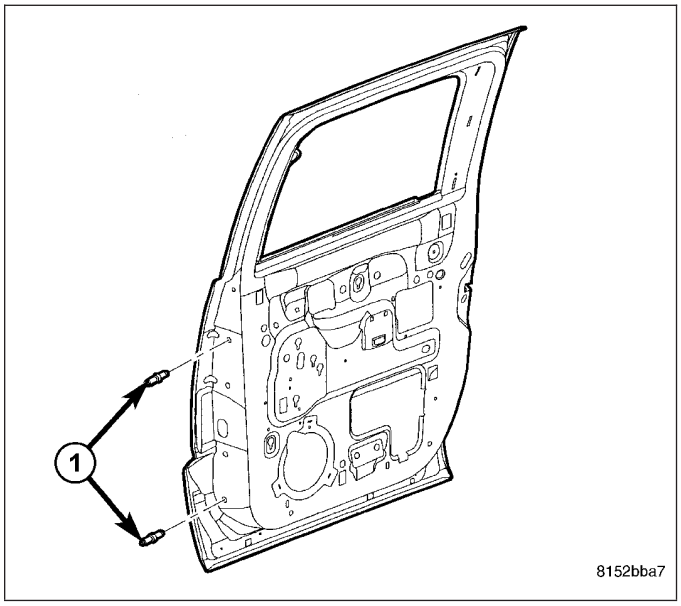
UP/DOWN

NOTE: Up/down door adjustment is done by loosening either the hinge to the hinge pillar fasteners or the hinge to door fasteners and moving the door to the correct position.

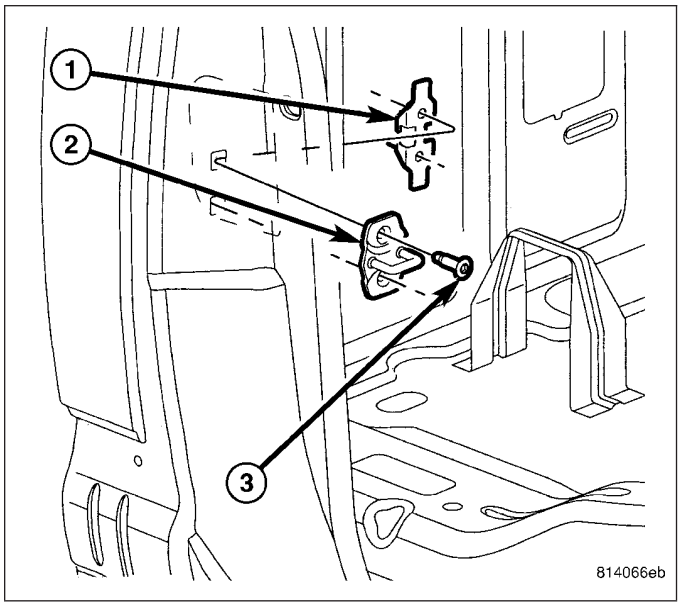
NOTE: When adjustment of the door requires the loosening of the door to hinge fasteners, it will be necessary to separate the welded washers with a chisel or other suitable tool.

NOTE: When adjusting a door with the door to hinge fasteners, it will be necessary to replace the shouldered door studs (1) with service studs without the shoulder in order to achieve correct door position adjustments.

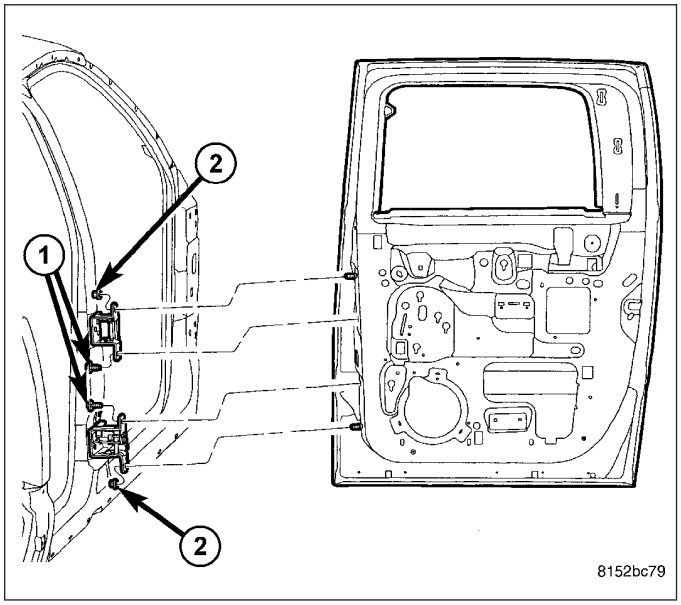
1. If required, install the service studs (1) and tighten to 12 N·m (105 in. lbs.).



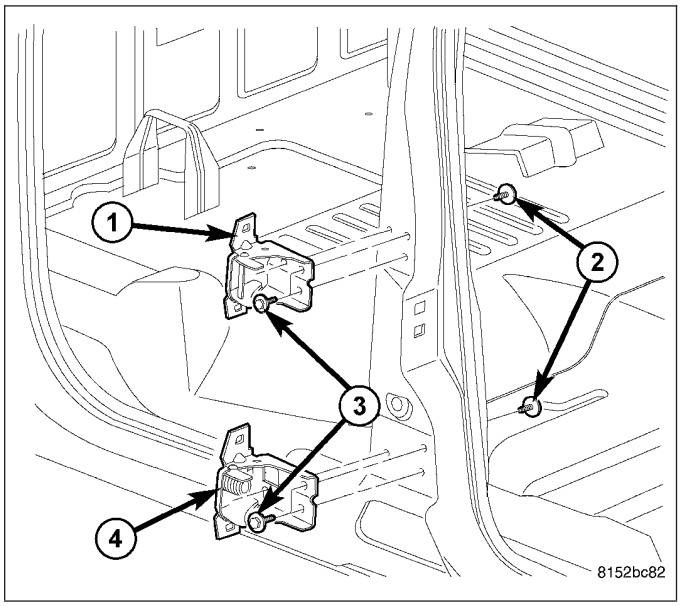
2. Support the door with a suitable lifting device.
3. Loosen the latch striker bolts (3). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)



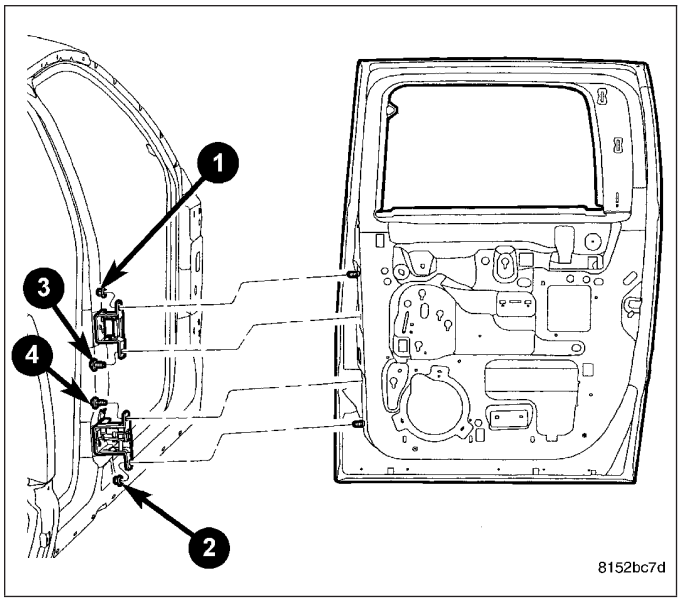
4. Loosen the hinge to door fasteners (1 and 2) (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL) or loosen the hinge to hinge pillar fasteners (Refer to 23 - BODY/DOOR - FRONT/HINGE - REMOVAL).
5. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)



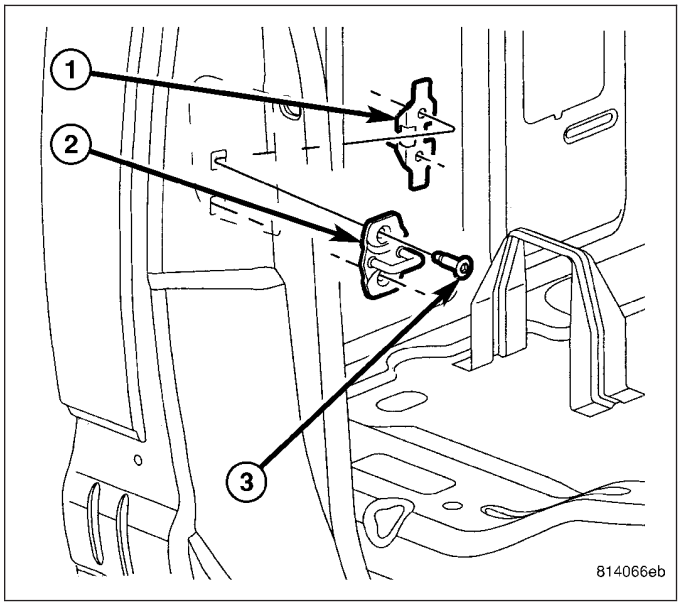
6. Tighten the hinge pillar fasteners to 28 N·m (21 ft. lbs.). (Refer to 23 - BODY/DOORS - REAR/HINGE - INSTALLATION)



7. Tighten the door to hinge fasteners to 23 N·m (17 ft. lbs.) using the sequence shown. (Refer to 23 - BODY/DOORS - REAR/DOOR - INSTALLATION)



8. Tighten the latch striker bolts (1). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - INSTALLATION)



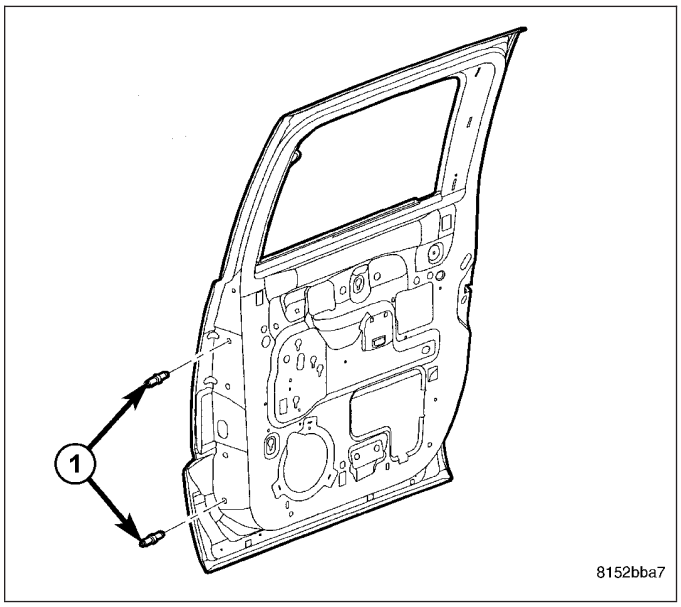
IN/OUT

NOTE: In/out door adjustment is done by loosening the hinge to door fasteners one hinge at a time and moving the door to the correct position.

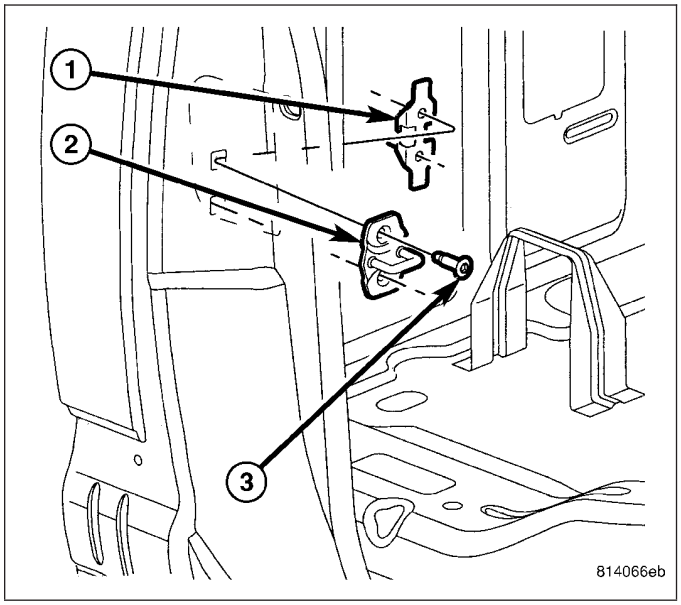
NOTE: When adjustment of the door requires the loosening of the door to hinge fasteners, it will be necessary to separate the welded washers with a chisel or other suitable tool.

NOTE: When adjusting a door with the door to hinge fasteners, it will be necessary to replace the shouldered door studs (1) with service studs without the shoulder in order to achieve correct door position adjustments.

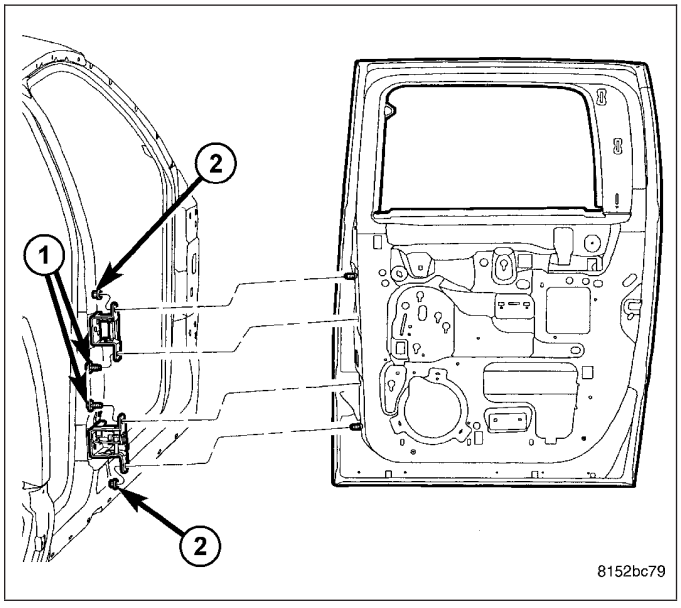
1. Install the service studs (1) and tighten to 12 N·m (105 in. lbs.).



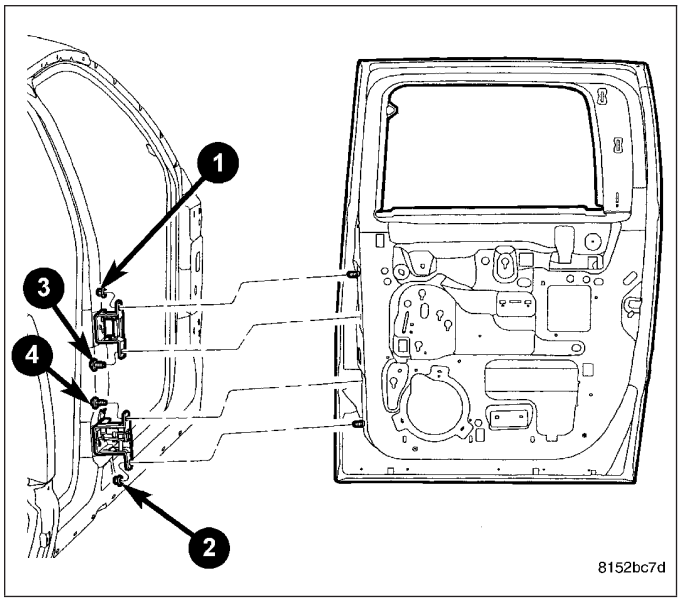
2. Support the door with a suitable lifting device.
3. Loosen the latch striker bolts (1). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)



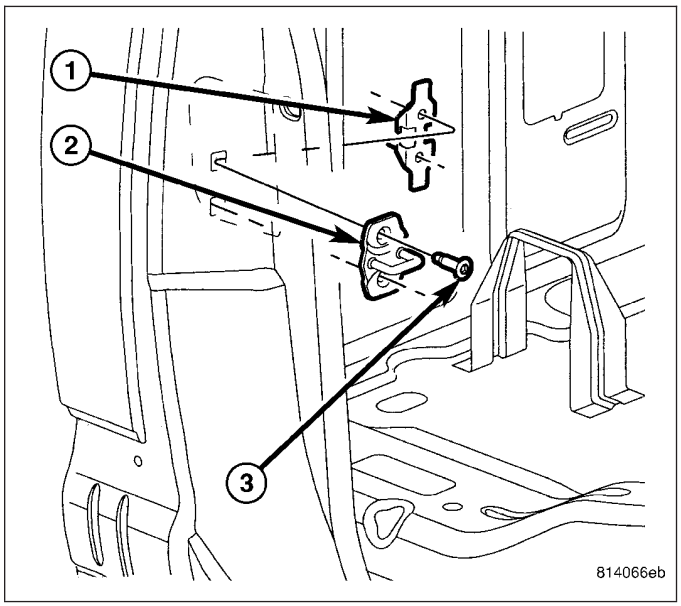
4. Loosen the hinge to door fasteners (1and 2). (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)
5. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)



6. Tighten the door to hinges fasteners to 23 N·m (17 ft. lbs.) using the sequence shown. (Refer to 23 - BODY/DOORS - REAR/DOOR - INSTALLATION)



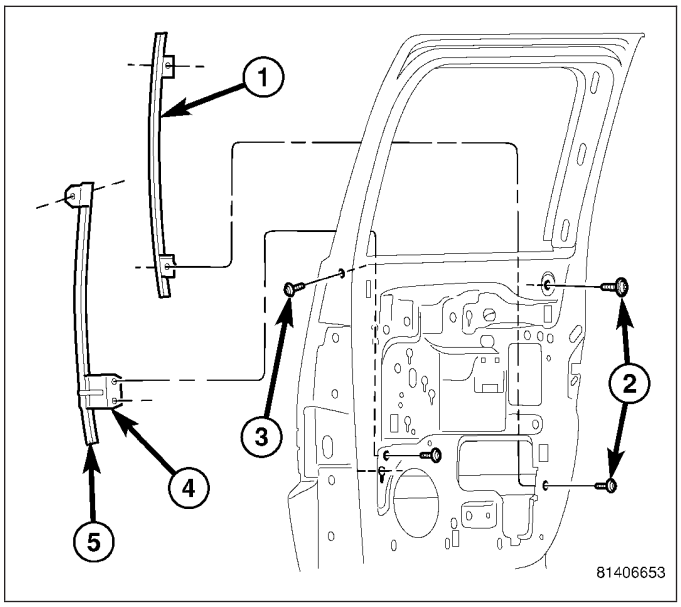
7. Tighten the latch striker bolts (1). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - INSTALLATION)



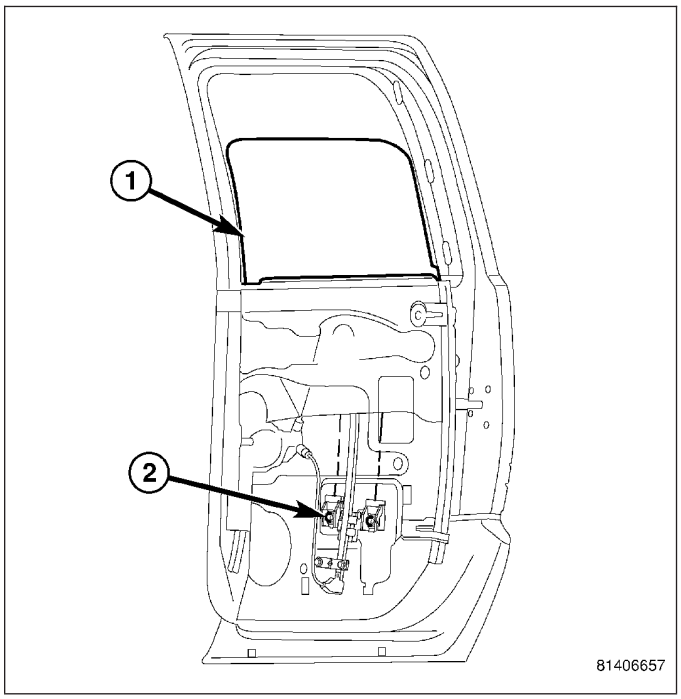
GLASS

REMOVAL

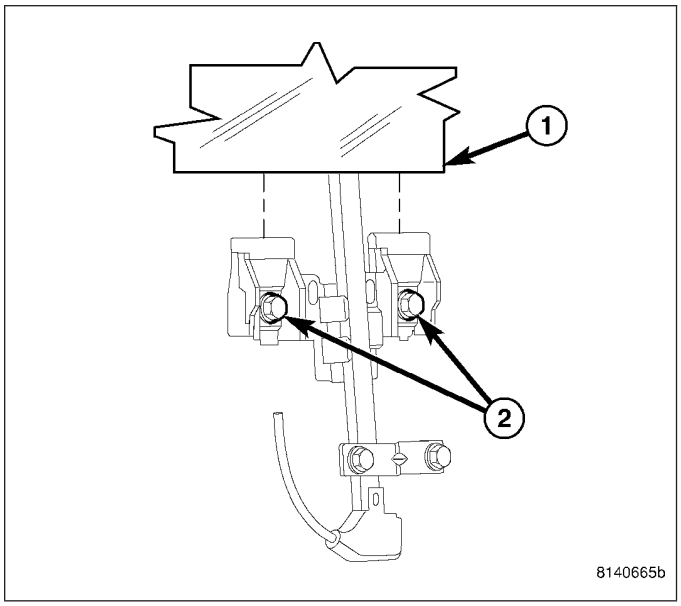
1. Remove the rear glass run channel (1). (Refer to 23 - BODY/DOORS - REAR/CHANNEL-GLASS - REMOVAL)



2. Temporarily install the window switch or window handle and position the glass (1) to gain access to the glass clamp screws (2).

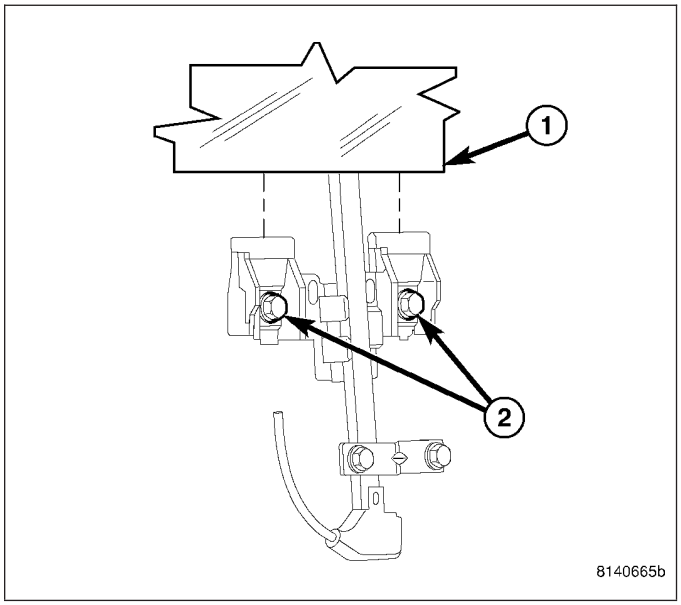


3. Pull rear of run channel weatherstrip out of channel.
4. Loosen the glass clamp screws (2) and carefully remove the glass (1) from the door.

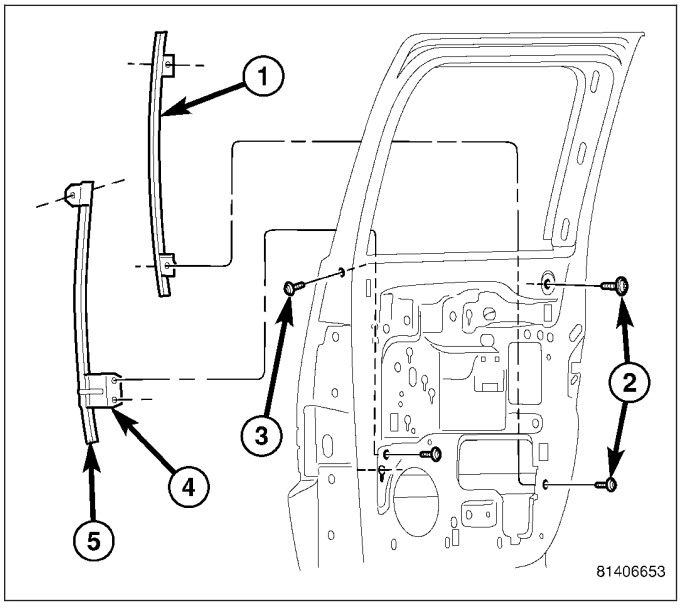


INSTALLATION

1. Install the glass into the door and position the glass (1) into the glass clamps.
2. Temporarily install the window crank handle or window switches and raise the glass into the full up position.
3. Tighten the glass clamp screws (2) securely.



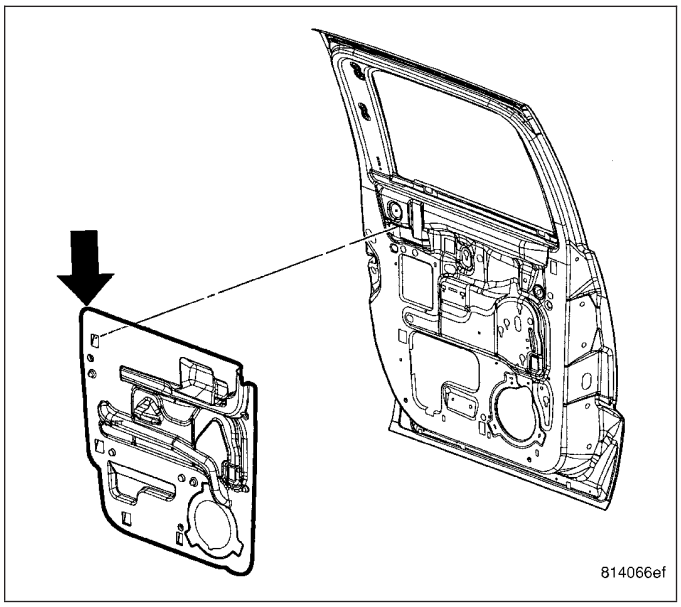
4. Remove the manual window crank or window switches, and install the rear glass run channel (1). (Refer to 23 - BODY/DOORS - REAR/CHANNEL-GLASS - INSTALLATION)



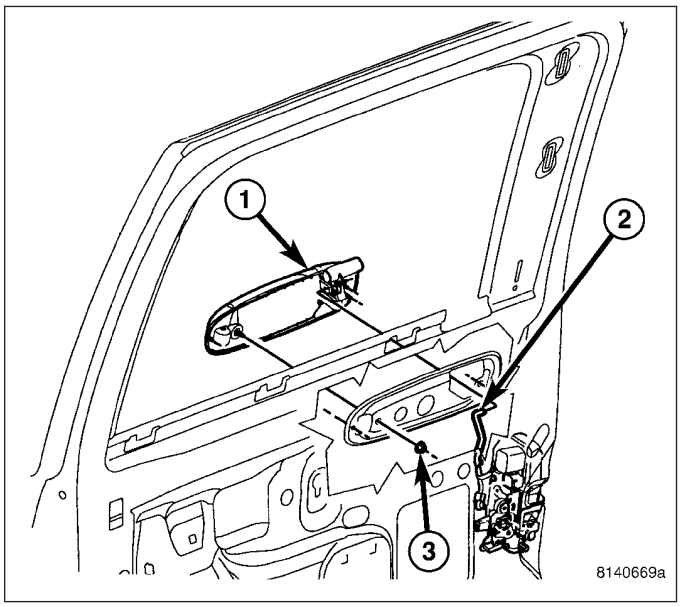
HANDLE-EXTERIOR

REMOVAL

1. Partially remove the watershield as necessary. (Refer to 23 - BODY/DOORS - REAR/WATERSHIELD - REMOVAL)

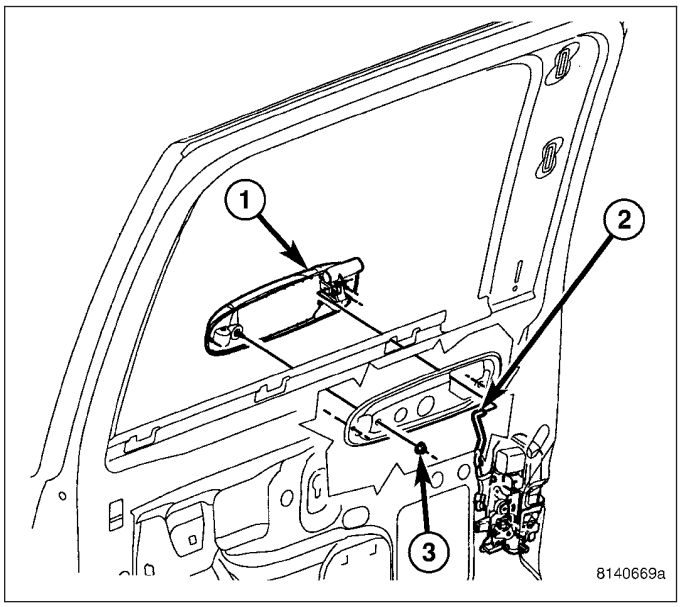


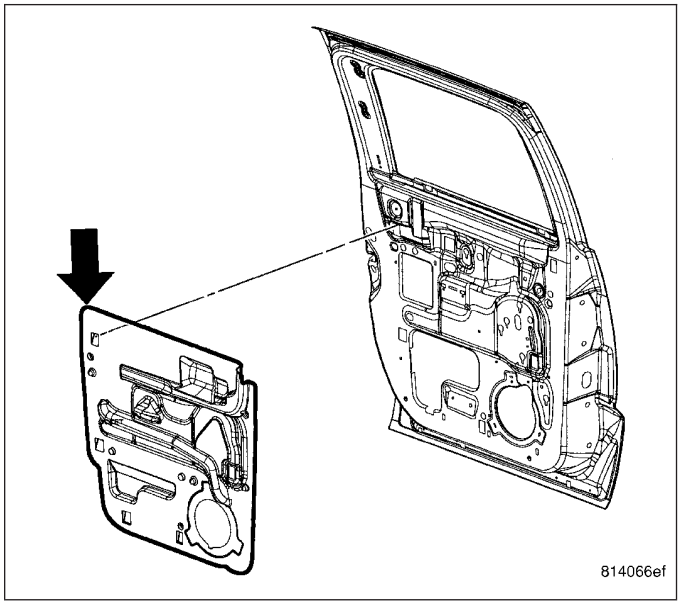
2. Remove the nuts (3) and separate the exterior handle (1).
3. Disconnect the latch link (2) and remove the handle.



INSTALLATION

1. Position the handle (1) and connect the latch link (2).
2. Install the handle and install the nuts (3).
3. Tighten the nuts too
4. Install the watershield. (Refer to 23 - BODY/ DOORS - REAR/WATERSHIELD - INSTALLATION)





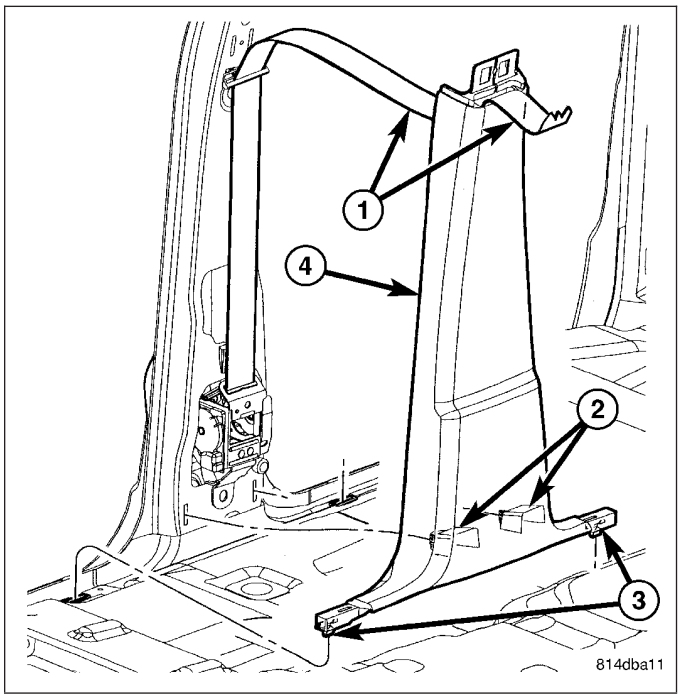
HINGE

REMOVAL

NOTE: It is not necessary to remove the door to replace the hinges if they are replaced one at a time.

NOTE: A suitable body sealant should be used when removing or moving the hinges.

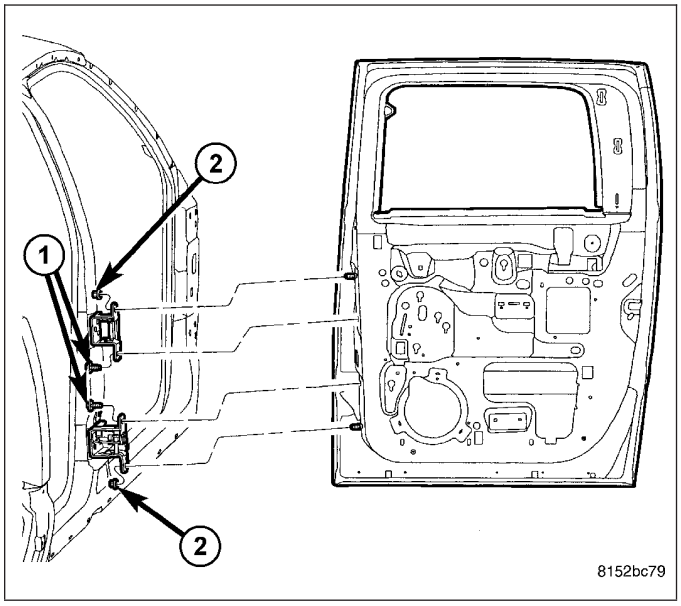
1. Open the front door.
2. Remove the lower b-pillar trim (4). (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL)



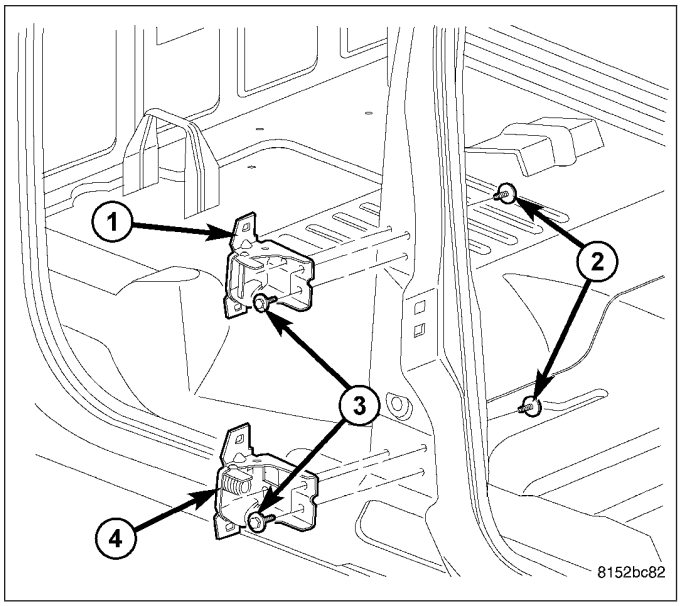
3. Using a grease pencil or equivalent, mark the location of the door hinges on the door.

NOTE: The epoxy bonded washers do not need to be separated from the hinges. If the washers are removed, the door may need to be re-adjusted.

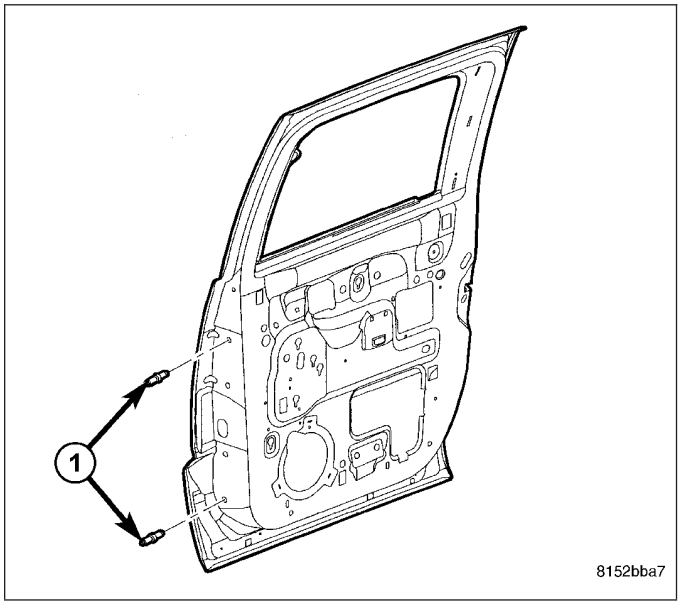
4. Support the door with a suitable lifting device and remove the two nuts (2) and two bolts (1) that secure the door to the hinges.



5. Using a grease pencil or equivalent, mark the position of the hinge on the door and b-pillar to aid installation.
6. Remove the two exterior bolts (3) per hinge.
7. From the inside of the vehicle remove the remaining bolt (2) attaching the hinge (1 or 4) to the b-pillar and remove the hinge.



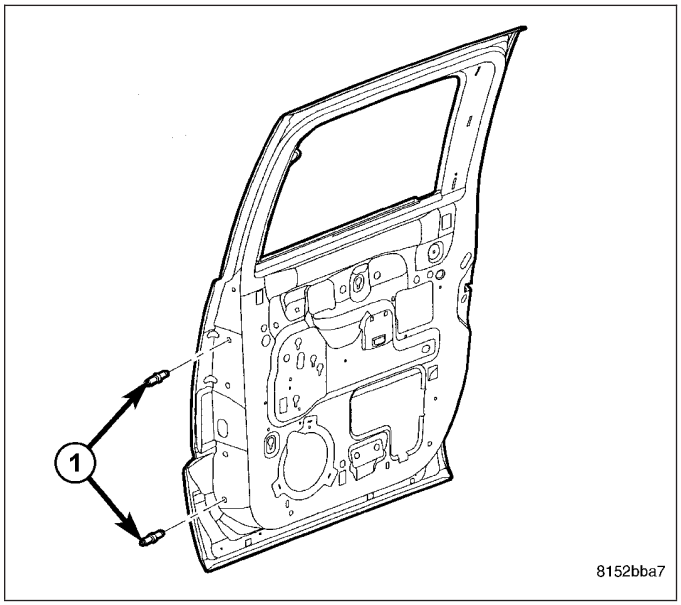
NOTE: When installing a door it will be necessary to replace the shouldered door studs (1) with service studs without the shoulder in order to achieve correct door position adjustments.



INSTALLATION

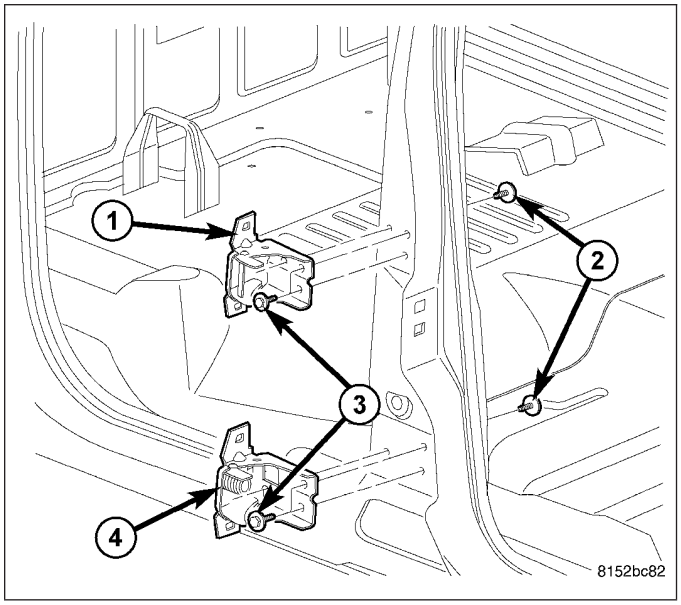
NOTE: When adjusting a door with the door to hinge fasteners, it will be necessary to replace the shouldered door studs (1) with service studs without the shoulder in order to achieve correct door position adjustments.

1. If required, install the service studs (1) and tighten to 12 N·m (105 in. lbs.).



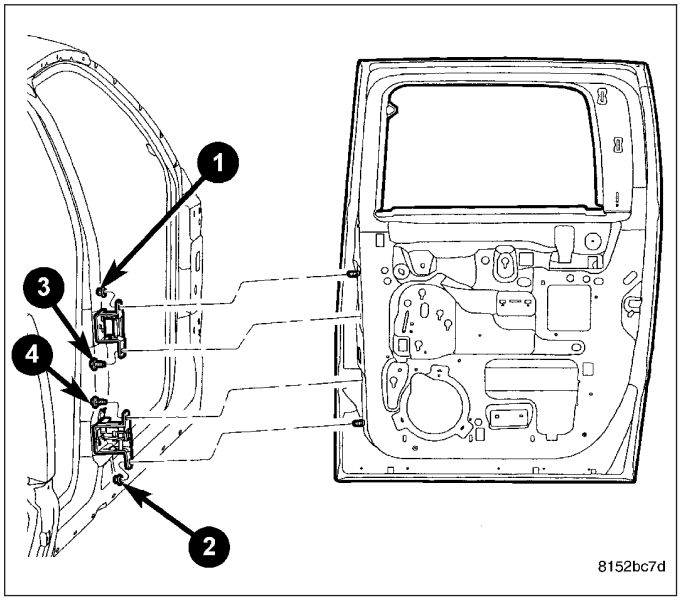
NOTE: A suitable body sealant should be used when removing or moving the hinges.

2. If necessary, paint replacement door hinge before installation.
3. Position door hinge (1 or 4) on the b-pillar using the marks made during removal and install the bolts (3).
4. Tighten the bolts (3) to 28 N·m (21 ft. lbs.).
5. Install the inner bolt (2) and tighten to 28 N·m (21 ft. lbs.).

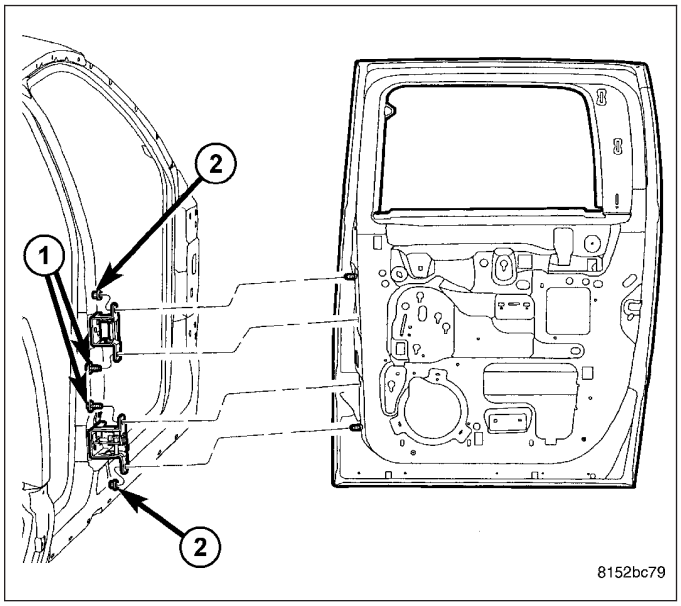


NOTE: If the epoxy bonded washers are separated from the hinges, the door may need to be adjusted.

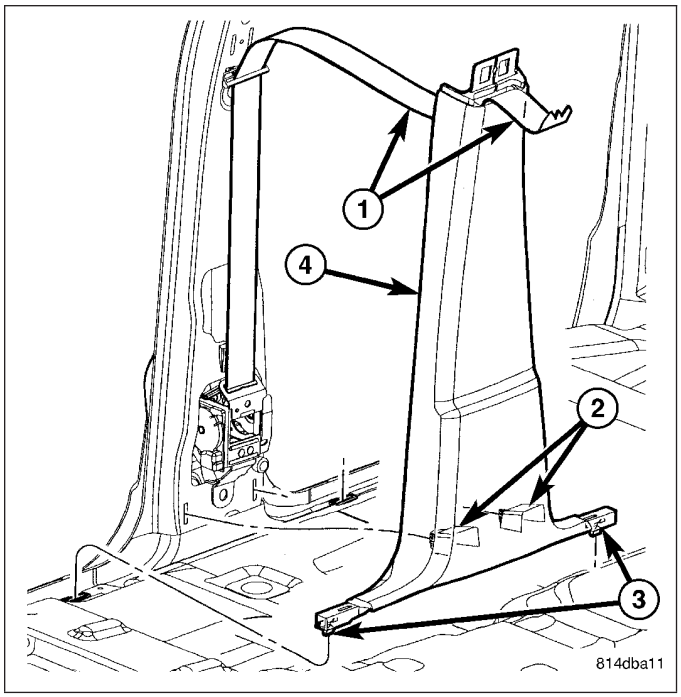
6. If removed, install the epoxy bonded washers.
7. Loosely install the two nuts (2) and the two bolts (1) that secure the door to the hinges.
8. Align the door to the hinges using the reference marks made during the removal procedure and tighten the nuts and bolts to 23 N·m (17 ft. lbs.) using the sequence shown.



9. Adjust the door if needed. (Refer to 23 - BODY/ DOORS - REAR/DOOR - ADJUSTMENTS)



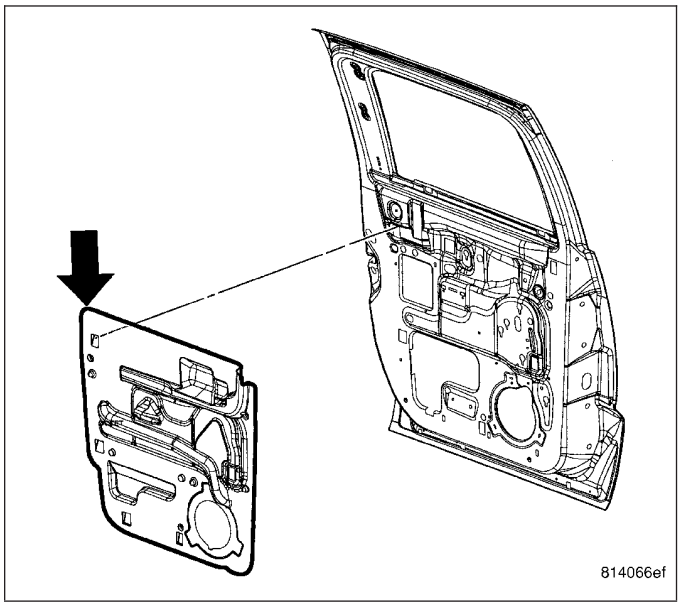
10. Install the lower b-pillar trim (4). (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - INSTALLATION)



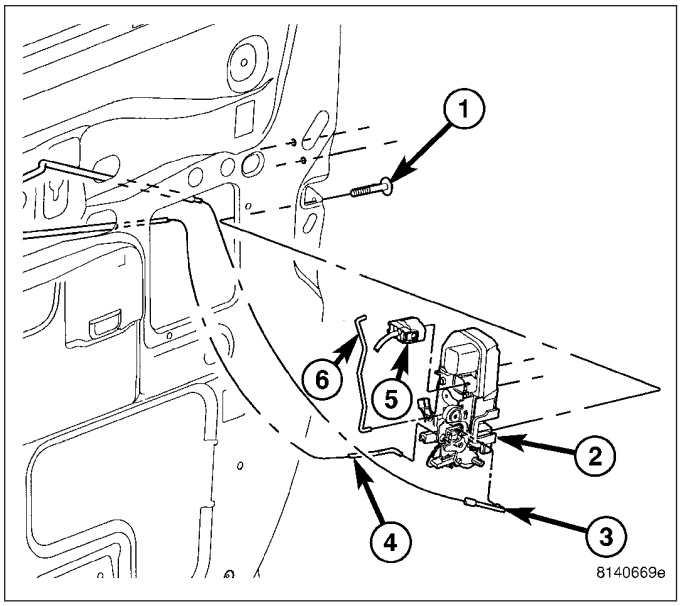
LATCH

REMOVAL

1. Remove the watershield. (Refer to 23 - BODY/ DOORS - REAR/WATERSHIELD - REMOVAL)

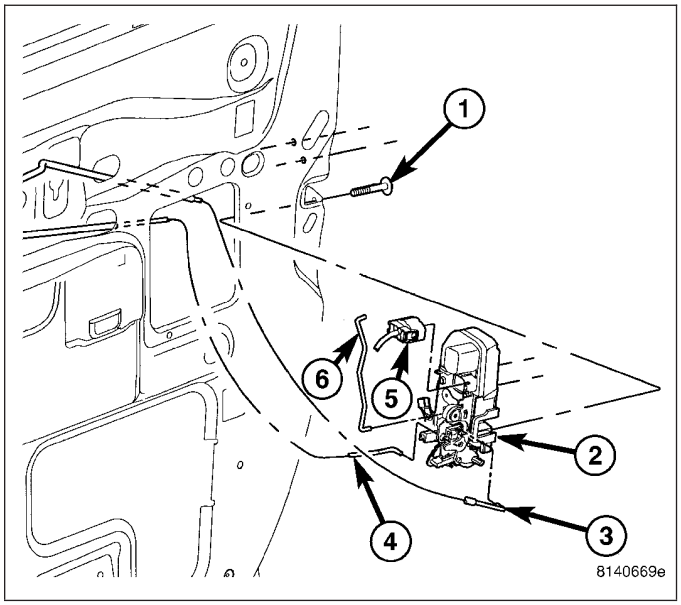


2. Disconnect the latch actuator rods (3, 4 and 6).
3. Remove the screws (1) and remove the latch (2).
4. Disconnect the electrical connector (5).

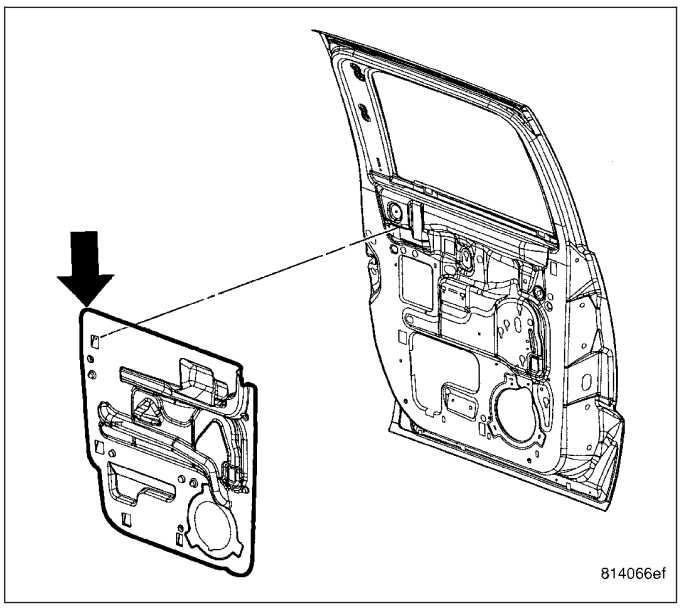


INSTALLATION

1. Position the latch (2) into the door and connect the electrical connector (5).
2. Install the latch and install the screws (1).
3. Tighten the screws to 10 N·m (85 in. lbs.).
4. Connect the actuator rods (3, 4 and 6).



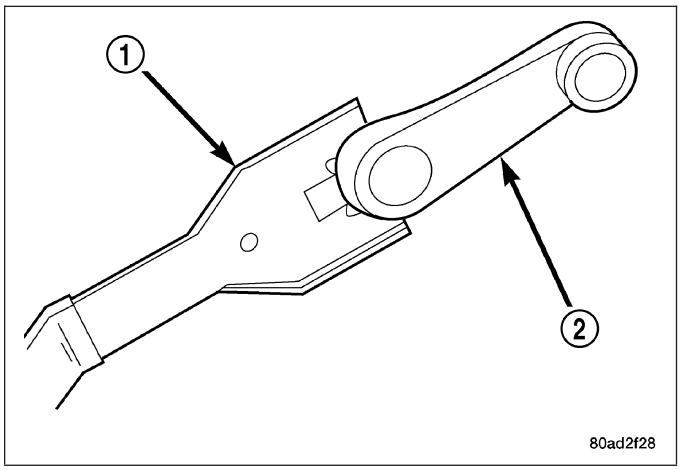
5. Install the watershield. (Refer to 23 - BODY/ DOORS - REAR/WATERSHIELD - INSTALLATION)



PANEL-TRIM

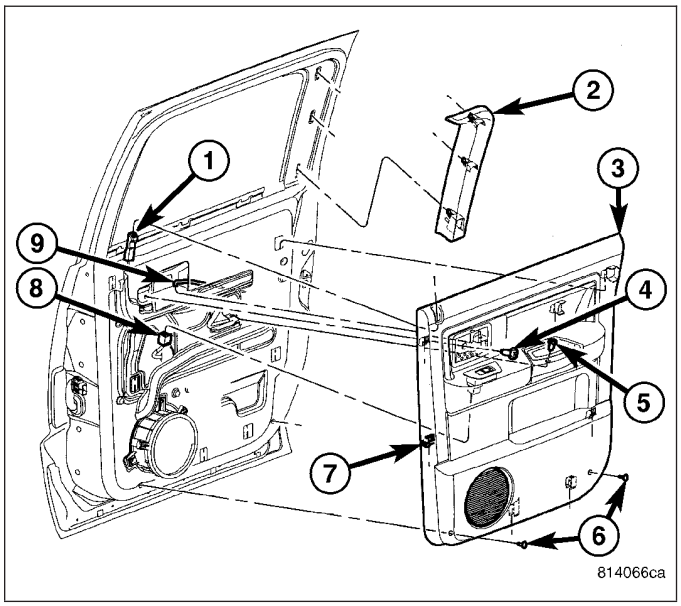
REMOVAL

1. Disconnect and isolate battery negative cable.
2. If equipped, remove the manual window crank (2) using a window crank removal tool (1).



3. Using a trim stick C-4755 or equivalent, separate and remove the close out panel (2).
4. Remove the screw (4) at the interior handle.
5. Remove the screw (5) from the pull cup.
6. Remove the lower screws (6).

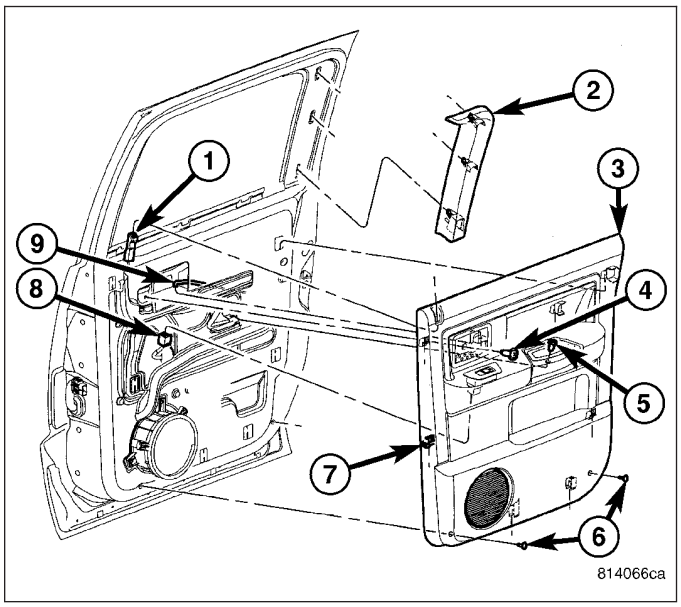
CAUTION: The door trim panel is attached to the door by molded plastic retaining clips that are integral to the door trim panel. Do not pull the door trim panel directly off of the door or damage to the trim panel and/or the power switch assembly will occur.



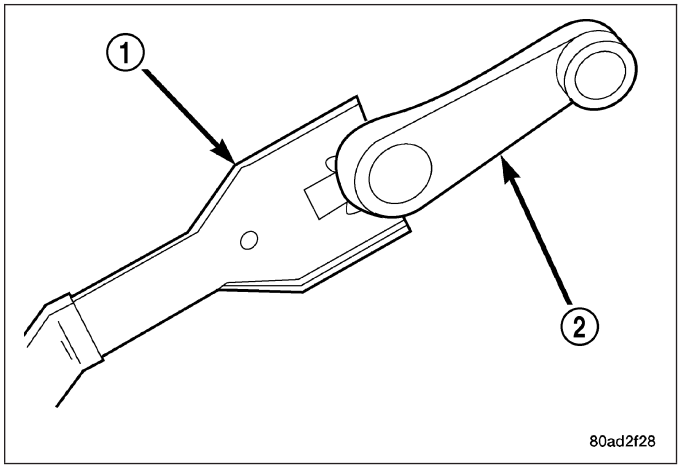
7. Lift the door trim panel straight upward to disconnect the molded plastic retaining clips (6) from the door.
8. Disconnect the interior handle actuator rod (9) from the handle.
9. Disconnect the electrical connector (8) for the window switch assembly, if equipped.

INSTALLATION

1. Position the trim panel (3) and connect the inside handle actuator rod (9).
2. Connect the electrical connectors (6).
3. Lift the trim panel up and onto the lock rod (1) and attachment hooks (7).
4. Install the lower screws (6).
5. Install the screw (5) from the pull cup.
6. Install the screw (4) at the interior handle.
7. Position the close out panel (2) and seat the fastener clips fully.



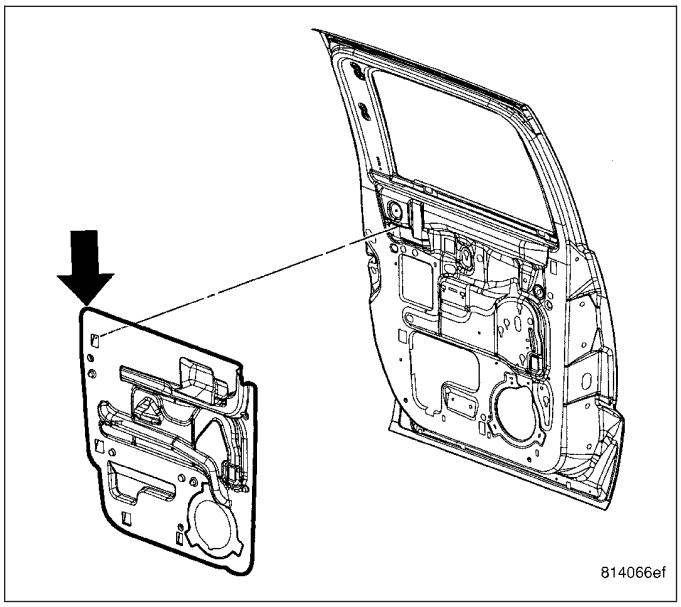
8. Install the manual window crank handle (2), if equipped.
9. Connect battery negative cable.



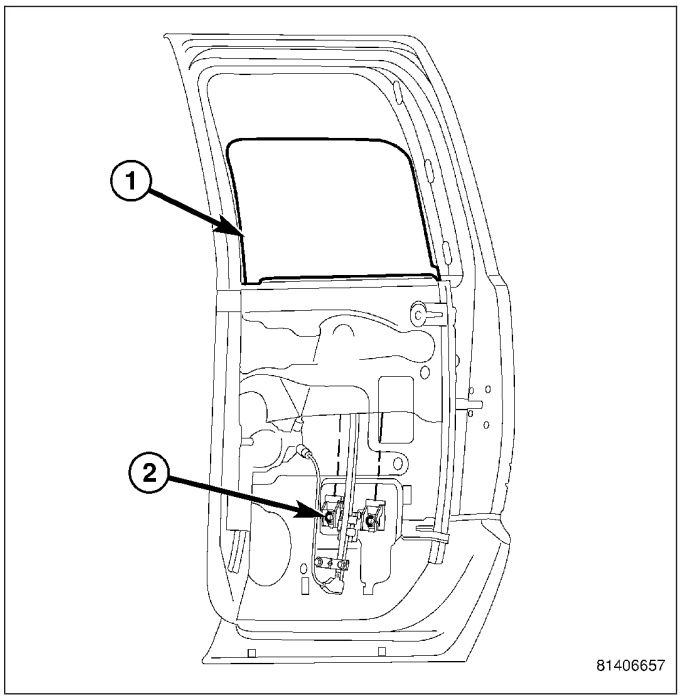
REGULATOR-WINDOW - MANUAL

REMOVAL

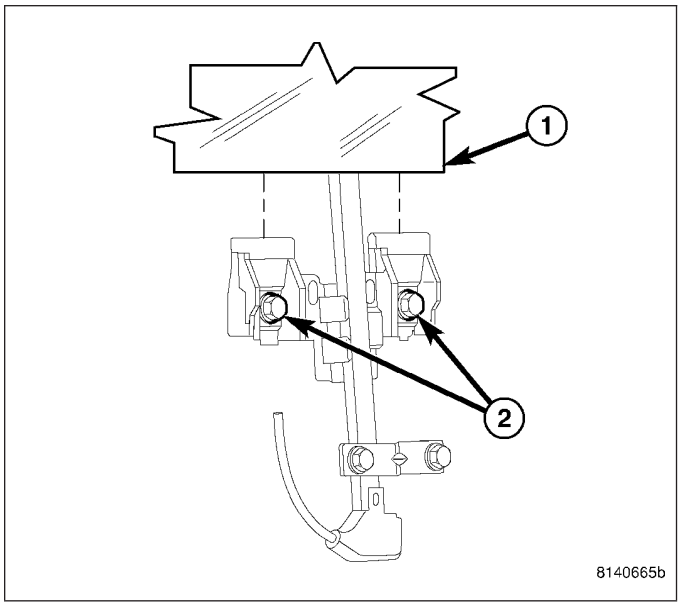
1. Remove the watershield. (Refer to 23 - BODY/ DOORS - REAR/WATERSHIELD - REMOVAL)



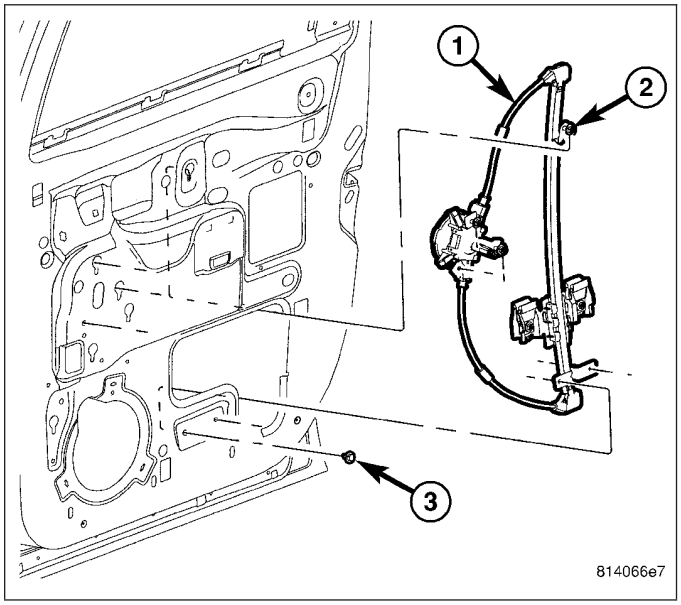
2. Reinstall the manual window crank and raise the door glass to the position shown (2).



3. Loosen the glass clamp screws (2).
4. Raise the glass into the full up position and secure into place with tape or equivalent.

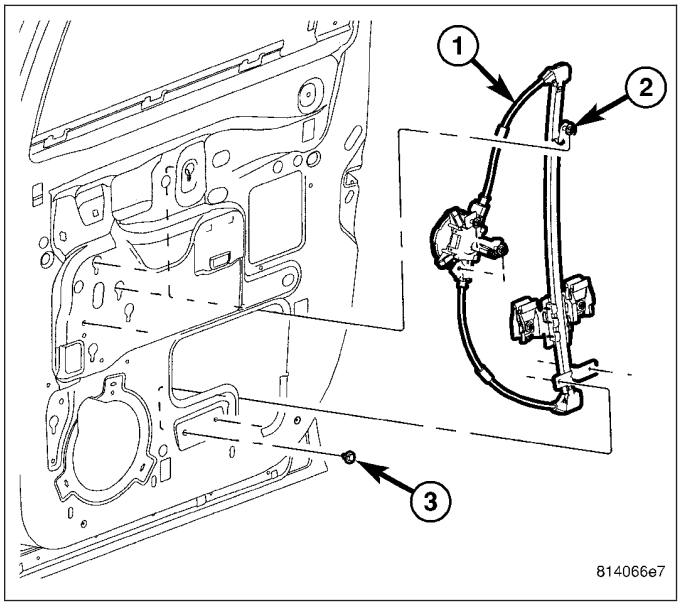


5. Remove the two lower regulator bolts (3).
6. Remove the one bolt at the crank mechanism.
7. Loosen the remaining three regulator bolts (2) located at the keyhole slots.
8. Lift regulator up and out of the keyhole slots and remove from door.

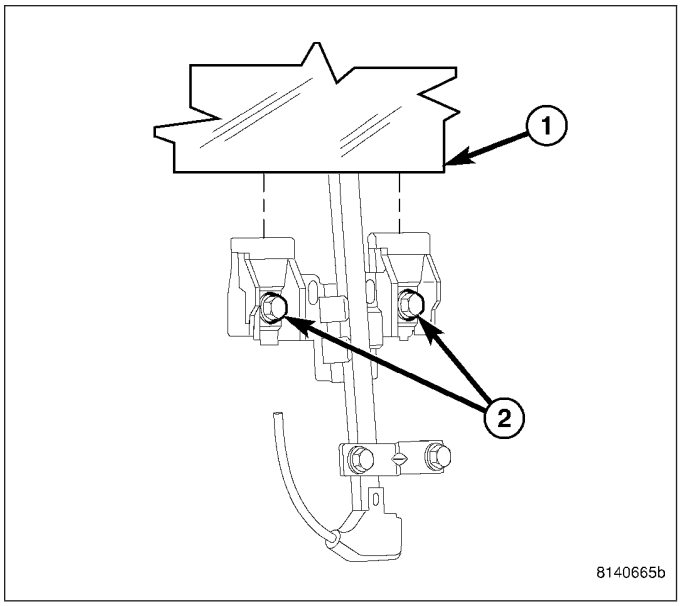


INSTALLATION

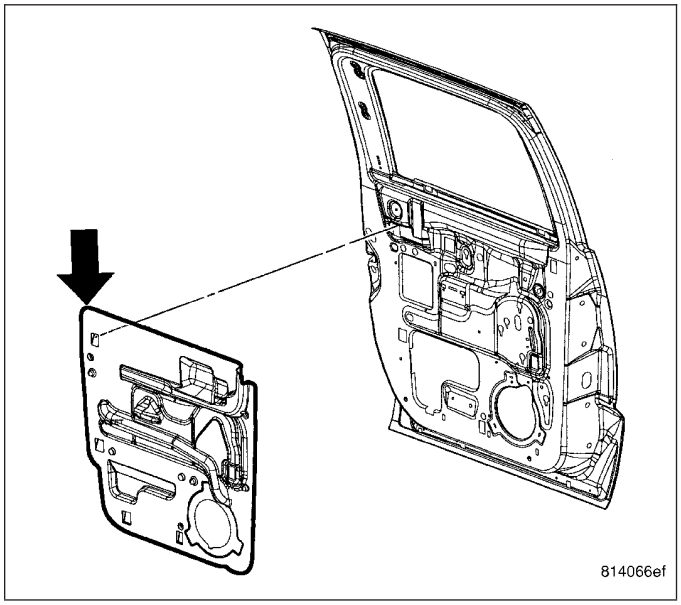
1. Place the regulator into the door and engage the bolts into the keyhole slots in the door.
2. Install the regulator lift mechanism bolt.
3. Install the two lower bolts (3).
4. Tighten all the regulator bolts to 10 N·m (85 in. lbs.).



5. Remove the tape used to secure the glass during removal and position the glass (1) into the glass clamps.
6. Temporarily install the window crank handle and raise the glass into the full up position.
7. Tighten the glass clamp screws (2) securely.



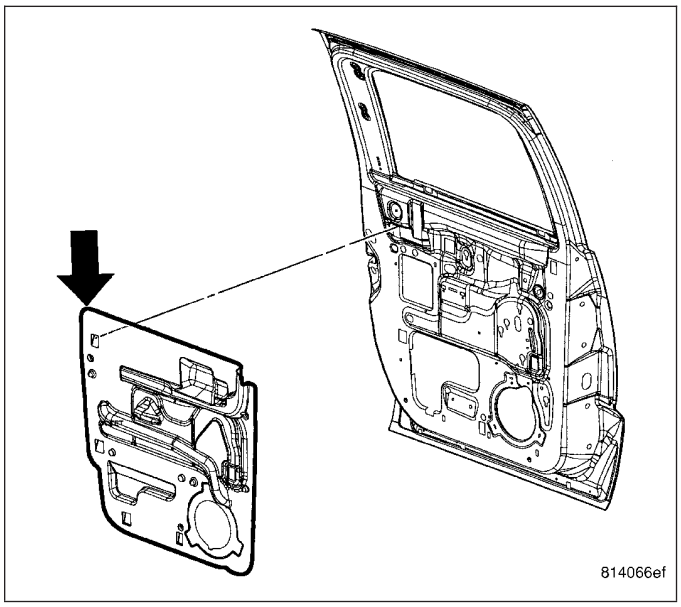
8. Remove the manual window crank and install the watershield. (Refer to 23 - BODY/DOORS - REAR/ WATERSHIELD - INSTALLATION)



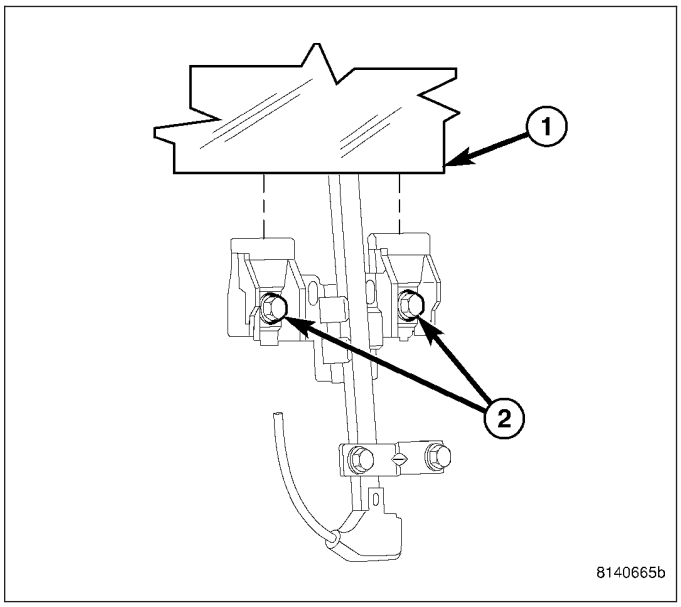
REGULATOR-WINDOW - POWER

REMOVAL

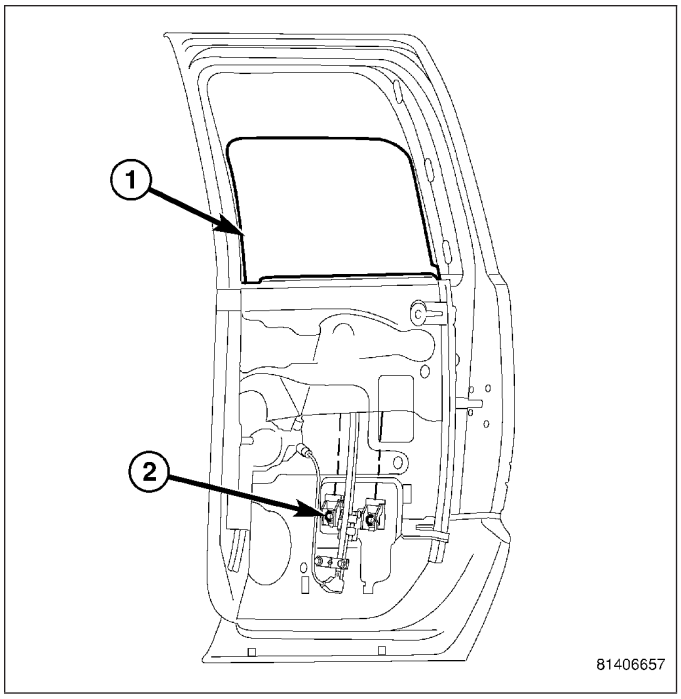
1. Remove the watershield. (Refer to 23 - BODY/ DOORS - REAR/WATERSHIELD - REMOVAL)



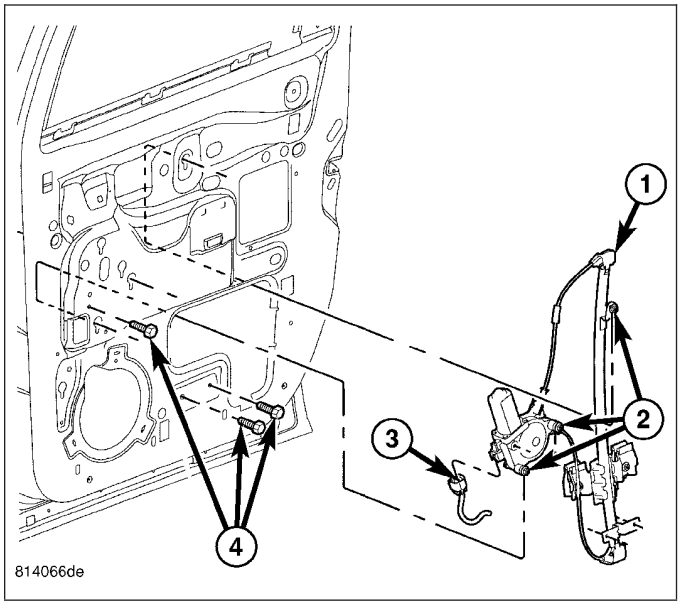
2. Temporarily install the window switch and position the glass (1) to gain access to the glass clamp screws (4).



3. Loosen the glass clamp screws (2).
4. Raise the glass (1) into the full up position and secure into place with tape or equivalent.

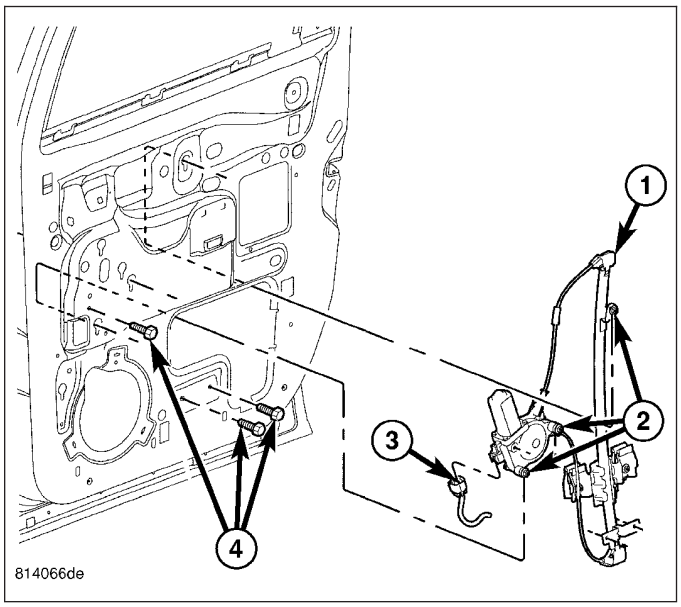


5. Disconnect the electrical connector (3).
6. Remove the two lower regulator bolts and the one bolt at the motor (4).
7. Loosen the remaining three regulator bolts (2) located at the keyhole slots.
8. Lift regulator (1) up and out of the keyhole slots and remove from door.

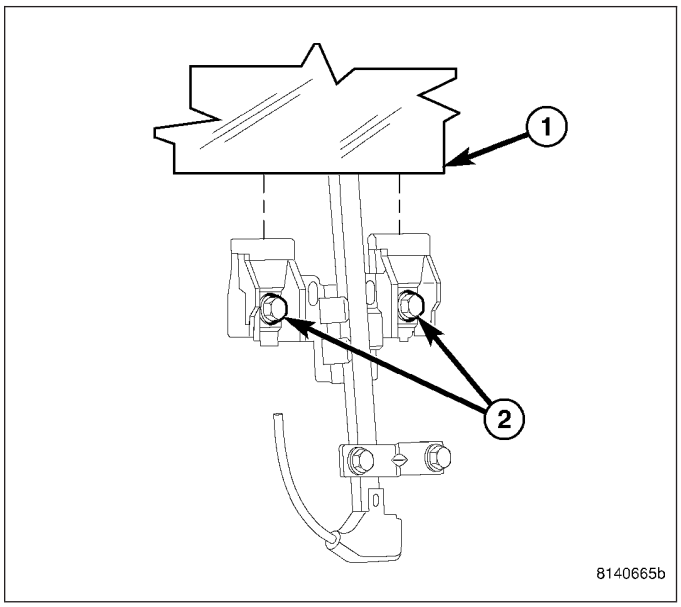


INSTALLATION

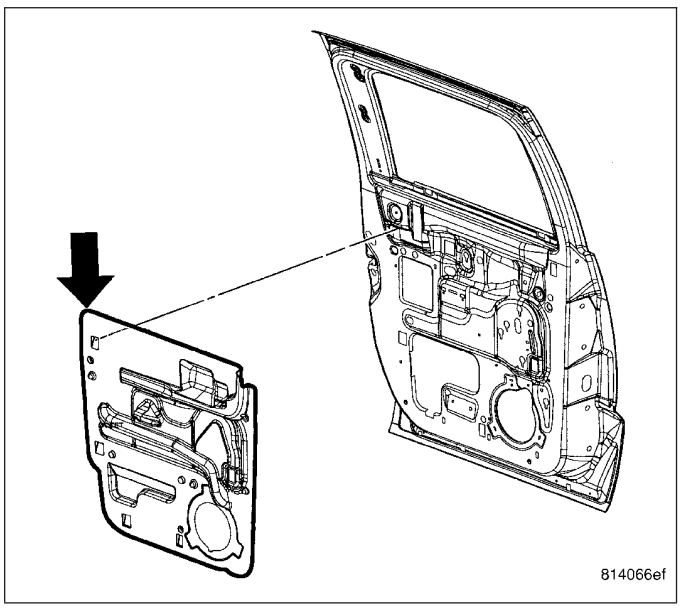
1. Place the regulator into the door and engage the bolts (2) into the keyhole slots in the door.
2. Install the one bolt at the motor and the two lower bolts (4).
3. Tighten all the regulator bolts to 10 N·m (85 in. lbs.).
4. Connect the electrical connector (3).



5. Remove the tape used to secure the glass during removal and position the glass (1) into the glass clamps.
6. Temporarily install the window switch and raise the glass into the full up position.
7. Tighten the glass clamp screws (2) securely.



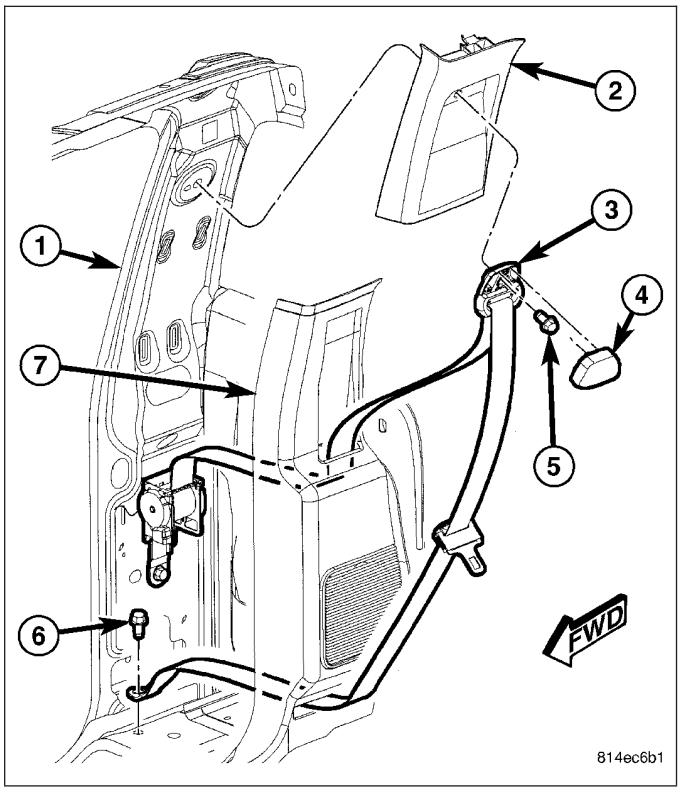
8. Remove the window switch and install the watershield. (Refer to 23 - BODY/DOORS - REAR/WATERSHIELD - INSTALLATION)



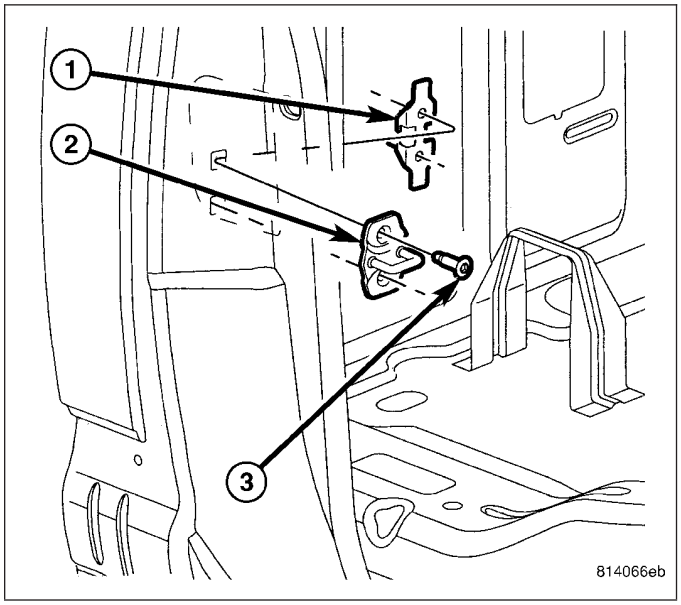
STRIKER

REMOVAL

1. Remove the lower c-pillar trim (7). (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - REMOVAL)

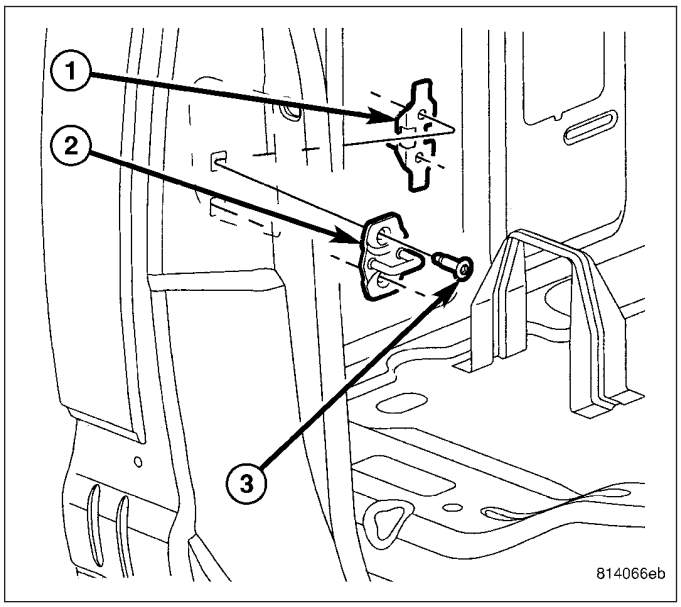


2. Using a grease pencil or equivalent, mark the position of the striker (2).
3. Remove the bolts (1) and remove the striker.

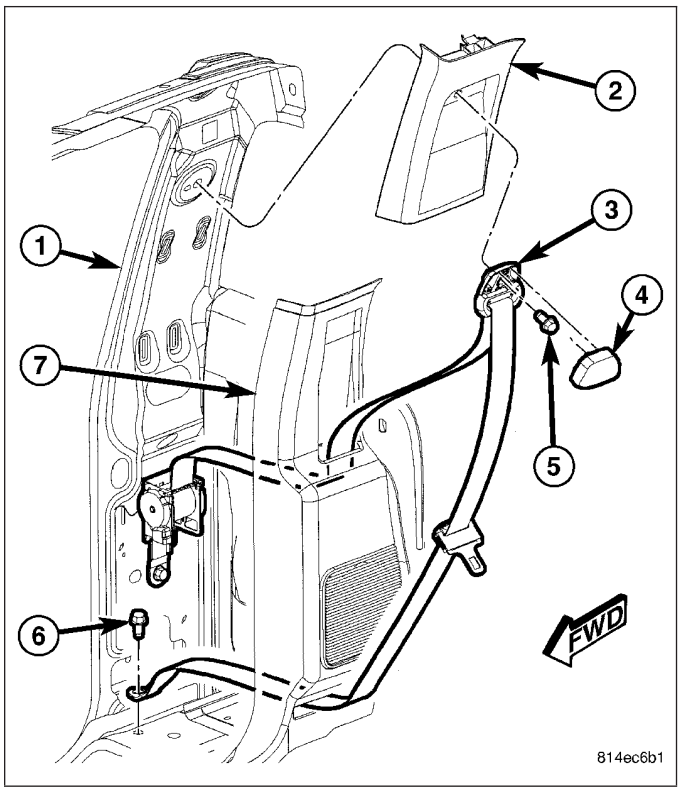


INSTALLATION

1. Position the tapping plate (1) into the b-pillar.
2. Install the striker (2) and install the bolts (3).
3. Tighten the bolts to 28 N·m (21 ft. lbs.).



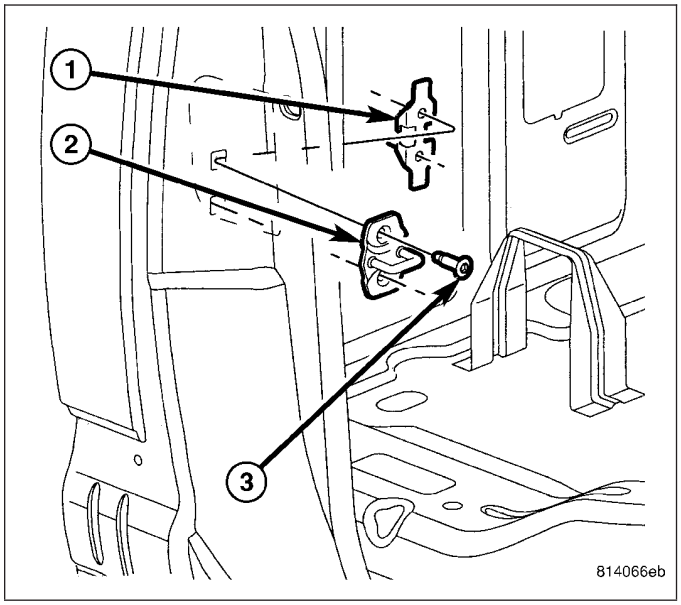
4. Adjust the striker if needed. (Refer to 23 - BODY/ DOORS - REAR/STRIKER - ADJUSTMENTS)
5. Install the lower c-pillar trim (7). (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - INSTALLATION)



ADJUSTMENTS

ADJUSTMENT

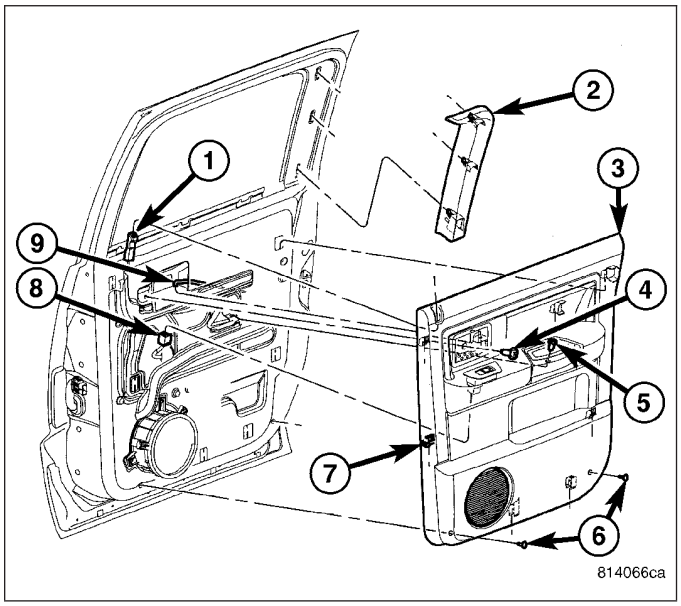
1. Using a grease pencil or equivalent, mark the position of the striker (2) to aid in adjustment.
2. Loosen the striker bolts (3).
3. Change the striker position to adjust the rear gap and flush measurement. (Refer to 23 - BODY/ BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
4. Tighten the bolts to 28 N·m (21 ft. lbs.).



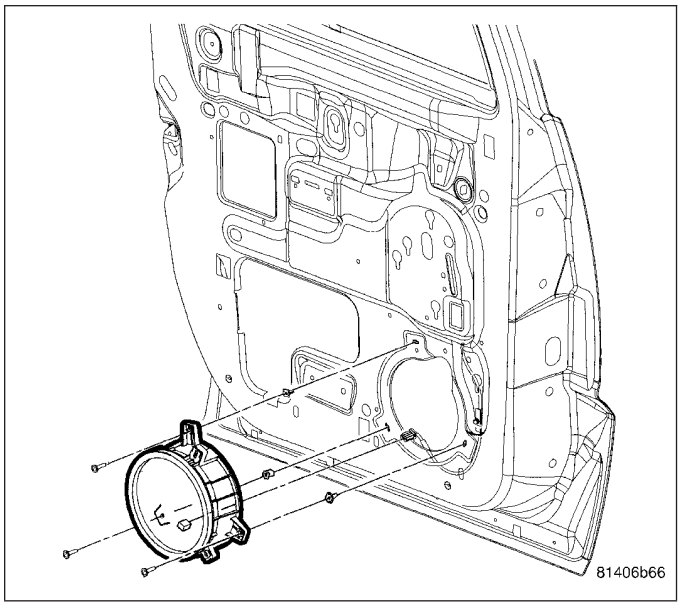
WATERSHIELD

REMOVAL

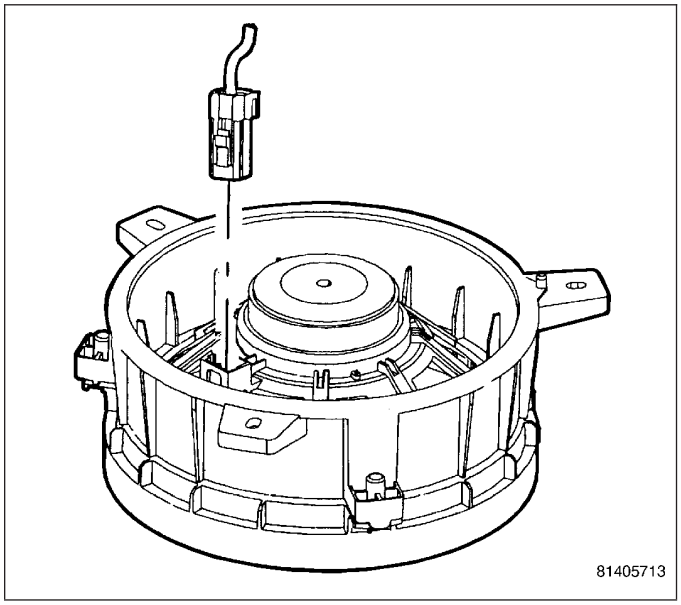
1. Disconnect and isolate the battery negative cable.
2. Remove the rear door trim panel (3). (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL)
3. Remove the pull cup bracket bolts and bracket.



4. Remove the speaker mounting fasteners.



5. Remove speaker and disconnect the electrical harness connector.

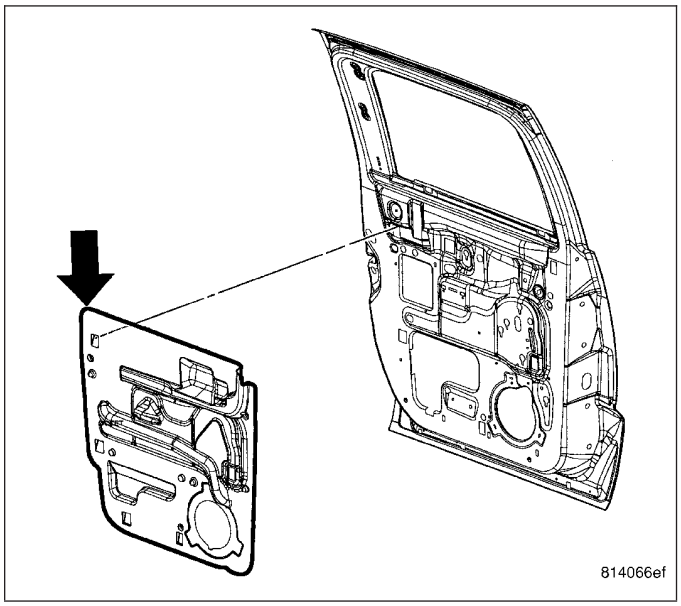


CAUTION: Do not allow the watershield or adhesive to become contaminated with dirt or other foreign substances.

Do not damage the watershield during removal and installation.

If the watershield becomes contaminated or damaged, replace the watershield.

6. Carefully remove the watershield from around the perimeter of the door.
7. Separate the watershield from the interior handle actuator rod and the door wire harness (if equipped) and remove the watershield.



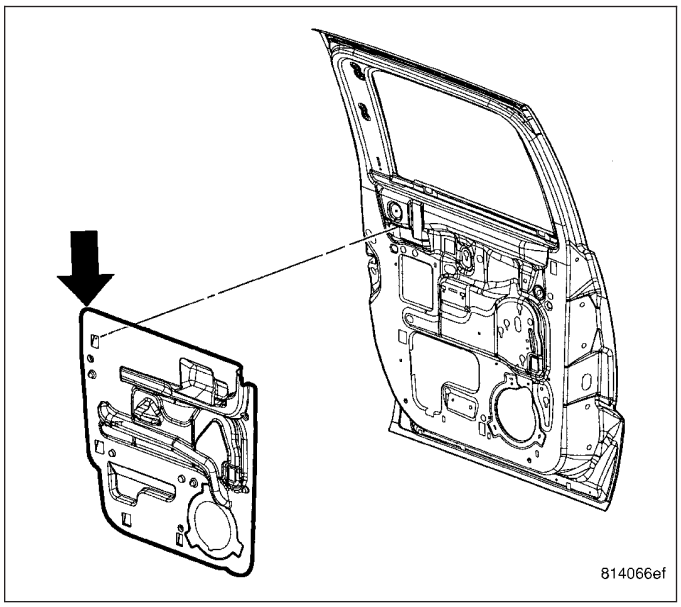
INSTALLATION

CAUTION: Do not allow the watershield or adhesive to become contaminated with dirt or other foreign substances.

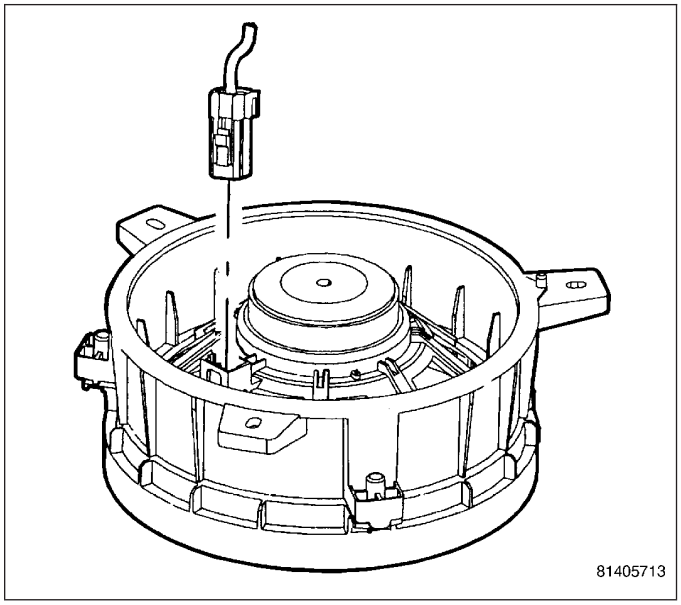
Do not damage the watershield during removal and installation.

If the watershield becomes contaminated or damaged, replace the watershield.

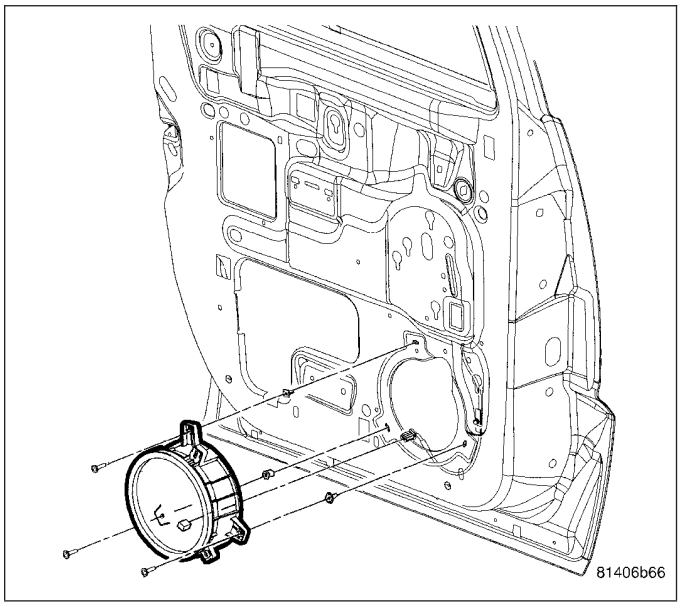
1. Position the wire harness and actuator rods through the holes in the watershield.
2. Secure the watershield to the inner door panel.



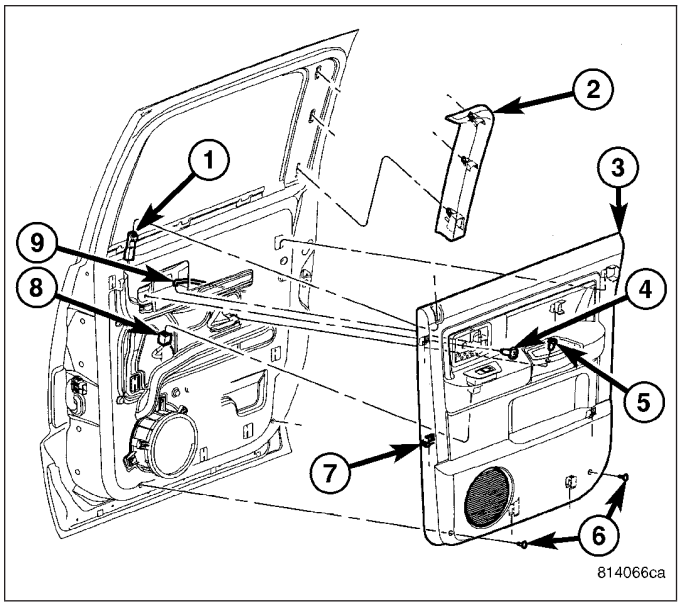
3. Connect electrical harness connector and position speaker to door.



4. Install and tighten mounting fasteners.



5. Install the door pull cup bracket and install the bolts.
6. Install door trim panel (3). (Refer to 23 - BODY/ DOORS - REAR/PANEL-TRIM - INSTALLATION)
7. Connect battery negative cable.



EXTERIOR

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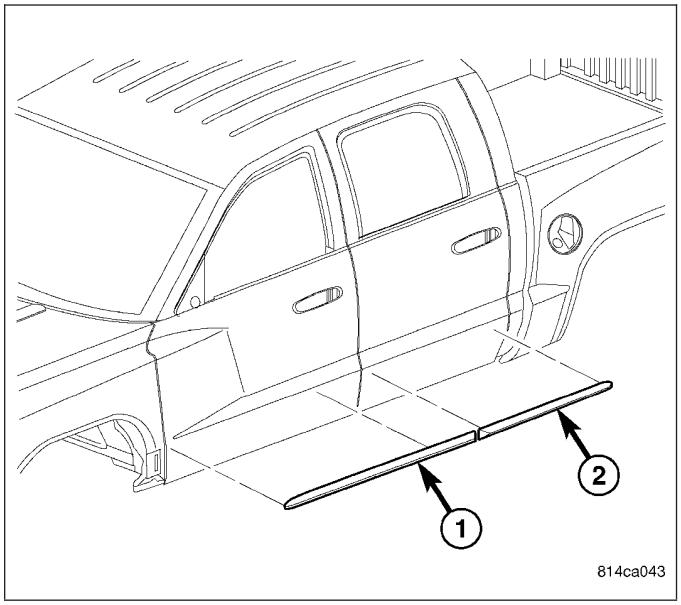
BODY SIDE MOLDINGS

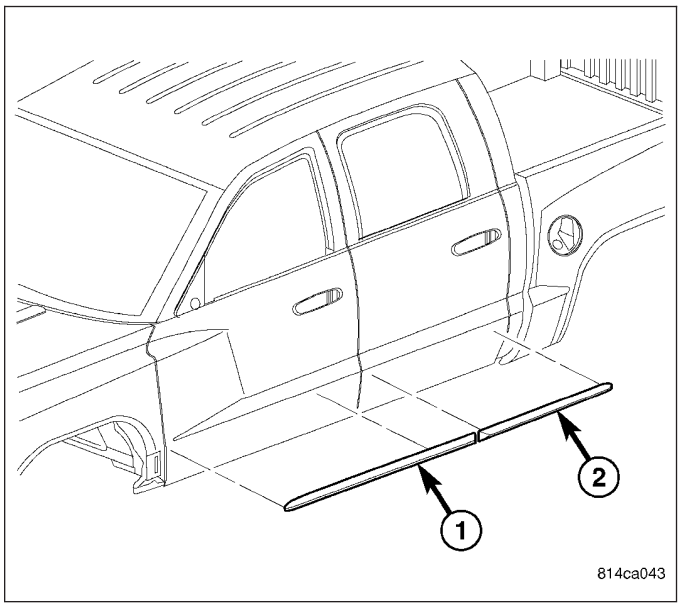
REMOVAL

1. Apply a length of masking tape on the body, parallel to the top edge of the molding to use as a guide, if necessary.
2. Warm the effected adhesive type molding and body metal to approximately 38°C (100°F) using a suitable heat lamp or heat gun.
3. Pull stick-on molding from painted surface.



INSTALLATION

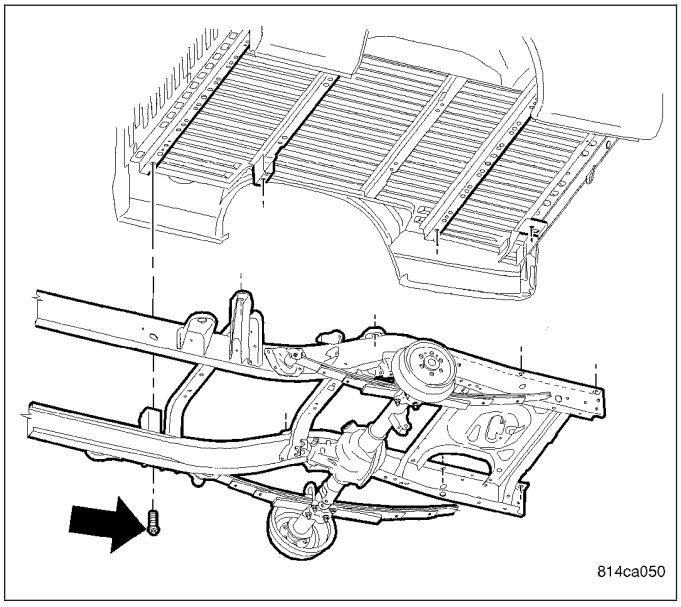
1. Clean body surface with MOPAR® Super Kleen solvent or equivalent. Wipe surface dry with lint free cloth.
2. Remove protective cover from tape on back of molding. Apply molding to body below the masking tape guide.
3. Remove masking tape guide and firmly press molding to body surface to assure adhesion.



CARGO BOX

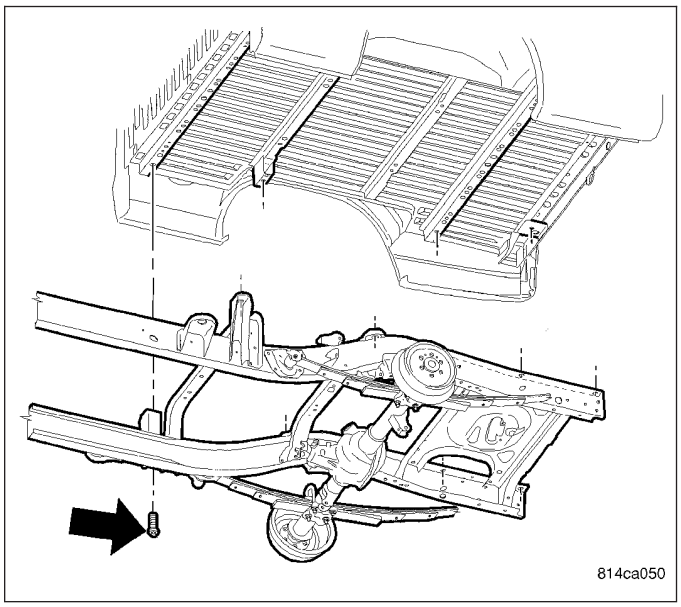
REMOVAL

1. Disconnect the fuel fill hose and vent hose. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL TANK - REMOVAL)
2. Disconnect the tail lamp wire harness.
3. Remove the cargo box bolts.
4. Remove the cargo box.



INSTALLATION

1. Install the cargo box and install the bolts.
2. Tighten the bolts to 108 N·m (80 ft. lbs.).
3. Connect the fuel fill and vent hoses. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL TANK - INSTALLATION)
4. Connect the tail lamp wire harness.

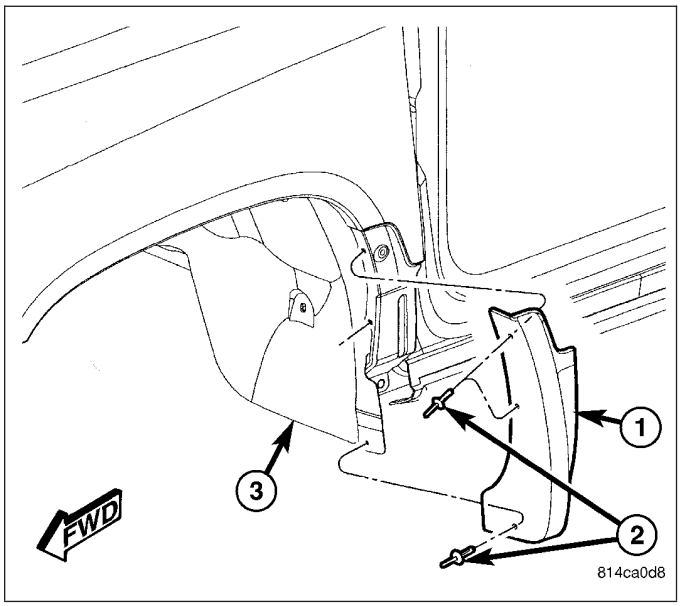


CLADDING-BODY SIDE

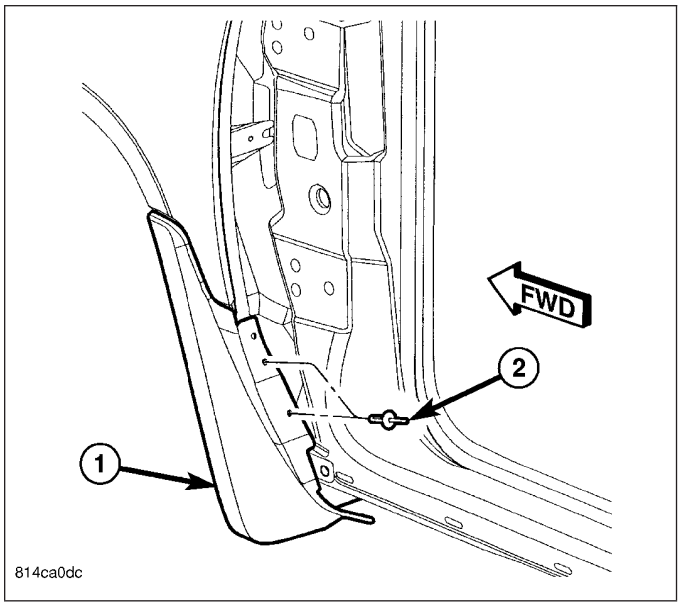
REMOVAL

FENDER CLADDING

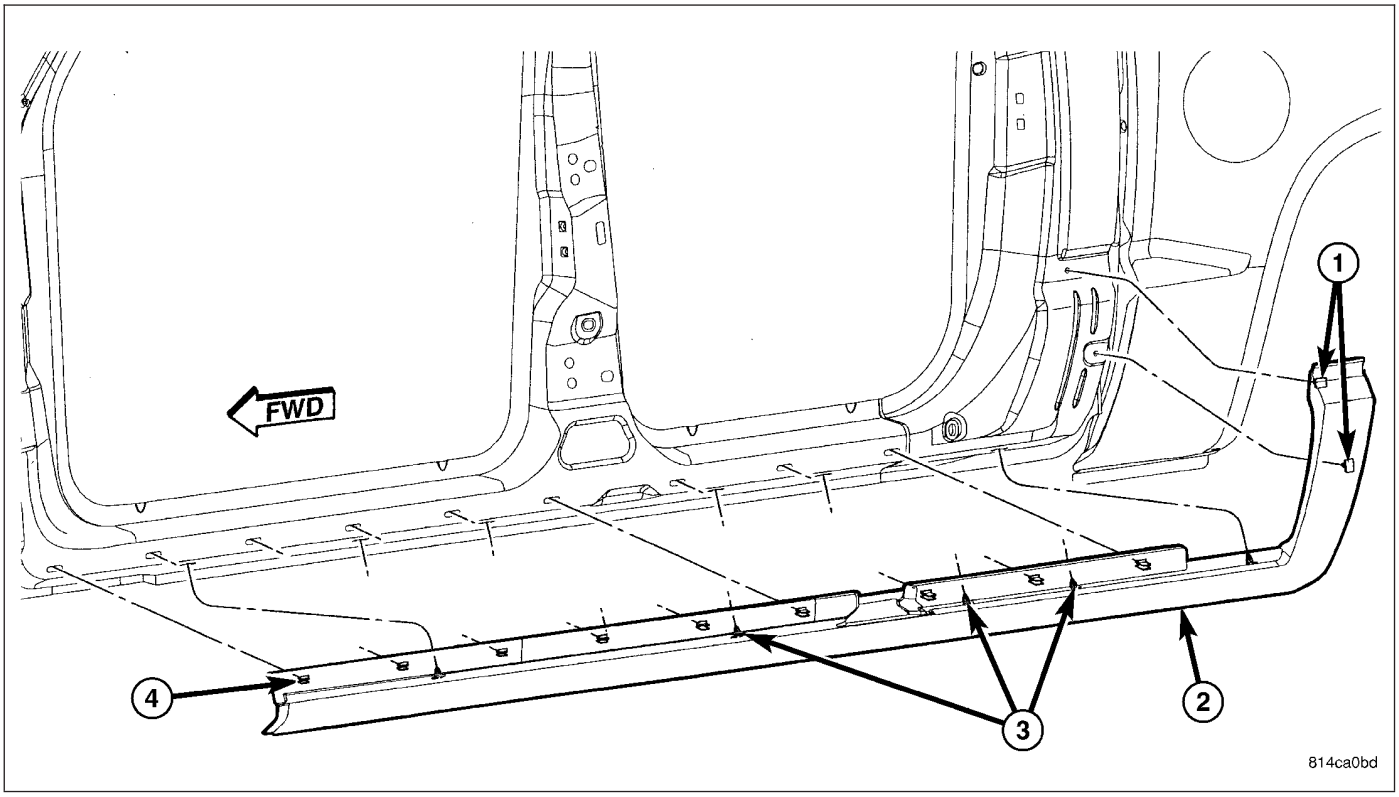
1. From inside the wheelwell (3), remove the fasteners (2) holding the fender cladding (1) to the fender.



2. Open the front door, from inside the a-pillar opening, remove the rear fasteners (2) from the fender cladding (1).



BODYSIDE CLADDING

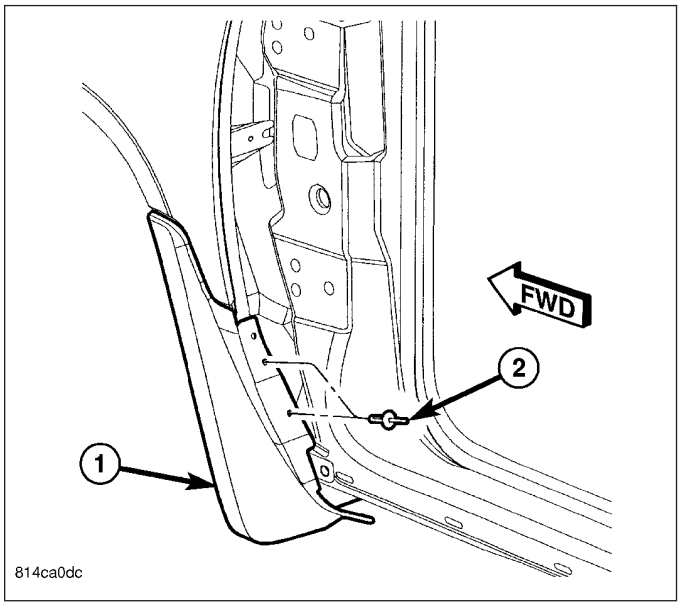


1. Open door(s) and remove the fasteners (3) holding the bodyside cladding (2) in the lower door opening.
2. Remove the two fasteners holding the rear (1) of the bodyside cladding (2) to the rear side of the cab.

INSTALLATION

FENDER CLADDING

1. Position the fender cladding (1) and install the fasteners (2) into the a-pillar opening.



2. From inside the wheelwell (3), install the fasteners (2) holding the fender cladding (1) to the fender.

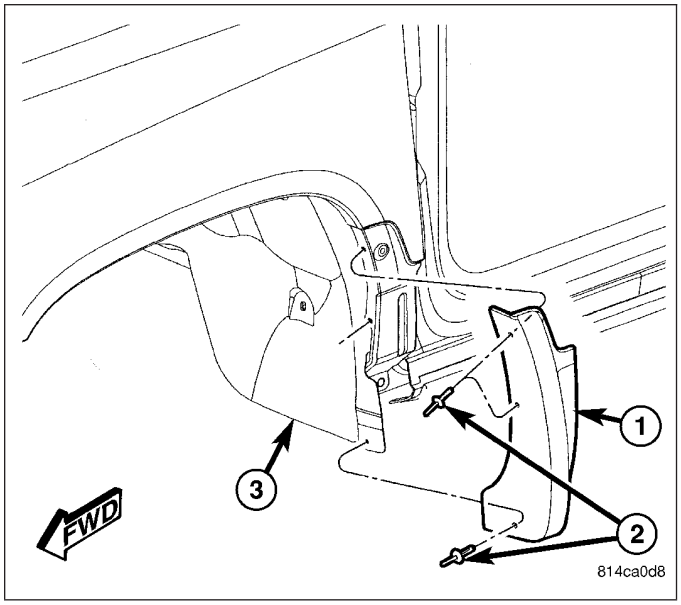
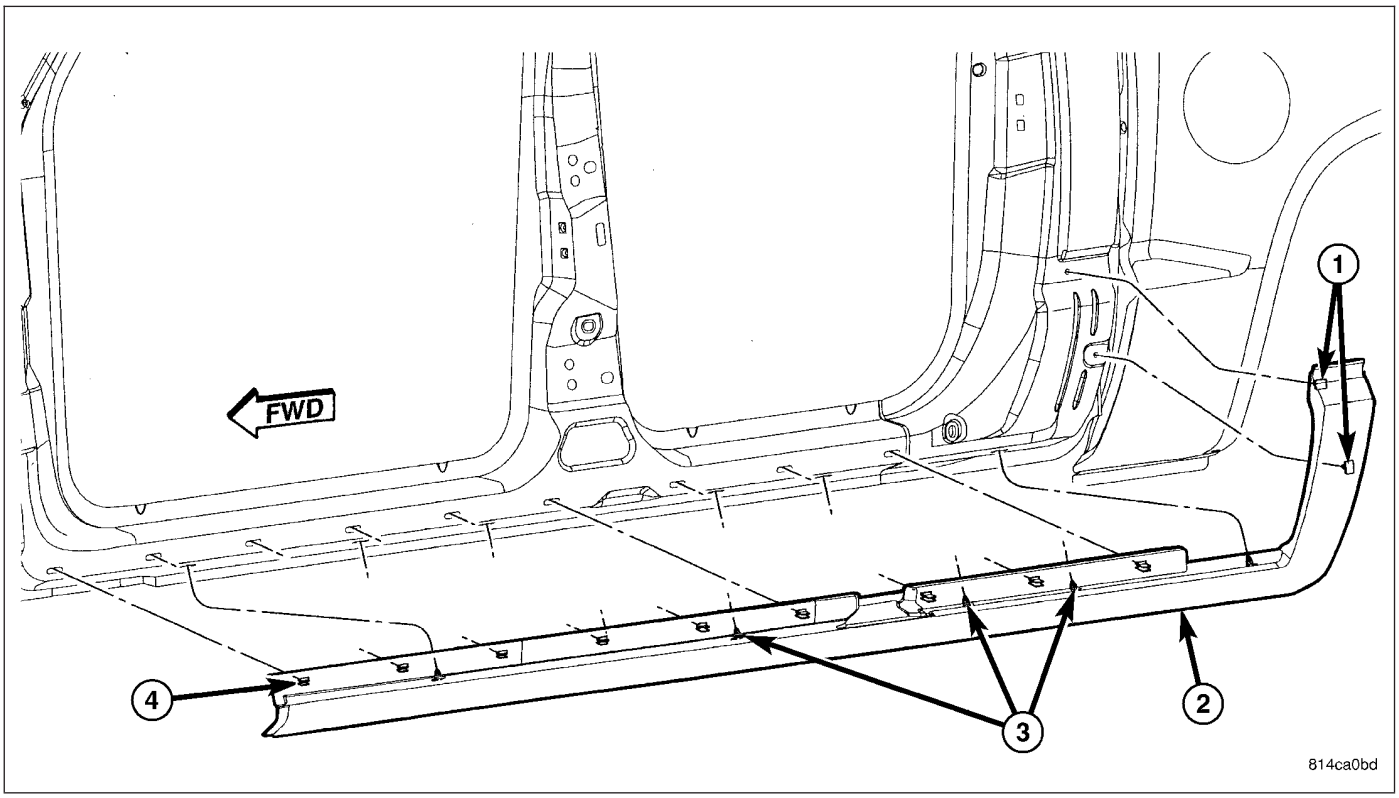


Fig. 1

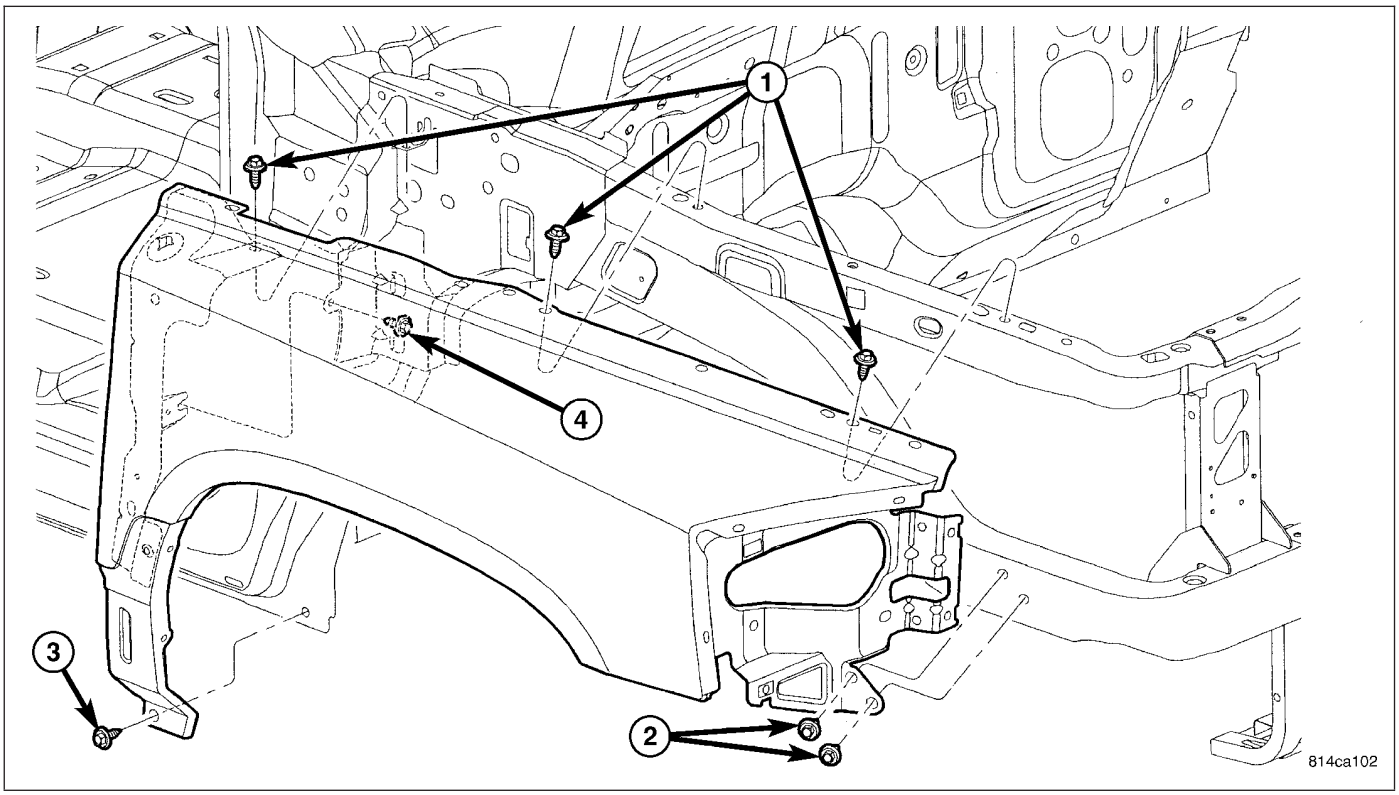
BODYSIDE CLADDING



1. Position the bodyside cladding (2) in the door opening(s) and install the fasteners (3).
2. Install the two fasteners holding the rear (1) of the bodyside cladding (2) to the rear side of the cab, just behind the c-pillar.

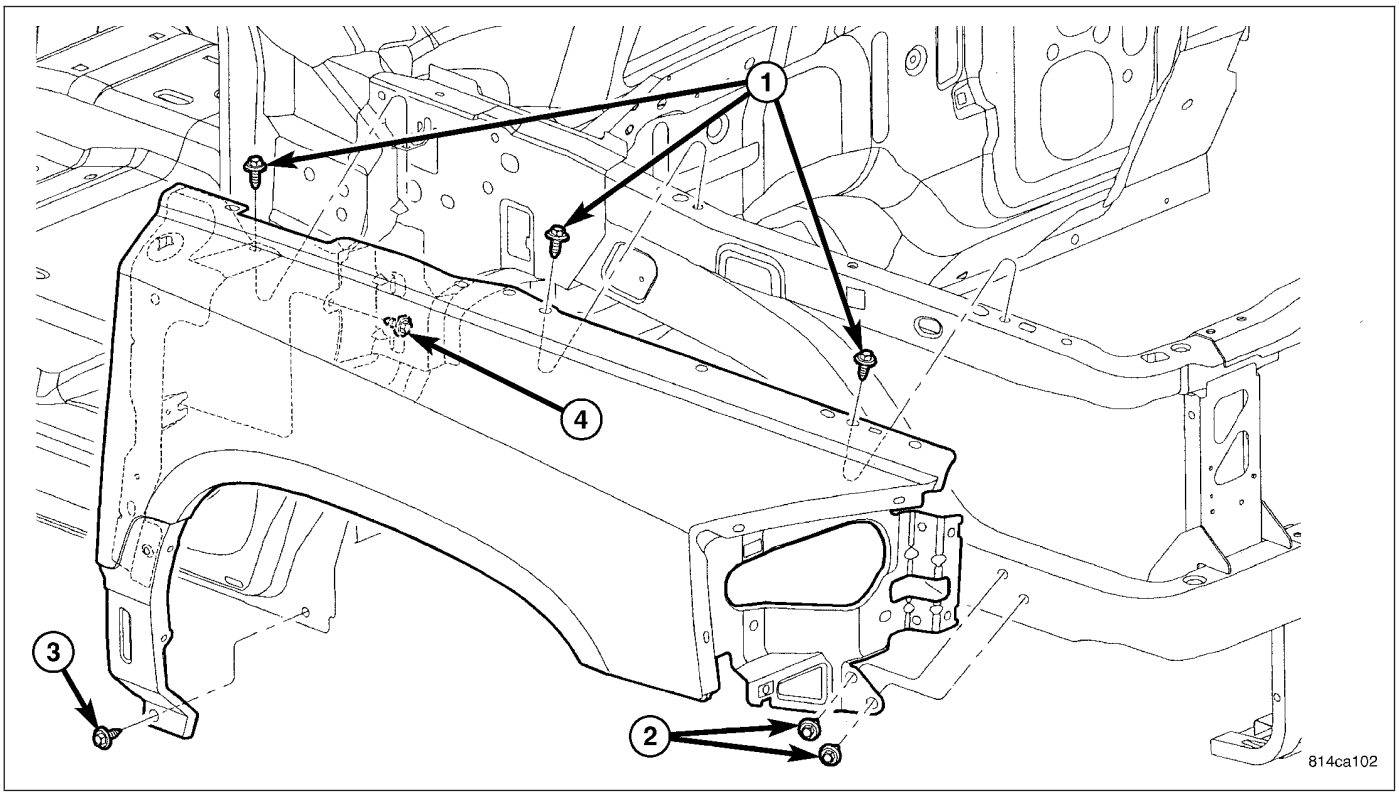
FENDER

REMOVAL



1. Remove the grille. (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL)
2. Remove the headlight assembly. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - REMOVAL)
3. Remove the wheelhouse splash shield. (Refer to 23 - BODY/EXTERIOR/FRONT WHEELHOUSE SPLASH SHIELD - DESCRIPTION)
4. Remove the cowl grille. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE AND SCREEN - REMOVAL)
5. When servicing the right side fender, remove the battery tray (1) and air cleaner bolts (2) from the front end sheet metal (3).
6. When servicing the left side fender, remove the power distribution center bolts (1) from the front end sheet metal (2).
7. Remove the two bolts from the fender behind the wheel.
8. Remove the bolt from inside the wheel well.
9. Remove the bolts from the headlamp opening.
10. Using a trim stick C-4755 or equivalent, remove the trim and remove the bolt at the upper rear of the fender.
11. Remove the upper fender bolt support bolt to the hood hinge.
12. Remove the front end sheet metal mounting bolts.
13. Slide the fender off the front end sheet metal mounting support.

INSTALLATION



1. When installing the left side fender, position the fender onto the Front End Sheet Metal mounting hydroform and slide under the power distribution center.
2. When installing the right side fender, position the fender onto the FESM mounting hydroform and slide under the battery tray and air cleaner mounting brackets.

NOTE: Tighten the fender fasteners only after all fasteners are installed loosely and fender is adjusted for gap and flush, using the sequence provided at the end of the installation procedure.

3. Loosely install the upper FESM mounting bolts.
4. Loosely install the bolt attaching the rear upper fender to the hood hinge.
5. Loosely install the bolt attaching the rear upper fender to the a-pillar.
6. Loosely install the two bolts located in the headlamp opening.
7. Loosely install the bolt located inside the wheel well.
8. Loosely install the two lower bolts located at the a-pillar.
9. Check the fender positioning and adjust as required by adding shims. (Refer to 23 - BODY/BODY STRUCTURE/ GAP AND FLUSH - SPECIFICATIONS)
10. Tighten the fender bolts to 8 N·m (75 in. lbs.) using the sequence shown.
11. When installing the left side fender, install the power distribution center bolts (1) to the FESM (2) and tighten to 11 N·m (100 in. lbs.).
12. When installing the right side fender, install the battery tray bolts and tighten to 11 N·m (100 in. lbs.).
13. Install the air cleaner mounting bolts and tighten to 10 N·m (85 in. lbs.).
14. Install the cowl grille. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE AND SCREEN - INSTALLATION)
15. Install the wheelhouse splash shield. (Refer to 23 - BODY/EXTERIOR/FRONT WHEELHOUSE SPLASH SHIELD - DESCRIPTION)
16. Install the headlight assembly. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - INSTALLATION)
17. Install the grille. (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION)

GLASS-OUTSIDE REARVIEW MIRROR

REMOVAL

WARNING: ALWAYS WEAR EYE AND HAND PROTECTION WHEN SERVICING THE MIRROR ASSEMBLY. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY FROM BROKEN GLASS.

1. Carefully pull/pry the broken glass holder from the mirror assembly.
2. Disconnect the heated mirror electrical connectors from the terminals on the mirror glass holder, if equipped.

INSTALLATION

CAUTION: It is important to make sure the motor is square to the glass holder (attaching fingers) prior to glass holder attachment, otherwise the glass holder could be installed incorrectly causing poor retention and possible repeat failure.

1. Position the new mirror glass holder to the mirror assembly.

NOTE: Position the mirror glass holder so that the moisture drain hole on the mirror glass holder assembly is facing downward.

2. Align the mirror glass holder's attaching fingers to the mirror motor housing.

NOTE: Ensure that the protective rubber cover of the mirror motor housing is positioned correctly around the bottom of the fingers area.

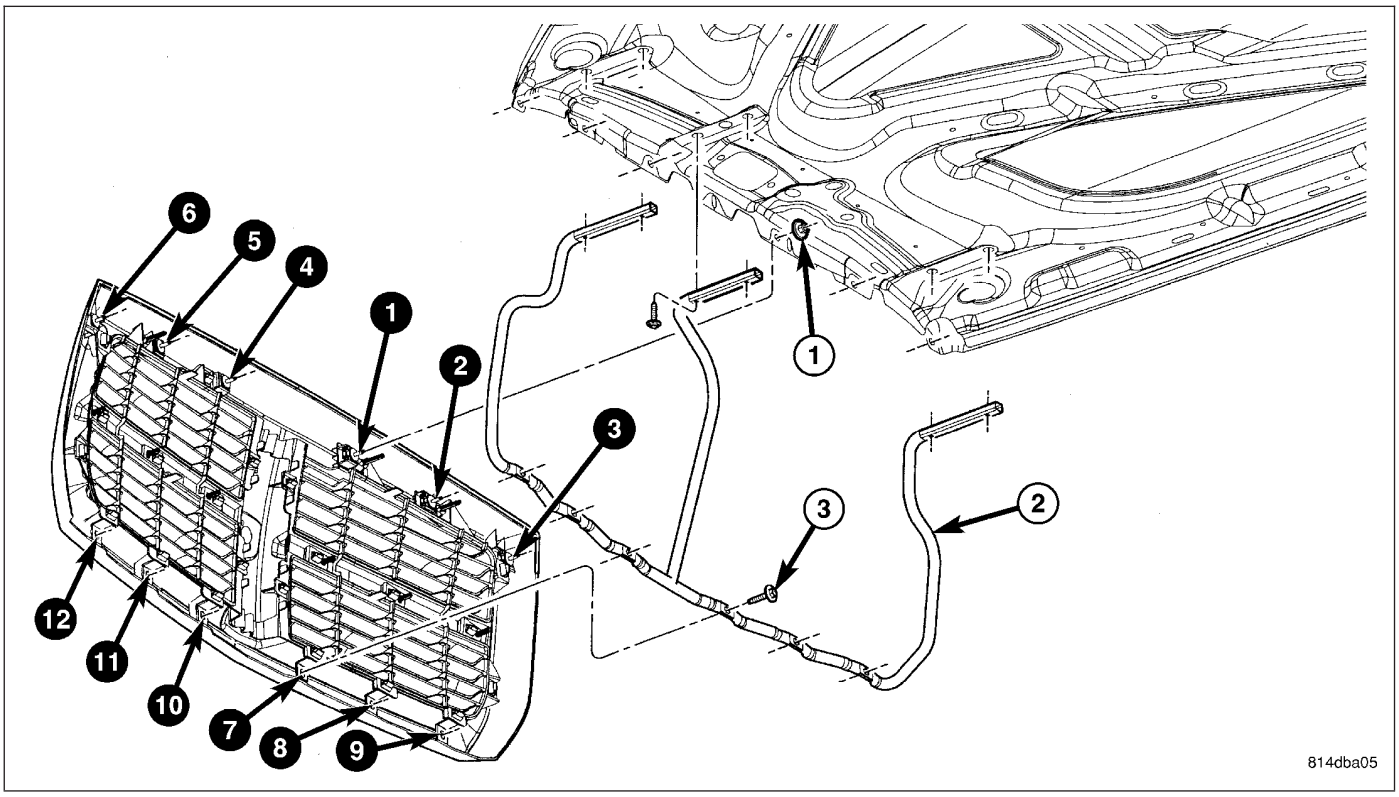
3. Using one hand, firmly press the mirror glass holder assembly into place while at the same time supporting the housing assembly from the backside with the other hand.

NOTE: Pressure must be applied equally over the center portion of the mirror to engage the mirror glass holder's attaching fingers to the corresponding fingers on the housing assembly. One or more clicks may be heard when finger engagement takes place.

4. Verify retention of the mirror glass holder assembly by gently pulling outward on the mirror glass holder.

GRILLE

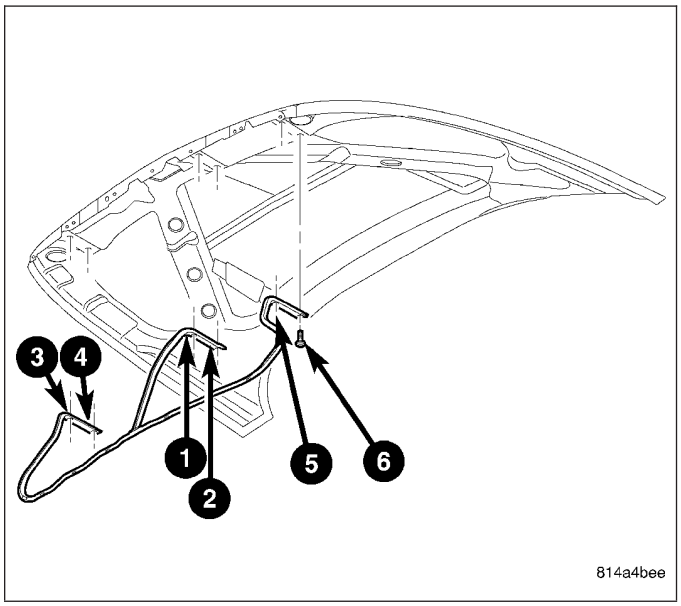
REMOVAL



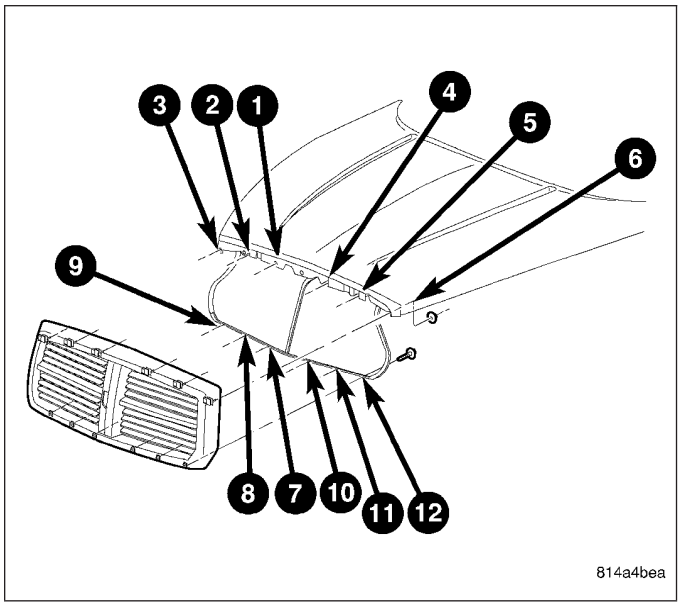
1. Open hood.
2. Remove the 12 screws and nuts and remove the grille from bracket.
3. Remove the screws and the grille bracket from hood.

INSTALLATION

1. Install the grille bracket and loose install the screws.
2. Tighten the screws to 3.2 N·m (29 ins. lbs.) using the sequence shown.

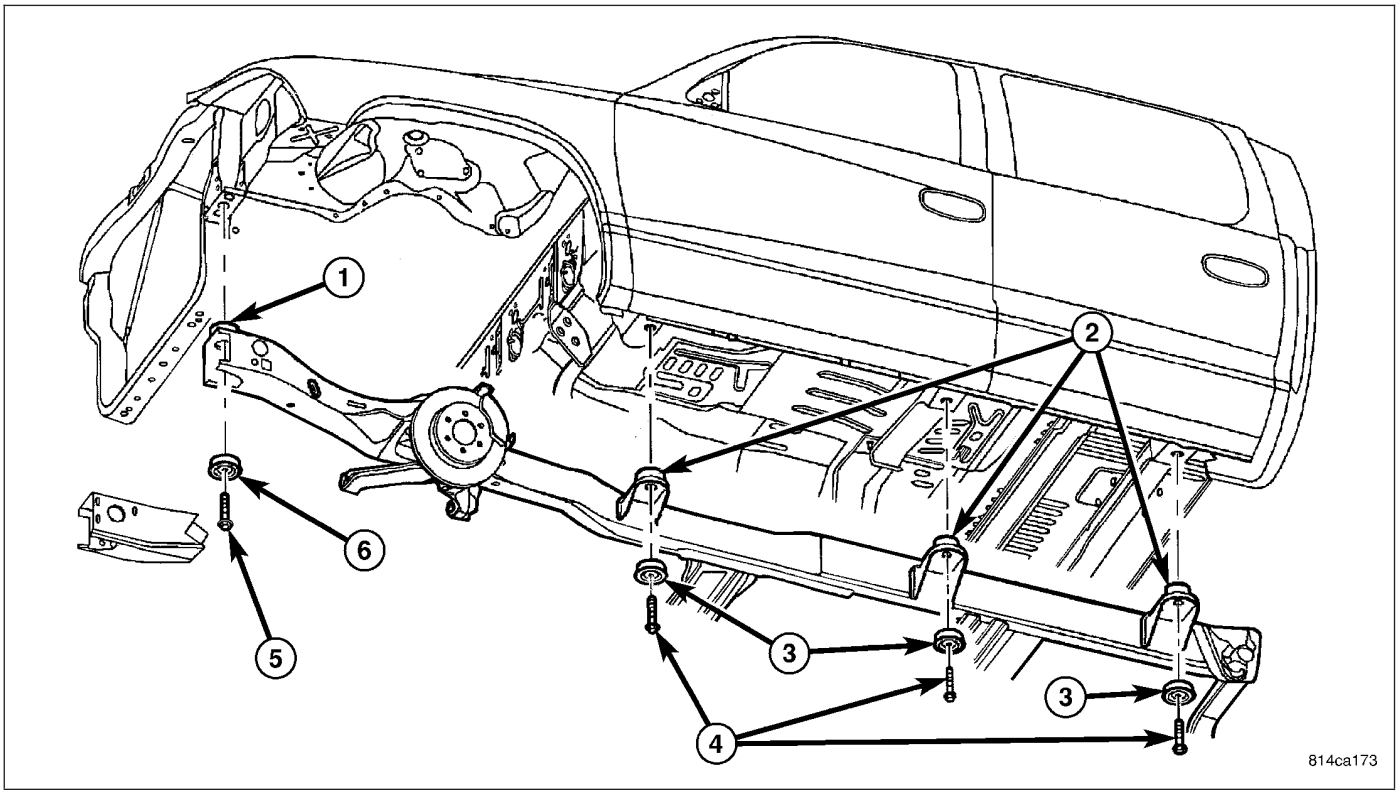


3. Install the grille to bracket and loose install the screws.
4. Tighten the screws to 3.2 N·m (29 ins. lbs.) using the sequence shown.



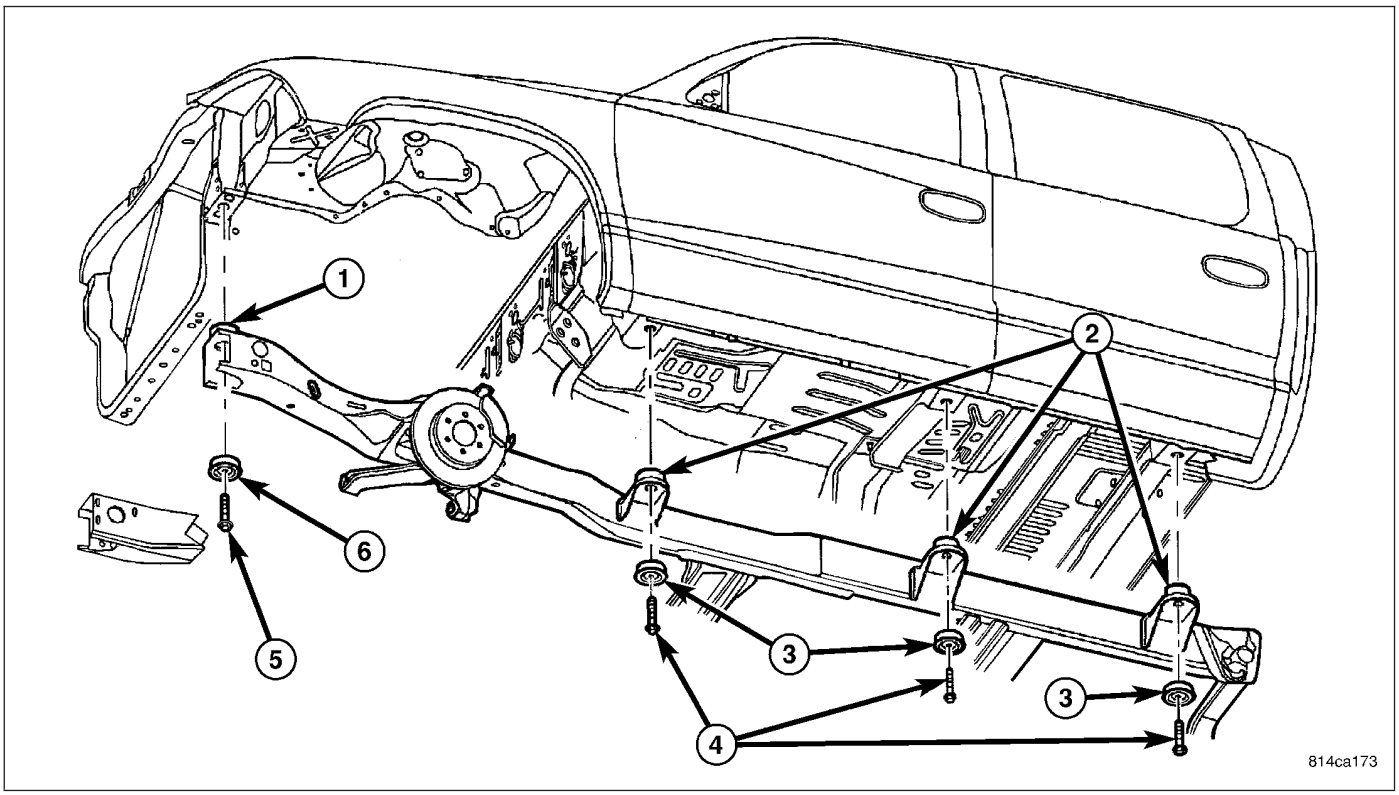
ISOLATORS-BODY

REMOVAL



1. Remove all cab to frame mounting bolts (4) and rebound cushions (3).
2. Remove the front end sheet metal mounting bolt (1).
3. Using a floor jack and block of wood under the cab sill, lift the body to gain access to the isolators.
4. Remove the cab isolators and the front end sheet metal mounting isolator (1).
5. Install new isolators and repeat steps one through 4, for the opposite side.

INSTALLATION

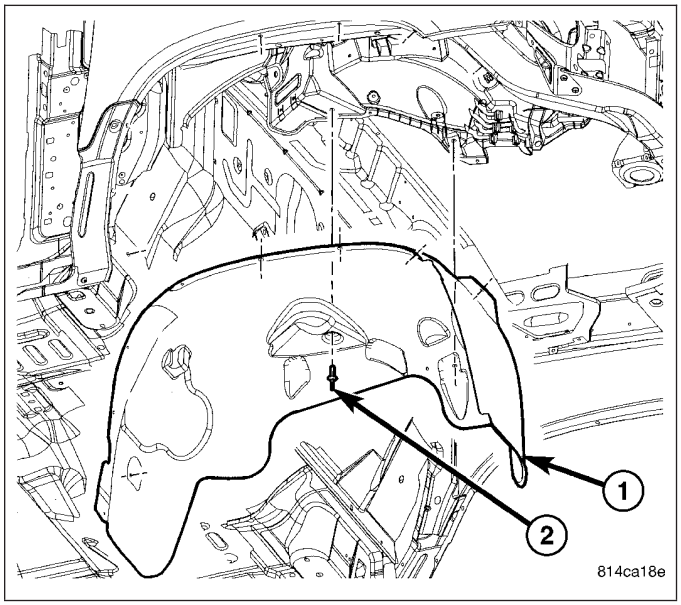


1. Install the isolators (3) rebound cushions (2), and bolts (4).
2. Install the front end sheet metal mounting isolators (1 & 6) and install the bolt (5).
3. Tighten the bolts to 81 N·m (60 ft. lbs.).

LINER-FRONT FENDER

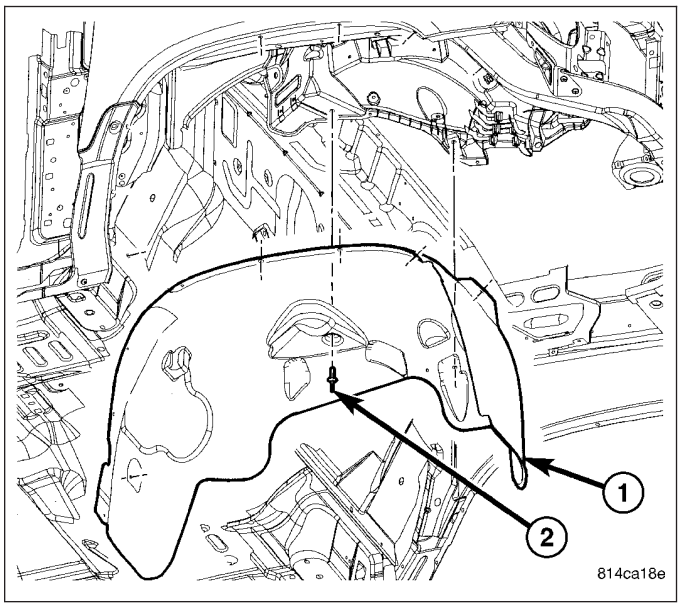
REMOVAL

1. If required, remove wheel.
2. Remove pushpins.
3. Drill out rivets.
4. Remove liner.



INSTALLATION

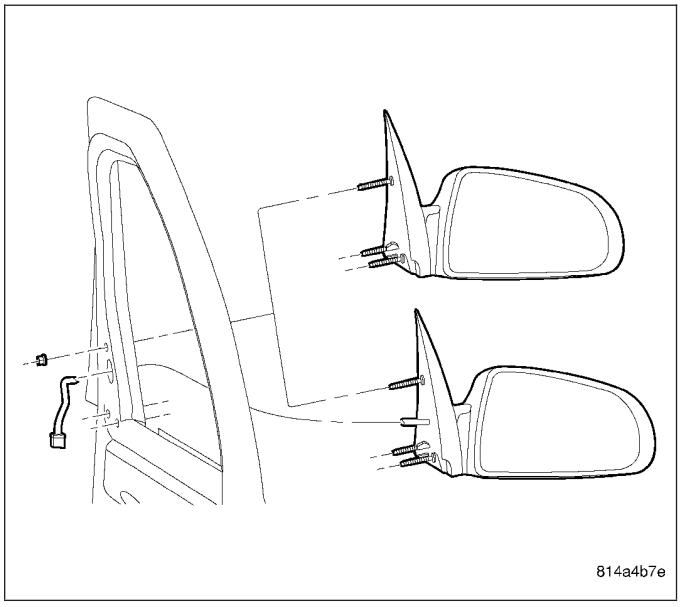
1. Install liner.
2. Install pushpins and rivets.
3. Install wheel if removed.



MIRROR-OUTSIDE REARVIEW

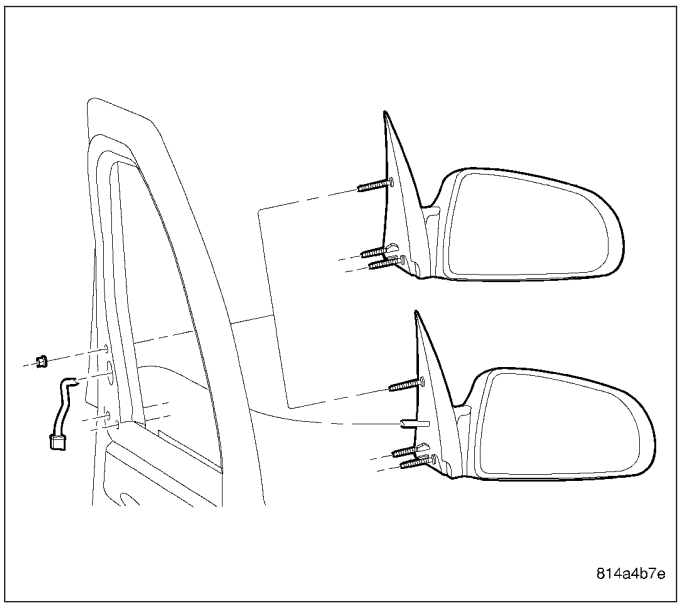
REMOVAL

1. Partially remove the door trim panel to gain access to the mirror fasteners (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).
2. Disconnect the electrical connector, if equipped.
3. Remove the nuts and remove the mirror.



INSTALLATION

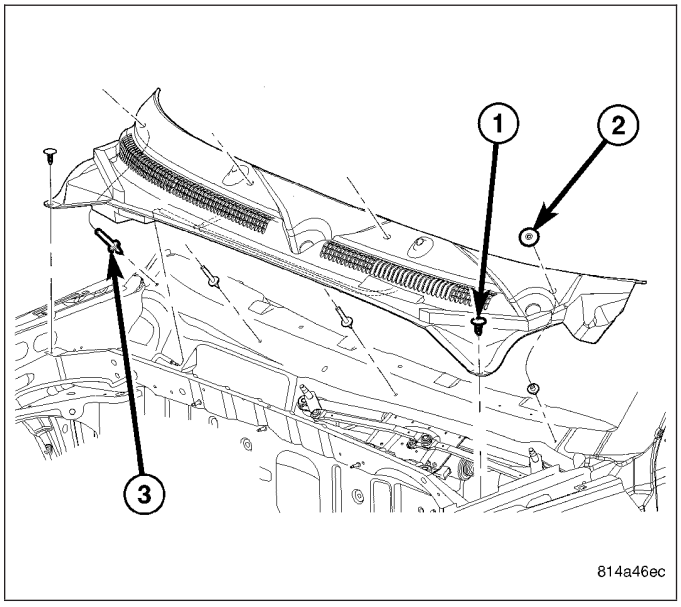
1. Install the mirror and install the nuts.
2. Tighten the nuts to 7 N·m (60 in. lbs.).
3. Connect the electrical connector.
4. Install the door trim panel (Refer to 23 - BODY/ DOOR - FRONT/TRIM PANEL - INSTALLATION).



PANEL-COWL TOP

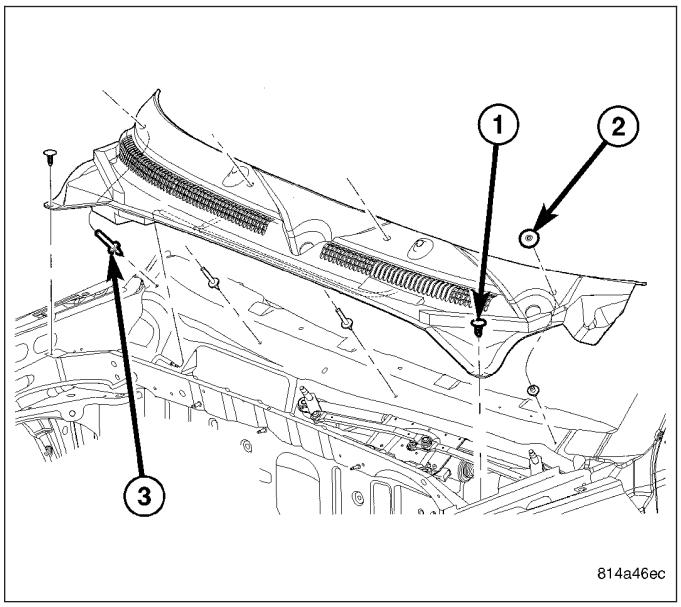
REMOVAL

1. Open the hood and remove the wiper arm nuts and wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/ WASHERS/WIPER ARMS - REMOVAL)
2. Remove the four rear nuts and the two front pins.
3. Remove the cowl grille.



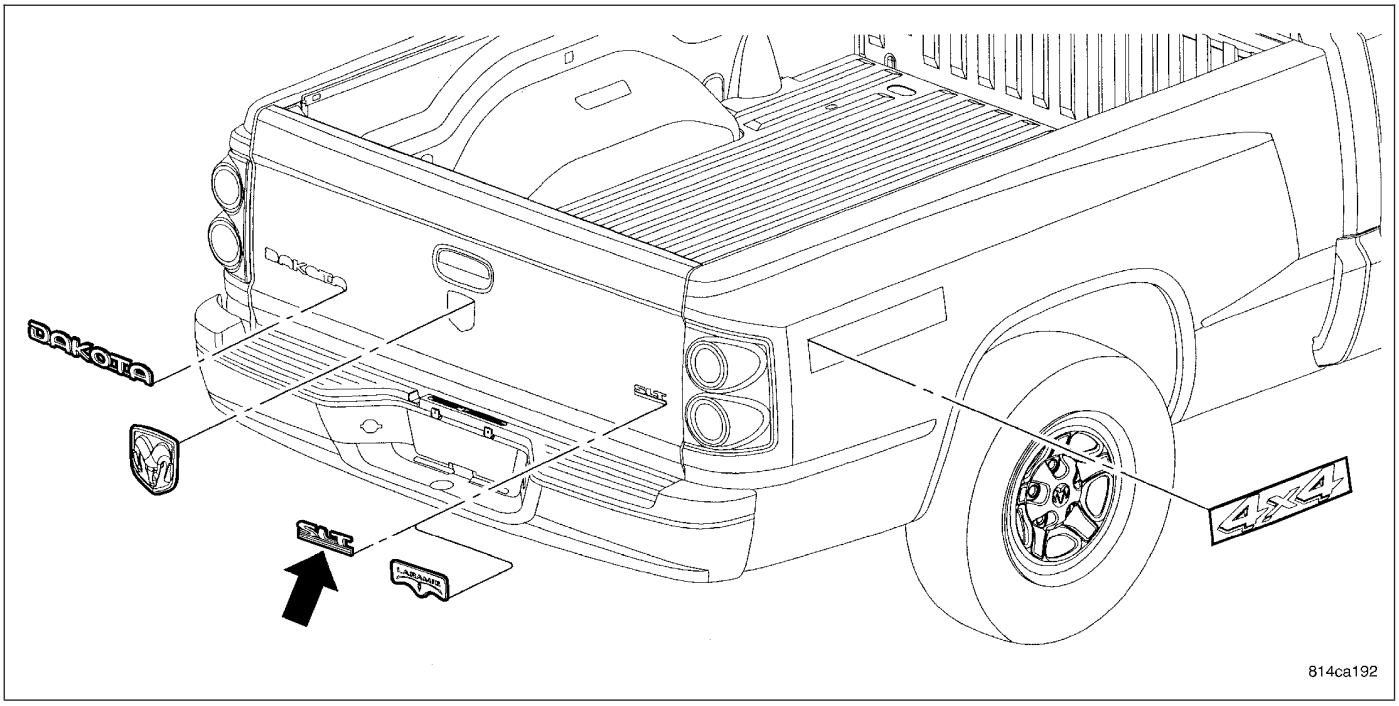
INSTALLATION

1. Install the grille and install the front pins and rear nuts.
2. Install the wiper arms and install the nuts (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - INSTALLATION).



PLATES-EXTERIOR NAME

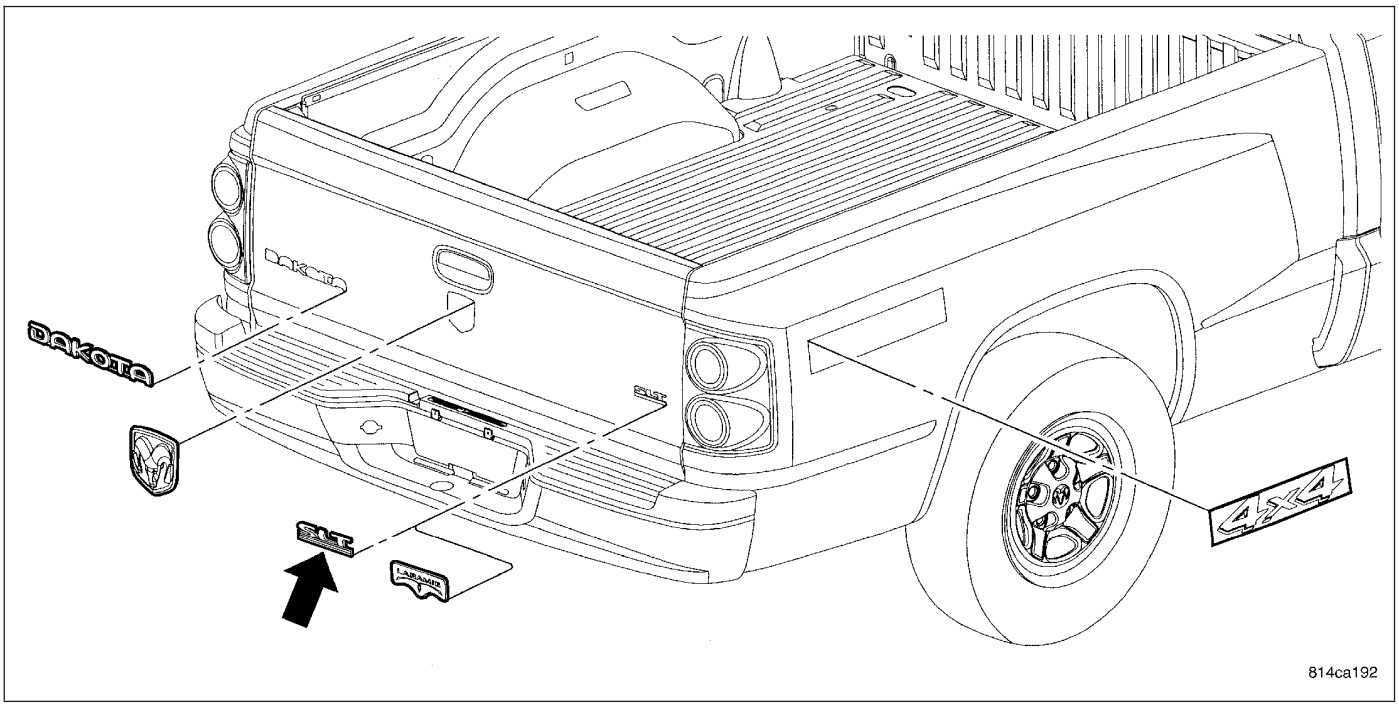
REMOVAL



NOTE: Exterior nameplates are attached to body panels with adhesive tape.

1. Apply a length of masking tape on the body, parallel to the top edge of the nameplate to use as a guide, if necessary.
2. If temperature is below 21°C (70°F) warm emblem with a heat lamp or gun. Do not exceed 52°C (120°F) when heating emblem.
3. Insert a plastic trim stick or a hard wood wedge behind the emblem to separate the adhesive backing from the body.
4. Clean adhesive residue from body with MOPAR® Super Clean solvent or equivalent.

INSTALLATION

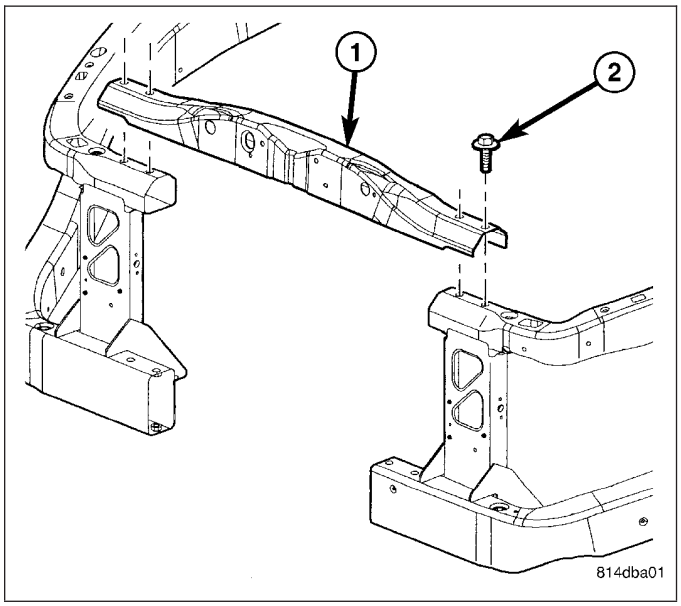


1. Remove carrier from adhesive tape on back of emblem.
2. Position emblem properly on body.
3. Press emblem firmly to body with palm of hand.
4. If temperature is below 21°C (70°F) warm emblem with a heat lamp or gun to assure adhesion. Do not exceed 52°C (120°F) when heating emblem.

RADIATOR CROSSMEMBER - UPPER

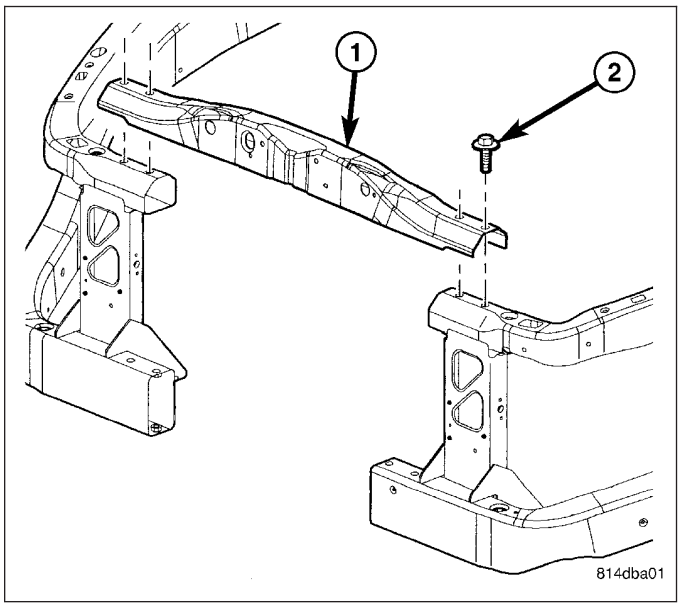
REMOVAL

1. Raise hood.
2. Remove the front hood seal.
3. Remove the center brace mounting nuts and remove hood latch.
4. Remove the crossmember mounting bolts.
5. Remove crossmember.



INSTALLATION

1. Install upper crossmember.
2. Install outer mounting bolts and tighten.
3. Install nuts attaching latch to radiator crossmember support. Tighten nuts to 11 N·m (8 ft. lbs.) torque.
4. Check hood fit and adjust if required. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. Install hood seal.



STRIPES AND DECALS-BODY

REMOVAL

1. Warm the panel to approximately 38°C (100°F) using a suitable heat lamp or heat gun.
2. Peel decal from body panel using an even pressure pull.
3. Remove adhesive residue from body panel using a suitable adhesive removing solvent.

INSTALLATION

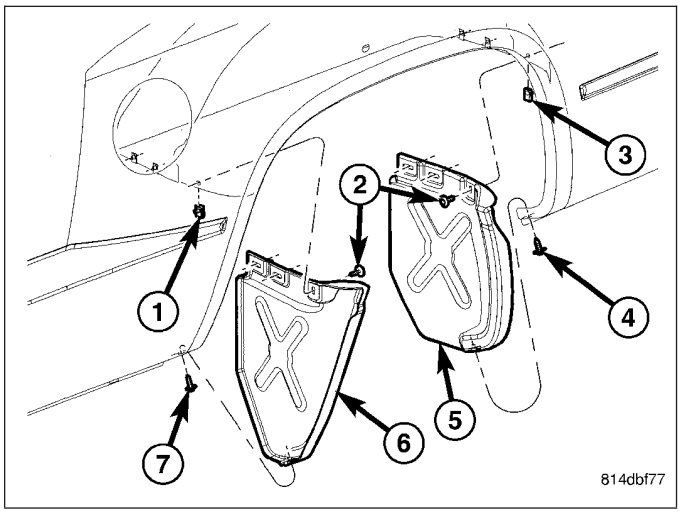
The painted surface of the body panel to be covered by a decal must be smooth and completely cured before decal can be applied. Ripples and feather edging will read through if surface is not properly prepared. Clean all residue from surface.

1. Peel paper backing away from decal exposing adhesive back of decal.
2. Apply soap solution liberally to adhesive back of decal.
3. Apply soap solution liberally to body panel surface.
4. Place decal into position on body panel. Smooth out wrinkles by pulling lightly on edges of decal until it lays flat on painted surface.
5. Push air pockets from under decal to the perimeter of the panel from the center of the decal out.
6. Squeegee soap solution and air bubbles from behind decal from the center of the panel out using a body putty applicator squeegee.
7. Small air or water bubbles under decal can be pierced with a pin and smoothed out.

SHIELD-SPLASH

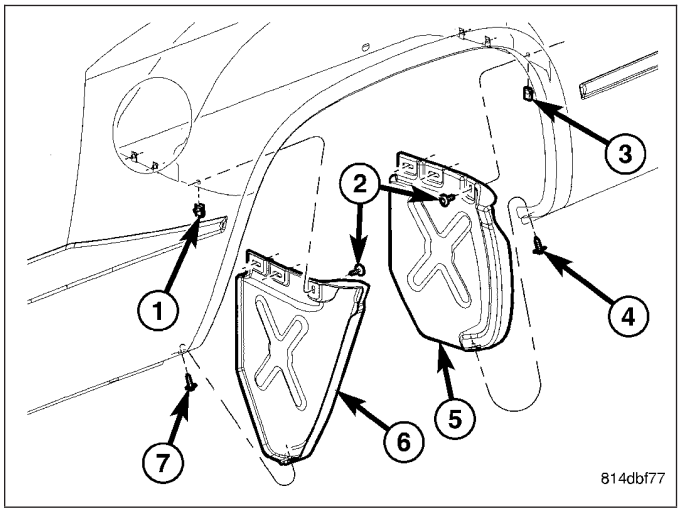
REMOVAL

1. Remove the screws and remove the shields.



INSTALLATION

1. Install the shields and install the screws.



HOOD

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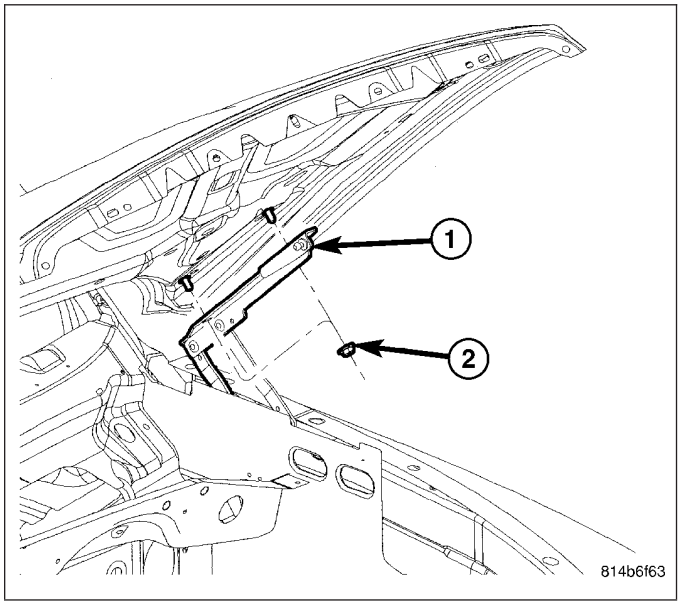
HINGE

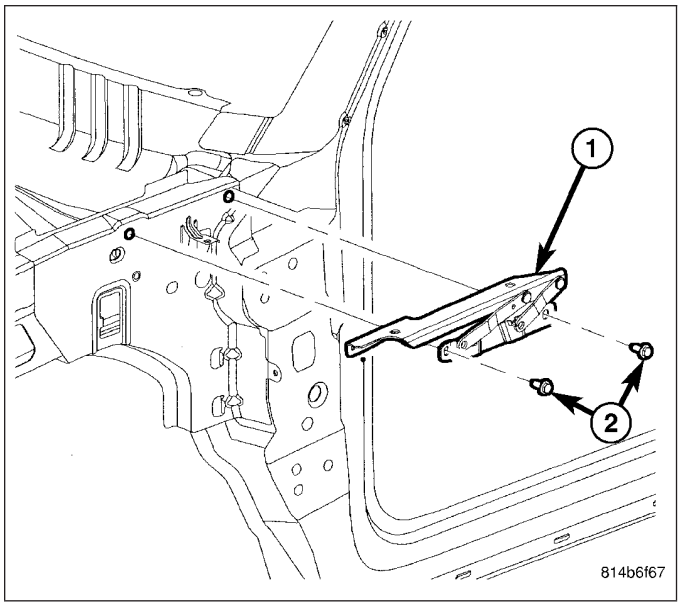
REMOVAL

NOTE: It is not necessary to remove the hood to replace one or both hinges. The hinges can be replaced one at a time.

1. Open hood and support the side that requires hinge replacement.
2. Mark all bolt and hinge attachment locations using a grease pencil or equivalent, to provide reference marks for installation.
3. Remove support cylinder from the upper hinge (1) (Refer to 23 - BODY/HOOD/SUPPORT CYLINDER - REMOVAL).
4. Remove the nuts (2) attaching the hinge (1) to the hood.

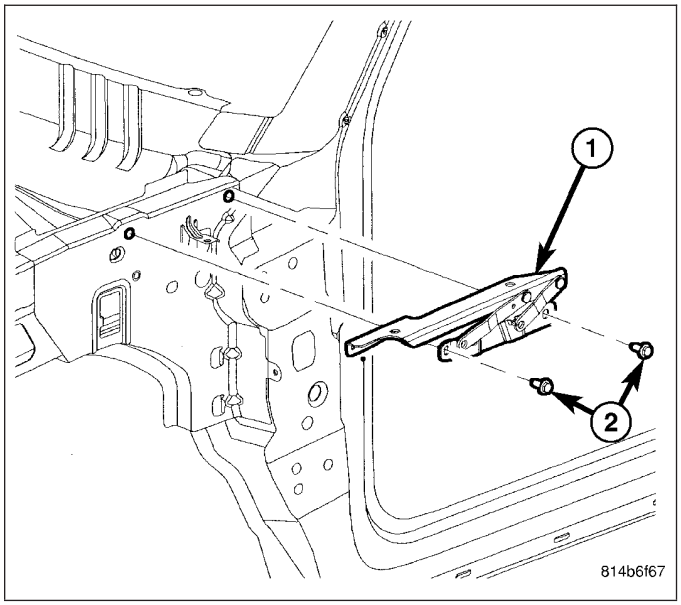


5. From inside the engine compartment, remove the two hinge bolts (2).
6. Slide the hinge (2) forward and remove from the fender rail.

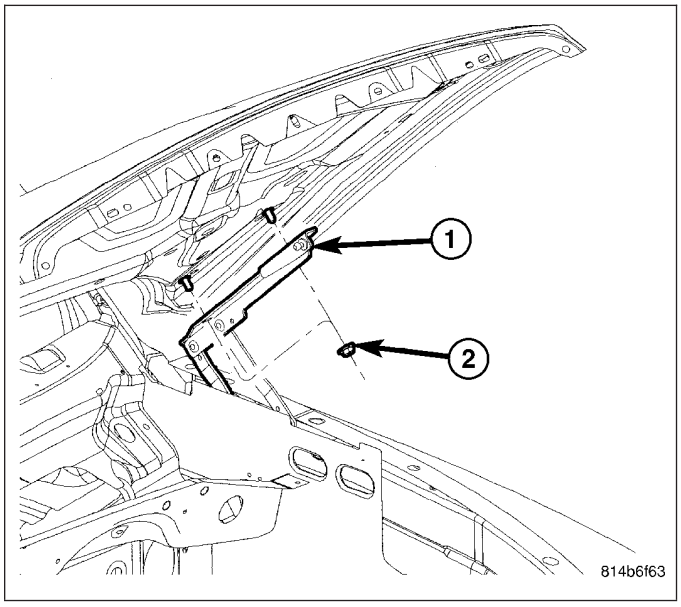


INSTALLATION

1. Install the hinge (1), slide back into position on the fender rail and align all marks.
2. From inside the engine compartment, install the two hinge bolts (2).
3. Tighten the rear bolt to 20 N·m (15 ft. lbs.)
4. Tighten the front bolt to 20 N·m (15 ft. lbs.)



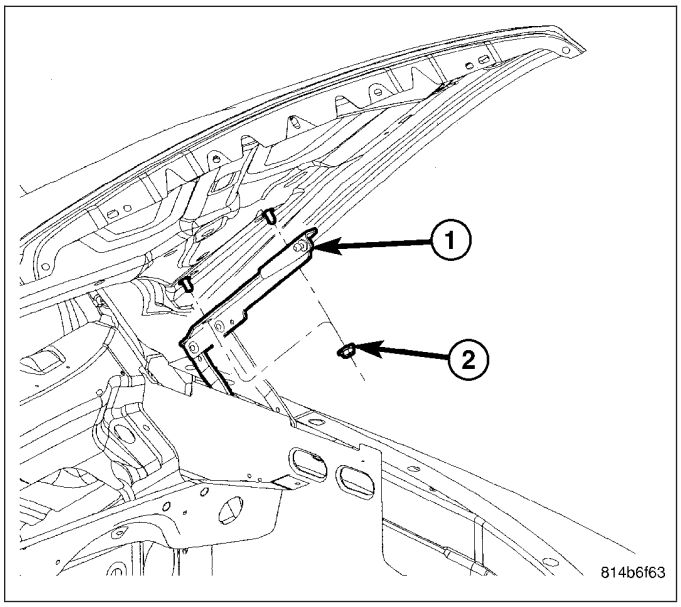
5. Install the nuts (2) attaching the hinge (1) to the hood and tighten the nuts to 23 N·m (17 ft. lbs.)
6. Install support cylinder (Refer to 23 - BODY/HOOD/ SUPPORT CYLINDER - INSTALLATION).
7. Check hood fit and adjust if required. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)



HOOD

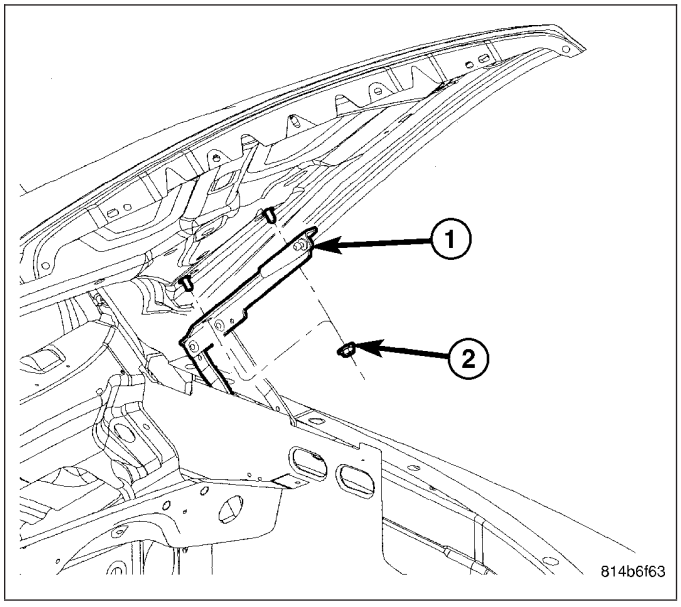
REMOVAL

1. Open and support hood. Disconnect the washer hoses.
2. Mark all nut and hinge attachment locations using a grease pencil or equivalent, to provide reference marks for installation.
3. Remove support cylinders (Refer to 23 - BODY/HOOD/SUPPORT CYLINDER - REMOVAL).
4. Remove the top nuts (2) attaching hood to hinge and loosen the bottom nuts (2) until they can be removed by hand.
5. Remove the bottom nuts (2) and separate the hood (1) from the vehicle.



INSTALLATION

1. Position the hood (1) onto the hinges.
2. Align all marks and install the nuts(2).
3. Tighten the nuts too 23 N·m (17 ft. lbs.).
4. Install support cylinder (Refer to 23 - BODY/HOOD/SUPPORT CYLINDER - INSTALLATION).
5. Connect the washer hoses.
6. Close hood and adjust as necessary. (Refer to 23 - BODY/HOOD/HOOD - ADJUSTMENTS)



ADJUSTMENTS

NOTE: For gap and flush specifications, (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS).

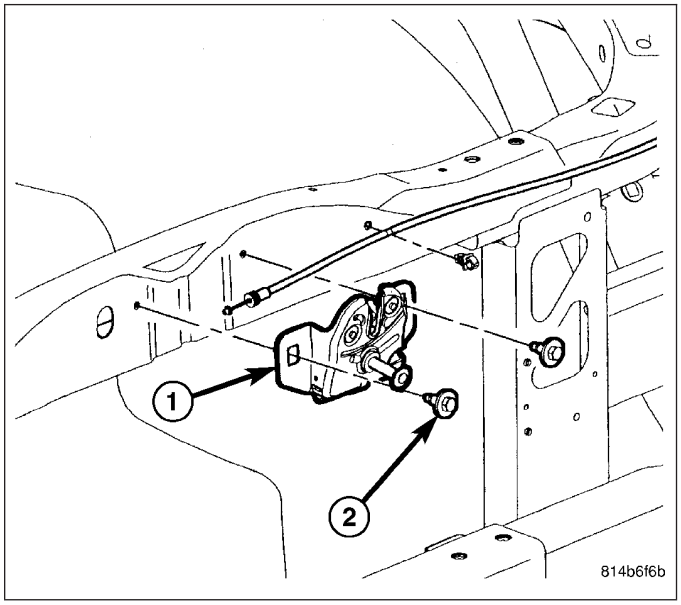
1. If hood is low in relation to cowl panel, loosen the hood to hinge nuts and insert shims between hinge and hood.
2. Adjust hood bumpers in or out to adjust hood-to-fender height alignment.
3. Loosen the hood latch screws.
4. Close the hood and check the fore/aft position of the hood.
5. Loosen the hood to hinge nuts to adjust the fore/aft position.
6. Once the fore/aft position of the hood is correct, tighten the hood to hinge nuts to 23 N·m (17 ft. lbs.).

7. Lower the hood. Inspect clearance between the hood and the cowl cover.
8. Adjust the hood latch as necessary and tighten the bolts to 11 N·m (8 ft. lbs.).
9. Align the latch striker so that striker enters the latch squarely and without binding.

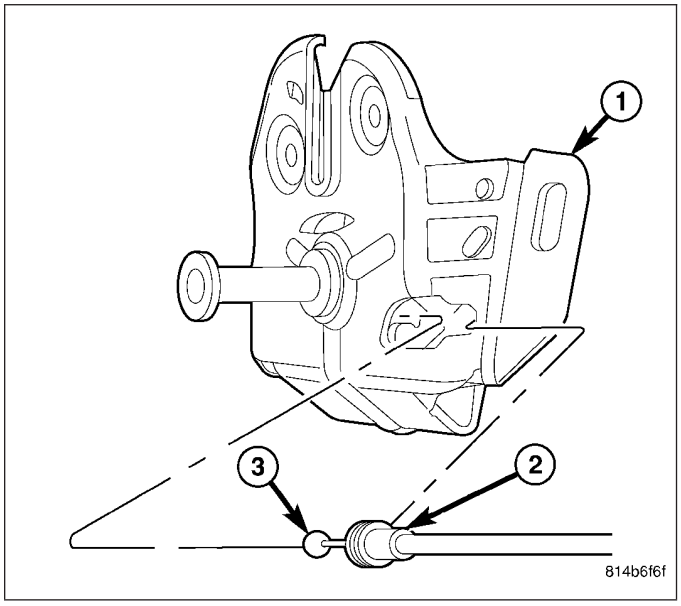
LATCH

REMOVAL

1. Remove the push pin fasteners and remove the upper radiator shroud.
2. Using a grease pencil or equivalent, mark latch position for installation alignment.
3. Remove bolts (2) attaching hood latch (1) to upper radiator crossmember.

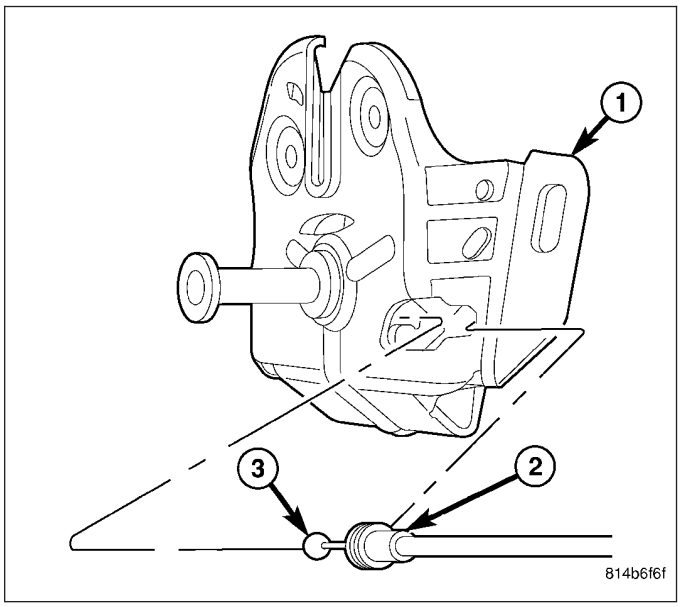


4. Separate hood latch (1) from crossmember and disconnect the release cable (2).

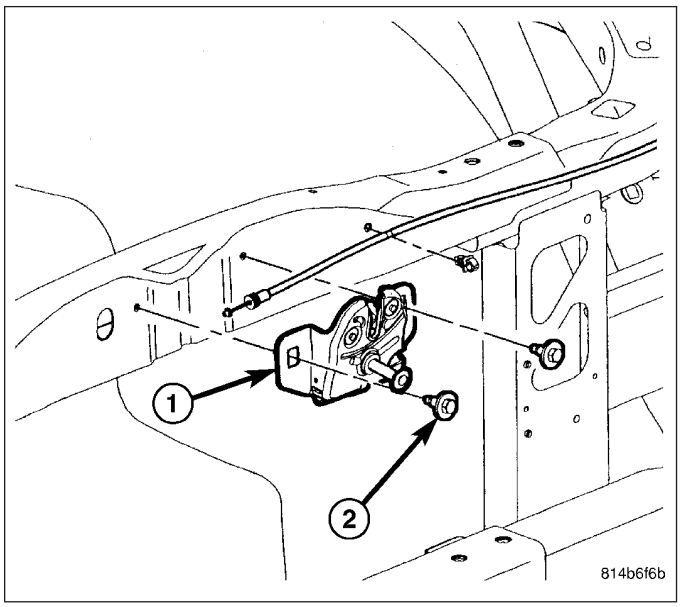


INSTALLATION

1. Connect release cable (2) to the hood latch (1).



2. Install the latch (1) lining up the marks made previously and install the bolts (2).
3. Tighten the bolts to 11 N·m (8 ft. lbs.).
4. Close hood and adjust latch as necessary. (Refer to 23 - BODY/HOOD/LATCH - ADJUSTMENTS)



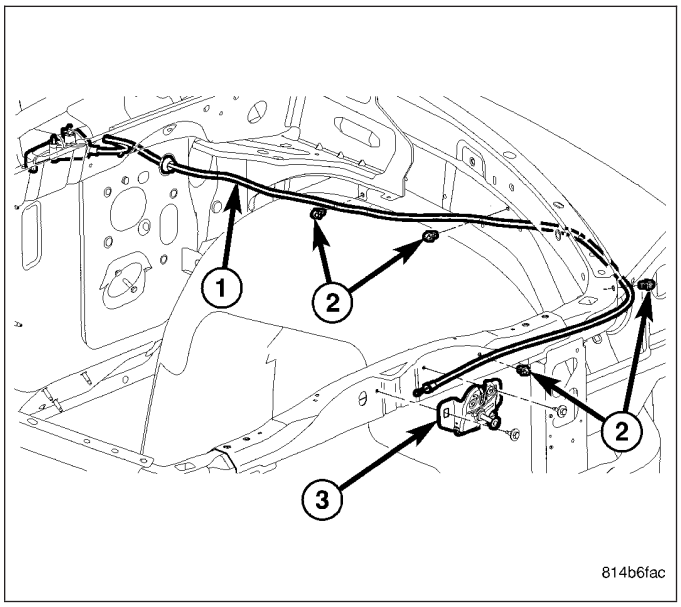
ADJUSTMENTS

1. Check and adjust the hood if required. (Refer to 23 - BODY/HOOD/HOOD - ADJUSTMENTS)
2. Remove the push pin fasteners and remove the upper radiator shroud.
3. Loosen the hood latch bolts.
4. Move the latch to the correct location and lightly tighten the bolts.
5. Close the hood slowly and observe the latching operation.
6. If necessary, adjust the latch position and tighten the bolts to 11 N·m (8 ft. lbs.).

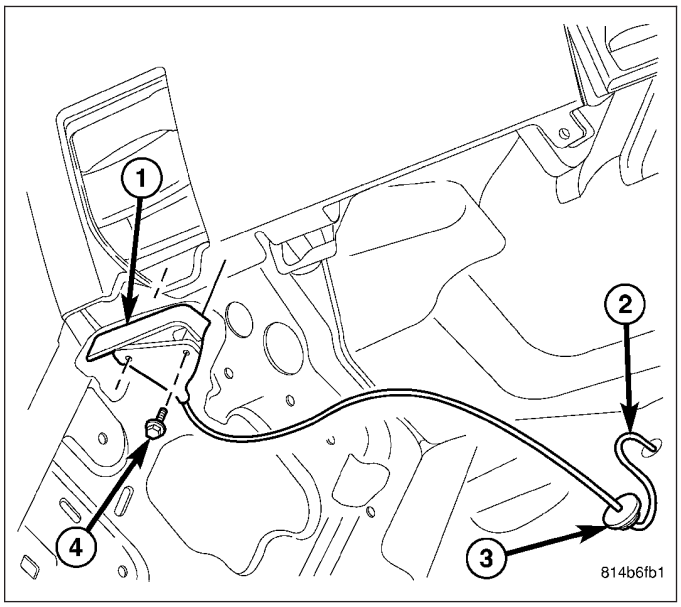
RELEASE-HOOD LATCH

REMOVAL

1. Remove hood latch (3). (Refer to 23 - BODY/ HOOD/LATCH - REMOVAL)
2. Detach the release cable (1) and the retainer clips (2) in the engine compartment.



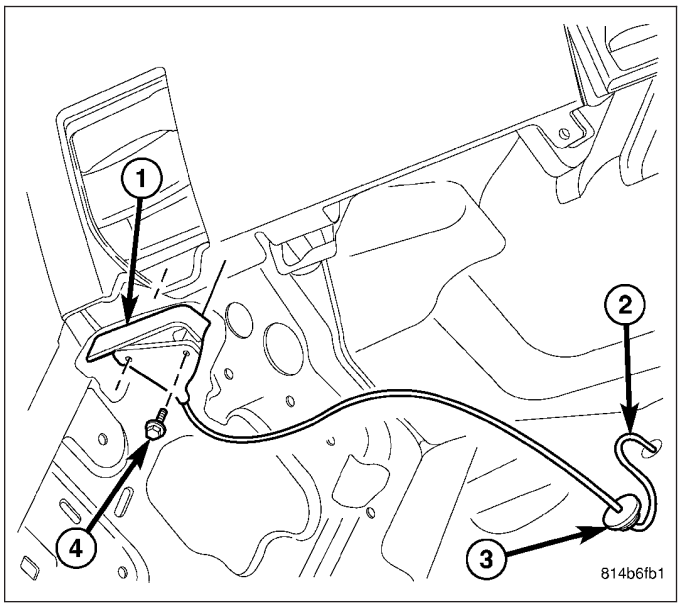
3. Separate the release cable grommet (3) from the dash panel hole.
4. Detach the release cable (2) and the retainer clips (4).
5. From the inside of the vehicle, remove the screws attaching the hood release handle to the bottom of the instrument panel (1).
6. Pull/route the hood release cable (2) through the dash panel hole and remove it from the inside of the vehicle.



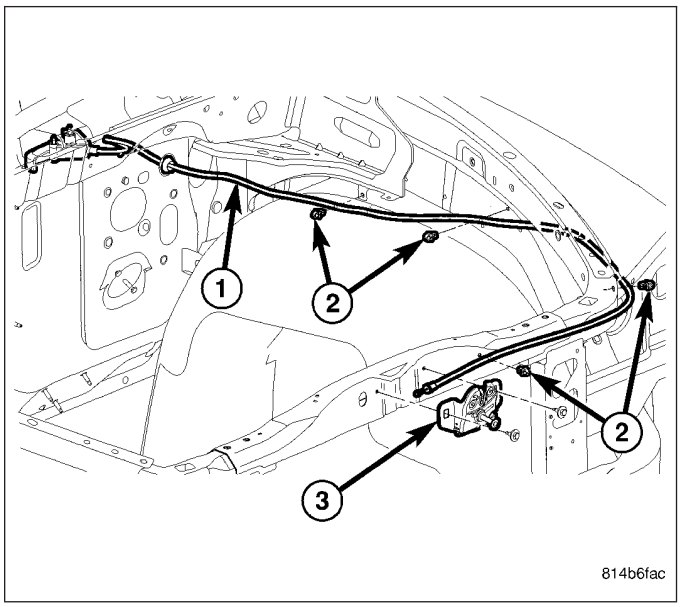
INSTALLATION

NOTE: If replacement hood latch is also being installed, ensure that it is thoroughly lubricated.

1. From inside the vehicle, pull/route the hood release cable (2) through the dash panel hole and into the engine compartment.
2. Install the hood release handle and install the screws.
3. Install the cable grommet (3) in the dash panel hole.
4. Attach the retainer clip (4) to the release cable and install.



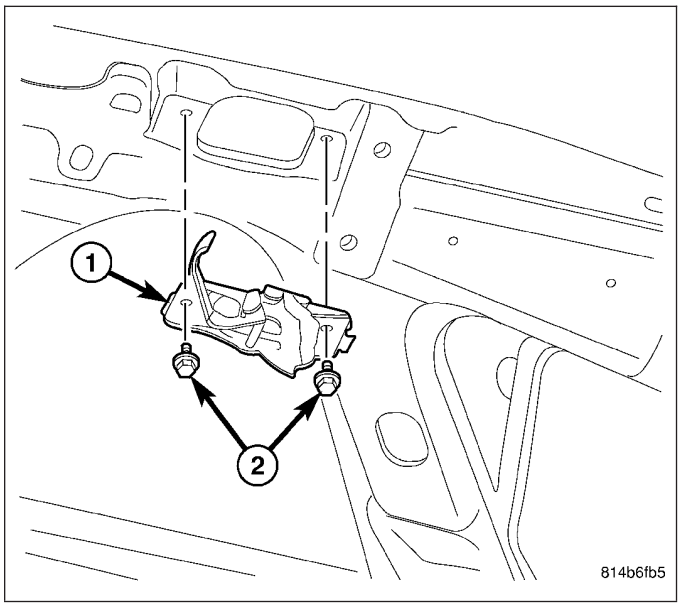
5. Attach the retainer clips (2) to the release cable and install them into the holes in the engine compartment.
6. Install hood latch (3). (Refer to 23 - BODY/HOOD/ LATCH - INSTALLATION)



STRIKER-HOOD LATCH

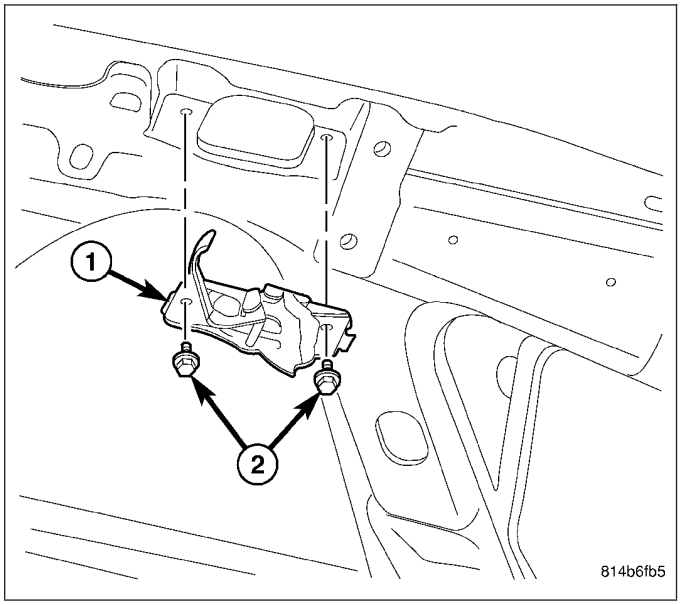
REMOVAL

1. Mark all bolt and striker attachment locations using a grease pencil or equivalent, to provide reference marks for installation.
2. Remove mounting bolts and striker (1).



INSTALLATION

1. Install the striker (1), slide back into position and align all marks.
2. From inside the engine compartment, install the two bolts (2).
3. Tighten the bolts to 20 N·m (15 ft. lbs.).



SUPPORT CYLINDER

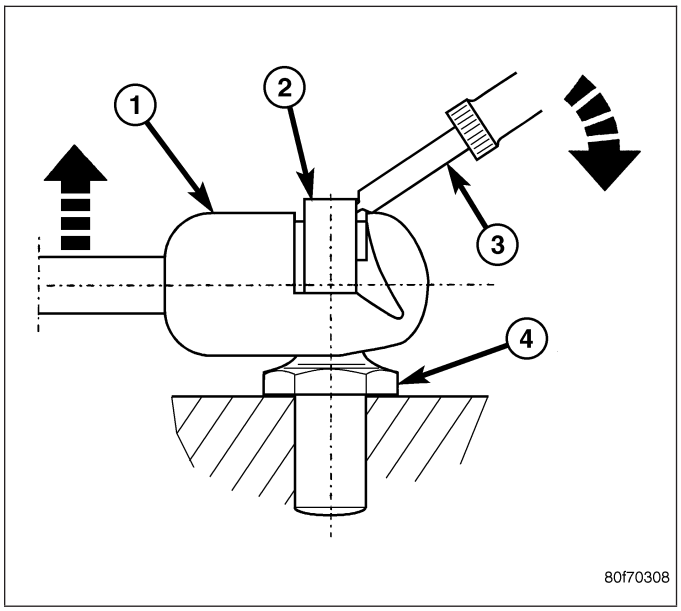
REMOVAL

NOTE: The hood support cylinders can be replaced one at a time.

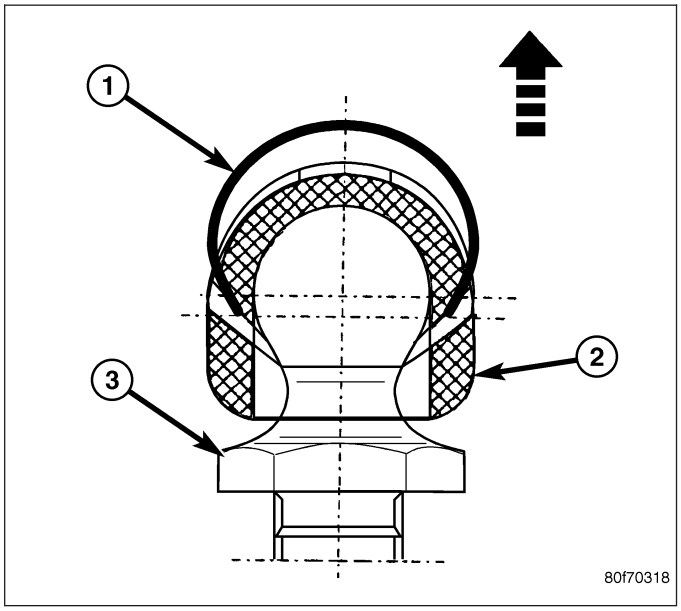
1. Open and support the hood.

CAUTION: Do not pull on the hood support cylinders at the middle of the support cylinder during removal. Failure to follow this caution can result in damage to the hood support cylinders.

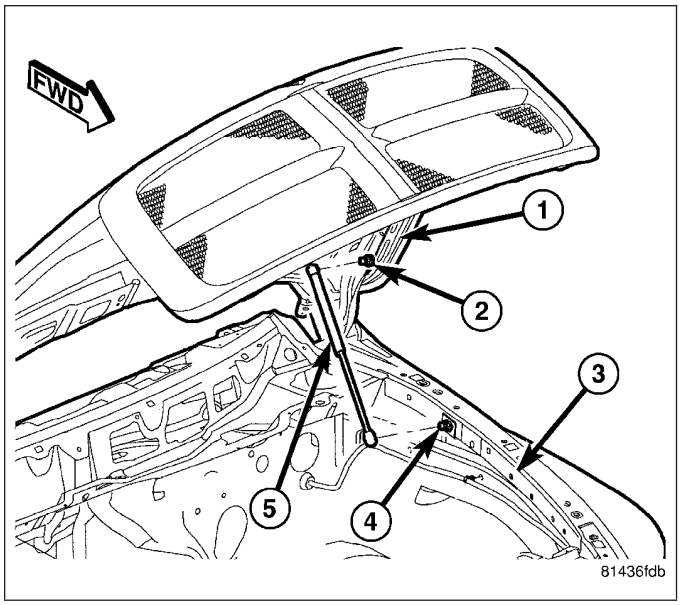
2. Using a small flat bladed tool, or equivalent (3), release the retaining clip (2) at each end of the support cylinder while carefully pulling the ball socket (1) away from the ball stud (4).



NOTE: Lift the clips (1) only enough to release the ball studs (3).



3. Disconnect the hood support cylinder (5) from the hood (1) and the fender rail (3).
4. If required, remove the upper ball stud (2) from hood and the lower ball stud (4) from the fender rail.



INSTALLATION

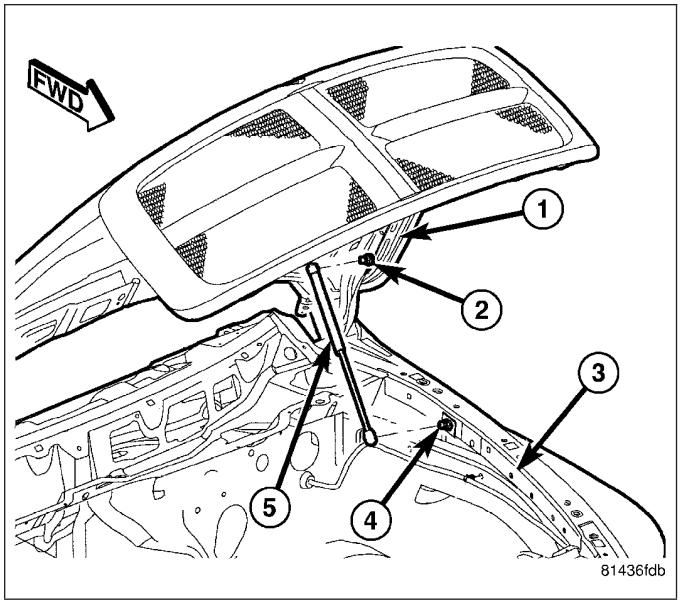
1. If removed, install the upper ball stud (2) onto the hood (1) and the lower ball stud (4) onto the fender rail (3). Install the ball studs securely.

CAUTION: Do not push on the hood support cylinders at the middle of the support cylinder during installation. Failure to follow this caution can result in damage to the hood support cylinders.

NOTE: Install the hood support cylinders with the cylinder end connected to the hood as shown.

NOTE: If required, only release each retaining clip enough to install the ball socket onto the ball stud.

2. Install the hood support cylinder (5) over the upper and lower ball studs and fully engage the retaining clips.



INSTRUMENT PANEL

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INSTRUMENT PANEL

WARNING

RESTRAINT SYSTEM

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the daimlerchrysler mopar parts catalog.

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death on vehicles equipped with airbags, before performing any welding operations disconnect and isolate the battery negative (ground) cable and disconnect all wire harness connectors from the airbag control module (acm). Failure to take the proper precautions could result in accidental airbag deployment and other possible damage to the supplemental restraint system circuits and components.

WARNING: To avoid personal injury or death, do not attempt to dismantle an airbag unit or tamper with its inflator. Do not puncture, incinerate, or bring into contact with electricity. Do not store at temperatures exceeding 93° c (200° f). An airbag inflator unit may contain sodium azide and potassium nitrate. These materials are poisonous and extremely flammable. Contact with acid, water, or heavy metals may produce harmful and irritating gases (sodium hydroxide is formed in the presence of moisture) or combustible compounds. An airbag inflator unit may also contain a gas canister pressurized to over 2500 psi.

WARNING: To avoid personal injury or death, when handling a seat belt tensioner retractor, proper care should be exercised to keep fingers out from under the retractor cover and away from the seat belt webbing where it exits from the retractor cover.

WARNING: To avoid personal injury or death, replace all restraint system components only with parts specified in the daimlerchrysler mopar parts catalog. Substitute parts may appear interchangeable, but internal differences may result in inferior occupant protection.

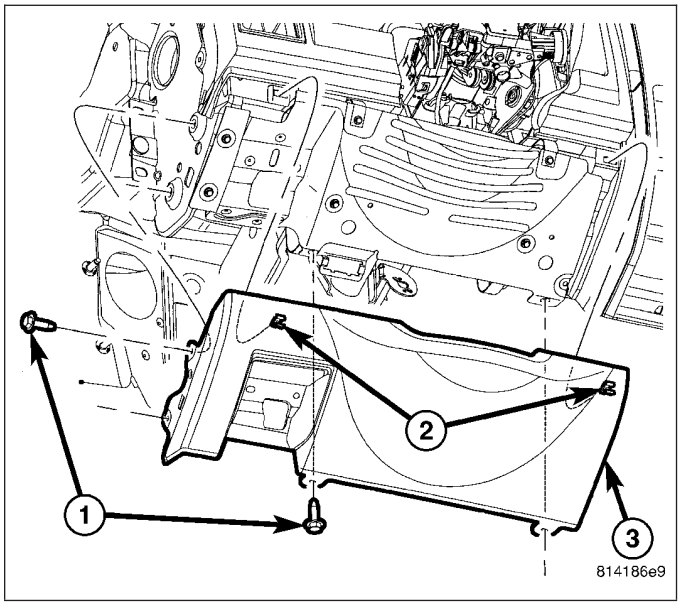
WARNING: To avoid personal injury or death, the fasteners, screws, and bolts originally used for the restraint system components must never be replaced with any substitutes. These fasteners have special coatings and are specifically designed for the restraint system. Any time a new fastener is needed, replace it with the correct fasteners provided in the service package or specified in the daimlerchrysler mopar parts catalog.

WARNING: To avoid personal injury or death, when a steering column has an airbag unit attached, never place the column on the floor or any other surface with the steering wheel or airbag unit face down.

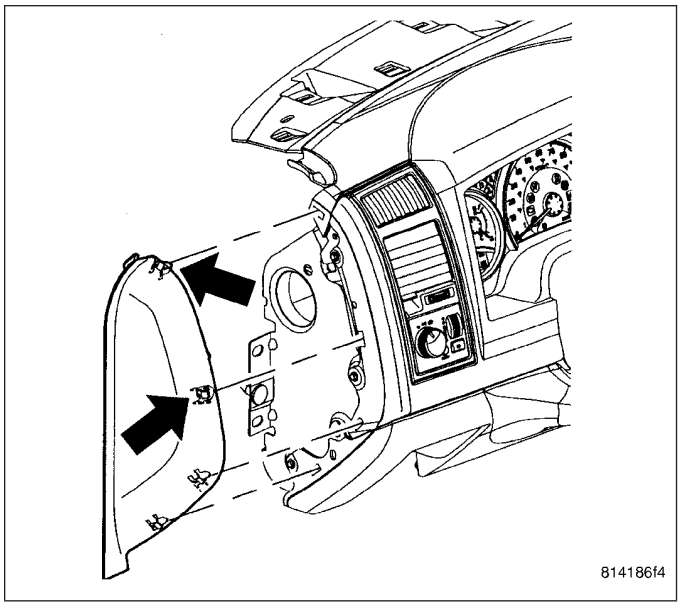
BEZEL-CLUSTER

REMOVAL

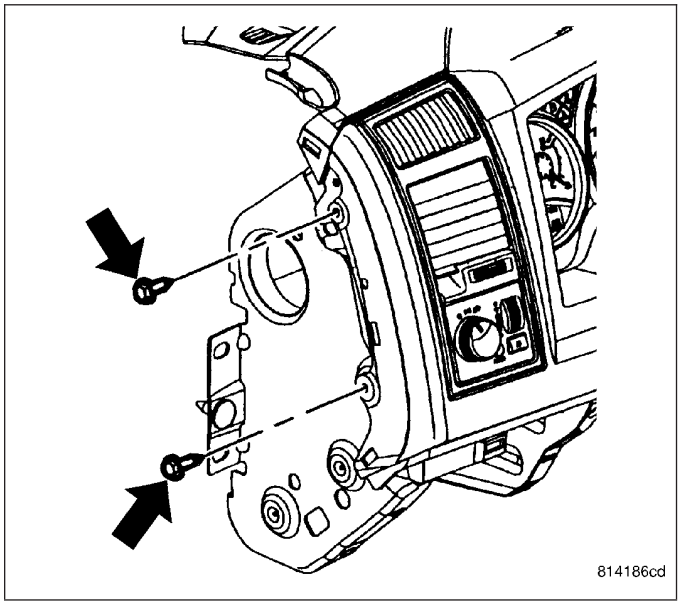
1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Remove the steering column opening cover (3). (Refer to 23 - BODY/INSTRUMENT PANEL/ STEERING COLUMN OPENING COVER - REMOVAL)



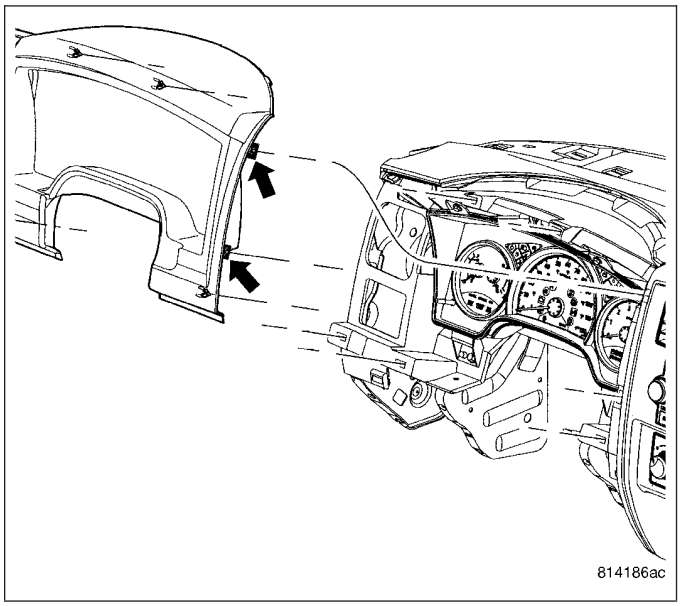
3. Using a trim stick C-4755 or equivalent, separate the end cap retaining clips and remove the end cap.



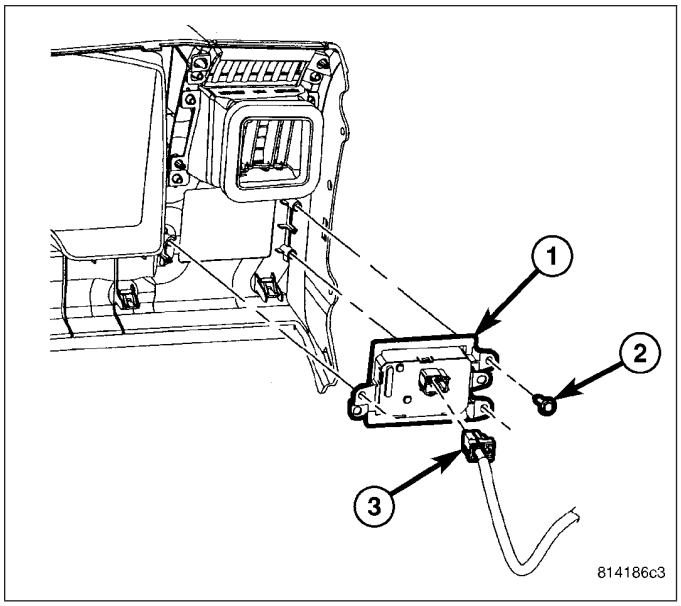
4. Remove the screws.



5. Using a trim stick C-4755 or equivalent, separate the cluster bezel from the instrument panel.

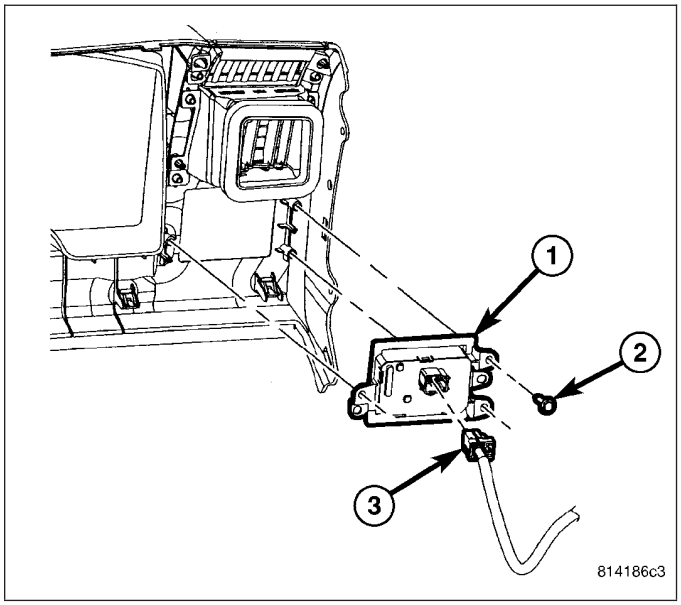


6. Disconnect the electrical connectors (3), if equipped.

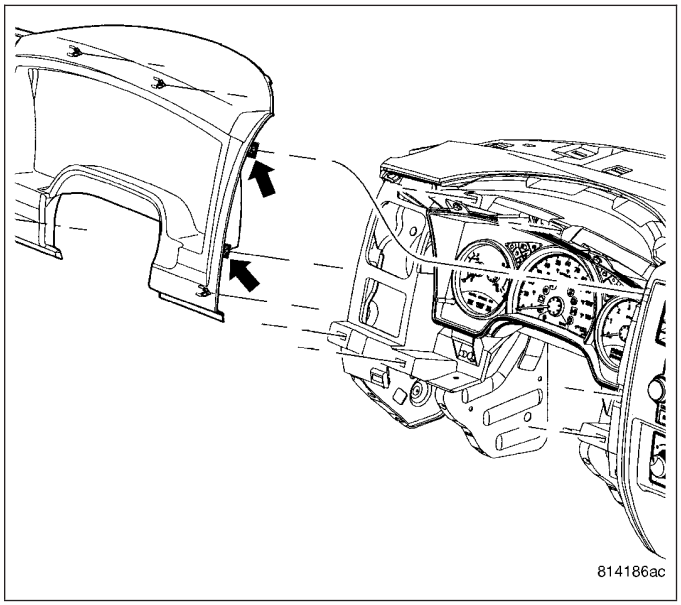


INSTALLATION

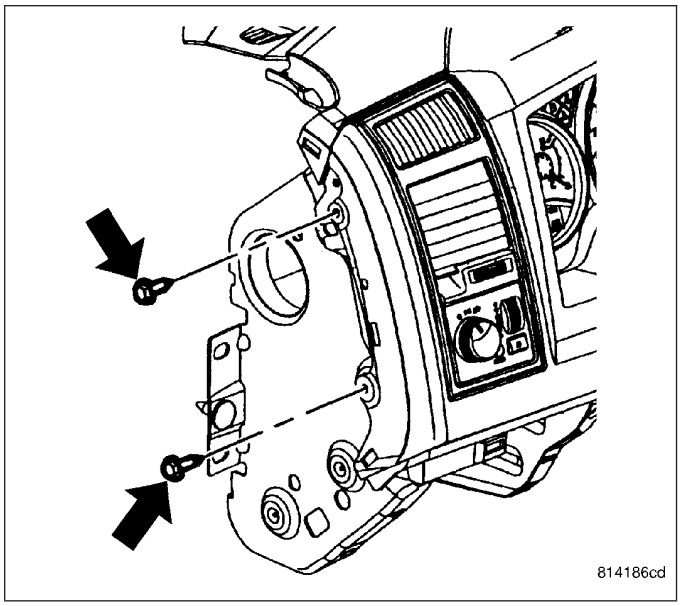
1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Connect the electrical connectors (3), if equipped.



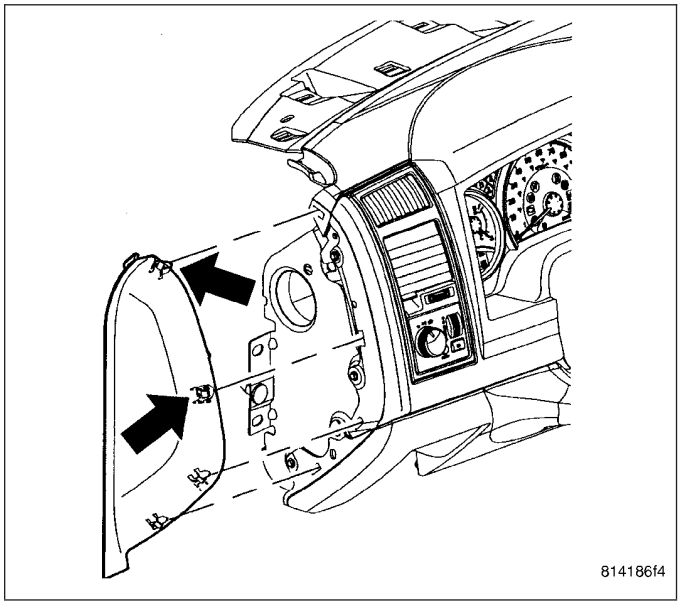
3. Position the bezel onto the instrument panel and seat the retaining clips fully.



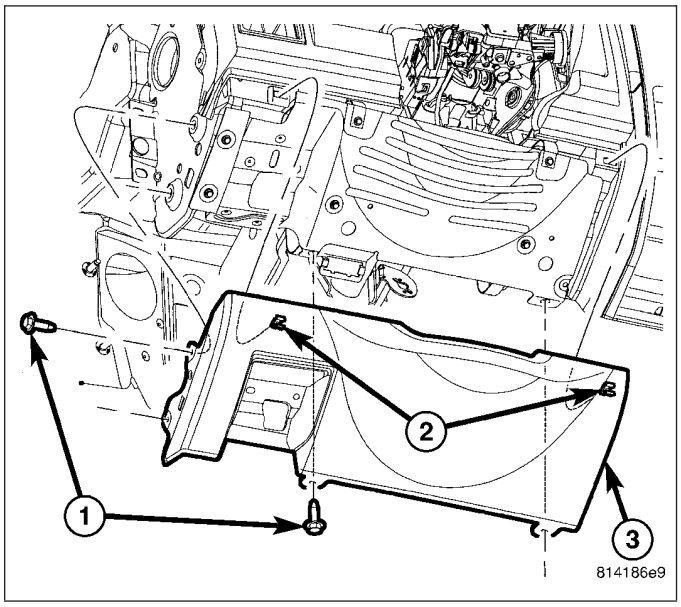
4. Install the screws.



5. Position the end cap and seat the retaining clips fully.



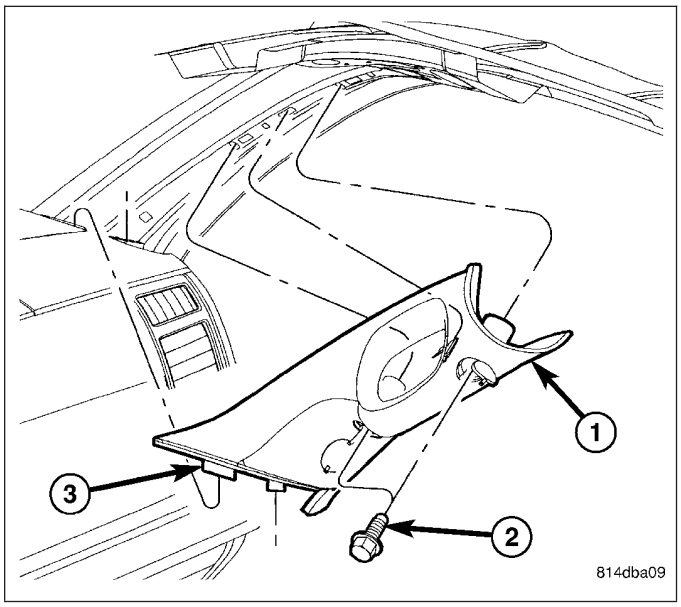
6. Install the steering column opening cover (3). (Refer to 23 - BODY/INSTRUMENT PANEL/ STEERING COLUMN OPENING COVER - INSTALLATION)



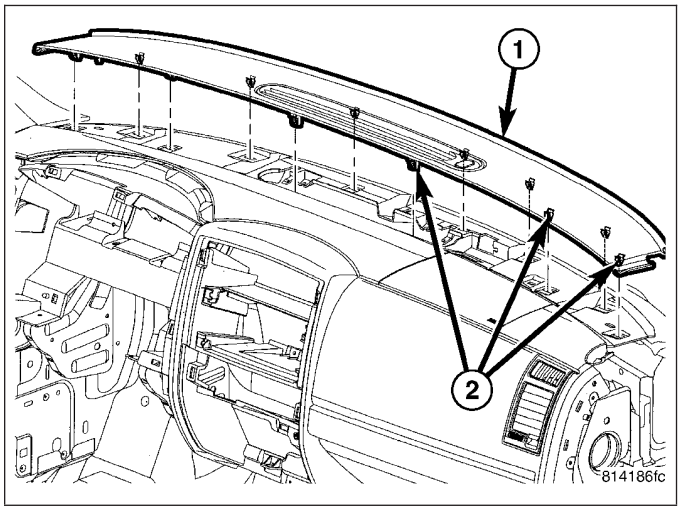
GRILLE-DEFROSTER

REMOVAL

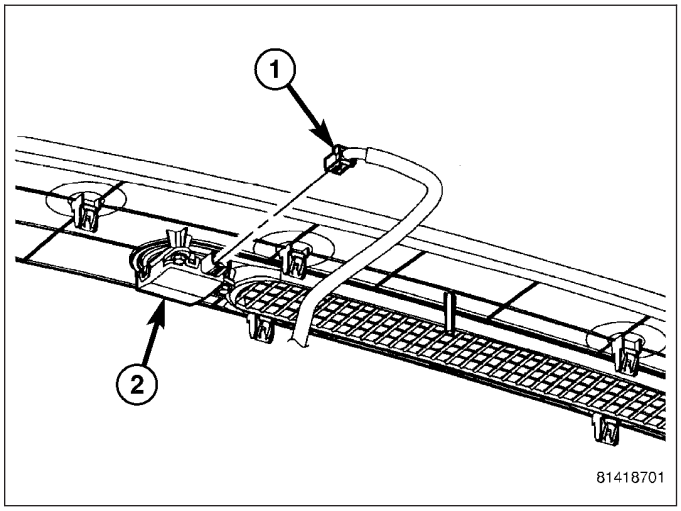
1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Open the trim covers in the a-pillar grab handle (1) and remove the bolts (2).
3. Remove the right and left a-pillar trim panels (1).



4. Using a trim stick C-4755 or equivalent, remove the instrument panel defroster grille.

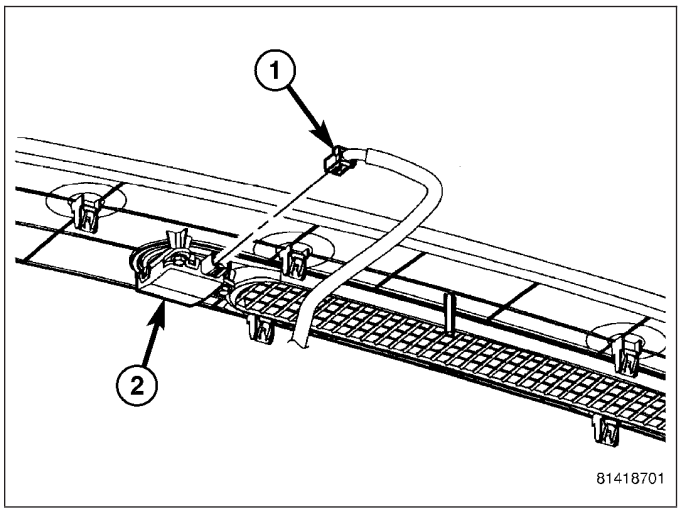


5. Disconnect the sensor electrical connector (1).
6. Remove the screw and remove the sensor (2).

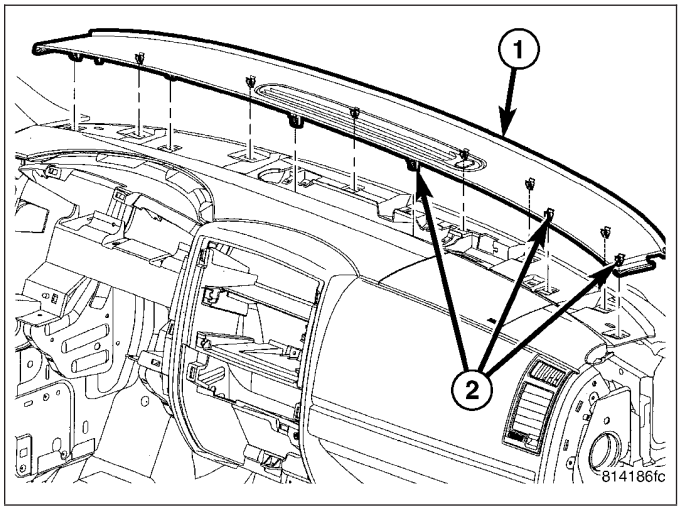


INSTALLATION

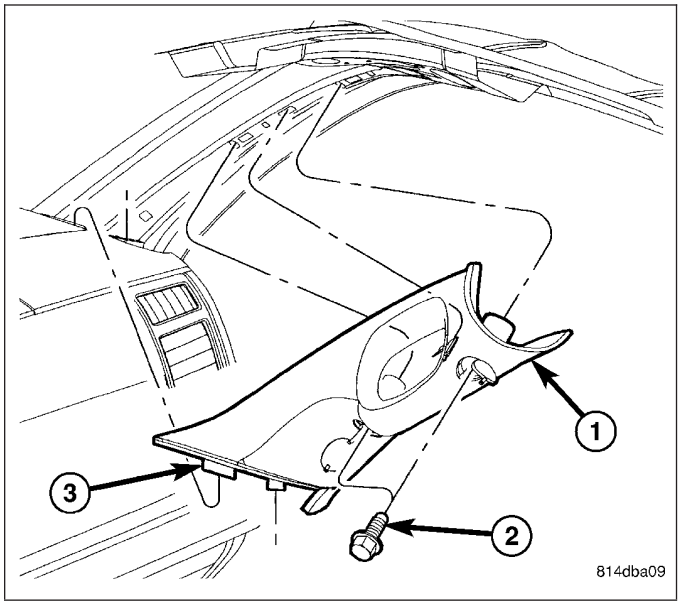
1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Install the sensor (2) and install the screw.



3. Connect the electrical connector (1).
4. Position the defroster grille (1) into place and and seat the retaining clips (2) fully.



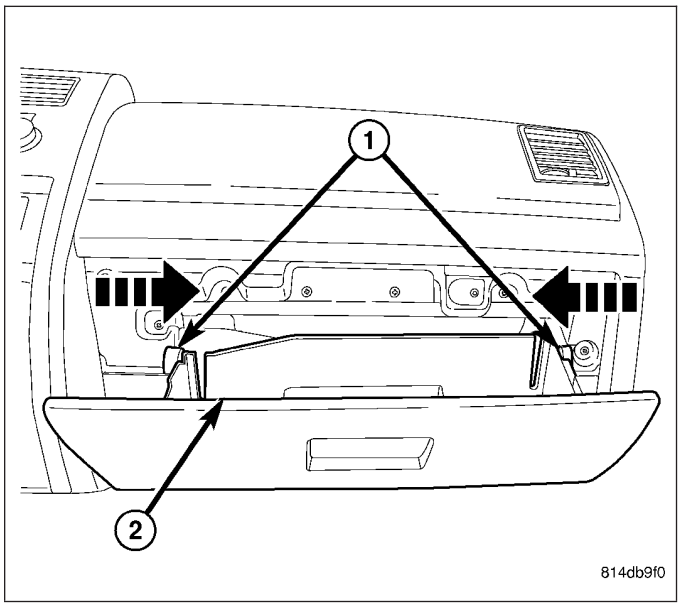
5. Position the a-pillar trim panel tabs (3) into place and seat both a-pillar panels (1) fully.
6. Install the bolts (1) and tighten to 6 N·m (55 in. lbs.).



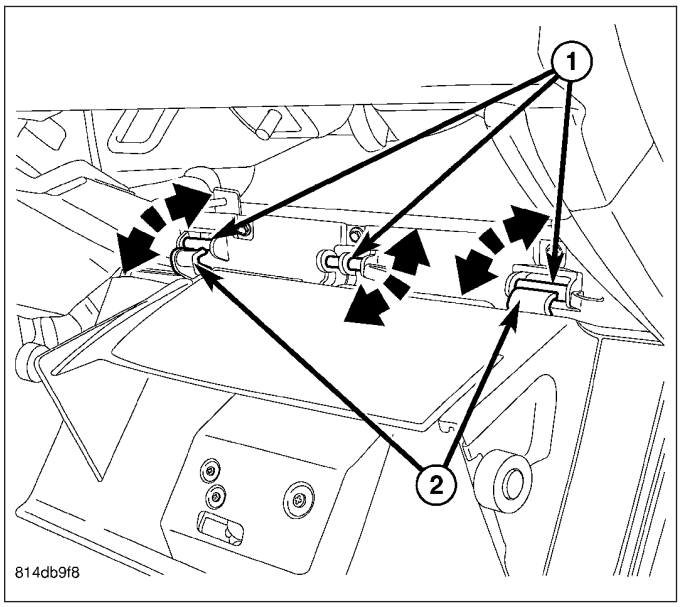
GLOVE BOX ASSEMBLY

REMOVAL

1. Open the glove box and squeeze the stop tabs inward.

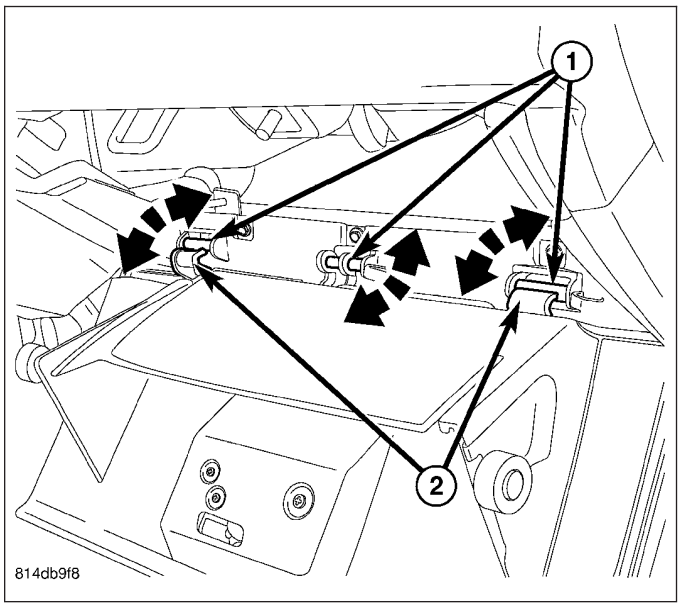


2. Lower the glove box and release the hinges (1) using a twisting motion and remove the glove box.

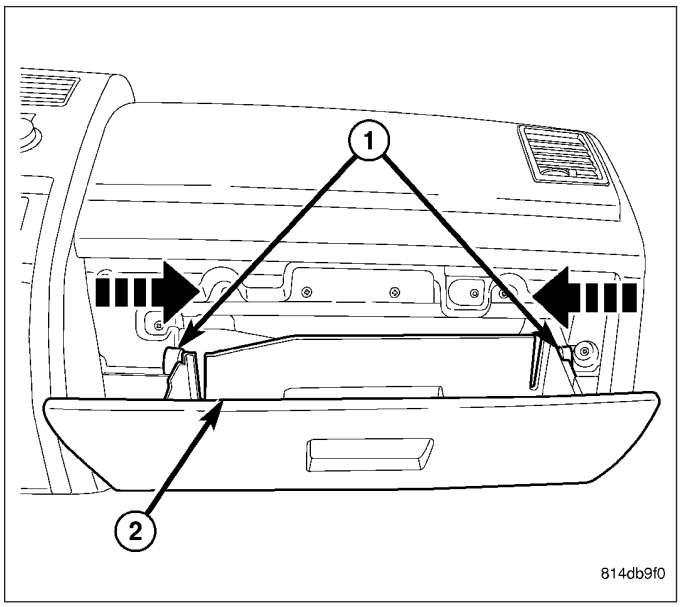


INSTALLATION

1. Position the glove box and twist the box tabs (2) onto the hinges (1) using a twisting motion as indicated.



2. Close the box and squeeze the stop tabs inward and engage into the instrument panel.



ASSEMBLY-INSTRUMENT PANEL

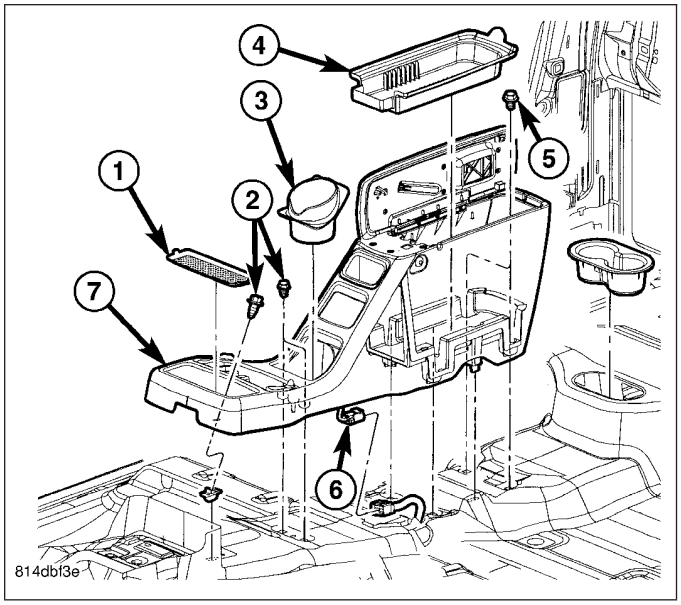
REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

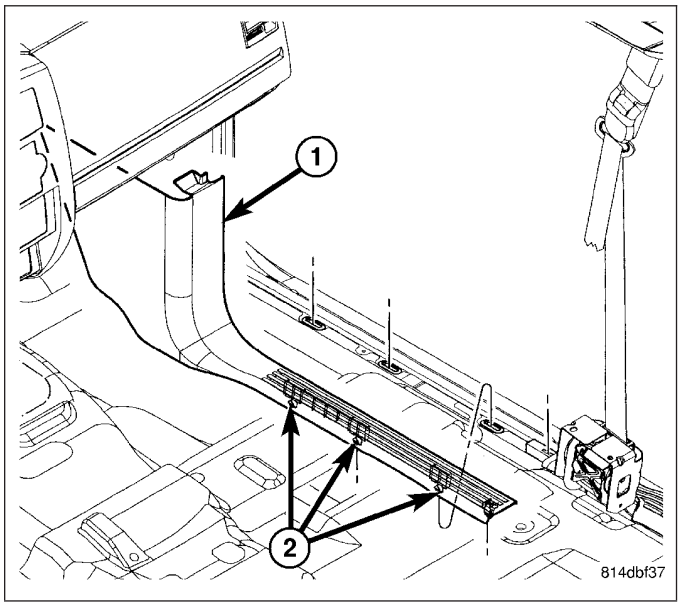
WARNING: To avoid personal injury or death, never strike or drop the occupant restraint controller, as it can damage the impact sensor or affect its calibration. The occupant restraint controller contains the impact sensor, which enables the system to deploy the supplemental restraints. If an airbag control module is accidentally dropped during service, the module must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper supplemental restraint deployment.

CAUTION: On vehicles equipped with the Occupant Classification System (OCS), never replace both the Occupant Restraint Controller (ORC) and the Occupant Classification Module (OCM) at the same time. If both require replacement, replace one. Then perform the supplemental restraint verification test before replacing the other. Both the ORC and the OCM store OCS calibration data, which they transfer to one another when one of them is replaced. If both are replaced at the same time, an irreversible fault will be set in both modules.

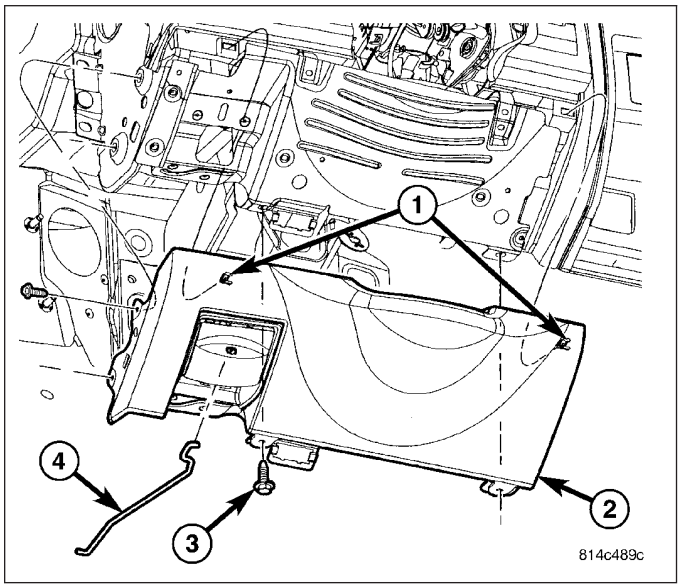
1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Disconnect and isolate battery negative cable.
3. Remove the floor console (7). (Refer to 23 - BODY/INTERIOR/CONSOLE-FLOOR - REMOVAL)



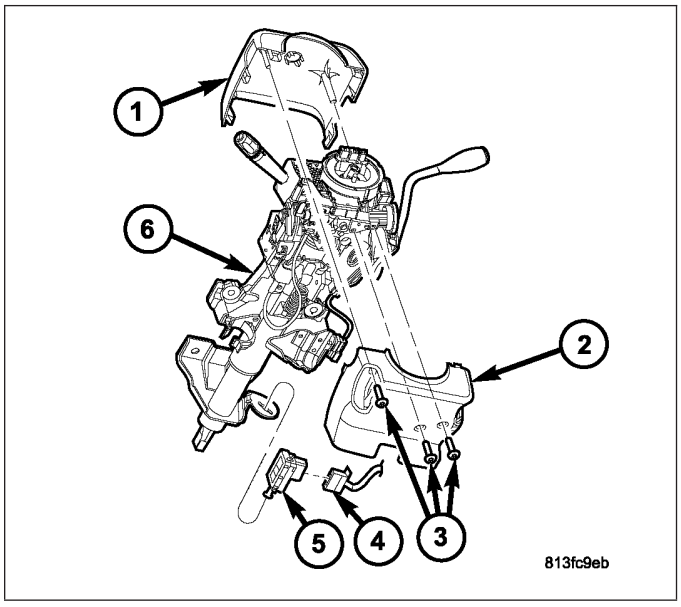
4. Remove the driver side door sill trim cover (1). (Refer to 23 - BODY/INTERIOR/PANEL-COWL TRIM - REMOVAL)



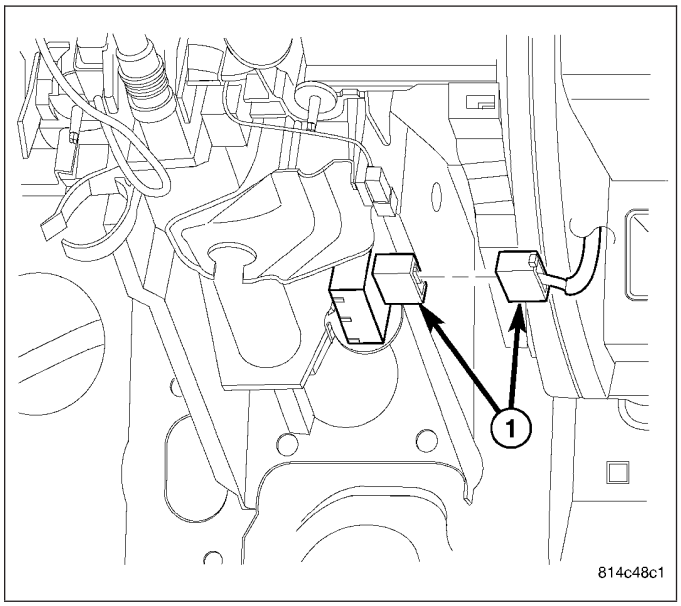
5. Remove the steering column opening cover (2). (Refer to 23 - BODY/INSTRUMENT PANEL/COVER-STEERING COLUMN OPENING - REMOVAL)



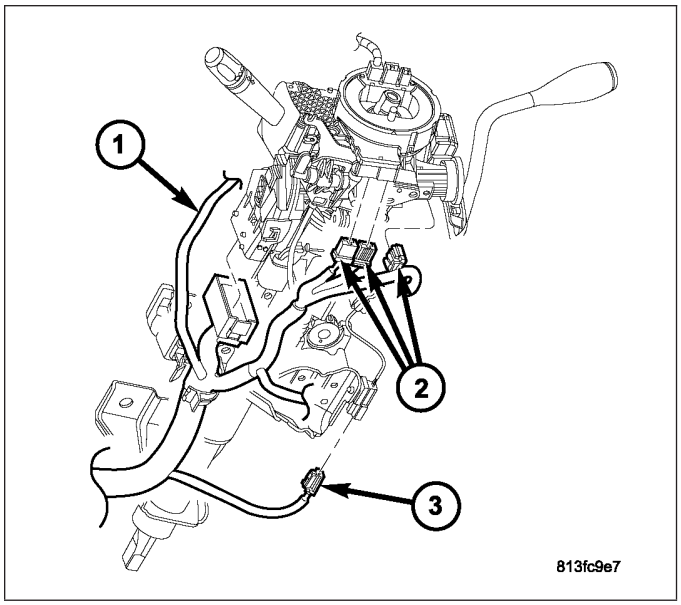
6. Position the front wheels **straight ahead**.
7. Remove the steering column tilt lever knob.
8. Remove the column shrouds (1& 2).



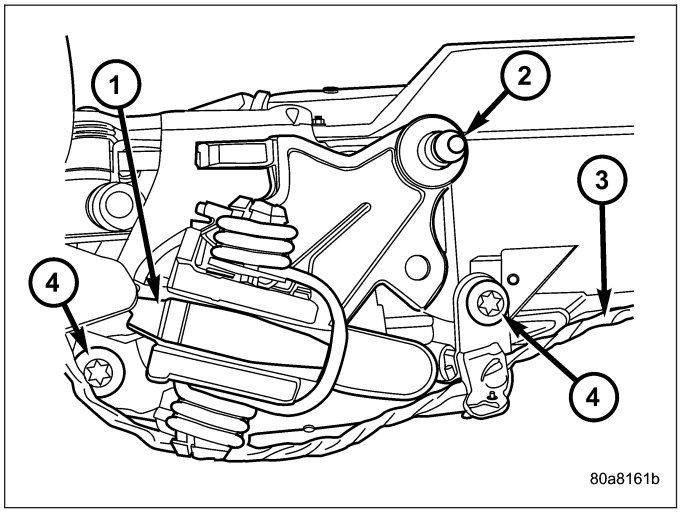
9. Disconnect the brake switch electrical connector (1). (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - REMOVAL).



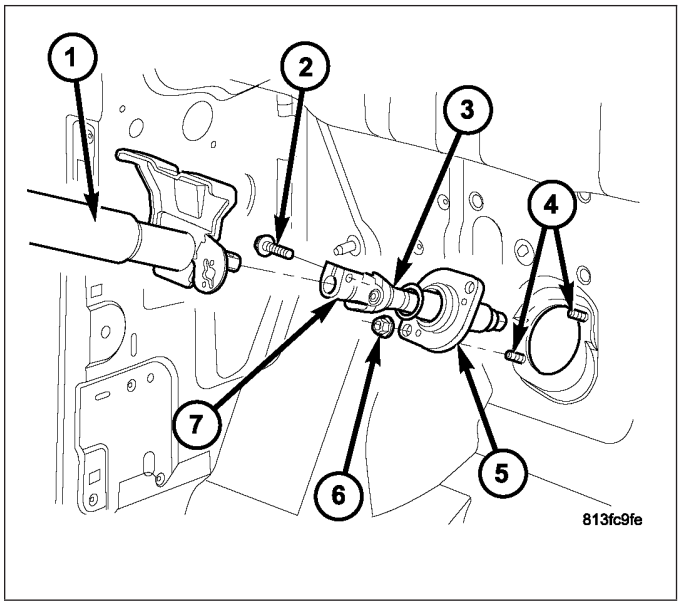
10. Disconnect the wiring harness to the column (1, 2 & 3).



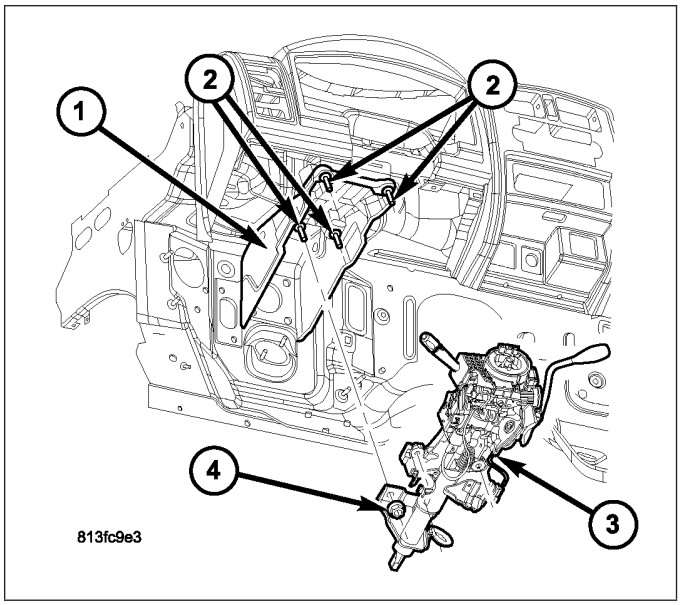
11. Remove the shift cable (2) from the column shift lever actuator (1) (Refer to 21 - TRANSMISSION/ TRANSAXLE/AUTOMATIC - 32RH/GEAR SHIFT CABLE - REMOVAL).
12. Release the shift cable from the column bracket and remove it from the bracket.
13. Remove the SKIM module in order to disconnect the electrical connector.



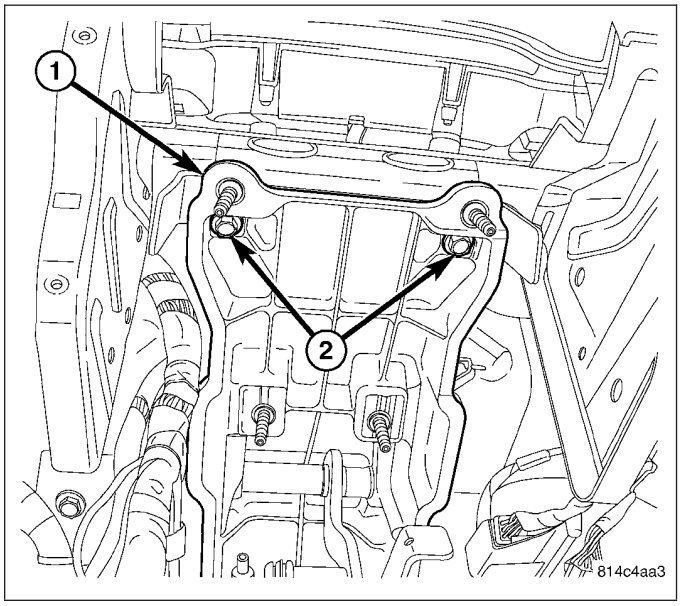
14. Remove the upper steering shaft coupler bolt (2) from the column (1).
15. Separate the shaft from the coupler (7).



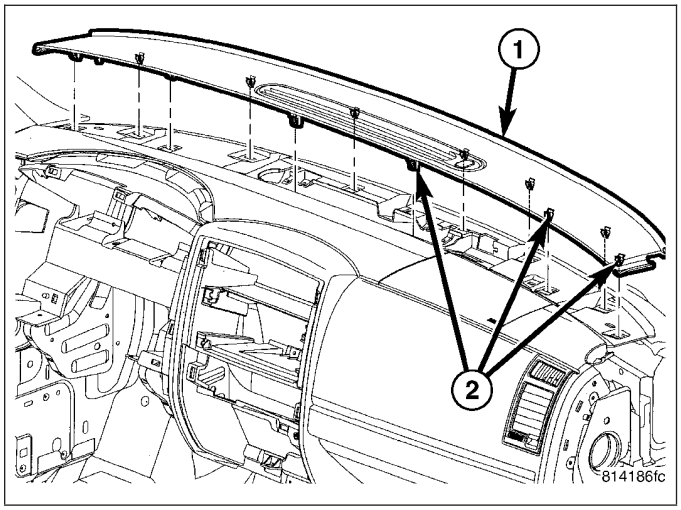
16. Remove the four steering column mounting nuts (4).
17. Remove the steering column assembly (3) from the vehicle.

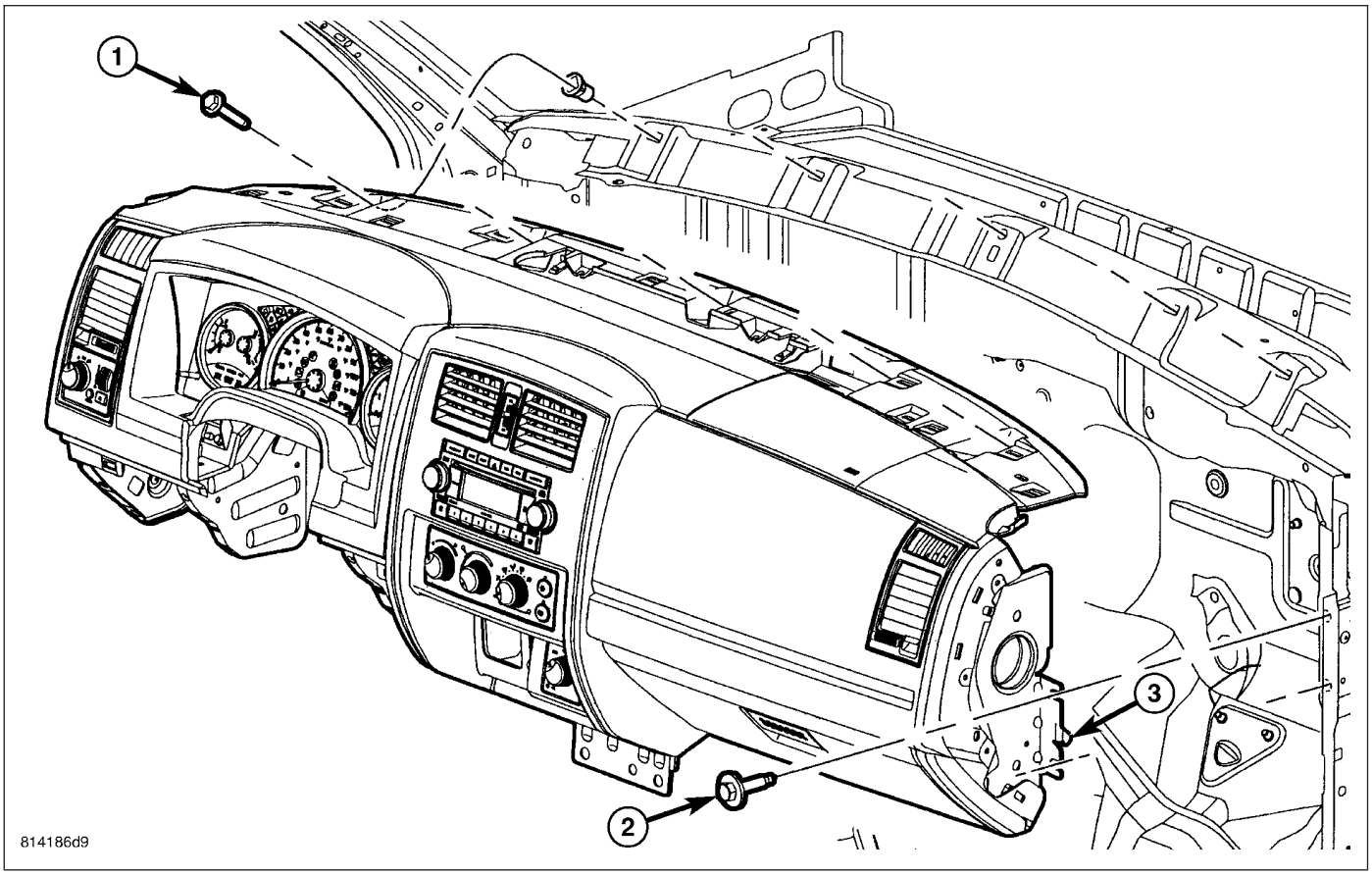


18. Remove the bolts (2) from the pedal support (1).

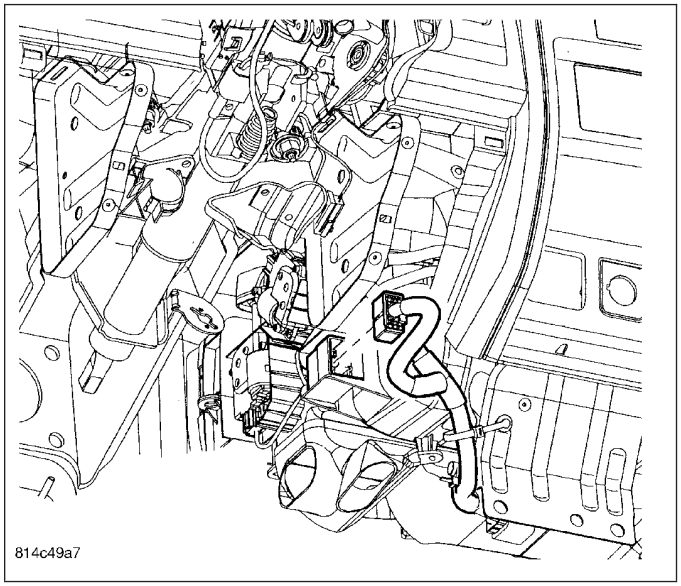


19. Remove the defroster grille (1). (Refer to 23 - BODY/INSTRUMENT PANEL/GRILLE-DEFROSTER - REMOVAL)

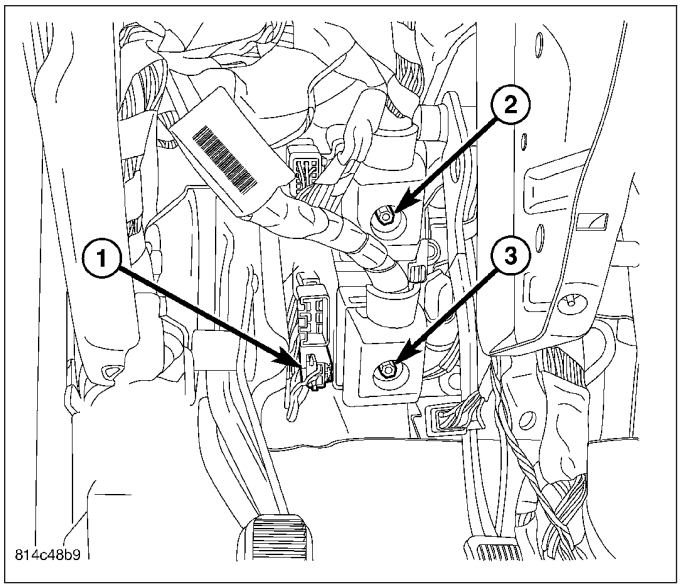




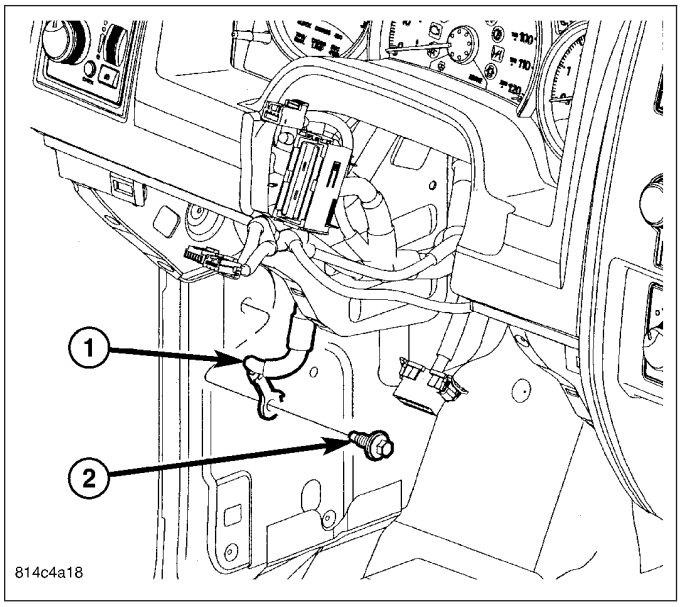
20. Remove the five upper fence line bolts (1).
21. Disconnect the HVAC electrical connector.



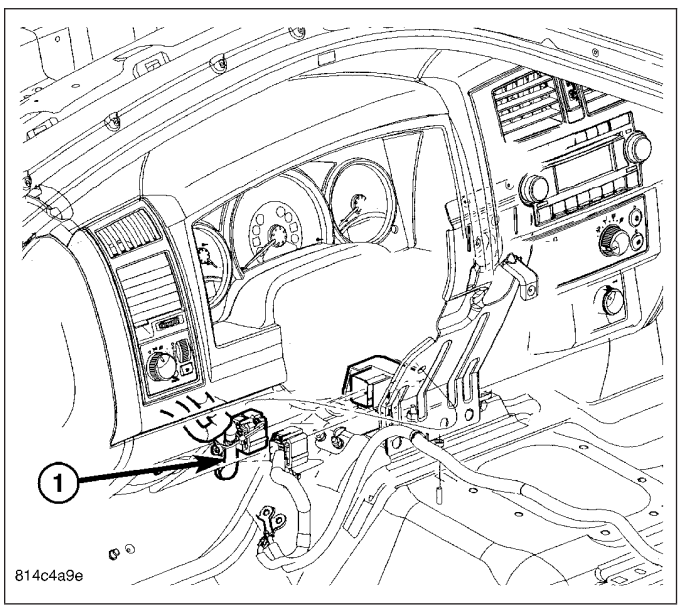
22. Loosen the screws (2 & 3) and disconnect the electrical connectors (1, 2 & 3).

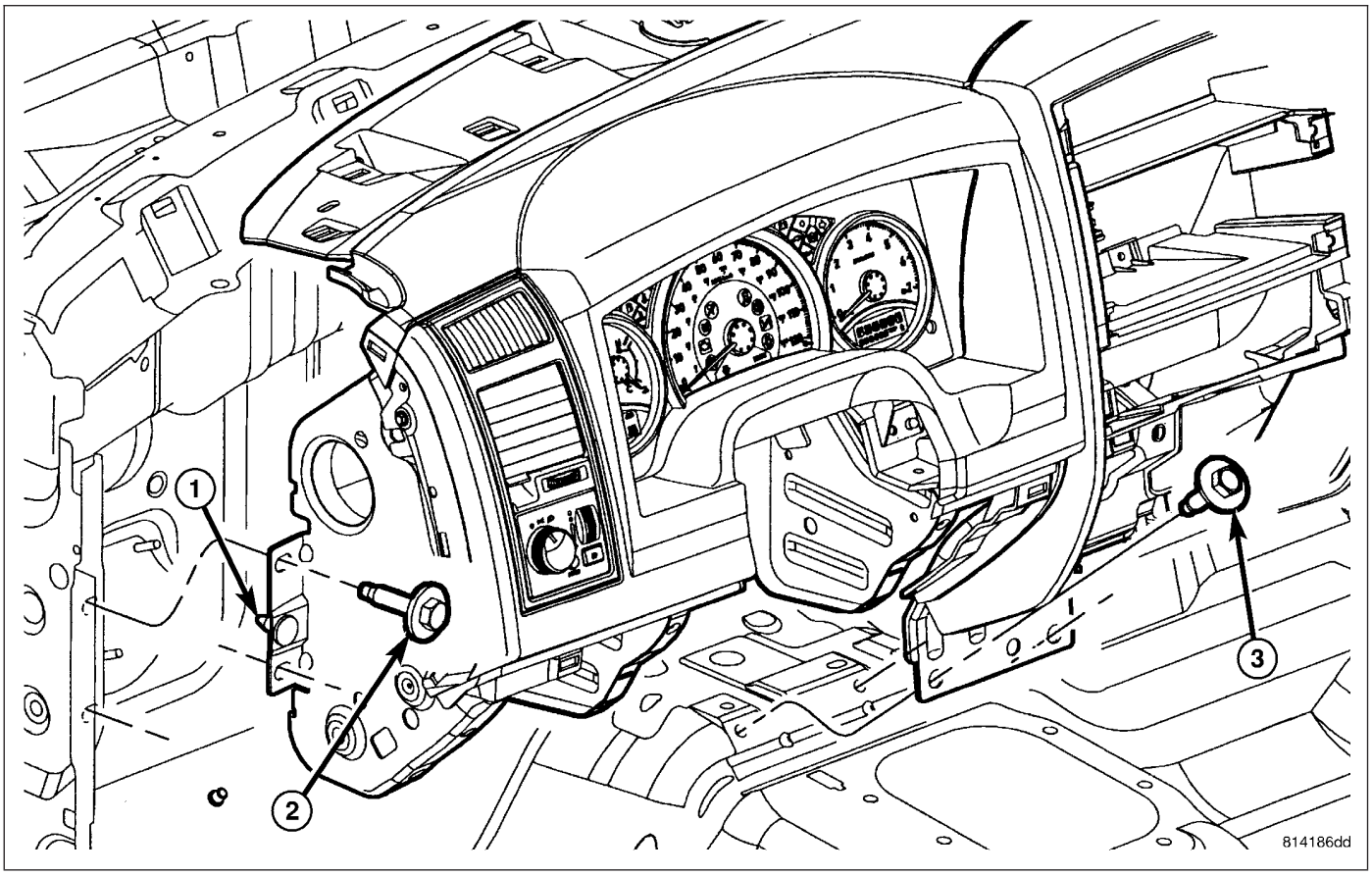


23. Remove the bolt (2) and the ground (1) from the left a-pillar.

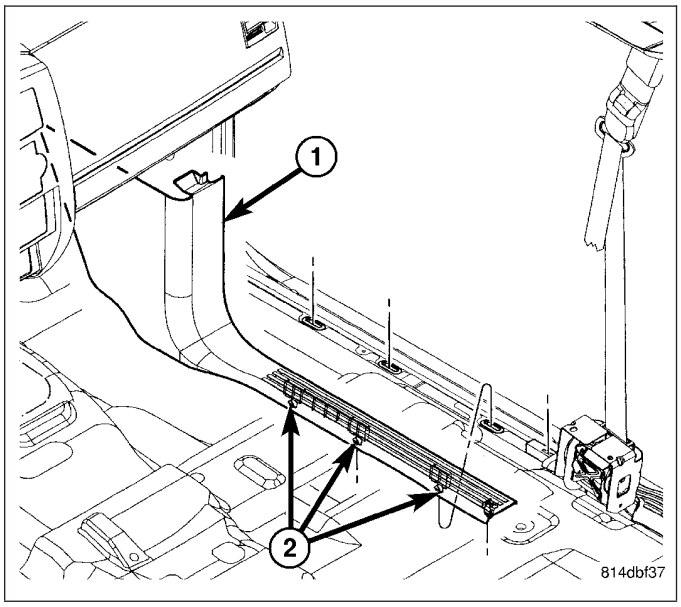


24. Disconnect the ABS module electrical connectors (1).
25. Separate the center wire harness from the center support.

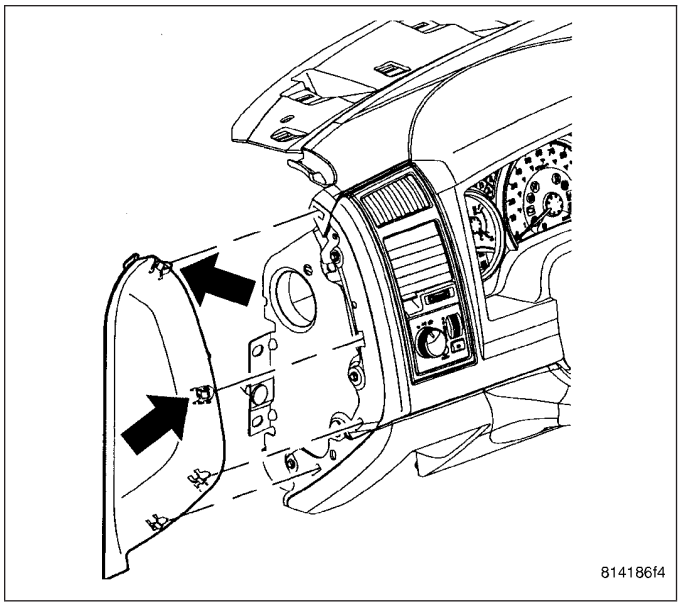




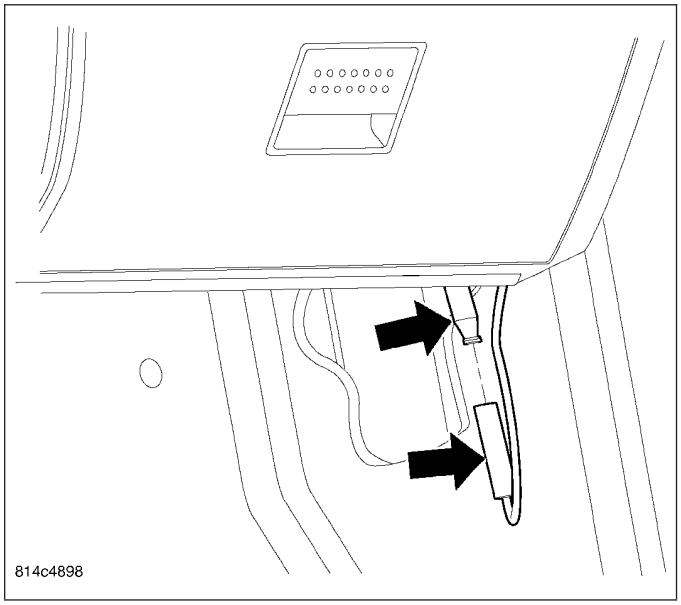
26. Remove the two center support bolts (3).
27. Remove the two left support bolts (2).
28. Remove the passenger door sill trim cover (1). (Refer to 23 - BODY/INTERIOR/PANEL-COWL TRIM - REMOVAL)



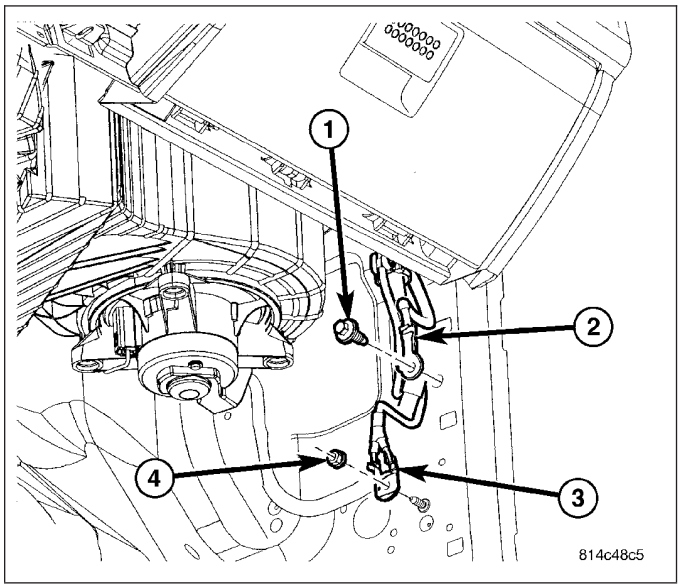
29. Remove the passenger side end cap.*Drivers side shown, passenger side similar.



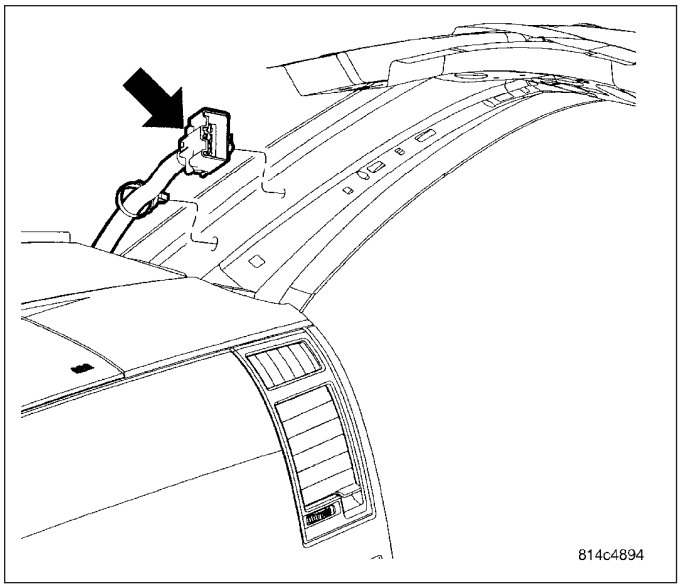
30. Disconnect the antenna cable.

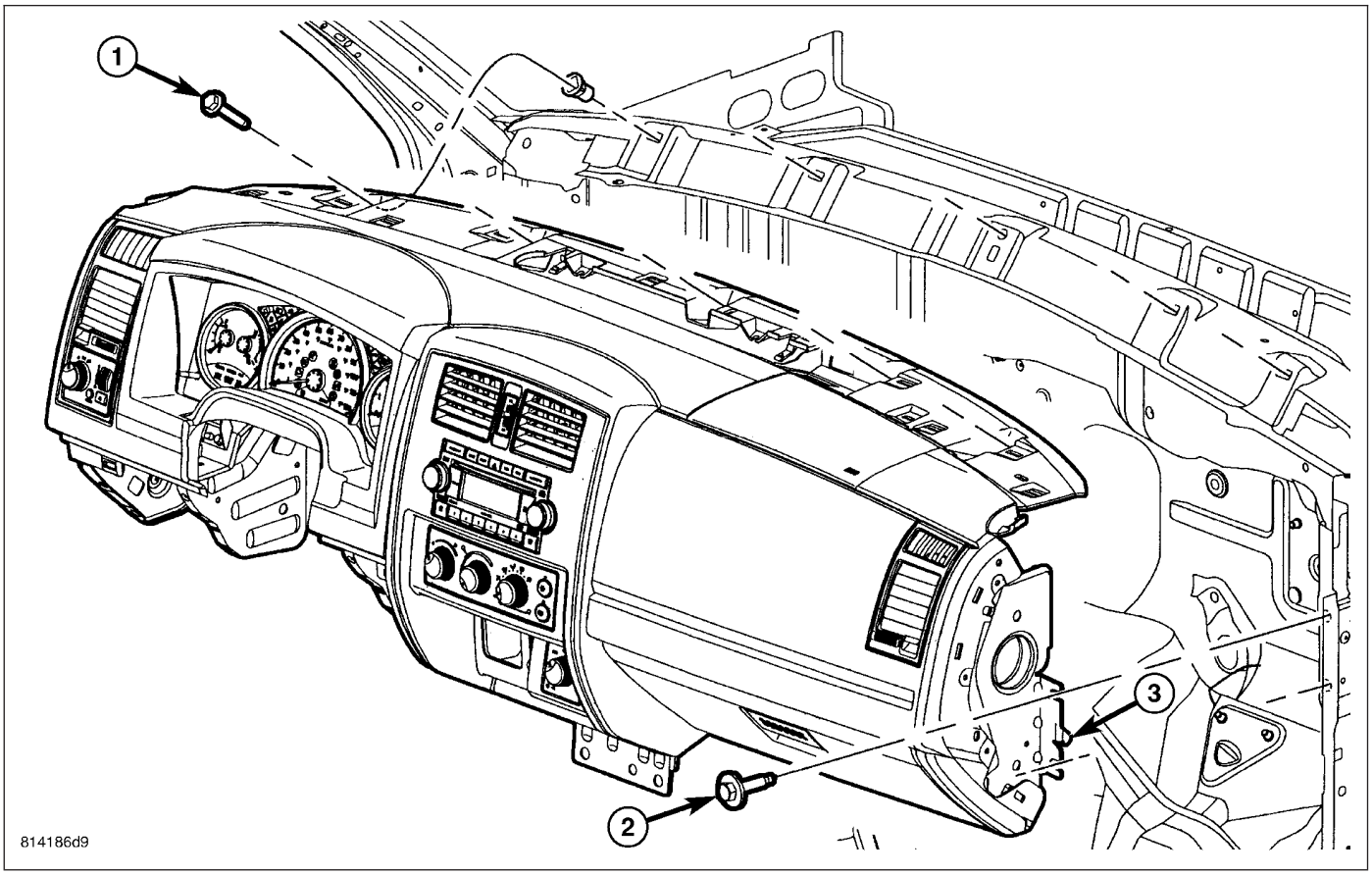


31. Remove the bolt (1) and nut (4) and disconnect the grounds (2 & 3).



32. Disconnect the antenna amplifier connector, if equipped.





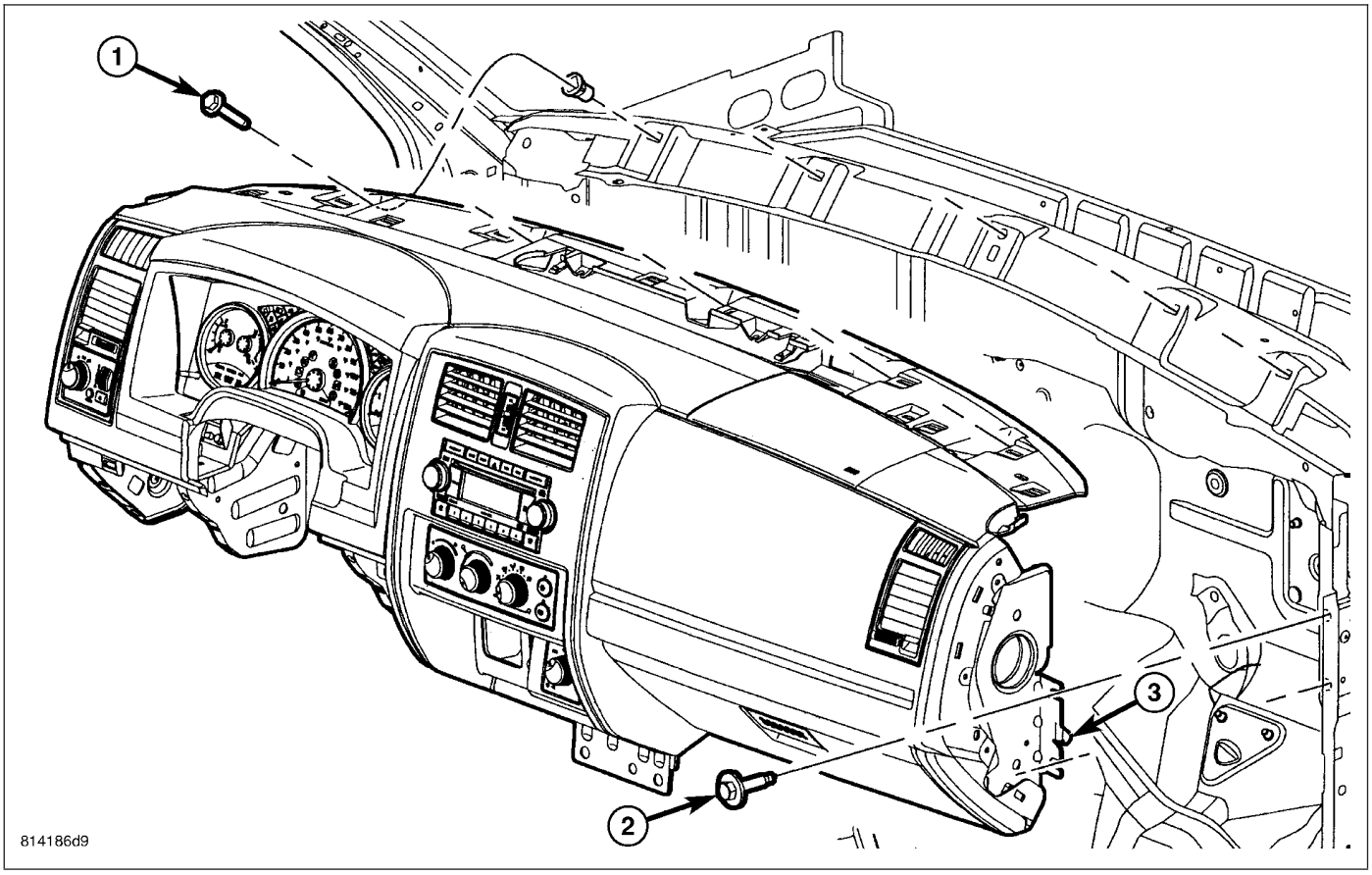
33. Remove the right side support bolts (2) and with the help of another person, remove the instrument panel assembly from the vehicle.

INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

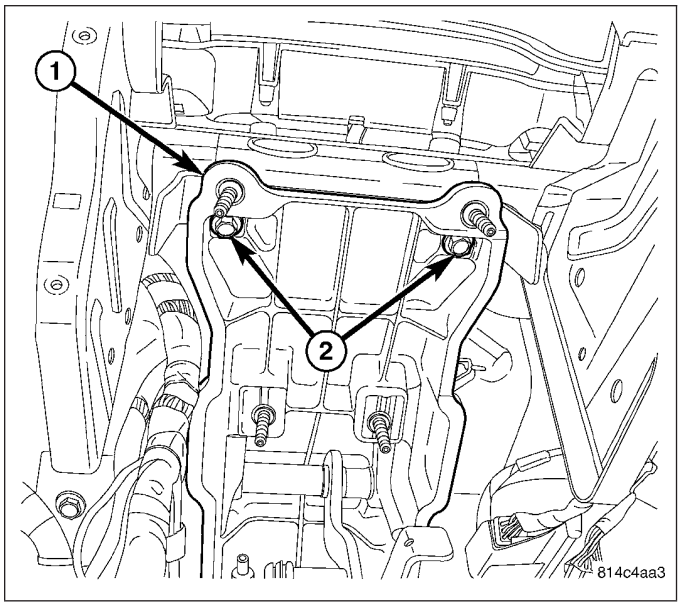
WARNING: To avoid personal injury or death, never strike or drop the occupant restraint controller, as it can damage the impact sensor or affect its calibration. The occupant restraint controller contains the impact sensor, which enables the system to deploy the supplemental restraints. If an airbag control module is accidentally dropped during service, the module must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper supplemental restraint deployment.

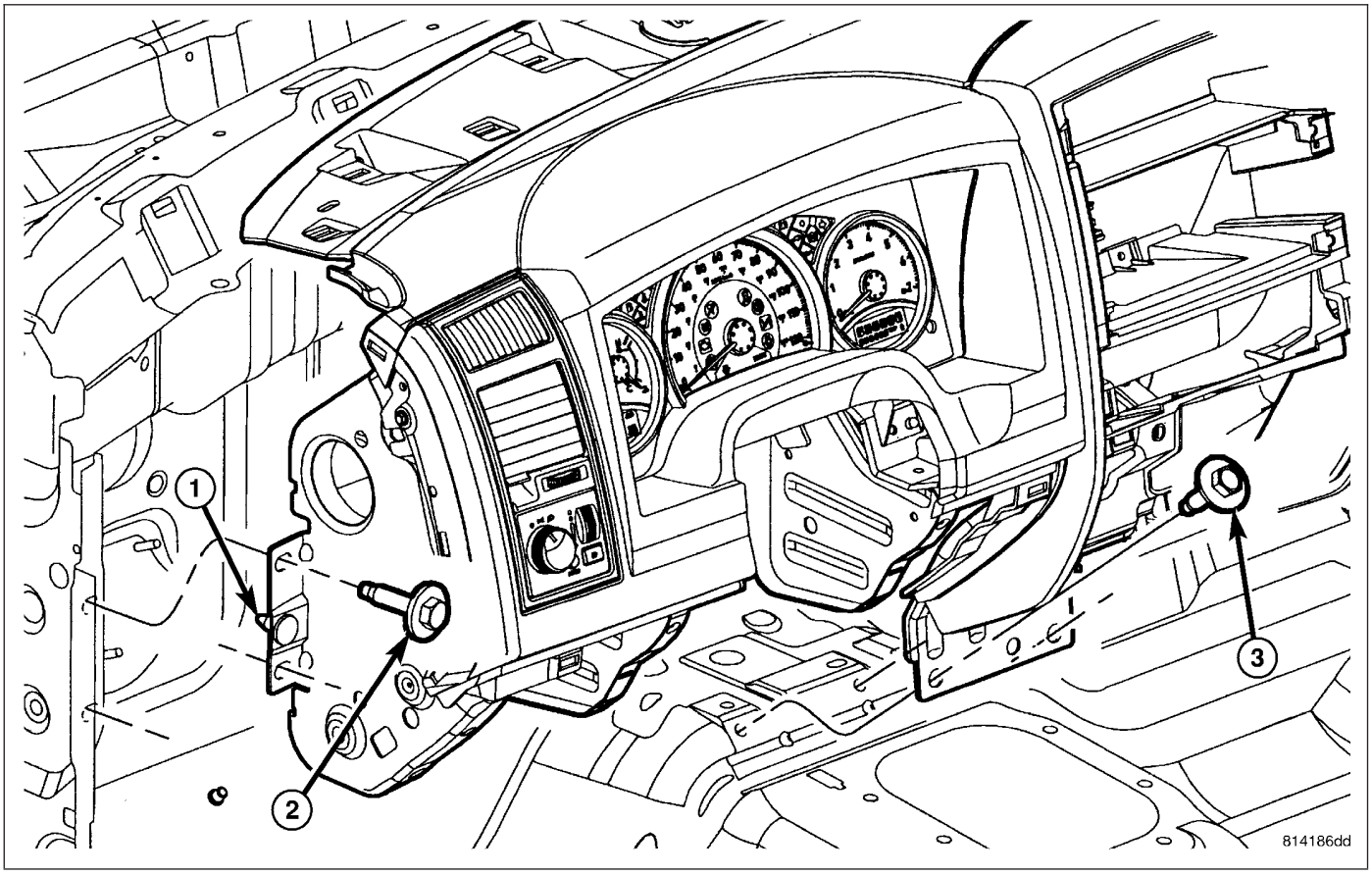
CAUTION: On vehicles equipped with the Occupant Classification System (OCS), never replace both the Occupant Restraint Controller (ORC) and the Occupant Classification Module (OCM) at the same time. If both require replacement, replace one. Then perform the supplemental restraint verification test before replacing the other. Both the ORC and the OCM store OCS calibration data, which they transfer to one another when one of them is replaced. If both are replaced at the same time, an irreversible fault will be set in both modules.



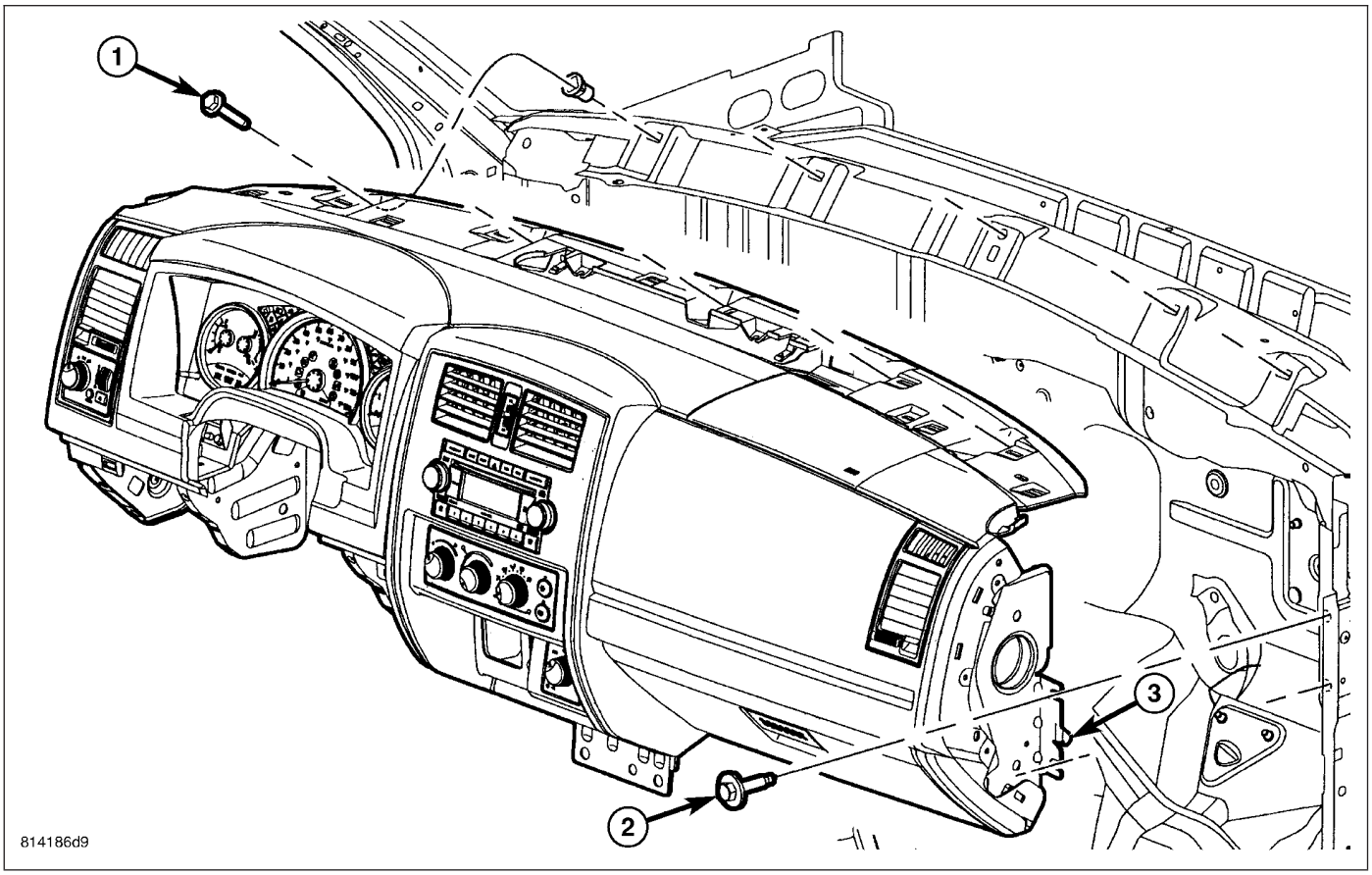
1. Install the instrument into the vehicle and guide onto the a-pillar studs (3).
2. Install the right side bolts (2).
3. Install the fenceline bolts (1).

4. Install the bolts (2) into the pedal support bracket.

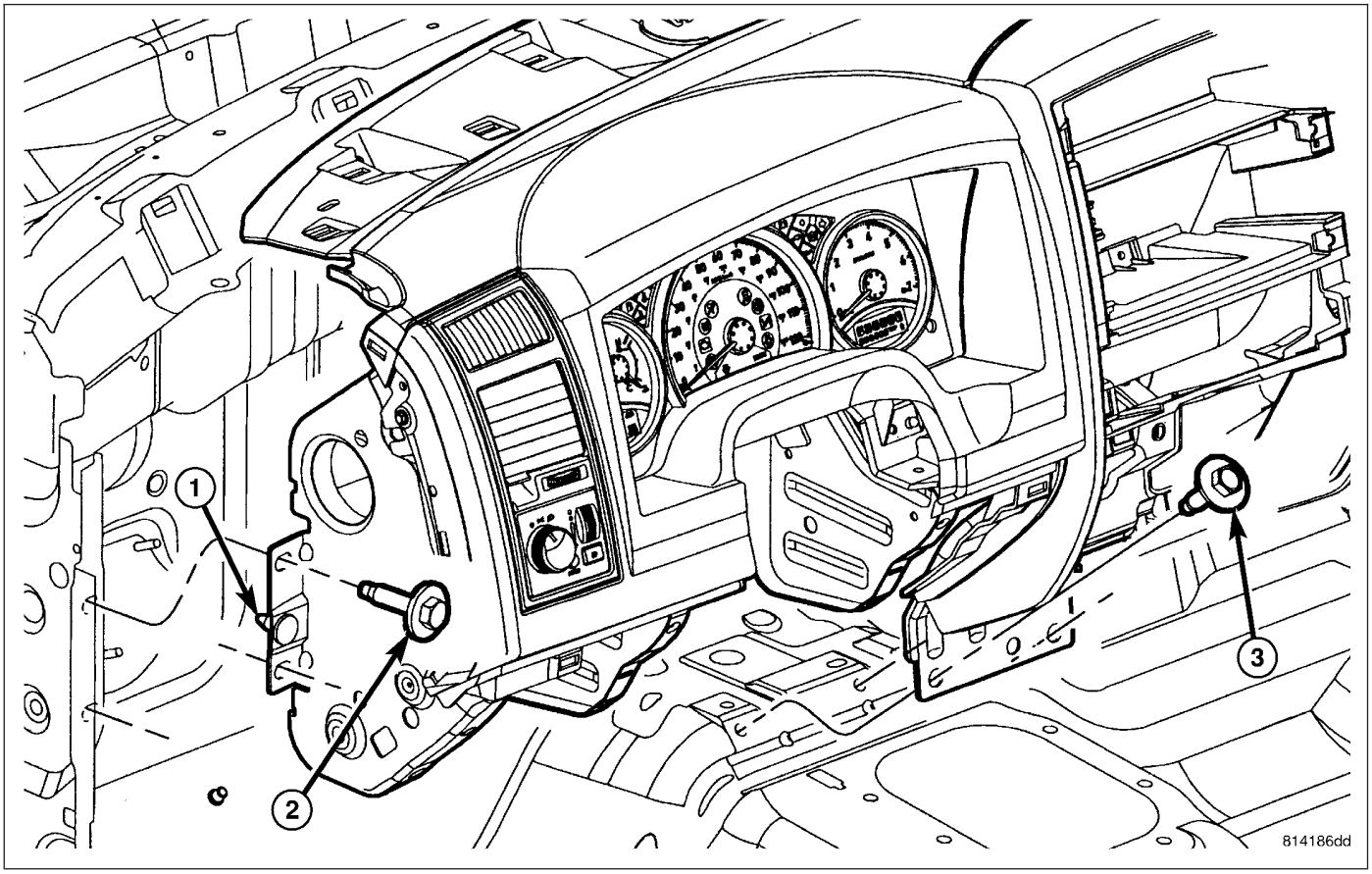




5. Install the left side support bolts (2).
6. Install the center support bolts (3).
7. Tighten the left side support bolts (2) to 12 N·m (105 in. lbs.).

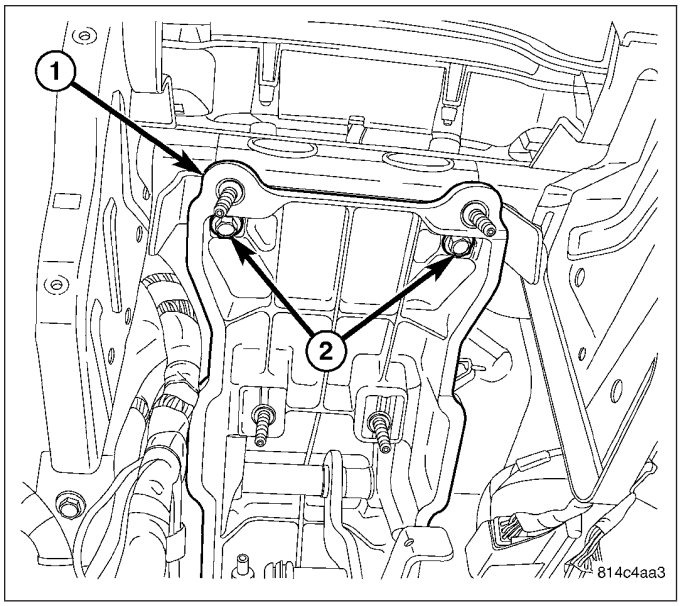


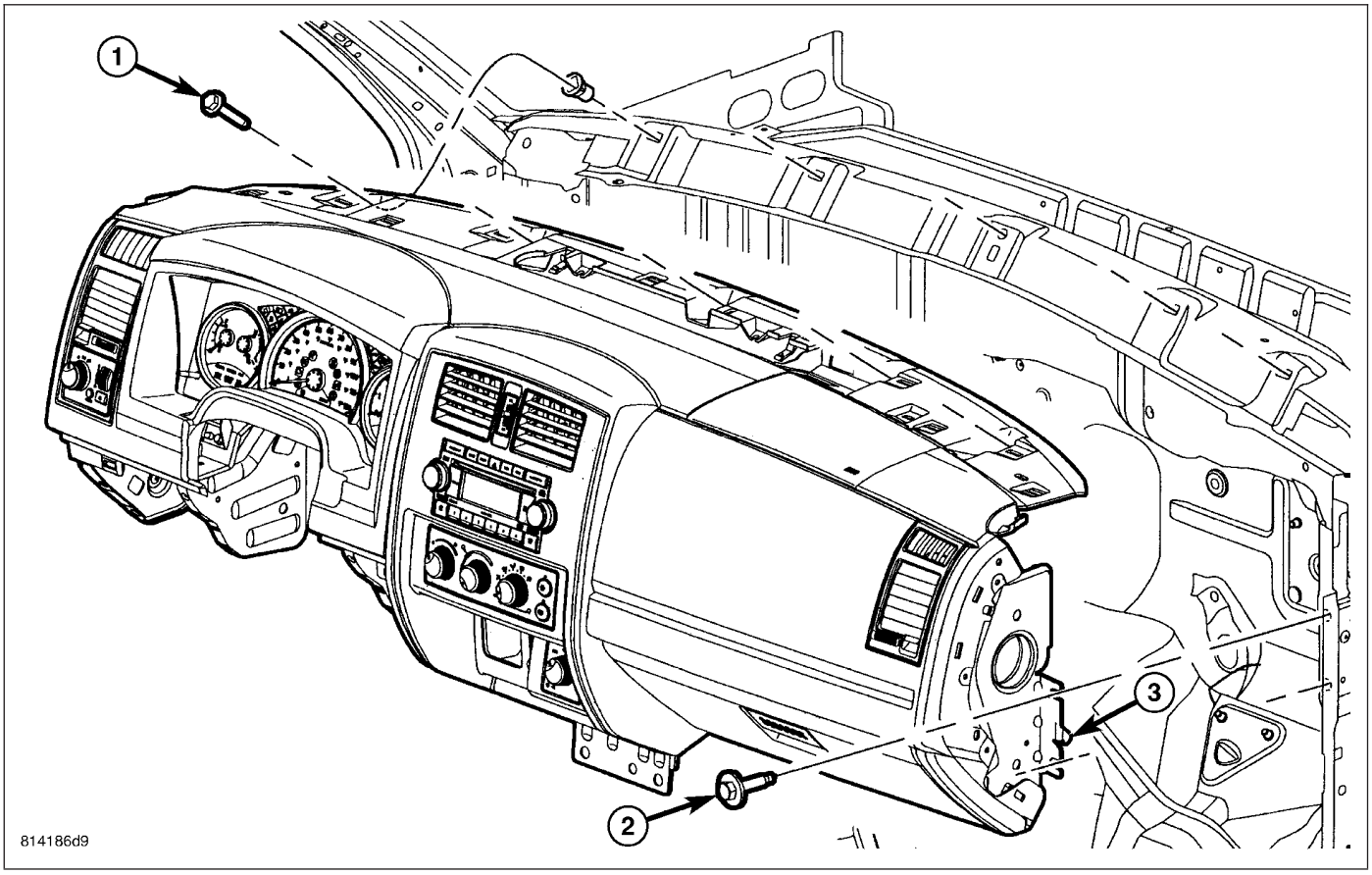
8. Tighten the right side support bolts (2) to 12 N·m (105 in. lbs.).



9. Tighten the center support bolts (3) to 12 N·m (105 in. lbs.).

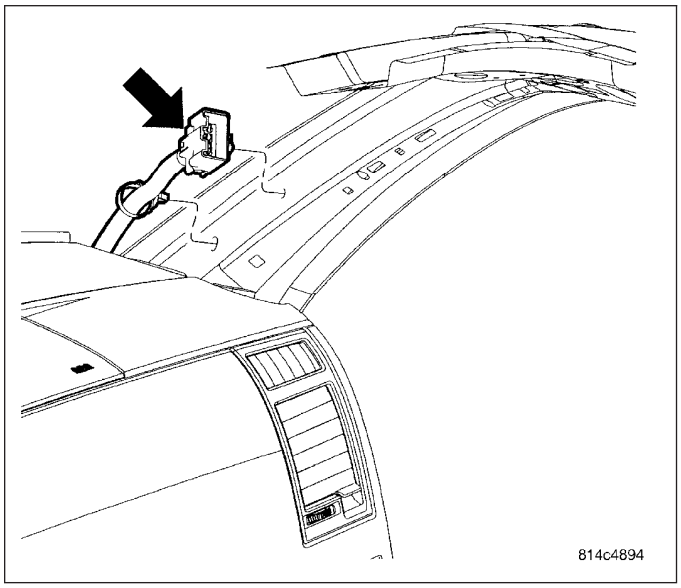
10. Tighten the pedal support bracket bolts (2) to 14 N·m (10 ft. lbs.).



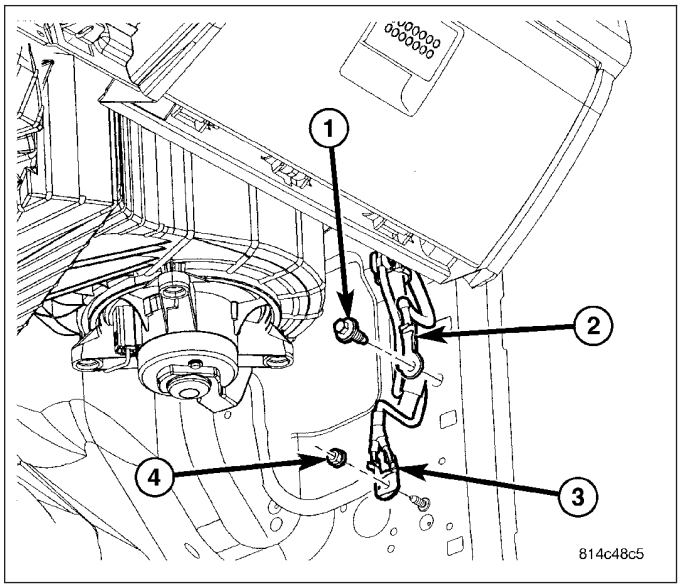


11. Tighten the fenceline bolts (1) to 10 N·m (85 in. lbs.).

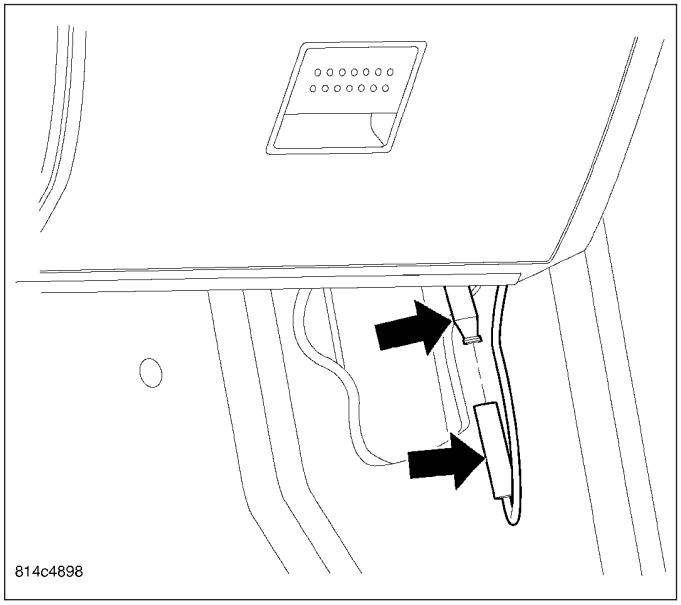
12. Connect the antenna amplifier connector, if equipped.



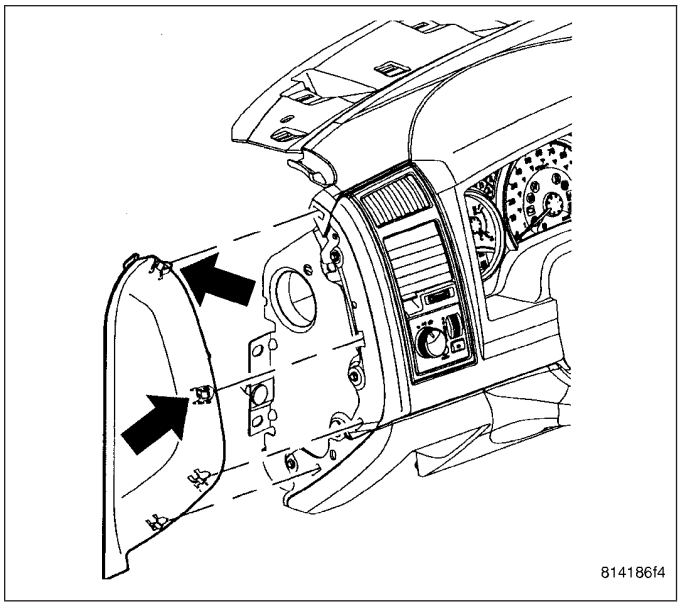
13. Install the grounds (2 & 3) and install the bolt (1) and nut (4).



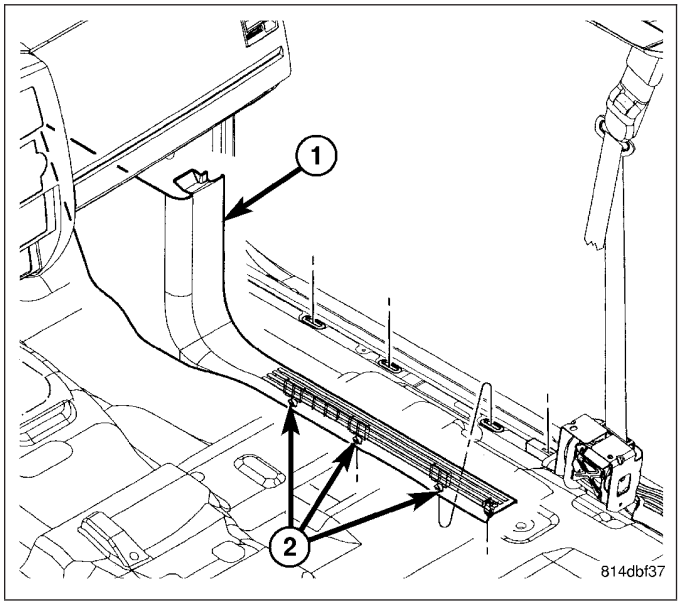
14. Connect the antenna cable.



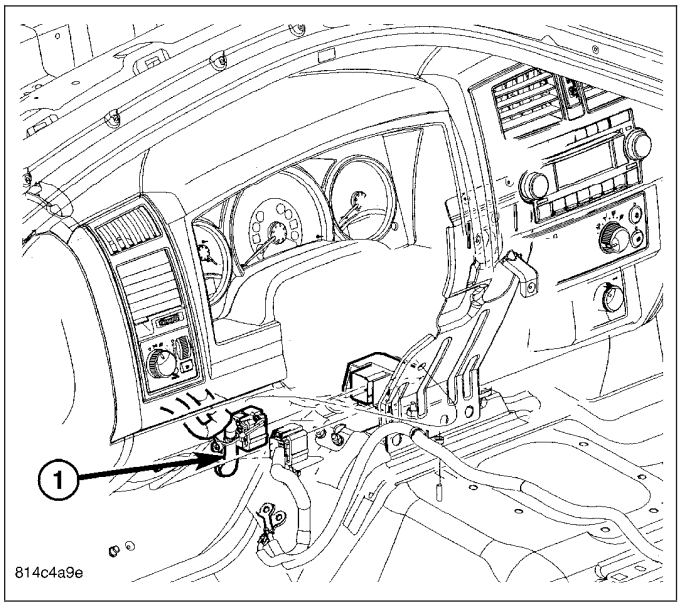
15. Install the passenger side end cap.* Drivers side shown, passenger side similar.



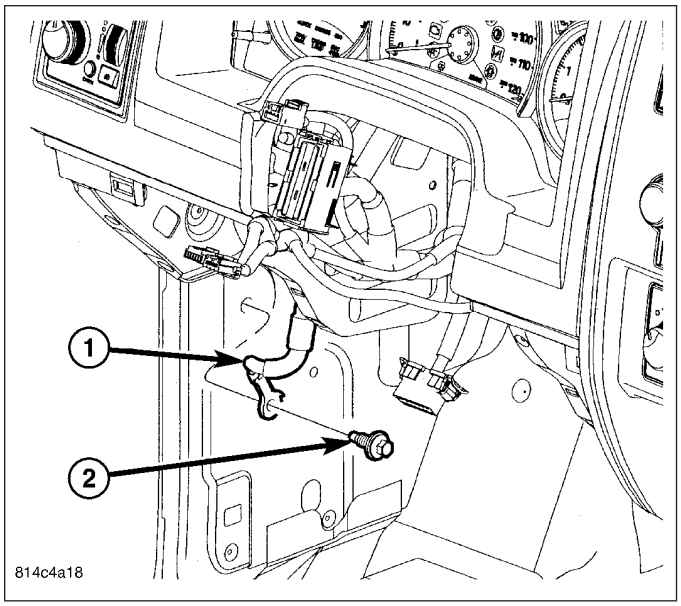
16. Install the passenger door sill trim cover (1). (Refer to 23 - BODY/INTERIOR/PANEL-COWL TRIM - INSTALLATION)



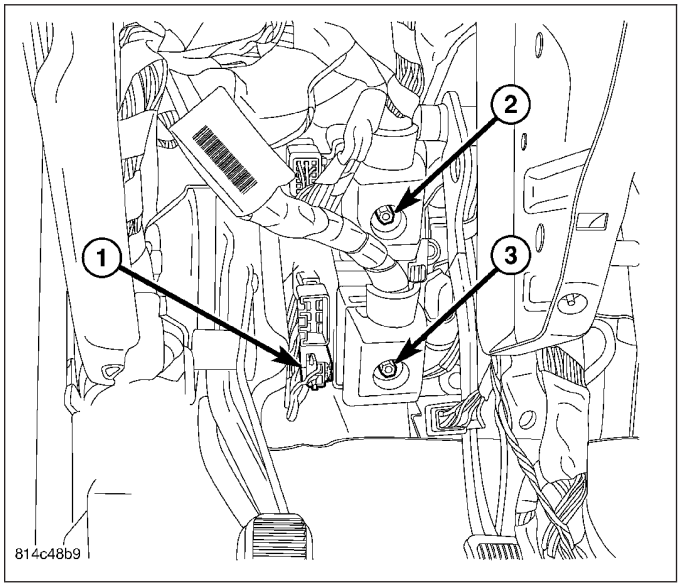
17. Position the center wire harness back and connect the ABS module connectors and grounds (1).



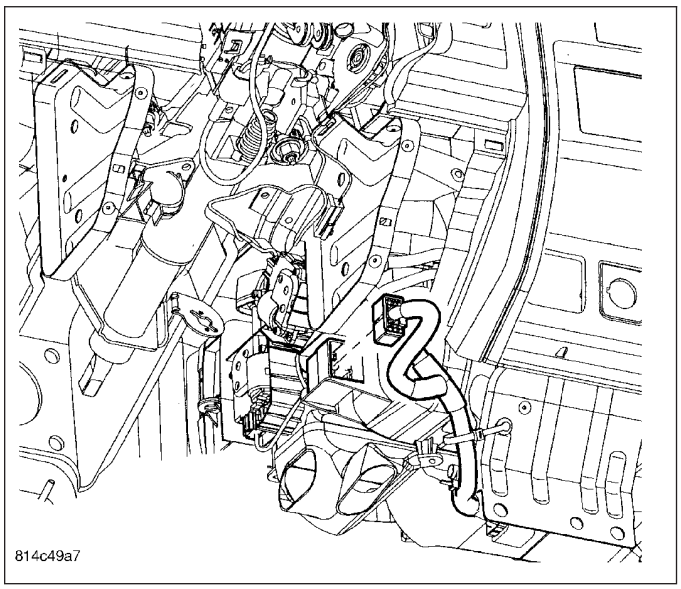
18. Install the ground (1) and install the bolts (2).



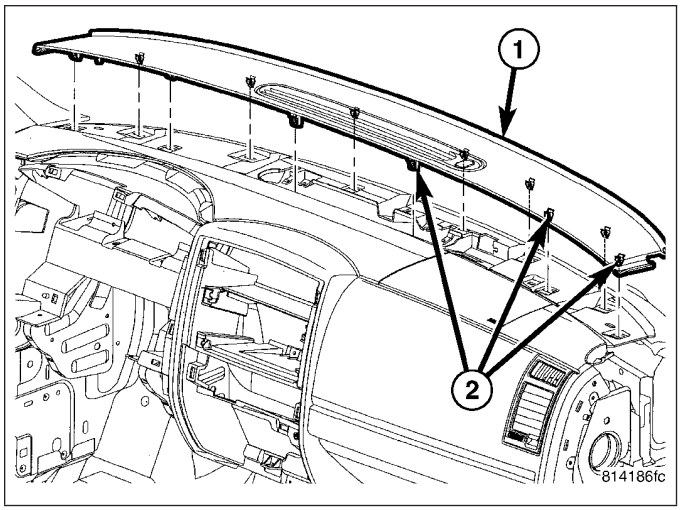
19. Connect the electrical connectors (1, 2 & 3) and tighten the screws (2 & 3) to 5 N·m (40 in. lbs.).



20. Connect the HVAC electrical connector.

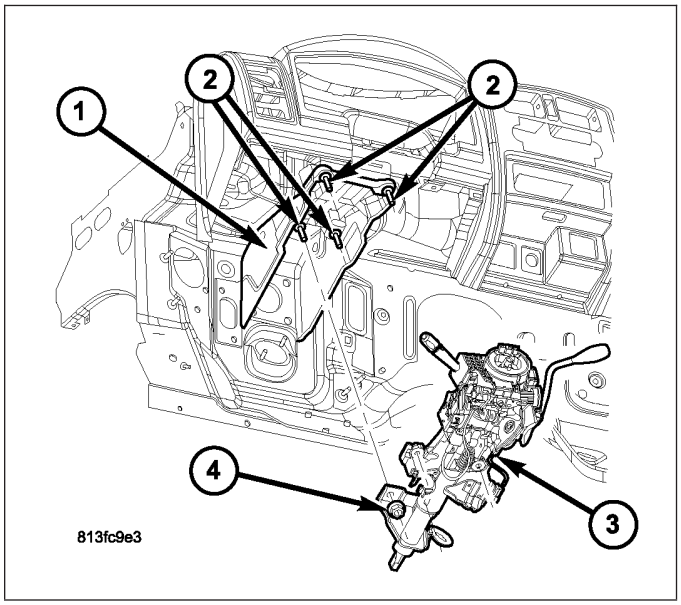


21. Install the defroster grille (1). (Refer to 23 - BODY/INSTRUMENT PANEL/GRILLE-DEFROSTER - INSTALLATION)



NOTE: Torque the upper left nut first then the lower right nut. Then torque the lower left nut then the upper right nut.

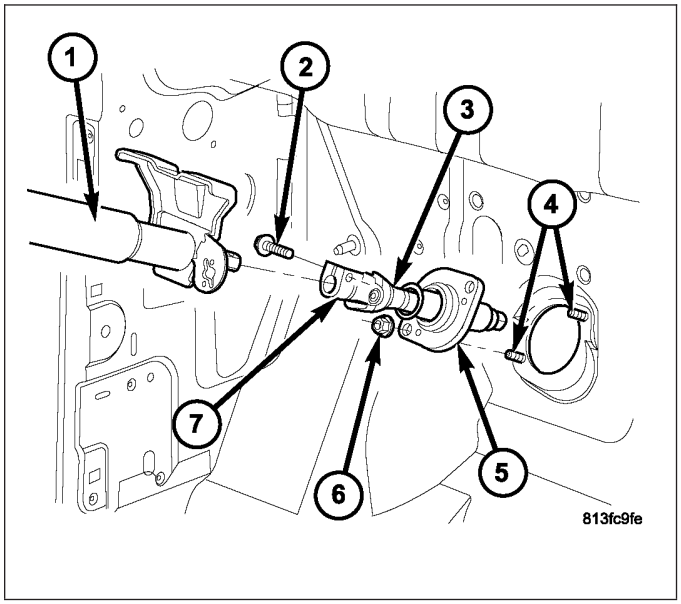
22. Position the steering column (3) on the dash panel support (1) and loosely install the mounting nuts (4).
23. Firmly slide the steering column upward against the studs (2) in dash panel and hand tighten the nuts.
24. Center steering column (3) in dash opening and tighten mounting nuts (4) to 28 N·m (21 ft. lbs.).



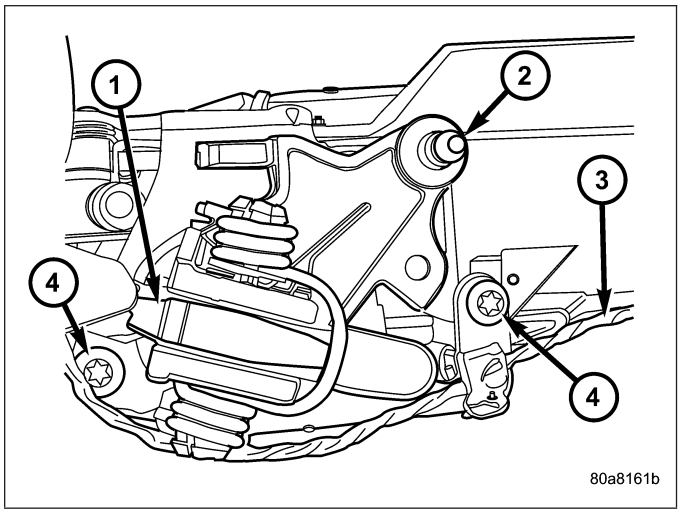
25. Install the steering shaft coupler (7) on the steering shaft (1) and loosely install a **new** bolt (2).

NOTE: A new bolt must be used for reinstallation.

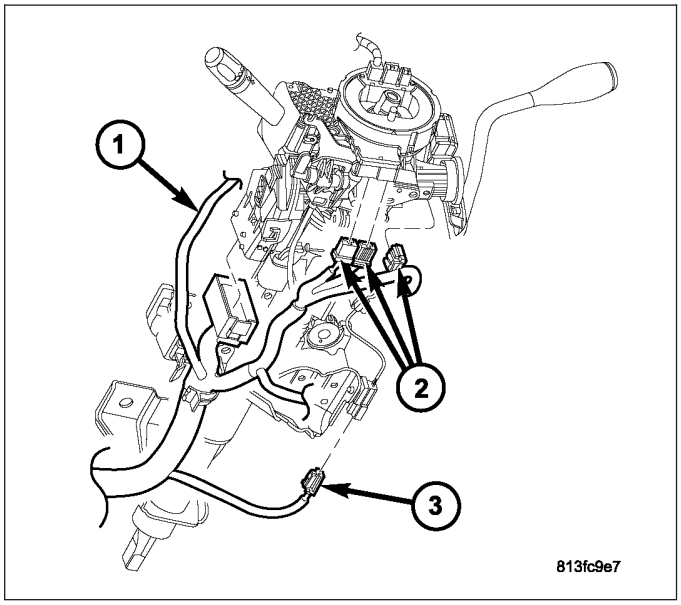
26. Tighten the coupler bolt (2) to 57 N·m (42 ft. lbs.).



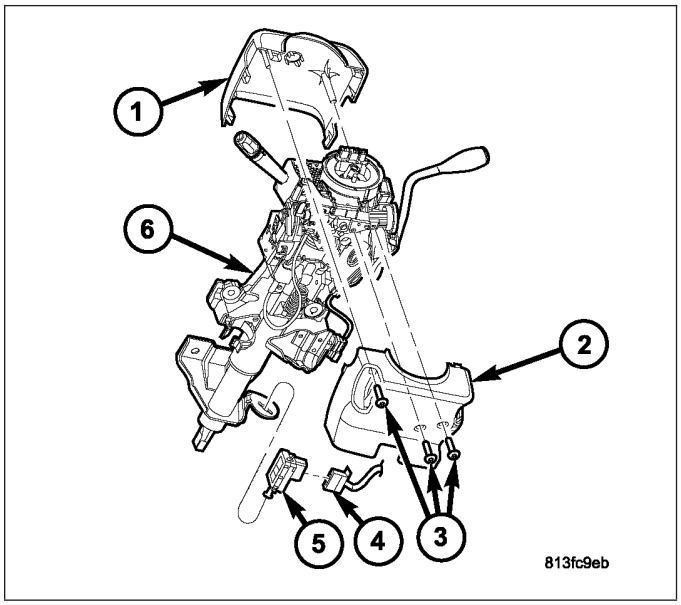
27. Install the shifter cable (2). (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 32RH/ GEAR SHIFT CABLE - INSTALLATION).



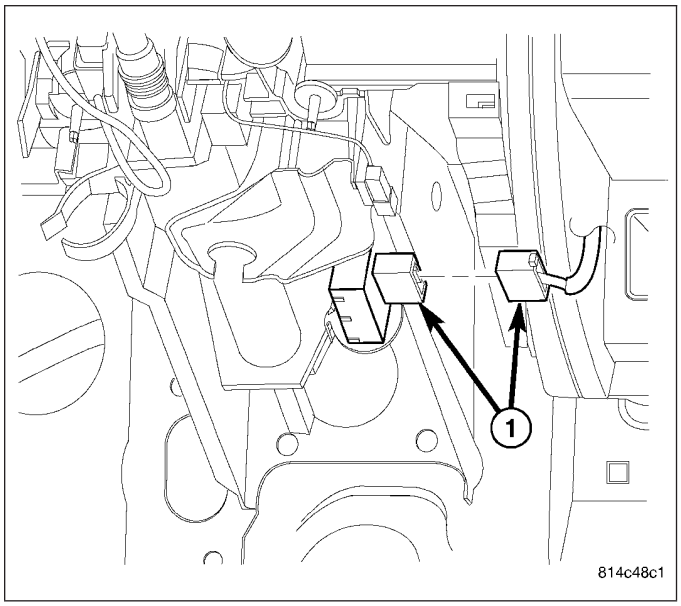
28. Connect the wiring harness (1, 2 & 3) to the column.
29. Install the SKIM module.



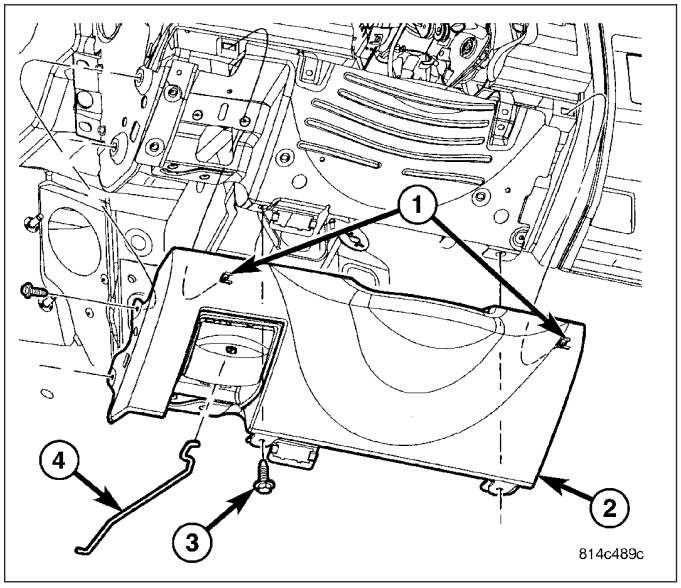
30. Install the shrouds (1 & 2).
31. Install the lilt lever knob.



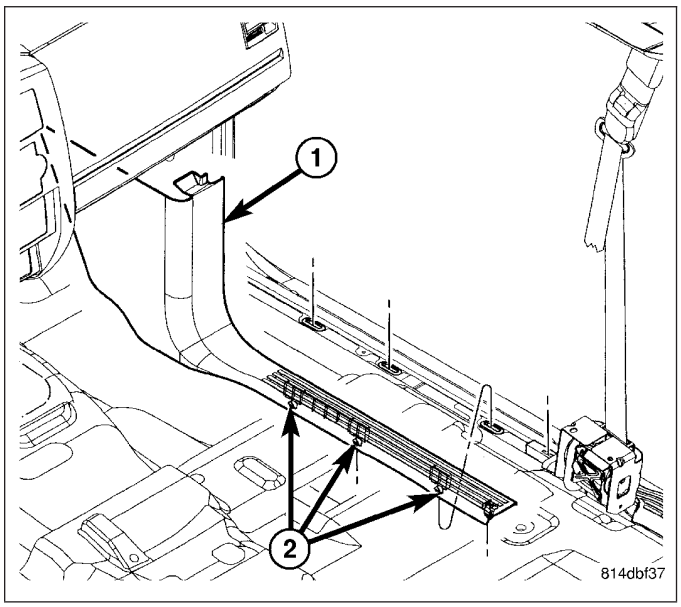
32. Connect the brake switch electrical connector (1).



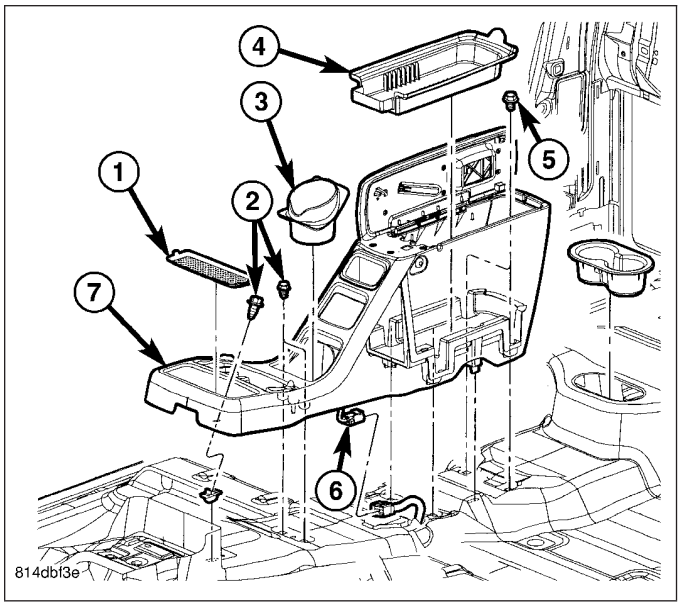
33. Install the steering column opening cover (2). (Refer to 23 - BODY/INSTRUMENT PANEL/COVER-STEERING COLUMN OPENING - INSTALLATION)



34. Install the driver side door sill trim cover (1). (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - INSTALLATION)



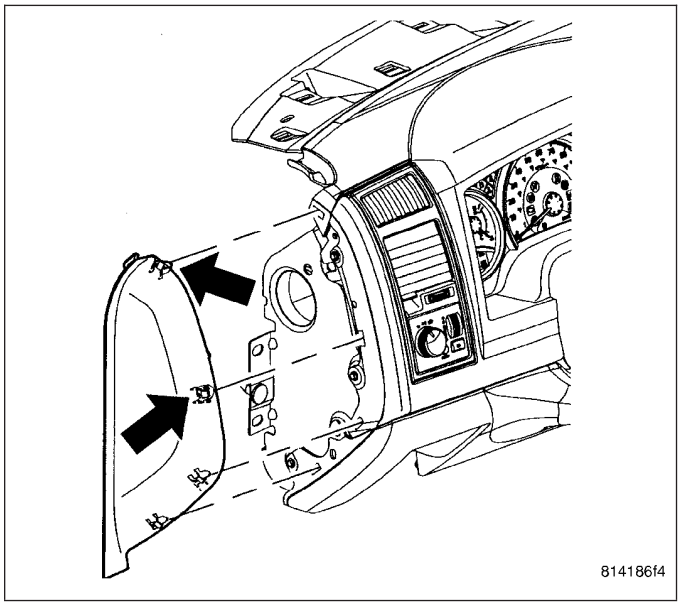
35. Install the floor console (7). (Refer to 23 - BODY/INTERIOR/CONSOLE-FLOOR - INSTALLATION)
36. Connect battery negative cable.



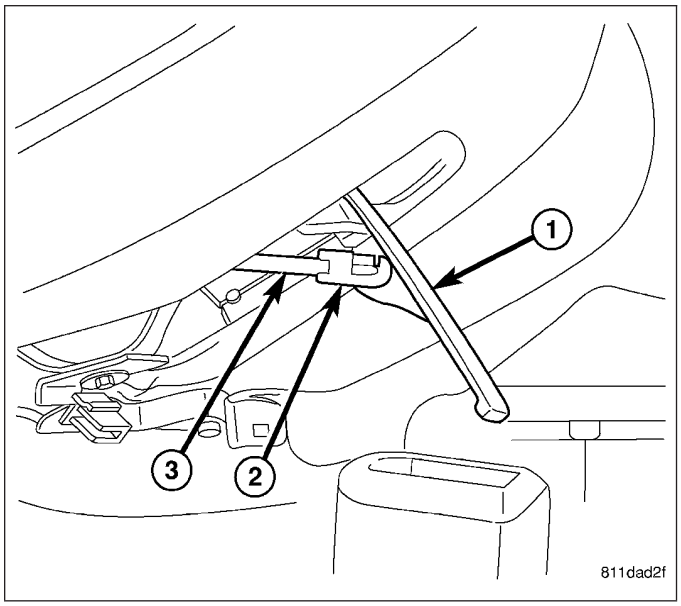
COVER-STEERING COLUMN OPENING

REMOVAL

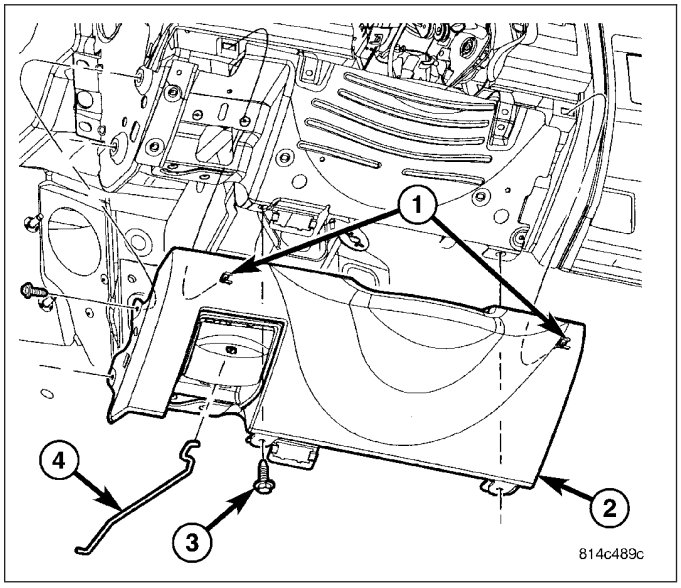
1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Using a trim stick C-4755 or equivalent, separate the end cap retaining clips and remove the end cap.



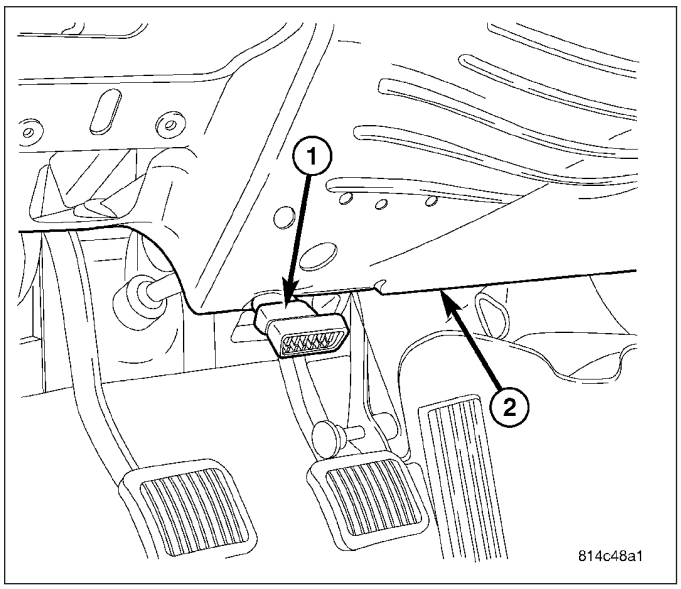
3. Pull the park brake release handle (1) out, release the clip (2) and disconnect the release rod (3).



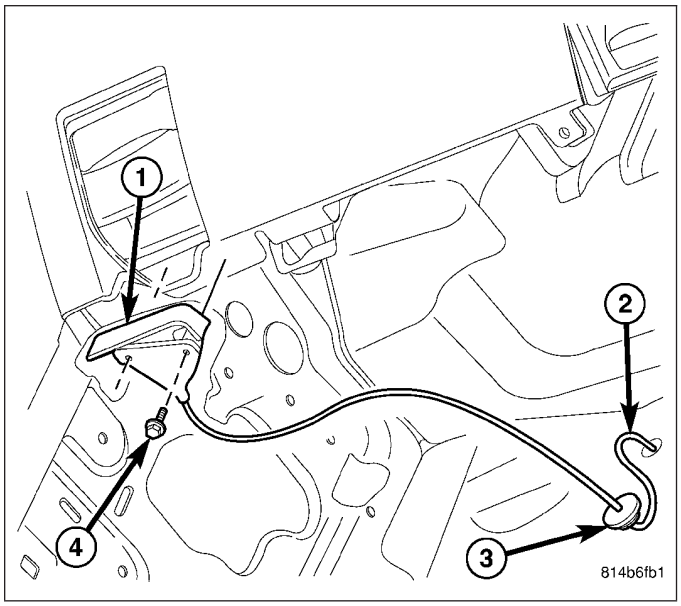
4. Remove the two screws (3).
5. Using a trim stick C-4755 or equivalent, separate the upper retaining clips (1) and remove the opening cover (2).



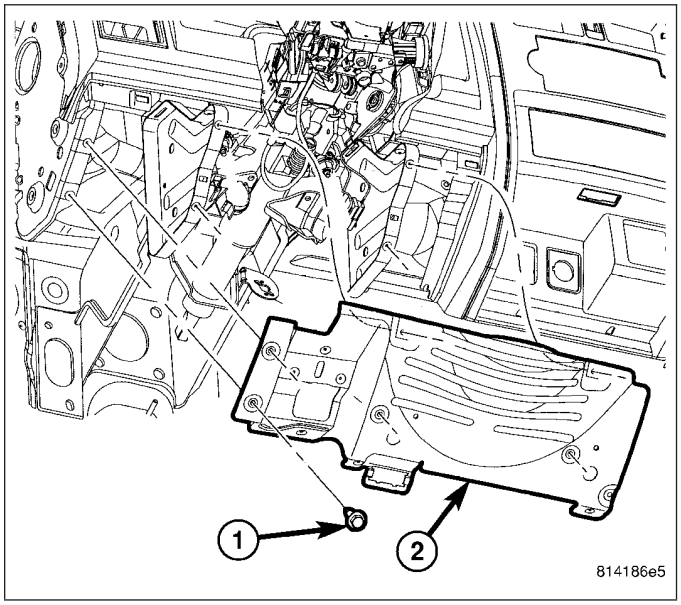
6. Release the side tabs and separate the diagnostic connector (1) from the opening cover reinforcement (2).



7. Remove the screws (4) and separate the hood release handle (1) from the opening reinforcement.

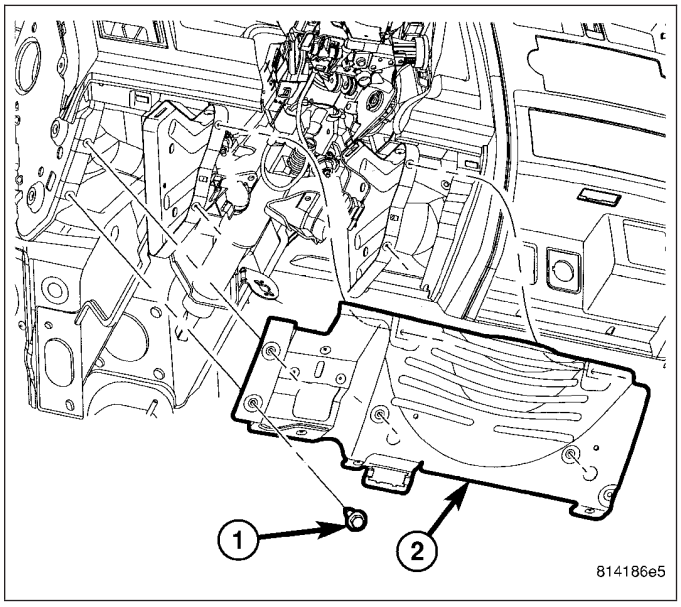


8. Remove the two screws (1).
9. Using a trim stick C-4755 or equivalent, separate the upper retaining clips and remove the opening cover reinforcement (2).

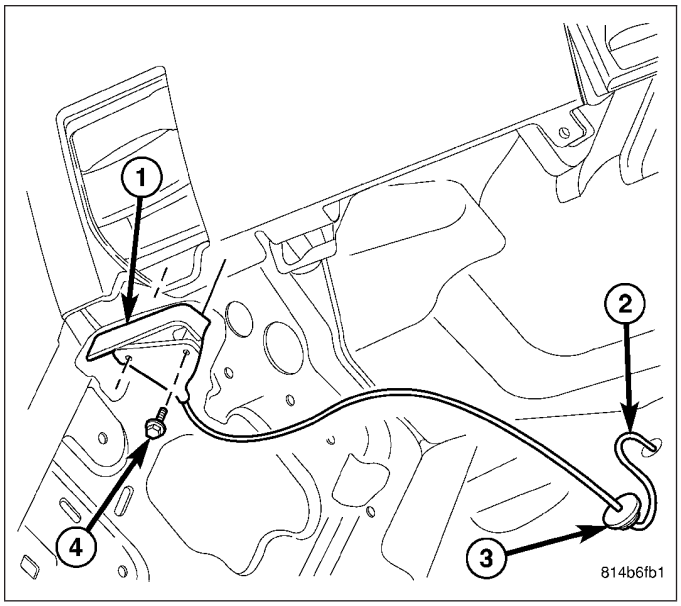


INSTALLATION

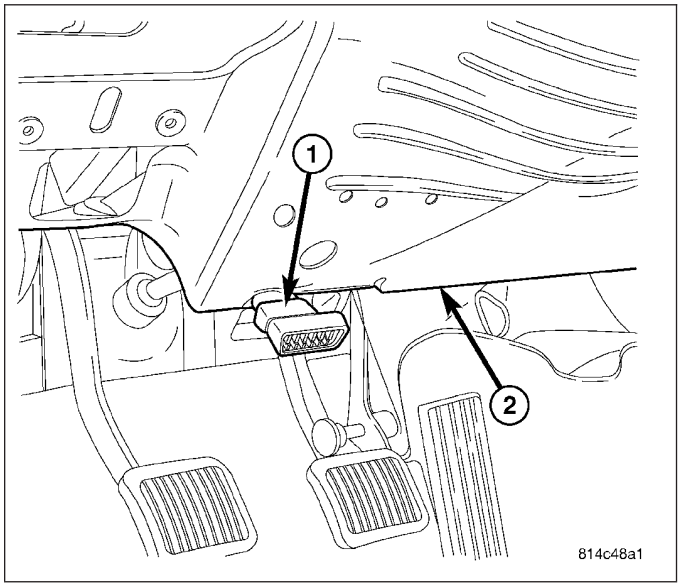
1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Install the opening cover reinforcement (2) and seat the upper clips fully.
3. Install the screws (1).



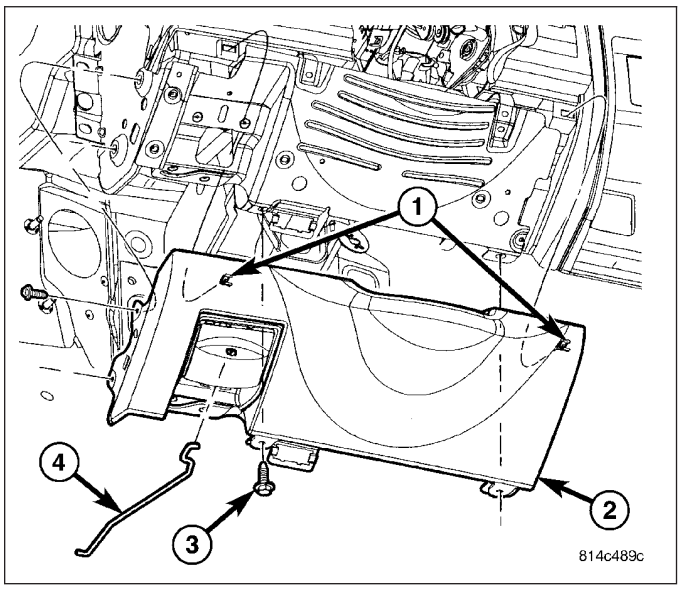
4. Position the hood release handle (1) back and install the screws (4).



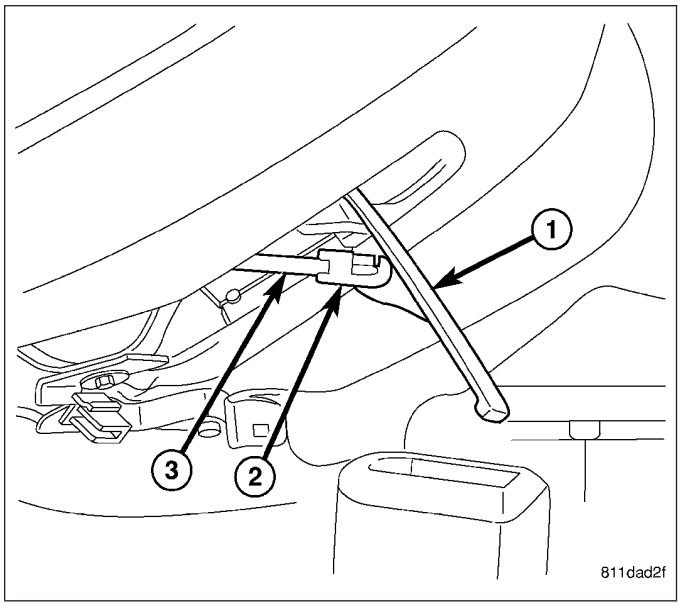
5. Snap the diagnostic connector (1) back into place on the reinforcement (2) and seat fully.



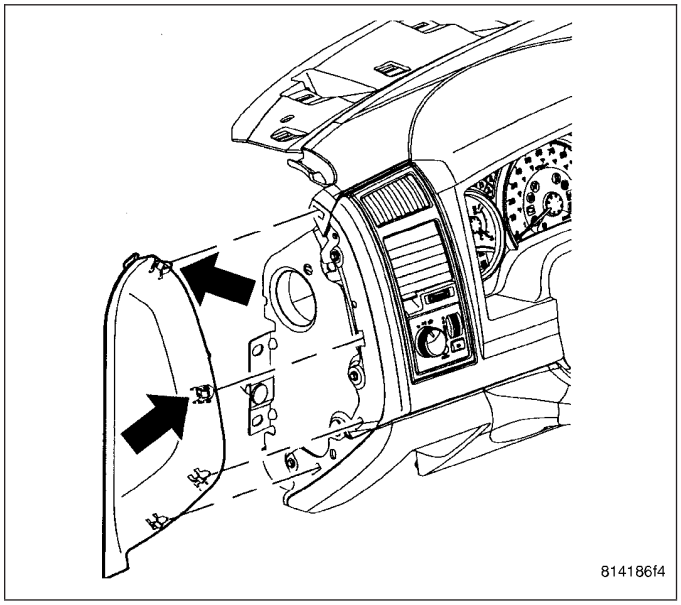
6. Position the column cover against the reinforcement and route the brake release rod through the hole in cover.
7. Seat the upper retaining clips (1) fully and install the bottom and side screws (3).



8. Connect the release rod (3) to the release handle (1) and secure the attachment clip (2) fully.



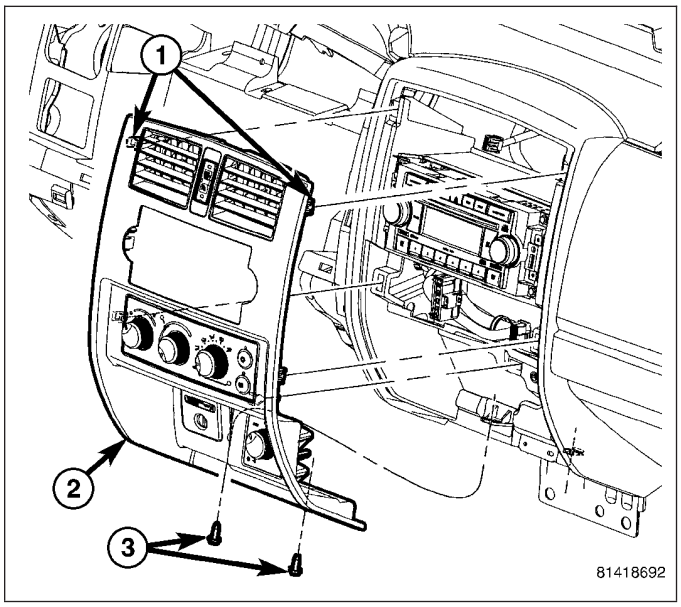
9. Position the end cap and seat the retaining clips fully.



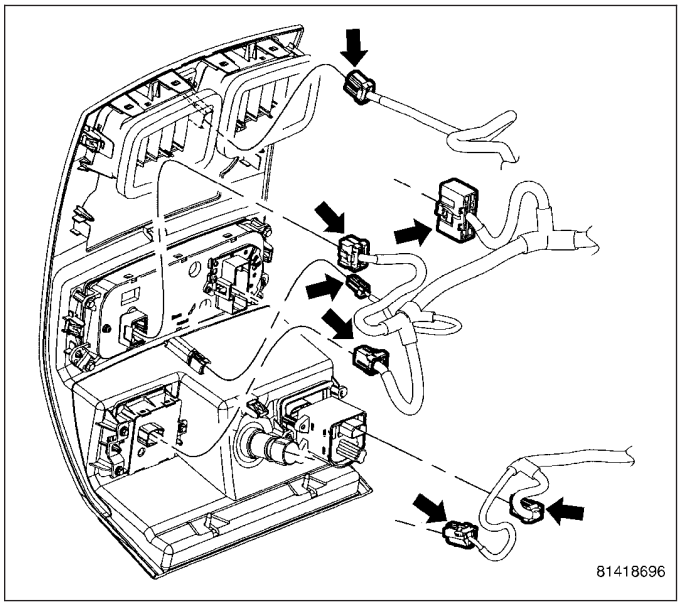
BEZEL-CENTER

REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Remove the two screws (2) and remove the bezel (1).
3. Using a trim stick C-4755 or equivalent, separate the four retaining clips (1) and remove the bezel (2).

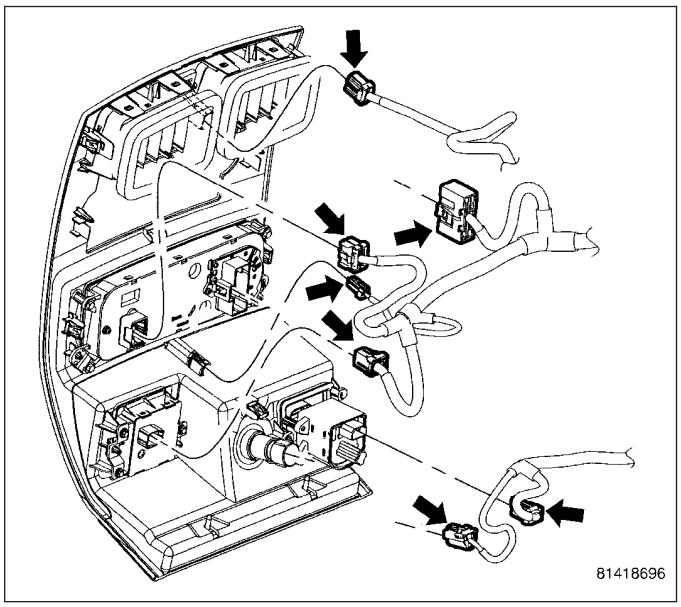


4. Disconnect the electrical connectors and remove the bezel.

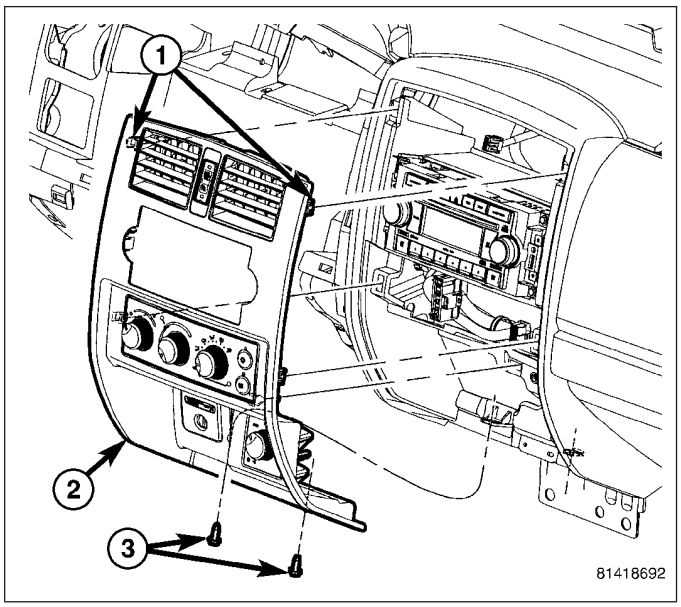


INSTALLATION

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Connect the electrical connectors.



3. Install the center bezel (2) and seat the four retaining clips (1) fully.
4. Install the screws (3).



INTERIOR

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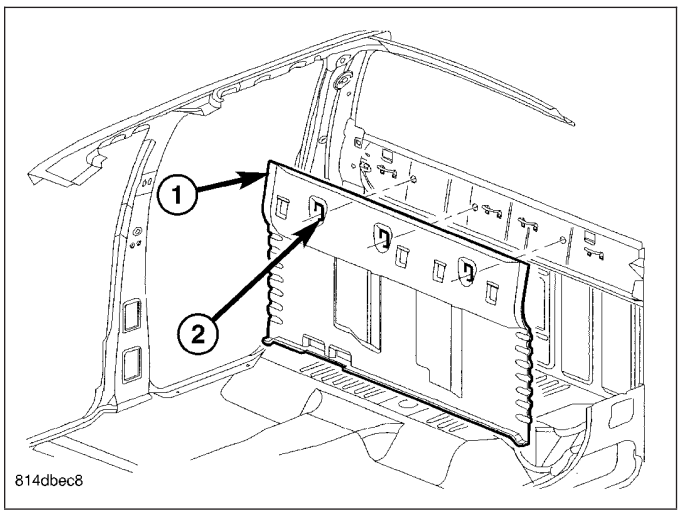
BODY VENT

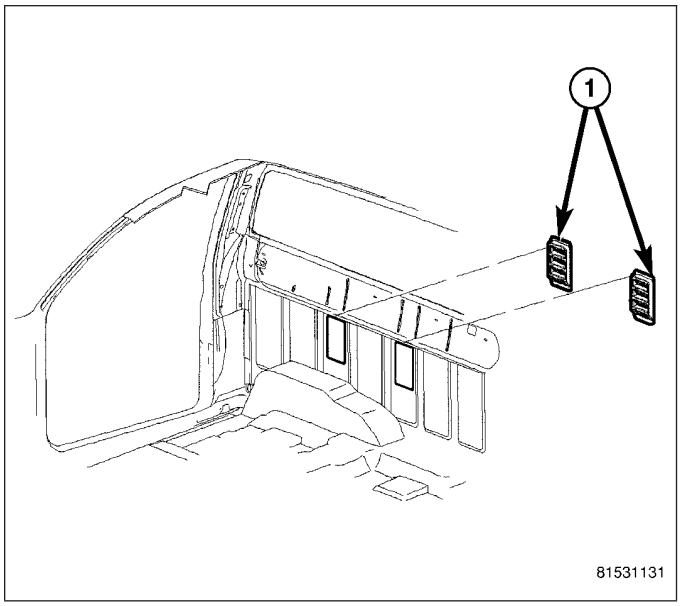
REMOVAL

NOTE: Cab back trim panel for Quad Cab models shown. Club Cab similar.

1. Remove the cab back trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-CAB BACK TRIM - REMOVAL).

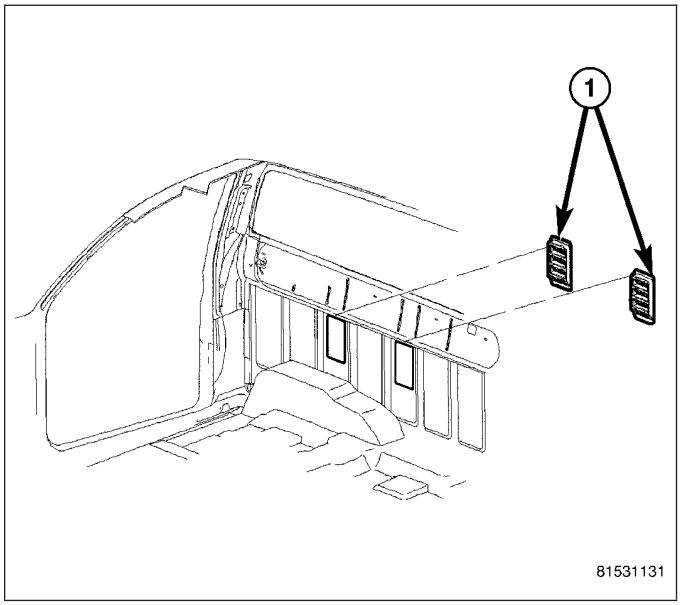


2. Disengage the four locking tabs that secure the body vent (1) to the sheet metal and remove the vent.



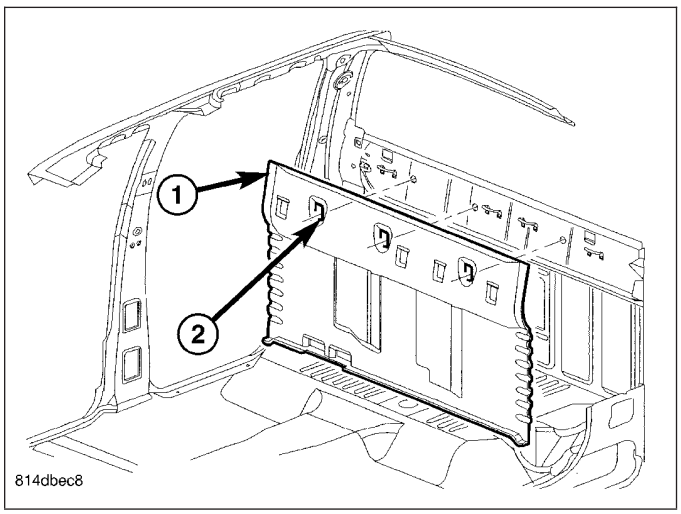
INSTALLATION

1. Position the bottom edge of the body vent (1) to the bottom flange of the opening in the sheet metal. Applying even pressure, roll the vent upward and engage the four locking tabs that secure the vent to the sheet metal. Verify that all four of the locking tabs lock on to the sheet metal.



NOTE: Cab back trim panel for Quad Cab models shown. Club Cab similar.

2. Install the cab back trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-CAB BACK TRIM - INSTALLATION).



CARPET

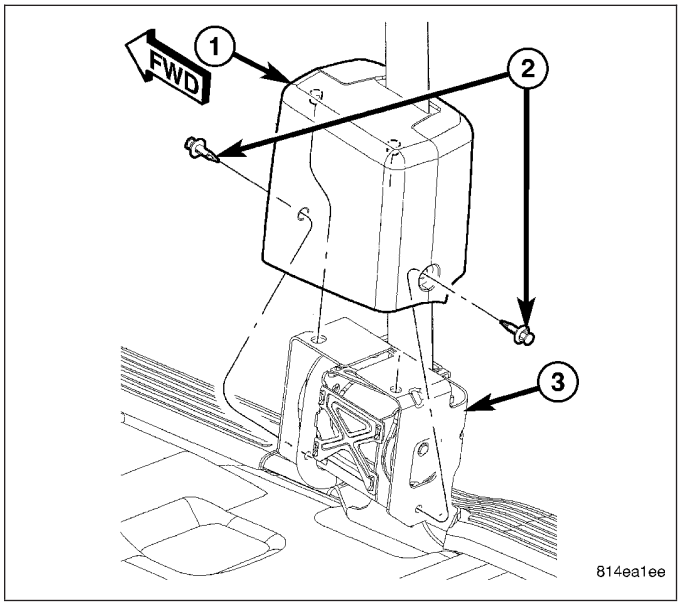
REMOVAL

Club Cab, Without Rear Jumper Seats

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

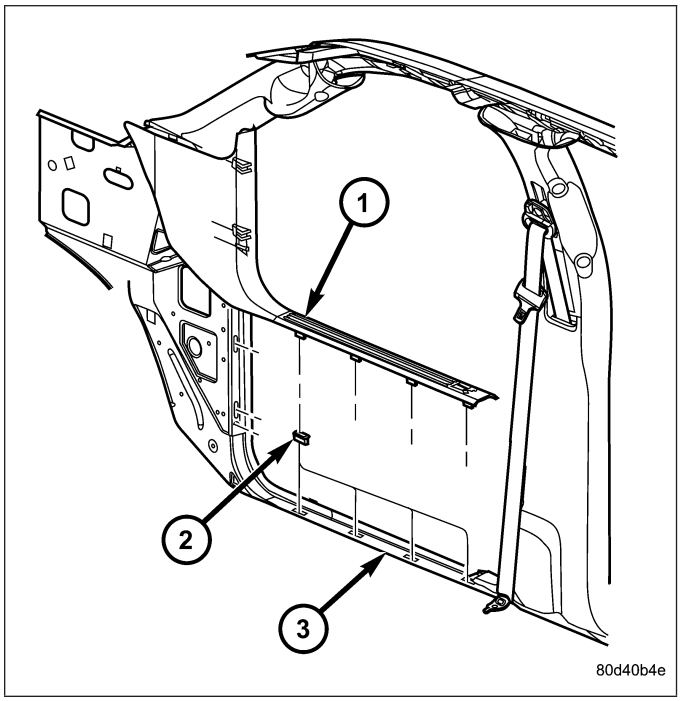
WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the outer front seat belt retractor covers, (Refer to 23 - BODY/INTERIOR/COVER-OUTER FRONT SEAT BELT RETRACTOR - REMOVAL).

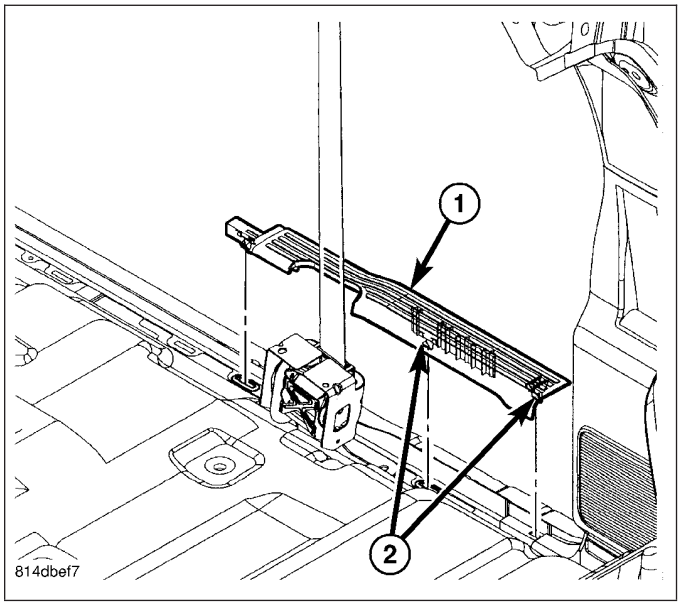


NOTE: Cowl trim panel for Quad Cab models shown. Club Cab similar.

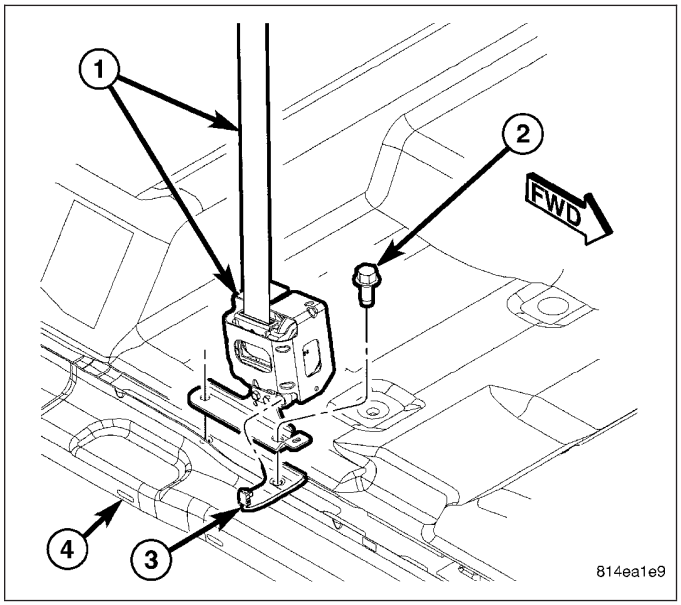
3. Remove the cowl trim panels, (Refer to 23 - BODY/ INTERIOR/PANEL-COWL TRIM - REMOVAL).



4. Remove the rear door sill scuff plates, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - REMOVAL).

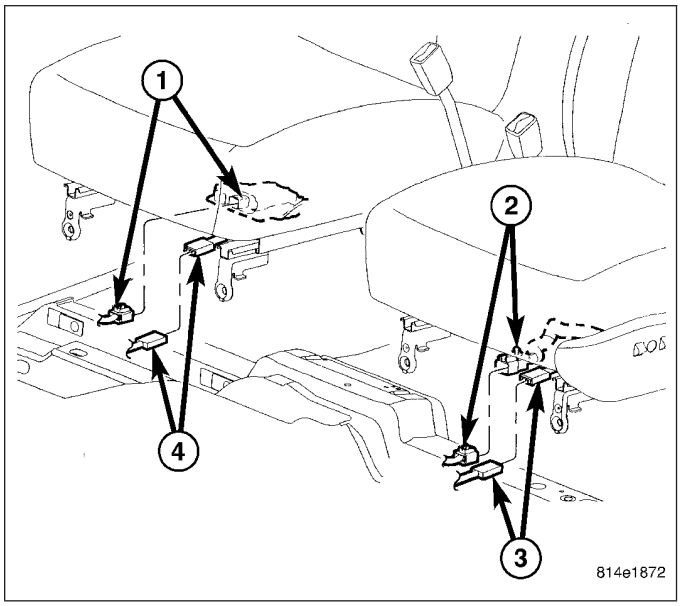


5. Disconnect the body wire harness connector (3) from the seat belt tensioner initiator on the retractor (1).
6. Remove the two screws (2) that secure the retractor mounting bracket to the floor panel inboard of the door sill (4) and position the retractor aside.



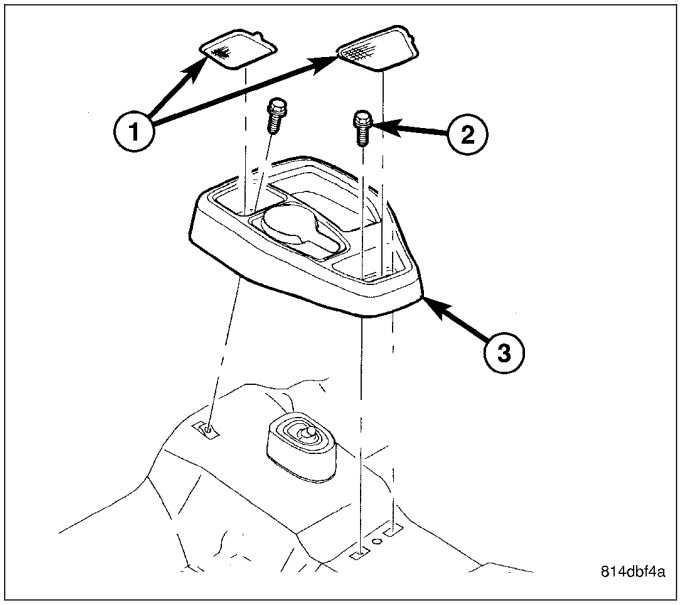
NOTE: Electric front seats shown. Other seats similar.

7. Remove the front seats, (Refer to 23 - BODY/SEATS/SEAT-FRONT - REMOVAL).

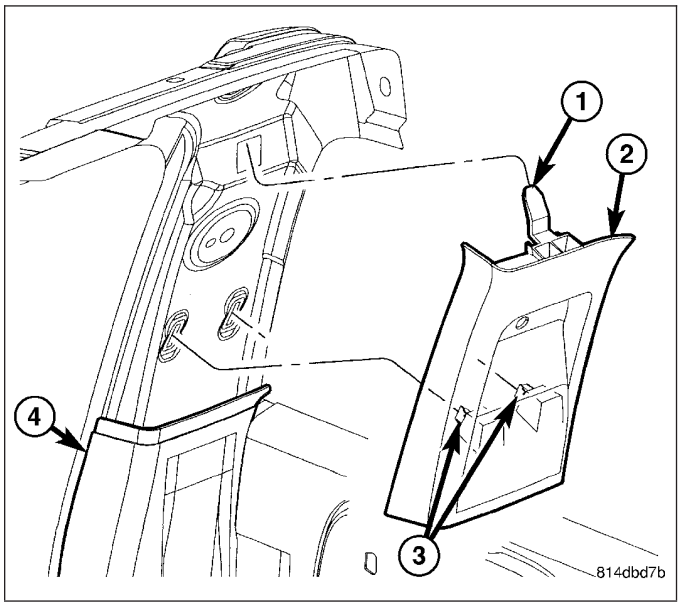


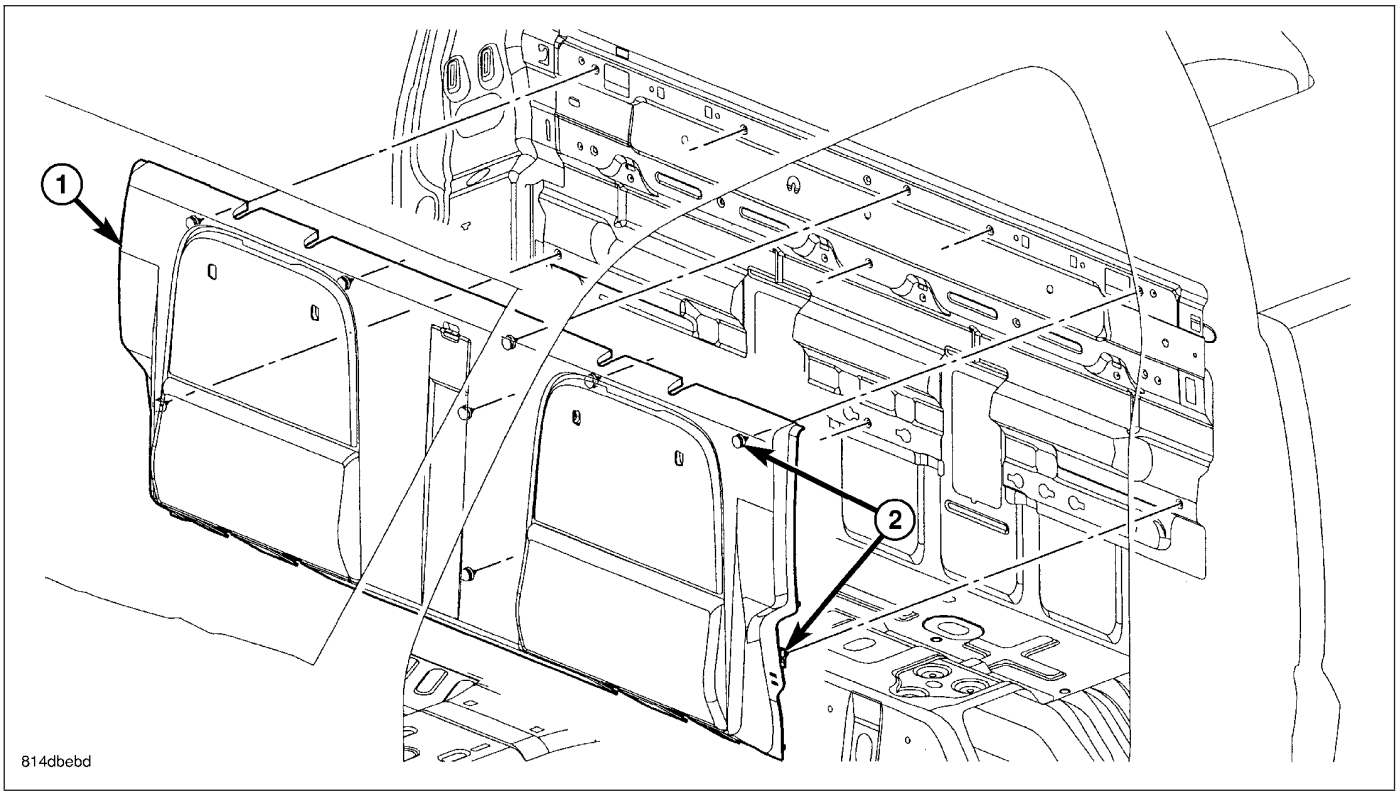
NOTE: Mini floor console shown. Full floor console different.

8. Remove the floor console, (Refer to 23 - BODY/INTERIOR/CONSOLE-FLOOR - REMOVAL).



9. Remove the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL).
10. Remove the lower C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - REMOVAL).





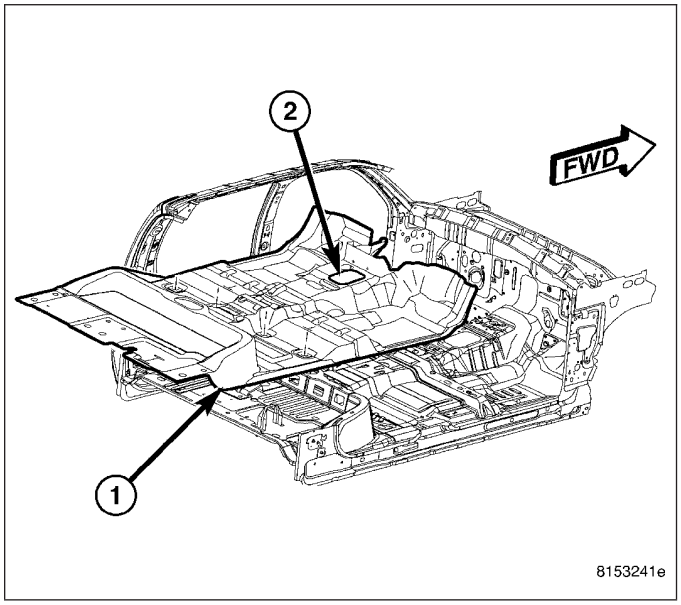
NOTE: Cab back trim panel with jumper seats shown. Trim panel without similar.

11. Remove the cab back trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-CAB BACK TRIM - REMOVAL).

12. Remove the jack storage compartment cover.

NOTE: Carpet for Quad Cab models shown. Club Cab similar.

13. Remove the carpet (1) from the vehicle.

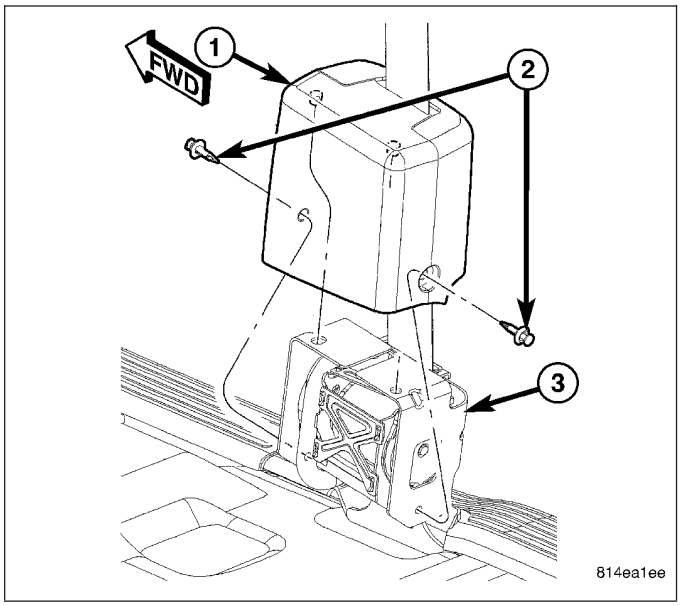


Club Cab, With Rear Jumper Seats

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

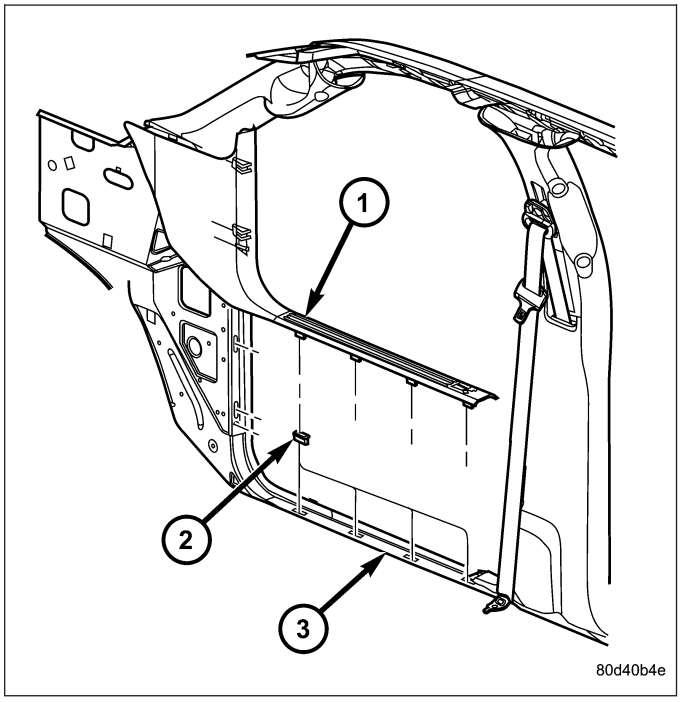
WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the outer front seat belt retractor covers, (Refer to 23 - BODY/INTERIOR/COVER-OUTER FRONT SEAT BELT RETRACTOR - REMOVAL).

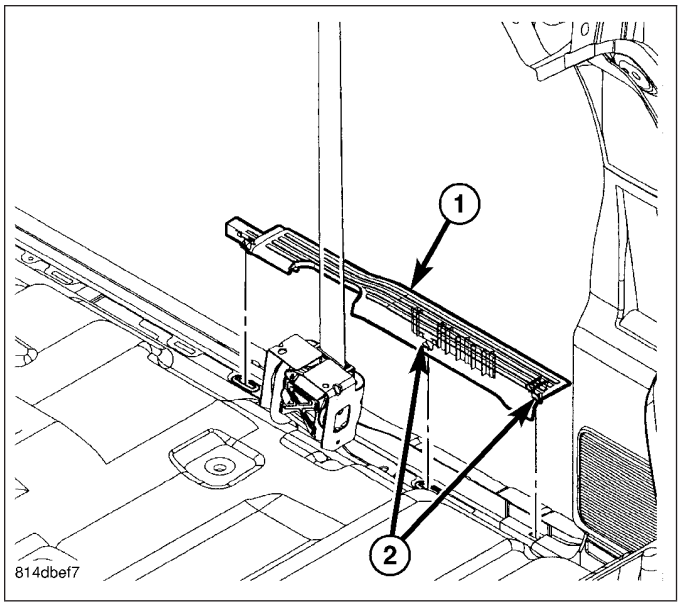


NOTE: Cowl trim panel for Quad Cab models shown. Club Cab similar.

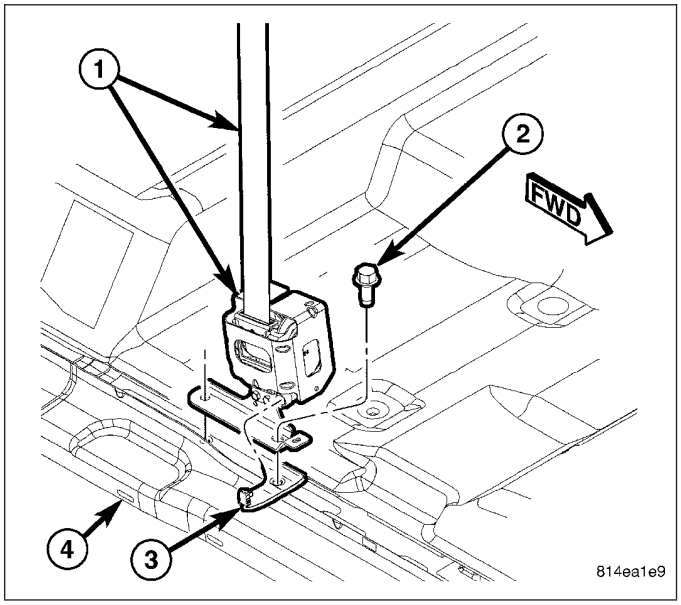
3. Remove the cowl trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-COWL TRIM - REMOVAL).



4. Remove the rear door sill scuff plates, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - REMOVAL).

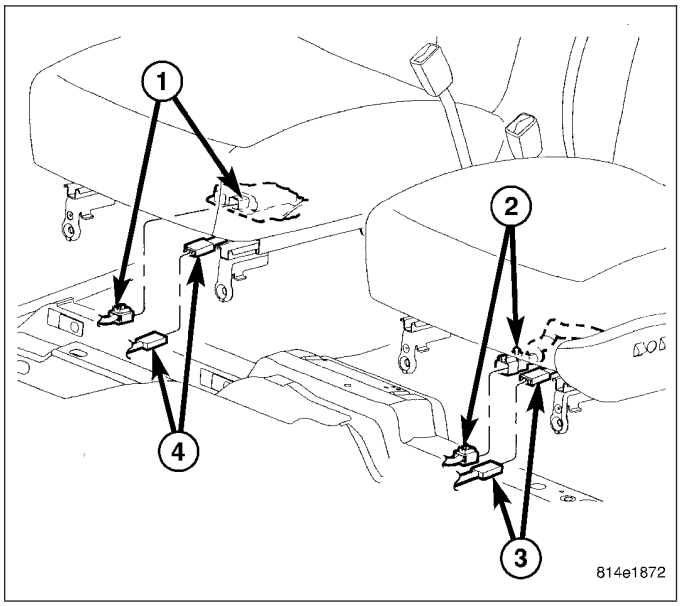


5. Disconnect the body wire harness connector (3) from the seat belt tensioner initiator on the retractor (1).
6. Remove the two screws (2) that secure the retractor mounting bracket to the floor panel inboard of the door sill (4) and position the retractor aside.



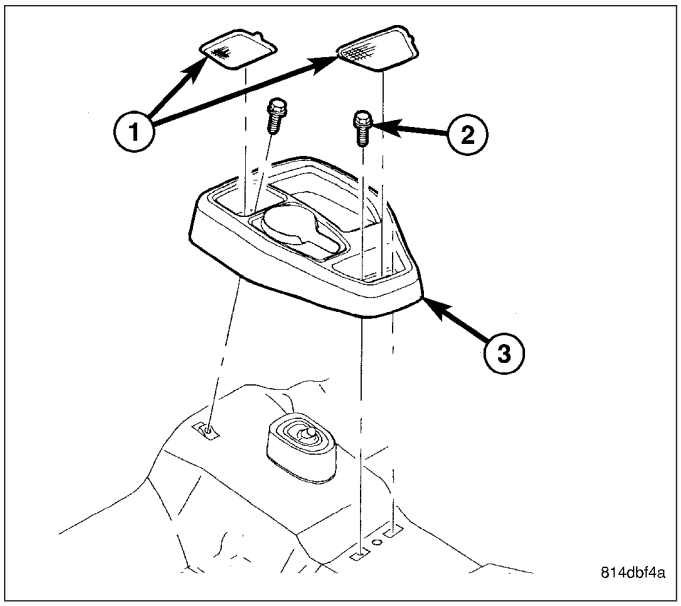
NOTE: Electric front seats shown. Other seats similar.

7. Remove the front seats, (Refer to 23 - BODY/SEATS/SEAT-FRONT - REMOVAL).

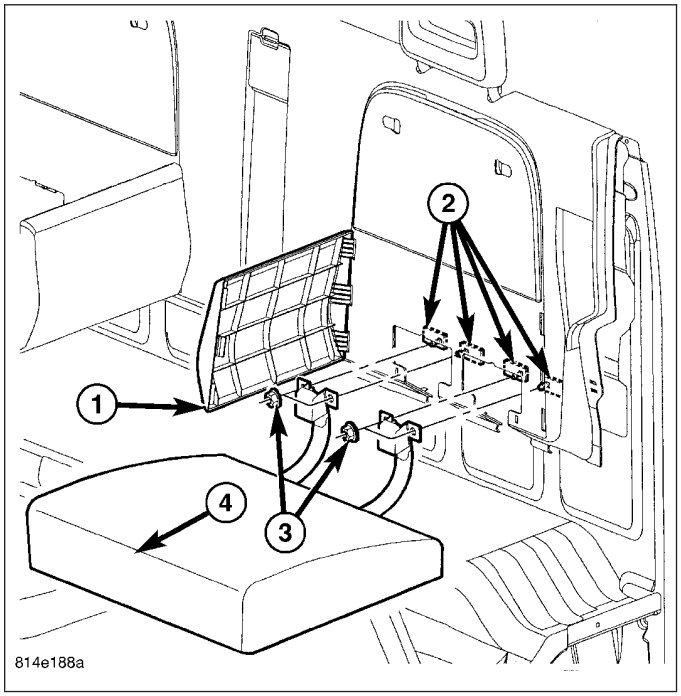


NOTE: Mini floor console shown. Full floor console different.

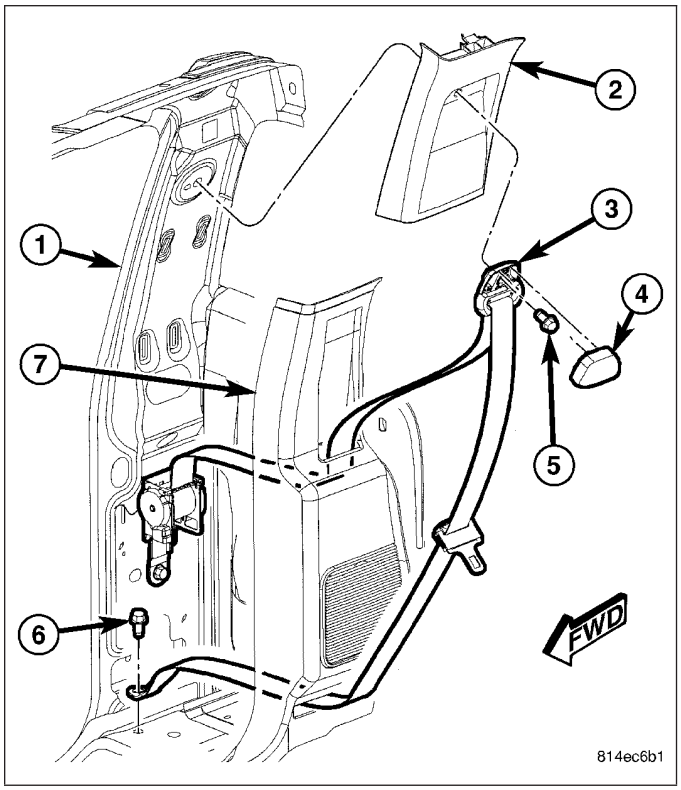
8. Remove the floor console, (Refer to 23 - BODY/INTERIOR/CONSOLE-FLOOR - REMOVAL).

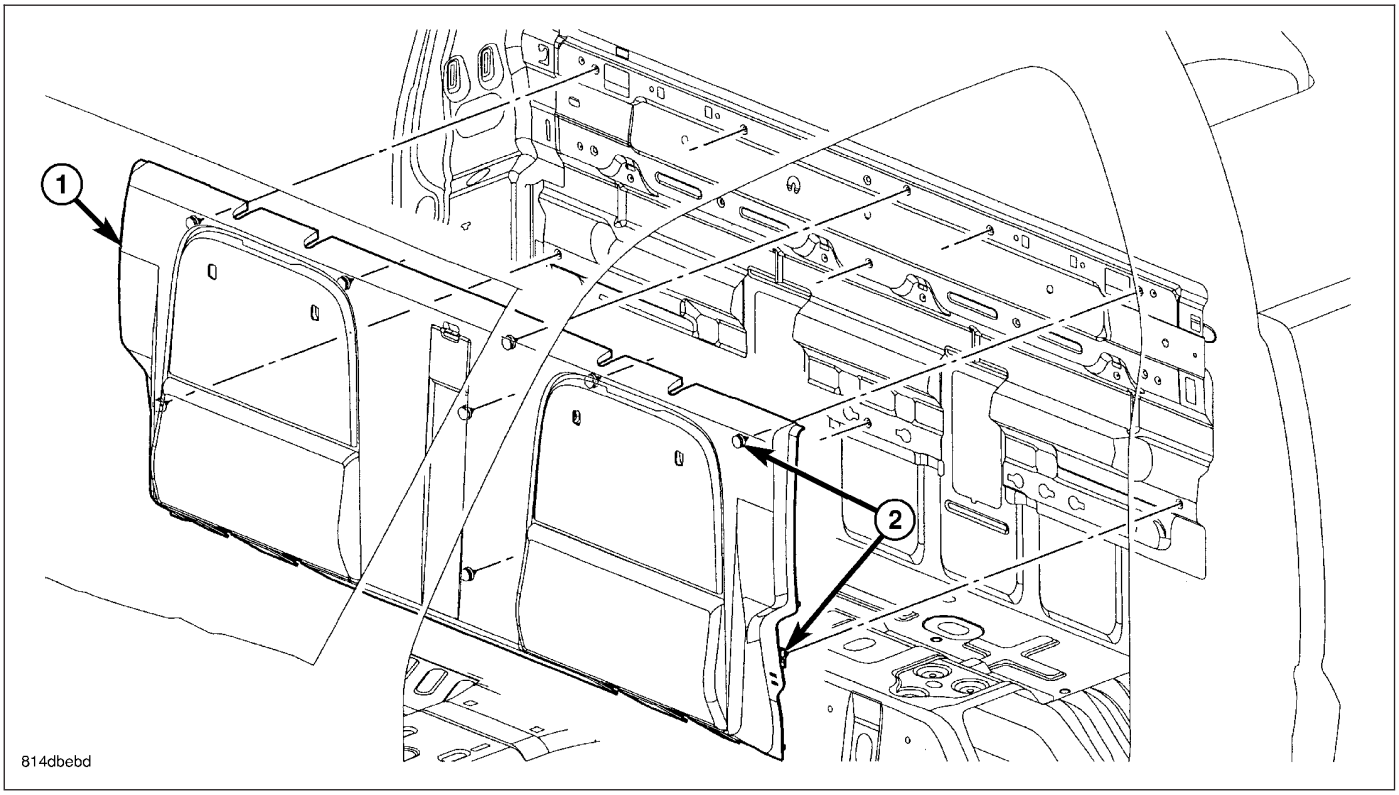


9. Remove the rear jumper seat cushions, (Refer to 23 - BODY/SEATS/SEAT-SECOND ROW - REMOVAL).



10. Remove the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL).
11. Remove the lower C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - REMOVAL).

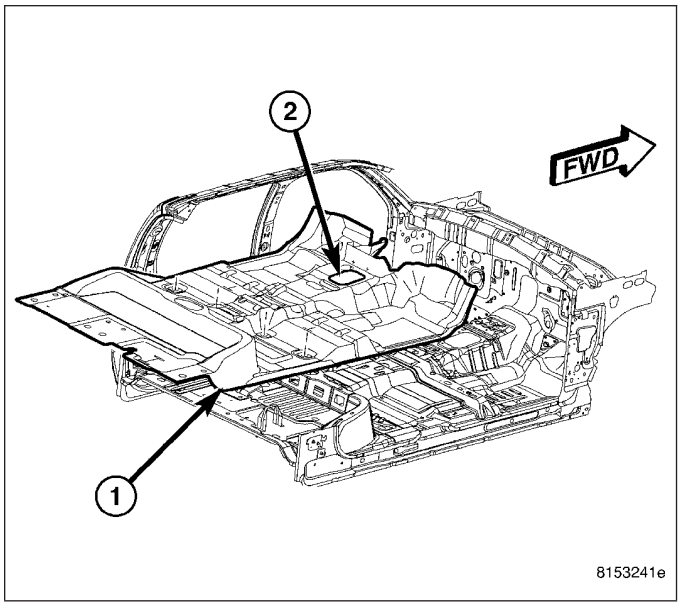




12. Remove the cab back trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-CAB BACK TRIM - REMOVAL).
13. Remove the jack storage compartment cover.

NOTE: Carpet for Quad Cab models shown. Club Cab similar.

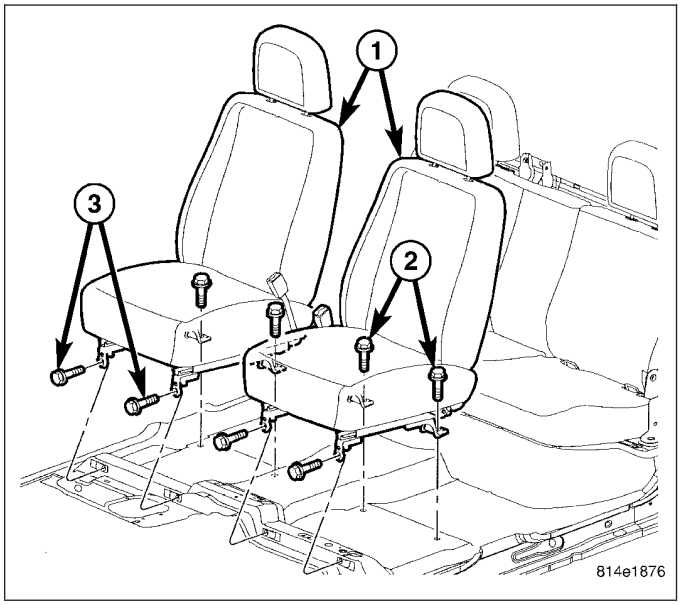
14. Remove the carpet (1) from the vehicle.



Quad Cab

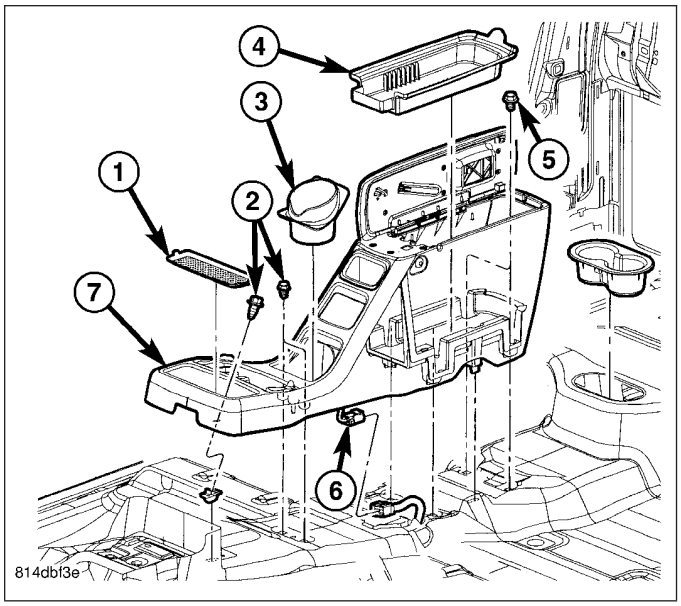
NOTE: Bucket seats shown. Bench seat similar.

1. Remove the front seats, (Refer to 23 - BODY/ SEATS/SEAT-FRONT - REMOVAL).

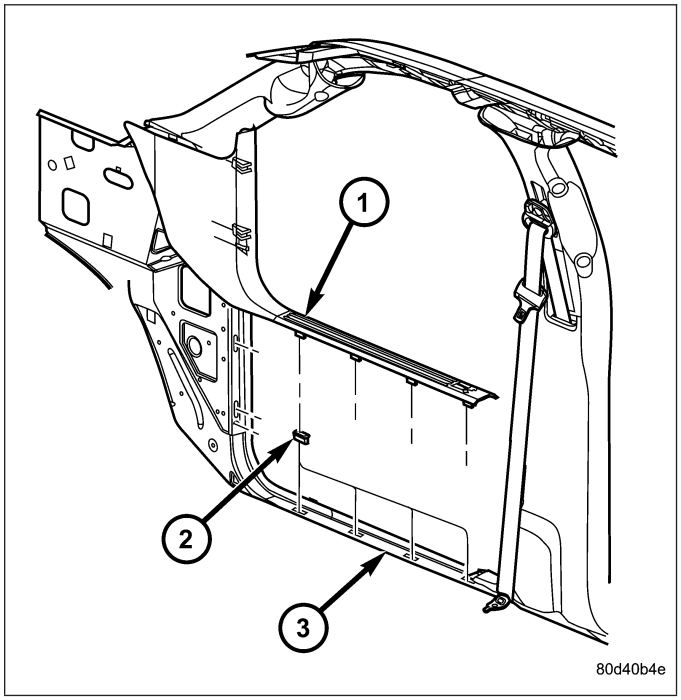


NOTE: Full floor console shown. Mini floor console different.

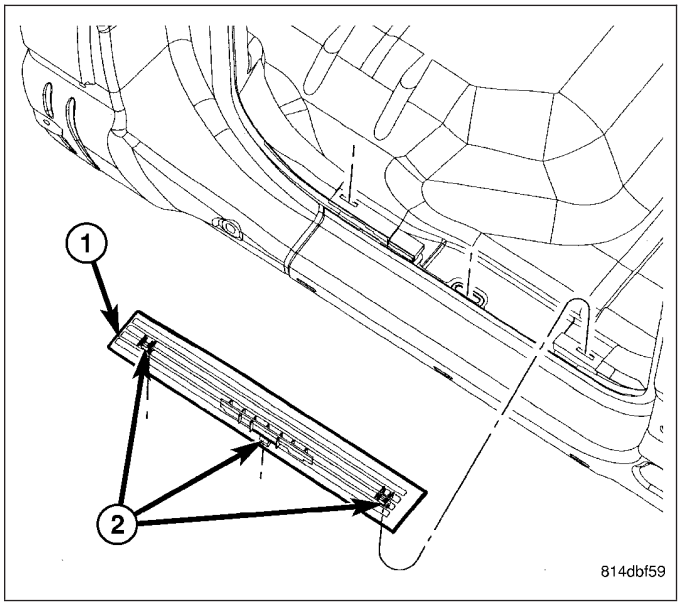
2. Remove the floor console, (Refer to 23 - BODY/INTERIOR/CONSOLE-FLOOR - REMOVAL).
3. Remove the rear cup holder.



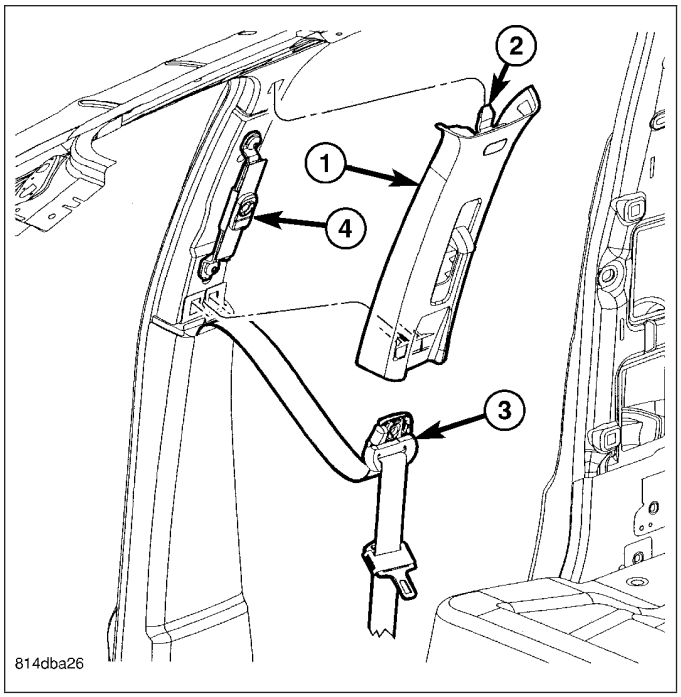
4. Remove the cowl trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-COWL TRIM - REMOVAL).



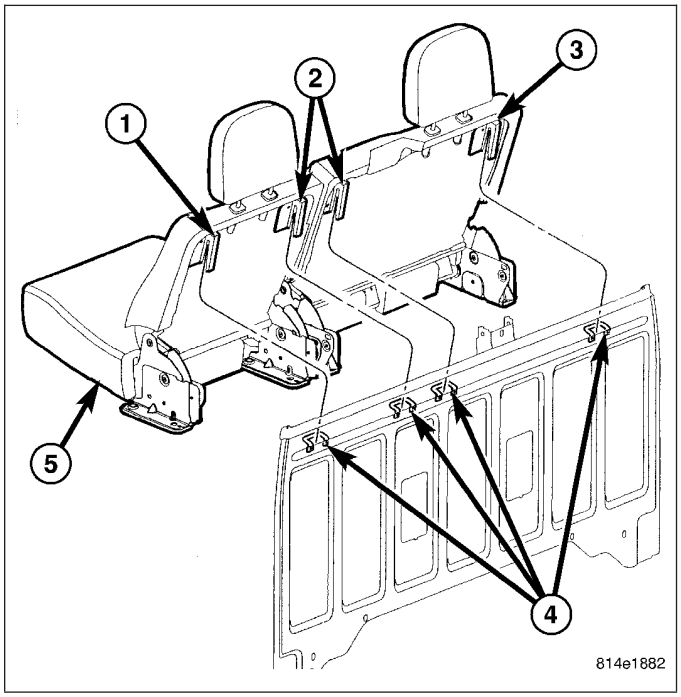
5. Remove the rear door sill scuff plates, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - REMOVAL)



6. Remove the upper B-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-B PILLAR UPPER TRIM - REMOVAL).
7. Remove the lower B-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-B PILLAR LOWER TRIM - REMOVAL).

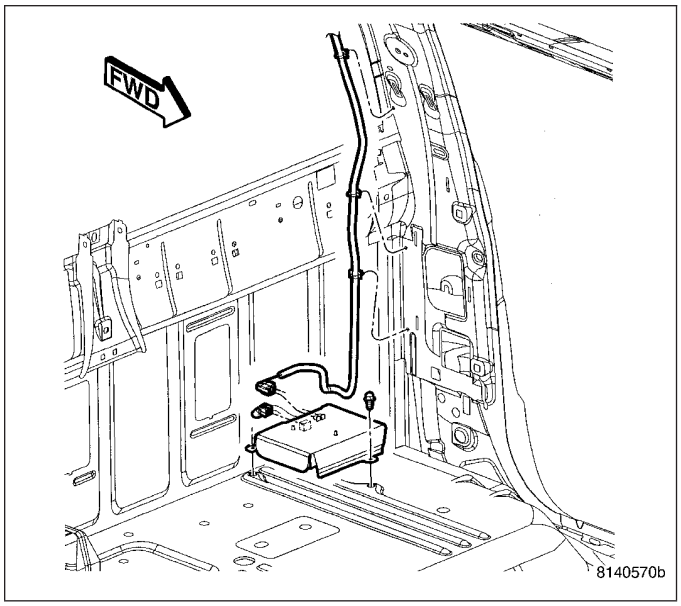


8. Remove the rear seat, (Refer to 23 - BODY/SEATS/SEAT-SECOND ROW - REMOVAL).

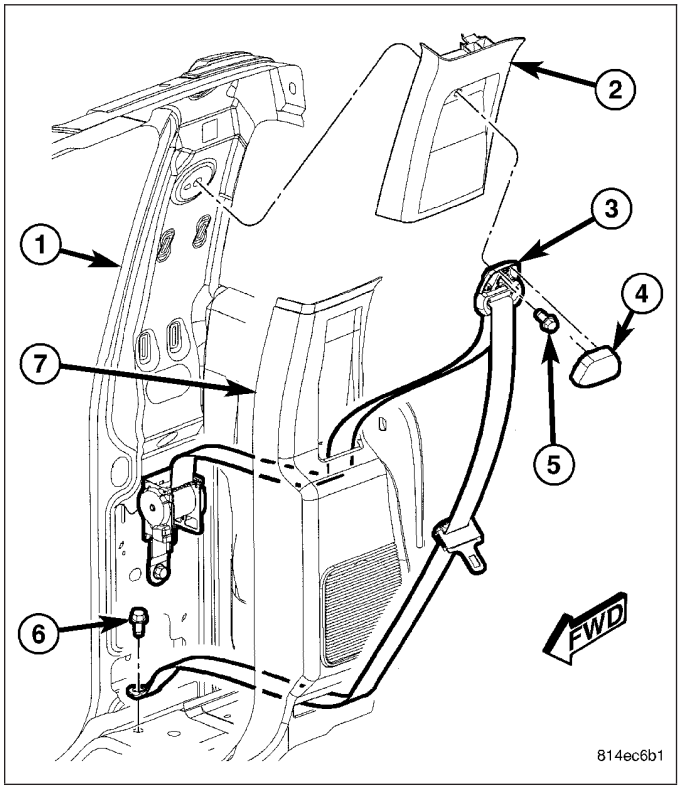


9. Remove the jack.

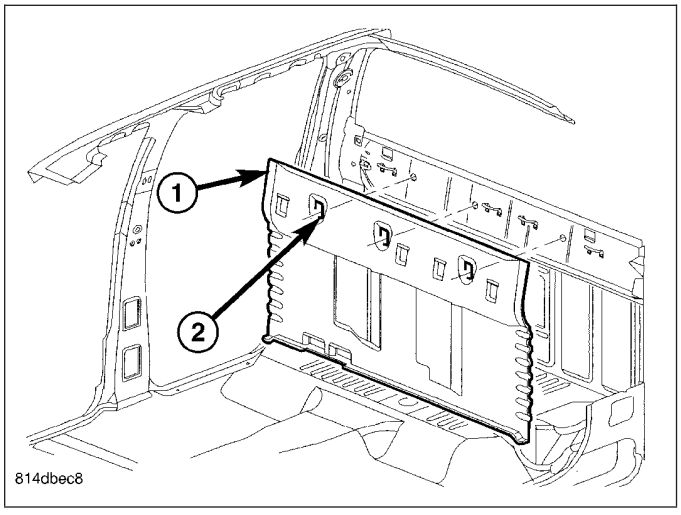
10. If equipped, remove the satellite receiver module, (Refer to 8 - ELECTRICAL/AUDIO/SATELLITE RECEIVER MODULE - REMOVAL).



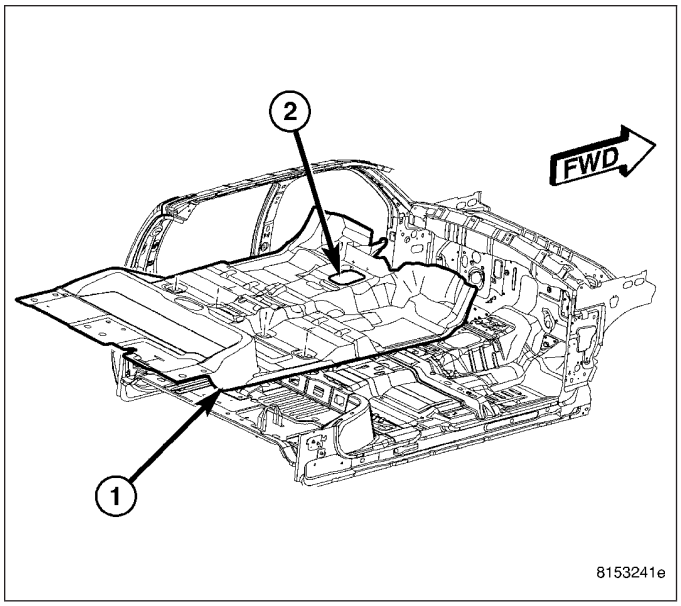
11. Remove the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL).
12. Remove the lower C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - REMOVAL).



13. Remove the cab back trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-CAB BACK TRIM - REMOVAL).



14. Remove the carpet (1) from the vehicle.



INSTALLATION

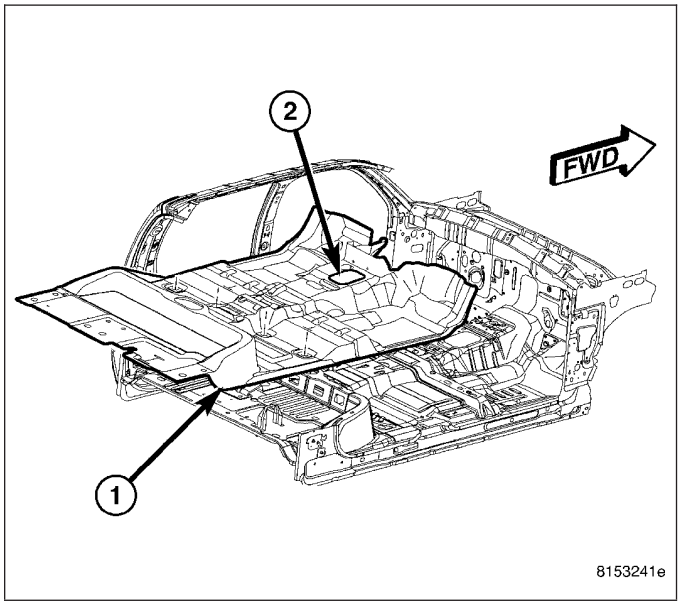
Club Cab, Without Rear Jumper Seats

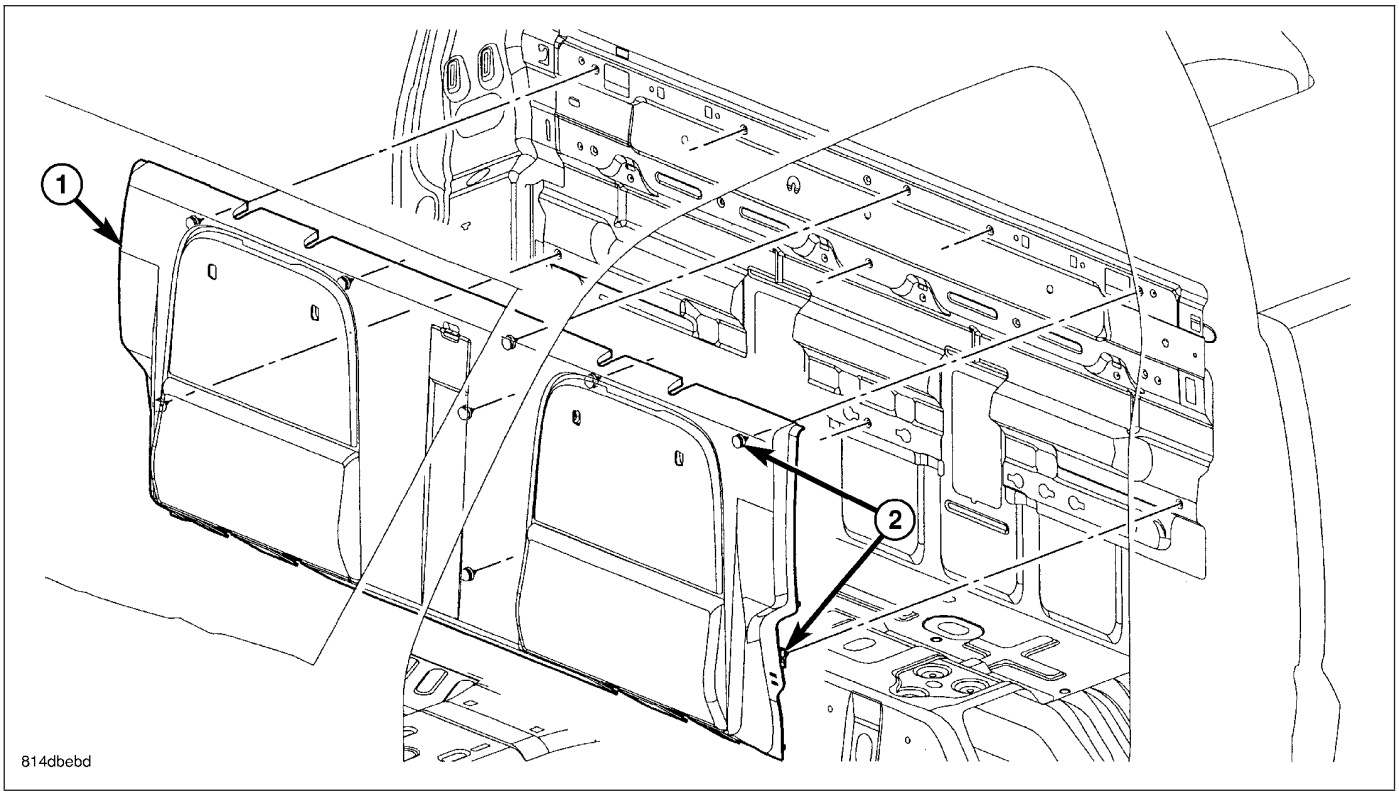
WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

NOTE: Carpet for Quad Cab models shown. Club Cab similar.

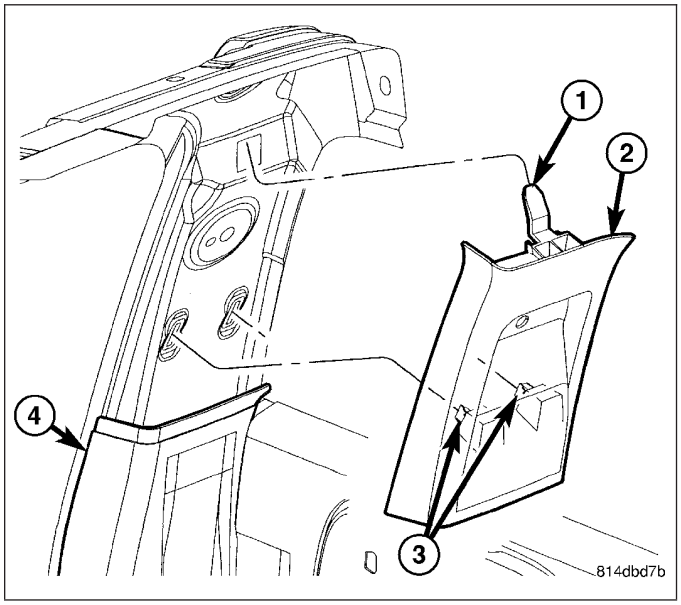
1. For vehicles equipped with a manual shift transmission, remove the cutout (2) from the carpet for the shifter assembly.
2. Position the carpet (1) in the vehicle.





NOTE: Cab back trim panel with jumper seats shown. Trim panel without similar.

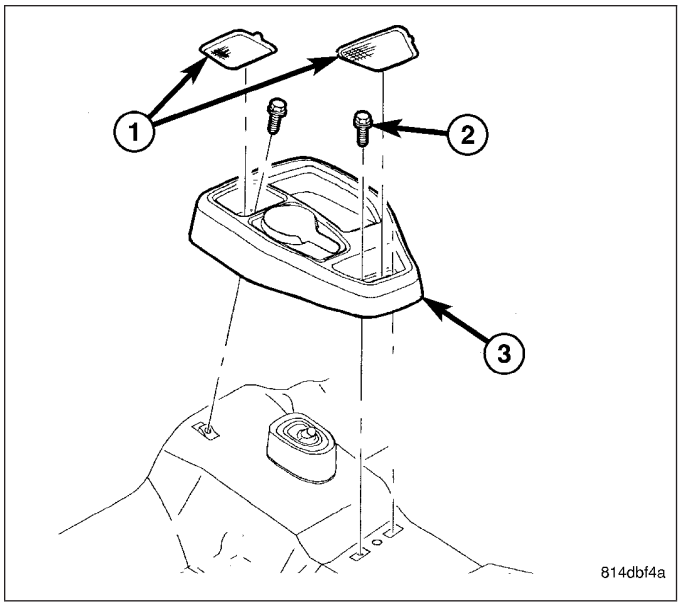
3. Install the cab back trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-CAB BACK TRIM - INSTALLATION).
4. Install the lower C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - INSTALLATION).
5. Install the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - INSTALLATION).



6. Install the jack storage compartment cover.

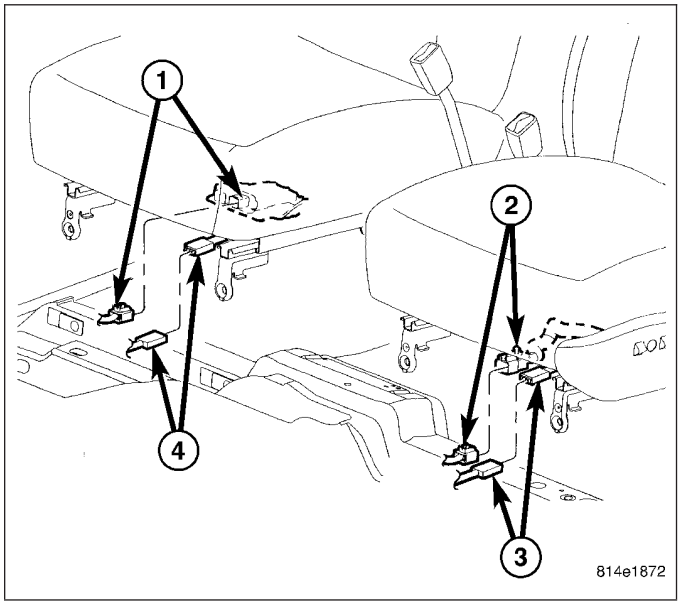
NOTE: Mini floor console shown. Full floor console different.

7. Install the floor console, (Refer to 23 - BODY/INTERIOR/CONSOLE-FLOOR - INSTALLATION).

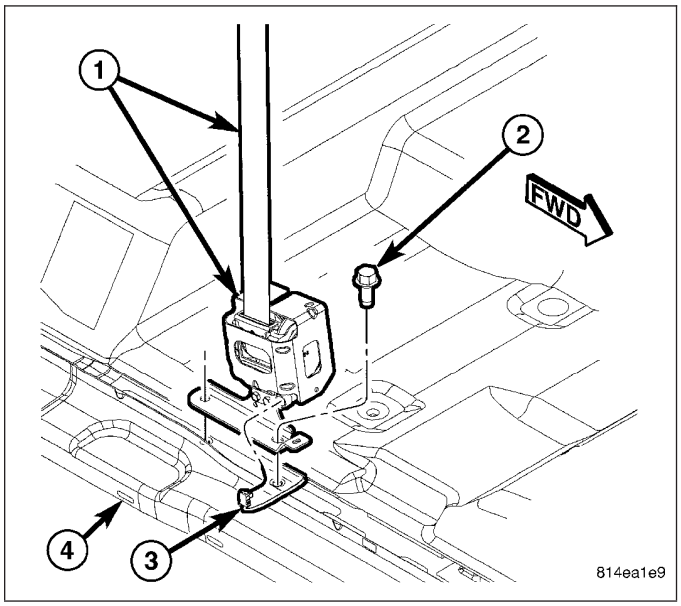


NOTE: Electric front seats shown. Other seats similar.

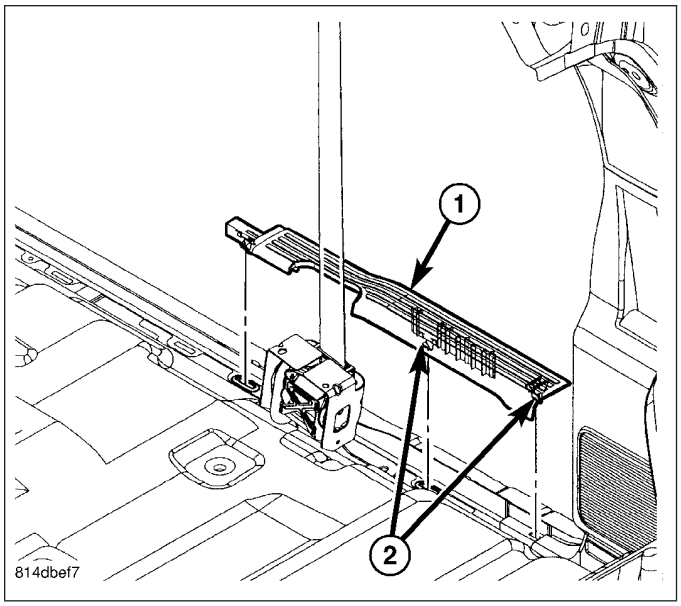
8. Install the front seats, (Refer to 23 - BODY/SEATS/SEAT-FRONT - INSTALLATION).



9. Position the retractor (1) mounting bracket to the mounting holes in the floor panel inboard of the door sill (4). Be certain that the seat belt webbing between the retractor and the turning loop is not twisted.
10. Install the two screws (2) that secure the retractor bracket to the floor panel. Tighten the screws to 39 N·m (29 ft. lbs.).
11. Reconnect the body wire harness connector (3) to the seat belt tensioner initiator on the retractor.

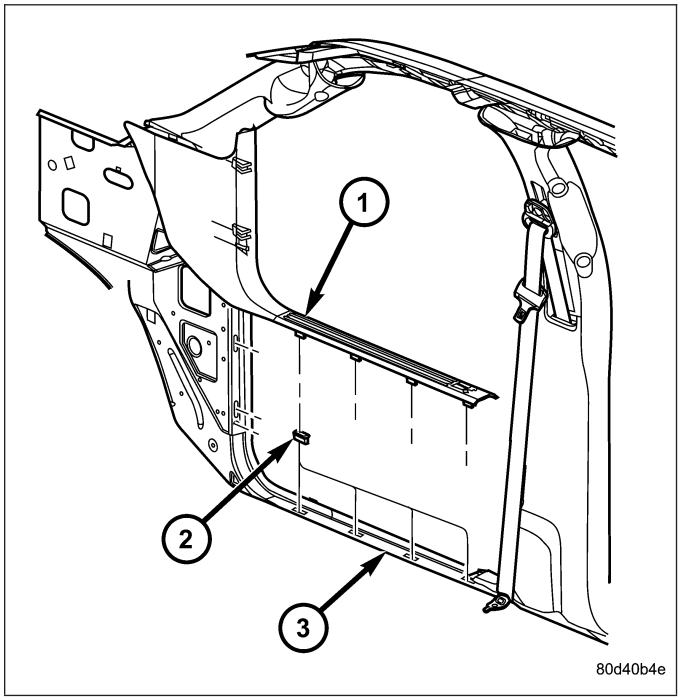


12. Install the rear door sill scuff plates, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - INSTALLATION).

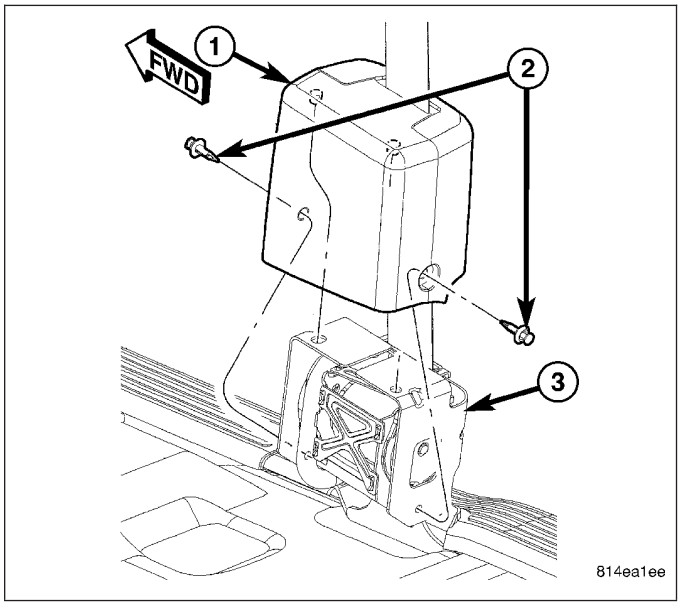


NOTE: Cowl trim panel for Quad Cab models shown. Club Cab similar.

13. Install the cowl trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-COWL TRIM - INSTALLATION).



14. Install the outer front seat belt retractor covers, (Refer to 23 - BODY/INTERIOR/COVER-OUTER FRONT SEAT BELT RETRACTOR - INSTALLATION).



15. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

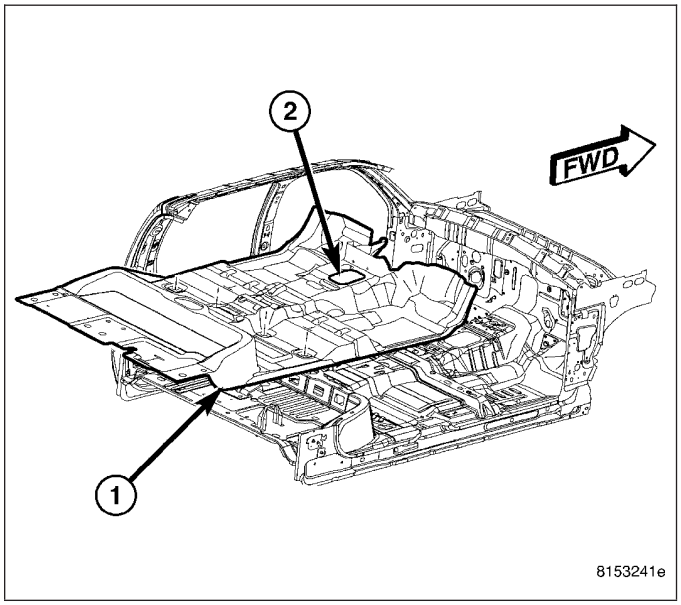
Club Cab, With Rear Jumper Seats

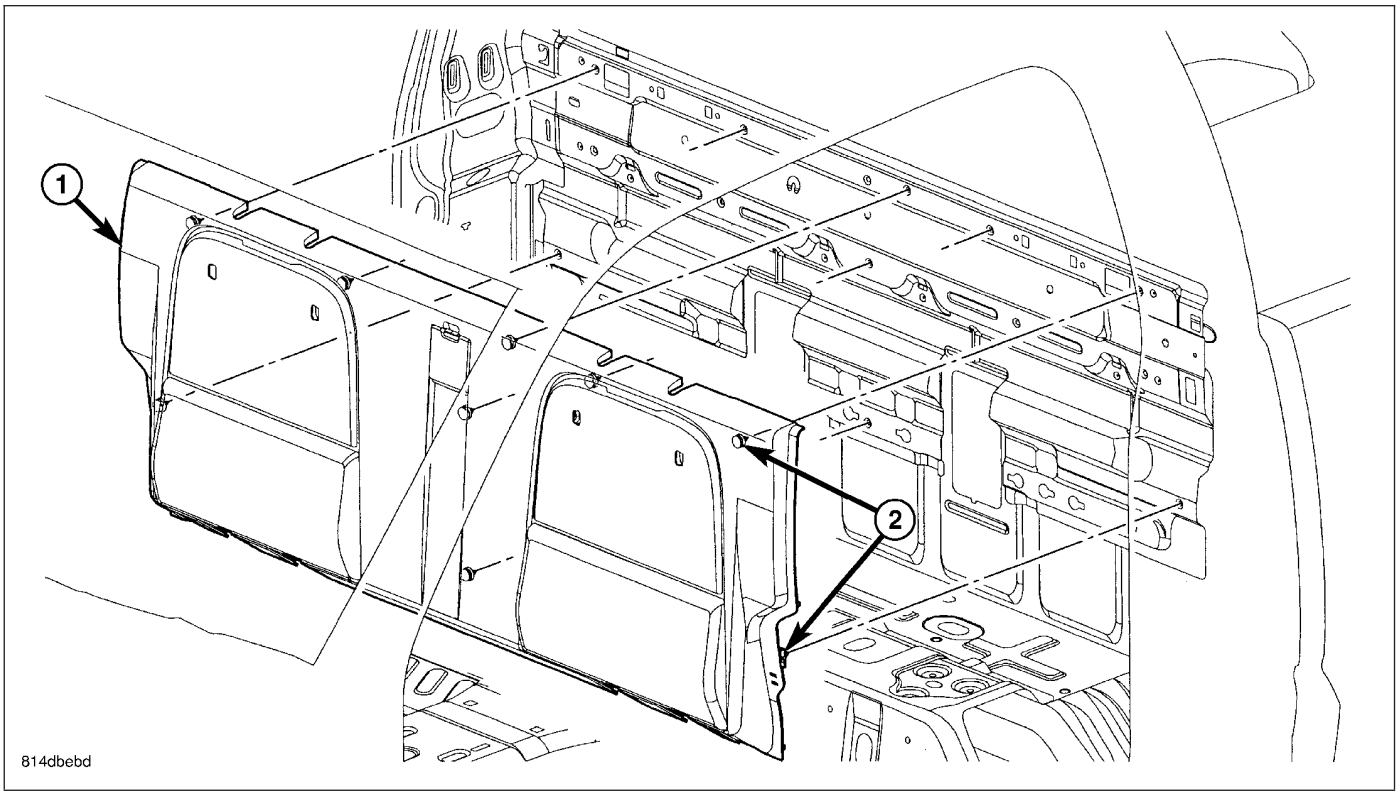
WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.

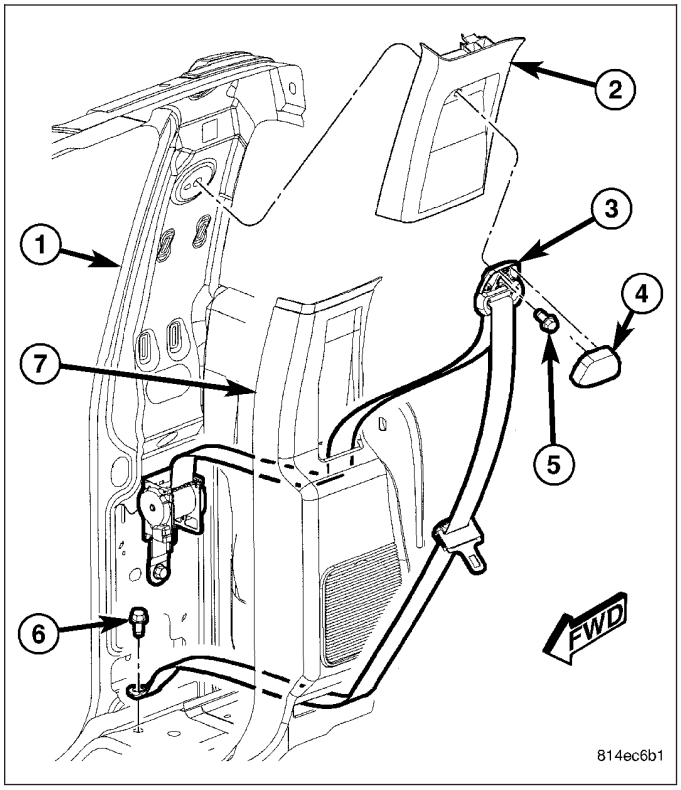
NOTE: Carpet for Quad Cab models shown. Club Cab similar.

1. For vehicles equipped with a manual shift transmission, remove the cutout (2) from the carpet for the shifter assembly.
2. Position the carpet (1) in the vehicle.

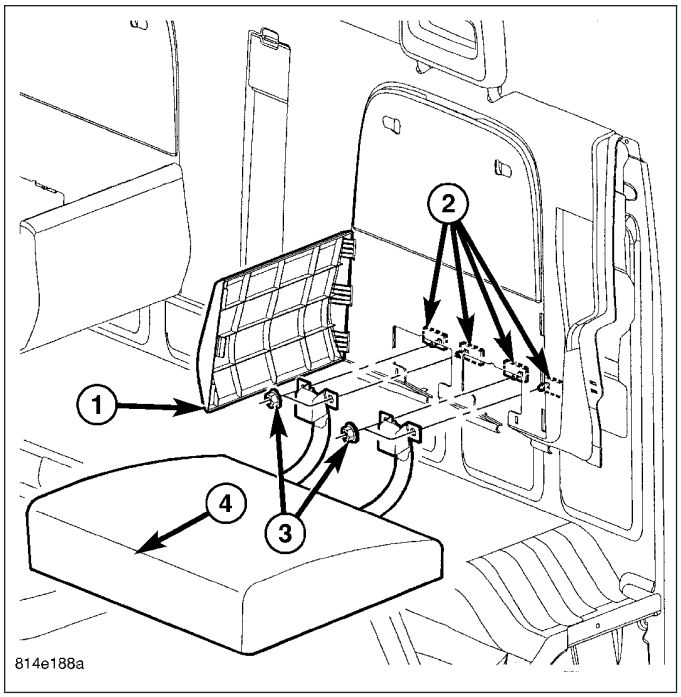




3. Install the cab back trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-CAB BACK TRIM - INSTALLATION).
4. Install the lower C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - INSTALLATION).
5. Install the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - INSTALLATION).



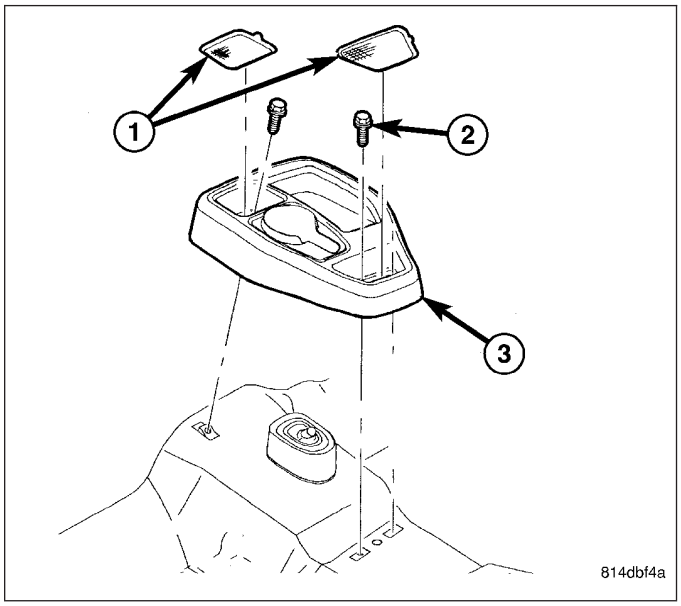
6. Install the rear jumper seat cushions, (Refer to 23 - BODY/SEATS/SEAT-SECOND ROW - INSTALLATION).



7. Install the jack storage compartment cover.

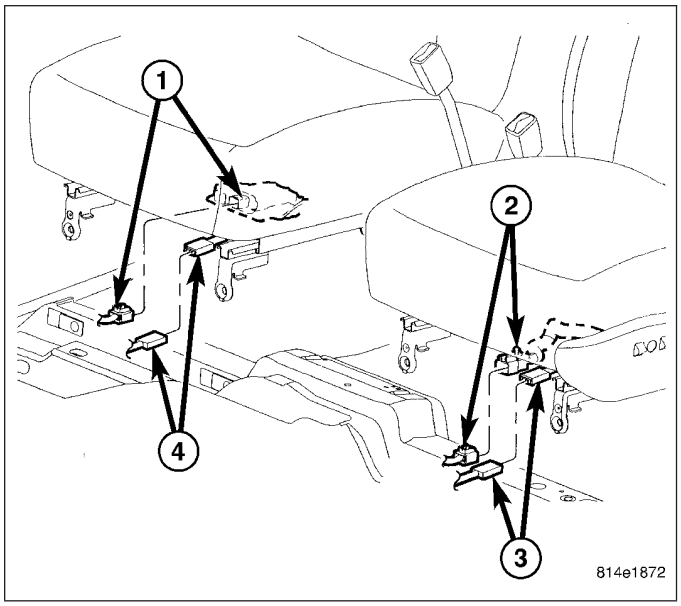
NOTE: Mini floor console shown. Full floor console different.

8. Install the floor console, (Refer to 23 - BODY/INTERIOR/CONSOLE-FLOOR - INSTALLATION).

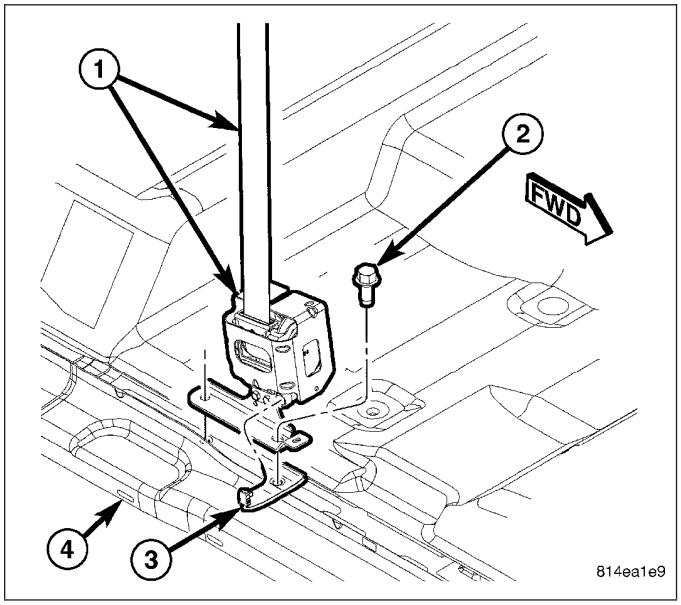


NOTE: Electric front seats shown. Other seats similar.

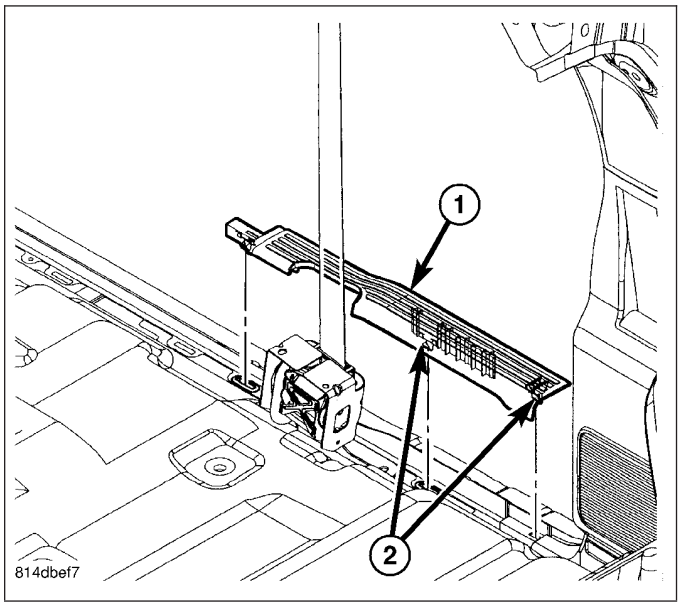
9. Install the front seats, (Refer to 23 - BODY/SEATS/ SEAT-FRONT - INSTALLATION).



10. Position the retractor (1) mounting bracket to the mounting holes in the floor panel inboard of the door sill (4). Be certain that the seat belt webbing between the retractor and the turning loop is not twisted.
11. Install the two screws (2) that secure the retractor bracket to the floor panel. Tighten the screws to 39 N·m (29 ft. lbs.).
12. Reconnect the body wire harness connector (3) to the seat belt tensioner initiator on the retractor.

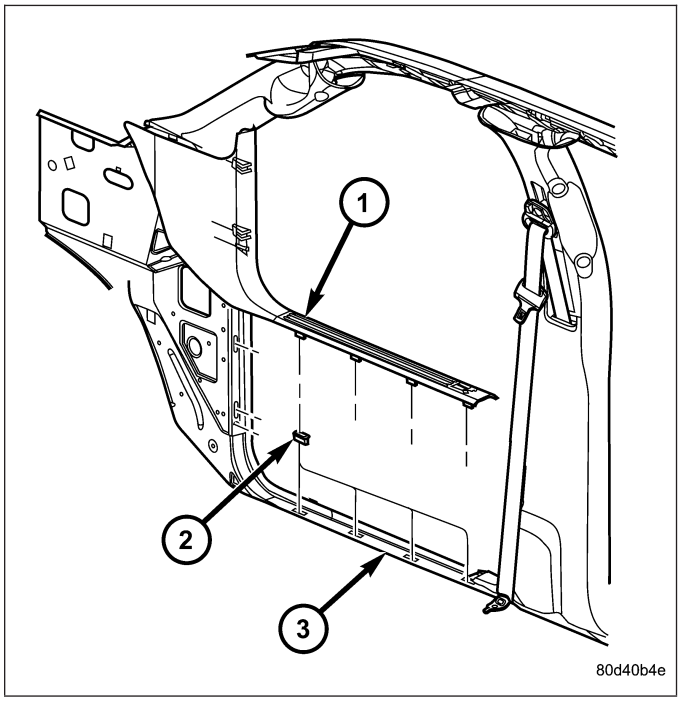


13. Install the rear door sill scuff plates, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - INSTALLATION).

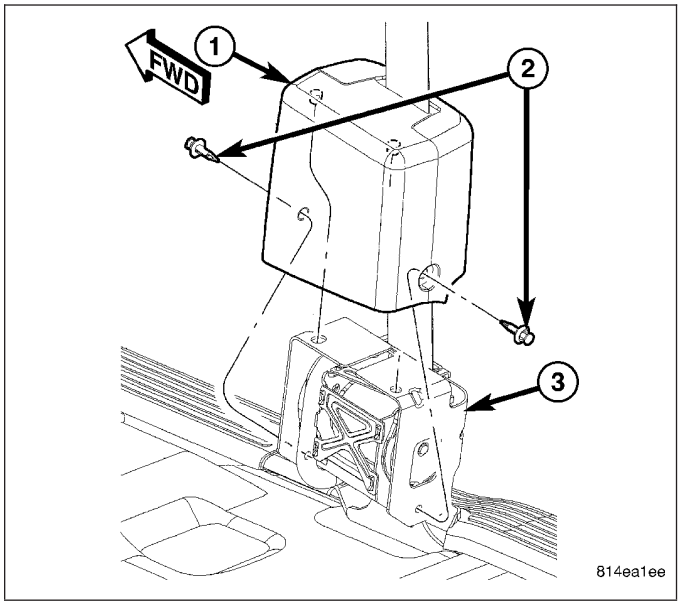


NOTE: Cowl trim panel for Quad Cab models shown. Club Cab similar.

14. Install the cowl trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-COWL TRIM - INSTALLATION).



15. Install the outer front seat belt retractor covers, (Refer to 23 - BODY/INTERIOR/COVER-OUTER FRONT SEAT BELT RETRACTOR - INSTALLATION).

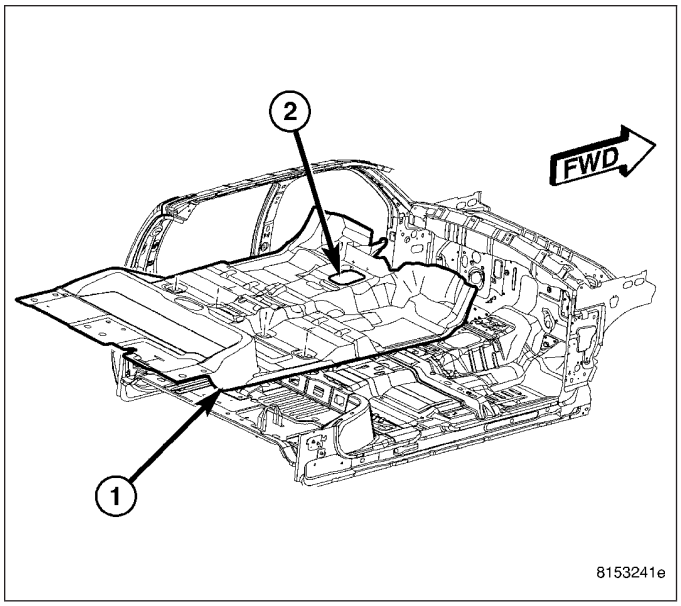


16. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

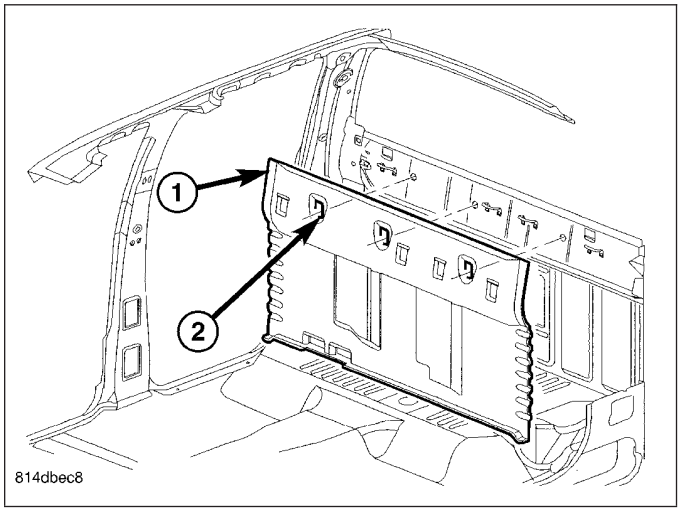
Quad Cab

NOTE: Bucket seats shown. Bench seat similar.

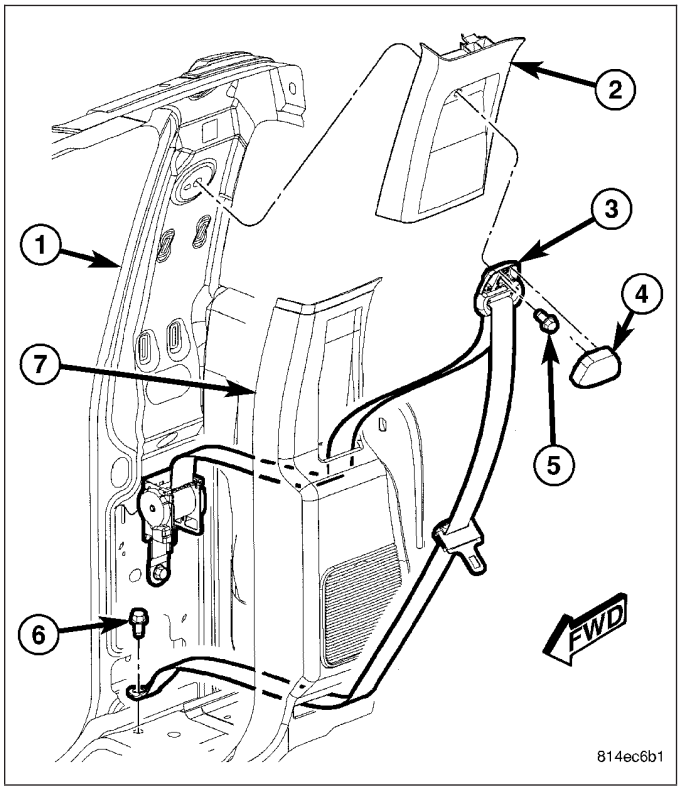
1. For vehicles equipped with a manual shift transmission, remove the cutout (2) from the carpet for the shifter assembly.
2. Position the carpet (1) in the vehicle.



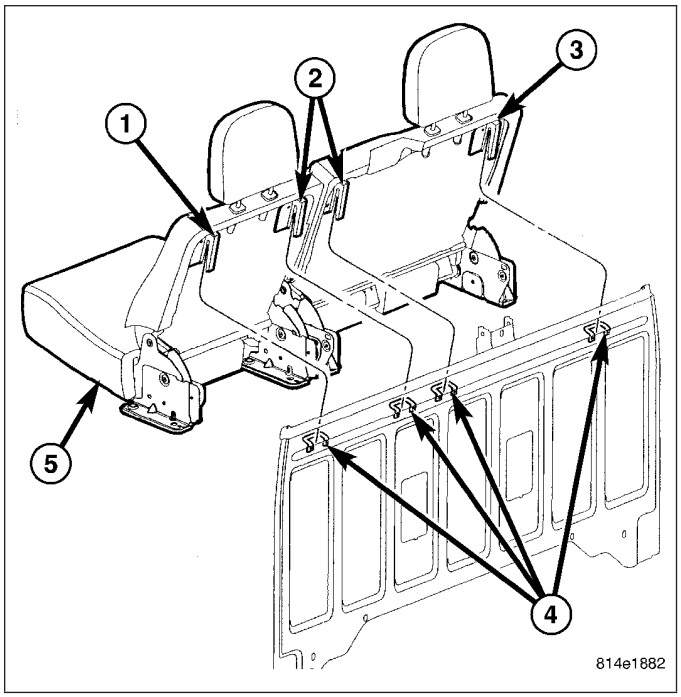
3. Install the cab back trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-CAB BACK TRIM - INSTALLATION).



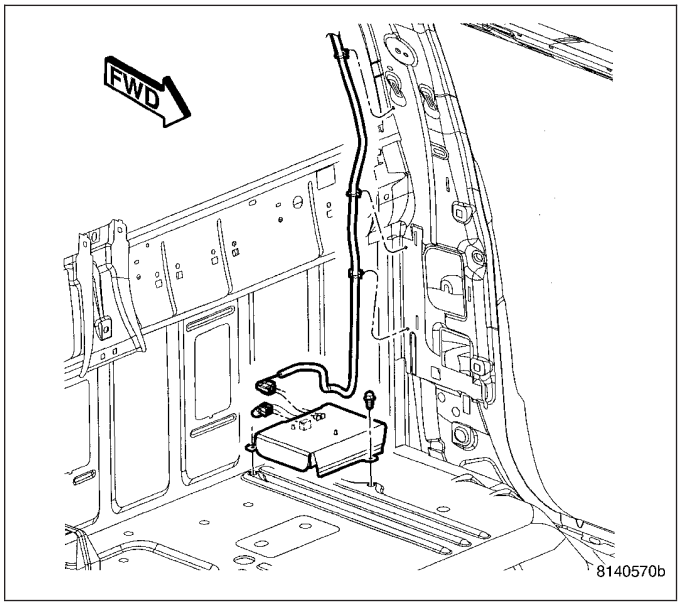
4. Install the lower C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - INSTALLATION).
5. Install the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - INSTALLATION).



6. Install the rear seat, (Refer to 23 - BODY/SEATS/ SEAT-SECOND ROW - INSTALLATION).

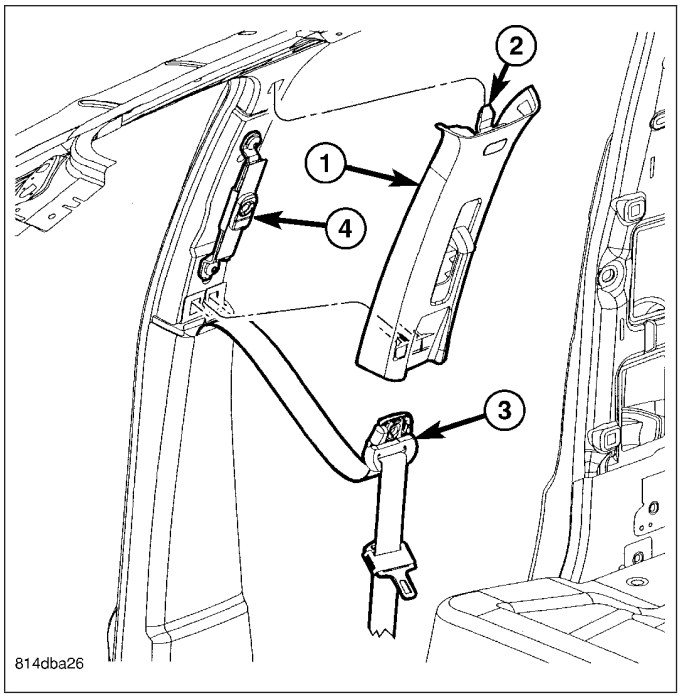


7. If equipped, install the satellite receiver module, (Refer to 8 - ELECTRICAL/AUDIO/SATELLITE RECEIVER MODULE - INSTALLATION).



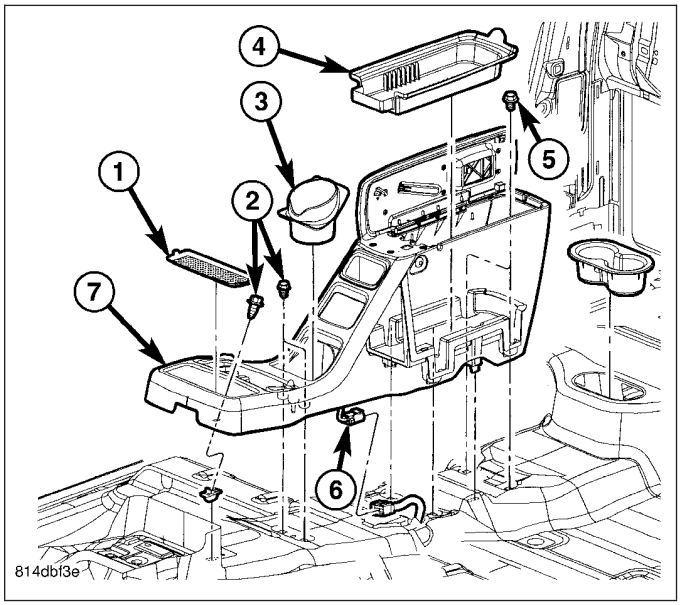
8. Install the jack.

9. Install the lower B-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-B PILLAR LOWER TRIM - INSTALLATION).
10. Install the upper B-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-B PILLAR UPPER TRIM - INSTALLATION).



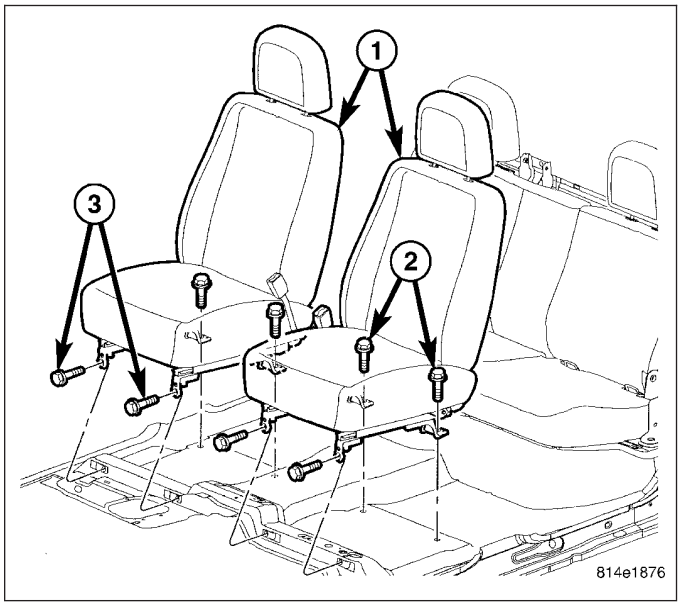
NOTE: Full floor console shown. Mini console different.

11. Install the floor console, (Refer to 23 - BODY/INTERIOR/CONSOLE-FLOOR - INSTALLATION).
12. Install the rear cup holder.

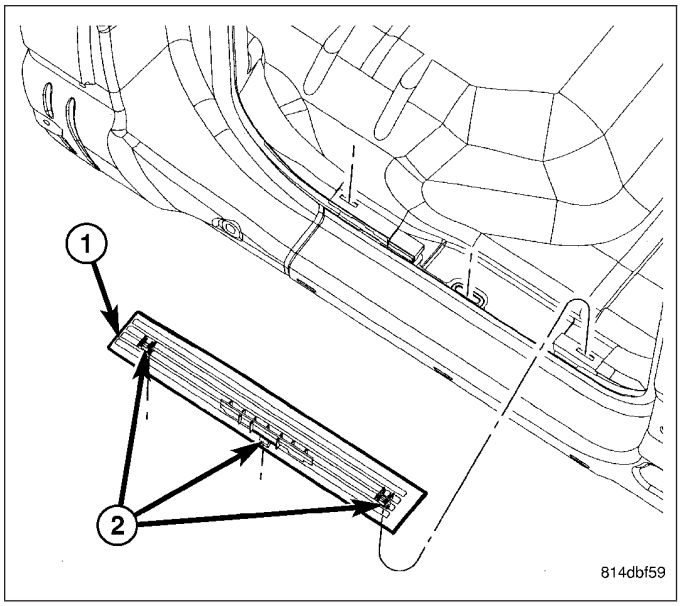


NOTE: Bucket seats shown. Bench seat similar.

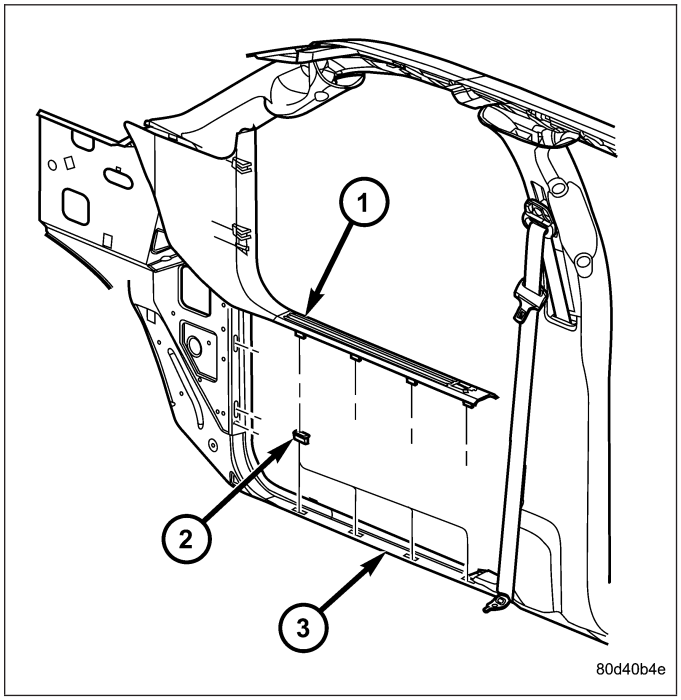
13. Install the front seats, (Refer to 23 - BODY/SEATS/SEAT-FRONT - INSTALLATION).



14. Install the rear door sill scuff plates, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - INSTALLATION).



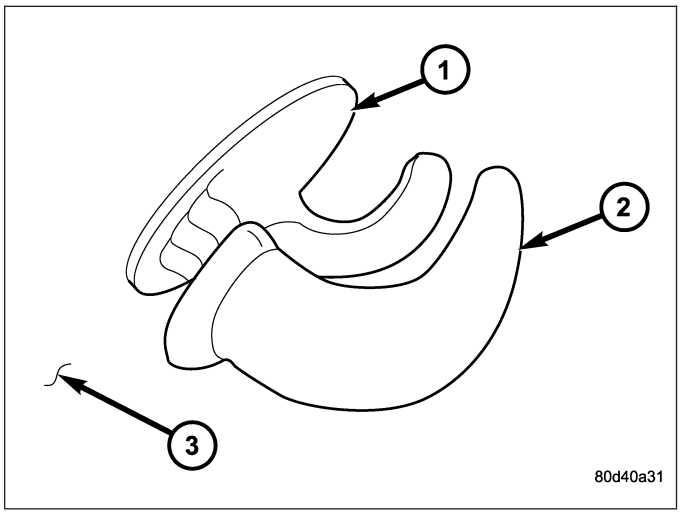
15. Install the cowl trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-COWL TRIM - INSTALLATION).



COAT HOOK

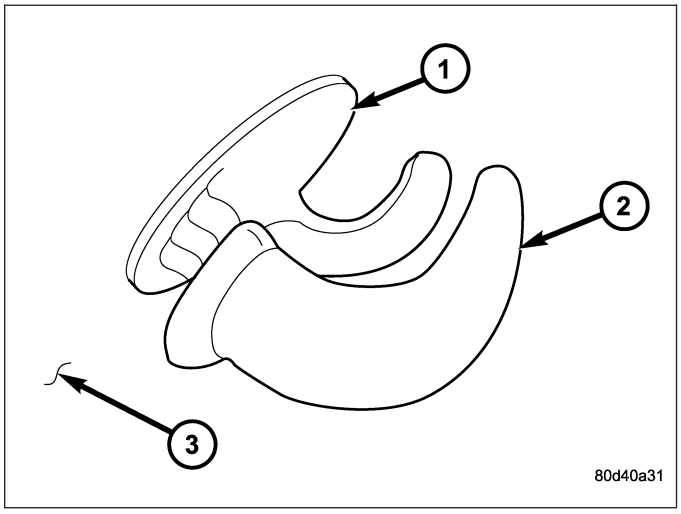
REMOVAL

1. Using a trim stick C-4755 or equivalent, disengage the release clip (2) as shown and remove the coat hook (1) from the headliner (3)



INSTALLATION

1. Position the coat hook (1) through the headliner (3) and fully seat the base of the support to the roof panel.
2. Engage the release clip (2).

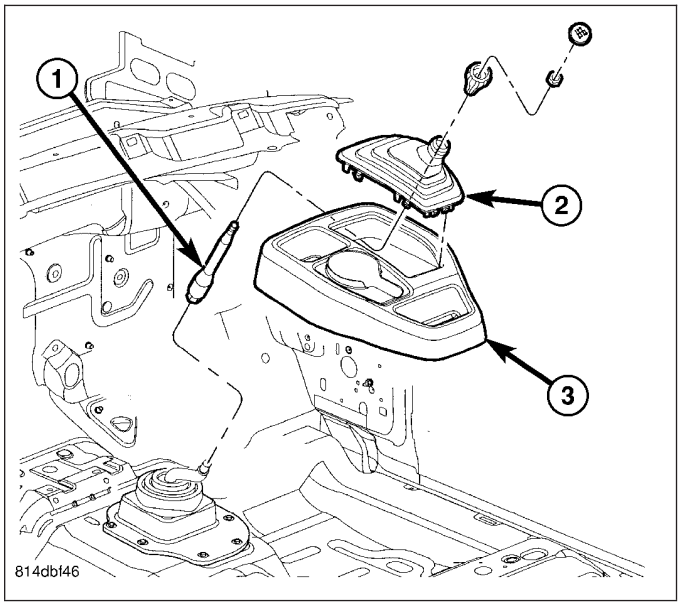


CONSOLE-FLOOR

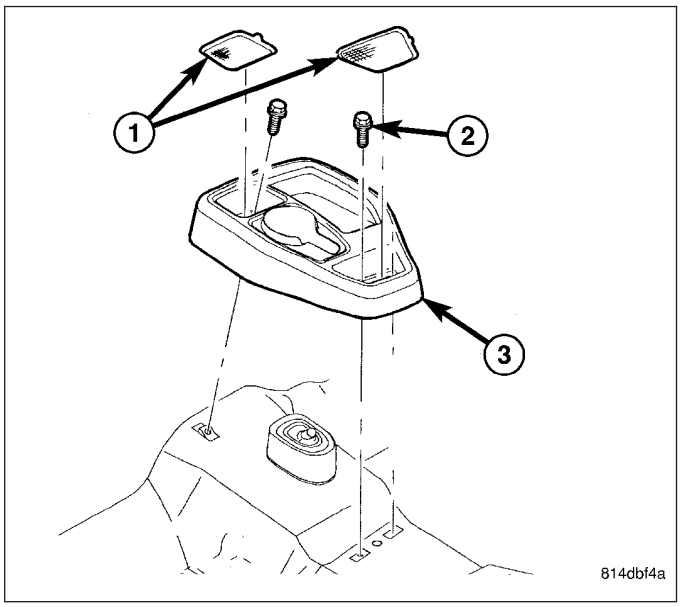
REMOVAL

MINI FLOOR CONSOLE

1. If equipped, remove the shift boot (2), (Refer to 23 - BODY/INTERIOR/SHIFT BOOT-FLOOR - REMOVAL).

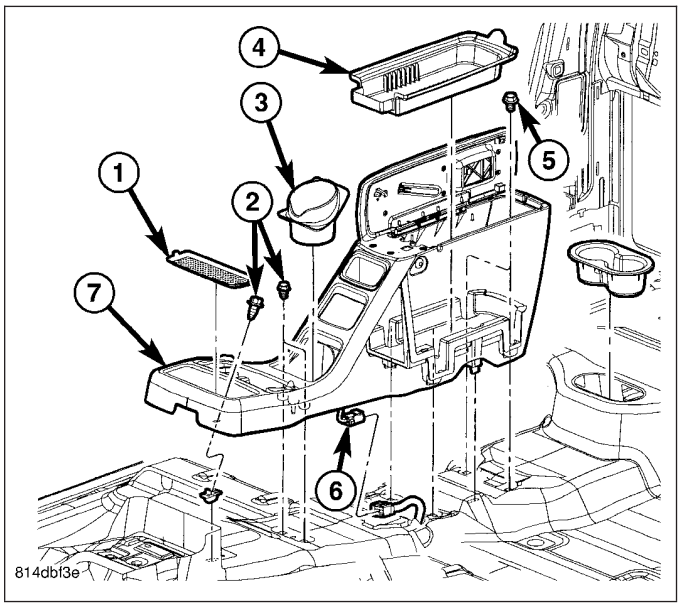


2. Remove the rubber liners (1).
3. Remove the screws (2) that secure the floor console (3) to the floor panel and remove the floor console.



FULL FLOOR CONSOLE

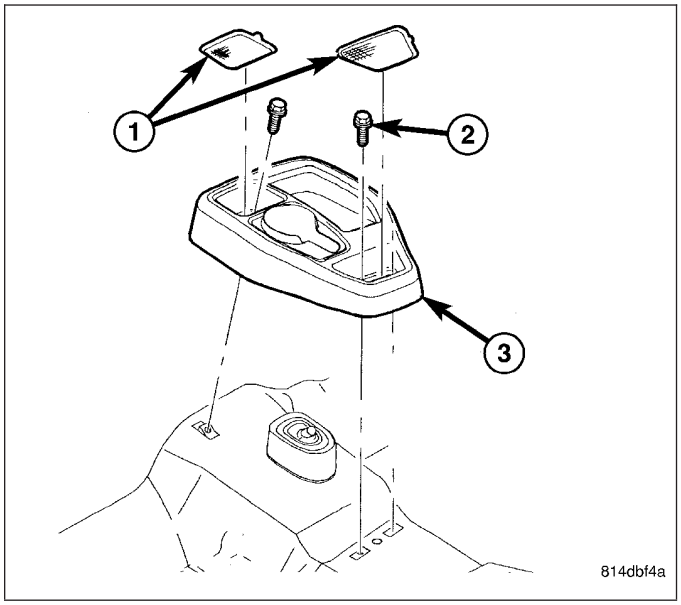
1. Remove the rubber liner (1).
2. Remove the cup holder (3).
3. Remove the tray (4).
4. Remove the screws (2) (5) that secure the floor console (7) to the floor panel.
5. Disconnect the console assembly wire harness connector (6) located underneath the floor console and remove the floor console from the vehicle.



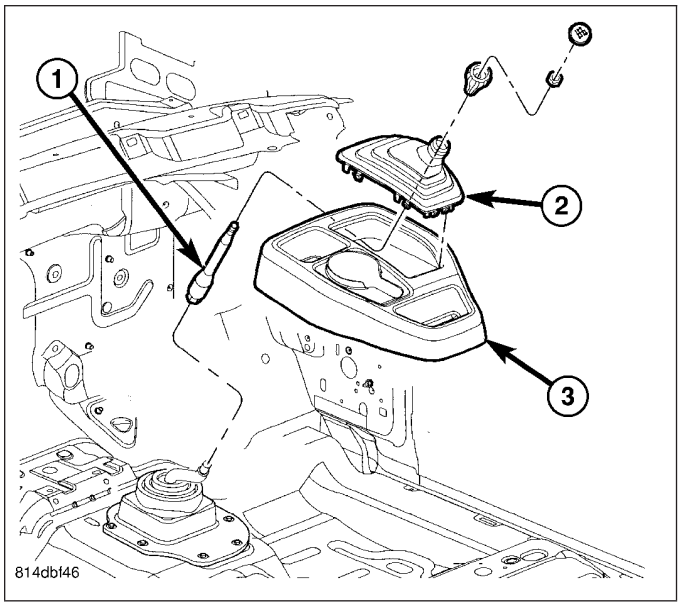
INSTALLATION

MINI FLOOR CONSOLE

1. Position the floor console (3) in the vehicle and install the screws (2) that secure the console to the floor panel.
2. Install the rubber liners (1).

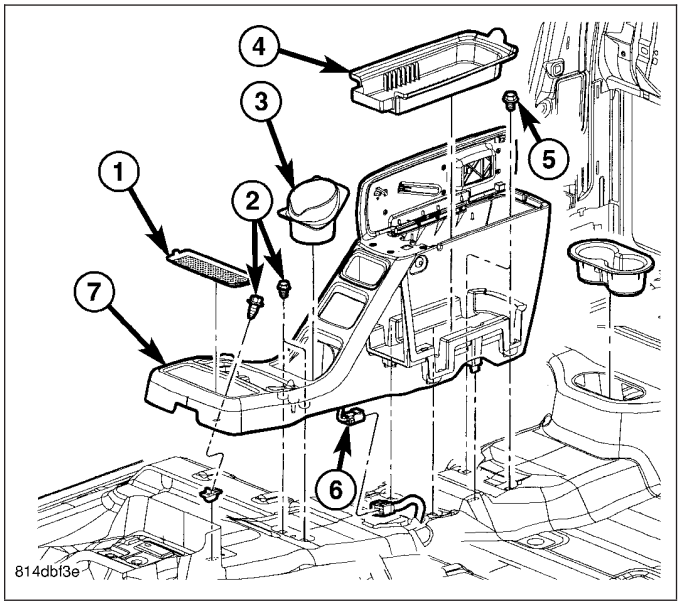


3. If equipped, install the shift boot (2), (Refer to 23 - BODY/INTERIOR/SHIFT BOOT-FLOOR - INSTALLATION).



FULL FLOOR CONSOLE

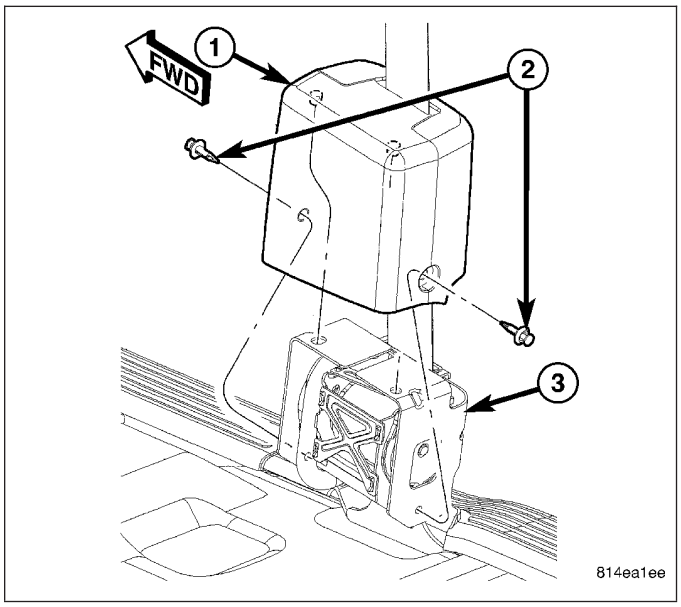
1. Position the floor console (7) in the vehicle and connect the console assembly wire harness connector (6).
2. Position the floor console to the floor panel and install the screws (2) (5) that secure the console to the floor panel.
3. Install the rubber liner (1).
4. Install the cup holder (3).
5. Install the tray (4).



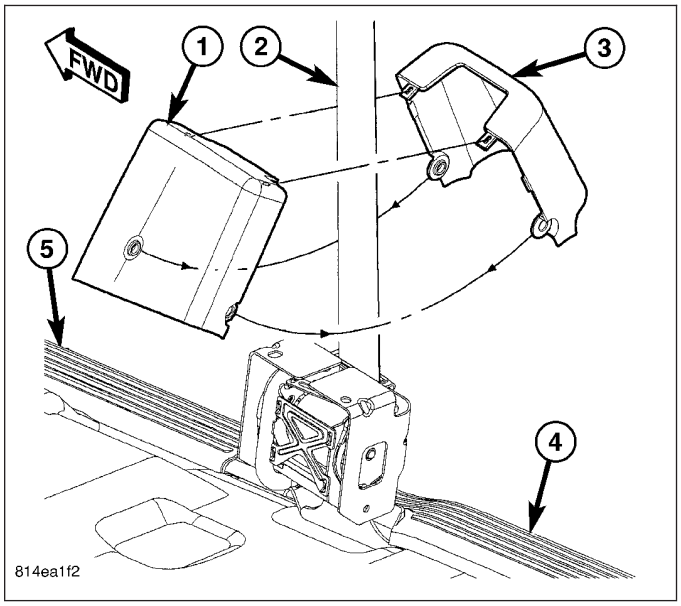
COVER-OUTER FRONT SEAT BELT RETRACTOR

REMOVAL

1. Remove the two plastic push-pin retainers (2) that secure the outer front seat belt retractor cover (1) to the outer front seat belt retractor (3).
2. Raise the retractor cover upward to disengage the two locator pins on the inside top of the inboard retractor cover from the locator holes in the top of the retractor.

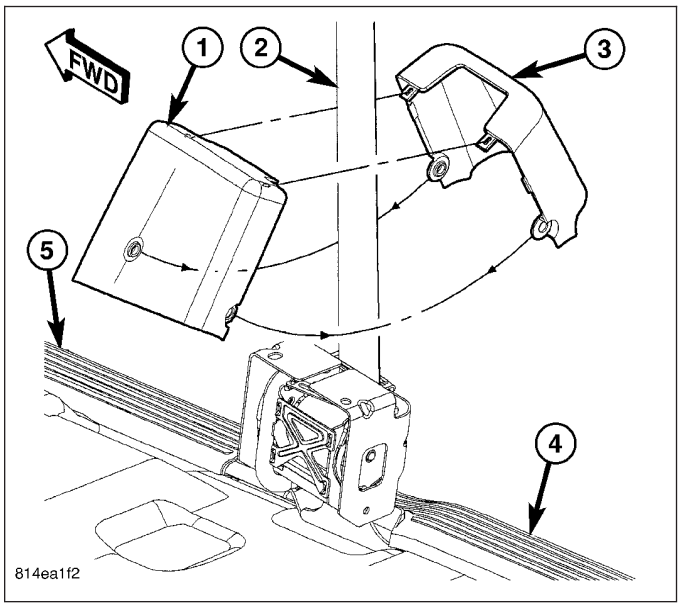


3. Spread the bottom of the inboard (1) and outboard (3) retractor cover halves apart and disengage the snaps located at the top of the cover halves and remove the cover halves.

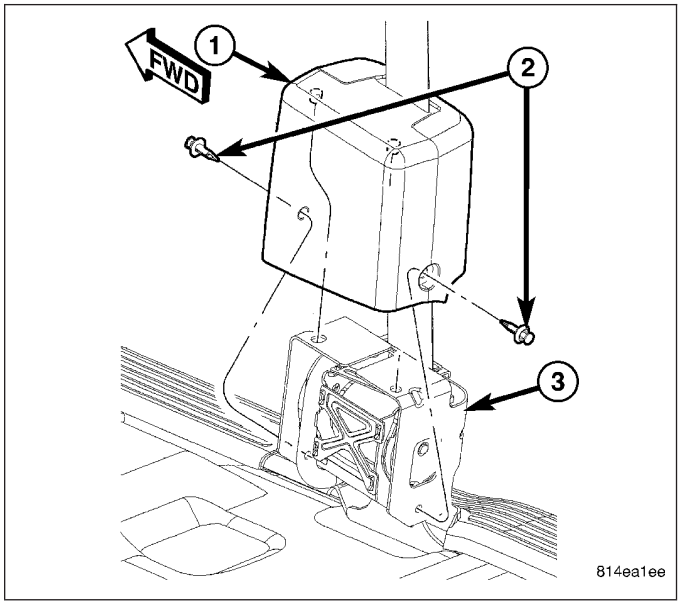


INSTALLATION

1. Position the inboard (1) and outboard (3) outer seat belt retractor cover halves around the seat belt (2) with the top of each half angled toward the other and engage the snaps that secure the two halves together. Then, close the cover around the seat belt.



2. Using hand pressure, push the retractor cover (1) downward over the retractor (3) far enough to engage the two locator pins in the top of the inboard cover half with the locator holes in the top of the retractor.
3. Install the two plastic push-pin retainers (2) that secure the retractor cover to the retractor.



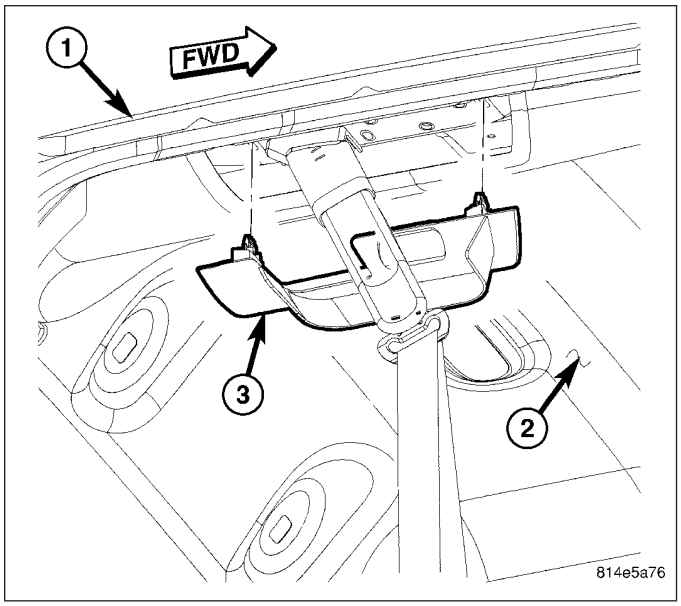
HEADLINER

REMOVAL

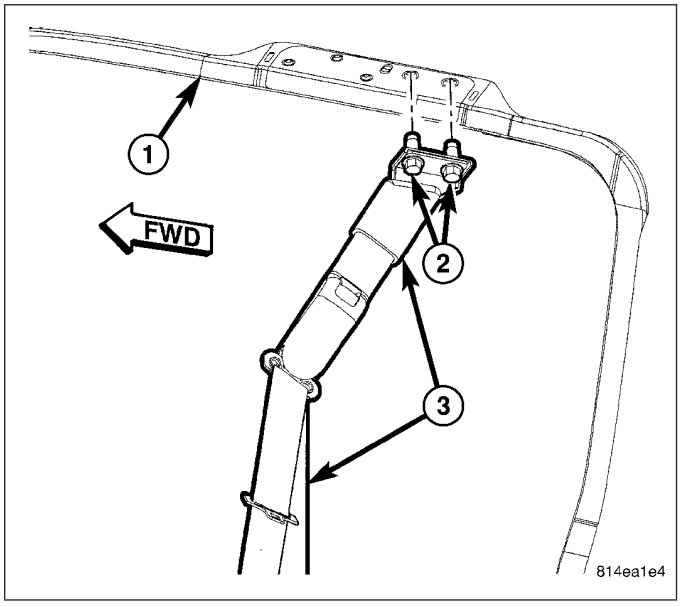
Club Cab, Without Rear Jumper Seats

1. Pull the top of each door seal downward slightly.

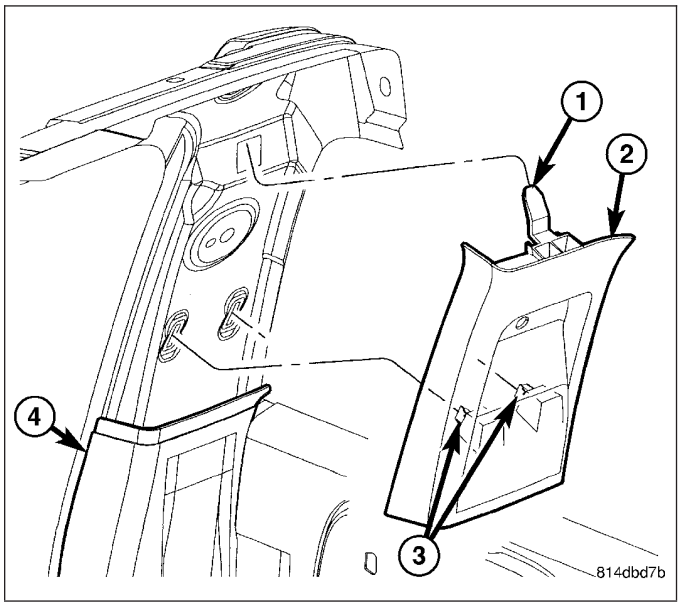
2. Remove the upper door striker trim covers (3) as follows:
   - Using a trim stick or another suitable wide flat-bladed tool, gently pry the edges of the upper door striker trim cover (3) away from the headliner (2) far enough to disengage the two snap clips that secure the cover to the upper roof rail (1).



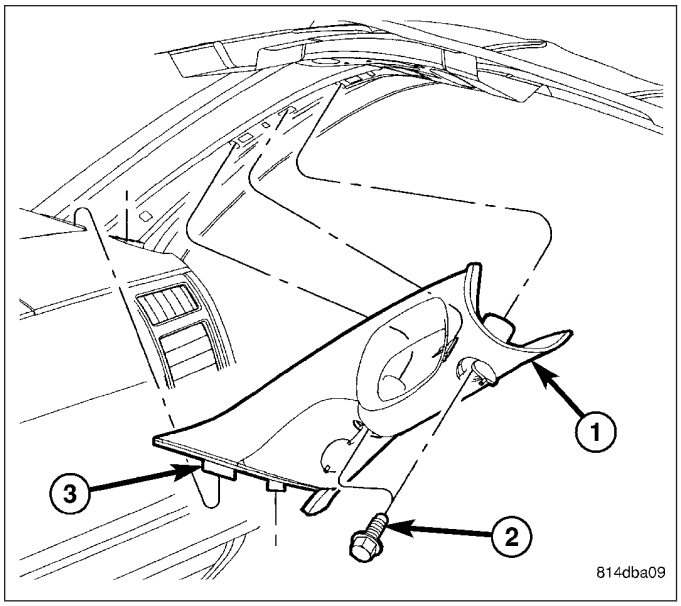
3. Determine which side of the vehicle the headliner will be removed from and disconnect the seat belt turning loop and height adjuster (3) from the upper roof rail (1) on that side of the vehicle as follows:
   - Remove the two screws (2) that secure the seat belt turning loop and height adjuster bracket (3) to the upper roof rail (1) and position it aside.



4. Remove the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL).

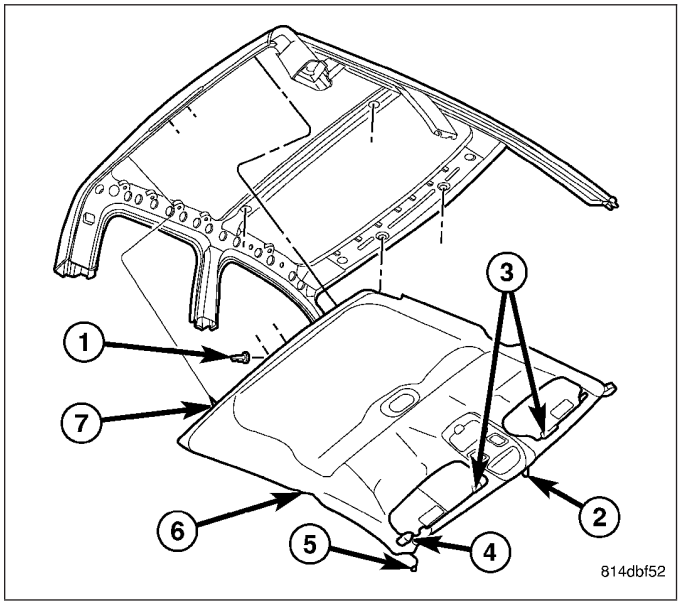


5. Remove the A-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-A PILLAR TRIM - REMOVAL).



NOTE: Headliner for Quad Cab models shown. Club Cab similar.

6. Disconnect the wire harness connector (5) located at the right A-pillar.
7. If equipped, disconnect the headliner wire harness connector (2) from the inside rear view mirror.
8. If equipped, remove the overhead console, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).
9. Remove the sun visors (4), (Refer to 23 - BODY/INTERIOR/SUN VISOR - REMOVAL).
10. Remove the sun visor supports (3), (Refer to 23 - BODY/INTERIOR/SUN VISOR SUPPORT - REMOVAL).
11. If equipped, remove the front dome lamp, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/FRONT DOME LAMP - REMOVAL).

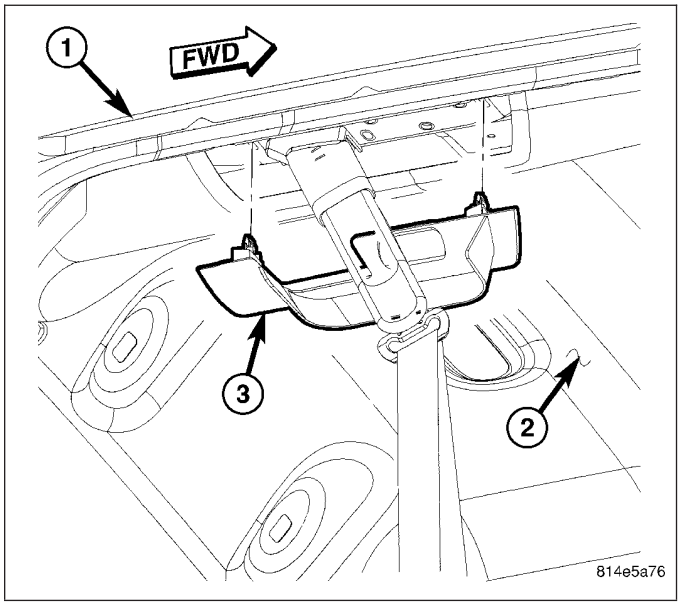


12. If equipped, remove the rear dome lamp, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/REAR DOME LAMP - REMOVAL).
13. Remove the two coat hooks, (Refer to 23 - BODY/INTERIOR/COAT HOOK - REMOVAL).
14. Remove the front seat headrests.
15. Lower the rear of the headliner (7) and disconnect the headliner wire harness connector (1) from the center high mounted stop lamp.
16. Recline the front seats.
17.

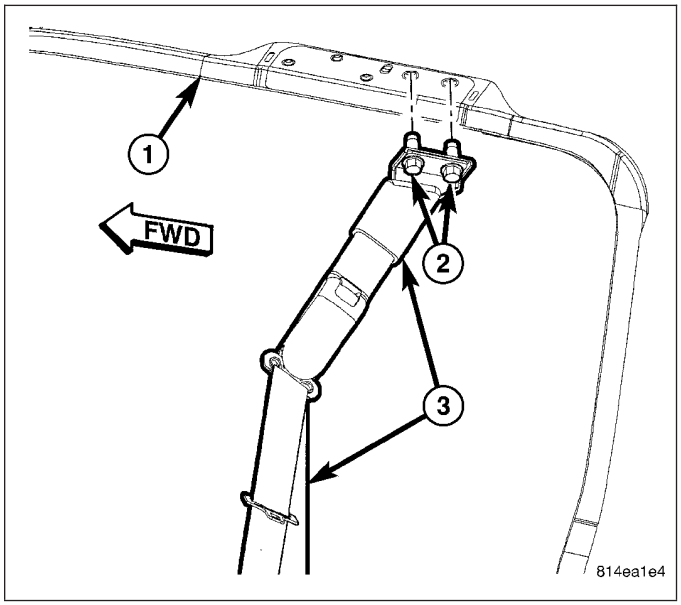
CAUTION: Be careful not to crease the headliner.Lower the front of the headliner and remove the headliner through the door opening where the seat belt turning loop and height adjuster was disconnected from the upper roof rail.

Club Cab, With Rear Jumper Seats

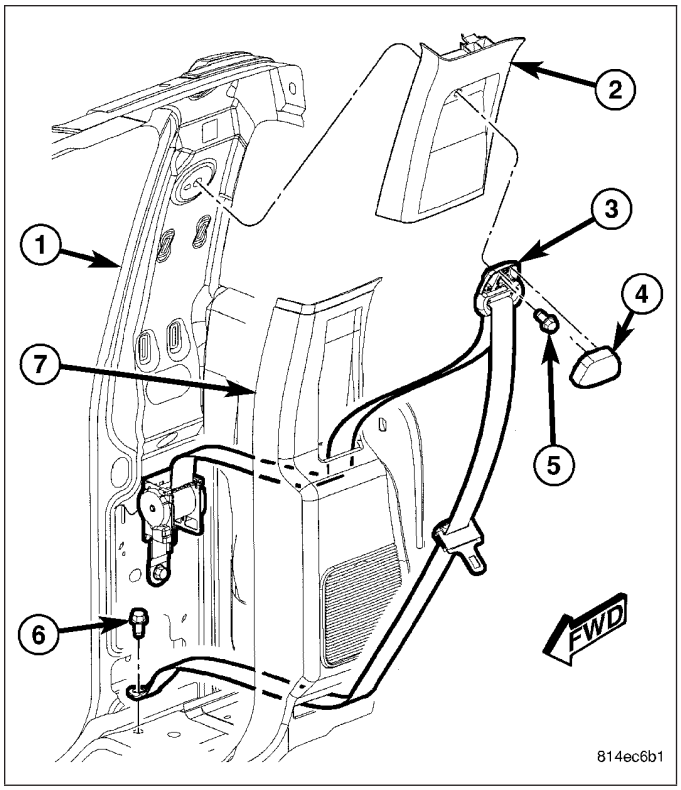
1. Pull the top of each door seal downward slightly.
2. Remove the upper door striker trim covers (3) as follows:
   - Using a trim stick or another suitable wide flat-bladed tool, gently pry the edges of the upper door striker trim cover (3) away from the headliner (2) far enough to disengage the two snap clips that secure the cover to the upper roof rail (1).



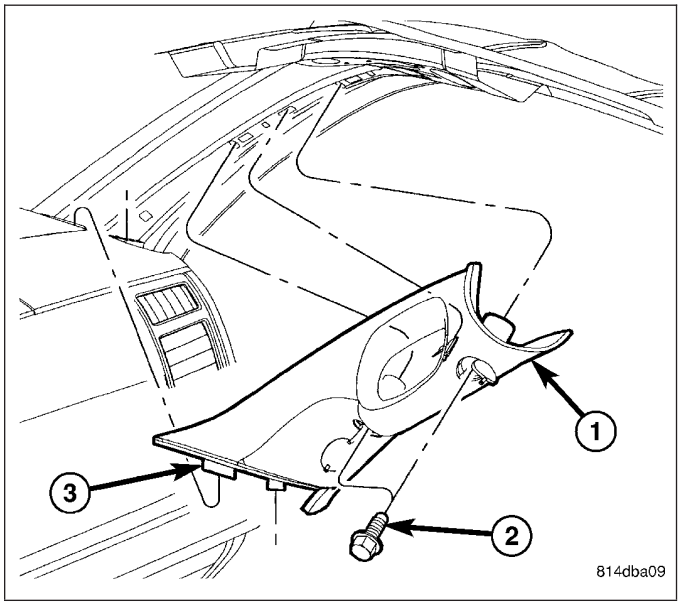
3. Determine which side of the vehicle the headliner will be removed from and disconnect the seat belt turning loop and height adjuster (3) from the upper roof rail (1) on that side of the vehicle as follows:
   - Remove the two screws (2) that secure the seat belt turning loop and height adjuster bracket (3) to the upper roof rail (1) and position it aside.



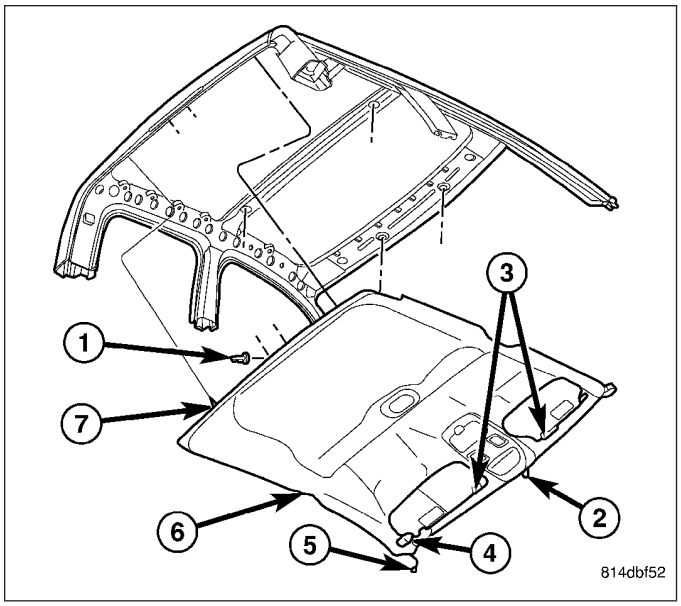
4. Remove the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL).



5. Remove the A-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-A PILLAR TRIM - REMOVAL).



NOTE: Headliner for Quad Cab models shown. Club Cab similar.



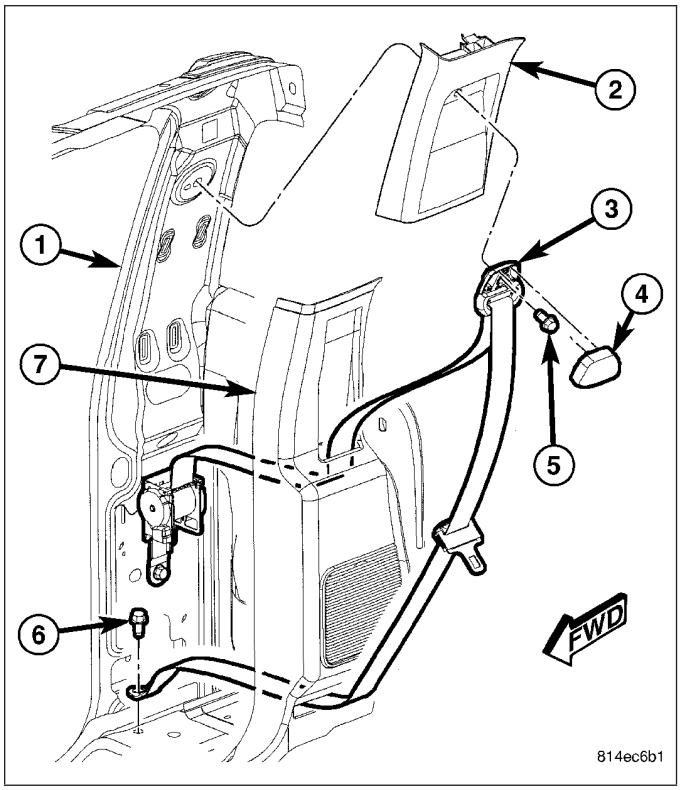
6. Disconnect the wire harness connector (5) located at the right A-pillar.
7. If equipped, disconnect the headliner wire harness connector (2) from the inside rear view mirror.
8. If equipped, remove the overhead console, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).
9. Remove the sun visors (4), (Refer to 23 - BODY/INTERIOR/SUN VISOR - REMOVAL).
10. Remove the sun visor supports (3), (Refer to 23 - BODY/INTERIOR/SUN VISOR SUPPORT - REMOVAL).
11. If equipped, remove the front dome lamp, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/FRONT DOME LAMP - REMOVAL).
12. If equipped, remove the rear dome lamp, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/REAR DOME LAMP - REMOVAL).
13. Remove the two coat hooks, (Refer to 23 - BODY/INTERIOR/COAT HOOK - REMOVAL).
14. Remove the front seat headrests.
15. Remove the cab back trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-CAB BACK TRIM - REMOVAL).
16. Remove the rear jumper seat headrests.
17. Remove the rear jumper seat headrest sleeves from the headliner.
18. Lower the rear of the headliner (7) and disconnect the headliner wire harness connector (1) from the center high mounted stop lamp.
19. Recline the front seats.
20.

CAUTION: Be careful not to crease the headliner.Lower the front of the headliner and remove the headliner through the door opening where the seat belt turning loop and height adjuster was disconnected from the upper roof rail.

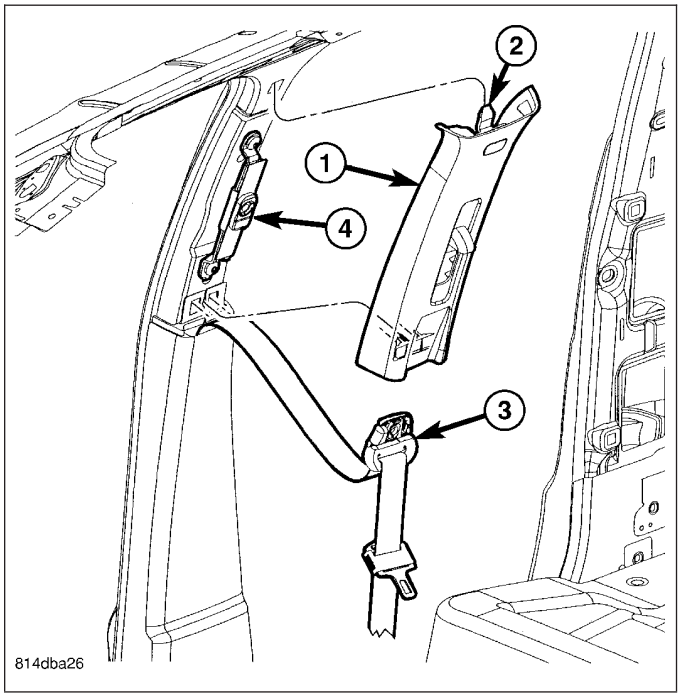
Quad Cab

1. Pull the top of each door seal downward slightly.

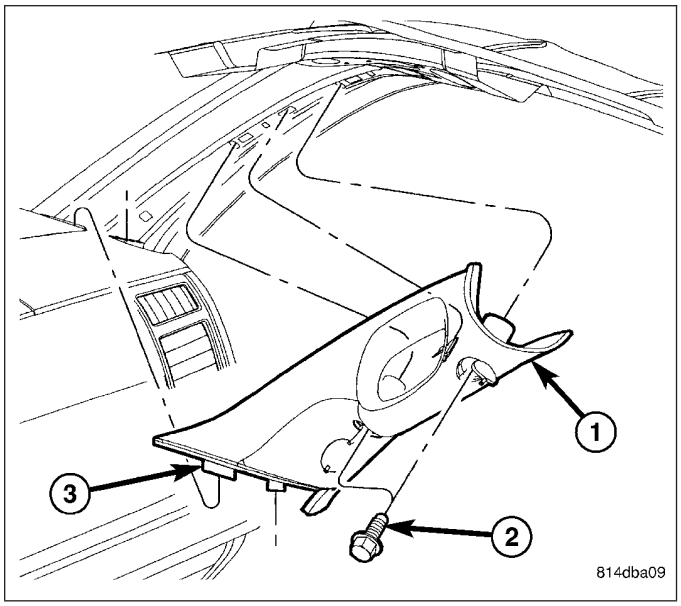
2. Remove the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL).



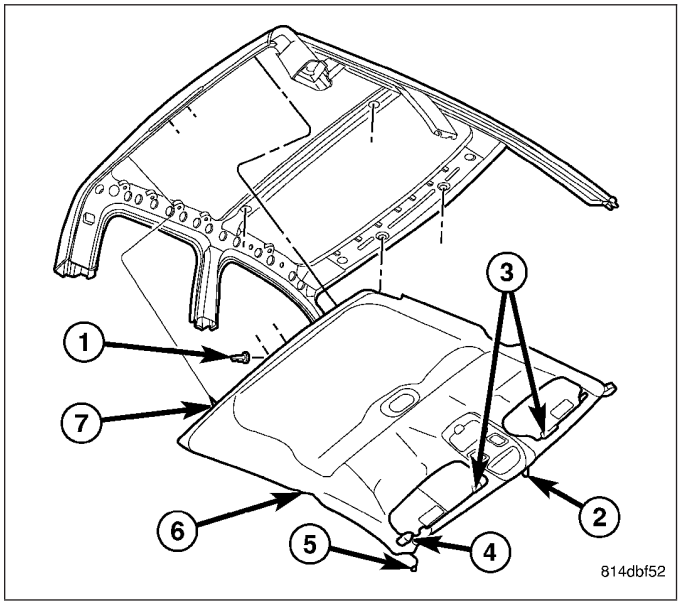
3. Remove the upper B-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-B PILLAR UPPER TRIM - REMOVAL).



4. Remove the A-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-A PILLAR TRIM - REMOVAL).



5. Disconnect the wire harness connector (5) located at the right A-pillar.
6. If equipped, disconnect the headliner wire harness connector (2) from the inside rear view mirror.
7. If equipped, remove the overhead console, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).
8. Remove the sun visors (4), (Refer to 23 - BODY/INTERIOR/SUN VISOR - REMOVAL).
9. Remove the sun visor supports (3), (Refer to 23 - BODY/INTERIOR/SUN VISOR SUPPORT - REMOVAL).
10. If equipped, remove the front dome lamp, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/FRONT DOME LAMP - REMOVAL).
11. If equipped, remove the rear dome lamp, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/REAR DOME LAMP - REMOVAL).



12. Remove the two coat hooks, (Refer to 23 - BODY/INTERIOR/COAT HOOK - REMOVAL).
13. Remove the right front seat headrest.
14. Recline the right front seat.
15. Remove the left front seat, (Refer to 23 - BODY/SEATS/SEAT-FRONT - REMOVAL).
16. Lower the rear of the headliner (7) and disconnect the headliner wire harness connector (1) from the center high mounted stop lamp.

CAUTION: Be careful not to crease the headliner.

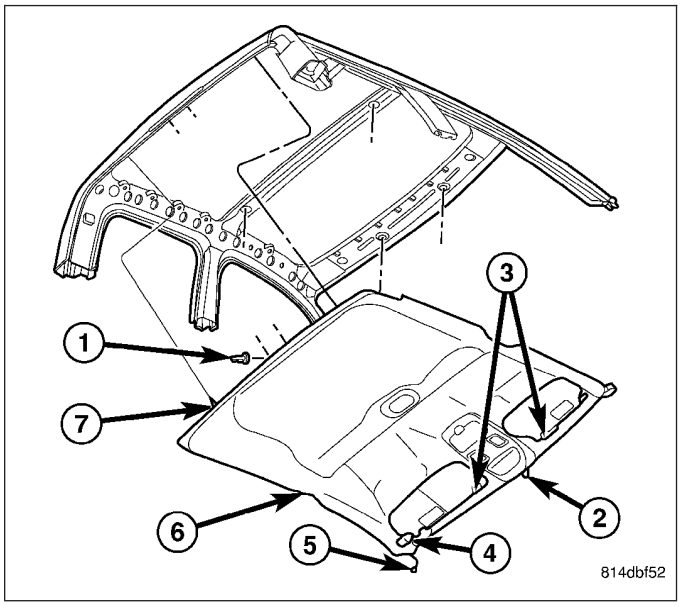
17. Lower the front of the headliner and remove the headliner through the left door opening.

INSTALLATION

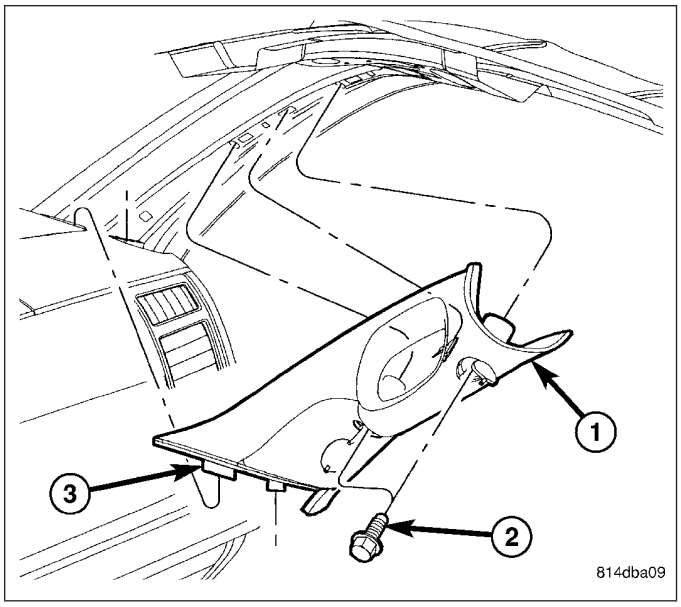
Club Cab, Without Rear Jumper Seats

CAUTION: Be careful not to crease the headliner.

NOTE: Headliner for Quad Cab model shown. Club Cab similar.

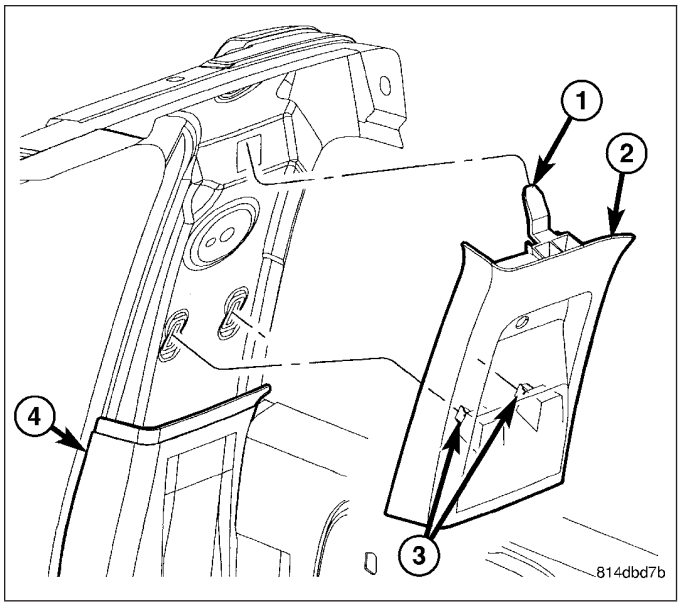


1. Position the headliner (6) in the vehicle through the door opening from which it was removed.
2. Connect the headliner wire harness connector (1) to the center high mounted stop lamp.
3. Raise the rear of the headliner (7) to the roof panel and install the two coat hooks, (Refer to 23 - BODY/INTERIOR/COAT HOOK - INSTALLATION).
4. Raise the front of the headliner to the roof panel and install the sun visor supports (3), (Refer to 23 - BODY/INTERIOR/SUN VISOR SUPPORT - INSTALLATION).
5. Connect the wire harness connector (5) located at the right A-pillar.
6. If equipped, connect the headliner wire harness connector (2) to the inside rear view mirror.
7. If equipped, install the overhead console, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION).
8. Install the sun visors (4), (Refer to 23 - BODY/INTERIOR/SUN VISOR - INSTALLATION).
9. If equipped, install the front dome lamp, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/FRONT DOME LAMP - INSTALLATION).
10. Install the A-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-A PILLAR TRIM - INSTALLATION).

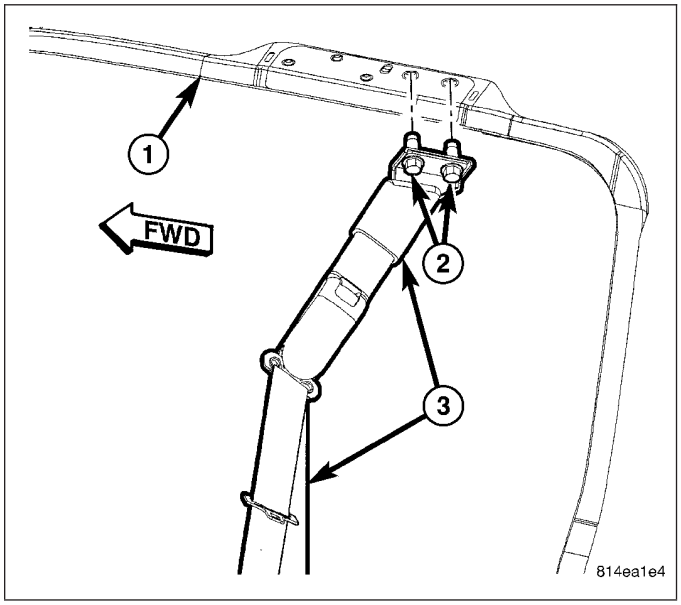


11. If equipped, install the rear dome lamp, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/REAR DOME LAMP - INSTALLATION).

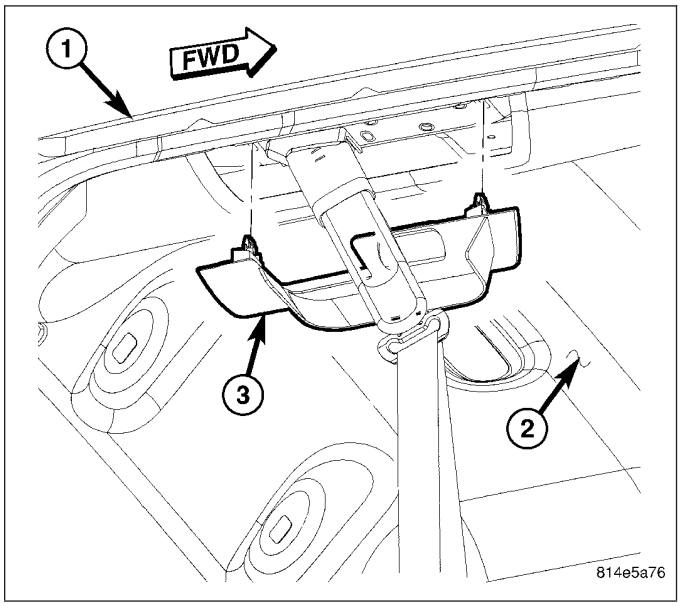
12. Install the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - INSTALLATION).



13. Position the seat belt turning loop and height adjuster (3) bracket to the mounting holes in the upper roof rail (1) and install the two screws (2) that secure the bracket to the roof rail. Tighten the screws to 39 N·m (29 ft. lbs.).



14. Install the upper door striker trim covers (3) as follows:
    - Position the trim cover (3) to the headliner (2) opening around the door striker and engage the retaining tabs that secure the cover to the roof rail.

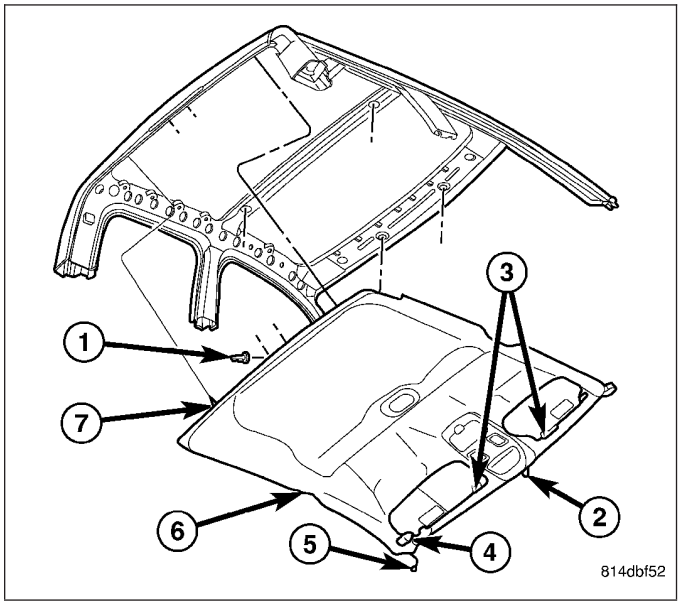


15. Install the front seat headrests.

16. Seat the top of each of door seal to the door opening.

Club Cab, With Rear Jumper Seats

NOTE: Headliner for Quad Cab model shown. Club Cab similar.

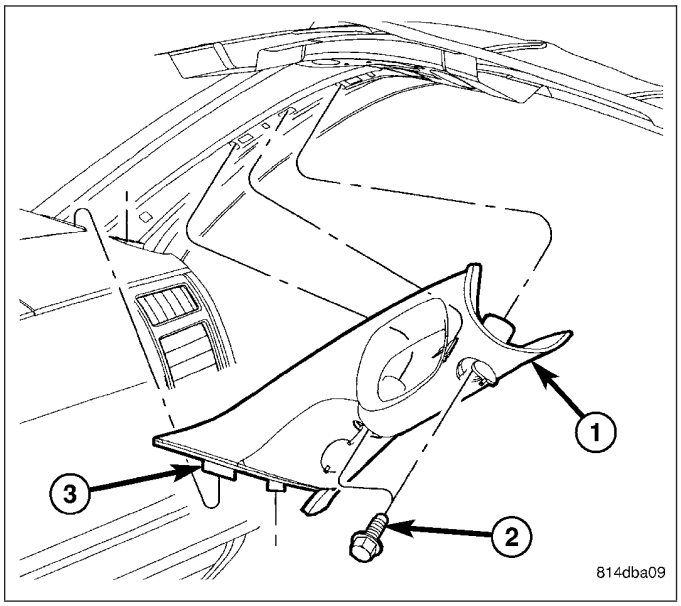


1.

CAUTION: Be careful not to crease the headliner.Position the headliner (6) in the vehicle through the door opening from which it was removed.

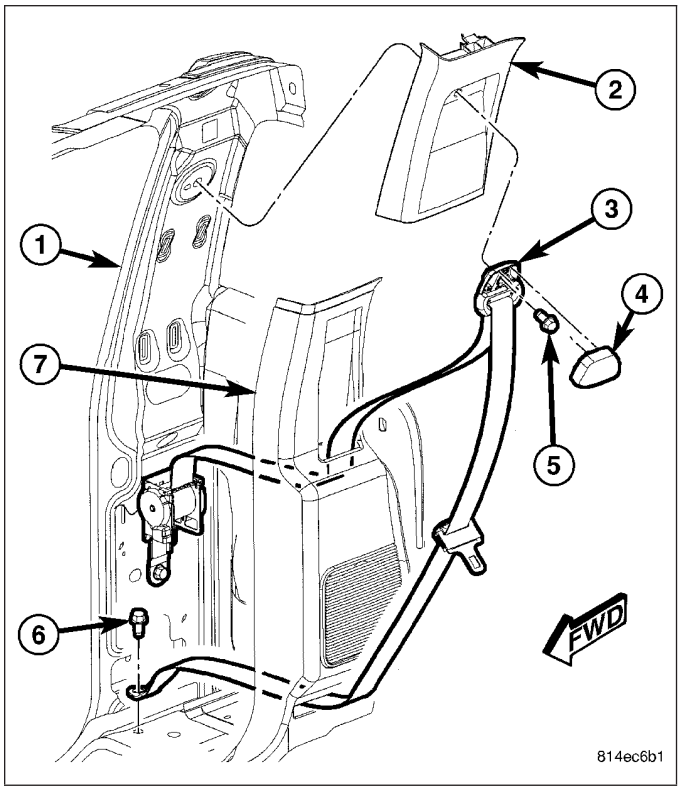
2. Connect the headliner wire harness connector (1) to the center high mounted stop lamp.
3. Raise the rear of the headliner (7) to the roof panel and install the two coat hooks, (Refer to 23 - BODY/INTERIOR/COAT HOOK - INSTALLATION).
4. Raise the front of the headliner to the roof panel and install the sun visor supports (3), (Refer to 23 - BODY/INTERIOR/SUN VISOR SUPPORT - INSTALLATION).
5. Connect the wire harness connector (5) located at the right A-pillar.
6. If equipped, connect the headliner wire harness connector (2) to the inside rear view mirror.
7. If equipped, install the overhead console, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION).
8. Install the sun visors (4), (Refer to 23 - BODY/INTERIOR/SUN VISOR - INSTALLATION).
9. If equipped, install the front dome lamp, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/FRONT DOME LAMP - INSTALLATION).

10. Install the A-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-A PILLAR TRIM - INSTALLATION).

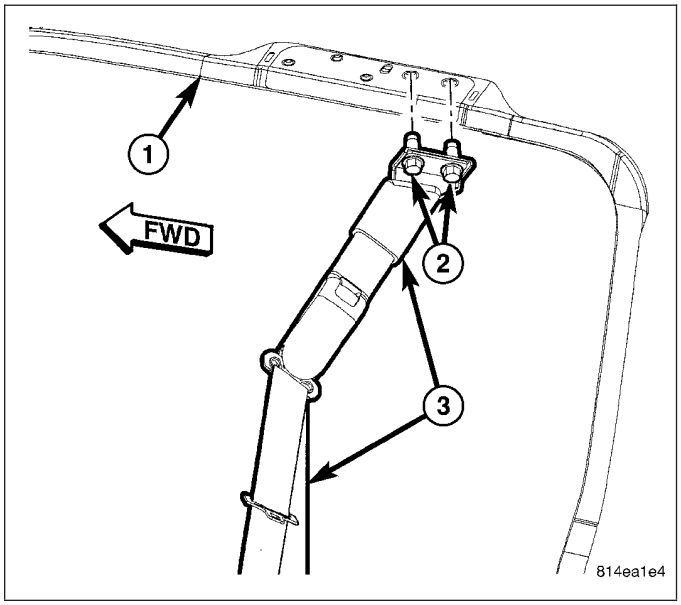


11. If equipped, install the rear dome lamp, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/REAR DOME LAMP - INSTALLATION).
12. Install the rear jumper seat headrest sleeves in the headliner.
13. Install the rear jumper seat headrests.
14. Install the cab back trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-CAB BACK TRIM - INSTALLATION).

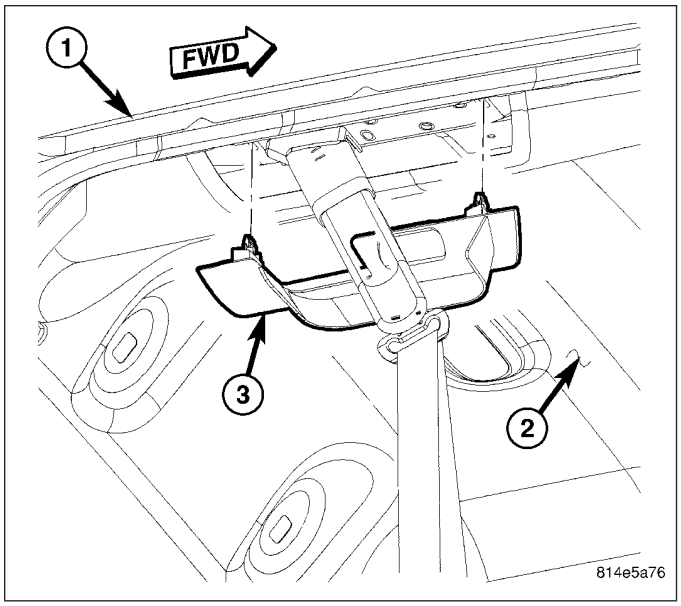
15. Install the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - INSTALLATION).



16. Position the seat belt turning loop and height adjuster (3) bracket to the mounting holes in the upper roof rail (1) and install the two screws (2) that secure the bracket to the roof rail. Tighten the screws to 39 N·m (29 ft. lbs.).



17. Install the upper door striker trim covers (3) as follows:
    - Position the trim cover (3) to the headliner (2) opening around the door striker and engage the retaining tabs that secure the cover to the roof rail.

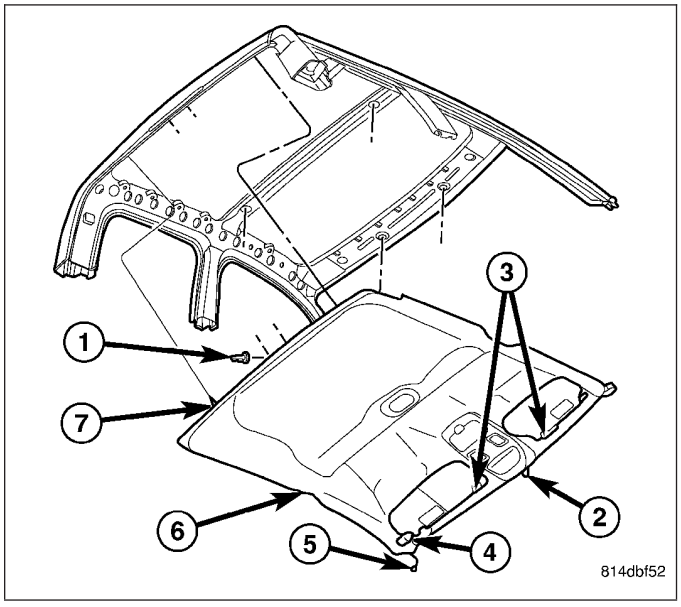


18. Install the front seat headrests.
19. Seat the top of each of door seal to the door opening.

Quad Cab

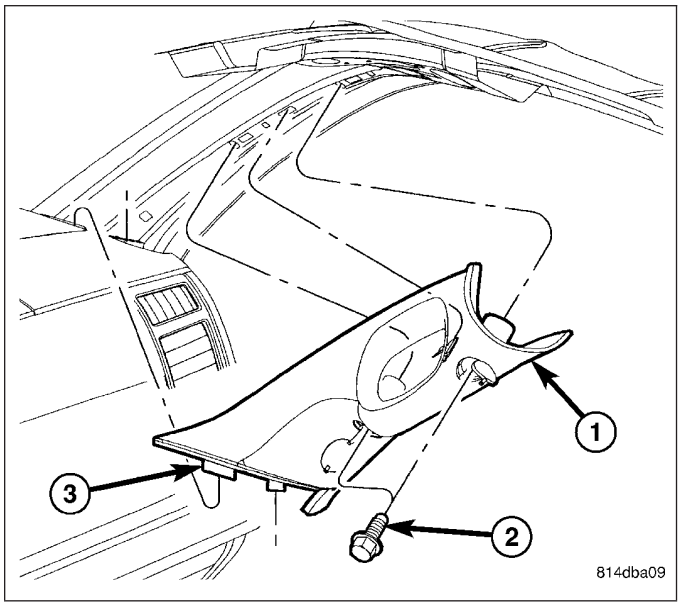
1.

CAUTION: Be careful not to crease the headliner.Position the headliner in the vehicle through the left door opening.

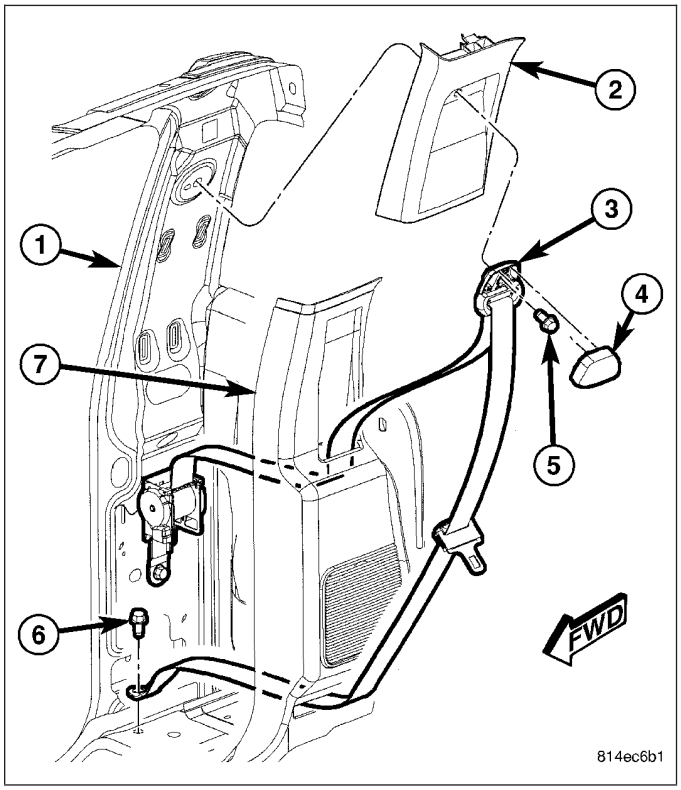


2. Connect the headliner wire harness connector (1) to the center high mounted stop lamp.
3. Raise the rear of the headliner (7) to the roof panel and install the two coat hooks, (Refer to 23 - BODY/INTERIOR/COAT HOOK - INSTALLATION).
4. Raise the front of the headliner to the roof panel and install the sun visor supports (3), (Refer to 23 - BODY/INTERIOR/SUN VISOR SUPPORT - INSTALLATION).
5. Install the left front seat, (Refer to 23 - BODY/SEATS/SEAT-FRONT - INSTALLATION).
6. Install the right front seat headrest.
7. Connect the wire harness connector (5) located at the right A-pillar.
8. If equipped, connect the headliner wire harness connector (2) to the inside rear view mirror.
9. If equipped, install the overhead console, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION).
10. Install the sun visors (4), (Refer to 23 - BODY/INTERIOR/SUN VISOR - INSTALLATION).
11. If equipped, install the front dome lamp, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/FRONT DOME LAMP - INSTALLATION).

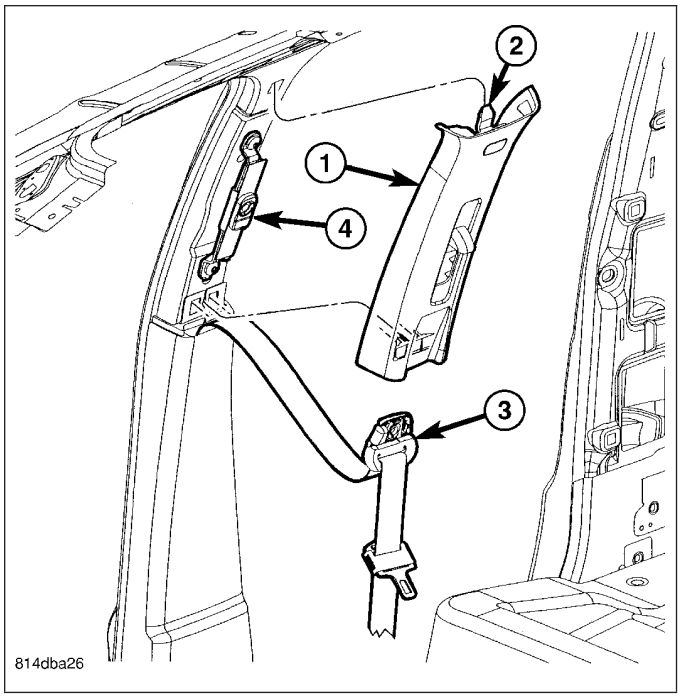
12. Install the A-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-A PILLAR TRIM - INSTALLATION).



13. If equipped, install the rear dome lamp, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/REAR DOME LAMP - INSTALLATION).
14. Install the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - INSTALLATION).



15. Install the upper B-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-B PILLAR UPPER TRIM - INSTALLATION).

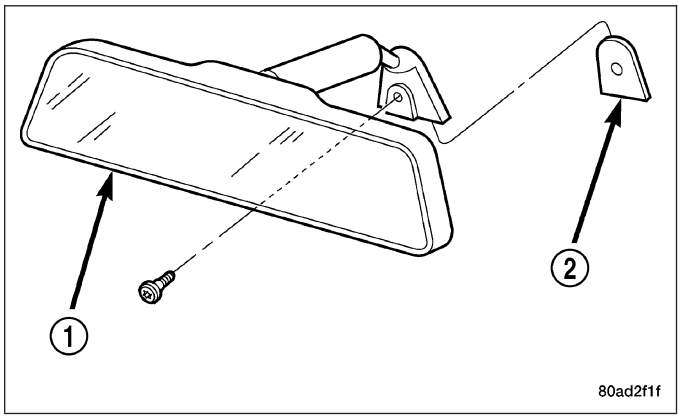


16. Seat the top of each of door seal to the door opening.

MIRROR-INSIDE REARVIEW

REMOVAL

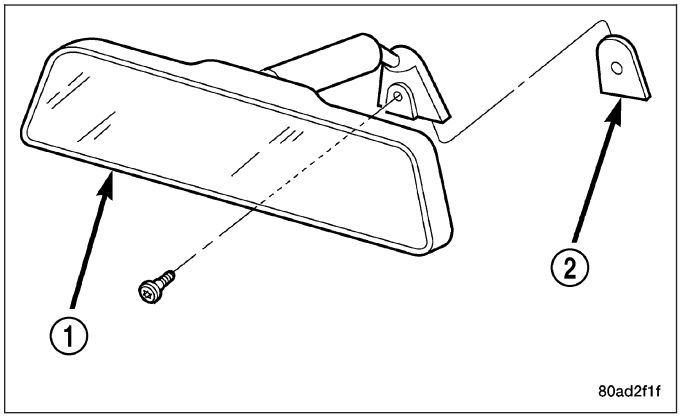
1. If equipped, disconnect the headliner wire harness connector from the mirror base (1).
2. Loosen the mirror base set screw.
3. Slide the mirror base upward and off of the support bracket (2).



INSTALLATION

INSTALLATION - REARVIEW MIRROR

1. Position the mirror base (1) to the support bracket (2) and slide it downward onto the bracket.
2. Tighten set screw to 1 N·m (9 in. lbs.).
3. If equipped, connect the headliner wire harness connector to the mirror base.



INSTALLATION - REARVIEW MIRROR SUPPORT BRACKET

1. Mark the position for the mirror bracket on the outside of the windshield glass with a wax pencil.
2. Clean the bracket contact area on the glass. Use a mild powdered cleanser on a cloth saturated with isopropyl (rubbing) alcohol. Finally, clean the glass with a paper towel dampened with alcohol.
3. Sand the surface on the support bracket with fine grit-sandpaper. Wipe the bracket surface clean with a paper towel.
4. Apply accelerator to the surface on the bracket according to the following instructions:
   - Crush the vial to saturate the felt applicator.
   - Remove the paper sleeve.
   - Apply accelerator to the contact surface on the bracket.
   - Allow the accelerator to dry for five minutes.
   - Do not touch the bracket contact surface after the accelerator has been applied.
5. Apply adhesive accelerator to the bracket contact surface on the windshield glass. Allow the accelerator to dry for one minute. Do not touch the glass contact surface after the accelerator has been applied.
6. Install the bracket according to the following instructions:
   - Apply one drop of adhesive at the center of the bracket contact-surface on the windshield glass.
   - Apply an even coat of adhesive to the contact surface on the bracket.
   - Align the bracket with the marked position on the windshield glass.
   - Press and hold the bracket in place for at least one minute.

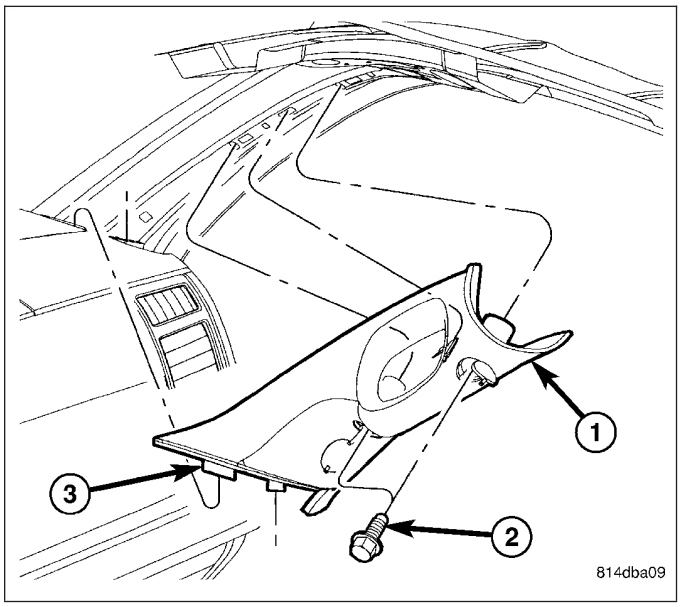
NOTE: Verify that the mirror support bracket is correctly aligned, because the adhesive will cure rapidly.

7. Allow the adhesive to cure for 8-10 minutes. Remove any excess adhesive with an alcohol-dampened cloth.
8. Allow the adhesive to cure for an additional 8-10 minutes before installing the mirror.

PANEL-A PILLAR TRIM

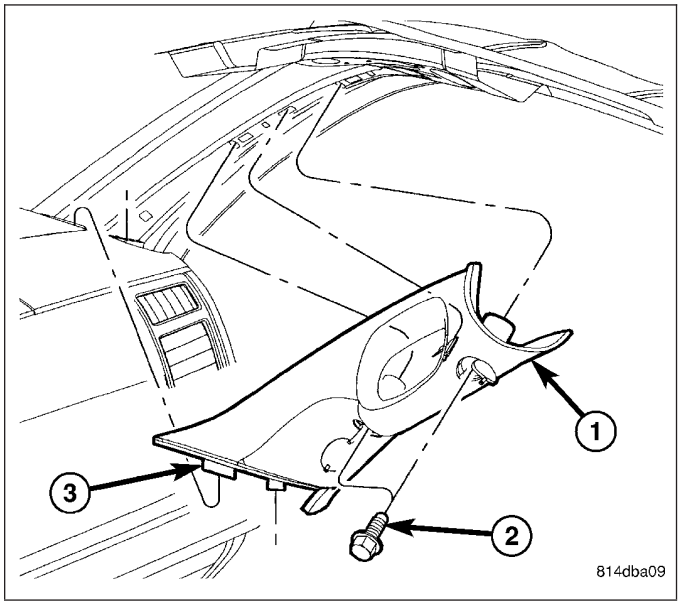
REMOVAL

1. Using a small flat bladed tool or equivalent, carefully open the two fastener covers in the A-pillar trim panel (1).
2. Remove the two bolts (2) that secure the A-pillar trim panel to the A-pillar and remove the trim panel.



INSTALLATION

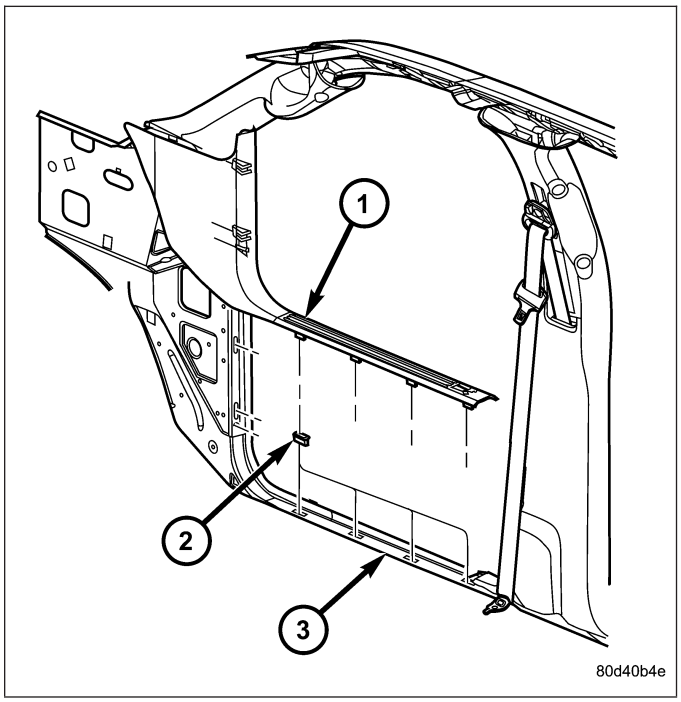
1. Position the locating tabs (3) of the A-pillar trim panel into the slots located in the top of the instrument panel and install the trim panel (1) onto the A-pillar.
2. Install the two bolts (2) that secure the A-pillar trim panel to the A-pillar. Tighten the bolts to 6 N·m (55 in. lbs.).
3. Close the two fastener covers in the A-pillar trim panel.



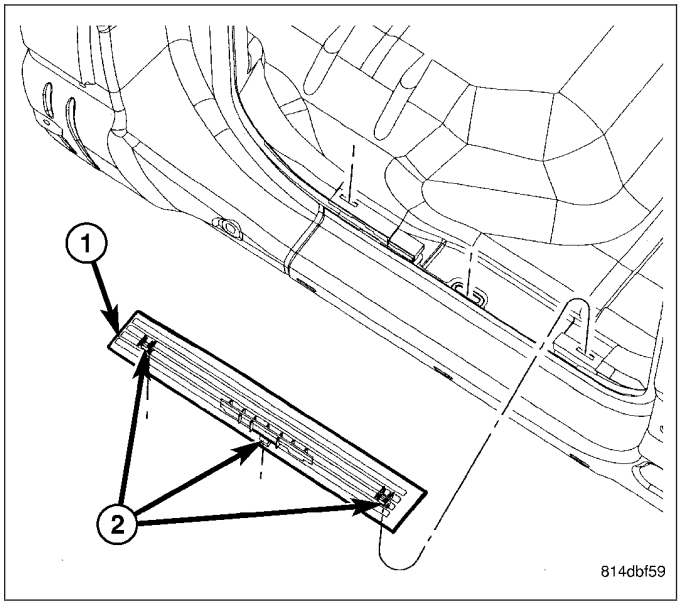
PANEL-B PILLAR LOWER TRIM

REMOVAL

1. Remove the cowl trim panel, (Refer to 23 - BODY/ INTERIOR/PANEL-COWL TRIM - REMOVAL).

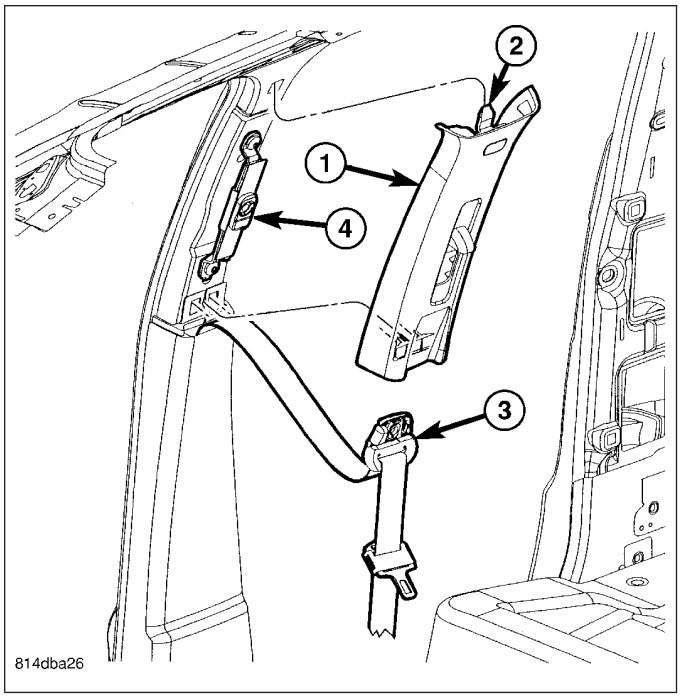


2. Remove the rear door sill scuff plate, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - REMOVAL).

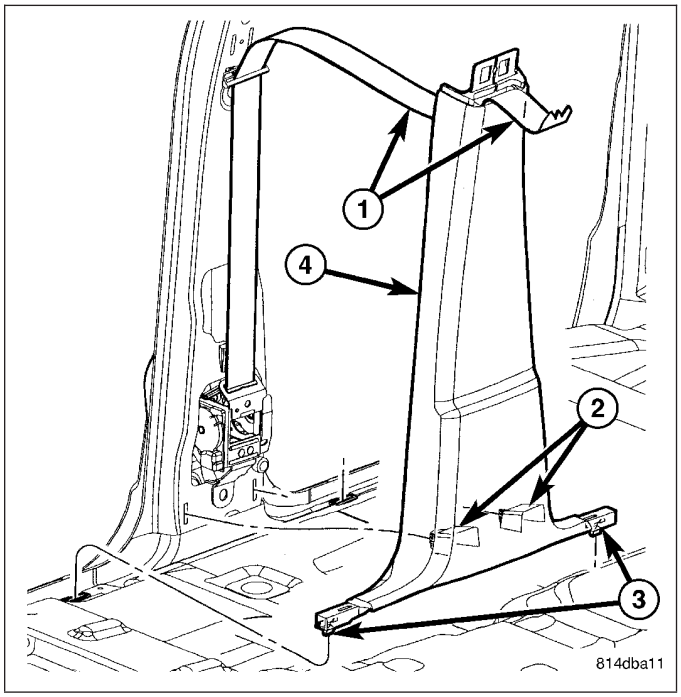


3. Adjust the front seat to its most forward position.

4. Remove the upper B-pillar trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-B PILLAR UPPER TRIM - REMOVAL).

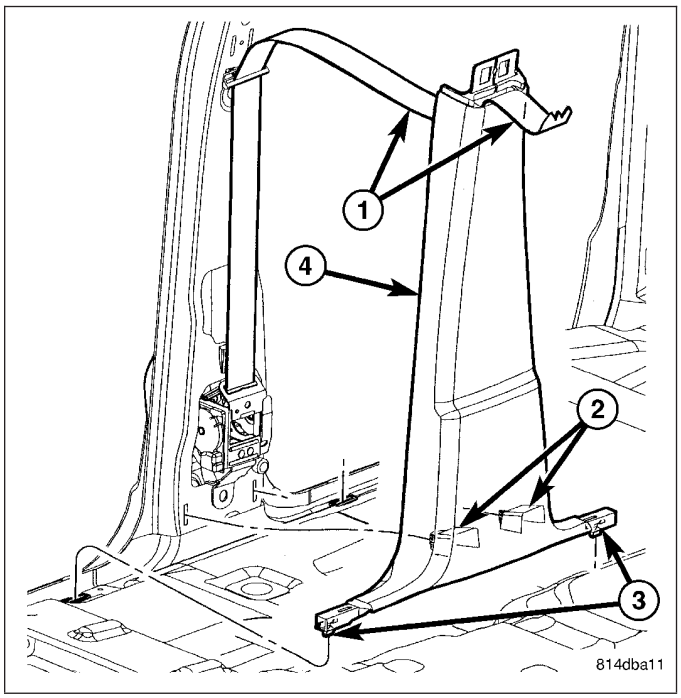


5. Using a trim stick C-4755 or equivalent, disengage the retaining tabs (2) (3) that secure the lower B-pillar trim panel (4) to the B-pillar.
6. Remove the seat belt (1) from the lower B-pillar trim panel through the slot provided and remove the trim panel.

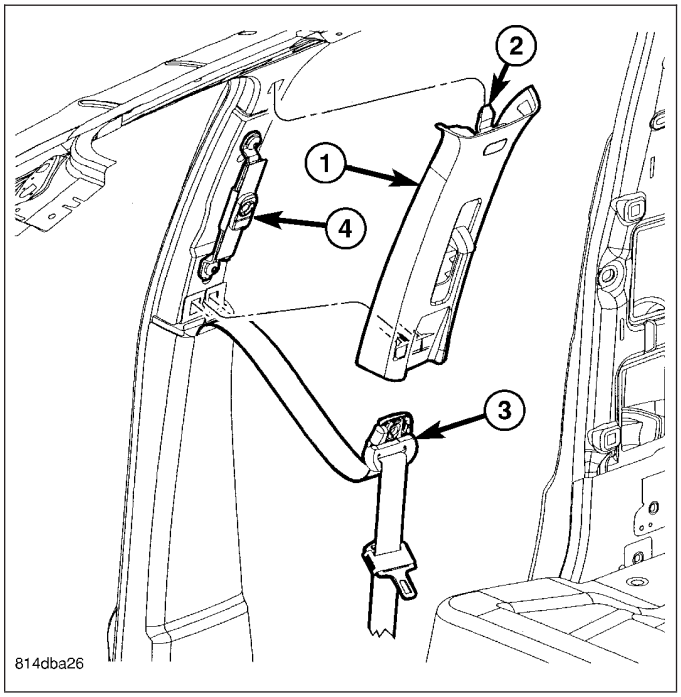


INSTALLATION

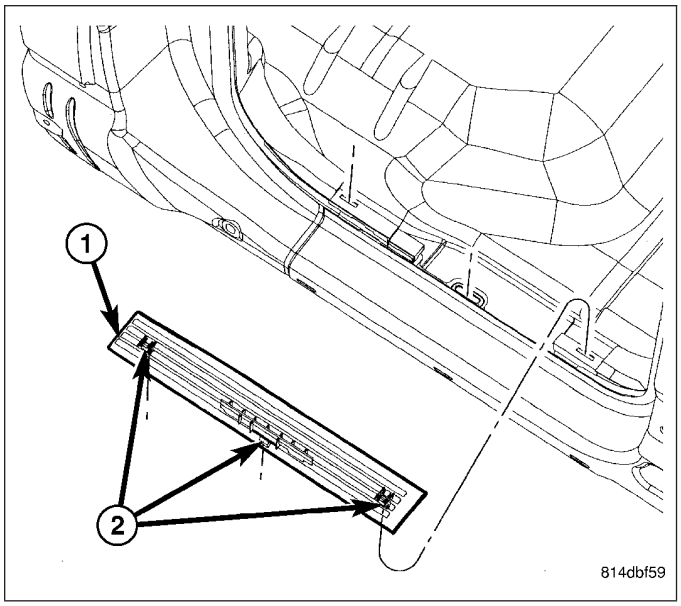
1. Position the lower B-pillar trim panel (4) in the vehicle.
2. Route the seat belt (1) through the slot provided in the lower B-pillar trim panel.
3. Position the lower B-pillar trim panel to the B-pillar and engage the retaining tabs (2) (3) that secure the trim panel to the B-pillar.



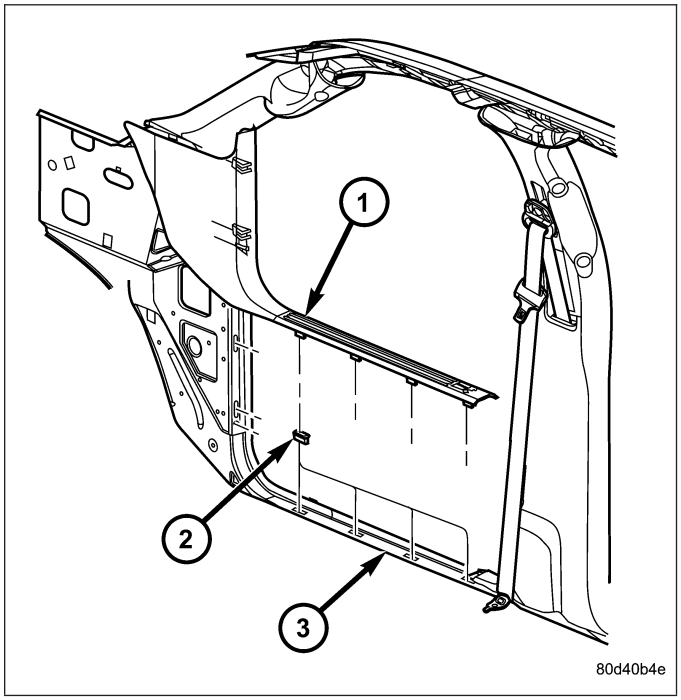
4. Install the upper B-pillar trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-B PILLAR UPPER TRIM - INSTALLATION).



5. Install the rear door sill scuff plate, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - INSTALLATION).



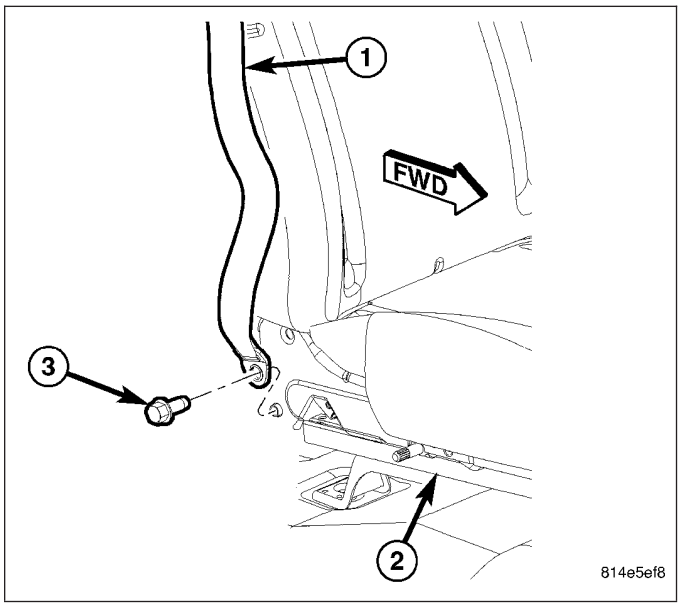
6. Install the cowl trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-COWL TRIM - INSTALLATION).



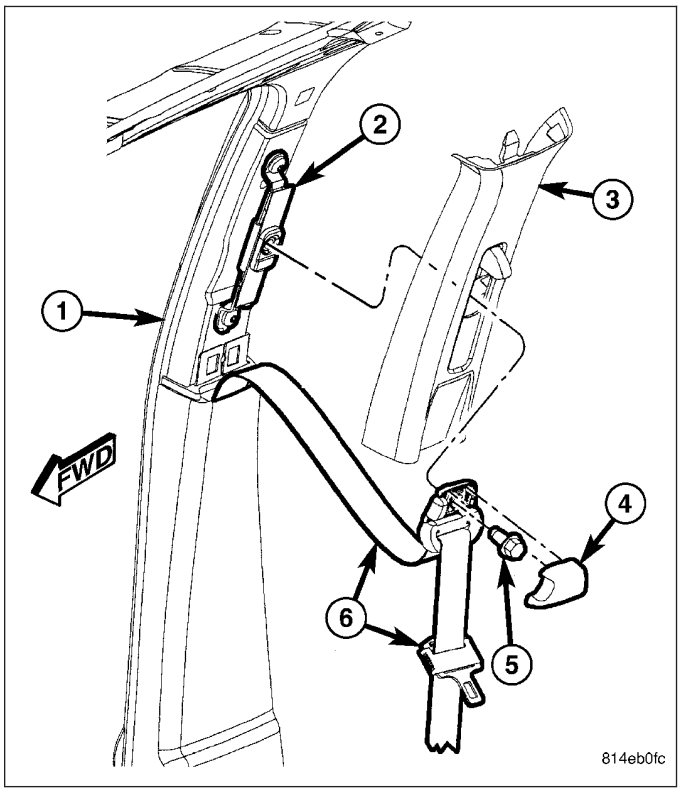
PANEL-B PILLAR UPPER TRIM

REMOVAL

1. Adjust the front seat to its most forward position.
2. Remove the screw (3) that secures the lower anchor to the outboard side of the front seat cushion frame (2).

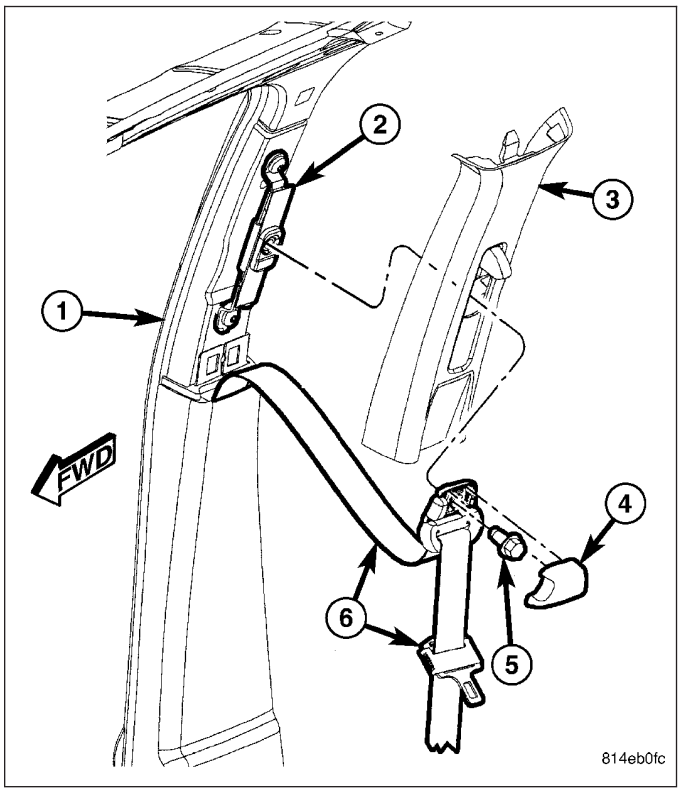


3. Unsnap the trim cover (4) from the front seat belt (6) turning loop.
4. Remove the screw (5) that secures the seat belt turning loop to the height adjuster (2) on the upper B-pillar.
5. Remove the seat belt turning loop from the height adjuster.
6. Using a trim stick C-4755 or equivalent, disengage the retaining tabs that secure the upper B-pillar trim panel (3) to the B-pillar (1) and remove the trim panel.

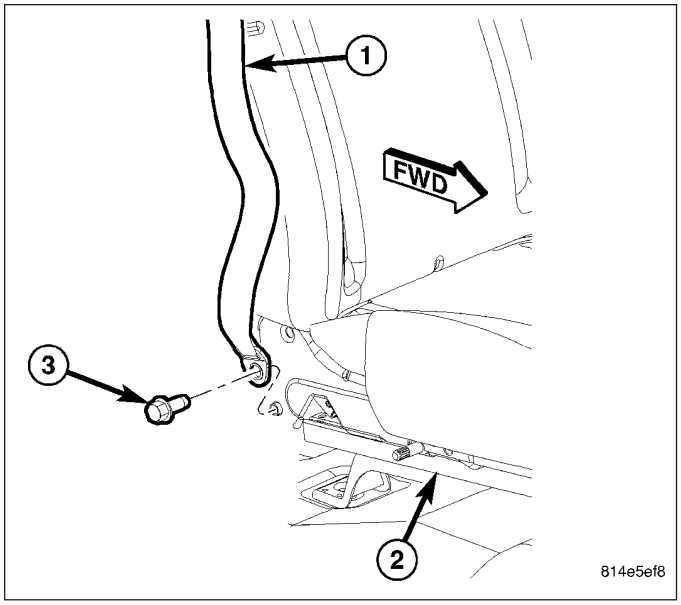


INSTALLATION

1. Slide the upper retaining tab of the upper B-pillar trim panel (3) into the hole in the B-pillar (1) and engage the retaining tabs that secure the trim panel to the B-pillar.
2. Position the seat belt (6) turning loop onto the height adjuster (2) on the upper B-pillar.
3. Install the screw (5) that secures the turning loop to the height adjuster. Tighten the screw to 39 N·m (29 ft. lbs.).
4. Engage the upper edge of a trim cover (4) over the top of the turning loop. Then, squeeze the lower end of the trim cover and the turning loop together firmly and evenly until the engagement tabs of the trim cover snap into the slots of the turning loop.



5. Position the seat belt (1) lower anchor to the mounting hole on the outboard side of the front seat cushion frame (2). Be certain that the seat belt webbing between the turning loop and the lower anchor is not twisted.
6. Install the screw (3) that secures the lower anchor to the outboard side of the front seat cushion frame. Tighten the screw to 39 N·m (29 ft. lbs.).



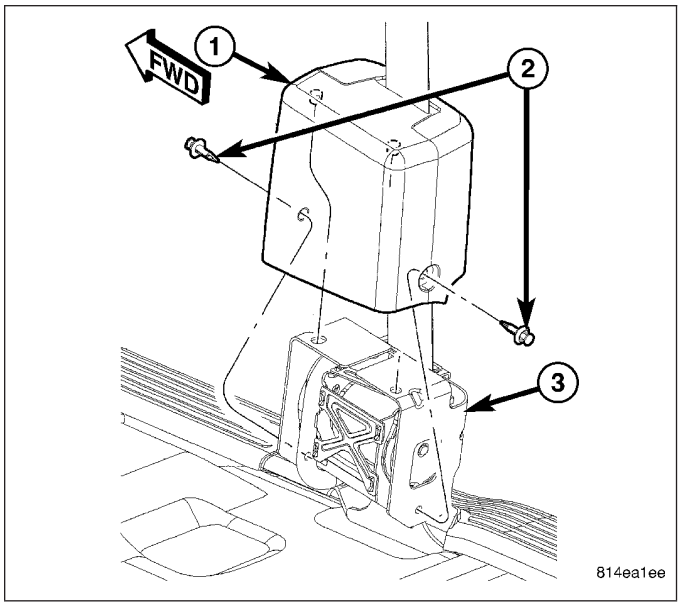
PANEL-C PILLAR LOWER TRIM

REMOVAL

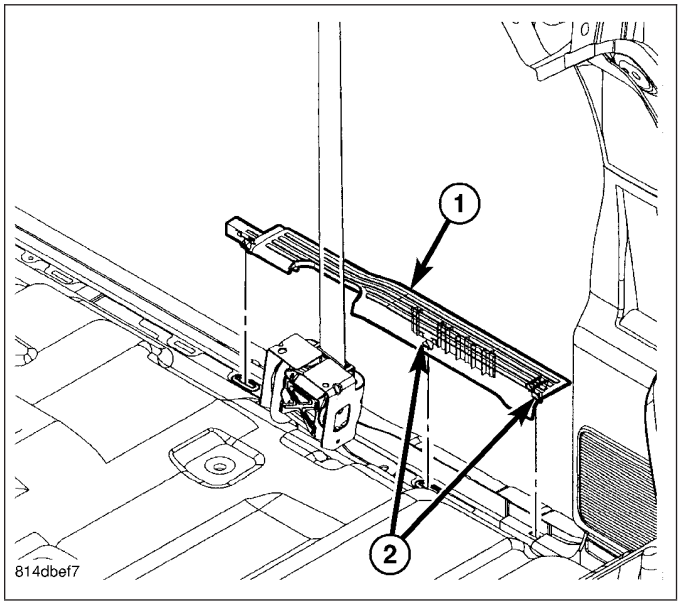
Club Cab, Without Rear Jumper Seats

1. Adjust the front seat to its most forward position.

2. Remove the outer front seat belt retractor cover, (Refer to 23 - BODY/INTERIOR/COVER-OUTER FRONT SEAT BELT RETRACTOR - REMOVAL).



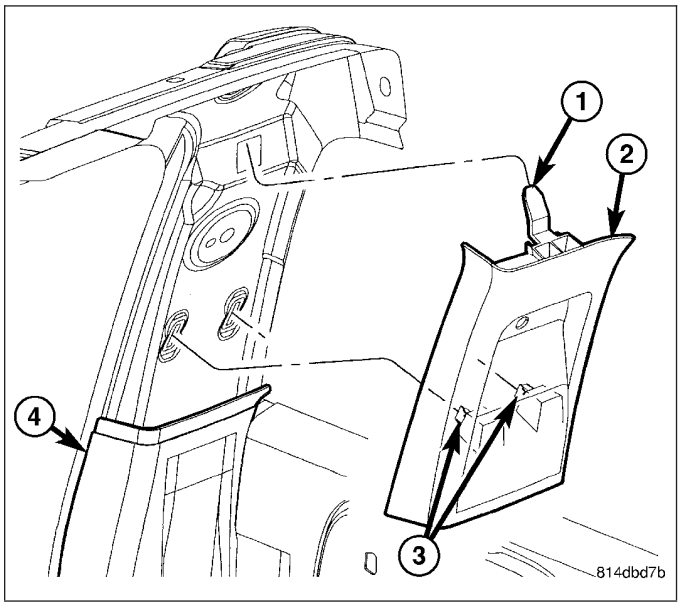
3. Remove the rear door sill scuff plate, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - REMOVAL).



4.

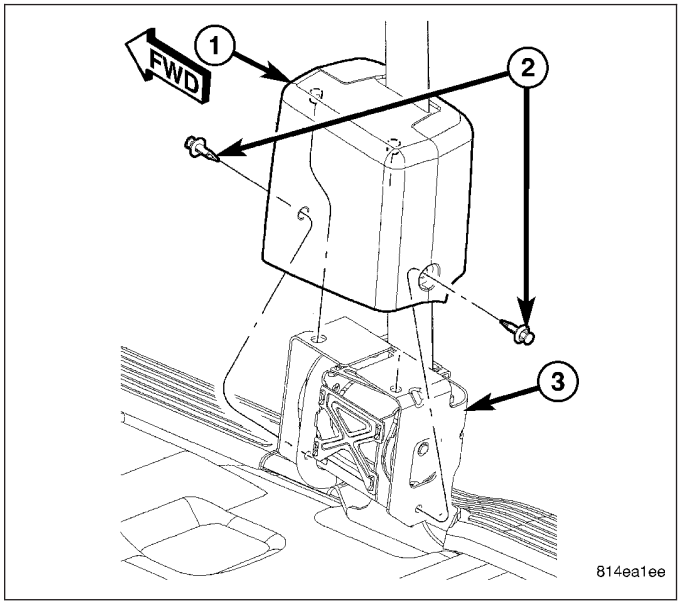
CAUTION: Keep the inner bottom end of the upper C-pillar trim panel away from the cab back trim panel when removing the upper C-pillar trim panel to prevent scratching the back trim panel.Remove the upper C-pillar trim panel, refer to (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL).

5. Using a trim stick C-4755 or equivalent, disengage the retaining tabs that secure the lower C-pillar trim panel (4) to the C-pillar and remove the trim panel.

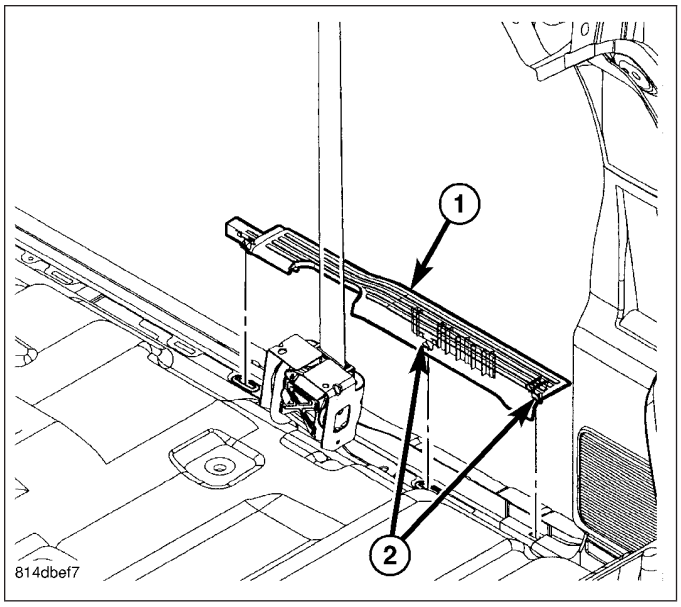


Club Cab, With Rear Jumper Seats

1. Adjust the front seat to its most forward position.
2. Fold up the rear jumper seat.
3. Remove the outer front seat belt retractor cover, (Refer to 23 - BODY/INTERIOR/COVER-OUTER FRONT SEAT BELT RETRACTOR - REMOVAL).



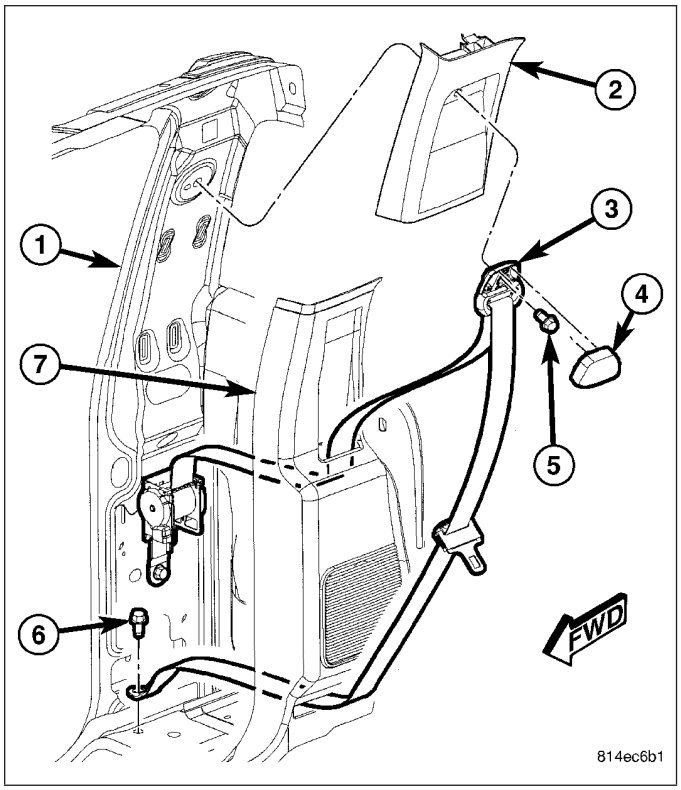
4. Remove the rear door sill scuff plate, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - REMOVAL).



5.

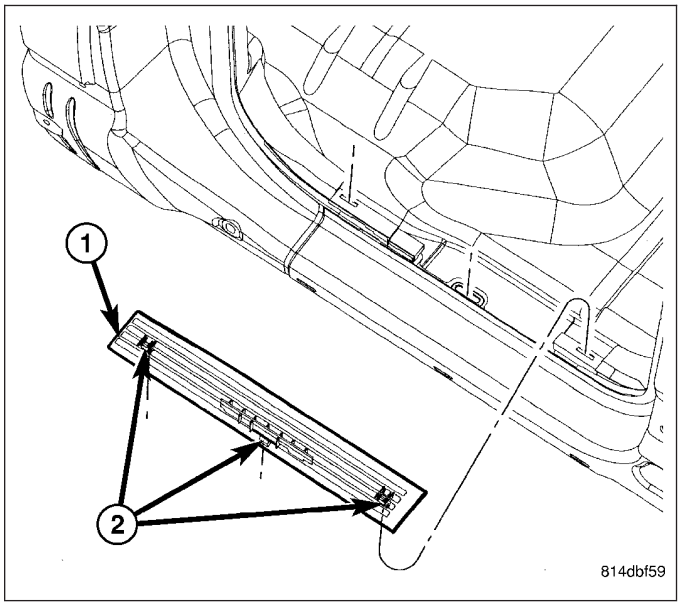
CAUTION: Keep the inner bottom end of the upper C-pillar trim panel away from the cab back trim panel when removing the upper C-pillar trim panel to prevent scratching the back trim panel.Remove the upper C-pillar trim panel, refer to (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL).

6. Using a trim stick C-4755 or equivalent, disengage the retaining tabs that secure the lower C-pillar trim panel (7) to the C-pillar (1).
7. Remove the screw (6) that secures the lower anchor to the floor panel near the base of the C-pillar.
8. Remove the seat belt (3) from the lower C-pillar trim panel through the slots provided and remove the trim panel.



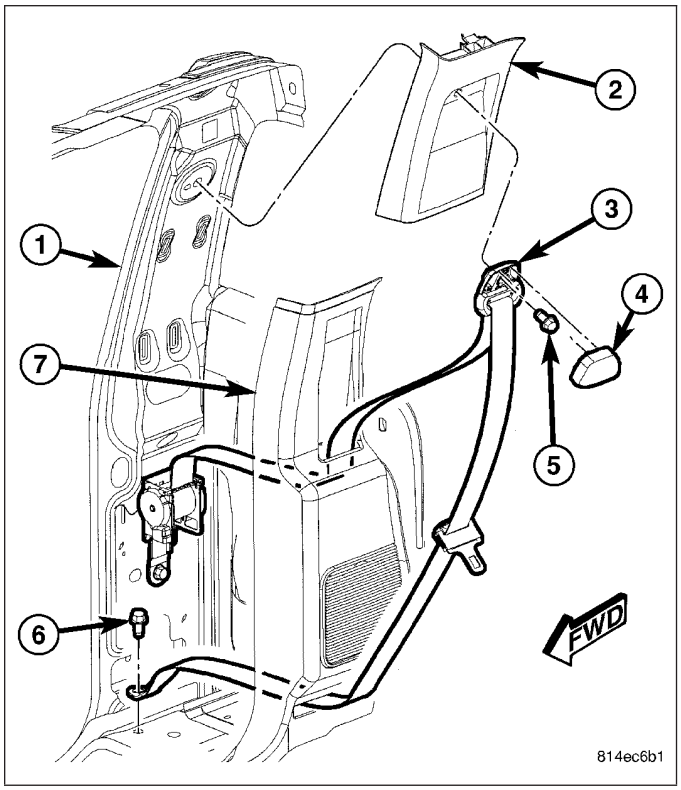
Quad Cab

1. Remove the rear door sill scuff plate, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - REMOVAL).



2. Remove the rear seat, (Refer to 23 - BODY/SEATS/SEAT-SECOND ROW - REMOVAL).

3. Remove the upper C-pillar trim panel, refer to (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL).
4. Using a trim stick C-4755 or equivalent, disengage the retaining tabs that secure the lower C-pillar trim panel (7) to the C-pillar (1).
5. Remove the screw (6) that secures the lower anchor to the floor panel near the base of the C-pillar.
6. Remove the seat belt (3) from the lower C-pillar trim panel through the slots provided and remove the trim panel.

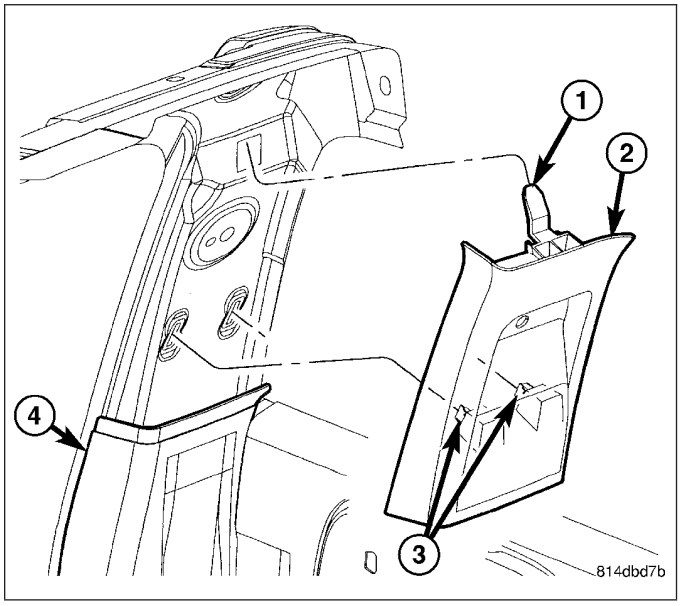


INSTALLATION

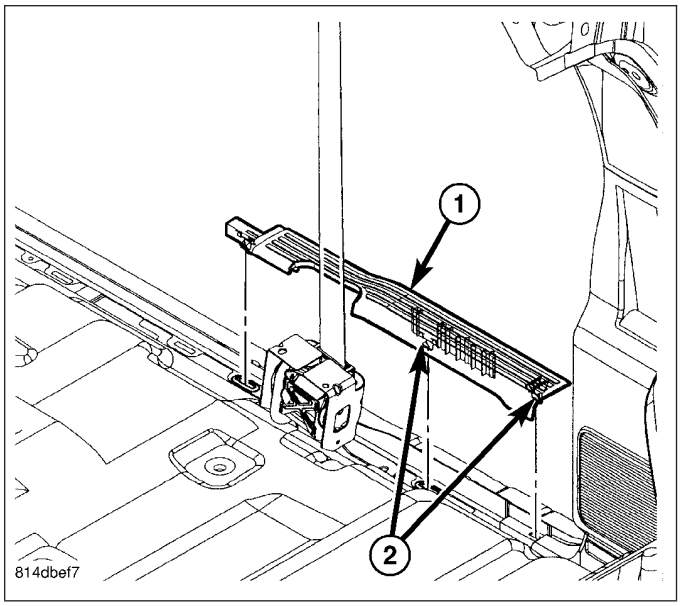
Club Cab, Without Rear Jumper Seats

1. Position the lower C-pillar trim panel (4) to the C-pillar and engage the retaining tabs that secure the trim panel to the C-pillar.
2.

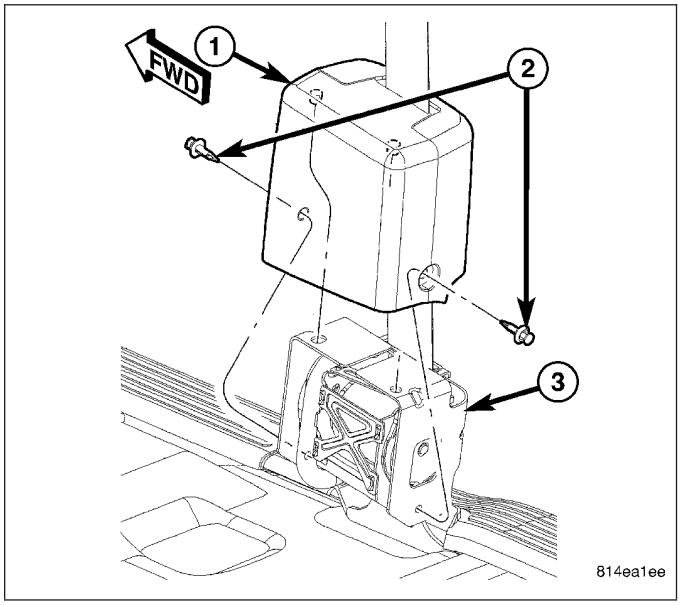
CAUTION: Keep the inner bottom end of the upper C-pillar trim panel away from the cab back trim panel when installing the upper C-pillar trim panel to prevent scratching the back trim panel.Install the upper C-pillar trim panel, (Refer to 23 - BODY/ INTERIOR/PANEL-C PILLAR UPPER TRIM - INSTALLATION).



3. Install the rear door sill scuff plate, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - INSTALLATION).



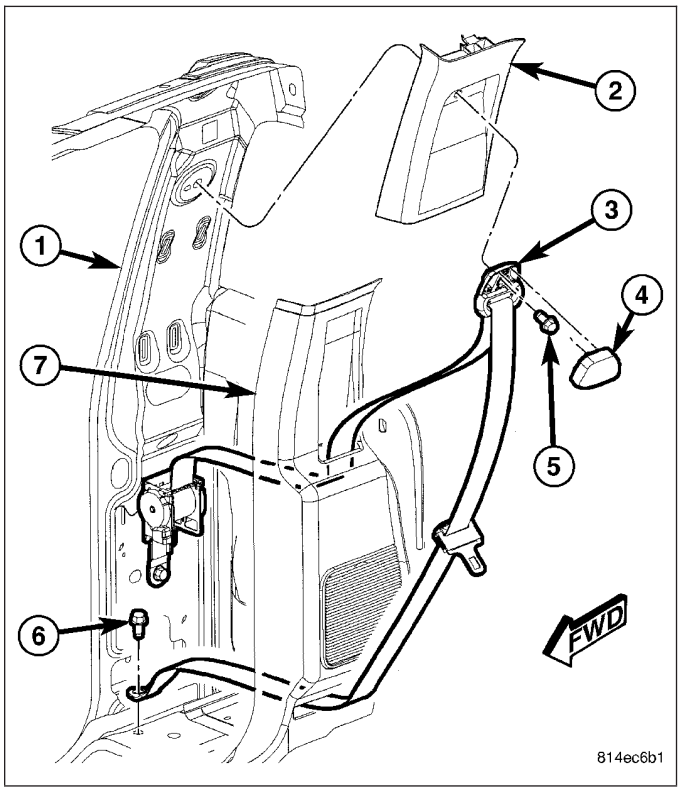
4. Install the outer front seat belt retractor cover, (Refer to 23 - BODY/INTERIOR/COVER-OUTER FRONT SEAT BELT RETRACTOR - INSTALLATION).



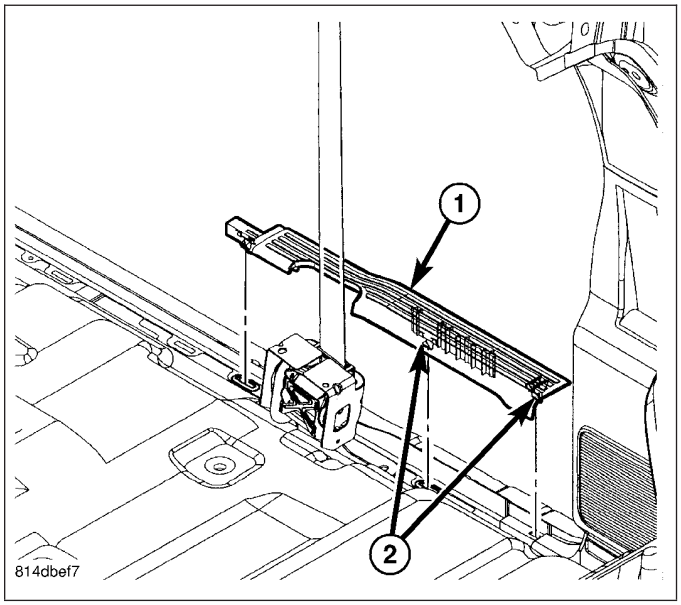
Club Cab, With Rear Jumper Seats

1. Position the lower C-pillar trim panel (7) in the vehicle.
2. Route the seat belt, lower anchor, latch plate and turning loop (3) through the slots provided in the lower C-pillar trim panel. Verify that the seat belt webbing between the retractor and the lower anchor is not twisted.
3. Position the seat belt lower anchor to the mounting hole in the floor panel near the base of the C-pillar and Install the screw (6) that secures the lower anchor to the floor panel. Tighten the screw to 39 N·m (29 ft. lbs.).
4. Position the lower C-pillar trim panel to the C-pillar (1) and engage the retaining tabs that secure the trim panel to the C-pillar.
5.

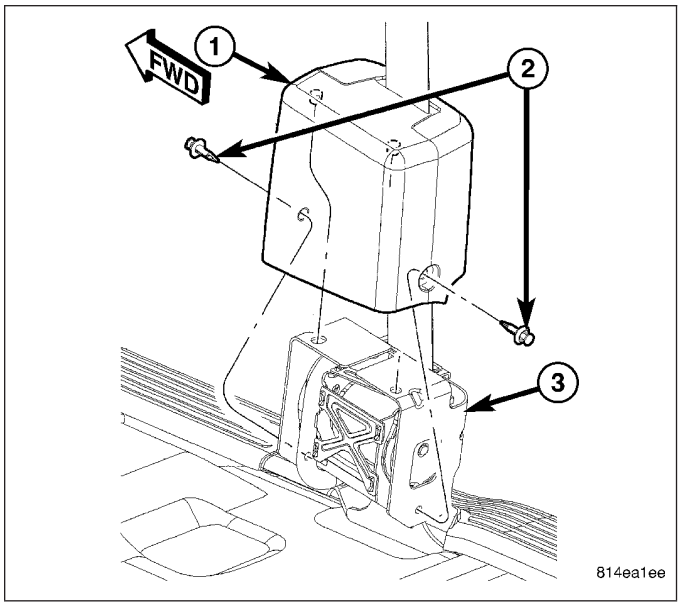
CAUTION: Keep the inner bottom end of the upper C-pillar trim panel away from the cab back trim panel when installing the upper C-pillar trim panel to prevent scratching the back trim panel.Install the upper C-pillar trim panel, (Refer to 23 - BODY/ INTERIOR/PANEL-C PILLAR UPPER TRIM - INSTALLATION).



6. Install the rear door sill scuff plate, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - INSTALLATION).

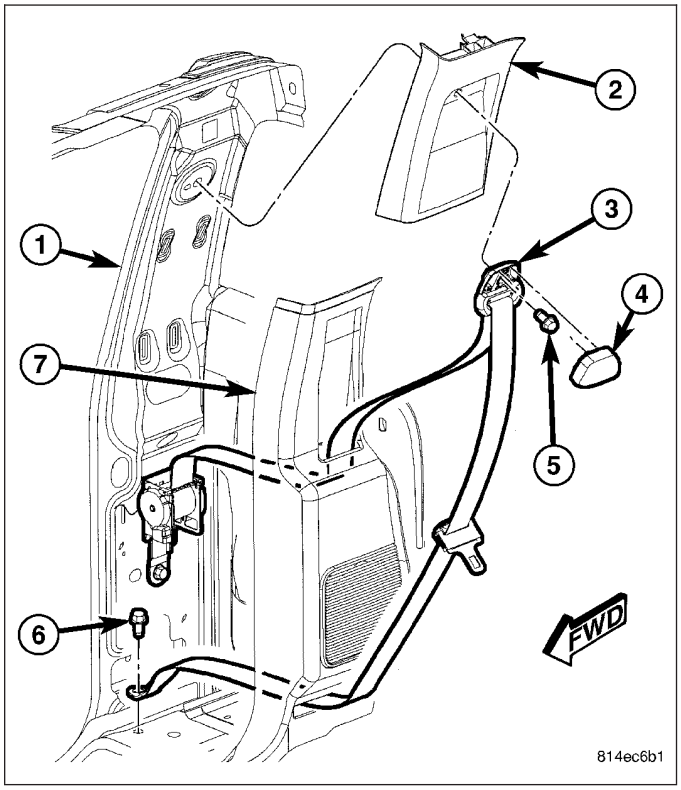


7. Install the outer front seat belt retractor cover, (Refer to 23 - BODY/INTERIOR/COVER-OUTER FRONT SEAT BELT RETRACTOR - INSTALLATION).



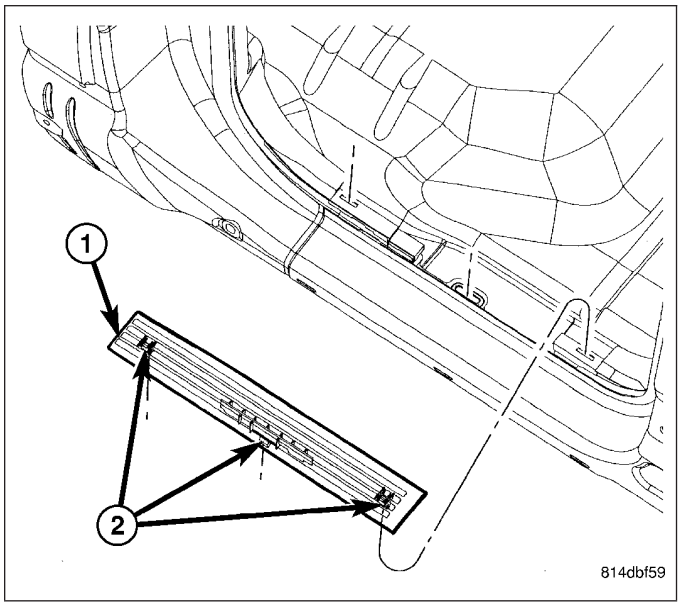
Quad Cab

1. Position the lower C-pillar trim panel (7) in the vehicle.
2. Route the seat belt, lower anchor, latch plate and turning loop (3) through the slots provided in the lower C-pillar trim panel. Verify that the seat belt webbing between the retractor and the lower anchor is not twisted.
3. Position the seat belt lower anchor to the mounting hole in the floor panel near the base of the C-pillar and Install the screw (6) that secures the lower anchor to the floor panel. Tighten the screw to 39 N·m (29 ft. lbs.).
4. Position the lower C-pillar trim panel to the C-pillar (1) and engage the retaining tabs that secure the trim panel to the C-pillar.
5. Install the upper C-pillar trim panel, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - INSTALLATION).



6. Install the rear seat, (Refer to 23 - BODY/SEATS/SEAT-SECOND ROW - INSTALLATION).

7. Install the rear door sill scuff plate, (Refer to 23 - BODY/INTERIOR/PLATE-DOOR SCUFF - INSTALLATION).



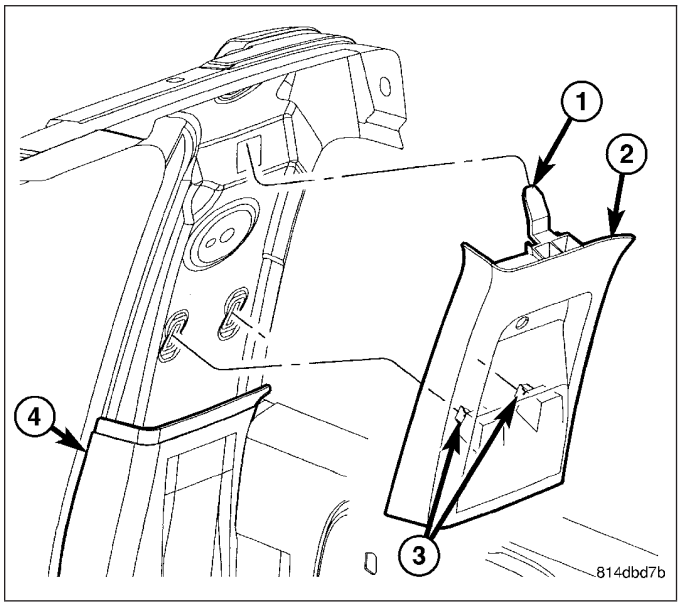
PANEL-C PILLAR UPPER TRIM

REMOVAL

Club Cab, Without Rear Jumper Seats

1. Adjust the front seat to its most forward position.
2.

CAUTION: Keep the inner bottom end of the upper C-pillar trim panel away from the cab back trim panel when removing the upper C-pillar trim panel to prevent scratching the back trim panel.Using a trim stick C-4755 or equivalent, disengage the retaining tabs (3) that secure the upper C-pillar trim panel (2) to the C-pillar. Pull the outer bottom end of the trim panel outward toward the door opening so that the inner bottom end of the trim panel doesn't touch the cab back trim panel. While maintaining the outward pressure, pull the trim panel away from the C-pillar and remove the trim panel.

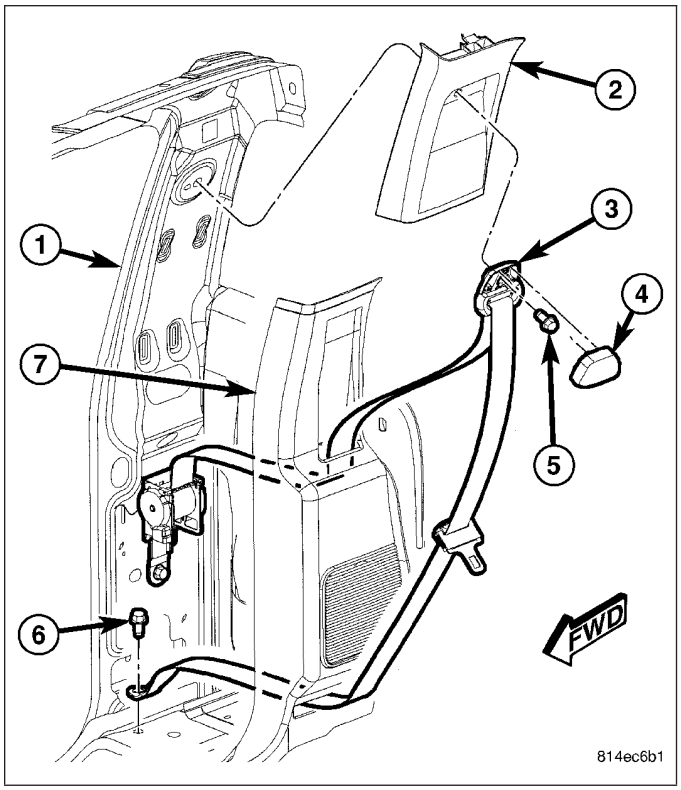


Club Cab, With Rear Jumper Seats

1. Adjust the front seat to its most forward position.

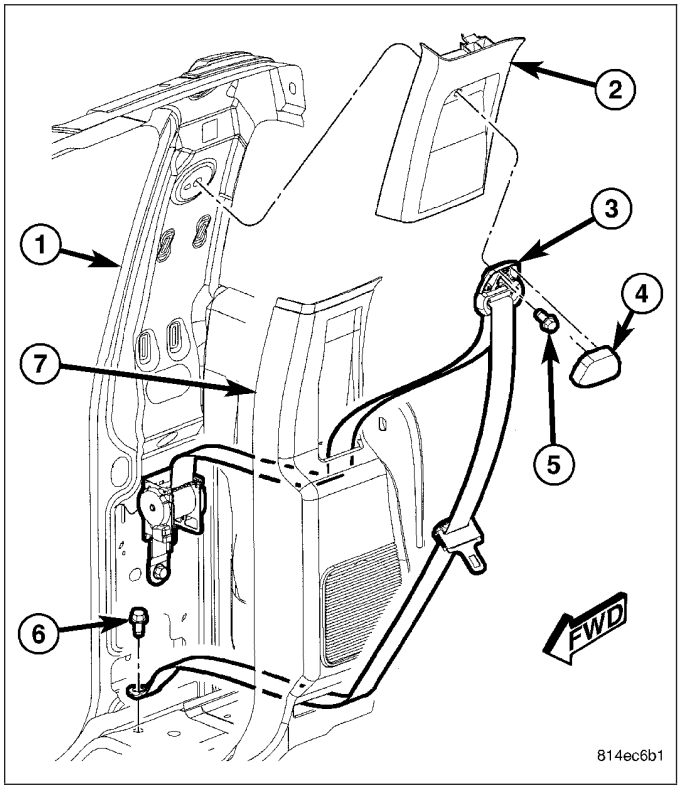
2. Unsnap the trim cover (4) from the rear seat belt turning loop (3).
3. Remove the screw (5) that secures the seat belt turning loop to the upper C-pillar (1).
4. Remove the seat belt turning loop from the C-pillar.
5.

CAUTION: Keep the inner bottom end of the upper C-pillar trim panel away from the cab back trim panel when removing the upper C-pillar trim panel to prevent scratching the back trim panel.Using a trim stick C-4755 or equivalent, disengage the retaining tabs that secure the upper C-pillar trim panel (2) to the C-pillar. Pull the outer bottom end of the trim panel outward toward the door opening so that the inner bottom end of the trim panel doesn't touch the cab back trim panel. While maintaining the outward pressure, pull the trim panel away from the C-pillar and remove the trim panel.



Quad Cab

1. Unsnap the trim cover (4) from the rear seat belt turning loop (3).
2. Remove the screw (5) that secures the seat belt turning loop to the upper C-pillar (1).
3. Remove the seat belt turning loop from the C-pillar.
4. Using a trim stick C-4755 or equivalent, disengage the retaining tabs that secure the upper C-pillar trim panel (2) to the C-pillar and then pull the trim panel away from the C-pillar and remove the trim panel.

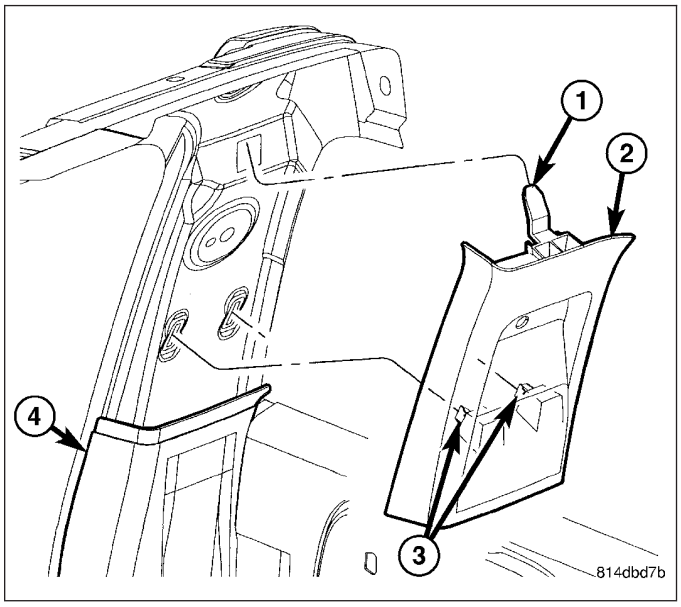


INSTALLATION

Club Cab, Without Rear Jumper Seats

1.

CAUTION: Keep the inner bottom end of the upper C-pillar trim panel away from the cab back trim panel when installing the upper C-pillar trim panel to prevent scratching the back trim panel.Keeping the inner bottom end of the upper C-pillar trim panel (2) away from the cab back trim panel, slide the upper retaining tab (1) of the trim panel into the hole in the C-pillar and engage the retaining tabs (3) that secure the trim panel to the C-pillar.

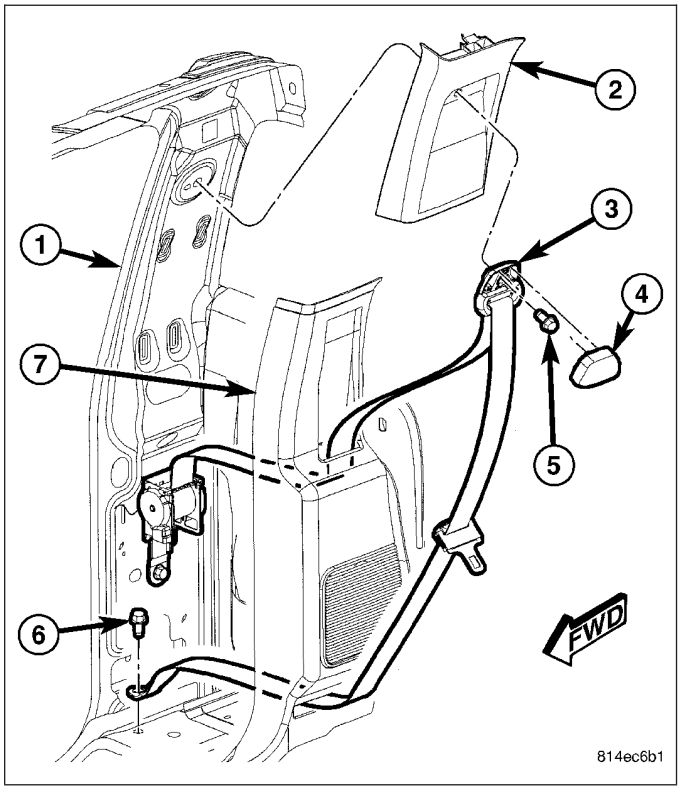


Club Cab, With Rear Jumper Seats

1.

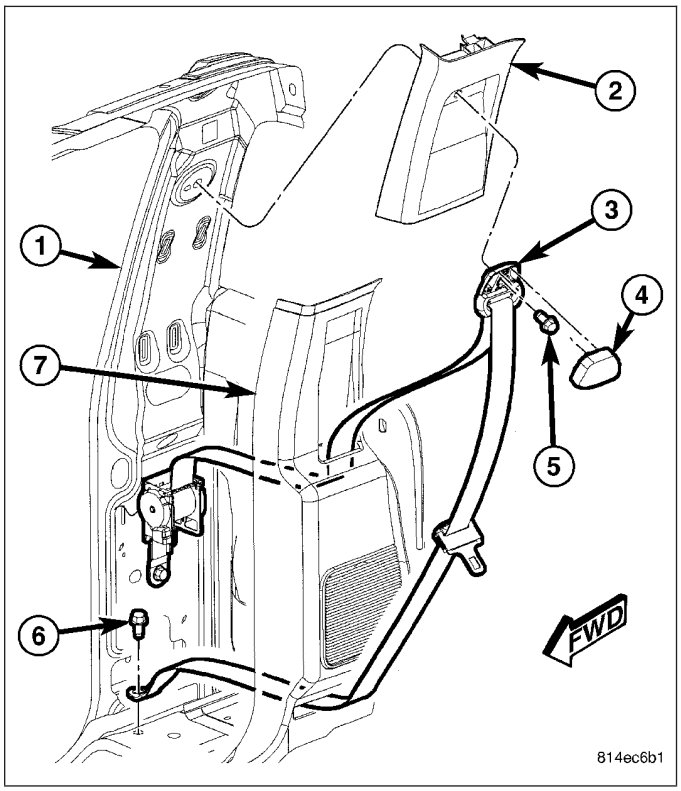
CAUTION: Keep the inner bottom end of the upper C-pillar trim panel away from the cab back trim panel when installing the upper C-pillar trim panel to prevent scratching the back trim panel.Keeping the inner bottom end of the upper C-pillar trim panel (2) away from the cab back trim panel, slide the upper retaining tab of the trim panel into the hole in the C-pillar and engage the retaining tabs that secure the trim panel to the C-pillar.

2. Position the seat belt turning loop (3) to the mounting hole in the upper C-pillar trim panel and install the screw (5) that secures the seat belt turning loop to the C-pillar. Tighten the screw to 39 N·m (29 ft. lbs.).
3. Engage the upper edge of the trim cover (4) over the top of the turning loop. Then, squeeze the lower end of the trim cover and the turning loop together firmly and evenly until the engagement tabs of the trim cover snap into the slots of the turning loop.



Quad Cab

1. Slide the upper retaining tab of the upper C-pillar trim panel (2) into the hole in the C-pillar and engage the retaining tabs that secure the trim panel to the C-pillar.
2. Position the seat belt turning loop (3) to the mounting hole in the upper C-pillar trim panel and install the screw (5) that secures the seat belt turning loop to the C-pillar. Tighten the screw to 39 N·m (29 ft. lbs.).
3. Engage the upper edge of the trim cover (4) over the top of the turning loop. Then, squeeze the lower end of the trim cover and the turning loop together firmly and evenly until the engagement tabs of the trim cover snap into the slots of the turning loop.

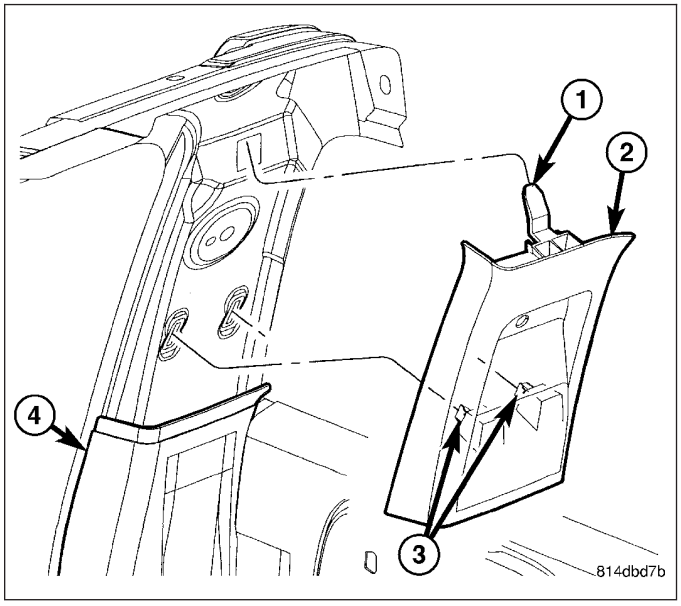


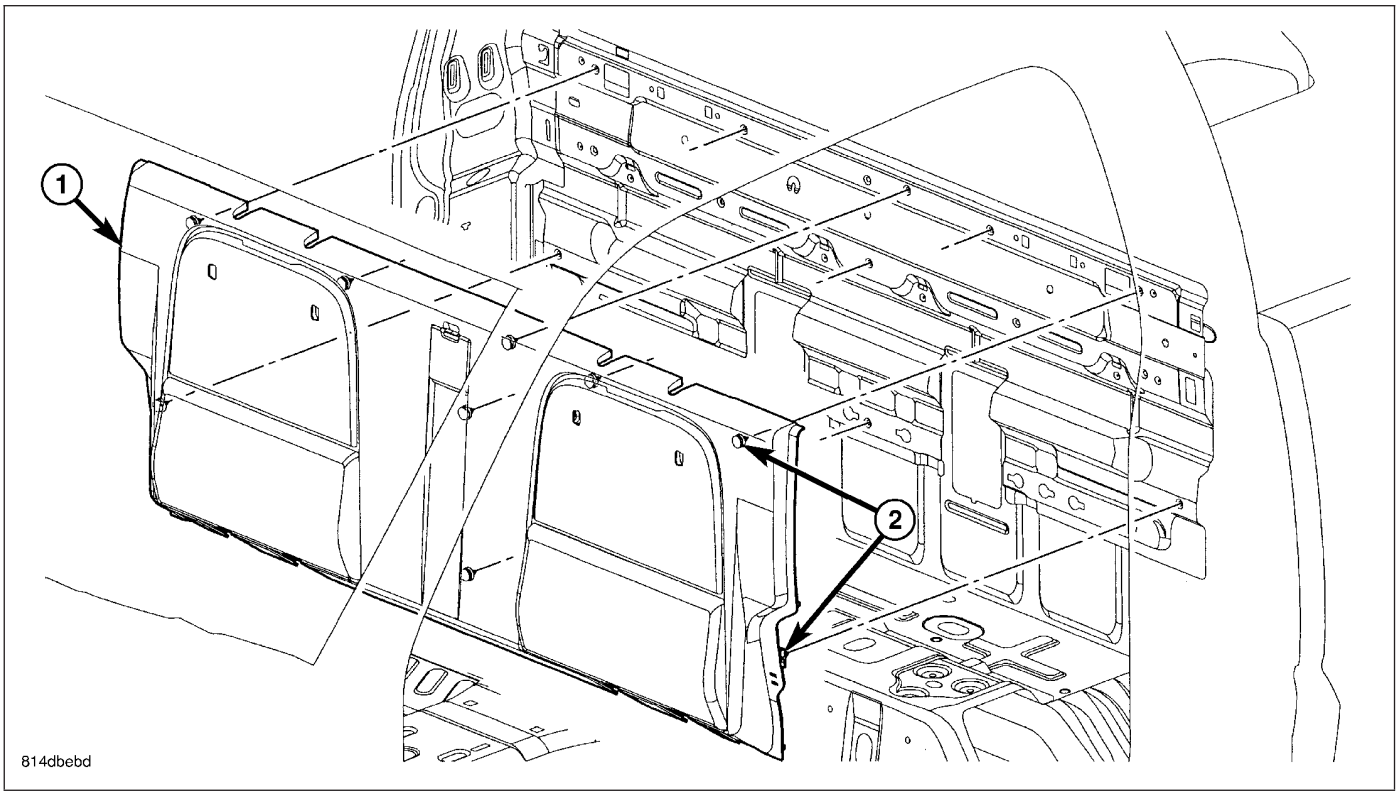
PANEL-CAB BACK TRIM

REMOVAL

Club Cab, Without Rear Jumper Seats

1. Remove the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL).
2. Remove the lower C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - REMOVAL).



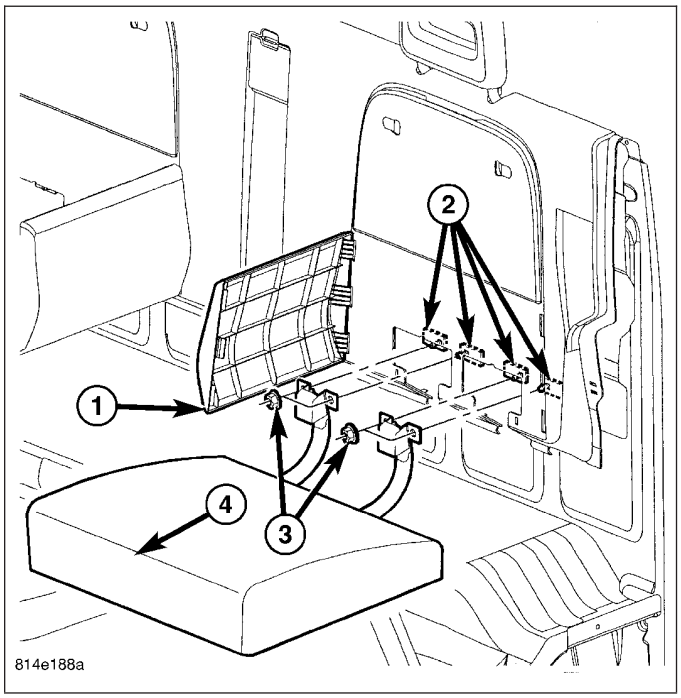


NOTE: Cab back trim panel with jumper seats shown. Trim panel without similar.

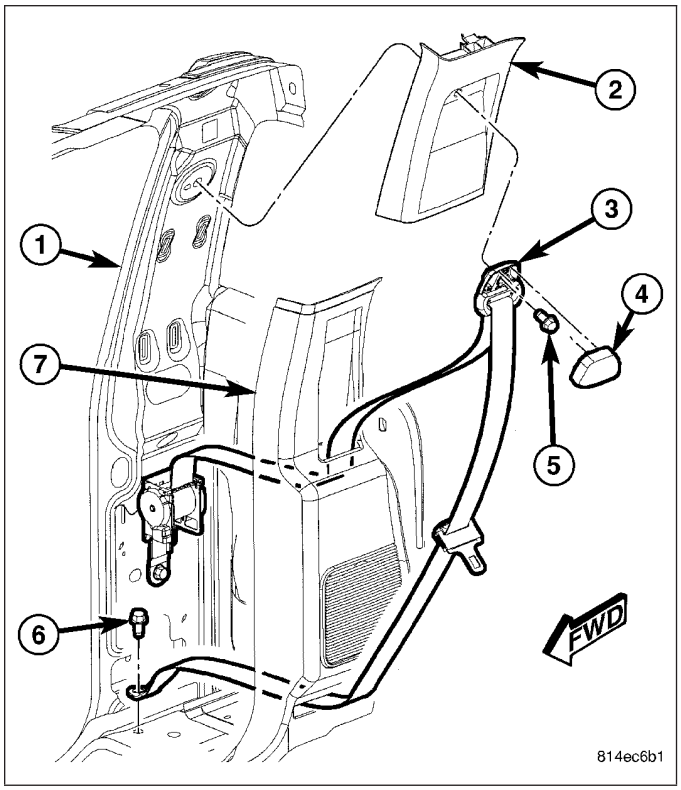
3. Using a trim stick C-4755 or equivalent, disengage the retaining clips (2) that secure the cab back trim panel (1) to the cab and remove the trim panel.

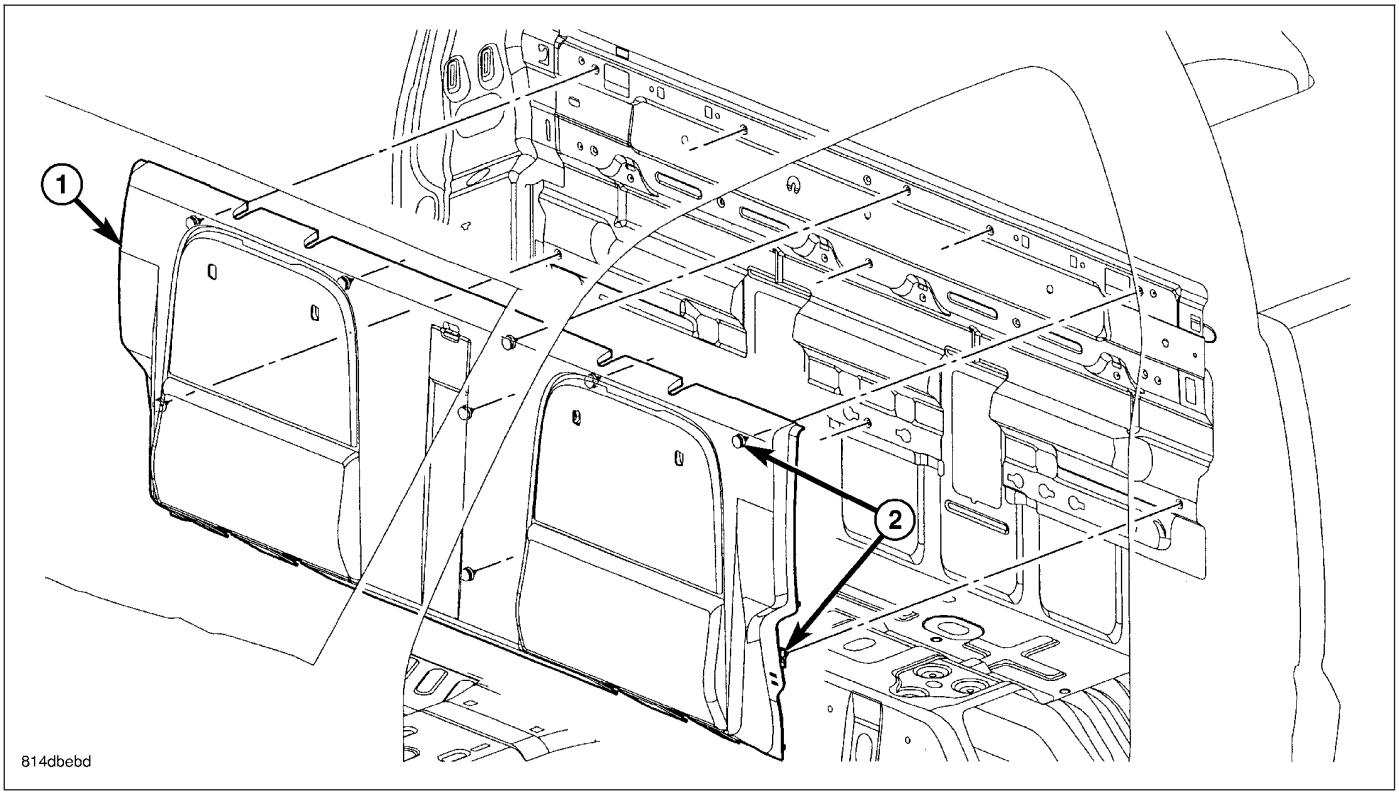
Club Cab, With Rear Jumper Seats

1. Remove the rear jumper seat cushions, (Refer to 23 - BODY/SEATS/SEAT-SECOND ROW - REMOVAL).



2. Remove the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL).
3. Remove the lower C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - REMOVAL).

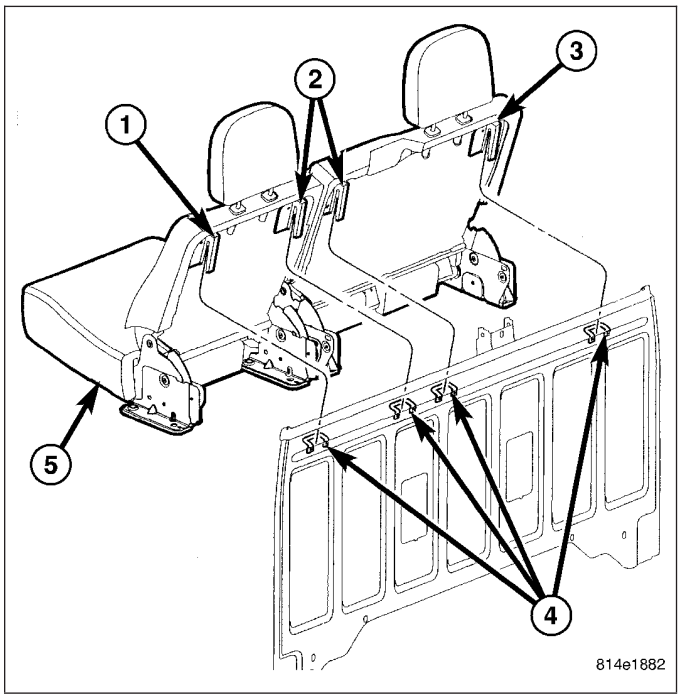




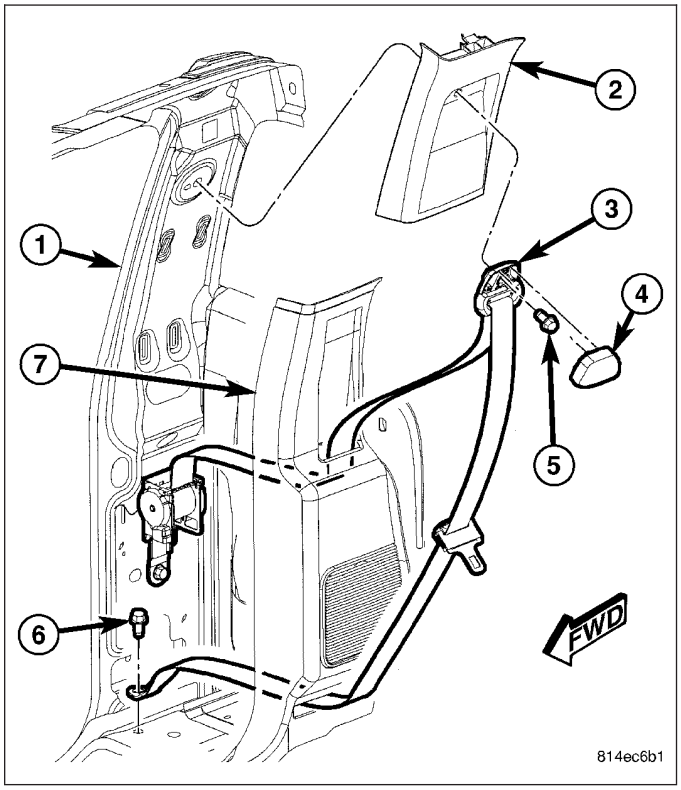
4. Using a trim stick C-4755 or equivalent, disengage the retaining clips (2) that secure the cab back trim panel (1) to the cab and remove the trim panel.

Quad Cab

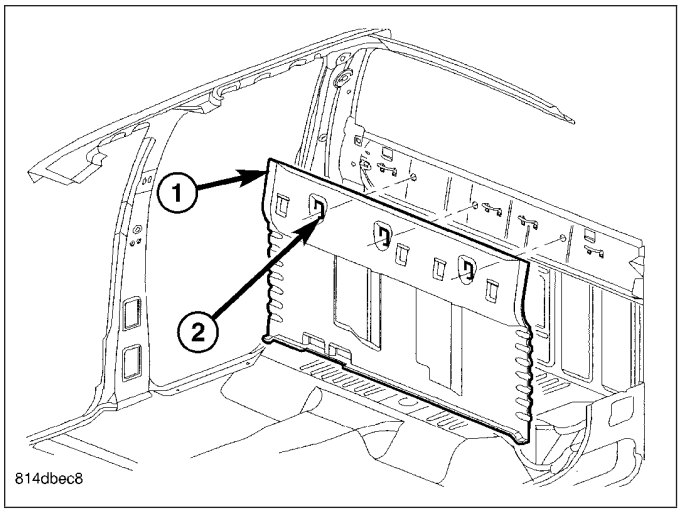
1. Remove the rear seats, (Refer to 23 - BODY/SEATS/SEAT-SECOND ROW - REMOVAL).



2. Remove the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL).
3. Remove the lower C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - REMOVAL).

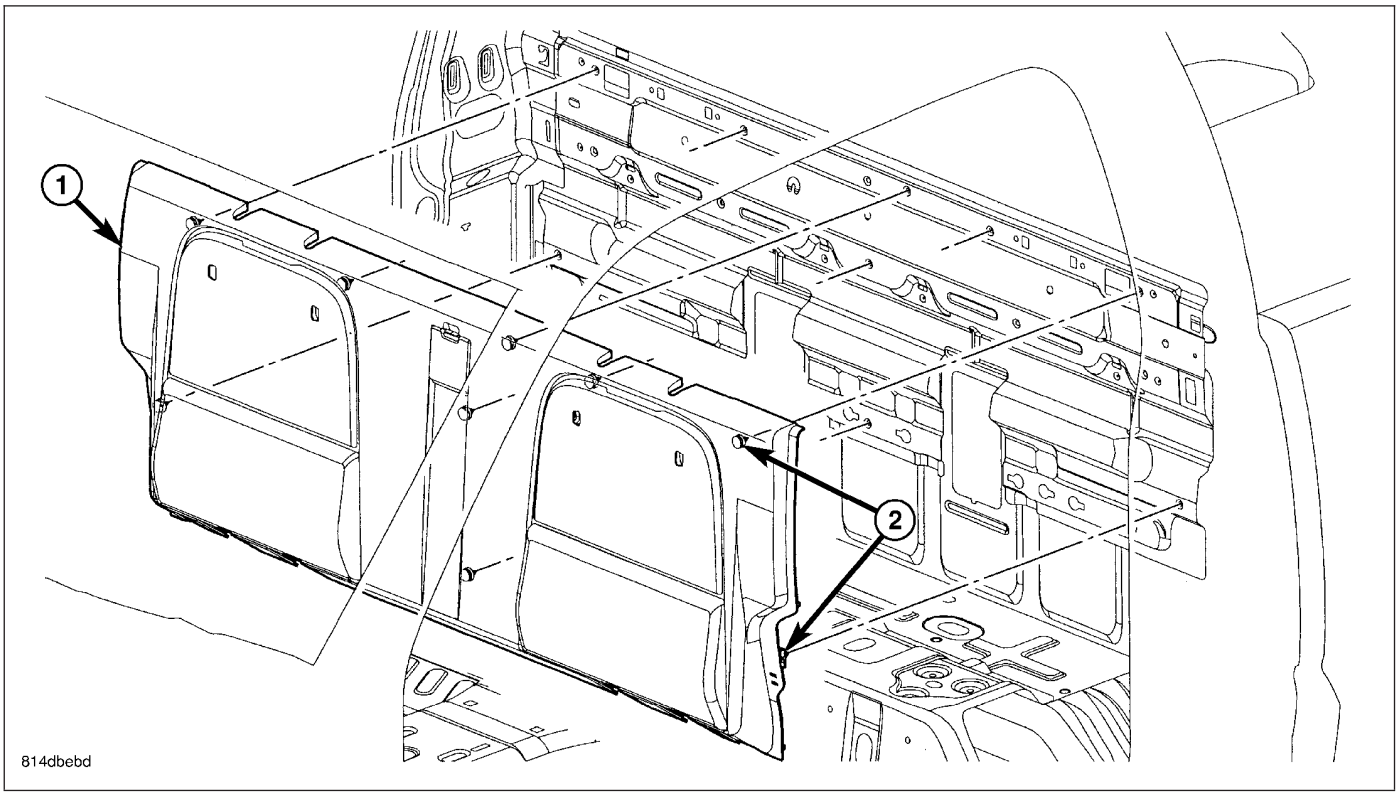


4. Remove the three fasteners (2) that secure the cab back trim panel (1) to the cab.
5. Using a trim stick C-4755 or equivalent, disengage the retaining clips that secure the cab back trim panel to the cab and remove the trim panel.



INSTALLATION

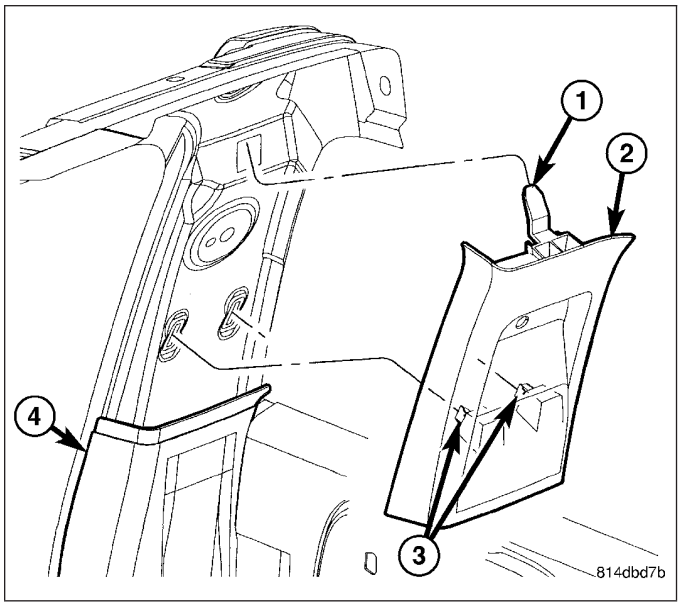
Club Cab, Without Rear Jumper Seats



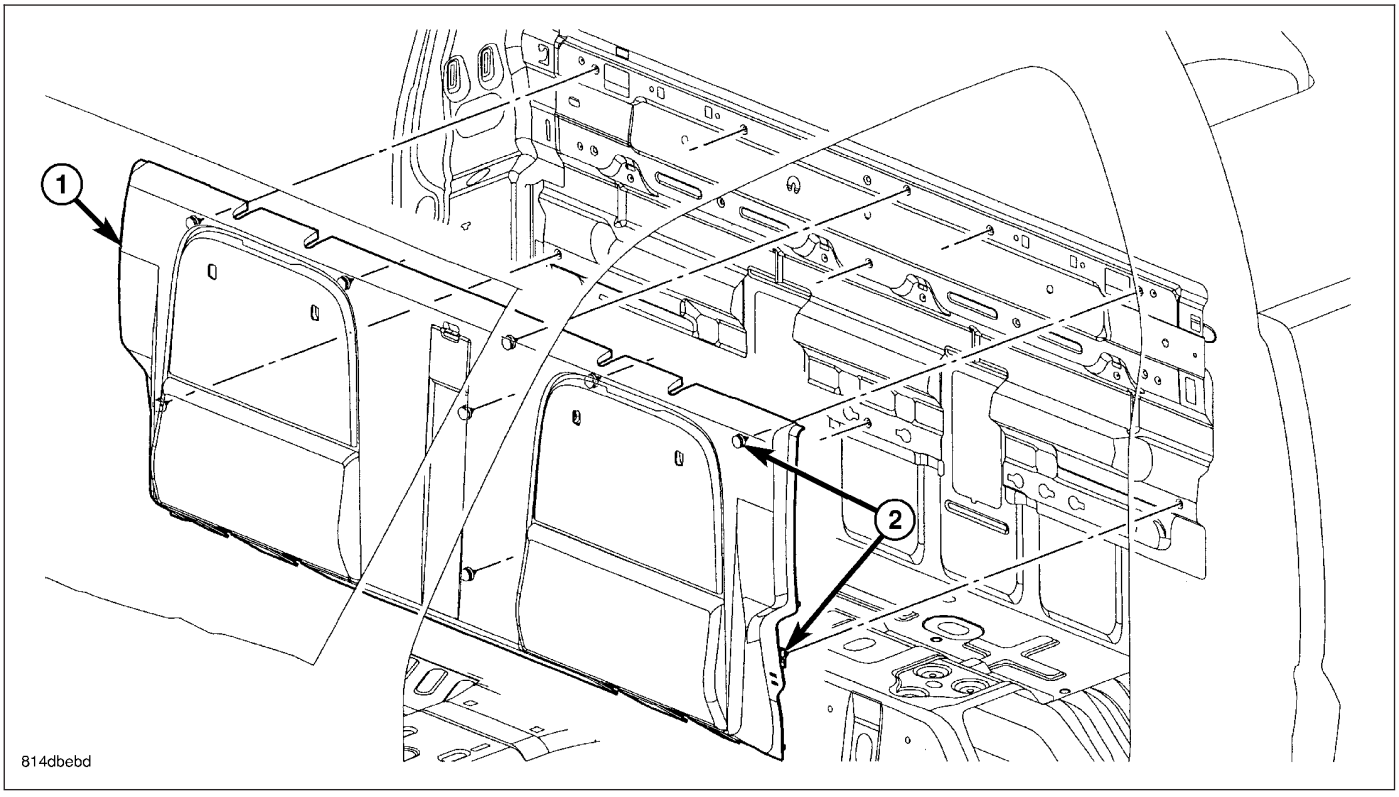
NOTE: Cab back trim panel with jumper seats shown. Trim panel without seats similar.

1. Position the cab back trim panel (1) in the vehicle.
2. Using hand pressure, engage the clips (2) that secure the cab back trim panel to the cab.

3. Install the lower C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - INSTALLATION).
4. Install the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - INSTALLATION).

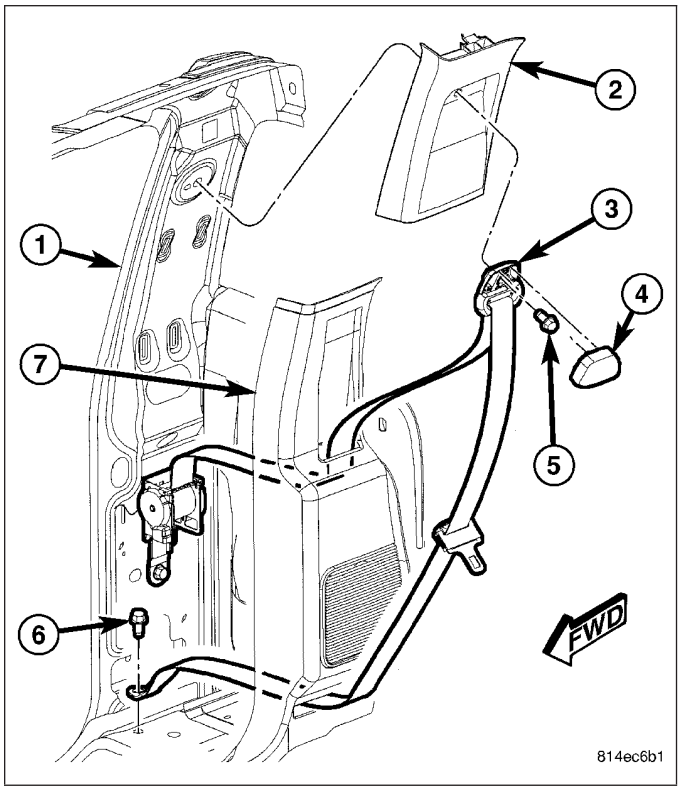


Club Cab, With Rear Jumper Seats

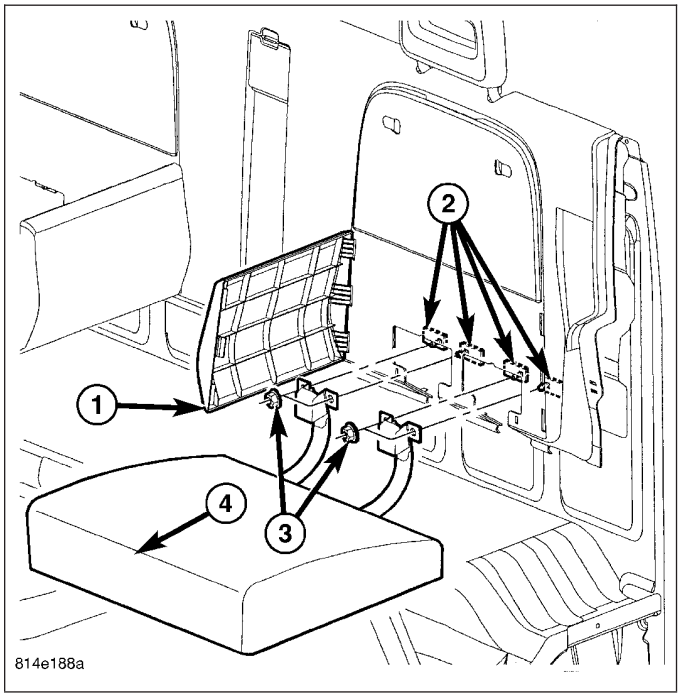


1. Position the cab back trim panel (1) in the vehicle.
2. Using hand pressure, engage the clips (2) that secure the cab back trim panel to the cab.

3. Install the lower C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - INSTALLATION).
4. Install the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - INSTALLATION).

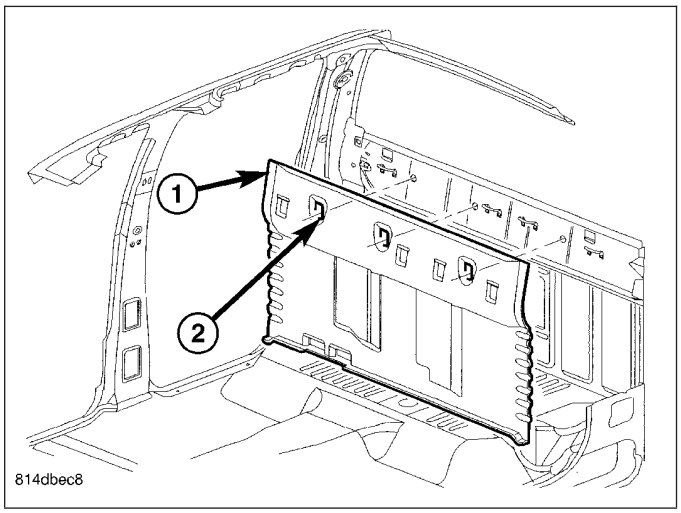


5. Install the rear jumper seat cushions, (Refer to 23 - BODY/SEATS/SEAT-SECOND ROW - INSTALLATION).

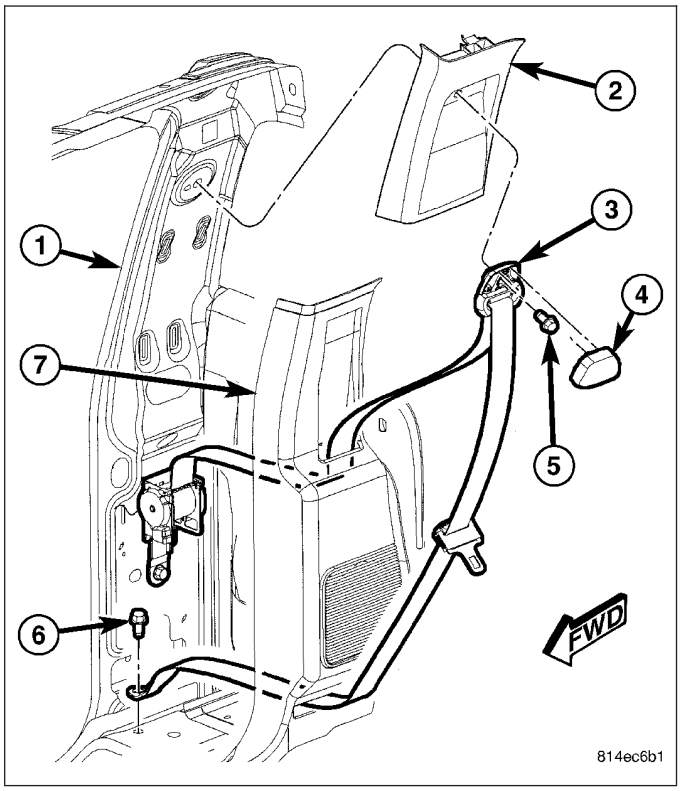


Quad Cab

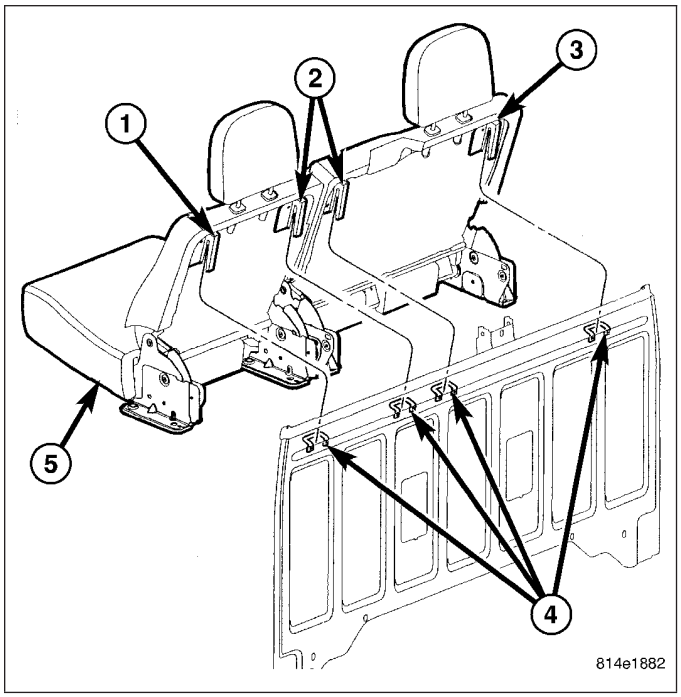
1. Position the cab back trim panel (1) in the vehicle.
2. Using hand pressure, engage the clips that secure the cab back trim panel to the cab.
3. Install the three fasteners (2) that secure the cab back trim panel to the cab.



4. Install the lower C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - INSTALLATION).
5. Install the upper C-pillar trim panels, (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - INSTALLATION).



6. Install the rear seats, (Refer to 23 - BODY/SEATS/SEAT-SECOND ROW - INSTALLATION).

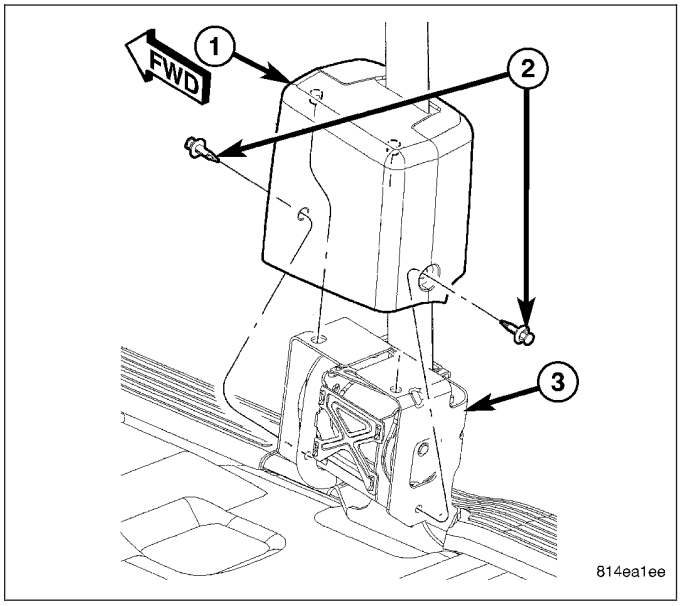


PANEL-COWL TRIM

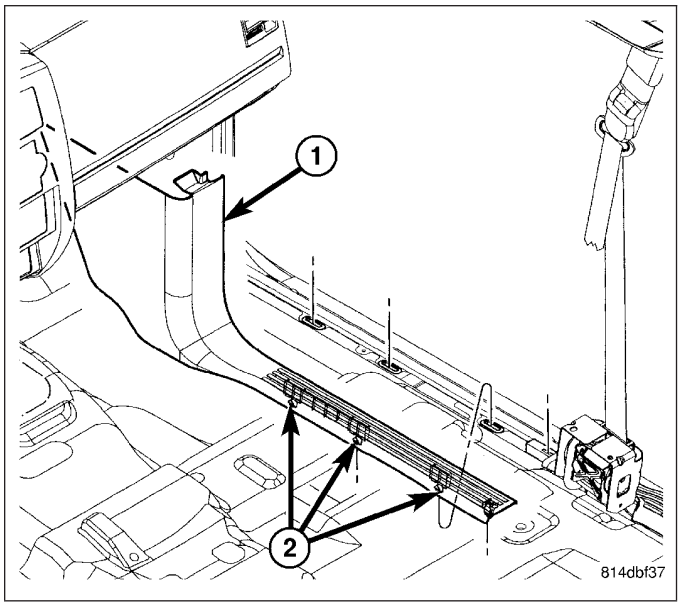
REMOVAL

Club Cab

1. Remove the outer front seat belt retractor cover, (Refer to 23 - BODY/INTERIOR/COVER-OUTER FRONT SEAT BELT RETRACTOR - REMOVAL).

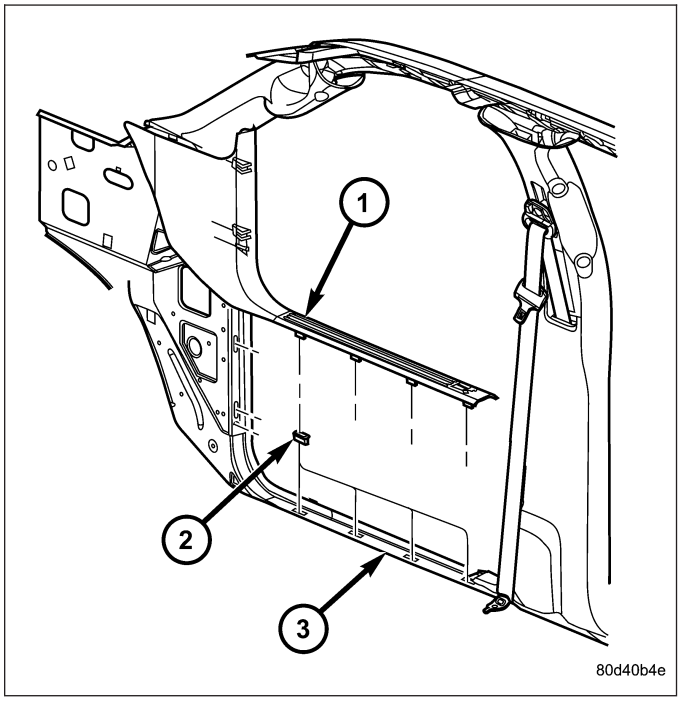


2. Using a trim stick C-4755 or equivalent, disengage the retaining tabs (2) that secure the door sill scuff plate end of the cowl trim panel to the retaining clips in the front door sill.
3. Pull the door sill scuff plate end of the cowl trim panel upward to disengage the retaining tabs that secure the trim panel (1) to the cowl and remove the trim panel.



Quad Cab

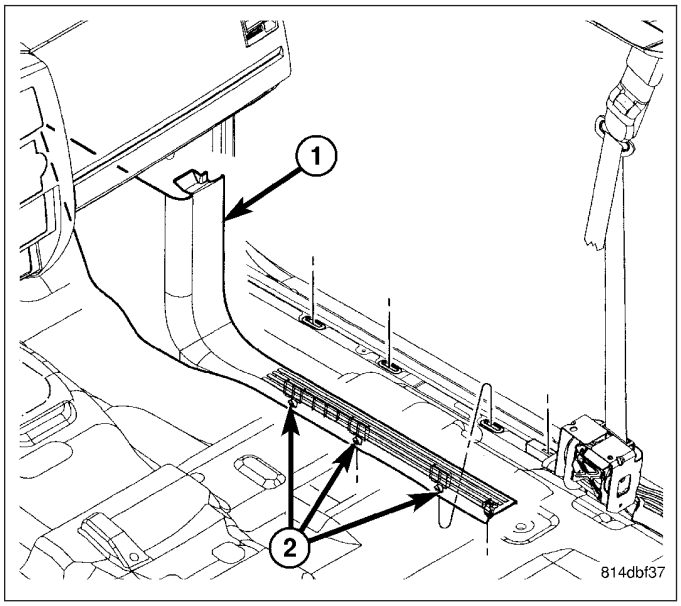
1. Using a trim stick C-4755 or equivalent, disengage the retaining tabs that secure the door sill scuff plate (1) end of the cowl trim panel to the retaining clips (2) in the front door sill (3).
2. Pull the door sill scuff plate end of the cowl trim panel upward to disengage the retaining tabs that secure the trim panel to the cowl and remove the trim panel.



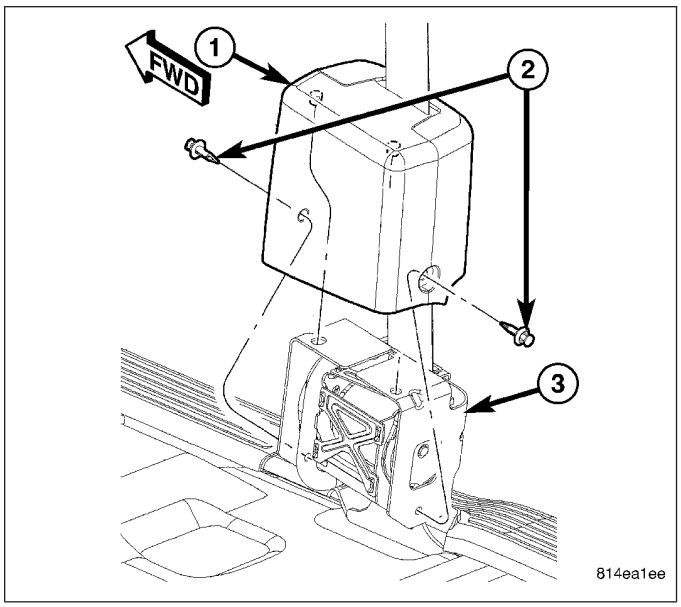
INSTALLATION

Club Cab

1. Position the cowl trim panel (1) in the vehicle with the door sill scuff plate end (2) of the trim panel angled upward. Seat the upper outer end of the trim panel underneath the dash panel and engage the retaining tabs that secure the trim panel to the cowl.
2. Align the retaining tabs on the door sill scuff plate end of the trim panel with the retaining clips in the front door sill and engage the retaining tabs that secure the trim panel to the door sill.



3. Install the outer front seat belt retractor cover, (Refer to 23 - BODY/INTERIOR/COVER-OUTER FRONT SEAT BELT RETRACTOR - INSTALLATION).



Quad Cab

1. Position the cowl trim panel in the vehicle with the door sill scuff plate end (1) of the trim panel angled upward. Seat the upper outer end of the trim panel underneath the dash panel and engage the retaining tabs that secure the trim panel to the cowl.
2. Align the retaining tabs on the door sill scuff plate end of the trim panel with the retaining clips (2) in the front door sill (3) and engage the retaining tabs that secure the trim panel to the door sill.

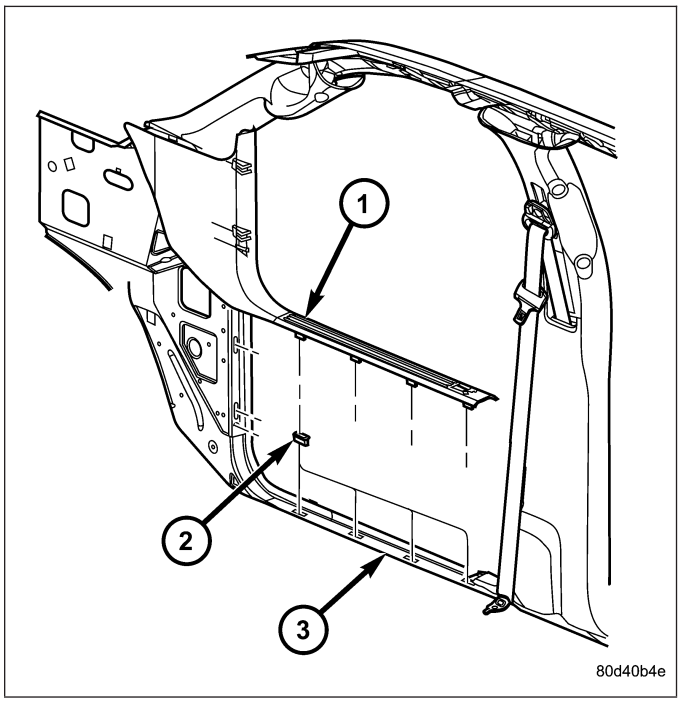
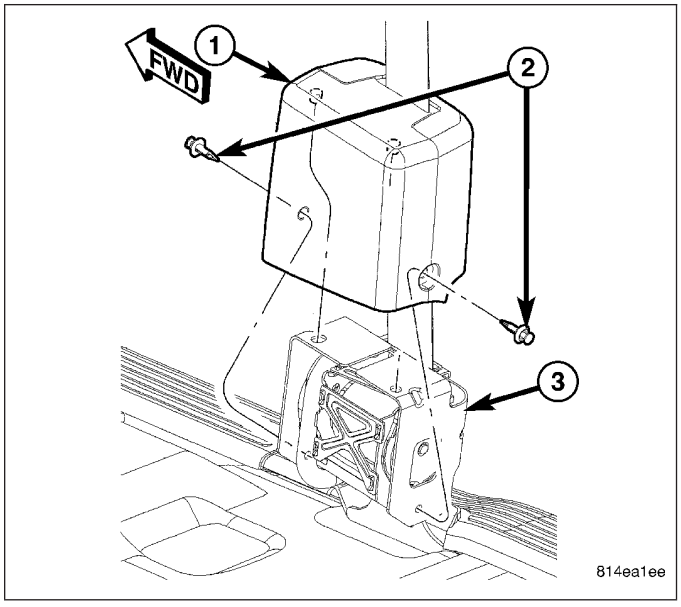


PLATE-DOOR SCUFF

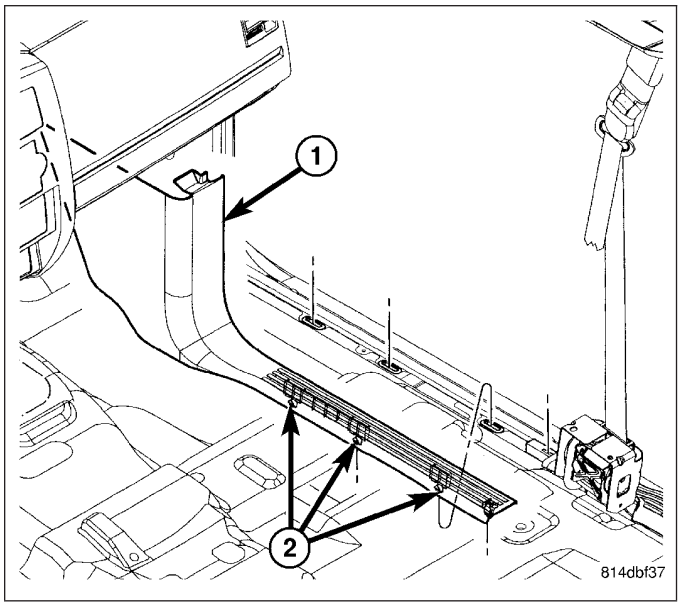
REMOVAL

Club Cab

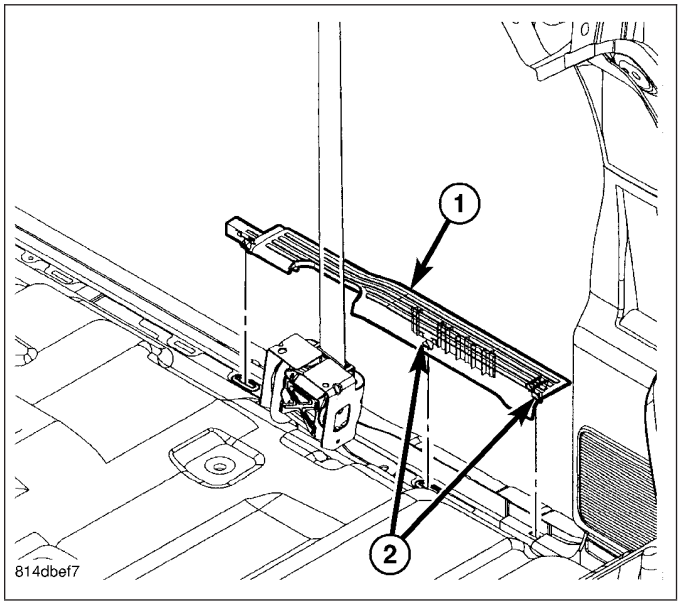
1. Remove the outer front seat belt retractor cover, (Refer to 23 - BODY/INTERIOR/COVER-OUTER FRONT SEAT BELT RETRACTOR - REMOVAL).



2. To access the rear door sill scuff plate for removal, use a trim stick C-4755 or equivalent to disengage enough of the retaining tabs (2) that secure the door sill scuff plate end of the cowl trim panel to the retaining clips in the front door sill.

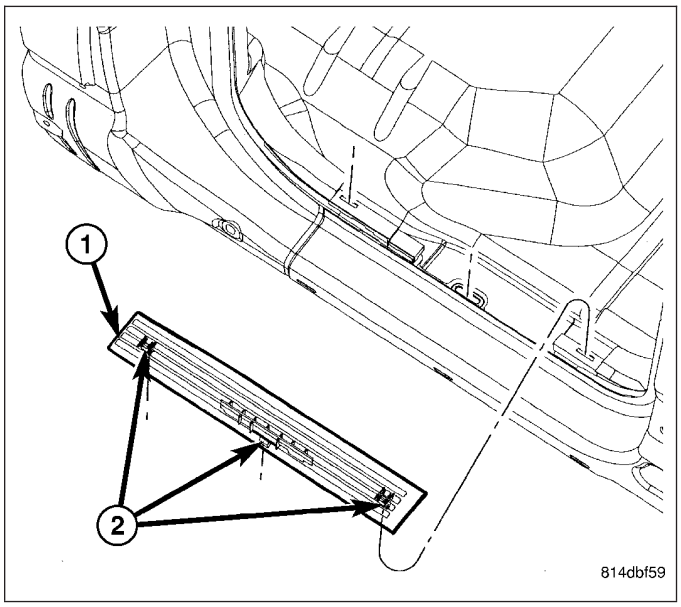


3. Using a trim stick C-4755 or equivalent, disengage the retaining tabs (2) that secure the rear door sill scuff plate (1) to the retaining clips in the rear door sill and remove the scuff plate.



Quad Cab

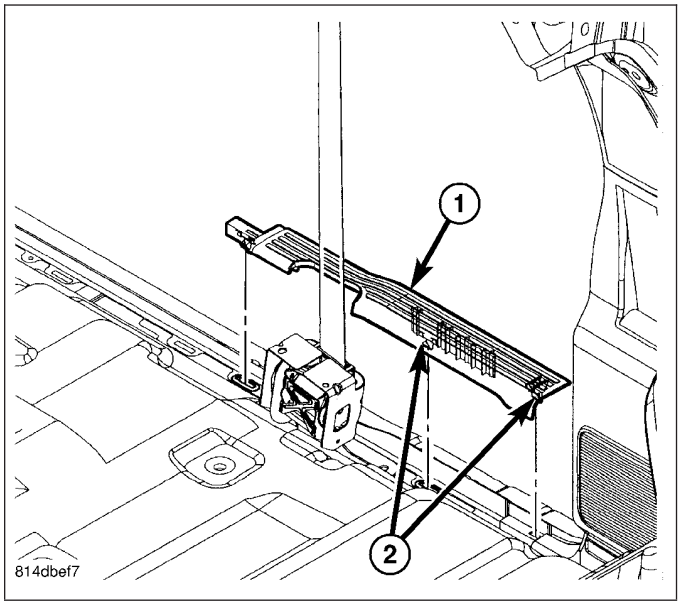
1. Using a trim stick C-4755 or equivalent, disengage the retaining tabs (2) that secure the rear door sill scuff plate (1) to the retaining clips in the rear door sill and remove the scuff plate.



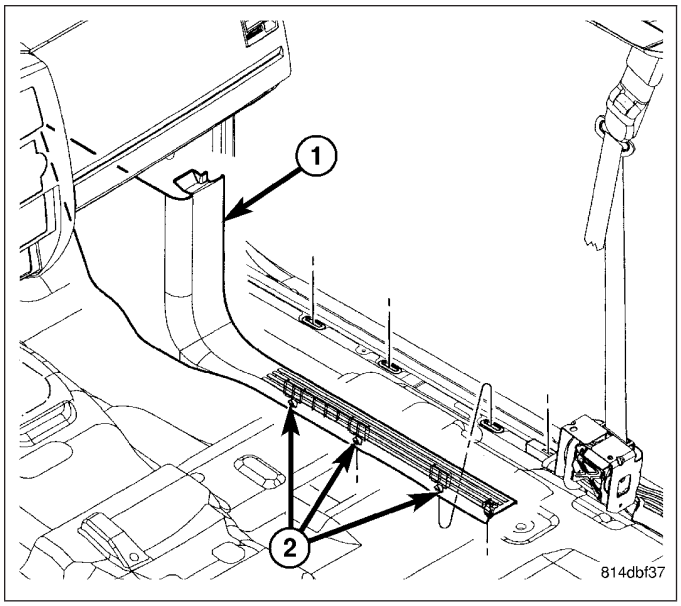
INSTALLATION

Club Cab

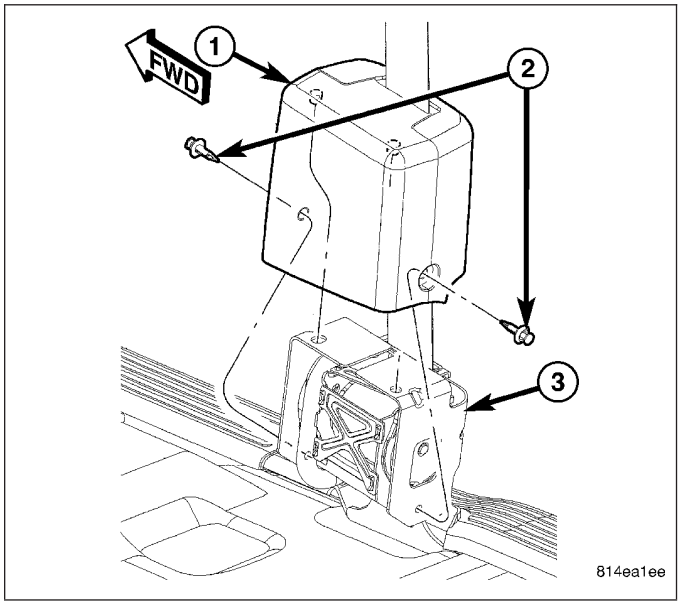
1. Align the retaining tabs (2) on the rear door sill scuff plate (1) with the retaining clips in the rear door sill and engage the retaining tabs that secure the scuff plate to the door sill.



2. Align the retaining tabs (2) on the door sill scuff plate end of the cowl trim panel with the retaining clips in the front door sill and engage the retaining tabs that secure the trim panel to the door sill.

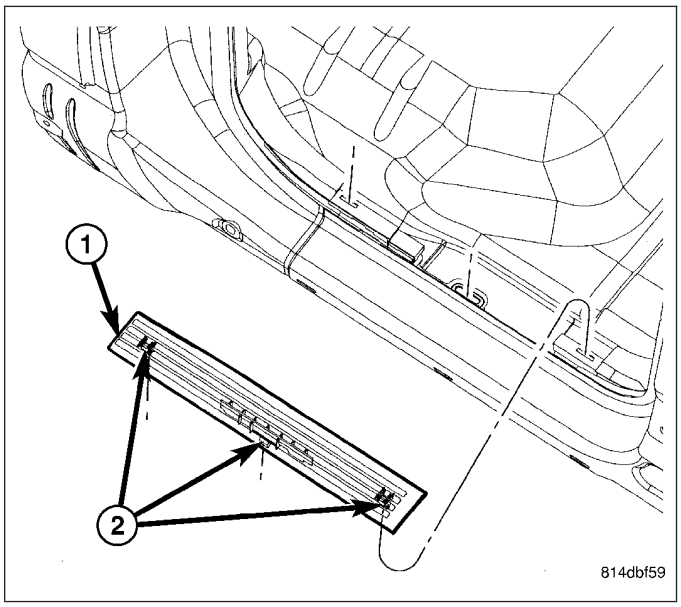


3. Install the outer front seat belt retractor cover, (Refer to 23 - BODY/INTERIOR/COVER-OUTER FRONT SEAT BELT RETRACTOR - INSTALLATION).



Quad Cab

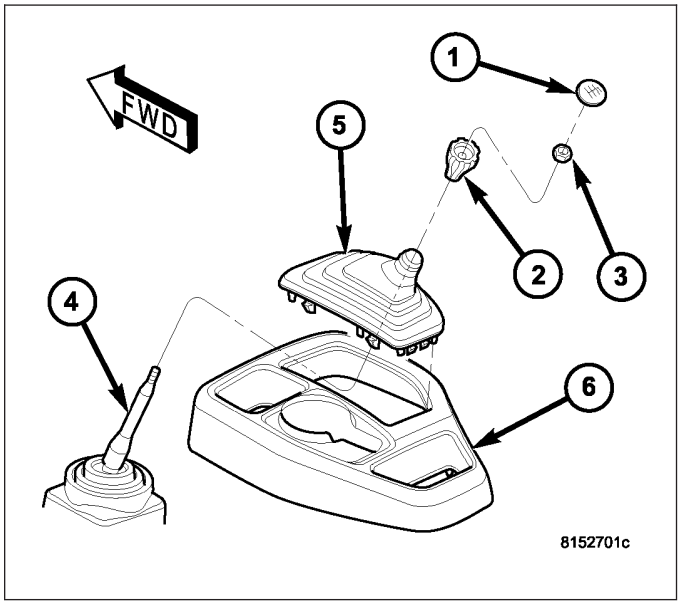
1. Align the retaining tabs (2) on the rear door sill scuff plate (1) with the retaining clips in the rear door sill and engage the retaining tabs that secure the scuff plate to the door sill.



SHIFT BOOT-FLOOR

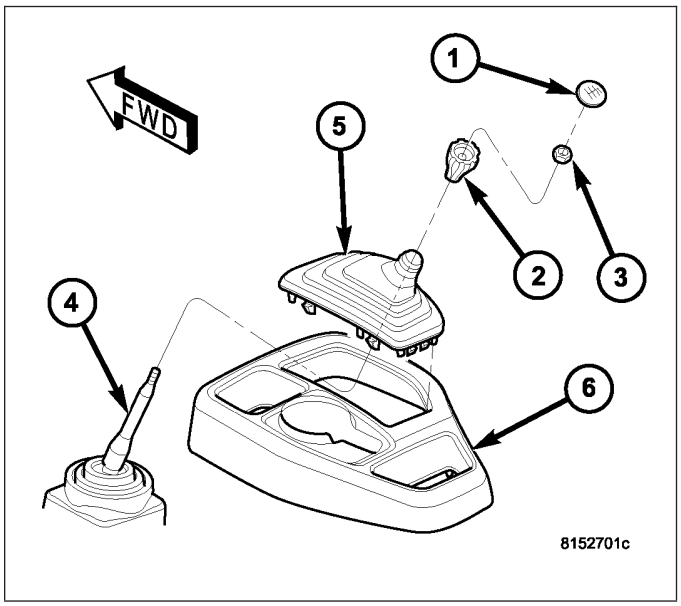
REMOVAL

1. Using a small flat-bladed tool, remove the insert (1) from the top of the gear shift knob (2).
2. Remove the nut (3) that secures the gear shift knob to the gear shift lever (4).
3. Remove the gear shift knob.
4. Using a trim stick C-4755 or equivalent, disengage the retaining tabs that secure the gear shift boot (5) to the floor console (6) and remove the boot.



INSTALLATION

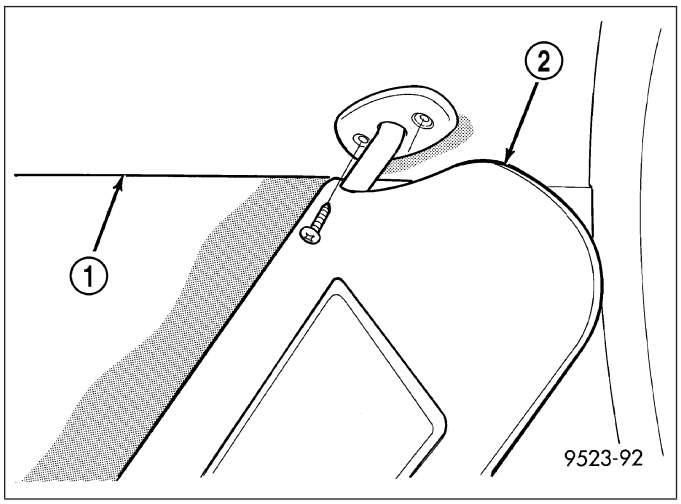
1. Position the gear shift boot (5) over the gear shift lever (4).
2. Engage the retaining tabs that secure the gear shift boot to the floor console (6).
3. Install the gear shift knob (2) onto the gear shift lever.
4. Install the nut (3) that secures the gear shift knob to the gear shift lever. Tighten the nut to 27 N·m (20 ft. lbs.).
5. Install the insert (1) into the top of the gear shift knob.



SUN VISOR

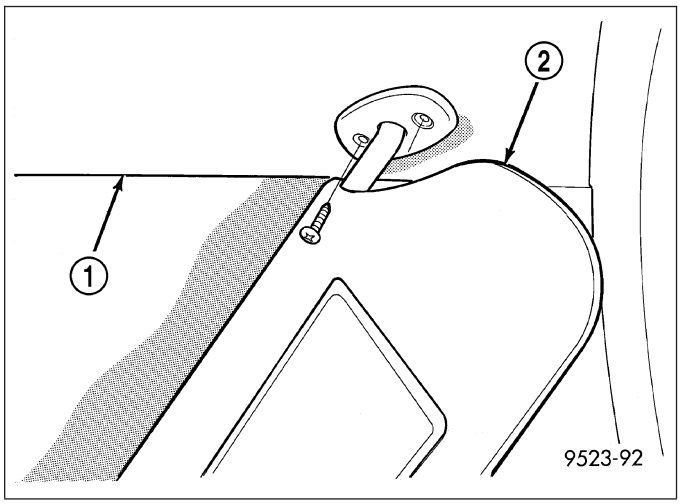
REMOVAL

1. Disengage the sun visor (2) from the sun visor support.
2. Remove the two screws that secure the sun visor to the roof panel and remove the sun visor from the headliner (1).
3. If equipped, disconnect the illuminated vanity mirror wire harness connector.



INSTALLATION

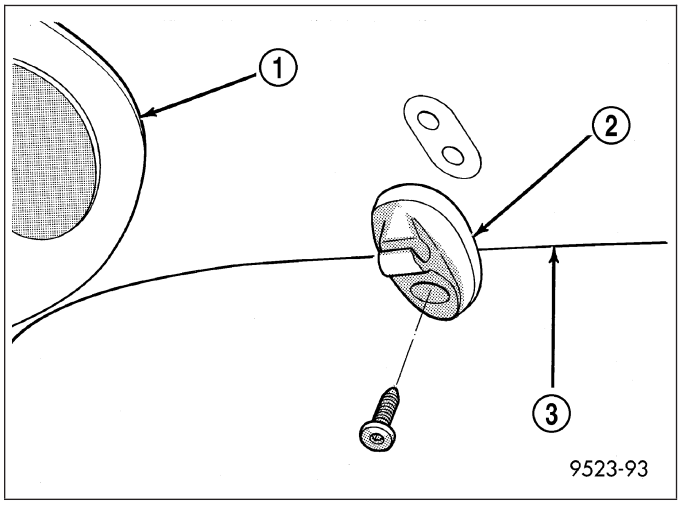
1. If equipped, connect the illuminated vanity mirror wire harness connector.
2. Position the sun visor (2) on the headliner (1) and install the two screws that secure the sun visor to the roof panel. Tighten the screws to 2.2 N·m (20 in. lbs.).
3. Engage the sun visor and sun visor support.



SUN VISOR SUPPORT

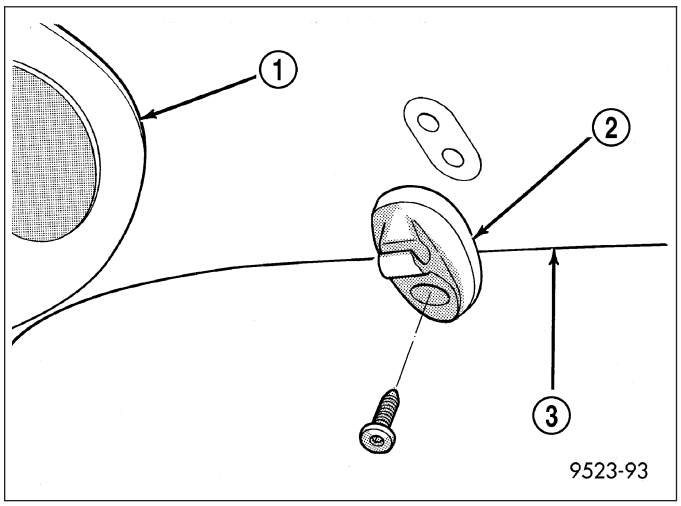
REMOVAL

1. Disengage the sun visor (1) from the sun visor support (2).
2. Remove the screw that secures the support to the roof panel and remove the support from the headliner (3).



INSTALLATION

1. Position the sun visor support (2) on the headliner (3) and install the screw that secures the support to the roof panel. Tighten the screw to 2.2 N·m (20 in. lbs.).
2. Engage the sun visor (1) and sun visor support.



PAINT

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PAINT

SPECIFICATIONS - PAINT CODES

EXTERIOR COLORS

EXTERIOR COLOR	DAIMLERCHRYSLER CODE
Deep Molten Red Pearlcoat	BR8
Flame Red Clearcoat	PR4
Mineral Gray Metallic Clearcoat	CDM
Light Almond Pearl Metallic Clearcoat	ZKJ
Patriot Blue Pearlcoat	WBT
Atlantic Blue Pearlcoat	ZBJ
Bright Silver Metallic Clearcoat	WSB
Black Clearcoat	DX8
Bright White Clearcoat	GW7

BASECOAT/CLEARCOAT FINISH

DESCRIPTION

The original equipment paint finish is a multi step process that involves cleaning, applying electro de-position (E-coat), anti-chip primer, basecoat, and clearcoat steps.

CAUTION: Do not use abrasive chemicals, abrasive compounds or harsh alkaline based cleaning solvents on the painted surfaces of a vehicle. Failure to follow this caution can result in damage to vehicle finish.

On most vehicles a two-part paint application (basecoat/clearcoat) is used. Color paint that is applied to primer is called basecoat. A clear coat paint is then applied to protect the basecoat from ultraviolet light and to provide a durable high-gloss finish.

PAINT CODE

DESCRIPTION

Exterior vehicle body colors are identified on the Vehicle Certification Label (Refer to VEHICLE DATA/VEHICLE INFORMATION/VEHICLE CERTIFICATION LABEL - DESCRIPTION). The first digit of the paint code listed on the vehicle indicates the sequence of application, i.e.: P = primary coat, Q = secondary coat. The color names provided in the Paint and Trim Code Description chart are the color names used on most repair product containers. (Refer to 23 - BODY/PAINT - SPECIFICATIONS)

PAINT TOUCH-UP

DESCRIPTION

When a painted metal surface has been scratched or chipped, it should be touched-up as soon as possible to avoid corrosion. For best results, use MOPAR® Scratch Filler/Primer, Touch-Up Paints and Clear Top Coat.

WARNING: USE AN OSHA APPROVED RESPIRATOR AND SAFETY GLASSES WHEN SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.

STANDARD PROCEDURE

1. Scrape loose paint and corrosion from inside scratch or chip.
2. Clean affected area with MOPAR® Tar/Road Oil Remover or equivalent, and allow to dry.
3. Fill the inside of the scratch or chip with a coat of filler/primer. Do not overlap primer onto good surface finish. The applicator brush should be wet enough to puddle-fill the scratch or chip without running. Do not stroke brush applicator on body surface. Allow the filler/primer to dry hard.
4. Cover the filler/primer with color touch-up paint. Do not overlap touch-up color onto the original color coat around the scratch or chip. Butt the new color to the original color, if possible. Do not stroke applicator brush on body surface. Allow touch-up paint to dry hard.
5. On vehicles without clearcoat, the touch-up color can be lightly finesse sanded (1500 grit) and polished with rubbing compound.
6. On vehicles with clearcoat, apply clear top coat to touch-up paint with the same technique as described in Step 4. Allow clear top coat to dry hard. If desired, Step 5 can be performed on clear top coat.

WARNING: AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.

FINESSE SANDING/BUFFING & POLISHING

DESCRIPTION

CAUTION: Do not remove more than 0.5 mils of clearcoat finish when sanding, hand buffing or polishing. Basecoat paint must retain clearcoat for durability.

CAUTION: If the finish has been finesse sanded in the past, it cannot be repeated. Failure to follow this caution can result in damage to vehicle finish.

NOTE: Finesse sanding should only be performed by a trained automotive paint technician.

Minor acid etching, orange peel, or smudging in a clearcoat or single-stage finish can be reduced with light finesse sanding, hand buffing and polishing. Use a Paint Thickness Gauge #PR-ETG-2X or equivalent to determine clearcoat or single-stage paint thickness before and after the repair.

SEATS

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SEATS

WARNING

RESTRAINT SYSTEM

WARNING: During and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar parts catalog. Failure to follow these instructions may result in personal injury or death.

WARNING: On vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment. Failure to follow these instructions may result in personal injury or death.

WARNING: On vehicles equipped with airbags, before performing any welding operations disconnect and isolate the battery negative (ground) cable and disconnect all wire harness connectors from the airbag control module (acm). Failure to take the proper precautions could result in accidental airbag deployment and other possible damage to the supplemental restraint system circuits and components. Failure to follow these instructions may result in personal injury or death.

WARNING: Replace all restraint system components only with parts specified in the DaimlerChrysler Mopar parts catalog. Substitute parts may appear interchangeable, but internal differences may result in inferior occupant protection. Failure to follow these instructions may result in personal injury or death.

WARNING: The fasteners, screws, and bolts originally used for the restraint system components must never be replaced with any substitutes. These fasteners have special coatings and are specifically designed for the restraint system. Any time a new fastener is needed, replace it with the correct fasteners provided in the service package or specified in the DaimlerChrysler Mopar parts catalog. Failure to follow these instructions may result in personal injury or death.

WARNING: On vehicles equipped with the occupant classification system (ocs) do not hang any after market devices from the front passengers seat back. Do not install a front drivers seat back cover with map pocket onto the passenger seat. Failure to follow these instructions may result in personal injury or death.

WARNING: The Seat Weight Sensor is a sensitive, calibrated unit and must be handled carefully. Do not drop or handle roughly. If dropped or damaged, replace with another sensor. Failure to follow these instructions may result in personal injury or death.

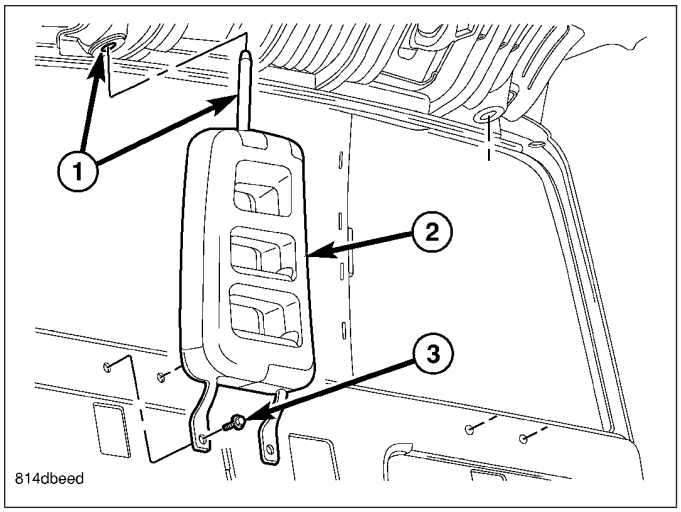
WARNING: The front passenger seat must be handled carefully as well. When removing the seat, be careful when setting on floor not to drop. If dropped, the sensor may be inoperative. Failure to follow these instructions may result in personal injury or death.

WARNING: When the seat is on the floor, no one should sit in the front passenger seat. This uneven force may damage the sensing ability of the seat weight sensors. If sat on and damaged, the sensor may be inoperative. Failure to follow these instructions may result in personal injury or death.

HEADREST-CLUB CAB

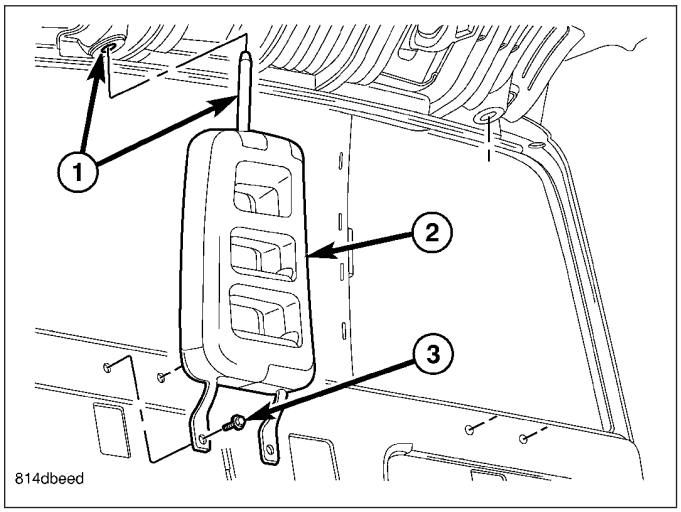
REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the cab back trim panel (Refer to 23 - BODY/INTERIOR/REAR CAB BACK PANEL TRIM - REMOVAL).
3. Remove the fasteners (3) securing the lower headrest to the cab back.
4. Lower the headrest (2) to disengage the upper post from the grommet (1).
5. Remove the headrest from the vehicle.



INSTALLATION

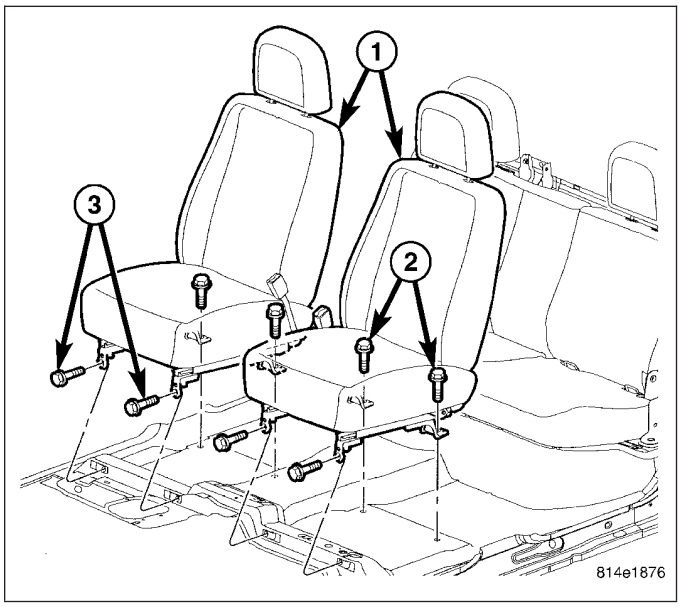
1. Position the headrest (2) into the vehicle.
2. Insert the upper post into the grommet (1) and push up slightly on the headrest (2).
3. Install the fasteners (3) to secure the lower headrest to the cab back.
4. Tighten the fasteners to 12 N·m (9 ft. lbs.).
5. Install the cab back trim panel (Refer to 23 - BODY/INTERIOR/REAR CAB BACK PANEL TRIM - INSTALLATION).
6. Connect the battery negative cable.



SEAT-FRONT

REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)

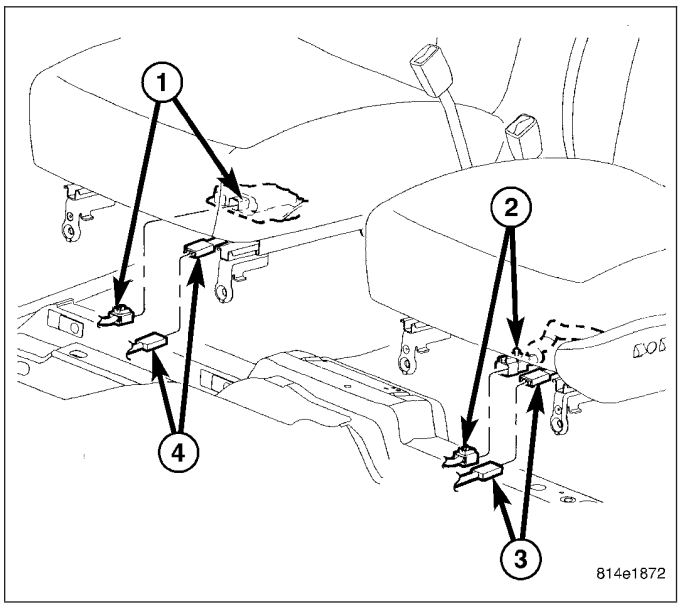


WARNING: The Seat Weight Sensor is a sensitive, calibrated unit and must be handled carefully. Do not drop or handle roughly. If dropped or damaged, replace with another sensor. Failure to follow these instructions may result in personal injury or death.

WARNING: The front passenger seat must be handled carefully as well. When removing the seat, be careful when setting on floor not to drop. If dropped, the sensor may be inoperative. Failure to follow these instructions may result in personal injury or death.

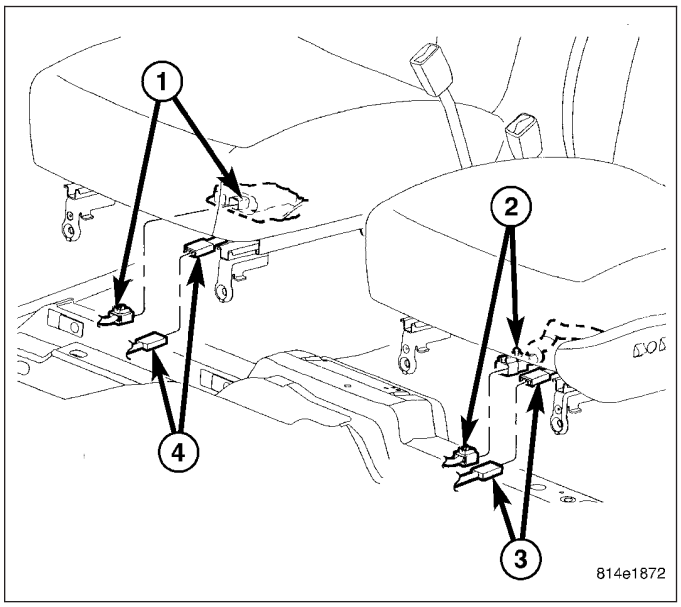
WARNING: When the seat is on the floor, no one should sit in the front passenger seat. This uneven force may damage the sensing ability of the seat weight sensors. If sat on and damaged, the sensor may be inoperative. Failure to follow these instructions may result in personal injury or death.

2. Move the seat forward to gain access to the rear (2) bolts.
3. Disconnect and isolate the battery negative cable.
4. Remove the cover and lower seat belt anchor.
5. Remove the front (3) and rear (2) bolts.
6. Disconnect the electrical connectors, if equipped, and remove the seat from the vehicle.



INSTALLATION

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)

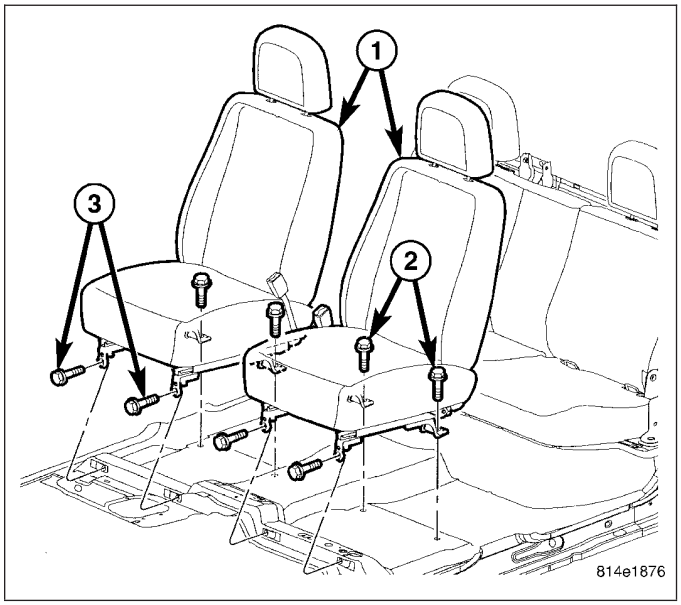


WARNING: The Seat Weight Sensor is a sensitive, calibrated unit and must be handled carefully. Do not drop or handle roughly. If dropped or damaged, replace with another sensor. Failure to follow these instructions may result in personal injury or death.

WARNING: The front passenger seat must be handled carefully as well. When removing the seat, be careful when setting on floor not to drop. If dropped, the sensor may be inoperative. Failure to follow these instructions may result in personal injury or death.

WARNING: When the seat is on the floor, no one should sit in the front passenger seat. This uneven force may damage the sensing ability of the seat weight sensors. If sat on and damaged, the sensor may be inoperative. Failure to follow these instructions may result in personal injury or death.

2. Position the seat into the vehicle and connect the electrical connectors, if equipped.

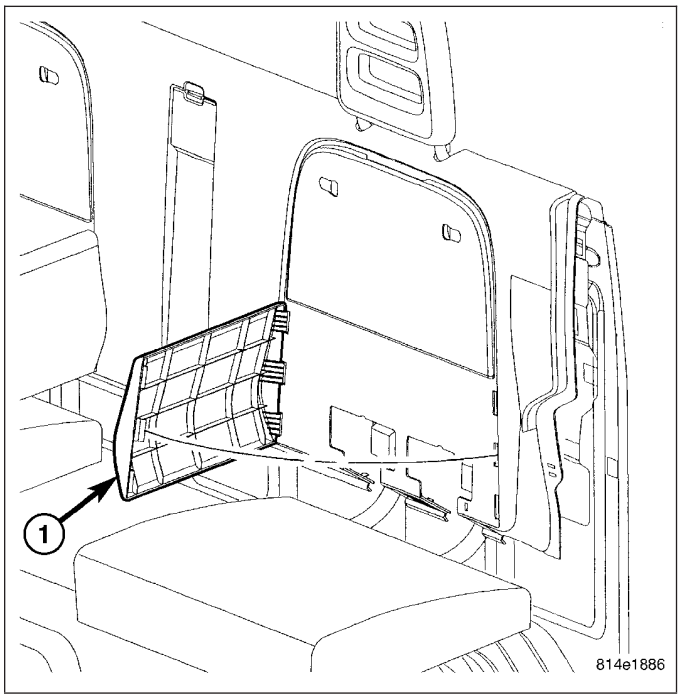


3. Install the front bolts (3) and rear bolts (2).
4. Tighten the front inner bolt to 27 N·m (20 ft. lbs.) then tighten the front outer bolt to 27 N·m (20 ft. lbs.).
5. Tighten the rear bolts to 47 N·m (35 ft. lbs.).
6. Install the lower seat belt anchor and install the bolt.
7. Tighten the bolt to 39 N·m (29 ft. lbs.) and install the trim cover.
8. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).
9. Following successful completion of the supplemental restraint system verification test procedure, perform the Occupant Classification System Verification Test using a scan tool. (Refer to 8 - ELECTRICAL/RESTRAINTS - *OCS VERIFICATION TEST - VER 1)

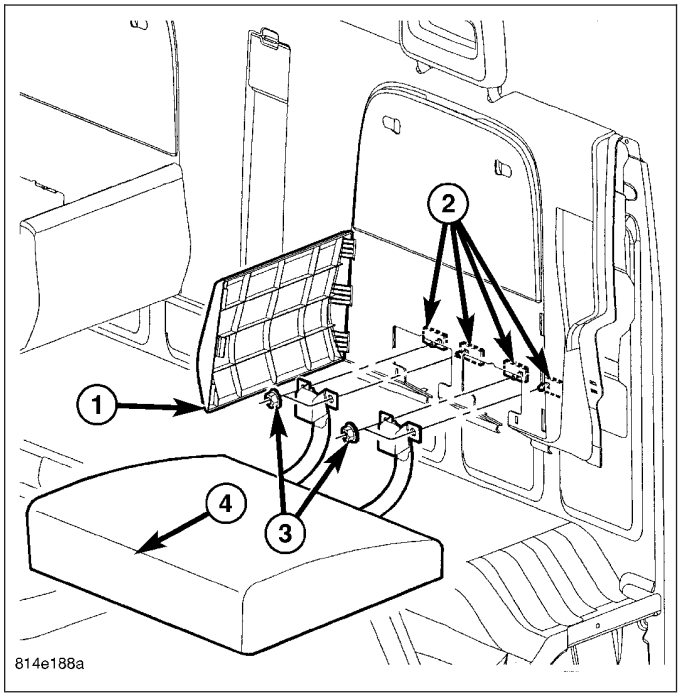
SEAT-CLUB CAB

REMOVAL

NOTE: The seat back is part of the cab back trim panel. (Refer to 23 - BODY/INTERIOR/REAR CAB BACK PANEL TRIM - REMOVAL) for the appropriate removal procedure.

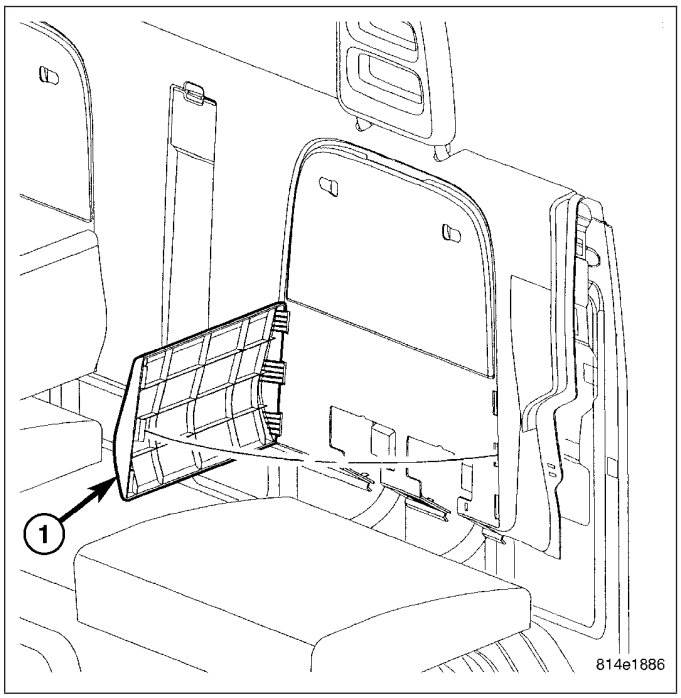


1. Remove the cab back trim panel (Refer to 23 - BODY/INTERIOR/REAR CAB BACK PANEL TRIM - REMOVAL).
2. Remove the fasteners (3) attaching rear seat cushion hinge to cab back panel (2).
3. Separate rear seat cushion (4) from vehicle.

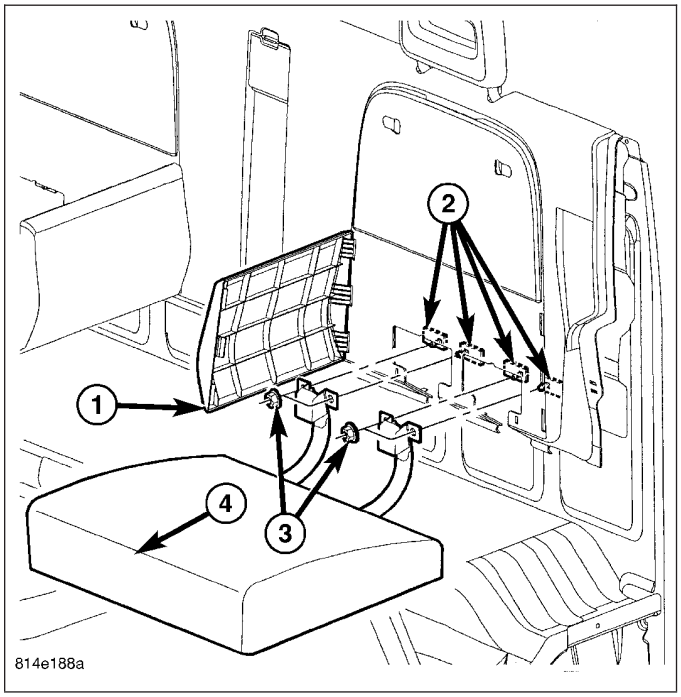


INSTALLATION

NOTE: The seat back is part of the cab back trim panel. (Refer to 23 - BODY/INTERIOR/REAR CAB BACK PANEL TRIM - INSTALLATION) for the appropriate installation procedure.



1. Position the rear seat cushion (4) in the vehicle.
2. Install the fasteners (3) attaching the rear seat cushion hinge to cab back panel (2).
3. Tighten the fasteners to 34 N·m (25 ft. lbs.).
4. Install the cab back trim panel, (Refer to 23 - BODY/INTERIOR/REAR CAB BACK PANEL TRIM - INSTALLATION).

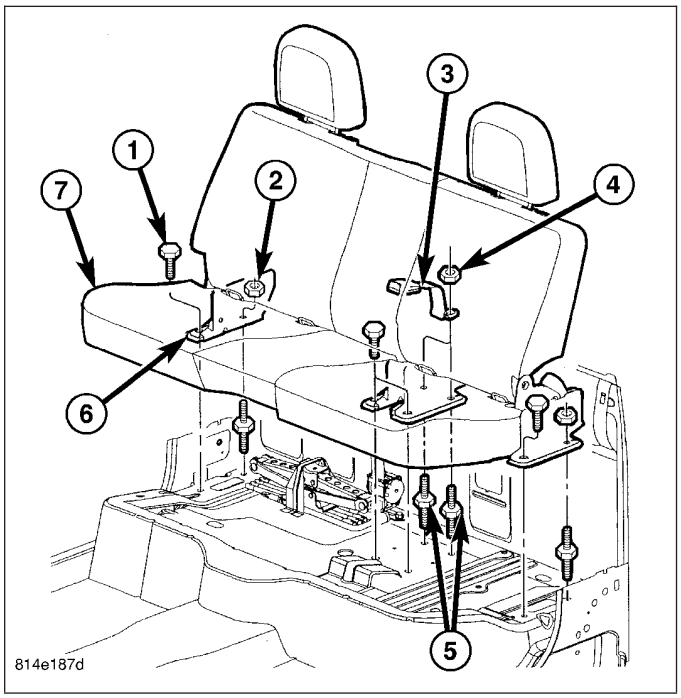


SEAT-QUAD CAB

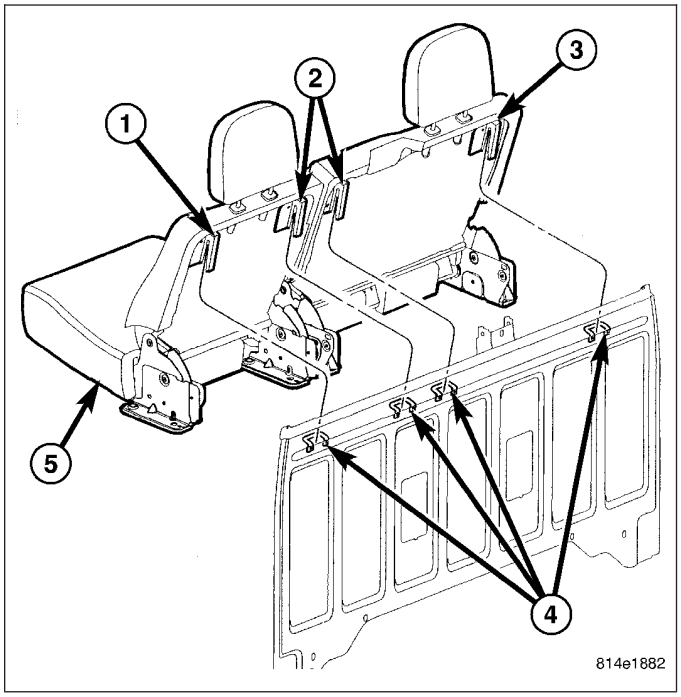
REMOVAL

NOTE: The quad cab rear seat is a 60/40 seat. Each seat is serviceable separately.

1. Fold the seating cushion (7) up.
2. Remove the jack assembly.
3. Remove the fastener (4) securing the center seat belt (3)(for left seat removal).
4. Remove the fasteners retaining the seat to the cab floor.

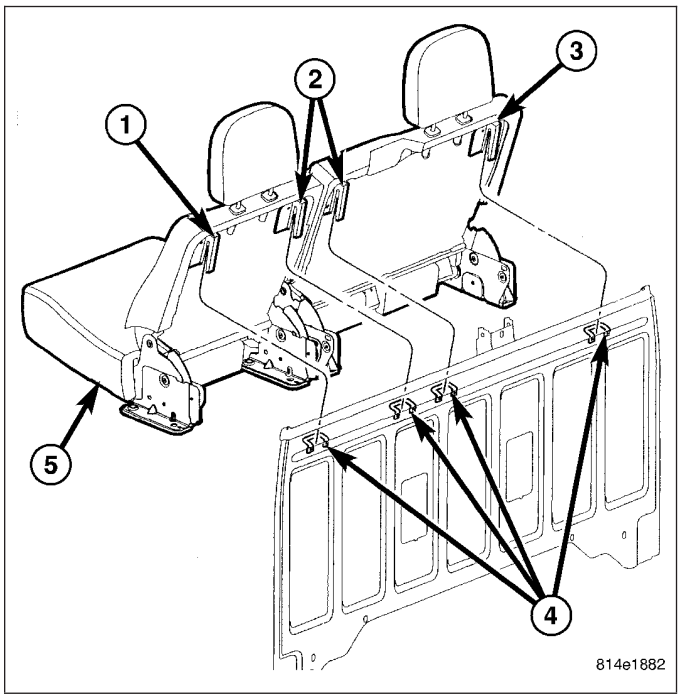


5. Lift the seat assembly (5) off the retaining studs and the cab back hooks (4).
6. Remove the seat through the rear door.

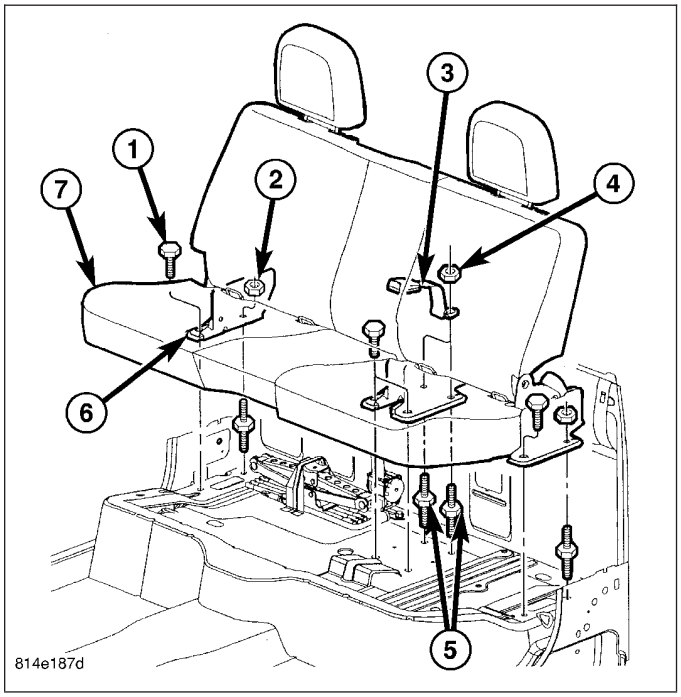


INSTALLATION

1. Position the seat (5) on the cab back hooks (4) and the floor studs.
2. Ensure the seat back is firmly hooked to the cab back retainers.



3. Position the center seat belt (3) onto the floor stud (5) (for left seat installation).
4. Install the floor fasteners.
5. Tighten the bolts to 52 N·m (38 ft. lbs.).
6. Tighten the nuts to 41 N·m (30 ft. lbs.).
7. Install the jack assembly.



STATIONARY GLASS

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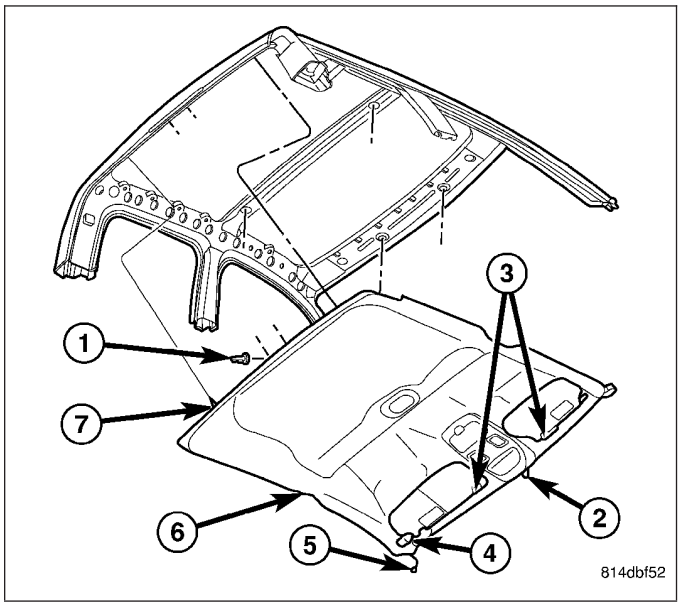
BACKLITE

REMOVAL

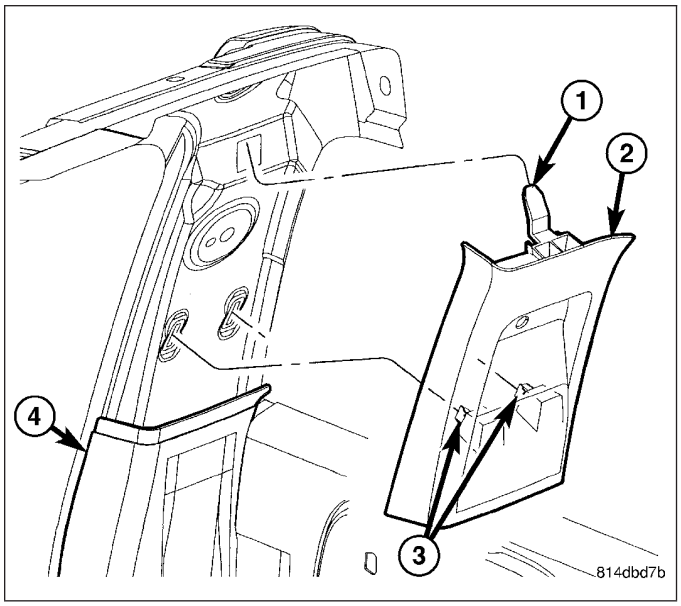
CAUTION: It is difficult to salvage the backlite during the removal operation. The backlite is part of the structural support for the roof. The urethane bonding used to secure the glass to the fence is difficult to cut or clean from any surface. Since the molding is set in urethane, it is unlikely it would be salvaged. Before removing the backlite, check the availability from the parts supplier.

NOTE: The backlite is attached to the window frame with urethane adhesive. The urethane adhesive is applied cold and seals the surface area between the window opening and the glass. The primer adheres the urethane adhesive to the backlite.

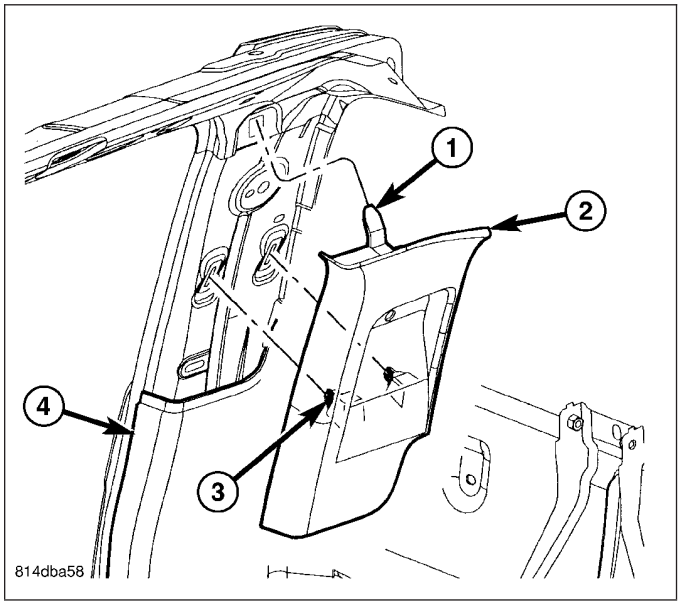
1. Roll down door glass.
2. Remove headliner (9) (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL).



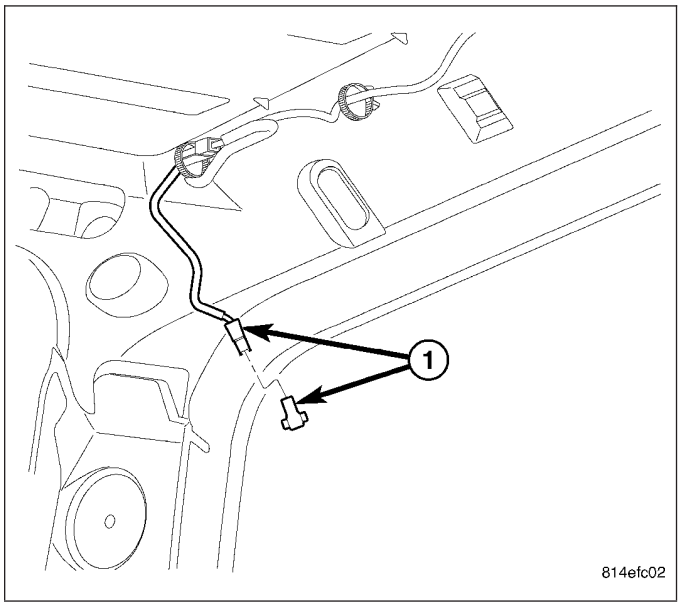
3. On club cab models remove the upper c-pillar trim (2). (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL)



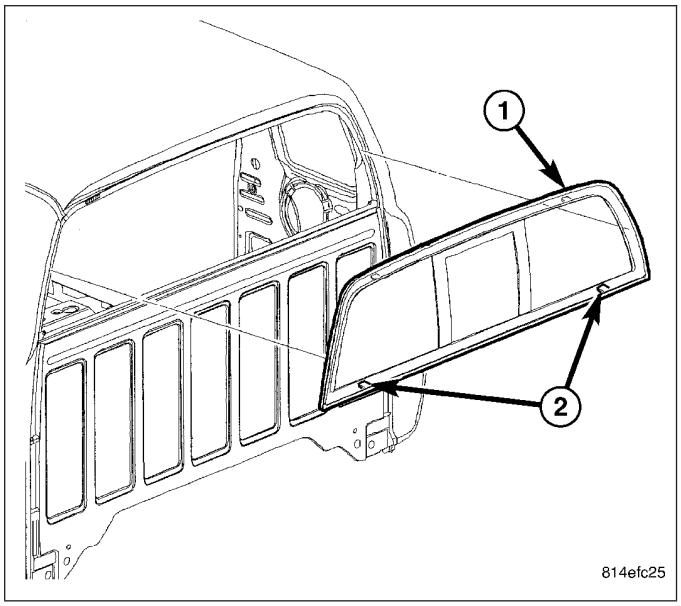
4. On quad cab models remove the upper c-pillar trim (2). (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR UPPER TRIM - REMOVAL)



5. Disconnect the rear window defogger electrical connector (1), if equipped.

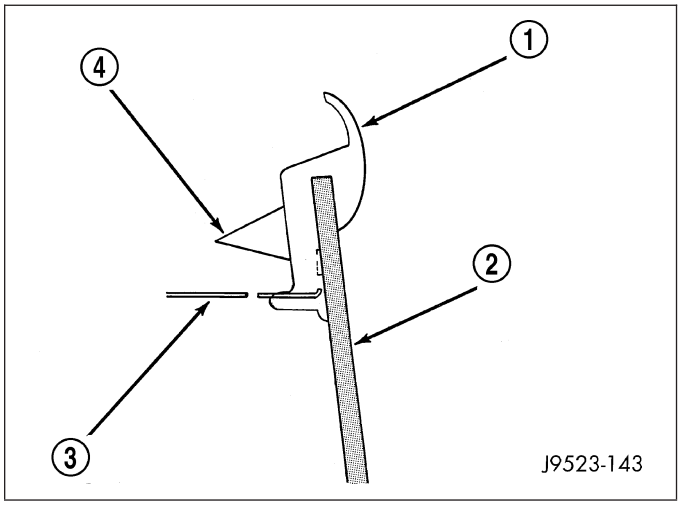


6. Bend backlite retaining tabs (2) inward against glass.
7. Using a suitable pneumatic knife from inside the vehicle, cut urethane holding backlite frame to opening fence.
8. Separate glass (1) from vehicle.

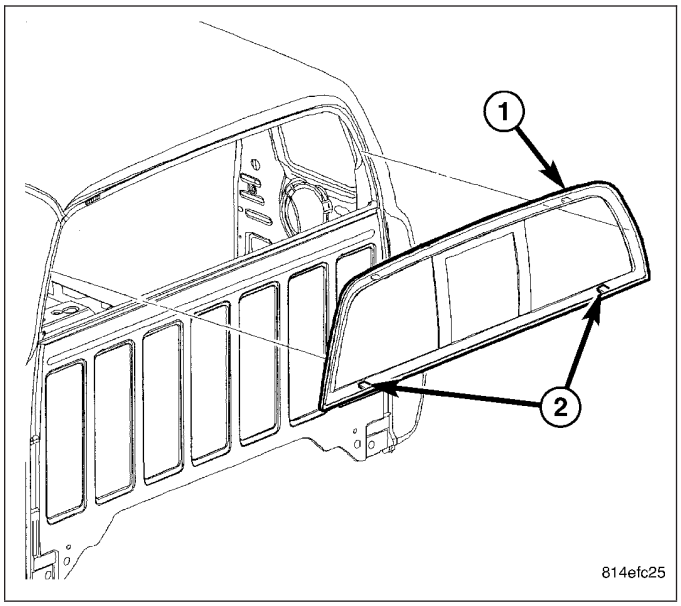


INSTALLATION

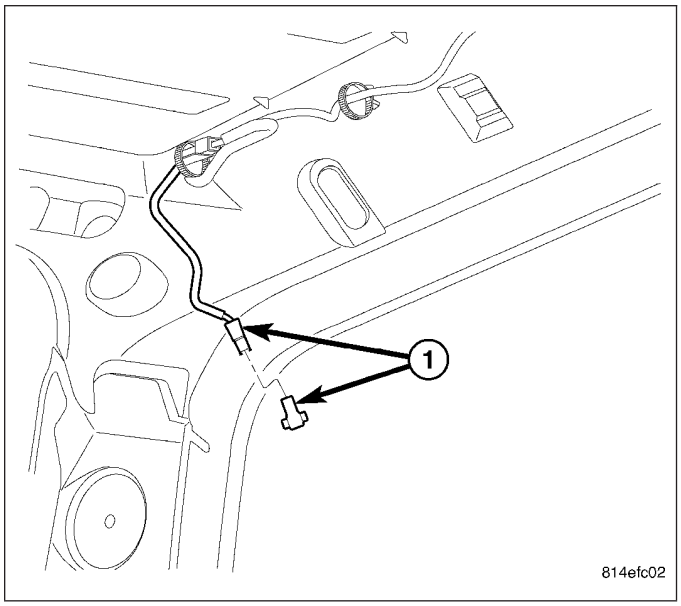
1. Clean urethane adhesive from around backlite opening fence.
2. If necessary, apply black-out primer to outer edge of replacement backlite frame (1).
3. If black-out primer was pre-applied on backlite, clean bonding surface with Isopropyl alcohol and clean lint free cloth. Allow 3 minutes for drying time.
4. Apply black-out primer to backlite opening fence.
5. Apply a 13 mm (0.5 in.) bead of urethane (4) around the perimeter of the window frame bonding surface (1).



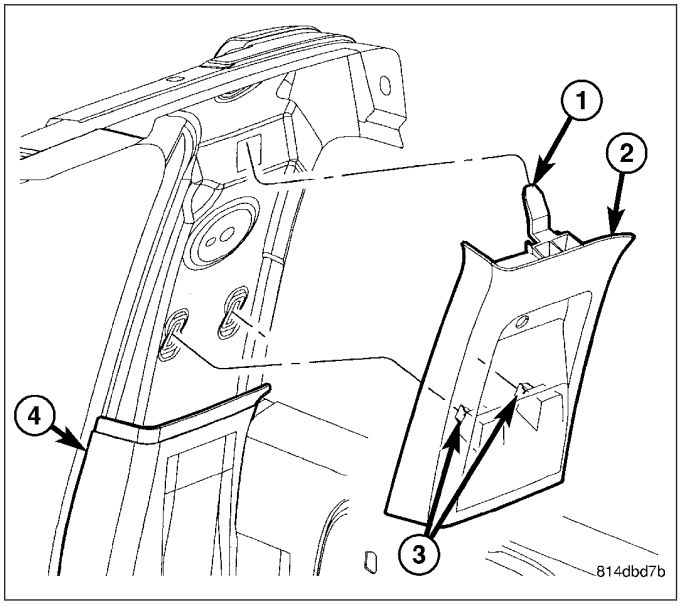
6. Set glass (1) on lower fence and move glass forward into opening.
7. Firmly push glass (1) against rear window glass opening fence.
8. Bend tabs (2) around edges of backlite opening fence to retain glass.
9. Clean excess urethane from exterior with MOPAR®, Super Clean or equivalent.
10. Allow urethane to cure at least 24 hours (full cure is 72 hours).
11. Water test to verify repair before returning vehicle to service.



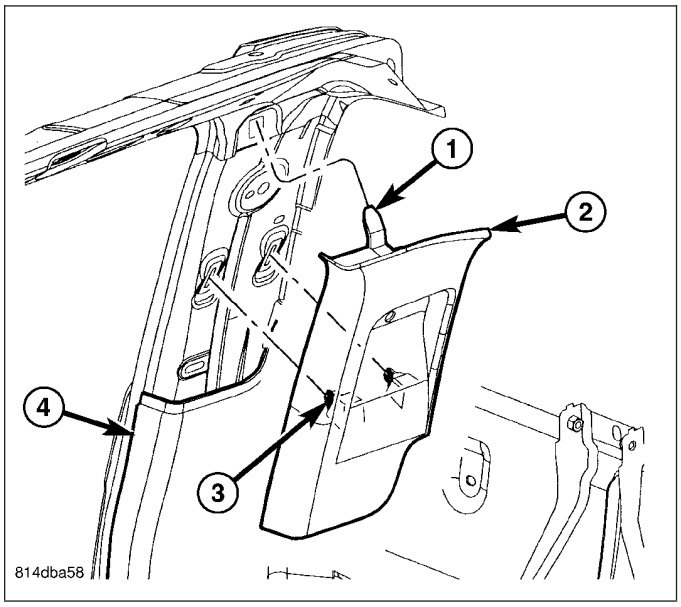
12. Connect the rear window defogger electrical connector, if equipped.



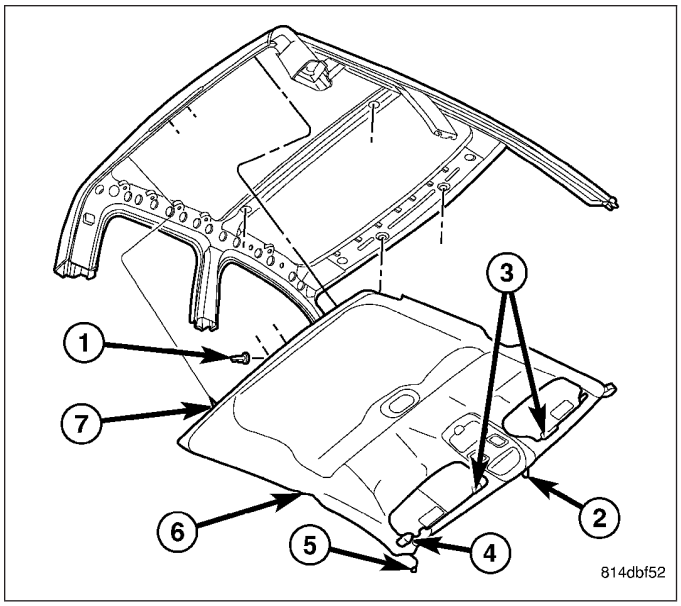
13. On club cab models, install the upper c-pillar trim (2) (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - INSTALLATION)



14. On quad cab models, install the upper c-pillar trim (2). (Refer to 23 - BODY/INTERIOR/PANEL-C PILLAR LOWER TRIM - INSTALLATION)



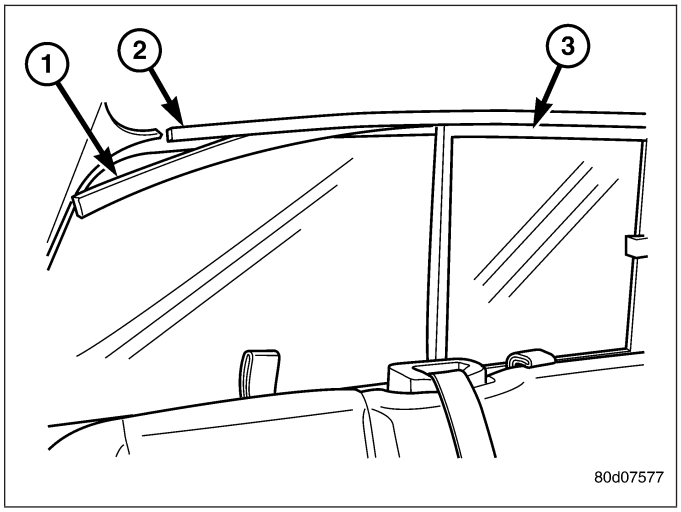
15. Install the headliner (6) (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION).



GLASS-BACKLITE SLIDING

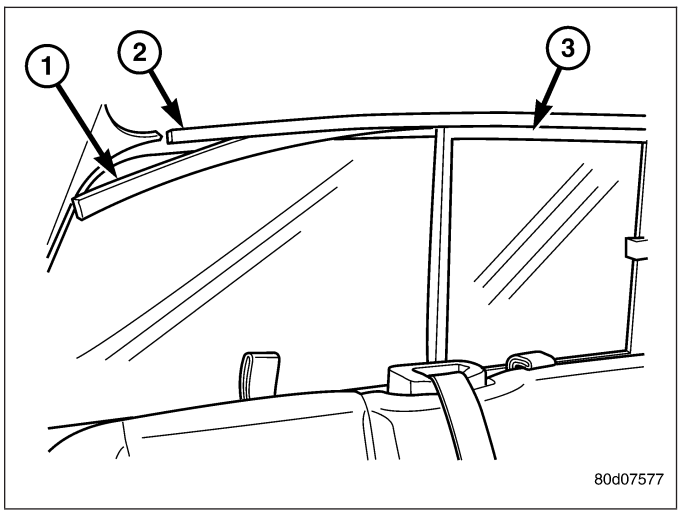
REMOVAL

1. Slide the upper run channel (1) out of the window frame (2).
2. Slide the vent glass (3) upward to remove from the lower window frame (2).
3. Lower the glass (3) out of the upper window frame (2) and remove.



INSTALLATION

1. Slide the vent glass (3) upper edge into window frame (2) and insert the lower edge into the lower molding.
2. Position the upper run channel (1) into the window frame (2) and slide it into place.
3. Verify vent glass (3) operation.

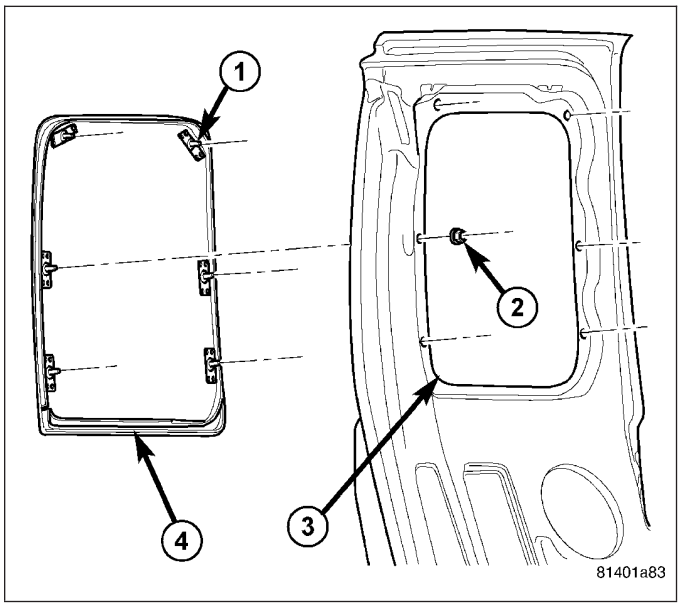


GLASS-REAR DOOR

DESCRIPTION

The rear door quarter glass (1) is seated within the rear door fence line, attached by nuts and sealed with butyl sealer.

1. To remove the quarter glass (1) (Refer to 23 - BODY/DOOR - CARGO/GLASS-DOOR - REMOVAL)



WINDSHIELD

WARNING

WINDSHIELD SAFETY PRECAUTIONS

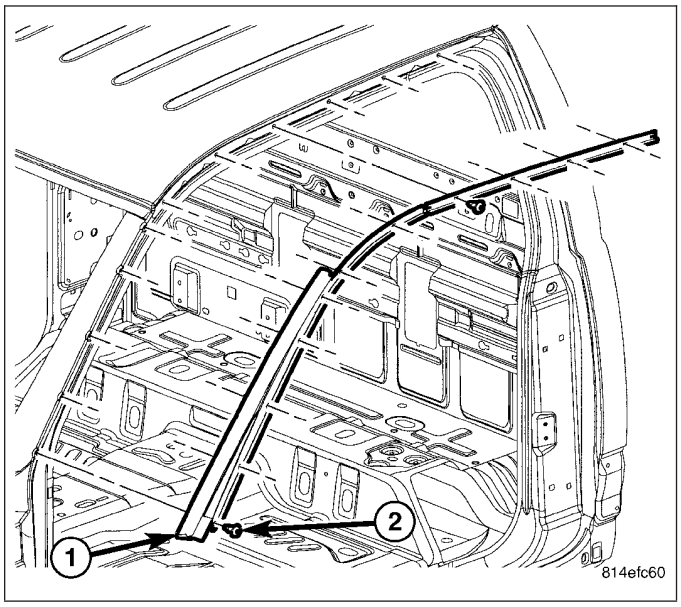
WARNING: Do not operate the vehicle within 24 hours of windshield installation. It takes at least 24 hours for urethane adhesive to cure. If it is not cured, the windshield may not perform properly in an accident.

- **Urethane adhesives are applied as a system. Use glass cleaner, glass prep solvent, glass primer, pvc (vinyl) primer and pinch weld (fence) primer provided by the adhesive manufacturer. If not, structural integrity could be compromised.**
- **Daimlerchrysler does not recommend glass adhesive by brand. Technicians should review product labels and technical data sheets, and use only adhesives that their manufactures warrant will restore a vehicle to the requirements of fmvss 212. Technicians should also insure that primers and cleaners are compatible with the particular adhesive used.**
- **Be sure to refer to the urethane manufacturer's directions for curing time specifications, and do not use adhesive after its expiration date.**
- **Vapors that are emitted from the urethane adhesive or primer could cause personal injury. Use them in a well-ventilated area.**
- **Skin contact with urethane adhesive should be avoided. Personal injury may result.**
- **Always wear eye and hand protection when working with glass.**

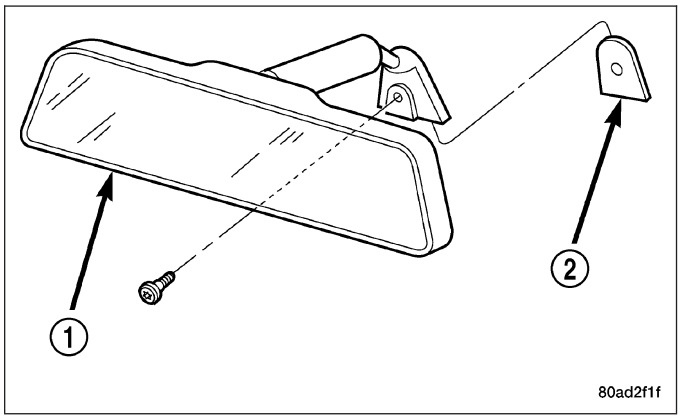
CAUTION: Protect all painted and trimmed surfaces from coming in contact with urethane or primers. Be careful not to damage painted surfaces when removing moldings or cutting urethane around windshield.

REMOVAL

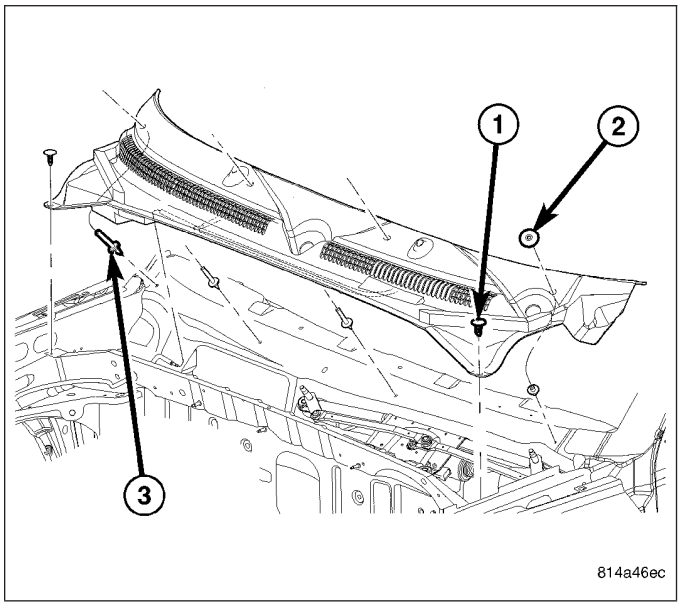
1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/STATIONARY GLASS/WINDSHIELD - WARNING)
2. Remove the screws (2) attaching the side windshield molding (1) to the a-pillars and remove the molding.



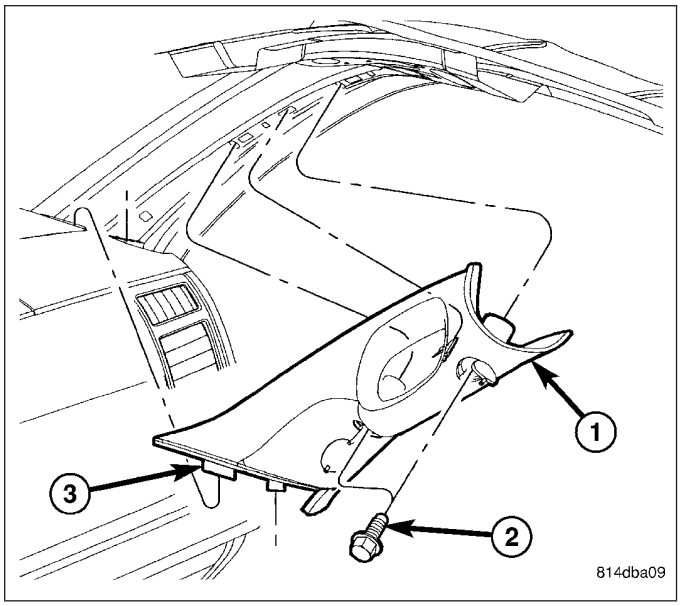
3. Remove rear view mirror (1). (Refer to 23 - BODY/INTERIOR/REAR VIEW MIRROR - REMOVAL)



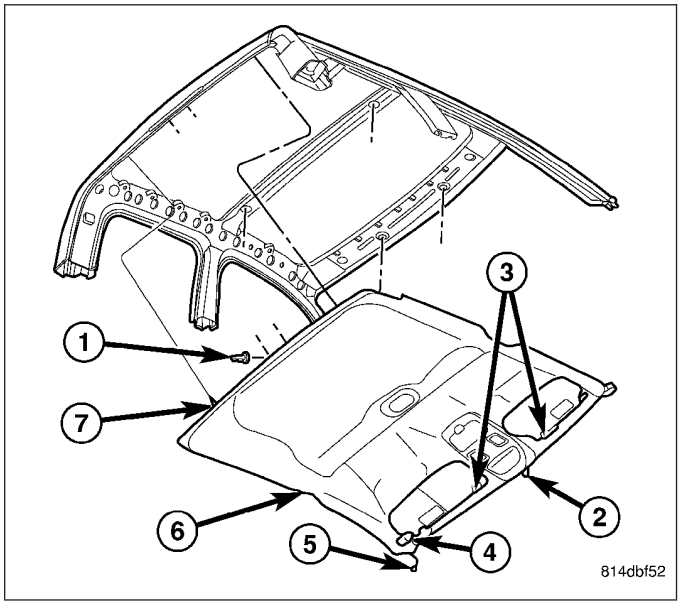
4. Remove the cowl grille. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE AND SCREEN - REMOVAL)



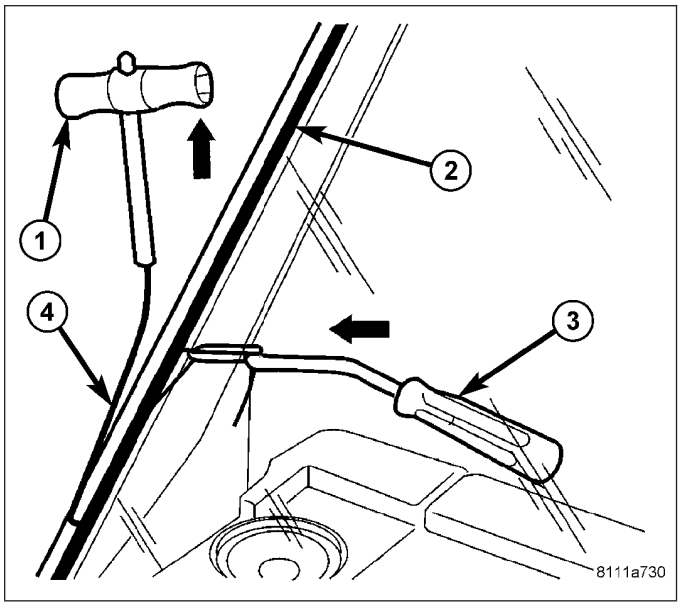
5. Remove the a-pillar trim panels (3). (Refer to 23 - BODY/INTERIOR/PANEL-A PILLAR TRIM - REMOVAL)



6. Remove the headliner (6). (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL)



7. Using a windshield cut-out wire (4) or equivalent, separate the adhesive (2).
8. Carefully remove windshield.



1 - T-HANDLE
2 - WINDSHIELD ADHESIVE
3 - COUNTER SUPPORT
4 - CUTTING WIRE

INSTALLATION

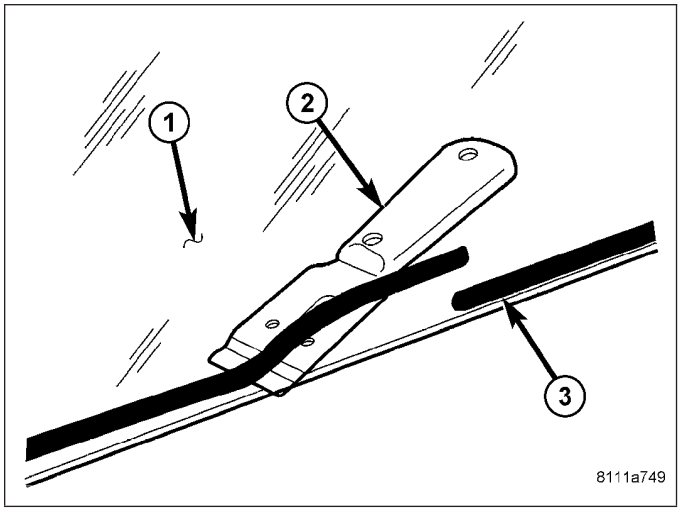
WARNING: Allow the urethane at least 24 hours to cure before returning the vehicle to use.

CAUTION: Roll down the left and right front door glass and open the rear glass slider (if available) before installing windshield to avoid pressurizing the passenger compartment if a door is slammed before urethane is cured. Water leaks can result.

NOTE: The windshield fence should be cleaned of most of its old urethane bonding material. A small amount of old urethane, approximately 1-2 mm in height, should remain on the fence. Do not grind off or completely remove all old urethane from the fence, the paint finish and bonding strength will be adversely affected. Support spacers located on the cowl at the bottom of the windshield opening should be replaced with new parts. Replace any missing or damaged spacers around the perimeter of the windshield opening.

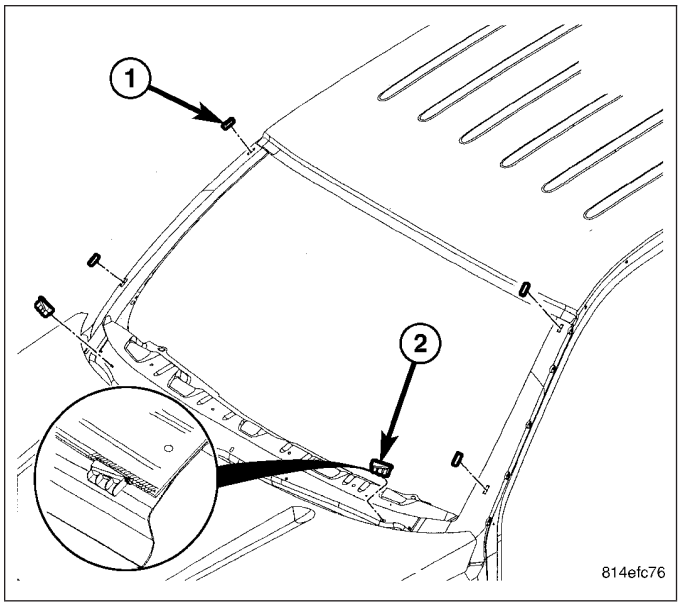
Windshield Preparation - Installing A Previously Installed Windshield

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/STATIONARY GLASS - WARNING)
2. Level old bead of windshield adhesive (3) to a thickness of approximately 1 mm (0.04 in.) and remove loose adhesive.

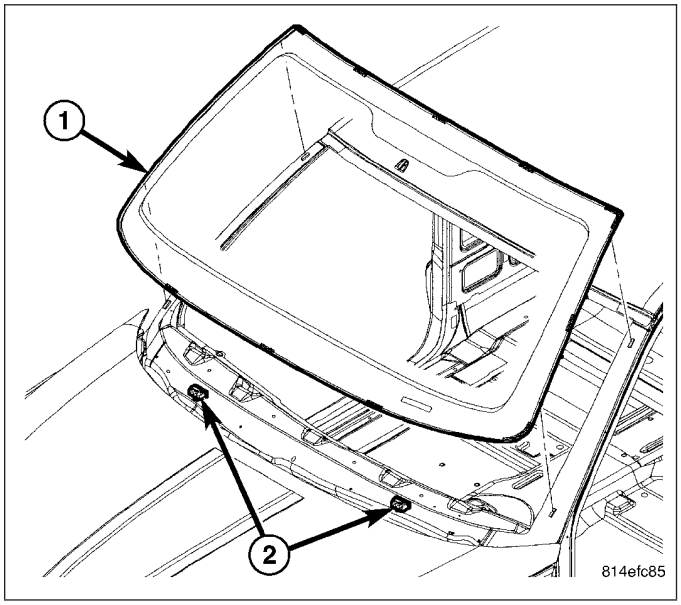


3. Apply four new spacers (1) to the a-pillars and place them evenly apart at the top and bottom.
4. Install the lower spacer assemblies (2) into the slotted holes and verify proper installation by pulling to make sure they are locked on.

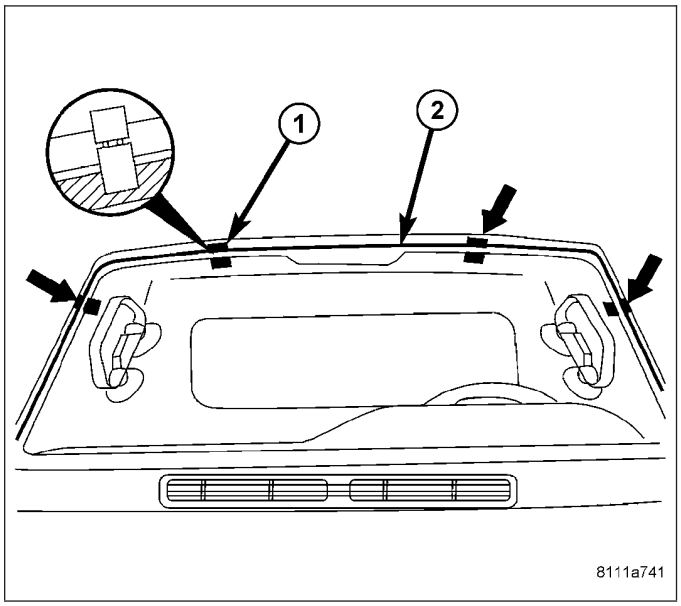
NOTE: Lower spacers must be facing with the flat side upwards when installing into the slotted holes.



5. Position windshield (1) in center of windshield opening and resting on the side and lower spacers (2).
6. Adjust the lower spacers (2) as required, to center the windshield in the windshield opening.

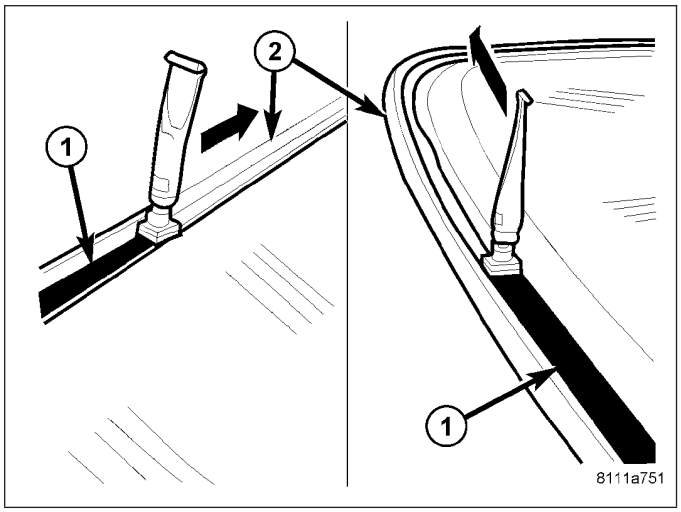


7. Apply adhesive tape (1) to the locations shown to aid with final installation.
8. Verify windshield gap is parallel to with windshield.
9. Cut tape with a sharp knife and remove windshield.

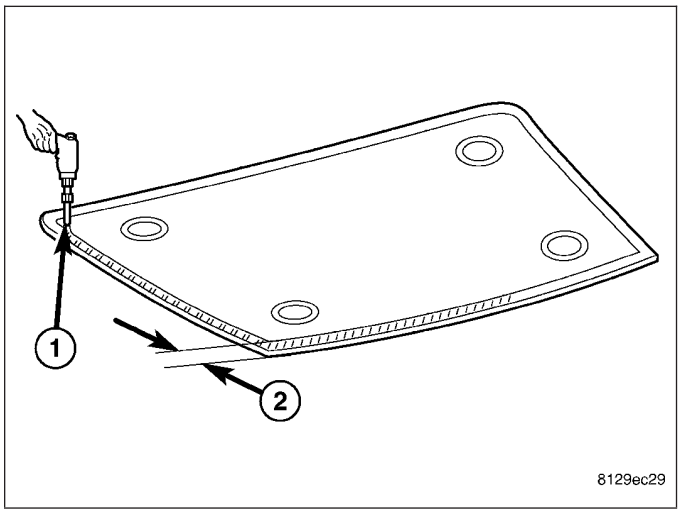


NOTE: Typical primer installation shown.

10. Clean and dry area of glass (2) to be re-glued with a suitable glass preparation solvent and rag.
11. Using a flash light, verify that glass primer is without damage.
12. Re-prime any damaged area. If old adhesive has been exposed for more than 12 hours, entire adhesive area needs to be re-primed.



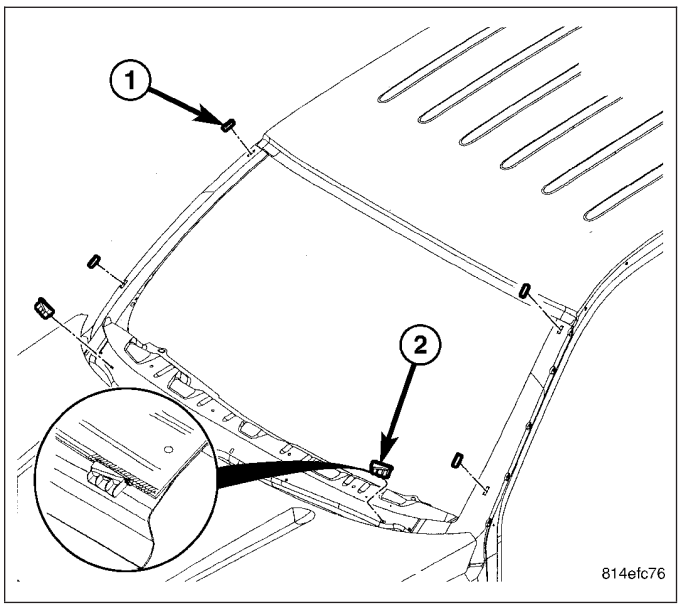
13. Apply primer (1) around the perimeter of the glass to a width of 15 mm (0.5 in.) (2).
14. Allow primer to air dry for at least 10 minutes.
15. Using a flash light, verify that glass primer is without damage.



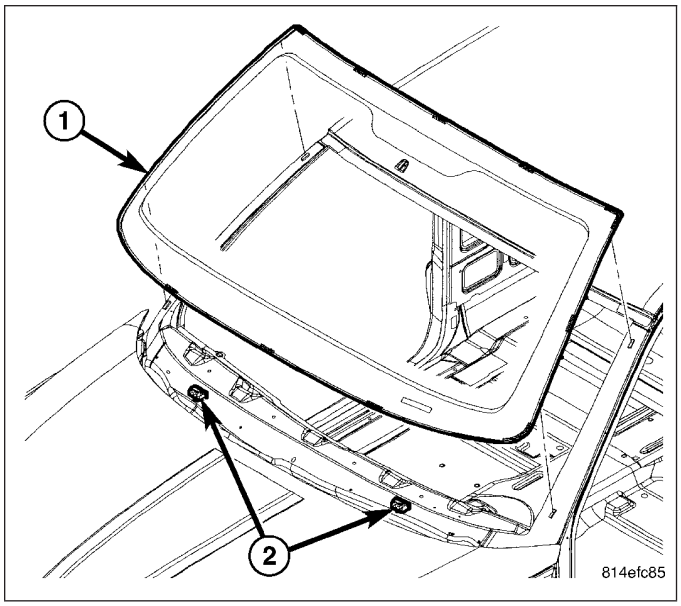
Windshield Preparation - Installing A New Windshield

1. Apply four new spacers (1) to the a-pillars and place them evenly apart at the top and bottom.
2. Install the lower spacer assemblies (2) into the slotted holes and verify proper installation by pulling to make sure they are locked on.

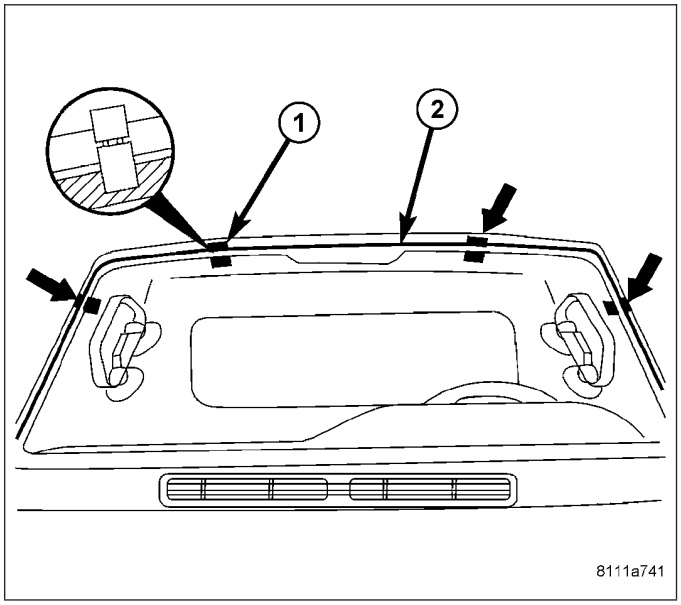
NOTE: Lower spacers must be facing with the flat side upwards when installing into the slotted holes.



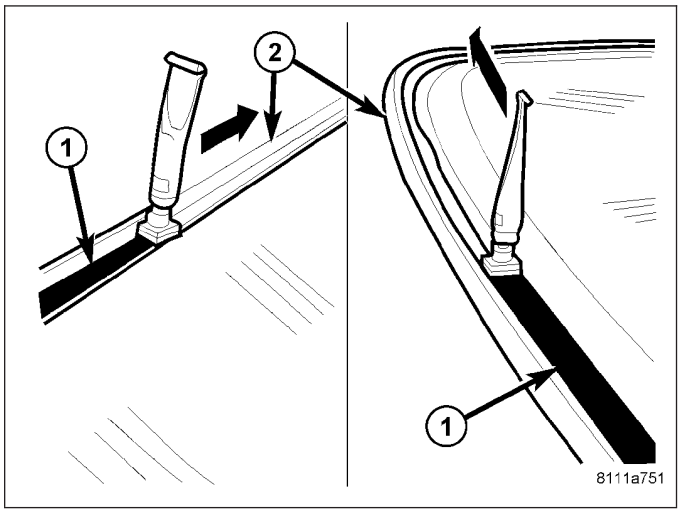
3. Position windshield (1) in center of windshield opening and resting on the side and lower spacers (2).
4. Adjust the lower spacers (2) as required, to center the windshield in the windshield opening.



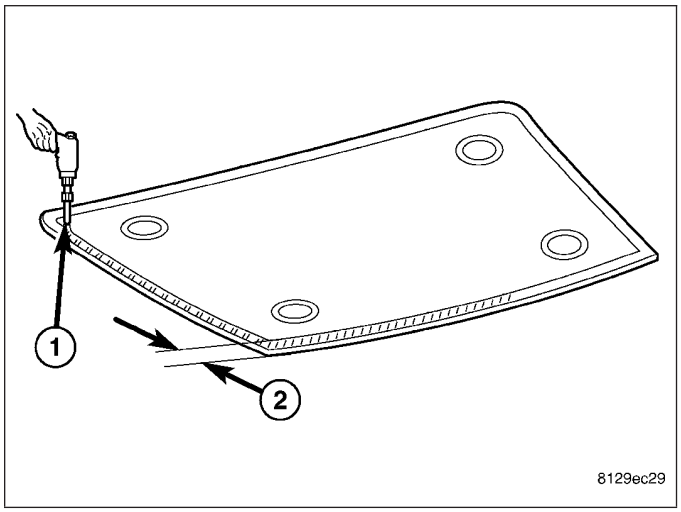
5. Clean and check windshield for damage.
6. Position windshield in center of windshield opening.
7. Apply adhesive tape to the locations shown to aid with final installation.
8. Verify windshield gap is parallel to with windshield.
9. Cut tape with a sharp knife and remove windshield.



10. Clean and dry area of glass to be glued with a suitable glass preparation solvent and rag.
11. Apply primer to gluing surface at windshield seal.

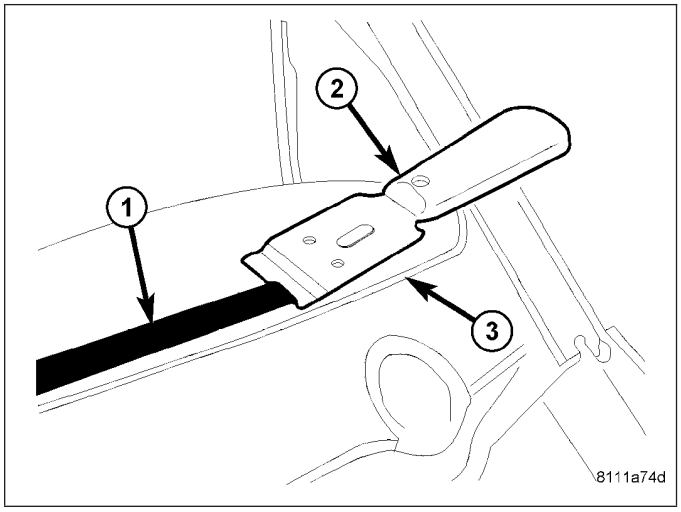


12. Apply primer (1) around the perimeter of the glass to a width of 15 mm (0.5 in.) (2).
13. Allow primer to air dry for at least 10 minutes.
14. Using a flash light, verify that glass primer is without damage.

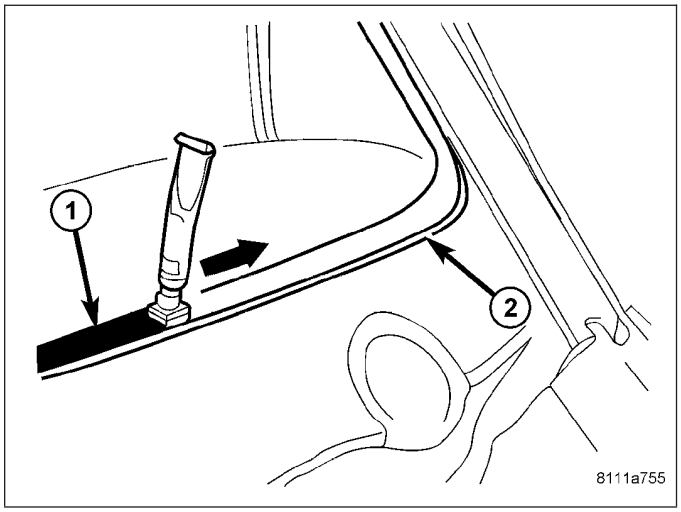


Windshield Opening Preparation

1. Clean and vacuum windshield opening.
2. Level old bead of windshield opening adhesive (1) to a thickness of approximately 1 mm (0.04 in.) and remove loose adhesive.



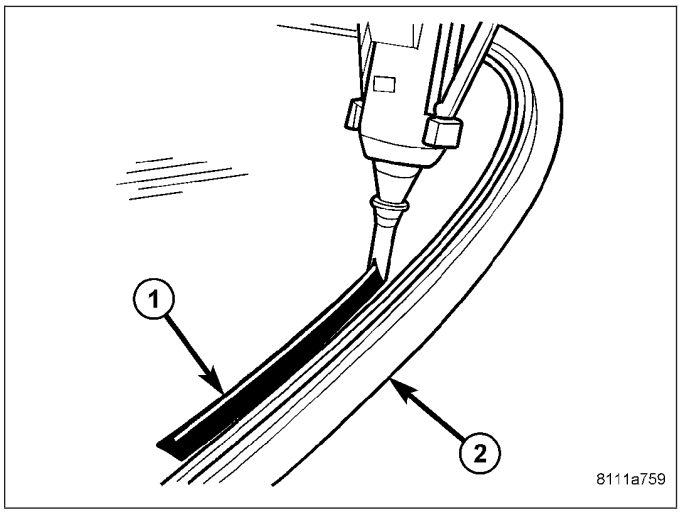
3. Clean and dry area of windshield opening to be reglued with a suitable glass preparation solvent and rag.
4. Re-prime any damaged area. If old adhesive has been exposed for more than 12 hours, entire adhesive area needs to be re-primed.
5. Allow primer to air dry for at least 10 minutes.



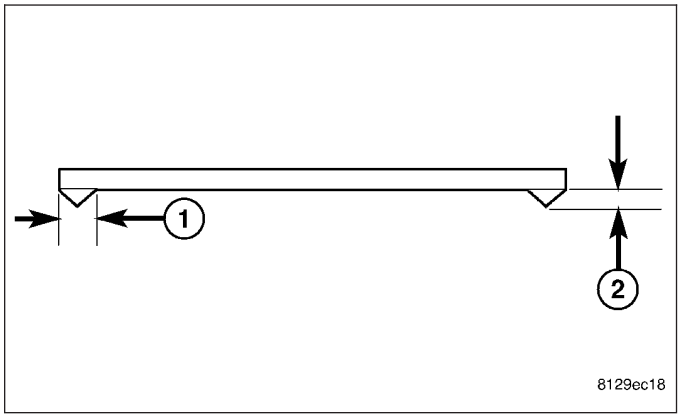
Windshield Installation

1. Apply bead of adhesive (1) with a triangular nozzle directly to the windshield seal starting at bottom in center of windshield.

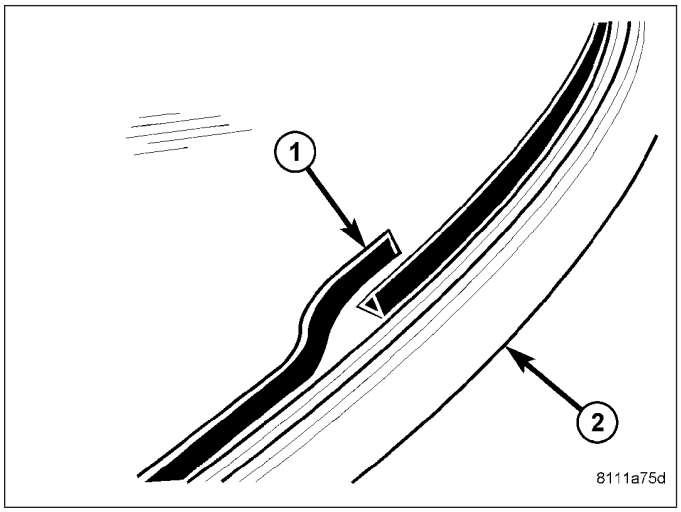
CAUTION: Always apply bead of adhesive to the windshield. Always install the windshield within 5 minutes after applying adhesive.



2. Bead dimensions should be approximately 9.5 - 12.0 mm wide (1) by 12.7 - 14.0 mm in height (2).



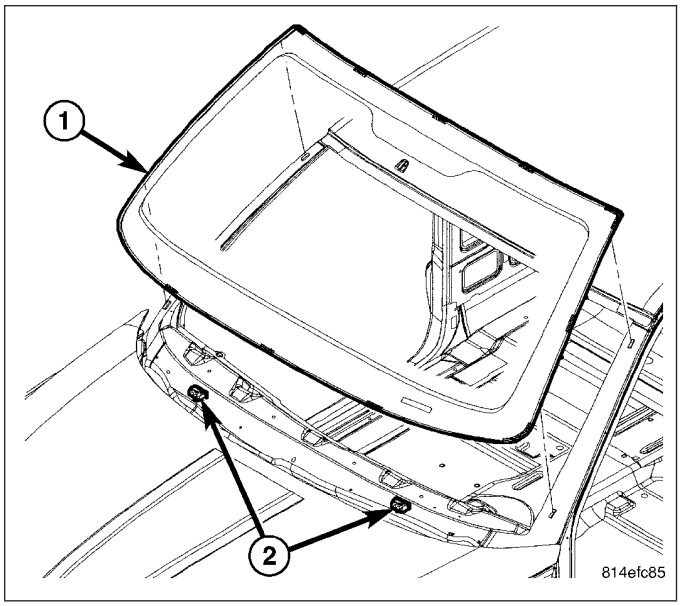
3. Allow end of adhesive bead to run out parallel to the start of the bead and smooth ends flush.



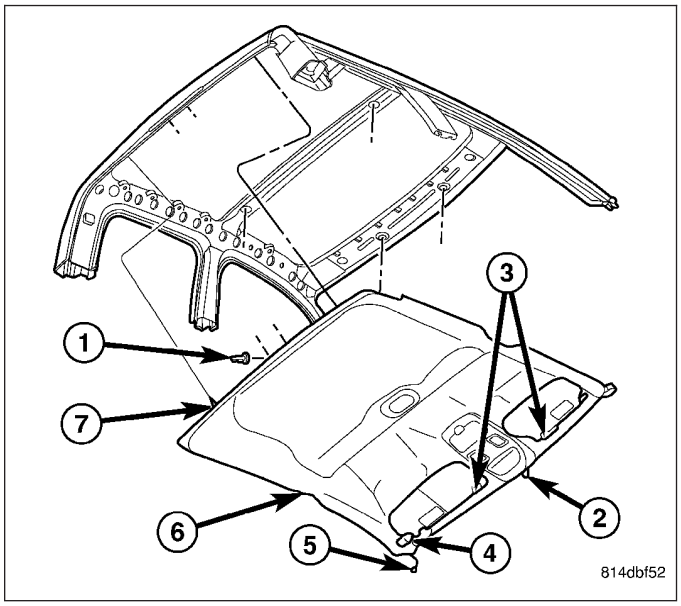
4. Lift windshield into place in the center of the windshield opening and use the tape as a guide to aid installation of the windshield into the center of the cutout.
5. Carefully lay down windshield and press on.

CAUTION: It is no longer possible to move the windshield after installation. The windshield should never be pressed into place by more than one person, because the windshield can break if pressed simultaneously on both sides.

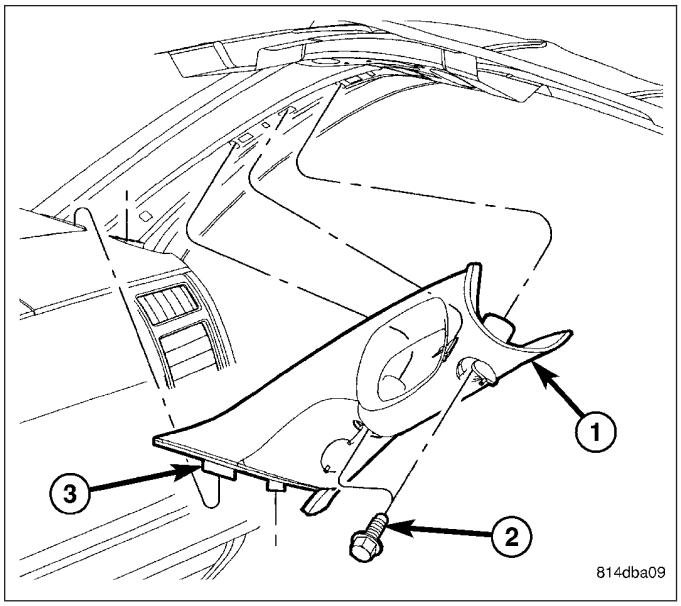
CAUTION: Roll down the left and right front door glass and open the rear glass slider (if available) before installing windshield to avoid pressurizing the passenger compartment if a door is slammed before urethane is cured. Water leaks can result.



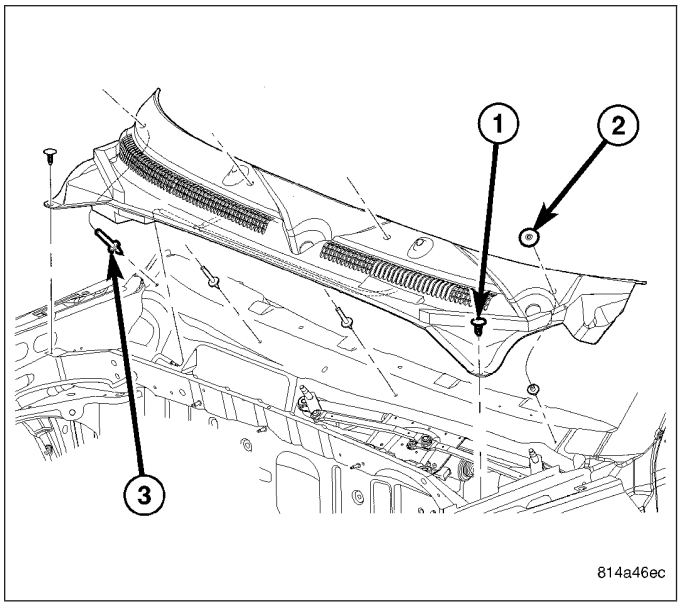
6. Install the headliner (6). (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION)



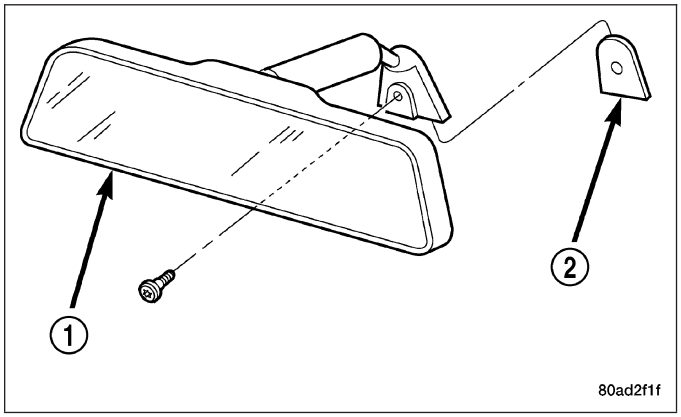
7. Install the a-pillar trim (3). (Refer to 23 - BODY/INTERIOR/PANEL-A PILLAR TRIM - INSTALLATION)



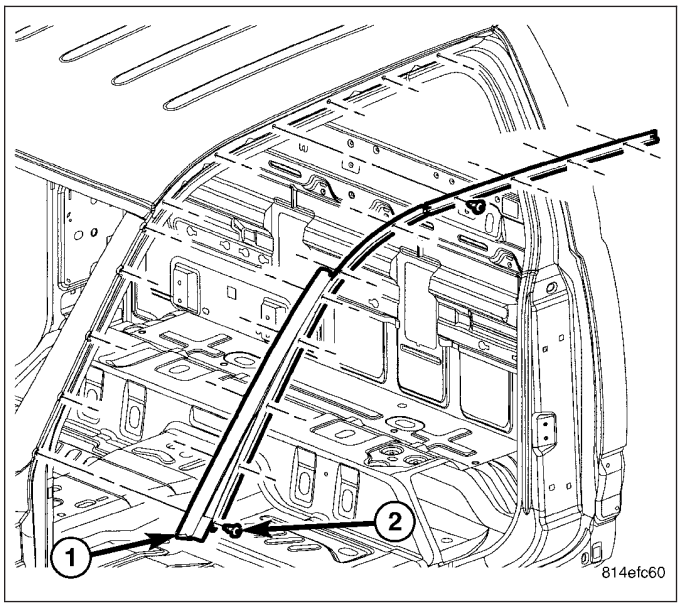
8. Install the cowl grille. (Refer to 23 - BODY/EXTERIOR/PANEL-COWL TOP - INSTALLATION)



9. Install the rearview mirror (1). (Refer to 23 - BODY/INTERIOR/REAR VIEW MIRROR - INSTALLATION)



10. Install the windshield molding retainer (1) and install the screws (2).



TAILGATE

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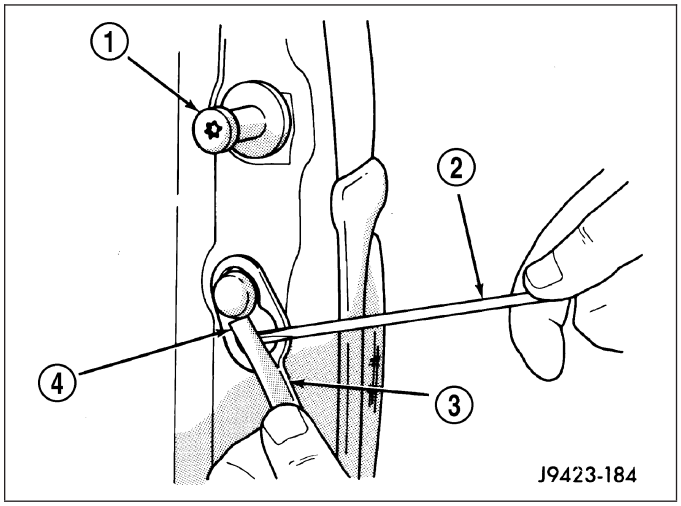
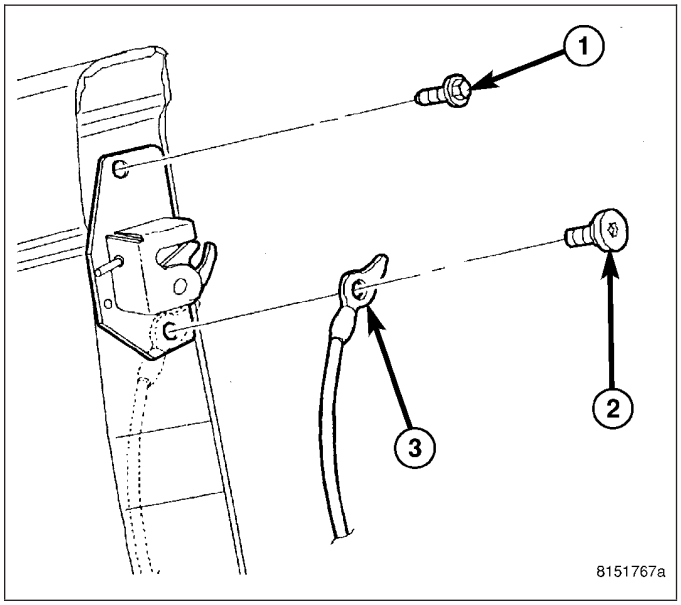
CABLE-CHECK

REMOVAL

1. Open the tailgate and locate the tailgate check cable (3) on the left and right of the cargo box below the tailgate striker (1) as necessary.
2. Pry the cable lock tab(s) (4) outward using a screwdriver or flat bladed tool (2) and remove the tailgate check cable(s) from the cargo box.

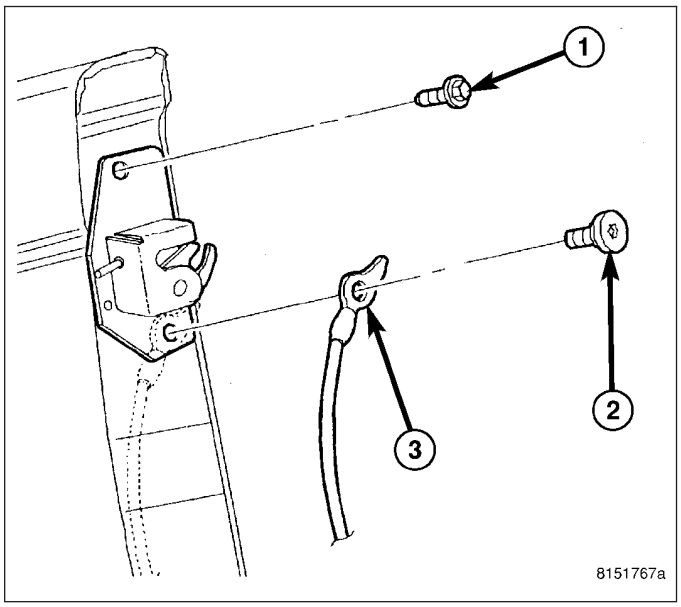


3. Remove the bolt (2) that secures the tailgate check cable (3) to the left and right side of the tailgate as necessary.
4. Remove the tailgate check cable(s) from the tailgate.

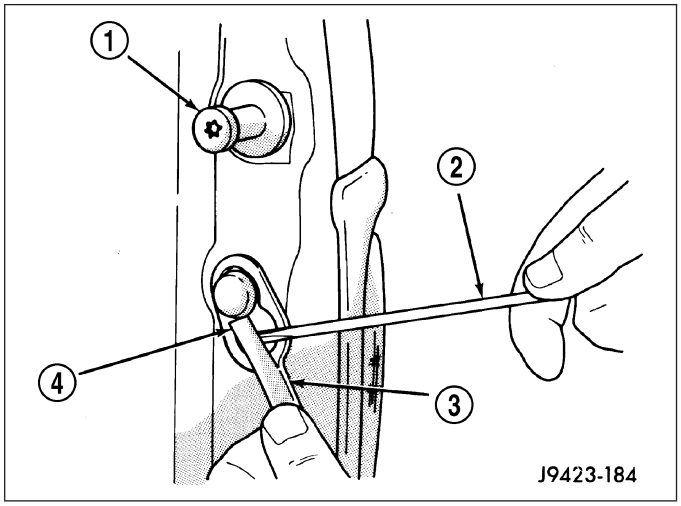


INSTALLATION

1. Position the tailgate check cable(s) (3) onto the tailgate, install the bolt (1) that secures the tailgate check cable (3) to the left and right side of the tailgate as necessary. Tighten bolt to 23 N·m (17 ft. lbs.).



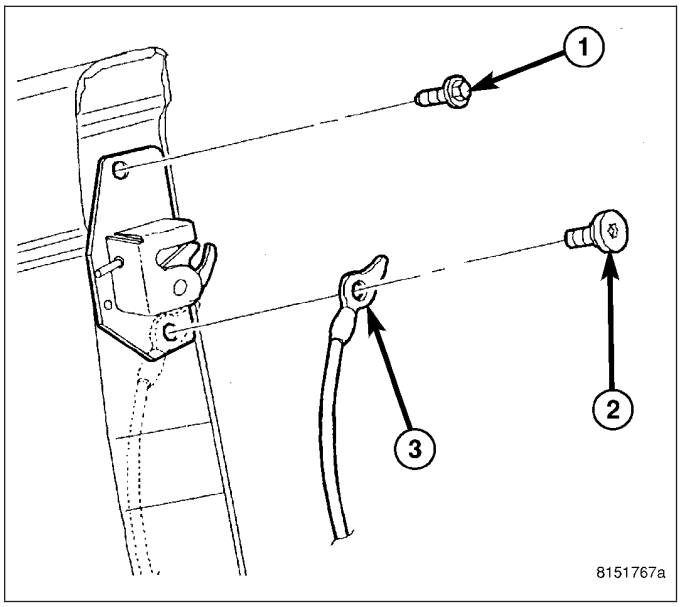
2. Slip the cable over the bolt on the cargo box until it snaps on, securing the lock tab(s) (4).



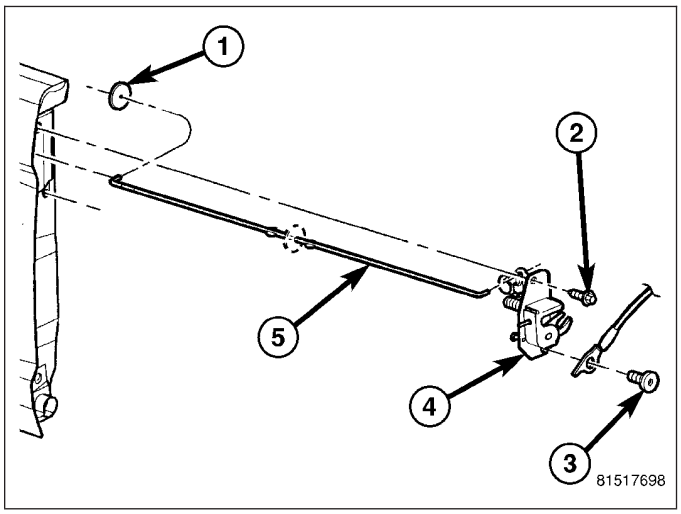
LATCH

REMOVAL

1. Remove the bolt (2) that secures the tailgate check cable (3) to the tailgate.

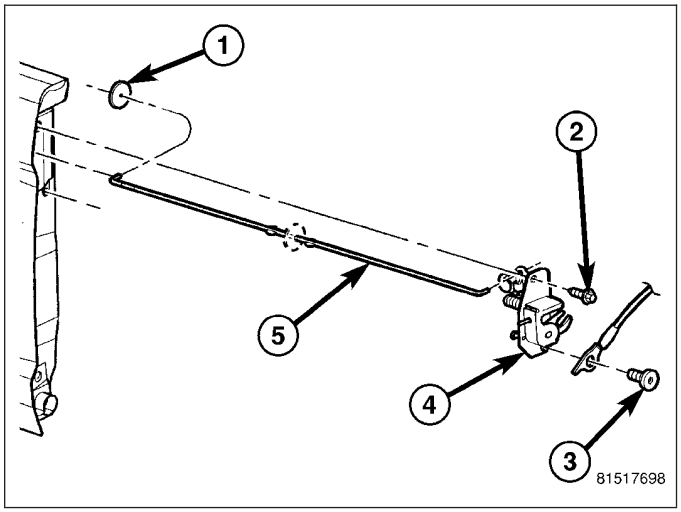


2. Remove the second bolt (2) to the latch (4) and remove from the side of the tailgate.
3. Remove the release handle link (5) from the latch (4).

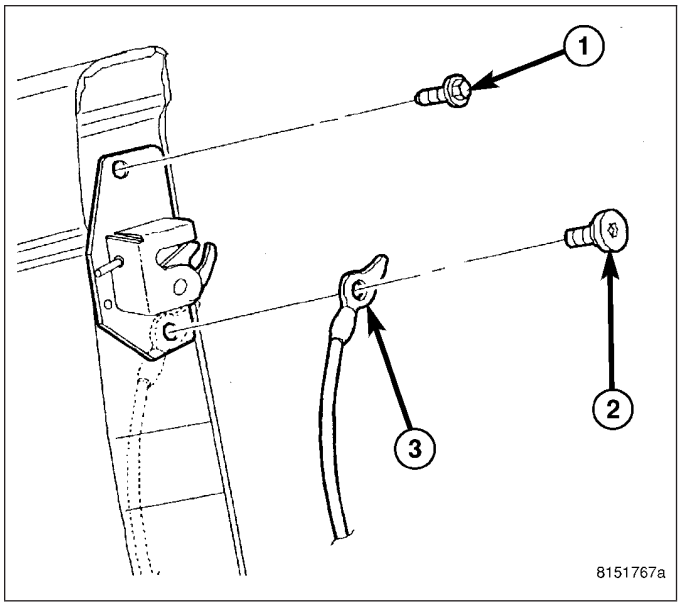


INSTALLATION

1. Connect the release handle link (5) to the latch assembly (4).
2. Position the latch assembly (4) into the tailgate and install the upper bolt (2).



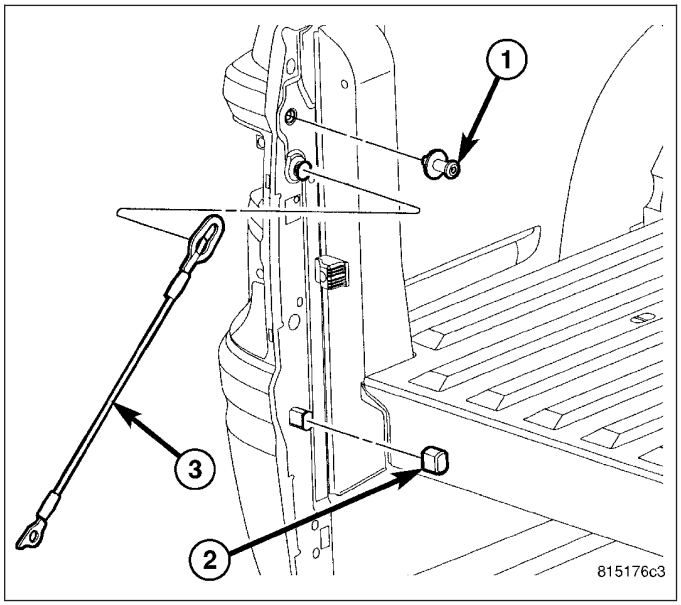
3. Install the bolt (2) that secures the tailgate check cable (3) to the tailgate. Tighten both bolts to 23 N·m (17 ft. lbs.).



LATCH STRIKER

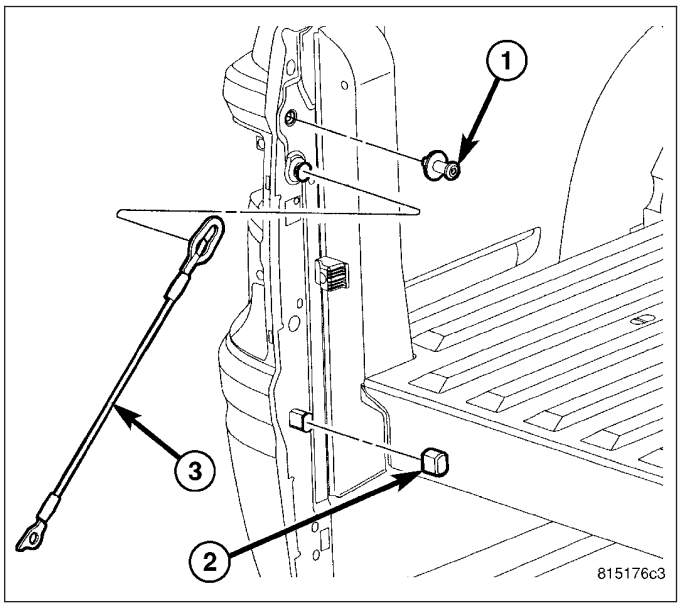
REMOVAL

1. Open the tailgate and remove the striker (1) from the cargo box.



INSTALLATION

1. Install the latch striker (1) and tighten to 34 N·m (25 ft. lbs.).

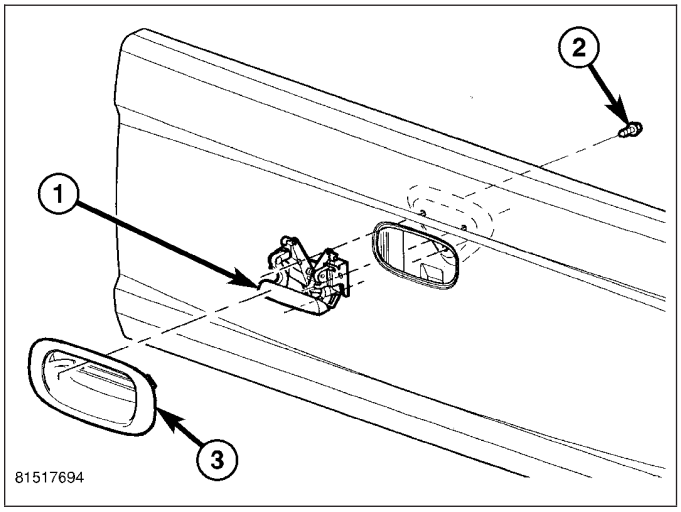


RELEASE HANDLE

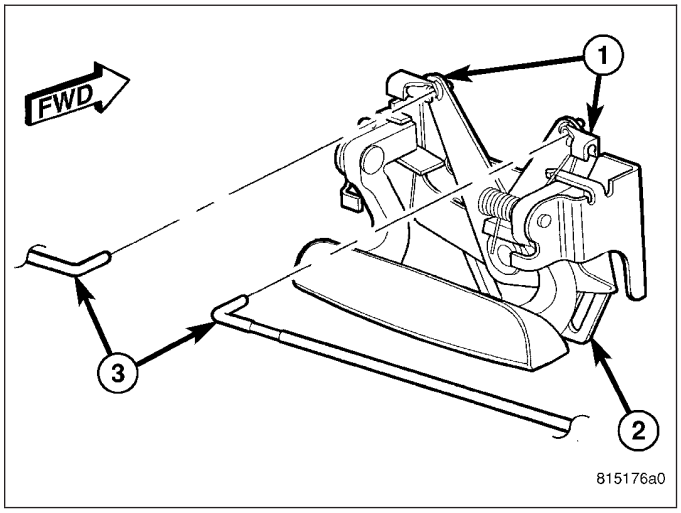
REMOVAL

NOTE: If equipped with a tailgate cover, it must be removed to access the release handle mounting bolts.

1. Remove the three mounting screws (2) to the release handle (1).

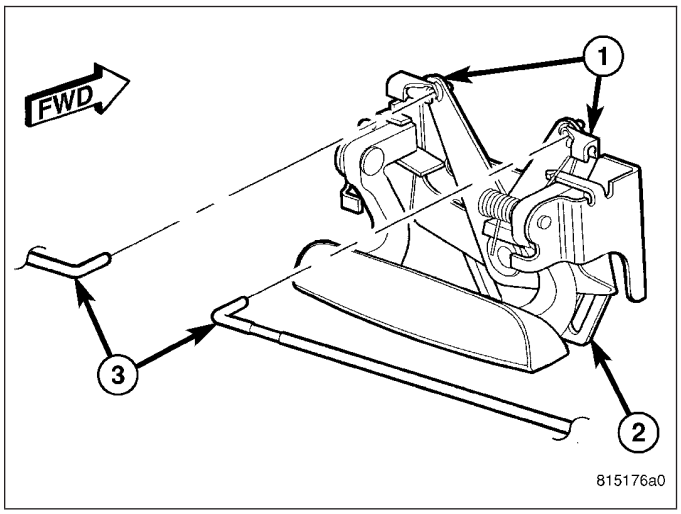


2. Pull out the release handle (2) far enough to disconnect the tailgate latch links (3) from the clips (1).



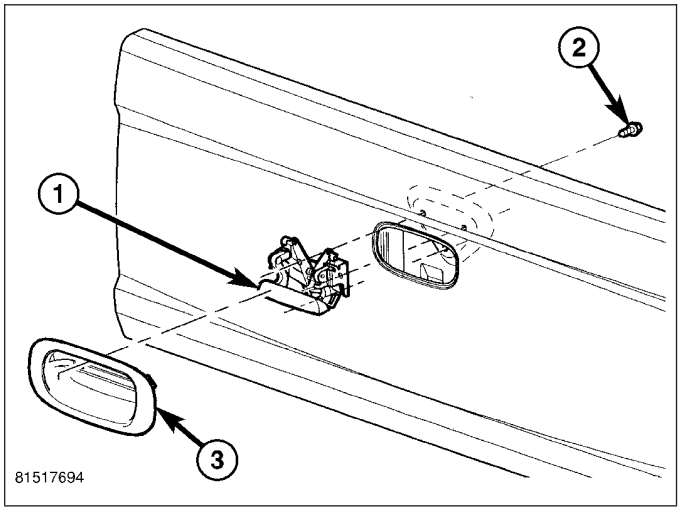
INSTALLATION

1. Position the release handle (3) in the tailgate and connect the latch links (3) to the clips (1).



2. Remove the three mounting screws (2) to the release handle (1). Tighten bolts to 7 N·m (60 in. lbs.).

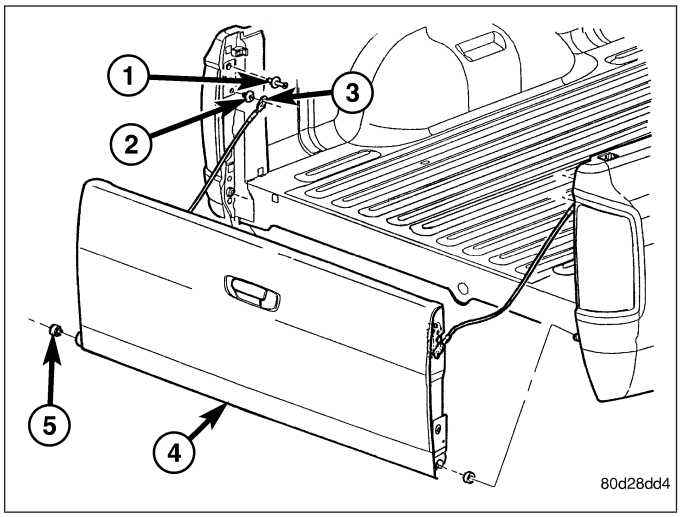
NOTE: If equipped with a tailgate cover, it must be reinstalled after the release handle mounting bolts are tightened.



TAILGATE

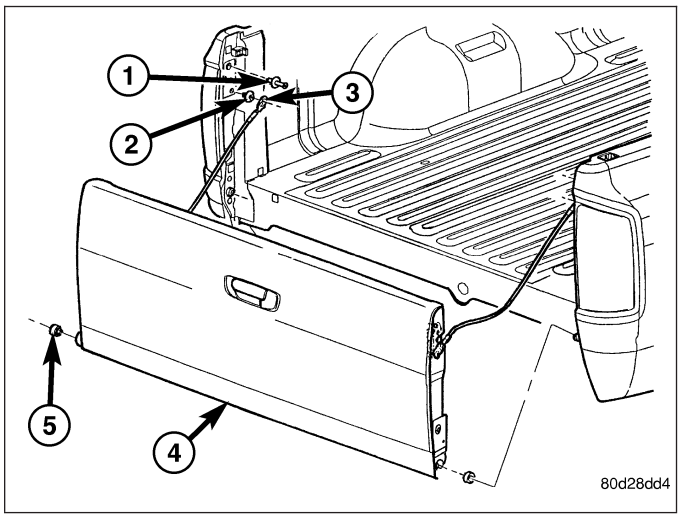
REMOVAL

1. Open the tailgate (4).
2. Disconnect the tailgate check cables (3) from the cable bolts (2) locate below each tailgate striker (1) (Refer to 23 - BODY/TAILGATE/CHECK CABLE - REMOVAL).
3. Partially close the tailgate so that the notch in the right side tailgate pivot aligns with the flats on the right side tailgate hinge.
4. Lift the tailgate upward and disconnect the tailgate pivot from the right side tailgate hinge.
5. Carefully slide the tailgate to the right and disconnect it from the left side tailgate hinge and remove the tailgate.
6. If required, remove the bushing (5) from each tailgate hinge.



INSTALLATION

1. If removed, install the bushing (5) onto each tailgate hinge.
2. Position the tailgate (4) onto the left side tailgate hinge.
3. Partially close the tailgate so that the notch in the right side tailgate pivot aligns with the flats on the right side tailgate hinge.
4. Lower the tailgate onto the right side tailgate hinge.
5. Connect the tailgate check cables (3) to the cable bolts (2) located below each tailgate striker (1) (Refer to 23 - BODY/TAILGATE/CHECK CABLE - INSTALLATION).



BODY STRUCTURE

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GAP AND FLUSH

SPECIFICATIONS

GAP AND FLUSH

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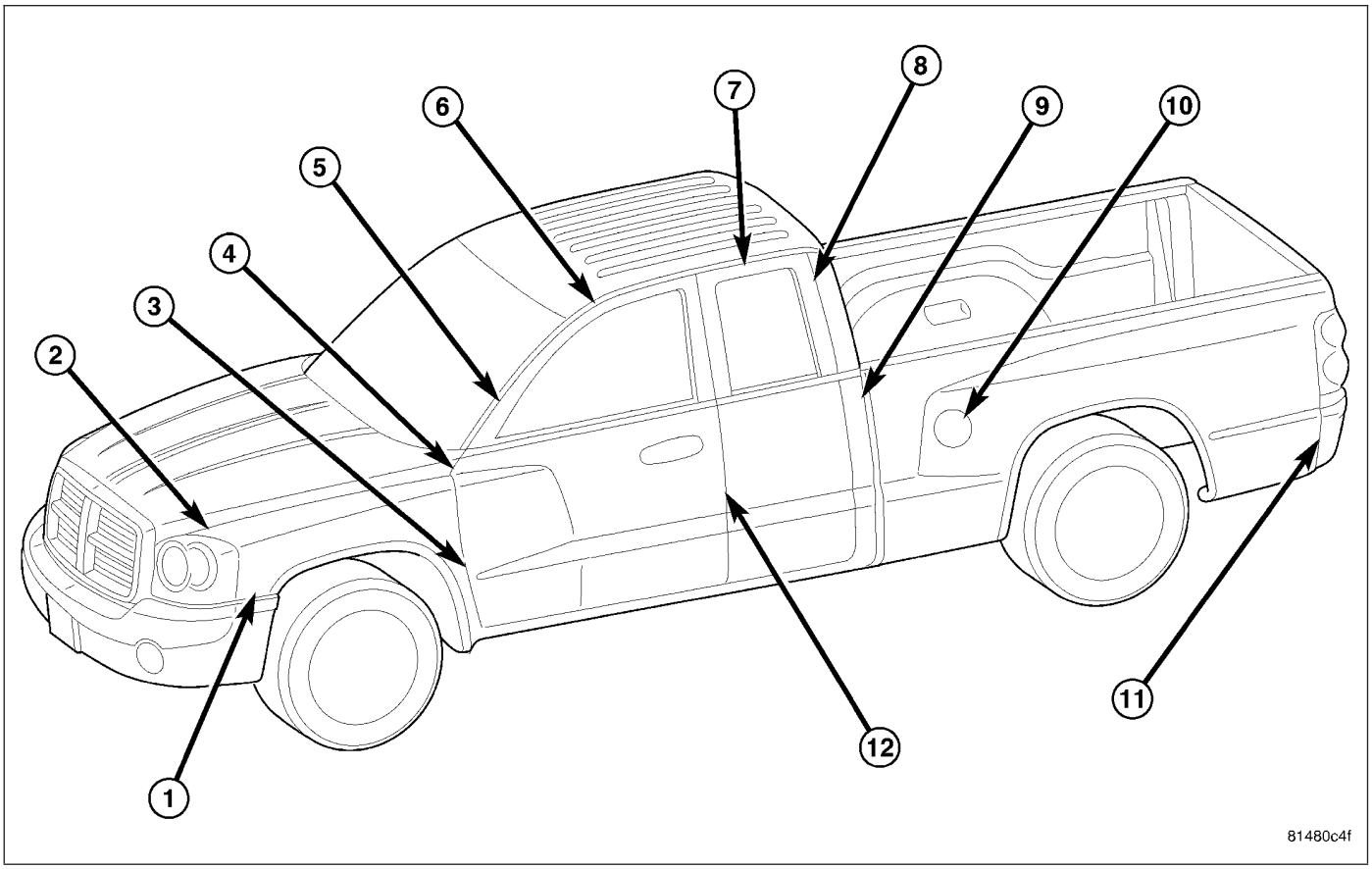

Fig. 1 GAP AND FLUSH - CLUB CAB (33) ONLY

GAP AND FLUSH - CLUB CA (33) ONLY

NOTE: All measurements are in mm.			
DIMENSION	DESCRIPTION	GAP	FLUSH
1	Fascia to fender	14.0 ± 4.0 Side to side within 3.0	Fascia over flush to fender
2	Hood to fender	5.0 ± 1.5	—
3	Fender to front door	5.0 ± 1.5 Parallel within 1.5	Overflush 5.0 ± 1.5 Parallel within 1.5
4	Hood to front door	5.0 ± 1.5 Parallel within 1.5	Overflush 5.0 ± 1.5 Parallel within 1.5
5	Front door to windshield	5.0 ± 1.5	Underflush 2.0 ± 1.5
6	Front door to roof	—	Overflush 6.0 ± 1.5 Parallel within 1.5
7	Cargo door to roof	—	Overflush 6.0 ± 1.5 Parallel within 1.5
8	Cargo door to quarter	5.5 ± 1.5 Parallel within 1.5	0.0 ± 1.5 Parallel within 1.5
9	Box outer to cab	24.5 ± 5.0 Parallel within 1.5	Underflush 3.5 ± 3.0
10	Box outer to fuel door	4.0 ± 1.5 Parallel within 1.0	Overflush 0.5 ± 1.5 Parallel within 1.5
11	Bumper to box outer	26.0 ± 4.0	—
12	Front door to cargo door	5.0 ± 1.5 Parallel within 1.5	0.0 ± 1.5 Parallel within 1.5

GAP AND FLUSH - QUAD CAB (84) ONLY

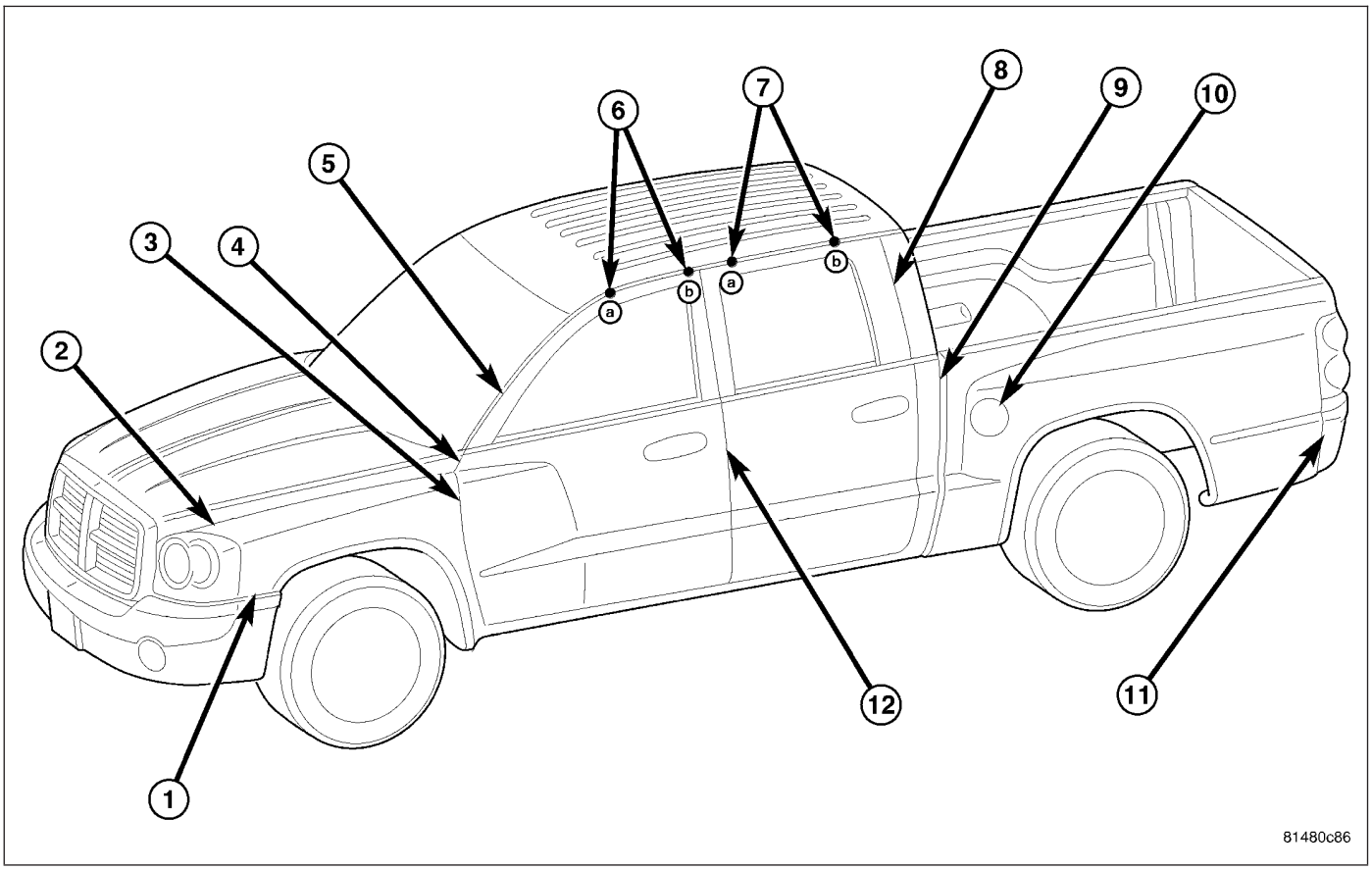

Fig. 2 GAP AND FLUSH - QUAD CAB (84) ONLY

NOTE: All measurements are in mm.			
DIMENSION	DESCRIPTION	GAP	FLUSH
1	Fascia to fender	14.0 ± 4.0 Side to side within 3.0	Fascia overflush to fender
2	Hood to fender	5.0 ± 1.5	—
3	Fender to front door	5.0 ± 1.5 Parallel within 1.5	Overflush 0.5 ± 1.5 Parallel within 1.5
4	Hood to front door	5.0 ± 1.5 Parallel within 1.5	Overflush 0.5 ± 1.5 Parallel within 1.5
5	Front door to windshield	5.0 ± 1.5	Underflush 2.0 ± 1.5
6	Front door to roof	—	a. Overflush 6.5 ± 1.5 b. Overflush 7.0 ± 1.5
7	Rear door to roof	—	a. Overflush
8	Rear door to quarter	5.0 ± 1.5 Parallel within 1.5	0.0 ± 1.5 Parallel within 1.5
9	Box outer to cab	24.5 ± 5.0 Parallel within 1.5	Underflush 3.5 ± 3.0
10	Box outer to fuel door	4.0 ± 1.5 Parallel within 1.0	Overflush 0.5 ± 1.5 Parallel within 1.5
11	Bumper to box outer	26.0 ±4.0	—
12	Front door to rear door	5.0 ± 1.0 Parallel within 1.5	0.0 ± 1.5 Parallel within 1.5

GAP AND FLUSH - CLUB CAB (33) AND QUAD CAB (84)

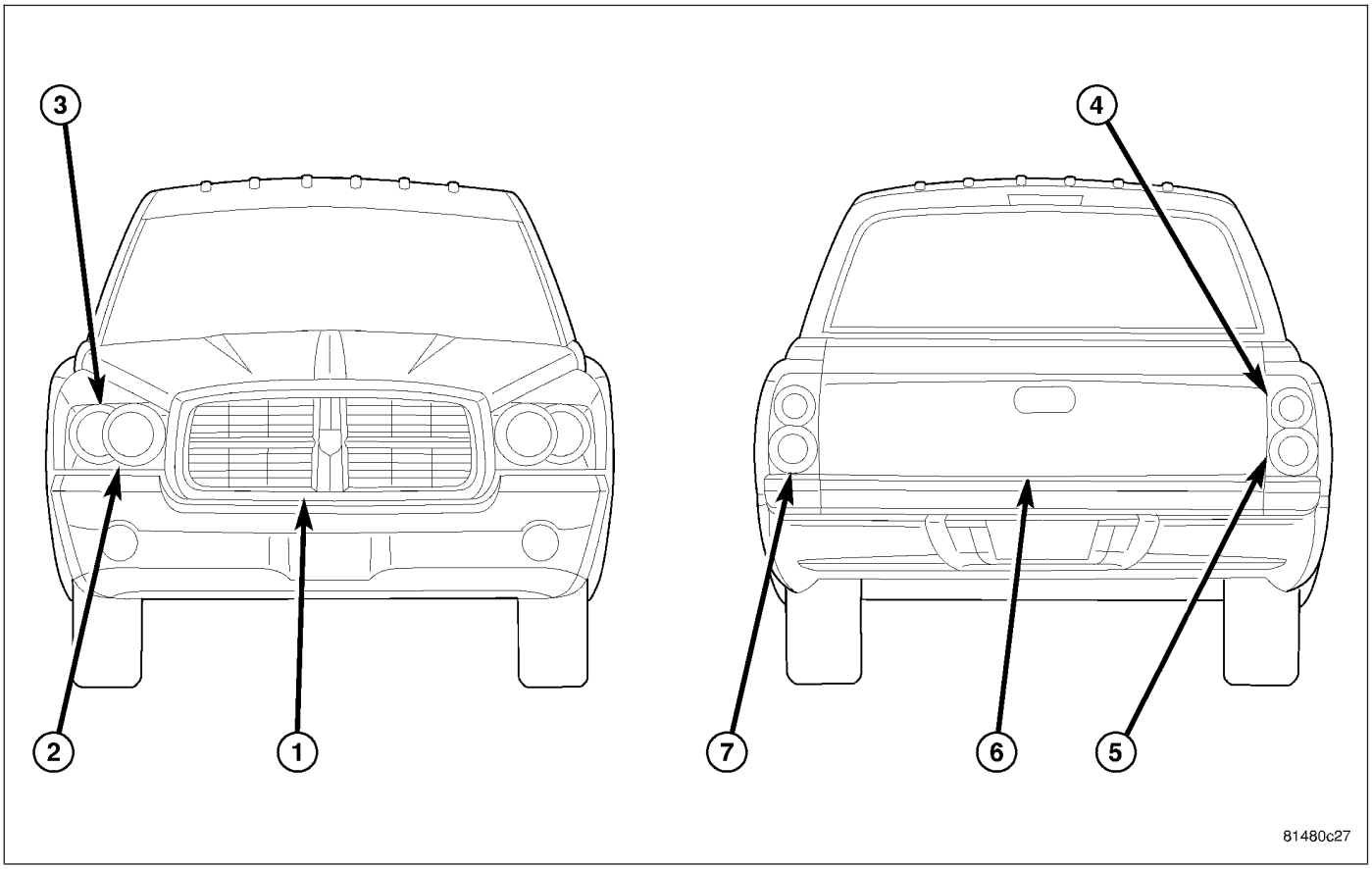

Fig. 3 GAP AND FLUSH - CLUB CAB (33) AND QUAD CAB (84)

NOTE: All measurements are in mm.			
DIMENSION	DESCRIPTION	GAP	FLUSH
1	Fascia to grille	19.0 ± 4.0 Parallel within 3.0	—
2	Fascia to headlamp	13.5 ± 3.5 Side to side within 3.0	—
3	Headlamp to fender	2.75 ± 1.5 Parallel within 1.0	Underflush 2.0 ± 1.5 Parallel within 1.0
4	Taillamp to tailgate	5.75 ± 2.0 Parallel within 1.5	—
5	Box outer to tailgate	5.0 ± 2.0 Parallel within 1.5 Side to side within 2.0	Flush 0.0 ± 1.5
6	Bumper to tailgate	15.0 ± 4.0 Parallel within 3.0	—
7	Taillamp to box outer	2.0 ± 1.5 Parallel within 1.0	Underflush 2.0 ± 1.5

OPENING DIMENSIONS

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OPENING DIMENSIONS

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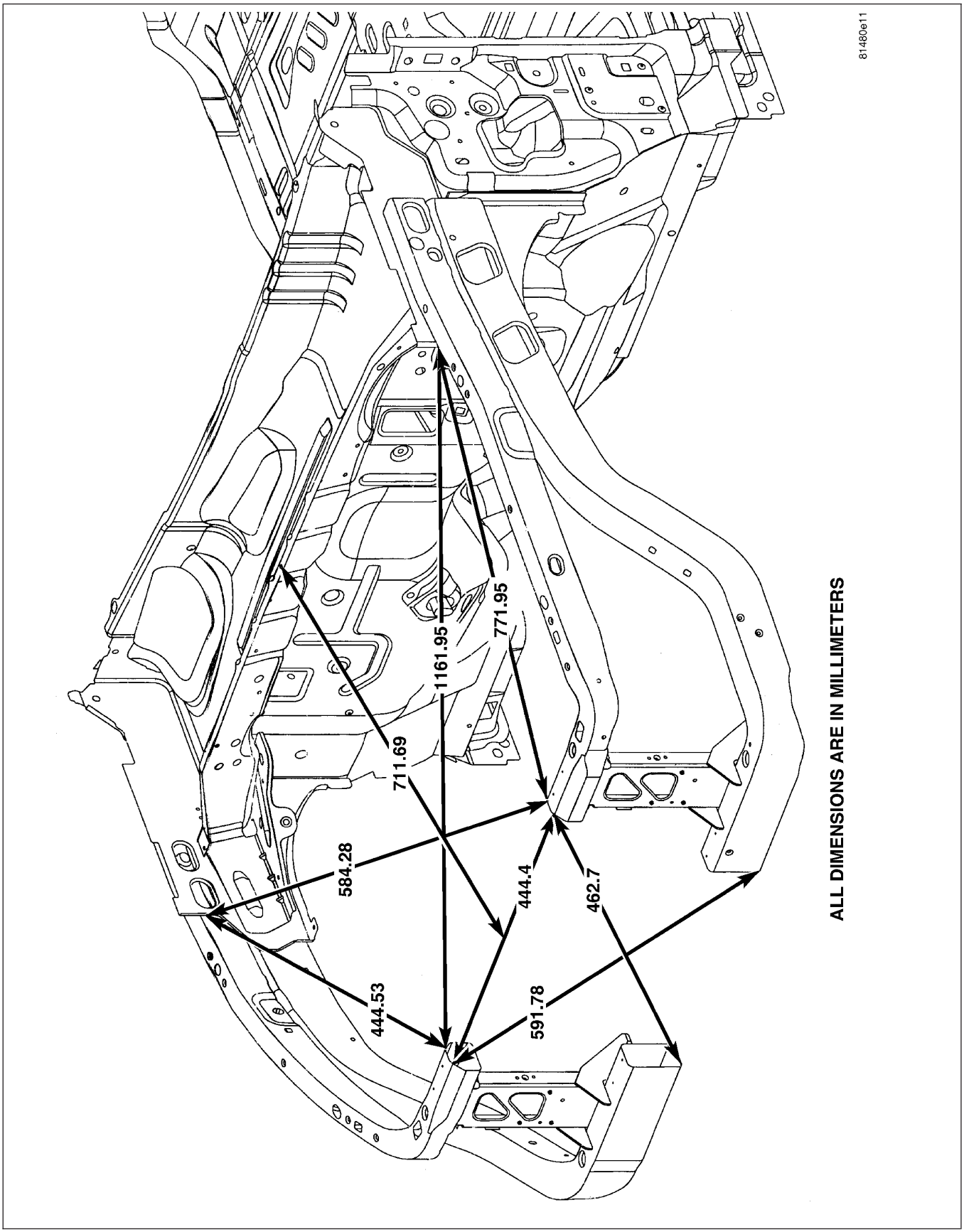

Fig. 4 ENGINE BOX - CLUB CAB (33) AND QUAD CAB (84)

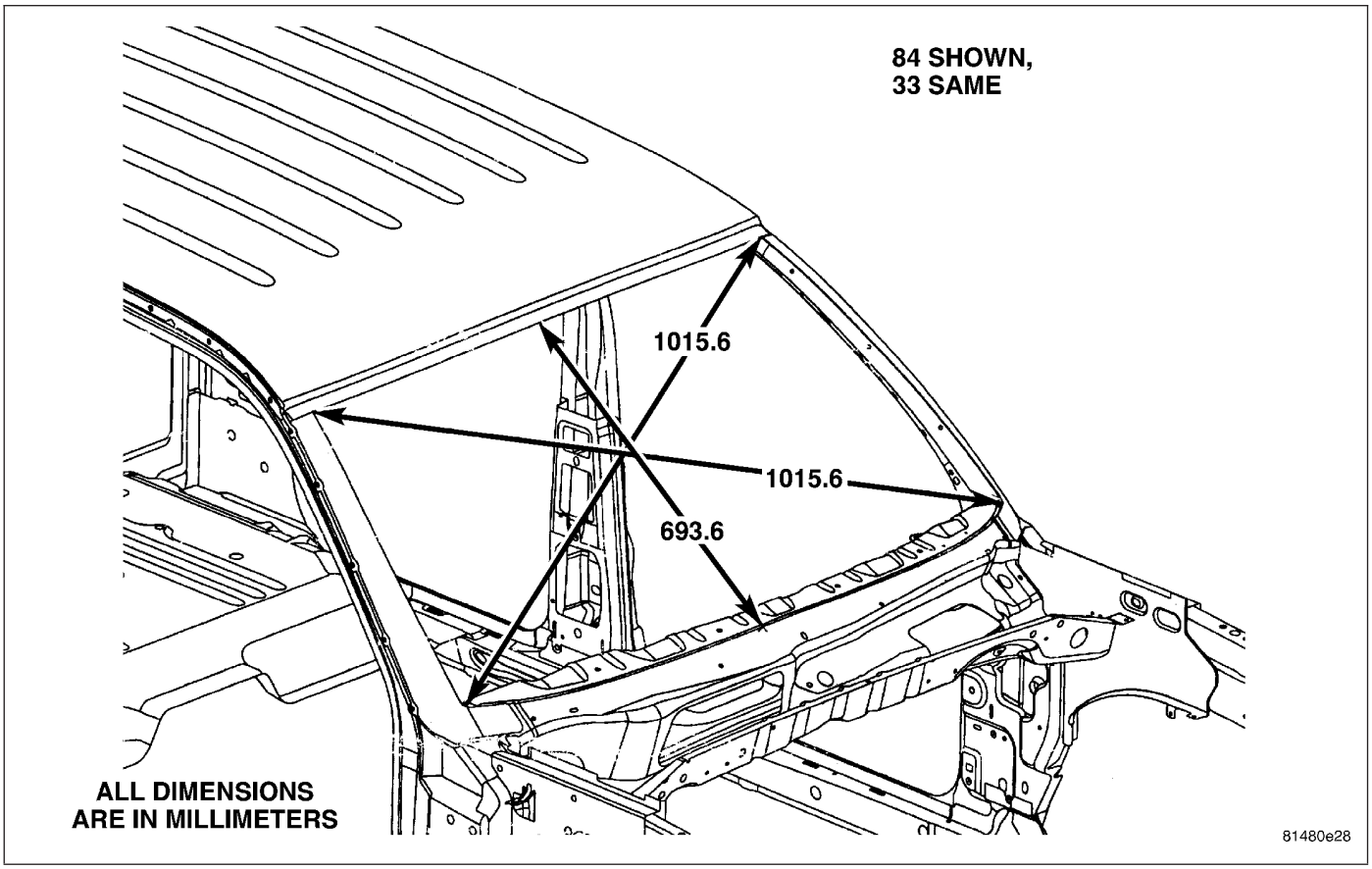

Fig. 5 WINDSHIELD OPENING - CLUB CAB (33) AND QUAD CAB (84)

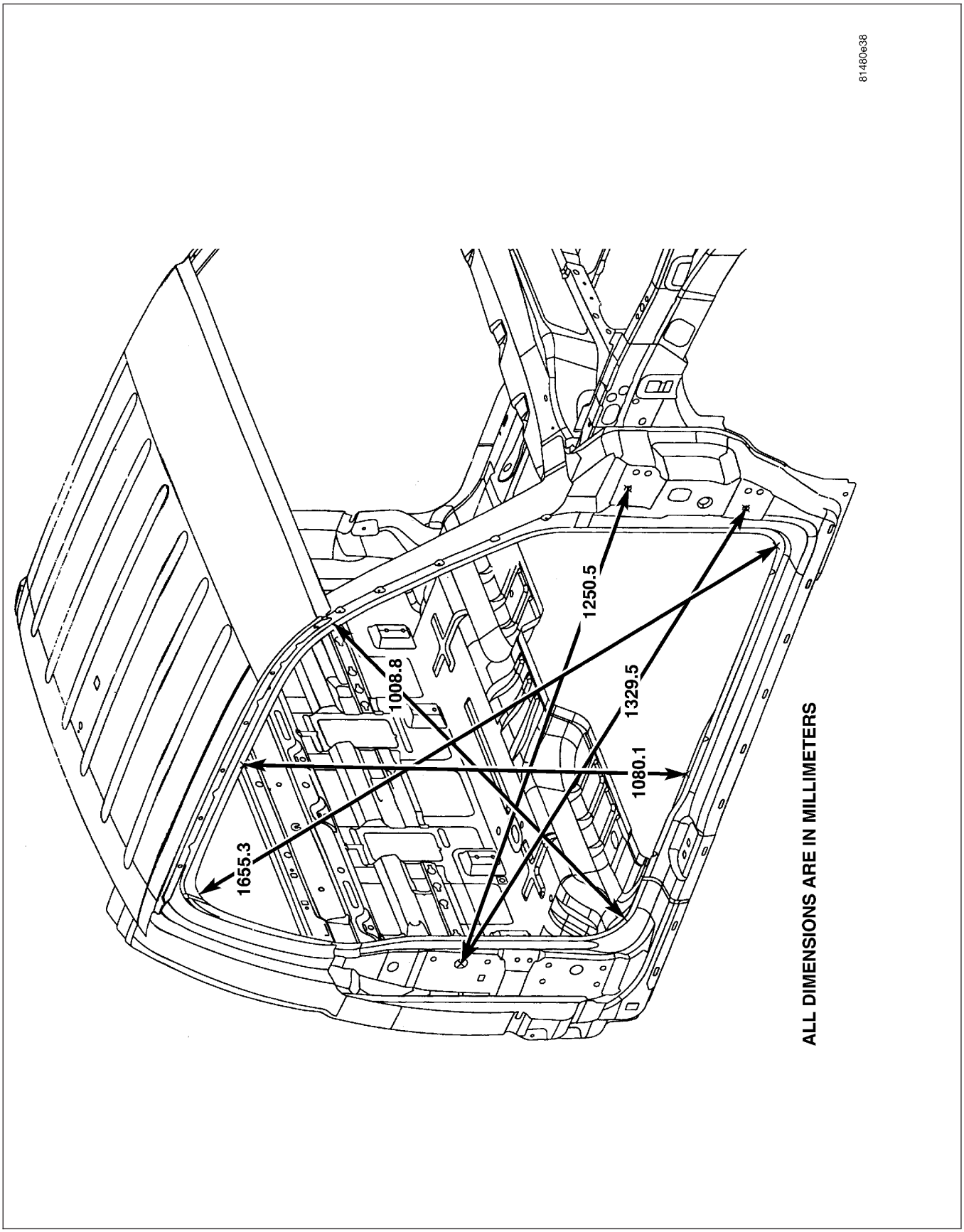

Fig. 6 DOOR OPENINGS - CLUB CAB (33) ONLY

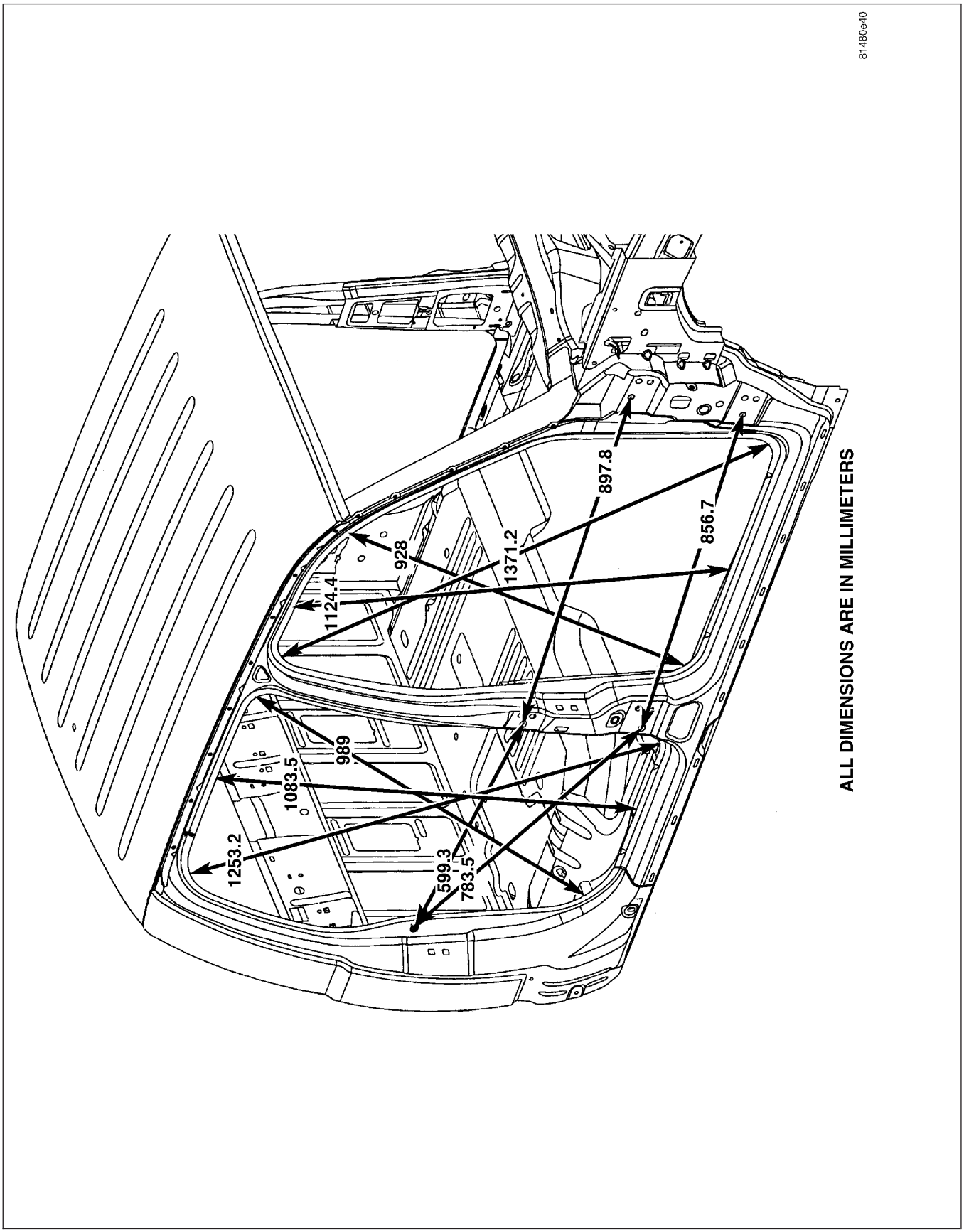

Fig. 7 DOOR OPENINGS - QUAD CAB (84) ONLY

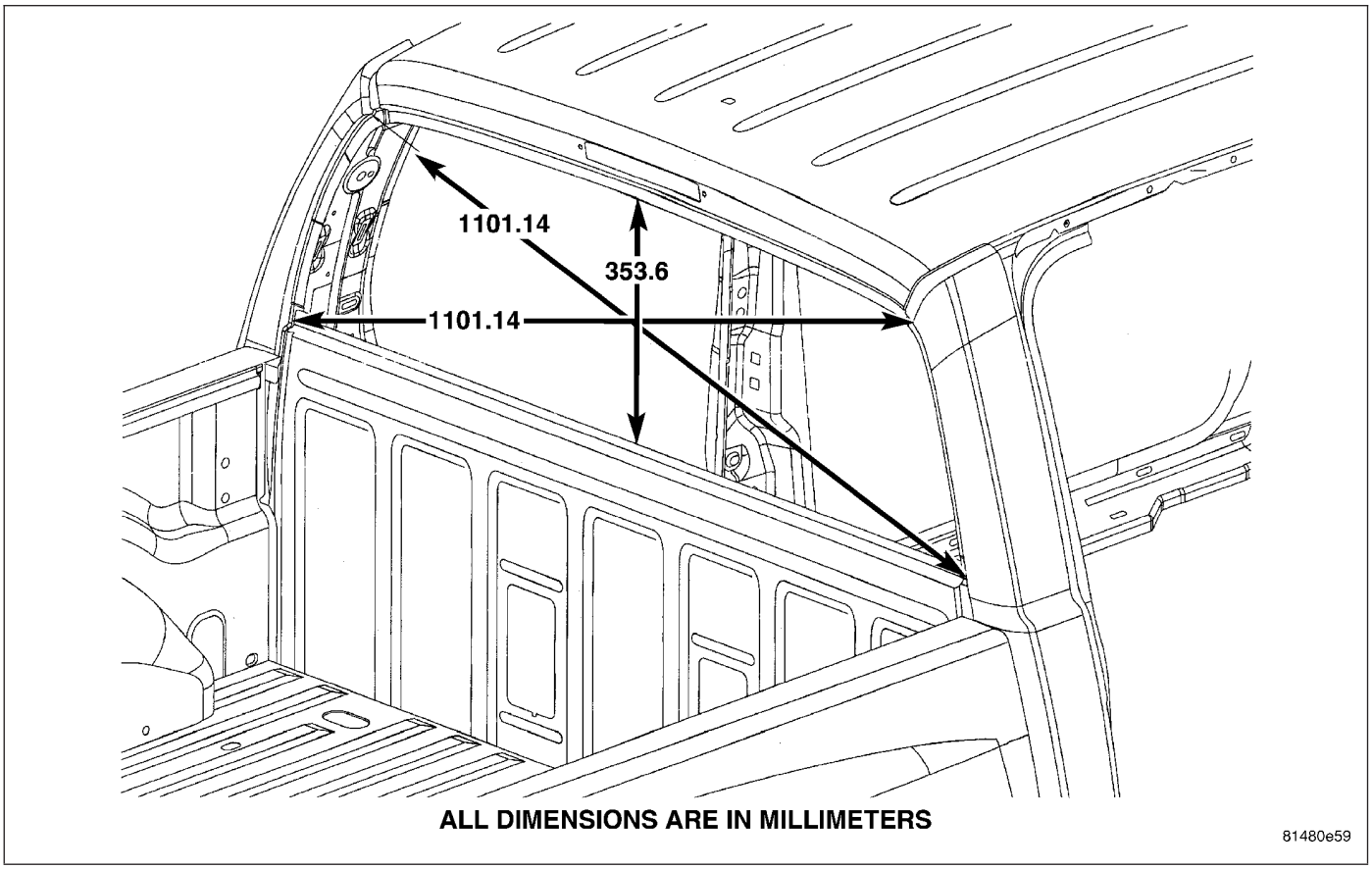

Fig. 8 CAB REAR WINDOW - CLUB CAB (33) AND QUAD CAB (84)

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Quad Cab (ND84)

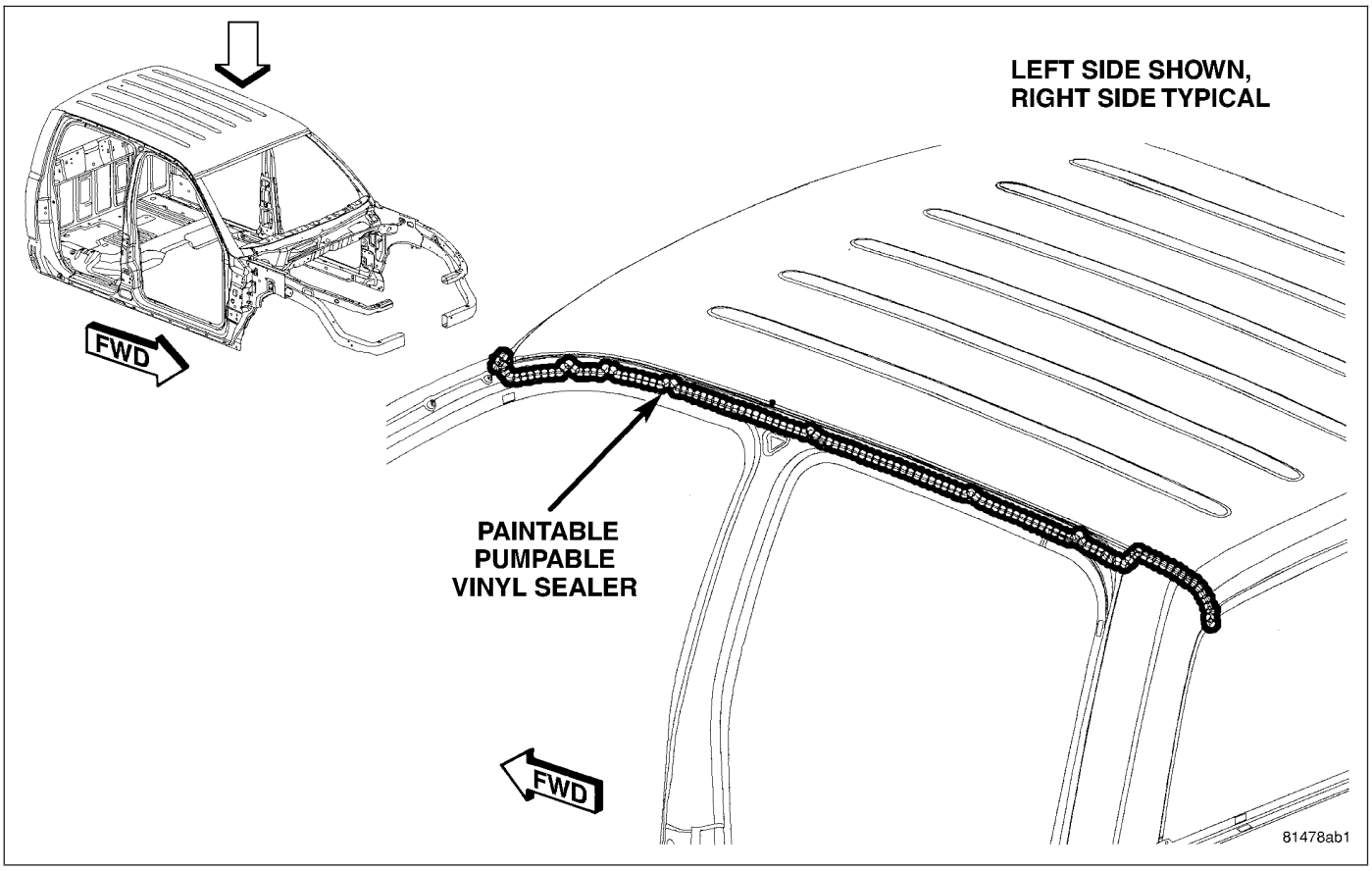

Fig. 9 ROOF/APERTURE - 84 ONLY

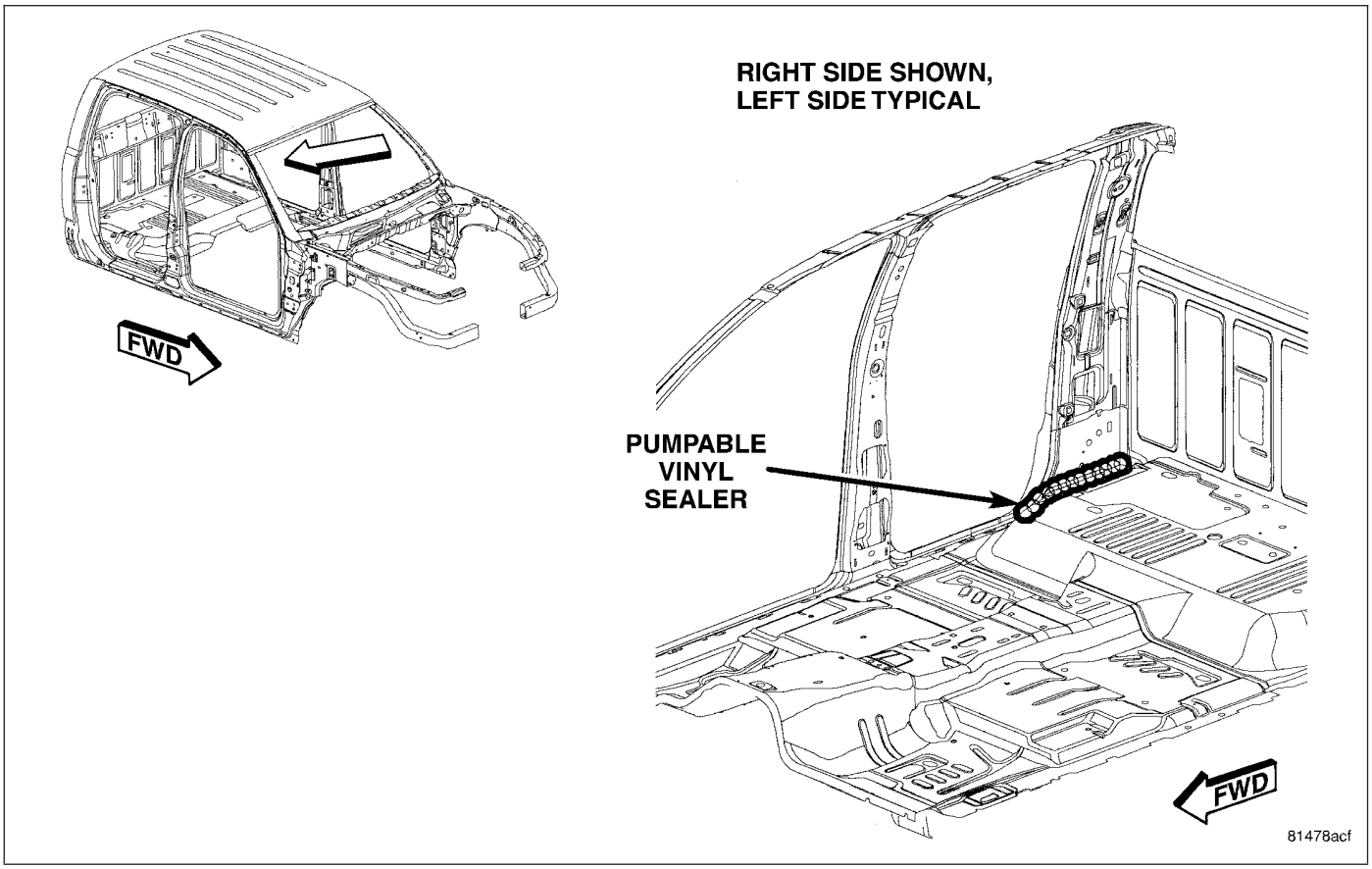

Fig. 10 SILL/REAR FLOOR PANEL - 84 ONLY

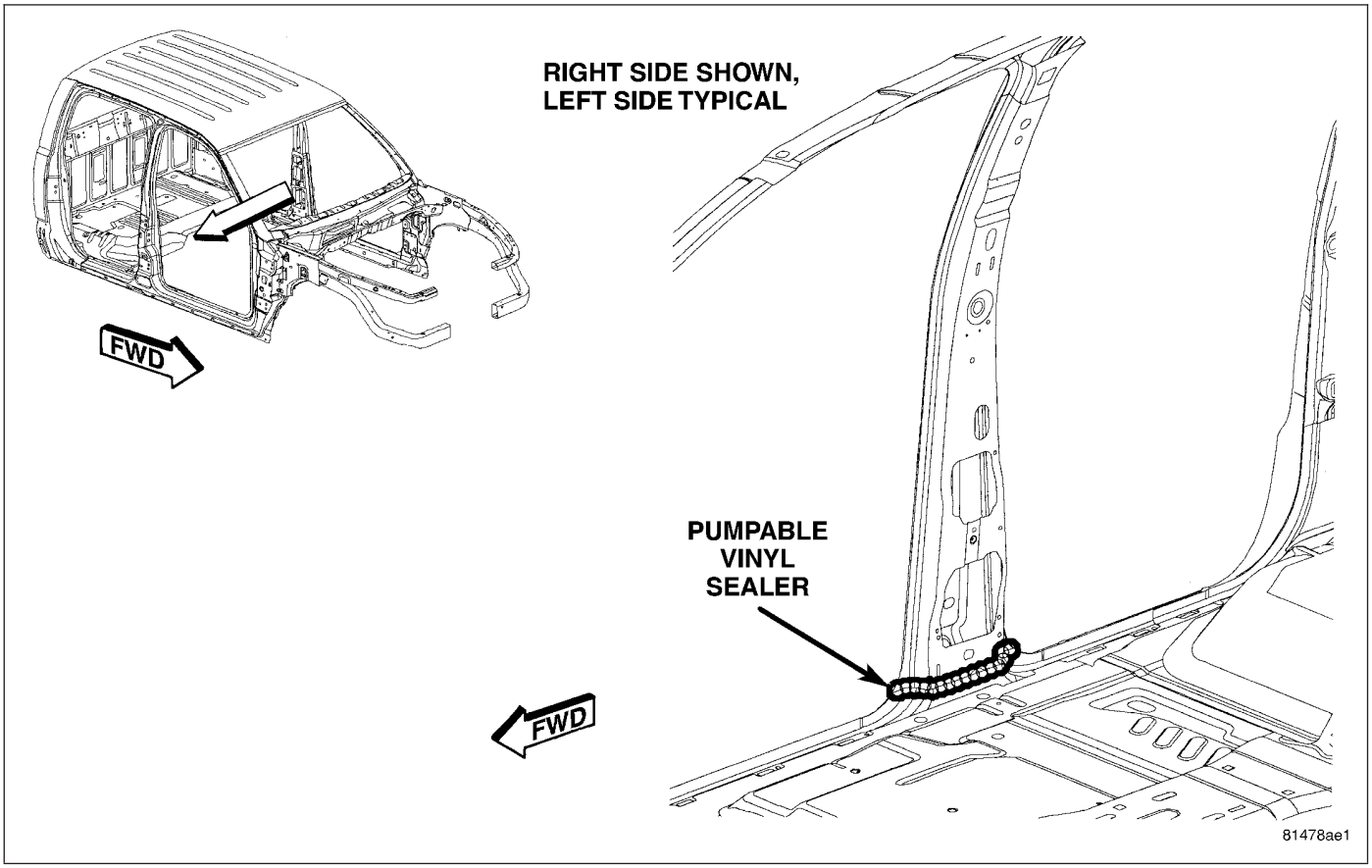

Fig. 11 SILL/INNER B-PILLAR - 84 ONLY

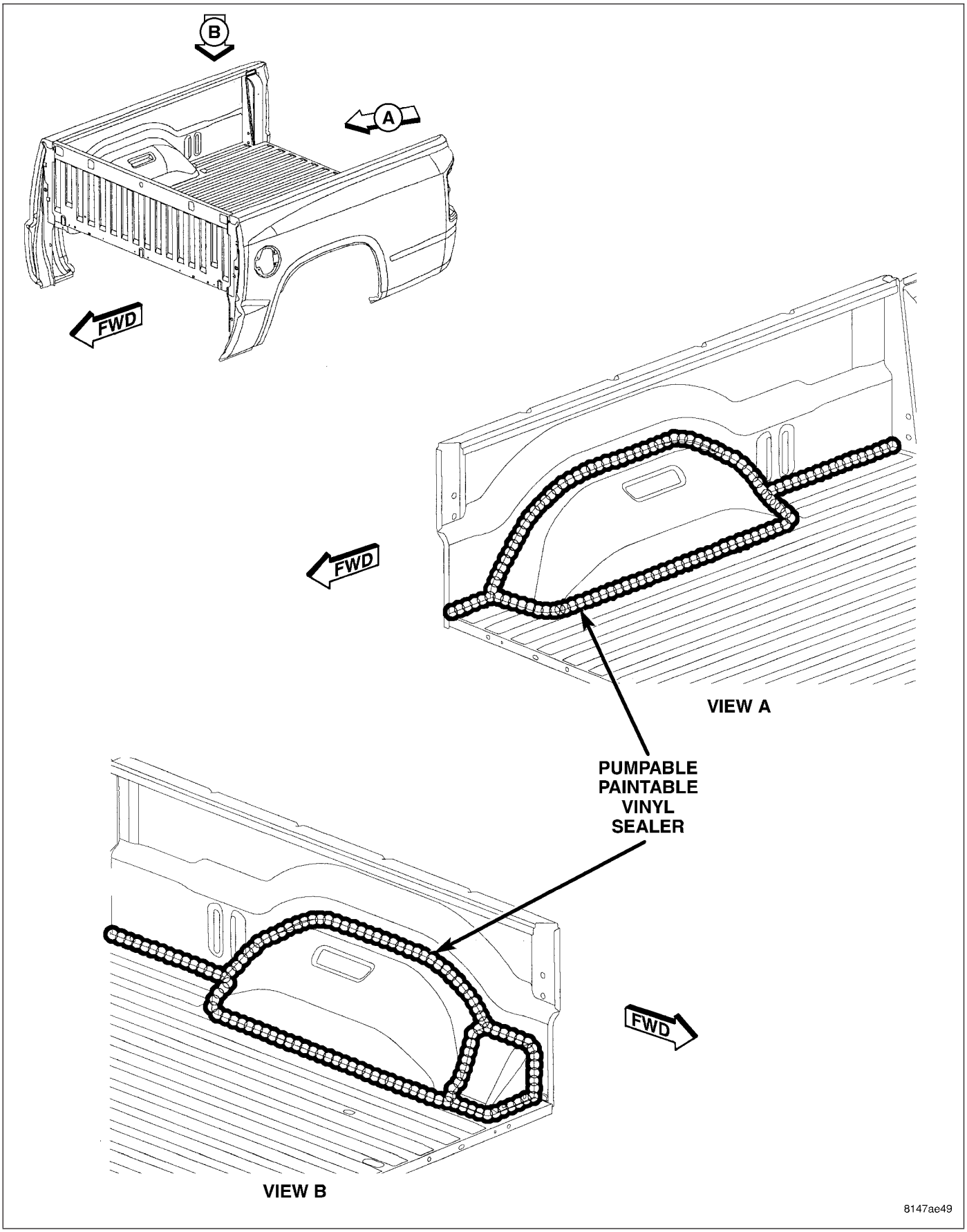

Fig. 12 BOX FLOOR/BOX SIDE INNER PANEL - 84 ONLY (5.5')

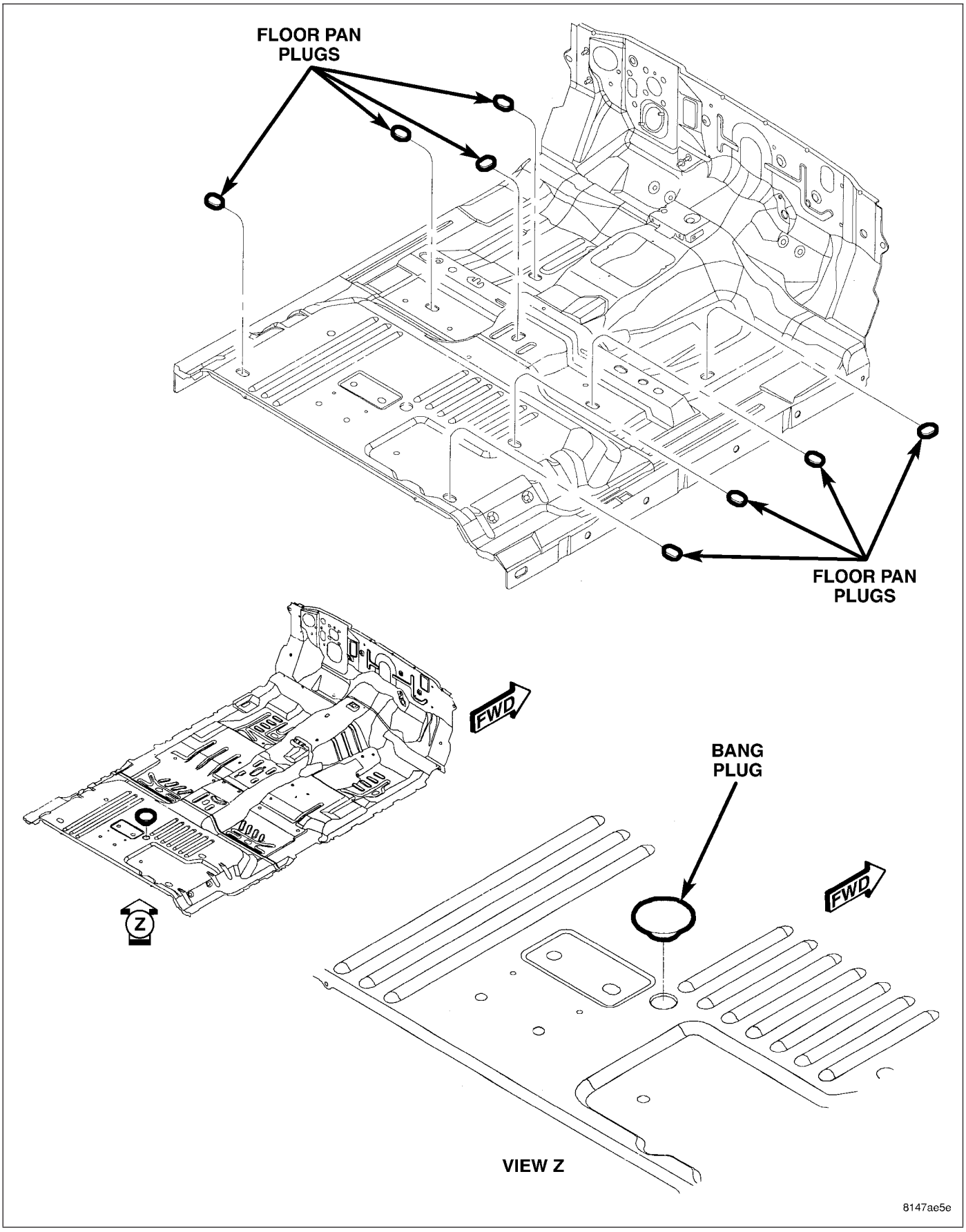

Fig. 13 FLOOR PAN PLUGS - 84 ONLY

Club Cab (ND33)

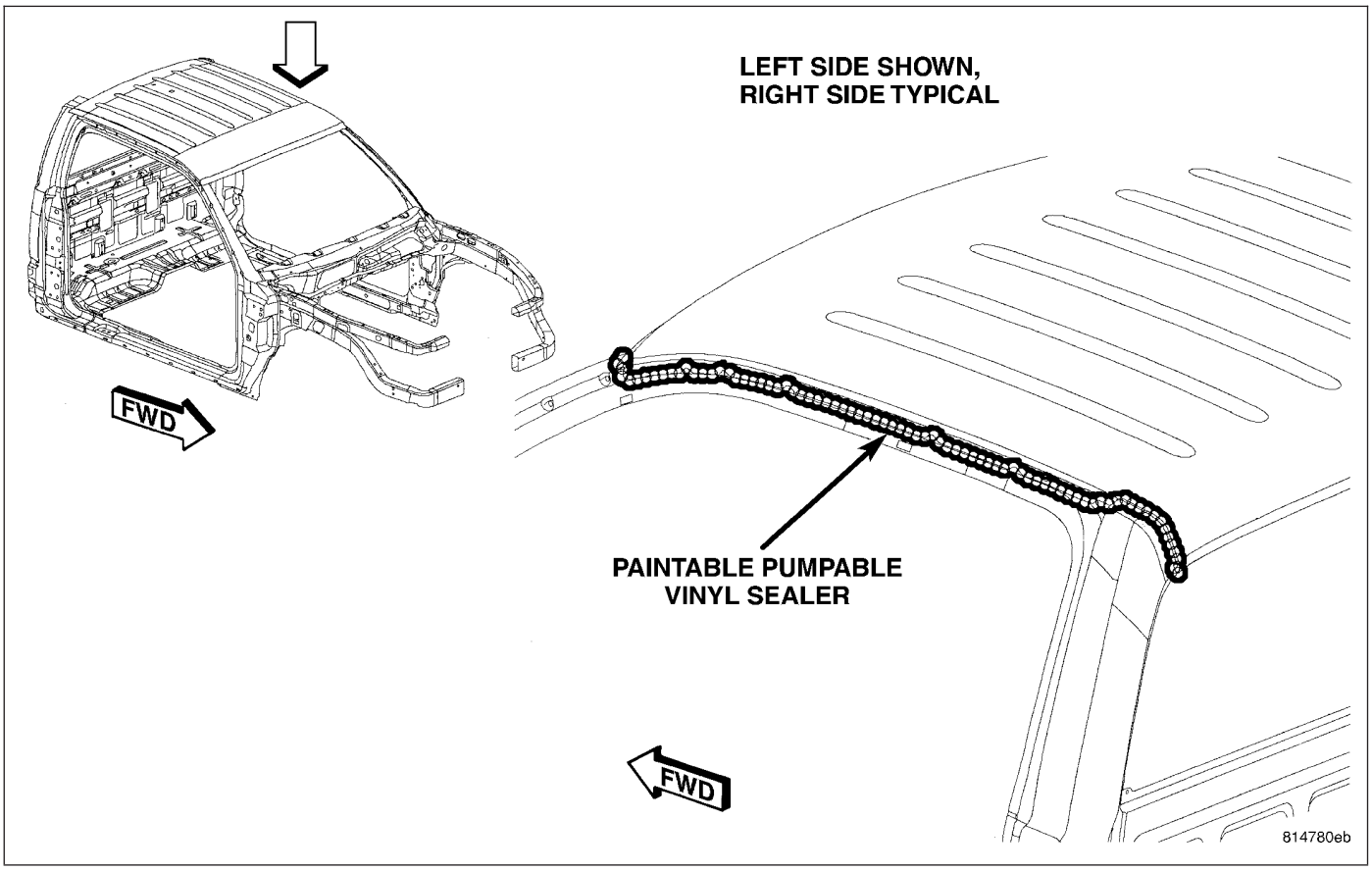

Fig. 14 ROOF/APERTURE - 33 ONLY

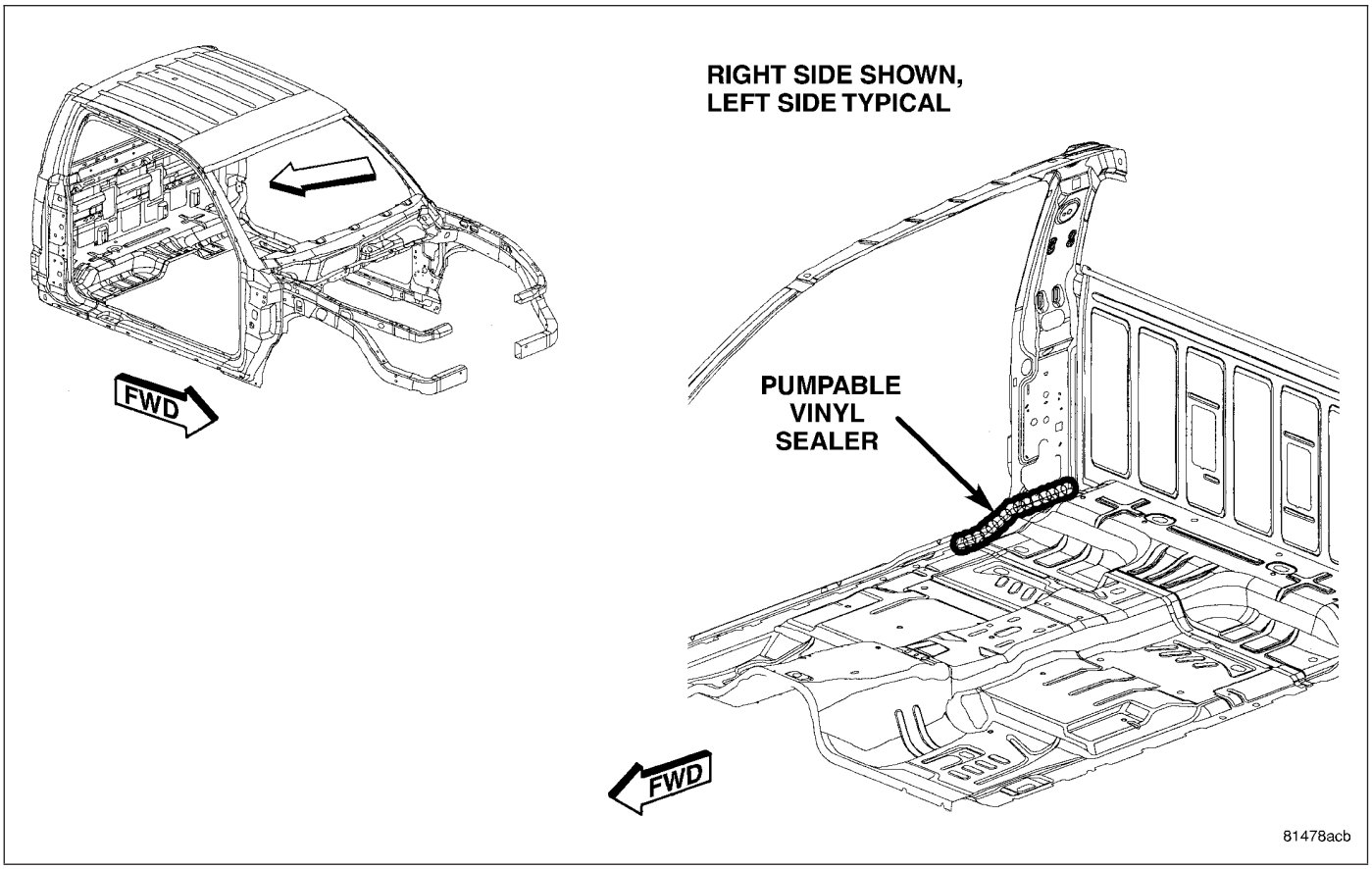

Fig. 15 SILL/REAR FLOOR PANEL - 33 ONLY

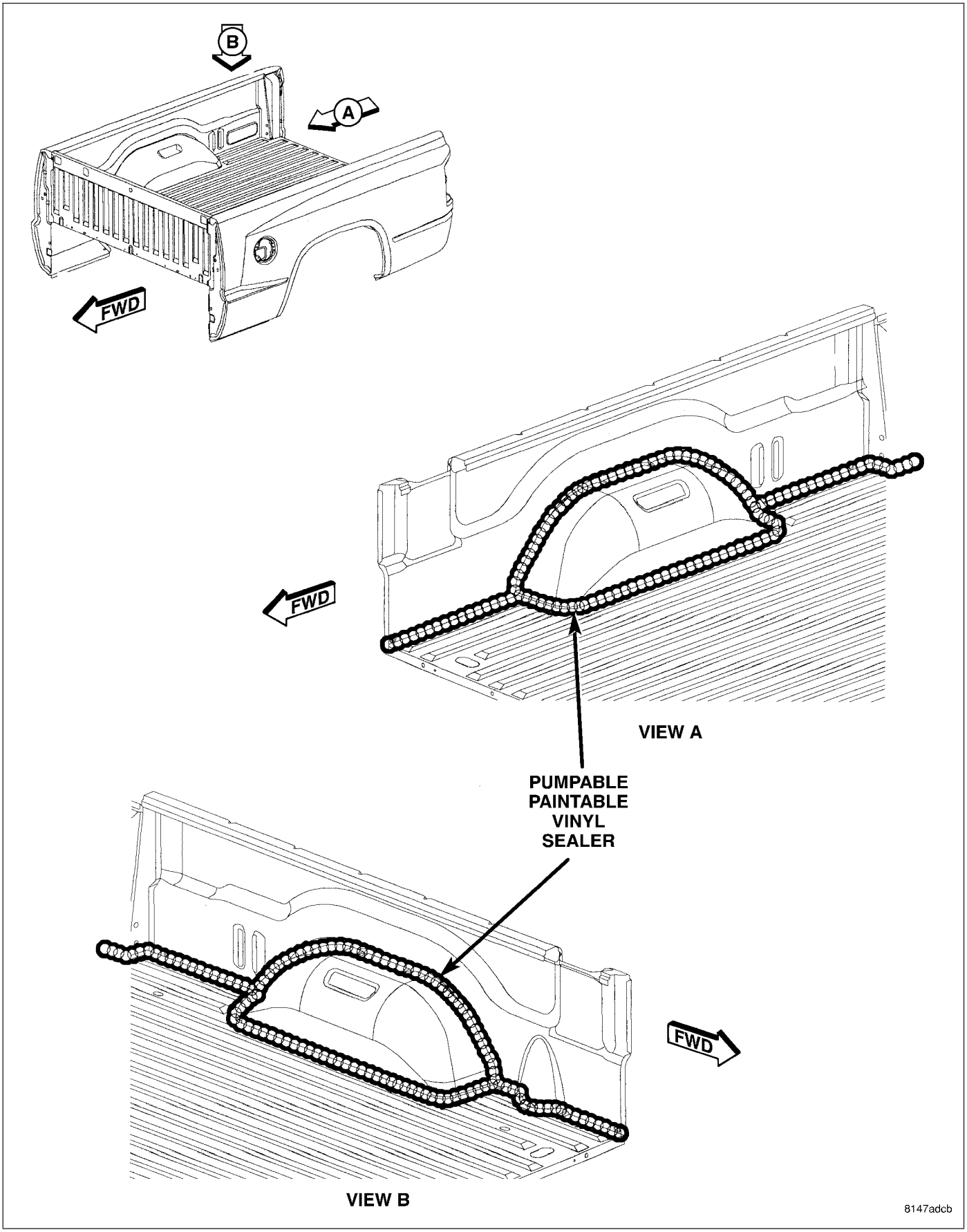

Fig. 16 BOX FLOOR/BOX SIDE INNER PANEL - 33 ONLY (6.5')

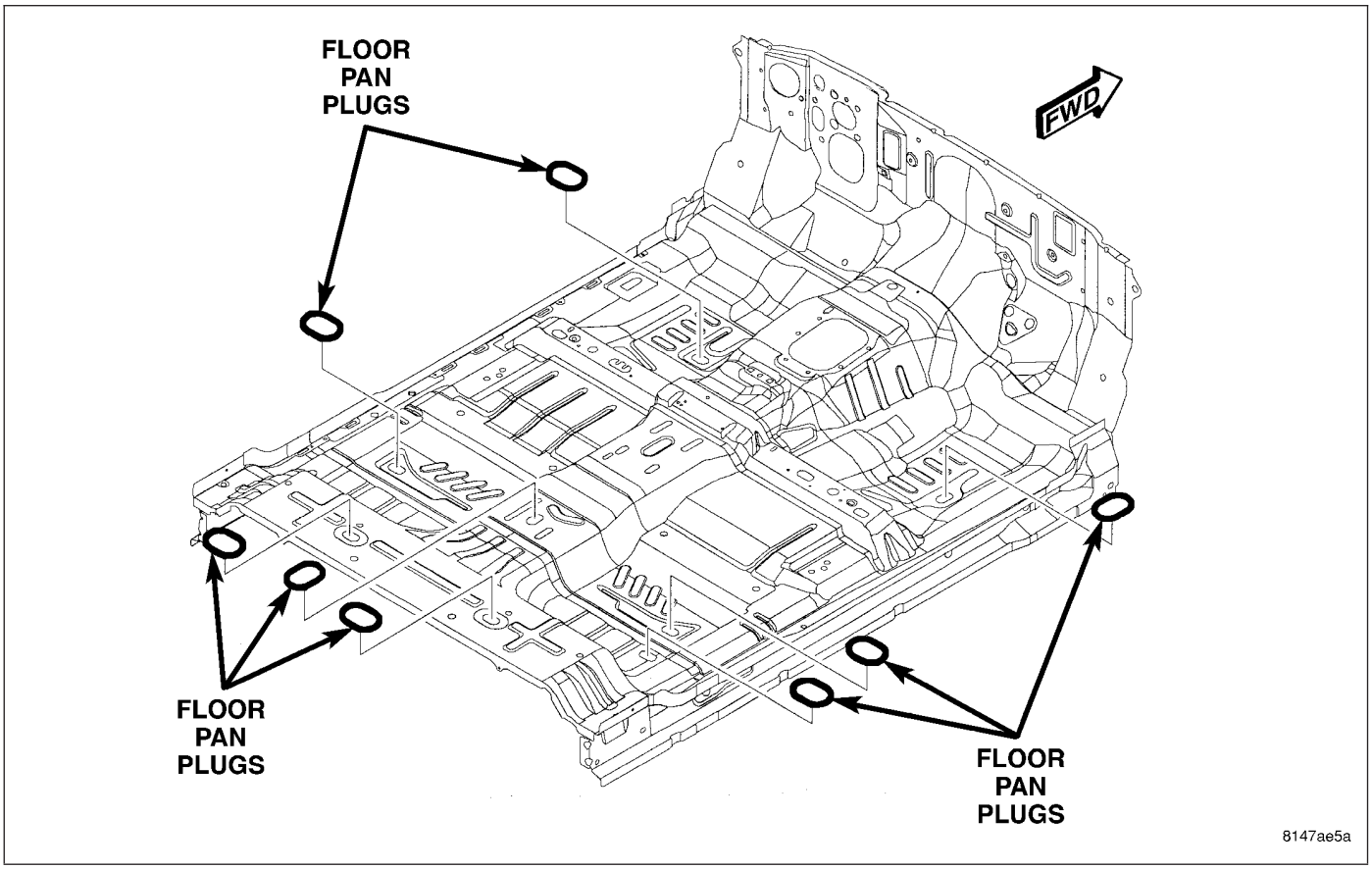

Fig. 17 FLOOR PAN PLUGS - 33 ONLY

Both Quad (ND84) and Club Cabs (ND33)

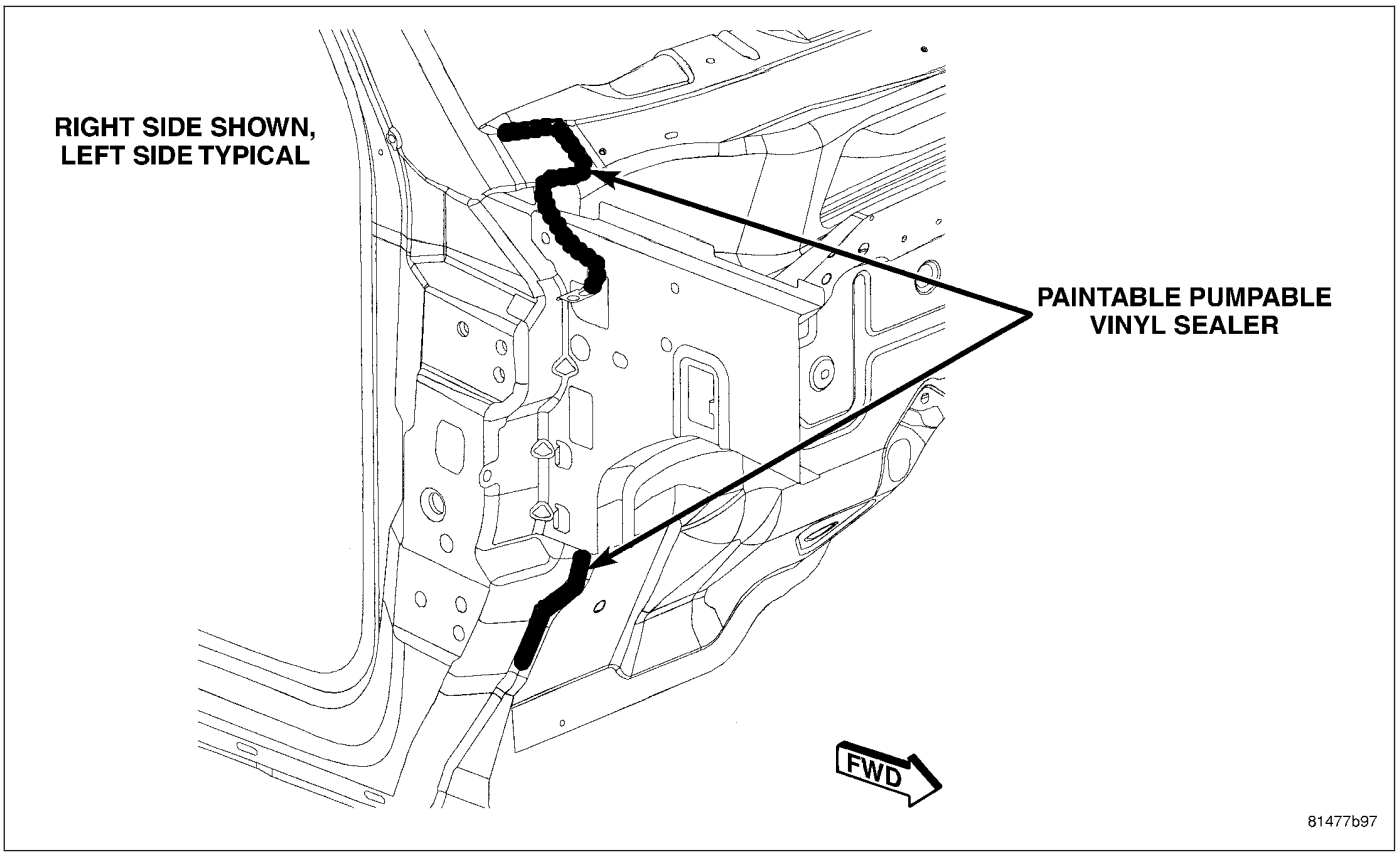

Fig. 18 APERTURE/COWL SIDE PANEL

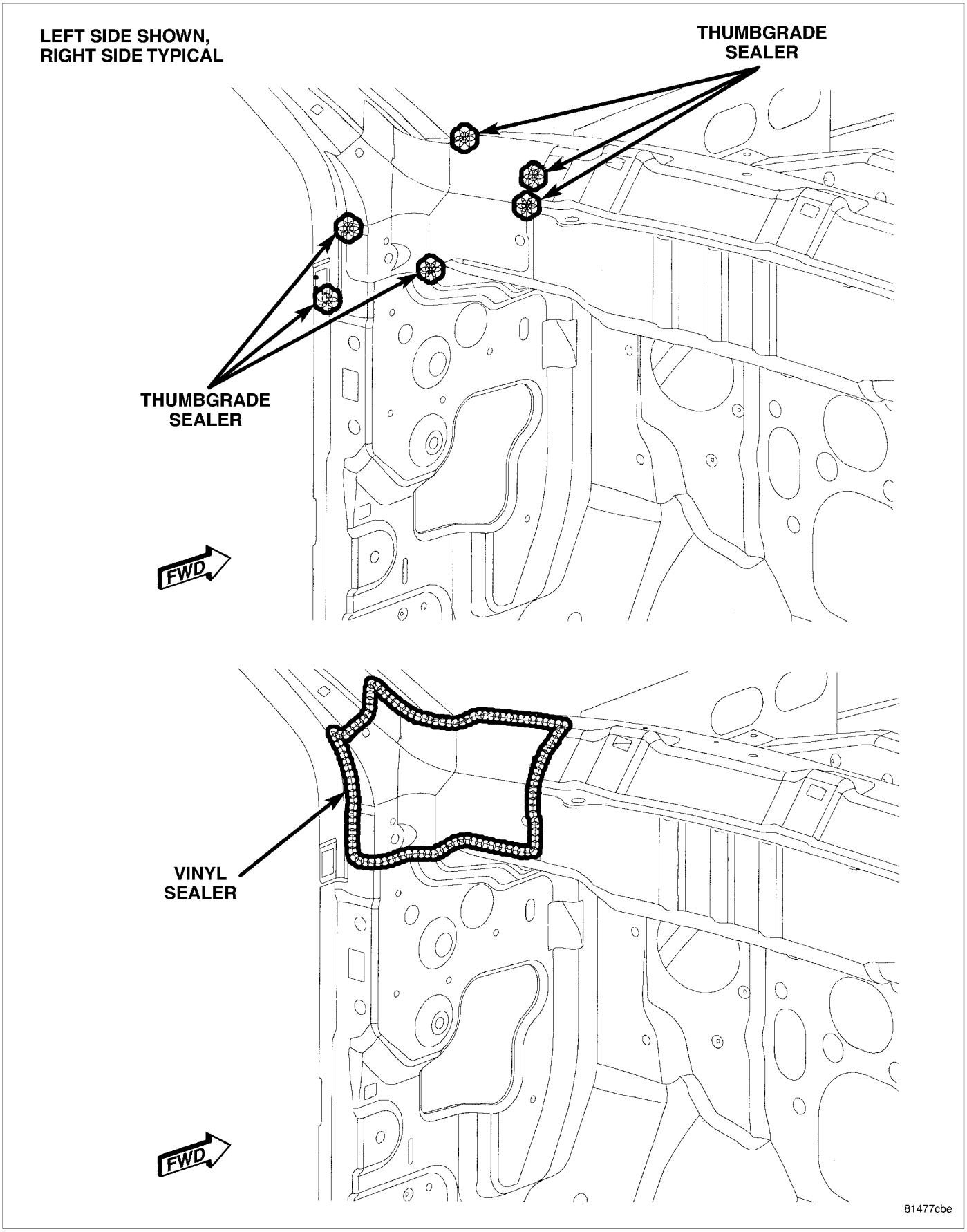

Fig. 19 COWL/A-PILLAR INNER PANEL

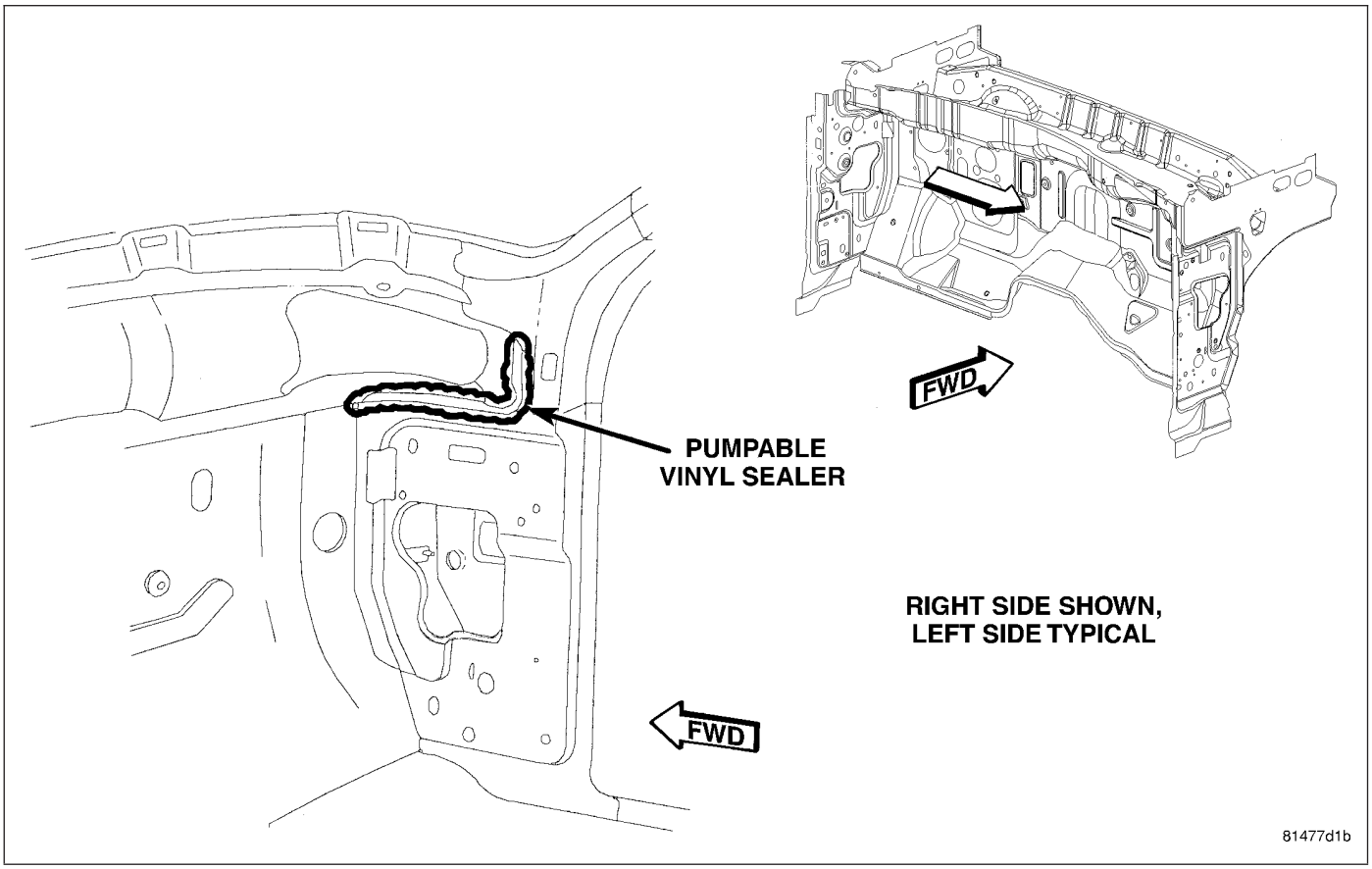

Fig. 20 PLENUM LOWER PANEL/COWL SIDE PANEL

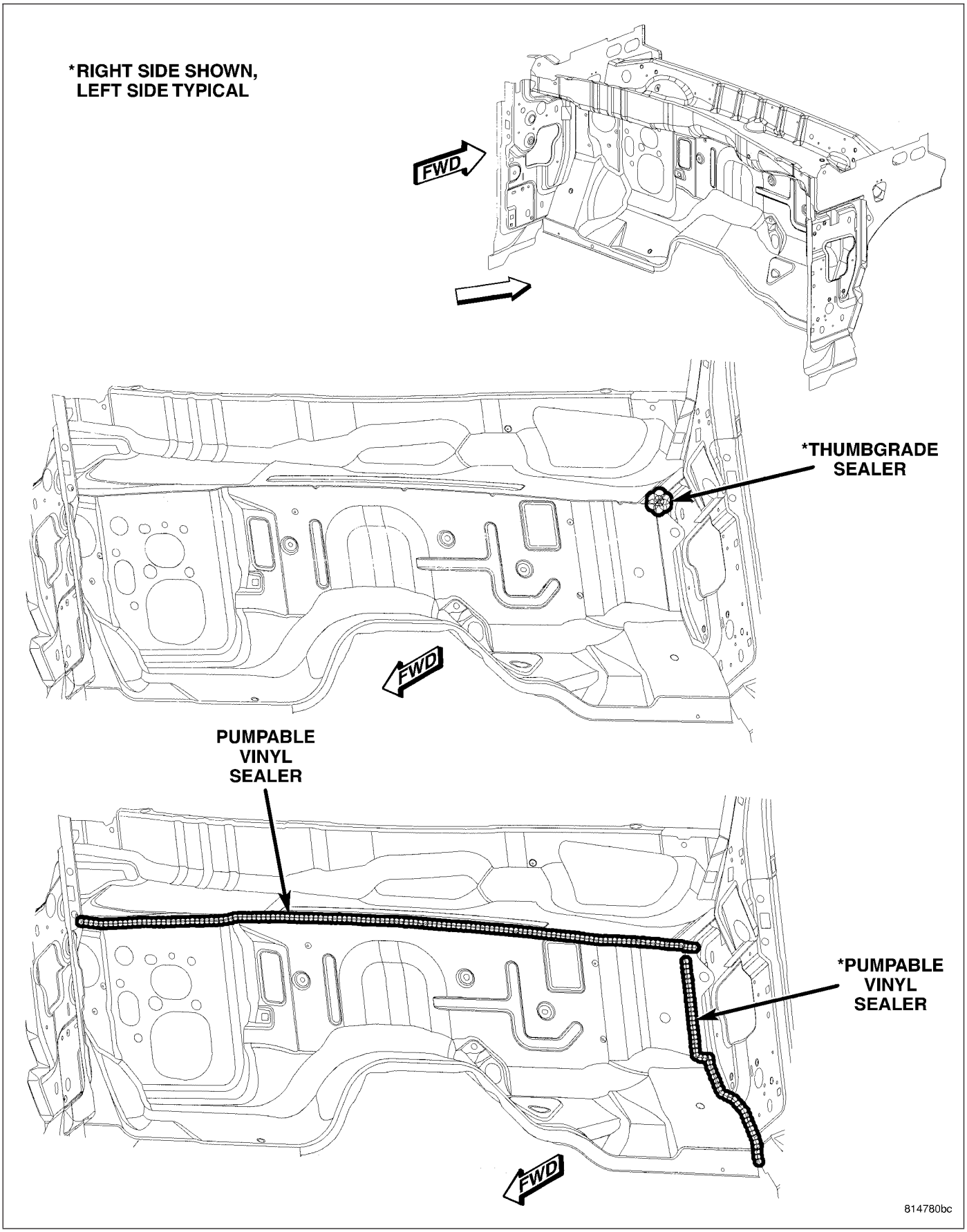

Fig. 21 UPPER DASH PANEL/PLENUM LOWER PANEL

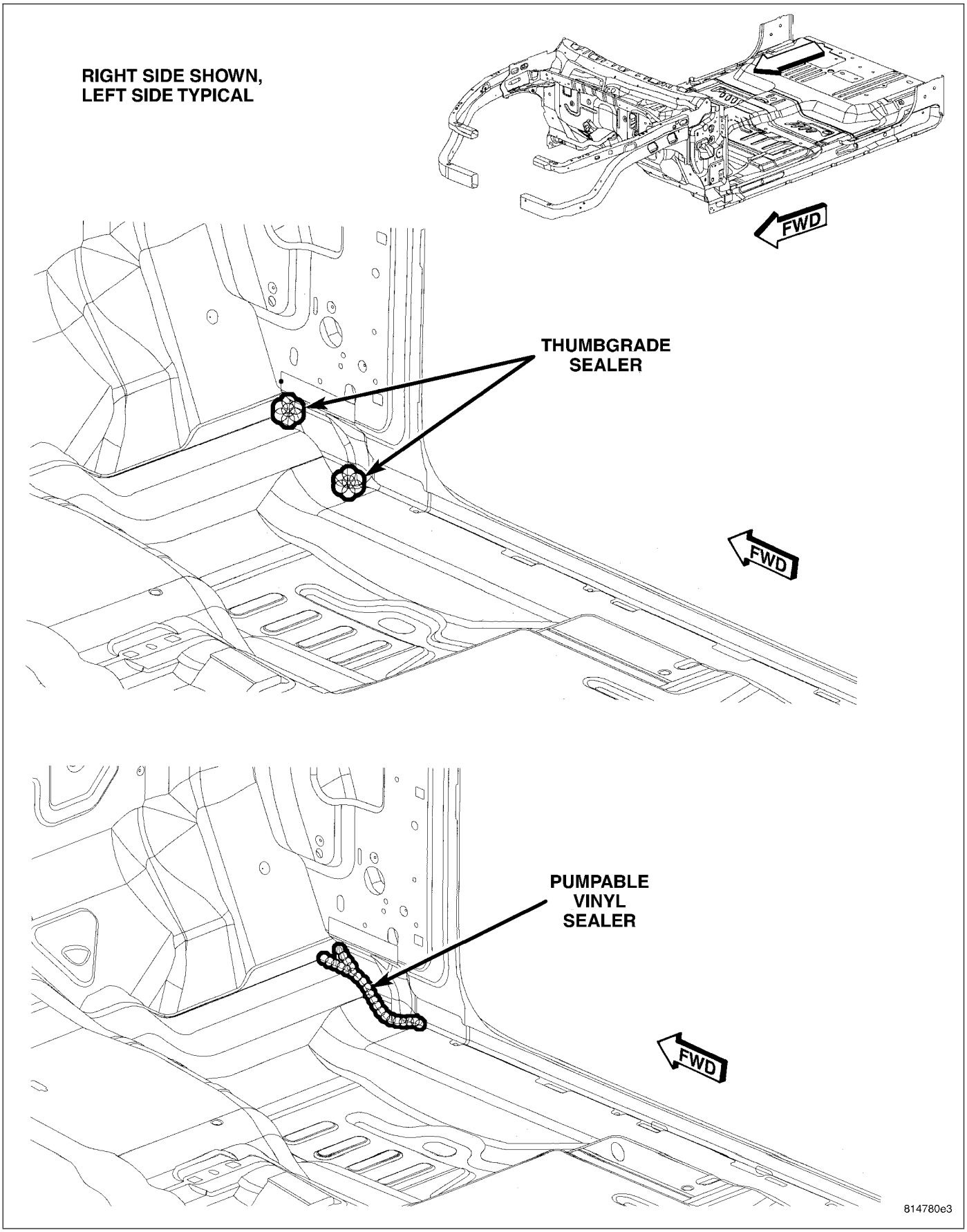

Fig. 22 FLOOR PAN/COWL SIDE PANEL

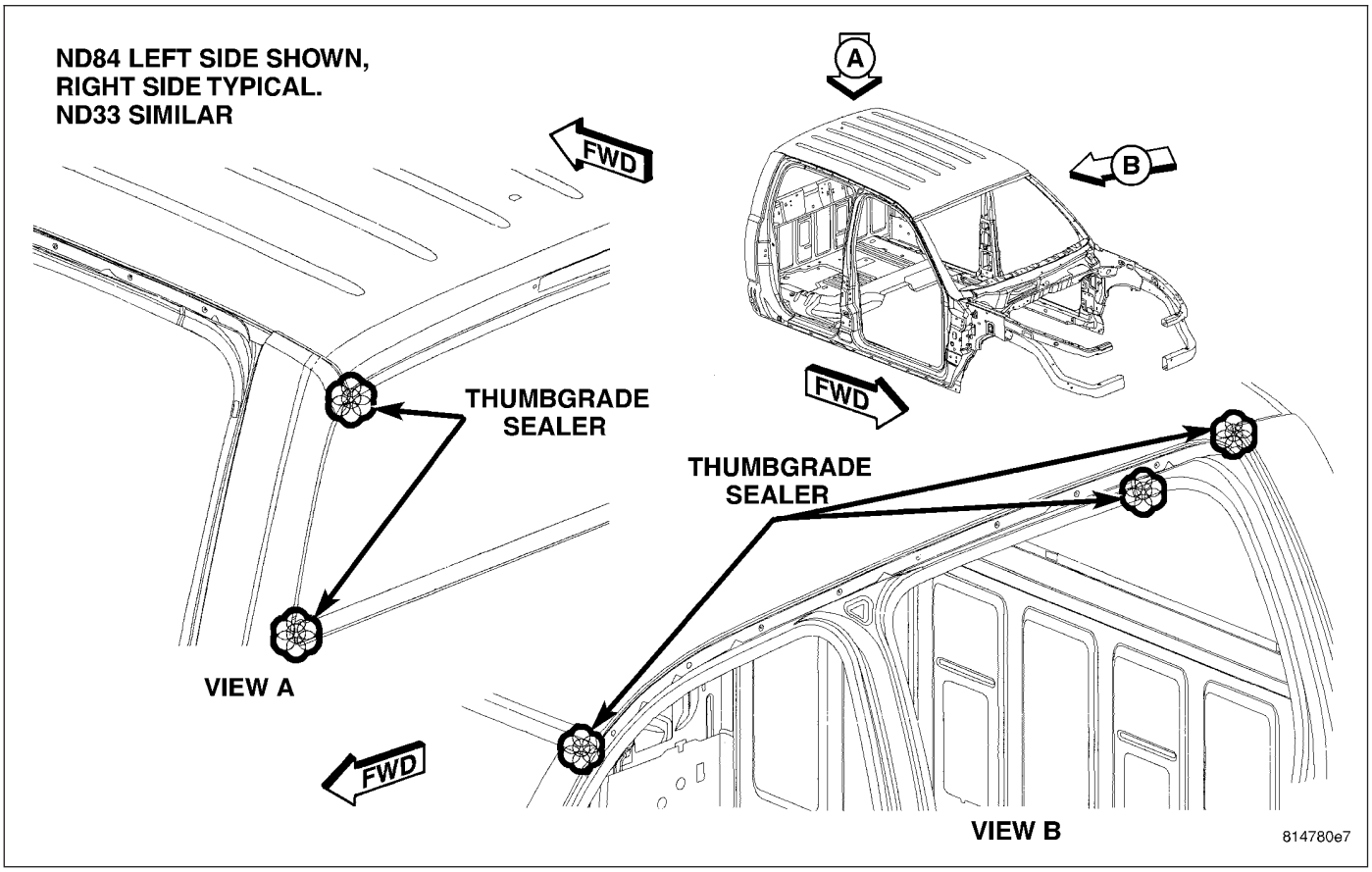

Fig. 23 ROOF/QUARTER OUTER PANEL

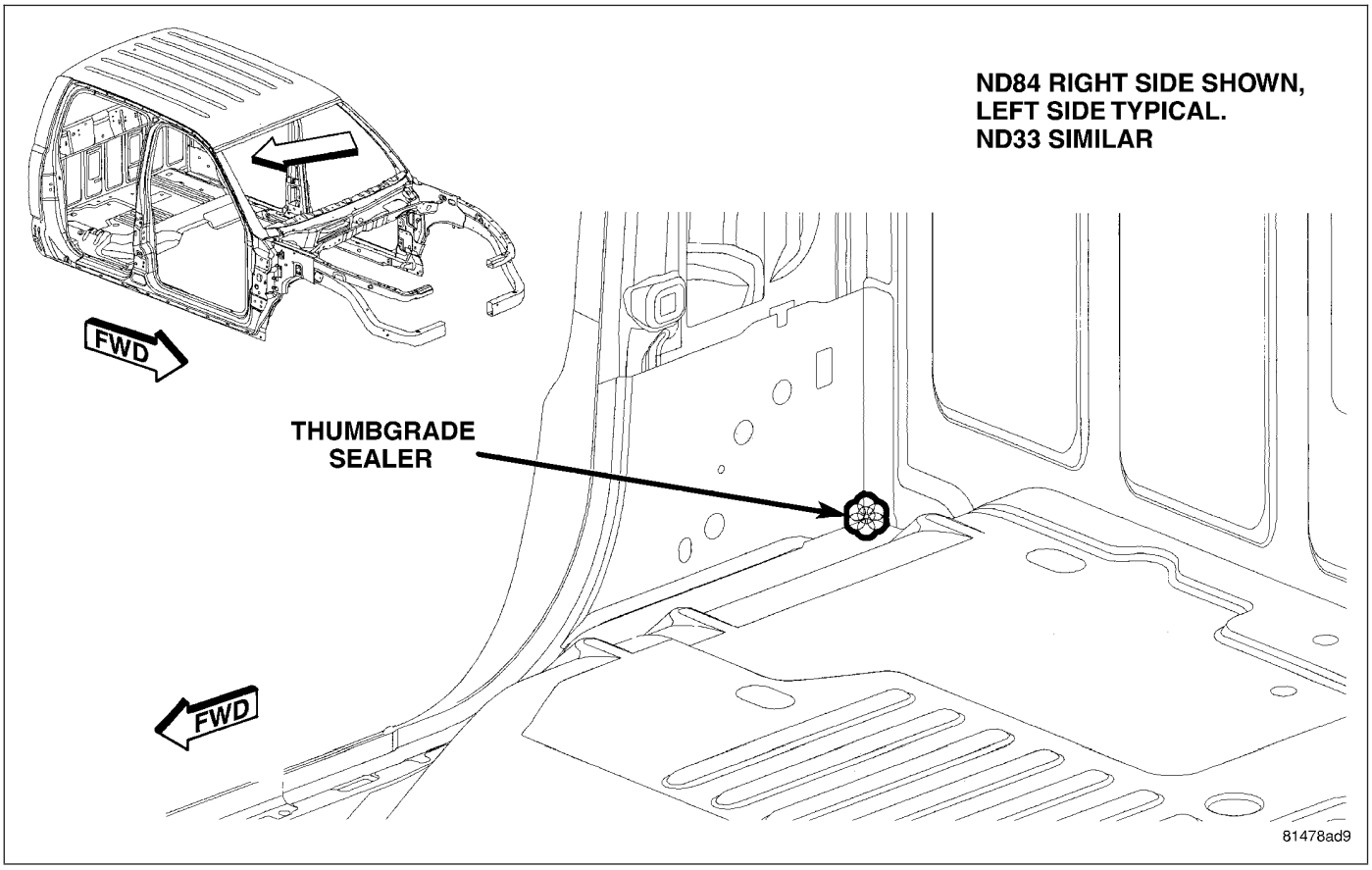

Fig. 24 CAB BACK/FLOOR/QUARTER INNER PANEL

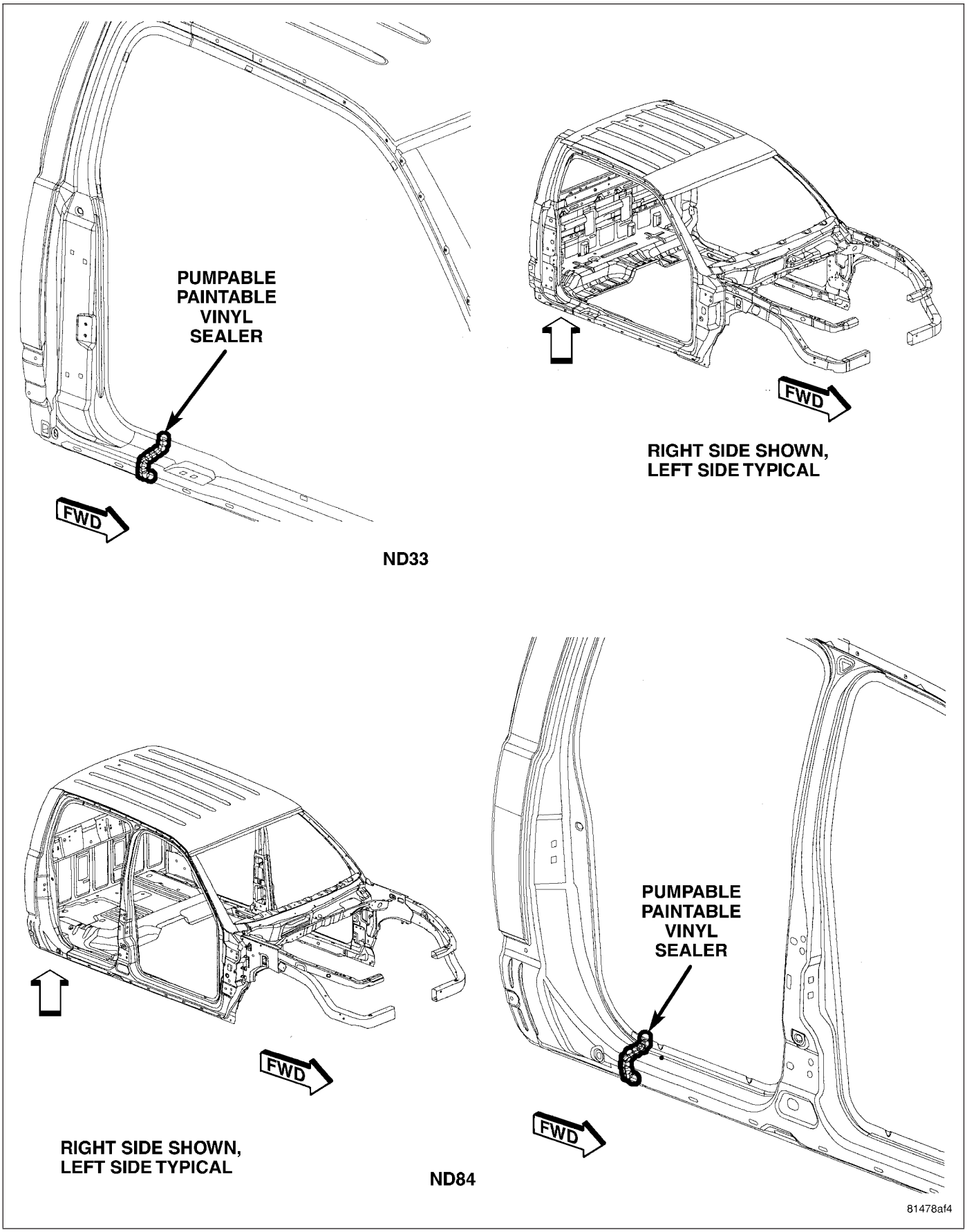

Fig. 25 QUARTER OUTER PANEL/APERTURE PANEL SIDE SILL

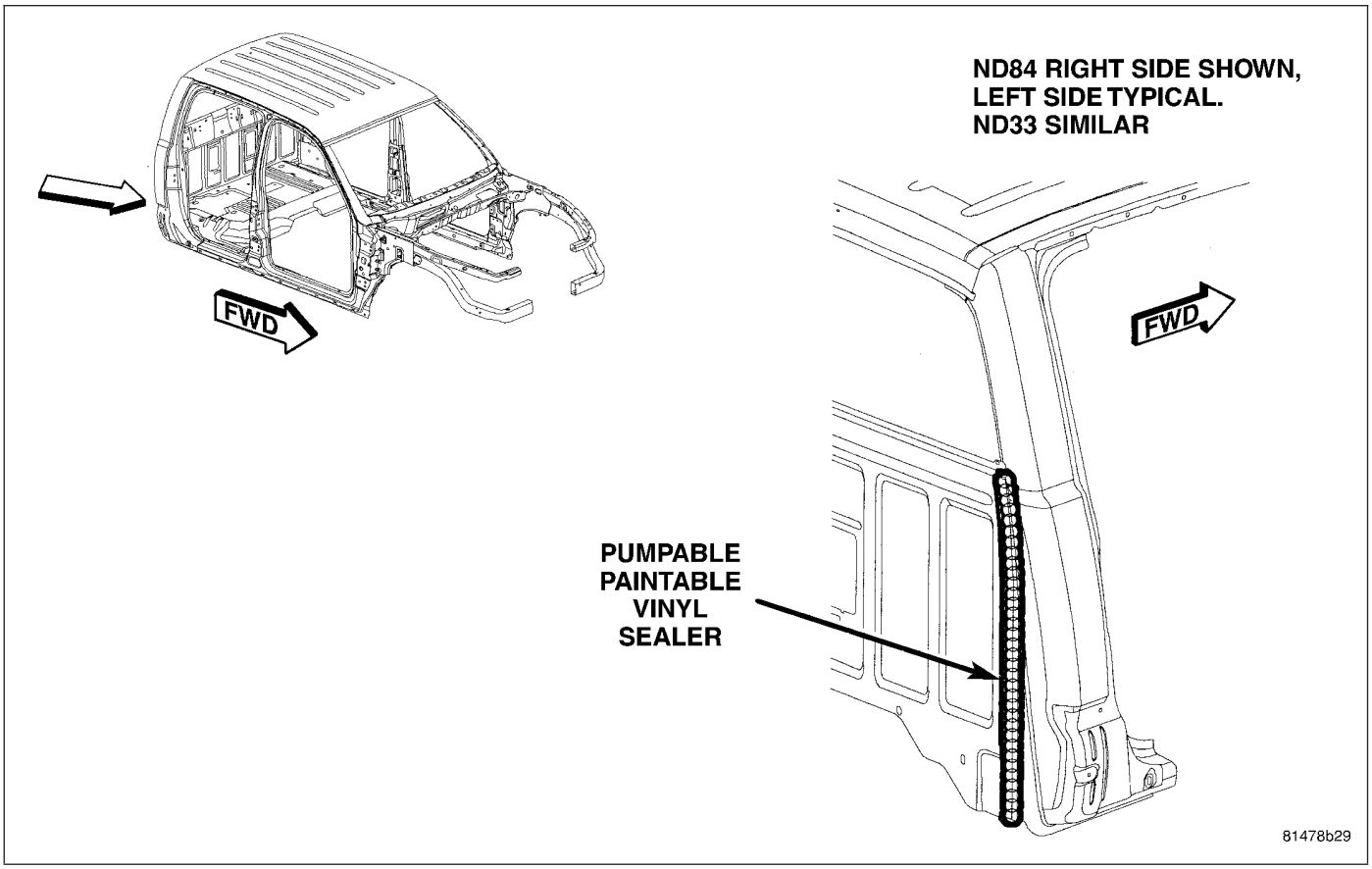

Fig. 26 CAB BACK/QUARTER OUTER PANEL

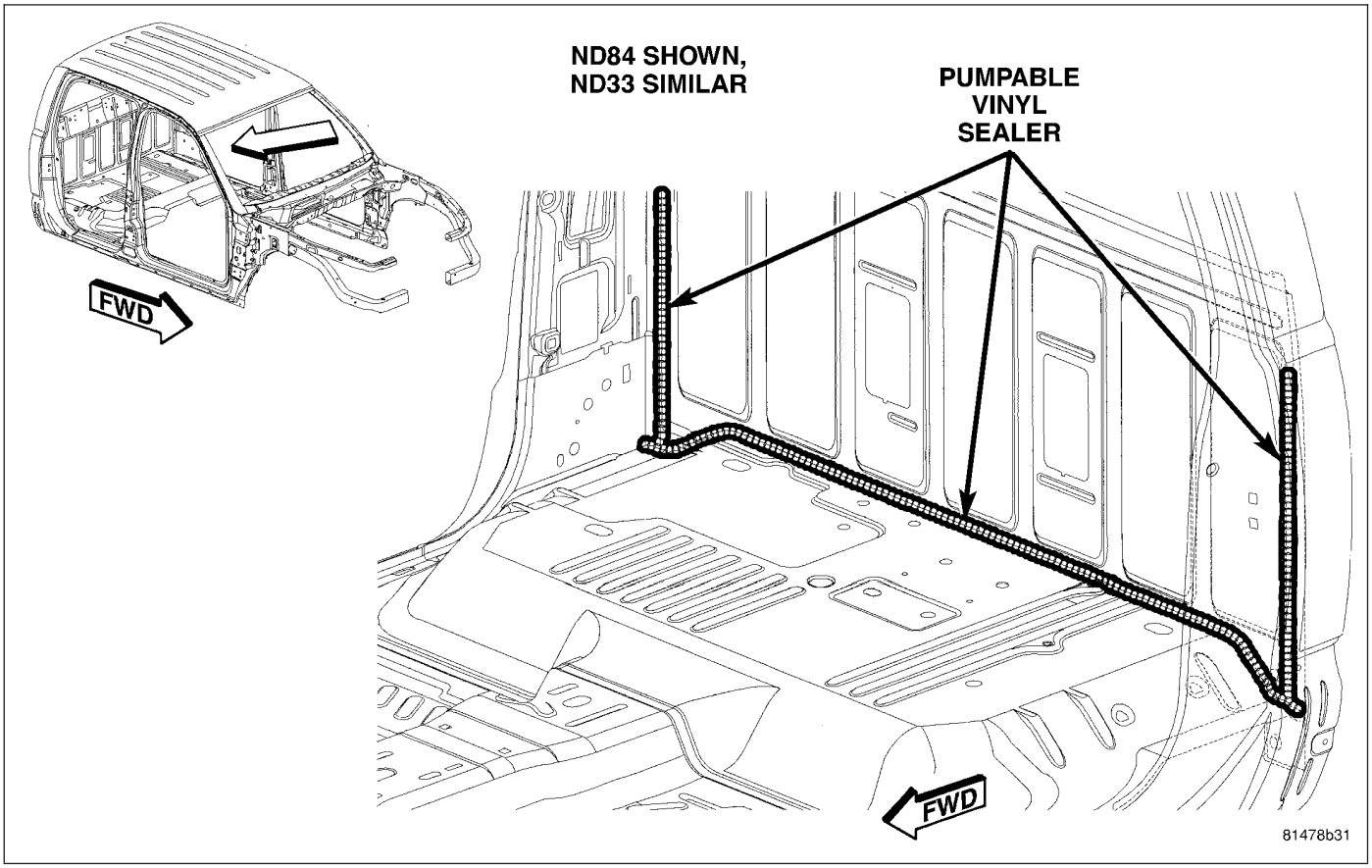

Fig. 27 FLOOR PAN/CAB BACK PANEL

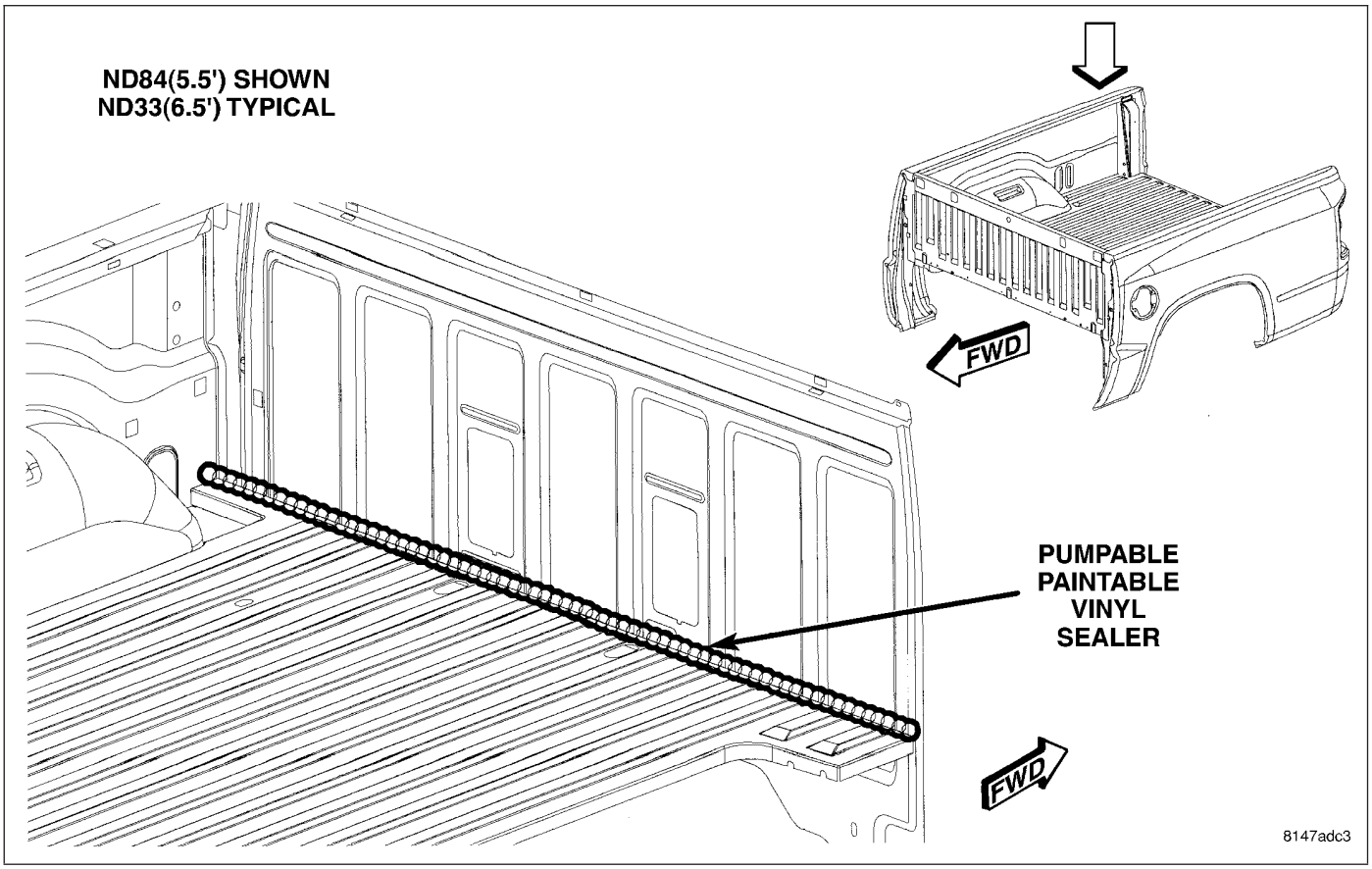

Fig. 28 BOX FLOOR/BOX FRONT

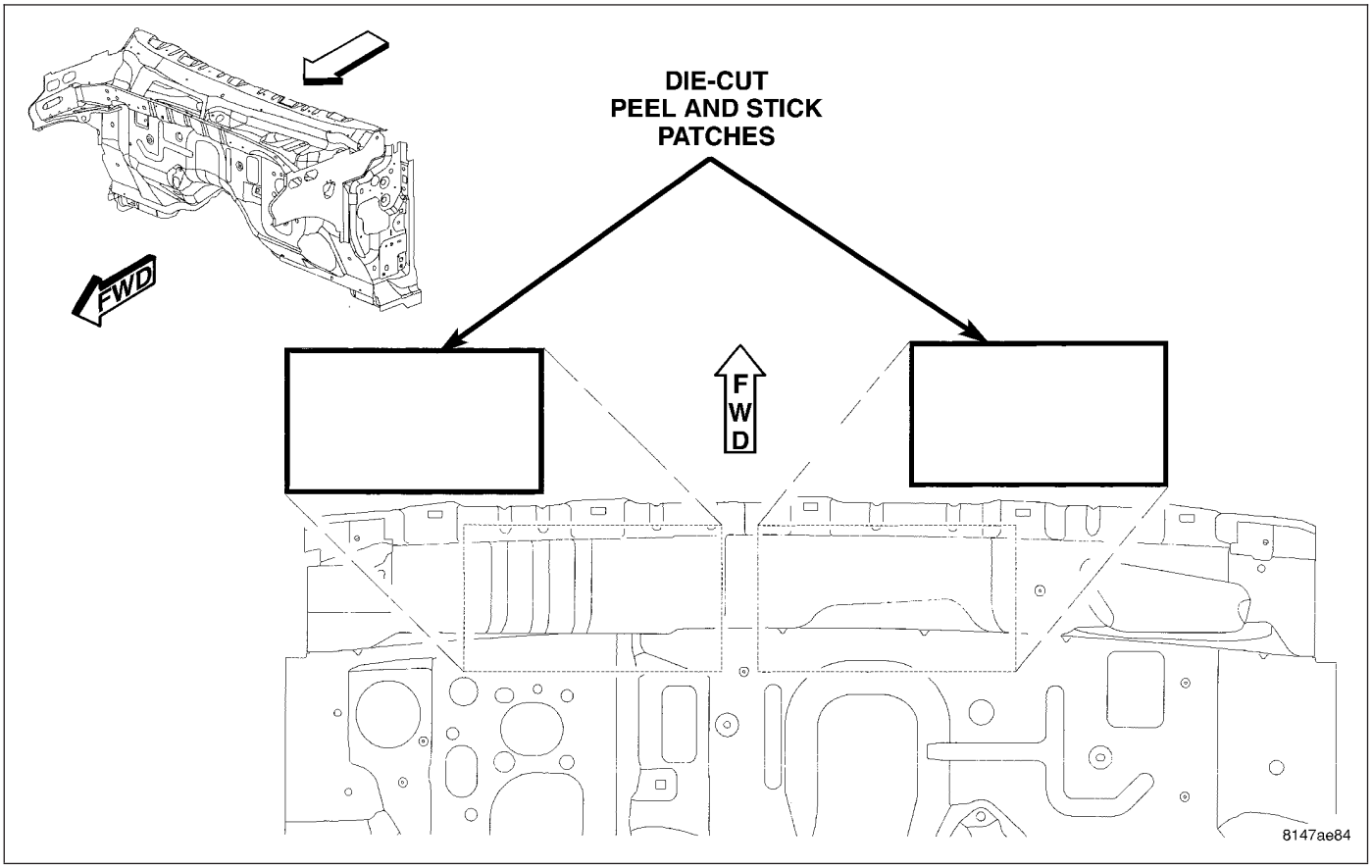

Fig. 29 PATCHES - LOWER PLENUM

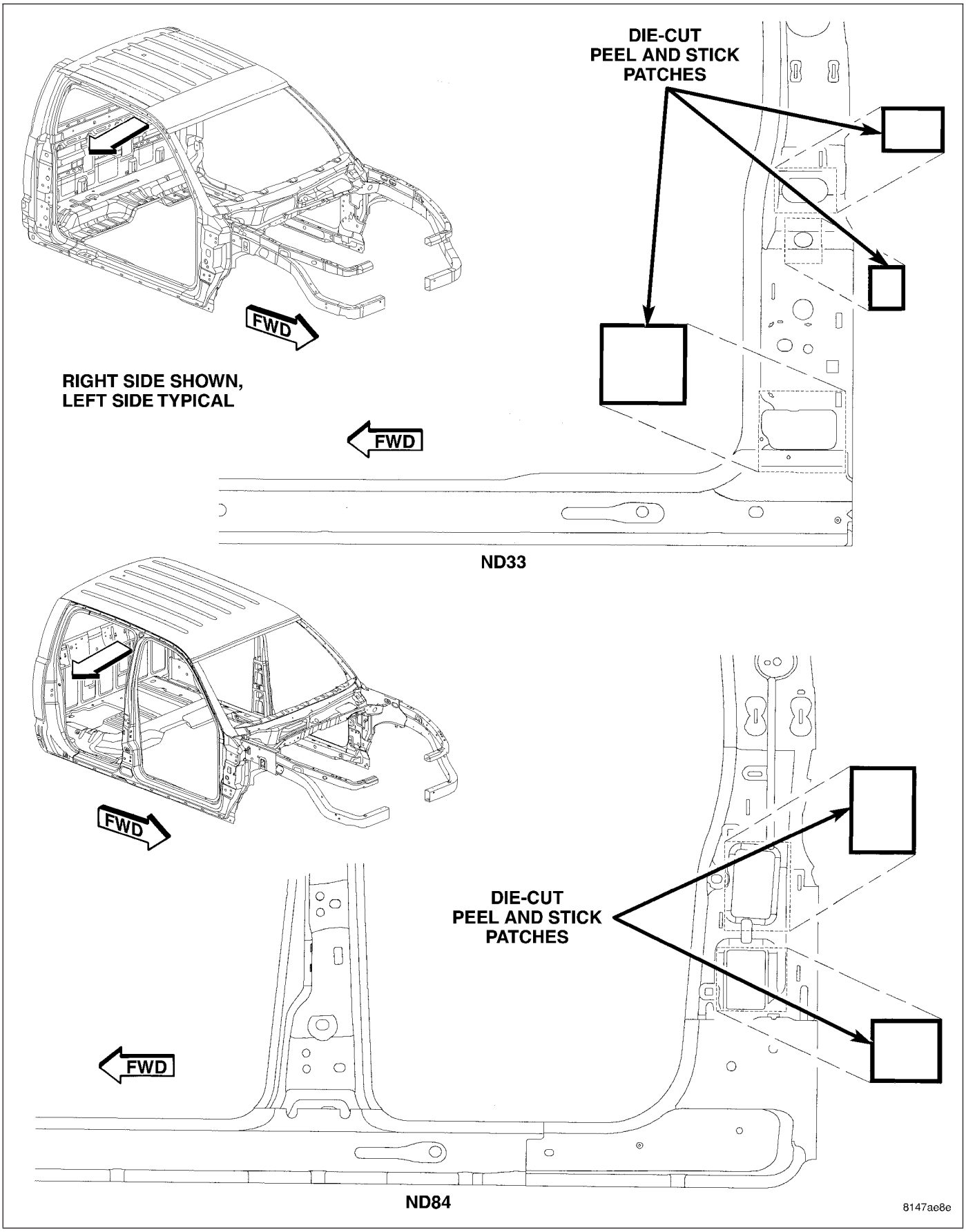

Fig. 30 PATCHES - BODY APERTURE

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STRUCTURAL ADHESIVE LOCATIONS

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Quad Cab (ND84)

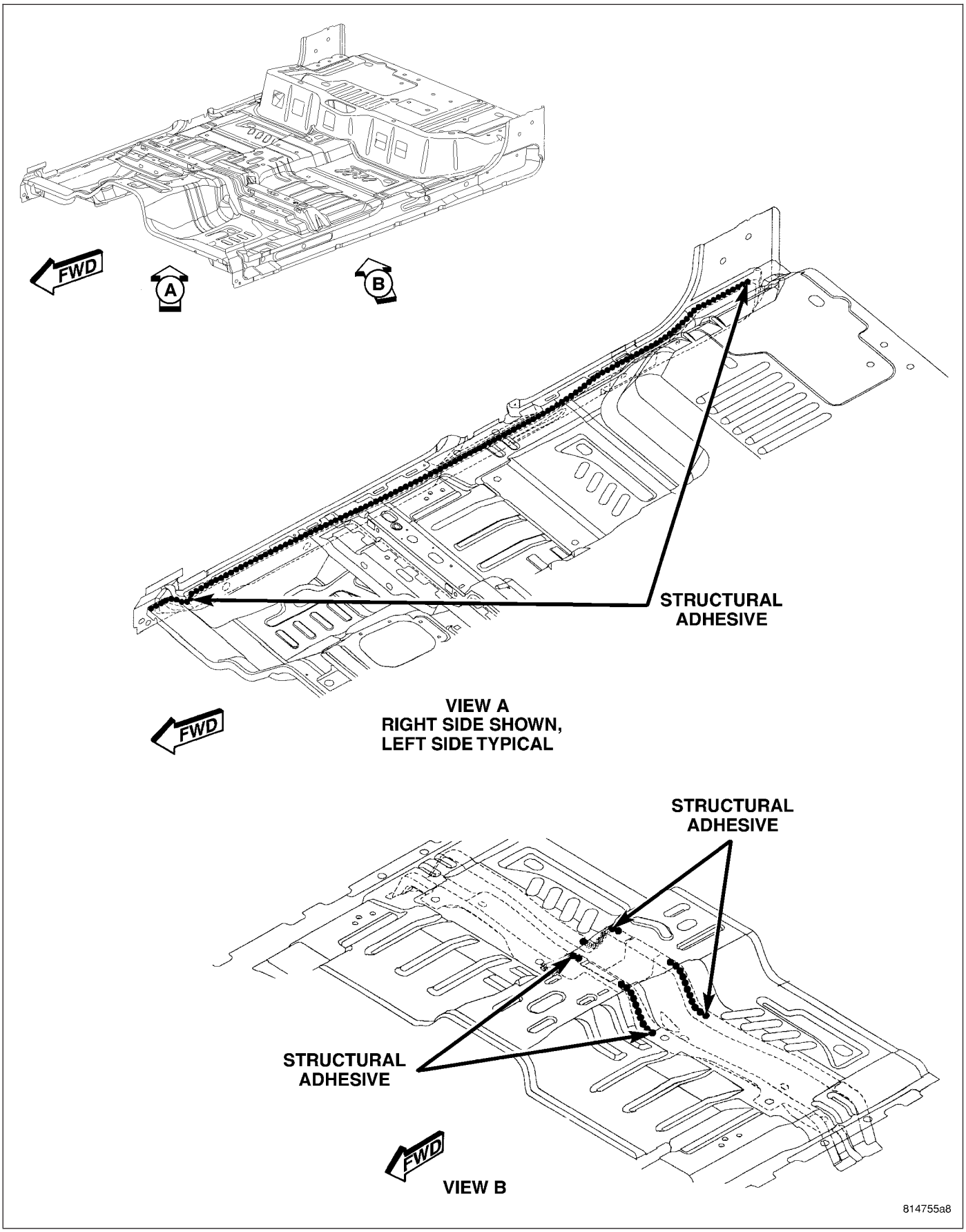

Fig. 31 UNDERBODY - 84 ONLY

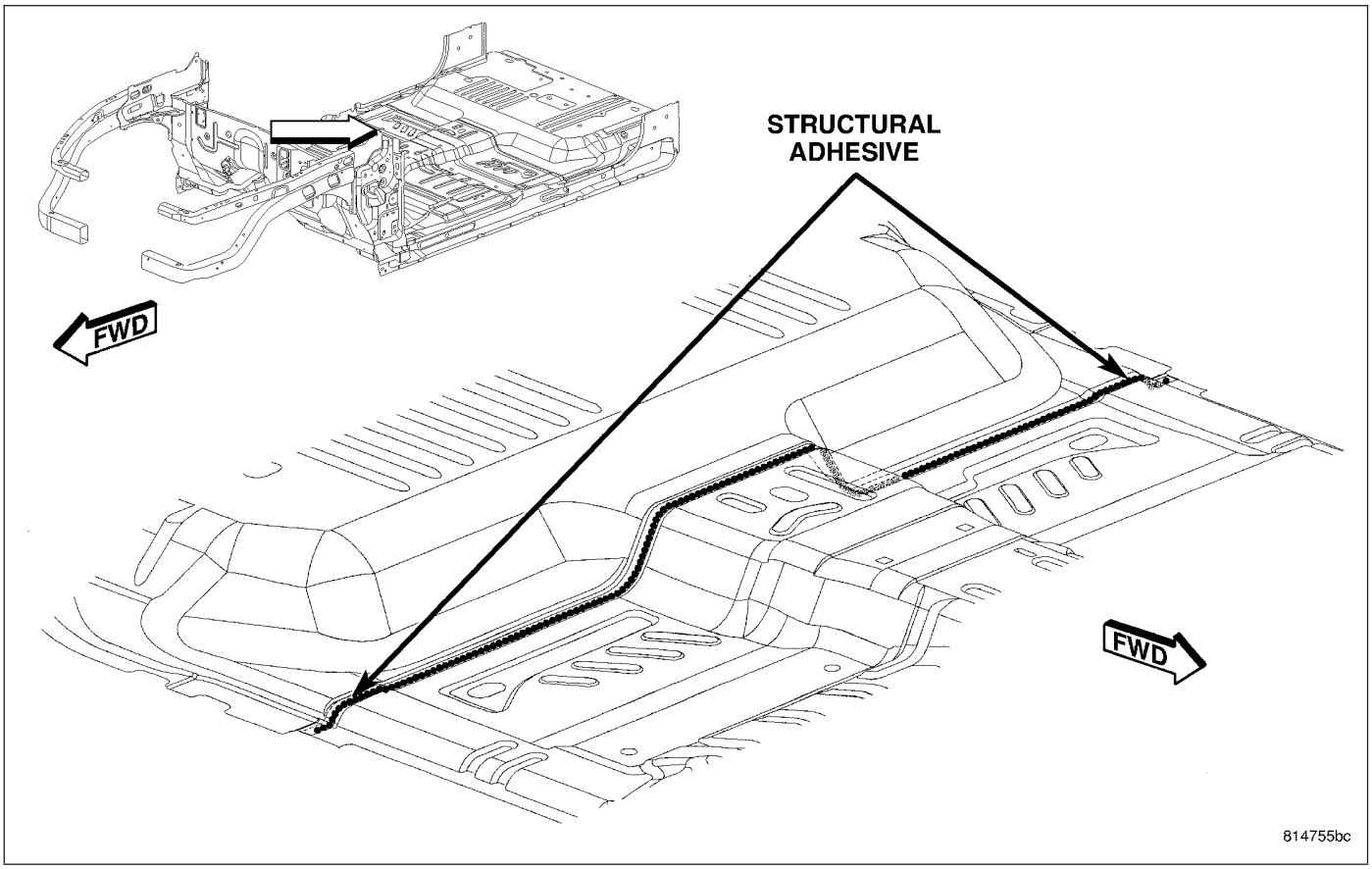

Fig. 32 UNDERBODY COMPLETE - 84 ONLY

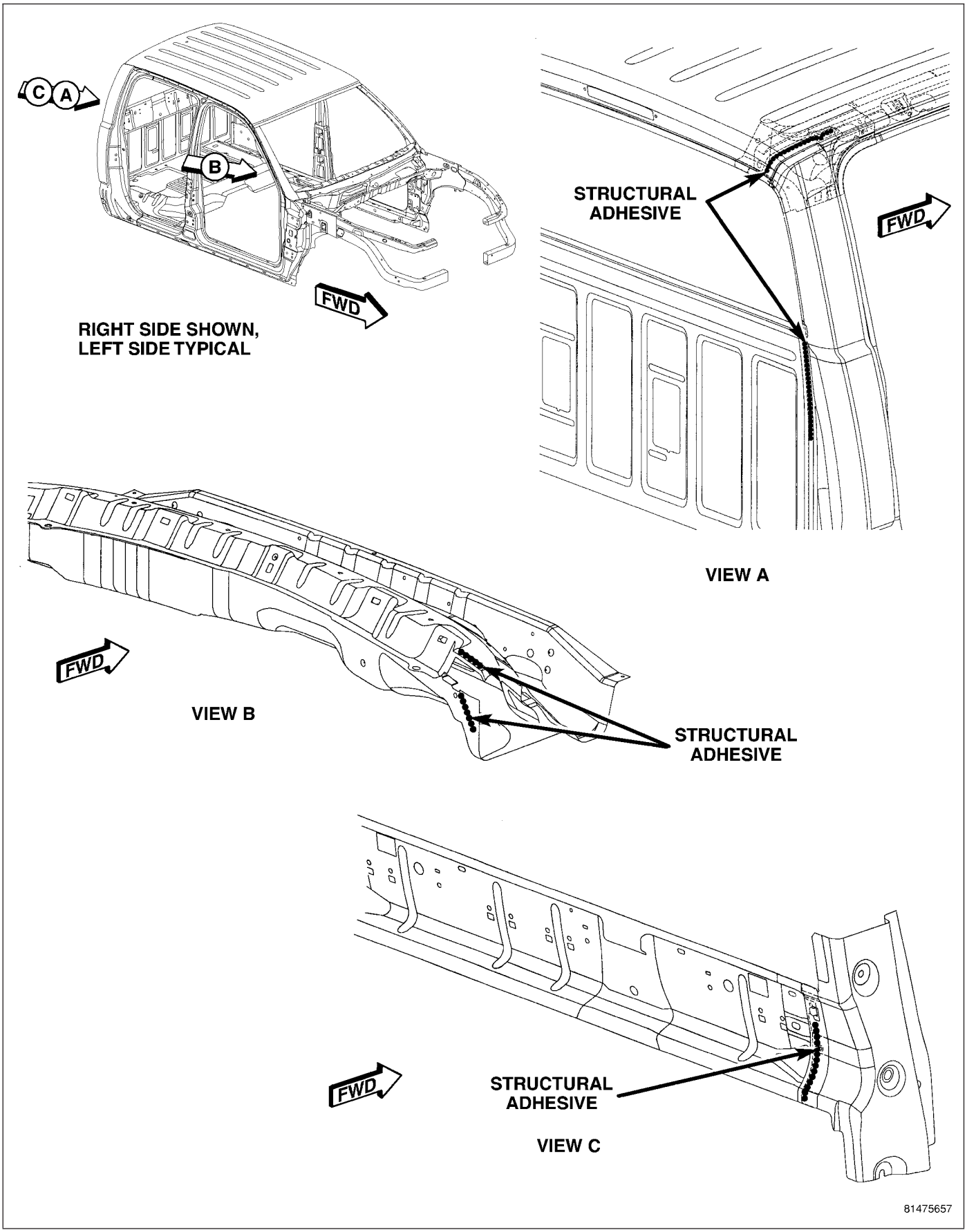

Fig. 33 CAB COMPLETE - 84 ONLY

Club Cab (ND33)

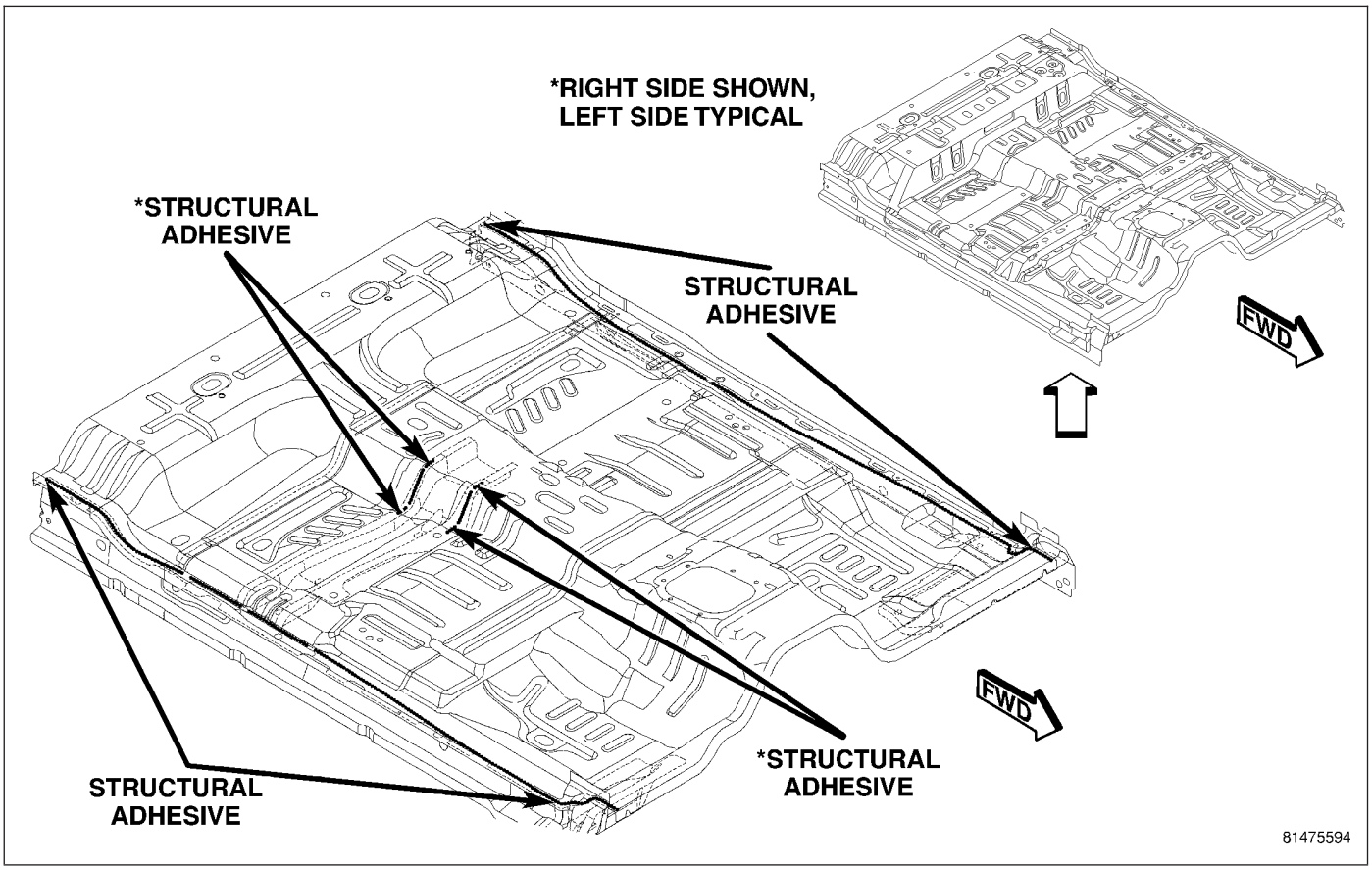

Fig. 34 UNDERBODY - 33 ONLY

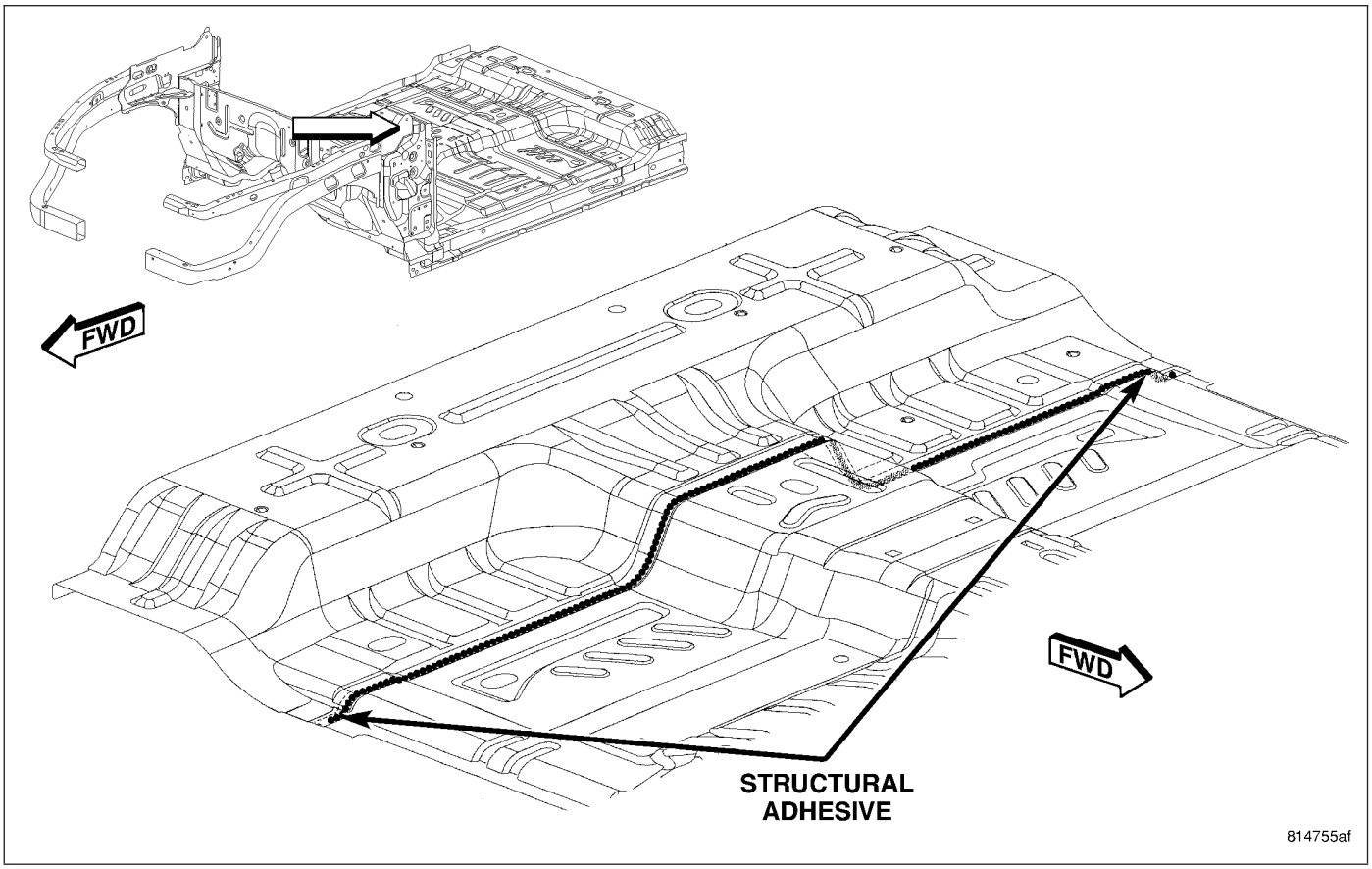

Fig. 35 UNDERBODY COMPLETE - 33 ONLY

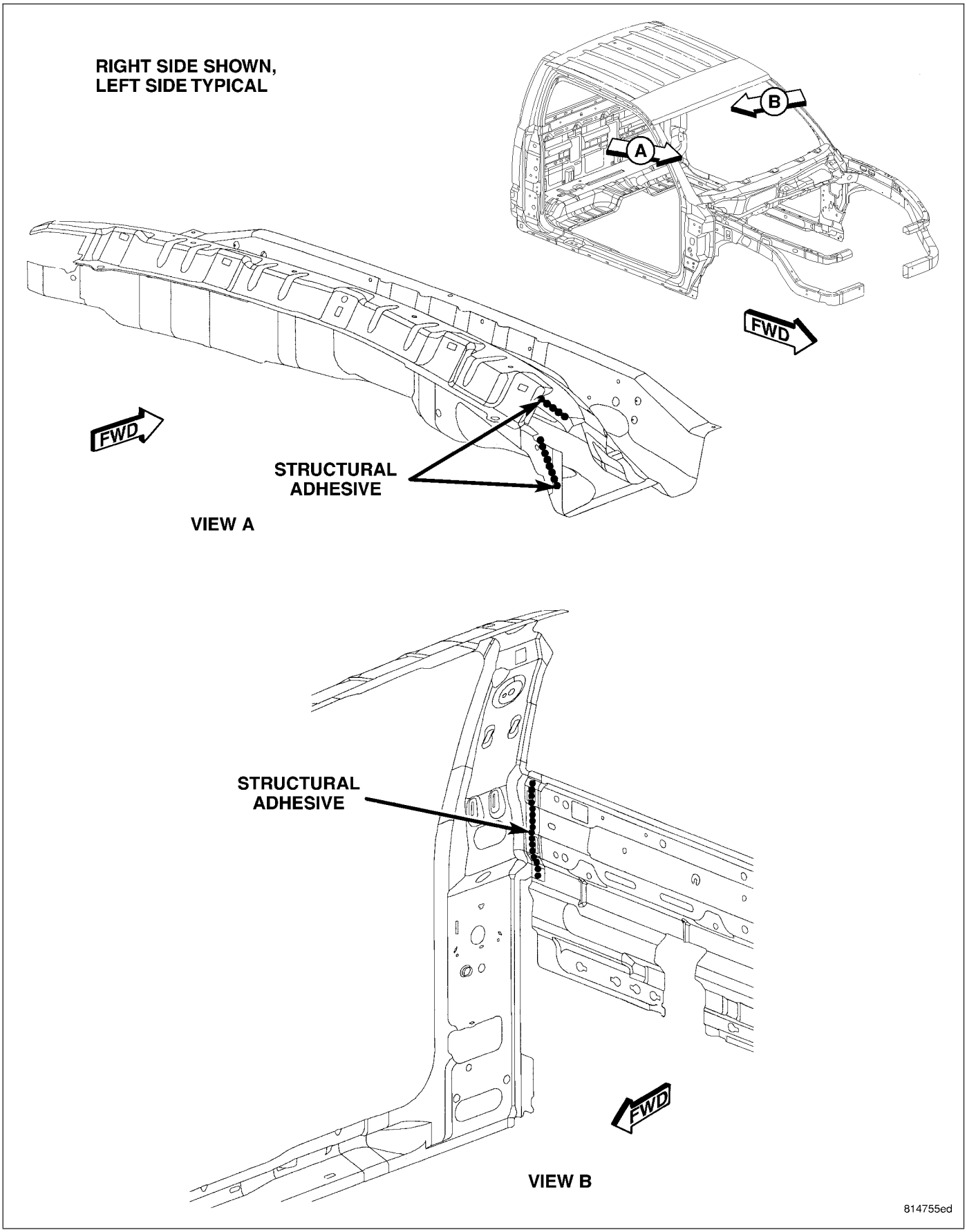

Fig. 36 CAB COMPLETE - 33 ONLY (1 OF 2)

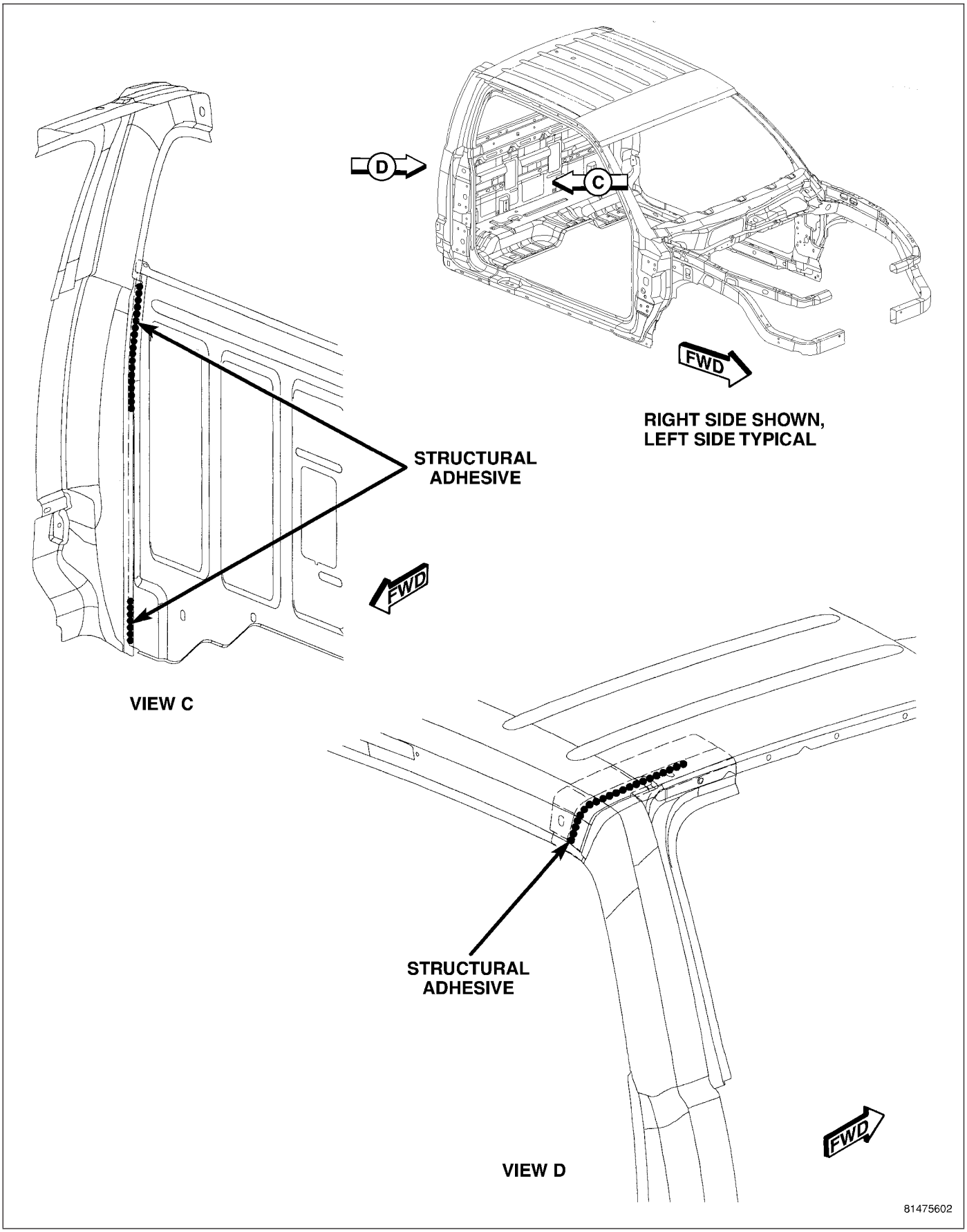

Fig. 37 CAB COMPLETE - 33 ONLY (2 OF 2)

Both Quad (ND84) and Club Cabs (ND33)

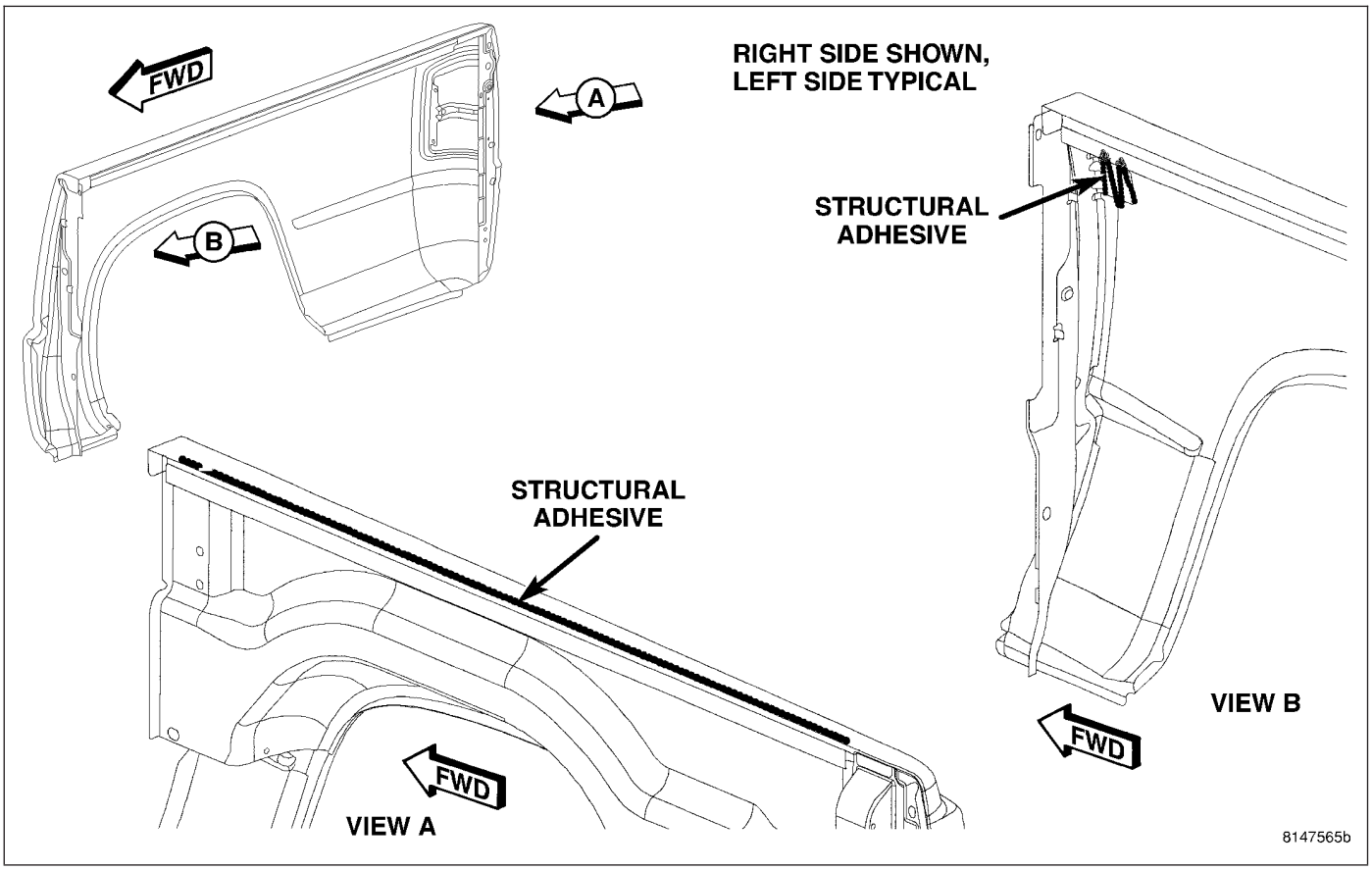

Fig. 38 BOX - 5.5 ONLY

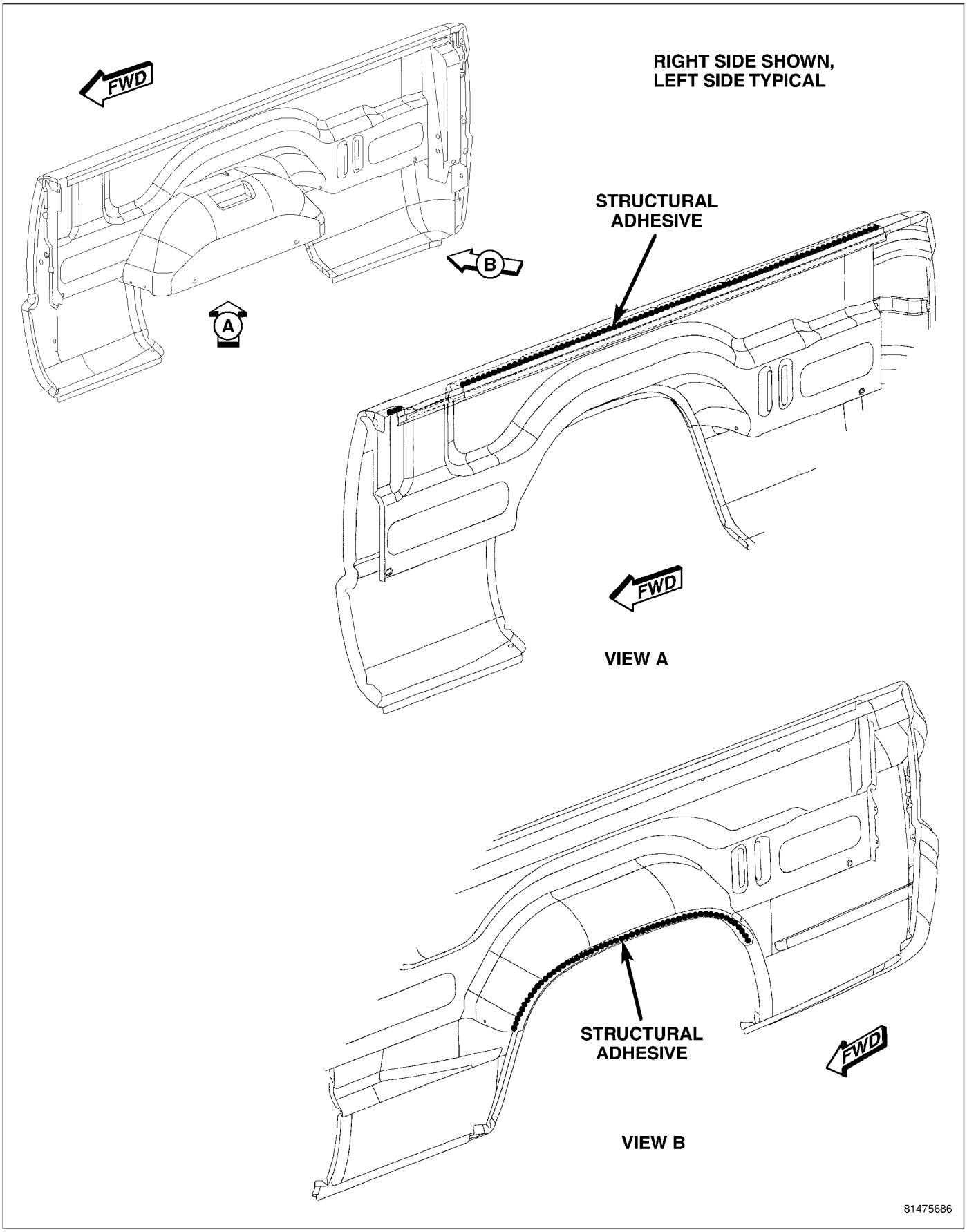

Fig. 39 BOX - 6.5 ONLY

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Quad Cab (ND84)

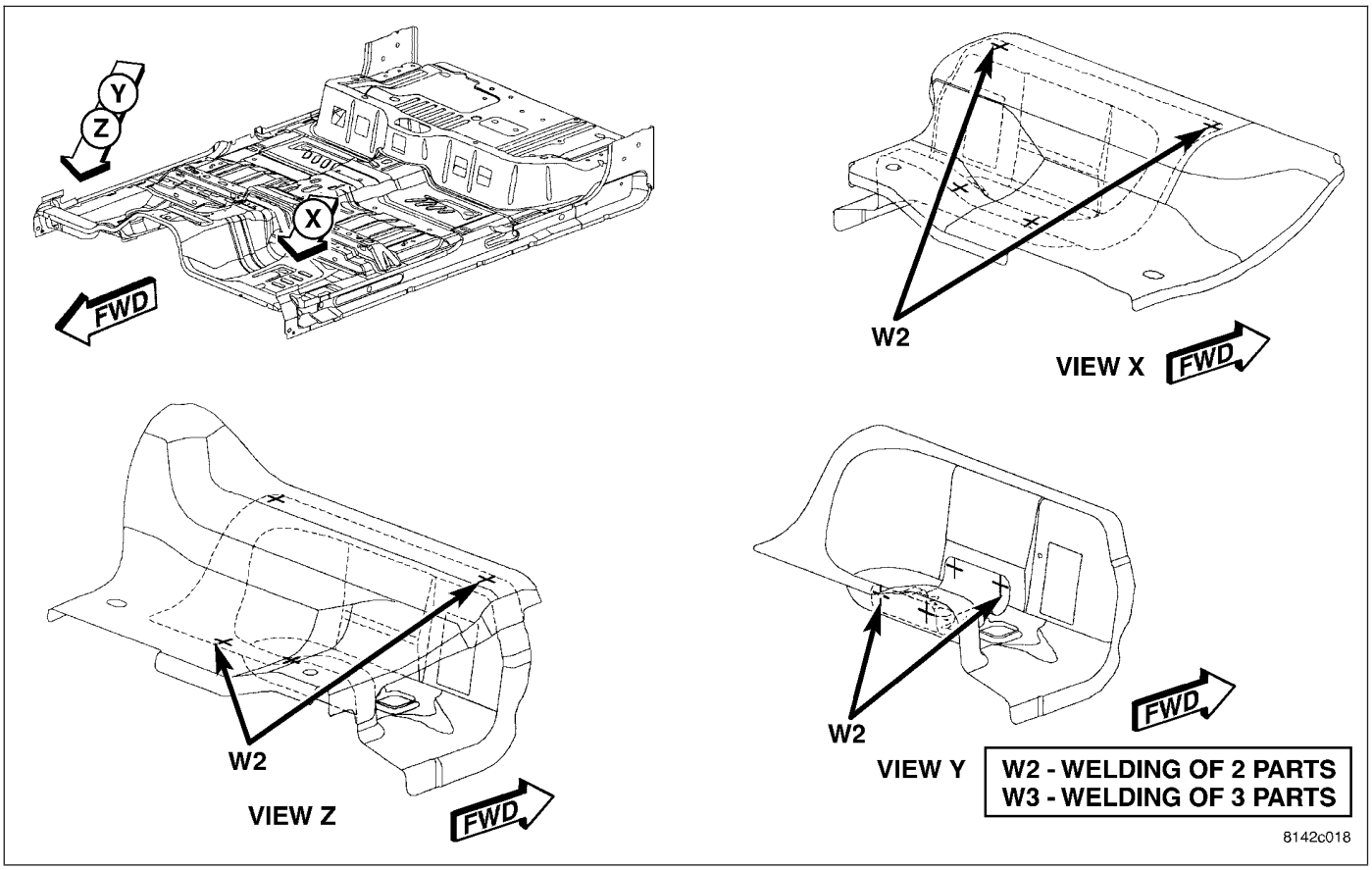


Fig. 40 UNDERBODY (1 OF 12)

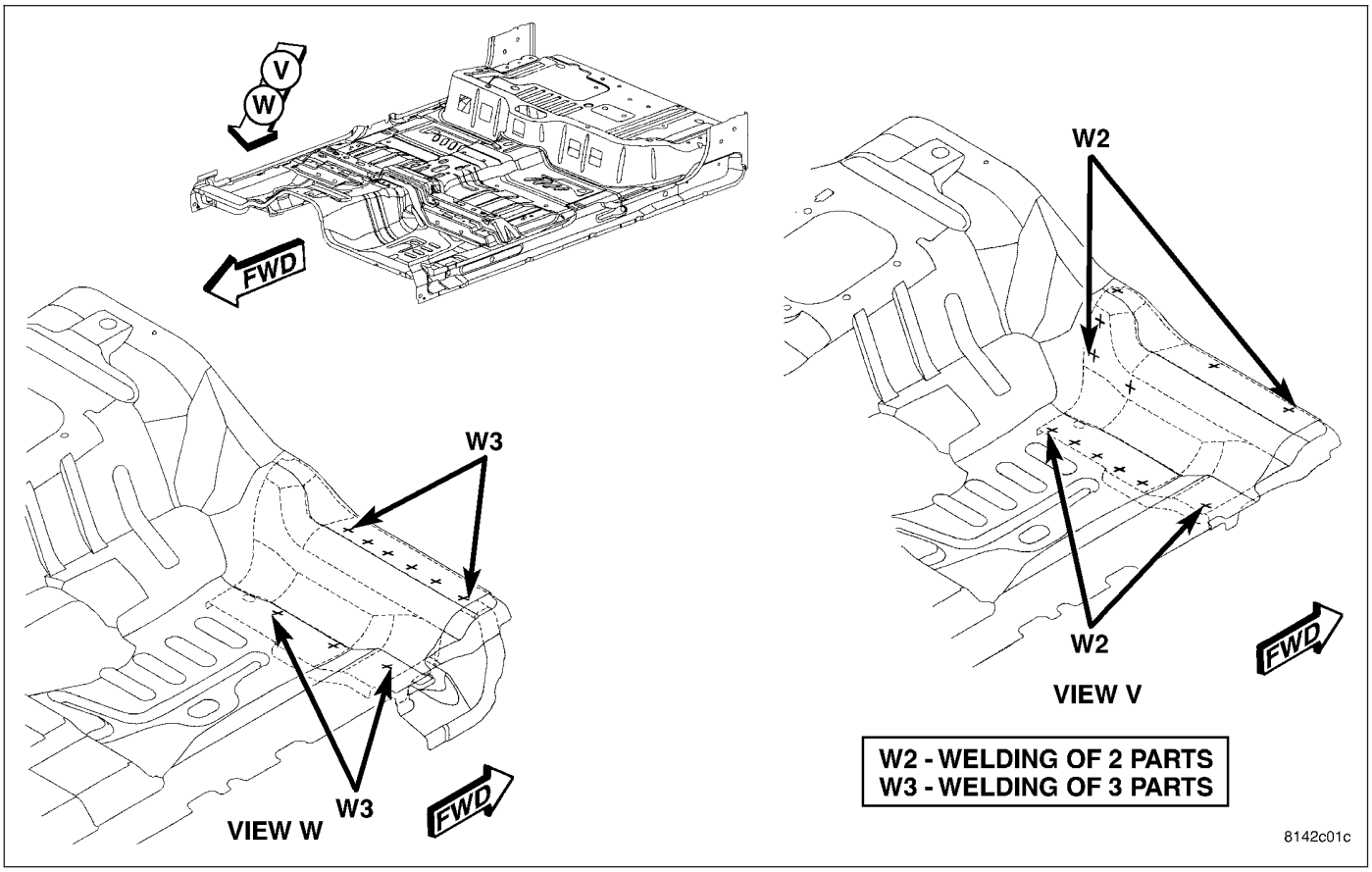


Fig. 41 UNDERBODY (2 OF 12)

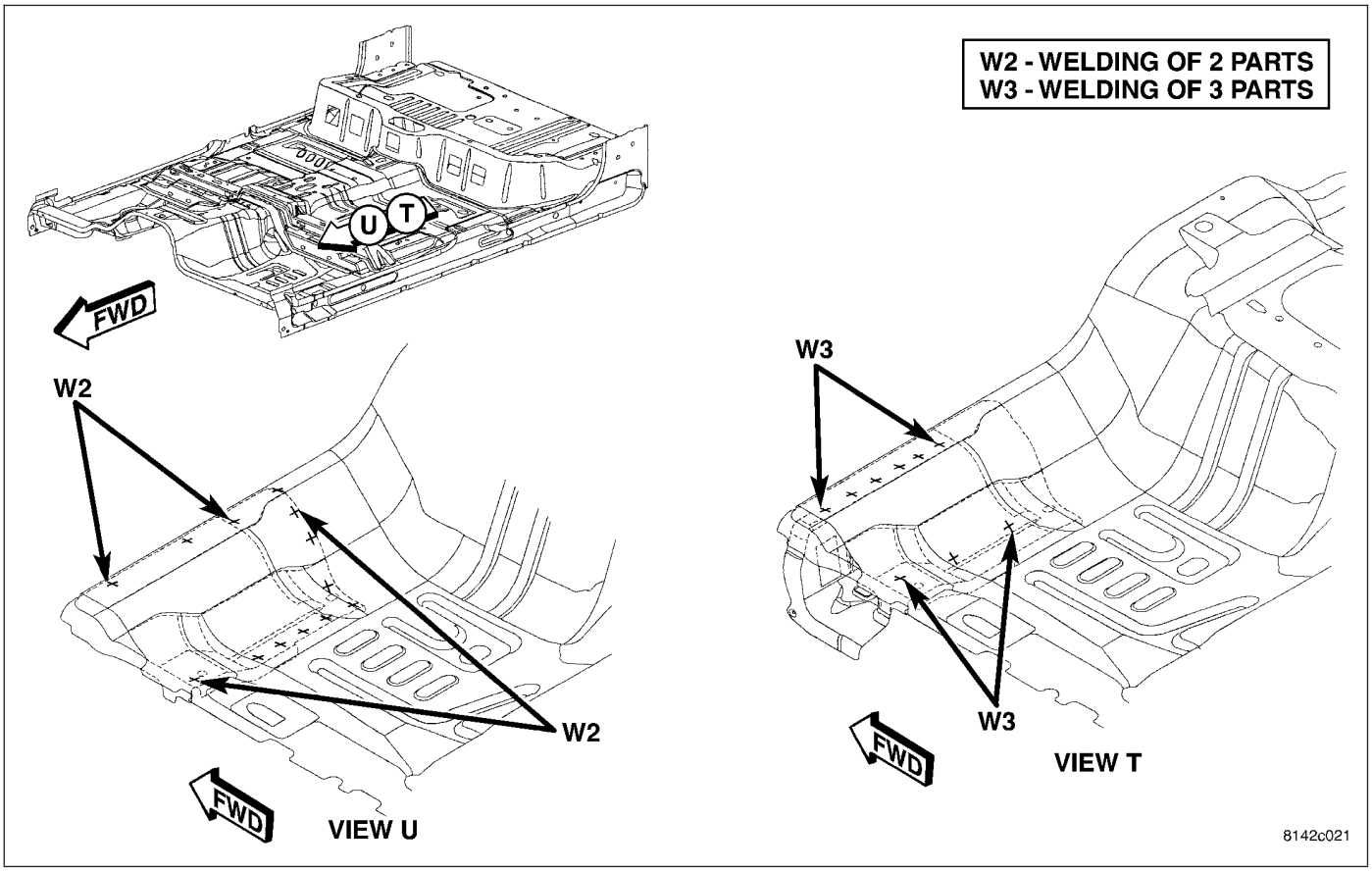


Fig. 42 UNDERBODY (3 OF 12)

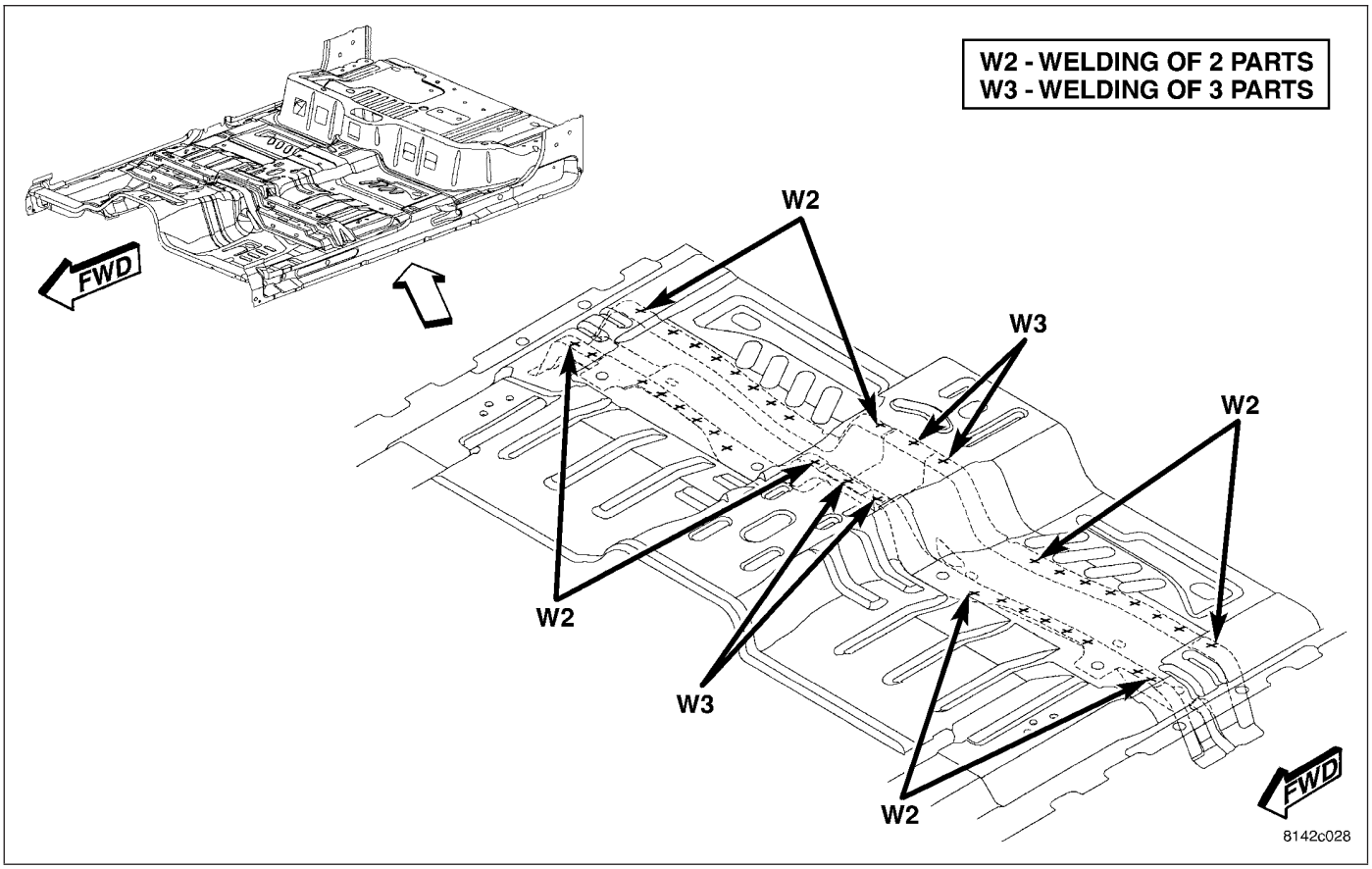


Fig. 43 UNDERBODY (4 OF 12)

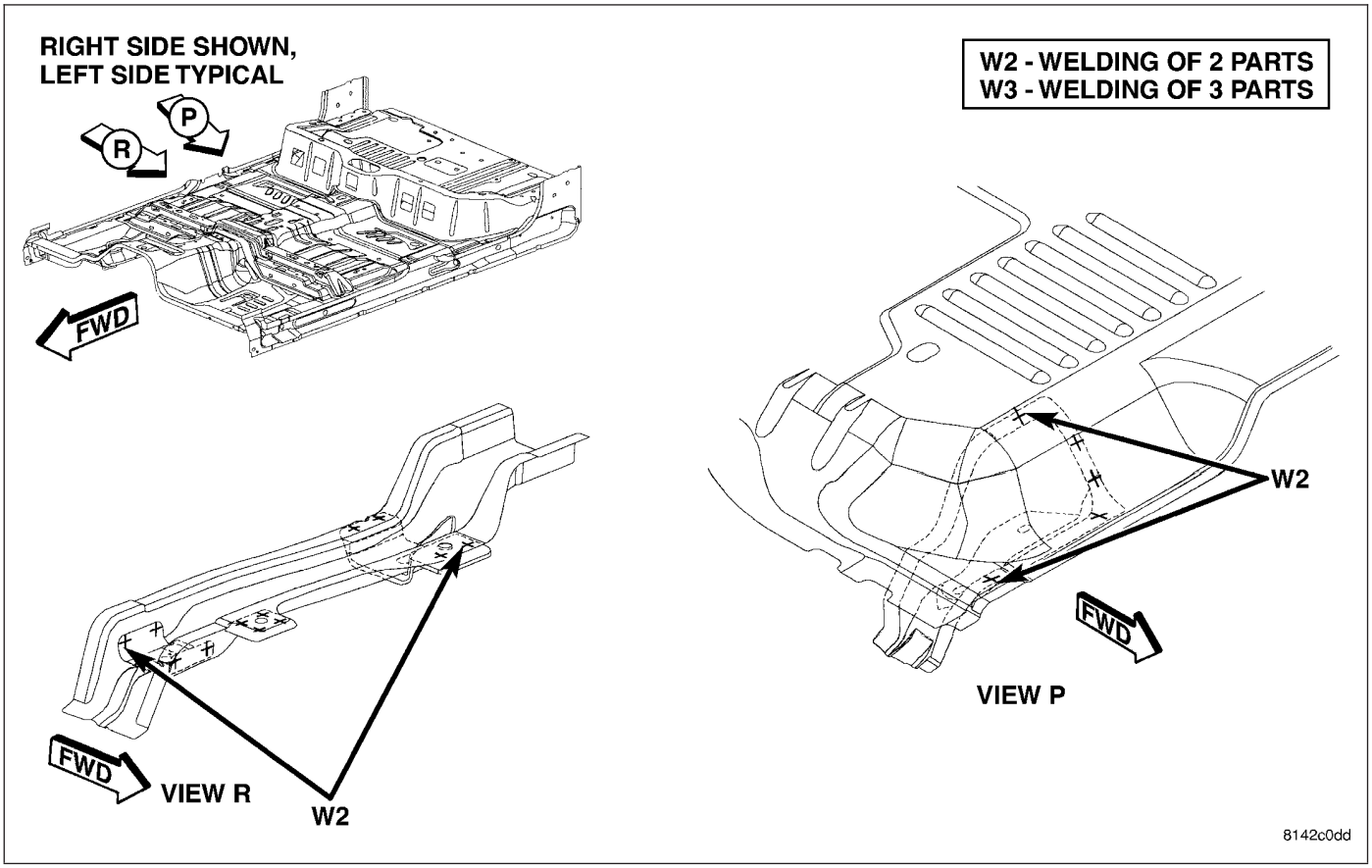


Fig. 44 UNDERBODY (5 OF 12)

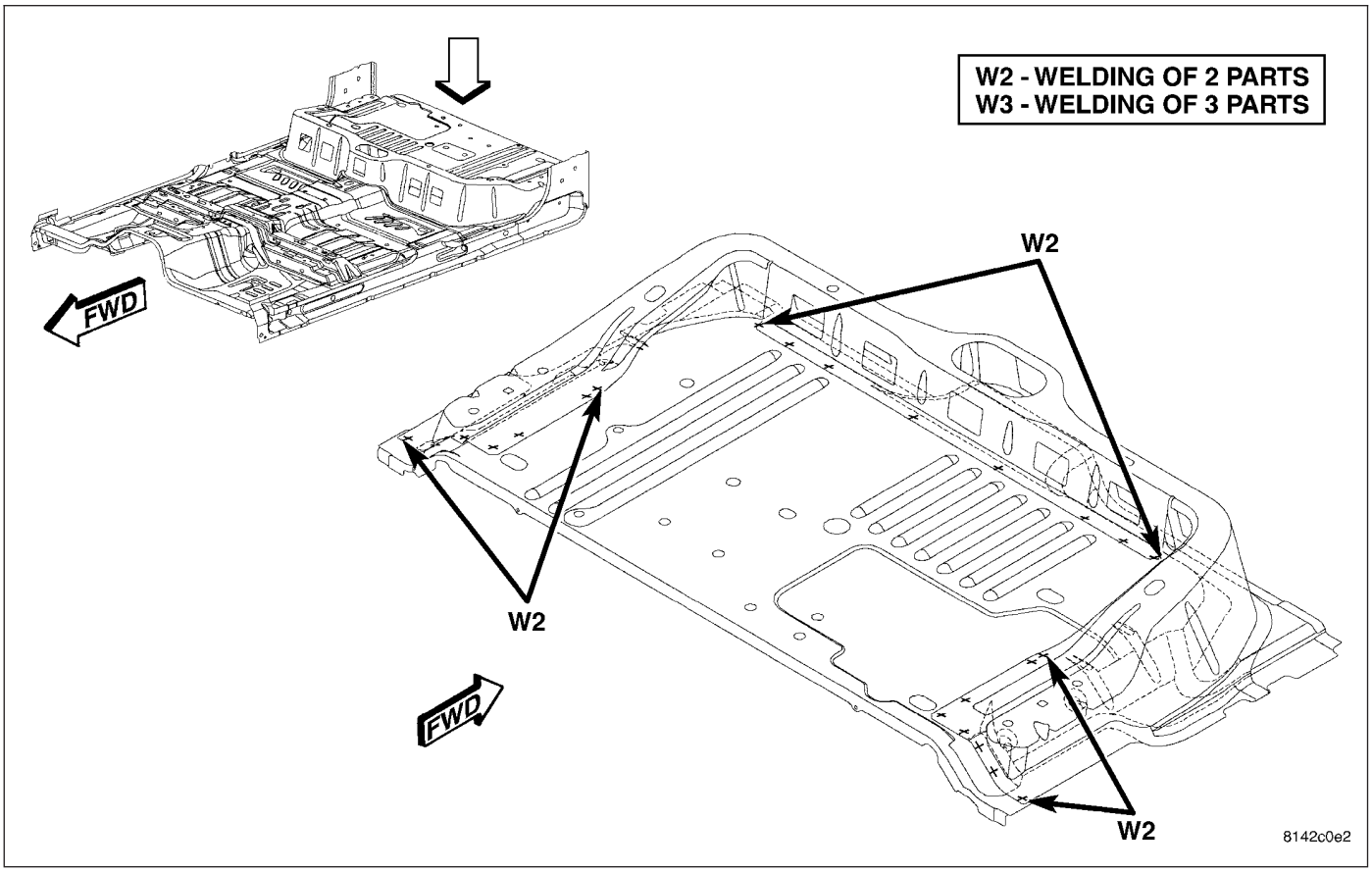


Fig. 45 UNDERBODY (6 OF 12)

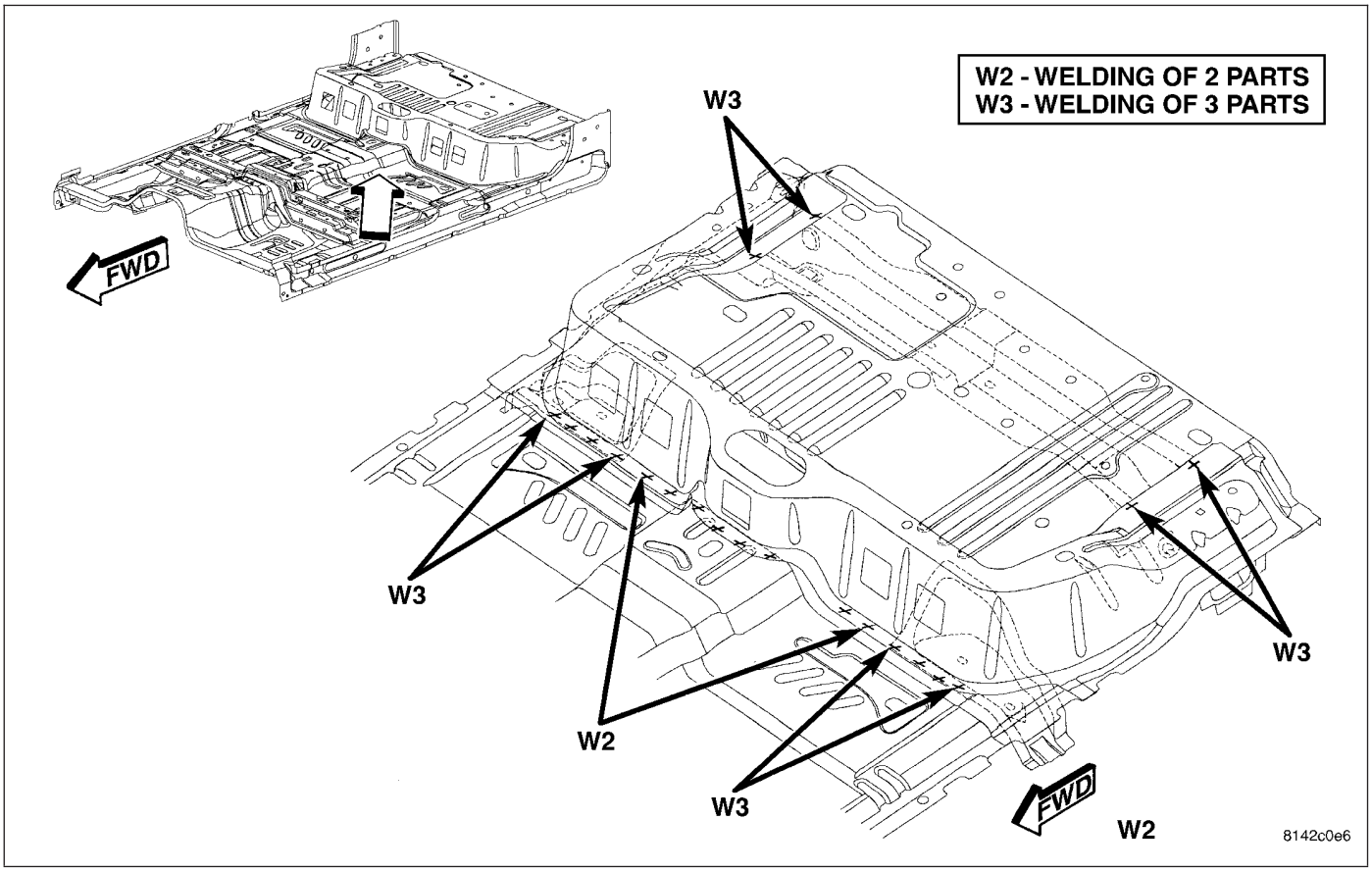


Fig. 46 UNDERBODY (7 OF 12)

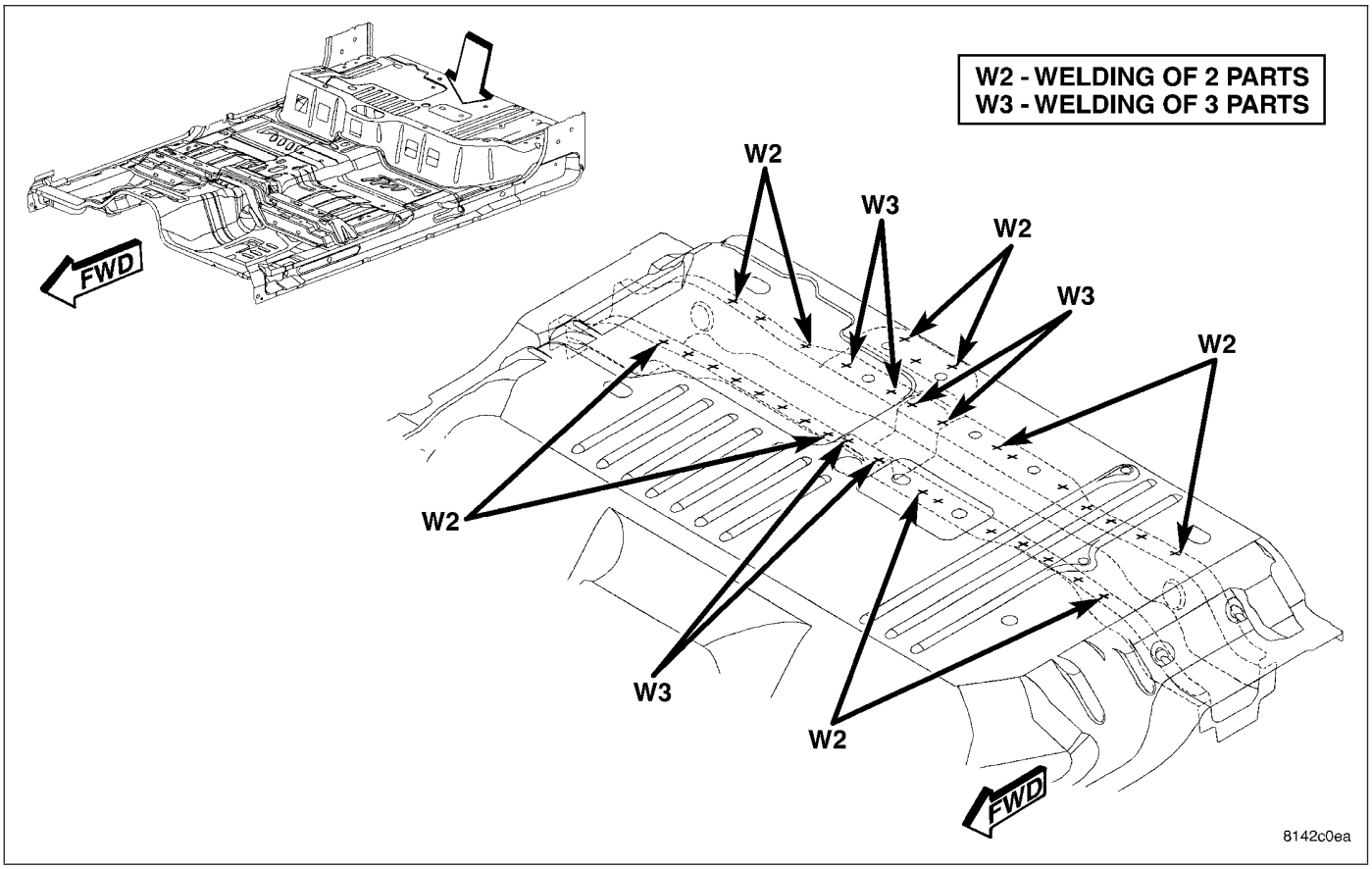


Fig. 47 UNDERBODY (8 OF 12)

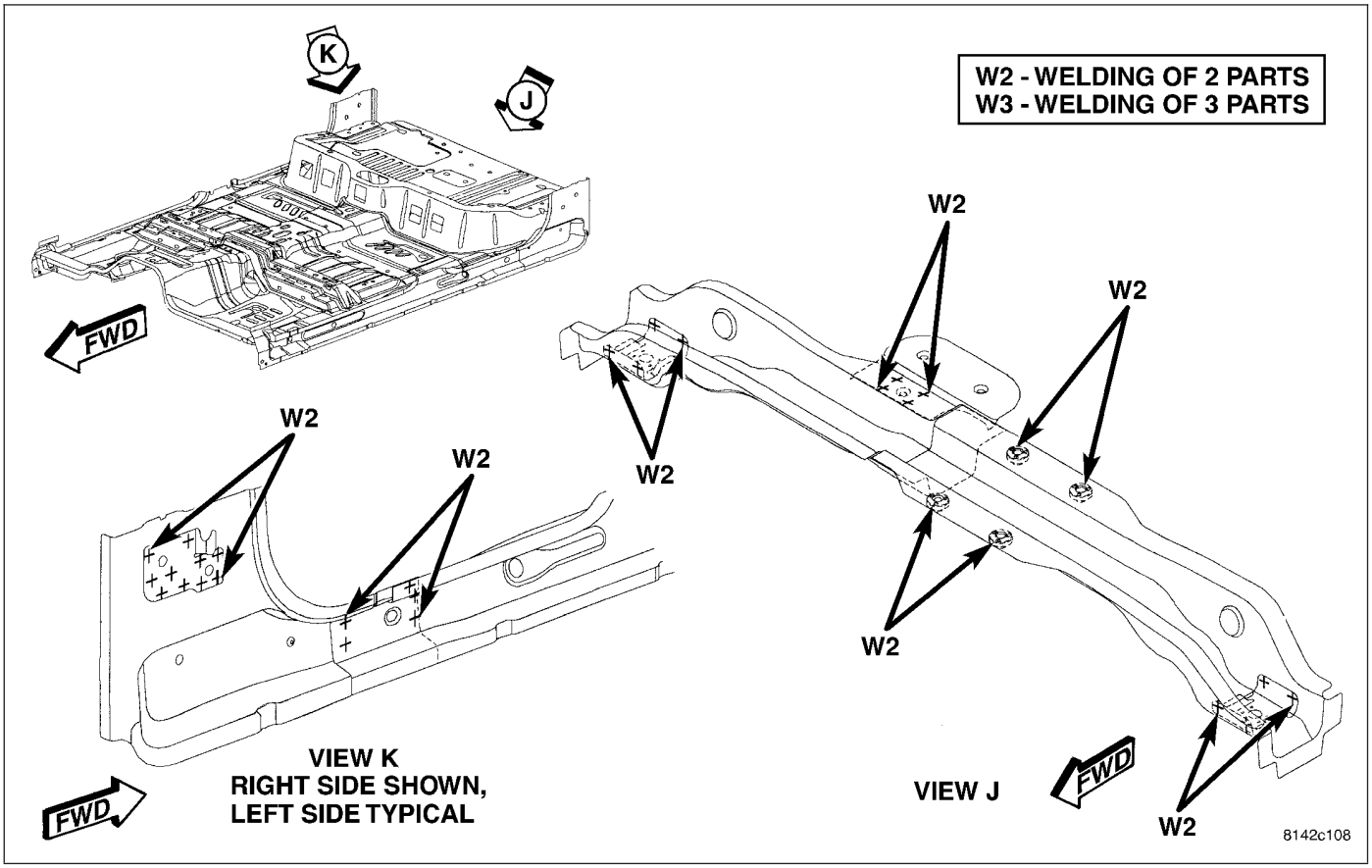


Fig. 48 UNDERBODY (9 OF 12)

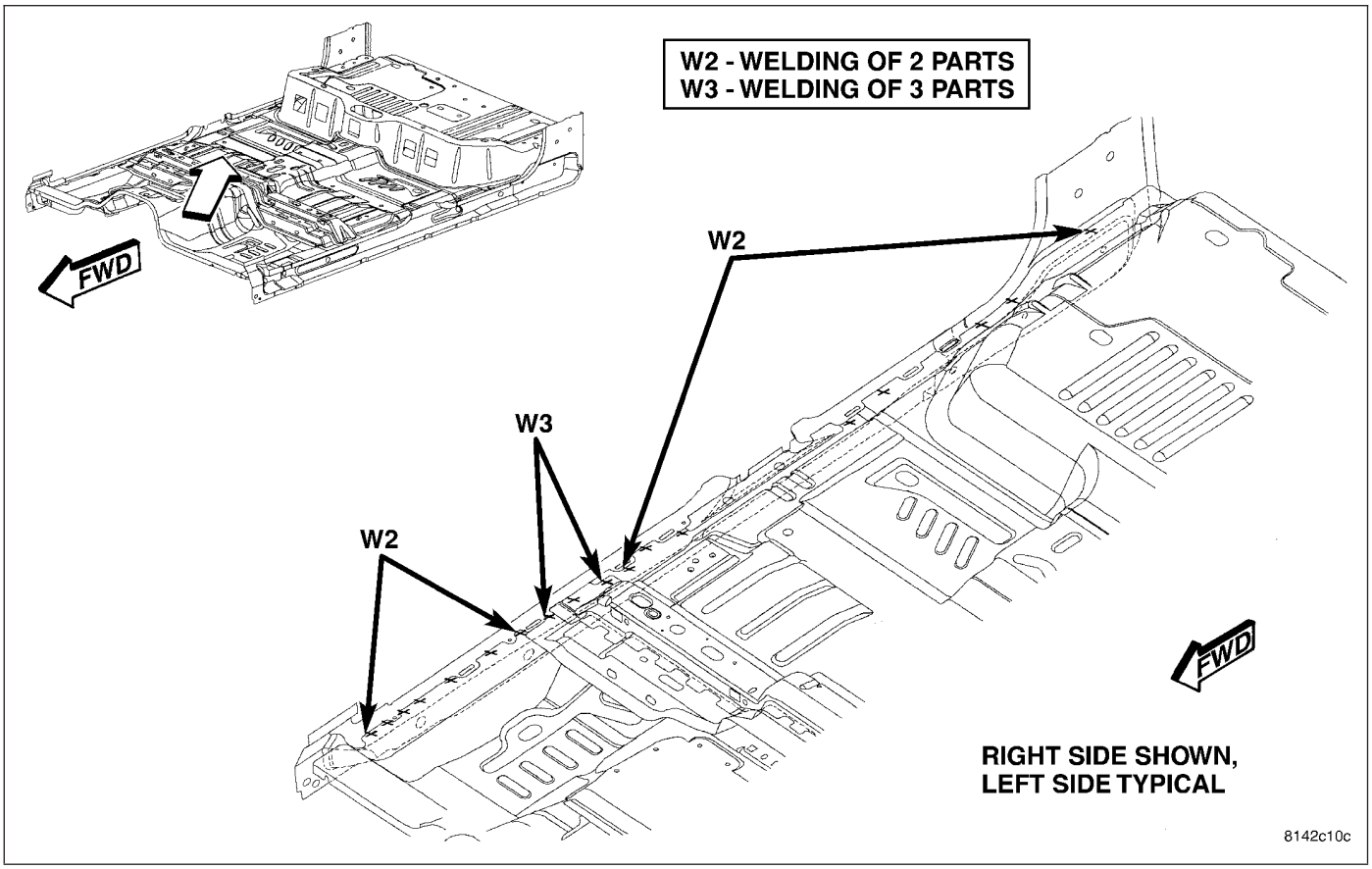


Fig. 49 UNDERBODY (10 OF 12)

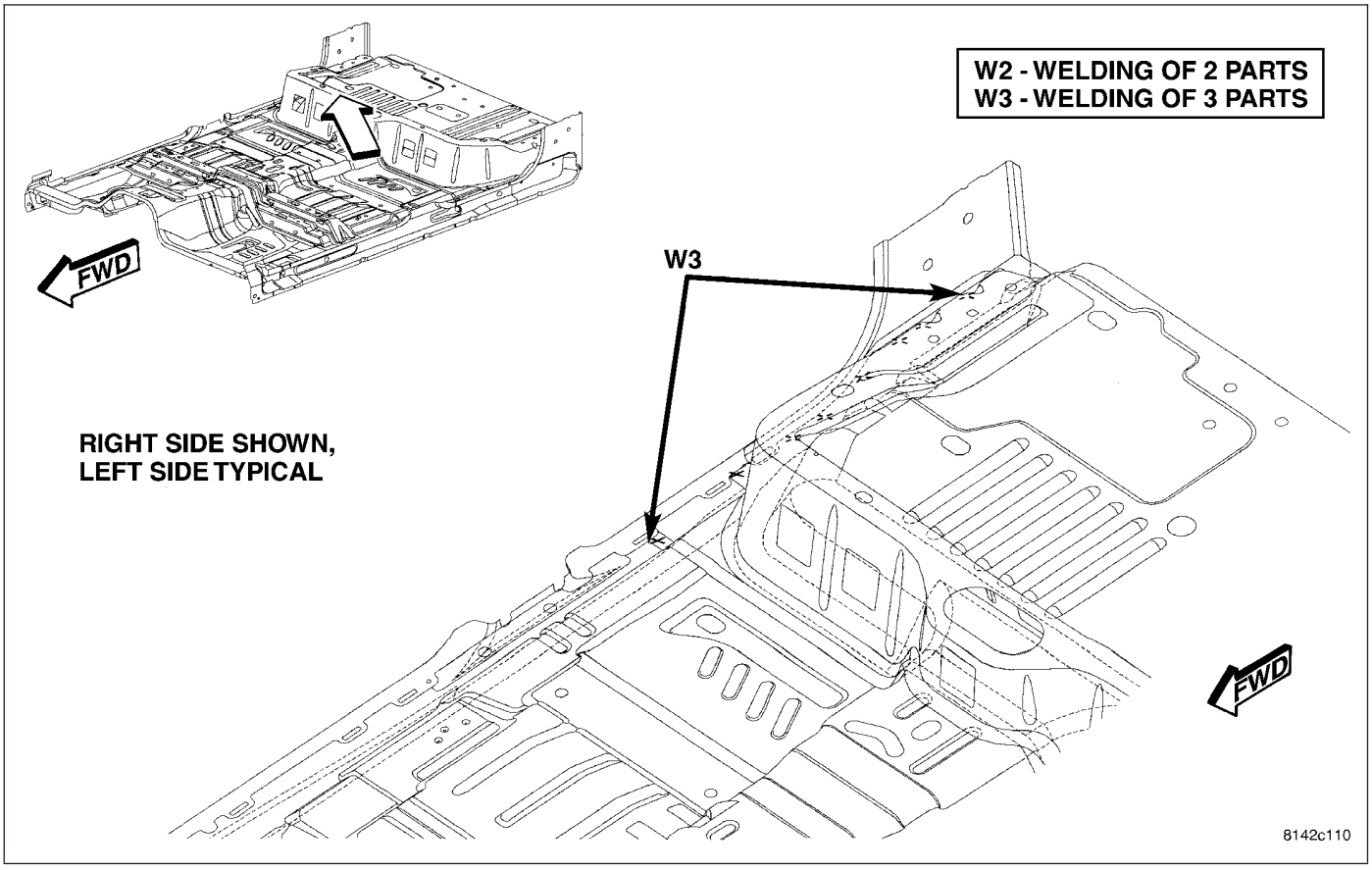


Fig. 50 UNDERBODY (11 OF 12)

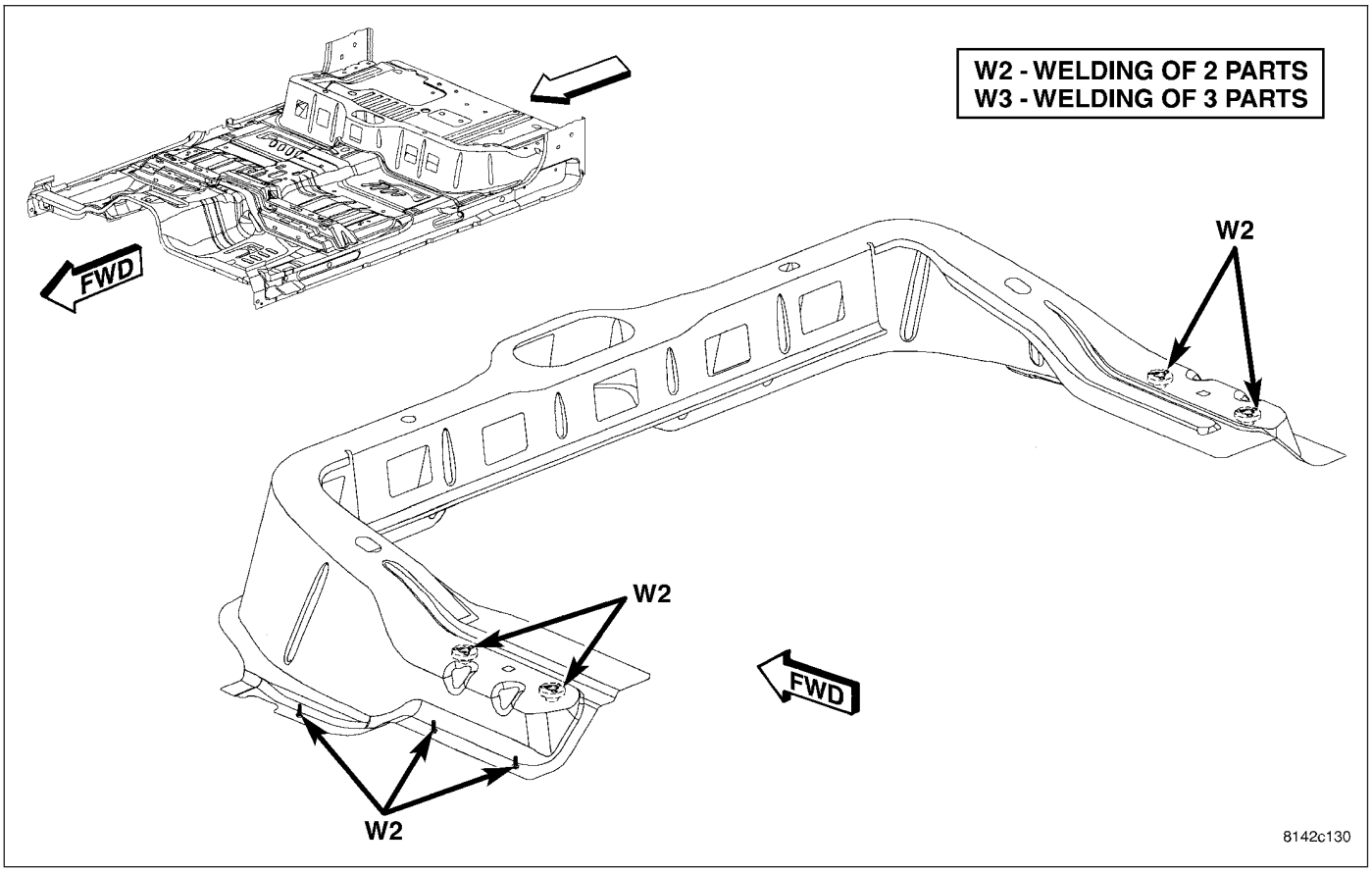


Fig. 51 UNDERBODY (12 OF 12)

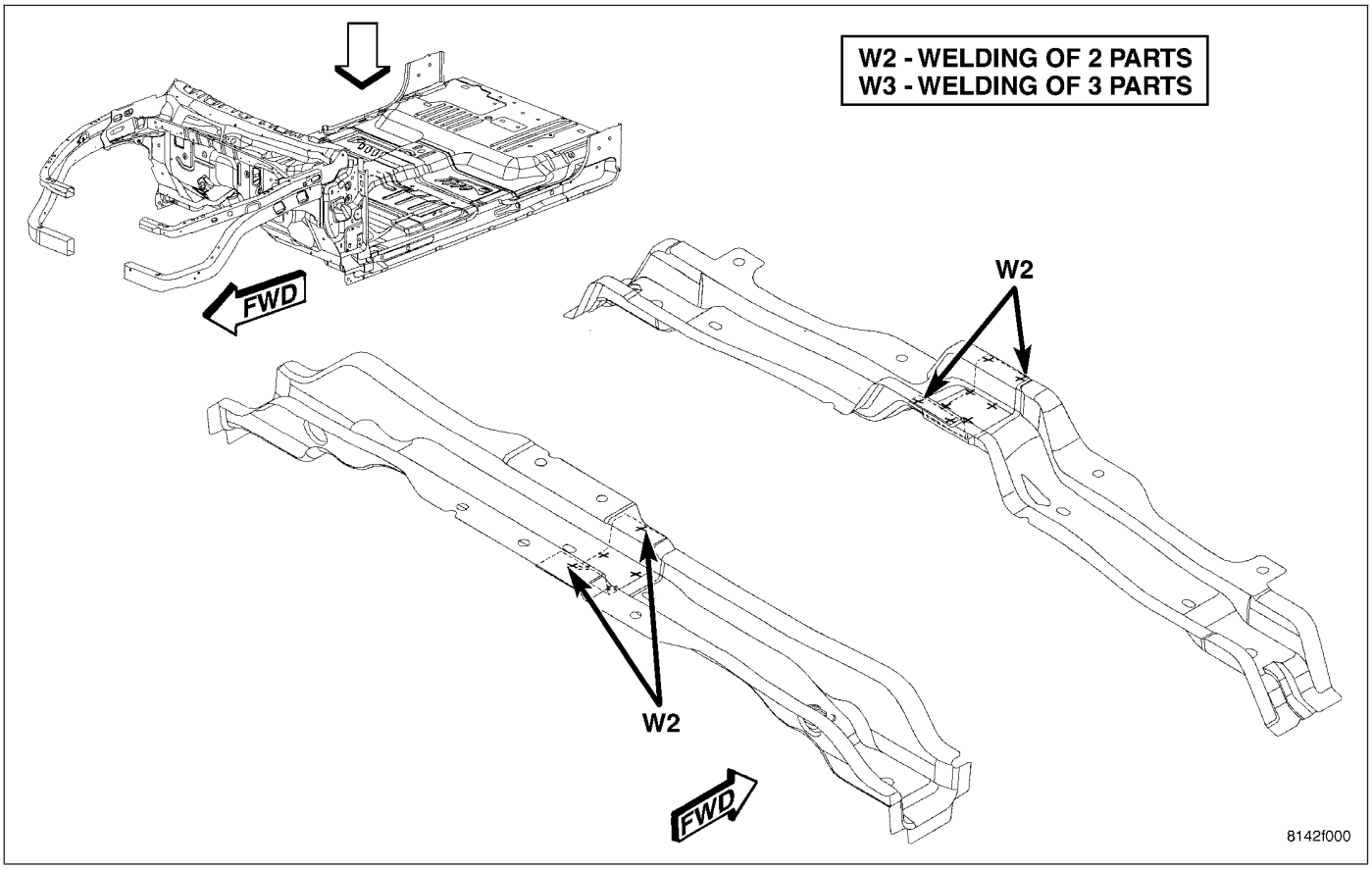


Fig. 52 UNDERBODY COMPLETE (1 OF 7)

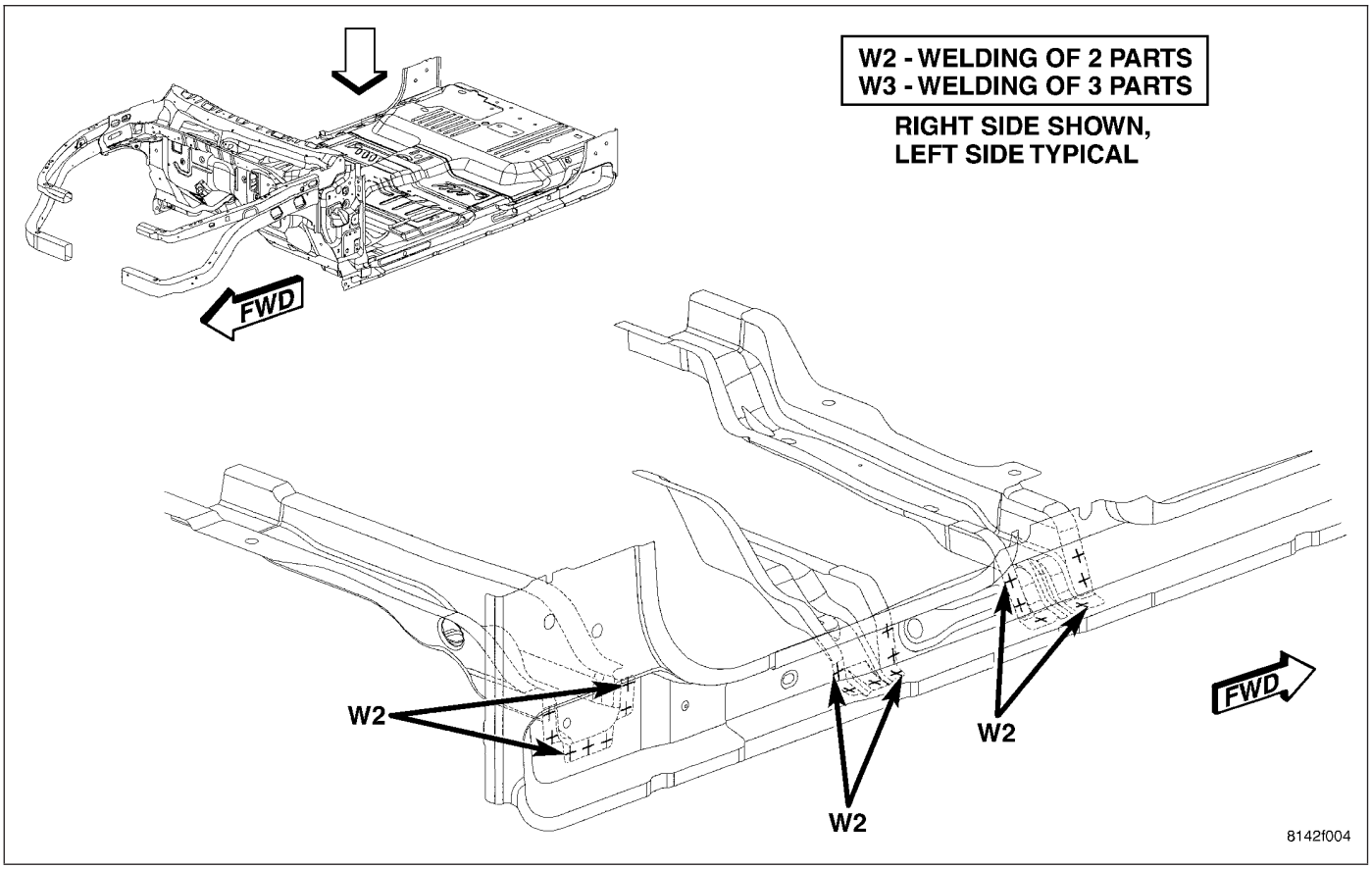


Fig. 53 UNDERBODY COMPLETE (2 OF 7)

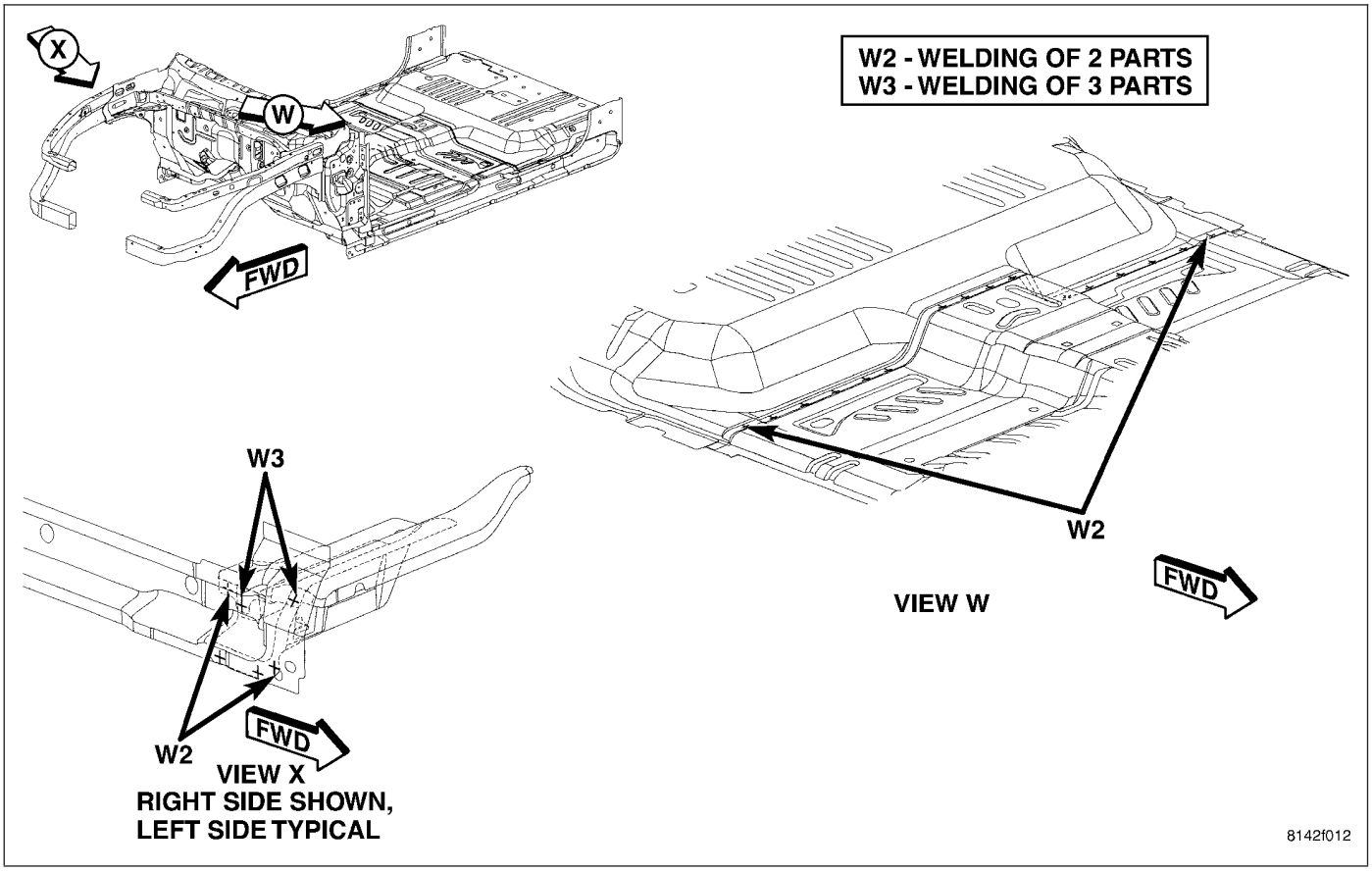


Fig. 54 UNDERBODY COMPLETE (3 OF 7)

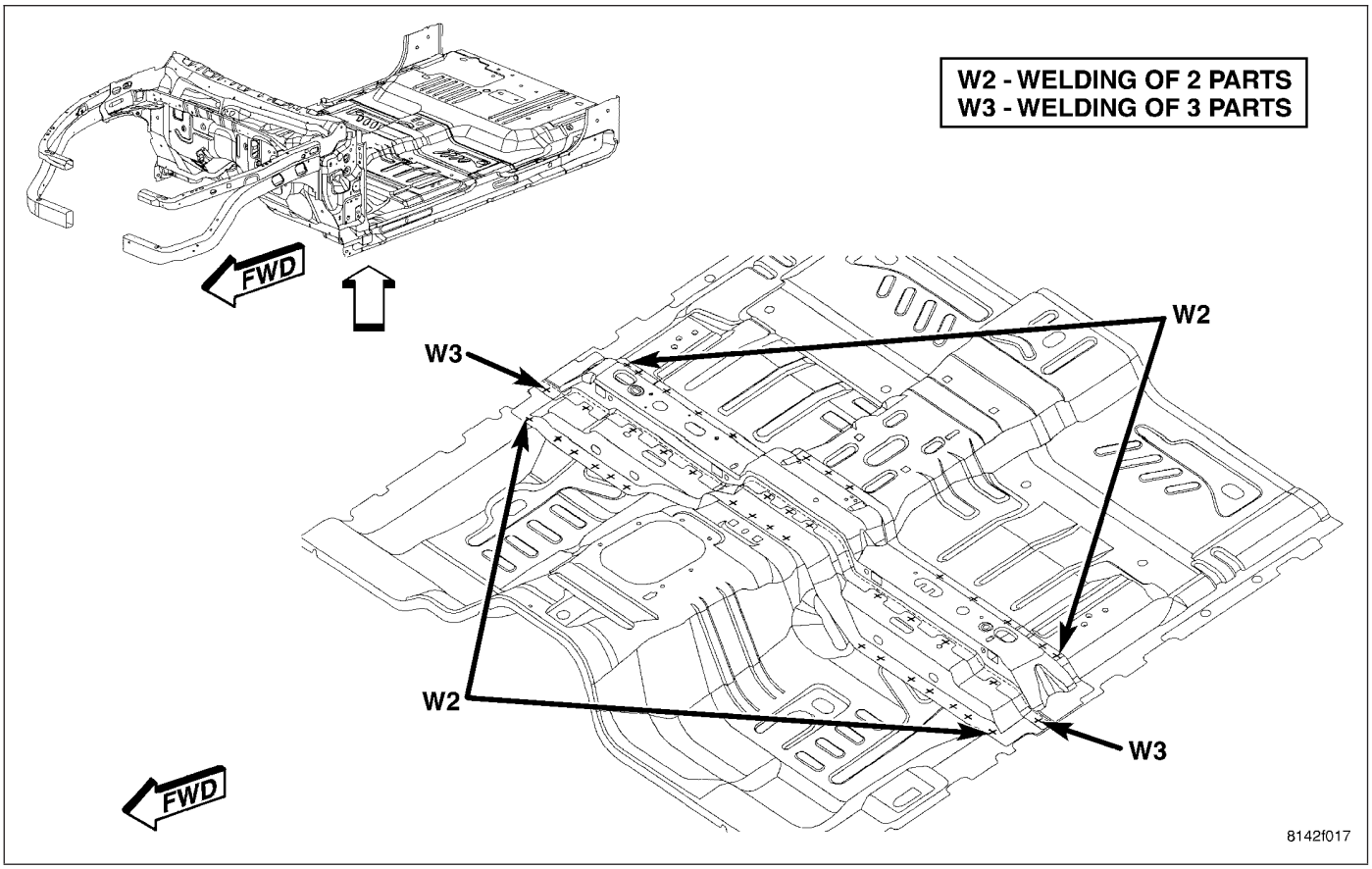


Fig. 55 UNDERBODY COMPLETE (4 OF 7)

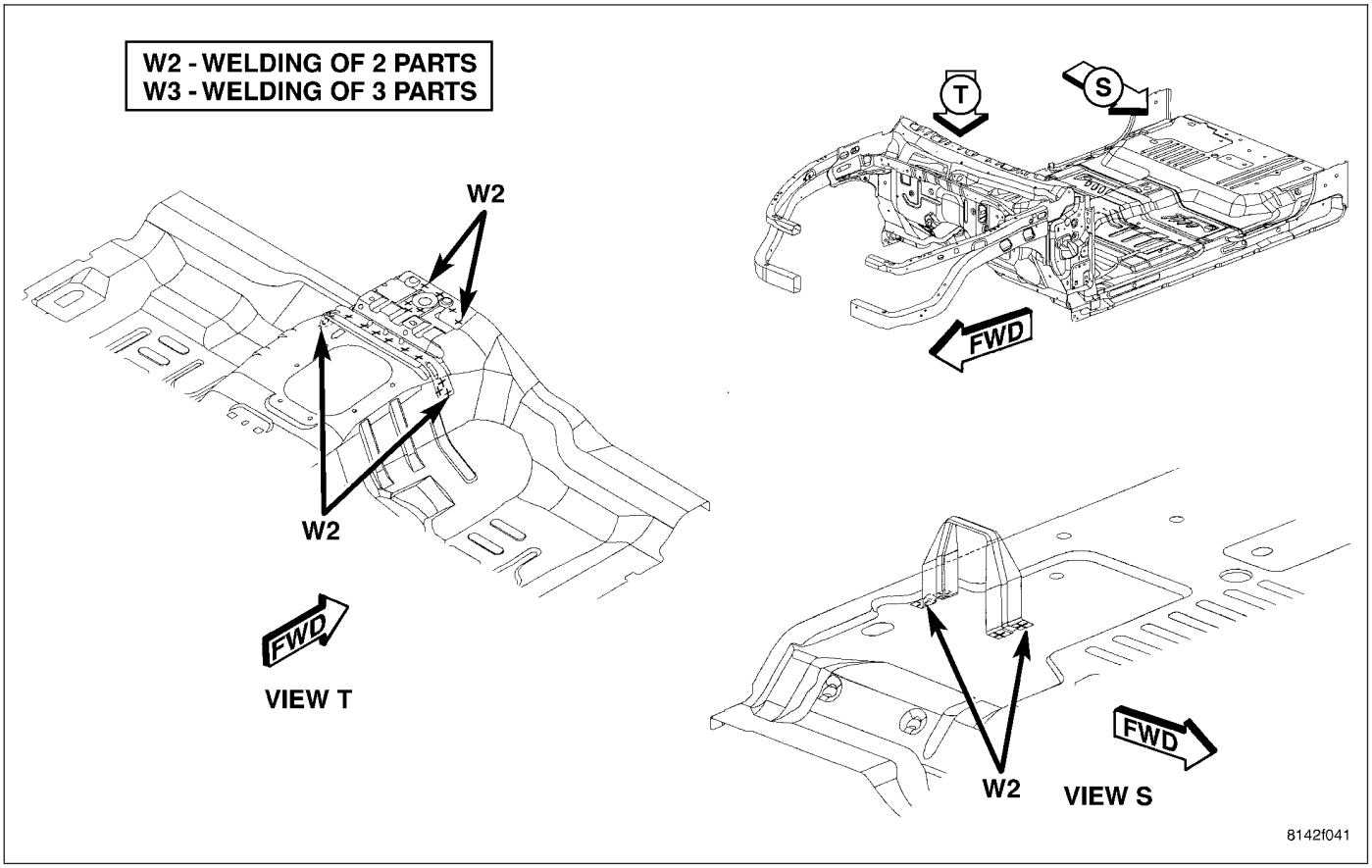


Fig. 56 UNDERBODY COMPLETE (5 OF 7)

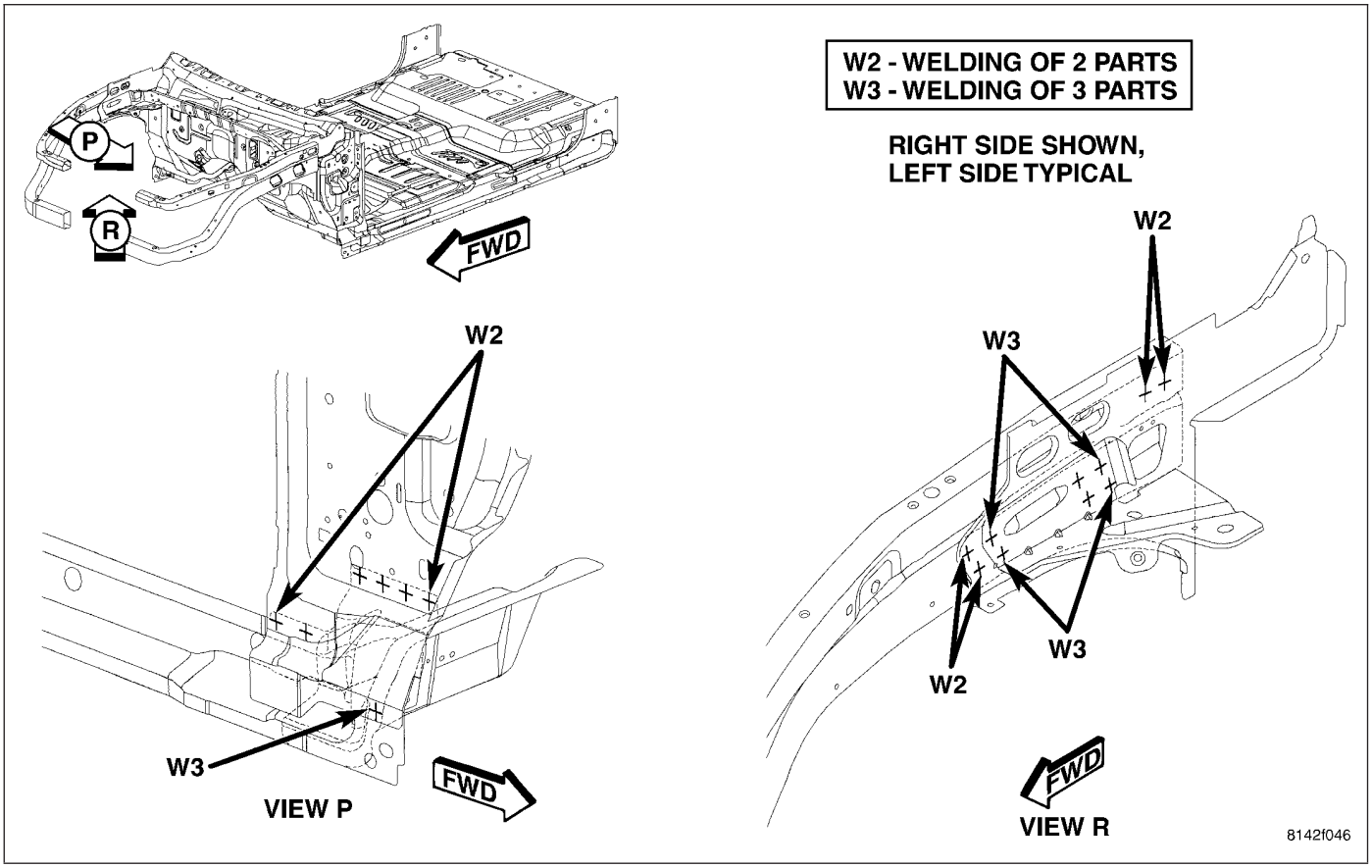


Fig. 57 UNDERBODY COMPLETE (6 OF 7)

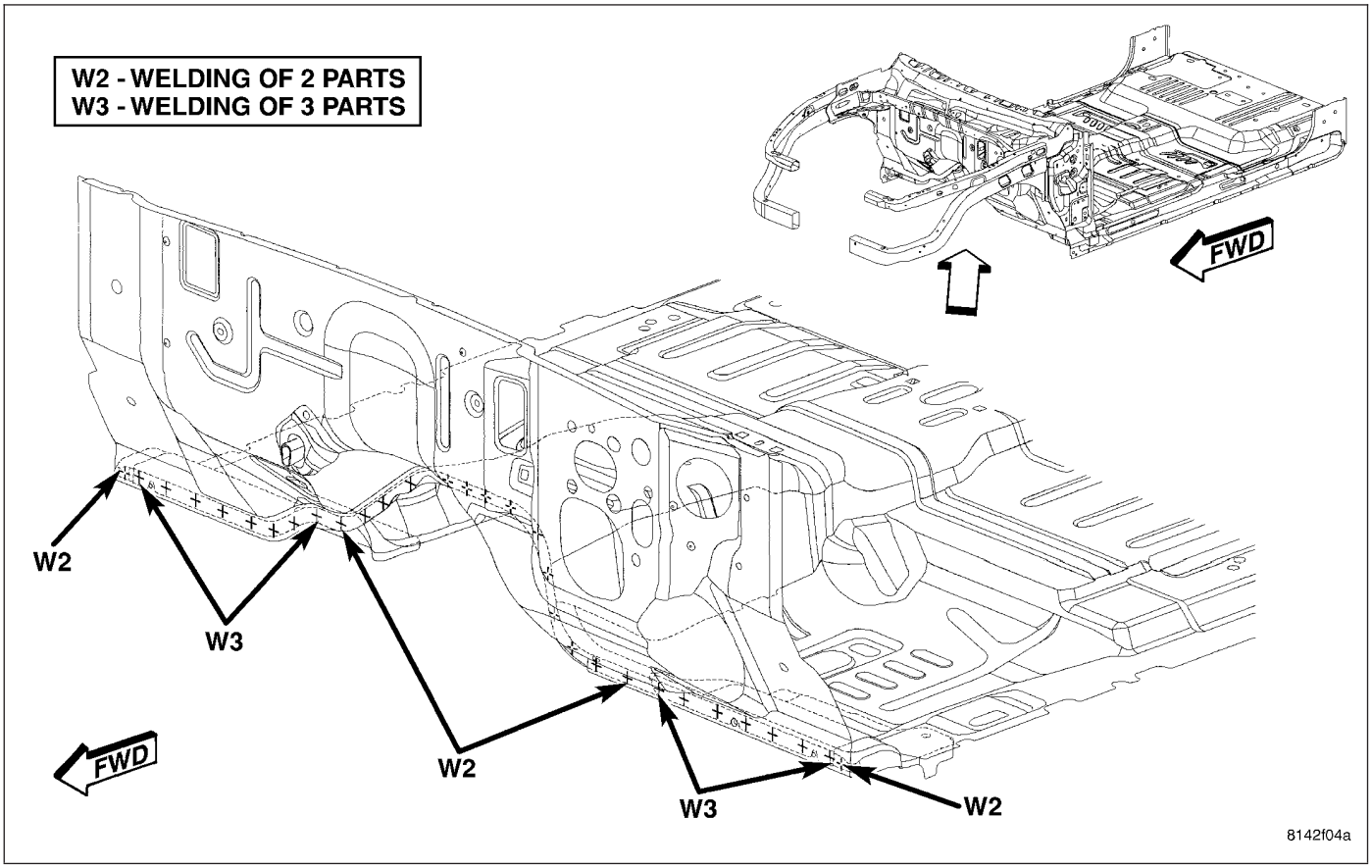


Fig. 58 UNDERBODY COMPLETE (7 OF 7)

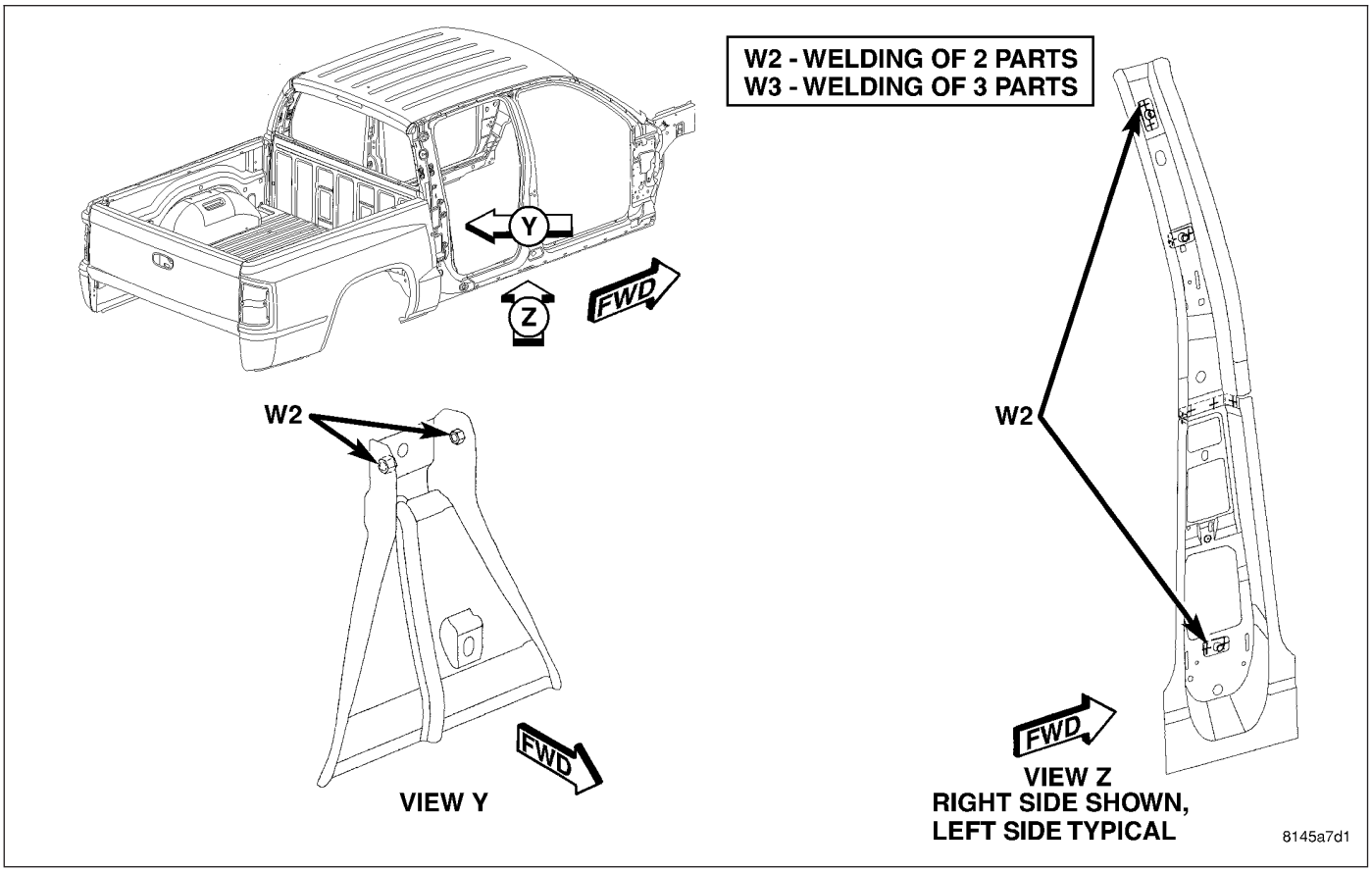


Fig. 59 BODY SIDE APERTURE (1 OF 3)

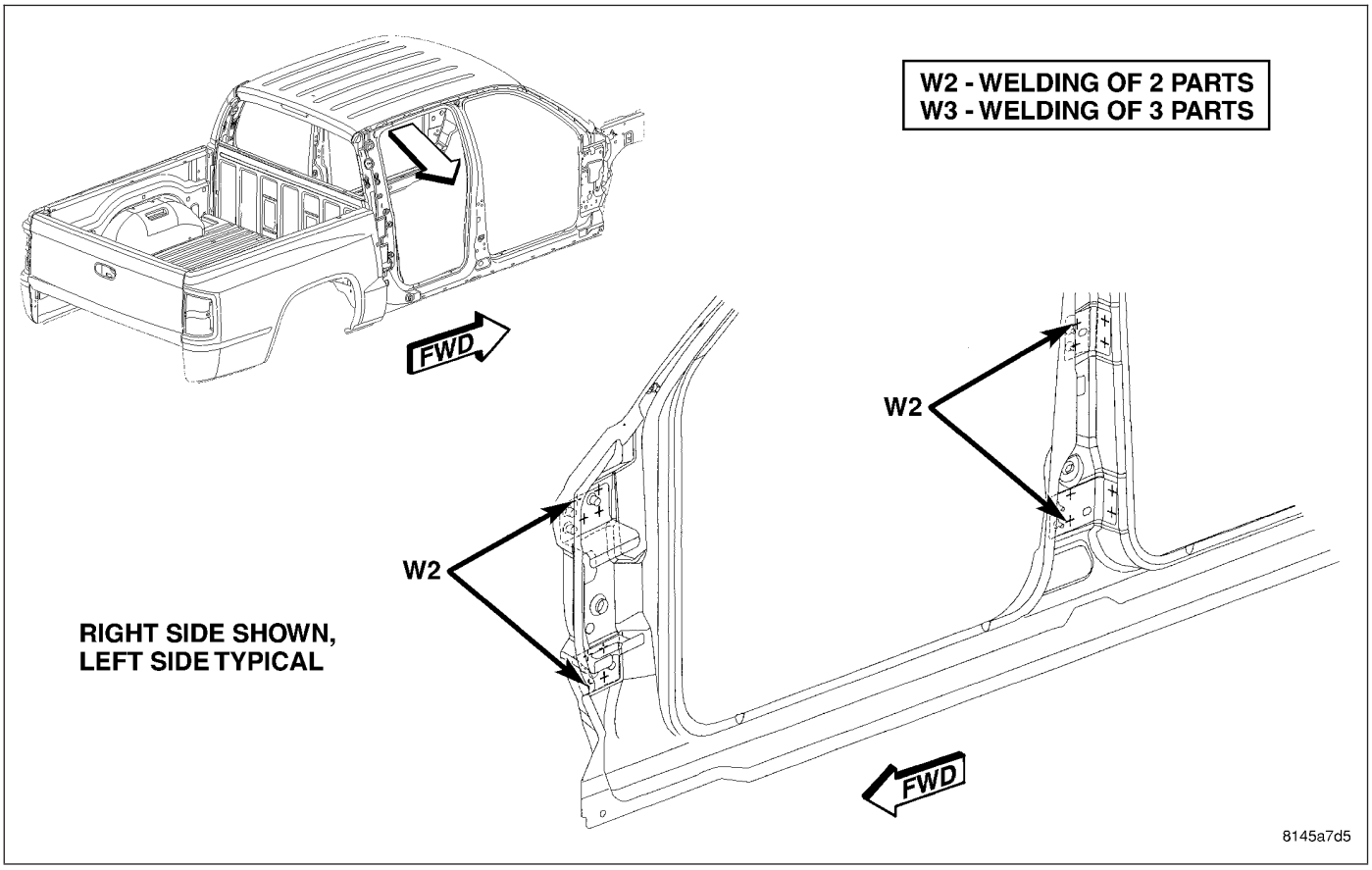


Fig. 60 BODY SIDE APERTURE (2 OF 3)

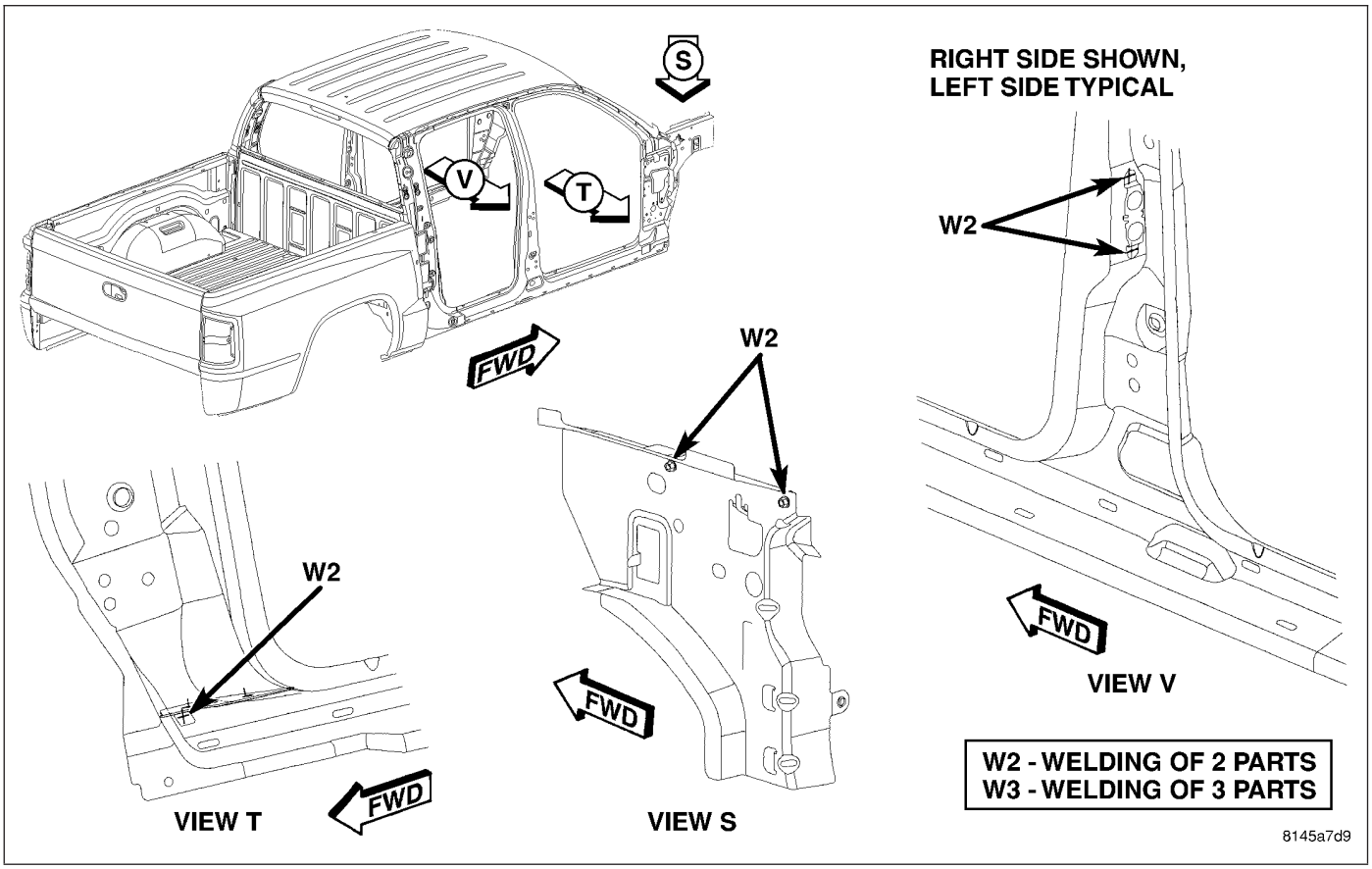


Fig. 61 BODY SIDE APERTURE (3 OF 3)

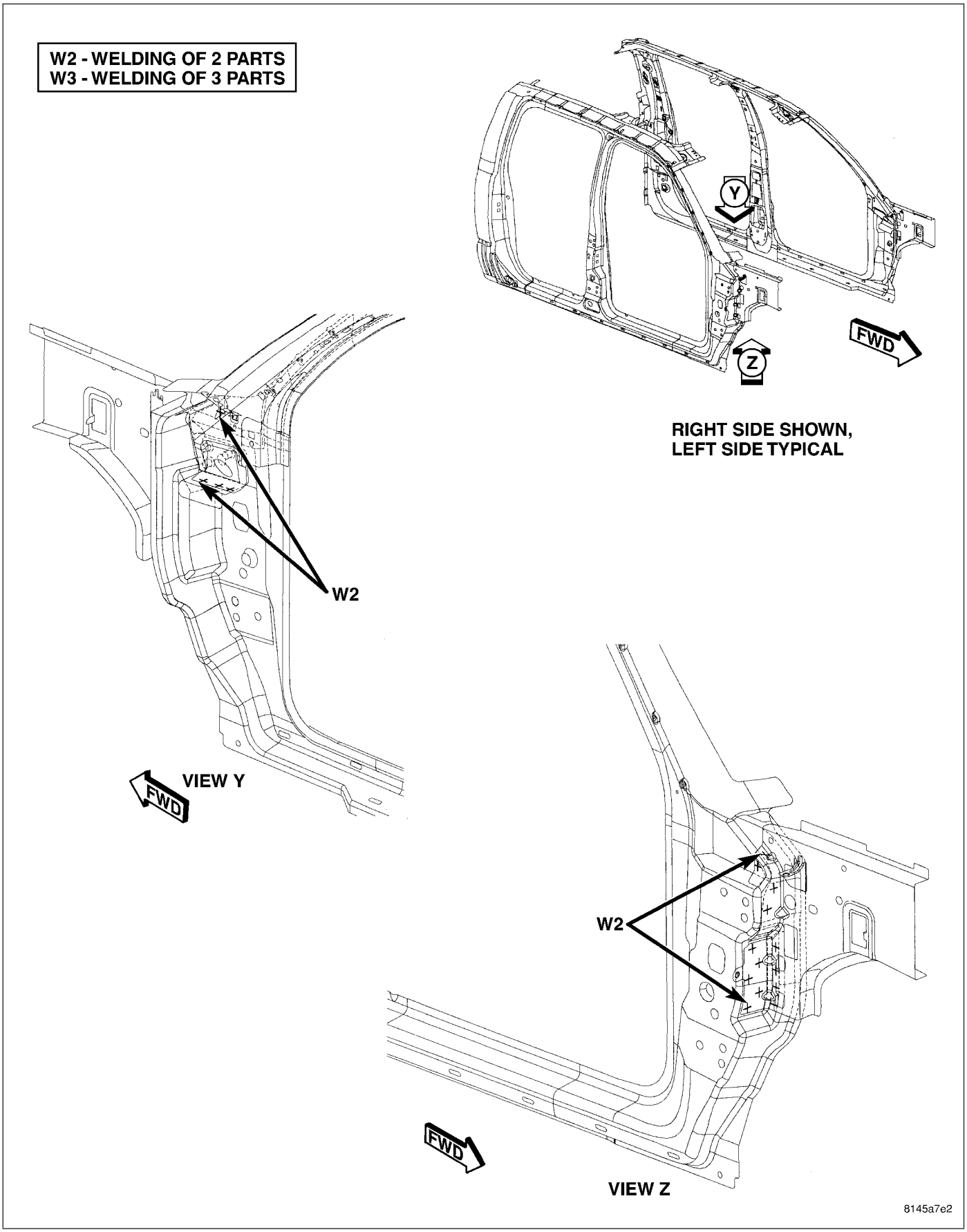


Fig. 62 BODY SIDE APERTURE - COMPLETE (1 OF 7)

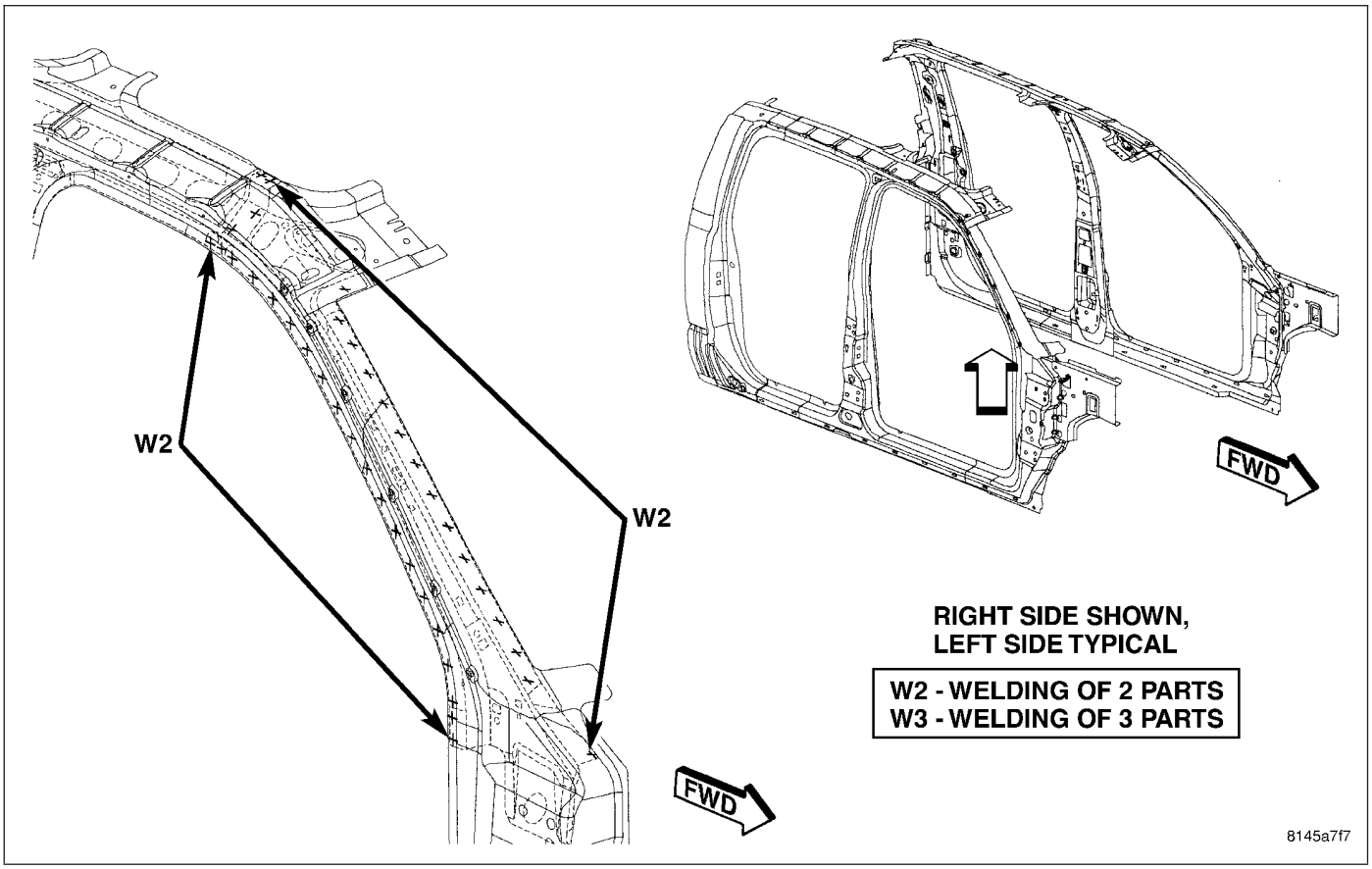


Fig. 63 BODY SIDE APERTURE - COMPLETE (2 OF 7)

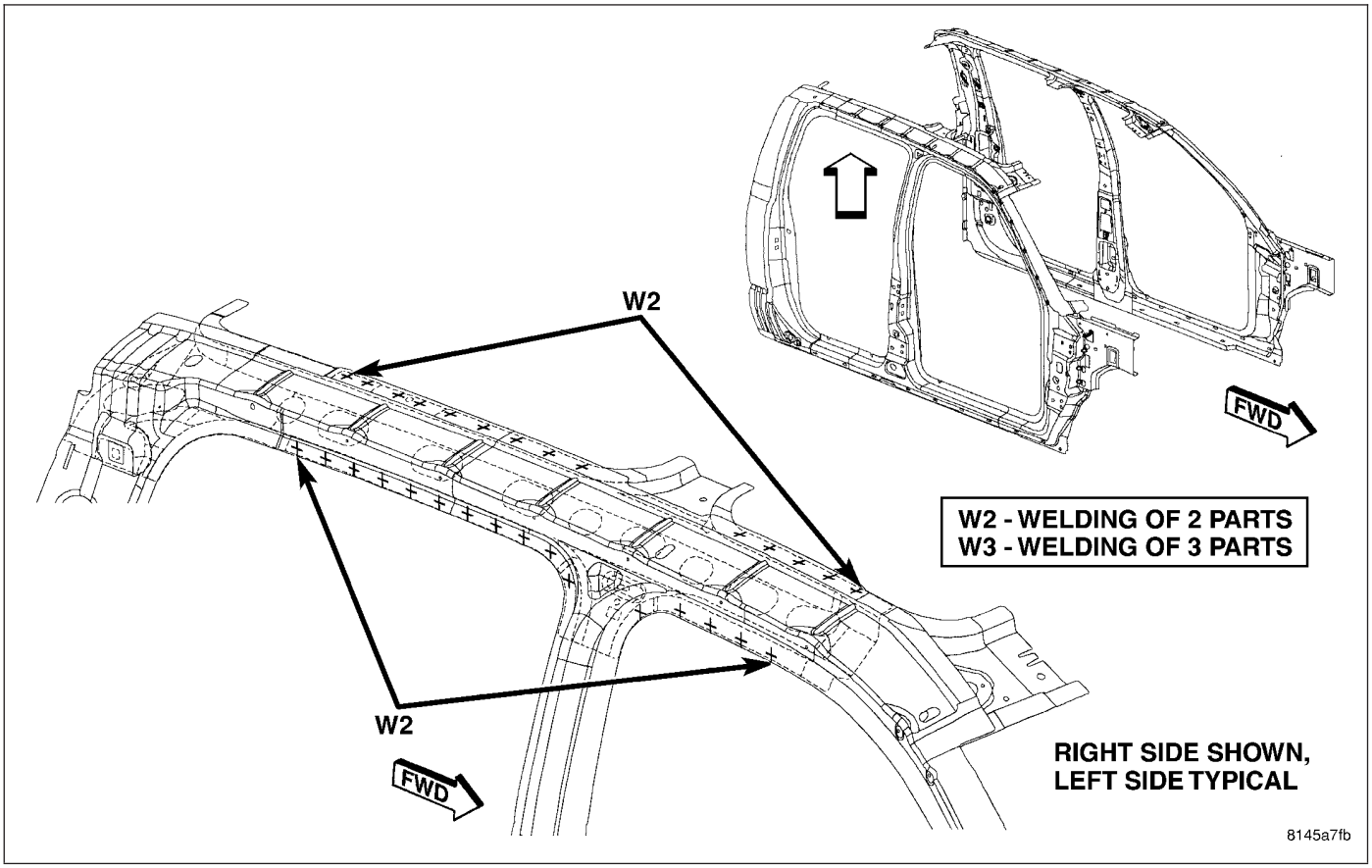


Fig. 64 BODY SIDE APERTURE - COMPLETE (3 OF 7)

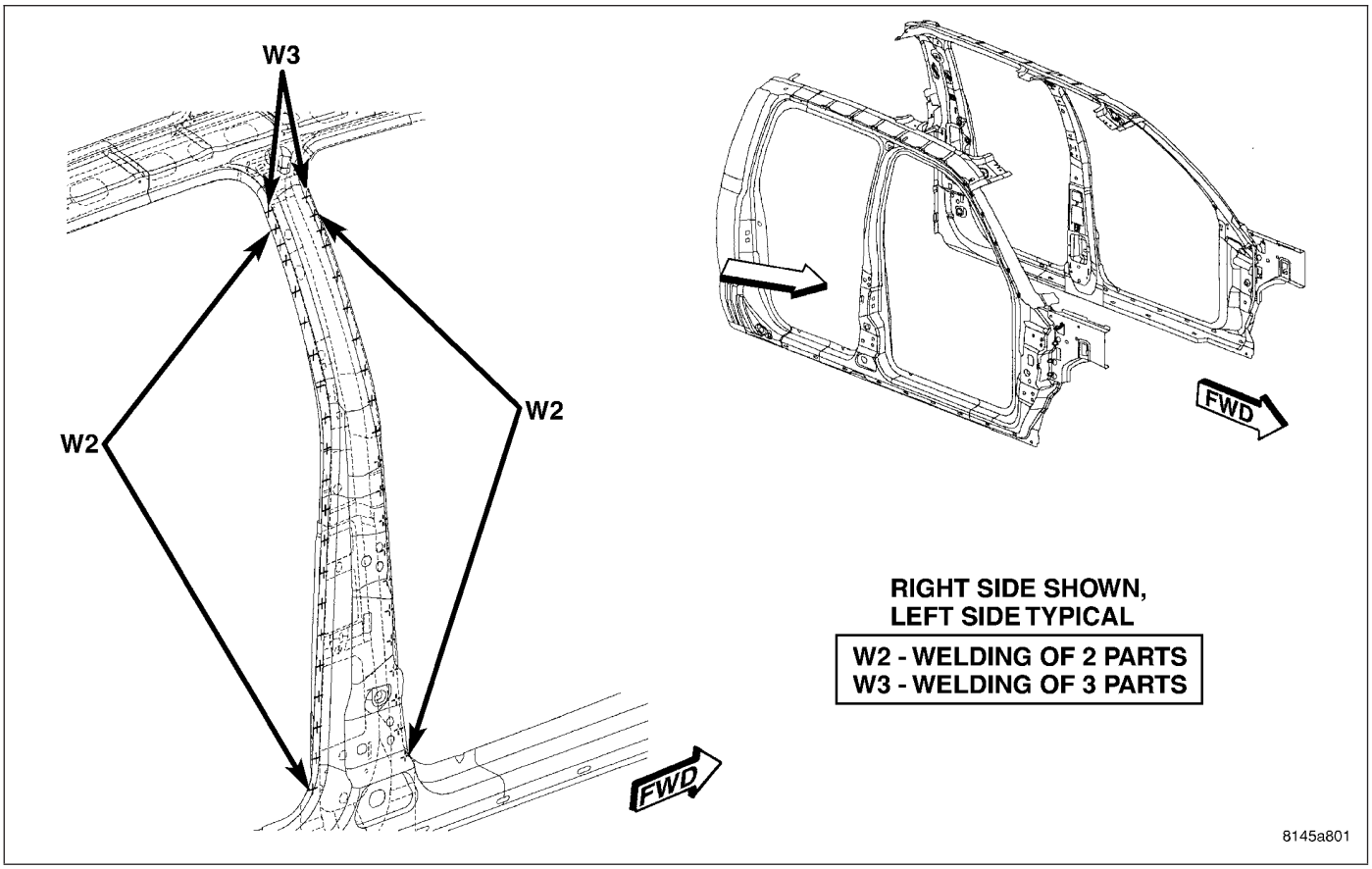


Fig. 65 BODY SIDE APERTURE - COMPLETE (4 OF 7)

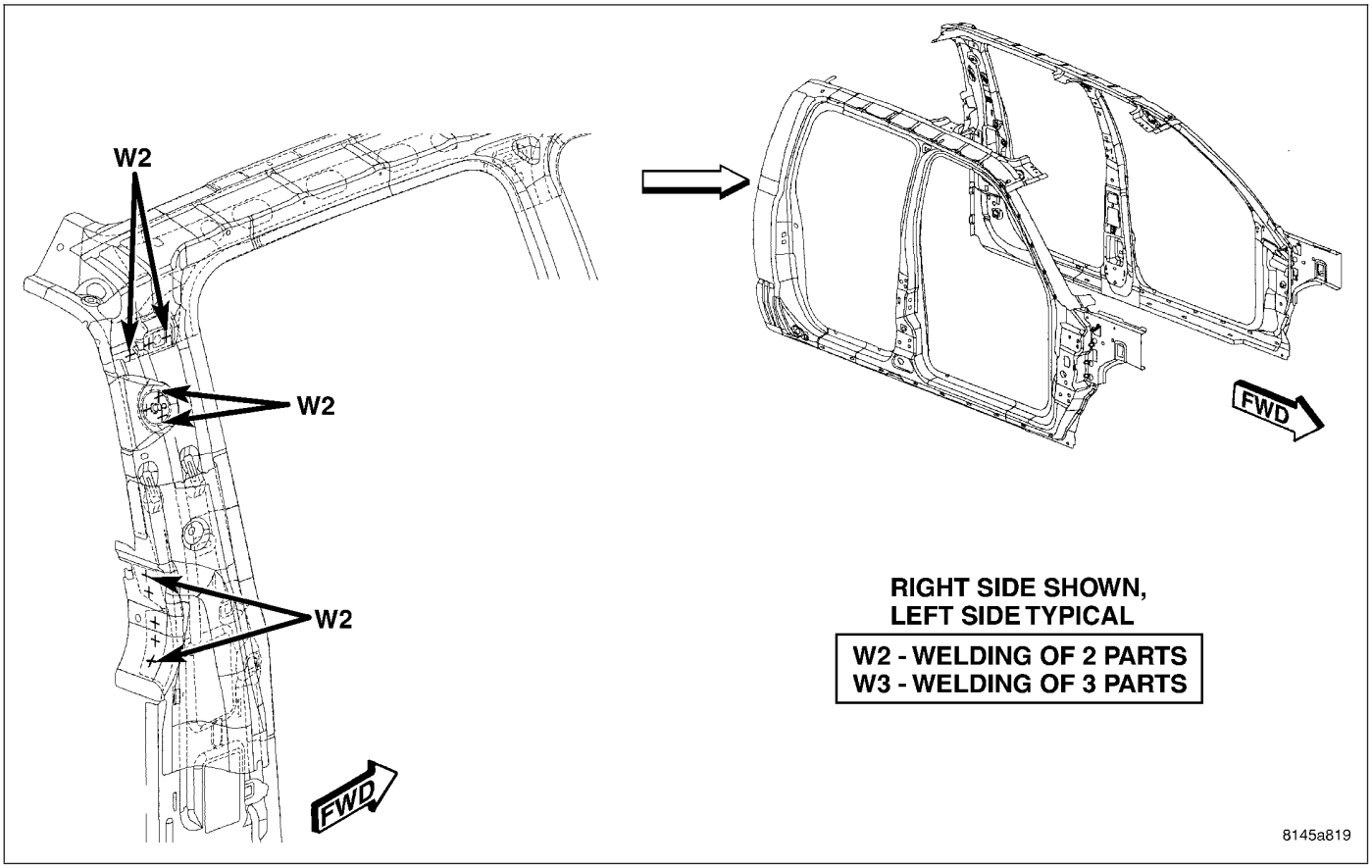


Fig. 66 BODY SIDE APERTURE - COMPLETE (5 OF 7)

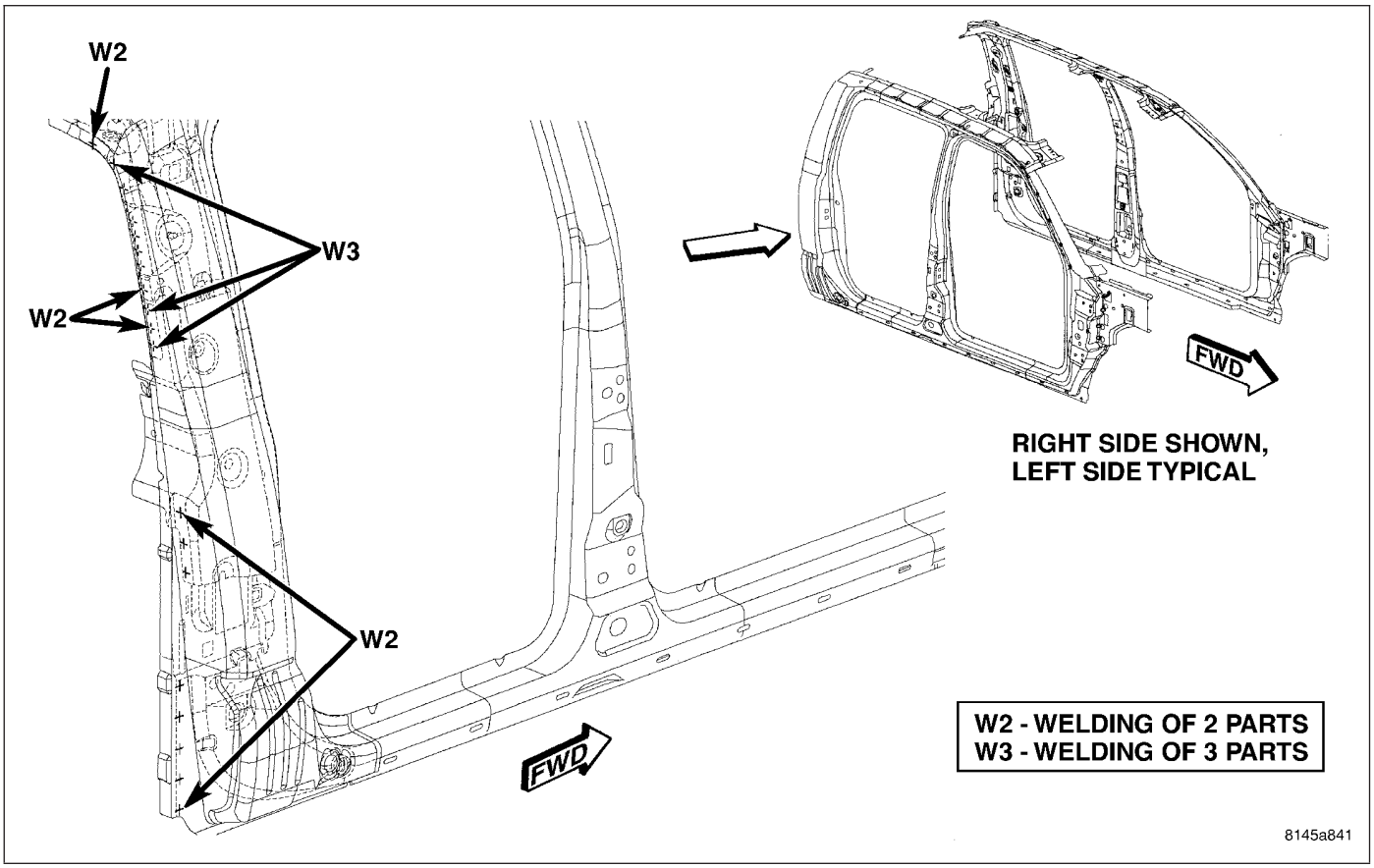


Fig. 67 BODY SIDE APERTURE - COMPLETE (6 OF 7)

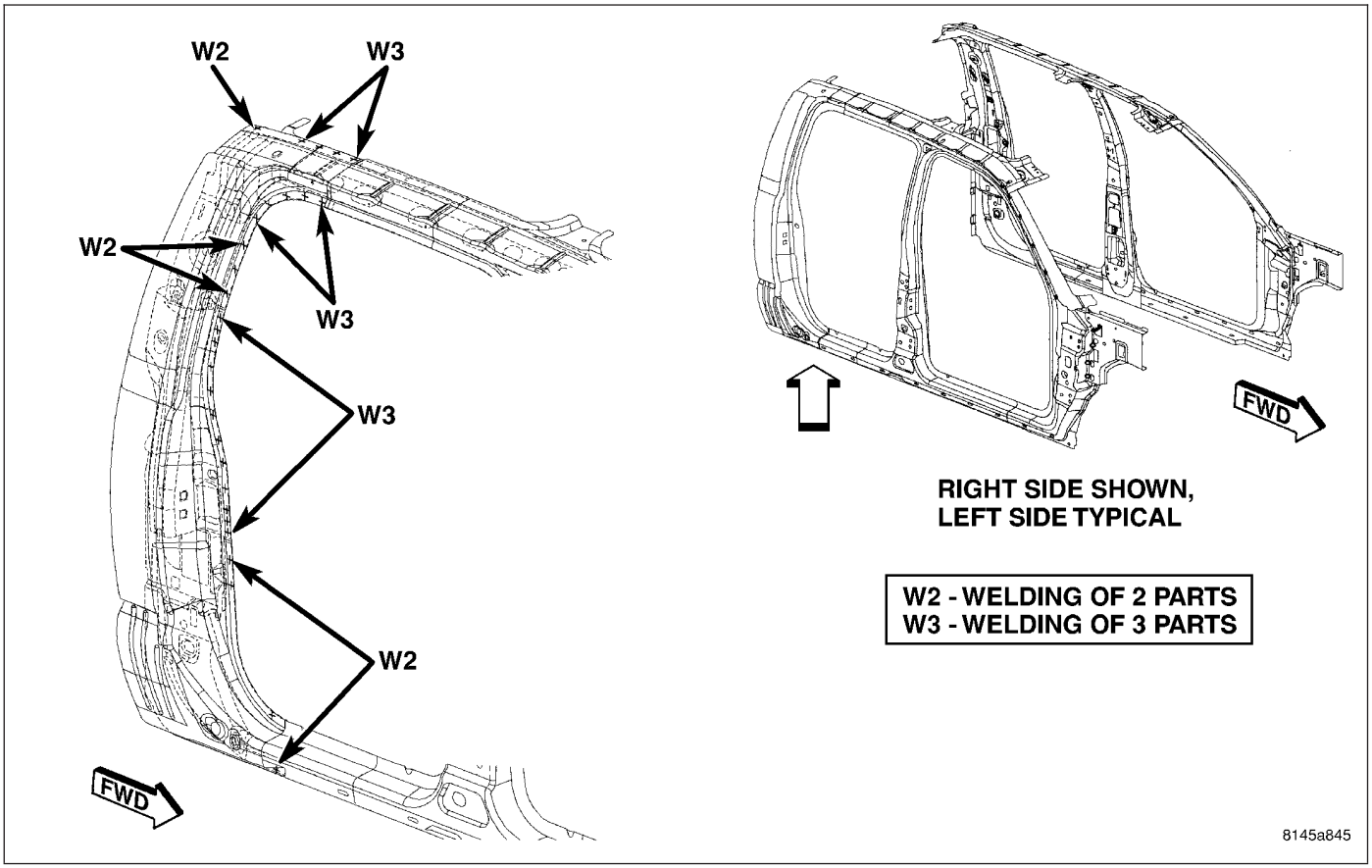


Fig. 68 BODY SIDE APERTURE - COMPLETE (7 OF 7)

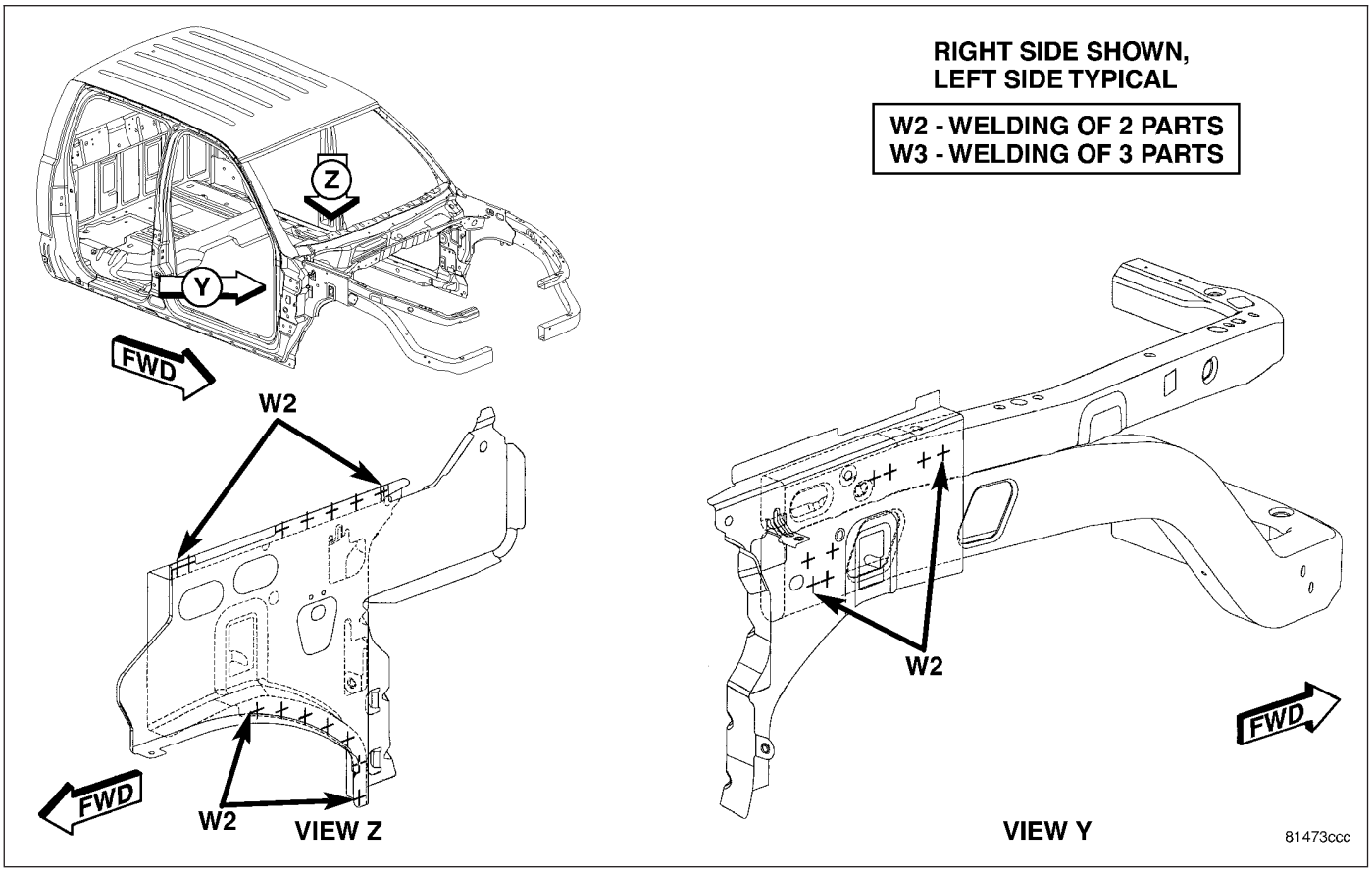


Fig. 69 CAB COMPLETE (1 OF 10)

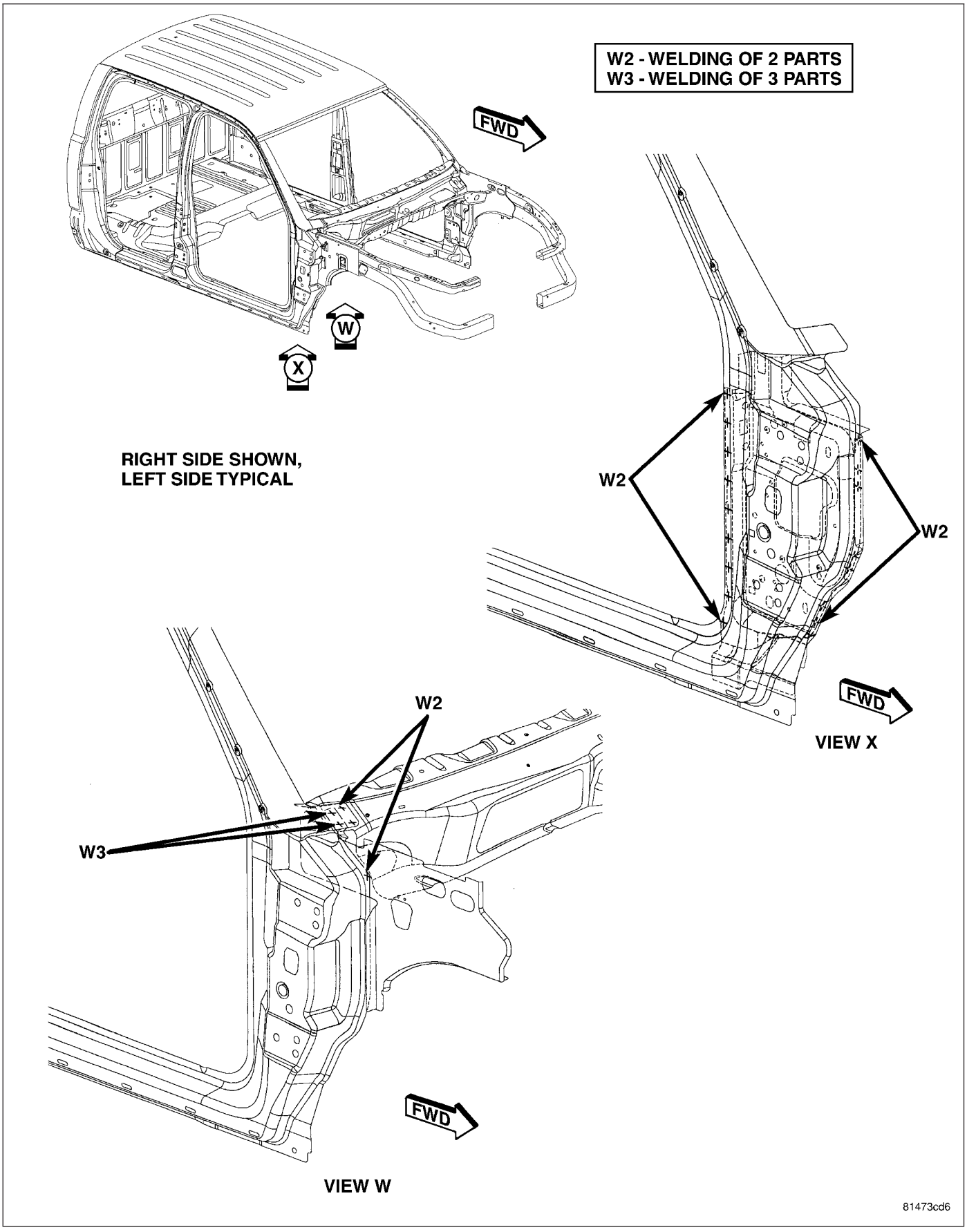


Fig. 70 CAB COMPLETE (2 OF 10)

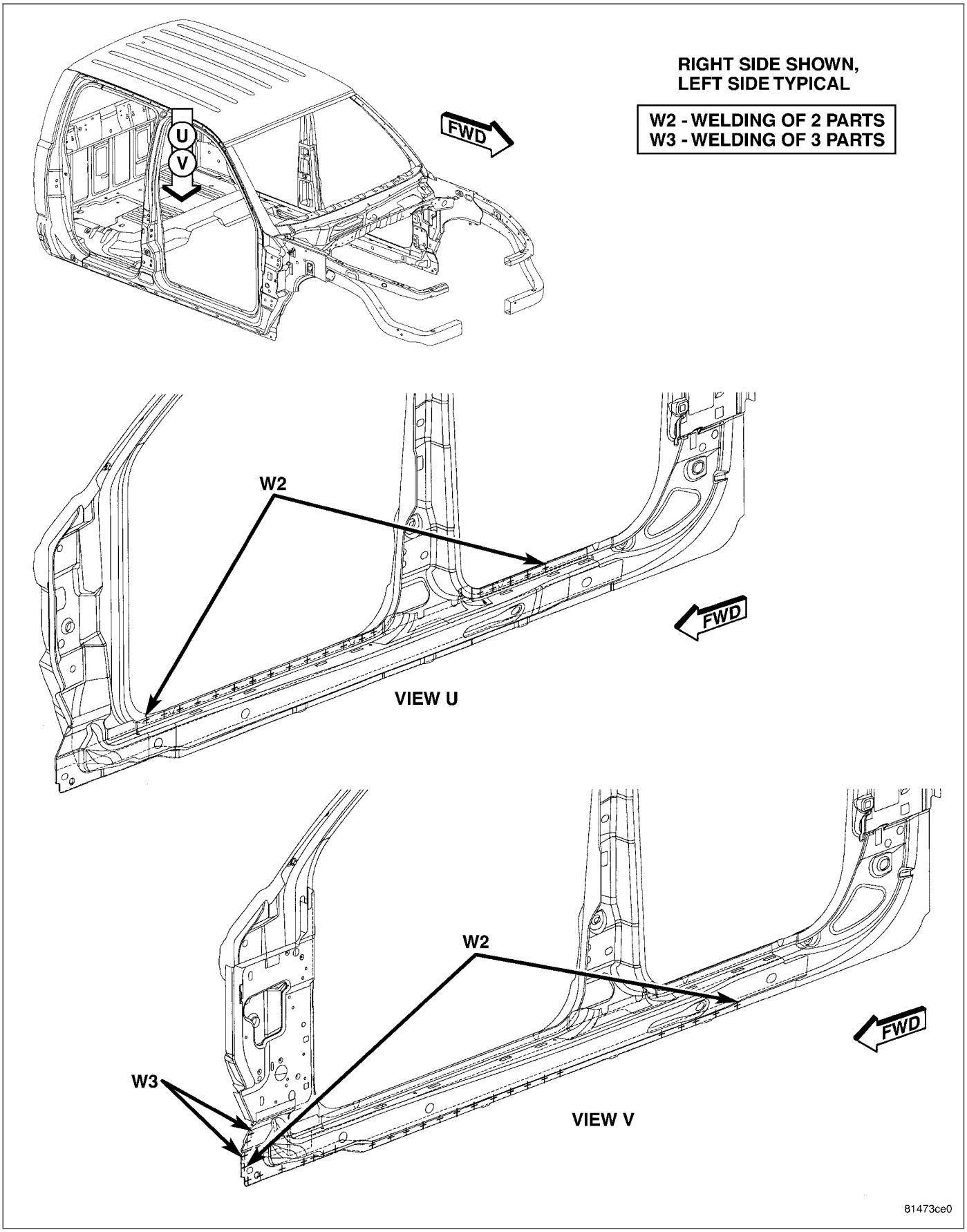


Fig. 71 CAB COMPLETE (3 OF 10)

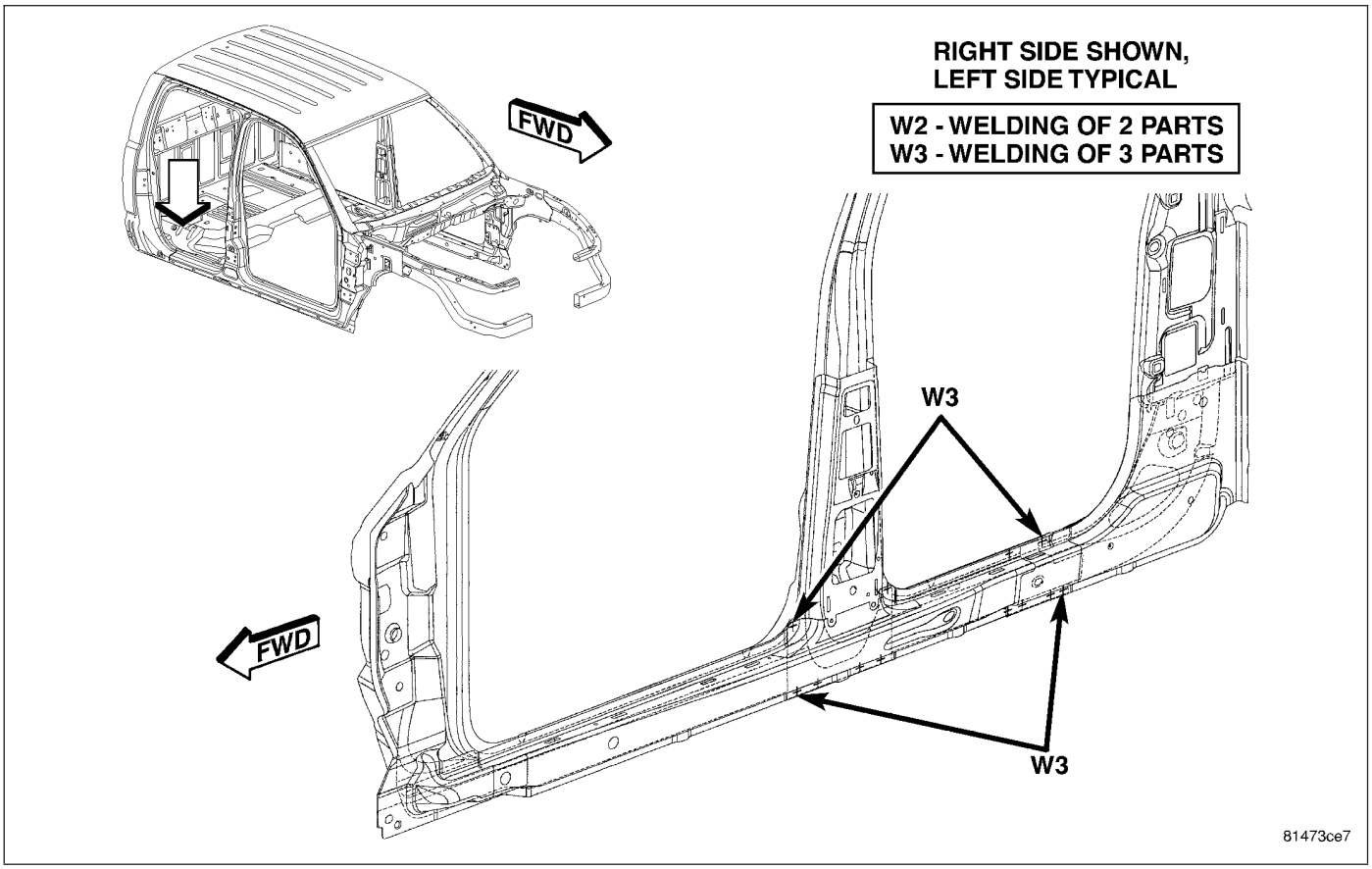


Fig. 72 CAB COMPLETE (4 OF 10)

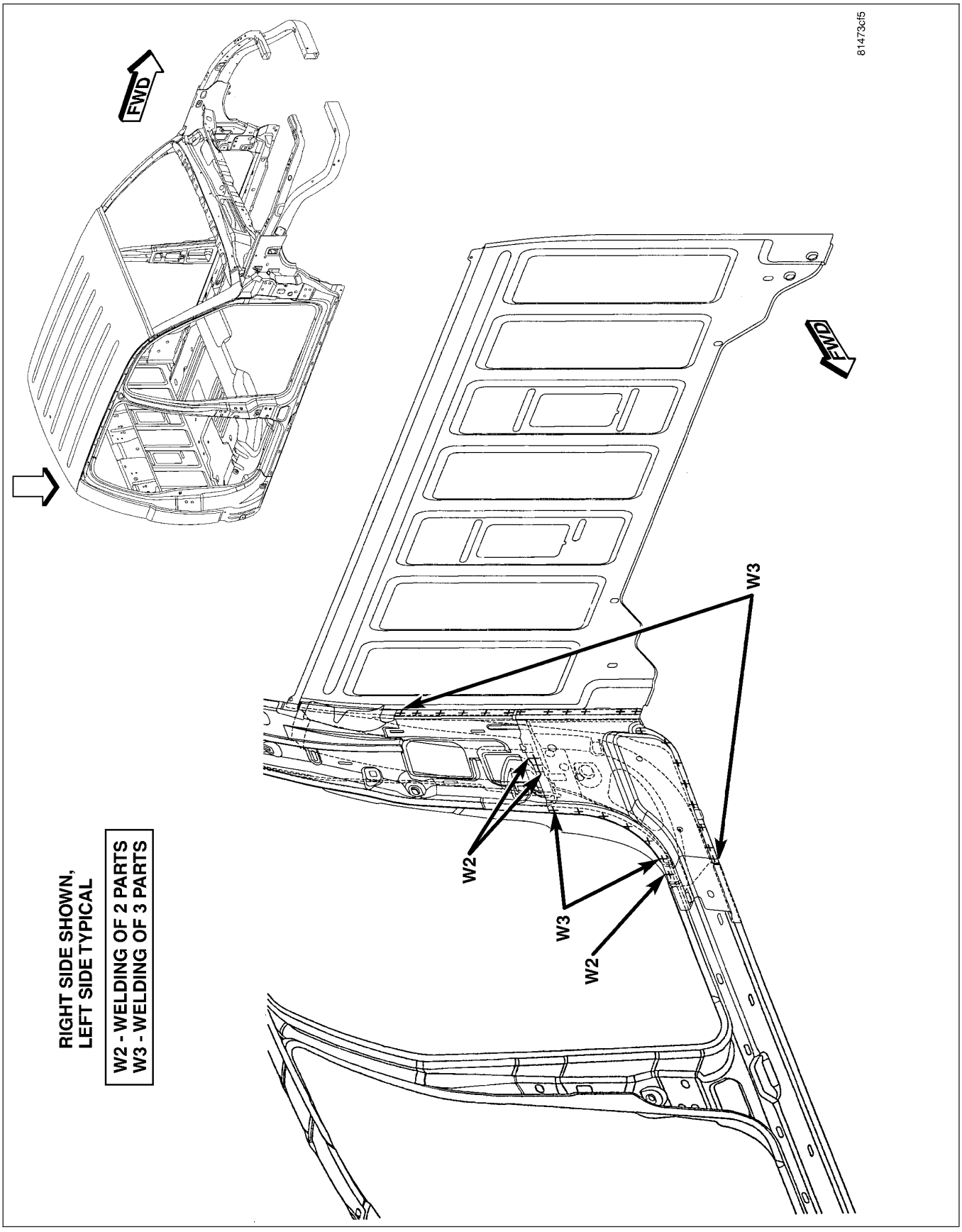


Fig. 73 CAB COMPLETE (5 OF 10)

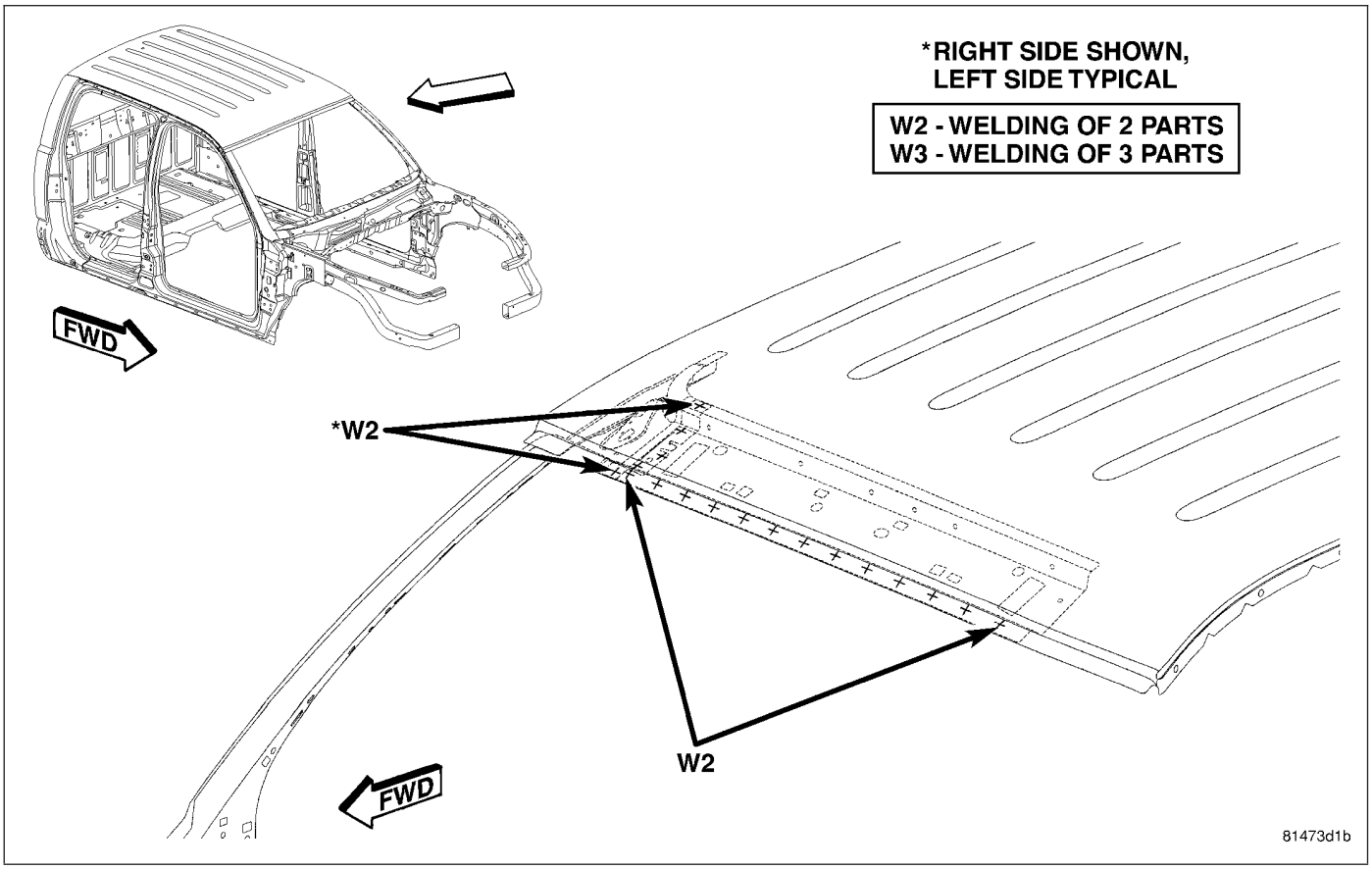


Fig. 74 CAB COMPLETE (6 OF 10)

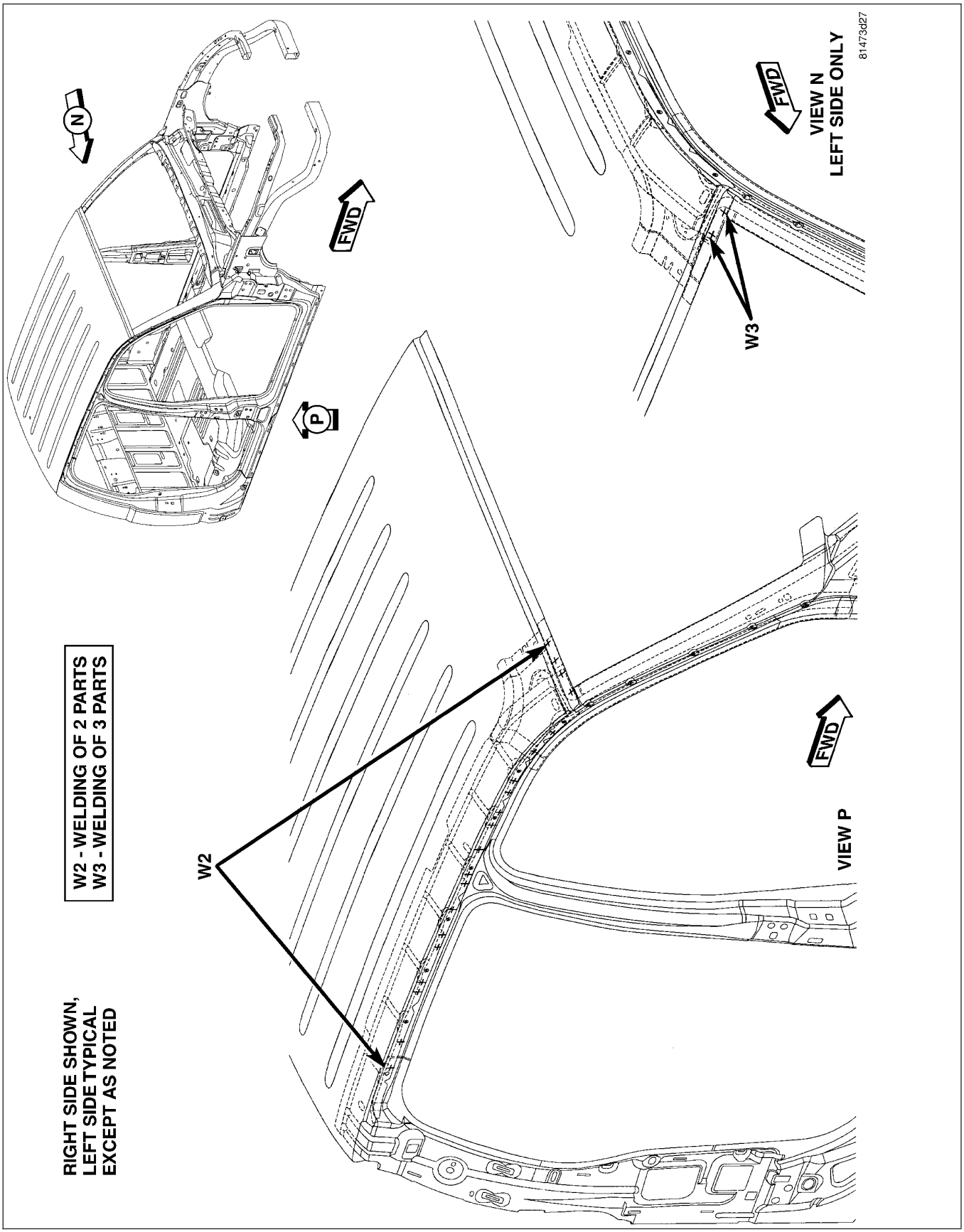


Fig. 75 CAB COMPLETE (7 OF 10)

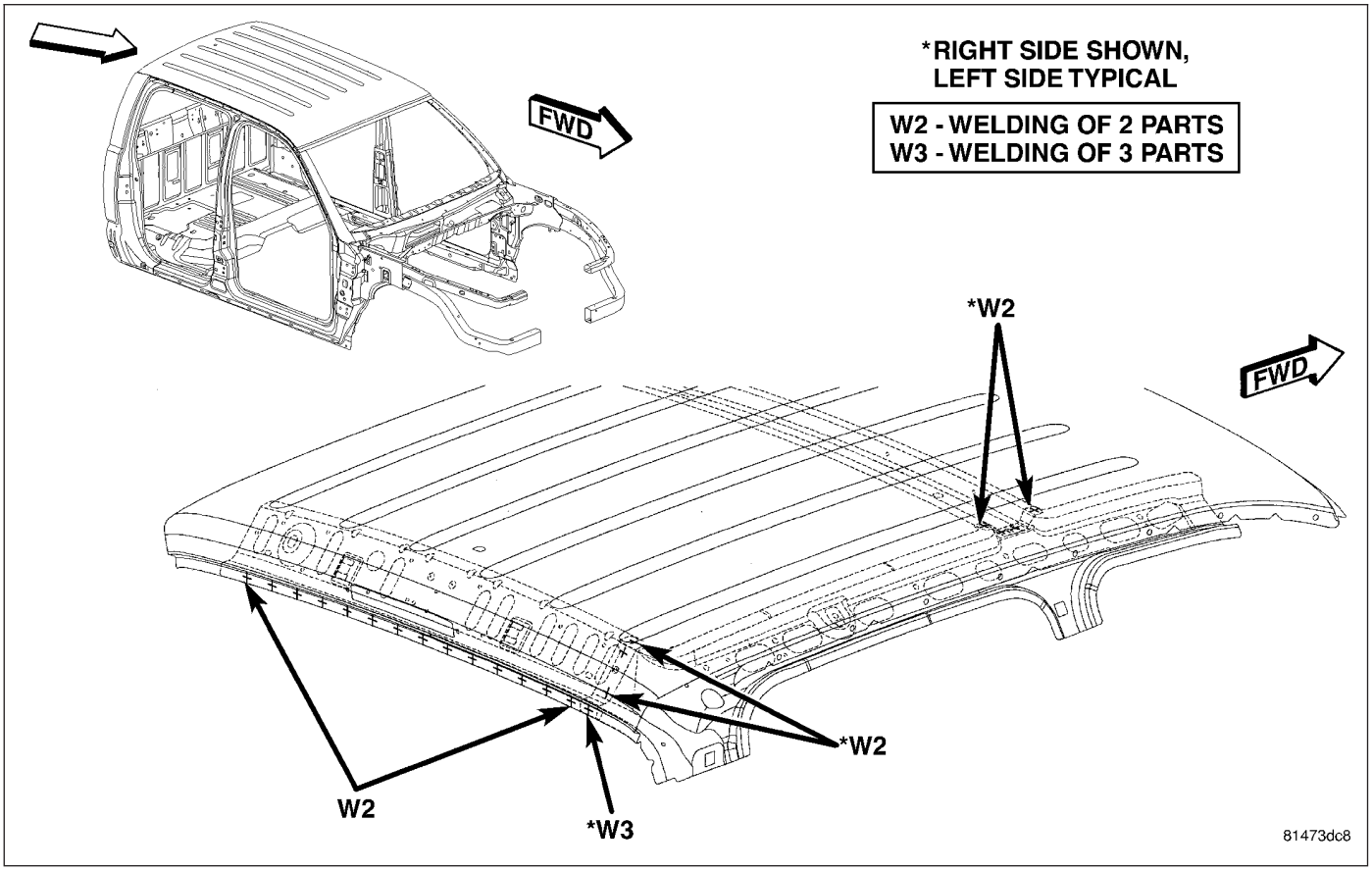


Fig. 76 CAB COMPLETE (8 OF 10)

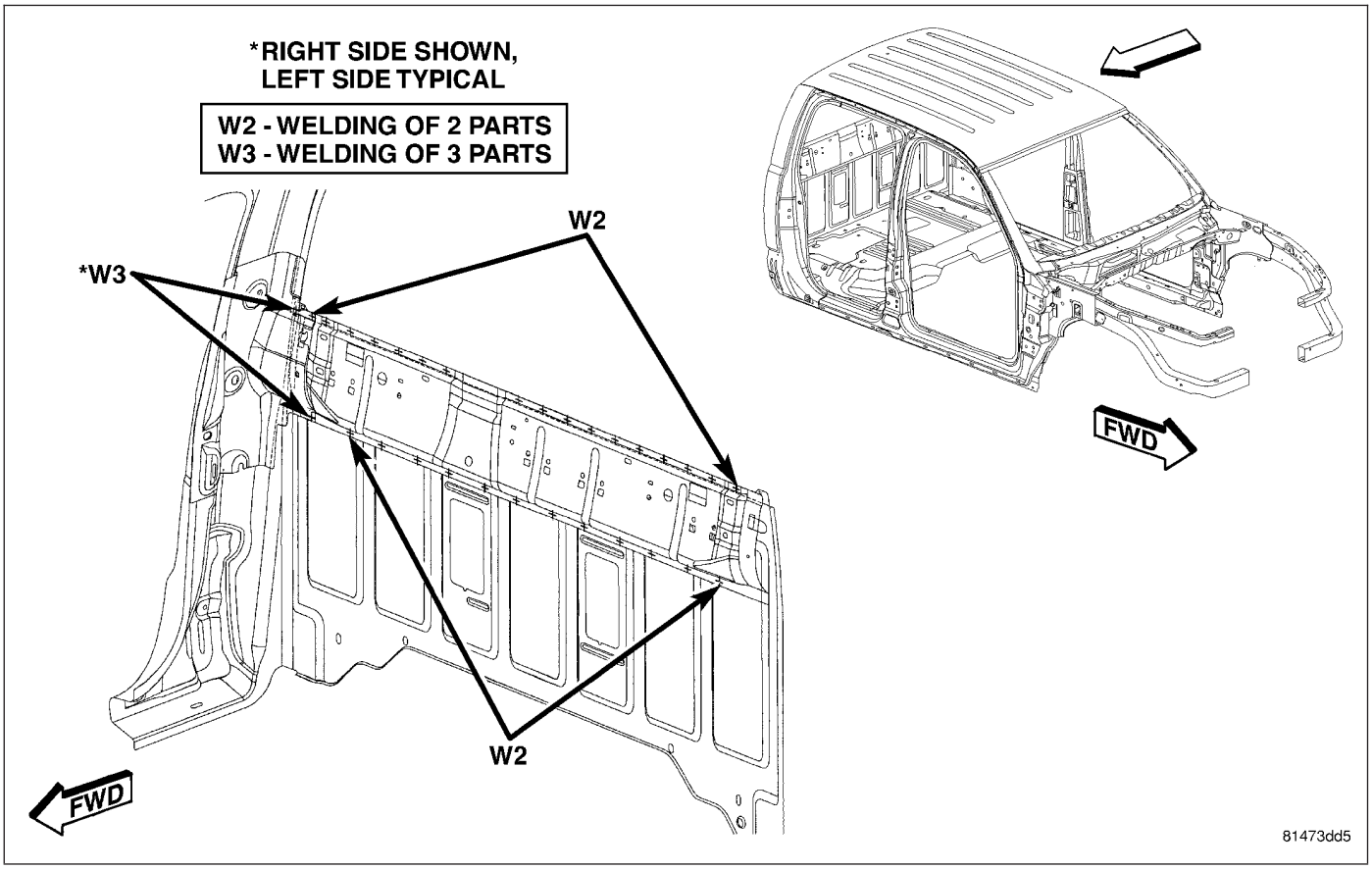


Fig. 77 CAB COMPLETE (9 OF 10)

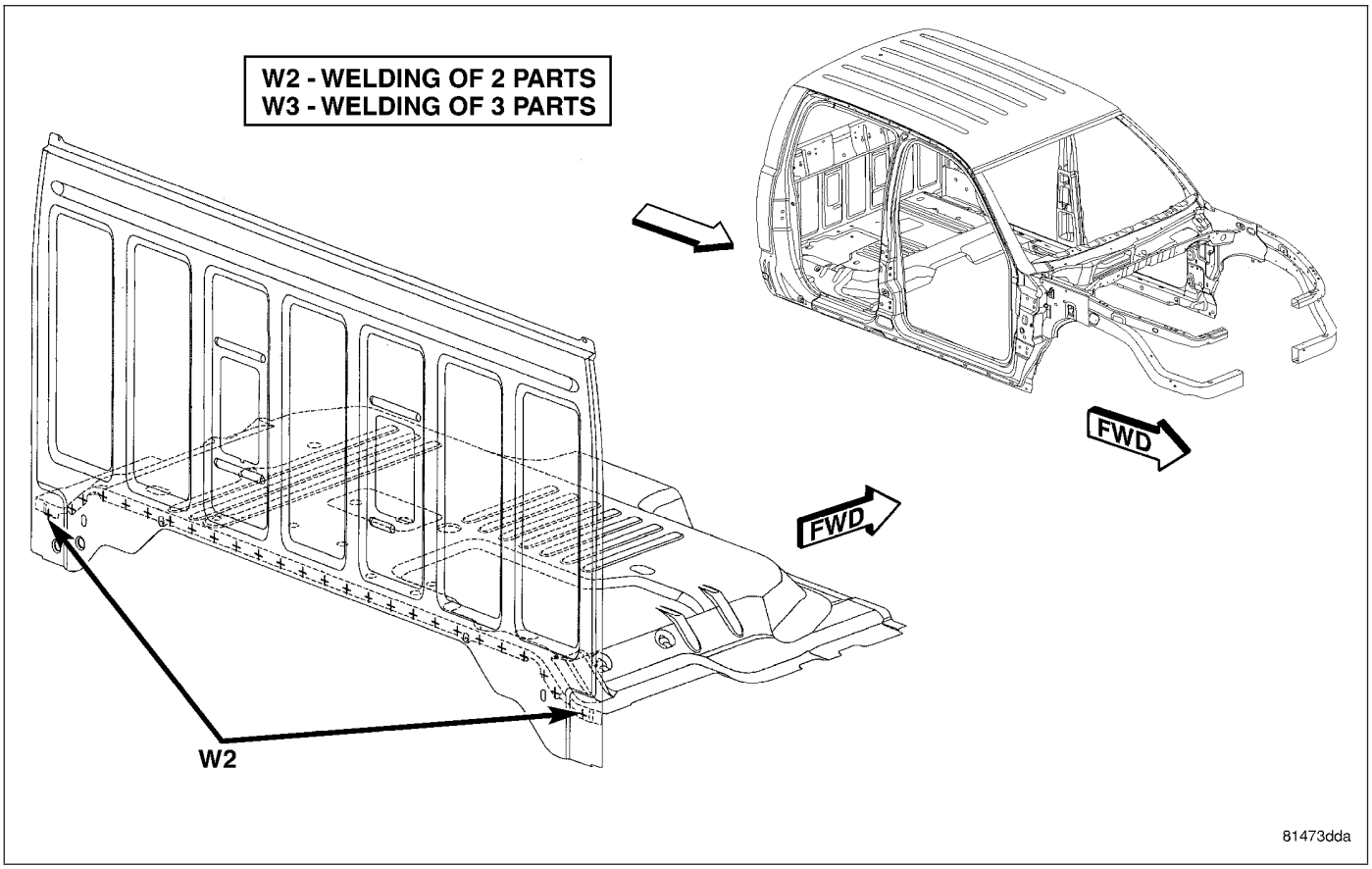


Fig. 78 CAB COMPLETE (10 OF 10)

Club Cab (ND33)

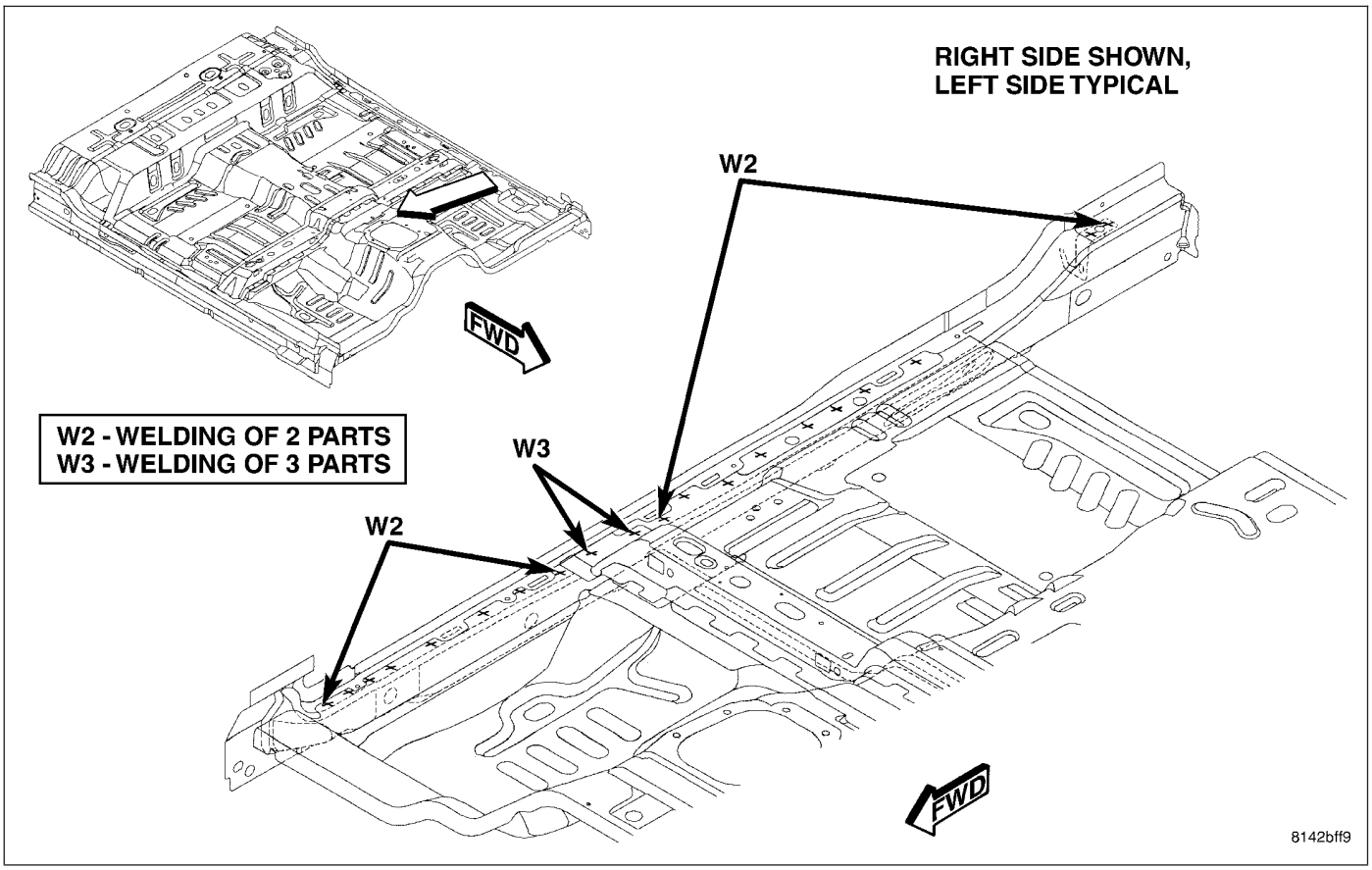


Fig. 79 UNDERBODY (1 OF 7)

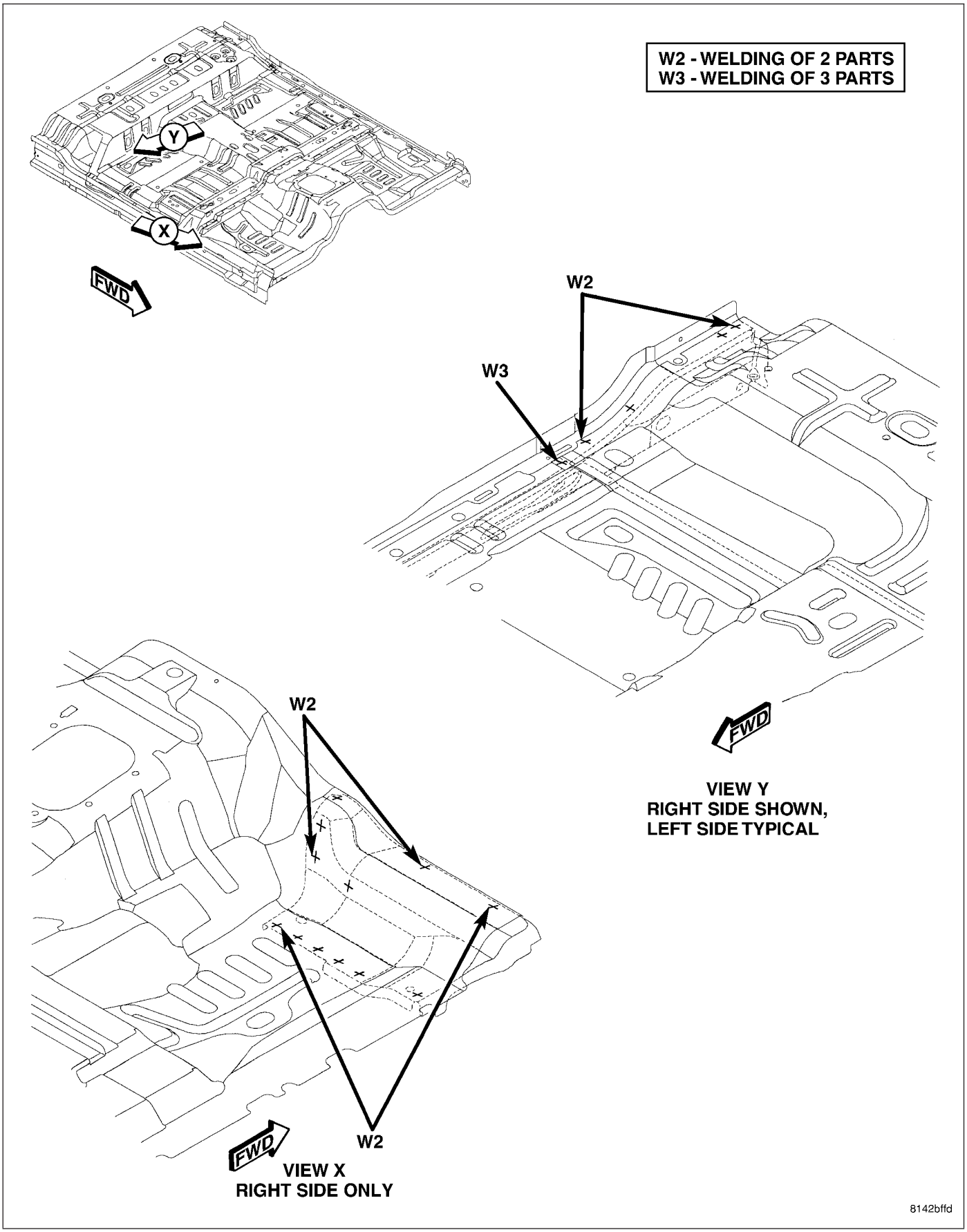


Fig. 80 UNDERBODY (2 OF 7)

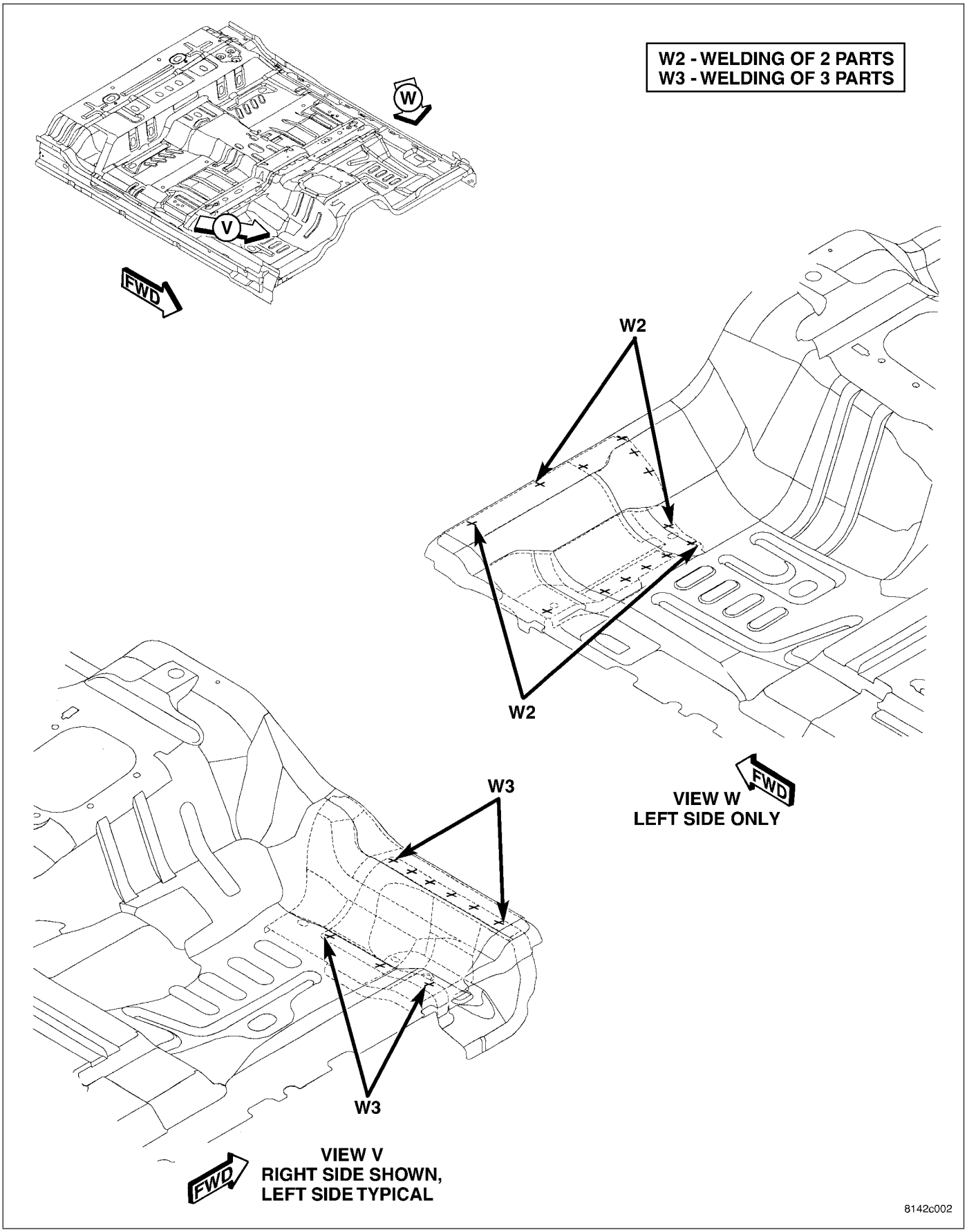


Fig. 81 UNDERBODY (3 OF 7)

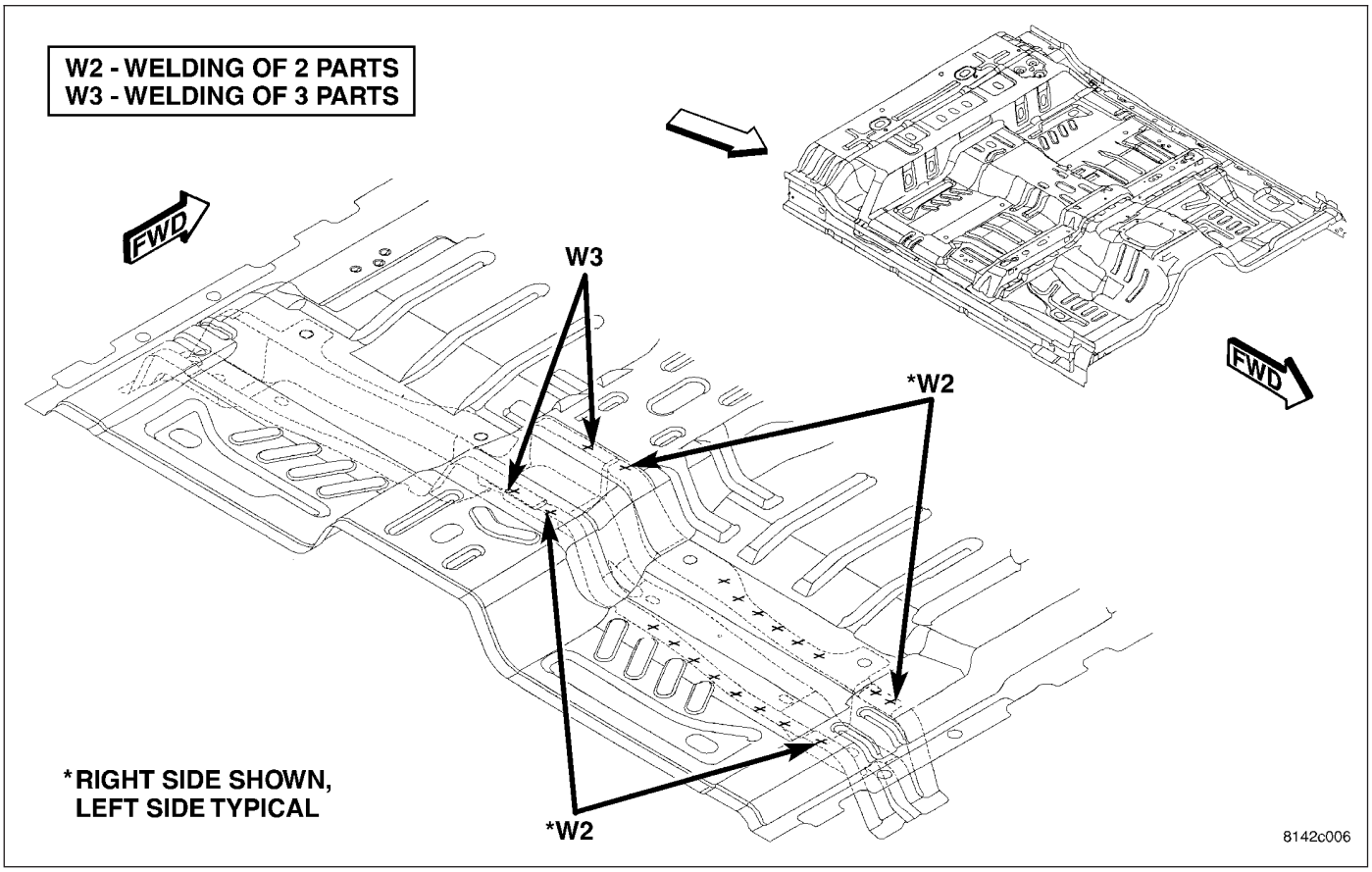


Fig. 82 UNDERBODY (4 OF 7)

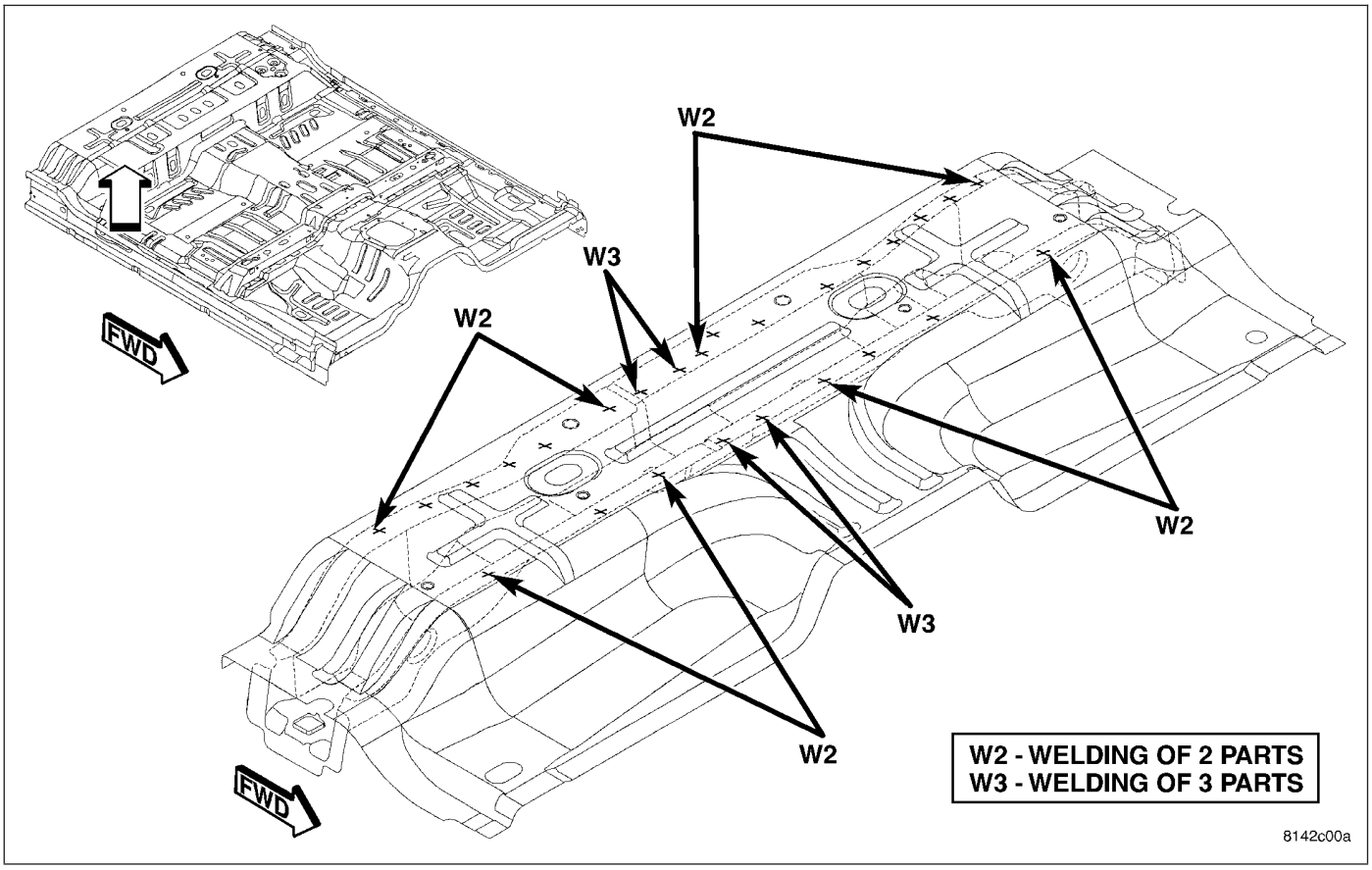


Fig. 83 UNDERBODY (5 OF 7)

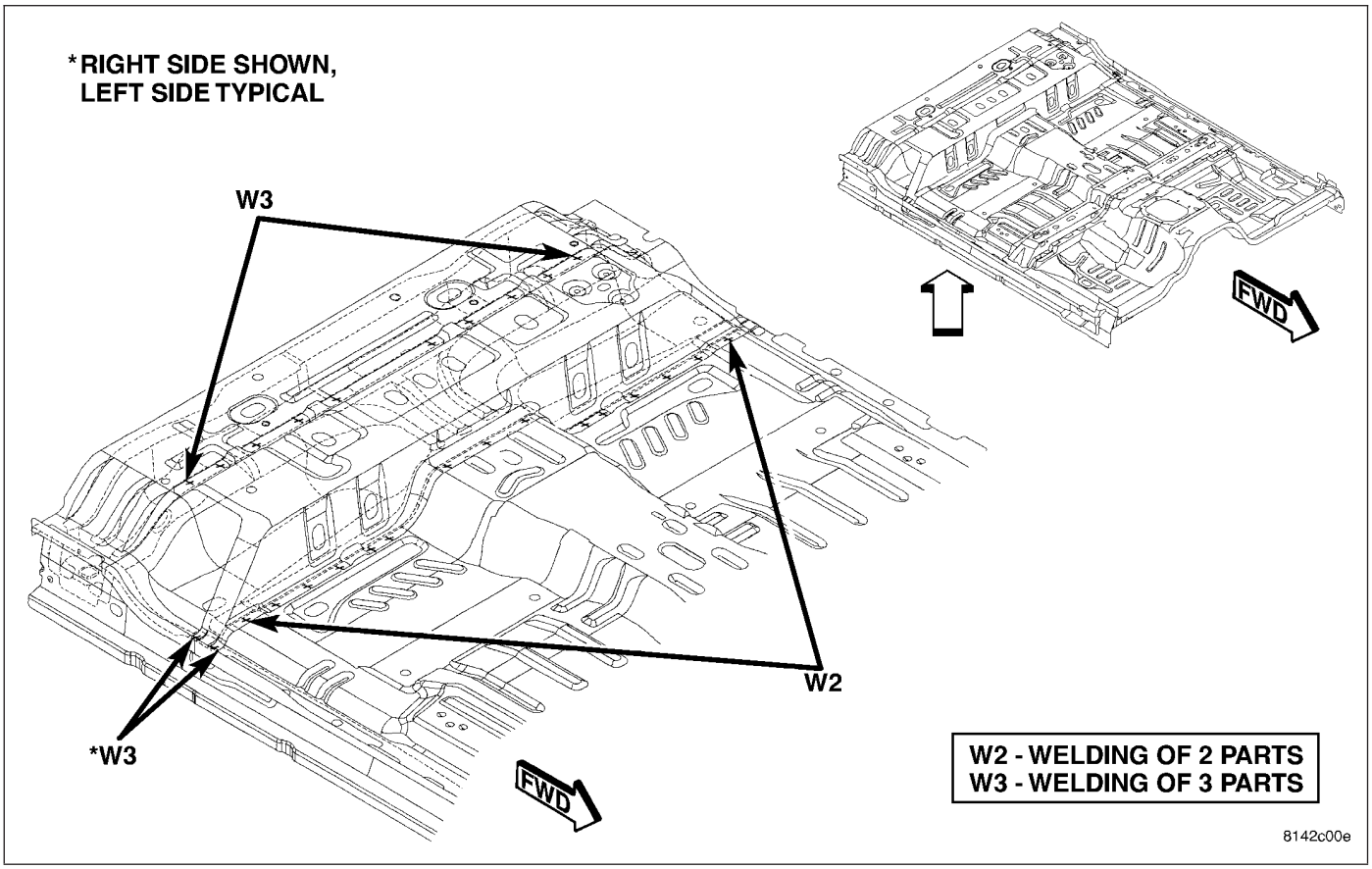


Fig. 84 UNDERBODY (6 OF 7)

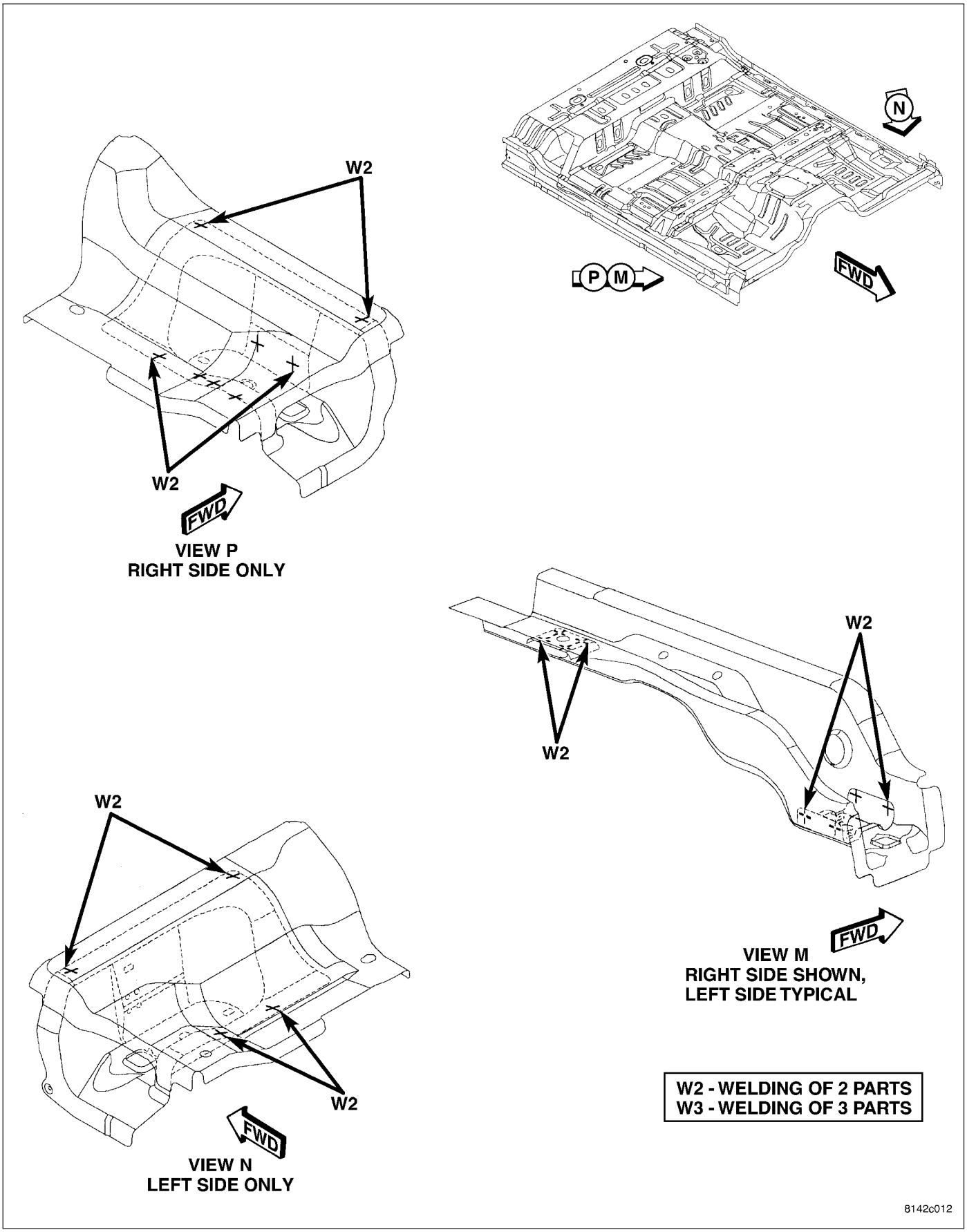


Fig. 85 UNDERBODY (7 OF 7)

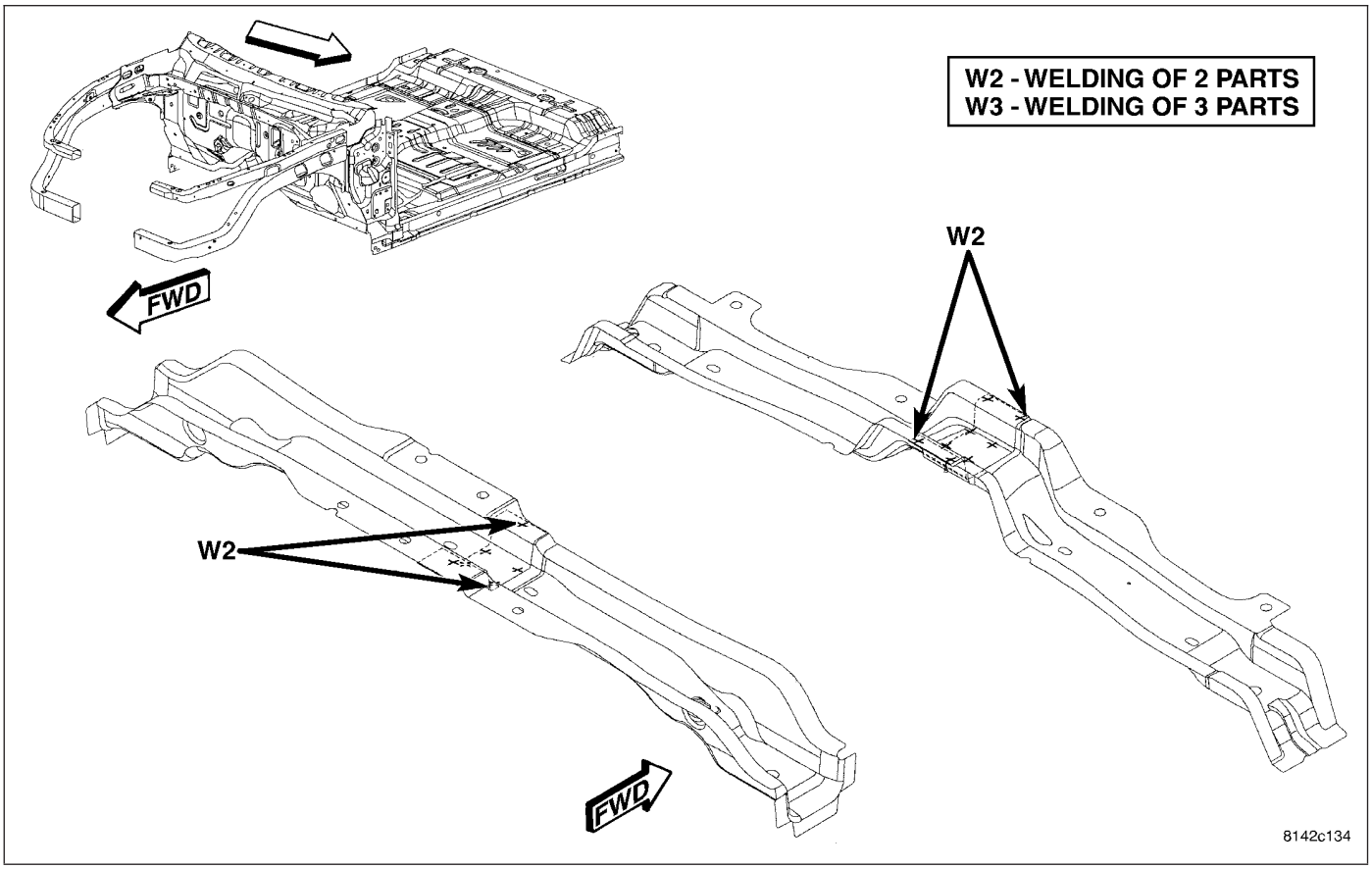


Fig. 86 UNDERBODY COMPLETE (1 OF 7)

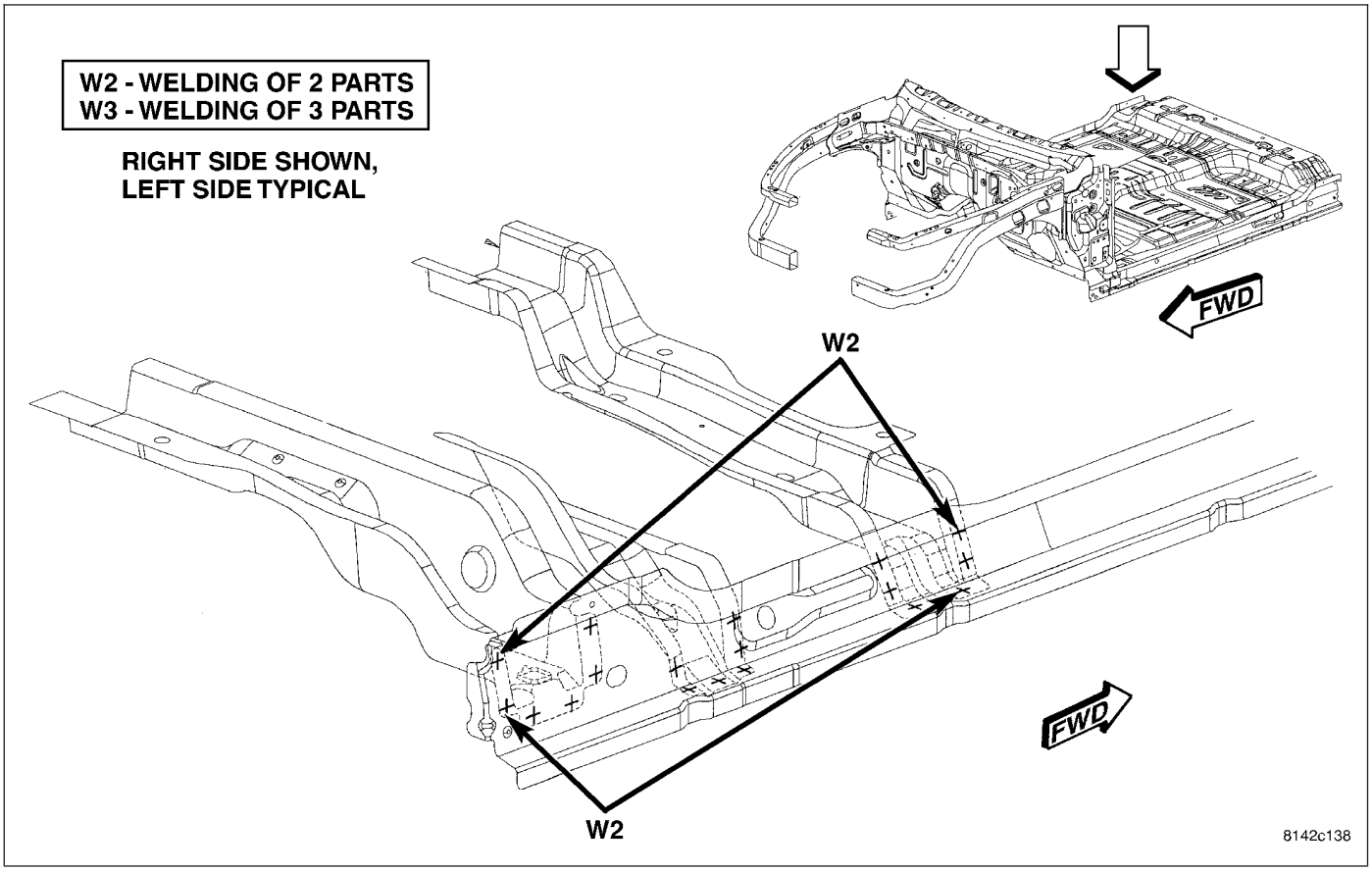


Fig. 87 UNDERBODY COMPLETE (2 OF 7)

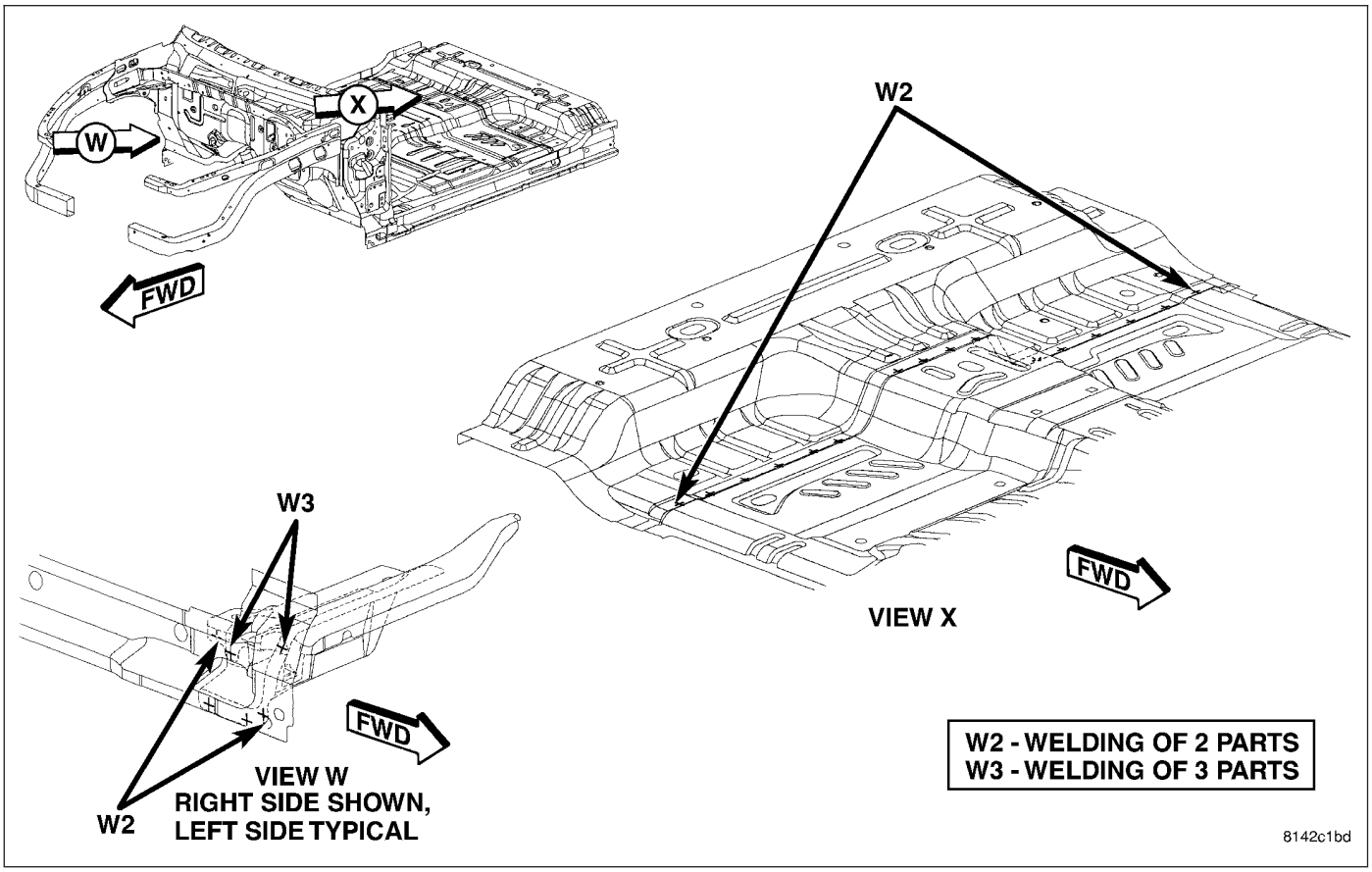


Fig. 88 UNDERBODY COMPLETE (3 OF 7)

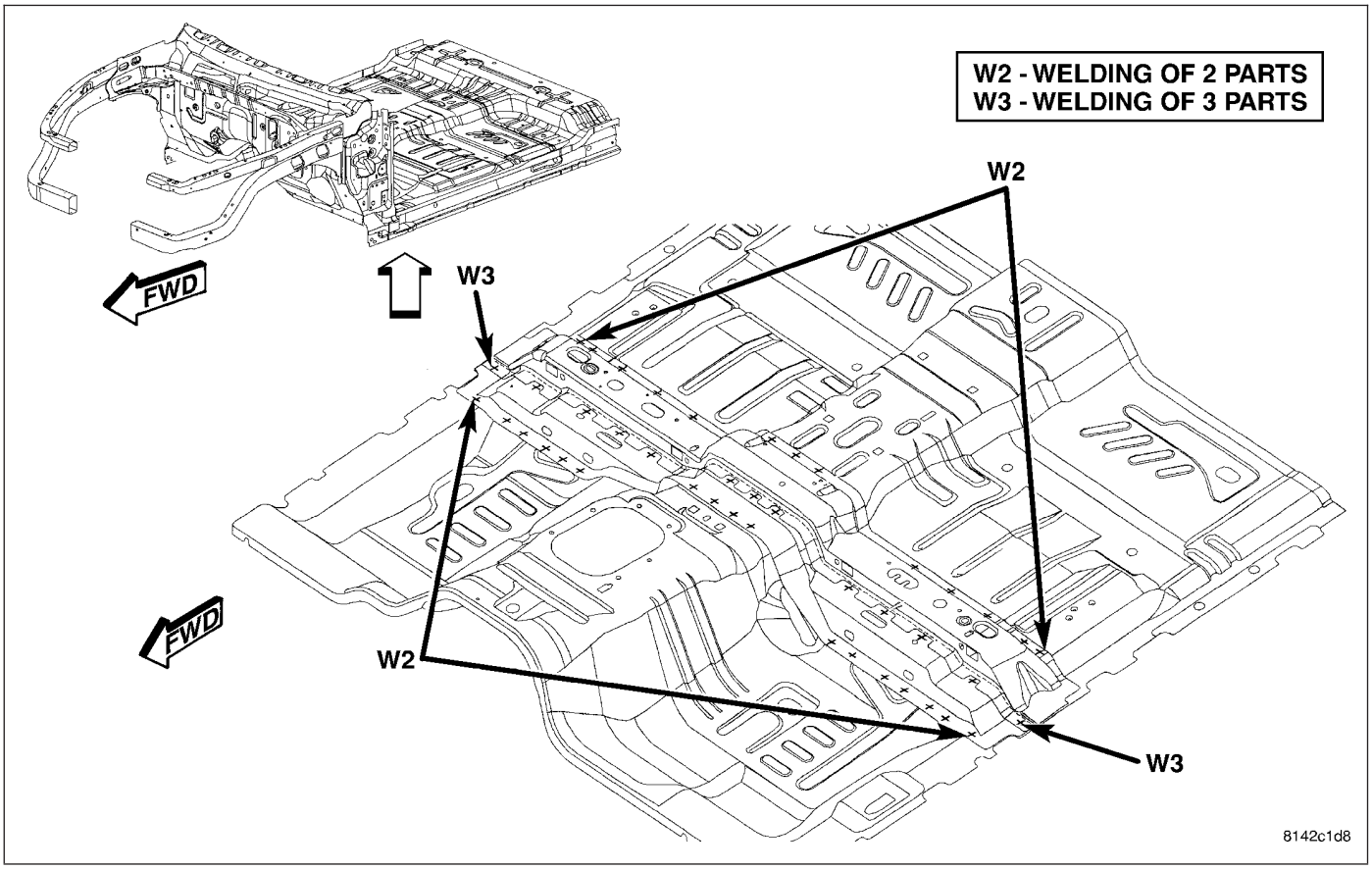


Fig. 89 UNDERBODY COMPLETE (4 OF 7)

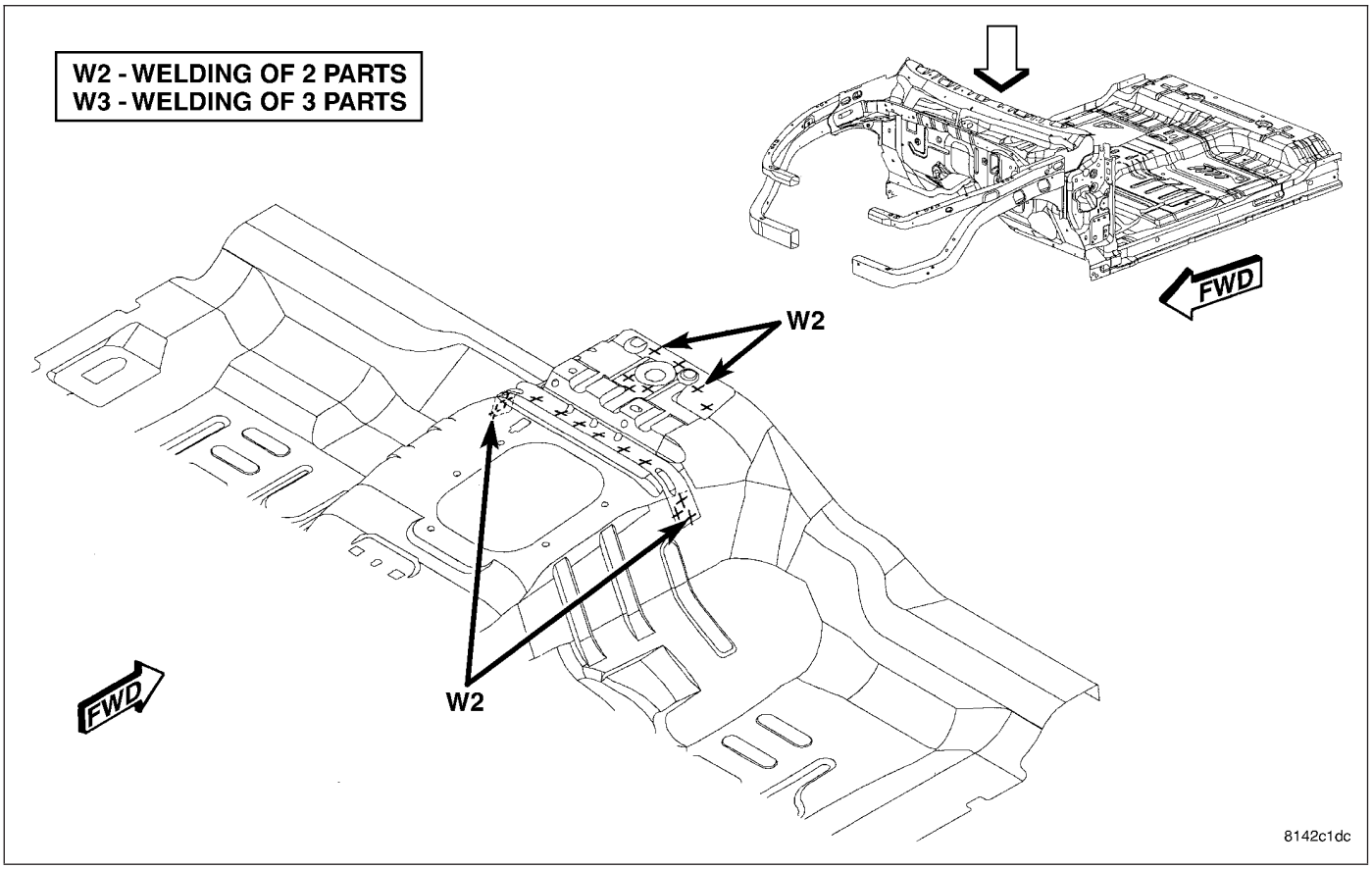


Fig. 90 UNDERBODY COMPLETE (5 OF 7)

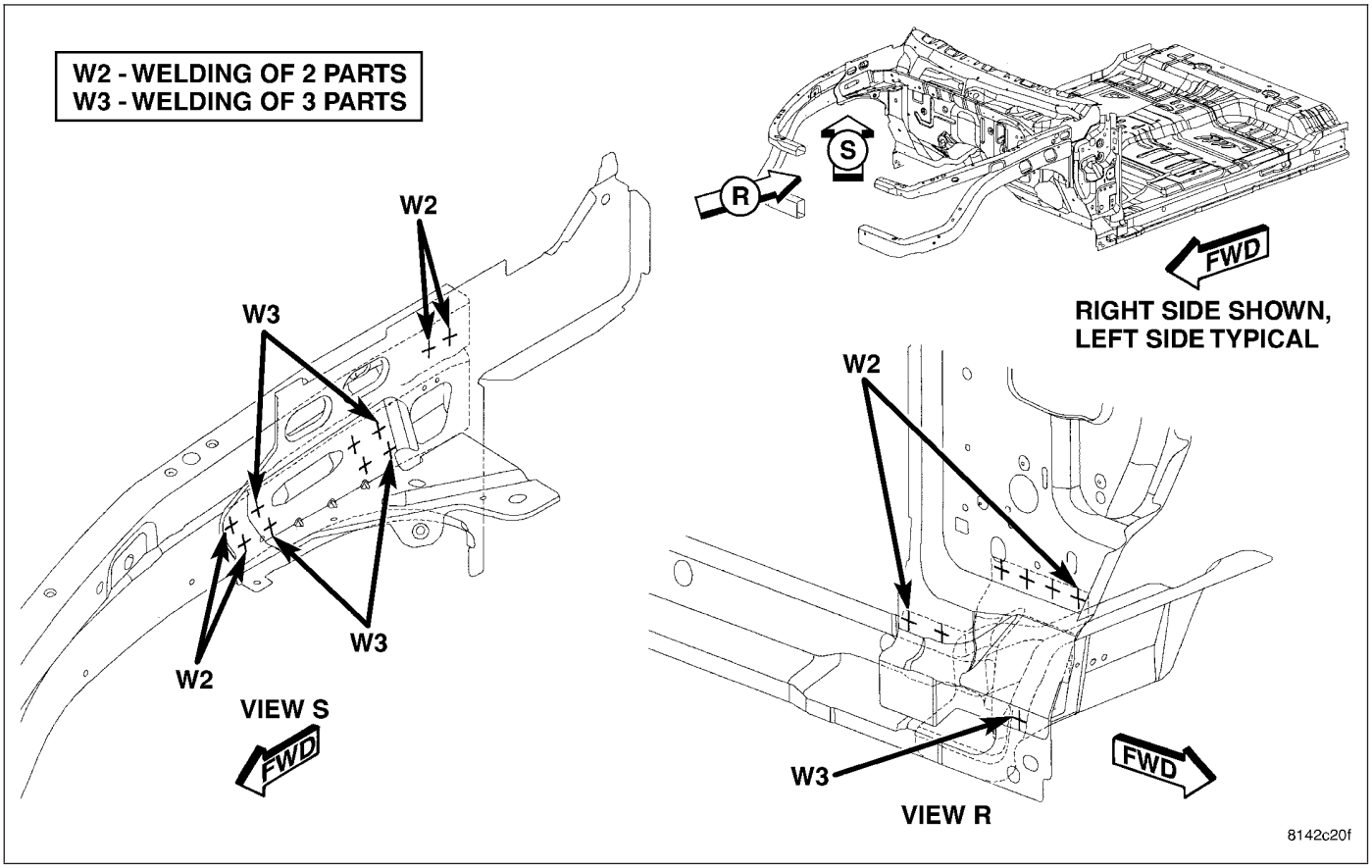


Fig. 91 UNDERBODY COMPLETE (6 OF 7)

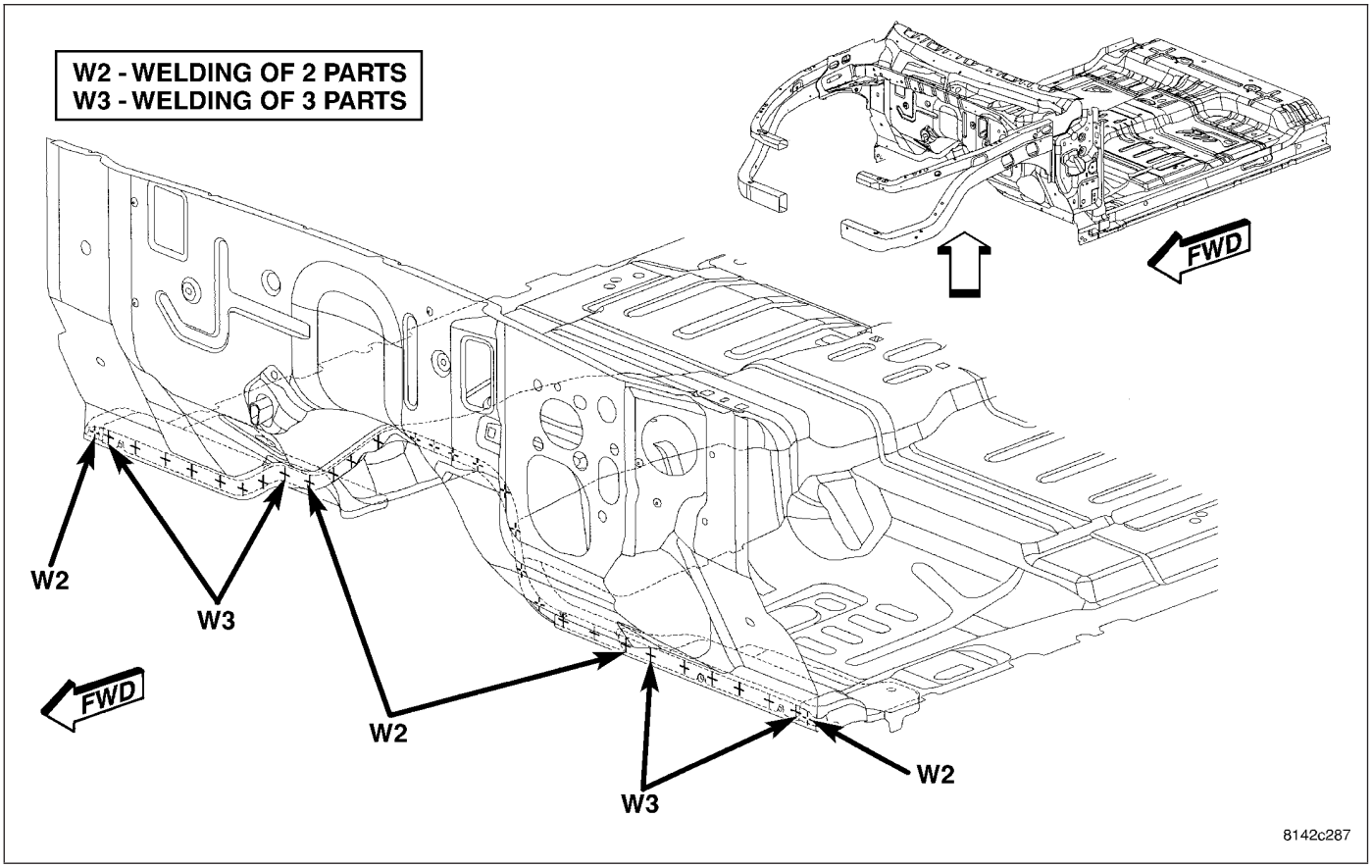


Fig. 92 UNDERBODY COMPLETE (7 OF 7)

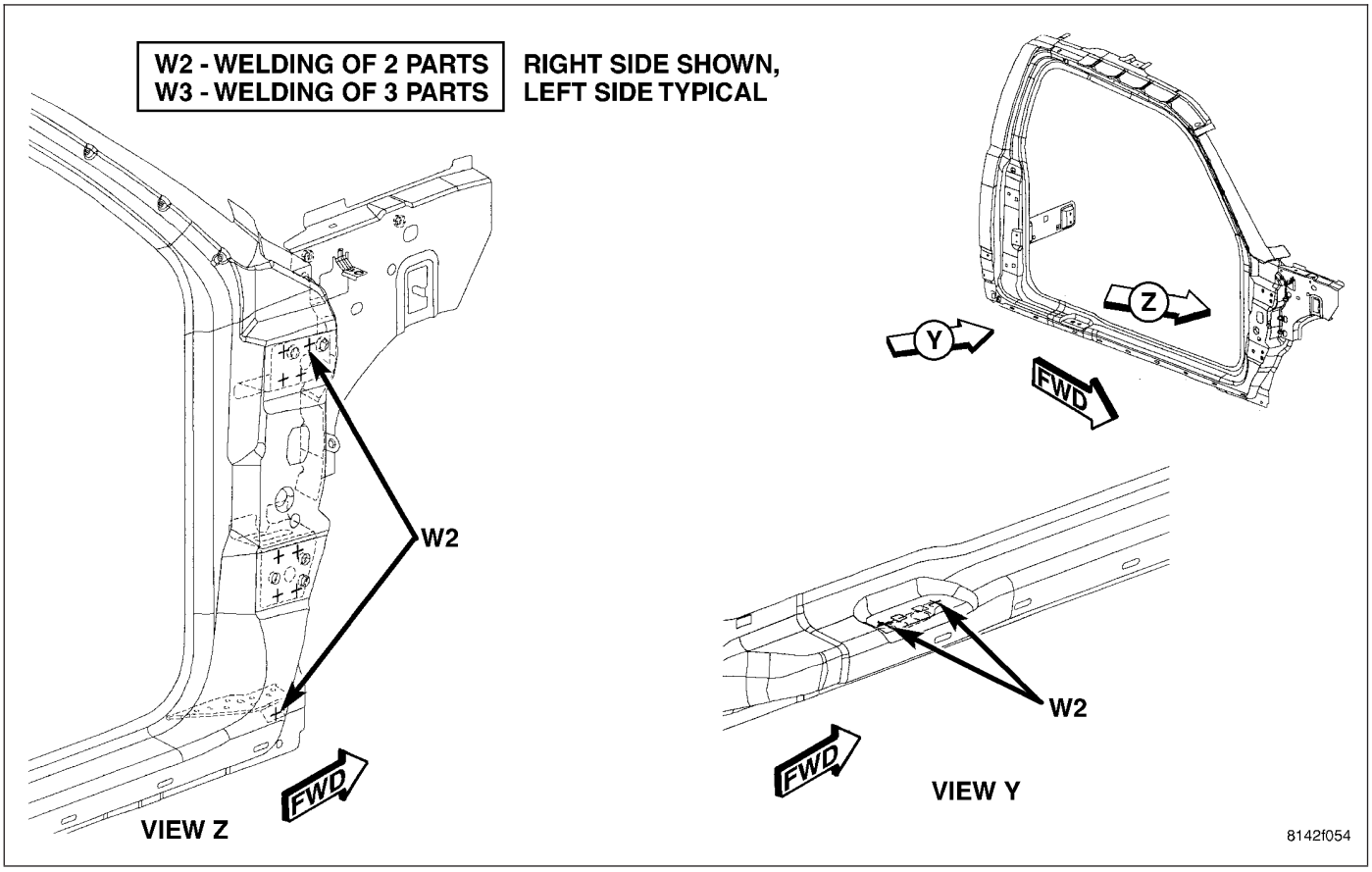


Fig. 93 BODY SIDE APERTURE (1 OF 4)

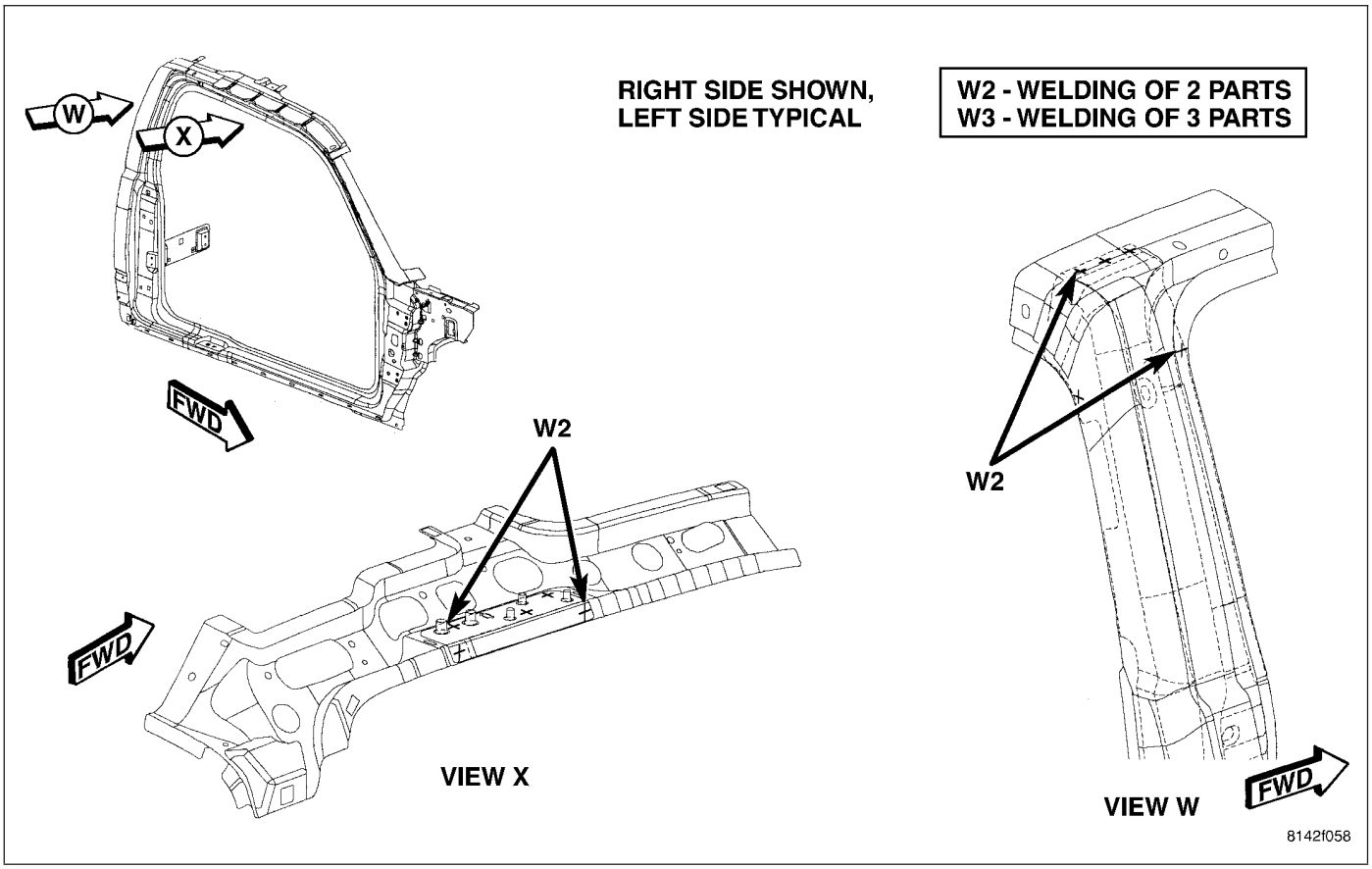


Fig. 94 BODY SIDE APERTURE (2 OF 4)

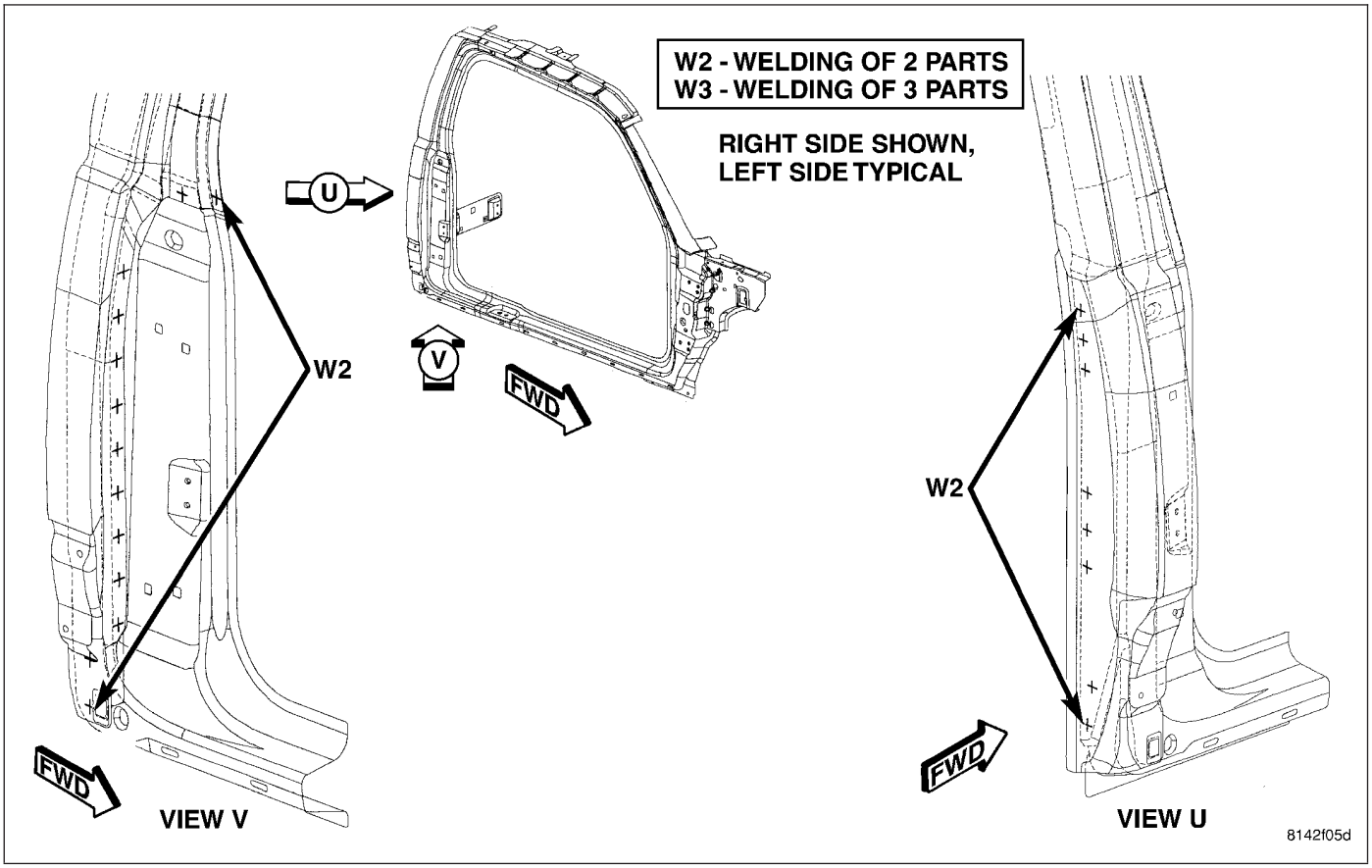


Fig. 95 BODY SIDE APERTURE (3 OF 4)

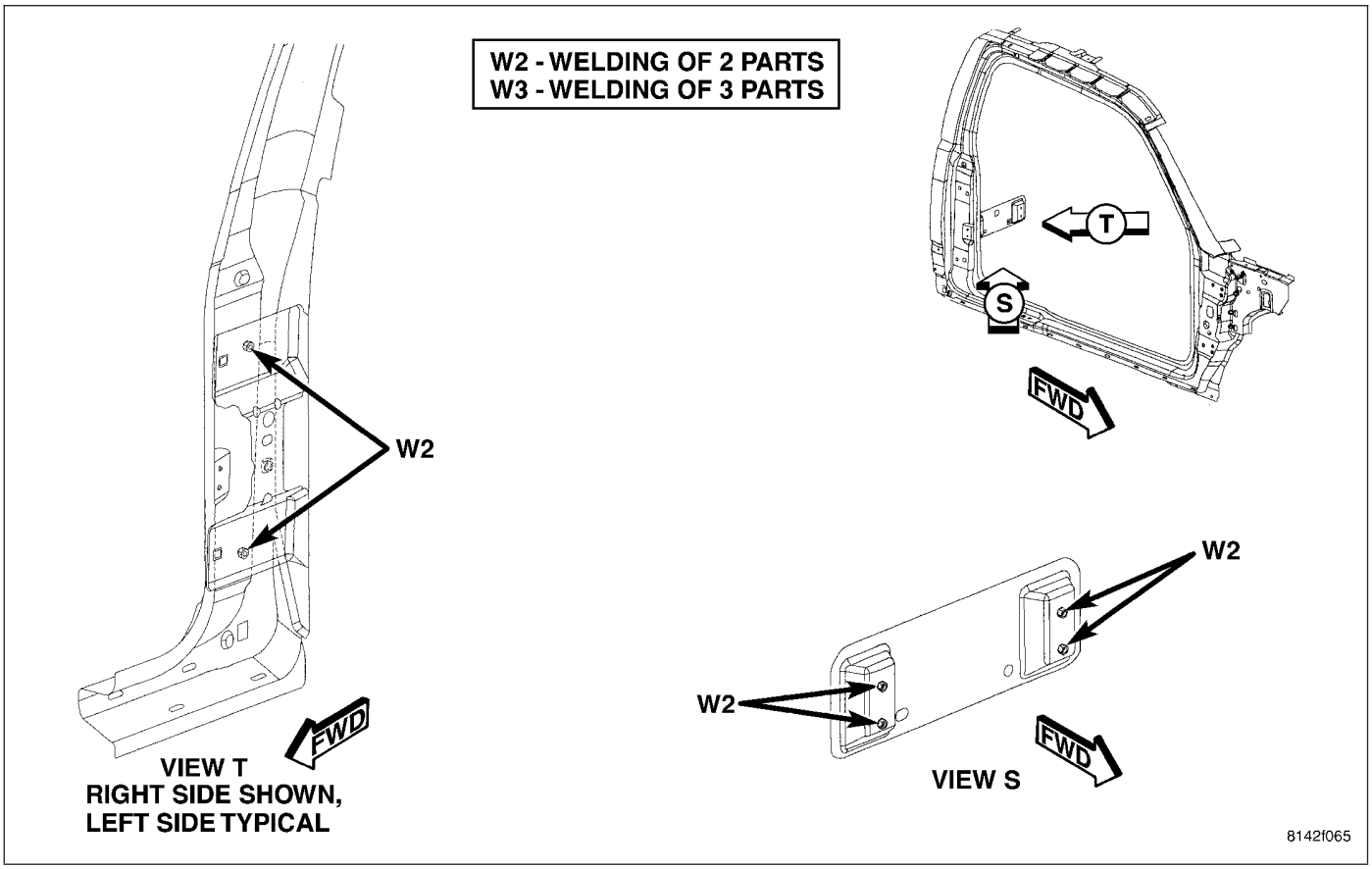


Fig. 96 BODY SIDE APERTURE (4 OF 4)

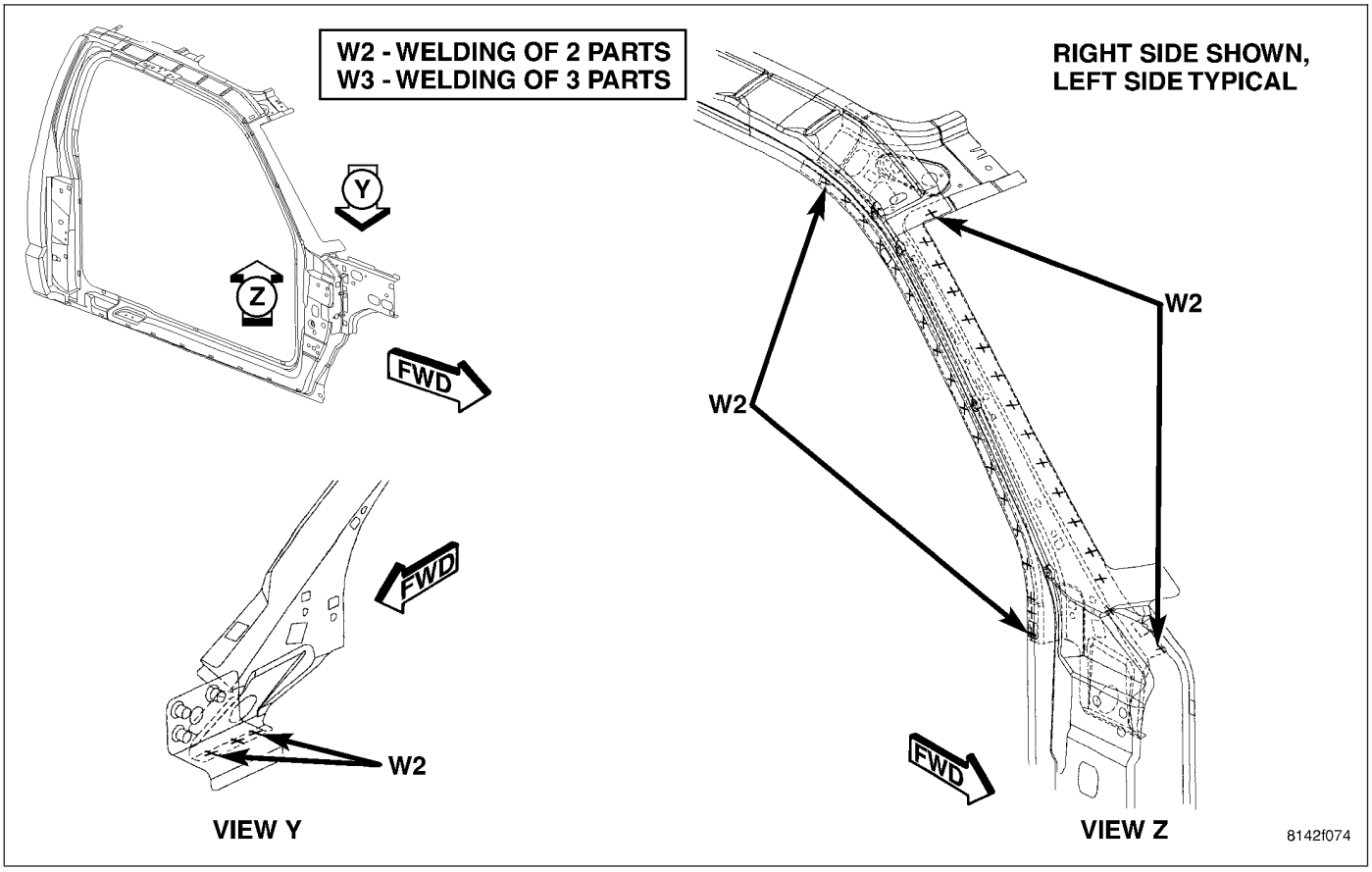


Fig. 97 BODY SIDE APERTURE - COMPLETE (1 OF 6)

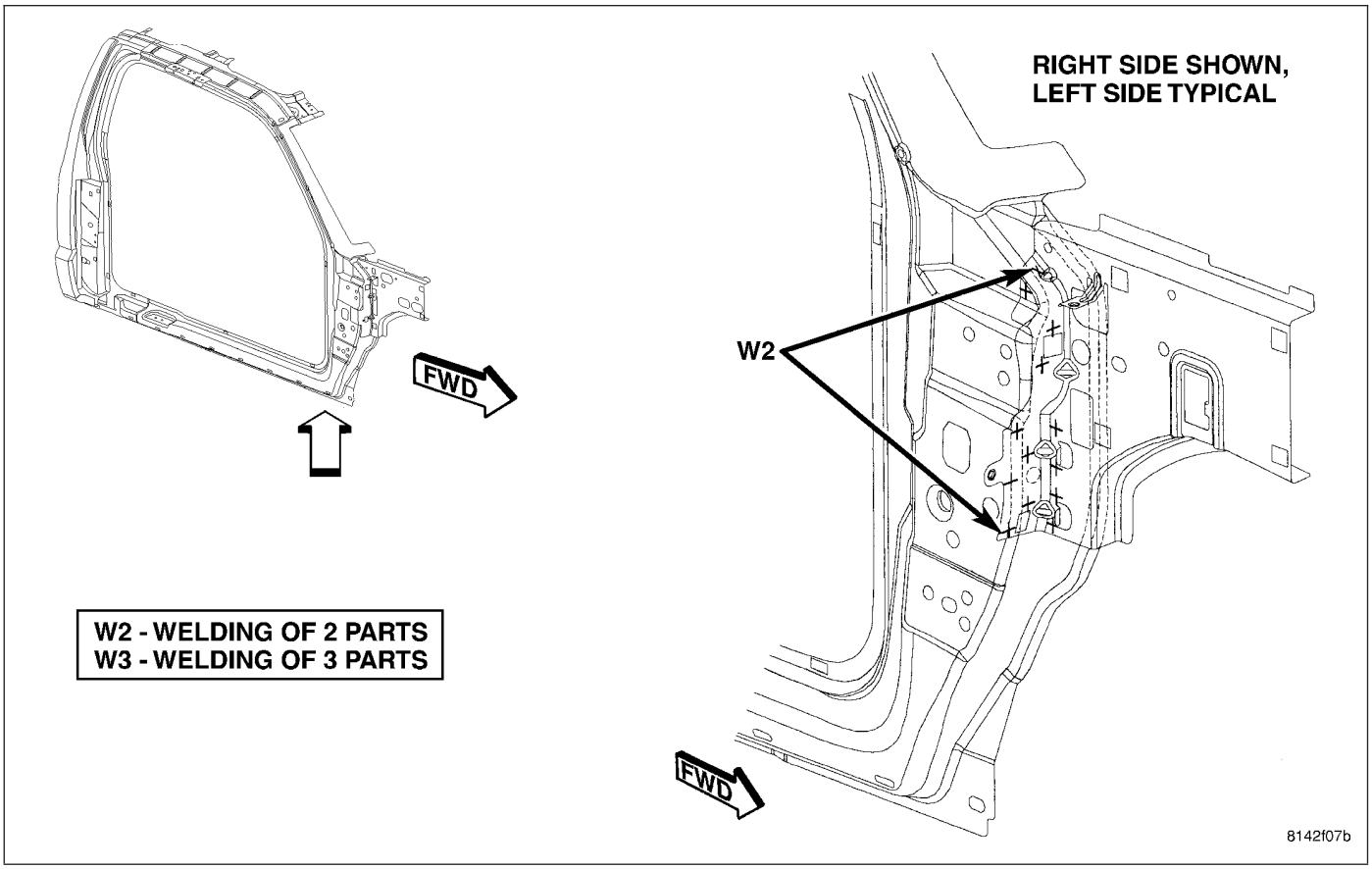


Fig. 98 BODY SIDE APERTURE - COMPLETE (2 OF 6)

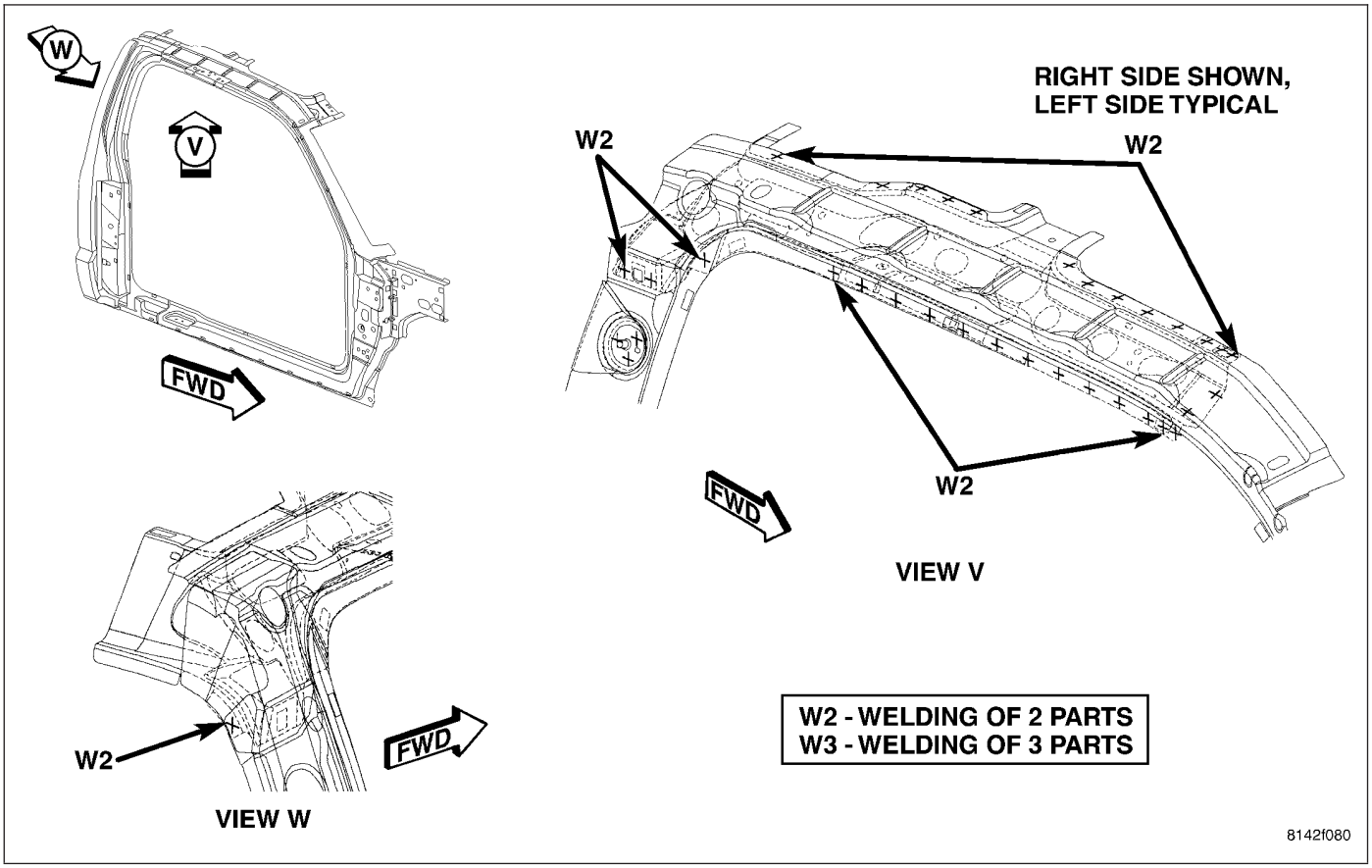


Fig. 99 BODY SIDE APERTURE - COMPLETE (3 OF 6)

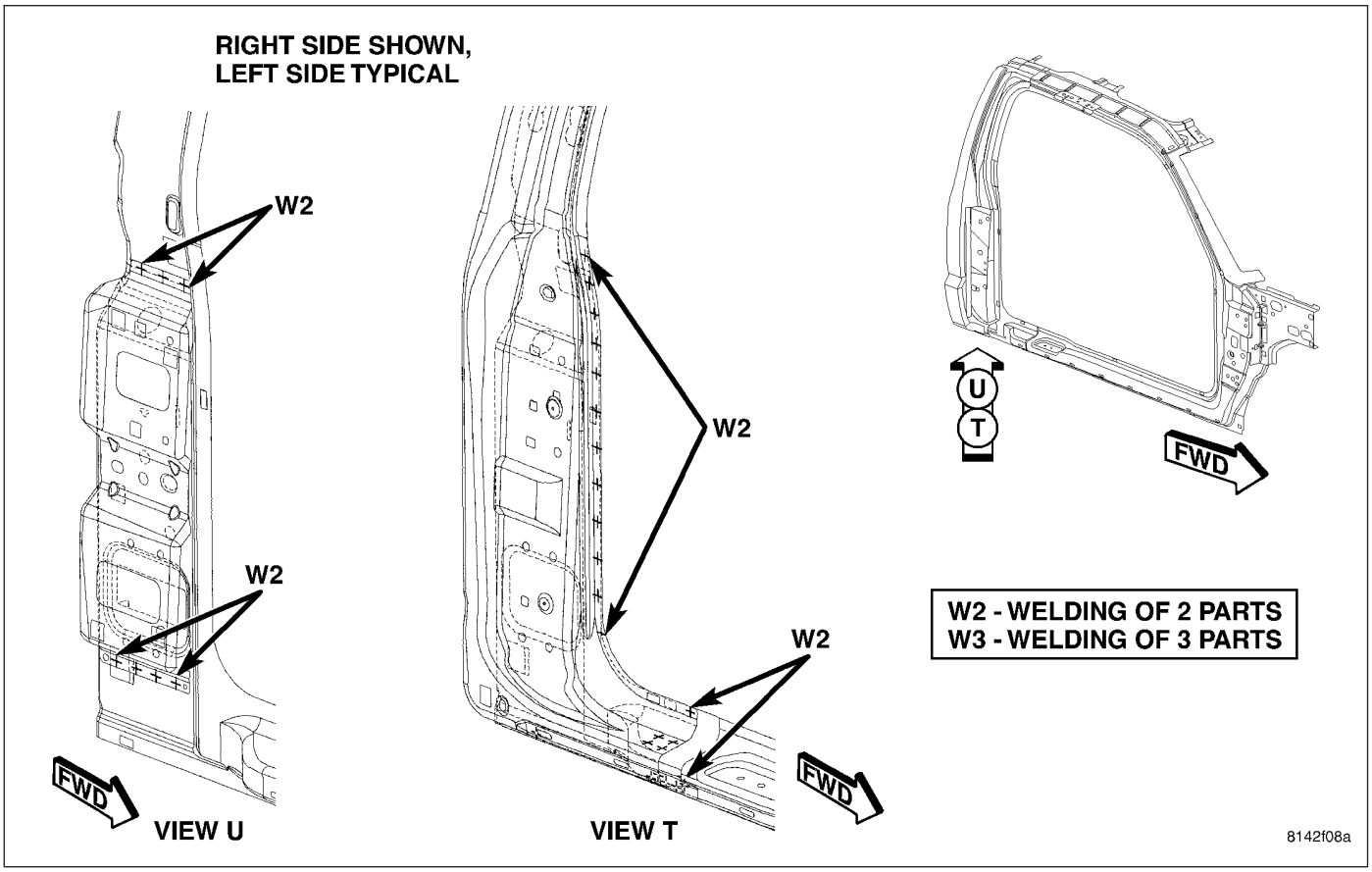


Fig. 100 BODY SIDE APERTURE - COMPLETE (4 OF 6)

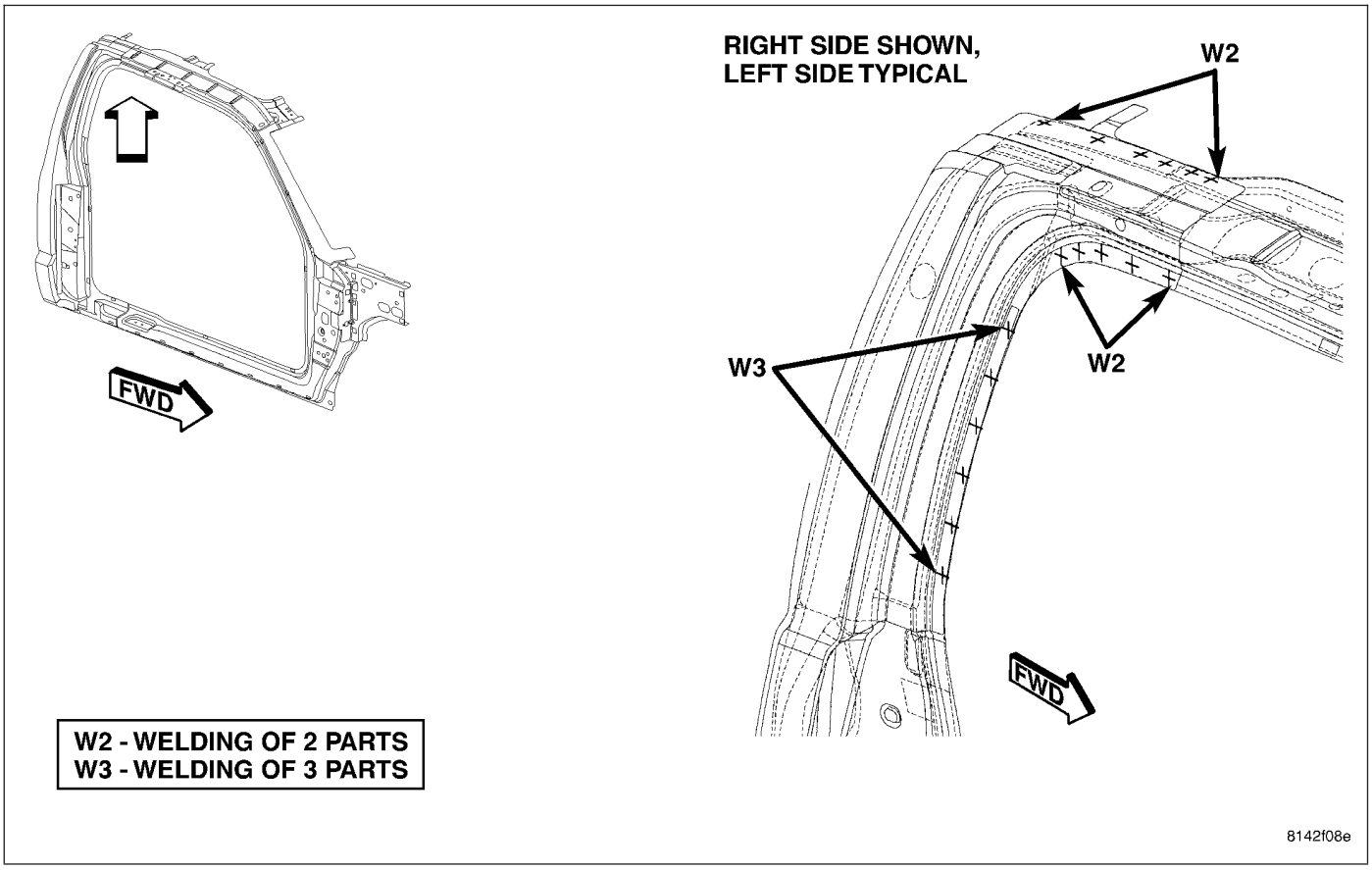


Fig. 101 BODY SIDE APERTURE - COMPLETE (5 OF 6)

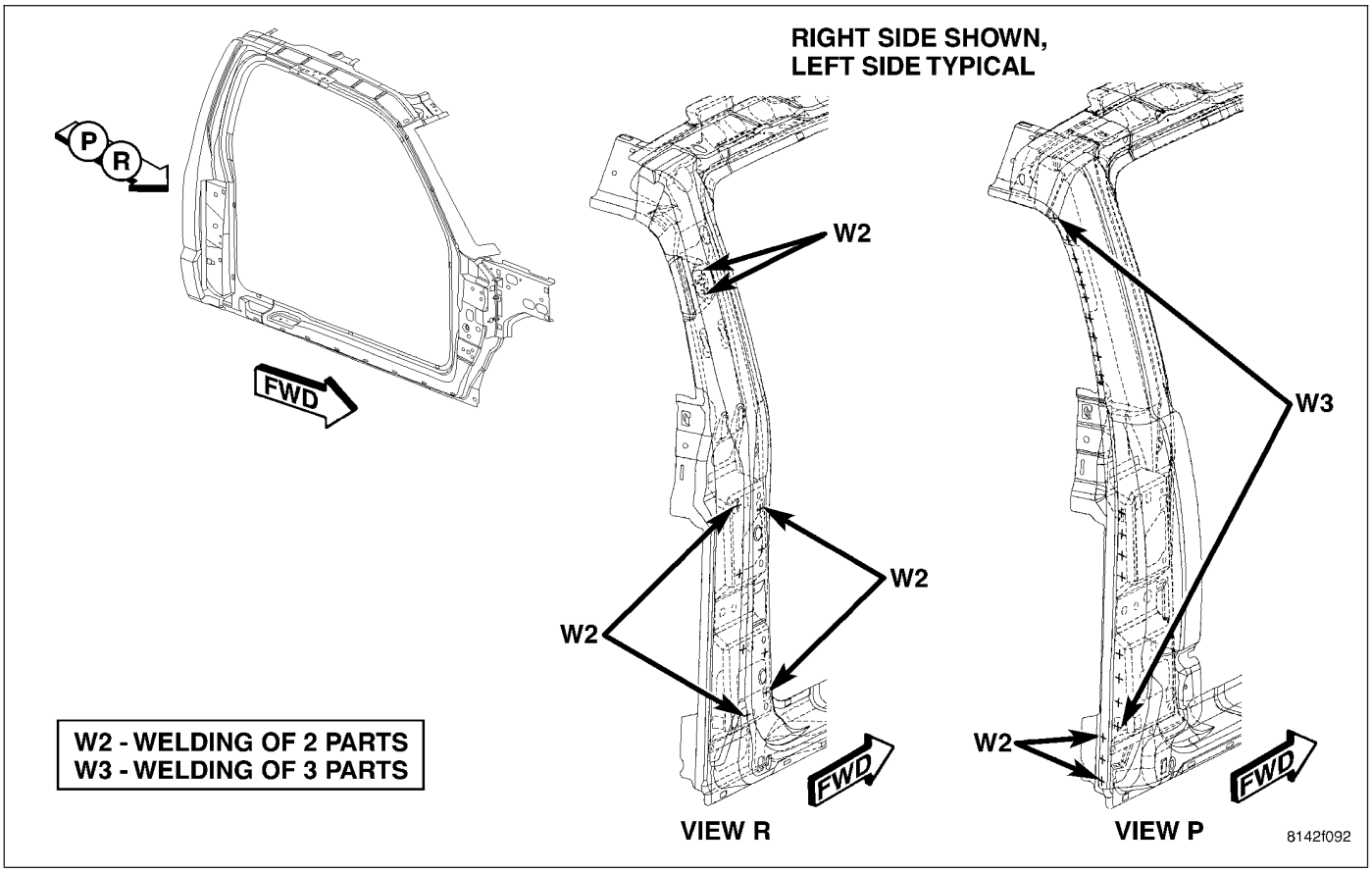


Fig. 102 BODY SIDE APERTURE - COMPLETE (6 OF 6)

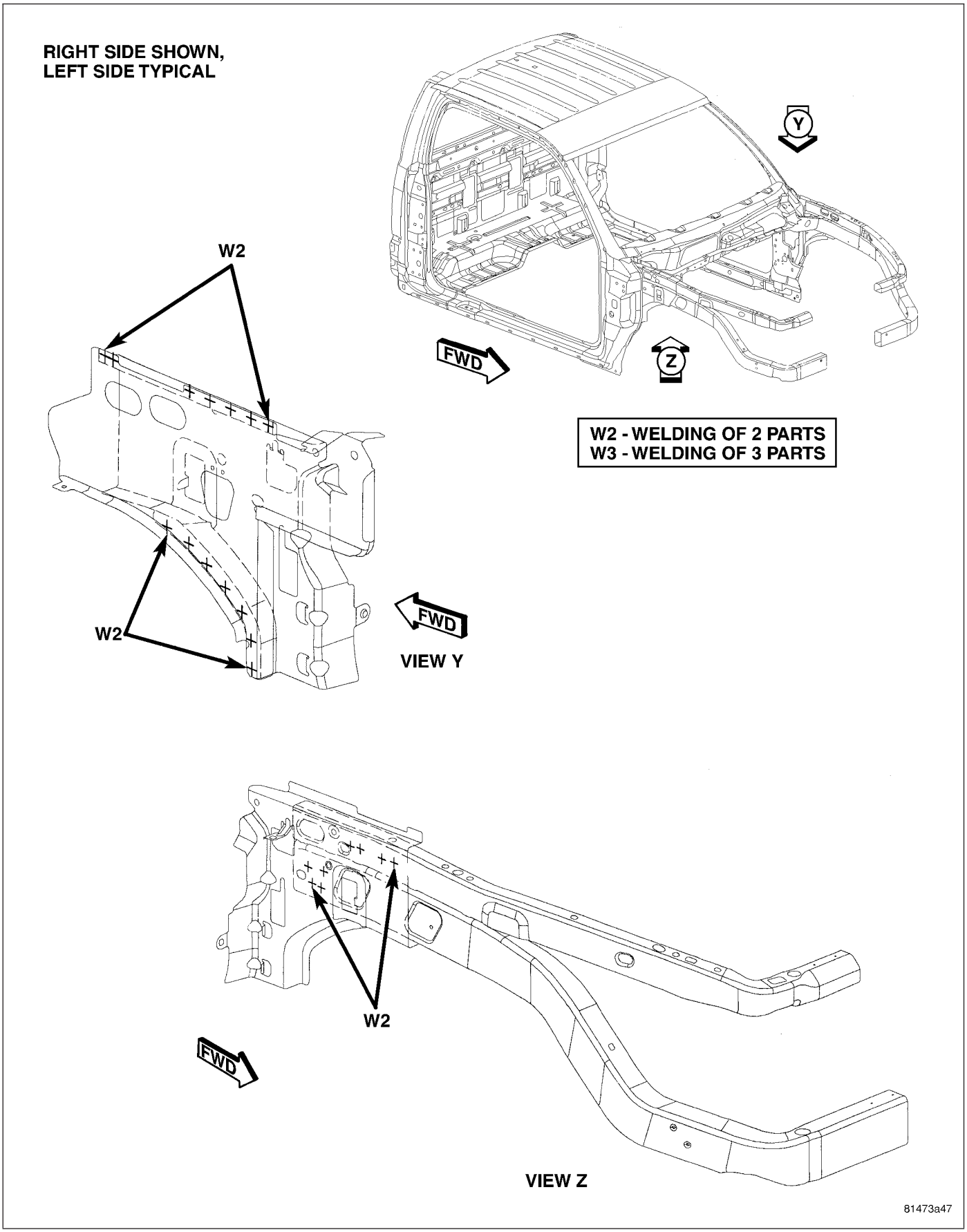


Fig. 103 CAB COMPLETE (1 OF 12)

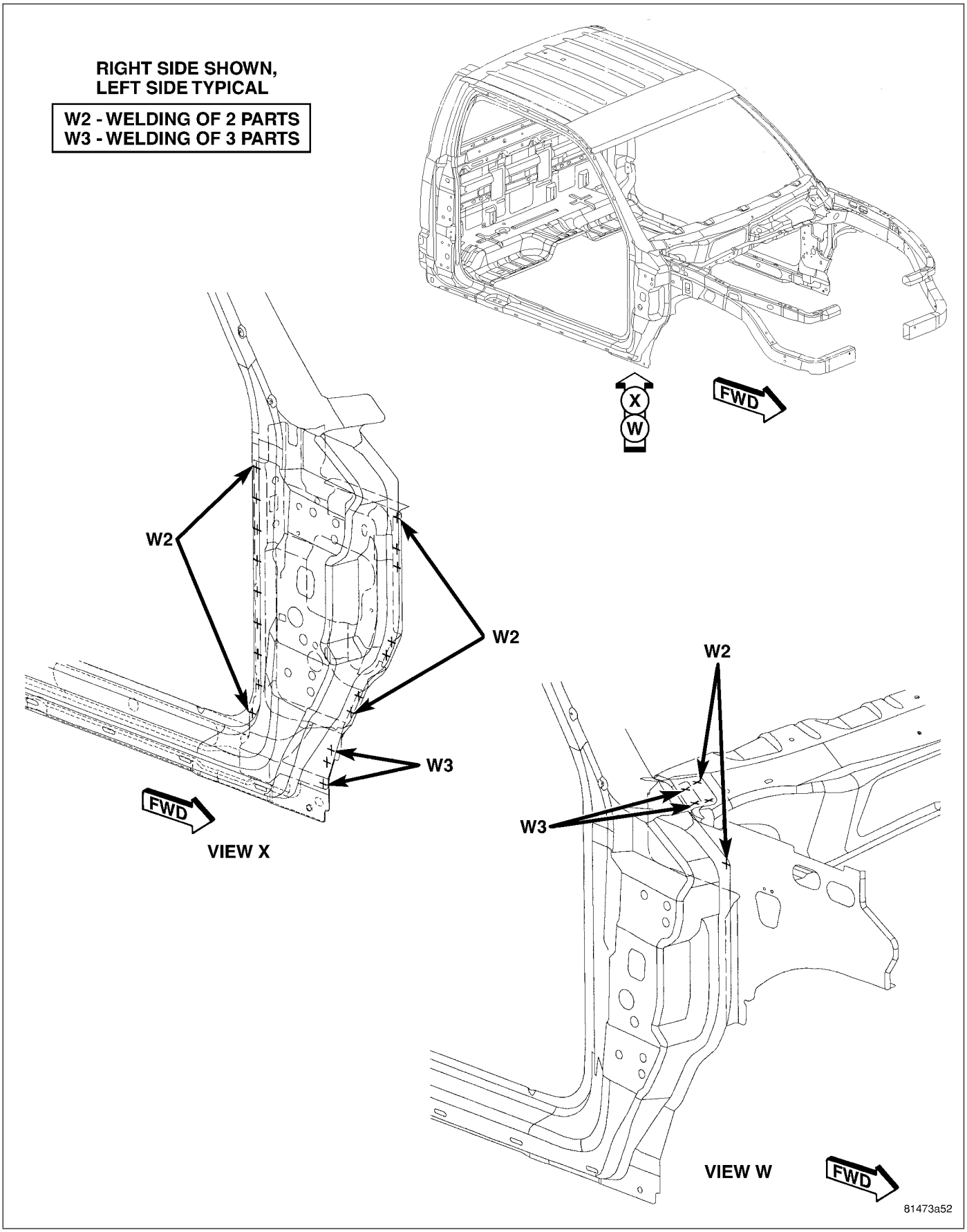


Fig. 104 CAB COMPLETE (2 OF 12)

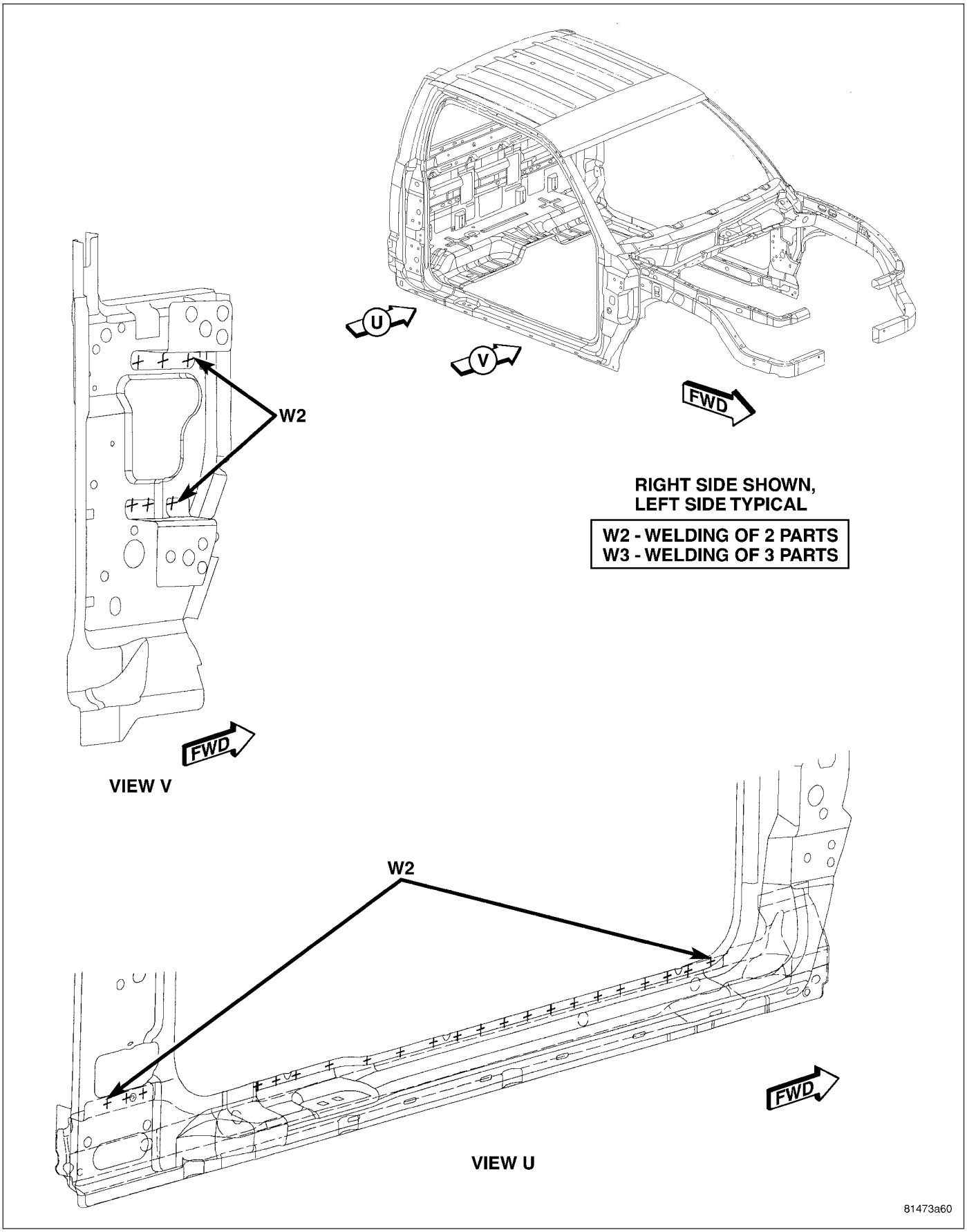


Fig. 105 CAB COMPLETE (3 OF 12)

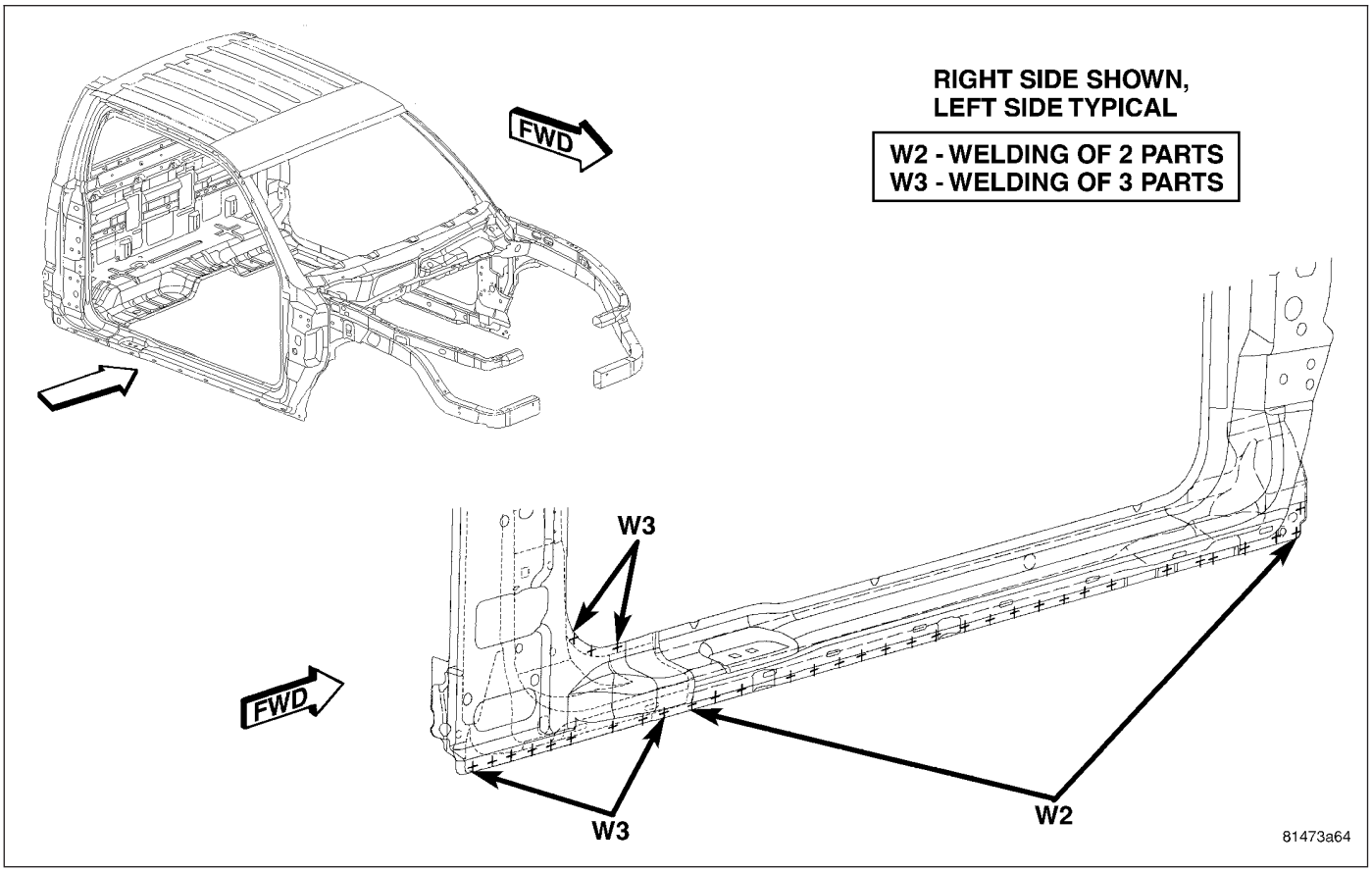


Fig. 106 CAB COMPLETE (4 OF 12)

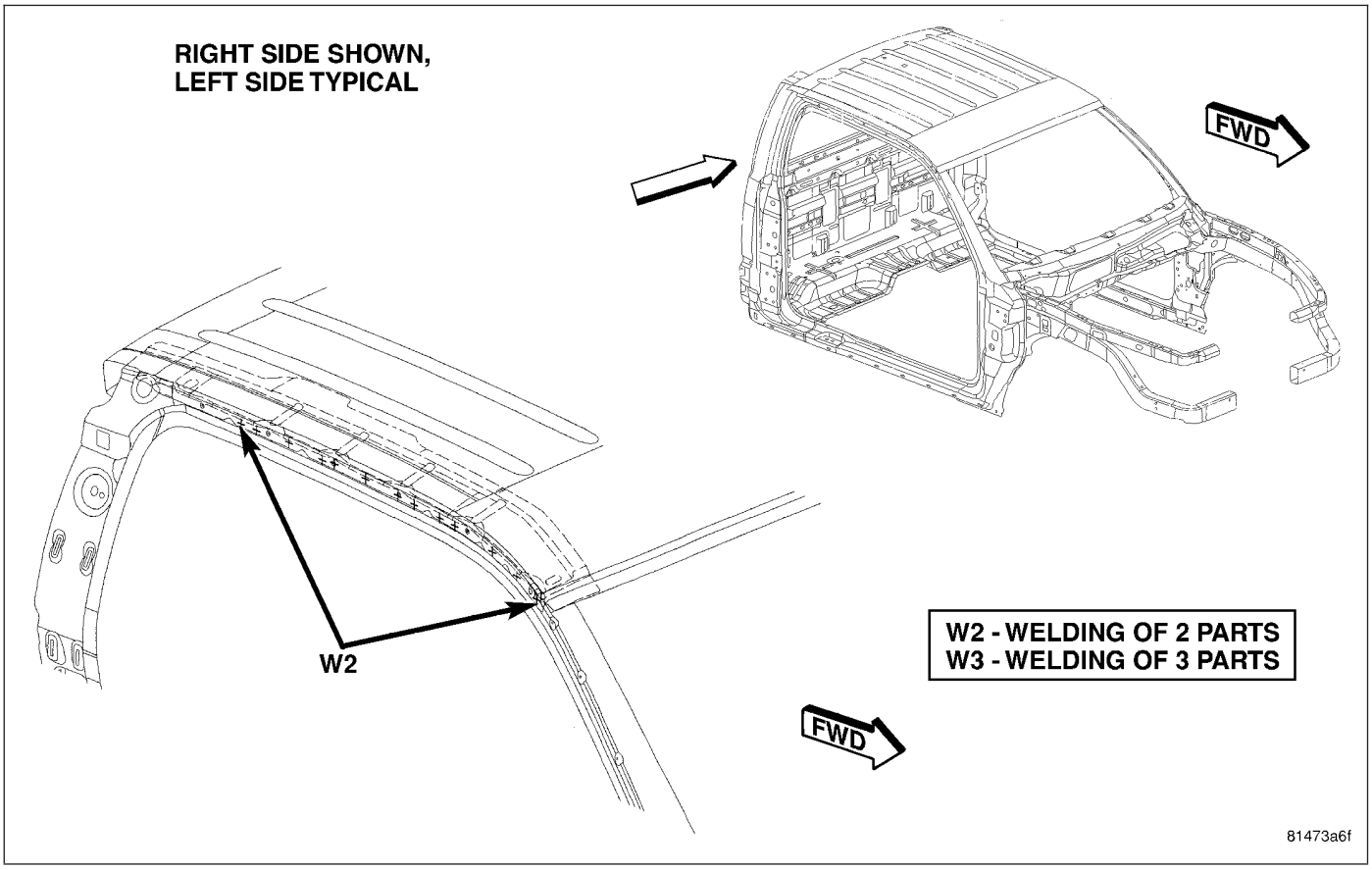


Fig. 107 CAB COMPLETE (5 OF 12)

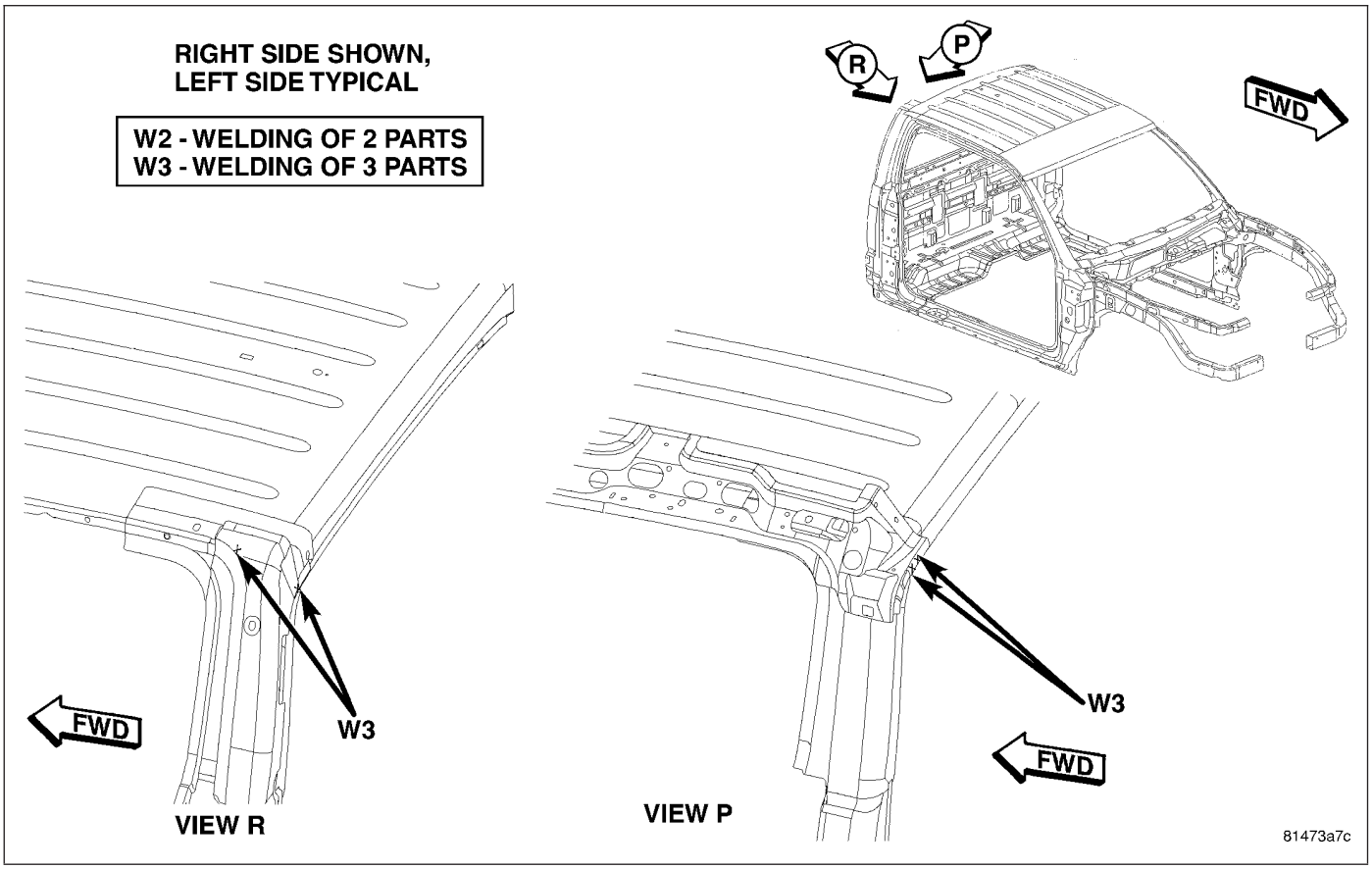


Fig. 108 CAB COMPLETE (6 OF 12)

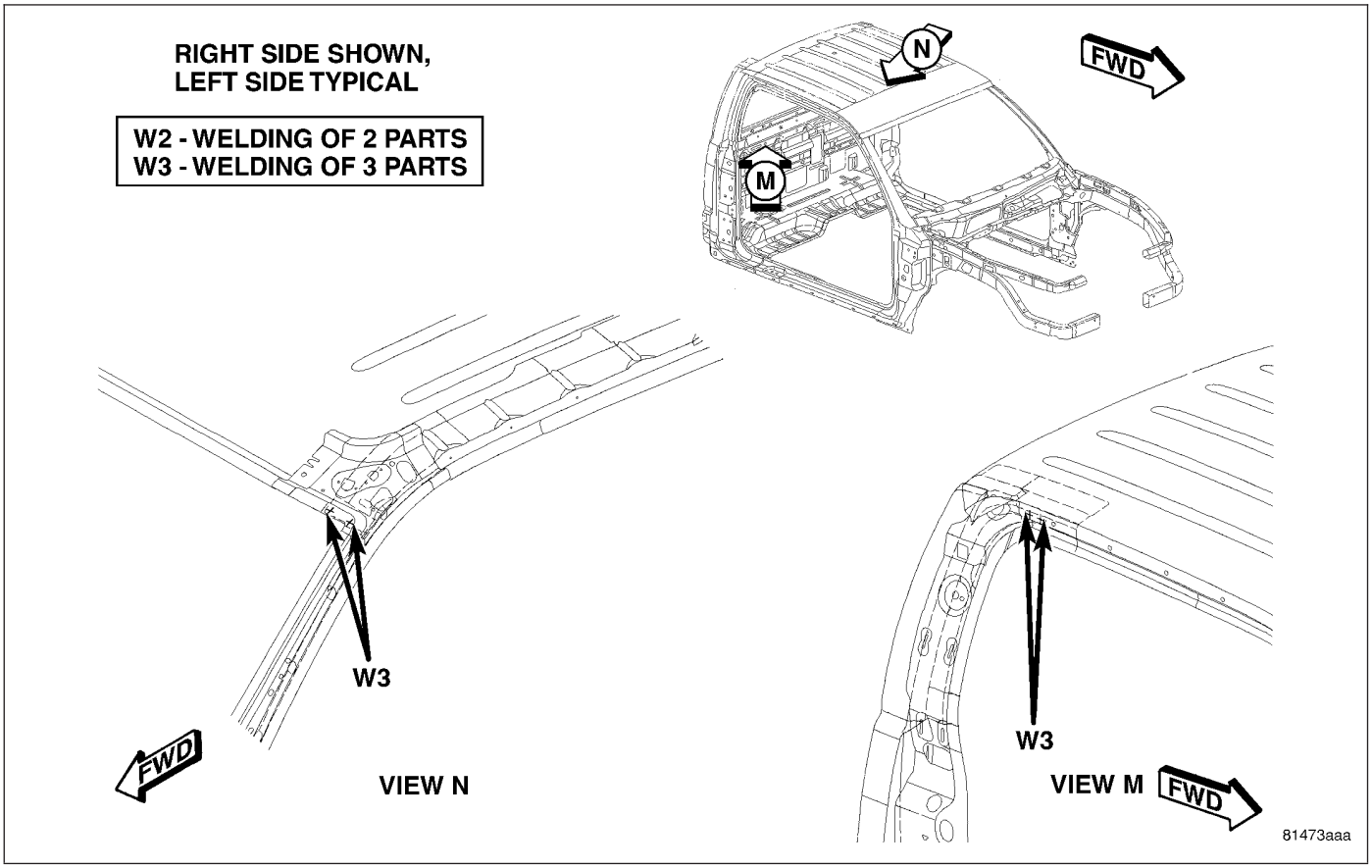


Fig. 109 CAB COMPLETE (7 OF 12)

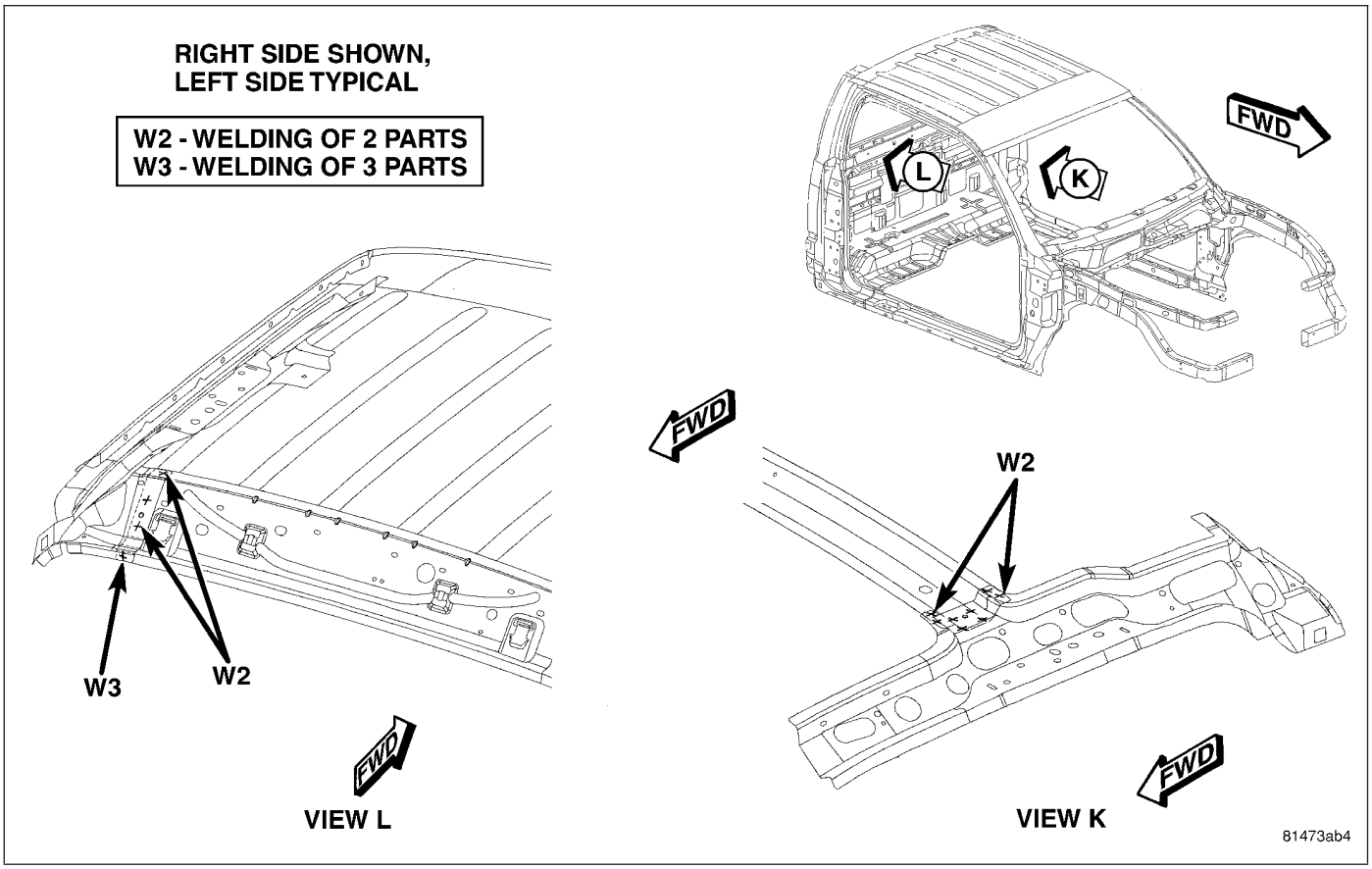


Fig. 110 CAB COMPLETE (8 OF 12)

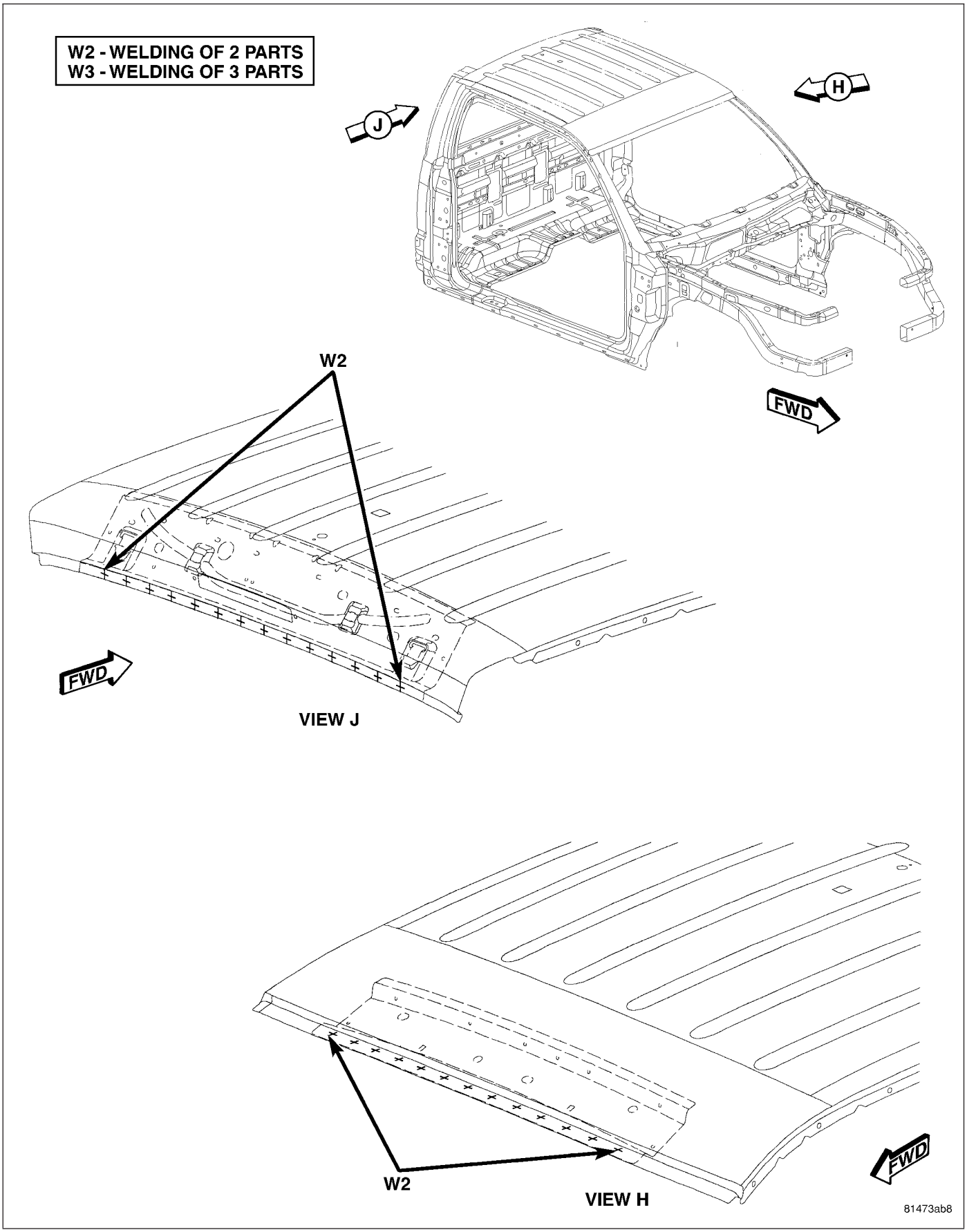


Fig. 111 CAB COMPLETE (9 OF 12)

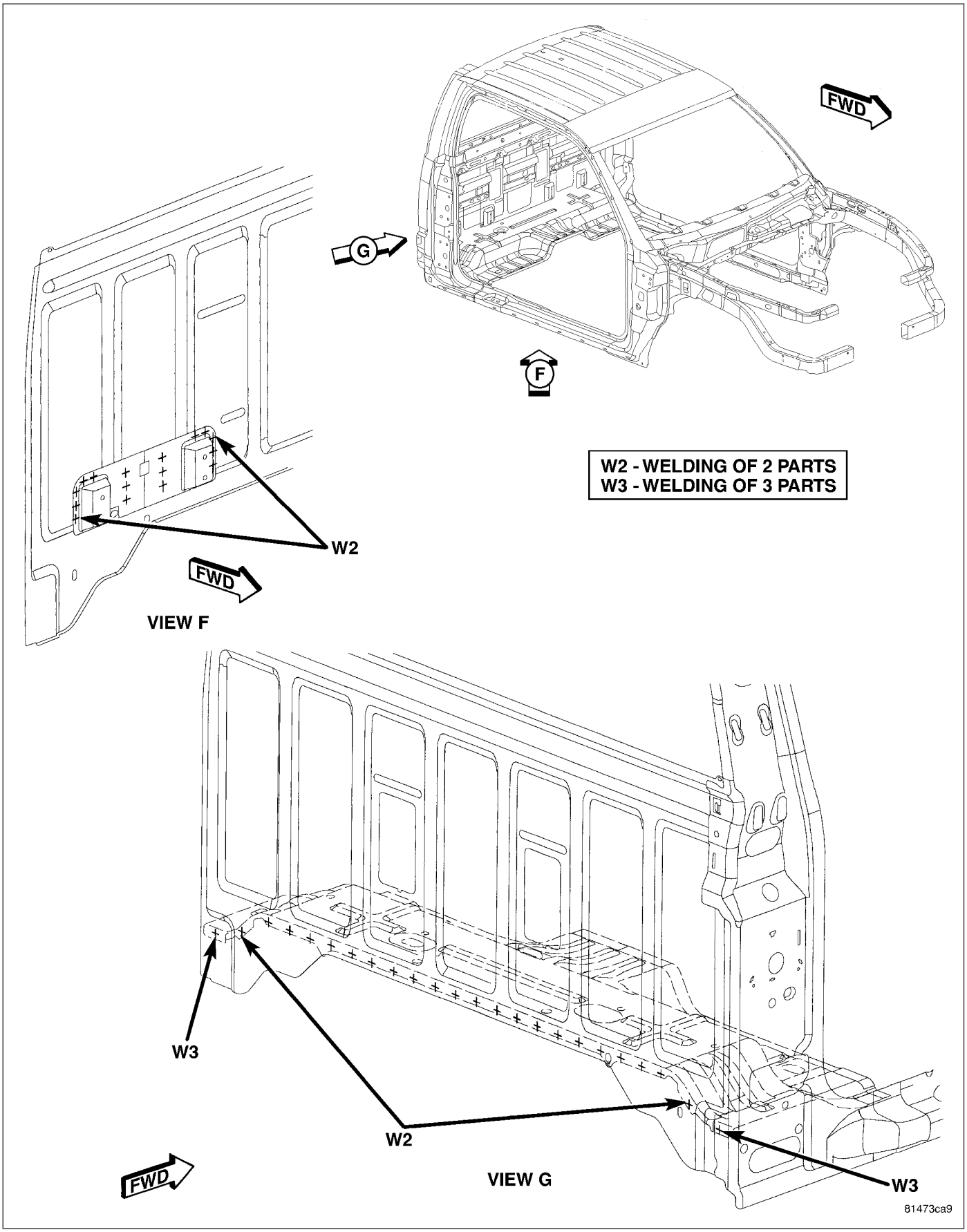


Fig. 112 CAB COMPLETE (10 OF 12)

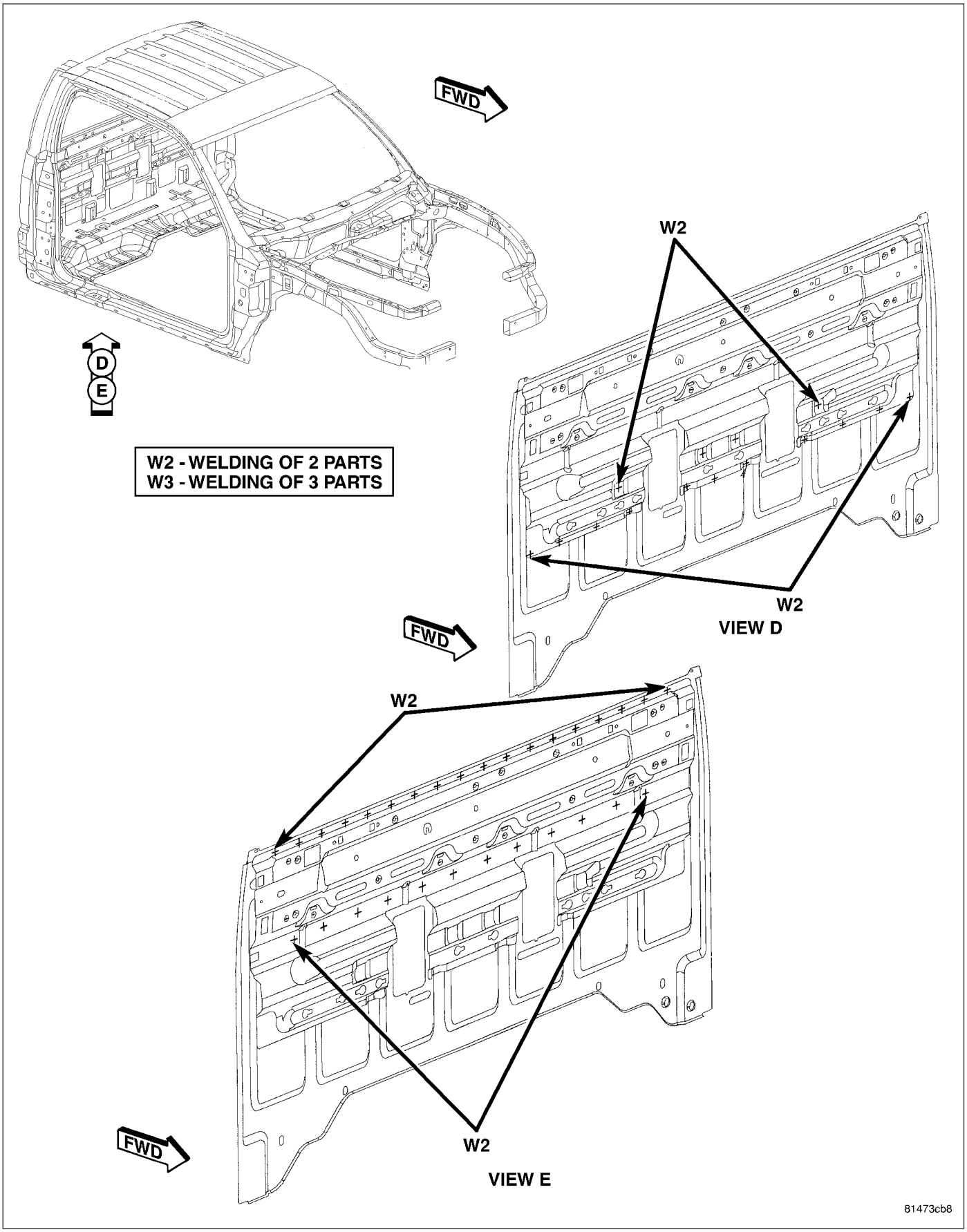


Fig. 113 CAB COMPLETE (11 OF 12)

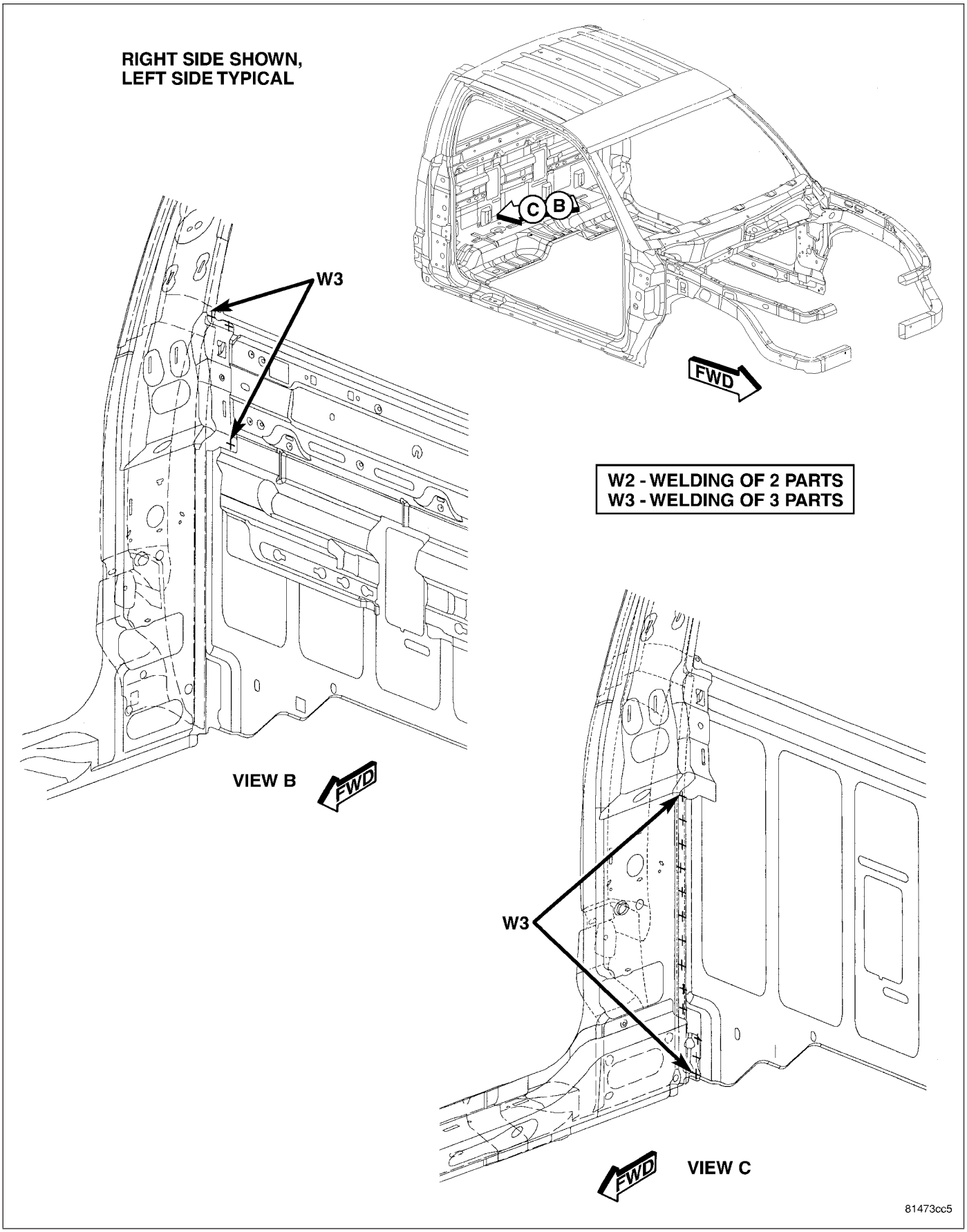


Fig. 114 CAB COMPLETE (12 OF 12)

Both Quad (ND84) and Club Cabs (ND33)

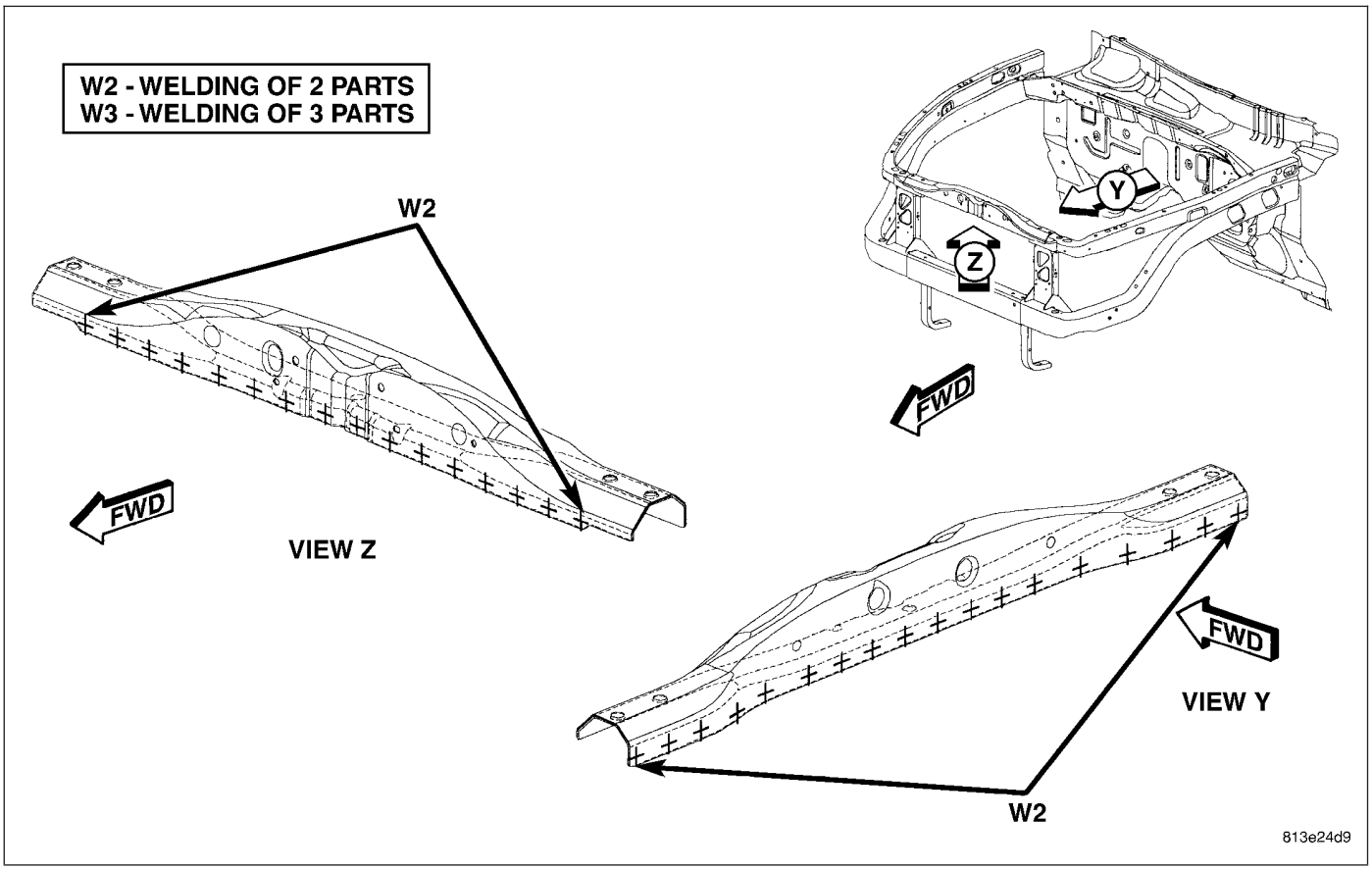


Fig. 115 ENGINE BOX (1 OF 4)

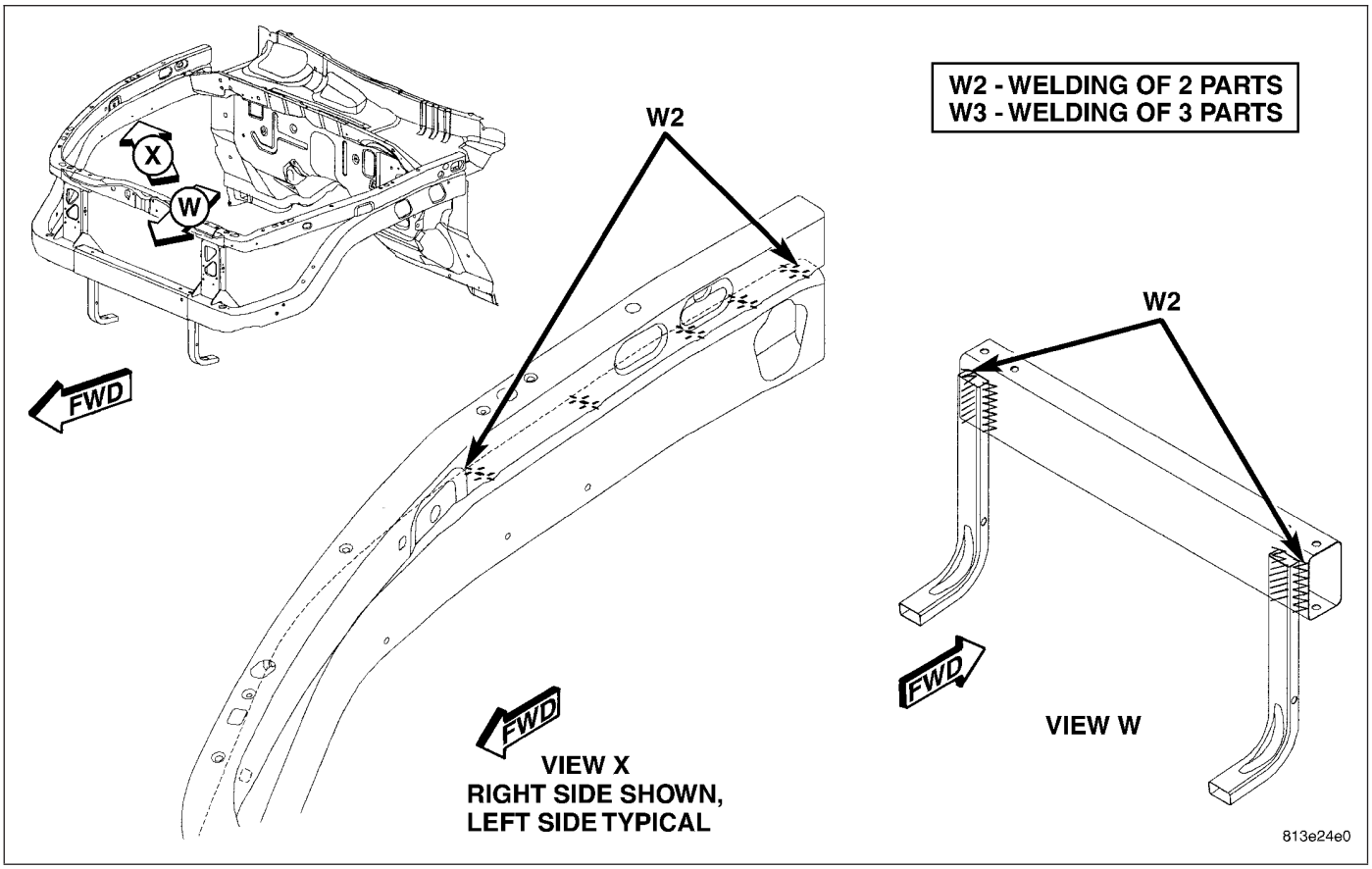


Fig. 116 ENGINE BOX (2 OF 4)

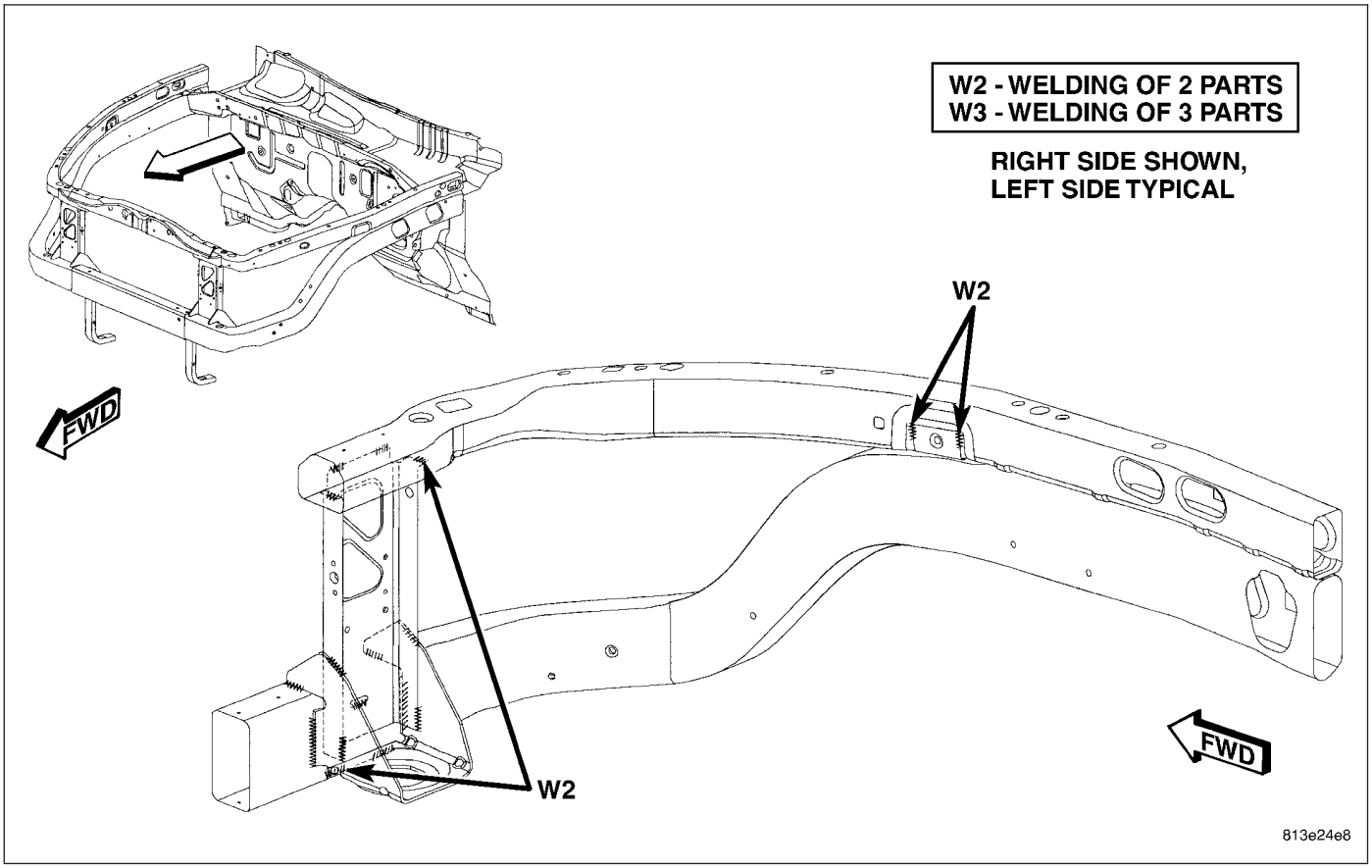


Fig. 117 ENGINE BOX (3 OF 4)

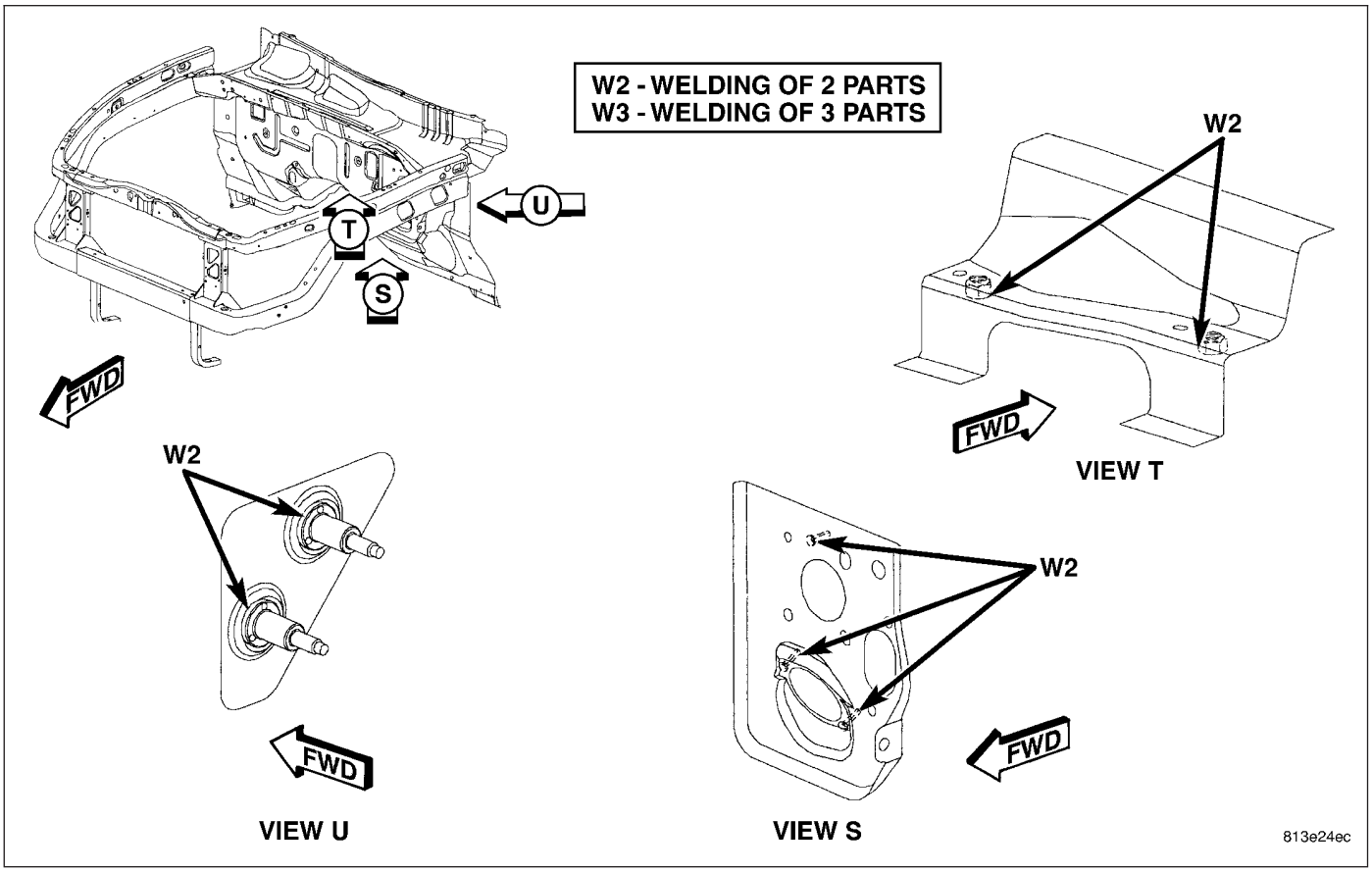


Fig. 118 ENGINE BOX (4 OF 4)

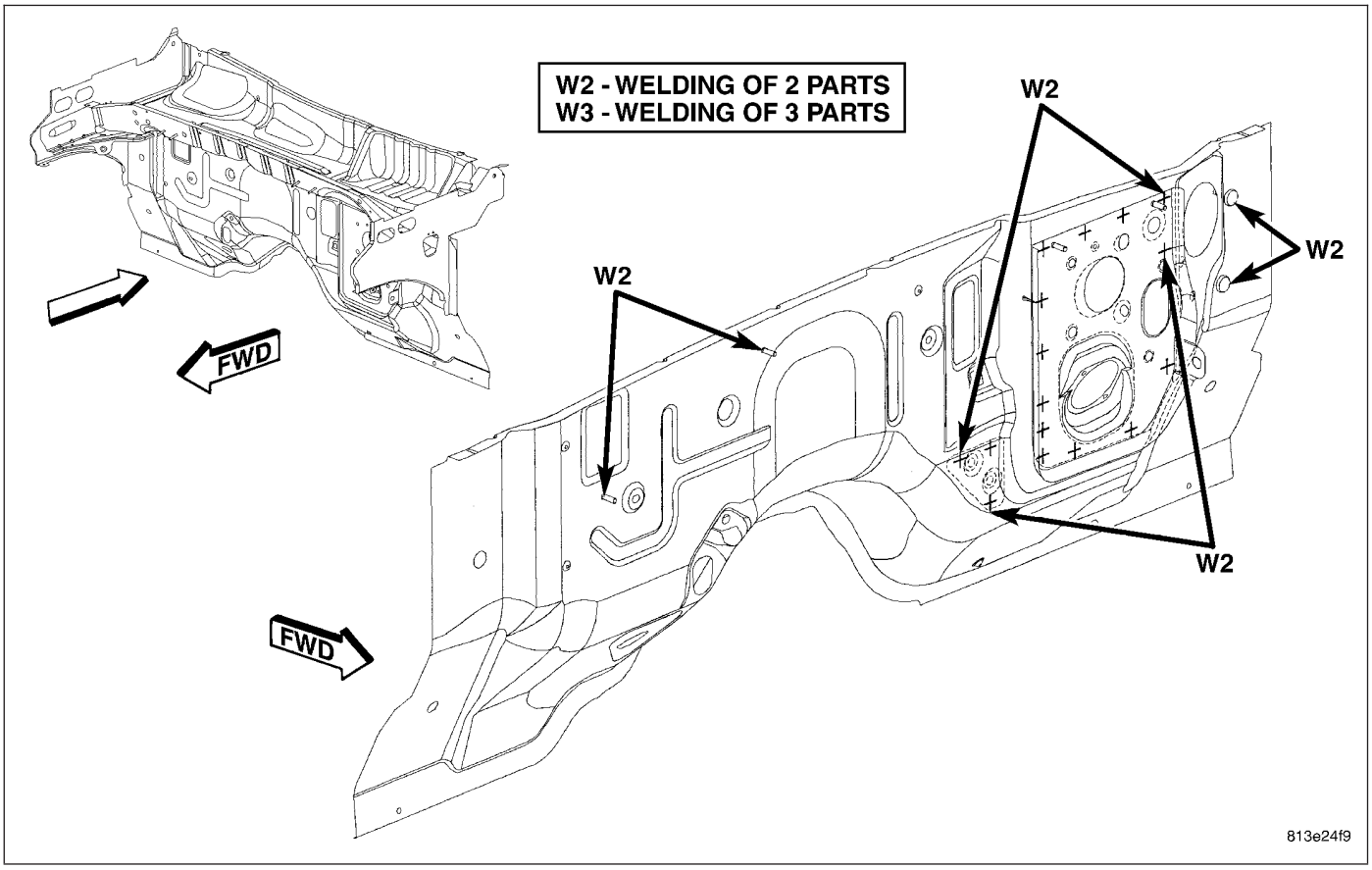


Fig. 119 DASH/PLENUM (1 OF 3)

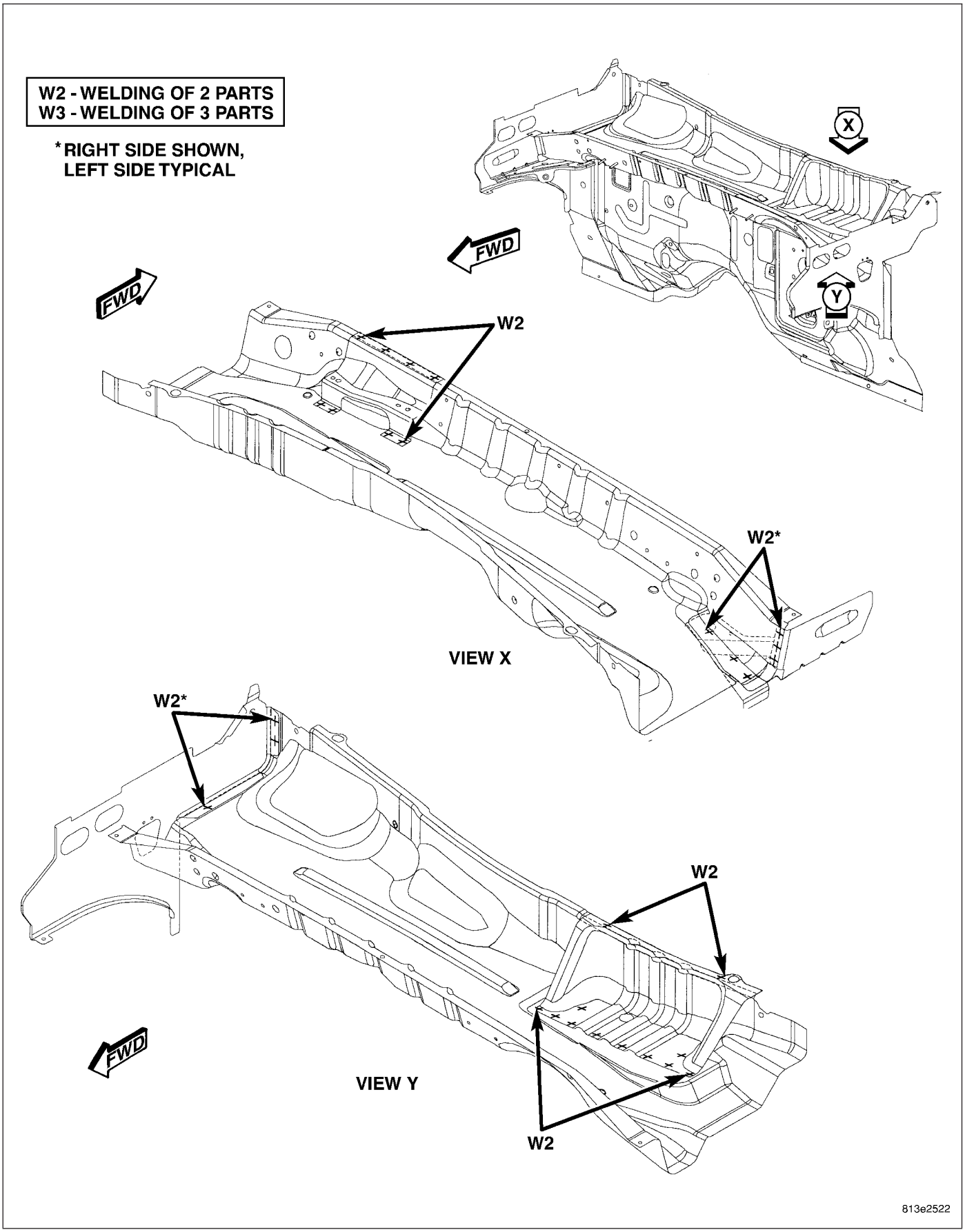


Fig. 120 DASH/PLENUM (2 OF 3)

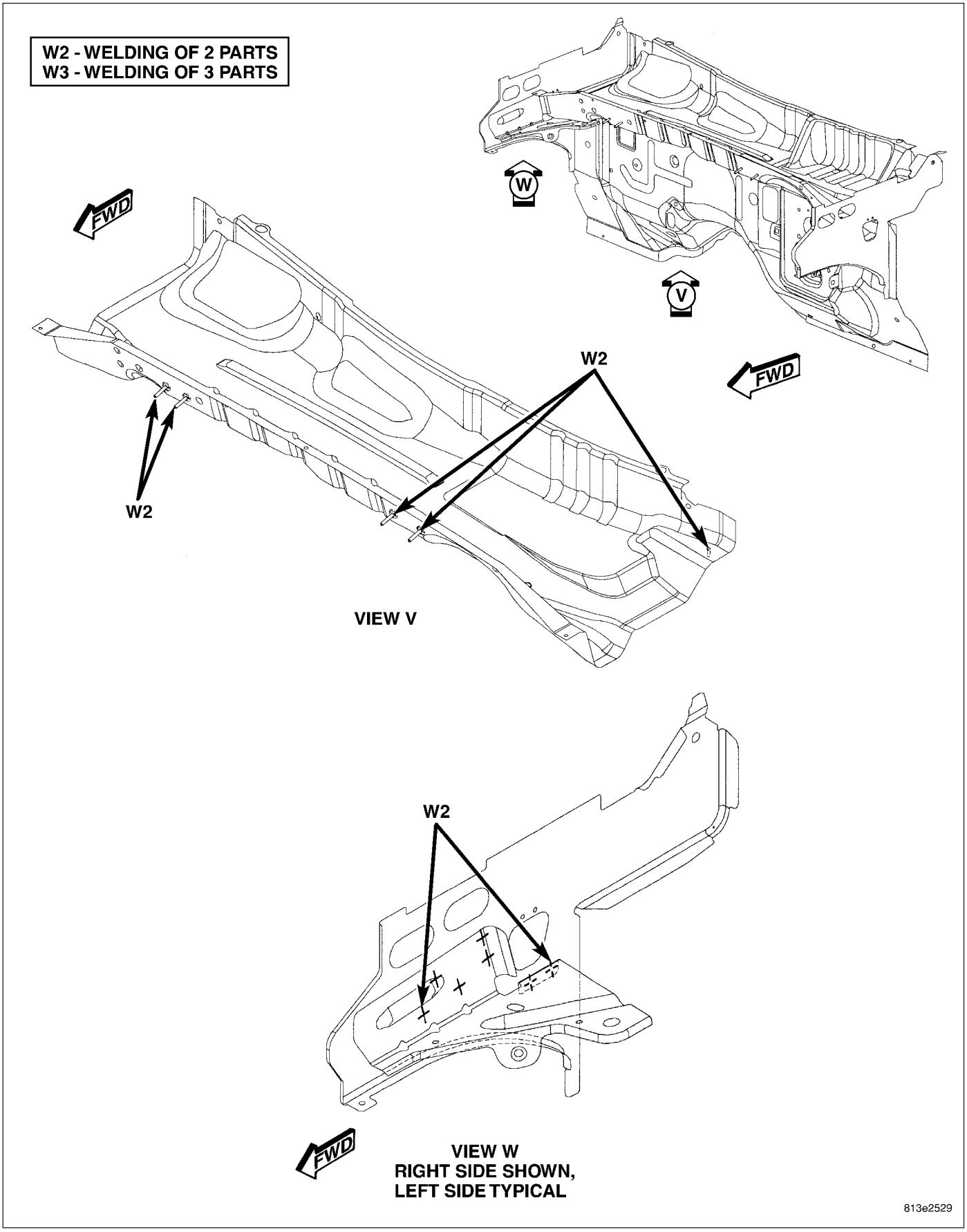


Fig. 121 DASH/PLENUM (3 OF 3)

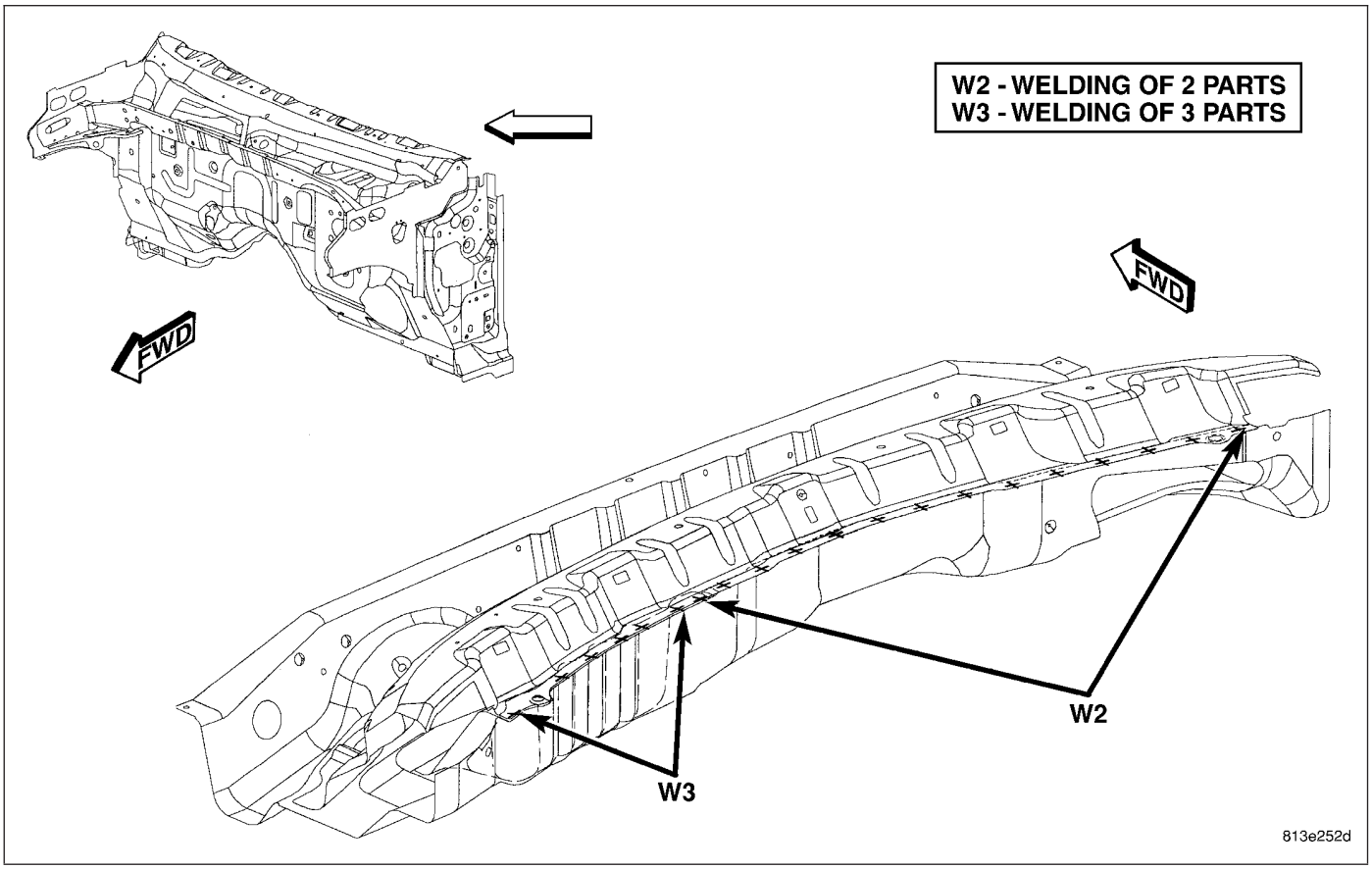


Fig. 122 DASH PANEL (1 OF 6)

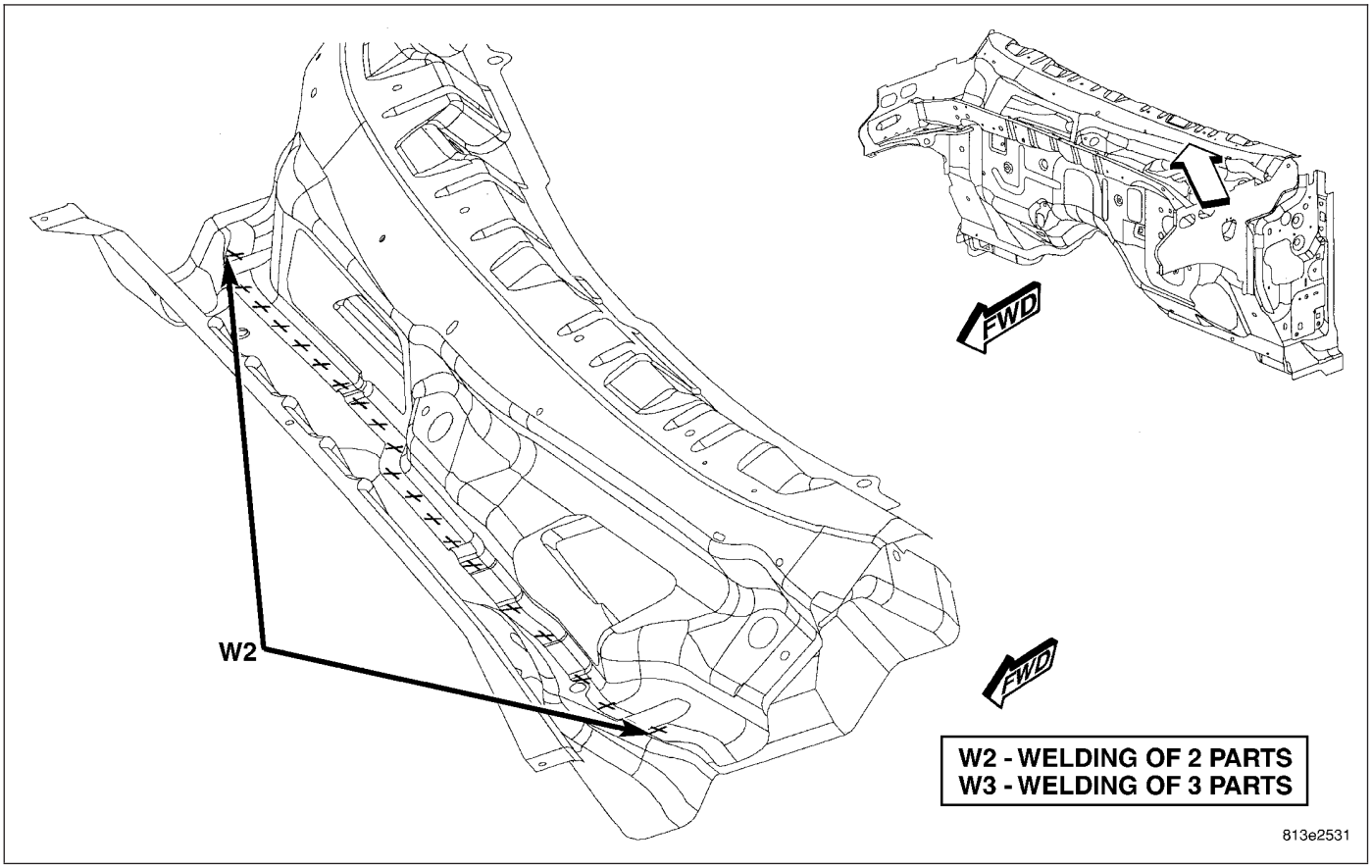


Fig. 123 DASH PANEL (2 OF 6)

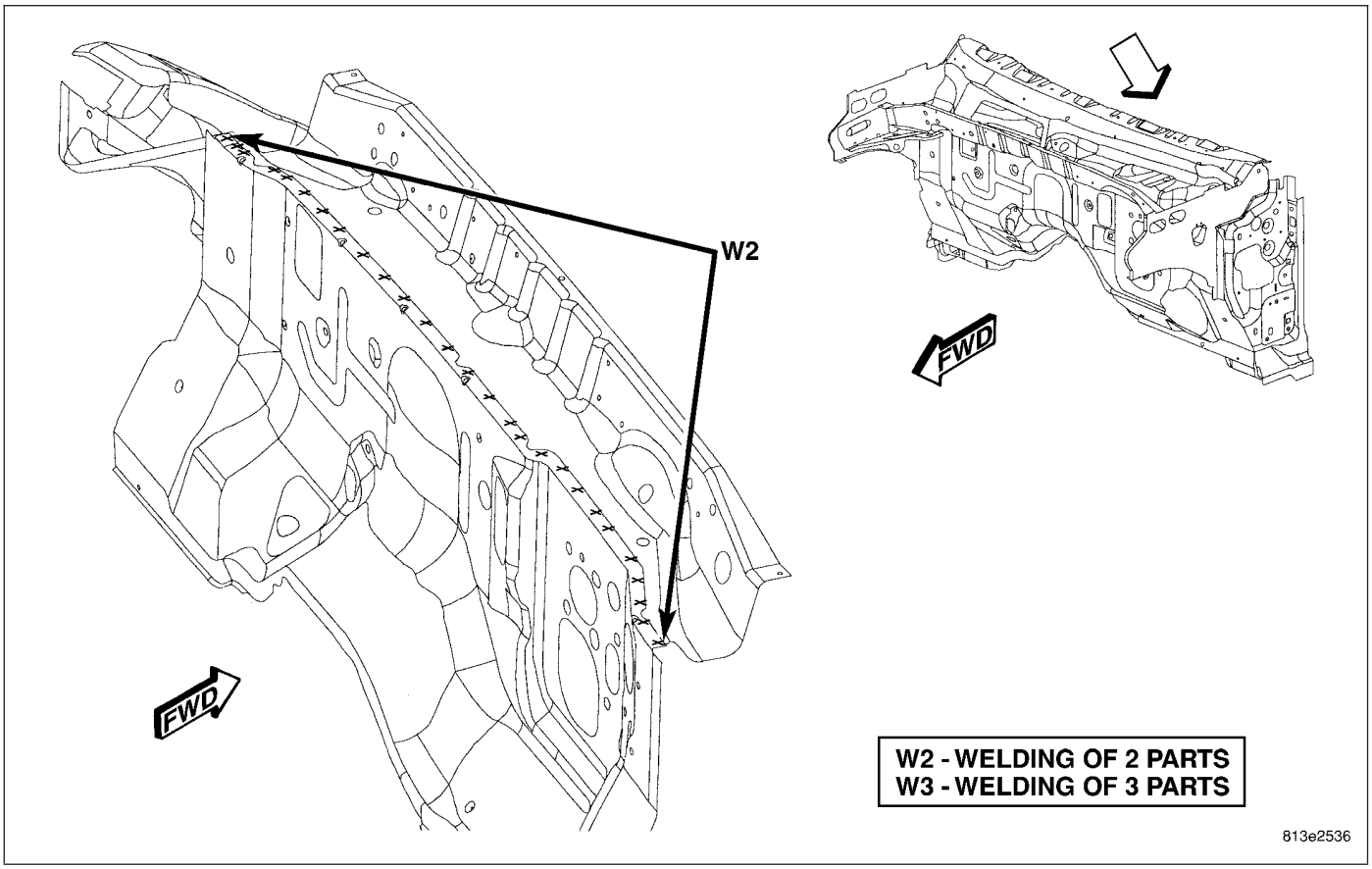


Fig. 124 DASH PANEL (3 OF 6)

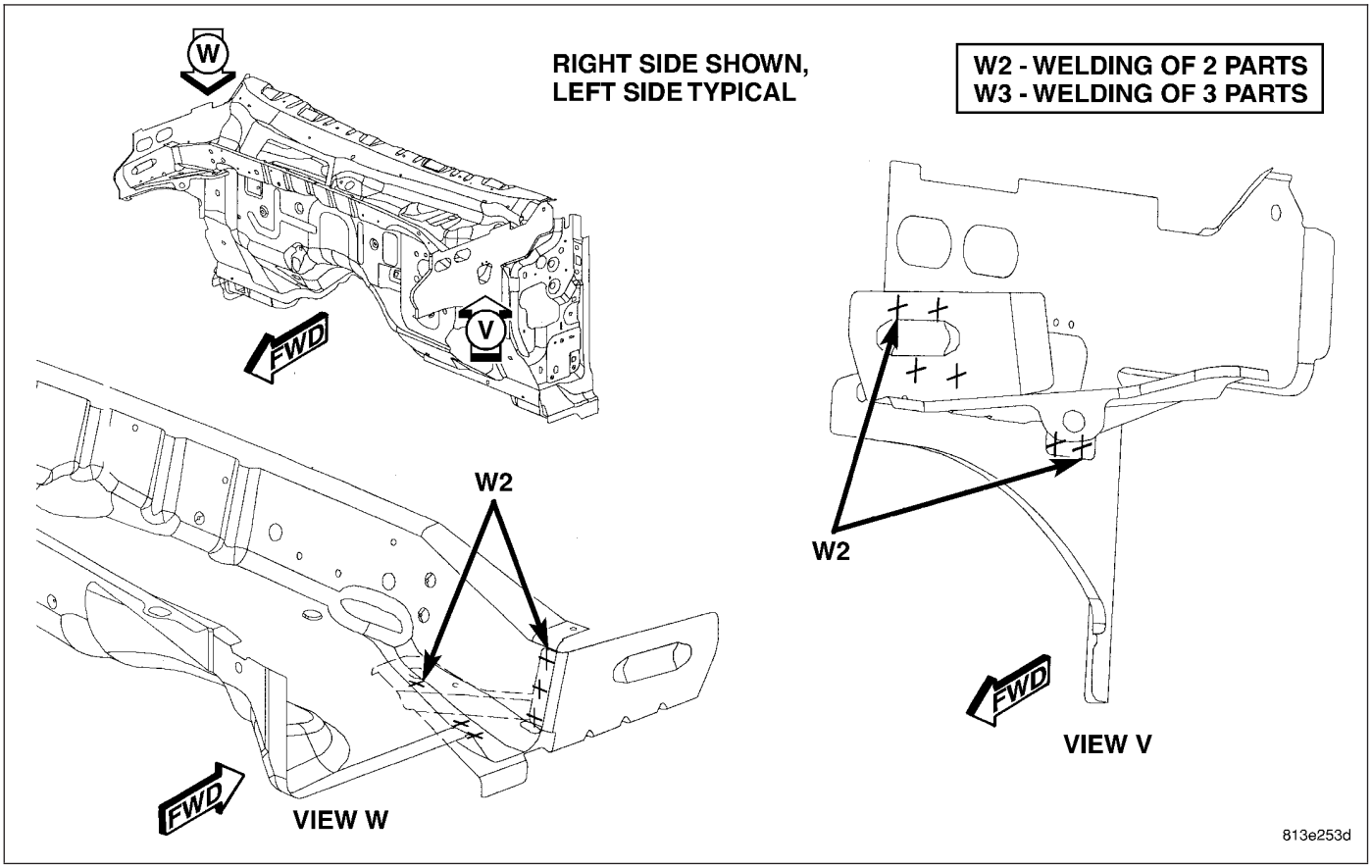


Fig. 125 DASH PANEL (4 OF 6)

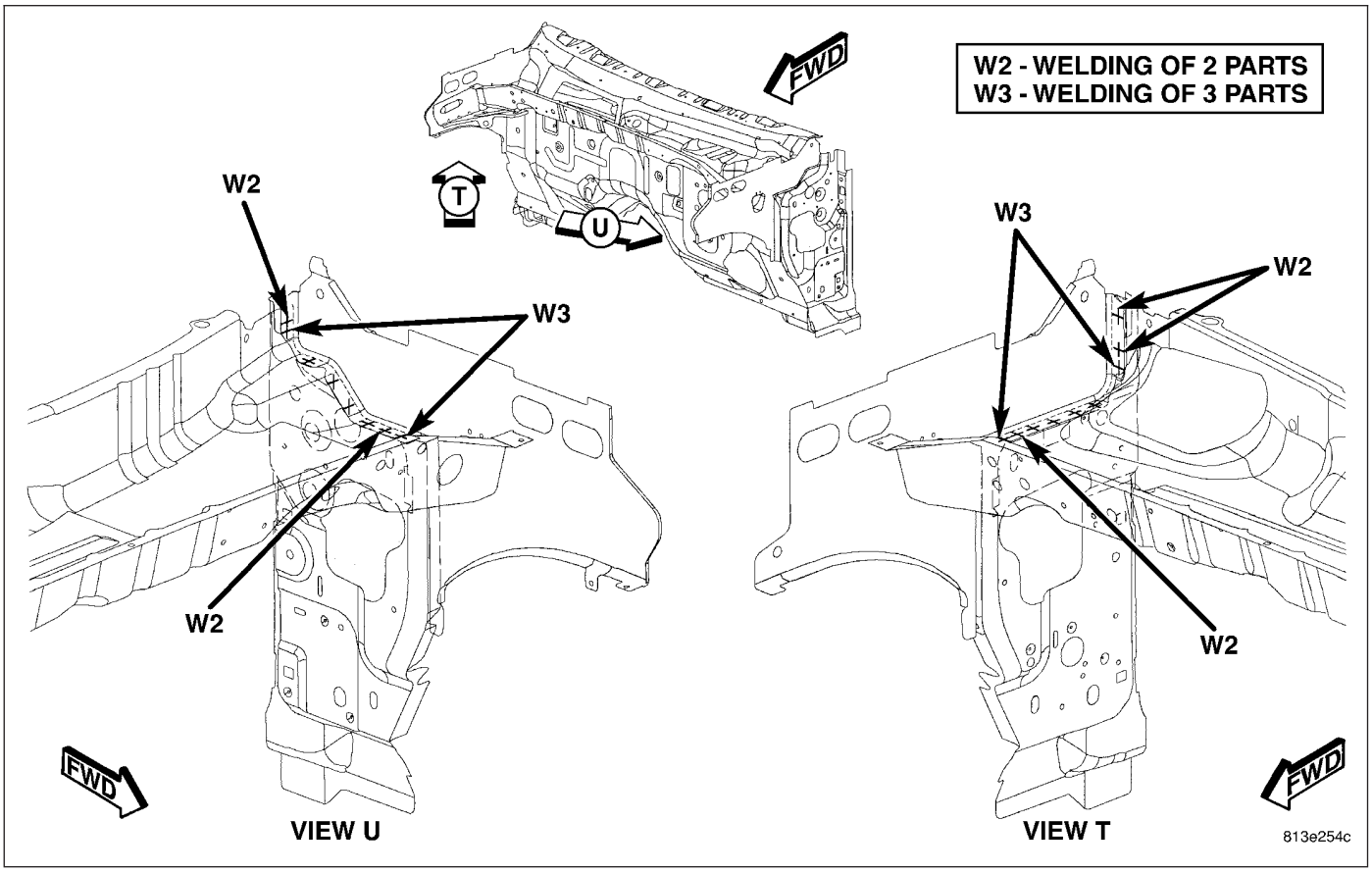


Fig. 126 DASH PANEL (5 OF 6)

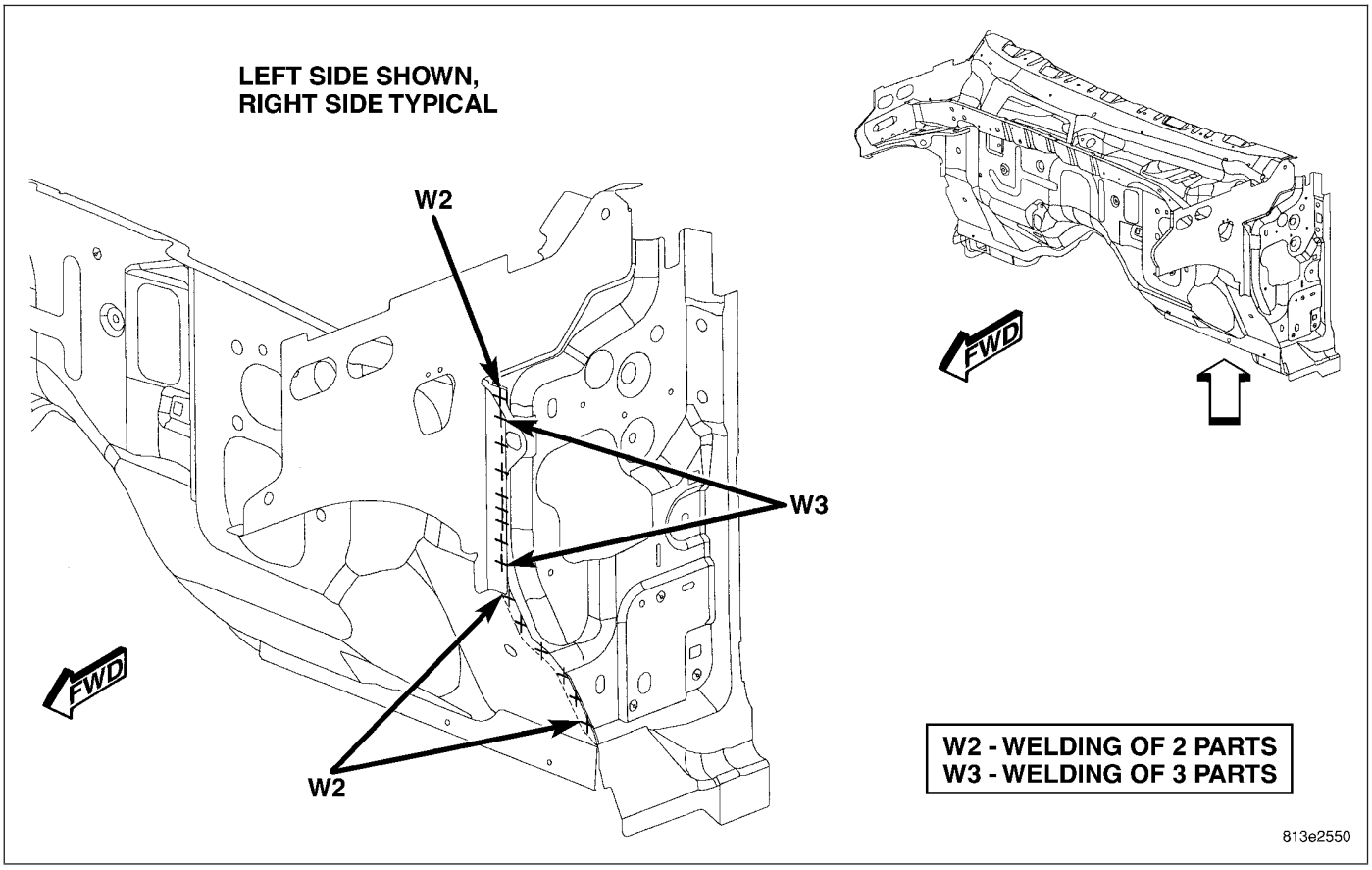


Fig. 127 DASH PANEL (6 OF 6)

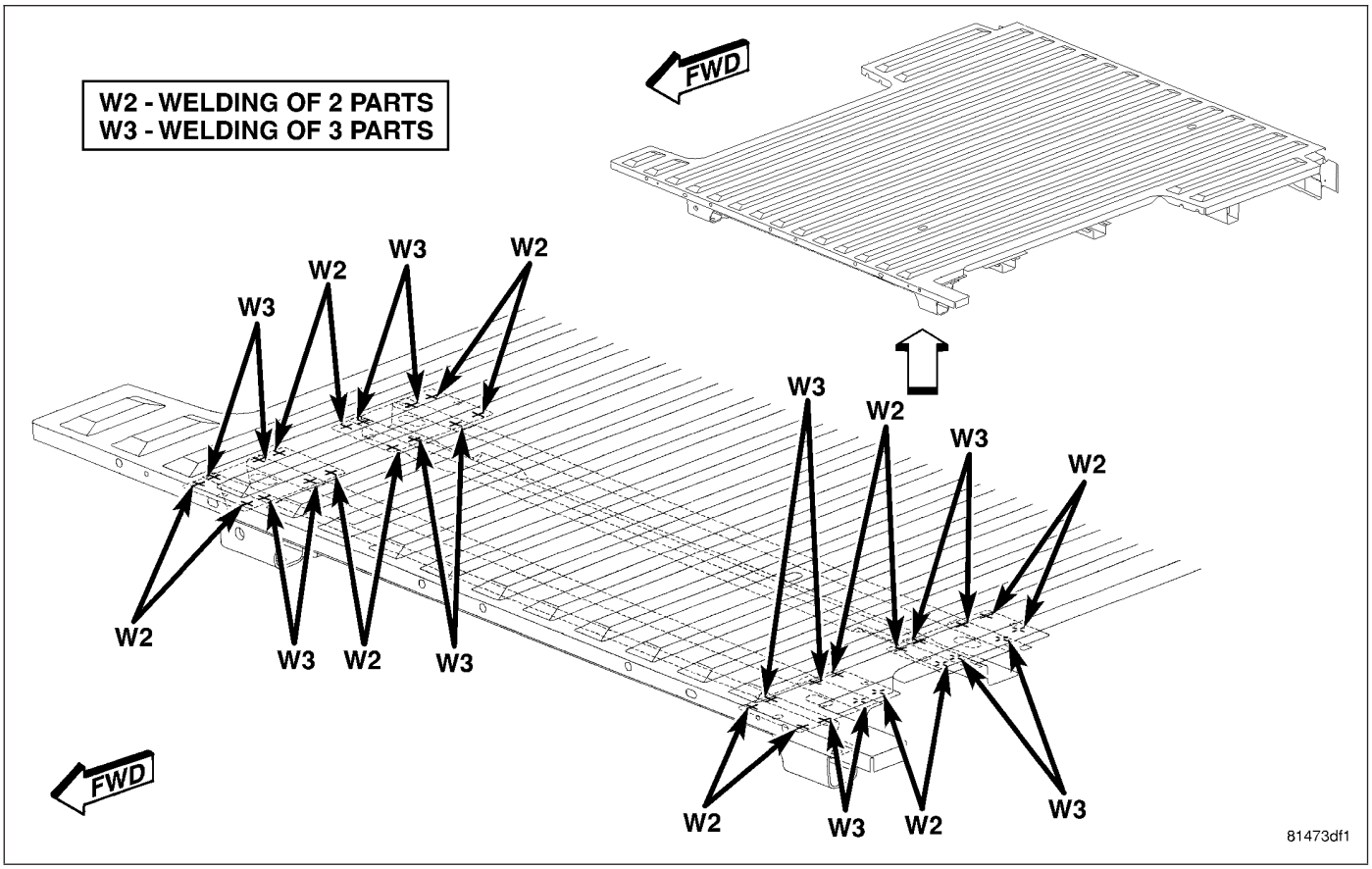


Fig. 128 BOX FLOOR 5.5 (1 OF 4)

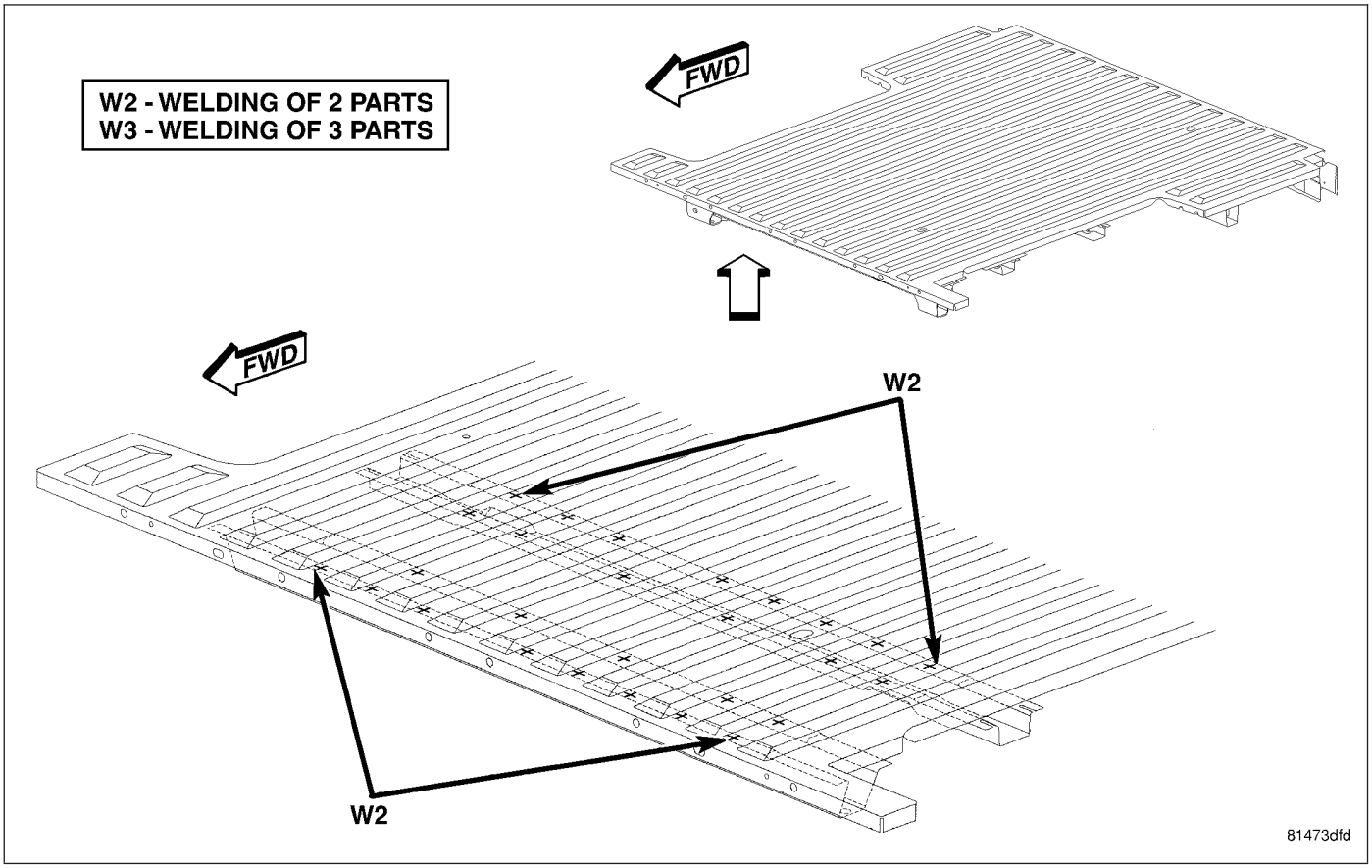


Fig. 129 BOX FLOOR 5.5 (2 OF 4)

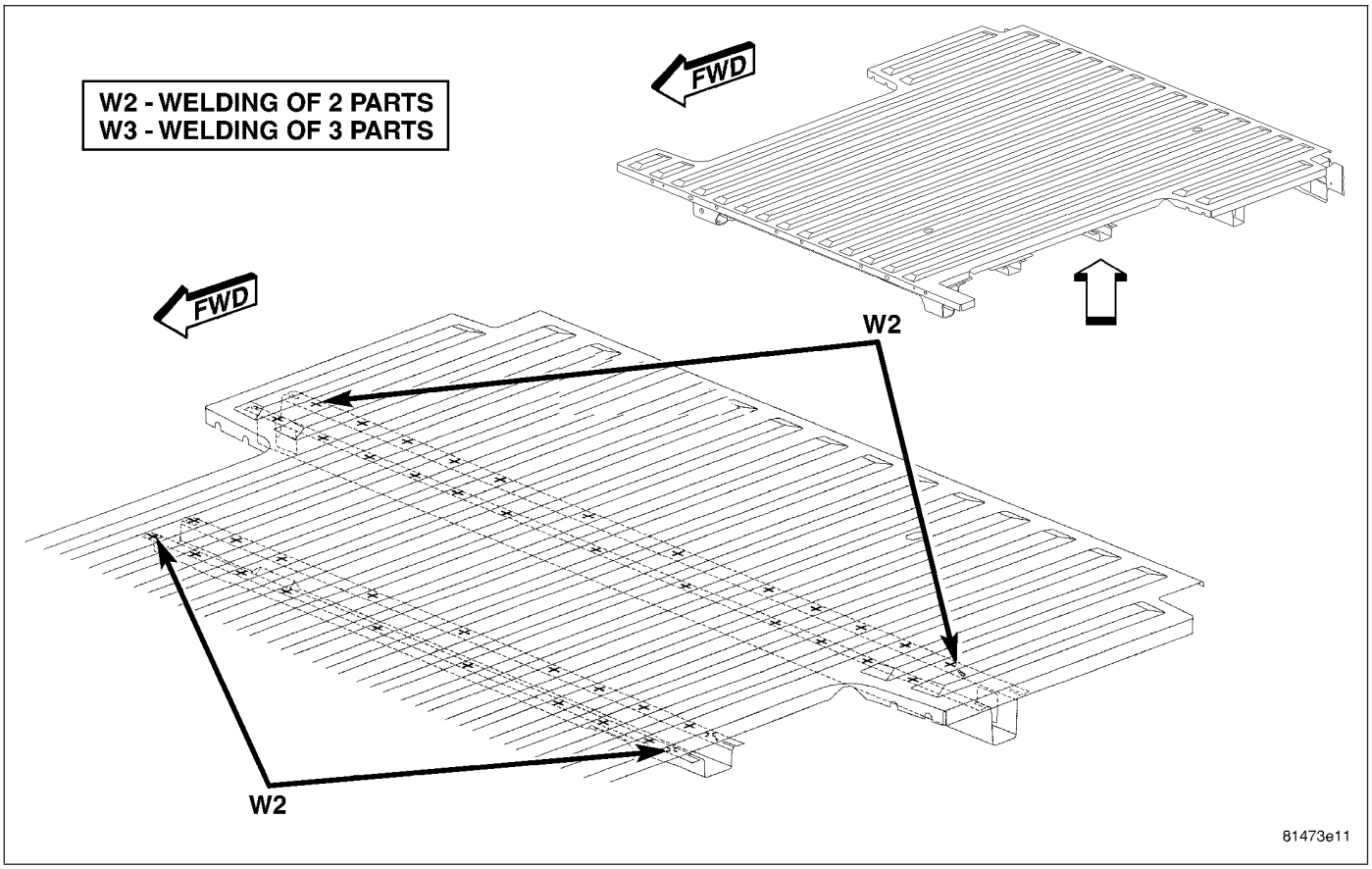


Fig. 130 BOX FLOOR 5.5 (3 OF 4)

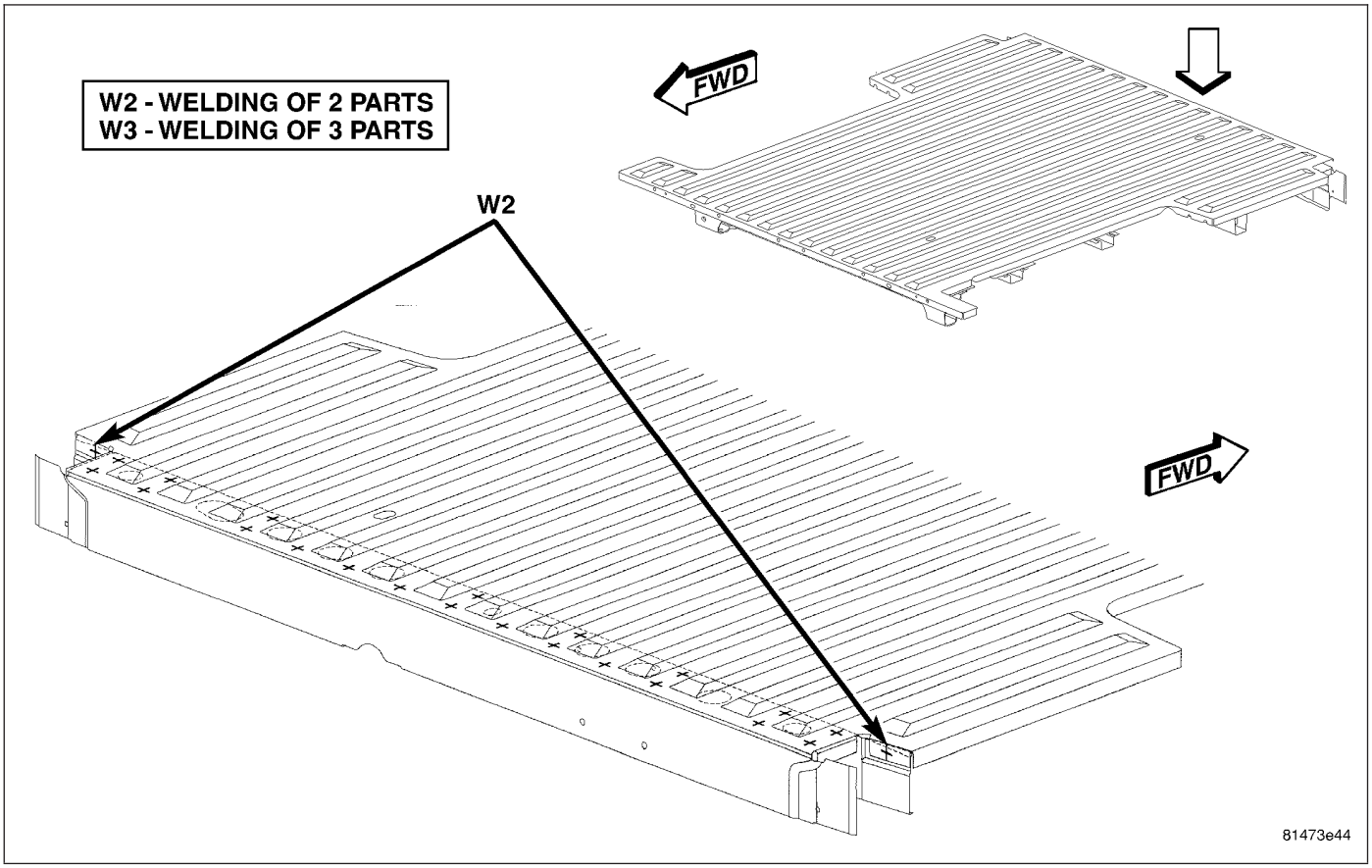


Fig. 131 BOX FLOOR 5.5 (4 OF 4)

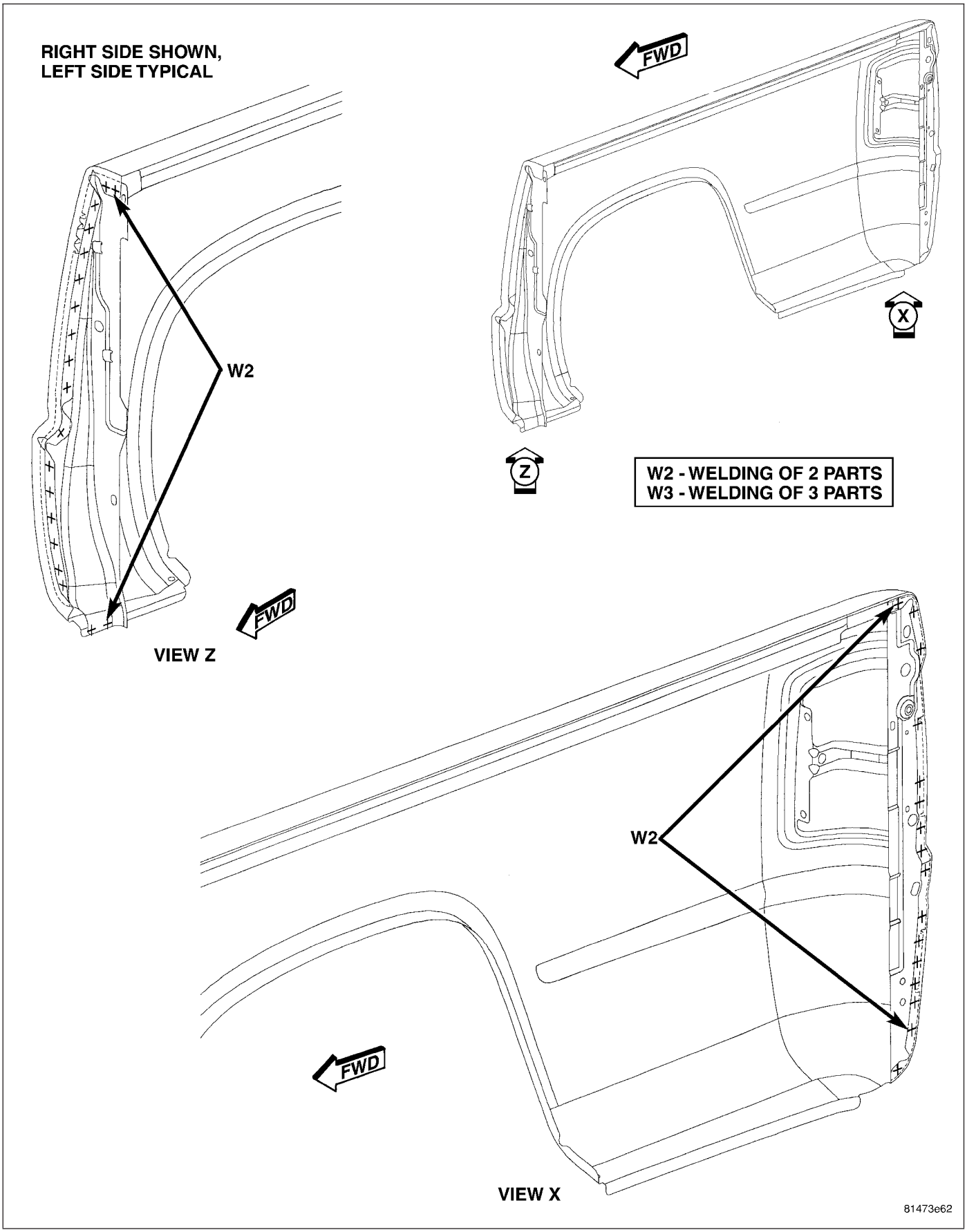


Fig. 132 BOX SIDE 5.5 (1 OF 3)

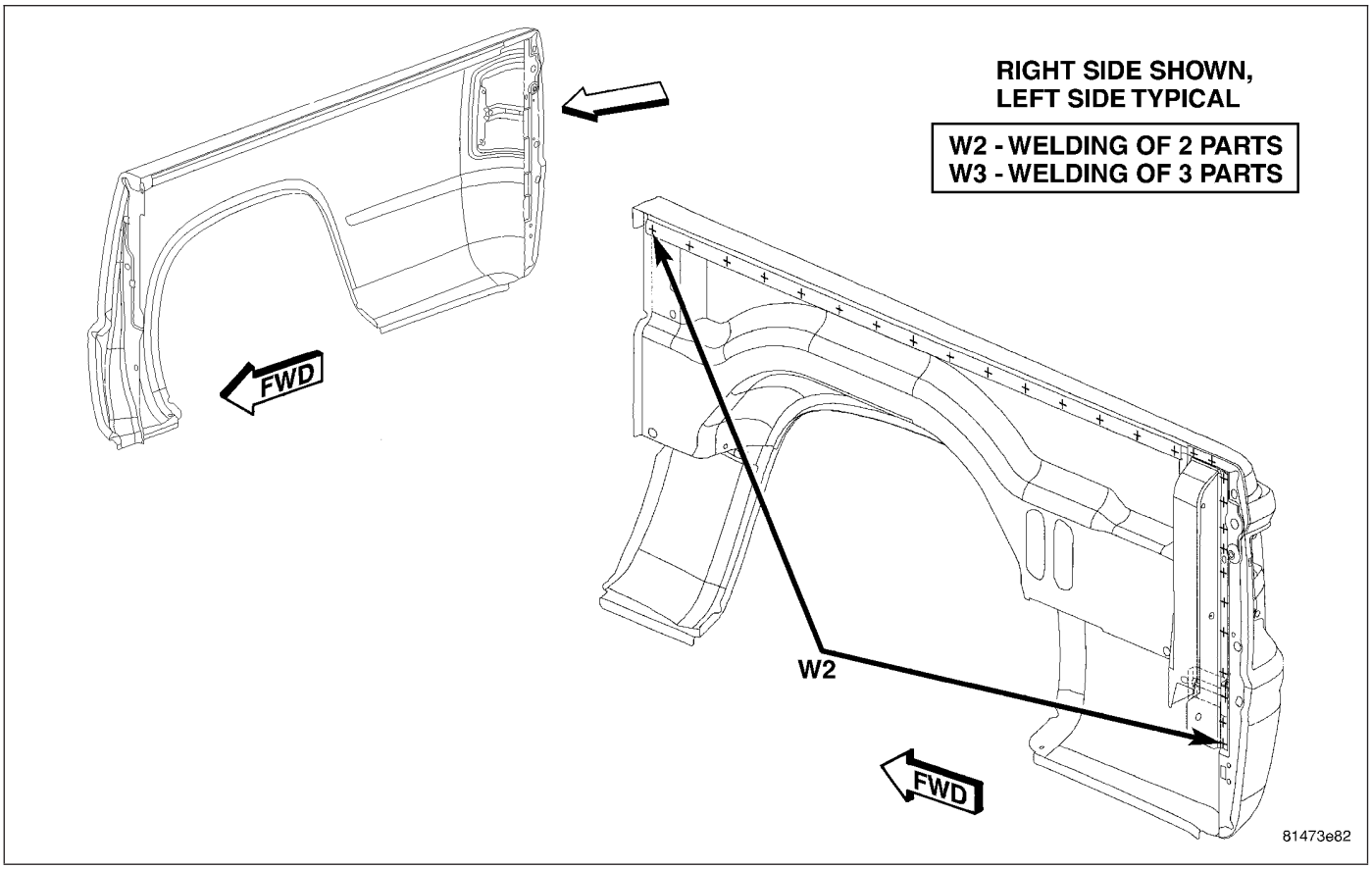


Fig. 133 BOX SIDE 5.5 (2 OF 3)

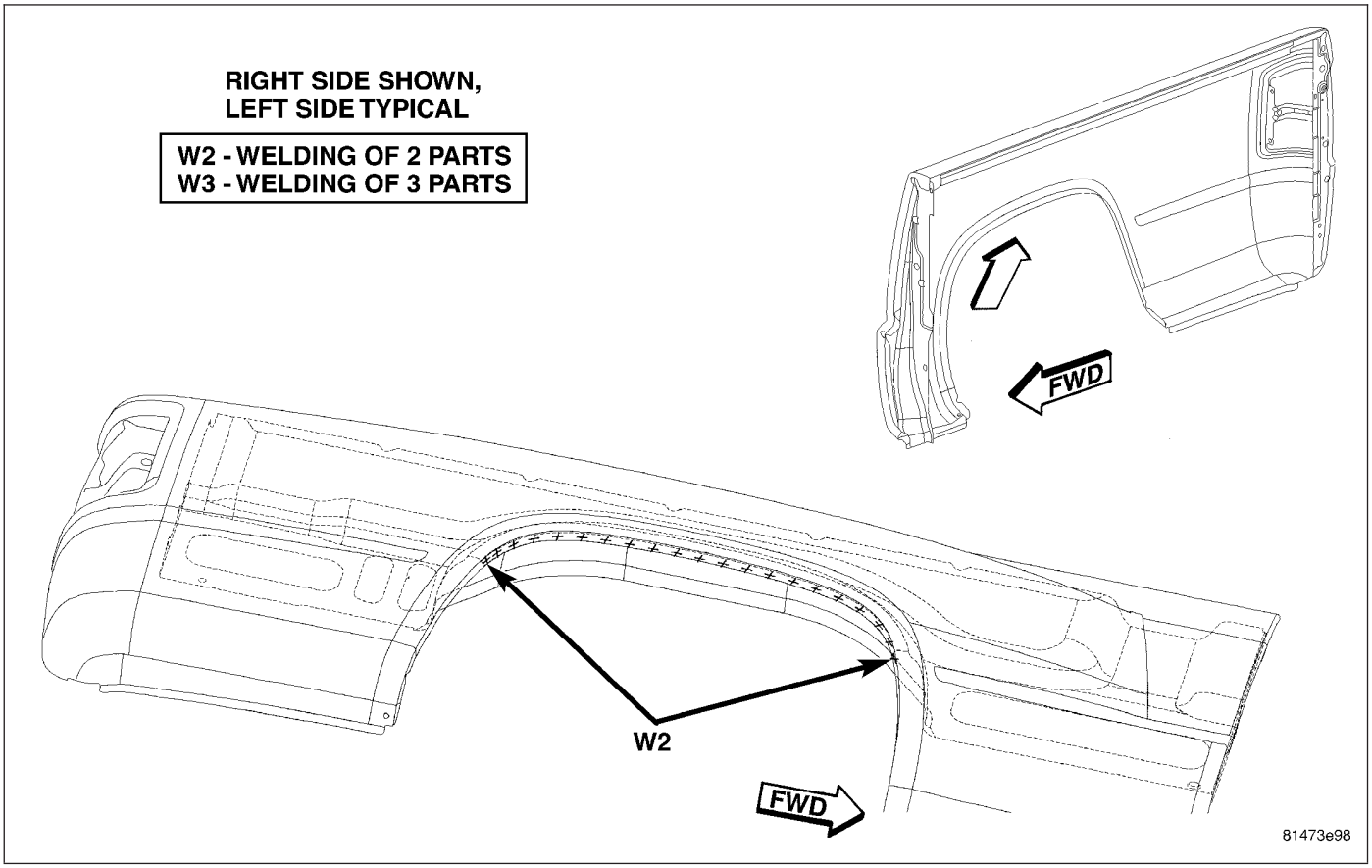


Fig. 134 BOX SIDE 5.5 (3 OF 3)

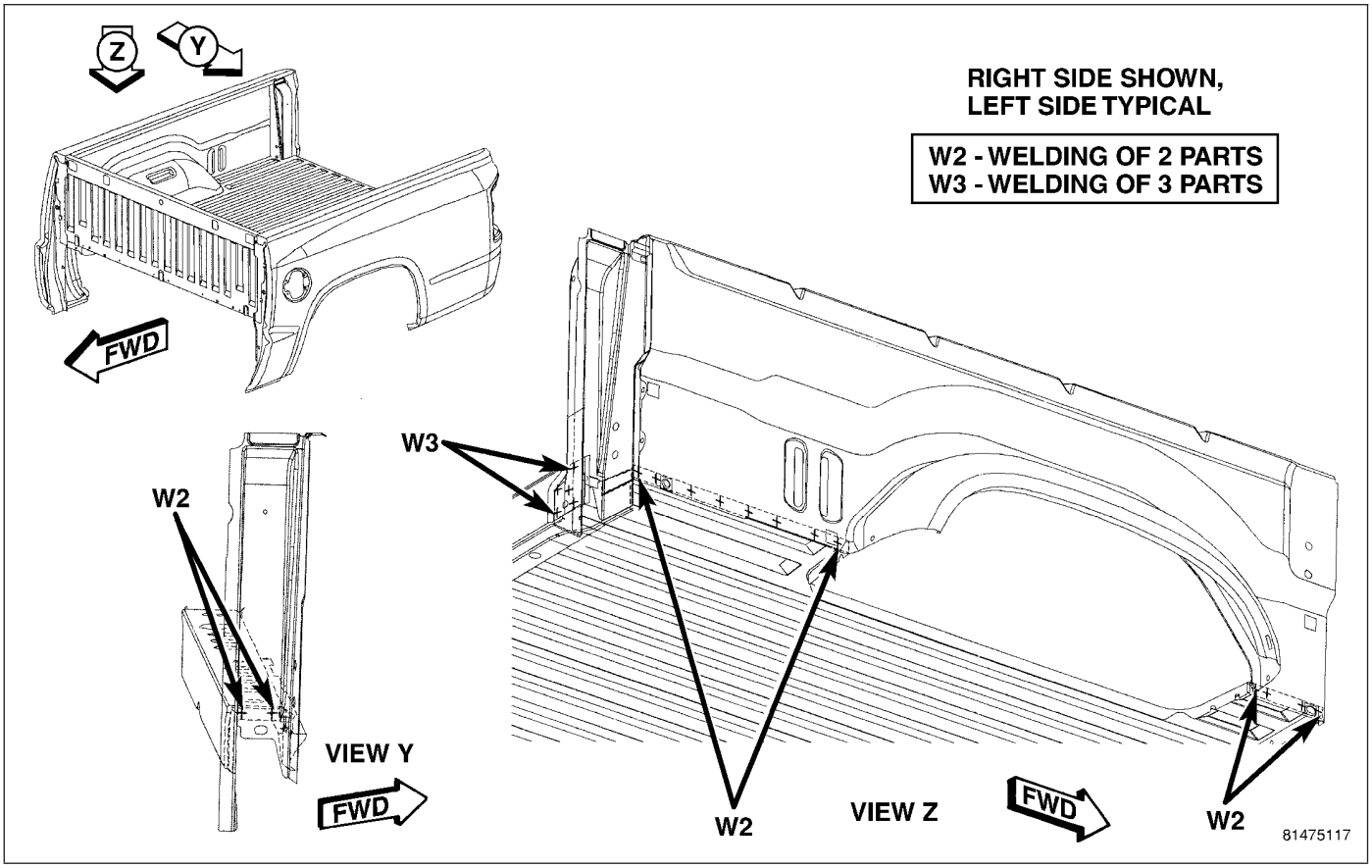


Fig. 135 BOX COMPLETE 5.5 (1 OF 5)

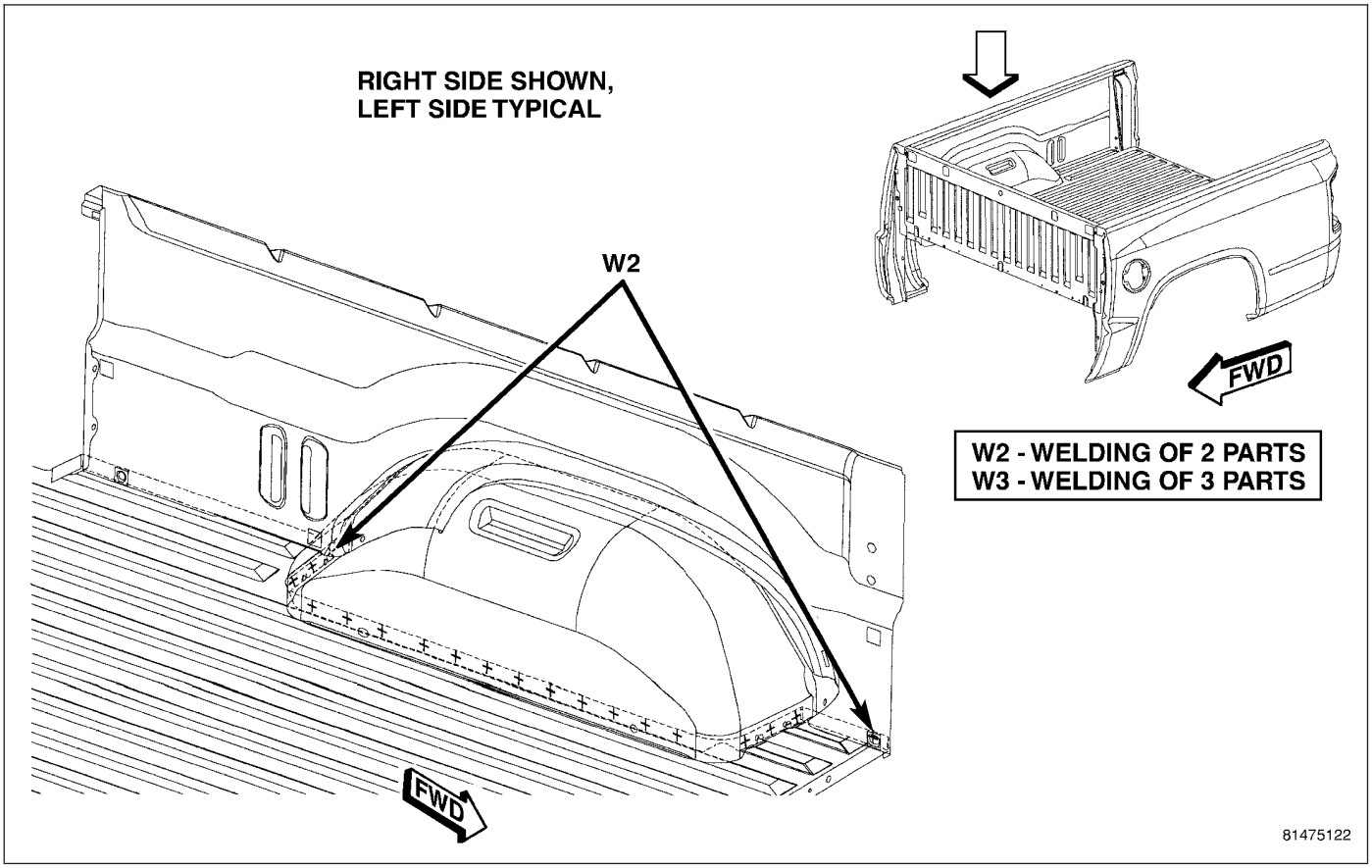


Fig. 136 BOX COMPLETE 5.5 (2 OF 5)

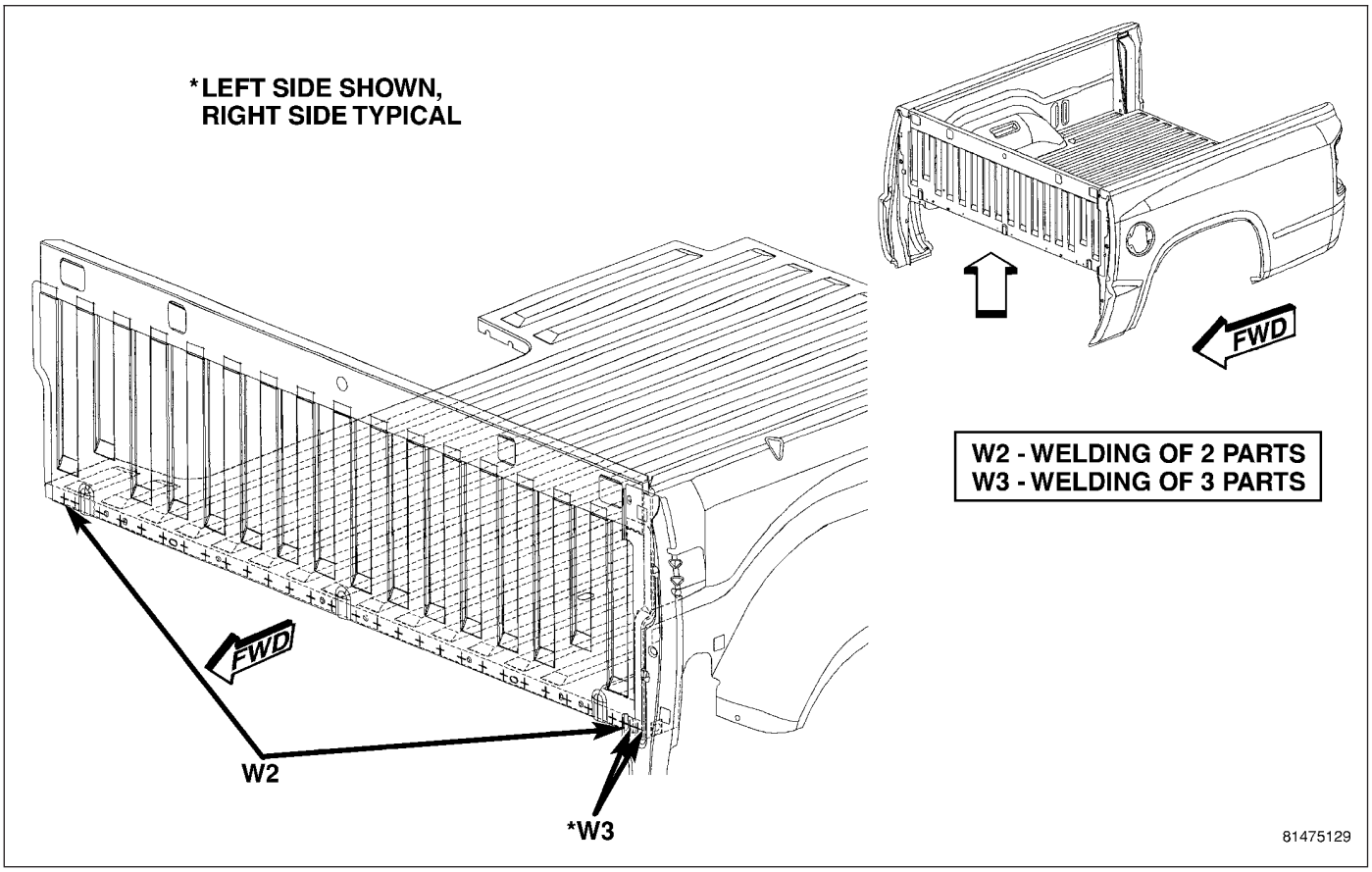


Fig. 137 BOX COMPLETE 5.5 (3 OF 5)

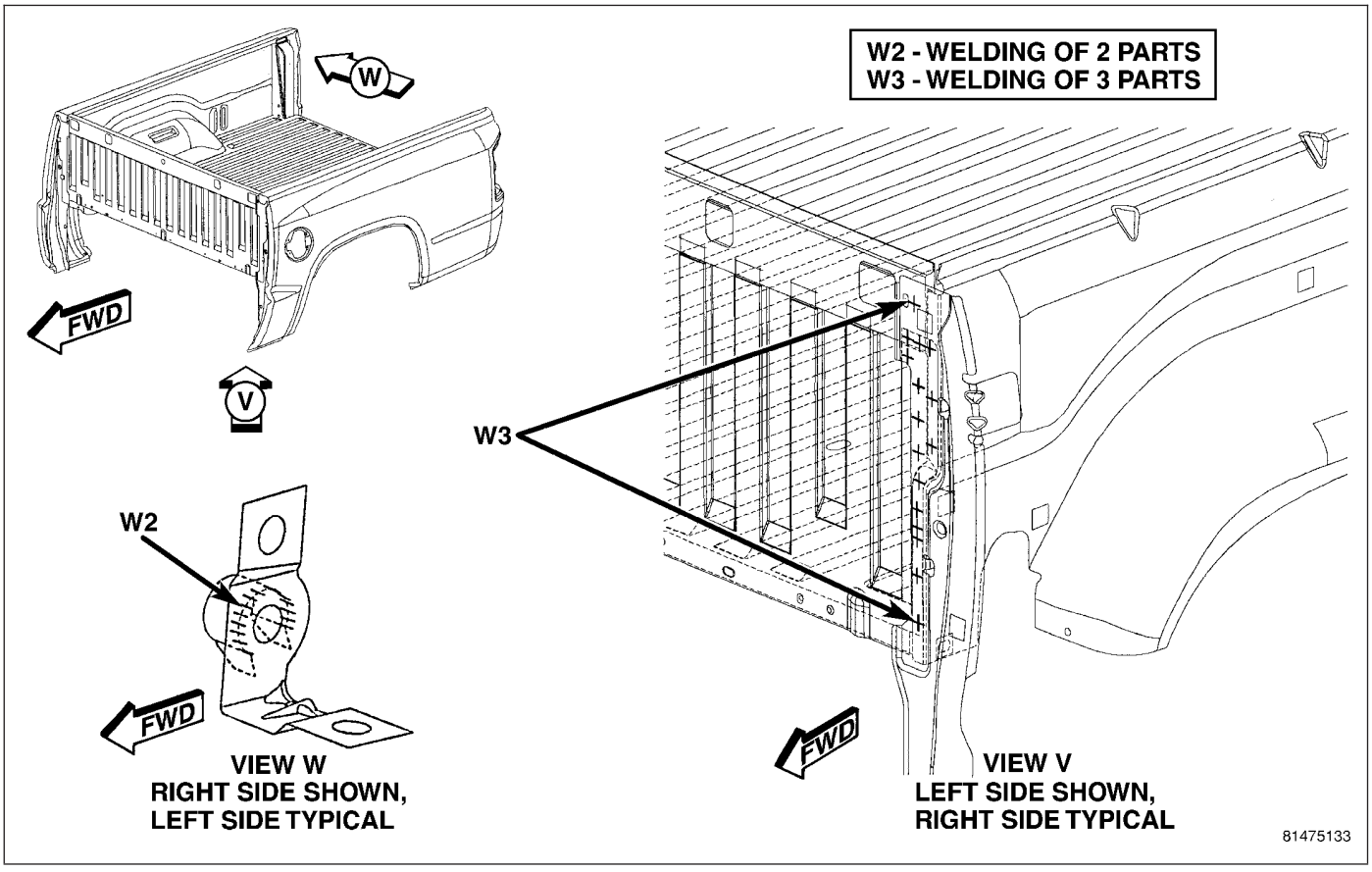


Fig. 138 BOX COMPLETE 5.5 (4 OF 5)

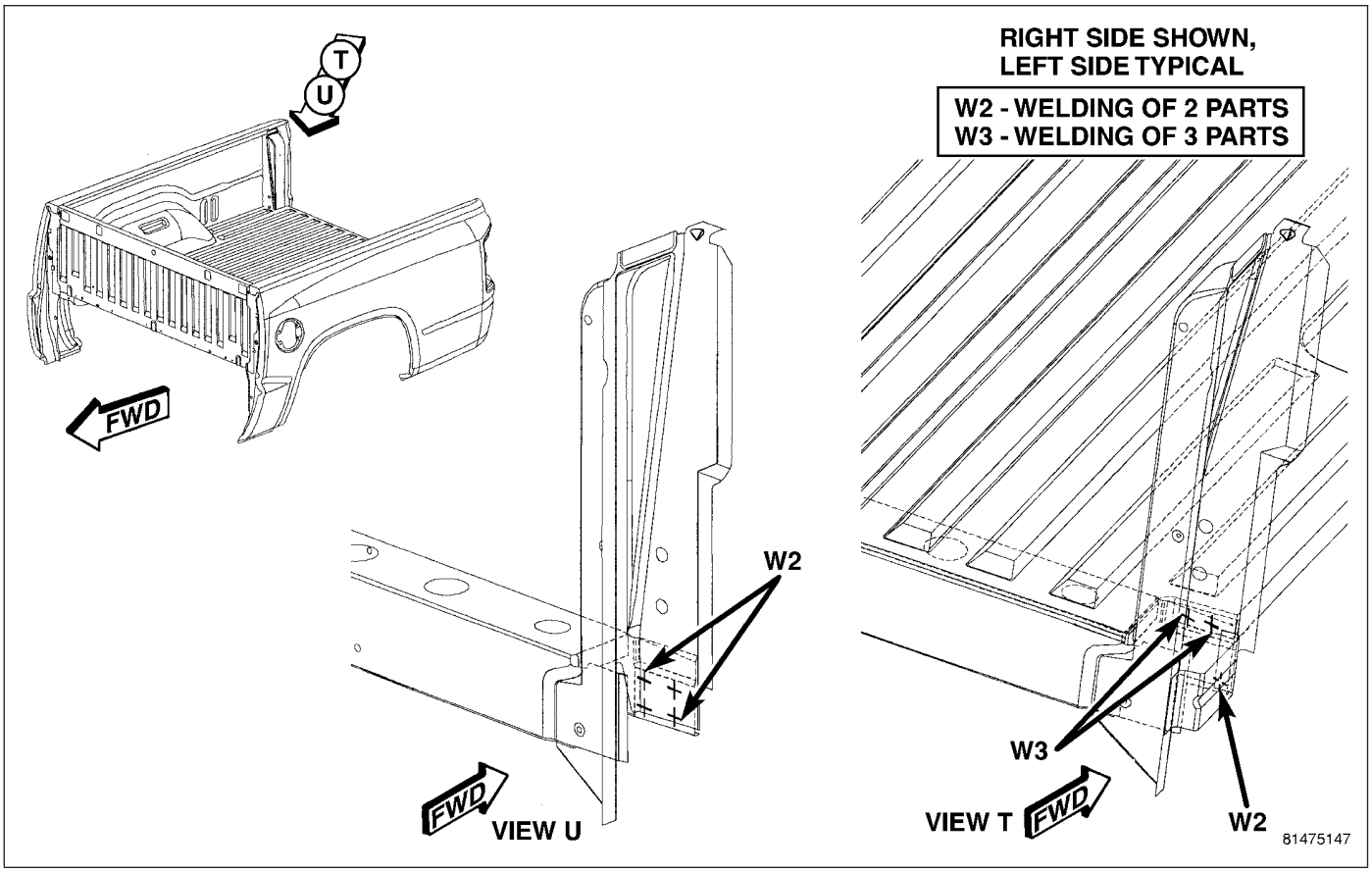


Fig. 139 BOX COMPLETE 5.5 (5 OF 5)

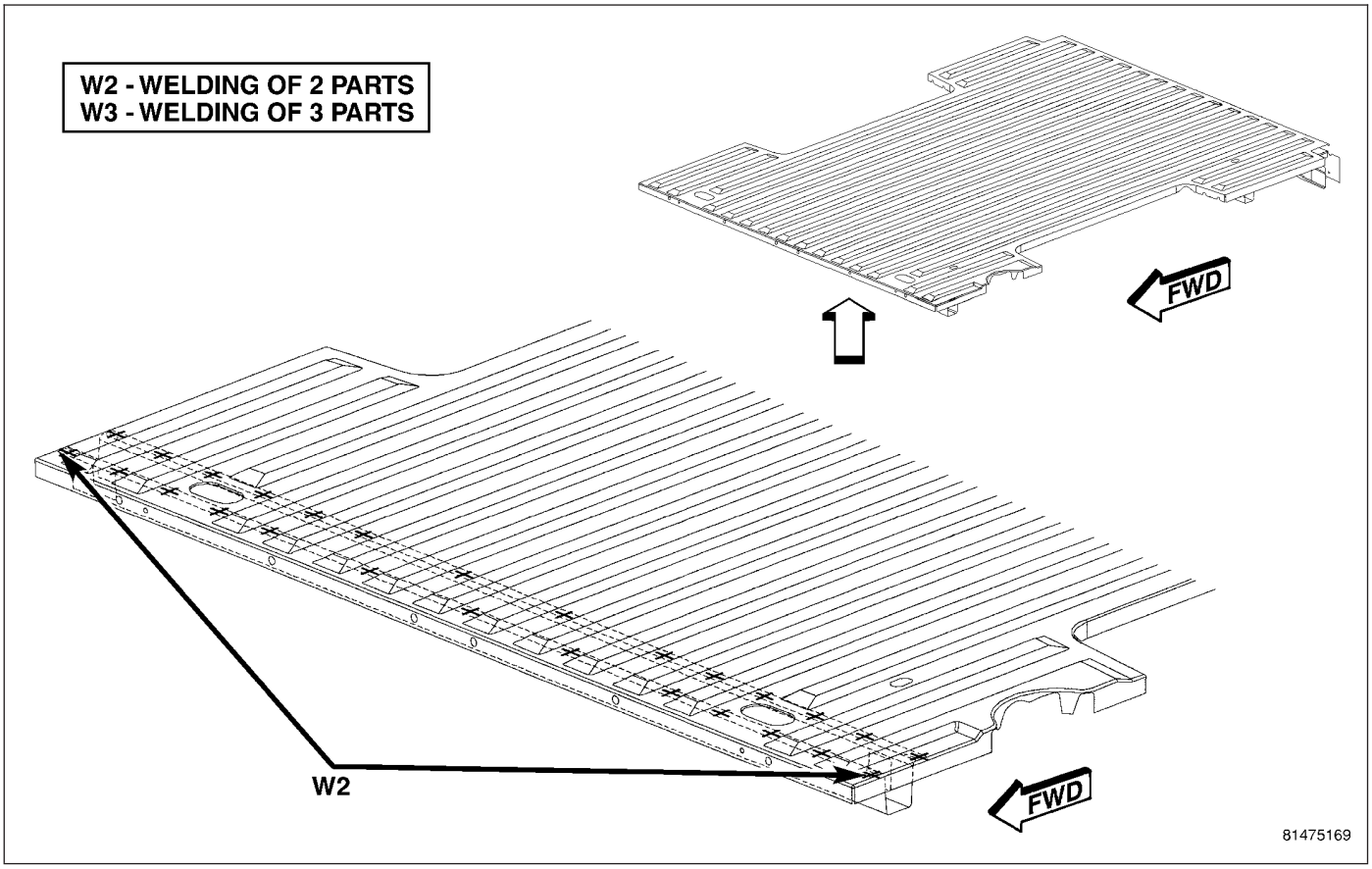


Fig. 140 BOX FLOOR 6.5 (1 OF 4)

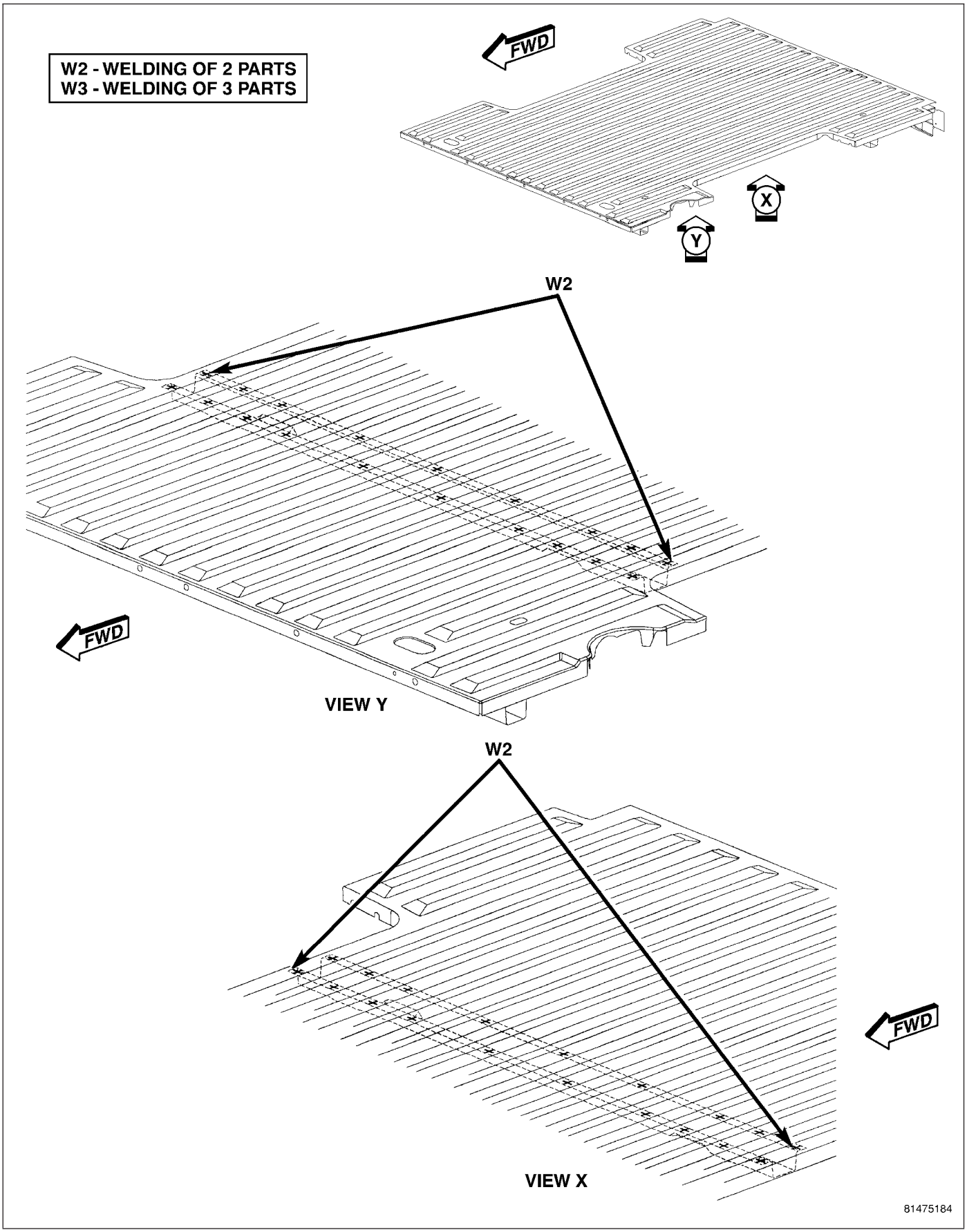


Fig. 141 BOX FLOOR 6.5 (2 OF 4)

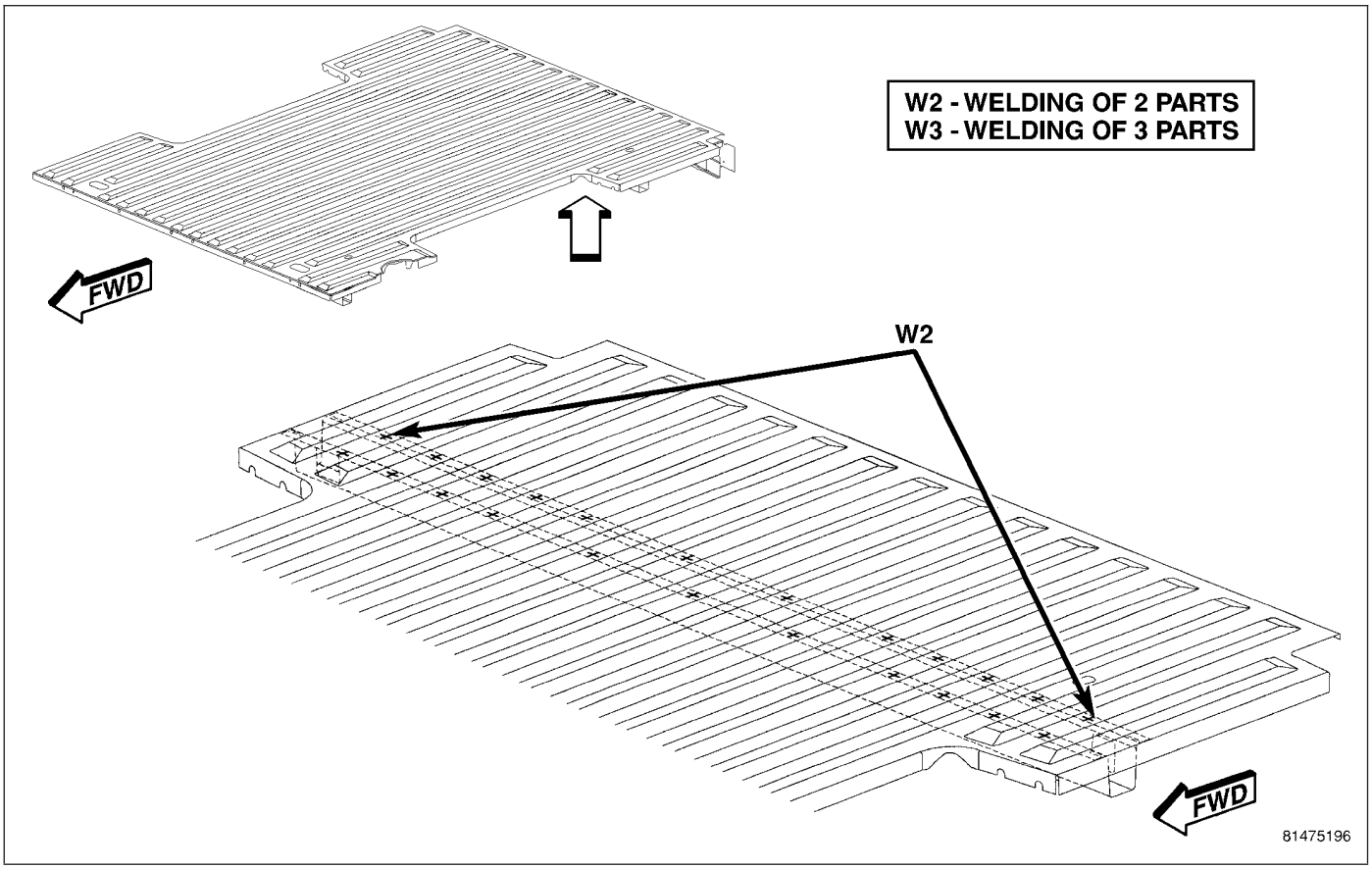


Fig. 142 BOX FLOOR 6.5 (3 OF 4)

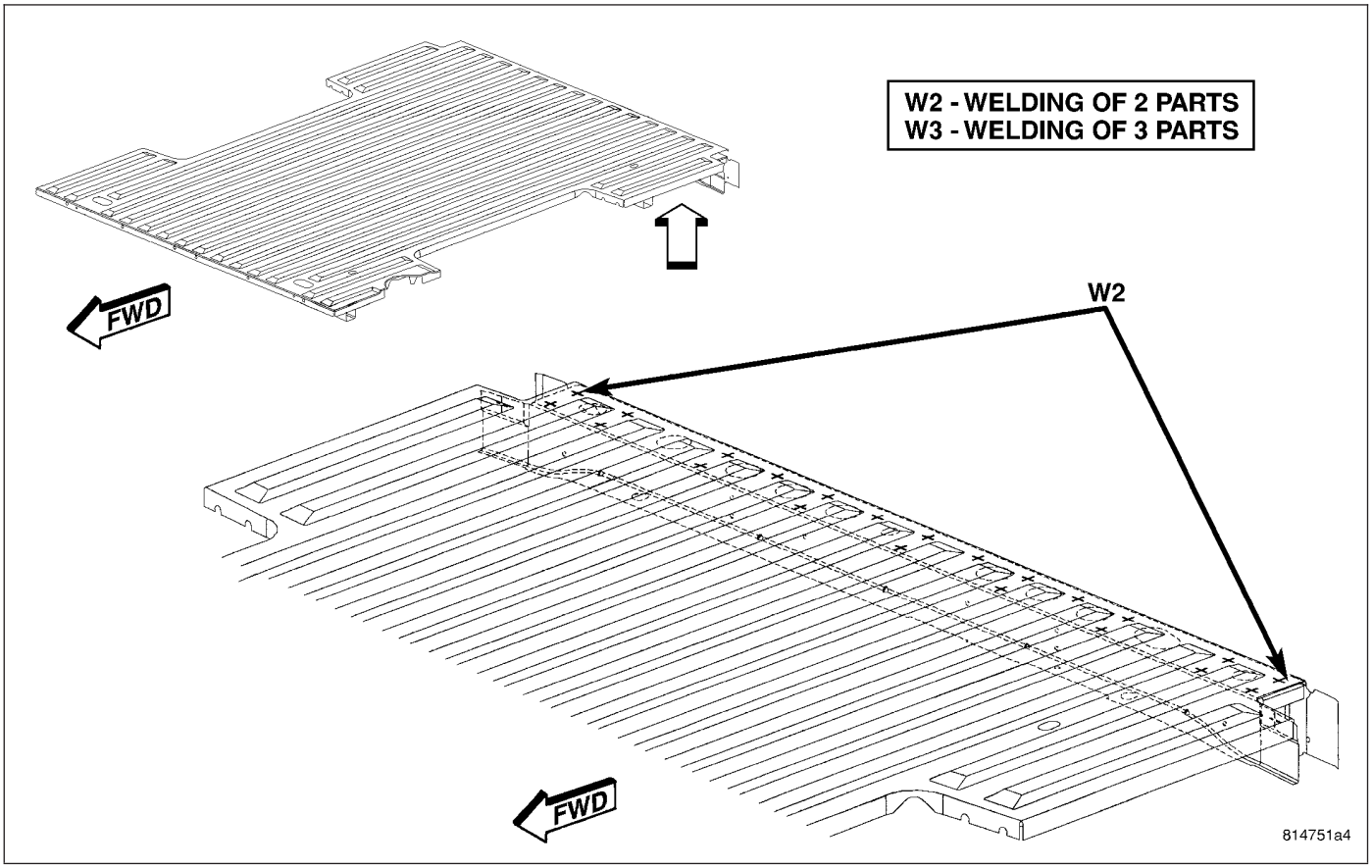


Fig. 143 BOX FLOOR 6.5 (4 OF 4)

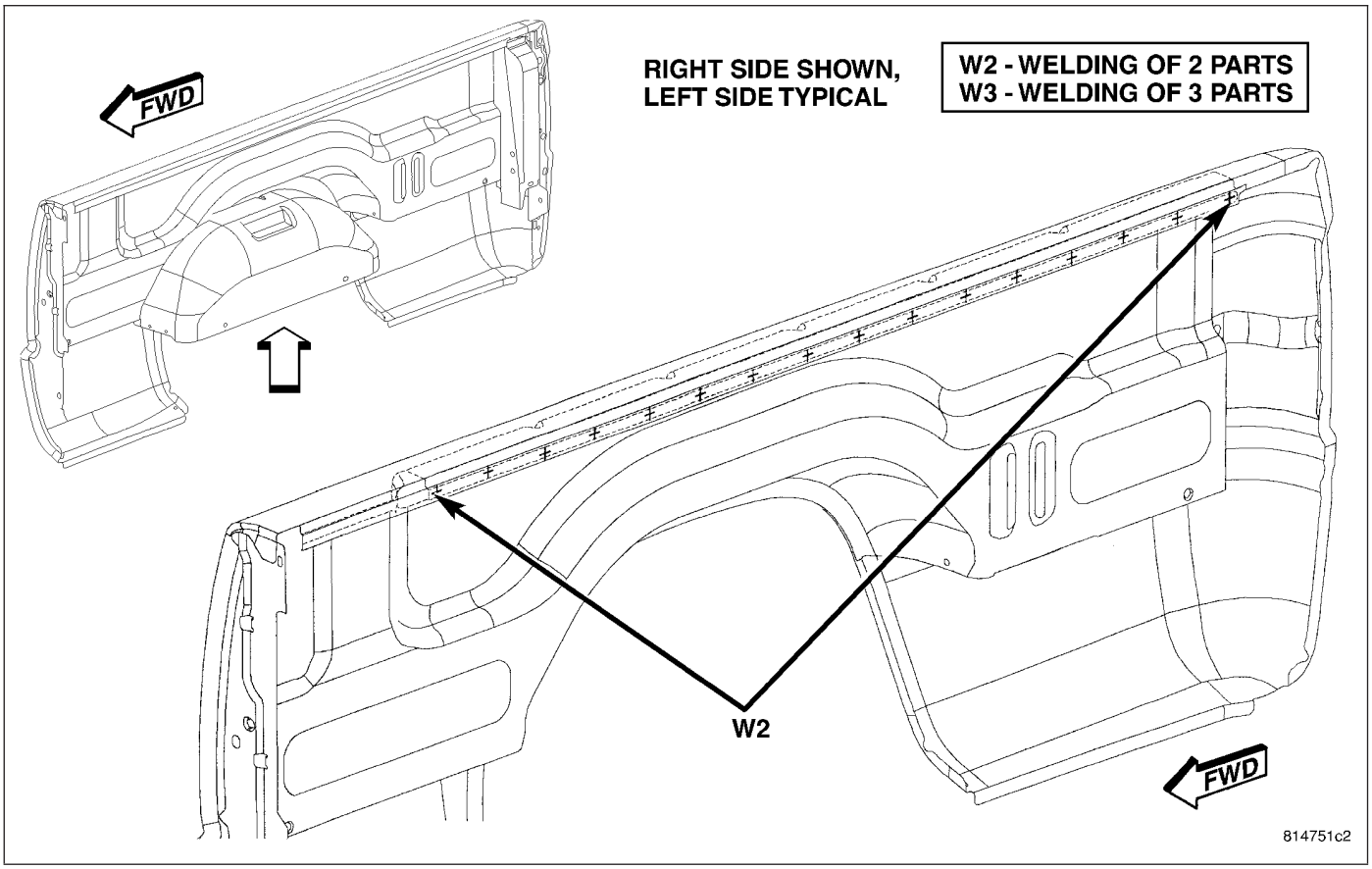


Fig. 144 BOX SIDE 6.5 (1 OF 6)

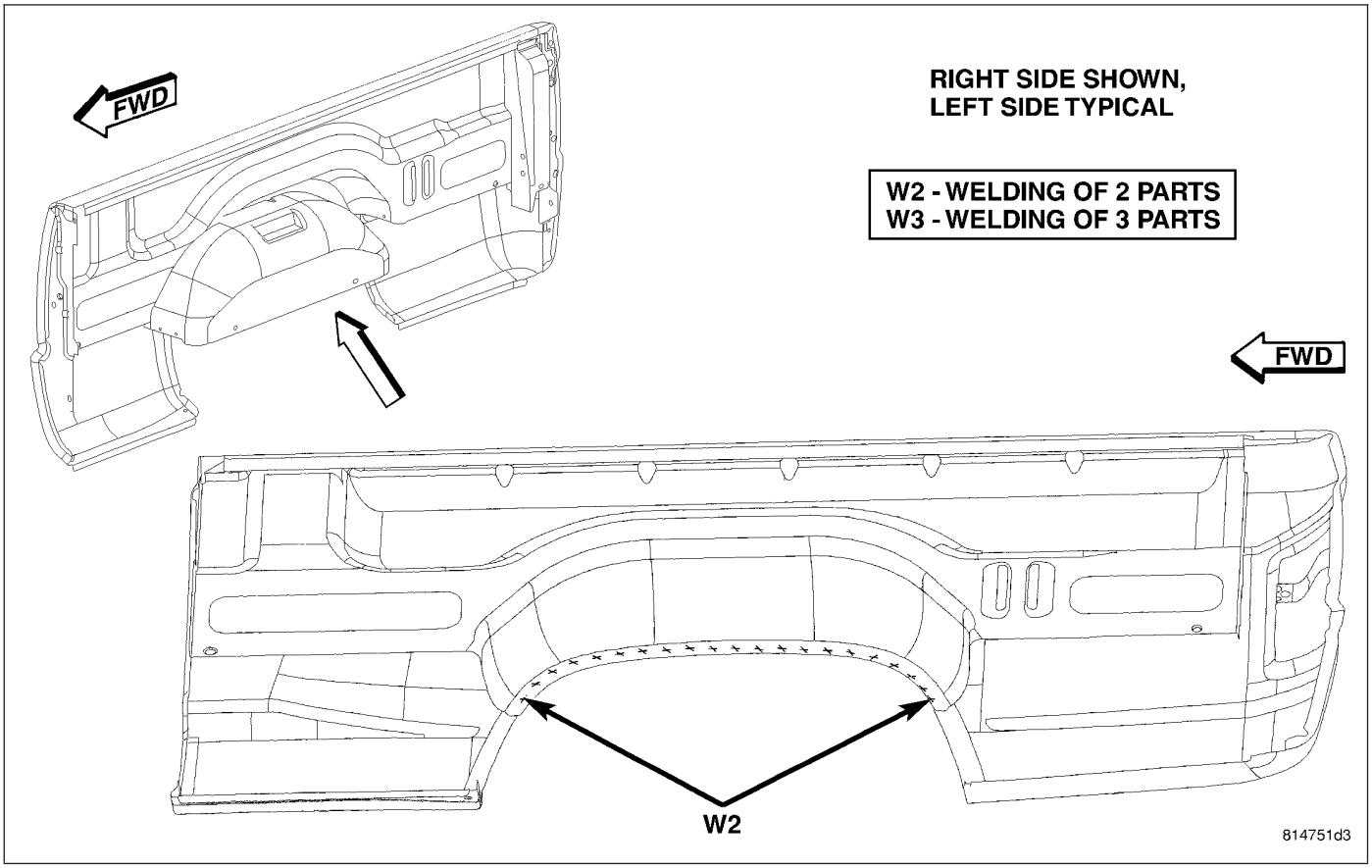


Fig. 145 BOX SIDE 6.5 (2 OF 6)

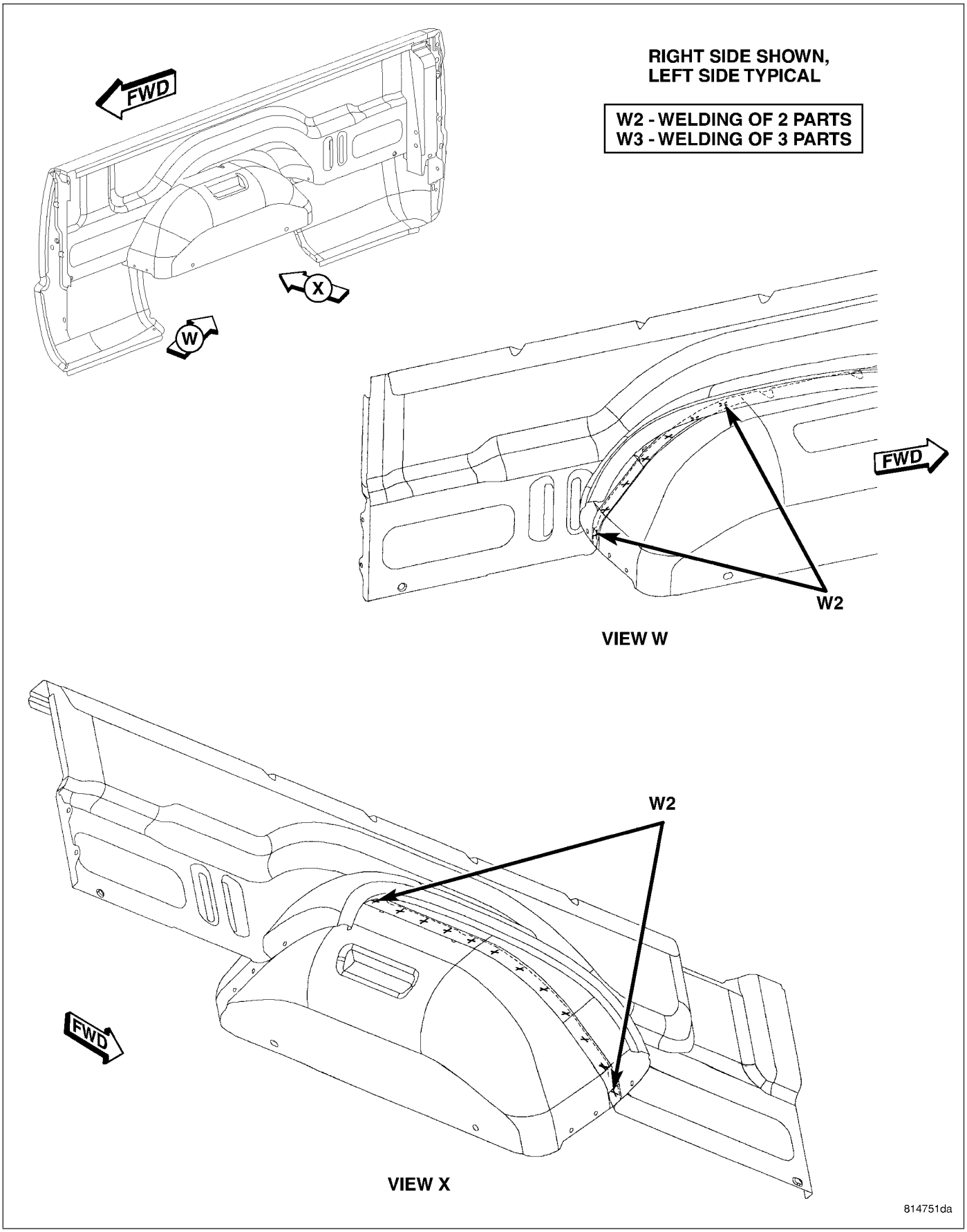


Fig. 146 BOX SIDE 6.5 (3 OF 6)

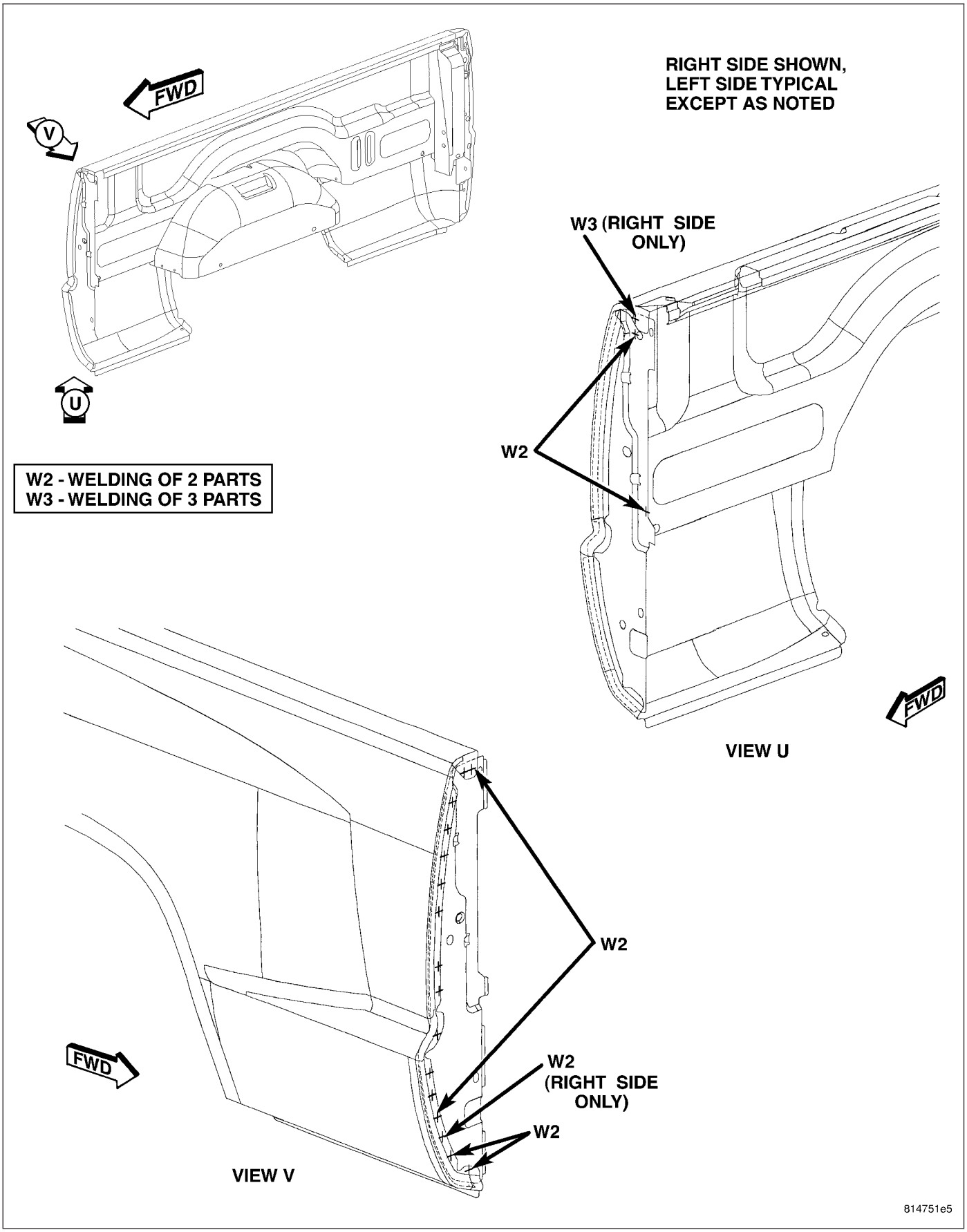


Fig. 147 BOX SIDE 6.5 (4 OF 6)

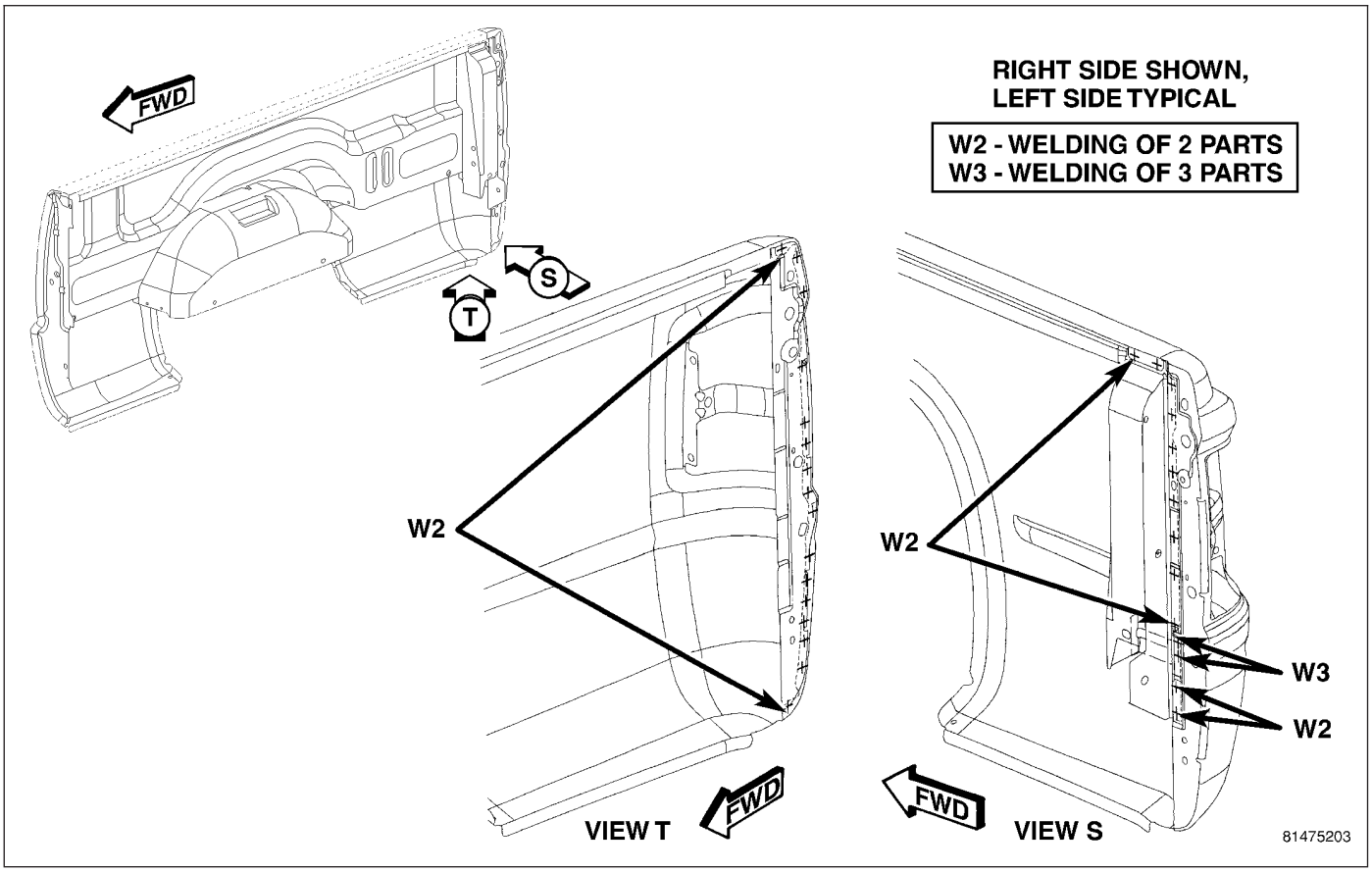


Fig. 148 BOX SIDE 6.5 (5 OF 6)

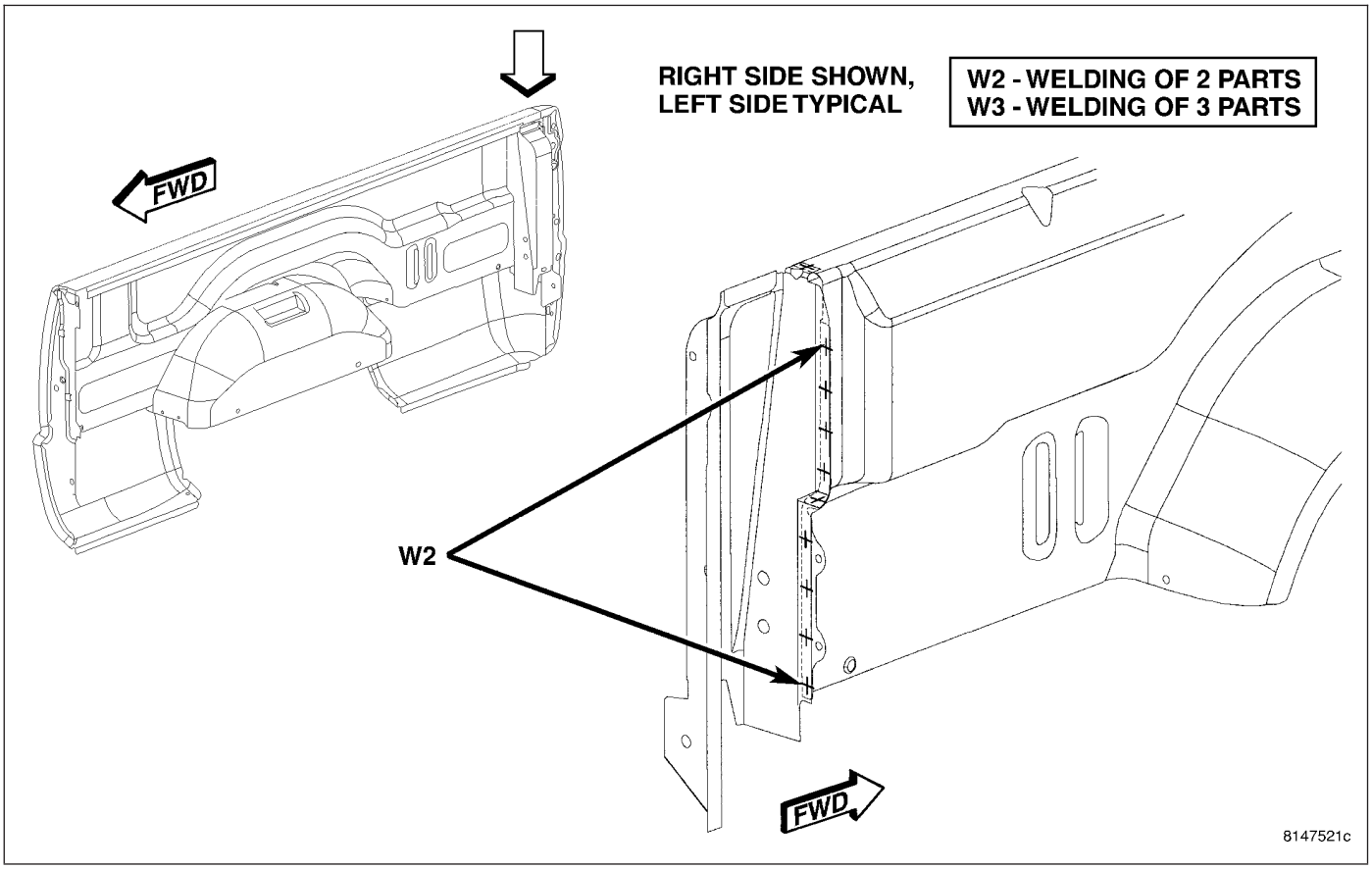


Fig. 149 BOX SIDE 6.5 (6 OF 6)

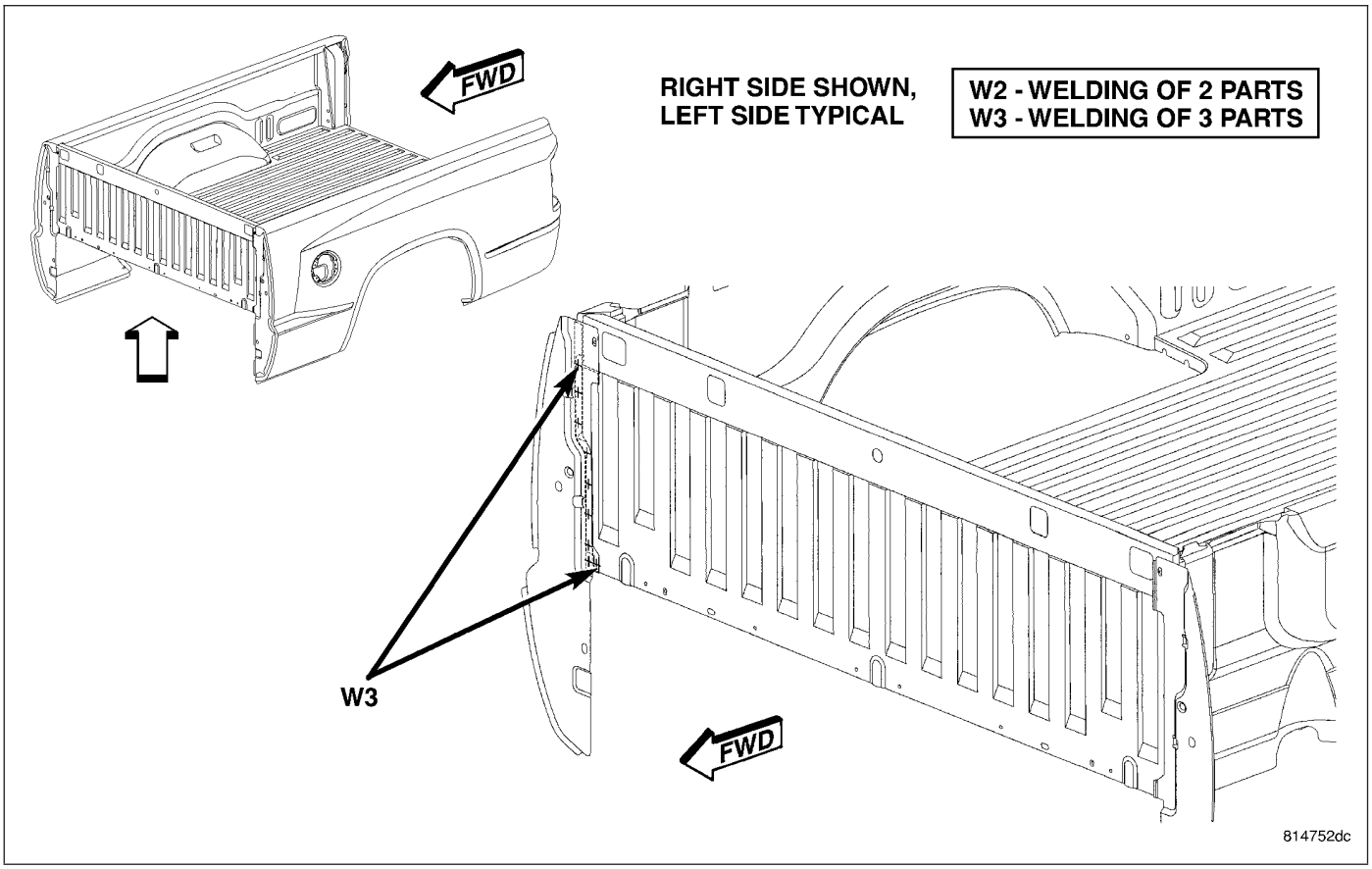


Fig. 150 BOX COMPLETE 6.5 (1 OF 4)

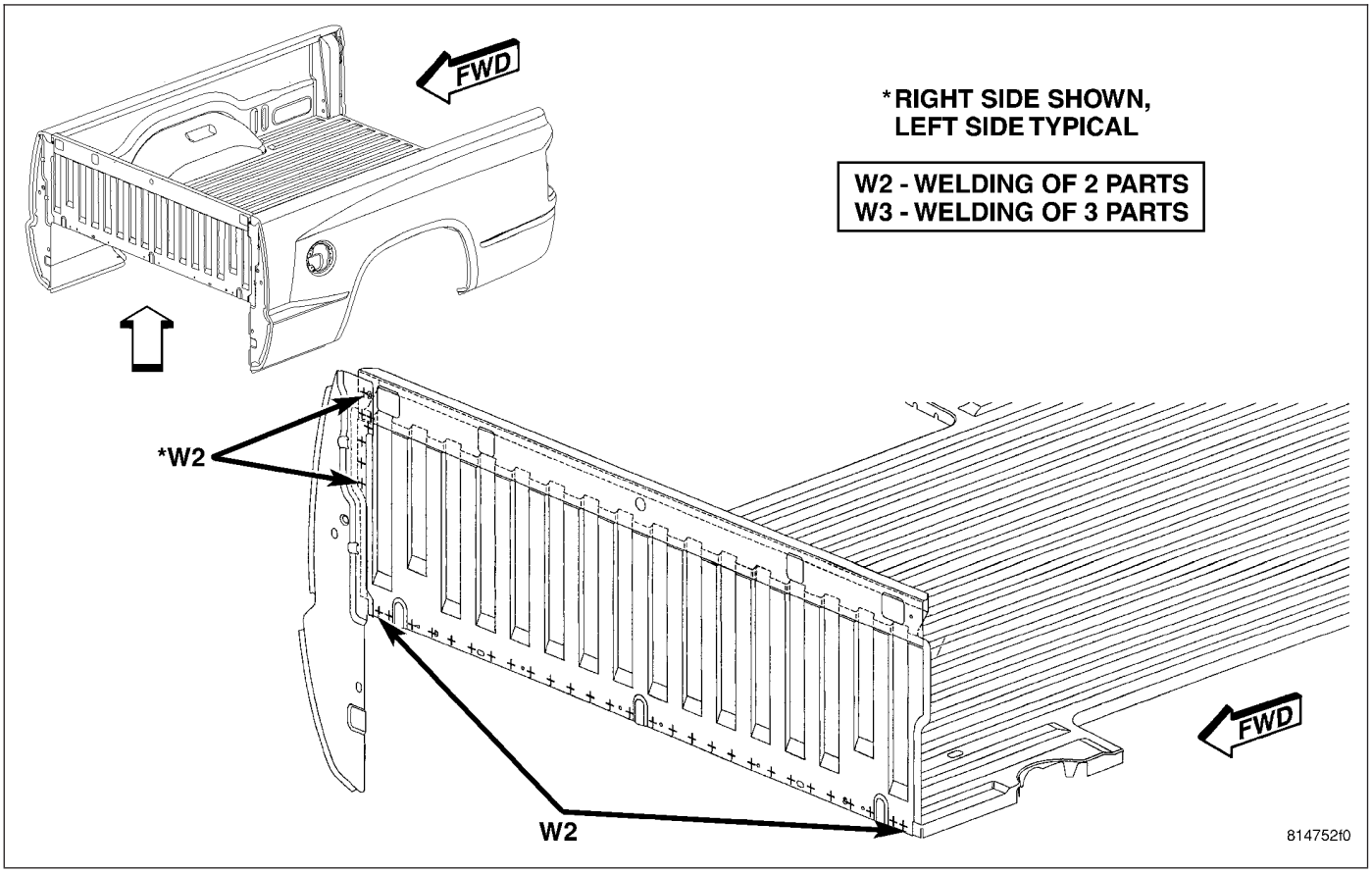


Fig. 151 BOX COMPLETE 6.5 (2 OF 4)

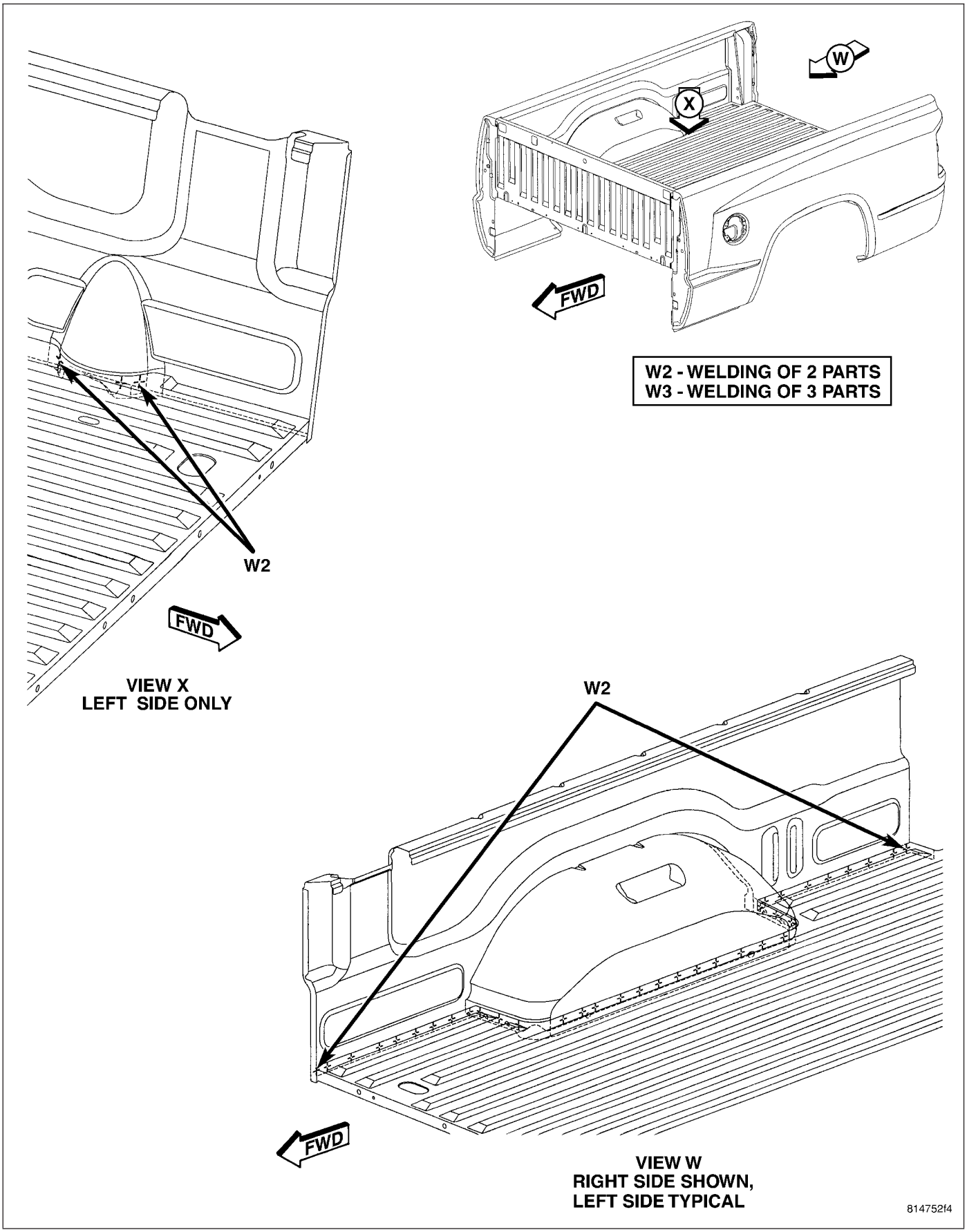
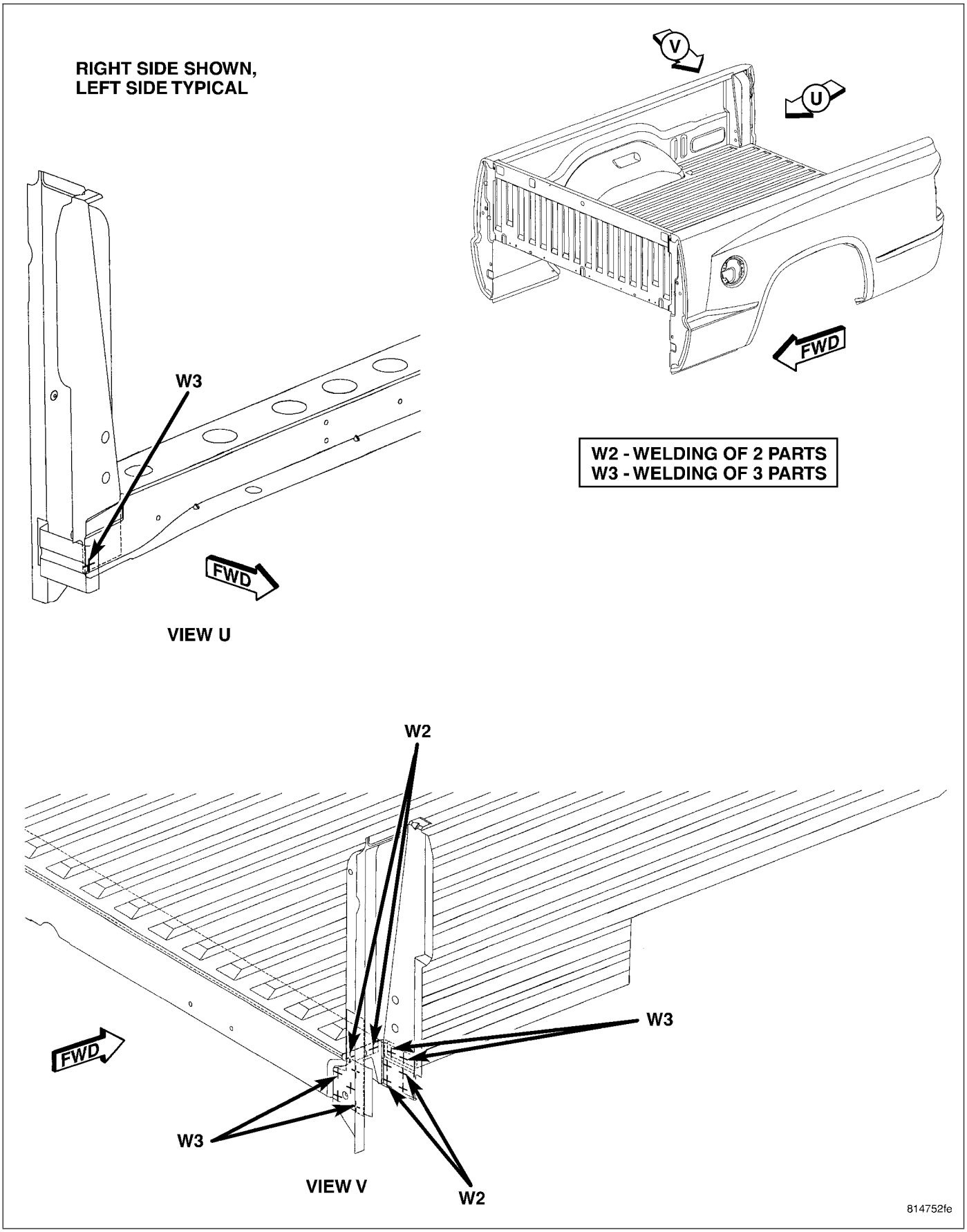


Fig. 152 BOX COMPLETE 6.5 (3 OF 4)



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HEATING & AIR CONDITIONING

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HVAC - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B104A–FLOOR/DEFROST MODE DOOR TRAVEL RANGE TOO SMALL

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control calibrates each actuator individually. Automatic calibration occurs upon power up after installing a new A/C Heater Control. Manual calibration occurs by sending a command with the scan tool. The purpose of actuator calibration is to determine the total span of door travel between physical stops. To calibrate the actuator, the A/C Heater Control first moves the door to an end stop, and then counts the number of pulses it takes to move the door to its other stop. An expected range of span is stored in the control's memory. If the measured calibration value is less than the expected range for this actuator, this DTC will set. Note that the control clears all stored calibration faults at the beginning of the calibration procedure.

- **When Monitored:**
  During actuator calibration.
- **Set Condition:**
  If the total span of the Mode 2 (Floor to Defrost) Door is less than the low range limit.

Possible Causes
DOOR DRIVER ELECTRICAL CIRCUIT(S)
MODE 2 (FLOOR TO DEFROST) DOOR SEIZED, BINDING, OBSTRUCTED
MODE DOOR 2 (FLOOR TO DEFROST) ACTUATOR
A/C HEATER CONTROL

Diagnostic Test

1. CHECK FOR ACTIVE CONTROL CIRCUIT/PERFORMANCE & CONTROL CIRCUIT OPEN DTCs

Turn the ignition on.

With the scan tool, read active HVAC DTCs.

Does the scan tool display any active: XXXX CONTROL CIRCUIT/PERFORMANCE or XXXX CONTROL CIRCUIT OPEN DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 2

---

2. RUN THE ACTUATOR DTC DETECTION TEST

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool display any DTCs?

Yes >> Diagnose and repair the DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs first, all short low DTCs second, and all open DTCs last. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 3

B104A–FLOOR/DEFROST MODE DOOR TRAVEL RANGE TOO SMALL (CONTINUED)

3. INSPECT ACTUATOR & HOUSING ASSEMBLY FOR A CONDITION CAUSING THE DOOR TO SEIZE OR BIND

Turn the ignition off.

Inspect the actuator, linkage, and housing assembly for a condition causing the door to seize or bind.

Are there any physical or mechanical problems with the door, housing, linkage, or actuator?

Yes >> Repair as necessary in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 4

---

4. CHECK MODE 2 (FLOOR TO DEFROST) DOOR TRAVEL

Remove the Mode Door 2 (Floor to Defrost) Actuator from the A/C Heater Housing Assembly.

By hand, attempt to rotate the door in both directions. The door should operate smoothly in both directions over approximately 80 degrees.

Does the door operate smoothly in both directions over approximately 80 degrees of travel?

Yes >> Replace the Mode Door 2 (Floor to Defrost) Actuator in accordance with the Service Information. Then, Go To 5.

No >> Repair as necessary in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

---

5. RUN ACTUATOR CALIBRATION TEST

Turn the ignition on.

With the scan tool, select System Tests and then select Actuator Calibration Test. When the test is complete, select View DTCs.

Does the scan tool display: B104A–FLOOR/DEFROST MODE DOOR TRAVEL RANGE TOO SMALL?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B104B–FLOOR/DEFROST MODE DOOR TRAVEL RANGE TOO LARGE

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control calibrates each actuator individually. Automatic calibration occurs upon power up after installing a new A/C Heater Control. Manual calibration occurs by sending a command with the scan tool. The purpose of actuator calibration is to determine the total span of door travel between physical stops. To calibrate the actuator, the A/C Heater Control first moves the door to an end stop, and then counts the number of pulses it takes to move the door to its other stop. An expected range of span is stored in the control's memory. If the measured calibration value exceeds the expected range for this actuator, this DTC will set. Note that the control clears all stored calibration faults at the beginning of the calibration procedure.

- **When Monitored:**
  During actuator calibration.
- **Set Condition:**
  If the total span of the Mode 2 (Floor to Defrost) Door exceeds the high range limit.

Possible Causes
DOOR DRIVER ELECTRICAL CIRCUIT(S)
MODE 2 (FLOOR TO DEFROST) DOOR OR A/C HEATER HOUSING COMPONENTS WARPED, WORN, DAMAGED, MISSING, BROKEN
MODE DOOR 2 (FLOOR TO DEFROST) ACTUATOR
A/C HEATER CONTROL

Diagnostic Test

1. CHECK FOR ACTIVE CONTROL CIRCUIT/PERFORMANCE & CONTROL CIRCUIT OPEN DTCs

Turn the ignition on.

With the scan tool, read active HVAC DTCs.

Does the scan tool display any active: XXXX CONTROL CIRCUIT/PERFORMANCE or XXXX CONTROL CIRCUIT OPEN DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 2

---

2. RUN THE ACTUATOR DTC DETECTION TEST

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool display any DTCs?

Yes >> Diagnose and repair the DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs first, all short low DTCs second, and all open DTCs last. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 3

B104B–FLOOR/DEFROST MODE DOOR TRAVEL RANGE TOO LARGE (CONTINUED)

3. CHECK FOR A BROKEN MODE DOOR 2 (FLOOR TO DEFROST) ACTUATOR

Turn the ignition off.

Remove the Mode Door 2 (Floor to Defrost) Actuator from the A/C Heater Housing assembly.

By hand, attempt to rotate the actuator in both directions.

Does the actuator turn in either direction?

Yes >> Replace the Mode Door 2 (Floor to Defrost) Actuator in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 4

---

4. CHECK MODE 2 (FLOOR TO DEFROST) DOOR & A/C HEATER HOUSING FOR WARPED, WORN, DAMAGED, MISSING, & BROKEN COMPONENTS

Inspect for excessively worn, disconnected, missing, or broken door linkage. Inspect for a damaged or broken A/C Heater Housing Assembly. Inspect for a warped or broken door, and missing door seals. Rotate the door from stop to stop. The door should rotate approximately 80 degrees.

Are there any physical or mechanical problems with the door or housing?

Yes >> Repair as necessary in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Replace the Mode 2 (Floor to Defrost) Actuator in accordance with the Service Information. Then, Go To 5.

---

5. RUN ACTUATOR CALIBRATION TEST

Turn the ignition on.

With the scan tool, select System Tests and then select Actuator Calibration Test. When the test is complete, select View DTCs.

Does the scan tool display: B104B–FLOOR/DEFROST MODE DOOR TRAVEL RANGE TOO LARGE?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B104C–BLEND DOOR CONTROL CIRCUIT/PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control monitors the door driver circuits during actuator operation for shorts to ground, shorts to battery, and shorts to other door driver circuits. If detected, the A/C Heater Control reports these types of faults as Control Circuit/Performance DTCs. It is important to note that Control Circuit/Performance DTCs do not indicate where or what type of short is present and that additional system testing is necessary to provide more details about the reported fault.

- **When Monitored:**
  When actuator movement is requested.
- **Set Condition:**
  If the A/C Heater Control detects an excessive current draw on any of the door driver circuits while attempting to drive this actuator. This DTC has a maturing time of 5 seconds and a de-maturing time of 10 seconds. If the DTC's status changes from active to stored, it will stay in memory for 100 ignition cycles.

Possible Causes
DOOR DRIVER CIRCUIT(S) SHORTED

NOTE: The DTC must be active for the results of this test to be valid. Do not perform this test if the DTC is stored. Refer to HVAC System Test for stored DTC test procedures.

Diagnostic Test

1. RUN THE ACTUATOR DTC DETECTION TEST

Turn the ignition on.

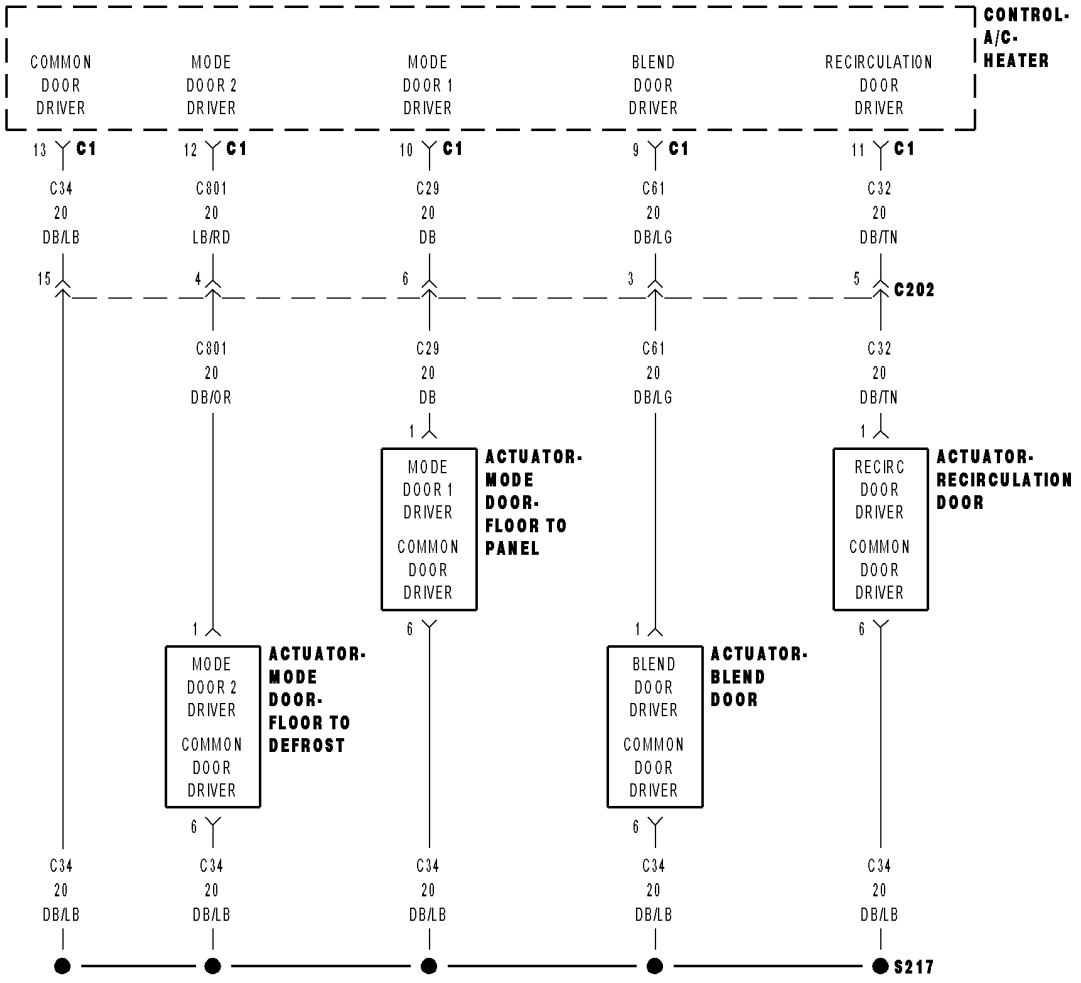
With the scan tool in HVAC, erase DTCs.

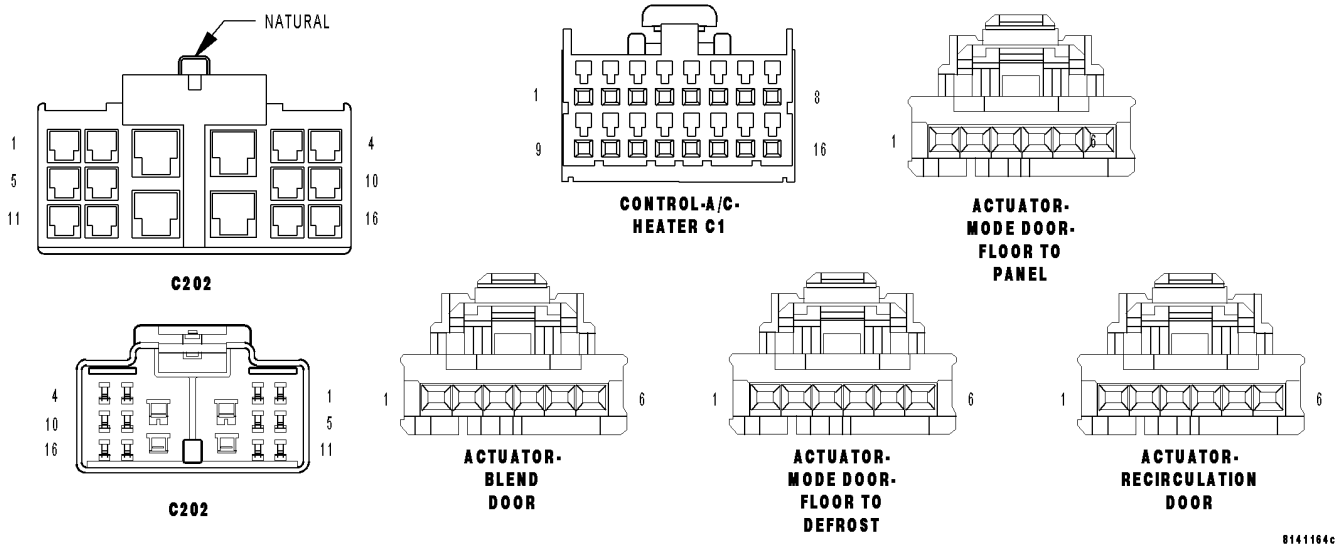
With the scan tool, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Repair

Diagnose and repair the DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs and then all short low DTCs. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

B104D–BLEND DOOR CONTROL CIRCUIT LOW





B104D–BLEND DOOR CONTROL CIRCUIT LOW (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Blend Door Actuator via the (C61) Blend Door Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver circuit. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the type of short, its location, and the direction the actuator is moving when the short is present.

- **When Monitored:**
  When the Actuator DTC Detection Test is executed.
- **Set Condition:**
  If the (C61) Blend Door Driver circuit is shorted to ground.

Possible Causes
(C61) BLEND DOOR DRIVER CIRCUIT SHORTED TO GROUND
(C61) BLEND DOOR DRIVER CIRCUIT SHORTED TO OTHER DOOR DRIVER CIRCUIT(S)
BLEND DOOR ACTUATOR
A/C HEATER CONTROL

Diagnostic Test

1. CHECK (C61) BLEND DOOR DRIVER CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

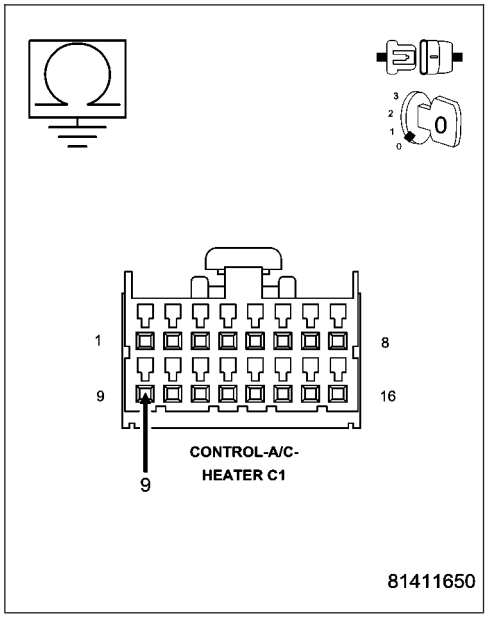
Disconnect the A/C Heater Control C1 harness connector.

Measure the resistance of the (C61) Blend Door Driver circuit between ground and the A/C Heater Control C1 harness connector.

Is the resistance below 10k ohms?

Yes >> Repair the (C61) Blend Door Driver circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

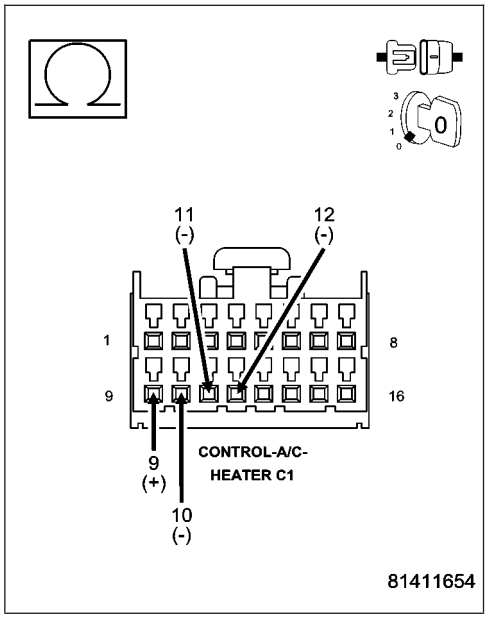
No >> Go To 2



B104D–BLEND DOOR CONTROL CIRCUIT LOW (CONTINUED)

2. CHECK (C61) BLEND DOOR DRIVER CIRCUIT FOR A SHORT TO OTHER DOOR DRIVER CIRCUITS

Measure the resistance between the (C61) Blend Door Driver circuit and the (C29) Mode Door 1 Driver circuit, the (C801) Mode Door 2 Driver circuit, and the (C32) Recirculation Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms between the (C61) Blend Door Driver circuit and any of the other door driver circuits?

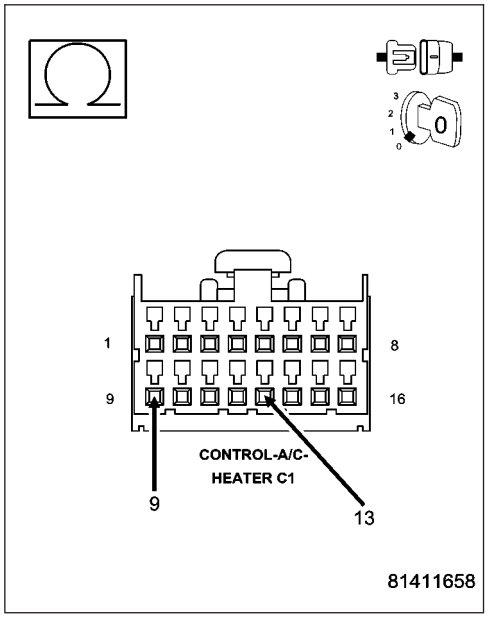
Yes >> Repair the circuit(s) with a resistance below 10k ohms for a short to the (C61) Blend Door Driver circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 3

3. CHECK BLEND DOOR ACTUATOR CIRCUIT RESISTANCE

Measure the resistance between the (C61) Blend Door Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 20 ohms?

Yes >> Go To 4

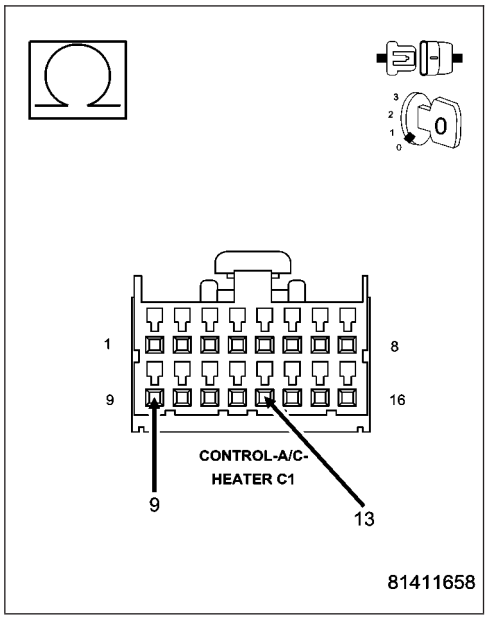
No >> Go To 5

B104D–BLEND DOOR CONTROL CIRCUIT LOW (CONTINUED)

4. CHECK (C61) BLEND DOOR DRIVER CIRCUIT FOR A SHORT TO (C34) COMMON DOOR DRIVER CIRCUIT

Disconnect the Blend Door Actuator harness connector.

Measure the resistance between the (C61) Blend Door Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms?

Yes >> Repair the (C61) Blend Door Driver circuit for a short to the (C34) Common Door Driver circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Replace the Blend Door Actuator in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

5. RUN THE ACTUATOR DTC DETECTION TEST

Reconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

With the scan tool, erase HVAC DTCs.

With the scan tool, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool only display: B104D–BLEND DOOR CONTROL CIRCUIT LOW ?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No, Other DTC(s) Displayed

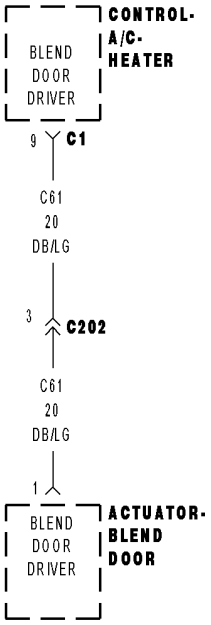
Diagnose and repair the other DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs and then all short low DTCs. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

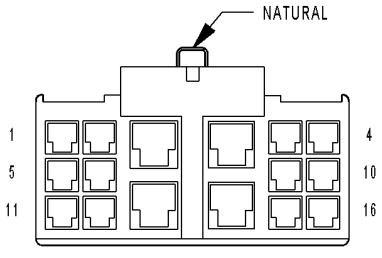
No, And No Other DTCs Displayed

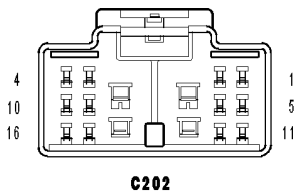
Using the wiring diagram as a guide, inspect the wiring and connectors for conditions causing an intermittent short. Repair as necessary.

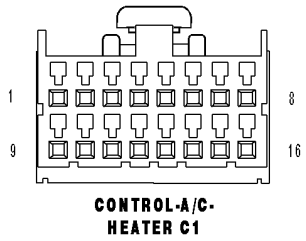
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

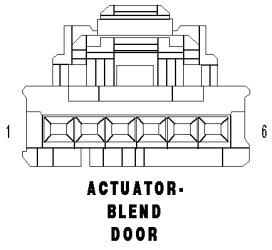
B104E–BLEND DOOR CONTROL CIRCUIT HIGH











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B104E–BLEND DOOR CONTROL CIRCUIT HIGH (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Blend Door Actuator via the (C61) Blend Door Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver circuit. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the type of short, its location, and the direction the actuator is moving when the short is present.

- **When Monitored:**
  When the Actuator DTC Detection Test is executed.
- **Set Condition:**
  If the (C61) Blend Door Driver circuit is shorted to voltage.

Possible Causes
(C61) BLEND DOOR DRIVER CIRCUIT SHORTED TO VOLTAGE
A/C HEATER CONTROL

Diagnostic Test

1. CHECK (C61) BLEND DOOR DRIVER CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

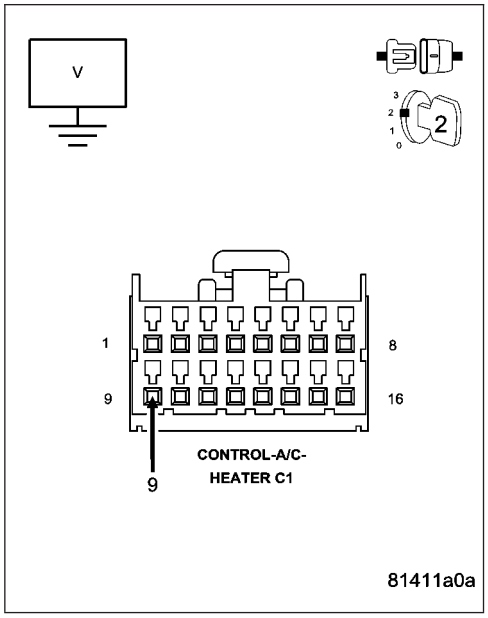
Measure the voltage of the (C61) Blend Door Driver circuit.

Is the voltage above 0.2 volts?

Yes >> Repair the (C61) Blend Door Driver circuit for a short to voltage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 2



B104E–BLEND DOOR CONTROL CIRCUIT HIGH (CONTINUED)

2. RUN THE ACTUATOR DTC DETECTION TEST

Turn the ignition off.

Reconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool only display: B104E–BLEND DOOR CONTROL CIRCUIT HIGH?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No, Other DTC(s) Displayed

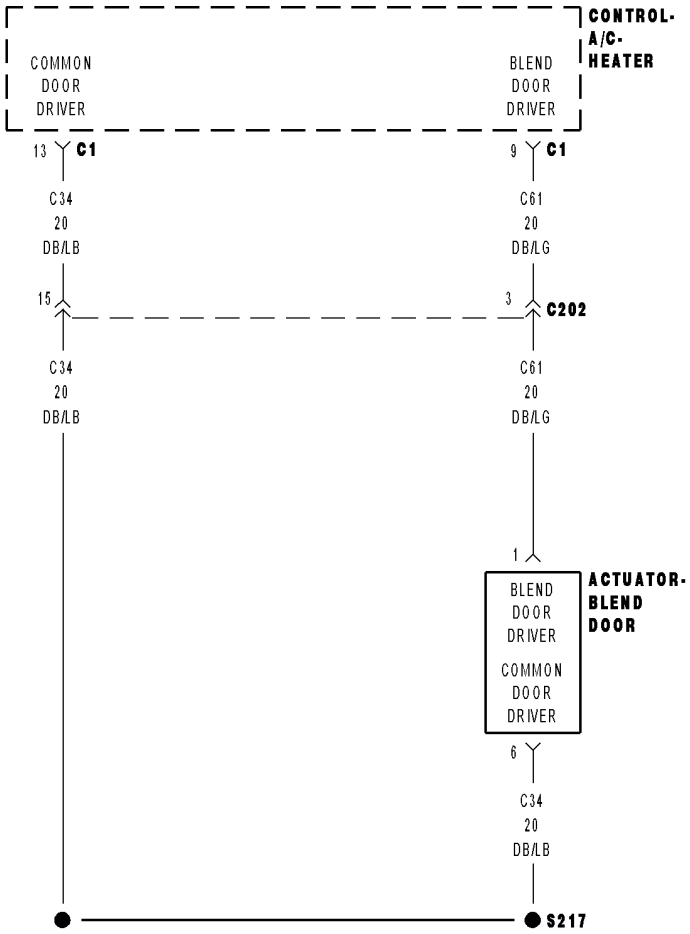
Diagnose and repair the other DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs and then all short low DTCs. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

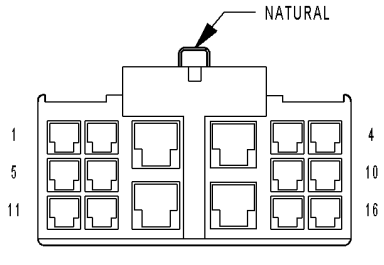
No, And No Other DTCs Displayed

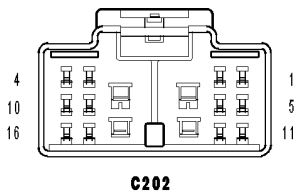
Using the wiring diagram as a guide, inspect the wiring and connectors for conditions causing an intermittent short. Repair as necessary.

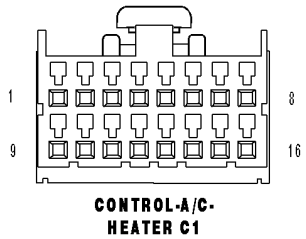
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

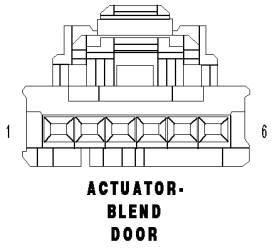
B104F–BLEND DOOR CONTROL CIRCUIT OPEN











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B104F–BLEND DOOR CONTROL CIRCUIT OPEN (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Blend Door Actuator via the (C61) Blend Door Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver circuit. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the location of the open circuit and the direction the actuator is moving when the open is present.

- **When Monitored:**
  When actuator movement is requested.
- **Set Condition:**
  If Blend Door Actuator's electrical circuit is open. This DTC has a maturing time of 5 seconds and a de-maturing time of 10 seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

Possible Causes
(C61) BLEND DOOR DRIVER CIRCUIT OPEN
(C34) COMMON DOOR DRIVER CIRCUIT OPEN
BLEND DOOR ACTUATOR
A/C HEATER CONTROL

NOTE: DTC B104F must be active for the results of this test to be valid. Do not perform this test if DTC B104F is stored. Refer to HVAC System Test for stored DTC test procedures.

Diagnostic Test

1. CHECK FOR ACTIVE CONTROL CIRCUIT/PERFORMANCE DTCs

Turn the ignition on.

With the scan tool, read active HVAC DTCs.

Does the scan tool display any active: XXXX CONTROL CIRCUIT/PERFORMANCE DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 2

B104F–BLEND DOOR CONTROL CIRCUIT OPEN (CONTINUED)

2. CHECK BLEND DOOR ACTUATOR CIRCUIT RESISTANCE

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

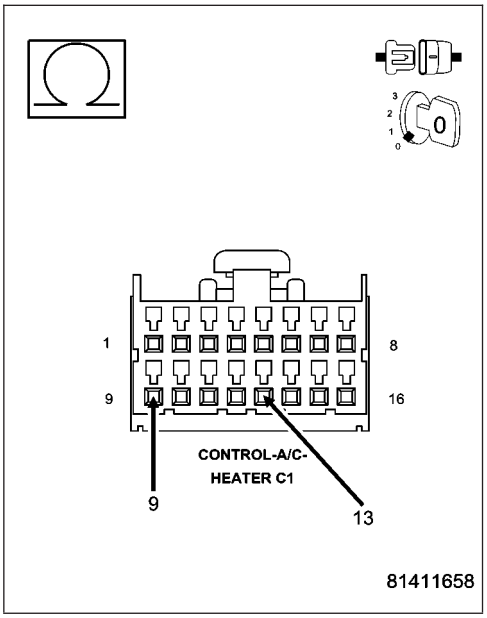
Measure the resistance between the (C61) Blend Door Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.

Is the resistance above 55 ohms?

Yes >> Go To 3

No >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).



3. CHECK (C61) BLEND DOOR DRIVER CIRCUIT FOR AN OPEN

Disconnect the Blend Door Actuator harness connector.

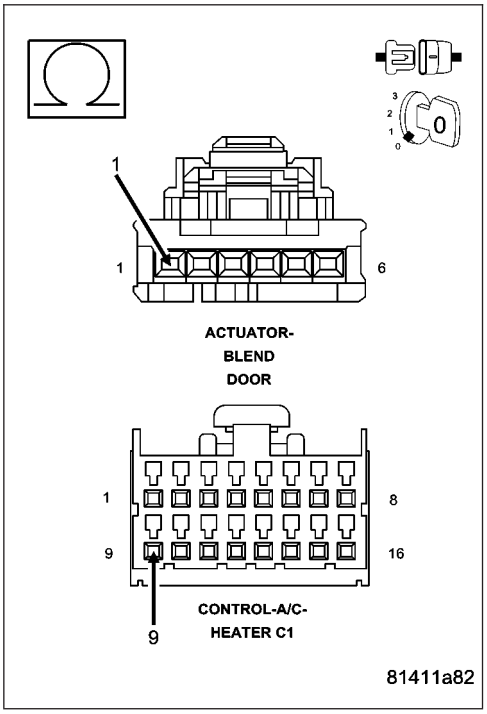
Measure the resistance of the (C61) Blend Door Driver circuit between the A/C Heater Control C1 harness connector and the Blend Door Actuator harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the (C61) Blend Door Driver circuit for an open.

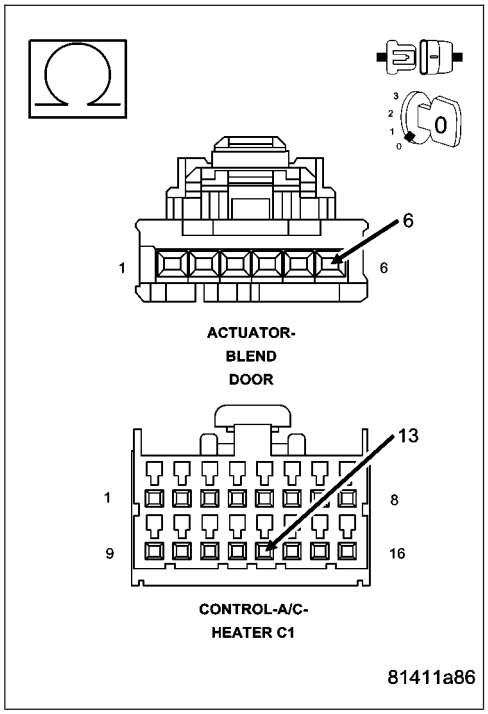
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).



B104F–BLEND DOOR CONTROL CIRCUIT OPEN (CONTINUED)

4. CHECK (C34) COMMON DOOR DRIVER CIRCUIT FOR AN OPEN

Measure the resistance of the (C34) Common Door Driver circuit between the A/C Heater Control C1 harness connector and the Blend Door Actuator harness connector.



Is the resistance below 5.0 ohms?

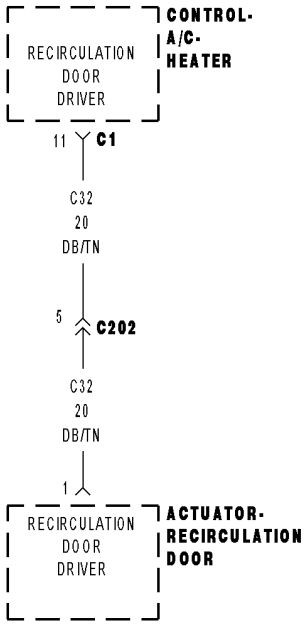
Yes >> Replace the Blend Door Actuator in accordance with the Service Information.

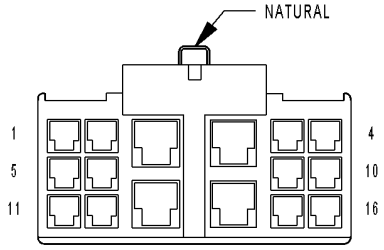
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

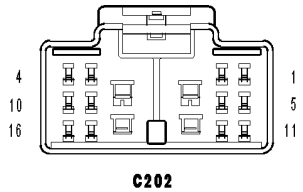
No >> Repair the (C34) Common Door Driver circuit for an open.

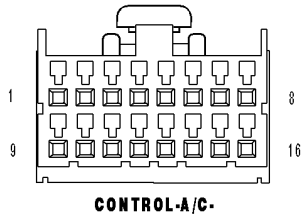
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

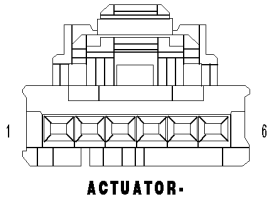
B105A–RECIRCULATION DOOR CONTROL CIRCUIT HIGH











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B105A–RECIRCULATION DOOR CONTROL CIRCUIT HIGH (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Recirculation Door Actuator via the (C32) Recirculation Door Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver circuit. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the type of short, its location, and the direction the actuator is moving when the short is present.

- **When Monitored:**
  When the Actuator DTC Detection Test is executed.
- **Set Condition:**
  If the (C32) Recirculation Door Driver circuit is shorted to voltage.

Possible Causes
(C32) RECIRCULATION DOOR DRIVER CIRCUIT SHORTED TO VOLTAGE
A/C HEATER CONTROL

Diagnostic Test

1. CHECK (C32) RECIRCULATION DOOR DRIVER CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

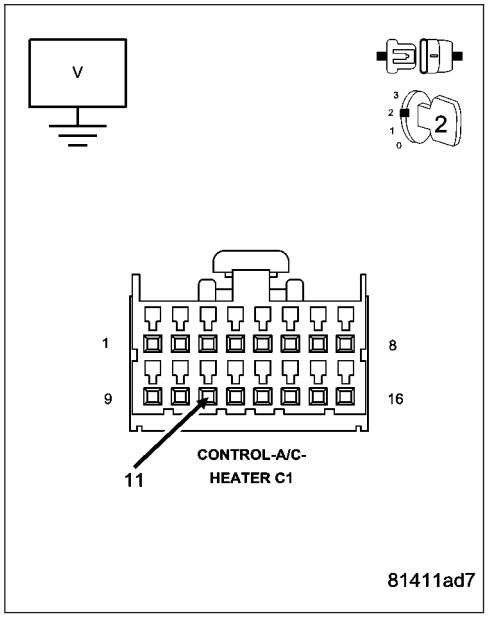
Measure the voltage of the (C32) Recirculation Door Driver circuit.

Is the voltage above 0.2 volts?

Yes >> Repair the (C32) Recirculation Door Driver circuit for a short to voltage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 2



B105A–RECIRCULATION DOOR CONTROL CIRCUIT HIGH (CONTINUED)

2. RUN THE ACTUATOR DTC DETECTION TEST

Turn the ignition off.

Reconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool only display: B105A–RECIRCULATION DOOR CONTROL CIRCUIT HIGH?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No, Other DTC(s) Displayed

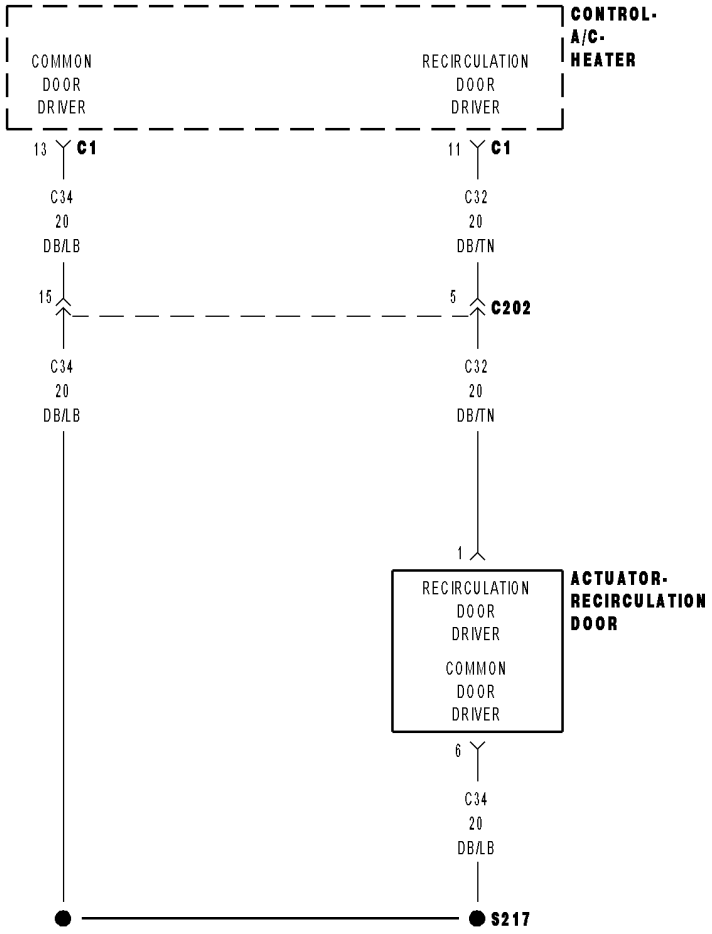
Diagnose and repair the other DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs and then all short low DTCs. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

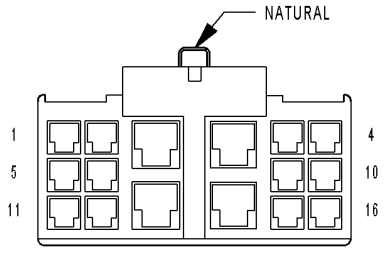
No, And No Other DTCs Displayed

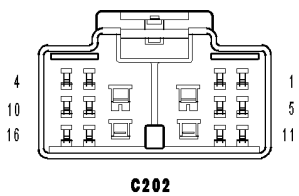
Using the wiring diagram as a guide, inspect the wiring and connectors for conditions causing an intermittent short. Repair as necessary.

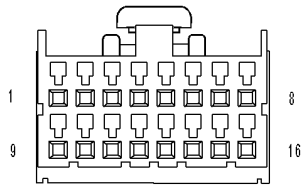
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

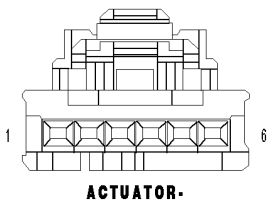
B105B–RECIRCULATION DOOR CONTROL CIRCUIT OPEN











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B105B–RECIRCULATION DOOR CONTROL CIRCUIT OPEN (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Recirculation Door Actuator via the (C32) Recirculation Door Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the location of the open circuit and the direction the actuator is moving when the open is present.

- **When Monitored:**
  When actuator movement is requested.
- **Set Condition:**
  If Recirculation Door Actuator's electrical circuit is open. This DTC has a maturing time of 5 seconds and a de-maturing time of 10 seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

Possible Causes
(C32) RECIRCULATION DOOR DRIVER CIRCUIT OPEN
(C34) COMMON DOOR DRIVER CIRCUIT OPEN
RECIRCULATION DOOR ACTUATOR
A/C HEATER CONTROL

NOTE: DTC B105B must be active for the results of this test to be valid. Do not perform this test if DTC B105B is stored. Refer to HVAC System Test for stored DTC test procedures.

Diagnostic Test

1. CHECK FOR ACTIVE CONTROL CIRCUIT/PERFORMANCE DTCs

Turn the ignition on.

With the scan tool, read active HVAC DTCs.

Does the scan tool display any active: XXXX CONTROL CIRCUIT/PERFORMANCE DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 2

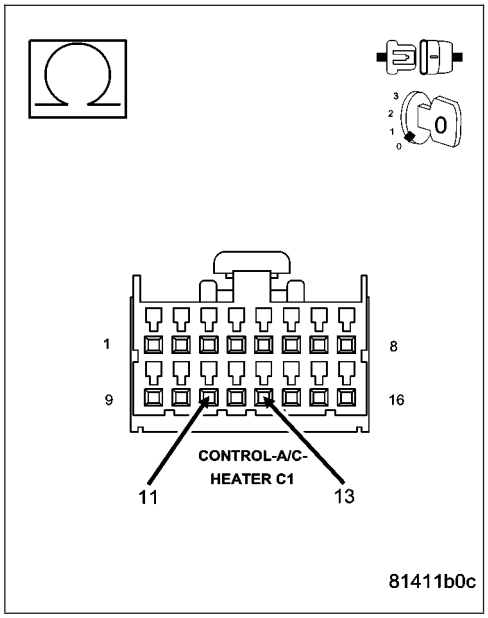
B105B–RECIRCULATION DOOR CONTROL CIRCUIT OPEN (CONTINUED)

2. CHECK RECIRCULATION DOOR ACTUATOR CIRCUIT RESISTANCE

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

Measure the resistance between the (C32) Recirculation Door Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance above 55 ohms?

Yes >> Go To 3

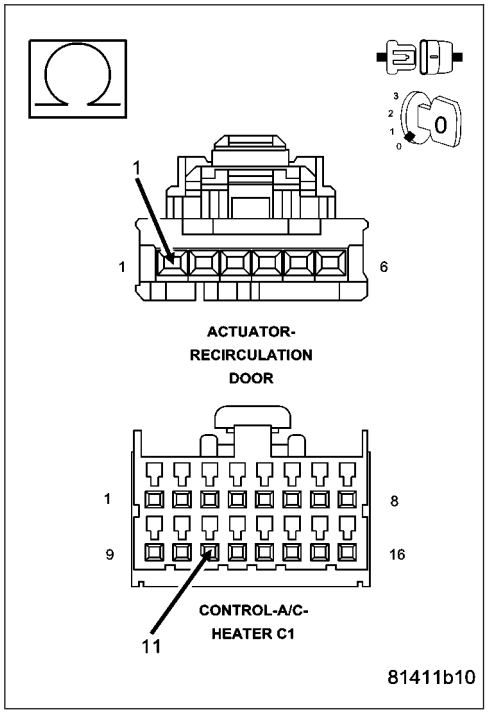
No >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

3. CHECK (C32) RECIRCULATION DOOR DRIVER CIRCUIT FOR AN OPEN

Disconnect the Recirculation Door Actuator harness connector.

Measure the resistance of the (C32) Recirculation Door Driver circuit between the A/C Heater Control C1 harness connector and the Recirculation Door Actuator harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 4

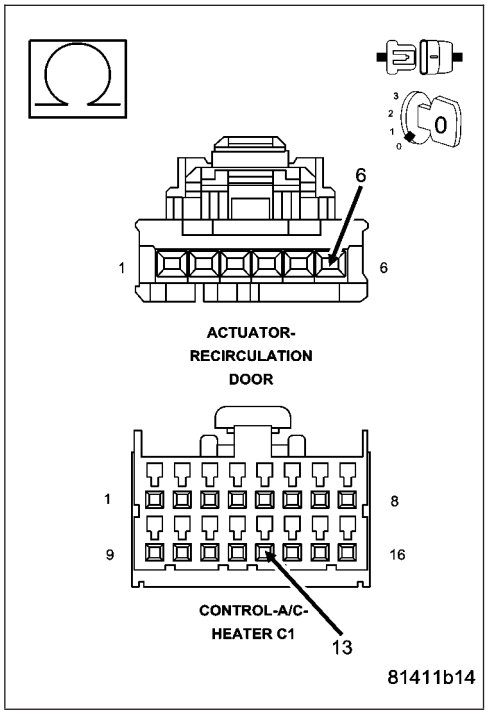
No >> Repair the (C32) Recirculation Door Driver circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B105B–RECIRCULATION DOOR CONTROL CIRCUIT OPEN (CONTINUED)

4. CHECK (C34) COMMON DOOR DRIVER CIRCUIT FOR AN OPEN

Measure the resistance of the (C34) Common Door Driver circuit between the A/C Heater Control C1 harness connector and the Recirculation Door Actuator harness connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the Recirculation Door Actuator in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Repair the (C34) Common Door Driver circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B105C–RECIRCULATION DOOR TRAVEL RANGE TOO SMALL

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control calibrates each actuator individually. Automatic calibration occurs upon power up after installing a new A/C Heater Control. Manual calibration occurs by sending a command with the scan tool. The purpose of actuator calibration is to determine the total span of door travel between physical stops. To calibrate the actuator, the A/C Heater Control first moves the door to an end stop, and then counts the number of pulses it takes to move the door to its other stop. An expected range of span is stored in the control's memory. If the measured calibration value is less than the expected range for this actuator, this DTC will set. Note that the control clears all stored calibration faults at the beginning of the calibration procedure.

- **When Monitored:**
  During actuator calibration.
- **Set Condition:**
  If the total span of the Recirculation Door is less than the low range limit.

Possible Causes
DOOR DRIVER ELECTRICAL CIRCUIT(S)
RECIRCULATION DOOR SEIZED, BINDING, OBSTRUCTED
RECIRCULATION DOOR ACTUATOR
A/C HEATER CONTROL

Diagnostic Test

1. CHECK FOR ACTIVE CONTROL CIRCUIT/PERFORMANCE & CONTROL CIRCUIT OPEN DTCs

Turn the ignition on.

With the scan tool, read active HVAC DTCs.

Does the scan tool display any active: XXXX CONTROL CIRCUIT/PERFORMANCE or XXXX CONTROL CIRCUIT OPEN DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 2

---

2. RUN THE ACTUATOR DTC DETECTION TEST

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool display any DTCs?

Yes >> Diagnose and repair the DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs first, all short low DTCs second, and all open DTCs last. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 3

B105C–RECIRCULATION DOOR TRAVEL RANGE TOO SMALL (CONTINUED)

3. INSPECT ACTUATOR & HOUSING ASSEMBLY FOR A CONDITION CAUSING THE DOOR TO SEIZE OR BIND

Turn the ignition off.

Inspect the actuator and the housing assembly for a condition causing the door to seize or bind.

Are there any physical or mechanical problems with the door, housing, or actuator?

Yes >> Repair as necessary in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 4

---

4. CHECK RECIRCULATION DOOR TRAVEL

Remove the Recirculation Door Actuator from the A/C Heater Housing Assembly.

By hand, attempt to rotate the door in both directions. The door should operate smoothly in both directions over approximately 90 degrees of travel.

Does the door operate smoothly in both directions over approximately 90 degrees of travel?

Yes >> Replace the Recirculation Door Actuator in accordance with the Service Information. Then, Go To 5

No >> Repair as necessary in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

---

5. RUN ACTUATOR CALIBRATION TEST

Turn the ignition on.

With the scan tool, select System Tests and then select Actuator Calibration Test. When the test is complete, select View DTCs.

Does the scan tool display: B105C–RECIRCULATION DOOR TRAVEL RANGE TOO SMALL?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B105D–RECIRCULATION DOOR TRAVEL RANGE TOO LARGE

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control calibrates each actuator individually. Automatic calibration occurs upon power up after installing a new A/C Heater Control. Manual calibration occurs by sending a command with the scan tool. The purpose of actuator calibration is to determine the total span of door travel between physical stops. To calibrate the actuator, the A/C Heater Control first moves the door to an end stop, and then counts the number of pulses it takes to move the door to its other stop. An expected range of span is stored in the control's memory. If the measured calibration value exceeds the expected range for this actuator, this DTC will set. Note that the control clears all stored calibration faults at the beginning of the calibration procedure.

- **When Monitored:**
  During actuator calibration.
- **Set Condition:**
  If the total span of the Recirculation Door exceeds the high range limit.

Possible Causes
DOOR DRIVER ELECTRICAL CIRCUIT(S)
RECIRCULATION DOOR OR A/C HEATER HOUSING COMPONENTS WARPED, WORN, DAMAGED, MISSING, BROKEN
RECIRCULATION DOOR ACTUATOR
A/C HEATER CONTROL

Diagnostic Test

1. CHECK FOR ACTIVE CONTROL CIRCUIT/PERFORMANCE & CONTROL CIRCUIT OPEN DTCs

Turn the ignition on.

With the scan tool, read active HVAC DTCs.

Does the scan tool display any active: XXXX CONTROL CIRCUIT/PERFORMANCE or XXXX CONTROL CIRCUIT OPEN DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 2

---

2. RUN THE ACTUATOR DTC DETECTION TEST

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool display any DTCs?

Yes >> Diagnose and repair the DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs first, all short low DTCs second, and all open DTCs last. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 3

B105D–RECIRCULATION DOOR TRAVEL RANGE TOO LARGE (CONTINUED)

3. CHECK FOR A BROKEN RECIRCULATION DOOR ACTUATOR

Turn the ignition off.

Remove the Recirculation Door Actuator from the A/C Heater Housing Assembly.

By hand, attempt to rotate the actuator in both directions.

Does the actuator turn in either direction?

Yes >> Replace the Recirculation Door Actuator in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 4

---

4. CHECK RECIRCULATION DOOR & A/C HEATER HOUSING FOR WARPED, WORN, DAMAGED, MISSING, & BROKEN COMPONENTS

Inspect for a damaged or broken A/C Heater Housing Assembly, a warped, worn, or broken door, and missing door seals. Rotate the door from stop to stop. The door should rotate approximately 90 degrees.

Are there any physical or mechanical problems with the door or housing?

Yes >> Repair as necessary in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Replace the Recirculation Door Actuator in accordance with the Service Information. Then, Go To 5.

---

5. RUN ACTUATOR CALIBRATION TEST

Turn the ignition on.

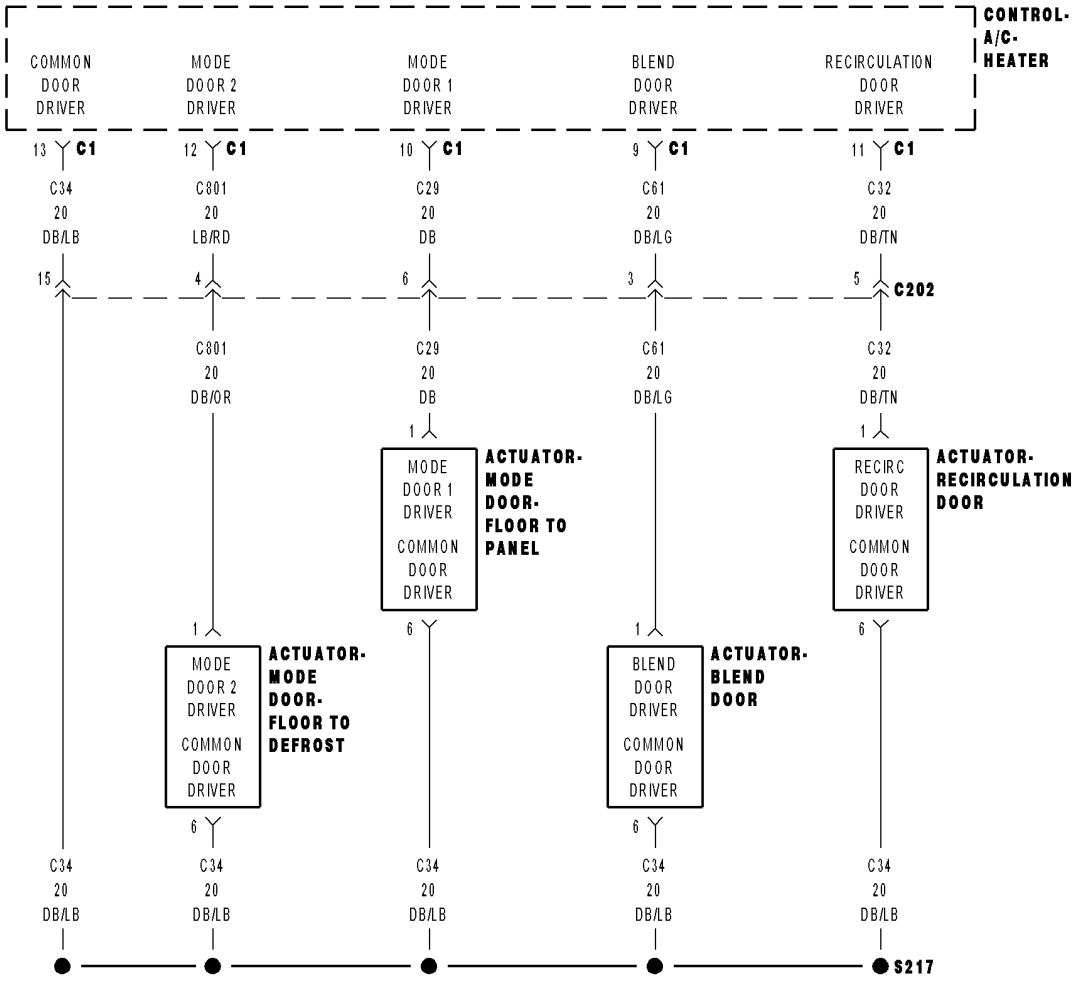
With the scan tool, select System Tests and then select Actuator Calibration Test. When the test is complete, select View DTCs.

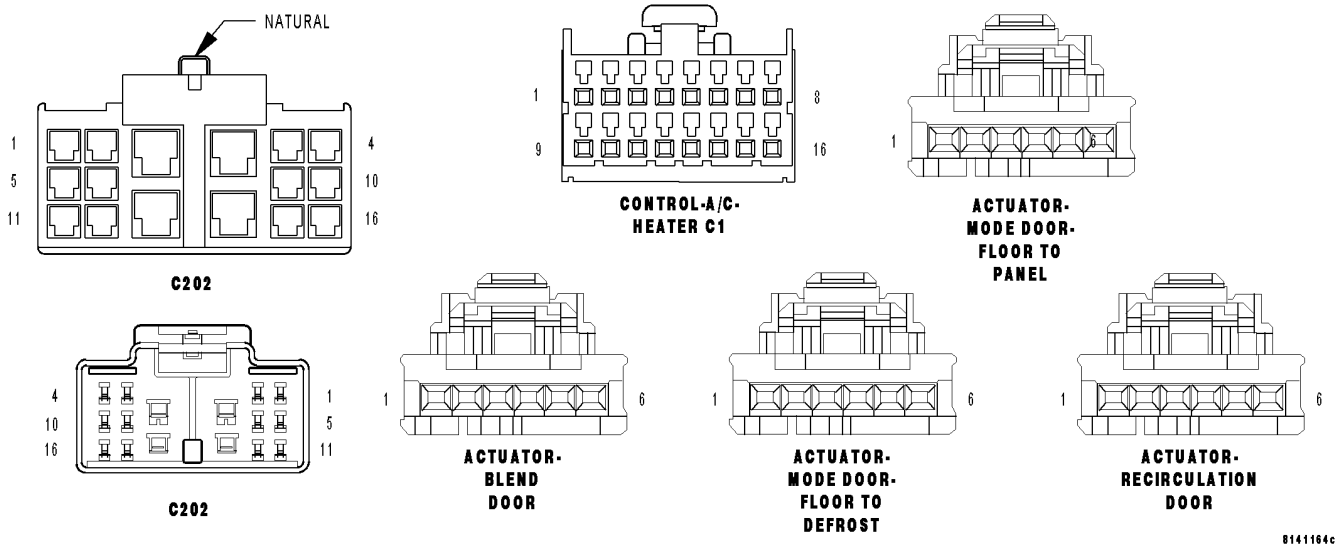
Does the scan tool display: B105D–RECIRCULATION DOOR TRAVEL RANGE TOO LARGE?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B105F–CLIMATE CONTROL MOTOR(S) COMMON 1 CONTROL CIRCUIT LOW





B105F–CLIMATE CONTROL MOTOR(S) COMMON 1 CONTROL CIRCUIT LOW (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Blend Door Actuator via the (C61) Blend Door Driver circuit and the (C34) Common Door Driver circuit. The A/C Heater Control drives the Mode Door 1 (Floor to Panel) Actuator via the (C29) Mode Door 1 Driver circuit and the (C34) Common Door Driver circuit. The A/C Heater Control drives the Mode Door 2 (Floor to Defrost) Actuator via the (C801) Mode Door 2 Driver circuit and the (C34) Common Door Driver circuit. The A/C Heater Control drives the Recirculation Door Actuator via the (C32) Recirculation Door Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver circuit. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the type of short, its location, and the direction the actuator is moving when the short is present.

- **When Monitored:**
  When the Actuator DTC Detection Test is executed.
- **Set Condition:**
  If the (C34) Common Door Driver circuit is shorted to ground.

Possible Causes
(C34) COMMON DOOR DRIVER CIRCUIT SHORTED TO GROUND
(C34) COMMON DOOR DRIVER CIRCUIT SHORTED TO OTHER DOOR DRIVER CIRCUIT(S)
BLEND DOOR ACTUATOR
MODE DOOR 1 (FLOOR TO PANEL) ACTUATOR
MODE DOOR 2 (FLOOR TO DEFROST) ACTUATOR
RECIRCULATION DOOR ACTUATOR
A/C HEATER CONTROL

Diagnostic Test

1. CHECK (C34) COMMON DOOR DRIVER CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

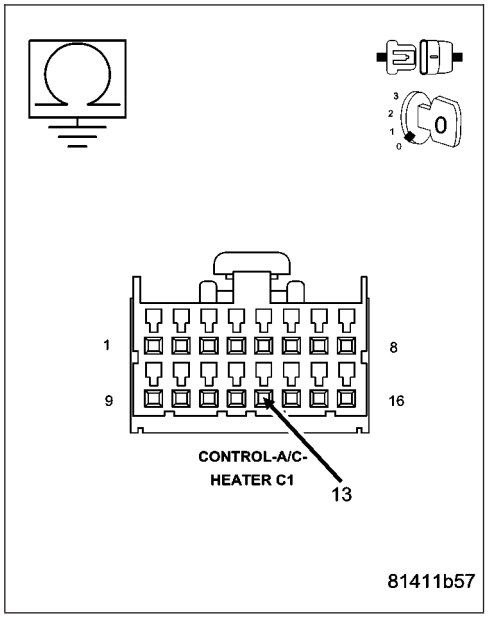
Disconnect the A/C Heater Control C1 harness connector.

Measure the resistance of the (C34) Common Door Driver circuit between ground and the A/C Heater Control C1 harness connector.

Is the resistance below 10k ohms?

Yes >> Repair the (C34) Common Door Driver circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

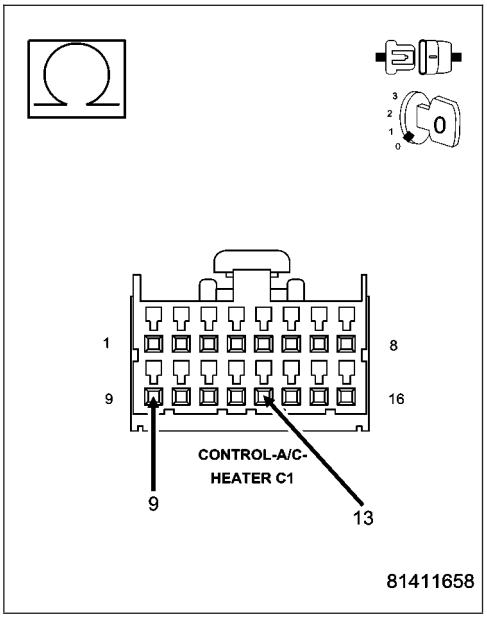
No >> Go To 2



B105F–CLIMATE CONTROL MOTOR(S) COMMON 1 CONTROL CIRCUIT LOW (CONTINUED)

2. CHECK BLEND DOOR ACTUATOR CIRCUIT RESISTANCE

Measure the resistance between the (C61) Blend Door Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 20 ohms?

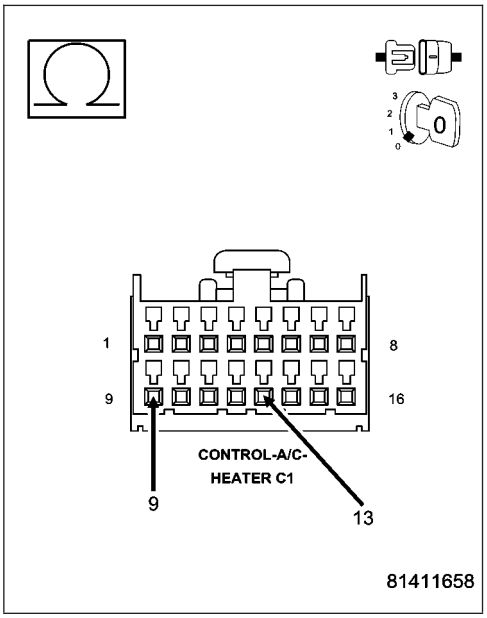
Yes >> Go To 3

No >> Go To 4

3. CHECK (C61) BLEND DOOR DRIVER CIRCUIT FOR A SHORT TO (C34) COMMON DOOR DRIVER CIRCUIT

Disconnect the Blend Door Actuator harness connector.

Measure the resistance between the (C61) Blend Door Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms?

Yes >> Repair the (C61) Blend Door Driver Circuit for a short to the (C34) Common Door Driver circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

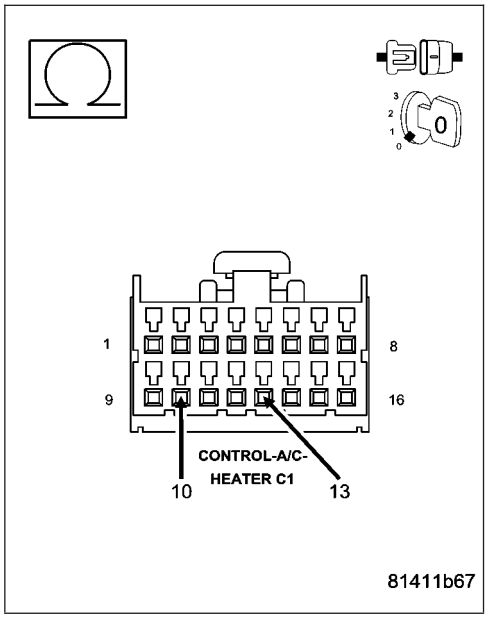
No >> Replace the Blend Door Actuator in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B105F–CLIMATE CONTROL MOTOR(S) COMMON 1 CONTROL CIRCUIT LOW (CONTINUED)

4. CHECK MODE DOOR 1 (FLOOR TO PANEL) ACTUATOR CIRCUIT RESISTANCE

Measure the resistance between the (C29) Mode Door 1 Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 20 ohms?

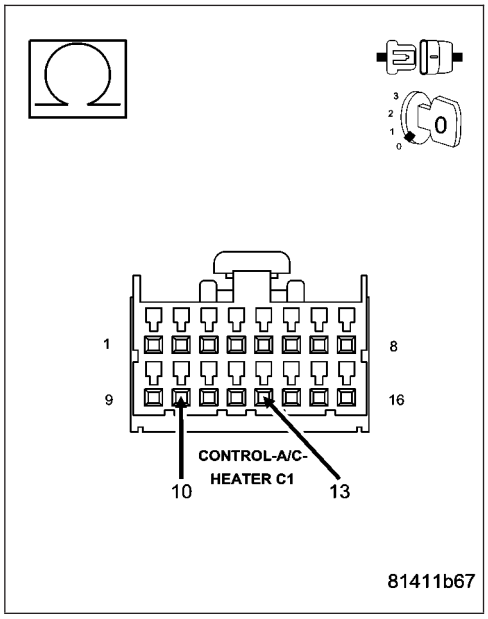
Yes >> Go To 5

No >> Go To 6

5. CHECK (C29) MODE DOOR 1 DRIVER CIRCUIT FOR A SHORT TO (C34) COMMON DOOR DRIVER CIRCUIT

Disconnect the Mode Door 1 (Floor to Panel) Actuator harness connector.

Measure the resistance between the (C29) Mode Door 1 Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms?

Yes >> Repair the (C29) Mode Door 1 Driver Circuit for a short to the (C34) Common Door Driver circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

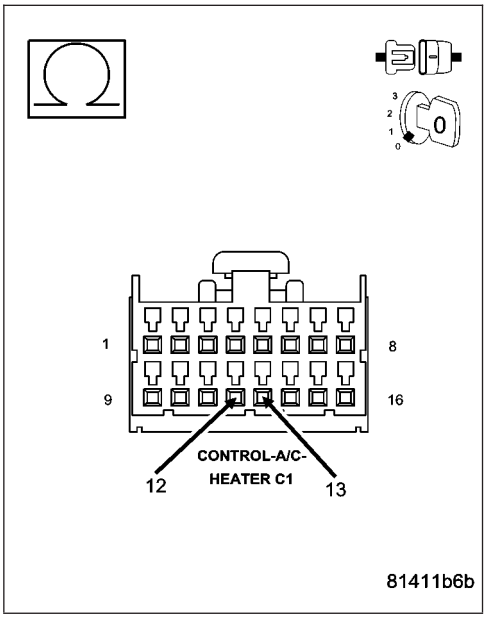
No >> Replace the Mode Door 1 (Floor to Panel) Actuator in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B105F–CLIMATE CONTROL MOTOR(S) COMMON 1 CONTROL CIRCUIT LOW (CONTINUED)

6. CHECK MODE DOOR 2 (FLOOR TO DEFROST) ACTUATOR CIRCUIT RESISTANCE

Measure the resistance between the (C801) Mode Door 2 Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 20 ohms?

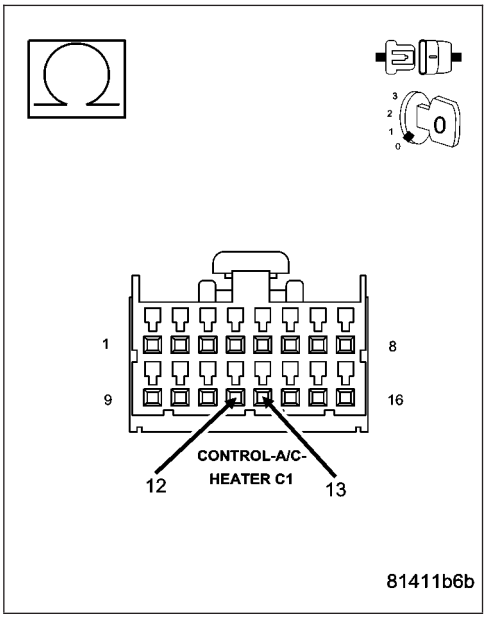
Yes >> Go To 7

No >> Go To 8

7. CHECK (C801) MODE DOOR 2 DRIVER CIRCUIT FOR A SHORT TO (C34) COMMON DOOR DRIVER CIRCUIT

Disconnect the Mode Door 2 (Floor to Defrost) Actuator harness connector.

Measure the resistance between the (C801) Mode Door 2 Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms?

Yes >> Repair the (C801) Mode Door 2 Driver Circuit for a short to the (C34) Common Door Driver circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

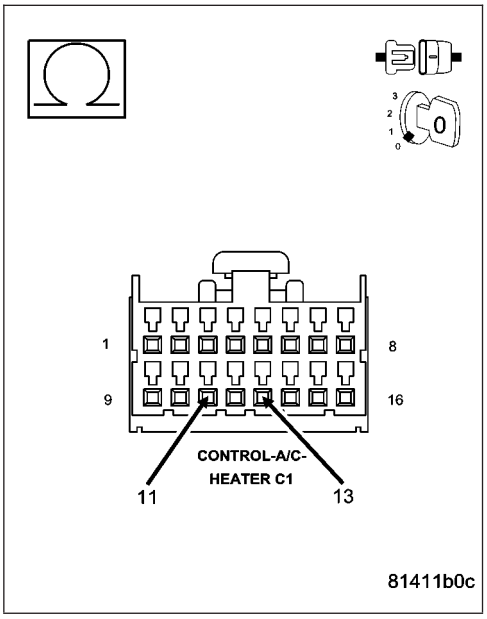
No >> Replace the Mode Door 2 (Floor to Defrost) Actuator in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B105F–CLIMATE CONTROL MOTOR(S) COMMON 1 CONTROL CIRCUIT LOW (CONTINUED)

8. CHECK RECIRCULATION DOOR ACTUATOR CIRCUIT RESISTANCE

Measure the resistance between the (C32) Recirculation Door Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 20 ohms?

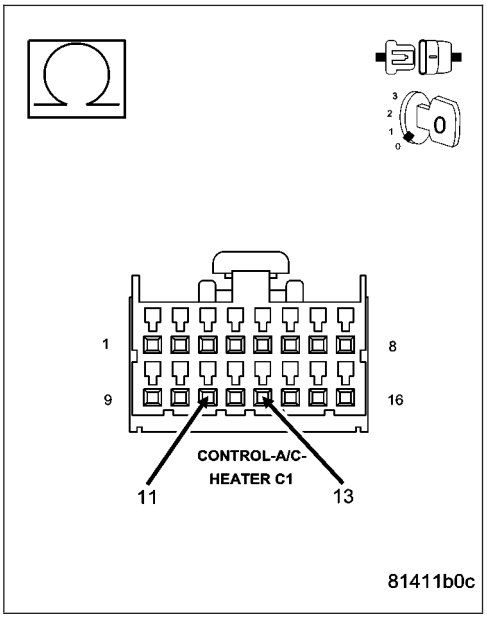
Yes >> Go To 9

No >> Go To 10

9. CHECK (C32) RECIRCULATION DOOR DRIVER CIRCUIT FOR A SHORT TO (C34) COMMON DOOR DRIVER CIRCUIT

Disconnect the Recirculation Door Actuator harness connector.

Measure the resistance between the (C32) Recirculation Door Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms?

Yes >> Repair the (C32) Recirculation Door Driver circuit for a short to the (C34) Common Door Driver circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Replace the Recirculation Door Actuator in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B105F–CLIMATE CONTROL MOTOR(S) COMMON 1 CONTROL CIRCUIT LOW (CONTINUED)

10. RUN THE ACTUATOR DTC DETECTION TEST

Reconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool only display: B105F–CLIMATE CONTROL MOTOR(S) COMMON 1 CONTROL CIRCUIT LOW?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No, Other DTC(s) Displayed

Diagnose and repair the other DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs and then all short low DTCs. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No, And No DTCs Displayed

Using the wiring diagram as a guide, inspect the wiring and connectors for conditions causing an intermittent short. Repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B1001–A/C SWITCH REQUEST INPUT CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The switch input changes when the switch is pushed down. A stored DTC B1001 indicates that the A/C mode switch was stuck in a pushed position for more than two minutes, but has since returned to its normal state. An active DTC B1001 indicates that the A/C mode switch is stuck in a pushed position. An active DTC B1001 will also prevent proper switch and status indicator function as evidenced by not being able to turn the A/C status indicator either on if off or off if on.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the A/C mode switch stays in a pushed position for more than two minutes. This DTC has a maturing time of two minutes and a de-maturing time of two seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

Possible Causes
A/C HEATER CONTROL DAMAGED
OBJECT HOLDING A/C MODE SWITCH IN A PUSHED POSITION
SUBSTANCE CAUSING A/C MODE SWITCH TO GET STUCK IN A PUSHED POSITION
A/C HEATER CONTROL

Diagnostic Test

1. INSPECT THE A/C HEATER CONTROL FOR DAMAGE

Inspect the A/C Heater Control for damage.

Is the A/C Heater Control damaged?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 2

---

2. INSPECT FOR OBJECT OR SUBSTANCE CAUSING THE A/C MODE SWITCH TO STAY OR STICK IN A PUSHED POSITION

Inspect the A/C Heater Control for anything that would cause the A/C mode switch to stay or stick in a pushed position.

Is anything present that would cause the A/C mode switch to stay or stick in a pushed position?

Yes >> Repair as necessary.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 3

B1001–A/C SWITCH REQUEST INPUT CIRCUIT LOW (CONTINUED)

3. CHECK FOR NORMAL A/C MODE SWITCH & STATUS INDICATOR FUNCTION

Turn the ignition on.

Turn the blower control on.

Press the A/C mode switch on and off several times while observing the A/C status indicator.

Does the A/C status indicator turn on and off with respect to the switch position?

Yes >> Go To 4

No >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

---

4. VERIFY THAT DTC B1001–A/C SWITCH REQUEST INPUT CIRCUIT LOW IS STILL ACTIVE

Turn the blower control off.

With the scan tool, erase HVAC DTCs.

Turn the ignition off, wait 10 seconds, and then turn the ignition on. Wait two minutes before proceeding.

With the scan tool, read HVAC DTCs.

Does the scan tool display active: B1001–A/C SWITCH REQUEST INPUT CIRCUIT LOW?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B1016–REAR DEFROST SWITCH REQUEST INPUT CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The switch input changes when the switch is pushed down. A stored DTC B1016 indicates that the Rear Defrost mode switch was stuck in a pushed position for more than two minutes, but has since returned to its normal state. An active DTC B1016 indicates that the Rear Defrost mode switch is stuck in a pushed position. An active DTC B1016 will also prevent proper switch and status indicator function as evidenced by not being able to turn the Rear Defrost status indicator either on if off or off if on.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Rear Defrost mode switch stays in a pushed position for more than two minutes. This DTC has a maturing time of two minutes and a de-maturing time of two seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

Possible Causes
A/C HEATER CONTROL DAMAGED
OBJECT HOLDING REAR DEFROST MODE SWITCH IN A PUSHED POSITION
SUBSTANCE CAUSING REAR DEFROST MODE SWITCH TO GET STUCK IN A PUSHED POSITION
A/C HEATER CONTROL

Diagnostic Test

1. INSPECT THE A/C HEATER CONTROL FOR DAMAGE

Inspect the A/C Heater Control for damage.

Is the A/C Heater Control damaged?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 2

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2. INSPECT FOR OBJECT OR SUBSTANCE CAUSING THE REAR DEFROST MODE SWITCH TO STAY OR STICK IN A PUSHED POSITION

Inspect the A/C Heater Control for anything that would cause the Rear Defrost mode switch to stay or stick in a pushed position.

Is anything present that would cause the Rear Defrost mode switch to stay or stick in a pushed position?

Yes >> Repair as necessary.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 3

B1016–REAR DEFROST SWITCH REQUEST INPUT CIRCUIT LOW (CONTINUED)

3. CHECK FOR NORMAL REAR DEFROST MODE SWITCH & STATUS INDICATOR FUNCTION

Turn the ignition on.

Press the Rear Defrost mode switch on and off several times while observing the status indicator.

Does the Rear Defrost status indicator turn on and off with respect to the switch position?

Yes >> Go To 4

No >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

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4. VERIFY THAT DTC B1016–REAR DEFROST SWITCH REQUEST INPUT CIRCUIT LOW IS STILL ACTIVE

With the scan tool, erase HVAC DTCs.

Turn the ignition off, wait 10 seconds, and then turn the ignition on. Wait two minutes before proceeding.

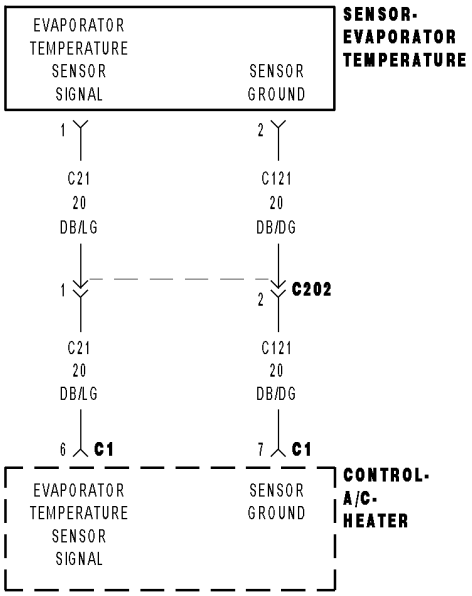
With the scan tool, read HVAC DTCs.

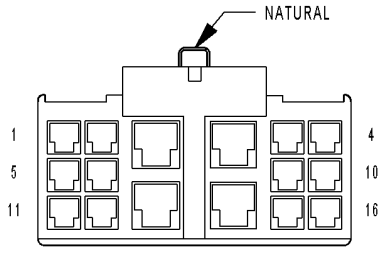
Does the scan tool display active: B1016–REAR DEFROST SWITCH REQUEST INPUT CIRCUIT LOW?

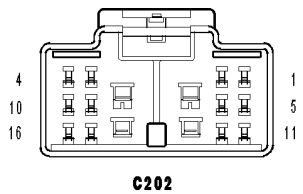
Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

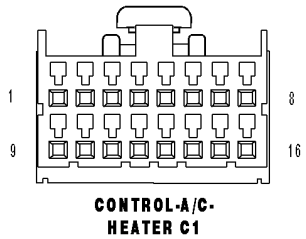
No >> Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

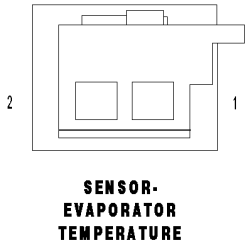
B1031–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT LOW











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B1031–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Evaporator Temperature Sensor input is out of range toward the low voltage threshold, (A/D counts reach low threshold of 16). This DTC has a maturing time of 5 seconds and a de-maturing time of 10 seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

Possible Causes
(C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO (C121) SENSOR GROUND
EVAPORATOR TEMPERATURE SENSOR
A/C HEATER CONTROL

NOTE: DTC B1031 must be active for the results of this test to be valid. Do not perform this test if DTC B1031 is stored. Refer to HVAC System Test for stored DTC test procedures.

Diagnostic Test

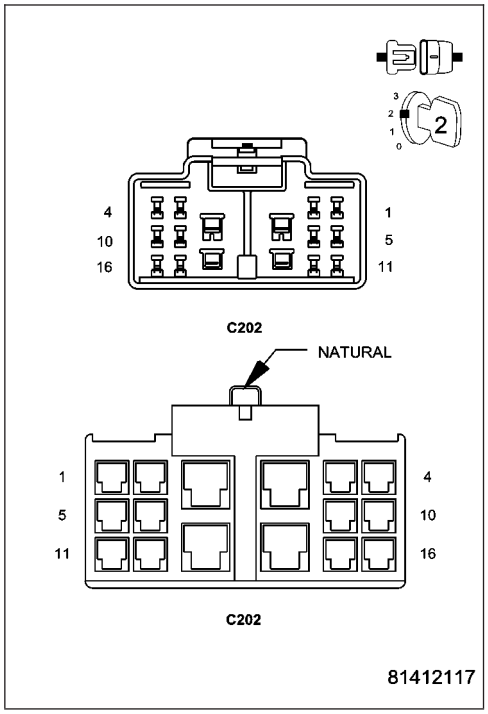
1. CHECK FOR DTC B1031–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT LOW WITH IN-LINE C202 HARNESS CONNECTOR DISCONNECTED

Turn the ignition off.
Disconnect the in-line C202 harness connector.
Turn the ignition on.
With the scan tool, erase HVAC DTCs.
With the scan tool, read HVAC DTCs.

Does the scan tool display: B1031–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT LOW?

Yes >> Go To 2

No >> Go To 4



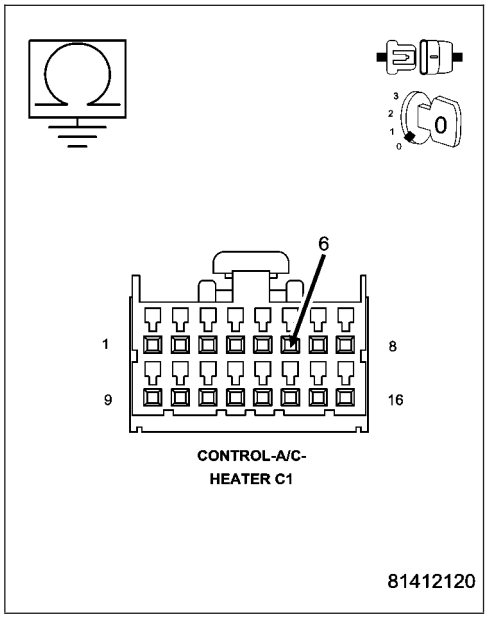
B1031–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

2. CHECK (C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

Measure the resistance of the (C21) Evaporator Temperature Sensor Signal circuit between ground and the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms?

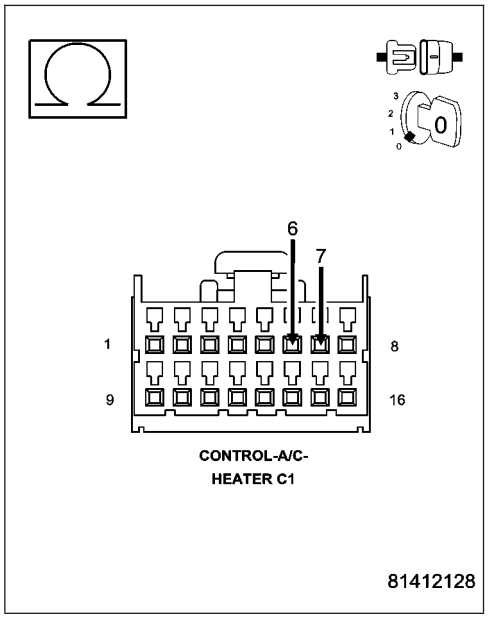
Yes >> Repair the (C21) Evaporator Temperature Sensor Signal circuit for a short to ground between the A/C Heater Control C1 harness connector and the in-line C202 (IP SIDE) harness connector.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 3

3. CHECK (C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO (C121) SENSOR GROUND

Measure the resistance between the (C21) Evaporator Temperature Sensor Signal circuit and the (C121) Sensor Ground circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms?

Yes >> Repair the (C21) Evaporator Temperature Sensor Signal circuit for a short to the (C121) Sensor Ground circuit between the A/C Heater Control C1 harness connector and the in-line C202 (IP SIDE) harness connector.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

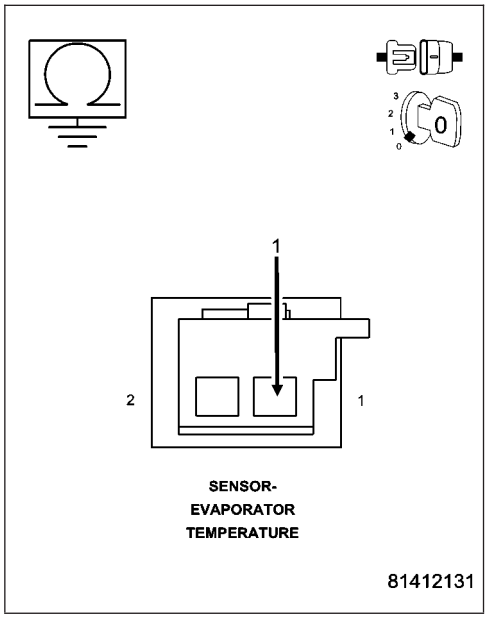
B1031–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

4. CHECK (C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the Evaporator Temperature Sensor harness connector.

Measure the resistance of the (C21) Evaporator Temperature Sensor Signal circuit between ground and the Evaporator Temperature Sensor harness connector.



Is the resistance below 10k ohms?

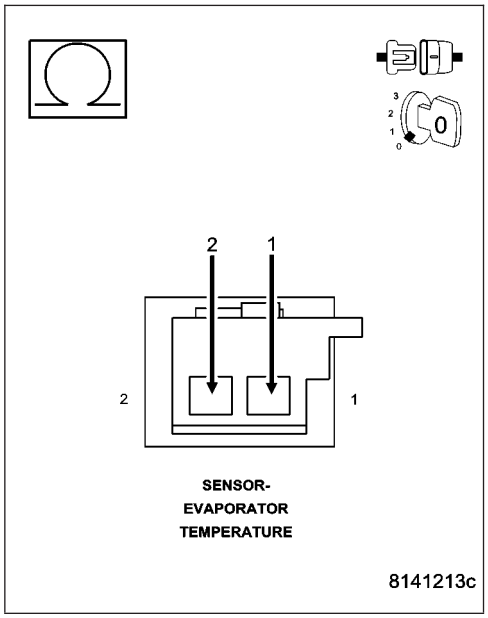
Yes >> Repair the (C21) Evaporator Temperature Sensor Signal circuit for a short to ground between the Evaporator Temperature Sensor harness connector and the in-line C202 (HVAC SIDE) harness connector.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 5

5. CHECK (C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO (C121) SENSOR GROUND

Measure the resistance between the (C21) Evaporator Temperature Sensor Signal circuit and the (C121) Sensor Ground circuit in the Evaporator Temperature Sensor harness connector.



Is the resistance below 10k ohms?

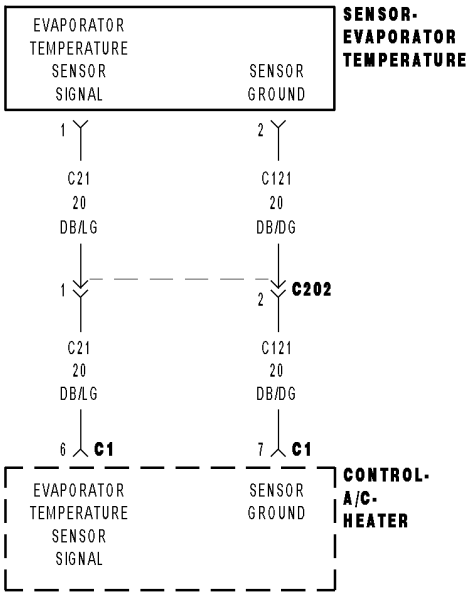
Yes >> Repair the (C21) Evaporator Temperature Sensor Signal circuit for a short to the (C121) Sensor Ground circuit between the Evaporator Temperature Sensor harness connector and the in-line C202 (HVAC SIDE) harness connector.

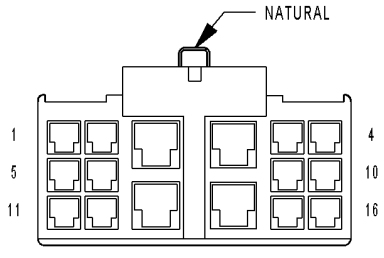
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

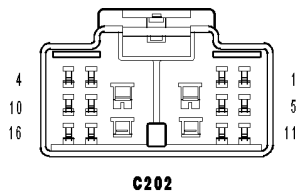
No >> Replace the Evaporator Temperature Sensor in accordance with the Service Information.

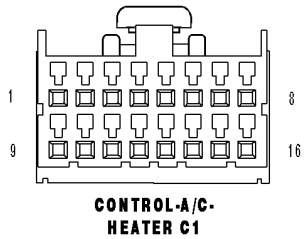
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

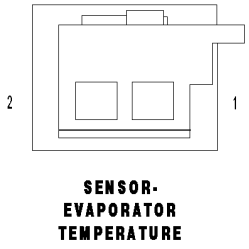
B1032–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT HIGH











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B1032–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Evaporator Temperature Sensor input is out of range toward the high voltage threshold, (A/D counts reach high threshold of 240). This DTC has a maturing time of 5 seconds and a de-maturing time of 10 seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

Possible Causes
(C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN
(C121) SENSOR GROUND CIRCUIT OPEN
EVAPORATOR TEMPERATURE SENSOR
A/C HEATER CONTROL

NOTE: This DTC must be active for the results of this test to be valid. Do not perform this test if this DTC is stored. Refer to HVAC System Test for stored DTC test procedures.

Diagnostic Test

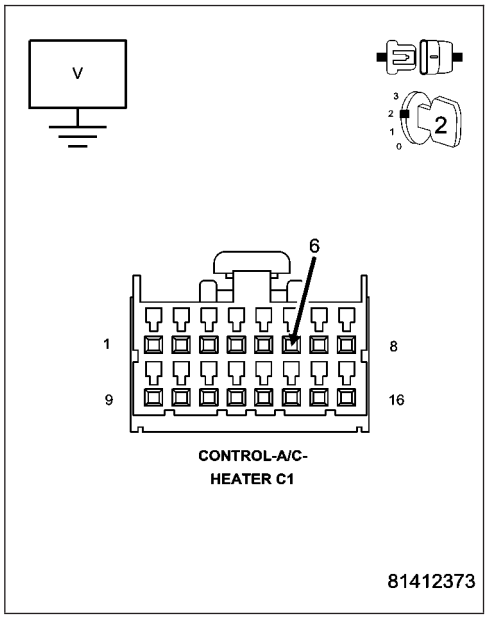
1. CHECK (C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

Measure the voltage of the (C21) Evaporator Temperature Sensor Signal circuit.



Is the voltage above 0.2 volts?

Yes >> Repair the (C21) Evaporator Temperature Sensor Signal circuit for a short to voltage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 2

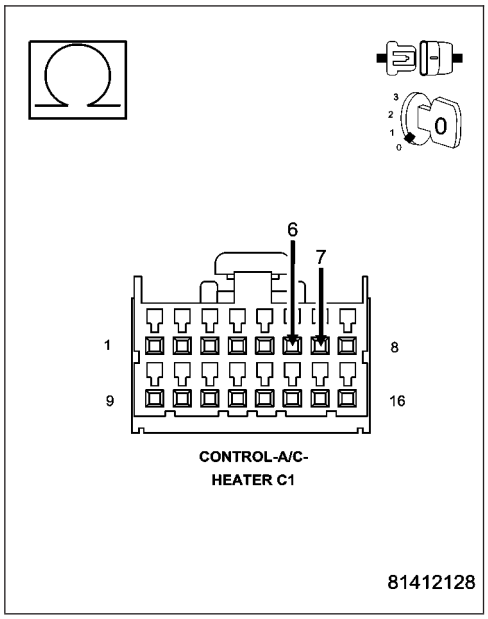
B1032–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

2. CHECK (C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT, (C121) SENSOR GROUND CIRCUIT, & EVAPORATOR TEMPERATURE SENSOR

Turn the ignition off.

Measure the resistance between the (C21) Evaporator Temperature Sensor Signal circuit and the (C121) Sensor Ground circuit in the A/C Heater Control C1 harness connector. The approximate circuit resistance should be as follows:

- 1468 ohms @ 40°C (104°F)
- 1800 ohms @ 35°C (95°F)
- 2221 ohms @ 30°C (86°F)
- 2757 ohms @ 25°C (77°F)
- 3443 ohms @ 20°C (68°F)
- 4330 ohms @ 15°C (59°F)
- 5485 ohms @ 10°C (50°F)
- 6998 ohms @ 5°C (41°F)
- 7354 ohms @ 4°C (39°F)
- 7731 ohms @ 3°C (37°F)
- 8130 ohms @ 2°C (36°F)
- 8553 ohms @ 1°C (34°F)
- 9000 ohms @ 0°C (32°F)



Is the resistance within the specifications?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 3

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3. CHECK (C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT FOR AN OPEN

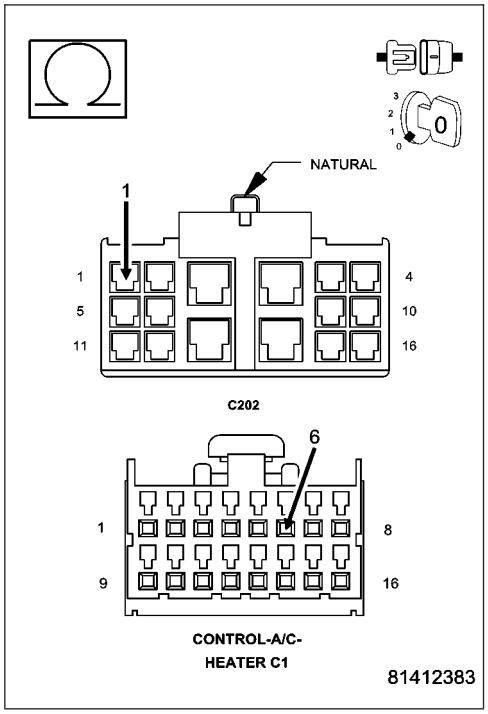
Disconnect the in-line C202 harness connector.

Measure the resistance of the (C21) Evaporator Temperature Sensor Signal circuit between the A/C Heater Control C1 harness connector and the in-line C202 (IP SIDE) harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the (C21) Evaporator Temperature Sensor Signal circuit for an open between the A/C Heater Control C1 harness connector and the in-line C202 (IP SIDE) harness connector.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).



B1032–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

4. CHECK (C121) SENSOR GROUND CIRCUIT FOR AN OPEN

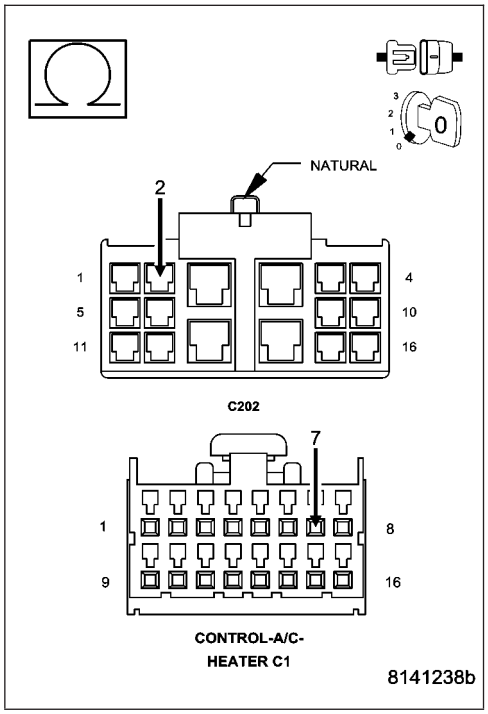
Measure the resistance of the (C121) Sensor Ground circuit between the A/C Heater Control C1 harness connector and the in-line C202 (IP SIDE) harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the (C121) Sensor Ground circuit for an open between the A/C Heater Control C1 harness connector and the in-line C202 (IP SIDE) harness connector.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).



5. CHECK (C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT FOR AN OPEN

Disconnect the Evaporator Temperature Sensor harness connector.

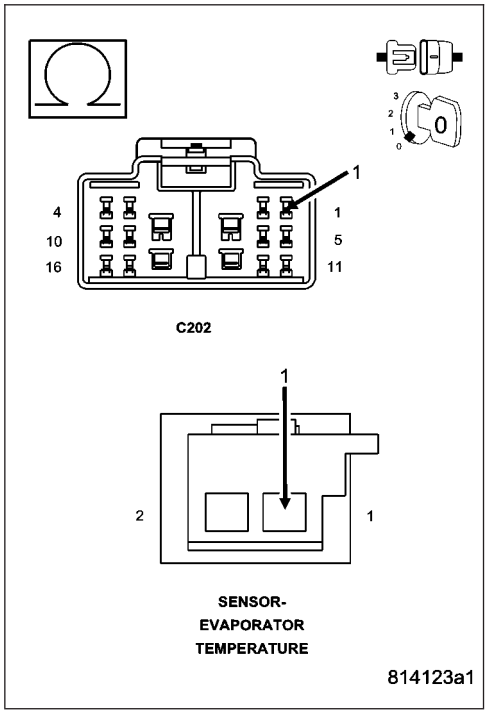
Measure the resistance of the (C21) Evaporator Temperature Sensor Signal circuit between the Evaporator Temperature Sensor harness connector and the in-line C202 (HVAC SIDE) harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the (C21) Evaporator Temperature Sensor Signal circuit for an open between the Evaporator Temperature Sensor harness connector and the in-line C202 (HVAC SIDE) harness connector.

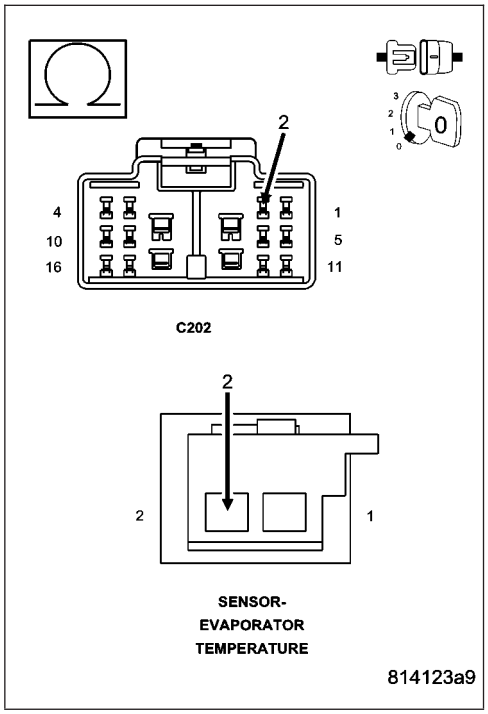
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).



B1032–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

6. CHECK (C121) SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the (C121) Sensor Ground circuit between the Evaporator Temperature Sensor harness connector and the in-line C202 (HVAC SIDE) harness connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the Evaporator Temperature Sensor in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Repair the (C121) Sensor Ground circuit for an open between the Evaporator Temperature Sensor harness connector and the in-line C202 (HVAC SIDE) harness connector.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

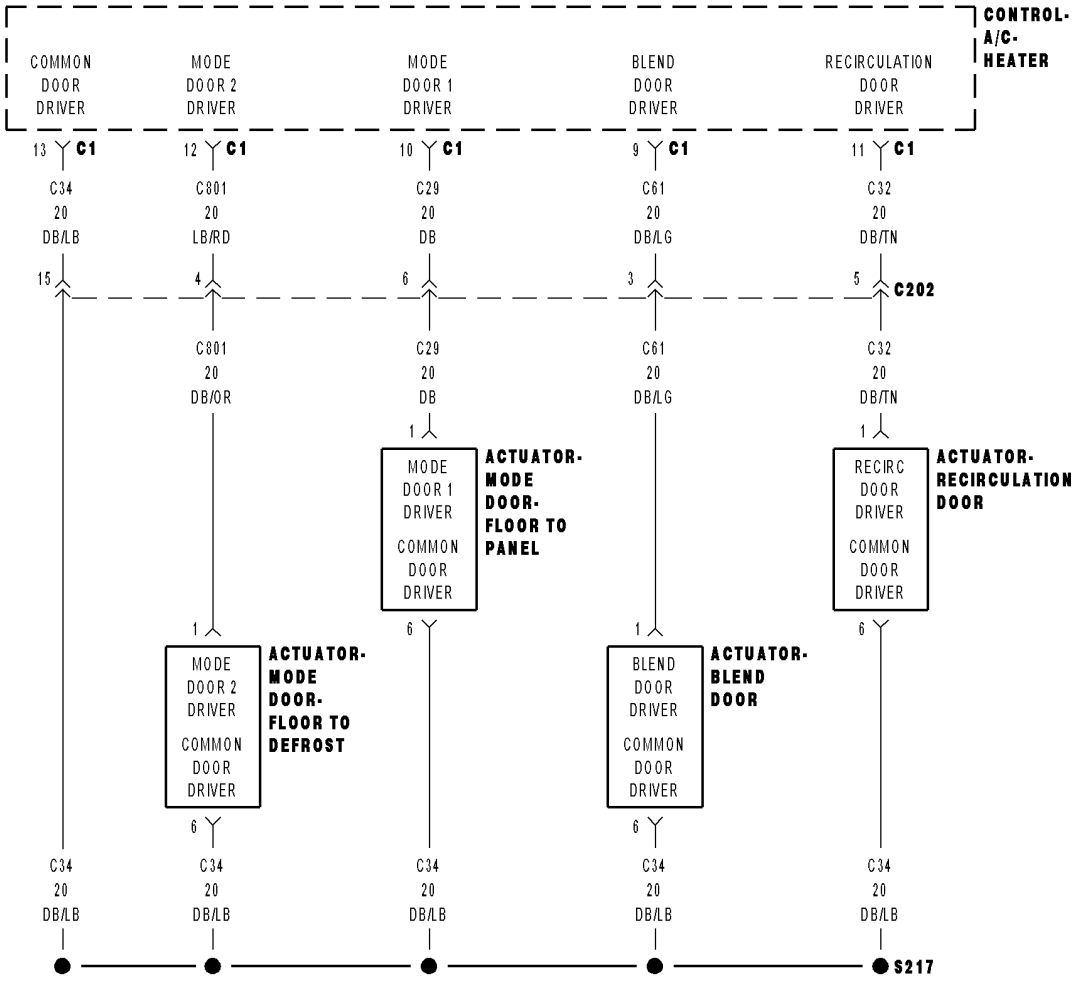
B1040–PANEL MODE DOOR 1 CONTROL CIRCUIT/PERFORMANCE

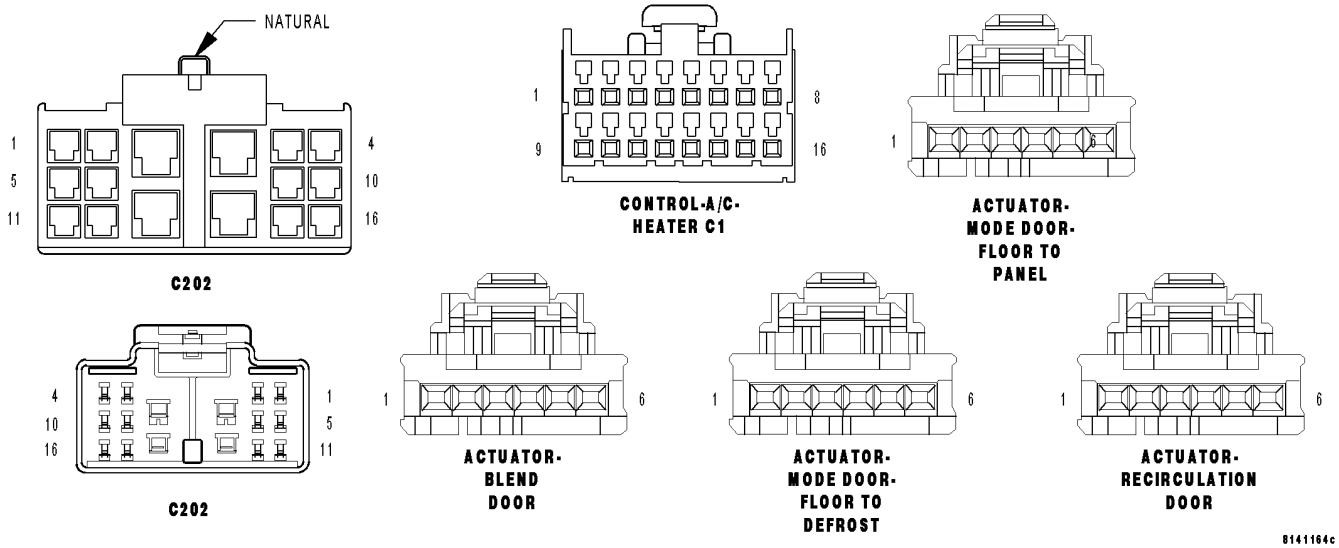
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When actuator movement is requested.
- **Set Condition:**
  If the A/C Heater Control detects an excessive current draw on any of the door driver circuits while attempting to drive this actuator. This DTC has a maturing time of 5 seconds and a de-maturing time of 10 seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

If this DTC is active, refer to B104C–BLEND DOOR CONTROL CIRCUIT/PERFORMANCE for the diagnostic test procedure. If this DTC is stored, refer to HVAC System Test for stored DTC test procedures.

B1041–PANEL MODE DOOR 1 CONTROL CIRCUIT LOW





B1041–PANEL MODE DOOR 1 CONTROL CIRCUIT LOW (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Mode Door 1 (Floor to Panel) Actuator via the (C29) Mode Door 1 Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver circuit. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the type of short, its location, and the direction the actuator is moving when the short is present.

- **When Monitored:**
  When the Actuator DTC Detection Test is executed.
- **Set Condition:**
  If the (C29) Mode Door 1 Driver circuit is shorted to ground.

Possible Causes
(C29) MODE DOOR 1 DRIVER CIRCUIT SHORTED TO GROUND
(C29) MODE DOOR 1 DRIVER CIRCUIT SHORTED TO OTHER DOOR DRIVER CIRCUIT(S)
MODE DOOR 1 (FLOOR TO PANEL) ACTUATOR
A/C HEATER CONTROL

Diagnostic Test

1. CHECK (C29) MODE DOOR 1 DRIVER CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

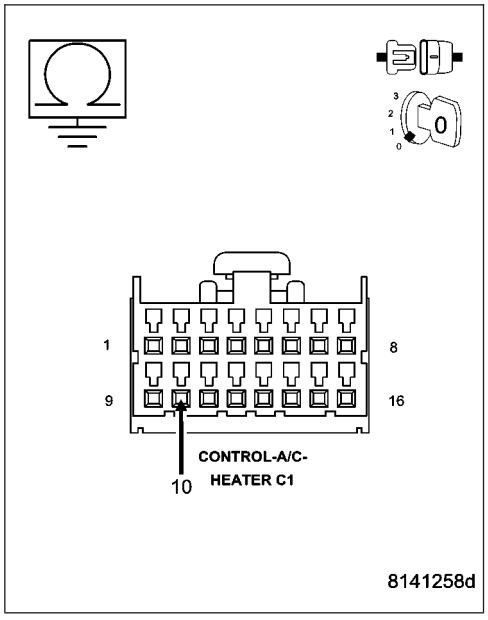
Disconnect the A/C Heater Control C1 harness connector.

Measure the resistance of the (C29) Mode Door 1 Driver circuit between ground and the A/C Heater Control C1 harness connector.

Is the resistance below 10k ohms?

Yes >> Repair the (C29) Mode Door 1 Driver circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

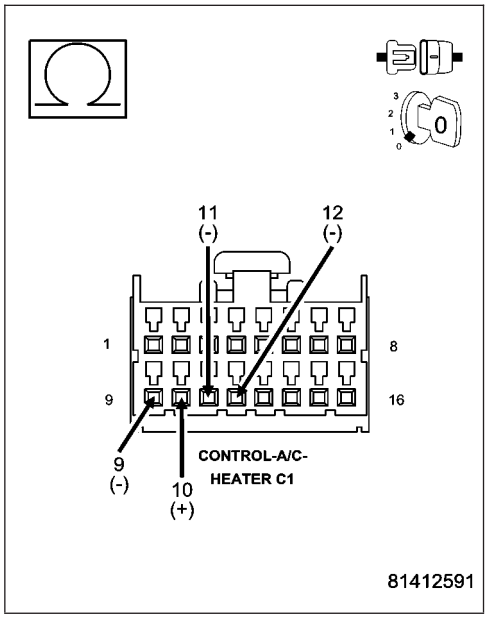
No >> Go To 2



B1041–PANEL MODE DOOR 1 CONTROL CIRCUIT LOW (CONTINUED)

2. CHECK (C29) MODE DOOR 1 DRIVER CIRCUIT FOR A SHORT TO OTHER DOOR DRIVER CIRCUITS

Measure the resistance between the (C29) Mode Door 1 Driver circuit and the (C61) Blend Door Driver circuit, the (C801) Mode Door 2 Driver circuit, and the (C32) Recirculation Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms between the (C29) Mode Door 1 Driver circuit and any of the other door driver circuits?

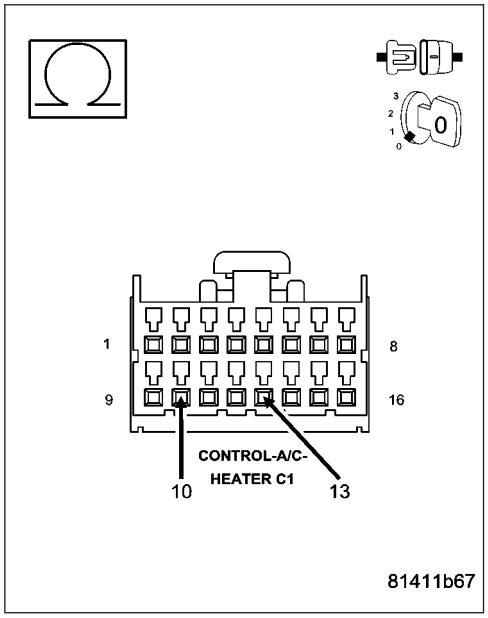
Yes >> Repair the circuit(s) with a resistance below 10k ohms for a short to the (C29) Mode Door 1 Driver circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 3

3. CHECK MODE DOOR 1 (FLOOR TO PANEL) ACTUATOR CIRCUIT RESISTANCE

Measure the resistance between the (C29) Mode Door 1 Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 20 ohms?

Yes >> Go To 4

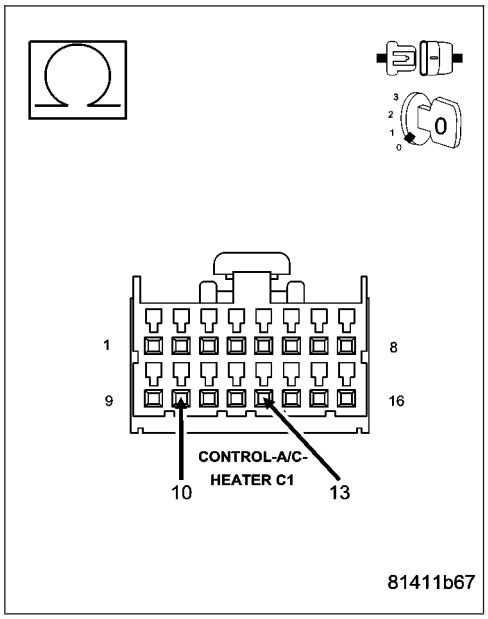
No >> Go To 5

B1041–PANEL MODE DOOR 1 CONTROL CIRCUIT LOW (CONTINUED)

4. CHECK (C29) MODE DOOR 1 DRIVER CIRCUIT FOR A SHORT TO (C34) COMMON DOOR DRIVER CIRCUIT

Disconnect the Mode Door 1 (Floor to Panel) Actuator harness connector.

Measure the resistance between the (C29) Mode Door 1 Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms?

Yes >> Repair the (C29) Mode Door 1 Driver circuit for a short to the (C34) Common Door Driver circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Replace the Mode Door 1 (Floor to Panel) Actuator in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

---

5. RUN THE ACTUATOR DTC DETECTION TEST

Reconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

With the scan tool, erase HVAC DTCs.

With the scan tool, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool only display: B1041–PANEL MODE DOOR 1 CONTROL CIRCUIT LOW?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No, Other DTC(s) Displayed

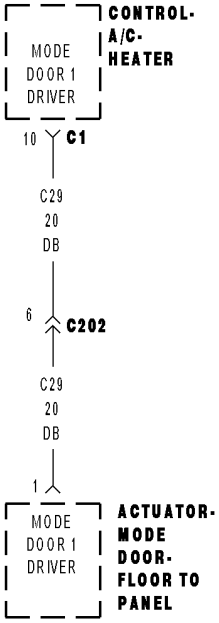
Diagnose and repair the other DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs and then all short low DTCs. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

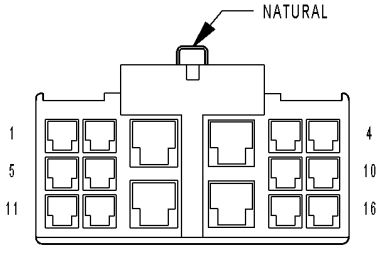
No, And No Other DTCs Displayed

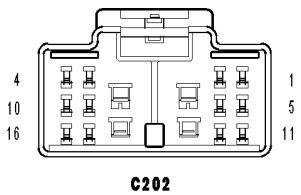
Using the wiring diagram as a guide, inspect the wiring and connectors for conditions causing an intermittent short. Repair as necessary.

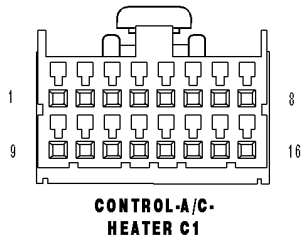
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

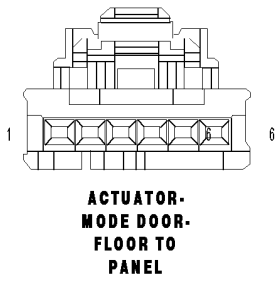
B1042–PANEL MODE DOOR 1 CONTROL CIRCUIT HIGH











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B1042–PANEL MODE DOOR 1 CONTROL CIRCUIT HIGH (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Mode Door 1 (Floor to Panel) Actuator via the (C29) Mode Door 1 Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver circuit. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Note that due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the type of short, its location, and the direction the actuator is moving when the short is present.

- **When Monitored:**
  When the Actuator DTC Detection Test is executed.
- **Set Condition:**
  If the (C29) Mode Door 1 Driver circuit is shorted to voltage.

Possible Causes
(C29) MODE DOOR 1 DRIVER CIRCUIT SHORTED TO VOLTAGE
A/C HEATER CONTROL

Diagnostic Test

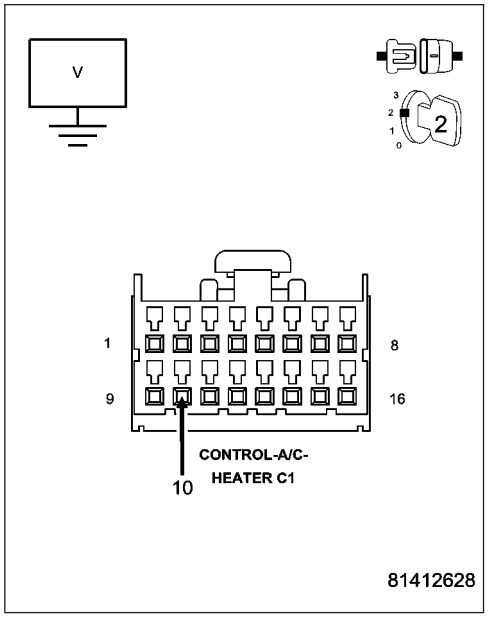
1. CHECK (C29) MODE DOOR 1 DRIVER CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

Measure the voltage of the (C29) Mode Door 1 Driver circuit.



Is the voltage above 0.2 volts?

Yes >> Repair the (C29) Mode Door 1 Driver circuit for a short to voltage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 2

B1042–PANEL MODE DOOR 1 CONTROL CIRCUIT HIGH (CONTINUED)

2. RUN THE ACTUATOR DTC DETECTION TEST

Turn the ignition off.

Reconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool only display: B1042–PANEL MODE DOOR 1 CONTROL CIRCUIT HIGH?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No, Other DTC(s) Displayed

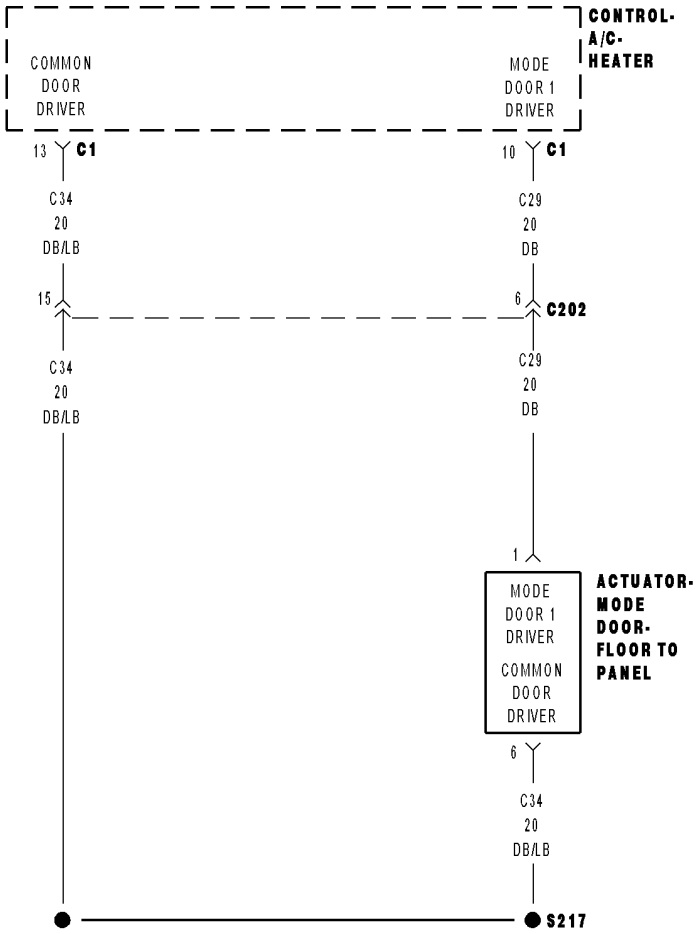
Diagnose and repair the other DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs and then all short low DTCs. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

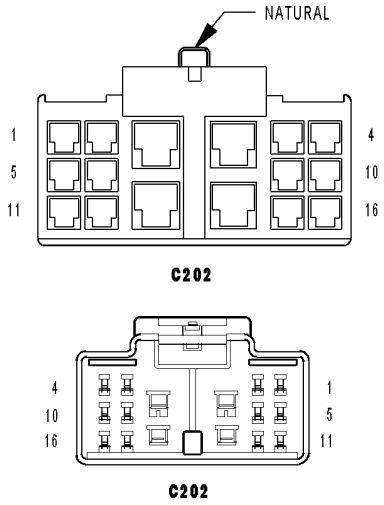
No, And No Other DTCs Displayed

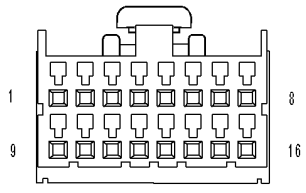
Using the wiring diagram as a guide, inspect the wiring and connectors for conditions causing an intermittent short. Repair as necessary.

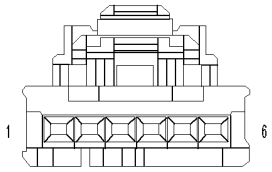
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B1043–PANEL MODE DOOR 1 CONTROL CIRCUIT OPEN









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B1043–PANEL MODE DOOR 1 CONTROL CIRCUIT OPEN (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Mode Door 1 (Floor to Panel) Actuator via the (C29) Mode Door 1 Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver circuit. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Note that due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the location of the open circuit and the direction the actuator is moving when the open is present.

- **When Monitored:**
  When actuator movement is requested.
- **Set Condition:**
  If the Mode Door 1 (Floor to Panel) Actuator's electrical circuit is open. This DTC has a maturing time of 5 seconds and a de-maturing time of 10 seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

Possible Causes
(C29) MODE DOOR 1 DRIVER CIRCUIT OPEN
(C34) COMMON DOOR DRIVER CIRCUIT OPEN
MODE DOOR 1 (FLOOR TO PANEL) ACTUATOR
A/C HEATER CONTROL

NOTE: DTC B1043 must be active for the results of this test to be valid. Do not perform this test if DTC B1043 is stored. Refer to HVAC System Test for stored DTC test procedures.

Diagnostic Test

1. CHECK FOR ACTIVE CONTROL CIRCUIT/PERFORMANCE DTCs

Turn the ignition on.

With the scan tool, read active HVAC DTCs.

Does the scan tool display any active: XXXX CONTROL CIRCUIT/PERFORMANCE DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 2

B1043–PANEL MODE DOOR 1 CONTROL CIRCUIT OPEN (CONTINUED)

2. CHECK MODE DOOR 1 (FLOOR TO PANEL) ACTUATOR CIRCUIT RESISTANCE

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

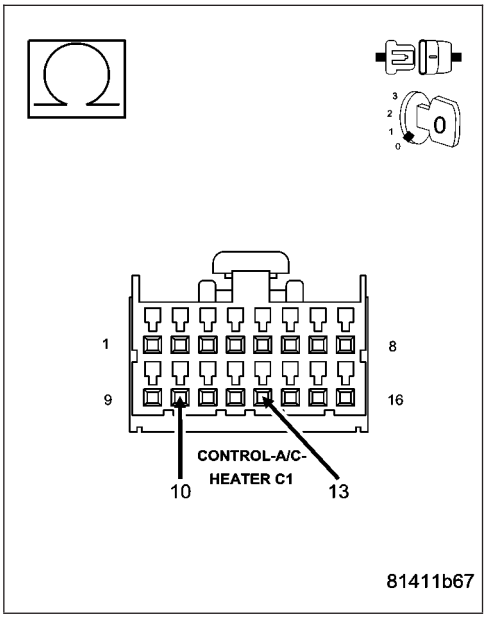
Measure the resistance between the (C29) Mode Door 1 Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.

Is the resistance above 55 ohms?

Yes >> Go To 3

No >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).



3. CHECK (C29) MODE DOOR 1 DRIVER CIRCUIT FOR AN OPEN

Disconnect the Mode Door 1 (Floor to Panel) Actuator harness connector.

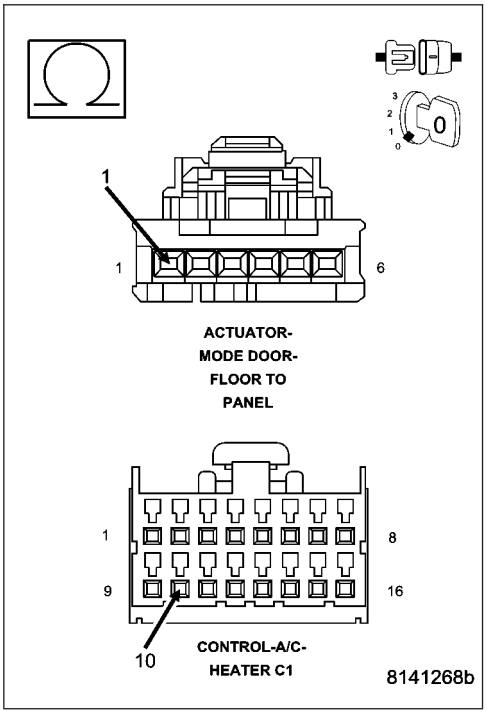
Measure the resistance of the (C29) Mode Door 1 Driver circuit between the A/C Heater Control C1 harness connector and the Mode Door 1 (Floor to Panel) Actuator harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the (C29) Mode Door 1 Driver circuit for an open.

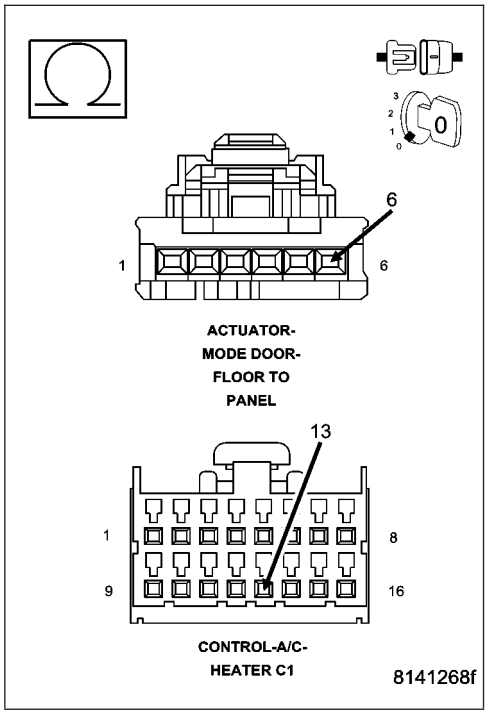
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).



B1043–PANEL MODE DOOR 1 CONTROL CIRCUIT OPEN (CONTINUED)

4. CHECK (C34) COMMON DOOR DRIVER CIRCUIT FOR AN OPEN

Measure the resistance of the (C34) Common Door Driver circuit between the A/C Heater Control C1 harness connector and the Mode Door 1 (Floor to Panel) Actuator harness connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the Mode Door 1 (Floor to Panel) Actuator in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Repair the (C34) Common Door Driver circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B1044–PANEL MODE DOOR 1 TRAVEL RANGE TOO SMALL

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control calibrates each actuator individually. Automatic calibration occurs upon power up after installing a new A/C Heater Control. Manual calibration occurs by sending a command with the scan tool. The purpose of actuator calibration is to determine the total span of door travel between physical stops. To calibrate the actuator, the A/C Heater Control first moves the door to an end stop, and then counts the number of pulses it takes to move the door to its other stop. An expected range of span is stored in the control's memory. If the measured calibration value is less than the expected range for this actuator, this DTC will set. Note that the control clears all stored calibration faults at the beginning of the calibration procedure.

- **When Monitored:**
  During actuator calibration.
- **Set Condition:**
  If the total span of the Mode 1 (Floor to Panel) Door is less than the low range limit.

Possible Causes
DOOR DRIVER ELECTRICAL CIRCUIT(S)
MODE 1 (FLOOR TO PANEL) DOOR SEIZED, BINDING, OBSTRUCTED
MODE DOOR 1 (FLOOR TO PANEL) ACTUATOR
A/C HEATER CONTROL

Diagnostic Test

1. CHECK FOR ACTIVE CONTROL CIRCUIT/PERFORMANCE & CONTROL CIRCUIT OPEN DTCs

Turn the ignition on.

With the scan tool, read active HVAC DTCs.

Does the scan tool display any active: XXXX CONTROL CIRCUIT/PERFORMANCE or XXXX CONTROL CIRCUIT OPEN DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 2

---

2. RUN THE ACTUATOR DTC DETECTION TEST

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool display any DTCs?

Yes >> Diagnose and repair the DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs first, all short low DTCs second, and all open DTCs last. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 3

B1044–PANEL MODE DOOR 1 TRAVEL RANGE TOO SMALL (CONTINUED)

3. INSPECT ACTUATOR & HOUSING ASSEMBLY FOR A CONDITION CAUSING THE DOOR TO SEIZE OR BIND

Turn the ignition off.

Inspect the actuator, linkage, and housing assembly for a condition causing the door to seize or bind.

Are there any physical or mechanical problems with the door, housing, linkage, or actuator?

Yes >> Repair as necessary in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 4

---

4. CHECK MODE 1 (FLOOR TO PANEL) DOOR TRAVEL

Remove the Mode Door 1 (Floor to Panel) Actuator from the A/C Heater Housing Assembly.

By hand, attempt to rotate the door in both directions. The door should operate smoothly in both directions over approximately 80 degrees of travel.

Does the door operate smoothly in both directions over approximately 80 degrees of travel?

Yes >> Replace the Mode Door 1 (Floor to Panel) Actuator in accordance with the Service Information. Then, Go To 5.

No >> Repair as necessary in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

---

5. RUN ACTUATOR CALIBRATION TEST

Turn the ignition on.

With the scan tool, select System Tests and then select Actuator Calibration Test. When the test is complete, select View DTCs.

Does the scan tool display: B1044–PANEL MODE DOOR 1 TRAVEL RANGE TOO SMALL?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B1045–PANEL MODE DOOR 1 TRAVEL RANGE TOO LARGE

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control calibrates each actuator individually. Automatic calibration occurs upon power up after installing a new A/C Heater Control. Manual calibration occurs by sending a command with the scan tool. The purpose of actuator calibration is to determine the total span of door travel between physical stops. To calibrate the actuator, the A/C Heater Control first moves the door to an end stop, and then counts the number of pulses it takes to move the door to its other stop. An expected range of span is stored in the control's memory. If the measured calibration value exceeds the expected range for this actuator, this DTC will set. Note that the control clears all stored calibration faults at the beginning of the calibration procedure.

- **When Monitored:**
  During actuator calibration.
- **Set Condition:**
  If the total span of the Mode 1 (Floor to Panel) Door exceeds the high range limit.

Possible Causes
DOOR DRIVER ELECTRICAL CIRCUIT(S)
MODE 1 (FLOOR TO PANEL) DOOR OR A/C HEATER HOUSING COMPONENTS WARPED, WORN, DAMAGED, MISSING, BROKEN
MODE DOOR 1 (FLOOR TO PANEL) ACTUATOR
A/C HEATER CONTROL

Diagnostic Test

1. CHECK FOR ACTIVE CONTROL CIRCUIT/PERFORMANCE & CONTROL CIRCUIT OPEN DTCs

Turn the ignition on.

With the scan tool, read active HVAC DTCs.

Does the scan tool display any active: XXXX CONTROL CIRCUIT/PERFORMANCE or XXXX CONTROL CIRCUIT OPEN DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 2

---

2. RUN THE ACTUATOR DTC DETECTION TEST

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool display any DTCs?

Yes >> Diagnose and repair the DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs first, all short low DTCs second, and all open DTCs last. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 3

B1045–PANEL MODE DOOR 1 TRAVEL RANGE TOO LARGE (CONTINUED)

3. CHECK FOR A BROKEN MODE DOOR 1 (FLOOR TO PANEL) ACTUATOR

Turn the ignition off.

Remove the Mode Door 1 (Floor to Panel) Actuator from the A/C Heater Housing Assembly.

By hand, attempt to rotate the actuator in both directions.

Does the actuator turn in either direction?

Yes >> Replace the Mode Door 1 (Floor to Panel) Actuator in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 4

---

4. CHECK MODE 1 (FLOOR TO PANEL) DOOR & A/C HEATER HOUSING FOR WARPED, WORN, DAMAGED, MISSING, & BROKEN COMPONENTS

Inspect for excessively worn, disconnected, missing, or broken door linkage. Inspect for a damaged or broken A/C Heater Housing Assembly. Inspect for a warped or broken door, and missing door seals. Rotate the door from stop to stop. The door should rotate approximately 80 degrees.

Are there any physical or mechanical problems with the door or housing?

Yes >> Repair as necessary in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Replace the Mode Door 1 (Floor to Panel) Actuator in accordance with the Service Information. Then, Go To 5.

---

5. RUN ACTUATOR CALIBRATION TEST

Turn the ignition on.

With the scan tool, select System Tests and then select Actuator Calibration Test. When the test is complete, select View DTCs.

Does the scan tool display: B1045–PANEL MODE DOOR 1 TRAVEL RANGE TOO LARGE?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

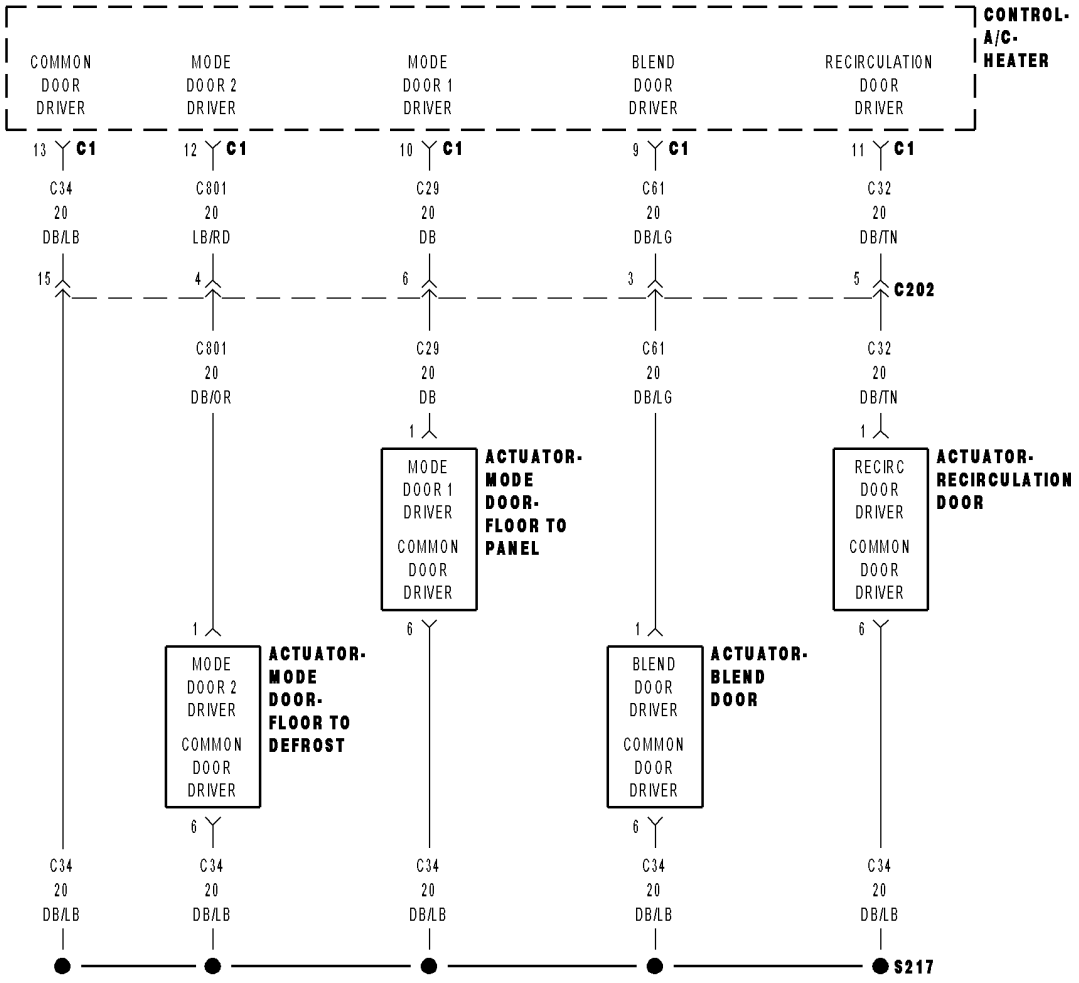
B1046–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT/PERFORMANCE

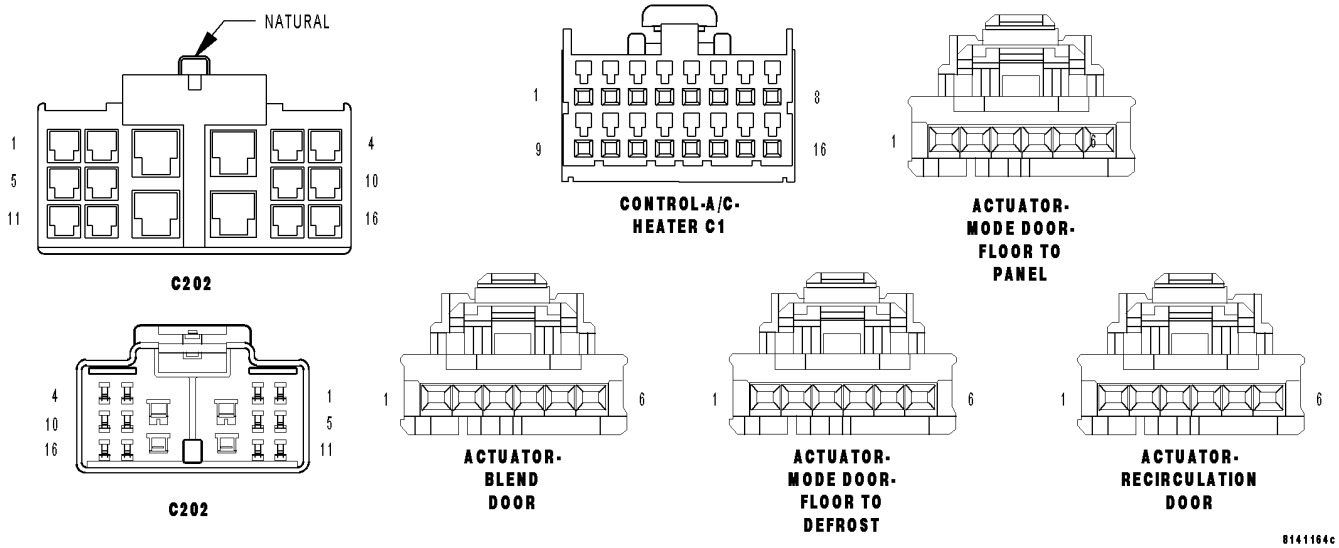
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When actuator movement is requested.
- **Set Condition:**
  If the A/C Heater Control detects an excessive current draw on any of the door driver circuits while attempting to drive this actuator. This DTC has a maturing time of 5 seconds and a de-maturing time of 10 seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

If this DTC is active, refer to B104C-BLEND DOOR CONTROL CIRCUIT/PERFORMANCE for the diagnostic test procedure. If this DTC is stored, refer to HVAC System Test for stored DTC test procedures.

B1047–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT LOW





B1047–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT LOW (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Mode Door 2 (Floor to Defrost) Actuator via the (C801) Mode Door 2 Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver circuit. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the type of short, its location, and the direction the actuator is moving when the short is present.

- **When Monitored:**
  When the Actuator DTC Detection Test is executed.
- **Set Condition:**
  If the (C801) Mode Door 2 Driver circuit is shorted to ground.

Possible Causes
(C801) MODE DOOR 2 DRIVER CIRCUIT SHORTED TO GROUND
(C801) MODE DOOR 2 DRIVER CIRCUIT SHORTED TO OTHER DOOR DRIVER CIRCUIT(S)
MODE DOOR 2 (FLOOR TO DEFROST) ACTUATOR
A/C HEATER CONTROL

Diagnostic Test

1. CHECK (C801) MODE DOOR 2 DRIVER CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

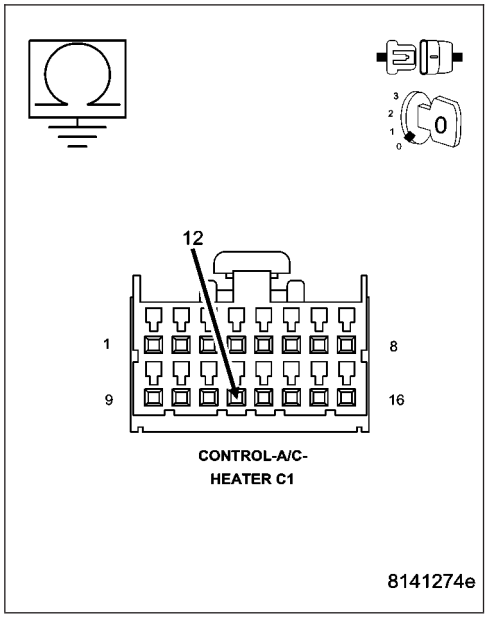
Disconnect the A/C Heater Control C1 harness connector.

Measure the resistance of the (C801) Mode Door 2 Driver circuit between ground and the A/C Heater Control C1 harness connector.

Is the resistance below 10k ohms?

Yes >> Repair the (C801) Mode Door 2 Driver circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

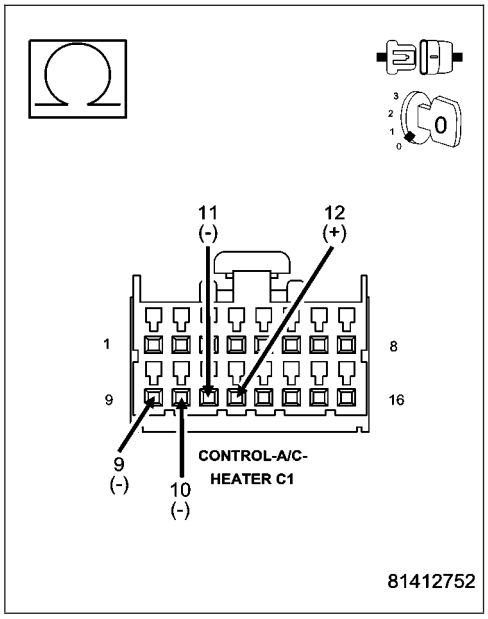
No >> Go To 2



B1047–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT LOW (CONTINUED)

2. CHECK (C801) MODE DOOR 2 DRIVER CIRCUIT FOR A SHORT TO OTHER DOOR DRIVER CIRCUITS

Measure the resistance between the (C801) Mode Door 2 Driver circuit and the (C32) Recirculation Door Driver circuit, the (C29) Mode Door 1 Driver circuit, and the (C61) Blend Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms between the (C801) Mode Door 2 Driver circuit and any of the other door driver circuits?

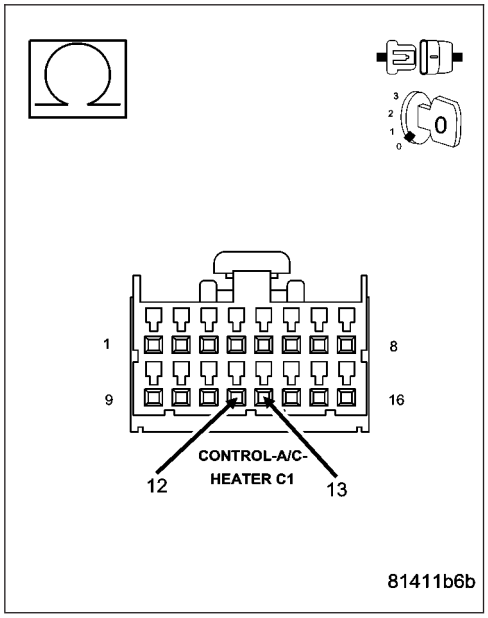
Yes >> Repair the circuit(s) with a resistance below 10k ohms for a short to the (C801) Mode Door 2 Driver circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 3

3. CHECK MODE DOOR 2 (FLOOR TO DEFROST) ACTUATOR CIRCUIT RESISTANCE

Measure the resistance between the (C801) Mode Door 2 Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 20 ohms?

Yes >> Go To 4

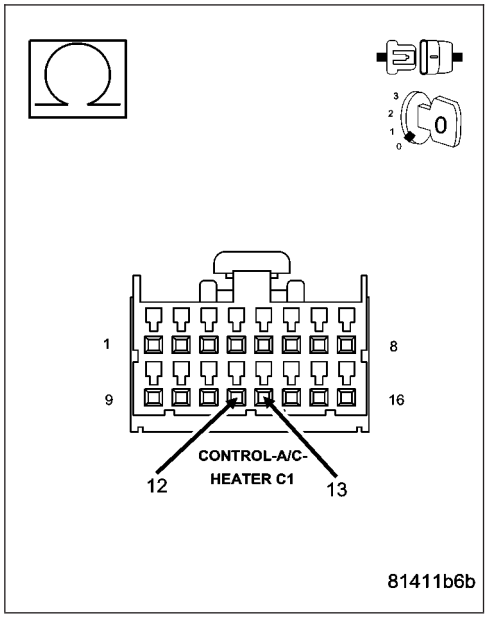
No >> Go To 5

B1047–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT LOW (CONTINUED)

4. CHECK (C801) MODE DOOR 2 DRIVER CIRCUIT FOR A SHORT TO (C34) FRONT COMMON DOOR DRIVER CIRCUIT

Disconnect the Mode Door 2 (Floor to Defrost) Actuator harness connector.

Measure the resistance between the (C801) Mode Door 2 Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms?

Yes >> Repair the (C801) Mode Door 2 Driver circuit for a short to the (C34) Common Door Driver circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Replace the Mode Door 2 (Floor to Defrost) Actuator in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

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5. RUN THE ACTUATOR DTC DETECTION TEST

Reconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

With the scan tool, erase HVAC DTCs.

With the scan tool, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool only display: B1047–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT LOW?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No, Other DTC(s) Displayed

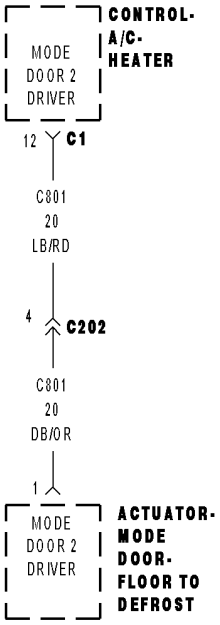
Diagnose and repair the other DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs and then all short low DTCs. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

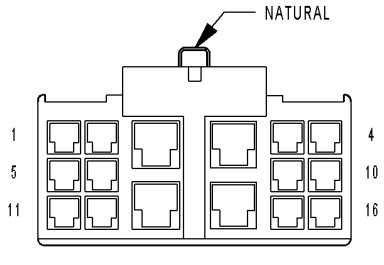
No, And No Other DTCs Displayed

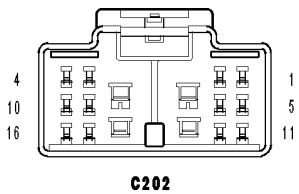
Using the wiring diagram as a guide, inspect the wiring and connectors for conditions causing an intermittent short. Repair as necessary.

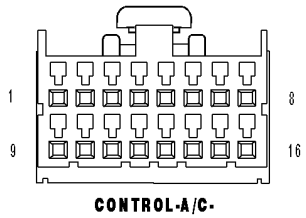
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

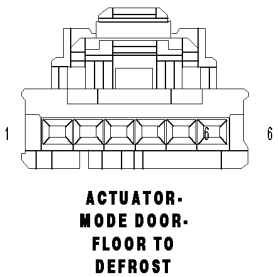
B1048–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT HIGH











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B1048–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT HIGH (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Mode Door 2 (Floor to Defrost) Actuator via the (C801) Mode Door 2 Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver circuit. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the type of short, its location, and the direction the actuator is moving when the short is present.

- **When Monitored:**
  When the Actuator DTC Detection Test is executed.
- **Set Condition:**
  If the (C801) Mode Door 2 Driver circuit is shorted to voltage.

Possible Causes
(C801) MODE DOOR 2 DRIVER CIRCUIT SHORTED TO VOLTAGE
A/C HEATER CONTROL

Diagnostic Test

1. CHECK (C801) MODE DOOR 2 DRIVER CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

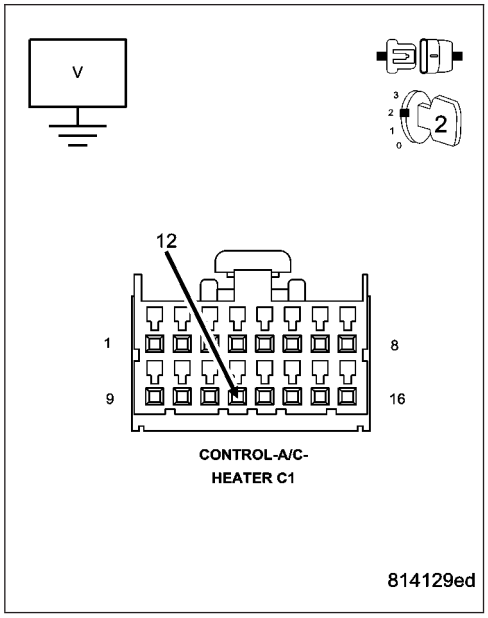
Measure the voltage of the (C801) Mode Door 2 Driver circuit.

Is the voltage above 0.2 volts?

Yes >> Repair the (C801) Mode Door 2 Driver circuit for a short to voltage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 2



B1048–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT HIGH (CONTINUED)

2. RUN THE ACTUATOR DTC DETECTION TEST

Turn the ignition off.

Reconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool only display: B1048–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT HIGH?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No, Other DTC(s) Displayed

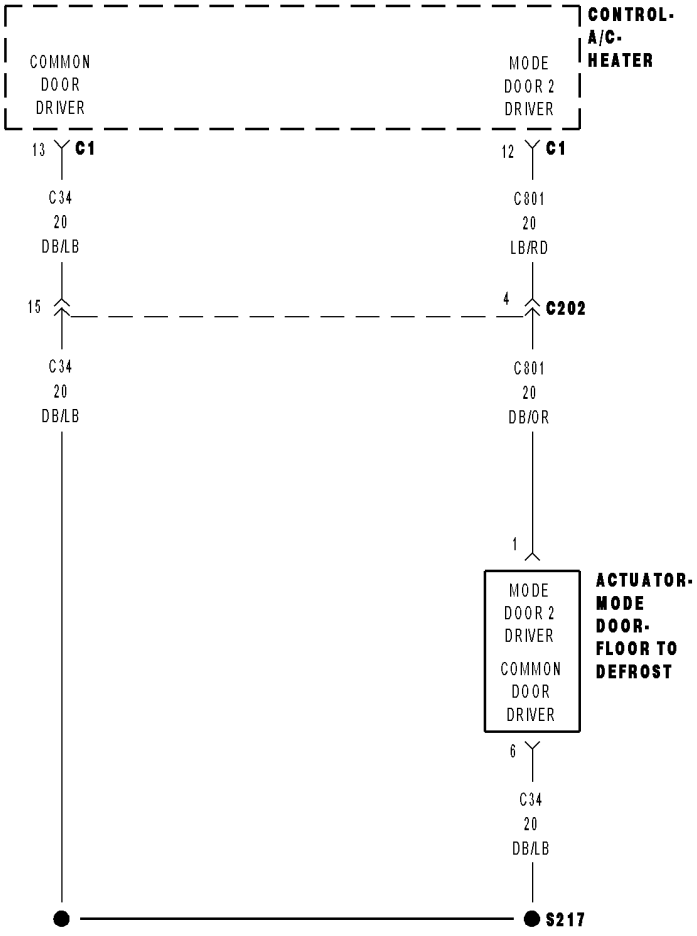
Diagnose and repair the other DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs and then all short low DTCs. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

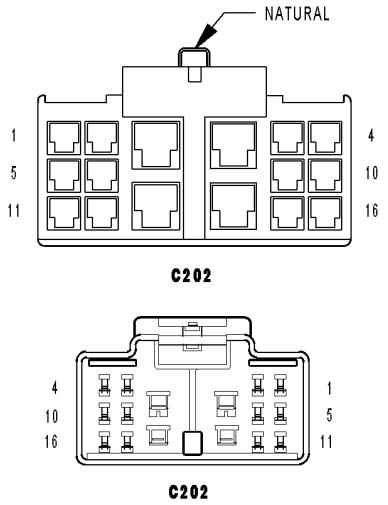
No, And No DTCs Displayed

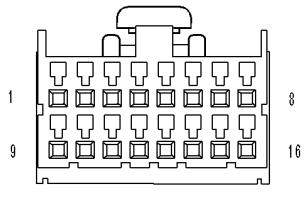
Using the wiring diagram as a guide, inspect the wiring and connectors for conditions causing an intermittent short. Repair as necessary.

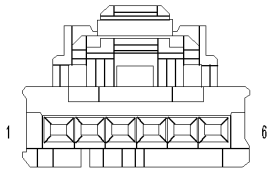
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B1049–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT OPEN









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B1049–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT OPEN (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Mode Door 2 (Floor to Defrost) Actuator via the (C801) Mode Door 2 Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver circuit. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the location of the open circuit and the direction the actuator is moving when the open is present.

- **When Monitored:**
  When actuator movement is requested.
- **Set Condition:**
  If the Mode Door 2 (Floor to Defrost) Actuator's electrical circuit is open. This DTC has a maturing time of 5 seconds and a de-maturing time of 10 seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

Possible Causes
(C801) MODE DOOR 2 DRIVER CIRCUIT OPEN
(C34) COMMON DOOR DRIVER CIRCUIT OPEN
MODE DOOR 2 (FLOOR TO DEFROST) ACTUATOR
A/C HEATER CONTROL

NOTE: DTC B1049 must be active for the results of this test to be valid. Do not perform this test if DTC B1049 is stored. Refer to HVAC System Test for stored DTC test procedures.

Diagnostic Test

1. CHECK FOR ACTIVE CONTROL CIRCUIT/PERFORMANCE DTCs

Turn the ignition on.

With the scan tool, read active HVAC DTCs.

Does the scan tool display any active: XXXX CONTROL CIRCUIT/PERFORMANCE DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 2

B1049–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT OPEN (CONTINUED)

2. CHECK MODE DOOR 2 (FLOOR TO DEFROST) ACTUATOR CIRCUIT RESISTANCE

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

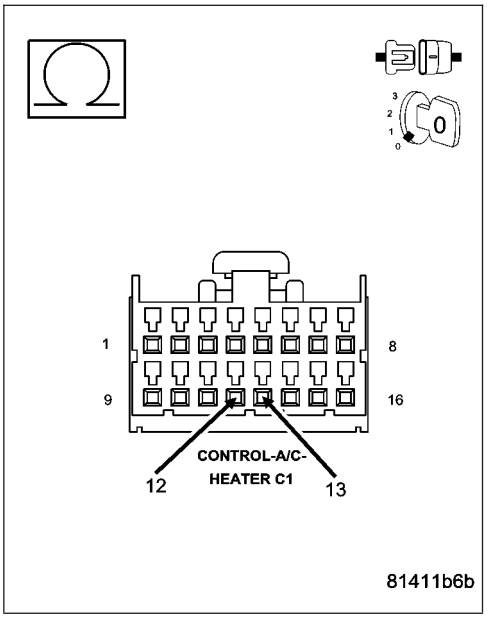
Measure the resistance between the (C801) Mode Door 2 Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.

Is the resistance above 55 ohms?

Yes >> Go To 3

No >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).



3. CHECK (C801) MODE DOOR 2 DRIVER CIRCUIT FOR AN OPEN

Disconnect the Mode Door 2 (Floor to Defrost) Actuator harness connector.

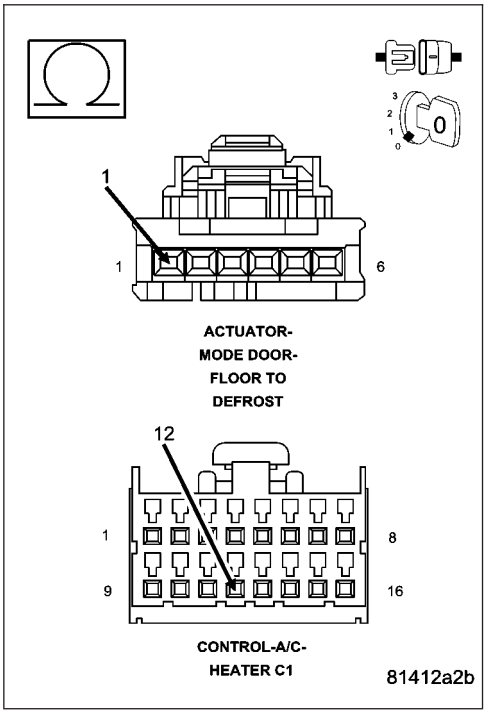
Measure the resistance of the (C801) Mode Door 2 Driver circuit between the A/C Heater Control C1 harness connector and the Mode Door 2 (Floor to Defrost) Actuator harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the (C801) Mode Door 2 Driver circuit for an open.

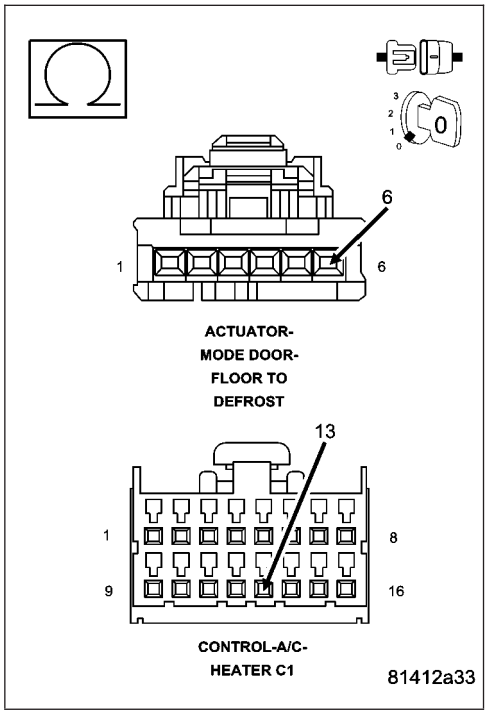
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).



B1049–FLOOR/DEFROST MODE DOOR CONTROL CIRCUIT OPEN (CONTINUED)

4. CHECK (C34) COMMON DOOR DRIVER CIRCUIT FOR AN OPEN

Measure the resistance of the (C34) Common Door Driver circuit between the A/C Heater Control C1 harness connector and the Mode Door 2 (Floor to Defrost) Actuator harness connector.



Is the resistance below 5.0 ohms?

Yes >> Replace the Mode Door 2 (Floor to Defrost) Actuator in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Repair the (C34) Common Door Driver circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B1050–BLEND DOOR TRAVEL RANGE TOO SMALL

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control calibrates each actuator individually. Automatic calibration occurs upon power up after installing a new A/C Heater Control. Manual calibration occurs by sending a command with the scan tool. The purpose of actuator calibration is to determine the total span of door travel between physical stops. To calibrate the actuator, the A/C Heater Control first moves the door to an end stop, and then counts the number of pulses it takes to move the door to its other stop. An expected range of span is stored in the control's memory. If the measured calibration value is less than the expected range for this actuator, this DTC will set. Note that the control clears all stored calibration faults at the beginning of the calibration procedure.

- **When Monitored:**
  During actuator calibration.
- **Set Condition:**
  If the total span of the Blend Door is less than the low range limit.

Possible Causes
DOOR DRIVER ELECTRICAL CIRCUIT(S)
BLEND DOOR SEIZED, BINDING, OBSTRUCTED
BLEND DOOR ACTUATOR
A/C HEATER CONTROL

Diagnostic Test

1. CHECK FOR ACTIVE CONTROL CIRCUIT/PERFORMANCE & CONTROL CIRCUIT OPEN DTCs

Turn the ignition on.

With the scan tool, read active HVAC DTCs.

Does the scan tool display any active: XXXX CONTROL CIRCUIT/PERFORMANCE or XXXX CONTROL CIRCUIT OPEN DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 2

---

2. RUN THE ACTUATOR DTC DETECTION TEST

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool display any DTCs?

Yes >> Diagnose and repair the DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs first, all short low DTCs second, and all open DTCs last. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 3

B1050–BLEND DOOR TRAVEL RANGE TOO SMALL (CONTINUED)

3. INSPECT ACTUATOR & HOUSING ASSEMBLY FOR A CONDITION CAUSING THE DOOR TO SEIZE OR BIND

Turn the ignition off.

Inspect the actuator, linkage, and housing assembly for a condition causing the door to seize or bind.

Are there any physical or mechanical problems with the door, housing, linkage, or actuator?

Yes >> Repair as necessary in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 4

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4. CHECK BLEND DOOR TRAVEL

Remove the Blend Door Actuator from the A/C Heater Housing Assembly.

By hand, attempt to rotate the door in both directions. The door should operate smoothly in both directions over approximately 80 degrees of travel.

Does the door operate smoothly in both directions over approximately 80 degrees of travel?

Yes >> Replace the Blend Door Actuator in accordance with the Service Information. Then, Go To 5.

No >> Repair as necessary in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

---

5. RUN ACTUATOR CALIBRATION TEST

Turn the ignition on.

With the scan tool, select System Tests and then select Actuator Calibration Test. When the test is complete, select View DTCs.

Does the scan tool display: B1050–BLEND DOOR TRAVEL RANGE TOO SMALL?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B1051–BLEND DOOR TRAVEL RANGE TOO LARGE

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control calibrates each actuator individually. Automatic calibration occurs upon power up after installing a new A/C Heater Control. Manual calibration occurs by sending a command with the scan tool. The purpose of actuator calibration is to determine the total span of door travel between physical stops. To calibrate the actuator, the A/C Heater Control first moves the door to an end stop, and then counts the number of pulses it takes to move the door to its other stop. An expected range of span is stored in the control's memory. If the measured calibration value exceeds the expected range for this actuator, this DTC will set. Note that the control clears all stored calibration faults at the beginning of the calibration procedure.

- **When Monitored:**
  During actuator calibration.
- **Set Condition:**
  If the total span of the Blend Door exceeds the high range limit.

Possible Causes
DOOR DRIVER ELECTRICAL CIRCUIT(S)
BLEND DOOR OR A/C HEATER HOUSING COMPONENTS WARPED, WORN, DAMAGED, MISSING, BROKEN
BLEND DOOR ACTUATOR
A/C HEATER CONTROL

Diagnostic Test

1. CHECK FOR ACTIVE CONTROL CIRCUIT/PERFORMANCE & CONTROL CIRCUIT OPEN DTCs

Turn the ignition on.

With the scan tool, read active HVAC DTCs.

Does the scan tool display any active: XXXX CONTROL CIRCUIT/PERFORMANCE or XXXX CONTROL CIRCUIT OPEN DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 2

---

2. RUN THE ACTUATOR DTC DETECTION TEST

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool display any DTCs?

Yes >> Diagnose and repair the DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs first, all short low DTCs second, and all open DTCs last. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> Go To 3

B1051–BLEND DOOR TRAVEL RANGE TOO LARGE (CONTINUED)

3. CHECK FOR A BROKEN BLEND DOOR ACTUATOR

Turn the ignition off.

Remove the Blend Door Actuator from the A/C Heater Housing Assembly.

By hand, attempt to rotate the actuator in both directions.

Does the actuator turn in either direction?

Yes >> Replace the Blend Door Actuator in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 4

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4. CHECK BLEND DOOR & A/C HEATER HOUSING FOR WARPED, WORN, DAMAGED, MISSING, & BROKEN COMPONENTS

Inspect for excessively worn, disconnected, missing, or broken door linkage. Inspect for a damaged or broken A/C Heater Housing Assembly. Inspect for a warped or broken door, and missing door seals. Rotate the door from stop to stop. The door should rotate approximately 80 degrees.

Are there any physical or mechanical problems with the door or housing?

Yes >> Repair as necessary in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Replace the Blend Door Actuator in accordance with the Service Information. Then, Go To 5.

---

5. RUN ACTUATOR CALIBRATION TEST

Turn the ignition on.

With the scan tool, select System Tests and then select Actuator Calibration Test. When the test is complete, select View DTCs.

Does the scan tool display: B1051–BLEND DOOR TRAVEL RANGE TOO LARGE?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

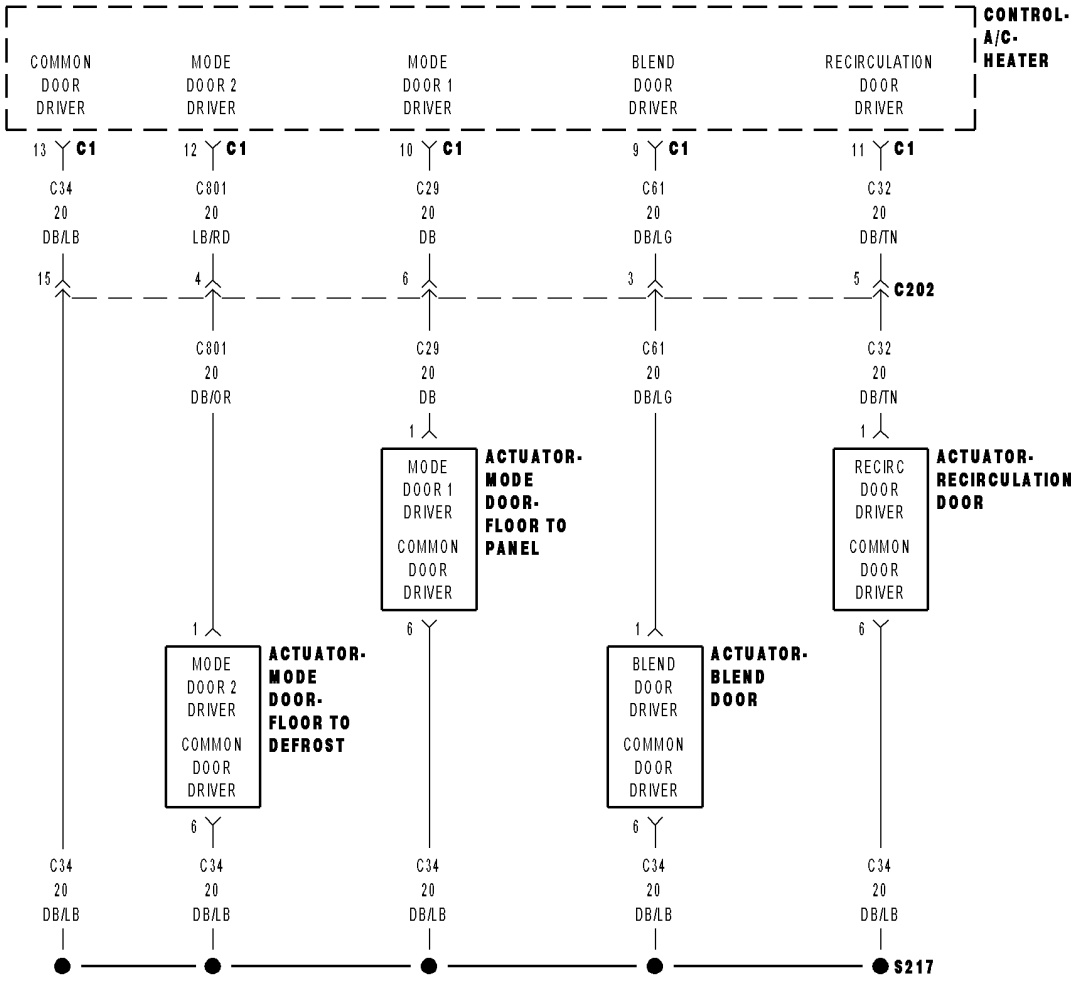
B1058–RECIRCULATION DOOR CONTROL CIRCUIT/PERFORMANCE

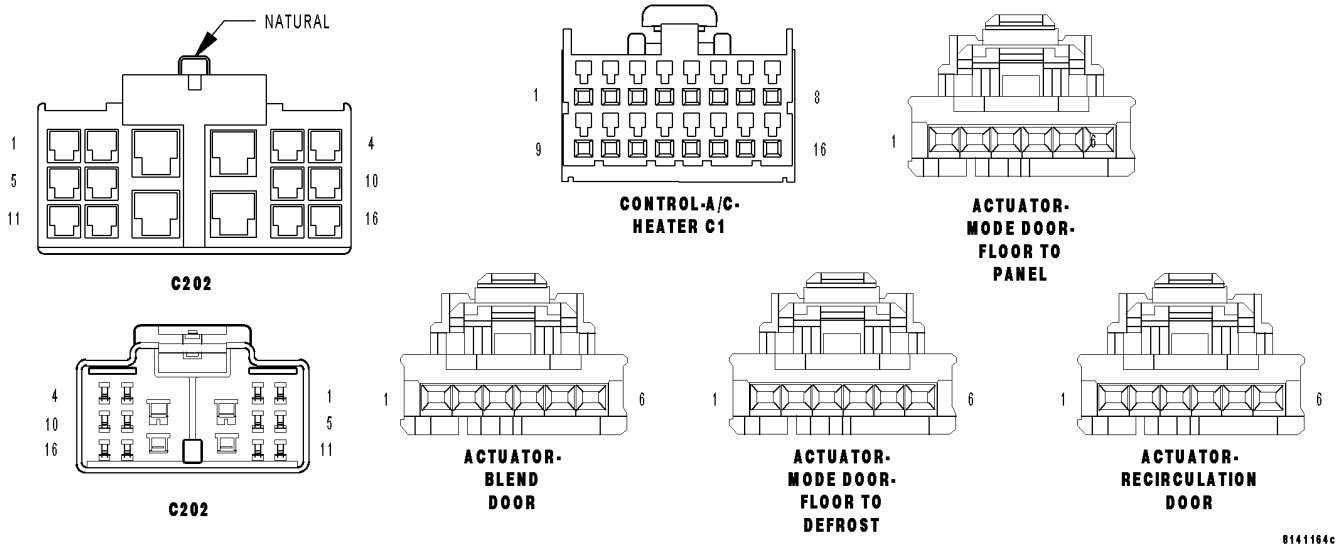
For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When actuator movement is requested.
- **Set Condition:**
  If the A/C Heater Control detects an excessive current draw on any of the door driver circuits while attempting to drive this actuator. This DTC has a maturing time of 5 seconds and a de-maturing time of 10 seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

If this DTC is active, refer to B104C–BLEND DOOR CONTROL CIRCUIT/PERFORMANCE for the diagnostic test procedure. If this DTC is stored, refer to HVAC System Test for stored DTC test procedures.

B1059–RECIRCULATION DOOR CONTROL CIRCUIT LOW





B1059–RECIRCULATION DOOR CONTROL CIRCUIT LOW (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Recirculation Door Actuator via the (C32) Recirculation Door Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver circuit. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the type of short, its location, and the direction the actuator is moving when the short is present.

- **When Monitored:**
  When the Actuator DTC Detection Test is executed.
- **Set Condition:**
  If the (C32) Recirculation Door Driver circuit is shorted to ground.

Possible Causes
(C32) RECIRCULATION DOOR DRIVER CIRCUIT SHORTED TO GROUND
C32) RECIRCULATION DOOR DRIVER CIRCUIT SHORTED TO OTHER DOOR DRIVER CIRCUIT(S)
RECIRCULATION DOOR ACTUATOR
A/C HEATER CONTROL

Diagnostic Test

1. CHECK (C32) RECIRCULATION DOOR DRIVER CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

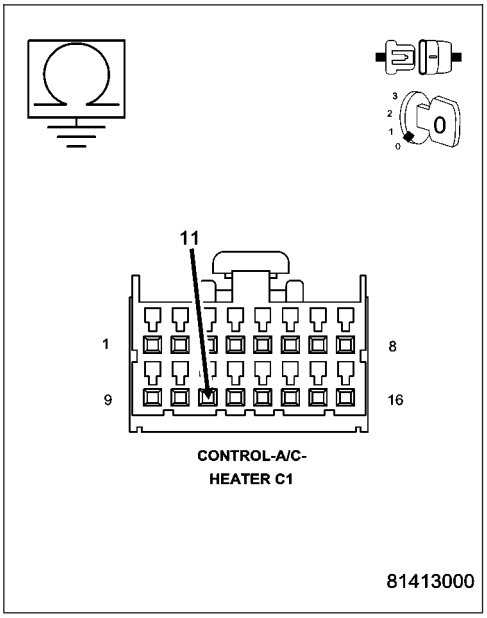
Disconnect the A/C Heater Control C1 harness connector.

Measure the resistance of the (C32) Recirculation Door Driver circuit between ground and the A/C Heater Control C1 harness connector.

Is the resistance below 10k ohms?

Yes >> Repair the (C32) Recirculation Door Driver circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

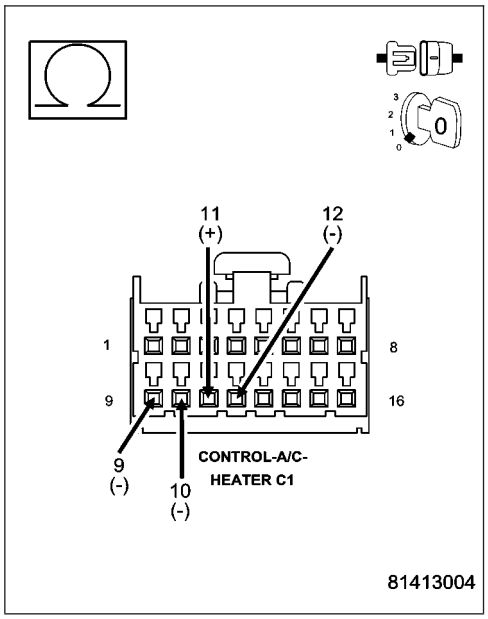
No >> Go To 2



B1059–RECIRCULATION DOOR CONTROL CIRCUIT LOW (CONTINUED)

2. CHECK (C32) RECIRCULATION DOOR DRIVER CIRCUIT FOR A SHORT TO OTHER DOOR DRIVER CIRCUITS

Measure the resistance between the (C32) Recirculation Door Driver circuit and the (C29) Mode Door 1 Driver circuit, the (C61) Blend Door Driver circuit, and the (C801) Mode Door 2 Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms between the (C32) Recirculation Door Driver circuit and any of the other door driver circuits?

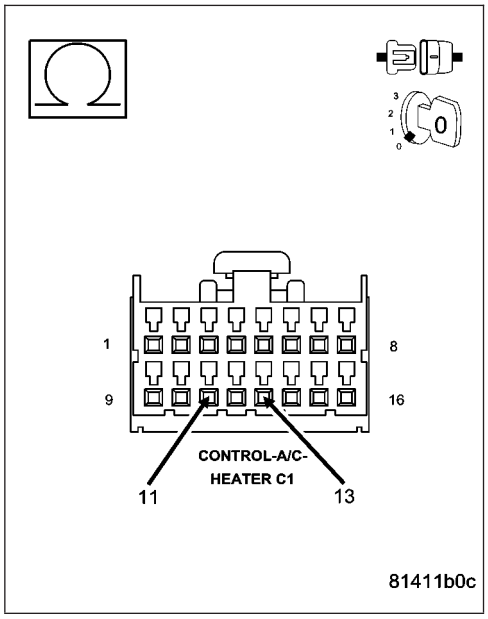
Yes >> Repair the circuit(s) with a resistance below 10k ohms for a short to the (C32) Recirculation Door Driver circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 3

3. CHECK RECIRCULATION DOOR ACTUATOR CIRCUIT RESISTANCE

Measure the resistance between the (C32) Recirculation Door Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 20 ohms?

Yes >> Go To 4

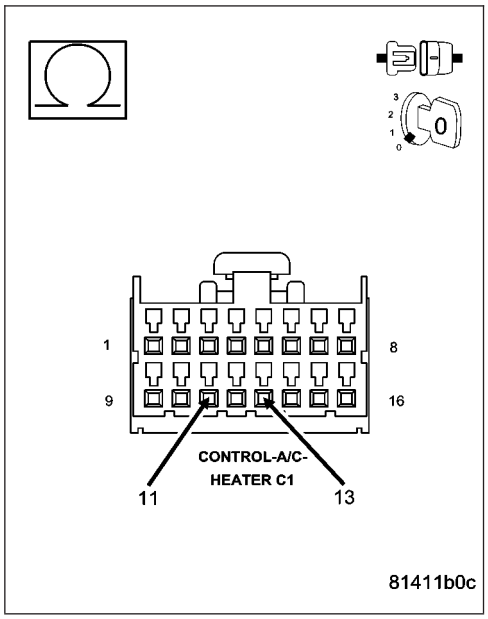
No >> Go To 5

B1059–RECIRCULATION DOOR CONTROL CIRCUIT LOW (CONTINUED)

4. CHECK (C32) RECIRCULATION DOOR DRIVER CIRCUIT FOR A SHORT TO (C34) COMMON DOOR DRIVER CIRCUIT

Disconnect the Recirculation Door Actuator harness connector.

Measure the resistance between the (C32) Recirculation Door Driver circuit and the (C34) Common Door Driver circuit in the A/C Heater Control C1 harness connector.



Is the resistance below 10k ohms?

Yes >> Repair the (C32) Recirculation Door Driver circuit for a short to the (C34) Common Door Driver circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Replace the Recirculation Door Actuator in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

5. RUN THE ACTUATOR DTC DETECTION TEST

Reconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

With the scan tool, erase HVAC DTCs.

With the scan tool, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool only display: B1059–RECIRCULATION DOOR CONTROL CIRCUIT LOW?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No, Other DTC(s) Displayed

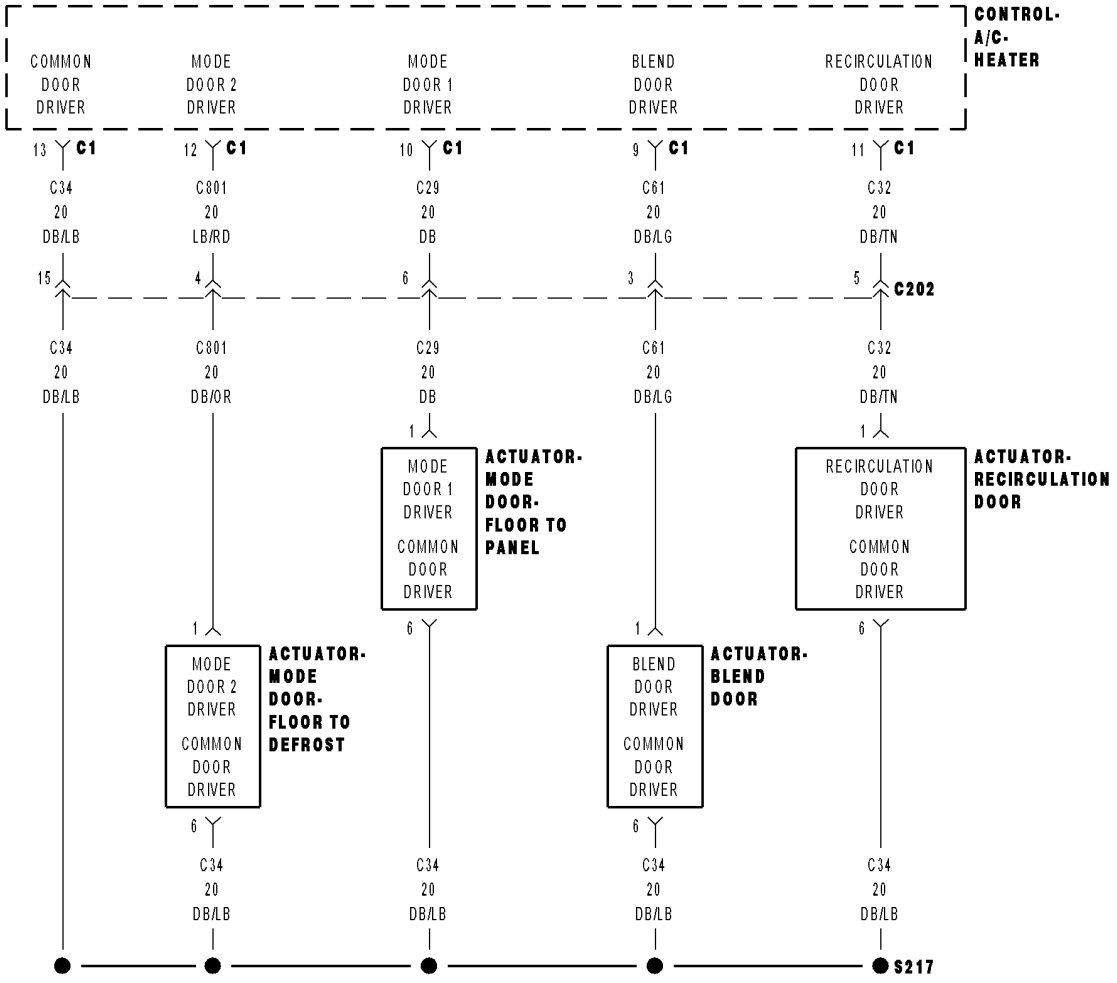
Diagnose and repair the other DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs and then all short low DTCs. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

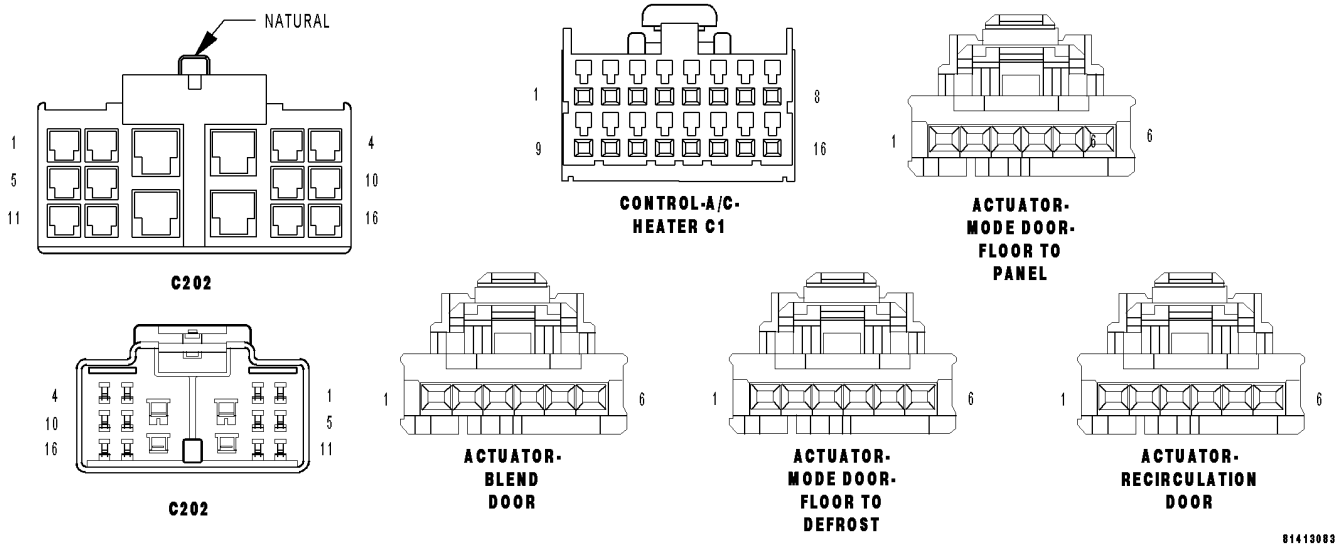
No, And No Other DTCs Displayed

Using the wiring diagram as a guide, inspect the wiring and connectors for conditions causing an intermittent short. Repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B1060–CLIMATE CONTROL MOTOR(S) COMMON 1 CONTROL CIRCUIT HIGH





B1060–CLIMATE CONTROL MOTOR(S) COMMON 1 CONTROL CIRCUIT HIGH (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The A/C Heater Control drives the Blend Door Actuator via the (C61) Blend Door Driver circuit and the (C34) Common Door Driver circuit. The A/C Heater Control drives the Mode Door 1 (Floor to Panel) Actuator via the (C29) Mode Door 1 Driver circuit and the (C34) Common Door Driver circuit. The A/C Heater Control drives the Mode Door 2 (Floor to Defrost) Actuator via the (C801) Mode Door 2 Driver circuit and the (C34) Common Door Driver circuit. The A/C Heater Control drives the Recirculation Door Actuator via the (C32) Recirculation Door Driver circuit and the (C34) Common Door Driver circuit. All of the door actuators share the (C34) Common Door Driver circuit. Inside the A/C Heater Control, each door actuator has its own unique driver, but all share a single common door driver circuit. Due to the shared circuitry similar DTCs can set at the same time for multiple actuators depending upon the type of short, its location, and the direction the actuator is moving when the short is present.

- **When Monitored:**
  When the Actuator DTC Detection Test is executed.
- **Set Condition:**
  If the (C34) Common Door Driver circuit is shorted to voltage.

Possible Causes
(C34) COMMON DOOR DRIVER CIRCUIT SHORTED TO VOLTAGE
A/C HEATER CONTROL

Diagnostic Test

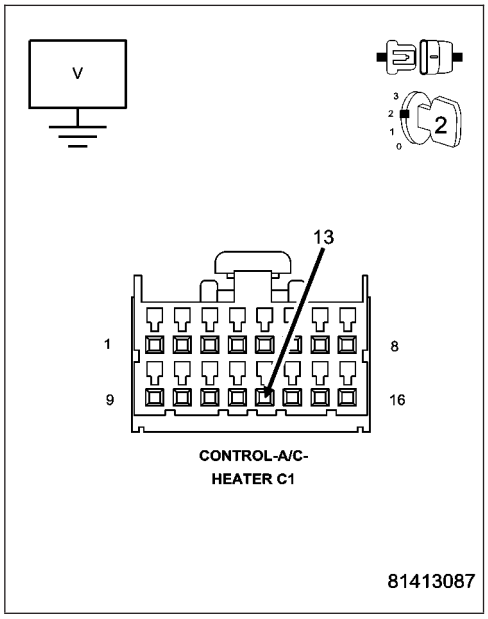
1. CHECK (C34) COMMON DOOR DRIVER CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

Measure the voltage of the (C34) Common Door Driver circuit.



Is the voltage above 0.2 volts?

Yes >> Repair the (C34) Common Door Driver circuit for a short to voltage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 2

B1060–CLIMATE CONTROL MOTOR(S) COMMON 1 CONTROL CIRCUIT HIGH (CONTINUED)

2. RUN THE ACTUATOR DTC DETECTION TEST

Turn the ignition off.

Reconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

With the scan tool in HVAC, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool only display: B1060–CLIMATE CONTROL MOTOR(S) COMMON 1 CONTROL CIRCUIT HIGH?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No, Other DTC(s) Displayed

Diagnose and repair the other DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs and then all short low DTCs. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No, And No Other DTCs Displayed

Using the wiring diagram as a guide, inspect the wiring and connectors for conditions causing an intermittent short. Repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B1079–CLIMATE CONTROL COOL DOWN TEST EXCESSIVE TIME

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The Cooldown Test checks A/C system performance based on Evaporator Temperature Sensor input. The main criteria is to lower evaporator temperature 11.11°C (20°F) within one minute. Before starting the test, the evaporator temperature must be above 18.3°C (65°F) and the blower speed must be set to high speed. When the test is running, A/C Select and A/C Request will be on and the A/C status indicator will flash. When the test is complete, the scan tool will display one or more test status messages to indicate the outcome of the Cooldown Test. A Successful Cooldown – Test Passed status message indicates that the main test criteria was met. A DTC Set During Routine – Test Not Passed status message indicates that the A/C system is unable to lower the evaporator temperature 11.11°C (20°F) within one minute. A Conditions Too Cold – Test Not Run status message indicates that the evaporator temperature was below 18.3°C (65°F) when starting the Cooldown Test. A Blowers Not On High – Test Not Run status message indicates that either the blower speed was not set to high speed prior to starting the Cooldown Test or the blower speed was changed from high speed to another setting after starting the Cooldown test. A Refrigerant Temperature Sensor Error status message indicates that a fault occurred with the Evaporator Temperature Sensor/sensor circuits. A No Results Stored/Test Not Complete status message indicates that the power was cycled while the test was running.

- **When Monitored:**
  When the Cooldown Test is executed.
- **Set Condition:**
  If the A/C system is unable to lower the evaporator temperature 11.11°C (20°F) within one minute.

Possible Causes
EVAPORATOR TEMPERATURE SENSOR CIRCUITS
EVAPORATOR TEMPERATURE SENSOR
OTHER HVAC SYSTEM FAULTS PRESENT SUCH AS INSUFFICIENT REFRIGERANT CHARGE
POWERTRAIN SYSTEM FAULTS PRESENT

Diagnostic Test

1. CHECK FOR DTCs IN THE A/C HEATER CONTROL MODULE

Turn the ignition on.

With the scan tool, select ECU View.

With the scan tool, select HVAC.

Are any DTCs present in the A/C Heater Control Module?

Yes >> Diagnose and Repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of HVAC related symptoms. Run the Cooldown Test again after the repair is complete.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Go To 2

B1079–CLIMATE CONTROL COOL DOWN TEST EXCESSIVE TIME (CONTINUED)

2. CHECK FOR DTCs IN THE PCM

With the scan tool, select PCM.

Are any DTCs present in the PCM?

Yes >> Diagnose and repair the DTC(s). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) for PCM DTCs. Run the Cooldown Test again after the repair is complete.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Refer to the Service Information for additional Cooldown Test related diagnostic information and testing procedures. Run the Cooldown Test again after the repair is complete.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

B2214–(HVAC) CLIMATE CONTROL INTERNAL

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the A/C Heater Control has an internal fault. This DTC has a maturing time of 5 seconds and a de-maturing time of 10 seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

Possible Causes
A/C HEATER CONTROL

NOTE: This DTC must be active for the results of this test to be valid. Do not perform this test if this DTC is stored. Refer to HVAC System Test for stored DTC test procedures.

Diagnostic Test

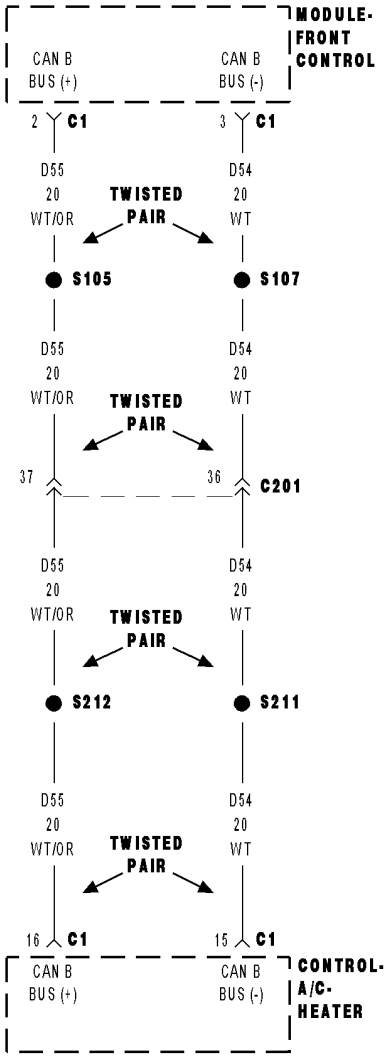
1. REPLACE THE A/C HEATER CONTROL

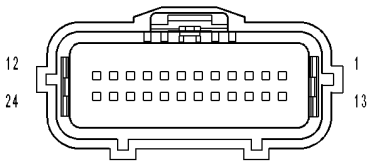
Repair

Replace the A/C Heater Control in accordance with the Service Information.

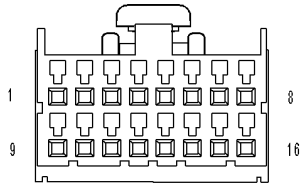
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

U0019–CAN B BUS





MODULE-
FRONT
CONTROL C1



CONTROL-A/C-
HEATER C1

814130a3

U0019–CAN B BUS (CONTINUED)

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  If the CAN B Bus (+) or CAN B Bus (-) circuit is open, shorted to voltage, or shorted to ground.

Possible Causes
ACTIVE U0019 CAN B BUS DTC IN FRONT CONTROL MODULE
(D55) CAN B BUS (+) CIRCUIT OPEN
(D54) CAN B BUS (-) CIRCUIT OPEN
A/C HEATER CONTROL

Diagnostic Test

1. VERIFY DTC U0019–CAN B BUS IS ACTIVE

Turn the ignition on.

With the scan tool, read HVAC DTCs.

Does the scan tool display active: U0019–CAN B BUS?

Yes >> Go To 2

No >> If the DTC is stored, check for an intermittent condition by inspecting the related wiring harness for chaffed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

---

2. CHECK FOR ACTIVE CAN B BUS RELATED DTCS IN THE FRONT CONTROL MODULE (FCM)

With the scan tool, read Front Control Module (FCM) DTCs

Does the scan tool display any active CAN B BUS related DTCs?

Yes >> Diagnose and repair the DTC(s). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).

No >> Go To 3

U0019–CAN B BUS (CONTINUED)

3. CHECK (D55) CAN B BUS (+) CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the negative battery cable.

Disconnect the A/C Heater Control C1 harness connector.

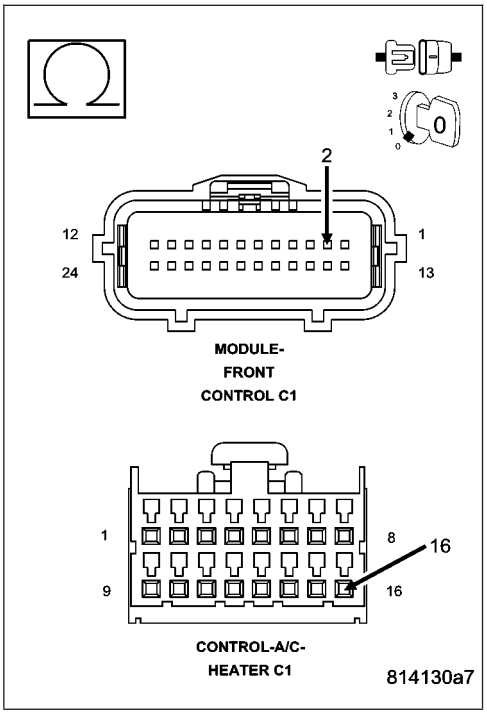
Disconnect the Front Control Module (FCM) C1 harness connector.

Measure the resistance of the (D55) CAN B Bus (+) circuit between the Front Control Module C1 harness connector and the A/C Heater Control C1 harness connector.

Is the resistance below 2.0 ohms?

Yes >> Go To 4

No >> Repair the (D55) CAN B Bus (+) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).



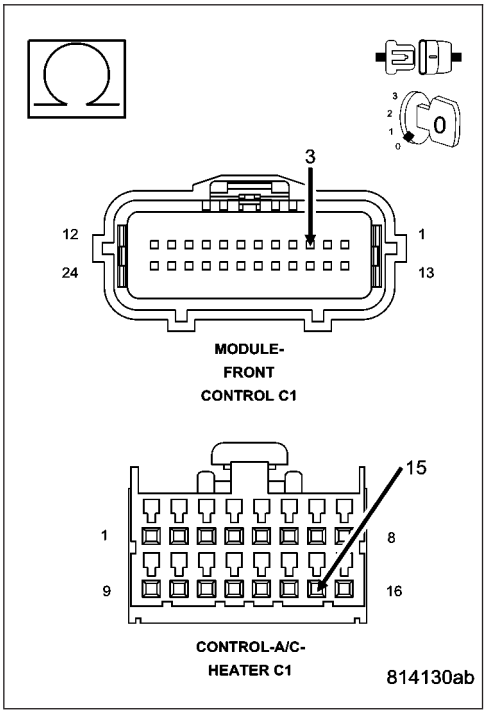
4. CHECK (D54) CAN B BUS (–) CIRCUIT FOR AN OPEN

Measure the resistance of the (D54) CAN B Bus (–) circuit between the Front Control Module C1 connector and the A/C Heater Control C1 harness connector.

Is the resistance below 2.0 ohms?

Yes >> Replace the A/C Heater Control in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

No >> Repair the (D54) CAN B Bus (–) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).



U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the A/C Heater Control looses communication with the Front Control Module (FCM). This DTC has a maturing time of 30 seconds and a de-maturing time of 10 seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0155–LOST COMMUNICATION WITH CLUSTER/CCN

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the A/C Heater Control looses communication with the Cluster (CCN). This DTC has a maturing time of 30 seconds and a de-maturing time of 10 seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

DTC SET DURING ROUTINE - TEST NOT PASSED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the Cooldown Test is executed.
- **Set Condition:**
  If the A/C system is unable to lower the evaporator temperature 11.11°C (20°F) within one minute.

Refer to B1079–CLIMATE CONTROL COOL DOWN TEST EXCESSIVE TIME for the diagnostic test procedure.

BLOWERS NOT ON HIGH - TEST NOT RUN

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the Cooldown Test is executed.
- **Set Condition:**
  If either the blower speed was not set to high speed prior to starting the Cooldown Test or the blower speed was changed from high speed to another setting after starting the Cooldown test.

Refer to B1079–CLIMATE CONTROL COOL DOWN TEST EXCESSIVE TIME for the diagnostic test procedure.

REFRIGERANT TEMPERATURE SENSOR ERROR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the Cooldown Test is executed.
- **Set Condition:**
  If a fault occurred with the Evaporator Temperature Sensor/sensor circuits.

Refer to B1079–CLIMATE CONTROL COOL DOWN TEST EXCESSIVE TIME for the diagnostic test procedure.

*HVAC SYSTEM TEST

For the Manual Temperature Control (MTC) circuit diagram (Refer to 24 - HEATING & AIR CONDITIONING - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The HVAC System Test provides a starting point in the diagnostic process by identifying the appropriate diagnostic procedure or system test to perform when diagnosing a given symptom, condition, or DTC. It also provides a means for testing the entire HVAC system by utilizing the A/C-heater control's On-Board System Tests. The On-Board System Tests can also assist in diagnosing stored DTCs. (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING) for additional information about on-board diagnostics.

Diagnostic Test

1. HVAC SYSTEM TEST

NOTE: Diagnose and repair all active DTCs before diagnosing and repairing stored DTCs.

Make a selection based on the symptom, condition, or DTC that you want to diagnose.

For Any Active DTC
Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

Scan Tool Indicates HVAC Not Active On Bus
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for no response related diagnostic procedures.

Complete HVAC System Test
Go To 2

A/C System Performance Test
Go To 2

Mode Switch & Door Actuator Ckt Test
Go To 3

Actuator DTC Detection Test
Go To 4

Actuator Calibration Test
Go To 5

***HVAC SYSTEM TEST (CONTINUED)**

2. A/C SYSTEM PERFORMANCE TEST

NOTE: The work area ambient temperature must be above 15.6°C (60°F) and the evaporator temperature must be above 18.3°C (65°F) in order to test A/C system performance.

NOTE: Before actuating the Cooldown Test, verify that the mode setting is not in a defrost position and that the A/C compressor is not running. If the compressor is running, turn the A/C off and allow the evaporator to warm up before proceeding with the test.

NOTE: Running the Cooldown test will cause the A/C status indicator to flash.

NOTE: One or more status messages will display on the scan tool after running the Cooldown Test. These messages will clear after paging back out of this test function. Therefore, it is important to note all messages before doing so.

Turn the ignition on.

Set the mode to the Panel position.

Verify that the blower motor operates correctly in all speeds. Diagnose and repair all blower related faults before proceeding with this test.

Start the engine.

Set the blower speed to high.

With the scan tool in HVAC, select System Tests and then select Cooldown test. Allow the test to run to completion.

Does the scan tool display a status message that indicates a fault has occurred?

Yes, Conditions Too Cold - Test Not Run

If running, turn the A/C compressor off. Verify that the work area ambient temperature is above 15.6°C (60°F). If not, move the vehicle to a warmer work area. Verify that the evaporator temperature is above 18.3°C (65°F). If not, set the blower to high speed and allow the blower to run for five minutes. Then, run the Cooldown Test again.

Yes, Blowers Not On High - Test Not Run

Set the blower speed to high speed and then run the Cooldown Test again.

Yes, No Results Stored/Test Not Complete

Verify that power is not interrupted while rerunning the Cooldown Test.

Yes, Refrigerant Temperature Sensor Error

Refer to B1079–CLIMATE CONTROL COOL DOWN TEST EXCESSIVE TIME for the diagnostic test procedure.

Yes, DTC Set During Routine - Test Not Passed

Refer to B1079–CLIMATE CONTROL COOL DOWN TEST EXCESSIVE TIME for the diagnostic test procedure.

No >> As necessary, either Go To 3, 4, or 5, or Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

***HVAC SYSTEM TEST (CONTINUED)**

3. MODE SWITCH & DOOR ACTUATOR CIRCUIT TEST

NOTE: If at anytime a DTC becomes active during this test, proceed to the conclusion question.

NOTE: If multiple DTCs become active, diagnose those that relate to a short circuit first.

If not done so previously, start the engine.

Set the blower speed to low.

Set the Blend control to full cold.

Set the Mode control to Bi-Level/Recirc.

Monitor the scan tool for active HVAC DTCs while performing the following test steps.

Press the A/C mode switch on, wait 30 seconds, press it off.

Press the Rear Defrost mode switch on, wait 30 seconds, press it off.

Set the Blend control to full hot, wait 30 seconds and then set it to full cold.

Turn the Mode control to every door position. Leave it in each position for 30 seconds.

Does the scan tool display any active DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of HVAC related symptoms.

No >> If you are here due to a stored DTC, it is possible that a technician may not have erased the DTC following a repair. If possible, verify if the vehicle was recently in for this type of service. Otherwise, either Go To 4 or 5, or visually inspect the related wiring harness for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals, and repair as necessary.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

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4. ACTUATOR DTC DETECTION TEST

If not done so previously, start the engine.

With the scan tool, select System Tests and then select Actuator DTC Detection. When the test is complete, select View DTCs.

Does the scan tool display any DTCs?

Yes >> Diagnose and repair the DTC(s). If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high DTCs and then all short low DTCs. Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> If you are here due to a stored DTC, it is possible that a technician may not have erased the DTC following a repair. If possible, verify if the vehicle was recently in for this type of service. Otherwise, either Go To 5 or visually inspect the related wiring harness for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals, and repair as necessary.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

***HVAC SYSTEM TEST (CONTINUED)**

5. ACTUATOR CALIBRATION TEST

If not done so previously, start the engine.

With the scan tool, select System Tests and then select Actuator Calibration Test. When the test is complete, select View DTCs.

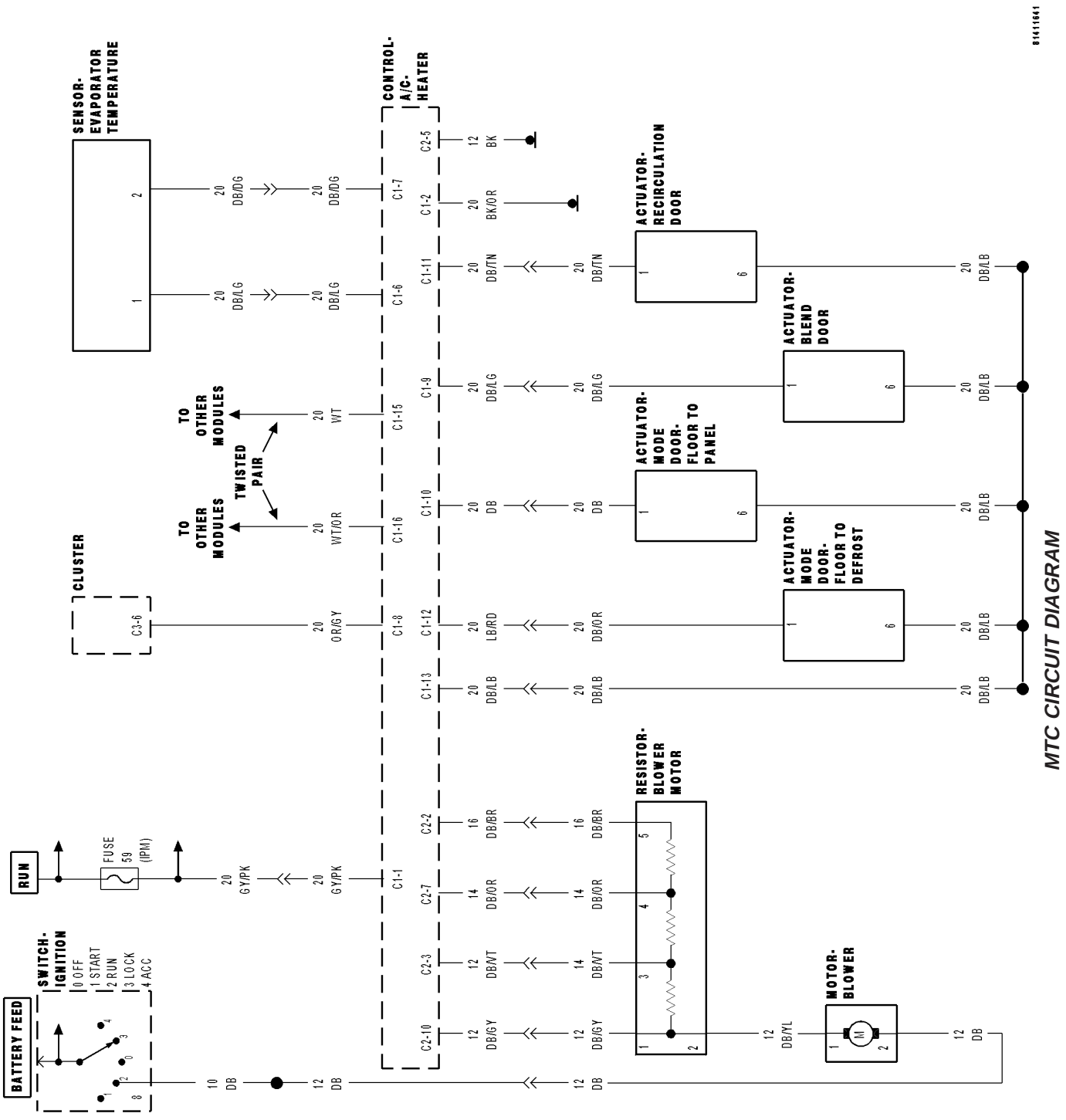
Does the scan tool display any DTCs?

Yes >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of all HVAC related symptoms.

No >> No problem found. However, if you are here due to a stored DTC, it is possible that a technician may not have erased the DTC following a repair. If possible, verify if the vehicle was recently in for this type of service. Otherwise, visually inspect the related wiring harness for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals, and repair as necessary.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING).

SCHEMATICS AND DIAGRAMS



HVAC - SERVICE INFORMATION

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HVAC - SERVICE INFORMATION

DESCRIPTION

HEATING AND AIR CONDITIONING SYSTEM

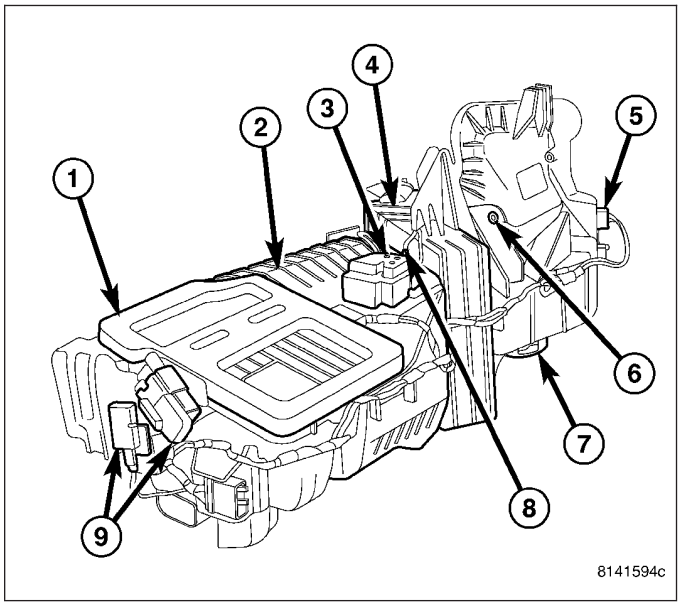
A manual temperature control (MTC) single zone type heating-A/C system is standard equipment on this vehicle.

To maintain the performance level of the heating, ventilation and air conditioning (HVAC) system, the engine cooling system must be properly maintained. The use of a bug screen is not recommended. Any obstructions in front of the radiator or A/C condenser will reduce the performance of the A/C and engine cooling systems.

The engine cooling system includes the radiator, thermostat, radiator hoses and the engine coolant pump. Refer to 7 - Cooling for more information before opening or attempting any service to the engine cooling system.

All vehicles are equipped with a common heater, ventilation and air conditioning (HVAC) housing (1). The heating-A/C system combines A/C, heating, and ventilating capabilities in a single HVAC housing mounted within the passenger compartment behind the instrument panel. The HVAC housing includes:

- Heater core (2)
- Blend-air doors and actuator (3)
- A/C evaporator (4)
- Blower motor resistor (5)
- Recirculation-air door and actuator (6)
- Blower motor (7)
- Evaporator temperature sensor (8)
- Mode-air doors and actuators (9)



Based upon the mode selected, conditioned air can exit the HVAC housing through one or a combination of the three main housing outlets: defrost, panel or floor. The defrost and panel outlets are located on the top of the HVAC housing and the floor outlet is located on the bottom of the HVAC housing. Once the conditioned air exits the HVAC housing, it is further directed through molded plastic ducts to the outlets within the vehicle interior. These outlets and their locations are as follows:

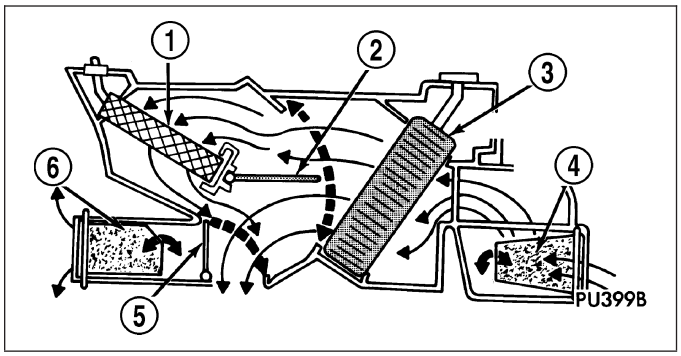
- **Defroster Outlet** - A single large defroster outlet is located in the center of the instrument panel top cover, near the base of the windshield.

- **Side Window Demister Outlets** - There are two side window demister outlets, one is located at each outboard end of the instrument panel face near the A-pillars.
- **Panel Outlets** - There are four panel outlets in the instrument panel, one located near each outboard end of the instrument panel facing the rear of the vehicle and two located at the top of the instrument panel center bezel.
- **Floor Outlets** - There are two floor outlets, one located above each side of the floor panel center tunnel near the dash panel.

OPERATION

The heating-A/C system used in this vehicle is a single zone, blend-air type system. In this blend-air heating-A/C system, two blend-air doors control the amount of conditioned air that is allowed to flow through, or around, the heater core. A temperature control determines the discharge air temperature by operating an electric actuator, which operates the blend-air doors. This allows an almost immediate control of the output air temperature of the system. The A/C system is designed for the use of non-CFC, R-134a refrigerant and uses an A/C evaporator to cool and dehumidify the incoming air prior to blending it with the heated air.

The heating-A/C system pulls outside (ambient) air through the cowl opening at the base of the windshield, then into the air inlet housing and through the A/C evaporator (3). Air flow can be directed either through or around the heater core (1). This is done by adjusting the blend-air doors (2) with the temperature controls located on the A/C-heater control in the instrument panel. The air flow can then be directed from the panel, floor and defrost outlets in various combinations using the mode control located on the A/C-heater control. Air flow velocity can be adjusted with the blower speed control located on the A/C-heater control.



The outside (fresh) air intake can be shut off by selecting the Recirculation Mode with the mode control. This will operate an electrically actuated recirculation-air door (4) that closes off the fresh air intake and recirculates the air that is already inside the vehicle.

The A/C compressor can be engaged in any mode by pressing the snowflake, A/C on/off button. It can also be engaged by placing the mode control in the mix to defrost positions. This will remove heat and humidity from the air before it is directed through or around the heater core. The mode control on the A/C-heater control is used to also direct the conditioned air to the selected system outlets. The mode control uses two electric actuators to control the mode-air doors (5 and 6).

The defroster outlet receives airflow from the HVAC housing through the molded plastic defroster duct, which connects to the HVAC housing defroster outlet. The airflow from the defroster outlet is directed by fixed vanes in the defroster outlet grille and cannot be adjusted. The defroster outlet grille is serviceable from the instrument panel.

The side window demister outlets receive airflow from the HVAC housing through the molded plastic demister ducts. The demisters direct air from the HVAC housing through the outlets located on the top corners of the instrument panel. The demisters operate when the mode control is positioned in the bi-level, floor, floor-defrost and defrost settings. The airflow from the side window demister outlets is directed by fixed vanes in the demister outlet grilles and cannot be adjusted. The demister outlet grilles are only serviced with the instrument panel outlets.

The instrument panel outlets receive airflow from the HVAC housing through a molded plastic center distribution duct, center panel duct and two end panel ducts. The two end panel ducts direct airflow to the left and right instrument panel outlets, while the center panel duct directs airflow to the two center panel outlets. Each of these outlets can be individually adjusted to direct the flow of air.

The floor outlets receive airflow from the HVAC housing through the floor distribution duct. The front floor outlets are integral to the molded plastic floor distribution duct, which is secured to the bottom of the HVAC housing. The floor outlets cannot be adjusted.

NOTE: It is important to keep the air intake opening clear of debris. Leaf particles and other debris that is small enough to pass through the cowl opening screen can accumulate within the HVAC housing. The closed, warm, damp and dark environment created within the housing is ideal for the growth of certain molds, mildews and other fungi. Any accumulation of decaying plant matter provides an additional food source for fungal spores, which enter the housing with the fresh intake-air. Excess debris, as well as objectionable odors created by decaying plant matter and growing fungi can be discharged into the passenger compartment during heater-A/C operation if the air intake opening is not kept clear of debris.

This A/C system uses an A/C orifice tube to meter the flow of refrigerant to the A/C evaporator. The A/C evaporator cools and dehumidifies the incoming air prior to blending it with the heated air. To maintain minimum evaporator temperatures and prevent evaporator freezing, an evaporator temperature sensor is used. The sensor is located downstream of the A/C evaporator and supplies an evaporator temperature signal to the A/C-heater control. The A/C-heater control broadcasts the A/C request on the controller area network (CAN) B bus, where it is read and processed by the front control module (FCM), which in turn broadcasts it on the CAN C bus, where it is read and processed by the powertrain control module (PCM) which cycles the A/C clutch relay as necessary.

DIAGNOSIS AND TESTING

HEATING-A/C SYSTEM DIAGNOSTICS

CAUTION: Do not exchange A/C Heater Controls from vehicle to vehicle. Software versions differ between models and model years. Installing an A/C Heater Control with software that is incompatible for a given vehicle can result in either improper or failed HVAC system operation.

ON-BOARD DIAGNOSTICS

The A/C-heater control communicates on the controller area network (CAN) B bus and is fully addressable with a scan tool.

The A/C-heater control's primary means of fault detection is through active and stored diagnostic trouble codes (DTCs). Active DTCs are those which currently exist in the system. The condition causing the fault must be repaired in order to clear this type of DTC. Stored DTCs are those which occurred in the system since the A/C-heater control received the last clear diagnostic info message. DTCs must be read with a scan tool. Refer to 24 - HVAC - Electrical Diagnostics for HVAC DTC diagnostic test procedures.

The A/C-heater control's secondary means of fault detection is through system tests. These tests include the HVAC System Test, the A/C Cooldown Test, Actuator Calibration, and Actuator DTC Detection. Refer to System Tests in this Section for a detailed description of each test.

SYSTEM TESTS

HVAC System Test

The HVAC System Test, found in 24 - HVAC - Electrical Diagnostics, provides a starting point in the diagnostic process by identifying the appropriate diagnostic procedure or system test to perform when diagnosing a given symptom, condition, or DTC. It also provides a means for testing the entire HVAC system by utilizing the A/C-heater control's On-Board System Tests. The On-Board System Tests can also assist in diagnosing stored DTCs.

A/C COOLDOWN TEST

The A/C Cooldown Test:

- is actuated with a scan tool.
- tests A/C system performance based on evaporator temperature sensor input.
- will fail if evaporator temperature is below 18.3° C (65° F) when initiating the test.
- will pass if the evaporator temperature drops 11.1° C (20° F).
- indicates an outcome by displaying one or more test status messages on the scan tool. These test status messages will clear after paging back out of this test function. Therefore, is it important to note all of the messages before doing so.
- will cause the A/C status indicator to flash while the test is running.

ACTUATOR CALIBRATION FUNCTION

The Actuator Calibration function:

- is actuated with a scan tool.
- homes and repositions door actuators.
- monitors for door span faults. Door span faults (XXX Door Travel Range Too Large or XXX Door Travel Range Too Small) will only display after calibration.
- will cause the electric backlight (EBL) status indicator (if equipped) to flash while the test is running.

ACTUATOR DTC DETECTION TEST

The Actuator DTC Detection Test:

- is actuated with a scan tool.
- supplements the continuous diagnostics on the actuator drive system.
- monitors for shorted actuator circuits allowing service to easily diagnose and troubleshoot up to three simultaneous shorts. Shorted actuator circuit faults (XXX Control Circuit High or XXX Control Circuit Low) will only display after running the Actuator DTC Detection Test.

After repairing each DTC, cycle the ignition switch, and then run the Actuator DTC Detection Test again to ensure that no new DTCs exist. If multiple DTCs are present, beginning with the common circuit, diagnose and repair all short high faults and then short low faults. When the test returns passed, clear all faults and run the Actuator Calibration function as a final check of system health.

A/C PERFORMANCE

The A/C system is designed to provide the passenger compartment with low temperature and low humidity air. The A/C evaporator, located in the HVAC housing is cooled to temperatures near the freezing point. As warm damp air passes over the fins of the A/C evaporator, the air transfers its heat to the refrigerant in the evaporator coils and the moisture in the air condenses on the evaporator fins. During periods of high heat and humidity, an A/C system will be more effective in the Recirculation mode (max-A/C). With the system in the Recirculation mode, only air from the passenger compartment passes through the A/C evaporator. As the passenger compartment air dehumidifies, the A/C system performance levels rise.

Humidity has an important bearing on the temperature of the air delivered to the interior of the vehicle. It is important to understand the effect that humidity has on the performance of the A/C system. When humidity is high, the A/C evaporator has to perform a double duty. It must lower the air temperature, and it must lower the temperature of the moisture in the air that condenses on the evaporator fins. Condensing the moisture in the air transfers heat energy into the evaporator fins and coils. This reduces the amount of heat the A/C evaporator can absorb from the air. High humidity greatly reduces the ability of the A/C evaporator to lower the temperature of the air.

However, evaporator capacity used to reduce the amount of moisture in the air is not wasted. Wringing some of the moisture out of the air entering the vehicle adds to the comfort of the passengers. Although, an owner may expect too much from their A/C system on humid days. A performance test is the best way to determine whether the system is performing up to design standards. This test also provides valuable clues as to the possible cause of trouble with the A/C system. The ambient air temperature of the vehicle and the location where the vehicle will be tested must be a minimum of 21° C (70° F) for this test. Also the evaporator temperature sensor probe (located between the evaporator fins) must be a minimum of 18° C (65° F) for this test as well.

A/C PERFORMANCE TEST

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.

NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.

1. Perform the A/C System Performance Test, which is found within the HVAC System Test (refer to 24 - HVAC Electrical Diagnostics). If no diagnostic trouble codes (DTCs) are found in the A/C-heater control or the powertrain control module (PCM), go to Step 2. If any DTCs are found, repair as required, then proceed to Step 2.

2. Connect a tachometer and a manifold gauge set.

NOTE: The ambient air temperature of the vehicle and the location where the vehicle will be tested must be a minimum of 21° C (70° F) before performing this test. Also the evaporator temperature sensor probe (located between the evaporator fins) must be a minimum of 18° C (65° F) for this test as well. If the vehicle has been sitting in the sun prior to testing, place the vehicle in the testing area until the temperature within the vehicle reaches a minimum of 18° C (65° F).

3. Set the A/C-heater control to the Recirculation mode (max-A/C) position, the temperature control to the full cool position, and the blower motor control to the highest speed position.
4. Start the engine and hold the idle at 1,000 rpm with the compressor clutch engaged. If the A/C compressor does not engage, see the A/C Pressure Diagnosis chart.
5. The engine should be at operating temperature and the doors and the windows closed.
6. Insert a thermometer in the driver side center panel outlet. Operate the A/C system until it stabilizes.
7. With the A/C compressor clutch engaged, compare the air temperature at the center panel outlet and the compressor discharge pressure (high side) to the A/C Performance and Pressure chart. The compressor clutch may cycle, depending upon the ambient temperature and humidity. If the clutch cycles, use the readings obtained before the clutch disengaged.

A/C PERFORMANCE TEMPERATURE AND PRESSURE

Ambient Air Temperature	21°C (70°F)	27°C (80°F)	32°C (90°F)	38°C (100°F)	43°C (110°F)
Maximum Allowable Air Temperature at Center Panel Outlet	9°C (48°F)	9°C (48°F)	12°C (54°F)	15°C (59°F)	18°C (65°F)
Suction Pressure at Service Port (Low Side)	138 to 310 kPa (20 to 45 psi)	138 to 345 kPa (20 to 50 psi)	207 to 365 kPa (30 to 55 psi)	207 to 414 kPa (30 to 60 psi)	241 to 448 kPa (35 to 65 psi)
Discharge Pressure at Service Port (High Side)	1034 to 1724 kPa (150 to 250 psi)	1379 to 2068 kPa (200 to 300 psi)	1551 to 2241 kPa (225 to 325 psi)	1724 to 2413 kPa (250 to 350 psi)	2068 to 2758 kPa (300 to 400 psi)

8. If the air outlet temperature fails to meet the specifications in the A/C Performance Temperature and Pressure chart, or if the compressor discharge pressure is high, refer to the A/C Pressure Diagnosis chart.

A/C PRESSURE DIAGNOSIS

Condition	Possible Causes	Correction
Rapid A/C compressor clutch cycling with poor panel outlet temperatures.	1. Low refrigerant system charge.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.

Condition	Possible Causes	Correction
Equal pressures, but the compressor clutch does not engage.	1. No refrigerant in the refrigerant system.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
	2. Faulty fuse.	2. Check the fuses in the Integrated Power Module. Repair the shorted circuit or component and replace the fuses, if required. Refer to Group 8.
	3. Faulty A/C compressor clutch coil.	3. See A/C Compressor Clutch Coil in this group. Test the compressor clutch coil and replace, if required.
	4. Faulty A/C compressor clutch relay.	4. See A/C Compressor Clutch Relay in this group. Test the compressor clutch relay and relay circuits. Repair the circuits or replace the relay, if required.
	5. Improperly installed or faulty evaporator temperature sensor.	5. See Evaporator Temperature Sensor in this group. Test the sensor and replace, if required.
	6. Faulty A/C pressure transducer.	6. See A/C Pressure Transducer in this group. Test the sensor and replace, if required.
	7. Faulty Powertrain Control Module (PCM).	7. Refer to Group 9 - Engine Electrical Diagnostics for testing of the PCM. Test the PCM and replace, if required.
Normal pressures, but A/C Performance Test air temperatures at center panel outlet are too high.	1. Excessive refrigerant oil in system.	1. See Refrigerant Oil Level in this group. Recover the refrigerant from the refrigerant system and inspect the refrigerant oil content. Restore the refrigerant oil to the proper level, if required.
	2. Blend door actuator improperly installed or faulty.	2. See Blend Door Actuator in this group. Inspect the actuator for proper operation and replace, if required.
	3. Blend door inoperative or sealing improperly.	3. See HVAC Housing in this group. Inspect the blend door for proper operation and sealing. Repair if required.
The low side pressure is normal or slightly low, and the high side pressure is too low.	1. Low refrigerant system charge.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
	2. Refrigerant flow through the A/C evaporator is restricted.	2. See A/C Evaporator in this group. Replace the restricted A/C evaporator, if required.
	3. Faulty A/C compressor.	3. See A/C Compressor in this group. Replace the compressor, if required.

Condition	Possible Causes	Correction
The low side pressure is normal or slightly high, and the high side pressure is too high.	1. A/C condenser air flow restricted.	1. Check the A/C condenser for damaged fins, foreign objects obstructing air flow through the condenser fins, and missing or improperly installed air seals. Clean, repair, or replace components as required.
	2. Refrigerant flow through the accumulator is restricted.	2. See Accumulator in this group. Replace the restricted accumulator, if required.
	3. Inoperative radiator cooling fan.	3. Test the radiator cooling fan and replace, if required. Refer to Group 7.
	4. Refrigerant system overcharged.	4. See Refrigerant System Charge in this group. Recover the refrigerant from the refrigerant system. Charge the refrigerant system to the proper level, if required.
	5. Air in the refrigerant system.	5. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
	6. Engine overheating.	6. Test the engine cooling system and repair, if required. Refer to Group 7.
The low side pressure is too high, and the high side pressure is too low.	1. Accessory drive belt slipping.	1. Inspect the accessory drive belt condition and tension. Tighten or replace the accessory drive belt, if required. Refer to Group 7.
	2. Faulty A/C orifice tube.	2. See A/C Orifice Tube in this group. Replace the orifice tube, if required.
	3. Faulty A/C compressor.	3. See A/C Compressor in this group. Replace the compressor, if required.
The low side pressure is too low, and the high side pressure is too high.	1. Restricted refrigerant flow through the refrigerant lines.	1. See Liquid Line, Suction Line and Discharge Line in this group. Inspect the refrigerant lines for kinks, tight bends or improper routing. Correct the routing or replace the refrigerant lines, as required.
	2. Restricted refrigerant flow through the A/C orifice tube.	2. See A/C Orifice Tube in this group. Replace the orifice tube, if required.
	3. Restricted refrigerant flow through the A/C condenser.	3. See A/C Condenser in this group. Replace the restricted condenser, if required.

HEATER PERFORMANCE

Before performing the following tests, refer to Group 7 - Cooling System for the procedures to check the engine coolant level and flow, engine coolant reserve/recovery system operation, accessory drive belt condition and tension, radiator air flow and the fan drive operation. Perform the A/C System Performance Test, which is found within the HVAC System Test (refer to 24 - HVAC Electrical Diagnostics). If any diagnostic trouble codes (DTCs) are found in the A/C-heater control or the powertrain control module (PCM), repair as necessary.

HEATER PERFORMANCE TEST

Engine coolant is delivered to the heater core through two heater hoses. With the engine idling at normal operating temperature, set the temperature control to the full hot position, the mode control to the floor position, and the blower motor control to the highest speed position. Using a test thermometer, check the temperature of the air being discharged at the HVAC housing floor outlets. Compare the test thermometer reading to the Heater Temperature Reference chart.

HEATER TEMPERATURE REFERENCE

Ambient Air Temperature	15.5° C (60° F)	21.1° C (70° F)	26.6° C (80° F)	32.2° C (90° F)
Minimum Heater System Air Outlet Temperature	52.2° C (126° F)	56.1° C (133° F)	59.4° C (139° F)	62.2° C (144° F)

If the heater outlet air temperature is below the minimum specification, refer to Group 7 - Cooling System. Both of the heater hoses should be hot to the touch. The coolant return heater hose should be slightly cooler than the coolant supply heater hose. If the return hose is much cooler than the supply hose, locate and repair the engine coolant flow obstruction in the cooling system. Refer to Group 7 - Cooling System for more information.

OBSTRUCTED COOLANT FLOW

- Faulty water pump.
- Faulty thermostat.
- Pinched or kinked heater hoses.
- Improper heater hose routing.
- Plugged heater hoses or supply and return ports at the cooling system connections.
- A plugged heater core.

If proper coolant flow through the cooling system is verified, and heater outlet air temperature is still low, a mechanical problem may exist.

MECHANICAL PROBLEMS

Possible locations or causes of insufficient heat:

- Obstructed cowl air intake.
- Obstructed heater system outlets.
- Faulty, obstructed or improperly installed blend-air door(s) or actuator.
- Faulty blower system.
- Faulty A/C-heater control.

TEMPERATURE CONTROL

If the heater outlet air temperature cannot be adjusted with the temperature control located in the A/C-heater control, the following could require service:

- A/C-heater control.
- Blend door actuator.
- Blend-air door(s).
- Cowl air intake.
- Engine cooling system.

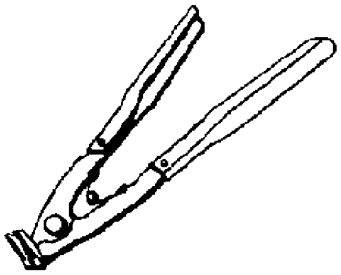
SPECIFICATIONS

A/C SYSTEM

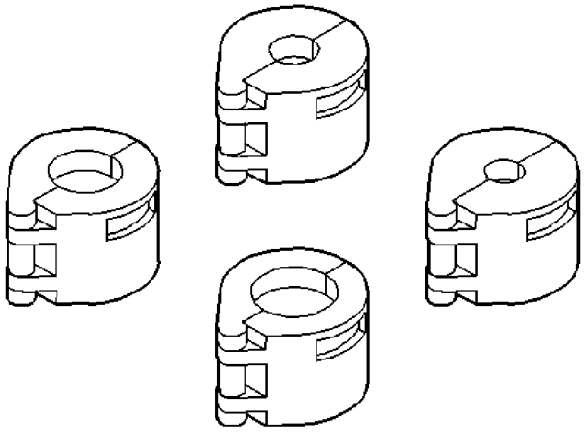
Item	Description	Notes
A/C Compressor	Denso 10S17	ND-8 PAG oil
Freeze–up Control	Evaporator Temperature Sensor	HVAC housing mounted - input to A/C-heater control
Low psi Control	A/C Pressure Transducer	Liquid line mounted - input to FCM - opens below 28 psi, closes above 34 psi
High psi Control	A/C Pressure Transducer	Liquid line mounted - input to FCM - opens above 460 psi, closed below 290 psi
Refrigerant Charge Capacity	Refer to the Underhood Specification Label in the engine compartment	R-134a refrigerant
A/C Clutch Coil Draw	3.3 amps	@ 12V ± 0.5V @ 21° C (70° F)
A/C Clutch Coil Resistance	3.6 ± 0.2 ohms	When measured across coil lead connector
A/C Clutch Air Gap	0.35 - 0.60 mm (0.014 - 0.024 in.)	

SPECIAL TOOLS

A/C SYSTEM



Snap Ring Pliers C-4574 are required to service the A/C clutch and field coil.



A/C Line Disconnect Tools 7193

A/C Line Disconnect Tools 7193 are required to service the A/C liquid line and the A/C accumulator.

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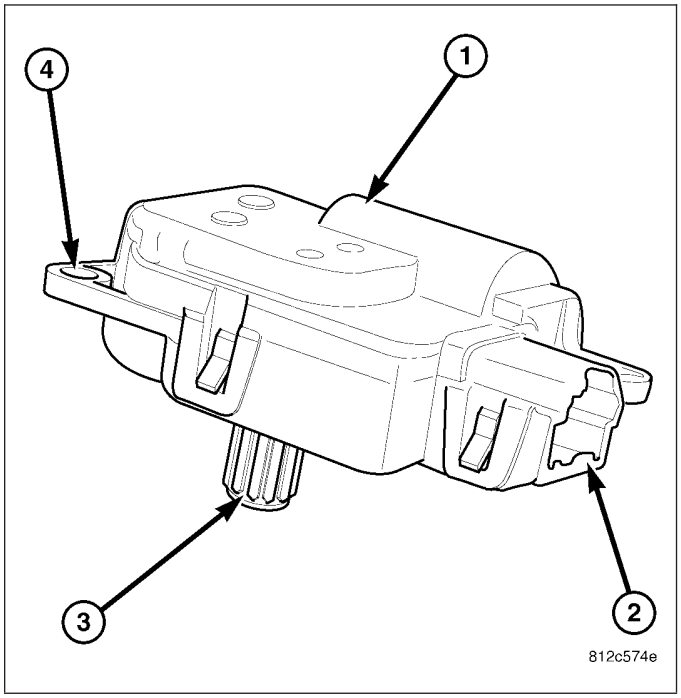
ACTUATOR-BLEND DOOR

DESCRIPTION

The blend door actuator (1) is a reversible, 12 volt direct current (DC), servo motor. The blend door actuator is located on the top of the HVAC housing. The blend door actuator is interchangeable with the actuators for the mode-air and recirculation-air doors. Each actuator is contained within an identical black molded plastic housing with an integral wire connector receptacle (2). Each actuator also has an identical output shaft with splines (3) that connects it to its respective door linkage and three integral mounting tabs (4) that allow the actuator to be secured to the HVAC housing. The blend door actuator does not require mechanical indexing to the blend-air doors, as it is electronically calibrated by the A/C-heater control.

The blend door actuator can be accessed for serviced by removing the instrument panel.



OPERATION

The blend door actuator is connected to the A/C-heater control through the vehicle electrical system by a dedicated two-wire lead and connector of the HVAC wire harness. The blend door actuator can move the blend-air doors in two directions. When the A/C-heater control pulls the voltage on one side of the motor connection high and the other connection low, the blend-air doors will move in one direction. When the A/C-heater control reverses the polarity of the voltage to the motor, the blend-air doors moves in the opposite direction.

When the A/C-heater control makes the voltage to both connections high or both connections low, the blend-air doors stop and will not move. The A/C-heater control uses a pulse-count positioning system to monitor the operation and relative position of the blend door actuator and the blend-air doors. The A/C-heater control learns the blend-air doors stop positions during the calibration procedure and will store a diagnostic trouble code (DTC) for any problems it detects in the blend door actuator circuit.

The blend door actuator is diagnosed using the scan tool. Refer to 24 - HVAC Electrical Diagnostics for more information.

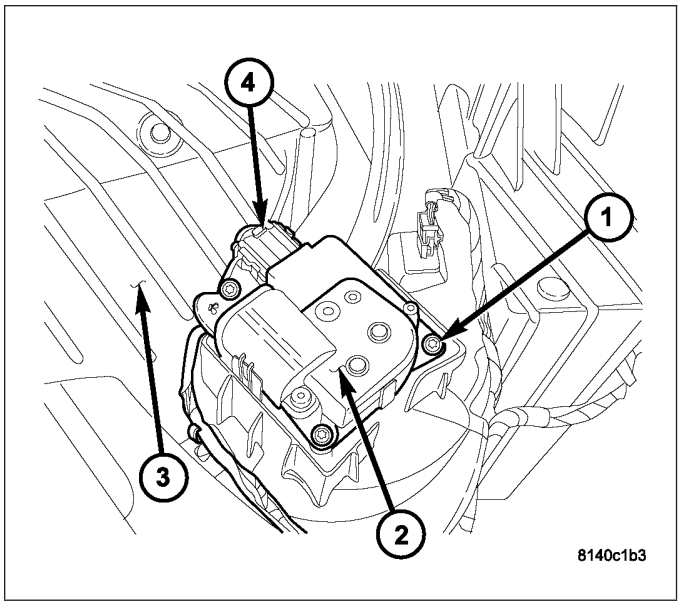
The blend door actuator cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

REMOVAL

WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

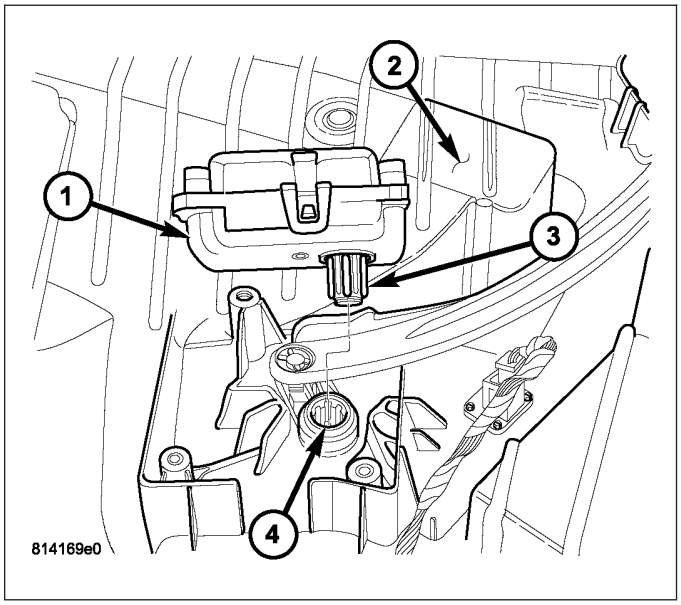
NOTE: Take the proper precautions to protect the front face of the instrument panel from cosmetic damage during this service procedure.

1. Disconnect and isolate the negative battery cable.
2. Remove the instrument panel (Refer to 23 - BODY/ INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).
3. Remove the three screws (1) that secure the blend door actuator (2) to the top of the HVAC housing (3).
4. Disconnect the HVAC wire harness connector (4) from the blend door actuator.
5. Remove the blend door actuator from the HVAC housing.

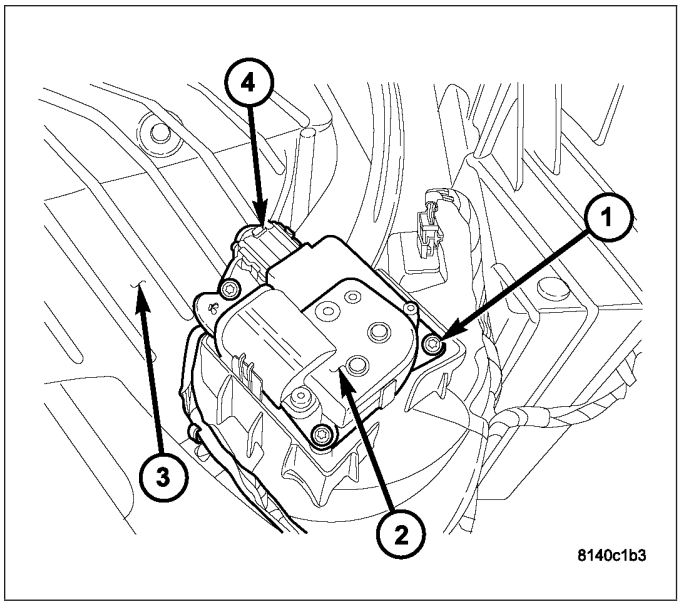


INSTALLATION

1. Position the blend door actuator (1) onto the top of the HVAC housing (2). If necessary, rotate the actuator slightly to align the splines on the actuator output shaft (3) with those on the blend-air door linkage (4).



2. Install the three screws (1) that secure the blend door actuator (2) to the HVAC housing (3). Tighten the screws to 2 N·m (17 in. lbs.).
3. Connect the HVAC wire harness connector (4) to the blend door actuator.
4. Install the instrument panel (Refer to 23 - BODY/ INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).
5. Reconnect the negative battery cable.
6. Initiate the Actuator Calibration function using a scan tool. Refer to HVAC System Test, found in 24 - HVAC - Electrical Diagnostics.

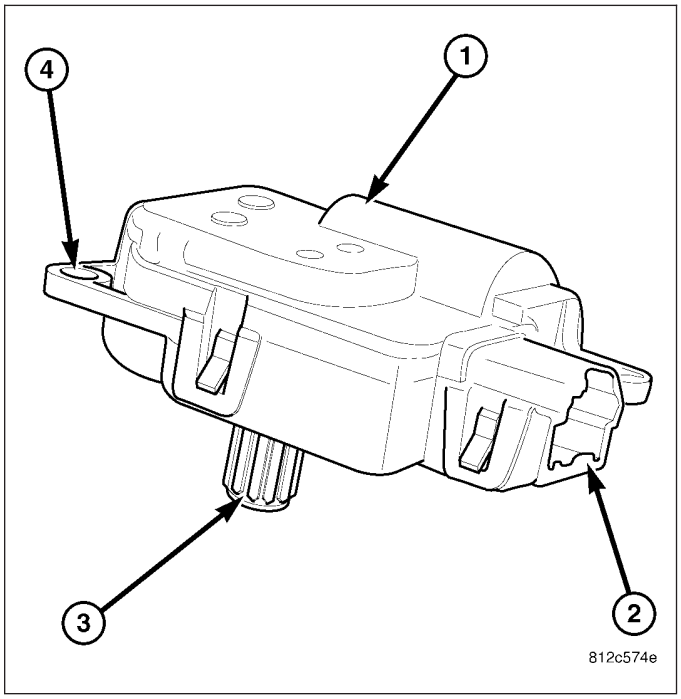


ACTUATOR-MODE DOOR

DESCRIPTION

The two mode door actuators (1) are reversible, 12–volt direct current (DC), servo motors. The mode door actuators are located on the driver side of the HVAC housing. The mode door actuators are mechanically connected to the floor/defrost and the panel-air doors. The mode door actuators are interchangeable with the actuators for the blend-air doors and the recirculation-air door. Each actuator is contained within an identical black molded plastic housing with an integral wire connector receptacle (2). Each actuator also has an identical output shaft with splines (3) that connects it to its respective door linkage and three integral mounting tabs (4) that allow the actuator to be secured to the HVAC housing. The mode door actuators do not require mechanical indexing to the mode-air doors, as they are electronically calibrated by the A/C-heater control.

The two mode door actuators can be serviced from underneath the drivers side of the instrument panel.



OPERATION

Both the floor/defrost actuator and the panel door actuator (mode door actuators) are connected to the A/C-heater control through the vehicle electrical system by dedicated two-wire leads and connectors of the HVAC wire harness. Each mode door actuator can move the floor/defrost or the panel-air doors in two directions. When the A/C-heater control pulls the voltage on one side of an actuator motor connection high and the other connection low, the respective mode-air door will move in one direction. When the A/C-heater control reverses the polarity of the voltage to the motor, the mode-air door moves in the opposite direction.

When the A/C-heater control makes the voltage to both connections high or both connections low, the respective mode-air door stops and will not move. The A/C-heater control uses a pulse-count positioning system to monitor the operation and relative position of both mode door actuators and the mode-air doors. The A/C-heater control learns

the mode-air door stop positions during the calibration procedure and will store a diagnostic trouble code (DTC) for any problems it detects in the mode door actuator circuits.

The mode door actuators are diagnosed using a scan tool. Refer to 24 - HVAC Electrical Diagnostics for more information.

The mode door actuators cannot be adjusted or repaired and, if faulty or damaged, they must be replaced.

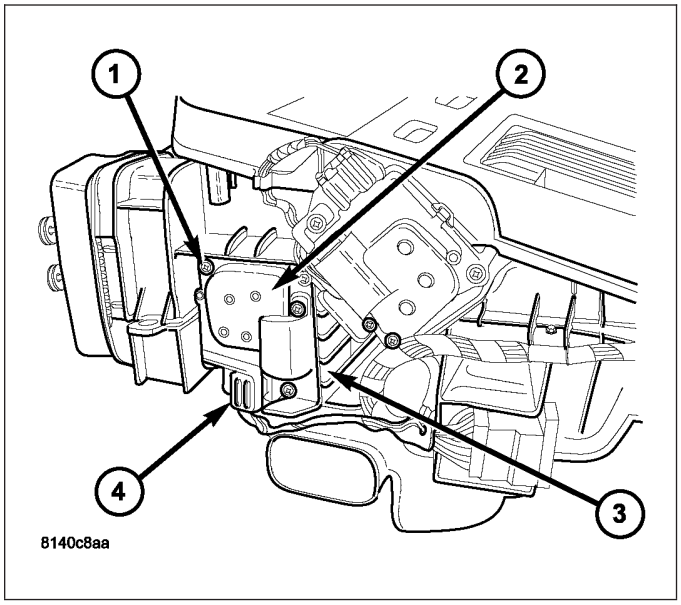
REMOVAL

WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: This heater-A/C system is equipped with two mode door actuators. One for the floor/defrost-air door and one for the panel-air door.

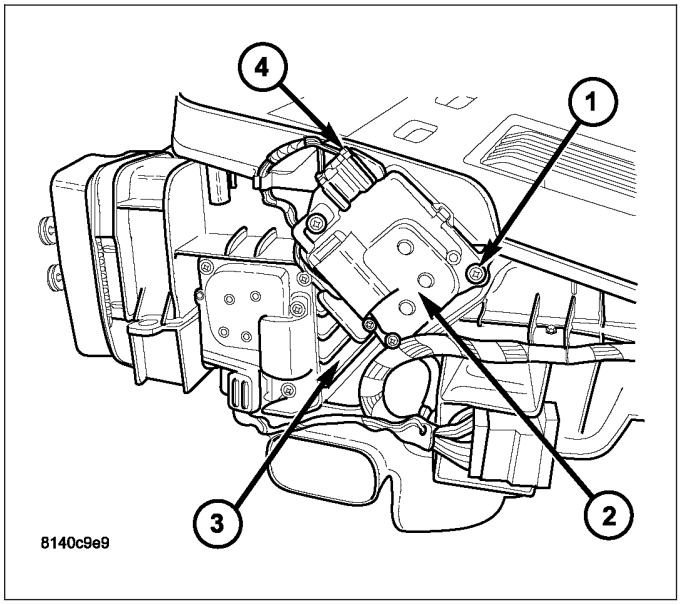
FLOOR/DEFROST DOOR ACTUATOR

1. Disconnect and isolate the negative battery cable.
2. Remove the three screws (1) that secure the floor/defrost door actuator (2) to the driver side end of the HVAC housing (3).
3. Disconnect the HVAC wire harness connector (4) from the floor/defrost door actuator.
4. Remove the floor/defrost door actuator from the HVAC housing.



PANEL DOOR ACTUATOR

1. Disconnect and isolate the negative battery cable.
2. Remove the three screws (1) that secure the panel door actuator (2) to the driver side end of the HVAC housing (3).
3. Disconnect the HVAC wire harness connector (4) from the panel door actuator.
4. Remove the panel door actuator from the HVAC housing.

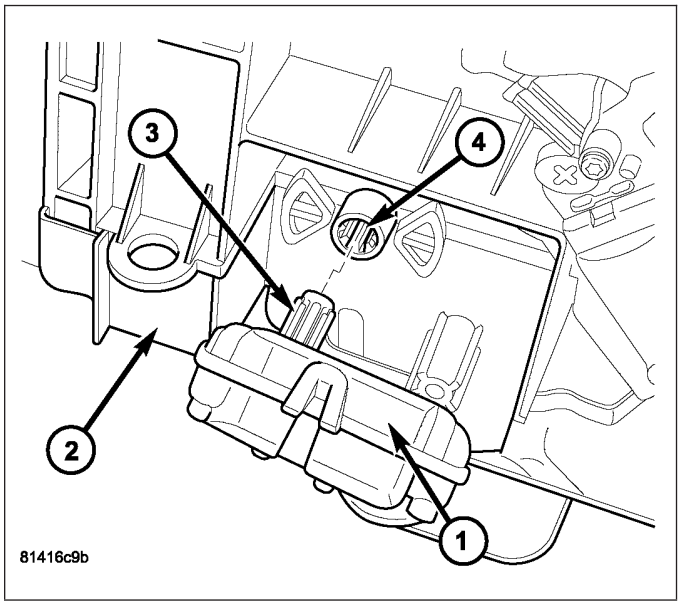


INSTALLATION

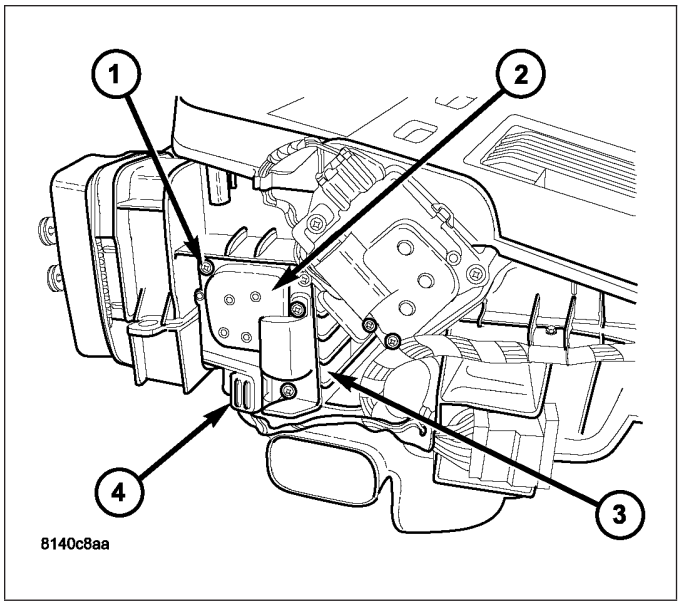
NOTE: This heater-A/C system is equipped with two mode door actuators. One for the floor/defrost-air door and one for the panel-air door.

FLOOR/DEFROST DOOR ACTUATOR

1. Position the floor/defrost door actuator (1) onto the driver side end of the HVAC housing (2). If necessary, rotate the actuator slightly to align the splines on the actuator output shaft (3) with those on the floor/defrost door pivot shaft (4).

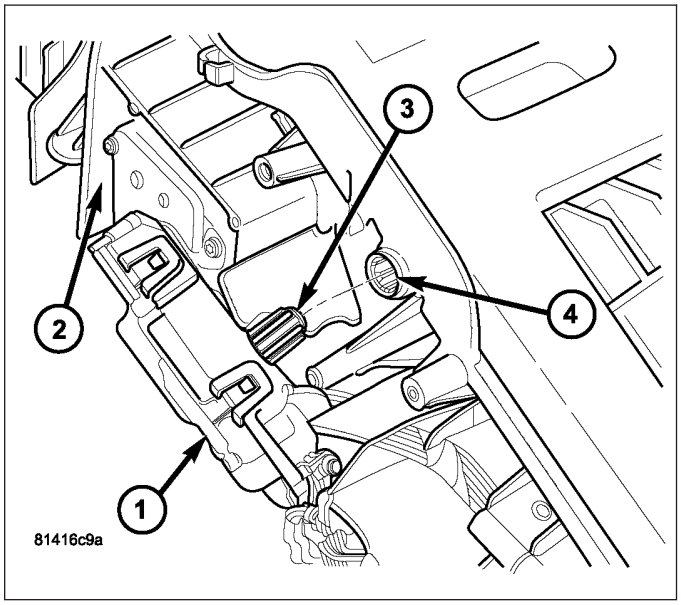


2. Install the three screws (1) that secure the floor/defrost door actuator (2) to the HVAC housing (3). Tighten the screws to 2 N·m (17 in. lbs.).
3. Connect the HVAC wire harness connector (4) to the floor/defrost door actuator.
4. Reconnect the negative battery cable.
5. Initiate the Actuator Calibration function using a scan tool. Refer to HVAC System Test, found in 24 - HVAC - Electrical Diagnostics.

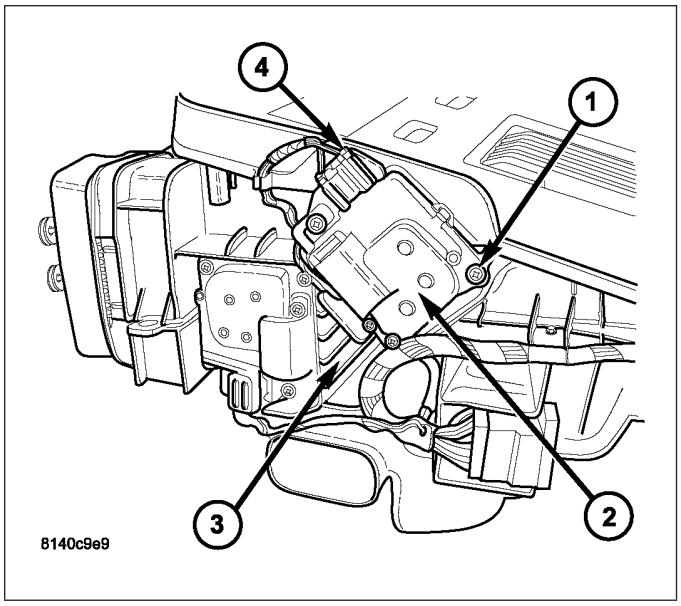


PANEL DOOR ACTUATOR

1. Position the panel door actuator (1) onto the driver side end of the HVAC housing (2). If necessary, rotate the actuator slightly to align the splines on the actuator output shaft (3) with those on the panel door pivot shaft (4).



2. Install the three screws (1) that secure the panel door actuator (2) to the HVAC housing (3). Tighten the screws to 2 N·m (17 in. lbs.).
3. Connect the HVAC wire harness connector (4) to the panel door actuator.
4. Reconnect the negative battery cable.
5. Initiate the Actuator Calibration function using a scan tool. Refer to HVAC System Test, found in 24 - HVAC - Electrical Diagnostics.

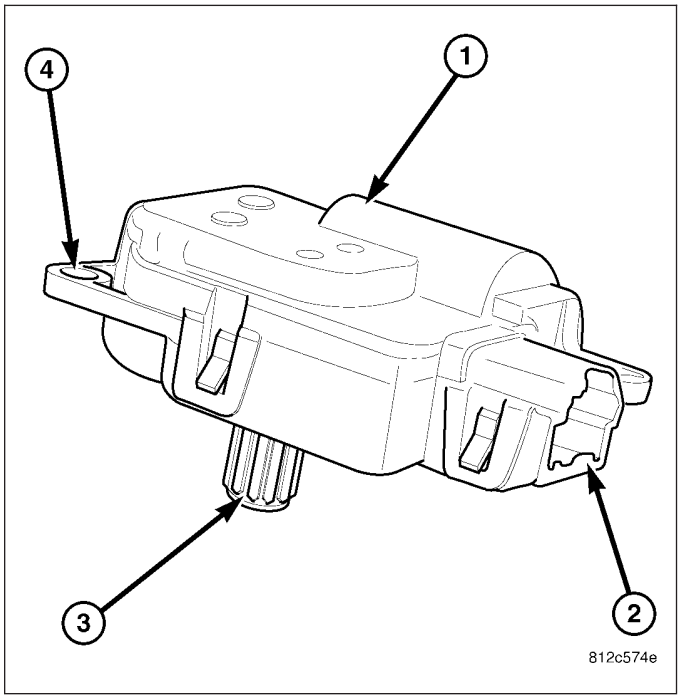


ACTUATOR-RECIRCULATION DOOR

DESCRIPTION

The recirculation door actuator (1) is a reversible, 12 volt direct current (DC), servo motor. The recirculation door actuator is located on the left side of the HVAC air inlet housing. The recirculation door actuator is interchangeable with the actuators for the blend-air doors and the mode-air doors. Each actuator is contained within an identical black molded plastic housing with an integral wire connector receptacle (2). Each actuator also has an identical output shaft with splines (3) that connects it to its door linkage and three integral mounting tabs (4) that allow the actuator to be secured to the air inlet housing. The recirculation door actuator does not require mechanical indexing to the recirculation-air door, as it is electronically calibrated by the A/C-heater control.

The recirculation door actuator can be accessed for serviced by removing the air inlet housing.



OPERATION

The recirculation door actuator is connected to the A/C-heater control through the vehicle electrical system by a dedicated two-wire lead and connector of the HVAC wire harness. The recirculation door actuator can move the recirculation-air door in two directions. When the A/C-heater control pulls the voltage on one side of the motor connection high and the other connection low, the recirculation-air door will move in one direction. When the A/C-heater control reverses the polarity of the voltage to the motor, the recirculation-air door moves in the opposite direction.

When the A/C-heater control makes the voltage to both connections high or both connections low, the recirculation-air door stops and will not move. The A/C-heater control uses a pulse-count positioning system to monitor the operation and relative position of the recirculation door actuator and the recirculation-air door. The A/C-heater control

learns the recirculation-air door stop positions during the calibration procedure and will store a diagnostic trouble code (DTC) for any problems it detects in the recirculation door actuator circuits.

The recirculation door actuator cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

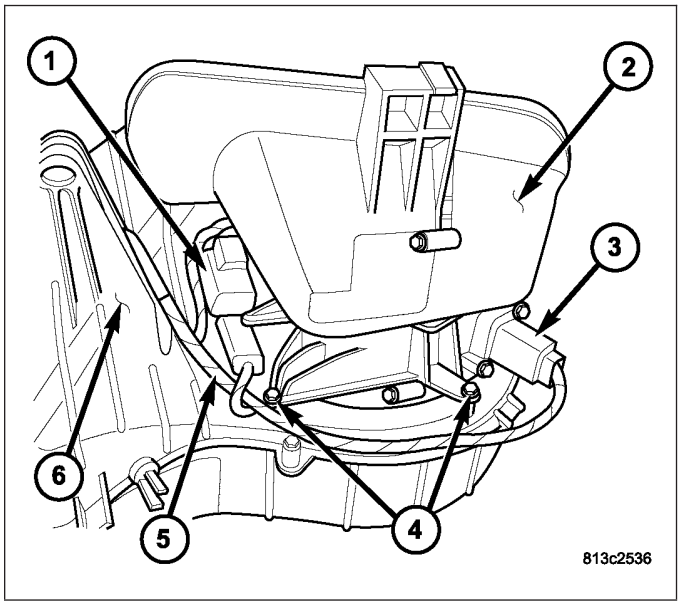
The recirculation door actuator is diagnosed using a scan tool. Refer to 24 - HVAC Electrical Diagnostics for more information.

REMOVAL

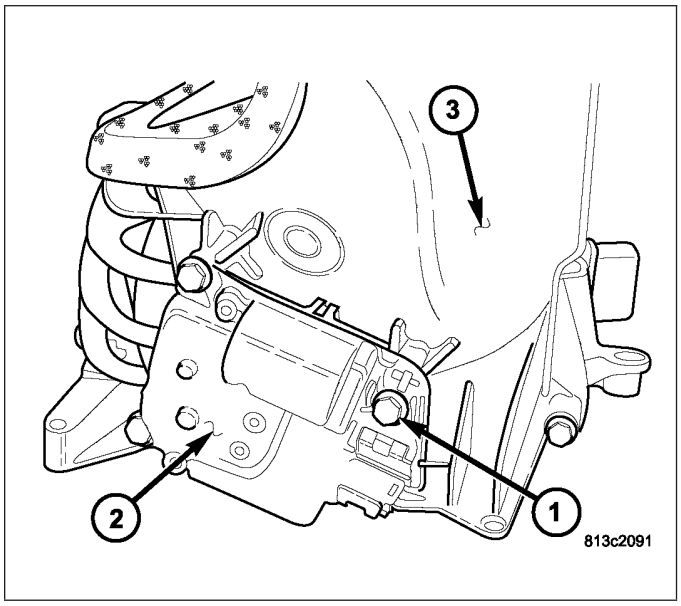
WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: Take the proper precautions to protect the front face of the instrument panel from cosmetic damage during this service procedure.

1. Disconnect and isolate the negative battery cable.
2. Remove the HVAC assembly (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - REMOVAL).
3. Disconnect the HVAC wire harness (5) from the recirculation door actuator (1) and the blower motor resistor (3).
4. Remove the four screws (4) that secure the air inlet housing (2) to the top of the HVAC housing (6).
5. Remove the air inlet housing from the HVAC housing and place it on a workbench.

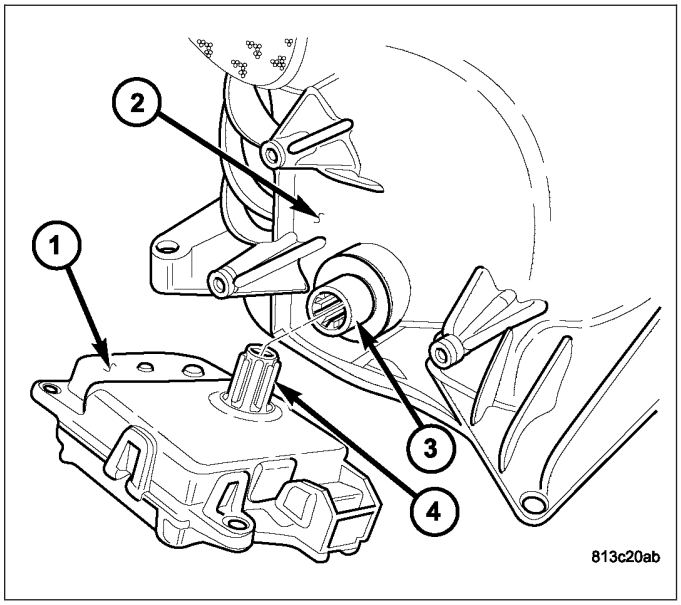


6. Remove the three screws (1) that secure the recirculation door actuator (2) to the air inlet housing (3).
7. Remove the recirculation door actuator from the air inlet housing.

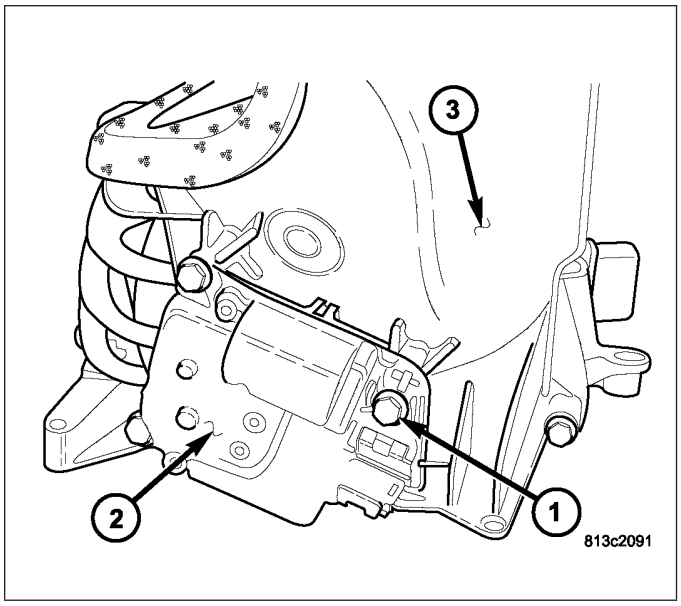


INSTALLATION

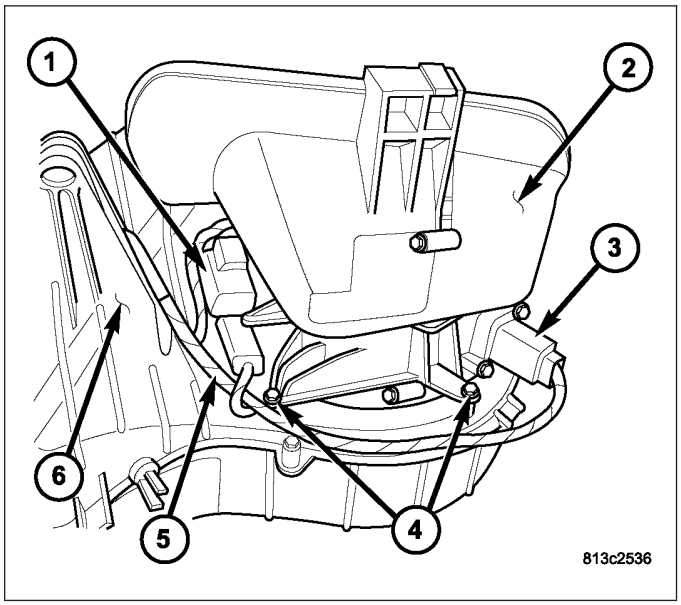
1. Position the recirculation door actuator (1) onto the air inlet housing (2). If necessary, rotate the actuator slightly to align the splines in the recirculation-air door pivot shaft (3) with those on the actuator output shaft (4).



2. Install the three screws (1) that secure the recirculation door actuator (2) to the air inlet housing (3). Tighten the screws to 2 N·m (17 in. lbs.).



3. Position the air inlet housing (2) onto the top of the HVAC housing (6).
4. Install the four screws (4) that secure the air inlet housing to the top of the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).
5. Connect the HVAC wire harness (5) to the recirculation door actuator (1) and the blower motor resistor (3).
6. Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - INSTALLATION).
7. Reconnect the negative battery cable.
8. Initiate the Actuator Calibration function using a scan tool. Refer to HVAC System Test, found in 24 - HVAC - Electrical Diagnostics.

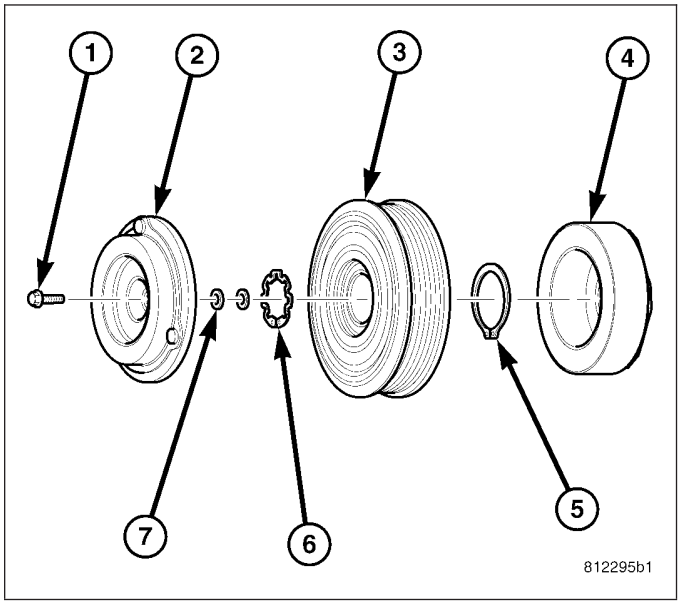


CLUTCH-A/C COMPRESSOR

DESCRIPTION

The A/C compressor clutch assembly consists of a stationary electromagnetic A/C clutch field coil (4), pulley bearing and pulley assembly (3), clutch plate (2) and shims (7). These components provide the means to engage and disengage the A/C compressor from the engine accessory drive belt.

The A/C clutch field coil and the pulley bearing and pulley assembly are both retained on the nose of the A/C compressor with snap rings (5 and 6). The clutch plate is splined to the compressor shaft and secured with a bolt (1).



OPERATION

The A/C compressor clutch components provide the means to engage and disengage the A/C compressor from the engine accessory drive belt. When the electromagnetic A/C clutch field coil is energized, it magnetically draws the clutch plate into contact with the clutch pulley and drives the compressor shaft. When the coil is not energized, the pulley freewheels on the clutch hub bearing, which is part of the pulley assembly.

The A/C compressor clutch engagement is controlled by the following components:

- A/C-heater control in the passenger compartment
- A/C pressure transducer on the A/C liquid line
- Powertrain control module (PCM) in the engine compartment
- A/C clutch relay in the power distribution center (PDC)

The A/C compressor clutch components cannot be repaired and, if faulty or damaged, they must be replaced.

DIAGNOSIS AND TESTING

A/C COMPRESSOR CLUTCH COIL

The A/C compressor clutch coil electrical circuit is controlled by the powertrain control module (PCM) through the A/C clutch relay. The A/C clutch coil can be tested by either measuring cluch field coil resistance or by measuring current draw. Begin testing of a suspected compressor clutch coil problem by performing the preliminary checks.

PRELIMINARY CHECKS

1. If the A/C compressor clutch will not engage, refer to 24 - HVAC Electrical Diagnostics to perform the A/C System Performance Test, which is found within the HVAC System Test. If no diagnostic trouble codes (DTCs) are found in the A/C-heater control or the powertrain control module (PCM), go to Step 2. If any DTCs are found, repair as required.
2. If the A/C compressor clutch still will not engage, verify the refrigerant charge level (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DIAGNOSIS AND TESTING - REFRIGERANT SYSTEM LEAKS). If the refrigerant charge level is OK, go to COIL RESISTANCE TEST and/or COIL CURRENT DRAW TEST . If the refrigerant charge level is not OK, adjust the refrigerant charge as required.

COIL RESISTANCE TEST

1. Disconnect and isolate the negative battery cable.
2. Disconnect the wire harness connector from the A/C clutch field coil lead connector.
3. Use an ohm meter and measure the resistance of the clutch coil at the coil lead connector terminals.
4. Refer to the A/C Clutch Coil Specifications chart for the acceptable A/C clutch coil resistance. Specifications apply for a work area temperature of 21° C (70° F).
   a. If the A/C clutch coil reading is below specifications, the coil is shorted and must be replaced.
   b. If the A/C clutch coil reading is above specifications, the coil is open and must be replaced.

COIL CURRENT DRAW TEST

1. Verify the battery state of charge (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - DIAGNOSIS AND TESTING).
2. Connect an ammeter (0 to 10 ampere scale selected) in series with the clutch coil feed terminal. Connect a voltmeter (0 to 20 volt scale selected) to measure voltage across the battery and the clutch coil.
3. With the A/C-heater control in the A/C mode and the blower motor at low speed, start the engine and allow it to run at a normal idle speed.
4. The A/C compressor clutch should engage immediately, and the clutch coil supply voltage should be within two volts of the battery voltage. If the coil supply voltage is OK, go to Step 5. If the coil supply voltage is not within two volts of battery voltage, test the clutch coil feed circuit for excessive voltage drop and repair as necessary.
5. Refer to the A/C Clutch Coil Specifications chart for the acceptable A/C clutch coil current draw. Specifications apply for a work area temperature of 21° C (70° F). If voltage is more than 12.5 volts, add electrical loads by turning on electrical accessories until voltage reads below 12.5 volts.
   a. If the A/C clutch coil current reading is zero, the coil is open and must be replaced.
   b. If the A/C clutch coil current reading is above specifications, the coil is shorted and must be replaced.

A/C CLUTCH COIL SPECIFICATIONS

Compressor	Current Draw	Coil Resistance
Denso 10S17	3.3 amps @ 11.5 - 12.5 volts	3.6 ± 0.2 ohms

STANDARD PROCEDURE

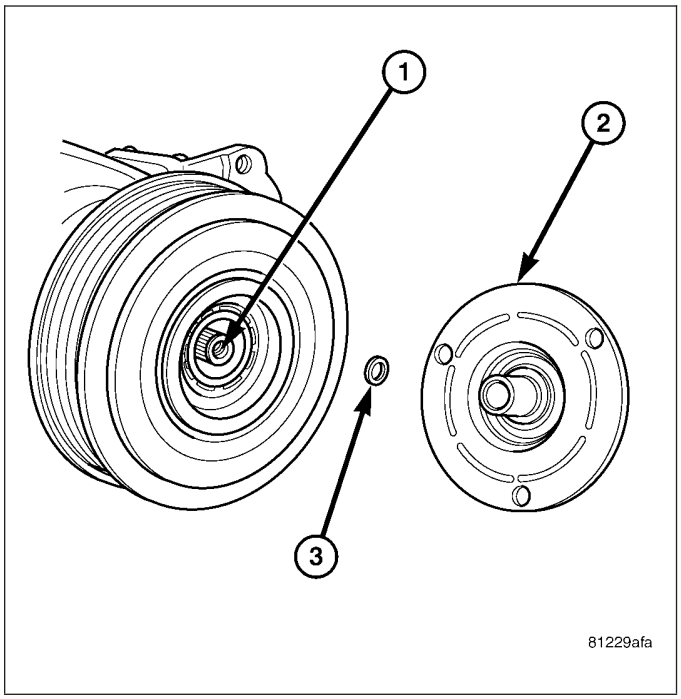
A/C CLUTCH PLATE INSPECTION

NOTE: The A/C clutch can be serviced in the vehicle. The refrigerant system can remain fully-charged during compressor clutch, pulley and bearing assembly, or coil replacement.

Examine the friction surfaces of the pulley and the clutch plate (2) for wear. The pulley and clutch plate should be replaced if there is excessive wear or scoring.

If the friction surfaces are oily, inspect the shaft and nose area of the A/C compressor (1) for refrigerant oil. If refrigerant oil is found, the compressor shaft seal is leaking and the A/C compressor must be replaced.

Check the pulley bearing for roughness or excessive leakage of grease. Replace the pulley and bearing assembly, if required.



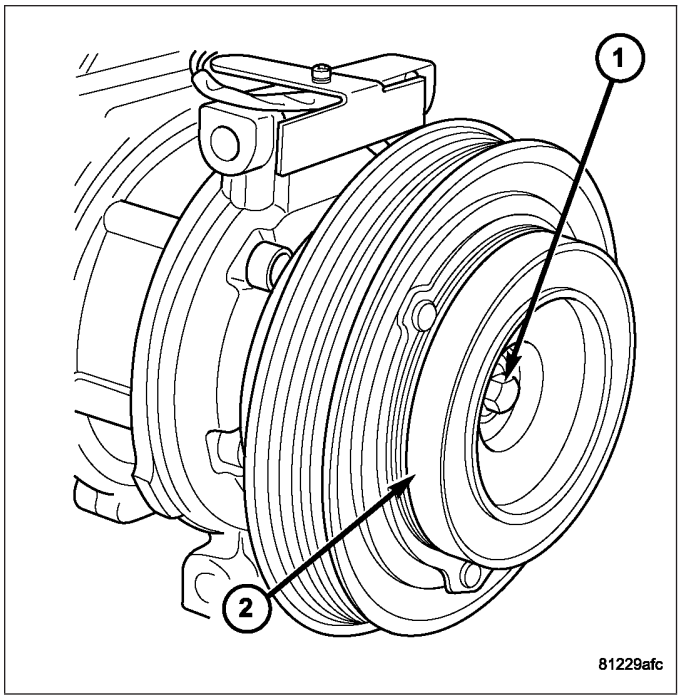
A/C CLUTCH BREAK-IN

After a new A/C compressor clutch has been installed, cycle the compressor clutch approximately twenty times (five seconds on, then five seconds off). During this procedure, set the A/C-heater controls to the A/C Recirculation Mode, the blower motor in the highest speed position, and the engine speed at 1500 to 2000 rpm. This procedure (burnishing) will seat the opposing friction surfaces and provide a higher compressor clutch torque capability.

REMOVAL

NOTE: The A/C compressor clutch can be serviced in the vehicle. The refrigerant system can remain fully-charged during compressor clutch, pulley and bearing assembly, or coil replacement.

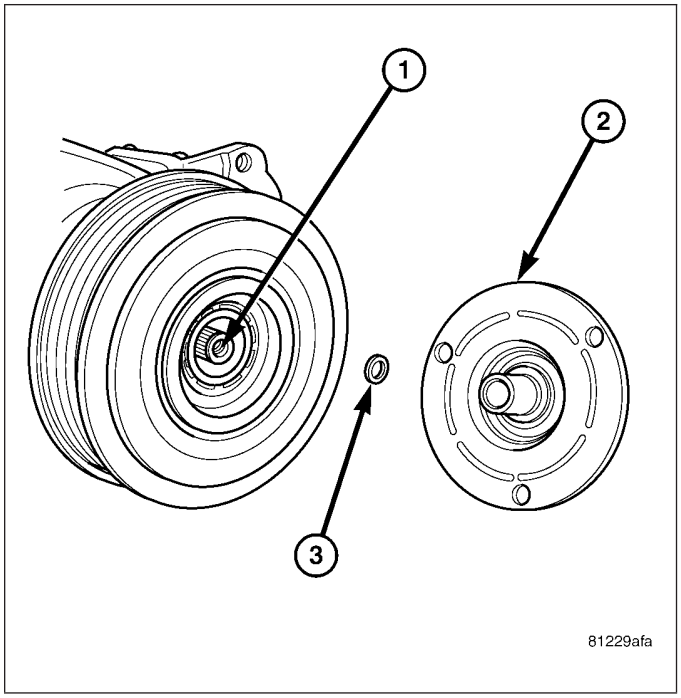
1. Disconnect and isolate the negative battery cable.
2. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/BELTS-DRIVE - REMOVAL).
3. Disconnect the engine wire harness connector for the A/C compressor clutch coil from the clutch field coil wire harness connector on the top of the A/C compressor.
4. Remove the bolts that secure the A/C compressor to the engine and support the A/C compressor.
5. Remove the compressor shaft bolt (1). A band-type oil filter wrench or a strap wrench may be used to secure the clutch plate (2) during bolt removal.



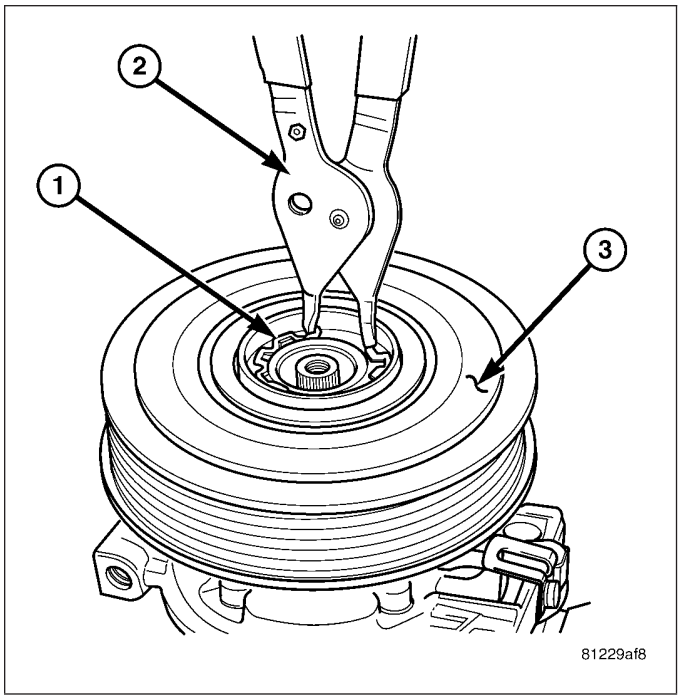
CAUTION: Do not pry between the clutch plate and the pulley and bearing assembly to remove the clutch plate from the compressor shaft as this may damage the clutch plate.

NOTE: Use care not to lose any clutch shim(s) during removal of the clutch plate, as they may be reused during the clutch plate installation process.

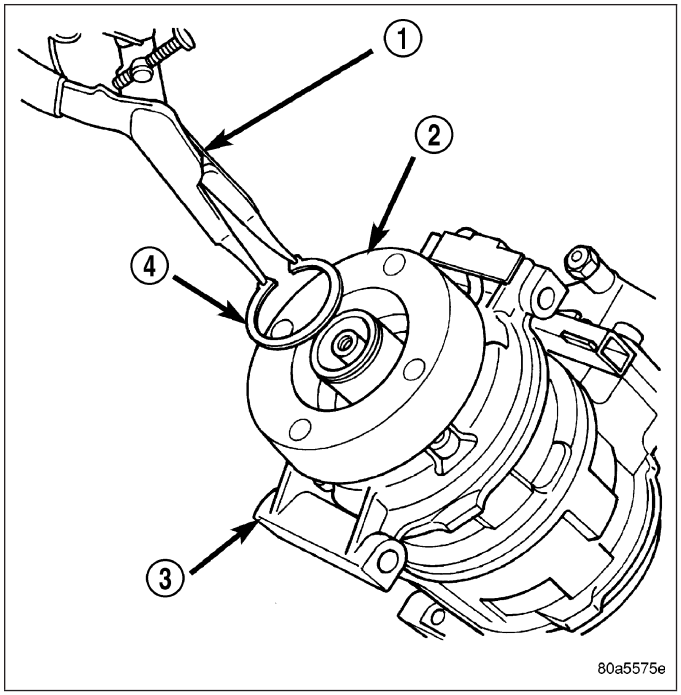
6. Tap the clutch plate (2) lightly with a plastic mallet to release it from the splines on the compressor shaft (1). Remove the clutch plate and shim(s) (3) from the compressor shaft.



7. Using snap ring pliers (Special Tool C-4574 or equivalent) (2), remove the external snap ring (1) that secures the pulley and bearing assembly (3) to the front cover of the A/C compressor, then slide the pulley and bearing assembly off of the A/C compressor.

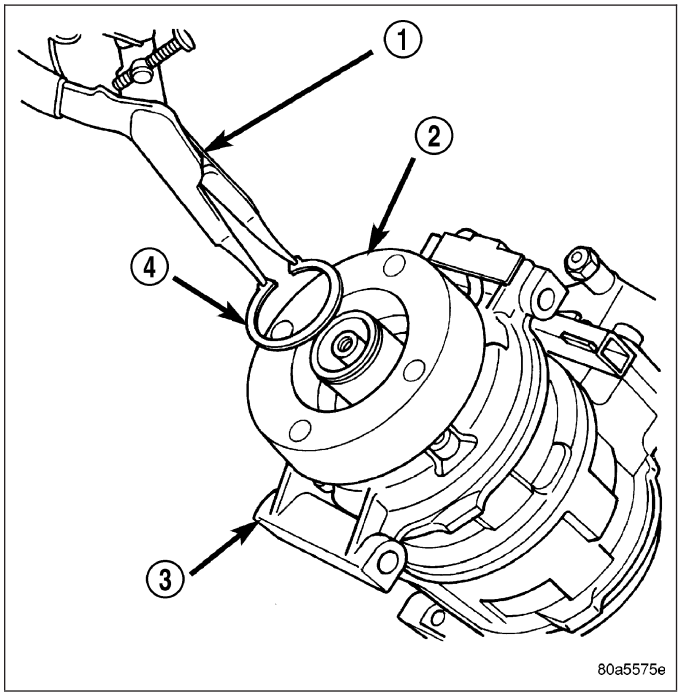


8. Remove the screw that secures the clutch coil pigtail wire connector bracket and ground clip to the top of the compressor housing (3).
9. Using snap ring pliers (Special Tool C-4574 or equivalent) (1), remove the external snap ring (4) that secures the clutch field coil (2) to the front cover of the compressor housing, then slide the clutch field coil off of the A/C compressor.



INSTALLATION

1. Align the dowel pin on the back of the clutch field coil (2) with the hole in the compressor front cover (3) and position the clutch field coil onto the A/C compressor. Be certain that the clutch coil wire harness is properly oriented and routed so that it is not pinched between the compressor front cover and the clutch field coil.



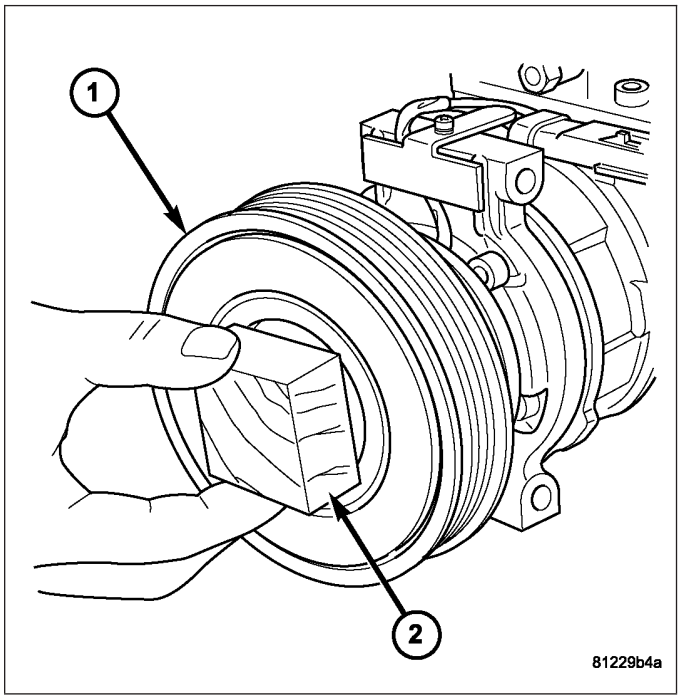
CAUTION: The snap ring must be fully and properly seated in the groove or it will vibrate out, resulting in a clutch failure and severe damage to the A/C compressor.

NOTE: A new snap ring must be used to secure the clutch field coil to the A/C compressor. The bevel side of the snap ring must face outward and both snap ring eyelets must be oriented to the right or to the left of the clutch field coil dowel pin location on the A/C compressor.

2. Using snap ring pliers (Special Tool C-4574 or equivalent) (1), install the external snap ring (4) that secures the clutch field coil to the front cover of the A/C compressor. Be certain that the snap ring is fully and properly seated in the groove and oriented correctly.
3. Install the screw that secures the clutch field coil wire harness connector bracket and ground clip to the top of the compressor housing. Tighten the screw securely.

CAUTION: When installing the pulley and bearing assembly, DO NOT mar the friction surfaces of the pulley or premature failure of the clutch will result.

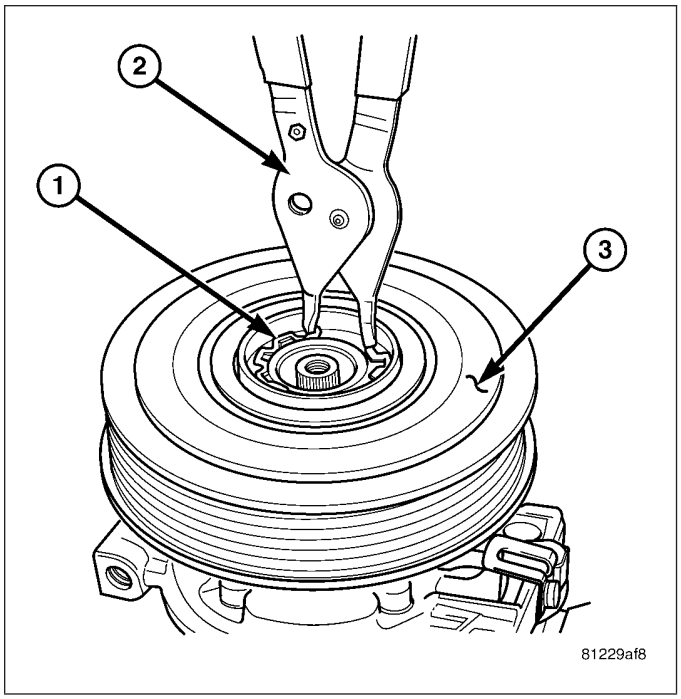
4. Install the pulley and bearing assembly (1) onto the front cover of the A/C compressor. If necessary, tap the pulley gently with a block of wood (2) placed on the pulley friction surface.



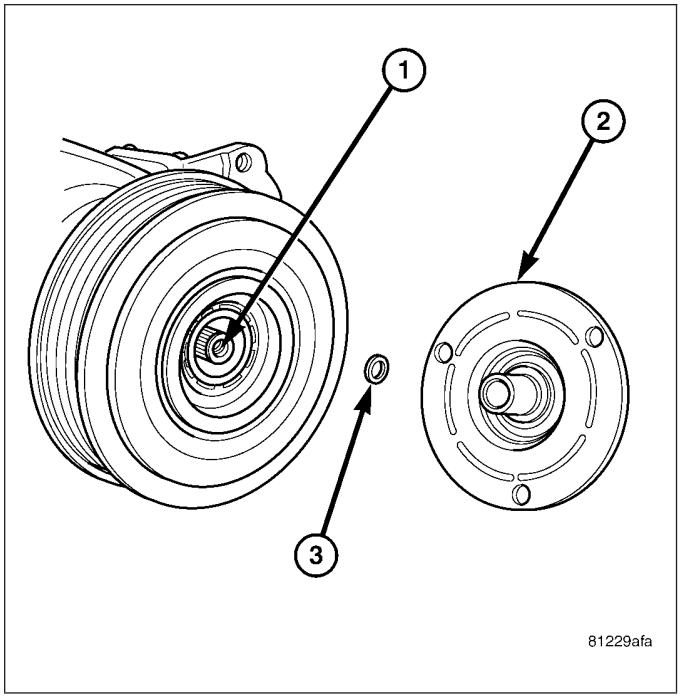
CAUTION: The snap ring must be fully and properly seated in the groove or it will vibrate out, resulting in a clutch failure and severe damage to the A/C compressor.

NOTE: A new snap ring must be used to secure the pulley and bearing assembly to the A/C compressor. The bevel side of the snap ring must face outward.

5. Using snap ring pliers (Special Tool C-4574 or equivalent) (2), install the external snap ring (1) that secures the pulley and bearing assembly (3) to the front cover of the A/C compressor. Be certain that the snap ring is fully and properly seated in the groove.



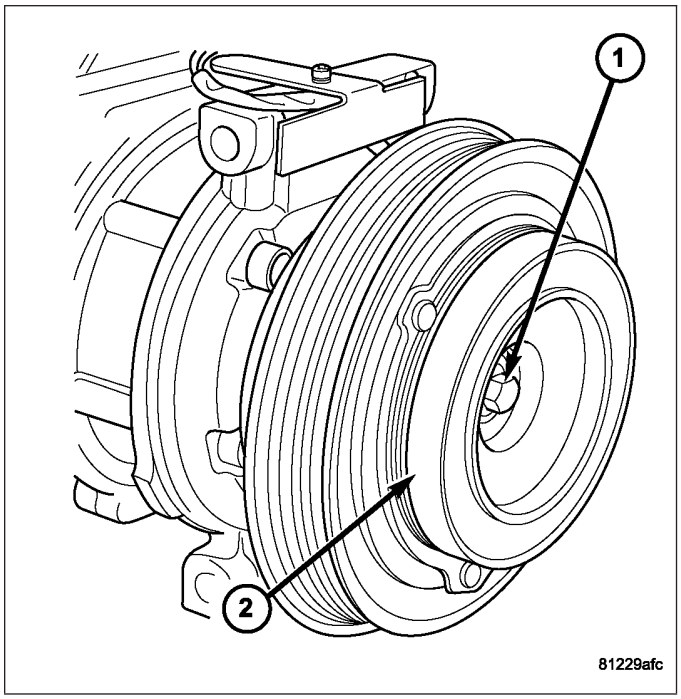
6. If the original clutch plate (2) and pulley and bearing assembly are to be reused, reinstall the original shim(s) (3) on the compressor shaft (1) against the shoulder. If a new clutch plate and/or pulley and bearing assembly are being used, install a trial stack of shims 2.54 mm (0.010 in.) thick on the compressor shaft against the shoulder.



7. Install the clutch plate (2) onto the compressor shaft.
8. Install the compressor shaft bolt (1). Tighten the bolt to 19 N·m (168 in. lbs.).

NOTE: The shims may compress after tightening the shaft bolt. Check the air gap in four or more places to verify the air gap is correct. Spin the pulley before performing a final check of the air gap.

9. With the clutch plate assembled tight against the shim(s), measure the air gap between the clutch plate and the pulley and bearing assembly faces with a feeler gauge. The air gap should be between specifications (Refer to 24 - HEATING & AIR CONDITIONING - SPECIFICATIONS). If the proper air gap is not obtained, add or subtract shims as needed until the desired air gap is obtained.
10. Install the bolts that secure the A/C compressor to the engine (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COMPRESSOR-A/C - INSTALLATION).



11. Connect the engine wire harness connector to the A/C compressor clutch coil.
12. Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/BELTS-DRIVE - INSTALLATION).
13. Reconnect the negative battery cable.

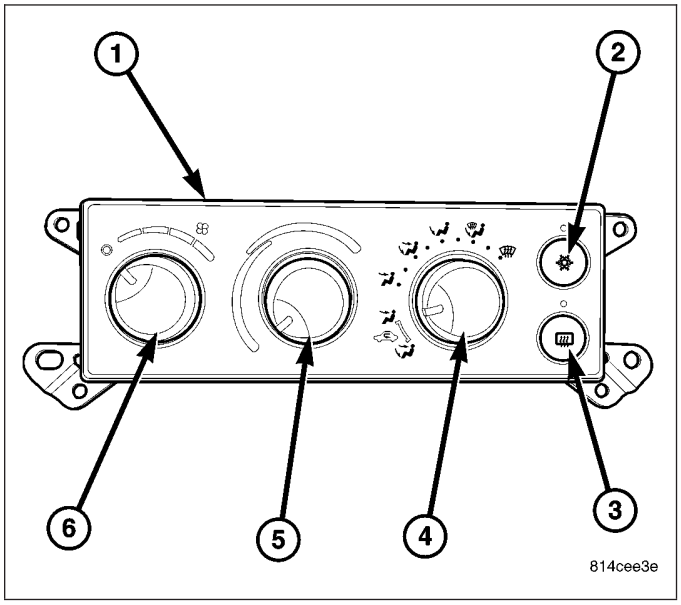
CONTROL-A/C HEATER

DESCRIPTION

The A/C-heater control (1) for the manual temperature control (MTC) single zone heating-A/C system allows one temperature setting for the entire vehicle. All controls are identified by ISO graphic symbols.

The A/C-heater control and integral computer is located in the instrument panel and contains:

- a push button A/C on/off control (2). The Snowflake button contains an LED that illuminates when the A/C system is in operation.
- a push button rear window defogger on/off control (3). The defogger button contains an LED that illuminates when the rear window defogger (EBL) system is in operation.
- a rotary control knob for recirculation and mode control of the discharged air (4).
- a rotary control knob for temperature control of the discharged air (5).
- a rotary control knob for fan speed selection and turning the heating-A/C system off (6).



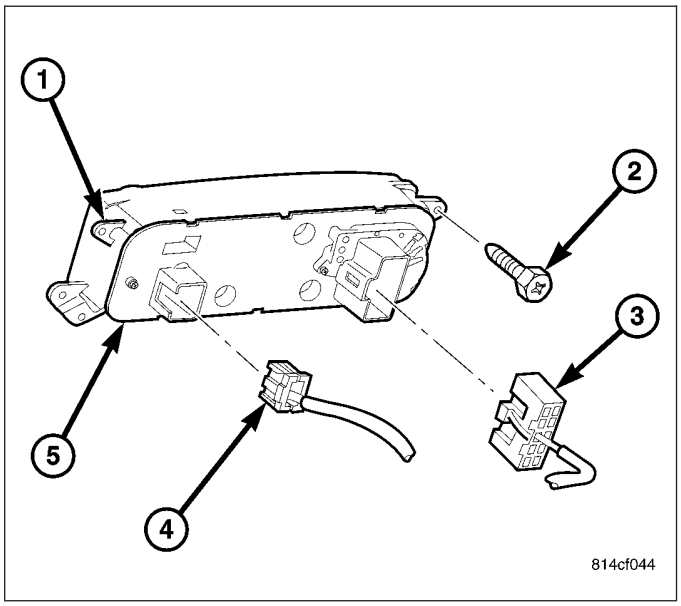
The A/C-heater control cannot be repaired and, if faulty or damaged, it must be replaced. The illumination lamps for the A/C-heater control are available for service replacement.

Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING and to 24 - HVAC Electrical Diagnostics for more information.

REMOVAL

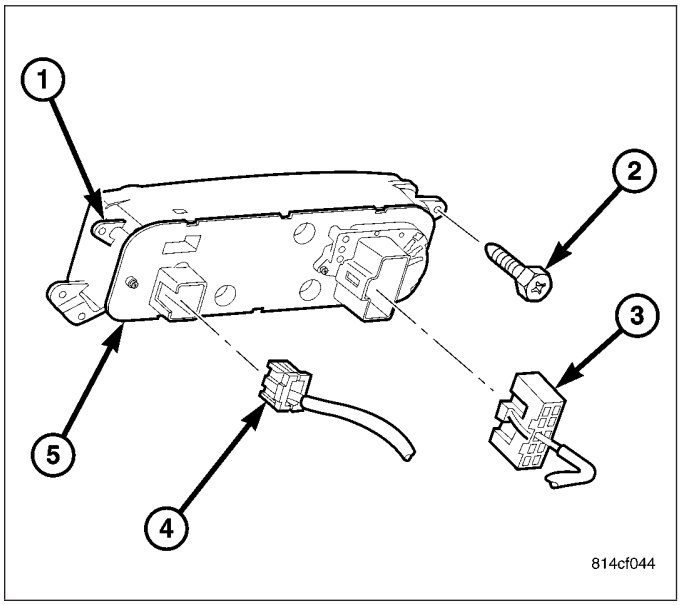
WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in an accidental airbag deployment and possible personal injury or death.

1. Disconnect and isolate the negative battery cable.
2. Remove the center bezel from the instrument panel and disconnect the wire harness connectors (3 and 4) from the A/C-heater control (1) (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL).
3. Place the center bezel on a workbench and remove the screws (2) that secure the A/C-heater control to the center bezel.
4. Remove the A/C-heater control from the center bezel.



INSTALLATION

1. Position the A/C-heater control (1) into the instrument panel center bezel.
2. Install the screws (2) that secure the A/C-heater control to the center bezel. Tighten the screws to 2 N·m (17 in. lbs.).
3. Connect the wire harness connectors (3 and 4) to the back of the A/C-heater control (5) and install the instrument panel center bezel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).
4. Reconnect the negative battery cable.

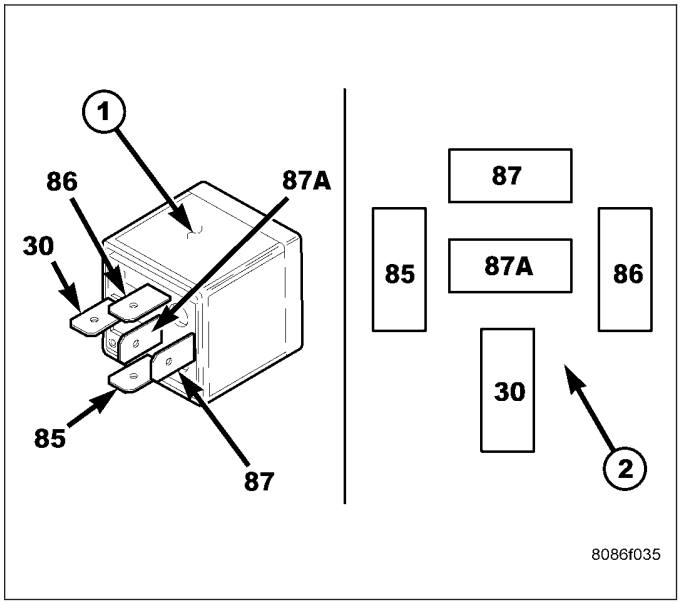


RELAY-A/C CLUTCH

DESCRIPTION

The A/C clutch relay (1) is a International Standards Organization (ISO)-type relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal functions and patterns (2).

The A/C clutch relay is located in the integrated power module (IPM) in the engine compartment.



OPERATION

The ISO-standard A/C clutch relay is an electromechanical switch that uses a low current input controlled by the powertrain control module (PCM) to control the high current output to the A/C clutch field coil. The movable, common feed relay contact is held against the fixed, normally closed relay contact by spring pressure. When the electromagnetic relay coil is energized, it draws the movable common feed relay contact away from the fixed, normally closed relay contact and, holds it against the fixed, normally open relay contact. This action allows high current to flow to the A/C clutch field coil.

When the relay coil is de-energized, spring pressure returns the movable relay contact back against the fixed, normally closed contact point. The resistor or diode is connected in parallel with the relay coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

The A/C clutch relay terminals are connected to the vehicle electrical system through a receptacle in the integrated power module (IPM). The inputs and outputs of the A/C clutch relay include:

- The common feed terminal (30) receives fused battery current through a B(+) circuit at all times.
- The coil ground terminal (85) receives a ground input from the PCM through the A/C clutch relay control circuit only when the PCM electronically pulls the control circuit to ground.
- The coil battery terminal (86) receives fused battery current an ignition switch output (Run) circuit only when the ignition switch is in the On position.
- The normally open terminal (87) provides a battery current output to the A/C clutch coil through the A/C clutch relay output circuit only when the compressor clutch relay coil is energized.
- The normally closed terminal (87A) is not connected to any circuit in this application, but provides a battery current output only when the A/C clutch relay coil is de-energized.

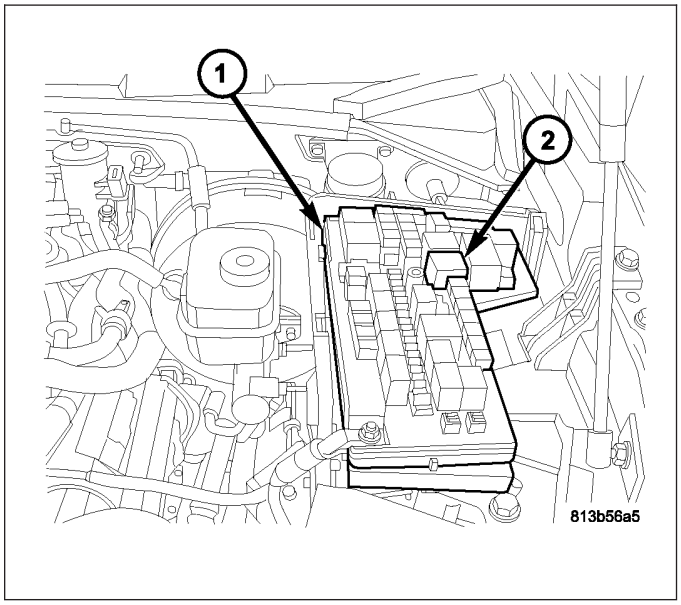
The A/C clutch relay cannot be repaired and, if faulty or damaged, it must be replaced. Refer to the appropriate wiring information for diagnosis and testing of the ISO-standard relay and for complete HVAC wiring diagrams.

REMOVAL

1. Disconnect and isolate the negative battery cable.
2. Open the cover of the integrated power module (IPM) (1) located in the engine compartment.

NOTE: Refer to the fuse and relay layout map on the IPM cover for A/C clutch relay identification and location.

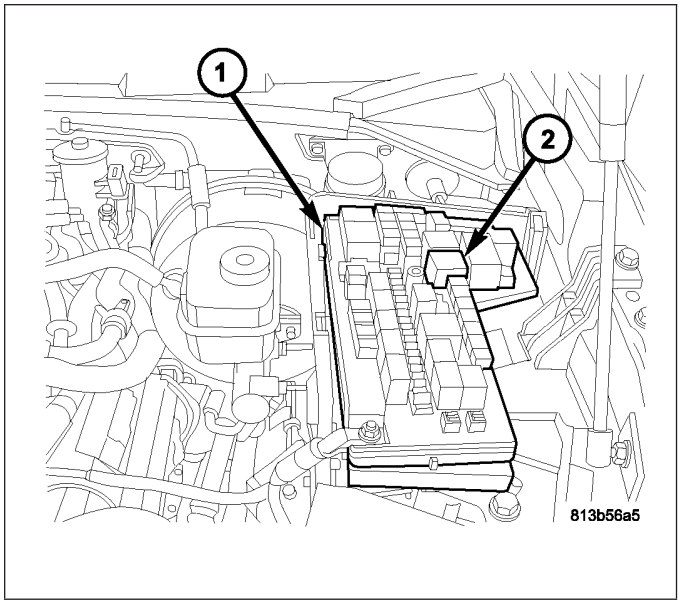
3. Remove the A/C clutch relay (2) from the IPM.



INSTALLATION

NOTE: Refer to the fuse and relay layout map on the integrated power module (IPM) cover for A/C clutch relay identification and location.

1. Position the A/C clutch relay (2) into the proper receptacle of the IPM (1).
2. Align the A/C clutch relay terminals with the terminal cavities in the IPM receptacle and push down firmly on the relay until the terminals are fully seated.
3. Close the cover of the IPM.
4. Reconnect the negative battery cable.

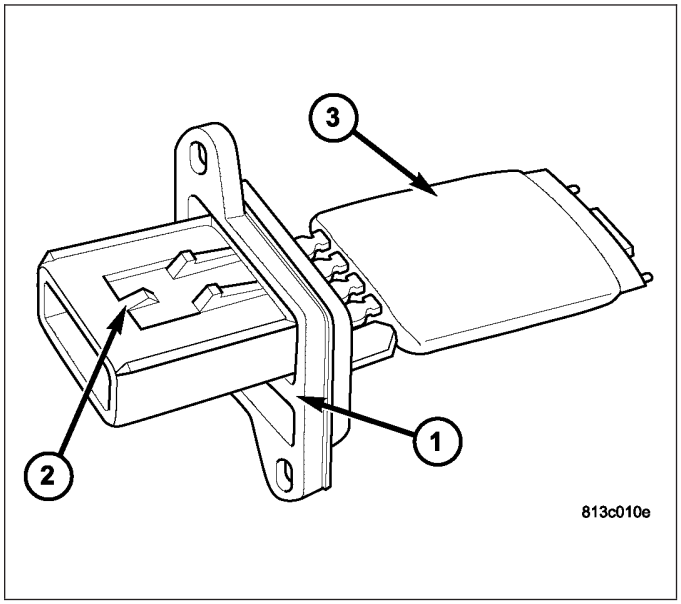


RESISTOR-BLOWER MOTOR

DESCRIPTION

The blower motor resistor is mounted to the HVAC air inlet housing, directly behind the glove box. The blower motor resistor consists of a molded plastic mounting plate (1) with an integral wire connector receptacle (2). Concealed behind the mounting plate are coiled resistor wires contained within a ceramic heat sink (3). The blower motor resistor is accessed for service by removing the glove box from the instrument panel.

The blower motor resistor is accessed for service by removing the glove box from the instrument panel.



OPERATION

The blower motor resistor is connected to the vehicle electrical system through a dedicated wire lead and connector of the HVAC wire harness. The blower motor resistor has multiple resistor wires, each of which will reduce the current flow through the blower motor to change the blower motor speed.

The blower motor control in the MTC heating-A/C system directs the ground path for the blower motor through the correct resistor wire to obtain the selected speed. With the blower motor control in the lowest speed position, the ground path for the blower motor is applied through all of the resistor wires. Each higher speed selected with the blower motor control applies the blower motor ground path through fewer of the resistor wires, increasing the blower motor speed.

The blower motor resistor cannot be adjusted or repaired and, if faulty or damaged (such as a cracked ceramic heat sink), it must be replaced.

DIAGNOSIS AND TESTING

BLOWER MOTOR RESISTOR

WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

1. Disconnect and isolate the negative battery cable.
2. Disconnect the wire harness connector from the blower motor resistor (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/RESISTOR-BLOWER MOTOR - REMOVAL).

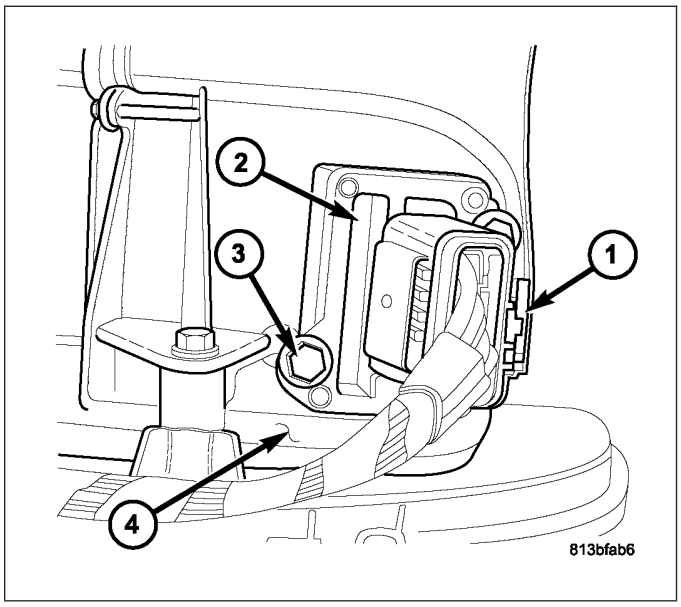
3. Using an ohmmeter, check for continuity between all of the blower motor resistor terminals. In each case there should be continuity. If OK, repair the wire harness circuits between the blower motor switch and the blower motor resistor or blower motor as required. If not OK, replace the faulty blower motor resistor.

REMOVAL

WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

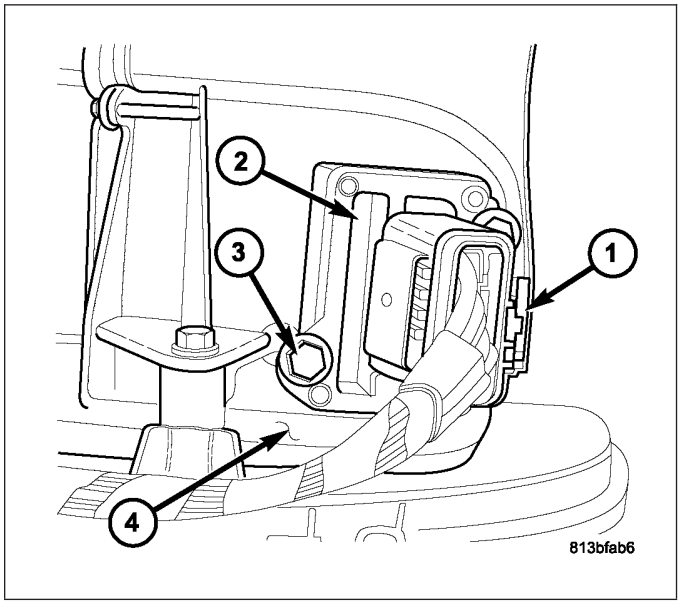
WARNING: The blower motor resistor may get very hot during normal operation. If the blower motor was turned on prior to servicing the blower motor resistor, wait five minutes to allow the resistor to cool before performing diagnosis or service. Failure to take this precaution can result in personal injury or death.

1. Disconnect and isolate the negative battery cable.
2. Remove the glove box (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).
3. Disengage the wire harness connector locking tab and disconnect the wire harness connector (1) from the blower motor resistor (2).
4. Remove the two screws (3) that secure the blower motor resistor to the HVAC housing (4).
5. Remove the blower motor resistor from the HVAC housing.



INSTALLATION

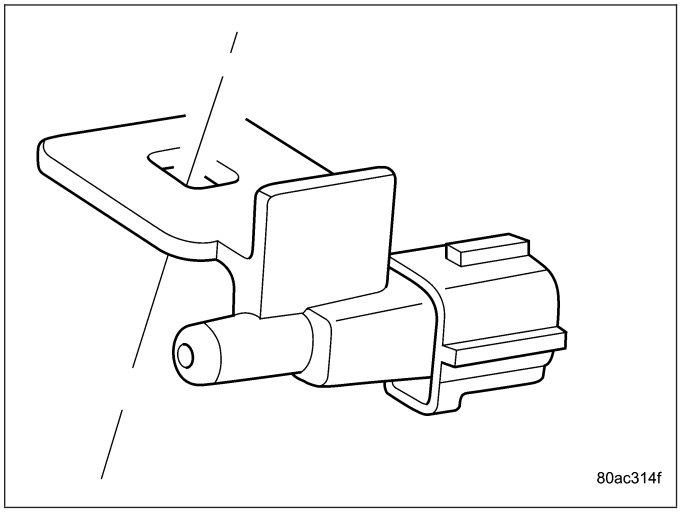
1. Position the blower motor resistor (2) into the HVAC housing (4).
2. Install the two screws (3) that secure the blower motor resistor to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).
3. Connect the wire harness connector (1) to the blower motor resistor and engage the wire harness connector locking tab.
4. Install the glove box (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).
5. Reconnect the negative battery cable.



SENSOR-AMBIENT AIR TEMPERATURE

DESCRIPTION

The ambient air temperature sensor is a variable resistor that monitors the air temperature outside of the vehicle. The ambient air temperature sensor is mounted onto the inside of the front bumper beam and its data is used by the heating-A/C system to maintain optimum cabin temperature levels.



OPERATION

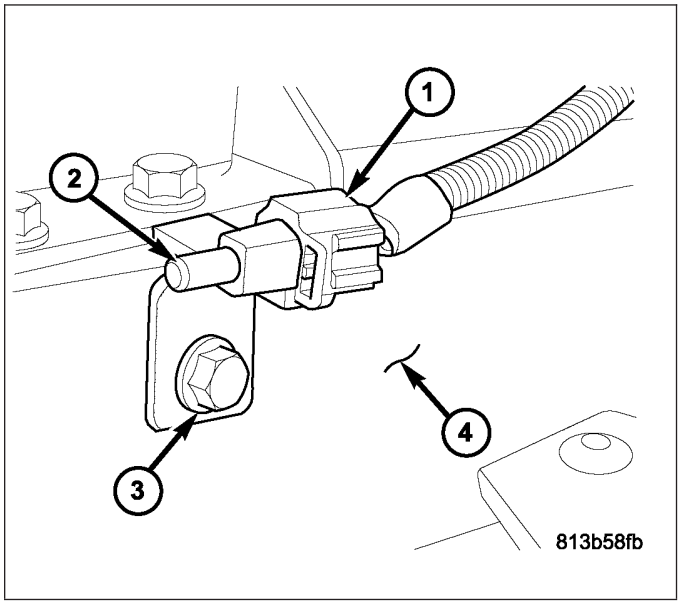
The ambient air temperature sensor is a variable resistor that operates on a ground circuit and a 5-volt reference signal circuit sent by the front control module (FCM) through a two-wire lead and connector of the vehicle wire harness. The ambient air temperature sensor changes its internal resistance in response to changes in the outside air temperature, which either increases or decreases the reference signal voltage read by the FCM. The FCM converts and broadcasts the sensor data over the controller area network (CAN) B bus, where it is read by the A/C-heater control and other various vehicle control modules.

The ambient air temperature sensor is diagnosed using the scan tool. Refer to 9 - Engine Electrical Diagnostics for more information.

The ambient air temperature sensor cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

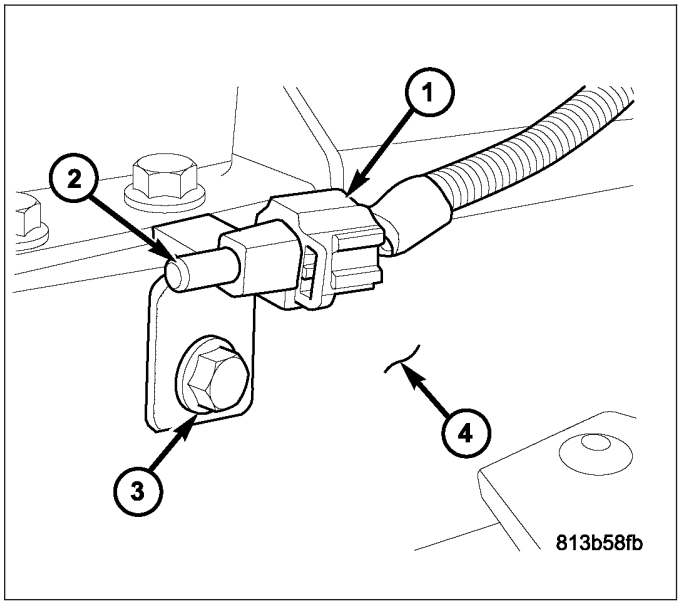
REMOVAL

1. Disconnect and isolate the negative battery cable.
2. Disconnect the wire harness connector (1) from the ambient air temperature sensor (2).
3. Remove the bolt (3) that secures the ambient air temperature sensor to the front bumper beam (4) and remove the sensor.



INSTALLATION

1. Position the ambient air temperature sensor (2) to the front bumper beam (4).
2. Install the bolt (3) that secures the ambient air temperature sensor to the front bumper beam. Tighten the bolt securely.
3. Connect the wire harness connector (1) to the ambient air temperature sensor.
4. Reconnect the negative battery cable.



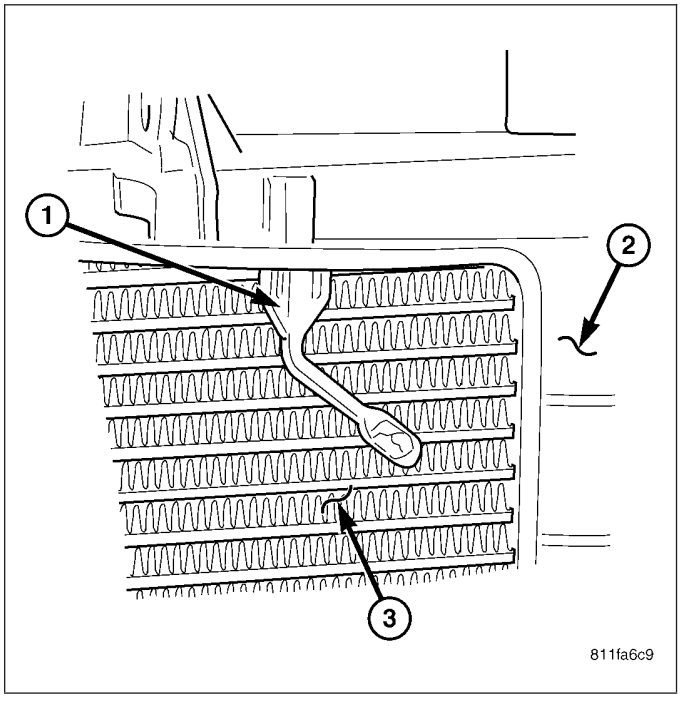
SENSOR-EVAPORATOR TEMPERATURE

DESCRIPTION

The evaporator temperature sensor (1) is an electrical thermistor located within a molded plastic case that is inserted into the HVAC housing (2) to measure the temperature of the conditioned air downstream of the A/C evaporator (3). Two terminals within the connector receptacle connect the sensor to the vehicle electrical system through a wire lead and connector of the HVAC wire harness.

NOTE: Cutaway of typical HVAC housing shown for clarity in illustration.

The external location of the evaporator temperature sensor allows the sensor to be removed or installed without disturbing the refrigerant in the A/C system.



OPERATION

The evaporator temperature sensor monitors the surface temperature of A/C evaporator and supplies an input signal to the A/C-heater control. The A/C-heater control uses the evaporator temperature sensor input signal to optimize A/C system performance and to protect the A/C system from evaporator freezing. The evaporator temperature sensor will change its internal resistance in response to the temperatures it monitors and is connected to the A/C-heater control through sensor ground circuit and a 5-volt reference signal circuit. As the temperature of the A/C evaporator decreases, the internal resistance of the evaporator temperature sensor decreases.

The A/C-heater control uses the resistance reading as an indication that conditions are correct to broadcast an A/C request message on the controller area network (CAN) B bus, where it is read by the front control module (FCM). The FCM then requests the powertrain control module (PCM) to cycle the A/C compressor clutch as necessary over the CAN C bus.

The evaporator temperature sensor is diagnosed using a scan tool. Refer to 24 - HVAC Electrical Diagnostics for more information.

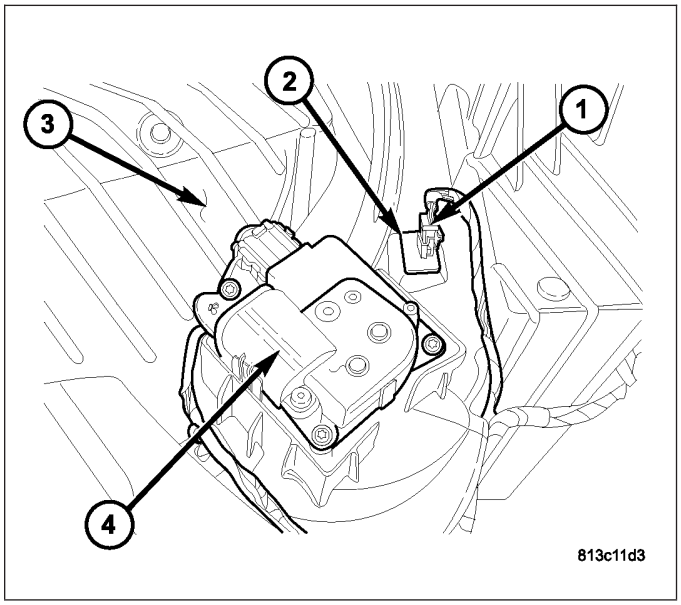
The evaporator temperature sensor cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

REMOVAL

WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

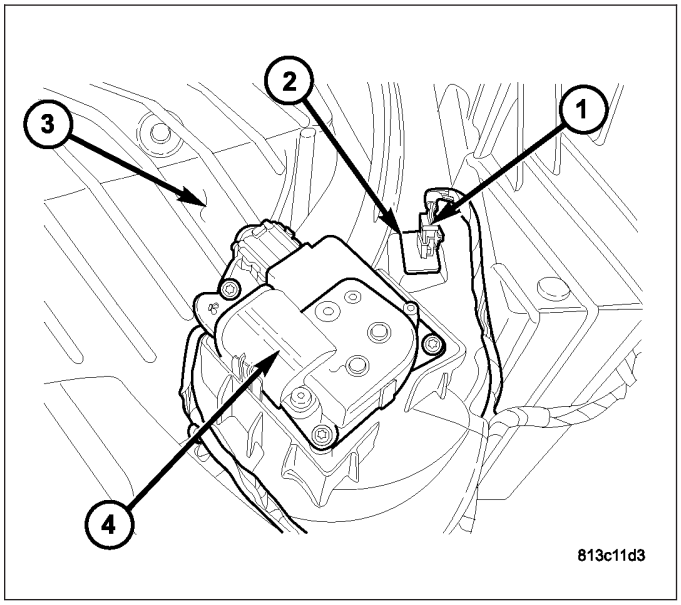
NOTE: Take the proper precautions to protect the front face of the instrument panel from cosmetic damage during this service procedure.

1. Disconnect and isolate the negative battery cable.
2. Remove the instrument panel assembly (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).
3. Disconnect the HVAC wire harness connector (1) from the evaporator temperature sensor (2) located on the top of the HVAC housing (3) near the blend door actuator (4).
4. Remove the evaporator temperature sensor from the HVAC housing.



INSTALLATION

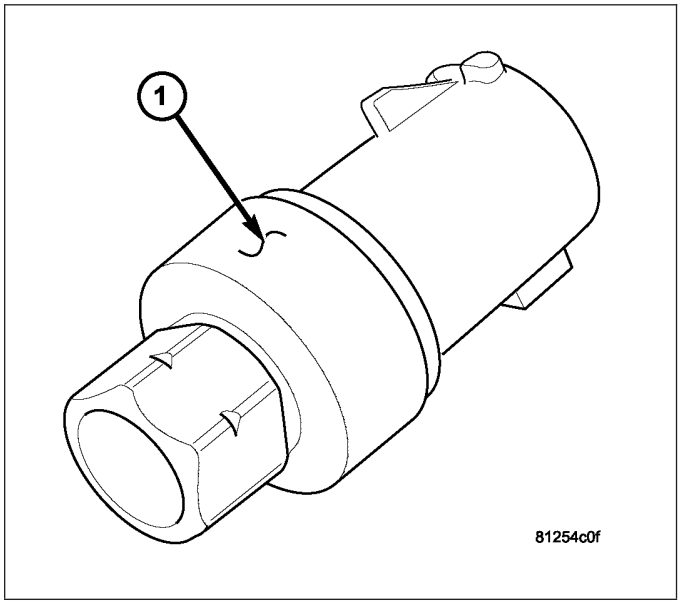
1. Install the evaporator temperature sensor (2) into the opening in the HVAC housing (3) near the blend door actuator (4).
2. Connect the HVAC wire harness connector (1) to the evaporator temperature sensor.
3. Install the instrument panel assembly (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).
4. Reconnect the negative battery cable.



TRANSDUCER-A/C PRESSURE

DESCRIPTION

The A/C pressure transducer (1) is a switch that is installed on a fitting located on the A/C liquid line. An internally threaded fitting on the A/C pressure transducer connects it to the externally threaded Schrader-type fitting on the A/C liquid line. A rubber O-ring seals the connection between the A/C pressure transducer and the liquid line fitting. The A/C pressure transducer is connected to the vehicle electrical system by a molded plastic connector with three terminals.



OPERATION

The A/C pressure transducer monitors the pressures in the high side of the refrigerant system through its connection to a fitting on the A/C liquid line. The A/C pressure transducer will change its internal resistance in response to the pressures it monitors. A Schrader-type valve in the liquid line fitting permits the A/C pressure transducer to be removed or installed without disturbing the refrigerant in the A/C system.

The front control module (FCM) provides a five volt reference signal to the A/C pressure transducer, then monitors the output voltage of the A/C pressure transducer on a sensor return circuit to determine refrigerant pressure. The FCM broadcasts a refrigerant pressure message to the PCM, which is programmed to respond to the A/C pressure transducer and other sensor inputs by controlling the operation of the A/C compressor clutch to help optimize A/C system performance and to protect the system components from damage. The PCM will disengage the A/C com-

pressor clutch when high side pressure rises above 3172 kPa (460 psi) and re-engage the clutch when high side pressure drops below 1999 kPa (290 psi). The A/C pressure transducer will also disengage the A/C compressor clutch if the high side pressure drops below 193 kPa (28 psi) and will re-engage the clutch when the high side pressure rises above 234 kPa (34 psi). The A/C pressure transducer message to the PCM will also prevent the A/C compressor clutch from engaging when ambient temperatures are below about 4.5° C (40° F) due to the pressure/ temperature relationship of the refrigerant.

The A/C pressure transducer is diagnosed using a scan tool. Refer to 9 - Engine Electrical Diagnostics for more information.

The A/C pressure transducer cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

DIAGNOSIS AND TESTING

A/C PRESSURE TRANSDUCER

The A/C pressure transducer is diagnosed using a scan tool. Refer to 9 - Engine Electrical Diagnostics for more information.. Before testing the A/C pressure transducer, be certain that the transducer wire harness connection is clean of corrosion and properly connected. For the A/C to operate, an A/C pressure transducer voltage reading between 0.451 and 4.519 volts is required. Voltages outside this range indicate a low or high refrigerant system pressure condition to the powertrain control module (PCM). The PCM is programmed to respond to a low or high refrigerant system pressure by suppressing operation of the A/C compressor. Refer to the A/C Pressure Transducer Voltage chart for the possible conditions indicated by the transducer voltage reading.

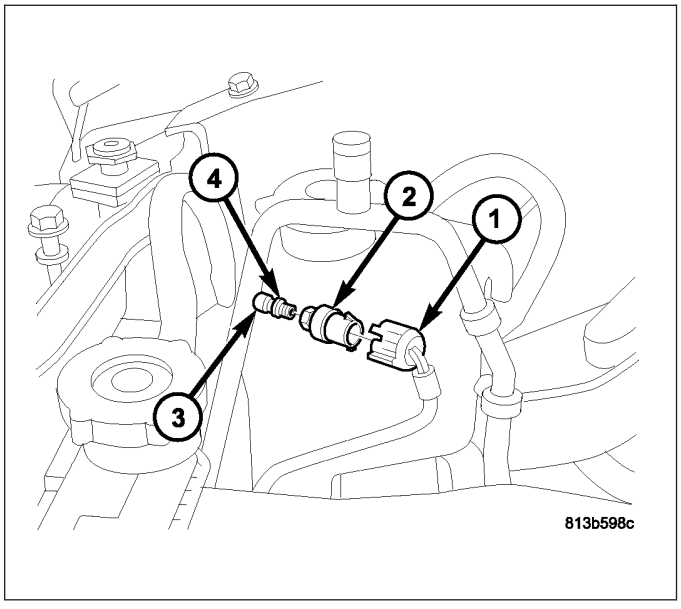
A/C PRESSURE TRANSDUCER VOLTAGE

Voltage	Possible Indication
0.0	1. No sensor supply voltage from PCM. 2. Shorted sensor circuit. 3. Faulty transducer.
0.150 TO 0.450	1. Ambient temperature below 10° C (50° F). 2. Low refrigerant system pressure.
0.451 TO 4.519	1. Normal refrigerant system pressure.
4.520 TO 4.850	1. High refrigerant system pressure.
5.0	1. Open sensor circuit. 2. Faulty transducer.

REMOVAL

NOTE: It is not necessary to discharge the refrigerant system to replace the A/C pressure transducer.

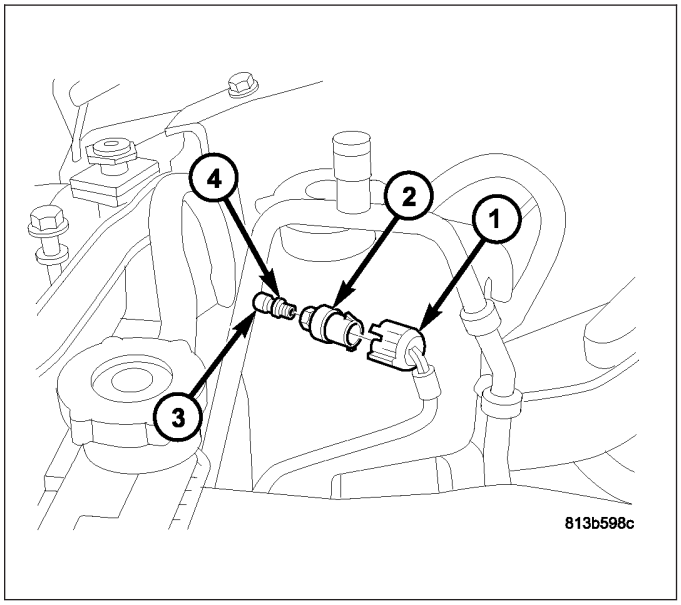
1. Disconnect and isolate the negative battery cable.
2. Disconnect the wire harness connector (1) from the A/C pressure transducer (2).
3. Remove the A/C pressure transducer from the A/C liquid line (3).
4. Remove the O-ring seal (4) from the liquid line fitting and discard.



INSTALLATION

NOTE: Use only the specified O-ring as it is made of special material for R-134a. Use only refrigerant oil of the type required for the A/C compressor.

1. Lubricate a new rubber O-ring seal (4) with clean refrigerant oil and install it onto the liquid line fitting (3).
2. Install the A/C pressure transducer (2) onto the A/C liquid line. Tighten the A/C pressure transducer securely.
3. Connect the wire harness connector (1) to the A/C pressure transducer.
4. Reconnect the negative battery cable.



DISTRIBUTION

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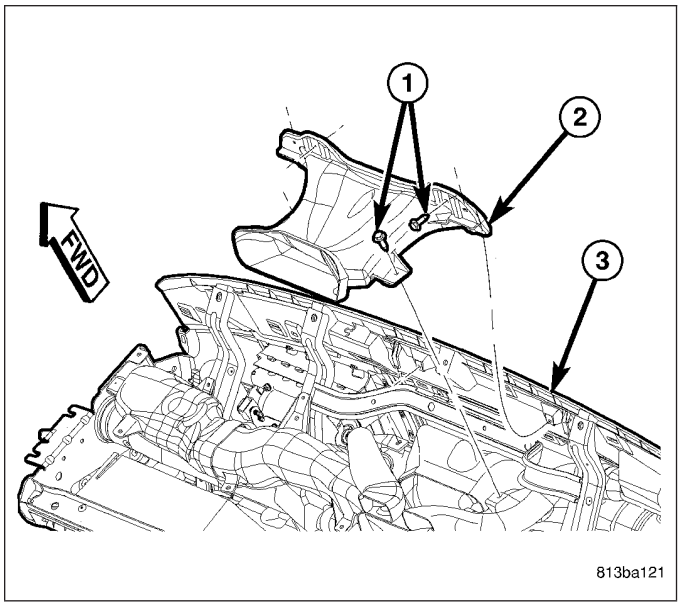
DUCT-DEFROSTER

REMOVAL

WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

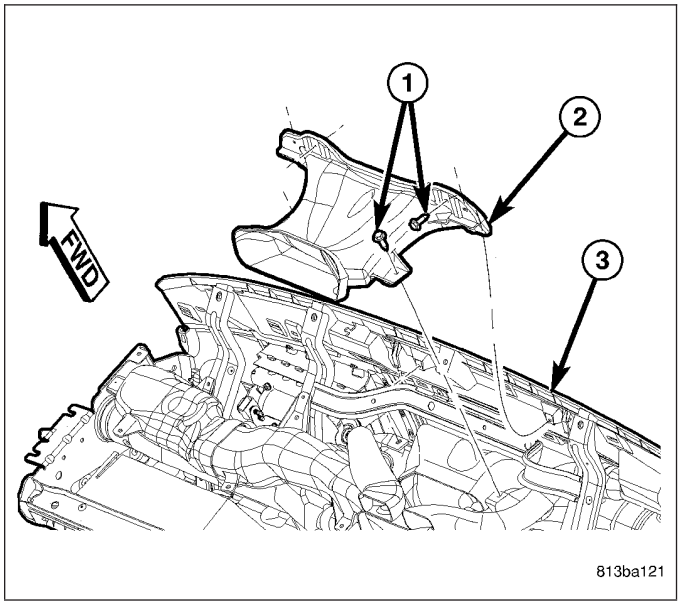
NOTE: Take the proper precautions to protect the front face of the instrument panel from cosmetic damage during this service procedure.

1. Remove the instrument panel and place it on a workbench (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).
2. Remove the screws (1) that secure the defroster duct (2) to the instrument panel (3) and remove the duct.



INSTALLATION

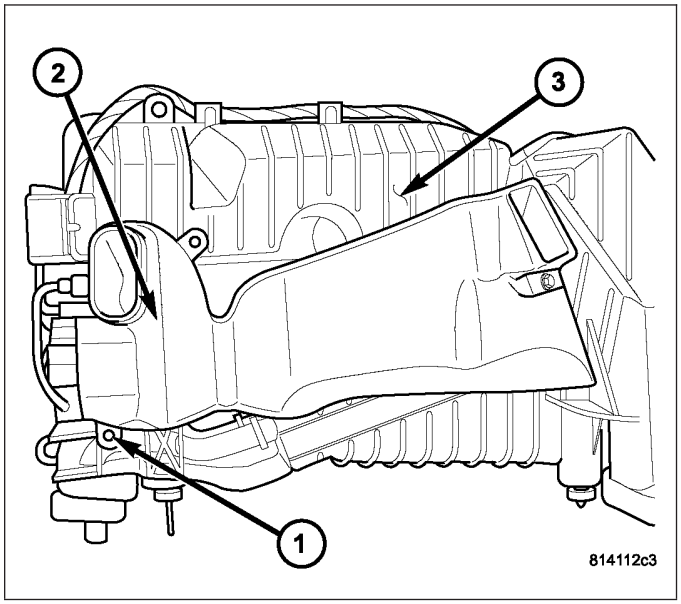
1. Position the defroster duct (2) into the instrument panel (3).
2. Install the screws (1) that secure the defroster duct to the instrument panel. Tighten the screws to 2 N·m (17 in. lbs.).
3. Install the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).



DUCT-FLOOR DISTRIBUTION

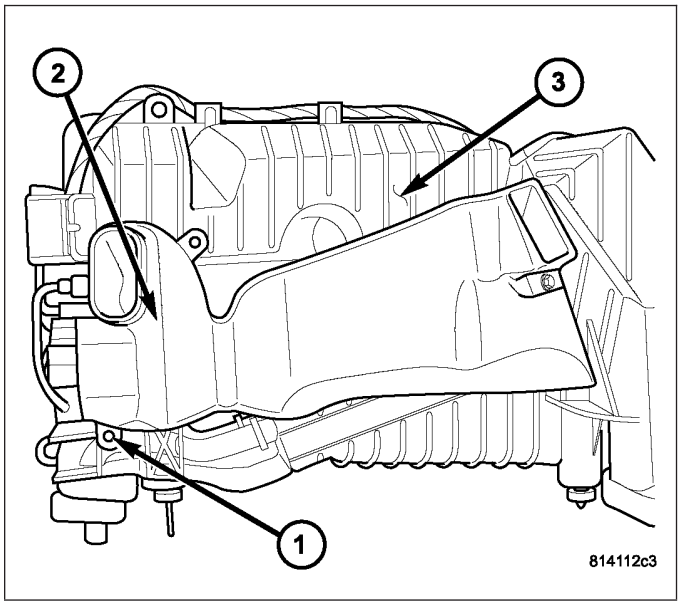
REMOVAL

1. Remove the HVAC Housing and place it on a workbench (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - REMOVAL).
2. Remove the screws (1) that secure the floor distribution duct (2) to the bottom of the HVAC housing (3).
3. Remove the floor distribution duct from the HVAC housing.



INSTALLATION

1. Position the floor distribution duct (2) onto the bottom of the HVAC housing (3).
2. Install the screws (1) that secure the floor distribution duct to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).
3. Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - INSTALLATION).

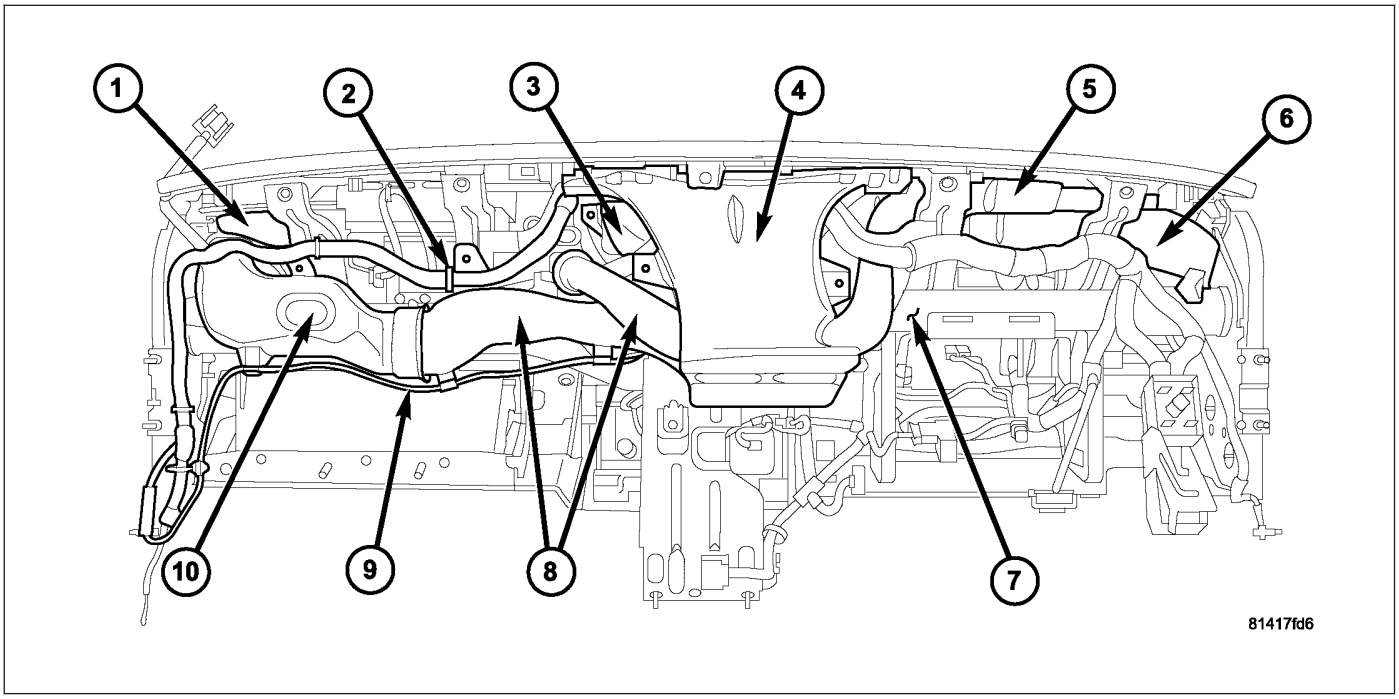


DUCT-INSTRUMENT PANEL

REMOVAL

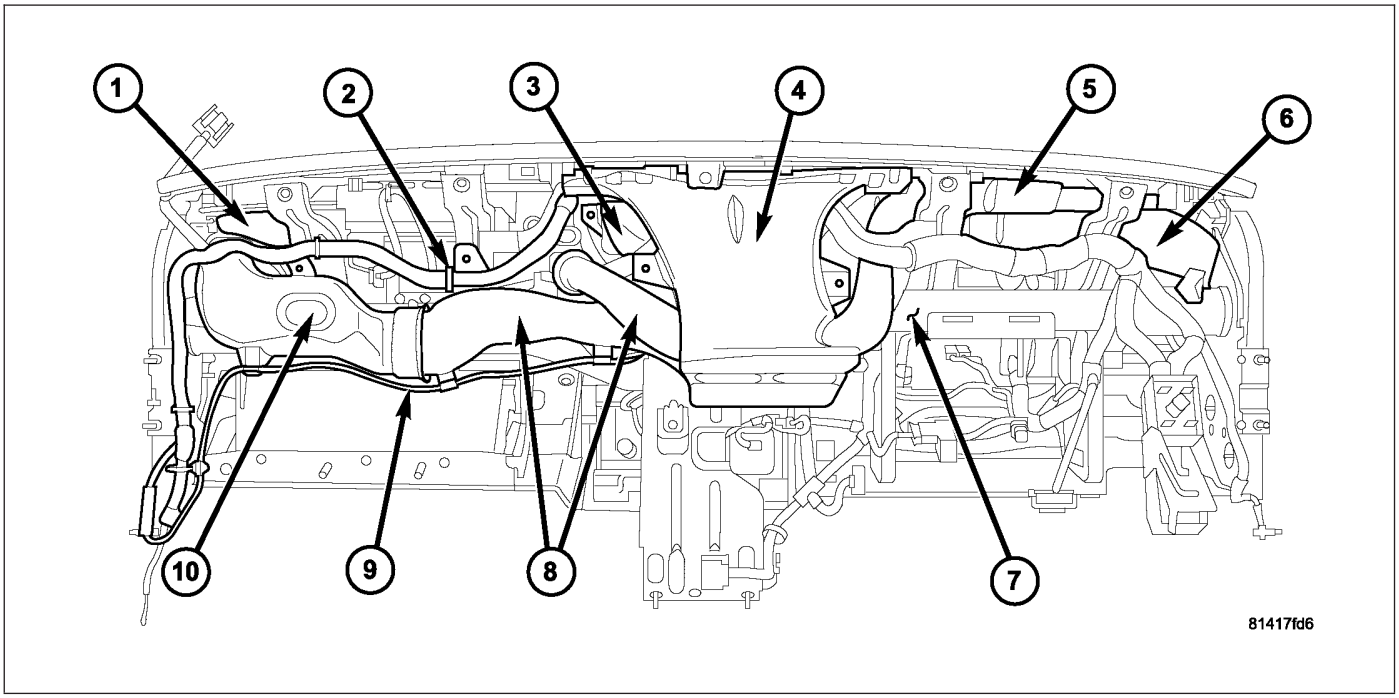
WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: Take the proper precautions to protect the front face of the instrument panel from cosmetic damage during this service procedure.



1. Remove the instrument panel and place it on a workbench (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).
2. Remove the instrument cluster (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).
3. Remove the defroster duct (4) (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCT-DEFROSTER - REMOVAL).
4. Remove the wire harness (2) from the center distribution duct (8) and position the wire harness out of the way.
5. Remove the radio coaxial cable (9) from the center distribution duct and the passenger side instrument panel duct (10) and position the coaxial cable out of the way.
6. Remove the screws that secure the passenger side instrument panel duct, center distribution duct and the center instrument panel duct (3) to the instrument panel and support assembly (7).
7. Disconnect the passenger side instrument panel duct from the center distribution duct and remove the instrument panel duct from the instrument panel.
8. Disconnect the center distribution duct from the passenger side demister duct (1).
9. Disconnect the center distribution duct from the center instrument panel duct.
10. Disconnect the center distribution duct from the driver side demister duct (5) and the driver side instrument panel duct (6) and the remove the center distribution duct from the instrument panel.
11. Remove the center instrument panel duct from the instrument panel.
12. Remove the screws that secure the driver side instrument panel duct to the instrument panel and remove the duct through the instrument cluster opening.

INSTALLATION



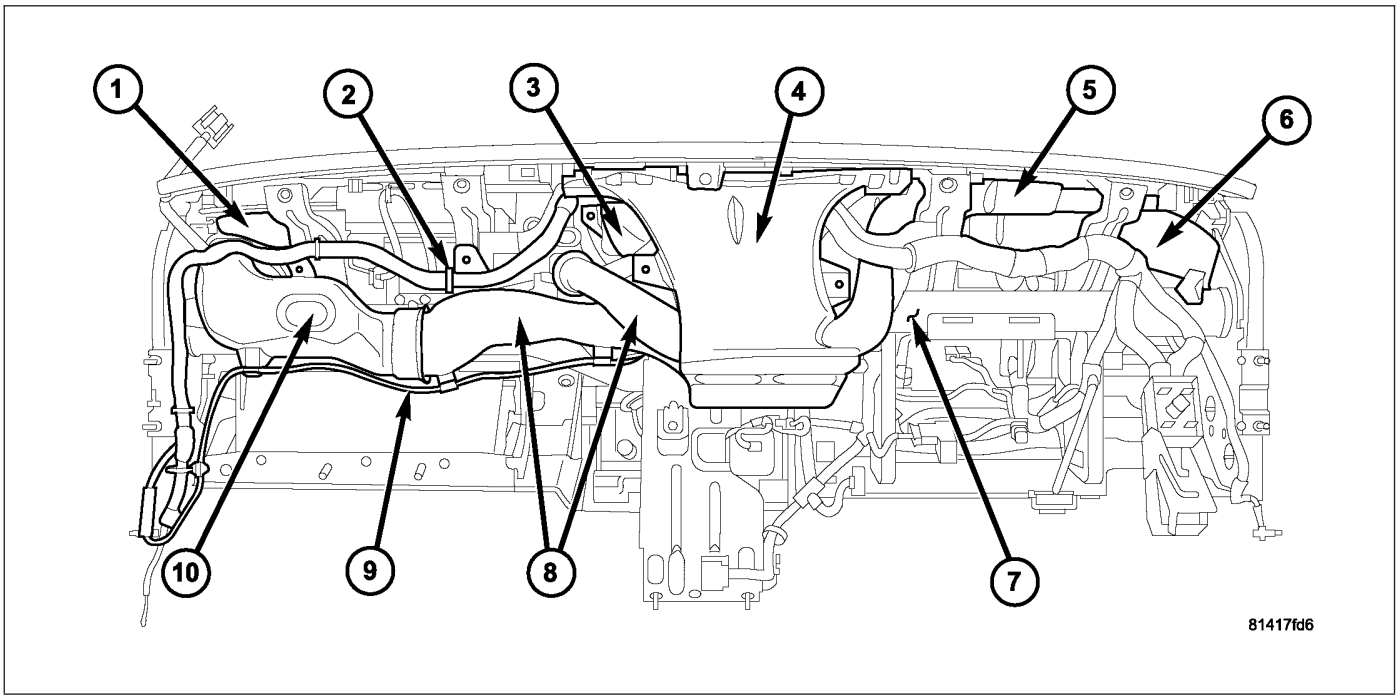
1. Position the driver side instrument panel duct (6) into the instrument panel through the instrument cluster opening.
2. Install the screws that secure the driver side instrument panel duct to the instrument panel and support assembly (7). Tighten the screws to 2 N·m (17 in. lbs.).
3. Position the center instrument panel duct (3) into the instrument panel.
4. Position the center distribution duct (8) into the instrument panel and connect it to the driver side instrument panel duct (6) and the driver side demister duct (5).
5. Connect the center distribution duct to the instrument panel duct.
6. Connect the center distribution duct to the passenger side demister duct (1).
7. Position the passenger side instrument panel duct (10) into the instrument panel and connect it to the center distribution duct.
8. Install the screws that secure the ducts to the instrument panel and support. Tighten the screws to 2 N·m (17 in. lbs.).
9. Install the wire harness (2) onto the center distribution duct.
10. Install the radio coaxial cable (9) onto the center distribution duct and the passenger side instrument panel duct.
11. Install the defroster duct (4) (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCT-DEFROSTER - INSTALLATION).
12. Install the instrument cluster (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).
13. Install the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).

DUCT-INSTRUMENT PANEL DEMISTER

REMOVAL

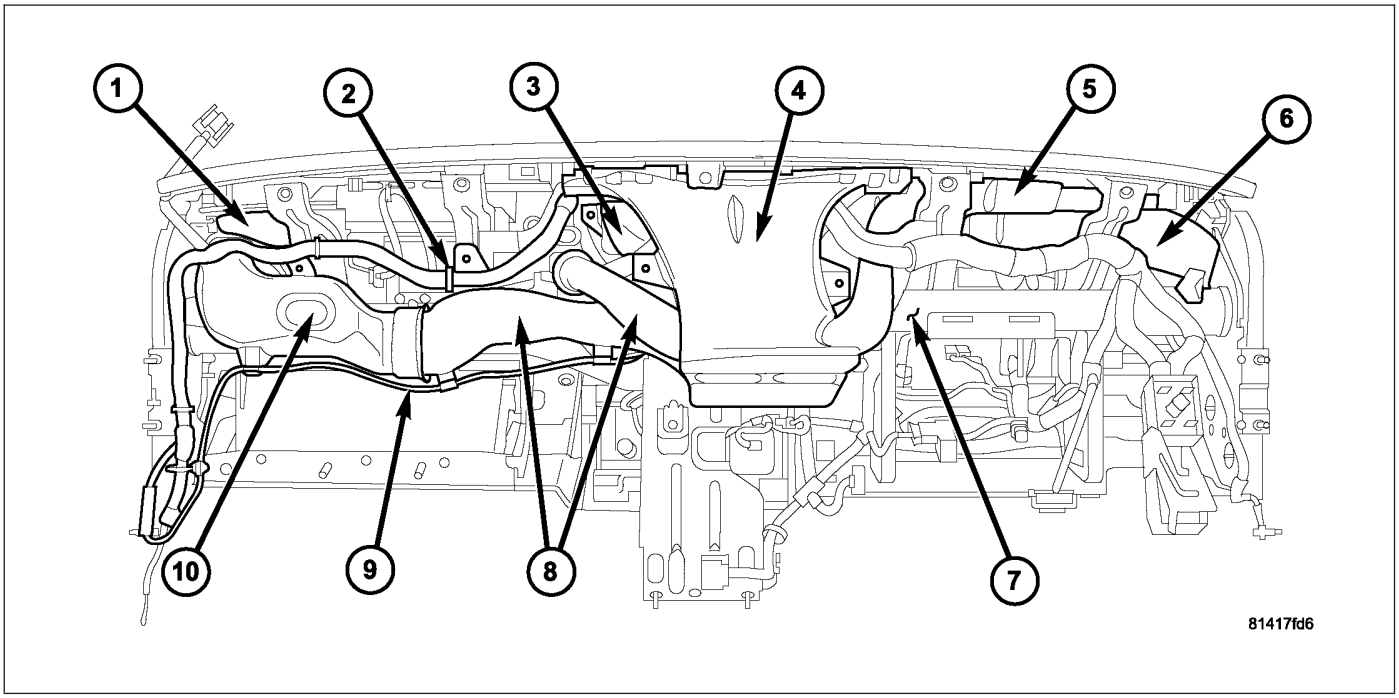
WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: Take the proper precautions to protect the front face of the instrument panel from cosmetic damage during this service procedure.



1. Remove the instrument panel and place it on a workbench (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).
2. Remove the instrument panel ducts (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-INSTRUMENT PANEL - REMOVAL).
3. Remove the screws that secure the passenger side demister duct (1) and the driver side demister duct (5) to the instrument panel and support assembly (7).
4. Remove the ducts from the instrument panel and support assembly.

INSTALLATION



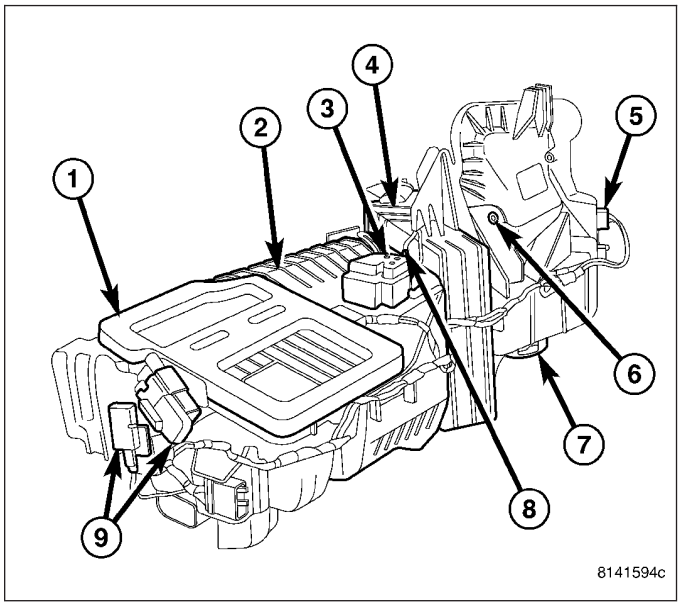
1. Position the passenger side demister duct (1) and the driver side demister duct (5) into the instrument panel and support assembly (7).
2. Install the screws that secure the demister ducts to the instrument panel and support assembly. Tighten the screws to 2 N·m (17 in. lbs.).
3. Install the instrument panel ducts (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-INSTRUMENT PANEL - INSTALLATION).
4. Install the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).

HOUSING-HVAC

DESCRIPTION

All models are equipped with a common HVAC housing assembly (1) that combines A/C and heating capabilities into a single unit mounted within the passenger compartment. The HVAC housing consists of the following:

- **HVAC housing** — The HVAC housing consists of an upper housing and a lower housing that are attached together by screws and metal retaining clips and is mounted to the dash panel behind the instrument panel. The HVAC housing contains the heater core (2), blend-air doors and actuator (3), A/C evaporator (4), blower motor (7), evaporator temperature sensor (8), mode-air doors and actuators (9), floor distribution duct, foam seals and the HVAC wire harness.
- **Air inlet housing** — The air inlet housing is mounted to the right end of the HVAC housing



and contains the blower motor resistor (5) and the recirculation-air door and actuator (6).

The heating-A/C system is a blend-air type system. The two blend-air doors control the amount of conditioned air that is allowed to flow through, or around, the heater core. This single zone heating-A/C system uses only one blend door actuator.

The A/C system is designed for the use of a non-CFC, R-134a refrigerant and uses an A/C evaporator to cool and dehumidify the incoming air prior to blending it with the heated air. A temperature control determines the discharge air temperature by operating the blend door actuator, which moves the blend-air doors. This allows an almost immediate control of the output air temperature of the system. The two mode door actuators operate the mode-air doors which direct the flow of the conditioned air out the various air outlets, depending on the mode selected. The recirculation door actuator operates the recirculation-air door which closes off the fresh air intake and recirculates the air already inside the vehicle. The electric door actuators are connected to the vehicle electrical system by the HVAC wire harness. The blower motor controls the velocity of air flowing through the HVAC housing assembly by spinning the blower wheel within the HVAC housings at the selected speed by use of the blower motor resistor.

The HVAC housing must be removed from the vehicle and disassembled for service of the heater core, A/C evaporator, blend-air and mode-air doors. The air inlet housing must be removed from HVAC housing for service of the recirculation door actuator and the recirculation-air door.

REMOVAL

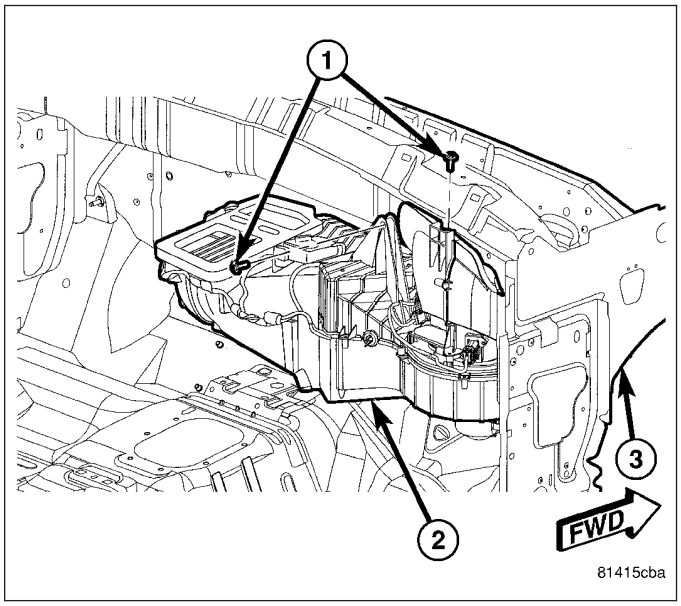
HVAC HOUSING

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.

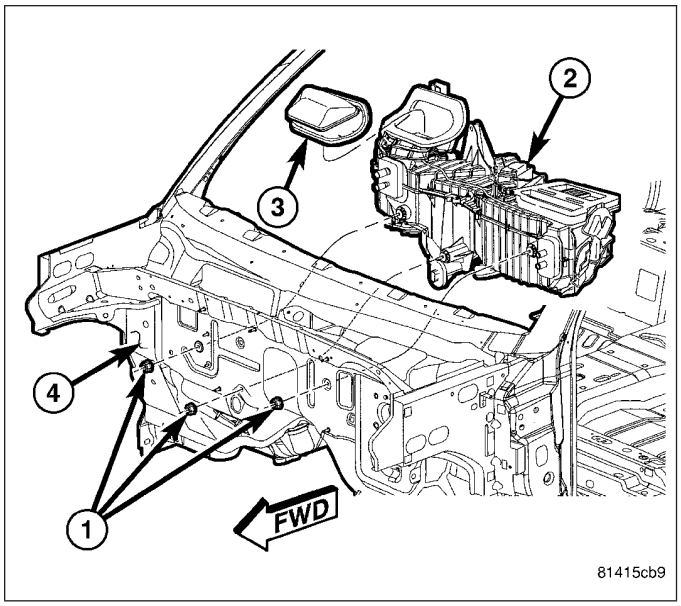
WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: The HVAC housing must be removed from the vehicle and disassembled for service of the heater core, A/C evaporator, mode-air and blend-air doors.

1. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
2. Drain the engine cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM DRAIN).
3. Disconnect and isolate the negative battery cable.
4. Remove the instrument panel from the passenger compartment (Refer to 23 - BODY/INSTRUMENT PANEL ASSEMBLY - REMOVAL).
5. Remove the two bolts (1) that secure the HVAC housing (2) to the passenger compartment side of the dash panel (3).



6. Disconnect the A/C liquid line and the A/C accumulator from the A/C evaporator and install plugs into or caps over the fittings and evaporator tubes (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LINE-A/C LIQUID - REMOVAL) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ACCUMULATOR-A/C - REMOVAL).
7. Disconnect the heater hoses from the heater core tubes and install plugs into or caps over the heater core tubes.
8. Remove the three nuts (1) that secure the HVAC housing (2) and the fresh air inlet screen (3) to the engine compartment side of the dash panel (4).
9. Pull the HVAC housing assembly rearward so that the mounting studs and condensate drain tube clear the dash panel and remove the HVAC housing from the passenger compartment.
10. If required, remove the fresh air inlet screen from the dash panel.



AIR INLET HOUSING

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.

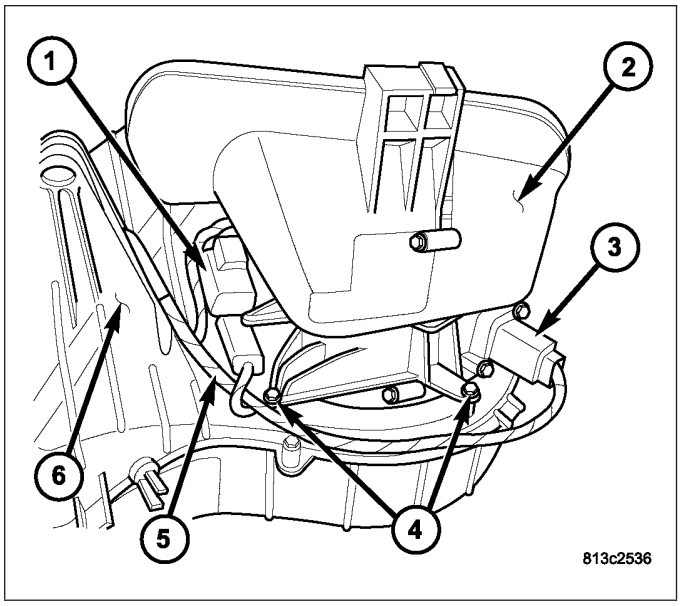
WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: The air inlet housing must be removed from HVAC housing and disassembled for service of the recirculation-air door.

1. Disconnect and isolate the negative battery cable.
2. Remove the HVAC housing (6) and place it on a workbench (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - REMOVAL).
3. Disconnect the HVAC wire harness (5) from the recirculation door actuator (1) and the blower motor resistor (3).
4. Remove the four screws (4) that secure the air inlet housing to the top of the HVAC housing and remove the air inlet housing.

NOTE: If the foam seal on the air inlet housing is deformed or damaged, it must be replaced.

5. If required, disassemble the air inlet housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR INLET - DISASSEMBLY).

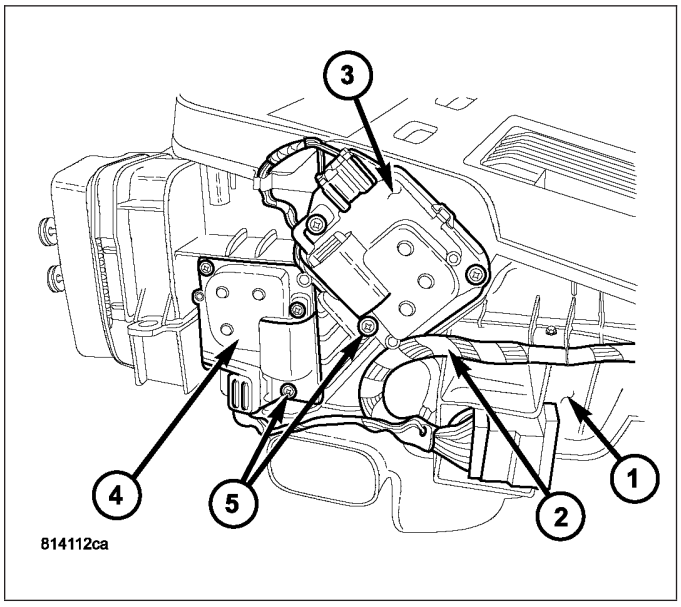


DISASSEMBLY

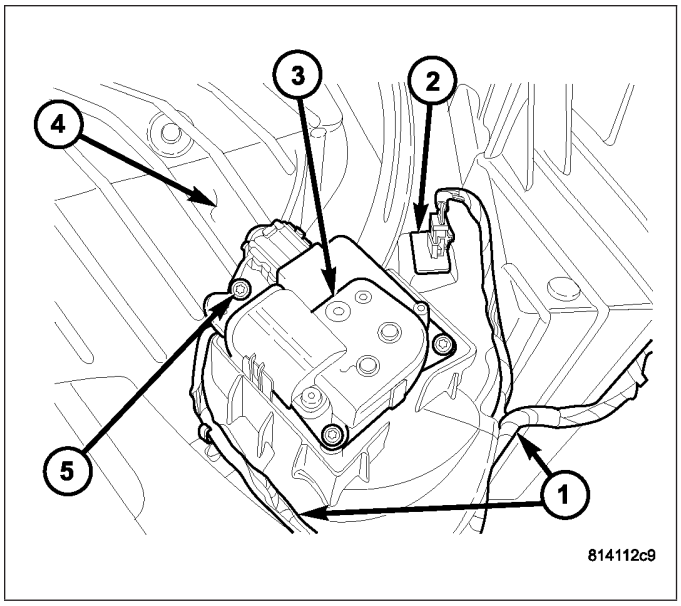
HVAC HOUSING

NOTE: The HVAC housing must be removed from the vehicle and disassembled for service of the heater core, A/C evaporator, mode-air and blend-air doors.

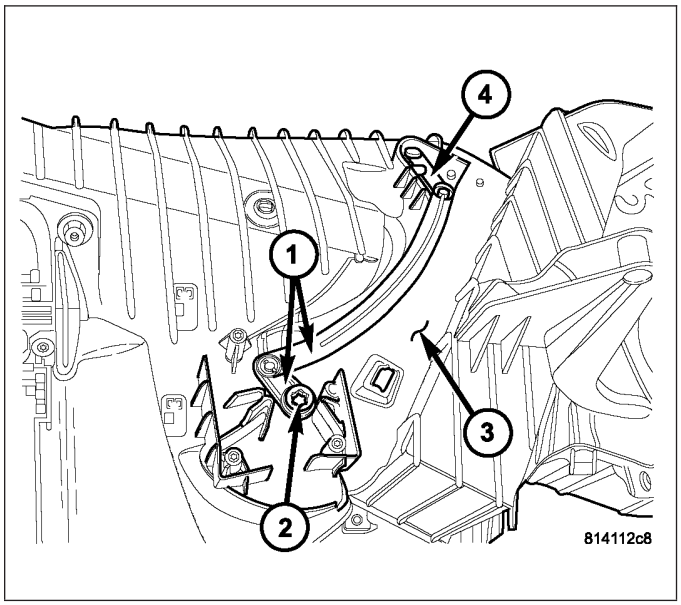
1. Remove the HVAC housing (1) and place it on a workbench (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION /HOUSING-HVAC - REMOVAL).
2. Disconnect the HVAC wire harness (2) from the mode door actuators (3 and 4) located on the driver side end of the HVAC housing.
3. Remove the screws (5) that secure the mode door actuators to the HVAC housing and remove the actuators.



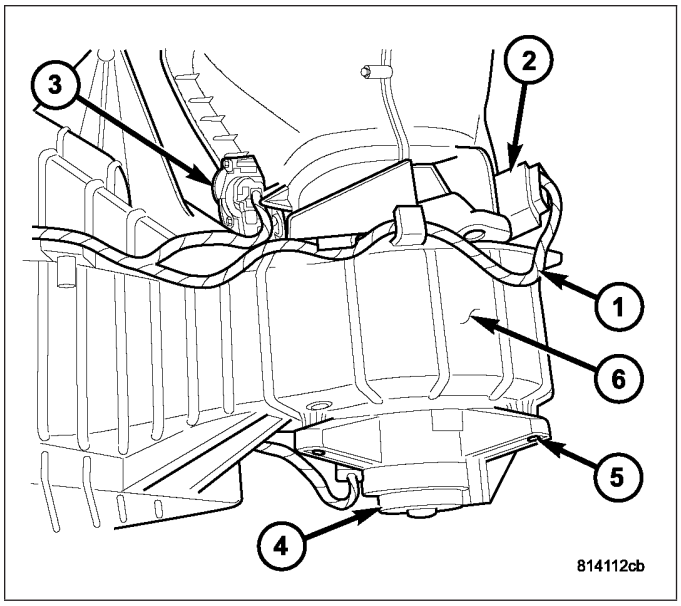
4. Disconnect the HVAC wire harness (1) from the evaporator temperature sensor (2) and the blend door actuator (3) located on the top of the HVAC housing (4).
5. Remove the screws (5) that secure the blend door actuator to the HVAC housing and remove the actuator.
6. Remove the evaporator temperature sensor from the HVAC housing.



7. Remove the lever and linkage rod (1) from the blend door pivot shaft (2) located on the top of the HVAC housing (3).
8. Carefully disconnect the lever and linkage rod from the blend door pivot lever (4).



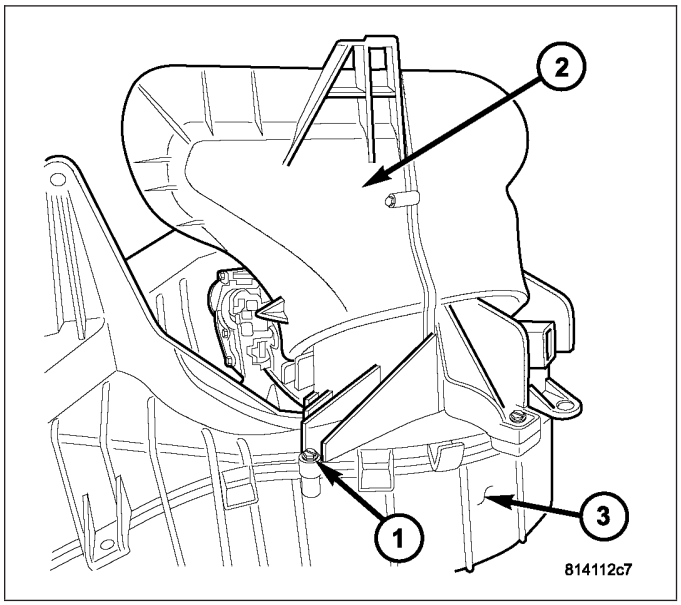
9. Disconnect the HVAC wire harness (1) from the blower motor resistor (2), recirculation door actuator (3), and the blower motor (4).
10. Remove the three screws (5) that secure the blower motor to the HVAC housing (6) and remove the blower motor.
11. Remove the HVAC wiring harness from the HVAC housing.



12. Remove the four screws (1) that secure the air inlet housing (2) to the top of the HVAC housing (3) and remove the air inlet housing.

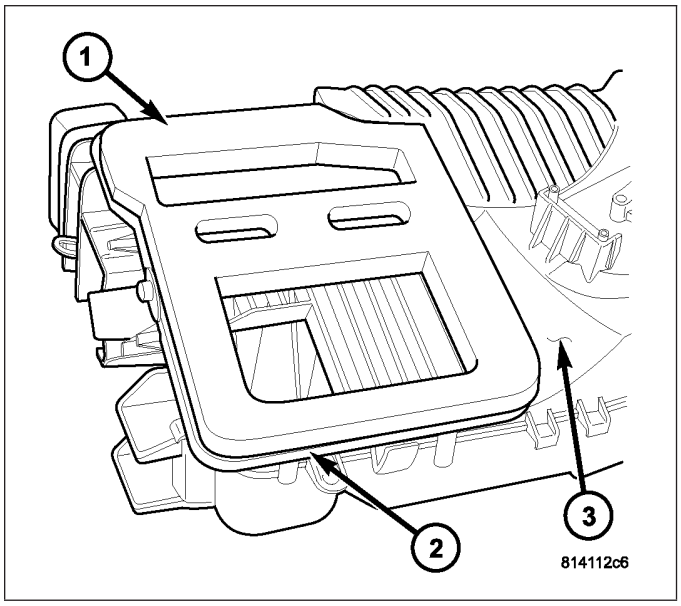
NOTE: If the foam seal on the air inlet housing is deformed or damaged, it must be replaced.

13. If required, disassemble the air inlet housing (Refer to 24 - HEATING & AIR CONDITIONING/ DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR INLET - DISASSEMBLY).

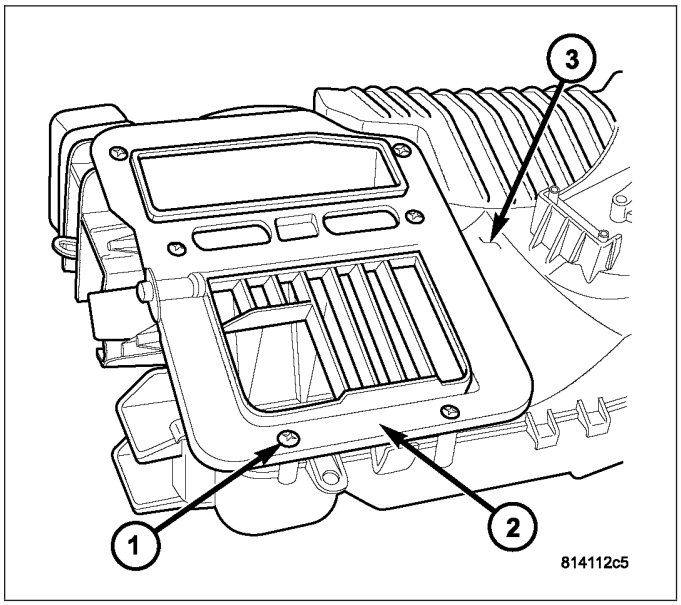


NOTE: If the foam seal on the panel/defrost outlet is deformed or damaged, it must be replaced.

14. Remove the foam seal (1) from the panel/defrost outlet (2) located on the top of the HVAC housing (3).

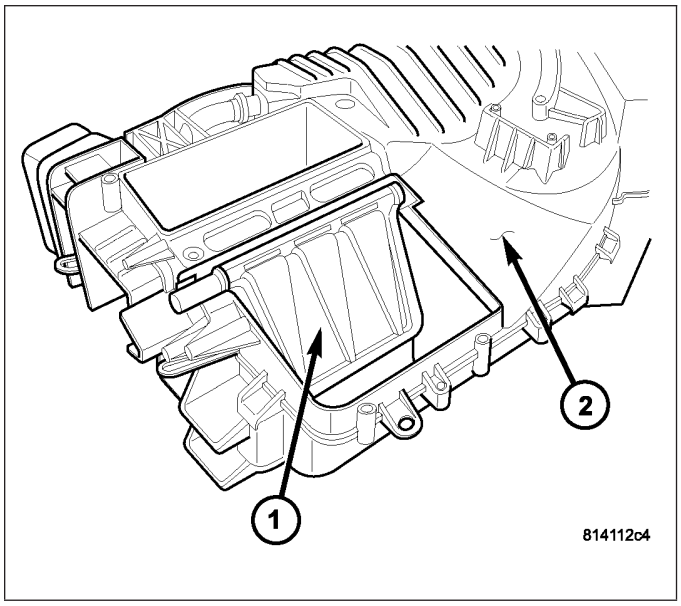


15. Remove the six screws (1) that secure the panel/ defrost outlet (2) to the top of the HVAC housing (3) and remove the outlet.

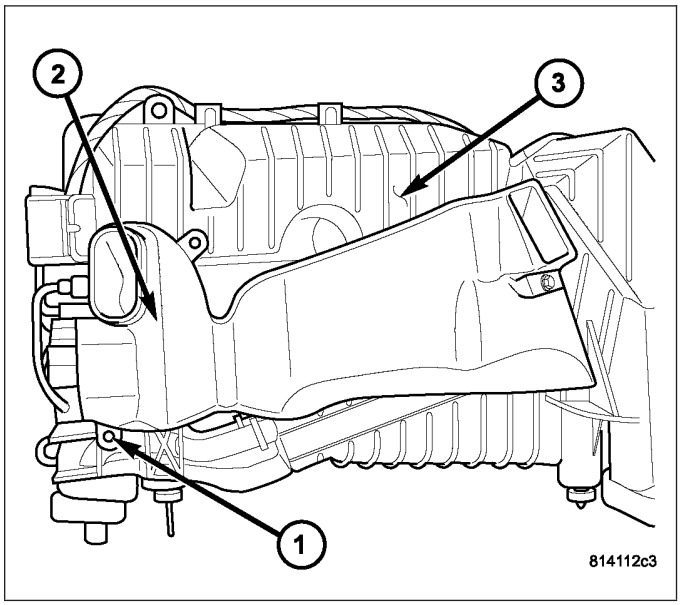


NOTE: If the seal on the air door is deformed or damaged, the air door must be replaced.

16. Remove the panel-air door (1) from the opening located at the top of the HVAC housing (2).

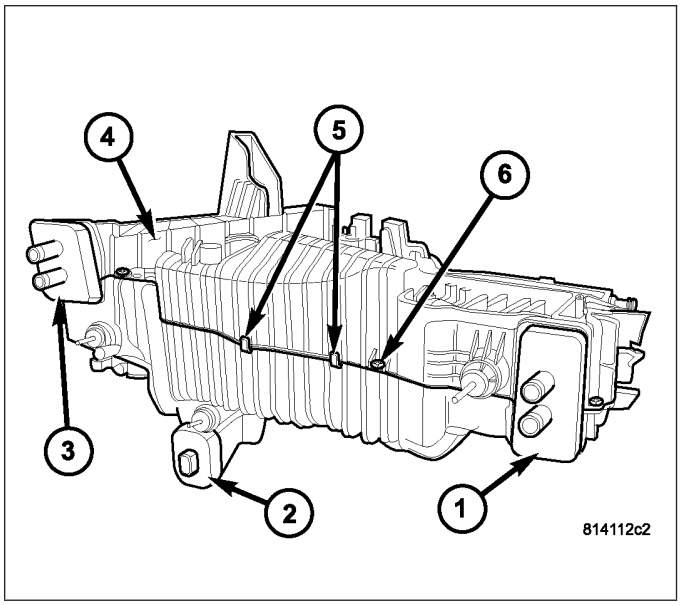


17. Remove the three screws (1) that secure the floor distribution duct (2) to the bottom of the HVAC housing (3) and remove the duct.



NOTE: If any of the foam seals are deformed or damaged, the seal(s) must be replaced.

18. Remove the three foam seals (1 , 2 and 3) from the HVAC housing (4).
19. Remove the two metal clips (5) eleven screws (6) that secure the upper and lower HVAC housing halves together and separate the housing halves.

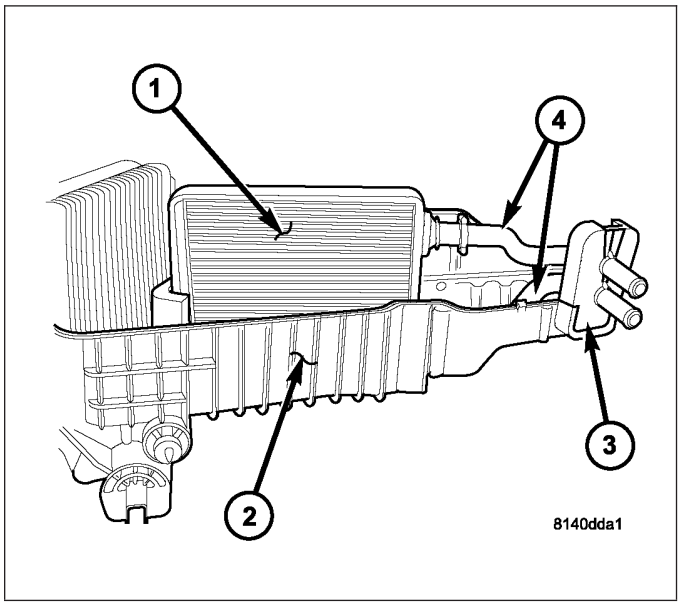


NOTE: If the foam seal around the heater core is deformed or damaged, the seal must be replaced.

20. Carefully lift the heater core (1) out of the lower half of the HVAC housing (2).

NOTE: If the rubber flange around the heater core tubes is deformed or damaged, the flange must be replaced.

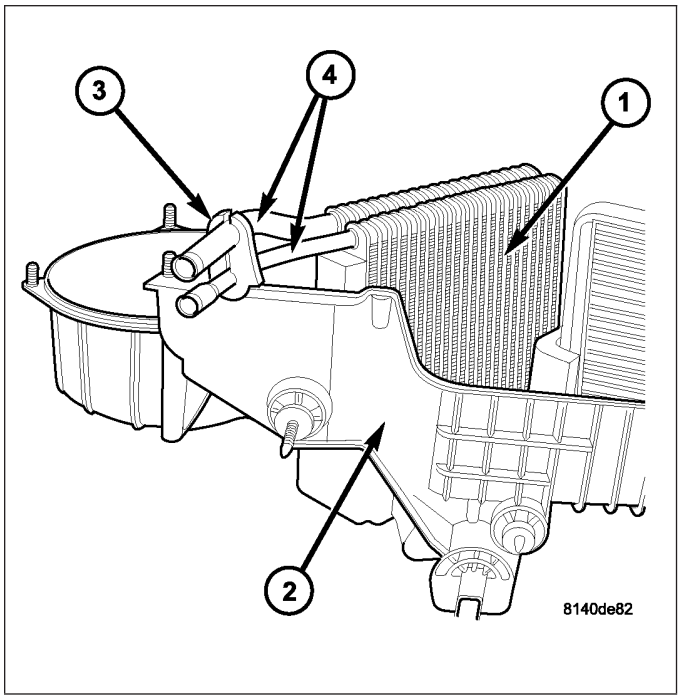
21. If required, remove the rubber flange (3) from around the heater core tubes (4).



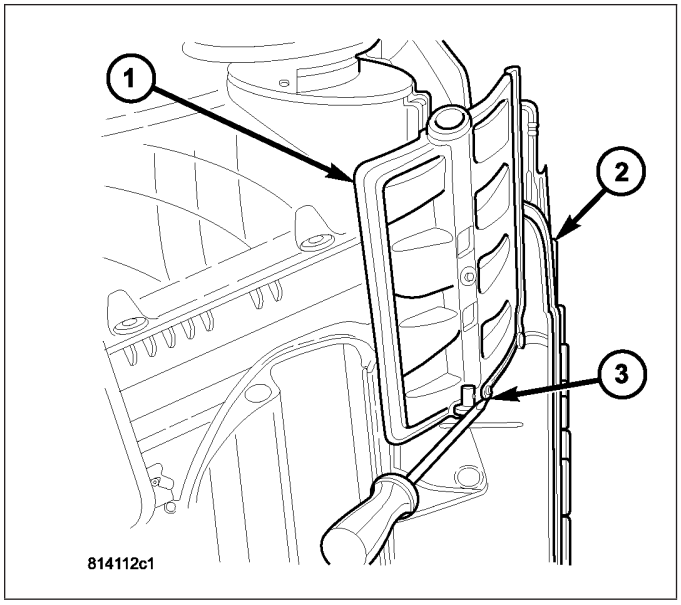
22. Carefully lift the A/C evaporator (1) out of the lower half of the HVAC housing (2).

NOTE: If the rubber flange around the evaporator tubes is deformed or damaged, the flange must be replaced.

23. If required, remove the rubber flange (3) from around the evaporator tubes (4).



24. To remove the blend-air door (1) from the inside of the HVAC housing (2), first carefully release the retaining tab of the blend door pivot lever (3) from the pivot shaft of the blend door, using a small pick-type tool.
25. Pull the blend door pivot lever out of the pivot shaft of the blend-air door.



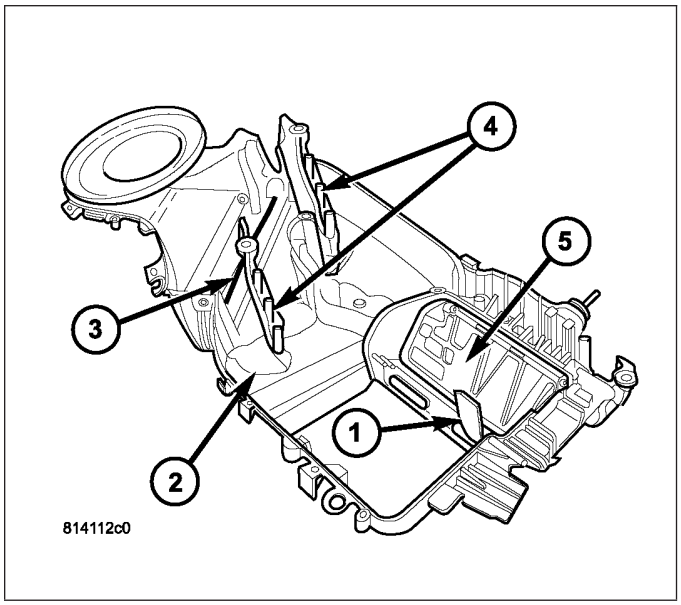
26. Remove the air vane (1) from the upper half of the HVAC housing (2).

NOTE: If the rubber evaporator core seal is deformed or damaged, the seal must be replaced.

27. Remove the rubber evaporator core seal (3) from the HVAC housing.

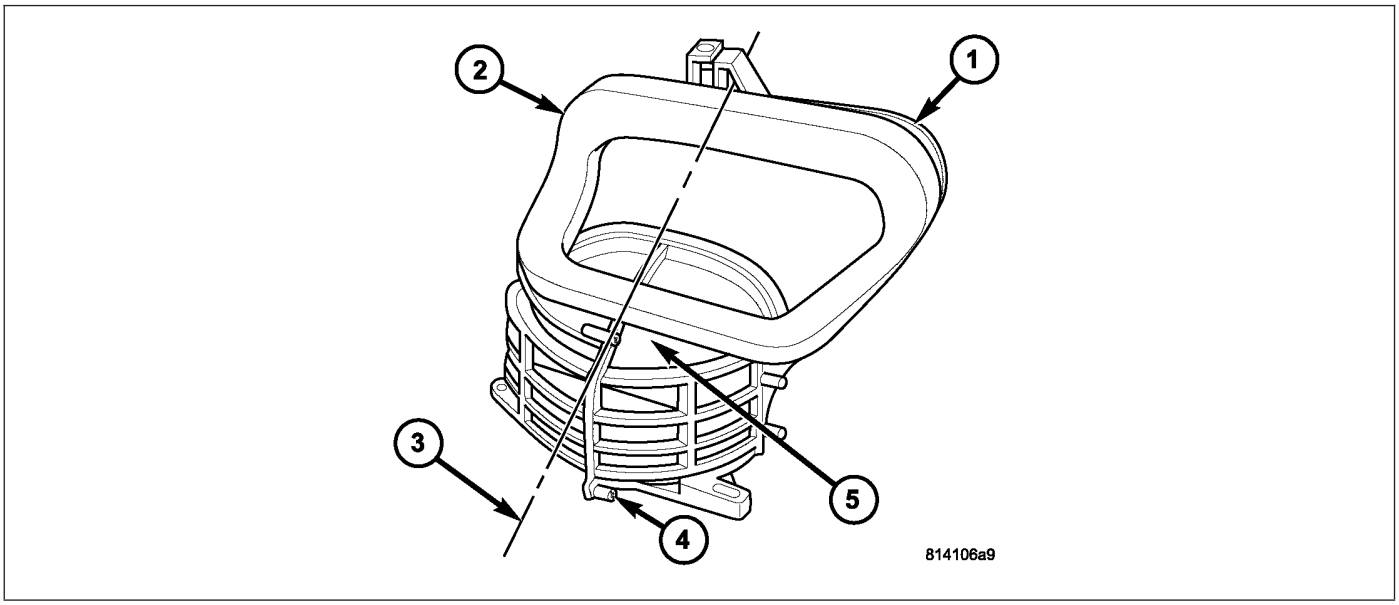
NOTE: If the seal on any air door is deformed or damaged, the air door must be replaced.

28. Remove both blend-air doors (4) and the defrost/floor-air door (5) from the HVAC housing.



AIR INLET HOUSING

NOTE: The air inlet housing must be removed from HVAC housing and disassembled for service of the recirculation-air door.



1. Remove the air inlet housing (1) from the HVAC housing and place it on a workbench (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR INLET - REMOVAL)
2. Remove the recirculation door actuator from the air inlet housing (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/ACTUATOR-RECIRCULATION DOOR - REMOVAL).
3. Remove the blower motor resistor from the air inlet housing (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/RESISTOR-BLOWER MOTOR - REMOVAL).

NOTE: If the foam seal on the air inlet housing is deformed or damaged, the seal must be replaced.

4. Carefully cut the foam seal (2) along the parting line (3) of the two halves of the air distribution housing.
5. Remove the four screws (4) that secure the two halves of the air distribution housing together and separate the housing.

NOTE: If the seal on the air door is deformed or damaged, the air door must be replaced.

6. Remove the recirculation-air door (5) from the air inlet housing.

ASSEMBLY

HVAC HOUSING

NOTE: The HVAC housing must be removed from the vehicle and disassembled for service of the heater core, A/C evaporator, mode-air and blend-air doors.

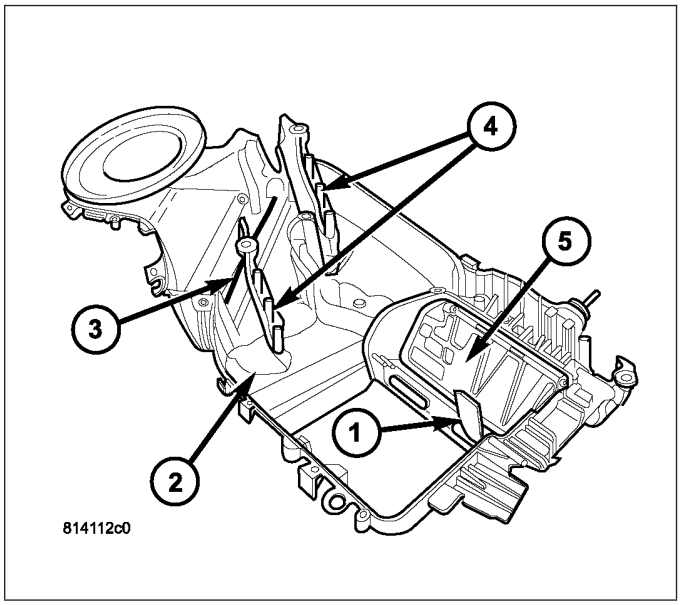
1. Install the air vane (1) into the upper half of the HVAC housing (2).

NOTE: If the rubber evaporator core seal is deformed or damaged, the seal must be replaced.

2. Install the rubber evaporator core seal (3) into the HVAC housing.

NOTE: If the seal on any air door is deformed or damaged, the air door must be replaced.

3. Install both blend-air doors (4) and the defrost/floor-air door (5) into the HVAC housing.

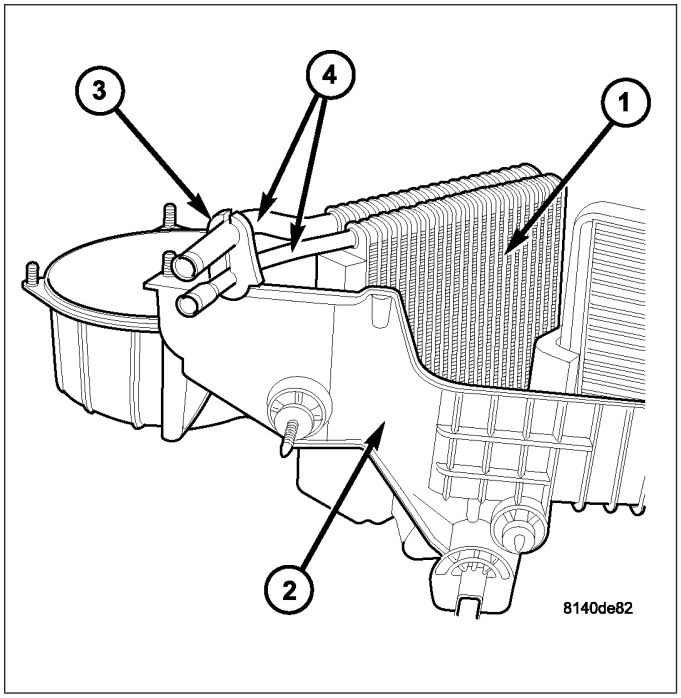


4. If removed, install the rubber flange (3) over the evaporator tubes (4).

NOTE: Make sure that the evaporator drain is clean and unrestricted and that the rubber seal and the rubber flange are properly positioned in the HVAC housings.

NOTE: If the A/C evaporator is being replaced, add 60 milliliters (2 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

5. Carefully install the A/C evaporator (1) into the lower half of the HVAC housing (2).

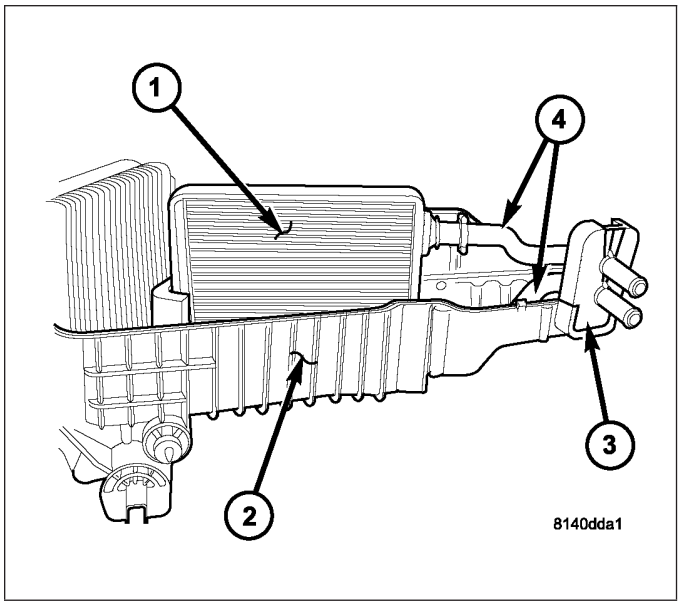


6. If removed, install the rubber flange (3) over the heater core tubes (4).

NOTE: If the foam seal around the heater core is deformed or damaged, the seal must be replaced.

NOTE: Make sure that the foam seal and the rubber flange are properly positioned in the HVAC housing.

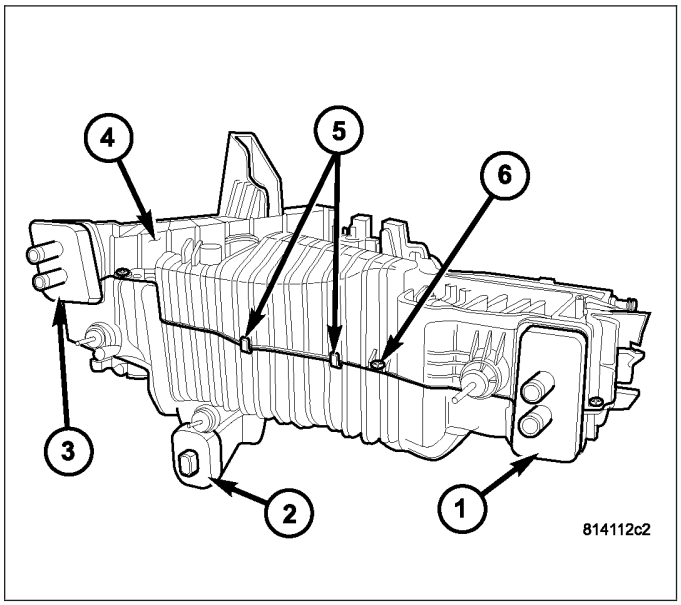
7. Carefully install the heater core (1) into the lower half of the HVAC housing (2).



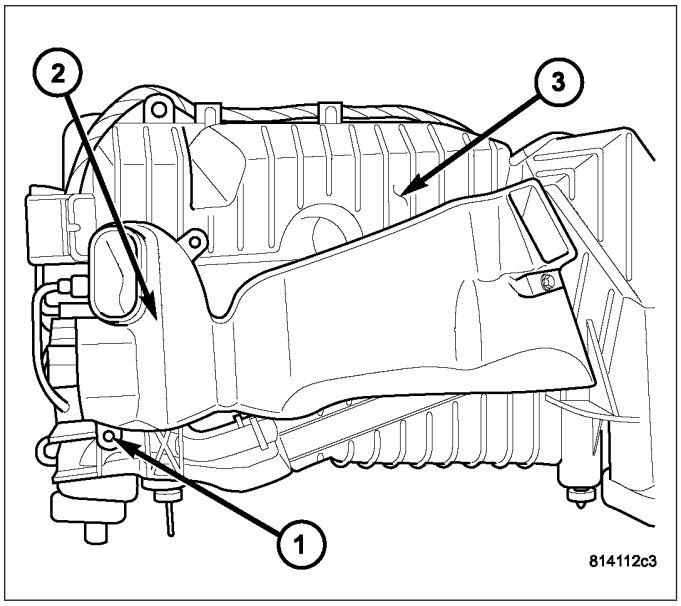
8. Align the air door pivot shafts with the pivot holes in the HVAC housing and install the two halves of the housing together (4).
9. Install the eleven screws (6) and the two metal clips (5) that secure the two housing halves together. Tighten the screws to 2 N·m (17 in. lbs.).

NOTE: If any of the foam seals are deformed or damaged, the seal(s) must be replaced.

10. Install the foam seals (1, 2 and 3) onto the HVAC housing.

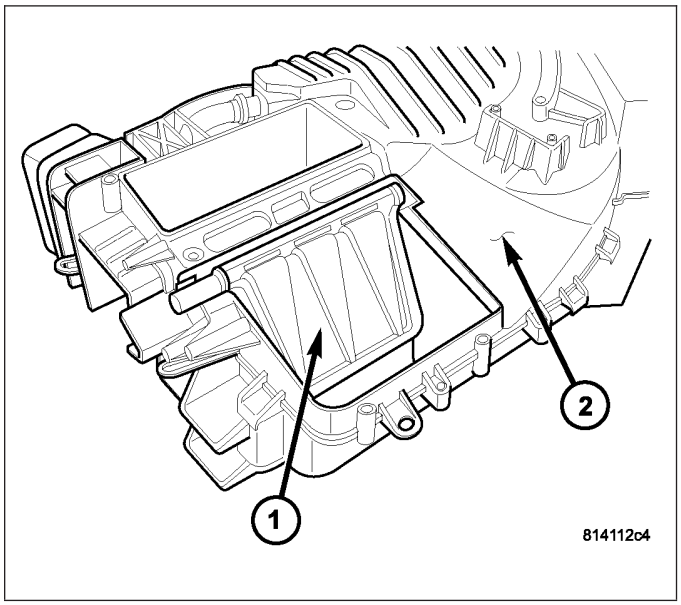


11. Position the floor distribution duct (2) onto the bottom of the HVAC housing (3).
12. Install the screws (1) that secure the floor distribution duct to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).

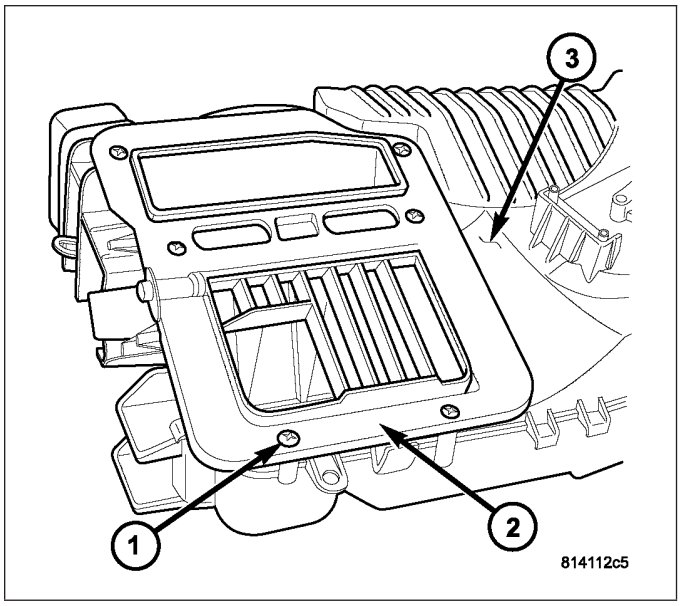


NOTE: If the seal on the air door is deformed or damaged, the air door must be replaced.

13. Align the pivot shaft of the panel-air door (1) with the pivot hole in the top of the HVAC housing (2) and install the panel-air door into the housing.

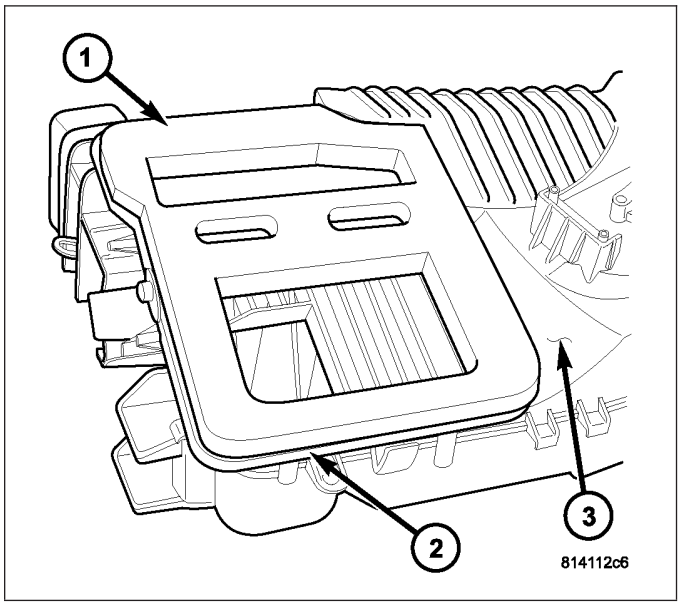


14. Install the panel/defrost outlet (2) onto the top of the HVAC housing (3).
15. Install the six screws (1) that secure the panel/defrost outlet to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).



NOTE: If the seal for the panel/defrost outlet is deformed or damaged, the seal must be replaced.

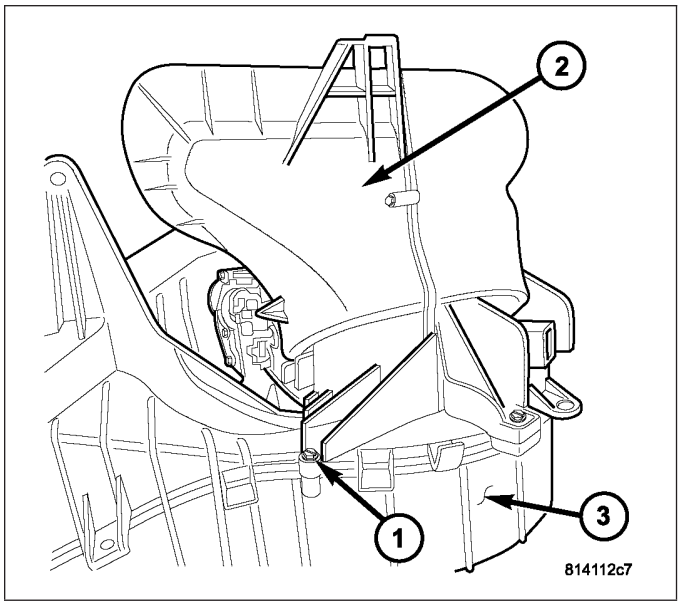
16. Install the foam seal (1) onto the panel/defrost outlet (2) located on the top of the HVAC housing (3).



17. Position the air inlet housing (2) onto the top of the HVAC housing (3).

NOTE: If the foam seal on the air inlet housing is deformed or damaged, the seal must be replaced.

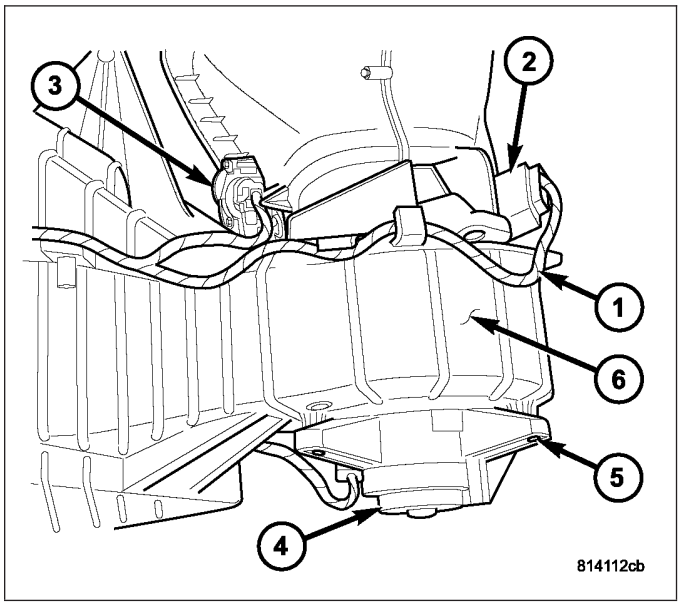
18. Install the four screws (1) that secure the air inlet housing to the top of the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).



19. Position the blower motor (4) into the HVAC housing (6).
20. Install the three screws (5) that secure the blower motor to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).

NOTE: Make sure that all HVAC wire harness leads are correctly routed through the wiring retainers.

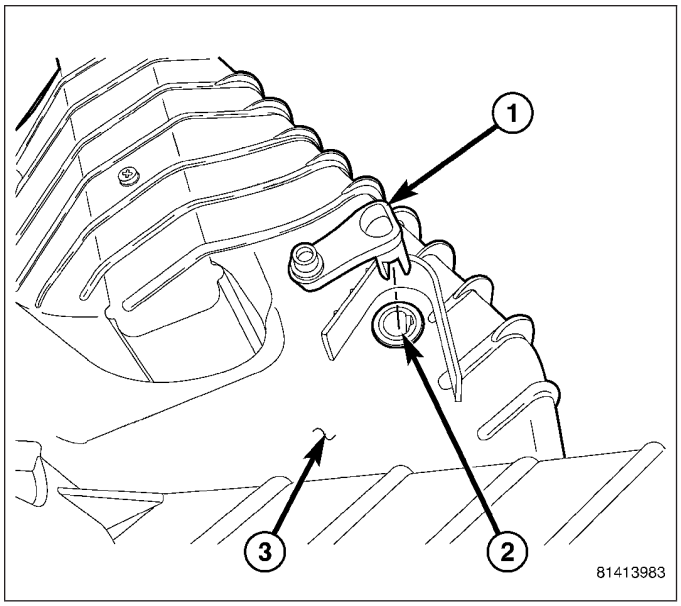
21. Install the HVAC wire harness (1) onto the HVAC housing.
22. Connect the HVAC wire harness to the blower motor resistor (2), recirculation door actuator (3) and the blower motor.



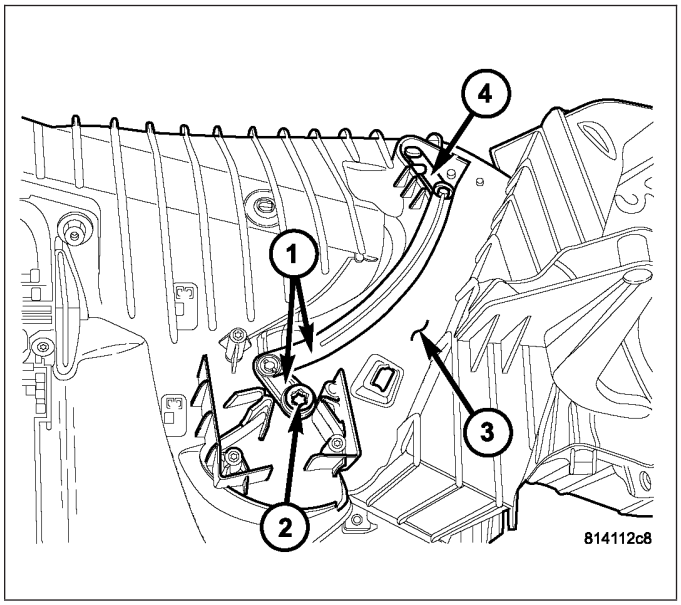
23. Align the blend door pivot lever (1) with the blend-air door pivot shaft (2) located on the top of the HVAC housing (3).

NOTE: Make sure that the pivot lever retaining tab is fully engaged to the blend-air door pivot shaft.

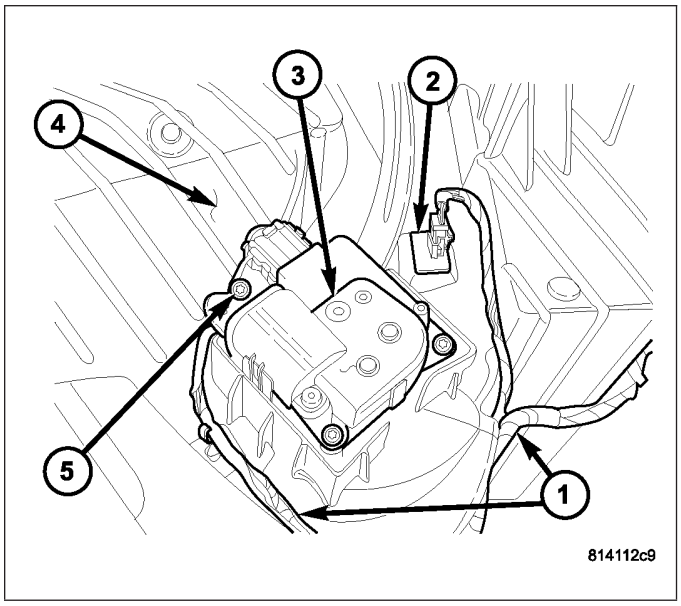
24. Install the blend door pivot lever into the blend-air door pivot shaft.



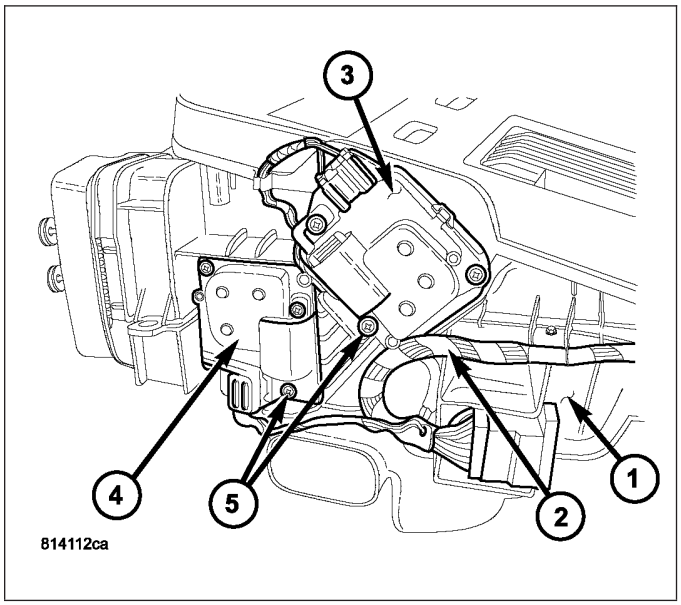
25. Connect the lever and linkage rod (1) to the blend door pivot lever (4) located on the top of the HVAC housing (3).
26. Install the lever and linkage rod onto the blend door pivot shaft (2).



27. Install the evaporator temperature sensor (2) into the opening located at the top of the HVAC housing (4).
28. Position the blend door actuator (3) onto the HVAC housing. If necessary, rotate the actuator slightly to align the splines on the actuator output shaft with those on the blend-air door linkage (Refer to 24 - HEATING & AIR CONDITIONING/ CONTROLS/ACTUATOR-BLEND DOOR - INSTALLATION).
29. Install the three screws (5) that secure the blend door actuator to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).
30. Connect the HVAC wire harness (1) to the evaporator temperature sensor and the blend door actuator.



31. Position the mode door actuators (3 and 4) onto the driver side end of the HVAC housing (1). If necessary, rotate the actuators slightly to align the splines on the actuator output shafts with those on the mode-air doors (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/ACTUATORS-MODE DOOR - INSTALLATION).
32. Install the three screws (5) that secure the mode door actuators to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).
33. Connect the HVAC wire harness (2) to the mode door actuator.
34. Install the HVAC housing assembly (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ HOUSING-HVAC - INSTALLATION).



AIR INLET HOUSING

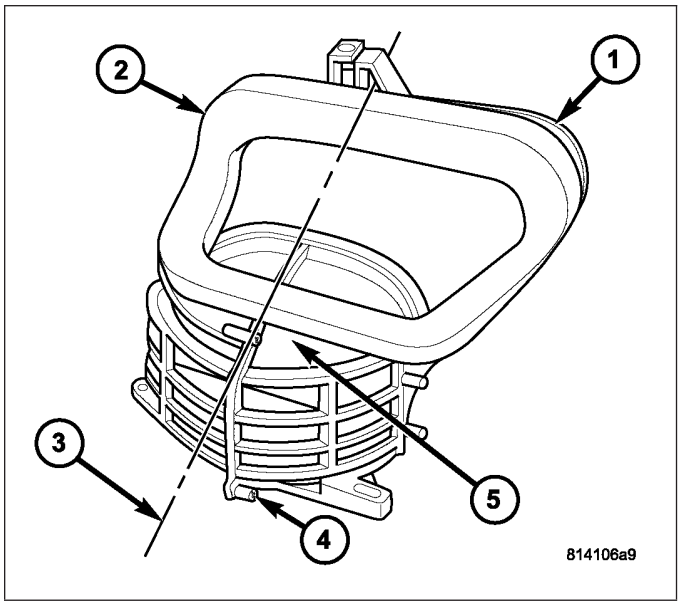
NOTE: The air inlet housing must be removed from HVAC housing and disassembled for service of the recirculation-air door.

1. Position the recirculation-air door (5) into the air inlet housing (1).

CAUTION: Make sure that the recirculation-air door pivot shaft is properly seated in the pivot holes located in the two halves of the air inlet housing.

NOTE: If the seal on the air door is deformed or damaged, the air door must be replaced.

2. Install the four screws (4) that secure the two halves of the air inlet housing together. Tighten the screws to 2 N·m (17 in. lbs.).
3. Install the blower motor resistor onto the air inlet housing (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/RESISTOR-BLOWER MOTOR - INSTALLATION).



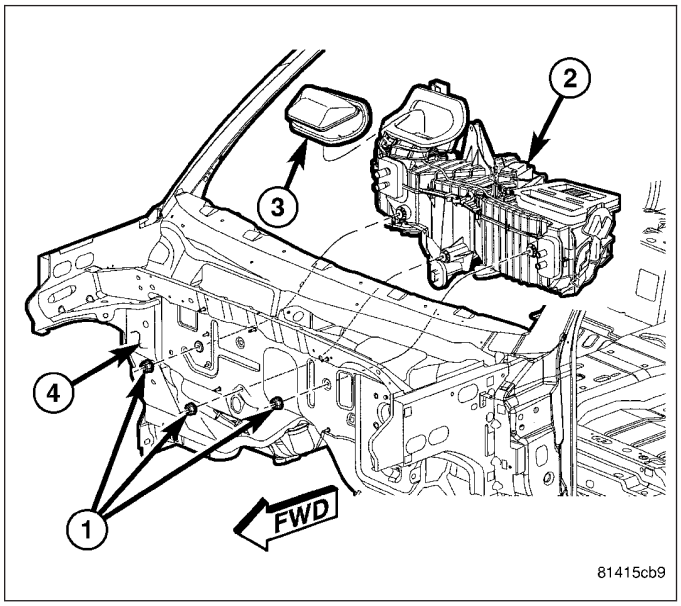
4. Install the recirculation door actuator onto the air inlet housing (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/ACTUATOR-RECIRCULATION DOOR - INSTALLATION).
5. Install the air inlet housing onto the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR INLET - INSTALLATION).

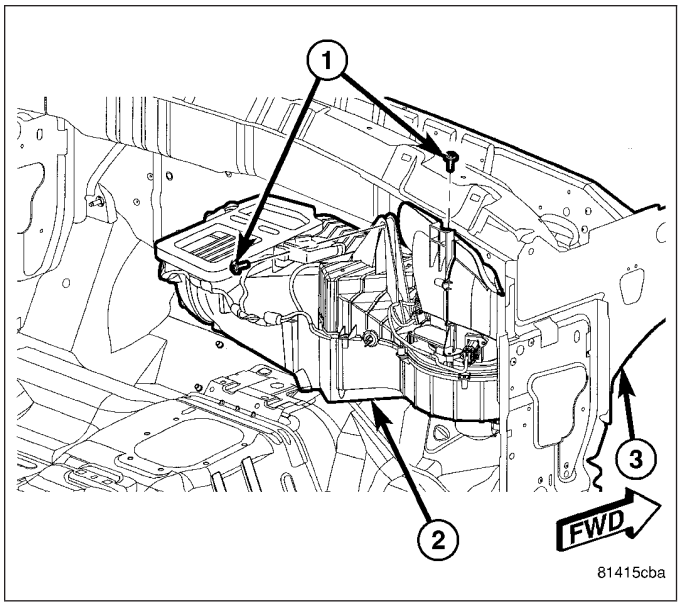
INSTALLATION

HVAC HOUSING

NOTE: The HVAC housing must be removed from the vehicle and disassembled for service of the heater core, A/C evaporator, mode-air and blend-air doors.

1. If removed, install the fresh air screen (3) onto the dash panel (4).
2. Position the HVAC housing (2) into the passenger compartment with the mounting studs and the condensate drain tube in their proper locations in the dash panel.
3. Loosely install the three nuts (1) that secure the HVAC housing to the engine compartment side of the dash panel.

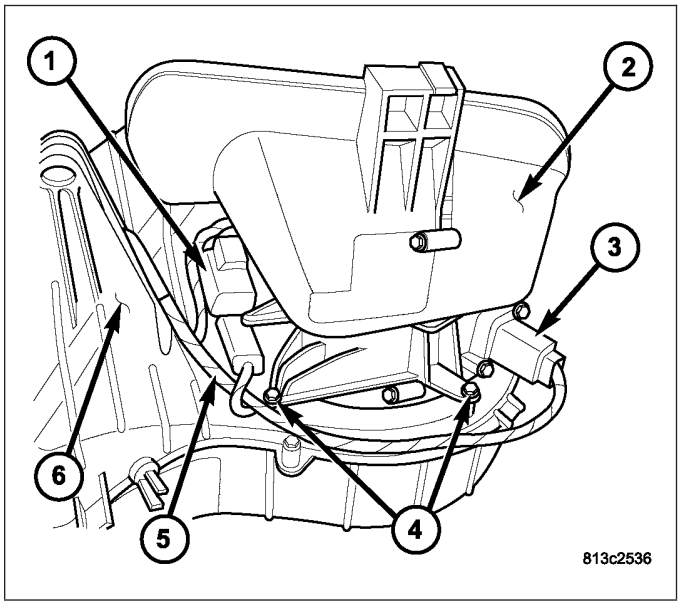




4. Loosely install the two bolts (1) that secure the HVAC housing to the passenger compartment side of the dash panel.
5. Tighten the three nuts that secure the HVAC housing to the engine compartment side of the dash panel to 7 N·m (62 in. lbs.).
6. Tighten the two bolts that secure the HVAC housing to the passenger compartment side of the dash panel to 3 N·m (26 in. lbs.).
7. Install the instrument panel (Refer to 23 - BODY/ INSTRUMENT PANEL ASSEMBLY - INSTALLATION).
8. Remove the previously installed plugs or caps and connect the heater hoses to the heater core tubes.
9. Remove the previously installed plugs or caps and connect the A/C liquid line and the A/C accumulator to the A/C evaporator (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING /LINE-A/C LIQUID - INSTALLATION) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ACCUMULATOR-A/C - INSTALLATION).
10. Reconnect the negative battery cable.
11. If the heater core is being replaced, flush the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM CLEANING/REVERSE FLUSHING).
12. Refill the engine cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM REFILL).
13. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
14. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

AIR INLET HOUSING

NOTE: The air inlet housing must be removed from HVAC housing and disassembled for service of the recirculation-air door.



1. Position the air inlet housing (2) onto the top of the HVAC housing (6).
2. Install the four screws (4) that secure the air inlet housing to the top of the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).
3. Connect the HVAC wire harness (5) to the blower motor resistor (3) and the recirculation door actuator (1).

NOTE: If the foam seal on the air inlet housing is deformed or damaged, the seal must be replaced.

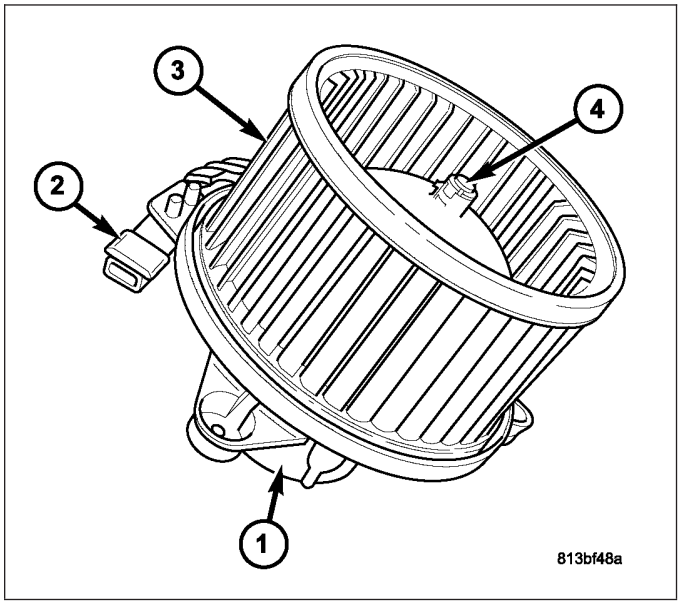
4. Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - INSTALLATION).
5. Reconnect the negative battery cable.

MOTOR-BLOWER

DESCRIPTION

The blower motor (1) is a 12-volt, direct current (DC) motor mounted within a plastic housing with an integral wire harness connector (2) and squirrel cage-type blower wheel (3) that is secured to the blower motor shaft (4). The blower motor wheel is located in the air inlet housing at the passenger side end of the HVAC housing.

The blower motor can be accessed for service from underneath the instrument panel.



OPERATION

The blower motor is used to control the velocity of air moving through the HVAC housing by spinning the blower wheel within the housing at the selected speed whenever the ignition switch is in the On position and the blower control switch is in any position except Off.

Blower motor speed is controlled by regulating the path to ground through the blower motor control switch and the blower motor resistor. The blower motor receives battery current whenever the blower motor relay is energized. The blower motor relay output circuit is protected by a fuse in the integrated power module (IPM) located in the engine compartment.

The blower motor and blower motor wheel are factory balanced and cannot be adjusted or repaired. If faulty or damaged, the blower motor and blower wheel must be replaced as an assembly.

DIAGNOSIS AND TESTING

BLOWER MOTOR

WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: For circuit descriptions and diagrams, refer to Air Conditioning/Heater in Group 8W - Wiring Diagrams.

OPERATION

Possible causes of an inoperative blower motor include:

- Faulty fuse
- Faulty blower motor resistor
- Faulty blower motor switch
- Faulty blower motor relay

- Faulty blower motor
- Faulty mode control switch
- Faulty blower motor circuit wiring or wire harness connectors

VIBRATION

Possible causes of a blower motor vibration include:

- Improper blower motor mounting
- Improper blower wheel mounting
- Deformed blower wheel
- Out of balance blower wheel due to foreign material in the wheel
- Faulty blower motor

NOISE

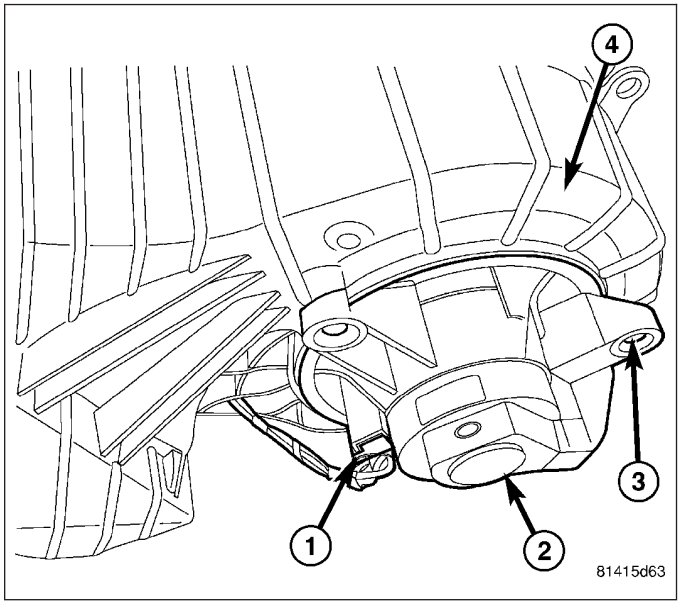
To determine if the blower motor is the source of the noise, simply switch the blower motor from Off to On. To verify that the blower motor is the source of the noise, unplug the blower motor wire harness connector and operate the heater-A/C system. If the noise goes away, possible causes include:

- Foreign material in the HVAC housing
- Improper blower motor mounting
- Improper blower wheel mounting
- Faulty blower motor

REMOVAL

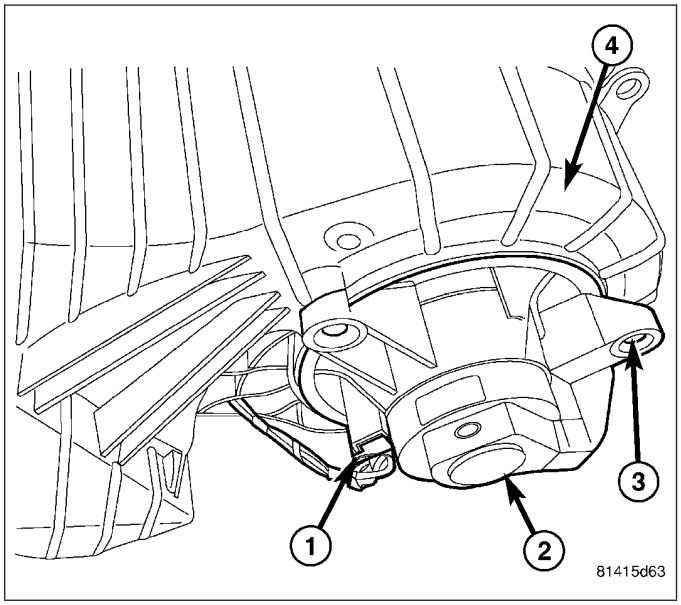
WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

1. Disconnect and isolate the negative battery cable.
2. Disconnect the wire harness connector (1) from the blower motor (2).
3. Remove the three screws (3) that secure the blower motor to the HVAC housing (4).
4. Remove the blower motor from the HVAC housing.



INSTALLATION

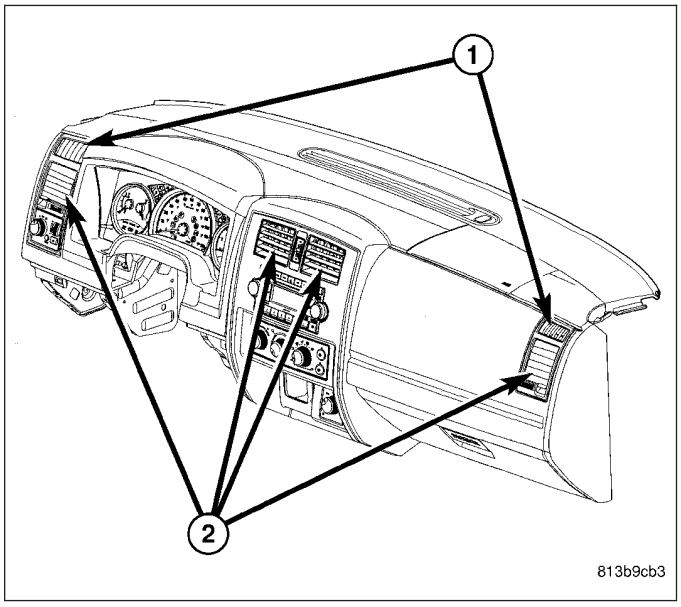
1. Position the blower motor (2) into the HVAC housing (4).
2. Install the three screws (3) that secure the blower motor to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).
3. Connect the wire harness connector (1) to the blower motor.
4. Reconnect the negative battery cable.



OUTLET-AIR

DESCRIPTION

There are two side window demister air outlets (1). One located at each end of the instrument panel near the A-pillars. The airflow from the side window demister air outlets is directed by fixed vanes in the demister outlet grilles and cannot be adjusted. The side window demister air outlets are only serviced with the instrument panel air outlets.



There are four instrument panel air outlets (2). One air outlet is located near each outboard end of the instrument panel facing the rear of the vehicle and two air outlets are located at the top of the instrument panel center bezel. Each of the instrument panel air outlets contain a grille with movable vanes that are used to direct or shut off the flow of the conditioned air leaving the instrument panel outlets. The instrument panel air outlets and grilles cannot be serviced separately (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL), (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL) and (Refer to 23 - BODY/INSTRUMENT PANEL/IP PASSENGER SIDE BEZEL - REMOVAL).

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PLUMBING

DESCRIPTION

The A/C refrigerant lines and hoses are used to carry the refrigerant between the various A/C system components. The refrigerant lines and hoses for the R-134a system on this vehicle consist of a barrier-hose design with a nylon tube sandwiched between rubber layers. The nylon tube helps to contain the R-134a refrigerant, which has a smaller molecular structure than R-12 refrigerant. The ends of the refrigerant lines are made from lightweight aluminum or steel, and commonly use braze-less fittings.

Any kinks or sharp bends in the refrigerant lines and hoses will reduce the capacity of the entire A/C system and can reduce the flow of refrigerant in the system. The radius of all bends in the flexible hose refrigerant lines should be at least ten times the diameter of the hose and the refrigerant lines should be routed so they are at least 80 millimeters (3 inches) away from the exhaust manifold(s) and exhaust pipe(s).

OPERATION

High pressures are produced in the refrigerant system when the A/C compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

The refrigerant lines and hoses are coupled to other A/C system components with block-type and quick-connect type fittings. Flat gaskets and O-rings are used to mate the refrigerant line fittings with A/C system components to ensure the integrity of the refrigerant system.

The refrigerant lines and hoses cannot be repaired and, if faulty or damaged, they must be replaced.

WARNING

WARNINGS

WARNING: The A/C system contains refrigerant under high pressure. Repairs should only be performed by qualified service personnel. Severe personal injury or death may result from improper service procedures.

WARNING: Avoid breathing the refrigerant and refrigerant oil vapor or mist. Exposure may irritate the eyes, nose, and/or throat. Wear eye protection when servicing the A/C refrigerant system. Serious eye injury can result from direct contact with the refrigerant. If eye contact occurs, seek medical attention immediately.

WARNING: Do not expose the refrigerant to open flame. Poisonous gas is created when refrigerant is burned. An electronic leak detector is recommended. Severe personal injury or death may result from improper service procedures.

WARNING: If accidental system discharge occurs, ventilate the work area before resuming service. Large amounts of refrigerant released in a closed work area will displace the oxygen and cause suffocation and death.

WARNING: The evaporation rate of R-134a refrigerant at average temperature and altitude is extremely high. As a result, anything that comes in contact with the refrigerant will freeze. Always protect the skin or delicate objects from direct contact with the refrigerant.

WARNING: The R-134a service equipment or the vehicle refrigerant system should not be pressure tested or leak tested with compressed air. Some mixtures of air and R-134a have been shown to be combustible at elevated pressures. These mixtures are potentially dangerous, and may result in fire or explosion causing property damage, personal injury or death.

WARNING: The engine cooling system is designed to develop internal pressures of 97 to 123 kilopascals (14 to 18 pounds per square inch). Do not remove or loosen the coolant pressure cap, cylinder block drain plugs, radiator drain, radiator hoses, heater hoses, or hose clamps while the engine cooling system is hot and under pressure. Allow the vehicle to cool for a minimum of 15 minutes before opening the cooling system for service. Failure to observe this warning can result in serious burns from the heated engine coolant.

CAUTION

CAUTIONS

CAUTION: Never add R-12 to a refrigerant system designed to use R-134a. Do not use R-12 equipment or parts on a R-134a A/C system. These refrigerants are not compatible and damage to the A/C system will result.

CAUTION: Never use R-12 refrigerant oil in a A/C system designed to use R-134a refrigerant oil. These refrigerant oils are not compatible and damage to the A/C system will result.

CAUTION: The use of A/C system sealers may result in damage to A/C refrigerant recovery/evacuation/recharging equipment and/or A/C system. Many federal, state/provincial and local regulations prohibit the recharge of A/C systems with known leaks. DaimlerChrysler recommends the detection of A/C system leaks through the use of approved leak detectors and fluorescent leak detection dyes. Vehicles found with A/C system sealers should be treated as contaminated and replacement of the entire A/C refrigerant system is recommended. A/C systems found to be contaminated with A/C system sealers, A/C stop-leak products or seal conditioners voids the warranty for the A/C system.

CAUTION: Recover the refrigerant before opening any fitting or connection. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.

CAUTION: If equipped, do not remove the secondary retention clip from any spring-lock coupler connection while the refrigerant system is under pressure. Recover the refrigerant before removing the secondary retention clip. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.

CAUTION: The internal parts of the A/C system will remain stable as long as moisture-free refrigerant and refrigerant oil is used. Abnormal amounts of dirt, moisture or air can upset the chemical stability. This may cause operational troubles or even serious damage if present in more than very small quantities. Before disconnecting a component, clean the outside of the fittings thoroughly to prevent contamination from entering the refrigerant system. Keep service tools and the work area clean. Do not open the refrigerant system or uncap a replacement component until you are ready to service the system. Immediately after disconnecting a component from the refrigerant system, seal the open fittings with a cap or plug. This will prevent contamination from entering the A/C system.

CAUTION: Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open a container of refrigerant oil until you are ready to use it. Replace the cap on the oil container immediately after using. Store refrigerant oil only in a clean, airtight, and moisture-free container.

CAUTION: Do not overcharge the refrigerant system. Overcharging will cause excessive compressor head pressure and can cause compressor noise and A/C system failure.

DIAGNOSIS AND TESTING

REFRIGERANT SYSTEM LEAKS

WARNING: R-134a service equipment or vehicle A/C system should not be pressure tested or leak tested with compressed air. Mixture of air and R-134a can be combustible at elevated pressures. These mixtures are potentially dangerous and may result in fire or explosion causing property damage, personal injury or death.
Avoid breathing A/C refrigerant and lubricant vapor or mist. Exposure may irritate eyes, nose and throat. Use only approved service equipment meeting SAE requirements to discharge R-134a system. If accidental system discharge occurs, ventilate work area before resuming service.

If the A/C system is not cooling properly, determine if the refrigerant system is fully charged with R-134a. This is accomplished by performing a system Charge Level-Check or Fill. If while performing this test A/C liquid line pressure is less than 345 kPa (50 psi) proceed to System Empty procedure. If liquid line pressure is greater than 345 kPa (50 psi) proceed to System Low procedure. If the refrigerant system is empty or low in refrigerant charge, a leak at any line fitting or component seal is likely. A review of the fittings, lines and components for oily residue is an indication of the leak location. To detect a leak in the refrigerant system, perform one of the following procedures as indicated by the symptoms.

SYSTEM EMPTY

1. Evacuate the refrigerant system to the lowest degree of vacuum possible (approximately 28 in Hg.). Determine if the system holds a vacuum for 15 minutes. If vacuum is held, a leak is probably not present. If system will not maintain vacuum level, proceed to Step 2.
2. Prepare a 0.284 Kg. (10 oz.) refrigerant charge to be injected into the refrigerant system.
3. Connect and dispense 0.284 Kg. (10 oz.) of refrigerant into the evacuated refrigerant system.
4. Proceed to Step 2 of System Low procedure.

SYSTEM LOW

1. Determine if there is any R-134a refrigerant in the system.
2. Position the vehicle in a wind free work area. This will aid in detecting small leaks.
3. Bring the refrigerant system up to operating temperature and pressure. This is done by allowing the engine to run for five minutes with the A/C system set to the following:
   - Transmission in Park or Neutral with parking brake set
   - Engine idling
   - Mode control set to the outside air position
   - Blower control set to the high speed position
   - A/C set to the ON position
   - All windows open

CAUTION: A leak detector only designed for R-12 refrigerant will not detect leaks in a R-134a refrigerant system.

4. Shut the vehicle Off and wait 2-7 minutes. Then use an electronic leak detector that is designed to detect R-134a refrigerant and search for leaks. Fittings, lines or components that appear to be oily usually indicate a refrigerant leak. To inspect the A/C evaporator for leaks, insert the leak detector probe into the drain tube opening or an air outlet. A dye for R-134a is available to aid in leak detection. Use only DaimlerChrysler approved refrigerant dye.

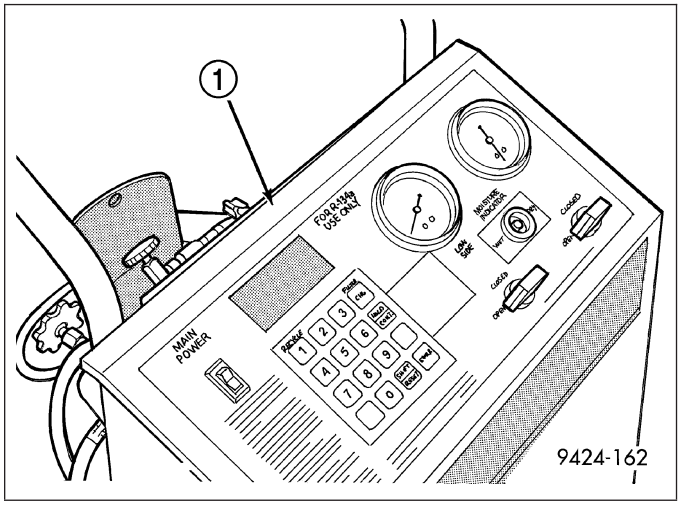
STANDARD PROCEDURE

REFRIGERANT SYSTEM SERVICE EQUIPMENT

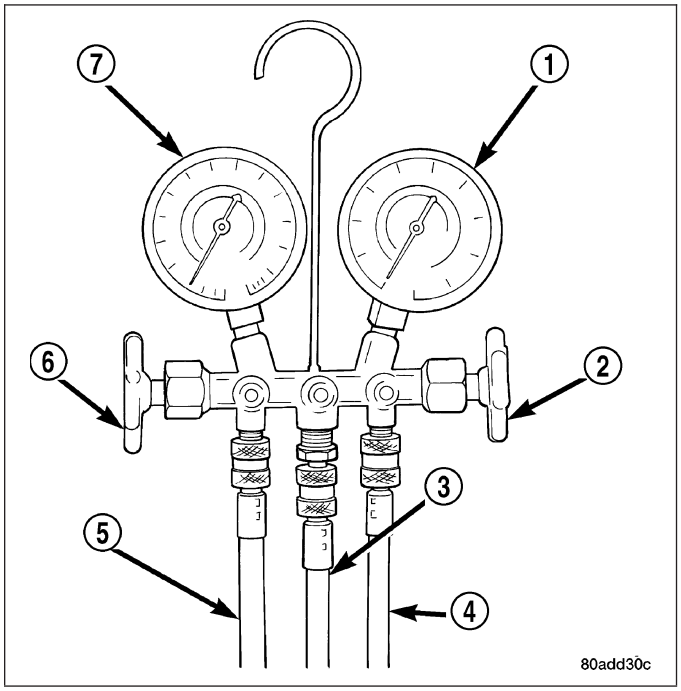
WARNING: Eye protection must be worn when servicing an A/C refrigerant system. Turn all valves off (rotate clockwise) on the equipment being used before connecting or disconnecting service equipment from the refrigerant system. Failure to observe these warnings may result in personal injury or death.

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.

When servicing the A/C system, a R-134a refrigerant recovery/recycling/charging station that meets SAE standard J2210 must be used (1). Contact an automotive service equipment supplier for refrigerant recovery/recycling/charging equipment. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.



A manifold gauge set (1) may be needed with some recovery/recycling/charging equipment. The manifold gauge set should have manual shut-off valves (2 and 6), or automatic back-flow valves located at the service port connector end of the manifold gauge set hoses (4 and 5). This will prevent refrigerant from being released into the atmosphere.



MANIFOLD GAUGE SET CONNECTIONS

CAUTION: Do not use an R-12 manifold gauge set on an R-134a system. The refrigerants are not compatible and system damage will result.

RECOVERY/RECYCLING/EVACUATION/CHARGING HOSE – The center manifold hose (Yellow, or White, with Black stripe) (3) is used to recover, evacuate, and charge the refrigerant system. When the low or high pressure valves on the manifold gauge set are opened, the refrigerant in the system will escape through this hose.

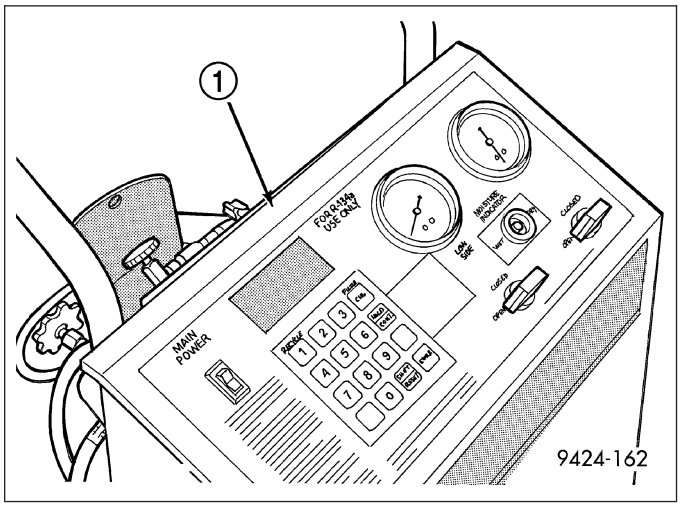
HIGH PRESSURE GAUGE HOSE – The high pressure hose (Red with Black stripe) (4) attaches to the high side service port. This service port is located on the A/C liquid line near the radiator cap. On this model, an A/C pressure transducer is also installed on the liquid line. A/C high-side pressures can be read using a scan tool. Refer to 9 - Engine Electrical Diagnostics for more information.

LOW PRESSURE GAUGE HOSE – The low pressure hose (Blue with Black stripe) (5) attaches to the low side service port. This service port is located on the accumulator.

REFRIGERANT SYSTEM RECOVERY

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.

An R-134a refrigerant recovery/recycling/charging station (1) that meets SAE standard J2210 must be used to recover the refrigerant from the R-134a refrigerant system. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.



REFRIGERANT SYSTEM EVACUATE

NOTE: Special effort must be used to prevent moisture from entering the A/C system oil. Moisture in the oil is very difficult to remove and will cause a reliability problem with the compressor.

If an A/C compressor designed to use R-134a refrigerant is left open to the atmosphere for an extended period of time. It is recommended that the refrigerant oil be drained and replaced with new oil or a new A/C compressor be used. This will eliminate the possibility of contaminating the refrigerant system.

If the refrigerant system has been open to the atmosphere, it must be evacuated before the system can be filled. Moisture and air mixed with the refrigerant will raise the compressor head pressure above acceptable operating levels. This will reduce the performance of the A/C system and damage the A/C compressor. Moisture will boil at near room temperature when exposed to vacuum. To evacuate the refrigerant system:

NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.

1. Recover the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
2. Connect a suitable charging station, refrigerant recovery machine or a manifold gauge set with vacuum pump and refrigerant recovery equipment (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM SERVICE EQUIPMENT).
3. Open the suction and discharge valves and start the vacuum pump. The vacuum pump should run a minimum of 45 minutes prior to charge to eliminate all moisture in system. When the suction gauge reads -88 kPa (- 26 in. Hg) vacuum or greater for 30 minutes, close all valves and turn off vacuum pump. If the system fails to reach specified vacuum, the refrigerant system likely has a leak that must be corrected. If the refrigerant system maintains specified vacuum for at least 30 minutes, start the vacuum pump, open the suction and discharge valves. Then allow the system to evacuate an additional 10 minutes.
4. Close all valves. Turn off and disconnect the vacuum pump.
5. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

REFRIGERANT SYSTEM CHARGE

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.

NOTE: Always refer to the underhood HVAC Specification Label for the refrigerant fill specification of the vehicle being serviced.

After all refrigerant system leaks have been repaired and the refrigerant system has been evacuated, a refrigerant charge can be injected into the system. For the proper amount of the refrigerant charge, refer to the underhood HVAC Specification Label.

A R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to charge the refrigerant system with R-134a refrigerant. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.

CHARGING PROCEDURE

CAUTION: A small amount of refrigerant oil is removed from the A/C system each time the refrigerant system is recovered and evacuated. Before charging the A/C system, you MUST replenish any oil lost during the recovery process. Refer the equipment manufacturer instructions for more information.

1. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
2. A manifold gauge set and an R-134a refrigerant recovery/recycling/charging station that meets SAE standard J2210 should be connected to the refrigerant system.
3. Measure the proper amount of refrigerant and heat it to 52° C (125° F) with the charging station. See the operating instructions supplied by the equipment manufacturer for proper use of this equipment.
4. Open both the suction and discharge valves, then open the charge valve to allow the heated refrigerant to flow into the system.
5. When the transfer of refrigerant has stopped, close both the suction and discharge valves.
6. If all of the refrigerant charge did not transfer from the dispensing device, open all of the windows in the vehicle and set the heating-A/C system controls so that the A/C compressor is engaged and the blower motor is operating at its lowest speed setting. Run the engine at a steady high idle (about 1400 rpm). If the A/C compressor does not engage, test the compressor clutch control circuit and repair as required.
7. Open the low-side valve to allow the remaining refrigerant to transfer to the refrigerant system.

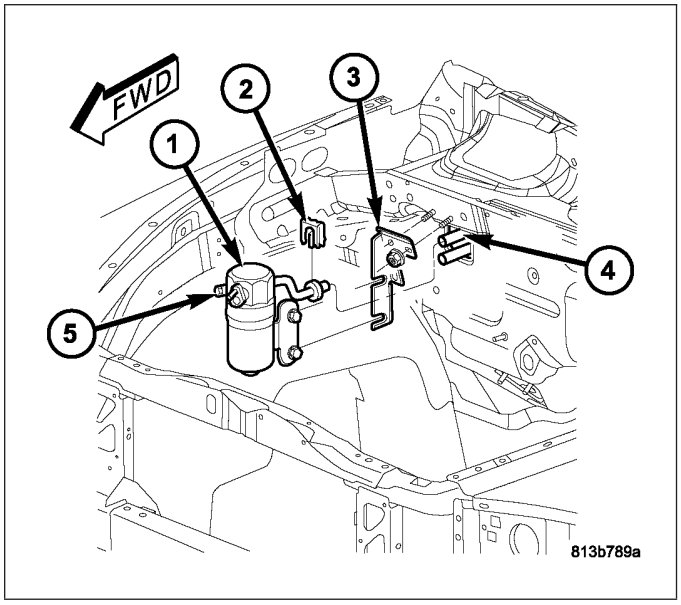
WARNING: Take care not to open the discharge (high pressure) valve at this time. Failure to follow this warning could result in possible personal injury or death.

8. Disconnect the charging station and manifold gauge set from the refrigerant system service ports.
9. Reinstall the caps onto the refrigerant system service ports.

ACCUMULATOR-A/C

DESCRIPTION

The A/C accumulator (1) is mounted in the engine compartment between the evaporator outlet tube (4) and the A/C suction line and includes the low- side service port (5). An integral mounting bracket secures the accumulator to the dash panel bracket (3). A spring-lock type quick-connect fitting is used to connect the accumulator to the evaporator outlet tube.



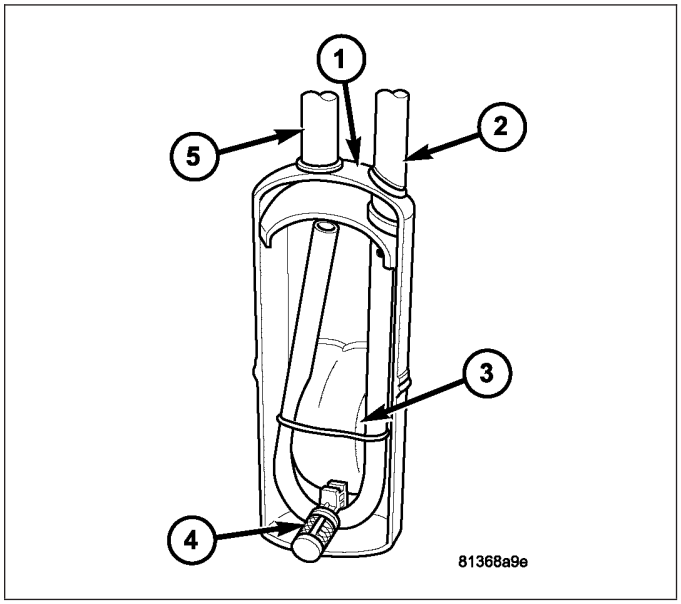
CAUTION: Use only O-ring seals specified for the vehicle. Failure to use the correct O-ring seals will cause the refrigerant system connections to leak.

The A/C accumulator has no serviceable parts except for the rubber O-ring seals, gasket, low-side service port valve and cap and the secondary retaining clip (2). The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant. The O-ring seals and gasket must be replaced whenever the A/C accumulator is removed and installed.

The A/C accumulator cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

NOTE: Typical A/C accumulator shown.

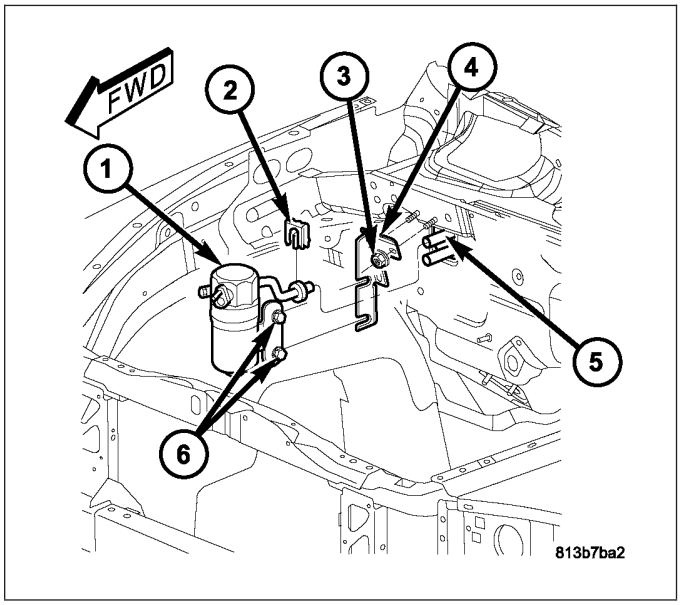


Refrigerant enters the A/C accumulator (1) mostly as a low pressure vapor through the inlet tube (2). Any liquid, oil-laden refrigerant falls to the bottom of the canister, which acts as a separator. A desiccant bag (3) is mounted inside the accumulator canister to absorb any moisture which may have entered and become trapped within the refrigerant system A filter (4) is also mounted inside the canister to trap any foreign material that may have entered the refrigerant system during assembly. The low pressure vapor exits the A/C accumulator through the outlet tube (5).

The A/C accumulator cannot be repaired. If the A/C accumulator is faulty or damaged, or if the refrigerant system has been contaminated or left open to the atmosphere for an indeterminable period or if the A/C compressor has failed, it must be replaced.

REMOVAL

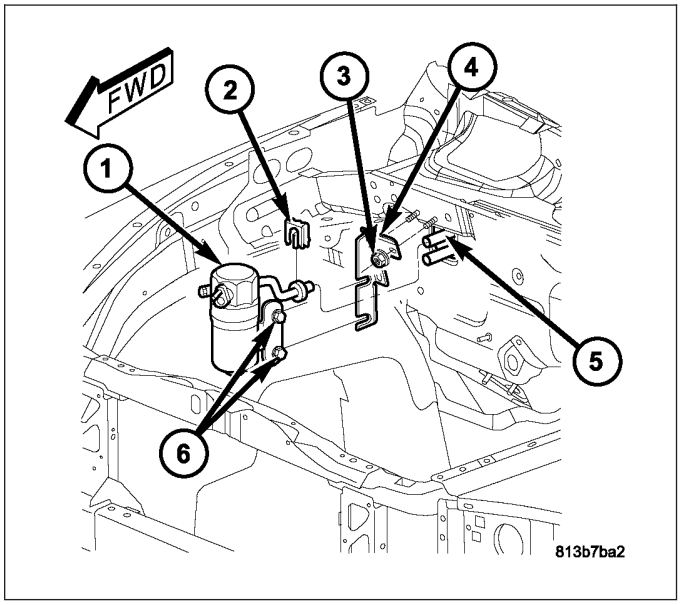
WARNING: Review the warnings and cautions in the front of this section before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS).



1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Remove the air filter housing to gain access to the A/C accumulator (1) (Refer to 9 - ENGINE/AIR INTAKE SYSTEM).
4. Disconnect the A/C suction line from the A/C accumulator and remove and discard the O-ring and gasket (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LINE-A/C SUCTION - REMOVAL).
5. Remove the secondary retaining clip (2) from the spring-lock coupler that secures the accumulator inlet tube to the evaporator outlet tube (5).
6. Loosen the bolts (6) that secure the A/C accumulator to the mounting bracket (4).
7. Using the proper A/C line disconnect tool, disconnect the accumulator inlet tube from the evaporator outlet tube (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COUPLER-REFRIGERANT LINE - REMOVAL) and remove and discard the O-ring seals.
8. Install plugs in, or tape over the opened refrigerant system connections.
9. If required, remove the nuts (3) that secure the accumulator mounting bracket to the dash panel and remove the bracket from the engine compartment.

INSTALLATION

NOTE: If the A/C accumulator is being replaced, add 60 milliliters (2 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.



1. If removed, install the accumulator mounting bracket (4) and retaining nuts (3). Tighten the nuts to 4.5 N·m (40 in. lbs.).
2. Position the A/C accumulator (1) onto the mounting bracket. Do not tighten the accumulator bracket bolts (6) at this time.
3. Remove the tape or plugs from the opened refrigerant system connections.
4. Lubricate new rubber O-ring seals with clean refrigerant oil and install them onto the accumulator spring-lock coupler fitting. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
5. Connect the spring-lock coupler to the evaporator outlet tube (5) and install the secondary retaining

clip (3) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COUPLER-REFRIGERANT LINE - INSTALLATION).

6. Tighten the accumulator bracket bolts to 4.5 N·m (40 in. lbs.).
7. Connect the A/C suction line to the A/C accumulator (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/SUCTION LINE - INSTALLATION).
8. Install the air filter housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM).
9. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
10. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).
11. Reconnect the negative battery cable.

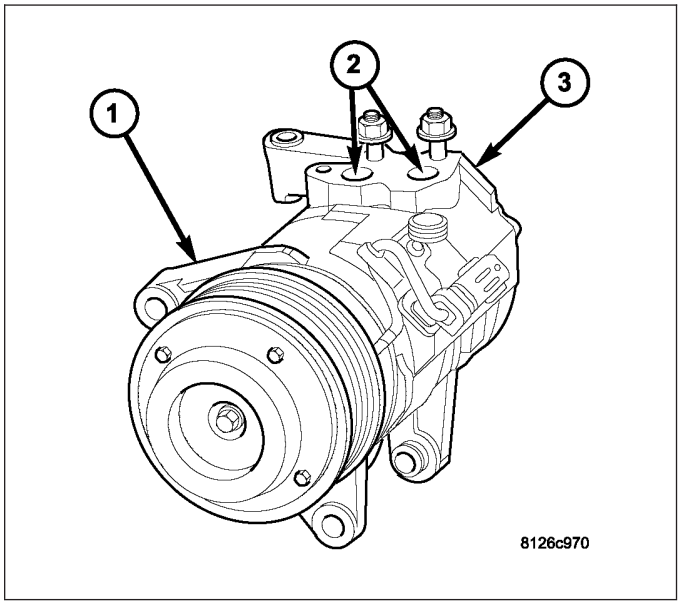
COMPRESSOR-A/C

DESCRIPTION

A/C COMPRESSOR

The A/C system uses a Denso 10S17 reciprocating swash plate-type compressor (1). This A/C compressor has a fixed displacement of 170 cubic centimeters (10.374) and has both the suction and discharge ports (2) located on the cylinder head (3) at the rear of the compressor.

A label identifying the use of R-134a refrigerant is located on the A/C compressor.



HIGH PRESSURE RELIEF VALVE

A high pressure relief valve is located on the compressor cylinder head, which is at the rear of the A/C compressor. This mechanical valve is designed to vent refrigerant from the A/C system to protect against damage to the A/C compressor and other A/C system components, caused by condenser air flow restriction or an overcharge of refrigerant.

OPERATION

A/C COMPRESSOR

The A/C compressor is driven by the engine through an electric clutch, drive pulley and belt arrangement. The A/C compressor is lubricated by refrigerant oil that is circulated throughout the refrigerant system with the refrigerant.

The A/C compressor draws in low-pressure refrigerant vapor from the A/C evaporator through its suction port. It then compresses the refrigerant into a high-pressure, high-temperature refrigerant vapor, which is then pumped to the A/C condenser through the compressor discharge port.

The A/C compressor cannot be repaired and, if faulty or damaged, it must be replaced. The compressor clutch, pulley and bearing assembly, and clutch field coil are available for service.

HIGH PRESSURE RELIEF VALVE

The high pressure relief valve vents refrigerant from the A/C system when a discharge pressure of 3445 to 4135 kPa (500 to 600 psi) or above is reached. The high pressure relief valve closes with a minimum discharge pressure of 2756 kPa (400 psi) is reached.

The high pressure relief valve vents only enough refrigerant to reduce the A/C system pressure, and then re-seats itself. The majority of the refrigerant is conserved in the A/C system. If the high pressure relief valve vents refrigerant, it does not mean the valve is faulty.

The high pressure relief valve is factory-calibrated and cannot be adjusted or repaired, and must not be removed or otherwise disturbed. The valve is only serviced as a part of the A/C compressor.

DIAGNOSIS AND TESTING

A/C COMPRESSOR

When investigating an A/C system related noise, you must first know the conditions under which the noise occurs. These conditions include: weather, vehicle speed, transmission in gear or neutral, engine speed, engine temperature, and any other special conditions. Noises that develop during A/C operation can often be misleading. For example: What sounds like a failed front engine bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets or a loose compressor clutch assembly.

Drive belts are speed sensitive. At different engine speeds and depending upon drive belt tension, drive belts can develop noises that are mistaken for an A/C compressor noise. Improper drive belt tension can cause a misleading noise when the compressor clutch is engaged, which may not occur when the compressor clutch is disengaged. Check the accessory drive belt condition and tension as described in Cooling before beginning this procedure.

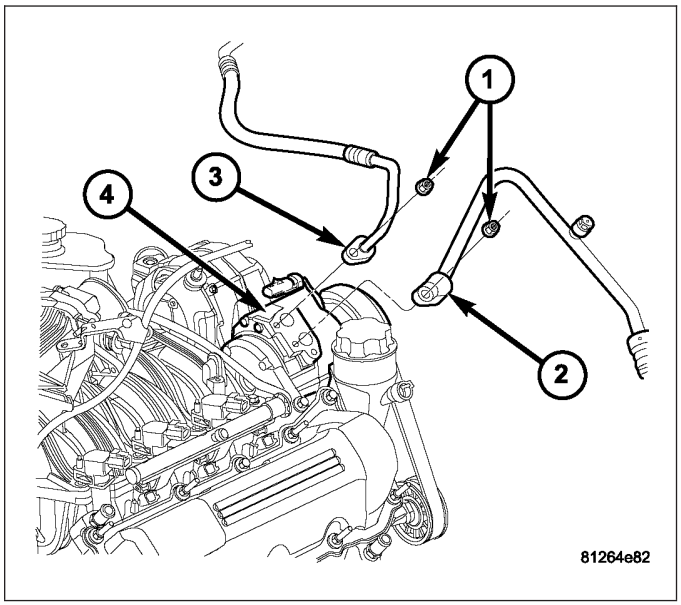
1. Select a quiet area for testing. Duplicate the complaint conditions as much as possible. Turn the A/C compressor On and Off several times to clearly identify the compressor noise. Listen to the A/C compressor while the clutch is engaged and disengaged. Probe the A/C compressor with an engine stethoscope or a long screwdriver with the handle held to your ear to better localize the source of the noise.
2. Loosen all of the compressor mounting hardware and retighten. Check the compressor clutch retainer. Be certain that the clutch field coil is mounted securely to the A/C compressor, and that the clutch plate and pulley are properly aligned and have the correct air gap (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CLUTCH-A/C COMPRESSOR - INSTALLATION).
3. To duplicate high-ambient temperature conditions (high head pressure), restrict the air flow through the A/C condenser. Install a manifold gauge set or a scan tool to be certain that the discharge pressure does not exceed 2760 kPa (400 psi).
4. Check the refrigerant system plumbing for incorrect routing, rubbing or interference, which can cause unusual noises. Also check the refrigerant lines and hoses for kinks or sharp bends that will restrict refrigerant flow, which can cause noises (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DESCRIPTION - REFRIGERANT LINES)
5. If the noise is from opening and closing of the high pressure relief valve, recover, evacuate and recharge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY), (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE). If the high pressure relief valve still does not seat properly, replace the A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COMPRESSOR-A/C - REMOVAL).
6. If the noise is from liquid refrigerant slugging in the A/C suction line, replace the A/C accumulator (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ACCUMULATOR-A/C - REMOVAL) and check the refrigerant oil level and the refrigerant system charge (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING- STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).
7. If a slugging condition still exists after replacing the A/C accumulator, then replace the A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COMPRESSOR-A/C - REMOVAL) and repeat Step 1.

REMOVAL

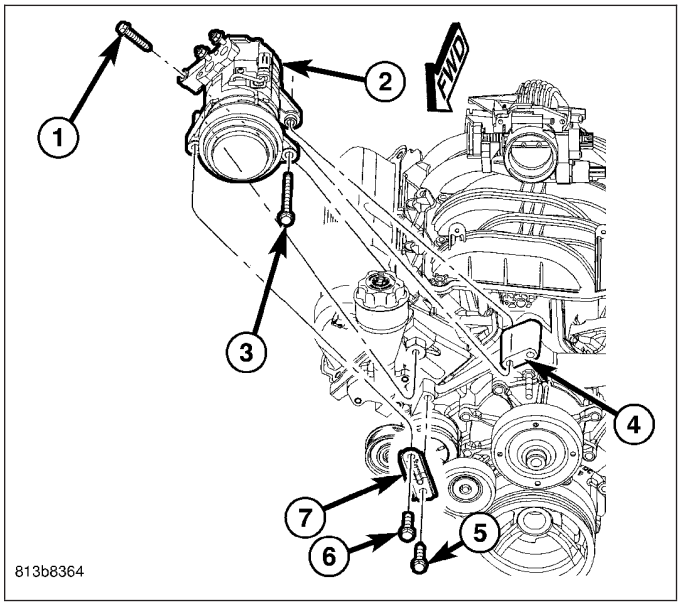
WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.

NOTE: The A/C compressor may be removed and repositioned without disconnecting the refrigerant lines or discharging the refrigerant system. Discharging is not necessary if servicing the compressor clutch, clutch coil, engine, engine cylinder head or the generator.

1. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - FRONT - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
2. Disconnect and isolate the negative battery cable.
3. Remove the resonator from the engine.
4. Remove the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/BELTS-DRIVE - REMOVAL).
5. Disconnect the wire harness connector from the A/C compressor clutch coil.
6. Remove the nuts (1) that secure the A/C suction line (2) and A/C discharge line (3) to the A/C compressor (4).
7. Disconnect the A/C suction and discharge lines from the A/C compressor and remove and discard the O-ring seals and gaskets.
8. Install plugs in, or tape over all of the opened refrigerant line fittings and the compressor ports.



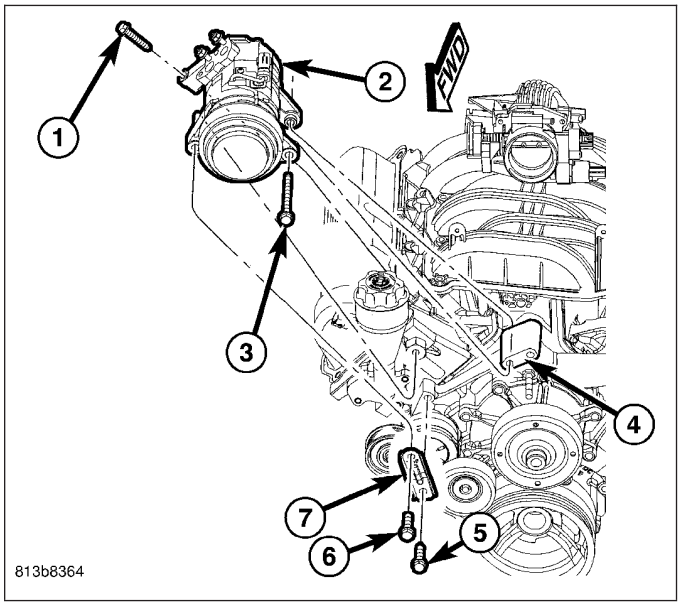
9. Loosen the bolt (5) that secures the bracket (7) to the accessory mounting bracket (4).
10. Remove the bolts (1, 6 and 3) that secure the A/C compressor (2) to the accessory mounting bracket.
11. Remove the A/C compressor from the engine compartment.



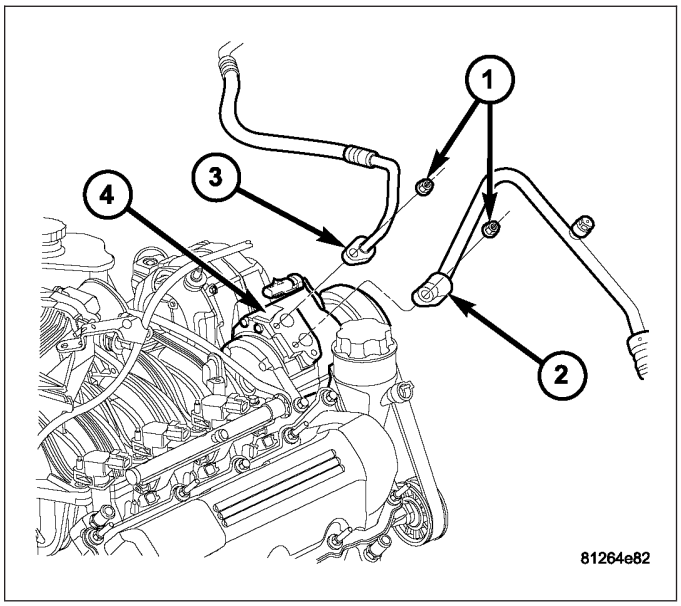
INSTALLATION

NOTE: Be certain to check the refrigerant oil level if the A/C compressor is being replaced. See Refrigerant Oil Level in this group for the procedures. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

1. Position the A/C compressor (2) onto the accessory mounting bracket (4).
2. Install and tighten the bolts in the following sequence:
   - Install bolt (3) and hand tightened.
   - Install bolt (6) and hand tightened.
   - Install bolt (1) and hand tightened.
   - Tightened bolt (3) to 40 N·m (30 ft. lbs.).
   - Tightened bolt (6) to 55 N·m (41 ft. lbs.).
   - Tightened bolt (1) to 55 N·m (41 ft. lbs.).
   - Tightened bolt (5) to 55 N·m (41 ft. lbs.).



3. Remove the tape or plugs from the opened A/C suction line (2) and the A/C discharge line (3) and the A/C compressor (4).
4. Lubricate new rubber O-ring seals with clean refrigerant oil and install them and new gaskets onto the suction and the discharge line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
5. Connect the A/C suction and discharge lines onto the A/C compressor.
6. Install the nuts (1) that secure the A/C suction and discharge lines to the A/C compressor. Tighten the nuts to 23 N·m (17 ft. lbs.).
7. Connect the wire harness connector to the A/C compressor clutch coil.
8. Install the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/BELTS-DRIVE - INSTALLATION).



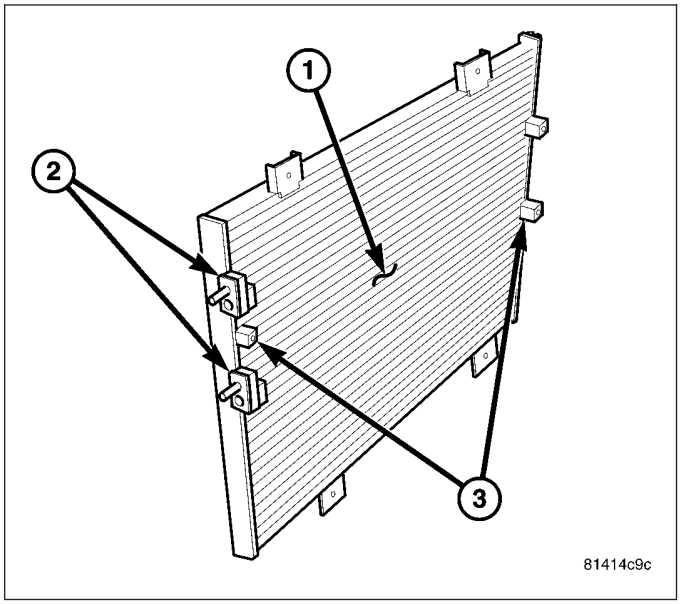
9. Install the resonator onto the engine.
10. Reconnect the negative battery cable.
11. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - FRONT - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
12. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - FRONT - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

CONDENSER-A/C

DESCRIPTION

The A/C condenser (1) is located in the front of the engine compartment behind the grille. The A/C condenser is a heat exchanger that allows the high-pressure refrigerant gas being discharged by the A/C compressor to give up its heat to the air passing over the condenser fins, which causes the refrigerant to cool and change to a liquid state.

The A/C condenser is equipped with tapping blocks for the A/C discharge line and the A/C liquid line (2) and mounting provisions for the power steering cooler (3).



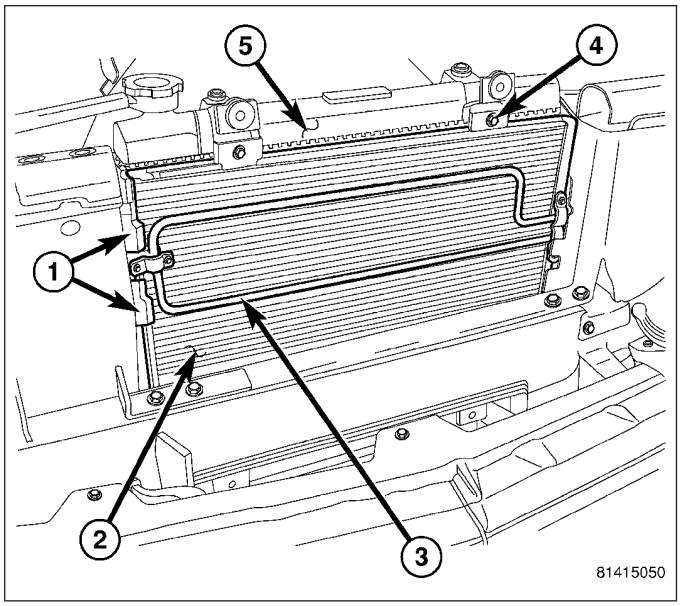
OPERATION

When air passes through the fins of the A/C condenser, the high-pressure refrigerant gas within the A/C condenser gives up its heat. The refrigerant then condenses as it leaves the A/C condenser and becomes a high-pressure liquid. The volume of air flowing over the condenser fins is critical to the proper cooling performance of the A/C system. Therefore, it is important that there are no objects placed in front of the radiator grille openings at the front of the vehicle or foreign material on the condenser fins that might obstruct proper air flow. Also, any factory-installed air seals or shrouds must be properly reinstalled following radiator or A/C condenser service.

The A/C condenser cannot be repaired and, if faulty or damaged, it must be replaced.

REMOVAL

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.



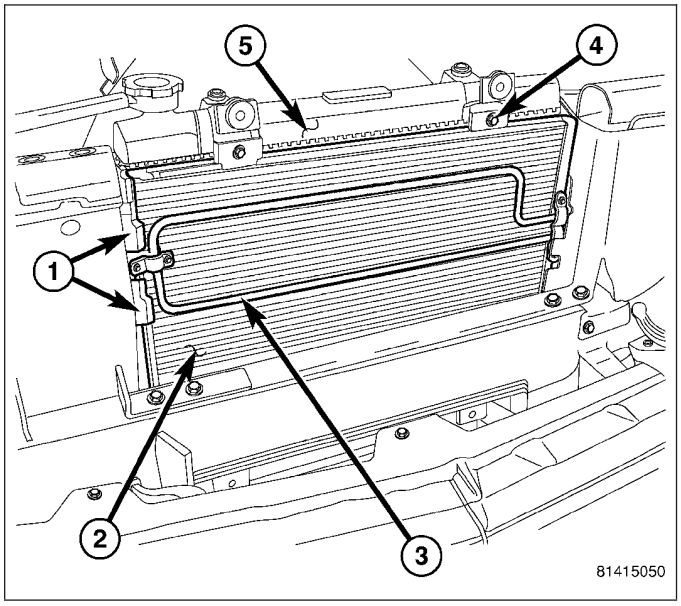
1. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
2. Disconnect and isolate the negative battery cable.

NOTE: It is not necessary to remove the hood latch from the upper radiator support when servicing the A/C condenser.

3. Remove the upper radiator support and position it out of the way (Refer to 23 - BODY/EXTERIOR/ RADIATOR CROSSMEMBER-UPPER - REMOVAL). .
4. Disconnect the A/C discharge line and the A/C liquid line from the tapping blocks (1) located on the right end of the A/C condenser (2) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ LINE-A/C DISCHARGE - REMOVAL) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LINE-A/C LIQUID - REMOVAL).
5. Remove the screws that secure the power steering cooler (3) to the A/C condenser and position the cooler out of the way.
6. Remove the four bolts (4) that secure the A/C condenser to the radiator (5).
7. Carefully push the radiator rearward and lift the A/C condenser out of the engine compartment.

INSTALLATION

NOTE: If the A/C condenser is being replaced, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.



1. Carefully push the radiator (5) rearward and position the A/C condenser (2) into the engine compartment.
2. Install the four bolts (4) that secure the A/C condenser to the radiator. Tighten the bolts to 4.5 N·m (40 in. lbs.).
3. Position the power steering cooler (3) onto the A/C condenser and install the retaining screws. Tighten the screws securely.
4. Connect the A/C discharge line and the A/C liquid line to the A/C condenser (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LINE-A/C DISCHARGE - INSTALLATION) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ LINE-A/C LIQUID - INSTALLATION).

NOTE: Make sure that the cable for the hood latch is correctly routed.

5. Install the upper radiator support (Refer to 23 - BODY/EXTERIOR/RADIATOR CROSSMEMBER-UPPER - INSTALLATION).
6. Reconnect the negative battery cable.
7. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

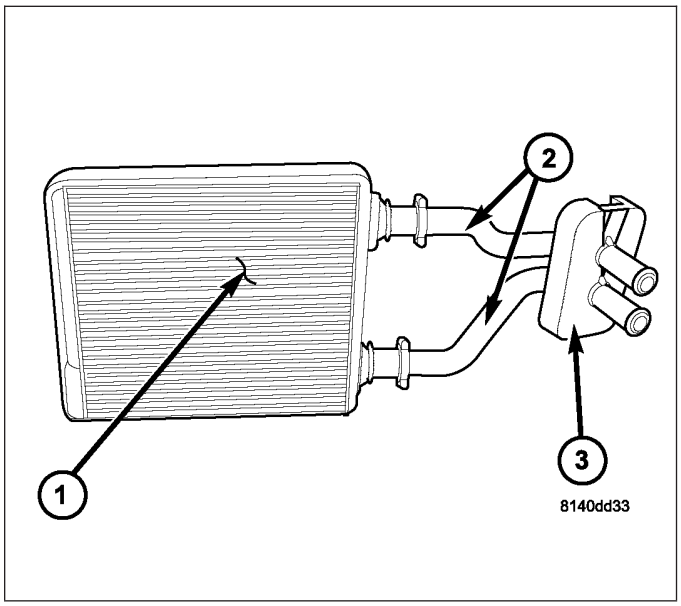
8. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

CORE-HEATER

DESCRIPTION

The heater core (1) for the heating-A/C system is located in the HVAC housing, behind the instrument panel. It is a heat exchanger made of rows of tubes with fins. The heater core is positioned within the HVAC housing so that only the selected amount of air entering the HVAC housing passes through the heater core before it is distributed through the heating-A/C system ducts and outlets. The heater core tubes (2) are attached to the side of the heater core and are secured to the HVAC housing by a removable flange (3).

The heater core can be serviced by removing the HVAC housing.



OPERATION

Engine coolant is circulated through the heater hoses to the heater core at all times. As the coolant flows through the heater core, heat is removed from the engine and is transferred to the heater core fins and tubes. Air directed through the heater core picks up the heat from the heater core fins. The blend-air door allows control of the heater output air temperature by regulating the amount of air flowing through the heater core within the HVAC housing. The blower motor speed controls the volume of air flowing through the HVAC housing.

The heater core cannot be repaired and, if faulty or damaged, it must be replaced.

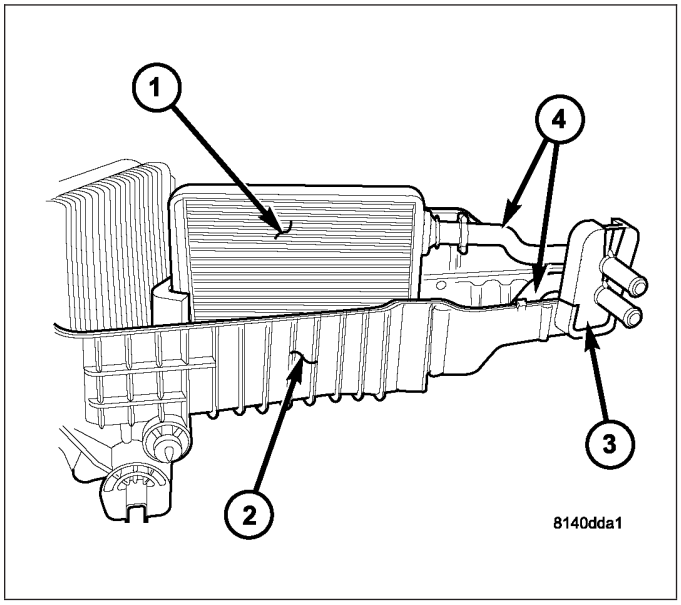
REMOVAL

1. Remove the HVAC housing and place it on a workbench (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - REMOVAL).
2. Disassemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - DISASSEMBLY).

NOTE: If the foam seal around the heater core is deformed or damaged, the seal must be replaced.

3. Carefully lift the heater core (1) out of the lower half of the HVAC housing (2).

NOTE: If the rubber flange around the heater core tubes is deformed or damaged, the flange must be replaced.



4. If required, remove the rubber flange (3) from around the heater core tubes (4).

INSTALLATION

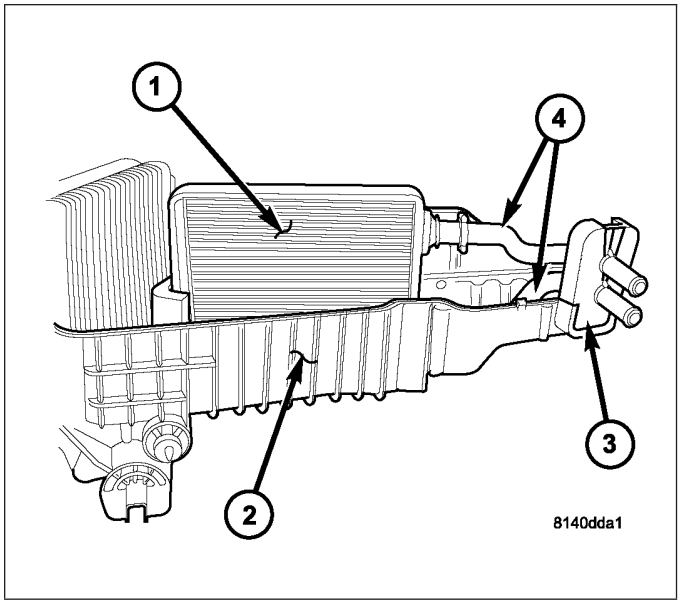
1. If removed, install the rubber flange (3) over the heater core tubes (4).

NOTE: Make sure that the foam seal and the rubber flange are properly positioned in the HVAC housing.

2. Carefully install the heater core (1) into the lower half of the HVAC housing (2).
3. Assemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - ASSEMBLY).

NOTE: If the heater core is being replaced, flush the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM CLEANING/REVERSE FLUSHING).

4. Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - INSTALLATION).



CORE-VALVE-SERVICE PORT

DESCRIPTION

Two refrigerant system service ports are used to recover/recycle/evacuate/charge and test the A/C refrigerant system. Unique sizes are used on the service ports for the R-134a refrigerant system to ensure the system is not accidentally contaminated with R-12 refrigerant or service equipment used for R-12 refrigerant.

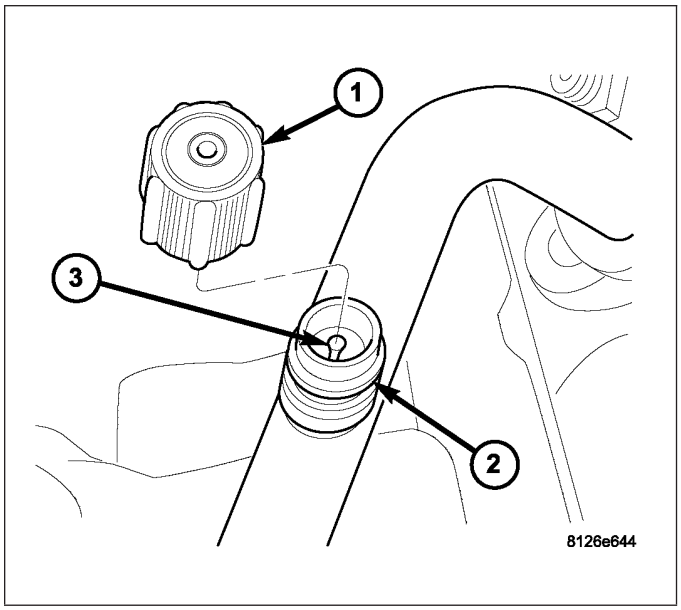
The high side service port is located on the A/C liquid line. The low side service port is located on the A/C accumulator. Both the high side and low side A/C service port valve cores are serviceable.

Each of the service ports has a threaded plastic protective cap installed over it from the factory. After servicing the refrigerant system, always reinstall both of the service port caps.

REMOVAL

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.

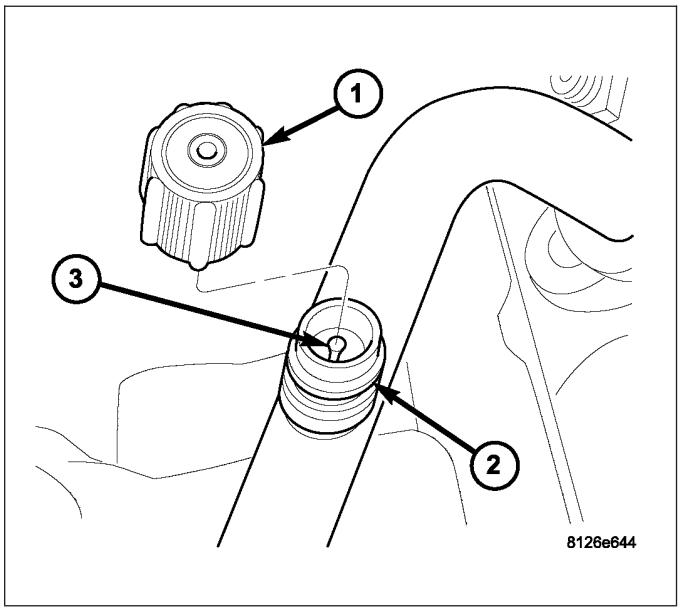
NOTE: Typical A/C service port shown.



1. Remove the protective cap (1) from the service port (2).
2. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Using a Schrader-type valve core tool, remove the valve core (3) from the service port.
4. Install a plug in or tape over the opened service port(s).

INSTALLATION

NOTE: Typical A/C service port shown.



1. Lubricate the valve core (3) with clean refrigerant oil prior to installation. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
2. Remove the tape or plug from the service port (2).

CAUTION: A valve core that is not fully seated in the A/C service port can result in damage to the valve during refrigerant system evacuation and charge. Such damage may result in a loss of system refrigerant while uncoupling the charge adapters.

3. Using a Schrader-type valve core tool, install and tighten the valve core into the service port(s).
4. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
5. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

NOTE: The protective cap helps aid in service port sealing and helps protects the refrigerant system from contamination. Remember to always reinstall the protective cap onto the service port when refrigerant system service is complete.

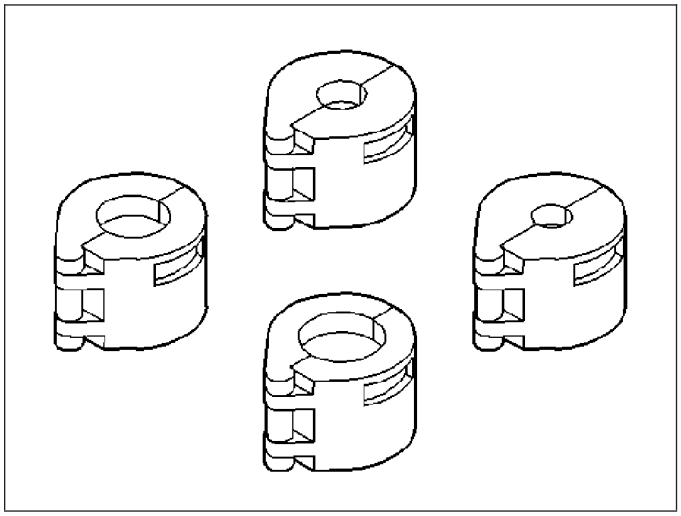
6. Install the protective cap (1) onto the service port.

COUPLER-REFRIGERANT LINE

DESCRIPTION

Spring-lock type refrigerant line couplers are used to connect the A/C accumulator and the A/C liquid line to the A/C evaporator. Secondary retaining clips are installed over the connected couplers for added protection.

The spring-lock refrigerant line couplers require A/C Line Disconnect Tools 7193 for disengaging the two coupler halves.



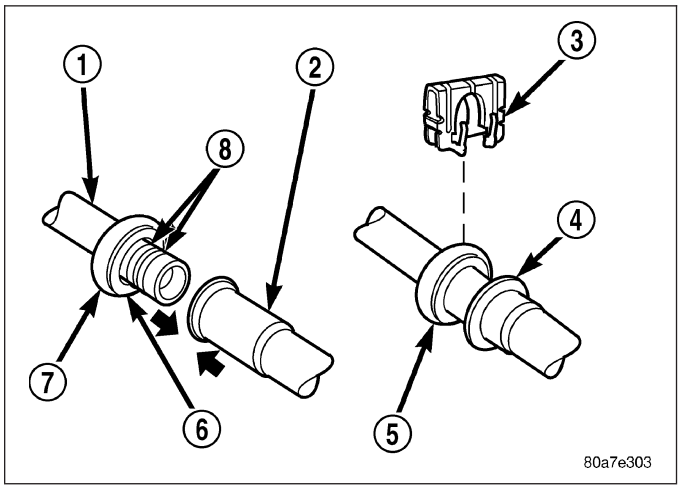
A/C Line Disconnect Tools 7193

OPERATION

The spring-lock type refrigerant line coupler is held together by a garter spring (6) inside a circular cage (7) on the male half of the fitting (1). When the two coupler halves are connected, the flared end of the female fitting (2) slips behind the garter spring inside the cage on the male fitting. The garter spring and cage prevent the flared end of the female fitting from pulling out of the cage. Some applications use a connection indicator ring (4) to help indicate when the two coupler halves are fully connected.

Two O-rings (8) are used to seal the coupler connections. These O-rings are compatible with R-134a refrigerant and must be replaced with O-rings made of the same material.

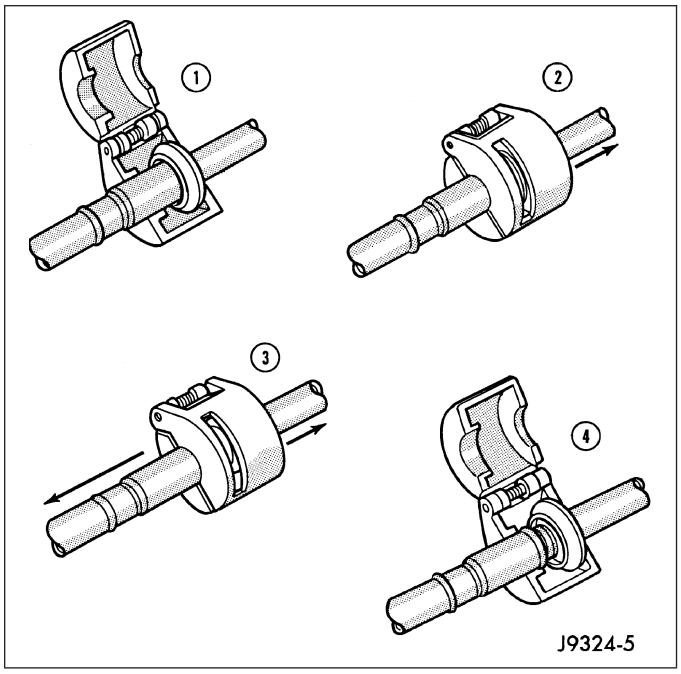
A secondary retaining clip (3) is installed over the connected coupler (5) for added protection.



REMOVAL

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.

1. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
2. Remove the secondary retaining clip from the spring-lock type refrigerant line coupler.
3. Fit the proper size A/C line disconnect tool (Special Tool Kit 7193 or equivalent) over the coupler cage (1).
4. Close the two halves of the A/C line disconnect tool around the coupler (2).

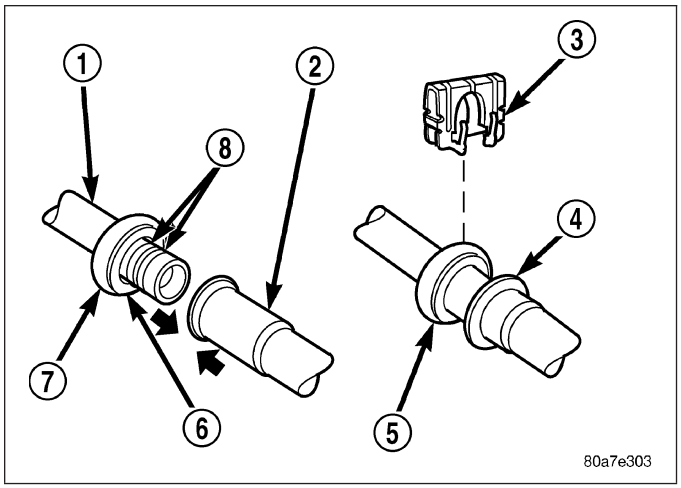


NOTE: The garter spring may not release if the A/C line disconnect tool is cocked while pushing it into the coupler cage opening.

5. Push the A/C line disconnect tool into the open side of the coupler cage to expand the garter spring (3). Once the garter spring is expanded, pull on the refrigerant line attached to the female half of the coupler until the flange on the female fitting is separated from the garter spring and cage on the male fitting.
6. Open and remove the A/C line disconnect tool from the refrigerant line coupler (4).

INSTALLATION

1. Clean any dirt or foreign material from the spring-lock type refrigerant line coupler.
2. Check to make sure that the garter spring (6) is located within the cage (7) of the male half of the refrigerant line coupler (1), and that the garter spring is not damaged.
   a. If the garter spring is missing, install a new spring by pushing it into the coupler cage opening.
   b. If the garter spring is damaged, remove it from the coupler cage with a small hook (DO NOT use a screwdriver) and install a new garter spring.



CAUTION: Use only the specified O-rings as they are made of a special material for the R-134a system. The use of any other O-rings may allow the connection to leak.

3. Install new O-rings (8) on the male half of the refrigerant line coupler.
4. Lubricate the O-rings, and the inside of the female half of the refrigerant line coupler (2) with clean R-134a refrigerant oil. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
5. Position the female half of the coupler over the male half of the coupler.
6. Push together firmly on the two halves of the refrigerant line coupler until the garter spring in the cage on the male half of the coupler snaps over the flanged end on the female half of the coupler.
7. Make sure that the refrigerant line coupler is fully engaged by firmly pulling the refrigerant lines away from each other on both sides of the coupler.
8. Install the secondary retaining clip (3) over connected coupler cage (5).
9. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

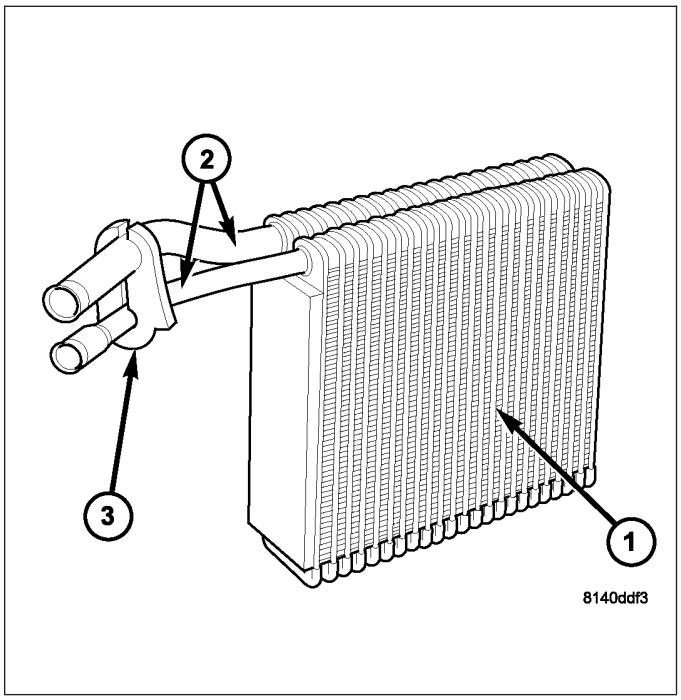
10. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

EVAPORATOR-A/C

DESCRIPTION

The A/C evaporator (1) for the heating-A/C system is located within the HVAC housing, behind the instrument panel. The A/C evaporator is positioned in the HVAC housing so that all air entering the housing must pass over the evaporator fins before it is distributed through the heating-A/C system ducts and outlets. However, air passing over the evaporator fins will only be conditioned when the A/C compressor is engaged and circulating refrigerant through the A/C evaporator. The evaporator tubes (2) are attached to the side of the A/C evaporator and are secured to the HVAC housing by a removable flange (3).

The A/C evaporator can be serviced by removing and disassembling the HVAC housing assembly.



OPERATION

Refrigerant enters the A/C evaporator through the A/C orice tube as a low-temperature, low-pressure mixture of liquid and gas. As air flows over the fins of the A/C evaporator, the humidity in the air condenses on the fins, and the heat from the air is absorbed by the refrigerant. Heat absorption causes the refrigerant to boil and vaporize. The refrigerant becomes a low-pressure gas when it leaves the A/C evaporator.

The A/C evaporator cannot be repaired and, if faulty or damaged, it must be replaced.

REMOVAL

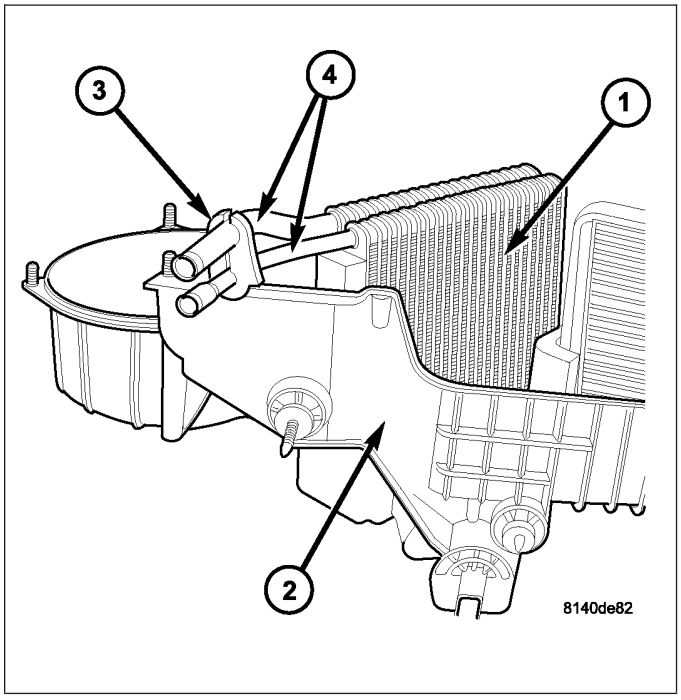
1. Remove the HVAC housing and place it on a workbench (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - REMOVAL).
2. Disassemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - DISASSEMBLY).

NOTE: Inspect the evaporator seal located in the upper half of the HVAC housing. If the seal is damaged or deformed, the seal must be replaced.

3. Carefully lift the A/C evaporator (1) out of the lower half of the HVAC housing (2).

NOTE: If the rubber flange around the evaporator tubes is deformed or damaged, the flange must be replaced.

4. If required, remove the rubber flange (3) from around the evaporator tubes (4).



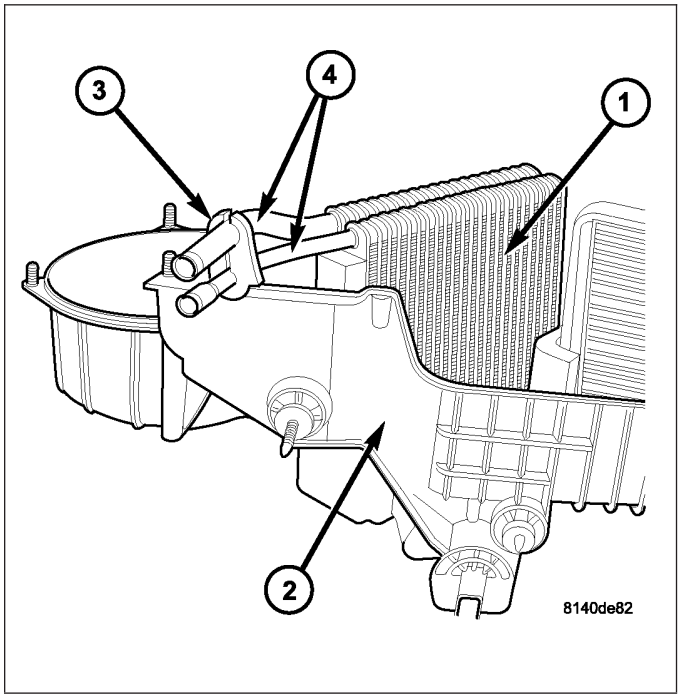
INSTALLATION

NOTE: If the A/C evaporator is being replaced, add 60 milliliters (2 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

1. If removed, install the rubber flange (3) over the evaporator tubes (4).

NOTE: Make sure that the evaporator drain is clean and unrestricted and that the rubber seal and the rubber flange are properly positioned in the HVAC housings.

2. Carefully install the A/C evaporator (1) into the lower half of the HVAC housing (2).
3. Assemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - ASSEMBLY).
4. Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - INSTALLATION).



LINE-A/C DISCHARGE

DESCRIPTION

The A/C discharge line is the refrigerant line that carries refrigerant from the A/C compressor to the A/C condenser.

CAUTION: Use only O-ring seals specified for the vehicle. Failure to use the correct O-ring seal will cause the refrigerant system connections to leak.

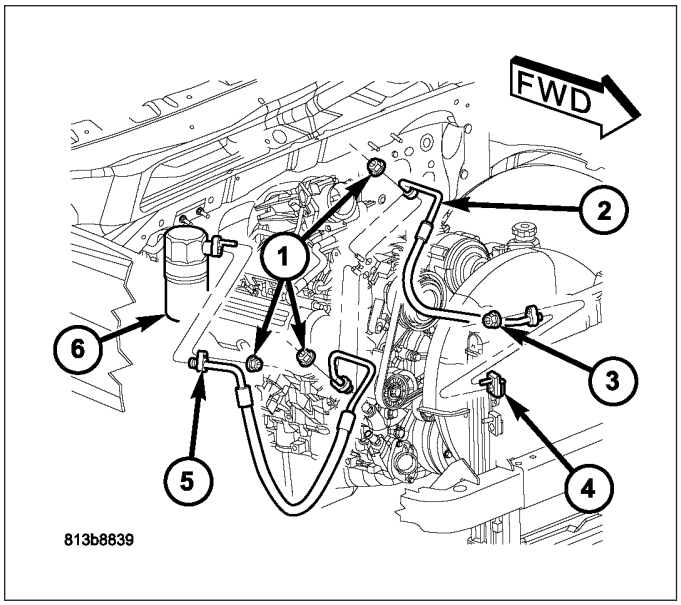
The A/C discharge line has no serviceable parts except for the rubber O-ring seals and gaskets. The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant. The O-ring seals and gaskets must be replaced whenever the A/C discharge line is removed and installed.

If the A/C discharge line is found to be leaking or is damaged, it must be replaced.

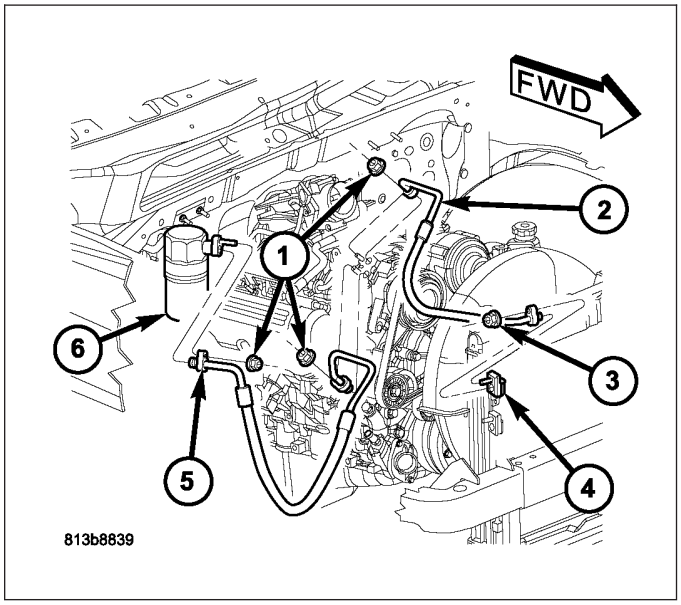
REMOVAL

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.

1. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
2. Disconnect and isolate the negative battery cable.
3. Remove the nut (1) that secures the A/C discharge line (3) to the A/C condenser (4).
4. Disconnect the A/C discharge line from the A/C condenser and remove and discard the O-ring seal and gasket.
5. Remove the nut (1) that secures the A/C discharge line to the A/C compressor.
6. Disconnect the A/C discharge line from the A/C compressor and remove and discard the O-ring seal and gasket.
7. Install plugs in, or tape over the discharge line fittings and the condenser and compressor ports.
8. Remove the A/C discharge line from the engine compartment.



INSTALLATION



1. Position the A/C discharge line (2) into the engine compartment.
2. Remove the tape or plugs from the opened discharge line fittings and the condenser and compressor ports
3. Lubricate new rubber O-ring seals with clean refrigerant oil and install them and new gaskets onto the discharge line fittings. Use only the specified O-ring as it is made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
4. Install the A/C discharge line to the A/C compressor.
5. Install the nut (1) that secures the A/C discharge line to the A/C compressor. Tighten the nut to 23 N·m (17 ft. lbs.).
6. Install the A/C discharge line to the A/C condenser (4).
7. Install the nut (3) that secures the A/C discharge line to the A/C condenser. Tighten the nut to 20 N·m (15 ft. lbs.).
8. Reconnect the negative battery cable.
9. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
10. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

LINE-A/C LIQUID

DESCRIPTION

The A/C liquid line is the refrigerant line that carries refrigerant from the A/C condenser to the A/C evaporator. The A/C liquid line uses a spring-lock type refrigerant line coupler to connect it to the A/C evaporator (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT LINE COUPLER - DESCRIPTION). The A/C liquid line is made from light-weight aluminum and uses braze-less fittings.

The A/C liquid line includes the high-side service port, the fixed A/C orifice tube and a fitting for the A/C pressure transducer. For more information refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/SERVICE PORT VALVE CORE - DESCRIPTION, 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C ORIFICE TUBE - DESCRIPTION and 24 - HEATING & AIR CONDITIONING/CONTROLS/TRANSDUCER-A/C PRESSURE - DESCRIPTION.

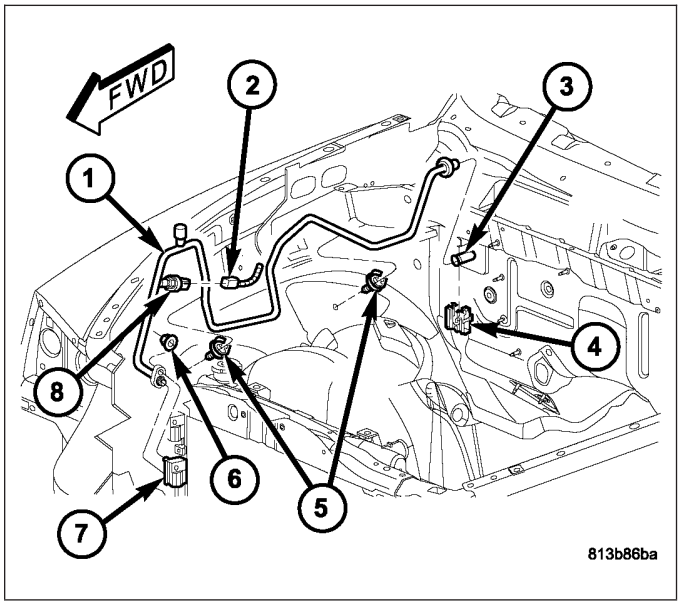
CAUTION: Use only O-ring seals specified for the vehicle. Failure to use the correct O-ring seal will cause the refrigerant system connections to leak.

The A/C liquid line has no serviceable parts except for the rubber O-ring seals and gasket, high-side service port valve, cap and secondary retaining clip. The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant. The O-ring seals and gasket must be replaced whenever the A/C liquid line is removed and installed.

If the A/C liquid line is found to be leaking or is damaged, it must be replaced.

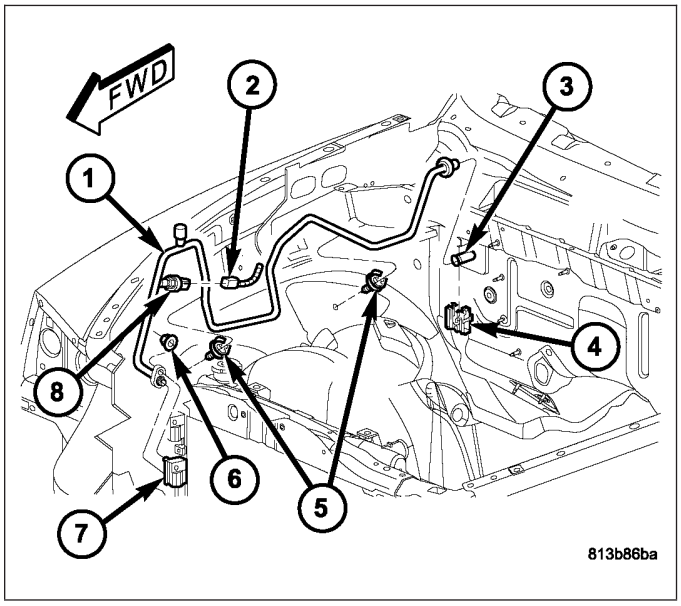
REMOVAL

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.



1. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
2. Disconnect and isolate the negative battery cable.
3. Disconnect the wire harness connector (2) from the A/C pressure transducer (8).
4. Remove the air filter housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR FILTER HOUSING - REMOVAL).
5. Remove the nut (6) that secures the A/C liquid line (1) to the condenser outlet port (7).
6. Disconnect the A/C liquid line from the A/C condenser and remove and discard the O-ring seal and gasket.
7. Disengage the A/C liquid line from the body retaining clips (5).
8. Remove the secondary retaining clip (4) from the spring-lock coupler that secures the A/C liquid line to evaporator inlet tube (3).
9. Using the proper A/C line disconnect tool, disconnect the A/C liquid line from the evaporator inlet tube and remove and discard the O-ring seals (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COUPLER-REFRIGERANT LINE - REMOVAL).
10. Install plugs in, or tape over the opened ends of the A/C liquid line and the condenser and evaporator ports.
11. Remove the A/C liquid line from the engine compartment.
12. If required , remove the A/C pressure transducer from the A/C liquid line (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/TRANSDUCER-A/C PRESSURE - REMOVAL).

INSTALLATION



1. If removed, install the A/C pressure transducer (8) onto the A/C liquid line (1).
2. Position the A/C liquid line into the engine compartment.
3. Remove the tape or plugs from the opened ends of the A/C liquid line and the condenser and evaporator ports.
4. Lubricate new O-ring seals with clean refrigerant oil and install them onto the liquid line spring-lock coupler fitting. Use only the specified O-ring seals as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
5. Connect the A/C liquid line to the evaporator inlet tube (3) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COUPLER-REFRIGERANT LINE - INSTALLATION).

6. Install the secondary retaining clip (4) onto the spring-lock coupler that secures the A/C liquid line to the evaporator inlet tube.
7. Engage the A/C liquid line into the body retaining clips (5).
8. Lubricate a new O-ring seal with clean refrigerant oil and install it and a new gasket onto the liquid line fitting. Use only the specified O-ring seal as it is made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
9. Connect the A/C liquid line to the condenser outlet port (7).
10. Install the nut (6) that secures the A/C liquid line to the condenser outlet port. Tighten the nut to 20 N·m (15 ft. lbs.).
11. Install the air filter housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR FILTER HOUSING - INSTALLATION).
12. Connect the wire harness connector (2) to the A/C pressure transducer.
13. Reconnect the negative battery cable.
14. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
15. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

LINE-A/C SUCTION

DESCRIPTION

The A/C suction line is the refrigerant line that carries refrigerant from the A/C accumulator to the A/C compressor.

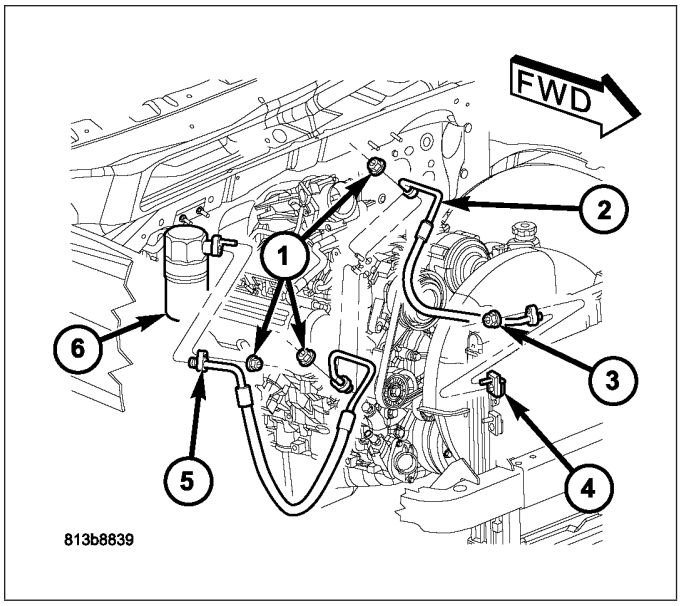
CAUTION: Use only O-ring seals specified for the vehicle. Failure to use the correct O-ring seals will cause the refrigerant system connections to leak.

The A/C suction line has no serviceable parts except for the rubber O-ring seals and gaskets. The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant. The O-ring seals and gaskets must be replaced whenever the A/C suction line is removed and installed.

If the A/C suction line is found to be leaking or is damaged, it must be replaced.

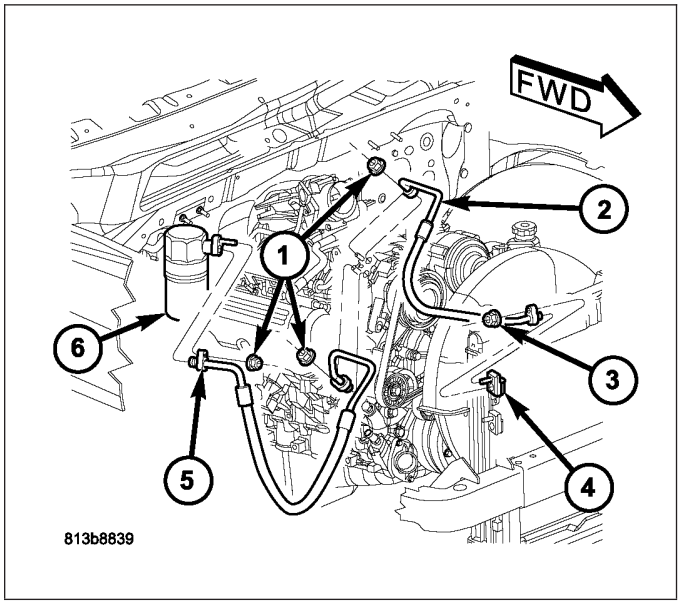
REMOVAL

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.



1. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
2. Disconnect and isolate the negative battery cable.
3. Remove the resonator from the engine.
4. Remove the nut (1) that secures the A/C suction line (5) to the A/C accumulator (6).
5. Disconnect the A/C suction line from the A/C accumulator and remove and discard the O-ring seal and gasket.
6. Remove the nut (1) that secures the A/C suction line to the A/C compressor.
7. Disconnect the A/C suction line from the A/C compressor and remove and discard the O-ring seal and gasket.
8. Install plugs in, or tape over the suction line fittings and the accumulator and compressor ports.
9. Remove the A/C suction line from the engine compartment.

INSTALLATION



1. Position the A/C suction line (5) into the engine compartment.
2. Remove the tape or plugs from the opened suction line fittings and the accumulator and compressor ports.
3. Lubricate new rubber O-ring seals with clean refrigerant oil and install them and new gaskets onto the suction line fittings. Use only the specified O-ring as it is made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
4. Install the A/C suction line to the A/C compressor.
5. Install the nut (1) that secures the A/C suction line to the A/C compressor. Tighten the nut to 23 N·m (17 ft. lbs.).
6. Install the A/C suction line to the A/C accumulator (6).
7. Install the nut (1) that secures the A/C suction line to the A/C accumulator. Tighten the nut to 20 N·m (15 ft. lbs.).
8. Install the resonator onto the engine.
9. Reconnect the negative battery cable.
10. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
11. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

OIL-A/C REFRIGERANT

DESCRIPTION

The refrigerant oil used in R-134a refrigerant systems is a synthetic-based, polyalkylene glycol (PAG), wax-free lubricant. Mineral-based R-12 refrigerant oils are not compatible with PAG oils, and should never be introduced to an R-134a refrigerant system.

There are different PAG oils available, and each contains a different additive package. The Denso 10S17 A/C compressor used in this vehicle is designed to use ND-8 PAG refrigerant oil. Use only this type of refrigerant oil in the refrigerant system.

OPERATION

After performing any refrigerant recovery or recycling operation, always replenish the refrigerant system with the same amount of the recommended refrigerant oil as was removed. Too little refrigerant oil can cause A/C compressor damage, and too much can reduce A/C system performance.

PAG refrigerant oil is more hygroscopic than mineral oil, and will absorb any moisture it comes into contact with, even moisture in the air. The PAG oil container should always be kept tightly capped until it is ready to be used. After use, recap the oil container immediately to prevent moisture contamination.

STANDARD PROCEDURE

REFRIGERANT OIL LEVEL

When an A/C system is assembled at the factory, all components except the A/C compressor are refrigerant oil free. After the refrigerant system has been charged and operated, the refrigerant oil in the A/C compressor is dispersed throughout the refrigerant system. The A/C accumulator, A/C condenser, A/C evaporator and the A/C compressor will each retain a significant amount of the needed refrigerant oil.

It is important to have the correct amount of refrigerant oil in the A/C system. This ensures proper lubrication of the A/C compressor. Too little oil will result in damage to the A/C compressor, while too much oil will reduce the cooling capacity of the A/C system and consequently result in higher discharge air temperatures.

CAUTION: The oil used in the Denso 10S17 A/C compressor is ND-8 PAG R-134a refrigerant oil. Only refrigerant oil of the same type should be used to service the A/C system. Do not use any other refrigerant oil. The oil container should be kept tightly capped until it is ready for use and then tightly capped after use to prevent contamination from dirt and moisture. Refrigerant oil will quickly absorb any moisture it comes in contact with, therefore, special effort must be used to keep all R-134a system components moisture-free. Moisture in the refrigerant oil is very difficult to remove and will cause a reliability problem with the A/C compressor.

NOTE: Most reclaim/recycling equipment will measure the lubricant being removed during recovery. This amount of lubricant should be added back into the system. Refer to the reclaim/recycling equipment manufacturers instructions.

It will not be necessary to check the oil level in the A/C compressor or to add oil, unless there has been an oil loss. An oil loss may occur due to a rupture or leak from a refrigerant line, a connector fitting, a component, or a component seal. If a leak occurs, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system after the repair has been made. Refrigerant oil loss will be evident at the leak point by the presence of a wet, shiny surface around the leak.

Refrigerant oil must be added when an A/C accumulator, A/C condenser or an A/C evaporator is replaced. See the Refrigerant Oil Capacities chart. When an A/C compressor is replaced, the refrigerant oil must be drained from the old compressor and measured. Drain all of the refrigerant oil from the new A/C compressor, then fill the new compressor with the same amount of refrigerant oil that was drained out of the old compressor.

REFRIGERANT OIL CAPACITIES

Component	ml	fl oz
Total System Fill	210	7.1
A/C Accumulator	90	3
A/C Condenser	30	1
A/C Evaporator	60	2
A/C Compressor	Drain and measure the oil from the old compressor - see text.	

REFRIGERANT-A/C

DESCRIPTION

The refrigerant used in this air conditioning system is a HydroFluoroCarbon (HFC), type R-134a. Unlike R-12, which is a ChloroFluoroCarbon (CFC), R-134a refrigerant does not contain ozone-depleting chlorine. R-134a refrigerant is a non-toxic, non-flammable, clear, and colorless liquefied gas.

Even though R-134a does not contain chlorine, it must be reclaimed and recycled just like CFC-type refrigerants. This is because R-134a is a greenhouse gas and can contribute to global warming.

OPERATION

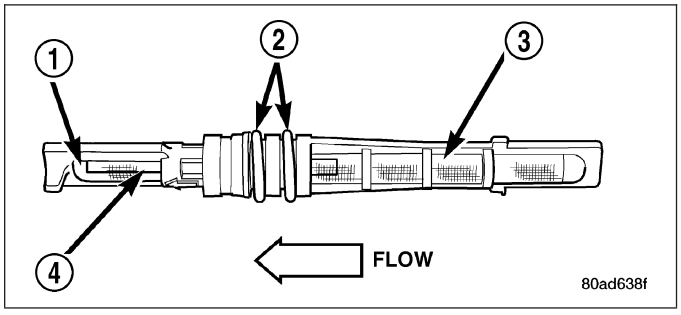
R-134a refrigerant is not compatible with R-12 refrigerant in an A/C system. Even a small amount of R-12 refrigerant added to an R-134a refrigerant system will cause A/C compressor failure, refrigerant oil sludge or poor A/C system performance. In addition, the polyalkylene glycol (PAG) synthetic refrigerant oils used in an R-134a refrigerant system are not compatible with the mineral-based refrigerant oils used in an R-12 refrigerant system.

R-134a refrigerant system service ports, service tool couplers and refrigerant dispensing bottles have all been designed with unique fittings to ensure that an R-134a refrigerant system is not accidentally contaminated with the wrong refrigerant (R-12). There are also labels posted in the engine compartment of the vehicle and on the A/C compressor to identify that the A/C system is equipped with R-134a refrigerant.

TUBE-A/C ORIFICE

DESCRIPTION

The fixed A/C orifice tube is installed in the A/C liquid line and provides a restriction in the liquid refrigerant line between the A/C condenser and the A/C evaporator. This restriction established the pressure differential between the high and low-pressure sides of the A/C system. The A/C orifice tube includes a diffuser screen (1), O-ring seals (2) to seal it to the inner wall of the A/C liquid line, an inlet filter screen (3) and the fixed orifice (4).



OPERATION

The fixed A/C orifice tube is used to meter the flow of liquid refrigerant into the A/C evaporator. The high-pressure liquid refrigerant from the A/C condenser expands into a low-pressure liquid as it passes through the metering orifice and diffuser screen of the A/C orifice tube.

The A/C orifice tube is not serviceable. The A/C orifice tube cannot be repaired and, if faulty or plugged, it must be replaced as part of the A/C liquid line.

DIAGNOSIS AND TESTING

A/C ORIFICE TUBE

WARNING: The A/C liquid line between the A/C condenser and the A/C orifice tube can become hot enough to burn the skin. Use extreme caution when performing the following test to prevent possible personal injury.

NOTE: The A/C orifice tube can be checked for proper operation using the following procedure. However, the A/C orifice tube is only serviced as a part of the A/C liquid line. If the results of this test indicate that the A/C orifice tube is obstructed or missing, the A/C liquid line must be replaced.

1. Confirm that the refrigerant system is properly charged. (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING - A/C PERFORMANCE)
2. Start the engine. Turn on the A/C system and confirm that the compressor clutch is engaged.
3. Allow the A/C system to operate for five minutes.
4. Lightly and cautiously touch the A/C liquid line near the condenser outlet at the front of the engine compartment. The A/C liquid line should be hot to the touch.
5. Touch the A/C liquid line near the evaporator inlet at the rear of the engine compartment. The A/C liquid line should be cold to the touch.
6. If there is a distinct temperature differential between the two ends of the A/C liquid line, the A/C orifice tube is in good condition. If there is little or no detectable temperature differential between the two ends of the A/C liquid line, the A/C orifice tube is obstructed or missing and the A/C liquid line must be replaced (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LINE-A/C LIQUID - REMOVAL).

EMISSIONS CONTROL

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EMISSIONS

DESCRIPTION

DESCRIPTION - TASK MANAGER

The PCM is responsible for efficiently coordinating the operation of all the emissions-related components. The PCM is also responsible for determining if the diagnostic systems are operating properly. The software designed to carry out these responsibilities is call the 'Task Manager'.

DESCRIPTION - MONITORED SYSTEMS

There are new electronic circuit monitors that check fuel, emission, engine and ignition performance. These monitors use information from various sensor circuits to indicate the overall operation of the fuel, engine, ignition and emission systems and thus the emissions performance of the vehicle.

The fuel, engine, ignition and emission systems monitors do not indicate a specific component problem. They do indicate that there is an implied problem within one of the systems and that a specific problem must be diagnosed.

If any of these monitors detect a problem affecting vehicle emissions, the Malfunction Indicator Lamp (MIL) will be illuminated. These monitors generate Diagnostic Trouble Codes that can be displayed with the MIL or a scan tool.

The following is a list of the system monitors:

- Misfire Monitor
- Fuel System Monitor
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Catalyst Monitor
- Leak Detection Pump Monitor (if equipped)

All these system monitors require two consecutive trips with the malfunction present to set a fault.

Refer to the appropriate Powertrain Diagnostics Procedures manual for diagnostic procedures.

The following is an operation and description of each system monitor :

OXYGEN SENSOR (O2S) MONITOR

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The O2S is also the main sensing element for the Catalyst and Fuel Monitors.

The O2S can fail in any or all of the following manners:

- slow response rate
- reduced output voltage
- dynamic shift
- shorted or open circuits

Response rate is the time required for the sensor to switch from lean to rich once it is exposed to a richer than optimum A/F mixture or vice versa. As the sensor starts malfunctioning, it could take longer to detect the changes in the oxygen content of the exhaust gas.

The output voltage of the O2S ranges from 0 to 1 volt. A good sensor can easily generate any output voltage in this range as it is exposed to different concentrations of oxygen. To detect a shift in the A/F mixture (lean or rich), the output voltage has to change beyond a threshold value. A malfunctioning sensor could have difficulty changing beyond the threshold value.

OXYGEN SENSOR HEATER MONITOR

If there is an oxygen sensor (O2S) shorted to voltage DTC, as well as a O2S heater DTC, the O2S fault MUST be repaired first. Before checking the O2S fault, verify that the heater circuit is operating correctly.

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572 ° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The voltage readings taken from the O2S sensor are very temperature sensitive. The readings are not accurate below 300°C. Heating of the O2S sensor is done to allow the engine controller to shift to closed loop control as soon as possible. The heating element used to heat the O2S sensor must be tested to ensure that it is heating the sensor properly.

The O2S sensor circuit is monitored for a drop in voltage. The sensor output is used to test the heater by isolating the effect of the heater element on the O2S sensor output voltage from the other effects.

LEAK DETECTION PUMP MONITOR (IF EQUIPPED)

The leak detection assembly incorporates two primary functions: it must detect a leak in the evaporative system and seal the evaporative system so the leak detection test can be run.

The primary components within the assembly are: A three port solenoid that activates both of the functions listed above; a pump which contains a switch, two check valves and a spring/diaphragm, a canister vent valve (CVV) seal which contains a spring loaded vent seal valve.

Immediately after a cold start, between predetermined temperature thresholds limits, the three port solenoid is briefly energized. This initializes the pump by drawing air into the pump cavity and also closes the vent seal. During non test conditions the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling due to the reed switch triggering of the three port solenoid that prevents the diaphragm assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized allowing atmospheric pressure to enter the pump cavity, thus permitting the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

Pump Mode: The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test length.

Test Mode: The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the Switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5” H20. The cycle rate of pump strokes is quite rapid as the system begins to pump up to this pressure. As the pressure increases, the cycle rate starts to drop off. If there is no leak in the system, the pump would eventually stop pumping at the equalized pressure. If there is a leak, it will continue to pump at a rate representative of the flow characteristic of the size of the leak. From this information we can determine if the leak is larger than the required detection limit (currently

set at .040" orifice by CARB). If a leak is revealed during the leak test portion of the test, the test is terminated at the end of the test mode and no further system checks will be performed.

After passing the leak detection phase of the test, system pressure is maintained by turning on the LDP's solenoid until the purge system is activated. Purge activation in effect creates a leak. The cycle rate is again interrogated and when it increases due to the flow through the purge system, the leak check portion of the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

Evaporative system functionality will be verified by using the stricter evap purge flow monitor. At an appropriate warm idle the LDP will be energized to seal the canister vent. The purge flow will be clocked up from some small value in an attempt to see a shift in the 02 control system. If fuel vapor, indicated by a shift in the 02 control, is present the test is passed. If not, it is assumed that the purge system is not functioning in some respect. The LDP is again turned off and the test is ended.

MISFIRE MONITOR

Excessive engine misfire results in increased catalyst temperature and causes an increase in HC emissions. Severe misfires could cause catalyst damage. To prevent catalytic convertor damage, the PCM monitors engine misfire.

The Powertrain Control Module (PCM) monitors for misfire during most engine operating conditions (positive torque) by looking at changes in the crankshaft speed. If a misfire occurs the speed of the crankshaft will vary more than normal.

FUEL SYSTEM MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide. The catalyst works best when the Air Fuel (A/F) ratio is at or near the optimum of 14.7 to 1.

The PCM is programmed to maintain the optimum air/fuel ratio of 14.7 to 1. This is done by making short term corrections in the fuel injector pulse width based on the O2S sensor output. The programmed memory acts as a self calibration tool that the engine controller uses to compensate for variations in engine specifications, sensor tolerances and engine fatigue over the life span of the engine. By monitoring the actual fuel-air ratio with the O2S sensor (short term) and multiplying that with the program long-term (adaptive) memory and comparing that to the limit, it can be determined whether it will pass an emissions test. If a malfunction occurs such that the PCM cannot maintain the optimum A/F ratio, then the MIL will be illuminated.

CATALYST MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide.

Normal vehicle miles or engine misfire can cause a catalyst to decay. This can increase vehicle emissions and deteriorate engine performance, driveability and fuel economy.

The catalyst monitor uses dual oxygen sensors (O2S's) to monitor the efficiency of the converter. The dual O2S's sensor strategy is based on the fact that as a catalyst deteriorates, its oxygen storage capacity and its efficiency are both reduced. By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream O2S is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. The PCM calculates the A/F mixture from the output of the O2S. A low voltage indicates high oxygen content (lean mixture). A high voltage indicates a low content of oxygen (rich mixture).

When the upstream O2S detects a lean condition, there is an abundance of oxygen in the exhaust gas. A functioning converter would store this oxygen so it can use it for the oxidation of HC and CO. As the converter absorbs the oxygen, there will be a lack of oxygen downstream of the converter. The output of the downstream O2S will indicate limited activity in this condition.

As the converter loses the ability to store oxygen, the condition can be detected from the behavior of the downstream O2S. When the efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same downstream as upstream. The output voltage of the downstream O2S copies the voltage of the upstream sensor. The only difference is a time lag (seen by the PCM) between the switching of the O2S's.

To monitor the system, the number of lean-to-rich switches of upstream and downstream O2S's is counted. The ratio of downstream switches to upstream switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer downstream switches than it has upstream switches i.e., a ratio closer to zero. For a totally ineffective catalyst, this ratio will be one-to-one, indicating that no oxidation occurs in the device.

The system must be monitored so that when catalyst efficiency deteriorates and exhaust emissions increase to over the legal limit, the MIL will be illuminated.

DESCRIPTION - TRIP DEFINITION

The term “Trip” has different meanings depending on what the circumstances are. If the MIL (Malfunction Indicator Lamp) is OFF, a Trip is defined as when the Oxygen Sensor Monitor and the Catalyst Monitor have been completed in the same drive cycle.

When any Emission DTC is set, the MIL on the dash is turned ON. When the MIL is ON, it takes 3 good trips to turn the MIL OFF. In this case, it depends on what type of DTC is set to know what a “Trip” is.

For the Fuel Monitor or Mis-Fire Monitor (continuous monitor), the vehicle must be operated in the “Similar Condition Window” for a specified amount of time to be considered a Good Trip.

If a Non-Contiuous OBDII Monitor fails twice in a row and turns ON the MIL, re-running that monitor which previously failed, on the next start-up and passing the monitor, is considered to be a Good Trip. These will include the following:

- Oxygen Sensor
- Catalyst Monitor
- Purge Flow Monitor
- Leak Detection Pump Monitor (if equipped)
- EGR Monitor (if equipped)
- Oxygen Sensor Heater Monitor

If any other Emission DTC is set (not an OBDII Monitor), a Good Trip is considered to be when the Oxygen Sensor Monitor and Catalyst Monitor have been completed; or 2 Minutes of engine run time if the Oxygen Sensor Monitor or Catalyst Monitor have been stopped from running.

It can take up to 2 Failures in a row to turn on the MIL. After the MIL is ON, it takes 3 Good Trips to turn the MIL OFF. After the MIL is OFF, the PCM will self-erase the DTC after 40 Warm-up cycles. A Warm-up cycle is counted when the ECT (Engine Coolant Temperature Sensor) has crossed 160°F and has risen by at least 40°F since the engine has been started.

DESCRIPTION - COMPONENT MONITORS

There are several components that will affect vehicle emissions if they malfunction. If one of these components malfunctions the Malfunction Indicator Lamp (MIL) will illuminate.

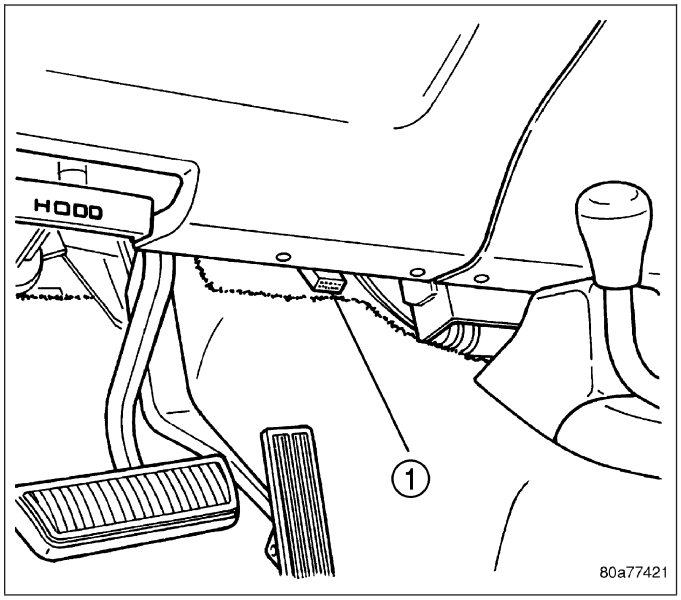
Some of the component monitors are checking for proper operation of the part. Electrically operated components now have input (rationality) and output (functionality) checks. Previously, a component like the Throttle Position sensor (TPS) was checked by the PCM for an open or shorted circuit. If one of these conditions occurred, a DTC was set. Now there is a check to ensure that the component is working. This is done by watching for a TPS indication of a greater or lesser throttle opening than MAP and engine rpm indicate. In the case of the TPS, if engine vacuum is high and engine rpm is 1600 or greater, and the TPS indicates a large throttle opening, a DTC will be set. The same applies to low vacuum if the TPS indicates a small throttle opening.

All open/short circuit checks, or any component that has an associated limp-in, will set a fault after 1 trip with the malfunction present. Components without an associated limp-in will take two trips to illuminate the MIL.

OPERATION

OPERATION

The Powertrain Control Module (PCM) monitors many different circuits in the fuel injection, ignition, emission and engine systems. If the PCM senses a problem with a monitored circuit often enough to indicate an actual problem, it stores a Diagnostic Trouble Code (DTC) in the PCM's memory. If the problem is repaired or ceases to exist, the PCM cancels the code after 40 warm-up cycles. Diagnostic trouble codes that affect vehicle emissions illuminate the Malfunction Indicator Lamp (MIL). The MIL is displayed as an engine icon (graphic) on the instrument panel. Refer to Malfunction Indicator Lamp in this section.



Certain criteria must be met before the PCM stores a DTC in memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

The PCM might not store a DTC for a monitored circuit even though a malfunction has occurred. This may happen because one of the DTC criteria for the circuit has not been met. **For example,** assume the diagnostic trouble code criteria requires the PCM to monitor the circuit only when the engine operates between 750 and 2000 RPM. Suppose the sensor's output circuit shorts to ground when engine operates above 2400 RPM (resulting in 0 volt input to the PCM). Because the condition happens at an engine speed above the maximum threshold (2000 rpm), the PCM will not store a DTC.

There are several operating conditions for which the PCM monitors and sets DTC's. Refer to Monitored Systems, Components, and Non-Monitored Circuits in this section.

Technicians must retrieve stored DTC's by connecting a diagnostic scan tool to the 16–way data link connector. The connector is located on the bottom edge of the instrument panel (1) near the steering column.

NOTE: Various diagnostic procedures may actually cause a diagnostic monitor to set a DTC. For instance, pulling a spark plug wire to perform a spark test may set the misfire code. When a repair is completed and verified, connect the diagnostic scan tool to the 16–way data link connector to erase all DTC's and extinguish the MIL.

OPERATION - TASK MANAGER

The Task Manager determines which tests happen when and which functions occur when. Many of the diagnostic steps required by OBD II must be performed under specific operating conditions. The Task Manager software organizes and prioritizes the diagnostic procedures. The job of the Task Manager is to determine if conditions are appropriate for tests to be run, monitor the parameters for a trip for each test, and record the results of the test. Following are the responsibilities of the Task Manager software:

- Test Sequence
- MIL Illumination
- Diagnostic Trouble Codes (DTCs)
- Trip Indicator
- Freeze Frame Data Storage
- Similar Conditions Window

Test Sequence

In many instances, emissions systems must fail diagnostic tests more than once before the PCM illuminates the MIL. These tests are know as 'two trip monitors.' Other tests that turn the MIL lamp on after a single failure are known as 'one trip monitors.' A trip is defined as 'start the vehicle and operate it to meet the criteria necessary to run the given monitor.'

Many of the diagnostic tests must be performed under certain operating conditions. However, there are times when tests cannot be run because another test is in progress (conflict), another test has failed (pending) or the Task Manager has set a fault that may cause a failure of the test (suspend).

- Pending
  Under some situations the Task Manager will not run a monitor if the MIL is illuminated and a fault is stored from another monitor. In these situations, the Task Manager postpones monitors **pending** resolution of the original fault. The Task Manager does not run the test until the problem is remedied.
  For example, when the MIL is illuminated for an Oxygen Sensor fault, the Task Manager does not run the Catalyst Monitor until the Oxygen Sensor fault is remedied. Since the Catalyst Monitor is based on signals from the Oxygen Sensor, running the test would produce inaccurate results.
- Conflict
  There are situations when the Task Manager does not run a test if another monitor is in progress. In these situations, the effects of another monitor running could result in an erroneous failure. If this **conflict** is present, the monitor is not run until the conflicting condition passes. Most likely the monitor will run later after the conflicting monitor has passed.
  For example, if the Fuel System Monitor is in progress, the Task Manager does not run the EGR Monitor. Since both tests monitor changes in air/fuel ratio and adaptive fuel compensation, the monitors will conflict with each other.
- Suspend
  Occasionally the Task Manager may not allow a two trip fault to mature. The Task Manager will **suspend** the maturing of a fault if a condition exists that may induce an erroneous failure. This prevents illuminating the MIL for the wrong fault and allows more precis diagnosis.
  For example, if the PCM is storing a one trip fault for the Oxygen Sensor and the EGR monitor, the Task Manager may still run the EGR Monitor but will suspend the results until the Oxygen Sensor Monitor either passes or fails. At that point the Task Manager can determine if the EGR system is actually failing or if an Oxygen Sensor is failing.

MIL Illumination

The PCM Task Manager carries out the illumination of the MIL. The Task Manager triggers MIL illumination upon test failure, depending on monitor failure criteria.

The Task Manager Screen shows both a Requested MIL state and an Actual MIL state. When the MIL is illuminated upon completion of a test for a third trip, the Requested MIL state changes to OFF. However, the MIL remains illuminated until the next key cycle. (On some vehicles, the MIL will actually turn OFF during the third key cycle) During the key cycle for the third good trip, the Requested MIL state is OFF, while the Actual MILL state is ON. After the next key cycle, the MIL is not illuminated and both MIL states read OFF.

Diagnostic Trouble Codes (DTCs)

With OBD II, different DTC faults have different priorities according to regulations. As a result, the priorities determine MIL illumination and DTC erasure. DTCs are entered according to individual priority. DTCs with a higher priority overwrite lower priority DTCs.

Priorities

- Priority 0 —Non-emissions related trouble codes
- Priority 1 — One trip failure of a two trip fault for non-fuel system and non-misfire.
- Priority 2 — One trip failure of a two trip fault for fuel system (rich/lean) or misfire.
- Priority 3 — Two trip failure for a non-fuel system and non-misfire or matured one trip comprehensive component fault.
- Priority 4 — Two trip failure or matured fault for fuel system (rich/lean) and misfire or one trip catalyst damaging misfire.

Non-emissions related failures have no priority. One trip failures of two trip faults have low priority. Two trip failures or matured faults have higher priority. One and two trip failures of fuel system and misfire monitor take precedence over non-fuel system and non-misfire failures.

DTC Self Erasure

With one trip components or systems, the MIL is illuminated upon test failure and DTCs are stored.

Two trip monitors are components requiring failure in two consecutive trips for MIL illumination. Upon failure of the first test, the Task Manager enters a maturing code. If the component fails the test for a second time the code matures and a DTC is set.

After three good trips the MIL is extinguished and the Task Manager automatically switches the trip counter to a warm-up cycle counter. DTCs are automatically erased following 40 warm-up cycles if the component does not fail again.

For misfire and fuel system monitors, the component must pass the test under a Similar Conditions Window in order to record a good trip. A Similar Conditions Window is when engine RPM is within ±375 RPM and load is within ±10% of when the fault occurred.

NOTE: It is important to understand that a component does not have to fail under a similar window of operation to mature. It must pass the test under a Similar Conditions Window when it failed to record a Good Trip for DTC erasure for misfire and fuel system monitors.

DTCs can be erased anytime with a DRB III. Erasing the DTC with the DRB III erases all OBD II information. The DRB III automatically displays a warning that erasing the DTC will also erase all OBD II monitor data. This includes all counter information for warm-up cycles, trips and Freeze Frame.

Trip Indicator

The **Trip** is essential for running monitors and extinguishing the MIL. In OBD II terms, a trip is a set of vehicle operating conditions that must be met for a specific monitor to run. All trips begin with a key cycle.

Good Trip

The Good Trip counters are as follows:

- Specific Good Trip
- Fuel System Good Trip
- Misfire Good Trip
- Alternate Good Trip (appears as a Global Good Trip on DRB III)
  - Comprehensive Components
  - Major Monitor
- Warm-Up Cycles

Specific Good Trip

The term Good Trip has different meanings depending on the circumstances:

- If the MIL is OFF, a trip is defined as when the Oxygen Sensor Monitor and the Catalyst Monitor have been completed in the same drive cycle.
- If the MIL is ON and a DTC was set by the Fuel Monitor or Misfire Monitor (both continuous monitors), the vehicle must be operated in the Similar Condition Window for a specified amount of time.
- If the MIL is ON and a DTC was set by a Task Manager commanded once-per-trip monitor (such as the Oxygen Sensor Monitor, Catalyst Monitor, Purge Flow Monitor, Leak Detection Pump Monitor, EGR Monitor or Oxygen Sensor Heater Monitor), a good trip is when the monitor is passed on the next start-up.
- If the MIL is ON and any other emissions DTC was set (not an OBD II monitor), a good trip occurs when the Oxygen Sensor Monitor and Catalyst Monitor have been completed, or two minutes of engine run time if the Oxygen Sensor Monitor and Catalyst Monitor have been stopped from running.

Fuel System Good Trip

To count a good trip (three required) and turn off the MIL, the following conditions must occur:

- Engine in closed loop
- Operating in Similar Conditions Window
- Short Term multiplied by Long Term less than threshold
- Less than threshold for a predetermined time

If all of the previous criteria are met, the PCM will count a good trip (three required) and turn off the MIL.

Misfire Good Trip

If the following conditions are met the PCM will count one good trip (three required) in order to turn off the MIL:

- Operating in Similar Condition Window
- 1000 engine revolutions with no misfire

Warm-Up Cycles

Once the MIL has been extinguished by the Good Trip Counter, the PCM automatically switches to a Warm-Up Cycle Counter that can be viewed on the DRB III. Warm-Up Cycles are used to erase DTCs and Freeze Frames. Forty Warm-Up cycles must occur in order for the PCM to self-erase a DTC and Freeze Frame. A Warm-Up Cycle is defined as follows:

- Engine coolant temperature must start below and rise above 160° F
- Engine coolant temperature must rise by 40° F
- No further faults occur

Freeze Frame Data Storage

Once a failure occurs, the Task Manager records several engine operating conditions and stores it in a Freeze Frame. The Freeze Frame is considered one frame of information taken by an on-board data recorder. When a fault occurs, the PCM stores the input data from various sensors so that technicians can determine under what vehicle operating conditions the failure occurred.

The data stored in Freeze Frame is usually recorded when a system fails the first time for two trip faults. Freeze Frame data will only be overwritten by a different fault with a higher priority.

CAUTION: Erasing DTCs, either with the DRB III or by disconnecting the battery, also clears all Freeze Frame data.

Similar Conditions Window

The Similar Conditions Window displays information about engine operation during a monitor. Absolute MAP (engine load) and Engine RPM are stored in this window when a failure occurs. There are two different Similar conditions Windows: Fuel System and Misfire.

FUEL SYSTEM

- **Fuel System Similar Conditions Window** — An indicator that 'Absolute MAP When Fuel Sys Fail' and 'RPM When Fuel Sys Failed' are all in the same range when the failure occurred. Indicated by switching from 'NO' to 'YES'.
- **Absolute MAP When Fuel Sys Fail** — The stored MAP reading at the time of failure. Informs the user at what engine load the failure occurred.
- **Absolute MAP** — A live reading of engine load to aid the user in accessing the Similar Conditions Window.
- **RPM When Fuel Sys Fail** — The stored RPM reading at the time of failure. Informs the user at what engine RPM the failure occurred.
- **Engine RPM** — A live reading of engine RPM to aid the user in accessing the Similar Conditions Window.
- **Adaptive Memory Factor** — The PCM utilizes both Short Term Compensation and Long Term Adaptive to calculate the Adaptive Memory Factor for total fuel correction.
- **Upstream O2S Volts** — A live reading of the Oxygen Sensor to indicate its performance. For example, stuck lean, stuck rich, etc.
- **SCW Time in Window (Similar Conditions Window Time in Window)** — A timer used by the PCM that indicates that, after all Similar Conditions have been met, if there has been enough good engine running time in the SCW without failure detected. This timer is used to increment a Good Trip.
- **Fuel System Good Trip Counter** — A Trip Counter used to turn OFF the MIL for Fuel System DTCs. To increment a Fuel System Good Trip, the engine must be in the Similar Conditions Window, Adaptive Memory Factor must be less than calibrated threshold and the Adaptive Memory Factor must stay below that threshold for a calibrated amount of time.
- **Test Done This Trip** — Indicates that the monitor has already been run and completed during the current trip.

MISFIRE

- **Same Misfire Warm-Up State** — Indicates if the misfire occurred when the engine was warmed up (above 160° F).
- **In Similar Misfire Window** — An indicator that 'Absolute MAP When Misfire Occurred' and 'RPM When Misfire Occurred' are all in the same range when the failure occurred. Indicated by switching from 'NO' to 'YES'.
- **Absolute MAP When Misfire Occurred** — The stored MAP reading at the time of failure. Informs the user at what engine load the failure occurred.
- **Absolute MAP** — A live reading of engine load to aid the user in accessing the Similar Conditions Window.

- **RPM When Misfire Occurred** — The stored RPM reading at the time of failure. Informs the user at what engine RPM the failure occurred.
- **Engine RPM** — A live reading of engine RPM to aid the user in accessing the Similar Conditions Window.
- **Adaptive Memory Factor** — The PCM utilizes both Short Term Compensation and Long Term Adaptive to calculate the Adaptive Memory Factor for total fuel correction.
- **200 Rev Counter** — Counts 0–100 720 degree cycles.
- **SCW Cat 200 Rev Counter** — Counts when in similar conditions.
- **SCW FTP 1000 Rev Counter** — Counts 0–4 when in similar conditions.
- **Misfire Good Trip Counter** — Counts up to three to turn OFF the MIL.
- **Misfire Data**— Data collected during test.
- **Test Done This Trip**— Indicates YES when the test is done.

OPERATION - NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems and conditions that could have malfunctions causing driveability problems. The PCM might not store diagnostic trouble codes for these conditions. However, problems with these systems may cause the PCM to store diagnostic trouble codes for other systems or components. **EXAMPLE:** a fuel pressure problem will not register a fault directly, but could cause a rich/lean condition or misfire. This could cause the PCM to store an oxygen sensor or misfire diagnostic trouble code

FUEL PRESSURE

The fuel pressure regulator controls fuel system pressure. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line fuel filter, or a pinched fuel supply or return line. However, these could result in a rich or lean condition causing the PCM to store an oxygen sensor or fuel system diagnostic trouble code.

SECONDARY IGNITION CIRCUIT

The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

CYLINDER COMPRESSION

The PCM cannot detect uneven, low, or high engine cylinder compression.

EXHAUST SYSTEM

The PCM cannot detect a plugged, restricted or leaking exhaust system, although it may set a fuel system fault.

FUEL INJECTOR MECHANICAL MALFUNCTIONS

The PCM cannot determine if a fuel injector is clogged, the needle is sticking or if the wrong injector is installed. However, these could result in a rich or lean condition causing the PCM to store a diagnostic trouble code for either misfire, an oxygen sensor, or the fuel system.

EXCESSIVE OIL CONSUMPTION

Although the PCM monitors engine exhaust oxygen content when the system is in closed loop, it cannot determine excessive oil consumption.

THROTTLE BODY AIR FLOW

The PCM cannot detect a clogged or restricted air cleaner inlet or filter element.

VACUUM ASSIST

The PCM cannot detect leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices. However, these could cause the PCM to store a MAP sensor diagnostic trouble code and cause a high idle condition.

PCM SYSTEM GROUND

The PCM cannot determine a poor system ground. However, one or more diagnostic trouble codes may be generated as a result of this condition. The module should be mounted to the body at all times, also during diagnostic.

PCM CONNECTOR ENGAGEMENT

The PCM may not be able to determine spread or damaged connector pins. However, it might store diagnostic trouble codes as a result of spread connector pins.

EVAPORATIVE EMISSIONS

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EVAPORATIVE EMISSIONS

SPECIFICATIONS

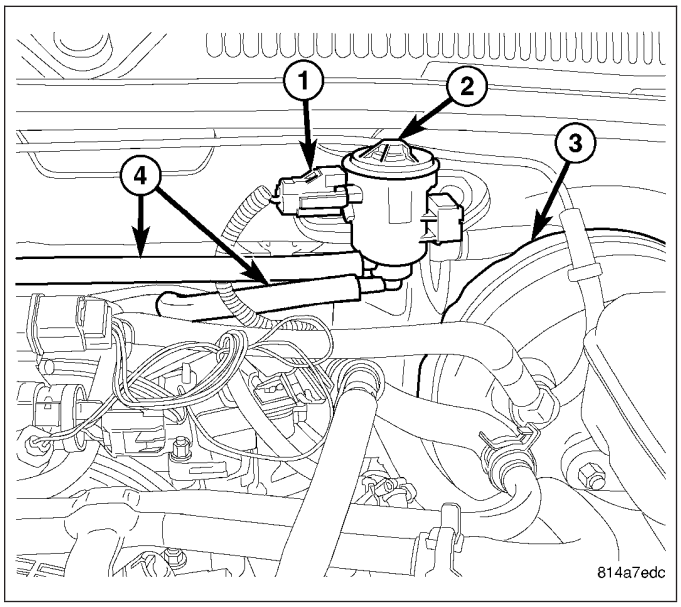
TORQUE - EVAP SYSTEM

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
EVAP Canister Mounting Nuts	11	-	95
EVAP Canister Mounting Bracket-to-Frame Bolts	14	10	125

SOLENOID - EVAP/PURGE

DESCRIPTION

The duty cycle EVAP canister purge solenoid (2) is located in the engine compartment. It is attached to a bracket near the brake power booster (3).



OPERATION

The Powertrain Control Module (PCM) operates the solenoid.

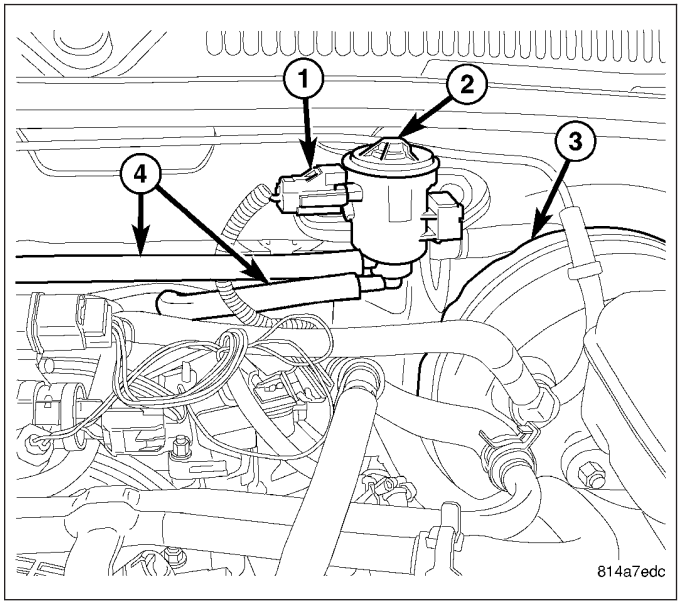
During the cold start warm-up period and the hot start time delay, the PCM does not energize the solenoid. When de-energized, no vapors are purged. The PCM de-energizes the solenoid during open loop operation.

The engine enters closed loop operation after it reaches a specified temperature and the time delay ends. During closed loop operation, the PCM energizes and de-energizes the solenoid 5 or 10 times per second, depending upon operating conditions. The PCM varies the vapor flow rate by changing solenoid pulse width. Pulse width is the amount of time the solenoid energizes. The PCM adjusts solenoid pulse width based on engine operating condition.

REMOVAL

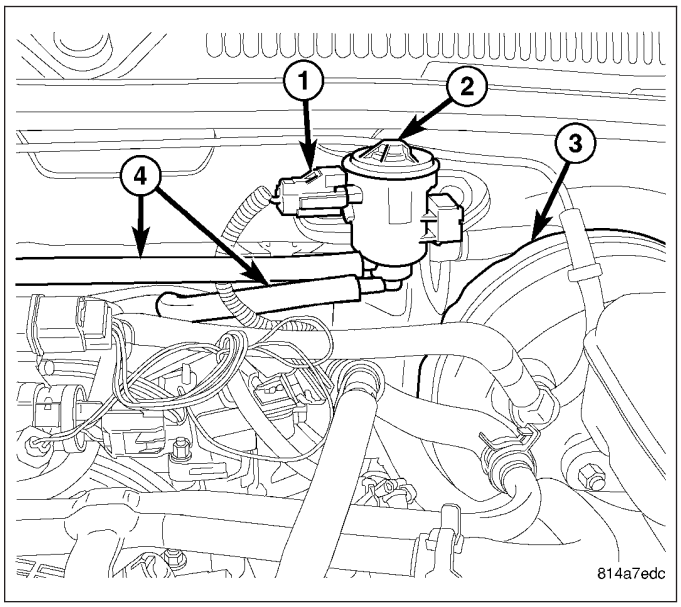
The duty cycle EVAP canister purge solenoid (2) is located in the engine compartment. It is attached to a bracket near the brake power booster (3).

1. Disconnect electrical wiring connector (1) at solenoid.
2. Disconnect vacuum hoses (4) at solenoid.
3. Remove solenoid from mounting bracket.



INSTALLATION

1. Install solenoid assembly (2) to mounting bracket.
2. Connect vacuum hoses (4).
3. Connect electrical connector (1).
4. **The vapor/vacuum lines and hoses must be firmly connected. Check the vapor/vacuum lines at the NVLD pump, pump filter and EVAP canister purge solenoid for damage or leaks. If a leak is present, a Diagnostic Trouble Code (DTC) may be set.**



CAP - FUEL FILLER

DESCRIPTION

The plastic fuel tank filler tube cap is threaded onto the end of the fuel fill tube. Certain models are equipped with a 1/4 turn cap.

OPERATION

The loss of any fuel or vapor out of fuel filler tube is prevented by the use of a pressure-vacuum fuel fill cap. Relief valves inside the cap will release fuel tank pressure at predetermined pressures. Fuel tank vacuum will also be released at predetermined values. This cap must be replaced by a similar unit if replacement is necessary. This is in order for the system to remain effective.

CAUTION: Remove fill cap before servicing any fuel system component to relieve tank pressure. If equipped with a Leak Detection Pump (LDP), or NVLD system, the cap must be tightened securely. If cap is left loose, a Diagnostic Trouble Code (DTC) may be set.

REMOVAL

REMOVAL/INSTALLATION

If replacement of the 1/4 turn fuel tank filler tube cap is necessary, it must be replaced with an identical cap to be sure of correct system operation.

CAUTION: Remove the fuel tank filler tube cap to relieve fuel tank pressure. The cap must be removed prior to disconnecting any fuel system component or before draining the fuel tank.

ORVR

DESCRIPTION

The ORVR (On-Board Refueling Vapor Recovery) system consists of a unique fuel tank, flow management valve, fluid control valve, one-way check valve and vapor canister.

OPERATION

The ORVR (On-Board Refueling Vapor Recovery) system is used to remove excess fuel tank vapors. This is done while the vehicle is being refueled.

Fuel flowing into the fuel filler tube (approx. 1" I.D.) creates an aspiration effect drawing air into the fuel fill tube. During refueling, the fuel tank is vented to the EVAP canister to capture escaping vapors. With air flowing into the filler tube, there are no fuel vapors escaping to the atmosphere. Once the refueling vapors are captured by the EVAP canister, the vehicle's computer controlled purge system draws vapor out of the canister for the engine to burn. The vapor flow is metered by the purge solenoid so that there is no, or minimal impact on driveability or tailpipe emissions.

As fuel starts to flow through the fuel fill tube, it opens the normally closed check valve and enters the fuel tank. Vapor or air is expelled from the tank through the control valve and on to the vapor canister. Vapor is absorbed in the EVAP canister until vapor flow in the lines stops. This stoppage occurs following fuel shut-off, or by having the fuel level in the tank rise high enough to close the control valve. This control valve contains a float that rises to seal the large diameter vent path to the EVAP canister. At this point in the refueling process, fuel tank pressure increases, the check valve closes (preventing liquid fuel from spiting back at the operator), and fuel then rises up the fuel filler tube to shut off the dispensing nozzle.

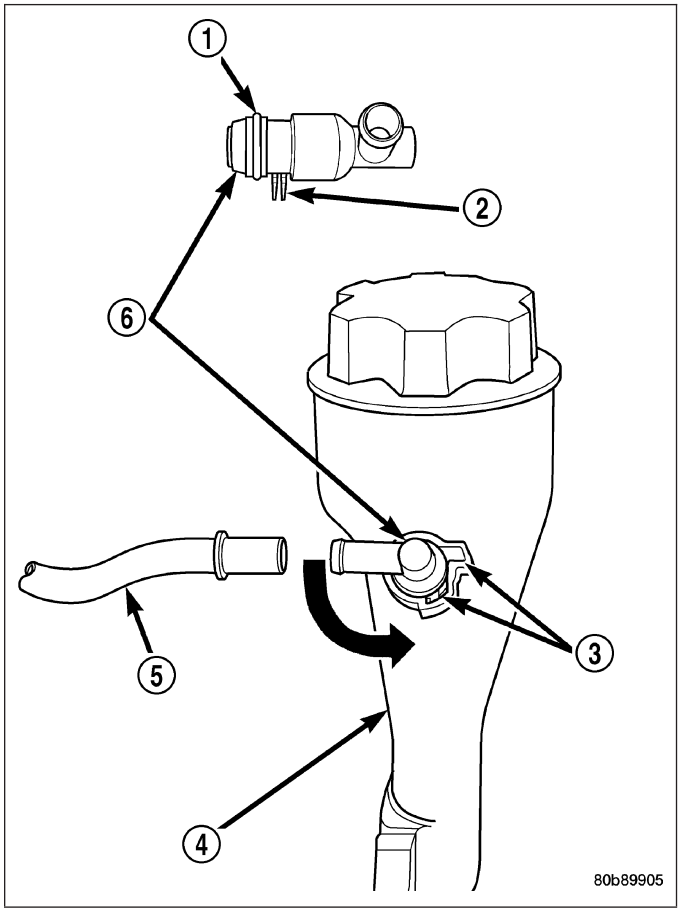
VALVE - PCV

DESCRIPTION

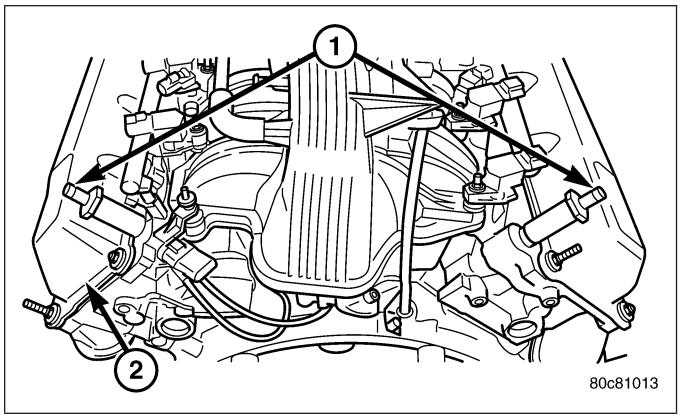
3.7L V-6 / 4.7L V-8

The 3.7L V-6 and 4.7L V-8 engines are equipped with a closed crankcase ventilation system and a Positive Crankcase Ventilation (PCV) valve.

This system consists of a PCV valve (6) sealed to the oil filler housing with an o-ring (1), the air cleaner housing, and tubes and hoses to connect the system components.



It also consists of two interconnected breathers (1) threaded into the rear of each cylinder head.

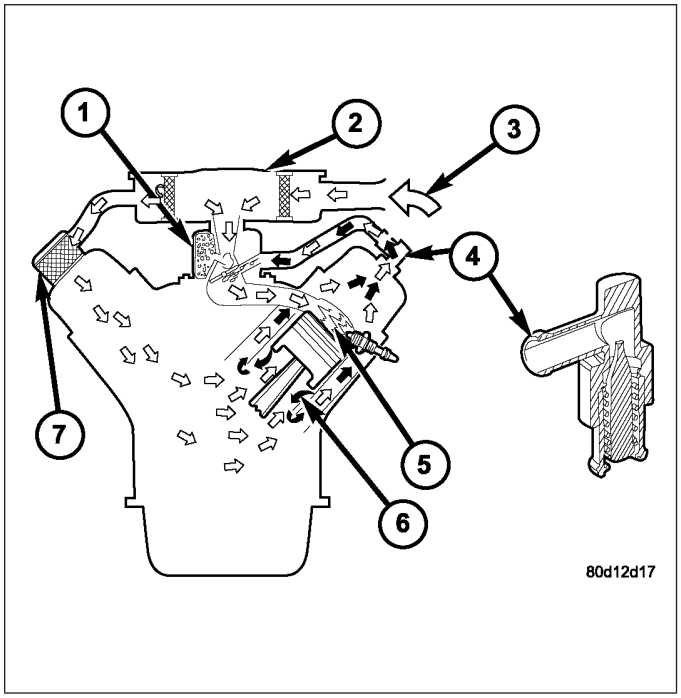


OPERATION

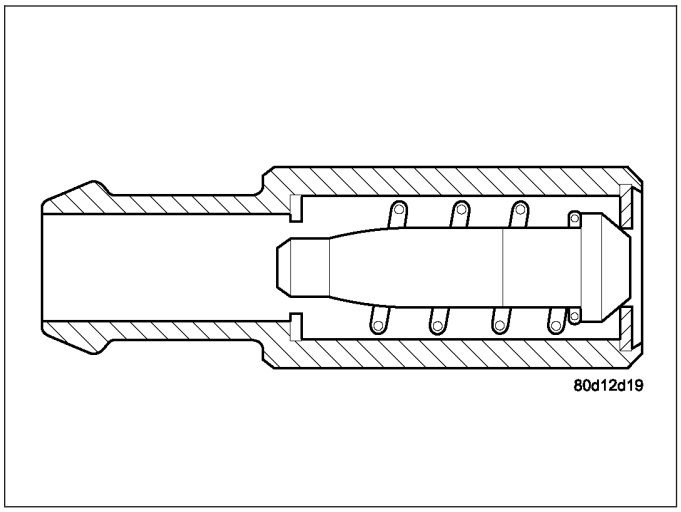
A typical enclosed crankcase ventilation system is shown in the graphic.

The PCV system operates by engine intake manifold vacuum. Filtered air is routed into the crankcase through the air cleaner hose. The metered air, along with crankcase vapors, are drawn through the PCV valve (4) and into a passage in the intake manifold. The PCV system manages crankcase pressure and meters blow by gases to the intake system, reducing engine sludge formation.

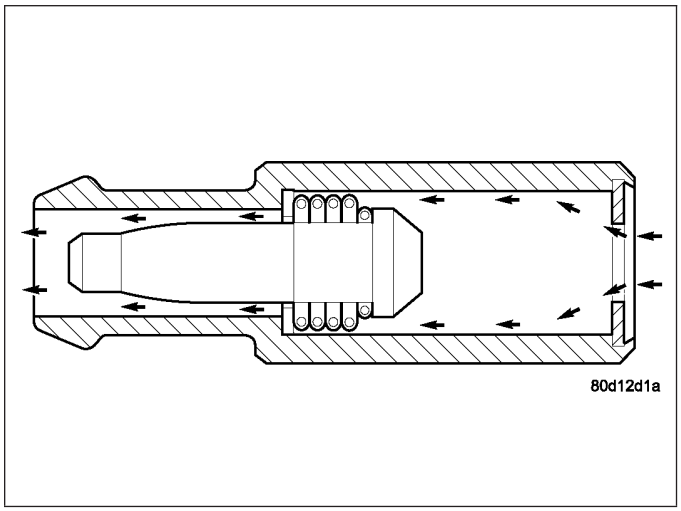
The PCV valve contains a spring loaded plunger. This plunger meters the amount of crankcase vapors routed into the combustion chamber based on intake manifold vacuum.



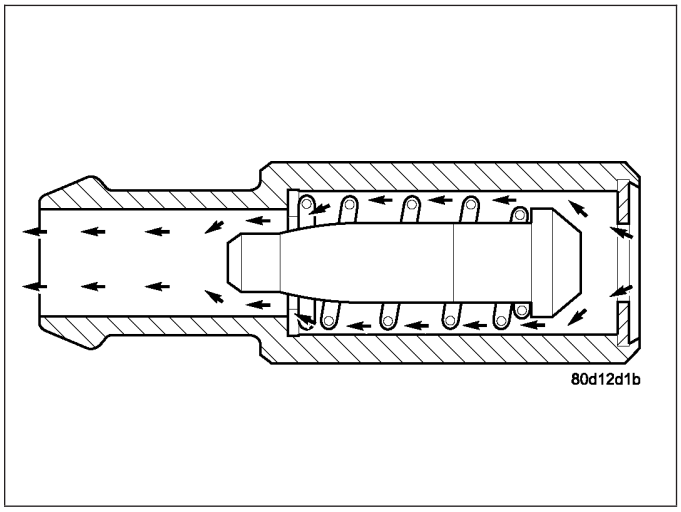
When the engine is not operating or during an engine pop-back, the spring forces the plunger back against the seat. This will prevent vapors from flowing through the valve.



During periods of high manifold vacuum, such as idle or cruising speeds, vacuum is sufficient to completely compress spring. It will then pull the plunger to the top of the valve. In this position there is minimal vapor flow through the valve.



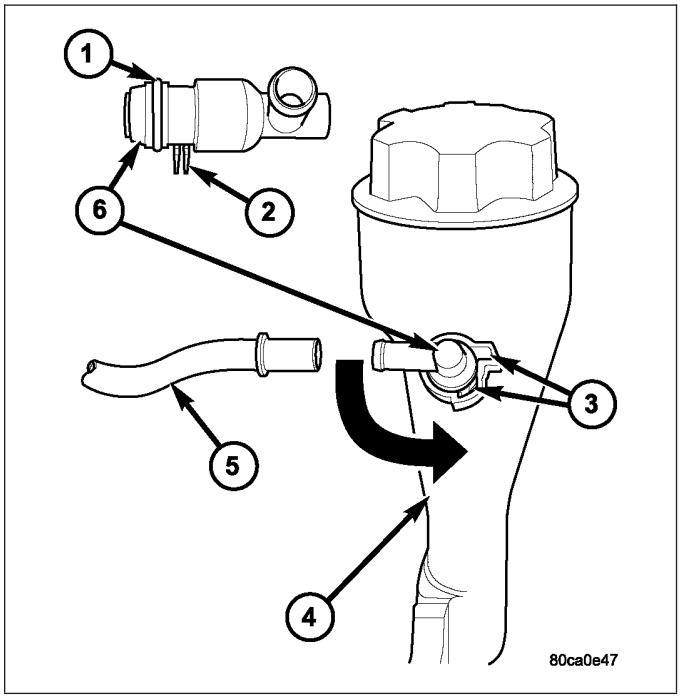
During periods of moderate manifold vacuum, the plunger is only pulled part way back from inlet. This results in maximum vapor flow through the valve.



DIAGNOSIS AND TESTING

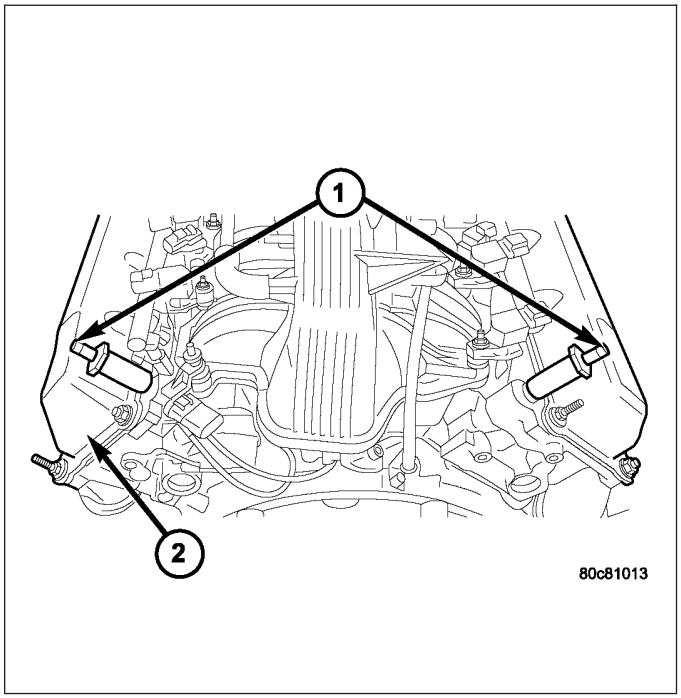
PCV VALVE - 3.7L V-6/ 4.7L V-8

1. Disconnect PCV line/hose (5) by disconnecting rubber connecting hose at PCV valve fitting.
2. Remove PCV valve at oil filler tube by rotating PCV valve downward until locating tabs (2) have been freed at cam lock (3). After tabs have cleared, pull valve straight out from filler tube. **To prevent damage to PCV valve locating tabs, valve must be pointed downward for removal. Do not force valve from oil filler tube.**
3. After valve is removed, check condition of valve o-ring (1). Also, PCV valve should rattle when shaken.
4. Reconnect PCV valve to its connecting line/hose.
5. Start engine and bring to idle speed.
6. If valve is not plugged, a hissing noise will be heard as air passes through valve. Also, a strong vacuum should be felt with a finger placed at valve inlet.
7. If vacuum is not felt at valve inlet, check line/hose for kinks or for obstruction. If necessary, clean out intake manifold fitting at rear of manifold. Do this

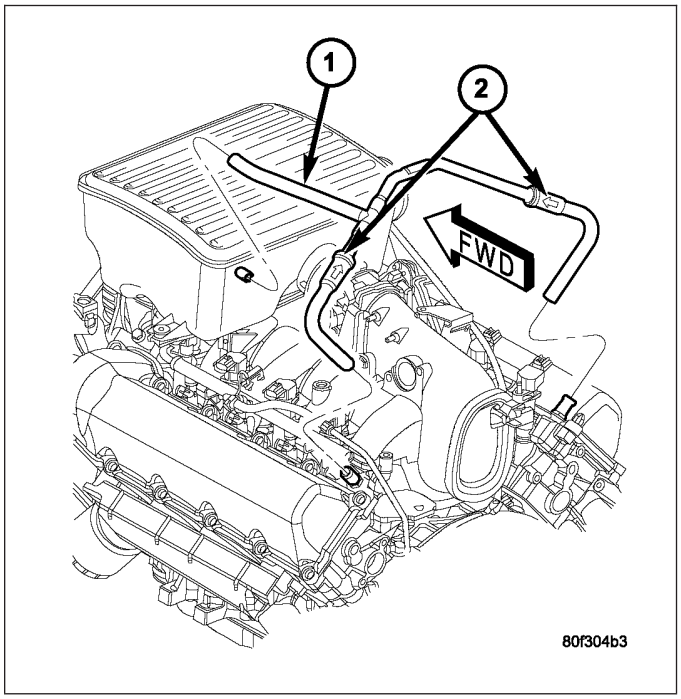


by turning a 1/4 inch drill (by hand) through the fitting to dislodge any solid particles. Blow out the fitting with shop air. If necessary, use a smaller drill to avoid removing any metal from the fitting.

8. **Do not attempt to clean the old PCV valve.**
9. Return PCV valve back to oil filler tube by placing valve locating tabs (2) into cam lock (3). Press PCV valve in and rotate valve upward. A slight click will be felt when tabs have engaged cam lock. Valve should be pointed towards rear of vehicle.
10. Connect PCV line/hose (5) and connecting rubber hose to PCV valve.
11. Disconnect rubber hose from fresh air fitting at air cleaner resonator box. Start engine and bring to idle speed. Hold a piece of stiff paper (such as a parts tag) loosely over the opening of the disconnected rubber hose.
12. The paper should be drawn against the hose opening with noticeable force. This will be after allowing approximately one minute for crankcase pressure to reduce.
13. If vacuum is not present, disconnect each PCV system hose at top of each crankcase breather (1). Check for obstructions or restrictions.
14. If vacuum is still not present, remove each PCV system crankcase breather (1) from each cylinder head. Check for obstructions or restrictions. If plugged, replace breather. Tighten breather to 12 N·m (106 in. lbs.) torque. Do not attempt to clean breather.



15. If vacuum is still not present, disconnect each PCV system hose (1) at each fitting, and at each check valve (2). Check for obstructions or restrictions.

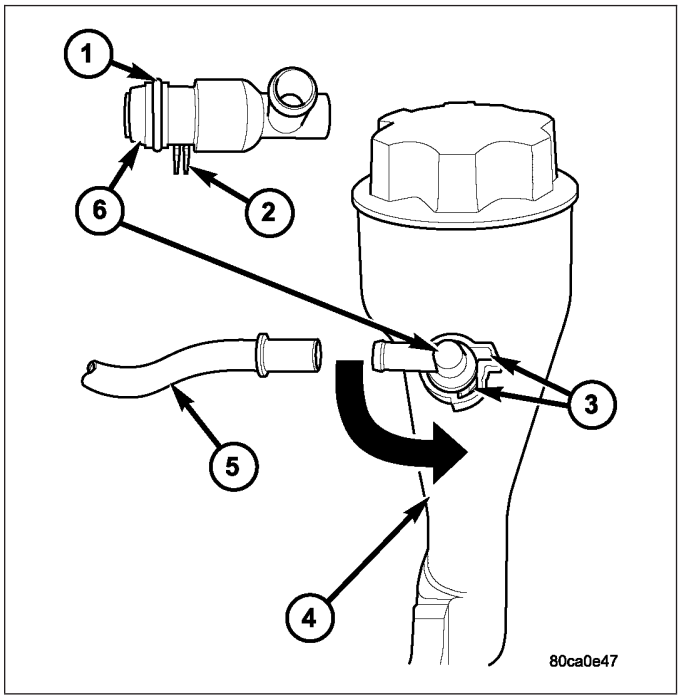


REMOVAL

3.7L V-6 / 4.7L V-8

The PCV valve (6) is located on the oil filler tube (4). Two locating tabs are located on the side of the valve (2). These 2 tabs fit into a cam lock (3) in the oil filler tube. An o-ring (1) seals the valve to the filler tube.

1. Disconnect PCV line/hose (5) by disconnecting rubber hose at PCV valve fitting.
2. Remove PCV valve at oil filler tube by rotating PCV valve downward (counter-clockwise) until locating tabs (2) have been freed at cam lock (3). After tabs have cleared, pull valve straight out from filler tube. **To prevent damage to PCV valve locating tabs, valve must be pointed downward for removal. Do not force valve from oil filler tube.**
3. After valve is removed, check condition of valve o-ring (1).



INSTALLATION

3.7L V6 / 4.7L V-8

The PCV valve is located on the oil filler tube. Two locating tabs are located on the side of the valve. These 2 tabs fit into a cam lock in the oil filler tube. An o-ring seals the valve to the filler tube.

1. Return PCV valve back to oil filler tube by placing valve locating tabs into cam lock. Press PCV valve in and rotate valve upward. A slight click will be felt when tabs have engaged cam lock. Valve should be pointed towards rear of vehicle.
2. Connect PCV line/hose and rubber hose to PCV valve.

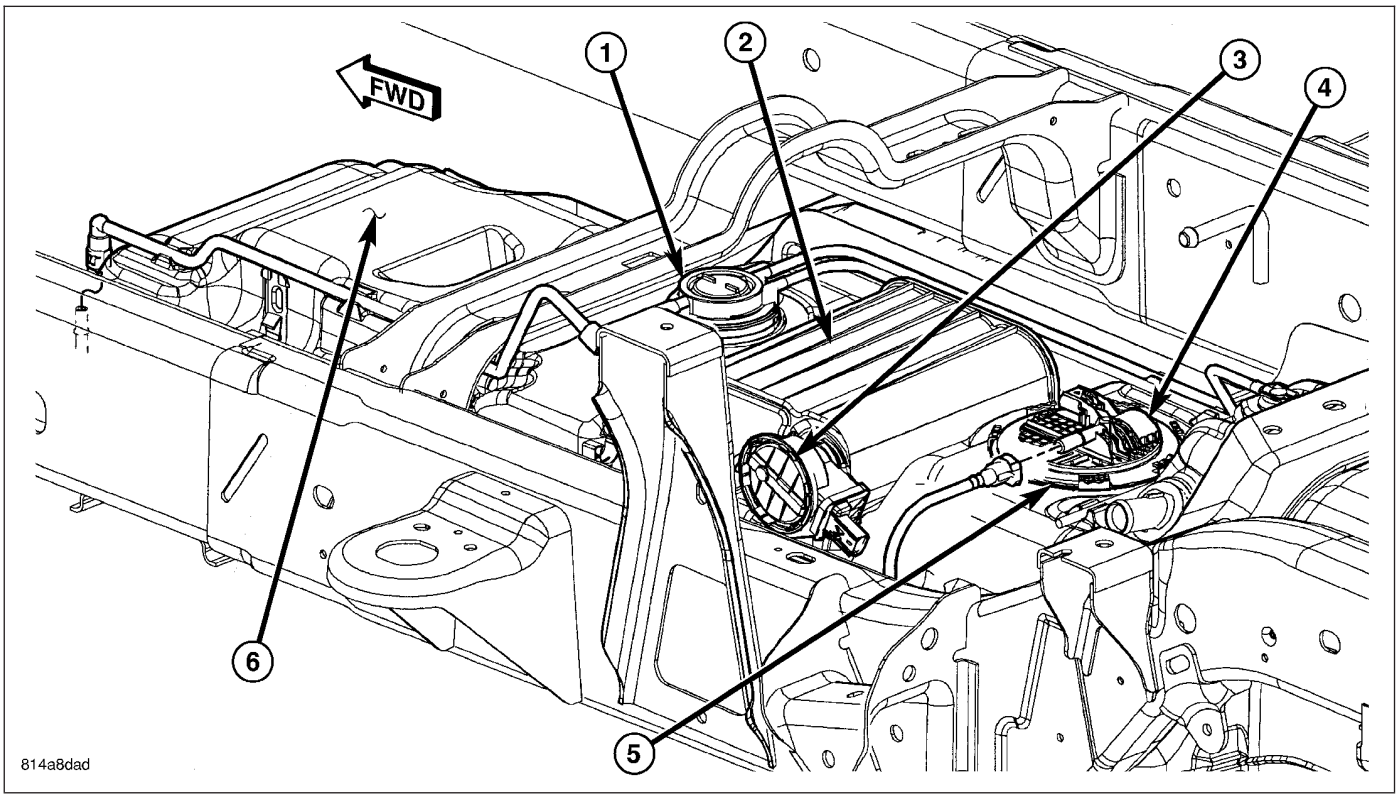
LINES - VACUUM

DESCRIPTION

A vacuum schematic for emission related items can be found on the vehicles VECI label. Refer to Vehicle Emission Control Information (VECI) Label for label location.

CANISTER - VAPOR

DESCRIPTION



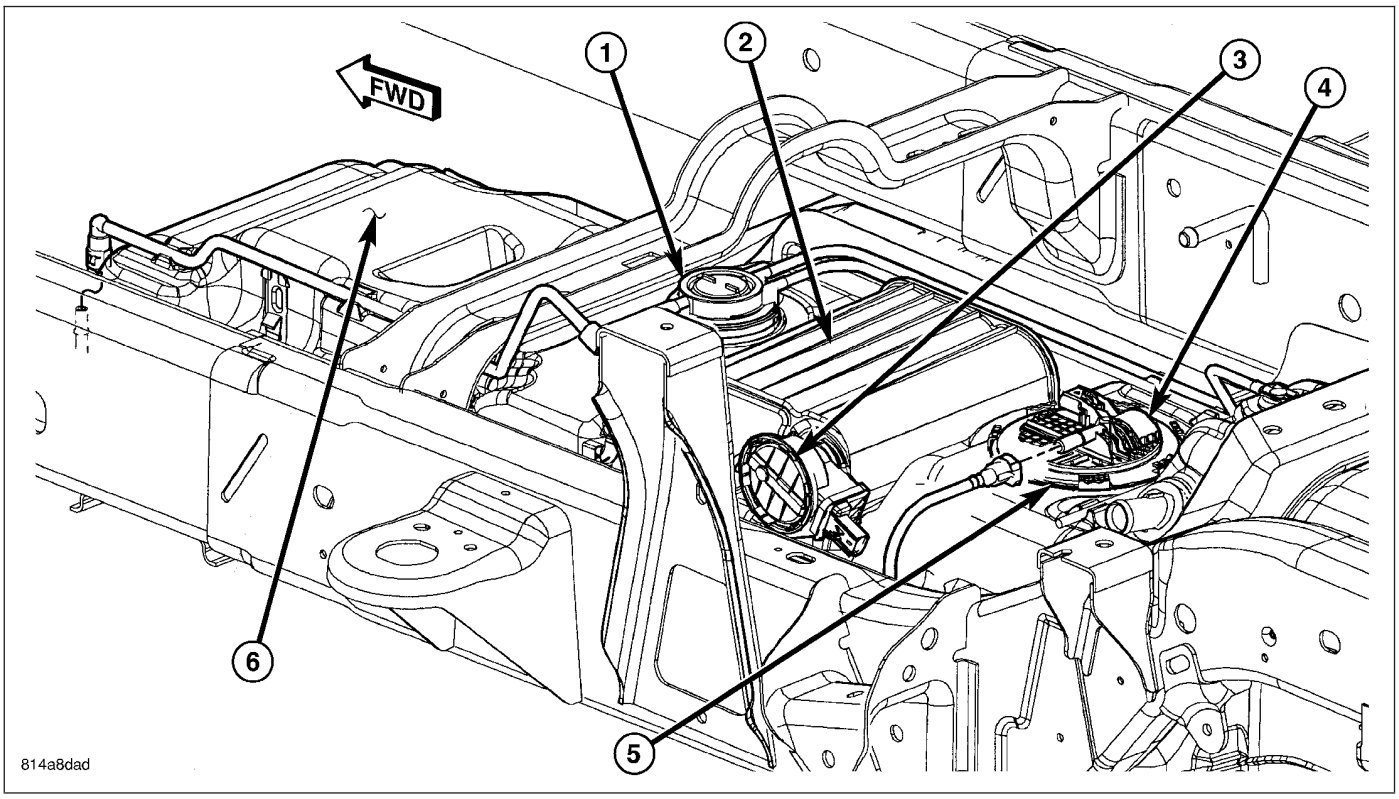
The maintenance free, EVAP canister (2) is mounted to the top of the fuel tank (6).

OPERATION

The EVAP canister is filled with granules of an activated carbon mixture. Fuel vapors entering the EVAP canister are absorbed by the charcoal granules.

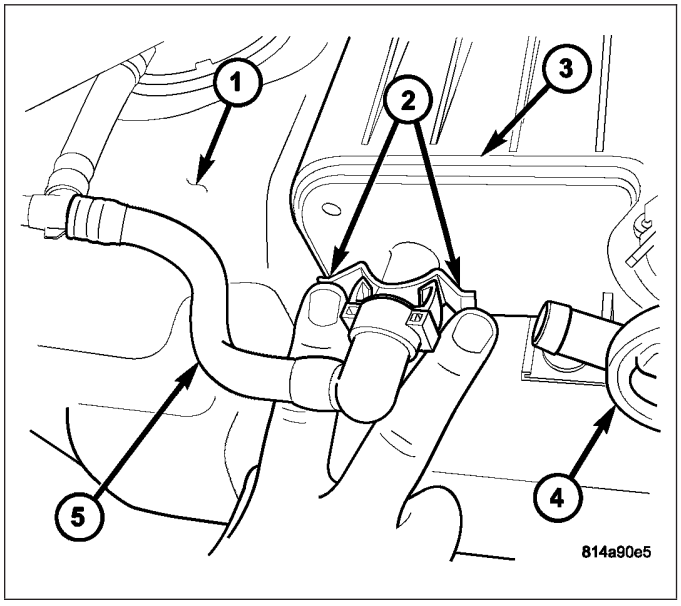
Fuel tank pressure vents into the EVAP canister. Fuel vapors are temporarily held in the canister until they can be drawn into the intake manifold. The duty cycle EVAP canister purge solenoid allows the EVAP canister to be purged at predetermined times and at certain engine operating conditions.

REMOVAL

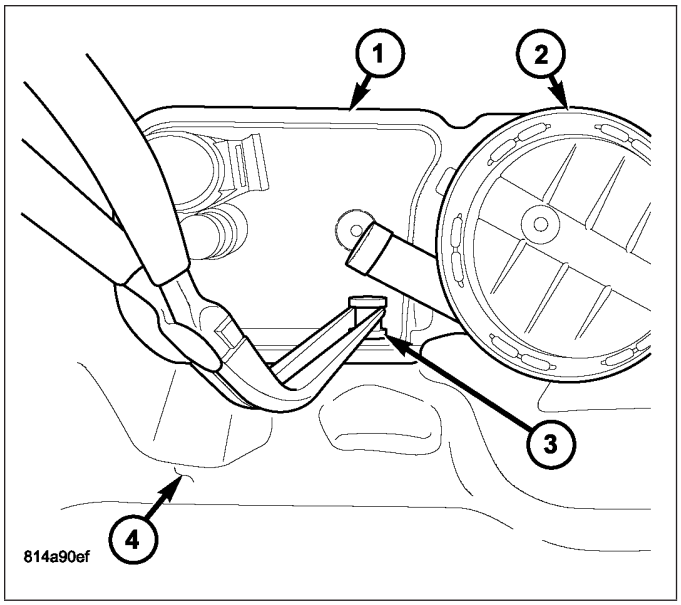


The EVAP canister (2) is mounted to the top of the fuel tank (6). Both the EVAP canister (2) and NVLD pump (3) can be removed without removing the fuel tank.

1. Raise and support vehicle.
2. Remove left-rear tire.
3. Remove plastic shield in front of left-rear tire. Access to both the EVAP canister (2) and NVLD pump (3) can be achieved from the area in front of the removed tire and plastic shield.
4. Remove vapor hose from NVLD pump (3).
5. Remove vapor line (5) from EVAP canister (3) by pressing on both tabs (2) simultaneously.

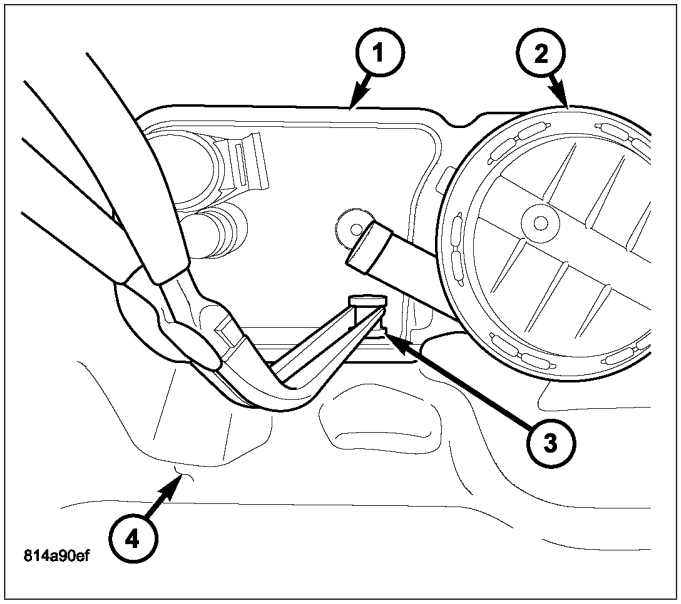


6. Pry up plastic mounting clip (3) and remove canister (1) from top of fuel tank. Note: The opposite end of the canister is supported by two plastic pins slipped into rubber grommets.



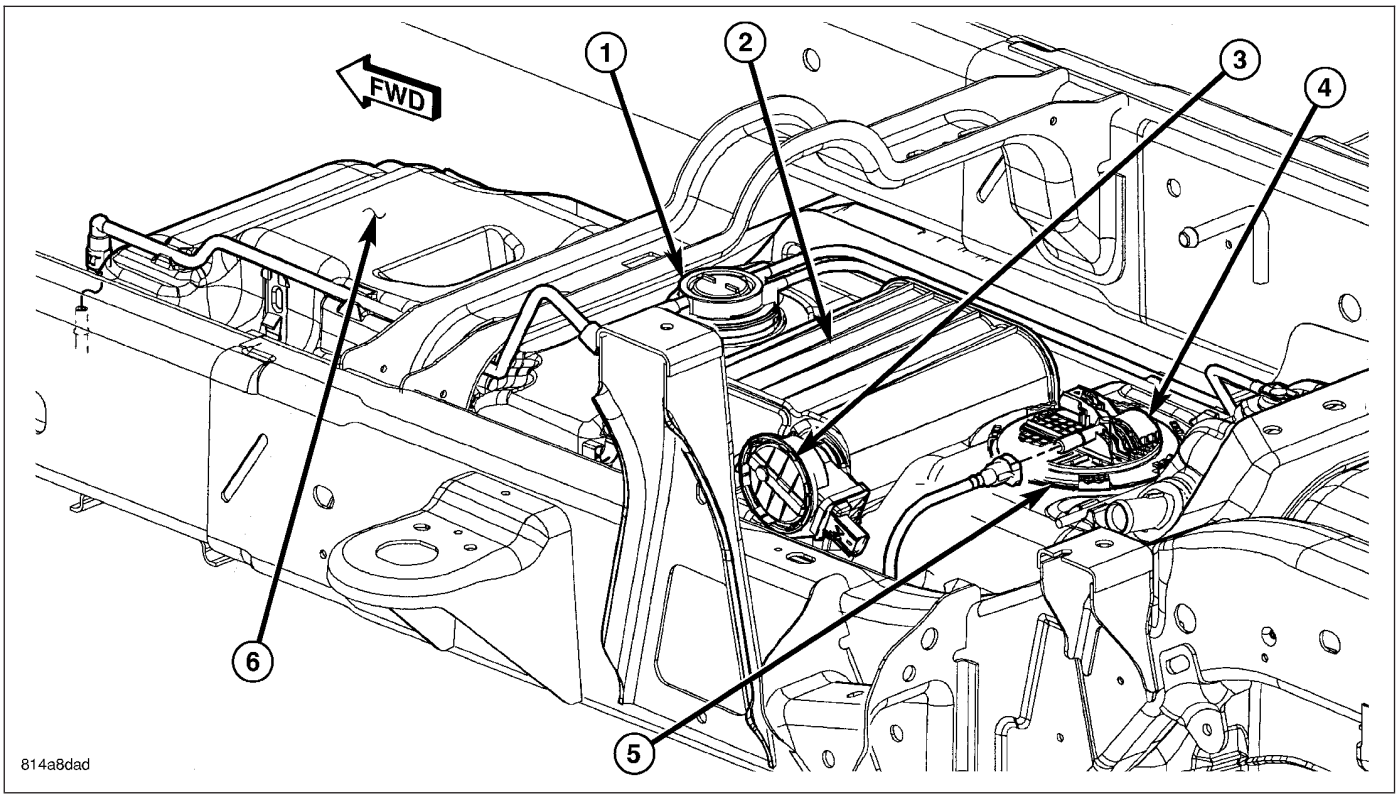
INSTALLATION

1. Guide the two plastic canister locating pins into the two rubber grommets.
2. Install pin (3). Press down on pin (3).
3. Install all vapor hoses and lines to both the EVAP canister and NVLD pump.
4. **The vapor/vacuum lines and hoses must be firmly connected. Also check the vapor/vacuum lines at the NVLD pump, NVLD filter and EVAP canister purge solenoid for damage or leaks. If a leak is present, a Diagnostic Trouble Code (DTC) may be set.**
5. Install plastic shield in front of left-rear tire.
6. Install left-rear tire.



PUMP-NATURAL VAC LEAK DETECTION

DESCRIPTION



The NVLD pump (3) is attached to the end of the EVAP canister (2).

OPERATION

Vehicles equipped with NGC engine control modules use an NVLD pump and system.Vehicles equipped with JTEC engine control modules use a leak detection pump. Refer to Leak Detection Pump (LDP) for additional information.

The Natural Vacuum Leak Detection (NVLD) system is the next generation evaporative leak detection system that will first be used on vehicles equipped with the Next Generation Controller (NGC). This new system replaces the leak detection pump as the method of evaporative system leak detection. This is to detect a leak equivalent to a 0.020″ (0.5 mm) hole. This system has the capability to detect holes of this size very dependably.

The basic leak detection theory employed with NVLD is the ″Gas Law″. This is to say that the pressure in a sealed vessel will change if the temperature of the gas in the vessel changes. The vessel will only see this effect if it is indeed sealed. Even small leaks will allow the pressure in the vessel to come to equilibrium with the ambient pressure. In addition to the detection of very small leaks, this system has the capability of detecting medium as well as large evaporative system leaks.

A vent valve seals the canister vent during engine off conditions. If the vapor system has a leak of less than the failure threshold, the evaporative system will be pulled into a vacuum, either due to the cool down from operating temperature or diurnal ambient temperature cycling. The diurnal effect is considered one of the primary contributors to the leak determination by this diagnostic. When the vacuum in the system exceeds about 1″ H2O (0.25 KPA), a vacuum switch closes. The switch closure sends a signal to the NGC. The NGC, via appropriate logic strategies, utilizes the switch signal, or lack thereof, to make a determination of whether a leak is present.

The NVLD device is designed with a normally open vacuum switch, a normally closed solenoid, and a seal, which is actuated by both the solenoid and a diaphragm. The NVLD is located on the atmospheric vent side of the canister. The NVLD assembly may be mounted on top of the canister outlet, or in-line between the canister and atmospheric vent filter. The normally open vacuum switch will close with about 1″ H2O (0.25 KPA) vacuum in the evaporative system. The diaphragm actuates the switch. This is above the opening point of the fuel inlet check valve in the fill tube so cap off leaks can be detected. Submerged fill systems must have recirculation lines that do not

have the in-line normally closed check valve that protects the system from failed nozzle liquid ingestion, in order to detect cap off conditions.

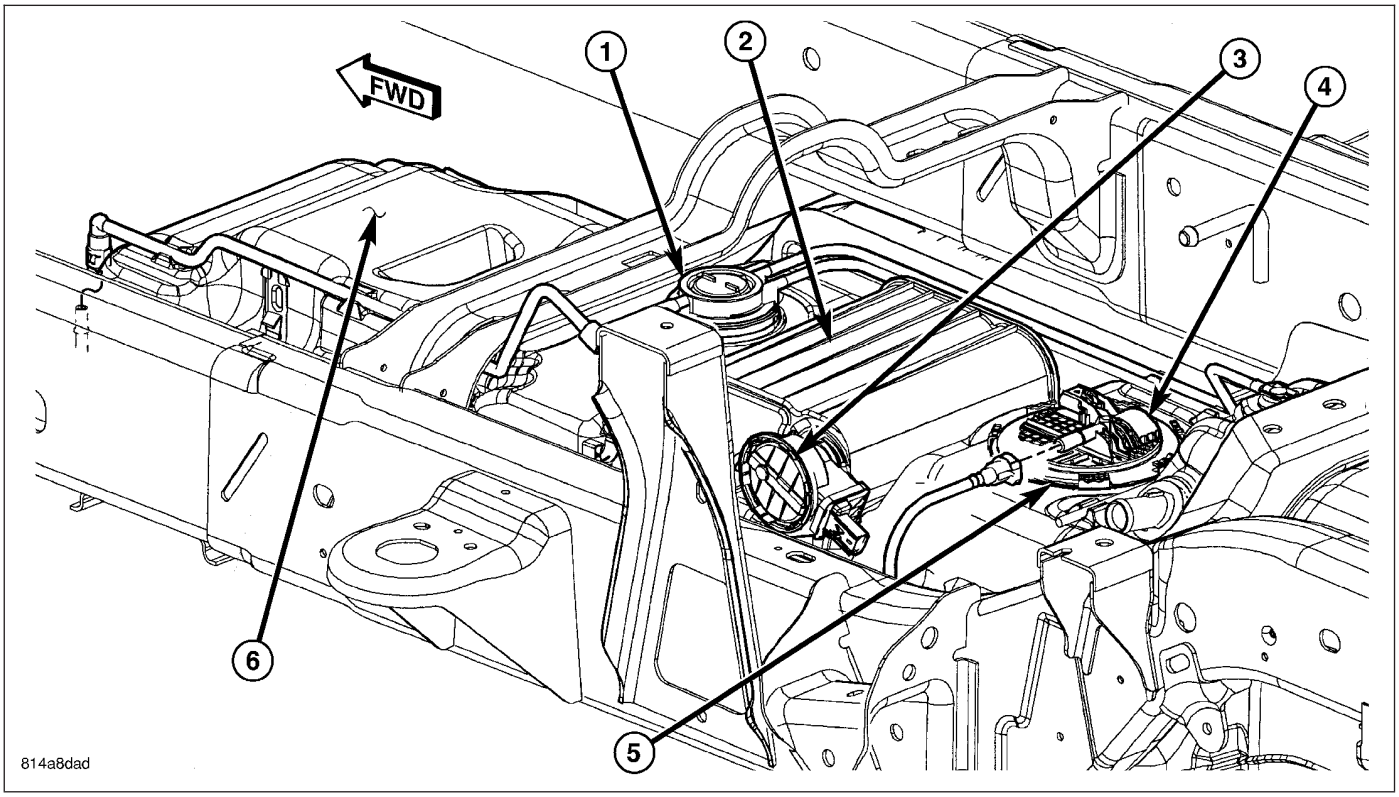
The normally closed valve in the NVLD is intended to maintain the seal on the evaporative system during the engine off condition. If vacuum in the evaporative system exceeds 3″ to 6″ H2O (0.75 to 1.5 KPA), the valve will be pulled off the seat, opening the seal. This will protect the system from excessive vacuum as well as allowing sufficient purge flow in the event that the solenoid was to become inoperative.

The solenoid actuates the valve to unseal the canister vent while the engine is running. It also will be used to close the vent during the medium and large leak tests and during the purge flow check. This solenoid requires initial 1.5 amps of current to pull the valve open but after 100 ms. will be duty cycled down to an average of about 150 mA for the remainder of the drive cycle.

Another feature in the device is a diaphragm that will open the seal in the NVLD with pressure in the evaporative system. The device will ″blow off″ at about 0.5″ H2O (0.12 KPA) pressure to permit the venting of vapors during refueling. An added benefit to this is that it will also allow the tank to ″breathe″ during increasing temperatures, thus limiting the pressure in the tank to this low level. This is beneficial because the induced vacuum during a subsequent declining temperature will achieve the switch closed (pass threshold) sooner than if the tank had to decay from a built up pressure.

The device itself has 3 wires: Switch sense, solenoid driver and ground. It also includes a resistor to protect the switch from a short to battery or a short to ground. The NGC utilizes a high-side driver to energize and duty-cycle the solenoid.

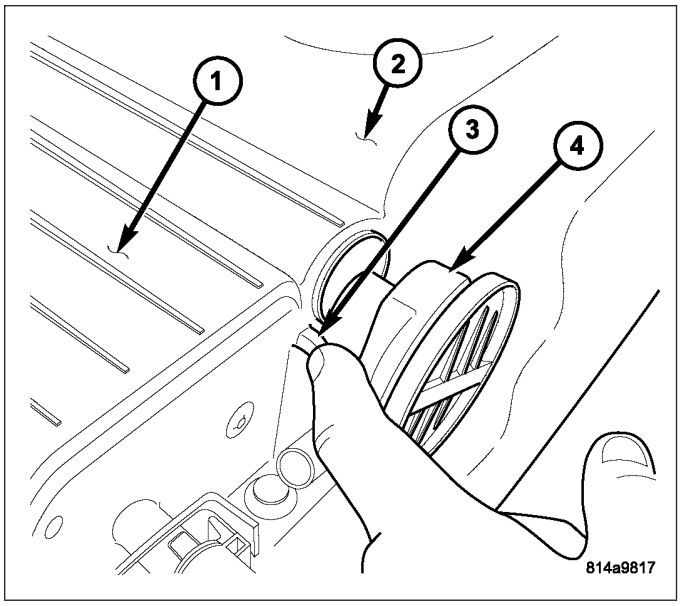
REMOVAL



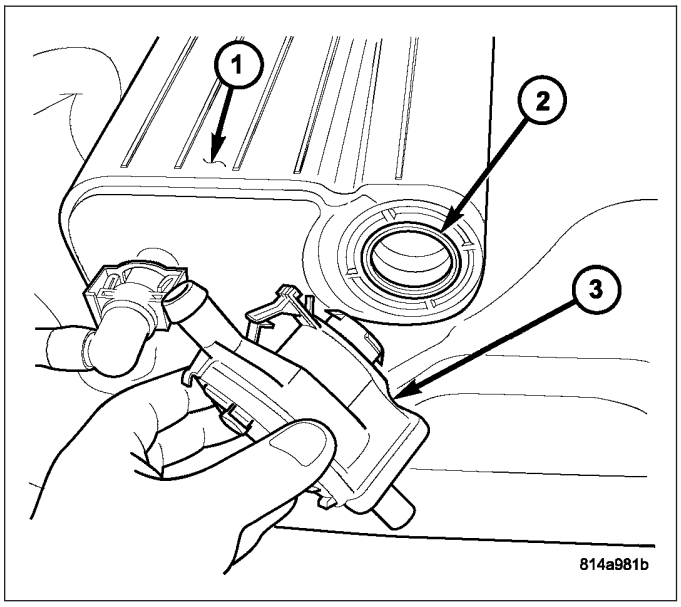
The EVAP canister (2) is mounted to the top of the fuel tank (6). Both the EVAP canister (2) and NVLD pump (3) can be removed without removing the fuel tank.

1. Raise and support vehicle.
2. Remove left-rear tire.
3. Remove plastic shield in front of left-rear tire. Access to both the EVAP canister (2) and NVLD pump (3) from the area in front of the removed tire.

4. Disconnect electrical connector at NVLD pump.
5. Remove vapor line at NVLD pump. Pry outward on tab (3) and rotate pump clock-wise about 70 degrees for removal.

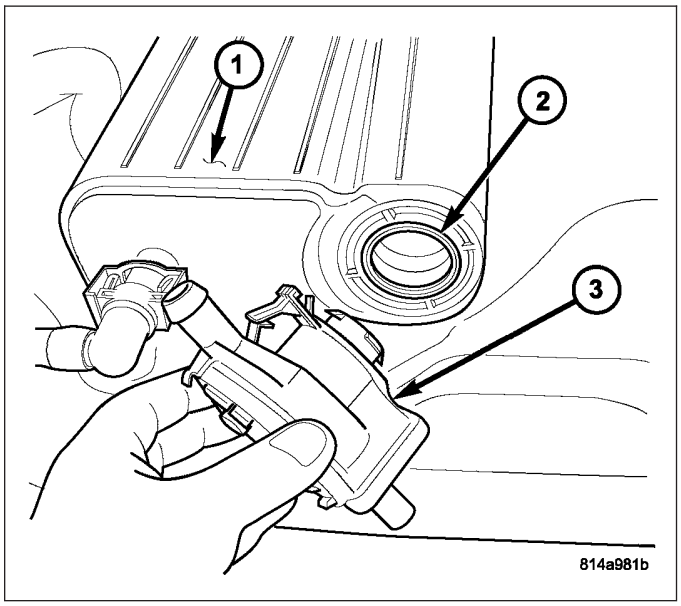


6. Remove NVLD pump o-ring (2) from EVAP canister (1).

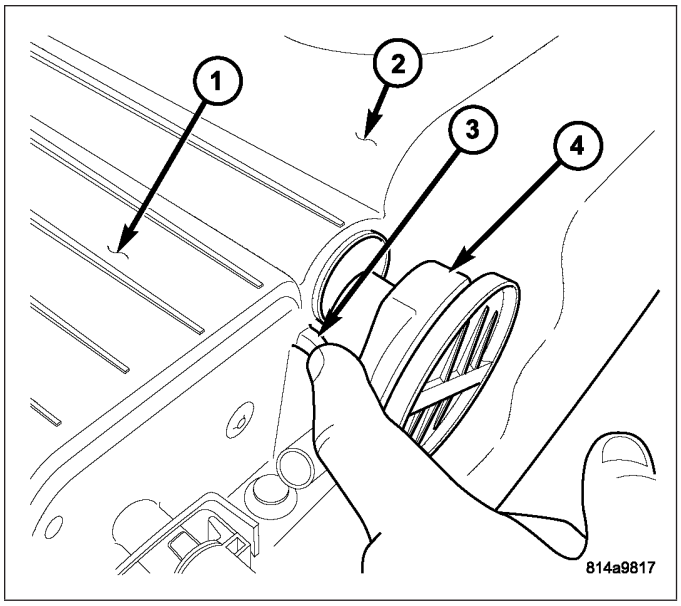


INSTALLATION

1. Install new NVLD pump o-ring (2) to EVAP canister (1).



2. Position NVLD pump (4) into EVAP canister (1).
3. Rotate pump (4) until tab (3) aligns with notch in EVAP canister (1).
4. Carefully install vapor/vacuum lines to NVLD pump. **The vapor/vacuum lines and hoses must be firmly connected. Check the vapor/vacuum lines at the NVLD pump, filter and EVAP canister purge solenoid for damage or leaks. If a leak is present, a Diagnostic Trouble Code (DTC) may be set.**
5. Connect electrical connector to pump.
6. Install plastic shield in front of left-rear tire.
7. Install left-rear tire.



EXHAUST GAS RECIRCULATION

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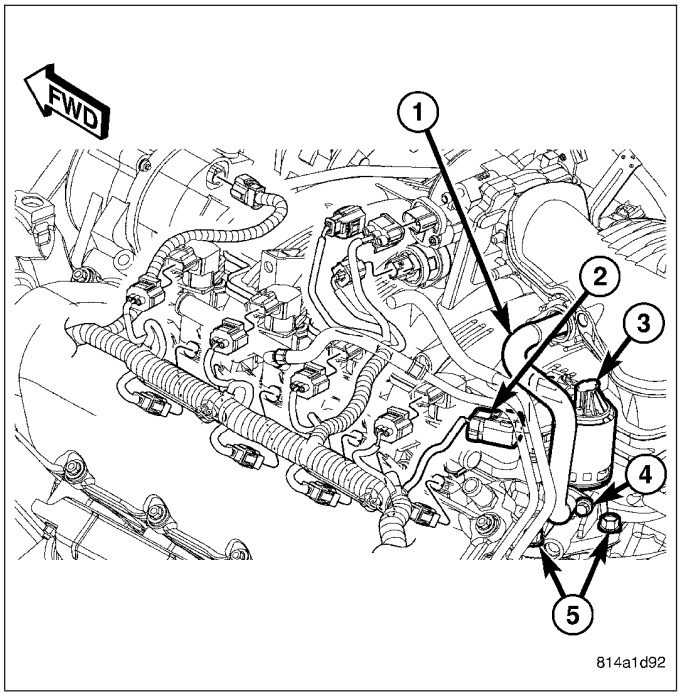
VALVE-EGR

DESCRIPTION

4.7L Engine

The electronic EGR valve and solenoid assembly (3) is attached to the rear of the left cylinder head. An exhaust gas routing tube (1) connects the EGR valve to the intake manifold.



OPERATION

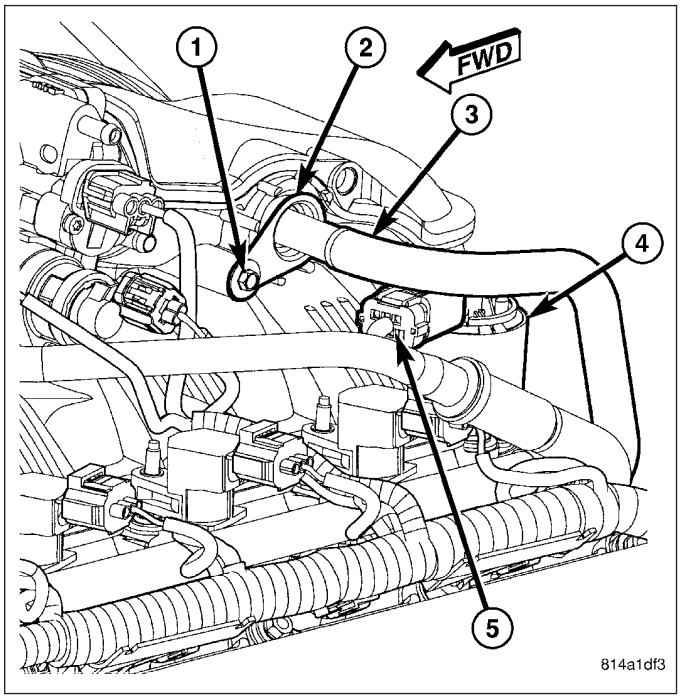
Exhaust gas recirculation flow is determined by the Powertrain Control Module (PCM) and is controlled by an electronic EGR valve assembly. For a given set of conditions, the PCM knows the ideal exhaust gas recirculation flow to optimize NOx and fuel economy as a function of the pintle position. Pintle position is obtained from the position sensor. The PCM adjusts the duty cycle of 128 Hz power supplied to the solenoid coil to obtain the correct position.

The electronic EGR valve assembly consists of a pintle, valve seat, and housing which contains and regulates exhaust gas flow. An armature, return spring, and solenoid coil provide the operating force to regulate exhaust gas flow by changing the pintle position. The solenoid coil assembly is wired in parallel with a diode that connects two internal connectors.

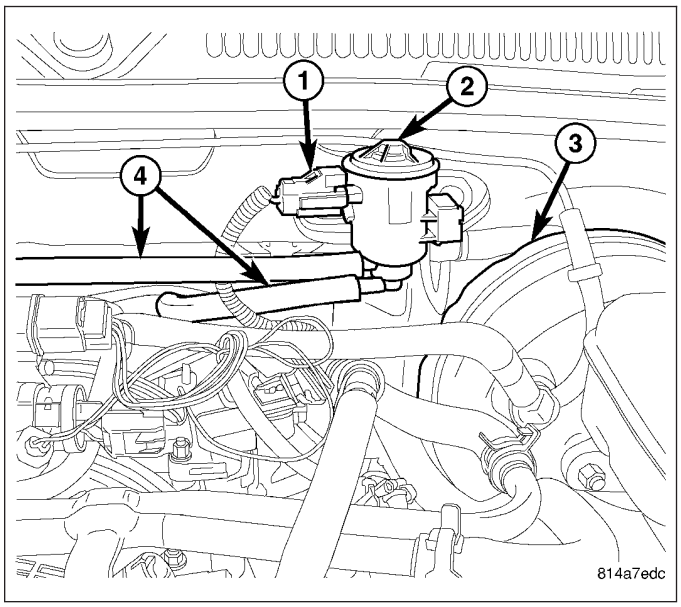
REMOVAL

4.7L Engine

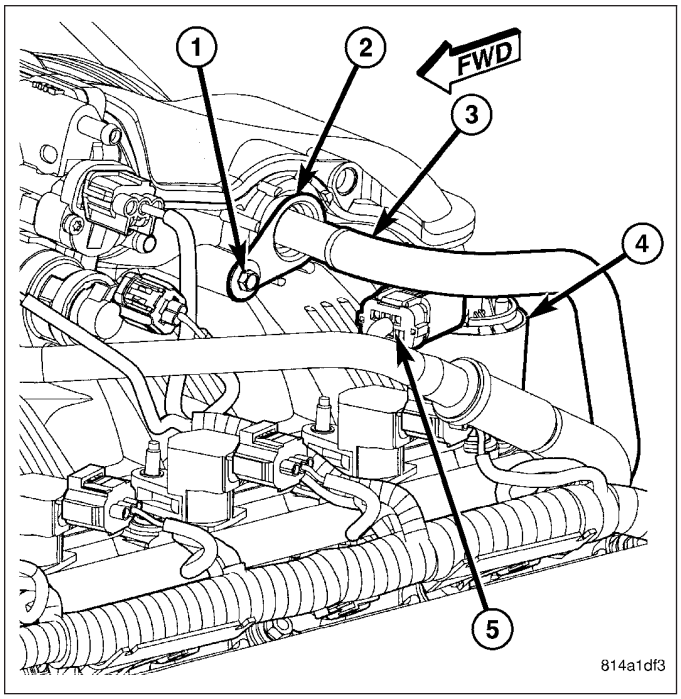
The electronic EGR valve and solenoid assembly (4) is attached to the rear of the left cylinder head. An exhaust gas routing tube (3) connects the EGR valve to the intake manifold.



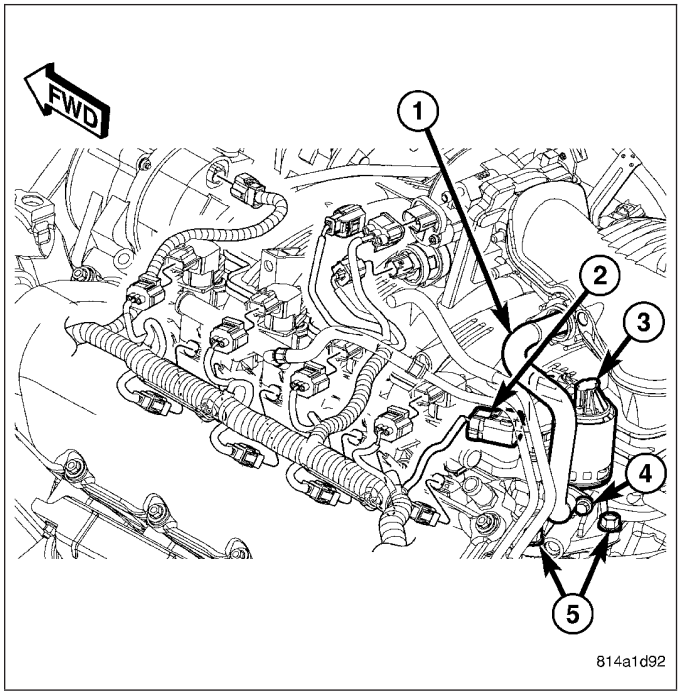
1. Remove EVAP solenoid (2). Refer to Solenoid - EVAP/PURGE Removal and Installation for procedures.



2. Remove electrical connector (5) at top of EGR valve solenoid.
3. Remove tube mounting bolt (1) at intake manifold.



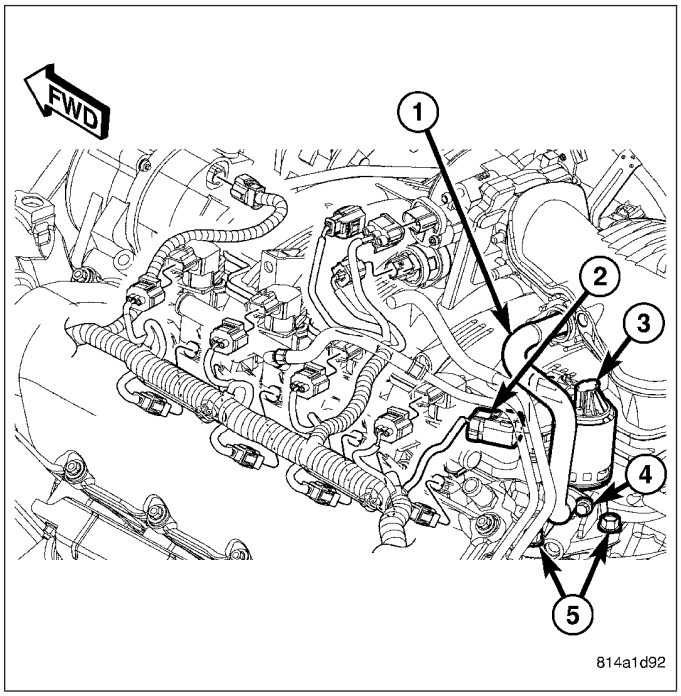
4. Remove two bolts (4) connecting EGR tube (1) to valve assembly.
5. Remove gasket located between EGR tube flange and EGR valve assembly.
6. Remove two EGR valve mounting bolts (5).
7. Separate valve assembly (3) from engine.
8. Remove and discard metal gasket located between cylinder head and valve assembly.



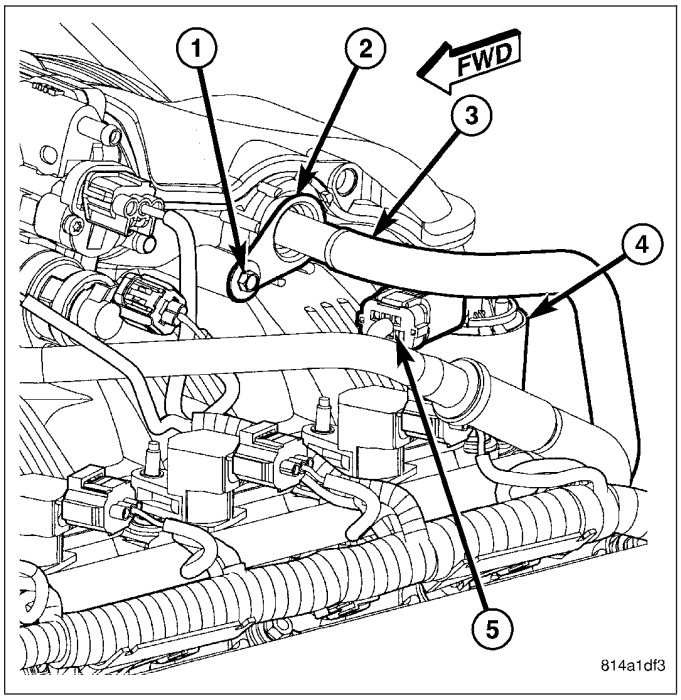
INSTALLATION

4.7L Engine

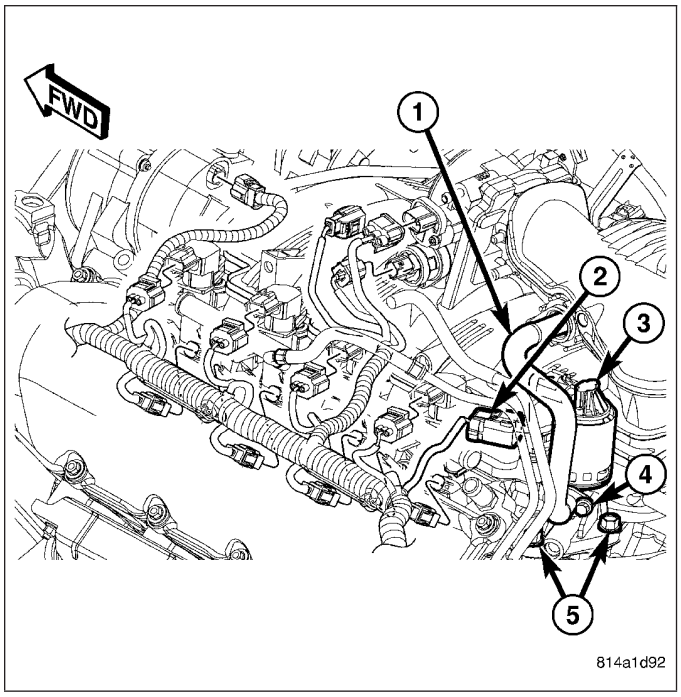
1. Clean area at rear of left cylinder head where it joins base of EGR valve.
2. Clean EGR tube where it joins EGR valve.
3. Position new gasket between EGR valve and cylinder head.
4. Position EGR valve to cylinder head. Install and tighten two bolts (5). Refer to Torque Specifications.
5. Position new gasket between EGR tube flange and EGR valve assembly.
6. Position EGR tube (1) to side of EGR valve and into intake manifold. Install two bolts (4) finger tight (temporarily).



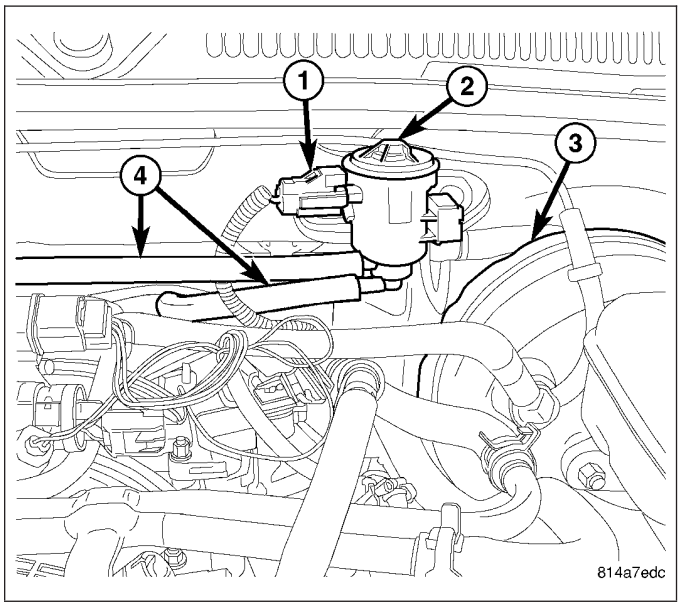
7. Install EGR tube flange bolt (1) at intake manifold. Tighten bolt. Refer to Torque Specifications.
8. Connect electrical connector (5) to top of EGR valve solenoid (2).



9. Do a final tightening of two EGR tube bolts (4). Refer to Torque Specifications.



10. Install EVAP solenoid (2). Refer to Solenoid - EVAP/PURGE Removal and Installation for procedures.



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SERVICE MANUAL COMMENTS

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